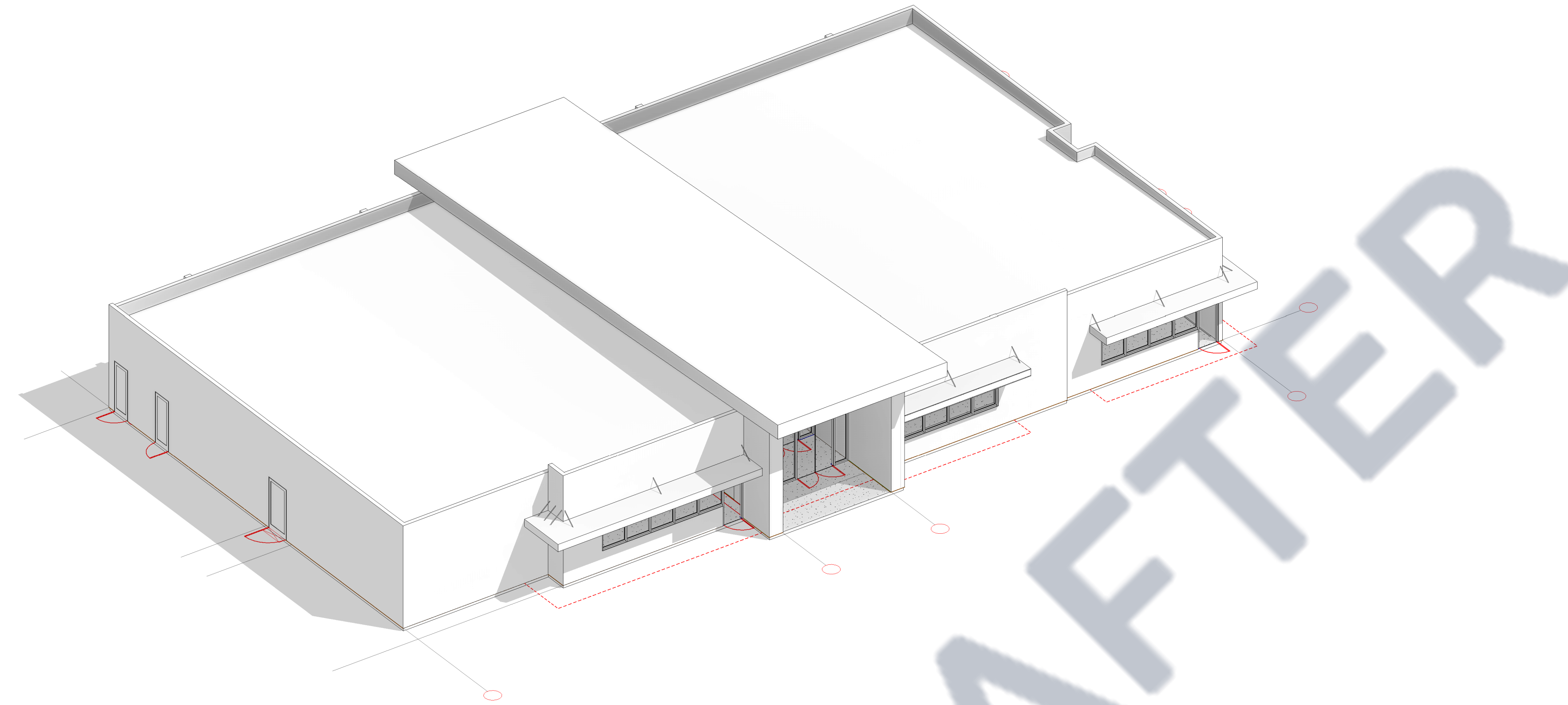


# 23 23 00 - 1.2D REFRIGERANT PIPING SD



## St. Jude's Healing Center Education Building

115 Healing Circle, Boulder City, NV 89005.

Submitted by



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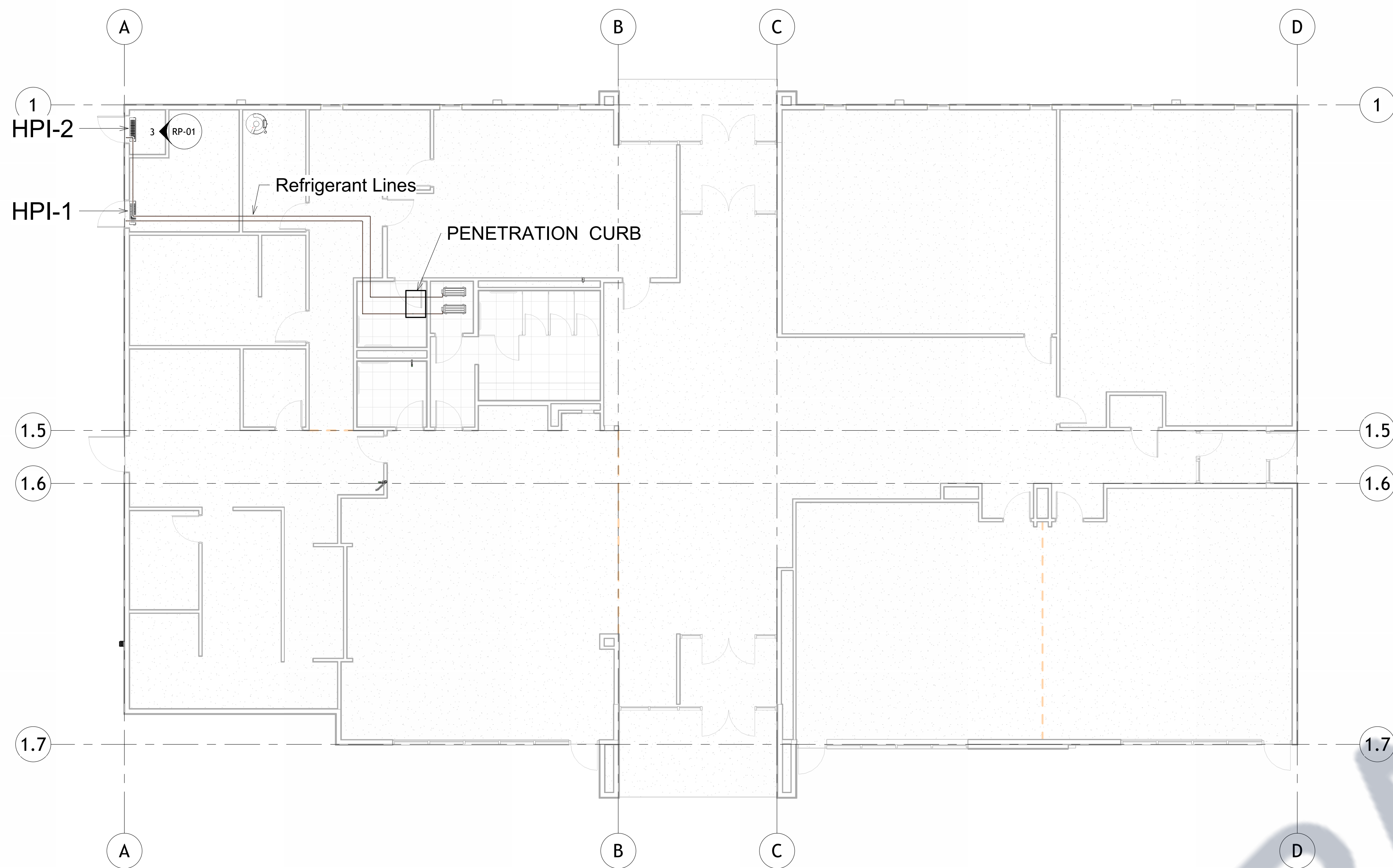
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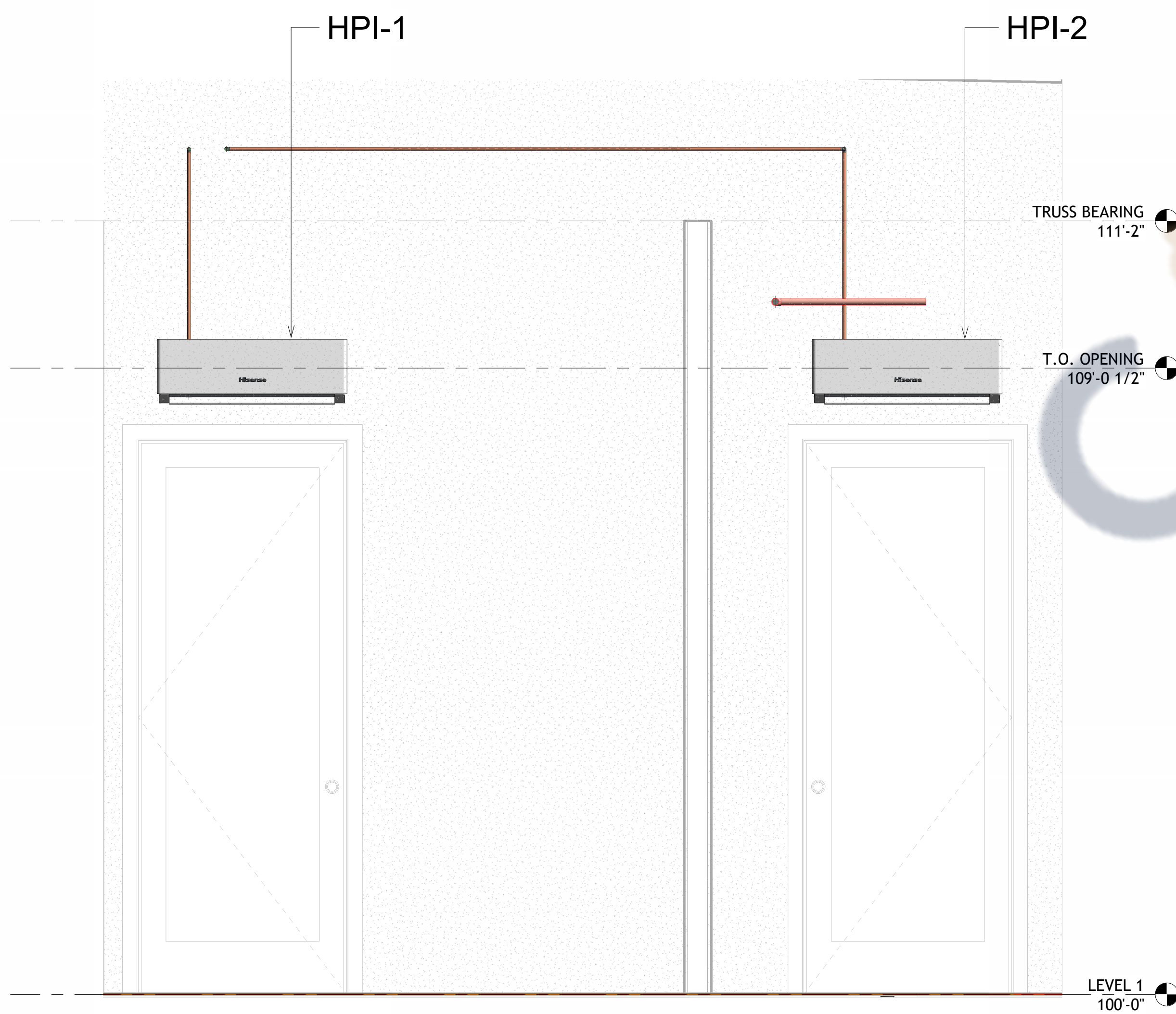
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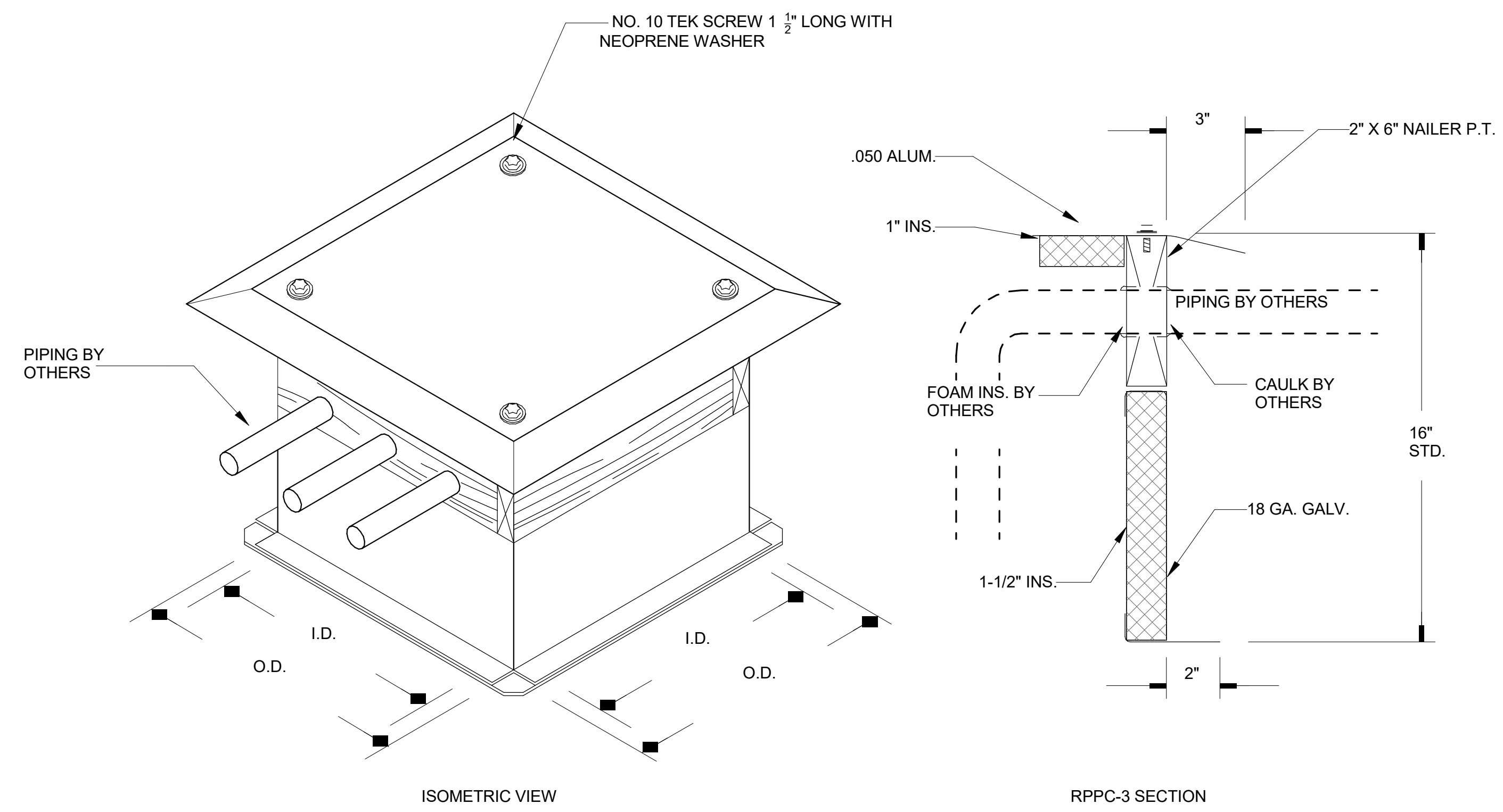
Scale 1/16" = 1'-0"



