Time-Saver Standards for Interior Design and Space Planning
Other McGraw-Hill Books of Interest

Binder • Corporate Facility Planning
Breyer • Design of Wood Structures
Burden • Entourage
Callender • Time-Saver Standards for Architectural Design Data
Colley • Practical Manual of Site Development
De Chiara • Handbook of Architectural Details for Commercial Buildings
De Chiara • Time-Saver Standards for Residential Development
De Chiara and Callender • Time-Saver Standards for Building Types
De Chiara and Koppelman • Time-Saver Standards for Site Planning
Dines • Landscape Perspective Drawing
Ehrenkrantz • Architectural Systems
Halse and George • Architectural Rendering
Harris • Dictionary of Architecture and Construction
Harris and Dines • Time-Saver Standards for Landscape Architecture
Izenour • Theater Technology
Leach • Photographic Perspective Drawing Techniques
Merritt • Building Design and Systems Handbook
Merritt • Standard Handbook for Civil Engineers
Nolon and Dickinson • Common Walls/Private Homes
Simonds • Landscape Architecture
Spaulding and D’Ella • Advanced Marketing Techniques for Architecture and Engineering Firms
Wentling • Housing By Lifestyle
Time-Saver Standards for Interior Design and Space Planning

Joseph De Chiara
Julius Panero
Martin Zelnik
Time-Saver Standards For Interior Design And Space Planning

International Editions 1992

Exclusive rights by McGraw-Hill Book Co-Singapore for manufacture and export. This book cannot be re-exported from the country to which it is consigned by McGraw-Hill.

Copyright © 1991 by McGraw-Hill, Inc. All rights reserved. Except as permitted under the United States Copyright Act of 1976, no part of this publication may be reproduced or distributed in any form or by any means, or stored in a data base or retrieval system, without the prior written permission of the publisher.

7 8 9 0 KHL FC 9 8 7

The sponsoring editor for this book was Joel Stein, the editing supervisor was Stephen M. Smith, the designer was Ron Lane, and the production supervisor was Suzanne W. Babeuf. It was set in Univers Light.

Information contained in this work has been obtained by McGraw-Hill, Inc., from sources believed to be reliable. However, neither McGraw-Hill nor its authors guarantees the accuracy or completeness of any information published herein and neither McGraw-Hill nor its authors shall be responsible for any errors, omissions, or damages arising out of use of this information. This work is published with the understanding that McGraw-Hill and its authors are supplying information but are not attempting to render engineering or other professional services. If such services are required, the assistance of an appropriate professional should be sought.

Library of Congress Cataloging-in-Publication Data

De Chiara, Joseph, date
Time-saver standards for interior design and space planning /
Joseph De Chiara, Julius Panero, Martin Zelnik.
p. cm.
Includes index.
ISBN 0-07-016299-9
1. Interior decoration—Standards—Handbook, manuals, etc.
2. Interior architecture—Standards—Handbook, manuals, etc.
I. Panero, Julius. II. Zelnik, Martin, date. III. Title.
NK2110.D35 1991 729—dc20 91-15189

When ordering this title, use ISBN 0-07-112589-2

Printed in Singapore
# Contents

<table>
<thead>
<tr>
<th>Contributors</th>
<th>vii</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizations</td>
<td>ix</td>
</tr>
<tr>
<td>Foreword</td>
<td>xii</td>
</tr>
<tr>
<td>Preface</td>
<td>xiii</td>
</tr>
</tbody>
</table>

1. Planning and Design of Interior Spaces 1
   Residential Spaces  3
     Period furniture  5
     Furniture dimensions  44
     Living rooms  51
     Dining rooms  80
     Bedrooms  87
     Bathrooms  109
     Kitchens  149
     Library/study  190
     Family/recreation rooms  196
     Laundry/sewing rooms  200
     Closets/storage areas  206
   Office Spaces  221
     General offices and multiple workstations  223
     Private offices  231
     Electronic workstations  241
     Conference rooms  249
     Reception areas  260
     Furniture, furnishings, and equipment  278
   Hospitality Spaces  305
     Restaurants  307
     Bars  346
     Hotels  374
   Retail Spaces  385
     Shops  387
     Banks  396
     Department stores  401
   Public Restrooms, Toilets, and Coatrooms  423
     Restrooms and toilets  425
     Coatrooms  460
## 2. Construction Details and Finishes

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partitions and wall finishes</td>
<td>469</td>
</tr>
<tr>
<td>Floors and floor finishes</td>
<td>516</td>
</tr>
<tr>
<td>Doors</td>
<td>566</td>
</tr>
<tr>
<td>Ceilings</td>
<td>641</td>
</tr>
<tr>
<td>Stairs</td>
<td>660</td>
</tr>
<tr>
<td>Fireplaces</td>
<td>724</td>
</tr>
<tr>
<td>Lighting</td>
<td>743</td>
</tr>
</tbody>
</table>

## 3. Architectural Woodwork

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard joinery and casework details</td>
<td>781</td>
</tr>
<tr>
<td>Woodwork details</td>
<td>804</td>
</tr>
<tr>
<td>Cornices and mouldings</td>
<td>866</td>
</tr>
<tr>
<td>Furniture hardware</td>
<td>887</td>
</tr>
</tbody>
</table>

## 4. Specialties

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plantscaping</td>
<td>906</td>
</tr>
<tr>
<td>Signage and graphics</td>
<td>931</td>
</tr>
<tr>
<td>Audio-visual systems</td>
<td>949</td>
</tr>
<tr>
<td>Auditorium seating</td>
<td>961</td>
</tr>
<tr>
<td>Security</td>
<td>977</td>
</tr>
<tr>
<td>Color theory</td>
<td>998</td>
</tr>
<tr>
<td>Window treatments</td>
<td>1015</td>
</tr>
<tr>
<td>Elevators</td>
<td>1060</td>
</tr>
<tr>
<td>Indoor recreation</td>
<td>1069</td>
</tr>
<tr>
<td>Accessories</td>
<td>1075</td>
</tr>
</tbody>
</table>

## 5. General Reference Data

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space planning</td>
<td>1106</td>
</tr>
<tr>
<td>Human factors</td>
<td>1110</td>
</tr>
<tr>
<td>Floor and wall covering</td>
<td>1122</td>
</tr>
<tr>
<td>Fabric</td>
<td>1150</td>
</tr>
<tr>
<td>Electrical</td>
<td>1132</td>
</tr>
<tr>
<td>Columns, capitals, and entablatures</td>
<td>1135</td>
</tr>
<tr>
<td>Nails, screws, and bolts</td>
<td>1136</td>
</tr>
<tr>
<td>Mathematical data and formulas</td>
<td>1139</td>
</tr>
</tbody>
</table>

Credits 1145

Index 1151
Contributors

Marvin Affrime
Andrew Alpern, AIA
Amon & Graecen Architects
David Appel, DLF, IALD
Bertram L. Bassuk Architect
Anthony Beaumont Architect
Jeannie Bochette Steelcase
Louis Bowman Architect
Scott Bromley Architect
Bromley Jacobsen Architecture and Design
Jerry Caldarli Architect
Tom Chi/Albert Chen Associates
Will Ching Planning and Design
Barbara Ciancel, IALD
Cameron Clark Architect
Davis, Brody & Wisniewski Architects
Majorie Earthile
Brad Elias, ASID
David Engel Landscape Architect
Engel/GGP Landscape Architects
Paul Eshelman, IDEC
Evans, Moore, Peterson & Woodbridge Architects
Charles D. Flayhan Associates, Inc.
Frank J. Forster Architect
Ulrich Franzen Architect
Gensler Associates
Franklin H. Gottschall
Adrienne Grad
Julius Gregory Architect
Albert Halse
Hochhelser Elias Design Group, Inc.
Caleb Hornbolstel Architect
Lees Horton
ISD Incorporated
Lawrence Israel, FAIA Architect
Francis Joannes Architect
Ely Jacques Kahn Architect
Mary Jean Kamln, ASID
William H. Kapple, AIA
Joseph Kleiman
Dorothy Lee
Sammy Lee Architect
Lori Lennon, ASID
Howard Litton, ASID
Steve Loule
Ronald Lubman Architect
Harry Lunstead Design, Inc.
Michael Lynn Architect
Michael Lynn & Associates
Nathan Jerry Maltz, AIA Architect
William M. Manley, FASID
Mays, Simpson & Hunskier Architects
Merrill, Humble, and Taylor Architects
Montgomery Winecoff & Associates, Inc.
William Morgan, FAIA
Bernhardt E. Muller Architect
Richard J. Neutra Architect
Julius Panero Architect
Panero Zelnik Associates
Parish Hadley Associates, Inc.
Perkins & Will Architects
Dennis Pierrmont, ASLA
Nicholas Polillo Professor, Fashion Institute of Technology
John Russell Pope Architect
William Pulgram Architect
Ramey, Himes & Buchner Architects
Antonin Raymond Architect
Frank Rispoli
Sararin, Swanson & Sarafin Architects
Jacqueline Siles
The Space Design Group
Richard Stonis
William Tarr
Andrew J. Thomas Architect
Thompson, Robinson, Toraby, Inc.
Darius Toraby Architect
Michael Trencher Professor, Pratt Institute
Verna, Cook, Salomonsky Architects
Walker & Gillette Architects
Walker Group/CNI
Leroy P. Ward Architect
Edgar I. Williams Architect
Charlie Wing
Martin Zelnik Architect
Simon B. Zelnik, FAIA Architect
Organizations

A & J Washroom Accessories
Access America
Alvarado Manufacturing Co., Inc.
American Olean Tile Company
American Parquet Association
American Sanitary Partition Corporation
American Specialties, Inc.
American Standard, Inc.
Architectural Paneling, Inc.
Architectural Woodwork Institute
Armor Elevator Company
Ascente
Bauman
Brown Manufacturing Co.
Buckingham-Virginia Slate Co.
Camden Window and Millwork
Clairson International
Closet Maid Systems
Conde Nast Publications, Inc.
Culter Manufacturing Corp.
Curvoflite
Designers Sign Company
Dover Elevator Systems
Eggers Industries
Eljer Plumbingware Division of Wallace-Murray Corporation
Eurollair
Focal Point, Inc.
Formica Corporation
Franciscan Tile Company
General Electric Lighting
General Services Administration
Glencoe Publishing Co.
Habitat
Halele
Hartco Flooring/Tibbats Flooring Co.
Haws
Herman Miller, Inc.
Hollow Metal Manufacturers Association
Horton Lees Lighting Designs, Inc.
Howe Furniture Company
Hussey Seating Company
Illinois Agricultural Experiment Station
Iittala, Inc.
Indiana Limestone Institute of America
Insulated Steel Door Systems Institute
Intergraph Corporation
Interkal, Inc.
JG Furniture Systems, Inc.
Just Bulbs Ltd.
Kinney Shoe Corporation
Kirsch Division of Cooper Industries, Inc.
Kohler
Lapeyre Stair Co.
Lehigh Furniture Corporation
Library Bureau, Inc.
Maclevy Health and Fitness Products
Manville
Marble Institute of America, Inc.
Marvin Windows
McGraw-Hill, Inc.
McKinney/Parker
Merillat
Midwest Plan Service
Modernfold
National Association of Architectural Metal Manufacturers
National Association of Ornamental Metal Manufacturers
National Cathode Corp.
National Retail Merchants Association
National Terrazzo and Mosaic Association, Inc.
Nesson Lamps, Inc.
New York City Housing Authority
Nichols Publishing
Niland Company
Osim Corporation
PAM International
Parker/Nutone
Phillips Lighting Co.
Phillips & Brooks, Inc.
Pittcon Softforms
Pittsburg Corning Corp.
Putnam Rolling Ladder Co., Inc.
Railex Corporation
Roberts Step-Lite Systems
Roppe Rubber Corporation
St. Charles Kitchens
Schlage Lock Company
Schulte
Selby Furniture Hardware Co., Inc.
Simon and Schuster
Sister Kenny Institute
Steel Door Institute
Steelcase
Sweet's Division of McGraw-Hill, Inc.

Tarkett
Tile Council of America, Inc.
Triangle Pacific Corp.
Western Wood Products Association
Whirlpool
White Consolidated Industries, Inc.
Winebarger Church Furniture
Woodwork Institute of California
United States Dept. of Agriculture
United States Dept. of Commerce
United States Dept. of Housing and Urban Development
United States Dept. of the Interior
United States Dept. of Transportation
Foreword

A resource of incredible range and detail, this volume was compiled by three remarkably inspired designers and educators. Because of their great knowledge of interior design and their sensitivity to the subject matter, they have created the most comprehensive source book for the field ever.

The editors spent three years bringing this volume to fruition, culling the best project drawings by outstanding designers to illustrate much of the subject matter and tapping their own anthropometric expertise to address space planning and special function areas. They also address the importance of historic influence on present-day design with an impressive review of period furniture and interior details. All of these things have produced a reference work of such scope and inclusiveness that the reader will be relieved of many hours in the pursuit of details and information, time saved that can be used for more innovation and creativity in developing solutions for client needs.

The authority and abundance of this book are a testimony to the maturation of this profession of ours and to the editors' appreciation and understanding of its importance.

Jack Lowery, FASID, IDEC

My pleasure in being invited to write part of the Foreword swiftly changed to respect and, in turn, awe at the scope and depth of this book.

To say that it is an encyclopedic compilation and mass of information is obvious. But it is especially and uniquely user-friendly. It presents the written and illustrative data without a trace of pedantry; it meets a real need in our interior designer professional resources. The editors' effort, dedication, and patience, sustained during a period of over three years, are truly heroic. An astonishing number of hours of input have produced a reference of incalculable value.

I offer the same cautionary advice mentioned in the Preface: If the book is a wonderfully comprehensive reference and support for interior design standards, historical material, suggested plan and design criteria, and regulatory limitations, it is not—it will never be—a substitute for the inspired, creative design act, for imaginative solutions are always driven by new cultural conditions, programs, and functional requirements.

So to all you designers: Continue to spin your dreams, but do not stray far from this great resource.

Lawrence J. Israel, AIA, FISP
Preface

Time-Saver Standards for Interior Design and Space Planning is a professional handbook dealing with the planning, design, and detailing of interior spaces. Its primary goal is to provide, within a single reference, information that typically is found dispersed throughout a multitude of sources, including manufacturers' catalogs, technical literature, books dealing with historic styles, and documents and drawings from various projects.

This handbook can be used by the small and medium-size interior design or architectural firm to establish an instant reference library of design data and details by providing a broad selection of detail types and techniques. In addition, the large firm will be able to substantially augment and modify an existing library of details.

Perhaps the most unique feature of this handbook is the vast array of construction and woodwork details reproduced directly from actual working drawings contributed by some of the nation's leading interior design and architectural firms. It is this that makes the handbook particularly useful to the interior designer, architect, and student alike.

This book consists of five sections. The first, entitled Planning and Design of Interior Spaces, deals with residential, office, hospitality, and retail spaces in terms of the relevant planning, design, and detailing data specifically associated with each. The second section, entitled Construction Details and Finishes, deals with various basic interior construction components associated with most interior spaces. These components include partitions, wall openings, wall finishes, floors and floor finishes, doors, ceilings, stairs, fireplaces, and lighting. Details relevant to each component have been contributed by practicing interior designers and architects as well as manufacturers.

The third section, entitled Architectural Woodwork, deals with standard joinery and casework details, customized woodwork details, cornices and mouldings, and furniture hardware. The fourth section, entitled Specialties, deals with various specialized areas of equipment, systems, furnishings, and decoration, including signage and graphics, audio-visual systems, window treatments, and accessories. Information for these subject areas is drawn from manufacturers, suppliers, and designers.

The fifth section, entitled General Reference Data, provides the most comprehensive set of time-saving reference materials found in handbooks of this type, including tables, charts, formulas, and planning guidelines. Of particular interest to the architect, interior designer, and facility manager are tables that can be easily used to determine carpet and wall covering yardage. Charts and drawings relative to human factors and planning standards are also provided.

It should be noted that since the details and other information pre-
sented in this book have been compiled from so many different sources, it is difficult to ensure that all the data are entirely accurate or appropriate; for example, in some instances planning guidelines may reflect minimum acceptable standards and not necessarily ideal or preferred standards. In other instances the details indicated may have been perfectly adequate in the context of the total building design of which they were a part, but they may well require modification to reflect design conditions and the reader’s intended use. It should also be noted that building codes, fire safety regulations, barrier-free standards, and many other laws governing the design and construction of buildings vary from state to state. Accordingly, the reader should consult all applicable local, state, and federal codes for conformance prior to applying any of the information contained in this book. Moreover, the reader is cautioned that the dimensional information provided in connection with furniture, equipment, appliances, accessories, etc., has been obtained from manufacturers and technical literature and thus varies from supplier to supplier and from source to source. Certain items may have been discontinued, others modified, and still others replaced. Although every effort has been made to ensure the reasonableness of the information, the reader is cautioned to consult the manufacturer of the item specified for current dimensional data.

The reader is also advised that most drawings and other illustrative material have been enlarged or reduced for reasons of page layout and page size. The reader is cautioned, therefore, to disregard any scale designations and not to scale the drawings in order to determine any additional dimensional information.

Finally, as mentioned before, the plans and details contained in this book were extracted from complete sets of actual working drawings prepared by many different contributors. They were selected both because they were representative of typical situations faced by the designer of interior spaces and because they were particularly informative. The authors would like to underscore the fact that these plans and details, as well as all the other material presented in this book, are intended to serve only as a helpful point of departure in connection with the design process, and not as a substitute for original thinking and creativity.

Although every effort has been made to present reasonably accurate information, the editors and publisher assume no liability or responsibility for damage to persons or property alleged to have occurred as a direct or indirect consequence of the use and application of any of the contents of this book. The reader is advised to view the subject matter primarily as guidelines for preliminary planning and detailing, and to properly review, modify, and process it to ensure conformance with local codes and practices and appropriateness of applicability.

Joseph De Chiara
Julius Panero
Martin Zelnik
Planning and Design of Interior Spaces
Residential Spaces

Period furniture 5
Furniture dimensions 44
Living rooms 61
Dining rooms 80
Bedrooms 87
Bathrooms 100
Kitchens 149
Library/study 190
Family/recreation rooms 196
Laundry/sewing rooms 200
Closets/storage areas 206
The 17th Century immigrants brought to America the building traditions of their native lands. The Parson Capen house (1683) at Topsfield, Mass., for example, closely resembles English houses of the same period. But the clapboards are typically American. In the panels at right are close-up details of the Early Colonial background.

The living room is typical of those in the more elaborate Early Colonial homes. The crewel-embroidered curtains are blue-green with touches of red. This is taken up by the upholstery—blue-green damask for the sofas, red tapestry for the chairs. The Oriental rug and the portrait above the fireplace are both in tones of red, brown and yellow, with red dominant.

An alternative color scheme would have blue and yellow upholstery (needlework for the chairs, satin for the sofas). The walls would be pine-paneled, adorned with silver sconces, the curtains a bright cotton print in red, yellow, blue and white.

Furniture made in America during the Early Colonial period (the seventeenth century and the first quarter of the eighteenth century) was necessarily, and possibly also by choice, of the simplest type. The early colonists, particularly those in New England, had no time or equipment to spare for any but the essentials of life.

Turning on the lathe was the simplest to achieve and thus the most common form of furniture decoration. It was also a process capable of infinite variations of design (some are shown in Fig. 1).
THE DINING ROOM

The color scheme in this dining room is keyed to the low tones of the pine paneling and walnut furniture, the soft gleam of the smooth polished brass chandelier. The banister back chairs have rush-bottom seats. Brilliant red and white printed cotton is used for the curtains. The hooked rug is in reds and greens.

Alternatively the curtains might be of red and yellow creely embroidery, the upholstery of red brocades. In the panels at right are furniture and fabrics suited to an Early Colonial dining room.

THE BEDROOM

This little bedroom with its pine paneling and low ceiling is typical of the Early Colonial period. The bed, decorated with hangings of crewel work in an Oriental design, is the most important feature of the room. The chairs are upholstered in yellow damask. The green printed cotton used for the little draped window curtains is echoed by the greens in the hooked rug on the floor.

Alternatively the walls might be painted a dark gray-blue, the curtain material being a red printed cotton on a gray ground. The furniture is of walnut and oak.

Even the most costly furniture in this Early Colonial period was usually of solid wood unfinished except for stain or waxing. Veneering and shellacking, to gain carefully patterned graining and high finish, were still unexploited. The pine paneling on the walls might be left unfinished, waxed, or painted. Other woods near at hand in the forests and so commonly used were oak, birch, maple, and walnut. Generally, American work is patterned upon English work of 10 or 20 years earlier. In Pennsylvania and Delaware, which were settled by colonists of Swedish and German descent (in addition to the English), much of the simple furniture was painted with its motifs transferred from European peasant art.

In the later years of the Early Colonial period, when New Englanders were already beginning to trade with the Orient, much Chinese porcelain was imported. The Oriental influence was strong in textiles; the Tree of Life pattern was very popular at this period. Native textiles copied the patterns
Residential Spaces
PERIOD FURNITURE
17th Century American: Colonial

### Armchair, side chairs
- "Can" chair, turned scroll and feet, cane back and seat
- Caned, turned legs
- "Can" chair, turned back
- High back, turned posts
- "Can" chair, plain seat

### Sideboards, dressers, chests
- Oak sideboard, carved legs, c. 1680
- High chest with drawers
- Oak sideboard, turned legs
- Heavily carved chest of drawers with turned legs
- Painted highboy
- Chest of drawers
- Walnut dresser, paneled doors
- Walnut dresser, paneled doors

### Dining-room accessories
- Wrought iron chandelier
- Painted silhouettes
- Brass candlesticks
- Brass candlesticks
- Dutch wall clock
- Mantle clock with turned case
- Dutch mantel clock
- Painted mirrors, glass door frames

### Chests, kas, highboy, chests of drawers
- American chest of drawers, c. 1680
- Painted chest, with turned posts
- Dutch kas, painted chest
- Painted kas, c. 1670

### Desk, lowboys, night tables, stools
- Walnut side chair
- Oak long stool
- Lowboy in oak, walnut
- American chest, c. 1720
- Walnut chest of drawers
- Chest of drawers
- Walnut chest of drawers
- Walnut chest of drawers

### Bedroom accessories
- Hall scrubber chandelier
- Resin light stand
- Chinese porcelain
- Mirror stool with shelf top
- Mirror stool with shelf top
- Mirror stool with shelf top
- Mirror stool with shelf top
- Mirror stool with shelf top
- Mirror stool with shelf top
- Mirror stool with shelf top

### Notes
- and colors of India, Persia, and China. The originals, or good copies of them, were usually imported from England.
- The colors in common use were of a piece with the solid, sturdy furniture. They seldom escaped from the conventional round of blue, red, gold, and natural gray. The only exceptions were imported fabrics and the occa-
- sional hard brilliance of the Chinese porcelain found in the great houses of the day. Whatever luxury there was at this time expressed itself in textiles and silver rather than in furniture. Settlers in the South, many of them English aristocrats, maintained a higher standard of comfort than those in the North; they imported most of their furniture and fabrics from England and continued to do so for a long time.
- Early Colonial furniture taken as a whole is sturdy, but not subtle. Furniture patterns in this country changed slowly. Paneling relieved the larger flat areas such as cupboard doors and drawer fronts. The latter were further decorated by quite elaborate fretted
### Residential Spaces

#### PERIOD FURNITURE

**17th Century American: Colonial**

<table>
<thead>
<tr>
<th>Fireplace designs</th>
<th>Eight typical paned doors</th>
<th>Drapery treatments for various window types</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Fireplace designs" /></td>
<td><img src="image" alt="Eight typical paned doors" /></td>
<td><img src="image" alt="Drapery treatments" /></td>
</tr>
</tbody>
</table>

- **Fireplace designs:**
  - Horizontal molding
  - Abbreviated mantel shelf
  - Plain molded surrounds were sometimes marbled for variety

- **Eight typical paned doors:**
  - Double-hung windows
  - French doors
  - Sash window
  - Barn door

- **Drapery treatments for various window types:**
  - On a single window with hierarchy
  - On a pair of louvered cabinet doors
  - Embroidery at the center of the curtain panel

<table>
<thead>
<tr>
<th>Corner cupboards, cabinets, secretaries, chest</th>
<th>Occasional tables, desk, lowboys, pedestals</th>
<th>Living-room accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Corner cupboards, cabinets, secretaries, chest" /></td>
<td><img src="image" alt="Occasional tables, desk, lowboys, pedestals" /></td>
<td><img src="image" alt="Living-room accessories" /></td>
</tr>
</tbody>
</table>

- **Corner cupboards, cabinets, secretaries, chest**
- **Occasional tables, desk, lowboys, pedestals**
- **Living-room accessories**

Brass and wrought-iron hardware (see Fig. 1). More carefully embellished than the earliest American furniture were the pieces imported by the colonists from their various homelands. These pieces, and the memories of others left behind, later served as models for American craftsmen. The dominant influences were Dutch, for the English had a Hollander, William of Orange, as king. He and his queen Mary gave their names to a style of which elaborate stretchers (particularly on highboys, lowboys, and occasional tables) and scrolled legs are among the most obvious characteristics.

- **Also from Dutch, Spanish, and Portuguese sources are derived most of the carved feet**

**Fig. 1 (Continued)**

- Which distinguish this Early Colonial furniture and often give clues to its date and place of origin.
THE EXTERIOR

The architectural details shown in the five panels at right are characteristic of the background for 18th Century Colonial decoration. As one of the finest houses of the period we have pictured (at right) "Westover" the great mansion erected by William Byrd in Charles City Co., Virginia. Typical of this period are the brick walls and chimneys, the stone or white painted brick trim. In the North wood was in common use than brick for the exterior, and the interior wooden trim was finely detailed.

Typical Colonial architecture

Cornices and trim

THE LIVING ROOM

The furniture, fabrics and accessories shown in these panels are all suitable to the living room, and are all typical of the 18th Century Colonial style.

The interior pictured at right is a fine Colonial living room carefully restored to its 18th Century state. The walls are Naples yellow, the columns and fireplace white. Red and green are dominant. In the Oriental rug, dark greens and browns in the portrait above the fireplace. So the sofa is upholstered in striped satin, the armchair in yellow Venetian brocade, the wing chair in a printed linen. The urns are of Chinese porcelain.

Another color scheme might be: pearly gray walls, oyster white columns and fireplace. Red would be dominant in the Oriental carpet, dark greens and red in the portrait. There would be red damask on the sofa, green rep on the wing chair, and gold damask for the armchair.

Decorating a Colonial living room

Fabrics for curtains and upholstery

Whereas furniture of the Early Colonial period was often so primitive as to be referred to as "Kitchen Colonial," in this succeeding era dignity and luxury prevail in the centers of taste. The furnishings reflect the fashionable contemporary styles of England and stately country homes, whether on New England farms or Virginian and Carolina plantations, followed these styles. This gave rise to a number of notable architects, craftsmen, and workers in metal and wood.

The eighteenth century Colonial period was the first of the really great eras in American cabinetmaking.

The manufacture of wallpaper in this country was begun by 1763. Before this it was from Europe. The "Pennsylvania fireplace" or "Franklin stove" was invented by Benjamin Franklin in 1742 and immediately became popular up and down the Atlantic seaboard. Philadelphia was a furniture style center in fact the most active in the creation of taste, with Boston and Charleston following.

A number of artists and craftsmen of this period bear mentioning. Among the architects were Samuel McIntire, Charles Bulfinch, John James, Richard Mundy, Peter Harrison, John Kirk, and Isaac Royall. These men were greatly influenced by the English architects Isaac Ware, James Gibbs, Robert Morris, Abraham Swan, William Halfpenny, Betty Langley, and William Pain, who in turn were in debt to the Italian masters Palladio and Giacomo Leoni. Among the cabinetmakers were Moses Dodge, Stephen Dwight, Henry Hardcastle, Gilbert Ash, Robert Wallace, Charles Shipman, John Brinnet, John Tremain, Charles Warham, John Brown, Berneley Wells, Thomas and Benjamin Laskey, Jonathan Goodhue, and Job Trask. Among the upholsterers were Stephen Callow, Richard Wenman, Joseph Cox, and John Taylor; among the metalworkers were William Coffin, Wilkins, Joseph Liddell, William Bradford, John Bassett, and Peter Harby; and among the painters were John Singleton Copley, Joseph Blackburn, John...
DINING ROOM

The furniture and fabrics shown in the five panels at right would look well in any dining room; but for your guidance in the selection of materials and colors we illustrate at right a fine Colonial dining room as it might have appeared in the 18th Century.

The pine-panelled walls are colored a light ocher, the niches Chinese red. Curtains are French blue. Blue, rust and beige predominate in the Oriental rug, dark green, blue and black in the portrait over the fireplace. Table and chairs are of walnut, the sideboard of mahogany.

An alternative color scheme would be light blue-gray walls with cream niches. Curtains would be oyster white silk, the Oriental rug having a greenish tan background.

BEDROOM

In the bedroom at right, choice of color and textures was designed to achieve an impression of warmth and intimacy. The paneled walls are in two tones of gray-green, the ceiling ocher. Curtains are antique gray-green satin.

Furniture is walnut, except for the mahogany bed, which has a yellow taffeta spread. Fireside chairs are covered in crimson damask side chairs in turkey work.

An alternative color scheme would be: warm gray walls with oyster white moldings. The ceiling would be cream, the carpet solid tan and the curtains of blue damask. The bed would have a white moire spread and blue valance. The side chairs would be upholstered in yellow damask, the wing chair in turkey work.

Decorating a Colonial dining room

Fabric for curtains and upholstery

- Brocade
- Printed linen
- Striped brocade

Decorating a Colonial bedroom

Fabrics for curtains, upholster, canopy

- Printed linen
- Tafel de dray
- Damask

Dining tables, consoles

- Mahogany console with rabari top, early 18th century style
- Indian rosewood drop leaf dining table
- American neoclassical dining table
- American rosewood console table
- Classical dining table 1770

Four-poster beds

- Mahogany four-poster bed
- Mahogany four-poster bed and tester
- Indian rosewood four-poster bed and tester
- Late 18th century four-poster bed

Rumagga, James Peale, and Charles Wilson Peale. Important manufacturers were, of wallpaper, Jackson of Battersea (England) and, of window and bottle glass, Baron Steig Colour and Caspar Winter.

Fabrics most commonly used during the Colonial period were damask, cambric, Indian gimp and binding, moreen (wooden drapery cloth), harriet cloth, block-printed cotton and linen, cashmere, calico, dimity, durance, stout worsted cloth, turkey work (tufled "pilelike"), pawnee (strong silk), soy, shallow, watchet, liney-wooley, fusian, silk muslin, chintz, Indian calico, tabby, senean, taffeta, horsehair, camak, bancours, and brocade.

Woods most commonly used were oak, ash, elm, red cedar, mahogany, walnut, maple, pine, and cherry.

The Chippendale style merges at one end with Queen Anne, at the other with Hopewhite, Sheraton, and Duncan Phyfe. The Rococo mounts to its zenith and starts to decline within these years. Walnut has a new rival in mahogany. And American craftsmen produced pieces of a quality which compared favorably with English work.
Marble was imported until after the Revolution when domestic marbles began to be used. Marble chimney pieces, window sash, lead roofing, and hardware were all imported from London. The size of glass window panes gradually increased as the century progressed.

An order of small pilasters or columns supporting the mantel in a chimney piece was found only in imported work prior to the Revolution. Fireplace openings with neither cornice nor mantel shelf were long common. Ears on the architraves were almost universal, and a pediment (always broken) was very common. After 1760 the scroll pediment, or a similar treatment of the architrave, occurs.
Residential Spaces

PERIOD FURNITURE

18th Century American: Colonial

Fireplace designs

Window details

Drapery treatments

Secretaries, highboy, clocks

Desks, tables, firescreen

Living room accessories
As a typical mansion of the Federal period we show Mappa Hall in Trenton, N.Y. It was started in the closing years of the 18th Century and completed in 1809. The portico and the simple pediment exemplify the prevailing Classic trend. In the panels to the right are some typical details from the Federal period background.

The Federal style is at its most suave and elegant in the furniture of Duncan Phyfe, a Scotch cabinetmaker who arrived in New York about 1795. He did not originate a style; he translated prevailing fashions into fine craftsmanship. Thomas Sheraton, then the current English favorite, and the French Directoire cabinetmakers set the style. All these designers were profoundly influenced by a rediscovery of the classic splendors of Greece and Italy.

Reeding of table, chair, and sofa legs and other framing members gives elegance to Federal furniture. Contrasting color veneer is used to outline the edges of tables and desks and to lend interest to large plain surfaces.

Fig. 2 Motifs characteristic of Federal furniture.
THE DINING ROOM

IN the dining room shown above the walls are mist gray, the chimney piece ochre and white marble. The drapery and upholstery are both cherry silk damask. The Oriental rug is in tones of brown, blue and beige. The furniture is mahogany.

An alternate scheme would include: soft gray-green walls, beige silk damask curtains, red damask upholstery. The sconces, clock and picture frames would be gilt.

This original Federal period dining room will give you ideas for using the furniture and fabrics shown in the panels at right. Or reproductions of similar pieces are appropriate.

DINING ROOM FABRICS

Dining tables, side tables, console

THE BEDROOM

This bedroom shown above is typical of those found in fine houses during the Federal period. Walls, woodwork and chimney piece are painted moss green. The upholstery is beige damask, except for yellow satin on the desk chair. The rug is in two tones of burgundy with a design of green, pink and white. On the walls are engravings in gilt frames.

An alternate color scheme would have walls and woodwork painted peach color. The rug would then be olive green with a design in yellow and pink. The upholstery would be blue, except for red satin on the seat of the desk chair. Other furniture and fabrics suitable for this room are shown at right.

BEDROOM FABRICS

Four-poster and other types of bed

Another characteristic subtlety is the raised hairline of wood, known as a cock beading, which is used to finish the edges of drawers. Phyfe used white wood linings for the drawers in his furniture, instead of the pine linings universally employed by other American cabinetmakers of this period.

Brass ornaments (probably for the most part imported) are used extensively on Federal pieces. They have brass feet and casters, ring handles, and other types of applied ornament. Toward the end of the period, about 1825, china and glass knobs began to supplant brass rings as drawer pulls.

The new United States was in its first throes of nationalism; consequently its emblem, the eagle, appears everywhere — on transparencies in windows, painted on fans, inlaid in mirrors, desks, knife boxes, and brass work. The "Spread Eagle" became a favorite tavern sign. All kinds of historic scenes and patriotic emblems appear as decoration on clocks.

And yet, the Classic influence was even stronger than the patriotic. Earthenware and porcelain such as Crown-Derby, Worcester,
and Wedgwood were molded in Classic forms and painted with delicate sepia figures in Classic robes. Silver and Sheffield plate (the latter replacing pewter) also followed Classic forms. Ireland sent Waterford glass. Fabrics most used were damask, brocade, satin, taffeta, haircloth, toile de Jouy, printed cotton, and silk.

Woods most used were mahogany, cherry, and maple; and fruit woods in less splendid furniture. Curly maple often replaced the satinwood used in European models. After 1800 rosewood was used for the more costly furniture. The Federal motifs derive almost exclusively from classical sources. The acanthus leaf, the lyre, the saber leg, the lion's mask and paw, the bowknot, rosettes, thunderbolts, trumpets, and drapery swags are all to be found on the list of standard Federal furniture motifs. After the War of 1812, when the Federal era rose to its zenith of popularity, the laurel, cornucopia, and eagle motifs became especially popular (See Fig. 2). Phyfe's treatment of the acanthus leaf is so typical that many of his pieces depend upon...
Fireplace designs

Hapery treatments for five different types of window

Secretaries, bookcases, cabinet, chest

Desks, tables, piano, music desk

Living room accessories

this for their identification. It is simplified into a series of rounded grooves and ridges with a raised tapering ridge up the center.

The lyre was used to fill in the backs of chairs, to decorate the arms of sofas, and (split apart) to support mirrors on dressing tables. Two crossed lyres are used as support for a pedestal table.

Fig. 2 (Continued)
The Exterior

Typical of the better country houses in the second half of the 18th Century is this design from Abraham Swan's British Architect, one of the many handbooks of builders' designs, which at this period carried news of architectural fashions from England to America. At right are close-up details of the Georgian background.

The Living Room

The pine-panelled walls in this characteristic Georgian living room are left unstained. The silk curtains are richly embroidered in many colors on a yellow ground which echoes the gilt frames used for pictures and mirrors. The crimson upholstery of the mahogany furniture is given added quality by the olive green carpet.

An alternative color scheme would be to have the walls painted dark grey-green with carving picked out in gold. The wall-to-wall carpet would be taupe, the upholstery of the wing chairs yellow damask. In both color schemes needlepoint and natural leather would be used for upholstering other chairs in the room.

Chippendale was a dominating factor in the history of Georgian furniture design and his name serves as a convenient tag for the period centering in the reign of the second of the three Georges who provide the period title. Yet this English cabinetmaker achieved eminence not so much by his own work as by that of his copyists. They all used the designs in The Gentleman and Cabinet-Makers' Director, published by Chippendale in 1754. To fill this book Chippendale commandeered all the ideas he could lay his hands on and then embroidered them with his own fancy, adapted them to his own forms. He plundered the design manuals of China and the French rococo, of the ancient Gothic masters, and of his immediate predecessors in the English furniture trade.

From the craftsmen of the early eighteenth century Chippendale borrowed such tested forms as the cabriole leg, the claw-and-ball foot, and the typical acanthus leaf ornament. But to each of them he added a grace and charm of which the earlier furniture makers had never been capable. Thomas Chippendale was a typical product of that brilliant English society which flourished during the mid-eighteenth century.
Residential Spaces

PERIOD FURNITURE

18th Century English: Georgian

THE DINING ROOM

Here the walls are pine-paneled, the wood being left its natural honey color. The consoles are also of pine. But brilliant against this pale background are the red damask curtains, and the mahogany furniture with its red and yellow striped silk upholstery.

Alternatively, the walls might be painted light blue as a background for yellow brocade curtains. The mahogany table and chairs stand on an Oriental rug which repeats colors found in the needlepoint upholstery. In the panels at right is furniture suitable for a room of this style.

THE BEDROOM

Characteristic of the Georgian period are the richly embroidered Chinese silk draperies and the delicately fretted four-poster bed in this room. The dominant tone is yellow, against which is posed green upholstery, with a gun-metal carpet for base, putty walls for background.

Alternatively, the walls could be pale green, the carpet brown, the upholstery blue-green and yellow, the ceiling pale apricot. In the panels at right are other pieces suitable for a room of this type. Modern reproductions of such authentic pieces are available in good furniture stores.

was a contemporary of Josiah Wedgwood, the potter, and of Edmund Burke, the orator. Boswell and Johnson, Benjamin Franklin, Garrick, Gibbon, and Graham, all added their wit and intelligence to the creation of a sturdy culture.

Thomas Chippendale served their changing taste and their fashionable whims. In his later years he was engaged in making furniture of classic, elegant simplicity for the brothers Adam. His earlier work to his own designs, his love of gild and gaudy color his fascination with the exotic - all typical of the age in which he lived - suggest that he might have made a brilliant stage designer. Chippendale is the first personality in the history of furniture style. This was due less to his fine craftsmanship than to his ability as a publicist. He was the first cabinetmaker to publish a book of furniture designs. The influence of his Director was particularly strong in Philadelphia, but the American cabinetmakers usually simplified his exuberant ornament to suit their clients' taste and
their workers' skill in carving. For it must be remembered that many of the published designs were too complex for reproduction in the solid, even by the most highly skilled English carvers. Such designs were intended for inspiration only.

The introduction of mahogany about 1725 was a fundamental influence on furniture design. Rosewood was another material in favor. Pine was used for paneling and also for intricate carving as, for example, on mirror frames. In the latter case it was usually gilt. Amboyna was occasionally used, mostly for inlays. But the considerable use of inlay is not found until the late Georgian period. From China come the rectangular leg and an infinite variety of fretted ornament, as well as the more obviously Oriental pagoda forms. From the France of Louis XV come the elaborate combinations of foliated C and S scrolls so typical of the rococo style of ornament. These came to a lush flowering in furniture hardware and gilt mirror frames. Serpentine fronts and sides broke down
even the solid rectangular forms of such traditionally four-square pieces as chests of drawers and tables. (For typical profiles and decorative motifs see Fig. 3.)

Romance was sought in the past as well as the East; the pointed Gothic arch and bugeoning crockets turn up in all kinds of furniture and decoration.

Fig. 3 (Continued)
THE EXTERIOR

The exterior of a later Georgian house, such as the one shown above, would have been finished in cream-painted stucco with stone trim. The Classic detail was in carved stone or molded stucco. At right are details of the architectural background at this period.

THE LIVING ROOM

Green brocade curtains, bound with gold, and green brocade upholstery on the sofa and adjacent chairs stand out brilliantly against the French white of these walls, A damask in tones of coffee and gold is used for the other chairs, a red moire for the other sofa. All these colors are repeated in the rug. The dark brown red of polished mahogany appears in the doors and furniture. Some of the smaller pieces are inlaid with satinwood.

Alternatively the walls might be pale pink with white moldings. Upholstery would be blue green except for the chairs by the fire in lemon yellow brocade and the sofa in gold satin.

Chippendale went for inspiration to Chinese and Gothic decoration. The great designers of the later Georgian period — the brothers Adam, George Hepplewhite, and Thomas Sheraton — were entranced by the recently discovered Classic glories of Pompeii and Herculaneum, and by the slim prettiness in vogue at the French court.

The motifs most characteristic of the later Georgian period (see Fig. 4) are all of Classic origin: acanthus leaf and honeysuckle, ram’s head, winged griffin and lion, laurel, and garland.

Characteristic of this period is the perfect coordination between architects, painters, and furniture designers. The four Adam brothers — John, Robert, James, and William, who trademarked themselves the Adelphi (Greek for brothers) — were Scots by birth, architects by profession. They did not consider their job at an end when they had designed the shell of a house. Every detail of furnishing, decoration, and lighting was especially designed by the Adams to give a rounded effect. Nothing was too small or unimportant to deserve their attention. The best craftsmen would then be employed to carry out their designs. Chippendale and Hepplewhite, perhaps Sheraton also, made furniture for the Adams.

All these designers followed Chippend-
The pale blue-green walls are relieved by grisaille paintings in delicate Classic taste. Gold appears in the leather chair seats, in the mirror above the consoles and in the binding of the white curtains. Green and beige enliven the carpet and painted ceiling design.

Alternatively the wall paintings might be brighter and more varied in color, including Naples yellow, mauve and green. Curtains and chair seats would be cherry, the ceiling painting cinnamon brown and white.

Pale colors are dominant here. The sofa, painted oyster white, is upholstered in apple green satin. The mahogany bed is covered in white taffeta trimmed with apple green, and the armchair upholstery is cinnamon and gold-striped damask. Curtains are white silk, gold-trimmed.

Alternatively the color scheme might be based on gold and white with kiso green silk on the bed and yellow satin upholstery on the armchair for contrast. In the panels to the right are a number of authentic pieces which might be used in a Georgian bedroom such as this.

Hepplewhite's work is usually characterized by his affection for curves, Sheraton's by a preference for straight lines. This was probably because Hepplewhite was more strongly influenced than Sheraton by contemporary French work, which was enlivened by a profusion of delicate curves. Of particular interest in Sheraton's work are his designs for ingenious folding and multipurpose furniture such as folding beds, combined bookcases and washstand, and couches that folded up to become tables. These were designed for use in those bedrooms which were now doubling as parlors during the day.

This later Georgian period has often been labeled the Age of Satinwood. All the designers eagerly exploited the possibilities of ve-
Armchairs, side chairs

Commodes, sideboards, cupboard

Dining-room accessories

Chests of drawers, wardrobes, commodes

Dressing tables, secretaries, candlestands

Bedroom accessories

**Residential Spaces**

**PERIOD FURNITURE**

18th Century English: Late Georgian

Armchairs, side chairs

Commodes, sideboards, cupboard

Dining-room accessories

Chests of drawers, wardrobes, commodes

Dressing tables, secretaries, candlestands

Bedroom accessories

Hepplewhite and Inlay with woods such as satinwood and amboyna, ebony, sycamore, holly, kingwood, and lime, ivory and brass inlay were often used to mark key plates.

Some of these motifs (the acanthus leaf, for example) had been in use by English designers for more than half a century. But now, reintroduced from Italy by means of measured drawings, they take on a fresh elegance. Italian painters were brought in—Pergolesi, Zucchi, and Cipriani—to provide the background of decoration. Angelica Kaufmann, a Swiss, filled their wreathed panels with neo-Classic figures.

Yet the solid tradition of English craftsmanship remained intact beneath all these changing fashions. The basic proportions remain almost inviolate. Hepplewhite attempted (in his own words) "to unite elegance with utility and to blend the useful with the agreeable."
Residential Spaces

PERIOD FURNITURE
18th Century English: Late Georgian

Fireplace designs

Interior doorways

Drapery treatments for Late Georgian windows

Secretaries, bookcases, desks, cabinets

Occasional tables, grandfather clocks

Living room accessories

Decorative panels and mouldings

Bordure and friezes

Fig. 4 (Continued)
The typical Directoire château shows French Renaissance tradition crossed with the newer Classic vogue. The center panel of this façade is of stone, the remainder in two shades of painted stucco, perhaps in such gay colors as salmon, tan and blue.

The exterior

THE LIVING ROOM

A characteristically pale range of colors keeps this room in period. The walls are a pinkish gray, the doors gray and gold. The curtains are oyster white bound in gray and the rug predominantly white except for green and gold in the center. Green recurs in the upholstery of the armchair, side chairs and sofa, and gold (satin) in the sofa and méridienne by the fireplace.

For added color the fireside pieces might be upholstered in red satin, the other furniture in gold and blue striped satin. In panels at right are other pieces suitable for such a room.

The Directoire was France's recovery period after the shock of a six-year revolution. The Directoire, established in 1795, lasted only a brief four years; but this was long enough for the designers to sketch in the outlines of a new style. Those outlines were to be filled in later as Directoire merged into Empire; these are but two stages in a single style.

With the rise of Napoleon to absolute power, the delicate style of the Directoire was taken over and developed "for the good of the State." It was to be made into a French national style thoroughly imbued with the political principles which were to guide the new state.

Imperial Rome was found to provide the dignity and impressiveness required in the prototype, so all the imperial symbols were converted to use. The symmetrical shapes of heavy proportion were taken over unchanged, copied in wood instead of being reproduced in stone or bronze.

Most pieces displayed large surfaces of highly polished wood, usually mahogany. They were not, as a rule, decorated by molding or paneling, or even by carving. Ornamentation was almost always applied or inlaid. Most typically it took the form of gilded bas reliefs tacked to the smooth wood sur-
Residential Spaces

PERIOD FURNITURE
Late 18th–Early 19th Century French: Directoire and Empire

### THE DINING ROOM

![Image of a dining room]

The rich brown of polished mahogany in this table is surrounded by chairs painted gold and white, upholstered in blue satin. The walls are painted oyster white and are decorated with yellow moldings. Above the doors are white Classic figure paintings with a blue background which is echoed in the blue taaffeta curtains. Alternatively the walls might be painted green with the cornice picked out in white and gold. The chairs would then be upholstered in red. Other pieces suitable for a room of this type are shown in the panels at right.

### Dining-room fabrics

- Painted silk
- Printed silk
- Silk damask

### Side chairs, armchair

- Armchair with leather seat designed by Joseph Joubert
- Chair of mahogany and leather

### THE BEDROOM

![Image of a bedroom]

Pink walls decorated in white and gold provide a good background for this mahogany and rosewood furniture. Relieved with brass mounts, fabrics are gayly colored here: blue taaffeta for curtains and bed canopy, striped yellow and red satin for the chairs, and yellow satin for the two stools (which have white-painted frames).

An alternative color scheme would have dark beige walls, green taaffeta for the curtains and bed canopy. Most of the furniture would be painted white and gold. At right are other pieces and fabrics suitable for this type of room.

### Bedroom fabrics

- More
- Print silk
- Silk damask

### Beds, chaises longues, méridiennes

- Mahogany bed with satin and linen decoration
- Chaise longue with satin and linen upholstery
- Mahogany chaise longue with upholstered seat
- Mahogany sofa upholstered in yellow satin
- Mahogany bed with upholstered seats

faces. Painted decoration was more commonly used on walls and ceilings than for furniture.

The general color scheme is rich, dark, and somewhat heavy. Rich deep mahogany, French polished and often stained red, was the favorite material. Rosewood and ebony were also in favor. Where other woods were used, their nature was concealed by staining to imitate the more popular species.

Round tables were popular. They usually stood on a pedestal or tripod base. The top was commonly of porphyry or marble. Beds developed into Classic ceremonial couches with scrolled ends. The popular craze for all things Roman extended to include women's dresses and Lucullian banquets.

In the early (Directoire) part of the period, fabrics were quite delicately colored, the decorative motifs still possessed some Gra-

From each of his campaigns he brought home some new decorative motif which he would turn over to his craftsmen for use in the net batch of furniture made to his order.
The Egyptian campaign yielded an impressive collection of sphinxes, pyramids, obelisks, and lotus leaf capitals. From Italy came all the paraphernalia of Imperial Roman decoration, acanthus leaves, laurel wreaths, torches, winged victories, cornucopias, and the rest, including the famous wreath of bees. Napoleon is usually accused of having appropriated from the arms of an old Italian family, the Barberini.

The early Empire pieces (Directoire) are simplified versions of the styles current under Louis XVI. These pieces have grace, simplicity, and charm. The hampering restrictions on foreign trade led to the use of native fruitwoods instead of mahogany.
Residential Spaces

PERIOD FURNITURE
Late 18th-Early 19th Century French: Directoire and Empire

Fireplace designs

Interior Doorways

Hudery treatments for Directoire windows

Armchairs, stools

Secretaries, bookcases, occasional tables

Living-room accessories

Typical legs, feet and arm

Metal mounts and latches

Fig. 5  (Continued)
Residential Spaces

PERIOD FURNITURE

17th and 18th Century American: Colonial

Colonial style

FIG. 1
Low Post Bed

FIG. 2
Rush Seated Bench

FIG. 3
Small Tea Table

FIG. 4
17th Century Arm Chair

FIG. 5
Corner Dresser

FIG. 6
Bow Back Windsor Arm Chair

FIG. 7
Pennsylvania Dining Table

FIG. 8
Banister Back Side Chair

FIG. 9
Tavern Table

FIG. 10
Pine Wind Chair

FIG. 11
Tilt Top Table with Snake Feet
Residential Spaces

PERIOD FURNITURE

17th and 18th Century American: Colonial

Colonial style
Though Duncan Phyfe adapted freely from the work of Sheraton, Hepplewhite & others he developed a distinct style.

Duncan Phyfe style
Residential Spaces

PERIOD FURNITURE
18th Century English: Early Jacobean

Early Jacobean period
Period Furniture

17th Century English: William & Mary

Fig. 1. William & Mary Highboy with Trumpet Turned Legs

Fig. 2. Shool

Fig. 3. Straight Top Secretary

Fig. 4. Lowboy. These were the dressing tables of the period.

Fig. 5. William & Mary Arm Chair

Fig. 6. Double Hood China Cabinet

Fig. 7. Lacquered Cabinets

Fig. 8. Tall Clock

Fig. 9. Card Table

William and Mary period
Residential Spaces

PERIOD FURNITURE

18th Century English: Queen Anne

Queen Anne period

The typical woods for Queen Anne furniture are Walnut, Mahogany

Was sometimes used.
Residential Spaces

PERIOD FURNITURE

18th Century English: Georgian (Chippendale)

FIG. 1
CHEST OF DRAWERS

FIG. 4
 TABLE OR DINING TABLE

FIG. 5
CARD TABLE

FIG. 2
HIGHBOY

FIG. 6
SWING LEG DINING TABLE

FIG. 8
CAMEL BACK SOFA

FIG. 10
FIRE SCREEN

Chippendale style
Residential Spaces

PERIOD FURNITURE

18th Century English: Late Georgian (Hepplewhite)

Hepplewhite style
The ornament on this sideboard table as well as the pilasters is carved in low relief. The height of the tables may be as much as 3 ⁹/₁₆ feet, as is the case when the proportions are varied accordingly.

**Brothers Adam Sideboard with Characteristic Classic Motifs.**

The Brothers Adam began the classical era in furniture of the Eighteenth Century. The legs, as viewed from the front were straight as may be seen on this plate. The plan views of tables, cabinets, and chairs showed fronts and oval fronts. The variety of ornament used was very great. It was rather architectural in character, having been influenced by the study of Roman ruins that Robert Adam made.

**Fig. 3**

Lyre Back Arm Chair

**Fig. 4**

Fire Screen

**Fig. 5**

Bookcase

**Fig. 6**

Window Seat

**Fig. 7**

Commode

Residential Spaces

PERIOD FURNITURE

18th Century English: Late Georgian (Brothers Adam)
All the furniture designed by the Brothers Adam was built by others. Hepplewhite, Chippendale, & others executed the commission. Most of these, marked with the possible exception of Chippendale were influenced by the work of these architects.

While the furniture is very formal in character, it is also very beautiful and tasteful. No detail was too small to receive their attention. Besides the ordinary pieces they designed lighting fixtures, upholstery, & numerous accessories.

The Brothers Adam were architects & the furniture they designed was intended for definite places in the houses they built. For this reason some of the pieces were large, as is the case of the table & mirror shown above. Some bookcases were made quite long. The proportions however, seem in most cases to have been excellent. It was only because of a desire to have every detail perfect in the houses they built that they designed the furniture for which they are famous today.

The doors of these cabinets were occasionally on the ends. The hand painted panel was the work of a famous artist.
The Important Periods in the French Styles Were Louis XIV, XV, \& XVI.

**Louis XVI Chair.** Backs are sometimes tapered toward the floor - that is they were wider at the top than at the floor. In this case, the back legs were square below the seat.

**Louis XIV Arm Chair.**

**Louis XVI Side Chair.**

**Louis XV Seat.**

**Louis XIV Side Chair.**

**Louis XV Seat.**

**Louis XVI Arm Chair.**

**Louis XIV Arm Chair.**

**Louis XV Chaise Longue.**

The fabrics used in upholstery for Louis XIV furniture were treasured, Pomegranate, Cuffs, and Satin. Tapestries of gold and silver, in Tapestries and Satins were employed. Louis XV pieces were upholstered with the same materials as those of Louis XIV, but decorative motifs differed somewhat. The formal element gave way to the highly decorative, small, leafy motifs. In Louis XVI pieces, the fabric was decorated with floral bouquets, ribbons, garlands of fruit, flowers, cups, on top of colors, predominantly in this style.
Residential Spaces

PERIOD FURNITURE

16th and 17th Century Spanish

These cabinets originated in Spain during the 16th Century. They were often used as a desk, and are easily the most important contribution of Spain to the furniture world.

17th Century chest with chip carved panels laid out in geometric designs, interrupted channel grooves on领导小组。

Panels & Styles. Spanish chests vary greatly in character. Some are designed with round lids, some are fastened by turned legs, others are covered with tooled leather or carved in Gothic, etc.

Cupboards of the 16th Century, Renaissance period. These cupboards were used to hold food such as bread, cheese & wine.

Spanish styles
<table>
<thead>
<tr>
<th>Period style</th>
<th>Associated styles</th>
<th>Walls and ceilings</th>
<th>Floors</th>
<th>Floor coverings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early English</td>
<td>Italian Renaissance</td>
<td>Oak panels</td>
<td>Hardwood flooring</td>
<td>Plain rugs</td>
</tr>
<tr>
<td>Tudor</td>
<td>Spanish Renaissance</td>
<td>Rough plaster with oak trim</td>
<td>or</td>
<td>patterned domestic rugs</td>
</tr>
<tr>
<td>Jacobean</td>
<td>William &amp; Mary</td>
<td>Parquetry ceilings</td>
<td>Stone</td>
<td>Oriental and large-patterned domestic rugs</td>
</tr>
<tr>
<td>Charles II</td>
<td>Larger pieces of Queen Anne</td>
<td></td>
<td>Tiles</td>
<td>Plain rugs</td>
</tr>
<tr>
<td>Anglo-Dutch</td>
<td>Chippendale</td>
<td>Papered</td>
<td>Hardwood flooring</td>
<td>Oriental and large-patterned domestic rugs</td>
</tr>
<tr>
<td>William &amp; Mary</td>
<td>Early Georgian</td>
<td>Painted (in light tones)</td>
<td></td>
<td>Plain rugs</td>
</tr>
<tr>
<td>Queen Anne</td>
<td>Louis XVI</td>
<td>Hung with fabric</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Smaller pieces of Jacobean, such as gate-leg table or Windsor chair</td>
<td>Paned</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early Georgian</td>
<td>Chippendale</td>
<td>Painted dado</td>
<td>Hardwood flooring</td>
<td>Plain or small-patterned rugs or carpets</td>
</tr>
<tr>
<td></td>
<td>Early Georgian</td>
<td>Painted</td>
<td></td>
<td>Oriental rugs</td>
</tr>
<tr>
<td></td>
<td>Louis XVI</td>
<td>Paned</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Smaller pieces of Jacobean, such as gate-leg table or Windsor chair</td>
<td>Papered upper section</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late Georgian</td>
<td>Chinese Chippendale</td>
<td>Plain plaster</td>
<td>Hardwood flooring</td>
<td>Plain or small-patterned rugs or carpets</td>
</tr>
<tr>
<td>Adam</td>
<td>Chippendale</td>
<td>Painted</td>
<td></td>
<td>Oriental rugs</td>
</tr>
<tr>
<td>Hepplewhite</td>
<td>Louis XVI</td>
<td>Paned</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sheraton</td>
<td>Duncan Phyfe</td>
<td>Large wood panels painted</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empire</td>
<td>Directoire</td>
<td>Gesso ceilings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal</td>
<td>All late Georgian styles 1 or 2 pieces of Directoire</td>
<td>Large wood panels painted and decorated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Louis XIV, XV, and XVI</td>
<td>Italian Renaissance</td>
<td>Wallpaper in Chinese motifs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Early English</td>
<td>Plain plaster</td>
<td></td>
<td>Spanish or Oriental rugs</td>
</tr>
<tr>
<td></td>
<td>Louis XV</td>
<td>Painted</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Paned</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spanish Renaissance</td>
<td>All late Georgian styles</td>
<td>Wood panels painted</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 or 2 pieces of Directoire</td>
<td>and decorated</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wallpaper in Chinese motifs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early Colonial</td>
<td>Oak panels</td>
<td>Hardwood flooring or</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>William &amp; Mary</td>
<td>plank</td>
<td>Braided or hooked rugs</td>
<td></td>
</tr>
<tr>
<td>Queen Anne</td>
<td>Queen Anne</td>
<td>with oak</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>wing chair</td>
<td>Parquetry ceilings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early American</td>
<td>Late Georgian</td>
<td>Smooth plaster, light trim</td>
<td>Dark hardwood flooring</td>
<td>Hooked, braided, Oriental, or domestic rugs</td>
</tr>
<tr>
<td></td>
<td>Chippendale</td>
<td>Wallpaper, scenic and</td>
<td>Vinyls in plain or jaspe</td>
<td>Carpet, plain, two-toned patterned</td>
</tr>
<tr>
<td></td>
<td>Queen Anne</td>
<td>Chinese designs</td>
<td>patterns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Duncan Phyfe</td>
<td>Paneling</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>French Provincial</td>
<td>Ceiling plaster</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modern</td>
<td>Swedish Modern</td>
<td>Painted solid colors,</td>
<td>Hardwood flooring</td>
<td>Rugs in solid colors, geometric patterns</td>
</tr>
<tr>
<td></td>
<td>Chippendale</td>
<td>striped, figured</td>
<td>Parquetry</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plain papers</td>
<td>Vinyls in modern pattern</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Combinations of above</td>
<td></td>
<td></td>
</tr>
<tr>
<td>French Provincial</td>
<td>18th-century American</td>
<td>Smooth plaster</td>
<td>Hardwood flooring</td>
<td>Aubussons Home spun carpet, small-patterned</td>
</tr>
<tr>
<td></td>
<td>Colonial</td>
<td>Wallpaper in scenic or</td>
<td></td>
<td>Oriental rugs</td>
</tr>
<tr>
<td></td>
<td>Federal</td>
<td>geometric designs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Victorian</td>
<td>Colonial</td>
<td>Painted solid colors,</td>
<td>Hardwood flooring</td>
<td>Oriental rugs</td>
</tr>
<tr>
<td></td>
<td>William &amp; Mary</td>
<td>striped, figured</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Queen Anne</td>
<td>Plain papers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Residential Spaces**

**Furniture Dimensions**

Children's Furniture and Tables

### Children's Furniture

| DIAPER CHANGER | H: 36" - 42" | W: 22" - 42" | D: 21" - 24" |
| POTTY CHAIR | H: 12" - 13" | W: 16" - 17" | D: 14" - 16" |
| FEEDING UNIT | H: 24" - 25" | W: 14" - 16" | D: 24" - 25" |
| HIGH CHAIR | H: 36" - 40" | W: 16" - 20" | D: 16" - 20" |
| SIDE CHAIR | H: 23" - 25" | W: 14" - 15" | D: 15" - 17" |
| ARM CHAIR | H: 23" - 25" | W: 14" - 15" | D: 15" - 17" |
| TABLE for 2 | H: 20" - 22" | W: 24" - 30" | D: 24" - 25" |

### Table for 4

| H: 20" - 22" | W: 36" - 42" | D: 36" - 42" |

### Tables

| END/SIDE | H: 30" | W: 36" | D: 20" |
| END/SIDE | H: 18" | W: 20" | D: 20" |
| END/SIDE | H: 18" | Diam. 18" |
| LOW/COFFEE | H: 18" | W: 36" | D: 24" |
| LOW/COFFEE | H: 18" | W: 36" | D: 36" |
| LOW/COFFEE | H: 18" | Diam. 36" |

### Stools

| STOOLS | H: 18" | W: 18" | D: 18" |

### Entry/Hallway

| ENTRY/HALLWAY | H: 33" | W: 48" | D: 20" |
Residential Spaces
FURNITURE DIMENSIONS
Sofas, Loveseats, Lounge Chairs, and Arm Chairs

**SOFAS**
- Sectional sofa
- Apartment-size sofa
- Full-size sofa

**LOVESEATS, LOUNGE CHAIRS, AND ARM CHAIRS**
- Loveseat
- Upholstered chair
- Lounge chair
- Arm chair
- Side chair
- Folding chair
- Chaise lounge
- Right corner
- Left corner
- Armless
- Ottoman
- Angled sectionals
Figure 1 provides the designer with an array of typical bed and mattress sizes with which rooms can be planned. Tables 1 and 2, however, suggest that within the bedding and mattress industries there exists a wide range of sizes from which to select. Many manufacturers use bed/mattress terminology that reflects different dimensional standards than that of other manufacturers. Ultimately, the designer, in consultation with the client, must verify exact measurements. Be sure to take your clients to see and test the bed or mattress selected. After all, they are the ones who will have to sleep on it.

**TABLE 1  Juvenile, Youth, and Adult Mattress Types and Sizes**

<table>
<thead>
<tr>
<th>Mattress Type</th>
<th>Width (in)</th>
<th>Length (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bassinet</td>
<td>17  23</td>
<td>36  40</td>
</tr>
<tr>
<td>Portable crib</td>
<td>22  26</td>
<td>45  52</td>
</tr>
<tr>
<td>Junior crib</td>
<td>24  32½</td>
<td>46  58</td>
</tr>
<tr>
<td>Youth bed</td>
<td>33  36</td>
<td>66  76</td>
</tr>
<tr>
<td>Bunk bed</td>
<td>30  33</td>
<td>75  76</td>
</tr>
<tr>
<td>Dorm bed</td>
<td>32  36</td>
<td>75  80</td>
</tr>
<tr>
<td>Hospital bed</td>
<td>36  36</td>
<td>75  80</td>
</tr>
<tr>
<td>Narrow twin</td>
<td>36  36</td>
<td>74  75</td>
</tr>
<tr>
<td>Twin bed</td>
<td>39  39</td>
<td>75  80, 84</td>
</tr>
<tr>
<td>Full-size or double</td>
<td>54  54</td>
<td>74  75</td>
</tr>
<tr>
<td>Queen-size bed</td>
<td>60  60</td>
<td>80  84</td>
</tr>
<tr>
<td>King-size bed</td>
<td>76  76</td>
<td>80  84</td>
</tr>
<tr>
<td>Extra-long double</td>
<td>54  54</td>
<td>80  80</td>
</tr>
<tr>
<td>Super twin</td>
<td>45  45</td>
<td>75  80</td>
</tr>
</tbody>
</table>

**TABLE 2  Pillow Types and Sizes**

<table>
<thead>
<tr>
<th>Pillow Type</th>
<th>Width (in)</th>
<th>Length (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>18  20</td>
<td>26  27</td>
</tr>
<tr>
<td>Queen</td>
<td>19  21</td>
<td>29  30</td>
</tr>
<tr>
<td>King</td>
<td>20  22</td>
<td>35  36</td>
</tr>
</tbody>
</table>

*Note: Many manufacturers also make and sell undersized pillows for cribs and youth beds as well as oversized pillows for the larger beds.
Residential Spaces

FURNITURE DIMENSIONS
Waterbeds, Sofa Beds/Convertible Sofas, and Wall Beds

WATERBEDS

<table>
<thead>
<tr>
<th>Twin</th>
<th>Single</th>
<th>Double</th>
<th>Queen</th>
<th>King</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterbeds</td>
<td>Waterbeds</td>
<td>Waterbeds</td>
<td>Waterbeds</td>
<td>Waterbeds</td>
</tr>
<tr>
<td>39&quot;</td>
<td>48&quot;</td>
<td>54&quot;</td>
<td>66&quot;</td>
<td>78&quot;</td>
</tr>
<tr>
<td>Width</td>
<td>Width</td>
<td>Width</td>
<td>Width</td>
<td>Width</td>
</tr>
</tbody>
</table>

SOFA BEDS/CONVERTIBLE SOFAS

96-in-diam round

WALL AND SIDE BEDS

<table>
<thead>
<tr>
<th>Side</th>
<th>Wall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>Depth</td>
</tr>
</tbody>
</table>

A Width of Bed  B Width of Clear Door Opening  C Depth From Back of Closet To Back of Doors  D Projection of Bed In Use From Back of Closet

<table>
<thead>
<tr>
<th>39&quot;</th>
<th>79&quot;</th>
<th>13&quot;</th>
<th>43 1/2&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>48&quot;</td>
<td>79&quot;</td>
<td>13&quot;</td>
<td>52 1/2&quot;</td>
</tr>
<tr>
<td>54&quot;</td>
<td>79&quot;</td>
<td>13&quot;</td>
<td>57&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEIGHT: FLOOR TO TOP OF OPENING 44 1/2&quot; for 39&quot; Bed, 53 1/4&quot; for 48&quot; Bed, 59&quot; for 54&quot; Bed.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A Width of Bed  B Width of Clear Door Opening  C Depth From Back of Closet To Back of Doors  D Projection of Bed In Use From Back of Closet

<table>
<thead>
<tr>
<th>39&quot;</th>
<th>42&quot;</th>
<th>19&quot;</th>
<th>85 1/2&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>54&quot;</td>
<td>57&quot;</td>
<td>19&quot;</td>
<td>85 1/2&quot;</td>
</tr>
</tbody>
</table>

HEIGHT: FLOOR TO TOP OF OPENING 80" - For 39", 48", and 54" Beds of Standard 78" Length 85" - For Queen, King and Extra Long Beds All 80" in Length

47
Residential Spaces

FURNITURE DIMENSIONS

Audio-Visual Equipment

19-in television
Rear-projection television
Front-projection television
VCR
Laser disc player

Tape recorder
Turntable
Receiver
CD player
Storage rack
The shape of the viewing area is approximately as shown in Fig. 2. Its size is always based on the size of the image to be viewed. The human eye comprehends detail only within a limited cone angle (about 2½ minutes of arc), and the length of chord subtending this arc, i.e., the image of width, varies with its distance from the observer. Thus an object 20 feet away and 6 feet long appears the same as a similar object 10 feet away and 3 feet long. The size of the viewing area is determined by three dimensions:

- the minimum distance (1), which is the distance from the nearest part of the image to the eye of the closest viewer
- the maximum distance (2), which is the distance from the furthest part of the image to the most distant viewer
- the maximum viewing angle (3), which is the angle between the projection axis and the line of sight of a person located as far from this axis as can be and still see all image detail in proper brilliance

Practical minimum and maximum distances are both expressed as multiples of the image width (W). They vary both with the medium being used and with the type and quality of material being projected, and may be affected also, in some degree, by personal preferences. They have not yet been precisely determined by scientific methods, and it's doubtful that such data would have much practical value anyway. The generally accepted values, resulting from numerous studies, are these:

<table>
<thead>
<tr>
<th>Film, slides, and projected TV</th>
<th>TV receivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum distance</td>
<td>2W</td>
</tr>
<tr>
<td>Maximum distance</td>
<td>6W to 10W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size of TV tube</th>
<th>Minimum viewing distance 4W</th>
<th>Maximum viewing distance 12W</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 in</td>
<td>4 ft 11 in</td>
<td>14 ft 9 in</td>
</tr>
<tr>
<td>19 in</td>
<td>5 ft 1 in</td>
<td>15 ft 2 in</td>
</tr>
<tr>
<td>21 in</td>
<td>6 ft 4 in</td>
<td>19 ft 0 in</td>
</tr>
<tr>
<td>23 in</td>
<td>6 ft 6 in</td>
<td>19 ft 4 in</td>
</tr>
<tr>
<td>24 in</td>
<td>7 ft 6 in</td>
<td>21 ft 5 in</td>
</tr>
<tr>
<td>27 in</td>
<td>9 ft 8 in</td>
<td>24 ft 5 in</td>
</tr>
</tbody>
</table>
Residential Spaces

FURNITURE DIMENSIONS

Fig. 3 Typical dining room furniture.

Fig. 4 Typical living room furniture.
INGRAM HIGH CHAIR
DESIGNER: Charles R. Macintosh
YEAR: 1900
MANUFACTURER: Atelier International
DIMENSIONS: 18¼"W x 17¼"D x 59¼"H

WASSILY CHAIR
DESIGNER: Marcel Breuer
YEAR: 1925
MANUFACTURER: Knoll International
DIMENSIONS: 30½"W x 20½"D x 28½"H

KUBUS CHAIR
DESIGNER: Joseph Hoffman
YEAR: 1910
DIMENSIONS: 36"W x 30½"D x 28½"H

MR. CHAIR
DESIGNER: Mies Van Der Rohe
YEAR: 1927
MANUFACTURER: Stendig
DIMENSIONS: 21¼"W x 32½"D x 32¼"H

HAU KOLLER CHAIR
DESIGNER: Joseph Hoffman
YEAR: 1911
DIMENSIONS: 35¼"W x 32"D x 37"H

LC1 SLING CHAIR
DESIGNER: Le Corbusier
YEAR: 1928
MANUFACTURER: Atelier International
DIMENSIONS: 23¾"W x 26½"D x 25½"H

MIDWAY CHAIR
DESIGNER: Frank Lloyd Wright
YEAR: 1914
MANUFACTURER: Atelier International
DIMENSIONS: 16¼"W x 13"D x 35"H

LC9 LOUNGE CHAIR
DESIGNER: Le Corbusier
YEAR: 1928
MANUFACTURER: Atelier International
DIMENSIONS: 22"W x 63"D
Residential Spaces

FURNITURE DIMENSIONS

20th Century Classic Chairs

CESCA ARMCHAIR
DESIGNER: Marcel Breuer
YEAR: 1928
MANUFACTURER: Knoll International
DIMENSIONS: 22 3/4"W x 21 1/4"D x 31 3/4"H

BARCELONA STOOL
DESIGNER: Mies Van Der Rohe
YEAR: 1929
MANUFACTURER: Knoll International
DIMENSIONS: 23"W x 22"D x 14 1/2"H

BRNO ARMCHAIR
DESIGNER: Mies Van Der Rohe
YEAR: 1929
MANUFACTURER: Stendig
DIMENSIONS: 18"W x 23"D x 31 1/2"H

CHAISE LOUNGE
DESIGNER: Mies Van Der Rohe
YEAR: 1931
MANUFACTURER: Knoll International
DIMENSIONS: 23 3/4"W x 47 1/2"D x 37 1/2"H

LC2 ARMCHAIR
DESIGNER: Le Corbusier
YEAR: 1929
MANUFACTURER: Atelier International
DIMENSIONS: 30"W x 27 1/4"D x 26 1/2"H

ZIG-ZAG CHAIR
DESIGNER: Gerrit Rietveld
YEAR: 1934
MANUFACTURER: Atelier International
DIMENSIONS: 14 1/2"W x 17"D x 29"H

BARCELONA CHAIR
DESIGNER: Mies Van Der Rohe
YEAR: 1929
MANUFACTURER: Knoll International
DIMENSIONS: 30"W x 30"D x 30"H

PAIMO CHAIR
DESIGNER: Alvar Aalto
YEAR: 1935
MANUFACTURER: Palazetti
DIMENSIONS: 23 1/4"W x 31 1/2"D x 25"H
BARREL CHAIR
DESIGNER: Frank Lloyd Wright
YEAR: 1937
MANUFACTURER: Atelier International
DIMENSIONS: 21⅛"W x 22"D x 32"H

MOLDED FIBERGLAS CHAIR
DESIGNER: Charles Eames
YEAR: 1949
MANUFACTURER: Herman Miller
DIMENSIONS: 26"W x 26⅜"D x 31"H

BUTTERFLY CHAIR
DESIGNER: Harday, Boner & Kurchan
YEAR: 1938
DIMENSIONS: 28"W x 27½"D x 36½"H

DIAMOND CHAIR
DESIGNER: Harry Bertola
YEAR: 1952
MANUFACTURER: Knoll International
DIMENSIONS: 33¾"W x 28"D x 30½"H

MOLDED PLYWOOD CHAIR
DESIGNER: Charles Eames
YEAR: 1946
MANUFACTURER: Herman Miller
DIMENSIONS: 21¾"W x 19¾"D x 29¾"H

LOUNGE CHAIR
DESIGNER: Charles Eames
YEAR: 1956
MANUFACTURER: Herman Miller
DIMENSIONS: 32½"W x 32¾"D x 33½"H

WOMB CHAIR
DESIGNER: Eero Saarinen
YEAR: 1948
MANUFACTURER: Knoll International
DIMENSIONS: 40"W x 39"D x 35½"H

OTTOMAN
DESIGNER: Charles Eames
YEAR: 1966
MANUFACTURER: Herman Miller
DIMENSIONS: 26"W x 21"D x 15"H
Residential Spaces

Furniture Dimensions

20th Century Classic Chairs

**ALUMINUM GROUP CHAIR**
DESIGNER: Charles Eames
YEAR: 1958
MANUFACTURER: Herman Miller
DIMENSIONS: 28\(\frac{1}{2}\)"W x 24\(\frac{1}{4}\)"D x 33\(\frac{3}{4}\)"H

**LOUNGE CHAIR**
DESIGNER: Richard Schultz
YEAR: 1966
MANUFACTURER: Knoll International
DIMENSIONS: 26"W x 28\(\frac{1}{4}\)"D x 26\(\frac{1}{2}\)"H

**SHERRIFF CHAIR**
DESIGNER: Sergio Rodriguez
YEAR: 1958
MANUFACTURER: OCA

**TUBO CHAIR**
DESIGNER: John Mascheroni
YEAR: 1968
MANUFACTURER: Vecta
DIMENSIONS: 32"W x 32"D x 32"H

**HAND CHAIR**
DESIGNER: Pedro Friedberg
YEAR: 1963
MANUFACTURER: Hand Crafted

**SAPPER COLLECTION**
DESIGNER: Richard Sapper
YEAR: 1977
MANUFACTURER: Knoll International
DIMENSIONS: 28\(\frac{3}{4}\)"W x 27\(\frac{1}{4}\)"D x 38\(\frac{1}{2}\)-41\(\frac{3}{4}\)"H

**PLATNER CHAIR**
DESIGNER: Warren Platner
YEAR: 1966
MANUFACTURER: Knoll International
DIMENSIONS: 36\(\frac{1}{4}\)"W x 25\(\frac{1}{4}\)"D x 30\(\frac{1}{4}\)"H

**BASIC OPERATIONAL**
DESIGNER: Niels Diffrient
YEAR: 1979
MANUFACTURER: Knoll International
DIMENSIONS: 25\(\frac{1}{4}\)"W x 21"D x 32\(\frac{1}{4}\)-36\(\frac{1}{4}\)"H
NOTHING CONTINUES TO HAPPEN CHAIR
DESIGNER: Horward Meisper
YEAR: 1981
MANUFACTURER: Art et Industrie
DIMENSIONS: 17"W x 16"D x 37"H

LOUNGE CHAIR
DESIGNER: Michael Graves
YEAR: 1982
MANUFACTURER: Sunar/Hauserman
DIMENSIONS: 32"W x 29"D x 29"H

QUEENE ANNE CHAIR
DESIGNER: Robert Venturi
YEAR: 1984
MANUFACTURER: Knoll International
DIMENSIONS: 26½"W x 23½"D x 38½"H

JEFFERSON CHAIR
DESIGNER: Niels Diffrient
YEAR: 1986
MANUFACTURER: Sunar/Hauserman
DIMENSIONS: 32½"W x 34"D x 43½"H

OTTOMAN
DESIGNER: Niels Diffrient
YEAR: 1986
MANUFACTURER: Sunar/Hauserman
DIMENSIONS: 25"W x 24"D x 17¾"H

ED ARCHER CHAIR
DESIGNER: Philippe Starck
YEAR: 1987
MANUFACTURER: Driade Italy
DIMENSIONS: 18½"W x 21½"D x 38½"H

STONE CHAIR
DESIGNER: James Kutasi
YEAR: 1988
MANUFACTURER: James Kutasi Australia
DIMENSIONS: 19¾"W x 19½"D x 35½"H
Residential Spaces

FURNITURE DIMENSIONS
Traditional Bedroom and Dining Room Furniture

BEDROOM FURNITURE

Plan  Elevation  Plan  Elevation  Plan  Elevation
Bureau  Chiffonier  Chest of drawers

Plan  Elevation
Dressing table  Makeup or powder table

DINING ROOM FURNITURE

Plan  Elevation  Plan  Elevation
Sideboard  Buffet

Plan  Elevation  Plan  Elevation
Dresser  Cupboards

Plan  Elevation  Plan  Elevation
China cabinets  Servers
Residential Spaces

FURNITURE DIMENSIONS
Traditional Sofas, Settees, and Benches

Sofas, couches, davenports, divans, lounges

Settees

Sofa

Bench

Seats (Windsor)

Dressing stools and benches
Residential Spaces

FURNITURE DIMENSIONS

Traditional Desks, Bookcases, and Chests

Desks

Bookcases

Chests

Umbrella stand
FURNITURE DIMENSIONS
Traditional Chairs

Residential Spaces

UNUPHOLSTERED CHAIRS

Kitchen chair
Side chair
Arm chairs

Windsor chairs
Dining room chairs

UPHOLSTERED CHAIRS

Wing chair
Barrel chair
Arm chairs

Rocking chair
Club chair
Tavern chair
Side chair

Office chairs
Special chairs

Arm Posture Chair
Swivel Chair
Large-with arms
Jury Chair
Judge's Chair
Tablet Arm Chair
Gossip or Tat. Booth Chair
Residential Spaces

FURNITURE DIMENSIONS

Traditional Tables

Library table

Tea and coffee tables

Serving table

Night table

Dressing table

Occasional table

Card tables

These are made in a variety of sizes, shapes, and heights, for many uses.

Drop leaf and butterfly tables

Tilt table

Draw top tables

Candle stand

Gate leg tables

Hutch table

Console table

Stands
The size of living rooms and the furniture arrangements contained within such spaces vary dramatically, depending on the size of the dwelling, the economic status and lifestyle of the user, and the relationship of the room to other areas of the dwelling. With regard to the luxury end of the scale, there are few limitations and no attempt has been made to identify the endless planning options possible. There are, however, minimum requirements and basic planning considerations that are applicable whatever the size of the space.

Minimum Requirements
A living room for a three- or four-bedroom dwelling unit requires more space for its occupants than one for a one- or two-bedroom dwelling unit. Luxury units will necessarily need more space to accommodate more furnishings. In any case, the minimum living room with no dining facilities should be approximately 180 ft² but preferably around 200 ft². Figures 1 and 2 show two living rooms with typical furniture groupings (no dining facilities).

Figure 3 shows a living room with one end used for dining. This area often is arranged in an "L" shape to achieve greater definition or privacy from the living activities. Dwelling units with three or more bedrooms should have separate dining rooms or clearly defined dining areas.

The minimum width of a living room should be 11-12 ft. This is extremely tight, however, and if at all possible the width should be at least 14 ft.

Planning Considerations
Planning considerations should include adequate floor and wall space for furniture groupings, separation of trafficways from centers of activity, and ease of access to furniture and windows.

Circulation within the living room should be as direct as possible and yet not interfere with furniture placement. Ideally, there should be no through traffic. If such traffic is necessary, it should be at one end, with the remaining portion of the room a "dead-end" space.

During social activities, people tend to gather or congregate in relatively small groups. Desirable conversation distance is also relatively small, approximately 10 ft in diameter.

When the living room is combined with the dining area, the dining area should be offset into an alcove or be clearly identified as an entity in itself.
When through traffic is unavoidable, pathways should skirt conversational or activity centers, as illustrated in (a), (b), and (c). (d) illustrates a more ideal layout in which the entire room is bypassed.
Figures 5 to 10 show various groupings and related clearances. Figure 5 shows that a space 12'6" x 15'6" should be provided in order to accommodate seating for five around a 56-in-diameter cocktail table. The piano, sofa, and cocktail table arrangement shown in Fig. 6 requires a space at least 11'0" x 16'0". Figure 7 suggests that a space at least 12'9" x 13'6" is required to accommodate a grouping to seat 6 or 7 persons, while Fig. 8 indicates that a corner arrangement for two requires a space at least 6'3" x 8'6".

When planning furniture arrangements, allowances for clearances should take into account the human dimension as well, as illustrated in Figs. 9 and 10.

It should be noted that these diagrams are not intended as models for complete living room layouts. They are intended only as guidelines to illustrate minimum clearances for preliminary planning purposes.
Fig. 11 Working drawings of a media cabinet, including plans, elevations, and sections of the installation. The design of the cabinet should take into account the actual electronic and other equipment to be housed and the clearances involved for operation. Power outlets should be coordinated and located so as to conceal unsightly wires and cables.
Fig. 12 Working drawings of a library/living room, including a plan of the space, wall elevations, and some of the many details involved.
Residential Spaces

LIVING ROOMS

Plans, Elevations, and Details

Fig. 12 (Continued)
Figure 13 shows a plan and elevations of modifications to an existing fireplace. Based on these drawings and inspection and measurement of existing conditions, the contractor prepares and submits shop drawings for the designer's approval. Since at least two trades are involved, coordination of the trades by the contractor and a thorough review of the shop drawings by both contractor and designer are essential. It is important, also, that modifications conform with all applicable codes. The extent of hearth extension, the materials used, and the distance of combustible materials from the fire box are among the numerous items governed by codes.
Fig. 14 Floor plan, elevations, and details of paneled living room/library.
Residential Spaces

LIVING ROOMS

Planning Data: Sofas

Traditional:
- Roll arms, loose-cushion back, kidney shape, solid base
- Roll arms, fixed-cushion back, tailored skirt
- Roll arms, loose-pillow back, shirred base
- Roll arms, one-piece back, solid base
- Roll arms, one-piece back, skirted base
- Roll arms, tufted
- Roll arms, fixed-cushion back, tailored skirt
- Roll arms, loose-cushion back, solid base
- Roll arms, loose-cushion back, kidney shape, pleated skirt

Contemporary:
- Curved arms, fixed-cushion back, solid base
- Dome arms, solid back, solid base
- Shaped sofa, shaped front view
- Square arms, loose-cushion back, solid base
- Miscellaneous slanted arms
- Roll arms, fixed-cushion back, shirred skirt
- Roll arms, tufted
- Roll arms, fixed-cushion back, tailored skirt
- Roll arms, fixed-cushion back, solid base
Residential Spaces

LIVING ROOMS

Planning Data: Sofas

Contemporary: wood frame arms and legs, one-piece curved back, open base

Contemporary: curved arms, fixed-cushion back, solid base

Traditional: roll arms, one-piece back, open base

Contemporary: slanted cushion arms, fixed-cushion back, open base

Contemporary: one-piece curved back and arms, wood legs, open base

Contemporary: slanted cushion arms, fixed-cushion back, open base

Contemporary: dome arms, solid back

Contemporary: square arms, fixed-cushion back, wood trim, open base

Traditional: roll arms, one-piece back, open base

Contemporary: dome arms, channel quilled back, seat, and arms, solid base

Contemporary: curved arms, fixed-cushion back, solid base

Traditional: roll arms, one-piece back, open base

Contemporary: dome arms, one-piece tufted back and seat, solid base

Contemporary: curved arms, fixed-cushion back, solid base

Contemporary: dome arms, fixed-cushion back, soft skirt

Contemporary: shaped sofa, partitioned back

Contemporary: curved arms, fixed-cushion back, solid base

Contemporary: modular

Contemporary: dome arms, solid back
**Spatial Characteristics and Arrangement**

**Requirement**

Each living unit should contain space for the purpose of dining. This area may be combined with the living room or kitchen, or may be a separate room.

**Criterion**

The amount of space allocated to dining should be based on the number of persons to be served and the proper circulation space. Appropriate space should be provided for the storage of china and large dining articles either in the dining area itself or in the adjacent kitchen.

Space for accommodating the following sizes of tables and chairs in the dining area should be provided, according to the intended occupancy, as shown:

- 1 or 2 persons: 2 ft 6 in by 2 ft 6 in
- 4 persons: 2 ft 6 in by 3 ft 2 in
- 5 persons: 3 ft 4 in by 4 ft 0 in or 4 ft 0 in round
- 8 persons: 3 ft 4 in by 6 ft 0 in or 4 ft 0 in by 4 ft 0 in
- 10 persons: 3 ft 4 in by 8 ft 0 in or 4 ft 0 in by 6 ft 0 in
- 12 persons: 4 ft 0 in by 8 ft 0 in

Dining chairs: 1 ft 6 in by 1 ft 6 in
Buffet or storage unit: 1 ft 6 in by 3 ft 6 in

Figures 1 to 6 show the minimum requirements of the U.S. Department of Housing and Urban Development.

**Commentary**

Size of the individual eating space on the table should be based upon a frontage of 24 in and an area of approximately 2 ft². In addition, table space should be large enough to accommodate serving dishes.

Desirable room for seating is a clear 42 in all around the dining table. The following minimum clearances from the edge of the table should be provided: 32 in for chairs plus access thereto, 38 in for chairs plus access and passage, 42 in for serving from behind chair, 24 in for passage only, 48 in from table to base cabinet (in kitchen).

In sizing the separate dining room, provision should be made for circulation through the room in addition to space for dining.

The location of the dining area in the kitchen is desirable for small houses and small apartments. This preference appears to stem from two needs: (1) housekeeping advantages; (2) the dining table in the kitchen provides a meeting place for the entire family. Where only one dining location is feasible, locating the dining table in the living room is not recommended.
Fig. 7 (a) to (e) illustrate, in plan and elevation, seating requirements and clearances for various dining table arrangements. (f) and (g) illustrate clearance guidelines for a typical armless dining chair and a dining chair with arms, respectively. It should be noted that the clearances indicated relate to chairs with depth dimensions of 20" and 22"; clearances should be adjusted depending on the chair size finally selected.
Residential Spaces

DINING ROOMS
Furniture Clearances

A dining room for 12.
A hutch or buffet is typically about 18" deep. A 42" wide table is common. There is space behind the chairs to edge past one side and one end, and to walk past on the other side and end. Table space is 24" per person, the minimum place setting zone. With arm chairs at the ends, allow an extra 2" for each; add 4" to the room length.

Minimum width for table and chairs.
8'-8" for 36" wide table, 32" on one side to rise from the table and 36" on the other side to edge past. A 48" long table seats 4 and requires 34.6 ft².

Dining space with benches.
5'-6" for benches on both sides of a 36" table. A 48" long table seats 4 and requires 34 ft².

Fig. 8

Figures 8 and 9 show clearances and room sizes for various dining arrangements. Since these data come from two sources, there may be slight disparities in suggested dimensions for similar conditions. Since these illustrations are intended only as guidelines for preliminary planning purposes, either set of any differing dimensions can be used.
Residential Spaces

DINING ROOMS

Furniture Clearances

Fig. 10 Minimum clearances for dining areas. (a) One end of table against wall. (b) Serving from one end and one side of table.

Fig. 11 Minimum clearances and circulation for combined living-dining areas.

To assure adequate space for convenient use of the dining area, not less than the following clearances from the edge of the dining table should be observed:
- 32 in for chair plus access thereto
- 38 in for chairs plus access and passage
- 42 in for serving from behind chair
- 24 in for passage only
- 48 in from table to base cabinet (in dining-kitchen)
Fig. 12 Seating capacities for round, square, rectangular, and boat-shaped tables of various sizes and the recommended minimum room sizes to accommodate each.
Residential Spaces

DINING ROOMS
Dining Tables and Room Sizes

RECTANGULAR TABLES

<table>
<thead>
<tr>
<th>W</th>
<th>L</th>
<th>Approx. Seating</th>
<th>Minimum Room Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>6'0&quot;</td>
<td>28'0&quot;</td>
<td>28-30</td>
<td>18'0&quot; x 40'0&quot;</td>
</tr>
<tr>
<td>6'0&quot;</td>
<td>26'0&quot;</td>
<td>26-28</td>
<td>18'0&quot; x 38'0&quot;</td>
</tr>
<tr>
<td>6'0&quot;</td>
<td>24'0&quot;</td>
<td>24-26</td>
<td>18'0&quot; x 36'0&quot;</td>
</tr>
<tr>
<td>5'0&quot;</td>
<td>22'0&quot;</td>
<td>22-24</td>
<td>15'0&quot; x 32'0&quot;</td>
</tr>
<tr>
<td>5'0&quot;</td>
<td>20'0&quot;</td>
<td>20-22</td>
<td>15'0&quot; x 30'0&quot;</td>
</tr>
<tr>
<td>4'6&quot;</td>
<td>18'0&quot;</td>
<td>18-20</td>
<td>13'6&quot; x 27'0&quot;</td>
</tr>
<tr>
<td>4'6&quot;</td>
<td>16'0&quot;</td>
<td>16-18</td>
<td>13'6&quot; x 25'0&quot;</td>
</tr>
<tr>
<td>4'6&quot;</td>
<td>14'0&quot;</td>
<td>14-16</td>
<td>13'6&quot; x 23'0&quot;</td>
</tr>
<tr>
<td>4'0&quot;</td>
<td>12'0&quot;</td>
<td>12-14</td>
<td>12'0&quot; x 21'0&quot;</td>
</tr>
<tr>
<td>4'0&quot;</td>
<td>10'0&quot;</td>
<td>10-12</td>
<td>12'0&quot; x 20'0&quot;</td>
</tr>
<tr>
<td>4'0&quot;</td>
<td>11'0&quot;</td>
<td>10-12</td>
<td>11'0&quot; x 19'0&quot;</td>
</tr>
<tr>
<td>4'0&quot;</td>
<td>10'0&quot;</td>
<td>8-10</td>
<td>10'0&quot; x 17'0&quot;</td>
</tr>
<tr>
<td>3'6&quot;</td>
<td>9'0&quot;</td>
<td>8-10</td>
<td>9'0&quot; x 16'0&quot;</td>
</tr>
<tr>
<td>3'6&quot;</td>
<td>8'0&quot;</td>
<td>8-10</td>
<td>8'0&quot; x 15'0&quot;</td>
</tr>
<tr>
<td>3'6&quot;</td>
<td>7'0&quot;</td>
<td>8-10</td>
<td>7'0&quot; x 14'0&quot;</td>
</tr>
<tr>
<td>3'6&quot;</td>
<td>6'0&quot;</td>
<td>6-8</td>
<td>6'0&quot; x 13'0&quot;</td>
</tr>
<tr>
<td>3'6&quot;</td>
<td>5'0&quot;</td>
<td>4-6</td>
<td>5'0&quot; x 12'0&quot;</td>
</tr>
</tbody>
</table>

BOAT SHAPED TABLES

<table>
<thead>
<tr>
<th>W</th>
<th>L</th>
<th>Approx. Seating</th>
<th>Minimum Room Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>3'5&quot;</td>
<td>8'0&quot;</td>
<td>8-10</td>
<td>10'0&quot; x 15'0&quot;</td>
</tr>
<tr>
<td>3'8&quot;</td>
<td>9'0&quot;</td>
<td>8-10</td>
<td>11'0&quot; x 16'0&quot;</td>
</tr>
<tr>
<td>3'10&quot;</td>
<td>10'0&quot;</td>
<td>10-12</td>
<td>12'0&quot; x 17'0&quot;</td>
</tr>
<tr>
<td>4'3&quot;</td>
<td>11'0&quot;</td>
<td>10-12</td>
<td>13'0&quot; x 19'0&quot;</td>
</tr>
<tr>
<td>4'7&quot;</td>
<td>12'0&quot;</td>
<td>12-14</td>
<td>14'0&quot; x 21'0&quot;</td>
</tr>
<tr>
<td>4'1&quot;</td>
<td>14'0&quot;</td>
<td>14-16</td>
<td>15'0&quot; x 23'0&quot;</td>
</tr>
<tr>
<td>5'0&quot;</td>
<td>16'0&quot;</td>
<td>16-18</td>
<td>16'0&quot; x 26'0&quot;</td>
</tr>
<tr>
<td>5'7&quot;</td>
<td>18'0&quot;</td>
<td>20-22</td>
<td>17'0&quot; x 29'0&quot;</td>
</tr>
<tr>
<td>6'0&quot;</td>
<td>20'0&quot;</td>
<td>20-24</td>
<td>18'0&quot; x 32'0&quot;</td>
</tr>
</tbody>
</table>

Fig. 12 (Continued)
Most of the clearances and bedroom sizes shown are minimum and intended primarily for preliminary planning purposes. Some building codes permit rooms of even smaller sizes, while rooms in many private homes and luxury apartments are much larger. Moreover, in the final analysis lifestyle, the size and scale of furniture, the activities to be accommodated, and barrier-free design are all factors that should be taken into account during the design process.

Ideally, the recommended minimum bedroom size should be 10’0" x 12’0" exclusive of closets, while the recommended minimum size for a larger bedroom or master bedroom should be 12’0" x 16’0" exclusive of closets. A larger proportion of the bedroom floor area is occupied by furniture than is the case with any other room; windows and doors account for a large percentage of the wall and partition space. These two factors complicate the planning of bedrooms, especially when the rooms are small.

Because of the room layout, some bedrooms with smaller areas better meet the needs than larger ones. The location of doors, windows, and closets must be properly planned to allow the best placement of the bed and other furniture.

Privacy, both visual and sound, are desirable for the bedroom. Children’s bedrooms should be located away from the living room, because conversation in the living room prevents the children from sleeping. Closets should be used between all bedrooms wherever possible.

Each child needs a space that is his or her own to develop a sense of responsibility and a respect for the property rights of others. The ideal plan would provide a bedroom for each child, but since this is not always possible, there should be a bed for each.

The minimum room width shall be determined by the space required for the bed, activity space, and any furniture facing the bed. Widths less than 9’0" will usually require extra area to accommodate comparable furniture.

Aside from sleeping, the bedroom is the center of dressing and undressing activities. An interrelationship exists between dressing, storage of clothes, and the bedroom.

Inevitably, in a small apartment, it is not only economical but necessary to plan the use of the bedroom for more than one activity. It is essential to incorporate in the bedroom other functions such as relaxation, work, or entertainment.

A master bedroom should accommodate at least one double bed 4’6" x 6’6" or two single beds 3’3" x 6’6" each, one crib 2’4" x 1’10" if necessary. one dresser 3’6" x 1’10", one chest of drawers 2’6" x 1’10", one or two chairs 1’8" x 1’10" each, two night tables, and possibly a small desk or table 1’6" x 3’0".

Figures 1 to 3 illustrate three configurations and the furniture clearances and room sizes required.

Ample storage is essential. Each bedroom requires at least one clothes closet. For master bedrooms, at least five linear feet of closet length is needed. For secondary bedrooms, at least three linear feet is needed. Clothes closets require a clear depth of two feet.

Each bedroom shall have at least one closet that meets or exceeds the following standards:

1. Depth: 2 feet clear
2. Length (for primary bedroom): 5 linear feet clear
3. Height:
   a. At least 6’4” clear hanging space
   b. Lowest shelf shall not be over 6’2” above the floor of room
4. One shelf and rod with at least 12 inches clear space above shelf
5. At least one-half the closet floor shall be level and not more than 12 inches above floor of adjacent room.
Residential Spaces

BEDROOMS
Furniture Clearances and Arrangements

Fig. 4 (a), (b) Primary bedroom; (c) primary bedroom without crib.

FURNITURE CLEARANCES
To assure adequate space for convenient use of furniture in the bedroom, not less than the following clearances should be observed (Figs. 4 and 5):
- 42 in at one side or foot of bed for dressing
- 6 in between side of bed and side of dresser or chest

FURNITURE ARRANGEMENTS
The location of doors and windows should permit alternate furniture arrangements.
- 36 inches in front of dresser, closet, and chest of drawers
- 24 in for major circulation path (door to closet, etc.)
- 22 in on one side of bed for circulation
- 12 in on least used side of double bed.
The least-used side of a single or twin bed can be placed against the wall except in bedrooms for the elderly.

Fig. 5 (a) Single-occupancy bedroom; (b) double-occupancy bedroom.
Residential Spaces

BEDROOMS

General Planning Data

Fig. 6 Although the recommended minimum size for a secondary bedroom is 10'0" x 12'0", these diagrams indicate how a double bed, night table, chair, and dresser can be accommodated in a room only 9'6" x 11'0".

Fig. 7 Double occupancy bedroom. Net area: 14.7 m² (160 ft²). The most likely occupants of this type of bedroom are adults, school-age children of the same sex, children of different sexes who are less than 9 years old, and preschoolers.

Fig. 8 Occupancy of a bedroom by more than two persons is not recommended. In cases where budgetary and/or space limitations offer no alternative, however, a dormitory arrangement may be necessary. The U.S. Department of Housing and Urban Development recommends the arrangement illustrated in this diagram.
Residential Spaces

BEDROOMS

Built-in Furniture

SECTION THRU CABINET & BEDROOM

SECTION THRU RADIATOR COVER, TYP.

PLAN & ELEVATION OF PLATFORMS & BEDS

SECTION PLAN PLATFORM

SECTION A-B Morrison Bedroom
Residential Spaces

BEDROOMS
Plan and Elevation of Walk-In Closet

NOTE: ALL HANG'G RODS TO BE METAL
Fig. 9 (a) illustrates a typical hat shelf and coat rod, while (b) shows relatively typical sections through a night table and a dresser. (c) illustrates a typical closet.
Residential Spaces

BEDROOMS

Cabinets

Additional Clearance necessary for garments on hook strips parallel to hanging pole.

HANGER

Width 10" Length 12" 3/8" Hemisphere Wood or Metal Hat Stand

Hat hung below shelf on slides

Rack may be set at angle to wall if desired

HATS

Interior or clear dimensions of Drawer determined by Dress Shirt. either 10" or 20" side may be front

DRAWER OR TRAY DIMENSIONS

Hardwood Tie Rack for back of Door

Face of Shelf

WOOD TIE RACK

-8/0-9-4-18"

-41/2"

AVERAGE MANS SHOES

CLEARANCES - VARIOUS ARTICLES OF CLOTHING

CABINET FOR BEDROOM CLOSET

SHOE RACKS & TRAY

Width of Closet

Hooks 4 to 6 at

CLOSET RACK

...•\n
\n
SHELF & HANGING POLE

4-Lc. Pole - Steel

4 or 3 or 1

3 or 2 or 1

Pegs - 11 or 12

Hanging Pole - Wood 1 1/2", Metal 1 1/2". Where length of Pole exceeds 4' additional support is required

Hanging Pole - Men's Shirts, Food, Shoes, etc. Shelves made adjustable on pegs

CLOSET RACK

 sect. Thr. Door

Finish Floor - 1/2" Metal Rod

Open Front Tray for Cabinet

Finish Bedroom Floor - Rough Floor

Possible Storage Drawer, Shoe Racks, etc

Tray-Open Front

1/2" Clear Hanger Height (Men), 3/4" (Women)

For Door Clearances see F-105 Serial #69

Trays-any type front

10" or 12"

4' or 6'

Possible Storage Drawer, Shoe Racks, etc

Cabinet may extend up to shelf or mounted cabinets

1/2" Clear Hanging Height (Men), 3/4" (Women)

If hanging space above Cabinet is not desired. Drawers may extend to under side of shelf above

4' of Hanging Pole 5-10" above Finish Bedroom Floor (Average)

Child - 8" Woman - 10" Man - 12"

8'10"-9"

3'-9/16"
**Residential Spaces**

**BEDROOMS**

**Closets**

Ordinary treatment of space above door. Note poor access and waste space.

- Space for Rack for Shoes
- Hook Strip space 6" extra
- 2'-0" x 6'-8"
- Approx. 12 Garments on hangers

**MINIMUM CLOSET**

Hook strips for Children's closets may be provided on rear of door or side walls & may be adjustable in height. (See Details)

- Dead Storage
- Pole above drawer

Approx. 12 Garments on hangers

**SHALLOW CLOSETS**

As much as possible of front walls should be doors to make entire length of shallow closets accessible.

- Hook strip space 6" extra
- 2'-2" Hinged, Folding or Sliding Doors
- Sliding hanger rods accommodate maximum number of garments without crushing.

**EXTREMELY SHALLOW**

- Cupboard above is impractical because depth is extreme. One or two shelves may be provided.

**DEEP CLOSETS**

- Closet lights desirable; controlled preferably by door switch.

- Closets should be flush with top of the door saddle.

- Finished Ceiling Line
- Individual compartment with separate cabinet doors
- Shelf & Hanging Pole

- May extend to shelf in Women's Closets
- Short Garments & Suits
- Long Garments & Dresses
- Space for Cabinet
- Space for Drawers & Racks

- MINIMUM CLOSET

- Hook strip space 6" extra
- 1'-0" Hinged, Folding or Sliding Doors
- Sliding hanger rods accommodate maximum number of garments without crushing.

- Hook strip space 6" extra
- 1'-0" Hinged, Folding or Sliding Doors

- MINIMUM CLOSET

- Hook strip space 6" extra
- 1'-0" Hinged, Folding or Sliding Doors

- Hook strip space 6" extra
- 1'-0" Hinged, Folding or Sliding Doors

**SHALLOW CLOSETS**

As much as possible of front walls should be doors to make entire length of shallow closets accessible.

- Hook strip space 6" extra
- 1'-0" Hinged, Folding or Sliding Doors
- Sliding hanger rods accommodate maximum number of garments without crushing.

- Hook strip space 6" extra
- 1'-0" Hinged, Folding or Sliding Doors

**Extremely Shallow**

- Cupboard above is impractical because depth is extreme. One or two shelves may be provided.

- Deep Closets

- Closet lights desirable; controlled preferably by door switch.

- Closet floors should be flush with top of the door saddle.
A bathroom should have enough area to accommodate a lavatory, a water closet, and a bathtub or shower. Arrangement for fixtures should provide for comfortable use of each fixture and permit at least 90° door swing unless sliding doors are used.

The bathroom should be convenient to the bedroom zone, and accessible from the living and work areas. Linen storage should be accessible from the bathroom, but not necessarily located within the bathroom.

Each complete bathroom should be provided with the following:
1. Grab-bar and soap dish at bathtub
2. Toilet paper holder at water closet
3. Soap dish at lavatory (may be integral with lavatory)
4. Towel bar
5. Mirror and medicine cabinet or equivalent enclosed shelf space
6. In all cases where shower head is installed, provide a shower rod or shower door

Each half bath should be provided with items 2 to 6 listed above.

### Minimal Shower Clearances

<table>
<thead>
<tr>
<th></th>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>54</td>
<td>137.2</td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>30.5</td>
</tr>
<tr>
<td>C</td>
<td>42 min.</td>
<td>106.7 min.</td>
</tr>
<tr>
<td>D</td>
<td>18</td>
<td>45.7</td>
</tr>
<tr>
<td>E</td>
<td>36 min.</td>
<td>91.4 min.</td>
</tr>
<tr>
<td>F</td>
<td>30</td>
<td>76.2</td>
</tr>
<tr>
<td>G</td>
<td>24</td>
<td>61.0</td>
</tr>
<tr>
<td>H</td>
<td>12 min.</td>
<td>30.5 min.</td>
</tr>
<tr>
<td>I</td>
<td>15</td>
<td>38.1</td>
</tr>
<tr>
<td>J</td>
<td>40–48</td>
<td>101.6–121.9</td>
</tr>
<tr>
<td>K</td>
<td>40–50</td>
<td>101.6–127.0</td>
</tr>
<tr>
<td>L</td>
<td>72 min.</td>
<td>182.9 min.</td>
</tr>
</tbody>
</table>

### Double Lavatory Clearances

<table>
<thead>
<tr>
<th></th>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>15–18</td>
<td>38.1–45.7</td>
</tr>
<tr>
<td>B</td>
<td>28–30</td>
<td>71.1–76.2</td>
</tr>
<tr>
<td>C</td>
<td>37–43</td>
<td>94.0–108.2</td>
</tr>
<tr>
<td>D</td>
<td>32–35</td>
<td>81.3–91.4</td>
</tr>
<tr>
<td>E</td>
<td>26–32</td>
<td>66.0–81.3</td>
</tr>
<tr>
<td>F</td>
<td>14–16</td>
<td>35.6–40.6</td>
</tr>
<tr>
<td>G</td>
<td>90</td>
<td>76.2</td>
</tr>
<tr>
<td>H</td>
<td>19</td>
<td>46.7</td>
</tr>
<tr>
<td>I</td>
<td>21–26</td>
<td>53.3–66.0</td>
</tr>
</tbody>
</table>

### Bidet Clearances

<table>
<thead>
<tr>
<th></th>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>12 min.</td>
<td>30.5 min.</td>
</tr>
<tr>
<td>B</td>
<td>28 min.</td>
<td>71.1 min.</td>
</tr>
<tr>
<td>C</td>
<td>34 min.</td>
<td>86.4 min.</td>
</tr>
<tr>
<td>D</td>
<td>47</td>
<td>119.4</td>
</tr>
<tr>
<td>E</td>
<td>52</td>
<td>132.1</td>
</tr>
<tr>
<td>F</td>
<td>12–18</td>
<td>30.5–45.7</td>
</tr>
<tr>
<td>G</td>
<td>12</td>
<td>30.5</td>
</tr>
<tr>
<td>H</td>
<td>18</td>
<td>45.7</td>
</tr>
<tr>
<td>I</td>
<td>30</td>
<td>76.2</td>
</tr>
</tbody>
</table>
Figure 1 deals primarily with some of the more critical male anthropometric considerations. A lavatory height above the floor of 37 to 43 in, or 94 to 109.2 cm, is suggested to accommodate the majority of users. It should be noted, however, that common practice is to locate the lavatory in the neighborhood of 31 in above the floor. In order to establish the location of mirrors above the lavatory, eye height should be taken into consideration.

Given the great variability in body sizes to be accommodated within a single family, a strong case can be presented for the development of a height adjustment capability for the lavatory. Until that is developed, there is no reason, on custom installations, why the architect or interior designer cannot take anthropometric measurements of the client to ensure proper interface between the user and the lavatory.

<table>
<thead>
<tr>
<th></th>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>48</td>
<td>121.9</td>
</tr>
<tr>
<td>B</td>
<td>30</td>
<td>76.2</td>
</tr>
<tr>
<td>C</td>
<td>19-24</td>
<td>48.3-61.0</td>
</tr>
<tr>
<td>D</td>
<td>27 min.</td>
<td>68.6 min.</td>
</tr>
<tr>
<td>E</td>
<td>18</td>
<td>45.7</td>
</tr>
<tr>
<td>F</td>
<td>37-43</td>
<td>94.0-109.2</td>
</tr>
<tr>
<td>G</td>
<td>72 max.</td>
<td>182.9 max.</td>
</tr>
<tr>
<td>H</td>
<td>32-36</td>
<td>81.3-91.4</td>
</tr>
<tr>
<td>I</td>
<td>69 max.</td>
<td>175.3 max.</td>
</tr>
<tr>
<td>J</td>
<td>16-18</td>
<td>40.6-45.7</td>
</tr>
<tr>
<td>K</td>
<td>26-32</td>
<td>66.0-81.3</td>
</tr>
<tr>
<td>L</td>
<td>32</td>
<td>81.3</td>
</tr>
<tr>
<td>M</td>
<td>20-24</td>
<td>50.8-61.0</td>
</tr>
</tbody>
</table>

Fig. 1 Lavatory: male anthropometric considerations.

Fig. 2 Lavatory: female and child anthropometric considerations.
Residential Spaces

BATHROOMS
Typical Plans and Fixture Arrangements

Fig. 3 Two-fixture plans: water closet and washbasin.

Fig. 4 Three-fixture plans: water closet, washbasin and tub.

Fig. 5 Two- and three-fixture noncompartmented plans: water closet, washbasin, and shower.
Fig. 6  Four-fixture compartmented plans: water closet, tub, and two washbasins.
Minimum half-bath.
18 ft² is about minimum for standard fixtures; 4'-6"x4'-6" gives a more spacious feeling.

Generous half-bath.
22.5 ft² is a generous half-bath. A wall-hung lavatory instead of a vanity squeezes into 2'-6" width and 16.3 ft².

Corner toilet in a half-bath.
A corner toilet and a small lavatory fit 13.5 ft². Consider this idea for installing a half-bath in a closet or under a stairway.

Corner shower.
A corner shower, toilet, and lavatory fit in 33 ft². Very little storage space available.

Fig. 7 A wide array of two-, three-, four-, and five-fixure toilet plans.

Small, 3-fixure bathroom.
A small 3-fixure bathroom with limited storage in a built-in vanity meets basic bathroom requirements in a space 37.5 ft². The door is 32" wide for a person with a cane or crutches. This bathroom is too small for a wheelchair.

Two-lavatory bathroom.
A 2-lavatory bathroom with adequate room at the toilet and each lavatory. Note storage space under the lavatories and in a floor-to-ceiling unit. Area: 63 ft².

Separate tub and shower.
This plan also includes a bidet. Storage is in the 48" long vanity. Area: 75.3 ft².
Large shower.
A generous 33"x48" shower is featured in this 32 ft² bathroom. Storage is under the 30" vanity and on shelves over the toilet.

Corner square tub.
Although not usually a space saver, a square tub fits some situations better than a rectangular one. This 32" bathroom has excellent storage but is only 59.5 ft².

Large 3-fixture bathroom.
With fixtures in separate compartments, this layout can replace a second bath by accommodating more than one person at a time. It is as large as two bathrooms but costs less because of fewer fixtures and less plumbing. Area: 106 ft² plus hallway storage.

Four-fixtures, two compartments.
Three people can use this bathroom at the same time. Consider a pocket door between the compartments. Even with generous storage space it takes only the same space as many non-compartmented bathrooms, about 80.5 ft².

Five fixtures, three compartments.
This bathroom serves as two full bathrooms in 87 ft². Two doors to each compartment are undesirable. Limited storage space available.

Fig. 7 (Continued)
Fig. 6 A variety of design possibilities for the more customized bathroom.
Fig. 8 (Continued)
Residential Spaces

BATHROOMS
Custom Designs

Fig. 8 (Continued)
Fig. 9 A selection of countertop lavatories.
Residential Spaces

BATHROOMS

Lavatory Types and Dimensions

110

Fig. 10 A selection of wall-hung and pedestal-type lavatories.
Fig. 11 Another selection of lavatories.
Fig. 12 A selection of whirlpool baths.
Residential Spaces

BATHROOMS
Bathtub Types and Dimensions

Dimensions: 42" x 37" x 12"

Dimensions: 60" x 311/2" x 16"

Dimensions: 60" x 311/2" x 16"

Fig. 13  A selection of standard baths.
Fig. 14 A selection of waterclosets.
Fig. 15 A selection of bidets.
Residential Spaces

BATHROOMS
Plans, Elevations, and Details

Three-fixture bathroom with tub

Three-fixture bathroom with shower
GUEST BATH

Four fixture bathroom with tub and shower
Four-fixure bathroom with bidet and tub
Residential Spaces

BATHROOMS
Plans, Elevations, and Details

PLAN

A
B
C

D
E
F

Powder room
Residential Spaces

BATHROOMS
Plans, Elevations, and Details

[Diagram of bathroom plan and details]
Residential Spaces

BATHROOMS
Accessory and Control Placement

ELEVATION OF TUB W/SHOWER

1. SHOWER CURTAIN ROD: KEEP WITHIN INSIDE OF TUB OR SHOWER.

1a. ENCLOSURE DOORS: IF SWINGING DOORS ARE USED, PLACE HINGES ON THE SIDE OPPOSITE CONTROL VALVES.

2. SHOWER HEAD: SEE ELEVATION OF TUB AND SHOWER STALL FOR RECOMMENDED HEIGHTS.

3. GRAB BARS SHALL BE MANUFACTURED OF SHATTER-RESISTANT MATERIAL, FREE FROM BURRS, SHARP EDGES AND PINCH POINTS. KNURLING OR SLIP-RESISTANT SURFACE IS DESIRABLE.

4. RECESSED SOAP DISH SHALL BE FREE FROM BURRS AND SHARP EDGES. WHERE GRAB BAR IS AN INTEGRAL PART OF THE SOAP DISH, IT MAY HAVE A MINIMUM LENGTH OF 6 INCHES.

5. FAUCET SHALL BE MANUFACTURED OF SHATTER-RESISTANT MATERIAL, FREE FROM BURRS AND SHARP EDGES. ALL FAUCET SETS IN SHOWERS, TUBS AND LAVATORIES SHALL BE EQUIPPED WITH A WATER-MIXING VALVE DELIVERING A MAXIMUM WATER TEMPERATURE OF 110°F ±5°F.

6. SHOWER STALL LIGHT: SHALL BE OF A VAPOR-PROOF FIXTURE WITH THE ELECTRICAL LIGHT SWITCH A MINIMUM OF 72 INCHES AWAY FROM SHOWER STALL.
Residential Spaces

BATHROOMS

Vanities; Lavatory Counters

TOILET ROOM CAB.

TOILET ROOM CAB.

PLASTIC LAM.

SPILL RETURN @ WALL

LAV. 1

5/8" RED OAK RIDgid. W/ RED OAK EDGES

4 1/2" BASE

DETAIL B/W.

6" PLATE GLASS MIRROR, L/ W. MET. FRAME. FULL HEIGHT FROM BACKSPLASH TO UNDERSIDE OF OGL.

PLASTIC LAM. FINISH.
BY: WILSONART
COLOR: KHAKI BROWN @ LADIES RM. D-20-15
BY: NEVAMAR
COLOR: BLACK PEARL S-6-14 T.

3/4" PLYWOOD.
(TYPE)

W/D BLOCKING.

NOTE:
ALL WOODWORK SHALL BE FIRE RETARDANT.

R.H. FLOOR.

DET. @ VANITY.

PROVIDE PIPE CHASE
BELOW VANITY, 6" TO COORDINATE W/ PLUMBER. FOR BLDG PIPE LOCATIONS.

SCALE 1/8" = 1'-0"

1/4"
Fig. 16  Typical details of a marble vanity-top installation.
Non-staining caulk

Lead expansion shield

Use with 1¼" thick stock only

Metal clip & screw

4 req’d

Fig. 16 (Continued)
**Residential Spaces**

**BATHROOMS**

Bathtub and Shower Details

### BATHTUB WALLS

#### Wood or Metal Studs

Cement Mortar

<table>
<thead>
<tr>
<th>Material</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceramic Tile</td>
<td>Bond Coat</td>
</tr>
<tr>
<td>Mortar Bed</td>
<td>Scratch Coat</td>
</tr>
<tr>
<td>Metal Lath</td>
<td>Membrane</td>
</tr>
<tr>
<td>Flexible Sealant</td>
<td>Path</td>
</tr>
<tr>
<td>Wood 1/2 Metal Studs</td>
<td></td>
</tr>
</tbody>
</table>

**Recommended Uses**

- Over dry, well-braced wood studs, furring, or metal studs
- Preferred method of installation over wood studs for bathtubs

#### Glass Mesh Mortar Units

<table>
<thead>
<tr>
<th>Material</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceramic Tile</td>
<td>Pre-Hydrated Dry-Set</td>
</tr>
<tr>
<td>Mortar Bed</td>
<td>Latex-Portland</td>
</tr>
<tr>
<td>Glass Mesh</td>
<td>Mortar Unit</td>
</tr>
<tr>
<td>Wood 1/2 Metal Studs</td>
<td>Flexible Sealant</td>
</tr>
<tr>
<td>Fabric 1/2 End</td>
<td>Glass Wood Block</td>
</tr>
<tr>
<td>Bath Tub Fleece Roofing When Required (BY OTHER TRADE)</td>
<td></td>
</tr>
</tbody>
</table>

**Recommended Use**

- In tub enclosures and tub showers over dry, well-braced wood studs, furring, or metal studs

#### Gypsum Board

- In tub enclosures and tub showers over water-resistant gypsum backing board on wood or metal studs

---

**TILE TUBS AND FOUNTAINS**

**Membrane**

**Cement Mortar**

<table>
<thead>
<tr>
<th>Material</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceramic Tile</td>
<td>Mortar Bed</td>
</tr>
<tr>
<td>Mortar Bed</td>
<td>Scratch Coat</td>
</tr>
<tr>
<td>Metal Lath</td>
<td>Waterproof Membrane Interior Grade Plywood</td>
</tr>
<tr>
<td>Wood Framing</td>
<td></td>
</tr>
</tbody>
</table>

**Wood Form**

<table>
<thead>
<tr>
<th>Material</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceramic Tile</td>
<td>Neat Cement Bond Coat</td>
</tr>
<tr>
<td>Mortar Bed</td>
<td>Scratch Coat (if needed)</td>
</tr>
<tr>
<td>Metal Lath</td>
<td>Waterproof Membrane Concrete Tank</td>
</tr>
</tbody>
</table>

**Concrete Tank** (Preferred)

**Existing Concrete Tank**

- Over wood or concrete subfloors; where old shower pan has failed

**Recommended Use**

- Over wood or concrete subfloors; where old shower pan has failed

**Requirements**

- Waterproof membrane required except in slab-on-grade installations where membrane may be omitted
- Slope tank so that membrane will slope to the drain
- Flange drain with weep holes required
- Wood framing, if used, should be pressure treated and designed to resist deflection and movement

---

Fig. 17 Typical installation details for bathtub walls, tile tubs, and shower receptors.
SHOWER RECEPTORS, WALLS

Cement Mortar

Recommended use
- over wood or concrete subfloors

Glass Mesh Mortar Units

Recommended use
- in showers over dry, well-braced wood studs, furring, or metal studs

Gypsum Board

Recommended use
- in showers over water-resistant gypsum backing board on wood or metal studs

COUNTERTOPS

Cement Mortar

Recommended uses
- on countertops, drainboards, lavatory tops, etc.
- preferred method where sink or lavatory is to be recessed

Thin-Bed

Recommended use
- on countertops where thin-set method is desired

Glass Mesh Mortar Unit

Recommended uses
- preferred thin-set mortar method on countertops, drainboards, lavatory tops, and similar uses
- preferred method where self-rimming sinks and lavatories are desired

Fig. 18  Typical installation details for shower receptors, walls, and countertops.
Residential Spaces

BATHROOMS

Ceramic Tile Details

TILE OVER TILE

Interior Walls

CASE I

CASE II

CASE III

CASE IV

Interior Floors

Recommended uses
- for alteration of ceramic-tiled areas where modernization or a change of design is desired in residences, motels and hotels, restaurants, public rest rooms, etc.
- also applicable to smooth walls of marble, stone, slate, etc.

Requirements
- existing installation must be sound, well bonded, and without major structural cracks

Materials, grouting, expansion joints, installation specifications
- for organic adhesive installation see Method W223
- for Dry-set or latex-Portland cement mortar installation see Method W202
- for epoxy adhesive installation refer to manufacturer’s literature

Fig. 19 Typical installation details for tile over tile.
ACCESSIBILITY

It is essential that the design of interior spaces, as well as exterior spaces, be responsive to the needs of those having physical disabilities. There is a plethora of state and local initiatives in this regard, and, more recently, federal legislation (Americans with Disabilities Act of 1990), that provides design guidelines and requirements. The designer should become familiar with those codes and other requirements in her or his area prior to initiation of design and, where possible, go beyond the very minimum standards. The design of the bathroom is perhaps one of those areas where the interface between the physically disabled and the interior space is most critical. Accordingly, on this page and the following pages are design guidelines prepared by the Veterans Administration and the U.S. Department of Housing and Urban Development.

Small Adaptable Bathroom in Conventional Configuration

- recommended self-supporting shelf and countertop
- recommended additional connection for hand-held shower head
- standard 5'-0" bathtub
- reinforced areas for possible future grab bar installation
- vanity cabinet removed and protection cover installed
- hand-held shower and grab bars added as needed
- clamp on tub seat added as needed
This sample bathroom meets the minimum space requirements of both ANSI and UFAS; note, however, that the space is very small and many wheelchair users will have difficulty using such a bathroom. More space should be allocated when possible.
Larger Adaptable Bathroom in Conventional Configuration

- Vanity cabinet installed in knee space
- Reinforced areas for possible future grab bar installation
- Offset controls
- Standard 5'-0" bathtub with built-in seat

Larger Adaptable Bathroom in Adjusted Configuration

- Vanity cabinet removed to expose knee space
- Built-in seat at rear of tub
- Grab bars added as needed
- Offset controls
Residential Spaces

BATHROOMS
Adaptable Bathrooms

hand-held shower

clamp-on removable tub seat

offset water valve

wall reinforcing areas

standard tub

built-in seat

Standard Bathtub with Removable Seat

Standard Bathtub with Built-in Seat

60"

30" min.

42" min. recommended

shower curtain

recommended additional waterproof floor area for water control

greater stall depth for easier use

ANSI Minimum Roll-in Shower

Preferred Deeper Roll-in Shower
Residential Spaces
BATHROOMS
Adaptable Bathrooms

POWDER RM. PLAN WITH 27" REMOVABLE VANITY CABINET

BATHROOM PLAN W/20" LAVATORY

BATHROOM TYPE WITH 24" REMOVABLE VANITY CABINET
BATHROOM PLAN WITH 24"
REMOVABLE VANITY CABINET

X = THE OUTER EDGE OF THE WATER CLOSET WILL NOT EXTEND INTO THE CLEAR SPACE REQUIRED FROM THE DOOR OPENING.

36"x 36" ADAPTABLE SHOWER STALL

MINIMUM BATHROOM REQUIRED W/ADDITIONAL SHOWER
**Residential Spaces**

**BATHROOMS**

Wheelchair Accessible Design

**Clear Floor Space at Water Closets**

**Grab Bars at Water Closets**

**Clear Floor Space at Lavatories**

**Lavatory Clearances**
RESIDENTIAL SPACES

BATHROOMS

Wheelchair Accessible Clearances

- Electrical outlets at convenient location.
- Mirror may be tilted or lowered.
  Single lever faucet.

Combination bathtub/shower.

- Floor-mounted water closet.
- Typical bathroom arrangement.

Shower.

- Levatory.
- Bathtub.
  “Roll-in” shower.
Residential Spaces

BATHROOMS

Wheelchair Accessible Design
Residential Spaces

BATHROOMS
Wheelchair Accessible Clearances

Clear Floor Space at Bathtubs

Grab Bars at Bathtubs
Residential Spaces

BATHROOMS
Wheelchair Accessible Clearances

Shower Size and Clearances

Shower Seat Design

Grab Bars at Shower Stalls
Residential Spaces

BATHROOMS
Wheelchair Accessible Design

1. ELEVATION 1: TYPICAL ACCESSIBLE BATHROOM
2. ELEVATION 2: TYPICAL ACCESSIBLE BATHROOM
3. ELEVATION 3: TYPICAL ADAPTED BATHROOM
4. ELEVATION 4: TYPICAL ADAPTED BATHROOM
5. ELEVATION 5: TYPICAL ADAPTED BATHROOM
6. ELEVATION 6: TYPICAL ADAPTED BATHROOM

148
The height of a kitchen workcounter, the proper clearance between cabinets or appliances for circulation, the accessibility to overhead or undercounter storage, and proper visibility are among the primary considerations in the design of cooking spaces. All must be responsive to human dimension and body size if the quality of interface between the user and the components of the interior space are to be adequate. In establishing clearances between counters, the maximum body breadth and depth of the user of larger body size must be taken into account as well as the projections of the appliances, Refrigerator doors, cabinet drawers, dishwashing machine doors, and cabinet doors all project to some degree in their open position into the space within which the user must circulate and must be accommodated.

Standard kitchen counter heights manufactured are all about 36 in, or 91.4 cm. But such a height does not necessarily accommodate the body dimension of all users for all tasks. Certain cooking activities, for example, may be more efficiently performed from a standing position, but with a counter height less than 36 in. In overhead cabinets the upper shelves are usually inaccessible to the smaller person, while the lower shelves are usually inaccessible to most without bending or kneeling. The logical answer is the development of kitchen cabinet systems capable of total adjustability to accommodate the human dimension of the individual user. Such a system could accommodate not only those of smaller and larger body size, but also elderly and disabled people.

Figure 1 provides some general anthropometric data for establishing basic heights of cabinetry and appliances above the floor. Figures 2 and 3 show in more detail the interface of the human body and the kitchen environment.
Figures 2 and 3 illustrate the clearances related to range centers. Figure 2 indicates a minimum clearance between appliances of 48 in, or 121.9 cm. The anthropometric basis for the clearances are amplified in Fig. 3.

The 40-in, or 101.6-cm, wall oven workzone clearance is adequate to accommodate the projected wall oven door in addition to the maximum body depth dimension of the user. The standing figure shown in broken line, however, indicates both dimensionally and graphically that the 40-in clearance will not permit comfortable circulation when appliances on both sides are in operation at the same time. The range workzone clearance, also 40 in, is adequate to accommodate the open range door and the body size of the kneeling user.

An extremely important, but frequently overlooked anthropometric consideration in kitchen design is eye height. In this regard, the distance from the top of the range to the underside of the hood should allow the rear burners to be visible to the user.

<table>
<thead>
<tr>
<th></th>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>48 min.</td>
<td>121.9 min.</td>
</tr>
<tr>
<td>B</td>
<td>40</td>
<td>101.6</td>
</tr>
<tr>
<td>C</td>
<td>15</td>
<td>38.1 min.</td>
</tr>
<tr>
<td>D</td>
<td>21–30</td>
<td>53.3–76.2</td>
</tr>
<tr>
<td>E</td>
<td>1–3</td>
<td>2.5–7.6</td>
</tr>
<tr>
<td>F</td>
<td>15 min.</td>
<td>38.1 min.</td>
</tr>
<tr>
<td>G</td>
<td>19.5–46</td>
<td>49.5–116.8</td>
</tr>
<tr>
<td>H</td>
<td>12 min.</td>
<td>30.5 min.</td>
</tr>
<tr>
<td>I</td>
<td>17.5 max.</td>
<td>44.5 max</td>
</tr>
<tr>
<td>J</td>
<td>96–101.5</td>
<td>243.8–257.8</td>
</tr>
<tr>
<td>K</td>
<td>24–27.5</td>
<td>61.0–69.9</td>
</tr>
<tr>
<td>L</td>
<td>24–26</td>
<td>61.0–66.0</td>
</tr>
<tr>
<td>M</td>
<td>30</td>
<td>76.2</td>
</tr>
<tr>
<td>N</td>
<td>60 min.</td>
<td>152.4 min.</td>
</tr>
<tr>
<td>O</td>
<td>35–36.25</td>
<td>88.9–92.1</td>
</tr>
<tr>
<td>P</td>
<td>24 min.</td>
<td>61.0 min.</td>
</tr>
<tr>
<td>Q</td>
<td>35 max.</td>
<td>88.9 max.</td>
</tr>
</tbody>
</table>
The U-shaped plan is the most efficient. When not broken, it provides the opportunity and floor space for several simultaneous activities. The corridor or gallery kitchen is typically accessible from both ends, often converting it from a work space to a corridor. It sometimes is closed off on one end, thereby creating a variation of the U-plan, which although small can produce a fairly comfortable kitchen.

The broken U-shaped plan often results from the necessity of locating a door along one or two of the three walls of a typical U-shaped scheme. The resulting through traffic reduces the compactness and efficiency of the plan.

The typical L-shaped kitchen allows for the location of a small breakfast area in the opposite corner.

---

**Residential Spaces**

**KITCHENS**

**Typical Layouts**

The U-shaped plan is the most efficient. When not broken, it provides the opportunity and floor space for several simultaneous activities. The corridor or gallery kitchen is typically accessible from both ends, often converting it from a work space to a corridor. It sometimes is closed off on one end, thereby creating a variation of the U-plan, which although small can produce a fairly comfortable kitchen.

The broken U-shaped plan often results from the necessity of locating a door along one or two of the three walls of a typical U-shaped scheme. The resulting through traffic reduces the compactness and efficiency of the plan.

The typical L-shaped kitchen allows for the location of a small breakfast area in the opposite corner.

---

**Fig. 4** U-shaped plans. If dishwasher is desired, it should be located at sink center.

**Fig. 5** Corridor plans. If dishwasher is desired, it should be located at sink center.

**Fig. 6** Broken U-shaped plans. If dishwasher is desired, it should be located at sink center.

**Fig. 7** L-shaped plan. If dishwasher is desired, it should be located at sink center.
KITCHENS

Fig. 8  These diagrams illustrate further variations of the typical plans shown in Figs. 4 to 7. A triangle perimeter of 23' 0" or less is usually indicative of a relatively efficient kitchen layout.

Minimum counter frontage.
For combined work centers.
Space Criterion
The size of the kitchen should be determined by the number of bedrooms provided in the living unit. Work centers for the following equipment, cabinets, and space for their use should be provided:
1. Range space with base and wall cabinet at one side for serving and storage of utensils and staples.
2. Sink and base cabinet with counter space on each side for cleanup. Wall cabinets for storage of dinnerware.
3. Refrigerator space with counter space at latch side of the refrigerator door.

Recommended minimum edge distance
Equipment should be placed to allow for efficient operating room between it and any adjacent corner cabinet. At least 9 in from the edge of the sink and range and 16 in at the side of the refrigerator is recommended.

Circulation space
A minimum of 40 in should be provided between base cabinets or appliances opposite each other. This same minimum clearance applies when a wall, storage wall, or work table is opposite a base cabinet.

Traffic
Traffic in the kitchen should be limited to kitchen work only. Serving circulation to the dining area should be without any cross traffic.

Height of shelving and counter tops
1. Maximum height of wall shelving 74 in.
2. Height of counter tops should be 36 in.
3. Minimum clearance height between sink and wall cabinet 24 in. between base and wall cabinets 15-in clearance.
KITCHEN STORAGE

Each kitchen or kitchenette should have (1) accessible storage space for food and utensils, (2) sufficient space for the average kitchen accessories, (3) sufficient storage space for those items of household equipment normally used and for which storage is not elsewhere provided.

<table>
<thead>
<tr>
<th>Height, Depth, and Spacing of Shelving and Countertop</th>
<th>width (w) in feet, times the depth (d) in feet, times the number of full-depth drawers equals area of drawer space</th>
</tr>
</thead>
<tbody>
<tr>
<td>wall shelving</td>
<td>area to be included in base shelving where access is from one side = ( \frac{1}{2} ) depth of corner where access is from both sides, allow full credit</td>
</tr>
<tr>
<td>3 s. ft.</td>
<td>Area of Drawer Space</td>
</tr>
<tr>
<td>2.5 x 2 = 5</td>
<td></td>
</tr>
<tr>
<td>3 x 3 = 9</td>
<td></td>
</tr>
<tr>
<td>4 x 3 = 12</td>
<td></td>
</tr>
<tr>
<td>total 30 s. ft.</td>
<td></td>
</tr>
<tr>
<td>base shelving</td>
<td>Area of Corner Base Shelving</td>
</tr>
<tr>
<td>4 s. ft.</td>
<td></td>
</tr>
<tr>
<td>x 4 = 16 s. ft.</td>
<td></td>
</tr>
<tr>
<td>counter top</td>
<td></td>
</tr>
<tr>
<td>4 s. ft.</td>
<td></td>
</tr>
<tr>
<td>2.5 x 1 = 2.5</td>
<td></td>
</tr>
<tr>
<td>2.5 x 1 = 2.5</td>
<td></td>
</tr>
<tr>
<td>drawers</td>
<td></td>
</tr>
<tr>
<td>1 x 4 = 4 s. ft.</td>
<td></td>
</tr>
<tr>
<td>4 x 6 = 24 s. ft.</td>
<td></td>
</tr>
<tr>
<td>4 x 10</td>
<td></td>
</tr>
<tr>
<td>total 35 s. ft.</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 9 Example: measurement of shelf and countertop areas.

CLEARANCES OVER COOKING RANGES

In Fig. 10, dimension A: 2 ft 6 in minimum clearance between the top of the range and the bottom of an unprotected wood or metal cabinet, or 2 ft 0 in minimum when the bottom of a wood or metal cabinet is protected.

Dimension B: 2 ft 0 in minimum when hood projection \( X \) is 18 in or more, or 1 ft 10 in min. when hood projection \( X \) is less than 18 in.

Dimension C: not less than width of range or cooking unit.

Dimension D: 10 in minimum when vertical side surface extends above countertops.

Dimension E: when range is not provided by builder, 40 in minimum.

Dimension F: Minimum clearance should not be less than 3 in.

Cabinet protection should be at least ½ in asbestos millboard covered with not less than 28-gauge sheet metal (0.015 stainless steel, 0.024 aluminum, or 0.020 copper).

Clearance for D, E, or F should be not less than listed UL or AGA clearances.
Above a sink, plan for a minimum of 22 in. to the bottom of a wall cabinet. Since the wall behind a sink often holds a window, measurement for a cabinet is academic. But if wall space is minimal, a cabinet over the sink makes good sense. The use of large pans, pancake flips and similar cooking maneuvers dictate a distance of 30 in. between rangetop and wall cabinet bottom. A fan mounted in the wall is the means here to exhaust cooking fumes to the outside.

Above a sink, plan for a minimum of 22 in. to the bottom of a wall cabinet. Since the wall behind a sink often holds a window, measurement for a cabinet is academic. But if wall space is minimal, a cabinet over the sink makes good sense. The use of large pans, pancake flips and similar cooking maneuvers dictate a distance of 30 in. between rangetop and wall cabinet bottom. A fan mounted in the wall is the means here to exhaust cooking fumes to the outside.

A range of 15 in. to 18 in. is the proper span between standard base and wall cabinets. Opt for the 15 in. distance if you are 5 ft. 4 in. or less; a wider span if you’re taller. The highest shelf: 6 ft. from the floor, is a reachable distance.

Kitchen activities become tiresome in poor light. A single fixture, centered on the ceiling is insufficient. Your need for light is greatest over the work centers. A good light there reduces the danger of cutting yourself; eases the task of monitoring color changes during a mix, and so on. The best place to install fixtures for this purpose is beneath the wall cabinets (with a shield to prevent glare when you’re seated in the kitchen). A workable alternative is found in fixtures installed in an extended soffit. Plan for light above a rangetop and over the sink, as well. Choose incandescent, deluxe warm white or deluxe cool white lamps for the fixtures to avoid poor color rendition.

Utensil and General Storage
Space for utensils includes storage for dishes, pots and pans, utensils, and appliances. With the increased use of such electrical appliances, their storage becomes a significant problem. General storage requires space for linen, towels, and kitchen supplies. Included in this category are brooms, mops, and other cleaning equipment and supplies.

<table>
<thead>
<tr>
<th>TABLE 1 Minimum Kitchen Storage Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total shelving in wall and base cabinets</td>
</tr>
<tr>
<td>Shelving in either wall or base cabinets</td>
</tr>
<tr>
<td>Drawer area</td>
</tr>
<tr>
<td>Countertop area</td>
</tr>
</tbody>
</table>

*Kitchen unit assemblies serving the kitchen function and occupying less than 40 ft² area in 0-BR living units shall not be less than 5 ft in length and shall provide at least 12 ft² of total shelving in wall and base cabinets. Drawer and countertop space shall also be provided. No room count is allowable for this type facility.
Residential Spaces

KITCHENS

Cabinet Dimensions

Example of the proper dimensional limits and relative placement of kitchen base cabinets and wall cabinets.
Residential Spaces
KITCHENS
Cabinet Sizes

WALL CABINETS
Wall cabinets are available in heights of 49", 30", 24", 18", 15", and 12". Most cabinets are available in widths ranging from 9" to 48" in 3" increments. Framed wall cabinets are 12" deep, not including doors. Frameless wall cabinets are 12¼" deep, including doors.

WALL BLIND CORNER CABINETS
Wall blind corner cabinets are available in heights of 49", 30", and 24". Most wall blind corner cabinets are available in widths of 94", 87", 70", 33", 36", 42", and 48".

BASE CABINETS
All base cabinets are 34½" tall. Most are available in widths ranging from 9" to 48" in 3" increments. Framed base cabinets are 24" deep, not including doors. Frameless base cabinets are 24 3/4" deep, including doors. Four-drawer base cabinets are available in widths ranging from 12" to 24" in 3" increments. Frameless base cabinets are also available in a three-drawer style in widths of 30" and 36".

BASE BLIND CORNER CABINETS
All base blind corner cabinets are 34½" high. Most are available in widths of 94", 70", 33", 30", 42", and 48".

SPECIALTY CABINETS
Lazy Susans: 36"-Wide
Range Hoods: (framed only)
30" & 30½"-Wide
Wall What-Not Shelves: (framed only)
30"-High
Base Open Shelves: (framed only)
34½"-High
Pantries: (framed only)
30" x 66½"
Utility Cabinets: (framed)
24" x 66½"
18" x 66½"
In 12½" and 15½" Depths
Utility Cabinets: (frameless)
36½" x 63½"
18½" x 63½"
In 12¼" and 94½" Depths

Tilt-Out Range Hoods: (frameless only)
30" x 94½"
Glass Door Wall Cabinets: (frameless only)
30" & 30½"-Wide
Microwave Cabinets: (framed only)
30" x 91½"
Microwave Shelves: 30" x 92½" (framed)
30" x 18½" (frameless)
Oven Cabinets: (framed)
27" x 66½"
30" x 66½"
33½" x 66½"
Oven Cabinets: (frameless)
27½" x 65½"
30½" x 65½"
33½" x 65½"
Up to six 6" drawers can be added to frameless oven cabinets.
Residential Spaces

KITCHENS
Cabinet Types and Dimensions
### Sink Cabinets & Fronts

**Sink Bases**
- SB24 or R
- SF24 L or R (Non-Trimmable)
- SB27
- SB30
- SB36
- SB32
- SB42
- SB33
- SB48

**Sink Fronts**
- SF30 L or R
- + SF30 (Without L or R Available in Nordico™ Not Shown) (Trimmable 3" per side Except Nordico™ Non-Trimmable)
- SF36
- SF48
- CSF36 L or R

**Corner Sink Front**
- 36" x 36"

### Oven Cabinets & Drop-In Range Fronts

**Oven Cabinets**
- 30" Max. Cut Out
- 60" Max. Cut Out
- Nordic™

**Drop-In Range Front**
- 90°
- 18°

### Utility Cabinets/Fronts & Pantry Cabinet

**Utility Cabinets/Fronts**
- UC1812x96 L or R
- UC1824x96 L or R
- UCF186 L or R
- UC1812
- UC1812
- UC1824
- UC1824
- UCF18 L or R

**Utility Cabinet Shelves**
- 16½" (width)
- 22½" (depth)
- 1½" (height)
- UCS1812
- UCS1824
- UCS2412
- UCS2424
- (Shipped 1 Shelf with 4 Shelf Supports)

**Pantry Cabinet**
- 24" x 24"
- UC2424 (Includes Lazy Susan Shelves & Racks) Available in Oak Lines, Except Oakcrest™ Euro™, X-Line™, & Spartan™

### Desk Cabinets

**Desk Unit**
- 28½"
- KDB15

**Kneehole Drawer**
- 30" (Trimmable 3" per side)

**Desk End Panel**
- KD30
Residential Spaces

KITCHENS
Cabinet Types and Dimensions

BASE CABINETS

DRAWER BASE CABINETS

SPECIAL DRAWER BASE CABINETS

COMBINATION SINK BASE CABINETS

ROTATING CORNER BASE CABINET

BLIND CORNER BASE CABINETS

PENINSULA BASE CABINETS

BLIND PENINSULA BASE CABINETS

**No Arched Door.**
**No Center Medallion. (Saxony)**

BL12 L or R
BL15 L or R
BL18 L or R
BL21 L or R
BL24 L or R

B27 B35
B30 B42
B33 B48

DB12 DB15
DB18 DB21
DB24

- DB18CB
(Includes Cutting Board, Cutlery Divider & Metal Bread Box.)

A B C
SB60 15" 30" 15"
SB66 15" 36" 15"
SB72 18" 36" 18"

* PLB24
* PLB30
* PLB36
(Drawers open on one side only in Peninsula Cabinet.)

* BLPB42 L or R (Pullable 6")
* BLPB48 L or R (Pullable 6")

**No Center Medallion. (Saxony)**

BL12 L or R
BL15 L or R
BL18 L or R
BL21 L or R
BL24 L or R

B27 B35
B30 B42
B33 B48

DB12 DB15
DB18 DB21
DB24

- DB18CB
(Includes Cutting Board, Cutlery Divider & Metal Bread Box.)

A B C
SB60 15" 30" 15"
SB66 15" 36" 15"
SB72 18" 36" 18"

* BLPB42 L or R (Pullable 6")
* BLPB48 L or R (Pullable 6")

(L-Shown, 3" Filler included, must use to allow doors to clear.)

* BLPB42 L or R (Pullable 6")
* BLPB48 L or R (Pullable 6")

(L-Shown, 3" Filler included, must use to allow doors to clear.)
Residential Spaces

KITCHENS
Cabinet Types and Dimensions

[Diagram of kitchen cabinetry and appliances, including elevations and section views.]
Residential Spaces

KITCHENS
Sink Types and Dimensions
Ranges and Built-In Ovens

Freestanding ranges and built-in ovens come in a variety of sizes and configurations. Some of the larger ranges consist of modular cooktops providing anywhere from two to seven heating elements as well as modular grills, griddles, and even downdraft built-in ventilators. Normally, a minimum clearance of 30° is required above any range or cooktop, but the designer is cautioned to carefully verify local code requirements. Manufacturers' specifications should be carefully reviewed for rough opening requirements and any venting requirements, particularly for self-cleaning ovens.

Dishwashers

Built-in, freestanding, and undersink dishwashers are fairly well standardized in terms of overall dimensions. Access to plumbing and waste lines is the major consideration, as is the method of securing the dishwasher in order to minimize vibration.

Refrigerators

Refrigerator door swings and clearances are of critical importance. While a 90° door swing may provide sufficient room for a person to observe storage within a refrigerator or freezer, a 180° door swing may be required to clean a refrigerator and remove storage bins. This is particularly true of the side-by-side door configuration. In addition, adequate clearance should be allowed between the sides and top of the refrigerator and any adjoining cabinetwork, especially if a built-in look is desired. The designer should check requirements with the manufacturer.

While these drawings can be used for preliminary planning, final dimensions and clearance must be verified with the manufacturer. Often overlooked are clearances for refrigerator handles or pulls as well as coils mounted at the rear of the refrigerator.
Residential Spaces

KITCHENS
Appliances

24" electric built-in double oven

24" electric built-in single oven

Gas built-in oven

Electric built-in single oven

27" electric built-in double oven

27" built-in microwave oven

30" electric built-in single oven

30" electric built-in double oven

30" built-in microwave oven

Note: Dimensions shown are for planning purposes only.
Residential Spaces

KITCHENS

Appliances

Conventional electric cooktop

36" electric cooktop

Glass cooktop

30" solid elements/glass cooktop

36" solid element/glass cooktop

30" gas cooktop

30" gas cooktop

RECOMMENDED AREA FOR ELECTRICAL JUNCTION BOX (LOCATE ON REAR WALL, AT LEAST 6 INCHES BELOW COUNTER TOP)

Note: Dimensions shown are for planning purposes only.
DEFINITIONS & DETAILS FOR PLASTIC LAMINATE TOPS

SQUARE BUTT JOINT. Where the junction of the counter top or back and end splash is made by two separate pieces.

COVE BACK SPLASH
SQUARE BUTT END SPLASH

COVE (Integral Cove). A curved junction of the counter top and splash, formed by bending a continuous sheet of plastic.

SELF EDGE
CUSTOM GRADE

SELF EDGE
PREMIUM GRADE
(TOP LAP OVER EDGE)

SELF EDGE. Application to the edge of plywood or particle board core of a plastic laminate of the same pattern as the face surface.

NO DRIP
BULLNOSE

NO DRIP -
TILT EDGE

NO-DRIP EDGE. Where the edge is raised, formed by a continuous sheet of plastic - may be either "A", a bull-nosed edge, or "B", a tilt or wedge edge. This is not a continuous sheet of plastic.

ROLLED EDGE. Sometimes referred to as "Waterfall". Formed by a continuous sheet of plastic rolled over the edge, with no raised portion.

WATERFALL. Curved upper portion of the back splash and the curved edge of the top, formed with a continuous sheet of plastic.

FULLY FORMED TOP

FULLY FORMED. A counter top made with a continuous sheet of plastic, combining a no-drip bull-nose edge, integral cove, and waterfall back splash. Radius may be from 1/4" to 3/4".

TYPES OF SINK INSTALLATIONS

Metal Sink Rim

Self Edge

TYPES OF EDGING

FLUSH METAL OR PLASTIC
TEE TYPE EDGE

SNAP ON
STAINLESS STEEL EDGE

TIGHT JOINT FASTENERS

Draw-Bolt

Fig. 11 Definitions and details for plastic laminate tops.
TOP SECTION WITH SHELF

- No. 10 - 2" F.H. Screws 24" o.c. Maximum Parkerized or equal.
- 1/4" WOOD MOULD Acid Resistant Coated if specified
- 1x3 Cleat cont. @ wall by Cab. Inst.

SINK CUTOUT

- 1/2" Standard / 7/8" Minimum
- Attach to Cabinet with 1/4" P.H. Screws No. 8 or 10 - Cadmium Plated

SPLASH

FINISHED EDGE

- Bomed Edge
- Relieved Corner
- Drip Groove

BUTT JOINT

- Color Matched Epoxy Cement
- 1/8" Maximum

Fig. 12 Composition stone top and sink details.
Residential Spaces

KITCHENS
Wheelchair Accessible Design

(a) Before Removal of Cabinets and Base

(b) Cabinets and Base Removed and Height Alternatives

Counter Work Surface

(a) Side-Hinged Door

(b) Bottom-Hinged Door

Kitchen Sink

Ovens without Self-Cleaning Feature

SYMBOL KEY:
1. Countertop or wall-mounted oven.
2. Pull-out board preferred with side-opening door.
3. Clear open space.
4. Bottom-hinged door.
EXAMPLE OF ADAPTABLE KITCHEN - U- SHAPED PLAN

EXAMPLE OF ADAPTABLE KITCHEN - L- SHAPED PLAN
Residential Spaces

KITCHENS
Wheelchair Accessible Design

Minimum-sized adaptable kitchen or kitchenette

Minimum-sized adaptable kitchen (galley type)

Kitchen clearance dimensions (not to scale)
Requirements

The ANSI and UFAS standards require accessible and adaptable features which make the kitchen usable by most people. The fixed accessible features specified in ANSI 4.32.5 and UFAS 4.34.6 include requirements for doors, clearances, clear floor space, appliances, storage, controls, and knee space. The adaptable features are removable base cabinets at knee spaces and counters that can be adjusted in height or fixed at a lower than standard height.

