DIVISION 08 - DOORS AND WINDOWS
SECTION 08342
STEEL SLIDING HANGAR DOORS

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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 335 (1989) Structural Steel Buildings
Allowable Stress Design and Plastic Design

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-973 (1996) Cold-Formed Steel Design Manual

ASTM INTERNATIONAL (ASTM)

ASTM A 36/A 36M (2003a) Carbon Structural Steel
ASTM A 366/A 366M (1997e1) Commercial Steel, Sheet, Carbon,(0.15 Maximum Percent Cold-Rolled**
ASTM A 569/A 569M (1998) Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip, Commercial
ASTM A 653/A 653M (2003) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process
ASTM C 920 (2002) Elastomeric Joint Sealants
ASTM E 84 (2003) Surface Burning Characteristics of Building Materials NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
NEMA ICS 1 (2000) Industrial Control and Systems: General Requirements NEMA ICS 2 (2000) Industrial Controls and Systems: Controllers, Contactors, and Overload Relays Rated Not More than 2000 Volts AC or 750 Volts DC
NEMA ICS 6 (1993; R 2001) Industrial Control and Systems: Enclosures NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
NFPA 70 (2002) National Electrical Code THE SOCIETY FOR PROTECTIVE COATINGS (SSPC) SSPC Paint 25 (1997; R 2000) Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II SSPC SP 6 (2000) Commercial Blast Cleaning
UNDERWRITERS LABORATORIES (UL) UL 506 (2000; Rev thru Feb 2004) Specialty

Transformers

1.2 DESIGN REQUIREMENTS

1.2.1 Door Design

The hangar doors shall be designed by the manufacturer in accordance with the criteria specified. Doors shall operate without binding, interference, or damage to weather-stripping. Doors shall fit closely and be free from warping.

1.2.2 Steel Design

AISC 335, AISI SG-973.

1.2.3 Loading

Design doors as a system to withstand an external wind load of 80 mph or the design wind load indicated for the building, whichever is greater, and an internal wind load of not less than one-half of the external wind load. In both cases, the deflection shall not exceed the height of the door divided by 120. The deflection due to design wind load shall not exceed length divided by 120 for any door member. Fiber stresses due to combined dead load and wind load shall not exceed the recommended design stresses for the material used and type of loading sustained.

1.2.3.1 Deflection

Design doors as a system to withstand the upward and downward deflections of the cantilevered structure supporting and bracing the top of the hangar door system.

a. Positive deflection (wind uplift) - 254 mm 10 inches
b. Negative deflection (live load) - 254 mm 10 inches

1.2.4 Connections

Design connections at top and bottom guide rails to withstand an external and an internal wind load of not less than 1.54 kPa 33 psf, or the design wind load for the building, whichever is greater, and a seismic load equal to 0.5 times the weight of the door.

1.3 SUBMITTALS

Submit eight (8) complete sets of submittals. Including, but not limited to the design, engineering, samples of weather-strip material, complete schematic wiring diagram and a complete physical location drawing. Submit drawings showing details of construction, installation, and operation; size, shapes, and thickness of materials; joints and connections; reinforcing; hardware; mechanical devices; electrical devices; and note data for work of other trades affected by hangar doors.

1.4 QUALITY ASSURANCE

1.4.1 Manufacturer's Qualifications

The hangar door manufacturer shall be one who is regularly engaged in the production of steel sliding hangar doors of type and size required for this project for a minimum of twenty-five (25) years.

1.4.2 Installer's Qualifications

The installation supervisor shall be an authorized representative of the door manufacturer. Mechanics shall be skilled and experienced in the erection of hangar doors of type and size required for this project.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials which are not shop installed on the doors in original rolls, packages, containers, boxes, or crates bearing the manufacturer's name, brand, and model number. Store materials and equipment in dry locations with adequate ventilation. Handle doors carefully to prevent damage. Remove damaged items that cannot be restored to like-new condition and provide new items.

PART 2 PRODUCTS

2.1 HANGAR DOORS

2.1.1 Structural Steel

Top Guide Rails: Installation of lateral supports shall not exceeding 10’ foot centers. The elevation of the lateral supports must maintain a tolerance of 1/2” of tolerance throughout the entire header system.

Bottom Rails: Standard A.S.C.E. rail weighing not less than 30 pounds per yard for door systems up to 39’ in height. Doors exceeding 40’ feet in height shall have Standard A.S.C.E. rail weighing not less than 40 pounds per yard. (Doors exceeding 50’ feet in height shall have Standard A.S.C.E. rail weighing not less than 60 pounds per yard.) Embed rails should be installed level, straight and true, maximum tolerances are 1/8” in 20’. Do not install the top guide track until the embed rails are installed.