2 PLUMBING SUPPLY PLAN Refrigeration Pipe  
1/8" = 1'-0"



3 Elevation 4 - a  
3/4" = 1'-0"



1 REFRIGERANT PIPING ROOF PENETRATION CURB DETAIL  
3" = 1'-0"

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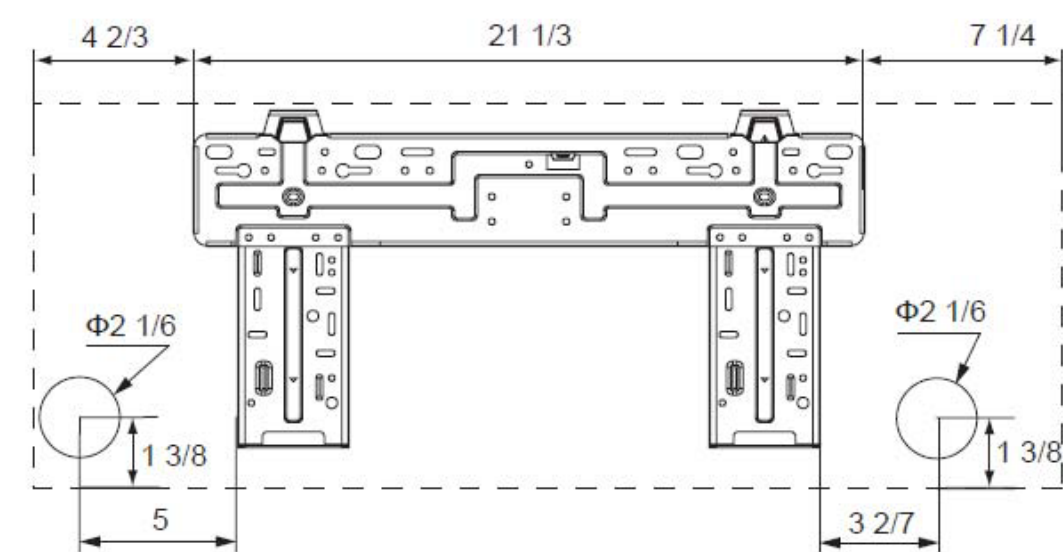
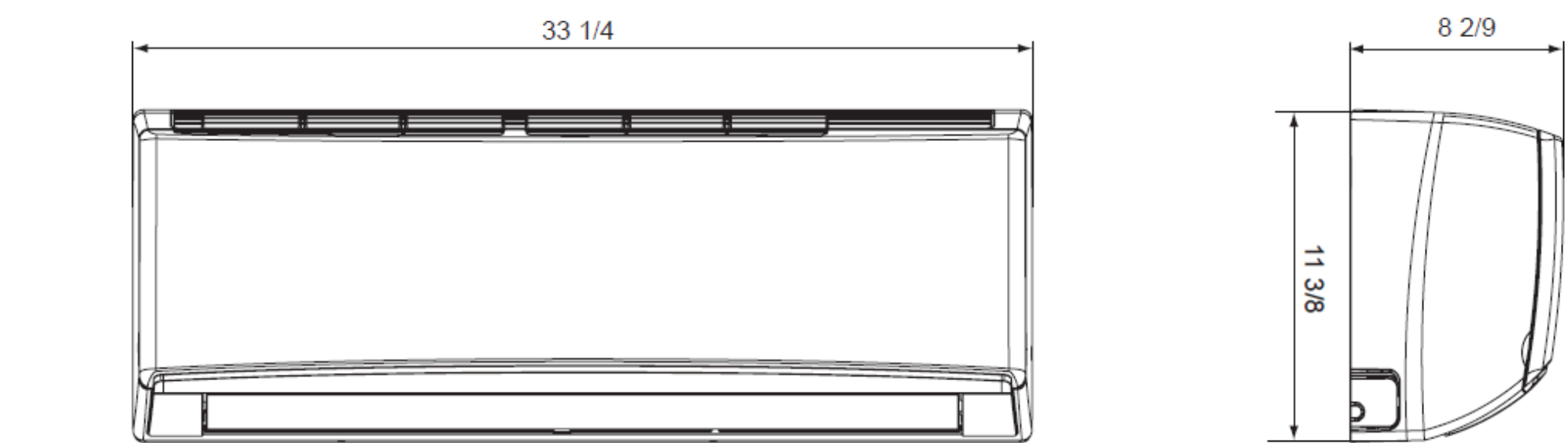
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**RP-01**  
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**DHX09NWB21S/DHX09CSB21S**

**Indoor Unit Dimensions**

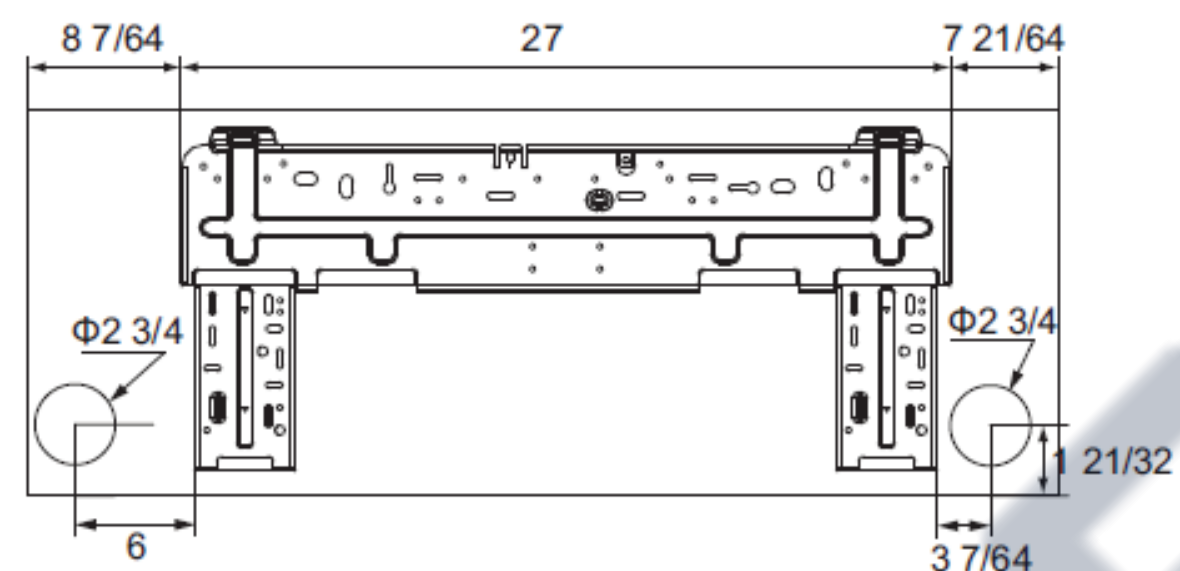
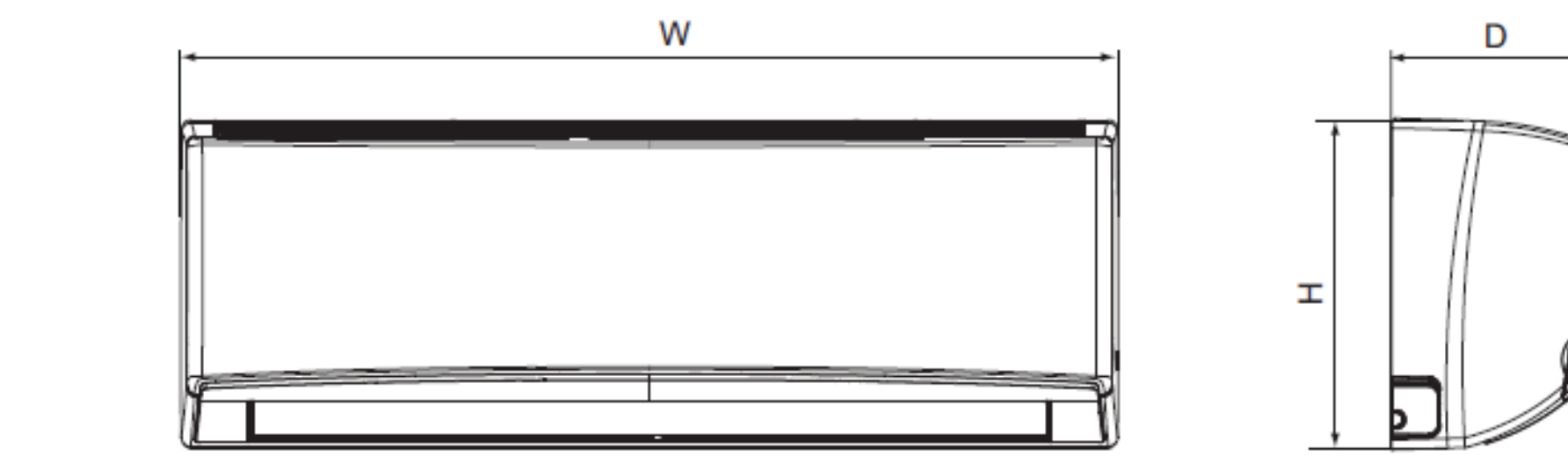


