

SECTION 01 73 20
OPENINGS AND PENETRATIONS IN CONSTRUCTION

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Methods of installing and sealing openings and penetrations in construction.
- B. Related specification sections include but are not necessarily limited to:
 - 1. Division 00, Procurement and Contracting Requirements.
 - 2. Division 01, General Requirements.
 - 3. Section 05 50 00, Metal Fabrications.
 - 4. Section 06 82 00, Glass-Fiber-Reinforced Plastic.
 - 5. Section 07 62 00, Sheet Metal Flashing and Trim.
 - 6. Section 07 84 00, Firestopping.
 - 7. Section 07 92 00, Joint Sealants.

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. The following is a list of standards which may be referenced in this section:
 - a. ASTM International (ASTM):
 - 1) A36, Standard Specification for Carbon Structural Steel.
 - 2) A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 3) A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - 4) A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
 - 5) A351, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
 - 6) A554, Standard Specification for Welded Stainless Steel Mechanical Tubing.
 - 7) A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc- Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 8) A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 9) A995, Castings, Austenitic-Ferritic (Duplex) Stainless Steel, for Pressure- Containing Parts.

- b. National Fire Protection Association (NFPA):
 - 1) 70, National Electrical Code (NEC): Article 501, Class 1 Locations.
 - 2) 90A, Standard for Installation of Air Conditioning and Ventilating Systems.
- c. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

1.03 DEFINITIONS

- A. Corrosive Areas:
 - 1. For the purpose of this specification section, the following areas are defined as corrosive:
 - a. None.
- B. Hazardous Areas: Areas shown in the Contract Documents as having Class I or Class II area classifications.
- C. Washdown Areas: Areas having floor drains or hose bibbs.

1.04 SUBMITTALS

- A. Shop Drawings:
 - 1. See Section 01 33 23, Submittal Procedures, for requirements for the mechanics and administration of the submittal process.
 - 2. For each structure provide dimensioned or scaled (minimum 1/8 inch equals 1 foot) plan view drawings containing the following information:
 - a. Vertical and horizontal location of all required openings and penetrations.
 - b. Size of all openings and penetrations.
 - c. Opening type.
 - d. Seal type.
 - 3. Manufacturer's installation instructions for standard manufactured products.

1.05 SITE CONDITIONS

- A. Reference the Project Geotechnical Report for groundwater levels.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pipe Sleeves:

1. Steel, Hot-dipped galvanized after fabrication.
2. Penetrations 24 inches Diameter or Less: ASTM A53, Schedule 40.
3. Penetrations Larger than 24 inches Diameter: ASTM A36, Minimum 1/4-thickness.
4. Provide weep ring where wall thickness permits.
5. Where wall thickness does not permit a weep ring, use SikaSwell product.

B. Backing Rod and Sealant: See Section 07 92 00, Joint Sealants.

C. Modular Mechanical Seals:

1. Acceptable Manufacturer: Link-Seal.
2. Type 316 stainless steel bolts, nuts and washers.

D. Integrally Cast Wall Pipes:

1. Match material of buried piping.
2. Grade equal to connecting piping system.
3. Provide weep ring where wall thickness permits.
4. Where wall thickness does not permit a weep ring, use SikaSwell product.

E. Firestopping Material: See Section 07 84 00, Firestopping.

F. Sheet Metal Sleeves:

1. Galvanized Steel: ASTM A653, ASTM G90.
2. Minimum 12 gauge.

G. Commercial Wall Castings:

1. Ductile iron, ASTM A536.
2. Grade equal to connecting piping system.

PART 3 EXECUTION

3.01 FABRICATION

A. Fabricate pipe sleeves in accordance with Section 05 50 00, Metal Fabrications.

- B. Fabricate sheet metal sleeves in accordance with Section 07 62 00, Sheet Metal Flashing and Trim.
- C. Provide waterstop plate/anchor flange for piping, ducts, castings and sleeves cast-in-place in concrete.
 - 1. For fabricated units, weld plate to sleeve, pipe, or ductwork.
 - 2. For commercial castings, cast water stop/anchor with wall pipe.
 - 3. Plate is to be same thickness as sleeve, pipe, casting or ductwork.
 - 4. For fabricated units, diameter of plate or flange to be 4 inches larger than outside diameter of sleeve, pipe or ductwork.
 - 5. For commercial castings, waterstop/anchor size to be manufacturer standard.
 - 6. Provide continuous around entire circumference of sleeve, pipe, or ductwork.