2.1.2 Formed Steel

AISI SG-973.

2.1.3 Sheet Steel

ASTM A 569/A 569M hot-rolled steel sheet, commercial quality, or ASTM A 366/A 366M cold-rolled steel sheet, commercial quality.

2.1.4 Galvanized Steel

ASTM A 653/A 653M, coating designation G 90 galvanized steel sheet, commercial quality.

2.1.5 Exterior Covering

By others or upon request.

2.1.6 Interior Covering

By others or upon request.

2.1.7 Insulation

By others or upon request.

Standard R19 Blanket Insulation.

2.1.8 Hardware

Provide hangar door hardware to accommodate actual dead loads plus wind loads specified. Provide top guide rollers, bottom wheels, interleaf bumpers, tractor pulls, track cleaners, and top bumpers as required for a complete and operational installation.

2.1.8.1 Wheel Assemblies

Bottom wheels shall be of steel plate, having a minimum tread diameter of 15” or as required for the actual wheel loading. Where the height-to-width ratio of the door leaf exceeds three, wheel assemblies shall be vertically adjustable. Construct wheel assemblies to permit removal of the wheel without removing the door leaf from its position on the rail.

a. Treads: Machine wheel treads concentric with bearing seats. The clear distance between flanges shall not exceed the width of the rail by more than 1/8 inch at the tread nor more than 1/4 inch at the edge of the flange. Machine internal bearing seats accurately for a press fit. Heat treat wheels 18 inches or greater in diameter to obtain a rim hardness of 320 Brinnel.

b. Wheel bearings: Provide tapered roller or spherical bearings, either internal or cartridge type, arranged so that both horizontal and vertical loads shall be transferred to the rail only through the bearing. Bearings shall be tightly sealed and equipped with high-pressure grease fittings.

2.1.8.2 Vertical Floating Head Top Guide Rollers

Provide top-roller assemblies to:

a. Move up and down within the specified live load positive and negative deflection of the roof in the vicinity of the door opening;
b. Allow easy removal through the top of the guide system; and
c. Include both horizontal and vertical rollers built into a frame which is connected in such a manner as to transmit the specified wind loads from the door to the hangar structure and to prevent disengagement of the door from the top guide.

2.1.9 Personnel Doors
The hangar door manufacturer shall provide structural frames and electrical interlock for personnel doors.

2.1.9.1 Doors and Frames
By others or upon request.

2.1.9.2 Hardware for Personnel Doors
By others or upon request.

2.1.9.3 Electrical Interlock
Provide each personnel door with an electrical interlock switch to prevent motor operation of the leaf or group in which it is located when the personnel door is open. Provide an identified indicator light at each door leaf control station indicating when the personnel door is in the open position.

2.1.10 Weather Stripping
Provide adjustable and readily replaceable material. Provide on vertical edges, sills, and heads to afford a weather-tight installation.

2.1.10.1 Neoprene/EPDM
Use flap-type, two-ply, cloth-inserted neoprene (EPDM) or extruded, double flap, single or dual opposed solid neoprene material on vertical edges and sills. The two-ply material shall have a minimum thickness of 1/8 inch and shall be retained continuously for its full length and secured with rust-resistant fasteners 12 inches o.c. Extruded weather stripping with heavy center section shall be attached at 12 inches o.c., but continuous bar may be omitted. Clearance between metal parts on vertical edges of leaves and between leaves and jambs which are to be weather-stripped shall be as indicated.

2.1.10.2 Hanging Head Flashing
By others or upon request, as applicable.

2.1.11 Fasteners
Self Drilling cadmium-plated steel.

2.1.12 Primer
Gray iron oxide, zinc oxide type, SSPC Paint 25.

2.1.13 Starters
Provide magnetic reversing starters in NEMA ICS 1, Type 12 enclosures equipped with access door-controlled, fused safety disconnect switches. Starters shall be factory wired with overload and under-voltage protection, mechanical and electrical interlocks, auxiliary contacts, relays and timing devices as required, control circuit transformers, and a numbered terminal strip. The control circuit transformer shall reduce the voltage in the control circuits to 115 volts or less, and shall conform to UL 506.

