

## **07721 ROOF ASSEMBLY SUPPORTS FOR ROOFTOP EQUIPMENT**

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**SPECIFIER:** All roof-related items above or outside the structural roof deck, including such work as blocking, insulation, membrane, sheet metal, hatches, smoke vents, pipe supports, and rooftop equipment curbs are components of the Roof Assembly.

The entire Roof Assembly carries a special warranty by the roof membrane producer, as specified in the lead section, 07500, and 07501. In this section, 07721, there is also a special warranty by the support producer.

From data on approved rooftop equipment supplied by the Contractor, the wind uplift and toppling forces on each item of rooftop equipment as fastened to its support will be calculated by the A/E..

Following the A/E's calculations, the Contractor provides the detailed design and fabrication of each "loose" equipment support except the steel framed ones specified in 05520..

The A/E's wind resistance calculations for rooftop equipment having integral support is specified here so that the Contractor can relay those requirements to the producers of equipment with attached curbs.

Note that no wood blocking is permitted.

CSI 2004 MasterFormat number: 07 72 10.

Optional keynotes to Drawings follow each major product title, for A/Es using National CAD Standard.

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### **PART 1 GENERAL**

#### **1.1 RELATED REQUIREMENTS**

- A. Coordinate Roof Assembly supports for rooftop equipment work with work before and after so that every item of roof-mounted equipment and associated piping and conduit is supplied with wind-resistant support. See especially:
- |   |        |
|---|--------|
| 1. Steel framed equipment supports  | 05590  |
| 2. The lead section (roof membrane) for the entire Roof Assembly  | 07522  |
| 3. Other Roof Assembly components such as insulation, roofing, steel blocking, sheet metal, hatches and smoke vents | Div 07 |
| 4. Air-cooled condensing units for insulated cold storage rooms   | 15650  |
| 5. Air-cooled condensing units  | 15670  |
| 6. Packaged air conditioning units  | 15770  |
| 7. Exhaust fans   | 15821  |
| 8. Unit ventilators   | 15836  |
| 9. Air handling units   | 15855  |
| 10. Air moving equipment  | 15861  |

#### **1.2 DEFINITIONS, REFERENCES, AND OVERALL STANDARDS** Follow 07500

#### **1.3 QUALITY ASSURANCE**

- A. Single Source:
1. For rooftop equipment fabricated without curbs: Provide rooftop equipment curbs from a single producer, as needed for each item.
  2. For rooftop equipment with integrally fabricated curbs: Each equipment producer of such items of equipment shall follow these specifications in fabricating curbs.
- B. Wind Uplift, Toppling and Fastening Calculations. After the Contractor has submitted the specified list of and data for items of approved rooftop equipment, the A/E will provide wind resistance calculations for each unit of equipment-fastened-to-its-support.
1. In addition to the name and data on the weights and basic dimensions of each item of rooftop equipment (as provided by Contractor), the A/E's calculations, following ASCE

7, will show the calculated uplift and toppling resistance of each item of equipment-fastened-to-its-support, including overturning forces on base flange attachments and overturning forces on restraint brackets, suitable for use in the Contractor's detailed design and fabrication of each support.

- C. Installer's Qualifications. 5 years of successful experience in the installation of roof top equipment supports.
- D. Insurer Certification. Assist Board in preparing rooftop equipment curb acceptance certification as needed for the fire and extended coverage insurance of the Roof Assembly.
- E. Pre-Installation Meeting. At least 6 weeks before installation of Roof Assembly, the Contractor shall conduct a meeting at the worksite with installers of each part of the Roof Assembly, A/E, AHJs, and Board representatives.