3.02 INSTALLATION AND APPLICATION

- A. Firestopping materials used in fire-resistance rated construction shall be in full compliance with Section 07 84 00, Firestopping.
- B. Seal openings and penetrations in non-fire-resistance-rated construction in accordance with Section 07 92 00, Joint Sealants.
- C. Obtain prior approval from Contracting Officer (CO) when any opening larger than 100 square inches must be made in existing or newly completed construction.
- D. Perform HVAC penetrations in accordance with NFPA 90A.
- E. Perform electrical penetrations in accordance with NFPA 70, Article 501.
- F. When mechanical or electrical work cannot be installed as structure is being erected, provide and arrange for building-in of boxes, sleeves, insets, fixtures or devices necessary to permit installation later.
 - 1. Lay out chases, holes or other openings which must be provided in masonry, concrete or other work.
- G. Where pipes, conduits or ducts pass through floors in washdown areas, install sleeves with top 3 inches above finish floors.
 - 1. In non-washdown areas, install sleeves with ends flush with finished surfaces.
- H. Size sleeves, blockouts and cutouts which will receive sealant seal such that free area to receive sealant is minimized and seal integrity may be obtained.

- I. For insulated piping and ducts, size sleeves, blockouts and cutouts large enough to accommodate full thickness of insulation.
- J. Where pipes, conduits or ducts pass through grating, provide banding at the entire perimeter of the opening.
 - 1. Metal Grating: See Section 05 50 00, Metal Fabrications.
 - 2. FRP Grating: See Section 06 82 00, Glass-Fiber-Reinforced Plastic.
- K. Where pipes, conduits or ducts are removed where passing through grating:
 - 1. Metal Grating:
 - a. Provide banding at perimeter and cover opening with 1/4-inch plate of the same material of the grating.
 - b. See Section 05 50 00, Metal Fabrications.
 - 2. FRP Grating:
 - a. Provide full depth cover meeting same loading requirement as existing material or replace grating section.
 - b. See Section 06 82 00, Glass-Fiber-Reinforced Plastic.
- L. Do not cut into or core drill any beams, joists, or columns.
- M. Do not install sleeves in beams, joists, or columns.
- N. Do not install recesses in beams, joists, columns, or slabs.
- O. Field Cutting and Coring:
 - 1. Saw or core drill with non-impact type equipment.
 - 2. Mark opening and drill small 3/4-inch or less holes through structure following opening outline.
 - 3. Sawcut opening outline on both surfaces.
 - a. Knock out within sawcuts using impact type equipment.
 - b. Do not chip or spall face of surface to remain intact.
 - c. Do not allow any overcut with saw kerf.
- P. Where alterations are necessary or where new and old work join, restore adjacent surfaces to their condition existing prior to start of work.
- Q. Where area is blocked out to receive sheet metal sleeve at later date:
 - 1. If blockout size is sufficient to allow placement, utilize dowels for interface of initially placed concrete and sleeve encasement concrete which is placed later.
 - a. Size blockout based on sleeve size required plus 4 inches to 6 inches each side of sleeve for concrete encasement.

- b. Provide No. 4 dowels at 12-inch spacing along each side of blockout with minimum of two dowels required per side.
 - 2. If blockout size is not sufficient to allow placement of dowels, provide keyway along all sides of blockout.
 - a. Size blockout based on sleeve size required plus 2 inches to 4 inches each side of sleeve for concrete encasement.
- R. For interior wall applications where backer rod and sealant are specified, provide backer rod and sealant at each side of wall.
- S. Refer to the Drawings for location of fire-rated walls, floors, and ceilings.
 - 1. Utilize firestopping materials and procedures specified in Section 07 84 00, Firestopping, in conjunction with scheduled opening type to produce the required fire rating.
- T. Use full depth expanding foam sealant for seal applications where single or multiple pipes, conduits, etc., pass through a single sleeve.
- U. Do not make duct or conduit penetrations below high water levels when entering or leaving tankage, wet wells, or other water holding structures.
- V. Modular Mechanical Seals:
 - 1. Utilize one seal for concrete thickness less than 8 inches and two seals for concrete, 8 inches thick or greater.
 - 2. Utilize two seals for piping 8-inch diameter and larger if concrete thickness permits.
 - 3. Install seals such that bolt heads are located on the most accessible side of the penetration.
- W. Backer Rod and Sealant:
 - 1. Install in accordance with Section 07 92 00, Joint Sealants.
 - 2. Provide backer rod and sealant for modular mechanical seal applications.
 - a. Apply on top side of slab penetrations and on interior, dry side wall penetrations.

3.03 SCHEDULES

- A. General Schedule of Penetrations through Floors, Roofs, Foundation Base Slabs, Foundation Walls, Foundation Footings, Partitions and Walls for Ductwork, Piping, and Conduit:
 - 1. Provide the following opening and penetration types:
 - a. Type A: Block out 2 inches larger than outside dimensions of duct, pipe, or conduits.