2.1.14 Electrical
Provide conduit, wire, flexible cables, boxes, devices, and accessories.

2.2 FABRICATION

2.2.1 Doors

2.2.1.1 Frames and Framing
Door leaves shall be of welded or bolted construction. Joints shall develop 100 percent of the strength of the framing members. Vertical members shall be continuous throughout the height of the door. When required, prepare splices to facilitate field assembly in accordance with standard practice. Frames and framing members shall be true to dimensions and square in all directions; no leaf shall be bowed, warped, or out of line in the vertical or horizontal plane of the door opening by more than 1/8 inch in 20 feet. Provide diagonal bracing so that the completed leaf assembly will be braced to withstand shipping, assembly, and operational loads. Exposed welds and welds which interfere with the installation of various parts such as cover sheets shall be ground smooth.

2.2.2 Locking Devices
Do not provide locking devices on motor-operated hangar doors.

2.2.3 Tractor Pulls
Provide tractor pulls so that leaves can be towed by a tractor or similar equipment in the event of power failure. The tractor pull shall be designed for drive force to tow door or 5000 pounds whichever is greater. Minimum thickness steel plate shall be 3/8 inch.

2.2.4 Track Cleaners
Provide a device to clear debris from the rail head and wheel flange grooves as the leaf is moved.

2.2.5 Insulation
By others or upon request.

2.2.6 Cable System for Group Doors
The minimum size for the cable which interconnects the leaves shall be 3/8 inch; the cables shall be improved plow steel with lubricated hemp centers or wire rope cores. Sheaves over which the cables operate shall have a diameter of at least 18 cable diameters and either sealed ball-or roller-type bearings or graphite bronze bearings of a sufficient capacity for the operating loads. Grease fittings shall be provided for the sheave bearings unless permanently lubricated bearings are used.

2.3 OPERATION

2.3.1 Hangar Door Types
NOTE: Edit to suit type of door operation required.
Hangar doors shall be bi-parting.

2.3.1.1 Individually Operated Doors
Each door leaf shall have a separate, traction-drive operating unit driving one or more of the bottom wheels. Each leaf shall have a motor-mounted, spring-set, solenoid-released motor brake. Each leaf shall move independently of the other leaves. Provide doors that require operating personnel to walk with the leaf as it moves.

2.3.1.2 Floating Group Doors
NOTE: Consider visual appearance when using the anchored or wraparound cable system. The cables used to move the door leaves are exposed to view.
Each group of three or more leaves shall have a separate, traction-drive operating unit located in each end leaf of the floating group doors, which drives one or more wheels of the end leaf, and a wraparound cable system on the intermediate leaves coupled to each

end leaf; or an interleaf pickup system. Movement of either end leaf shall allow stacking and un-stacking of the other end and shall also allow intermediate leaves to move in concert. The group of leaves traveling abreast may then be positioned as desired in the opening. Provide necessary cables, fittings, cable sheaves, housings, guards, pickups, brackets, anchors, and miscellaneous hardware.

2.3.1.3 Anchored Group Doors
Each group of leaves shall have a traction-drive operating unit located in the lead leaf of the group and driving one or more wheels of the lead leaf. The leaves in each group shall start to move at the same time and arrive at their fully open or fully closed positions simultaneously. Provide necessary cables, fittings, sheaves, housings, guards, pickups, brackets, anchors, and miscellaneous hardware.

2.3.2 Operating Units

NOTE: Delete "lead" for individually operated doors. Leave in for group doors.

Each operating unit shall move its lead leaf at a speed of approximately 45-50 feet per minute at zero wind load conditions and to be operable up to and including a maximum wind load of 0.4 kilopascals 8 pounds per square foot. The operating units shall consist of either a separate motor and gear reducer or a gear-head motor, high-speed shaft brake, and necessary roller chains and sprockets. The systems shall be provided with overload protection for the drive units and a means for emergency tractor towing operation.

a. Motors shall be single speed, squirrel-cage type of sufficient size to operate the leaves under zero wind load conditions at not more than 75 percent of their rated capacity.
b. Gear reduction units shall allow a reversal of effort through the gears without damage to the units.
c. Operating mechanisms shall be covered on the interior of the leaf by a hinged 1.5 mm thick 16 gage flat steel cover.

2.3.3 Braking Systems
Braking systems shall be designed to ensure stoppage of the leaves under normal, dry rail conditions within the safety edge over-travel limit. The braking systems shall be either a magnetic, spring-set, solenoid-released brake or hydraulic type. Provide a hand release to release the brake when it becomes necessary to move the leaf with an outside force. The hand release shall be an automatic reset type so that the brake will be operable during subsequent electrical operation of the door.

2.3.4 Controls

NOTE: Edit to suit type of door operation required.