The adaptable features for kitchens specified in the standards are shown in Figs. 13 and 14. In Fig. 13, the kitchen is shown in a standard configuration with the counter height at 36 inches and the knee spaces covered with base cabinets.

In Fig. 14, the kitchen has been adapted by exposing the knee spaces and lowering the work surface and sink counter segments. No other changes have been made to the kitchen.

Since removable base cabinets and adjustable height counters are not now products that are readily available for purchase, they are usually custom-made items.
Residential Spaces

KITCHENS
Wheelchair Accessible Design

adjustable height sink counter segment with removable base cabinet, and pipe protection and appearance screen

range with up-front controls

adjustable height work surface counter segment with removable base cabinet

recommendation: position refrigerator so door can swing back 180°

ANSI/UFAS complying refrigerator freezer with 50% storage within reach ranges ANSI 2.34

counter support bracket and appearance cover

removed base cabinet

Fig. 15 A small kitchen with adaptable features: plan.

Fig. 16 A small kitchen with adaptable features: perspective.
The kitchen shown in Figs. 17 and 18 is an example of a more elaborate kitchen having ANSI/UFAS accessible/adaptable features. This kitchen exceeds the ANSI/UFAS minimum requirements.
Work Surfaces

People who use wheelchairs and other people who must or wish to sit down while preparing food need at least one work surface lower than the usual 36-in-high counter (Fig. 18).

The standards (ANSI 4.32.5.4 and UFAS 4.34.6.4) require that at least one 30-in-wide, adjustable-height work surface be provided in an adaptable kitchen, although a wider size is preferred. The wider work surface provides space for pots, dishes, and other utensils as well as small appliances, and makes it easier to work on several things at once or to cook using many ingredients.

Fig. 19  Seated person at lowered work surface.

Fig. 20  Use of a wider, lowered work surface.
Work surfaces at ovens: If a wall oven is installed, a lowered work surface with knee space should be installed next to the wall oven. The standards specify that when the wall oven is not self-cleaning, a knee space must be located next to the oven to permit a disabled person in a wheelchair to pull up close enough to clean the oven.

Even if a self-cleaning oven is installed, locating the knee space next to the oven makes it easier and safer for a disabled person to remove hot items from the oven.

When an oven with a side-opening door is used, a pull-out shelf located beneath the oven must be installed. The shelf is used as a transfer surface for dishes as they are placed into or taken out of the oven. When not needed, the shelf is pushed back into the oven cabinet (Fig. 23). When an oven with a drop-front door is used (Fig. 21), the pullout shelf is not needed because the door serves as a transfer shelf.

See ANSI 4.32.5.7 and UFAS 4.34.6.7 for dimensions and details of oven.

knee space allows someone to get close to oven

knee spaces not required if ovens are self-cleaning

Fig. 22 Use of knee space next to oven.

Work surfaces at ovens: If a wall oven is installed, a lowered work surface with knee space should be installed next to the wall oven. The standards specify that when the wall oven is not self-cleaning, a knee space must be located next to the oven to permit a disabled person in a wheelchair to pull up close enough to clean the oven.

Even if a self-cleaning oven is installed, locating the knee space next to the oven makes it easier and safer for a disabled person to remove hot items from the oven.

When an oven with a side-opening door is used, a pull-out shelf located beneath the oven must be installed. The shelf is used as a transfer surface for dishes as they are placed into or taken out of the oven. When not needed, the shelf is pushed back into the oven cabinet (Fig. 23). When an oven with a drop-front door is used (Fig. 21), the pullout shelf is not needed because the door serves as a transfer shelf.

See ANSI 4.32.5.7 and UFAS 4.34.6.7 for dimensions and details of oven.

knee space allows someone to get close to oven

knee spaces not required if ovens are self-cleaning

Fig. 22 Use of knee space next to oven.

Work surfaces at ovens: If a wall oven is installed, a lowered work surface with knee space should be installed next to the wall oven. The standards specify that when the wall oven is not self-cleaning, a knee space must be located next to the oven to permit a disabled person in a wheelchair to pull up close enough to clean the oven.

Even if a self-cleaning oven is installed, locating the knee space next to the oven makes it easier and safer for a disabled person to remove hot items from the oven.

When an oven with a side-opening door is used, a pull-out shelf located beneath the oven must be installed. The shelf is used as a transfer surface for dishes as they are placed into or taken out of the oven. When not needed, the shelf is pushed back into the oven cabinet (Fig. 23). When an oven with a drop-front door is used (Fig. 21), the pullout shelf is not needed because the door serves as a transfer shelf.

See ANSI 4.32.5.7 and UFAS 4.34.6.7 for dimensions and details of oven.

knee space allows someone to get close to oven

knee spaces not required if ovens are self-cleaning

Fig. 22 Use of knee space next to oven.
Residential Spaces
KITCHENS
Wheelchair Accessible Design

Cooktops in Adjustable Height Counter Segments
ANSI 4.32.5.6 and UFAS 4.34.6.6 permit use of a standard range if the controls comply with ANSI 4.26 or UFAS 4.27. The controls must be placed along the front or the side of the range so that a seated person need not reach across a hot burner to adjust the controls (Fig. 24).

Some wheelchair users cannot use conventional ranges because the surface is too high and there is no knee space for maneuvering. Cooktops in lowered counter segments with knee space below allow some wheelchair users to get close enough to operate the controls and move heavy pots and pans (Fig. 25).

Cooktops with smooth surfaces are preferred by people with limited hand and arm strength because they can slide pots of hot food on and off the cooktop rather than lifting them over raised burners and knobs.

When a cooktop is installed in a lowered counter, the width of the counter segment and knee space should be at least 30 inches and should provide space to the side of the cooktop for utensils and maneuvering. An additional 30 inches to the side is recommended (Fig. 26).

When the knee space is under a cooktop, the standards require that the bottom of the cooktop be insulated to protect against accidental burns.

While this type of installation may be the only way that some people can cook, it does expose a person in a wheelchair to the hazard of spilling hot food in his/her lap. People who pull up beneath the cooktop must exercise extreme care and cool hot foods before moving them.

---

Fig. 24 Standard range.

Fig. 25 Use of cooktop with knee space.

Fig. 26 Lowered cooktop with knee space and wide counter.
KITCHENS
Wheelchair Accessible Design

Kitchen arrangements

Counter-mounted cook top

Sink

Knee-space clearance

Knee-recess work area

Disposal sink

Armrest clearance

NOTE: All dimensions are approximations and are intended as guidelines. Actual dimensions may vary depending on specific design requirements and accessibility considerations.
Residential Spaces

KITCHENS
Wheelchair Accessible Design
It is difficult to develop precise formulas by which to design residential library shelving or to project the number of books that can be accommodated on a unit basis because of the many variables involved. The size of books, the types of books and other reading materials, the reach limitations of the user, etc., all have an impact upon the design requirements.

It is possible, however, for preliminary planning purposes, to apply the broad guidelines indicated in Figs. 1 to 3. Seven volumes per foot of shelving can be used as a rule-of-thumb to project capacity. The height of the highest shelf above the floor should be limited to between 78 and 81 in; 24 in is the minimum height above the floor to gain access to a shelf without squatting. Limitations for shelving to serve children will differ and are indicated in Fig. 3.

### Table 1: Library Shelving: Volumes per Linear Foot of Shelf Based on Subject

(Standard stack section 3 ft wide × 7½ ft high with 7 shelves)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Volumes per foot of shelf</th>
<th>Volumes per single face section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art (excluding oversize)</td>
<td>7</td>
<td>147</td>
</tr>
<tr>
<td>Nonfiction</td>
<td>8</td>
<td>168</td>
</tr>
<tr>
<td>Economics</td>
<td>8</td>
<td>168</td>
</tr>
<tr>
<td>Fiction</td>
<td>6</td>
<td>168</td>
</tr>
<tr>
<td>General literature</td>
<td>7</td>
<td>147</td>
</tr>
<tr>
<td>History</td>
<td>4</td>
<td>84</td>
</tr>
<tr>
<td>Law</td>
<td>5</td>
<td>105</td>
</tr>
<tr>
<td>Medical</td>
<td>5</td>
<td>105</td>
</tr>
<tr>
<td>Periodicals, bound</td>
<td>5</td>
<td>105</td>
</tr>
<tr>
<td>Public documents</td>
<td>5</td>
<td>105</td>
</tr>
<tr>
<td>Technical and scientific</td>
<td>6</td>
<td>128</td>
</tr>
<tr>
<td><strong>Average for overall estimating</strong></td>
<td><strong>125</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Figures

- **Fig. 1** Optimum shelving conditions for adults.
- **Fig. 2** Optimum shelving conditions for teenagers.
- **Fig. 3** Optimum shelving conditions for children.
Here is a simple method of building in bookshelves, bar units, etc., for residences and other types of buildings by using an egg-crater system. The front of the shelf is supported by the vertical members and the back of the shelf is nailed to the plywood back. These built-in bookshelves and bar units were developed for a residence on the Eastern Shore of Maryland. In this design Hugh Newell Jacobsen, FAIA, divided the built-in bookcases into units of three shelf widths and introduced a recessed vertical divider 3" deep by 7⅛" wide between bookcase units. The major trim piece is solid wood 1⅛" x 1⅛" with a ¾" wide by ⅝" deep groove at the middle. This simple trim piece acts as framing for sides, top, and bottom of the bookshelves and also for the bar unit with glass shelves and mirrored back, sides, top, and bottom.
TOP FIXTURES FOR
NO. 1 ROLLING LADDER
No. 210—Roll Type Top Fixture
No. 230—Hook Slide Top Fixture

No. 210

No. 230

TOP FIXTURES FOR
NO. 1 ROLLING LADDER
No. 1 Bottom Fixture No. 270 Regular
No. 1 Bottom Fixture No. 270 Old Style

BOTTOM FIXTURES FOR NO. 1 ROLLING LADDER

BRACKETS FOR TRACK

No. 1 Track
Roll Top
No. 210

No. 14
No. 27
No. 29

No. 14 H
No. 27 H
No. 29 H

No. 14
No. 14 H
No. 14H

No. 27
No. 27 H
No. 27H

No. 29GR
No. 29

No. 29H
Residential Spaces
FAMILY/RECREATION ROOMS
Arrangements and Clearances

Recreational Activities
Indoor recreational activities invariably require definite spaces for equipment and clearances for using it. Not all games occupy floor areas indicated as necessary for those diagramed on this page. But if interiors are planned to accommodate large units of equipment such as that required for table tennis, and provide necessary playing clearances, spaces will be adequate for many other uses as well.

Dimensions of game equipment and floor areas required for its use are both subject to variation. Sizes noted here are comfortable averages, not absolute minima.

Fig. 1 Play room.
### TABLE 1  Pool and Billiard Table Sizes (In feet)

<table>
<thead>
<tr>
<th>Size</th>
<th>Where used</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 x 8</td>
<td>Home</td>
</tr>
<tr>
<td>3½ x 7</td>
<td>Home</td>
</tr>
<tr>
<td>4 x 8</td>
<td>Home, Commercial standard in South America, Mexico, and Spain</td>
</tr>
<tr>
<td>4½ x 9</td>
<td>Popular U.S. commercial standard</td>
</tr>
<tr>
<td>5 x 10</td>
<td>U.S. professional standard</td>
</tr>
<tr>
<td>6 x 12</td>
<td>Commercial standard in Canada and England</td>
</tr>
</tbody>
</table>

Standard ping pong table sizes are 3 ft x 6 ft; 3 ft 6 in x 7 ft 0 in; 4 ft 0 in x 8 ft 0 in; 4 ft 8 in x 8 ft 6 in; 5 ft 0 in x 9 ft 2 in; 5 ft 6 in x 10 ft 2 in; 6 ft 8 in x 12 ft 8 in.
This small residential bar with double lighting was designed so that the back bar shelves would display all the types of bar glasses and the liquor bottles as a decorative element. Note how the recessed fluorescent tube fixtures indirectly light up all the glasses and the 2" open slot in the bottom shelf indirectly lights up the liquor bottles on the back bar shelf. The entire front bar has recessed light fixtures in the ceiling above; this allows for two different methods of lighting the bar area. Note also that the bar front is slightly padded with foam rubber and the entire bar top is finished with dark brown leatherette.
HOME LAUNDRY ACTIVITIES

Home laundry includes the processes from sorting through ironing of clothes and household linens, including pretreating, washing, drying, and sprinkling.

General Planning Suggestions
1. It is desirable to plan space for specific laundry processes.
2. Moistureproof surfaces are needed for pretreating and sprinkling of clothes.
3. Drying areas should be accessible for use under all climatic conditions.
4. To control moisture in the room, dryers should be located to permit venting to the outside of the house.
5. Adequate storage for washing equipment and supplies should be located near the place of first use.
6. Facilities for storing dry-clean garments after washing should be provided.
7. In locating the washing equipment consideration should be given to convenience of inter-related household activities, distances from the source of soiled clothes and the drying areas, and the isolation of clutter.

Figures 1 and 2 illustrate arrangements of laundry equipment. Space needed by a single worker in front of equipment or between equipment placed opposite is indicated. Overall dimensions of areas will vary with type and size of equipment selected. No allowance has been made between the back of equipment and the wall for electrical, plumbing, and dryer vent connections. The space required will depend on the type of installation used.

Counter space is provided for sorting and folding three washer loads of clothes. The space under the counters has been used for bins, one for soiled clothing and the other for dry, clean articles that require further treatment before use or storage. Additional counter space can be provided by the tops of the dryer and washer, depending upon the type selected.

A tall storage cabinet for laundry supplies would complement each arrangement. This cabinet, if an ironing board, iron, mops, and buckets (needed for cleaning the laundry area) may also be stored.

<table>
<thead>
<tr>
<th>Type and size of equipment</th>
<th>Auxiliary equipment</th>
<th>Work area, in</th>
<th>Total floor area, in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stacked arrangement: washer, 31 x 26 in; dryer, 31 x 26 in</td>
<td>Basket, 19-in diameter</td>
<td>43 x 37</td>
<td>43 63</td>
</tr>
<tr>
<td>Angle arrangement: washer 26 x 26 in; dryer, 31 x 26 in</td>
<td>Basket, 19-in diameter</td>
<td>36 x 59</td>
<td>62 76</td>
</tr>
<tr>
<td>Straight-line arrangement: washer 26 x 26 in; dryer, 31 x 26 in</td>
<td>Basket, 19-in diameter</td>
<td>36 x 66</td>
<td>62 66</td>
</tr>
</tbody>
</table>
**Residential Spaces**

**LAUNDRY/SEWING ROOMS**

Laundry Room Layouts

---

**Fig. 5** Automatic washer. A = 24–30 in, B = 26–30 in, C = 42 in, D = 36 in.

**Fig. 6** Automatic dryer. A = 24–28 in, B = 24–26 in, C = 42 in, D = 36 in.

**Fig. 7** Compact washer.

**Fig. 8** Compact dryer.

**Fig. 10** Clearance in front of automatic washer and dryer. If the space in front of the automatic washer and dryer is a corridor, this dimension should be increased to at least 1200 mm (4 ft). This will permit a second person to pass through when someone is doing the laundry. If a washer and dryer are located opposite each other, this dimension should also be 1200 mm (4 ft).

---

**Fig. 9** When space is limited, it may be possible to locate the laundry space next to a corridor.

**Fig. 11** Clearance in front of laundry tub.

**Fig. 12** Clearance in front of sorting counter or table.
Residential Spaces

LAUNDRY/SEWING ROOMS
Laundry Room Layouts

LAUNDRY LOCATION
The ideal location of the laundry space is a matter of preference. The laundry area may be separate or combined with the bathroom, the kitchen, the utility space, or the corridor. The most frequently mentioned advantages and disadvantages of these various options are listed below.

Separate Laundry
Advantages
A separate space can be used for other activities such as sewing and hobbies, if it is large enough.
Clothes may be hung for air drying without interfering with other household activities.
Noise from laundry appliances can be shut off from the rest of the dwelling.
Temporary holding or storage of clothing to be washed or ironed is made easier.

Disadvantages
Providing this extra room increases the cost of the dwelling.

Laundry in Combination with Bathroom
Advantages
When the bathroom is located near the bedrooms, the washer and dryer are close to where most laundry originates. This facilitates gathering soiled articles and putting away clean linen and clothing.
Combining the laundry space with a half bathroom adjacent to the kitchen provides many of the advantages of a separate laundry room.
The tops of the laundry appliances provide useful horizontal space on which to lay clothes.
Floor and wall finishes in bathrooms are usually resistant to high humidities.
Usually, additional plumbing costs are minimal.
The bathroom sink may be used for hand washing.
Mechanical ventilation can be provided economically for both functions.

Disadvantages
A bathroom will usually accommodate only washing and drying facilities. Other laundry related activities such as ironing, will have to be carried out elsewhere in the dwelling.
Occupants may wish to use the bathroom when laundry is being washed or dried.
Laundry in Combination with Kitchen

Advantages
- Suitable in housing for young families because the person doing the laundry can keep an eye on the washing machine while doing other jobs and supervising the children.
- Direct access to the outside for clothes drying is likely to be easier than from laundries located in a basement or on a second storey.
- Kitchen sinks are usually sizeable and can be used for laundering.
- Additional plumbing costs are usually small.

Disadvantages
- Danger of cross-contamination through the handling of dirty washing during food preparation.
- Grease and cooking smells can be passed on to clean clothes.
- Noise generated by running appliances cannot easily be shut off from the rest of the dwelling.

Laundry in Combination with Utility Space in Basement

Advantages
- Generally, as much space as needed can be provided.
- Noise generated by running appliances can be easily shut off from the rest of the dwelling.

Disadvantages
- Laundry must be carried up and down stairs, although automatic dryers have eased the problem of carrying heavy baskets of damp clothes to outdoor clotheslines.

Laundry in Combination with Corridor

Advantages
- The space is used more economically (Fig. 3).
- The space above the appliances may be used as a linen closet.
- The appliances can be hidden from sight when they are not in use; they can be recessed into the wall and enclosed with doors.

Disadvantages
- Noise generated by running appliances cannot be easily shut off from the rest of the dwelling.
- An alcove adjacent to a corridor will accommodate only a minimum-sized laundry area. Other laundry related activities, such as ironing, will have to be carried out elsewhere in the dwelling.
Planning for Efficiency

The sequence of laundering operations determines the planning of space and facilities and the placing of equipment. Convenience and time-and-step saving are easily achieved by placing the elements in their natural order of use: (1) clothes chute (with or without bins or hampers), (2) sorting table or counter, (3) washing machine, (4) laundry trays, (5) dryer, (6) ironer or mangle, (7) ironing board, (8) rack, "horse," or table for finished laundry. In addition, storage closet or cabinets will be necessary for soaps, powders, bluing, bleaches, starch, basket, clothespins, iron, etc.

KEY

1. STORAGE CLOSET
2. CLOTHES CHUTE
3. SORTING SHELF
4. LAUNDRY TRAY
5. WASHING MACHINE
6. DRYER
7. IRONER
8. IRONING BOARD

KITCHEN AND LAUNDRY LAYOUT

LAUNDRY-SEWING-MENDING

KEY

CLOS. STORAGE CLOSET
CH. CLOTHES CHUTE
SORT. SH. SORTING SHELF
TRAY LAUNDRY TRAY
W.M. WASHING MACHINE
DRY. DRYER
IR’N IRONER
IR. B’D IRONING BOARD

UNIT MAY CARRY CLOTHES BASKET IF TOP SHELF IS REMOVED.

WASH BOARD MAY BE HUNG ON THE INSIDE OF ONE DOOR

WALL AND BASE CABINETS ARE STOCK TYPES WITH SHADOW BOX ADDED. IF SPECIALLY BUILT, CAN BE PORTABLE.
General Planning Suggestions

1. An area especially planned for sewing, convenient to other activity areas, is desirable.

2. Most houses need storage space for sewing materials and equipment. The amount and kind of storage required varies according to the quality and frequency of sewing.

3. A minimum sewing area should include the machine, auxiliary work surfaces, a chair that permits freedom of motion, and storage arrangements. The work surface for layout and cutting may be outside the area for sewing machine operations and serve multiple purposes.

4. Consideration should be given to work surfaces at comfortable heights for the varying activities of sewing.

5. Light should be adequate for the activity.

TABLE 2 Dimensions of Area for Layout and Cutting Garments

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Dimensions, in</th>
<th>Minimum</th>
<th>Adequate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working surface</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td></td>
<td>66</td>
<td>72</td>
</tr>
<tr>
<td>Width</td>
<td></td>
<td>28</td>
<td>36</td>
</tr>
<tr>
<td>Table, free-standing</td>
<td></td>
<td>28</td>
<td>32</td>
</tr>
<tr>
<td>Table obstructed on one side</td>
<td></td>
<td>28</td>
<td>32</td>
</tr>
<tr>
<td>Height</td>
<td></td>
<td>34–40 (range)</td>
<td>36 (median)</td>
</tr>
<tr>
<td>Clearance for worker</td>
<td></td>
<td>18</td>
<td>24</td>
</tr>
</tbody>
</table>

TABLE 3 Dimensions of Fitting Space

<table>
<thead>
<tr>
<th>Use of Space</th>
<th>Minimum</th>
<th>Adequate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viewing in mirror:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mirror dimensions, in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Width</td>
<td>16</td>
<td>18</td>
</tr>
<tr>
<td>Length</td>
<td>42</td>
<td>60</td>
</tr>
<tr>
<td>Top to floor</td>
<td>70</td>
<td>72</td>
</tr>
<tr>
<td>Clearance in front of mirror</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Width</td>
<td>6–8</td>
<td>10</td>
</tr>
<tr>
<td>Length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clearance while fitting self</td>
<td>6 × 4</td>
<td></td>
</tr>
<tr>
<td>Clearance while being fitted</td>
<td>8½ × 4</td>
<td></td>
</tr>
<tr>
<td>Fitting garment on dress form</td>
<td>5 × 4</td>
<td>7 × 6</td>
</tr>
</tbody>
</table>

Fig. 13 Mean heights and clearances for sewing machine use.

Fig. 14 Arrangement of sewing equipment based on flow of work.

Fig. 15 Sewing room.
Residential Spaces

CLOSETS/STORAGE AREAS

Figures 1 and 2 show the vertical clearances related to male and female closet and storage facilities. Wherever possible or practical, the closet shelf should be located within human reach. The height shown for the high shelf has been established based on fifth percentile male and female data in order to place it within reach of individuals of smaller body size. Any shelf located at a greater distance should be used primarily for storage that requires only infrequent access. The location of the shelf just above the rod is essentially a function of rod height. The clearance between the bottom of the shelf and the top of the rod should allow for easy removal of the hanger.

Figure 3 illustrates two various types of walk-in storage facilities. Undoubtedly, it can be argued that the 36-in, or 91.4-cm, clearance shown between the hanging garment and the storage shelf or between opposite garments could be reduced about 60 percent. The authors contend, however, that in order to achieve any degree of comfort in the selection and removal of the desired garment, a minimum of 36 in should be maintained. The degree to which this dimension can be reduced is a question of the level of comfort the user is prepared to tolerate in exchange for the floor space saved. The two drawings of the plan view of the human figure illustrate clearances required for donning a coat or putting on a pair of stockings.

<table>
<thead>
<tr>
<th></th>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>64–68</td>
<td>162.6–172.7</td>
</tr>
<tr>
<td>B</td>
<td>72–76</td>
<td>182.9–193.0</td>
</tr>
<tr>
<td>C</td>
<td>12–18</td>
<td>30.5–45.7</td>
</tr>
<tr>
<td>D</td>
<td>8–10</td>
<td>20.3–25.4</td>
</tr>
<tr>
<td>E</td>
<td>20–28</td>
<td>50.8–71.1</td>
</tr>
<tr>
<td>F</td>
<td>34–36</td>
<td>86.4–91.4</td>
</tr>
<tr>
<td>G</td>
<td>10–12</td>
<td>25.4–30.5</td>
</tr>
<tr>
<td>H</td>
<td>60–70</td>
<td>152.4–177.8</td>
</tr>
<tr>
<td>I</td>
<td>69–72</td>
<td>175.3–182.9</td>
</tr>
<tr>
<td>J</td>
<td>76</td>
<td>193.0</td>
</tr>
<tr>
<td>K</td>
<td>68</td>
<td>172.7</td>
</tr>
<tr>
<td>L</td>
<td>42</td>
<td>106.7</td>
</tr>
<tr>
<td>M</td>
<td>46</td>
<td>116.8</td>
</tr>
<tr>
<td>N</td>
<td>30</td>
<td>76.2</td>
</tr>
<tr>
<td>O</td>
<td>18</td>
<td>45.7</td>
</tr>
</tbody>
</table>

Fig. 1 Closet and storage facilities: male.

Fig. 2 Closet and storage facilities: female.

Fig. 3 Walk-in closet and storage facilities.
CLOTHES CLOSETS

The capacity of a clothes closet depends upon the accessible length of rod. Three types of closets are common.

Reach-in closet The minimum front-to-back depth of space for hanging clothes is 24”. The accessible rod length is equal to the width of the door opening plus 6” on each side.

Walk-in closet This type provides rods on one or both sides of an access path at least 20’ wide. A wider access space within the closet may be used as a dressing area.

Edge-in closet By providing an edge-in space of at least 18”, the accessible rod length can be much longer than the door width. This requires less wall space than a full front opening.

Rod Lengths and Heights

The Minimum Property Standards of HUD (1973) require that each bedroom have a closet, with rod and shelf, with minimum dimensions of:

- For double-occupancy bedrooms: 24” by 60”
- For single-occupancy bedrooms: 24” by 36”
- For closet at entrance to house: 24” by 24”

A more desirable front-to-back depth would be 28” for bedroom closets and 30” for entrance closets to accommodate bulky outer garments.

The average rod space per garment is about 2” for women’s clothing, 2½” for men’s clothing, and 4” for heavy coats.

Recommendations of heights of rods are 68” for long robes, 63” for adult clothing, and 32” for children’s clothing.

Shelf Space and Lighting

The shelf is normally located 2” above the rod, and another shelf may be located 12” higher. Shelves higher than the rod may also be installed at the end of the closet.

A fluorescent fixture over the door is recommended for lighting a closet. Deluxe cool white tubes match daylight for selecting clothes.

MINIMUM SHALLOW & WIDE

NARROW & DEEP

WALK-IN TYPES

SHALLOW & WIDE

6’0” LARGER

FLAT TOPS

5’0” & LARGER

FITTING MIRROR

5’6” LARGER

SHELVES

DRESSES
Residential Spaces

CLOSETS/STORAGE AREAS

Clothes Closet Details

Fig. 4  Bedroom closet designed for one person. This diagram shows dimensions for rods, shelves, and drawers to hold underwear, sweaters, shoes, hats, purses, and ties. Research shows that each person needs at least 48 inches of rod space for hanging clothing.

<table>
<thead>
<tr>
<th>TABLE 1 Garment Dimensions</th>
<th></th>
<th>Allowance per garment, in</th>
<th>Allowance per garment, in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men's garments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy jackets and coats</td>
<td>3</td>
<td>Coats and jackets:</td>
<td></td>
</tr>
<tr>
<td>Medium-weight jackets, coats, and raincoats</td>
<td>2</td>
<td>Heavy</td>
<td></td>
</tr>
<tr>
<td>Sweaters, light-weight jackets, and raincoats</td>
<td>1</td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>Work pants:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Folded on hanger</td>
<td>2 1/4</td>
<td>Sweaters</td>
<td>1 1/4</td>
</tr>
<tr>
<td>Hung full length</td>
<td>1 1/4</td>
<td>Other garments:</td>
<td></td>
</tr>
<tr>
<td>Other garments:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top coats</td>
<td>2 1/2</td>
<td>Dress coats, winter</td>
<td>3 1/2</td>
</tr>
<tr>
<td>Robes</td>
<td>2</td>
<td>Robes</td>
<td>2</td>
</tr>
<tr>
<td>Suits (trousers full length under jacket)</td>
<td>3</td>
<td>Suits, wool (skirt under jacket)</td>
<td>2 1/2</td>
</tr>
<tr>
<td>Trousers</td>
<td>1 1/2</td>
<td>Skirts</td>
<td>1</td>
</tr>
<tr>
<td>Jackets</td>
<td>2</td>
<td>Jackets</td>
<td>2</td>
</tr>
<tr>
<td>Sweater jacket</td>
<td>1</td>
<td>House dresses</td>
<td>1 1/4</td>
</tr>
<tr>
<td>Shirts (all kinds)</td>
<td>1 1/1</td>
<td>Other dresses:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Average</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Full-skirted</td>
<td>2 1/2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Straight-line</td>
<td>1 1/4</td>
</tr>
<tr>
<td>Women's garments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suits, medium and short coats</td>
<td></td>
<td>Blouses, jackets</td>
<td>25-35</td>
</tr>
<tr>
<td>Trousers</td>
<td></td>
<td>Skirts</td>
<td>31-43</td>
</tr>
<tr>
<td>Folded over hanger</td>
<td>23-37</td>
<td>Dresses, long coats, short robes</td>
<td>48-55</td>
</tr>
<tr>
<td>Full length</td>
<td>47-53</td>
<td>Long robes, long evening dresses</td>
<td>61-68</td>
</tr>
<tr>
<td>Overcoats, robes</td>
<td>48-54</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 4  Bedroom closet designed for one person. This diagram shows dimensions for rods, shelves, and drawers to hold underwear, sweaters, shoes, hats, purses, and ties. Research shows that each person needs at least 48 inches of rod space for hanging clothing.
Residential Spaces
CLOSETS/STORAGE AREAS
Clothes Closet Details

CLOSET SHELF DETAIL

NORTH ELEVATION SPACE # 4A
Residential Spaces

CLOSETS/STORAGE AREAS
Clothes Closet Details

**PLAN SECTION AT COAT CLOSET**

- Hangrod shelf
- V.I.K. magnetic catch
- 1/2 x 2" paint grade blocking
- 1 3/4" WD door w/ Flas, lam. finish (PL-11)

**VERT. SECTION AT COAT CLOSET**

- Stanley #327 hinge top 4 bot
- 3/4" Plywood w/ Flas, lam. fin. (PL-11)
- End bracket & (1) intermediate support
- S.S. hangrod 1" diameter
- Bot. hinge 1/4" above carpet

**COORD**

- Chrome hang rod

**COAT CLOSET SHELF**

Provide intermediate support for spans greater than 3'-0"
Residential Spaces
CLOSETS/STORAGE AREAS
Closet Wall Details

ELEVATION OF CLOSET DOORS & DRAWERS

SECTION THRO DRAWERS

PLAN

SECTION THRO SLIDE

PLAN THRO DRAWERS

PLAN SECTION THRO DOOR

SECTION THRO DRAWERS
Residential Spaces
CLOSETS/STORAGE AREAS
General Storage Shelving

ELEVATION OF STORAGE CLOSETS 4'-0" OR LESS IN LENGTH
@ $3" = 1'-0"

ELEVATION OF STORAGE CLOSETS OVER 4'-0" IN LENGTH
@ $3" = 1'-0"

STORAGE CLOSET
SHELVING DETAILS

4
PANTRY

Front View
Multiple-stacked, wrap-around storage shelving. Optional baskets and door racks. (5', 12', 16' and 20' widths available)

Top View
All the shelving you'll ever need for full-size family food storage. Sliding baskets hold fruit, vegetables and other kitchen supplies. Optional door racks maximize storage area by utilizing all available space.

HOUSEKEEPING/UTILITY ROOM

Front View
Double, full-width upper storage shelving with stacked storage shelving. (12', 16' widths available)

Top View
Makes housework easier to handle by storing household cleaning items just where you need them. Plenty of shelving space for cloths, detergents and brushes. Wide storage area holds vacuum cleaner, brooms, mops and small appliances.

Front View
Double, full-width storage shelving with side-mounted shelving and basket unit and optional door/wall storage rack. (12', 16' widths available)

Top View
Make a clean sweep of cleaning with full-length shelves that hold a variety of utensils. Storage baskets pack brushes, cloths and sundry items. Bottled detergents and cleaning products can be stored neatly and safely in optional door racks.
**Residential Spaces**

**CLOSETS/STORAGE AREAS**

**Wire Basket and Shelving Systems**

**BEDROOM APPLICATIONS**

**Front View**
Single and double hang with upper storage, center pole support and shoe racks. (12', 16' widths available)

**Top View**
Combination convenience for single and double hanging clothes. The perfect his and hers closet. Extra wide shelf space for clothing, linen and blankets in your master bedroom. Plus lots of room for her long dresses and coats — his shirts, suits and slacks. Shoe racks on both sides.

**CHILDREN’S CLOSETS**

**Front View**
Full-width, double hanging with lower shelving height. Sliding basket system and shoe racks. (12', 16' widths available)

**Top View**
Specially designed for the children's room. Extra low-hanging shelf makes it easy for kids to reach. Stores toys and sports equipment in easy-access sliding baskets. Shoe rack keeps sneakers and other footwear neatly organized.

Front View
Walk-In. Single and double hang with upper storage and central shelving unit with additional clearance and shoe racks. (12', 16' widths available)

**Top View**
Single hanging space for coats and other long garments. Convenient hanging convenience for shorter garments. Full shelves with central storage unit allow easy storage of sweaters, boots, sports equipment, tall and over-sized items. Tailor-made for couples with a 2nd bedroom.

Front View
Standard. Double hang with shoe rack and off-center pole support. (12', 16' widths available)

**Top View**
Makes kids stuff out of chaos in any teenager's room. Plenty of storage space for footballs, beach equipment, basketballs, skates and other cumbersome items. Doubles as storage area for dresses and coats. Conveniently placed hanging rod for all your teenager's clothing.
LINEN

Front View
Multiple-stacked linen shelving with pole support and sliding basket system. (9", 12", 16" and 20" widths available)

Top View
Four extra-wide shelves for linen and blankets. Storage baskets slide out and hold dish cloths, pillowcases and smaller items. The perfect linen closet.

FOYER/Front Entry Closet

Front View
Single hang with upper storage and off-center storage unit and shoe racks. (12", 16" widths available)

Top View
A welcome addition to any home. Full-width, upper storage holds hats, gloves and sweaters. Off-center storage for umbrellas and winter items. Shelves, shoe racks and generous hanging space lets guests know they're welcome.

Front View
Multiple-stacked linen shelving. (9", 12", 16" and 20" widths available)

Top View
Bathroom linen closet stores towels, sheets and cleaning supplies in one easy-access area.
**Residential Spaces**

**CLOSETS/STORAGE AREAS**

Wire Basket and Shelving Systems

**MASTER BEDROOMS**

**Front View**
Walk-in. Single hang with upper storage and central shelving/basket unit and shoe racks. (12'16" widths available)

**Top View**
Keeps shoes, shirts and clothing neatly organized. Sliding baskets for easy access to linen, underwear, etc. Full-length clothes storage for dresses, shirts and suits. Ideal for master bedroom.

**Front View**
Walk-in. Single and double hang with upper storage, central shelving and shoe racks. (12'16" widths available)

**Top View**
Hang dresses and suits on one side, shirts and shorter garments on the other. Central shelving actually replaces a piece of furniture in the master bedroom!

**Front View**
Single hang with upper storage and central shelving and basket unit, additional clearance and shoe racks. (12'16" widths available)

**Top View**
So well designed it actually replaces a piece of furniture! Four sliding baskets provide multiple storage capacity for shirts, underwear, socks and sweaters. Full-length clothes hanging space, full-width shoe racks and lots of shelf space make this system a must for your 2nd bedroom.

**Front View**
Single hang with upper storage and full-width shoe racks. (12'16" widths available)

**Top View**
Doubles shelf/storage space. Single hanging for clothes, coats, shirts and jackets. Expands easily to accommodate future needs. Two full-length shoe racks.
# Office Spaces

<table>
<thead>
<tr>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>General offices and multiple workstations</td>
<td>223</td>
</tr>
<tr>
<td>Private offices</td>
<td>231</td>
</tr>
<tr>
<td>Electronic workstations</td>
<td>241</td>
</tr>
<tr>
<td>Conference rooms</td>
<td>249</td>
</tr>
<tr>
<td>Reception areas</td>
<td>260</td>
</tr>
<tr>
<td>Furniture, furnishings, and equipment</td>
<td>278</td>
</tr>
</tbody>
</table>
Office Spaces

INTRODUCTION

The amount of office space built during the past few decades can be measured in the hundreds of billions of square feet. Within these buildings, workers spend nearly half their waking hours and a third of their entire lives.

Over the life span of a typical office building, the same spaces may be occupied by a succession of different tenants, each with their own programmatic requirements. Consequently, interior spaces may be recycled and redesigned many times, simply to accommodate the changing needs of new corporate users. In many instances redesign may be necessitated solely by the effect of technological change on the methodology of transacting business. Moreover, the escalating costs of land acquisition and construction and the increasing scarcity of urban building sites make it essential that the redesign reflects an efficient, cost-effective utilization of space, as well as one that is responsive to the human factors involved. It is necessary, therefore, for the designer to be familiar not only with the general planning criteria associated with office design, but with the architectural detailing of some of the typical interior elements contained within these spaces.

Accordingly, this section includes general planning criteria and examples of actual working drawings of typical interior conditions, prepared by various design professionals. The details alluded to include such items as trading desks, elevated computer floors, library furniture, built-in storage cabinets, work counters, wall paneling, vanities, reception desks, and conference room elements. Also included are illustrations and dimensional data pertaining to typical office furniture, equipment, and electronic media storage.
The so-called general office takes on a variety of forms and configurations. In its simplest variation it may be nothing more complex than several standard desks with returns located within a room or space. In its more sophisticated and ergonomically designed form, the general office may be based on an open planning or office landscaping concept, involving a system of workstations. The workstations include desk surfaces, files, acoustic partitions, and a host of other optional components to suit the nature of the particular work tasks involved. The systems are extremely flexible, allowing the workstations to be configured in a variety of shapes. Provision for power and lighting is quite common.

The design of the general office, like the design of the private office, requires a knowledge of the basic dimensional requirements and clearances of the workstation and, where applicable, of the visitor seating to be accommodated.

In certain instances, where customized and/or built-in storage elements, work counters, credenzas, etc., are required, a knowledge of architectural woodworking, as may be related to the design of such elements, can be quite helpful.

Accordingly, this part includes basic planning criteria for general office design, in addition to examples of architectural woodworking details in connection with some of the more common customized components of general office spaces.

The basic workstation, as illustrated in plan in Fig. 1, is the fundamental building block in understanding the anthropometric considerations for the planning and design of the general office. The worktask zone must be large enough to accommodate the paper work, equipment, and other accessories that support the user's function. The work/activity zone dimension, shown in Fig. 1, is established by the space requirements needed for use of the typical return. In no case should this distance be less than the 30 in. or 76.2 cm, needed to provide adequate space for the chair clearance zone. The visitor seating zone, ranging in depth from 30 to 42 in, or 76.2 to 106.7 cm, requires the designer to accommodate both the buttock-knee and buttock-toe length body dimensions of the larger user. If an overhang is provided or the desk's modesty panel is recessed, the visitor seating zone can be reduced due to the additional knee and toe clearances provided.

The specific type and size of the seating (i.e., if it swivels or if it has casters) also influence these dimensions.

Figure 2 shows the typical workstation expanded into the basic U-shaped configuration. The work/activity zone dimension range is shown as 48 to 58 in, or 121.9 to 147.3 cm; additional space is needed to allow for drawer extension of the lateral file. Not only does it provide more storage, the lateral file unit is generally the same height as that of the worksurface and is often utilized as a supplementary worksurface. The distance between this unit and that of the primary worksurface must be sufficient to allow for movement and rotation of the chair.

### Planning Data: Basic Workstations

<table>
<thead>
<tr>
<th>Measurement</th>
<th>In</th>
<th>Cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>90-126</td>
<td>228.6-320.0</td>
</tr>
<tr>
<td>B</td>
<td>30-36</td>
<td>76.2-91.4</td>
</tr>
<tr>
<td>C</td>
<td>30-48</td>
<td>76.2-121.9</td>
</tr>
<tr>
<td>D</td>
<td>6-12</td>
<td>15.2-30.5</td>
</tr>
<tr>
<td>E</td>
<td>60-72</td>
<td>152.4-182.9</td>
</tr>
<tr>
<td>F</td>
<td>30-42</td>
<td>76.2-106.7</td>
</tr>
<tr>
<td>G</td>
<td>14-18</td>
<td>35.6-45.7</td>
</tr>
<tr>
<td>H</td>
<td>16-20</td>
<td>40.6-50.8</td>
</tr>
<tr>
<td>I</td>
<td>18-22</td>
<td>45.7-55.9</td>
</tr>
<tr>
<td>J</td>
<td>18-24</td>
<td>45.7-61.0</td>
</tr>
<tr>
<td>K</td>
<td>6-24</td>
<td>15.2-61.0</td>
</tr>
<tr>
<td>L</td>
<td>60-84</td>
<td>152.4-213.4</td>
</tr>
<tr>
<td>M</td>
<td>24-30</td>
<td>61.0-76.2</td>
</tr>
<tr>
<td>N</td>
<td>29-30</td>
<td>73.7-76.2</td>
</tr>
<tr>
<td>O</td>
<td>15-18</td>
<td>38.1-45.7</td>
</tr>
</tbody>
</table>

Fig. 1 Basic workstation with visitor seating.
Office Spaces

GENERAL OFFICES AND MULTIPLE WORKSTATIONS

Planning Data: Basic Workstations

Fig. 2  Basic U-shaped workstation.

<table>
<thead>
<tr>
<th></th>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>26–27</td>
<td>66.0–68.6</td>
</tr>
<tr>
<td>B</td>
<td>14–20</td>
<td>35.6–50.8</td>
</tr>
<tr>
<td>C</td>
<td>7.5 min.</td>
<td>19.1 min.</td>
</tr>
<tr>
<td>D</td>
<td>29–30</td>
<td>73.7–76.2</td>
</tr>
<tr>
<td>E</td>
<td>7 min.</td>
<td>17.8 min.</td>
</tr>
<tr>
<td>F</td>
<td>18–24</td>
<td>45.7–61.0</td>
</tr>
<tr>
<td>G</td>
<td>46–58</td>
<td>116.8–147.3</td>
</tr>
<tr>
<td>H</td>
<td>30–36</td>
<td>76.2–91.4</td>
</tr>
<tr>
<td>I</td>
<td>42–50</td>
<td>106.7–127.0</td>
</tr>
<tr>
<td>J</td>
<td>18–22</td>
<td>45.7–55.9</td>
</tr>
<tr>
<td>K</td>
<td>60–72</td>
<td>152.4–182.9</td>
</tr>
<tr>
<td>L</td>
<td>76–94</td>
<td>193.0–238.8</td>
</tr>
<tr>
<td>M</td>
<td>94–118</td>
<td>238.8–299.7</td>
</tr>
</tbody>
</table>
Minimum Square Footage Standards for the Open and Screened Workstation

The Nonautomated Task. Square footage workstation standards for the nonautomated task are developed primarily according to task profile, equipment, conferencing, and privacy requirements.

Open
No requirement of equipment or task for privacy, concentration

Screened
Privacy required for reading, working, thinking, calculating, meetings, confidential phone calls, elimination of visual and acoustical distractions

Task Profile: Processing paper on work surface with quick turnaround.
- Continued flow of material is processed as it arrives at the workspace and is passed on to either another function or to group storage.
- Storage for permanent files and reference materials minimal.
- Reference material accessed infrequently. Telephone tasks may require concentration.

Task Profile: Typewriter the primary tool for processing paper.
- Continued flow of material is processed as it arrives at the workspace and is passed on to either another function or to group storage.
- Storage for permanent files and reference materials minimal.
- Reference material access may be frequent. Tasks may require concentration.

Task Profile: Typewriter the primary tool for processing paper.
- Continued flow of material is processed as it arrives at the workspace and is passed on to either another function or to group storage.
- Storage for permanent files and reference materials minimal.
- Reference material access may be frequent. Tasks may require concentration. Limited conferencing required at the workspace.
- Need to see and hear co-workers or subordinates of secondary priority.
GENERAL OFFICES AND MULTIPLE WORKSTATIONS
Planning Data: Basic Workstations

### The Noneautomated Task

**Open**

No requirement of equipment or task for privacy, concentration

**Screened**

Privacy required for reading, working, thinking, calculating, meetings, confidential phone calls, elimination of visual and acoustical distractions

**Task Profile:** Same as 1 with addition of extended conferencing requirements at individual workstation.

---

**Open**

- 2 Guest chair
- 30 x 60 Primary work surface
- No Secondary work surface
- 3-4 File drawers
- No Shelves

**Screened**

- 65 sq.ft.

**Task Profile:** Same as 3 with addition of extended conferencing requirements at individual workstation.

---

**Open**

- 2 Guest chair
- 30 x 60 Primary work surface
- 18 x 42 Secondary work surface
- 3-4 File drawers
- No Shelves

**Screened**

- 65 sq.ft.

**Task Profile:** Data Entry.

- Paper, material, or information processed and/or maintained.
- Multiple reference sources may be used on a task.
- Reference materials used frequently.
- Limited volume of supplies and permanent records kept at the workspace.
- Electronic equipment used for keeping records current, information inputting, and maintaining data and records.
- Ability to see and hear co-workers may be desirable.
- Tasks may also require screening for concentration.

---

**Open**

- No 4x5 (114 x 114 cm)
- 30 x 30 (76 x 76 cm)
- 1-2 File drawers
- 0-2 Shelves

**Screened**

- 48 sq.ft.
Fig. 3 Depending upon function, the sizes of individual and multiple workstations vary dramatically. Size of worksurface, length and depth of return, chair size, and circulation patterns all influence the gross square footage requirements.
GENERAL OFFICES AND MULTIPLE WORKSTATIONS
Planning Data: Multiple Workstations

Floating or free-standing workstations tend to utilize more floor area than workstations placed against a wall or sharing the same wall panel. Clustering of workstations will ultimately result in the use of less floor area, but at the expense of major ergonomic considerations. Decisions relative to both acoustical privacy and personal space are often sacrificed in the name of economy.
Multiple workstations can result in efficient utilization of space and sharing of expensive computer terminals and equipment. If use of computer terminals is intensive, individual CRT's should be provided. Figures 5, 6, and 7 each show eight workstations, yet the setups range in area from 448 to 1012 ft². Furniture size, function, and ergonomic considerations all affect setup.
It is not unusual to have two or more persons share an enclosed office space. In planning this type of office space, both circulation and clearance become critically important. Door swings, the extension of file drawers, and points of entry must all be carefully considered.
The design of the private office requires a knowledge of the basic dimensional requirements and clearances of the executive workstation and, where applicable, of visitor seating accommodations. In certain instances where various aspects of the office interior are customized and/or built into the construction, a knowledge of architectural woodwork detailing is also desirable.

This page and the following pages include the necessary planning criteria required, as well as details of certain customized components.

Executive workstation and/or desk size and configuration can be customized depending on desired image, scale, and ambiance. Desks are also available in generally accepted standard sizes. It is these standard desks that are most used in the design of the private office. Figure 1 illustrates the range of desk dimensions, chair dimensions, and clearances involved.

Many private executive offices are being designed with desks that do not conform with the basic rectangular shape. Such a situation is illustrated in Fig. 2, which shows a circular executive desk. Such a desk is often selected if the executive in question plans to hold conferences within the office and prefers the psychology of having either visitors or employees gather around the worksurface in an egalitarian fashion. While a minimum desk size of 48 in, or 121.9 cm, is shown, this dimension is also influenced by the number of side chairs to be grouped around the desk.

A circular executive desk must be supported by supplementary credenza or file storage within easy reach of the executive chair. Side arm reach relative to the work/activity zone must always be studied carefully.

Figure 3 illustrates a typical circular lounge grouping found within an executive office. Providing for the appropriate leg clearance of 12 to 18 in, or 30.5 to 45.7 cm, is also determined by the sitting zone requirements. Buttock-knee length must also be considered.

### Table: Executive Workstation Dimensions

<table>
<thead>
<tr>
<th>Letter</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>30–39 in / 76.2–99.1 cm</td>
</tr>
<tr>
<td>B</td>
<td>66–84 in / 167.6–213.4 cm</td>
</tr>
<tr>
<td>C</td>
<td>21–28 in / 53.3–71.1 cm</td>
</tr>
<tr>
<td>D</td>
<td>24–28 in / 61.0–71.1 cm</td>
</tr>
<tr>
<td>E</td>
<td>23–29 in / 58.4–73.7 cm</td>
</tr>
<tr>
<td>F</td>
<td>42 min. / 106.7 min.</td>
</tr>
<tr>
<td>G</td>
<td>105–130 in / 266.7–330.2 cm</td>
</tr>
<tr>
<td>H</td>
<td>30–45 in / 76.2–114.3 cm</td>
</tr>
<tr>
<td>I</td>
<td>33–43 in / 83.8–109.2 cm</td>
</tr>
<tr>
<td>J</td>
<td>10–14 in / 25.4–35.6 cm</td>
</tr>
<tr>
<td>K</td>
<td>6–16 in / 15.2–40.6 cm</td>
</tr>
<tr>
<td>L</td>
<td>20–26 in / 50.8–66.0 cm</td>
</tr>
<tr>
<td>M</td>
<td>12–15 in / 30.5–38.1 cm</td>
</tr>
<tr>
<td>N</td>
<td>117–148 in / 297.2–375.9 cm</td>
</tr>
<tr>
<td>O</td>
<td>45–61 in / 114.3–154.9 cm</td>
</tr>
<tr>
<td>P</td>
<td>30–45 in / 76.2–114.3 cm</td>
</tr>
<tr>
<td>Q</td>
<td>12–18 in / 30.5–45.7 cm</td>
</tr>
<tr>
<td>R</td>
<td>29–30 in / 73.7–76.2 cm</td>
</tr>
<tr>
<td>S</td>
<td>22–32 in / 55.9–81.3 cm</td>
</tr>
</tbody>
</table>

![Fig. 1 Executive desk/visitor seating.](image-url)
Office Spaces

PRIVATE OFFICES
Executive Workstation

Fig. 2 Circular executive desk.

Fig. 3 Circular lounge grouping.

<table>
<thead>
<tr>
<th></th>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>77-88</td>
<td>195.6-223.5</td>
</tr>
<tr>
<td>B</td>
<td>30</td>
<td>76.2</td>
</tr>
<tr>
<td>C</td>
<td>46-58</td>
<td>116.8-147.3</td>
</tr>
<tr>
<td>D</td>
<td>22-28</td>
<td>55.9-71.1</td>
</tr>
<tr>
<td>E</td>
<td>24-30</td>
<td>61.0-91.4</td>
</tr>
<tr>
<td>F</td>
<td>24-28</td>
<td>61.0-71.1</td>
</tr>
<tr>
<td>G</td>
<td>2-3</td>
<td>5.1-7.6</td>
</tr>
<tr>
<td>H</td>
<td>20-22</td>
<td>50.8-55.9</td>
</tr>
<tr>
<td>I</td>
<td>48-60</td>
<td>121.9-152.4</td>
</tr>
<tr>
<td>J</td>
<td>92-116</td>
<td>233.7-294.6</td>
</tr>
<tr>
<td>K</td>
<td>36-42</td>
<td>91.4-106.7</td>
</tr>
<tr>
<td>L</td>
<td>6-9</td>
<td>15.2-22.9</td>
</tr>
<tr>
<td>M</td>
<td>24</td>
<td>61.0</td>
</tr>
<tr>
<td>N</td>
<td>42-60</td>
<td>106.7-152.4</td>
</tr>
<tr>
<td>O</td>
<td>36-48</td>
<td>91.4-121.9</td>
</tr>
<tr>
<td>P</td>
<td>57-78</td>
<td>144.8-198.1</td>
</tr>
<tr>
<td>Q</td>
<td>33-49</td>
<td>83.8-121.9</td>
</tr>
<tr>
<td>R</td>
<td>12-18</td>
<td>30.5-45.7</td>
</tr>
<tr>
<td>S</td>
<td>21-30</td>
<td>53.3-76.2</td>
</tr>
<tr>
<td>T</td>
<td>24-32</td>
<td>61.0-81.3</td>
</tr>
</tbody>
</table>
Fig. 4  12 ft × 15 ft, 180 ft².

Fig. 5  14 ft × 12 ft, 168 ft².

Fig. 6  13 ft × 12 ft, 156 ft².

Fig. 7  12 ft × 13 ft, 156 ft².

Fig. 8  9 ft × 15 ft, 135 ft².

Fig. 9  11 ft × 14 ft, 154 ft².

Fig. 10  10 ft × 11 ft, 110 ft².

Fig. 11  9 ft × 12 ft, 108 ft².
The private offices illustrated in Figs. 12 to 17 reflect middle to senior management functional, as well as status requirements. Each office layout should be carefully reviewed with the client to ensure that all programmatic functions have been met. Offices of this size do not easily accommodate an independent conference function.
Office Spaces

PRIVATE OFFICES
Planning Data: Typical Room Arrangements

Fig. 18  14 ft × 22 ft, 308 ft².

Fig. 19  14 ft × 28 ft, 392 ft².

Fig. 20  19 ft × 33 ft, 627 ft².
Fig. 21 Custom architectural woodwork, or "built-ins," is often required for executive offices. These architectural working drawings reflect the custom design of a storage wall for a partner in a law office. Careful analysis shows the incorporation of file, book, and coat storage within a floor-to-ceiling mahogany wood unit.
Fig. 22. These details represent typical vertical sections taken through various storage components for the partner wall unit shown in Fig. 21. Careful attention must be given to integration of electronic equipment, electrical wiring, and task lighting.
Fig. 23 In many instances, the utilization of standard wood moldings can enhance the overall appearance of an otherwise relatively simple workwall unit. Other cost-saving devices illustrated here are the application of a wood panel to a standard metal file and the use of a fabric-wrapped tack board. The incorporation of an undercabinet task light is almost always required.
Fig. 24 These plan oblique drawings provide detailed design information to both client and architectural woodwork contractor. These drawings are particularly helpful when the office project for which these wall units are intended consists of many offices, and each office is to be customized within certain constraints.
Many private offices require the detailing of custom credenzas and storage units. The sophistication and complexity of such details can significantly influence the budget for the space as well as the time of installation. Figure 25 represents a “high-end” approach, while Fig. 26 is more appropriate for offices with a moderate budget.
New electronic technologies, together with the advent and proliferation of the microcomputer and the availability of inexpensive packaged software, have changed the complexion of the office workplace. The ergonomic considerations related to this new work environment have necessitated a reevaluation of the traditional interface between the seated office worker and his or her workplace. It is essential that the design of this electronic workstation be responsive to human factors in order to avoid physical discomfort for the user. The location of the keyboard, angle of the visual display terminal, adjustability of the chair, field of vision, provisions for back support, and height of the seat above the floor are a few of the considerations in the design process.

This page and the following pages provide a variety of anthropometric and ergonomic planning data and details for use as reference in the design of the electronic workstation.

Figure 1 illustrates guidelines for use in establishing preliminary design assumptions for a workstation display console. Since the types of displays and the nature of the tasks associated with those displays vary considerably, Fig. 1 cannot be taken too literally. The configuration shown, however, is fairly representative. Certain basic factors should be noted anthropometrically. The use of an adjustable chair will permit the eye height of the seated viewer to be raised or lowered to view the display as may be required depending on body size. An adjustment range of between 15 and 18 in. or 38.1 and 45.7 cm, should be adequate to accommodate the eye height sitting requirements of about 90 percent of all viewers. Adjustability, however, will be of little value if the vertical distance between the underside of the desk and the floor is insufficient to accommodate the knee height and thigh clearance when the seat is adjusted to the appropriate position. If such distance is not less than 26.5 in. or 67.3 cm, the majority of viewers will be accommodated.

The location of the top of the display should align with the standard sight line for optimum viewing conditions. Since the eye and the head can rotate within certain limitations and, in doing, increase the area that can be scanned, displays can be located above the standard sight line when absolutely necessary. It should also be noted that the more perpendicular the normal sight line is to the display plane, the greater the viewing comfort. Accordingly, consideration should be given to sloping the display plane since the normal sight line is about 15° below the horizontal.

The vertical distance from the floor to the top of the head, measured while the subject stands erect, looking straight ahead.

Elbow height is the distance measured vertically from the floor to the depression formed at the elbow where the forearm meets the upper arm.

Eye height is the vertical distance from the floor to the inner corner of the eye, measured with the subject looking straight ahead and standing erect.

Sitting height erect is the vertical distance from the sitting surface to the top of the head with the subject sitting erect.

Sitting height normal is the vertical distance from the sitting surface to the top of the head, measured with the subject sitting relaxed.

Eye height is the vertical distance from the inner corner of the eye to the sitting surface.

Shoulder height is the distance taken vertically from the sitting surface to a point on the shoulder midway between the neck and acromion.

Shoulder breadth is the maximum horizontal distance across the deltoid muscles.

Elbow to elbow is the distance across the lateral surfaces of the elbows measured with elbows flexed and resting lightly against the body with the forearms extended horizontally.

Hip breadth is the breadth of the body as measured across the widest portion of the hips. Note that a hip breadth measurement can also be taken with the subject in a standing position, in which case the definition would be the maximum breadth of the lower torso.

Elbow rest height is the height from the top of the sitting surface to the bottom of the tip of the elbow.

Thigh clearance is the distance taken vertically from a sitting surface to the top of the thigh at the point where the thigh and the abdomen intersect.

Knee height is the vertical distance from the floor to the midpoint of the kneecap. Popliteal height is the distance, taken vertically, from the floor to the underside of the portion of the thigh just behind the knee while the subject is seated with body erect. The knees and ankles are usually perpendicular, with the bottom of the thigh and the back of the knees barely touching the sitting surface.

Buttock-heel length is the horizontal distance from the rearmost surface of the buttock to the back of the lower leg.

Buttock-knee length is the horizontal distance from the rearmost surface of the buttocks to the front of the kneecap.

Buttock-toe length is the horizontal distance from the rearmost surface of the buttocks to the tip of the toe.

Buttock-heel length is the horizontal distance from the base of the heel to a wall against which the subject sits erect with his leg maximally extended forward along the sitting surface. This is sometimes referred to as buttock-leg length.

Vertical reach is the height above the sitting surface of the tip of the middle finger when the arm, hand, and fingers are extended vertically.

Vertical grip reach is usually measured from the floor to the top of a bar grasped in the right hand while the subject stands erect and the hand within which the bar is grasped is raised as high as it can be conveniently without experiencing discomfort or strain.

Side arm reach is the distance from the center line of the body to the outside surface of a bar grasped in the right hand while the subject stands erect and the arm is conveniently outstretched horizontally without experiencing discomfort or strain.

Thumb tip reach is the distance from the wall to the tip of the thumb measured with the subject’s shoulders against the wall, his arm extended forward, and his index finger touching the tip of his thumb.

Maximum body depth is the horizontal distance between the most anterior point on the body to the most posterior. Anterior points are usually located on the chest or abdomen while the posterior points are usually found in the buttock or shoulder region.

Maximum body breadth is the maximum distance, including arms, across the body.

<table>
<thead>
<tr>
<th></th>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>16-18</td>
<td>40.6-45.7</td>
</tr>
<tr>
<td>B</td>
<td>16 min.</td>
<td>40.6 min.</td>
</tr>
<tr>
<td>C</td>
<td>16 min.</td>
<td>40.6 min.</td>
</tr>
<tr>
<td>D</td>
<td>15-18 adjust.</td>
<td>38.1-45.7</td>
</tr>
<tr>
<td>E</td>
<td>26.5 min.</td>
<td>67.3 min.</td>
</tr>
<tr>
<td>F</td>
<td>30</td>
<td>76.2</td>
</tr>
</tbody>
</table>

Fig. 1
Office Spaces

ELECTRONIC WORKSTATIONS
Planning Data: Anthropometrics

- Both the work surface and the display monitors must be lowered and raised as a unit with 31.8 cm of travel.
- The work surface must be tilted anywhere between a horizontal position to 35° below horizontal. The work surface, at its lowest setting and with a 10° tilted angle, as is common in use, must be 63.5 cm in height at its front edge.
- The work surface must raise to a horizontal height of 104 cm, accommodating a majority of people in a standing position.
- The monitor screens must be tiltable to any position between 15° forward of vertical and 15° back. This lets the user adjust the screen to avoid reflective glare, and it accommodates various working positions of different lines of sight.
- Adjustment controls designed for hand operation must be located within the operator's extended reach envelope.
- All surfaces must have matte or dull finishes. This reduces the likelihood of reflective glare.
- The workstation must be compact and relatively easy to move through a standard 81-cm doorway.
- No structural components shall exist which inhibit the workstation's operation by users in wheelchairs, ensuring a barrier-free workstation.
- Service personnel must have easy access to electrical components.
- The digitizing surface must accommodate standard European and American D size drawings.
- Screen depth of view must allow alphanumeric characters to be viewed at an angle between 20 and 28 arc minutes.
### The Automated Task

Square footage workstation standards for the automated task are also developed primarily according to task profile, equipment, conferencing, and privacy requirements.

<table>
<thead>
<tr>
<th>Open</th>
<th>Screened</th>
</tr>
</thead>
<tbody>
<tr>
<td>No requirement of equipment or task for privacy, concentration</td>
<td>Privacy required for reading, working, thinking, calculating, meetings, confidential phone calls, elimination of visual and acoustical distractions</td>
</tr>
</tbody>
</table>

**Task Profile: Data Retrieval.**
- Paper, material, or information processed, analyzed, and/or maintained.
- Multiple reference sources may be used on a task.
- Reference materials used frequently.
- Limited volume of supplies and permanent records kept at the workspace.
- Electronic equipment may be used for easy reference, retrieval, keeping records current, and maintaining data and records.
- Additional equipment such as microfilm viewers may be required.
- Ability to see and hear co-workers may be desirable.
- Tasks may also require screening for concentration.

![Software](image1.png)

#### Guest chair
- 45 x 45
- Primary work surface
- 30 x 45
- Secondary work surface
- 3-4
- File drawers
- 0-2
- Shelves

56 sq. ft.

**Task Profile: Shared Tasks.**
- Paper, material, or information processed, analyzed, and/or maintained.
- More than one task may be performed concurrently.
- More than one operator uses same equipment.
- Multiple reference sources may be used on a task.
- Reference materials used may be used frequently.
- Electronic equipment may be used for easy reference, inputting/maintaining data and records, retrieval, keeping records current.
- Storage requirements vary according to task.

![Software](image2.png)

#### Guest chair
- 45 x 45
- Primary work surface
- 30 x 60
- Secondary work surface
- 1-2
- File drawers
- 0-4
- Shelves

81 sq. ft.

**Task Profile: Administrative Specialist/Secretary.**
- Paper, material, or information processed, analyzed, and/or maintained.
- More than one task may be performed concurrently.
- Multiple reference sources may be used on a task.
- Reference materials used frequently.
- Electronic equipment may be used for easy reference, retrieval, keeping records current, inputting/maintaining data and records.
- If supervising, ability to see subordinates may be desirable to direct activities.
- If monitoring, visual access may be desirable.
- Moderate amount of storage required at the workspace, that is, casework, client accounts, supplies.

![Software](image3.png)

#### Guest chair
- 45 x 45
- Primary work surface
- 30 x 60
- Secondary work surface
- 3-4
- File drawers
- 1-2
- Shelves

64 sq. ft.
Office Spaces

ELECTRONIC WORKSTATIONS

The Automated Task

Open
No requirement of equipment or task for privacy, concentration

Screened
Privacy required for reading, working, thinking, calculating, meetings, confidential phone calls, elimination of visual and acoustical distractions

Task Profile: Administrative Specialist/Secretary (+ Guest).
- Paper, material, or information processed, analyzed, and/or maintained.
- More than one task performed concurrently.
- Multiple reference sources used on a task.
- Reference materials used frequently.
- Limited volume of supplies and permanent records kept at the workspace.
- Electronic equipment may be used for easy reference, retrieval, keeping records current.
- Tasks are complex enough to require concentration.
- Extensive use of telephone and additional equipment such as desk-top printer and microfilm viewer may be required.
- Need to see and hear co-workers is secondary priority.
- Limited conferencing required at workspace.
- If supervising, ability to see subordinates may be desirable.
- If monitoring, visual access may be desirable.

Task Profile: Word Processing.
- Time divided among administrative, processing paper, material, or information.
- More than one task may be performed concurrently.
- Multiple reference sources may be used on a task.
- Reference materials moderate but used frequently.
- Limited storage primarily for supplies.
- Ability to see and hear co-workers or subordinates is desirable.
- Typewriter and/or electronic equipment may be used to expedite processing and administrative tasks. For example, VDT, printer, transcriber, OCR, microfilm viewer, separate disk drives.

Task Profile: Word Processing (+ Guest).
- Time divided among administrative, processing paper, material, or information, and limited conferencing at workspace.
- More than one task may be performed concurrently.
- Multiple reference sources may be used on a task.
- Reference materials moderate but used frequently.
- Limited storage primarily for supplies.
- Typewriter and/or electronic equipment (VDT, printer, and so on) may be used to expedite processing and administrative tasks.
- Tasks are complex enough to require concentration for analysis, or heavy equipment operations require acoustical screening.
- Work surface needed for organization of work.

<table>
<thead>
<tr>
<th>1</th>
<th>Guest chair</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 x 45</td>
<td>Primary work surface</td>
</tr>
<tr>
<td>30 x 45</td>
<td>Secondary work surface</td>
</tr>
<tr>
<td>3-4</td>
<td>File drawers</td>
</tr>
<tr>
<td>1-2</td>
<td>Shelves</td>
</tr>
</tbody>
</table>

80 sq. ft.

<table>
<thead>
<tr>
<th>1</th>
<th>Guest chair</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 x 45</td>
<td>Primary work surface</td>
</tr>
<tr>
<td>30 x 45</td>
<td>Secondary work surface</td>
</tr>
<tr>
<td>3-4</td>
<td>File drawers</td>
</tr>
<tr>
<td>1-2</td>
<td>Shelves</td>
</tr>
</tbody>
</table>

67 sq. ft.

<table>
<thead>
<tr>
<th>1</th>
<th>Guest chair</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 x 45</td>
<td>Primary work surface</td>
</tr>
<tr>
<td>30 x 45</td>
<td>Secondary work surface</td>
</tr>
<tr>
<td>3-4</td>
<td>File drawers</td>
</tr>
<tr>
<td>1-2</td>
<td>Shelves</td>
</tr>
</tbody>
</table>

86 sq. ft.
The Automated Task

Open
No requirement of equipment or task for privacy, concentration

Screened
Privacy required for reading, working, thinking, calculating, meetings, confident phone calls, elimination of visual and acoustical distractions

Task Profile: Technical/Systems Analyst/Programmer.
- Time divided among administrative, processing paper, material, or information, and limited conferencing at workspace.
- More than one task may be performed concurrently.
- Multiple reference sources may be used on a task.
- Reference materials may be extensive and used frequently.
- Ability to see and hear co-workers or subordinates desirable.
- Typewriter and electronic equipment (VDT, printer, and so on) may be used to expedite processing and administrative tasks.
- Moderate to extensive amount of storage required at the workspace for manuals, binders, computer printouts, coding sheets, supplies, permanent files, reference materials.

Task Profile: Administrative/Managerial.
- Extensive conferencing at individual workspace.
- Analysis of reports, computerized materials, and so on.
- Varied tasks or projects performed simultaneously on an ongoing basis.
- Large amounts of storage extensively used.
- Storage for client/project files, reference manuals, documentation, correspondence.
- Telephone used extensively.
- Supervision of subordinates almost universal.
- Electronic equipment accommodation is secondary priority, used primarily for communication/electronic mail, scheduling.

Task Profile: Administrative/Total Enclosure.
- Extensive conferencing at individual workspace.
- Analysis of reports, computerized materials, and so on.
- Varied tasks on projects performed simultaneously on an ongoing basis.
- Large amounts of storage extensively used.
- Storage for client/project files, reference manuals, documentation, correspondence.
- Telephone used extensively.
- Supervision of subordinates almost universal.
- Electronic equipment accommodation is secondary priority, used primarily for communication/electronic mail, scheduling.
- Subject matter of job responsibilities requires confidentiality.
Technologically and electronically complex trading desks must be ergonomically correct in every respect. With little, if any, margin for error when designing and detailing multiple workstations of this type, a full-size mockup is always required.
ERGONOMIC FACTORS - PLAN

TYPICAL PLAN LAYOUT

ELEVATION/SECTION

SECTION THRU TYPICAL DESK
Office Spaces

ELECTRONIC WORKSTATIONS

Trading Table Details

A PLAN OF TREASURY TRADING TABLE

B PARTIAL ELEVATION

C C SECTION

D D SECTION
Consideration must be given to clearances and circulation around the larger conference table, as indicated in Figs. 1 and 2. A minimum of 48 in, or 121.9 cm, is suggested from the edge of the table to the wall or nearest obstruction. This dimension under ordinary circumstance allows for a circulation zone beyond the sitting zone of 30 to 36 in, or 76.2 to 91.4 cm, based upon a maximum body breadth measurement of the larger person. The greater dimension is recommended to allow for the chair in a pulled-out position.

The actual dimensions of the conference table are a function of the number of people to be seated. The square table illustrated in Fig. 1 provides for eight people, with each side ranging from 54 to 60 in, or 137.2 to 152.4 cm. The larger dimension is more appropriate to accommodate people of larger body size and to allow for a more generous work zone for each person. This translates into 30 in, or 76.2 cm, per person, which constitutes a comfortable perimeter allocation. The circular table shown in Fig. 2 comfortably accommodates five people while allowing for a 30-in, or 76.2-cm, access zone between chairs. To accommodate both sitting zone and circulation zone, a space with a radius ranging from 72 to 81 in, or 182.9 to 205.7 cm, must be provided.

<table>
<thead>
<tr>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>48-60</td>
</tr>
<tr>
<td>B</td>
<td>4-6</td>
</tr>
<tr>
<td>C</td>
<td>20-24</td>
</tr>
<tr>
<td>D</td>
<td>6-10</td>
</tr>
<tr>
<td>E</td>
<td>18-24</td>
</tr>
<tr>
<td>F</td>
<td>30-36</td>
</tr>
<tr>
<td>G</td>
<td>54-60</td>
</tr>
<tr>
<td>H</td>
<td>30</td>
</tr>
<tr>
<td>I</td>
<td>72-81</td>
</tr>
<tr>
<td>J</td>
<td>42-51</td>
</tr>
<tr>
<td>K</td>
<td>24-27</td>
</tr>
<tr>
<td>L</td>
<td>48-54</td>
</tr>
</tbody>
</table>

Fig. 1 Square conference table.

Fig. 2 Circular conference table.
Round conference tables offer the advantages of intimacy, "equality," and compactness. On the other hand, if status is an issue, or if one wall within the space is an audiovisual wall, this table shape can be less than satisfactory. The same problems can arise with a square conference table. In both instances, however, the total seating around each table shape must be viewed in the context of chair size, chair spacing, and tasks to be performed at the table.

### ROUND TABLES

<table>
<thead>
<tr>
<th>Diam.</th>
<th>Circum.</th>
<th>Approx. Seating</th>
<th>Recommended Minimum Room Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>10'0&quot;</td>
<td>31'5&quot;</td>
<td>12-13</td>
<td>10'0&quot;x10'0&quot;</td>
</tr>
<tr>
<td>9'0&quot;</td>
<td>28'2&quot;</td>
<td>11-14</td>
<td>9'0&quot;x9'0&quot;</td>
</tr>
<tr>
<td>8'0&quot;</td>
<td>25'1&quot;</td>
<td>10-12</td>
<td>8'0&quot;x8'0&quot;</td>
</tr>
<tr>
<td>7'0&quot;</td>
<td>22'0&quot;</td>
<td>9-11</td>
<td>7'0&quot;x7'0&quot;</td>
</tr>
<tr>
<td>6'0&quot;</td>
<td>18'10&quot;</td>
<td>8-9</td>
<td>6'0&quot;x6'0&quot;</td>
</tr>
<tr>
<td>5'0&quot;</td>
<td>15'9&quot;</td>
<td>7-8</td>
<td>5'0&quot;x5'0&quot;</td>
</tr>
<tr>
<td>4'0&quot;</td>
<td>12'6&quot;</td>
<td>5-6</td>
<td>4'0&quot;x4'0&quot;</td>
</tr>
<tr>
<td>3'6&quot;</td>
<td>11'0&quot;</td>
<td>4-5</td>
<td>3'6&quot;x3'6&quot;</td>
</tr>
</tbody>
</table>

### SQUARE TABLES

<table>
<thead>
<tr>
<th>W</th>
<th>L</th>
<th>Approx. Seating</th>
<th>Recommended Minimum Room Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>5'0&quot;</td>
<td>5'0&quot;</td>
<td>8-12</td>
<td>13'0&quot;x13'0&quot;</td>
</tr>
<tr>
<td>4'6&quot;</td>
<td>4'6&quot;</td>
<td>4-8</td>
<td>12'0&quot;x12'0&quot;</td>
</tr>
<tr>
<td>4'0&quot;</td>
<td>4'0&quot;</td>
<td>4-8</td>
<td>11'6&quot;x11'6&quot;</td>
</tr>
<tr>
<td>3'6&quot;</td>
<td>3'6&quot;</td>
<td>4</td>
<td>10'6&quot;x10'6&quot;</td>
</tr>
<tr>
<td>3'0&quot;</td>
<td>3'0&quot;</td>
<td>4</td>
<td>9'0&quot;x9'0&quot;</td>
</tr>
</tbody>
</table>
Rectangular and boat-shaped conference tables lend themselves toward formal settings where status and hierarchy are important. Both table shapes are also more suitable in a room where an audiovisual wall is placed at one end of the space, or where speakers are making presentations. The boat-shaped table also offers greater visibility of others seated at the table, as well as ease of circulation around its perimeter.

### Rectangular Tables

<table>
<thead>
<tr>
<th>W (in)</th>
<th>L (in)</th>
<th>Approx. Seating</th>
<th>Recommended Minimum Room Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>6'0&quot;</td>
<td>28'0&quot;</td>
<td>28-30</td>
<td>18'0&quot; x 40'0&quot;</td>
</tr>
<tr>
<td>6'0&quot;</td>
<td>26'0&quot;</td>
<td>26-28</td>
<td>18'0&quot; x 38'0&quot;</td>
</tr>
<tr>
<td>6'0&quot;</td>
<td>24'0&quot;</td>
<td>24-26</td>
<td>18'0&quot; x 36'0&quot;</td>
</tr>
<tr>
<td>5'0&quot;</td>
<td>22'0&quot;</td>
<td>22-24</td>
<td>15'0&quot; x 32'0&quot;</td>
</tr>
<tr>
<td>5'0&quot;</td>
<td>20'0&quot;</td>
<td>20-22</td>
<td>15'0&quot; x 30'0&quot;</td>
</tr>
<tr>
<td>4'6&quot;</td>
<td>18'0&quot;</td>
<td>18-20</td>
<td>13'6&quot; x 27'0&quot;</td>
</tr>
<tr>
<td>4'6&quot;</td>
<td>16'0&quot;</td>
<td>16-18</td>
<td>13'6&quot; x 25'0&quot;</td>
</tr>
<tr>
<td>4'6&quot;</td>
<td>14'0&quot;</td>
<td>14-16</td>
<td>13'6&quot; x 23'0&quot;</td>
</tr>
<tr>
<td>4'0&quot;</td>
<td>12'0&quot;</td>
<td>12-14</td>
<td>12'0&quot; x 21'0&quot;</td>
</tr>
<tr>
<td>4'0&quot;</td>
<td>10'0&quot;</td>
<td>10-12</td>
<td>12'0&quot; x 20'0&quot;</td>
</tr>
<tr>
<td>4'0&quot;</td>
<td>9'6&quot;</td>
<td>8-10</td>
<td>12'0&quot; x 19'0&quot;</td>
</tr>
<tr>
<td>4'0&quot;</td>
<td>9'0&quot;</td>
<td>8-10</td>
<td>12'0&quot; x 18'0&quot;</td>
</tr>
<tr>
<td>3'6&quot;</td>
<td>8'6&quot;</td>
<td>8-10</td>
<td>10'6&quot; x 16'0&quot;</td>
</tr>
<tr>
<td>3'6&quot;</td>
<td>8'0&quot;</td>
<td>8-10</td>
<td>10'6&quot; x 15'0&quot;</td>
</tr>
<tr>
<td>3'6&quot;</td>
<td>7'6&quot;</td>
<td>6-8</td>
<td>10'6&quot; x 14'0&quot;</td>
</tr>
<tr>
<td>3'6&quot;</td>
<td>7'0&quot;</td>
<td>6-8</td>
<td>10'6&quot; x 13'0&quot;</td>
</tr>
<tr>
<td>3'0&quot;</td>
<td>6'6&quot;</td>
<td>6-8</td>
<td>10'0&quot; x 12'0&quot;</td>
</tr>
<tr>
<td>3'0&quot;</td>
<td>6'0&quot;</td>
<td>6-8</td>
<td>10'0&quot; x 11'0&quot;</td>
</tr>
<tr>
<td>2'6&quot;</td>
<td>5'6&quot;</td>
<td>4-6</td>
<td>9'0&quot; x 12'0&quot;</td>
</tr>
<tr>
<td>2'6&quot;</td>
<td>5'0&quot;</td>
<td>4-6</td>
<td>9'0&quot; x 12'0&quot;</td>
</tr>
</tbody>
</table>

### Boat Shaped Tables

<table>
<thead>
<tr>
<th>W (in)</th>
<th>L (in)</th>
<th>Approx. Seating</th>
<th>Recommended Minimum Room Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>3'5&quot;</td>
<td>8'0&quot;</td>
<td>8-10</td>
<td>10'0&quot; x 15'0&quot;</td>
</tr>
<tr>
<td>3'8&quot;</td>
<td>9'0&quot;</td>
<td>8-10</td>
<td>11'0&quot; x 16'0&quot;</td>
</tr>
<tr>
<td>3'11&quot;</td>
<td>10'0&quot;</td>
<td>10-12</td>
<td>12'0&quot; x 17'0&quot;</td>
</tr>
<tr>
<td>4'3&quot;</td>
<td>11'0&quot;</td>
<td>10-12</td>
<td>13'0&quot; x 19'0&quot;</td>
</tr>
<tr>
<td>4'7&quot;</td>
<td>13'0&quot;</td>
<td>12-14</td>
<td>14'0&quot; x 21'0&quot;</td>
</tr>
<tr>
<td>4'11&quot;</td>
<td>14'0&quot;</td>
<td>14-16</td>
<td>15'0&quot; x 23'0&quot;</td>
</tr>
<tr>
<td>5'3&quot;</td>
<td>16'0&quot;</td>
<td>16-18</td>
<td>16'0&quot; x 20'0&quot;</td>
</tr>
<tr>
<td>5'7&quot;</td>
<td>18'0&quot;</td>
<td>20-22</td>
<td>17'0&quot; x 29'0&quot;</td>
</tr>
<tr>
<td>6'0&quot;</td>
<td>20'0&quot;</td>
<td>20-24</td>
<td>18'0&quot; x 32'0&quot;</td>
</tr>
</tbody>
</table>
Office Spaces

CONFERENCE ROOMS
Planning Data: Table Sizes and Seating Capacities

CONFERENCE/MEETING ROOMS

**Solid Conference**
For 20 people
- 4-30"x72" tables
- 2-30"x60" tables

**Race Track**
For 26 people
- 6-30"x72" tables
- 4-30" wide crescents

**Trapezoid/Round**
For 12 people
- 6-30"x30"x30"x60" tables

**V-Shape**
For 20 people

**Boat Shape**
For 26 people

BANQUET ROOMS

**60" diameter tables**
Capacity: 180 people

**30" x 96" tables**
Capacity: 180 people

**18" x 72" classroom style tables**
Capacity: 162 people

<table>
<thead>
<tr>
<th>Table Size</th>
<th>Capacity</th>
<th>Centerline Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>48&quot; dia.</td>
<td>6 persons</td>
<td>7'5&quot;</td>
</tr>
<tr>
<td>54&quot; dia.</td>
<td>6-8 persons</td>
<td>7'10&quot;</td>
</tr>
<tr>
<td>60&quot; dia.</td>
<td>8-10 persons</td>
<td>8'3&quot;</td>
</tr>
<tr>
<td>66&quot; dia.</td>
<td>10 persons</td>
<td>8'8&quot;</td>
</tr>
<tr>
<td>72&quot; dia.</td>
<td>10-12 persons</td>
<td>9'1&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table Size</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>30&quot;x48&quot;</td>
<td>4-6 persons</td>
</tr>
<tr>
<td>30&quot;x60&quot;</td>
<td>6 persons</td>
</tr>
<tr>
<td>30&quot;x72&quot;</td>
<td>8 persons</td>
</tr>
<tr>
<td>30&quot;x96&quot;</td>
<td>10 persons</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table Size</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>18&quot;x80&quot;</td>
<td>2 persons</td>
</tr>
<tr>
<td>18&quot;x72&quot;</td>
<td>3 persons</td>
</tr>
<tr>
<td>18&quot;x96&quot;</td>
<td>4 persons</td>
</tr>
</tbody>
</table>
Fig. 3  These conference tables are useful in making initial space planning allocations.
Office Spaces

CONFERENCE ROOMS
Planning Data: Table Sizes and Seating Capacities

Fig. 4 These drawings provide the designer with a variety of conference room sizes, table shapes, floor areas, and seating capacities. They are useful in client discussions and in making preliminary area allocations. Chair size and circulation areas behind the chairs will, of course, cause overall dimensions to vary.
CONFERENCE ROOMS
Planning Data: Room Layouts

Seats 8, 272 ft²

Seats 10, 294 ft²

Seats 12, 338 ft²

Seats 18, 480 ft²

Seats 16, 690 ft²
It is important for the designer to understand and appreciate some of the important details that make up a conference table. The base treatments shown in Fig. 5 are but a few of the myriad possibilities. Perhaps even more important to consider are the finished edges of glass and wood conference tables, representative details of which are shown in Figs. 6 and 7. Other edge details could be made of marble, granite, or even leather. Fingers, hands, and arms make intimate contact with these edge details, something that should be carefully considered.

Fig. 5 Base treatment.

Fig. 6 Glass edge treatment.

Fig. 7 Wood edge treatment.
Custom credenza units are often designed to complement the details of a conference table. They serve multiple functions, including storage, incorporation of electronic media equipment, display, and as a work surface. In addition, architectural woodwork is used to enclose existing convector covers and to frame window openings. It is important for the designer to consider providing ease of access to the heating and air-handling elements behind the woodwork, as well as allowing the appropriate flow of air.
Proper design of the reception area is critical in communicating an organization's desired corporate image. Reception spaces are both the first and last areas with which the visitor interacts and, accordingly, have considerable visual impact in communicating that image.

Not only must the reception space look attractive, but it must function properly as well. The two most important planning elements in this regard are the visitor's seating area and the receptionist's workstation or desk.

While most of the examples in this part are drawn from corporate interiors, the designer is urged to take into consideration the needs of special user groups who must interact with a receptionist. If small children are to communicate (or see or be seen), how high is the privacy wall? If a wheelchair-bound user is to approach the reception desk, is there room for the footrests to be accommodated? The designer must consider all user populations.

This part deals primarily with basic planning data relative to the design of a receptionist's workstation and furniture arrangements of the seating areas. Also included are related details directly from the working drawings of design firms.

For the purpose of privacy or security, the receptionist's workstation is often an area physically separated by built-in furniture and/or partitions. Figure 1 shows a counter height receptionist's workstation. While the relationship of worksurface to seat height is key, other anthropometric considerations are eye height and sitting height normal. The minimum height of the opening above the floor has been established at 78 in. or 198.1 cm. Sitting height and eye height are significant in providing unobstructed vision. Figure 2 depicts a desk height receptionist's workstation. The depth of the worksurface ranges from 26 to 30 in., or 66 to 76.2 cm, allowing for thumb tip reach required for the exchange of papers and packages. Both Figs. 1 and 2 show in broken line an added counter top element often provided for security or as a visual screen of the work surface top.

<table>
<thead>
<tr>
<th></th>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>40-48</td>
<td>101.6-121.9</td>
</tr>
<tr>
<td>B</td>
<td>24 min.</td>
<td>61.0 min.</td>
</tr>
<tr>
<td>C</td>
<td>18</td>
<td>45.7</td>
</tr>
<tr>
<td>D</td>
<td>22-30</td>
<td>55.9-76.2</td>
</tr>
<tr>
<td>E</td>
<td>78 min.</td>
<td>198.1 min.</td>
</tr>
<tr>
<td>F</td>
<td>24-27</td>
<td>61.0-68.6</td>
</tr>
<tr>
<td>G</td>
<td>36-39</td>
<td>91.4-99.1</td>
</tr>
<tr>
<td>H</td>
<td>8-9</td>
<td>20.3-22.9</td>
</tr>
<tr>
<td>I</td>
<td>2-4</td>
<td>5.1-10.2</td>
</tr>
<tr>
<td>J</td>
<td>4</td>
<td>10.2</td>
</tr>
<tr>
<td>K</td>
<td>44-48</td>
<td>111.8-121.9</td>
</tr>
<tr>
<td>L</td>
<td>34 min.</td>
<td>86.4 min.</td>
</tr>
<tr>
<td>M</td>
<td>44-48</td>
<td>111.8-121.9</td>
</tr>
<tr>
<td>N</td>
<td>54</td>
<td>137.2</td>
</tr>
<tr>
<td>O</td>
<td>26-30</td>
<td>66.0-76.2</td>
</tr>
<tr>
<td>P</td>
<td>24</td>
<td>61.0</td>
</tr>
<tr>
<td>Q</td>
<td>30</td>
<td>76.2</td>
</tr>
<tr>
<td>R</td>
<td>15-18</td>
<td>38.1-45.7</td>
</tr>
<tr>
<td>S</td>
<td>29-30</td>
<td>73.7-76.2</td>
</tr>
<tr>
<td>T</td>
<td>10-12</td>
<td>25.4-30.5</td>
</tr>
<tr>
<td>U</td>
<td>6-9</td>
<td>15.2-22.9</td>
</tr>
<tr>
<td>V</td>
<td>39-42</td>
<td>99.1-106.7</td>
</tr>
</tbody>
</table>
The seating arrangements illustrated here provide some typical conditions that the designer must address. Individual seats are preferred over sofas. Corner seating arrangements must always consider leg clearance. Circulation between low tables and the edges of chairs must be adequate to allow for the legs of persons seated in the chairs. Convenient locations for side tables, so that magazines, ashtrays, artwork, or portable lighting can be placed on them, are important.
Fig. 4  Depending upon the size of an office, a reception desk can be either relatively simple and small in scale, or relatively complex and large in scale, sometimes staffed by two or more persons. The reception desk illustrated here shows a typical L-shaped unit with 44-in-high privacy panel. Reception desks of this type can either be custom designed or purchased from a manufacturer.
More privacy can be achieved in the design of a reception desk when there is enclosure on three sides, as is shown here. When designing custom reception desks, it is important to fully understand the tasks that the person working there will be asked to perform, in order to provide for adequate storage, work surfaces at the appropriate height, the incorporation of electronic equipment, and task lighting.
Fig. 6. The reception desk shown here is designed in order to provide privacy on three sides with partial privacy on the fourth side. In this example, a right-hand typing return has been provided. Careful consideration should always be given to the height and placement of task lighting in order to ensure that the surface or task below is being lit properly. Many designers do not give this adequate thought. Overall costs of custom-designed reception desks can be reduced by integrating standard metal file components into the architectural woodwork.
A larger reception desk can accommodate work surfaces on three sides, as shown here. With this type of configuration, however, the designer must be concerned with the orientation of the open side. As with all custom reception desks, the designer must anticipate the integration of wiring and electronic equipment within the architectural woodwork.
Fig. 8  Total privacy of the receptionist's workstation can be achieved through enclosure on all four sides. In addition to enhancing visual privacy, such a design can also provide added security and control by the addition of a door. Such a design might be particularly appropriate for a reception area where the designer might wish to control access by children.
Fig. 8 (Continued)
A reception desk can often consist of two workstations.
A circular reception desk can make a bold and sophisticated corporate statement. The designer is cautioned, however, to carefully analyze the minimum radius required for chair movement. Custom built-in files and drawers, if also curved, can become costly and sometimes impractical.
Fig. 11 A fully detailed reception desk will require many large-scale vertical sections to explain the various storage, drawer, work surface, lighting, and electrical requirements. Examples of such details are shown here.
RECEPTION AREAS
Reception Desk Details

VERTICAL SECTION - RECEPTION DESK

SECTION AT COUNTER FRONT

1/2" MEDITE W/ PERMA-GOAT FINISH

SECTION OF COUNTER & STATIONARY FILE
Fig. 12. A receptionist's workstation need not be freestanding within a reception area, where security and privacy are of critical importance. A receptionist may be located on the opposite side of a glass partition as shown here. Such a solution is often suggested when the receptionist performs multiple tasks such as typing and answering phones.
Office Spaces

RECEPTION AREAS
Reception Window/Pass-Through

Fig. 12 (Continued)
Fig. 13 While the reception desk is typically the major element to be designed and detailed for a reception area, other custom-designed components must also be carefully considered. A phone shelf, a wall shelf, a coat hanging area, and a work surface are often items that must be carefully designed and detailed.
Office Spaces

FURNITURE, FURNISHINGS, AND EQUIPMENT

'Decks and Seating'

Furniture, furnishings, and equipment are the basic building blocks in the design of office spaces. The illustrations and dimensional data contained in this part are based on the product lines available from particular manufacturers.

Although the data, to a great extent, are fairly standard throughout the industry, there will be some variations according to manufacturer. Accordingly, although the information presented is adequate for preliminary planning purposes, the designer is cautioned to reconcile preliminary assumptions with the actual dimensional data of the manufacturer whose product is ultimately specified.

Included in the data provided in this part are examples of filing cabinets, storage cabinets, conference tables, desks, and electronic media.

---

**DESK DIMENSIONS**

<table>
<thead>
<tr>
<th>DESKS</th>
<th>RETURNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOUBLE PEDESTAL</td>
<td>SINGLE PEDESTAL</td>
</tr>
<tr>
<td>STANDARD RANGE</td>
<td>STANDARD RANGE</td>
</tr>
<tr>
<td>W</td>
<td>D</td>
</tr>
<tr>
<td>2'-6&quot;</td>
<td>2'-0&quot; - 3'-3&quot;</td>
</tr>
</tbody>
</table>

DESKS - SINGLE OR DOUBLE PEDESTAL

WORK TABLES ARE OF SIMILAR DIMENSIONS.

FOR EXECUTIVE DESKS WITH RETURNS, RETURNS ARE AVAILABLE AT THE SAME HEIGHT AS THE DESK SURFACE.

A MINIMUM CLEAR WIDTH OF 22" SHOULD BE PROVIDED FOR KNEE ROOM, 24" IS NORMAL.

---

**CHAIR DIMENSIONS**

<table>
<thead>
<tr>
<th>CHAIR</th>
<th>STACK CHAIR</th>
<th>RIGID ARMCHAIR</th>
<th>SWIVEL ARMCHAIR</th>
<th>SECRETARIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>D</td>
<td>H</td>
<td>W</td>
<td>D</td>
</tr>
<tr>
<td>1'-5&quot;</td>
<td>1'-4&quot; - 1'-6&quot;</td>
<td>2'-4&quot;</td>
<td>1'-6&quot; - 2'-6&quot;</td>
<td>1'-10&quot;</td>
</tr>
</tbody>
</table>

---

**LOUNGE CHAIR AND SOFA DIMENSIONS**

<table>
<thead>
<tr>
<th>LOUNGE CHAIR</th>
<th>SOFA</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>D</td>
</tr>
<tr>
<td>2'-6&quot;</td>
<td>2'-6&quot; - 3'-4&quot;</td>
</tr>
<tr>
<td>2'-7&quot;</td>
<td>2'-5&quot; - 3'-4&quot;</td>
</tr>
<tr>
<td>2'-6&quot;</td>
<td>2'-1&quot; - 3'-4&quot;</td>
</tr>
<tr>
<td>1'-3&quot;</td>
<td>1'-0&quot; - 1'-6&quot;</td>
</tr>
</tbody>
</table>

---

Fig. 1 Office planning: desks — sizes.

Fig. 2 Office planning: seating — sizes.
Chair types are often associated with certain generic job titles. The designer, however, is cautioned not to make assumptions as to chair selection without a thorough understanding of the tasks the individual is to perform. Ergonomic considerations are to be carefully reviewed in order to select a chair with appropriate attributes, i.e., seat height, adjustability back and arm support, firmness, etc. Overall chair size must be understood within the context of available clearances and workstation configuration.
Office Spaces

FURNITURE, FURNISHINGS, AND EQUIPMENT

Chairs

- 25" height range:
  - 33"-35" pneumatic
  - 33"-37" manual
  - 26"-28" head
- Arm height range:
  - 16"-22"
- Seat height range:
  - 10"-22" pneumatic
  - 10"-22" manual
  - 10" fixed

- 22" height range:
  - 21"-25"
- Arm height:
  - 20" chair
  - 20" stool
- Seat height:
  - 17" chair
  - 17" stool

- 20" height range:
  - 19"-23"
- Arm height:
  - 16" chair
  - 16" stool
- Seat height:
  - 16" chair
  - 16" stool

- 17" height range:
  - 16"-20"
- Arm height:
  - 13" chair
  - 13" stool
- Seat height:
  - 13" chair
  - 13" stool

- 15" height range:
  - 14"-18"
- Arm height:
  - 11" chair
  - 11" stool
- Seat height:
  - 11" chair
  - 11" stool

- 12" height range:
  - 11"-15"
- Arm height:
  - 9" chair
  - 9" stool
- Seat height:
  - 9" chair
  - 9" stool

Shipped:

- 35 pounds
- 56 pounds
- 67 pounds
- 72 pounds
- 89 pounds
- 98 pounds
- 110 pounds
- 122 pounds
- 135 pounds
- 148 pounds
Office Spaces

FURNITURE, FURNISHINGS, AND EQUIPMENT

Chairs

Executive Chairs

Tilt-Swivel Chair with Casters

Option: CA

Non-Swivel Lounge Chair

Swivel Lounge Chair

Non-Swivel Lounge Armchair

Swivel Lounge Armchair

Non-Swivel Lounge Arm Chair

Swivel Lounge Arm Chair

Tilt-Swivel Reclining Arm Chair

Ottoman

Lounge

Non-Swivel Lounge Chair

Swivel Lounge Chair

Non-Swivel Lounge Armchair

Swivel Lounge Armchair

Non-Swivel Lounge Arm Chair

Swivel Lounge Arm Chair

Tilt-Swivel Reclining Arm Chair

Option: CA

Executive Chairs

Tilt-Swivel Chair with Casters

Ottoman

Side/Pull-up Chairs

Non-Swivel Side Chair

Swivel Side Chair

Non-Swivel Arm Chair

Swivel Arm Chair

Tilt-Swivel Arm Chair with Glides

Adjustable Executive Tilt-Swivel Lounge Chair

Eames Executive Lounge Chairs

Nelson Sling Sofa

Eames™ Chaise

Sofa Compact

Executive Swivel Lounge Chair

Tilt-Swivel Chair with Glides

Adjustable Tilt-Swivel
Office Spaces

FURNITURE, FURNISHINGS, AND EQUIPMENT

Reception and Lounge Seating

Fig. 3 Reception and lounge seating can assume various sizes, shapes, and configurations. Modular seating units can offer a custom built-in look, and can often incorporate table and storage components. Overall sizes will vary from manufacturer to manufacturer.
Conference tables come in an infinite variety of shapes and sizes. Figures 4 to 6 attempt to provide a representative sampling of such tables, along with dimensional information and seating capacities. The designer is cautioned to use such information as a preliminary planning tool only, and to carefully lay out conference rooms with actual furniture pieces that have been selected. Chair width and spacing will ultimately dictate conference table seating capacity.

Figures 4 to 6 attempt to provide a representative sampling of such tables, along with dimensional information and seating capacities. The designer is cautioned to use such information as a preliminary planning tool only, and to carefully lay out conference rooms with actual furniture pieces that have been selected. Chair width and spacing will ultimately dictate conference table seating capacity.

**Fig. 4**

- 42" diameter, seats 4
- 48" diameter, seats 5
- 54" diameter, seats 6
- 60" diameter, seats 7

**Veneer Tops**

- "Diamond"
- "Reverse diamond"
- "Sunburst"

Fig. 5

- 60" x 122", seats 10
- 60" x 180", seats 14
- 60" x 60", seats 8
- 53" x 151", seats 12
- 60" x 209", seats 16
- 60" x 238", seats 18
Office Spaces

FURNITURE, FURNISHINGS, AND EQUIPMENT

Conference Tables

60" × 118", seats 6–8

60" × 176", seats 10–12

60" × 206", seats 12–14

53" × 140", seats 8–10

53" × 198", seats 12–14

60" × 234", seats 14–16

One piece top, 48" × 96", seats 8

One piece top, 48" × 117½" × 29", seats 6–8

Two piece top, 48" × 126½", seats 10

Two piece top, 53" × 146½" × 29", seats 8–10

Two piece top, 60" × 204½" × 29", seats 12–14

Two piece top, 54" × 156", seats 12

Two piece top, 60" × 175½" × 29", seats 10–12

Two piece top, 60" × 233½" × 29", seats 14–16

Two piece top, 60" × 185½", seats 14

Two piece top, 60" × 216", seats 16

Two piece top, 60" × 245½", seats 18

Fig. 6
### TABLE 1 Vertical File Cabinets

<table>
<thead>
<tr>
<th>Description</th>
<th>Cabinet height</th>
<th>Outside dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Depth</td>
</tr>
<tr>
<td>Letter</td>
<td>58%&quot;</td>
<td>28%&quot;</td>
</tr>
<tr>
<td>Legal</td>
<td>58%&quot;</td>
<td>28%&quot;</td>
</tr>
<tr>
<td>Card</td>
<td>28%&quot;</td>
<td>14%&quot;</td>
</tr>
</tbody>
</table>

| Letter      | 52%"           | 28%"  | 14%"  | 52%"  |
| Legal       | 52%"           | 28%"  | 17%"  | 52%"  |
| Card        | 28%"           | 14%"  | 28%"  | 52%"  |

| Letter      | 41%"           | 28%"  | 14%"  | 41%"  |
| Legal       | 41%"           | 28%"  | 17%"  | 41%"  |

| Letter      | 29%"           | 30"   | 14%"  | 29%"  |
| Legal       | 29%"           | 30"   | 17%"  | 29%"  |
| Card        | 29%"           | 30"   | 29%"  | 29%"  |

Standard vertical file cabinets are usually designed to accommodate standard height drawers and half-height file insert drawers (optional). Cabinets are available in letter-size widths (14%") and legal-size widths (17%"), vertical file drawers are usually 12" high and accommodate front-to-back filing. Standard cabinets are available in four heights: five-drawer (58"), four-drawer (52"), three-drawer (41"), and two-drawer (29" or 27"). The depths of the three-, four-, and five-drawer cabinets are 28", while the depth of the 2-drawer cabinets is 30". Table 1 lists these dimensional data. It should be noted that although adequate for preliminary planning purposes, the data are based on Steelcase cabinets.

### Guidelines for Customizing Vertical Files

Depending on the manufacturer, vertical file cabinets can be customized. Usually two half-height file insert drawers may be substituted for a 12-in-high drawer in any or all positions. Table 2 indicates the dimensions and linear capacities of such insert drawers, while Fig. 7 illustrates basic guidelines for customizing.
TABLE 2  Vertical File Insert Drawers

<table>
<thead>
<tr>
<th>Description</th>
<th>Inside dimensions</th>
<th>Linear capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Half-height (3x6 or 4x8 cards)</td>
<td>267/8&quot; x 9(2) x 4 1/4&quot;</td>
<td>53 7/8&quot; * (2 rows)</td>
</tr>
<tr>
<td>Half-height (checks)</td>
<td>267/8&quot; x 10(3) x 4 1/4&quot;</td>
<td>287/8&quot;</td>
</tr>
<tr>
<td>Half-height (cash)</td>
<td>267/8&quot; x 6(12) x 4 1/4&quot;</td>
<td>Storage</td>
</tr>
<tr>
<td>Half-height (box)</td>
<td>267/8&quot; x 15(4) x 4 1/4&quot;</td>
<td>Coin tray</td>
</tr>
<tr>
<td>Half-height (microfilm)</td>
<td>267/8&quot; x 4(3) x 4 1/4&quot;</td>
<td>804/4&quot; ** (3 compartments)</td>
</tr>
<tr>
<td>Full-height (letter size)</td>
<td>267/8&quot; x 6(2) x 10 1/4&quot;</td>
<td>53 7/8&quot; ** (2 compartments)</td>
</tr>
<tr>
<td>Full-height (legal size)</td>
<td>267/8&quot; x 7(12) x 10 1/4&quot;</td>
<td>See style no. C</td>
</tr>
<tr>
<td>Full-height (legal size)</td>
<td>267/8&quot; x 5(13) x 10 1/4&quot;</td>
<td>See style no. D</td>
</tr>
</tbody>
</table>

*Deduct 1/2" when compressor is used.

TABLE 3  Drawers, Overfile Cabinets, and Roll-Away File Cart

<table>
<thead>
<tr>
<th>Description</th>
<th>Inside dimensions</th>
<th>Linear capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot; Letter-size drawer</td>
<td>27 1/8&quot; x 12 1/2&quot; x 10 1/2&quot;</td>
<td>27 1/8&quot; front-to-back</td>
</tr>
<tr>
<td>12&quot; Legal-size drawer</td>
<td>27 1/8&quot; x 15 1/4&quot; x 10 1/4&quot;</td>
<td>27 1/8&quot; front-to-back</td>
</tr>
<tr>
<td>Overfile cabinet</td>
<td>29 5/8&quot; x 28&quot; x 28&quot;</td>
<td>55 7/8&quot; side-to-side on 2 shelves (1 adj., 3&quot; thick)</td>
</tr>
<tr>
<td>Overfile cabinet</td>
<td>35 1/8&quot; x 28 1/2&quot; x 28&quot;</td>
<td>67&quot; side-to-side on 2 shelves (1 adj., 3/4&quot; thick)</td>
</tr>
<tr>
<td>Overfile cabinet</td>
<td>44 1/8&quot; x 28 1/2&quot; x 28&quot;</td>
<td>85 1/8&quot; side-to-side on 2 shelves (1 adj., 3/4&quot; thick)</td>
</tr>
<tr>
<td>Overfile cabinet</td>
<td>53 1/8&quot; x 28 1/2&quot; x 28&quot;</td>
<td>103 3/8&quot; side-to-side on 2 shelves (1 adj., 3/4&quot; thick)</td>
</tr>
<tr>
<td>Roll-away file cart</td>
<td>30 1/2&quot; x 28&quot; x 15 1/4&quot;</td>
<td>25&quot; Letter/legal</td>
</tr>
</tbody>
</table>

*Deduct 1/4" when compressor is used.
+Deduct 1/2" when ordered with sliding doors.
Standard lateral file cabinets are usually available in three widths—30", 36", and 42"—and with 12"-high drawers or roll-out shelves. Some cabinets are designed on a 9" module to accommodate 3", 6", 9", 12", and 15"-high drawers and shelves.

Ganging hardware is usually included with each file cabinet. Cabinets should be ganged with adjacent files or bolted to the floor. Counterbalance weights should be used for single-application files.

Table 4 shows the outside and inside dimensions of four lateral file cabinets, and their loaded floor weights based on 12"-high drawers filled to capacity. It should be noted that the dimensional data and load factors are based on Steelcase cabinets. Although these data are adequate for preliminary planning purposes, it is essential that the data of the equipment being specified are verified with its manufacturer.

### Table 4: Lateral File Cabinets

<table>
<thead>
<tr>
<th>Description (cabinet inside height)</th>
<th>Cabinet width</th>
<th>Outside/inside dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Depth</td>
</tr>
<tr>
<td>60&quot;</td>
<td>30&quot;</td>
<td>18'17/16&quot;</td>
</tr>
<tr>
<td></td>
<td>36&quot;</td>
<td>18'17/16&quot;</td>
</tr>
<tr>
<td></td>
<td>42&quot;</td>
<td>18'17/16&quot;</td>
</tr>
<tr>
<td>48&quot;</td>
<td>30&quot;</td>
<td>18'17/16&quot;</td>
</tr>
<tr>
<td></td>
<td>36&quot;</td>
<td>18'17/16&quot;</td>
</tr>
<tr>
<td></td>
<td>42&quot;</td>
<td>18'17/16&quot;</td>
</tr>
<tr>
<td>36&quot;</td>
<td>30&quot;</td>
<td>18'17/16&quot;</td>
</tr>
<tr>
<td></td>
<td>36&quot;</td>
<td>18'17/16&quot;</td>
</tr>
<tr>
<td></td>
<td>42&quot;</td>
<td>18'17/16&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>30&quot;</td>
<td>18'17/16&quot;</td>
</tr>
<tr>
<td></td>
<td>36&quot;</td>
<td>18'17/16&quot;</td>
</tr>
<tr>
<td></td>
<td>42&quot;</td>
<td>18'17/16&quot;</td>
</tr>
</tbody>
</table>

### Loaded Weights

<table>
<thead>
<tr>
<th>Description</th>
<th>24&quot;</th>
<th>36&quot;</th>
<th>48&quot;</th>
<th>60&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cabinet width</td>
<td>30&quot;</td>
<td>36&quot;</td>
<td>42&quot;</td>
<td>30&quot;</td>
</tr>
<tr>
<td>Loaded weight in pounds</td>
<td>285</td>
<td>336</td>
<td>391</td>
<td>401</td>
</tr>
</tbody>
</table>

* Deduct 1/4" when compressor is used.
Filling Arrangements

Most lateral file drawers are designed for filing both letter-size and legal-size documents, in addition to EDP printouts. Lateral file drawers can usually accommodate materials in a front-to-back (F to B) arrangement or in a side-to-side (S to S) arrangement. In some instances a combination of the two is possible. The actual capacity in linear inches for each arrangement and for each particular drawer or shelf has been calculated and is shown in the “Linear capacity” column in Tables 2, 3, 6, 7 and 8. It should be noted that the dimensional data in Table 5 are based on Steelcase drawers.

TABLE 5 Filing Arrangements

<table>
<thead>
<tr>
<th>Description</th>
<th>30” width</th>
<th>36” width</th>
<th>42” width</th>
</tr>
</thead>
<tbody>
<tr>
<td>Letter/legal, 12” drawer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2” drawer</td>
<td>F to B</td>
<td>F to B</td>
<td>F to B</td>
</tr>
<tr>
<td>4” drawer</td>
<td>F to B</td>
<td>F to B</td>
<td>F to B</td>
</tr>
<tr>
<td>6” drawer</td>
<td>F to B</td>
<td>F to B</td>
<td>F to B</td>
</tr>
<tr>
<td>EDP binders, 16” drawer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2” drawer</td>
<td>F to B</td>
<td>F to B</td>
<td>F to B</td>
</tr>
<tr>
<td>4” drawer</td>
<td>F to B</td>
<td>F to B</td>
<td>F to B</td>
</tr>
<tr>
<td>6” drawer</td>
<td>F to B</td>
<td>F to B</td>
<td>F to B</td>
</tr>
<tr>
<td>EDP folders, 18” drawer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2” drawer</td>
<td>F to B</td>
<td>F to B</td>
<td>F to B</td>
</tr>
<tr>
<td>4” drawer</td>
<td>F to B</td>
<td>F to B</td>
<td>F to B</td>
</tr>
<tr>
<td>6” drawer</td>
<td>F to B</td>
<td>F to B</td>
<td>F to B</td>
</tr>
</tbody>
</table>
### TABLE 6  Drawers, Shelves, Add-On Cabinets

<table>
<thead>
<tr>
<th>Description</th>
<th>File cabinet width</th>
<th>Style no.</th>
<th>Outside/Inside dimensions</th>
<th>Linear capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot; legal fixed shelf with door</td>
<td>30&quot;</td>
<td>18½&quot;</td>
<td>28½&quot; 10½&quot;</td>
<td>28½&quot; side-to-side</td>
</tr>
<tr>
<td></td>
<td>36&quot;</td>
<td>18½&quot;</td>
<td>34½&quot; 10½&quot;</td>
<td>34½&quot; S to S</td>
</tr>
<tr>
<td></td>
<td>42&quot;</td>
<td>18½&quot;</td>
<td>40½&quot; 10½&quot;</td>
<td>40½&quot; S to S</td>
</tr>
<tr>
<td>15&quot; legal fixed shelf with door</td>
<td>30&quot;</td>
<td>18½&quot;</td>
<td>28½&quot; 13½&quot;</td>
<td>28½&quot; S to S</td>
</tr>
<tr>
<td></td>
<td>36&quot;</td>
<td>18½&quot;</td>
<td>34½&quot; 13½&quot;</td>
<td>34½&quot; S to S</td>
</tr>
<tr>
<td></td>
<td>42&quot;</td>
<td>18½&quot;</td>
<td>40½&quot; 13½&quot;</td>
<td>40½&quot; S to S</td>
</tr>
<tr>
<td>Center hook filing hanger bar</td>
<td>30&quot;</td>
<td>17&quot;</td>
<td>28½&quot; 10½&quot; (12&quot; high door)</td>
<td>28½&quot; S to S</td>
</tr>
<tr>
<td></td>
<td>36&quot;</td>
<td>17&quot;</td>
<td>34½&quot; 10½&quot; (12&quot; high door)</td>
<td>34½&quot; S to S</td>
</tr>
<tr>
<td></td>
<td>42&quot;</td>
<td>17&quot;</td>
<td>40½&quot; 10½&quot; (12&quot; high door)</td>
<td>40½&quot; S to S</td>
</tr>
<tr>
<td>T-bar</td>
<td>30&quot;</td>
<td>17&quot;</td>
<td>28½&quot; 10½&quot; (15&quot; high door)</td>
<td>28½&quot; S to S</td>
</tr>
<tr>
<td></td>
<td>36&quot;</td>
<td>17&quot;</td>
<td>34½&quot; 10½&quot; (15&quot; high door)</td>
<td>34½&quot; S to S</td>
</tr>
<tr>
<td></td>
<td>42&quot;</td>
<td>17&quot;</td>
<td>40½&quot; 10½&quot; (15&quot; high door)</td>
<td>40½&quot; S to S</td>
</tr>
<tr>
<td>Wire tape rack</td>
<td>30&quot;</td>
<td>17&quot;</td>
<td>28½&quot; 7½&quot; (9&quot; high door)</td>
<td>28½&quot; S to S</td>
</tr>
<tr>
<td></td>
<td>36&quot;</td>
<td>17&quot;</td>
<td>34½&quot; 7½&quot; (12&quot; high door)</td>
<td>34½&quot; S to S</td>
</tr>
<tr>
<td></td>
<td>42&quot;</td>
<td>17&quot;</td>
<td>40½&quot; 7½&quot; (15&quot; high door)</td>
<td>40½&quot; S to S</td>
</tr>
<tr>
<td>Add-on cabinet</td>
<td>30&quot;</td>
<td>830-810</td>
<td>18&quot;16½&quot; 30&quot;28½&quot; 15W/13½&quot;</td>
<td>28½&quot; S to S</td>
</tr>
<tr>
<td></td>
<td>36&quot;</td>
<td>836-810</td>
<td>18&quot;16½&quot; 36&quot;34½&quot; 15W/13½&quot;</td>
<td>34½&quot; S to S</td>
</tr>
<tr>
<td></td>
<td>42&quot;</td>
<td>842-810</td>
<td>18&quot;16½&quot; 42&quot;40½&quot; 16W/13½&quot;</td>
<td>40½&quot; S to S</td>
</tr>
<tr>
<td></td>
<td>30&quot;</td>
<td>830-710</td>
<td>18&quot;16½&quot; 30&quot;28½&quot; 28W/26½&quot;</td>
<td>28½&quot; S to S</td>
</tr>
<tr>
<td></td>
<td>36&quot;</td>
<td>836-710</td>
<td>18&quot;16½&quot; 36&quot;34½&quot; 28W/25½&quot;</td>
<td>34½&quot; S to S</td>
</tr>
<tr>
<td></td>
<td>42&quot;</td>
<td>842-710</td>
<td>18&quot;16½&quot; 42&quot;40½&quot; 28W/25½&quot;</td>
<td>40½&quot; S to S</td>
</tr>
</tbody>
</table>

*Deduct ½" when compressor is used.
Standart cabinets often provide a fast, flexible, and economical solution to many storage problems. Table 7 provides dimensional data and capacities for four typical cabinet types. These cabinets are manufactured by Steelcase. The dimensions of cabinets of other manufacturers will differ somewhat. The data in Table 7, however, are adequate for preliminary planning purposes.

<table>
<thead>
<tr>
<th>Description</th>
<th>Outside/inside dimensions</th>
<th>Linear capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage cabinet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18&quot;/17&quot; x 36&quot;/33 ³/₄&quot; x 41 ¾&quot;/35 ³/₄&quot;</td>
<td>99 ¾&quot; side-to-side on 3 shelves (2 adj., 1&quot; thick)</td>
<td></td>
</tr>
<tr>
<td>19&quot;/17&quot; x 36&quot;/33 ³/₄&quot; x 52&quot;/46 ³/₄&quot;</td>
<td>89 ¾&quot; S to S on 3 shelves (2 adj., 1&quot; thick)</td>
<td></td>
</tr>
<tr>
<td>19&quot;/17&quot; x 36&quot;/33 ³/₄&quot; x 64&quot;/58 ³/₄&quot;</td>
<td>132 ¾&quot; S to S on 4 shelves (3 adj., 1&quot; thick)</td>
<td></td>
</tr>
<tr>
<td>18&quot;/17&quot; x 36&quot;/33 ³/₄&quot; x 80&quot;/74 ¹/₄&quot;</td>
<td>166 ¾&quot; S to S on 5 shelves (4 adj., 1&quot; thick)</td>
<td></td>
</tr>
<tr>
<td>24&quot;/23&quot; x 36&quot;/33 ³/₄&quot; x 64&quot;/58 ³/₄&quot;</td>
<td>132 ¾&quot; S to S on 4 shelves (3 adj., 1&quot; thick)</td>
<td></td>
</tr>
<tr>
<td>24&quot;/23&quot; x 36&quot;/33 ³/₄&quot; x 80&quot;/74 ¹/₄&quot;</td>
<td>166 ¾&quot; S to S on 5 shelves (4 adj., 1&quot; thick)</td>
<td></td>
</tr>
<tr>
<td>Wardrobe cabinet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18&quot;/17&quot; x 36&quot;/33 ³/₄&quot; x 52&quot;/46 ³/₄&quot;</td>
<td>Not for filing</td>
<td></td>
</tr>
<tr>
<td>18&quot;/17&quot; x 36&quot;/33 ³/₄&quot; x 64&quot;/58 ³/₄&quot;</td>
<td>Not for filing</td>
<td></td>
</tr>
<tr>
<td>18&quot;/17&quot; x 36&quot;/33 ³/₄&quot; x 80&quot;/74 ¹/₄&quot;</td>
<td>Not for filing</td>
<td></td>
</tr>
<tr>
<td>24&quot;/23&quot; x 36&quot;/33 ³/₄&quot; x 64&quot;/58 ³/₄&quot;</td>
<td>Not for filing</td>
<td></td>
</tr>
<tr>
<td>24&quot;/23&quot; x 36&quot;/33 ³/₄&quot; x 80&quot;/74 ¹/₄&quot;</td>
<td>Not for filing</td>
<td></td>
</tr>
<tr>
<td>Wardrobe/storage cabinet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18&quot;/17&quot; x 36&quot;/33 ³/₄&quot; x 52&quot;/46 ³/₄&quot;</td>
<td>43 ¾&quot; S to S on 3 shelves (2 adj., 1&quot; thick)</td>
<td></td>
</tr>
<tr>
<td>19&quot;/17&quot; x 36&quot;/33 ³/₄&quot; x 64&quot;/58 ³/₄&quot;</td>
<td>56 ¾&quot; S to S on 4 shelves (3 adj., 1&quot; thick)</td>
<td></td>
</tr>
<tr>
<td>19&quot;/17&quot; x 36&quot;/33 ³/₄&quot; x 80&quot;/74 ¹/₄&quot;</td>
<td>56 ¾&quot; S to S on 4 shelves (3 adj., 1&quot; thick)</td>
<td></td>
</tr>
<tr>
<td>24&quot;/23&quot; x 36&quot;/33 ³/₄&quot; x 64&quot;/58 ³/₄&quot;</td>
<td>56 ¾&quot; S to S on 4 shelves (3 adj., 1&quot; thick)</td>
<td></td>
</tr>
<tr>
<td>24&quot;/23&quot; x 36&quot;/33 ³/₄&quot; x 80&quot;/74 ¹/₄&quot;</td>
<td>56 ¾&quot; S to S on 4 shelves (3 adj., 1&quot; thick)</td>
<td></td>
</tr>
<tr>
<td>Wardrobe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18&quot;/15½&quot; x 18&quot;/15 ³/₄&quot; x 41&quot;/35 ¾&quot;</td>
<td>15 ¾&quot; on bar</td>
<td></td>
</tr>
<tr>
<td>18&quot;/15½&quot; x 18&quot;/15 ³/₄&quot; x 52&quot;/47&quot;</td>
<td>15 ¾&quot; on bar</td>
<td></td>
</tr>
<tr>
<td>18&quot;/15½&quot; x 18&quot;/15 ³/₄&quot; x 64&quot;/58 ¾&quot;</td>
<td>15 ¾&quot; on bar</td>
<td></td>
</tr>
</tbody>
</table>
# Office Spaces

## FURNITURE, FURNISHINGS, AND EQUIPMENT

### Interior Card Trays

(For use in vertical or lateral files)

<table>
<thead>
<tr>
<th>Description</th>
<th>Style No.</th>
<th>Inside dimensions</th>
<th>Linear capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Depth</td>
<td>Width</td>
</tr>
<tr>
<td>3 x 5 card</td>
<td>4335</td>
<td>11½&quot;</td>
<td>5&quot;</td>
</tr>
<tr>
<td>3 x 5 card</td>
<td>4337M</td>
<td>14½&quot;</td>
<td>5&quot;</td>
</tr>
<tr>
<td>5 x 8 card</td>
<td>4355</td>
<td>11½&quot;</td>
<td>8½&quot;</td>
</tr>
<tr>
<td>5 x 8 card</td>
<td>4357</td>
<td>14½&quot;</td>
<td>8½&quot;</td>
</tr>
<tr>
<td>4 x 6 card</td>
<td>800-TN-46</td>
<td>12&quot;</td>
<td>6½&quot;</td>
</tr>
<tr>
<td>4 x 6 card</td>
<td>800-TW-46</td>
<td>15&quot;</td>
<td>6½&quot;</td>
</tr>
<tr>
<td>Tab card</td>
<td>7201</td>
<td>11½&quot;</td>
<td>7½&quot;</td>
</tr>
<tr>
<td>Tab card</td>
<td>7204</td>
<td>14½&quot;</td>
<td>7½&quot;</td>
</tr>
<tr>
<td>Coin and bill</td>
<td>4388</td>
<td>8½&quot;</td>
<td>3½&quot;</td>
</tr>
<tr>
<td>Coin and bill</td>
<td>4389</td>
<td>7½&quot;</td>
<td>3½&quot;</td>
</tr>
</tbody>
</table>

### Dimensions

- Dimensions of each of 6 bill compartments.
- Dimensions of each of 5 coin compartments.
- Coin cards cannot be installed in 8" high shelf located directly below a door. Use 3" high shelf and refer to guidelines.

### 6" High Shelves/Drawers

<table>
<thead>
<tr>
<th>B42 DWDV-6</th>
<th>B42 SWDV-6</th>
<th>B36 DWDV-6</th>
<th>B36 SWDV-6</th>
<th>B30 DWDV-6</th>
<th>B30 SWDV-6</th>
<th>B30 SWDV-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>4</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Number of card trays accommodated per 8" high drawer or shelf:

<table>
<thead>
<tr>
<th>Style No.</th>
<th>4337M</th>
<th>800TW46</th>
<th>4387</th>
<th>7204M</th>
</tr>
</thead>
<tbody>
<tr>
<td>4337M</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>800TW46</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>4387</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7204M</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

*Dimensions of each of 6 bill compartments.
†Dimensions of each of 5 coin compartments.
‡Card trays cannot be installed in 6" high shelf located directly below a door. Use 3" high shelf and refer to guidelines.
Office Spaces

FURNITURE, FURNISHINGS, AND EQUIPMENT

Storage Components Glossary

**Lower storage/Lateral file**
- Free-standing wall- or panel-mounted files with width dimension greater than depth dimension.

**Media compartment kit**
- Can be retrofit or factory assembled to 800/900 Series 6" roll-out shelf. Provides dividers and partitions adjustable for storing a variety of media-cassettes, mini-cassettes, cartridges, floppy disks, and more.

**Mobile pedestal**
- Supports drawers in several combinations and has casters for mobility.

**Overfile cabinet**
- For use above lateral or vertical files, sliding door, lock, and shelf modifier options.

**Partition**
- A double metal wall that mounts into a lateral file drawer to divide drawer.

**Personal drawer**
- For personal items. An adjustable divider is included. 3" high.

**Pull-out keyboard shelf**
- Attaches beneath work surface for computer keyboard support and storage.

**Rail**
- Mount in lateral file for drawer suspended filing, front-to-back or side-to-side.

**Storage cabinet**
- Storage for general supplies. Available in 2, 3, or 4 adjustable shelves.

**T-bar filing for bound printouts**
- Accepts EDP printouts in T-bar type binders.

**Vertical file**
- Letter- or legal-size filing cabinet with depth dimension greater than width dimension. For front-to-back filing only.

**Vertical file drawer**
- 6" high and 12" high drawers for letter or legal-size filing cabinets.

**Wardrobe**
- Provides full-width coat rod for hanging clothes mounted beneath full-width shelf.

**Wire tape racks**
- Racks can be freestanding or built-in to lateral files for storage of magnetic tapes and disk cartridges on edge. Dividers can be positioned to accommodate media of different thicknesses.
### Office Spaces

**FURNITURE, FURNISHINGS, AND EQUIPMENT**

### Storage Component Glossary

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bookcase</td>
<td>Units have adjustable shelves which can accommodate rows of standard ring binders and other bound materials.</td>
</tr>
<tr>
<td>Center hook filing hanging bar</td>
<td>Accepts printouts and magnetic tape reels with center hooks.</td>
</tr>
<tr>
<td>Combination wardrobe and storage cabinet</td>
<td>Units are divided – space for hanging clothes and two or three vertically adjustable shelves.</td>
</tr>
<tr>
<td>Compressor</td>
<td>A spring-loaded plate that supports file material. Can be moved and locked in position. Used in vertical and lateral file drawers, pedestal file drawers and card trays.</td>
</tr>
<tr>
<td>Divider</td>
<td>Metal plate used to separate and support file material. For lateral file and pedestal file drawers, fixed and roll-out shelves.</td>
</tr>
<tr>
<td>Double-door storage cabinet</td>
<td>For miscellaneous storage below worksurface. Includes one adjustable shelf and two swing-arm doors.</td>
</tr>
<tr>
<td>File insert drawers</td>
<td>For use in vertical files instead of card trays.</td>
</tr>
<tr>
<td>Hanging folder frame</td>
<td>A metal rod mounted in lateral and vertical files for suspended file material. Can be mounted on partitions for front-to-back filing.</td>
</tr>
<tr>
<td>Interior card trays</td>
<td>Portable trays in various sizes for common card sizes: 3 x 6, 4 x 6, etc. Compressor included.</td>
</tr>
<tr>
<td>Lateral file drawer</td>
<td>3&quot; tray drawer, 5&quot; card drawer, and 9&quot; 12&quot; and 15&quot; high file drawers. Latter or legal-size filing. Dividers, three-saw blocks, compressor, hanging folder frames, rails, or partitions available.</td>
</tr>
<tr>
<td>Lateral file fixed shelf</td>
<td>12&quot; or 15&quot; high shelves with or without doors and with three dividers.</td>
</tr>
<tr>
<td>Lateral file posting shelf</td>
<td>Metal pull-out shelf option on 48&quot; and 60&quot; interior height lateral files. When not specified, the space will be filled by a posting shelf filler.</td>
</tr>
<tr>
<td>Lateral file roll-out shelf</td>
<td>3&quot;, 5&quot;, 12&quot;, and 15&quot; high shelves extend for accessibility.</td>
</tr>
<tr>
<td>Lateral file worksheet</td>
<td>3&quot; high roll-out worksheet with laminate surface.</td>
</tr>
</tbody>
</table>
Office Spaces

FURNITURE, FURNISHINGS, AND EQUIPMENT

Electronic Media Storage

Microfiche

Description: Microfiche is a 4” x 6” film transparency containing multiple rows of greatly reduced page images of any written, printed, or graphic material. Image reductions range from 13 up to several hundred times smaller than the originals. A microfiche viewer enlarges the images so that they are readable. Labeling information is written or printed on a narrow strip along the long edge at the top of the microfiche.

Microfiche may be stored in interior card trays, in lateral file 8”-high roll-out shelves, and in a lateral file media compartment.

Microfilm

Description: Microfilm is roll photographic film on a reel or in a square cartridge that contains images of pages of written, graphic, or printed material reduced hundreds of times. A microfilm viewer enlarges the images so that they are readable. Microfilm on a reel is kept in a square plastic or cardboard box for protection and ease of handling. Microfilm is most conveniently stored on edge. Labeling is placed on one of the edges of the reel or box.

Microfilm may be stored in the lateral file media compartment kit, in an interior card tray, and in lateral file 8”-high drawers or shelves.

Print-out Paper

Description: Print-out paper, also known as continuous form data processing paper, is used in almost all computer printers and some word processing equipment. The most common types are recognizable by:

- Small “pin-feed” holes along both edges which are used by the printer to grip and advance the paper.
- Green or grey-shaded stripes across the paper which serve to organize the printed information.

After printing, the print-out may exist in a “fan-folded” stack or it may be “burst”, i.e., separated into individual sheets along the perforations that exist at the fold lines. If the print-out consists of a significant number of sheets, it may be “bound” for easier handling. Fan-folded printouts must be bound along the top or long edge. Print-outs that have been burst may be bound along either the long edge or the short edge. The binding may consist of only a narrow metal or plastic clamp or it may be include a stiff plastic or fiberboard cover. Frequently the binding may include hooks at both ends so the print-out may be hung from two rails like a hanging file folder. Other hooks may be used to suspend it from special bars or rails.

Identification information may be marked on one of the edges (depending on how the print-out is stored) or on the front sheet of the binding cover.

Print-out paper may be stored in Steelcase lateral and vertical files depending on the paper size. Check the file which will accommodate your paper. Boxed paper can be stored in storage cabinets.

Cartridges

Description: Cartridges have ¼” wide magnetic tape loaded into a reel-to-reel cartridge generally made of clear plastic with metal back plate. They look similar to an oversize recording cassette. Cartridges come in and are sometimes stored in a “flip-open” plastic or cardboard box. Labels or identification information are located on the long edge or on the side along the long edge of the cartridge or the box.

Cartridges may be stored in interior card trays or in a media compartment kit in lateral file 8”-high drawers or shelves.
Cassettes

Description: Cassettes are available in "standard" and "mini" sizes and consist of magnetic tape loaded into a reel-to-reel configuration in a plastic case. Standard cassettes for electronic equipment are identical in size and appearance to those used for home recording. Cassettes may be used in microcomputers and in word processing or dictation equipment. They come in and are frequently stored in a flip-open plastic case. Labels or identification information may be located on the long edge or side of the cassette or its case.

Cassettes may be stored in a lateral file media compartment kit.

Standard Cassette Case
$1\frac{1}{4}" \times 2\frac{3}{4}" \times 4\frac{3}{4}"

Mini Cassette Case
$\frac{3}{4}" \times 1\frac{1}{2}" \times 2\frac{3}{4}"

Disk Cartridges

Description: Disk cartridges are round plastic cases which contain a series of rotating platters (or disks) on which data is magnetically recorded. The number of platters in a case varies with the height of the case. In use, the entire case is inserted in a computer disk drive unit where recording arms, which read/record information, enter the case through a slot with a spring door.

Disk cartridges are flat in appearance with an elongated Y-shaped protrusion on the top. They can be stored flat or on edge. Labels for identification are usually located on the edge of the disk cartridge. Frequently disk cartridges have to be stored in a temperature/humidity controlled environment.

Disk cartridges may be stored in lateral file 6"-high roll-out shelves, storage cabinets, and bookcases.

1" x 10" diameter
3" x 10" diameter
1" x 15" diameter
3" x 15" diameter

Disk Packs

Description: Disk packs are round plastic cases which contain a series of rotating platters (or disks) on which data is magnetically recorded. The number of platters in a unit varies with the height of the plastic case. In use, the entire case is inserted in a computer disk drive unit where recording arms, to read/record information, enter the case through a slot with a spring door. Disk packs are flat on the bottom and upright with the handle on top. Identification is generally located on the edge of the disk pack. These units should be stored in a temperature/humidity controlled environment. Disk packs must not be stored one on another.

Disk packs may be stored in storage cabinets, bookcases, and on 3"- and 6"-high lateral file shelves.

7" x 10" diameter
7" x 15" diameter

Floppy (Flexible) Disks

Description: Floppy disks, also called diskettes or flexible disks, are small record-like disks each permanently enclosed in a square, stiff paper envelope. They are used to magnetically record information in all types of small computer and word processing equipment. Labels are placed on the paper envelope.

Floppy disks may be stored in 12"-high lateral file drawers and shelves.

8" x 8"
$5\frac{1}{4}" \times 5\frac{1}{4}"
3\frac{1}{2}" \times 3\frac{1}{2}"

Office Spaces

FURNITURE, FURNISHINGS, AND EQUIPMENT
Electronic Media Storage

295
**Office Spaces**

**FURNITURE, FURNISHINGS, AND EQUIPMENT**

**Electronic Media Storage**

**Laser Disks**

*Description* Laser disks look like long-play record albums complete with a paper protective sleeve. Data are stored and retrieved by laser beam. Laser disks may be stored in 15”-high lateral file drawers and shelves.

```
12 1/4” x 12 1/4” jacket
12” diameter
4 1/4” diameter
```

**Magnetic, Tab, and Aperture Cards**

*Description* Magnetic cards, also known as mag cards, are a tab-size black plastic card with magnetic material coated on one or both sides. The cards are used to record or reproduce information in word processing equipment. In some cases one or more of the cards will be kept in a paper envelope, identifying information will be marked on the face of the envelope.

Tab cards, also known as keypunch cards, are 80 column cards or punch cards with small holes in them to represent bits of data. Although they may be stored in a workstation or central storage area, they are usually used and produced in a mainframe computer room or keypunch department, and are stored in specially separated decks. The decks are most frequently identified by markings across the edges of the cards.

Aperture cards are tab cards with a piece of microfilm mounted over a hole in their center. They are most frequently used for microfilm images of engineering or architectural drawings. Aperture card reader/printers enlarge the image on a screen for reference and, if required, reproduce a full-sized copy of the drawing. Identifying information is printed in a narrow band along the top (long edge) of the card.

These cards may be stored in interior card trays and in lateral file 6”-high drawers and roll-out shelves.

```
3 1/4” x 7 1/4”
```

**Magnetic Tape Reels**

*Description* Magnetic tape is typically 1/2” wide and loaded on reels of varying diameters. A flexible plastic strip locks around the outside of the reel to protect the tape and prevent unraveling when it is not in use. This media is used in large tape drive units that are generally found only in computer rooms. The long-term storage of magnetic tapes is subject to strict temperature and humidity requirements to prevent damage. Tapes are labeled, both on the side and on the flexible strip that is placed around the edge of the reel. They can be stored flat or on edge. For flat storage, handle like disk cartridges.

Magnetic tape reels may be stored in the lateral file add-on cabinets, storage cabinets, or in free-standing wire racks on lateral file shelves.

```
1” x 7 1/4” diameter
1” x 8 1/2” diameter
1” x 10 1/2” diameter
1” x 15” diameter
```
Office Spaces
FURNITURE, FURNISHINGS, AND EQUIPMENT
File Countertop
Office Spaces

FURNITURE, FURNISHINGS, AND EQUIPMENT

Office Pantry

[Diagram of Office Pantry showing plans and details]
## Hospitality Spaces

<table>
<thead>
<tr>
<th>Category</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restaurants</td>
<td>307</td>
</tr>
<tr>
<td>Bars</td>
<td>346</td>
</tr>
<tr>
<td>Hotels</td>
<td>374</td>
</tr>
</tbody>
</table>
The basic components of any restaurant interior are the chair and the table. Depending upon restaurant type, menu, service, table setting, furniture selection, and degree of intimacy required, table size and overall chair space requirements can, and should, vary greatly. A restaurant that encourages rapid turnover of customers will normally provide smaller table top and chair sizes. On the other hand, those restaurants that encourage limited turnover and emphasize the wining and dining experience will typically provide larger table top sizes and larger, more comfortable chairs, with greater distance between table groupings.

There is no agreement among even the most experienced restaurateurs and restaurant designers as to what the optimal table and chair dimensions should be. In addition, many other design factors will influence the final decision, including circulation and egress, accessibility standards, methods of service, and the overall dimensions of any given space.

Figures 1 to 19 provide the designer with restaurant planning standards that have been developed by many experienced architects and interior designers. These drawings not only show the various individual table and chair arrangements, but provide the designer with groupings of these arrangements, as well as an indication of overall size, floor area, and number of persons accommodated. These arrangements, however, should only be utilized for preliminary planning information.
RESTAURANTS
Types and Sizes of Table Arrangements

2 PEOPLE

4 PEOPLE

LUXURIOUS SEATING SUCH AS DINING 16 SQ. FT./PERSON

INTERMEDIATE SEATING CAFETERIA RESTAURANT 12 SQ. FT./PERSON

ECONOMICAL SEATING SUCH AS JOINING 14 SQ. FT./PERSON

SQUARE SPACING
SERVICE AISLES. SQUARE SEATING 60" MIN. BETW. TABLE TOPS. 24" Aisle PLUS TWO CHAIRS BACK TO BACK 36" CHAIRS 1'7" TO 1'8" FROM FLOOR TO SEAT. 1'7" PREFERRED FOR WOMEN TABLES 29" TO 30" HIGH

DIAGONAL SPACING
SERVICE AISLES. DIAGONAL SEATING 30" MIN. BETW. CORNERS OF TABLE TOPS

Fig. 2
RESTAURANTS
Types and Sizes of Table Arrangements

Fig. 3 Seating for 2.

Fig. 4 Seating for 4.
RESTAURANTS
Types and Sizes of Table Arrangements

Fig. 5  13 ft × 27 ft, 351 sq ft, seats 18.

Fig. 6  8 ft × 27 ft, 216 sq ft, seats 12.

Fig. 7  33 ft × 11 ft, 363 sq ft, seats 12.
RESTAURANTS
Types and Sizes of Table Arrangements

Fig. 8  33 ft x 22 ft, 726 ft², seats 26.

Fig. 9  11 ft x 28 ft, 308 ft², seats 12.
Fig. 10. These drawings highlight several critical dimensions that the designer must consider. Aisle circulation must be adequate in width; other clearances to consider include chair depth from edge of table and clearance between chairs. While laying out chair and table arrangements, a designer must anticipate the potential conflict between a patron leaving a seat and a tray-carrying waiter.
**Fig. 11** Mixed banquet seating.

**Fig. 12** Banquettes for 2, 4, and 6 persons.

**Fig. 13** 21 ft × 9 ft, 189 sq ft, seats 12.

**Fig. 14** 27 ft × 10 ft, 270 sq ft, seats 12.
Fig. 15  18 ft x 9 ft, 171 ft², seats 12.

Fig. 16  19 ft x 15 ft, 235 ft², seats 24.

Fig. 17  21 ft x 19 ft, 400 ft², seats 24.
Fig. 18  24 ft x 20 ft, 480 ft², seats 36. A = main circulation, B = activity zone.

Fig. 19  13 ft x 13 ft, 169 ft², seats 16.
Restaurant and Dining Room Seating

Dispersed seating suitable for guests with restricted mobility should be available in
restaurants, coffee shops, and dining facilities. As a guide, the Uniform Federal Ac-
cessibility Standards (UFAS) require a mini-
mum of 5 percent of restaurant seating to be
accessible. Accessible aisles should connect
the entrance to these seating locations,
public restrooms, and self-service areas such
as salad bars, condiment stands, or buffet
tables. Comfortable seating for waiting
should be available to customers near the
entrance.

A variety of accessible seating should be
available, suitable for large and small dining
groups. Small tables may not be accessible
to guests in wheelchairs because of the
restricted kneespace. Therefore, a party of
one or two may require a table usually set up
for four. Restaurants or coffee shops with
built-in seating, such as booths or ban-
quetttes, should also provide some chairs for
guests who have difficulty getting into and
out of bench seating. These chairs can be
removed to seat guests in wheelchairs.

Where seating areas are raised on platforms,
accessible seating and similar services
should be available on the main-floor level or
a ramp to the upper level should be provided.

Aisles serving accessible seating should
be at least 3'0" wide, which typically requires
a 6'0" clearance between parallel tables, or
4'6" between rotated tables. (See Fig. 21.)
Aisles should also provide room for
customers to be seated at tables. At least a
2'6" clear space should be available behind
each seating location. This space allows
chairs to be withdrawn from the table and
staff to assist guests reposition chairs close
to the table.

For wheelchair seating, a 3'0" to 3'6" aisle
is necessary, depending on the width of the
kneespace. (See Fig. 25.) Wheelchairs
positioned at tables project approximately 6"
farther into aisles than most chairs. To allow
guests with restricted mobility to turn
around, seating arrangements should also
include a 5'0" diameter circle or T-shaped
clear area at dead-end aisles.

Dining Tables and Chairs

Accessible seating locations should allow
guests with restricted mobility to dine with
ambulatory customers. Tables should pro-
vide kneespace for customers in wheel-
chairs, and dining chairs should be coor-
dinated to provide comfortable seating at
the same table height.

Dining room chairs should be stable to
maintain balance as guests seat themselves,
and comfortable to sit in during dinner. Chairs
should be light and easy to reposition. The
seat should have a slight slant to the rear to
transfer body weight to the back of the chair.
However, an exaggerated incline makes it
difficult to rise. The seat should be approx-
imately 16" deep and at least 16" wide to
allow space for customers to reposition
themselves during the meal. Padding or
cushions on the chair seat should be firm,
and the chair back should also be slightly
inclined to the rear. To help guests sit and rise,
dining chairs should have armrests 7" to 8"
above the front edge of the seat. (See Fig.
22.) Supports or cross-bracing should not
Dining room tables should have a stable surface at a convenient height and kneespaces and legroom below the tabletop for customers in wheelchairs. Narrow table configurations allow face-to-face seating, which reduces the distance between diners, making conversation easier and table lighting more effective. For safety, the corners and edges of the top should be rounded.

Full-height wheelchair knee space is 2'6", which requires tabletops to be at least 2'7" above the floor; too high for most seating. Many wheelchairs now provide adjustable or two-tier armrests, which allow customers to sit close to tables in a knee space only 2'3" high. To provide this knee space, the tabletop (without an apron) should be 2'4½" to 2'5½" above the floor. This is 11" to 11½" above the chair seat, 10½" to 11½" above the seat of wheelchairs, and convenient for both. This knee space also permits the armrests of chairs to pass below the tabletop so seated customers can draw close. This combination of tables and chairs is suitable for the majority of wheelchair users and most ambulatory guests.

Footroom is important for customers with wheelchairs or leg braces. The footrests of wheelchairs are 2½" to 3" above the ground and angled slightly forward, which requires 1'7" of footroom, measured from the edge of the tabletop. The outside width of footrests is typically 1'6", but 2'0" of side-to-side clearance is necessary to maneuver into position beneath the table. To provide knee space, table legs should be at least 2'6" apart, and the tabletop, for face-to-face seating, should be 3'6" wide. Portable base tables should have low, tapered bases and a minimum diameter of 3'6", although 4'0" is preferred.

A portable raised leaf should be available to modify tables for customers in wheelchairs with high armrests. The leaf should be approximately the size of a place setting. 1'4" by 2'0", and secured to the underside of an accessible table with clamps. The raised leaf should project 6" beyond the edge of the table and provide 2'6" clearance above the floor. (See Fig. 24.)

**Fig. 22** Dining room chairs should have a seat 10½" to 11½" below the top of the table and armrests 7½" to 8½" above the seat. To coordinate with an accessible table, the seat height should be 18". Numbers in parentheses are dimensions in centimeters.

**Fig. 23** Accessible tables should provide knee space at least 2'3" high by 2'6" wide with 1'7" of footroom. To increase the knee space height, a raised portable leaf can be provided. (See Fig. 24.) Numbers in parentheses are dimensions in centimeters.

**Fig. 24** A portable raised leaf can be provided for accessible tables to accommodate customers in wheelchairs with high armrests. Numbers in parentheses are dimensions in centimeters.

**Fig. 25** The necessary maneuvering room required to access a knee space depends on its width.
Figure 27 shows the basic dimensions for the design of banquette seating. The lack of armrests makes it difficult to define seat boundaries. The user, therefore, tends to establish a territory by assuming a desired sitting posture and placing personal articles next to him or her, such as a briefcase, purse, or package. Since the nature of this type of seating can permit some form of body contact, hidden dimensions and personal space also play an important part in how close the users sharing the banquette will sit. Because of the many hidden psychological factors involved, the actual efficiency of this seating type in terms of capacity is questionable. Figure 27 indicates two possible seating situations, each dictated by the anthropometrics involved. One arrangement is based on the premise that the user's elbows will be extended, possibly in conjunction with some activity, such as reading, or simply as an attempt to stake out additional territory, as would be the case in the strategic positioning of some personal article on the seat. In this situation it would be reasonable to assume that each user would take up about 30 in, or 76.2 cm, of space. The other diagram shows a more compact seating arrangement. Figure 26 shows a section through a typical banquette.

<table>
<thead>
<tr>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>18–24</td>
</tr>
<tr>
<td>B</td>
<td>15.5–16</td>
</tr>
<tr>
<td>C</td>
<td>16–17</td>
</tr>
<tr>
<td>D</td>
<td>30</td>
</tr>
<tr>
<td>E</td>
<td>24</td>
</tr>
</tbody>
</table>

SECTION
Fig. 26 Banquette seating.

Fig. 27 Banquette seating.
Banquette seating provides the designer with one of the few opportunities to custom design restaurant seating. While there can be a great variety of aesthetic solutions achieved through use of various materials, ergonomic considerations must be analyzed carefully. Specific attention should be given to depth of seat, slope of seat and back, height of back, and relationship of seat height to table height.
Banquette seating can be detailed relatively simply, as Figs. 28 to 30 suggest. The simplest form of banquette seating may take the form of a plywood seating platform with a removable seat cushion, or a box cushion seat and back support. Such seating is appropriate in fast food or quick turnover restaurant operations.

Fig. 28

Fig. 29

Fig. 30
Figure 31 shows some of the basic clearances required for a typical counter: 36 in, or 91.4 cm, for workspace behind the counter; 18 to 24 in, or 45.7 to 61 cm, for the counter top; and 60 to 66 in, or 152.4 to 167.6 cm, between the front face of the counter and the nearest obstruction. Figure 32 shows a section through the counter and back counter. Most counters are about 42 in, or 106.7 cm, in height. The clearance from the top of the seat to the underside of the counter top and the depth of the counter top overhang are extremely important. Buttock-knee length and thigh clearance are the key anthropometric measurements to consider for proper body fit. Footrest heights should take into consideration popliteal height. In most cases this is ignored, and 42 in counters are provided with 7 in, or 17.8 cm, footrests that are 23 in, or 68.4 cm, below the seat surface, which cannot work. The popliteal height of the larger user, based on 99th percentile data, is only about 20 in, or 50.8 cm. Therefore, the feet dangle unsupported several inches above the footrest and the body is deprived of any stability. The footrest shown in Fig. 32, although higher, only serves a portion of the seated users and is intended primarily for standing patrons. The most logical solution is a separate footrest, integral with the stool.

<table>
<thead>
<tr>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 60–66</td>
<td>152.4–167.6</td>
</tr>
<tr>
<td>B 18–24</td>
<td>45.7–61.0</td>
</tr>
<tr>
<td>C 36</td>
<td>91.4</td>
</tr>
<tr>
<td>D 24</td>
<td>61.0</td>
</tr>
<tr>
<td>E 12–18</td>
<td>30.5–45.7</td>
</tr>
<tr>
<td>F 35–36</td>
<td>88.9–91.4</td>
</tr>
<tr>
<td>G 42</td>
<td>106.7</td>
</tr>
<tr>
<td>H 30–31</td>
<td>75.2–78.7</td>
</tr>
<tr>
<td>I 11–12</td>
<td>27.9–30.5</td>
</tr>
<tr>
<td>J 10</td>
<td>25.4</td>
</tr>
<tr>
<td>K 12–13</td>
<td>30.5–33.0</td>
</tr>
</tbody>
</table>

Fig. 31 Lunch counter.

Fig. 32 Lunch counter.
Hospitality Spaces

RESTAURANTS

Miscellaneous Counter Details

A ELEVATION OF SERVING ISLAND

B COUNTER DETAILS

1/2" TYP

2"     2"     2"     2"     2"

PLASTIC LAMINATE

BOL BRONZE

PLASTIC LAMINATE

MARBEL TO HAVE 2" RADIUS TOP EDGE TO BE BONDED TO WOOD SUPPORT AS NECESSARY

1/2" X 5/8" BOL BRONZE 2

ROVER TILE BASE

SECTION THRU HOOD

SECTION THRU SERVING COUNTER
Fig. 33  Waiter stations and host/hostess counters can be designed as freestanding elements or integrated into the interior architecture, as shown by these details. Special attention must be given to specific drawer and storage requirements.
Self-Service Areas

Salad bars, buffet lines, condiment stands, and other self-service areas should be accessible. Cafeterias or food-service lines should have a minimum width of 3'0", but a width of 3'6" is recommended to permit ambulatory customers to pass customers in wheelchairs.

The tray slide should be 2'10" above the floor; the maximum height for customers in wheelchairs and convenient for ambulatory guests. The tray slide should be continuous, if possible, from the entrance to the cashier. Tray slides restrict access to the counters and therefore should not be wider than necessary (1'0" recommended). In this instance, the reach of a customer in a wheelchair is extended if the wheelchair can be angled or positioned perpendicular to the tray slide. This is possible if the lower face of the counter is recessed to provide low knee space. (See Fig. 34.)

For guests with a limited range-of-motion, food, beverages, utensils, or other items should be displayed near the edge of the counter where they are easier to see and reach. When duplicate items are displayed, a vertical rather than horizontal arrangement allows customers to select items at the most convenient height. Self-service systems, such as beverage or ice-dispensers, should be easy to operate without fine hand function. Instructions and price information should be prominently displayed in large clear lettering.