Liquid Line Valve	1/4-in OD Flared
Gas Line Valve	3/8-in OD Flared
Drain Connector	5/8-in OD

① RP - 01  
12" = 1'-0"

**DHX24NWB21S/DHX24CSB21S**

**Indoor Unit Dimensions**

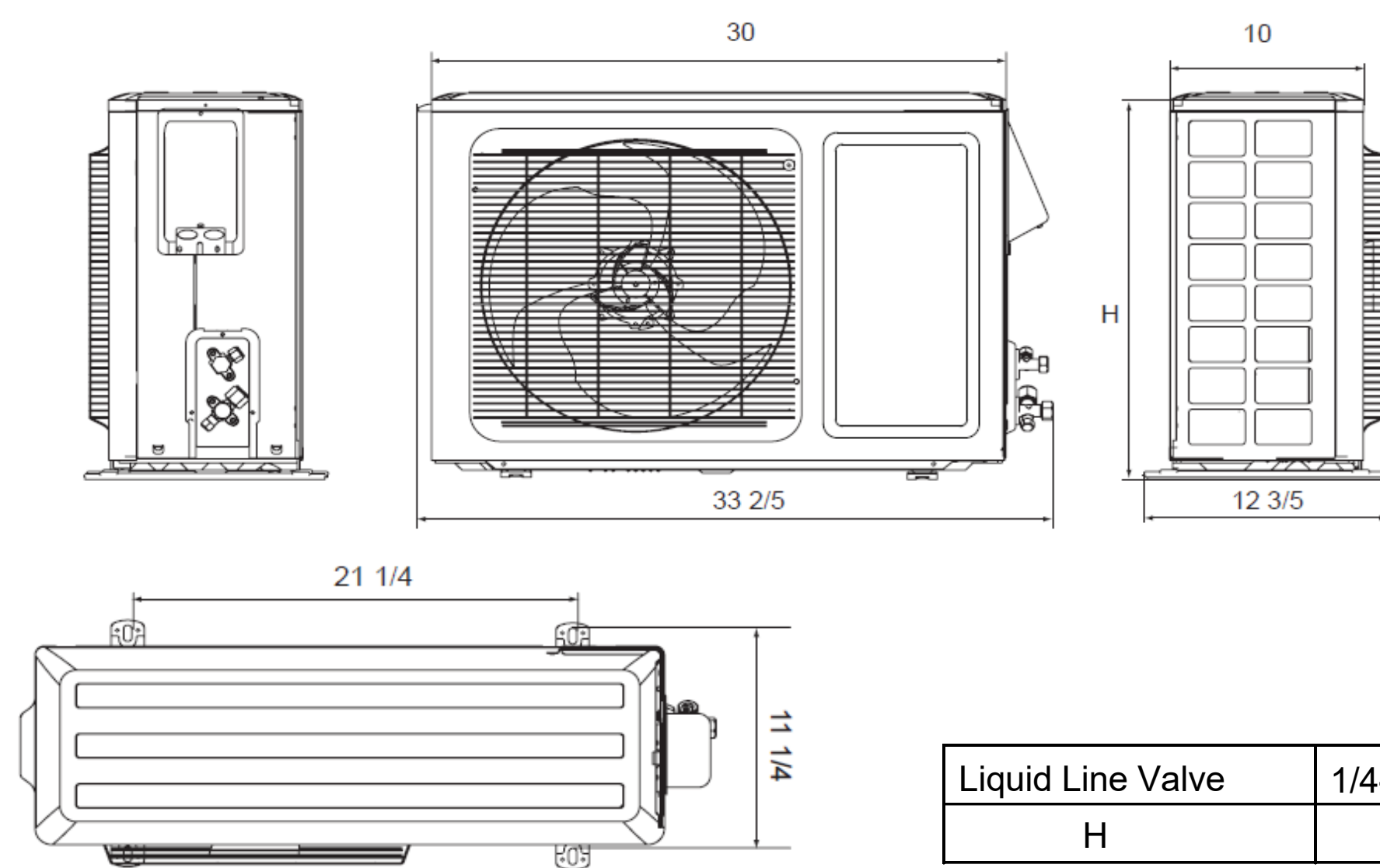


Dimensions	
W	42 7/16
H	12 51/64
D	9 11/16

Liquid Line Valve	1/4-in OD Flared
Gas Line Valve	5/8-in OD Flared
Drain Connector	5/8-in OD

③ RP - 03  
12" = 1'-0"

**Outdoor Unit Dimensions**



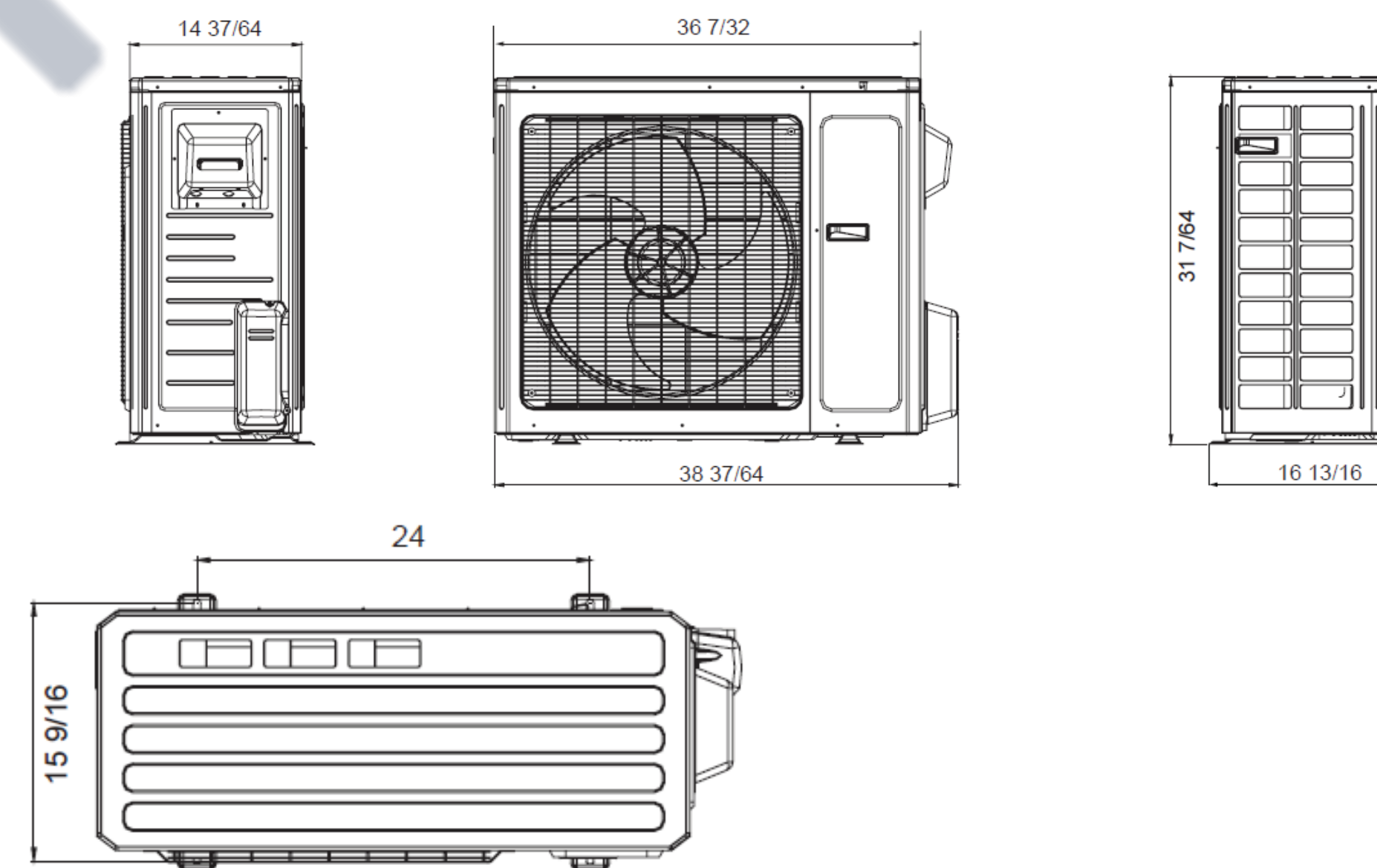
Liquid Line Valve	1/4-in OD Flared
H	21 1/4

**Notes:**

1. Recommended cable type between Outdoor and Indoor Unit, 14-4 AWG Stranded Copper THHN 600V Wire
2. Power wiring cable size must comply with applicable national and local codes
3. Test conditions are based on AHRI 210/240

② RP - 02  
12" = 1'-0"

**Outdoor Unit Dimensions**



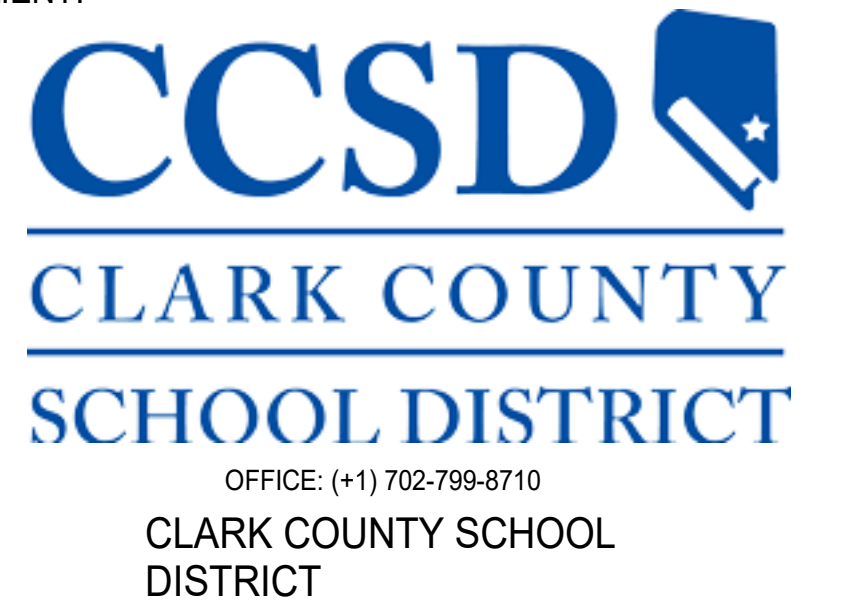
**Notes:**

1. Recommended cable type between Outdoor and Indoor Unit, 14-4 AWG Stranded Copper THHN 600V Wire
2. Power wiring cable size must comply with applicable national and local codes
3. Test conditions are based on AHRI 210/240