Doors shall be controlled by constant pressure push buttons mounted on the door leaves. Removing pressure from the button shall stop the movement of the leaves. The control equipment shall conform to NEMA ICS 1 and NEMA ICS2. Interior push buttons shall be mushroom head type, mounted in heavy-duty, oil-tight enclosures conforming to NEMA ICS 6, Type 13, except that enclosure for reversing starter with disconnect switch shall be Type 1 or Type 12. Exterior push buttons shall be in watertight enclosures conforming to NEMA ICS 6, Type 4, as required.

2.3.4.1 Push Buttons for Individually Operated Doors
The leaves mounted on the outer rails shall have the push buttons mounted on the exterior face; the leaves on the inner rails shall have the buttons mounted on the interior face; and the leaves on the middle rails shall have the buttons mounted on both the exterior and interior faces. The button at each edge of a leaf shall allow the leaf to travel with that edge as the leading edge only. The controls shall not be reversible. Location of each control button shall be as indicated.

2.3.4.2 Push Buttons for Floating Group Doors
Each group shall be controlled by push button stations mounted at each end of each group of leaves. Stations shall contain one button for stacking the leaves, one button for un-

stacking the leaves, and a third button for moving the leaves in a group. The leaves mounted on the outer rail shall have the push buttons mounted on the exterior face. The leaves mounted on the inner rail shall have the push buttons mounted on the interior face. Location of each control station shall be shown on manufacturer's drawings.

2.3.4.3 Push Buttons for Anchored Group Doors
Each group shall be controlled by a two-button push button station marked "OPEN" and "CLOSE" mounted near the inside leading edge of the lead leaf.

2.3.5 Limit Switches

NOTE: Edit to suit type of door operation required.

Provide limit switches to prevent over-travel and bumping. Safety edges shall not be used as limit switches.

2.3.5.1 Plunger-Type Limit Switches/Proximity Sensors
Provide at each end of each group of floating group doors. Limit switches shall be of adjustable length. The device shall activate so that the leaves cannot bump any portion of the building or be damaged when being towed.

2.3.5.2 Lever Arm Type Limit Switches
Provide for anchored group doors to stop the travel of each group in the fully open and fully closed positions. The limit switches shall be:

a. Positive acting, snap action, lever arm type with actuating cams designed with sufficient over-travel to permit the group to come to a complete stop without over-traveling the limit switches.

b. Mounted on the leaves, and the actuating cams mounted either on the top guides or on adjacent door leaves.

2.3.6 Safety Edges

NOTE: Edit to suit type of door operation required.

Provide fail-safe safety edges on the leading edge of the drive leaf of anchored group doors from 1 inch above the floor to the top of the door leaf. For leaves 12 inches thick (including siding) or less, provide a single run of safety edge the full width of door. For leaves over 12 inches thick (including siding,) provide a double run of safety edge spaced to provide the maximum degree of safety in stopping the leaves. For leaves over 12 inches thick (including siding) provide a double run of safety edges on the outer edge of each side of door leaf covering no less than 60% of leaf.

a. Design: Provide safety edges to provide a minimum of 3 ½ inches of over-travel after actuation until solid resistance is met and door motion comes to a complete stop. If door requires more than 3 ½ inches to come to a complete stop, provide additional over-travel built into safety edge the distance required for door motion to come to a complete stop. Use electric safety edges.

b. Specs: Use sensing edges of reinforced polyvinyl chloride cover or other Government-approved material with chemical resistance to diesel and JP-4 fuel, hydraulic fluids, SAE-30 oil and salt water. Use cover that provides hermetic seal for weather and moisture resistant protection of internal foam and contact elements. Internal foam may be polyurethane and/or latex foam per military specification MIL-R-5001, medium density. Use two contact elements separated by perforated foam or other Government approved materials and design to perform the switching function when the sensing edge encounters an obstruction along any portion of its active length.

b. Operation: Actuation of the safety edge on leading edge of a group of leaves shall stop movement of the group. Actuation of a safety edge shall lock out the motor control in the direction of travel until reset, but shall permit the door to be reversed away from the obstruction which tripped the safety edge. Safety edges shall be alive only when doors are moving. Safety edges shall be reset by moving doors away from the obstruction. The lower portion of the safety edges to a height of approximately 5 feet shall be independently removable for convenience in servicing or repair. The remainder of the

edge may be in one piece up to a maximum of 20 feet.
c. Bumper(s): Each door leaf edge provided with a safety edge shall be protected by a spring type bumper(s). Bumper shall be designed to absorb 150 percent of the door drive force when door is pushed in an emergency. For continuous safety edges, bumpers shall extend to the sides. For sectional safety edges, the bumper can interrupt the safety edge for a distance not greater than 12 inches.
d. Keyed bypass: Provide a keyed bypass to the door controls to render the safety edges in a temporary "repair" mode, if necessary. The door drive shall be restored from its "fail safe" mode by activation of the keyed bypass.

