DIVISION 8
DOORS AND WINDOWS

Division 8 of the Carnegie Mellon University Design and Construction Standards Manual addresses the following standards related to doors and windows on University projects.

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08100 GENERAL

This section addresses some general requirements that are discussed in more detail in the following sections.

Compliance with all codes and ordinances applicable to a particular project is mandatory.

For each door and frame assembly that is required to be fire-rated and that exceeds the limitations of labeled assemblies, the Contractor shall submit certification from the manufacturer as to the equivalency with the requirement for labeled assembly of the design, material, and construction.

With few exceptions, doors shall be a minimum of 3-ft wide and a minimum of 7-ft high. All doors along accessible routes must meet the requirements of the Americans with Disabilities Act (ADA). All doors with smaller dimensions must be approved by the Design Consultant on a case by case basis. Storage and special access needs may require larger doors.

Composition and construction features for interior doors shall meet functional needs such as radio wave screening, radiation shielding, and safety glass.

Fire protection in laboratory areas requires special design and specifications. The Design Consultant must contact the University’s Office of Environmental Health and Safety (EH&S) to determine any hazards associated with these areas.

Work associated with historical buildings must be reviewed and approved by the University Project Manager.

08110 METAL DOORS AND FRAMES

This section addresses requirements for exterior and interior metal doors and frames for use on University projects.

Exterior Metal Doors

Materials shall be anodized aluminum, stainless steel, or painted hollow metal. Hollow metal doors are frequently used at the University, except as main entrance doors.

Energy conservation through insulation and thermal isolation is required. Thermal-rated assemblies shall be provided in accordance with ASTM C 236 or C 976.

Aluminum doors shall be fabricated of two outer layers of 19-gage aluminum alloy sheet material.

Stainless steel doors shall be fabricated of two outer layers of 18-gage minimum stainless steel sheets.

All double exterior doors shall have a center post so that conventional hardware can be used.

Hollow metal steel doors shall be fabricated of two outer layers of 14-gage steel face sheets. Inserts shall be a minimum of 0.1875-in. thick.
All hollow metal steel doors shall be 1.75-in. thick flush design and of seamless hollow construction unless where insulation is required.

Exterior hollow metal frames shall use standard rectilinear profiles. All exterior frames must be weather-stripped and incorporate a minimum of three silencers.

All exterior doors shall be adequately weather-stripped in accordance with the manufacturer’s standards for thermal loss control. Copper and stainless steel are acceptable materials.

**Interior Metal Doors**

The most common interior use of metal interior doors is for fire doors or special access doors.

Interior door facing sheets and metal frames shall be 16-gage steel.

Hollow metal doors shall have a stile width of at least 3.5 in., top and bottom rail heights of not less than 5 and 10 in., respectively, and shall be of heavy duty, institutional construction. Heavy duty reinforcing is required.

All hollow core metal doors shall be ordered with metal reinforcing for hardware installation. Reinforcing placement will be coordinated with the hardware schedule from the door manufacturer.

Interior metal frames shall accommodate three silencers.

Labels on rated doors and frames shall not be removed or obscured with paint and shall be in place before the final inspection.

Interior doors for the Mellon Institute Building must be reviewed by the University Project Manager. Corridor and public access doors in Mellon Institute are historic aluminum doors. The University has existing aluminum doors in storage that are suitable for reuse. The availability of these doors for use shall be verified with the University Project Manager.

**08211 FLUSH WOOD DOORS**

All flush wood doors shall be manufactured and installed in accordance with the following:

- Quality Standard “Architectural Woodwork Quality Standards” of the Architectural Woodwork Institute (AWI) for grade of door, core, construction, finish, and other requirements
- Quality Standard “Manual of Millwork” of the Woodwork Institute of California (WIC) for grade of door, core, construction, finish, and other requirements
The Contractor shall provide a WIC-certified compliance certificate indicating that doors meet the requirements of the grades specified and a WIC-certified compliance certificate for installation.

**Exterior Wood Doors**

To preserve the established architectural treatment in certain areas of the campus, solid-core wood doors, finished on four edges, will be required.

Solid-core doors shall be constructed with a 1.75-in. thick bonded core with a minimum of five plies. Paint or stain grades are acceptable for solid-core doors.