Salad bars and buffets should provide a 3'0"-wide clear space for access on all sides and plate slides, or areas to temporarily set plates, at a maximum height of 2'10". This permits customers to serve themselves with one hand, without simultaneously balancing the plate or bowl. Knee space 2'3" high below the counter or table allows front wheelchair approach, to increase customers' forward reach. Condoms should be located as low and close to the edge of the counter or table as practical. A tilted mirror above the food display at salad bars also aids customers in wheelchairs and children. (See Fig. 35.) For some customers with restricted mobility, poor balance, or limited hand function, it is more difficult to carry a plate. Therefore trays should be available at both salad bars and buffets.

Fig. 34 Cafeteria lines should be wide enough to accommodate guests in wheelchairs. Food and beverages should be within a convenient vertical and horizontal reach. Numbers in parentheses are dimensions in centimeters.

Fig. 35 A plate slide is recommended at salad bars and a knee space at the counter. A mirrored surface above the bar is a further aid to guests in wheelchairs. Numbers in parentheses are dimensions in centimeters.
Hospitality Spaces

RESTAURANTS

Cafeteria Counter Plans, Elevations, and Details

ELEVATION A

ELEVATION B

ELEVATION E
A ELEVATION OF TYPICAL 'ROTARY SERVING' UNIT

B PARTIAL PLAN OF TYPICAL 'ISLAND'

C PARTIAL ELEVATION

D SECTION OF TRAY SLIDE
Hospitality Spaces

RESTAURANTS
Service Counter; Host Cabinet; Walter's Station; Trash Counter

SECTION THRU SERVICE COUNTER
All Scale: 1" = 1'-0"

SECTION OF HOST CABINET
All Scale: 1" = 1'-0"

TOP VIEW WALTER'S STATION CABINET
All Scale: 1" = 1'-0"

SECTION OF TRASH COUNTER CABINET
All Scale: 1" = 1'-0"
Hospitality Spaces

RESTAURANTS
Condiment Counter Details

DETAIL SECTION AT
CONDIMENT COUNTER
VERT. SECTION THROUGH CABINET AT SALAD BAR

VERT. SECTION AT CENTER OF SALAD BAR & PROTECTIVE GLASS GUARD
COLD BEVERAGE & DESSERT STAND

TRAY SLIDE

TYPICAL BASE DETAIL & SERVERY MILLWORK
Hospitality Spaces

BARS
Bar Section Details

The distance between bar and backbar should allow adequate workspace. A minimum of 36 in, or 90 cm, should provide space for one bartender to serve and another to circulate behind. Maximum body depth and maximum body breadth are the primary anthropometric considerations in establishing clearance. A one-bartender operation would require a 30-in, or 75-cm, clearance.

In regard to bar stools, clearance between the stool seats is more critical than centerline spacing, and it should allow patrons of larger body size a comfortable side approach and departure from the stool without body contact with the next person. A 12-in, or 30-cm wide stool on 24-in, or 61-cm, centers, which is quite common, will allow only less than 5 percent of male users access to the stool without disturbing the next patron, while a 30-in, or 76-cm, spacing will accommodate 95 percent of the users. The tradeoff however would be the loss of two seats for every 120 in, or 300 cm, of bar length. A spacing of 12-in stools on 28-in, or 70-cm, centers is suggested as a compromise. The ultimate decision is an individual one and must reconcile human factors with economic viability.

<table>
<thead>
<tr>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>54</td>
</tr>
<tr>
<td>B</td>
<td>18-24</td>
</tr>
<tr>
<td>C</td>
<td>24</td>
</tr>
<tr>
<td>D</td>
<td>30</td>
</tr>
<tr>
<td>E</td>
<td>16-18</td>
</tr>
<tr>
<td>F</td>
<td>24-30</td>
</tr>
<tr>
<td>G</td>
<td>30-36</td>
</tr>
<tr>
<td>H</td>
<td>28-38</td>
</tr>
<tr>
<td>I</td>
<td>100-128</td>
</tr>
<tr>
<td>J</td>
<td>42-45</td>
</tr>
<tr>
<td>K</td>
<td>11-12</td>
</tr>
<tr>
<td>L</td>
<td>6-7</td>
</tr>
<tr>
<td>M</td>
<td>7-9</td>
</tr>
<tr>
<td>N</td>
<td>6-9</td>
</tr>
<tr>
<td>O</td>
<td>22-26</td>
</tr>
<tr>
<td>P</td>
<td>60-69</td>
</tr>
<tr>
<td>Q</td>
<td>36-42</td>
</tr>
</tbody>
</table>

BAR AND BACK-BAR

Fig. 1
To ensure proper circulation and interface, adequate clearances in front of the bar are illustrated in Fig. 2. A customer activity zone of 18 to 24 in, or 45.7 to 61.0 cm, should be provided to allow for seating, standing, and access, in addition to a general circulation zone of at least 30 in, or 76.2 cm. If a supplementary drinking surface or shelf is provided, a smaller activity zone of 18 in is suggested in front of the shelf. The shelf can be 10 to 12 in, or 25.4 to 30.5 cm, deep. Figure 3 shows suggested clearances for 18 or 24 in cocktail tables.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>76–84</td>
<td>193.0–213.4</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>66–72</td>
<td>167.6–182.9</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>10–12</td>
<td>25.4–30.5</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>18</td>
<td>45.7</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>30</td>
<td>76.2</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>18–24</td>
<td>45.7–61.0</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>76</td>
<td>193.0</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>54–56</td>
<td>137.2–142.2</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>6–9</td>
<td>15.2–22.9</td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>7–9</td>
<td>17.8–22.9</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>42–45</td>
<td>106.7–114.3</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>24</td>
<td>61.0</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>29–33</td>
<td>73.7–83.8</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>32–36</td>
<td>81.3–91.4</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 2 Bar/clearances public side.

Fig. 3 Cocktail tables/seating for two.
Bar shapes, seating capacities, overall dimensions, and "footprints" of bar areas vary greatly. Figures 4 to 22 show examples of bar designs drawn at a scale of $\frac{1}{4}\text{"}} = 1\text{"}. Careful study of these designs would suggest that seating width, spacing, and circulation areas must be given special attention.

**Fig. 4** U shape: 16 ft × 11 ft, 176 ft², seats 9.

**Fig. 5** Straight/enclosed: 20 ft × 10 ft, 200 ft², seats 9.

**Fig. 6** Straight bar: 25 ft × 10 ft, 250 ft², seats 8.
Fig. 7 Angular: 30 ft × 12 ft, 320 ft², seats 10.

Fig. 8 Enclosed/rounded end: 22 ft × 9 ft, 198 ft², seats 10.
Bars

Bar Shapes: Planning Criteria

Fig. 9 L shape: 30 ft x 13 ft, 390 ft², seats 15.

Fig. 10 Angular: 16 ft x 16 ft, 250 ft², seats 11.
Fig. 11 Octagon/partial: 26 ft x 18 ft, 468 ft², seats 16.

Fig. 12 L shape: 27 ft x 20 ft, 510 ft², Bar seating, 17; additional seating, 10.
Fig. 13 Polygon: 36 ft × 11 ft, 396 ft², seats 18.

Fig. 14 U shape: 21 ft × 20 ft, 420 ft², seats 22.
Fig. 15 Curvilinear bar: 500 ft², seats 25.

Fig. 16 Straight bar: 40 ft × 10 ft, 400 ft², seats 24.
Fig. 17 Octagon/freestanding: 28 ft $\times$ 21 ft, 558 ft$^2$.

Fig. 18 Circular/freestanding: 22 ft $\times$ 22 ft, 334 ft$^2$, seats 26.
Fig. 19  Polygon irregular: 20 ft x 25 ft, 360 ft², seats 27.

Fig. 20  Octagon: 25 ft x 25 ft, 429 ft², seats 28.
Hospitality Spaces

BARS

Bar Shapes: Planning Criteria

Fig. 21  Horseshoe/oval end: 34 ft × 19 ft, 546 ft², seats 34.

Fig. 22  Racetrack: 50 ft × 19 ft, 750 ft², seats 48.
The detailing of bars and backbars can vary from the very simple and basic to the complicated and intricate. Figures 23 to 40 provide the designer with selected examples of working drawings from some of the most experienced restaurant and hospitality design firms in the world. Careful review of these drawings would suggest that overall dimensions and clearances vary from detail to detail. In that regard, individual requirements based upon bar type and the hospitality area serviced must be given careful consideration. In addition, local building codes and health codes must be consulted.
Hospitality Spaces

BARS
Bar Plans, Elevations, and Sections

Fig. 23 (Continued)
Hospitality Spaces

BARS

Bar Plans, Elevations, and Sections

---

Fig. 25

Partial Vertical Section 1/2" Scale

2" Granite Floor
SECTION THRU BAR CABINET

VERTICAL SECTION
AT METAL POST AND LIGHT BOX
Hospitality Spaces

BARS

Bar Plans, Elevations, and Sections

A PLAN

B ELEVATION

CC ELEVATION

Fig. 27
Hospitality Spaces

BARS
Bar/Serving Counter Details

Fig. 38

Details of Bar Counter & Glass Rack
Scale: 1/8" = 1'-0"

Section of Serving Counter # 104
Scale: 1/8" = 1'-0"
Hospitality Spaces

BARS
Bar Section Details

VERTICAL SECTION - LOBBY BAR

VERTICAL SECTION - LIQUOR STORAGE UNIT

VERTICAL SECTION - DRINK RAIL

SECTION - PICK UP STATION

Fig. 37
Fig. 38

Bar Section and Elevation

1-10
Hospitality Spaces

BARS
Bar Section Details

Fig. 39
Hospitality Spaces
BARS
Bar Section Details

BACK BAR SECTION

SECTION AT CURVED BAR

VERTICAL SECTION AT BAR

SECTION AT BAR

Fig. 40
It is interesting to note how trends in hotel design have headed off in two directions, especially in regard to the design of rooms. On one hand, an effort is being made to provide more luxurious multipurpose rooms and suites. The hotel room as office away from work or as fantasy sleeping/relaxation environment often results in rooms with work areas, living rooms, and hot tubs, just to name a few of the more popular amenities. On the other hand, there is a trend toward economy accommodations. Hotel rooms are being designed as a place to rest and sleep, a place to feel comfortable and safe at a reasonable cost. Accordingly, these rooms use less floor area and provide less secondary or frill items. With both of these approaches, however, designers must ensure that the room or suite layouts are accessible to the physically challenged. In that regard, various room layouts and bathroom plans are provided in this section that address this issue.

Fig. 1 (a) Uris Brothers Hotel, New York. (b) Americana Hotel, New York, typical tower room. (c) Loews N.Y. Motel, typical room. (d) Causeway Inn, Tampa, Florida.
Fig. 2 Guestroom plans. (a) Typical double-double finishes plan: vinyl wallcovering (WC), paint (P), carpet (C), ceramic tile (CT) identified and keyed to legend. (b) King-studio (Holiday Inn): standard layout with armoire unit and large lounge area including a convertible sofa. (c) Reversed layout (Sheraton, Washington, D.C.): unusual room with bed placed in front of window and lounge area near bathroom. (d) Luxury king room (Sheraton Grande, Los Angeles): oversized room with shelf/ledge in place of headboard, large desk surface, and lounge area; four-fixture bathroom.
Fig. 3 Motel rooms — exterior entrance.

Fig. 4 Motel rooms — interior corridor.
Guestroom Plans

Accessible guestrooms have design features and floor plans that provide the maneuvering clearances for guests with limited mobility. Figures 6 to 9 show sample plans of guestrooms and bathrooms with the required:
- Widths and clearances at the entry, connecting, closet, and bathroom doors
- Maneuvering space in front of the closet, in the sleeping area, and within the bathroom
- Clearances to use and transfer to fixtures in the bathroom
- Clearances to open dresser drawers, to maneuver into kneespace at the desk, and to access the bed, bedside table, windows, blinds, and thermostat

Clearances may depend on the design of specific furnishings. The width of the access aisle at the bed is determined by the design of the bedside table. Access to dressers is determined by the width of the drawer. The maneuvering space to turn into the desk is determined by the width of the kneespace.

14' Bay-spacing

Fig. 5 Bay-spacings of (a) 14', (b) 15', and (c) 16' can easily accommodate guests with restricted mobility.
Fig. 6. This alternative 12'0" bay-spacing design requires the dresser to be offset from the foot of the bed. The bathroom wall is stepped back to provide clearances for the bathroom door and connecting door. The heating/cooling unit projects into the room to allow access to the thermostat. If balconies are provided, a minimum depth of 5'0" is recommended to allow guests with wheelchairs to turn around.

Fig. 7. A 13'0" bay-spacing provides room for wheelchair clearances, including a turning space in front of the closet and at the foot of the beds, an access aisle between the beds, a T-turnaround at the window aisle for access to temperature controls and blinds and drapes, door clearances, and a bathroom that meets ANSI standards.
Accessible suites should meet the same requirements for accessible guestrooms and guest baths. Because suites are usually more generous in terms of space, providing accessibility is less difficult. If a small kitchenette is included, a kneespace 2'-3" high should be provided below the sink. A countertop height of 2'-10" (2" lower than standard) is suitable for both ambulatory guests and guests in wheelchairs. A pull-out lapboard at a height of 2'-0" provides a workspace for guests in wheelchairs. The kitchenette should include a 5'-0" turning space.

**Suite with 14' Bay-spacing**

Fig. 8
These two diagrams illustrate the same bathroom plan with the required clearances for door operation and turning space and access to each fixture, including the tub/shower, vanity, and water closet. Clearances for maneuvering space, door operation, and individual fixtures can "overlap." Because of the vertical characteristics of wheelchairs, clearances can include toesspace (9" high) below water closet and kneespace (2'3" high) below vanities.
The hotel registration desk serves as both a symbol of hospitality for the arriving guest and the operational nerve center for the hotel. With the advent of electronic check-in procedures, credit cards, and computer-aided management, the registration desk has become a sophisticated electronic workstation not unlike a trading table or an airline reservations desk. At the same time, this electronic data processing capability is meant to be maintained at low visibility for reasons of hotel image and confidentiality. Accordingly, the designer must be able to project the appropriate hospitality image while at the same time integrating all of the required technologies. Figures 10 to 13 show examples of architectural working drawings and details that meet many of these requirements.

The design of a front desk or registration desk can take many forms and be constructed with a variety of materials. Regardless of the design vocabulary used or architectural style, certain important design considerations must be observed.

1. The number of persons actively staffing the counterlike facility will dictate both the width and overall depth of the front desk. It is suggested that between 5-7 ft be allocated per staff workstation and that one workstation be allocated for every 125-150 rooms. For every additional 125–160 rooms, an additional workstation should be provided. Peak check-in/check-out loads could require even more staff workstations.

2. The front desk should be easily accessible from and to the main hotel entrance. "Easily accessible" strongly implies clear visibility.
3. Elevators servicing the hotel guest rooms should be readily visible from the front desk. This is not always feasible in extremely large hotels.

4. The front desk should be designed in such a way as to take into consideration the various users it will accommodate. Special attention should be given to the fact that hotel guests may be physically challenged or chairbound. The overall height, writing surfaces, and overhangs should be designed to accommodate a hotel guest seated in a wheelchair.

5. The basic front desk design should avoid, wherever possible, visual obstructions that block sightlines or create blind spots. Accordingly, columns and high walls should be avoided.

6. Equipment and custom elements that are typically incorporated within the front desk include computer monitors/CRTs with keyboards and printer, room racks, reservation racks, information racks, room status displays, mail drawers, key drawers, alpha guest listings, message-waiting display, credit card imprints, fax and telex, guest/employee paging system, automatic wake-up system, electric receptacles, cable chases, alarm systems, and file and cash drawers.
RECEPTION DESK STORAGE

1/2" = 1'-0"

10-21

Fig. 12
Retail Spaces

<table>
<thead>
<tr>
<th>Shops</th>
<th>387</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banks</td>
<td>396</td>
</tr>
<tr>
<td>Department stores</td>
<td>401</td>
</tr>
</tbody>
</table>
The essential function of retail spaces is to display and sell merchandise. The design of these spaces involves the manipulation and coordination of architectural, interior design, and merchandising elements as necessary to meet the programmatic needs of the client. It is critical that the space in which the customer and store personnel function is of the highest quality. Ensuring this quality requires a knowledge of the planning and design of the various interior components that constitute the building blocks of retail spaces.

Figure 1 shows the clearances involved for a 42-in, or 106.7-cm, high counter to service a seated user. By filling the recess with an additional display, however, the counter can also be used exclusively as a typical sales counter. It should be noted, however, that although sometimes used for special display situations, such a counter height is not recommended. Both the customer and the sales clerk of smaller body size would find coping with such a height uncomfortable anthropometrically, particularly when one considers that the counter would be higher than the elbow height of slightly over 5 percent of the population. From a merchandising viewpoint, where customer convenience is of paramount importance, it would be unwise to exceed 39 to 40 in, or 99 to 101.6 cm, as a counter height. In addition, the smaller sales clerk forced to tend such a counter for extended periods of time could be subjected to severe backaches and pains. Getting on and off a high stool for elderly and disabled people or those of smaller body size can be not only difficult, but hazardous. Figure 2 illustrates the clearances for a typical sales counter.

<table>
<thead>
<tr>
<th></th>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>26–30</td>
<td>66.0–76.2</td>
</tr>
<tr>
<td>B</td>
<td>18–24</td>
<td>45.7–61.0</td>
</tr>
<tr>
<td>C</td>
<td>42</td>
<td>106.7</td>
</tr>
<tr>
<td>D</td>
<td>28</td>
<td>71.1</td>
</tr>
<tr>
<td>E</td>
<td>84–112</td>
<td>213.4–284.5</td>
</tr>
<tr>
<td>F</td>
<td>18</td>
<td>45.7</td>
</tr>
<tr>
<td>G</td>
<td>18–24</td>
<td>45.7–61.0</td>
</tr>
<tr>
<td>H</td>
<td>30–48</td>
<td>76.2–121.9</td>
</tr>
<tr>
<td>I</td>
<td>18–22</td>
<td>45.7–55.9</td>
</tr>
<tr>
<td>J</td>
<td>35–38</td>
<td>88.9–96.5</td>
</tr>
<tr>
<td>K</td>
<td>72</td>
<td>182.9</td>
</tr>
</tbody>
</table>

Fig. 1  Seated customer/high counter height.

Fig. 2  Typical sales area/standing customer.
Figure 3 shows the clearances required for a medium height display counter. The suggested seat height of 21 to 22 in, or 53.3 to 55.8 cm, requires a footrest for the seated customer. The counter height shown will allow the display to be viewed by both the seated customer and the standing sales clerk. The customer activity zone allows adequate space for the chair. Knee height, buttock-knee length, popliteal height, and eye height sitting are all significant human dimensions to consider in the design of counters to be used by a seated customer.

Figure 4 shows a low 30-in, or 76.2-cm, display counter also for use by a seated customer. The anthropometric considerations are the same. Although the counter height is responsive to the anthropometric requirements of the seated customer, it is less than ideal for the standing clerk. For the standing user's optimum comfort, the counter height should be about 2 or 3 in, or 5 to 7.6 cm, below elbow height. This will allow a person to handle objects comfortably on the counter surface or use the counter as support for his or her arms. The 30-in height is too low to permit such use.

<table>
<thead>
<tr>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>36</td>
</tr>
<tr>
<td>B</td>
<td>26–30</td>
</tr>
<tr>
<td>C</td>
<td>18–24</td>
</tr>
<tr>
<td>D</td>
<td>30 min.</td>
</tr>
<tr>
<td>E</td>
<td>10</td>
</tr>
<tr>
<td>F</td>
<td>21–22</td>
</tr>
<tr>
<td>G</td>
<td>5</td>
</tr>
<tr>
<td>H</td>
<td>23–25</td>
</tr>
<tr>
<td>I</td>
<td>4–6</td>
</tr>
<tr>
<td>J</td>
<td>34–36</td>
</tr>
<tr>
<td>K</td>
<td>30</td>
</tr>
<tr>
<td>L</td>
<td>16–17</td>
</tr>
</tbody>
</table>

Fig. 3  Seated customer/desirable counter height.

Fig. 4  Seated customer/low counter height.
Shelving is probably used more than any other single interior component for the storage and/or display of merchandise. Not only must the merchandise be within reach anthropometrically, but it must be fairly visible as well. The heights established must therefore be responsive to vertical grip reach dimensions as well as to eye height. In establishing height limits, the body size data of the smaller person should be used. Since in retail spaces, departments may cater exclusively to members of one sex or the other, two sets of data are presented. One is based on the body size of the smaller female and the other on the body size of the smaller male. The suggested heights reflect a compromise between reach requirements and visibility requirements.

Figure 6 illustrates the clearances involved in hanging-type merchandise cases. Rod heights should be related not only to human reach limitations, but in certain cases to the sizes of the merchandise displayed. There is usually no conflict in respect to garments.

<table>
<thead>
<tr>
<th></th>
<th>in</th>
<th>cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>46 max.</td>
<td>121.9 max.</td>
</tr>
<tr>
<td>B</td>
<td>30–36</td>
<td>76.2–91.4</td>
</tr>
<tr>
<td>C</td>
<td>51 min.</td>
<td>129.5 min.</td>
</tr>
<tr>
<td>D</td>
<td>66</td>
<td>167.6</td>
</tr>
<tr>
<td>E</td>
<td>72</td>
<td>182.9</td>
</tr>
<tr>
<td>F</td>
<td>84–96</td>
<td>213.4–243.8</td>
</tr>
<tr>
<td>G</td>
<td>20–26</td>
<td>50.8–66.0</td>
</tr>
<tr>
<td>H</td>
<td>28–30</td>
<td>71.1–76.2</td>
</tr>
<tr>
<td>I</td>
<td>18–24</td>
<td>45.7–61.0</td>
</tr>
<tr>
<td>J</td>
<td>18 min.</td>
<td>45.7 min.</td>
</tr>
<tr>
<td>K</td>
<td>72 max.</td>
<td>182.9 max.</td>
</tr>
<tr>
<td>L</td>
<td>4</td>
<td>10.2</td>
</tr>
<tr>
<td>M</td>
<td>42</td>
<td>106.7</td>
</tr>
<tr>
<td>N</td>
<td>26 min.</td>
<td>66.0 min.</td>
</tr>
</tbody>
</table>
Retail Spaces

SHOPS

Sales Counter

Half Elevation 1/2 scale

Section 1/2 scale

Plan thru Counter

Plan above Counter

Section 2 3/4 scale

Section 1 3/4 scale
Retail Spaces

BANKS

Teller's Counter

SECTION AT CHECK DESK
(DEPOSIT SLIP AREA)

SECTION AT TELLER COUNTER

VERTICAL SECTION AT TELLERS COUNTER
VERTICAL SECTION AT CHECK STAND

VERTICAL SECTION AT CHECK DESK

HALF PLAN THRU CHECK DESK
ELEVATION

SCALE: 3/4" = 1'-0"
CEILING LINE AT 11'-0" A.F.F.

8'5 FT. RK. CURTAINWALL SEE ELEVATIONS FOR SPECIFIC DETAILS

SOFFIT & FASCIA 3/4" PLYWD. W/ PL. LAM. FIN.

1/2" DIA. VENT HOLES

COMBINATION AM/PM G-4000, ANTENNA OUTLETS 2'-0" G.C. HORIZ. BY P.F.C.

1/2" DIA. VENT HOLES

PANEL DOORS, 2'-4 1/4" W. X 4' 7" H. 3/4" PLYWD. W/ PL. LAM. FIN. ON CONCEALED HINGES AND CUTOUTS FOR TV'S.

2" DIA. WIRE RUN HOLES

CABINET 3/4" PLYWD. W/ PL. LAM. FIN.

PLUSH ACCESS PANELS 3/4" PLYWOOD W/ PL. LAM. FIN. ON CONCEALED HINGES AND MAGNETIC CATCHES

REMOVABLE BASE CABINET 3/4" PLYWOOD W/ PL. LAM. FIN.

COMBINATION AM/PM G-4000, ANTENNA OUTLETS 2'-0" G.C. HORIZONTALLY FURNISHED & INSTALLED BY P.F.C.

3/4" PLYWOOD SHELF W/ PL. LAM. ON PILASTER STANDARDS

CONCEALED HINGED DOOR 3/4" PLYWD. W/ PL. LAM. FIN. WITH LOCK AND 4" WIRE PULLS

SECTION

SCALE: 3/4"=1'-0"
DEPARTMENT STORES
Shelving Details

SHELF DETAIL
SCALE: 3" = 1'-0"

PLAN SECTION @ SHELF
SCALE: 3/4" = 1'-0"

PLAN WHERE SHELVES ABUT
SCALE: 3/4" = 1'-0"
Retail Spaces

DEPARTMENT STORES

Shelving Details

DETAILED

SCALE: 1/2" = 1'-0"

DETAILED

SCALE: 1/2" = 1'-0"

FLUOR. LIGHTING FIXT. BY E.C.
SEE ELEVATIONS FOR SPECIFIC DESIGN DETAILS
ACRYLIC DIFFUSER 4" X 4" ANGLES BY R.F.C.

3/4" PLYWOOD SHELF W/ BULLNOSE TRIM, PL. LAM., FIN., AND FLUOR. STRIP BY R.F.C.

DIVIDER PANEL 3/4" PARTED W/ PL. LAM., FIN.
RECESSED 4"-6" PLUGMOLD BY E.C. W/ OUTLETS 6" O.C.

REMOVABLE PADS W/ FABRIC COV'G BY R.F.C.
SEE DETAIL, 1/P. 3

CONTINUOUS HARRWOOD BULLNOSE TRIM 2" DIA. COL. LAG. FIN.

REMOVABLE SHAM BASE 3/4" PARTICLE BOARD W/ PL. LAM., FIN. ON ALL EXPOSED SURFACES

RECESSED BASE 4" H. 3/4" SOLID WOOD W/ PL. LAM., FIN

SECTION

SCALE: 3/4" = 1'-0"
Retail Spaces

DEPARTMENT STORES

Feature Wall Lighting

SECTION
SINGLE/DUOUE
HANG-ROD
WITH OPEN VALANCE

SECTION
SLOPED SHELVING
WITH OPEN VALANCE

SECTION
SINGLE/DUOUE
HANG-ROD
WITH OPEN VALANCE

SECTION
STEPPEP SHELVING
MERCHANDISE DISPLAY
Retain Spaces

DEPARTMENT STORES

Feature Wall Lighting

SECTION

STEPPE SHELVING
MERCHANDISE DISPLAY

SECTION

FEATURE WALL DISPLAY
WITH ILLUMINATED
SOPFIT AND ACCENT LIGHT

SECTION

FEATURE WALL DISPLAY
WITH RECESSED COVE
IN SOPFIT AND TRACK LIGHT

SECTION

FEATURE WALL DISPLAY
DROPPED SOPFIT ABOVE
BANQUETTE SEATING
Retail Spaces

DEPARTMENT STORES

Valance and Cove Lighting Details

SHIELDED VALANCE WITH TWO (2) SINGLE LAMP FLUORESCENT CHANNELS AND TRACK LIGHT WITH INCANDESCENT CURtain WALL-TYPE

LIGHT SHIELDING MATERIAL AS SPECIFIED

SHIELDED VALANCE WITH TWO (2) SINGLE LAMP FLUORESCENT CHANNELS

LIGHT SHIELDING MATERIAL AS SPECIFIED

RECESSED ADJUSTABLE ACCENT LIGHT

75W PAR 30 LAMPS
LAMP HOUSING
DROPPED CEILING
Valence and Cove Lighting Details

Access Door Thru Merchandise Display Curtain Wall

Access Door Thru Merchandise Display "Open Valence"

Valance with Single Lamp Fluorescent Channel

Valence with Single Lamp Fluorescent Channel

Existing Wall

Fluorescent Channel

Shielded Valance

with Single Lamp Fluorescent Channel

Curtain Wall Type

Drywall Construction

Metal Stud

3/4" Plywood Box

Single Lamp Fluorescent Channel

Use 58" and 4.0' lengths only

Preassembled Reflector

Asymmetrical Configuration

Depth Varies

Centerline of Lamp to Align with Return Edge of Wood Valance

Existing Wall

Fluorescent Channel

Shielded Valance

with Single Lamp Fluorescent Channel

Curtain Wall Type

Drywall Construction

Metal Stud

3/4" Plywood Box

Single Lamp Fluorescent Channel

Use 58" and 4.0' lengths only

Preassembled Reflector

Asymmetrical Configuration

Depth Varies

Centerline of Lamp to Align with Return Edge of Wood Valance
DEPARTMENT STORES
Valence and Cove Lighting Details

DIRECT COVE
SINGLE/DOUBLE ROW
STAGGERED FLUORESCENT

SHIELDED VALANCE
WITH TWO (2) SINGLE LAMP FLUORESCENT CHANNELS
"CURTAIN WALL" TYPE

Acrylic Diffuser
with Prismatic Lenses

DRI-3/4" RADIUS

Light Shiplap MATERIAL AS SPECIFIED

DRAINAGE TO BE PLANTED
LIGHT VALUE/COLOR

GAS LAMP FLUORESCENT
CHANNEL TO BE
STAGGERED with a
minimum clearance
of 12" to 20" to
allow shadow cast
by receptacles/rods.
Use 90° 60-45° LAMPS only.

INTERIOR TO BE PLANTED
LIGHT VALUE/COLOR

DRI-3/4" RADIUS

DRI-3/4" RADIUS
DEPARTMENT STORES
Wall Display Systems

WATERFALL
Average Quantity of Garments Per Post: 48

FACE OUT & WATERFALL

POST FACE OUT WITH STRAIGHT HANGING
Average Quantity of Garments Per 4'-0" Section: 94

STRAIGHT HANGING & FACE OUT

FACE OUT WITH DISPLAY
Average Quantity of Garments Per 4'-0" Section: 49
- Compatible with universal 1/2" slotting
- Unique new oval hangrail

FACE OUT
Average Quantity of Garments Per Post: 46

STRAIGHT WITH HANGRAIL FACE OUT
Average Quantity of Garments Per 4'-0" Section: 96

ROD DISPLAYS
6 or 7 Rods Per 4'-0" Section
• Design continuity from wall to floor carries theme throughout the department or the store
• Designed for high volume merchandising
• Flexible merchandising
• Designed to be compatible with other Pam International Systems

- Binning System
- Multi-Net System
- Baskets & Shelves
- Wood or Glass Shelves
- Multi-Net Panels
- Mesh Panel Systems
- Grid Wall Panels

- All Multiples/Systems 2™ upright posts are engineered with easily changeable post covers (Pat. Pend.)
- All metal components are coated with a durable, long lasting, baked on epoxy powder finish.
Retail Spaces

DEPARTMENT STORES

Rack Display Systems

Two-arm costumers

Four-way racks

Circular racks

420
MEDIUM DUTY-\(\frac{1}{2}\)" SLOTS 1" O.C.

For General Use
The Standard of
Wall Standards:
24" 30" 36" 42" 48"

For Medium Load
Single or Double
Strutted:
22" 28" 34" 40" 46"

Concealed wall
standard for 5/8"
or less wall panels:
60" 72" 84" 96"

For additional
strength:
60" 72" 84" 96"

HEAVY DUTY-1"
SLOTS 2" D.C.

For your heaviest
load requirements.
60" 72" 84" 96"

Concealed wall
standard for 5/8"
or less wall panels.
72" 84" 96"

Regular Duty Brackets for use with 1" O.C. Strutting.
6" hard steel .063 thickness

Polished Chrome. Felt lines to prevent scratching of hang rail.

Satin Zinc.

For 1" and 1 1/16" Tube 114" 134" 154" 174"

For 1 1/16" and 1 5/16" Tube 194" 214"

Polished Chrome. Felt lines to prevent scratching of hang rail.

Satin Zinc.

For 1 1/16" and 1 5/16" Tube 194" 214" 234"

For 1 1/8" Tube 34" 44" 54"

Satin Zinc.

Heavy Duty Brackets for use with 2" O.C. Strutting
6" hard steel .080 thickness

Polished Chrome. Felt lines to prevent scratching of hang rail.

Satin Zinc.

For 1" and 1 1/8" Tube 114" 134" 154" 174"

For 1 1/8" and 1 5/16" Tube 194" 214" 234" 254"

Satin Zinc.
Public Restrooms, Toilets, and Coatrooms

Restrooms and toilets  425
Coatrooms  460
| Assembly — pluses of | No. of fixtures | No. of spots | Urinals may be provided in | No. of spots | No. of spots | Where motion picture projection booths contain more than | 1 for ea. 1,000 | 1 for ea. 8 persons; for | Laundry trays — 1 for ea. 50 | 1 for ea. 8 persons | 1 for ea. 8 persons | Kitchen sink — 1 for each dwelling unit |
| Assembly — other places of worship (including but not | 1,100 | 1 | No. of spots | No. of spots | No. of spots | than 2 projectors, at least 1 water closet and 1 lavatory | 1 for ea. 1,000 | persons of the same | women's dressing rooms, 1 | 1 for ea. 8 persons for | 1 for ea. 8 persons, 1 for ea. 8 persons | 1 for ea. 8 persons | |
| worship), theaters, convention halls and all spaces classified as f-4 | 101-200 | 2 | No. of spots | No. of spots | No. of spots | shall be provided on the same level and within 20 ft. of the | 1 for ea. 1,000 | persons of the same | booth | ea. 8 persons, 1 for ea. 8 persons | 1 for ea. 8 persons for | 1 for ea. 8 persons, 1 for ea. 8 persons | 1 for ea. 8 persons | |
| Dormitories — school or labor, also institutional | 1 for ea. sex. for ea. 8 persons | 1 | No. of spots | No. of spots | No. of spots | 1 for ea. 12 persons | 1 for ea. 12 persons | 1 for ea. 8 persons | 1 for ea. 8 persons | 1 for ea. 8 persons || |
| Single room occupancies for sleeping accommodations only | 1 for ea. 6 persons | 1 | No. of spots | No. of spots | No. of spots | 1 for ea. 8 persons | 1 for ea. 8 persons | 1 for ea. 8 persons | 1 for ea. 8 persons | 1 for ea. 8 persons || |
| Dwellings — one- and two-family | 1 for each dwelling unit | 1 | No. of spots | No. of spots | No. of spots | 1 for ea. 75 persons | 1 for ea. 75 persons | 1 for ea. 8 persons | 1 for ea. 8 persons | 1 for ea. 8 persons || |
| Public buildings, offices, business mercantile, storage, | 1 for ea. sex. for ea. 30 persons | 1/40 | No. of spots | No. of spots | No. of spots | 1 for ea. 75 persons | 1 for ea. 75 persons | 1 for ea. 8 persons | 1 for ea. 8 persons | 1 for ea. 8 persons || |
| warehouses, factories and | 1 for ea. sex. for ea. 35 students | 1/40 | No. of spots | No. of spots | No. of spots | 1 for ea. 75 persons | 1 for ea. 75 persons | 1 for ea. 8 persons | 1 for ea. 8 persons | 1 for ea. 8 persons || |
| institutional employment | 1/30 workers | 1/30 workers | No. of spots | No. of spots | No. of spots | 1 for ea. 75 persons | 1 for ea. 75 persons | 1 for ea. 8 persons | 1 for ea. 8 persons | 1 for ea. 8 persons || |
| Industrial — foundries only | 1/30 workers | 1/30 workers | No. of spots | No. of spots | No. of spots | 1 for ea. 75 persons | 1 for ea. 75 persons | 1 for ea. 8 persons | 1 for ea. 8 persons | 1 for ea. 8 persons || |
| Kitchen for public or | 1 for ea. sex. for ea. 150 persons | 1 for ea. sex. for ea. 150 persons | No. of spots | No. of spots | No. of spots | 1 for ea. 75 persons | 1 for ea. 75 persons | 1 for ea. 8 persons | 1 for ea. 8 persons | 1 for ea. 8 persons || |
| employees dining | 1 for ea. sex. for ea. 150 persons | 1 for ea. sex. for ea. 150 persons | No. of spots | No. of spots | No. of spots | 1 for ea. 75 persons | 1 for ea. 75 persons | 1 for ea. 8 persons | 1 for ea. 8 persons | 1 for ea. 8 persons || |
| Dwellings — multiple or | 1 for each dwelling unit or | 1 for each dwelling unit or | No. of spots | No. of spots | No. of spots | 1 for ea. 75 persons | 1 for ea. 75 persons | 1 for ea. 8 persons | 1 for ea. 8 persons | 1 for ea. 8 persons || |
| apartment | 1 for each dwelling unit or apartment | 1 for each dwelling unit or apartment | No. of spots | No. of spots | No. of spots | 1 for ea. 75 persons | 1 for ea. 75 persons | 1 for ea. 8 persons | 1 for ea. 8 persons | 1 for ea. 8 persons ||

*The population used in determining the number of fixtures required shall be based on the number of people to occupy the space but in no case shall the population be less than that determined by allowing 125 sq. ft. of net floor area per person.

*Such facilities may be in adjacent buildings under the same ownership or control, and shall be accessible during periods when the assembly space is occupied.

*If facilities for employees in a storage building or warehouse may be located in an adjacent building, under the same ownership, where the maximum distance of travel from the working space to the toilet facilities does not exceed 500 ft. horizontally.
While Fig. 1 provides specific vertical dimensions of both plumbing fixtures and accessories, the designer is cautioned that every plumbing fixture and accessory must be carefully analyzed in light of the users to be served. Plumbing contractors will follow the manufacturer's recommendations or their own standards unless the designer provides this information on the working drawings. In large-scale projects, it is suggested that the designer carefully provide all fixture mounting heights on all interior elevations or on a separate diagramatic drawing, such as is shown in Fig. 1.

![Diagram showing fixture heights](image)

**Fig. 1** Fixture heights.

**Partition Mounted Units**

![Diagram showing partition mounted units](image)

**Fig. 3** Typical back to back male/female washroom stalls using partitions mounted units to accommodate a handicapped stall and one standard stall. If room permits, grab bars should be placed on all three sides, resulting in a "U"-shaped configuration. Most codes require toilet stall doors to open outward.

**Handicapped Washrooms**

![Diagram of handicapped washrooms](image)

**Fig. 2** Suggested mounting heights for various bathroom accessories.
Fig. 4 This drawing of a part plan and part elevation of a men's toilet room demonstrates how mounting heights of plumbing fixtures and accessories are indicated. In addition, spacing of plumbing fixtures is indicated by use of a horizontal dimension from centerline to centerline of the lavatories. Many designers prefer to show horizontal dimensions on the plan. a = recessed waste receptacle, b = recessed towel dispenser and soap dispenser with shelf.
Fig. 5 Mounting heights or vertical dimensions are always taken from the finished floor. When installing accessories on tile walls, the tile module and dimensions should be taken into consideration. a = full length mirror, b = recessed feminine napkin dispenser, c = recessed towel cabinet and waste receptacle, d = recessed soap dispenser with shelf.
The mounting heights of plumbing fixtures and accessories for a private toilet are, in many instances, determined by the physical characteristics of the primary user. A person 6'6" tall might require the mounting height of a lavatory, mirror, or shower head to be higher than usual. Note that any electrical outlets near a lavatory or shower must be specified with a ground fault interrupter. c = first aid cabinet and medicine cabinet.
Fig. 7 These drawings show minimum dimensions both for toilet enclosures and between partitions and walls. These layouts are recommendations provided by the General Services Administration, but they may not be in conformity with other codes or desired bathroom layouts, especially in regard to accessibility. Remember, too, that codes provide minimum, not optimal, standards.
Fig. 8 These working drawings provide both vertical and horizontal dimensions for placement of plumbing fixtures and accessories. Note that accessories are identified or "called out" through the use of letters, which would be coordinated with either a legend or a schedule.
In multiple-fixtured public toilets, at least one water closet and lavatory must be designed to conform to barrier-free or accessibility standards.
MEN'S TOILET

1

2

3

4
The women's room shown in Fig. 9 requires approximately 250 ft² for the toilet area and about the same for the vanity area. Wall elevations for the two areas are shown in Fig. 10. The designer should carefully analyze the number of lavatories and water-closets specified for a given facility. Research suggests that most "fixture counts" provided by city or state codes are too low and do not adequately reflect the amount of time that women require. As a result, it is not unusual to see long lines in front of women's rooms, particularly those that service places of public assembly. Note that the plan in Fig. 9 provides supplemental vanity or counter surfaces.

Fig. 9
Fig. 10 Wall elevations for the women's room plan in Fig. 9.
Public Restrooms, Toilets, and Coatrooms

RESTROOMS AND TOILETS
Plans and Elevations

Fig. 11 This men's room and women's room complex, including a janitor's closet, requires slightly more than 400 ft² of floor area. Corresponding wall elevations are shown in Fig. 12.

Fig. 12 Wall elevations for the men's room and women's room complex shown in Fig. 11.
Fig. 12 (Continued)
Fig. 13 These drawings show how some designers indicate the heights of certain fixtures and bathroom accessories.
Public Restrooms, Toilets, and Coatrooms

RESTROOMS AND TOILETS
Plans and Elevations
RESTROOMS AND TOILETS

Fig. 14 Detailed large-scale wall elevations such as this are required to show materials, accessory mounting heights, the coordination and placement of plumbing fixtures, and even manufacturer's model numbers.

Fig. 15 The large-scale counter detail shown here provides all the information needed to construct this essential bathroom element. Not only are the construction details carefully defined and described, but all the other design relationships are clearly shown. Note the relationships of the mirror, soap dispenser, and lavatory to the plastic laminate counter. Other lavatory counter details are shown in Figs. 16 to 19.
RESTROOMS AND TOILETS

Lavatory Counter Details

VANITY DETAILS

225-224 - WEST

Fig. 17
Fig. 19

Fig. 19

PUBLIC RESTROOMS, TOILETS, AND CLOSETS

RESTROOMS AND TOILETS

Lavatory Counter Details

ELEVATION & VANITY - RML 110 / 111

SECTION 1

VANITY DETAIL

MIRROR
W/SHEVEL OVER STUD WALL
CERAMIC TILE - THIN SET
LAMINATED PLASTIC FORMED COUNTER-TOP W/ 48" COFFERED SPLASH (ONE SIDE & BACK "NO DRIP EDGE")
LAM. PLASTIC FACE TO MATCH TOP
2X SUPPORT FRAME SECURED TO WALL

STEEL BRACKET - STANLEY No. 766
(1/4" X 8" OR EQUAL) PROVIDE STUD "D" BRACKET, PAINT TO MATCH LAM. PLASTIC - SEE INT. ELEV.

2-1/2" METAL STUDS
9/16" GYP. BD

BLOCKING PLASTIC LAM. TOP EDGES & SPLASH

3/4" PLYWOOD

2X CONT
9/16" 8X8 GUTTER STANDARD 8" CHAR.
2X4 LEDGER

HORSE SUPPORT AS REQUIRED RM 108

3/4" THK. END PANEL - RM 108 (FLAT, LAM. ALL SURFACES)
Elegantly detailed lavatory cabinets are shown here. Note the use of an exposed oil-finished red mahogany frame or edge surrounding a verdi antique marble top. Complementary telephone shelf details in plan, elevation, and large-scale detail are also shown.
Public Restrooms, Toilets, and Coatrooms

RESTROOMS AND TOILETS
Wheelchair Accessible Design

The design data contained on the following pages are intended to illustrate functional accessibility concepts. Some examples illustrate minimum federal requirements, while others are culled from among the various state standards. Designers are cautioned to consult local standards in their respective jurisdictions.

The current minimum federal standard is ANSI A117.1-1986, published by the American National Standards Institute, Inc. It specifies a stall typified by detail a/G. This "front transfer" type stall requires a watercloset mounted at 1'8" a.f.f., preferably wall hung. Stall doors must be outswinging.

Because a significant portion of people using wheelchairs cannot transfer in this manner, the side transfer stall (b/G) has been developed. Clear stall dimensions and seat heights vary somewhat with jurisdiction. Most standards that address side transfer stalls require lower seat heights with 15'-17" mounting heights being typical.

We recommend locking devices for doors that do not require twisting and grasping motions, avoidance of foot operated flush valves, installation of ceiling or wall-hung partitions as practical, and avoidance of curtains in lieu of doors.

Federal standards mandate grab bars of 1/2" o.d. The bars must be securely mounted 11/4" clear from the wall or partition. This mounting distance is critical, as it provides a "cradle" for a forearm during transfer or if a user loses her or his grip.

TOILET AND RESTROOM DESIGN
Public Restrooms, Toilets, and Coatrooms

RESTROOMS AND TOILETS
Wheelchair Accessible Design

Lavatories need not be specialized designs to be accessible. Utilization of clearances shown will do much to make lavatories accessible. Because persons with loss of sensation in their legs cannot feel pain (and because they heal at a slower rate), hot water lines and drains must be insulated. Also, under several state codes, faucets are required to be lever, blade, or multi-arm handle operated.

Single lever controls are preferable. Spring-operated faucets must have time delay devices.

At least one mirror must be located with the reflecting surface mounted at 3'4" a.f.f. (3'2" or lower preferable). Where possible, full-length mirrors are preferable.

At least one of each type of toilet accessory must also be located at 3'4" a.f.f. or less. Note that this dimension is measured to the highest control required for operation. Controls that require twisting and grasping motions should be avoided.

Because people that use wheelchairs require increased fluid intake, drinking fountains become more than convenience items. While there is not space here to address all configurations, the following concerns are typical to all: controls should be operable without the need for precise grasping; the faucet should not direct spray away from the user and must be located as near the front edge as practical; the units must be free of sharp edges and corners and overhead obstructions.
Urinals, if provided, should have elongated bowls with the opening of the basin located at 18” a.f.f. or less, or mounted level with the main floor. Many state standards specify maximum mounting heights of 15”--16” a.f.f. These lower dimensions are preferable.

The toilet room itself should provide a clear floor area with minimum dimensions of 60” x 60” to facilitate maneuvering wheelchairs. Additionally, provide a minimum of 3’6” clearance in front of accessible toilet stalls to facilitate entry.

Similarly, adequate clearances must be provided at entrances. The spaces shown in details i/3 to o/3 represent typical dimensions specified in state codes. Note, however, that federal and many state standards require 12” clear jamb areas adjoining both sides of all doors. A clearance of 18” or more on the strike side of a door is more effective. In vestibules having doors in series, there must be space for a wheelchair to clear one door prior to opening another.
Public Restrooms, Toilets, and Coatrooms

RESTROOMS AND TOILETS
Wheelchair Accessible Design

Fig. 23 Toilet stalls.
In Figs. 24 to 30, various generic toilet accessories and grab bar configurations are illustrated. While most manufacturers have similar accessories and grab bars within their catalogs, overall dimensions and methods of installation vary greatly. Placement of accessories in relationship to plumbing fixtures, door swings, and interior circulation is to be carefully studied by the designer.

Facial tissue dispenser

Dual feminine napkin/tampon vendor

Sanitary napkin disposal

Dual feminine napkin/tampon vendor

Sanitary napkin disposal

Recessed dual napkin/tampon dispenser and disposal

Recessed seat cover and toilet tissue dispenser

Wall urn ash tray

Toilet seat cover dispenser

Liquid soap dispenser

Recessed powdered soap dispenser

Recessed horizontal soap dispenser and shelf

All-purpose unit with concealed towel cabinet

Multipurpose unit with mirror, shelf, towel, and liquid soap dispensers

Disposal valve soap gun
Public Restrooms, Toilets, and Coatrooms

RESTROOMS AND TOILETS
Toilet Accessories

Ash trays

Waste receptacles

Shelves

Medicine cabinets

Fig. 26
Public Restrooms, Toilets, and Coatrooms

RESTROOMS AND TOILETS

Toilet Accessories

Sanitary napkin dispensers

Sanitary napkin disposals

Combined sanitary napkin dispenser and disposal

Hand and hair dryers

Paper cup dispenser

Paper cup disposal

Multipurpose cabinet

Fig. 27
Public Restrooms, Toilets, and Coatrooms

RESTROOMS AND TOILETS

Grab Bar Configurations

Fig. 29
Public Restrooms, Toilets, and Coatrooms

RESTROOMS AND TOILETS

Grab Bar Configurations

right hand shown left hand opp.

right hand shown left hand opp.

right hand shown left hand opp.

right hand shown left hand opp.

right hand shown left hand opp.

right hand shown left hand opp.

36" from side wall to side wall

right hand shown left hand opp.

Fig. 30
Coatrooms typically fall into two categories: those that are self-service and those that are controlled by one or more attendants. The latter category of coatroom can be more compact because only one, or perhaps two, attendants have access to the coats. A self-service coatroom must have more space between rows of coats so that several persons can enter and get their coats.

Self-service coatrooms are susceptible to theft of property, particularly expensive outerwear. Therefore, it is desirable that these coatrooms be visible to someone at all times, such as a maitre d' in a restaurant or a receptionist in an office. In those situations where a supervised self-service coatroom is inappropriate or cannot be provided, self-service keyed locks offer a viable alternative. In addition to being able to provide secure coat storage, lockers can also store briefcases, packages, or other encumbrances.

### Floor Area Requirements

<table>
<thead>
<tr>
<th>Number of coats (capacity)</th>
<th>Floor area (with attendant) Min</th>
<th>Floor area (with attendant) Max</th>
<th>Floor area (without attendant) Min</th>
<th>Floor area (electric conveyor) Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>35</td>
<td>60</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>100</td>
<td>65</td>
<td>80</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>150</td>
<td>90</td>
<td>110</td>
<td>145</td>
<td>110</td>
</tr>
<tr>
<td>200</td>
<td>125</td>
<td>150</td>
<td>180</td>
<td>140</td>
</tr>
<tr>
<td>250</td>
<td>150</td>
<td>180</td>
<td>210</td>
<td>150</td>
</tr>
<tr>
<td>300</td>
<td>180</td>
<td>215</td>
<td>270</td>
<td>180</td>
</tr>
<tr>
<td>350</td>
<td>200</td>
<td>240</td>
<td>300</td>
<td>200</td>
</tr>
<tr>
<td>400</td>
<td>225</td>
<td>270</td>
<td>330</td>
<td>220</td>
</tr>
<tr>
<td>450</td>
<td>260</td>
<td>310</td>
<td>370</td>
<td>260</td>
</tr>
<tr>
<td>500</td>
<td>300</td>
<td>365</td>
<td>425</td>
<td>300</td>
</tr>
<tr>
<td>550</td>
<td>350</td>
<td>425</td>
<td>480</td>
<td>350</td>
</tr>
<tr>
<td>750</td>
<td>450</td>
<td>540</td>
<td>600</td>
<td>450</td>
</tr>
<tr>
<td>1000</td>
<td>800</td>
<td>720</td>
<td>800</td>
<td>720</td>
</tr>
<tr>
<td>1500</td>
<td>800</td>
<td>950</td>
<td>1080</td>
<td>950</td>
</tr>
<tr>
<td>2000</td>
<td>1000</td>
<td>1200</td>
<td>1500</td>
<td>1200</td>
</tr>
<tr>
<td>3000</td>
<td>1600</td>
<td>1850</td>
<td>2200</td>
<td>1850</td>
</tr>
</tbody>
</table>

Note: The above floor areas are approximate and should only be used for preliminary space planning requirements.

Since the number of coats per linear foot of hanging can vary from 4 to 8, the floor area can vary dramatically. A lightweight overcoat, for example, can measure 1-1.5 inches in width. A medium weight to heavyweight coat might measure from 2 to 4 inches. A fur coat might require a minimum of 4-6 in. The designer must consider the overall size of coatroom based on the following critical factors: (1) geographic location/climate; (2) attendants required or not required; (3) aisle clearance; (4) peak entry/exit loads for coat retrieval; (5) assumed garment thickness or garments per linear foot; (6) linear feet of counter surface and overhead shelving; and (7) other storage components, i.e., hats, umbrellas, briefcases, packages, etc.
Three basic types of manufactured or prefabricated coat storage units are shown in Figs. 1 to 3. Exact coat storage capacities are provided by the manufacturer. All units can be customized to suit various room configurations. Note the adjoining counter space to speed operations. Coat capacities relative to length are listed in Table 2.

Fig. 1 Electric carousel coat storage.

Fig. 2 Rotating reels coat storage.

Fig. 3 Stationary coat storage.
### COATROOMS

**Electric Checkroom Systems**

![Fig. 4](image_url)

#### TABLE 2

<table>
<thead>
<tr>
<th>Overall length with garments*</th>
<th>Length of hanging capacity</th>
<th>Coat capacity: no. of slots†</th>
</tr>
</thead>
<tbody>
<tr>
<td>7' 5&quot;</td>
<td>13' 0&quot;</td>
<td>144</td>
</tr>
<tr>
<td>7'11/4&quot;</td>
<td>14' 1&quot;</td>
<td>156</td>
</tr>
<tr>
<td>8' 6&quot;</td>
<td>15' 2&quot;</td>
<td>168</td>
</tr>
<tr>
<td>9' 1&quot;</td>
<td>16' 3&quot;</td>
<td>180</td>
</tr>
<tr>
<td>9' 7&quot;</td>
<td>17' 4&quot;</td>
<td>192</td>
</tr>
<tr>
<td>10' 11/4&quot;</td>
<td>18' 5&quot;</td>
<td>204</td>
</tr>
<tr>
<td>10' 9&quot;</td>
<td>19' 6&quot;</td>
<td>216</td>
</tr>
<tr>
<td>11' 7/4&quot;</td>
<td>20' 7&quot;</td>
<td>228</td>
</tr>
<tr>
<td>11' 9&quot;</td>
<td>21' 8&quot;</td>
<td>240</td>
</tr>
<tr>
<td>12' 3/4&quot;</td>
<td>22' 9&quot;</td>
<td>252</td>
</tr>
<tr>
<td>12'10&quot;</td>
<td>23'10&quot;</td>
<td>264</td>
</tr>
<tr>
<td>13' 4/5&quot;</td>
<td>24'11&quot;</td>
<td>276</td>
</tr>
<tr>
<td>13'11&quot;</td>
<td>25' 0&quot;</td>
<td>288</td>
</tr>
<tr>
<td>14' 5/8&quot;</td>
<td>26' 1&quot;</td>
<td>300</td>
</tr>
<tr>
<td>16' 0&quot;</td>
<td>28' 2&quot;</td>
<td>312</td>
</tr>
<tr>
<td>15' 6/5&quot;</td>
<td>29' 3&quot;</td>
<td>324</td>
</tr>
<tr>
<td>16' 1&quot;</td>
<td>30' 4&quot;</td>
<td>336</td>
</tr>
<tr>
<td>16' 7/4&quot;</td>
<td>31' 5&quot;</td>
<td>348</td>
</tr>
<tr>
<td>17' 2&quot;</td>
<td>32' 6&quot;</td>
<td>360</td>
</tr>
<tr>
<td>17' 6/5&quot;</td>
<td>33' 7&quot;</td>
<td>372</td>
</tr>
<tr>
<td>18' 3&quot;</td>
<td>34' 8&quot;</td>
<td>384</td>
</tr>
<tr>
<td>16' 8/5&quot;</td>
<td>35' 9&quot;</td>
<td>396</td>
</tr>
<tr>
<td>18' 4&quot;</td>
<td>36'10&quot;</td>
<td>408</td>
</tr>
<tr>
<td>19'10/11&quot;</td>
<td>37'11&quot;</td>
<td>420</td>
</tr>
<tr>
<td>20' 5&quot;</td>
<td>38' 0&quot;</td>
<td>432</td>
</tr>
<tr>
<td>20'11/4&quot;</td>
<td>39' 1&quot;</td>
<td>444</td>
</tr>
<tr>
<td>21' 6&quot;</td>
<td>41' 2&quot;</td>
<td>456</td>
</tr>
<tr>
<td>22' 6/5&quot;</td>
<td>42' 3&quot;</td>
<td>468</td>
</tr>
<tr>
<td>22' 7&quot;</td>
<td>43' 4&quot;</td>
<td>480</td>
</tr>
<tr>
<td>23' 1/4&quot;</td>
<td>44' 5&quot;</td>
<td>492</td>
</tr>
<tr>
<td>23' 8&quot;</td>
<td>45' 6&quot;</td>
<td>504</td>
</tr>
<tr>
<td>24' 2/5&quot;</td>
<td>46' 7&quot;</td>
<td>516</td>
</tr>
<tr>
<td>24' 9&quot;</td>
<td>47' 8&quot;</td>
<td>528</td>
</tr>
<tr>
<td>25' 3/4&quot;</td>
<td>48' 9&quot;</td>
<td>540</td>
</tr>
<tr>
<td>25'10&quot;</td>
<td>49'10&quot;</td>
<td>552</td>
</tr>
<tr>
<td>26' 4/5&quot;</td>
<td>50'11&quot;</td>
<td>564</td>
</tr>
<tr>
<td>26'11&quot;</td>
<td>52' 0&quot;</td>
<td>578</td>
</tr>
<tr>
<td>27' 8/5&quot;</td>
<td>53' 1&quot;</td>
<td>590</td>
</tr>
<tr>
<td>28' 0&quot;</td>
<td>54' 2&quot;</td>
<td>602</td>
</tr>
</tbody>
</table>

*Add 4" minimum clearance to each end and each side when adjacent to walls, columns, obstructions, or other machines.

†This provides 1.1" per coat. In areas or facilities where bulky coats are customary, the actual capacity may be reduced one-third.
Public Restrooms, Toilets, and Coatrooms

COATROOMS
Stationary Checkroom Systems

<table>
<thead>
<tr>
<th></th>
<th>Length</th>
<th>Number of Coats</th>
<th>Number of Shelves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall Mounted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3'0''</td>
<td>36</td>
<td>0/1/2</td>
</tr>
<tr>
<td></td>
<td>4'0''</td>
<td>48</td>
<td>0/1/2</td>
</tr>
<tr>
<td></td>
<td>5'0''</td>
<td>80</td>
<td>0/1/2</td>
</tr>
<tr>
<td>Single Face</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3'4''</td>
<td>36</td>
<td>0/1/2</td>
</tr>
<tr>
<td></td>
<td>4'4''</td>
<td>48</td>
<td>0/1/2</td>
</tr>
<tr>
<td></td>
<td>5'4''</td>
<td>60</td>
<td>0/1/2</td>
</tr>
<tr>
<td>Double Face</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3'4''</td>
<td>72</td>
<td>0/1/2</td>
</tr>
<tr>
<td></td>
<td>4'4''</td>
<td>96</td>
<td>0/1/2</td>
</tr>
<tr>
<td></td>
<td>5'4''</td>
<td>120</td>
<td>0/1/2</td>
</tr>
</tbody>
</table>
A typical coatroom configuration will often consist of a counter with an access door plus the required shelves and hang rods. The overall size of the coatroom will vary with the number and types of coats to be stored. In high-volume coatroom situations, the design should provide appropriate counter space for those persons working behind the counter.
ELEVATION OF UNITS UNDER 8'-0"
1/4" = 1'-0"

ELEVATION OF UNITS OVER 8'-0"
1/4" = 1'-0"

Continuously use blocking screw to wall & back of shelf unit as shown

Line of dividers

3/4" vertical dividers as required

Screw to wall

Center hang, at vertical dividers

Capital A-235 satin chrome finish

Face of wall

1'-0"

1 1/2" face of wall

1 1/2" face of wall

FACE OF WALL

V-Groove Hangrail

Garco A-235 Hanger

Socket, note: in gypsum board partitions provide wood blocking or sheet metal plate to receive screws

1 1/2" face of wall

Hinge chrome hangrod

PART ELEVATION
@ 3" = 1'-0"

SECTION
@ 3" = 1'-0"

SECTION
@ 3" = 1'-0"

NOTE: SEE SHEET E-12 FOR SCHEDULE

TYPICAL OPEN COAT AREA

SCALE AS NOTED
Construction Details
and Finishes

Partitions and wall finishes 469
Floors and floor finishes 516
Doors 566
Ceilings 641
Stairs 660
Fireplaces 724
Lighting 743
Selecting the appropriate partition or wall type is both a science and an art. In fact, there are so many options available to the designer that it is not unusual to refer to the partition or wall as a system, a combination of framing, sheathing, and finish elements, all working together to meet aesthetic, functional, code, and economic requirements.

In that regard, this section explores the great variety of wall and partition types, examining all of their characteristics with the exception of load-bearing capacity and cost of labor and materials. With respect to load-bearing or structural capacities, while many of the wall and partition types are able to carry superimposed loads, it is not the intent of this book to discuss structural issues. With respect to cost, too many factors and variables make this a topic that is difficult to analyze with any precision.

Information on both traditional and contemporary partitions and wall types is provided. Many traditional materials and methods of construction, such as solid gypsum plaster and plaster on clay tile, are cited, thus providing information to the designer who is redesigning or altering older structures.

A large portion of this section is devoted to the detailing of contemporary partition systems. In addition to providing examples of partition types, these pages place great emphasis on the detailing of unusual interface conditions that many designers often leave to the contractor to work out in the field. It should be noted that most, if not all, of these details have been selected from the working drawings of outstanding architectural and interior design firms.

While general information has also been provided about acoustics, sound transmission, and fire ratings of various walls and partitions, the designer is cautioned to verify all such information with manufacturers’ certified test results, as well as with those building and fire codes having jurisdiction. It also should be noted that while test results may demonstrate a certain fire rating or sound transmission classification, it is important to determine if the results have been accepted by the local building or fire department.

It is often necessary to apply a finish to a wall or partition. Again, both traditional and contemporary methods to apply wood paneling, ceramic tile, and stone are clearly illustrated through the use of architectural details.

Finally, walls and partitions must ultimately meet floors and ceilings, and, of course, have doors and openings penetrate them. While some examples are provided in this section, the designer will also find important information in the sections Floors and Floor Finishes; Doors; and Ceilings, which follow.
<table>
<thead>
<tr>
<th>DRAWING AND DESCRIPTION</th>
<th>FIRE-RATING</th>
<th>SOIL AND DAMAGE RESISTANCE</th>
<th>ACoustics</th>
<th>REMARKS</th>
<th>COST COMPARISON</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 inch face brick, tooled joints; Actual thickness, 3% inches; Weight, 40 lbs. per square foot of wall surface</td>
<td>Incombustible, with one hour fire-rating</td>
<td>Good</td>
<td>Very good, transmission loss, 43 decibels</td>
<td>Low maintenance, but limited flexibility; a good-looking wall, but poor light reflection</td>
<td>Installation cost</td>
</tr>
<tr>
<td>4 inch concrete block, tooled joints, two coats of paint on each side; Actual thickness, 3% inches; Weight, 30 lbs. per square foot</td>
<td>Incombustible, with one hour fire-rating</td>
<td>Good</td>
<td>Good, transmission loss, 40 decibels</td>
<td>Inexpensive; attractive if constructed neatly; frequently used for corridors, gyms, assembly rooms, etc.; no flexibility</td>
<td>Maintenance and insurance cost for 20 years</td>
</tr>
<tr>
<td>4 inch cinder block, 3% inch layer of plaster on each side, 2 coats of paint on each side; Actual thickness, 3% inches; Weight, 30 lbs. per square foot</td>
<td>Incombustible, with two hour fire-rating</td>
<td>Poor</td>
<td>Good, transmission loss, 43 decibels</td>
<td>A smooth, dense finish; a good light reflector if painted a light color; no flexibility</td>
<td>Maintenance and insurance cost for 20 years</td>
</tr>
<tr>
<td>3 inch cinder block, 3% inch layer of plaster on each side, 2 coats of paint on each side; Thickness, 4% inches; Weight, 31 lbs. per square foot</td>
<td>Incombustible, with two hour fire-rating</td>
<td>Poor</td>
<td>Good, transmission loss, 39 decibels</td>
<td>A smooth, dense finish; a good light reflector if painted a light color; no flexibility</td>
<td>Maintenance and insurance cost for 20 years</td>
</tr>
<tr>
<td>4 inch structural facing tile, glazed on each side; Actual thickness, 3% inches; Weight, 40 lbs. per square foot</td>
<td>Incombustible, with a fire-rating of less than one hour</td>
<td>Very good</td>
<td>Good, transmission loss, 35 decibels</td>
<td>Used well in classrooms, corridors, also in toilets and showers; care must be taken with the design to avoid bright reflectivity; no flexibility</td>
<td>Maintenance and insurance cost for 20 years</td>
</tr>
<tr>
<td>4 inch concrete block, 2 coats of vinyl plastic spray over entire surface of each side; Actual thickness, 3% inches; Weight, 35 lbs. per square foot</td>
<td>Incombustible, with one hour fire-rating</td>
<td>Good</td>
<td>Good, transmission loss, 40 decibels</td>
<td>Sleek finish, but no flexibility</td>
<td>Maintenance and insurance cost for 20 years</td>
</tr>
<tr>
<td>2 by 4 inch wood studs, spacial 16 inches apart; metal lath and plaster, 2 coats of paint on each side; Thickness, 4% inches; Weight, 20 lbs. per square foot</td>
<td>Combustible</td>
<td>Poor</td>
<td>Good, transmission loss, 39 decibels</td>
<td>Good light reflector, not much flexibility</td>
<td>Maintenance and insurance cost for 20 years</td>
</tr>
</tbody>
</table>
PARTITIONS AND WALL FINISHES

Partition and Wall Types

1. DOUBLE W-22 WOOD PUMICE
2. W-3 SAME ANOTHER WOOD SAME 3 SAME 12%
3. W-15 SAME 12%
4. W-21 SAME 3
5. W-17 SAME 3
6. W-18 SAME 3
7. W-19 SAME 3
8. W-20 SAME 3
9. W-21 SAME 3
10. W-22 SAME 3
11. W-23 SAME 3
12. W-24 SAME 3
13. W-25 SAME 3
14. W-26 DOUBLE CLAY TILE: 9/16"x12½"x12" 6½"x12½"x12" 1½" BROWN AND WHITE GYPSUM PLASTER BOTH SIDES
15. W-27 DOUBLE PARTITION WITH AIR SPACE TWO WALLS OF 3½"x12½"x12" 3-CELL CLAY TILE, 1" PLASTER, 1½"x12½"x12" 3-CELL CLAY TILE,
16. W-28 PUMICE & PORTLAND CEMENT 3-CELL TILE 4½"x3½"x16"
17. W-29 SAME AS W-28, BUT 1½" GYPSUM PLASTER ON ONE SIDE ONLY
18. W-30 SAME AS W-28, BUT 1½" GYPSUM PLASTER ON BOTH SIDES
19. W-31 GLASS BRICK ¾"-4½"x8"
PARTITIONS AND WALL FINISHES

Partition and Wall Types

SOUND CONTROL BY STAGGERED STUDS

SOUND CONTROL - STAGGERED STUDS AND WALL BOARD

SOUND CONTROL - STAGGERED STUDS AND BLANKET CENTER

SOUND CONTROL - SIDewise STUDS AND BLANKET CENTER

GYPSUM SOLID OR HOLLOW PARTITION TILE - 1

GYPSUM SOLID OR HOLLOW PARTITION TILE - 2

FRAMING FOR WIDE OPENING ABOVE SUB-STRUCTURE

TERRA COTTA HOLLOW PARTITION TILE

GYPSUM SOLID OR HOLLOW PARTITION TILE - 1

GYPSUM SOLID OR HOLLOW PARTITION TILE - 2

FRAMING FOR WIDE OPENING ABOVE SUB-STRUCTURE

TERRA COTTA HOLLOW PARTITION TILE
Construction Details and Finishes

PARTITIONS AND WALL FINISHES

Modular  Engineer  Economy  Double

Roman  Norman  Norwegian  King Norman  Triple

Fig. 1  Typical clay brick.

Fig. 2  Structural clay tile.

Fig. 3  Structural facing tile.
Fig. 4  Solid brick: bearing or nonbearing (sections). A = brick, B = nominal wall thickness, C = finish.

Fig. 5  Hollow brick units: bearing or nonbearing (sections). A = brick, B = nominal wall thickness, C = finish.

Fig. 6  Structural clay tile: bearing (sections). A = structural clay tile, B = nominal wall thickness, C = finish.
PARTITIONS AND WALL FINISHES

Types of Masonry

Fig. 7 Faced or veneered construction: bearing (sections). A = brick; B = sheathing; C = corrosion-resistant metal ties spaced 24 in on centers, vertically and horizontally; D = wood or steel studs; E = plaster or gypsum wallboard; F = masonry bond; G = masonry backing unit.

Fig. 8 Cavity type: bearing (sections). A = clay brick, B = corrosion-resistant metal ties spaced to provide one tie to each 3 ft² of wall surface, C = gypsum plaster, D = structural clay load-bearing tile, E = concrete masonry units of load-bearing grade, F = exterior face of wall.

Fig. 9 Hollow concrete masonry units (sections). (a) Bearing, (b) Non-bearing. A = concrete masonry units conforming to ASTM, Standard Specifications for Hollow Load-bearing Concrete Masonry Units; B = nominal wall thickness, C = nominal shell thickness, D = gypsum plaster.
Fig. 10 Structural clay tile: nonbearing (sections). A = structural clay tile, B = nominal wall thickness, C = finish, D = fill.

Fig. 11 Gypsum tile or block: nonbearing (sections). A = gypsum block, B = nominal wall thickness, C = finish.

Fig. 12 Structural clay facing tile: nonbearing (sections). A = clay tile, B = nominal wall thickness, C = plaster, D = glazed or smooth-surfaced side of tile.
PARTITIONS AND WALL FINISHES

Brick Types and Bonds

AMERICAN

RROMAN

NORMAN

ENGLISH

PLACEMENT OF BRICK

SIX FACES OF BRICK

CLOSER

KING CLOSER

QUEEN CLOSER

HALF OR BAT

SPLIT

THREE QUARTER

CUTTER

BULL STRETCHER

BULL STRETCHER

BULL HEADER

HEADER

STRETCHER

STRETCHER

QUEENS

CULL

FACE

SIDE

BED

BED

END

CUTTER

HALF OR BAT

SPLIT

THREE QUARTER

CLOSER

KING CLOSER

QUEEN CLOSER

METHOIDS OF CUTTING BRICK

BRICK JOINTS

COMMON HEADER BOND

HEADER COURSE EVERY 6TH COURSE

7.58 BRICK PER SQ FT

COMMON FLEMISH BOND

ALTERNATE FULL HEADERS EVERY 6TH COURSE

7.45 BRICK PER SQ FT

ENGLISH BOND

HEADER EVERY 6TH COURSE - HALF BRICK

USED FOR HEADER COURSE EXCEPT EVERY 6TH

7.88 BRICK PER SQ FT

BASKET PATTERN

6.75 BRICK PER SQ FT

FLEMISH CROSS BOND

ALTERNATE FULL HEADER EVERY 6TH COURSE

7.15 BRICK PER SQ FT

ENGLISH CROSS BOND

CONTINUOUS FULL HEADERS EVERY 6TH COURSE

7.88 BRICK PER SQ FT
Fig. 13  Designs of standard-size hollow concrete-masonry units.

Fig. 14  Stone ashlar and rubble masonry.
Masonry Partitions

Typical Sizes and Shapes of Concrete Block

- Half - Hi
- Brick
- Frog
- Jumbo
- Split Face
- Slump
- Coping
- Faced
- Shadow (Decorative)
- Chimney
- Lintel
- Pilaster
- Sill
- Header
- Partition
- Chimney
- Lintel
- Pilaster
- Screen (Decorative)
- Control Joint
- Sill Top
- Grade
- Jamb
- JAMB BLOCKS
- Brick (2 core)
- Blocker (2 core)
- Half - Corner
- Double - Corner
- Bullnose
- Return (or "L") Corner
PARTITIONS AND WALL FINISHES

Metal Stud and Gypsum Board

ACOUSTICAL PARTITION

'10' CONTINUOUS VAPOR BARRIER @
CEILING EAVES
'10' WATER RESISTANT GYP. BD. ON GYPSUM FACE
PARTITIONS AND WALL FINISHES

Metal Stud and Gypsum Board

Metal stud and gypsum board: braced to slab

Metal stud and gypsum board partition: floor to slab

Metal channels and gypsum board: wall furring

Metal stud and gypsum board partition: floor to slab
PARTITIONS AND WALL FINISHES

Metal Stud and Gypsum Board

Metal stud and gypsum board: underside of ceiling

Metal channels and gypsum board: wall turring
PARTITIONS AND WALL FINISHES

Metal Stud and Gypsum Board

Construction Details and Finishes

Metal stud and gypsum board: shaftwall

Metal stud and gypsum board: movable
PARTITIONS AND WALL FINISHES

Metal Stud and Gypsum Board

**Metal Stud and Gypsum Board**

**Type 1 (Typical Partition)**

- Structural slab
- Continuous caulking
- Metal lath 1/2" mesh
- 1 ½" redwood furring strip
- Acoustic tile cladding

**Type 2 (4 Hour Acoustical Partition)**

- Structural slab
- Continuous caulking
- Metal lath 1/2" mesh
- 1 ½" redwood furring strip
- Acoustic tile cladding

**Type 3 (2 Hour Fire-Rated Partition)**

- Structural slab
- Continuous caulking
- Metal lath 1/2" mesh
- 1 ½" redwood furring strip
- Acoustic tile cladding

**Type 4 (B Type Not Covered, Pinned Out)**

- Structural slab
- Continuous caulking
- Metal lath 1/2" mesh
- 1 ½" redwood furring strip
- Acoustic tile cladding
**Construction Details and Finishes**

**PARTITIONS AND WALL FINISHES**

*Metal Stud and Gypsum Board Details*

---

**DETAIL A**

Scale: 3\(\frac{3}{8}\)" = 1'-0"

- **Exposed Spline Grid**
- **1\(\frac{1}{2}\)" C.R. Channel**
- **Acoustical Panel Ceiling**
- **Paint to Match Partition**
- **Top Runner**
- **Sht. Rk. Panel on Metal Stud**

Note: Secure top runner to susp'l clg. w/ toggle bolts.

---

**DETAIL B**

Scale: 3\(\frac{3}{8}\)" = 1'-0"

- **Toggle Bolt**
- **Furring Channel Clip**
- **Furring Channel**
- **\(\frac{5}{8}\)" Sht. Rk. Clg.**
- **Paint to Match Partition**
- **Top Runner**
- **Sht. Rk. Panel on Metal Stud**

---

**DETAIL C**

Scale: 3\(\frac{3}{8}\)" = 1'-0"

- **Dustproof Membrane**
- **1\(\frac{1}{2}\)" C.R. Channel**
- **\(\frac{5}{8}\)" Sht. Rk. Ceiling**
- **Furring Channel**
- **Building Wall**

---

**DETAIL D**

Scale: 3\(\frac{3}{8}\)" = 1'-0"

- **Sheet Rock Panel**
- **Metal Stud**
- **4\(\frac{1}{4}\)" Vinyl Base by Flr Covg Contr.**
- **Fin. Floor**

---

**DETAIL E**

Scale: 3\(\frac{3}{8}\)" = 1'-0"

- **Sheet Rock Panel**
- **Furring Channel**
- **Building Wall**
- **4\(\frac{1}{4}\)" Vinyl Base by Flr Covg Contr.**
- **Fin. Floor**

---

487
Construction Details and Finishes

PARTITIONS AND WALL FINISHES

Metal Stud and Gypsum Board Details
Metal stud and gypsum board: partition to mullion detail

Metal stud and gypsum board: partition to column detail

Metal stud and gypsum board: partition to mullion detail
PARTITIONS AND WALL FINISHES

Metal Stud and Gypsum Board: Column Enclosures and Fireproofing

**Construction Details and Finishes**

**Metal Stud and Gypsum Board: Column Enclosures and Fireproofing**

**Note:** Each column is encased by a 2 ft. wide partition - gypsum board to be 2 layers w/ calcium & perimeter.

**Fireproofing @ Col.'s - SHE RATED**

A-27

1/2" FIRECODE 'C' GYP BD BOTH SIDES ON 8" 16 GA. METAL FRAMING @ 10" O.C.

1/2 CEMENTITIOUS FIREPROOF SPRAY APPLIED TO 3.4 lbs./sq. yd. METAL LATH TIE LATH TO COL. W/ #16 SANS GALV. MET. WIRE NEW DESIGN #X 709

1 1/2" METAL FRAMING W/ ONE LAYER 5/8" FIRECODE GYPS BD.

**Typical Col. Fireproofing @ Perimeter of Atrium**

A-27

1 1/2" FIN. COL. WIDTH U. O. N.
PARTITIONS AND WALL FINISHES
Miscellaneous Metal Stud and Gypsum Board Details

Construction Details and Finishes

SECTION B METAL DUCT ENCLOSURE

NOTES:
1. DUCT ENCLOSURE TO EXTEND 24" FROM FACE OF WALL
2. MAINTAIN 1/2" VERTICAL MINOR BETWEEN DUCT AND TWO METAL STUDS.

SECTION AT SUPPLY AIR DUCT ENCLOSURE

FINISHED CEILING

COLUMN FURRING

ENFORCEMENT OF CONSTRUCTION

STEP 1.
Paste temporary 2" x 2" angle to slab. Paste top member of partition to temporary angle and erect stud. (Maintain 1" air space between member and slab.)

STEP 2.
Apply gypsum board laterally to one side of stud.

STEP 3.
Paste 2" x 2" continuous angle (with 1/2" felt glued to side) to slab only (no fasteners except to side angle).

STEP 4.
Install one bar mineral wool between studs.

STEP 5.
Remove temporary angle and replace with 2" x 2" continuous angle (with 1/2" felt glued to side). Paste top angle to slab only.

SOFT TERMINATION OF PARTITIONS

SCALE: 1/2" = 1'-0"
The resistance of a building element, such as a wall, to the passage of airborne sound is rated by its sound transmission class (STC). Thus, the higher the number, the better the sound barrier. The approximate effectiveness of walls with varying STC numbers is shown in the following tabulation:

<table>
<thead>
<tr>
<th>STC</th>
<th>WALL DETAIL</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>1/2&quot; gypsum wallboard</td>
<td>A</td>
</tr>
<tr>
<td>32</td>
<td>5/8&quot; gypsum wallboard</td>
<td>A</td>
</tr>
<tr>
<td>37</td>
<td>5/8&quot; gypsum lath (nailed) plus 1/2&quot; gypsum plaster with whitecoat finish (each side)</td>
<td>B</td>
</tr>
<tr>
<td>39</td>
<td>6&quot; concrete block</td>
<td>E</td>
</tr>
<tr>
<td>45</td>
<td>1/2&quot; sound deadening board (nailed) plus 1/2&quot; gypsum wallboard (laminated) (each side)</td>
<td>D</td>
</tr>
<tr>
<td>46</td>
<td>Resilient clips to 5/8&quot; gypsum backer board</td>
<td>E</td>
</tr>
<tr>
<td>52</td>
<td>1/2&quot; fiberboard (laminated) (each side)</td>
<td>E</td>
</tr>
</tbody>
</table>

**Wall Construction**

As the preceding STC tabulation shows, a wall providing sufficient resistance to airborne sound transfer likely has an STC rating of 45 or greater. Thus, in construction of such a wall between the rooms of a house, its cost as related to the STC rating should be considered. As shown in Fig. 5, details A, with gypsum wallboard, and B, with plastered wall, are those commonly used for partition walls. However, the hypothetical rating of 45 cannot be obtained in this construction.

Good STC ratings can be obtained in a wood-frame wall by using the combination of materials shown in Fig. 5D and E. One-half-inch sound-deadening board nailed to the studs, followed by a lamination of 1/4" gypsum wallboard, will provide an STC value of 48 at a relatively low cost. A slightly better rating can be obtained by using 1/4" gypsum wallboard rather than 1/8". A very satisfactory STC rating of 52 can be obtained by using resilient clips to fasten gypsum backer boards to the studs, followed by adhesive-laminated 1/8" fiberboard (Fig. 5E). This method further isolates the wall covering from the framing.

A similar isolation system consists of resilient channels nailed horizontally to 2" by 4" studs spaced 16" on center. Channels are spaced 24" apart vertically and 1/4" gypsum wallboard is screwed to the channels. An STC rating of 47 is thus obtained at a moderately low cost.

Thus use of a double wall, which may consist of a 2" by 6" or wider plate and staggered 2" by 4" studs, is sometimes desirable. One-half-inch gypsum wallboard on each side of this wall (Fig. 6A) results in an STC value of 46. However, two layers of 1/8" gypsum wallboard add little, if any, additional sound-transfer resistance (Fig. 6B). When 1/8" blanket insulation is added to this construction (Fig. 6C), the STC rating increases to 48. This insulation may be installed as shown or placed between studs on one wall. A single wall with 3/8" of insulation will show a marked improvement over an open stud space and is low in cost.

The use of 1/2" sound-deadening board and a lamination of gypsum wallboard in the double wall will result in an STC rating of 50 (Fig. 6D). The addition of blanket insulation to this combination will likely provide an even higher value, perhaps 53 or 54.
PARTITIONS AND WALL FINISHES

Acoustical and Fire-Rated Metal Stud and Gypsum Board

1. ONE HOUR FIRE RATED PARTITION
   SAME AS 1 BUT WITH SOUND ATTENUATION BLANKET

2. TWO HOUR FIRE RATED PARTITION
   SAME AS 2 BUT WITH SOUND ATTENUATION BLANKET

3. SOUND PARTITION / CLASS A /

4. SOUND PARTITION / CLASS B /
PARTITIONS AND WALL FINISHES

Acoustical Wood Veneer Plywood Wall Paneling

**Acoustic Wall Treatment Details**

- **A-1** Perforated Hardwood Veneer Plywood Finish
- **A-2** Unperforated Hardwood Veneer Plywood Finish

**NOTE:** Perforated hardwood veneer panels shall have 3/16" dia. holes 1" O.C. Holes shall be drilled not punched. Open area to be at least 11%.

**Pattern for Perforated Plywood**

- 3/16" holes drilled

**Diagram**

- 2" min. hold
- FACR of wall
- 1/4" air space hold
- 2" thick 4 lb. density fiberglass or mineral wool acoustical blanket, as manufactured, by Baldwin-Wilmette Hill Div. of Selens Corporation
- 1/4" hardwood veneer plywood panels, det. A-1 perforated (see note)
- Det A-2 unperforated, see schedule of interior finishes for species of wood-glue panels to plywood straps
- Continuous 1/4" x 3" plywood strips nailed to 2x2 furring
- 2" x 2" wood furring 24" O.C. in both directions
- Shims as req'd to set furring plumb & level

**Construction Details and Finishes**
### Wood Frame Partition Systems for Sound Control

<table>
<thead>
<tr>
<th>Partition System</th>
<th>Wall Number</th>
<th>Wall Face</th>
<th>STC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single Stud Walls</strong></td>
<td>1</td>
<td>Single gypsum board each side, applied with screws; no resilient channels</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Single gypsum board laminated and nailed(^1) over sound board each side; no resilient channels</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Single gypsum board applied with screws 1 side; opposite side on resilient channels</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Single gypsum board laminated and nailed(^1) over sound board, opposite side on resilient channels</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Single gypsum board on resilient channels each side</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Double ½&quot; gypsum board, base sheet vertical; face sheet horizontal; applied on resilient channels one side</td>
<td>59</td>
</tr>
<tr>
<td><strong>Double Stud Walls with a Common Plate</strong></td>
<td>7</td>
<td>Single gypsum board each side, applied with screws (2x3 studs—16&quot; o.c.); no resilient channels</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Single gypsum board laminated and nailed(^1) over sound deadening board each side (2x4 studs—16&quot; o.c.); no resilient channels</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Single gypsum board nailed one side. Single gypsum board on resilient channels opposite</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Single gypsum board laminated and nailed(^1) over sound deadening board 1 side. Single gypsum board on resilient channels opposite (2x3 studs—16&quot; o.c.)</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Double gypsum board (½&quot; over ½&quot;) nailed one side; single gypsum board on resilient channels opposite (2x4 studs—24&quot; o.c.)</td>
<td>56</td>
</tr>
<tr>
<td><strong>Double Stud Walls on Separate Plates</strong></td>
<td>12</td>
<td>Single gypsum board each side applied with screws</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Single gypsum board laminated and nailed(^1) over sound board each side</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Same as wall 13</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>Single gypsum board laminated and nailed(^1) over sound board 1 side; single gypsum board on resilient channels opposite</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>Double gypsum board; nailed each side</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>Double gypsum board each side; outer layer laminated and nailed(^1); base layer nailed</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>Double gypsum board laminated and nailed(^1) one side. Single gypsum board on resilient channels opposite</td>
<td>57</td>
</tr>
</tbody>
</table>

\(^1\) Design No. 6—1 Hr. combustible (bearing wall) Underwriters' Lab, Inc. (10)

\(^1\) Face laminated vertically with three 6-inch wide strips of construction adhesive and nailed with about half the usual number of nails.
PARTITIONS AND WALL FINISHES

1. OUTDOOR ANGLED CORNER DETAIL (TYPICAL)
   SCALE 1/8" = 1'-0"

2. Furring at window jamb
   SCALE 1/8" = 1'-0"

3. Metal "Z" furring and gypsum board: exterior walls
   SCALE 1/8" = 1'-0"

4. Furring at door jamb (typical exterior walls)
   SCALE 1/8" = 1'-0"

Metal "Z" furring and gypsum board: door jamb details

Note: The above details are solutions for the same condition.

OJ AAD CONNER, DETAIL (TTPCAL)
SCALE I/S - O-
PARTITIONS AND WALL FINISHES
Wood Veneer Plywood Wall Paneling

Installation Methods
PARTITIONS AND WALL FINISHES

Wood Wall Paneling Details and Conditions

2A TYPICAL JOINT FOR W.V.P. WALLS

2B WALL/CEILING/FASCIA INTERSECTIONS IN SANTUARY/Foyer

2C WALL/FASCIA INTERSECTION (WITH NO SOFFIT)

2D W.V.P. WALL/AC. TILE CEILING/FASCIA INTERSECTIONS
PARTITIONS AND WALL FINISHES

Wood Wall Paneling and Wainscoting Details and Conditions

- **Wood Wall Paneling**
  - Paneling should always be solid wood.

- **Wainscoting**
  - Wainscoting panels should be of a single piece, to avoid gaps and inconsistencies.

- **Details and Conditions**
  - Cabinets and stairways should be thoroughly sealed.
  - All woodwork should be of the best grade, well matched for grain, and thoroughly kiln-dried.

- **Composition**
  - Floor bases should be properly sealed.

- **Construction Details**
  - Fill left-overs to cover joints.
PARTITIONS AND WALL FINISHES
Ceramic Tile Wall Finishes

Wood Studs or Furring
Cement Mortar

- Ceramic Tile
- Bond Coat
- Mortar Bed
- Scratch Coat
- Metal Lath
- Membrane
- Wood Studs or Furring

Recommended uses:
- over dry, well-braced wood studs or furring
- preferred method of installation over wood studs in showers and tub enclosures

Metal Studs
Cement Mortar

- Ceramic Tile
- Dry-set or Latex-Portland Cement Mortar Bond Coat
- Gypsum Board
- Wood or Metal Studs

Recommended uses:
- over metal studs

Gypsum Board
Organic Adhesive

- Ceramic Tile Adhesive
- Single or Multiple Layers Gypsum Board
- Metal Studs

Recommended uses:
- over gypsum board screwed to metal studs, single or double layer installed in accordance with GA-216
- where a gypsum board, non-load-bearing partition is desired with durable, low-maintenance finish
- for fire-resistant, sound-insulated, ceramic-tiled walls (fire-resistance and sound-insulation ratings calculated on partitions before tiling)
- for dry areas in schools, institutions, and commercial buildings

Wood or Metal Studs
Gypsum Board
Dry-Set Mortar or Latex
Portland Cement Mortar

- Ceramic Tile
- Dry-set or Latex-Portland Cement Mortar Bond Coat
- Gypsum Board
- Wood or Metal Studs

Recommended uses:
- dry interiors over gypsum wall board
- for dry areas in schools, institutions, and commercial buildings

Glass Mesh Mortar Unit
Dry-Set Mortar or Latex
Portland Cement Mortar

- Ceramic Tile
- Dry-set or Latex-Portland Cement Mortar Bond Coat
- Glass Mesh Mortar Unit
- Wood or Metal Studs

Recommended uses:
- in wet areas
- over dry, well-braced wood studs or furring
- over well-braced metal studs

505
PARTITIONS AND WALL FINISHES

Ceramic Tile Wall Finishes

Masonry
Cement Mortar

Recommended use
- over masonry or concrete on exteriors

Dry-Set Mortar or Latex-Portland Cement Mortar

Recommended use
- over clean, sound, dimensionally stable masonry or concrete

Masonry or Concrete
Cement Mortar Bonded

Recommended use
- over clean sound, dimensionally stable masonry or concrete

Solid Backing
Cement Mortar

Recommended use
- over masonry, plaster, or other solid backing that provides firm anchorage for metal lath
- ideal for remodeling or on surfaces that present bonding problems

One Coat Method

Recommended use
- over masonry, plaster, or other solid backing that provides firm anchorage for metal lath
- ideal for remodeling or on surfaces that present bonding problems
- ideal for remodeling where space limitations exist
- preferred method of applying tile over gypsum plaster or gypsum board in showers and tub enclosures

Organic Adhesive

Recommended use
- interiors over gypsum board, plaster, dimensionally stable masonry, or other smooth surfaces
Fig. 15 Standard trim shapes and designations (6 by 4½ in wall tile set in conventional mortar bed).

Fig. 16 Standard trim shapes and sizes.
1/4" is the very least space that should be allowed for marble ashlar or wainscot. Some marbles require backing up with liners or extra thickness & require more space. The kind of marble determines the space required.

Fig. 17 Marble treatment for walls and wainscots.
Fig. 18 Anchorage details.
PARTITIONS AND WALL FINISHES

Slate Panel Veneer

Fig. 19 Slate panel veneer.

Fig. 20 Slate panels applied to concrete wall.
PARTITIONS AND WALL FINISHES

Bi-Fold Door Details

**Vinyl Fabric on Planter**

**Grant # 2060**
**Bi-Fold Hardware or Equal**

**Easing Bead**

**Oak Edge**

**3/4" Oak Plywood**
**Bi-Fold Doors**

**Screw & Plug**
**Oak Frame**

**Head**

**Plywood Bi-Fold Door**

**Veneer # 2615-4**
**Flush Bolt or Equal**

**Sill**

**Flush Bolt Detail**

@ 1/2 Full Size

**Chapel**

**Sill**

**Family Alcove**

**Bi-Fold Door Details**

@ 5'-1"-0"
Partition and Wall Finishes

Column Fireproofing Details

**Gypsum Lath & Plaster Fireproofing**

- **Thin Bead**
- **Double Stratum 1/8" Metal Wire**
- **Steel Cover - Structural Lines**

**Metal Lath & Plaster Fireproofing**

- **Thin Bead**
- **Channel Brackets Laid Flat**

**Masonry Fireproofing**

<table>
<thead>
<tr>
<th>Material</th>
<th>Thickness</th>
<th>1 HR</th>
<th>2 HR</th>
<th>3 HR</th>
<th>4 HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brick (Burnt Clay or Ash)</td>
<td>2 1/4&quot;</td>
<td>2 1/4&quot;</td>
<td>2 1/4&quot;</td>
<td>2 1/4&quot;</td>
<td></td>
</tr>
<tr>
<td>Brick (Sand Lime)</td>
<td>2 1/4&quot;</td>
<td>2 1/4&quot;</td>
<td>2 1/4&quot;</td>
<td>2 1/4&quot;</td>
<td></td>
</tr>
<tr>
<td>Concrete Block, Base, Pile except Gypsum Concrete Units</td>
<td>2 1/4&quot;</td>
<td>2 1/4&quot;</td>
<td>2 1/4&quot;</td>
<td>2 1/4&quot;</td>
<td></td>
</tr>
<tr>
<td>Hollow Concrete, Block &amp; Tile Using a Compressive Strength of at least 3,000 psi Per Sq.Ft.</td>
<td>1 1/4&quot;</td>
<td>1 1/4&quot;</td>
<td>1 1/4&quot;</td>
<td>1 1/4&quot;</td>
<td></td>
</tr>
<tr>
<td>Hollow Concrete Blocks, Provided That the Steel Reinforcement on the Inner Wall is Not Less Than 1/2&quot; Steel Per Sq.Ft.</td>
<td>2&quot;</td>
<td>2&quot;</td>
<td>2&quot;</td>
<td>2&quot;</td>
<td></td>
</tr>
<tr>
<td>Hollow Concrete Blocks, Provided That the Steel Reinforcement on the Inner Wall is Not Less Than 1/2&quot; Steel Per Sq.Ft. with at least 1/2&quot; Gypsum Plaster</td>
<td>2 1/4&quot;</td>
<td>2 1/4&quot;</td>
<td>2 1/4&quot;</td>
<td>2 1/4&quot;</td>
<td></td>
</tr>
</tbody>
</table>

---

**Diagram Details**

- **Column Dimensions**
- **Steel Cover - Structural Lines**
- **Double Stratum 1/8" Metal Wire**
- **Gypsum Lath & Plaster**

---

514
PARTITIONS AND WALL FINISHES

Column Fireproofing Details

**GYPSEM BOARD FIREPROOFING — 2 HR. RATING**

FOR 2 HR. RATING AND 1 ADDITIONAL LAYER OF 5/8" FIREPROOF GYPSUM BOARD

<table>
<thead>
<tr>
<th>RATING</th>
<th>PLASTER TYPE</th>
<th>LATH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 HR.</td>
<td>5/8&quot;</td>
<td>2-1/2&quot; DIAMOND MESH METAL LATH</td>
</tr>
<tr>
<td>2 HR.</td>
<td>1&quot;</td>
<td>2-1/2&quot; DIAMOND MESH METAL LATH</td>
</tr>
<tr>
<td>3 HR.</td>
<td>1-1/2&quot;</td>
<td>2-1/2&quot; DIAMOND MESH METAL LATH</td>
</tr>
<tr>
<td>4 HR.</td>
<td>2&quot;</td>
<td>2-1/2&quot; DIAMOND MESH METAL LATH</td>
</tr>
</tbody>
</table>

**VERMICULITE OR GYPSEM PELZITE FIREPROOFING**

Sprayed on fireproofing

Note: N.Y.C. Code - 4 HR. Rating may be obtained with Vermiculite plaster, one 6-8. Laths, & Backing of loose Vermiculite.
The designer must be familiar with the great variety of floor types, finishes, and patterns in order to specify and detail architectural flooring properly. While some examples of “soft finishes” such as carpeting and resilient flooring are shown, this section explores in depth the installation and detailing of “hard” or architectural finishes.

It is important for the designer to research the various characteristics of the floor finish being specified. While aesthetics and color are obviously important considerations, the designer must also analyze other factors. Among these factors are wear resistance and durability, soil resistance, maintenance, resiliency, flammability, costs of installation, and life cycle cost. Once these factors have been analyzed, the final specification and detailing of the architectural finish must be developed.

Examples of standard patterns are provided, but the designer must become familiar with the infinite number of pattern possibilities. The inherent limitations of materials control their sizes and thicknesses. The patterns of certain materials are dictated by both the thickness of the material and the weight or “dead load” of the material superimposed upon the structure. For example, a large pattern of marble or granite will necessitate a slab of material that will weigh much more per square foot than that of a smaller pattern. This greater weight might have structural consequences, as well as make floor transitions more significant.

Transitions between flooring materials, particularly under doors or at entrances, and transitions between flooring and walls are some of the key material interfaces that have to be detailed. Again, this section provides such information using both traditional and contemporary approaches.

Finally, a portion of this section is devoted to the detailing of raised computer room floors. While not traditionally a floor finish, raised computer room floors seem appropriate for this section. While generic architectural details are provided, the designer should always develop final details in conjunction with the manufacturer(s) being specified.
<table>
<thead>
<tr>
<th>DRAWING AND DESCRIPTION</th>
<th>WEAR RESISTANCE</th>
<th>SOIL RESISTANCE, CLEANING AND MAINTENANCE</th>
<th>RESILIENCE</th>
<th>REMARKS</th>
<th>COST COMPARISON</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 inch hardened cement finish on concrete slab</td>
<td>Good</td>
<td>Poor; frequent cleaning needed; must be refinished every ten years</td>
<td>Very hard</td>
<td>Cement base costs little, is too hard a floor to be comfortable; infrequently used in classrooms, sometimes used in corridors, shops and inexpensive toilet rooms</td>
<td>Installation cost</td>
</tr>
<tr>
<td>3/4 inch terrazzo finish, with 3/8 inch cement underbed on a concrete slab</td>
<td>Very good</td>
<td>Very good; needs cleaning once a week with detergent and water</td>
<td>Very hard</td>
<td>Terrazzo base is easy to clean and sanitary, but not resilient and sometimes noisy; seldom used in classrooms, often used in corridors, vestibules, toilets and shower rooms</td>
<td></td>
</tr>
<tr>
<td>Ceramic mosaic tile, 3/4 inch setting bed on concrete slab</td>
<td>Very good</td>
<td>Very good</td>
<td>Very hard</td>
<td>Used in toilet rooms, showers, food service areas, seldom used in classrooms</td>
<td></td>
</tr>
<tr>
<td>3/4 inch asphalt tile finish installed in mastic on concrete slab</td>
<td>Fair; usually needs replacing every ten years</td>
<td>Fair; must be cleaned and waxed once a week</td>
<td>Fair</td>
<td>Low first cost; finish requires careful maintenance</td>
<td></td>
</tr>
<tr>
<td>3/4 inch linoleum finish installed in mastic on concrete slab</td>
<td>Good</td>
<td>Fair; must be cleaned and waxed once a week</td>
<td>Fair</td>
<td>Serviceable; a sanitary floor for classrooms, corridors, assembly and administration rooms</td>
<td></td>
</tr>
<tr>
<td>3/4 inch cork tile floor installed in mastic on concrete slab</td>
<td>Good</td>
<td>Fair; needs frequent cleaning and waxing</td>
<td>Very good</td>
<td>Used primarily in libraries and kindergartens; floor is subject to indentations by chair legs; acoustically good</td>
<td></td>
</tr>
<tr>
<td>3/4 inch rubber tile finish installed in mastic on concrete slab</td>
<td>Good</td>
<td>Fair; needs cleaning and waxing once a week</td>
<td>Very good</td>
<td>Subject to slight indentation by chair legs</td>
<td></td>
</tr>
<tr>
<td>3/4 inch vinyl tile finish installed in mastic on concrete slab</td>
<td>Good</td>
<td>Fair; needs a weekly cleaning and waxing</td>
<td>Very good</td>
<td>Subject to indentation</td>
<td></td>
</tr>
<tr>
<td>25/32 inch maple strip flooring set in 1/4 inch hot asphalt mastic on concrete slab</td>
<td>Very good</td>
<td>Good; requires monthly cleaning with steelwool and a wax finish</td>
<td>Fair</td>
<td>Steel angles necessary to cover expansion joints; used in gymnasiums and playrooms; not suitable for damp areas or climates</td>
<td></td>
</tr>
<tr>
<td>25/32 inch maple finish, 1 by 4 inch cypress sub-floor laid diagonally: 2 by 6 inch cypress sleep- ers, 12 inches apart, set in two 3/4 inch layers of hot asphalt mastic</td>
<td>Very good</td>
<td>Good; requires a monthly cleaning with steelwool and a wax finish; sand and re-finish every 2 years</td>
<td>Excellent</td>
<td>A deluxe gymnasium floor</td>
<td></td>
</tr>
</tbody>
</table>
By groups of four squares as a unit separated by wider joints, the scale is increased.

A diagonal pattern of square tiles is emphasized by a border.

By a few rows of broken joints, an effect of border is produced in a field of square tiles.

When the small squares are less than one-quarter of the area of the large squares, the pattern runs off at the side.

When the small squares are one quarter of the area of the large squares, the pattern has more repose.

A decorative pattern that can be made on the job.

By breaking joints in one course, the border is made wide.

Another way to increase the scale with small tiles.

An arrangement adapted to large rooms.

The simplest floor of square tiles is interesting if the joints are in scale.

When double squares are laid "basket pattern," the necessary allowance for joints adds interest.

A good pattern for corridors.

When square tiles are laid with broken joints, long lines in one direction are the result.

Varieties of "herringbone."

Two combinations suggesting plaids.

A simple device for a panel or a floor for a large room.
NOTE: Size of marble tiles vary with design. If several varieties are used, the abrasive hardness (Hv) of each should be similar. (ASTM C241).

TYPICAL MARBLE FLOORING DESIGNS

[1] MORTAR BED

[2] MORTAR BED

[3] THIN SET MORTAR

[4] ADHESIVE

[5] MORTAR BED

[6] ADHESIVE

METHODS OF INSTALLATION

HALF SIZE

Fig. 1 Marble flooring details.
**Marble Floor Patterns and Details**

**Fig. 2** Marble floor setting methods.

- **a. Standard floor tile, preferred method**
- **b. Standard floor tile, thin-set method**
- **c. Thin marble tile, preferred method**
- **d. Thin marble tile, thin-set method**

**Fig. 3** Flagging patterns.

- **a. Random rectangular**
- **b. Coursed**
- **c. Irregular or mosaic**

Flagging 1 to 1 1/2 in.
Sand bed 4 in.

Flagging 3/4 to 1 in.
Setting bed 1 to 1 1/2 in.
Reinforced concrete slab 4 in.
Gravel or cinders 4 in.

Flagging 3/4 to 1 in.
Setting bed 1 to 1 1/2 in.
Reinforced concrete slab 4 in.
Wood subfloor 3/4 in.
Construction Details and Finishes

Floors and Floor Finishes

Saddles/Floor Transitions
Construction Details and Finishes

FLOORS AND FLOOR FINISHES

Saddles/Floor Transitions

[Diagram showing floor transitions and finishes]
Construction Details and Finishes

Floors and Floor Finishes
Floor Finish Transition Details

1. Section 1: Floor Transition Opt. Tile/CPT
   - Details:
   - Opt. Tile
   - Header (as approved by architect)

2. Section 2: Floor Transition Opt. Tile/CPT
   - Details:
   - Opt. Tile
   - Header (as approved by architect)
   - Carpet

3. Section 3: Floor Transition CPT/CPT
   - Details:
   - CPT Tile
   - Carpet

4. Section 4: Floor Transition CPT/CPT
   - Details:
   - CPT Tile
   - Header (as approved by architect)
   - Carpet

5. Section 5: No Saddle
   - Details:
   - CPT
   - No Saddle

6. Section 6: No Saddle
   - Details:
   - CPT
   - No Saddle
**Construction Details and Finishes**

**Floors and Floor Finishes**

**Edgings; Tile/Carpet Joiners; Reducer Strips**

- **Vinyl Snap Down Divider**
  - ⅛" wide removable section for joining carpets

- **Vinyl Snap Down Edging**
  - ⅛" wide removable section for joining carpet to tile

- **Vinyl Single Flange Track**

- **Vinyl 5/16" Glue Down Reducer**
  - ⅛" butting gauge undercut
  - Long flange, smooth taper

- **Vinyl Custom Edge**
  - General purpose edge and cap

- **Vinyl 1/4" Square Cove Cap**
  - Cap for coved carpets and wall paneling

- **Vinyl Tile Carpet Joiner**
  - Provides smooth carpet/tile transition

- **Vinyl 3/16" Glue Down Reducer**
  - Undercut, flange, and transition combined
  - Undercut 3/16" smooth transition

- **Vinyl Carpet Cove Cap**
  - Trim for coved carpet
  - Undercut 3/16" (Flexible)

- **Vinyl 9/32" Cap**
  - For capping coved carpets, ceramics, and paneling

- **Vinyl Tackless Carpet Bar**
  - ⅛" butting edge to accept tackless strip
  - Deep undercut

- **Vinyl Tackless Carpet Bar Reducer**
  - ⅛" butting edge to accept tackless strip

- **Vinyl Corner Guard**
  - Protects corners and columns from bumps, abrasion, wear

- **Vinyl Fillet Strip**
  - Superb backing for flashing up the wall
  - Black only

- **Vinyl Underslung Reducer**
  - Binder-bar type edging for resilient flooring
  - Undercut, 105° for use with 1/16" to 1/8" material

- **Vinyl 1/4" Glue Down Reducer**
  - ⅛" butting gauge undercut
  - Long flange, smooth taper

- **Vinyl 1/16" Tile Reducer**
  - Beveled edge for resilient flooring material
  - 1/16" (.063") butting gauge

- **Vinyl 3/32" Tile Reducer**
  - Beveled edge for resilient flooring material
  - 3/32" (.094") butting gauge

- **Vinyl 1/8" Tile Reducer**
  - Beveled edge for resilient flooring material
  - 1/8" (.125") butting gauge
BASE TYPES

FLOORS AND FLOOR FINISHES
Base Details

- CERAMIC TILE
- CERAMIC MOSAIC TILE
- STRAIGHT VINYL BASE
- CARPET
- VINYL COVER BASE
- QUARRY TILE
- TILES FLOOR
- VERTICAL PIECE BOARDS
- CARPET
- HARDWOOD VENEER, PANELS
- DEEPET
Construction Details and Finishes

FLOORS AND FLOOR FINISHES

Stone Floor Patterns and Details

STONE FLOORING PATTERN DETAIL  
TYP FLOORS 31ST THRU 45TH PL

STONE DET. & ELEV DOOR SILL

STONE FLOORING DET & ENTRY DOORS

TYP. STONE FLOORING DET  
@ LODGY PANEL WALL

TYP. STONE BUTT JOINT DETAIL
FLOORS AND FLOOR FINISHES

Terrazzo Floor Construction Details

**RUSTIC TERRAZZO - STRUCTURAL SYSTEM**

OVER GRANULAR FILL

**RUSTIC TERRAZZO - BONDED SYSTEM WITH SETTING BED - OVER STRUCTURAL CONCRETE**

**RUSTIC TERRAZZO OVER SLABS WITH HEATED SPACE, BELOW & OVER INSULATED & WATERPROOFED SLABS**
Construction Details and Finishes

FLOORS AND FLOOR FINISHES
Terrazzo Floor Construction Details

Monolithic Terrazzo

SAND CUSHION TERRAZZO

BONDED TO CONCRETE

“L” Type Strip

Terrazzo Over Wood

STRUCTURAL TERRAZZO SYSTEMS
FLOORS AND FLOOR FINISHES
Terrazzo Floor Construction Details

**SAND CUSHION TERRAZZO OVER PRECAST CONCRETE TYPE DECK**

**TERRAZZO OVER CORRUGATED METAL TYPE FLOOR**

**TERRAZZO OVER CELL TYPE FLOOR**

**EPOXY, POLYESTER, TERRAZZO FLOOR & BASE**

**POLYACRYLATE TERRAZZO FLOOR & BASE**

---

Diagram of Terrazzo Floor Construction Details

Dividers and joints are indicated with specific details such as minimum thickness, grout, and isolation membranes.

Fig. 5

- **Slab Control Joint**
- **Isolation Joint**

---

Fig. 5 Angle or "L" Strip
Two Strips Positioned
Back to Back Directly over saw cuts
Construction Details and Finishes

Floors and Floor Finishes

Terrazzo Base Details

Precast Terrazzo Base

Poured Terrazzo Base

Flush Type

Wall Finish

Metal Base Bead

1/2" Terrazzo

1/4" Underbed

R = 1" or 1 1/2"

The Terrazzo base height should be 6 inches or more to use this detail.

Shadow Type

Terrazzo Base

2 layers
Sheet Rock
Metal Base Bead
2/3" Terrazzo
Underbed
Galv. Metal Lath anchored to steel studs
R=1" or 1 1/2"

Note: Provide Dimension In
Space Indicated "Varies"

Vertical Terrazzo

Scale 3'-1/8"

Splay Type

PROJECTING Type

Note: Provide Dimension In
Space Indicated "Varies"

Solid Partitions

Scale 2'-1/8"
PRE-CAST TERRAZZO STAIRS

NOTE: Abrasive inserts should be positioned 1/16 inch higher than Terrazzo surface.

POURED TERRAZZO STAIRS

Steel Pan-Type

Tread on Steel Stairs

VERTICAL RUSTIC TERRAZZO

TEXTURED MOSAIC

Epoxy, Polyester or Polyacrylate
Construction Details and Finishes

FLOORS AND FLOOR FINISHES
Ceramic Tile, Terrazzo, and Brick

CERAMIC TILE SET IN MORTAR

CERAMIC TILE SET IN ADHESIVE

CERAMIC TILE SET IN DRY-SET MORTAR

CERAMIC TILE
FLOORS AND FLOOR FINISHES

Marble, Resilient Tile, Slate, Wood, and Quarry Tile

**MORTAR BED METHOD**

- Slate Flooring, Natural Cleft Face and Bottom
- Grouted Joints, 2 Parts Fine Silica Sand to 1 Part Cement
- Waterproof Membrane or Concrete Board on Plywood Subfloor
- Concrete Slab
- Floor Joist

**THINSET METHOD**

- Slate Flooring, Natural Cleft Face and Gauged Bottom
- Acrylic Latex Grout, Can Be Tight Joint When Slate is 1/4"
- Plywood or Concrete Board-to-Plywood Subfloor
- Concrete Slab
- Floor Joist

**QUARRY TILE**

- Slate Flooring, Natural Cleft Face and Bottom
- Mortar Bed
- Structural Slab

**RESILIENT TILING**

- Resilient Tiling, Set in Felt Paper as Per Manufacturer's Specifications
- Structural Slab

**WOOD FLOORING**

- Wooden Flooring
- Structural Slab

**STONE FLOORING**

- Stone Flooring
- Structural Slab
Construction Details and Finishes

FLOORS AND FLOOR FINISHES

Wood Floor Construction Details

- **Wood Floor Over Pre-Cast Gypsum Base and Ceiling — Wood Joists**
- **Cement Floor Over Pre-Cast Gypsum Base and Ceiling — Wood Joists**
- **Tile Floor on Flat-Top and Bevelled Wood Joists**
- **Sound-Control With Staggered Joists and Sub-Flooring**
- **Sound-Control With Insulation Blanket Between Rough and Finished Flooring**
- **Sound-Control With Insulation Blanket**

- **Partition Over Partition Parallel With Joists**
- **Partition Not Over Partition — On Double Joists**
- **Partition Over Partition At Right Angles To Joists**
FLOORS AND FLOOR FINISHES
Wood Strip Floor Construction Details

Perhaps the most widely used pattern is a 3/16- by 2 1/4-in strip flooring. These strips are laid lengthwise in a room and normally at right angles to the floor joists. Some type of a subfloor of diagonal boards or plywood is normally used under the finish floor. Strip flooring of this type is tongued-and-grooved and end-matched (Fig. 6). Strips are random length and may vary from 2 to 18 ft or more. End-matched strip flooring in 3/16-in thickness is generally hollow backed (Fig. 6A). The face is slightly wider than the bottom so that tight joints result when flooring is laid. The tongue fits tightly into the groove to prevent movement and floor "squeaks." All of these details are designed to provide beautiful finished floors that require a minimum of maintenance.

Another matched pattern may be obtained in 3/8- by 2-in size (Fig. 6B). This is commonly used for remodeling work or when subfloor is edge-blocked or thick enough to provide very little deflection under loads.

Square-edged strip flooring (Fig. 6C) might also be used occasionally. It is usually 3/8 by 2 inches in size and is laid up over a substantial subfloor. Facenailing is required for this type.

Fig. 6 Types of strip flooring: A, side- and end-matched — 3/16-in; B, thin flooring strips — matched; C, thin flooring strips — square-edged.

Fig. 7 Application of strip flooring: A, general application; B, starting strip.
### FLOORS AND FLOOR FINISHES

#### Wood Parquet Patterns

<table>
<thead>
<tr>
<th>PRODUCT DESCRIPTION AND PATTERN</th>
<th>PANEL SIZE</th>
<th>GRADE</th>
<th>SPECIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>STANDARD Pattern Unfinished—pecan-faced</td>
<td>5/16&quot; x 19&quot; x 19&quot;</td>
<td>Select &amp; Better</td>
<td>Cherry, Maple, Red Oak, White Oak, Cedar, Pecan, Walnut, Oak, Pecan, Oak, Red Oak, White Oak, Pecan</td>
</tr>
<tr>
<td>STANDARD Pattern Unfinished—Webback or Mesh-Back</td>
<td>5/16&quot; x 19&quot; x 19&quot;</td>
<td>Select &amp; Better</td>
<td>Pecan, Oak, Red Oak, White Oak</td>
</tr>
<tr>
<td>STANDARD Pattern Unfinished—Webback (For Industrial Use)</td>
<td>5/16&quot; x 1&quot; x 1&quot;</td>
<td>Select &amp; Better</td>
<td>Red Oak, White Oak, Pecan</td>
</tr>
<tr>
<td>STANDARD Pattern Unfinished—Webback (For Industrial Use)</td>
<td>11/16&quot; x 11&quot; x 11&quot;</td>
<td>Rustic</td>
<td>Red Oak, White Oak</td>
</tr>
<tr>
<td>STANDARD Pattern Factory-Finished and Unfinished (Available in various colors)</td>
<td>5/16&quot; x 6-1/2&quot; x 6-1/2&quot;</td>
<td>Select &amp; Better</td>
<td>White Oak, Pecan, Oak</td>
</tr>
<tr>
<td>STANDARD Pattern Factory-Finished and Unfinished (Available in various colors)</td>
<td>5/16&quot; x 6/32&quot;</td>
<td>Pre-Finished</td>
<td>Black Walnut, Oak, Pecan, Red Oak, White Oak</td>
</tr>
<tr>
<td>ANTIQUE TEXTURED (Factory-Finished and Unfinished)</td>
<td>5/16&quot; x 6/32&quot;</td>
<td>Pre-Finished</td>
<td>Red Oak, White Oak</td>
</tr>
<tr>
<td>ANTIQUE TEXTURED (Factory-Finished and Unfinished)</td>
<td>5/16&quot; x 6/32&quot;</td>
<td>Pre-Finished</td>
<td>Red Oak, White Oak</td>
</tr>
<tr>
<td>MONTICELLO Pattern Unfinished—Paper-Faced—Mesh-Back</td>
<td>5/16&quot; x 6/32&quot;</td>
<td>Pre-Finished</td>
<td>Red Oak, White Oak</td>
</tr>
<tr>
<td>HADDOX HALL Pattern Unfinished—Paper-Faced—Mesh-Back</td>
<td>5/16&quot; x 6/32&quot;</td>
<td>Pre-Finished</td>
<td>Red Oak, White Oak</td>
</tr>
<tr>
<td>HERRINGBONE Pattern Unfinished—Paper-Faced—Mesh-Back</td>
<td>5/16&quot; x 6/32&quot;</td>
<td>Pre-Finished</td>
<td>Red Oak, White Oak</td>
</tr>
<tr>
<td>SAXONY Pattern Unfinished—Paper-Faced—Mesh-Back</td>
<td>5/16&quot; x 6/32&quot;</td>
<td>Pre-Finished</td>
<td>Red Oak, White Oak</td>
</tr>
<tr>
<td>CANTERBURY Pattern Unfinished—Paper-Faced—Mesh-Back</td>
<td>5/16&quot; x 6/32&quot;</td>
<td>Pre-Finished</td>
<td>Red Oak, White Oak</td>
</tr>
<tr>
<td>RHYOMBUS Pattern Unfinished—Paper-Faced—Mesh-Back</td>
<td>5/16&quot; x 6/32&quot;</td>
<td>Pre-Finished</td>
<td>Red Oak, White Oak</td>
</tr>
<tr>
<td>BASKET WEAVE Pattern Unfinished—Paper-Faced—Mesh-Back</td>
<td>5/16&quot; x 6/32&quot;</td>
<td>Pre-Finished</td>
<td>Red Oak, White Oak</td>
</tr>
<tr>
<td>ITALIAN DOMINO Pattern Unfinished—Paper-Faced—Mesh-Back</td>
<td>5/16&quot; x 6/32&quot;</td>
<td>Pre-Finished</td>
<td>Red Oak, White Oak</td>
</tr>
</tbody>
</table>

#### FLOOR AND FLOOR FINISHES

- **Product Description and Pattern**
- **Panel Size**
- **Grade**
- **Species**
Construction Details and Finishes

FLOORS AND FLOOR FINISHES

Wood Floor Patterns

Pattern #1
Same length of any size

Pattern #2
Same length of any size

Pattern #3
Same length of any size

Pattern #4
Same length of any size

Pattern #5
Same length of any size

Pattern #6
Same length of any size

Pattern #7
Same length of any size

Pattern #8
Same length of any size

Pattern #9
Same length of any size

Pattern #10
36" and 18" lengths

Pattern #11
36" and 18" lengths

Pattern #12
Same length of any size

Pattern #13
36" and 9" lengths

Pattern #14
9" lengths

Pattern #15
16" and 9" lengths

Pattern #16
18" lengths

Pattern #17
36" and 9" lengths

Pattern #18
9" lengths

Pattern #19
36" and 9" lengths

Pattern #20
18" and 9" lengths

Pattern #21
36" and 27" lengths

Pattern #22
27" and 9" lengths

Pattern #23
Same length of any size

Pattern #24
36" and 9" lengths

Pattern #25
36" and 9" lengths

Pattern #26
36" and 9" lengths

Pattern #27
18" and 9" lengths

Pattern #28
36" and 9" lengths

Pattern #29
9" lengths

Pattern #30
27" and 9" lengths
Construction Details and Finishes

FLOORS AND FLOOR FINISHES
Wood Parquet and Plank Floor Patterns

5/16" x 13-1/16" x 13-1/16"

5/16" x 13-1/16" x 13-1/16"

5/16" x 15-1/8" x 15-1/8"

5/16" x 10" x 10"

3/4" x 3¼", 5", & 7"

3/4" x 3½", & 7½"

3/4" thick design formed with 6" x 6" blocks and 2¼" x 14-1/4" planks

3/4" x 2-1/4" single slat.

3/4" x 3" single slat.
Lengths: 6", 9", 12", 15", 18"

3/4" x 16" x 15"

3/4" x 16" x 16" Units

5/16" x 14-1/8" x 16-1/8"

Set Length: 4-3/4"x

5/16" x 15-1/4" x 18-1/8"

Set Length: 5-1/2"
Wood Floor Over Concrete With Underlayer of Nailing Concrete

Finished Floor Directly on Sleepers Set in Mastic Cement & Nailed to Concrete

Wood Block Floor Over Concrete

Cork Tile Floor Over Concrete

Wood Floor Applied Over Earth
Sound insulation between an upper floor and the ceiling of a lower floor not only involves resistance of airborne sounds but also that of impact noises. Thus, impact noise control must be considered as well as the STC value. Impact noise is caused by an object striking or sliding along a wall or floor surface, such as by dropped objects, footsteps, or moving furniture. It may also be caused by the vibration of a dishwasher, bathtub, food-disposal apparatus, or other equipment. In all instances, the floor is set into vibration by the impact or contact and sound is radiated from both sides of the floor.

A method of measuring impact noise has been developed and is commonly expressed as the impact noise ratings (INR). The greater the positive value of the INR, the more resistant is the floor to impact noise transfer. For example, an INR of $-2$ is better than one of $-17$, and one of $+5$ INR is a further improvement in resistance to impact noise transfer.

Figure 8 shows STC and approximate INR values for several types of floor constructions. Figure 8A, perhaps a minimum floor assembly with tongued-and-grooved floor and 9/8 in. gypsum board ceiling, has an STC value of 30 and an approximate INR value of $-18$. This is improved somewhat by the construction shown in Fig. 8B, and still further by the combination of materials in Fig. 8C.

The value of isolating the ceiling joists from a gypsum lath and plaster ceiling by means of spring clips is illustrated in Fig. 8A. An STC value of 30 and an approximate INR value of $-18$ result.

ASound-rubber padding and carpeting improve both the STC and the INR values. The STC value increases from 31 to 45 and the approximate INR from $-17$ to $+6$ (Fig. 8B and 8C). This can likely be further improved by using an isolated ceiling finish with spring clips. The use of sound-deadening board and a lamination of gypsum board for the ceiling would also improve resistance to sound transfer.

An economical construction similar to (but an improvement over) Fig. 8C, with a STC value of 48 and an approximate INR of $+18$, consists of the following: (a) a pad and carpet over 3/4-in. tongued-and-grooved plywood underlayment, (b) 3-in. fiberglass insulating

### Table

<table>
<thead>
<tr>
<th>DETAIL</th>
<th>DESCRIPTION</th>
<th>STC RATING</th>
<th>APPROX. INR</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Floor Plan A" /></td>
<td>FLOOR 7/8 G. FLOORING + 9/8 GYPSUM BOARD</td>
<td>30</td>
<td>-18</td>
</tr>
<tr>
<td><img src="image" alt="Floor Plan B" /></td>
<td>FLOOR 3/4 SUBFLOOR + 3/4 FINISH FLOOR + 3/4 FIBERBOARD</td>
<td>42</td>
<td>-12</td>
</tr>
<tr>
<td><img src="image" alt="Floor Plan C" /></td>
<td>FLOOR 3/4 SUBFLOOR + 3/4 FINISH FLOOR + 1/2 FIBERBOARD LATH + 3/4 GYPSUM PLASTER + 3/4 FIBERBOARD</td>
<td>45</td>
<td>-4</td>
</tr>
</tbody>
</table>

Fig. 8 Relative Impact and sound transfer in floor-ceiling combinations (2- by 8-in. joists).
batts between joists, (c) resilient channels spaced 24 in apart, across the bottom of the joists, and (d) ¾-in gypsum board screwed to the bottom of the channels and finished with taped joints.

The use of separate floor joists with staggered ceiling joists below provides reasonable values but adds a good deal to construction costs. Separate joists with insulation between and a soundboard between subfloor and finish provide an STC rating of 53 and an approximate INR value of -3.

**Sound absorption** Design of the "quiet" house can incorporate another system of sound insulation, namely, sound absorption. Sound-absorbing materials can minimize the amount of noise by stopping the reflection of sound back into a room. Sound-absorbing materials do not necessarily have resistance to airborne sounds. Perhaps the most commonly used sound-absorbing materials is acoustic tile. Wood fiber or similar materials are used in the manufacture of the tile, which is usually processed to provide some fire resistance and designed with numerous tiny sound traps on the tile surfaces. These may consist of tiny drilled or punched holes, fissured surfaces, or a combination of both.

Acoustic tile is most often used in the ceiling and areas where it is not subjected to excessive mechanical damage, such as above a wall wainscoating. It is normally manufactured in sizes from 12 by 12 to 12 by 48 in. Thicknesses vary from ½ to ¾ in, and the tile is usually factory finished ready for application. Paint or other finishes which fill or cover the tiny holes or fissures for trapping sound will greatly reduce its efficiency.

Acoustic tile may be applied by a number of methods — to existing ceilings or any smooth surface with a mastic adhesive designed specifically for this purpose, or to furring strips nailed to the underside of the ceiling joists. Nailing or stapling tile is the normal application method in this system. It is also used with a mechanical suspension system involving small "H," "Z," or "T" members. Manufacturers' recommendations should be followed in application and finishing.

<table>
<thead>
<tr>
<th>DETAIL</th>
<th>DESCRIPTION</th>
<th>STC RATING</th>
<th>APPROX. INR</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Diagram A" /></td>
<td>2 x 10 in 3/4&quot; SUBFLOOR (BUILDING PAPER) 3/4&quot; FINISH FLOOR CEILING GYPSUM LATH AND SPRING CLIPS ½&quot; GYPSUM PLASTER</td>
<td>52</td>
<td>-2</td>
</tr>
<tr>
<td><img src="image2" alt="Diagram B" /></td>
<td>2 x 10 in 5/8&quot; PLYWOOD SUBFLOOR ½&quot; PLYWOOD UNDERLAYERMENT ½&quot; VINYL-ASBESTOS TILES CEILING ½&quot; GYPSUM WALLBOARD</td>
<td>31</td>
<td>-17</td>
</tr>
<tr>
<td><img src="image3" alt="Diagram C" /></td>
<td>2 x 10 in 5/8&quot; PLYWOOD SUBFLOOR ½&quot; PLYWOOD UNDERLAYERMENT FOAM RUBBER PAD 3/8&quot; NYLON CARPET CEILING ½&quot; GYPSUM WALLBOARD</td>
<td>45</td>
<td>-5</td>
</tr>
</tbody>
</table>

Fig. 9 Relative impact and sound transfer in floor-ceiling combinations (2- by 10-in joists).
### Conventional Wood Floor Joist Systems for Sound Control

<table>
<thead>
<tr>
<th>Floor System</th>
<th>Floor Number</th>
<th>Floor Covering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>1</td>
<td>1/8&quot; vinyl asbestos tile on 1/4&quot; plywood underlayment</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>.075&quot; vinyl sheet on 3/8&quot; plywood underlayment</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Carpet and pad directly over subfloor</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>3/8&quot; oak strip floor over subfloor</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Carpet and pad added to No. 4</td>
</tr>
<tr>
<td>Conventional</td>
<td>6</td>
<td>Wood block (3/8&quot;) laminated to underlayment</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Carpet and pad</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Vinyl flooring laminated to underlayment applied over sound board with 4-inch circular gobs of glue</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Vinyl covering like 8 with sleepers glued between sound board and underlayment</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Oak strip flooring (3/8&quot;) nailed to 2x3 sleepers glued over sound board strips 3/8&quot; glass fiber between sleepers</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Vinyl flooring (0.07&quot;) on 3/8&quot; T&amp;G plywood underlayment glued to 2x2 sleepers glued to subfloor 16&quot; o.c. Sand fill over subfloor to depth of sleepers (11/8&quot;). Balance as in basic construction</td>
</tr>
<tr>
<td>Conventional</td>
<td>12</td>
<td>Ceiling nailed to joists; no absorptive material; with carpet and pad</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Ceiling nailed to joists; 3&quot; glass fiber with carpet and pad</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Basic construction—(no floor covering) with carpet and pad</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>Add 1/2&quot; sound board between concrete and subfloor with vinyl tile with carpet and pad</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>Basic construction—but with 3/4&quot; thick gypsum concrete in place of 13/8&quot; thick cellular concrete; 3/8&quot; gypsum ceiling without floor covering</td>
</tr>
</tbody>
</table>

The improved resistance to airborne sound transmission gained by isolating the ceiling with resilient channels and adding absorptive material is evident by comparing Floors 2 to 3 with No. 1. A 10-point increase in STC reduces the loudness of transmitted noise by one-half. Improved resistance to impact noise transmission is gained by adding carpet and pad as is evident by comparing Floor No. 3 with No. 2 or Floor No. 5 with 4. An R/C of 51 is often recommended as an acceptable level of impact insulation.
**Standard toe base**

No-toe base: Adds a decorative touch to carpeted interiors.

Butt toe base: Engineered to butt precisely to 1/4" floor coverings.

Long toe base: For special applications. Features a longer toe extending 1" to cover wide irregularities between floor and wall.

**TABLE 1  Cove Base Specifications**

<table>
<thead>
<tr>
<th>Type</th>
<th>Sizes available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard toe base</td>
<td>2 1/4&quot; 4&quot; 6&quot;</td>
</tr>
<tr>
<td>No-toe base</td>
<td>2 1/2&quot; 4&quot; 6&quot;</td>
</tr>
<tr>
<td>Butt toe base</td>
<td>4&quot; 6&quot;</td>
</tr>
<tr>
<td>Long toe base</td>
<td>4&quot;</td>
</tr>
</tbody>
</table>

Length: 48"

**TABLE 2  Corner Specifications**

<table>
<thead>
<tr>
<th>Type</th>
<th>Length of return</th>
<th>Sizes available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside/outside</td>
<td>2 1/4&quot;</td>
<td>2 1/4&quot; 4&quot; 6&quot;</td>
</tr>
<tr>
<td>Underlap outside</td>
<td>3&quot; (with underlap)</td>
<td>4&quot;</td>
</tr>
<tr>
<td>No-toe outside</td>
<td>2 1/4&quot;</td>
<td>2 1/4&quot; 4&quot;</td>
</tr>
<tr>
<td>Long toe outside</td>
<td>2 1/4&quot;</td>
<td>4&quot;</td>
</tr>
</tbody>
</table>
Ceramic Tile Patterns

Unglazed quarry tile

- 6" X 6"
- 6" hexagon
- 4" X 4"
- 2½" X 2½"
- 2½" X 3" (hexagon)
- 3" X 8"
- 8" X 8"
- 8" X 10" (Valencia)

Thickness from ¼" to 1¼"

Ceramic glazed tile

- 2" hexagon
- 2" X 2" (hexagon)
- 2" X 1" (square)
- 1" X 1"
- 4" X 4"
- 1½" X 1½"
- 4½" octagon
- 6" X 4½"

Thickness from ¼" to ⅝"

Fig. 10 Ceramic tile shapes.

Fig. 11 Ceramic tile patterns.
Serpentine Circles (8 ft. Module) Quantity for 100 sq. feet: 3.5 pcs circle, 76 pcs small wedge, 288 pcs medium wedge, 600 pcs large wedge

Meandering Serpentine Quantity for 100 sq. feet: 3 pcs circle, 76 pcs small wedge, 288 pcs medium wedge, 600 pcs large wedge

Serpentine Fan Quantity for 100 sq. feet: 106 pcs. small wedge, 290 pcs medium wedge, 484 pcs large wedge
Fig. 12 1 x 1 overall patterns.
Fig. 13  1 x 1 six-inch borders.

Fig. 14  1 x 1 twelve-inch borders.
Fig. 18 1" hex overall patterns. All patterns master-set 12" × 24" sheets.
Due to the complexity of mounting 1" Hexagon border pattern corners which require a number of special sheets on smaller jobs, a premium charge is made. To avoid this, it is suggested that on smaller jobs the border be formed using 1" squares with a hexagon field.

If a Hexagon border is required, you must provide a plan of the area with dimensions because the Hexagon configuration precludes interchanging sheets. We will provide specific sheets for those areas and setting plans.

Note that on three of these border patterns a full sheet is used for the corner. Some designs, however, will require a half sheet for the corner as shown in SB-1404. In this case a right and left corner will be on one sheet and the sheet is cut in half before placement.

Fig. 16 1" hex border patterns. All patterns master-set 12" × 24" sheets.
Ceramic Tile Patterns

**Single sheet repeat pattern. Repeat for overall pattern.**

**Three sheet repeat pattern. Three different sheets complete the pattern, then repeat throughout.**

Fig. 17 1" hex overall patterns. All patterns master-cut 12" x 24" sheets.
### Floors

#### Cement Mortar

**Recommended use**
- Over all wood floors that are structurally sound.

#### Organic Adhesive

**Recommended use**
- Over wood floors exposed to residential traffic only.

#### Wood Subfloor

**Epoxy Mortar and Grout**

**Recommended uses**
- Over wood floors where resistance to foot traffic in better residential, normal commercial, and light institutional use is desired with thin-set construction.
- Where water, chemical, and stain resistance is desired.
- For tilework exposed to prolonged high temperatures, use high temperature, chemical resistant epoxy mortar, and grout.

### Stairs

#### Cement Mortar

**Recommended use**
- Over wood floors.

#### Concrete Stairs

**Recommended uses**
- Over structurally sound plywood where lightweight construction is a factor.
- Where water resistance is desired.
- Eliminates necessity of recessing subfloor to accommodate portland cement mortar bed.

#### Metal Stairs

**Recommended uses**
- Over a mortar bed.
- Over glass mesh mortar units.
- Over clean, sound, dimensionally stable concrete.
- Over metal lath attached directly to the bottom of wood joists or trusses; spacing not to exceed 16" on center.

#### Wood Stairs

**Recommended uses**
- Over clean, sound, dimensionally stable concrete.
- Over glass mesh mortar units.
- Over a mortar bed.

#### Ceilings, Soffits

**Recommended uses**
- Over structurally sound plywood where lightweight construction is a factor.
- Where water resistance is desired.
- Eliminates necessity of recessing subfloor to accommodate portland cement mortar bed.
CERAMIC TILE on Concrete Slab Floor Construction Details

**Concrete Subfloor**

**Cement Mortar**
- Cleavage Membrane

**Recommended use**
- over structural floors subject to bending and deflection
- reinforcing mesh mandatory
- motor bed thickness to be uniform, nominal 1/4" thick

**Organic Adhesive or Epoxy Adhesive**

**Recommended use**
- with tile set by Method F111 requiring good stain resistance and resistance to erosion caused by occasional contact with mild chemicals such as found in commercial dining areas, photographic dark rooms, public toilets, public foyers, etc.
- for use with quarry tile and paver tile

**Waterproof Membrane**

**Cement Mortar Bed**

**Recommended use**
- wherever a waterproof interior floor is required in conjunction with ceramic tile installed on a portland cement mortar bed

**Thin-Set**

**Recommended use**
- wherever a waterproof interior floor is required in conjunction with ceramic tile installed in a thin-set method

**Dry-Set Mortar or Latex-Portland Cement Mortar**

**Recommended uses**
- on slab-on-grade construction where no bending stresses occur
- on properly cured structural slabs where deflection does not exceed 1/360 of span
- on properly cured structural slabs of limited area
Construction Details and Finishes

Floors and Floor Finishes

Ceramic Tile on Concrete Slab Floor Construction Details

Recommended uses:
- for setting and grouting ceramic mosaics, quarry tile, and paver tile
- for setting and grouting ceramic mosaics, quarry tile, and paver tile
- for tilework exposed to prolonged high temperatures, use high-temperature, chemical-resistant epoxy mortar and grout

Recommended uses:
- where leveling of subfloor is required
- where leveling of subfloor is required
- where moderate chemical exposure and severe cleaning methods are used, such as in commercial kitchens, dairies, breweries, food processing plants, etc.
- where moderate chemical exposure and severe cleaning methods are used, such as in commercial kitchens, dairies, breweries, food processing plants, etc.

Recommended uses:
- for setting and grouting house tile in areas of continuous or severe chemical exposure where special protection against leakage or damage to concrete subfloor is required

Recommended uses:
- for setting and grouting quarry tile and paver tile
- for setting and grouting quarry tile and paver tile

Recommended uses:
- in kitchens, chemical plants, etc.
- in kitchens, chemical plants, etc.

Expansion Joints

Vertical and Horizontal

Use these details for control, contraction, and isolation joints
FLOORS AND FLOOR FINISHES

Raised Computer Room Floors

Typical Elevated Floor

Elevated Floor Against Masonry Wall

Elevated Floor - A Continuation of Existing Floor

Partition Edge of Elevated Floor

Air Grille
Construction Details and Finishes

DOORS
Hollow Metal Door Construction

The design, specification, and detailing of a door can have serious consequences for functional considerations such as accessibility and sound transmission. The door is also one of the most important architectural elements with respect to design image and aesthetics. A door can be a major part of design expression: a monumental door to a church or synagogue, the main entrance to a residence, the doors to a corporate board room—all of these doors have symbolic importance.

Doors come in a variety of standard heights, widths, and thicknesses, yet they may also be custom designed, assume a variety of shapes and forms, and be constructed with a variety of materials. The design, specification, and detailing of a door is, in fact, a rather complex task.

A door is typically set within a frame or jamb, but may also be installed within a wall without a frame or jamb. The frame/jamb interface between door and wall partition is another area requiring special attention by the designer.

The design of a door is never complete without the specification of hardware. Hinges, locksets, closers, stops, and thresholds are but a few of the hardware elements that a designer must consider.

This section on doors provides the designer with extensive information on door types, materials, door frames, and materials and methods of door construction and installation. Details show doors and frames installed in all types of walls and partitions, including wood and metal stud, masonry, concrete, and glass.

Of special interest to the designer are examples of less standard door types such as elevator doors, sliding pocket doors, and fabric-covered doors. The majority of the details in this section are taken from the actual working drawings of successfully executed projects.

PANEL CONSTRUCTION

There are two basic types of panel construction:

- Steel stiffened: Face sheets supported by steel stiffeners, which are channels, Z-shaped sections, hat-shaped sections, or similar members, positioned vertically. Sheets are attached to these members by spot welding.
- Laminated core: Sandwich construction employing a core of impregnated kraft paper honeycomb, plastic foam, or structural mineral blocking, to which the steel face sheets are laminated, using a structural adhesive.

STEEL STIFFENERS

LAMINATED CONSTRUCTIONS

CHANNEL

ZEE

OFFSET CHANNEL

HAT SECTIONS

HAT SECTIONS

REPRESENTATIVE STIFFENER SECTIONS

Other sections used by some manufacturers
Types of Construction

The four basic types of construction for hollow metal swing doors are illustrated and identified in Fig. 1. The type usually specified in commercial work is the continuously welded edge seam construction, Type A, and it is this type which is the basis of NAAMM Standard HMMA 861.

Most custom hollow metal doors are of the full flush type with continuously welded edges (Type A). When glazed openings, recessed panels, or louvers are to be provided, they are built into the door during fabrication, rather than being cut out of a flush panel door by field modification.

Fire-rated doors may differ in certain details of construction; see NAAMM Standard HMMA 860, Fire-Rated Hollow Metal Doors and Frames.

---

**Fig. 1** The top edge of Types A and B doors may have only an inverted channel (standard construction) or may have an additional closing channel. Types C and D have tubular rails and stiles, with no edge seams. \( S \) = stile (hinge stile is stile at edge where hinges or pivots are located; lock stile is stile in which a lock or latch is installed; and meeting stile is stile adjacent to another door, in a pair of doors). \( TR \) = top rail, \( CR \) = center rail, \( BR \) = bottom rail, \( P \) = panel, \( P/G \) = panel or glass.
### DOORS

#### Hollow Metal Door Types

**DIMENSIONS AND HINGE LOCATIONS**

Hinge locations shown represent the industry standard, but may be altered to suit requirements.

**MOST COMMON SIZES FOR 1¼-INCH THICK DOORS**

<table>
<thead>
<tr>
<th>Width of Opening</th>
<th>Height of Opening</th>
</tr>
</thead>
<tbody>
<tr>
<td>2’0”</td>
<td>6’8”</td>
</tr>
<tr>
<td>2’4”</td>
<td>6’8”</td>
</tr>
<tr>
<td>2’8”</td>
<td>6’8”</td>
</tr>
<tr>
<td>3’0”</td>
<td>6’8”</td>
</tr>
<tr>
<td>3’4”</td>
<td>6’8”</td>
</tr>
<tr>
<td>3’6”</td>
<td>6’8”</td>
</tr>
<tr>
<td>3’8”</td>
<td>6’8”</td>
</tr>
<tr>
<td>4’0”</td>
<td>6’8”</td>
</tr>
</tbody>
</table>

*Sizes shown are for single doors only; for pairs of doors, use twice the width indicated.

**OTHER DOOR SIZES:** The sizes listed are those most commonly used, but custom hollow metal doors are available in any width, height and thickness desired. It is not uncommon to supply them in widths of 5' or more and/or heights of 10' or more. Standard doors, on the other hand, are generally available from inventory only in the most commonly used sizes.

**LISTING DESIGNATION:** Always preface the door listing with “SGL” or “PR,” followed by the designation of the opening size. For example, a single flush door for a 4’0” × 8’0” frame opening is listed SGL 4080F, and a pair of flush doors for an 8’0” × 8’0” frame opening is listed as PR 8080F.

**REPRESENTATIVE DOOR DESIGNS**

<table>
<thead>
<tr>
<th>G3</th>
<th>FV4</th>
<th>FNLV</th>
<th>FNV2</th>
<th>FMV</th>
<th>FRV</th>
<th>FDV</th>
<th>FOV</th>
<th>FCV</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG2L</td>
<td>FG3L</td>
<td>1G</td>
<td>1G3</td>
<td>1G6</td>
<td>L1</td>
<td>L2</td>
<td>FDG1</td>
<td>FD</td>
</tr>
</tbody>
</table>

| F | FL | FV | FVL | FNV | FNLV | FG | FGL | FG4 |

**NOTE:** Some manufacturers may use differing designations for some designs.
TYPICAL HARDWARE PREPARATION

A. BUTT HINGE
- 1/4" (6.4 mm) mild. backset
- continuously welded
- invisible seam

B. TOP PIVOT
- 14 ga. plates
- lock support clips

C. INTERMEDIATE PIVOT
- 7 ga. offset plate
- cutout for pivot arm

D. BOTTOM PIVOT
- 7 ga. plate welded to bottom channel
- may be drilled, for some types of pivot

E. CYLINDER LOCK
- 18 ga. channels
- flush with cutout

F. UNIT LOCK
- cutout for pivot arm

G. MORTISE LOCK
- 12 ga. offset clip

H. MORTISED CLOSER (CONCEALED IN DOOR)
- 7 ga. plate welded to top channel
- cutout for closer as req'd.

KEY ELEVATIONS
- 9 ga. offset clip
- top channel

NOTE: CUTOUTS AND/OR REINFORCEMENTS OF SIMILAR NATURE ARE PROVIDED FOR ALL OTHER HARDWARE ITEMS SUCH AS FLUSH BOLTS, SURFACE-MOUNTED CLOSERS, FIRE EXIT HARDWARE, PULLS, ETC.
### DOOR SCHEDULE

<table>
<thead>
<tr>
<th>Opening Number</th>
<th>Type</th>
<th>Material</th>
<th>Nominal Size*</th>
<th>Sill Detail</th>
<th>Louver</th>
<th>Glass</th>
<th>Special Detail</th>
<th>Type</th>
<th>Material</th>
<th>Jamb</th>
<th>Head</th>
<th>Sill</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>F</td>
<td>HM</td>
<td>3-0 7-0 1⅝</td>
<td>⅝</td>
<td>5/8</td>
<td>—</td>
<td></td>
<td>1</td>
<td>HM</td>
<td>7/16</td>
<td>7/16</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>102</td>
<td>IG</td>
<td>AL</td>
<td>2 6-0 8-0 1⅛</td>
<td>⅛</td>
<td>⅛</td>
<td>—</td>
<td>TEMP</td>
<td>2</td>
<td>AL</td>
<td>⅝</td>
<td>⅝</td>
<td>—</td>
<td>8</td>
</tr>
<tr>
<td>103</td>
<td>FGL</td>
<td>WD</td>
<td>1 3-0 7-0 1¾</td>
<td>⅜</td>
<td>⅜</td>
<td>—</td>
<td>⅝</td>
<td>1</td>
<td>HM</td>
<td>7/16</td>
<td>7/16</td>
<td>—</td>
<td>4</td>
</tr>
<tr>
<td>104</td>
<td>FG</td>
<td>HM</td>
<td>1 3-0 7-0 1⅔</td>
<td>⅜</td>
<td>⅜</td>
<td>—</td>
<td>⅝</td>
<td>1</td>
<td>HM</td>
<td>7/16</td>
<td>7/16</td>
<td>—</td>
<td>C</td>
</tr>
<tr>
<td>105</td>
<td>FV</td>
<td>HM</td>
<td>3 4-0 7-0 1¾</td>
<td>⅜</td>
<td>⅜</td>
<td>—</td>
<td>⅝</td>
<td>3</td>
<td>HM</td>
<td>7/16</td>
<td>7/16</td>
<td>—</td>
<td>1</td>
</tr>
<tr>
<td>106</td>
<td>F</td>
<td>HM</td>
<td>2 7-0 7-0 1⅞</td>
<td>⅜</td>
<td>⅜</td>
<td>—</td>
<td>—</td>
<td>2</td>
<td>HM</td>
<td>7/16</td>
<td>7/16</td>
<td>—</td>
<td>A</td>
</tr>
<tr>
<td>107</td>
<td>FL</td>
<td>HM</td>
<td>1 3-0 7-0 1¾</td>
<td>⅜</td>
<td>⅜</td>
<td>—</td>
<td>⅝</td>
<td>3</td>
<td>HM</td>
<td>7/16</td>
<td>7/16</td>
<td>—</td>
<td>7</td>
</tr>
<tr>
<td>108</td>
<td>F</td>
<td>WD*</td>
<td>1 2-10 7-0 1⅛</td>
<td>⅜</td>
<td>⅜</td>
<td>—</td>
<td>⅝</td>
<td>1</td>
<td>HM</td>
<td>7/16</td>
<td>7/16</td>
<td>—</td>
<td>4</td>
</tr>
<tr>
<td>109</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>110</td>
<td>FGL</td>
<td>HM</td>
<td>1 3-0 7-0 1¾</td>
<td>⅜</td>
<td>⅜</td>
<td>⅝</td>
<td>⅝</td>
<td>4</td>
<td>HM</td>
<td>7/16</td>
<td>7/16</td>
<td>⅝/⅝</td>
<td>⅝/⅝</td>
</tr>
<tr>
<td>111</td>
<td>F</td>
<td>HM</td>
<td>1 3-0 7-0 1¾</td>
<td>⅜</td>
<td>⅜</td>
<td>—</td>
<td>⅝</td>
<td>1</td>
<td>HM</td>
<td>7/16</td>
<td>7/16</td>
<td>—</td>
<td>2</td>
</tr>
</tbody>
</table>

*Use metric units if desired; 1 inch = 25.4 mm, 1 foot = 0.305 m.

1. **Opening Number**
   - Number all openings individually, with the numbering system reflecting floor numbers if practicable.

2. **Door Type**
   - Use alphabetical designation for types, as shown on elevation views on facing page. Elevations should show door configurations and all features such as louveres, vision lights, etc. Do not use one elevation with dash lines to indicate variations.

3. **Door Material**
   - Designate material from which door is made: HM = hollow metal; AL = aluminum; WD = wood. * Indicates special facing as noted in Remarks column. Type of core construction should be stated in specifications.

4. **Nominal Size**
   - List number of doors per framed opening, plus width, height and thickness of door. State head and jamb clearances in specifications, using Hollow Metal Manufacturers Association recommended standards unless special conditions require otherwise.

5. **Sill Detail**
   - Reference sill detail, which shows sill clearance, threshold if any, and any special condition. Reference number shows detail number first, followed by sheet number.

6. **Louver**
   - Note width and height (in inches) of louver panel. Louver types may be either specified or shown in detail drawings.

7. **Glass**
   - Note thickness and type of glass to be used in glazed opening.

8. **Special Detail**
   - Reference detail(s) showing special features such as astragal (on pair), flush door shelf, flush transom panel or other.

9. **Frame Type**
   - Use numerical designation for type, as shown on elevation views facing page.

10. **Frame Material**
    - Designate material from which frame is made, using same symbols as for door materials.

11. **Frame Sections**
    - Reference details, showing frame sections at head and jamb, and details of such members as transom bars, millions and other special features.

12. **Fire Rating**
    - State fire rating, if any, required for opening.

13. **Hardware Set**
    - State applicable hardware set number as described in specifications.

14. **Remarks**
    - Note here any special characteristics or required features of the opening, to insure that the contractor or supplier will be properly informed.
REPRESENTATIVE DETAILS ACCOMPANYING DOOR SCHEDULE

DOOR TYPES:

| F | FL | FV | FG | FGL | 1G |

FRAME TYPES:

| 1 | 2 | 3 | 4 | 5 |

DETAILS:

| 1 & 2 | 3 | 10 | 13 | 5 | 24 | 25 | 16 | 19 |
### DOORS

#### Hollow Metal Door Schedules

<table>
<thead>
<tr>
<th>Door Schedule</th>
<th>Location</th>
<th>Material</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cellar</td>
<td>Hollow Metal</td>
<td>Flush</td>
</tr>
<tr>
<td>2</td>
<td>Hallway</td>
<td>Hollow Metal</td>
<td>Flush</td>
</tr>
<tr>
<td>3</td>
<td>Entrance</td>
<td>Hollow Metal</td>
<td>Flush</td>
</tr>
<tr>
<td>4</td>
<td>Apartment</td>
<td>Hollow Metal</td>
<td>Flush</td>
</tr>
</tbody>
</table>

#### Notes:

- Hollow metal doors with flush finish.
- Steel trim and hardware.

<table>
<thead>
<tr>
<th>Door Schedule</th>
<th>Location</th>
<th>Material</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Entry</td>
<td>Hollow Metal</td>
<td>Flush</td>
</tr>
</tbody>
</table>

#### Dimensions:

- Door widths and heights vary by location.
- All doors are hollow metal with flush finishes.