- b. Type B: Saw cut or line-drill opening. Place new concrete with integrally cast sheet metal or pipe sleeve.
 - c. Type C: Fabricated sheet metal sleeve or pipe sleeve cast-in-place. Provide pipe sleeve with water ring for wet and/or washdown areas.
 - d. Type D: Commercial type casting or fabrication.
 - e. Type E: Saw cut or line-drill opening. Place new concrete with integrally cast pipe, duct or conduit spools.
 - f. Type F: Integrally cast pipe, duct or conduit.
 - g. Type G: Saw cut or line-drill and remove area 1 inch larger than outside dimensions of duct, pipe or conduit.
 - h. Type H: Core drill.
 - i. Type I: Block out area. At later date, place new concrete with integrally cast sheet metal or pipe sleeve.
 - j. Type J: Grating Banding for any field cut openings.
2. Provide seals of material and method described as follows:
 - a. Category 1: Modular Mechanical Seal.
 - b. Category 2: Roof curb and flashing according to SMACNA specifications unless otherwise noted on the Drawings. Refer to Section 07 62 00, Sheet Metal Flashing and Trim, and roofing specification sections for additional requirements.
 - c. Category 3: 12 GA sheet metal drip sleeve set in bed of silicon sealant with backing rod and sealant used in sleeve annulus.
 - d. Category 4: Backer rod and sealant.
 - e. Category 5: Full depth compressible sealant with escutcheons on both sides of opening.
 - f. Category 6: Full depth compressible sealant and flanges on both sides of opening. Flanges constructed of same material as duct, fastened to duct and minimum 1/2 inch larger than opening.
 - g. Category 7: Full depth compressible sealant and finish sealant or full depth expanding foam sealant depending on application.
 - h. Category 8: Banding for all grating openings and banding and cover plate of similar materials for abandoned openings.
 3. Furnish openings and sealing materials through new floors, roofs, grating, partitions, and walls in accordance with Supplement Schedule A – Openings and Penetrations Schedule for New Construction.
 4. Furnish openings and sealing materials through existing floors, grating, roofs, partitions, and walls in accordance with Supplement Schedule B – Openings and Penetrations Schedule for Existing Construction.

3.04 SUPPLEMENTS

A. The supplements listed below, following “End of Section,” are a part of this specification:

1. Schedule A – Openings and Penetrations Schedule for New Construction.
2. Schedule B – Openings and Penetrations Schedule for Existing Construction.

END OF SECTION

SCHEDULE A
OPENINGS AND PENETRATIONS SCHEDULE FOR NEW CONSTRUCTION

APPLICATIONS	DUCTS		PIPING		CONDUIT	
	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY
Through floors on grade above water table	C	4	C	7	C	4
	F	Not Req	F	Not Req	F	Not Req
	I	4	I (1)	7	I (1)	7
Through slab on grade below water table	F	Not Req	F	Not Req	F	Not Req
Through floors in washdown areas	C	4	C	4	F	Not Req
	I	4	H (2)	3	H (2)	3
			I (1)	4	I (1)	7
Through exterior wall below grade above water table	C	7	C	1	F	Not Req
	F	Not Req	D	Not Req	I (1)	7
	I	7	F	Not Req 1		
			I (1)			
Through wall from tankage or wet well (above high water level) to dry well or dry area	C	7	C	1	C	7
	F	Not Req	D	Not Req	F	Not Req
	I	7	F	Not Req	H (2)	7
			H (2)	1	I (1)	7
Through wall from tankage or wet well (below high water level) to dry well or dry area	F	Not Req	F	Not Req	F	Not Req
Through exterior wall above grade	A B C	6	A	5	C	5
		6	B	5	H (2)	4
		6	D H (2)	Not Req 5		
Roof penetrations	A	2	A	2	A	2
Through interior walls and slabs not covered by the above applications	A	4	A	4	A C F	4
	C	4	C	4		4
						Not Req
Grating openings and penetrations	J	8	J	8	J	8

SCHEDULE B
OPENINGS AND PENETRATIONS SCHEDULE FOR EXISTING CONSTRUCTION

APPLICATIONS	DUCTS		PIPING		CONDUIT	
	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY	OPENING TYPE	SEAL CATEGORY
Through floors on grade above water table	B	7	B	7	B	7
Through slab on grade below water table	E	Not Req	E	Not Req	E	Not Req
Through floors in washdown areas	G	3	G H (2)	3 3	G H (2)	3 3
Through exterior wall below grade above water table	B	7	B (1) B (3) H (2)	7 1 7	B (1) (3) H (2)	7 7
Through wall from tankage or wet well (above high water level) to dry well or dry area	B E	7 Not Req	B E H (2)	1 Not Req 1	B (1) (3) E H (2)	7 Not Req 7
Through wall from tankage or wet well (below high water level) to dry well or dry area	E	Not Req	E	Not Req	E	Not Req
Through exterior wall above grade	G	6	G (1) (3) H (2)	5 5	G (1) (3) H (2)	5 7
Roof penetrations	G	2	G (1) (3) H (2)	2	G	2
Through interior walls and slabs not covered by the above applications	G	4	G (1) (3) H (2)	4 4	G (1) (3) H (2)	4 4
Grating openings and penetrations	J	8	J	8	J	8

(1) Multiple piping 3 inches and smaller or multiple conduits.

(2) Single pipe 3 inches and smaller or single conduit.

(3) Single pipe or conduit larger than 3 inches.