All exterior doors shall be adequately weather-stripped in accordance with the manufacturer’s standards for thermal loss control. Copper and stainless steel are acceptable materials.

Wood frames may be used in conjunction with wood exterior doors, but only with the approval of the University Project Manager.

Plastic laminate doors are not acceptable for exterior door applications.

**Interior Wood Doors**

The material, finish, and style of interior doors must be suitable for the particular project. Sliding, bi-fold, or hollow-core doors are not acceptable on University projects.

The top and bottom edges of wood doors must be finished in the same manner as the faces. Construction and interior composition of doors shall meet applicable code requirements and specific functional needs—such as radiation shielding or one-way view.

Where wood doors are required to be fire-rated, the doorframe shall be metal and the assembly shall meet code requirements. In some cases, wood frames that meet code requirements may be used. Knockdown hollow metal frames are not acceptable. Frames shall be heavy duty with hardware reinforcing.

**Door Louvers and Vision Lights**

Door louvers are not permitted on University projects.

Clear glass vision panels shall be installed in doors between corridors, stairwells, and classrooms subject to specific room requirements. All exterior door glass shall be tempered. Fire-rated egress corridors and glass window walls shall be wire glass, as required by the code.

**08315 SPECIAL DOORS**

In construction involving secure areas such as computer file rooms, security doors are required. Door weight must be considered in the structural design of the supporting floors and walls.
Where combination and/or timed locks are required, they must be reviewed and approved by the University Project Manager.

Where high-traffic or high-impact doors are required, the method of hanging, resistance to impact, and possible use of double action hinges shall be considered. Door construction must be solid-core, high-impact material with a long-wearing durable surface. Hardware shall include push and kick plates. Automatic sliding glass doors shall be specified to include breakaway hardware. Appropriate locks shall be provided (see Section 08700).

Sound-control doors shall be solid with no louvers and mounted in hollow metal frames with ball-bearing hinges. All edges of the doors and adjacent frames shall be designed to contain acoustic sealing material, and the kick rail shall have an automatic drop plate to seal off sounds at the threshold. The sound loss rating shall be specified.

All doors for special uses that require sound reduction shall meet ASTM E 90-81 and E 413-473 requirements for sound transmission.

Folding doors, sliding doors, or folding grilles shall not be used on University projects without prior approval from the University Project Manager.

Screen and storm doors are not permitted on University projects.

08410 ALUMINUM ENTRANCES AND STOREFRONTS

The Contractor shall provide aluminum entrance and storefront assemblies that comply with structural performance, air infiltration, water penetration, and thermal transmittance as follows:

Structural Performance—In accordance with tests that comply with ASTM E 330, assemblies shall be capable of withstanding wind pressures of 20 psf inward and 20 psf outward acting perpendicular to the plane of the wall. Deflection shall not exceed 1/175 (0.57%) of the clear span.

Air Infiltration—The air infiltration rate shall not be more than 0.06 cfm per square foot of fixed area in accordance with ASTM E 283 at an inward test pressure differential of 1.57 psf.

Water Penetration—There shall be no uncontrolled water penetration as defined in the test method in accordance with ASTM E 331 at an inward test pressure differential of 6.24 psf.

Condensation Resistance—Where framing systems are “thermal-break” construction, a condensation resistance factor (CRF) of not less that 45 in tests in accordance with American Architectural Manufacturers Association (AAMA) 1503 shall be required.

Thermal Transmittance—Framing systems shall have an overall U-value of not more than 0.65 Btu/hr/ft$^2$/°F at 15-mph exterior wind velocity in accordance with AAMA 1503.

In addition to the above, storefront assemblies shall be constructed of extruded aluminum framing assemblies in accordance with ASTM B 221; may utilize standard aluminum...
anodized finishes; and shall incorporate thermal-breaks, flashing, and isolation of aluminum from differing materials

All entrances and storefront systems must be reviewed and approved by the University Project Manager.

08460 AUTOMATIC ENTRANCE DOORS

Main entrances along accessible routes shall be equipped with automatic doors accessible to the disabled, in accordance with ADA requirements.

Automatic entrance door assemblies shall be provided that comply with the following performance requirements:

Wind Load—Automatic entrance door assemblies shall be capable of withstanding wind pressure of 20 psf inward and 20 psf outward.