### Schedule Details:

- Door sizes and dimensions are provided for each location.
- Hardware includes steel trim and hinges.
- Notes indicate specific requirements for each door type.

---

572
(a) Masonry with plaster, one or both sides

(b) Two-inch plaster wall

(c) Wood stud and plaster

(d) Two-inch solid dry wall

(e) Steel stud and plaster

(f) Masonry block. Wrap-around or butt joint

Fig. 2 Typical jamb installations.
Construction Details and Finishes

DOORS
Hollow Metal Door Frames

BACKBEND OR PLASTER STOP — See optional profiles below

BASIC DOOR FRAME PROFILES AND THEIR PARTS

any face and backbend profile

minimum flange width — \( \frac{3}{8} \)" (for 18 ga.)

BACKBENDS NEED NOT BE THE SAME ON OPPOSITE TRIM FACES — ANY COMBINATION MAY BE USED

TYPICAL BACKBEND or PLASTER STOP PROFILES

Frame depth to fit any wall thickness or finish
Any face profile may be combined with any backbend profile

splayed jamb
drywall

REPRESENTATIVE FRAME PROFILES
Construction Details and Finishes

DOORS
Hollow Metal Door Frames

WOOD STUD
MASONRY CHANNEL STUD
SOLID PLASTER
METAL WIRE STUD
WIRE LOOP (MASONRY)
STRAP & STIRRUP (MASONRY)
T-STRAP (MASONRY)

COMMON TYPES OF JAMB ANCHOR FOR PRE-SET FRAMES

WOOD STUD
WOOD STUD

TYPICAL FRAME ASSEMBLY
As shipped

STANDARD FLOOR ANCHOR

90° closed end
45° closed end
FLOOR LINE
CUTOFF (SANITARY) STOPS

ANCHORAGE OF FRAMES IN PREPARED OPENINGS

FJMS
expansion shell

1

Pipe spacer

2

mold optional

CABINET JAMB FIELD ASSEMBLED
SPLIT JAMB PRE-ASSEMBLED
FRAMES WITH ROUGH BUCK

Removable stop

3
Construction Details and Finishes

DOORS
Hollow Metal Door Frames

**FLOOR STILT**
- Terrazzo or other base mix.

**FIXED MULLION ANCHOR**
- Anchored to overhead construction.
- Frame head 14 ga.
- Cartilage bolt in keyhole slot.

**SPATS**
- Light gauge stainless steel wrap-around covering.
- May be used with either cutoff or full length stops.
- Stainless steel same thickness as frame and flush with all jamb surfaces.

**HEAD ADAPTER**
- For frames extending from slab to slab.

**CEILING STRUTS**
- 1 3/8" x 1/4" steel strap.
- Wedge.

**SOUND BARRIER FRAME**
- Lead lining in frame provides barrier to x-rays, which travel in straight line, in gap between lead-lined wall and door.

**LEAD-LINED FRAME**
- Head reinforcement should never be used in place of structural lintel.

**KEY ELEVATION**
- Alternate head sections "A".

**ALTERNATE HEAD SECTIONS "A"**
- Open ends capped at center of head.

**DETAILS OF DOUBLE EGRESS FRAME**
DOORS
Hollow Metal Door Frames

1. CONC. OR CINDER BLK

2. CONC. OR CINDER BLK

3. CONC. OR CINDER BLK
   PLASTER BOTH SIDES

4. CONC. OR CINDER BLK
   PLASTER ONE SIDE

5. CONCRETE OR CINDER BLK

6. CONCRETE OR CINDER
   BLOCK - PLASTER BOTH SIDES
Construction Details and Finishes

DOORS
Hollow Metal Door Frames

7. Cinder or conc. blk. plastered one side

8. Cinder or conc. blk. - plaster / ceramic tile in cem. mort. tile

9. Cinder or conc. blk. - plaster / ceramic tile - thin set mortar

10. Cinder or conc. blk. - plaster & ceramic tile

11. Gypsum block - plaster both sides

12. Masonry block & plaster
Construction Details and Finishes

DOORS
Hollow Metal Door Frames

[Diagrams and text]
Construction Details and Finishes

DOORS
Hollow Metal Door Frames

- Hollow Metal Door Frames
- Typical Hardwood Mullion
- Typical H.M. Mullion
Construction Details and Finishes

DOORS

Hollow Metal and Wood Door Frames
DOORS
Hollow Metal and Wood Door Types

[Diagrams of door and partition construction details]

F-19
Hollow Wood Frame

F-20
Hollow Wood Frame

F-21
Hardwood Frame

F-22
Hardwood Frame

F-23
Hardwood Frame

F-24
External Hollow Metal Frame
**FULL MORTISE BUTT HINGE**

Two equal square-edged leaves, one mortised into door edge, the other into frame rabbet. Two bearings, as shown, on regular weight hinges, four on heavy weight.

Typical Uses:
- By far the most common type of hinge for both interior and exterior hollow metal and wood swing doors, in all types of buildings.

Usual Sizes (see NOTE below):
- heights — 4 3/8"; 5" for doors over 36" w.
- widths — 4 1/2" for 1 3/4" door and 1 1/2" trim clearance (dimension A); 5" (or more) for thicker doors or larger clearances.

**HALF MORTISE BUTT HINGE**

One square-edged leaf mortised into door edge; the other leaf, bevel-edged, mounted on face of frame.

Typical Uses:
- Used with hollow metal or kalamein doors in structural channel frames, usually in industrial type buildings.

Usual Sizes:
- 4½", 5" and 6" heights.

**HALF SURFACE BUTT HINGE**

One leaf, bevel-edged, mounted on face of door; the other leaf, square-edged, mortised into frame rabbet.

Typical Uses:
- Used with hollow metal or kalamein doors in hollow metal frames, usually in industrial buildings. Heavy weight type also used on lead-lined doors.

Usual Sizes: 4½", 5" and 6" heights.

**FULL SURFACE BUTT HINGE**

Two bevel-edged leaves of differing widths, one surface-mounted on door face, the other on frame face.

Typical Use:
- Used with hollow metal or kalamein doors in structural channel frames, in industrial buildings. Heavy weight type may be used on lead-lined doors.

Usual Sizes: 4½", 5" and 6" heights.

**ANCHOR HINGE**

Heavy weight hinge with each leaf extended at its top edge and bent to form a flange that fastens to top edge of door and to frame head rabbet. May be used as top hinge on heavy doors and doors having high frequency usage.

**THRUST PIVOT UNIT AND HINGE SET**

Pivot unit for top of door, with both jamb and top plates for both door and frame. Used, with conventional butt hinges, on wide doors that may be subjected to abnormal abuse. The hinge is almost invisible when door is closed.

**PIVOT REINFORCED HINGE**

Heavy weight hinge with added pivot on the same pin. Leaves of pivot are interlocked with hinge leaves. Used with conventional butt hinges on doors subject to abnormal abuse, particularly with overhead closers.
**DOORS**

**Hollow Metal Door Hardware: Hinges**

**HOSPITAL “SWING CLEAR” TYPES**

These hinges have their pins located approximately 2” beyond the door edge, providing an unobstructed clear frame opening width when the door is open 90°.

They are used on hospital corridor doors to patients’ rooms, operating rooms, emergency rooms, or wherever a completely clear opening is required in hospitals, institutional or public buildings.

**FULL MORTISE**

Both leaves bent; one mortised into frame rabbet, the other into door edge.

**HALF MORTISE**

One bent leaf mortised into edge of door, one flat, bevel-edged leaf surface-mounted on frame face.

**HALF SURFACE**

Offset bevel-edged leaf surface-mounted on door face, bent leaf mortised into frame rabbet.

**FULL SURFACE**

Offset bevel-edged leaf surface-mounted on door face, other bevel-edged leaf surface-mounted on frame face.

**INVISIBLE HINGE**

Full mortised, centered on door thickness. Hinge is completely concealed when door is closed.

**OLIVE KNUCKLE HINGE**

(PAUMELLE HINGE SIMILAR)

Full mortised; door leaf usually centered on door thickness. When door is closed, only the knuckle is visible.
**OFFSET TYPE**
Used on single-acting doors only. Need for intermediate pivot depends upon the size, weight and usage of door; recommendation of hardware manufacturer should be followed. Pivot knuckles visible when door is closed.

Pivots are stronger and more durable than hinges and are better able to withstand the racking stresses to which doors are subjected. Their use is generally recommended on oversize doors, on heavy doors such as lead-lined doors, and on entrance doors to public buildings such as schools, theaters, banks, store and office buildings.

NOTE: Because of adjustments that must be made during the installation of doors with bottom pivots, it is recommended that reinforcements be furnished in blank and that drilling and tapping be done in the field by the contractor.

**CENTER TYPE**
Used at top and bottom of double-acting doors only. Pivots are completely invisible when door is closed.
LOCKS, LATCHES, AND DEADLOCKS

The selection of the proper lock type is very important. The types shown here are those most commonly used, but are by no means the only types available. Their names serve to identify either the type of lock construction or the type of installation. Mortise locks provide the greatest variety of lock functions, the best security, and excellent durability. Another popular type, with rugged construction and easily operated, is the preassembled lock, which is completely assembled at the factory. It does not have as many lock functions as the mortise lock, but can have a separate deadbolt. The bored lock is the least secured type and is not available with a separate deadbolt.

MORTISE LOCK

The mortise lock is so named because it is installed in a prepared recess (mortise) in the door. Working parts are contained in a rectangular case with holes for cylinder and knob spindle. Anti-friction split bolts are available for smooth retraction of the lock bolt. Lock front may be armored to protect against burglars getting at cylinder screws and lock fasteners. Lever handles may be used if desired, and trim may be either sectional or full plate.

UNIT LOCK

This lock is preassembled in the factory and consists of a one-piece extruded or cast brass frame within which all parts are contained. It is installed in a rectangular reinforced notch cut in the door edge. Lever handles may be used in place of knobs.

BORED (CYLINDRICAL) DEADLOCK

This is a cylindrical type of lock having a deadbolt only. It fits into the same type of cylindrical cutout as that required for the bored lock.

The selection of the proper lock type is very important. The types shown here are those most commonly used, but are by no means the only types available. Their names serve to identify either the type of lock construction or the type of installation. Mortise locks provide the greatest variety of lock functions, the best security, and excellent durability. Another popular type, with rugged construction and easily operated, is the preassembled lock, which is completely assembled at the factory. It does not have as many lock functions as the mortise lock, but can have a separate deadbolt. The bored lock is the least secured type and is not available with a separate deadbolt.

MORTISE LOCK

The mortise lock is so named because it is installed in a prepared recess (mortise) in the door. Working parts are contained in a rectangular case with holes for cylinder and knob spindle. Anti-friction split bolts are available for smooth retraction of the lock bolt. Lock front may be armored to protect against burglars getting at cylinder screws and lock fasteners. Lever handles may be used if desired, and trim may be either sectional or full plate.

UNIT LOCK

This lock is preassembled in the factory and consists of a one-piece extruded or cast brass frame within which all parts are contained. It is installed in a rectangular reinforced notch cut in the door edge. Lever handles may be used in place of knobs.

BORED (CYLINDRICAL) DEADLOCK

This is a cylindrical type of lock having a deadbolt only. It fits into the same type of cylindrical cutout as that required for the bored lock.
Fig. 3 Surface mounted, on hinge face of door.

Fig. 4 Concealed in door, with exposed arm.

Also available with concealed arm

Fig. 5 Surface mounted, on stop face of door.

Fig. 6 Concealed in head, with concealed arm.

Fig. 7 Concealed in head, with exposed arm.

Fig. 8 Concealed in transom bar.
OVERHEAD AND FLOOR CLOSERS

Overhead closers (Figs. 3 to 8) are hydraulic devices, containing a piston, fluid chambers, and a spring. When the door is opened the piston is pulled back, the spring is compressed, and the fluid is moved from one side of the piston to the other. With release of the door, a reverse action takes place, closing the door. Closing speed is controlled by an adjustable valve. Overhead closers may be installed on either single- or double-acting doors.

Floor closers, generally more durable than overhead closers, provide concealed closing mechanisms often appropriate for doors having a high frequency of use. As shown, the type of closer used depends on whether the door is hung on hinges, offset pivots, or center pivots.

Both overhead and floor closers are available in a range of sizes for various door sizes, locations, and job conditions. The manufacturer's recommendations should always be followed in determining which size and type should be used.

Where surface-mounted closers are specified, internal reinforcement plates shall be provided in the door and frame by the manufacturer. Drilling and tapping for the closer shall be done in the field by the installer. Only after the door is installed and adjusted can the closer be mounted for proper operation. If drilling and tapping have been done at the factory, the necessary field adjustments become difficult if not impossible.
PANIC AND FIRE EXIT HARDWARE

Types of Installation

Panic hardware is tested and labeled for casualty only, fire exit hardware for both casualty and fire resistance. Only the latter may be used where fire rated doors are required. Both types are always releasable from the inside by depressing the crash bar. The mortise type (Fig. 9) and the concealed vertical rod type (Fig. 10) are the least conspicuous, and either of these types is readily applicable to custom hollow metal doors.

Panic hardware is tested and labeled for casualty only, fire exit hardware for both casualty and fire resistance. Only the latter may be used where fire rated doors are required. Both types are always releasable from the inside by depressing the crash bar.

Panic hardware is tested and labeled for casualty only, fire exit hardware for both casualty and fire resistance. Only the latter may be used where fire rated doors are required. Both types are always releasable from the inside by depressing the crash bar.

Panic hardware is tested and labeled for casualty only, fire exit hardware for both casualty and fire resistance. Only the latter may be used where fire rated doors are required. Both types are always releasable from the inside by depressing the crash bar.

Panic hardware is tested and labeled for casualty only, fire exit hardware for both casualty and fire resistance. Only the latter may be used where fire rated doors are required. Both types are always releasable from the inside by depressing the crash bar.

Panic hardware is tested and labeled for casualty only, fire exit hardware for both casualty and fire resistance. Only the latter may be used where fire rated doors are required. Both types are always releasable from the inside by depressing the crash bar.

Panic hardware is tested and labeled for casualty only, fire exit hardware for both casualty and fire resistance. Only the latter may be used where fire rated doors are required. Both types are always releasable from the inside by depressing the crash bar.
FLUSH BOLTS

These bolts are installed on the inactive leaf of a pair of doors to secure it in the closed position to serve as a latching point for the active leaf. They may also be used as auxiliary locking devices for added security. Bolts may be either surface-mounted or flush (concealed rod); only the latter type is illustrated in Fig. 15.

There are many variations of these flush bolts; only the more common types being shown in Fig. 15. Due to the variety of frame construction encountered, the selection of the most appropriate type of strike is particularly important, and clearance at the floor must be very carefully controlled to insure proper engagement.

The manual type (Fig. 15A) requires hand operation of the operating lever for both latching and unlatching. The variable length of the extension rod, however, permits convenient location of the operating mechanism in the door edge. The self-latching types (Fig. 15B and C) latch automatically when the inactive leaf is closed, but must be unlatched manually. The automatic type (Fig. 15D) both latches and unlatches automatically when the inactive leaf is closed or opened.

None of these types of flush bolt should be used on doors that are intended to serve as emergency exits. NFPA pamphlet 80 should be consulted for the selection of bolts for fire-rated pairs of doors.

Fig. 15  Except for Type C, only top bolts are shown; bottom bolts are similar in all cases.
CONCEALED TYPE
For single- or double-acting doors

These are devices used to limit and control the swing of the door or hold it in the open position. By controlling the door action they serve to protect against damage to the door and/or hinges caused by abusive usage, and damage to the holder caused by violent opening of the door.

OVERHEAD DOOR HOLDERS

CONCEALED TYPE
For single- or double-acting doors

EXPOSED TYPES
For single-acting doors only

HOSPITAL DOOR LATCH
Designed primarily for use in hospitals, on corridor doors leading to patient rooms. May also be used on any door requiring push-pull operation, particularly by forearm or elbow, when hands are engaged in carrying objects.

EMERGENCY DOOR STOP
Intended primarily for use in hospitals, on doors between patient rooms and toilets. This stop permits door to be opened from the stop side in the event that an incapacitated patient should block the normal swing by falling. Door must be hung on center (double-acting) pivots.
DOORS

Hardware Locations

- Frame head rabbet:
  - 5"

- Hinges:
  - 10"
  - 598

- Hospital arm pull (vertical type): 48"
- Roller latch and hospital push-pull latch: 38"
- Door pull grip and push-pull bar: 42"
- Knob on lock or latch and cross bar on fire exit device: 47"

- Finish floor level: 45"

- Deadlock:
  - 60"

*Except when used with push-pull plates cut for cylinders.*
Construction Details and Finishes

DOORS
Hollow Metal Door Edge Treatments

V-BEVEL
Used on double-acting center-pivoted doors

BULLNOSE

RABBETED
These two types may be used on double egress doors

PARALLEL BEVEL
with flat surface astragal

with molded surface astragal

RECESSED
ADJUSTABLE ASTRAGAL
Surface-mounted type also used

COMMON MEETING STILE EDGE PROFILES

All joint seams continuously welded and ground smooth

STILE EDGE DETAILS — TYPE A DOORS

HARDWARE REINFORCEMENTS are provided on doors wherever hardware is to be attached, to insure that it is firmly and securely fastened.

STANDARD
FLUSH
(closing channel)

AUTOMATIC WEATHERSTRIP

TOP EDGE DETAILS

TOP EDGE DETAILS
WITH FLUSH TRANSOM PANEL ABOVE
Construction Details and Finishes

DOORS
Fire-Protected Wood Doors

**SOLID WOOD CORE FLUSH DOORS**

- Solid wood core
- Crossbanding
- Veneer

**BATTENED DOORS**

- 5-inch min. width battens and brace
- 2-inch nominal T & G or splined stock not over 6 inches wide

**PROTECTED PANEL DOORS**

- Spring hinge or door closer
- Sheet iron, copper not less than 28 U. S. gage, fastened on each side to stiles, rails and edges with nails or screws

**HARDWARE**

- Doors more than 5 ft high: minimum 3 butts not less than 4" by 4"
- Fire-retardant treated wood stop, glued and nailed to frame on not more than 6-inch centers
- Minimum throw of latch 3/4"

**FRAMES**

- Treated wood
- Untreated wood
- Metal covered
- Pressed or rolled steel
Thresholds are essential for nearly every type of door. Usually a standard section is satisfactory. Where conditions require, special sections may be designed.

Thresholds of plain surface, extruded or rolled.

Thresholds with fluted surface, extruded or rolled.

Thresholds cast with plain or abrasive surface.

Thresholds for weather strips.

Threshold fastened to wood with wood screws.

Threshold fastened with screw in fibre plug or expansive metal anchor. Floor may be cement, terrazzo or similar construction.

Threshold fastened with screws tapped to clips set in cement.

<table>
<thead>
<tr>
<th>FIG</th>
<th>WIDTH</th>
<th>HEIGHT</th>
<th>CAST</th>
<th>STEEL</th>
<th>BRASS</th>
<th>BRONZE</th>
<th>ALUMINUM</th>
<th>NICKEL</th>
<th>SILVER</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>2 │</td>
<td>1/2</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>3 │</td>
<td>1/4</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>4 │</td>
<td>1/2</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>5 │</td>
<td>1/2</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>6 │</td>
<td>1/2</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>7 │</td>
<td>1/2</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8 │</td>
<td>1/2</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>9 │</td>
<td>1/2</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>1/2</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Casts metal may be iron, aluminum, bronze, or nickel silver, with or without abrasive surface.

These thresholds are representative of a great many sections produced in various metals, widths, heights, and types of surface. For other sections refer to manufacturers' catalogs.
DOORS

Thresholds and Joint Strips

Steel loading door threshold anchored to concrete.

Steel shipping door threshold anchored to concrete.

Steel shipping door threshold screwed to floor.

Elevator door threshold for double doors cast with grooves. Surface may be abrasive or plain of cast iron, aluminum or bronze.

Elevator door threshold for double doors of rolled sections, steel, bronze or aluminum.

Elevator door threshold for single doors cast with grooves. Surface may be abrasive or plain of cast iron, aluminum or bronze. Thresholds with concealed steel anchors are usually fastened to anchors with flat head machine screws, the anchors independently fastened to the floor construction.

Threshold for single acting floor check.

Threshold for double acting floor check.

Threshold for single acting floor check.

Threshold for double acting floor check.

Thresholds for floor checks may be obtained in the same metals and sections as standard thresholds or may be designed to fit special conditions. All thresholds fitted to floor checks must be designed with removable cover plate. Screw spacing must fit floor check. Dimension "A" is determined by type of floor check, usually 5\(\frac{3}{8}\), 6\(\frac{1}{4}\) or 7\(\frac{1}{4}\). Dimension "B" may be same as "A" or less as specified.

SPECIFY:
- Type, location
- Width, length
- Metal and finish
- Show detail of special requirements

Joint strips, also called dividing strips or division bars, used for separation of floors of different materials, may be of steel or non-ferrous metals. They may be of angles or other sections with anchors attached, or of a patented design.

Terrazzo strips for design or pattern work in terrazzo floors are not considered architectural metal.
Construction Details and Finishes

DOORS
Thresholds and Edging Strips

T-1: Ceramic tile adhesive applied or cork tile flooring.

T-2: Normal floor line.

T-3: Normal floor line.

T-4: Normal floor line.

T-5: Marble threshold, resilient flooring, carpet.

T-6: Aluminum threshold, resilient flooring, carpet.

T-7: Neoprene weatherstrip, resilient flooring, carpet.

NOTES:
1. For door swing, see other drawings.
2. For schedule of floor finishes, see other drawings.
3. For gauges of metal see specifications.
8-A52 ELEVATION
A36 1/2" 1'-0"

9-A52 SECTION
A52 1/2" 1'-0"

12-A52 DETAIL
A39 1/2" 1'-0"
DOORS
Light- and Soundproofing of Wood and Hollow Metal Door Frames

LIGHT & SOUNDPROOFING FOR WOOD DOOR FRAME

LIGHT & SOUNDPROOFING FOR HOLLOW METAL FRAME

NOTE: DOOR BOTTOM SIMILAR TO WOOD DOOR ABOVE.
USE ZERO #365 AUTO-DOOR BOTTOM
SEE CATALOG OF ZERO WEATHER-STRIPPING CO.
The prime functions of the door frame are to hold the door and its controls in the opening, and to trim the opening. But frames often serve other esthetic or functional purposes also, such as trimming a wall opening having no door, or enclosing glazed areas that provide through-wall visibility or admitting light and/or air. Hollow metal frames, which are strong, sturdy, and durable, serve all such functions economically.

The variety of configurations available in custom hollow metal frames is virtually unlimited. Illustrated in Fig. 16 are some of the more common and representative types.

Fig. 16
Construction Details and Finishes

DOORS
Hollow Metal Door Frames

F.11A
H.M. FRAME
H.WD. TEMP./ONE SIDE
3" x 10".

F.11
H.M. FRAME
H.WD. TEMP./ONE SIDE
3" x 10".

F.12
H.M. EXTERIOR FRAME
3" x 10".

F.13
HARDWOOD FRAME
3" x 10".

F.14
TEMPERED PLATE GLASS
Caulk.
<table>
<thead>
<tr>
<th>PARTICLE</th>
<th>STAVE</th>
<th>HOLLOW</th>
<th>ACOUSTICAL STC 31, 36, 38, &amp; 40</th>
<th>LEAD</th>
<th>STILE AND RAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1½&quot;</td>
<td></td>
</tr>
<tr>
<td>MAX. SIZE</td>
<td>6&quot; x 12&quot;</td>
<td>6&quot; x 12&quot;</td>
<td>6&quot; x 12&quot;</td>
<td>6&quot; x 12&quot;</td>
<td></td>
</tr>
<tr>
<td>CORE</td>
<td>Mill-formed wood products treated to core</td>
<td></td>
<td></td>
<td>4&quot; x 12&quot;</td>
<td></td>
</tr>
<tr>
<td>DOORS</td>
<td>½&quot; to 1½&quot; thick</td>
<td></td>
<td></td>
<td>1½&quot;</td>
<td></td>
</tr>
<tr>
<td>STILES</td>
<td>½&quot; to 1½&quot; thick</td>
<td></td>
<td></td>
<td>1½&quot;</td>
<td></td>
</tr>
<tr>
<td>RAILS</td>
<td>½&quot; to 1½&quot; thick</td>
<td></td>
<td></td>
<td>1½&quot;</td>
<td></td>
</tr>
<tr>
<td>FACES</td>
<td>All available domestic and foreign veneers</td>
<td></td>
<td></td>
<td>1½&quot;</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- Particleboard should be treated to core.
- All available veneers are compatible with lacquer-based finishes.
- Limited veneer matching.
- Special details include safety standards, fire ratings, and acoustic ratings.

**Standards:**
- WENONA 10-1
- AWWA Standards - 1200 P.C.
- Federal LULUS91 Type I, Class 1
- NAWA 10-1

**Warranty:**
- Interior - 1 year
- Exterior - Not recommended

**Finish on edges/panels:** Minimal munsing per AWI Section 1000.
- No rating guaranteed on doors with iron or steel.
Construction Details and Finishes

DOORS

Door Types

*MM-4 GLASS WOOD

**

Fig. 17 Typical interior doors showing the dimensions of stiles and rails.

Fig. 18 Sizes of panelled interior doors.

STANDARD SIZES OF ONE, TWO, AND SIX PANEL DOORS

TWO PANEL

- 2'-0"x6'-0", 13/4"
- 2'-0"x6'-6", 13/4"
- 2'-0"x7'-0", 13/4"
- 2'-4"x6'-6", 13/4"
- 2'-4"x6'-8", 13/4"
- 2'-6"x6'-0", 13/4"
- 2'-6"x6'-6", 13/4"
- 2'-6"x6'-8", 13/4"
- 2'-8"x7'-0", 13/4"

ONE PANEL

- 2'-0"x6'-0", 13/4"
- 2'-0"x6'-6", 13/4"
- 2'-0"x7'-0", 13/4"
- 2'-4"x6'-6", 13/4"
- 2'-4"x6'-8", 13/4"
- 2'-6"x6'-0", 13/4"
- 2'-6"x6'-6", 13/4"
- 2'-6"x6'-8", 13/4"
- 2'-8"x7'-0", 13/4"

ONE AND TWO PANEL DESIGNS

Manufactured in Ponderosa Pine with laminated flat panels of pine, fir, gum, or birch. Moulded CSB, BGC or Ovolo Sticking. Standard thickness of doors 13/4" or 11/2". Made also in any hardwood with veneered stiles, rails and panels.

Fig. 19 Sizes of French or casement doors.

CASEMENT DESIGNS

Casement doors can also be divided into:

- 8 lights (2 wide—4 high) and 12 lights (3 wide—4 high).

Pairs of casement doors in openings less than 5'-0" wide have 3/4" stiles as shown while pairs in openings 5'-0" wide and wider have 13/4" stiles.

STANDARD SIZES OF FRENCH OR CASEMENT DOORS

- 4'-0" opening, 2'-0"x6'-0"
- 4'-8" opening, 2'-4"x6'-0"
- 5'-0" opening, 2'-4"x6'-0" or 2'-0"x6'-0"
- 5'-4" opening, 2'-8"x6'-0" or 2'-0"x6'-8"
DOORS
Door Types

FIVE X PANEL
Fig. 21 Interior wood doors.

SIX PANEL
EIGHT PANEL
EIGHT PANEL

SINGLE PANEL
TWO PANEL
FOUR PANEL

Fig. 20 Exterior wood doors.
DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes

DOORS
Wood Door Frames

Construction Details and Finishes
Construction Details and Finishes

DOORS

Wood Door Frames
Construction Details and Finishes

DOORS
Exterior Wood Entrance Doors

Fig. 22  Door for an architect's office.
SECTION 'A-A'

Corner of Tower - "A"

ELEVATION

SCALE: 1'-0" = 1'-0"

BASE

SECTION 'BB'

SCALE: 1'-0" = 1'-0"

Details of Door and Base Sections

Construction Details and Finishes

DOORS

Exterior Wood Entrance Doors
Construction Details and Finishes

DOORS

Exterior Wood Entrance Doors
Fig. 23 Exterior door and frame. Exterior-door and combination-door (screen and storm) cross sections: A, head jamb; B, side jamb; C, sill.
Wood clad metal door frames

Marble jamb and head details at elevator
Construction Details and Finishes

DOORS
Bi-Fold Doors

VINYL FABRIC ON PLASTER
GRANT # 2620
BI-FOLD HARDWARE OR EQUAL
CABING BEAD
OAK EDGE
9/16" OAK PLYWOOD
BI-FOLD DOORS
SCREW & PLUG
OAK FRAME

PLYWOOD BI-FOLD DOOR
LIVES & 2615-1-4
FLUSH BOLT OR EQUAL

SILL

FLUSH BOLT DETAIL
3/4" FULL SIZE

CHURCH

FAMILY ALCOVE

BI-FOLD DOOR DETAILS
G, 6'-11-2"

PLASTIC LAMINATE
TOP, BOTTOM & STAIRS

PLASTIC LAMINATE
TOP & BOTTOM

FOLDING SHELF FOR DUTCH DOORS
Hardware for doors may be obtained in a number of finishes, with brass, bronze, and nickel perhaps the most common. Door sets are usually classed as (a) entry lock for exterior doors, (b) bedroom set (inside lock control with safety slot for opening from the outside), (c) bedroom lock (keyed lock), and (d) passage set (without lock).

**Hinges**

Using three hinges for hanging 1 3/4-in exterior doors and two hinges for the lighter interior doors is common practice. There is some tendency for exterior doors to warp during the winter because of the difference in exposure on the opposite sides. The three hinges reduce this tendency. Three hinges are also useful on doors that lead to unheated attics and for wider and heavier doors that may be used within the house.

Loose-pin butt hinges should be used and must be of the proper size for the door they support. For 1 3/4-in-thick doors, use 4 by 4-in butts; for 1 1/2-in doors, 3 1/2 by 3 1/2-in butts. After the door is fitted to the framed opening, with the proper clearances, hinge halves are fitted to the door. They are routed into the door edge with about a 3/16-in back distance (Fig. 26A). One hinge half should be set flush with the surface and must be fastened square with the edge of the door. Screws are included with each pair of hinges.
Locks not designated as reversible are made right-hand, left-hand, right-hand reverse bevel, or left-hand reverse bevel.

The hand of a lock is invariably determined from the outside of an entrance door or from the corridor or hall side of a room door. An easy method of determining the hand of a lock is to imagine oneself on that side of the opening from which the lock is controlled or operated by the key. Viewing the opening in this position, note which one of the following is true: (1) if the door swings in and is hinged at your right hand, the lock is right-hand; (2) if hinged at your left hand, the lock is left-hand; (3) if the door swings toward you and is hinged at your right, the lock is right-hand reverse bevel; (4) if hinged at your left hand, the lock is left-hand reverse bevel.

You may find that many locks are marked “reversible,” meaning that they are interchangeably right- or left-hand, and in these instances no reference to hand or bevel of lock is necessary. These are locks which operate alike from both sides or locks which can be inverted in order to reverse the locking functions.

Features
- Deadbolt
- Latchbolt, Anti-friction
- Auxiliary (guarded) Latch
- Stop Button

Features of and symbols for door hardware

Symbols
- Cylinder
- Outside knob or lever
- Inside knob or lever
- Emergency turn piece
- Cylinder turn
- Solid spindle
- Occupancy indicator
- Two piece spindle
## DOORS

### Lock Functions

#### OFFICE
- For Inner Office and Area Entry Doors.
  - Latchbolt retracted by lever or knob from either side unless outside is locked by stop button.
  - When outside is locked, latchbolt is retracted by key outside and lever or knob inside.
  - Auxiliary latch deadlocks latchbolt when door is closed.
  - Latch holdback available.

#### APARTMENT ENTRANCE
- For Apartment House or Office Building Entrance Doors.
  - Latchbolt retracted by lever or knob either side unless outside is locked by key from inside.
  - When locked, latchbolt retracted by tenant key outside, lever or knob inside.
  - Auxiliary latch deadlocks latchbolt when door is closed.

#### INSTITUTION
- For Permanently Locked Passage Doors.
  - Latchbolt retracted by key from either side.
  - Both levers or knobs always inoperative.
  - Auxiliary latch deadlocks latchbolt when door is closed.
  - Latch holdback available.

#### STORE DOOR
- For Store Entrance Doors.
  - Latchbolt retracted by lever or knob from either side unless outside is locked by stop button.
  - When locked, latchbolt retracted by key outside and lever or knob inside.
  - Deadbolt operated by key from either side.
  - Auxiliary latch deadlocks latchbolt when door is closed.

#### CYLINDER X TURN PIECE
- Deadlock
  - Deadbolt operated by key outside and turn inside.

#### DOUBLE CYLINDER
- Double Cylinder Deadlock
  - Deadbolt operated by key from either side.
  - Bolt automatically deadlocks when fully thrown.

#### CLASSROOM
- Classroom Deadlock
  - Deadbolt operated by key outside.
  - Cylinder turn inside will retract deadbolt but will not project it.
  - Bolt automatically deadlocks when fully thrown.

#### HOTEL
- Hotel Deadlock
  - Deadbolt operated by key from one side.
  - No trim on opposite side.
  - Bolt automatically deadlocks when fully thrown.

#### CLASSROOM
- Latchbolt retracted by lever or knob from either side unless outside is locked by key.
- Inside lever or knob always free for immediate exit.
- Auxiliary latch deadlocks latchbolt when door is closed.

#### STOREROOM
- Latchbolt retracted by lever or knob inside, by key outside.
- Outside lever or knob always inoperative. Knob is free spinning.
- Auxiliary latch deadlocks latchbolt when door is closed.
  - Latch holdback available.

#### ENTRANCE
- For Commercial and Residential Entry Doors.
  - Deadbolt and latchbolt retracted by lever or knob trim either side unless outside is locked by stop button.
  - When locked, key outside and lever or knob inside retracts deadbolt and latchbolt simultaneously. Outside remains locked until stop button is reset to unlocked position.
  - Deadbolt operated by key and turn piece. Throwing deadbolt automatically locks stop button.
  - Auxiliary latch deadlocks latchbolt when door is closed and locked.

#### CONVALESCENT
- For Convalescent or Bedroom Doors.
  - Latchbolt retracted by lever or knob from either side when unlocked.
  - Deadbolt operated by key outside and turn piece inside.
  - Throwing deadbolt disengages outside lever or knob.
  - Turning inside lever or knob retracts deadbolt and latchbolt simultaneously for immediate exit and unlocks outside.

#### CLOSET
- For Closet, Storeroom, or Utility Room Doors.
  - Latchbolt retracted by lever or knob from either side at all times.
  - Deadbolt operated by key outside.

#### DORMITORY
- For Dormitory or Bedroom Doors.
  - Latchbolt retracted by lever or knob from either side at all times.
  - Deadbolt is operated by key outside and by turn piece inside.

#### HOTEL
- For Corridor Doors to Guest Rooms.
  - Outside lever or knob always inoperative. Knob is free spinning.
  - Latchbolt retracted by guest key outside except when deadbolt is thrown by turn piece inside.
  - When thrown occupancy indicator is engaged, all keys inoperative except emergency or display keys.
  - Turning inside lever or knob retracts deadbolt and latchbolt simultaneously. Aux. latch deadlocks latchbolt when door is closed.

#### HOTEL
- For Corridor Doors to Guest Rooms.
  - Same as B5P function except that visual “DO NOT DISTURB” plate replaces occupancy indicator button.
  - Available for 1½” doors and escutcheon trim only.
### Non-Keyed Locks

<table>
<thead>
<tr>
<th>ANSI A156.2 Series 4000</th>
<th>ANSI A156.2 Series 4000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Passage Latch</strong>: Both knobs always unlocked</td>
<td></td>
</tr>
<tr>
<td><strong>Exit Lock</strong>: Unlocked by knob inside only. Outside knob always fixed.</td>
<td></td>
</tr>
<tr>
<td><strong>Closet Latch</strong>: Outside knob and inside thumbturn are always unlocked.</td>
<td></td>
</tr>
<tr>
<td><strong>Exit Lock</strong>: Blank plate outside. Inside knob always unlocked. (Specify door thickness, 1⅞&quot; or 1¾ &quot;).</td>
<td></td>
</tr>
<tr>
<td><strong>Patio Lock</strong>: Push-button locking. Turning inside knob releases button. Closing door on A &amp; D series also releases button.</td>
<td></td>
</tr>
<tr>
<td><strong>Bath/Bedroom Privacy Lock</strong>: Push-button locking. Can be opened from outside with small screwdriver or flat-narrow tool. Turning inside knob releases push-button. Closing door on A, C and D series also releases button, preventing lock-out.</td>
<td></td>
</tr>
<tr>
<td><strong>Communicating Lock</strong>: Turn button in outer knob locks and unlocks knob and inside thumbturn.</td>
<td></td>
</tr>
<tr>
<td><strong>Hospital Privacy Lock</strong>: Push-button locking. Unlocked from outside by turning emergency turn-button. Rotating inside knob or closing door releases inside button.</td>
<td></td>
</tr>
</tbody>
</table>

### Dummy Trim

**Single Dummy Trim**: Single dummy trim for one side of door. Used for door pull or as matching inactive trim.

### Keyed Locks

<table>
<thead>
<tr>
<th>ANSI A156.2 Series 4000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Entrance Lock</strong>: Unlocked by key from outside when outer knob is locked by turn-button in inside knob. Inside knob always unlocked.</td>
</tr>
<tr>
<td><strong>Entrance/Office Lock</strong>: Push button locking. Pushing button locks outside lever until unlocked with key or by turning inside lever.</td>
</tr>
<tr>
<td><strong>Service Station Lock</strong>: Unlocked by key from outside when outer knob is locked by universal button in inside knob. Closing door releases button. Outside knob may be fixed by rotating universal button.</td>
</tr>
<tr>
<td><strong>Vestibule Lock</strong>: Unlocked by key from outside when outside knob is locked by key in inside knob. Inside knob is always unlocked.</td>
</tr>
<tr>
<td><strong>Store Lock</strong>: Key in either knob locks or unlocks both knobs.</td>
</tr>
<tr>
<td><strong>Classroom Lock</strong>: Outside knob locked and unlocked by key. Inside knob always unlocked.</td>
</tr>
<tr>
<td><strong>Communicating Lock</strong>: Key in either knob locks or unlocks each knob independently.</td>
</tr>
<tr>
<td><strong>Dormitory Lock</strong>: Locked or unlocked by key from outside. Push-button locking from inside. Turning inside knob or closing door releases button.</td>
</tr>
<tr>
<td><strong>Classroom Hold-Back Lock</strong>: Outside knob locked or unlocked by key. Inside knob always unlocked. Latch may be locked in retracted position by key.</td>
</tr>
</tbody>
</table>

---

**Details**

- ANSI: American National Standards Institute
- A.N.S.I.: American National Standards Institute
- A.N.S.I.: American National Standards Institute
- A.N.S.I.: American National Standards Institute
- A.N.S.I.: American National Standards Institute
- A.N.S.I.: American National Standards Institute
- A.N.S.I.: American National Standards Institute
- A.N.S.I.: American National Standards Institute
- A.N.S.I.: American National Standards Institute
- A.N.S.I.: American National Standards Institute
- A.N.S.I.: American National Standards Institute
- A.N.S.I.: American National Standards Institute
- A.N.S.I.: American National Standards Institute
### Keyed Locks

<table>
<thead>
<tr>
<th>ANSI A156.2 Series 4000</th>
<th>A. N. S. L. No. Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communicating Lock: Locked or unlocked by key from outside. Blank plate inside.</td>
<td></td>
</tr>
<tr>
<td>Store Room Lock: Outside knob fixed. Entrance by key only. Inside knob always unlocked.</td>
<td></td>
</tr>
<tr>
<td>Institution Lock: Both knobs fixed. Entrance by key in either knob.</td>
<td></td>
</tr>
</tbody>
</table>

### Deadbolt Locks

<table>
<thead>
<tr>
<th>ANSI A 156.5</th>
<th>A. N. S. L. No. Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Cylinder Deadbolt Lock: Deadbolt thrown or retracted by key from outside or by inside turn unit. Bolt automatically deadlocks when fully thrown.</td>
<td></td>
</tr>
<tr>
<td>Double Cylinder Deadbolt Lock: Deadbolt thrown or retracted by key from either side.</td>
<td></td>
</tr>
<tr>
<td>One-Way Deadbolt Lock: Deadbolt thrown or retracted by key only. Blank plate inside.</td>
<td></td>
</tr>
<tr>
<td>Classroom Deadbolt Lock: Deadbolt thrown or retracted by key outside. Inside turn unit will retract bolt only.</td>
<td></td>
</tr>
<tr>
<td>Cylinder Lock: Deadbolt thrown or retracted by key from one side. No inside trim.</td>
<td></td>
</tr>
<tr>
<td>Door Bolt: Deadbolt thrown or retracted by turn unit only. No outside trim.</td>
<td></td>
</tr>
</tbody>
</table>

### Deadlatch Locks

<table>
<thead>
<tr>
<th>ANSI A156.5</th>
<th>A. N. S. L. No. Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Night Latch: Deadlocking latchbolt retracted by key from outside or by inside turn unit. Rotating turn unit and activating hold-back feature keeps latch retracted.</td>
<td></td>
</tr>
<tr>
<td>Double Cylinder Deadlatch: Deadlocking latchbolt retracted by key from either side. No hold-back feature.</td>
<td></td>
</tr>
<tr>
<td>Exit Latch: Deadlocking latchbolt retracted by inside turn unit only. No outside trim. Rotating turn unit and activating hold-back feature keeps latch retracted.</td>
<td></td>
</tr>
</tbody>
</table>

### Lever Functions

| Lever Passage Latch: For use on passage, closet and doors that do not require locking. Rotating either lever retracts latchbolt. (Specify door hand.) |
| Single Dummy Trim-Double Dummy Trim: For use on single or pairs of doors when fixed turn is required. (Specify door hand.) |

### Grip Handle Sets

| Entrance Lock: Unlocked by key from outside when thumb-piece is locked by inside turn-button. |
| Entrance Lock: Deadbolt thrown or retracted by key from outside or by inside turn unit. Latch retracted by thumbpiece from outside or by inside knob. |
| Double Cylinder Entrance Lock: Deadbolt thrown or retracted by key from either side. Latch retracted by thumbpiece from outside or by inside knob. |

**CAUTION:** Double cylinder locks on residences and any door in any structure which is used for egress are a safety hazard in times of emergency and their use is not recommended. Installation should be in accordance with existing codes only.
**Dummy Trim**

**Outside and Inside Dummy Trim:** For use as door pull or as dummy trim on an inactive pair of doors. Fixed thumbpiece and inside knob. Thru bolted dummy cylinder.

**Outside and Inside Dummy Trim:** For use as door pull or as dummy trim on inactive leaf of pair of doors. Fixed thumbpiece and inside knob. Dummy cylinder with inside plate.

**Interconnected Locks**

**Entrance—Single Locking:** Deadbolt thrown or retracted by key in upper lock from outside or by inside turn unit. Latchbolt retracted by knob from either side. Turning inside knob retracts deadbolt and latchbolt simultaneously for immediate exit.

**Entrance—Double Locking:** Deadbolt thrown or retracted by key in upper lock from outside or by inside turn unit. Deadlatch retracted by key in outer knob when locked by pushing turn-button in inner knob. Outer knob may be fixed in locked position by rotating turn-button. Inside knob retracts deadbolt and deadlatch simultaneously for immediate exit.

**Storeroom Lock:** Bolt may be operated by key from outside or by turn unit from inside. Bolt automatically deadlocks when fully thrown. Lock may be opened by key from outside. Inside knob will retract both latch and deadbolt. Latch automatically deadlocks when door is closed, inside knob always free for immediate exit. Outer knob always fixed.

**Hotel-Motel Lock:** Deadbolt thrown or retracted by key in upper lock from outside or by inside turn unit. Deadlatch retracted by key in outer fixed knob. Push-button in inner knob activates visual occupancy indicator, allowing only emergency masterkey to operate. Rotation of inside spanner-button provides lockout feature by keeping indicator thrown. Turning inside knob retracts deadbolt simultaneously for immediate exit.

**Dummy Trim**

**Single Dummy Inside Trim:** Snap-on rose and knob. Concealed mounting screws.

**Dummy Trim Inside and Outside:** Snap-on rose and knobs thru-bolted.

---

**Mortise Locks**

**Non-Keyed**

**Passage Latch:** Latch bolt retracted by lever or knob from either side at all times.

**Bath/Bedroom Privacy Lock:** Latchbolt retracted by lever or knob from either side unless outside is locked by inside turn piece. Operating inside lever or knob or closing door unlocks outside lever or knob. To unlock from outside, remove emergency button, insert turn piece (furnished) in access hole and rotate.

**Single Dummy Trim:** Lever or knob on both sides fixed by mounting bar.

**Pair Dummy Trim:** Lever or knob on both sides fixed by mounting bar.

**Single Dummy Trim:** Lever or knob on one side fixed. Includes lock chassis and armor front.

**Pair Dummy Trim:** Lever or knob both sides fixed. Includes lock chassis and armor front.

---

**Keyed Locks**

**Office and Inner Entry Lock:** Latchbolt retracted by lever or knob from either side unless outside is made inoperative by key outside or by rotating inside turn piece. When outside is locked, latchbolt is retracted by key outside or by lever or knob inside. Outside lever or knob remains locked until thumbturn is turned to vertical or by counter clockwise rotation of key. Auxiliary latch deadlocks latchbolt when door is closed.

**Apartment Entrance Lock:** Latchbolt retracted by lever or knob from either side unless outside is locked by key from inside. When locked, latchbolt retracted by key outside or lever or knob inside. Auxiliary latch deadlocks when door is closed.

**Classroom Lock:** Latchbolt retracted by lever or knob from either side unless outside is locked by key. Unlocked from outside by key. Inside lever or knob always free for immediate exit. Auxiliary latch deadlocks latchbolt when door is closed.

**When armored front is required as strike for inactive door, specify L9177 for single or L9178 for pair of dummy trim. Specify door hand.**
Keyed Locks

Storeroom Lock: Latchbolt retracted by key outside or by lever or knob inside. Outside lever or knob always inoperative. Auxiliary latch deadlocks latchbolt when door is closed.

Storeroom Lock: Electrically locked. Outside lever or knob continuously locked by 24V AC or DC. Latchbolt retracted by key outside or by lever or knob inside. Switch or power failure allows outside lever or knob to retract latchbolt. Auxiliary latch deadlocks latchbolt when door is closed. Inside lever or knob always free for immediate exit.

Storeroom Lock: Electrically unlocked. Outside lever or knob unlocked by 24V AC or DC. Latchbolt retracted by key outside or by lever or knob inside. Auxiliary latch deadlocks latchbolt when door is closed. Inside lever or knob always free for immediate exit.

Institution Lock: Latchbolt retracted by key from either side. Lever or knob on both sides always inoperative. Auxiliary latch deadlocks latchbolt when door is closed.

Entrance Lock: Latchbolt retracted by lever or knob from either side unless outside is locked by 20° rotation of thumbturn. Deadbolt thrown or retracted by 90° rotation of thumbturn. When locked, key outside or lever or knob inside retracts deadbolt and latchbolt simultaneously. Outside lever or knob remains locked until thumbturn is restored to vertical position. Throwing deadbolt automatically locks outside lever or knob. Auxiliary latch deadlocks latchbolt when door is closed.

Dormitory/Exit Lock: Latchbolt retracted by lever or knob from either side. Deadbolt thrown or retracted by key outside or inside thumbturn. Throwing deadbolt locks outside lever or knob. Rotating inside lever or knob simultaneously retracts deadbolt and latchbolt, and unlocks outside lever or knob.

Closed/Storeroom Lock: Latchbolt retracted by lever or knob from either side except when deadbolt is extended. Deadbolt extended or retracted by key outside.

Store/Utility Room Lock: Latchbolt retracted by knob or lever from either side except when deadbolt is extended. Deadbolt extended or retracted by key from either side.

Dormitory/Bedroom Lock: Latchbolt retracted by knob or lever from either side except when deadbolt is extended. Deadbolt extended or retracted by key outside or thumbturn inside.

Keyed Locks

Hotel Lock: Latchbolt by key outside or by lever or knob inside. Outside lever or knob always fixed. Deadbolt thrown or retracted by inside thumbturn. When deadbolt is thrown, all keys become inoperative except emergency or display keys. Turning inside lever or knob retracts both deadbolt and latchbolt simultaneously. Auxiliary latch deadlocks latchbolt when door is closed.

Hotel Lock: Latchbolt retracted by key outside or by lever or knob inside. Outside lever or knob always fixed. Deadbolt thrown or retracted by inside thumbturn. When deadbolt is thrown, "DO NOT DISTURB" plate is displayed—all keys become inoperative except emergency or display keys. Turning inside lever or knob retracts both deadbolt and latchbolt simultaneously. Auxiliary latch deadlocks latchbolt when door is closed.

Deadlocks

Cylinder X Thumbturn: Deadbolt thrown or retracted by key outside or thumbturn inside.

Double Cylinder: Deadbolt operated by key from either side.

Classroom Lock: Deadbolt thrown or retracted by key from outside. Inside cylinder turn retracts deadbolt but cannot project it.

Cylinder Lock: Deadbolt thrown or retracted by key from one side. No trim on opposite side.
This section provides the designer with information on both suspended ceilings and ceilings directly attached to the structure above. It starts with a review of generic suspension systems and then provides details and discussion of the various suspended ceiling types.

Large-scale details show how, in addition to standard acoustical tiles, other ceiling materials such as plaster, metal panels, baffles, gypsum board, and wood can be attached to suspension systems. A variety of unusual conditions are also detailed, including curved and vaulted ceilings, wall conditions, light coves, and lighting fixture framing.

The designer is cautioned that in many jurisdictions, suspension systems must attain a higher level of structural integrity than most other architectural elements. For example, wire hangers may not be an acceptable method of suspending channels from the structure above. Rather, steel rods of a minimum diameter or flat bar hangers of a minimum width and thickness may be required. Local or state codes should always be consulted prior to finalizing such details.

In many situations, the ceiling "skin" takes on further importance beyond aesthetic, acoustical, or visual requirements. It can also be used to complete an envelope that provides a fire-resistive rating to the structural members above. Again, it is necessary to thoroughly investigate the building and fire codes that might govern ceiling design.

### Acoustical Tile and Lay-in Panel Ceiling Suspension Systems

A) **HUNG SUSPENSION SYSTEM**

- HANGER
- WALL MOULDING
- ACOUSTICAL LAY IN PANELS
- CARRYING CHANNEL
- MAIN RUNNER
- CROSS RUNNERS (SPANNING MAIN RUNNER)

B) **HUNG SUSPENSION SYSTEM**

- HANGER
- CARRYING CHANNEL
- ACOUSTICAL TILE
- WALL MOULDING
- SUPPORT CLIP FOR MAIN RUNNER

C) **FURRING BAR SUSP. SYSTEM**

- HANGER
- BACKING BD.
- Furring bars or nailing bar
- CARRYING CHANNEL
- ACOUSTICAL TILE
Construction Details and Finishes

CEILINGS

Suspension System Types

**NOTES**

1. At ends of suspended systems, interconnecting header tee or hanging bar must be used.
2. The total weight of a light fixture and other equipment (or boxes, etc.) shall not exceed the allowable deflection of the spans. Deflection data shall be furnished by the manufacturer.
3. Surface or pendant fixtures must not be supported from the ceiling (either from floor or roof construction).

**EXPOSED T GRID SYSTEM**

**CONCEALED 2 BAR SYSTEM**
Construction Details and Finishes

CEILINGS

Suspension System Types

Notes:
1. A HOLLOW CEILING BAR CANNOT BE INSTALLATON OF CONTINUOUS LENGTH. THE Z BAR OR BAR SHALL BE SUPPORTED IN 4'L INTERVALS. MINIMUM SUPPORT 5' BEYOND WALL, SHEET METAL, OR OTHER HANGING.
2. THE TOTAL WEIGHT OF A LIGHT FIXTURE MUST BE SUPPORTED BY THE CEILING MATERIAL TO WHICH IT IS ATTACHED. THE MAXIMUM LOAD OF ANY POINT OF THE WOOD, CEILING CONSTRUCTION, MUST BE STATED AND STATED BY THE MANUFACTURER.
3. SURFACE OR PENDANT FIXTURES MUST BE SUPPORTED BY THE CONSTRUCTION ABOVE AT THE POINT OF SUPPORT OR BY THE CONSTRUCTION ABOVE.

Exposed Z Bar System
**Construction Details and Finishes**

**CEILINGS**

**Gypsum Board Suspended Ceilings**

### Assembly

<table>
<thead>
<tr>
<th><strong>Gypsum Board, Attached</strong></th>
<th><strong>Remarks</strong></th>
</tr>
</thead>
</table>
| **Direct to Framing**     | • secured directly to framing members or to solid furring.  
                            • most widely used in residential and light commercial construction.  
                            • two layers may be required for an improved fire resistance rating or for better resistance to sound transmission.  
                            • directly affected by deflection and/or expansion/contraction in supporting framing. |
| ![Diagram](image1) | ![Diagram](image2) |
| 15" to 24" o.c. | 15" to 24" o.c. |
| Spacing of Supports | Spacing of Supports |
| One or Two Layers | One or Two Layers |

<table>
<thead>
<tr>
<th><strong>Furred-Down</strong></th>
<th><strong>Remarks</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3" alt="Diagram" /></td>
<td><img src="image4" alt="Diagram" /></td>
</tr>
<tr>
<td>15&quot; to 60&quot; o.c.</td>
<td>15&quot; to 24&quot; o.c.</td>
</tr>
<tr>
<td>Spacing of Supports</td>
<td>Spacing of Supports</td>
</tr>
<tr>
<td>Metal or Wood Furring Channels</td>
<td>Metal Resilient Channel</td>
</tr>
<tr>
<td>One or Two Layers</td>
<td>One or Two Layers</td>
</tr>
</tbody>
</table>

### Gypsum Board, Suspended

<table>
<thead>
<tr>
<th><strong>Primary Supports only</strong></th>
<th><strong>Remarks</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image5" alt="Diagram" /></td>
<td><img src="image6" alt="Diagram" /></td>
</tr>
<tr>
<td>60&quot; to 96&quot; + o.c.</td>
<td>24&quot; to 48&quot; o.c.</td>
</tr>
<tr>
<td>Spacing of Supports</td>
<td>Spacing of Supports</td>
</tr>
<tr>
<td>Nailing Channels or Metal Joist Furring</td>
<td>Prefabricated Metal Suspension Grid</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Primary and Secondary Supports</strong></th>
<th><strong>Remarks</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7" alt="Diagram" /></td>
<td><img src="image8" alt="Diagram" /></td>
</tr>
<tr>
<td>60&quot; to 96&quot; + o.c.</td>
<td>60&quot; to 96&quot; + o.c.</td>
</tr>
<tr>
<td>Spacing of Supports</td>
<td>Spacing of Supports</td>
</tr>
<tr>
<td>Furring Channels Main Channel</td>
<td>Furring Channels Main Channel Secondary Supports</td>
</tr>
</tbody>
</table>

- when framing is spaced more than 24 inches on centers, or when a plenum space for mechanical/electrical service lines is required, a suspension/support system consisting of wood or metal sections or special nailing channels is generally provided.  
- prefabricated metal suspension systems are available.  
- primary suspension system may also include a secondary system of furring channels used to align the primary system and/or to provide resilient mounting of the membrane.  
- it is a high cost assembly and not widely used.  
- resilient furring channels generally used with wood framing.
## Construction Details and Finishes

### Ceilings

#### Plaster, Attached

**DIRECT TO FRAMING**

<table>
<thead>
<tr>
<th>16&quot; to 36&quot; o.c.</th>
<th>SPACING OF SUPPORTS</th>
<th>16&quot; to 24&quot; o.c.</th>
</tr>
</thead>
<tbody>
<tr>
<td>METAL LATH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GYPSUM LATH</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Metal or gypsum lath secured directly to framing.
- Membrane will be directly affected by deflection and/or expansion/contraction in supporting framing.
- Metal lath may be backed for machine application of plaster.
- Fire resistance ratings for different assemblies have been established.

**FURRED-DOWN**

<table>
<thead>
<tr>
<th>24&quot; to 60&quot; o.c.</th>
<th>SPACING OF SUPPORTS</th>
<th>24&quot; to 80&quot; o.c.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FURRING CHANNELS 16&quot; to 24&quot; on CENTER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FURRING CHANNELS 16&quot; to 24&quot; on CENTER</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Furring channels secured to framing, lath supported by furring.
- Furring will minimize effects of deflection and expansion/contraction upon membrane.
- Large areas of membrane should have expansion joints and should not be restrained at the perimeter.
- Corners of openings in gypsum lath membranes should have metal lath reinforcing.

#### Plaster, Suspended

**PRIMARY SUPPORTS ONLY**

<table>
<thead>
<tr>
<th>16&quot; to 24&quot; o.c.</th>
<th>SPACING OF SUPPORTS</th>
<th>16&quot; to 24&quot; o.c.</th>
</tr>
</thead>
<tbody>
<tr>
<td>METAL LATH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FURRING CHANNELS 16&quot; to 24&quot; on CENTER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GYPSUM LATH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FURRING CHANNELS 16&quot; to 24&quot; on CENTER</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Suspended membrane with furring channels only is similar to furred membrane except that furring channels are suspended from, rather than directly attached to, framing members.
- Suspension of membrane may be a requirement in some fire resistance rated floor or roof/ceiling assemblies.
- Spacing of hangers is quite close and limits the size and/or extent of mechanical/electrical service lines in plenum space.

**PRIMARY AND SECONDARY SUPPORTS**

<table>
<thead>
<tr>
<th>24&quot; to 60&quot; o.c.</th>
<th>SPACING OF SUPPORTS</th>
<th>24&quot; to 60&quot; o.c.</th>
</tr>
</thead>
<tbody>
<tr>
<td>METAL LATH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FURRING CHANNELS MAIN CHANNELS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GYPSUM LATH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FURRING CHANNELS MAIN CHANNELS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- When spacing of framing is wide and/or the number of hangers must be reduced, a primary support system consisting of main carrying channels may be used; the furring channels are then a secondary system, secured to such primary supports.
- For wide hanger spacing, metal joists instead of carrying channels may be used.
### CEILINGS

#### Exposed Grid Suspended Ceilings

**ASSEMBLY**

#### EXPOSED GRID: FLAT UNITS

**SQUARE EDGE**

- Lay-in panels should be secured in place by clips when assembly requires a fire resistance rating; also against uplift due to pressure differential.
- Fixtures generally have to be boxed-in for fire resistance rating; fire dampers must be provided at all openings, such as diffusers.
- Hangers secured to framing members, structural deck, or to secondary framing system.

#### RECESSED EDGE

- Clearance required for all lay-in panels for tilting them into place.
- Suspension system used is the same as for square edge tile, but tile only available in 2x2 foot size.
- May be used in fire resistance-rated floor or roof/ceiling assemblies; clips to secure tiles in place and opening protection generally required.

#### EXPOSED GRID, SHAPED UNITS

**INLAY PANELS, CORRUGATED, RIBBED**

- Metal panels generally perforated, with sound absorbing blankets.
- Plastic panels generally solid; used in luminous ceiling installations.
- Corrugated/ribbed metal or plastic panels generally used with main runners only.
- Flat plastic panels generally either 2x4 or 2x2 feet in size, used with main runners and cross tees.

**PRE-ASSEMBLED MODULES**

- Flat pre-assembled modules are also available.
- When pressurized plenum and ventilating tile are used, air return must be ducted through plenum.
- With ventilating plenum, dirt streaking may result unless the membrane is made completely air tight.
- May be used in fire resistance-rated floor or roof/ceiling assemblies.
### ASSEMBLY

#### CONCEALED GRID, SHAPED UNITS

**METAL PAN TILE**

- Tile may be repeatedly repainted without loss in sound absorbing characteristics.
- Heating/cooling piping may be incorporated into the system.
- Combination lighting/infrared heating fixtures may be integrated into membrane.
- Secondary suspension system generally required.
- Tile may be used for supply/return air.

**LINEAR PANELS**

- Formed prefinished metal panels in long lengths.
- Air supply/return and lighting fixtures may be integrated into the system.
- May be used outdoors in protected locations, such as large soffits, canopies.
- Some assemblies may be used as required components in fire resistance rated floor or roof/ceiling assemblies.
- Membranes may be curved perpendicular to direction of panels.

**BAFFLES**

- Baffles available in shaped metal, with or without sound absorbent material cores, or in faced sound absorbent material.
- Various arrangements available, such as linear, radial, hexagonal.
- Used to: provide additional sound absorption in selected locations; for visual interest, or to conceal mechanical/electrical services.

#### CONCEALED GRID, PLAT UNITS

**KERFED EDGE**

- Tile, generally 12 x 12 inches in size with kerfed edges secured in place by main runners in one direction, and cross tees or splines in the other.
- Secondary supports, such as carrying channels may be used to reduce spacing of hangers to framing system.
- May be used as component in fire resistance rated floor or roof/ceiling assemblies.
- Special panels available to provide access to plenum.
CEILINGS
Suspended Ceiling Types

Concealed 2-spline system with acoustical tile

Concealed 2-spline system with aluminum-clad acoustical tile

Suspended plaster ceiling

Suspended ceiling with gypsum board

Suspended ceiling with plywood finish
Construction Details and Finishes

CEILINGS
Suspended Ceiling Types

TYPICAL HUNG GYPSUM BOARD
CEILING DETAIL

TYPICAL CEILING DETAIL

TYPICAL LAY-IN TILE
CEILING DETAIL

TYPICAL CONCEALED SPLINE
CEILING DETAIL
CEILINGS
Suspended Ceiling Types

1. Existing structural steel, as required.
2. Furring channel, as required.
3. Existing window wall.
5. D.W.C. furring channels.
6. 90° O.D. plain, as required.
7. Drywall acoustical molding, as required.
8. Suspended acoustic tile, as required.

Ceiling height: 8'6" at Det. No. 1.

2. 9/16" black iron.
4. Fluorescent lighting, 2 runs, staggered.
5. Channel hangers.
7. 5/8" O.D. plain.
8. 15x15" Louvers, 1/4" plastic.

Ceiling height: 8'6" at Det. No. 2.

3. 9/16" (1/2" aluminum, l.a. on with elev. door head).
4. 90° O.D. plain, as required.
5. Brackets as required.
7. Susp. drywall acoustical holding, as required.
CEILINGS

Curved Ceiling with Recessed Lighting

4 LIGHT BULB AT SPRINGLINE EDGE OF CHAPEL CEILING VAULT 8'-5"-

5 TYPICAL SPRINGLINE EDGE OF CHAPEL CEILING VAULTS 8'-5"-
CONSTRUCTION DETAILS AND FINISHES

CEILINGS

Gypsum Board and Plaster-Suspended Ceilings

1. PLASTER ON METAL LATH & STEEL Furring

2. PLASTER ON GYPSUM LATH & STEEL Furring

3. GYPSUM BOARD ON STEEL Furring

HANGERS (MAX. SPACING 4'-0" O.C.)

1/2" FLAT BAR, 8 GAGE WIRE,
1/2" G.C., 1/2" O.D. MILD STEEL RODS

1/2" Furring Channels 4'-0" O.C.

3/4" RIB METAL LATH

3/4" GYPSUM PLASTER

NOTE: WHERE FIRE RATING IS REQUIRED, CHECK U.S. GYPSUM CATALOG FOR SPECIFICATIONS.

HANGERS—SEE DETAIL 1 ABOVE

1/2" Furring Channels 4'-0" O.C.

1/4" Furring Channels 10'-0" O.C.

1/2" GYPSUM PLASTER

1/8" PERFORATED GYPSUM LATH FASTENED TO 2" X 4" WITH METAL CLIPS

NOTE: WHERE FIRE RATING IS REQUIRED, CHECK U.S. GYPSUM CATALOG FOR THICKNESS & SPACING AS REQUIRED.

HANGERS—SEE DETAIL 2 ABOVE

1/2" Furring Channels 4'-0" O.C.

TYPE "S" SCREWS
5/8" GYPSUM BOARD

METAL FURRING CS CLIPPED OR WIRED WITH 10 GA. TIE WIRE TO 1/2" FURRING CS—SPACE 2'-0" O.C.

NOTE: CHECK CODE FOR FIRE RATING
ACOUSTIC TILE CONCEALED ZEE SUSPENSION SYSTEM

ACOUSTIC TILE H & T SUSPENSION SYSTEM

ACOUSTIC TILE Z & L SUSPENSION SYSTEM
CEILINGS
Reflected Ceiling Plan

CEILING LEGEND

Completed design for an office space
STAIRS

Planning Data

Purpose

The six diagrams in Fig. 3 represent unit plans for types of nonwinder stairways which are most frequently encountered in the average residential planning problem. Tabular information with each was developed from data contained in Table 1.

Unit plans are drawn to 1/4" scale and therefore can be supplied directly as a check of stair layouts to sketch plans and elevations. Each represents an average condition with a stair pitch well within the comfort zone. The basis is a 9'6" floor-to-floor height with 16 risers each 7.13" in height. Width is 3'0" from wall to wall.

Tabular data with each unit plan indicate dimensional variations which occur when stairways of substantially similar pitches are planned for floor-to-floor heights from 8 to 11 ft.

Width is the only critical dimension missing from this unit plan information. This varies with requirements of design and stair use and should be selected from data in Table 2.

Application of Unit Plans

Diagrammatic data can be used on sketches as a graphic check as noted. Tabular data can be applied to either sketches or working drawings to eliminate the necessity of developing experimental stairway sections to determine run, proportional rise, horizontal and vertical areas, and location of under-rake minimum headroom.

Dimensional data have been confined to a single pitch for all floor-to-floor heights. The pitch indicated is that most generally desirable for human comfort. Data for other pitches listed as tread and riser proportions in Table 1 can be substituted for values of \( L_1 \), \( L_2 \), and \( M \).
Fig. 3 (Continued)
Construction Details and Finishes

STAIRS
Spiral and Circular Stairs

**SPIRAL STAIRS**

- 5' diameter — spiral
- 6' diameter — spiral

**CIRCULAR STAIRS**

- 8' diameter — circular
- 9' diameter — circular
- 13' diameter — circular
- 15' diameter — circular

Note: All drawings left-hand turn (looking down).
Types of Stairs
Four types of stairs are defined: straight stairs, circular stairs, curved stairs, and spiral stairs.
Straight stairs are by far the most common type, representing the bulk of the stair market. Though the term “straight” is self-explanatory, for purposes of classification a straight stair is defined as one in which the stringers are straight members. Straight stairs, unlike stairs of the other three types, may be arranged in several different ways:
Straight run: Either a single flight extending between floors, as shown in Fig. 5A, or a series of two or more flights in the same line, with intermediate platforms between them, as shown in Fig. 5B.
Parallel: Successive flights which parallel each other and are separated only by one or more intermediate platforms, as shown in Fig. 5C.
Angled: Successive flights placed at an angle of other than 180° to each other (often 90°), with an intermediate platform between them, as shown in Fig. 5D or E. The type shown in Fig. 5D is often referred to as a “trussed” stair.
Spiral: A pair of straight run flights parallelling each other in plan and running in opposite directions on opposite sides of a dividing wall, as shown in Fig. 5F.
Circular stairs are stairs which, in plan view, have an open circular form, with a single center of curvature. They may or may not have intermediate platforms between floors.
Curved stairs are stairs which, in plan view, have two or more centers of curvature, being oval, elliptical, or some other compound curved form. They also may or may not have one or more intermediate platforms between floors.
Spiral stairs are stairs with a closed circular form, having uniform sector shaped treads and a supporting center column.

Classes of Stairs
The class designation of stairs, as already noted, is a key to the type of construction, the quality of materials, details and finish and, in mortgage cases, the relative cost. As stairs of all classes are built to meet the same standards of performance in respect to load carrying capacity and safety, these class distinctions do not represent differences in functional value, but in character and appearance. It is important to recognize that where function is the prime concern, and esthetics are of minor importance, significant economies can be achieved by specifying one of the less expensive classes.
The following four classes of stairs are listed in order of increasing cost (as a general rule); the general construction characteristics of each class are described.

Industrial class. Stairs of this class are purely functional in character and consequently they are generally the most economical. They are designed for either interior or exterior use, in industrial buildings such as factories and warehouses, or as fire escapes or emergency exitways. They do not include stairs which are integral parts of industrial equipment.

Architectural class stairs are similar in nature to any light steel construction. Hex head bolts are used for most connections, and welds, when used, are not ground. Stringers may be either flat plate or open channels, treads and platforms are usually made of grating or formed of floor plate, and risers are usually open, though in some cases filled pan type treads and steel risers may be used. Railings are usually of either pipe, tubing, or light steel angle construction.

Service class. This class of stairs serves chiefly functional purposes, but is not unattractive in appearance. Service stairs are usually located in enclosed stairwells and provide a secondary or emergency means of travel between floors. In multistoried buildings they are commonly used as egress stairs. They may serve employees, tenants, or the public, and are generally used where economy is a consideration.

Stringers of service stairs are generally the same types as those used on stairs of the industrial class. Treads may be one of several standard types, either filled or formed of floor or tread plate, and risers are either exposed steel or open construction. Railings are typically of pipe construction, or a simple bar type with tubular newels, and soffits are usually left exposed. Connections on the underside of the stairs are made with hex head bolts, and only those welds in the travel area are smooth.

Commercial class. Stairs of this class are usually for public use and are of more attractive design than those of the service class. They may be placed in open locations or may be located in closed stairwells or in public, institutional, or commercial buildings.

Stringers for this class of stairs are usually exposed open channel or plate sections. Treads may be any of a number of standard types, and risers are usually exposed steel. Railings vary from ornamental bar or tube construction with metal handrails to simple pipe construction, and soffits may or may not be covered. Exposed bolted connections in areas where appearance is critical are made with countersunk flat or oval head bolts; otherwise, hex head bolts are used. Welds in conspicuous locations are smooth, and all joints are closely fitted.

Architectural class. This classification applies to any of the more elaborate and usually more expensive stairs, those which are designed to be architectural features in a building. They may be wholly custom designed or may represent a combination of standard parts with specially designed elements such as stringers, railings, treads, or platforms. Usually this class of stair has a comparatively low pitch, with relatively low risers and correspondingly wider treads. Architectural metal stairs may be located either in the open or in enclosed stairwells in public, institutional, commercial, or monumental buildings.

The materials, fabrication details, and finishes used in architectural class stairs vary widely, as dictated by the architect’s design and specifications. As a general rule, construction joints are made as inconspicuous as possible, exposed welds are smooth, and soffits are covered with some surfacing material. Stringers may be special sections exposed, or may be structural members enclosed in other materials. Railings are of an ornamental type and, like the treads and risers, may be of any construction desired.

General Requirements, All Classes of Stairs
All fixed metal stairs, regardless of class, are of fire-resistant construction and are designed and constructed to carry a minimum 500 pounds of person per square foot of projected plan area or an alternative concentrated load of 300 pounds applied at the center of any tread span. Railings and handrails are designed and constructed to withstand a minimum force of 200 pounds applied in any direction at any point on the rail.
STAIRS
General Purpose Steel Stairs

**PLAN A-A**

**LAYOUT FOR:**
MULTIPLE STORY
INTERMEDIATE PLATFORM
TWO RUNS PER STORY

**SECTION SCALE 1/8"=1'-0"**

**NUMBER OF RISERS VARIABLE**

**PLAN B-B**

**TREADS**

**PLAT**

**ROUGH WELL**

**ROUGH BEAM**

**START-AT POST**

**WALL STRING**

**SCALE 1/8"=1'-0"**

**SPECIFICATION FOR STAIR AS DETAILED:**
Furnish and erect steel stairs and railings complete as detailed. Strings 10"x1"x1/8" steel channels with 1 1/2"x1 1/4"x1/8" angle brackets, facia same section bolted to newels and floor construction. Headers of channels bolted or welded to newels and strings, Angle struts placed in wall, bolted to strings and to floor construction. Riser and sub-treads of 14 gauge steel, sub-platforms of 12 gauge steel reinforced with angle or tee stiffener. Fill, 2" for treads, 3" for platforms, by others. Newels 4" square pipe, rolling balusters 1/2" square spaced 4/5" and welded into 1"x1/8" channels top and bottom with handrail section as shown. All surfaces to be cleaned and painted one shop coat. Shop drawings, to show construction methods and fastenings, are to be approved before fabrication.

**ALTERNATE SPECIFICATIONS:**
Strings may be channels, flat plates, or formed plates.
Tread Brackets may be other size angles, or bars.
Riser brackets may be omitted.
Hanger Rods may be used in place of struts.
Sub-Treads, Riser and Sub-Platforms may be heavier gauge.
Newels and Railings may be of other construction as designed by architect.
Wall Ralls, where required, may have some handrail section as railing.
Prime Coat may be red lead, black graphite, zinc chromate, or other approved paint.
STAIRS

Steel Stairs

LAYOUT FOR:
MULTIPLE STORY
INTERMEDIATE PLATFORMS
PLATFORM AT FLOOR
TWO RUNS PER STORY
Strings and rails finishing against face of rectangular newels, allowing minimum hand clearance between strings and rails. For wider center well, two square newels replace one rectangular newel.

LAYOUT FOR:
MULTIPLE STORY
INTERMEDIATE PLATFORMS
THREE RUNS PER STORY
Open center well allowing intermediate stair runs at 90 degrees. One square newel at each platform.

LAYOUT FOR:
MULTIPLE STORY
INTERMEDIATE PLATFORMS
ONE AND TWO RUNS PER STORY
Arrangement for stairs in corridors, or other restricted spaces, either closed or open well.
STAIRS
Steel Stairs

SECTION
NUMBER OF RISERS VARIABLE.

PLAN A-A
SCALE 1"
13 TREADS
TILE OR LINOLEUM MAY BE USED FOR TREAD COVERING

CLIPS FOR METAL LATH 15° C.C.

CLIPS FOR METAL LATH 15° C.C.

ROUGH BEAM
2"
6"

WALL STRING-TREAD-RISER

BASE

SCALE 1/4" = 1-0'
6" BENT PL.

10°-6.5°

ALTERNATE STRING CONSTRUCTION

WOOD

RUBBER TILE OR LINOLEUM

ALTERNATE TREAD CONSTRUCTION
SUPPORTING BRACKETS ARE OMITTED WHEN TREADS ARE WELDED TO STRINGS

ALTERNATE RAIL CONSTRUCTION

HALF OVAL
The platform (Fig. 6) is shown constructed with a steel channel, A, of adequate strength to span the well on line X, through Secs. 1, 2, and 3, and supported at both ends by the wall strings. Newel posts rest on this channel through angle clips, around which the platform plate is cut (Sec. 3). Face strings have welded end plates with flathead screws tapped into the newels (Sec. 2).

The two platforms with two intermediate risers (Fig. 7) are shown constructed with the load carried on line Y by string B, post C, and channel D, which are shown bolted together (Secs. 8, 9, and 10) with through bolts. The load is also carried from post C on line Z in the same manner.

The members at post C may be brought together and welded and the post fitted over the connection, or the entire unit welded.

Stairs are supported by one or more of the following methods, (a) String at floor rests directly on floor construction, (b) String at landing or platform extends into adjacent load-bearing wall, or (d) String at landing or platform is supported by struts extending to the floor below, these being of angles, I-beams or pipes either set in the wall or exposed, or (e) String at landing or platform is supported by rods hung from the floor above, either set in walls or exposed; (a) String parallel to load-bearing wall may have shelf brackets on the back of the strings and set in wall; similar brackets may be used with struts or hanger rods.
STAIRS

Stairwell

Width of stair is usually considered center line of rail to finished wall. When wall rail is required allowance should be made for clearance to comply with any legal requirements as to net width.

METHOD OF ESTABLISHING THE WIDTH OF A STAIR WELL

Height of riser and width of tread vary to fit the type of stair and its use. Legal requirements often limit the minimum tread and maximum rise. A tread of 10" and a rise of 7 3/4" are considered average. Stairs of easy runs are often 10 1/2" to 11" treads with risers under 7". Stairs used exclusively by maintenance and operating men are often constructed with a rise and tread to equal a pitch greater than 40°. Tread width is always face to face of riser.

METHOD OF ESTABLISHING THE LENGTH OF A STAIR WELL

In some localities laws or ordinances establish a minimum platform width in relation to stair width.
Width of stair is usually measured from inside face of balusters or newel to finished wall. However, governing codes should be consulted for points of measurement.

A minimum clearance of ¼" should be allowed between edge of stringer and wall.

Refer to governing codes to establish dimensions

3½" maximum projection into required egress width. If more than 3½", egress width should be increased by the excess of projection over 3½".

Minimum 1½" hand clearance between rails, and between handrail and wall, or other obstructions.

Stair Width Dimensions

Minimum code requirements are usually measured from finished wall to finished wall. When establishing rough stair well dimensions, allowance should be made for thicknesses of any finish materials to be applied to the rough walls.

Platform width not less than width of stair, usually measured from inside face of balusters or newel to finished wall. However, governing codes should be consulted for points of measurement.

A minimum clearance of ¼" should be allowed between edge of stringer and wall.

All handrail heights to meet minimum requirements of governing codes.

Length determined by tread run and number of treads required by code.

Varies; recommended minimum 1½".

Varies; recommended minimum 1½".

Stair Well Width — Distance Between Walls
STAIRS

Stair Length Dimensions

REFER TO GOVERNING CODES TO ESTABLISH DIMENSIONS

Height of riser and tread run vary according to governing codes. A tread of 10" and a rise of 7" to 7½" are considered average. Stair treads for more comfortable runs are often 10½" to 11" with risers less than 7". Treads and risers should be so proportioned that the sum of two risers and one tread run is not less than 24" or more than 26".

In establishing stair well dimensions, tread run is always face to face of riser.

Minimum code requirements are usually measured from finished wall to finished wall. When establishing rough stair well dimensions, allowance should be made for thickness of any finish materials to be applied to the rough walls.
Construction Details and Finishes

STAIRS

Tread and Riser Construction

Steel riser and sub tread with formed nosing, angle supporting brackets.

Steel riser and sub tread with abrasive safety nosing, sanitary cove, flat bar supporting brackets.

Steel riser and sub tread with grooved safety nosing and tile or linoleum fill, angle supporting bracket. Other types of safety nosing or tread covering may be used.

Grating Tread.

Steel riser and sub tread with precast or wood treads, angle supporting brackets.

Steel riser and sub tread with marble tread and riser, angle supporting brackets.

Treads and riser brackets may be 1 1/4" x 1 1/4" x 1/8" or 1/8" angles, welded or riveted to string, or 1 1/4" x 1/8" bar welded. Treads and risers are usually bolted to brackets with round head bolts. Cast or grating treads are usually bolted to string with two 5/8" bolts at each end. Brackets back of risers may be omitted when more economical construction is desired.

Stairs with concrete or terrazzo fill may be constructed with the top of supporting bracket 2" below the tread surface and 3" below the platform surface. These thicknesses may be less for narrow stairs or where use is limited. Fill is always considered the distance from string bracket to finish tread.

Steel floor plate tread, angle tread bracket, with or without steel riser.

Cast metal abrasive tread, with or without steel riser.
Construction Details and Finishes

STAIRS
Tread Sections

Steel sub-tread and riser with formed nosing at 45 degrees, with or without sanitary cove. Concrete filled tread.

Steel sub-tread and riser with or without sanitary cove, with square formed nosing. Concrete filled tread.

Steel sub-tread and riser with riser sloped to meet formed nosing. Concrete filled tread with resilient tile covering.

Steel sub-tread without riser, concrete filled and reinforced.

Steel sub-tread and riser formed to receive pre-fabricated tread such as pre-cast concrete.

Steel floor plate or aluminum tread plate formed tread and riser.

Steel floor plate or aluminum tread plate formed tread with sheet steel or aluminum riser optional.

Steel or aluminum grating with nosing. End plates welded to grating and bolted to stringer.

Extruded aluminum tread.

Steel channel sub-tread concrete filled.
These string sections include a majority of the various types of strings employed for steel stairs. Other types also are used, and other methods of combining with railings are sometimes desired.

The various types of trim moldings shown are only illustrative of the possibilities of design. The various forms of box type strings shown illustrate several methods of accomplishing this type of construction.

Because of the great number of extrusion and rolling dies now in use for the manufacture of moldings of steel, aluminum, bronze and other metals, the architectural plans should give the manufacturers molding numbers selected, if the moldings shown are designed specially for the project the plans should so state.

Flat plate strings with floor plate tread and pipe railing.

Bent plate strings with cast tread, with or without abrasive.

Structural steel channel strings with grooving type treads.

Box type face string of two plates and two channels.

Box type face string of steel channel and ferrous or non-ferrous exposed face; steel plate wall string.
STAIRS
Stringer Sections

Steel plate stringers, carrier angles, floor plate treads, pipe railing on side of face stringer. Aluminum tread plate may be used when specified. Wall not plastered.

Steel plate stringers, carrier angles, steel sub-tread and riser, concrete filled tread. Pipe railing on side of face stringer, wall not plastered.

Standard steel channel stringers, grating tread bolted or welded to stringer, pipe railing bolted or welded to top flange of face stringer. Wall not plastered.

Steel junior channel stringers, carrier bars, steel sub-tread and riser. Concrete filled tread. Railing with bottom channel fastened to top flange of face stringer. Optional closure piece fastened to top flange of wall stringer in the field. Wall not plastered.
Cast abrasive nosing with short lip, available in iron, bronze or aluminum as specified. Standard drilling with wing anchors, bolts and nuts or drilled as required.

Cast abrasive nosing with deep lip, available in iron, bronze or aluminum as specified. Standard drilling with wing anchors, bolts and nuts or drilled as required.

Extruded aluminum base with epoxy top, containing abrasive. Available in colors, integral anchors for fresh concrete. Also available drilled to specifications without the anchors.

Extruded aluminum or brass with abrasive filled ribs. Concealed integral anchor runs full length of tread. Also available drilled to specifications, without the integral anchor.

Extruded aluminum with abrasive ribs. Special design for pan stairs with sloped risers. Drilled to specification or furnished with strap anchors or wing anchors.

Barrier free design to meet standards for the physically handicapped. Aluminum base with epoxy containing abrasive top. Integral anchors for fresh concrete.

Cast abrasive structural tread, available in iron or aluminum, integrally cast and lugs for bolting directly to stringers.

Cast abrasive double nosed tread, available in iron or aluminum and is reversible. Supported by carrier angles bolted to tread and either bolted or welded to stringer.

Cast abrasive tread, available in iron or aluminum. Nosing and toe plate can be drilled for attaching flat plate risers. Supported by carrier angles.
**STAIRS**

**Handrails**

NOTE: When the railing and stringer metals are weldable to each other, the railing post can be welded directly to the stringer.

**A**

PLAN AT A

Stair platform or landing with pipe railings, railings not connected, for stairwell having minimum clearance. Short newels, supported on header.

**B**

PLAN AT B

Stair platform or landing with pipe railing, one post at return. Lower rail returned into post, two or more posts used at wide wells. Short newels, supported on header.

**C**

PLAN AT C

Stair platform or landing with rectangular or square newel, pipe railing members capped and welded to newel post.

**D**

PLAN AT D

2" x 4" STAINLESS STEEL HANDRAIL

BLUESTONE TREADS

HARD LEAD CAULKING CEMENT GROUT

STEEL SLEEVE 2 1/2" x 4 1/2" (INSIDE DIM) x 6"

STEEL BASE PLATE 4" x 6" W/CONTINUOUS WATERTIGHT FILLET WELD

TOP RISER  BOTTOM RISER

HANDRAIL
Stair start with square newel, baluster type railing with channel top and bottom, pipe handrail.

Stair start with short newel, parallel bar type railing with end and intermediate posts of square, rectangular or round section, extruded handrail with mitered, forged or cast terminal.

Stair start with square newel, parallel bar type railing with Intermediate posts of square, rectangular or round section; extruded or rolled handrail section mitered to form cap over newel.

Square or rectangular newel, pipe rail fitted with offset lug to center on stringer.

Square or rectangular newel, pipe rail fitted with offset lug for positioning inside of stringer.

Section showing fastening for Intermediate posts to stringers.

Rectangular newel, pipe rail and stringer welded or bolted to face.
STAIRS
Newels and Railings

Stair landing with stringers and fascia framed square. Square railing return, end balusters centered on newels and landing extended on up flight to set-back riser.

Stair landing with stringers and fascia framed into full height newel, baluster railing with channel top and bottom. Continuous pipe handrail offset from balusters and newels by brackets.
Figures 9 and 10 indicate typical railings for decks, platforms, balconies, roofs, and similar locations, adapted for residential, apartment, or hotel construction. These railings may be fastened with wood screws or lag bolts to wood, or with expansion bolts to masonry. On roofs or decks the setting of the post bases should be waterproofed.

Fig. 9

Space for ornament
Design by architect

Opening

Fig. 10

-1-
Section

Methods of constructing railing top members.

Scale 1/8" = 1'-0"

To specify:
Give locations.
Indicate kind of metal.
Specify finish.
Give sizes of members.
Give height.
Provide scale details of ornaments, finishes and bases.
Specify method of fastening, or have fabricator provide fastenings best suited to each condition.

Railing with balusters and bottom longitudinal member supporting balusters. Posts extending into masonry.

Railing without bottom longitudinal member, each baluster set in masonry and fitted with slip flange or base. Masonry specifications should specify holes.
STAIRS
Ornamental Railings

1. Railing panels set between columns or jambbs. Posts extended to floor construction for support.

2. Railing for balcony or mezzanine with double posts and panels. Posts extended to support facia and fastened to floor construction.

3. Railing for balcony or mezzanine with curved section. Facia fastened to floor construction. Railing fastened to facia.
Center railings are recommended for wide stairs. They may be a single pipe or tubing railing or they may be designed with double rails and panels of interesting design.

Note: A number of codes require that railings have a level extension beyond the nosings at the floors as indicated in Fig. 11 by dashed lines. This applies to both wall and center railings.

1

Alternate Sections

Hinged Bracket

Non-ferrous or stainless steel sleeves may be used on exterior rails to prevent staining masonry or concrete.
STAIRS
Railings

ELEVATION OF WELDED PIPE RAILING
@ 8” x 1-0”

1/2” PIPE

POST SET IN PIPE OR SHEET METAL SLEEVE
ANCHOR W/ CONC. OR EPOXY, PLANK MAY BE
LOOSE OR FASTENED TO POST.

NOTE: MOLTEN LEAD OR LEAD WOOD
MAY BE USED FOR ANCHORING,
WHERE THE TENDENCY TO FLOW
IS NOT A FACTOR, INVOLVING
STRENGTH.

CONC.
METAL SLEEVE
3” x 3” x 3/4” PL. WELDED TO
BOTTOM

1/2” PIPE

1/2” x 1/4” PLATE WELDED TO
STRINGER

STRINGER

WELDED PIPE RAILING DETAIL
FOR STEEL STAIRS
@ 3” x 1-0”

RECOMMENDED
POST SPACING
FOR PIPE RAILING

<table>
<thead>
<tr>
<th>SIZE OF PIPE</th>
<th>MAXIMUM SPACING</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4”</td>
<td>4”</td>
</tr>
<tr>
<td>1”</td>
<td>6”</td>
</tr>
<tr>
<td>1 1/4”</td>
<td>7”</td>
</tr>
<tr>
<td>1 1/2”</td>
<td>8”</td>
</tr>
<tr>
<td>2”</td>
<td>9”</td>
</tr>
<tr>
<td>2 1/2”</td>
<td>10”</td>
</tr>
<tr>
<td>3”</td>
<td>10”</td>
</tr>
</tbody>
</table>
TYPICAL EXTRUDED ALUMINUM AND BRONZE POST SECTIONS

1 1⁄8"  
1 1⁄4"  
2 3⁄4"  
2 1⁄2"  
2"  

Flanges for box and solid stringers.  
Flanges for channel stringers.  

Post mounted on box stringer.  
Post mounted on channel stringer.  
Post mounted on concrete step using post anchor.  

Sections — Railing posts with brackets.

Fig. 12  
Stair landing with box stringers attached to sides of newel, parallel type bar railing supported by brackets at newels and intermediate posts. Risers offset to allow metal soffits of stair to meet at intersection with soffit of landing. Bottom and top rails must be the same and have symmetrical cross section to obtain proper mitered connection.

Fig. 13  
Elevation of Fig. 12: rectangular newel post.


**TYPICAL EXTRUDED ALUMINUM AND BRONZE HANDRAIL SECTIONS**

![Diagram of typical extruded aluminum and bronze handrail sections]

- **A = 1-5/8", 1-15/16", 2-1/4"**
  - Aluminum and Bronze
- **A = 1-3/4", 2-1/8"**
  - Aluminum and Bronze
- **A = 1.66" and 1.90" typical.**
  - Aluminum and Bronze
- **A = 2-3/8" Aluminum**
- **A = 1-1/2", 2", 2-1/2" Aluminum**

**Fig. 14**

Most of these sections can be mounted on channels or flats, secured by screws from below. Some are designed for mounting on handrail brackets. The use of channels instead of solid bars often simplifies the attachment of balusters and ornaments. The channels may be of the same or a different metal.

---

**TYPICAL ROLLED STEEL HANDRAIL SECTIONS**

![Diagram of typical rolled steel handrail sections]

- **A = 1-3/4" Steel**
- **A = 1-15/16", 2-1/4" Steel**
- **A = 3-1/4" Steel**

**Fig. 15**

Most of these sections can be mounted on channels or flats, secured by screws or welding from below. Sometimes they are welded directly to the baluster (see Fig. 15) or attached to handrail brackets (see Fig. 14). The use of channels often simplifies the attachment of balusters and ornaments.
### Representative Extruded and Tubular Stainless Steel Handrail Sections

Stainless Steel Extrusion

Stainless Steel (other sizes available)

Stainless Steel

Stainless tubular handrail sections usually have a wall thickness of .065".

### Plastic Handrail Coverings

**Fig. 16**

**Fig. 17**

**Fig. 18**

**Fig. 19**

### Table 4: Table of Dimensions for Plastic Handrail Coverings

<table>
<thead>
<tr>
<th>Fig.</th>
<th>Inside width</th>
<th>Inside height</th>
<th>Outside width</th>
<th>Outside height</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>1&quot;</td>
<td>1½&quot;</td>
<td>1¾&quot;</td>
<td>1½&quot;</td>
</tr>
<tr>
<td></td>
<td>1¼&quot;</td>
<td>1½&quot;</td>
<td>1¾&quot;</td>
<td>1½&quot;</td>
</tr>
<tr>
<td></td>
<td>½&quot;</td>
<td>1½&quot;</td>
<td>1¾&quot;</td>
<td>1½&quot;</td>
</tr>
<tr>
<td>17</td>
<td>1¼&quot;</td>
<td>1½&quot;</td>
<td>1¾&quot;</td>
<td>9½&quot;</td>
</tr>
<tr>
<td></td>
<td>½&quot;</td>
<td>1½&quot;</td>
<td>1¾&quot;</td>
<td>1½&quot;</td>
</tr>
<tr>
<td></td>
<td>2&quot;</td>
<td>1½&quot;</td>
<td>2½&quot;</td>
<td>1½&quot;</td>
</tr>
<tr>
<td>18</td>
<td>1¾&quot;</td>
<td>2&quot;</td>
<td>3½&quot;</td>
<td>9½&quot;</td>
</tr>
<tr>
<td></td>
<td>1¾&quot;</td>
<td>2&quot;</td>
<td>3½&quot;</td>
<td>9½&quot;</td>
</tr>
<tr>
<td>19</td>
<td>1¾&quot;</td>
<td>2&quot;</td>
<td>3½&quot;</td>
<td>9½&quot;</td>
</tr>
</tbody>
</table>

**Caution:** Consult manufacturers for fabrication limitations.

### General Information

Functional and decorative plastic handrail mouldings of polyvinyl chloride plastics are available in a variety of sizes and profiles, several of which are illustrated in Figs. 16 to 19. Consult suppliers' current literature for variations in details and features.

Plastic handrail mouldings are not structural and require bar, tube, or channel members to support vertical and horizontal loads.

Plastic handrail mouldings are produced in a range of colors from subdued to bright, to suit either formal or informal design situations. The color is integral with the plastic, which is highly resistant to wear, weathering, and corrosion.

The thermoplastic material becomes pliable when heated (not over 165°F), at which time it can be fitted over the support member and conforms to vertical, horizontal, or combined vertical and horizontal curves within certain limitations.

Lateral bends should have a minimum centerline radius of not less than 2 times the width of the plastic section or 2¾ to 3 times the width of the support section, whichever is greater. Mitered corners should be used if sharper turns are required.

Combined vertical and horizontal turns can be formed by twisting the moulding. The material can be joined by thermal welding, and end caps can be shaped using a knife, a file, or abrasives.

The use of a cleaning solution for removing grease and foreign material is recommended, after which a solvent is used for polishing or removing abrasive scratches. Normal cleaning requires only soap and water.
Wall rail bracket of conventional cast design, malleable iron, aluminum or bronze. 3/8" bolt into wall.

Wall rail bracket of extruded aluminum, made to set at right angle to wall rail or set vertically. 3/8" bolt into wall.

Wall rail bracket of conventional cast design, malleable iron, aluminum or bronze, 3/8" stud into wall, tapped into arm of bracket.

Two-piece wall rail bracket of aluminum. Wall plate bolted into wall through expansion type anchor. Outer sleeve screwed to rail. Outer sleeve fastened to wall plate by set screw.

Wall rail bracket of aluminum with fittings to handrail adjustable to any pitch. 3/8" stud into wall.

Wall rail bracket of formed steel. Filler and anchor bolt through gypsum board on masonry. Bracket fastened to filler by three screws or by 3/8" bolt through center.
STEEL STAIRS

- 3½ x 4½" steel newel
- Metal door
- Wall string
- Face string
- 1½" dia iron pipe rail
- Wall pipe rails secured with C1 brackets 5-0 ac
- 3½ x 4½" steel newels with C1 caps and drops
- ½" x 11/16" x 3/4" steel newel
- Tread and risers in section
- Metal or Kalumair doors and trim
- Wall string opposite side
- 12 x 12 string bent to 10" width
- 7 ½ sq bars 300 ac
- ³/₈" iron pipe
- Sunk riser (see detail)
- 12 x 14" Plate string bent 10" wide
- Stacked iron molding for face strings
- 1/4" x 1/4" sheet metal stringer
- Plaster line

SECTION ON A-A SHOWING CONSTRUCTION OF TYPICAL STEEL STAIR
Scale ⅞"=1'-0"

SECTION THRU TRUSS RISER D-D ³/₈"=1'-0"

DETAILED SPICE FOR STRING

DETAILED NON-SLIP NOSING FOR TREAD ⅛"=1'-0"

Pipe cap
1½" Pipe hand rail
Wall bracket

ELEVATION OF BRACKET & HAND (WALL) RAIL
Construction Details and Finishes

STAIRS

Steel Stair Details

**Detail of Typical Handrail at Stair #1**

Scale: 1" = 1'-0"

**Detail of Handrail at Stair #2**

Scale: 1" = 1'-0"

**Detail of Tread & Raiser at Stairs #3 & 5**

Scale: 1" = 1'-0"
STEEL STAIRS WITH TERRAZZO TREADS

1. STAIR DETAIL (TERRAZZO TREAD) 5'-0" x 7'-0"

STEEL STAIRS WITH TERRAZZO TREADS AND RISERS

1. STAIR DETAIL WITH TERRAZZO RISERS & TREADS

2. DOVETAIL ANCHOR @ 72" FULL SIZE

<table>
<thead>
<tr>
<th>LENGTH (FT)</th>
<th>THICKNESS (MIN) IN</th>
</tr>
</thead>
<tbody>
<tr>
<td>70'-0&quot;-90&quot;</td>
<td>1 3/8&quot;</td>
</tr>
<tr>
<td>90'-0&quot;-96&quot;</td>
<td>1 7/8&quot;</td>
</tr>
<tr>
<td>96'-0&quot;-120&quot;</td>
<td>2&quot;</td>
</tr>
</tbody>
</table>

3. SECTION @ 72" FULL SIZE

MINIMUM RECOMMENDED THICKNESS FOR TERRAZZO TREAD RISERS & STRINGERS

NOTE: PLASTER STRINGER, PUNCHED TO RECEIVE ANCHOR OF FINISHED MARBLE STRINGER.
Construction
Material may be steel, stainless steel, cast iron, or aluminum. Treads are supported in cantilever fashion by the column, each consecutive tread being rotated at a predetermined angle. The platform attaches to the column and is fastened to the floor structure to hold the column secure. The spiral railing is supported by balusters attached to the outer ends of the treads.

Tread Designs
Fabricators provide several standard types and designs of treads and platforms. These include open riser, closed riser, and cantilever types, with surface of checkered plate, abrasive plate, steel grating, or plain surface to receive wood, resilient flooring, carpet, or other covering. Pan type treads to receive concrete or terrazzo fill are also available.

Stair Height
Spiral stairs are adaptable to any height, the height being equal to the distance from finished floor to finished floor.

Stair Diameter
Spiral stairs are available in various diameters from 3'6" to 8'0"; normally in 6" increments. A 4'0" diameter is considered minimum for general access purposes; a 5'0" diameter provides a comfortable general purpose stair. Larger diameters are used chiefly for architectural effect. Note that the diameter of the finished well opening should be at least 2" greater than the stair diameter to provide hand clearance.

Hand of Stairs
Left-hand stairs: User ascends in clockwise direction, with handrail at left.
Right-hand stairs: User ascends in counterclockwise direction, with handrail at right.

**TABLE 5** Riser Heights for Various Tread Angles

<table>
<thead>
<tr>
<th>Tread angle of riser*</th>
<th>Min. height of riser</th>
<th>Treads per 3/4 circle</th>
<th>Treads per full circle</th>
</tr>
</thead>
<tbody>
<tr>
<td>30°</td>
<td>8 1/4&quot;</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>27°</td>
<td>8&quot;</td>
<td>10</td>
<td>13 = 361°</td>
</tr>
<tr>
<td>24 1/4&quot;</td>
<td>7 1/4&quot;</td>
<td>11</td>
<td>15 = 371 1/4&quot;</td>
</tr>
<tr>
<td>22 1/2&quot;</td>
<td>6 1/4&quot;</td>
<td>12</td>
<td>16</td>
</tr>
</tbody>
</table>

*Minimum height to attain 6'6" clear headroom using a 90° landing, 2" thick.

**TABLE 6** Chart for Selection of Number and Height of Risers

<table>
<thead>
<tr>
<th>Floor to floor height</th>
<th>Number of risers and height of each in inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>7'0&quot;</td>
<td>10</td>
</tr>
<tr>
<td>7'4&quot;</td>
<td>11</td>
</tr>
<tr>
<td>7'8&quot;</td>
<td>12</td>
</tr>
<tr>
<td>8'0&quot;</td>
<td>13</td>
</tr>
<tr>
<td>8'2&quot;</td>
<td>14</td>
</tr>
<tr>
<td>8'4&quot;</td>
<td>15</td>
</tr>
<tr>
<td>8'6&quot;</td>
<td>16</td>
</tr>
<tr>
<td>9'0&quot;</td>
<td>17</td>
</tr>
<tr>
<td>9'4&quot;</td>
<td>18</td>
</tr>
<tr>
<td>9'8&quot;</td>
<td>19</td>
</tr>
<tr>
<td>10'0&quot;</td>
<td>20</td>
</tr>
<tr>
<td>10'4&quot;</td>
<td>21</td>
</tr>
<tr>
<td>10'8&quot;</td>
<td>22</td>
</tr>
<tr>
<td>11'0&quot;</td>
<td>23</td>
</tr>
<tr>
<td>11'4&quot;</td>
<td>24</td>
</tr>
<tr>
<td>11'8&quot;</td>
<td>25</td>
</tr>
<tr>
<td>12'0&quot;</td>
<td>26</td>
</tr>
</tbody>
</table>

<diagram>
STAIRS
Spiral Stairs

**Diameter and head room**  Spiral stairs may be made in diameters from 3'6" to 6'0" or greater, with 4'0" usually considered the minimum for easy travel. The well hole should be at least 3" larger in diameter than the stair, for railing clearance. Spiral stairs are usually constructed with 12 or 16 treads to the circle. Head room should be calculated on the basis of three-fourths of a circle. On a 12-tread circle, 9" is approximately the minimum rise, providing 6'9" head room. On a 16-tread circle, 7" rise will provide 7'0" head room. A rise up to 12" per tread may be employed.

CAST METAL SPIRAL STAIR CONSTRUCTION:
Spiral stairs may be constructed with cast metal treads and landings of plain or checkered surface, made with or without abrasive material. Each tread has a collar which slips over a stand pipe of steel. Risers are not desirable as toe room near the stand pipe is limited. The treads are bolted together at the outer edge, either by bolts or by using the railing posts as bolts. Fabricators may have several types of standard design treads and landings which may be satisfactory without preparation of special patterns.
Circular stairs placed between walls may be built self-supporting at the inner string and be supported by concealed struts or hangers at the outer string. When completely exposed, a circular stair may be designed to require few supports between floors.

In constructing a circular stair, the overall size of the well and the tread length of the stairs may be adjusted to fit the particular conditions of the structure. Treads should be a minimum width of 8" at a distance 15" out from the inside railing. The treads may be of steel, abrasive cast iron, abrasive non-ferrous metal, cement, tile, linoleum, wood, marble or other material.

Landings and platforms may be constructed as part of the stair, and may be supported by beam or cantilever construction. Wall rails and brackets may be constructed with handrail sections matching the railing. Face strings and railings may be similar to those used on straight stairs but should be designed of shapes adaptable to abrupt curved construction. The small radius to which these are constructed offers possibilities of design that should not be overlooked. Combinations of contrasting metal colors can be effectively employed in such installations.
STAIRS
Concrete Stairs

Typical reinforced concrete scissors stair
Fig. 21 Sections (a) and (b) are marble treads and risers supported by steel stringers; section (c), marble treads only; section (d), cubic marble treads supported by concrete or steel stringers.

Fig. 22 Interior marble details.
Construction Details and Finishes

STAIRS

Slate Treads

Suggested detail for slate treads and risers, exterior and/or interior

Slate treads and risers set on metal pan stair

Lobby Plate Pin to Match Slate Tread

Exxist Slab

Secure to exist steel

1/4" Steel Rods, Angles & Tread Pan

Steel Channel Stringer

Detail of Top End Stair #4 @ Lobby Level

1/4" Slate Tread on Conc. Bed

1/4" Steel Tread Pan & Riser

1/4" x 14" Steel Angles

1/4" Slate Riser

Steel Angle with Expansion Bolt Anchor

Detail of Stair #4 Landing

Scale: 1/4" = 1'-0"
Any potential hazards must be eliminated. Stairs should be “easy going,” that is, there must be an appropriate relationship of riser to tread. Treads are of nonslip material which is also extended onto platforms and landings for a distance equal to the width of the stair treads. Double handrails, one higher than the other, are provided on stairs for each line of short or tall pupils. The posts, which support the center handrails of double stairs, are extended high enough above the top handrail to prevent pupils from sliding down.
STAIRS
Barrier-Free Design Data

NOTE:
X is the 12 in minimum handrail extension required at each top riser.
Y is the minimum handrail extension of 12 in plus the width of one tread that is required at each bottom riser.

Fig. 23 Stair handrails.

Fig. 24 Size and spacing of handrails and grab bars.
Steps and Stairs

Steps and stairs should have nonprotruding nosings so that people with stiff joints, braces, artificial legs, or other leg or stability problems will not catch their toes as they climb.

Handrails should be oval or round with 1 7/8" cm hand clearance between the rails and the wall. 1 1/4 cm clearance will provide ease of grip but will prevent the hand or wrist from slipping between the handrail and the wall if the person loses balance. Handrails should be positioned on both sides of steps and stairs and should extend beyond the first and last steps on at least one side and preferably on both to allow people with long leg braces to pull themselves beyond these points. To guard against falls and to help children, some codes require another, lower handrail.

Steps, stairs, and handrails should not be made of slippery material.

Fig. 26 Usable tread width and examples of acceptable nosings.
Construction Details and Finishes

STAIRS

Ladders

56° STEEL

56° WOOD

68° STEEL

68° ALUMINUM
STAIRS
Steel Pen Cement-Filled Stairs

1. STAIR DETAIL

2. STRINGER DETAIL

3. SECTION AT CONCRETE SLAB FLOOR

4. SECTION AT FLOOR

5. SECTION AT LANDINGS WITH POST

6. SECTION AT LANDINGS WITHOUT POST
**Slopes and rise**  Provide the least practical slope for any ramp or curb ramp subject to the following new construction requirements:

1. Maximum running slope shall not exceed 1:12 (8.3%)  
2. Maximum rise for any run shall not exceed 2'6" (760 mm)

**Width**  Ramps and curb ramps shall have a minimum clear width of 3'0" (915 mm) exclusive of edge protection or flared sides.

**Cross-slope and surface**  Cross-slope of ramp surfaces shall not exceed 1:48 (¼ in/ft).

<table>
<thead>
<tr>
<th>slope</th>
<th>maximum rise</th>
<th>maximum projection</th>
</tr>
</thead>
<tbody>
<tr>
<td>in     mm</td>
<td>ft    m</td>
<td></td>
</tr>
<tr>
<td>1:12 = 1:16  30</td>
<td>760   30</td>
<td></td>
</tr>
<tr>
<td>1:16 = 1:20  30</td>
<td>760   40</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>slope</th>
<th>maximum rise</th>
<th>maximum projection</th>
</tr>
</thead>
<tbody>
<tr>
<td>in     mm</td>
<td>ft    m</td>
<td></td>
</tr>
<tr>
<td>1:10 = 1:8    3 75 2 0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1:12 = 1:10   6 150 5 1.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 27**  Examples of edge protection and handrail extensions.
The function of the fireplace today differs dramatically from its role of years ago. Whereas its original function was primarily to provide heat for warmth and cooking, today it serves more as a decorative asset and as a focal point of interior spaces and conversational groupings, providing the aesthetic pleasure and comfort of firelight.

Of particular interest to the interior designer is the proportion and scale of the fireplace opening, the treatment of wall surfaces surrounding the fireplace, the design of mantel pieces and hearth extensions, and the array of fireplace accessories available. Accordingly, the information contained in this section addresses these considerations. Drawings include elevations, plans, and details of various fireplaces; elevations of a wide selection of prefabricated mantel types; and a sampling of fireplace accessories including andirons, wrought iron fire sets, and log grates. It should be noted that, aside from their decorative aspects, the fireplace and chimney have important structural implications and require special foundations. Moreover, the fireplace must be designed to carry smoke away safely.

With respect to hearth extensions, most building codes require that for fireplaces having an opening of less than 8 ft² (0.76 m²), the hearth must extend a minimum of 16 in (408 mm) beyond the face of the opening and a minimum of 6 in (203 mm) on each side. For fireplaces whose openings exceed 8 ft², the hearth must extend a minimum of 20 in (508 mm) beyond the face of the opening and 12 in (305 mm) on each side.

Most building codes also require that woodwork or other combustible materials not be placed within 6 in (153 mm) of a fireplace opening, and that combustible material within 12 in (305 mm) of a fireplace opening not project more than 1/4 in for each 1-in distance from such an opening.

Since building codes may vary, it is important that the designer have her or his plans checked for conformance with the applicable local or state codes. Any structural modifications to an existing fireplace and chimney or the design of a new fireplace and chimney should be reviewed by a professional engineer or registered architect.

A fireplace that draws properly can be assured by applying proper principles of design. The size of flue should be adequate and should be based upon the size of the fireplace opening. One rule commonly used is to take one-tenth of the area of the fireplace opening to find the minimum area of the flue. For example, if a fireplace had an opening 3 ft wide by 2 ft 6 in high, it would have an area of 1080 in². One-tenth of 1080 in² equals 108 in². The standard-size flue nearest to this requirement and readily available is a 13-1/2 by 13-in flue lining, which has an inside cross-sectional area of 126.58 in². One could also use a 13-in round flue that has a cross-sectional area of 113.0 in².

The front of the fireplace should be wider than the back and the upper part of the back should tilt forward to meet the throat in order to throw heat into the room instead of up the chimney. The arch over the top of the fireplace opening should be only 4 in thick, and the throat should project toward the front as much as possible to form the smoke shelf behind it. The area of the throat should be 1/4 times the area of the flue, with minimum and maximum width of 3 and 4 1/8 in, respectively, so that the narrow throat will cause a quick suction into the flue. The sides of the fireplace above the throat are drawn together to form the flue, which always starts exactly over the center of the width of the fireplace.

The smoke shelf is very necessary to stop back drafts. The depth of the fireplace should be one-half the height of the opening, with a maximum of 24 in. The back should rise one-half the height of the opening before sloping forward and should be two-thirds the opening in width.

The back, sides, and parts of the hearth that are under the fire must be built of heat-resistant materials. Firebrick laid in fire clay is the best combination.

The damper is a large valve that can be adjusted to regulate the draft. Many types of commercial damper units are manufactured. The position of a damper unit is important. The damper is generally set about 8 in above the top of the fireplace opening and is concealed by the brickwork. One advantage of these units is that they are correctly designed and have correctly proportioned throat damper and chamber to provide a form for the masonry and to reduce the risk of failure in the function of the completed fireplace.

The hearth consists of two parts, the front or finish hearth and the back hearth under the fire. The front hearth is simply a precaution against flying sparks and, while it must be noncombustible, it need not resist intense prolonged heat. Because the back hearth must withstand intense heat, it is built of heat-resistant materials. In buildings with wood floors, the hearth in front of the fireplace should be supported on masonry. The front hearth should project at least 16 in from the front of the fireplace.

At the back part of the hearth it is customary to have an ash dump for dropping the ashes into the ash pit, which is generally located in the basement with a door for cleaning out ashes.
Fig. 1 Construction details of a typical fireplace.
Construction Details and Finishes

FIREPLACES

Fig. 2 Construction details of a typical fireplace.

TABLE 1 Recommended Dimensions for Fireplaces and Size of Flue Lining Required
(Letters in column heads refer to Fig. 2; all dimensions in inches)

<table>
<thead>
<tr>
<th>Size of fireplace opening</th>
<th>Width, w</th>
<th>Height, h</th>
<th>Depth, d</th>
<th>Minimum width of back wall, c</th>
<th>Height of vertical back wall, a</th>
<th>Height of inclined back wall, b</th>
<th>Standard rectangular (outside dimensions)</th>
<th>Standard round (inside diameter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>24</td>
<td>16-18</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>16</td>
<td>8½ × 13</td>
<td>10</td>
</tr>
<tr>
<td>28</td>
<td>28</td>
<td>16-18</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>16</td>
<td>8½ × 13</td>
<td>10</td>
</tr>
<tr>
<td>30</td>
<td>28-30</td>
<td>16-18</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>18</td>
<td>8½ × 13</td>
<td>10</td>
</tr>
<tr>
<td>36</td>
<td>28-30</td>
<td>16-18</td>
<td>22</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>8½ × 13</td>
<td>12</td>
</tr>
<tr>
<td>42</td>
<td>28-32</td>
<td>16-18</td>
<td>28</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>13 × 13</td>
<td>12</td>
</tr>
<tr>
<td>48</td>
<td>32</td>
<td>18-20</td>
<td>14</td>
<td>14</td>
<td>28</td>
<td>28</td>
<td>13 × 13</td>
<td>15</td>
</tr>
<tr>
<td>54</td>
<td>36</td>
<td>18-20</td>
<td>32</td>
<td>14</td>
<td>28</td>
<td>28</td>
<td>13 × 18</td>
<td>15</td>
</tr>
<tr>
<td>60</td>
<td>36</td>
<td>18-20</td>
<td>36</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>13 × 18</td>
<td>15</td>
</tr>
<tr>
<td>68</td>
<td>40</td>
<td>20-22</td>
<td>36</td>
<td>17</td>
<td>30</td>
<td>30</td>
<td>18 × 18</td>
<td>18</td>
</tr>
<tr>
<td>72</td>
<td>40</td>
<td>22-28</td>
<td>51</td>
<td>17</td>
<td>30</td>
<td>30</td>
<td>18 × 18</td>
<td>18</td>
</tr>
</tbody>
</table>
FIREPLACES

SECTION WITH DAMPER

SECTION WITHOUT DAMPER

ELEVATION

MATERIALS

<table>
<thead>
<tr>
<th>Location</th>
<th>Material and Thickness</th>
<th>Back Hearth &amp; Reflecting Walls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Hearth</td>
<td>Any Masonry 2 to 4&quot;</td>
<td>Brick 4&quot; Soapstone 4&quot;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hard-Burned Tile 3&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>RECOMMENDED FLUE SIZES (In Inches)</th>
<th>FIREPLACE WIDTH</th>
<th>NOMINAL OR OUTSIDE DIMENSION</th>
<th>INSIDE DIMENSION</th>
<th>EFFECTIVE AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>24 to 84</td>
<td>24</td>
<td>6½ X 6½</td>
<td>7½ X 7½</td>
<td>41&quot;</td>
</tr>
<tr>
<td>H</td>
<td>3½ to ¾ W</td>
<td>30 to 34</td>
<td>8½ X 13</td>
<td>7 X 11½</td>
<td>70&quot;</td>
</tr>
<tr>
<td>D</td>
<td>1½ to 3½ H (1½ to 2¼ (Rec) for Out</td>
<td>36 to 44</td>
<td>13 X 13</td>
<td>11½ X 11½</td>
<td>99&quot;</td>
</tr>
<tr>
<td></td>
<td>(Rec) for Wood</td>
<td>46 to 56</td>
<td>13 X 18</td>
<td>11½ X 6½</td>
<td>156&quot;</td>
</tr>
<tr>
<td>FLUE (Effective Area)</td>
<td>18 Wh for unlined flue</td>
<td>50 to 68</td>
<td>18 X 18</td>
<td>15¾ X 5¾</td>
<td>195&quot;</td>
</tr>
<tr>
<td>T (Rec.)</td>
<td>¾ to ½ FLUE AREA</td>
<td>70 to 84</td>
<td>20 X 24</td>
<td>17 X 21</td>
<td>1278&quot;</td>
</tr>
<tr>
<td>T (Width)</td>
<td>3 minimum to 4½ maximum</td>
<td></td>
<td></td>
<td></td>
<td>380.13&quot;</td>
</tr>
</tbody>
</table>

ASH DUMP

ASH PIT

Ash Pit may receive ashes thru flue tile from more than one fireplace.
### TABLE 2: Table of Dimensions and Equipment (in inches)

<table>
<thead>
<tr>
<th>Width of opening, A</th>
<th>Height of opening, B</th>
<th>Damper height, E</th>
<th>Smoke chamber, F</th>
<th>Old flue size</th>
<th>New flue size</th>
<th>Angle (2 req'd),°</th>
<th>J</th>
<th>L</th>
<th>Tee</th>
<th>Ash dump</th>
<th>Ash-pit door</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>24</td>
<td>30</td>
<td>19</td>
<td>13</td>
<td>13</td>
<td>12</td>
<td>16</td>
<td>A-36</td>
<td>36</td>
<td>36</td>
<td>68</td>
</tr>
<tr>
<td>32</td>
<td>29</td>
<td>35</td>
<td>21</td>
<td>13</td>
<td>18</td>
<td>16</td>
<td>16</td>
<td>A-40</td>
<td>40</td>
<td>36</td>
<td>68</td>
</tr>
<tr>
<td>36</td>
<td>29</td>
<td>35</td>
<td>21</td>
<td>13</td>
<td>18</td>
<td>16</td>
<td>20</td>
<td>A-42</td>
<td>44</td>
<td>43</td>
<td>68</td>
</tr>
<tr>
<td>40</td>
<td>29</td>
<td>35</td>
<td>27</td>
<td>18</td>
<td>18</td>
<td>16</td>
<td>20</td>
<td>A-48</td>
<td>48</td>
<td>47</td>
<td>58</td>
</tr>
<tr>
<td>48</td>
<td>32</td>
<td>37</td>
<td>32</td>
<td>18</td>
<td>18</td>
<td>20</td>
<td>20</td>
<td>B-54</td>
<td>56</td>
<td>55</td>
<td>56</td>
</tr>
</tbody>
</table>

*Angle sizes: A—3 x 3 x 3/8; B—3½ x 3½ x 3/4.*

Note Y from Fig. 3: The damper and the steel T should not be built-in solid at the ends, but given freedom to expand with heat.
**FIREPLACES**

**Corner Design**

**Table of Dimensions and Equipment (in inches)**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>Old Flue Sizes</th>
<th>New Flue Sizes</th>
<th>Steel Angle J*</th>
<th>Plate Lintel K</th>
<th>Corner Post N</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>28</td>
<td>28</td>
<td>20</td>
<td>14</td>
<td>20</td>
<td>29</td>
<td>11</td>
<td>13</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>28</td>
<td>20</td>
<td>14</td>
<td>20</td>
<td>32</td>
<td>11</td>
<td>13</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>36</td>
<td>28</td>
<td>20</td>
<td>14</td>
<td>20</td>
<td>35</td>
<td>11</td>
<td>13</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>29</td>
<td>20</td>
<td>14</td>
<td>20</td>
<td>35</td>
<td>15</td>
<td>13</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>48</td>
<td>29</td>
<td>24</td>
<td>14</td>
<td>24</td>
<td>43</td>
<td>15</td>
<td>13</td>
<td>15</td>
<td>18</td>
</tr>
</tbody>
</table>

* Angle Sizes: *A 3\*x3\*x3/4, *B 3\*x3\*x1/4

**Fig. 4** Corner fireplace.

**Fig. 5** A shallow fireplace with a copper hood, built as shown, throws out considerable heat after the hood gets hot. The wall should be of fire-resistant masonry.
Fig. 6 These wood mantels are readily available.
Fig. 7 Fireplaces offer opportunities for the use and display of a variety of metal items of decorative value. These may be selected or designed to match other material in the room. Metals used for wrought and cast fireplace products are usually cast iron, steel in a dark hammered finish, or polished brass. Combinations of these metals and other metals may be used very effectively.
Although lighting design is a discipline in and of itself, the interior designer and architect must be knowledgeable about the interface between lighting elements and the interior architecture. This section, therefore, focuses primarily on the detailing of this interface. Details from actual contract drawings, prepared by various interior design and architectural firms, are provided for the reader's reference. Among the details are those for valence and cove lighting and for the lighting of stairs, columns, and skylights. This section also provides some basic planning data including illuminance values for residences, offices, stores, and industrial spaces.

**Fig. 1** Measuring when the lamp is at the side — when sitting, lying down, or playing the piano.

**Fig. 2** Measuring when the lamp is behind — when sitting.
**LIGHTING**

Planning Data: Minimum Shade Heights

<table>
<thead>
<tr>
<th>LAMP TYPE</th>
<th>Top Dia. &quot;</th>
<th>Depth &quot;</th>
<th>Bottom Dia. &quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sr. Floor Swing Type</td>
<td>10</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>Jr. Floor Swing Type</td>
<td>10</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>Diffuser Type Bridge</td>
<td>14</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>End Table</td>
<td>8</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>Diffuser Type</td>
<td>14</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Sr. Table</td>
<td>14</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>Wall Lamp</td>
<td>8</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>Diffuser Type</td>
<td>4</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>Study Type — pair</td>
<td>6</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Make-Up — pair</td>
<td>7</td>
<td>7</td>
<td>9-10</td>
</tr>
<tr>
<td>Double Dresser — pair</td>
<td>8</td>
<td>8</td>
<td>12-14</td>
</tr>
</tbody>
</table>

Base Height (measure from table to shade bottom)

± Table Height

\[ \text{Seated Eye Height} \approx \text{40”-42” off floor} \]

**FLOOR LAMPS**

Measure from floor to bottom of shade.

**SHADES**

Measure top and bottom diameters, and depth vertically through center.

Minimum 15” to shade bottom. Shade fairly dense, or opaque, in a light but not strong color.

**Exception: Make-Up**

White or ivory highly translucent shades.

Fig. 3 Measuring when the lamp is in front — when studying, sewing, or grooming oneself.
LIGHTING
Floor Lamps
Construction Details and Finishes

LIGHTING
Wall-Mounted Task Lamps
CONSTRUCTION DETAILS AND FINISHES

LIGHTING

Planning Data: Residential Valance Lighting

Fig. 4 Valance faceboard may be tilted.

Fig. 5 With side-mounting channels, no extender is necessary.

Fig. 6 Intermediate brackets are required to support long faceboards.

Fig. 7 Variation of valance lighting. (If distance between wall and lamp is increased, light will be distributed more evenly, but shielding may be required at the bottom of the faceboard.)

Fig. 8 Minimum dimensions for cornice lighting installation.

Fig. 9 Cornice lighting with two tubes may require shielding.
Construction Details and Finishes

LIGHTING

Planning Data: Residential Down Lighting

Fig. 10 Common types of downlights.

Fig. 11 Pinhole spot, a recessed downlight with adjustable shutters to shape beam pattern.

Fig. 12 "Eyeball" semirecessed fully adjustable downlight.

Fig. 13 Luminous panel or soffit lighting, used over a kitchen or bathroom counter.

Fig. 14 Critical dimensions for luminous panel and luminous ceiling lighting. (S should not exceed 1½ to 2 times L.)

Fig. 15 Basic relationship for the design of luminous panels. [A light level of 60 fc (600 lux) is produced by seven rows of three 40-W fluorescent tubes on 18-in (457 mm) centers. Light distribution and surface luminance are approximately uniform.]

<table>
<thead>
<tr>
<th>Table 1: Illuminance Values for Residences*</th>
<th>Illuminance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific visual tasks</td>
<td>Foot-candles</td>
</tr>
<tr>
<td>Dining</td>
<td>15</td>
</tr>
<tr>
<td>Grooming, shaving, makeup</td>
<td>50</td>
</tr>
<tr>
<td>Handcraft</td>
<td></td>
</tr>
<tr>
<td>Ordinary seeing tasks</td>
<td>70</td>
</tr>
<tr>
<td>Difficult seeing tasks</td>
<td>100</td>
</tr>
<tr>
<td>Very difficult seeing tasks</td>
<td>150</td>
</tr>
<tr>
<td>Critical seeing tasks</td>
<td>200</td>
</tr>
<tr>
<td>Ironing (hand and machine)</td>
<td>50</td>
</tr>
<tr>
<td>Kitchen duties</td>
<td></td>
</tr>
<tr>
<td>Food preparation and cleaning</td>
<td>150</td>
</tr>
<tr>
<td>Serving and other noncritical tasks</td>
<td>50</td>
</tr>
<tr>
<td>Laundry</td>
<td></td>
</tr>
<tr>
<td>Preparation, sorting, inspection</td>
<td>50</td>
</tr>
<tr>
<td>Tub area—soaking, tinting</td>
<td>50</td>
</tr>
<tr>
<td>Washer and dryer areas</td>
<td>30</td>
</tr>
<tr>
<td>Reading and writing</td>
<td></td>
</tr>
<tr>
<td>Handwriting, reproductions, and poor copies</td>
<td>70</td>
</tr>
<tr>
<td>Books, magazines, newspapers</td>
<td>30</td>
</tr>
<tr>
<td>Reading piano or organ scores</td>
<td></td>
</tr>
<tr>
<td>Advanced (substandard size)</td>
<td>150</td>
</tr>
<tr>
<td>Advanced</td>
<td>70</td>
</tr>
<tr>
<td>Simple</td>
<td>30</td>
</tr>
<tr>
<td>Sewing (hand and machine)</td>
<td></td>
</tr>
<tr>
<td>Dark fabrics</td>
<td>200</td>
</tr>
<tr>
<td>Medium fabrics</td>
<td>100</td>
</tr>
<tr>
<td>Light fabrics</td>
<td>50</td>
</tr>
<tr>
<td>Occasional—high contrast</td>
<td>30</td>
</tr>
<tr>
<td>Study</td>
<td>70</td>
</tr>
<tr>
<td>Table games</td>
<td>30</td>
</tr>
<tr>
<td>General lighting</td>
<td></td>
</tr>
<tr>
<td>Conversation, relaxation, entertainment</td>
<td>10</td>
</tr>
<tr>
<td>Passage areas, for safety</td>
<td>10</td>
</tr>
<tr>
<td>Areas other than kitchen involving visual tasks</td>
<td>30</td>
</tr>
<tr>
<td>Kitchen</td>
<td>50</td>
</tr>
</tbody>
</table>

*Minimum on the task at all times.
† Lux is an SI unit equal to 0.0929 footcandle.
Construction Details and Finishes

LIGHTING

Cove Lighting Details

DETAIL OF LIGHT COVE RECESS IN SANCTUARY @ 3'-10"
Construction Details and Finishes

LIGHTING
Cove Lighting Details

DETAIL - LIGHT COVE & RECEPTION AREA

DETAIL - LIGHT COVE & ELEVATOR LOBBY
Construction Details and Finishes

LIGHTING

Cove Lighting Details

[Diagram showing cove lighting details with various specifications and dimensions]
CONSTRUCTION DETAILS AND FINISHES

LIGHTING

Fluorescent Cove Lighting Details

- Recessed 2-12 lamps in continuous row.
- Ceiling board cavity, paint all exterior surfaces of cavity matte white.
- Acrylic prismatic diffuser

FINISHED CEILING
- L/9 x 9/16" aluminum edge cove, painted finish to match value shown as selected by architect.
- Finished wall

SECTION THRU CONTINUOUS COVE LIGHT
Construction Details and Finishes

LIGHTING

Fluorescent Cove Lighting Details

Details:
- Rapid Start T-12 Lamps in continuous row
- Gypsum board cavity, paint all interior surfaces of cavity matte white
- White acrylic diffuser

Vanity Lighting Cove Detail:
- Rapid Start T-12 Lamps in continuous row
- Gypsum board cavity, paint all interior surfaces of cavity matte white
- Acrylic prismatic diffuser

Details:
- 1/2" x 1/2" x 1/2" aluminum channel leader painted light to medium value color as selected by architect

757
Construction Details and Finishes

LIGHTING
Miscellaneous Lighting Details

**SECTION TYPE L**

- **SECTION TYPE M**

- **SECTION TYPE G**

- **SECTION PLANS**

- **DETAILS**

- **NOTES**

- **SPECIALTY LIGHTING**

- **MATERIALS**
Construction Details and Finishes

LIGHTING
Miscellaneous Lighting Details

- OPEN TYPE F. ONLY
- SQUARE OR
- RECTANGULAR SHAPE GLASS,
- CUSHION AS REQUIRED.
- FRONT SURFACE GLASS IS GLASS SMOOTH.
- TYPE F.
- CABINET WORK PROVIDE LIGHT
- CUT OUT NUTCH TO REMOVE
- GLASS.

- LIGHTS LED @ TYPE F1.
- 35WATT, SUT WHITE @ TYPE F.
- PORCELAIN SOCKET MOUNTED
- AS REQUIRED BY ELECTRICAL
- CONTRACTOR ON J-BOX OR
- CONDUIT STUB OR OTHER
- CODE METHOD.

- RELAY THIS DIMEN.
- SION TO CABINET MAKER

- WALL BRACKET CROSS SECTIONS
- 3/4" WIDE METAL ANGLE
- BRACE OR OTHER
- APPROPRIATE FASTENERS
- ON 16" CENTERS
- SINGLE OR DOUBLE-LAMP
- FLUORESCENT LIGHT STRIPS.

- 5/8" HARDWOOD FACEBOARD
- AND END RETURN, FINISHED
- TO SUIT OUTSIDE, SATIN WHITE
- FINISH INSIDE.

- BLOCKING
- MINIMUM LAMPS = 4 1/2" WATT
- 3FT LENGTH, WITH 2 1/2" WATT
- HOLLOW LAMPS OR MOUNTED
- AT 2 WOLTS
- POLISHED BRASS:
- POSTIC MOUNTING PLATE TO BE
- ATTACHED TO BLOCKING.
- FOR LINES ACCESS TO THIS BOX
- REMOVE BLOCKING MOUNTING
- SPRING.
- CABINET DOOR
- CABINET TOP

- PASSAGE ABOVE CABINET
- TYPE J-ALUMA LAMPS, HEMISPHERIC
- FIXTURES @ LAMPS. @ 10-30 X @ 10-60
- LUMENS PERFIXTURE. SEE LIGHTING FRAMES
- FOR LOCATIONS.

- MIRROR CUP
- CABINET
- JALSTON BOX

762
Lighted wood and glass guardrail

- Hardwood trim
- Gypsum board backing
- Continuous fluorescent light strips between posts
- Lighting cutoff line
- Support posts 4' to 6' to the inside per lamp lengths
- 1/8" tempered glass baluster panels

Lighted low-partition guardrail

- Hardwood trim
- Continuous cold cathode lamps, exposed or concealed
- Full-width partition at corner
- Metal stud and gypsum board construction

Extruded aluminum light rail

- Extruded aluminum top railing
- Continuous fluorescent lamps between support posts
- Support posts 4' to 6' to the inside per lamp lengths
- Pavement line

Elevation of lighted guardrail planter demonstrates the use of combined 3-foot and 4-foot fluorescent light strips to achieve overall lengths in 1-foot multiples. To minimize dark areas between lamps, use strips without end caps and install lamps back to back.

Open circulation areas can be illuminated with lighted railings, as shown in this section of a lighted guardrail planter.

Sight line for shielding lamps from below

Finish floor line
Lighting

Stair Lighting Photometrics

**Footcandles**

<table>
<thead>
<tr>
<th>Height Above Floor (in)</th>
<th>Lighted Width (in)</th>
<th>Average</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>11</td>
<td>5.0</td>
<td>13.0</td>
</tr>
<tr>
<td>8</td>
<td>14</td>
<td>3.8</td>
<td>9.6</td>
</tr>
<tr>
<td>10</td>
<td>18</td>
<td>3.0</td>
<td>7.8</td>
</tr>
<tr>
<td>12</td>
<td>21</td>
<td>2.6</td>
<td>6.5</td>
</tr>
<tr>
<td>18</td>
<td>32</td>
<td>1.7</td>
<td>4.4</td>
</tr>
<tr>
<td>24</td>
<td>42</td>
<td>1.3</td>
<td>3.3</td>
</tr>
<tr>
<td>30</td>
<td>53</td>
<td>1.0</td>
<td>2.6</td>
</tr>
<tr>
<td>36</td>
<td>63</td>
<td>0.8</td>
<td>2.1</td>
</tr>
</tbody>
</table>

**Notes:**
1. Footcandles directly below light fixture.
2. Average footcandles over lighted width.
3. Maximum footcandles level falls to 10% of maximum.

**Details:**

- **Carpet**
- **Wood Nosings**
- **PVC Extrusion**
- **LITE FIXTURE**
- **RISER**
- **CARPET TREAD**
- **TREAD**
- **RISER**
- **TREAD NOISING**
- **PVC Extrusion**
- **LITE FIXTURE**

**Figures:**

- **Fig. 16** Surface-mounted step light.
- **Fig. 17** Recessed step light.
Wall recessed stair lighting

Adjustable snap-on lamp reflectors

Rite angle electrode lamps fabricated to shape and length of architectural design
continuous line of light — no shadows

Rite angle electrode lampholders

94" o.c. max.

Luminous cover (by others)
to protect lighting from weather and vandalism. Clear/translucent/acrylic/lexan
as desired with foam gaskets & tamperproof screws.

Luminous cover with foam neoprene gaskets (to protect lighting from vandalism and weather)

典型 section through riser (exterior or interior)

Downlighting
Assymetrical spread
planters, benches

Uplighting
Assymetrical spread
parapets, dwarf plants

Side lighting
desks, counters

Typical designs/suggested constructions.
Exact construction as required within parameters of illumination desired, lamps and lampholders.
Construction Details and Finishes

LIGHTING
Stair Lighting Details

Carpeted cast-in-place step light

Exposed cast-in-place step light

Concrete surface-applied bonded extrusion

Wood surface-applied bonded extrusion

Brick steps with recessed light

STOP RACEWAY AT THIS POINT - PULL WIRES OUT APPROX. 12 INCHES - FILL END OF RACEWAY WITH SILICONE SEALANT.

\(1/4''\) RACEWAY TO SECONDARY SIDE OF TRANSFORMER
Construction Details and Finishes

LIGHTING
Skylight Lighting Details

Fig. 18. Skylight lighting. Skylight serves as fixture — does not interfere with natural lighting, will not cast shadows on luminous element. Spiral, M, U, and straight lamps fabricated to fit curb opening.
Construction Details and Finishes

LIGHTING

Lighted Column Details

---

PLAN DETAIL OF LIGHTED COLUMN

ELEVATION OF LIGHTED COLUMN

SECTION OF LIGHTED COLUMN
Construction Details and Finishes

LIGHTING
Lighted Column Details

![Diagram of lighted column details]


2. Center banquet. See plan view. See detail.
Construction Details and Finishes

LIGHTING

Ceiling-Mounted Cold Cathode Lighting Details

Exposed/sculpture lamp lighting

Cold cathode lighting, an architectural lighting tool with unusual flexibility. Lamps fabricated to the architectural design, continuous line of light—low brightness—no glare—high efficiency—long life—approaches a permanent light source.

Remote transformers—no wiring troughs, ballasts, ballast failures, or hum. Only 2 leads for up to 120 feet of lamps. Excellent uniform dimming—no premature flickering of individual lamps as with hot cathode lighting.

RTE ANGLE ELECTRODE LAMPHOLDERS
Continuous line of light

8R LAMPHOLDER
95° o.c. max.

RTE ANGLE ELECTRODE LAMPS

Clear nylon lamp ties

RTE ANGLE ELECTRODE LAMPHOLDERS
94" o.c. max.

Continuous line of light fabricated to shape of soffit

Stem hanger
Lampholder housing

RTE ANGLE ELECTRODE LAMPHOLDERS

Double row warm white on dimmer
Clear glass neon on dimmer

RECESSED LAMPHOLDER
95° o.c. max.

LAMP TIES—for hanging down lamp only.

RITE ANGLE ELECTRODE LAMPS
Continuous line of light

Vertical Blinds
### Principal types of lamps for general lighting purposes

<table>
<thead>
<tr>
<th>Category</th>
<th>Type</th>
<th>Maximum lamp efficacy (lm/W)</th>
<th>Average life (hrs)</th>
<th>Characteristic features</th>
<th>Typical application areas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Incandescent Lamps</strong></td>
<td>Normal incandescent lamps and reflector lamps</td>
<td>22</td>
<td>1,000</td>
<td>Easy to install; easy to use; many different versions; instant start; low cost price; reflector lamps allow concentrated light beams</td>
<td>General lighting in the home; decorative lighting; localized lighting; accent and decorative lighting (reflector lamps)</td>
</tr>
<tr>
<td></td>
<td>Halogen</td>
<td>27</td>
<td>2,000</td>
<td>Compact; high light output; white light; easy to install; long life compared with normal incandescent lamps</td>
<td>Accent lighting; floodlighting</td>
</tr>
<tr>
<td><strong>Fluorescent Lamps</strong></td>
<td>Tubular</td>
<td>104</td>
<td>20,000</td>
<td>Wide choice of light colors; high lighting levels possible; economical in use</td>
<td>All kinds of commercial and public buildings; street lighting; home lighting</td>
</tr>
<tr>
<td></td>
<td>SL*</td>
<td>61</td>
<td>10,000</td>
<td>Energy-effective; direct replacement for incandescent lamps</td>
<td>Most applications where incandescent lamps were used before</td>
</tr>
<tr>
<td></td>
<td>PL*</td>
<td>80</td>
<td>10,000</td>
<td>Compact; long life; energy-effective</td>
<td>To create a pleasant atmosphere in social areas, local lighting; signs, security, orientation lighting and general lighting</td>
</tr>
<tr>
<td><strong>Gas-Discharge Lamps</strong></td>
<td>Self-ballasted</td>
<td>28</td>
<td>12,000/16,000</td>
<td>Long life; good color rendering; easy to install; better efficacy than incandescent lamps</td>
<td>Direct replacement for incandescent lamps; small industrial and public light projects; plant irradiation</td>
</tr>
<tr>
<td></td>
<td>High pressure mercury</td>
<td>63</td>
<td>24,000 +</td>
<td>High efficacy; long life; reasonable color quality</td>
<td>Residential area lighting; sports grounds; factory lighting</td>
</tr>
<tr>
<td></td>
<td>Metal halide</td>
<td>94</td>
<td>15,000</td>
<td>Very high efficacy combined with excellent color rendering; long life</td>
<td>Floodlighting, especially for color TV; Industrial lighting; road lighting; plant irradiation</td>
</tr>
<tr>
<td></td>
<td>High pressure sodium</td>
<td>125</td>
<td>24,000 +</td>
<td>Very high efficacy; extremely long life; good color rendering</td>
<td>Public lighting; floodlighting; industrial lighting; plant irradiation EL; direct replacement for mercury lamps</td>
</tr>
<tr>
<td></td>
<td>Low pressure sodium</td>
<td>200</td>
<td>18,000</td>
<td>Extremely high efficacy; very long life; high visual acuity; poor color rendering; monochromatic light</td>
<td>Many different application areas: wherever energy/cost-effectiveness is important and color is not critical</td>
</tr>
</tbody>
</table>
INCADESCENT BULBS

A Bulb designation consists of a letter(s) to indicate the shape and a figure(s) to indicate the approximate major diameter in eighths of an inch. Bulbs are measured through their greatest diameter, in eighths of an inch. Thus, a F-15 bulb is a flame shape, 15/8 of an inch or 1 5/8 inches in diameter.
## OFFICE

**LIGHT LEVEL RECOMMENDATIONS**

<table>
<thead>
<tr>
<th>Type of Work</th>
<th>Foot Candles*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corridors, lobbies</td>
<td>10-15-20</td>
</tr>
<tr>
<td>Easy tasks (Typed originals, ball-point pen handwriting, large print)</td>
<td>20-30-50</td>
</tr>
<tr>
<td>Medium tasks (Poor copies, medium hard pencil, small print)</td>
<td>50-75-100</td>
</tr>
<tr>
<td>Difficult tasks (Very poor copies, hard pencil writing)</td>
<td>100-150-200</td>
</tr>
</tbody>
</table>

*Choose an illuminance value in the mid-range for your type of activity. Then decide upon a specific value (same, lower, or higher) within that range by considering the age of the workers and the importance of the work.

### SELECTING THE PROPER FIXTURE

- **Light Output/Efficiency**
  
  The more light, the fewer fixtures needed in new lighting systems and lower operating cost.

- **Visual Comfort**
  
  Fixtures should direct light to the task and away from the eyes. The fixture's VCP rating, available from the fixture manufacturer, should be 70 or above.

- **Maintainability**
  
  Check ease of lamp replacement, cleanability, and permanence of finishes.

- **Fit In Application**
  
  Should look right and cover the area to be lighted (consider smaller fixtures closer together, such as 2 x 2s instead of 2 x 4s, for lower ceilings, or lower light levels or high-panelled work stations).

### STORE

**LIGHT LEVEL RECOMMENDATIONS**

<table>
<thead>
<tr>
<th>High Activity Area (Mass Merchandiser)</th>
<th>Circulation</th>
<th>Merchandising</th>
<th>Feature Displays</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>100</td>
<td>500</td>
<td></td>
</tr>
</tbody>
</table>

| Medium (Family Dept. Store)           | 20          | 70            | 300              |

| Low (Boutique, Specialty Stores)      | 10          | 30            | 150              |

### INDUSTRIAL

**LIGHT LEVEL RECOMMENDATIONS**

<table>
<thead>
<tr>
<th>Footcandles Maintained on the Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>GARAGES - SERVICE</td>
</tr>
<tr>
<td>active traffic areas</td>
</tr>
<tr>
<td>inactive</td>
</tr>
</tbody>
</table>

| LOADING PLATFORM                     | 20fc        |

| MACHINE SHOPS AND ASSEMBLY AREAS     |
| rough bench/machine work, simple assembly | 20-50fc   |
| medium bench/machine work, moderately difficult assembly | 50-100fc |
| difficult machine work, assembly     | 100-200fc  |
| fine bench/machine work, assembly    | 200-500fc* |

| RECEIVING & SHIPPING                 | 20-50fc     |

| WAREHOUSES, STORAGE ROOMS            |
| active-large items/small items, labels | 15fc/30fc  |
| inactive                             | 5fc         |

*Higher illuminance values may be achieved through a combination of supplementary and general lighting.

- **Shielding Materials**
  
  Comparison of lighting characteristics for typical 2 x 4 troffer luminaries:
Architectural Woodwork

- Standard joinery and casework details: 781
- Woodwork details: 804
- Cornices and mouldings: 866
- Furniture hardware: 887
INTRODUCTION

Most residential and commercial projects require the design of a certain amount of architectural woodwork. Such woodwork may be in the form of built-in furniture, cabinets, display cases, reception desks, credenzas, work counters, kitchen cabinets, etc. The extent of detail necessary to intelligently communicate and identify the scope and character of required woodwork is an important consideration in the preparation of contract drawings. It is necessary, therefore, that the designer have a knowledge of basic wood joinery and understand how to apply it in the preparation of construction details.

Accordingly, the information in this section can be used as a general guide in the detailing of most woodwork items and addresses four areas of concern. The first deals with basic joinery and typical casework details. This information is fundamental to an understanding of the detailing of woodwork. The typical joints illustrated vary in sophistication and structural integrity and represent the most common methods of joining any two wood members. The casework details are intended to illustrate the construction of routine casework and are divided into three categories: exposed face frame, flush overlay, and reveal overlay. The second area deals with custom woodwork and includes details of woodwork items selected directly from contract drawings contributed by various interior design and architectural firms. This information should prove helpful in providing the reader with a more global perspective of how different firms approach the detailing of some common types of woodwork items and the extent of that detailing. The third area of this section deals with standard cornices and mouldings, and is intended to simply provide the designer with dimensional and design information relative to the many standard items available on the market. Since many woodwork items involve some moveable elements, the fourth area of this section deals with furniture hardware.
Characteristics of Joints
Joints may be divided into four general types: butted, shiplapped, tongued-and-grooved, and mitered. Used in their simplest basic form, none is satisfactory for cabinet work except the tongued-and-grooved type in certain instances. However, when variously combined or when reinforced with gluing and dowels or splines, satisfactory joints can be developed.

**Butt Joint**  A simple but weak joint that opens easily and may show end wood when used at angles. Strength and range of use is greatly increased by use of the mortise and tenon and dowels, and even more when a straight spline is included. Use of a glued butterfly spline with a butt joint produces an extremely strong joint. These variations are widely used to produce large flush surfaces of solid wood or backing for veneers.

**Shiplap Joint**  Stronger than a butt joint but subject to opening from shrinkage. Rarely used in a simple form in cabinet work except for door rebates. It is often moulded to conceal shrinkage in quirks or combined as a miter and shoulder for corners. Another variation is the shoulder joint.

**Tongue-and-groove Joint**  A strong joint, widely used for re-entrant angles. Effect of wood shrinkage is concealed when the joint is beaded or otherwise moulded. In expensive cabinet work glued dovetail and multiple tongue-and-groove are used.

Miter joints are weak and difficult to fit if used alone. Joints with miter brads are sufficiently strong for short lengths. Joints made in combination with other forms, as a tongue-and-groove miter, are tight and sturdy.

**Use of Joints**
Use of certain types of joints depends to a large degree upon the type of work and skill involved. The following notes indicate use of joints in various categories, but cannot be regarded as an inclusive check list.

**For panels, shelving, etc., or wherever the end of one piece butts against the face of another:**
- **housed joint,** with or without cover mould, or some type of tongue-and-groove joint. Omit glue to avoid splitting due to swelling or shrinkage.
- **For joining stiles and rails:** mortise and tenon, glued in better work. Dowels may be used or hardwood wedges may be driven and glued into ends of tenons in high grade work.

**For re-entrant corners:** shoulder joints for inexpensive work. Tongue-and-groove is sturdy. Both should be glued, are often screwed together, and may be glued to a rough frame.

**For external corners:** simple miter and quirk and miter both lack strength. Miter brads are practical only for short lengths. Miter and shoulder glued and face-screwed or nailed is satisfactory (generally "millwork"). Miter and spline is preferable. In high grade work exterior corners are reinforced by glue to a corner post or short lengths of blocking.

**Glued joints:** when screws, nails, etc., cannot be used, or when fine work is to be veneered, strength of the joint depends on accuracy of milling and total glue surface. Glue surface may be tremendously increased by using multiple or offset tongues and grooves, by forming miter cuts into waves, multiple shoulders, tongues and grooves, etc. Such work is cabinet work. If done by a reliable cabinet maker a guarantee should be obtained and joint detail and composition of glue left to him or her.

**Mouldings** should be applied in continuous lengths if possible. Use simple miter for necessary joints, cope re-entrant angles less excessively undercut, miter external corners.

### TYPICAL JOINTS

**Letters indicate class of woodwork in which joint is commonly used. See text.**

<table>
<thead>
<tr>
<th>BUTTED...</th>
<th>SHIPLAPPED</th>
<th>TONGUED &amp; GROOVED...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butt (not recommended)</td>
<td>Butlap (sheeting etc.)</td>
<td>Tongue &amp; Groove (flooring etc.)</td>
</tr>
<tr>
<td>Dowelled</td>
<td>Rebated (Bead &amp; V)</td>
<td>Tongue &amp; Groove</td>
</tr>
<tr>
<td>Splined</td>
<td>Shoulder</td>
<td>Lapped Dove Tail</td>
</tr>
<tr>
<td>Butterfly Spline</td>
<td>Shoulder, Bead</td>
<td>Tongue &amp; Bead</td>
</tr>
<tr>
<td></td>
<td>Multiple Tongue &amp; Groove</td>
<td></td>
</tr>
<tr>
<td>Dovetailed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MITERED...**

<table>
<thead>
<tr>
<th>BUTTED...</th>
<th>SHIPLAPPED</th>
<th>TONGUED &amp; GROOVED...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butt (Mouldings &amp; Baseboards)</td>
<td>Butlap</td>
<td>Tongue &amp; Groove (Flooring etc.)</td>
</tr>
<tr>
<td>Miter (Mouldings &amp; Baseboards)</td>
<td>Rebated, Bead</td>
<td>Tongue &amp; Groove</td>
</tr>
<tr>
<td></td>
<td>Shoulder</td>
<td>Lapped Dove Tail</td>
</tr>
<tr>
<td>Miter</td>
<td>Multiple Tongue &amp; Groove</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Architectural Woodwork

STANDARD JOINERY AND CASEWORK DETAILS

**Typical Joints**
<table>
<thead>
<tr>
<th>TYPICAL JOINTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUTT</td>
</tr>
<tr>
<td>TONGUE &amp; GROOVE</td>
</tr>
<tr>
<td>SPLINE</td>
</tr>
<tr>
<td>HALF LAP</td>
</tr>
<tr>
<td>HALF LAP</td>
</tr>
<tr>
<td>SCARF</td>
</tr>
<tr>
<td>FINGER</td>
</tr>
<tr>
<td>DOWELED</td>
</tr>
<tr>
<td>MORTISE &amp; TENON, SLOTTED</td>
</tr>
<tr>
<td>MORTISE &amp; TENON, STUB</td>
</tr>
<tr>
<td>MORTISE &amp; TENON, BLIND</td>
</tr>
<tr>
<td>MORTISE &amp; TENON, THROUGH</td>
</tr>
<tr>
<td>RABBET</td>
</tr>
<tr>
<td>LOCK</td>
</tr>
<tr>
<td>DOVETAIL</td>
</tr>
<tr>
<td>DOVETAIL DADO</td>
</tr>
<tr>
<td>DOVETAIL, BLIND</td>
</tr>
<tr>
<td>DADO</td>
</tr>
<tr>
<td>DADO, BLIND OR STOPPED</td>
</tr>
<tr>
<td>DADO, BLIND OR STOPPED</td>
</tr>
<tr>
<td>MITER</td>
</tr>
<tr>
<td>SPLINED MITER</td>
</tr>
<tr>
<td>MITER, SHOULDER</td>
</tr>
<tr>
<td>MITER, LOCK</td>
</tr>
</tbody>
</table>
Terminology

**Spline joint** Used for gluing plywood in width or length. Since the spline serves to align faces, this joint is also used for items requiring site assembly.