④ RP - 04  
12" = 1'-0"

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COVER SHEET Copy 2**

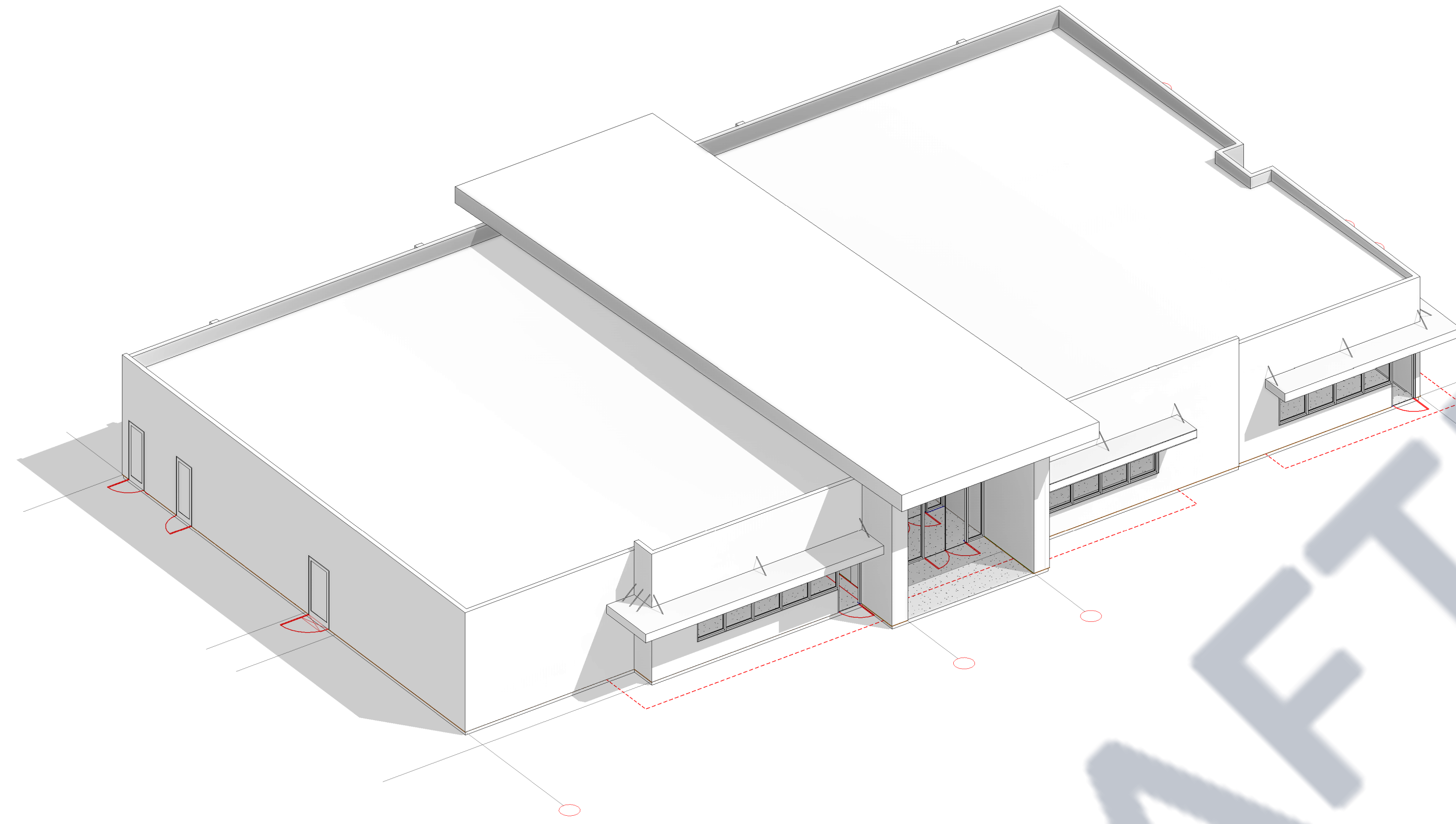
Project Number	2020157
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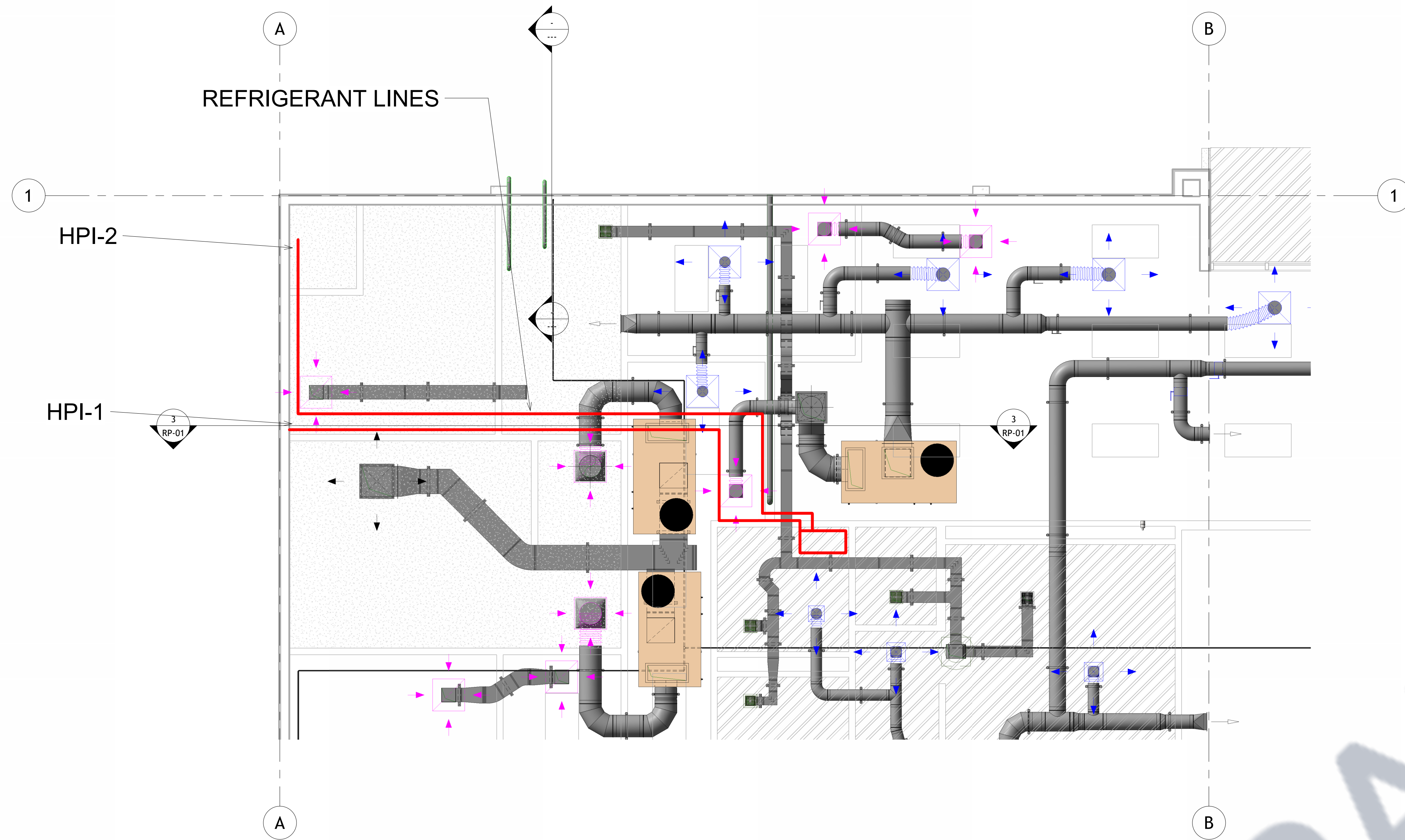
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REFRIGERANT PIPING  
COVER SHEET**