Transmission Characteristics—Jamb and head frames shall limit air leakage to a rate not to exceed 1.25 cfm per square foot of door area at an inward pressure differential of 1.57 psf in accordance with ASTM E 283.

Operators—Operators shall open and close doors and shall maintain them in fully closed position when subjected to a 20 mph wind velocity.

As some University students are severely disabled, the University standard is an automatic door system that requires the least physical dexterity to operate. Pushbutton control sensor-activation or mat-activation are the only recommended mechanisms.

The Design Consultant and University Project Manager shall meet prior to finalizing specifications for the various door openings requiring automatic doors.

08520 ALUMINUM WINDOWS

Aluminum windows shall be provided that comply with structural performance, air infiltration, and water penetration requirements indicated in AAMA 101 as follows:

Structural Performance—Windows shall sustain no failure or permanent deflection in excess of 0.4% of any member’s span after removal of the imposed load, for a positive (inward) and negative (outward) test pressure of 30 psf.

Air Infiltration—An air infiltration rate of not more than 0.37 cfm per square foot of operable sash joint for an inward pressure of 6.24 psf is required.

Water Penetration—There shall be no uncontrolled water penetration as defined in the test method in accordance with ASTM E 331 at an inward pressure of 15% of the design pressure.

Condensation Resistance—Window units employing thermal-break construction shall comply with thermal performance in accordance with AAMA 1503.1 showing a CRF of 45.
Thermal Transmittance—A maximum U-value of 0.69 Btu/hr/ft²/ºF at 15-mph exterior wind velocity in accordance with AAMA 1503.1 is required.

Aluminum windows may be of the sliding, projected, or hopper types. Casement windows with crank operators can be used in specific existing buildings only when approved by the University Project Manager. All window selection colors and finishes must also receive prior approval.

All windows must be operable to provide ventilation and ease of cleaning. Controls and operating mechanisms shall be operable with one hand. The force required to activate controls shall be no greater than 5 lbf (22.2 N) and controls shall not be positioned higher than 48 in. above the floor.

All windows shall be manufactured, arranged, and installed so that complete maintenance, including glazing, washing, and screening can be accomplished from the room side. Windows with fixed lights shall be designed to allow the fixed portion to be operable only for cleaning and maintenance. Insect screens for windows are required for most installations; plastic cloth may be used.

Aluminum window frames and sashes shall be anodized.

All exterior windows shall be adequately weather-stripped in accordance with manufacturer’s standards for thermal loss control. Copper and stainless steel are acceptable materials.

The use of steel frames and sashes is not permitted in University projects.

08610 WOOD WINDOWS

Wood windows shall be used in specific historic buildings. All wood types except casement windows may be used. When matching new windows to original existing windows, custom-made units are required. The University Project Manager must approve all window selections.

Manufactured wood windows (grade 60) shall comply with the following performance requirements:

Air Infiltration—An air infiltration rate of not more than 0.25 cfm per square foot of overall frame area at an inward test pressure of 1.57 psf is required.

Water Penetration—There shall be no uncontrolled water penetration as defined in the test method in accordance with ASTM E 331 at an inward test pressure of 4.43 psf.

Structural Performance—There shall be no glass breakage, damage to hardware, or permanent deformation that would impair operation of the unit, or residual deflection greater than 0.4% of the span at a positive (inward) and negative (outward) test pressure of 40 psf.

Pass and observation windows must be in accordance with ADA requirements.

All windows shall be arranged and installed so that complete maintenance, including glazing, washing, and screening, can be accomplished from the room side.
Insect screens for windows are required for most installations; plastic cloth may be used. All exterior windows shall be adequately weather stripped in accordance with the manufacturer’s standards for thermal loss control. Copper and stainless steel are acceptable materials.

**08700 HARDWARE**

This section addresses hardware requirements for doors and windows used in University projects.

**Closers**

All door closers shall be of the heavy-duty type. The use of concealed overhead closers must be approved by the University Project Manager case by case. The use of floor closers is discouraged.

Overhead closers shall be mounted so that they are not exposed to the weather and so that they do not strike walls or other surfaces when doors are opened to full swing. (A minimum full swing is 90°.) Closers shall be mounted to doors with through-bolts.