#### 1.4 SUBMITTALS

Follow 01330

- A. Special Warranties. Before making any other submittals, and at least 10 weeks before pre-installation meeting, submit and obtain approval of draft of (or form for) each specified Special Warranty.
- B. General Product Data for the A/E's Calculations.
  - 1. List of and Data for Approved Rooftop Equipment. Compile and submit to the A/E a list of approved rooftop equipment together with data stating the weight, dimensions, and elevation-above-grade of each item of rooftop equipment. Data shall be suitable for the A/E's calculating of the static and dynamic load that each support must bear, the uplift and toppling resistance of each item of equipment-fastened-to-its-support, and the base flange attachment and restraint bracket resistances.
  - 2. Include in the list:
    - a. Integral roof curbs that are permitted to be supplied with some rooftop equipment items, with data on each item of equipment so supported..
    - b. Steel framed roof supports, with data on each item of equipment so supported..
  - 3. Include basic data for each item in the list.
    - a. Example, for a roof curb: Inside dimensions, wall thickness and R-value, height from structural roof to top of curb, weight and approximate size of each item of the roof-mounted equipment it supports, the method of tying-down to structure as needed to augment the tie-down value of curb, and the method of fastening both curb-to-deck and equipment-to-curb.
    - b. Example, for a condensate line support: Material of support and pan, height, number of pipes it will support, method of fastening the pipe(s) to support.
  - 4. Fastenings. Detail fastenings and hold-downs at each support and list the type and number of both support-to-deck and equipment-to-support fastenings. List the number of needed bolts and holes, their size and spacing.
  - 5. Certification. Obtain approval of this submittal before ordering any rooftop equipment that has either an integral or loose curb.
- C. Shop Drawings and Specific Product Data. Submit:
  - 1. Drawings and data for items of rooftop equipment with their type of support and the overall wind uplift and toppling resistance of equipment-when-fastened-to-support as designed by the Contractor following calculations made by the A/E following ASCE 7.
    - a. Attach calculations by Contractor's engineer as specified.

- b. Include calculations for equipment with integral roof curbs and steel framed equipment supports.
  - 2. Details showing curb interface between structural deck and roofing. Show crickets and expansion joints and how they will be flashed.
    - a. Show the fasteners in curbs needed to fasten to roof structure, and how steel cants and receivers for flashing are accommodated.
  - 3. Note that curbs that are an integral part of rooftop equipment and that meet the requirements of this section should be supplied with that equipment. Make the dimensions and construction of those integral curbs a part of this submittal for all curbs on the roof. Obtain approval of this submittal before ordering any rooftop equipment that will have an integral curb.
- D. Producers' Installation Instructions. Include detailed provisions for fastening curbs directly to each type of roof deck to resist wind forces.

## 1.5 SPECIAL WARRANTIES

Follow 01786

- A. By Membrane Producer. Provide a 20 year Special Warranty from the roof membrane producer covering correction of defects in the supports for rooftop equipment component of the Roof Assembly.
- B. By Producer(s) of Support for Rooftop Equipment. Provide a 5-year Special Warranty in which the producer(s) of the rooftop equipment supports agree to correct defective supports.
  - 1. See 07500 for full list of requirements that shall be included in this Special Warranty (that will accompany the Roof Assembly Special Warranty).
  - 2. At the time of project closeout, submit this signed Special Warranty to the roof membrane producer, signed by each producer of rooftop equipment support, for transmittal to Contractor, A/E and Board.

## PART 2 PRODUCTS

Follow 01600

### 2.1 ROOF EQUIPMENT CURBS (LOOSE) [07720.rec]

- A. Function and Design. Flashable, 4-sided, structural supports for rooftop-mounted mechanical equipment, bearing on the structural roof deck, with an open top and bottom to permit the passage of pipes, conduit and ducts through an opening in the roof deck, and to which rooftop equipment can be fastened
  - 1. Equipment bases: The term "curbs" includes open or compartmented equipment bases that are reinforced to handle heavier, vibrating loads.
  - 2. Provide loose curbs, as specified in this section, along with each item of equipment that does not have an integral curb.
  - 3. Integral curbs. See article that follows.
- B. Description. All-steel, galvanized, all-welded construction, insulated, each unit custom fabricated to support the weight of equipment and wind uplift and toppling forces.
  - 1. Height of curbs. Fabricate to a total height that will place the bottom of the supported equipment at least 12 in. above the level of the roof membrane and its underlying insulation, including crickets.
  - 2. Cants: Do not fabricate integral cants as part of any loose curb. Steel cants for installation at the roof membrane level will be supplied and installed under 07600.