**Stub tenon** Joinery method for assembling stile and rail type frames that are additionally supported, such as web or skeleton case frames.

**Conventional mortise and tenon joint** Joinery method for assembling square-edged surfaces such as case face frames.

**Dowel joint** Alternative joinery method for serving same function as conventional mortise and tenon.

**Haunch mortise and tenon joint** Joinery method for assembling paneled doors or stile and rail type paneling.

**French dovetail joint** Method for joining drawer sides to fronts when fronts conceal metal extension slides or overlay the case faces.

**Conventional dovetail joint** Traditional method for joining drawer sides to fronts or backs. Usually limited to flush or lipped type drawers.

**Drawer lock-joint** Another joinery method for joining drawer sides to fronts. Usually used for flush type installation but can be adapted to lip or overlay type drawers.

**Edge banding** Method of concealing plys or inner cores of plywood or particleboard when edges are exposed. Thickness or configuration will vary with manufacturers' practices.

**Through dado** Conventional joint used for assembly of case body members — dado usually concealed by application of case face frame.

**Blind dado** Variation of conventional dado with applied edge "stopping" or concealing dado groove. Used when case body edge is exposed.

**Stop dado** Another method of concealing dado exposure. Applicable when veneer edging or solid lumber is used.

**Exposed end detail** Illustrates attachment of finished end of case body to front frame using butt joint.

**Exposed end detail** Illustrates attachment of finished end of case body to front frame using mitered joint.

**Paneled door details** Joinery techniques when paneled effect is desired. Profiles are optional as is the use of flat or raised panels. Solid lumber raised panels may be used when width does not exceed 10 in. Rim raised panels recommended when widths exceed this dimension or when transparent finish is used.
Architectural Woodwork

STANDARD JOINERY AND CASEWORK DETAILS

Typical Joints

Blind Dado

Exposed End Detail

Stop Dado

Exposed End Detail

Paneled Door Detail

Typical Frame Parts

Paneled Door Detail
Architectural Woodwork

STANDARD JOINERY AND CASEWORK DETAILS

Cabinet Work

TYPICAL CABINET CONSTRUCTION

DIAGRAMMATIC PLAN

(No Scale)

Corner Space may be used for secret storage. Possible door and stop shown dotted. Finish coat of plaster usually omitted when concealed.

Access Door if desired. Door Stops if desired.

Solid or Plywood Back-panel. Concealed faces back-painted.

Return against paneling.

Canvas covered plaster. Any Panel scribed to wall.

Any Trim may be used for support. Studs or open space below. Doled lines indicate applied stops when used.

Missed Corners (Quirk, Shoulder, Spline, Tongue & Groove, Shoulder & Bead Joints).

Linear Trim mitered at external corner.

Narrow Trim

Dust Panel or open space below.

Dotted lines indicate. Drawer Runners below.

Linear Trim usually coped at re-entrant angle.

Any Type of Door

Linear Trim mitered at external corner.

Any Trim

DRAWER CLEARANCE FOR CLOSET CABINET

Finish plaster coat may be omitted ½" (desirable). Any Complete Cabinet. Nail Cover Mould to ground, not to Cabinet. Grounds are carefully located before erecting.

Access Door if desired. Door Stops if desired.

Line of Drawer opened (min. clearance)
Architectural Woodwork

STANDARD JOINERY AND CASEWORK DETAILS

Cabinet Work

SECTIONAL PLAN

When any type of patented drawer slide is used, consult manufacturer's catalogue for this dimension. The lapped front conceals slide.

Dust-Proof & Top of drawer Runners should be flush.

Dust-Proof & Hidden Runners concealed by joint concealed by moulds.

The Sides of drawers should be dovetailed to fronts. Usual methods shown.

When any type of patented drawer slide is used, consult manufacturer's catalogue for this dimension. The lapped front conceals slide.

The lapped cover all joint conceals slide. Dust-Proof £ top face of drawer.

Runners should be flush. Bottomless-

For towds, for flush Lattice Bottom-Permits air circulation for linens etc.

A Guide at side of drawer, fastened to Drawer Runner

B Guide (Hardwood) to side of Drawer.

SLIDING DOORS (Removable)

MITER & SHOULDER Joint

Removable Moldings

DETAILS FOR GLAZED DOORS

MITER Joint with Miter Rail

Invisible Hinges Optional

DETAILS FOR PANNELED DOORS

(Panels may be either plain or plywood)

DOORS

This detail permits the use of different woods.

This detail may be used if Cabinet extends to finish, floor.

TOE SPACE
**Purpose**

The following information outlines methods of assembly and installation of common cabinet work. Solutions of typical problems are presented without attempting to detail specific cabinets.

**Assembly**

High-grade cabinet and veneered work is assembled as far as possible at the shop. Joints are glued and blocked, and sometimes secured with finishing nails or screws. Carpentry and millwork are generally put together with finishing nails of soft wood, or with screws if of hardwood. Hardwood should be drilled to prevent splitting before using nails or screws, and heads should be countersunk and concealed by mending blocks, moulding quirks, or putty, plastic wood, or other filler, colored to match the finish. No nails, screws, or joints should be visible unless they are intentionally incorporated in the design.

**Shrinkage and warping** effects can be largely eliminated by proper detailing and construction. Wide flat surfaces (solid or veneered) should be made up of several narrow strips glued and dowelled, spliced, or dovetailed together. Ceats may also be screwed or keyed to backs of wide surfaces. Joints in corners, sheathing, etc., should be concealed within quirks of moulds (as in moulded tongue-and-groove) or return faces (shoulder joints). Panels should be rigidly secured on one side only, and are often left entirely loose. Housed joints, not glued, permit panels to expand and contract without splitting.

**Shrinking**

Large moulded surfaces (such as cornices or manteis) should always be shop-assembled and delivered with scribe-moulds (see "Scribing" below) loosely tacked to assembled units.

**Installation**

All grades of woodwork should be preservative treated or back painted before erection, preferably before delivery to the job. Satisfactory priming coats are an aluminum paint or white lead in linseed oil, thinned with turpentine or mineral spirits.

**Preparation**

On frame walls plaster may be limited to one or two coats, may be recessed between studs, or may be omitted. In the latter case, building paper should be used between woodwork and studs. On masonry, plaster may consist of one or two coats or may be omitted. Masonry surfaces, particularly exterior walls, should be waterproofed or woodwork should be protected by a layer of waterproof paper and should always be furred out. When finish of the interior of cabinets is plaster, either plain or canvas covered, the final coat of plaster is applied after erection of cabinet.

**Grounds** of soft wood for attaching cabinet work must be accurately located, are secured directly to framing members or furring, and must be concealed.

**Blocking** of rough lumber should be erected for supporting raised floors and large or heavy cabinet work, if it can be concealed. Blocking must be accurately placed and secured with nails.

**Shimming** Minor irregularities in blocking, furring, or placement of studs may be corrected by using shims (wedge-shaped pieces of wood, often shingles) to bring complete work to plumb and level lines. Shimming should be concealed.

**Scribing** is the practice of fitting edges of cabinet work accurately to all irregularities of finish plaster, masonry, or other abutting surfaces. Wood mouldings, panel frames, or cabinet returns to be scribed should be provided with a beveled edge.

**Prefabricated woodwork** is generally delivered knocked down for assembly on the job and is erected similarly to custom-made work. Consult manufacturers' data.


Casework Definitions
A. Exposed portions
1. All surfaces visible when doors and drawers are closed.
2. Underside of bottoms of cabinets over 4'0" above finished floor.
3. Cabinet tops under 6'0" above finished floor or if over 6'0" and visible from an upper building level or floor.
4. Visible front edges of web frames, ends, divisions, tops, shelves, and hanging stiles.
5. Sloping tops of cabinets that are visible.
6. Visible surfaces in open cabinets or behind glass for premium grade only.
7. Interior faces of hinged doors for premium grade only.
8. Visible portions of bottoms, tops, and ends in front of sliding doors in custom and premium grades only.
B. Semi-exposed portions
1. Shelves.
2. Divisions.
3. Interior face of ends, backs, and bottoms.
4. Drawer sides, subfronts, backs, and bottoms.
5. The underside of bottoms of cabinets between 2'6" and 4'0" above the finished floor.
6. Interior faces of hinged doors, except premium grade.
7. Visible surfaces in open cabinets or behind glass for economy and custom grades and all rooms designated as storage, janitor, closet, or utility.
8. Visible portion of bottoms, tops, and ends in front of sliding doors in economy grade only.
C. Concealed portions
1. Toe space unless otherwise specified.
2. Sleepers.
3. Web frames, stretchers, and solid subtops.
5. Underside of bottoms of cabinets less than 2'6" above the finished floor.
6. Flat tops of cabinets 6'0" or more above the finished floor, except if visible from an upper building level.
7. The three nonvisible edges of adjustable shelves.
8. The underside of countertops, knee spaces, and drawer aprons.
9. The faces of cabinet ends of adjoining units that butt together.

---

Fig. 1 Inside surfaces of open shelf cabinets and behind glass are considered exposed for premium grade and tops of tall cabinets and upper cabinets 6 ft above the floor that are exposed from upper levels are considered exposed.
Fig. 2 Casework construction details — base cabinet.
Fig. 3 Casework construction details — upper cabinets at the ceiling.
### DRAWER DETAILS

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram 1" /></td>
<td><img src="image2.png" alt="Diagram 2" /></td>
<td><img src="image3.png" alt="Diagram 3" /></td>
</tr>
<tr>
<td>CUSTOM &amp; PREMIUM GRADES</td>
<td>FLUSH OVERLAY CUSTOM &amp; PREMIUM GRADES</td>
<td>FLUSH OVERLAY CUSTOM &amp; PREMIUM GRADES</td>
</tr>
<tr>
<td><img src="image4.png" alt="Diagram 4" /></td>
<td><img src="image5.png" alt="Diagram 5" /></td>
<td><img src="image6.png" alt="Diagram 6" /></td>
</tr>
<tr>
<td>ECONOMY GRADE</td>
<td>CUSTOM &amp; PREMIUM GRADES</td>
<td>CUSTOM &amp; PREMIUM GRADES</td>
</tr>
<tr>
<td><img src="image7.png" alt="Diagram 7" /></td>
<td><img src="image8.png" alt="Diagram 8" /></td>
<td><img src="image9.png" alt="Diagram 9" /></td>
</tr>
<tr>
<td>ECONOMY GRADE</td>
<td>CUSTOM &amp; PREMIUM GRADES</td>
<td>CUSTOM &amp; PREMIUM GRADES</td>
</tr>
<tr>
<td><img src="image10.png" alt="Diagram 10" /></td>
<td><img src="image11.png" alt="Diagram 11" /></td>
<td><img src="image12.png" alt="Diagram 12" /></td>
</tr>
<tr>
<td>CUSTOM &amp; PREMIUM GRADES</td>
<td>ALL GRADES</td>
<td>ALL GRADES</td>
</tr>
<tr>
<td><img src="image13.png" alt="Diagram 13" /></td>
<td><img src="image14.png" alt="Diagram 14" /></td>
<td><img src="image15.png" alt="Diagram 15" /></td>
</tr>
<tr>
<td>ALL GRADES</td>
<td>ALL GRADES</td>
<td>PREMIUM GRADE</td>
</tr>
<tr>
<td><img src="image16.png" alt="Diagram 16" /></td>
<td><img src="image17.png" alt="Diagram 17" /></td>
<td><img src="image18.png" alt="Diagram 18" /></td>
</tr>
<tr>
<td>PREMIUM GRADE</td>
<td>PREMIUM GRADE</td>
<td>PREMIUM GRADE</td>
</tr>
</tbody>
</table>

### DRAWER GUIDE DETAILS

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image19.png" alt="Diagram 19" /></td>
<td><img src="image20.png" alt="Diagram 20" /></td>
<td><img src="image21.png" alt="Diagram 21" /></td>
</tr>
<tr>
<td>SIDE RUNNER ALL GRADES</td>
<td>SIDE ALL GRADES</td>
<td>CORNER ALL GRADES</td>
</tr>
<tr>
<td><img src="image22.png" alt="Diagram 22" /></td>
<td><img src="image23.png" alt="Diagram 23" /></td>
<td></td>
</tr>
<tr>
<td>CENTER ALL GRADES</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

(1) Premium Grade requires top edge of sides to be shaped or stop shaped.
(2) Dado not required. Must be securely attached.

---

Fig. 4 Drawer details.
Flush Overlay Type Casework Construction Details

**NOTE:** Grain of drawer fronts may run vertically or horizontally unless specified otherwise.

Sections shown are typical; however, variations are permitted as provided in the standard established for each grade.

Fig. 5 Flush overlay type casework construction details.
Architectural Woodwork

STANDARD JOINERY AND CASEWORK DETAILS

Typical Flush Overlay Casework Construction
STANDARD JOINERY AND CASEWORK DETAILS

Typical Flush Overlay Casework Construction
Architectural Woodwork

STANDARD JOINERY AND CASEWORK DETAILS

Solid Core Wood Flush Doors

TOP AND BOTTOM RAILS
- MINIMUM 1 INCH (25.40mm)

WIDTH OF STILES
- MINIMUM 1 INCH (25.40mm)

CORE OF MAT-FORMED COMPOSITION BOARD

COMBINED THICKNESS OF EACH FACE PANEL
- MINIMUM 1/12 INCH (2.12mm)

FACE VENEER

Fig. 6 Mat-formed wood particleboard core (7-ply construction illustrated).

CORE OF MAT-FORMED COMPOSITION BOARD

TOP AND BOTTOM RAILS
- MINIMUM 1 INCH (25.40mm)

WIDTH OF STILES
- MINIMUM 1 INCH (25.40mm)

FACE VENEER

Fig. 7 Mat-formed wood particleboard core (5-ply construction illustrated).

TOP AND BOTTOM RAILS
- MINIMUM 1 INCH (25.40mm)

CORE OF MAT-FORMED COMPOSITION BOARD

WIDTH OF STILES
- MINIMUM 1 INCH (25.40mm)

FACE VENEER

COMBINED THICKNESS OF EACH FACE PANEL
- MINIMUM 1/12 INCH (2.12mm)

Fig. 9 Glued block core (5-ply construction illustrated).

TOP, BOTTOM, AND SIDE EDGE BANDS
- GLUED TO CORE
  - MINIMUM 1/2 INCH (12.7mm)

WOOD CORE BLOCKS
- ANY LENGTH
- JOINTS STAGGERED
- BLOCKS GLUED TOGETHER

COMBINED THICKNESS OF EACH FACE PANEL
- MINIMUM 1/12 INCH (2.12mm)

FACE VENEER

Fig. 8 Mat-formed wood particleboard core (3-ply construction illustrated).

Fig. 3 Glued block core (5-ply construction illustrated).
**Architectural Woodwork**

**STANDARD JOINERY AND CASEWORK DETAILS**

**Solid Core and Hollow Core Wood Flush Doors**

**SOLID CORE WOOD FLUSH DOORS**

- **TOP AND BOTTOM RAILS**
  - Minimum 1 inch (25.40mm)

- **WIDTH OF STILES**
  - Minimum 1 inch (25.40mm)

- **WOOD CORE BLOCKS**
  - Any length
  - Joints staggered
  - Blocks glued together

- **COMBINED THICKNESS OF EACH FACE PANEL**
  - Minimum 1/12 inch (2.12mm)

- **FACE VENEER**

Fig. 10 Framed block glued core (7-ply construction illustrated).

**HOLLOW CORE WOOD FLUSH DOORS**

- **TOP AND BOTTOM RAILS**
  - Minimum 2% inches (57.2mm)

- **WIDTH OF STILES**
  - Minimum 1 inch (25.4mm)

- **WOOD OR WOOD DERIVATIVE STRIPS**
  - Strips may be staggered or full core size
  - Strips may run vertical or horizontal

- **LOCK BLOCKS**
  - Required
  - Minimum length 20 inches (508mm)
  - Mid point of lock block located at mid point of stile
  - Width as specified in 3.1.4

- **COMBINED THICKNESS OF EACH FACE PANEL**
  - Minimum 1/10 inch (2.54mm)

- **FACE VENEER**

Fig. 12 Ladder core (7-ply construction illustrated).

Fig. 11 Wood block lined core (7-ply construction illustrated).

Fig. 13 Mesh or cellular core (7-ply construction illustrated).
a. **FLUSH CABINET DOORS. All WIC Grades.**

**TYPE “1”**
Veneer/tape banding, 1/16” maximum.

**TYPE “2”**
Solid banding.

**TYPE “3” — Medium Density Fiberboard.**
Banding not required for Economy and Custom Grades.
Band required for Premium Grade.

b. **LIPPED CABINET DOORS.**

**TYPE “4”**
Veneer/tape banding, 1/16” maximum, required.

**TYPE “5”**
Solid banding.

**TYPE “6” — Medium Density Fiberboard.**
Banding not required for Economy and Custom Grades.
Band required for Premium Grade.

c. **STILE AND RAIL CABINET DOORS. All WIC Grades.**

**TYPE “7”, S4S Stop.**

**TYPE “8”, Solid Stuck.**

**TYPE “9”, Moulded Stop.**

d. The top and bottom edges of sliding doors do not require an edge band.
Architectural Woodwork

STANDARD JOINERY AND CASEWORK DETAILS

Stile and Rail Joinery Details

Fig. 14 Full-height stile and rail raised paneling. Stile and rail wall paneling accented by raised panels creates a beautiful effect of traditional architectural woodwork. Framed within the stiles and rails and accented by the shadow lines, this construction offers limitless opportunities for various effects through the use of different wood species and veneer cuts. Each design creates a unique atmosphere complimented by the finely proportioned paneling.
Fig. 15 Flap paneled wainscot. Flat panels set within the frame of the stile and rail create a rich effect of traditional architectural woodwork. Different results can be produced through the use of veneer selections with transparent finish or painted finishes chosen by the architect or designer.

Fig. 16 Paneled doors. Stile and rail doors designed to accent the adjacent wall panelling whether traditional or contemporary, or used alone, beautify an entryway or area.
Fig. 17  Full-height contemporary raised paneling. This design, distinguished by its simplicity, is a contemporary expression of the stile and rail construction.
# Profiles of Stock Sticking for Sash & Doors

<table>
<thead>
<tr>
<th>Sash &amp; French Doors</th>
<th>Panel Doors</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="OGEE Profile" /></td>
<td><img src="image2.png" alt="OGEE Profile" /></td>
</tr>
<tr>
<td><img src="image3.png" alt="SQUARE Profile" /></td>
<td><img src="image4.png" alt="SQUARE Profile" /></td>
</tr>
<tr>
<td><img src="image5.png" alt="B &amp; C Profile" /></td>
<td><img src="image6.png" alt="OVolo Profile" /></td>
</tr>
<tr>
<td><img src="image7.png" alt="OGEE Profile" /></td>
<td><img src="image8.png" alt="SQUARE Profile" /></td>
</tr>
<tr>
<td><img src="image9.png" alt="B &amp; C Profile" /></td>
<td><img src="image10.png" alt="SQUARE Profile" /></td>
</tr>
</tbody>
</table>
Fig. 18  Double hung windows: stock designs. Standard widths are  1'6", 2'0", 2'6", 3'0", 3'6", 4'0", 4'6", and 5'0". Standard heights are  2'0", 2'6", 3'0", 3'6", 4'0", 4'6", 5'0", 5'6", and 6'0". Standard thicknesses are 1/4" and 1/2". Stock thickness is 1/4". Standard glazing is s.s.b. glass — not bedded.

Fig. 19  Single sash: stock designs. Standard widths are  2'0", 2'6", 3'0", 3'6", 4'0", 4'6", 5'0", 5'6", and 6'0". Standard heights are  2'0", 2'6", 3'0", 3'6", 4'0", 4'6", 5'1", 5'6", 6'0", 6'6", and 7'0". Standard thicknesses are 1/4" and 1/2". Stock thickness is 1/4". Standard glazing is s.s.b. glass — not bedded.
Fig. 20 Casements in pairs: stock designs. Standard widths are 2'6", 3'0", 3'6", 4'0", 4'6", and 5'0". Standard heights are 2'0", 2'6", 3'0", 3'6", 4'0", 4'6", 5'1", 5'6", and 6'0". Standard thicknesses are 1¼" and 1¼". Stock thickness is 1¼". Standard glazing is s.s.b. glass — not beded.

Fig. 21 Windows and sash: typical diamond light cut-ups.
Architectural Woodwork

WOODWORK DETAILS
Corner Cupboard

ELEVATION
Scale: \( \frac{3}{4}'' = 1'-0' \)

PLAN
\( \frac{3}{4}'' = 1'-0' \)
WOODWORK DETAILS

Bookcases

In design of bookcases, keep in mind type of books. Free shelves are to accommodate for the home a 125 to 150 books is sufficient, for the office, businesses, etc. having big books greater depth is required.

The use of adjustable shelf supports is recommended.
Architectural Woodwork

WOODWORK DETAILS
Library Cabinets and Bookcases

VERTICAL SECTION
LIBRARY CABINETS

VERTICAL SECTION - LIBRARY BOOKCASE
Architectural Woodwork

WOODWORK DETAILS

Bar Sinks
ELEVATION OF GIFT DISPLAY CASE
Architectural Woodwork

WOODWORK DETAILS

Display Case

Fig. 2 (Continued)
Architectural Woodwork

WOODWORK DETAILS

Work Counter

Fig. 3 Countertop.

Fig. 4 Back counter.
Fig. 5  Word processing counter.

Fig. 6  Cashier counter.

Fig. 7  Base and work counter.

Fig. 8  Walkup counter.
Architectural Woodwork

WOODWORK DETAILS

Overfile Cabinet

FILE END

PNL
Architectural Woodwork

WOODWORK DETAILS

Overfile Cabinet

Fig. 9 Wall unit with overhead cabinets.

Fig. 10 Free-standing island unit.
Architectural Woodwork

WOODWORK DETAILS
Book and Shawl Cabinet

ELEVATIONS OF BOOK & SHAWL CABINETS

PLAN OF BOOK & SHAWL CABINETS

TYPICAL STILE DETAIL

Fig. 11
Fig. 11 (Continued)
Architectural Woodwork

WOODWORK DETAILS

Storage Shelves

ELEVATION OF STORAGE CLOSETS 4'-0" OR LESS IN LENGTH

ELEVATION OF STORAGE CLOSETS OVER 4'-0" IN LENGTH
WOODWORK DETAILS

PANTRY CABINETS

VERTICAL SECTION - PANTRY CABINETS
Altars

Pulpit
3'9" High x 3'6" Wide x 1'8½" D
Table
2'7" High x 5'0" Long x 2' D
Center Pulpit Chair
4' High x 2'2½" Wide x 1'10" D
Side Pulpit Chair
3'9" High x 2'2½" Wide x 1'10" D
Communion Chair
3'4" High x 1'8½" Wide x 1'7½" D
Flower Stand
2'6" High x 1'3" Square

Pulpit
4'0" High x 3'6" Wide x 1'8" D
Table
2'9" High x 6'0" Long x 2'0" D
Flower Stand
2'0" High x 1'2" Square
Clergy Pew End

Pulpit
3'9" High x 3'4" Wide x 1'8" D
Table
2'9" High x 6'0" Long x 2'0" D
Flower Stand
2'0" High x 1'2" Square
Clergy Pew End

Pulpit
4'0" High x 3'8" Wide x 1'9" D
Table
2'9" High x 4'6" Long x 2'0" D
Flower Stand
2'0" High x 1'2" Square
Clergy Pew End

Fig. 14
Fig. 15 Fully upholstered seat. All exposed surfaces of the seat and back are fully upholstered.

Fig. 16 Combination upholstered/wood seat. An upholstered seat with a wooden back (either solid or veneer laminate).

Fig. 17 All wood seat. Either solid wood or veneered seat and back. Generally the most expensive option. Wood seats and backs can be contoured for increased comfort.

Fig. 18 Pew accessories.

Fig. 19 Screens are adaptable for many uses in the sanctuary. They serve as modesty screens in front of the first row of pews, or they can be adapted for use as communion rails, as choir boxes, or as wainscoting.
Architectural Woodwork

WOODWORK DETAILS
Sanctuary Doors and Miscellaneous Details

SECTIONS - SANCTUARY DOORS

PLAN AT INTERSECTION OF CHANCEL RAIL AND COLUMN

SECTION AT SANCTUARY COLUMN

SECTION AT WAINSCOAT

TREFOIL LAYOUT
Architectural Woodwork

WOODWORK DETAILS

Lectern

SECTION VIEW THRU LECTERN STANDS

PLAN VIEW OF LECTERN STANDS

CROSS SECTION OF PODIUM

PLAN SECTION
Architectural Woodwork

WOODWORK DETAILS

Boardroom Table

VERTICAL SECTION - BOARDROOM TABLE

SECTION
CROSS SECTION AT BOARDROOM TABLE
ARCHITECTURAL WOODWORK

WOODWORK DETAILS

Wood Railing and Gate

PLAN OF RAIL AND GATE

ELEVATION OF RAIL AND GATE

SECTION A - A

SECTION B - B

SECTION C - C

ELEVATION

CAM LOCK ASSEMBLY
Typical Trim and Cornice

Section at Entablature

Section—Typical Ceiling Mouldings
DETAIL OF WOOD CORNICE AND PANELING
Architectural Woodwork

WOODWORK DETAILS

Cornices

Detail of Wood Wall & Cornice: Library.
Architectural Woodwork

WOODWORK DETAILS
Detail of Wood-Paneld Wall and Bookcase

SECTION B: ONE HALF INCH ELEVATION

SECTION B: 1/2 FULL SIZE
MATERIAL: KNOTTY PINE
STAINED AND WAXED

DIV. FUEL SHAFT

PLAN A: 1/4 FULL SIZE
Architectural Woodwork

WOODWORK DETAILS
Display Cases

SHOWCASE SECTION

VERTICAL SECTION-DISPLAY CASE

VERTICAL SECTION JEWELRY CASE

PLAN SECTION JEWELRY CASE
## FINISHING MATERIALS

<table>
<thead>
<tr>
<th>GENERIC TYPE</th>
<th>RECOMMENDED USAGE</th>
<th>CHARACTERISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System #1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lacquers</td>
<td>For all wood surfaces except medium to heavy acid areas; Interior use.</td>
<td>Good coverage; Easy to apply; Sands easy; Poor water resistance.</td>
</tr>
<tr>
<td>Catalyzed Lacquers</td>
<td>For wood surfaces requiring medium acid resistance; Interior use.</td>
<td>Tough wearing surface; Good water resistance; Can be repaired.</td>
</tr>
<tr>
<td><strong>System #2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Varnishes</td>
<td>For all wood surfaces; Interior use; Exterior use — spar varnishes.</td>
<td>Good build; Tends to amber with age; Slow drying.</td>
</tr>
<tr>
<td>Conversion Varnishes</td>
<td>For all wood surfaces; Some acid resistance; Interior use.</td>
<td>Good build and solids; Can be repaired.</td>
</tr>
<tr>
<td><strong>System #3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polyurethane</td>
<td>For all wood surfaces; Interior use.</td>
<td>Tough surface; Excellent wear and abrasion resistance; Can be repaired.</td>
</tr>
<tr>
<td>Catalyzed Polyurethane</td>
<td>For all wood surfaces; High acid resistance; Interior use.</td>
<td>Tough surface; Excellent wear and abrasion resistance; Can be repaired.</td>
</tr>
<tr>
<td><strong>System #4</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epoxy</td>
<td>For all wood surfaces; High acid resistance; Interior use.</td>
<td>Very hard surface; Excellent wear and abrasion resistance; Limited pot life; High water resistance.</td>
</tr>
<tr>
<td><strong>System #5</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penetrating Oils</td>
<td>For all wood surfaces; Performs well on Oak, Teak, Walnut, etc.</td>
<td>Easy to apply; Makes touch-up easy; Average wear and abrasion qualities; Easy to repair.</td>
</tr>
<tr>
<td><strong>System #6</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synthetic Enamels</td>
<td>Most wood and wood product surfaces; Interior use; Most colors available.</td>
<td>Good coverage; Tough wearing; Can be re-coated or repaired; Easy to apply.</td>
</tr>
<tr>
<td><strong>System #7</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vinyl Lacquer</td>
<td>For all wood products; Interior use; Light acid resistance.</td>
<td>Tough surface; Good wearing; Resists light chemicals.</td>
</tr>
<tr>
<td>Catalyzed Vinyl</td>
<td>For all wood products; Interior use; Excellent for residential kitchens, etc.; Better acid resistance.</td>
<td>Tough surface; Good wearing; Repairs not easy.</td>
</tr>
<tr>
<td><strong>System #8</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire Retardant Coatings (Intumescent)</td>
<td>For surfaces of wood products requiring flame spread protection. (See WIC Technical Bulletin No. 423 — Section 19.)</td>
<td>Leaching will result if exposed directly to high humidity or direct water. Can be coated with compatible overcoat system or waterproofing materials. Available for transparent and opaque finishes.</td>
</tr>
</tbody>
</table>

865
Architectural Woodwork

CORNICES AND MOULDINGS
Deep Sculpt and Crown Mouldings

Deep Sculpt Mouldings

Crown Mouldings
Architectural Woodwork

CORNICES AND MOULDINGS

Door Trim Mouldings
Architectural Woodwork

CORNICES AND MOULDINGS

Miscellaneous Mouldings

Chair Rail Mouldings

Picture/Mirror Hanging Mouldings

Door Trim Moulding

Panel and Trim Mouldings
CORNICES AND MOULDINGS
Crown Mouldings

Solid Crowns
Architectural Woodwork

CORNICES AND MOULDINGS
Miscellaneous Mouldings

1 1/8 x 5 1/2 & 1 1/8 x 7 1/2

Pilaster

3/16 x 13/4

Tongue and Groove Siding

1 15/16 x 2

1 5/8 x 1 1/2

1 1/8 x 1 1/4

1 1/4 x 2

1 1/2 x 2

1 1/16 x 2

1 3/32 x 2

1 1/8 x 1 1/16

1 1/16 x 1 3/8

Fluted Pilaster

1 11/16 x 1 3/4

1 11/16 x 1 7/8

Brick Moulds

Drip Caps
CORNICES AND MOULDINGS
Miscellaneous Mouldings

Mullion Centers
Sash Stops
Sash Beads
Skew Back
Shelf Edge
Screen

Astragals
Panel Mouldings
"T" Astragal

Sanitary Cap
Back Band
Parting Strip

Cornerguards
Architectural Woodwork

CORNICES AND MOULDINGS

Base Mouldings

Quarter Round Moulds

Base Shoe & Floor Moulds
Architectural Woodwork

CORNICES AND MOULDINGS

Ceilings
CORNICES AND MOULDINGS

Seeded Casings

Specialty casings
CORNICES AND MOULDINGS
Handrails, Balusters, and Rounds
CLAM SHELL MOULDINGS

STOP MOULDINGS

Sanitary

Sash

Clam Shell

Colonial

Sash

Lattice
Architectural Woodwork

CORNICES AND MOULDINGS
Hand-Carved Brackets

Flute & Lyre
10½"W x 11"H

Bracket
6½"W x 12½"H x 5½"D.

Bracket
8"W x 12"H x 4"D.

Left & Right Scroll
8¼"W x 11½"H

Bracket
4½"W x 13"H x 9½"D.

Bracket
4"W x 8¼"H x 1½"D.

Bracket
2½"W x 12¾"H x 7"D

Bracket
7¼"W x 14"H x 7½"D
TABLE 1 Butt Hinges

<table>
<thead>
<tr>
<th>No.</th>
<th>Type</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Standard brass butt: A, solid drawn type; B, pressed pattern</td>
<td>General usage</td>
</tr>
<tr>
<td>2</td>
<td>Back flap hinge</td>
<td>With wide plates for table leaves and rebated or rabbeted fallflaps</td>
</tr>
<tr>
<td>3</td>
<td>Strap hinge</td>
<td>For narrow sections</td>
</tr>
<tr>
<td>4</td>
<td>Lift-off butt</td>
<td>For doors which have to be removed from time to time without disturbing setting</td>
</tr>
<tr>
<td>5</td>
<td>Loose pin hinge; ball-tipped hinge</td>
<td>Where it is necessary to throw door clear of carcass frame with the whole or the hinge knuckle protruding</td>
</tr>
<tr>
<td>6</td>
<td>Stopped hinge</td>
<td>Opens through 90° only for box lids, etc.</td>
</tr>
<tr>
<td>7</td>
<td>Piano hinge</td>
<td>Continuous strip form for supporting long lengths; supplied in drilled and countersink or undrilled blanks</td>
</tr>
<tr>
<td>8</td>
<td>Clock case hinge</td>
<td>One plate is wider to allow for a projecting door</td>
</tr>
</tbody>
</table>
**Left- and Right-Hand Hinges**

Hinges with screw-mounted flanges should be viewed as if in mounted condition with the countersunk screw holes facing you. If the female flange is uppermost on the left, the hinge is a left-hand hinge and vice versa.

**Cranked Hinges and Their Uses**

The position of the door relative to the side panel can vary considerably, being decided at the design stage in accordance with the final effect required. A wide variety of hinge types has developed from variations in mounting methods, which must be coordinated at the design stage.

**Straight hinge**

For butting, flush or front-hung doors. The barrel is positioned centrally between the two flanges.

**Crank B**

Mounting with set-back doors. One flange is cranked by an amount equivalent to the thickness of the material.

**Crank C**

Similar to crank B but for forward-set doors.

**Crank D**

Mounting with rebated doors with flanges of non-uniform width (reduced female flanges).

---

**Crank L1**

Mounting with butting front-hung doors
Door opening range 270°
Crank features internal roll.

**Butt Hinge Designations**

Butt hinges for cupboards, windows, and doors, and hinges with mortise-type flanges should be viewed with the barrel facing you. If the female flange is positioned on the left of the barrel, it is a left-hand hinge and vice versa.

**Butt hinge**

The hinge is made with offset flanges for mortised mounting. The door-mounted flange is secured with screws or pins from the rear or front (giving exposed heads).

**Double butt hinge**

Suitable for mounting two doors to a single centre panel. The door opening range is 180° each (centre flange only mortised).
FOLDING TABLE HINGE

Functional diagram

Self-supporting hinge, for folding and sewing machine tables, flush-mounted

Functional diagram (seen from below)

Folding table hinge, flush-mounted

Card table hinge Two-way table-leaf hinge, flush-mounted

FLAP HINGES

Specimen mounting

Dimensions in mm.
**MITRED HINGE**

The hinges are suitable for wooden doors and side panels from 16 mm to 22 mm in thickness, chamfered at an angle of 45°.

An all-metal mitred hinge, specially designed to enable door and carcase edges to meet at an angle of 45°.

Since both bosses have the same adjustment facilities, the complete hinge can be adjusted in three directions, vertically, laterally and from front to back.

**CONCEALED HINGES**

Specimen installation of a butting, flush-fitting cupboard door. Doors may, however, be set back or forward if preferred, provided the housing recesses are appropriately offset. If doors are set back, care must be taken to ensure that the opening angle is restricted as little as possible.

Dimensions in mm.
Pivot hinge, without stop
Hollow drawn, with one short flange

Dimensions in mm

Pivot hinge, without stop
Smooth drawn, with one short flange

Corner pivot hinge, without stop
With outer knuckle, straight

Corner pivot hinge, without stop
With outer knuckle, cranked

Pivot hinges for writing bureau drop leaf mounting.
Smooth drawn.

Dimensions in mm.
Architectural Woodwork

FURNITURE HARDWARE

Glass Door Hinges

For flush-fitted doors

Drilling diagram (top)

For flush-fitted doors

One left and one right hinge per mounting

For flush-fitted doors

One left and one right hinge per mounting

For flush-fitting doors

For front-hung doors

For front-hung doors

One left and one right hinge per mounting

Magnetic Pressure Catches

Dimensions in mm.
### Architectural Woodwork

**FURNITURE HARDWARE**

**Flap Stays with Brake**

Dimensions in mm.

<table>
<thead>
<tr>
<th>Vertical mounting</th>
<th>Internal carcase height (mm)</th>
<th>Distance A (mm)</th>
<th>Distance C (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>300 to 400</td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>325</td>
<td>350 to 450</td>
<td>306</td>
<td></td>
</tr>
<tr>
<td>450</td>
<td>400 to 500</td>
<td>430</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Horizontal mounting</th>
<th>Internal carcase height (mm)</th>
<th>Distance A (mm)</th>
<th>Distance C (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>300 to 400</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>325</td>
<td>350 to 450</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>450</td>
<td>400 to 500</td>
<td>150</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vertical mounting</th>
<th>Internal carcase height (mm)</th>
<th>Distance A (mm)</th>
<th>Distance C (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>160</td>
<td>250 to 350</td>
<td>127</td>
<td></td>
</tr>
<tr>
<td>190</td>
<td>300 to 400</td>
<td>151</td>
<td></td>
</tr>
<tr>
<td>220</td>
<td>350 to 450</td>
<td>175</td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>400 to 500</td>
<td>196</td>
<td></td>
</tr>
<tr>
<td>280</td>
<td>450 to 550</td>
<td>222</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Horizontal mounting</th>
<th>Internal carcase height (mm)</th>
<th>Distance A (mm)</th>
<th>Distance C (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>160</td>
<td>200 to 300</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>190</td>
<td>230 to 330</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>220</td>
<td>260 to 360</td>
<td>127</td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>290 to 400</td>
<td>148</td>
<td></td>
</tr>
<tr>
<td>280</td>
<td>320 to 430</td>
<td>177</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vertical mounting</th>
<th>Internal carcase height (mm)</th>
<th>Distance A (mm)</th>
<th>Distance C (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>min. 130</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>min. 170</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>min. 210</td>
<td>140</td>
<td></td>
</tr>
</tbody>
</table>
Extension type
Soft-Roller systems are capable of varying degrees of extension, depending on design. Basically, three types are employed:

**E - Single extension**
The withdrawal distance offered by single extensions is designed to be less than the installation length. Drawers cannot be opened clear of the carcass.

**V - Full extension**
The full extension model incorporates a pull-out distance as great as, or greater than, the installation length. Drawers can be opened completely clear of the carcass.

**T - Telescopic extension**
Telescopic extensions are fully extending systems. Their particular design is such that all the elements travel on a central axis resulting in a particularly neat, space-saving, compact assembly.

Mounting method
An indication as to how the rails are secured to the drawer or pull-out element.

**A - Base mounted**

**S - Side mounted**

**N - Groove mounted**

**T - Shelf mounted**

Single extensions with friction bearing mounted nylon rollers

Telescopic extensions guided by means of ball cages
Architectural Woodwork

FURNITURE HARDWARE

Shelf Supports

- Shelf supports, pin mounted
- Plug-in, Ø 3 mm hole
- Plug-in, Ø 5 mm hole
- Plug-in, Ø 4 mm hole
- Shelf supports, plastic
- Shelf supports, with added screw fastening
- Shelf supports, with splining clip
- Plug-in, Ø 1/4 in. hole
- Shelf supports, with sleeves (steel)
- Shelf supports, with sleeves (plastic)
- Plug-in, Ø 6 mm hole
- Shelf retainers, in Ø 5 mm hole
- Shelf retainers, in Ø 5 mm hole
- Glass shelf supports, in 5 Ø mm holes
- Glass shelf supports, in Ø 5 mm holes
- Shelf supports, screw-in type
- Shelf supports, surface-mounted
- Shelf support systems, screw-mounted
- Shelf support systems, groove-mounted

Mirror mount, for mirror with backing panel
### Furniture Glides

#### Knock-in furniture glides

<table>
<thead>
<tr>
<th>Size</th>
<th>13 mm</th>
<th>15 mm</th>
<th>18 mm</th>
<th>20 mm</th>
<th>23 mm</th>
<th>25 mm</th>
<th>30 mm</th>
</tr>
</thead>
</table>

#### Chair leg glide (pin type)

Finish: nickel-plated steel

<table>
<thead>
<tr>
<th>Size</th>
<th>13 mm</th>
<th>15 mm</th>
<th>18 mm</th>
<th>20 mm</th>
</tr>
</thead>
</table>

#### Chair leg cups with three lugs

Finish: nickel-plated steel

<table>
<thead>
<tr>
<th>Size</th>
<th>13 mm</th>
<th>15 mm</th>
<th>18 mm</th>
<th>20 mm</th>
</tr>
</thead>
</table>

#### Glide (pin type)

With rubber washer
Finish: nickel-plated steel; black rubber

<table>
<thead>
<tr>
<th>Size</th>
<th>16 mm</th>
<th>20 mm</th>
<th>23 mm</th>
<th>25 mm</th>
<th>30 mm</th>
</tr>
</thead>
</table>

#### Felt glide

Finish: felt, in plastic case, grey

<table>
<thead>
<tr>
<th>Size</th>
<th>20 mm</th>
<th>24 mm</th>
<th>30 mm</th>
</tr>
</thead>
</table>

#### Plastic glide

Finish: white plastic

<table>
<thead>
<tr>
<th>Size</th>
<th>10 mm</th>
<th>13 mm</th>
<th>16 mm</th>
<th>19 mm</th>
<th>22 mm</th>
</tr>
</thead>
</table>

#### Plastic glide (pin type)

With rubber washer
Finish: white plastic; black rubber

<table>
<thead>
<tr>
<th>Size</th>
<th>15 mm</th>
<th>20 mm</th>
<th>25 mm</th>
<th>30 mm</th>
</tr>
</thead>
</table>
## Specialties

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plantscaping</td>
<td>906</td>
</tr>
<tr>
<td>Signage and graphics</td>
<td>931</td>
</tr>
<tr>
<td>Audio-visual systems</td>
<td>949</td>
</tr>
<tr>
<td>Auditorium seating</td>
<td>961</td>
</tr>
<tr>
<td>Security</td>
<td>977</td>
</tr>
<tr>
<td>Color theory</td>
<td>998</td>
</tr>
<tr>
<td>Window treatments</td>
<td>1015</td>
</tr>
<tr>
<td>Elevators</td>
<td>1060</td>
</tr>
<tr>
<td>Indoor recreation</td>
<td>1069</td>
</tr>
<tr>
<td>Accessories</td>
<td>1075</td>
</tr>
</tbody>
</table>
In most instances, the design process requires a knowledge of, or at the very least, an awareness of, certain specialized elements that can contribute heavily to the success or failure of a project in terms of aesthetics or function, or both. These elements may take the form of manufactured “off-the-shelf” products or consist of design theories, standards, and guidelines for certain areas of expertise. Accordingly, this section deals with ten such elements, ranging from plantscaping to accessories.

Information can be found concerning the height, spacing, and diameter of indoor trees and floor plants. Also included are planting standards, details, and maintenance information. The section dealing with signage and graphics provides information on signage systems, symbols, mounting heights, and locations. Other sections provide data on audio-visual systems, including projection room layouts and details, and auditorium seating arrangements and sightlines. The section dealing with security includes information on door and window hardware, mailbox rooms, lighting, and security systems. Still other sections provide information on color theory and window treatments, including draperies and curtains, shutters and shades, and rods, holdbacks, and ties.
DESIGNING WITH PLANTS

Any successful design uses plants that are compatible not only in an aesthetic design sense, but also in their growing requirements. No matter how beautiful the design, if the plants are not matched to the correct growing conditions, parts of the design will either deteriorate or require elaborate maintenance. The aesthetic design considerations involve choosing the proper variety of plant textures, heights, and spacing to give the desired effect. The growing considerations involve the proper matching of light intensity, soil, and water, as well as proper container size, to the plant environmental requirements.

Of all the growing conditions, the most important is the light intensity. It is easy to underestimate the amount of available light, since the human eye can easily see in 20 footcandles of light, while even the most sensitive interior lighting will need only 50 to 75 footcandles to remain healthy. If the light intensity is too low, the plants should be chosen accordingly. Adding the needed lighting fixtures after the initial electrical installation is often expensive or impossible. In smaller-scale situations, such as offices or homes, extra light fixtures should be added or the plants should be chosen according to the available light. If the plants do not have the proper light intensity, they will die. The lower the light intensity below the minimum needed by the species, the faster they will do so.

Since the light source (incandescent, fluorescent, sun, or other) is not important, but the light intensity is, accurate intensity measurements are essential. For these measurements we recommend the General Electric Model 213 or 214 light meter or its equivalent. The meter should be held vertically along the level of the plant foliage; it must be moved several times a day on several days typical of the location if sunlight is used, and they must not be positioned near wallslight shielding devices into account. Only light hitting the top of the leaves is effective. While under lighting with spotlights can create dramatic effects, it does very little to help the plants. After the light intensity is determined, the plants should be selected appropriately (see Fig. 7), consistent with the design aims. Plants that will grow near one another should also have similar water requirements (also given in Fig. 7). If plants with different water requirements must be close, they should be kept in their own growing containers so they can be watered separately.

An interior planting design creates the mood through the interplay of plant texture and plant height, working only with those plants that will live under the predetermined light intensity. Color cannot really be used as a design element, since the average interior light intensity is seldom more than 100 footcandles and brightly colored plants or blooming flowers need up to 1000 footcandles. If flowering plants are used where the lighting conditions are normal, they will generally have to be replaced every few days.

Plant Texture

The good designer will provide for design variety through the clever use of plant texture. The term is used here to describe the general appearance, height, and shape of a plant. Regardless of height, it includes the size, shape, edging, and thickness of the plant's foliage, and as well as its overall shape and arrangement and number of leaves on the plant.

The five general rules concerning texture should be kept in mind:

1. Plant texture and height should be varied through the planting design, since the average interior light intensity is seldom more than 100 footcandles and brightly colored plants or blooming flowers need up to 1000 footcandles. If flowering plants are used where the lighting conditions are normal, they will generally have to be replaced every few days.

2. Avoid too much of the same type of foliage (e.g., large flat leaves) in one area, unless the plants are varied enough to avoid this.

3. An exception to this is when the palings of plants are desired. Although all plants have similar foliage, they vary slightly in color and interest, so that different types of plants may be planted together.

4. To create interest, mix small-leaved with large-leaved plants, and narrow-leaved with broad-leaved plants.

5. When using plants as specimens, especially as interior design elements in offices or homes, pick the plant with the background fabric, carpet, or wallpaper in mind. For example, a "busy" foliage plant will clash with a "busy" fabric.

Plant Height

Plant height not only determines the scale of the design, but it adds variety to the plant groupings. There are six general rules regarding plant height selection to keep in mind:

1. In the plant group, build up with the low plants in front, if the grouping can be seen from all sides, the grouping must be well balanced throughout and built up to the center height.

2. If a plant has canes with no lower foliage, try to place the lower plants in front to conceal the absence of foliage of the taller plants in the rear.

3. Uneven sizes throughout a grouping add more interest than consistent levels of foliage.

4. If a single plant is desired to hide a column or some other object, be sure that the plant height, including its container, is about three-fourths the height of the object to be concealed.

5. Keep the scale of the surroundings in mind when choosing the plant height. A 3-foot plant is fine next to a desk, but a plant of at least 6 feet should be selected if it is to be viewed when entering a room.

6. By convention, interior plant heights are measured from the top of the root ball, or planter, while exterior plant heights are measured from the top of the root ball. The reason is that interior planters are usually placed in a container or raised planter, and the total available height from floor to ceiling is fixed.

Plant Spacing

Under certain conditions, the plants of an interior landscaping design will grow. Therefore, any possible change in the plant size must be considered by the designer. If the lighting intensity is at or below the recommended level, there will be little or no plant growth and the plant size and relationships will change little over time. If the lighting intensity is well above the required level, there will be plant growth, with different plant species growing at different rates.

Unlike outdoor plants, indoor tropical plants seldom grow outward; most of their growth occurs upward. The main exceptions are the Ficus family and the Schefflera, and the Philodendron Selloum, which will spread somewhat outward. If a full plant design is desired, the required number of plants should be placed close together at the time of installation since future growth will seldom fill in the bare spots.

Even if the light intensity is high enough, before the plant can grow significantly, its root system must be able to expand. Thus, the best way to ensure that the size relationships of the plants do not change is to keep them in their original growing containers and not to replant them into a growing medium. If they are kept in the original containers, they will become pot-bound and future growth will be automatically limited.

Plant material is sold on the basis of height or growing-container size, and one must be familiar with the particular species to know what the spread will be. For each plant species considered here, Fig. 1 lists the height range for each plant in each standard growing-container size and gives a recommended minimum center-to-center plant spacing. This recommended spacing is based on experience with the plant's branching habits and growth patterns and will give the best plant design, if an open or penetrated design is called for, the spacing should be increased.

When the plants are to be displayed in individual planters or decorative containers, each plant, still in its growing can, is placed directly into the planter or container, on top of a layer of drainage material of the appropriate depth. However, many standard planters have lips that reduce the interior diameter to less than the overall diameter. This inner diameter should be limited to the growing can's diameter so that the plant can be placed directly into it without being reported and risking the attendant danger of root damage. To emphasize this requirement, Fig. 2 gives the standard planter diameter needed for each standard size of growing container. The size of the lip changes when a nonstandard type is used. If space is limited, this measurement should be carefully checked.
### INDOOR TREES

<table>
<thead>
<tr>
<th>Species</th>
<th>Height Range</th>
<th>Recommended Center-to-Center Plant Spacing</th>
<th>Growing Can Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paddle-leaf fig (Ficus lyrata)</td>
<td>3 - 4 ft</td>
<td>24 - 36 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>4 - 6 ft</td>
<td>30 - 42 in</td>
<td>14 in</td>
</tr>
<tr>
<td></td>
<td>6 - 11 ft</td>
<td>42 in &amp; up</td>
<td>17 in</td>
</tr>
<tr>
<td>Indian laurel (Ficus retusa)</td>
<td>5 - 7 ft</td>
<td>42 - 54 in</td>
<td>14 in</td>
</tr>
<tr>
<td></td>
<td>7 - 9 ft</td>
<td>48 - 60 in</td>
<td>17 in</td>
</tr>
<tr>
<td></td>
<td>9 - 12 ft</td>
<td>60 in &amp; up</td>
<td>22 in</td>
</tr>
<tr>
<td>Rubber plant (Ficus elastica cv. 'Decora'), tree standard</td>
<td>4 - 5 ft</td>
<td>48 - 60 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>5 - 6 ft</td>
<td>54 - 66 in</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>6 - 7 ft</td>
<td>60 - 72 in</td>
<td>14 in</td>
</tr>
<tr>
<td>Rubber plant (Ficus elastica cv. 'Decora'), bush type</td>
<td>1½ - 2 ft</td>
<td>12 - 18 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>2 - 2½ ft</td>
<td>12 - 24 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>3 - 4 ft</td>
<td>24 - 36 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>4 - 5 ft</td>
<td>30 - 42 in</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>4 - 5 ft</td>
<td>48 - 60 in</td>
<td>14 in</td>
</tr>
<tr>
<td>Weeping fig (Ficus benjamina)</td>
<td>3 - 4 ft</td>
<td>24 - 36 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>4 - 5 ft</td>
<td>30 - 42 in</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>5 - 7 ft</td>
<td>36 - 48 in</td>
<td>14 in</td>
</tr>
<tr>
<td></td>
<td>6 - 8 ft</td>
<td>48 - 60 in</td>
<td>17 in</td>
</tr>
<tr>
<td></td>
<td>9 - 10 ft</td>
<td>60 in &amp; up</td>
<td>22 in</td>
</tr>
<tr>
<td></td>
<td>9 - 12 ft</td>
<td>60 in &amp; up</td>
<td>28 in</td>
</tr>
<tr>
<td></td>
<td>10 - 12 ft</td>
<td>72 in &amp; up</td>
<td>36 in</td>
</tr>
<tr>
<td>Norfolk Island pine (Araucaria heterophylla)</td>
<td>1½ - 2 ft</td>
<td>18 - 30 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>2 - 3 ft</td>
<td>24 - 36 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>3 - 5 ft</td>
<td>30 - 42 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>4 - 5 ft</td>
<td>36 - 48 in</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>4 - 6 ft</td>
<td>42 - 54 in</td>
<td>14 in</td>
</tr>
<tr>
<td></td>
<td>6 - 7 ft</td>
<td>54 - 66 in</td>
<td>17 in</td>
</tr>
<tr>
<td>Schefflera (Brassaia actinophylla)</td>
<td>3 - 4 ft</td>
<td>36 - 48 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>4 - 5 ft</td>
<td>36 - 48 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>5 - 7 ft</td>
<td>55 - 66 in</td>
<td>14 in</td>
</tr>
<tr>
<td></td>
<td>7 - 8 ft</td>
<td>60 - 72 in</td>
<td>17 in</td>
</tr>
<tr>
<td></td>
<td>8 - 9 ft</td>
<td>60 in &amp; up</td>
<td>22 in</td>
</tr>
<tr>
<td></td>
<td>9 - 12 ft</td>
<td>72 in &amp; up</td>
<td>Metal tubs</td>
</tr>
</tbody>
</table>

### FLOOR PLANTS

<table>
<thead>
<tr>
<th>Species</th>
<th>Height Range</th>
<th>Recommended Center-to-Center Plant Spacing</th>
<th>Growing Can Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bamboo palm (Chamaedorea erumpens)</td>
<td>3 - 4 ft</td>
<td>30 - 42 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>4 - 6 ft</td>
<td>36 - 48 in</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>5 - 7 ft</td>
<td>42 - 54 in</td>
<td>14 in</td>
</tr>
<tr>
<td></td>
<td>7 - 9 ft</td>
<td>48 - 60 in</td>
<td>17 in</td>
</tr>
<tr>
<td>Corn plant (Dracaena fragrans cv. 'Massangeana')</td>
<td>1½ - 2 ft</td>
<td>24 - 30 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>3½ - 4 ft</td>
<td>24 - 36 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>4½ - 6 ft</td>
<td>30 - 42 in</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>5 - 7 ft</td>
<td>36 - 48 in</td>
<td>14 in</td>
</tr>
<tr>
<td>Corn plant bush (Dracaena fragrans cv. 'Massangeana')</td>
<td>1 - 1½ ft</td>
<td>18 - 24 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>1½ - 2½ ft</td>
<td>18 - 30 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>3 - 4 ft</td>
<td>24 - 36 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>4 - 5 ft</td>
<td>30 - 42 in</td>
<td>14 in</td>
</tr>
<tr>
<td></td>
<td>5 - 7 ft</td>
<td>36 - 48 in</td>
<td>17 in</td>
</tr>
<tr>
<td>Dwarf date palm (Phoenix Roebelenii)</td>
<td>2 - 3 ft</td>
<td>30 - 42 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>3 - 4 ft</td>
<td>36 - 48 in</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>4 - 5 ft</td>
<td>42 - 54 in</td>
<td>14 in</td>
</tr>
<tr>
<td></td>
<td>5 - 6 ft</td>
<td>48 - 60 in</td>
<td>17 in</td>
</tr>
<tr>
<td></td>
<td>5 - 6 ft</td>
<td>54 - 66 in</td>
<td>22 in</td>
</tr>
</tbody>
</table>

Fig. 1 Spacing recommendations.
### Species

**PLANTSCAPING**

**Plant Height, Spacing, and Diameter**

<table>
<thead>
<tr>
<th>Species</th>
<th>Height Range</th>
<th>Recommended Center-to-Center Plant Spacing</th>
<th>Growing Can Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dwarf dragon tree (Dracaena marginata)</td>
<td>3-4 ft</td>
<td>24-36 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>4.5 ft</td>
<td>30-42 in</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>5.7 ft</td>
<td>36-48 in</td>
<td>14 in</td>
</tr>
<tr>
<td></td>
<td>7.9 ft</td>
<td>48 in &amp; up</td>
<td>17 in</td>
</tr>
<tr>
<td>Dwarf schefflera (Brassia arborescens)</td>
<td>1-1.5 ft</td>
<td>18-24 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>1.5-2 ft</td>
<td>30-42 in</td>
<td>8 in</td>
</tr>
<tr>
<td>Falso aralia (Dizygoceras elegantissima)</td>
<td>1.5-2 ft</td>
<td>18-30 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>3-4 ft</td>
<td>30-42 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>5-7 ft</td>
<td>36-48 in</td>
<td>14 in</td>
</tr>
<tr>
<td></td>
<td>7-8 ft</td>
<td>42-54 in</td>
<td>17 in</td>
</tr>
<tr>
<td>Green dracaena (Dracaena deremensis cv. 'Janet Craig')</td>
<td>1-1.5 ft</td>
<td>18-24 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>1.5-2 ft</td>
<td>18-30 in</td>
<td>8 in</td>
</tr>
<tr>
<td>Lady palm (Rhapis excelsa)</td>
<td>3-4 ft</td>
<td>24-36 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>4.5 ft</td>
<td>30-42 in</td>
<td>14 in</td>
</tr>
<tr>
<td></td>
<td>5-7 ft</td>
<td>36-48 in</td>
<td>17 in</td>
</tr>
<tr>
<td>Green pleomele (Dracaena reflexa)</td>
<td>1.5-2 ft</td>
<td>12-18 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>3-4 ft</td>
<td>18-30 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>4-5 ft</td>
<td>30-45 in</td>
<td>14 in</td>
</tr>
<tr>
<td></td>
<td>5-6 ft</td>
<td>36-48 in</td>
<td>17 in</td>
</tr>
<tr>
<td>Kentia palm (Howea Forsterana)</td>
<td>3-4 ft</td>
<td>36-48 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>4.5 ft</td>
<td>42-54 in</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>5-8 ft</td>
<td>48-60 in</td>
<td>14 in</td>
</tr>
<tr>
<td>Lady palm (Rhapis excelsa)</td>
<td>3-4 ft</td>
<td>36-48 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>4-5 ft</td>
<td>42-54 in</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>5-7 ft</td>
<td>48-60 in</td>
<td>14 in</td>
</tr>
<tr>
<td>Mock orange (Phitosporum Tahira)</td>
<td>1.5-1.5 ft</td>
<td>24-36 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>1.5-2 ft</td>
<td>30-42 in</td>
<td>12 in</td>
</tr>
<tr>
<td>Narrow-leaved pleomele (Dracaena angustifolia)</td>
<td>3-4 ft</td>
<td>24-36 in</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>5-6 ft</td>
<td>30-42 in</td>
<td>14 in</td>
</tr>
<tr>
<td></td>
<td>6.7 ft</td>
<td>36-48 in</td>
<td>17 in</td>
</tr>
<tr>
<td>Neanthe bella palm (Chamaedorea elegans)</td>
<td>1-1.5 ft</td>
<td>18-30 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>1.5-2 ft</td>
<td>24-36 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>2.5-3 ft</td>
<td>30-42 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>4-5 ft</td>
<td>36-48 in</td>
<td>14 in</td>
</tr>
<tr>
<td>Ponytail (Beaucarnea recurvata)</td>
<td>1.5-2 ft</td>
<td>24-36 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>2-3 ft</td>
<td>30-42 in</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>3-4 ft</td>
<td>36-48 in</td>
<td>14 in</td>
</tr>
<tr>
<td></td>
<td>4-5 ft</td>
<td>42-54 in</td>
<td>17 in</td>
</tr>
<tr>
<td>Reed palm (Chamaedorea Seifrit)</td>
<td>4-6 ft</td>
<td>36-48 in</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>6-7 ft</td>
<td>42-54 in</td>
<td>14 in</td>
</tr>
<tr>
<td></td>
<td>7-9 ft</td>
<td>48-60 in</td>
<td>17 in</td>
</tr>
<tr>
<td>Self-heading philodendron (Philodendron Selloum)</td>
<td>3 ft</td>
<td>30-42 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>4 ft</td>
<td>42-54 in</td>
<td>14 in</td>
</tr>
<tr>
<td></td>
<td>5 ft</td>
<td>54-66 in</td>
<td>17 in</td>
</tr>
<tr>
<td>Southern yew (Podocarpus macrophyllus var. Maki)</td>
<td>4.5 ft</td>
<td>36-48 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>5.6 ft</td>
<td>42-54 in</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>5-6 ft</td>
<td>48-60 in</td>
<td>14 in</td>
</tr>
<tr>
<td></td>
<td>6-7 ft</td>
<td>54-66 in</td>
<td>17 in</td>
</tr>
</tbody>
</table>

Fig. 1 (Continued)
### TABLE OR DESK PLANTS—GROUND COVER

<table>
<thead>
<tr>
<th>Species</th>
<th>Height Range</th>
<th>Recommended Center-to-Center Plant Spacing</th>
<th>Growing Can Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boston fern (Nephrolepis exaltata cv. ‘Bostoniensis’)</td>
<td>1 ft</td>
<td>24-30 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>1 - 1½ ft</td>
<td>30-36 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>1½ - 2 ft</td>
<td>36-42 in</td>
<td>10 in</td>
</tr>
<tr>
<td>Common philodendron (Philodendron scandens oxycardium)</td>
<td>1 ft</td>
<td>18-24 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>1½ - 1¾ ft</td>
<td>24-30 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>1¾ - 1½ ft</td>
<td>24-36 in</td>
<td>12 in</td>
</tr>
<tr>
<td>Chinese evergreen (Aglaonema commutatum var. macrostachyum)</td>
<td>1 ft</td>
<td>18-24 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>1½ - 2 ft</td>
<td>24-30 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>2 - 2½ ft</td>
<td>30-36 in</td>
<td>10 in</td>
</tr>
<tr>
<td>Dumb cane (Dieffenbachia maculata cv. ‘Rudolph Rohrs’)</td>
<td>1 ft</td>
<td>18-24 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>2 ft</td>
<td>24-30 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>3 ft</td>
<td>30-36 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>3 - 3½ ft</td>
<td>36-42 in</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>3½ - 4 ft</td>
<td>42-48 in</td>
<td>14 in</td>
</tr>
<tr>
<td>Golden pothos (Epipremnum aureum or Scindapsus aureus)</td>
<td>1 ft</td>
<td>12-18 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>1 ft</td>
<td>18-24 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>1½ - 1¾ ft</td>
<td>24-30 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>1¾ - 1½ ft</td>
<td>30-36 in</td>
<td>12 in</td>
</tr>
<tr>
<td>Grape ivy (Cissus rhombifolia)</td>
<td>1 ft</td>
<td>18-24 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>1 - 1½ ft</td>
<td>18-30 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>1½ - 1¾ ft</td>
<td>24-36 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>1¾ - 2 ft</td>
<td>24-36 in</td>
<td>12 in</td>
</tr>
<tr>
<td>Jade plant (Crassula argentea)</td>
<td>1 ft</td>
<td>18-24 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>2 ft</td>
<td>24-36 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>2 - 2½ ft</td>
<td>30-42 in</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>2½ - 3 ft</td>
<td>36-48 in</td>
<td>14 in</td>
</tr>
<tr>
<td>Prayer plant (Maranta leuconeura)</td>
<td>1 ft</td>
<td>18-24 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>1 ft</td>
<td>24-30 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>1½ - 1¾ ft</td>
<td>24-30 in</td>
<td>10 in</td>
</tr>
<tr>
<td>Swedish ivy (Plectranthus australis)</td>
<td>1 ft</td>
<td>18-24 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>1 - 1½ ft</td>
<td>18-30 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>1½ - 1¾ ft</td>
<td>24-36 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>1¾ - 2 ft</td>
<td>24-36 in</td>
<td>12 in</td>
</tr>
<tr>
<td>Wax plant (Hoya carnosa)</td>
<td>1 ft</td>
<td>12-18 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>1 ft</td>
<td>18-24 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>1 ft</td>
<td>24-30 in</td>
<td>10 in</td>
</tr>
<tr>
<td>White flag (Spathiphyllum cv. ‘Clevelandii’)</td>
<td>1½ - 1¾ ft</td>
<td>24-36 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>2 ft</td>
<td>30-42 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>2½ - 3 ft</td>
<td>36-48 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>3 - 4 ft</td>
<td>48-64 in</td>
<td>14 in</td>
</tr>
<tr>
<td>White-striped Dracaena (Dracaena deremensis cv. ‘Warneckii’)</td>
<td>1½ - 1¾ ft</td>
<td>18-24 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>2 ft</td>
<td>24-30 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>3 - 4 ft</td>
<td>24-36 in</td>
<td>10 in</td>
</tr>
<tr>
<td></td>
<td>4 - 5 ft</td>
<td>30-42 in</td>
<td>12 in</td>
</tr>
<tr>
<td></td>
<td>4 - 7 ft</td>
<td>36-48 in</td>
<td>14 in</td>
</tr>
<tr>
<td>Green dracaena (Dracaena deremensis cv. ‘Janet Craig’)</td>
<td>1 ft</td>
<td>18-24 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>1½ - 2 ft</td>
<td>24-30 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>3 - 4 ft</td>
<td>30-42 in</td>
<td>10 in</td>
</tr>
<tr>
<td>Neanthes bella palm (Chamaedorea elegans)</td>
<td>1 ft</td>
<td>18-24 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>1½ - 2 ft</td>
<td>24-36 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>2½ - 3 ft</td>
<td>30-42 in</td>
<td>10 in</td>
</tr>
<tr>
<td>Self-heading philodendron (Philodendron Selloum)</td>
<td>1 ft</td>
<td>18-24 in</td>
<td>6 in</td>
</tr>
<tr>
<td></td>
<td>2 ft</td>
<td>24-36 in</td>
<td>8 in</td>
</tr>
<tr>
<td></td>
<td>3 ft</td>
<td>30-42 in</td>
<td>10 in</td>
</tr>
</tbody>
</table>
PLANTSCAPING
Design Guidelines

Writing Specifications
The interior landscaping business is very competitive, and a common practice is for the architect or designer to send out the landscaping specifications for bids. Unless the specifications for the job are well-written, however, there are many ways for the contractor to cut corners and still be within the specifications. Consequently, the final installation may not be what the designer had in mind. The lowest bid is not necessarily the best bargain, unless the specifications are very tightly written or unless the architect is dealing with a well-established landscape contractor with a reputation for high-quality work.

The following are some suggested guidelines to use in writing specifications. If they are observed, the bids received will accurately reflect the design requirements of the job.

1. Specify the plant heights within a 6-inch bracket. For example, designate 5 to 5.5 feet or 5 to 6 feet. If the specification were simply "5 to 6 feet," the supplier could use all 5-foot plants, which are considerably less expensive than 6-foot plants.

2. For corn plants, dwarf dragon trees, and the like, specify the number of canes and approximate number of foliage heads, as well as the height. The difference in cost between a two-cane and a three-cane corn plant of the same height is not minor.

3. For red palms, bamboo palms, and the like, specify the number of stems desired. For five to six being medium full.

4. For the green dracaena and white-striped dracaena, list the number of main foliage stems desired. They range from one to three stems.

5. For ficus trees, it should be specified whether the bush style or standard tree style is desired. In the bush style, the plant has multiple stems (ranging from two to five in number) branching out from the base of the plant. The standard tree or "follop" style has one main 5- to 6-foot stem with a sheared, ball-shaped foliage head.

6. Small plants should be specified as to single plants or combinations or several plants. Examples are dumb cane, Chinese evergreen, and white flag.

7. If ivy trailers are desired, their length should be specified. The trailers take up to eight months to grow, depending on the length, so the designer must plan for these up to a year before installation. Examples are grape ivy, swedish ivy, golden pothos, common philodendron, and wax plant.

8. Specifications should call for plant cleaning and spraying before installation.

9. Perlite should be specified as the drainage material for both planters and decorative containers. Styrofoam, which is much cheaper, is often used but has little long-term value.

10. The amount of ingredients in large planters (soil mixture, drainage material, soil separator) should be specified, as should the composition of each of the ingredients.

11. If bark chips, moss cover, or other soil coverings are desired, they should be specified.

12. Special attention should be given to the description of specimen plants, including the number of heads, stems, or canes, and any unusual stem structure that is desired. If canes with character (such as angle and peculiarity of growth) or foliage at various heights, or other unusual features are wanted, they should be specifically mentioned.

13. If the landscape contractor will not maintain the plants after installation, provision should be made for a maintenance program. Also, the contractor should provide plans for one week's initial maintenance of the plants and replacement of any that fail below specifications during the period.

14. If the landscape contractor is to maintain the plants after the installation (usually the best all-around solution), such an agreement should be reached before the plants are installed and a maintenance contract should be signed. This contract should include a provision for the replacement of any plant that fails below specifications because of faulty maintenance. This stipulation gives the contractor incentive for professional-quality maintenance.

15. If a large garden is planned and the landscape contractor is given design responsibility for it, the contractor should provide a floor plan of the garden for the designer's approval, before the installation.

16. If the architect or designer provides the landscape contractor with a detailed planting plan, the contractor finds it impossible to meet all the specifications (because of unavailability of certain species, etc.), the contractor and the designer or architect should agree in writing on any changes.

USE OF INTERIOR PLANTS AND PROCEDURES
The general rule of interior planting design is to very the plant heights, shapes, and textures to give the desired design feeling consistent with the available light level and planting space. The best way to learn to apply this rule to specific situations is to study successful designs.

Interior planting designs have usually been found to fall into one of two categories: (1) interior gardens, both large and small, such as those seen in residential and hotel lobbies, corporate headquarters reception areas, and enclosed shopping mall public spaces, and (2) open plan or specimen design, like office landscaping designs and designs that use individual plants as living sculptures. In both categories of design, the main requirements to be considered are the available light intensity, the scale of the design, and the client's wishes and budget. After these basic requirements are determined, however, the design considerations are somewhat different for the two types of design.

Interior Gardens
Interior gardens are planting areas, sometimes contained in built-in planters, that have a variety of plants and that convey their design feeling through plant arrangements rather than through individual plant specimens. Small gardens generally contain only a single grouping of plants, act as a single design element, and have uniform lighting and watering requirements throughout.

Large gardens have a variety of plant groupings and varying design feelings among the groupings, and they can encompass areas of different lighting and watering requirements. Since any garden conveys its effects through the juxtaposition of different plants, a single dominant plant cannot be considered a garden from the design point of view, even if it is in a built-in planter with ground-cover plants.

In designing any built-in planter, enough planter depth must be provided to allow the root ball or the planting can to be covered with soil and to rest on 4 to 8 inches of drainage material. Since soil and gravel are expensive, it is best not to overdesign the planter, by making it larger than necessary, and to use too much soil to fill in between the plants. (For example, a depth of 1½ to 2 feet is usually enough for most small gardens.) Figure 1 lists the size of the growing can for different sizes of plants of each species. The depth of the largest growing can, plus the depth of the drainage material, yields the minimum planter size for the garden. The volume of the planter minus the total volume of all the growing cans indicates the amount of additional soil and drainage material to be provided.

If the planter is already in place, its depth may limit the size of the plants that may be used. Since soil must reach to the top of the root ball or the container, the only way to utilize too shallow a planter is to put the large plant in the center and to build up from the edge inward. The planter must be wide enough to slant the soil gradually so that the slope is not too great.

Small gardens While a garden may be large enough to have only a single design function, that function can be quite varied, provided that the lighting intensity is appropriate. It can serve as a small garden or a large decorative planter, or it can be simply a large decorative planter. The garden can be airy and open or it can be dense and closed. Planter depth of 1½ to 2 feet is usually sufficient. Also, some small gardens can be designed to be changed with the seasons. Often, flowering plants, such as chrysanthemums or azaleas, are used, but the plants can then be replaced every two weeks. If the seasonal or flowering plant changes are desired, the plants should be left in their containers so that they can be easily moved. Some care should be given to the planter design so that the growing cans are not obvious and do not detract from the arrangement.

Creative additions of volcanic rocks, small ponds, or fountains can be quite attractive and set off and enhance the plants. However, with the usual small space, the small garden, these additions can produce a crowded or overdone appearance. Overcrowding will give a jungle effect that is rarely desired.

Just as in other design fields, good proportion and good sense will create a pleasing design that is neither overlooked or overbearing.

Large gardens Large gardens are simply large versions of small gardens. Their very size opens up many design possibilities, since they may be subdivided into related sections. The shape, height, and texture of the plants may be varied from section to section.
container, and the drainage material is poured into the bottom and leveled. The plant growing can is placed on top of the drainage layer and surrounded with more of the drainage material. For the smaller plants (in pots 6 inches or less in diameter), a 1-inch depth of drainage material is usually enough. For the larger plants, a layer 3 to 4 inches is sufficient. For very large gardens, about one-third of the planter depth should be the drainage layer provided it leaves enough room for the root ball to develop. The drainage material can be perlitie (a readily available synthetic material) alone or mixed with small pebbles or gravel. The perlite is suggested since it is porous enough to feed back the excess water to the soil and the soil dries out. If only gravel or pebbles are used, the excess water will sit and stagnate in the reservoir and will not be fed back to the plants. Even with the proper drainage layer over-watering is possible if so much excess water is used that it fills up the reservoir. The water level in a small container can be determined by tapping the container at various intervals and listening for the change in sound. In large planted areas, it is wise to provide for "dip-stick" readings of the water level. To take such a reading, rigid hollow plastic tubes, with a cloth over their lower ends, are "planted" at intervals along with the plants. The hollow tubes reach from the top of the container to just above the drainage layer and the cloth on the bottom prevents soil or drainage material from entering the tube. A dipstick is lowered into the tube until it touches the cloth. If the stick, upon removal, shows more than 1/2 inch of water, there is too much water in the bottom of the planter. If gravel is used as part of the drainage material, it should be 1/4 inch to 1/2 inch in diameter. Under no circumstances should limestone be used, since it is alkaline and will raise the pH of the water to a level that is too high for most tropical plants. Solari separator: If the plants are removed from their growing cans and replanted in growing soil, it is usually best to use a soil separator between the drainage layer and the planting soil. The separator is a semipermeable sheet, often composed of fiberglass wool, which serves to keep the soil from falling into the drainage layer. If the separator is not used, soil will clog the drainage material. fiberglass wool of building material grade should not be used, as it contains chemicals that will damage the plant (Fig. 3). Planting medium: Because the root systems of tropical plants are much finer than those of outdoor plants, pure topsoil is too heavy and too easily compacted to be used as a planting medium. It will constrict the plant roots and will retain too much water. For the common tropical plants discussed here, we recommend the use of the foliage plant mix developed by Cornell University. Because it is easiest to calculate the quantity of needed soil in terms of the volume of the planter to be filled, the formula given here is for 1 cubic yard of soil. For conversion purposes, 1 cubic yard equals 21.7 bushels, 786 liters, or 27 cubic feet. Sphagnum peat moss: 1/3 cu yd = 383 lt Vermiculite #2: 1/4 cu yd = 191 lt Perlite, medium fine: 1/4 cu yd = 191 lt Ground limestone, dolomitic: 0.85 gal = 13.5 cup = 3.2 lit Superphosphate 20 percent solution: 0.21 gal = 0.79 lit 10-10-10 fertilizer: 0.32 gal = 5.1 lit Iron sulphate: 0.11 gal = 1.7 cup = 0.41 lit Potassium nitrate: 0.11 gal = 1.7 cup = 0.41 lit

While this Cornell foliage plant mix gives the best all-around results, a simpler mix that gives good results in most cases is as follows: 1/3 by volume sterilized commercial mix of peat moss and vermiculite 1/6 by volume sterilized topsoil This mix is particularly effective for container planting. If it is to be used in a larger garden planting, such as a shopping mall, more perlite should be added for improved drainage. The peat and topsoil mix is considerably heavier than the Cornell mix and both are heavier wet than dry. If the garden is not situated at grade level, this weight can be an important consideration. Figure 4 gives guidelines to be used in estimating the weight of the planting medium. Planting organization: The basic ingredients for a large planting installation are drainage material, planting medium, soil separator, plant material, material-handling equipment, light, water, and labor. Organization of all these ingredients is important since every one must be ready and available for a successful installation. Arrangements for all these factors should be made in good time, and they should be ready and waiting when the plants are delivered. The amount of interior volume in the planters and containers determines the amount of needed drainage material, soil separator, and planting medium. If detailed blueprints are not available, actually measuring the planters is generally a good way to obtain this volume. The relationship between planting medium, drainage material, and soil separator can be determined using the guidelines of the previous subsection. If the plants are to be left in their cans (as generally recommended), the space between the plants is filled with drainage material. If they are removed from their cans, the space between plants is filled with planting medium. In either case, the amount of volume displaced by the plants is simply the sum of the volume contained in the growing cans. Information for each standard size of growing container is given in Fig. 5. The installation should not be started unless all lights and water connections are operating, as the plants will need both light and water during the installation — especially the light. If the plants are delivered dry, they should be watered in their cans unless they are to be planted at once and watered immediately after planting. If the plants are removed from their cans and placed into dry planting medium, they are left in their cans and the topsoil should be thoroughly watered immediately.
Plant Use and Procedures

It is recommended that each section be planted in the following order. First, leftover building material and other debris are removed from the planting areas. Second, drainage material is added to the proper depth and leveled. Third, the plants, either in or out of their growing containers, are placed on top of the drainage material and the soil separator if present, and arranged according to the design. The spaces between the plants are then filled in with drainage material or planting medium, depending on whether the plants are in or out of their growing containers. If planting medium is used, it should be lightly compacted to prevent its settling later. (If the light intensity is below specifications and periodic replacement of the plants is expected, the plants should be left in their cans.)

After the spaces between the large plants have been filled in, the groundcover, if any, is planted. The use of decorative bark or marble chips on top of the soil is not recommended as they easily mix with the soil and are hard to remove if the plants are replaced.

After all the spaces have been filled, the plants should be thoroughly watered and the maintenance schedule begun. If dry planting medium is used, it should be watered thoroughly several times during the first week to ensure that it is completely wet.

Removing plants from cans or burlap is a healthy root system is necessary for the maintenance of a healthy plant. It is the new, very fine, feathery roots that are the most important and also the most easily damaged. This damage is very likely if the soil between the fine roots is disturbed in the course of repotting. Whether the tropical plants are delivered in growing cans or with their roots wrapped in burlap, the root system must be handled with care.

The best procedure for removing a plant from its container is to lean the pot on its side, tlap on the container sides and bottom, and carefully slide out the plant. In large container-grown plants (in 17-inch or larger cans), the root system may be held very tightly in the can. In this case, a can cutter, which works on either metal or rubber cans, may be the most gentle way of removing the can. Once the can is removed, the root ball of soil and roots should be scored by making ⅛-inch-deep vertical cuts at 3-inch intervals around the root ball from top to bottom. If the can removal and ball scoring are done near the planting site, the exposed root system is subjected minimum handling.

Very large plants and trees are frequently field-grown rather than container-grown. The root balls of such plants will come wrapped in burlap. When planting them, only the upper half of the burlap should be removed. The lower portion will disintegrate in the soil after the plant is installed.

### Planting Bed Material

| Cornstalk foliage mix | 12-18 lb/cu ft | 25-35 lb/cu ft |
| Peat/topsoil mix | 38-42 lb/cu ft | 70-90 lb/cu ft |
| Topsoil (loam) | 80-100 lb/cu ft | 100-120 lb/cu ft |
| Gravel | 120-135 lb/cu ft | 120-135 lb/cu ft |
| Sand | 95-110 lb/cu ft | 120-130 lb/cu ft |

Note: For conversion to metric system: 1 lb = 0.454 kg; 1 cu ft = 0.028 cu m.

### Soil Volume

<table>
<thead>
<tr>
<th>Pot Size</th>
<th>Soil Volume</th>
<th>Pot Diameter x Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 in</td>
<td>1 gal</td>
<td>6 1/2 in x 6 in</td>
</tr>
<tr>
<td>8 in</td>
<td>2 gal</td>
<td>8 in x 7 in</td>
</tr>
<tr>
<td>10 in</td>
<td>3 gal</td>
<td>10 in x 9 in</td>
</tr>
<tr>
<td>12 in</td>
<td>4 gal</td>
<td>11 in x 10 in</td>
</tr>
<tr>
<td>14 in</td>
<td>7 gal</td>
<td>13 1/2 in x 12 in</td>
</tr>
<tr>
<td>17 in</td>
<td>10 gal</td>
<td>17 in x 16 in</td>
</tr>
<tr>
<td>22 in</td>
<td>20 gal</td>
<td>21 in x 17 in</td>
</tr>
<tr>
<td>30 in</td>
<td>35 gal</td>
<td>29 in x 17 1/2 in</td>
</tr>
<tr>
<td>32 in</td>
<td>65 gal</td>
<td>32 in x 22 in</td>
</tr>
<tr>
<td>36 in</td>
<td>95 gal</td>
<td>36 in x 24 in</td>
</tr>
</tbody>
</table>

Note: For conversion to different units, use the following factors. 1 gal = 0.02495 cu yd = 0.00388 cu m = 0.194 cu ft = 3.79 l; 1 in = 2.54 cm.

Rock formations and decorative pools

Natural elements, such as rock formations, decorative pools, water fountains, and waterfalls, can add an artistic touch and turn an unimaginative large planting arrangement into a full garden. Unfortunately, the oversize of such-design elements is tempting, since they are usually inexpensive compared with the cost of filling the same area with plants. Provided they are not overused, they can serve as natural sculpture or as the answer for areas with too little light to support plants or where conditions limit the variety of plants that can be used.

In rock formations, volcanic rock is the most commonly used type because it is much lighter than ordinary rock. This weight factor can be of considerable importance when the weight of the garden must be limited. This type of rock is also easy to shape with a hammer and chisel.

Although a large decorative pool or fountain must be custom-designed, there are small fiberglass pools that can be purchased in a variety of sizes and are available in kidney, free-form, or rectangular shapes. They are usually no longer than 6 feet, but they are of a standard 16-inch depth, which is deep enough to accommodate any water plants, recirculating pump, and a filter tray with mat and gravel. Their high-capacity, low-pressure pumps are usually adequate for small fountains and waterfalls.

If decorative pools are used, some thought might be given to using water plants in them. These plants are very attractive and can be easily grown indoors. As with all plants, different species have different growing and flowering habits. A reputable dealer should be consulted for information.

The use of fish in pools should be carefully studied in light of the plant maintenance requirements. Fertilizer, plant chemicals, and limestone runoff from the planting area may enter the circulating water system and kill the fish. Fish can be an attractive design element, but their maintenance requirements must be considered along with the maintenance requirements of the plants.

Open Plan and Specimen Design

Modern offices are sometimes sterile places in which to work. The introduction of live plants into such an environment is one way of making the space seem less austere and more comfortable without disrupting the integrity of the original design. For windowless offices, plants provide an attractive natural setting appreciated by the occupant.

For offices and other windowed areas, the...
plants provide a transition which makes indoors and outdoors seem to flow together. In all locations, however, the light intensity must be at the proper level before the plants are introduced. The intensity cannot be taken for granted, since artificial lighting designed for office vision is seldom enough for any but the lowest-light plant species. Even a large window will not provide enough light if it has an overhang or a northern exposure. If the light intensity cannot be directly measured or calculated from detailed ceiling plans, one must assume the worst and use only low-light material. There is sometimes a tendency to use plants to fill in otherwise forgotten spots, such as corners, stairwells, and hallways. Such areas are often poorly lit and no plant will survive there unless additional lighting is installed.

In large areas with barely enough light, the usual design problem is how to arrange the limited number of low-light species so that different areas stand out from one another. Design interest can be accomplished by using different types of foliage (for example, fragmented and solid) in the different areas, varying the plant sizes among the areas or using specimen plants selectively. Specimen plants usually have fuller foliage or an unusual stem structure and hence appear to be different from other plants of that species. The true specimen plants are more expensive than ordinary plants of the same species, but can solve many a design problem. However, a plant with fuller foliage than most will also require more light than most to maintain the foliage.

If the office has floor-to-ceiling walls, the best design procedure is to select specimens that act as living sculptures. Since these plants are used for visual emphasis, the plant height and container size should conform to the scale of the rest of the interior design. The plant texture and container finish should blend with each other and with the wall and floor treatments. The particular plant specimen chosen should have an inherently interesting shape and texture.

If the office area is very large or is designed along an "office landscaping" plan with movable partitions, the plants can become an integral part of the design. They can be used with the partitions as space dividers and are excellent for indicating the importance of the space. They also may be effective in relating widely separated areas with one another. They break the monotony of the partitions with both color and texture. They act as sound absorbers. Also, specimen plants can be used in the office landscaping scheme for visual emphasis.

**PLANTSCAPING**

**Plant Containers**

**Planting into individual planters** Individual decorative containers are used for individual plants or small plant groupings. The plants are left in their growing containers and placed directly into the decorative planter or on top of 4 to 6 inches of perlite as the drainage material. The decorative planter or container must be tall enough to accommodate the growing can and the perlite, and wide enough to accommodate the width of the growing can. The space between the growing can and the inner wall of the planter can be filled with additional perlite. (See Fig. 2 for size-selection guidelines.) As a decorative finishing, bark chips or sheet moss may be placed on the surface of the soil in the growing can. This decorative cover can be easily removed if the plant is replaced and it does not mix with the soil, as sometimes happens in large gardens.

Removing the plant from the growing can and repotting it directly into the planter is not generally recommended. Replacing the plant, if necessary, is a messy job unless drainage material and soil separator are added to the bottom of the container. Also, once removed from its growing container, the plant may take up to four weeks to adjust fully to its new environment.

**CONTAINERS**

**Decorative Containers: Different Types**

A plant container should be more than decorative. Its proper selection is the first element of proper maintenance, since the container must provide the plant roots with sufficient growing room and with adequate drainage.

All small to medium-size plants are received from the grower in growing containers, usually metal cans or rubber tubes. Large plants are either in large growing containers or their root balls are wrapped in burlap. As a rule, these growing care provide the proper volume of soil for the size of the plant and have a hole in the bottom for drainage. There is seldom any need to remove the plant from its growing container, especially since rough handling of the root system can shock the plant. Only the smaller plants, such as ivy, can be repotted without much disturbance of the root system. If it is absolutely necessary to repot a larger plant, it should be done carefully as outlined earlier, and it should be always into a larger volume of soil, never into a smaller one.

The decorative container should be chosen so that its inside dimensions are large enough that the plant-growing container can be dropped directly into it. In addition, it should be deep enough for the growing container to rest on at least 2 inches of perlite or other drainage material, and leave about 1 inch between the top of the growing can and the top of the decorative container. Some care must be taken in the choice since the interior dimensions of the decorative container are often not uniformly related to the exterior dimensions. For example, some fiberglass containers have a large lip which limits the size of the growing can that can be dropped directly into them. Also some containers have a large false bottom, which makes the interior depth much less than the outside height.

With these simple size-selection rules in mind, the proper decorative container can be selected using Fig. 6 as a guide. This figure lists the decorative pros and cons of the most common types of containers.

**Excess Water in Container**

Overwatering of plants is more harmful than underwatering. This problem is most likely to occur when the plants are in individual decorative containers that do not allow the excess water to flow off. To minimize this danger, we have recommended that a plant in a decorative container be double-potted. In the bottom of the decorative container below the plant growing can, there should be at least 2 inches of perlite or other drainage material to act as a reservoir for excess water. Nevertheless, if the plant is continually overwatered, this reservoir will fill up and lead to root rot because the roots are in a pool of water.

If the plant soil is continually wet to the touch, excess water may be the problem. The water level in the container may be determined by tapping the sides of the container. If the water level indicates excess water, the container is tilted on its side, the plant gently pulled from the container, and the excess water drained from the perlite. If the perlite is completely saturated or appears old, it must be discarded and replaced with new drainage material. If the plant has been sitting in a pool of water for some time, the root ball should be allowed to dry before repotting.

If a very large container or garden has been overwatered and there is no way to drain out the excess water, not really much can be done short of using a small electric pump. One must simply avoid watering the plant or garden at all until the soil has begun to dry out and feels dry to the touch.
<table>
<thead>
<tr>
<th>Design Type</th>
<th>Plant Name</th>
<th>Watering Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH-LIGHT PLANTS—150 FOOTCANDLES AND UP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>Fiddle-leaf fig (Ficus lyrata)</td>
<td>W</td>
</tr>
<tr>
<td>T</td>
<td>Indian laurel (Ficus retusa)</td>
<td>W</td>
</tr>
<tr>
<td>T</td>
<td>Rubber plant (Ficus elastica cv. 'Decora')</td>
<td>W</td>
</tr>
<tr>
<td>T</td>
<td>Weeping fig (Ficus benjamina)</td>
<td>W</td>
</tr>
<tr>
<td>T</td>
<td>Norfolk island pine (Araucaria heterophylla)</td>
<td>LP</td>
</tr>
<tr>
<td>T</td>
<td>Schefflera (Brassia actinophylla)</td>
<td>W</td>
</tr>
<tr>
<td>FP</td>
<td>Dwarf date palm (Phoenix Roebelenii)</td>
<td>MF</td>
</tr>
<tr>
<td>FP</td>
<td>Dwarf schefflera (Brassia arborescens)</td>
<td>W</td>
</tr>
<tr>
<td>FP</td>
<td>False aralia (Diospyros elegans)</td>
<td>W</td>
</tr>
<tr>
<td>FP</td>
<td>Lady palm (Raphis excelsa)</td>
<td>W</td>
</tr>
<tr>
<td>FP</td>
<td>Mock orange (Pittosporum Tobira)</td>
<td>W</td>
</tr>
<tr>
<td>FP</td>
<td>Ponytail (Beaucarnea recurvata)</td>
<td>LF</td>
</tr>
<tr>
<td>FP</td>
<td>Southern yew (Podocarpus macrophyllus var. Makl)</td>
<td>LF</td>
</tr>
<tr>
<td>DTP</td>
<td>Jade plant (Crassula argentea)</td>
<td>LF</td>
</tr>
<tr>
<td>DTP</td>
<td>Swedish ivy (Plectranthus australis)</td>
<td>MF</td>
</tr>
<tr>
<td>DTP</td>
<td>Wax plant (Hoya carnosa)</td>
<td>MF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Design Type</th>
<th>Plant Name</th>
<th>Watering Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDIUM-LIGHT PLANTS—100 TO 150 FOOTCANDLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>Indian laurel (Ficus retusa)</td>
<td>W</td>
</tr>
<tr>
<td>T</td>
<td>Schefflera (Brassia actinophylla)</td>
<td>W</td>
</tr>
<tr>
<td>T</td>
<td>Weeping fig (Ficus benjamina)</td>
<td>W</td>
</tr>
<tr>
<td>FP</td>
<td>Bamboo palm (Chamaedorea erumpens)</td>
<td>MF</td>
</tr>
<tr>
<td>FP</td>
<td>Corn plant (Dracaena fragrans cv. 'Massangeana')</td>
<td>W</td>
</tr>
<tr>
<td>FP</td>
<td>Dwarf date palm (Phoenix Roebelenii)</td>
<td>MF</td>
</tr>
<tr>
<td>FP</td>
<td>Dwarf dragon tree (Dracaena marginata)</td>
<td>W</td>
</tr>
<tr>
<td>FP</td>
<td>Dwarf schefflera (Brassia arborescens)</td>
<td>W</td>
</tr>
<tr>
<td>FP</td>
<td>Green dracaena (Dracaena deremensis cv. 'Janet Craig')</td>
<td>W</td>
</tr>
<tr>
<td>FP</td>
<td>Green pleomele (Dracaena reflexa)</td>
<td>W</td>
</tr>
<tr>
<td>FP</td>
<td>Kentia palm (Howea Forsteriana)</td>
<td>W</td>
</tr>
<tr>
<td>FP</td>
<td>Narrow-leaved pleomele (Dracaena angustifolia 'honorata')</td>
<td>W</td>
</tr>
<tr>
<td>FP</td>
<td>Neanthe bella palm (Chamaedorea elegans)</td>
<td>W</td>
</tr>
<tr>
<td>FP</td>
<td>Reed palm (Chamaedorea Seifrittai)</td>
<td>MF</td>
</tr>
<tr>
<td>FP</td>
<td>Self-heading philodendron (Philodendron Selloum)</td>
<td>MF</td>
</tr>
</tbody>
</table>

A Final Word about Lighting Intensity: The preceding lighting-intensity recommendations are based on experience and the assumption that these levels will be provided eight hours a day, five days a week, and that the plants have been fully acclimatized. If light can be provided for more hours each day or more days each week, the plant material will look its best for longer periods. On the other hand, the energy costs of the longer lighting exposure are more than the costs of plant replacement. However, if the plants are not to be maintained by the landscape contractor with a plant replacement guarantee, provision should be made for giving the plants light exposure seven days a week.

![Fig. 7](image_url)  
Growing requirements. Design type: T = tree; FP = floor plant; DTP = desk or table plant or ground cover. Watering requirements: W = water weekly; MF = water more frequently, as required; LF = water less frequently, as required.
Automatic Watering Devices

In areas where regular maintenance would be difficult, the use of automatic watering devices can be of considerable help. Even when they are used, however, the plant must be checked periodically to see that the device is working properly, that its water reservoir is full, and that no other maintenance problems have developed.

Automatic watering devices are either external to the container or are built into the planters. The external devices tend to work well only with small plants, and also, they are likely to detract from the design. For these reasons, the built-in type of device is preferred. The planters with this type come in both cylindrical and rectangular shapes and in several colors. The planter has a hollow space within its double-wall sides which serves to hold a three- to four-week water supply feeding the water to the plant soil by a wick mechanism, sensor, or capillary action. Most types have a float to indicate the amount of water remaining in the reservoir.

Since the soil must be in contact with the wick or capillary tubes for the device to work, the plant must be removed from its original growing can and repotted directly in the planter. As the soil never dries out, the plant must be watched for symptoms of over-watering. Because different plants use water at different rates under different humidity and temperature conditions, a timetable should be kept for each container so the maintenance staff will know when to refill each reservoir.

The use of automatic watering devices will not eliminate maintenance personnel, but it will reduce the number of workers needed. One person can handle many more plants, devoting more time to cleaning and trimming, since the reservoir has to be refilled only every month or so. Occasionally, however, one will find a client who will resist the use of the automatic devices because he or she likes the assurance of seeing a person with a watering can once a week.

The use of the automatic watering devices is expected to increase in the future as more architects and designers become aware of them and convince their clients of their usefulness, and as the manufacturers produce more colors and styles and improve the efficiency of the devices.

<table>
<thead>
<tr>
<th>Container Type</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiberglass</td>
<td>Large selection of sizes, shapes, and colors. Light weight, easy to move. Some types have casters. Reasonable prices. Many manufacturers.</td>
<td>Easily scratched. Some types have large lips.</td>
</tr>
<tr>
<td>Metal</td>
<td>Large selection of sizes and styles. Rich appearance. Polished or brushed finish.</td>
<td>Expensive.</td>
</tr>
<tr>
<td>Baskets, traditional</td>
<td>Good range of styles and textures. Combines well with all furniture styles. Reasonable prices.</td>
<td>Limited sizes. Tend to sag. Need saucers under plant can to prevent water spillage.</td>
</tr>
<tr>
<td>Baskets woven around metal</td>
<td>Good texture range. Reasonable prices. Do not sag. Need no saucers. Combine well with all furniture styles.</td>
<td>Sizes limited.</td>
</tr>
<tr>
<td>Hanging planters (Heavy; must be used with a rotating hook which can support the weight and allow for easy plant access.)</td>
<td>Available in ceramic, fiberglass, plastic, and metal. Ceramic in various shapes and textures. Metal in various finishes. Plastic and fiberglass are inexpensive. All are versatile.</td>
<td>Makes plants susceptible to drafts from heating and air conditioning. Difficult to water without spilling on floor. Metal very expensive. All need inner pot to allow for drainage. Ceramic is porous and presents condensation problem.</td>
</tr>
</tbody>
</table>

Fig. 6 Comparison of container types.
Specialties

PLANTSCAPING

Typical Plants

(False) Aralia
A plant of grace and elegance with narrow, ribbonlike, notched leaves of dark green, usually born on slender, single stems. The aralia is attractive if two or three plants are planted together in one pot. It grows very quickly so prune the stem tips from time to time to prevent the foliage from thinning at the bottom.

Temperature The aralia is tolerant of warm temperatures if there is plenty of humidity.

Light/sun The plant likes a semishady to semishady window; an east or west window is ideal.

Water/humidity Keep the soil damp but not soggy. The false aralia likes a humid atmosphere. Place your plant on a pebble tray and mist the foliage daily.

Soil The soil should be equal parts loam, sand, and peat moss.

Special care You can rejuvenate leggy plants by drastically cutting the stems back to four to six inches from the pot. Do this in the spring and leave the plant in a sheltered location, being sure to fertilize and water frequently.

African Violet
The African violet, a longtime favorite houseplant, does insist on more care and attention, but its beautiful blossoms make the effort worthwhile.

Temperature African violets are more contented and grow best within a temperature range of 65 to 80 degrees. Be careful that your plants are not in an open window or a draft.

Light/sun The African violet enjoys a place in an east or west window. Direct sun is too strong, unless filtered through a curtain. Excess sun will cause spotting and loss of color; too little light causes elongated stems and no blooms.

Water/humidity African violets should be watered from the saucer underneath in the morning with lukewarm water. Water when the soil begins to dry out. Do not keep it soggy. If the air is dry in your home, place the potted plant in a tray of moistened pebbles.

Soil The soil should be porous for good drainage and should contain ample organic matter such as compost or peat moss. Commercial African violet soil mixture is specially prepared for these plants; however, add sand or perlite to ensure adequate drainage. A plastic pot is less likely to cause the lower leaves to rot where they touch the pot.

Asparagus Fern - Emerald Feather
The bright feathery green of this delightful plant is best displayed in a hanging container. The long branches drape gracefully and are studded with tiny white flowers that ripen into red-orange berries.

Temperature Asparagus fern is not fussy about temperatures, but prefers a range of 60 to 68 degrees.

Light/sun The bright filtered sun of an east or west window is a good location for this plant.

Water/humidity Soak the soil in the pot thoroughly and allow it to become dry to the touch before rewatering.

Soil A well-drained potting soil or a mixture of equal parts of loam, peat moss, and sand or perlite.

How to start new plants Allow the berries to ripen and when dry sow the seeds they contain. Asparagus fern can usually be grown from seed quite well.
Avocado
The avocado comes easily from seed and is grown for its ornamental foliage. It makes a nice tree for your indoor garden. Allow the plant to reach the desired height and then begin regular pinching to force branching and encourage bushy growth.

Temperature Temperatures between 60 and 70 degrees suit the avocado well.

Light/sun Keep your avocado in bright light but protected from direct sun. Avocados are easily sunburned, especially when they are first moved outside.

Boston Fern
Exaltant is a good adjective for this family of ferns that can fill a corner with rich green foliage. These ferns are excellent for hanging baskets. Initially the fern may need a lot of attention until the right combination of environmental factors is achieved, but the effort is well worth it. The leaflets grow on a midrib that is covered with fine brown hairs and vary from smooth-edged to feathery and even ruffled. A mature fern can have fronds ranging in length from two to three feet and two to three inches across.

Temperature With lots and lots of humidity ferns will do well in house temperatures in the 60 to 70 degree range.

Light/sun Ferns need a location with good bright light, but this means filtered sunlight. Avoid direct sunlight.

Water/humidity It is essential that the roots of the ferns never dry out at any time. Soak the soil regularly. Clay pots and hanging baskets can be soaked in a bucket or the sink for half an hour and then drained. The soil should be checked daily to make sure that it is not drying out. Humidity is the most important ingredient to successful fern growing. Place pots of ferns on a pebble tray. Mist foliage daily with room temperature water.

Soil Ferns need a soil that is loose and easily penetrated by their dense root system. The soil mixture should be rich in peat moss and organic matter with a liberal amount of sand for drainage. A sprinkling of charcoal mixed in the soil helps to keep the soil from becoming sour from the frequent waterings. When potting ferns, place a layer of bits of broken pots or gravel in the bottom of the pot. Ferns do not take kindly to having their roots tampered with, so be careful not to damage them when repotting.

Chinese Evergreen
This beautiful foliage plant has waxy dark green leaves. The leaves grow on a canadile stem and are oblong, tapering to a thin tip. Some of the varieties are variegated with splashes of creamy white or yellow. Under optimal conditions, it will produce a flower spike surrounded by a white spathe. The flower is similar to a calla lily. The great thing about this plant is that it will adapt to a variety of environments which makes it a good plant for a beginner or a difficult location.

Temperature A range of 60 to 70 degrees suits this plant well.

Light/sun A shady spot, an artificial light, or any other location will suit this plant. The Chinese evergreen is an excellent plant for a north window.

Water/humidity Keep the soil moist but not soggy. To avoid waterlogged soil, allow the surface soil to become dry to the touch before watering. The Chinese evergreen can be grown in water. The roots are attractive so a clear glass container shows them off to best advantage. It is important to wash the leaves regularly to keep them dust free.

Soil The soil should be equal parts of garden loam, peat moss, and sand.
Specialties

PLANTSCAPING

Typical Plants

Dracaenas

There are several varieties of dracaenas which vary in foliage color, variegation, and size. Here are three that are commonly available.

Dracaena deremensis "Warneckei": is a good choice for a location without much light. The gray green foliage is striped with white and gray.

Dracaena marginata: has clusters of narrow deep green leaves edged with red and gray stems strongly marked with leaf scars. This variety will reach a height of five or six feet.

Dracaena sanderiana: resembles a corn plant in the brightness of the green and the size and shape of the leaves with the difference that the leaves are striped with white.

Temperature: Moderate household temperatures in the 60 to 70 degree range suit these plants best. It is important to keep plants away from heating vents.

Light/sun: The marginata and sanderiana should get only filtered sun or bright light. The Warneckei will fare well in a spot with very little light; it will flourish when more light is available.

Water/humidity: These plants all like soil that is kept evenly moist but not soggy. Soak the soil in the pot thoroughly and then rewater when the soil surface feels dry to the touch. Humidity is a must. Brown crispy leaf tips and margins mean too little moisture in the air. It is a good idea to place the dracaenas in pebble trays and mist the foliage daily.

Soil: Commercial potting soil is adequate but added drainage material such as sand or perlite is advisable.

Dumb Cane

The cool-looking foliage of this plant is yellow-green, mottled with white. The leaves are pointed oval that become quite large as the plant matures. The dieffenbachia is known as the "mother-in-law" plant or the dumb cane because when a piece of the stem is placed on the tongue it causes temporary numbness and loss of speech. All joking aside, this plant is poisonous.

Temperature: The dieffenbachia prefers warm temperatures and will tolerate hot dry places with added humidity.

Light/sun: This plant does well in an east or west window where it can bask in the sun for a few hours.

Water/humidity: The soil should be allowed to dry out for a few days before rewatering. The plants indicate a need for water when the leaves show signs of dropping. Regular misting keeps the foliage dust-free and luxuriant.

Soil: A porous soil of equal parts loam, peat moss, and sand is fine.

Gardenia

The gardenia is a handsome foliage plant with intensely fragrant blooms, but it has an extremely temperamental nature. It is a challenging plant to grow successfully indoors. The most frequently available varieties are Gardenia radicans florapla, a low spreading plant with small double flowers, and Gardenia florida, which blooms in summer.

Temperature: The temperature must be kept above 65 degrees to maintain healthy foliage and flower buds. These plants hate drafts. Loss of flower buds is often due to sudden changes in temperature.

Light/sun: The gardenia needs lots of light, but avoid strong sun that might burn the leaves.

Water/humidity: The soil must be kept constantly moist without becoming soggy. Submerge the pot in a bucket of lukewarm water and allow it to soak for half an hour or until the soil is moist on the surface. Do not allow the pot to sit in water as that will cause the roots to rot. Gardenias need very high humidity at all times. Place the pot in a tray of moistened pebbles. Mist the foliage daily with tepid water. Leaf or bud drops indicate the air is too dry.

Soil: Potting soil should be a mixture of equal parts peat moss, loam and well-decayed manure with sand or perlite added for drainage.
Grape Ivy
Grape ivy is a climber or trailer. The olive-colored green leaves look a bit like those of holly without the stiffness or the sharp tips. The leaves form attractive groups of three and are accompanied by furry tendrils.

Temperature The plant is fairly tolerant of a wide temperature range. Increase the amount of humidity as the temperature goes up.

Light/sun Grape ivy will do all right in low light and is often used in low-light areas. But it flourishes with bright light or filtered sunlight.

Water/humidity Soak the pot and soil thoroughly and then allow the soil to become dry to the touch before rewetting. Mist frequently and wash the foliage regularly to remove dust and restore the luster of the leaves.

Soil A potting soil that is rich in organic matter is the best. Be sure to add plenty of drainage material to the soil mixture.

Jade Plant
The jade plant is a tough plant well-suited to the hot dry conditions so prevalent in office and apartment buildings. The rounded leaves are in pairs on the branched tree-like stem. A plant that is six to eight years old will produce clusters of lacy-looking star-shaped flowers.

Temperature Temperatures ranging from 65 to 75 degrees are fine. Lower and higher temperature will be tolerated.

Light/sun The jade plant will require full sunlight with shade at midday if possible. A west or south window would be good locations. If you put the plant outside in the summer, place it in a lightly shaded spot.

Water/humidity The soil should remain dry for several days between waterings. The fleshy leaves soak up the soil water and store it for future use. Too much water will cause stem and root rot and certain death.

Soil The jade plant will do well in rich garden soil that has coarse sand or fine bits of broken pots added to it for drainage. Each year give the pot a top dressing of humus. A new pot will be necessary only after about three or four years.

Norfolk Island Pine
The delightful symmetry of this evergreen makes it a desirable house plant. The branches grow in tiers of six, each tier representing a year's growth. The bright green needles are soft and pleasant to touch.

Temperature The ideal temperature is between 50 and 60 degrees. High temperatures are tolerated when sufficient humidity is available.

Light/sun The filtered sun of an east or west window is best. Yellowing of the needles might mean too much sun.

Water/humidity Provide the plant with a well-drained soil and pot. Water thoroughly and allow the soil surface to become dry before rewetting. Daily misting is necessary for the warmer temperatures of most houses and offices. A pebble tray will help to add more moisture to the air around the plant.

Soil Garden loam mixed with equal parts of sand and peat moss makes a suitable potting mixture. Repot the Norfolk Island pine only when it has become pot-bound (the pot is crammed with roots). This would be about every two or three years.
Specialties

PLANTS CAPING

Typical Plants

Parlor Palm

The palm trees are not the easiest plants to grow. However, once you have discovered their basic needs they are a delightful addition to your indoor garden. This palm grows to about four feet tall. It is most attractive when two or three plants are grouped together in a pot. The long feathery fronds grow out of a single stem. Other varieties to try are C. selfridii, C. orinamensis, and C. costaricana.

Temperature
The best growing temperatures for palms range between 60 and 75 degrees.

Light/sun
Palms are good plants for locations without much light. They do not like direct sunlight.

Water/humidity
During the active growing season, between March and October, the palm needs moist soil but it will not tolerate soggy soil. In the winter months, allow the soil to dry on the surface before rewatering. If the foliage shows signs of browning and drying on the tips, it needs more humidity. Misting regularly is recommended to keep the foliage healthy.

Soil
The palm needs well-drained soil of equal parts rich garden loam, peat moss, and sand. It will need repotting only every two or three years. It prefers being a bit potbound.

Philodendron

By nature, the philodendron is a climbing plant, but it also trails. It looks best on a bracket beside the window frame, and for good effect must be kept strongly pinched back so that the plant is full of bushy young growth and does not deteriorate into two or three stringlike stems.

Temperature
Normal house or office temperatures are fine.

Light/sun
The philodendron is quite hardy and robust and will grow almost anywhere. However, it will fare better in a well-lighted area.

Water/humidity
The plant should be kept evenly moist and never allowed to dry out. Be certain water does not remain in the saucer after watering. The foliage should be misted daily and the leaves cleaned of accumulated dust.

Soil
Potting soil mixed with perlite, vermiculite, or sand and peat moss is recommended.

Windowleaf Philodendron

This philodendron has large heart-shaped leaves that are slashed irregularly. It is an enthusiastic climber and needs a piece of bark or totem for support. The aerial roots can be inserted in the soil or encouraged to attach to the totem. Keep the growing tips pinched back so that the plant doesn't get leggy.

Temperature
The windowleaf prefers temperatures between 65 and 70 degrees.

Light/sun
Bright light is best for this plant. However, avoid putting the plant in a location where the plant would get direct sun.

Water/humidity
Soak the plant thoroughly and allow the soil surface to remain dry for a day or two before rewatering. Mist the foliage daily and wash the leaves weekly to remove dust.

Soil
A soil mixture of equal parts garden loam, peat moss, and sand is fine.
**Purple Passion Plant — Velvet Plant**

The strikingly rich royal purple coloring and velvety texture of the foliage and stems attract many growers. The green leaves and stems are covered with tiny purple hairs. The straggly growth habit is best kept in check by frequent pruning.

**Temperature** The purple passion plant likes temperatures in the 65 to 70 degree range.

**Light/sun** Direct or partial sun will promote the color.

**Water/humidity** It is important that the velvety plant not dry out. Keep the soil evenly moist at all times. A humid atmosphere is important to keep the brilliant color. Mist the foliage frequently and place the pot in a tray of moistened pebbles to raise the humidity.

**Soil** Use potting soil of equal parts garden loam, peat moss, and sand. This plant will also grow in water.

---

**Rubber Tree Plant**

This house plant with dark green glossy leaves can grow to be four feet high with a little care and not too much water.

**Temperature** Due to its hardy nature, the plant does well in any normal household temperature.

**Light/sun** The plant will do well in almost any light, but a well-lighted area is best for the rich green foliage characteristic of the rubber tree plant.

**Water/humidity** Water only when the soil is completely dry all through the pot. You should set the entire pot in a bucket when watering, so that moisture can penetrate the deepest roots. Clean the leaves every two weeks or so with a damp cloth. Do not artificially shine the leaves as this clogs the plant's pores and does not allow it to breathe.

**Soil** Soil should be a well-drained mixture of equal parts of sand, peat moss, and garden loam. If pot is plastic or rubber be sure to provide plenty of drainage material in the bottom of the pot.

---

**Wandering Jew**

This is a particularly attractive hanging plant. It is hardy and easy to grow with only one special requirement, which is regular pinching to keep it full and bushy. There are several plants called Wandering Jew, distinguished from each other by their different colorings and markings. The illustration is a *Zebrina pandula*. The leaf is a pointed oval with a deep purple underside, and the upperside is dark green striped with pale silvery-green. *Tradescantia fluminensis* has small oval green leaves marked with white, silver and white, or yellow.

**Temperature** These plants prefer warm temperatures.

**Light/sun** Bright indirect sunlight keeps the foliage brilliant. Avoid direct sunlight as they are susceptible to sunburn.

**Water/humidity** Water generously, keeping the soil moist at all times. During the winter months it will not need quite as much water.

**Soil** This plant grows in a well-drained potting soil or water.
Schefflera – Umbrella Tree
If you are looking for a tree for your indoor garden, a schefflera is a good choice. It has handsome deep green leaves that radiate out from a long slender stalk rather like the ribs of an umbrella.

Temperature The umbrella tree does well in a room where the temperature ranges from 55 to 75 degrees.

Light/sun The schefflera does not like direct sunlight. It grows best in good light from a shaded window.

Water/humidity When watering your schefflera, soak the pot thoroughly and then allow the soil to dry before rewatering. The plant likes a humid atmosphere and responds well to daily misting with warm water. This is essential if the plant is in a room with forced hot air heat. This plant needs a pebble tray.

Soil The soil mixture for the umbrella tree should be equal parts of peat moss, garden soil, and sand. The pot should have a layer of gravel or bits of broken pots underneath the soil to ensure good drainage.

Snake Plant
Seen in many homes and offices, this spikey, banded plant will take almost any abuse.

Temperature Normal household temperatures are best, but do not allow the plant to become suddenly chilled!

Light/sun The snake plant is a good low light plant but needs sun in order to bloom.

Water The plant likes the dryness of the home and should never be overwatered. The leaves should be cleaned with clear water every two weeks.

Soil Garden loam, peat moss, and sand mixed together provides the best soil for the snake plant.

Spider Plant
With its green and white foliage, the spider plant makes one of the best hanging plants. The graceful trailing runners have plantlets and white star-shaped flowers. There are all-green varieties but the more commonly seen one has a green leaf striped with white.

Temperature The plant lives best in a warm location.

Light/sun This lovely plant does very well hanging in indirect sun or a moderately lighted area.

Water/humidity The spider plant should be allowed to dry out before rewatering. Drying leaf tips usually indicates lack of humidity. To tidy up the plant just snip these off.

Soil The plant grows contentedly in a rich soil composed of garden loam, sand, and peat moss.
Zebra Plant
The zebra plant is one of the showiest house plants one can grow. Its spike of waxy yellow flowers and deep shiny green leaves veined in white makes it a striking specimen.

Temperature  The zebra plant needs warm temperatures free from drafts.

Light/Sun  The plant wants bright light but not direct sunlight.

Water/Humidity  It is important never to allow the soil to dry out. Set the pot in a pebble tray and mist the foliage daily.

Soil  The zebra plant likes loose soil consisting of one part garden loam, one part sand or perlite, and two parts peat moss.

Typical Planting Detail

SOIL LEVEL

NURSERY CONTAINER (MAJOR PLANT)

PLANTING MEDIUM (SEE SPECS)

9" CRUSHED STONE

DRAINAGE LAYER

MINOR PLANT

CONTRACTOR SHALL CUT VERTICAL SLOTS IN CONTAINER PRIOR TO PLANTING

DECORATIVE PLANTER, FIBERGLASS OR CUSTOM WOOD, SEE PLANS

SOIL SEPARATOR

TYPICAL PLANTING DETAIL
Specialties

PLANTSCAPING

Planting Standards and Details
PLANTSCAPING

Plant Containers

By crushed stone

Zamiaculcas planted in fiberglass containers

Mosses covering all exposed soil and voids

Premix-B planting media

Root ball

Soil separator

Planting detail in "false" planter
Specialties
PLANTSCAPING

PLANTER

SECTION •/ PLANTER.

© WINDOW PAVING & RICK V LARGE

STONE AT BOTTOM WITH 1/3 TOPSOIL AND 1/3 REDWOOD OR CEDAR CHIPS AT TOP

WHITE GALVANIZED STEEL PAN PAINTED WITH ASPHALT ER WATERPROOFING PAINT

1" STEEL PIPE ASPHALT-COATED CONNECTED TO A DRY WELL ON EXTERIOR

FLOOR LEVEL PLANT WITH FLOOR & FINISH EXTERIOR GRADE

Fig. 8 Detail 1: In this window planter, the plants are placed directly in the earth or growing medium filling the planter and continue to grow and blossom there. The entire planter is contained within a galvanized steel pan with drain. The 6-in-high perforated pipe allows for drainage of excess water over a long period of time before the entire planter has to be cleaned out and started anew. Detail 2: This is a simple floor-level planter where the drainage can easily be connected to the building's drainage system. Here also, plants are installed and grow naturally until a complete planting change is required. Detail 3: A room divider planter for the Ackermann residence, Southampton, New York, consists of a planter-bookcase combination. Here the plants remain in their clay pots and are inserted in the planter with or without gravel or some other type of filler. The entire planter is pitched toward one end, where the drain empties into a small container which catches any extra water.
Specialties

PLANTSCAPING

Plants

Section of window planter in a south wall

Planter for a warm climate

Planter for a restaurant or store

Floor planter

Fig. 9 Detail 1: The plants remain in their own clay pots. The use of pea gravel at top and only 4 in of 1/4-in gravel at bottom permits easy changes of the plants. To take care of watering and drainage, the copper pan is simply sloped to one side and two screened drains are connected, trapped, and joined to a waste line. This takes care of any excess water, as it is eliminated by gravity drainage. Detail 2: This planter is for areas where freezing does not occur, and the drainage of excess water can be taken care of by simply extending small pipes directly to the exterior. Detail 3: In this planter the plants remain within the planter and excess water is carried off by a screened pipe at the bottom. Pea gravel is used as a 1-in topping so that odds and ends dropped into the planter can easily be removed. Detail 4: A planter in a commercial lobby or entrance is shown in this detail. The plants are permanently installed and the tall drainage pipe takes care of any top applied water. The white sand at the top is to bring contrast to the colors of the plants.
Specialties
PLANTSCAPING
benches

FRONT ELEVATION

SECTION

- 2' x 1' members (cullpeper nuxvum)
- 2' x 2' x 6' wood metal screws for 3/4" hole (all screws banded in members) (in 5/8" x 5/8" steel straps)
- Steel strap 9/16" x 9/16" pedestal 9/16" x 9/16" center of bench and 2' from each end
- 9/16" x 9/16" steel tube
- 4' x 1/2" x 1/8" steel plate
- Expansion shields & bolts into existing concrete
Specialties

PLANTSCAPING
Bench

---

Diagram:

**Front Elevation**

- 2½ x 1¼" members (pilipped mahogany)
- Internal ½" & galvanized steel rod w/plugged ends

**Section**

- (9) 9/16" internal galvanized rods
- Slotted recessed spacer (3/4" recess)
- Ends plugged (1/2" typ)
- 9/16" 5" x 1/8" steel plate
- 1/2" eye bolt, nuts & washer
- 4" x 1/2" J-14 pan/Phillips head wood screw
- 2" x 4" x 1/4" steel tube
- 2½" x 3/8" x 1/2" steel plate
- Expansion shields & bolts into existing concrete
SIGNAGE SYSTEM DESIGN CRITERIA

Initial consideration should be directed toward determining the basic parameters required in developing the sign system. Each of these merits discussion here.

Performance Requirements

Signs usually must be designed to meet specific performance requirements. The good designer will determine how a system is to perform within given space relationships. The sign system may function entirely on its own merit, or it may be supplemented by staff personnel at major decision-making locations, such as the main lobby and reception areas. Sign devices may become decorative amenities to be featured within the environment, or they may be subtle and low-key elements of minor importance. Supergraphics may be considered in certain areas simply as an art form, or as a functional graphic device presented in large scale for emphasis of context. Certainly, a combination of the two is feasible. These are only several performance considerations that should be addressed prior to the development of the signage system. The designer must evaluate the needs of the client, the unique traffic flow requirements and mounting restrictions dictated by the structure, and the basic performance requirements desired of the signing devices to be utilized.

Usage Considerations

The general nature of the building complex often defines how signs are to be used. They may be given an appearance of being fixed and an integral part of the architecture by the appropriate selection of materials, colors, and mountings, or they may appear changeable and temporary should need so dictate. Some signage requires constant change to properly relate information to people or to people to facility, while most sign devices are considered permanent fixtures within a given space. The designer is responsible for determining how signs are to be used most effectively, and at the same time, for enhancing the environment.

Durability Requirements

Prior to the selection of materials for a signing system, durability requirements must be considered. The vast assortment of materials available for signs covers a wide spectrum of durability from soft plastics to metals. The sign copy and background material should be evaluated both individually and jointly when considering durability requirements.

Vandalism Considerations

Signs located in controlled spaces are often free from destructive vandalism; however, in many instances vandalism becomes rampant and uncontrolled. There are no materials that may accurately be labeled "vandal-proof." However, some materials are more vandal-resistant than others. Where vandalism is of prime importance, only materials and graphic techniques engineered to resist destruction should be considered.

Flexibility to Accommodate Changes and Additions

Modern architectural structures are designed to accommodate inner spatial changes to meet tenant needs. Partition systems, prehanging door units, room dividers, and modular furniture have ensured ease of change in office spaces. The sign system may also require alterations to preserve continuity. Changes and additions to a sign system should be considered by the designer prior to the selection of materials, graphic techniques, and mounting methods to be used.

Readability Factors

Sign readability is determined by the letter style selected, size of copy, interletter spacing, copy position relevant to background, colors, and angle of observance.

Letter style Letter styles are classified as sans serif and serif. Serifs letters, such as Helvetica, are more contemporary than serif letters, such as Clarendon (Fig. 1). Each letter style has its own unique personality and flavor. Printers carry alphabets in most letter styles, including lowercase letters as well as uppercase (Fig. 2). Test results indicate that messages starting with an initial uppercase letter and followed by lowercase characters are more recognizable than messages formed with uppercase characters only. Lowercase letters have more "personality" because their shape is varied by ascenders and descenders, resulting in characteristic word forms that are much easier to recognize than all-uppercase word forms. Also, people are more accustomed to reading text in upper- and lowercase than in all uppercase. The proper selection of a particular alphabet should be carefully considered, not only from a legibility point of view but also from a "personality" standpoint. The letter style should make some contribution to meaningful impression in the environment it serves.

Readability Readability is directly related to the size of copy. Visibility studies indicate that 1-inch-high Helvetica Medium, for example, is readable from a distance of 40 feet. Using this as a measure for comparison, 1-inch-high Clarendon style would be readable from a somewhat lesser distance, approximately 25 feet. The distance visibility per 1-inch height may be used as a guideline to determine distance readability for larger letters; that is, 2-inch-high Helvetica Medium will be readable at 80 feet, and 3-inch-high at 120 feet. This direct proportion may be helpful for determining copy (text) sizes for signs used in pedestrian situations. However, the direct proportion may not hold true for vehicular traffic applications where many other factors are involved. The designer must exercise caution after selecting the alphabet and copy size to make certain the lettering will fit properly on the sign background. The sign size should be determined using the longest line of copy and the maximum number of copy lines that may be required.

Letters and line spacing Interletter spacing and interline spacing of copy greatly affect the overall readability of a sign. Message legibility and ease of recognition are increased when proper visual relationships are established between individual characters, words, and lines of copy. Copy with spacing too tight becomes very difficult to read; copy with too open spacing tends to break the message down into fragments (Fig. 3). Proper spacing depends largely on the distance from which the message is to be read. Messages to be read at close distances should employ tighter spacing than messages that will be read at greater distances. Spacing is also affected by the angle at which the message is to be viewed: Greater angles of observance require wider interletter spacing to prevent the characters of the message from appearing to run together.

Copy position The position of copy on the sign background influences the overall readability. Signs on which copy occupies most of the background are not as readable as signs that have sufficient background material surrounding the copy to form a visual barrier separating the message from the environment (Fig. 4 and 5). Emphasis should be placed on selecting an appropriate sign size to best accommodate the sign message. There are nine basic copy placement positions to be considered in determining the important relationship of copy to sign background. They are: upper left, upper centered, upper right, centered left, centered, centered right, lower left, lower centered, and lower right. Traditionally, the most popular placement selections have been the centered and upper left positions.

Color Color of copy and sign background greatly affect readability. Strong contrasting colors are more readable than less dramatic color combinations. White copy on a black background offers the greatest contrast and readability. Color also influences the apparent relationship between the copy size and the background. For example, white copy on a black field appears larger than black copy on a white field, although letter height, size, and copy position remain the same in both examples (Fig. 6). Colors in a signage system should also relate harmoniously with the palette of colors selected for the building and its environment. The designer may choose to select colors that blend with the environment or vibrant primary colors that accent the sign system and perhaps contrast with the architectural color scheme.
The viewing angle The angle of observance is influential in the design of a signage system, since it affects interletter spacing and overall readability. Normally, interior signs are viewed chiefly from a straight-on position; however, exterior signs are frequently seen from more than one angle. Signs to be read from vehicles moving at varying speeds with different angles of observance may require a compromise in letter spacing to best communicate the message.

Multilingual Needs

The jet age is a contributing factor in bringing people together from all over the world to visit and transact business. Transportation terminals and public facilities that may be used by visitors unaccustomed to reading English should employ sign systems that bridge any visual communication gap. Multilingual messages in English and the dominant foreign languages used by visitors may be combined and presented on one sign background. However, sign design and graphic formats become very critical to prevent confusion. A more popular solution involves the use of pictorial symbols as word substitutes. Pictographic signs are bold, recognizable images not bound by language barriers.

Regulatory Considerations

The designer should become aware of regulations governing signs. Federal regulations concerning safety signs are enumerated in Occupational Safety and Health Administration (OSHA) publications. American National Standards Institute (ANSI) publishes standards concerning signage for the physically handicapped. Underwriters' Laboratory (UL) issues standards applicable to illuminated signs. State and local codes contain regulatory information concerning sign sizes, mounting locations and height, quantities of signs allowable in various zoning areas, and other restrictions relating to exterior signs. These rules, and those of other regulatory bodies, should be under advisement prior to completing a comprehensive signage program.

Need for Illumination

Many signs are required to relate their messages after dark as well as during natural daylight. The careful designer will determine which signs require artificial illumination and decide on the method of illumination. Signs can be externally illuminated by readily available stock fixtures produced by many manufacturers, or they can be internally illuminated. Fluorescent lighting is the most common source of internal illumination, although metal arc lamps, incandescent lamps, and neon are frequently employed.

Need for a Graphics Manual

Many signage programs are developed for institutions that have a continuing need not only to maintain, but also to augment or change, their signage systems. The preparation of a signage manual containing all the information required to create additional signs or components would benefit the client and ensure continuity in the system as changes and additions are made. The designer should determine this potential need and include the manual with other documents developed for the signage program.

SIGN TYPES CATEGORIZED BY FUNCTION

Signage systems should be logically broken down into various types of signs to be utilized on a particular project. Many categories of sign types may be developed, but one of the most conclusive listings is based on function. The following discussion of signage system components, including sign requirements for specific applications, covers these functions.

Exterior Signs

Exterior sign systems are normally viewed from vehicles or by pedestrians who have parked their vehicles and are walking toward their destination.

Primary Identification

All architectural projects require some form of identification that is both easily readable and recognizable. A person's first association with a building is the identifying device selected to "label" the structure. The importance of the first impression created by this device should be recognized. A sign that produces an image in keeping with the environment it serves reflects the quality of the people associated with that environment. Major corporations spend large sums of money on corporate identity programs to ensure the visual image presented to the public best reflects corporate philosophy and product desirability. Equal emphasis should be placed upon the image presented by the device employed to identify an architectural structure.

Secondary Identification

Many complexes containing more than one basic structure require secondary identification signs to properly identify the various elements within the complex. A systems approach to design will provide continuity in the relationship of primary to secondary identification signs.

Vehicular advance notice

A system of road signs suitably located in advance of decision-making points will allow vehicular traffic to execute the proper decisions smoothly and safely at the appropriate times.

Vehicular directional

Intersections and parking facility entrances are major decision-making locations requiring directional devices to guide drivers toward their destination.

Traffic regulatory and control

Vehicular traffic can be systematically controlled by employing signing devices. Traffic codes are usually clear as to what signs are required, where they are to be located, and the height at which they are to be mounted. Usually, colors, sizes, and shapes are standardized by the traffic authorities. Stop, yield, and speed limit signs are representative of this classification of signs.

Instructional

Frequently, signs are required to instruct vehicular and pedestrian traffic. These notices must be properly installed in carefully selected locations to be effective. Examples include parking procedures, delivery and service directions, and the like.

Informational

Signs are required to present information that is both relevant to the location and important to the viewer. This information may pertain to parking rates, hours of operation, and security, or it may relate to items of interest within the environment.

Decorative

Decorative graphics may be employed to enhance the beauty or decor of a particular area; form, color, and design may be utilized to create interest and to become features of the exterior landscape.
interior Signs

Interior sign system components should assist visitors to travel from the building entrances throughout the complex until they reach their desired destination.

Identification

Multiple-occupancy buildings require tenant identification; frequently, busy pedestrian traffic should have direction-identification in the main lobby or reception areas to reinforce the corporate signature. Criteria for multiple-tenant signage are very important and should be included in lease documents to provide for visual continuity and architectural harmony. When individuals are allowed to implement their own desires concerning signage, each will attempt to oust the other, resulting in clutter confusion, and visual pollution. Signs that are both too gaudy, too repressive, and poorly conceived and executed will become commonplace unless controls on tenant identification are established and enforced.

Primary directory

Information relevant to one's location within a complex should be clearly identified on the primary directory, usually located in a very visible area of the main lobby. Alphabetized listings of tenants, departments, and individuals should be concise and should designate the floor and room numbers. Such directories may be flush or recessed wall mounts, horizontal projected wall mounts, or pedestal or kiosk mounts, and information will be permanent or not, depending upon the ambient lighting conditions.

Elevator lobby floor directory

High-rise structures require well-positioned signage that not only identifies each individual floor but also serves as a secondary directory system for that floor. Frequently, the floor identification, directory, and corridor directional signage may be included in one device. When a visitor exits from an elevator on a chosen floor or directories showing the floor number and also the direction of the office or room number sought is both helpful and reassuring.

Pictorial "you are here" indicators

Pictorial schematic maps may become an integral part of directory systems, or they may be utilized separately as visual aids in depicting one's intended passage through a complex. Hospitals, sports complexes, and transportation centers, are good examples of structure that may require pictorial maps to supplement word messages. Caution will be exercised by the expert designer to keep the pictorial map simple and correctly oriented in the building according to where the viewer is standing, and to evaluate the need of color coding as part of the visual aid. Too frequently, designers employ a complicated color-coded system that becomes very confusing to the viewer and, in fact, compromises the effectiveness of the system.

Primary directional

The maze that often results from interior corridor layouts creates many decision-making points for a visitor. Primary directional signs may be ceiling-mounted, wall-mounted, or floor-mounted as kiosk-type units in open areas. Areas with heavy pedestrian traffic should have directional signs located so that people do not obstruct the line of sight to the sign device. Normally, ceiling-suspended or kiosk-type units are the best choice to enhance visibility.

Secondary directional

Directional signs should be considered in locations where traffic flow and corridor layouts do not demand primary directional devices but do require some guidance for direction control. Corridors within suites of offices and corridors that change direction should be considered as decision-making points that may require a secondary directional signage device.

Area Identification

Specific areas within a complex should be properly identified. These areas may be tenant spaces, divisions, or departments. When occurring along main corridors, they are usually designated by wall, door, or transom-mounted devices. Ceiling-suspended signs are a good solution in open spaces.

Room Identification

Wall- or door-mounted room identification signs are required to "label" the function of a particular room. Work functions are properly identified within tenant areas, while service and maintenance functions should be suitably designated in most situations.

Desk Identification

Reception areas may require a sign device located on a desk or counter to identify a particular service or individual rendering assistance to visitors. Such signs may be permanently affixed or removable, and may provide for changeable name inserts.

Personnel Identification

Persons rendering a service to the public, such as nurses, maintenance personnel, and food service personnel, generally are identified by name badges or pins.

Regulatory and control signs

Signs that authorize or prohibit certain actions are required, frequently by law or code, to inform people using the facility. Examples include signs for the handicapped and signs relevant to no smoking areas, elevator capacities, "no entry" areas, fire control, and "authorized personnel only" areas. These signs are usually mounted on doors or their adjacent walls; they may employ colors which deviate from the standard colors used in the comprehensive signage system to emphasize a dangerous situation or the need for caution.

Exits

Exit signs are required by codes to designate exits effectively in times of emergency. Supplemental devices are used to give additional information pertaining to a particular exit such as "Emergency Exit Only" and "Alarm Sounds When Door Is Opened." OSHA-approved exit signs are standard items manufactured by many lighting and electrical companies and are generally provided by the electrical contractor.

Information exhibit cases

Notices, posters, attractions, and promotional pieces should be contained within an appropriately designed case to control the display of this type of information. Standard units featuring vinyl-covered cork panels housed within extruded aluminum frames with lockable doors are available from many directory manufacturers.

Decorative features

Decorative designs may be reproduced on walls as interior features. Reproduction processes include appliqués, painting, and screen printing on location; or industrial processes, which are applied much like wall-coverings, may be considered. Doors may also receive supergraphic treatments in which copy may become an integral part of the design.

Dedicated plaques

Building dedication plaques should be carefully conceived and implemented, using materials that reflect favorably upon the talents involved in the realization of the project. Historically, these plaques have been bronze or aluminum castings. However, modern technology has provided photographic methods and photochemical processes which offer the designer a freedom of size, format, letterform, and color not available in the casting operation.

Donor recognition

Buildings constructed in part by contributions from donors require special recognition for both "thank you" and performing arts centers, and service institutions rely on gifts to assist in financing buildings, additions, and furnishings, and usually stipulate that donors will be remembered and recognized in some prestigious location in the building. The designer is responsible for establishing controls and developing a system that fulfills promises made by those soliciting funds, while allowing flexibility to expand the system as future needs may dictate. Location selection is very important in the overall effectiveness of the donor recognition signage.

Mechanical, Instrumentation, and Control system markings

Many industrial and mechanical installations require equipment, control, and pipe markings to meet codes, assist maintenance and service personnel, and ensure safety. Often, these locations are not public spaces, and require an industrial, rather than an architectural, approach to signage. Elevator floor numbers, however, should receive special attention and be considered in a comprehensive signage program.

CONCEPTUAL DESIGN OF THE SIGN FACE

Emphasis will not be placed on the graphic design of each sign required in a comprehensive signage program. However, the following considerations will help to ensure continuity, correctness, and aesthetic acceptability.

Alphabet selection

An alphabet must be carefully chosen that best exemplifies the graphic image to be portrayed to the public without compromising legibility and performance requirements. More than one alphabet may be selected, depending on the use of the sign. However, good design practices should be maintained in choosing the family of alphabets to be employed.

Interletter, word, and line spacing

Each alphabet has its own "personality" and visual impact; therefore, spacing between characters, words, and lines of copy must be carefully developed to give the best legibility and visual harmony possible (Fig. 8).
**Architectural Signage Systems**

**Planning - Design - Implementation**

These Doors Should Not Be Opened Except During An Emergency

Emergency Exit Only

---

**Arrow selection** Directional arrows should be designed to reflect the "personality" of the letterform selected. Stroke width and size relationships are important considerations (Fig. 9).

**Copy determination** The message for each sign must be accurately determined and the copy condensed to the fewest words that will still relay the desired message. Wordy signs are frequently misread or not read at all. The message must be concise, clear, and informative (Fig. 10 and 11).

**Copy placement format** The placement of copy on a sign face may take one of the nine basic positions or a custom format for special situations (Fig. 12).

**Size determination of the sign face** After the copy for each sign is in final form, the sign with the greatest amount of copy is selected from each of the sign types utilized and the desired copy height is determined for each type. This height should be based upon the distance from which the sign will be read and the graphic design portrayed. Using this letter height, the message should be laid out with photographic type or transfer lettering to scale, incorporating the copy placement and spacing requirements. The most pleasing shape and size for the message to be contained are then determined, realizing that this particular layout is for the maximum copy required for that particular sign type. A shape and size format should be chosen that works well as a module which can be proportioned and become applicable to the entire family of sign types. While this may be ideal, frequently the proportional system is not applicable. An example of each sign type should be drawn to scale and fully dimensioned to serve as a production guide for signs within that type. (Fig. 13).

**Color selections** Selection is then made of the copy and background colors that offer good contrast and harmoniously blend with the prominent colors in the environment. It is also wise to consider any corporate colors required by the client.

**SIGNAGE SYSTEM DEVELOPMENT CHECKLIST**

The completed sign schedule, location plans, scaled drawings of typical examples from each sign type, construction or assembly details or both, mounting details, and specifications form the documents required to bid competitively or to negotiate signage projects. Well-prepared documents prevent individual interpretation by vendors and result in comparable competitive bids.

The following systematic approach to the design and development of a comprehensive signage program will serve as a guideline to problem solving, employing the concepts contained in this chapter. This checklist may be expanded or condensed to meet individual project parameters. The basic systematic thought process, however, is applicable to all projects.

1. Develop the signage system design criteria based on:
   a. Performance requirements
   b. Usage considerations
   c. Durability requirements
   d. Vandalism considerations
   e. Flexibility to accommodate changes and additions
   f. Readability factors
   g. Multilingual needs
   h. Regulatory considerations
   i. Need for illumination
   j. Need for graphics manual for ongoing implementation and system maintenance

2. Study the traffic flow patterns, determine all sign locations, and draw the location symbols on the site and floor plans.

3. Evaluate and select the sign types required from the following list, categorized by function, that meet the design criteria:

   - a. Exterior sign types:
     - Type A - Primary identification
     - Type B - Secondary identification
     - Type C - Vehicular advance notice
     - Type D - Vehicular directional
     - Type E - Traffic regulatory and control
     - Type F - Instructional
     - Type G - Informational
     - Type H - Decorative

   - b. Interior sign types:
     - Type I - Primary identification
     - Type J - Primary directory
     - Type K - Elevator lobby floor directories
     - Type L - Pictorial "You Are Here" indicators
     - Type M - Primary directional
     - Type N - Secondary directional
Type O - Area identification
Type P - Room identification
Type Q - Desk identification
Type R - Personnel identification
Type S - Regulatory and control
Type T - Exit
Type U - Information exhibit cases
Type W - Dedicated
Type Y - Mechanical, instrumentation, and control system markings
Type Z - Other (to be specified by designer)

4. Select the best signing devices for each sign type designated above from the following lexicon of signage system components that most effectively satisfy the design criteria established:
   a. Elevated pylons
   b. Monolithic sign structures
   c. Panel and post assemblies
   d. Illuminated sign cabinets
   e. Directory and informational systems
   f. Die-cut pressure-sensitive lettering
   g. Dimensional graphics
   h. Plaque signage
   i. Environmental graphics
   j. Other (to be defined by the designer)

5. Conceptually design the sign face for each sign type selected, indicating:
   a. Alphabet selection
   b. Interletter, word, and line spacing
   c. Arrow selection
   d. Copy determination
   e. Copy placement format
   f. Size determination of copy and sign face
   g. Color selections

6. Complete the location plans by filling in the symbol indicating sign number and type.
7. Prepare scaled drawings of typical examples from each sign type.
8. Prepare the detailed sign schedule.
9. Prepare typical construction and assembly details, mounting details, and engineering drawings for wind loading, foundations, and illumination.
10. Prepare detailed specifications for all materials, techniques, and components required in the system.
Specialties
SIGNAGE AND GRAPHICS
Standard Sign Type and Mounting Heights

STANDARD SIGN SYSTEM

12" x 48"
12" x 72"

18" 36" max

9" x 9"
12" x 12"

9" x 9"
6" x 6"

Overhead  Directional  Area  Room

CODE SIGNS

fire evacuation map

Stair markings

on glass doors and sidelites

Elevator  Stair  Distraction strips

STANDARD MOUNTING HEIGHTS AND LOCATIONS

Overhead  Directional  Door

minimum 7'-0" 66"
**Specialties**

**SIGNAGE AND GRAPHICS**

**Sign Type**
- DIRECTIONAL (CEILING-HUNG)
- DIRECTIONAL (WALL-MOUNTED)

**Material Choices**
- MDO board, acrylic
- Acrylic, aluminum, acrylic with metal laminate

**Finishes**
- Painted, plastic laminate, metal laminate
- Painted acrylic or aluminum, natural aluminum or brass (satin or polished), laminates available in standard laminate finishes

**Graphics**
- Vinyl die cuts, silkscreen, dimensional applied letters
- Silkscreen, front surface or reverse

**Standard Mounting Materials**
- 1. Backpanel: backplate with countersunk screws with shields; magnetic, form, or vinyl tape with adhesive
- 2. Strips: vinyl tape
- Vinyl or magnetic tape, foam tape, silastic adhesive
- acrylic sign
- adhesive & tape mount

**Standard Size Definitions**

<table>
<thead>
<tr>
<th>Material</th>
<th>Dimensions</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDO board, acrylic</td>
<td>10&quot; x 24&quot;</td>
<td></td>
</tr>
<tr>
<td>Acrylic</td>
<td>12&quot; x 48&quot;</td>
<td></td>
</tr>
<tr>
<td>Acrylic</td>
<td>12&quot; x 72&quot;</td>
<td></td>
</tr>
<tr>
<td>Acrylic</td>
<td>18&quot;</td>
<td></td>
</tr>
<tr>
<td>Acrylic</td>
<td>2&quot;</td>
<td>TENANT info strip</td>
</tr>
<tr>
<td>Acrylic</td>
<td>4&quot;</td>
<td>DIRECTORY directional strip</td>
</tr>
<tr>
<td>Acrylic</td>
<td>6&quot;</td>
<td></td>
</tr>
<tr>
<td>Acrylic</td>
<td>9&quot;</td>
<td></td>
</tr>
<tr>
<td>Acrylic</td>
<td>12&quot;</td>
<td></td>
</tr>
</tbody>
</table>

---

* should not exceed 36" high
### Signage and Graphics

**Sign Type**
ROOM IDENTIFIER (WALL-MOUNTED)

**Material Choices**
Acrylic, aluminum, acrylic with metal laminate face

**Finishes**
Painted acrylic or aluminum, natural aluminum or brass (satin or polished), laminates available in standard laminate finishes

**Graphics**
Silkscreen, front surface or reverse

**Standard Mounting Materials**
Vinyl tape, foam tape, magnetic tape, silastic adhesive

**Standard sizes**

- 6”
  - Copy
  - 6”

- 9”
  - Copy
  - 2”

- 12”
  - Copy

**Elevation and section**

**Sign Type**
ROOM IDENTIFIER, CHANGEABLE MESSAGE (WALL-MOUNTED)

**Material Choices**
Holder, acrylic; insert, vinyl

**Finishes**
Painted (surface or subsurface)

**Graphics**
Silkscreen or vinyl die cuts

**Standard Mounting Materials**
Vinyl tape, foam tape, silastic adhesive

**Elevation and section**

**Sign Type**
FRAMED PLAQUE SIGNS, WALL-MOUNTED (previous plaque types are insertable into standard frame signs)

**Material Choices**
Molded acrylic, aluminum, brass

**Finishes**
Painted, satin, polished

**Standard Frame Mounting Materials**
1. Frame: screw mount, tape and adhesive
2. Insert: adhesive or magnetic tape, Velcro, magnet

**Standard sign sizes**

- 6”
  - Copy
  - 6”

- 9”
  - Copy
  - 2”

- 6”
  - Copy
  - 3”

**Standard insert sizes**

- 1-5/8”
  - Insert

- 12”

**Elevation and section**
**Specialties**

**SIGNAGE AND GRAPHICS**

**Sign Type**
COUNTERTOP/FLAG MOUNT

**Extrusion Material**
Aluminum

**Insert Material**
Acrylic, aluminum, acrylic with metal laminate

**Graphics**
See area and room plaques

**Standard Mounting Details**
1. Counter: free-standing with extruded aluminum base
2. Flag mount: countersunk screws and shields

![Diagram of sign types]

**Standard sizes**

- 6" x 9"
- 9" x 9"
- 12" x 12"
- Wall mount

**Note:** Changeable face available by using acrylic sign plaque.

**Sign Type**
CUT LETTERS: FLUSH, PROJECTED

**Material Choices**
Acrylic, acrylic with metal laminate face, brass, aluminum

**Finishes**
Polished, painted, brushed, sand blasted

**Standard Mounting Details**
Adhesive mount, flush pin mount, standoff mount

**Standard Letter Sizes**
Varies from 2" to 18"
Specialties

SIGNAGE AND GRAPHICS

Medical Symbols

Medical

Nursing Homes
Medical Complexes
First-Aid Centers

Pictograms not shown:
1.516 Parking
1.372 Playroom
1.150 Library or Reading
1.147 Chest

1.508
1.518
1.184
1.188

Hospital
Pharmacy
Dental Care
Wheelchair

1.148
1.148
1.440
1.450

X-Ray
Physiotherapy
General Medicine, Female
General Medicine, Male

1.448
1.417
1.448
1.123

Coronary Care
Hematology
Urology
Eye

1.129
1.473
1.137
1.368

Podiatry
Mental Health
Ear, Nose & Throat
Oxygen

1.375
1.411
1.302
1.359

Shower
Isolation
Nursery
Laboratory

1.408
1.347
1.483
1.157
Commercial

Shopping Centers
Stores & Shops
Eating Facilities
Community Services

Cocktail Lounge
Pub
Coffee Shop
Liquor Store

Mens' Furnishings
Furniture
Cinema
Camera Store

Gift Shop
Florist
Dress Shop
Shoe Store

Restaurant
Soda Fountain
Grocery Store
Tobacco Shop

Bookstore
Record Shop
Fuel
Toy Shop

Theater
Van
Beauty Salon
Barber Shop

Picto'graphics not shown:
1.218 Concrete Mixer
1.219 Cushman Vehicle
1.222 Dump Truck
1.226 Flatbed Truck
1.304 Basket
1.314 Vegetable Produce
1.363 Newspaper Vendor
1.370 Record Store
1.394 Cooking

1.344
1.361
1.360
1.307

1.352
1.315
1.126
1.338

1.339
1.393
1.321
1.375

1.354
1.341
1.337
1.316

1.305
1.455
1.336
1.372

1.449
1.290
1.192
1.149
Specialties

SIGNAGE AND GRAPHICS

Commercial and Travel Symbols
Travel

Pictograms not shown:
1.350 Motel
1.266 Seaplane Base

Airport
Departures
Arrivals
Car Rentals

1.253
1.255
1.254
1.202

Bus
Subway
Train
Taxi

1.206
1.205
1.278
1.203

Monorail
Ferry
Cable Car
Automobile

1.239
1.225
1.215
1.201

Lost & Found
Porter
Locker
Fuel

1.310
1.319
1.306
1.336

Baggage Claim
Customs
Immigration
Money Exchange

1.303
1.125
1.464
1.532

Motorcycle
Moving Sidewalk
Lodging
Ice Cubes

1.241
1.145
1.173
1.303
Recreation and Sports

Sports Arenas
Parks
Recreation Facilities
Amusement Parks

Picnics
Curling
1.112
Dancing
1.115
LaCrosse
1.140
Hockey
1.138
Tobogganing
1.183
Wintersports
1.471
Outdoor Recreation
1.387

Campers
Picnic Area
Midway
Trailer Train

Water
Swimming
Canoeing
Sailing

Marina, Boating
Life Preserver
Snowmobiling
Camping

Judging
Bicycling
Women's/Girl's Toilet
Fishing

Skiing
Soccer
Ice Skating
Football

Hunting, Shooting
Golf
Baseball
Tennis, Badminton
Specialties
SIGNAGE AND GRAPHICS
Universal Symbols

Universal

Entry
Exit
Ramp up
Ramp down

Emergency
Women's Toilet
Men's Toilet
Stairs

Handicapped
No Smoking
Telephone
Escalator

Elevator
Down
No Parking
Drinking fountain

Mail Box
Check Room
Up
No Entry

Shower
Waiting Room
Telegraph Office
Information

Applicable to any building or facility

1.110  Children
1.144  Man with boy
1.340  Fragile
1.372  Playroom
1.410  Church
1.472  Synagogue
1.469  Police
1.493  Smoke
1.516  Parking
1.488  Keep Dry
1.155  Janitor

Photos not shown:

1.110  Children
1.144  Man with boy
1.340  Fragile
1.372  Playroom
1.410  Church
1.472  Synagogue
1.469  Police
1.493  Smoke
1.516  Parking
1.488  Keep Dry
1.155  Janitor

1.188  Handicapped
1.189  Man
1.143  Woman
1.377  Stairs

1.311  Elevator
1.402B  Down
1.351B  No Parking
1.139B  Drinking fountain

1.326  Mail Box
1.317  Check Room
1.402A  Up
1.3463  No Entry

1.376  Shower
1.151  Waiting Room
1.367  Telegraph Office
1.155B  Information

International symbol of accessibility
<table>
<thead>
<tr>
<th>Font Name</th>
<th>Style</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternate</td>
<td>Gothic No. 3</td>
<td>Specialties</td>
</tr>
<tr>
<td>Americana</td>
<td>Bold</td>
<td>Americana</td>
</tr>
<tr>
<td>Americana</td>
<td>Italic</td>
<td>Specialties</td>
</tr>
<tr>
<td>Aster</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Avant Garde</td>
<td>Gothic Medium</td>
<td>Specialties</td>
</tr>
<tr>
<td>Baker Danmark</td>
<td>2</td>
<td>Specialties</td>
</tr>
<tr>
<td>Baker Sans</td>
<td>Bold Regular</td>
<td>Specialties</td>
</tr>
<tr>
<td>Baskerville</td>
<td>Bold Italic</td>
<td>Specialties</td>
</tr>
<tr>
<td>Bodoni</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Bookman</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Caledonia</td>
<td>Bold Italic</td>
<td>Specialties</td>
</tr>
<tr>
<td>Caslon</td>
<td>Bold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Century Schoolbook</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Century Schoolbook</td>
<td>Bold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Cheltenham</td>
<td>Medium</td>
<td>Specialties</td>
</tr>
<tr>
<td>Columbus</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Copperplate</td>
<td>Gothic Light</td>
<td>Specialties</td>
</tr>
<tr>
<td>Craw Clarendon</td>
<td>Book</td>
<td>Specialties</td>
</tr>
<tr>
<td>Craw Clarendon</td>
<td>Bold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Craw Modern</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Delta</td>
<td>Medium</td>
<td>Specialties</td>
</tr>
<tr>
<td>Eastern Souvenir</td>
<td>Medium</td>
<td>Specialties</td>
</tr>
<tr>
<td>Eurostile</td>
<td>Bold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Eurostile</td>
<td>Bold Extended</td>
<td>Specialties</td>
</tr>
<tr>
<td>Eurostile</td>
<td>Bold Extended</td>
<td>Specialties</td>
</tr>
<tr>
<td>Firmin Didot</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Folio</td>
<td>Medium</td>
<td>Specialties</td>
</tr>
<tr>
<td>Folio</td>
<td>Medium Extended</td>
<td>Specialties</td>
</tr>
<tr>
<td>Fortuna</td>
<td>Light</td>
<td>Specialties</td>
</tr>
<tr>
<td>Franklin Gothic</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Futura</td>
<td>Medium</td>
<td>Specialties</td>
</tr>
<tr>
<td>Futura</td>
<td>Bold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Garamond</td>
<td>Bold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Gerstner Program</td>
<td>Medium</td>
<td>Specialties</td>
</tr>
<tr>
<td>Gill Sans</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Harry</td>
<td>Bold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Hellenic</td>
<td>Wide</td>
<td>Specialties</td>
</tr>
<tr>
<td>Helvetica</td>
<td>Light</td>
<td>Specialties</td>
</tr>
<tr>
<td>Helvetica</td>
<td>Medium</td>
<td>Specialties</td>
</tr>
<tr>
<td>Helvetica</td>
<td>Medium Outline</td>
<td>Specialties</td>
</tr>
<tr>
<td>Horizon</td>
<td>Medium</td>
<td>Specialties</td>
</tr>
<tr>
<td>Karen</td>
<td>Bold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Korinna</td>
<td>Bold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Korinna</td>
<td>Bold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Lydian</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Melior</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Melior</td>
<td>SemiBold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Microgramma</td>
<td>Normal</td>
<td>Specialties</td>
</tr>
<tr>
<td>Microgramma</td>
<td>Bold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Microgramma</td>
<td>Bold Extended</td>
<td>Specialties</td>
</tr>
<tr>
<td>Modula</td>
<td>Medium</td>
<td>Specialties</td>
</tr>
<tr>
<td>News Gothic</td>
<td>Bold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Olive</td>
<td>Antique</td>
<td>Specialties</td>
</tr>
<tr>
<td>Optima</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Optima</td>
<td>SemiBold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Palatino</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Palatino</td>
<td>SemiBold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Permanent</td>
<td>Medium</td>
<td>Specialties</td>
</tr>
<tr>
<td>Perpetua</td>
<td>Roman</td>
<td>Specialties</td>
</tr>
<tr>
<td>Plantin</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Quorum</td>
<td>Medium</td>
<td>Specialties</td>
</tr>
<tr>
<td>Romana</td>
<td>Normal</td>
<td>Specialties</td>
</tr>
<tr>
<td>Schadow</td>
<td>SemiBold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Serif Gothic</td>
<td>Normal</td>
<td>Specialties</td>
</tr>
<tr>
<td>Serif Gothic</td>
<td>Bold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Solitaire</td>
<td>Bold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Souvenir</td>
<td>Light</td>
<td>Specialties</td>
</tr>
<tr>
<td>Souvenir</td>
<td>Medium Italic</td>
<td>Specialties</td>
</tr>
<tr>
<td>Standard</td>
<td>Medium</td>
<td>Specialties</td>
</tr>
<tr>
<td>Stymie</td>
<td>Bold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Times</td>
<td>Roman</td>
<td>Specialties</td>
</tr>
<tr>
<td>Times</td>
<td>Roman Bold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Trooper</td>
<td>Roman</td>
<td>Specialties</td>
</tr>
<tr>
<td>Trooper</td>
<td>Roman Light</td>
<td>Specialties</td>
</tr>
<tr>
<td>Univers 55</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Univers 56</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Univers 65</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Univers 67</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Univers 53</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Univers 63</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Univers 65 Outline</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Univers 65 Outline</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Univers 83 Outline</td>
<td></td>
<td>Specialties</td>
</tr>
<tr>
<td>Venus</td>
<td>Medium</td>
<td>Specialties</td>
</tr>
<tr>
<td>Venus</td>
<td>ExtraBold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Venus</td>
<td>ExtraBold Condensed</td>
<td>Specialties</td>
</tr>
<tr>
<td>Venus</td>
<td>Bold Extended</td>
<td>Specialties</td>
</tr>
<tr>
<td>Walbaum</td>
<td>Medium</td>
<td>Specialties</td>
</tr>
<tr>
<td>Weiss</td>
<td>Roman ExtraBold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Windsor</td>
<td>ExtraBold</td>
<td>Specialties</td>
</tr>
<tr>
<td>Windsors</td>
<td>ExtraBold Outline</td>
<td>Specialties</td>
</tr>
</tbody>
</table>
Clarendon Medium
abcdefgijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ
0123456789 !"#$%&'()*+,-./
Optima Regular
abcdefgijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ
0123456789 !"#$%&'()*+,-./

Helvetica Medium
abcdefgijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ
0123456789 !"#$%&'()*+,-./
Times New Roman
abcdefgijklmnopqrstuvwxyz
ABCDEFGHIJKLMNOPQRSTUVWXYZ
0123456789 !"#$%&'()*+,-./

General Symbols Extended

Fig. 14 General type styles with maximum readability. ½" cap height is legible up to 25'; ¾"-1" cap height is legible up to 50'; 1-2" cap height is legible up to 100'.
DESIGNING THE SYSTEM

The formulation of a communications program is based on the functional requirements delineated in the feasibility study. The presentation modes to be utilized are a part of such a program. They may include slides, films, videotape, and a sound-recording and playback system. The detailed design of the facility includes the selection of basic equipment, possible modification of that equipment, and provision for additional optical elements, as well as the engineering of the electrical control circuitry and the design of the electromechanical devices that may be needed.