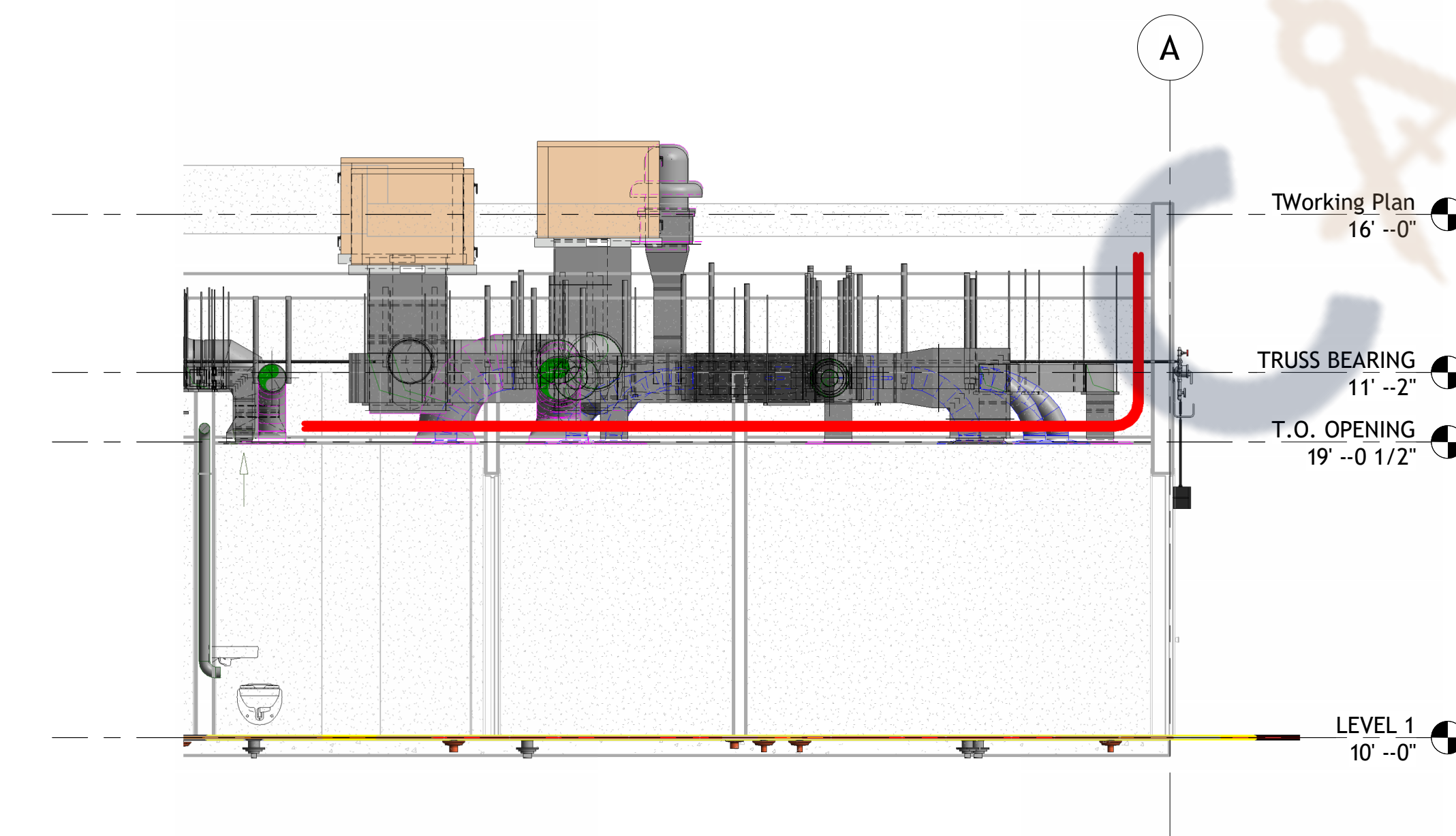
Project Number 2020157  
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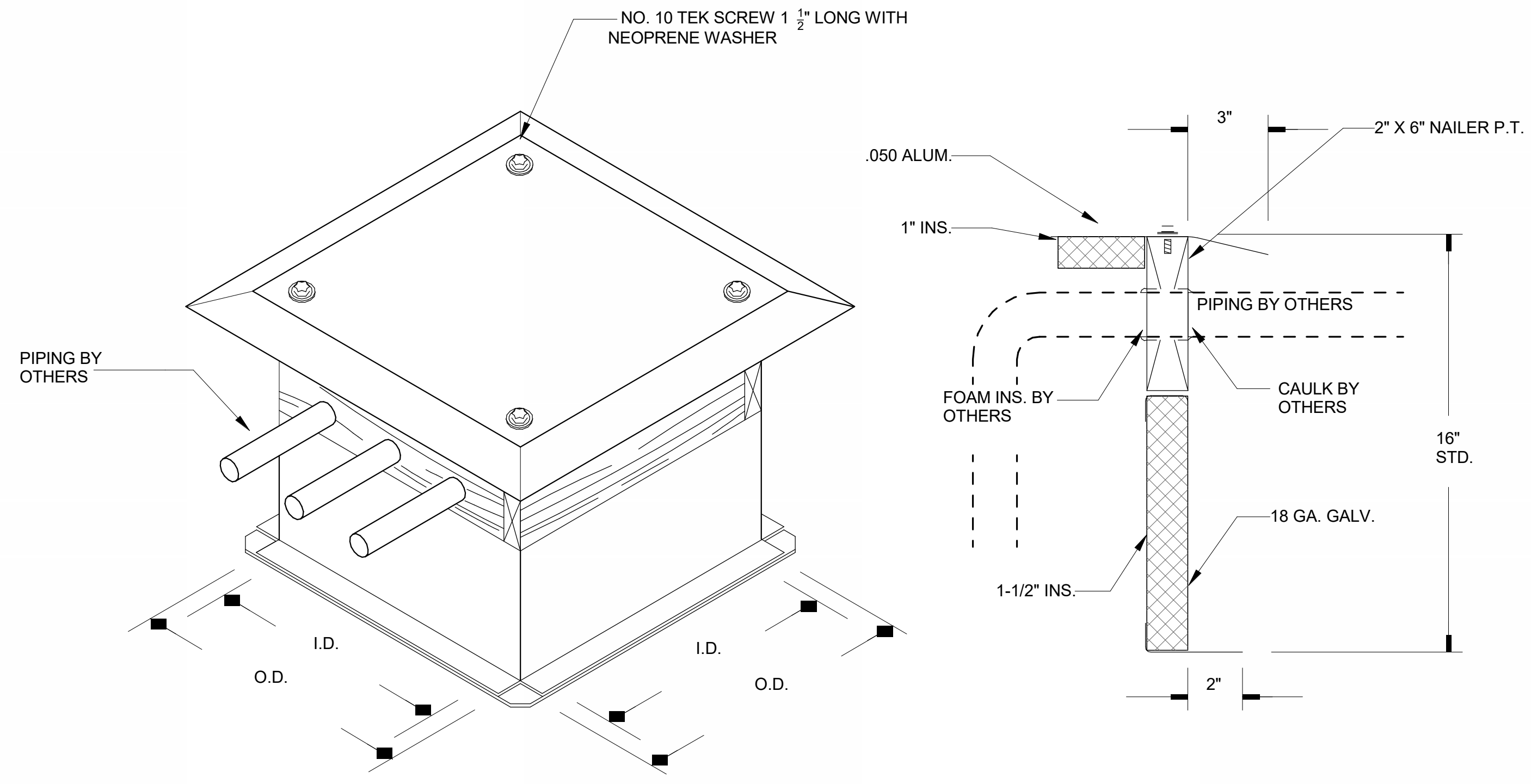
Scale 1/16" = 1'-0"



① Second Floor Mechanical Plan  
1/4" = 1'-0"



③ Section 5  
1/4" = 1'-0"



② REFRIGERANT PIPING ROOF PENETRATION CURB DETAIL  
3" = 1'-0"  
NOTE: PIPE PENETRATIONS ARE FIELD CUT.

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 CLARK COUNTY SCHOOL DISTRICT

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 REFRIGERANT PIPING LAYOUT PLAN

Project Number	2020157
Date	11-23-2023
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 Scale As indicated

## Using This Guide

This Guide covers R-22, R-407C, R-410A, and R-134a used in commercial air conditioning systems. It does not apply to industrial refrigeration and/or Variable Refrigerant Volume (VRV) systems. Illustrations and figures are not to scale. Examples showing how to perform an analysis appear under shaded headlines as seen below.

### How to Determine Equivalent Length

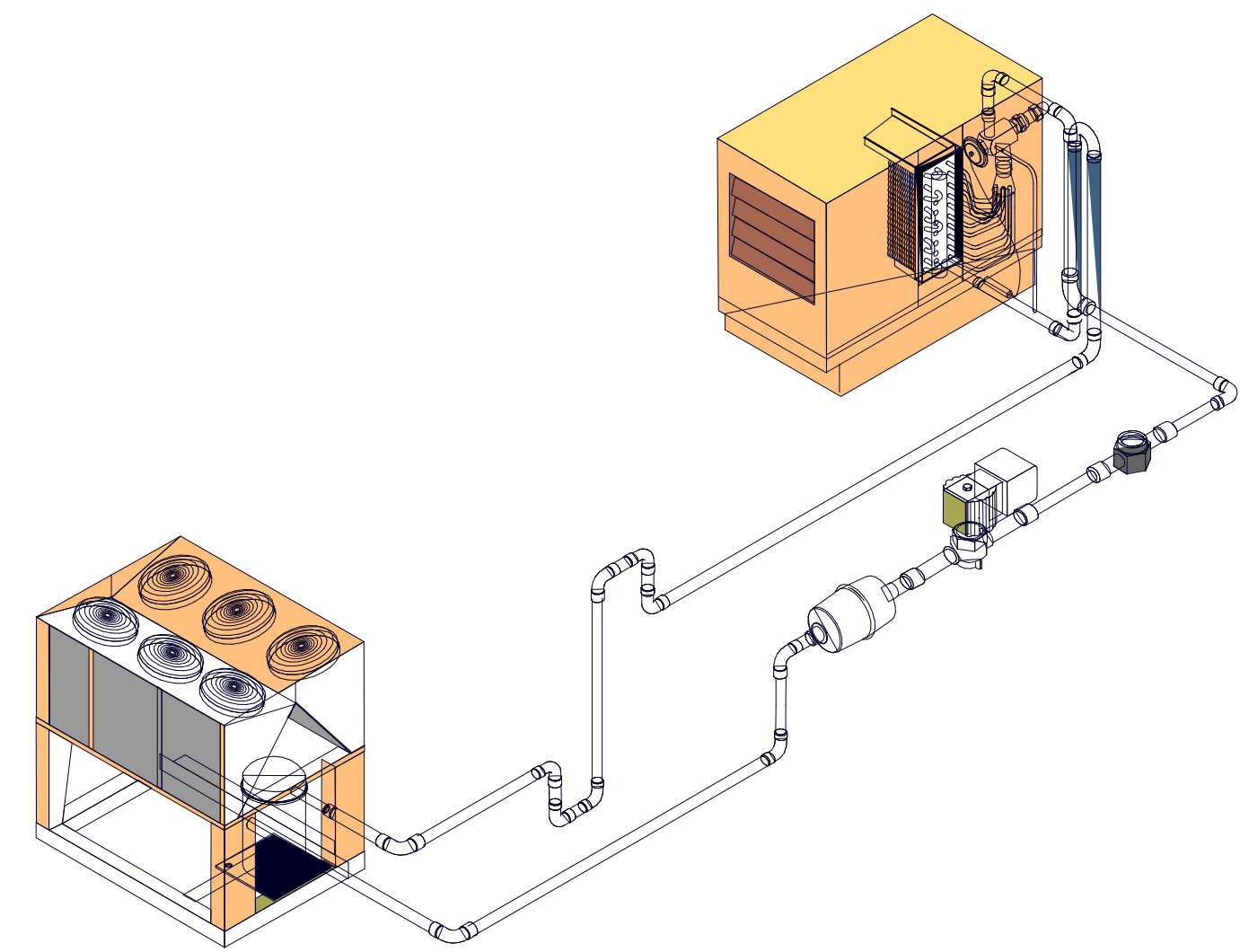
Calculate the equivalent length of the liquid line for the following condensing unit with DX air-handling unit.

The liquid line is composed of the following elements:

- 30 ft (9.14 m) of 1-3/8 inch (35 mm) piping
- 4 long radius elbows
- 1 filter-drier
- 1 sight glass
- 1 globe type isolating valve

To determine the equivalent length for the refrigerant accessories use Table 5 and Table 6 on page 41.

Item	Quantity	Dimension, ft (m)	Total, ft (m)
Long radius elbow	4	2.3 (0.7 m)	9.2 (2.8 m)
Filter-drier	1	35 (10.7 m)	35 (10.7 m)
Sight glass	1	2.5 (0.76 m)	2.5 (0.76 m)
Globe valve	1	38 (11.6 m)	38 (11.6 m)
Piping	1	30 (9.1 m)	30 (9.1 m)
<b>Total</b>			<b>117.7 (34.96 m)</b>



## Refrigerant Piping

Several HVAC systems require field refrigeration piping to be designed and installed on-site.