- 3. Preparation for fastening: Provide fastener holes and reinforcement during fabrication after approval of shop drawings that show fastener sizes, locations and reinforcement adequate to resist design uplift loads and wind-toppling loads, calculated by a structural engineer registered in the State of Florida employed by the Contractor or the Contractor's curb producer.
  - 4. Design at base: Provide flat, non-canted roof flanges 6 in. wide (not 4 in.) that have fastening holes and reinforcement capable of withstanding High Velocity Hurricane Zone (HVHZ) wind pressures acting on each item of equipment and its curb..
  - 5. Height increase for overhanging equipment: Increase freeboard distance of the curb above the roof membrane at least 1 in. for every 4 in. of equipment overhang to permit proper servicing and maintenance of equipment.
  - 6. Curb construction: Double steel walls, reinforced to support equipment weight, 2 in. (nominal) thick, filled with 2 in. of extruded foamed styrene or isocyanurate insulation producing an R-value of at least 10.0 (styrene) or 12.0 (isocyanurate). Make curb walls watertight.
  - 7. Wall thickness: For equipment weighing 1000 lb or more, provide 14 ga steel walls outside and inside, at top of curb, and at roof flange. For equipment weighing less than 1000 lb, thickness of curb skins may be reduced to 16 or 18 ga as long as they are sufficient to support weight of equipment and toppling forces under 146 mph wind pressures from any direction.
    - a. Weld in steel reinforcements within the curb wall cavity as will aid in supporting equipment weight and in withstanding HVHZ wind uplift and toppling pressures.
  - 8. Design at top: Provide 14 ga or heavier galvanized and prime coated steel surface to which roof-mounted equipment can be fastened to withstand HVHZ wind pressures.
    - a. Provide a level bearing surface – not parallel to roof deck slope.
    - b. Use no wood, only steel, for fastening equipment to curb.
  - 9. Galvanized steel; ASTM A653-04a, CS Type B, G60
  - 10. Finish: Rust-inhibiting prime coat + TGIC polyester powder coat.
- C. Product Producer. This specification is based on the properties and performance of one Basis of Design (BOD) product. Provide either the specified BOD product or submit a design approval request for a specific product from a specified TAE producer.
1. BOD product / producer: Heavy Duty Roof Curb, by Nystrom..
  2. Other producers: Babcock-Davis, .Bilco, Nystrom, O'Keeffe's.

## 2.2 CURBS THAT ARE INTEGRAL WITH ROOFTOP EQUIPMENT

- A. The design and supplying of curbs that are fabricated as part of rooftop equipment is not included in the work of this section. Only the procedure for obtaining the A/E's calculating of wind uplift and toppling figures for equipment with integral curbs is specified here.
  1. It is the responsibility of the Contractor to ensure that the fabrication of integral equipment curbs is performed following the requirements of ASCE 7.
- B. Design and Performance. Wood-free, equal to the height requirement specified and the structural performance specified in the loose Rooftop Equipment Curbs article above.
  1. The R-value requirement for the integral curb may be reduced to  $R = 8.0$  if the A/E determines that the R-values specified in the Rooftop equipment curbs article above cannot be attained by the rooftop-mounted equipment producer.
- C. Description. Integral curbs: Curbs and equipment bases that are fabricated as part of the item of equipment, without cants, for fastening to roof structure.

1. Provide integral curbs, as described in this section, as an integral part of items of rooftop equipment in Div 15 that need support and access for pipes and conduit.