Closers and/or magnetic hold-open devices shall be integral—one complementary to the other. Closers shall have cast iron bodies and have at least a 10-year warranty. Aluminum closer bodies are not acceptable. Closers shall be provided on all exterior doors.

The maximum force for pushing or pulling open a door shall be 8.5 lbf (37.8 N). If this is not possible, automatic or power-assisted doors shall be utilized. Sensor-operated doors are recommended for entrance doors on handicap-accessible routes.

The following closers have been selected for installation in University projects without substitution.

**LCN Door Closers (Surface):**

- 4040 Series Super Smoothee Closers; mounting - parallel arm (push side)
- 4041 Designed for reduced opening force (handicap)
- 4240 EDA (extra duty arm)
- 4040 DEL (delayed action; handicap) Closers shall be LCN, type 4040 or 4041 series allowing 180° of swing when conditions permit.

**Rixson Door Closer (Surface):**

- 2002-6 series; mounting - parallel arm (push side)
- 180° of swing where conditions permit

**Rixson Floor Closers:**

- Heavy duty exterior and interior floor closers shall be used where conditions permit.
- Rixson or LCN exterior and interior overhead concealed closers shall be used for narrow stile aluminum doors and frames.
- Rixson or LCN pivots and pivot sets shall be used when necessary.
Stops
Overhead stops shall be used on exterior doors. The overhead stop shall be coordinated to stop the door simultaneously with the door closer check mechanism, when provided. Hold-open or select-hold-open features on overhead stops of exterior doors are generally not permitted. Standards for handicap accessibility shall apply to the closing time and opening resistance of all door closers.

For interior doors, integral stop holders, and select-hold-open features may be used, except at fire doors. Floor stops shall not be used where they could pose a tripping hazard. Knob bumpers mounted on drywall construction shall be backed up by intermediate steel plates and channel reinforcement.

Pulls
Pulls on exterior doors shall be through-bolted and shall not create a lever action at the point of attachment to the doors. Mountings shall be made with a minimum two-point connection to the door. Push plates shall also be provided where major space division, corridor, stair, and exterior doors are provided.

Push plates, pull plates, doorstops, kickplates, flush bolts, and dust proof strikes shall be similar to Rockwood or Ives heavy duty.

Hinges
Butt-mounted hinges shall be used. The use of pivot hinges is unacceptable. All doors shall have a minimum of one and a half pairs of hinges. Doors wider than 3 ft or have closers shall have ball-bearing hinges.

Keying
The University utilizes a keying system manufactured by the Best Lock Corporation: the Great-Great-Great-Grand Master seven-pin keying system. Because competitive hardware is not necessarily standard, all cylinders and cores must be manufactured by Best. The core must be seven-pin and removable. The procurement, keying, and installation of cylinders and cores will be accomplished by Facilities Management Services’ lockshop personnel.

Lock Cylinders
All cylinders shall be seven-pin removable cone type as manufactured by Best, keyed and master-keyed according to schedules that will be prepared by the University locksmiths.

The Contractor shall use construction cones furnished by the University locksmiths.

Contractors desiring security during the construction may install contractor-supplied temporary cylinders and cores at no cost to the University. Upon official occupancy, these cylinders and cores will be removed and replaced with Best seven-pin cylinders and cores by the University lockshop.
The University is presently evaluating identification proximity card access systems. The Design Consultant shall consider using card access systems and shall confirm the appropriateness of their use through the University Project Manager.

**Locksets**

All locksets shall be extra heavy duty, manufactured by Sargent or Best. All locksets shall comply with applicable codes for their function.

All interior locksets shall be lever handles with removable core mortise locks. This lockset may have either a US10 or US226 B finish in the Sargent 8200 or Best 35H Series or equal.

All panic devices shall be heavy duty, push-bar type capable of accepting a seven-pin Best cylinder and core, through-bolted with six bolts where possible.

Push-button combination locks can be authorized where conditions warrant. These locks shall have an override key cylinder keyed to the University’s key system.

All lockset functions shall be identified using standard lockset function names.

The following locksets have been selected for installation in University projects without substitution.