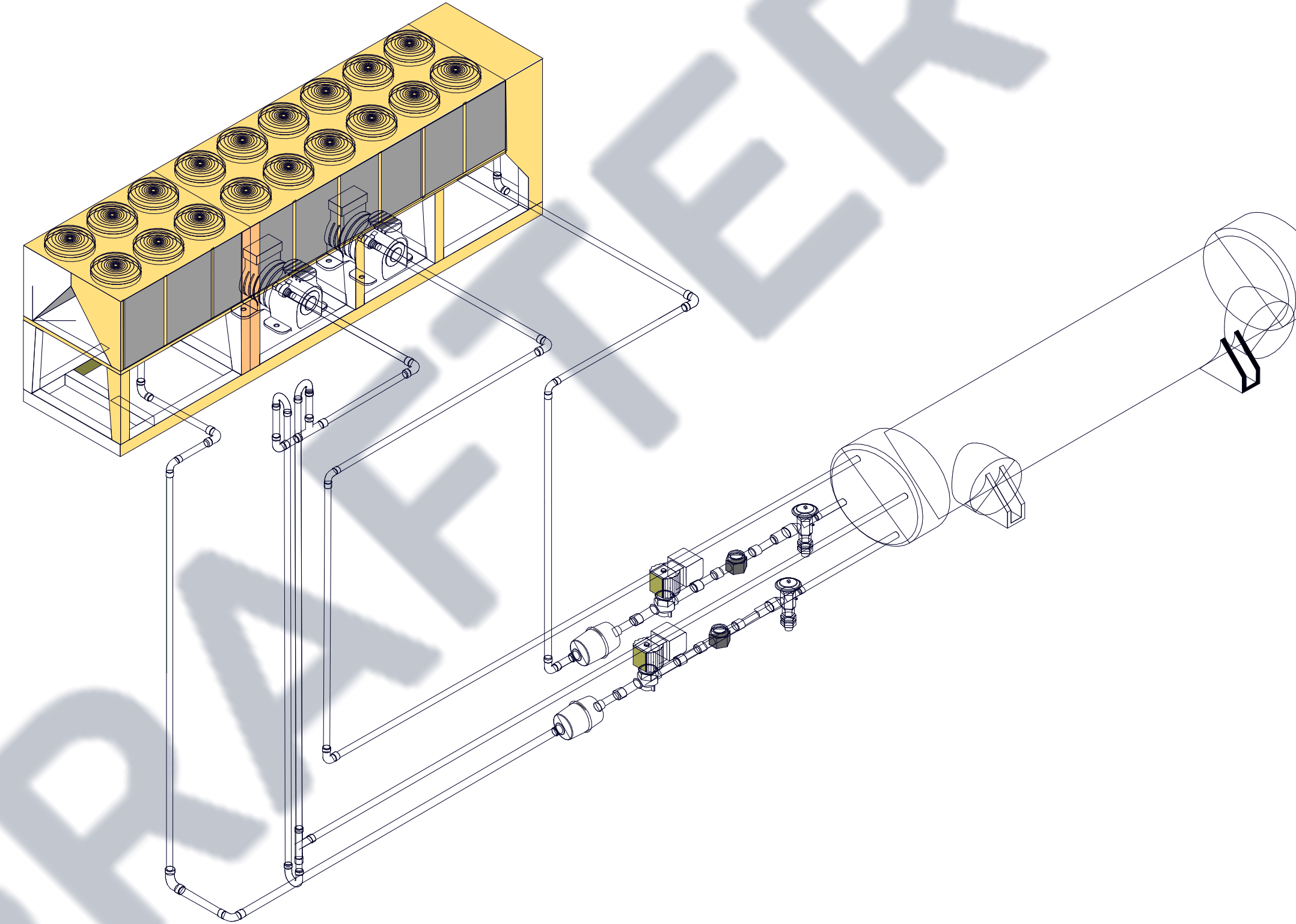
Examples include:

- Condensing units
- Direct expansion (DX) coil in air handlers
- Remote evaporators with air-cooled chillers (Figure 1)
- Chiller with a remote air-cooled condensers

The information contained in this Application Guide is based on Chapter 2 of ASHRAE's Refrigeration Handbook and Daikin Applied's experience with this type of equipment. A properly designed and installed refrigerant piping system should:

- Provide adequate refrigerant flow to the evaporators, using practical refrigerant line sizes that limit pressure drop
- Avoid trapping excessive oil so that the compressor has enough oil to operate properly at all times
- Avoid liquid refrigerant slugging
- Be clean and dry

Figure 1: Typical Field Piping Application

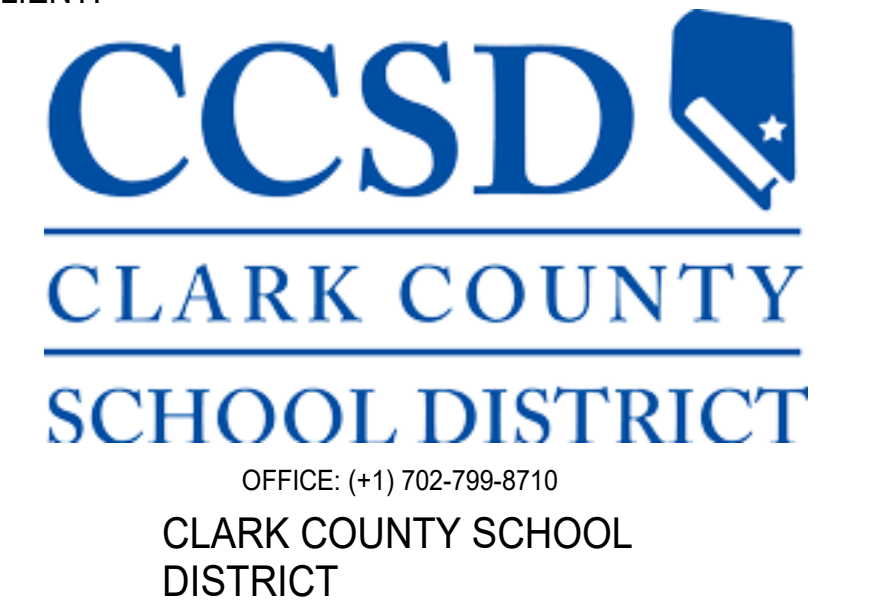


1 REFRIGERANT PIPING ROOF  
PENETRATION CURB DETAIL  
12" = 1'-0"

2 REFRIGERANT PIPING ROOF  
PENETRATION CURB DETAIL  
12" = 1'-0"

Date	Description	No.

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RP-02

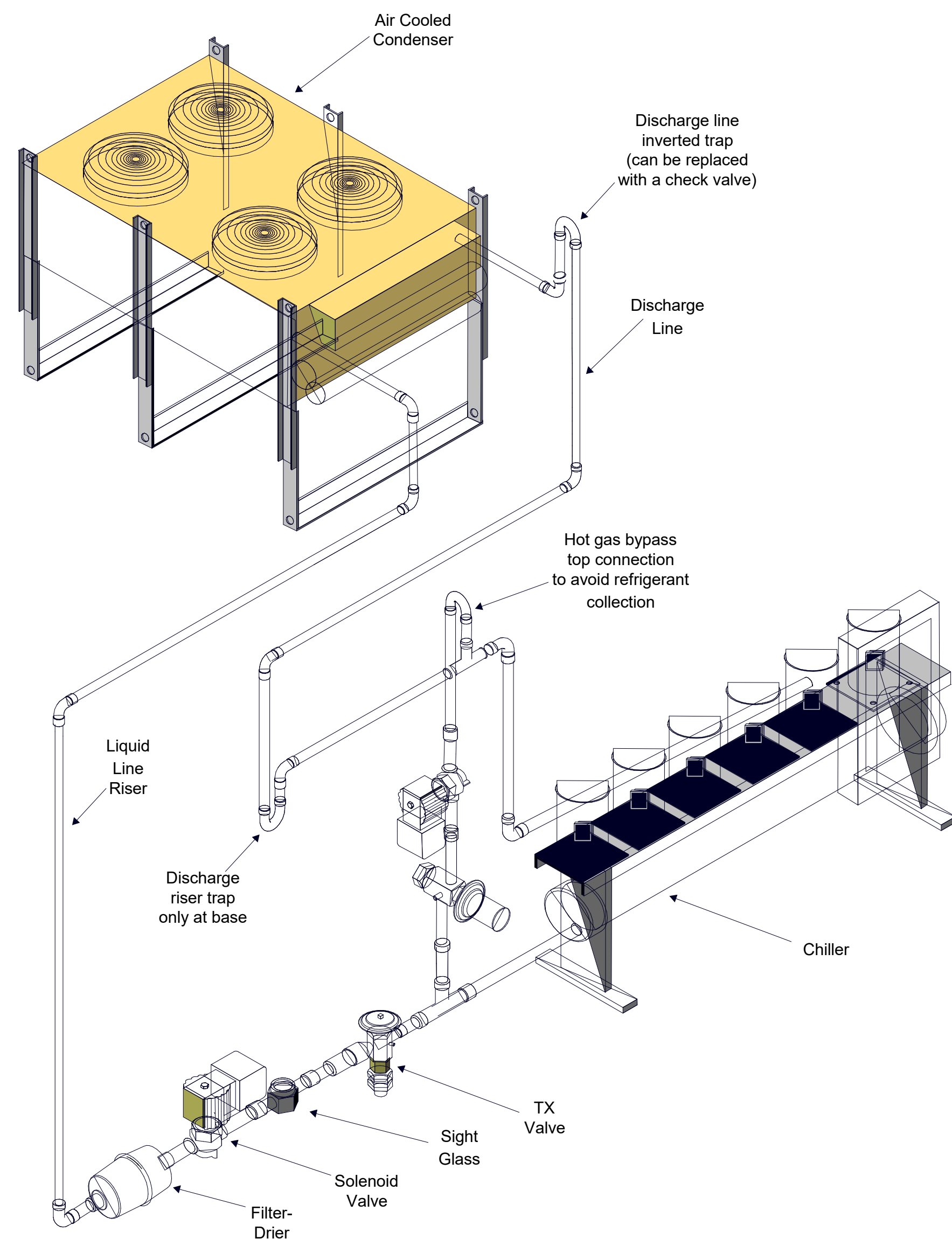
Scale 12" = 1'-0"

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Figure 4 shows an indoor chiller with a remote air-cooled condenser on the roof.

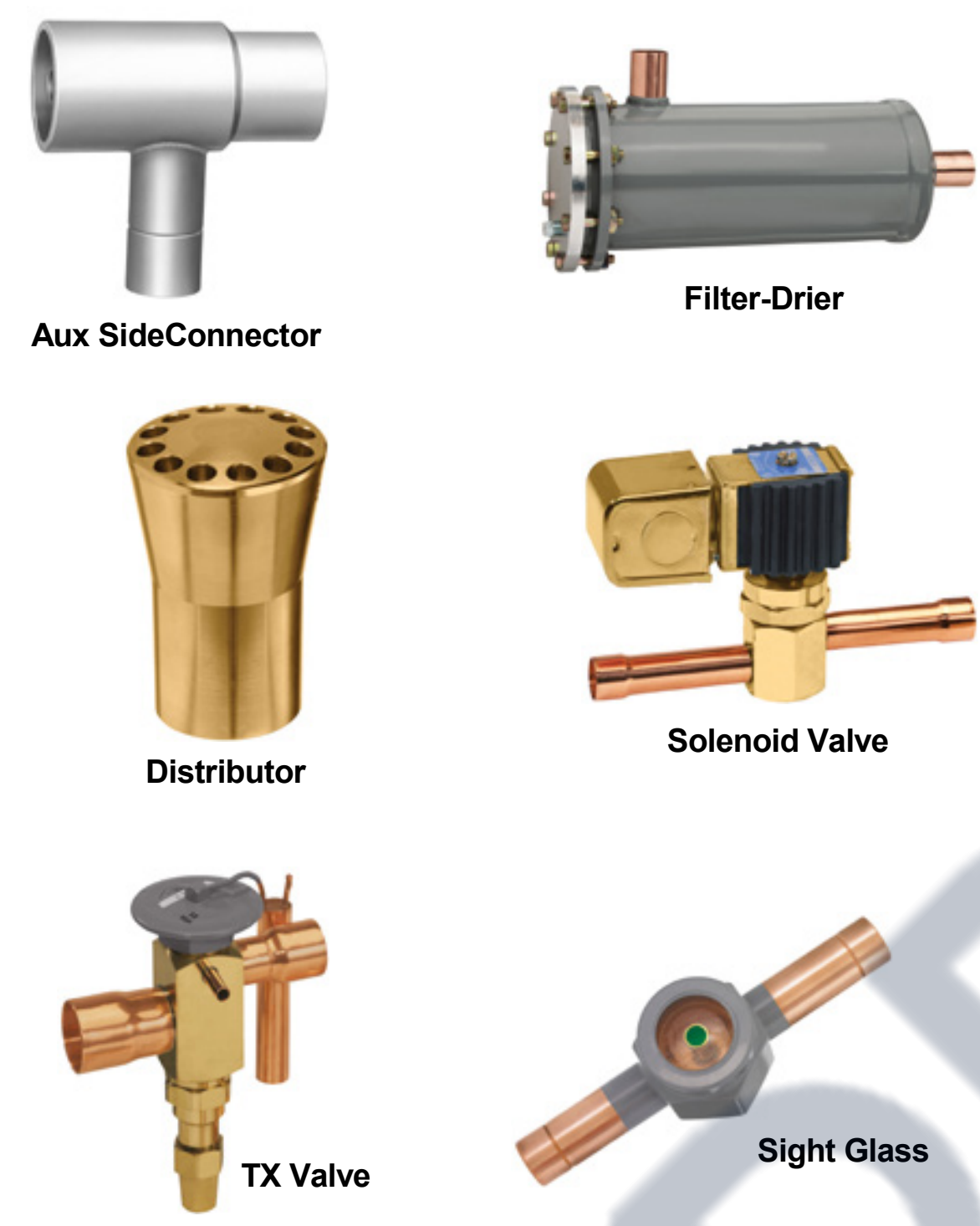
1. The discharge gas line runs from the discharge side of the compressor to the inlet of the condenser.
2. The liquid line connects the outlet of the condenser to a TX valve at the evaporator.
3. The hot gas bypass line on the circuit runs from the discharge line of the compressor to the liquid line connection at the evaporator.