2.3.6.1 Electrical Safety Edges
Connect the safety edge in series with the necessary relays and resistors to make the system complete. The service shall be not more than 110 volts and the circuit shall be normally energized so that the malfunction of any of the component parts will make the door inoperative. Wire sensing edges to provide for control reliable 4-wire operation of hangar door so that any power loss to the sensing edges is experienced, then the door becomes inoperable until power is restored and a reset operation is initiated. Install sensing edges to operate through a normally energized relay so that when the sensing edge is compressed the relay contacts open. Install relay contacts to also open if any component in the sensing edge control circuit is broken so as to break continuity. Use 100 volts electrical service to the control circuit. Ensure service to the sensing edge does not exceed a nominal 110 volts.

2.3.7 Warning Device
Provide a clearly audible signal on each group of leaves. The warning device shall:
a. Operate when the push button is actuated for movement of the do or in either direction;
b. Sound 5 seconds before the door moves, and while the door is moving; and
c. Consist of not less than a 6 inch diameter bell or equivalent decibel-rated horn, loud enough to be heard in the hangar and on the apron.

2.3.8 Emergency Operation
Hangar doors shall be constructed and equipped so that they can be operated-manually or by tractors from the hangar floor in case of power failure. Manual operation of hangar doors shall be designed to avoid damage to safety edges.

2.3.8 Electrical Work
NOTE: Edit to suit type of door operation required.
The door manufacturer shall provide the proper electrical equipment and controls built in accordance with the latest NEMA standards. Equipment, control circuits, and safety edge circuits shall conform to NFPA 70. Where located 18 inches or less above the floor, they shall be explosion-proof as defined in NFPA 70, Article 513. Manual or automatic control devices necessary for motor operation of the doors shall be provided, including push button stations, limit switches, combination fused disconnect switches and magnetic reversing starters, control circuit transformers, relays, timing devices, warning devices, and trolley ducts with collectors or trolleys.

2.3.8.1 Trolley Ducts
Provide one or more runs of trolley duct as required for the door system provided. Ducts shall have solid copper conductors in a protective steel [or polyvinyl chloride] housing. Locate ducts as shown on door manufacturer's drawings. Provide adequate clearances in the top guide system for the ducts.
a. Each run shall consist of the required number of sections of straight track, a section of dropout track, feed boxes, end caps, couplings, hangers, and other accessories to make the system complete and workable. Provide expansion tracks in each run where the system crosses a building expansion joint in the roof construction and in the top guides.

b. Furnish one track-supported tandem trolley or self-supporting collector for each [individually motor-operated door] [group of doors], complete with spring-loaded brush contacts. Provide trolley pulling brackets and corrosion-protected chains attached from each side of the pulling bracket to each side of the tandem trolley or support bracket for self-supporting collectors.

2.3.8.2 Electrical Cables
Flexible cables or cable reels shall be provided in accordance with the door manufacturer's approved drawings and wiring diagrams.

2.3.9 Emergency Operation
Hangar doors shall be constructed and equipped so that they can be operated manually or by tractors from the hangar floor in case of power failure.

PART 3 EXECUTION
3.1 PROTECTIVE COATINGS

3.1.1 Cleaning
After fabrication, thoroughly clean metal surfaces.

3.1.2 Shop Painting
After cleaning, coat steel surfaces other than machine-finished parts with priming paint. Keep paint off of finished bearing surfaces. Before assembly, prime surfaces that will be inaccessible after assembly. Handle painted materials with care to avoid scraping or breaking the protective film.

3.2 ERECTION
Assemble doors and accessories in accordance with approved shop drawings. Do not erect doors until the work of other trades in preparing the opening has been completed, the hangar roof is under full dead load, and the top guide and rail systems are within specified tolerances. After completing erection and before starting field painting, clean interior and exterior door surfaces. Clean abraded surfaces, field welds, and field bolts; and coat with priming paint.

PAINTS AND COATINGS.
3.3 FIELD QUALITY CONTROL

3.3.1 Manufacturer's Field Services
Provide an authorized representative of the door manufacturer to supervise erection of doors.

3.3.2 Tests
Immediately after the door installation is complete, the door manufacturer or his representative shall perform a complete operating test in the presence of the Contracting Officer. Correct defects disclosed by the test. Retest the doors and adjust them until the entire installation is fully operational and acceptable to the Contracting Officer.
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