**Best Mortise Locks:**
- 35H - Services
- 35H7EW - Storeroom
- 35H7A - Entrance lock, office, classroom (deadbolt)
- 35H7FW - Dormitory
- 35H/35H7L - Bathroom lock
- Trim: Lever - 12; Rose - H
- Trim: Lever - 12; Esutcheon - G

**Best Mortise Lock (Handicap):**
- Same as above.
- Trim: Dallas; Lever - 7; Eseutcheon - G

**Best Auxiliary Lock:**
- 38H Series - Mortise deadlocks
- 38H7K - Public bathrooms, closets
- Finishes: 612, 626

**Sargent Mortise Locks (Handicap) (to be used everywhere):**
- 8204 - Storeroom
- 8205 - Office
- 8243 - Entrance lock, office, classroom (deadbolt)
- 8225 - Dormitory
- 8265 - Bathroom
• Trim: LNW Design: Rose - 695LN ; Lever - 1445B
• Trim: LNW Design: Escutcheon - LT wrought; Lever - (Any lever can be used.)

Sargent Auxiliary Locks:
• 4870 - Line mortise deadlocks
• 4875 - Deadlock, public bathrooms, closets
• Finishes: US10, US26D

Sargent Exit Devices (Touch-bar type):
• 8900 Series (Rim)
• 8800 Series (Mortise)
• 8500 Series (Mortise)
• 8300 Series (Mortise)
• 8300 Series (Rim)
• Function - 04 or 63
• Trim: ET Lever handle control
• Finishes: US10, US26D
• Additional Requirements:
  – No vertical rod type exit devices are permitted.
  – No door coordinators are permitted.
  – Removable mullions (Open-back strikes are preferred.)
  – Flush bolts are preferred.

Von Duprin Exit Devices: (99 Series) with trim 992 LV

**Thresholds**

Metal thresholds shall be solidly anchored to floors. Under certain conditions, treated wood thresholds may be used when wood floors terminate at exterior doors.

Overlapping weather-stripping metal must be specified for exterior thresholds and sills. Where sound transmission is a major consideration, drop-type threshold devices shall be used. Thresholds must provide accessibility for disabled persons.

**Window Hardware**

Operating hardware must provide security and be accessible to disabled persons (ANSI A117.1, paragraph 4.12). The use of a pole to raise and lower windows is not acceptable. All window hardware finishes shall be consistent with that of the door hardware.
Cabinet Hardware

All cabinets shall be equipped with sturdy concealed hinges, magnetic catches, silencers, and accessible pulls. In areas housing laboratory equipment, locks shall be installed for doors and drawers where required. All drawers shall have mechanical guides.

08800 GLAZING

Thermal energy efficiency is a primary consideration in the selection of glazing. Tinted glass, when required, must be approved by the University Project Manager.

Exterior glazed areas are subject to maximum limitations for energy conservation. The use of glass in exterior walls of buildings shall not exceed 17.5% of the exposed gross outside wall area. Should the characteristics or circumstances of a particular project indicate the need to exceed this percentage, a waiver must be requested through the University Project Manager. Regardless of the percentage of glass, the Design Consultant must maintain thermal efficiency in the building as though the percentage of glass was 17.5% or less.

For all building exteriors, the use of double-glazing with a vacuum seal and “solar” glass of a uniform color is required. Consideration shall also be given to the use of sunshade materials and any other devices that will prevent excessive solar gain.

In historic buildings, double-glazing may be acceptable if the system proposed will not alter the exterior appearance of the building. Approval must be obtained from the University Project Manager.

All glazing shall be manufactured in accordance with the requirements of the Flat Glass Marketing Association (FGMA) Publication, “FMS Glazing Manual.” Additional requirements include:

- Safety Glass ANSI 297.1 and ASTM 61048
- Fire Resistive Glazing ASTM E 163 and UL listed
- Insulating Glass Insulating Glass Certification Council (IGCC)

Where tempered glass is used, it shall meet the requirements of ANSI 297.1. Glazing stops that cover mill marks in the glass shall be provided.

Glazing for interior partitions shall have a minimum thickness of 0.25 in. Where entire partitions of glass are provided, the partitions must be designed to resist the normal activity of the users. Cross rails are required to protect individuals from walking through glass.

The UL listing label displayed on wire glass shall be left intact by the Contractor. The University will remove the labels after acceptance of the work.