**Figure 4: Indoor Chiller with Remote Air-cooled Condenser**



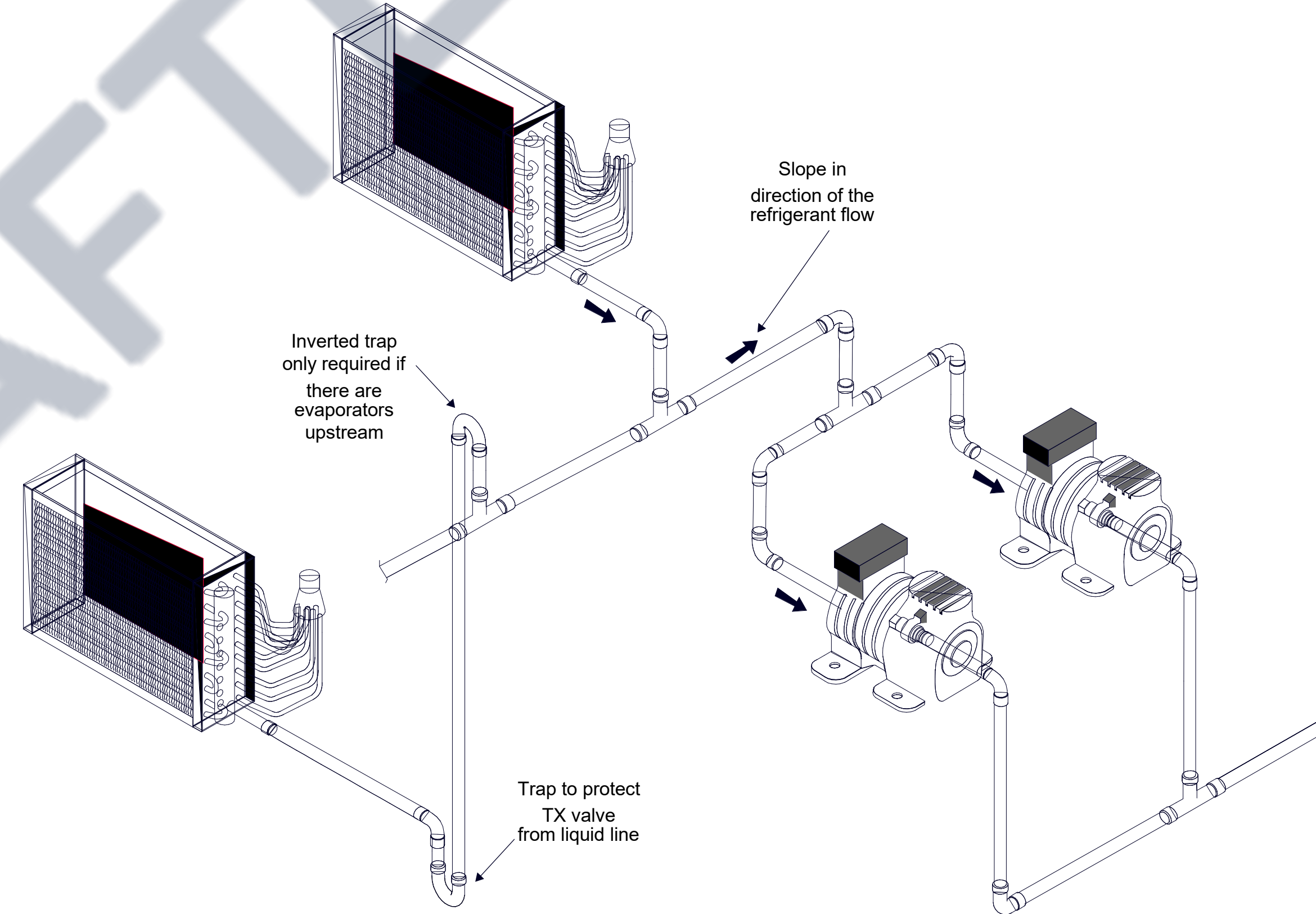
REFRIGERANT PIPING ROOF PENETRATION CURB DETAIL  
12" = 1'-0"

**Figure 6: Refrigerant Accessories**

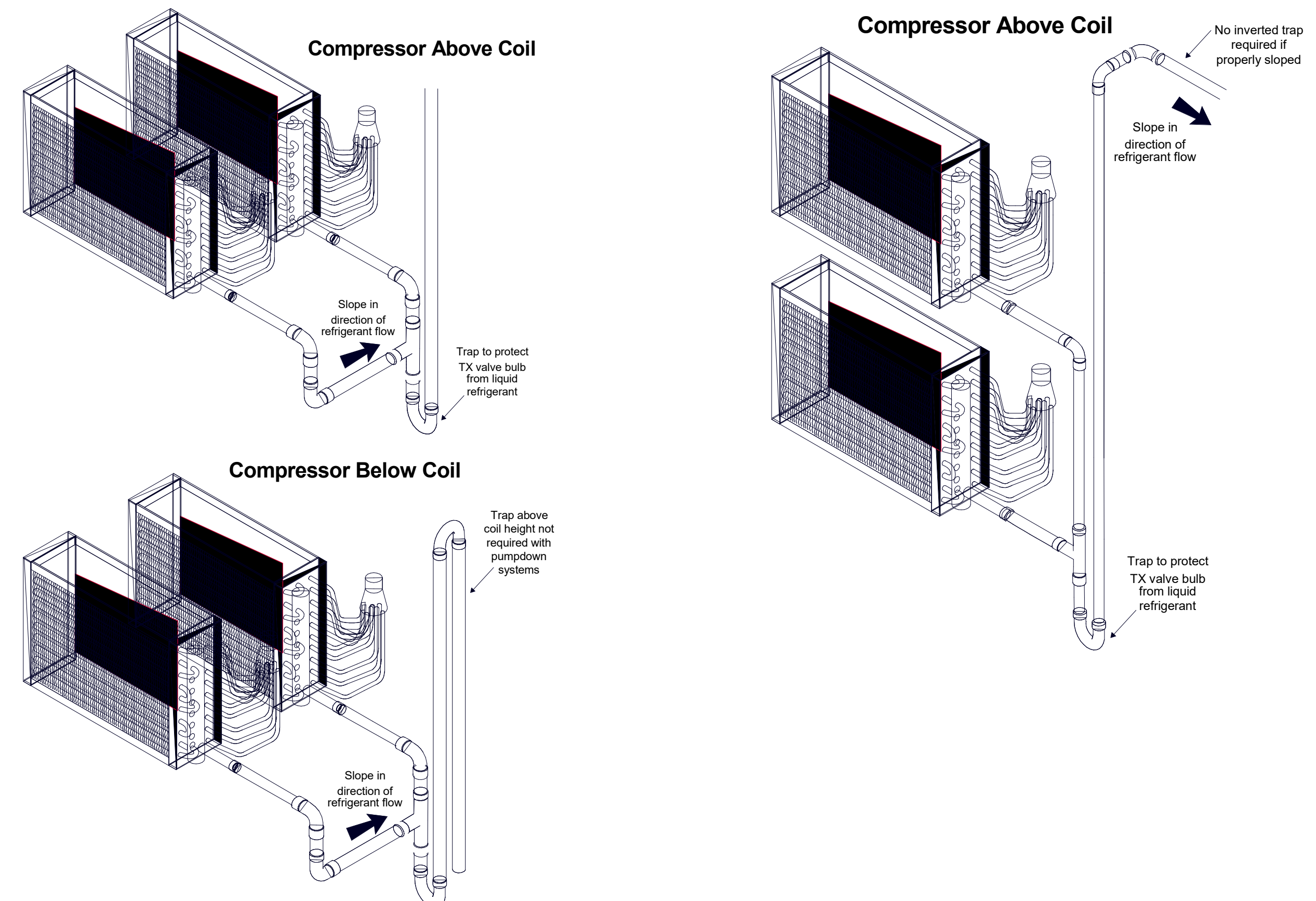


Photos courtesy of Sporlan Division – Parker Hannifin Corporation  
REFRIGERANT PIPING ROOF PENETRATION CURB DETAIL  
12" = 1'-0"

**Figure 7: Remote Evaporator Piping Detail**



**Figure 8: Suction Piping Details**



REFRIGERANT PIPING ROOF PENETRATION CURB DETAIL  
12" = 1'-0"

**Figure 5: Refrigerant Grade Copper Tubing**



**Table 1: Temperature versus Pressure Drop**

Refrigerant	Suction Pressure Drop		Discharge Pressure Drop		Liquid Pressure Drop	
	°F (°C)	PSI (kPa)	°F (°C)	PSI (kPa)	°F (°C)	PSI (kPa)
R-22	2 (1.1)	2.91 (20.1)	1 (0.56)	3.05 (21.0)	1 (0.56)	3.05 (21.0)
R-407C	2 (1.1)	2.92 (20.1)	1 (0.56)	3.3 (22.8)	1 (0.56)	3.5 (24.1)
R-410A	2 (1.1)	4.5 (31.0)	1 (0.56)	4.75 (32.8)	1 (0.56)	4.75 (32.8)
R-134a	2 (1.1)	1.93 (13.3)	1 (0.56)	2.2 (15.2)	1 (0.56)	2.2 (15.2)

NOTE: Suction and discharge pressure drops based on 100 equivalent feet (30.5 m) and 40°F (4.4°C) saturated temperature.