The implementation of a proposed A-V system is not merely an exercise in mechanical assembly. It is a highly complex process of logistics that involves providing specific functional requirements within architectural and economic constraints. Careful engineering and balancing of the alternatives available will generally achieve optimum results.

A large number of variables is encountered in every A-V design problem. As an example, the dimensions of the presentation room have a significant effect on the audience size, the acoustic characteristics, the size of the projected image, the choice of equipment, and the location and the interrelationship of the components.

The A-V consultant who is responsible for the program planning, the design, and the engineering of this complex, multifaceted discipline should be intimately familiar with the problems of fabrication, installation, and operation of such systems. This knowledge will enable the consultant to plan a facility whose execution will not create difficulties and whose construction and operation can be effected without costly changes. However, even when the consultant has experience as an adviser to members of the architectural and engineering professions, the creation of a well-integrated facility is not necessarily assured. His or her work and the completed facilities should be viewed and evaluated.

Optical Aspects

It is of critical importance for an A-V system to have the ability to display bright, sharp images to all viewers and to maintain the stability and consistency of those images in a simple and straightforward manner. The picture quality is a function of a number of factors requiring careful attention during all phases of the project. These include:

- The quality of the original photography or artwork
- The density, contrast, and sharpness of the visual being projected
- The output intensity of the projector light source
- The optical characteristics of each projection device
- The optical characteristics of the integrated system
- The ratio of the projection distance to the image size
- The centering integrity of the light path from the material being projected to its image on the screen
- The characteristics of the projection screen or other viewing surface

Projection Engineering

Room size Ideally, the dimensions of the viewing room should be an outgrowth of the estimate of the audience size that was established in the original A-V study. In many cases, however, the A-V design engineer must utilize a predetermined space. Given the characteristics of that space, the designer can determine the ideal audience size for each type of seating arrangement, and also ascertain whether a front or rear projection mode is feasible and what the image size should be.

The type of relationship that is desired between the person making the presentation and the audience will determine the seating configuration; theatre, lecture, or conference format. That configuration will in turn dictate the number of viewers that can be comfortably seated for optimum viewing (Fig. 1). As an illustration, a room 20 feet by 32 feet can accommodate about 49 people in a theatre configuration (Fig. 2); in a lecture arrangement, the audience size would be 24 (Fig. 3); a U-shaped table would seat 18 (Fig. 4); and 15 people could fit comfortably at a conference table (Fig. 5). Circular and multiuse arrangements (Figs. 6 and 7) are additional examples of the relationship of seating configuration and audience size.

Other seating configurations have been devised for other types of communication program modes, each with a direct relationship between room size and audience size. The audience size is also affected by the angle of view between each member of the audience and the screen (Fig. 1).

Whenever the A-V design engineer has the opportunity of establishing the dimensions of the presentation room, he or she should be aware of the important fact that a longer projection throw for a particular image size results in more even light distribution and sharpness as well as a better angle of view. Consequently a larger audience can be accommodated than would be possible using a system with a short projection distance and a narrower angle of view. This question of projection distance applies to both front and rear projection systems. However, as the throw is normally quite short when a rear projection screen is used, this factor of design in rear projection facilities is an extremely critical planning element.

Distortion, sometimes called "keystoning," will result if the viewing surface is not precisely parallel to the plane of the image being projected. Therefore, the light path, which is usually perpendicular to the projected material, must be carefully controlled in relation to the projector and the screen. The size of the audience and the room, as well as the mode of projection, will determine whether the screen will be vertical or at an angle (Fig. 6). Normally a rear projection screen will permit a vertical viewing surface.
Specialties

AUDIO-VISUAL SYSTEMS

Typical Projection Room Layout and Sightlines

Fig. 2 A room 20 feet by 32 feet, seating 49 people in theatre style.

Fig. 3 A room 20 feet by 32 feet, seating 24 people in lecture style.

Fig. 4 A room 20 feet by 32 feet, seating 18 people at a U-shaped table.

Fig. 5 A room 20 feet by 32 feet, seating 15 people at a boat-shaped conference table.
Specialties

AUDIO-VISUAL SYSTEMS

Typical Projection Room Layout and Sightlines

Fig. 6 A room 20 feet by 24 feet, seating 13 people at a circular table. With the depth increased to 32 feet, from 7 to 14 observers can also be accommodated.

Fig. 7 A modified classroom arrangement including both lecture and separate tables.

Fig. 8 Cross section of a theatre-style auditorium with stepped seating showing both front and rear projection. Note that the projected light beam is perpendicular to the screen in both cases.
Screen image area  The most useful screen is one that is square, as it will permit both vertical and horizontal images, as well as square ones, of course (Fig. 9). A single image format will need one such screen, while a dual format will have a viewing surface that is the width of two images placed side by side (Figs. 9 and 10). It is an easy matter to determine the minimum image size necessary for a room of a given size. For a front projection screen the minimum size is the distance between it and the farthest viewer divided by 6. For a rear projection screen, the division factor is 7.5. As illustration: When the distance between the front projection screen and the last row of viewers, is 45 feet, the minimum image size will be 7.5 feet; with a rear projection screen, the minimum size should be 6 feet. These calculations assume that the original artwork from which the projection materials are made meets the generally accepted basic minimum standards.

Front projection  The projector in a front projection system transmits the image in the form of a light beam to an opaque screen where it is reflected back to the viewers, creating the image. As the screen reflects any light falling on its surface, the general light level in the room during a presentation must be extremely low. If the full color and contrast of the projected image is to be retained, the ambient skin should be no greater than 0.3 percent of the average screen brightness. Projectors are generally noisy and should be separated from the audience to avoid distractions. If the space is available, a separate projection booth can be built behind the room's rear wall. Besides insulating the viewers from unwanted sound and light spill, this arrangement provides the opportunity for equipment to remain in place ready for use. There are other possible arrangements when space is constricted (Figs. 11, 12, and 13).

Creating an A-V front projection system that is both aesthetically pleasing and functionally efficient requires a high level of technical expertise and design skill. The results of such a combination can be effective yet unobtrusive. Fig. 18 provides an example of a multimedia front projection system that is compatible with the decor of the room and its formalized seating arrangement.

Rear projection  The image in a rear projection system is focused on the back of a translucent screen and is visible to the audience on the other side. Since the light passes through the screen rather than being reflected off its front surface, there can be a reasonable light level in the viewing room during the presentation without affecting the quality of the image. It is only in the immediate vicinity of the screen that the room lights need be dimmed.

As is the case with all projection systems, for minimum distractions the equipment should be separated from the audience. This can be effected by means of a separate projection booths or by an enclosed cabinet within the viewing room. A separate room usually requires more space, but it may be the best solution for a particular situation. A cabinet within the viewing room permits front access to the projector, enabling the presenter to load the equipment without assistance.

While technical expertise and design skills are needed for the creation of a front projection A-V system, they are even more important for a system intended for rear projection, as a rear-mode arrangement has more inherent problems to overcome.

A rear projection system utilizing the indirect deep method in a separate projection booth requires a considerable amount of space. In addition, if more than one projector is used in such a system, either the projectors must be optically aligned each time a change is made (as there is only one true screen axis), or they are permanently positioned a little off axis, resulting in a slight "keystone" or distortion effect in the projected image (Fig. 17).

For good image clarity, the distance between the image source and the screen must be at least twice the picture size. To achieve this clarity within a limited amount of space, the folded light-path method can be used (Figs. 18 and 19). As the name implies, the light path from the projector is "folded" by means of a large mirror usually placed some distance away. This arrangement has the advantage of reducing the depth required behind the screen while retaining an adequate projection distance. As a further advantage, several projectors can be aligned in optically true positions by the use of a movable mirror with preset position stops.

The use of the folded light-path method of projection and a movable mirror can also be engineered in a cabinet that is directly accessible from the presentation room for "hands-on" operation by the person making the presentation. Both single-image and side-by-side dual-image systems can be designed in this manner (Figs. 20 and 21). A great number of variations are possible using the same basic engineering concepts.
These variations can accommodate different functional requirements, spatial limitations, and image-quality parameters. Figures 14, 15, 22, and 23 illustrate some of the possible arrangements. User requirements and job conditions will guide the A-V engineer in the design of a specific system.

The Optical Design Factor
A projection system — of whatever nature — is only as good as the quality of the image on the screen. The clarity, sharpness, resolution, and angle of view that can be expected are a direct result of the thought and care that go into the optical design of the system. The more complex the system becomes, the more critical is the system optics. The need for larger images, sharper images, multiple images, multiple image sources and the existence of physically constraining parameters all add to the conflicting requirements that must be satisfied. And they must be satisfied if an acceptable image quality is to be achieved.

The Sound System
The quality and the functional characteristics of the sound system that is part of an audiovisual facility are as important as the quality and functional characteristics of the optical system. The two aspects of a facility are mutually complementary and the one should not be neglected in relation to the other if the goal of an effective and useful facility is to be attained.

The quality of the sound, as perceived by the listener, is influenced by such factors as:
- The sensitivity of controls
- The quality of the amplifiers
- The quality of the speakers
- The location of the speakers
- The elimination of extraneous sounds
- The overall acoustical characteristics of the space

The design factors that govern the functional characteristics of the sound system might include the following:
- Sound sources: voice, movie soundtrack, videotape, audiotape
- Telecommunication facilities for outside program sources
- Mixing and control requirements
- Quantity and placement of speakers
- Room size and function: conference room, classroom, auditorium
- Provision for flexibility and future expansion

The Remote-Control System
Most people who make informational presentations are not audiovisual specialists. Their primary concern is with the material they are presenting and not with the mechanics of how it is to be presented. As a result, any control devices they may be required to operate should be simple and logical. The presenter should be asked to make only a minimum of effort to determine how to manipulate the controls in order to achieve a desired result. The fewer operations necessary to reach a particular goal, the better. For example, in order for a change to be made from one presentation mode to another, it may be necessary to alter the ambient room lighting, reposition a mirror, turn one machine

Fig. 11 A typical rear-access equipment arrangement for front projection.

Fig. 12 A rear-access reduced-depth arrangement of equipment for front projection.

Fig. 13 A front-access equipment cabinet for front projection.
Fig. 14 An arrangement of two enclosed rear projection systems serving a single large room.

Fig. 15 The two enclosed and pivoted rear projection systems positioned to serve the two separate rooms that are created when a hidden dividing partition is extended.
off and then another on. If all these things can be accomplished merely by flipping one clearly marked switch, the presenter is freed from mechanical distractions and can concentrate full attention on the message being delivered. The location and spacing of the various switches on the panel, as well as the use of nomenclature unmistakable to a non-technical person, are important parts of the design of a remote-control system that will aid the presenter in the use of the audiovisual facility.

Other considerations that may affect the design of a remote-control system include:

- The seating configuration
- The room lighting
- The number of control points required
- The use of a lectern incorporating a control module
- The number and type of functions to be controlled
- The degree of automation required to meet system objectives

SUMMARY

An audiovisual presentation facility is made up of many components and subsystems which are interdependent and must perform as an integrated unit. Regardless of its size or scope, the A-V system must be conceived, designed, and installed to function as a totality – as a single entity that works with optimum efficiency and effectiveness in an unobtrusive manner.

In order to achieve this goal – that of developing a logical and workable solution to any particular communication problem – careful and detailed preliminary investigations must be made. These will determine the functional requirements that make up the design program. From this program, the space needs for the equipment and for the audience can be established early enough in the development of the project to avoid undesirable procrastinate solutions later. The selection, adaptation, manufacture, assembly, and installation of equipment and components should be carefully coordinated to ensure their functional integrity and performance.

Ultimately, a successful audiovisual system is one that serves as a logical and natural extension of the human capabilities of the person using it. It should respond easily and unobtrusively to the communicator's needs, and it should reproduce the material being communicated with the highest possible degree of fidelity.

RECAP

Front Projection

1. Viewing distance factor is 6. (For example, if image size is 5 feet the alphanumericics would be clear at a maximum distance of 30 feet to a viewer with a 20/40 vision if characters are 1/8 inch on 6-by 9-inch original copy area.)
2. Advantages
   a. Good angle of view
   b. Good for checking laboratory quality of all projectors
   c. Virtually no apparent fall-off to the sides
3. Disadvantages
   a. High ceilings are required to utilize a square screen to accommodate vertical as well as horizontal images.
   b. Distraction occurs when the presenter or viewers interrupt the light beam.
   c. Any ambient light adversely affects image quality. The room must be relatively dark to achieve the desired picture contrast.
   d. An overhead projector cannot be used most effectively.

Rear Projection (Rigid or Flexible Material)

1. Viewing distance factor is 7.5. (For example, if image size is 5 feet the maximum viewing distance would be 37.5 feet.)
2. Advantages
   a. A 20 percent smaller image than is required by front projection permits minimum standards to be met in low-ceilinged rooms.
   b. Can be used in higher ambient light conditions.
   c. No distracting light beam. (Presenter can more comfortably point at material.)
   d. In a brighter room, the presenter easily maintains eye contact.
   e. An overhead projector can be used, so that neither it nor the presenter blocks the image from the viewers.
3. Disadvantages
   a. The inherent grain and directional quality of the rear screen eliminate it as a viewing medium to determine laboratory quality of projectors.
   b. The projection system must be designed to overcome apparent illumination falloff at the sides and improve the angle of view.
   c. Mirrored image is required for proper use.
   d. More space is required than with front projection.
   e. Usually costs more.

Seating

(Plan should permit several arrangements.)

1. A U- or V-table layout provides for best viewing and viewer/presenter interaction (lowest audience capacity).
2. Conference table (boat-shape or oval) provides good interaction for conferences but not so good as the U- or V-table layout for audiovisual communication.
3. Random seating style (usually with writing tablets) is frequently selected for high-level visitor presentations. It permits larger capacity and creates a more luxurious atmosphere than the two arrangements above.
4. Classroom style (shallow tables parallel to front wall with chairs behind) is the next best method but less conducive to student interaction.
   a. Stumped, curved seating (lecture hall) provides unobstructed viewing.
   b. When classroom style is contemplated, study and programmed-learning carrels should be considered.
5. Auditorium style provides the largest capacity seating and is generally used for large group-orientation and overview types of presentation.

Rear Projection System Factors

1. The physical center of all projector lenses must be in perfect alignment with the physical center of the screen to eliminate any "keystone" effect. (For dissolve mode, 2° off center vertically is permitted.)
2. A front-surface mirror should be used to reverse the image so that the rear of the room can be loaded as much as it is for front projection; slides in magazines need not be reversed, and special reversed prints are not needed for motion pictures. The use of a mirror can also extend the projection distance appreciably by folding the light path. Remember, the longer the projection distance, the better the viewing angle. Minimum projection distance should be at least 2 times the image size.
3. The screen-image area should be considered to be square to accommodate vertical and horizontal images unless the system is to be used for a special, limited requirement.
4. Apparent light falloff at the sides can be diminished or eliminated by increasing the projection distance and projector illumination. Another minor contributor to slide density is the amount of light transmission. This condition increases apparent light falloff.
Specialties

AUDIO-VISUAL SYSTEMS

Equipment Arrangement

Fig. 16 A custom-designed recessed front-access equipment cabinet for a multi-image front projection system.

Fig. 17 A deep, indirect-method, rear projection arrangement using the minimum recommended ratio of 2 to 1 between projection distance and image size.

Fig. 19 An indirect rear projection arrangement using the folded-light-path method and the minimum recommended 2 to 1 ratio of projection distance to image size. This permits a flexible equipment arrangement within tight space limitations.

Fig. 18 An indirect rear projection arrangement using the folded-light-path method, resulting in a ratio of 3.5 to 1 within the same depth. This improves the image quality and increases the possible viewing angle as well as allowing rear projection of overhead transparencies with the overhead projector in the presentation room.
Fig. 20 A front-access rear projection arrangement using the folded-light-path method for single-image presentations.

Fig. 21 A front-access rear projection arrangement using the folded-light-path method for dual-image presentations.

Fig. 22 A rear-access rear projection arrangement using the folded-light-path method for dual-image or single central-image presentations.

Fig. 23 A rear projection arrangement for dual-image and single central-image presentations utilizing both deep indirect projection and the folded-light-path method.
Specialties

AUDIO-VISUAL SYSTEMS

Typical Projection Room Layout

Front wall supplied with system.

5'0" x 5'0" REAR PROJECTION SCREEN

5'0" x 10'0" REAR PROJECTION SCREEN

Front wall supplied with system.
Specialties

AUDIO-VISUAL SYSTEMS

Typical Projection Room Layout

TYPICAL CONFIGURATION

TYPICAL CONFIGURATION
Specialties

AUDIO-VISUAL SYSTEMS

Typical Projection Room Layout

TYPICAL CONFIGURATION

TYPICAL CONFIGURATION

(AUDIENCE AREA)
Sight line studies vary depending on the particular event and seating configuration. The following are some basic design elements. (Note: Remember to review and verify slope, rise heights, tread depths, etc., with pertinent national and local code requirements.)

The visibility profile shown in Fig. 1:

Angle A: Shifting position to look between heads in row immediately in front of spectator and over all other heads.

Angle B: Shifting position to look between heads of two rows immediately in front of spectators and over all other heads.

Generally, the variables considered in determining these angles are:
- 3° eye level in the seated position
- 5° minimum eye clearance
- Row spacing and row rise.

Angle A is commonly used in determining floor slope for auditorium, performing arts or theater type seating configurations. When angle A profile is used in conjunction with a staggered seating arrangement (chairs staggered or alternated in arrangement of sizes opposite every other row) it allows unobstructed view of spectators to a determined focal point at screen on stage. The final analysis is to have all sight lines to intersect the desired focal point (usually 5°-6° elevation either at screen or 12°-10° back from front of stage).

Angle B is most commonly used in determining riser or stepped applications for gymnasium, arena, or stadium type seating configurations. When the angle B profile is used (generally associated with an aligned seating arrangement) it allows unobstructed view of spectators to a determined focal point at court line or line of play. The final analysis is to have all the critical sight lines to intersect the focal point or line of play at generally a 3° elevation.

Legal responsibility lies with the owners and users of equipment in acquiring acceptance with local officials. The following are some basic guidelines.

**Standard Seating**

1. Row spacing shall provide a clear space of not less than 12" (30.5 cm) from the back of one chair to the front of the most forward projection of the chair directly behind it when measured with the self-rising seat in the up position.

2. Rows of chairs shall not exceed 14 chairs between aisles and exceed seven chairs from an aisle to a row end.

3. Aisles serving 60 seats or less shall be a minimum of 30" (76 cm) wide. Aisles serving more than 60 seats shall be at least 3' (91 cm) wide when serving seats on one side and at least 3'6" (107 cm) wide when serving seats on both sides. These minimum widths, measured at the point furthest from an exit, cross aisles, or foyer shall be increased 1\% (3.8 cm) for each 5' (152 cm) in length toward the exit, cross aisle, or foyer. Where egress is possible in either direction, aisles shall be uniform in width. Dead end aisles are not allowed over 20'0" (61.0 m) in length.

4. Cross aisles, foyer or exit widths shall be not less than the sum of the required width of the widest aisle plus 50% of the total required width of the remaining aisles that it serves.

**Continental Seating**

1. Row spacing shall provide a clear space of not less than: 18" (45.7 cm) between rows of 18 chairs or less; 20" (50.8 cm) between rows of 35 chairs or less; 21" (53.3 cm) between rows of 45 chairs or less; 22" (55.9 cm) between rows of 46 chairs or more to a maximum of 100 chairs per row measured from the back of one chair to the front of the most forward projection of the chair directly behind it with the self-rising seat in the up position.

2. There shall be exits of 66" (168 cm) minimum clear width along each side aisle of the chair rows for each five rows of chairs.

3. Aisles shall not be less than 44" (112 cm) in clear width.
**AUDITORIUM SEATING**

**Row Length**

Row length = \( q \) to \( q + (2A) \) measured at the Chair Size Line

![Diagram of auditorium seating showing row length and chair size line.]

**EXAMPLE:**

(3) 20" chairs = 5'-4" row length.

---

**DIMENSIONS: Center line to center line (\( \xi \) to \( \xi \))**

<table>
<thead>
<tr>
<th>QTY</th>
<th>18&quot;</th>
<th>19&quot;</th>
<th>20&quot;</th>
<th>21&quot;</th>
<th>22&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3'-0&quot;</td>
<td>3'-2&quot;</td>
<td>3'-4&quot;</td>
<td>3'-6&quot;</td>
<td>3'-8&quot;</td>
</tr>
<tr>
<td>3</td>
<td>4'-6&quot;</td>
<td>4'-9&quot;</td>
<td>5'-0&quot;</td>
<td>5'-3&quot;</td>
<td>5'-6&quot;</td>
</tr>
<tr>
<td>4</td>
<td>6'-0&quot;</td>
<td>6'-4&quot;</td>
<td>6'-8&quot;</td>
<td>7'-0&quot;</td>
<td>7'-4&quot;</td>
</tr>
<tr>
<td>5</td>
<td>7'-6&quot;</td>
<td>7'-11&quot;</td>
<td>8'-4&quot;</td>
<td>8'-9&quot;</td>
<td>9'-2&quot;</td>
</tr>
<tr>
<td>6</td>
<td>9'-0&quot;</td>
<td>9'-6&quot;</td>
<td>10'-0&quot;</td>
<td>10'-6&quot;</td>
<td>11'-0&quot;</td>
</tr>
<tr>
<td>7</td>
<td>10'-6&quot;</td>
<td>11'-1&quot;</td>
<td>11'-8&quot;</td>
<td>12'-3&quot;</td>
<td>12'-10&quot;</td>
</tr>
<tr>
<td>8</td>
<td>12'-5&quot;</td>
<td>12'-8&quot;</td>
<td>13'-4&quot;</td>
<td>14'-0&quot;</td>
<td>14'-8&quot;</td>
</tr>
<tr>
<td>9</td>
<td>13'-6&quot;</td>
<td>14'-3&quot;</td>
<td>15'-0&quot;</td>
<td>15'-9&quot;</td>
<td>16'-6&quot;</td>
</tr>
<tr>
<td>10</td>
<td>15'-0&quot;</td>
<td>15'-10&quot;</td>
<td>16'-8&quot;</td>
<td>17'-6&quot;</td>
<td>18'-4&quot;</td>
</tr>
<tr>
<td>11</td>
<td>16'-6&quot;</td>
<td>17'-5&quot;</td>
<td>18'-4&quot;</td>
<td>19'-3&quot;</td>
<td>20'-2&quot;</td>
</tr>
<tr>
<td>12</td>
<td>18'-0&quot;</td>
<td>19'-0&quot;</td>
<td>20'-0&quot;</td>
<td>21'-0&quot;</td>
<td>22'-0&quot;</td>
</tr>
<tr>
<td>13</td>
<td>19'-6&quot;</td>
<td>20'-7&quot;</td>
<td>21'-8&quot;</td>
<td>22'-9&quot;</td>
<td>23'-10&quot;</td>
</tr>
<tr>
<td>14</td>
<td>21'-0&quot;</td>
<td>22'-2&quot;</td>
<td>23'-4&quot;</td>
<td>24'-6&quot;</td>
<td>25'-8&quot;</td>
</tr>
<tr>
<td>15</td>
<td>22'-6&quot;</td>
<td>23'-9&quot;</td>
<td>25'-0&quot;</td>
<td>26'-3&quot;</td>
<td>27'-6&quot;</td>
</tr>
<tr>
<td>16</td>
<td>24'-0&quot;</td>
<td>25'-4&quot;</td>
<td>26'-8&quot;</td>
<td>28'-0&quot;</td>
<td>29'-4&quot;</td>
</tr>
<tr>
<td>17</td>
<td>25'-6&quot;</td>
<td>26'-11&quot;</td>
<td>28'-4&quot;</td>
<td>29'-9&quot;</td>
<td>31'-2&quot;</td>
</tr>
<tr>
<td>18</td>
<td>27'-0&quot;</td>
<td>28'-6&quot;</td>
<td>30'-0&quot;</td>
<td>31'-6&quot;</td>
<td>33'-0&quot;</td>
</tr>
<tr>
<td>19</td>
<td>28'-6&quot;</td>
<td>30'-1&quot;</td>
<td>31'-8&quot;</td>
<td>33'-3&quot;</td>
<td>34'-10&quot;</td>
</tr>
<tr>
<td>20</td>
<td>30'-0&quot;</td>
<td>31'-8&quot;</td>
<td>33'-4&quot;</td>
<td>35'-0&quot;</td>
<td>36'-8&quot;</td>
</tr>
<tr>
<td>21</td>
<td>31'-6&quot;</td>
<td>33'-3&quot;</td>
<td>35'-0&quot;</td>
<td>36'-9&quot;</td>
<td>38'-6&quot;</td>
</tr>
<tr>
<td>22</td>
<td>33'-0&quot;</td>
<td>34'-10&quot;</td>
<td>36'-8&quot;</td>
<td>38'-6&quot;</td>
<td>40'-4&quot;</td>
</tr>
<tr>
<td>23</td>
<td>34'-6&quot;</td>
<td>36'-5&quot;</td>
<td>38'-4&quot;</td>
<td>40'-3&quot;</td>
<td>42'-2&quot;</td>
</tr>
<tr>
<td>24</td>
<td>36'-0&quot;</td>
<td>38'-0&quot;</td>
<td>40'-0&quot;</td>
<td>42'-0&quot;</td>
<td>44'-0&quot;</td>
</tr>
<tr>
<td>25</td>
<td>37'-6&quot;</td>
<td>39'-7&quot;</td>
<td>41'-8&quot;</td>
<td>43'-9&quot;</td>
<td>45'-10&quot;</td>
</tr>
<tr>
<td>26</td>
<td>39'-0&quot;</td>
<td>41'-2&quot;</td>
<td>43'-4&quot;</td>
<td>45'-6&quot;</td>
<td>47'-8&quot;</td>
</tr>
<tr>
<td>27</td>
<td>40'-6&quot;</td>
<td>42'-9&quot;</td>
<td>45'-0&quot;</td>
<td>47'-3&quot;</td>
<td>49'-6&quot;</td>
</tr>
<tr>
<td>28</td>
<td>42'-0&quot;</td>
<td>44'-4&quot;</td>
<td>46'-8&quot;</td>
<td>49'-0&quot;</td>
<td>51'-4&quot;</td>
</tr>
<tr>
<td>29</td>
<td>43'-6&quot;</td>
<td>45'-11&quot;</td>
<td>48'-4&quot;</td>
<td>50'-9&quot;</td>
<td>53'-2&quot;</td>
</tr>
<tr>
<td>30</td>
<td>45'-0&quot;</td>
<td>47'-6&quot;</td>
<td>50'-0&quot;</td>
<td>52'-6&quot;</td>
<td>55'-0&quot;</td>
</tr>
<tr>
<td>31</td>
<td>46'-6&quot;</td>
<td>49'-1&quot;</td>
<td>51'-8&quot;</td>
<td>54'-3&quot;</td>
<td>56'-10&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>QTY</th>
<th>18&quot;</th>
<th>19&quot;</th>
<th>20&quot;</th>
<th>21&quot;</th>
<th>22&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>48'-0&quot;</td>
<td>50'-8&quot;</td>
<td>53'-4&quot;</td>
<td>56'-0&quot;</td>
<td>59'-8&quot;</td>
</tr>
<tr>
<td>33</td>
<td>49'-6&quot;</td>
<td>52'-3&quot;</td>
<td>55'-0&quot;</td>
<td>57'-9&quot;</td>
<td>60'-6&quot;</td>
</tr>
<tr>
<td>34</td>
<td>51'-0&quot;</td>
<td>53'-10&quot;</td>
<td>56'-8&quot;</td>
<td>59'-6&quot;</td>
<td>62'-4&quot;</td>
</tr>
<tr>
<td>35</td>
<td>52'-6&quot;</td>
<td>55'-5&quot;</td>
<td>58'-4&quot;</td>
<td>61'-3&quot;</td>
<td>64'-2&quot;</td>
</tr>
<tr>
<td>36</td>
<td>54'-0&quot;</td>
<td>57'-0&quot;</td>
<td>60'-0&quot;</td>
<td>63'-0&quot;</td>
<td>66'-0&quot;</td>
</tr>
<tr>
<td>37</td>
<td>55'-6&quot;</td>
<td>58'-7&quot;</td>
<td>61'-8&quot;</td>
<td>64'-9&quot;</td>
<td>67'-10&quot;</td>
</tr>
<tr>
<td>38</td>
<td>57'-0&quot;</td>
<td>60'-2&quot;</td>
<td>63'-4&quot;</td>
<td>66'-6&quot;</td>
<td>69'-8&quot;</td>
</tr>
<tr>
<td>39</td>
<td>58'-6&quot;</td>
<td>61'-9&quot;</td>
<td>65'-0&quot;</td>
<td>68'-3&quot;</td>
<td>71'-6&quot;</td>
</tr>
<tr>
<td>40</td>
<td>60'-0&quot;</td>
<td>63'-4&quot;</td>
<td>66'-8&quot;</td>
<td>70'-0&quot;</td>
<td>73'-4&quot;</td>
</tr>
<tr>
<td>41</td>
<td>61'-6&quot;</td>
<td>64'-11&quot;</td>
<td>68'-4&quot;</td>
<td>71'-9&quot;</td>
<td>75'-2&quot;</td>
</tr>
<tr>
<td>42</td>
<td>63'-0&quot;</td>
<td>66'-6&quot;</td>
<td>70'-0&quot;</td>
<td>73'-6&quot;</td>
<td>77'-0&quot;</td>
</tr>
<tr>
<td>43</td>
<td>64'-6&quot;</td>
<td>68'-1&quot;</td>
<td>71'-8&quot;</td>
<td>75'-3&quot;</td>
<td>78'-10&quot;</td>
</tr>
<tr>
<td>44</td>
<td>66'-0&quot;</td>
<td>69'-8&quot;</td>
<td>73'-4&quot;</td>
<td>77'-0&quot;</td>
<td>80'-8&quot;</td>
</tr>
<tr>
<td>45</td>
<td>67'-6&quot;</td>
<td>71'-3&quot;</td>
<td>75'-0&quot;</td>
<td>78'-9&quot;</td>
<td>82'-6&quot;</td>
</tr>
<tr>
<td>46</td>
<td>69'-0&quot;</td>
<td>72'-10&quot;</td>
<td>76'-8&quot;</td>
<td>80'-6&quot;</td>
<td>84'-4&quot;</td>
</tr>
<tr>
<td>47</td>
<td>70'-6&quot;</td>
<td>74'-5&quot;</td>
<td>78'-4&quot;</td>
<td>82'-3&quot;</td>
<td>86'-2&quot;</td>
</tr>
<tr>
<td>48</td>
<td>72'-0&quot;</td>
<td>76'-0&quot;</td>
<td>80'-0&quot;</td>
<td>84'-0&quot;</td>
<td>88'-0&quot;</td>
</tr>
<tr>
<td>49</td>
<td>73'-6&quot;</td>
<td>77'-7&quot;</td>
<td>81'-8&quot;</td>
<td>85'-9&quot;</td>
<td>89'-10&quot;</td>
</tr>
<tr>
<td>50</td>
<td>75'-0&quot;</td>
<td>79'-2&quot;</td>
<td>83'-4&quot;</td>
<td>87'-6&quot;</td>
<td>91'-8&quot;</td>
</tr>
<tr>
<td>51</td>
<td>76'-6&quot;</td>
<td>80'-9&quot;</td>
<td>85'-0&quot;</td>
<td>89'-3&quot;</td>
<td>93'-6&quot;</td>
</tr>
<tr>
<td>52</td>
<td>78'-0&quot;</td>
<td>82'-4&quot;</td>
<td>86'-8&quot;</td>
<td>91'-0&quot;</td>
<td>95'-4&quot;</td>
</tr>
<tr>
<td>53</td>
<td>79'-6&quot;</td>
<td>83'-11&quot;</td>
<td>88'-4&quot;</td>
<td>92'-9&quot;</td>
<td>97'-2&quot;</td>
</tr>
<tr>
<td>54</td>
<td>81'-0&quot;</td>
<td>85'-6&quot;</td>
<td>90'-0&quot;</td>
<td>94'-8&quot;</td>
<td>99'-0&quot;</td>
</tr>
<tr>
<td>55</td>
<td>82'-6&quot;</td>
<td>87'-1&quot;</td>
<td>91'-8&quot;</td>
<td>96'-3&quot;</td>
<td>100'-10&quot;</td>
</tr>
<tr>
<td>56</td>
<td>84'-0&quot;</td>
<td>88'-8&quot;</td>
<td>93'-4&quot;</td>
<td>98'-0&quot;</td>
<td>102'-8&quot;</td>
</tr>
<tr>
<td>57</td>
<td>85'-6&quot;</td>
<td>90'-3&quot;</td>
<td>95'-0&quot;</td>
<td>99'-9&quot;</td>
<td>104'-6&quot;</td>
</tr>
<tr>
<td>58</td>
<td>87'-0&quot;</td>
<td>91'-10&quot;</td>
<td>96'-8&quot;</td>
<td>101'-6&quot;</td>
<td>106'-4&quot;</td>
</tr>
<tr>
<td>59</td>
<td>88'-6&quot;</td>
<td>93'-5&quot;</td>
<td>98'-4&quot;</td>
<td>103'-3&quot;</td>
<td>108'-2&quot;</td>
</tr>
<tr>
<td>60</td>
<td>90'-0&quot;</td>
<td>95'-0&quot;</td>
<td>100'-0&quot;</td>
<td>105'-0&quot;</td>
<td>110'-0&quot;</td>
</tr>
</tbody>
</table>
EXAMPLE:
4 rows (3 spaces) at 33" = 8'-3"

ROW SPACE

CLEAR SPACE

See elevation drawings for envelope dimensions

See elevation drawings for dimensions

4 rows (3 spaces) at 33" = 8'-3"

OVERALL SPACING OF CHAIRS (back to back)

<table>
<thead>
<tr>
<th>Number of seating rows (spaces + 1)</th>
<th>ROW SPACE DIMENSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>32&quot;</td>
<td>33&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>34&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>35&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>36&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>37&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>38&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>39&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>40&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>41&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>42&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>43&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>44&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>45&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>46&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>47&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>48&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>49&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>50&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>51&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>52&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>53&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>54&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>55&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>56&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>57&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>58&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>59&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>60&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>61&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>62&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>63&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>64&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>65&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>66&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>67&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>68&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>69&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>70&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>71&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>72&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>73&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>74&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>75&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>76&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>77&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>78&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>79&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>80&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>81&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>82&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>83&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>84&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>85&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>86&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>87&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>88&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>89&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>90&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>91&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>92&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>93&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>94&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>95&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>96&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>97&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>98&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>99&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>100&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>101&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>102&quot;</td>
</tr>
</tbody>
</table>

Notes:
1. Refer to applicable building codes.
2. Spacing varies with tablet arm applications.
3. Row space dimension will be the sum of "clear space" (see building codes) plus "chair envelope" (see chair dimensions) plus any additional space as desired for convenience to permit patron easy access to concessions, restrooms, etc.
Auditorium Seating
Chair Dimensions
Auditorium Seating
Chair Dimensions and Row Seating

Dimensions:
- Chair dimensions
- Row seating arrangements

Minimum Radii:
- 15'-0" for 21' to 22'
- 15'-0" for 20' or 21'

Specifications:
- Height: 31" (7.5 cm)
- Depth: 22-3/4" (58 cm)
- Seat: 17-3/4" (45 cm)
- Back: 20-1/8" (51 cm)
- Armrest: 14" (36 cm)
- Leg: 21" (53 cm)
- Seat depth: 15-1/2" (39 cm)
- Leg spread: 10'-0" (305 cm)

Default settings:
- 21" to 22"
Seating arrangements in an assembly space will either be identified as "multiple-aisle" or "continental." These terms are commonly found in design standards manuals, building codes, and similar architectural reference documents. Each is unique with specific guidelines governing row size, row spacing, and exitways.

Basically, a multiple-aisle arrangement (Fig. 2) will have a maximum of 14–16 chairs per row with access to an aisleway at both ends. If an aisle can be reached from one end of a row only, the seat count may then be limited to 7 or 8. It should be noted here that the maximum quantities will always be established by the governing building code.

In a continental arrangement (Fig. 3) all seats are located in a central section. Here the maximum quantity of chairs per row can greatly exceed the limits established in a multiple-aisle arrangement. In order to compensate for the greater length of rows allowed, building codes will require wider row spacing, wider aisles and strategically located exit doors.

Although more space would appear to be called for, a continental seating plan is often not any less efficient than a multiple-aisle arrangement. In fact, carefully planned, a continental arrangement can frequently accommodate more seating within the same space. For early planning an average 7.5 sq. ft. per person may be used. This will include both the seating area and space necessary for aisleways.

Fig. 2 Multiple-aisle arrangement.

Fig. 3 Continental arrangement.
Design Considerations

1. Layout per applicable building and life safety codes, regulations, and ordinances.
2. Allow sufficient distance between aisles for desired quantity and size of chairs plus end space.
3. Space rows to allow for proper seat to back clear space.
4. Determine radius or straight rows and locate by the chair size line.
5. Allow 1" minimum clearance from either side or rear of chair to any adjacent side wall, end walls, etc.
6. Provide adequate sightlines for either sloping or stepped (riser) floor configurations.
7. Seating area should be free of obstructions.
8. To allow for sufficient aisle illumination: Aisle lights are generally located in the end panel standards at least every other row. Locate aisle light junction box 6" from the standard.
9. Provide adequate floor or riser materials for sound anchorage.

TYPICAL PLAN OF SEATING AND TERMINOLOGY
**Seal Width**

Seating comfort is initially determined by individual chair widths. Available sizes range from 15" to 24" however, all may not be produced by a single manufacturer. The most commonly used chair widths are 19", 20", 21", and 22". It should be noted that these dimensions are nominal, being measured from center to center of the support legs. If seating comfort is a high priority, thought must be given to a particular width and the space taken up by chair arms to determine an actual size. Usually, smaller sizes of 16" and 18" have limited application due to the minimum clearance provided. Typically, all manufacturers state their chairs along an imaginary line which may be referred to as a "datum line" or a similar name. For accurate planning, an assembly area, this line must be identified so as not to over or underestimate the potential of a row of chairs.

**Row Spacing**

Row spacing or "back to back" spacing of seats is also very important in developing a comfortable assembly area. A minimum dimension occasionally used is 2'-6" (32") This spacing provides marginal clearance between a seated person's knees and the back of the chair in the next forward row. At the same time, however, it will require that a seated person stand to permit the passage of another individual. As the row spacing is increased to 3'0" (36"), seating comfort is dramatically improved and passage along a row of seated persons is accomplished with less disruption.

**Floor Design**

Seating comfort will also be affected by the design of the assembly space floor. Flat or less steeply sloped floors will usually allow a person to extend their knees and legs even under minimum row spacing dimensions. Here an individual can take advantage of the open area under a seat and the free space created by the pitched back of a chair. As the floor slope is increased, this "free" space diminishes. The extreme condition exists where a large elevation change between rows is combined with a minimum row spacing. An example would be a 12" high riser and a 32" wide row spacing. At this point, it becomes necessary to consider increasing the back to back dimension to provide more leg room.

*The free space under a chair is also lost when a row of seats is located directly behind a low wall. In this case, a recommended minimum clearance would be 11" measured from seat edge in the lowered position to face of wall. The back to back dimension of a row of seats abutting a rear wall should also be carefully studied. Normally, the pitched back of a chair will overlap a rear face automatically reducing the width of that row unless succeeding rows are similarly positioned. Where a rear wall exists the recommended procedure is to increase the dimension of the last row sufficiently to accommodate any overlap plus a minimal space between the wall and top edge of the chair back.*
Visibility in an assembly space is a function of seat location. As stated earlier, building codes, comfort guidelines, floor design and the overall form of an assembly space will play a part in seating arrangements. This information combined with a basic understanding of sightline analysis and related planning guidelines can result in achieving an acceptable, if not optimum, level of viewing for spectators.

Perhaps film projection requires the most critical sightline analysis, since poor seat location will result in distorted images. For this activity the seating parameters are established by the screen or image size. An angle of 30° up to 45° measured perpendicular to the far and near edges of the screen can establish a side to side seating limit, while the screen or image height may determine the maximum distance. The minimum dimension or closest recommended seat will also be set by the screen height. (It should be noted that these figures are approximate and apply principally to flat screen projection.)
Specialties

AUDITORIUM SEATING
End Stage; ¼ Arena

<table>
<thead>
<tr>
<th>Basic Theater Form</th>
<th>¼ Arena</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of Seats</td>
<td>56</td>
</tr>
<tr>
<td>Seating Area</td>
<td>622 Sq. Ft.</td>
</tr>
<tr>
<td>Space per Seat</td>
<td>11.1 Sq. Ft.</td>
</tr>
<tr>
<td>Row Spacing</td>
<td>3' - 3'</td>
</tr>
<tr>
<td>Most Distant Seat</td>
<td>32' - 0'</td>
</tr>
<tr>
<td>Stage Elevation</td>
<td>None</td>
</tr>
<tr>
<td>Floor Design</td>
<td>Riser 4'</td>
</tr>
</tbody>
</table>

Basic Theater Form | End Stage                        |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of Seats</td>
<td>56</td>
</tr>
<tr>
<td>Seating Area</td>
<td>450 Sq. Ft.</td>
</tr>
<tr>
<td>Space per Seat</td>
<td>8.23 Sq. Ft.</td>
</tr>
<tr>
<td>Row Spacing</td>
<td>2'-0&quot;</td>
</tr>
<tr>
<td>Most Distant Seat</td>
<td>22'-0&quot;</td>
</tr>
<tr>
<td>Stage Elevation</td>
<td>None</td>
</tr>
<tr>
<td>Floor Design</td>
<td>Flat/One Rise 6&quot;</td>
</tr>
</tbody>
</table>
AUDITORIUM SEATING
End Stage

Basic Theater Form: End Stage

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of Seats</td>
<td>80</td>
</tr>
<tr>
<td>Seating Area</td>
<td>700 Sq. Ft.</td>
</tr>
<tr>
<td>Space per Seat</td>
<td>8.75 Sq. Ft.</td>
</tr>
<tr>
<td>Row Spacing</td>
<td>3'-6&quot;</td>
</tr>
<tr>
<td>Most Distant Seat</td>
<td>25'-6&quot;</td>
</tr>
<tr>
<td>Stage Elevation</td>
<td>3'-6&quot;</td>
</tr>
<tr>
<td>Floor Design</td>
<td>Risers 8&quot;</td>
</tr>
</tbody>
</table>

Basic Theater Form: End Stage

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of Seats</td>
<td>92</td>
</tr>
<tr>
<td>Seating Area</td>
<td>950 Sq. Ft.</td>
</tr>
<tr>
<td>Space per Seat</td>
<td>10.4 Sq. Ft.</td>
</tr>
<tr>
<td>Row Spacing</td>
<td>3'-0&quot;</td>
</tr>
<tr>
<td>Most Distant Seat</td>
<td>37'-0&quot;</td>
</tr>
<tr>
<td>Stage Elevation</td>
<td>12'</td>
</tr>
<tr>
<td>Floor Design</td>
<td>Flat</td>
</tr>
</tbody>
</table>
Specialties

AUDITORIUM SEATING
End Stage

<table>
<thead>
<tr>
<th>Basic Theater Form</th>
<th>End Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of Seats</td>
<td>99</td>
</tr>
<tr>
<td>Seating Area</td>
<td>953 Sq. Ft.</td>
</tr>
<tr>
<td>Space per Seat</td>
<td>9.62 Sq. Ft.</td>
</tr>
<tr>
<td>Row Spacing</td>
<td>3'-5&quot;</td>
</tr>
<tr>
<td>Most Distant Seat</td>
<td>32'-0&quot;</td>
</tr>
<tr>
<td>Stage Elevation</td>
<td>12&quot;</td>
</tr>
<tr>
<td>Floor Design</td>
<td>Risers 12&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Basic Theater Form</th>
<th>End Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of Seats</td>
<td>105</td>
</tr>
<tr>
<td>Seating Area</td>
<td>903 Sq. Ft.</td>
</tr>
<tr>
<td>Space per Seat</td>
<td>8.6 Sq. Ft.</td>
</tr>
<tr>
<td>Row Spacing</td>
<td>3'-0&quot;</td>
</tr>
<tr>
<td>Most Distant Seat</td>
<td>30'-0&quot;</td>
</tr>
<tr>
<td>Stage Elevation</td>
<td>5&quot;</td>
</tr>
<tr>
<td>Floor Design</td>
<td>Risers 12&quot;</td>
</tr>
</tbody>
</table>
Specialties

AUDITORIUM SEATING
End Stage; Wide Fan

<table>
<thead>
<tr>
<th>Basic Theater Form</th>
<th>End Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of Seats</td>
<td>180</td>
</tr>
<tr>
<td>Seating Area</td>
<td>1218 Sq. Ft.</td>
</tr>
<tr>
<td>Space per Seat</td>
<td>6.8 Sq. Ft.</td>
</tr>
<tr>
<td>Row Spacing</td>
<td>2'-8&quot;</td>
</tr>
<tr>
<td>Most Distant Seat</td>
<td>50'-0&quot;</td>
</tr>
<tr>
<td>Stage Elevation</td>
<td>1'-6&quot;</td>
</tr>
<tr>
<td>Floor Design</td>
<td>Incidental Slope</td>
</tr>
</tbody>
</table>

Basic Theater Form: Wide Fan
Quantity of Seats: 283
Seating Area: 1790 Sq. Ft.
Space per Seat: 7.1 Sq. Ft.
Row Spacing: 3'-0"
Most Distant Seat: 48'-0"
Stage Elevation: None
Floor Design: Risers—Varying, Height 10½" to 16"
Basic Theater Form: End Stage
Quantity of Seats: 430
Seating Area: 2586 Sq. Ft.
Space per Seat: 6.5 Sq. Ft.
Row Spacing: 2'-8 1/4"
Most Distant Seat: 58'-0"
Stage Elevation: 2'-6"
Floor Design: Sloped 7.1"

Basic Theater Form: End Stage
Quantity of Seats: 224
Seating Area: 1660 Sq. Ft.
Space per Seat: 7.4 Sq. Ft.
Row Spacing: 2'-0"
Most Distant Seat: 60'-0"
Stage Elevation: None
Floor Design: Sloped 7.1'/Risers 13 3/4"
### Specialties

**AUDITORIUM SEATING**

**Wide Fan**

<table>
<thead>
<tr>
<th>Basic Theater Form</th>
<th>Wide Fan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of Seats</td>
<td>207</td>
</tr>
<tr>
<td>Seating Area</td>
<td>1557 Sq. Ft.</td>
</tr>
<tr>
<td>Space per Seat</td>
<td>7.5 Sq. Ft.</td>
</tr>
<tr>
<td>Row Spacing</td>
<td>2'-8&quot;</td>
</tr>
<tr>
<td>Most Distant Seat</td>
<td>45'-0&quot;</td>
</tr>
<tr>
<td>Stage Elevation</td>
<td>5&quot;</td>
</tr>
<tr>
<td>Floor Design</td>
<td>Risers 14&quot;</td>
</tr>
</tbody>
</table>

![Diagram of Auditorium Seating](image_url)
CONTROL OF GROUNDS

Fencing can be a very effective means of limiting access to secondary exits and to vulnerable ground-level dwellings. Fencing functions as a control by requiring entry through a single, limited, highly visible area. The fencing surrounding most single-family homes does not have locked gates. It is intended primarily to keep pets, children, and friends out of yards, family areas, and gardens, and to define the area immediately around the home as the private outdoor space of that household. Any intrusion into the area within the fence is therefore noticeable. As a security measure, such fencing, used symbolically, is of minimal value against premeditated crime, but it does make criminal intent visible and so is an important deterrent.

A conventional use of fencing in multifamily complexes is to limit access to backyards and windows of a housing cluster. On conventional city blocks, backyards of row housing are accessible only through one of the uses. However, with modern designs, such backyards are left open to public access. In this situation, addition of a limited amount of fencing can protect a large group of homes (see Fig. 1). This approach can also subdivide the superblock and so create small, natural clusters.

The Lobby

Improving visibility is the most important ingredient in providing a natural surveillance
lobby. It is crucial that a tenant entering a building be able to see what is going on in the lobby from the outside. Hidden nooks and blind curves provide perfect hiding places. Where such features cannot be removed structurally, the use of mirrors, windows, and improved lighting may ease the situation.

Ideally, a person walking down a path to enter a building should be able to see anyone standing in the lobby and elevator waiting area. In fact, it is often advantageous if the arriving person can see into the elevator from across the lobby.

CONTROL OF INTERIOR PUBLIC SPACES OF MULTIFAMILY DWELLINGS

The most vulnerable locations in multifamily buildings are the interior public spaces: lobbies, elevators, stairwells, and corridors. These are areas open to the public but without the attending surveillance given a public street by passersby and police. The crimes that occur in these interior public spaces are the most fearful types of crimes involving acts of personal confrontation such as robbery, assault, and rape. Limiting access to these spaces through the use of a door-monitor intercom/hook system can be of substantial benefit.

Lobby visibility discourages a number of different kinds of crime. Crimes of personal confrontation may be deterred primarily because the potential victim can readily perceive and avoid a suspicious person in the lobby. The potential criminal must also fear the possibility that another tenant of the police may be viewing the crime in the well-lit open area.

Mailbox crime — generally the theft of checks — can be deterred when mailboxes are located in a highly protected area of the lobby. This protection can consist of placing the mailboxes behind an intercom or in a locked mailroom. It is essential that the mailboxes be visible from as many different viewpoints as possible. Improved visibility in this context can be a significant deterrent to crime.

Some managers designate an area of the lobby as a legitimate resting place, where chairs and other lounging items are provided. Lounging may aid security, particularly if the building includes a high proportion of elderly. The best locations for such seating are areas with high visibility. Often tenant patrol's use these areas as a station and provide still another dimension of security.

A bulletin board is an inexpensive device that can improve lobby security by providing a diversion. If, for example, a tenant enters the lobby and sees someone he doesn't recognize waiting for an elevator, he may need a reasonable excuse for not taking the same elevator. The bulletin board provides the tenant with a natural excuse to pause and survey the situation.

The area around the main entry to a multifamily building should be clearly distinguished from the public walkway which leads to it. A person entering through the main door should feel distinctly that he is entering a space controlled by the residents of the building. The main entry should be well lit and clearly visible from outside.

Entry doors should be constructed of a transparent material covering as large an area as possible. In vandalism-prone areas, the main entry doors should be made of unbreakable glass or other similar, very sturdy transparent material. Because of the need for good visibility, replacing glass panels with metal or other material should be avoided. For window walls and doors where the incidence of vandalism is extreme, glass panels less than 2 feet from the ground and higher than 7 feet from the ground may be replaced by solid materials.

Fire Doors and Fire Stairs

Secondary exit doors are the weakest link in security of buildings. An ideal secondary exit door would be one that allows exit but not entry. Unfortunately, there is no acceptable emergency exit system that allows reentry only.

In the design of any security system there is a continuing clash between the need for safety against crime and the need for safety in case of fire. Fire doors are frequently used for entry and exit by criminals. Installation of panic hardware and the absence of exterior hardware sometimes prevent criminal use. These measures will not suffice, however, where tenants do not cooperate in avoiding use of secondary exits and ensuring they are kept closed.

To a large extent, the design and location of secondary fire exits determine tenant attitudes about the exits. For example, a building's main entry may face the street, but the parking lot may be to the rear of the building. If the secondary exit is also at the rear and close to this destination, the temptation to use the fire door as an entry or exit will be difficult to resist. Similarly, security is decreased in buildings where the main entries face the interior of the project while the fire doors face the surrounding streets with their parking and shopping facilities. Where the fire exit does not represent any shortcut or improved convenience to the tenant, it is far more likely to remain closed. A securely designed building is one in which the fire doors exit to an area that is less convenient or desirable than the area outside the main door.

In cases of persistent breaks in security of secondary exits, it is possible to modify the building plan at the ground level and open a new doorway in a better location. However, this improvement is costly and can only be done where architecturally possible.

Another architectural modification to improve security involves making a fire exit into a legitimate secondary entry and developing a security system that protects both the main and secondary entries. If a fire door exits to a
SECURITY

General Control Guidelines; Doors and Hardware

parking area, for example, this modification may be more successful than efforts to prevent people from using that exit. If the main entry is equipped with an intercom system, the secondary entry should be similarly equipped and made easily surveillable through the use of lighting and windows.

Other mechanisms can be used to limit access to and prevent circulation through the emergency exit system. A fire exit passageway, for example, can be modified by installing a second door inside the building a short distance from the existing exterior door. Both doors should be equipped with hardware so that they can be opened only from the inside. The point of this system is that it is unlikely that both doors will be propped or jammed open at the same time. A tenant entering an open exterior fire door which leads only to the locked second door will have to exit and use another door. A few exceptions to this kind will convince most tenants that it is probably more convenient to go directly through the main entrance. This double-door system generally does not conflict with fire codes.

An extension of this concept is to have the fire door on each floor above ground level operable from the corridor only. Thus, once someone has gone into a stairwell he can only exit at the ground level. This system may be somewhat inconvenient to tenants accustomed to moving easily between floors, but it does create roadblocks for anyone attempting to enter the building from the ground-level exit door.

The improvements outlined above are generally applicable to all dwellings, in buildings which have such security personnel, additional measures are possible.

A doorman or security guard can only be effective if he controls all access to the building, including access through fire doors. In a well-designed building, the doorman can see the fire doors from his position at the main entry. Where this is not possible, an inexpensive and effective solution is to install panic hardware with an alarm, and make sure the doorman can hear and respond to the alarm. If the doorman has access to closed-circuit TV, this may be used to monitor the fire doors. If the doorman can also be given a device for controlling the secondary door, it becomes very difficult for a criminal to use the fire entry.

Elevators

There are virtually no structural modifications that can improve security within elevators. The only possible improvements are use of mirrors, communication devices, emergency buttons, or an electronic surveillance system.

Security modifications to other areas of a building improve security within the elevator. If the elevator waiting area and the elevator cab can be locked from the exterior of the lobby, the residents are afforded some protection. Similarly, if the fire door and fire stairs are secure, there is less chance of a criminal entering the elevator on an upper floor. In this sense, the safety of the elevator is dependent upon the general security of the building.

SECURING THE DWELLING

Illegal entry into dwelling units is traditionally prevented by use of hardware. However, there are building design features which in themselves limit access, improve surveillance, and promote neighbor recognition.

Windows

Ground-level windows are generally most vulnerable to illegal entry and breakage. (All windows whose lower ledges are less than 7 feet off the ground should be considered ground level.) There are three ways to discourage criminal entry through ground-floor windows: design ground-floor areas which need few windows; house activities on the ground floor which hold no interest to the burglar; and assign the grounds immediately adjacent to the building for the use of the neighboring resident and fence off the grounds for his protection.

Elaborate security details—protuding ledges, for example—often increase the vulnerability of lower windows. Fences, garbage containers, and parked cars, when located near windows, are used as stepping stones to an otherwise inaccessible window. Care should be taken to prevent this type of situation.

Most windows above the ground floor are relatively inaccessible, with very important exceptions. Fire escapes make windows accessible. Little can be done to modify fire escapes, except in terms of hardware, because of fire safety and fire codes. One solution is to ensure that the ladder from the lowest fire escape is at least 12 feet above the ground. The ground area under the fire escape should be highly visible.

Another point of entry to the fire escape is the roof, which can be secured with panic hardware and properly patrolled. The roof also provides possible entry to windows or balconies on the top floor. Therefore, security of the roof is quite essential, particularly to top-floor residents. Other accessible windows are those located diagonally across from a stairwell window. The criminal can open a stairwell window and cross from the stairwell into the units. It is not advisable to equip the stairway with grilles or bars, as they provide the security of visibility to the stairwell and may have a fire safety function.

Accessible windows are also those located above or near door canopies. Criminals can reach the canopy by climbing onto it from the ground or from a stair or hall window.

Doors

Security of doors, beyond the hardware aspect, depends upon surveillance and neighbor recognition. An experienced burglar needs just a few seconds to enter a locked apartment door equipped with minimal hardware. Within this interval, the crucial factors are: Will the intruder be seen or heard by tenants, will the viewer perceive that the potential criminal is in fact an intruder, and will the viewer respond by calling authorities or in some way challenge the criminal?

Physical design can directly influence the opportunity for surveillance of doors. Corridors that are open to view, either single loaded or with windows, are more easily surveillable by residents and police. Thus the opportunity for the criminal to attempt entry undetected is reduced.

In most single-family homes (detached or row) where the entrance door is on the street, the only means of improving surveillance is to avoid placing trees and shrubs where they hide the doors and windows, and to locate lighting to improve visibility around these openings.

In multiple-family dwellings, the apartment building is expected to have a doorman. However, some of these buildings, particularly those located at multifamily dwellings, will also deter forcible entry, robbery, and vandalism.

HARDWARE

This section describes hardware devices that secure the individual residential dwelling and the multifamily dwelling. Much of this material is intended to prevent burglary. However, some of the measures, particularly those directed at multifamily dwellings, will also deter forcible entry, robbery, and vandalism.

THE RESIDENTIAL DWELLING

Door Materials

The major security tests of door material are sound transmission, fire, heat, and impact by brute strength and its ability to retain securely the locking devices attached. Materials most commonly used for doors are wood, aluminum, steel, and glass, often in combination with hardboard, fiberboard, asbestos, and plastic. The two most common door designs are panel and flush. Panel doors are designed of vertical and horizontal members framing rectangular areas in which opaque panels, panes of glass, or louvers are located. Flush doors consist of flat panels running the full height and width of the door. (See Fig. 2.)

Solid-steel flush doors, although most secure, are rarely used except in very high-security areas such as banks and prisons. Steel-clad doors, which are steel flush doors constructed of 24-gauge sheetmetal facing bonded to a nonresilient, kiln-dried wood interior, provide an optimum weight-strength ratio. Hollow steel doors (1½-inch flush type) are satisfactory in multiple-dwelling buildings. Aluminum doors can provide sufficient protection but may be comparatively expensive.

While less strong than steel-clad doors, wood doors can be secured. All exterior wooden doors should be of solid-core construction with a minimum thickness of 1½ inches. Although flush doors provide better security, if panel doors are desired for aesthetic reasons, the panels should have a minimum 16-inch thickness (see Fig. 3). Both hollow-core wood doors and thin-wood panel doors are unacceptable where security is a factor.
Door Frames
The sides and top of a doorway are provided with a door frame which holds the door in position. The side members of the door frame are called jambs; the top member is called the head (see Fig. 4). The strike is the portion of the jamb which is cut out or drilled out to allow installation of a metal plate, which accepts the latch or bolt from the door lock (see Fig. 5).

Wooden frames provide an unacceptable level of security unless they are at least 2 inches thick. Metal-covered wood frames provide an optimum cost-security investment when used in combination with metal-covered wood doors. If a hollow steel frame is used, the residual air space behind the frame should be filled with a crush-resistant material such as cement grout, especially in the area of the strike (see Fig. 6). This will prevent an intruder from wedging a crowbar between the door and frame and crushing the frame to free the lock.

For doors swinging in, rabbeted jambs should be used. These are jambs containing a metal extension that protrudes beyond the edges of the closed door, thus preventing tampering in the area of the strike (see Fig. 7).

For doors without rabbeted jambs, an L-shaped piece of angle-iron at least 2 feet long, mounted in the area of the strike, gives extra protection (see Fig. 8). The iron acts as a lip which protects the strike from attack.

---

Fig. 2 Door types.

Fig. 3 Panel door.

Fig. 4 Door frame.

Fig. 5 Door strike.

Fig. 6 Hollow metal door frame.

Fig. 7 Rabbeted jamb.
For doors opening out, a flat metal plate, called an escutcheon plate, can be mounted to the face of the door in the area of the lock. This plate, which extends beyond the edge of the door and fits flush with the jamb when the door is closed, will protect the lock from attack in the area of the strike (see Fig. 9). All plates located on the outsides of doors should be attached with tamper-resistant connectors such as round-headed carriage bolts or one-way screws.

**Door Hinges and Closers**

Spring hinges close the door automatically by using spring force. A spring hinge prevents a criminal from slipping in behind a resident who has neglected to close the door immediately upon entering. Also, spring hinges prevent the resident from leaving the door open when he exits. Door closers (see Fig. 10) serve the same purpose. These are for more heavy duty and are commonly used in lobbies and commercial facilities.

Hinges should be mounted on the inside of the door so that burglars cannot remove the door from the hinges to enter. If hinges must be placed on the outside, they should have nonremovable pins. Pins can be made nonremovable by peening the straight end or by drilling and tapping a machine screw into the middle portion of each pin from the inside of the open hinge (see Fig. 11). Doors with outside hinge pins can also be protected by screwing two screws halfway into the jamb edge of the door. One screw is placed near each hinge, and a receiving hole is drilled into the jamb for each screw. These protruding screws hold the door when it is closed, even if the hinge pins are removed.
Door Locks
Locks must withstand or seriously delay not only a forced entry but also sophisticated criminal attack. Locks may also guard against window entry-door exit crimes.

Parts of the lock are defined as follows:

Cylinder: A cylinder is that part of the lock into which the key is inserted. If the proper key is used, the cylinder will allow the key to turn, thus moving a bolt or latch.

Deadbolt: A deadbolt (or bolt lock) is a heavy metal bar which moves horizontally into the strike of the door jamb, thus locking the two together. It is called a deadbolt because it cannot be pushed back unless the knob is turned by the correct key.

Latch: A latch (or spring lock) is the part of the lock that keeps the door in a closed position by extending into the strike automatically when the door is closed. The latch is most often operated by the doorknob. Most latches can be pushed back by external pressure without having to turn the doorknob.

Deadlatch: In a deadlatch, the latch is positively held in the projected position by an automatic mechanism which is depressed against the strike plate (see Fig. 12).

Strike: The strike is the portion of the jamb where a metal plate has been placed to receive the deadbolt and/or the latch (see Fig. 5).

Stopworks: Stopworks consist of two buttons located under the latch. Pressing the top button in allows the doorknob to turn freely and operate the latch, from both inside and out. Pressing the lower button in allows the inside doorknob to operate the latch, but "freezes" the outside doorknob.

Throw: The throw of a lock is the length (in inches) that the deadbolt extends beyond the face of the lock.

Primary locks Primary locks operate in conjunction with the latch. There are two major types: mortise locks and cylindrical or bore-in tubular locks (commonly called key-in-the-knob locks).

Mortise locks (see Fig. 13) are more common than key-in-the-knob locks and will provide good security. All mortise locks with latches should contain a deadbolt with at least a 1-inch throw constructed of case-hardened steel, brass or zinc alloy or bronze. Federal FF-H 103a heavy-duty series 88 mortise locks or 185 latch and 198K modified deadbolts are recommended. The deadbolt and latch should be key-operated from the exterior and operated from the inside by a device not requiring a key.

Mortise locks with latches used in residences should not contain an automatic spring latch with stopworks. Although stopworks prevent a bolt from being turned, they leave the premises open to easy entry because they do not prevent the latch from being pushed back. An intruder need only insert a credit card into the strike area, push back the spring latch, and open the door (called "loiding" or "shimming" the lock). In locks without stopworks, the deadbolt (which cannot be loided) must be thrown by the key of the resident. Eliminating the stopworks prevents the resident from relying on the stopwork and latch mechanism alone.

Key-in-the-knob locks (see Fig. 14) are less secure than mortise locks. Although inex-

pensive due to easy installation, key-in-the-knob locks can be easily gripped by a tool and twisted until they break. A key-in-the-knob lock can include a deadbolt, at a comparable to slightly higher price than a mortise lock.

Secondary locks A secondary lock (rim lock) operates independently of the latch. "Secondary" is perhaps a poor name, since this type of lock is essential for good security. Secondary locks are usually mounted above the primary lock at shoulder level. They are operated by a key from the outside, and by a turnbolt from the inside. Both mortise and secondary locks may require keys to open them from inside and outside—useful where access to premises may be gained through a small opening other than the door (window transom), since this will prevent the thief from using the door to remove large objects or to escape.

There are three major types of secondary locks: spring bolt, horizontal deadlock, and vertical deadlock. The spring bolt lock operates much the same as the primary door latch. Because the bolt must be spring loaded and beveled to allow automatic latching, the bolt can be easily opened. A button (slide stop) may be set to deadlock the bolt. However, the button must be set from the inside and can only be used when another means of egress is available. The spring bolt is not recommended as a secondary lock (see Fig. 15).

Horizontal bolt rim locks operate much the same as deadbolts on primary locks. While horizontal deadbolts afford much better protection than spring bolts, they still can be easily overcome. By inserting a crowbar between the door and the jamb, the intruder can pry them apart to release the bolt from the strike. For this reason, the longer the throw of the deadbolt, the greater protection it affords. However, throws of over 1½ inches may have excessive cantilever. The recommended minimum throw is 1 inch (see Fig. 16).

Vertical bolt deadlocks should be used as secondary locks wherever possible. These utilize two deadbolts that fit vertically into eyeholes or sockets attached to the jambs. This creates a firm bond between the door and the jamb. The vertical bolt deadlock made by Segal is highly recommended, both for its pressed-steel construction and for its ability to hold up under heavy use (see Fig. 17). For additional security, a pick-resistant cylinder should be installed in a good vertical deadbolt body. This combination provides excellent security.
Specialties

SECURITY
Doors and Hardware

Fig. 14. Key-in-knob lock.

Fig. 15. Spring bolt.

Fig. 16. Horizontal bolt.

Fig. 17. Vertical bolt.

Fig. 18. Buttress door lock.

Fig. 19. "Magic Eye" lock with thumb turn.

Fig. 20. Buttress door lock with deadbolt.
The locks discussed so far rely on the rigidity of an existing door frame to resist attacks on the lock. Since older buildings may contain weak door frames, a buttress-type door lock is advisable. Locks of this type include a bar set against a plate on the door and into a receptacle in the floor, thus forming a triangular buttress (see Fig. 18). Most of these locks can be operated only by a key from the outside. The Magic Eye Company buttress lock can be operated from the outside by a key and from the inside by a turnbolt to prevent accidental locking (see Fig. 19). One model contains a heavy-duty deadbolt as well as the buttress bar and affords still further protection (see Fig. 20).

The double-bar lock may also be used to increase the strength of a door by means of two steel bars that extend up to 2 1/2 inches into each side of the jamb (see Fig. 21). The cylinder is protected on the outside by an escutcheon plate to prevent forcible removal. A pick-resistant cylinder can be installed for added protection. The Fox Police Lock and the Fitchet Locking Bar are examples of high-quality double-bar locks.

**Cylinders** Regardless of the type of lock purchased, the cylinder is critical in providing protection. It must withstand efforts by sophisticated criminals such as lock pick experts.

The cylinder is the part of the lock into which the key is inserted. The most common type of cylinder is the pin tumbler which operates as follows: As the key is inserted, spring-loaded pins are raised to the proper position to allow the barrel and the key to turn; the turning causes the bolt or latch (or both) to move. If the wrong key is used, the pins will line up incorrectly and prevent the barrel from turning (see Fig. 22).

Recently, cylinders have become available which utilize special keyways and keys to make the cylinder pick proof or pick resistant (see Fig. 23). Medeco, Illinois Duo, Sargent, Kaso, Eagle Three Star, Mela, Fitchet, and Miracle Magnetic are highly pick resistant. Such cylinders provide improved security, but may require registered keys that can be duplicated only at the factory upon receipt of a signed request. A compromise is the use of a key type whose blank is not available normally but for which spare blanks are kept for replacements.

Of all cylinders on the market, Medeco has proven most difficult to overcome. Medeco utilizes twisting tumblers operated by a key with angular or criss-cross cuts. Only if the proper key is inserted will the pins twist the exact amount needed to allow the barrel to turn.

If special keyway cylinders are deemed unnecessarily secure or costly (Medeco cylinders cost about two times the next adequate), the cylinder used should be of solid bar-stock bronze and machined for a tight fit. The cylinders of a master-key system of locks are constructed so that individual keys fit only one lock, but a single master key can open all locks in the system. Use of a master-key system makes maintenance and other authorized access simpler; but the dangers of improper use of a lost or stolen master key far outweigh the benefits.

From a security standpoint, a cylinder should have at least six pins. This often results in the cylinder being longer than the
thickess of the door, in mortise locks (which are recessed into doors), a six-pin cylinder often extends slightly beyond the surface of the door, thus making it susceptible to forcible removal by use of a gripping tool. To prevent use of such a tool, protruding cylinders should be protected by one of the following:

*Spinner ring:* A hardened steel ring that forms a collar around the cylinder and which spins freely around the cylinder when gripped (see Fig. 24).

*Bevelled ring cylinder guard:* A case-hardened steel ring that prevents the cylinder from being gripped by a tool because of its bevelled shape (see Fig. 25). Scotsman makes a flat, very secure, cylinder guard ring.

*Escutcheon plate:* A metal plate mounted to the door, which covers all of the cylinder except the core (the part where the key is inserted), thus protecting the cylinder from attack. The escutcheon plate should be constructed of malleable cast iron and attached to the door with one-way screws. Machine bolts should not be used to mount escutcheon plates on mortise locks, as the increased pressure can have an adverse effect on the mechanism (see Fig. 26).

**Sliding Doors**

Sliding doors opening onto a ground-level patio or accessible balcony (on the first floor or top floor, or adjacent to other balconies) should be constructed so the movable section of the door slides on the inside of the fixed portion. Sliding doors should be break resistant (plate glass) and equipped with a vertical-bolt Segal lock (see Fig. 27), which uses a hook-type bolt to grip door and frame together, or a Loxem Sli-door lock that hoods at top and bottom (see Fig. 26).
Doors with Large Glass Panels

Exterior doors containing panes of glass are not recommended for security. French doors that open out should have hinges with nonremovable pins. The vertical stile incorporating the lock should withstand a concentrated horizontal load of 300 pounds. The doors should contain a mortise-type lock that is key operated from the inside and outside. The lock should contain a pin-tumbler cylinder with at least six pins (a pick-resistant cylinder can be used for extra protection).

Even when fitted with key-operated locks inside and outside, doors with large panes of glass are a security problem. Use of break-resistant glass substitutes is one modification. Bars or metal grilles, while providing good security, may be aesthetically unacceptable. Alarms may also be used on these vulnerable doors.

Double Doors

On double doors, the active leaf should be equipped with a mortise-type lock. The inactive leaf should be equipped with flush bolts with at least a ¾-inch throw at head and foot (see Fig. 24).

Private Garage Doors

Many rolling overhead doors operated by electric motors offer adequate security because the motors are controlled by a key switch inside the garage or by a low-power radio transmitter. Manually operated doors should be provided with slide bolts on the bottom bar (see Fig. 30). Chair-operated doors should be provided with a cast-iron keeper and pin for securing the hardened-steel chain.

Door Interviewers

Interviewers are devices installed on an opaque door to allow residents to see and hear who is outside the door without opening it.
glass has a thin, hardening coating and, while no stronger than plate glass, will not cut someone who breaks it.

Several companies have developed unbreakable, transparent polycarbonate materials which look like glass but are very difficult to break. GE's Lexan, for example, is guaranteed unbreakable. It costs two to three times as much as glass and has low resistance to scratching. An improved material, Lexan MR-4000, is slightly more expensive but is much less easily scratched. These polycarbonate materials have not yet been extensively used for private dwellings.

Another type of durable "glass" is fabricated much like the safety glass used in automobiles: two layers of high-quality glass are bonded together with a layer of tough vinyl between. This is sold by one company as Secur-lite. While Secur-lite can eventually be broken, the noise and trouble required to do so are considerable deterrents.

Oversized glazed areas should be avoided. Anything beyond standard size (6 feet by 8 feet for glass, for example) is expensive and may be difficult to obtain.

The only reliable devices are those with a key-operated locking mechanism. Yale and Ideal Security manufacture a window lock which is a modification of the pin-type lock. It can be locked in either of two positions, one of which allows the window to be open slightly at the bottom for ventilation (see Fig. 38). Fox makes a window lock combining a pin-type lock and a hasp and padlock. Although somewhat unsightly, it provides excellent protection. Ideal Security manufactures a modification of the crescent sash lock which requires a key to operate.

All of these devices provide adequate security for normal residential use. A set of keys should be convenient to the window for use in emergencies but far enough away so that a burglar cannot reach them.
glass has a thin, hardening coating and, while no stronger than plate glass, will not cut someone who breaks it.

Several companies have developed unbreakable, transparent polycarbonate materials which look like glass but are very difficult to break. GE's Lexan, for example, is guaranteed unbreakable. GE's Lexan, for example, is guaranteed unbreakable. It costs two to three times as much as glass and has low resistance to scratching. An improved material, Lexan MR-4000, is slightly more expensive but is much less easily scratched. These polycarbonate materials have not yet been extensively used for private dwellings.

Another type of durable "glass" is fabricated much like the safety glass used in automobiles: two layers of high-quality glass are bonded together with a layer of tough vinyl between. This is sold by one company as Secur-lite. While Secur-lite can eventually be broken, the noise and trouble required to do so are considerable deterrents.

Oversized glazed areas should be avoided. Anything beyond standard size (6 feet by 8 feet for glass, for example) is expensive and may be difficult to obtain.

The only reliable devices are those with a key-operated locking mechanism. Yale and Ideal Security manufacture a window lock which is a modification of the pin-type lock; it can be locked in either of two positions, one of which allows the window to be open slightly at the bottom for ventilation (see Fig. 38). Fox makes a window lock combining a pin-type lock and a hasp and padlock. Although somewhat unsightly, it provides excellent protection. Ideal Security manufactures a modification of the crescent sash lock which requires a key to operate.

All of these devices provide adequate security for normal residential use. A set of keys should be convenient to the window for use in emergencies but far enough away so that a burglar cannot reach them.
Window Bars, Grilles, and Gates

Where tighter security is desired, metal bars, grilles, and gates have proven most reliable. If a wire mesh grille is used, the metal should be at least one-eighth of an inch in diameter and the openings should not exceed 2 inches (see Figs. 39 and 40). The grille should be attached to the window frame with machine or roundhead bolts which cannot be removed from the outside.

If bars are used, they should be placed not more than 6 inches apart. The bars should have a diameter of at least three-quarters of an inch and be set at least 3 inches into the masonry.

Sliding gates afford excellent protection and can be pushed aside or opened for emergency exit. The gates should be set in tracks on the top and bottom to prevent them from being pulled or pried away from the window (see Fig. 41). Protect-A-Guard gates are highly recommended for residential and commercial use.

All of these devices should be installed inside the window for maximum security.

Skylights

The best protection for skylights is installation of metal bars, grilles, or mesh. Bars should be made of steel not less than three quarters of an inch in diameter and should be placed not more than 6 inches apart (see Fig. 42). If mesh is used, it should be at least one-eighth of an inch thick and the spaces should not be greater than 2 inches. Mesh should be secured firmly by machine or roundhead bolts that cannot be removed from the outside.

If metal is undesirable, a securely fastened hasp and padlock will discourage entry and exit through the roof, if the glass is not removed.

Both hook-in-eye and sliding-bolt devices are unacceptable security measures for skylights.
MULTIFAMILY DWELLINGS

Lobby Doors and Walls

All lobby entrance doors should provide maximum visibility of the lobby. This often requires large glass areas in the lobby doors. Where there is a high degree of vandalism and crime, use of Lexan is recommended. In all cases, oversized glass sheets should be avoided. Glazed areas should be divided so that sheets larger than 6 by 8 feet are not needed. The doorframe should be constructed of rugged, heavy-duty metal. The vertical jamb incorporating the lock should withstand a concentrated load of 500 pounds and be a minimum of 5 inches thick so that it can receive heavy-duty mortise lock sets.

The main outer lobby door should have a key-operated lock with a pin-tumbler cylinder containing at least six pins. The key for this lock should not open any other door (such as an apartment door) so that the lobby-door cylinder susceptible to picking. An antifriction latch (see Fig. 43) and a sturdy door closer should be used in conjunction with the lock.

Lobby doors, especially if locked or equipped with intercoms, should open out for fire safety and to reduce vandalism (tenants who have misplaced their keys can kick an in-swinging door hard enough to break the locking mechanism).

Secondary Exits

In multifamily dwellings, exit doors leading to fire stairwells on each landing should have self-locking deadlatches to allow free egress while prohibiting entry. The stairside surface of the door should be free of hardware to prevent access to one floor from another via the stairwell. Hardware should limit access to the roof or ground-floor exits via the stairwell.

Panic hardware, if required, should be in the form of vertical-bolt latches on the top and bottom of the door. This hardware makes the door more sturdy and makes entry from the outside difficult (see Fig. 44).

Doors leading into the buildings from garage areas should have self-locking deadlatches with a minimum throw of one-half inch that allow free egress but require a key for entry into the building. The door should be protected in the area of the strike. All exit doors should be equipped with a self-closing apparatus that can be adjusted to the desired tension.

Since fire doors are required by law to be operable from the inside, they are often a means of escape. Exit alarms (see Fig. 45) bring immediate attention to fire doors that are opened when there is no apparent fire. A panic bar or other device simultaneously opens the door and sounds a local alarm. However, effectiveness of the alarm as a security measure depends upon the speed and consistence of response to the signal.

Exit alarms on fire exits leading to roofs keep burglars from using the roof for escape or for access to top-floor apartments. However, the alarm may prove more a nuisance than a good security measure if teenage vandalism is prevalent. Telnaps often set off the alarm to harass the local official, who must respond to the signal and reset the alarm.

Elevators

In most middle-income multifamily dwellings, vandalism of elevators is relatively rare. However, in many high-crime areas and low-income housing developments, this vandalism is reaching a critical level. In New York City Housing Authority projects, vandalism to elevators and elevator equipment is responsible for almost 80 percent of elevator outages. Parts of the elevator most commonly vandalized are the hall buttons, indicator lights, hatch door glass, hatch door interlock, and buttons located inside the cab, especially the emergency and light switches.

Hall buttons are most commonly vandalized because of their accessibility. Impatient tenants push the buttons excessively and often kick or smash them in frustration. To prevent damage to the button and the electrical contacts inside, a stainless steel mushroom-type button should be used (see Fig. 46). The shape of the button prevents the contacts from being damaged by the button's being pushed too heavily against them. Another stainless steel button has been developed on the same principle, except that the button is inside the mechanism so that the button has the more familiar stoned-cone appearance.

Use of indicator lights for the lobby, the cab, and the other floors should be decided by the management. In some projects, indicator lights are so vandalized that it is easier to eliminate them. In other developments, indicator lights dampen user impatience and the result is less wear and tear on the buttons. If indicator lights are used, they should be protected by a heavy-duty plastic shield.

There are two types of elevator doors: swing and slide. This nomenclature refers to the doors on each floor; the elevator door is always a slide door. Slide doors, which are automatic, are becoming increasingly popular despite higher initial cost, because they increase protection against vandalism. Swing doors are inconvenient and more subject to vandalism (short-circuiting of door interlocks, jamming of closing mechanisms, and joyriding on top of cabs).
In many older elevators (especially the swing-door type), the hatch and cab door contain small glass windows which allow people to see inside before entering and allow passengers to see what floor they're passing. In high-crime areas, this glass has proven more dangerous than helpful. Vandals smash the glass readily, even if wire glass is used. The opening left when the glass is broken presents a very dangerous situation. Hatch door glass should be eliminated by welding or bolting a piece of metal over the opening.

Where this is prohibited by a strict building code, a variance is often granted in a high-crime area. A less desirable modification is to install a heavy steel grille over the opening and replace the glass with Lexan.

Interlocks are more commonly vandalized on swing-door elevators. Causes of damage are excessive pulling on the elevator door while the cab is at another floor and short circuiting due to water or urine damage. The latter problem can be solved by installing interlocks with hydrophilic (non-water-absorbing) contacts. When damaged, this type of interlock requires replacement of only the contact plates rather than the entire mechanism. Damage caused by excessive pulling may be alleviated by signs cautioning tenants against such pulling. Closing mechanisms (keepers) can be made to fit more securely when the bolt is in place to prevent too much play in the door. The emergency stop button presents a problem because it is often misused. The button may be activated to stop the elevator between floors to commit crimes such as mugging, rape, and drug abuse. Because every elevator has several automatic safety mechanisms that prevent it from falling freely down the shaft, the stop button is primarily a psychological comfort to passengers. Wherever possible, the stop button should be eliminated. The building code requirement for stop buttons is being challenged in New York and several other cities. If code change is unlikely, a variance should be applied for where elevator crime is common. A constant-pressure alarm switch is also somewhat better than the conventional toggle switch.
Secer Light and Kendall are among the manufacturers of elevator dome lights that are highly vandal resistant (see Fig. 47). They are constructed of durable steel and contain a shatterproof plastic plate to protect the bulb. Where use of these lights is economically prohibitive, Lexan or an equivalent should be used to protect the light bulb.

Aside from vandalism, joyriding on top of elevator cabs is becoming prevalent in high-crime areas. Injury occurs most often when children are struck by the counterweight when the cab and counterweight pass each other. In other cases, children are crushed between cabs, struck by dividing beams, or squashed under a cab in the pit.

There are numerous means of access to elevator roofs and shafts: door interlocks are jammed by using simple household tools; emergency stop switches are abused; and roof escape hatch doors are forced. Once on top, children often abuse passengers inside the cabs and interfere with normal elevator operation.

It is difficult to prevent crime by modifying elevator equipment. Restricted access to the building through the use of a buzzer-reply system, tenant patrol groups, or doormen is more likely to be effective. Closed-circuit television and audio-intercom systems mounted on elevators are other possible crime control devices.

A common device used to increase visibility in an elevator is a convex mirror placed in the upper back corner of the elevator. This allows a person to see if anyone is waiting inside the elevator before he walks into a possible assault situation (see Fig. 48).

An elevator modification that may deter crime is the up-discharge, down-collect system. When controlled in this way an elevator will only stop for a person who has selected "up" (discharge) at the ground-floor level. Passengers on the upper floor can only enter the elevator on its way down (collect). The advantage is that a person entering the elevator on the first floor can be assured that the elevator will not stop at another floor to allow a suspicious person to enter. Such a system may be inconvenient for residents—a person wishing to go from the fifth to the seventh floor would have to travel down to the ground floor and then up again. The system is far from foolproof, as criminals can operate in other ways; but the modification is inexpensive and may deter crime in buildings without security personnel.
Garage Doors and Secondary Entries

Doors to interior garages provide a means of entry that circumvents many security precautions. If access to the building is to be limited, entry through the garage door must be carefully controlled.

The most practical solution is to have a locked door which tenants can open but which automatically closes behind them, usually within 15 seconds. A large number of manufacturers provide such self-closing doors. The major variation is the means for opening the garage door. Radio-controlled devices, requiring each auto to have a transistor, are expensive and far from foolproof. If a device is stolen from one car, all the devices should be replaced (an expensive procedure). A convenient and less elaborate system has a key-operated switch mounted on the driver’s side of the garage, allowing the driver to use a key without leaving his car.

Despite these controls, the garage door should be monitored by tenants, security personnel, or electronic equipment if a building is to retain a high level of security.

A door leading directly from a parking area to the building interior must be treated the same as a main entry. Such a door will be used continually, and requires equivalent security measures.

The secondary lock recommended for storage rooms containing valuables is the Fox double-bar lock.

Mailboxes and Mailbox Rooms

Mailboxes are a major target for criminals within multifamily dwellings, particularly in low-income communities. The mail includes welfare, social security, and veterans’ checks as well as others. These checks are particularly vulnerable because they arrive on set days of the month.

The bank of mailboxes should be located in the most secure and easily surveyed space available. Some brands of mailboxes do provide security, but any mailbox can be opened in the 10 minutes required to force open the door. If there is any control of access to the building (interroom or doorman), mailboxes should be located inside the protected area.

Mailboxes may be located in a locked room. Such a room must contain a large window to make it visible from the lobby, and be lighted 24 hours a day to reduce its potential as a location for muggings and other crimes. The door to a mailbox room should have sturdy self-locking hardware. Where back-loading mailboxes (generally secure) are used, a separate mail-loading room is often provided (see Fig. 49).

The better mailboxes are constructed of 16-gauge metal. The doors are tightly fitted and without holes to prevent prying them open and to prevent matches from being dropped in. The metal may be corrugated for additional strength. Cylinder locks, with at least five pins should be used. Door size should be kept to a minimum to further limit the possibility of prying doors open (see Fig. 50). American and Gortz manufacture such mailboxes.
LIGHTING

Good lighting in a residential development permits adequate visibility and surveillance. Generally, the higher the lighting level, the better the security. An appropriate level of lighting should be provided in each area; the light should be without excessive glare and generate no heavy shadows; and lighting should be resistant to vandalism and easy to maintain.

Fluorescent lamps are tubular glass lights that require special current-control devices called ballasts. Operating costs of fluorescent lamps are significantly lower than for incandescent bulbs: fluorescent tubes typically produce 3 to 4 times as much light per watt and operate 7 to 10 times longer than incandescent bulbs (due in part to lower operating temperatures).

Interior Lighting
Lobbies, elevators, stairwells, and corridors must be well lit. Interior lighting normally requires only conventional incandescent bulbs, but low-glare or "frosted" incandescent or fluorescent luminaries are preferable. Low wattages of 25 to 200 watts generally suffice. It is usually desirable to install low-wattage fixtures at close intervals to minimize shadows and glare.

The most common problem of interior lighting is vandalism. Naked bulbs provide maximum illumination at minimal installation cost, but they are so often and so easily broken that maintenance costs are very high, and crime is encouraged by lack of lights. Recessed lighting suffers less from accidental breakage and vandalism. Transparent bulb protectors allow nearly total passage of light, but since the bulb can be seen, a vandals will likely try to break it. Translucent bulb covers are therefore preferable, even though some of the light is blocked by the cover.

Secor and Kendall have developed fixtures that are vandal resistant. They are made of plastic and come in a variety of shapes and sizes.

Exterior Lighting
All heavily used spaces such as paths, entries, and parking areas should be lit by 5- to 10-foot candles. Higher fixture locations have a variety of advantages. As a general rule, the useful ground coverage of an elevated light fixture is roughly twice the height of the fixture. Thus, a 150-watt incandescent lamp mounted 8 feet above the ground can provide adequate light for 16 feet along a walk. Higher luminaries are safer from vandalism. However, lighting fixtures mounted higher than the second floor may create a feeling of being in a "compound."

A variety of specialized, high-intensity light sources can illuminate large outdoor areas such as recreation facilities and parking lots. Mercury-vapor and sodium-vapor lamps are available in sizes up to 1500 watts; the eerie bluish light of early mercury-vapor lamps may be avoided by selecting one of the newer "color-corrected" models. Once again, the point is to provide an appropriate level of light without creating glare or shadows.

Lamp and fixture breakage can be controlled in part by installing fixtures of tough, break-resistant plastic. The spherical, white glass fixtures so common today are less vulnerable, though not as tough as the more expensive plastic models.

A final comment on lighting is specifically relevant to a building or residential development inhabited primarily by the elderly. The pupil in the human eye gradually decreases in size due to advancing age. As a result, about twice as much actual brightness is required to create the same degree of brightness on the retina of a 60-year-old as on the retina of a 20-year-old (the ratio reaches 3 by age 75). Therefore, lighting levels in residences for the elderly should be well in excess of conventional standards and much higher than what seems adequate to a (younger) management staff.
Electronic security equipment includes alarms designed to detect unauthorized entrance; closed-circuit television systems, apartment-lobby intercom locks, and various audio equipment. While the initial cost of many of these systems is high, each could reasonably be installed in moderate-income residential complexes and could prevent future need for more costly measures.

ALARMS

An alarm performs two functions: it detects the presence of an intruder, and it reports the intrusion. The quality of an alarm mechanism is measured by its ability to perform these two functions.

A wide range of devices detect intrusion of a criminal into a building. These fall roughly into two categories: contact devices and motion-detection devices.

Contact Devices

Contact devices are mechanical switches that detect movement or perhaps the breakage of glass. A common type consists of a contact on the door (or window) and a contact on the frame. When the door is closed, the two contacts form part of an electrical circuit. When the door is opened, the contact is broken, the circuit is opened, and the alarm circuit is activated (see Fig. 51). A similar device, called a string-pull alarm, employs a slight variation in that the opening of the door pulls a string, which closes a switch that trips the alarm. Many contact devices are purely mechanical (as just described), while others include magnetic and mercury switches.

Usefulness of a contact depends upon its sensitivity (how much the device can be jarred without being activated) and its reliability. Most situations call for a device sufficiently sensitive that a skilled burglar cannot enter without setting off the alarm, but not so delicate that an innocent jostling will disturb it.

Foil strips are a related mechanism used primarily to detect breakage of glass in windows and doors. A delicate strip of metal foil is glued or taped to the glass. The foil strip acts as one long, continuous electrical circuit. If the glass is broken, the foil is broken, which interrupts the circuit and activates the alarm.

Foil can be circumvented if it is possible to break the glass or release a lock without breaking the foil. Primarily because of their unattractiveness, foil strips are seldom installed in residences.

Contact devices can be made part of a lock mechanism (see Fig. 52). This type of alarm is set off whenever an attempt is made to force or pick the lock.

Contact devices themselves are very inexpensive; a simple magnetic contact pair costs about $2. But each contact device can protect only one opening; therefore, even a single-family house requires several devices to protect all points of entry. In addition, it is often expensive to install the alarms and connect them to an alarm-reporting device.

Contacts may be hidden so criminals cannot locate and dismantle them easily. Hiding an alarm system lessens its value as a deterrent, but increases the criminal’s chances of being apprehended while com-

Fig. 51 Contact switch on door.

Fig. 52 Lock alarm.

Fig. 53 Ultrasonic detector.
mitting a crime. Since deterrence is the primary goal of residential security efforts, it is quite common to advertise the existence of an alarm without revealing the location of the mechanisms. This advertising is sometimes done where no alarm system exists. Considering the minimal expense involved in such a ruse, it may be worth the cost, but even very unsophisticated criminals can pick out such fake systems.

Heat-sensitive devices are sometimes combined with contact switches to provide an inexpensive fire-security alarm system.

**Motion-Detection Devices**

These devices detect the motion of an intruder as he moves about the protected space. This detection can be accomplished in a variety of ways. Seismographic devices are turned on by vibrations or weight upon the floor; these devices have been perfected so they are not triggered by a passing truck. Photoelectric cells ("seeing-eye" mechanisms) use a beam of light to detect any motion across a protected span. Ultrasonic devices instead send sound waves through a room (see Fig. 53). Movement by an intruder changes the pattern of reflected sound waves and thus triggers an alarm. Increased sensitivity improves the effectiveness of each of these systems, but also raises their costs.

Motion detectors are far more expensive than contact devices, but one motion device can protect an entire area, regardless of the number of points of entry. Installation costs are often minimal, as the detection device need not be connected to any part of the structure. Motion detectors are most useful in spaces not used during scheduled periods of time, such as in commercial establishments which are totally empty at night and in homes left empty during vacation. More expensive motion-detection devices can protect limited areas, such as a single door or window.

**Alarm Reporting Systems**

The term "alarm-reporting system" describes the mechanism that receives the message of an intrusion and reacts. Essentially there are only two kinds of alarm-reporting systems: Intrusion is reported either by a loud alarm on the premises (called a local alarm) or via wires to a security force which is prepared to react when notified (called a central alarm or silent alarm).

A local alarm has a bell or buzzer connected to the intrusion device which produces a loud audio signal on the premises when the alarm is activated. This is the simplest type of alarm and can be installed readily. The deterrent effect is dependent upon the burglar's being intimidated and driven off immediately by the noise. Noise of the local alarm can also stop a crime in progress and aid in apprehension if someone responds to the alarm. Local alarms are often operated by batteries (see Fig. 54). Instead of an alarm being sounded, lights in the building can be turned on by an alarm system, or lights and alarm can both be activated.

This local system also protects people sleeping in a house by alerting them that a break-in is being attempted. Generally, keys are required to shut off local alarms.

A central alarm-reporting system sounds an alarm at a remote point usually connected to the detection device by wires (telephone lines are used in many cases). The remote point is sometimes the residence of the owner of a protected business establishment and sometimes the local police station; but generally, it is the headquarters of a private protective agency. These agencies have guards stationed at the headquarters who will respond to the alarm signal. Usefulness of the alarm system is dependent upon the speed and reliability of the response.

A local alarm signal is often activated at the same time as a central alarm, thus simultaneously frightening the criminal and alerting the authorities. If only a central alarm-reporting system is activated, the criminal is not warned that an alarm has been sent. This system (called a "silent" alarm) increases the possibility of apprehension while eliminating the possibility of driving the intruder off with noise.

A variation on this central-alarm arrangement is to utilize regular city police to respond to the central alarm. In high-income, low-density, high-burglary-risk communities, the city police allow alarms to be hooked up to the police headquarters, where the dispatcher serves as monitor. Another arrangement is for the detection device to trigger a tape-recorded message that is automatically telephoned to the police, telling them the location of a burglary in progress.

The single major problem of all alarm systems is the possibility of false alarms. They can be caused by defects in the intrusion-detection device or the reporting system. False alarms diminish the credibility of the entire system.

If neighbors experience repeated false alarms, if security guards are called out unnecessarily, or if police are accidentally telephoned a tape-recorded message, response by all of these persons slows dramatically and will eventually cease. Thus, the intrusion device must be designed so that it is not accidentally activated by noncriminal occurrences.

Related to the false alarm issue is the question of how an alarm is turned off. The most common method is for the alarm to operate after a 20-second delay; that is, the alarm will not sound for 20 seconds after a contact is broken or motion detected, allowing the resident a brief period in which to switch off the entire system. The switch can be simply a button located in a hidden place. A key-operated switch is more secure, but the possibility of false alarms increases because residents often forget or cannot locate their keys. However, the turnoff mechanism should not be so simple or accessible that the criminal can activate it.

**Selecting Alarm Systems**

The security alarm business is large and complex. It is therefore impossible to specify manufacturers or even types of alarm systems for general use. The quality of installation and the maintenance program that backs up the system are crucial elements that should outweigh initial price in the selection of equipment. The best advice is to deal with firms that have a verifiable history of quality installation, a reliable guarantee/warranty record, and an established repair and maintenance program.

The concept of a consistent "level of security" avoids excessive expenditures for one piece of equipment while other means of entry are unprotected. Equipment characteristics should fit specific installation situations. It is often difficult to install contact switches in older houses because window frames often have warped or buckled. String-pull devices have to be set from the inside and therefore cannot be used for a normal exit door.

Selection of alarm equipment should be based on specific system characteristics desired: Is deterrence of crime or apprehension of criminals the primary goal? Should the system be visible to deter attempted burglary, or should it be hidden to increase the likelihood of apprehending a burglar?

**CLOSED-CIRCUIT TELEVISION**

When used in residential settings, closed-circuit television (CCTV) is intended to provide "electronic windows"; that is, a visual surveillance where physical design has obviated needed surveillance. The purpose is to create an environment in which residents know that normal restraints of surveillance by citizens and their authorized agents exist, albeit aided by electronics. While initially costly, CCTV often reduces security personnel requirements or obviates the need for expensive redesign of existing structures.
Electronically aided surveillance is not equal to personal surveillance. A corrective response to a detected crime is obviously a step further away if the viewer sees the crime on a TV receiver rather than on the spot. The deterent of having a policeman or other person on hand is lost. There is also the possibility of equipment malfunction. But CCTV has a quality of its own: being watched while unable to ascertain who, if anyone, is doing the watching is somehow unnerving, and definitely is a deterrent. A remotely controlled surveillance camera can be fitted with an automatic panning device so that the camera swings from side to side continuously, even when no one is monitoring the system.

**CCTV System Requirements**

In general, a CCTV system should perform at approximately the same level as commercial broadcast receivers. Specific equipment and the quality of image needed are determined by the nature of the area under surveillance, schedules of operation, makeup of the monitoring staff and their expected responses to emergencies, and use of special equipment.

American and foreign manufacturers have TV cameras suitable for security work. All equipment should meet the standards of the Electronic Industries Association for CCTV. Service and maintenance are generally more difficult and expensive than installation; therefore, the capability and reputation of a local supplier is crucial. City police or traffic departments often have had experience with manufacturers, suppliers, and maintenance operations. To encourage reliance on the system by users, and to prevent criminals from taking advantage of a lapse, the CCTV system should break down as infrequently as possible and be repaired quickly in the event of a breakdown.

Picture resolution depends primarily on camera quality and lighting levels: Higher lighting levels permit the use of less sensitive, less expensive cameras. The entire system should operate uninterrupted. This requires electronically stable equipment, meaning, for example, that a camera should be required to constantly adjust the lens of the camera.

It is difficult to project costs of CCTV systems because of the variety of system sizes and configurations and the range of equipment costs. Camera prices start as low as $200, but more sophisticated models, such as those sensitive to very low light levels, cost up to $10,000 each. Complicated accessories including zoom lenses, remote pan (side-to-side movement) and til (up-and-down movement) mechanisms, and low-light equipment can increase installation and maintenance costs tremendously. The cost of camera equipment alone can be lower than the cost of a conventional television receiver, but more specialized and sensitive equipment is far more expensive.

**Camera Locations**

Locations of a CCTV camera and the light level at that point are key cost-effectiveness factors. A camera's location defines the area to be observed by the camera, and the nature of its illumination greatly influences the camera's vulnerability to theft and vandalism.

Available lighting dictates the type of camera needed to produce a final image of adequate quality. Of course, supplemental lighting may be provided at additional cost. The camera must be able to view an area that is significant in terms of crime control. Wide-angle or other special lenses should be avoided by choosing a different camera location. Most importantly, the camera itself must be protected from theft and vandalism. This means that the body and lens of the camera should be in an inaccessible place. A mirror is often used to reflect the image into the lens, so that the expensive lens will not be broken by pointed instruments, thrown objects, or bullies (see Fig. 55). All interior cameras should be placed inside sturdy housings which are installed with tamper-proof connectors. Cameras must be accessible for maintenance and repair, however.

A number of locations meet all of these requirements. An elevator in a high-rise building is often protected by CCTV. The camera is generally mounted on the outside of the elevator cab wall so that the image passes via a mirror in a corner of the elevator to the protected lens. In case of camera failure, the elevator must be stopped so that the camera maintenance man can step onto the top of the cab and reach over the side to repair the unit. This is not overly inconvenient for repairmen, but it does make access to the camera more difficult for a potential thief.

Building lobbies are another common location of interior cameras. Lobby cameras are commonly hung from the ceiling or recessed into the ceiling. The elevated locations require that the repairmen use a ladder. Use of a ladder, however, would make a thief very conspicuous.

Outdoor locations usually depend upon inaccessibility to protect equipment from theft and vandalism. Cameras are located atop steel poles or on poles extending from roofs or walls. An alternative is to place the camera in a wall or window of an accessible apartment.

**Lighting for CCTV Systems**

Lighting plays a key role in the cost and effectiveness of a CCTV system. For camera locations inside buildings, it is almost always less expensive to raise the light levels than to use low-light-level equipment. The required lighting level is only slightly higher than normal for building interiors, can be achieved without glare, and has an intrinsic value as a crime deterrent.

Exterior lighting can be very expensive. Cameras used outdoors are almost always more flexible and sensitive, being capable of adapting to full sun, cloudiness, and dusk. As indicated earlier, camera costs rise dramatically for low-light-level equipment. While increasing of lighting levels is also expensive, well-designed extra lighting again has an intrinsic value as a crime deterrent.

**Monitoring of CCTV Systems**

Effectiveness of CCTV depends on the nature and quality of monitoring. Many people may be used as monitors: city police, project security personnel, members of organized tenant patrols, tenants acting as individuals, and various combinations of these groups. The choice depends principally upon availability of personnel and their monitoring costs.

City police will monitor CCTV systems only if they believe it is the most efficient use of manpower. Police use of CCTV systems is generally limited to shopping districts and city-center areas. Police normally monitor large systems that include several cameras (each equipped with pan, tilt, and zoom capability) and a monitoring console, so that the viewer can watch activity in several places at once and adjust his equipment to concentrate on a particular place, incident, or individual.

Commercial and industrial facilities often hire private security personnel to monitor CCTV systems. Guards are used less frequently in residential complexes. The major advantage of use of guards is that a single guard can control several entrances to a building or complex of buildings. Usually the guard can see all entrance doors, the lobby, and the elevator interiors on the monitor screens. He can be given audio contact with the lobby area. With the use of an intercom...
system, he can also control garage and front door entrances. He can also be given the ability to stop the elevator in midflight. Thus the security guard can see and hear every person entering the premises; he can prevent them from entering; and he can even exert some control after they enter.

It is also possible to staff a monitoring panel with members of tenant patrols. Use of volunteer personnel eliminates payment of guard salaries. Because they are personally acquainted with the project residents, tenant monitors can easily pick out strangers and perhaps distinguish a minor argument among friends from an impending flight.

But, there are serious drawbacks in using tenant monitors. It is difficult to guarantee the performance of unpaid people. The novelty of working with TV monitors will wear off quickly, and declining interest increases the likelihood of patrol members simply not showing up. Additionally, tenant patrol members are not equipped or empowered to take much action. The tenant monitoring the CCTV has no real authority over police or security personnel. Finally, there is the problem of tenant patrol members using their position to harass or intimidate other tenants.

An alternative is in-apartment tenant monitoring. Tenants of a building or housing project can monitor CCTV on their home TV screens. By connecting CCTV equipment to a master antenna within a building, tenants can have the option of tuning into unused TV channels to monitor lobby, elevator, playground, or parking lot activity. Tenants may watch CCTV when they are expecting someone to arrive, or when a child is playing within viewing range of a camera in a playground area. Older people may watch for less specific reasons. Obviously, this does not assure continuous monitoring, but if one or more of 200 tenants is watching, it would be risky for intruders to take chances.

An in-apartment tenant monitoring system requires that a cable TV or master antenna system be in operation in the building. CCTV is clearly most suited to large, high-rise dwellings. Picture quality of the CCTV systems should be comparable to that of commercial broadcasting to promote tenant usage. While some picture disintegration may be acceptable in a conventionally monitored CCTV system, there should be no distortion in a system designed for in-apartment monitoring. It is desirable (and generally not expensive) to install a microphone system so that sound accompanies the TV picture, which makes the system more interesting and enjoyable.

It is possible to organize a voluntary in-apartment monitoring program to improve coverage. A tenant organization could arrange for persons to watch CCTV in their homes during specified hours. Such a scheduled system would promote better coverage and facilitate participation because there would be no requirement that residents leave their apartments.

Also, CCTV monitors should be placed where responsible individuals, such as management staff and patroling guards, are at work or pass by continually.

**INTERCOM SYSTEMS**

Most urban multifamily dwellings are equipped with buzzer-reply systems to limit access to the building to tenants and to people who have been interviewed by tenants on an intercom system. A typical buzzer-reply intercom system in an apartment building functions as follows: A panel located outside the lobby entrance door lists the names and apartment numbers of all tenants in the building. Next to each tenant’s name is a call button that when pressed rings a bell or buzzer within that tenant’s apartment. The tenant responds to the call by walking to a panel mounted on the wall of his apartment and speaking via an intercom system to the person outside the door. When identification is satisfactorily established, the tenant pushes a button on the panel which momentarily allows the entrance door to be opened without a key. Because the costs involved in installing wiring for such a system in an existing building are very high, buzzer-reply systems should be installed in all new buildings during the construction phase.

A modified version of the traditional buzzer-reply system has recently come into use. Local telephone companies install and service front-door intercom systems that use existing telephone wires instead of a separately wired system. The panel mounted outside the lobby door differs from a conventional panel in that it is supplied with a telephone receiver, and the list of residents has a three-digit number next to each name.

A person wishing to enter the building dials the appropriate three-digit number, which makes the phone of the tenant buzz (not ring). The tenant then speaks with the person over the phone. If recognition is established, the tenant dials “4” to open the front door. If a tenant is speaking on the phone when the buzzer sounds, he can depress the receiver once, speak to the person in the lobby, buzz him in by dialing “4,” and then depress the receiver again to return to his initial telephone conversation. For tenants without telephones, a special unit that can be used only for the intercom can be installed. Fees for installation and service are billed by the phone company and added to the tenants’ monthly rent.

**ELEVATOR AUDIO SYSTEMS**

Use of audio systems in elevators is rapidly increasing. An elevator audio system is an uncomplicated sound-transmission installation consisting of a microphone and speaker located in the elevator cab and connected to similar devices near the elevator doors on each floor. The system allows someone inside the elevator to speak to anyone standing in the elevator waiting area, and vice versa. In office buildings or high-income residential buildings, an additional connection is made so that a doorman, guard, or maintenance man can respond to persons inside the elevator. In low-income housing, the equipment in the cab is simply connected to the elevator on each floor.

Some systems are designed to remain on all the times, but most require the person in the cab to push a button before he can talk to the outside location. A continuous voice relay system reassures the elevator rider that he can communicate with the outside if any trouble arises; whereas the need to push a button limits the usefulness of a noncontinuous audio system in crime situations. Any elevator audio device is useful when breakdowns occur and someone is trapped inside the cab.
Specialties

COLOR THEORY

Primary colors The longest extended slices on the color wheel (Fig. 1) show the three primary colors—red, yellow, and blue. They are called primary because all the other colors come from combinations of these three colors.

Secondary colors Mix any two primary colors and you get the secondary colors:
- Orange (red and yellow)
- Green (blue and yellow)
- Violet (red and blue)

Tertiary colors All of the other six colors on the wheel are called tertiary or intermediate colors. They are a mixture of the primary colors plus an adjacent secondary color. Thus:
- Yellow orange (yellow and orange)
- Yellow green (yellow and green)
- Blue green (blue and green)
- Blue violet (blue and violet)
- Red violet (red and violet)
- Red orange (red and orange)

Color has three dimensions: the hue, distinguishing one color from another—such as red, green, blue, etc.; the value, denoting lightness or darkness; and the tone or intensity, which is the brightness or dullness. These hues, values, and intensities can appear to change when different ones are used together. Two or more light values combined afford little contrast; nor will darker values in combination provide much interest. But, when a light value is used with a dark, the light appears lighter while the dark appears darker. White is the lightest of all colors, and values range from it through varying gradations of gray to black. Colors that are nearer white in value are called tints and colors that are closer to black in value are called shades.

Intensities or tones also have similar effects. A brightly upholstered chair will appear brighter and will stand out when used with a carpet of dull color, as it will produce a spot of interest. In contrast, a dull-colored piece of furniture will sink into the background if the room contains brighter-colored rugs, draperies, and other furnishings.

Contrasting or opposite hues will emphasize one another. Red with green will make the red look redder and the green appear more orange, while the red-purple will take on a bluish tone.

There are many ways of combining colors for interest. Related color schemes such as reds, purples, and blues together can produce very pleasing effects. Contrasting hues, such as blues with oranges, can also be combined to give more vibrant results.

Some people enjoy excitement. Warm colors such as yellow, orange, and red are exciting because they are associated with things like sunshine, fire, heat, and even blood. Warm colors tend to "advance," and a predominantly warm-colored wall will seem to come forward. They are especially effective in rooms that are on the east or north side of a house, because light entering from these directions tends to make the room seem cozier and warmer. Cool colors are those associated with water, verdure, and the sky—blues, greens, and violets. These tend to "recede," and under most conditions, light, cool-colored walls will create an illusion of greater space. They are good choices for rooms on the south and west side of the house, since these areas receive a lot of sunlight all year around. Theirs is a cooling effect in the warm-light areas, another complementary association.

Black, white, gray, and brown—and the tones of the latter two, known as griege and beige—are not considered to be colors so much as neutrals. In practice, they are the "no-color" colors, which are used with other colors to modify them or to contrast with them. But they are far from being negative. As you work with color, you will find that all colors are influenced by the company they keep. This is particularly true of the tints, shades, and so-called neutral colors. A juxtaposition of two must be a cool light. The warm colors of the warm-light areas, another complementary association.

Colors also have visual weights. Dark and bright appear heavy, while light or dull seem to weigh less. Remember that a dominant color is the one that "controls" a room, while the others are accents.

Basic Color-Scheme Planning

Successful decorating often depends on how well the total effect is anticipated. Here are four types of schemes that professional decorators have in mind when they start to plan a job. They are no guarantee of perfect results, but they do make an unwieldy subject easier to handle.

Monochromatic This scheme is based around one color, using it somewhere in its full intensity and then varying it with a number of shades, tints of the same color. For example, in a monochromatic scheme of yellow, the range could be from dark shades of gold, through clear yellow, to light, pale-yellow tints. A monochromatic color scheme can be restful, create a feeling of spaciousness, and provides a good background for art objects, collections or similar decorations. But generally, when employing a monochromatic color scheme, the interest of the room comes through by using a variety of textures and patterns.

Analogous or related Because it's the easiest color scheme to work with, an analogous scheme is the one that enjoys the greatest popularity at the present time. It is based on two or three colors, such as yellow, yellow orange, and red orange, that lie close to each other on the color wheel, with "relief" provided by tints and shades of the same that range from one side to the other. These paired with adjacent hues, a patch of vermillion. The analogous color scheme is restful and refreshing also, and the colors are more interesting because of their variations in intensity and value. Tertiary color scheme that is easily changed, a slight shift of emphasis here and there is all that is necessary to completely change the character of the room.

Complementary or contrasting This scheme, which is rapidly coming into favor, uses colors that are opposite each other on the color wheel—blue and orange, red and green, yellow and blue. A color is usually a primary color and the other a secondary color. Using such contrasting colors will give a lively and vibrant room, but it is a color scheme that must be used with caution. One color should always dominate, with the others being primarily dramatic accents. The "shock" impact of a complementary color scheme can be softened by selecting unexpected shades and tints of the two colors. That is, a vivid color and its complement can be quieted, if you prefer by graying them, or reduced on the saturation and brightness. In these instances, the color scheme tends to make a room seem smaller.

Accented This is a combination of adjacent, related, or analogous colors—call them what you will—accented by a bold touch of color from the opposite side of the wheel. An example would be a scheme ranging through a number of strong, soft, and grayed yellows, spiked with purple or violet.

There are also other color schemes, such as triad and split-complementary that you can adapt from the color wheel, but the four suggested above are the easiest to visualize and to carry out.

In whatever basic scheme you use, do not forget the neutrals: black, white, the grays, and browns—to which you might add metallic gold and silver. Since they will appear, of themselves, in the wood and metal of your furnishings, they must at all times be considered for the part they play in the total effect. If you wish, the neutrals can constitute a fifth, and very sophisticated, color scheme of their own! But usually they must be more or less just "accepted," and played up or played down by the other colors you combine with them. Incidentally, some black and white is an asset to almost any color scheme, but too many and indefinite neutrals, used with stronger colors, tend to compromise a color scheme and make it look confused or merely drab. It is best to think of any neutral as a distinctive note of color, whether it is the fieldstone of a fireplace or a hardwood floor.
Fig. 1  The basic wheel with a three-dimensional projection of the attributes of color—hue, value, and intensity—as shown in their relation to one another. The circular band represents the hues: G, green; B, blue; P, purple; R, red; and Y, yellow. The upright center axis is the scale of value. Paths leading from the center indicate color intensity.
Specialties
COLOR THEORY
Color Schemes and Combinations

DIRECTIONS FOR USING COLOR COMBINATION CHARTS

1. DOMINANT OR CONTROLLING COLOR

Decide on your dominant or controlling color, which may dominate by covering a large area or by strength of color in a smaller area. Decide whether your foundation or background color is to be the dominant or a secondary color. Plan to use a large amount of color background color, a small amount of bold, strong color. All large foundation areas should be in light or grayed tones.

2. GRAYING

Clear colors are gay, more cheerful, but grayed tones are more restful, their harmonies more subtle. Mixing gray with bright colors brings them into relation with other colors in the room. As . . . red and yellow in bright tones seem to clash, mixed with gray, they become more fun and go very well together. Use this principle also in buying materials. Avoid too much graying. It gives muddy tones, dirty gray, flat gray. A little gray goes far.

3. RELIEF AND CONTRAST COLORS

Decide on relief and contrast colors and bring them into all parts of the room composition. Remember the order in the amount of space allowed each one—foundation, then relief, then contrast. All colors—including background colors—should be keyed to the dominant color. Safen strong contrast colors with white. Contrast is less in lighter tints. Safen darker contrasts with gray.

4. ACCENT COLORS

Use pure bright intense colors only in accessories, etc. Distribute them so they will not be spotty. The smaller the area the brighter the color may be. The larger the area the softer the tone should be. Don’t use large amounts of pure bright color.

5. KEYING

This is another means of creating harmony. A key color is the one about which the color scheme is built—the dominant, or controlling color. All other colors in the room must be “keyed” with it—harmonized. Two colors in which any part of a third color is present will be linked together. Examples: To key red and yellow to each other, mix them both with a little of the third primary hue-blue. Violet and green will result, and these are harmonious to use with your strong tones. Remember this principle in buying as well as mixing colors. A lovely pearl or pastel object will have these tones keyed for you, and you can use them for your own composition. The sole rule is to avoid too many colors and too strong tones except in accents, etc. Most colors will “go together” if you use them.
WHAT DECORATORS MEAN WHEN THEY USE THESE COLOR TERMS

HUE: Each section in the color wheel is called a hue. To change a hue, another color (not black, white or pure gray) must be added to it. Every hue has a different wave length from every other hue. Mixed with its complement most likely produces gray.

PRIMARY COLORS: Also called "primary," and "fundamental," Primaries are the three pigment colors which cannot be produced by any mixture of other pigments. Red, blue, yellow are the primary colors.

SECONDARY COLORS: Secondary colors are the three colors which are produced by mixing two of the three primaries in equal amounts. Red + yellow = orange; red + blue = violet; yellow + blue = green.

TERTIARY COLORS: Tertaries are the colors produced by mixing a primary with a secondary, the exact shade depending upon the proportion. Red + orange produces shades such as rose, brown orange, coral, etc. Red + blue-purple—mixture, amethyst, orchid, etc. & blue-purple—heliotrope, lavender, lilac, lavender, etc. Blue + green—turquoise, aqua, bottle green, etc. Yellow + orange—maize, primrose, flame, etc. Yellow + green—apple, lime, olive, chartreuse, etc. Mixtures of complementsaries not included, because these produce shades of gray—a neutral. Some authorities consider, also, the shades produced by mixing two secondaries as tertaries, such as slate, cirtom, buff, sage, etc.

COMPLEX COLORS: Colors which are made up of more than one tinted, shade and tones. Such as rose, purple, brown, etc.

TINTS: The light tones resulting when white is mixed with a color. Much white makes a color cold.

SHADES: The dark tones resulting when black is mixed with a color. Much black deadens the color.

TONE: Each hue has many tones. By hue—neutral value—we mean the relative strength of the hue as it approaches black or white at the opposite ends of the value scale. Mixed with white, a color is "pale" in tone; mixed with black, it is "dark" in tone. The upper and lower extremes of any color would be white (or very pale gray), and black.

CHEMICAL: This term is used interchangeably with color, tone value, and intensity. The intensity of a color such as yellow is "luminous," the intensity of a color such as Nile blue is "dark." When a color fades, it loses chroma.

LUMINOUSITY: This term is used to describe a quality of warm clear colors in light-reflecting tones and flushed, such as light golden-yellow. Clear white is also luminous. Lightly "luminous" are only metals in gold, silver, platinum, or clear plastics.

COLOR AREAS AND SAMPLES

COLOR COMBINATION CHARTS

S = SECONDARY       T = TERTIARY

COLOR THEORY

Terminology and Combinations

Specialties
COLOR THEORY

Munsell System of Color

One of the best-known and widely respected systems of color standardization used in the United States today is that developed by Albert H. Munsell. He became greatly interested in the practical application of color and was disturbed by the fact that the popular names for colors did not describe them adequately for professional purposes. They are named after flowers or plants, such as violet, indigo, old rose, primrose; after fruits, such as peach, pomegranate, grape, avocado, plum; after places such as french blue, naples yellow or prussian blue; or after persons, such as Davy's gray or Hooker's green.

Essentially the system consists of an orderly arrangement of colors in the shape of a three-dimensional color solid. The system is based on a color circle of ten major hues made up of five principal hues, red, yellow, green, blue, and purple, and five intermediate hues, yellow-red, green-yellow, blue-green, purple-blue, and red-purple. Each hue is indicated by a symbol as follows:

- Red: R
- Yellow: Y
- Green: G
- Blue: B
- Purple: P
- Yellow-red: YR
- Green-yellow:GY
- Blue-green: BG
- Purple-blue: PB
- Red-purple: RP

Each of the above major hues has been given a value of 5 in the inner scale around the hue circle (see Fig. 2, hue symbols), i.e., 5 R, 5 YR, 5 Y, 5 GY, 5 G, 5 BG, 5 B, 5 PB, 5 P, and 5 RP. Between each of the major hues are values of 2.5, 10, and 7.5 for rough indication of hue. The outer scale of the hue circuit is divided into 100 segments to provide greater accuracy for indicating hue where needed.

In the Munsell color tree each hue [H] is allotted ten segments of the hue circle, making 100 hues, and these hues form the horizontal center, or equator, of the color solid. The center segment of each color is considered the true color and the remaining segments in each hue section vary according to their proximity to adjoining colors; for example, as red gets closer to yellow it contains more yellow and this is indicated by the numerical designation.

The value (V) notation denotes the lightness or darkness of a hue, which is determined by a neutral core at the center of the hue circle. The core contains ten gradations from a supposedly perfect white (one having 100 percent reflectance) at the top to 0, a perfect black (having 0 percent reflectance) at the bottom.

The chroma (C) notation indicates the saturation of the hue, or the strength of the color. The chroma scale extends outward from the central core or axis, and the increments vary from 0 at a neutral gray to as high as 16, according to the amount of saturation produced by a given hue at a given value level. Since colors vary in chroma, or saturation, some colors extend farther from the neutral axis than others, and the solid is therefore not symmetrical. Pure red, with a chroma of 14, for instance, extends farther than blue-green, with a chroma of only 6 (see Fig. 1).

A Munsell notation indicating hue, value, and chroma [HVC] might be given as follows:

- Vermilion: 5R 5/14
- Rose: 5R 6/4

With this information it is possible to describe exactly any given hue and to locate its place in the color solid. Furthermore, as Munsell stated, one can "select one familiar color, and study what others will combine with it to please the eye," by the use of three typical paths: one vertical, with rapid change of value; another lateral, with rapid change of hue; and a third, inward, through the neutral center, to seek out the opposite color field. All other paths are combined by two or three of these typical directions in the color solid.
## THE RED FAMILY

**REPRESENTATIVE MEMBERS OF THE RED FAMILY**...**FLESH-PINK**...**SHELL-PINK**...**ROSE**...**DUSTY ROSE**...**OLD ROSE**...**CARDINAL OR CRIMSON**...**RASPBERRY**...**BURGUNDY OR WINE RED**...**MAROON**...**ETC.**

**CHARACTERISTICS**...Warm, enthusiastic...Cheerful, hospitable, active...In strong tones, stimulating, bold, vital, dramatic, exciting.

**WHAT THEY CAN DO**...Make objects seem closer...Large, make rooms seem smaller by bringing background closer...Focus attention on wall or object...Bring life, brightness, warmth, to dark, dull or too-cool rooms.

**CORRECT USES**...In light limits, charming background for fairly light, large rooms...In bright tones, highly decorative when used for comparatively small areas, as in accessories, accents, etc. In darker shades, rich and warm for draperies, carpets, upholstery, especially in large rooms with heavy furniture.

**CAUTION**...Do not use too much red—especially in large, bright rooms, and in light rooms. Safer to soften a little by "graying," except when used for accent...Do not use the Red Family for background of a room that is small or crowded. Do not use bright red for large objects, unless you want to call attention to them...Do not forget when using the Red Family to include cool colors in your color scheme...It takes two cool colors, or of large area of one cool color, to balance red.

### SUGGESTED COLOR SCHEMES IN WHICH MEMBERS OF RED FAMILY PLAY A DOMINANT ROLE

<table>
<thead>
<tr>
<th>DOMINANT COLOR</th>
<th>MAJOR WALL COLOR</th>
<th>MAJOR FLOOR COLOR</th>
<th>DRAPERIES AND UPHOLSTERY</th>
<th>ACCENT COLORS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHELL-PINK</td>
<td>Shell Pink</td>
<td>Light Blue</td>
<td>Off-white background, powder-blue and shell-pink in patterns</td>
<td>Italian Red</td>
<td>Charming for bedroom. In slightly darker tones of same colors, could be adapted to living rooms, fuminate feeling.</td>
</tr>
<tr>
<td>MELOM PINK (like Baby Pink)</td>
<td>Melon Pink</td>
<td>Brown</td>
<td>Light rosy background, melon-pink with green olive in design</td>
<td>Green Olive</td>
<td>Good for living or dining room with mahogany or walnut furniture.</td>
</tr>
<tr>
<td>VENETIAN PINK</td>
<td>Venetian Pink</td>
<td>Patterned rug, soft tones, green, moire, red</td>
<td>Draperies, yellow and white stripes, Upholstery, green and dull pink stripes</td>
<td>Red</td>
<td>Good for living room with 18th Century furniture.</td>
</tr>
<tr>
<td>DUSTY PINK</td>
<td>Dusty Pink</td>
<td>Deep Brown</td>
<td>Draperies, pale amethyst (dusty pink curving), Curls and bed cover, coco and pink stripes with coco brown filtering</td>
<td>White</td>
<td>Interesting for modern bedroom with furniture in coco tones.</td>
</tr>
<tr>
<td>BOIS DE ROSE</td>
<td>Bois de Rose</td>
<td>Sage Green</td>
<td>Draperies, pale green, trimmed with bois de rose Upholstery, pale grey with silverwhite</td>
<td>Green and Silver</td>
<td>Living room color scheme with fuminate feeling.</td>
</tr>
<tr>
<td>DAWN ROSE</td>
<td>Dawn Rose</td>
<td>Dark Green</td>
<td>Neutral background, deep rose and leaf-green in pattern</td>
<td>White Leaf-green</td>
<td>Appropriate for bedroom.</td>
</tr>
<tr>
<td>LIGHT ROSE</td>
<td>Light Rose</td>
<td>Deep Blue-green</td>
<td>Draperies, dusty rose background, blue-green and foliage tones in design Upholstery, blue, blue-green and green, plaits, pattern and stripes</td>
<td>Blue</td>
<td>Suitable for fairly large room with average light.</td>
</tr>
<tr>
<td>ROSE (1)</td>
<td>Warm Gray</td>
<td>Rose Tose</td>
<td>Draperies, rose Upholstery, rose and cream stripes</td>
<td>Blue or Green</td>
<td>Appropriate for almost any living or bedroom.</td>
</tr>
<tr>
<td>ROSE (2)</td>
<td>Oyster White</td>
<td>Rose Red</td>
<td>Draperies, oyster white Upholstery, oyster white with reds, blues and green</td>
<td>Red</td>
<td>Charming for bedroom or warm room's living room.</td>
</tr>
<tr>
<td>ASHES OF ROSES</td>
<td>Ashes of Roses</td>
<td>Cafe au lait</td>
<td>White</td>
<td>Strong Blue</td>
<td>Appropriate for bedroom or living room.</td>
</tr>
<tr>
<td>DUSTY ROSE (1)</td>
<td>Deep dusty Rose</td>
<td>Brown</td>
<td>Light dusty rose, white and brown</td>
<td>Silver</td>
<td>Good color scheme for living room or dining room.</td>
</tr>
<tr>
<td>DUSTY ROSE (2)</td>
<td>Pickled wood</td>
<td>Pinkish beige</td>
<td>Draperies, dusty rose Upholstery, frosh green and natural</td>
<td>Pale Green</td>
<td>Appropriate to living room, traditional or modern.</td>
</tr>
<tr>
<td>OLD ROSE (1)</td>
<td>Old Rose</td>
<td>Warm Gray</td>
<td>Blue and pale yellow, with touch of old rose</td>
<td>Jade Green</td>
<td>This color scheme is charming and delicate, suitable for bedroom and dressing room.</td>
</tr>
<tr>
<td>OLD ROSE (2)</td>
<td>Paper, Old Rose</td>
<td>Old rose</td>
<td>Old rose and grey</td>
<td>Blue and Silver</td>
<td>With woodwork painted warm grey, this scheme would be attractive for bedroom or dressing room.</td>
</tr>
<tr>
<td>OLD ROSE (3)</td>
<td>Paper, blue and rose pattern</td>
<td>Ivory</td>
<td>Draperies, ivory background, rose, blue and green in pattern Upholstery, old rose, and drapery fabric</td>
<td>Green</td>
<td>Appropriate for formal living room.</td>
</tr>
<tr>
<td>RED (1)</td>
<td>Soft gray Green</td>
<td>Patterned rug with red background</td>
<td>Draperies, plain gray background, red in pattern Upholstery, plaits green, red and green stripes</td>
<td>Blue and Orange</td>
<td>Suitable for living room or dining room.</td>
</tr>
</tbody>
</table>

**COLOR FAMILY**...Red

"COLOR THEORY"...Specialties...Red
<table>
<thead>
<tr>
<th>Specialties: COLOR THEORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color Families: Red</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RED (1)</th>
<th>RED (2)</th>
<th>RED (4)</th>
<th>RED (5)</th>
<th>SOFT RED (1)</th>
<th>SOFT RED (2)</th>
<th>CARMINE (1)</th>
<th>CARMINE (2)</th>
<th>CHINESE RED</th>
<th>LACQUER RED (1)</th>
<th>LACQUER RED (2)</th>
<th>ITALIAN RED</th>
<th>CRANBERRY RED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good for Early American rooms, with gilding or metal trim</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
</tr>
<tr>
<td>Colored type face room or library</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
</tr>
</tbody>
</table>

Note: The table above represents a color theory chart with various color families, including Red, and details the use of these colors in different room settings and design elements.
### The Orange Family

**Representative Members of the Orange Family...** Ivory... Peach... Coral... Beige... Rust... Terra Cotta... Warm Brown... In softened tones, excellent background color for dark or cold rooms... Wonderful accent color in proper combinations.

**Characteristics...** Always warm, inviting... Cheerful, welcoming, gay, vibrant, glowing... In strong tones, able to red... In softer tones, a good mixer.

**What They Can Do...** In slightly less degree, Orange repeats the activities of the Red Family... Effective for "toning" up a room in too dull or quiet colors, or warming a cold room.

**Correct Uses...** Best in all shades, except for some... For a room that needs warming up, with cool touches... Copper... Modern color scheme appropriate for living room or library... Very good for late Colonial dining room with Duncan Phyfe style furniture... Color scheme to lighten dark bedroom... Charming for woman's bedroom... Charming for young girl's room... Charming for living room in library... Charming for dining room in Dyeastic feeling with furniture painted yellow and gold... Appropriate for living room in Early American style furniture... Good color scheme for large, formal, English-style living room, with furniture in natural oak and walnut... Appropriate for boy's room... Rusty, cheerful color scheme for library... Attractive for modern living room or dining room.

### Suggested Color Schemes in Which Members of Orange Family Play a Dominant Role

<table>
<thead>
<tr>
<th>Dominant Color</th>
<th>Major Wall Color</th>
<th>Major Floor Color</th>
<th>Draperies and Upholstery</th>
<th>Accent Colors</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ivory</td>
<td>Ivory Woodwork, Ivory</td>
<td>Floor, painted Ivory Rug, Jade Green</td>
<td>Ivory background, rose and blue green in patterns</td>
<td>Rose and Jade Green</td>
<td>Charming for bedroom or lady's sitting room with ivory painted furniture</td>
</tr>
<tr>
<td>Peach (1)</td>
<td>Peach</td>
<td>Peach</td>
<td>Apple green</td>
<td>Bittersweet</td>
<td>Attractive for bedroom, modern or traditional</td>
</tr>
<tr>
<td>Peach (2)</td>
<td>Old Green</td>
<td>Peach and upholstery, peach, with old blue</td>
<td>Old Blue</td>
<td>For a room that needs warming up, with cool touches</td>
<td></td>
</tr>
<tr>
<td>Peach (3)</td>
<td>Warm Brown</td>
<td>Draperies, brown and coral stripes</td>
<td>Upholstery, brown background, with coral, beige and tan</td>
<td>Copper</td>
<td>Modern color scheme appropriate for living room or library</td>
</tr>
<tr>
<td>Peach (4)</td>
<td>Paper, shades of yellow, through peach to brown</td>
<td>Brown</td>
<td>Draperies, brown Upholstery, light and dark peach</td>
<td>Yellow</td>
<td>Good modern living room color scheme</td>
</tr>
<tr>
<td>Peach (5)</td>
<td>Floral pattern paper, white ground, peach and green</td>
<td>Red</td>
<td>Draperies, peach Upholstery (chair seat), green</td>
<td>Green</td>
<td>Very good for late Colonial dining room with Duncan Phyfe style furniture</td>
</tr>
<tr>
<td>Peach (6)</td>
<td>Yellowish Pink</td>
<td>Eggplant</td>
<td>Draperies, peach background, blue in design Upholstery, peach and blue</td>
<td>Coral and yellow</td>
<td>Good color scheme to lighten dark bedroom</td>
</tr>
<tr>
<td>Apricot</td>
<td>Apricot</td>
<td>Rose and Green</td>
<td>Draperies, rose and white Bed and furniture covering, apricot, trimmed with black</td>
<td>Orchid</td>
<td>Charming for living room in library</td>
</tr>
<tr>
<td>Coral (1)</td>
<td>Coral Woodwork, soft blue</td>
<td>Coral Woodwork, soft blue</td>
<td>Coral colors, red and white in design, Coral Woodwork, coral</td>
<td>Coral and peach</td>
<td>Good color scheme to lighten dark bedroom</td>
</tr>
<tr>
<td>Coral (2)</td>
<td>Coral Woodwork, soft blue</td>
<td>Coral Woodwork, soft blue</td>
<td>Coral colors, red and white in design, Coral Woodwork, coral</td>
<td>Coral and peach</td>
<td>Good color scheme to lighten dark bedroom</td>
</tr>
<tr>
<td>Coral (3)</td>
<td>Coral Woodwork, soft blue</td>
<td>Coral Woodwork, soft blue</td>
<td>Coral colors, red and white in design, Coral Woodwork, coral</td>
<td>Coral and peach</td>
<td>Good color scheme to lighten dark bedroom</td>
</tr>
<tr>
<td>Warm Beige (1)</td>
<td>Warm Beige</td>
<td>Warm Beige</td>
<td>Brown and Copper</td>
<td>Bright Green</td>
<td>Modern living room or library</td>
</tr>
<tr>
<td>Warm Beige (2)</td>
<td>Warm Beige</td>
<td>Warm Beige</td>
<td>Draperies, old white and beige Upholstery, dusty pink and pale olive green</td>
<td>Terra Cotta</td>
<td>Rustic living room color scheme</td>
</tr>
<tr>
<td>Warm Beige (3)</td>
<td>Warm Beige</td>
<td>Warm Beige</td>
<td>Draperies, burgundy background, white and beige in design, Upholstery, burgundy and navy</td>
<td>White</td>
<td>Good for living room, library, or man's bedroom</td>
</tr>
<tr>
<td>Warm Beige (4)</td>
<td>Warm Beige</td>
<td>Warm Beige</td>
<td>Draperies, rust (beige gray) Upholstery, brown with tan cushions</td>
<td>Tan</td>
<td>Rustic, chintz color scheme</td>
</tr>
<tr>
<td>Warm Beige (5)</td>
<td>Warm Beige</td>
<td>Warm Beige</td>
<td>Draperies, rose with pink coat Upholstery, brown with tan stripes or checks</td>
<td>Red and white</td>
<td>Elegant living room or boy's room</td>
</tr>
<tr>
<td>Henna (1)</td>
<td>Henna</td>
<td>Henna</td>
<td>Henna, green and gray</td>
<td>Gold</td>
<td>Living room or man's bedroom</td>
</tr>
<tr>
<td>Henna (2)</td>
<td>Henna</td>
<td>Henna</td>
<td>Henna, with valance of bedspread material Bedspread, henna, light and dark green and tan stripes Upholstery, some combination in patterned material</td>
<td>Henna</td>
<td>Man's bedroom</td>
</tr>
<tr>
<td>Terra Cotta</td>
<td>Terra Cotta</td>
<td>Terra Cotta</td>
<td>Terra Cotta, pinkish yellow, trimmed with terra cotta Upholstery, blue de rose</td>
<td>Pale Green</td>
<td>Charming for dining room in Dyeastic feeling with furniture painted yellow and gold</td>
</tr>
<tr>
<td>Copper (1)</td>
<td>Copper</td>
<td>Copper</td>
<td>Copper toned background with orange, yellow and green in pattern</td>
<td>Blue and copper</td>
<td>Appropriate for living room in Early American style furniture</td>
</tr>
<tr>
<td>Copper (2)</td>
<td>Copper</td>
<td>Copper</td>
<td>Copper toned background with orange, yellow and green in pattern</td>
<td>Copper</td>
<td>Good color scheme for large, formal, English-style living room, with furniture in natural oak and walnut</td>
</tr>
<tr>
<td>Burnt Orange</td>
<td>Burnt Orange</td>
<td>Burnt Orange</td>
<td>Burnt orange and green</td>
<td>Blue</td>
<td>Good for dining room with walnut furniture</td>
</tr>
<tr>
<td>Warm Brown (1)</td>
<td>Tobacco Brown</td>
<td>Tobacco Brown</td>
<td>Citrus in yellow, beige and warm brown in design</td>
<td>White</td>
<td>Modern living room or library</td>
</tr>
<tr>
<td>Warm Brown (2)</td>
<td>Tobacco Brown</td>
<td>Tobacco Brown</td>
<td>Tobacco, copper and orange Upholstery, warm brown</td>
<td>Orange, French Blue</td>
<td>Appropriate for boy's room</td>
</tr>
<tr>
<td>Warm Brown (3)</td>
<td>Tobacco Brown</td>
<td>Tobacco Brown</td>
<td>Tobacco and apple green</td>
<td>Greenshade Blue</td>
<td>Rusty, cheerful color scheme for library</td>
</tr>
<tr>
<td>Warm Brown (4)</td>
<td>Tobacco Brown</td>
<td>Tobacco Brown</td>
<td>Shades of warm brown and orange</td>
<td>Silver</td>
<td>Attractive for modern living room or dining room</td>
</tr>
</tbody>
</table>
### THE YELLOW FAMILY

**Representative Members of the Yellow Family**... 
Cream... Buff... Straw... Canary
... Gold... Tan... Brown.
**Characteristics**... Warm, somewhat advancing... The sunlit color—gay, happy, bright, cheerful
... In light spaces, luminous, radiant.

**What They Can Do**... Diffuse and increase light by reflection, making dark rooms seem lighter and brighter.
... In pale tints, yellow tints up a small room without making it seem smaller because reflective influence of yellow balances its advancing quality as a warm color.

**Correct Uses**... Excellent background for all areas of rooms... In light tints, best wall background for poorly lighted rooms... In clear, bright tones, soft accent color almost everywhere.

**Caution**... Do not use yellow without testing under artificial light, and providing lamp shades to offset color changes... Don't use in wide expanses in a very sunny room... Don't use bright tones without neutral color combinations.