## 2.3 STEEL FRAMED EQUIPMENT SUPPORTS

- A. The design and supplying of steel framed equipment supports is not included in the work of this section. Instead, only heights and clearances at the supports and the wind uplift and toppling resistance requirements for the equipment and its support are specified here.
  1. It is the responsibility of the Contractor to ensure that the fabrication of steel framed equipment supports (05590) is performed following the height, clearance, equipment weight, and wind uplift and toppling resistance requirements of this section.
- B. Description. Open-sided structural steel frames of beams and flashable legs that support large units of equipment 18 in. clear (and higher) above the roof membrane and providing ample clearance below for service by related piping, ducts, conduit, and wiring.

## 2.4 ROOF PORTALS

[07720.rp]

- A. Description. Curbs with a lid and clamped elastomeric opening that permit watertight passage of pipes and conduit to equipment on the roof. Flashed sheet metal hoods with seals for emerging pipe and conduit (07620) are preferred by the Board for this use.
  1. Where portals are approved by Board for use in place of flashed sheet metal hoods, they shall be provided by the provider of the equipment that is served by the portals.
- B. Product / Producer: Same as for loose roof curbs.

## 2.5 PIPING SUPPORTS

[07720.ps]

- A. Description. Stainless steel supports, rectangular in plan, set on and fastened to roof structure (not the roof membrane), for one or more pipes or conduit, with no top-to-bottom opening, built much like a curb, the closed top surface of which supports a 2-leg adjustable channel rack (with clamps), securing pipes against wind pressures while permitting some thermal movement.
  1. Provide racks, as described in this section, in the types, sizes and quantity needed to support piping or conduit at least 16 in. above the roof membrane.
- B. Product / Producer: Same as for loose roof curbs.

## 2.6 CONDENSATE SUPPORTS

[07720.cs]

- A. Description. Concrete masonry units (CMU) without voids, atop roof membrane; for clamping up to 3 condensate pipes under 1-1/2 in: Set supports on SBS bases.
  1. Provide condensate supports, as described in this section, in the types, sizes and quantity needed to support pipes at least 2 in. above the roof membrane.
  2. SBS base. Sheet of walkway tread material, projecting at least 8 in. on each side of the CMU. Adhere support to base, and adhere base to the roof membrane using a heavy coat of SBS modified bitumen.
  3. Clamps. Fasten stainless steel clamps to CMU with shielded s/s screws that will secure condensate pipes against wind pressures, yet permit thermal movement.
  4. Condensate pipe supports are the only curbs or supports that are permitted to be set atop the roof membrane instead of being supported by the roof structure.

### 3.1 EXAMINATION AND PREPARATION

- A. Check and prepare structural roof deck surfaces to receive rooftop equipment supports.
  - 1. Concrete condition: Dry, smooth, and free of shrinkage cracks, laitance, bond-breaking substances, loose material, pits, honeycomb, ridges and roughness.
  - 2. Metal condition: Clean and smooth. Coat dissimilar metals with bituminous paint.
- B. Delivery, Storage and Weather. Deliver and store products in sealed protective packaging. Install products dry, in dry weather.
- C. Do not start the installation of this work until conditions detrimental to its proper completion have been corrected.

### 3.2 INSTALLATION OF SUPPORTS FOR ROOFTOP EQUIPMENT.

- A. Install supports following approved shop drawings and producers current published instructions, except as more stringently specified herein.
  - 1. Install supports to even, smooth, sound, thoroughly clean and dry surfaces of the building structure that are free from defects that might affect performance. Fasten to building structure, isolating dissimilar metals with isolation sheets or heavy isolation coatings. Exception: Condensate line supports may be placed over roof membrane.
- B. Curb Flashing, and Counterflashing:
  - 1. Install sheet metal counterflashings after curbs, portals and their SRB cants are in place and after bituminous base flashings are complete.
  - 2. Set counterflashings in place. Solder corners and corner miter laps watertight.
  - 3. Fasten counterflashings to vertical edge of curbs with #10 stainless steel sheet metal screws through sealant washers at not over 12 in. oc
  - 4. Seal joints with sealant as specified in Section 07920. ///