### Suggested Color Schemes in Which Members of Yellow Family Play a Dominant Role

<table>
<thead>
<tr>
<th>Dominant Color</th>
<th>Major Wall Color</th>
<th>Major Floor Color</th>
<th>Draperies and Upholstery</th>
<th>Accent Colors</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CREAM</strong></td>
<td>Cream Woodstock, cream</td>
<td>Patterned rug, mat, berry, green and cream</td>
<td>Draperies, light, cream trimmings, Upolstery, green and green yellow</td>
<td>Mulberry</td>
<td>Appropriate for bedrooms, especially in Directoire feeling with cream and gold furniture.</td>
</tr>
<tr>
<td><strong>BUFF</strong></td>
<td>Buff</td>
<td>Buff</td>
<td>Copenhagen blue and burgundy</td>
<td>Orange, Tete de Nape</td>
<td>Glowing color scheme for living room or man's bedroom.</td>
</tr>
<tr>
<td><strong>PALE YELLOW (1)</strong></td>
<td>Pale Yellow</td>
<td>Soft Beige</td>
<td>Draperies, light yellow background, soft red, green, and blue in pattern</td>
<td>Green and Red</td>
<td>Good color scheme for medium-sized dark room.</td>
</tr>
<tr>
<td><strong>PALE YELLOW (2)</strong></td>
<td>Pale Yellow</td>
<td>Pale Yellow</td>
<td>Taffeta</td>
<td>Coral</td>
<td>Colorful for bedroom or small sitting room.</td>
</tr>
<tr>
<td><strong>BRIGHT LEMON (1)</strong></td>
<td>Bright Lemon</td>
<td>Beige</td>
<td>Draperies, beige background, yellow green and lavender</td>
<td>Wet Leaf Green</td>
<td>This color scheme will brighten up a dark dining room.</td>
</tr>
<tr>
<td><strong>PALE LEMON (2)</strong></td>
<td>Pale Lemon Yellow Woodstock, white</td>
<td>Tobacco Brown</td>
<td>Draperies, white with yellow trimmings, Upolstery, soft yellow, green and white</td>
<td>Orange</td>
<td>Suitable for living room with light yellow.</td>
</tr>
<tr>
<td><strong>JONQUI LEMON (1)</strong></td>
<td>Jonquil Yellow</td>
<td>Gray</td>
<td>Draperies, white, trimmed with Chinese red</td>
<td>Chinese Red</td>
<td>Charm for living room, modern or traditional.</td>
</tr>
<tr>
<td><strong>JONQUI LEMON (2)</strong></td>
<td>Jonquil Yellow</td>
<td>Soft Blue-Green</td>
<td>Draperies, white and yellow</td>
<td>White</td>
<td>Good for any room without too much light.</td>
</tr>
<tr>
<td><strong>YELLOW (1)</strong></td>
<td>Yellow</td>
<td>Brown</td>
<td>Blue and gold</td>
<td>Black</td>
<td>Good for room with cold light.</td>
</tr>
<tr>
<td><strong>YELLOW (2)</strong></td>
<td>Yellow</td>
<td>Brown</td>
<td>Dark blue and white</td>
<td>Bright Red</td>
<td>Attractive for informal living room.</td>
</tr>
<tr>
<td><strong>YELLOW (3)</strong></td>
<td>Barometer yellow paper Woodstock, deep green</td>
<td>Deep Green</td>
<td>Draperies, green, yellow, trimmed with Chinese red, Upolstery, cream and white</td>
<td>Blue</td>
<td>Charm for dining room, especially in Directoire feeling.</td>
</tr>
<tr>
<td><strong>YELLOW (4)</strong></td>
<td>Paper in Yellow and Ivory stripes, divided by narrow plum lines</td>
<td>Yellow Tan</td>
<td>Draperies, gray background, yellow, plum and rose in pattern</td>
<td>Old Gold</td>
<td>Good combination for dark maple woodwork.</td>
</tr>
<tr>
<td><strong>GRAYED YELLOW</strong></td>
<td>Grayed Yellow</td>
<td>Brown</td>
<td>Draperies, brown and beige stripes, Upolstery, yellow, beige, moss green</td>
<td>White</td>
<td>Pleasant for living room or man's bedroom.</td>
</tr>
<tr>
<td><strong>SOFT YELLOW</strong></td>
<td>Soft Yellow</td>
<td>Deep Brown</td>
<td>Draperies, yellow</td>
<td>Chartreuse</td>
<td>Attractive and restful for library or living room.</td>
</tr>
<tr>
<td><strong>EMPIRE YELLOW</strong></td>
<td>Slate Gray</td>
<td>Lime Green</td>
<td>Draperies, Empire yellow, Upolstery, beige and green</td>
<td>Silver</td>
<td>Suitable for living room or dining room.</td>
</tr>
<tr>
<td><strong>CITRON YELLOW</strong></td>
<td>Citron Yellow</td>
<td>Citron Yellow</td>
<td>Coral</td>
<td>Silver</td>
<td>Modern or traditional living room.</td>
</tr>
<tr>
<td><strong>LEMON YELLOW</strong></td>
<td>Lemon Yellow</td>
<td>Tete de Nape</td>
<td>Brown and honey</td>
<td>Orange</td>
<td>Distinctive for modern living room.</td>
</tr>
<tr>
<td><strong>SULPHUR YELLOW</strong></td>
<td>Sulphur Yellow</td>
<td>Olive Green</td>
<td>Shades of green and sulphur</td>
<td>Coral</td>
<td>Colorful modern living room.</td>
</tr>
<tr>
<td>Specialties</td>
<td>Deep Yellow</td>
<td>Red</td>
<td>Draperies, gold damask upholstery, plum, wine red, gold with red, blue, lavender in pattern</td>
<td>Gold</td>
<td>Suitable for period room with Queen Anne, Sheraton, and other Georgian style furniture</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------</td>
<td>-----</td>
<td>----------------------------------------------------------------------------------------</td>
<td>------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>MUTED GOLD</td>
<td>Cerulean</td>
<td>Bleached wood, rubbed with gold and waxed</td>
<td>Draperies, soft coral taffeta, trimmed with brown upholstery, brown and yellow</td>
<td>Ebony</td>
<td>Unusual modern living room scheme where there is plenty of light</td>
</tr>
<tr>
<td>GOLD (1)</td>
<td>Yellow, sati silk Woodwork, Olive Green</td>
<td>Old gold carpet</td>
<td>Draperies, old gold, trimmed with green upholstery, olive green and peplum</td>
<td>Light Green</td>
<td>Charming for modern living room with blend wood</td>
</tr>
<tr>
<td>GOLD (2)</td>
<td>Grey and pale Yellow paper</td>
<td>Harvest Gold and Gray</td>
<td>Draperies, oyster white, trimmed with multi-color fringe upholstery, rose and silk</td>
<td>Brass</td>
<td>Traditional or modern dining room</td>
</tr>
<tr>
<td>TAN (1)</td>
<td>Neutral Tan</td>
<td>Dark Tan</td>
<td>Draperies, burnt orange upholstery, brown and burnt orange</td>
<td>Rich Chocolate</td>
<td>Good with natural wood tones</td>
</tr>
<tr>
<td>TAN (2)</td>
<td>Tan linen color</td>
<td>Light and dark Tan</td>
<td>Draperies, tan and rose stripes upholstery, lines color with rose, tan, grey and blue in pattern</td>
<td>Rose</td>
<td>Attractive for living room or library with walnut woodwork and furniture</td>
</tr>
<tr>
<td>TAN (3)</td>
<td>Tan</td>
<td>Brown's Taupe</td>
<td>Dark green and vermillion</td>
<td>Brown</td>
<td>Rich, warm color scheme for living room or library, especially with walnut furniture and paintings</td>
</tr>
<tr>
<td>TAN (4)</td>
<td>Brownish Tan</td>
<td>Floor, Oak Multi-colored scatter rugs</td>
<td>Draperies, brown with red yellow and blue pattern upholstery, old red and yellow chiffon</td>
<td>Blue</td>
<td>Suitable for bedroom with oak furniture in Early English feeling</td>
</tr>
<tr>
<td>BROWN (1)</td>
<td>Brown paneled</td>
<td>Deep Brown</td>
<td>Beige background with brilliant gold, scarlet and orange tones of fall foliage</td>
<td>Blue</td>
<td>Attractive for living room with plenty of light</td>
</tr>
<tr>
<td>BROWN (2)</td>
<td>Pine paneled</td>
<td>Pine</td>
<td>Old chintz in blue and brown</td>
<td>Silver and Pewter</td>
<td>Dining room in French Provincial style</td>
</tr>
<tr>
<td>BROWN (3)</td>
<td>Worn Belize with brown cast</td>
<td>Brown</td>
<td>Draperies, brown, beige and dusty pink upholstery, brown and olive</td>
<td>White</td>
<td>Appropriate for modern living room</td>
</tr>
<tr>
<td>BROWN (4)</td>
<td>Pine paneled</td>
<td>Hickory Rugs</td>
<td>Yellow, copper and blue chiffon</td>
<td>Green</td>
<td>Suitable early American living room with maple furniture</td>
</tr>
<tr>
<td>BROWN (5)</td>
<td>Chalk White</td>
<td>Brown</td>
<td>Turquoise</td>
<td>Peach</td>
<td>Charming bedroom color scheme</td>
</tr>
<tr>
<td>SABLE BROWN (1)</td>
<td>Sable Brown</td>
<td>Off-white</td>
<td>Draperies, off-white with turquoise upholstery, shell pink and off-white</td>
<td>Turquoise</td>
<td>Distinctive modern living room</td>
</tr>
<tr>
<td>SABLE BROWN (2)</td>
<td>Sable Brown</td>
<td>Deep worn Belize</td>
<td>Draperies, bright yellow upholstery, pearl chiffon with white pattern</td>
<td>Earth Brown</td>
<td>Some as above</td>
</tr>
<tr>
<td>CHESTNUT BROWN</td>
<td>Fawn</td>
<td>Chestnut Brown</td>
<td>Champagne background, beaver, turquoise and apricot in pattern and trimming</td>
<td>Turquoise</td>
<td>Appropriate for living or dining room</td>
</tr>
<tr>
<td>TAWNY BROWN</td>
<td>Tobacco Brown Pine</td>
<td>Light beige and tan</td>
<td>Blue on light ground</td>
<td>Yellow</td>
<td>Good for dining room in French period feeling</td>
</tr>
<tr>
<td>GOLDEN BROWN</td>
<td>Knotty Pine</td>
<td>Golden Brown Navajo rug</td>
<td>Draperies, colorful hunting point upholstery, red leather</td>
<td>Blue and Green</td>
<td>Library or Den</td>
</tr>
<tr>
<td>NUT BROWN</td>
<td>Nut Brown Pine</td>
<td>Moss Green</td>
<td>Draperies, dark lines upholstery, green, brown and white</td>
<td>Yellow</td>
<td>Handsome living room color scheme</td>
</tr>
<tr>
<td>TOBACCO BROWN</td>
<td>Tobacco Brown</td>
<td>Beige</td>
<td>Clear yellow chintz with beige and dark brown in design</td>
<td>White</td>
<td>Suitable modern dining room with much sunlight</td>
</tr>
<tr>
<td>CHOCOLATE BROWN</td>
<td>Chocolate Brown</td>
<td>Eggshell</td>
<td>Draperies, white upholstery, chocolate, brown and eggshell</td>
<td>Chartreuse</td>
<td>Interesting modern color scheme for living room or dining room</td>
</tr>
<tr>
<td>DARK BROWN (1)</td>
<td>Deep Beige</td>
<td>Dark Brown</td>
<td>Draperies, pale, clear blue upholstery, cinnamon brown</td>
<td>Pale Clear Blue</td>
<td>Good for dining room or living room</td>
</tr>
<tr>
<td>DARK BROWN (2)</td>
<td>Light Chartreuse</td>
<td>Dark Brown</td>
<td>Light tan and brown</td>
<td>White</td>
<td>Good for modern living room</td>
</tr>
<tr>
<td>BROWNS</td>
<td>Light Brown</td>
<td>Deep Brown</td>
<td>Draperies, off-white upholstery, Wedgewood green and off-white</td>
<td>Gold</td>
<td>Suitable for living or dining room</td>
</tr>
</tbody>
</table>
The Green Family

Representative members of the green family... Nile, lettuce, pea, grass, sea, olive, bottle, etc.

Characteristics... Cool, invigorating except when mixed with a warm color. Most restful color...

Friendly with all other colors, refreshing, versatile... Endless variety of tones and combinations.

What they can do... In light, soft tones, makes rooms seem larger because the wall seems farther away. Makes objects seem farther away, therefore smaller. Brings atmosphere of rest and relaxation.

Correct uses... One of the best background colors for average rooms, especially where restfulness is important... Great corrective value for rooms too small or too warm... Suitable in proper tones for background in any part of rooms—floor, walls, ceiling.

Caution... Do not use in quantity in cold, dark or over-large rooms—chooses warm, advancing colors for backgrounds, keeping green for smaller areas.

Suggested color schemes in which members of green family play a dominant role

<table>
<thead>
<tr>
<th>Dominant Color</th>
<th>Major Wall Color</th>
<th>Major Floor Color</th>
<th>Draperies and Upholstery</th>
<th>Accent Colors</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pale Green (1)</td>
<td>Pale Green</td>
<td>Dark Green</td>
<td>Draperies, off-white background, with pale blues, greens, and some in pattern. Upholstery, darker blue.</td>
<td>Nature and Violet</td>
<td>Appropriate for average living room and bedroom</td>
</tr>
<tr>
<td>Pale Green (2)</td>
<td>Pale Green</td>
<td>Plum</td>
<td>Draperies, natural lines color, with flowered plum and green in design. Upholstery, plum, gold, green.</td>
<td>Gold</td>
<td>Especially good for traditional living room</td>
</tr>
<tr>
<td>Light Green (1)</td>
<td>White</td>
<td>Light Green</td>
<td>Draperies, white with dark green pattern. Upholstery, dark green and white.</td>
<td>Yellow</td>
<td>Pleasant color scheme for modern room</td>
</tr>
<tr>
<td>Light Green (2)</td>
<td>Pickled Pine</td>
<td>Light Green</td>
<td>Draperies, off-white and light green. Upholstery, light green.</td>
<td>Brown</td>
<td>Attractive for living room or library</td>
</tr>
<tr>
<td>Light Green (3)</td>
<td>Off-white</td>
<td>Soft Light Green</td>
<td>Shell-pink, green and off-white.</td>
<td>Crystal</td>
<td>Charming and cool for small living room or sitting room</td>
</tr>
<tr>
<td>Apple Green (1)</td>
<td>Apple Green</td>
<td>Plum</td>
<td>Draperies, apple green. Upholstery, gold, yellow and ivory.</td>
<td>Gold</td>
<td>Good for small living room</td>
</tr>
<tr>
<td>Apple Green (2)</td>
<td>Apple Green</td>
<td>Yellow Green</td>
<td>Gauzy, blue, and touches of light yellow.</td>
<td>Light Yellow</td>
<td>This combination makes cool room</td>
</tr>
<tr>
<td>Apple Green (3)</td>
<td>Pale Apple Green</td>
<td>Floor, brown walnut, blue and tan.</td>
<td>Draperies, royal blue background, with rose and green leaves in pattern. Upholstery, some draperies chintz, also rose, antique silks, apple green and green stripes.</td>
<td>Black, gold, white and ruby</td>
<td>Early American living room with maple or cherry furniture</td>
</tr>
<tr>
<td>Soft Green (1)</td>
<td>Soft Green</td>
<td>Deeper Green</td>
<td>Draperies, plum background with beige and green in pattern. Upholstery, plum, beige and green.</td>
<td>Orange</td>
<td>Restful Color Scheme</td>
</tr>
<tr>
<td>Soft Green (2)</td>
<td>Soft Grayed Green</td>
<td>Deeper Green</td>
<td>Draperies, corn yellow. Upholstery, grayed green and off-white.</td>
<td>Pine Green</td>
<td>Adaptable to living room, dining room or bedroom</td>
</tr>
<tr>
<td>Soft Green (3)</td>
<td>Pale Soft Grayed Green</td>
<td>Ivy Green</td>
<td>Draperies, soft grayed green. Upholstery, golden yellow and white.</td>
<td>Lacquer Red</td>
<td>Excellent to add feeling of space to small room</td>
</tr>
<tr>
<td>Foam Green</td>
<td>Slate Gray</td>
<td>Foam Green</td>
<td>Draperies, lemon yellow and white. Upholstery, lemon yellow and gray.</td>
<td>Gold</td>
<td>Good modern color scheme</td>
</tr>
<tr>
<td>Ivy Green</td>
<td>Clear Beige</td>
<td>Ivy Green</td>
<td>Draperies, beige with light and dark green floral design. Upholstery, some chintzes and some clear beiges.</td>
<td>Black</td>
<td>Appropriate for living room</td>
</tr>
<tr>
<td>Deep Lime</td>
<td>Deep Lime</td>
<td>Deep Lime</td>
<td>White, green and melon pink.</td>
<td>White</td>
<td>Dramatic modern scheme, especially good with blond wood</td>
</tr>
<tr>
<td>NILE GREEN</td>
<td>Nile Green</td>
<td>Green</td>
<td>Glazed chintz with green background and white in design, red lining and trimmings</td>
<td>Crystal</td>
<td>Cool, airy bedroom</td>
</tr>
<tr>
<td>MINT GREEN</td>
<td>Pure White, Woodwork, white</td>
<td>Palmetto Mint Green, apricot-dashed with turquoise and yellow</td>
<td>Turquoise, yellow and mint green</td>
<td>White</td>
<td>Adaptable for informal living room, dining room or bedroom</td>
</tr>
<tr>
<td>JADE GREEN</td>
<td>Pale Jade</td>
<td>Dark Blue</td>
<td>Drapery, blue upholstery, blue and jade green</td>
<td>Silver</td>
<td>Attractive for modern living room</td>
</tr>
<tr>
<td>SAGE</td>
<td>Slate Gray</td>
<td>Soft Deep Sage</td>
<td>Gray and blue with green touches</td>
<td>Silver</td>
<td>Excellent color to make small sunny room seem larger and cooler</td>
</tr>
<tr>
<td>BOTTLE GREEN</td>
<td>Pale Amethyst</td>
<td>Bottle Green</td>
<td>Green, amethyst and topaz</td>
<td>Topaz</td>
<td>Good for living room or dining room</td>
</tr>
<tr>
<td>CHARTREUSE GREEN</td>
<td>Chartreuse Green</td>
<td>Shades of Jade de Négre</td>
<td>Drapery, chartreuse green upholstery, shades of heliotrope</td>
<td>Silver</td>
<td>Modern bedroom. Good with furniture painted chartreuse</td>
</tr>
<tr>
<td>CHARTREUSE GREEN</td>
<td>Gray</td>
<td>Chartreuse</td>
<td>Chartreuse and bright blue</td>
<td>Silver</td>
<td>Adaptable to any modern room</td>
</tr>
<tr>
<td>TURQUOISE</td>
<td>Light Turquoise</td>
<td>Patterned rug, Green with Moss Rose</td>
<td>Drapery, turquoise, green and rose stripes upholstery, turquoise</td>
<td>Rose</td>
<td>Attractive for bedroom with mahogany furniture</td>
</tr>
<tr>
<td>BLUE GREEN (1)</td>
<td>Deep Creme</td>
<td>Blue Green</td>
<td>Apple green, greenish blue, touch of burnt orange</td>
<td>Burnt Orange</td>
<td>Versatile color scheme for average room</td>
</tr>
<tr>
<td>BLUE GREEN (2)</td>
<td>Blue Green</td>
<td>Blue Green</td>
<td>Drapery, light grayish tan background, turquoise, rose and green in pattern upholstery, some pink and some soft rose</td>
<td>Green</td>
<td>Very restful for living room or bedroom</td>
</tr>
<tr>
<td>BLUE GREEN (3)</td>
<td>Doll blue Green</td>
<td>Rug, light field, red violet and green leaves in pattern</td>
<td>Drapery, white upholstery, red violet</td>
<td>Dark Green</td>
<td>Dining room in period feeling with walnut furniture</td>
</tr>
<tr>
<td>WAVY GREEN</td>
<td>Deep Lime</td>
<td>Bronze</td>
<td>White background, wood leaves, deep rose and bright lime in pattern</td>
<td>Rose</td>
<td>Sophisticated modern color scheme</td>
</tr>
<tr>
<td>DEEP GREEN (1)</td>
<td>Deep Green</td>
<td>Grey</td>
<td>Drapery, sky blue chinette with rose and green pattern upholstery, emerald green and gray</td>
<td>Gold and Rose</td>
<td>Suitable for living room or man's bedroom</td>
</tr>
<tr>
<td>DEEP GREEN (2)</td>
<td>Grey and White paper, black pattern</td>
<td>Deep Green</td>
<td>Drapery, yellow upholstery, yellow flowers and pale green leaves on grey background</td>
<td>Blue and Green</td>
<td>Modern living room or dining room</td>
</tr>
<tr>
<td>DEEP GREEN (3)</td>
<td>Greens, lighter than carpet</td>
<td>Deep Soft Green</td>
<td>Drapery, off-white upholstery, off-white and Wedgewood green</td>
<td>Yellow</td>
<td>Very cool and fresh</td>
</tr>
<tr>
<td>DEEP GREEN (4)</td>
<td>Greenish Gray</td>
<td>Deep Green</td>
<td>Drapery, apple green upholstery, prayed green and white</td>
<td>Salmon</td>
<td>Good combination to make small room seem larger</td>
</tr>
<tr>
<td>DEEP GREEN (5)</td>
<td>Deep Soft Green</td>
<td>Light Brown</td>
<td>Golden yellow and white</td>
<td>White</td>
<td>Modern or traditional setting</td>
</tr>
<tr>
<td>GEORGIAN GREEN</td>
<td>Deep Georgian Green</td>
<td>Deep Green</td>
<td>Drapery, soft golden yellow upholstery, golden yellow and deep green</td>
<td>Gold</td>
<td>Very cool and restful for period living room or library</td>
</tr>
<tr>
<td>DARK GREEN (1)</td>
<td>Ivory Green</td>
<td>Dark Green</td>
<td>Drapery, white with dark green pattern upholstery, off-white, off-white and dark green</td>
<td>Black</td>
<td>Subtle color combination. Good for living room or dining room</td>
</tr>
<tr>
<td>DARK GREEN (2)</td>
<td>Warm Gray</td>
<td>Dark Green</td>
<td>Drapery, dark green or grey background upholstery, light green</td>
<td>Yellow</td>
<td>Cool and restful for living room</td>
</tr>
<tr>
<td>DARK GREEN (3)</td>
<td>Dark Green</td>
<td>Tan</td>
<td>Drapery, chartreuse blue-green and soft red upholstery, some chartreuse, also some soft red</td>
<td>Copper</td>
<td>Charming for sunny living room</td>
</tr>
<tr>
<td>GREEN OLIVE</td>
<td>Green Olive</td>
<td>Red Coral</td>
<td>Lime green, red-coral, antique white</td>
<td>Coral and White</td>
<td>Daring modern color scheme. Good with traditional or modern furniture in light finish</td>
</tr>
</tbody>
</table>
# THE BLUE FAMILY

**Representative Members of the Blue Family:** Pale, Baby, Sky, Powder, Navy, Midnight, etc.

**Characteristics:** Calmest, most restful, color mixed with warm colors. Serene, quiet, "spacey". Much loved hue. Too much of it in dull tones may be depressing.

**What They Can Do:** Make room seem larger, cooler, more airy and spacious. Make objects look smaller because they seem more distant. In dark tones, make lighter contrast colors more luminous.

**Correct Uses:** In light tones, excellent background for small, dark, warm rooms. Good combining color, especially in soft tones. Effective background for many other colors.

**Caution:** Do not use in quantity in cold or dark or over-large rooms. Do not use too much in dull shades. Do not use without some warm bright accent color.

## Suggested Color Schemes in Which Members of Blue Family Play a Dominant Role

<table>
<thead>
<tr>
<th>Dominant Color</th>
<th>Major Wall Color</th>
<th>Major Floor Color</th>
<th>Draperies and Upholstery</th>
<th>Accent Colors</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pale Blue (1)</td>
<td>Pale Blue</td>
<td>Dark Blue</td>
<td>Tan draperies and upholstery</td>
<td>Silver</td>
<td>Modern color scheme for bedroom with furniture in lemon color</td>
</tr>
<tr>
<td>Sky Blue</td>
<td>Garden Sky Blue</td>
<td>Champagne</td>
<td>Champagne, sky blue and orchid</td>
<td>Orchid</td>
<td>Modern color scheme, good with light natural finish woods</td>
</tr>
<tr>
<td>Powder Blue (1)</td>
<td>Powder Blue</td>
<td>Delight Blue</td>
<td>Draperies, cream yellow Upholstery, yellow and powder blue</td>
<td>Off-white</td>
<td>Cool and fresh for bedroom</td>
</tr>
<tr>
<td>Powder Blue (2)</td>
<td>Powder Blue</td>
<td>Powder Blue</td>
<td>White draperies and upholstery</td>
<td>Peach</td>
<td>Dainty feminine bedroom</td>
</tr>
<tr>
<td>Larkspur Blue (1)</td>
<td>Larkspur Blue</td>
<td>Pale Grey</td>
<td>Draperies, white, trimmed with white Upholstery, deep blue and white</td>
<td>Deep Blue and White</td>
<td>Good modern living room combination</td>
</tr>
<tr>
<td>Larkspur Blue (2)</td>
<td>Larkspur Blue</td>
<td>Blue</td>
<td>Neutral background, blue and pink in patterns</td>
<td>Red Dahlia</td>
<td>Any period room with enough light</td>
</tr>
<tr>
<td>Blue (1)</td>
<td>Pale Blue, deep Rose and Ivory paper</td>
<td>Blue</td>
<td>Blue, gold and rose with touches of black—in stripes or plain</td>
<td>Black</td>
<td>Attractive for traditional living room</td>
</tr>
<tr>
<td>Blue (2)</td>
<td>Faded Blue (middle value)</td>
<td>Floor, dark Brown Carpet, Grey and Yellow</td>
<td>Draperies, old yellow Upholstery, yellow, old yellow, and touch of Venetian red, also same blue</td>
<td>Blue</td>
<td>Bedrooms with Directoire feeling and walnut furniture</td>
</tr>
<tr>
<td>Blue (3)</td>
<td>Striped wallpaper in tones of light and medium blue and White</td>
<td>Dark Blue</td>
<td>Draperies, blue with white in patterns and trim Upholstery, lemon yellow</td>
<td>Dark Blue</td>
<td>Good for small, low-ceilinged but light room</td>
</tr>
<tr>
<td>Hydrangea Blue (1)</td>
<td>Pale Hydrangea Blue</td>
<td>Eggplant</td>
<td>Draperies, peach background with white, copper, gold and hydrangea blue in design Upholstery, some chintz, also old blue</td>
<td>Old Blue</td>
<td>Good for room with strong light, especially with 18th Century furniture</td>
</tr>
<tr>
<td>Hydrangea Blue (2)</td>
<td>Hydrangea Blue</td>
<td>Deeper Blue</td>
<td>Draperies, salmon pink Chair seats, black and gold</td>
<td>Gold</td>
<td>Dining room with Directoire feeling</td>
</tr>
<tr>
<td>Copenhagen Blue</td>
<td>Copenhagen Blue</td>
<td>Burgundy</td>
<td>Gray with blue and burgundy</td>
<td>Rose and Silver</td>
<td>Attractive for traditional living room</td>
</tr>
<tr>
<td>Pencil Blue</td>
<td>Lemon Yellow</td>
<td>Pencil Blue</td>
<td>Blue background with yellow in patterns and trim</td>
<td>Silver</td>
<td>Setting for dining room with modern furniture</td>
</tr>
<tr>
<td>COLOR</td>
<td>Base</td>
<td>Suggested Combinations</td>
<td>Additional Information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MEDIUM BLUE (1)</strong></td>
<td>Blue</td>
<td>Mulberry ground&lt;br&gt;Deep teal with rose and charcoal, some places in rose and gold</td>
<td>Good for living room, especially in 18th century French feeling</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MEDIUM BLUE (2)</strong></td>
<td>Blue</td>
<td>Malta&lt;br&gt;Lavender, gray, and some rose</td>
<td>Rose&lt;br&gt;Adaptable for lady's bedroom in lighter blues, also to living room in darker shades of delft blues</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MEDIUM BLUE (3)</strong></td>
<td>Cream</td>
<td>Blue&lt;br&gt;French Blue&lt;br&gt;Jade green</td>
<td>Good for small living room or bedroom</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DUSTY BLUE</strong></td>
<td>Dark blue</td>
<td>Dark Burgundy&lt;br&gt;French Blue&lt;br&gt;Jade Green&lt;br&gt;Crystal&lt;br&gt;Restful for living room or bedroom</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SOFT DULL BLUE</strong></td>
<td>Ivory</td>
<td>Soft Dull Blue&lt;br&gt;Soft blue with rose and green in design, some pieces in old rose</td>
<td>Green&lt;br&gt;Bedroom or informal living room</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>OLD BLUE</strong></td>
<td>Old Blue</td>
<td>Deeper Blue&lt;br&gt;Faded Pink, or chintz with blue, green and pink&lt;br&gt;Green&lt;br&gt;Charming for living room or bedroom</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>GRAYED BLUE</strong></td>
<td>Gray Blue</td>
<td>Deeper grayed Blue&lt;br&gt;Yellow, white, and gold&lt;br&gt;Red&lt;br&gt;Dining room in Directoire feeling with mahogany</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TURQUOISE BLUE</strong></td>
<td>Pale Turquoise Blue</td>
<td>Turquoise&lt;br&gt;Deeper blue with rose and green in design, some pieces in old rose</td>
<td>White&lt;br&gt;Any room not too large or too dark&lt;br&gt;Stained glass windows for added color</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TURQUOISE BLUE</strong></td>
<td>Grayed Turquoise</td>
<td>Grayed Turquoise&lt;br&gt;Wine and ivory&lt;br&gt;Peach&lt;br&gt;Stained glass windows for added color</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>GREEN BLUE</strong></td>
<td>Green Blue</td>
<td>Plum rug, flowered pattern&lt;br&gt;Plum with green and white&lt;br&gt;Peach&lt;br&gt;Stained glass windows for added color</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ROYAL BLUE (1)</strong></td>
<td>Walls, Silver&lt;br&gt;Woodwork, Royal Blue</td>
<td>Floor, painted Gray&lt;br&gt;Gray, Blue&lt;br&gt;Drapery, blue, trimmed with silver&lt;br&gt;Upholstery (chairs), silver and blue leather&lt;br&gt;Silver and Black&lt;br&gt;Distinctive modern dining room</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ROYAL BLUE (2)</strong></td>
<td>Old White</td>
<td>Royal Blue&lt;br&gt;Clear yellow&lt;br&gt;Silver&lt;br&gt;Modern living or dining room&lt;br&gt;Startling for living room</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ROYAL BLUE (3)</strong></td>
<td>Dusty Blue</td>
<td>Rug, Deep Blue ground with green and white&lt;br&gt;Drapery, royal blue&lt;br&gt;Chair Seats, royal blue&lt;br&gt;Moroccan&lt;br&gt;Silver&lt;br&gt;Attractive for modern dining room, especially with lemon wood furniture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DEEP BLUE (1)</strong></td>
<td>Pale Amethyst</td>
<td>Deep Blue&lt;br&gt;Deep blue, trimmed with gold&lt;br&gt;Amethyst and Gold&lt;br&gt;Cold and charming for living room not too dark</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DEEP BLUE (2)</strong></td>
<td>Deep Blue</td>
<td>Dark Blue rug with Ton and Rose in pattern&lt;br&gt;Drapery, dust always&lt;br&gt;Upholstery (chairs), terry or rayon red leather&lt;br&gt;Red&lt;br&gt;Colorful for dining room with plenty of light</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DEEP BLUE (3)</strong></td>
<td>Deep Blue</td>
<td>Dark Blue rug with rose and white in pattern&lt;br&gt;Drapery, deep sea blue&lt;br&gt;Upholstery, canary yellow&lt;br&gt;White&lt;br&gt;Modern living room or dining room</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DEEP BLUE (4)</strong></td>
<td>Pale Yellow</td>
<td>Natural&lt;br&gt;Drapery, deep sea blue (gold, green, or blue)&lt;br&gt;Upholstery, deep blue&lt;br&gt;White&lt;br&gt;Good when blue is dominant color in a dark room</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DEEP BLUE (5)</strong></td>
<td>Creamy White</td>
<td>Blue&lt;br&gt;Drapery, deep blue&lt;br&gt;Upholstery, yellow with dash of white&lt;br&gt;Gold, Rose-Red and Blue&lt;br&gt;Good for bedroom, furniture painted blue with flower decorations, and some smaller cyber white pieces</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>GARDEN POOL BLUE</strong></td>
<td>Garden Pool Blue</td>
<td>Garden Pool Blue&lt;br&gt;Chair Seats, red leather&lt;br&gt;White and Silver&lt;br&gt;Dramatic modern living room with furniture in rich mahogany or velvet tones</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DARK BLUE</strong></td>
<td>Cream and beige paper</td>
<td>Dark Blue rug with rose and tan in pattern&lt;br&gt;Drapery, linen color with blues, greens and rose reds in pattern&lt;br&gt;Chair Seats, dark blue&lt;br&gt;Blue and Silver&lt;br&gt;Good for dining room where light is needed</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## THE VIOLET (OR PURPLE) FAMILY

**Representative Members of the Violet Family...**

**Color Families:** Violet/Purple

- Color Family: Violet/Purple
- Characteristics: Cool when mixed with blue, warm when mixed with red...in purple tones, rich and dignified but not friendly. May be depressing.

- **What they can do:** Add to impression of room size and coolness, especially when mixed with blue. Create restful, quiet atmosphere when used in soft tones.

**Correct Uses:** In light, soft shades, excellent wall and setting background for an overall room...Strong shades good for accent...in deep, soft tones, attractive for carpets, upholstery, draperies.

- **Caution:** Do not use blue tones of violet in cold, dark, over-large rooms. Be careful when using strong shades for dominant color...Do not use without some warm contrast.

### Suggested Color Schemes in Which Members of Violet Family Play a Dominant Role

<table>
<thead>
<tr>
<th>Dominant Color</th>
<th>Major Wall Color</th>
<th>Major Floor Color</th>
<th>Draperies and Upholstery</th>
<th>Accent Colors</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Orchid (1)</strong></td>
<td>Orchid</td>
<td>Blue</td>
<td>Champagne, orchid and blue</td>
<td>Black and Silver</td>
<td>Attractive for living room</td>
</tr>
<tr>
<td><strong>Orchid (2)</strong></td>
<td>Panelled paper in Orchid and Pale Yellow</td>
<td>Mulberry</td>
<td>Green, yellow and orchid chintz</td>
<td>Green</td>
<td>Cool, airy bedroom</td>
</tr>
<tr>
<td><strong>Lavender (1)</strong></td>
<td>Lavender</td>
<td>Lavender with mossy border</td>
<td>Gray, light blue and touches of jade green</td>
<td>Jade Green</td>
<td>Good for sunny room</td>
</tr>
<tr>
<td><strong>Lavender (2)</strong></td>
<td>Lavender, Blue and White</td>
<td>Blue</td>
<td>Lavender</td>
<td>Rose</td>
<td>Feminine bedroom</td>
</tr>
<tr>
<td><strong>Lavender (3)</strong></td>
<td>Pale Lavender</td>
<td>Rose</td>
<td>Pink, lavender and white</td>
<td>Lavender</td>
<td>Bedroom with warm light</td>
</tr>
<tr>
<td><strong>Heliotrope (1)</strong></td>
<td>Gray</td>
<td>Beige</td>
<td>Heliotrope draperies and upholstery</td>
<td>Violet and Silver</td>
<td>Lovely color scheme for woman with gray hair</td>
</tr>
<tr>
<td><strong>Mauve (1)</strong></td>
<td>Gray</td>
<td>Mauve</td>
<td>Light blue, Nile green, sea rose</td>
<td>Rose</td>
<td>Good for sunny bedroom</td>
</tr>
<tr>
<td><strong>Mauve (2)</strong></td>
<td>Panelled wall painted Pale Mauve</td>
<td>Deep Purple</td>
<td>Mauve and yellow</td>
<td>Crystal and Sepia</td>
<td>Especially attractive for Louis XVI style bedroom with walnut furniture</td>
</tr>
<tr>
<td><strong>Heliotrope (2)</strong></td>
<td>Pearl Gray</td>
<td>Heliotrope</td>
<td>Draperies, heliotrope trimmed with silver</td>
<td>Green</td>
<td>Cool and restless living room</td>
</tr>
<tr>
<td><strong>Violet</strong></td>
<td>Dove Gray</td>
<td>Black and White</td>
<td>Draperies, violet</td>
<td>Silver and Black</td>
<td>Attractive with silver gray painted woodwork and violet lines, slate white and gold furniture</td>
</tr>
<tr>
<td><strong>Mulberry (1)</strong></td>
<td>Dusty Mulberry</td>
<td>Mahogany</td>
<td>Draperies, clear blue chintz with mulberry and brown in pattern</td>
<td>White</td>
<td>Very good for traditional living room or dining room</td>
</tr>
<tr>
<td><strong>Mulberry (2)</strong></td>
<td>Dusty Mulberry</td>
<td>Ebony</td>
<td>Draperies, creamy peach chintz with gray, old rose and alabaster design</td>
<td>Black</td>
<td>Good for sunny living room or dining room</td>
</tr>
<tr>
<td><strong>Mulberry (3)</strong></td>
<td>Sastic paper Woodwork, wood</td>
<td>Deep Mulberry</td>
<td>Mulberry</td>
<td>Orange</td>
<td>Traditional dining room</td>
</tr>
<tr>
<td><strong>Purple</strong></td>
<td>Paper in Gray and soft Purple stripes</td>
<td>Gray</td>
<td>Purple, with blue, green and gray</td>
<td>Burnt Orange</td>
<td>Hall or living room</td>
</tr>
</tbody>
</table>
### TABLE 1 Reflective Values

<table>
<thead>
<tr>
<th>Color</th>
<th>Approx. percent of reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>White, dull or flat</td>
<td>75-85</td>
</tr>
<tr>
<td>White, gloss</td>
<td>85-90</td>
</tr>
<tr>
<td>Light tints</td>
<td></td>
</tr>
<tr>
<td>Cream or eggshell</td>
<td>79</td>
</tr>
<tr>
<td>Ivory</td>
<td>75</td>
</tr>
<tr>
<td>Pale pink and pale yellow</td>
<td>75-80</td>
</tr>
<tr>
<td>Light green, light blue, light orchid</td>
<td>70-75</td>
</tr>
<tr>
<td>Soft pink, light peach</td>
<td>69</td>
</tr>
<tr>
<td>Light beige, pale grey</td>
<td>70</td>
</tr>
<tr>
<td>Medium tones</td>
<td></td>
</tr>
<tr>
<td>Apricot</td>
<td>56-62</td>
</tr>
<tr>
<td>Pink</td>
<td>84</td>
</tr>
<tr>
<td>Tan, yellow gold</td>
<td>56</td>
</tr>
<tr>
<td>Light greys</td>
<td>35-50</td>
</tr>
<tr>
<td>Medium turquoise</td>
<td>44</td>
</tr>
<tr>
<td>Medium light blue</td>
<td>42</td>
</tr>
<tr>
<td>Yellow green</td>
<td>45</td>
</tr>
<tr>
<td>Old gold, pumpkin</td>
<td>34</td>
</tr>
<tr>
<td>Rose</td>
<td>29</td>
</tr>
<tr>
<td>Deep tones</td>
<td></td>
</tr>
<tr>
<td>Cocoa brown, mauve</td>
<td>24</td>
</tr>
<tr>
<td>Medium green, medium blue</td>
<td>21</td>
</tr>
<tr>
<td>Unsuitable dark colors</td>
<td></td>
</tr>
<tr>
<td>Dark brown, dark grey</td>
<td>10-15</td>
</tr>
<tr>
<td>Olive green</td>
<td>12</td>
</tr>
<tr>
<td>Dark blue, blue green</td>
<td>5-10</td>
</tr>
<tr>
<td>Forest green</td>
<td>7</td>
</tr>
<tr>
<td>Natural wood tones</td>
<td></td>
</tr>
<tr>
<td>Birch and beech</td>
<td>35-50</td>
</tr>
<tr>
<td>Light maple</td>
<td>25-35</td>
</tr>
<tr>
<td>Light oak</td>
<td>25-35</td>
</tr>
<tr>
<td>Dark oak, cherry</td>
<td>10-15</td>
</tr>
<tr>
<td>Redwood</td>
<td>10-15</td>
</tr>
<tr>
<td>Black walnut, mahogany</td>
<td>6-15</td>
</tr>
</tbody>
</table>

Recommended ceiling values should be in the range of 60-90%. Floor reflection values should be in the range of 15-35%. Overall reflection values of a room should be in the 35-60% range.

### Safety Color Guides

Physical hazards:
- **Red**: Fire protection equipment and apparatus; danger; stop
- **Orange**: Dangerous parts of moving machinery
- **Yellow**: Physical hazards that might cause stumbling, falling, etc.
- **Green**: Safety – first-aid dispensary or kits, stretchers, safety deluge showers, etc.
- **Blue**: Caution against movement or use of equipment being worked on such as elevators, scaffolding, etc.

**Black and White**: Traffic direction; sanitation

Equipment in industrial plants:
- **Red**: Fire protection systems and equipment
- **Orange**: Dangerous materials, nonflammable, such as acids, alkalis, toxic materials, gases, oxygen
- **Yellow**: Dangerous materials, flammable, such as fuel oil, gasoline, kerosene, alcohol, propane, butane, acetylene, hydrogen, and solvent
- **Green**: Safe materials, such as drinking water, service water, brine
- **Blue**: Protective materials
- **Violet**: Valuable materials
- **Black**: Electrical conduit
**TABLE 2**

**Color Effects of White Fluorescent Lamps**

<table>
<thead>
<tr>
<th>Lamp appearance; effect on neutral surfaces</th>
<th>Cool* White</th>
<th>Deluxe* White</th>
<th>Warm* White</th>
<th>Deluxe* White</th>
<th>Daylight</th>
<th>White</th>
<th>Soft White—Natural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral to moderately cool</td>
<td>White</td>
<td>White</td>
<td>Yellowish white</td>
<td>Yellowish white</td>
<td>Blush white</td>
<td>Pale yellowish white</td>
<td>Pinkish white</td>
</tr>
<tr>
<td>Effect on &quot;atmosphere&quot;</td>
<td>Neutral to moderately cool</td>
<td>Warm</td>
<td>Warm</td>
<td>Very cool</td>
<td>Moderately warm</td>
<td>Warm, pinkish</td>
<td></td>
</tr>
<tr>
<td>Colors strengthened</td>
<td>Orange, yellow, blue</td>
<td>All nearly equal</td>
<td>Orange, yellow</td>
<td>Red, orange, yellow, green</td>
<td>Green, blue</td>
<td>Orange, yellow</td>
<td>Red, orange</td>
</tr>
<tr>
<td>Colors grayed</td>
<td>Red</td>
<td>None appreciably</td>
<td>Red, green, blue</td>
<td>Blue</td>
<td>Red, orange</td>
<td>Red, green, blue</td>
<td>Green, blue</td>
</tr>
<tr>
<td>Remarks</td>
<td>Blends with natural daylight</td>
<td>Best overall color rendition; simulates natural daylight</td>
<td>Blends with incandescent light</td>
<td>Excellent color rendition; simulates incandescent light</td>
<td>Usually replaceable with CW</td>
<td>Usually replaceable with CW or WWX</td>
<td>Usually replaceable with CW or WW</td>
</tr>
</tbody>
</table>

**Color Effects of Mercury and Filament Lamps**

<table>
<thead>
<tr>
<th>Lamp appearance; effect on neutral surfaces</th>
<th>Mercury</th>
<th>White Mercury</th>
<th>Color-Impressed Mercury</th>
<th>Deluxe White Mercury</th>
<th>Filament</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenish blue white</td>
<td>Greenish white</td>
<td>Yellowish white</td>
<td>White</td>
<td>Yellowish white</td>
<td></td>
</tr>
<tr>
<td>Effect on &quot;atmosphere&quot;</td>
<td>Very cool, greenish</td>
<td>Moderately cool, greenish</td>
<td>Warm, yellowish</td>
<td>Moderately cool</td>
<td>Warm</td>
</tr>
<tr>
<td>Colors strengthened</td>
<td>Yellow, green, blue</td>
<td>Yellow, green, blue</td>
<td>Yellow, green, blue</td>
<td>Orange, yellow, blue</td>
<td>Red, orange, yellow</td>
</tr>
<tr>
<td>Colors grayed</td>
<td>Red, orange</td>
<td>Red, orange</td>
<td>Blue</td>
<td>Green</td>
<td>Blue</td>
</tr>
<tr>
<td>Remarks</td>
<td>Poor overall color rendering</td>
<td>Color rendering often acceptable, but not equal to any white fluorescent</td>
<td>Color rendering good; compares favorably with CWX fluorescent</td>
<td>Excellent color rendering</td>
<td></td>
</tr>
</tbody>
</table>

* Greater preference at higher levels.
1 Greater preference at lower levels.
Windows are available in many types, each having advantages. The principal types are double-hung, casement, stationary, awning, and horizontal sliding. They may be made of wood or metal. Heat loss through metal frames and sash is much greater than through similar wood units. Glass blocks are sometimes used for admitting light in places where transparency or ventilation is not required.

Insulated glass, used both for stationary and movable sash, consists of two or more sheets of spaced glass with hermetically-sealed edges. This type has more resistance to heat loss than a single thickness and is often used without a storm sash.

Wood sash and door and window frames should be made from a clear grade of all-heartwood stock of a decay resistant wood species or from wood which is given a preservative treatment. Species commonly used include ponderosa and other pines, the cedars, cypress, redwood, and the spruces.

**Double-Hung Windows**

The double-hung window is perhaps the most familiar window type. It consists of an upper and lower sash that slide vertically in separate grooves in the side jambs or in full-width metal weatherstripping. This type of window provides a maximum face opening for ventilation of one-half the total window area. Each sash is provided with springs, balances, or compression weatherstripping to hold it in place in any location. Compression weatherstripping, for example, prevents air infiltration, provides tension, and acts as a counterbalance; several types allow the sash to be removed for easy painting or repair.

The jambs (sides and top of the frame) are made of nominal 1-inch lumber; the width provides for use with dry-wall or plastered interior finish. Sills are made from nominal 2-inch lumber and sloped at about 3 in 12 for good drainage. Sash are normally 1¾ inches thick and wood combination storm and screen windows are usually 1½ inches thick. Sash may be divided into a number of lights by small wood members called muntins. A ranch-type house may provide the best appearance with top and bottom sash divided into two horizontal lights. A colonial or Cape Code house usually has each sash divided into six or eight lights. Some manufacturers provide preassembled dividers which snap in place over a single light, dividing it into six or eight lights. This simplifies painting and other maintenance.

Assembled frames are placed in the rough opening over strips of building paper put around the perimeter to minimize air infiltration. The frame is plumbed and nailed to side studs and header through the casings or the blind at the sides. Where nails are exposed, such as on the casing, use the corrosion-resistant type.

Hardware for double-hung windows includes the sash lifts that are fastened to the bottom rail, although they are sometimes eliminated by providing a finger groove in the rail. Other hardware consists of sash locks or fasteners located at the meeting rail. They not only lock the window, but draw the sash together to provide a “windtight” fit.

Double-hung windows can be arranged in a number of ways — as a single unit, doubled (or mullion) type, or in groups of three or more. One or two double-hung windows on each side of a large stationary insulated window are often used to effect a window wall. Such large openings must be framed with headers large enough to carry roofloads.

**Casement Windows**

Casement windows consist of side-hinged sash, usually designed to swing outward because this type can be made more weathertight than the inswinging style. Screens are located inside these outswinging windows and winter protection is obtained with a storm sash or by using insulated glass in the sash. One advantage of the casement window over the double-hung type is that the entire window area can be opened for ventilation.

Weatherstripping is also provided for this type of window, and units are usually received from the factory entirely assembled with hardware in place. Closing hardware consists of a rotary operator and sash lock. As in the double-hung units, casement sash can be used in a number of ways — as a pair or in combinations of two or more pairs. Style variations are achieved by divided lights. Snap-in muntins provide a small, multiple-pane appearance for traditional styling.

Metal sash are sometimes used but, because of low insulating value, should be installed carefully to prevent condensation and frosting on the interior surfaces during cold weather. A full storm-window unit is sometimes necessary to eliminate this problem in cold climates.

**Stationary Windows**

Stationary windows used alone or in combination with double-hung or casement windows usually consist of a wood sash with a large single light of insulated glass. They are designed to provide light, as well as for attractive appearance, and are fastened permanently into the frame. Because of their size (sometimes 8 to 8 feet wide), 1¾-inch-thick sash is used to provide strength. The thickness is usually required because of the thickness of the insulated glass.
### Window Types

<table>
<thead>
<tr>
<th>Operation</th>
<th>Ventilation</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double-hung window: upper and lower sections slide vertically to open; spring balance; lock at meeting rail</td>
<td>Substantial airflow, but not directed well; drafty without a shield</td>
<td>No parts project even when open; sometimes difficult to open if schoolroom has usual shelving at sill level; usually a glass deflector is installed to prevent drafts</td>
</tr>
<tr>
<td>Casement window with fixed glass section at bottom, two swing-out sections at top; crank-operated</td>
<td>Substantial airflow, but not directed well; drafts are difficult to avoid</td>
<td>Easily operated; shades can be drawn without obstruction when window is open (but they will billow in breeze); these windows must be placed carefully—there is danger of children running into them outdoors if open; rarely used in schools</td>
</tr>
<tr>
<td>Projected window: with fixed upper section of glass, vent (hopper type) at bottom opening in: crank-operated</td>
<td>Adequate airflow in most climates; well directed, not drafty</td>
<td>Easily operated, can be used with shades or blinds closed over most of its area; view is unobstructed, even when window is closed</td>
</tr>
<tr>
<td>Projected window with sections opening out at top, in at bottom; crank-operated</td>
<td>Very good airflow, both in quantity and quality (not drafty)</td>
<td>Easily operated; does provide some ventilation even when partially shaded; view through this type is almost unhindered with few obstructions at eye level</td>
</tr>
<tr>
<td>Awning window four horizontal sections project out; crank-operated</td>
<td>Large quantities of airflow are easily controlled, with fairly good draft control</td>
<td>Can be opened quite wide even during rainstorms; is easily operated; shades can be drawn without obstruction; framing does obstruct outdoor view somewhat whether window is open or closed</td>
</tr>
<tr>
<td>Sliding window with lower fixed section</td>
<td>Substantial airflow, but hard to control, drafty</td>
<td>No parts project either inward or outward when open, but window is sometimes difficult to slide with the usual schoolroom shelf at sill level</td>
</tr>
<tr>
<td>Combination window: upper section is of glass block, supported on angle and channel girts attached to columns; lower section is half fixed glass, and half hopper: (crank-operated)</td>
<td>Adequate, well directed air flow for most climates</td>
<td>Some types of glass block refract light to ceiling, providing good light distribution across classroom and eliminating need for shades or blinds; however, designer must take care to use properly; this type does not always meet brightness tests for good schoolroom lighting</td>
</tr>
<tr>
<td>TYPE</td>
<td>DESCRIPTION</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>SIDE HINGED</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| CASEMENT          | **materials** - wood, steel, aluminum  
|                   | **use** - common in residences and apartments  
|                   | **operation** - rotary crank or lever operators hold the vent open to desired position, up to 180°, but usually 90°  
|                   | **note** - available also as a single vent  
|                   | * generally allow exterior of glazing to be cleaned from inside when outswinging.  
|                   | * provide 100 percent opening in the ventilation area  
|                   | * will be subject to wind pressures when opened.  |
| CASEMENT-HOPPER   | **materials** - wood, aluminum  
|                   | **use** - especially appropriate for high-rise, life safety installations  
|                   | **operation** - sophisticated hardware  
|                   | **note** - no protection from rain when open'  
|                   | * available to limited extent as "tilt and turn" type which acts as a bottom hung window in normal use, but which can be converted by use of secondary hinges into a side-hung, inswinging type, allowing for easy cleaning.  |
| CASEMENT-COMBINATION | **materials** - wood, aluminum, steel in varied quality grades  
|                   | **use** - commonly known as the "classroom window"  
|                   | **operation** - combination of in-swinging hopper and out-swinging casement vents offer flexibility for ventilation control  |
| **BOTTOM HINGED** |                                                                             |
| HOPPER            | **materials** - wood, aluminum and steel  
|                   | **use** - where vent will not interfere with interior conditions  
|                   | **note** - no protection from rain when open  
<p>|                   | * lower cost utility quality is commonly used for residential basements  |</p>
<table>
<thead>
<tr>
<th>TYPE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BOTTOM HINGED, continued</strong></td>
<td></td>
</tr>
</tbody>
</table>
| HOPPER-SPECIAL | materials • steel, stainless steel  
use • in commercial and industrial buildings where appearance is not of major importance and resistance to forced entry is  
operation • combined with fixed lights or with projecting vents above, which offer high and low openings that are best for natural-air circulation (due to principles of stratification)  
notes • vents limited in size  
• muntins usually separate openings of 88 inches square |
| HOPPER-MULTIPLE | materials • steel  
use • in housing for mental patients, to provide protection against exit while minimizing appearance of restraint  
note • vents have a maximum clear opening of about 6 inches |

| TOP HINGED | |
| **AWNING** | materials • wood, steel, aluminum  
use • multiple assemblies are used mostly in steel for industrial buildings  
• separate units are commonly combined with fixed lights, or with hoppers for maximum stratification ventilation (These are available also in wood and aluminum.)  
operation • are out-swinging projected windows that create a "canopy" against rain penetration  
• when in multiple, vertical stacks, the mechanical operation will allow for the bottom vent to open before the other vents, which will then open in unison |
| **PROJECTED** | materials • steel or aluminum  
use • medium quality grade is called "intermediate" and is commonly used in commercial, institutional and industrial type buildings  
• architectural windows are frequently used for schools, hospitals, office buildings, etc.  
operation • similar to awning windows but with optional fixed glass lights and/or hoppers. |
| **JALOUSIE** | materials • wood, steel, aluminum  
use • primarily for sunrooms, porches, and the like where protection from the weather is desired with maximum fresh air  
operation • multiple vents combine unobstructed vision with controlled ventilation  
• the louvers are fully adjustable and can be set in any position  
• can be fitted with storm sash on the inside to provide more weather tightness  
• screens, interchangeable with storm sash, are furnished  
• various types of glass, including obscure and colored, often are used for privacy or decoration |
## WINDOW TREATMENTS
### Window Types

#### GLIDING

<table>
<thead>
<tr>
<th>TYPES</th>
<th>DESCRIPTION</th>
</tr>
</thead>
</table>
| **DOUBLE-HUNG** | materials • wood, aluminum, steel in different designs and weights to meet various service requirements for all types of buildings  
                use • with combination of fixed windows for maximum window openings  
                operation • top and bottom openings optimize natural stratification ventilation  
                note • also available in single-hung (only one sash operating) and triple hung (three operable sash) |

| **SLIDING** | materials • wood, aluminum (with various coatings and claddings)  
                use • mostly in residential buildings  
                operation • provide only one half of opening for ventilation;  
                             • sash height to width ratio should not exceed 1 to 2 for good operation  
                note • sash usually removable for cleaning and may be very large |

| **DUAL-VENT** | materials • aluminum  
                 use • mostly in hospitals  
                 operation • essentially two sets of double-hung sash—air circulates through the bottom outer sash and then through the top inner sash  
                 note • provides ventilation while protecting from rain and drafts  
                             • check cost |

| **PIVOT** | materials • wood, aluminum and steel  
             use • mostly in air conditioned buildings  
             operation • consists of large vent, usually pivoted in the center of the head and sill of the main frame, which rotates 180° or 360° around its vertical axis for cleaning  
             note • not primarily designed for ventilation, although may be held open up to 4° with special hardware (unless unlocked by maintenance personnel) |
<table>
<thead>
<tr>
<th>TYPES</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>HORIZONTAL PIVOT</td>
<td>operation • similar to vertically pivoted but rotates around a horizontal axis</td>
</tr>
</tbody>
</table>
| INDUSTRIAL PIVOT     | materials • steel, aluminum  
|                      | use • often used horizontally and vertically to form entire walls  
|                      |                     • lower cost for use in industrial and utilitarian buildings  
|                      | note • mechanical operators are available                                  |
| SPECIAL              | CONTINUOUS                                                                  |
|                      | materials • steel  
|                      | use • for top lighting and ventilation in monitor and sawtooth roof construction  
|                      | operation • hinged at the top to the structural-steel framing members of the building and swing outward at the bottom  
|                      | note • mechanical operators may be either manual or motor-powered         |
| AUSTRAL              | materials • wood and steel  
|                      | use • schools, hospitals and other institutional buildings  
|                      | • upper and lower sash counterbalanced on arms pivoted to frame  
|                      | • upper and lower sash operate simultaneously  
|                      | note • difficult to screen, shade or curtain                                |
| REVERSIBLE           | materials • wood and steel  
|                      | use • residential and Industrial buildings  
|                      | operation • similar to double-hung in appearance, but may be tilted for better control of ventilation, or reversed for cleaning  
|                      | note • not universally available                                            |
| CUSTOM TYPES         | VARIOUS CONFIGURATIONS                                                      |
|                      | materials • aluminum, steel, stainless steel  
|                      | use • special types for windows in houses of worship, mausoleums, and memorial buildings  
|                      | operation • various arrangements available                                  |
1. Round Top over casements
2. Full Round with operating center
3. Round Top with authentic divided lites
4. Separated Round Top
5. Eyebrow with Gothic divided lites
6. Round Top over double-hung
7. Simulated Round Top
8. Round Top with quarter panes
9. Transom Round Top
10. 3 point Round Top
11. Quarter Rounds
12. Round Top over picture window
13. 12 foot Round Top with decorative divided lites
14. Inverted corners
15. 12 foot wide Round Top with operating center
16. Ovals
17. Spider Web
18. Gothic head
19. Rounded casements
20. Rounded double hung with Gothic lite pattern.
Specialties

WINDOW TREATMENTS

Window Types

Two-light window, the all-purpose window

Two-light window, three lights over one light

Two-light window, divided twelve lights

Two-light window, divided sixteen lights

Two-light window, six lights over one light

Two-light window, four horizontal lights high

Two-light window, six lights over nine

Two-light window, eight lights over twelve

Typical styles of windows
Window Types: Projected and Stationary

Fig. 1 Projected window. Cross sections: A, head jamb; B, horizontal mullion; C, sill.

Fig. 2 Stationary window. Cross sections: A, head jamb; B, muntin; C, sill.
Specialties

WINDOW TREATMENTS

Window Types: Double-Hung and Casement

Fig. 3 Double-hung windows. Cross sections: A, head jamb; B, meeting rails; C, side jamb; D, sill.

Fig. 4 Outswinging casement sash. Cross sections: A, head jamb; B, meeting styles; C, side jambs; D, sill.
Fig. 5 Double-hung metal windows. Cross sections: A, head; B, side jamb; C, sill.

Fig. 6 Solid-section steel outswinging casement sash. Cross sections: A, head jamb; B, side jamb; C, sill.
Specialties

WINDOW TREATMENTS

Window Types

Wood Trim

The casing around the window frames on the interior of the house should be the same pattern as that used around the interior door frames. Other trim which is used for a double-hung window frame includes the sash stops, stool, and apron (Fig. 7A). Another method of using trim around windows has the entire opening enclosed with casing (Fig. 7B). The stool is then a filler member between the bottom sash rail and the bottom casing.

The stool is the horizontal trim member that laps the window sill and extends beyond the casing at the sides, with each end notched against the plastered wall. The apron serves as a finish member below the stool. The window stool is the first piece of window trim to be installed and is notched and fitted against the edge of the jamb and the plaster line, with the outside edge being flush against the bottom rail of the window sash (Fig. 7A). The stool is blind-nailed at the ends so that the casing and the stop will cover the nailheads. Predrilling is usually necessary to prevent splitting. The stool should also be nailed at midpoint to the sill and to the apron with finishing nails. Face-nailing to the sill is sometimes substituted or supplemented with toenailing of the outer edge to the sill (Fig. 7A).

The casing is applied and nailed as described for door frames, except that the inner edge is flush with the inner face of the jambs so that the stop will cover the joint between the jamb and casing. The window stops are then nailed to the jambs so that the window sash slides smoothly. Channel-type weather stripping often includes full-width metal sub-jambs into which the upper and lower sash slide, replacing the parting strip. Stops are located against these instead of the sash to provide a small amount of pressure. The apron is cut to a length equal to the outer width of the casing line (Fig. 7A). It is nailed to the window sill and to the 2- by 4-inch framing sill below.

When casing is used to finish the bottom of the window frame as well as the sides and top, the narrow stool butts against the side window jamb. Casing is then mitered at the bottom corners (Fig. 7B) and nailed as previously described.

Fig. 7 Installation of window trim: A, with stool and apron; B, enclosed with casing.
CURTAINS
Curtains are soft window coverings that generally are shirred (gathered onto a rod) or have headings attached to solid-wood rods, round or oval metal rods, or café rods rather than cord-operated traverse rods. Curtains may be either stationary fabric panels or slid open and closed by hand. They are flexible in that they can be short or long, layered or tiered, or used alone or in combination with other soft, or with hard treatments. Curtain is traditionally a term for informal treatments, such as café curtains. However, curtains also may be quite formal, as are shirred and elegant tied-back fabric treatments.

Even though curtains are generally thought to be shirred treatments, other headings might be included in this category. Indeed, there is a crossover of terminology between draperies and curtains. Generally draperies are installed on cord-operated traverse rods, although they may be stationary pleated panels. Curtains may be installed on traverse rods (as in a pleated café curtain, for example), and headings such as the pencil pleat; drawstring pencil pleat; shirred, spaced pencil pleat; alternate pencil pleat; ruffled shirring tape heading; and smocked heading may be called either curtain or drapery treatments.

DRAPERIES
Draperies are made with pleats. They are hung with drapery hooks onto carriers of conventional, architectural, or decorative traverse rods or into the rings of wood rods or café curtain rods; or they may thread onto spring-system traverse rods. Generally draperies are either hung straight to the floor or tied back. Thus they operate, or "draw," by opening and closing with a cord or a wand or by hand. The exception is tied-back draperies, which sometimes are let down at night. However, tied-back draperies are trained to tie back at an angle and therefore should not be handled to any extent. Draperies draw in a pair and meet in the center (center-meet) or draw one way from left to right or from right to left. One-way draw draperies require one-way traverse rods.

Draperies that hang at a doorway rather than at a window are called portières. They may be pleated in any fashion or shirred. They may be placed on a traverse rod, but historically (and they were used extensively in the Victorian era), they were tied-back stationary panels made of a heavy fabric that were let down when privacy or insulation was needed.

Draperies can be made of any fabric. The selection will depend on the style, use, and needs. Sheer fabrics do best as diffusers of glare and as providers of daytime privacy. Medium- to heavyweight fabrics are excellent choices for overdrapery and plain tieback draperies. Lining fabrics are the right weight for privacy liners or underdraperies. If a drapery is given a ruffled edge or a banding, that trim should be a lightweight, semi-crisp, flexible fabric, not a heavy, stiff fabric or a sheer, slippery fabric.
### Specialties

#### WINDOW TREATMENTS

#### Curtains/Draperies

<table>
<thead>
<tr>
<th>Period style</th>
<th>Fabric</th>
<th>Colors</th>
<th>Design</th>
<th>Upholstery fabrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early English Tudor Jacobean Charles II</td>
<td>Crewel, embroidery, hand-blocked linen, silk and worsted damask, velvet, brocade</td>
<td>Full-bodied crimson, green, and yellow</td>
<td>Large bold patterns: tree branch, fruits, flowers, oak leaf, animals, heraldic designs</td>
<td>Tapestry, leather, needlework, velvet, brocade</td>
</tr>
<tr>
<td>Anglo-Dutch William &amp; Mary Queen Anne</td>
<td>Crewel, embroidery, hand-blocked linen, silk and worsted damask, velvet, brocade, India print</td>
<td>Full-bodied crimson, green, and yellow</td>
<td>Large bold patterns: tree branch, fruits, flowers, oak leaf, animals, heraldic designs</td>
<td>Tapestry, leather, needlework, velvet, brocade</td>
</tr>
<tr>
<td>Early Georgian Chippendale</td>
<td>Crewel, embroidery, hand-blocked linen, silk and worsted damask, velvet, brocade, Indian print</td>
<td>Full-bodied crimson, green, and yellow</td>
<td>Jacobean motifs, classic medallions and garlands</td>
<td>Tapestry, leather, needlepoint, velvet, brocade</td>
</tr>
<tr>
<td>Late Georgian Adam Hepplewhite Sheraton Empire Federal</td>
<td>Brocade, damask, chintz, taffeta, satin, toile de jouy</td>
<td>Delicate subdued hues of rose, yellow, mauve, green, and gray</td>
<td>Classic designs, small in scale: garlands, urns, floral, animals, etc.</td>
<td>Damask, brocade, velour, satin, petit point, leather in libraries</td>
</tr>
<tr>
<td>Louis XIV Louis XV Louis XVI</td>
<td>Silk, satin, damask, taffeta, muslin, brocade, toile de jouy</td>
<td>Delicate powder blue, oyster white, pearl, rose, pale greens, mauve, yellow</td>
<td>Stripes sprinkled with ribbons, flowers, medallions, lyres, and other classic motifs</td>
<td>Petit point, satin, moire velour, chintz, damask, brocade, tapestry</td>
</tr>
<tr>
<td>Spanish renaissance</td>
<td>Velvet, damask, crewel, India print, printed and embroidered linen</td>
<td>Rich vigorous colors, red, green, and gold</td>
<td>Bold patterns in classic and heraldic designs; also arabesques</td>
<td>Leather, tapestry, velvet, linen, brocatelle</td>
</tr>
<tr>
<td>Early colonial</td>
<td>Crewel, embroidery, hand-blocked linen, silk and worsted damask, velvet, brocade</td>
<td>Full-bodied crimson, green, and yellow</td>
<td>Large bold patterns: tree branch, fruits, flowers, oak leaf, animals, heraldic designs</td>
<td>Tapestry, leather, needlepoint, velvet, brocade</td>
</tr>
<tr>
<td>Early American</td>
<td>Toile de jouy, damask, chintz, organdy, cretonne</td>
<td>All colors, but more subdued than in early period</td>
<td>Scenic, birds, animals, floral</td>
<td>Haircloth, mohair, linen, chintz, velours</td>
</tr>
<tr>
<td>Modern</td>
<td>Textured and novelty weaves, all fabrics</td>
<td>All colors, bright to pastel</td>
<td>Solid colors, modern designs, stripes</td>
<td>All fabrics, novelty weaves, plastics</td>
</tr>
<tr>
<td>French provincial</td>
<td>Chintz, cretonne, hand-blocked linen, velvet</td>
<td>Subdued colors, pastel shades</td>
<td>Screen prints, block prints</td>
<td>Solid colors, textured weaves, tapestry</td>
</tr>
<tr>
<td>Victorian</td>
<td>Velvet, brocade, damask</td>
<td>Turkey red, other rich colors</td>
<td>Solid colors, formal patterns</td>
<td>Haircloth, needlework</td>
</tr>
</tbody>
</table>
Curtains/Draperies of Colonial and Federal Periods

18th-century colonial: tieback damask drapery with balled fringe

18th-century colonial: staggered tieback with plain edge asymmetric panels

18th-century colonial: swagged valance over bishop sleeve draperies over holdback

Federal: tieback panels with fringed raised valance of contrasting color

Federal: waterfall over holdback with draped valance

Federal: asymmetric tieback with fringed valance

Federal: heavy valance over straight draperies
Specialties

WINDOW TREATMENTS

Curtains/Draperies of Georgian and Directoire Periods

Georgian: tieback drapery with Austrian valance with fringes

Georgian: tieback heavy woven drapery with fabric-covered heading - sheer curtains behind

Georgian: tieback drapery with tapered French pleat heading

Late Georgian: curved fabric cartridge valance over holdback draperies

Late Georgian: gilt wood cornice over fixed lambrequins and sheer curtains

Late Georgian: gilt metal cornice over fixed tieback draperies and sheer curtains

Directoire: tieback draperies with contrasting edging on decorative brass rod

Directoire: fringed overdrapery valance on fringed sleeve tiebacks and fringed drapery

Directoire: painted stepped wood cornice over swag with twin cascades and tieback draperies
Specialties

WINDOW TREATMENTS
Curtains/Drapes of Victorian Period

Mid-19th-century Victorian: central swag with twin cascades over heavy draperies with braided tieback over sheer undercurtain

Late-19th-century Victorian: looped festoon over decorative brass rod

Late-19th-century Victorian: neo-Greek-style cornice with fringed valance over tieback fringed fabric with lace undercurtains
Specialties

WINDOW TREATMENTS

Curtains/Draperies of 1940s

- Fringed finger festoon over brackets over straight line draperies with sheer undercurtains

- Fringed fabric valance with cascades over bishop sleeve draperies
Specialties

WINDOW TREATMENTS

Curtains/Draperies

Tieback draperies with ruffles on center arch rod — pleated shade beneath

High tieback draperies with ruffled multirow valance — woven shade beneath

Full-length straight draperies with ruffled valance — decorative bows

Shirred, ruffled balloon valance over ruffled, shirred heading on narrow rod

Shirred heading on brass pole — fixed draperies with rosette tieback

Shirred heading on brass pole — fixed panel draperies

Shirred balance with shirred tieback draperies over blinds

Penta balloon valance over ribbon tieback draperies

Shirred valance with horizontal accent banding — tieback draperies with matching edge banding
Specialties

WINDOW TREATMENTS
Curtains/Draperies

Bishop sleeve fringed-tip valance with ribbon tieback draperies

Triple-row fringed heading with shirred tieback draperies

Fabric-covered straight cornice over paired tieback draperies and scalloped curtain on brass rod

Pinch pleated draperies with horizontal tiebacks over standard roller shades
Specialties

WINDOW TREATMENTS

Curtains/Draperies

Café curtains with scalloped edges on brass rods

Single pleated draperies over paired double hung windows with tab headed café curtains on rod

Fabric-covered cornice board valance — ribbon tiebacks on drapery

Ruffled valance heading over brass rod with straight draperies over scalloped café curtain
Specialties

WINDOW TREATMENTS
Curtains/Draperies

Simple traditional swag with cascade draperies

Rosette tieback priscilla curtains with continental heading

Scalloped café curtains on brass rod with pleated valance

Bow tieback curtains with fringed trim and gathered valance

Bow tieback gathered curtains on brass rod
Specialties

WINDOW TREATMENTS

Curtains/Draperies

- Overlapping swag on rod with ball-fringed cascades
- Swag with bow and asymmetric cascades
- Symmetrical swags and cascades with center rosette
- Symmetrical draped swag over brass rod
- Asymmetrical swag drapery over brass rod with sheer curtain
- Symmetrical draped swag on rod with ties at end over sheer or solid curtain
Specialties

WINDOW TREATMENTS
Curtains/Draperies

Triple-tail cascades with dual swags and rosette holds

Swag over rod with rosette holds

Swag, draped valance, cascading ends
Specialties

WINDOW TREATMENTS

Curtains/Drapes

Asymmetrical double-rod-supported swags and draperies — contemporary

Symmetrical long cascades and swags with center swag and bishop sleeve draperies

Overlapped double swag thrown over door-high holdbacks, with draperies billowed at floor
Flared cornice box with geometric trimmed scallops over reverse swags and asymmetric floor-tip cascades

Trimmed cornice box over asymmetric tieback drapery

Symmetrical box-pleated draperies on brass rod with double-tiered rosette holdbacks
Specialties

WINDOW TREATMENTS

Curtains/Draperies

- Pleated shade
- Miniblinds - custom fitted
- Wooden shutters
- Rounded valance with drapery
- Double swags with balloon drapery
- Double swags with cascades and drapery
- Shirred curtain with sunburst
- Pleated shade with shirred curtain
- French pleats with shaped top under curtain
Specialties

WINDOW TREATMENTS

Headings

- Triple shirred heading with ruffle gathered on 3 narrow rods
- Decorative heading on a wide rod
- Triple shirred heading gathered on 3 narrow rods
- Grouped French pleats
- Scalloped heading with rings and bows
- Tab heading spaced evenly on rod
- Scalloped heading with rings
- Double butterfly pleat heading
- Single butterfly pleat heading
- French pleats with scalloped heading
Specialties

WINDOW TREATMENTS

Tiebacks and Holdbacks

- Straight
- Tapered
- Banded
- Tapered with welling
- Oversized welling
- Shirred with welling
- Shirred with braided trim
- Braided
- Rosette
- Fringed with welling
- Scalloped
- Frilled
- Twin ruffles
- Straight with scallops
- Twin welling with box pleating
- Rosette with cascade
- Ruffles
- Bow/ribbon
- Bow with welling and tassel
- Tapered with welling, rosette, and tassels
Specialties

WINDOW TREATMENTS
Tiebacks and Holdbacks

Leaf motif
Decorative holdback
Scalloped with welting
Layered with pleats
Decorative with tassel

Decorative bow and ribbon
Square holdback with insert
Decorative knob with 2 inserts
Decorative knob holdback with tassel
Stylized rosette

Decorative knob with inserts
Decorative knob holdback with two tassels
Decorative bow holdback
Standard knob with cascade
Decorative knob with circular insert and cascade
Specialties

WINDOW TREATMENTS
Mounts, Brackets, and Couplers

MOUNTS

Flush mount — closed top
Outside mount — open top
Outside mount — closed side
Flush mount — open top
Outside mount — closed top
Inside mount bracket

BRACKETS

Flush extra-projection bracket
Base-mounted extra-projection bracket
Curved bracket
Support bracket
Curved support bracket
Double rod bracket

COUPLERS

Extra-projection base-mounted coupler
Base-mounted coupler
Specialties

WINDOW TREATMENTS
Finials, Rings, and Hooks

FINIALS

RINGS

Plain ring
Round eyelet ring
Oval eyelet ring
Square eyelet ring
Round clip-on ring
Oval clip-on ring
Rounded-end clip-on ring

HOOKS

Metal and plastic hooks for standard tapes
Metal hooks for decorative tapes
Specialties

WINDOW TREATMENTS

Rods

- Flat curtain rod
- Double flat curtain rod
- Cafe curtain rod
- Fluted wood rod
- Tension rod with adjustable screw
- Sash rods
- Separated curtain rod
- Extra wide telescoping projection rod
- Swinging arm separated rod
- Polyvinyl chloride (PVC) with end caps curtain rod
- Wide telescoping curtain rod
- PVC pipe with elbows for projection
Specialties

WINDOW TREATMENTS
Traverse Rods

Conventional single hung traverse rod — A, projecting end brackets; B, end housing; C, telescoping rod; D, center support; E, master carriers; F, carriers; G, end bracket; H, cord; I, tension pulley

Double traverse rod

One-way traverse rod with two center supports

Double traverse rod with valence
## TABLE 2  Fabric Panel Widths and Pleating Guidelines

<table>
<thead>
<tr>
<th>Desired pleated panel coverage</th>
<th>Flat fabric without hems</th>
<th>Hemmed flat fabric</th>
<th>Number of 4&quot; flat spaces between pleats</th>
<th>Number of pleats</th>
<th>Width of fabric in each pleat</th>
</tr>
</thead>
<tbody>
<tr>
<td>16&quot;</td>
<td>43&quot;</td>
<td>38&quot;</td>
<td>4</td>
<td>5</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>20&quot;</td>
<td>51&quot;</td>
<td>47&quot;</td>
<td>5</td>
<td>6</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>69&quot;</td>
<td>56&quot;</td>
<td>6</td>
<td>7</td>
<td>3 1/2&quot;</td>
</tr>
<tr>
<td>28&quot;</td>
<td>87&quot;</td>
<td>63&quot;</td>
<td>7</td>
<td>8</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>32&quot;</td>
<td>105&quot;</td>
<td>71&quot;</td>
<td>8</td>
<td>9</td>
<td>3 1/2&quot;</td>
</tr>
<tr>
<td>36&quot;</td>
<td>123&quot;</td>
<td>79&quot;</td>
<td>9</td>
<td>10</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>40&quot;</td>
<td>141&quot;</td>
<td>87&quot;</td>
<td>10</td>
<td>11</td>
<td>3 1/2&quot;</td>
</tr>
<tr>
<td>44&quot;</td>
<td>159&quot;</td>
<td>95&quot;</td>
<td>11</td>
<td>12</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>48&quot;</td>
<td>177&quot;</td>
<td>103&quot;</td>
<td>12</td>
<td>13</td>
<td>3 1/2&quot;</td>
</tr>
<tr>
<td>52&quot;</td>
<td>195&quot;</td>
<td>111&quot;</td>
<td>13</td>
<td>14</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>56&quot;</td>
<td>213&quot;</td>
<td>119&quot;</td>
<td>14</td>
<td>15</td>
<td>3 1/2&quot;</td>
</tr>
<tr>
<td>60&quot;</td>
<td>231&quot;</td>
<td>127&quot;</td>
<td>15</td>
<td>16</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>64&quot;</td>
<td>249&quot;</td>
<td>135&quot;</td>
<td>16</td>
<td>17</td>
<td>3 1/2&quot;</td>
</tr>
<tr>
<td>68&quot;</td>
<td>267&quot;</td>
<td>143&quot;</td>
<td>17</td>
<td>18</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>72&quot;</td>
<td>285&quot;</td>
<td>151&quot;</td>
<td>18</td>
<td>19</td>
<td>3 1/2&quot;</td>
</tr>
<tr>
<td>76&quot;</td>
<td>303&quot;</td>
<td>159&quot;</td>
<td>19</td>
<td>20</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>80&quot;</td>
<td>321&quot;</td>
<td>167&quot;</td>
<td>20</td>
<td>21</td>
<td>3 1/2&quot;</td>
</tr>
<tr>
<td>84&quot;</td>
<td>339&quot;</td>
<td>175&quot;</td>
<td>21</td>
<td>22</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>88&quot;</td>
<td>357&quot;</td>
<td>183&quot;</td>
<td>22</td>
<td>23</td>
<td>3 1/2&quot;</td>
</tr>
<tr>
<td>92&quot;</td>
<td>375&quot;</td>
<td>191&quot;</td>
<td>23</td>
<td>24</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>96&quot;</td>
<td>393&quot;</td>
<td>199&quot;</td>
<td>24</td>
<td>25</td>
<td>3 1/2&quot;</td>
</tr>
<tr>
<td>100&quot;</td>
<td>411&quot;</td>
<td>207&quot;</td>
<td>25</td>
<td>26</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>104&quot;</td>
<td>429&quot;</td>
<td>215&quot;</td>
<td>26</td>
<td>27</td>
<td>3 1/2&quot;</td>
</tr>
<tr>
<td>108&quot;</td>
<td>447&quot;</td>
<td>223&quot;</td>
<td>27</td>
<td>28</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>112&quot;</td>
<td>465&quot;</td>
<td>231&quot;</td>
<td>28</td>
<td>29</td>
<td>3 1/2&quot;</td>
</tr>
<tr>
<td>116&quot;</td>
<td>483&quot;</td>
<td>239&quot;</td>
<td>29</td>
<td>30</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>120&quot;</td>
<td>501&quot;</td>
<td>247&quot;</td>
<td>30</td>
<td>31</td>
<td>3 1/2&quot;</td>
</tr>
<tr>
<td>124&quot;</td>
<td>519&quot;</td>
<td>255&quot;</td>
<td>31</td>
<td>32</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>128&quot;</td>
<td>537&quot;</td>
<td>263&quot;</td>
<td>32</td>
<td>33</td>
<td>3 1/2&quot;</td>
</tr>
</tbody>
</table>

## TABLE 3  Rod Lengths Needed for Various Widths of Windows and Stackback Spaces

<table>
<thead>
<tr>
<th>If the glass is</th>
<th>The stackback* should be</th>
<th>Your rod length and drapery</th>
<th>coverage should be</th>
<th>(add for overlaps and returns)</th>
</tr>
</thead>
<tbody>
<tr>
<td>38&quot;</td>
<td>28&quot;</td>
<td>64&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>44&quot;</td>
<td>28&quot;</td>
<td>72&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50&quot;</td>
<td>30&quot;</td>
<td>80&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>56&quot;</td>
<td>32&quot;</td>
<td>88&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>62&quot;</td>
<td>34&quot;</td>
<td>96&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>68&quot;</td>
<td>36&quot;</td>
<td>104&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>74&quot;</td>
<td>38&quot;</td>
<td>112&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80&quot;</td>
<td>40&quot;</td>
<td>120&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>86&quot;</td>
<td>42&quot;</td>
<td>128&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>92&quot;</td>
<td>44&quot;</td>
<td>136&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>98&quot;</td>
<td>46&quot;</td>
<td>144&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>104&quot;</td>
<td>48&quot;</td>
<td>152&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>110&quot;</td>
<td>50&quot;</td>
<td>160&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>116&quot;</td>
<td>52&quot;</td>
<td>168&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>122&quot;</td>
<td>54&quot;</td>
<td>176&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>128&quot;</td>
<td>56&quot;</td>
<td>184&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>134&quot;</td>
<td>58&quot;</td>
<td>192&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>140&quot;</td>
<td>60&quot;</td>
<td>200&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>146&quot;</td>
<td>62&quot;</td>
<td>208&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>152&quot;</td>
<td>64&quot;</td>
<td>216&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>158&quot;</td>
<td>66&quot;</td>
<td>224&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>164&quot;</td>
<td>68&quot;</td>
<td>232&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>170&quot;</td>
<td>70&quot;</td>
<td>240&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>176&quot;</td>
<td>72&quot;</td>
<td>248&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>182&quot;</td>
<td>74&quot;</td>
<td>256&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*For one-way draws, deduct 7" from stackback.

Note: Figures are based on average pleating and medium-weight fabric. For extra bulky fabrics, add to stackback to compensate for the additional space they require.
Specialties

WINDOW TREATMENTS

Shades

Overlapping trimmed valance over scalloped shade

Banded valance over Roman shade

Shirred cornice box over tri-part balloon shade

Twin bow cloud shade with gathered heading

Inset flush Roman shade with horizontal folds

Tri-part Austrian shade with ruffled trim

Inset flush bottom pull Roman shade with horizontal folds
Woven wood blinds are long slats of wood from 1/4 to 1 inch width that are held together by decorative vertical yarns. They range in designs from those that are made mostly from exposed wood to those that are mainly yarns of several colors, creating various interesting effects. Woven wood blinds can be used with many window treatments including draperies and café curtains, and such shade types as Roman-fold, spring-rolls, cord and pulley, and duo-fold. Top treatments include canopies, valances, and arches, while scallops, fringes, and trims are suitable for the bottom. Because woven wood blinds add color and texture to a window, they are particularly adaptable to the "natural" look in decorating.
Fig. 9 Inside shutters can be used next to windows in place of curtains. Some are put under curtains or draperies; others are used café style either above or beneath café curtains. Shutters may be made from wood or metal. Natural wood tones are often used to enhance the beauty of the shutters. The inside section may be made from any of the following materials: fabric mesh, cane, grill cloth, or screening.
Specialties

WINDOW TREATMENTS

Shutters

CROSS SECTION OF LOUVER
1-3/4" louver 1/4" to 1/8"aper

Louveres are attached to tilt control rail with insertion pins for extra storm proofing.

Headrail 1/16" 1 of multiple dowel upper louver light blind

Side 1/4""""1-1/16" 1-3/4" louveres spaced 1 on 1" centers.

5/16" Louver projection 5/16" from back of panel

Lower louver light blind 1 of multiple dowels Bottom rail 11/16" in

In the interest of space head and bottom rails are shown smaller in

IMPORTANT:
Distance "A" on window stop MUST be 7/16" or greater for solid, square fit. (See cross section below)

Heavy duty (0.050) offset brass finish hinges are adjustable up and down, left and right allowing for perfect alignment of shutters on any window.

CROSS SECTION IMPORTANT:
Distance "A" on window stop MUST be 7/16" or greater for solid, square installation of hanging shutters.

Measure to point X if window stop is NOT removed

lock rail
2-panel single hung

lock rail
2-panel single hung

lock rail
Bi-fold single hung

lock rail
Bi-fold double hung
Specialties

WINDOW TREATMENTS

Shutters and Venetian Blinds

- Authentic Alpine wood at 5/8" thickness with long lift worm gear
- Authentic Small Alaskan yellow cedar gracefully rounded at ends
- Authentic wooden tassel
- Molded wooden bottom rail matching tilt rail
- Installation bracket 3/8" x 3/8"
- Headrail/tilt rail
- Multi stop cord lock
- Installation bracket 3/8" projection x 3/8" height
- 1/8" cotton web tape available in many traditional colors.
- Lift Stop w/ cotton cord and open reinforced carrier
- Bracket projection allows 1/2" clearance from behind blind.

Position a below shows bracket installed inside of the window casing (OBM). Distance “A” on stop molding must be 3/8" or greater for solid square fit.

Position b and c shows bracket installation on the face of casing (OBM).

Position d shows bracket installation on the wall beyond of above the casing. In this position bracket will allow 1/2" projection in order that blind will clear casing.

Cross section of typical double hung window

Standard Double Hung Window

Hanging hinges are mortised

Cross section of louvers 2-1/2" x 3/8" flat louver with radius edges

Louveres are attached to tilt control using multiple dowels for extra strong hold

Headrail 15/16" 1 of multiple dowels
Upper louver light blind
Bottom rail 1-1/8" x 2/16" 2-1/2" dowels installed on 2" center

Headrail/tilt rail

Louvered light blind hanging stop showing mortising position on window side behind shutters.
Installation surface on window stop MUST be 5/16" or greater (see distance “A” cross section below)

Heavy duty L.P.S. silver brass finish hinges is adjustable up and down, left and right allowing for perfect alignment of shutters on any window.

Cross section of standard double hung window

Window Casement

Window stop Distance “A” MUST be 5/16" or greater for solid square fit (see cross section below).

Distance A on window stop MUST be 5/16" or greater for solid, square installation of hanging stop

Lighted by a light bulb

Measures to point T window stop is NOT removed.

Measures to point T window stop is NOT removed.
DECORATIVE RODS
Measuring for Most Windows

Outside mount. Decorative rods should be mounted on the wall. Measure width of glass; if total glass exposure is desired, add for stackback (see Table 4). Rods should be hung so that drapery headings (pleated tops of panels) are at least 4" above the glass, so they can’t be seen from the outside.

Figuring Stackback
Stackback is the amount of wall space needed if open panels are to clear the glass completely. This dimension, added to the window opening, gives you the proper rod length. Begin by measuring the window opening, then consult Table 4. Find your opening measurement and read across for the right rod length.

<table>
<thead>
<tr>
<th>Window opening</th>
<th>Rod length</th>
<th>Stackback*</th>
</tr>
</thead>
<tbody>
<tr>
<td>24&quot;</td>
<td>21&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>30&quot;</td>
<td>23&quot;</td>
<td>5 3/4&quot;</td>
</tr>
<tr>
<td>36&quot;</td>
<td>25&quot;</td>
<td>6 1/4&quot;</td>
</tr>
<tr>
<td>42&quot;</td>
<td>26&quot;</td>
<td>7 1/2&quot;</td>
</tr>
<tr>
<td>48&quot;</td>
<td>28&quot;</td>
<td>8&quot;</td>
</tr>
<tr>
<td>54&quot;</td>
<td>30&quot;</td>
<td>9&quot;</td>
</tr>
<tr>
<td>60&quot;</td>
<td>31&quot;</td>
<td>9 1/2&quot;</td>
</tr>
<tr>
<td>66&quot;</td>
<td>32&quot;</td>
<td>10&quot;</td>
</tr>
<tr>
<td>72&quot;</td>
<td>34&quot;</td>
<td>10 1/2&quot;</td>
</tr>
<tr>
<td>78&quot;</td>
<td>36&quot;</td>
<td>11&quot;</td>
</tr>
<tr>
<td>84&quot;</td>
<td>37&quot;</td>
<td>11 1/4&quot;</td>
</tr>
<tr>
<td>90&quot;</td>
<td>39&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>96&quot;</td>
<td>39&quot;</td>
<td>12 1/2&quot;</td>
</tr>
<tr>
<td>102&quot;</td>
<td>40&quot;</td>
<td>13&quot;</td>
</tr>
<tr>
<td>108&quot;</td>
<td>41&quot;</td>
<td>13 1/2&quot;</td>
</tr>
<tr>
<td>114&quot;</td>
<td>43&quot;</td>
<td>14&quot;</td>
</tr>
<tr>
<td>120&quot;</td>
<td>45&quot;</td>
<td>15&quot;</td>
</tr>
</tbody>
</table>

*Added 7" for one-way draw.

Layered Treatments
Decorative traverse rods are often used for overtreatments. If the undertreatment is inside mounted or is an outside mounted mini-blind, pleated shade, Romanette woven wood or a cafe curtain, set the brackets for maximum clearance. Drapery returns will be 4½".

If you are using an undertreatment, you will want a utility curtain rod. It comes with its own brackets/supports.

If you are using undertreatments, double brackets are available. They hold both rods and automatically align the headings. Over-drapery returns will be 6" to 9".

PEATED SHADES
Measuring for Most Windows

Inside mount Measure width at top, center and bottom. Use narrowest measurement. Shades will be made narrower to slip inside easily. Measure length from inside top of opening to sill. A 1½" deep recess is needed for flush mounting. 2½" for Duette in ¾.

Outside mount Measure width of opening. Add at least 1¾ on each side for overlap. Measure from top of frame to sill or 1½ below opening if there is no sill. (If brackets are to go above window frame, add an extra 1½ for bracket bases.)

Ceiling mount Measure desired width and length of blind. Overlap window openings by at least 1½" on each side.

Measuring for Special Windows

Multiple shades. At very wide or sectioned windows, and sliding doors, it’s wise to use two shades hung from one header. Make a drawing of the window; include measurements of glass, woodwork, and overall size. Your dealer will do the rest.

Corner windows. Inside-mounted shades need no special measuring instructions. If outside or ceiling-mounted shades are used, they can be overlapped. Make a drawing of the window; include measurements of glass, woodwork and overall size. Your dealer will do the rest.

Other special windows. Bays and other unusual windows can frequently be fitted for pleated shades. Make a drawing of the window; include measurements of glass, woodwork, and overall size. Or ask your dealer to do the measuring for you.

Layered Treatments
Pleated shades are most often used with an undertreatment. If inside mounted, no extra projection is needed for the undertreatment. If outside mounted, the overtreatment must have a clearance of 2½" to clear the header. A cornice used over pleated shades should have a 4½" return.

Table 5 Stack Chart

<table>
<thead>
<tr>
<th>Shade length</th>
<th>Stack</th>
</tr>
</thead>
<tbody>
<tr>
<td>24&quot;</td>
<td>1½&quot;</td>
</tr>
<tr>
<td>30&quot;</td>
<td>1¾&quot;</td>
</tr>
<tr>
<td>36&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>42&quot;</td>
<td>2¼&quot;</td>
</tr>
<tr>
<td>48&quot;</td>
<td>2½&quot;</td>
</tr>
<tr>
<td>54&quot;</td>
<td>3&quot;</td>
</tr>
<tr>
<td>60&quot;</td>
<td>3¼&quot;</td>
</tr>
<tr>
<td>66&quot;</td>
<td>3½&quot;</td>
</tr>
<tr>
<td>72&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>78&quot;</td>
<td>4¼&quot;</td>
</tr>
<tr>
<td>84&quot;</td>
<td>4½&quot;</td>
</tr>
<tr>
<td>90&quot;</td>
<td>5&quot;</td>
</tr>
<tr>
<td>96&quot;</td>
<td>5¼&quot;</td>
</tr>
<tr>
<td>102&quot;</td>
<td>5½&quot;</td>
</tr>
<tr>
<td>108&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>114&quot;</td>
<td>6¼&quot;</td>
</tr>
<tr>
<td>120&quot;</td>
<td>6½&quot;</td>
</tr>
</tbody>
</table>

Measurements are from top of headrail to bottom of bottom rail.

CONVENTIONAL TRAVERSE RODS
Measuring for Most Windows

Outside or ceiling mount. Conventional rods may be mounted on the wall or ceiling. Measure the width of glass; if total glass exposure is desired, add for stackback (see Table 4). Rods should be hung so that drapery headings (pleated tops of panels) are at least 4" above the glass, so they can’t be seen from the outside.

Figuring Stackback
Stackback is the amount of wall space needed if open panels are to clear the glass completely. This dimension, added to the window opening, gives you the proper rod length. Begin by measuring the window opening, then consult Table 4. Find your opening measurement and read across the right rod length.

Measuring for Special Windows
Sliding doors. Measure as for outside mounted rod. Convert rod from two to one-way draw.

Corner and bay windows. Decorative rods may be used in these windows. However, it is best to consult your dealer or designer about the measuring.
Corner and bay windows. Measure each window as if it were set flat into the wall. At corners, run one rod into the corner and butt the other into it. At bays, butt all rods. Use either one or two-way draw rods for corners. For bays, use three two-way rods or two one-ways with a two-way in the center.

Layered Treatments

Conventional traverse rods come in sets specifically for layered treatments. If you are using an undercurn, you will want a traverse and plain rod set; both rods are on one set of brackets. Overdrapery returns will be 4Vi" to 5Vi".

If you are using underdrcapers, use a double traverse rod set. Again, one set of brackets holds both rods. Overdrapery returns will be 5Vi" to 6Vi".

The underdrcapment is inside mounted or is an outside mounted mini-blind, pleated shade, Romanette woven wood or a cafe curtain, use a single rod and set the brackets for maximum clearrance. Drapery returns will be 4Vi".

If the undertreatment is an outside-mounted vertical blind or a woven wood shade other than Romanette, special extenders plates for brackets and supports are available. Overdrapery returns will be 5Vi" to 6Vi".

Remember, whenever you change the clearrance of the brackets, you also change the drapery return.

VERTICAL BLINDS

Measuring for Most Windows

Inside mount: Measure wrdth at top, center and bottom. Use narrowest measurement. Verticals will be made slightly narrower to slip inside easily. Measure length from inside top of opening to sill. A minimum 3Vi" recess is required for track; 4Vi" if open vanes are to be flush with front of opening.

Outside mount: Measure width of opening. Add for stackback (see Tables 6 and 7). Measure from a point 2Vi" above top of frame to sill or floor; deduct 4Vi" for clearance.

Minimum projection of front of vane from wall is 5"; maximum is 6Vi". Minimum clearance of back of vane from wall is 1; maximum is 2Vi".

Sliding doors: Use a one-way draw. Measure width from trim to trim. Add to this measurement desired extra width for overlap beyond door. If total glass exposure is desired, also add for stackback (see Tables 6 and 7). Measure from a point 2Vi" from door trim to floor; deduct 3Vi" for clearance.

Layered Treatments

When layered, verticals are most often used as an undertreatment. If inside mounted, no extra clearance is needed for the overtreatment. If outside mounted, the overtreatment must have a clearance of 6" to clear the open vanes. A cornice used over verticals should have a 6" return.

Figuring Stackback

Stackback is the amount of wall space needed if open verticals are to clear the glass completely. This dimension, added to the window opening, gives you the proper track length.

Begin by measuring the window opening, then consult Table 6 or 7 for the type of treatment you desire — one- or two-way draw. Find your opening measurement and read across for the right track. (Note: Stackback figure for two-way draw is total stack; one-half of this is on each side of the window).

If your window opening is somewhere in between the measurements in the tables, go to the next smallest opening. Add the stackback listed there to your opening dimension.

Ceiling mount: Measure desired width and length of blind. Overlap window openings by at least 1Vi" on each side. Measure from top of frame to sill or 1Vi" below opening if there is no sill.

---

**TABLE 6 Two-Way Draw Stackback**

<table>
<thead>
<tr>
<th>Window opening</th>
<th>Track</th>
</tr>
</thead>
<tbody>
<tr>
<td>24&quot;</td>
<td>9&quot;</td>
</tr>
<tr>
<td>30&quot;</td>
<td>10&quot;</td>
</tr>
<tr>
<td>36&quot;</td>
<td>11&quot;</td>
</tr>
<tr>
<td>42&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>48&quot;</td>
<td>14&quot;</td>
</tr>
<tr>
<td>64&quot;</td>
<td>16&quot;</td>
</tr>
<tr>
<td>60&quot;</td>
<td>16&quot;</td>
</tr>
<tr>
<td>66&quot;</td>
<td>17&quot;</td>
</tr>
<tr>
<td>72&quot;</td>
<td>19&quot;</td>
</tr>
<tr>
<td>78&quot;</td>
<td>20&quot;</td>
</tr>
<tr>
<td>84&quot;</td>
<td>21&quot;</td>
</tr>
<tr>
<td>90&quot;</td>
<td>22&quot;</td>
</tr>
<tr>
<td>96&quot;</td>
<td>23&quot;</td>
</tr>
<tr>
<td>102&quot;</td>
<td>26&quot;</td>
</tr>
<tr>
<td>108&quot;</td>
<td>28&quot;</td>
</tr>
<tr>
<td>114&quot;</td>
<td>27&quot;</td>
</tr>
<tr>
<td>120&quot;</td>
<td>29&quot;</td>
</tr>
</tbody>
</table>

**TABLE 7 One-Way Draw Stackback**

<table>
<thead>
<tr>
<th>Window opening</th>
<th>Track</th>
</tr>
</thead>
<tbody>
<tr>
<td>24&quot;</td>
<td>7&quot;</td>
</tr>
<tr>
<td>30&quot;</td>
<td>8&quot;</td>
</tr>
<tr>
<td>36&quot;</td>
<td>9&quot;</td>
</tr>
<tr>
<td>42&quot;</td>
<td>11&quot;</td>
</tr>
<tr>
<td>48&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>64&quot;</td>
<td>13&quot;</td>
</tr>
<tr>
<td>60&quot;</td>
<td>14&quot;</td>
</tr>
<tr>
<td>66&quot;</td>
<td>15&quot;</td>
</tr>
<tr>
<td>72&quot;</td>
<td>17&quot;</td>
</tr>
<tr>
<td>78&quot;</td>
<td>18&quot;</td>
</tr>
<tr>
<td>84&quot;</td>
<td>19&quot;</td>
</tr>
<tr>
<td>90&quot;</td>
<td>20&quot;</td>
</tr>
<tr>
<td>96&quot;</td>
<td>21&quot;</td>
</tr>
<tr>
<td>102&quot;</td>
<td>22&quot;</td>
</tr>
<tr>
<td>108&quot;</td>
<td>23&quot;</td>
</tr>
<tr>
<td>114&quot;</td>
<td>25&quot;</td>
</tr>
<tr>
<td>120&quot;</td>
<td>26&quot;</td>
</tr>
</tbody>
</table>

**TABLE 8 Stack Chart**

<table>
<thead>
<tr>
<th>Blind length</th>
<th>Mini stack</th>
<th>Micro stack</th>
</tr>
</thead>
<tbody>
<tr>
<td>36&quot;</td>
<td>3&quot;</td>
<td>3Vi&quot;</td>
</tr>
<tr>
<td>48&quot;</td>
<td>4Vi&quot;</td>
<td>4%&quot;</td>
</tr>
<tr>
<td>60&quot;</td>
<td>4Vi&quot;</td>
<td>4%&quot;</td>
</tr>
<tr>
<td>72&quot;</td>
<td>4Vi&quot;</td>
<td>4%&quot;</td>
</tr>
<tr>
<td>84&quot;</td>
<td>4Vi&quot;</td>
<td>5Vi&quot;</td>
</tr>
<tr>
<td>96&quot;</td>
<td>5Vi&quot;</td>
<td>5%&quot;</td>
</tr>
<tr>
<td>108&quot;</td>
<td>5Vi&quot;</td>
<td>5%&quot;</td>
</tr>
</tbody>
</table>

Measurements are from top of headrail to bottom of bottomrail.
ELEVATOR TYPES

Hydraulic: For low-rise buildings — speeds up to 200 fpm. Ideal where design limitations preclude overhead supports and machine rooms. Economical to install and maintain; no penthouse or load-bearing walls required.

Geared traction: For low- to medium-rise buildings — speeds up to 400 fpm. Recommended for all types of buildings where higher speeds are not essential.

Gearless traction: Recommended for high-rise applications requiring the ultimate in service — speeds of 500 fpm and up.

ELEVATOR PLANNING

Starting Point Recommendations for All Types of Buildings

When preparing schematics for a particular type of building, select the quantity capacity and speed from one of Tables 1 to 4 and keep in mind that generally speaking:

- Passenger elevators should be wide and shallow with center-opening or single slide doors.
- Service elevators should be narrow and deep with two-speed doors.
- Combination passenger/service elevators should be almost square with either center-opening or two-speed center-opening doors.
- Freight elevator size and shape should be determined by the dimensions of goods to be carried and by the loading/unloading methods used. Doors should be of the vertical-bi-parting type.

The data contained in Tables 1 to 4 are based upon the following criteria.

Office buildings 100 square feet per person; an interval of 30 sec.; net rentable area = 80% of gross area; 5 minute carrying capacity of 12% of building population; typical floor heights were estimated at 12' and the main floor at 18'. When the building exceeds 250,000 square feet total, it is suggested that consideration be given to the use of separate freight elevators which are not included in Table 1.

Hospitals 5 minute vehicular demand = .04 × the number of rooms; interval of 35-60 seconds for vehicular traffic; visitor and staff population = 3 × number of beds; 5 minute carrying capacity equal to 12% of building population.

HOTELS Registration during conventions = 1.5 × the total number of rooms; maximum 1 hour peak is 1.15 × total registrations; 5 minute carrying capacity = 10% of total 1 hour peak load.

Apartments Population est. @ 2 persons per bedroom; 5 minute carrying capacity of 7%; maximum waiting interval of 60-90 seconds; average of 9'0'' floor height. Further, Table 4 applies only for average or medium income apartments. For applications beyond the scope of the table such as local-express arrangements, luxury apartment buildings and other considerations, please consult your local elevator company representative.

Table 4: Apartment Buildings — Passenger Elevators Only

<table>
<thead>
<tr>
<th>Number of Floors Including Main</th>
<th>BEDROOMS/FLOOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 floors</td>
<td></td>
</tr>
<tr>
<td>10 Bedrooms</td>
<td></td>
</tr>
<tr>
<td>2 Elev.</td>
<td></td>
</tr>
<tr>
<td>2000# @ 150 fpm</td>
<td></td>
</tr>
<tr>
<td>16 Bedrooms</td>
<td></td>
</tr>
<tr>
<td>2 Elev.</td>
<td></td>
</tr>
<tr>
<td>2000# @ 150 fpm</td>
<td></td>
</tr>
<tr>
<td>22 Bedrooms</td>
<td></td>
</tr>
<tr>
<td>2 Elev.</td>
<td></td>
</tr>
<tr>
<td>2000# @ 200 fpm</td>
<td></td>
</tr>
<tr>
<td>3 Elev.</td>
<td></td>
</tr>
<tr>
<td>2000# @ 250 fpm</td>
<td></td>
</tr>
<tr>
<td>30 Bedrooms</td>
<td></td>
</tr>
<tr>
<td>4 Elev.</td>
<td></td>
</tr>
<tr>
<td>2000# @ 350 fpm</td>
<td></td>
</tr>
<tr>
<td>4 Elev.</td>
<td></td>
</tr>
<tr>
<td>2500# @ 400 fpm</td>
<td></td>
</tr>
<tr>
<td>16 Elev.</td>
<td></td>
</tr>
<tr>
<td>2500# @ 500 fpm</td>
<td></td>
</tr>
<tr>
<td>32 Elev.</td>
<td></td>
</tr>
<tr>
<td>2500# @ 600 fpm</td>
<td></td>
</tr>
<tr>
<td>40 Elev.</td>
<td></td>
</tr>
</tbody>
</table>

* Due to the complexities such as local and express arrangements and service requirements inherent in taller and larger buildings, we suggest you contact your Armor representative when the limitations of this chart are exceeded.
Specialties

ELEVATORS

Low- and Mid-Rise Elevators

HYDRAULIC ELEVATORS

Ideal for use in buildings up to six floors. Supported and raised by a powerful hydraulic plunger, the hydraulic is renowned for smooth performance, quiet operation, and accurate floor leveling. And since it's supported from below, no vertical load is placed on the building. That means hoistways can be of lighter construction and no penthouse is needed. The machine room can be located nearly anywhere to let you maintain a flat roof line and save money on construction.

RECOMMENDED SIZES AND CAPACITIES

<table>
<thead>
<tr>
<th>TYPE</th>
<th>APARTMENT</th>
<th>OFFICE/MOTEL</th>
<th>LARGE OFFICE/STORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODEL</td>
<td>FLEETWOOD 2-H</td>
<td>MARQUIS 25</td>
<td>SEVILLE 30</td>
</tr>
<tr>
<td>CAPACITY (IN POUNDS)</td>
<td>2100</td>
<td>2500</td>
<td>2500</td>
</tr>
<tr>
<td>DIMENSIONS</td>
<td>5'-8&quot;</td>
<td>6'-8&quot;</td>
<td>6'-8&quot;</td>
</tr>
<tr>
<td></td>
<td>4'-3&quot;</td>
<td>4'-3&quot;</td>
<td>4'-3/4&quot;</td>
</tr>
<tr>
<td></td>
<td>3'-6&quot;</td>
<td>3'-6&quot;</td>
<td>3'-6&quot;</td>
</tr>
<tr>
<td></td>
<td>7'-4&quot;</td>
<td>8'-4&quot;</td>
<td>8'-4&quot;</td>
</tr>
<tr>
<td></td>
<td>5'-9&quot;</td>
<td>5'-9&quot;</td>
<td>6'-81/2&quot;</td>
</tr>
<tr>
<td></td>
<td>15'-0&quot;</td>
<td>17'-0&quot;</td>
<td>17'-0&quot;</td>
</tr>
<tr>
<td></td>
<td>3'-0&quot;</td>
<td>3'-6&quot;</td>
<td>3'-6&quot;</td>
</tr>
</tbody>
</table>

1 Inside dimensions.
2 Single car dimensions.
δ These models meet minimum size for handicapped use.

Hoistway dimensions are based on no provisions for seismic conditions and 6'-0" O.A. nominal cab height.

POWER UNIT (MACHINE) LOCATION: The most desirable machine room location is on the lowest floor, adjacent to the elevator hoistway. It may, however, be located remote from hoistway if necessary. Typical size for one-car installation: 7'-10" x 5'-6" x 8'-0" high; for two cars: 10'-9" x 6'-6" x 8'-0" high. Enclosure to meet local code requirements must be provided. A sound-isolated machine room is recommended for quietest operation. Adequate heating and ventilation of machine spaces must be provided.
TRACTION ELEVATORS
For use in buildings over six floors. They can serve up to 27 landings and can be used in office buildings, apartment complexes, dormitories, hotels, and other structures. These elevators can travel up to 1000 ft/min and are ideal for high-rise buildings of all kinds.

Recommended Sizes and Capacities

<table>
<thead>
<tr>
<th>MODEL</th>
<th>SPF21-H</th>
<th>SPF25-</th>
<th>SPF30-</th>
<th>SPF35-</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPACITY (IN POUNDS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIMENSIONS</td>
<td>2100</td>
<td>2500</td>
<td>3000</td>
<td>3500</td>
</tr>
<tr>
<td>A1</td>
<td>5'8&quot;</td>
<td>6'8&quot;</td>
<td>6'8&quot;</td>
<td>6'8&quot;</td>
</tr>
<tr>
<td>B1</td>
<td>4'3&quot;</td>
<td>4'3&quot;</td>
<td>4'9&quot;</td>
<td>5'5&quot;</td>
</tr>
<tr>
<td>C</td>
<td>-</td>
<td>3'6&quot;</td>
<td>3'6&quot;</td>
<td>3'6&quot;</td>
</tr>
<tr>
<td>D2</td>
<td>7'4&quot;</td>
<td>8'4&quot;</td>
<td>8'4&quot;</td>
<td>8'4&quot;</td>
</tr>
<tr>
<td>E</td>
<td>6'8&quot;</td>
<td>6'8&quot;</td>
<td>7'2&quot;</td>
<td>7'10&quot;</td>
</tr>
<tr>
<td>F</td>
<td>15'0&quot;</td>
<td>17'0&quot;</td>
<td>17'0&quot;</td>
<td>17'0&quot;</td>
</tr>
<tr>
<td>G</td>
<td>3'0&quot;</td>
<td>3'6&quot;</td>
<td>3'6&quot;</td>
<td>3'6&quot;</td>
</tr>
</tbody>
</table>

1. Inside dimensions
2. Single car dimensions
3. These models meet minimum size for handicapped use.

Hoistway dimensions are based on 1" out of plumb, no provisions for seismic conditions, and no occupied space below hoistway. If these conditions cannot be met, then consideration must be given for additional required space.

Minimum Pit, Overhead, Machine Room Dimensions

<table>
<thead>
<tr>
<th>CAPACITY (IN LBS.)</th>
<th>DIMENSIONS</th>
<th>SPEED (FEET PER MINUTE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2100</td>
<td>L</td>
<td>16'0&quot; 16'0&quot; -</td>
</tr>
<tr>
<td></td>
<td>O</td>
<td>15'4&quot; 15'4&quot; -</td>
</tr>
<tr>
<td></td>
<td>P*</td>
<td>5'0&quot;   5'0&quot; -</td>
</tr>
<tr>
<td>2500</td>
<td>L</td>
<td>16'0&quot; 16'0&quot; 16'0&quot;</td>
</tr>
<tr>
<td></td>
<td>O</td>
<td>15'4&quot; 15'4&quot; 16'4&quot;</td>
</tr>
<tr>
<td></td>
<td>P*</td>
<td>5'0&quot;   5'0&quot; 6'6&quot;</td>
</tr>
<tr>
<td>3000</td>
<td>L</td>
<td>16'0&quot; 16'0&quot; 16'0&quot;</td>
</tr>
<tr>
<td></td>
<td>O</td>
<td>15'4&quot; 16'0&quot; 16'4&quot;</td>
</tr>
<tr>
<td></td>
<td>P*</td>
<td>5'0&quot;   5'0&quot; 6'6&quot;</td>
</tr>
<tr>
<td>3500</td>
<td>L</td>
<td>16'0&quot; 16'0&quot; 16'0&quot;</td>
</tr>
<tr>
<td></td>
<td>O</td>
<td>15'4&quot; 16'0&quot; 17'6&quot;</td>
</tr>
<tr>
<td></td>
<td>P*</td>
<td>5'0&quot;   5'0&quot; 6'6&quot;</td>
</tr>
</tbody>
</table>

Overhead "O" based on 8'-0" O.A. nominal cab height.
1. Machine beams designed per ANSI/ASME code A17.1 and does not include floor weight and loads on floor.
2. 6'-0" min. "P" travel above 250'-0" SPF21 SPF25
   travel above 225'-0" SPF30
   travel above 200'-0" SPF35  for speeds up to 350 F/M
### RECOMMENDED SIZES AND CAPACITIES

<table>
<thead>
<tr>
<th>TYPE BUILDING</th>
<th>SMALL</th>
<th>AVERAGE</th>
<th>LARGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIMENSIONS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>2100</td>
<td>2500</td>
</tr>
<tr>
<td></td>
<td>3000</td>
<td>3500</td>
<td>4000</td>
</tr>
<tr>
<td>A1</td>
<td>6'-0&quot;</td>
<td>5'-8&quot;</td>
<td>6'-8&quot;</td>
</tr>
<tr>
<td></td>
<td>6'-8&quot;</td>
<td>6'-8&quot;</td>
<td>6'-8&quot;</td>
</tr>
<tr>
<td>B1</td>
<td>3'-7&quot;</td>
<td>4'-3&quot;</td>
<td>4'-9&quot;</td>
</tr>
<tr>
<td></td>
<td>5'-5&quot;</td>
<td>5'-5&quot;</td>
<td>5'-5&quot;</td>
</tr>
<tr>
<td>C</td>
<td>3'-0&quot;</td>
<td>3'-6&quot;</td>
<td>3'-6&quot;</td>
</tr>
<tr>
<td></td>
<td>3'-6&quot;</td>
<td>3'-6&quot;</td>
<td>3'-6&quot;</td>
</tr>
<tr>
<td>D2</td>
<td>7'-8&quot;</td>
<td>7'-4&quot;</td>
<td>8'-4&quot;</td>
</tr>
<tr>
<td></td>
<td>8'-4&quot;</td>
<td>8'-4&quot;</td>
<td>8'-4&quot;</td>
</tr>
<tr>
<td>E2</td>
<td>6'-0&quot;</td>
<td>6'-8&quot;</td>
<td>6'-8&quot;</td>
</tr>
<tr>
<td></td>
<td>7'-2&quot;</td>
<td>7'-10&quot;</td>
<td>7'-10&quot;</td>
</tr>
<tr>
<td>F</td>
<td>15'-8&quot;</td>
<td>17'-0&quot;</td>
<td>17'-0&quot;</td>
</tr>
<tr>
<td></td>
<td>19'-0&quot;</td>
<td>19'-0&quot;</td>
<td>19'-0&quot;</td>
</tr>
<tr>
<td>G</td>
<td>3'-0&quot;</td>
<td>3'-6&quot;</td>
<td>3'-6&quot;</td>
</tr>
<tr>
<td></td>
<td>3'-6&quot;</td>
<td>3'-6&quot;</td>
<td>3'-6&quot;</td>
</tr>
<tr>
<td></td>
<td>4'-0&quot;</td>
<td>4'-0&quot;</td>
<td>4'-0&quot;</td>
</tr>
</tbody>
</table>

1. Inside dimensions
2. Single car dimensions
3. Add 3" when speed = 500 FPM or above
4. Add 4" when speed = 1000 FPM

### MINIMUM PIT, OVERHEAD, MACHINE ROOM DIMENSIONS

<table>
<thead>
<tr>
<th>SPEED (FEET PER MINUTE)</th>
<th>200</th>
<th>350</th>
<th>450</th>
<th>500</th>
<th>700</th>
<th>800</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>16'-0&quot;</td>
<td>15'-4&quot;</td>
<td>15'-4&quot;</td>
<td>16'-4&quot;</td>
<td>16'-6&quot;</td>
<td>16'-6&quot;</td>
<td>16'-6&quot;</td>
</tr>
<tr>
<td>O</td>
<td>5'-0&quot;</td>
<td>5'-0&quot;</td>
<td>5'-0&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>16'-0&quot;</td>
<td>15'-4&quot;</td>
<td>15'-4&quot;</td>
<td>16'-4&quot;</td>
<td>16'-6&quot;</td>
<td>16'-6&quot;</td>
<td>16'-6&quot;</td>
</tr>
<tr>
<td>P</td>
<td>5'-0&quot;</td>
<td>5'-0&quot;</td>
<td>5'-0&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
</tr>
<tr>
<td>2500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>16'-0&quot;</td>
<td>15'-4&quot;</td>
<td>15'-4&quot;</td>
<td>16'-4&quot;</td>
<td>16'-6&quot;</td>
<td>16'-6&quot;</td>
<td>16'-6&quot;</td>
</tr>
<tr>
<td>O</td>
<td>5'-0&quot;</td>
<td>5'-0&quot;</td>
<td>5'-0&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>16'-0&quot;</td>
<td>15'-4&quot;</td>
<td>15'-4&quot;</td>
<td>16'-4&quot;</td>
<td>16'-6&quot;</td>
<td>16'-6&quot;</td>
<td>16'-6&quot;</td>
</tr>
<tr>
<td>O</td>
<td>5'-0&quot;</td>
<td>5'-0&quot;</td>
<td>5'-0&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>16'-0&quot;</td>
<td>15'-4&quot;</td>
<td>15'-4&quot;</td>
<td>16'-4&quot;</td>
<td>16'-6&quot;</td>
<td>16'-6&quot;</td>
<td>16'-6&quot;</td>
</tr>
<tr>
<td>O</td>
<td>5'-0&quot;</td>
<td>5'-0&quot;</td>
<td>5'-0&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>16'-0&quot;</td>
<td>15'-4&quot;</td>
<td>15'-4&quot;</td>
<td>16'-4&quot;</td>
<td>16'-6&quot;</td>
<td>16'-6&quot;</td>
<td>16'-6&quot;</td>
</tr>
<tr>
<td>O</td>
<td>5'-0&quot;</td>
<td>5'-0&quot;</td>
<td>5'-0&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
<td>6'-6&quot;</td>
</tr>
<tr>
<td>P</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** These dimensions are for general application to custom designed elevators.
Overhead "O" based on 8'-0" O.A. nominal cab height.
Machine beams designed per ANSI/ASME code A17.1 and does not include floor weight and loads on floor.
**CENTRE-OPENING DOORS**

These permit quickest entry and exit, thus speeding elevator service, and provide an attractive balanced appearance both in the hallway and inside the elevator car. They should always be used in high-speed applications.

**TWO-SPEED SLIDING DOORS**

Doors of this type provide the widest possible opening width for small cars but do not afford the entry and exit speed of center-opening doors. The two doors move in the same direction, one sliding behind the other.

**SINGLE SLIDING DOORS**

This is the most economical type of elevator door, and also the slowest. The single door moves either to right or left from one side of the elevator car, the opening being limited by the width of the door and car.
Floor plan of elevator cars

The floor area of elevator cars shall provide space for wheelchair users to enter the car, maneuver within reach of controls, and exit from the car. Acceptable door opening end inside dimensions shall be as shown in Fig. 1. The clearance between the car platform sill and the edge of any hoistway opening shall be no greater than 1/4 in (32 mm).

Illumination levels

The level of illumination at the car controls, platform, and car thresholds and landing sill shall be at least 5 footcandles (53.8 lux).

Car controls

Elevator control panels shall have the following features:

1. Buttons. All control buttons shall be at least 1/4 in (19 mm) in their smallest dimension. They may be raised or flush.

2. Tactile and visual control indicators. All control buttons shall be designated by raised standard alphabet characters for letters, Arabic characters for numerals, or standard symbols as shown in Fig. 3(a), and as required in ANSI A17.1-1978 and A17.1a-1979. The call button for the main entry floor shall be designated by a raised star at the left of the floor designation [see Fig. 3(a)]. All raised designations for control buttons shall be placed immediately to the left of the button to which they apply. Applied plates, permanently attached, are an acceptable means to provide raised control designations. Floor buttons shall be provided with visual indicators to show when each call is registered. The visual indicators shall be extinguished when each call is answered.

3. Height. All floor buttons shall be no higher than 48 in (1220 mm), unless there is a substantial increase in cost, in which case the maximum mounting height may be increased to 54 in (1370 mm) above the floor.

Emergency controls, including the emergency alarm and emergency stop, shall be grouped at the bottom of the panel and shall have their centerlines no less than 35 in (890 mm) above the floor [see Fig. 3(a) and (b)].

4. Location. Controls shall be located on a front wall if cars have center opening doors, and at the side wall or at the front wall next to the door if cars have side opening doors [see Fig. 3(c) and (d)].

Car position indicators

In elevator cars, a visual car position indicator shall be provided above the car control panel or over the door to show the position of the elevator in the hoistway. As the car passes or stops at a floor served by the elevators, the corresponding numerals shall illuminate, and an audible signal shall sound. Numerals shall be a minimum of 1/2 in (13 mm) high. The audible signal shall be no less than 20 decibels with a frequency no higher than 1500 Hz. An automatic verbal announcement of the floor number at which a car stops or which a car passes may be substituted for the audible signal.

Emergency communications

If provided, emergency two-way communication systems between the elevator and a point outside the hoistway shall comply with ANSI A17.1-1978 and A17.1a-1979. The highest operable part of a two-way communication system shall be a minimum of 48 in (1220 mm) from the floor of the car. It shall be identified by a raised or recessed symbol and located adjacent to the device, if the system uses a handset, then the length of the cord from the panel to the handset shall be at least 28 in (735 mm). The emergency intercommunication system shall not require voice communication.

NOTE: The automatic door reopening device is activated if an object passes through either line A or line B. Line A and line B represent the vertical locations of the door reopening device not requiring contact.

Fig. 1 Minimum dimensions of elevator cars.

Fig. 2 Hoistway and elevator entrances.
**ELEVATORS**

Barrier-Free Considerations

---

**Panel Detail**

- 3/4 control diameter
- Octagon symbol shall be tactile, but the X is not

---

**Control Height**

- 35 min
- 850 max
- 1220

---

**Alternate Locations of Panel with Center Opening Door**

---

**Alternate Locations of Panel with Side Opening Door**

---

Fig. 3 Car controls.
Specialties

ELEVATORS

Typical Section of Escalator

2nd Floor Escalator, No. 1 & 2

Scale 1/4" = 1'-0"

Section A-A

Scale 1/4" = 1'-0"
Specialties

ELEVATORS

Wheelchair Lifts

Fig. 4 Wheelchair lift. In certain installations where ramps may be impossible due to space limitations, small mechanical wheelchair lifts can be installed to overcome level changes. Manufactured lifts have a lift range from two to several feet and are either electro-mechanical, hydraulic, or pneumatically operated. Lifts can be semi-enclosed and equipped with entrance interlocks for safety, and either key-operated for limited use or button-type. "Dead-man" controls are recommended for safety.
Fig. 1 NCAA basketball. The color of the lane space marks and neutral zone marks shall contrast with the color of the bounding lines. The midcourt marks shall be the same color as the bounding lines. All lines shall be 2 in wide (neutral zone excluded). All dimensions are to inside edge of lines except as noted. Backboard shall be of any rigid weather-resistant material. The front surface shall be flat and painted white unless it is transparent. If the backboard is transparent, it shall be marked with a 3-in wide white line around the border and an 18 x 24-in target area bounded with a 2-in wide white line. [High school recommended court is 94 x 50 ft with a 10-ft unobstructed space on all sides (3 ft minimum).] Collegiate recommended court is 94 x 50 ft with a 10-ft unobstructed space on all sides (3 ft minimum).

Fig. 2 AAU basketball court. All dimensions are to inside edge of lines except as noted. All lines to be .05 m (2") wide. Backboard shall be of any rigid weather-resistant material. The front shall be flat and painted white unless it is transparent. If the backboard is transparent, it shall be marked with a .05-m-wide white line around the border and a .45 x .59-m target area bounded with a .05-m-wide white line.
Specialties

INDOOR RECREATION
One-, Three-, and Four-Wall Handball

Fig. 3 One-wall handball. Playing court is 20' 0" wide by 34' 0" long plus a required 11' 0" minimum width of surfaced area to the rear and a recommended 8' 6" minimum width on each side. Courts in battery are to be a minimum of 6' 0" between courts. Court markings: 1½-in-wide lines painted white, red, or yellow.

Fig. 4 Handball court layout — four-wall. All court markings to be 1½-in wide and painted white, red, or yellow. Playing court is 20' 0" wide by 40' 0" long plus a minimum 10' 0" to the rear of the three-wall court. Overhead clearance required is 20' 0" minimum.
Fig. 6 Gymnasium plan and section.
Specialties

INDOOR RECREATION
Tennis and Paddle Tennis

Fig. 7 Tennis court. All measurements for court markings are to the outside of lines except for those involving the center service line which is equally divided between the right and left service courts. All court markings to be 2 in wide.

Fig. 8 Paddle tennis court. All measurements for court markings are to the outside of lines except for those involving the center service line, which is equally divided between right and left service court. All court markings to be 1 1/2 in wide.
Specialties

INDOOR RECREATION
Badminton and Volleyball

Fig. 9 Badminton court. All measurements for court markings are to the outside of lines except for those involving the center service line which is equally divided between right and left service courts. All court markings to be 11/16" wide and preferably white or in color. Minimum distance between sides of parallel courts to be 5' 0".

Fig. 10 Volleyball court. All measurements for court markings are to the outside of lines except for the centerline. All court markings to be 2" wide except as noted.
Fig. 11. Shuffleboard court. All dimensions are to centers of lines and to edge of court. Maximum line width 1/8 in., minimum 1/4 in. Playing court is 60' x 52'0" plus a recommended minimum of 2'0" on each side or 4'0" between courts in battery.
# ACCESSORIES

**Letter Boxes**

<table>
<thead>
<tr>
<th>NO. OF OPENINGS</th>
<th>FOR 3, 4 &amp; 5 WIDE NESTS</th>
<th>NET OVERALL WIDTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>SINGLE</td>
<td>DOUBLE</td>
<td>ROUGH OPENING</td>
</tr>
<tr>
<td></td>
<td>SUGGESTED ARRANGEMENT</td>
<td>CABINET</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>3-3</td>
</tr>
<tr>
<td>7</td>
<td>14</td>
<td>3-4</td>
</tr>
<tr>
<td>8</td>
<td>16</td>
<td>4-4</td>
</tr>
<tr>
<td>9</td>
<td>18</td>
<td>4-5</td>
</tr>
<tr>
<td>10</td>
<td>20</td>
<td>5-5</td>
</tr>
<tr>
<td>11</td>
<td>22</td>
<td>4-3-4</td>
</tr>
<tr>
<td>12</td>
<td>24</td>
<td>4-4-4</td>
</tr>
<tr>
<td>13</td>
<td>26</td>
<td>4-5-4</td>
</tr>
<tr>
<td>14</td>
<td>28</td>
<td>5-5-5</td>
</tr>
<tr>
<td>15</td>
<td>30</td>
<td>5-5-5</td>
</tr>
<tr>
<td>16</td>
<td>32</td>
<td>6-5-5</td>
</tr>
<tr>
<td>17</td>
<td>34</td>
<td>5-4-4</td>
</tr>
<tr>
<td>18</td>
<td>36</td>
<td>5-4-4</td>
</tr>
<tr>
<td>19</td>
<td>38</td>
<td>5-4-5</td>
</tr>
<tr>
<td>20</td>
<td>40</td>
<td>5-5-5</td>
</tr>
<tr>
<td>21</td>
<td>42</td>
<td>5-4-4-4</td>
</tr>
<tr>
<td>22</td>
<td>44</td>
<td>5-4-4-5</td>
</tr>
<tr>
<td>23</td>
<td>46</td>
<td>5-5-3-5</td>
</tr>
<tr>
<td>24</td>
<td>48</td>
<td>5-5-4-5</td>
</tr>
<tr>
<td>25</td>
<td>50</td>
<td>5-5-5-5</td>
</tr>
<tr>
<td>26</td>
<td>52</td>
<td>5-4-4-4-5</td>
</tr>
<tr>
<td>27</td>
<td>54</td>
<td>5-4-4-5-5</td>
</tr>
<tr>
<td>28</td>
<td>56</td>
<td>5-5-4-5-5</td>
</tr>
<tr>
<td>29</td>
<td>58</td>
<td>5-5-5-5-5</td>
</tr>
<tr>
<td>30</td>
<td>60</td>
<td>5-5-5-5-5</td>
</tr>
<tr>
<td>31</td>
<td>62</td>
<td>5-4-4-4-5</td>
</tr>
<tr>
<td>32</td>
<td>64</td>
<td>5-5-4-4-5</td>
</tr>
<tr>
<td>33</td>
<td>66</td>
<td>5-5-5-4-5</td>
</tr>
<tr>
<td>34</td>
<td>68</td>
<td>5-5-5-5-5</td>
</tr>
<tr>
<td>35</td>
<td>70</td>
<td>5-5-5-5-5</td>
</tr>
<tr>
<td>36</td>
<td>72</td>
<td>5-5-5-5-5</td>
</tr>
<tr>
<td>37</td>
<td>74</td>
<td>5-5-5-5-5-5</td>
</tr>
<tr>
<td>38</td>
<td>76</td>
<td>5-5-5-5-5-5</td>
</tr>
<tr>
<td>39</td>
<td>78</td>
<td>5-5-5-5-5-5</td>
</tr>
<tr>
<td>40</td>
<td>80</td>
<td>5-5-5-5-5-5</td>
</tr>
<tr>
<td>41</td>
<td>82</td>
<td>4-4-5-5-5-5-4-4</td>
</tr>
<tr>
<td>42</td>
<td>84</td>
<td>4-5-5-5-5-5-5-5</td>
</tr>
<tr>
<td>43</td>
<td>86</td>
<td>5-5-5-5-5-5-5-5</td>
</tr>
<tr>
<td>44</td>
<td>88</td>
<td>5-5-5-5-5-5-5-5</td>
</tr>
<tr>
<td>45</td>
<td>90</td>
<td>5-5-5-5-5-5-5-5</td>
</tr>
</tbody>
</table>
Specialties

ACCESSORIES

Mail Drops

**Contemporary**
30" H x 18" W x 10" D

**Classic Bronze**
36" H x 19" W x 10" D

**Letterslot**
6 1/2" H x 14" W

**Book Depository**
10 1/2" H x 20" W

**Plate Front**
26" H x 39" W
Key Storage Cabinet
The safest way to keep keys stored in one central secure location. Available in four different sizes, holding from 32 to 128 keys.

Holds 32 Keys
9 1/4" H x 13 3/8" W

Holds 64 Keys
18 3/8" H x 13 3/8" W

Holds 96 Keys
23 1/4" H x 13 3/8" W

Holds 128 Keys
30 1/4" H x 13 3/8" W

Key Keeper
For use in a mail room (rear loading) installation. The arrow lock is accessed by the postman to retrieve the mail room door key, and stored safely when not in use.
Accessories

Types of Grilles

1. Cast metal grille of unit design, cast in one piece. Grille size is governed by unit sizes plus width of border.

2. Cast metal grille of unit design, units cast separately and built into frame. Grille size is governed by unit sizes plus width of border.

3. Cast metal grille of unit design. Units cast separately and built into grille spaces. Grille size must conform to unit sizes plus widths of bars and borders.

Fig. 1 Cast metal grilles may be designed and built in various combinations. They may be made in small units cast separately or as one complete piece.
Stamped metal grille, square holes. Holes may be from \(\frac{1}{4}\)" to \(1\frac{1}{2}\)" or larger, in \(\frac{1}{8}\)" steps, with bars or frets from \(\frac{1}{8}\)" to \(\frac{3}{8}\)" or greater.

Stamped metal grille, square holes arranged to form diagonal center.

Stamped metal grille, shell or fish scale design, made in several unit sizes and variations.

Stamped metal grille, square holes diagonally arranged.

Stamped metal grille, Grecian or Union Jack design, made in a number of unit sizes and variations.

Stamped metal grille, square holes arranged to form plain border with diagonal center.

Stamped metal grille, square holes arranged to form plain border with diagonal center.

Foundation or Bulkhead Grille

Foundation or Bulkhead Grille

Screwdriver Operated Catch

Lock and Dead Bolt

**Scale** 1\(\frac{1}{2}\)" = 1'-0" AND 1\(\frac{1}{4}\)" = 1'

**PROVIDE STOP AS REQUIRED**

**Thumb Latch**

**SPECIFY:**
- Sizes of holes or unit stampings
- Thickness
- Metal and finish
- Approximate width of margins
- Method of fastening
- Hinges and locks where required
- Invisible hand hole doors

Fig. 2 Stamped metal grilles are produced in a great variety of designs, metals, thicknesses, and sizes. Percentage of free area of stamped grilles may vary from about 25% to over 70%, with a great many designs in the 55% to 65% range. Margin widths can be made to accord with requirements of particular installations, consideration being given to duct openings and overall dimensions. Metal may be steel, painted or otherwise finished, bronze, aluminum, monel metal, or other nonferrous metals, in thicknesses from 16 gauge to \(\frac{1}{4}\)".
Perforated metal grilles may be obtained in several designs and are produced of 18 gauge steel in sheets of standard sizes. Sheets may be cut to any size and placed in frames of metal or other material. Perforated metal grilles are used for vent openings, panels, covers, shelves, partitions, cabinets, metal furniture, boxes, machinery guards, enclosures and many other purposes. They are also available in many other patterns in any ferrous or nonferrous metal that can be perforated, and in thicknesses from about 24 gauge in the smaller perforations to 1/8" or 1/4" in the larger perforations.

SPECIFY:
- Pattern of perforations
- Metal
- Finish
- Gauge or thickness
- Give frame details

SCALE \(\frac{1}{2} \times 1\)
Fig. 4. Design of wrought metal grilles includes the use of other metal forms, such as sheets, extruded mouldings, castings, and stampings. Thus, in addition to plain bar sections and forged items, use is made of the unlimited number of extruded mouldings in non-ferrous metals; stamped leaves, rosettes, and ornaments of many kinds; cast iron, bronze, nickel silver, and aluminum items of every character; and rolled or drawn sections of many shapes.
Types of Grilles

- Grille of round or square vertical bars welded to horizontal bars set in masonry.
- Grille with anchors set in masonry and grille bolted or riveted to anchors.
- Grille with short alternate vertical bars, angle clips fastened to opening jambs.
- Grille, with ornament between bars, set in masonry opening.
- Grille of welded construction set on face of wall.
- Grille of welded construction set on face of wall.

Methods of forming vertical bars.

Fig. 5 Window grilles are of plain construction when used for protection only, and when used for ornamental effect, may be designed with many unique and interesting ideas. Window grilles may be set in the masonry openings or on the face of the wall, with either plain or ornamental brackets or supports. They may also be attached to window frames, or may be arranged to swing, with hinges and locks. Material sizes in window grilles may vary according to the degree of protection required, and in proportion to the size of the grille.
Methods of fastening grilles. Cast and stamped metal grilles may be fastened by screws or hinges and locks to walls of wood, plaster, marble, or other material in a variety of ways, depending upon the type of the grille, the type of framing to be used around the grille, and the appearance or effect desired. These methods show a number of ways in which cast and stamped grilles may be fastened. In selecting the method desired, consideration should be given to whether or not the grille will require frequent removal. The size and weight of the grille will have a bearing upon the size of frames, screws, and hinges.
Grille Fastening Methods

Two members crossed, one member cut and welded to the other. Two members crossed, each member halved. Pin may be countersunk or peined. Two members crossed, one member split permitting other to pass through. Two members crossed, one member laid upon the other, with round-head or countersunk rivet. Two members crossed, one member punched permitting other to pass through. Two members crossed, each member crimped.

Two members crossed, each member flattened, with round head rivet. Two members linked. Formed members welded to sides of straight member. Formed members banded to sides of straight member. Formed members terminated and banded to sides of straight member.

One member cut and welded to side of other. One member set into punched hole in other member and welded. One member set against other member and attached by flat head tapped screw. One member attached to side of other member by angle clips bolted or riveted. Formed member with knife edge, welded to side of straight member. Formed member with blunt end and welded to side of straight member.

Corner members welded. Corner members fitted, with two flat head tapped screws. Corner members bolted through angle clips. Corner members with welded gusset plates.

Formed member attached to the other member by band in slot. Two parallel members attached by spool and pin.

Methods of splitting members and forming into scrolls, ends, ornaments, or structural elements.

SCALE 1/2 = 1'-0"

Fig. 7 Wrought metal grilles are fabricated by the use of a great many different methods of crossing and joining members. Some of the more widely employed of these methods are shown here.
Specialties

ACCESSORIES

Vinyl Wall Protection Guards

Ceiling height — flush mount

Wainscot installation — surface mount
CONDITION 1 — COLUMN PASSES THROUGH CEILING; REQUIRES INSTALLATION PRIOR TO FINISHING CEILING.

A. Passes through GPDW ceiling without reveal

B. Passes through GPDW ceiling with reveal

C. Passes through lay-in tile ceiling without reveal

CONDITION 2 — COLUMN INSTALLED BETWEEN FIXED CEILING AND FLOOR

D. Flush to ceiling

E. Reveal board at ceiling

F. Scribe ring at ceiling

G. Reveal board at floor

H. Flush to floor

I. Scribe ring at floor
Specialties
ACCESSORIES
Column Covers

2 1/2" METAL STUDS
FIRE RATED GPDW 2 LAYERS

SO-9-075  SO-9-100

TAPE & SPACKLE PACK COMPLETELY WITH FIRE RATED THERMABEER

SO-9-150

2 1/2" METAL STUDS
FIRE RATED GPDW 2 LAYERS

6" BENT MTL STUD
FIRE RATED GPDW 2 LAYERS

SO-9-250

SO-9-250

2 1/2" METAL STUDS

SO-9-300

6" BENT MTL STUD
2 1/2" MTL STUD

SO-9-300
EXISTING STEEL COLUMN WITH FIREPROOF INSULATION

TAPES & SPACKLE

SO: 9-150
REFER PAGE SS 28.2

TAPE & SPACKLE

1 1/16" x 1 1/16" MTL ANGLE

TWO OFFSET 2 1/4" MTL STUDS

1/4" OR 1/8" GPOW

TO CONSTRUCTION FOR COMPLETE APPLICATION DIRECTIONS

EXISTING STEEL COLUMN WITH FIREPROOF INSULATION

COLUMN COVERS

ACCESSORIES
Specialties

ACCESSORIES

Column Covers

EXISTING STEEL COLUMN WITH FIREPROOF INSULATION

METAL CLADDING OR CONTRASTING PAINT

TWO OFFSET 2¼" MTL STUDS

¼" OR ½" GIPOW

EXISTING STEEL COLUMN WITH FIREPROOF INSULATION

THREE QUARTER COLUMN COVER

PARTIAL COLUMN COVER

REFER TO SOFTFORMS SERIES 100 COLUMN COVER BROCHURE

TAPE & SPACKLE

½" OR ¾" GIPOW
3-ARM HIGH-TRAFFIC MANUAL AND ELECTRIC TURNSTILES

1.18
1.19

2" DIA. SHOWN CONDUIT
WIRE HOLES - 2 TYP.

Plan

A

FINISHED FLOOR

Side elevation

Front elevation

25"
15½"

Anchor details

1.75" O.D.

Square Socket for
Yokes & Turnstiles

1.5"

Socket Plug

3.5"

Round Socket for
Posts

3.5"

1.365"

55°

90°

34"

Side elevation

Front elevation

Details "B"

CUP

ANCHOR BOLT

FINISHED FLOOR

CONCRETE

HALF SCALE

ANCHOR

SEE DETAIL "B"

Vertical section
Specialties
ACCESSORIES

Emergency - quick release

Finger latch

MODEL BA-1
Break-away finger latch features an adjustable tension setting. SAME mounting as Gate Finger.

Triple rail - finger latch

Single rail - cart security with flip sleeve latch

Triple rail - alarm system

Double rail - flip sleeve latch

Double rail - aisle closure with flip sleeve latch

Double rail - self-closing or self-opening

Single section welded rail - electrically controlled gate latch, wheelchair access

V' 38”, 24”, 30”, 36”, 48” OR 60” OPENING

27”, 33”, 39” or 51” CL

36” or 48” OPENING

30”, 36”, 46” OR 60” OPENING

30”, 36” or 48” OPENING

32”, 39” or 51” CL

30”, 36”, 46” OR 60” OPENING

32”, 39” or 51” CL

24”, 30”, 36”, 48” OPENING

27”, 33”, 39” or 51” CL

24”, 30”, 36”, 48” OPENING

27”, 33”, 39” or 51” CL

30”, 36”, 46” OR 60” OPENING

27”, 33”, 39” or 51” CL

30”, 36”, 46” OR 60” OPENING

27”, 33”, 39” or 51” CL
Specialties

ACCESSORIES

Water Coolers

NOTES: FOR DIFFERENT FOUNTAIN INSTALLATION HEIGHTS, DIMENSIONS MARKED BY "M" MUST BE ADJUSTED ACCORDINGLY.

* THIS IS A DUAL-PURPOSE DRINKING WATER FACILITY. THE DIMENSIONS NOTED ARE RECOMMENDED HEIGHTS ONLY. WHEN INSTALLING THE UNIT, LOCAL, STATE OR FEDERAL CODES SHOULD BE ADHERED TO AND DIMENSIONS ADJUSTED ACCORDINGLY.
Specialties

ACCESSORIES

Accessible Drinking Fountains

Drinking Fountains and Water Coolers
## General Reference Data

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space planning</td>
<td>1106</td>
</tr>
<tr>
<td>Human factors</td>
<td>1110</td>
</tr>
<tr>
<td>Floor and wall covering</td>
<td>1122</td>
</tr>
<tr>
<td>Fabric</td>
<td>1130</td>
</tr>
<tr>
<td>Electrical</td>
<td>1132</td>
</tr>
<tr>
<td>Columns, capitals, and entablatures</td>
<td>1135</td>
</tr>
<tr>
<td>Nails, screws, and bolts</td>
<td>1136</td>
</tr>
<tr>
<td>Mathematical data and formulas</td>
<td>1139</td>
</tr>
</tbody>
</table>
This section provides a variety of time-saving reference material in the form of tables, charts, formulas, and planning guidelines. Included are area requirements for the preliminary space planning of various building types and human factors data related to anthropometrics, space, and acoustics. Also included are a number of tables for determining carpet and wall covering yardage quantities. In addition, a series of tables dealing with electrical data provides typical amperage ratings for office and electronic equipment and for residential appliances. Still other tables and charts contain mathematical data relative to functions of numbers, metric system conversions, and areas of plane figures.
General Reference Data

SPACE PLANNING

Area Requirements By Use

The first portion of Table 1 shows some of the planning guidelines for several types of office use. Of course, usable areas per employee vary greatly depending on the type of work performed and types of support space and common areas required, such as file rooms, data processing, conference rooms, and so forth.

Rules of Thumb

Office use: 125 to 150 net sq. ft. area per person.
Retail space: 30 net sq. ft. per person on ground floor; 50 net sq. ft. per person on upper floors.
Classrooms: 20 net sq. ft. per pupil.

<table>
<thead>
<tr>
<th>Building/Use Type</th>
<th>Sq. Ft. per Unit</th>
<th>Area Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office buildings, all types</td>
<td>100-250 net</td>
<td>usable</td>
</tr>
<tr>
<td>Work station, minimum clerical</td>
<td>40 person</td>
<td>usable</td>
</tr>
<tr>
<td>Work station, clerical with VDT</td>
<td>55 person</td>
<td>usable</td>
</tr>
<tr>
<td>Work station, with visitor space</td>
<td>65 person</td>
<td>usable</td>
</tr>
<tr>
<td>Work station, supervisor</td>
<td>100 person</td>
<td>usable</td>
</tr>
<tr>
<td>Manager, private office</td>
<td>150-225 person</td>
<td>usable</td>
</tr>
<tr>
<td>Law firm</td>
<td>450 attorney</td>
<td>total usable</td>
</tr>
<tr>
<td>Law firm library</td>
<td>25-30 attorney</td>
<td>usable</td>
</tr>
<tr>
<td>Law firm conference</td>
<td>25-30 attorney</td>
<td>usable</td>
</tr>
<tr>
<td>Insurance company, branch</td>
<td>100 average work station</td>
<td>usable</td>
</tr>
<tr>
<td>Insurance company, branch</td>
<td>155-165 employee</td>
<td>total usable</td>
</tr>
<tr>
<td>Total, Includes common areas and circulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy company</td>
<td>255 employee</td>
<td>total usable</td>
</tr>
<tr>
<td>Conference and dining rooms</td>
<td>15 person</td>
<td>net</td>
</tr>
</tbody>
</table>

Restaurants

Dining areas (includes dining room but not waiting, coat room, etc.)

<table>
<thead>
<tr>
<th>Type</th>
<th>Meals per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 200</td>
<td>200-400</td>
</tr>
<tr>
<td>Cafeterias</td>
<td>7.5-5.0</td>
</tr>
<tr>
<td>Hotels</td>
<td>18.0-4.0</td>
</tr>
<tr>
<td>Restaurants</td>
<td>7.0-4.0</td>
</tr>
</tbody>
</table>

Serving and service areas

<table>
<thead>
<tr>
<th>Type</th>
<th>Meals per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cafeterias</td>
<td>6 person</td>
</tr>
<tr>
<td>Restaurants</td>
<td>5 person</td>
</tr>
</tbody>
</table>

Add to totals space for food storage, administration, waiting.
### TABLE 1  Space Planning By Building Type (Continued)

<table>
<thead>
<tr>
<th>Building/Use Type</th>
<th>Sq. Ft. per Unit</th>
<th>Area Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Night clubs</strong></td>
<td>25 person</td>
<td>net</td>
</tr>
<tr>
<td>Bars</td>
<td>18 person</td>
<td>net</td>
</tr>
<tr>
<td><strong>Hotel</strong></td>
<td>550–600 room</td>
<td>gross</td>
</tr>
<tr>
<td><strong>1.5 persons per room without extensive conferencing facilities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Large stores</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Retail</strong></td>
<td>30–50 person</td>
<td>net</td>
</tr>
<tr>
<td><strong>Public library</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Stack space</strong></td>
<td>0.08 bound vols.</td>
<td>net</td>
</tr>
<tr>
<td><strong>Reading rooms</strong></td>
<td>20–35 user</td>
<td>net</td>
</tr>
<tr>
<td><strong>Staff space</strong></td>
<td>100 staff person</td>
<td>net</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td>50 person</td>
<td>net</td>
</tr>
<tr>
<td><strong>Museums, exhibition areas</strong></td>
<td>15 person</td>
<td>net</td>
</tr>
<tr>
<td><strong>Theater and assembly areas</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Seating area, fixed seats</strong></td>
<td>7.5 seat</td>
<td>net</td>
</tr>
<tr>
<td><strong>Seating, movable seating</strong></td>
<td>15 seat</td>
<td>net</td>
</tr>
<tr>
<td><strong>Theaters, fixed seating</strong></td>
<td>8–12 seat</td>
<td>net</td>
</tr>
<tr>
<td><strong>(Does not include stage, lobby, etc.)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Stage/backstage</strong></td>
<td>100% seating area</td>
<td></td>
</tr>
<tr>
<td><strong>Performing arts theater</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lobbies</strong></td>
<td>3 person</td>
<td>net</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td>30% seating area</td>
<td></td>
</tr>
</tbody>
</table>

### Educational

**Elementary**

The following figures are based on the number of students in the particular space listed.

- **Small classrooms** 20–30 student net
- **Library** 40 student net
- **Art room** 40 student net

**Secondary**

The following figures are based on the number of students in the particular space listed.

- **Cafeteria** 12–15 student 1/3 of total
- **Small classrooms** 20–25 student net
- **Large classrooms** 15 student net
- **Art classrooms** 50–60 student net
- **Home economics** 50–60 student net
- **Laboratory classrooms** 55–70 student net
- **Library** 40 student 20% of total
- **Music rooms** 30–35 student net
- **Physical education** 125 student net
- **Shops/vocational rooms**
  - Small 50 student net
  - Wood, metal, etc. 120–140 student net

**University**

- **Classrooms, small** 20 student net
- **Classrooms, large** 12–15 student net
SPACE PLANNING
Area Requirements By Use

TABLE 1  Space Planning By Building Type (Continued)

<table>
<thead>
<tr>
<th>Building/Use Type</th>
<th>Sq. Ft. per Unit</th>
<th>Area Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture halls</td>
<td>9-12 seat</td>
<td>net</td>
</tr>
<tr>
<td>Dormitory, no dining</td>
<td>160 student</td>
<td>net</td>
</tr>
<tr>
<td>Dormitory, no dining</td>
<td>210-240 student</td>
<td>gross</td>
</tr>
<tr>
<td>Dormitory, dining</td>
<td>235-260 student</td>
<td>gross</td>
</tr>
<tr>
<td>Food service, table service</td>
<td>18-26 seat</td>
<td>net, all areas</td>
</tr>
<tr>
<td>Food service, cafeteria</td>
<td>14-19 seat</td>
<td>net, all areas</td>
</tr>
<tr>
<td>Laboratories</td>
<td>34-45 student</td>
<td>net</td>
</tr>
<tr>
<td>Laboratory storage</td>
<td>6-10 student</td>
<td>net</td>
</tr>
<tr>
<td>Library</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Book stacks, less than 300,000 volumes</td>
<td>0.10 volume</td>
<td>net</td>
</tr>
<tr>
<td>Book stacks, 300,000-1,000,000 volumes</td>
<td>0.7-0.8 volume</td>
<td>net</td>
</tr>
<tr>
<td>Book stacks, over 1,000,000 volumes</td>
<td>0.5 volume</td>
<td>net</td>
</tr>
<tr>
<td>Reading, study</td>
<td>25-35 station</td>
<td>net</td>
</tr>
<tr>
<td>(provide stations equal to 25% to 40% of student population):</td>
<td>6.25-10 student</td>
<td>net</td>
</tr>
<tr>
<td>Total service space</td>
<td>25% of reading</td>
<td>net</td>
</tr>
</tbody>
</table>

Residential

| Apartments              | 250 Occupant     | net        |
| Senior citizen housing  |                  |            |
| Living units            | 300-380 1-person unit | net |
| Living units            | 350-425 2-person unit | net |
| Living units            | 400-600 unit      | gross      |
| Dining, lounge, lobby, administration, etc. | 33%-45% of living unit space, gross area |

Health Care Facilities

| General hospital | 1000 bed | gross |
| Medical center   | 1100 bed | gross |

The above figures are based on usable square footage, which in the language of leasing includes the area within the boundaries of the leased space. Most building owners lease space based on the rentable area, which includes a tenant's prorated share of common areas such as toilet rooms, elevator lobby, public corridors, and so on. The multiplying figure can be obtained from the building owner, or a figure of 1.1 to 1.15 can be used as an estimated multiplying factor.

TABLE 2  Gross to Net Ratios for Common Building Types

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Multiplying Factor</th>
<th>Building Type</th>
<th>Multiplying Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>1.25-1.35</td>
<td>Library reading space</td>
<td>1.5</td>
</tr>
<tr>
<td>Retail</td>
<td>1.35</td>
<td>Museum</td>
<td>1.2</td>
</tr>
<tr>
<td>Bank</td>
<td>1.4</td>
<td>Theater</td>
<td>1.3-1.7</td>
</tr>
<tr>
<td>Restaurant, table service</td>
<td>1.4-1.5</td>
<td>School, classroom</td>
<td>1.5-1.65</td>
</tr>
<tr>
<td>Restaurant, cafeteria</td>
<td>1.5</td>
<td>School, dormitory</td>
<td>1.5-1.8</td>
</tr>
<tr>
<td>Bars, nightclubs</td>
<td>1.3-1.4</td>
<td>School, laboratory</td>
<td>1.7</td>
</tr>
<tr>
<td>Hotel</td>
<td>1.4-1.6</td>
<td>School, gymnasium</td>
<td>1.4-1.45</td>
</tr>
<tr>
<td>Public library</td>
<td>1.25-1.3</td>
<td>Apartment</td>
<td>1.25-1.5</td>
</tr>
<tr>
<td>Library stack space</td>
<td>1.1-1.3</td>
<td>Hospital</td>
<td>1.5-1.85</td>
</tr>
</tbody>
</table>
LIBRARY PLANNING

Libraries represent a unique building type in that a majority of space is devoted to housing books and not people. The number of volumes to be housed becomes the primary planning parameter, rather than numbers of people. For a detailed layout of book stacks, you can use the figures given in Table 3. For preliminary planning, the following general guidelines are useful.

Rules of Thumb

Public library: 12–18¾ volumes per sq. ft.
Law library: 5–7 volumes per sq. ft.
To stack space, add a "configuration loss" of from 6% to 20%, to account for inefficiencies in stack layout.
Minimum aisle between open stacks: 3 ft. 0 in.
Staff spaces: 100 net sq. ft. per person.
Reading room seating: 15–35 sq. ft. per person plus 6% configuration loss.
Net/gross multiplier: 1.25.
Maximum of 15,000–20,000 sq. ft. per floor.
Example A 100,000 volume public library is planned. How much space should be devoted to open stacks?
Plan about 15 volumes per sq. ft. (100,000 + 15 = 6667 sq. ft.). Add a configuration loss of 10%, to give a total area of 6667 + 667, or 7333 sq. ft. of stack space.

TABLE 3 Library Shelving — Volumes per Linear Foot of Shelf Based on Subject
(Standard stack section 3 ft wide x 7½ ft high with 7 shelves)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Volumes per foot of shelf</th>
<th>Volumes per single face section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art (excluding oversize)</td>
<td>7</td>
<td>147</td>
</tr>
<tr>
<td>Circulating, non-fiction</td>
<td>8</td>
<td>168</td>
</tr>
<tr>
<td>Economics</td>
<td>8</td>
<td>188</td>
</tr>
<tr>
<td>Fiction</td>
<td>8</td>
<td>188</td>
</tr>
<tr>
<td>General literature</td>
<td>7</td>
<td>147</td>
</tr>
<tr>
<td>History</td>
<td>7</td>
<td>147</td>
</tr>
<tr>
<td>Law</td>
<td>4</td>
<td>84</td>
</tr>
<tr>
<td>Medical</td>
<td>5</td>
<td>105</td>
</tr>
<tr>
<td>Periodicals, bound</td>
<td>5</td>
<td>105</td>
</tr>
<tr>
<td>Public documents</td>
<td>5</td>
<td>105</td>
</tr>
<tr>
<td>Technical and scientific</td>
<td>6</td>
<td>126</td>
</tr>
<tr>
<td>Average for overall estimating</td>
<td>125</td>
<td></td>
</tr>
</tbody>
</table>

These figures should be reduced by at least 10% to avoid overcrowding and to allow for expansion.
APPRIOPRATENESS

It is essential, due to the many variables involved, that the data selected be appropriate to the user of the space or furniture to be designed. It becomes necessary, therefore, for the intended user population to be properly defined in terms of such factors as age, sex, occupation, and ethnicity. If the user is an individual, or constitutes a very small group, it may, in certain situations, be feasible to develop your own primary anthropometric data by actually having individual body measurements taken. Surely, if one is prepared to take the time to be fitted for a dress or a suit, one should be willing to spend the time to be fitted for an interior environment or components of that environment, particularly since, in most cases, the latter will reflect a far greater financial investment. The measurements, in the event individual data are generated, should, however, be taken with proper instruments by a trained observer. In situations where specific body dimensions or other data for a particular user population are unavailable, and both time and funds prevent undertaking sophisticated studies, an engineering anthropometrist can be consulted to discuss the statistical methods of obtaining the necessary information.

"AVERAGE MAN" FALLACY

As suggested previously, a very serious error in the application of data is to assume that the 50th percentile dimensions represent the measurements of an "average man" and to create a design to accommodate 50th percentile data. The fallacy in such an assumption is that by prior definition 50 percent of the group may suffer. There simply is no "average man." Depending on the nature of the design problem, the design should usually be conceived to accommodate the 5th or the 95th percentile, so that the greatest portion of the population is served.

Dr. H.T.E. Hertzberg, one of the country's most distinguished research physical anthropologists, in discussing the so-called average man, indicated, "There is really no such thing as an 'average' man or woman. There are men who are average in weight, or in stature, or in sitting height, but the men who are average in two dimensions constitute only about 7 percent of the population; those in three, only about 3 percent; those in four, less than 2 percent. There are no men average in as few as 10 dimensions. Therefore, the concept of the 'average' man is fundamentally incorrect, because no such creature exists. Work pieces to be efficient should be designed according to the measured range of body size."

REACH, CLEARANCE, AND ADJUSTABILITY

The selection of appropriate anthropometric data is based on the nature of the particular design problem under consideration. If the design requires the user to reach from a seated or standing position, the 5th percentile data should be utilized. Such data for arm reach indicates that 5 percent of the population would have an arm reach of a shorter dimension, while 95 percent of the population, the overwhelming majority, would have longer arm reaches. If the design

in a reach situation can accommodate the user with the shortest arm reach, obviously it will function for the users with longer reaches as well. It is equally obvious that the opposite is not true, as shown in Fig. 1(a).

In designs where clearance is the primary consideration, the larger or 95th percentile data should be used. The logic is simple. If the design will allow adequate clearance for the users with the largest body size, it would also allow clearance for those with smaller body size. Here, too, it can be seen from Fig. 1(b) that the opposite is not true.

In other situations it may be desirable to provide the design with a built-in adjustment capability. Certain chair types, adjustable shelves, etc., are examples of such. The range of adjustment should be based on the anthropometrics of the user, the nature of the task, and the physical or mechanical limitations involved. The range should allow the design to accommodate at least 90 percent of the user population involved, or more.

It should be noted that all the foregoing examples were used primarily to illustrate the basic logic underlying the selection of the body dimensions involved and the particular percentiles to be accommodated. Wherever possible, however, it is naturally more desir-
**HUMAN FACTORS**

**Anthropometrics**

**Adult Male and Female Miscellaneous Structural Body Dimensions in Inches and Centimeters by Age and Selected Percentiles**

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in cm</td>
<td>in cm</td>
<td>in cm</td>
<td>in cm</td>
<td>in cm</td>
<td>in cm</td>
<td>in cm</td>
</tr>
<tr>
<td><strong>MEN</strong></td>
<td>58.2</td>
<td>91.9</td>
<td>47.3</td>
<td>120.1</td>
<td>68.8</td>
<td>174.2</td>
<td>20.7</td>
</tr>
<tr>
<td><strong>WOMEN</strong></td>
<td>53.0</td>
<td>81.3</td>
<td>43.5</td>
<td>118.7</td>
<td>64.1</td>
<td>152.8</td>
<td>17.0</td>
</tr>
<tr>
<td><strong>MEN</strong></td>
<td>50.8</td>
<td>78.2</td>
<td>41.3</td>
<td>104.9</td>
<td>60.8</td>
<td>194.4</td>
<td>17.1</td>
</tr>
<tr>
<td><strong>WOMEN</strong></td>
<td>26.8</td>
<td>68.1</td>
<td>36.6</td>
<td>92.0</td>
<td>56.9</td>
<td>140.0</td>
<td>14.9</td>
</tr>
</tbody>
</table>

**Adult Male and Female Functional Body Dimensions in Inches and Centimeters by Age, Sex, and Selected Percentiles**

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in cm</td>
<td>in cm</td>
<td>in cm</td>
<td>in cm</td>
<td>in cm</td>
<td>in cm</td>
</tr>
<tr>
<td><strong>95</strong></td>
<td>95.3</td>
<td>57.3</td>
<td>48.1</td>
<td>117.1</td>
<td>51.1</td>
<td>151.1</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>36.2</td>
<td>52.2</td>
<td>40.0</td>
<td>124.4</td>
<td>45.1</td>
<td>194.7</td>
</tr>
<tr>
<td><strong>95</strong></td>
<td>32.4</td>
<td>62.3</td>
<td>39.4</td>
<td>100.1</td>
<td>50.0</td>
<td>140.0</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>29.2</td>
<td>75.9</td>
<td>34.0</td>
<td>85.4</td>
<td>55.3</td>
<td>160.2</td>
</tr>
</tbody>
</table>
able to accommodate the greatest percentage of the user population. In this regard, there is no substitute for common sense. If a shelf can just as easily be placed an inch or two lower, without significantly impacting on other design or cost factors, thereby accommodating 98 or 99 percent of the user population, obviously that is the correct design decision.

The clearances shown in Fig. 3 are intended to introduce general guidelines for barrier-free design. While we have utilized the wheelchair as our design subject, it does not represent the largest number of disabled. However, it is usually the most demanding for which to design. To provide practical limits for this design, we have chosen to plot the range of reach for the short female to the tall male. The overlapping areas of ability for the handicapped and the non-handicapped demonstrate the field of good design practice common to both.

When planning for accessibility, it is important to consider the attitude at which the wheelchair approaches the object desired. Reach limits differ for frontal and side reach. Because of this, range of reach is plotted for each. The elevation targets represent the maximum height at which controls requiring manual dexterity should be located.

Wheelchairs vary in size. They are fitted to their users in much the same manner as clothing is. A range of sizes is given, with the dimensions for the "typical" collapsible, manual chair indicated. Electrically powered wheelchairs require more space. Further, the wheelchair must be considered in its "occupied" state, as the user imparts additional space requirements with arms and feet as well as basic maneuvering space.

We consider the basic space requirement for an occupied wheelchair to function to be 3 ft wide by 4 ft deep. This same space will accommodate most people who use canes, crutches, and walkers. Blind people using the cane technique for perceiving obstacles can also be accommodated in this space. For a person in a wheelchair to make a complete turn, an area of approximately 5 ft by 5 ft is required. As the elevations of surrounding surfaces change, so do the space requirements. The length of time that one is confronted by close quarters also affects the required clearance. An opening through a wall may be 2 ft 6 in clear as it represents only a short time involvement. As travel distance and traffic increase, passage width must also.

The complexity of space also affects minimum clearance. To make a simple 90° turn, adjoining passages 3 ft wide are required (and 3 ft 6 in preferred if a normal walking is to be maintained). A 180° turn around a fixed partition requires more space.

As clearances relate to general circulation requirements, space needs again increase with traffic speed and volume. Narrow corridors (4 ft) should be restricted to basically short, one-directional traffic patterns. Generally maintain at least 5 ft clearances or more as determined by code.
clearance
scale: 3/8" = 1'-0"

openings
scale: 3/8" = 1'-0"

360° turn
scale: 3/8" = 1'-0"

90° turn
scale: 1/4" = 1'-0"

180° turn
scale: 1/4" = 1'-0"

one-way
scale: 3/8" = 1'-0"

two-way
scale: 3/8" = 1'-0"

Fig. 3 (Continued)
NOTE: Footrests may extend further for very large people.

Fig. 5  Dimensions of adult-sized wheelchairs.
Fig. 6 Minimum clear floor space for wheelchairs.
HUMAN FACTORS
Wheelchair Clearances at Doors

(a) Front Approaches — Swinging Doors

NOTE: x = 12 in (305 mm) if door has both a closer and latch.

(b) Hinge Side Approaches — Swinging Doors

NOTE: x = 54 in (1370 mm) minimum if y = 60 in (1525 mm); x = 42 in (1065 mm) minimum if y = 54 in (1370 mm).

(c) Latch Side Approaches — Swinging Doors

NOTE: y = 48 in (1220 mm) minimum if door has both a latch and closer.

(d) Front Approach — Sliding Doors and Folding Doors

NOTE: All doors in alcoves shall comply with the clearances for front approaches.

(e) Slide Side Approach — Sliding Doors and Folding Doors

NOTE: All doors in alcoves shall comply with the clearances for front approaches.

Fig. 7  Maneuvering clearances at doors.
Fig. 8 Two hinged doors in series.
Fig. 9  Mounting heights and clearances for telephones.

*Height to highest operable parts which are essential to basic operation of telephone.

Fig. 10  Control reach limitations.
TYPES OF SPACE

Besides needing enough space in order to move about and perform various tasks, people react to space in a variety of ways. Several researchers have defined the space surrounding the individual in terms of the limits within which people categorically respond (see Figs. 11 and 12). Intimate space is that area in which a person tends not to allow anyone to intrude unless intimate relationships are expected. Personal space is that area within which a person allows only selected friends or fellow workers with whom personal discussion is mandatory. Social space is that area within which the individual expects to make purely social contacts on a temporary basis. And, finally, public space is that area within which the individual does not expect to have direct contact with others. Obviously, the more intimate the spatial relationship becomes, the more people resist intrusion by others. Personal space factors are important in establishing the privacy requirements for architectural design.

Distance Relationships Among People
(Hall)

- **Intimate**: 1/2 - 1 1/2 ft.
- **Personal**: 1 1/2 - 4 ft.
- **Social**: 4 - 12 ft.
- **Public**: 12 ft. & more

---

**Fig. 11**

**Fig. 12**
Although few research data have been generated with regard to how people respond to specific spatial factors (at least in terms of being able to prescribe precise, quantitative guidelines), it is important for the designer to reflect on potentially negative reactions that often result when a given space is not made compatible with what the user expects in terms of the size, shape, organization, color and illumination of a particular space. The considerations listed in Table 4 are suggested as a checklist for the designer.

<table>
<thead>
<tr>
<th>Space Characteristic</th>
<th>Probable Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size (generally volume)</td>
<td>If the space is too small for the number of people, furnishings, equipment, or other objects that occupy it, people will consider it to be crowded. Although they may accept a crowded condition on a temporary basis, they will object to living or working in such a space for extended periods of time. If the space is too large for the people, furnishings, equipment, or other objects that occupy it, people will consider it &quot;unfriendly,&quot; inefficient, and/or overly demanding in terms of communicating, travel distance, maintenance, etc. Although they may accept the &quot;familiar&quot; atmosphere for temporary periods, they will object to living or working in such a space for extended periods of time.</td>
</tr>
<tr>
<td>Shape (generality proportion)</td>
<td>If the space is out of proportion (too narrow, wide, long, high, etc.) for the intended use, people will consider it awkward and often distracting or oppressive. Although they may accept proportional distortion on a short-term basis (i.e., as they pass through briefly), they will object to living or working in such a space for extended periods of time. If the space contains such distortions as all curved surfaces, acute wall junctures, and too many projections or surface changes, people will consider it confusing and difficult to maneuver in and/or furnish. Although they may accept such distortions (or even consider them interesting) on a temporary or one-time basis, they will object to living or working in such a space for extended periods of time. It should also be noted that blind people depend on the constant proportions of right-angle corners to aid them in negotiating a space; such individuals are easily confused by curved surfaces, walls that are not at right angles, and periodic projections that imply they may have reached a turning point. When a ceiling is extremely high relative to the lateral dimension of a space, people feel as though they are working in a pit and that the walls are closing in on them. When a ceiling is extremely low and the space in front of the observer is very long, people feel as though the room is &quot;endless&quot; or as if they will hit their heads unless they duck.</td>
</tr>
<tr>
<td>Color and Illumination</td>
<td>If a space is dark (unless this is required for a particular operation, such as a motion picture presentation), people tend to become lethargic and less active, or they may feel anxious. As a rule, the less bright a room is, the less cheerful it seems. A small space will seem even smaller. If a space is too bright, people will feel overly exposed, or they will complain of glare or thermal discomfort (even though actual glare in terms of accepted light levels or inappropriate thermal conditions for comfort are not present). If there are too many different colors, too large expanses of very saturated color, or too many and too &quot;busy&quot; patterns of color within a space, most people become irritated after more than a brief exposure to the space. If there is too little color, no visual pattern, or no other decorative &quot;break&quot; in the visual environment, people will find the space monotonous, tiring, and eventually irritating to the point of wanting to escape. Although lukewarm points of highly reflective surface provide interest, all-metallic and highly reflective surface treatments create both subjective and directly objective interference for most people who have to work in the space.</td>
</tr>
<tr>
<td>Windows</td>
<td>Generally, most people do not like to live and work in a space that is devoid of windows. First and foremost, people seem to need visual contact with the outside world. Too many windows, on the other hand, can cause the following possible negative reactions: too much glare, too much exposure (blackout effect), lack of protection from outside elements, true anxiety (caused by floor-to-ceiling glass at high elevations).</td>
</tr>
<tr>
<td>Space organization</td>
<td>The internal components within a space and the traffic corridors and entrance and exit locations will seem either well organized or badly organized. The furnishings, partitions, decorative objects, etc., will appear as being either organized or disorganized, depending on the observer's ability to comprehend what things are and where they are with respect to his or her vantage point. Key behavioral response issues are apparent capability to find one's way to specific locations, apparent ease for interacting and communicating with others with whom the individual must associate, apparent privacy provisions necessary to perform individual tasks. Although these are sometimes conflicting needs, the people who use a space will perform on the basis of how well each of these factors has been executed for them, not for the designer or the boss. The organization of internal space components obviously interacts with all the other space characteristics; i.e., the individual perceives and reacts to the combined effects of size, shape, color, and illumination, windows, and organization simultaneously. A significant behavioral response will be an individual's interpretation of whether sufficient outlets are available for local modification of his or her own portion of the space. Even though people may never require a modification, they react to their own space in terms of permanently established restrictions that eventually elicit the feeling that the space is too small, the wrong shape, too dark, or isolated from the rest of the world, for example.</td>
</tr>
<tr>
<td>Furnishings</td>
<td>As a general rule, people are sensitive to improperly proportioned furniture, i.e., furniture that is too large, too small, or in the wrong shape for the space in which it is placed. Although the designer normally tries to select furnishings that are properly proportioned for the space he or she has created, this may ultimately restrict the efficiency of the individual (e.g., a desk or storage cabinet may be too small). Thus, although the general visual proportions of furniture in relation to space must be taken into account to avoid negative observational responses, shortchanging the individual in terms of specific furniture and use requirements soon stimulates an even stronger negative response.</td>
</tr>
</tbody>
</table>
### TABLE 5  Comparison of Sound Pressure Levels and Loudness Sensations

<table>
<thead>
<tr>
<th>Sound Pressure Level (decibels—A scale)</th>
<th>Source</th>
<th>Sensation</th>
</tr>
</thead>
<tbody>
<tr>
<td>130</td>
<td>Jet Aircraft at 100'</td>
<td>Physical Pain</td>
</tr>
<tr>
<td>120</td>
<td>Bass Drum at 3'</td>
<td>Painful (siren)</td>
</tr>
<tr>
<td>110</td>
<td>Auto Horn at 3'</td>
<td>Deafening</td>
</tr>
<tr>
<td>100</td>
<td>Thunder, Artillery, Nearby Riveter</td>
<td>Deafening</td>
</tr>
<tr>
<td>90</td>
<td>Elevated Train Discotheque</td>
<td>Very Loud</td>
</tr>
<tr>
<td>80</td>
<td>Loud Street Noise Noisy Factory</td>
<td>Very Loud</td>
</tr>
<tr>
<td>80</td>
<td>Truck Unmuffled Police Whistle</td>
<td>Very Loud</td>
</tr>
<tr>
<td>70</td>
<td>Cocktail Party Noisy Office Average Street Noise</td>
<td>Loud</td>
</tr>
<tr>
<td>70</td>
<td>Average Radio Average Factory</td>
<td>Loud</td>
</tr>
<tr>
<td>60</td>
<td>Noisy Home Inside General Office</td>
<td>Moderate</td>
</tr>
<tr>
<td>60</td>
<td>Face to Face Conversation Quiet Radio</td>
<td>Moderate</td>
</tr>
<tr>
<td>50</td>
<td>Quiet Home Private Office</td>
<td>Faint</td>
</tr>
<tr>
<td>40</td>
<td>Empty Auditorium Quiet Conversation</td>
<td>Faint</td>
</tr>
<tr>
<td>30</td>
<td>Rustle of Leaves Whisper</td>
<td>Very Faint</td>
</tr>
<tr>
<td>10</td>
<td>Soundproof Room</td>
<td>Very Faint</td>
</tr>
<tr>
<td>0</td>
<td>Threshold of Audibility</td>
<td>Very Faint</td>
</tr>
</tbody>
</table>

### TABLE 6  Speech-Interference Levels that Barely Permit Reliable Conversation

<table>
<thead>
<tr>
<th>Distance between talker and listener, ft</th>
<th>Normal</th>
<th>Raised</th>
<th>Very loud</th>
<th>Shouting</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>71</td>
<td>77</td>
<td>83</td>
<td>89</td>
</tr>
<tr>
<td>1.0</td>
<td>65</td>
<td>71</td>
<td>77</td>
<td>83</td>
</tr>
<tr>
<td>2.0</td>
<td>63</td>
<td>65</td>
<td>71</td>
<td>77</td>
</tr>
<tr>
<td>3.0</td>
<td>65</td>
<td>61</td>
<td>67</td>
<td>73</td>
</tr>
<tr>
<td>4.0</td>
<td>63</td>
<td>65</td>
<td>66</td>
<td>71</td>
</tr>
<tr>
<td>5.0</td>
<td>61</td>
<td>67</td>
<td>63</td>
<td>89</td>
</tr>
<tr>
<td>6.0</td>
<td>60</td>
<td>65</td>
<td>61</td>
<td>87</td>
</tr>
<tr>
<td>12.0</td>
<td>43</td>
<td>49</td>
<td>55</td>
<td>61</td>
</tr>
</tbody>
</table>

### TABLE 7  Speech Interference Levels (SIL) and Noise Criteria (NC) Recommended for Rooms

<table>
<thead>
<tr>
<th>Type of room</th>
<th>Maximum permissible level (measured in vacant rooms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secretarial offices, typing</td>
<td>60 50–55</td>
</tr>
<tr>
<td>Coliseum for sports only (amplification)</td>
<td>55 50</td>
</tr>
<tr>
<td>Small private office</td>
<td>45 30–35</td>
</tr>
<tr>
<td>Conference room for 20</td>
<td>35 30</td>
</tr>
<tr>
<td>Conference room for 50</td>
<td>30 20–30</td>
</tr>
<tr>
<td>Theaters for drama, 500 seats (no amplification)</td>
<td>30 20–25</td>
</tr>
<tr>
<td>Homes, sleeping areas</td>
<td>30 20–25</td>
</tr>
<tr>
<td>Assembly halls (no amplification)</td>
<td>30</td>
</tr>
<tr>
<td>Schoolrooms</td>
<td>30 25</td>
</tr>
<tr>
<td>Concert halls (no amplification)</td>
<td>25 15–20</td>
</tr>
</tbody>
</table>
### TABLE 8 Length and Width of Carpet Roll Converted to Area

<table>
<thead>
<tr>
<th>Length, ft</th>
<th>9 ft</th>
<th>12 ft</th>
<th>15 ft</th>
<th>Width of carpet roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>172</td>
<td>230</td>
<td>301</td>
<td>51</td>
</tr>
<tr>
<td>3</td>
<td>216</td>
<td>288</td>
<td>372</td>
<td>51</td>
</tr>
<tr>
<td>4</td>
<td>275</td>
<td>363</td>
<td>462</td>
<td>51</td>
</tr>
<tr>
<td>5</td>
<td>352</td>
<td>462</td>
<td>594</td>
<td>51</td>
</tr>
<tr>
<td>6</td>
<td>450</td>
<td>594</td>
<td>780</td>
<td>51</td>
</tr>
<tr>
<td>7</td>
<td>564</td>
<td>780</td>
<td>1068</td>
<td>51</td>
</tr>
<tr>
<td>8</td>
<td>696</td>
<td>1068</td>
<td>1516</td>
<td>51</td>
</tr>
<tr>
<td>9</td>
<td>840</td>
<td>1320</td>
<td>1980</td>
<td>51</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length, ft</th>
<th>9 ft</th>
<th>12 ft</th>
<th>15 ft</th>
<th>Width of carpet roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>172</td>
<td>230</td>
<td>301</td>
<td>54</td>
</tr>
<tr>
<td>3</td>
<td>216</td>
<td>288</td>
<td>372</td>
<td>54</td>
</tr>
<tr>
<td>4</td>
<td>275</td>
<td>363</td>
<td>462</td>
<td>54</td>
</tr>
<tr>
<td>5</td>
<td>352</td>
<td>462</td>
<td>594</td>
<td>54</td>
</tr>
<tr>
<td>6</td>
<td>450</td>
<td>594</td>
<td>780</td>
<td>54</td>
</tr>
<tr>
<td>7</td>
<td>564</td>
<td>780</td>
<td>1068</td>
<td>54</td>
</tr>
<tr>
<td>8</td>
<td>696</td>
<td>1068</td>
<td>1516</td>
<td>54</td>
</tr>
<tr>
<td>9</td>
<td>840</td>
<td>1320</td>
<td>1980</td>
<td>54</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length, ft</th>
<th>9 ft</th>
<th>12 ft</th>
<th>15 ft</th>
<th>Width of carpet roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>172</td>
<td>230</td>
<td>301</td>
<td>57</td>
</tr>
<tr>
<td>3</td>
<td>216</td>
<td>288</td>
<td>372</td>
<td>57</td>
</tr>
<tr>
<td>4</td>
<td>275</td>
<td>363</td>
<td>462</td>
<td>57</td>
</tr>
<tr>
<td>5</td>
<td>352</td>
<td>462</td>
<td>594</td>
<td>57</td>
</tr>
<tr>
<td>6</td>
<td>450</td>
<td>594</td>
<td>780</td>
<td>57</td>
</tr>
<tr>
<td>7</td>
<td>564</td>
<td>780</td>
<td>1068</td>
<td>57</td>
</tr>
<tr>
<td>8</td>
<td>696</td>
<td>1068</td>
<td>1516</td>
<td>57</td>
</tr>
<tr>
<td>9</td>
<td>840</td>
<td>1320</td>
<td>1980</td>
<td>57</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length, ft</th>
<th>9 ft</th>
<th>12 ft</th>
<th>15 ft</th>
<th>Width of carpet roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>172</td>
<td>230</td>
<td>301</td>
<td>60</td>
</tr>
<tr>
<td>3</td>
<td>216</td>
<td>288</td>
<td>372</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>275</td>
<td>363</td>
<td>462</td>
<td>60</td>
</tr>
<tr>
<td>5</td>
<td>352</td>
<td>462</td>
<td>594</td>
<td>60</td>
</tr>
<tr>
<td>6</td>
<td>450</td>
<td>594</td>
<td>780</td>
<td>60</td>
</tr>
<tr>
<td>7</td>
<td>564</td>
<td>780</td>
<td>1068</td>
<td>60</td>
</tr>
<tr>
<td>8</td>
<td>696</td>
<td>1068</td>
<td>1516</td>
<td>60</td>
</tr>
<tr>
<td>9</td>
<td>840</td>
<td>1320</td>
<td>1980</td>
<td>60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length, ft</th>
<th>9 ft</th>
<th>12 ft</th>
<th>15 ft</th>
<th>Width of carpet roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>172</td>
<td>230</td>
<td>301</td>
<td>63</td>
</tr>
<tr>
<td>3</td>
<td>216</td>
<td>288</td>
<td>372</td>
<td>63</td>
</tr>
<tr>
<td>4</td>
<td>275</td>
<td>363</td>
<td>462</td>
<td>63</td>
</tr>
<tr>
<td>5</td>
<td>352</td>
<td>462</td>
<td>594</td>
<td>63</td>
</tr>
<tr>
<td>6</td>
<td>450</td>
<td>594</td>
<td>780</td>
<td>63</td>
</tr>
<tr>
<td>7</td>
<td>564</td>
<td>780</td>
<td>1068</td>
<td>63</td>
</tr>
<tr>
<td>8</td>
<td>696</td>
<td>1068</td>
<td>1516</td>
<td>63</td>
</tr>
<tr>
<td>9</td>
<td>840</td>
<td>1320</td>
<td>1980</td>
<td>63</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length, ft</th>
<th>9 ft</th>
<th>12 ft</th>
<th>15 ft</th>
<th>Width of carpet roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>172</td>
<td>230</td>
<td>301</td>
<td>66</td>
</tr>
<tr>
<td>3</td>
<td>216</td>
<td>288</td>
<td>372</td>
<td>66</td>
</tr>
<tr>
<td>4</td>
<td>275</td>
<td>363</td>
<td>462</td>
<td>66</td>
</tr>
<tr>
<td>5</td>
<td>352</td>
<td>462</td>
<td>594</td>
<td>66</td>
</tr>
<tr>
<td>6</td>
<td>450</td>
<td>594</td>
<td>780</td>
<td>66</td>
</tr>
<tr>
<td>7</td>
<td>564</td>
<td>780</td>
<td>1068</td>
<td>66</td>
</tr>
<tr>
<td>8</td>
<td>696</td>
<td>1068</td>
<td>1516</td>
<td>66</td>
</tr>
<tr>
<td>9</td>
<td>840</td>
<td>1320</td>
<td>1980</td>
<td>66</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length, ft</th>
<th>9 ft</th>
<th>12 ft</th>
<th>15 ft</th>
<th>Width of carpet roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>172</td>
<td>230</td>
<td>301</td>
<td>69</td>
</tr>
<tr>
<td>3</td>
<td>216</td>
<td>288</td>
<td>372</td>
<td>69</td>
</tr>
<tr>
<td>4</td>
<td>275</td>
<td>363</td>
<td>462</td>
<td>69</td>
</tr>
<tr>
<td>5</td>
<td>352</td>
<td>462</td>
<td>594</td>
<td>69</td>
</tr>
<tr>
<td>6</td>
<td>450</td>
<td>594</td>
<td>780</td>
<td>69</td>
</tr>
<tr>
<td>7</td>
<td>564</td>
<td>780</td>
<td>1068</td>
<td>69</td>
</tr>
<tr>
<td>8</td>
<td>696</td>
<td>1068</td>
<td>1516</td>
<td>69</td>
</tr>
<tr>
<td>9</td>
<td>840</td>
<td>1320</td>
<td>1980</td>
<td>69</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length, ft</th>
<th>9 ft</th>
<th>12 ft</th>
<th>15 ft</th>
<th>Width of carpet roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>172</td>
<td>230</td>
<td>301</td>
<td>72</td>
</tr>
<tr>
<td>3</td>
<td>216</td>
<td>288</td>
<td>372</td>
<td>72</td>
</tr>
<tr>
<td>4</td>
<td>275</td>
<td>363</td>
<td>462</td>
<td>72</td>
</tr>
<tr>
<td>5</td>
<td>352</td>
<td>462</td>
<td>594</td>
<td>72</td>
</tr>
<tr>
<td>6</td>
<td>450</td>
<td>594</td>
<td>780</td>
<td>72</td>
</tr>
<tr>
<td>7</td>
<td>564</td>
<td>780</td>
<td>1068</td>
<td>72</td>
</tr>
<tr>
<td>8</td>
<td>696</td>
<td>1068</td>
<td>1516</td>
<td>72</td>
</tr>
<tr>
<td>9</td>
<td>840</td>
<td>1320</td>
<td>1980</td>
<td>72</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Length, ft</th>
<th>9 ft</th>
<th>12 ft</th>
<th>15 ft</th>
<th>Width of carpet roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>172</td>
<td>230</td>
<td>301</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>216</td>
<td>288</td>
<td>372</td>
<td>75</td>
</tr>
<tr>
<td>4</td>
<td>275</td>
<td>363</td>
<td>462</td>
<td>75</td>
</tr>
<tr>
<td>5</td>
<td>352</td>
<td>462</td>
<td>594</td>
<td>75</td>
</tr>
<tr>
<td>6</td>
<td>450</td>
<td>594</td>
<td>780</td>
<td>75</td>
</tr>
<tr>
<td>7</td>
<td>564</td>
<td>780</td>
<td>1068</td>
<td>75</td>
</tr>
<tr>
<td>8</td>
<td>696</td>
<td>1068</td>
<td>1516</td>
<td>75</td>
</tr>
<tr>
<td>9</td>
<td>840</td>
<td>1320</td>
<td>1980</td>
<td>75</td>
</tr>
</tbody>
</table>

General Reference Data

**FLOOR AND WALL COVERING**

**Length and Width of Carpet Roll Converted to Area**
### TABLE 9 Paperhanging Walls and Ceilings

<table>
<thead>
<tr>
<th>Size of room, ft</th>
<th>Height of ceiling</th>
<th>8 ft</th>
<th>9 ft</th>
<th>10 ft</th>
<th>8 ft</th>
<th>9 ft</th>
<th>10 ft</th>
<th>Yards of border</th>
<th>Rolls of ceiling</th>
<th>Single rolls for walls</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 x 8</td>
<td></td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>11</td>
<td>2</td>
<td></td>
<td></td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>4 x 10</td>
<td></td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>11</td>
<td>2</td>
<td></td>
<td></td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>4 x 12</td>
<td></td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>12</td>
<td>2</td>
<td></td>
<td></td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>6 x 10</td>
<td></td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>12</td>
<td>2</td>
<td></td>
<td></td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>6 x 12</td>
<td></td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>13</td>
<td>3</td>
<td></td>
<td></td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>8 x 8</td>
<td></td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>3</td>
<td></td>
<td></td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>8 x 14</td>
<td></td>
<td>11</td>
<td>12</td>
<td>14</td>
<td>16</td>
<td>4</td>
<td></td>
<td></td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>10 x 14</td>
<td></td>
<td>12</td>
<td>14</td>
<td>15</td>
<td>18</td>
<td>5</td>
<td></td>
<td></td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>10 x 16</td>
<td></td>
<td>13</td>
<td>15</td>
<td>16</td>
<td>19</td>
<td>6</td>
<td></td>
<td></td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>12 x 16</td>
<td></td>
<td>14</td>
<td>16</td>
<td>17</td>
<td>20</td>
<td>7</td>
<td></td>
<td></td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td>15 x 18</td>
<td></td>
<td>15</td>
<td>17</td>
<td>19</td>
<td>22</td>
<td>8</td>
<td></td>
<td></td>
<td>22</td>
<td>8</td>
</tr>
<tr>
<td>15 x 19</td>
<td></td>
<td>16</td>
<td>18</td>
<td>20</td>
<td>24</td>
<td>9</td>
<td></td>
<td></td>
<td>24</td>
<td>9</td>
</tr>
<tr>
<td>15 x 20</td>
<td></td>
<td>17</td>
<td>20</td>
<td>22</td>
<td>25</td>
<td>10</td>
<td></td>
<td></td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>15 x 22</td>
<td></td>
<td>18</td>
<td>21</td>
<td>23</td>
<td>28</td>
<td>11</td>
<td></td>
<td></td>
<td>28</td>
<td>11</td>
</tr>
<tr>
<td>15 x 24</td>
<td></td>
<td>19</td>
<td>22</td>
<td>24</td>
<td>29</td>
<td>12</td>
<td></td>
<td></td>
<td>29</td>
<td>12</td>
</tr>
<tr>
<td>15 x 26</td>
<td></td>
<td>20</td>
<td>23</td>
<td>26</td>
<td>31</td>
<td>13</td>
<td></td>
<td></td>
<td>31</td>
<td>13</td>
</tr>
<tr>
<td>15 x 30</td>
<td></td>
<td>21</td>
<td>24</td>
<td>26</td>
<td>31</td>
<td>13</td>
<td></td>
<td></td>
<td>31</td>
<td>13</td>
</tr>
<tr>
<td>15 x 36</td>
<td></td>
<td>22</td>
<td>25</td>
<td>28</td>
<td>33</td>
<td>16</td>
<td></td>
<td></td>
<td>33</td>
<td>16</td>
</tr>
<tr>
<td>20 x 26</td>
<td></td>
<td>21</td>
<td>24</td>
<td>26</td>
<td>31</td>
<td>14</td>
<td></td>
<td></td>
<td>31</td>
<td>14</td>
</tr>
<tr>
<td>20 x 30</td>
<td></td>
<td>22</td>
<td>25</td>
<td>28</td>
<td>33</td>
<td>17</td>
<td></td>
<td></td>
<td>33</td>
<td>17</td>
</tr>
<tr>
<td>20 x 36</td>
<td></td>
<td>23</td>
<td>26</td>
<td>28</td>
<td>33</td>
<td>17</td>
<td></td>
<td></td>
<td>33</td>
<td>17</td>
</tr>
<tr>
<td>30 x 36</td>
<td></td>
<td>27</td>
<td>30</td>
<td>33</td>
<td>39</td>
<td>21</td>
<td></td>
<td></td>
<td>39</td>
<td>21</td>
</tr>
</tbody>
</table>

Allowance for waste is included in all figures. Deduct one roll for every 36 sq ft of openings. Deduct one roll for every 2 doors. Deduct for windows as area of each opening. One roll of wallpaper equals 36 sq ft (24 ft by 18 in.).

### TABLE 10 Covering Capacity

<table>
<thead>
<tr>
<th>Material</th>
<th>Surface or use</th>
<th>Coverage per gallon, sq ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priming paint</td>
<td>Wood</td>
<td>450</td>
</tr>
<tr>
<td>Flat house paint</td>
<td>Metal</td>
<td>500</td>
</tr>
<tr>
<td>Oil paint</td>
<td>Over primer</td>
<td>500</td>
</tr>
<tr>
<td>Paint 1 coat</td>
<td>Masonry</td>
<td>400</td>
</tr>
<tr>
<td>Stucco (smooth)</td>
<td>Concrete</td>
<td>300</td>
</tr>
<tr>
<td>Stucco (rough)</td>
<td>Wood shingle siding, first coat</td>
<td>200</td>
</tr>
<tr>
<td>Stain</td>
<td>Wood shingle siding, second coat</td>
<td>150</td>
</tr>
</tbody>
</table>

### TABLE 11 Flooring Tile

(Net covering capacity per 100 sq ft)

<table>
<thead>
<tr>
<th>Tile size, in.</th>
<th>No. of pieces per 100 sq ft</th>
<th>No. of pieces per sq ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 x 6</td>
<td>400</td>
<td>4.00</td>
</tr>
<tr>
<td>6 x 12</td>
<td>200</td>
<td>2.00</td>
</tr>
<tr>
<td>9 x 9</td>
<td>178</td>
<td>1.78</td>
</tr>
<tr>
<td>12 x 12</td>
<td>100</td>
<td>1.00</td>
</tr>
<tr>
<td>12 x 24</td>
<td>50</td>
<td>0.50</td>
</tr>
<tr>
<td>18 x 18</td>
<td>45</td>
<td>0.45</td>
</tr>
<tr>
<td>18 x 24</td>
<td>34</td>
<td>0.33</td>
</tr>
<tr>
<td>18 x 36</td>
<td>23</td>
<td>0.23</td>
</tr>
<tr>
<td>36 x 36</td>
<td>11</td>
<td>0.11</td>
</tr>
</tbody>
</table>

### General Reference Data

**FLOOR AND WALL COVERING**

**Covering Capacity of Wallpaper, Paint, and Tile**
### General Reference Data

#### FLOOR AND WALL COVERING

**Table 14: Wall Area of Rooms (10-ft Ceiling), ft²**

<table>
<thead>
<tr>
<th>Feet</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>320</td>
<td>340</td>
<td>360</td>
<td>380</td>
<td>400</td>
<td>420</td>
<td>440</td>
<td>460</td>
<td>480</td>
</tr>
<tr>
<td>4</td>
<td>420</td>
<td>440</td>
<td>460</td>
<td>480</td>
<td>500</td>
<td>520</td>
<td>540</td>
<td>560</td>
<td>580</td>
</tr>
<tr>
<td>5</td>
<td>520</td>
<td>540</td>
<td>560</td>
<td>580</td>
<td>600</td>
<td>620</td>
<td>640</td>
<td>660</td>
<td>680</td>
</tr>
<tr>
<td>6</td>
<td>620</td>
<td>640</td>
<td>660</td>
<td>680</td>
<td>700</td>
<td>720</td>
<td>740</td>
<td>760</td>
<td>780</td>
</tr>
<tr>
<td>7</td>
<td>720</td>
<td>740</td>
<td>760</td>
<td>780</td>
<td>800</td>
<td>820</td>
<td>840</td>
<td>860</td>
<td>880</td>
</tr>
<tr>
<td>8</td>
<td>820</td>
<td>840</td>
<td>860</td>
<td>880</td>
<td>900</td>
<td>920</td>
<td>940</td>
<td>960</td>
<td>980</td>
</tr>
<tr>
<td>9</td>
<td>920</td>
<td>940</td>
<td>960</td>
<td>980</td>
<td>100</td>
<td>102</td>
<td>104</td>
<td>106</td>
<td>108</td>
</tr>
<tr>
<td>10</td>
<td>102</td>
<td>104</td>
<td>106</td>
<td>108</td>
<td>110</td>
<td>112</td>
<td>114</td>
<td>116</td>
<td>118</td>
</tr>
</tbody>
</table>

Note: The table continues with similar data for subsequent rows.

---

1125
### Table 15: Standard Modular Panel Conversion Chart

(For plywood, architectural woodwork, sheathing, plastic laminate, gypsum board, and other modular wall components)

<table>
<thead>
<tr>
<th>No. of units</th>
<th>Size (areas in square feet)</th>
<th>No. of units</th>
<th>Size (areas in square feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4' x 8'</td>
<td></td>
<td>4' x 8'</td>
</tr>
<tr>
<td>10</td>
<td>320</td>
<td>11</td>
<td>352</td>
</tr>
<tr>
<td>11</td>
<td>352</td>
<td>12</td>
<td>384</td>
</tr>
<tr>
<td>12</td>
<td>384</td>
<td>13</td>
<td>416</td>
</tr>
<tr>
<td>13</td>
<td>416</td>
<td>14</td>
<td>448</td>
</tr>
<tr>
<td>14</td>
<td>448</td>
<td>15</td>
<td>480</td>
</tr>
<tr>
<td>15</td>
<td>480</td>
<td>16</td>
<td>512</td>
</tr>
<tr>
<td>16</td>
<td>512</td>
<td>17</td>
<td>544</td>
</tr>
<tr>
<td>17</td>
<td>544</td>
<td>18</td>
<td>576</td>
</tr>
<tr>
<td>18</td>
<td>576</td>
<td>19</td>
<td>608</td>
</tr>
<tr>
<td>19</td>
<td>608</td>
<td>20</td>
<td>640</td>
</tr>
<tr>
<td>20</td>
<td>640</td>
<td>21</td>
<td>672</td>
</tr>
<tr>
<td>21</td>
<td>672</td>
<td>22</td>
<td>704</td>
</tr>
<tr>
<td>22</td>
<td>704</td>
<td>23</td>
<td>738</td>
</tr>
<tr>
<td>23</td>
<td>738</td>
<td>24</td>
<td>768</td>
</tr>
<tr>
<td>24</td>
<td>768</td>
<td>25</td>
<td>800</td>
</tr>
<tr>
<td>25</td>
<td>800</td>
<td>26</td>
<td>832</td>
</tr>
<tr>
<td>26</td>
<td>832</td>
<td>27</td>
<td>864</td>
</tr>
<tr>
<td>27</td>
<td>864</td>
<td>28</td>
<td>896</td>
</tr>
<tr>
<td>28</td>
<td>896</td>
<td>29</td>
<td>928</td>
</tr>
<tr>
<td>29</td>
<td>928</td>
<td>30</td>
<td>960</td>
</tr>
<tr>
<td>30</td>
<td>960</td>
<td>31</td>
<td>992</td>
</tr>
<tr>
<td>31</td>
<td>992</td>
<td>32</td>
<td>1024</td>
</tr>
<tr>
<td>32</td>
<td>1024</td>
<td>33</td>
<td>1056</td>
</tr>
<tr>
<td>33</td>
<td>1056</td>
<td>34</td>
<td>1088</td>
</tr>
<tr>
<td>34</td>
<td>1088</td>
<td>35</td>
<td>1120</td>
</tr>
<tr>
<td>35</td>
<td>1120</td>
<td>36</td>
<td>1152</td>
</tr>
</tbody>
</table>
ESTIMATING THE AMOUNT OF HARDWOOD STRIP FLOORING REQUIRED

An allowance for side-matching, plus 5% for end-matching and normal waste are incorporated in these percentages.

Take the Square Footage and ADD the percentage below opposite the size strip flooring to be used.

<table>
<thead>
<tr>
<th>Condition</th>
<th>3/4x1-1/2&quot;</th>
<th>3/4x2&quot;</th>
<th>3/4x2-1/4&quot;</th>
<th>3/4x3-1/4&quot;</th>
<th>3/8x1-1/2&quot;</th>
<th>3/8x2&quot;</th>
<th>1/2x2-1/2&quot;</th>
<th>1/2x2&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>55%</td>
<td>55%</td>
<td>42-1/2%</td>
<td>38-1/3%</td>
<td>29%</td>
<td>38-1/3%</td>
<td>30%</td>
<td>38-1/3%</td>
<td>30%</td>
</tr>
</tbody>
</table>

Above percentages are for laying flooring straight across the room. Additional flooring should be estimated for diagonal applications and bay windows or other projections.

CONVERTING SQUARE FEET OF FLOOR SPACE

To Board Feet of Strip Flooring Required.

<table>
<thead>
<tr>
<th>FLOOR SPACE</th>
<th>BOARD FEET REQUIRED (5% Cutting Waste Included)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square Feet</td>
<td>3/4x2&quot;</td>
</tr>
<tr>
<td>--------------</td>
<td>--------</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>20</td>
<td>28</td>
</tr>
<tr>
<td>30</td>
<td>42</td>
</tr>
<tr>
<td>40</td>
<td>55</td>
</tr>
<tr>
<td>50</td>
<td>69</td>
</tr>
<tr>
<td>60</td>
<td>83</td>
</tr>
<tr>
<td>70</td>
<td>97</td>
</tr>
<tr>
<td>80</td>
<td>111</td>
</tr>
<tr>
<td>90</td>
<td>125</td>
</tr>
<tr>
<td>100</td>
<td>138</td>
</tr>
<tr>
<td>200</td>
<td>277</td>
</tr>
<tr>
<td>300</td>
<td>415</td>
</tr>
<tr>
<td>400</td>
<td>553</td>
</tr>
<tr>
<td>500</td>
<td>692</td>
</tr>
<tr>
<td>600</td>
<td>830</td>
</tr>
<tr>
<td>700</td>
<td>968</td>
</tr>
<tr>
<td>800</td>
<td>1107</td>
</tr>
<tr>
<td>900</td>
<td>1245</td>
</tr>
<tr>
<td>1000</td>
<td>1383</td>
</tr>
</tbody>
</table>
Carpets are manufactured in three different ways: woven, knitted, or tufted.

**Woven carpet.** The surface pile and backing of woven carpet are interwoven at the same time, creating a single fabric. Due to the interweaving, which locks all of the yarns together inside the single woven fabric, the pile yarns cannot be pulled out. Some carpet weaves presently available are velvets, wilton, and axminster. Velvet is best suited for solid-color carpet; however, tweeds, stripes, and salt-and-pepper effects can be produced on velvets looms. The usual velvet is a solid-color carpet with smooth surface and even pile. Sometimes the pile is cut to produce a plushlike surface (see Fig. 14(a)). It may also be had in loop pile, or twist.

Wilton weave comes in almost unlimited numbers of textures and sculptured effects, as well as patterns. The pile is sometimes cut, sometimes left uncut; a combination of cut and uncut may also be obtained. In multicolor wiltons, one color may be seen on the surface pile, while other colors are hidden in the body of the carpet. Embossed and sculptured effects are also made by the wilton looms, and cut and uncut pile can be combined with cut pile for the top level, with loops at other levels. Another variation is to have some pile yarn straight and others twisted (see Fig. 14(b)).

In the axminster weave, which is similar in appearance to handweaving, we find a complete flexibility in the use of color. In this method each tuft is inserted separately and while solid-color carpets can be made by this method, it is nearly always used for multicolored pattern carpet such as orientals, or modern and geometric designs (see Fig. 14(c)).

**Tufted carpet.** In the tufted process, which was only recently perfected, the tufts are attached to a previously made backing, as compared with the methods described above in which the backing and pile are integral. The tufts are held in place by a heavy coating of latex applied to the backing, which is usually cotton, jute, or kraft cord. By the use of this method, a wide variety of textures is possible. For example, the tufted pile can be made in several levels; it can be cut or uncut; and carved or striated effects can be obtained. The pile can be looped or plush. Tufted carpets are made in multicolor patterns with an increasing number of textural effects and refinements (see Fig. 14(d)).
### HOME-DECORATING FABRIC CHART

In the chart below are listed the fabrics usually classified as primarily decorating materials. In addition to these, practically all drapery materials may be used, and are often woven to suit wide use for this purpose. Among those are light-weight cloths such as chambray, chintz, chintz, gingham, muslin, percale, poplin, seersucker, silk crepe, all used for informal draperies, bed coverings, drawing room curtains, etc.; stiff cloths such as buckram and crinoline for upholstering chair tops, valances, etc.; cottons such as Canton flannel used for linings, and sheets for linings; heavy utility cloths such as canvas, denim, drill, gingham, plaid, all suited to certain types of draperies, couch covers, etc.; sheers of linen such as cheesecloth, dimly, plain and dotted Swiss, lace, lawn, organdy, voile, all used for glass curtains, bed coverings, etc.; oil cloths such as canvas, pongee, velveteen, velvet, velour, velveteen, all excellent for upholstery, drop cloths, etc.; silk cloths such as faille, muller (waxed silk), pongee and shantung, satins, taffetas, all used for drop cloths, bed coverings, slips, sometimes upholstery, sheer silks such as chiffon for glass curtains, lamp shades, etc.

<table>
<thead>
<tr>
<th>FABRIC</th>
<th>DESCRIPTION</th>
<th>SUITABLE FOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>BATIK</td>
<td>Japanese process of coloring fabrics by blocking out various parts of the pattern with wax before dying.</td>
<td>Curtains and panels. Other decorative effects.</td>
</tr>
<tr>
<td>BOBBINET</td>
<td>Net with hexagonal openings. Originally handmade with a bobbin.</td>
<td>Glass curtains. Dressing table skirts, etc.</td>
</tr>
<tr>
<td>BROCADE</td>
<td>Rich, colorful fabric with embroidery effects on tiefla, twill, sateen or damask woven background. Gold or silver metallic threads sometimes introduced in the figures. Brocade is also the name designating a certain type of Jacquard weave.</td>
<td>Draperies. Medium-weight upholstery. Especially good for rooms of Queen Anne, Chippendale, Hepplewhite or Sheraton furnishings of 18th Century.</td>
</tr>
<tr>
<td>BROCADETTE</td>
<td>A heavy fabric with general characteristics of damask, but far more refined and velvety in quality giving embossed effect.</td>
<td>Draperies on very large studio-size windows. Heavy-weight upholstery.</td>
</tr>
<tr>
<td>BROCHE</td>
<td>Brocade with small floral pattern.</td>
<td>Lined or unlined drop cloths. Medium-weight upholstery.</td>
</tr>
<tr>
<td>CALICO</td>
<td>Light-weight cotton fabric in plain weave. May be printed, plain or patterned, in deep color. Designs usually small. (Also for draperies.)</td>
<td>Curtains, drop cloths, bedspreads, comforter. Excellent with Early American or French Provincial furnishings.</td>
</tr>
<tr>
<td>CANDLEWICK</td>
<td>Cotton yarn used for hard tufting on multi-shaft carpet. Yarn may be white or in color. Design simple or elaborate.</td>
<td>Bedspreads, drop cloths, and other decorative purposes.</td>
</tr>
<tr>
<td>CANVAS</td>
<td>A coarse, plain cotton or linen material, rough finish, plain weave. May be bleached, unbleached, starched, dyed, or printed.</td>
<td>Awning, couch covers, etc. Also used for stiff interlinings as at top of drop cloths.</td>
</tr>
<tr>
<td>CASEMENT CLOTH</td>
<td>Light, plain, and usually neutral in color. Made in cotton, linen, muslin, silk, wool or rayon. Sometimes comes in small figures.</td>
<td>Fine for draw-curtains; also glass curtains in sheer textures.</td>
</tr>
<tr>
<td>CELLOPHANE</td>
<td>Glossy, transparent synthetic product woven on warp threads of cotton. Often woven in with other materials and used for many novelty effects.</td>
<td>Drop cloths in modern Interiors. Trimmings, etc.</td>
</tr>
<tr>
<td>CHENILLE</td>
<td>Various types of fabrics woven with chenille yarn of silk, wool, mercerized cotton, or rayon.</td>
<td>Draperies. Yarn used for tufting, fringes, etc.</td>
</tr>
<tr>
<td>CHEVRON CLOTH</td>
<td>Fabric with broken twill weave forming chevron pattern.</td>
<td>Draperies, etc.</td>
</tr>
<tr>
<td>CHINTZ</td>
<td>A firm plain weave cotton fabric usually printed in gay patterns, but may be had in plain colors. May be semi-glazed or fully glazed. Some chintz has special finish so that it will retain glass after washing. Glazed chintz is more resistant to dirt, while its shiny surface and stiff texture adds to its charm. There are many grades of chintz, and some have self-reinforced special finish.</td>
<td>May be formal or Informal in pattern. Suitable in any room according to pattern, quality and treatment. Used for draperies, upholstery, slip covers, lamp shades, etc.</td>
</tr>
<tr>
<td>CRETONNE</td>
<td>Cotton or linen fabric named for French town of Creton, with pleat, rap or damask weave background printed in large designs. Does not muss easily and can be washed often.</td>
<td>Draperies, upholstery, slip covers, bed covers, etc. Often more formal than chintz.</td>
</tr>
<tr>
<td>CREWEL EMBROIDERY</td>
<td>A type of wool embroidery worked on unbleached cotton or linen ground in large floral, bird, or tree designs.</td>
<td>Draperies and upholstery. Used extensively during Jacobean period.</td>
</tr>
<tr>
<td>DAMASK</td>
<td>The term originated with the beautiful silks woven in Damascus during the 12th Century. Damasks are made of linen, cotton, wool, or any of the synthetic fibers, or combinations of the two. In twills weave on satin ground, this fabric in light or pattern is usually reversible. Damask is also one given to a kind of Jacquard weave.</td>
<td>In silk or cotton it is used for drop cloths and upholstery. Appropriate for Queen Anne, Chippendale, Hepplewhite or Sheraton furnishings of 18th Century.</td>
</tr>
<tr>
<td>DUCK</td>
<td>Heavy plain weave cotton fabric.</td>
<td>Outdoor cushions, etc.</td>
</tr>
<tr>
<td>FELT</td>
<td>A material made by matting together, under heat or pressure, woolen fibers, mohair, cashmere, or mixed fibers.</td>
<td>Upholstery and couch covers. Rugs.</td>
</tr>
<tr>
<td>FABRIC</td>
<td>DESCRIPTION</td>
<td>SUITABLE FOR</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>FILET NET</td>
<td>Cotton or linen net with square mesh. Hand-rolled filet has a knot at each corner of square mesh.</td>
<td>Curtains, tablecloths, scarves, etc.</td>
</tr>
<tr>
<td>FORTUNY PRINTS</td>
<td>Fabrics produced in Venice by a secret printing process which gives cotton cloth the effect of antique brocades and damasks. Comes in beautiful color combinations.</td>
<td>Draperies, Wall hangings, screens, etc.</td>
</tr>
<tr>
<td>FRIAR'S CLOTH</td>
<td>Like droid's cloth but with finer basket weave.</td>
<td>Glass curtains.</td>
</tr>
<tr>
<td>FRISÉ</td>
<td>Uncut pile fabric of wool, mohair, cotton, or linen. Patterns may be printed or produced by using yarns of different colors, or by cutting some of the loops to give sculptured effect. Very durable.</td>
<td>Some as droid's cloth.</td>
</tr>
<tr>
<td>GAUZE</td>
<td>Thin, sheer transparent fabric of plain weave, sometimes printed. May be all silk, or cotton, linen, wool, mohair, synthetic fiber, or combinations.</td>
<td>Upholstery.</td>
</tr>
<tr>
<td>HAIR CLOTH</td>
<td>A fabric with warp of cotton, worsted, or linen, and huckelstitch, wool, woven plain, striped or patterned. May now be dyed in colors and variety of woven designs.</td>
<td>Upholstery. Used extensively in England and America during middle of 19th Century.</td>
</tr>
<tr>
<td>HOMESPUN</td>
<td>Coarse hand-woven woolen, cotton or linen fabrics. Also trade name given to imitations made on power looms.</td>
<td>Curtains and upholstery in informal rooms. Bedspreads in cotton.</td>
</tr>
<tr>
<td>INDIA PRINTS</td>
<td>Printed cotton cloth with clear colors and characteristic designs of India or Persia. Handprinted with many colors on white or natural background.</td>
<td>Draperies. Wall hangings. Bed coverings, etc.</td>
</tr>
<tr>
<td>JASPE</td>
<td>Fabric having warp threads of different colors giving material streaked or mottled effect, resembling (jasper).</td>
<td>Draperies and other decorative effects.</td>
</tr>
<tr>
<td>LAME</td>
<td>A fabric with silk and metal threads in plain weave or with a woven pattern.</td>
<td>Drapery. Panels.</td>
</tr>
<tr>
<td>LAMPAS</td>
<td>A fabric similar to damask in appearance and breadth of weave. Generally all silk with self-colored pattern on plain background, often cased in design.</td>
<td>Used as damask is used.</td>
</tr>
<tr>
<td>MARQUISSETTE</td>
<td>Sheer cloth in gauze weave of cotton, silk, rayon, often with woven figure. It comes in wide range of colors, and may be dyed or printed.</td>
<td>Excellent for glass curtains. Plush, dainty, tailored spreads.</td>
</tr>
<tr>
<td>METALASSE</td>
<td>Fabric with brocaded pattern in raised, dotted or blistered effect.</td>
<td>Draperies.</td>
</tr>
<tr>
<td>MOHAIR</td>
<td>Various types of fabric made from the fleece of the Angora goat. Most durable of all textiles. New woven in combination with cotton, linen, silk or wool into many types of plain, twill or pile fabrics.</td>
<td>Very durable and widely used for upholstery.</td>
</tr>
<tr>
<td>MONK'S CLOTH</td>
<td>Heavy cotton fabric of coarse basket weave.</td>
<td>Drapery material.</td>
</tr>
<tr>
<td>MOQUETTE</td>
<td>Pile fabric resembling flax, woven on Jacquard loom with small set patterns in different colors.</td>
<td>Used for upholstery in mohair, wool, or heavy cotton.</td>
</tr>
<tr>
<td>NINON</td>
<td>A semi-transparent fabric of silk or rayon.</td>
<td>Glass curtains.</td>
</tr>
<tr>
<td>PLUSH</td>
<td>High pile fabric resembling fur, made of silk, wool, cotton or synthetic fiber. Pile may be cut or uncut.</td>
<td>Upholstery.</td>
</tr>
<tr>
<td>SAIL CLOTH</td>
<td>Souff, fine, plain weave cotton material similar to canvas in construction but lighter. Has a stiff, hard texture and is printed in gay, bright colors.</td>
<td>Draperies. Slip covers. Bedspreads, etc.</td>
</tr>
<tr>
<td>SLIPPER SATIN</td>
<td>Sleek, smooth very heavy satin in rayon or silk; may be slightly stiff because of thickness.</td>
<td>Drapery and upholstery, bed coverings, etc. Suitable in formal and period rooms for draperies.</td>
</tr>
<tr>
<td>SCRIM</td>
<td>Fabric of coarse two-ply yarns in plain, open weave. Often mercerized.</td>
<td>Curtains, bedspreads, etc.</td>
</tr>
<tr>
<td>STRE</td>
<td>Tensile used to designate fabric with woven streaked effect. This process gives two-toned appearance to textiles, stencil, etc.</td>
<td>According to fabric.</td>
</tr>
<tr>
<td>TERRY CLOTH</td>
<td>Light cotton fabric similar to both twill and cord. Woven with uncut loops. May be dyed or printed. In designs of one or two colors. Rich texture and reversible.</td>
<td>Draperies. Draw-curtains.</td>
</tr>
<tr>
<td>THEATRICAL GAUZE</td>
<td>Loosely woven, transparent plain-weave fabric of cotton or linen. Obtainable in brilliant as well as soft colors, inexpensive.</td>
<td>Glass curtains.</td>
</tr>
<tr>
<td>TOILES DE JOUY</td>
<td>Printed cotton material with repeat designs showing landscapes, or historical scenes. Reproductions of famous printed cotton fabrics of Jouy, near Paris, France. Designs and figure groups usually in colors on white or cream background.</td>
<td>Draperies, wall hangings, upholstery, bed coverings. Excellent for French, English and American period rooms of late 18th Century and early 19th Century, also French Provincial.</td>
</tr>
<tr>
<td>TWEED WEAVERS</td>
<td>Tweed applied in a large group of woven goods made from worsted yarns, woven in plain, twill, or herringbone twill weave in harmonious types.</td>
<td>Draperies and upholstery. Very good for modern or masculine rooms.</td>
</tr>
<tr>
<td>VELOUR</td>
<td>Very a French word for velvets. Though common usage, a short-pile velvet.</td>
<td>Same as velvet.</td>
</tr>
</tbody>
</table>
### Table 16: Typical Amperage Ratings

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Electronic Equipment*</th>
<th>Amperage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video Display Terminals (Detached Keyboards)</td>
<td>Normal maximum</td>
<td>2.50</td>
</tr>
<tr>
<td></td>
<td>Burroughs/MT 983 TP110</td>
<td>.08</td>
</tr>
<tr>
<td></td>
<td>DigitalMT 278 Decmate</td>
<td>1.26</td>
</tr>
<tr>
<td></td>
<td>Form-Phase Systems/8115-2</td>
<td>.48</td>
</tr>
<tr>
<td></td>
<td>Harris/8660A</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Hewlett-Packard/2382A</td>
<td>.75</td>
</tr>
<tr>
<td></td>
<td>IBM/G101</td>
<td>1.20</td>
</tr>
<tr>
<td></td>
<td>IBM/3278 or 3276</td>
<td>1.33</td>
</tr>
<tr>
<td></td>
<td>IBM/3279</td>
<td>2.50</td>
</tr>
<tr>
<td></td>
<td>IBM/5251 Model 11</td>
<td>2.10</td>
</tr>
<tr>
<td></td>
<td>IBM/6680</td>
<td>4.80</td>
</tr>
<tr>
<td></td>
<td>ITT Courier/2790-2A</td>
<td>1.50</td>
</tr>
<tr>
<td></td>
<td>Perkin-Elmer/1251</td>
<td>1.30</td>
</tr>
<tr>
<td></td>
<td>Prime/FT45</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Raytheon/PTS100</td>
<td>.80</td>
</tr>
<tr>
<td></td>
<td>Sperry-Univac/UTS20 (313)</td>
<td>.50</td>
</tr>
<tr>
<td></td>
<td>Texas Instruments/840/200</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td>Texas Instruments/DOS90</td>
<td>2.20</td>
</tr>
<tr>
<td></td>
<td>Wang/5603</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>Xerox/8000 Series</td>
<td>.50</td>
</tr>
<tr>
<td>Video Display Terminals (Integrated Keyboard)</td>
<td>Normal maximum</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>Hewlett-Packard/HP-9845A</td>
<td>4.50</td>
</tr>
<tr>
<td></td>
<td>Lear Siegler/ADM31</td>
<td>.50</td>
</tr>
<tr>
<td></td>
<td>NCR/7900-01</td>
<td>.60</td>
</tr>
<tr>
<td></td>
<td>Perkin-Elmer/656B</td>
<td>.80</td>
</tr>
<tr>
<td></td>
<td>Tektronics/4112</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>Wang/5536</td>
<td>2.00</td>
</tr>
<tr>
<td>Printers (Stand Alone)</td>
<td>Digital Equipment/LA-120AA</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>Wang/5603</td>
<td>4.00</td>
</tr>
<tr>
<td></td>
<td>Xerox/8000 Print Server</td>
<td>11.00</td>
</tr>
<tr>
<td>Printers (Desk Top)</td>
<td>Normal maximum</td>
<td>3.50</td>
</tr>
<tr>
<td></td>
<td>Centronics/7030</td>
<td>1.50</td>
</tr>
<tr>
<td></td>
<td>Digital Equipment/Decwriter IV</td>
<td>1.30</td>
</tr>
<tr>
<td></td>
<td>Form-Phase Systems/8125</td>
<td>1.80</td>
</tr>
<tr>
<td></td>
<td>Hewlett-Packard/7221B</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Hewlett-Packard/HP7240A</td>
<td>2.50</td>
</tr>
<tr>
<td></td>
<td>IBM/3287</td>
<td>2.38</td>
</tr>
<tr>
<td></td>
<td>IBM/5256</td>
<td>4.70</td>
</tr>
<tr>
<td></td>
<td>Epson/FX 185</td>
<td>.70</td>
</tr>
<tr>
<td></td>
<td>NEC/3510</td>
<td>2.50</td>
</tr>
<tr>
<td></td>
<td>ITT Courier/8700</td>
<td>1.60</td>
</tr>
<tr>
<td></td>
<td>Lear Siegler/300 Series</td>
<td>1.60</td>
</tr>
<tr>
<td></td>
<td>Perkin-Elmer/850</td>
<td>1.50</td>
</tr>
<tr>
<td></td>
<td>Raytheon/PTS 1200 3472</td>
<td>1.50</td>
</tr>
<tr>
<td></td>
<td>Sperry-Univac/0786</td>
<td>4.00</td>
</tr>
<tr>
<td></td>
<td>Tektronics/4612</td>
<td>3.30</td>
</tr>
<tr>
<td></td>
<td>Texas Instruments/Omni-800 810R0</td>
<td>5.00</td>
</tr>
<tr>
<td></td>
<td>Wang/6E31-2 with floor mount</td>
<td>1.70</td>
</tr>
<tr>
<td></td>
<td>Wang/6E77 (DV-20 Series)</td>
<td>1.20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Electronic Equipment*</th>
<th>Amperage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory Storage Devices (Desk Top)</td>
<td>Wang/5503 Disk</td>
<td>4.00</td>
</tr>
<tr>
<td></td>
<td>Xerox/8000 NS</td>
<td>12.00</td>
</tr>
<tr>
<td></td>
<td>Digital Equipment/RIX02</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>Hewlett-Packard/8282 2M</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Hewlett-Packard/9895A</td>
<td>1.80</td>
</tr>
<tr>
<td></td>
<td>Sperry-Univac/8408</td>
<td>1.50</td>
</tr>
<tr>
<td></td>
<td>Texas Instruments/WD-500</td>
<td>3.00</td>
</tr>
<tr>
<td></td>
<td>Bell/Western Electric/Cataphone 300/1200</td>
<td>.08</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Office Equipment*</th>
<th>General</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Typewriter</td>
</tr>
<tr>
<td></td>
<td>Transcriber</td>
</tr>
<tr>
<td></td>
<td>Microfiche</td>
</tr>
<tr>
<td></td>
<td>Manuscript holder</td>
</tr>
<tr>
<td></td>
<td>Calculator</td>
</tr>
<tr>
<td></td>
<td>A.C. adapter</td>
</tr>
<tr>
<td></td>
<td>Electric eraser</td>
</tr>
<tr>
<td></td>
<td>Pencil sharpener</td>
</tr>
<tr>
<td></td>
<td>Fan</td>
</tr>
<tr>
<td></td>
<td>Space heater (1,000 watts)</td>
</tr>
<tr>
<td></td>
<td>Space heater (1,250 watts)</td>
</tr>
<tr>
<td></td>
<td>Space heater (1,500 watts)</td>
</tr>
<tr>
<td></td>
<td>Coffee pots</td>
</tr>
<tr>
<td></td>
<td>Copy machine</td>
</tr>
<tr>
<td></td>
<td>Clock</td>
</tr>
<tr>
<td></td>
<td>CRT (average)</td>
</tr>
<tr>
<td></td>
<td>Printer (average)</td>
</tr>
</tbody>
</table>

**Note:** These figures are for quick reference only. For specific information consult the manufacturer.

*Some appliances — such as large copiers, coffee makers, or space heaters — require most of the current available on a 20-amp circuit. It is recommended that such devices be supplied with their own receptacle, directly from the building. This leaves the capacity of Series 9000 circuits available for the more dynamic requirements of the office occupants.
**General Reference Data**

**ELECTRICAL**

**Locations of Receptacles in Dwelling Units**

**Receptacle required if any wall width is 2 ft or more**

Walls with sliding glass doors or floor-to-ceiling windows must be counted as wall space requiring receptacles.

Receptacle required at each counter space wider than 12 in.

**Inaccessible receptacles.**

This receptacle is rendered inaccessible by refrigerator, therefore another receptacle must be installed to serve counter top.

**Location of receptacle will vary, depending upon available wall space. Arrows show several possibilities. A receptacle in a medicine cabinet or in the bathroom lighting fixture does not satisfy this rule.**

Receptacle required adjacent to wash basin in residence.

**Receptacle required if any wall width is 2 ft or more**

Walls with sliding glass doors or floor-to-ceiling windows must be counted as wall space requiring receptacles.

Receptacle required at each counter space wider than 12 in.

**Inaccessible receptacles.**

This receptacle is rendered inaccessible by refrigerator, therefore another receptacle must be installed to serve counter top.

**Location of receptacle will vary, depending upon available wall space. Arrows show several possibilities. A receptacle in a medicine cabinet or in the bathroom lighting fixture does not satisfy this rule.**

Receptacle required adjacent to wash basin in residence.
TABLE 17 Residential Appliance, Load, and Circuit Chart*

<table>
<thead>
<tr>
<th>Appliance</th>
<th>Typical wattage</th>
<th>Voltage</th>
<th>Amperage needed</th>
<th>Wire and Size fuse</th>
<th>Type of circuit and comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>12,000</td>
<td>115/230</td>
<td>30 A</td>
<td>5,000</td>
<td>Grounded—adequate outlet for motor protection.</td>
</tr>
<tr>
<td>Cookstove range</td>
<td>6,000</td>
<td>115/230</td>
<td>15 A</td>
<td>2,000</td>
<td>Separate circuit—grounded.</td>
</tr>
<tr>
<td>Oven built-in</td>
<td>3,000</td>
<td>115/230</td>
<td>10 A</td>
<td>1,000</td>
<td>Separate circuit—grounded.</td>
</tr>
<tr>
<td>Dishwasher</td>
<td>1,200</td>
<td>115/230</td>
<td>10 A</td>
<td>600</td>
<td>Grounded—adequate outlet for motor protection.</td>
</tr>
<tr>
<td>Refrigerator</td>
<td>500</td>
<td>115</td>
<td>15 A</td>
<td>500</td>
<td>Separate circuit—grounded.</td>
</tr>
<tr>
<td>Fryer</td>
<td>1,500</td>
<td>115</td>
<td>13 A</td>
<td>300</td>
<td>Grounded—adequate outlet for motor protection.</td>
</tr>
<tr>
<td>Coffee maker</td>
<td>3,000</td>
<td>115</td>
<td>20 A</td>
<td>1,000</td>
<td>Separate circuit—grounded.</td>
</tr>
<tr>
<td>Toaster</td>
<td>1,100</td>
<td>115</td>
<td>10 A</td>
<td>500</td>
<td>Separately fed.</td>
</tr>
<tr>
<td>Iron</td>
<td>1,200</td>
<td>115</td>
<td>10 A</td>
<td>500</td>
<td>Grounded—adequate outlet for motor protection.</td>
</tr>
<tr>
<td>Washer</td>
<td>500</td>
<td>115</td>
<td>9 A</td>
<td>250</td>
<td>Separate circuit—grounded.</td>
</tr>
<tr>
<td>Dishwasher</td>
<td>5,000</td>
<td>115/230</td>
<td>30 A</td>
<td>2,500</td>
<td>Separate circuit—grounded.</td>
</tr>
<tr>
<td>Water heater</td>
<td>1,500</td>
<td>115</td>
<td>13 A</td>
<td>750</td>
<td>Separate circuit—grounded.</td>
</tr>
<tr>
<td>Water heater</td>
<td>1,500</td>
<td>115</td>
<td>13 A</td>
<td>750</td>
<td>Separate circuit—grounded.</td>
</tr>
</tbody>
</table>

*Some appliances such as coffee pots, copiers, printers, and heaters consume most of the amperage available on a circuit. It is recommended that these devices be connected directly to the building power supply, leaving flexibility for other circuit planning.

TABLE 18 Typical Office Amperage Loads

<table>
<thead>
<tr>
<th>Appliance</th>
<th>Load capacity (in hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAD station*</td>
<td>10.00–20.00</td>
</tr>
<tr>
<td>Calculator</td>
<td>.25</td>
</tr>
<tr>
<td>Coffee pot*</td>
<td>8.50–15.00</td>
</tr>
<tr>
<td>Clock</td>
<td>.03</td>
</tr>
<tr>
<td>Radio</td>
<td>.03</td>
</tr>
<tr>
<td>Stereo</td>
<td>.33</td>
</tr>
<tr>
<td>Tape recorder</td>
<td>.07</td>
</tr>
<tr>
<td>Laser printer*</td>
<td>6.00–10.00</td>
</tr>
<tr>
<td>Desktop copier*</td>
<td>10.00–15.00</td>
</tr>
<tr>
<td>Electric eraser</td>
<td>.25</td>
</tr>
<tr>
<td>Fan</td>
<td>1.10</td>
</tr>
<tr>
<td>Freestanding copier*</td>
<td>15.00–20.00</td>
</tr>
<tr>
<td>Pencil sharpener</td>
<td>1.00</td>
</tr>
<tr>
<td>Task light*</td>
<td>.67</td>
</tr>
<tr>
<td>Adding machine</td>
<td>.35</td>
</tr>
<tr>
<td>Letter opener</td>
<td>1.90</td>
</tr>
<tr>
<td>Dictaphone</td>
<td>.25</td>
</tr>
<tr>
<td>Telecopier</td>
<td>.50</td>
</tr>
<tr>
<td>Word processor</td>
<td>1.50–3.00</td>
</tr>
<tr>
<td>Postage meter</td>
<td>2.80</td>
</tr>
<tr>
<td>Tape dispenser</td>
<td>1.80</td>
</tr>
<tr>
<td>Personal computer</td>
<td>3.50–8.00</td>
</tr>
<tr>
<td>Desktop printer</td>
<td>1.50–5.00</td>
</tr>
<tr>
<td>CRT</td>
<td>1.00–3.00</td>
</tr>
<tr>
<td>Space heater*</td>
<td>12.50</td>
</tr>
<tr>
<td>Typewriter</td>
<td>1.50</td>
</tr>
<tr>
<td>Microfiche reader</td>
<td>.85</td>
</tr>
<tr>
<td>Transcriber</td>
<td>.15</td>
</tr>
<tr>
<td>A.C. adapter</td>
<td>.05</td>
</tr>
<tr>
<td>100-W lamp</td>
<td>.80</td>
</tr>
</tbody>
</table>

*Courtesy Agricultural Extension Service, South Dakota State University.

TABLE 19 Common House Circuits

<table>
<thead>
<tr>
<th>Appliance</th>
<th>Load capacity (in hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General purpose</td>
<td>115–120</td>
</tr>
<tr>
<td>Agitator</td>
<td>115–120</td>
</tr>
<tr>
<td>Refrigerator</td>
<td>115–120</td>
</tr>
<tr>
<td>Vacuum cleaner</td>
<td>115–120</td>
</tr>
<tr>
<td>Water heater</td>
<td>115–120</td>
</tr>
<tr>
<td>Dishwasher</td>
<td>115–120</td>
</tr>
<tr>
<td>Range</td>
<td>115–120</td>
</tr>
</tbody>
</table>

*Some appliances such as coffee pots, copiers, printers, and heaters consume most of the amperage available on a circuit. It is recommended that these devices be connected directly to the building power supply, leaving flexibility for other circuit planning.
General Reference Data

NAILS, SCREWS, AND BOLTS

Nails

Common nails

8d

4d

Finishing nails

| No. | 1   | 1-1/2 | 2   | 2-1/2 | 3   | 4   | 5   | 6   | 8   | 10  | 12  | 14  | 16  | 18  | 20  | 22  | 24  |
|-----|-----|-------|-----|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Ins.| 3/16" | 7/32" | 1/4" | 5/32" | 3/32" | 7/64" | 1/6" | 9/64" | 5/32" | 7/64" | 11/64" | 3/16" | 13/64" | 7/32" | 15/64" | 1" | 1-1/8" |

STANDARD TACK SIZES

ESTABLISHED LENGTHS OF TACKS MEASURED UNDER THE HEAD
<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nails</td>
<td></td>
</tr>
<tr>
<td>Barbed</td>
<td>for fastening shingles or other flexible materials</td>
</tr>
<tr>
<td>Boat spike</td>
<td>long spike used in timber construction</td>
</tr>
<tr>
<td>Brad</td>
<td>finishing nail less than 1 inch long</td>
</tr>
<tr>
<td>Box</td>
<td>for nailing thin dry wood close to edge</td>
</tr>
<tr>
<td>Cement-coated box</td>
<td>coated with resin that increases holding power</td>
</tr>
<tr>
<td>Casing</td>
<td>similar to finishing, but with dulled point to penetrate thin trim without splitting</td>
</tr>
<tr>
<td>Common</td>
<td>for rough and heavy construction</td>
</tr>
<tr>
<td>Concrete</td>
<td>hardened steel nail with diamond point</td>
</tr>
<tr>
<td>Fluted concrete</td>
<td>hardened steel nail with fluting to increase holding power</td>
</tr>
<tr>
<td>Escutcheon pin</td>
<td>small nail used to attach escutcheons</td>
</tr>
<tr>
<td>Fence</td>
<td>large-head nail for holding weathered boards</td>
</tr>
<tr>
<td>Finishing</td>
<td>slender nail that can be set below surface</td>
</tr>
<tr>
<td>Cut finishing</td>
<td>finishing nail used in historic restoration</td>
</tr>
<tr>
<td>Blunt flooring</td>
<td>nail with blunt tip to prevent splitting hardwood flooring</td>
</tr>
<tr>
<td>Cut flooring</td>
<td>for historic restoration</td>
</tr>
<tr>
<td>Drive-screw flooring</td>
<td>nail with screw-drive to increase holding power</td>
</tr>
<tr>
<td>Annular drywall</td>
<td>for attaching drywall to framing; rings increase holding power</td>
</tr>
<tr>
<td>Gutter spike</td>
<td>for attaching gutter to fascia</td>
</tr>
<tr>
<td>Hinge</td>
<td>for attaching large hinges such as for barn doors</td>
</tr>
<tr>
<td>Annular hinge</td>
<td>hinge with rings to increase holding power</td>
</tr>
<tr>
<td>Lath</td>
<td>small nail for installing wood lath</td>
</tr>
<tr>
<td>Offset head</td>
<td>for use with power nailer</td>
</tr>
<tr>
<td>Parquet flooring</td>
<td>thin nail to prevent splitting parquet</td>
</tr>
<tr>
<td>Pole barn</td>
<td>large spike for attaching framing to poles</td>
</tr>
<tr>
<td>Ring shank underlayment</td>
<td>nail with rings to increase holding power</td>
</tr>
<tr>
<td>Spike</td>
<td>common nail 4-1/2 inches or longer</td>
</tr>
<tr>
<td>Built-up roofing</td>
<td>for attaching roofing felt</td>
</tr>
<tr>
<td>No-leak roofing</td>
<td>nail with rubber gasket to seal metal roofing</td>
</tr>
<tr>
<td>Scaffold</td>
<td>nail with double head to make nail easy to pull for temporary fastening</td>
</tr>
<tr>
<td>Shingle</td>
<td>for attaching cedar shingles</td>
</tr>
<tr>
<td>Cut shingle</td>
<td>used in historic restoration</td>
</tr>
<tr>
<td>Siding</td>
<td>used to install beveled wood siding</td>
</tr>
<tr>
<td>Screw-thread siding</td>
<td>nail with a screw thread to increase holding power</td>
</tr>
<tr>
<td>Cement-coated sinker</td>
<td>used to install underlayment</td>
</tr>
<tr>
<td>Slating</td>
<td>used to attach roofing slates</td>
</tr>
<tr>
<td>Fing shank underlayment</td>
<td>nail with rings to increase holding power</td>
</tr>
<tr>
<td>Roofing</td>
<td>for attaching asphalt roofing to underlayment</td>
</tr>
</tbody>
</table>
NAILS, SCREWS, AND BOLTS

Screws and Bolts

**SCREWS**
- **Flat head wood screw:** for fastening wood to wood
- **Oval head wood screw:** decorative
- **Round head wood screw:** used with washer
- **Sheet metal screw:** for thin metal
- **Oven head machine screw:** older design
- **Oval head machine screw:** attractive

**SCREW AND BOLT HEADS**
- Slotted
- Phillips
- Combination Phillips/slotted
- Square
- Frearson
- Internal torx
- Clutch
- External torx
- Tamper-proof
- Tamper-proof
- Tamper-proof hexagon
- Tamper-proof torx

**WASHERS**
- Flat USS
- Flat SAE
- Finish
- Internal-external-tooth
- Split-lock

1138
**Linear Measure**

<table>
<thead>
<tr>
<th>Length</th>
<th>Inches</th>
<th>Feet</th>
<th>Yards</th>
<th>Metres</th>
<th>Chains</th>
<th>Kilometres</th>
<th>Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>1</td>
<td>0.1</td>
<td>0.0333</td>
<td>0.0001</td>
<td>0.001</td>
<td>0.00002</td>
<td>0.000</td>
</tr>
<tr>
<td>3</td>
<td>0.25</td>
<td>0.02</td>
<td>0.0083</td>
<td>0.0003</td>
<td>0.0004</td>
<td>0.00001</td>
<td>0.000</td>
</tr>
<tr>
<td>36</td>
<td>3</td>
<td>0.25</td>
<td>0.1</td>
<td>0.0083</td>
<td>0.004</td>
<td>0.00004</td>
<td>0.001</td>
</tr>
</tbody>
</table>

**Nautical Units**

- 1 cable length = 1 nautical mile
- 1 fathom = 6 feet

**Surveyor’s or Gunter’s Measure**

- 1 mile = 5280 feet
- 1 furlong = 660 feet

**Liquid or Fluid Measure**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 gills</td>
<td>= 1 pint</td>
</tr>
<tr>
<td>2 pints</td>
<td>= 1 quart</td>
</tr>
<tr>
<td>4 quarts</td>
<td>= 1 gallon</td>
</tr>
<tr>
<td>7.4805 gallons</td>
<td>= 1 cubic foot</td>
</tr>
</tbody>
</table>

**Volume and Capacity Equivalents**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.0005787</td>
<td>0.0000193</td>
<td>0.0000069</td>
<td>1.728</td>
<td>0.1239</td>
<td>0.02046</td>
<td>0.00351</td>
</tr>
<tr>
<td>12</td>
<td>0.0006944</td>
<td>0.0000078</td>
<td>0.0000111</td>
<td>1.900</td>
<td>0.1594</td>
<td>0.02790</td>
<td>0.00471</td>
</tr>
<tr>
<td>100</td>
<td>0.006944</td>
<td>0.000078</td>
<td>0.00111</td>
<td>15.76</td>
<td>1.1944</td>
<td>0.2155</td>
<td>0.3720</td>
</tr>
</tbody>
</table>

**General Reference Data**

**Mathematical Data and Formulas**

**Units of Measurement**

**Nautical Units**

- 1 cable length = 1 nautical mile
- 1 fathom = 6 feet

**Surveyor’s or Gunter’s Measure**

- 1 mile = 5280 feet
- 1 furlong = 660 feet

**Liquid or Fluid Measure**

- 4 gills = 1 pint
- 2 pints = 1 quart
- 4 quarts = 1 gallon
- 7.4805 gallons = 1 cubic foot

**Volume and Capacity Equivalents**

- 1 cubic inch = 0.0005787 cubic feet
- 1 cubic foot = 1233.48 cubic inches

**Weight Equivalents**

- 20 pounds = 1.002500 short tons
- 1 pound = 0.4536 kilograms
- 1 ounce = 0.0283495 kilograms
- 1 grain = 64.7989 milligrams

**Mass Equivalents**

- 1 kilogram = 1.09361 pounds
- 1 pound = 0.453592 kilograms

Subscripts after any figure, oz, sq., etc., mean that the figure is to be repeated the indicated number of times.

**Subscripts**

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

Subscripts after any figure, oz, sq., etc., mean that the figure is to be repeated the indicated number of times.

**Subscripts**

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

Subscripts after any figure, oz, sq., etc., mean that the figure is to be repeated the indicated number of times.

**Subscripts**

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

Subscripts after any figure, oz, sq., etc., mean that the figure is to be repeated the indicated number of times.

**Subscripts**

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

Subscripts after any figure, oz, sq., etc., mean that the figure is to be repeated the indicated number of times.

**Subscripts**

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

Subscripts after any figure, oz, sq., etc., mean that the figure is to be repeated the indicated number of times.

**Subscripts**

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

Subscripts after any figure, oz, sq., etc., mean that the figure is to be repeated the indicated number of times.

**Subscripts**

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

Subscripts after any figure, oz, sq., etc., mean that the figure is to be repeated the indicated number of times.

**Subscripts**

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

Subscripts after any figure, oz, sq., etc., mean that the figure is to be repeated the indicated number of times.

**Subscripts**

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

Subscripts after any figure, oz, sq., etc., mean that the figure is to be repeated the indicated number of times.

**Subscripts**

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

Subscripts after any figure, oz, sq., etc., mean that the figure is to be repeated the indicated number of times.

**Subscripts**

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

Subscripts after any figure, oz, sq., etc., mean that the figure is to be repeated the indicated number of times.

**Subscripts**

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

Subscripts after any figure, oz, sq., etc., mean that the figure is to be repeated the indicated number of times.

**Subscripts**

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

Subscripts after any figure, oz, sq., etc., mean that the figure is to be repeated the indicated number of times.

**Subscripts**

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

Subscripts after any figure, oz, sq., etc., mean that the figure is to be repeated the indicated number of times.

**Subscripts**

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

Subscripts after any figure, oz, sq., etc., mean that the figure is to be repeated the indicated number of times.
### Metric Conversion Tables

#### Metric Weight

<table>
<thead>
<tr>
<th>Customary</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 milligram (mg)</td>
<td>0.00154 gr.</td>
</tr>
<tr>
<td>1 centigram (cg)</td>
<td>0.00154 gr.</td>
</tr>
<tr>
<td>1 dekagram (dag)</td>
<td>0.15343 gr.</td>
</tr>
<tr>
<td>1 gram (g)</td>
<td>1.53432 gr.</td>
</tr>
<tr>
<td>1 dekagram (dag)</td>
<td>100 cg</td>
</tr>
<tr>
<td>1 hectogram (hg)</td>
<td>10 dag</td>
</tr>
<tr>
<td>1 kilogram (kg)</td>
<td>100 cg</td>
</tr>
<tr>
<td>1 quintal (q)</td>
<td>100 kg</td>
</tr>
<tr>
<td>1 metric ton (M.T.)</td>
<td>10 q or 1,000 kg</td>
</tr>
</tbody>
</table>

#### Avoirdupois Weight

<table>
<thead>
<tr>
<th>Avoirdupois</th>
<th>Customary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 grain (gr.)</td>
<td>142.829 g</td>
</tr>
<tr>
<td>1 dram (dr.)</td>
<td>27.34375 gr.</td>
</tr>
<tr>
<td>1 ounce (oz.)</td>
<td>16 dr.</td>
</tr>
<tr>
<td>1 pound (lb.)</td>
<td>16 oz.</td>
</tr>
<tr>
<td>1 hundredweight (cw.)</td>
<td>100 lb.</td>
</tr>
<tr>
<td>1 short ton (lt.)</td>
<td>2,000 lb.</td>
</tr>
</tbody>
</table>

#### Wood Measurements

<table>
<thead>
<tr>
<th>Customary</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 board foot (bd. ft.)</td>
<td>144 cu. ft. (ft. x ft. x ft.)</td>
</tr>
<tr>
<td>1 cord foot (cd. ft.)</td>
<td>8 cu. ft. (ft. x ft. x ft.)</td>
</tr>
<tr>
<td>1 cord (ed.)</td>
<td>1 cord foot (cd. ft.)</td>
</tr>
<tr>
<td>1 stere</td>
<td>1 m³</td>
</tr>
</tbody>
</table>

#### Length and Distance

<table>
<thead>
<tr>
<th>Customary</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch (in.)</td>
<td>0.0254 m</td>
</tr>
<tr>
<td>1 foot (ft.)</td>
<td>0.3048 m</td>
</tr>
<tr>
<td>1 yard (yd.)</td>
<td>0.9144 m</td>
</tr>
<tr>
<td>1 rod (rd.)</td>
<td>5.0292 m</td>
</tr>
<tr>
<td>1 furlong (fur.)</td>
<td>201.168 m</td>
</tr>
<tr>
<td>1 statute mile (mi.)</td>
<td>1.6093 km</td>
</tr>
<tr>
<td>1 league</td>
<td>3 mi.</td>
</tr>
</tbody>
</table>

#### Liquid Capacity Measurements

<table>
<thead>
<tr>
<th>Customary</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 pint (pt.)</td>
<td>0.473176 l</td>
</tr>
<tr>
<td>1 quart (qt.)</td>
<td>0.946353 l</td>
</tr>
<tr>
<td>1 gallon (gal.)</td>
<td>3.7854 l</td>
</tr>
</tbody>
</table>

#### Metric Land Measurements

<table>
<thead>
<tr>
<th>Customary</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 centiare (ca)</td>
<td>1,540 sq. cm</td>
</tr>
<tr>
<td>1 are (a)</td>
<td>100 ca</td>
</tr>
<tr>
<td>1 hectare (ha)</td>
<td>100 a</td>
</tr>
<tr>
<td>1 square kilometer (km²)</td>
<td>100 ha or 0.3861 sq. mi.</td>
</tr>
</tbody>
</table>

#### Volume Measurements

<table>
<thead>
<tr>
<th>Customary</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cubic inch (cu. in.)</td>
<td>16.387 cu. cm</td>
</tr>
<tr>
<td>1 cubic foot (cu. ft.)</td>
<td>1,728 cu. in.</td>
</tr>
<tr>
<td>1 cubic yard (cu. yd.)</td>
<td>27 cu. ft.</td>
</tr>
</tbody>
</table>

#### Metric Capacity Measurements

<table>
<thead>
<tr>
<th>Customary</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 milliliter (ml)</td>
<td>0.001 l</td>
</tr>
<tr>
<td>1 centiliter (cl)</td>
<td>0.01 l</td>
</tr>
<tr>
<td>1 deciliter (dl)</td>
<td>0.1 l</td>
</tr>
<tr>
<td>1 liter (l)</td>
<td>1 l</td>
</tr>
</tbody>
</table>

#### Household Capacity Measurements

<table>
<thead>
<tr>
<th>Customary</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 tablespoon</td>
<td>15 ml</td>
</tr>
<tr>
<td>1 cup</td>
<td>8 fl. oz.</td>
</tr>
</tbody>
</table>

#### Surface and Area

<table>
<thead>
<tr>
<th>Customary</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 square inch (sq. in.)</td>
<td>6.4516 cm²</td>
</tr>
<tr>
<td>1 square foot (sq. ft.)</td>
<td>144 sq. in.</td>
</tr>
<tr>
<td>1 square yard (sq. yd.)</td>
<td>9 sq. ft.</td>
</tr>
<tr>
<td>1 square rod (ac.)</td>
<td>30.25 sq. yd.</td>
</tr>
<tr>
<td>1 acre (A)</td>
<td>160 sq. rd.</td>
</tr>
<tr>
<td>1 square mile (sq. mi.)</td>
<td>640 A.</td>
</tr>
</tbody>
</table>

#### Metric

<table>
<thead>
<tr>
<th>Customary</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 square millimeter (mm²)</td>
<td>0.001 sq. in.</td>
</tr>
<tr>
<td>1 square centimeter (cm²)</td>
<td>0.0001 m²</td>
</tr>
<tr>
<td>1 square decimeter (dm²)</td>
<td>0.01 m²</td>
</tr>
<tr>
<td>1 square meter (m²)</td>
<td>1 m²</td>
</tr>
</tbody>
</table>

### Liquid Capacity Measurements

<table>
<thead>
<tr>
<th>Customary</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 gill (gl.)</td>
<td>0.1806 l</td>
</tr>
<tr>
<td>1 quart (qt.)</td>
<td>0.946353 l</td>
</tr>
<tr>
<td>1 gallon (gal.)</td>
<td>3.7854 l</td>
</tr>
</tbody>
</table>

### Imperial

<table>
<thead>
<tr>
<th>Customary</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 dry pint</td>
<td>0.5682 l</td>
</tr>
<tr>
<td>1 dry quart</td>
<td>1.1365 l</td>
</tr>
</tbody>
</table>

### Dry Capacity Measurements

<table>
<thead>
<tr>
<th>Customary</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 dry pint</td>
<td>0.5682 l</td>
</tr>
<tr>
<td>1 dry quart</td>
<td>1.1365 l</td>
</tr>
</tbody>
</table>
### Mathematical Data and Formulas

**Fraction, Decimal, and Metric Conversion Tables**

#### Decimal of an Inch and of a Foot

<table>
<thead>
<tr>
<th>Fractions of Inch or Foot</th>
<th>Inch Equivalents</th>
<th>Fractional Parts of an Inch</th>
<th>Fractions of Foot</th>
<th>Inch Equivalents</th>
<th>Fractional Parts of a Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/64</td>
<td>.00390625</td>
<td>6/64</td>
<td>1/64</td>
<td>.00390625</td>
<td>6/64</td>
</tr>
<tr>
<td>1/32</td>
<td>.0078125</td>
<td>3/32</td>
<td>1/32</td>
<td>.0078125</td>
<td>3/32</td>
</tr>
<tr>
<td>1/16</td>
<td>.015625</td>
<td>15/16</td>
<td>1/16</td>
<td>.015625</td>
<td>15/16</td>
</tr>
<tr>
<td>1/8</td>
<td>.03125</td>
<td>31/64</td>
<td>1/8</td>
<td>.03125</td>
<td>31/64</td>
</tr>
<tr>
<td>5/32</td>
<td>.15625</td>
<td>156/64</td>
<td>5/32</td>
<td>.15625</td>
<td>156/64</td>
</tr>
<tr>
<td>1/4</td>
<td>.25</td>
<td>25/64</td>
<td>1/4</td>
<td>.25</td>
<td>25/64</td>
</tr>
<tr>
<td>5/16</td>
<td>.3125</td>
<td>125/64</td>
<td>5/16</td>
<td>.3125</td>
<td>125/64</td>
</tr>
<tr>
<td>3/8</td>
<td>.375</td>
<td>375/64</td>
<td>3/8</td>
<td>.375</td>
<td>375/64</td>
</tr>
<tr>
<td>7/16</td>
<td>.4375</td>
<td>14375/64</td>
<td>7/16</td>
<td>.4375</td>
<td>14375/64</td>
</tr>
<tr>
<td>1/2</td>
<td>.5</td>
<td>25/64</td>
<td>1/2</td>
<td>.5</td>
<td>25/64</td>
</tr>
<tr>
<td>9/16</td>
<td>.5625</td>
<td>15625/64</td>
<td>9/16</td>
<td>.5625</td>
<td>15625/64</td>
</tr>
<tr>
<td>5/8</td>
<td>.625</td>
<td>1625/64</td>
<td>5/8</td>
<td>.625</td>
<td>1625/64</td>
</tr>
<tr>
<td>11/16</td>
<td>.6875</td>
<td>16875/64</td>
<td>11/16</td>
<td>.6875</td>
<td>16875/64</td>
</tr>
<tr>
<td>3/4</td>
<td>.75</td>
<td>175/64</td>
<td>3/4</td>
<td>.75</td>
<td>175/64</td>
</tr>
<tr>
<td>13/16</td>
<td>.8125</td>
<td>18125/64</td>
<td>13/16</td>
<td>.8125</td>
<td>18125/64</td>
</tr>
<tr>
<td>7/8</td>
<td>.875</td>
<td>1875/64</td>
<td>7/8</td>
<td>.875</td>
<td>1875/64</td>
</tr>
<tr>
<td>15/16</td>
<td>.9375</td>
<td>19375/64</td>
<td>15/16</td>
<td>.9375</td>
<td>19375/64</td>
</tr>
<tr>
<td>11/16</td>
<td>1</td>
<td>100/64</td>
<td>11/16</td>
<td>1</td>
<td>100/64</td>
</tr>
</tbody>
</table>

#### Metric Conversion Factors

**Metric to American**

<table>
<thead>
<tr>
<th>Millimeters</th>
<th>+ 25.4 = inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centimeters</td>
<td>× 0.3937 = inches</td>
</tr>
<tr>
<td>Meters</td>
<td>× 39.37 = inches</td>
</tr>
<tr>
<td>Millimeters</td>
<td>× 0.03937 = feet</td>
</tr>
<tr>
<td>Centimeters</td>
<td>× 0.03281 = feet</td>
</tr>
<tr>
<td>Meters</td>
<td>× 3.281 = feet</td>
</tr>
<tr>
<td>Meters</td>
<td>× 1.094 = yards</td>
</tr>
<tr>
<td>Kilometers</td>
<td>× 0.621 = miles</td>
</tr>
<tr>
<td>Square kilometers</td>
<td>+ 645.1 = square inches</td>
</tr>
<tr>
<td>Square centimeters</td>
<td>+ 0.65 = square inches</td>
</tr>
<tr>
<td>Square meters</td>
<td>× 10.764 = square feet</td>
</tr>
<tr>
<td>Square kilometers</td>
<td>× 247.1 = acres</td>
</tr>
</tbody>
</table>

**Cubic Measure**

| Cubic centimeters | = cubic inches |
| Cubic meters | = cubic feet |
| Cubic kilometers | = cubic yards |
| Kilograms | = pounds |
| Kilograms | = tons |

**American to Metric**

| Inches | × 2.54 = millimeters |
| Inches | × 0.0254 = meters |
| Feet | × 0.3048 = millimeters |
| Feet | × 0.03048 = meters |
| Yards | × 0.9144 = meters |
| Miles | × 1.6093 = kilometers |
| Feet | + 328.08 = kilometers |
| Square inches | × 0.00014 = square millimeters |
| Square inches | × 6.451 = square centimeters |
| Square foot | × 0.0929 = square meters |
| Acres | × 4046.8 = square kilometers |
| Acres | + 2.471 = hectares |
| Cubic inches | × 16.387 = cubic centimeters |
| Cubic feet | × 0.0283 | cubic meters |
| Cubic yards | × 0.764 | cubic meters |
| Gallons (US) | × 3.785 | liters |
| Cubic feet | × 28.316 | cubic meters |
| Cubic yards | × 27.432 | cubic meters |
| Cubic inches | + 0.015 = cubic feet |
| Cubic feet | + 27.432 = cubic meters |

**Weights**

| 10 milligrams | = 1 centigram |
| 10 centigrams | = 1 gram |
| 10 grams | = 1 kilogram |

**Linear Measures**

| 10 millimeters | = 1 centimeter |
| 10 centimeters | = 1 meter |
| 10 meters | = 1 decameter |
| 10 decameters | = 1 hectometer |

### Metric Measures

<table>
<thead>
<tr>
<th>Linear</th>
<th>Liquid and Dry</th>
<th>Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 millimeters</td>
<td>= 1 centimeter</td>
<td>10 millimeters</td>
</tr>
<tr>
<td>10 centimeters</td>
<td>= 1 meter</td>
<td>10 centigrams</td>
</tr>
<tr>
<td>10 meters</td>
<td>= 1 decameter</td>
<td>10 grams</td>
</tr>
<tr>
<td>10 decameters</td>
<td>= 1 hectometer</td>
<td>10 decigrams</td>
</tr>
<tr>
<td>10 hectometers</td>
<td>= 1 kilometer</td>
<td>10 decagrams</td>
</tr>
<tr>
<td>Gallons (US)</td>
<td>= 26.42 = cubic meters</td>
<td></td>
</tr>
</tbody>
</table>

**Conversion Factors**

1141
**Square**

Diagonal = \(d = \sqrt{2a}\)

Area = \(a^2\)

Example: \(a = 5\) \( \Rightarrow \) \(d = \sqrt{2 \times 5^2} = \sqrt{50}\) \( \Rightarrow \) \(a = 5 \times \sqrt{2}\)

**Rectangle and Parallelogram**

Area = \(ab\) or \(b \times (a - b)\)

Example: \(a = 6; b = 8\)

Area = \(3 \times 6 = 18\) \( \Rightarrow \) \(a = 3; b = 6\)

**Trapezoid**

Area = \(\frac{1}{2} (a + b) h\)

Example: \(a = 4; b = 8; h = 5\)

Area = \(\frac{1}{2} (4 + 8) \times 5 = 30\) \( \Rightarrow \) \(a = 3; b = 6\)

**Triangles**

Both formulas apply to both figures:

Area = \(\frac{1}{2} bh\)

Example: \(a = 2; b = 3; c = 4\)

Area = \(\frac{1}{2} \times 3 \times 4 = 6\) \( \Rightarrow \) \(a = 3; b = 4\)

Area = \(\sqrt{3\text{h}^2 - (\text{h}^2 - d^2)}\) when \(d = \frac{1}{2} (\text{h} - b)\)

Example: \(a = 2; b = 3; c = 4\)

Area = \(\sqrt{3 \times 2^2 - (2^2 - 1^2)} = \sqrt{9 - 3} = \sqrt{6}\) \( \Rightarrow \) \(a = 3; b = 1\)

**Regular Polygons**

\[\text{Area} = \frac{n}{4} \times a^2 \times \tan \left( \frac{180^\circ}{n} \right)\]

**Spandrel**

Area = \(\frac{1}{2} ah\)

Example: \(a = 3; b = 4\)

Area = \(\frac{1}{2} \times 3 \times 4 = 6\) \( \Rightarrow \) \(a = 3; b = 4\)

**Ellipses**

Area = \(\pi ab\)

Example: \(a = 3; b = 4\)

Area = \(\pi \times 3 \times 4 = 3.1416\) \( \Rightarrow \) \(a = 3; b = 4\)

Circumference = \(2 \times \pi \times \sqrt{\frac{a^2 + b^2}{2}}\)

Example: \(a = 3; b = 4\)

Area = \(3.1416 \times 3 \times 4 = 37.6992\) \( \Rightarrow \) \(a = 3; b = 4\)

Circumference = \(2 \times 3.1416 \times \sqrt{\frac{3^2 + 4^2}{2}} = 6.2832 \times 3.5355 = 22.21\) \( \Rightarrow \) \(a = 3; b = 4\)

**Circle**

\[r = \frac{d}{2}, \quad A = \pi r^2, \quad p = \pi d, \quad \text{circumference or periphery}, \quad \text{radius}\]

Area = \(\frac{1}{2} d^2\)

Example: \(d = 8\)

Area = \(\frac{1}{2} \times 8^2 = 32\) \( \Rightarrow \) \(d = 8\)

Circumference = \(\pi d = \pi \times 8 = 25.1327\) \( \Rightarrow \) \(d = 8\)

**Data**

- \(\sqrt{2} = 1.41421356237\)
- \(\sqrt{3} = 1.73205080756\)
- \(\pi = 3.14159265359\)
- \(\cot = 0.57735026923\)
- \(\text{degrees} \times \pi/180 = \text{radians}\)

**Formulas**

<table>
<thead>
<tr>
<th><strong>Form</strong></th>
<th><strong>Method of Finding Areas</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangle</td>
<td>Base ( b ) ( \times ) perpendicular height ( \sqrt{3} ) ( \times ) ( \text{sum of the three sides} \ a, b, c )</td>
</tr>
<tr>
<td>Trapezium</td>
<td>Sum of area of the two triangles</td>
</tr>
<tr>
<td>Trapezoid</td>
<td>(\frac{1}{2} \times \text{sum of parallel sides} \times \text{perpendicular height} )</td>
</tr>
<tr>
<td>Parallelogram</td>
<td>Base ( b ) ( \times ) perpendicular height</td>
</tr>
<tr>
<td>Polygon</td>
<td>(\frac{1}{2} \times \text{sum of sides} \times \text{average radius} )</td>
</tr>
<tr>
<td>Circle</td>
<td>(\pi d \times d / 4 \times \pi \times \text{circumference} )</td>
</tr>
<tr>
<td>Sector of a circle</td>
<td>(\pi \times \text{area} \times \text{degree} / 360 )</td>
</tr>
<tr>
<td>Segment of a circle</td>
<td>(\text{area} \times \sin \theta / 2 \times \cos \theta )</td>
</tr>
<tr>
<td>Cosegment of a circle</td>
<td>(\text{area} \times \sin \theta / 2 \times \cos \theta )</td>
</tr>
<tr>
<td>Square</td>
<td>Side ( s ) ( \times ) diameter ( \times \pi / 4 )</td>
</tr>
<tr>
<td>Ellipse</td>
<td>Long diameter ( 2a ) ( \times ) short diameter ( 2b )</td>
</tr>
<tr>
<td>Parabola</td>
<td>Base ( x ) ( \times ) perpendicular height</td>
</tr>
<tr>
<td>NO.</td>
<td>SQUARE</td>
</tr>
<tr>
<td>-----</td>
<td>--------</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>36</td>
</tr>
<tr>
<td>7</td>
<td>49</td>
</tr>
<tr>
<td>8</td>
<td>64</td>
</tr>
<tr>
<td>9</td>
<td>81</td>
</tr>
<tr>
<td>10</td>
<td>100</td>
</tr>
</tbody>
</table>

TABLE 20 Functions of Numbers
<table>
<thead>
<tr>
<th>NO.</th>
<th>SQUARE ROOT</th>
<th>CUBE ROOT</th>
<th>LOGARITHM</th>
<th>RECIPROCAL</th>
<th>CIRCUM.</th>
<th>AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
<td>106276</td>
<td>217391</td>
<td>144.51</td>
<td>1661.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>167210</td>
<td>212766</td>
<td>147.65</td>
<td>1734.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>168124</td>
<td>208333</td>
<td>150.80</td>
<td>1809.56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>169020</td>
<td>204082</td>
<td>153.94</td>
<td>1885.74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>169897</td>
<td>200000</td>
<td>157.08</td>
<td>1963.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>170757</td>
<td>166078</td>
<td>160.22</td>
<td>2042.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>171600</td>
<td>192308</td>
<td>163.36</td>
<td>2123.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>172428</td>
<td>188679</td>
<td>166.50</td>
<td>2206.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>173239</td>
<td>185185</td>
<td>169.66</td>
<td>2290.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>174036</td>
<td>181818</td>
<td>172.79</td>
<td>2375.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>174819</td>
<td>178571</td>
<td>175.93</td>
<td>2463.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>175587</td>
<td>175439</td>
<td>179.07</td>
<td>2551.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>176343</td>
<td>172414</td>
<td>182.21</td>
<td>2642.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>177106</td>
<td>169492</td>
<td>185.36</td>
<td>2733.97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>177815</td>
<td>166667</td>
<td>188.50</td>
<td>2827.43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>178533</td>
<td>163934</td>
<td>191.64</td>
<td>2922.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>179239</td>
<td>161290</td>
<td>194.78</td>
<td>3019.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>179934</td>
<td>158370</td>
<td>197.92</td>
<td>3117.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>180618</td>
<td>156250</td>
<td>201.06</td>
<td>3216.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>181291</td>
<td>153845</td>
<td>204.20</td>
<td>3318.31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>181954</td>
<td>151515</td>
<td>207.35</td>
<td>3421.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>182607</td>
<td>149254</td>
<td>210.49</td>
<td>3525.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>183251</td>
<td>147059</td>
<td>213.63</td>
<td>3631.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>183895</td>
<td>144928</td>
<td>216.77</td>
<td>3739.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>184510</td>
<td>142857</td>
<td>219.91</td>
<td>3848.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>71</td>
<td>185126</td>
<td>140845</td>
<td>223.05</td>
<td>3955.19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>72</td>
<td>185733</td>
<td>138889</td>
<td>226.19</td>
<td>4071.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>73</td>
<td>186332</td>
<td>136866</td>
<td>229.34</td>
<td>4186.39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>74</td>
<td>186923</td>
<td>135315</td>
<td>232.48</td>
<td>4300.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>187506</td>
<td>133533</td>
<td>235.62</td>
<td>4417.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>76</td>
<td>188081</td>
<td>131579</td>
<td>238.76</td>
<td>4536.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>77</td>
<td>188649</td>
<td>129970</td>
<td>241.90</td>
<td>4666.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>78</td>
<td>189209</td>
<td>128206</td>
<td>245.04</td>
<td>4778.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>79</td>
<td>189763</td>
<td>126582</td>
<td>248.19</td>
<td>4901.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>190309</td>
<td>125000</td>
<td>251.33</td>
<td>5026.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>190849</td>
<td>123457</td>
<td>254.47</td>
<td>5153.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>82</td>
<td>191381</td>
<td>121951</td>
<td>257.61</td>
<td>5281.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>83</td>
<td>191908</td>
<td>120482</td>
<td>260.75</td>
<td>5410.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>84</td>
<td>192428</td>
<td>119084</td>
<td>263.89</td>
<td>5541.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>192942</td>
<td>117647</td>
<td>267.04</td>
<td>5674.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>86</td>
<td>193450</td>
<td>116279</td>
<td>270.18</td>
<td>5808.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>87</td>
<td>193952</td>
<td>114943</td>
<td>273.32</td>
<td>5944.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>88</td>
<td>194448</td>
<td>113636</td>
<td>276.46</td>
<td>6082.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>89</td>
<td>194939</td>
<td>112360</td>
<td>279.60</td>
<td>6221.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>195424</td>
<td>111111</td>
<td>282.74</td>
<td>6361.73</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Credits

1. Planning and Design of Interior Spaces

Residential Spaces


Pages 62, 63, 61, 62, 63, 64, 65, 66, 67: Architectural Forum, October 1937.

Pages 65-68, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100: Verna Cook Salomonsky, Architect.


Pages 73-76: Parrish Hadley Associates.


Pages 85, 86: Lehigh Furniture Company.


Pages 90-93, 125-127, 135, 166, 167: Bromley/Jacobsen.


Page 95: Comparative Architectural Details, Pencil Points Sesles (Francis Y. Joannes, Architect), 1936.

Page 97: Genial Associates; ISD; Bromley/Jacobsen.


Pages 106-108: Kohler.

Pages 109, 110, 114, 170 (bottom): Eljer.


Pages 130, 131: Marble Institute of America.


Pages 141, 142, 179, 180: New York City Building Code.


Pages 145, 146, 165, 166, 169, 185, 189, 191, 192: Jerry Caidari, Architect.

Page 155: Fornice Corporation.

Pages 157, 158, 172, 173: Merillat.

Pages 159, 160: St. Charles.


Page 171: Eurofaire by Frigidaire.


Page 193: Penni Points, April 1934.


Page 207 (top): Council Notes, University of Illinois.


Page 208 (left): General Services Administration.

Page 208 (right): Illinois Agricultural Experiment Station.


Pages 210 (top), 216: Bertram Bassuk, FAIA.

Pages 210 (bottom), 211 (top), 212: ISD.


Page 216: Schulte.


**Office Spaces**


Pages 239, 264, 271: ISD.

Page 242: Intergraph Corp., Interiors.


Pages 250, 251: Lehigh Furniture Company.

Page 252: Howe Furniture Corp.


Page 258: Panero Zeinik Associates.


Page 262: Will Ching, Planning and Design.

Page 265: Marble Institute of America.

Pages 273, 276: Bertram Bassuk, FAIA.


Pages 279, 280, 281: Herman Miller.

Page 282: Vecta.

**Hospitality Spaces**


Pages 319, 320: Panero Zeinik Associates.


Pages 323, 324, 331: Space Design Group.


Pages 335–337: Gensler Associates.


Pages 340–345: ISD.
Retail Spaces

Pages 390, 394, 400: Selected Architectural Details, Reinhold, New York.
Pages 393, 401-411: Walker Group/CNI.
Pages 395: Marble Institute of America.
Pages 418-422: PAM International Co., Inc.

Public Restrooms, Toilets, and Coatrooms

Pages 427-430: General Services Administration.
Pages 431-438, 465: Bertram Bassuk, FAIA.
Page 439: William Morgan, FAIA.
Page 446: Tani Chi and Associates.
Pages 454-457: Parker/Nutone.
Pages 458, 459: American Specialties, Inc.
Pages 461-463: Railex.

2. Construction Details and Finishes

Bertram Bassuk, FAIA.
Pages 481-483, 484 (bottom), 490 (bottom), 629, 645, 651 (top), 652, 754, 755 (top): ISD.
Pages 484 (top), 485, 486, 492, 493, 495, 496, 520, 530, 534, 564, 653, 654, 656, 751 (top), 752, 753: Geneler Associates.
Pages 486, 500, 605, 659, 669 (top): William Morgan, FAIA.
Pages 490 (top), 660, 651 (bottom): Charles D. Flayhan Associates.
Pages 491, 764 (top), 765 (bottom): Michael Lynn Associates.
Pages 499, 504, 768, 769: Panero Zelnik Associates.
3. Architectural Woodwork


Page 806: Comparative Architectural Details, Pencil Points Series (Frank J. Forster, Architect), 1935.


Pages 812, 813, 839 (right), 842, 845, 847, 848, 849 (bottom), 853–856, 859, 862–864: Design Solutions.

Pages 814, 816: Space Design Group; ISD.


Page 818: Thompson, Robinson, Cecil, Inc.

Pages 819–823, 829, 831–839: Bertram Bassuk, FAIA.


Page 825: ISD.

Pages 826, 827, 830, 839 (left), 841: Gensler Associates.

Pages 840, 841: Winebarger Church Furniture.


Page 844: Hochheller-Elies.

Pages 844 (top), 852: General Services Administration.


Page 857: Hyde and Shepherd, Architects.

Page 858: Howard and Frenaye, Architects.

Pages 860, 861: Comparative Architectural Details, Pencil Points.


Pages 866–870, 888: Architectural Panelling, Inc.


Pages 890–902: Hafele.

4. Specialties


Pages 923 (bottom), 924–926, 929, 930: Engel/OGP.


Pages 936–939: Designers Sign Company/Frank Rispoli.


Pages 951–964: Hufsey Seating Company.


Pages 1017–1020: Sweet's Catalog.

Page 1021: Marvin Windows.
Pages 1066-1059: Kirsch.
Page 1060: Armor Elevator.
Pages 1061-1064: Dover Elevator Co.
Pages 1067-1074: Outdoor Sports Facilities, Departments of the Army, Navy, and Air Force, Washington, D.C.
Pages 1075-1078: Cutler Manufacturing.
Page 1079: Phillips and Brooks, Inc.
Pages 1087-1089: Brown Manufacturing Co.
Page 1090: Bertram Bassuk, FAIA.
Pages 1091-1096: Pittcon Softforms.
Pages 1097-1099: Alvarado Manufacturing Co.
Pages 1100-1101: Haws.

5. General Reference Data
Pages 1112, 1113: Access America, Washington, D.C.
Pages 1114 (top): Sister Kenny Institute.
Pages 1132, 1134: Steelcase.
Page 1135: Indiana Limestone Institute.
Architectural woodworking, counters (Cont.): work, 824–826
display cases, 819–823, 829, 862, 863
door finishes, 865
file countertop, 836
finishes, 865
hidden door, 853
lecterns, 843–846
lobby display, 829
mouldings, 856–861
overfile cabinets, 827, 828
panelling, 804, 805, 860, 861
pantry cabinet, 839
pass-through vision panel, 275, 276
pews, 841
plaster/storage cabinets, 831
raised panel door, 794, 799, 801, 854
sanctuary door, 842
sash, 801
screen, 850
storage shelves, 834
storage walls, 816
tables, conference, 847, 848
trader's wall, 814, 815
wardrobes, 817
window seat, 851
windows, 802, 803
wood panelling, 804, 805
wood railing and gate, 852
wood stairs, 665–671, 673

Area requirements, 1106–1109

Areas of planes, 1142

Astragal, 875

Audio-visual systems, 950–960
equipment, 48, 953, 960
front projection, 952
optical design factors, 953
planning guidelines, 952–955
projection rooms, 961–966
rear screen, 952
remote control, 953
sound system, 953

Auditorium seating (Cont.):
sightlines, 950, 951, 961
terminology, 967
visibility, 969

Awning windows, 1016, 1018

Backbar, 347
Badminton court, 1073
Bank teller's counters, 396–400, 855
Banquet seating, 292
Banquette seating, 319–321
design criteria, 313–315, 318
details of, 316–321
Bar configurations, 348–356
Bar details, 346, 347, 358–373
Bar sink cabinet, 818
Bar stool spacing, 346–356
Barrier-free design:
bathrooms, 143–146, 317, 380
drinking fountains, 1102
elevators, 1065
kitchens, 178–189
ramps, 723
restrooms, 449–452
stairs, 718, 719
toilets, 449–462
water coolers, 1102
wheelchairs, 1114
(See also Accessible design)

Bars, 346–356
anthropometric data, 346, 347
backbar, 347
bar cabinet, 361
bar shapes, planning criteria, 348–356
bar stool spacing, 349–356
bottle steps, 383, 368, 389
clearances, public slide, 347
cocktail tables, 347
customer activity zone, 347
dimensions of, 348–356
elevations of, 357, 362, 367
front- and backbar, 348–356, 358, 359, 364,
365–369
glass racks over, 365, 370
leaning, 347
planning criteria, 346, 347, 358–362,
364–368, 369–373
planners, elevations, and sections, 368–373
sections through, 346, 347, 356–362,
364–366, 368–373
standing, 347
working drawings of, 358–373

Base cabinets, 789, 792, 794, 837
Base cap mouldings, 877

Above is the index page of a book or a document, listing various topics and their page numbers. This index page is designed to help readers quickly find specific information within the document. The index entries are organized alphabetically, covering a wide range of subjects such as architectural woodworking, bars, and accessibility considerations. Each entry includes a page number range, indicating where the reader can find more detailed information on that topic.
Doors (Cont.):
edges, 599
entrance, 616–628
exterior, 613, 617–628
fire-protected, 600
flush, 796, 796
frames, 571–587, 607–609
hollow metal, 571, 573–582, 585, 586
French, 612
hardware, 586, 590, 589–596, 634–644, 1129
hidden, 663
hinges, 586, 596
hollow metal, 586–599
laminated, 566
lead-lined, 610
lightproofing, 576, 606
paneled, 612, 613, 615, 616
particle board, 610
raised panel, 842, 853, 854
saddles, 522–528
sanctuary, 842
sausage, 801
schedules, 570–572
screen, 611
secret, 616, 808
shoji, 611
sizes, 568
sliding, 801, 811
sound proofing, 576, 608
stave, 610
stile and rail, 610
thresholds, 602–604
wood, 573, 587, 588, 600, 610–628, 632–634
wood-clad, 582, 584, 608
Double hung windows, 802
Down lighting, 749, 760
Draperies, 5, 6, 9, 10, 13, 14, 17, 18, 20–22,
24–26, 28, 1027–1042
bishop sleeve, 1035
cascade, 1037
colonial, 1029
colors, 1028
design, 1028
Directorio, 1030
fabric, 1028
Federal, 1029
finials, 1048
full-length, 1029–1032, 1034, 1035
Georgian, 1030
hardware, 1046–1061
headings, 1043, 1044
historical styles, 5, 6, 9, 10, 13, 14, 17, 18,
20–22, 24–26, 28
holdbacks, 1034
hooks, 1048
lame Georgian, 1030
lame Victorian, 1031
mid-19th-century Victorian, 1031
mousses, 1047
neo-Greek, 1031
panel widths, 1051
period styles, 1026–1032
rings, 1048
rods, 1049, 1050
single pleated, 1036
stackback requirements, 1058
Draperies (Cont.):
swags, 1028–1031, 1038–1040, 1042
upholstery, 1028
Drawers:
capacities of, 286–291
card file, 291
details, 785, 789–791, 797
glossary, 292, 293
insert, 286
lateral file, 287, 287
legal file, 285
letter file, 285
linear capacities of, 286–291
with shelves and add-on cabinets, 289
vertical file, 285, 286
Dresser, 97
Drinking fountains, 1100–1102
Drywall partitions, 481–496
Electrical:
emperance ratings, 1132, 1134
appliance loads, 1134
circuits, 1134
receptacle location, 1133
requirements, 1132–1134
Electronic media storage, 294, 295
Electronic workstations, 241–248
administrative, 244, 245
analyst/programmer, 245
anthropometrics, 241, 242
area requirements, 243–245
computer requirements, 241, 242
data retrieval, 243
managerial, 245
planning data, 241–248
secretarial, 243
shared tasks, 243
square footage for, 243, 245
task profiles, 243–245
trading desk details, 246–248
word processing, 244
Elevators:
barrier-free considerations, 1065, 1066, 1068
doors, 1064
gearless traction, 1060
gearless traction, 1061
hydraulic, 1061
low and mid rise, 1061
passenger, 1060–1066
planning guidelines, 1060
security of, 978, 989–991
selection of, 1060
traction high rise, 1062, 1063
wheelchair lifts, 1068
Escalators, 1087
Exit doors, security of, 989
Fabrics:
characteristics and suitability of, 1130, 1131
types, 1130, 1131
Face out display systems, 413, 414, 418
Family/recreation rooms, 196–199
arrangement and clearances, 196, 197
recreational activities, 196, 197
File cabinets, 286–289
card file drawers, 281
File cabinets (Cont.):
dimensions of, 286–287
drawer types in, 285–289
insert drawers, 286
lateral, 287, 288
legal file drawers, 285
tetter file drawers, 285
linear capacities in, 286
overfile, 286
roll-away, 286
vertical, 285
weights of, load, 287
File storage, details of, 298, 299
Fire doors, 600
Fireplaces, 68–71, 724–742
accessories for, 742
construction details of, 725, 729
dimensions of, 725–729, 804
flue sizes of, 726–729
mantels, 68–71, 520, 521, 730–741, 804, 859
planning data, 724–729
Fireproofing, 514, 515
Fixture heights plumbing, 117
Flagstone, 520
Floor:
raised, 554, 565
sound rated, 548–550
Floor construction:
details, 516–565
computer floors, 564, 565
marble, 521
slate, 541
terrazzo, 535–541
wood, 542–560
wood on concrete slab, 547
wood strip flooring, 543
sound insulation, 548–550
Floor finishes:
bases, 532, 533, 786
brick, 540
ceramic tile, 519, 540, 541, 552–568
characteristics of, 517
edgings, 531
marble, 541
parquet, 544–546
quarry tile, 541
resilient tile, 541, 551
saddles, 522–526
slate, 541
terrazzo, 535–541
transitions, 527–530
wood, 541, 544, 547
Floor lamps, 743, 745
Floor patterns:
ceramic tile, 519, 562–563
marble, 520, 521
stone, 534
tile, 519
Flush bolts, 596
Folding table hinges, 891
French doors, 801
French paneling, 805
Functions of numbers, 1144
Furniture arrangements, living room, 51
elemental
Furniture clearances:
dining rooms, 50, 56, 80–84
Furniture clearances (Cont):
- living room, 50, 57, 63

Furniture dimensions:
- audio-visual equipment, 48
- bedroom, 56
- beds and mattresses, 46
- bookcases, 808-812
- chairs, 45, 51-55, 59
- chaise lounges, 45
- chests, 58
- children’s furniture and tables, 44
- convertible sofas, 47
- couches, 5, 9, 13, 17, 21, 25, 26, 45, 57, 77-79
- desks, 58
- dining room, 50, 58
- highboys, 58
- love seats, 45
- lowboy, 58
- mattresses and beds, 46
- pianos, types and sizes, 199
- secretary, 58
- settees, 57
- sofa beds, 47
- sofas, 5, 9, 13, 17, 21, 25, 26, 45, 57, 77-79
- tables, 44, 45, 50, 60
- television sets, 50
- 20th century classic chairs, 51-55
- wall beds, 47
- waterbeds, 47

Furniture, furnishings, and equipment, 278-304
- chair dimensions, 278-281
- chair types, 278-281
- conference tables, 282-284
- corner tops with base cabinets, 303
- desks, 7, 8, 12, 24, 27, 30, 38
- file cabinets, 285-289
- file counter tops, 298, 304
- kitchen, compact, 304
- lounge seating, 282
- office pantry details, 300-303
- overhead cabinets, 299
- reception seating, 282
- storage cabinets, 290
- furniture glides, 202
- Furniture hardware, 890-901

Furniture types/styles, 5-43
- American, 17th century colonial, 5-8, 29, 30
- American, 18th century colonial, 9-12, 29, 30
- American, 19th century Federal, 13-16
- American, late 18th—early 19th century Federal, 13-16
- Brothers Adam, 39, 40, 17-24
- Chippendale, 36
- colonial, 5-16, 24, 30
- Directoire and Empire, 25-28
- Duncan Phyfe, 31
- English 18th century Jacobean, 32
- English, 17th century Jacobean, 33
- English 17th century William and Mary, 34
- English 18th century Georgian, 17-20, 36
- English 18th century late Georgian, 21-24, 37, 38
- English 18th century Queen Anne, 35
- Federal, 13-16

Furniture types/styles (Cont):
- French, 17th and 18th century Louis XV, XV, and XVI, 41
- Georgian, 17-24, 36-38
- Hepplewhite, 37
- Jacobean, 32, 33
- late Georgian, 39, 40
- Louis XIV, XV, and XVI, 41
- Queen Anne, 35
- Sheraton, 38
- Spanish, 42
- table of, 43
- William and Mary, 34

Furnishings:
- columns, 488, 491
- walls, 483, 484, 496, 499
- wood, 497

Garage doors, 992-995

Gardens:
- drainage, 911
- interior, 910
- large, 910
- planting procedures, 910-913
- small, 910

(See also: Plants; Plantscaping)
- General offices, 222-230
- area allocations, 226, 226
- basic workstations, 223-226
- groupings, 224
- minimum square footage, 225, 226
- multiple workstations, 227-230
- open workstations, 225, 226
- screened workstations, 225, 226
- square footage for, 225, 226
- task profiles, 225, 226
- U-shaped workstation, 224
- Glass door cabinet hinges, 694
- Glass partitions, 492
- Glass shelving details, 402-404, 407, 408, 409, 413, 414
- Glazing windows, 1019
- Grab bars, 456, 459
- Grilles, 1080-1086
- Guards, wall protection, 1087, 1098
- Guestroom plans, 374-380
- accessible, 377-380
- Gymnasium, 1071
- Gypsum board partitions, 481-496

Handball courts, 1070

Handrail details, 665-666, 671, 672, 681, 682, 692, 707, 719, 710

Hardware:
- bolts, 898, 1138
- cabinet, 887-902
- catches, 898
- closet, 901
- coordinators, 595
- door, 586, 590, 599-599, 634-640
- door closers, 593-594
- door holders, 593-594
- door stop, emergency
- fire exit, 595
- flush bolts, 596
- furniture, 887

Hardware (Cont):
- hand of lock, 635
- hinge locations, 568
- hinges, 589-591, 634, 887-894
- hospital door latch, 597
- installation in wood door, 554
- locations of, 634, 1129
- lock functions, 635
- lockset types and descriptions, 592, 638-640
- panic, 595
- wood door, 594, 592, 638-640

Headings, drapery, 1043, 1044
- Hearths, 726-729
- Highboy, 58

Hinge types:
- anchor, 589
- butt, 887, 890
- concealed, 892
- flaps, 891, 895
- folding table, 891
- full mortise butt, 589, 590
- full surface butt, 589, 590
- full surface-swing clear, 590
- glass door, 894
- half mortise, 589, 590
- half mortise butt, 589, 590
- half surface butt, 589, 580
- hospital “swinging” clear, 590
- invisible, 589
- mitred, 892
- pivot, 888, 889, 893

Hinges, 887-894

Holdbacks, 1045, 1046

Hollow metal door frames, 571-582, 585, 586
- anchorage of, 575, 577
- details, 571, 573, 577-586
- light and soundproofing of, 576
- profiles, 574, 575, 576, 599
- typical jamb installations, 571, 573, 577-586
- schedules, 570-572
- wood and metal, 582, 584

Hollow metal door hardware, 559, 589-598

Hollow metal doors, 566-599

construction types, 567
- designs of, 568, 571
- dimensions of, 568
- edge treatments, 590
- hardware, 569, 589-588
- hinge locations, 568, 598
- laminated construction, 566
- sizes of, 568
- steel stiffened, 566

Hospitality spaces, 307-383
- bars, 346-373
- guestroom plans, 374-380
- hotel room plans, 374-380
- hotels, 374-383
- restaurants, 307-345

Hotel room plans, 374
- accessible, 377-380
- Hotel, 374-383
- accessible bathrooms, 143-148, 317, 380, 449-452
- accessible guestroom plans, 377-380
- guestroom plans, 374-380
Hotels (Cont.): reception desk, 384
registration desks, 381-383
room layouts, 374-380

Indoor recreation, 1069-1073
Indoor trees, 907
Interior plants, 906-930

Jalousie window, 1018
Jams:
  hollow metal, 571, 573-582, 585, 586
  marble, 629
  wood, 581-586, 608
Joinery details, 781-803
Joinery types, 781-803
stile and rail, 503, 610, 796, 799, 805, 813
Joint, 781-784
buttered, 781, 782
cabinet, 785-793
characteristics, 781
furniture, 781-784
mitred, 781, 782
shiplapped, 781, 782
terminology, 783
tongue and groove, 781-786
typical, 781-784

Kitchen layouts:
  adaptable, 178-189
  broken U, 151-153
corridor, 151-153
  L-shaped, 151-153
  U-shaped, 151-153
Kitchens:
  accessible, 178-189
  adaptable, 181-185
  anthropometric data, 149, 150
  appliances, 171-173
  barrier free design, 178-189
  cabinet details, 154-169
  cabinet types and dimension, 158-164
clearances, 149, 150, 153-156
  compact, details of, 304
  countertops, 174, 175
elevations and equipment, 153
  layouts of, 151-153
  microwave cabinets, 163
  minimum counter frontage, 153
  planning information, 149, 150-156
  plans, elevations and details, 178, 177
  sink types and dimensions, 170
  space criteria, 153
  storage and cabinets, 154, 158
  storage requirements, 154, 155
  typical layouts, 151, 152
  wheelchair accessible designs, 178-189

Ladders, 720, 721
Lamp (bulb) types, 774-776
Lamps (portable), 743-748
desk, 744, 747
floor, 743, 746
minimum shade dimensions, 743-746
personal, 743, 744
table, 744-746

Lamps (portable) (Cont.):
  wall-mounted task, 748
Laundry room locations, 202, 203
Laundry/bathroom combinations, 202
Laundry/kitchen combinations, 204
Laundry/sewing combinations, 200-205
Laundry/sewing rooms, 200-205
  sewing center clearances, 205
  washer/dryer arrangements, 200, 201
Lavatory clearances, 100-103
Lavatory counter details, 441-446
Lavatory countertop, 441-446
Lavatory heights, 100, 101, 140
  wheelchair accessible, 450
  Lavatory types and dimensions, 109-112
  Lectern, 843-848
Letterboxes, 1075
Lettering typstyle, 947, 948
Libraries/studies, 190-196
  anthropometric data, 190
  bookcases, 808-812
  capacities of, 190
columns, 192-195
heights of, 190
  plan, elevations, and details, 191-194
  rolling ladders for, 195
  volumes per linear foot, 190

Lid stays, 885
Lighting, 743-778, 1014
cold cathode ceiling mounted, 774, 752
cove, 413-417, 761-759
  feature walls, 412-417
  handrail lighting, 765
lighted column, 771-773
merchandise, 407-409, 412-417
miscellaneous, 760-764
nosing and treads, 765-769
planning data, 743, 744, 749, 750, 774-778
  retail stores, 407-409, 415-417
  skylight lighting, 770
  stair lighting, 765-769
Lighting levels, 760
  industrial, 778
  office, 778
  plants, 915
  residential, 750
  store, 778
Lighting plan, 859
Lighting types:
  cornice, 749
downlighting, 749, 750
valence, 415-417, 749
Living rooms, 61-79
  bars in, 72
circulation, 62
design regulation area, 62-64
fireplaces, 69-71
floor plan of, 67, 68, 73-76
  furniture arrangements, 61
  furniture clearances, 63
  furniture dimensions, 50
  media cabinet details, 65, 66
  planning considerations, 61-63
  plans, elevations, and details of, 67, 76
  sofas, 77-79

Living rooms (Cont.):
television viewing areas, 64
Locks, 592
  bored, 592
  bored cylindrical deadlock, 592
  functions of, 631-640
  furniture, 899
  mortise, 592
  mortise deadlock, 592
  unit, 592
  Locks, latches, and deadlocks, 592, 636-640
  Lockset functions, 636-640
  Lockset types and descriptions, 592, 636-640
  Lounge seating, 261, 281, 282
Lowboy, 58
Lunch counters, 322

Mail chutes, 1078
Mail drops, 1077
Mailboxes, 1076
Mantels, 68-71, 520, 521, 733, 735, 736, 738-741
  marble, 733-735
  wood, 736-741, 804
Marble:
ceilings, 509
details, 68-71, 520-521, 733, 735, 736, 738-741
patterns, 520, 521
walls, 508-510
Marble flooring, 519, 520, 521
Marble jams, 629
Marble stairs, 715
Masonry partitions and walls, 473-480
Mathematical data and formulas, 1139-1144
Mattress types and sizes, 46
Mattresses and beds, 46
Measurement conversion tables, 1139-1144
Media rooms, 65, 66
Medical symbols, 940
Men's toilet room, 427, 433, 436, 437, 440
Metal studs and gypsum board, 461-498
Metric conversion tables, 1140
Mirrors, triple, 410
Modular panel conversion chart, 1126
Mortar beds, 132, 541, 561-563
Mouldings, 856-858, 861, 866-886
  backbands, 873
  balustrade, 864
  base, 876, 877
  base cap, 877
  base shoe, 876
  brackets, wood, 886
  brick, 874
casings, 878, 879, 880
  chair rail, 870, 883
cramped shell, 885
colonnade, 885
corner guards, 875
cove, 881
crown, 866, 867, 868, 871, 872
deep sculpt, 866, 887
door trim, 869, 870
door, 876
ehalf round, 884
ehandrail, 884
Mouldings (Cont.):
- lattice, 865
- mirror, 870
- miscellaneous, 873–875
- panel, 870, 882
- picture, 870, 873
- pilaster, 874
- round, 824
- sanitary, 875, 885
- sash, 875, 885
- step, 873
- stop, 885
- trim, 870

(See also Cornices)
Mounting heights, telephone, 1079
Mounts, curtain rods, 1047
Munsell color system, 1002

Nail types and sizes, 1136, 1137
Newels and railings, 665, 666, 673, 692, 693, 694, 699, 703, 705
Nosings, stair lighting In, 768–769
Nosings and treads, abrasive, 687, 688, 691, 715, 722

Office spaces, 223–304
- conference rooms, 248–269
- electronic workstations, 241–248
- furniture, furnishings, and equipment, 278–304
- general offices and multiple workstations, 223–230
- pass-through windows, 512
- private, 231–240
- room arrangements, 233–235
- reception areas, 260–277
- workstations types, 223–232
- open workstations, 225, 226
- Overfile cabinet, 827, 828

Paddle tennis court, 1072
Panel conversion chart, 1126
Panel mouldings, 503
Panelled door:
- details of, 764, 799, 801, 854
- frame parts of, 784
Panelled wainscot, 503, 799
Panelled walls, 798, 799, 800, 801, 804, 805, 813, 814, 842, 856–861, 860, 861
Paneling, 500–504, 804, 805, 860, 861
- French, 804, 805
- raised, 503, 800
- wood, 500–504, 736, 737
Panik hardware, 595, 596
Pantry cabinets, 839
Parquet flooring, 544–546
Partitions and wall finishes, 469–515

Partition types:
- metal stud and gypsum board, 481–496
- toilet, 447, 448
- Partitions, 470–499
- acoustical, 494–498
- brick, 473–478
- concrete block, 480, 483
- drywall, 481–496
- fire-rated, 495

Partitions (Cont.):
- glass, 492
- gypsum board, 461–496
- Interior, 470–499
- marble, 508–510
- masonry, 473–478, 480, 483
- miscellaneous types, 493
- piers, 473
- plaster, 470–473, 475–477, 508–511
- slate, 511
- sound transmission, 494–498
- stone, 478, 508–511
- wood stud, 472, 473, 493, 498

Pass-through windows, 275, 276
People, distance relationships, 1119, 1120

Periodic furniture:
- American, 17th century Colonial, 5–8, 29, 30
- American, 18th century Colonial, 9–12, 29, 30
- American, 18th century Federal, 13–16
- American, late 18th century–early 19th century Federal, 13–16
- Brothers Adam, 30, 40
- Chippendale, 36
- Colonial, 5–16, 29, 30
- Directoire and Empire, 25–28
- Duncan Phyfe, 31
- English 17th century Jacobean, 32
- English 17th century Jacobean, 33
- English 17th century William and Mary, 34
- English 18th century Georgian, 17–20, 36
- English 18th century, late Georgian, 21–24, 37, 38
- English 18th century Queen Anne, 35
- Federal, 13–16
- French, 17th and 18th century Louis XIV, XV, and XVI, 41
- French, late 18th century–early 19th century, 25–28, 41
- Georgian, 17–24
- Hepplewhite, 37
- Jacobean, 32, 33
- late Georgian, 30, 40
- Louis XIV, XV, and XVI, 41
- Queen Anne, 35
- Sheraton, 38
- Spanish 16th and 17th century, 42
- table of, 43
- William and Mary, 34

Plants, 841
- Pianos, 199
- photometrics, 766
- Picture mouldings, 870, 873
- Pivot hinges, 888, 889, 893
- Pivot windows, 1019, 1022
- Plant containers, 831, 912
- Planters, 831
- diameters, 905–909, 912
- window, 927, 928

Plating, 911, 912, 916–928
- bed material, 411, 912, 916–923
- details, 923–928
- medium, 911, 912, 916–923
- standards, 906–915
- Plants, 906–930
- design guidelines for, 906–915

Plants (Cont.):
- diameters of, 908–909
- floor, 907
- heights of, 906–909
- high light level, 915
- light and sun requirements, 916–923
- low light level, 916
- medium light level, 915
- procedures for planting, 910–913
- requirements, 908–915
- soil requirements, 911, 912, 916–923
- spacing, 906–909
- species, 907
- specifications, 910
- temperature requirements of, 913–916
- texture, 906
- trees, indoor, 907
- typical, 916–923
- water and humidity requirements, 916–923
- water requirements, 915
- Plantscaping, 906–930
- design guidelines, 906–915
- specifications, 910

Plauses, 936–939
- Plated shades, 1053
- measurements, 1058
- Plains, 1051, 1043, 1044
- Plumbing fixtures, 107, 109–116
- Pools, 912
- Pot sizes, 906–909, 912
- Projection, 950–960
- distances, 953
- front, 952
- rear, 952
- Projection room layouts, 950–960
- Projection screens, 949–960

Quarry tile, 541

Railings, 665–669, 671, 672, 681, 682, 692, 707, 718
- Raised floors, 564–565
- Raised paneling, 503
- Raised wood panels, 503
- Ramps, 723
- barrier-free, 718, 719, 723
- Rear projection, 952

Receptacles, electrical, 1133

Reception areas:
- planning data, 260, 261
- receptionists’ workstation In, 262–276
- seating arrangements, 261
- Reception desks, 260, 262–272, 855
- hotel, 381–384
- Reception rooms: 260–277
- seating, 261
- Reception window detail, 273–276, 512
- Recreation, indoor, 196, 197
- Reference data, general, 1106–1144
- Reflective ceiling plans, 760
- Reflective values, color, 1013
- Registration desks, 381–383
- Residential spaces, 5–219
- bathrooms, 100–148
- bedrooms, 87–99
- closet/storage areas, 206–220
Residential spaces (Cont.):
  dining rooms, 80–88
  family/recreation rooms, 196–199
  kitchens, 140–149
  laundry/sewing rooms, 200–205
  libraries/studios, 190–195
  living rooms, 61–79
  period furniture, 5–43
  Resilient floors, 541, 651
  Restaurants, 307–345
    accessible design, 317, 330
    banquet seating, 313–316, 318–321
    booth seating, 316
    cafeteria/servery, 333–345
    confidem cabinet, 339, 341, 342
    counter details, 333–337
    counters, 323–327
    dining room seating, 316
    host cabinet, 338
    lunch counters, 322
    design criteria, 322
    maître d’ station, 338
    salad bar serving counter, 840, 844
    seating, 313–316, 318–321
    self-service counter, 329
    servery counter, 843, 845
    service counter, 338
    table spacing, 306–316
    trash counter, 338
    tray pickup, 341
  Restrooms and toilets, 425–465
    accessible design, 317, 430, 449–452
    accessories, 453–457
    accessory heights, 426–429, 431, 433, 435–441, 450, 452
    clearances for wheelchair access, 317, 449–452
(see Bathrooms; Hotels)
  fixture requirements, fixture count, 425
  grab bar configurations, 468, 469
  lavatory counter details, 442–446
  lavatory heights, wheelchair accessible, 450
  plans and elevations, 430–441
  plumbing data, 425
  plumbing fixture heights, 428–429, 431, 433, 435–441
  public, 425–465
  show facility for accessibility, 147
  toilet accessories, 453–459
  toilet stall details, 447, 449
  toilet stalls, accessible, 446–452
  vanity details, 441–446
  wheelchair accessible, 317, 430, 449–452
  women’s toilet/powder room, 430, 434–437
  Retail spaces, 387–422
    anthropometric considerations, 387–389
    back island details, 401
    banks, 386–400
    binning, 419
    counter heights, 387–389, 391, 392, 384–402
    department stores, 401–423
    display cases, 387–393, 402–404, 408, 409, 862, 863
    facia, 413, 414, 418
    Retail spaces (Cont.):
      feature walls, 412–417
      garment capacities, 418
      lighting, 407–409, 412–417, 759
      planning data, 367–369
      rack display systems, 420–421
      refrigerated case, 392
      sales counters, 387–389, 391, 392, 394–402
      shelving, 407–409, 412–414, 422
      shops, 387–389
      showcases, 397–393, 402–404, 408, 409
      store fronts, 390
      triletic mirror, 410
      valence and cove lighting, 415–417
      wall display systems, 412, 413
      Risers, 671, 686–688, 708, 713–716, 719
      Rock formations, 912
      Roof display system, 421
      Rods:
        drapery-curtain, 1048–1050
        traverse, 1050
      Roll-in showers, 140
      Rolling ladders, 996
      Row length and spacing, 961–969, 970–976
    Saddles, 522–528
    under doors, 522–528
    Salad bar counter, 340
    Sales counters, 387–389, 391, 392, 394–402
    Sash, profiles of, 801
    Screens:
      projection, 962
      shoji, 611
    Screw types, 1138
    Seat widths, 968
    Seating arrangements, 966, 970–976
    auditorium, 961–967
    standard, 961
    Seating:
      continental, 968
      multiple, 968
    Secondary entries, security of, 999
    Security, 977–979
    alarms, 971
    bars, grill, and gates, 988
    closers, 980
    control of grounds, 977, 978
    cylinders, 981, 983, 984
    doors, 977–988
    electronic systems, 994, 995, 997
    elevators, 976, 998
    exit doors, secondary, 998
    fire doors and fire stairs, 977
    garage doors, 992–995
    general control guidelines, 977, 978
    hardware, 979–986
    hinges, 980
    lighting, 993
    lobby spaces, 977
    locks, 961, 966, 987
    mailbox rooms, 992, 993
    multilamily dwelling, 977
    public spaces of multiple dwelling, 977
    secondary entries, 999
    skylights, 998
  Security (Cont.):
    sliding doors, 984
    window and hardware, 978, 986–988
    Security alarms, 994–997
    Settees, 5, 9, 17, 25, 33, 57
    Sewing equipment, arrangement of, 205
    Sewing machines, heights and clearances, 205
    Sewing rooms, 205
    planning of, 205
    Shades, window, 1052–1054
    lamp, 743–746
    Shelf and hanging pole, 835
    Shelf edge, 826, 830, 834, 835
    Shelf heights:
      closets, 835
      storage, 826, 834
    Shelf light details, 296
    overhead file storage details, 827, 828
    Shelf supports, 830
    Shelf types:
      coat, 277
      coatrooms, 465
      phone, 277
      wall, 277
      wire basket and shelving system, 215–220
    Showcase types:
      cosmetic display, 391, 402–404
      island display, 392
      Jewelry, 391, 401
      refrigerated, 392
      shirt display, 391
    Shower floor details, 132, 133
    Shower seat design, 132
    Shower wall details, 132
    Showers:
      grab bars for, 140, 142, 144, 147
      roll-in, 140, 144, 147
      wheelchair accessibility, 140
    Shuffleboard court, 1074
    Shutter details, 1057
    Shutters, 1058–1059
    Stairs types, 831–848
    area designation-wall mounted plaques, 937
    ceiling hung, 937
    code, 936
    counter top, 939
    cut letters, 939
    design criteria, 931–935
    desk top, 939
    directional, overhead, 937
    directional, wall mounted, 937
    framed wall-mounted plaques, 938
    room identifier, 938
    Signage:
      ceiling hung, 937
      checklist for, 934, 935
      counter top, 939
      desk bar, 939
      desk top, 939
      directional, 937
      flag mount, 939
      framed wall-mounted plaques, 938
      room identifier, wall mounted, 938
      symbols, 940–946
Wheelchair: terminology, 1114
Whirlpool baths, 113, 135
Window bars, grilles and gates, 1080–1086
Window treatments, 1015–1059
Walls:
- wallpaper, 1052–1054
- shutters, 1055, 1056
Window types, 1016–1026
austrian, 1020
awning, 1016, 1018
bottom hinged, 1017
casement, 1015, 1024, 1025
casement hopper, 1017
custom shapes, 1021
double hung, 1015, 1016, 1019, 1022, 1024,
1026
dual vent, 1019
gliding, 1019
Gothic, 1021
hopper, 1017, 1018
jalousie, 1016
metal, 1018, 1020
oval, 1021
pivot, 1019, 1020
projected, 1018
reversible, 1020
round top, 1021
side hinged, 1017
sliding, 1019
special, 1020
stationary, 1023
top hinged, 1018
two-light, 1022
wood, 1017–1026
Windows, 1015–1026
pass-through, 275, 276
reception, 273–276, 512
security of, 976, 986–988
Windows and hardware, 1015–1028
Wire shelving systems, 216–220
Women's toilets, 430, 434–437
Wood:
- board feet of, 1127
door frames, 608, 809
floor construction, 642–650
flooring types, 544–547
joinery details, 781–787
paneling, 661, 804, 805, 860
parquet, 544–546
railing and gate, 852
railing, 665–671
stairs, 665–671, 673
strip flooring, 543
windows, 802, 803
Woodwork details, 804–886
altars, 840
bar sills, 818
bars, 346, 347, 356–382, 382–386, 386–373,
864
base cabinets, 837
benches, 849
book and prayer shawl cabinets, 832, 833
bookcases, 808–812
cabinet doors, 717
casework, 788–794
clothes storage, 835
cost closet, 835
corner cupboards, 806, 807
cornices, 856–861
counters, teller's, 855
counters, work, 824–828, 836, 855
display cases, 819–823, 829, 862, 863
door finishes, 865
drawers, 791
file countertop, 836
finishes, 865
hidden door, 853
lecterns, 843–846
lobby display, 829
overfile cabinets, 827, 828
moulding, 856–861
panelling, 804, 805, 860, 861
pantry cabinet, 839
pass-through vision panel, 275, 276
pews, 941
planter/storage cabinets, 831
raised panel door, 794, 799, 801, 854
sanctuary door, 842
sash, 801
screen, 850
storage shelves, 834
storage walls, 816
tables, conference, 847, 848
teller's counters, 855
trader's wall, 814, 815
wardrobes, 817
window seat, 851
windows, 802, 803
workshop, 804, 805
wood ralling and gate, 852
wood stairs, 665–671, 673
work counters, 824–826
Workstation types, 223–232
bar, 223–226
electronic, 241–248
anthropometrics of, 241, 242
executive, 231, 232
general, 223–230
multiple, 227–229
receptionist, 260
trading desks, 246, 247
trading tables, 248
wood stud partitions, 472, 473, 494, 498
About the Editors

Joseph De Chiara is a practicing architect and city planner in New York City. He has taught at Columbia University, Pratt Institute, Cooper Union, the New York Institute of Technology, and the State University of New York at Farmingdale. He is coauthor of *Time-Saver Standards for Site Planning* and the author of *Handbook of Architectural Details for Commercial Buildings* and *Time-Saver Standards for Building Types*, all published by McGraw-Hill. De Chiara received a Bachelor of Architecture degree from Pratt Institute and a Master's degree in Urban Planning from Columbia University.

Julius Panero, AIA, ASID, is a practicing architect, interior designer, and Professor of Interior Design at the Fashion Institute of Technology in New York City. He has taught interior design for the past 32 years and was a former chairperson of the interior design department at FIT. A graduate of Pratt Institute, where he received a Bachelor of Architecture, and Columbia University, where he received a Master of Science in Urban Planning, Panero is a member of the American Institute of Architects and the American Society of Interior Designers.

Licensed to practice architecture in New York, Panero is a principal in the architectural and consulting firm of Panero Zelnik Associates, Architects/Interior Designers. He is coauthor of *Human Dimension & Interior Space*, a sourcebook of design reference standards. In 1986, he was awarded the prestigious ASID Joel Polsky Prize for this book. He is also the author of *Anatomy for Interior Designers* and a contributing author to the *Time-Saver Standards* series.

Martin Zelnik, AIA, ASID, IDEC, is a practicing architect, interior designer, and Professor of Interior Design at the Fashion Institute of Technology in New York City, where he has taught interior design for the past 23 years. He served as chairperson of the interior design department from 1983 to 1986. He is a graduate of Brandeis University, where he received a Bachelor of Fine Arts degree, and
Columbia University, where he earned a Master of Architecture degree. Zelnik is a member of the Interior Design Educators Council, the American Society of Interior Designers, and the American Institute of Architects; has served as a special consultant to the National Council of Interior Design Qualifications; and holds certification with the National Council of Architectural Registration Boards.

He has been a principal in the New York City–based architectural and consulting firm of Panero Zelnik Associates, Architects/Interior Designers, for over 18 years. The firm specializes in institutional, religious, and transportation facilities, and corporate interiors. Zelnik is coauthor of Human Dimension & Interior Space, a sourcebook of design reference standards. In 1986, he was awarded the prestigious ASID Joel Polsky Prize for this book.
TIME-SAVER STANDARDS FOR INTERIOR DESIGN AND SPACE PLANNING

A comprehensive one-volume graphics and text reference on interior design and space planning.