REFRIGERANT PIPING ROOF PENETRATION CURB DETAIL  
12" = 1'-0"

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Scale 12" = 1'-0"

Figure 10: Discharge Line Piping Details

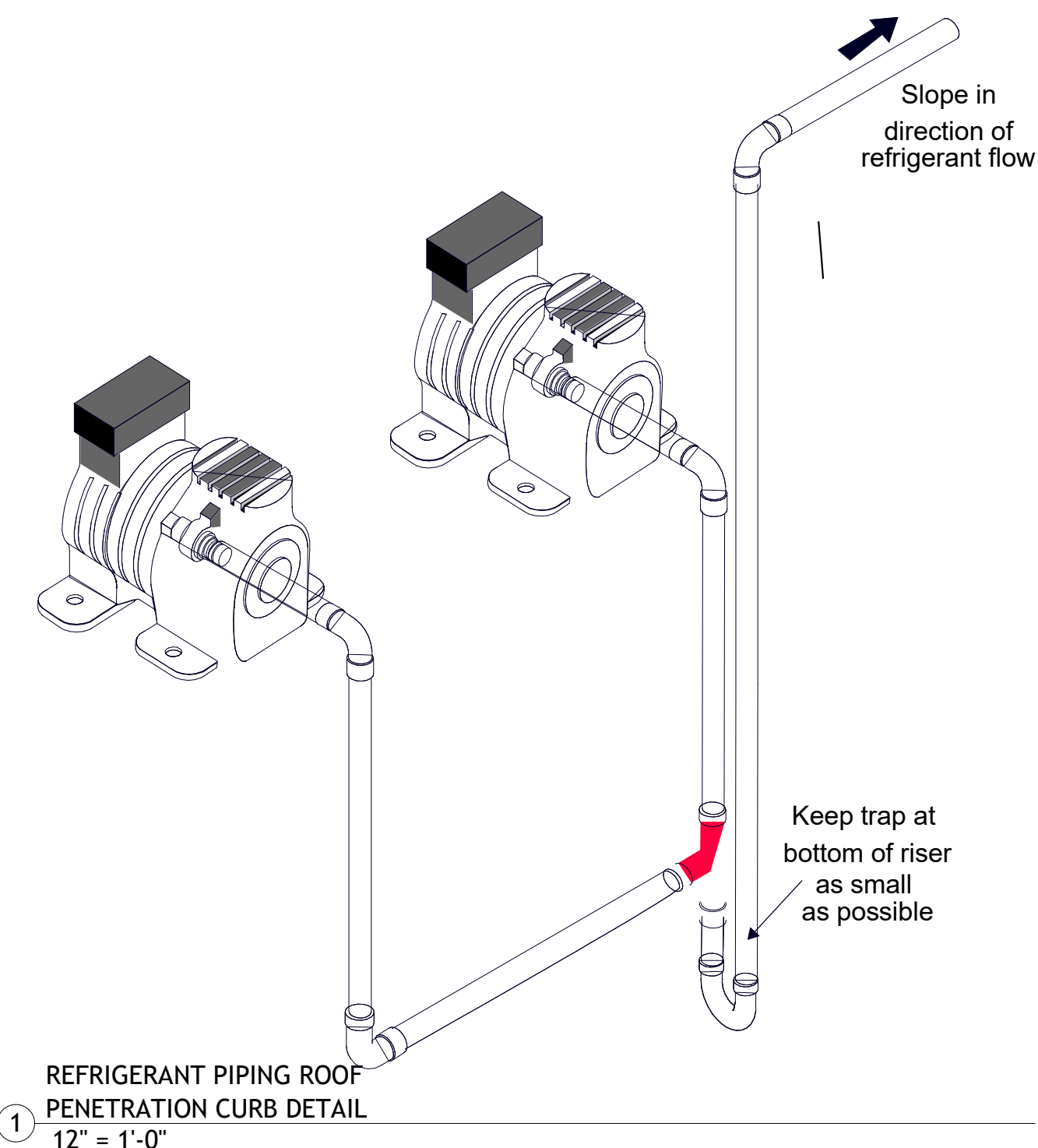


Figure 11: DX Coils with Multiple Circuits

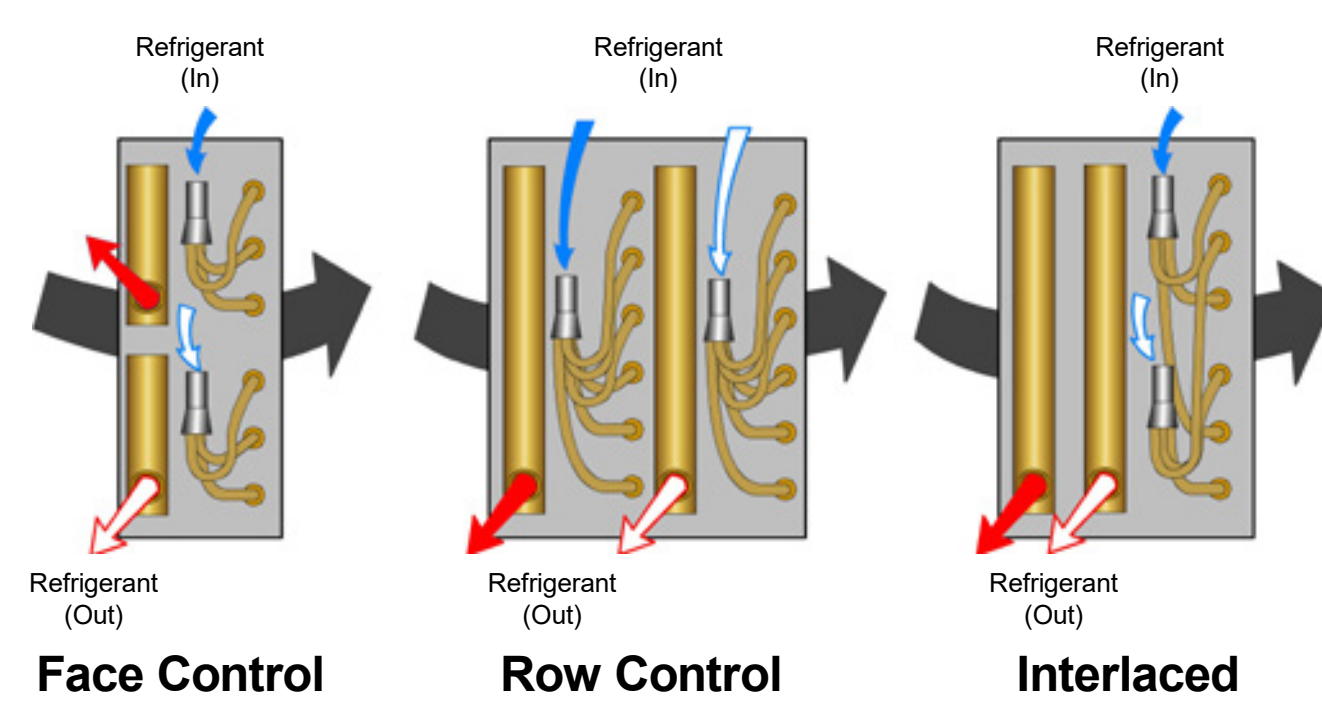
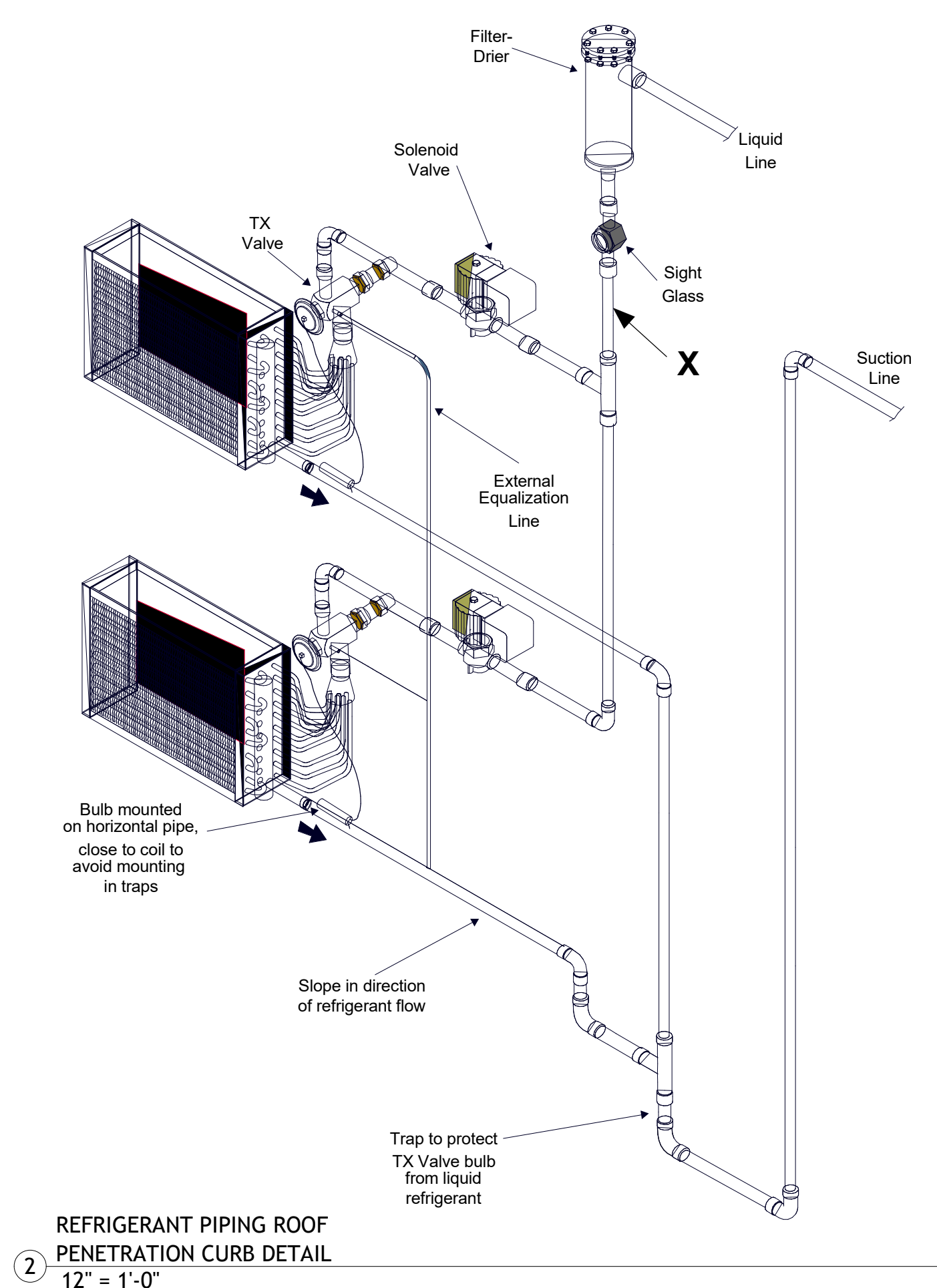


Figure 12: Two Evaporators on a Common Refrigeration Circuit



## Equivalent Length for Refrigerant Lines

Table 5 and Table 6 on page 41 in Appendix 2 (page 40) provide information for estimating equivalent lengths. The actual equivalent length is estimated by calculating the path length in feet (meters) that the piping will follow and adding the pressure drops of the fittings and/or accessories along that length. The tables provide pressure drops in equivalent feet of straight pipe for fittings and accessories.

For example, in Table 5, we see that a 7/8-inch (22 mm) long radius elbow has a pressure drop equivalent to 1.4 feet (0.43 m) of straight copper pipe.

### How to Determine Equivalent Length

Calculate the equivalent length of the liquid line for the following condensing unit with DX air-handling unit:

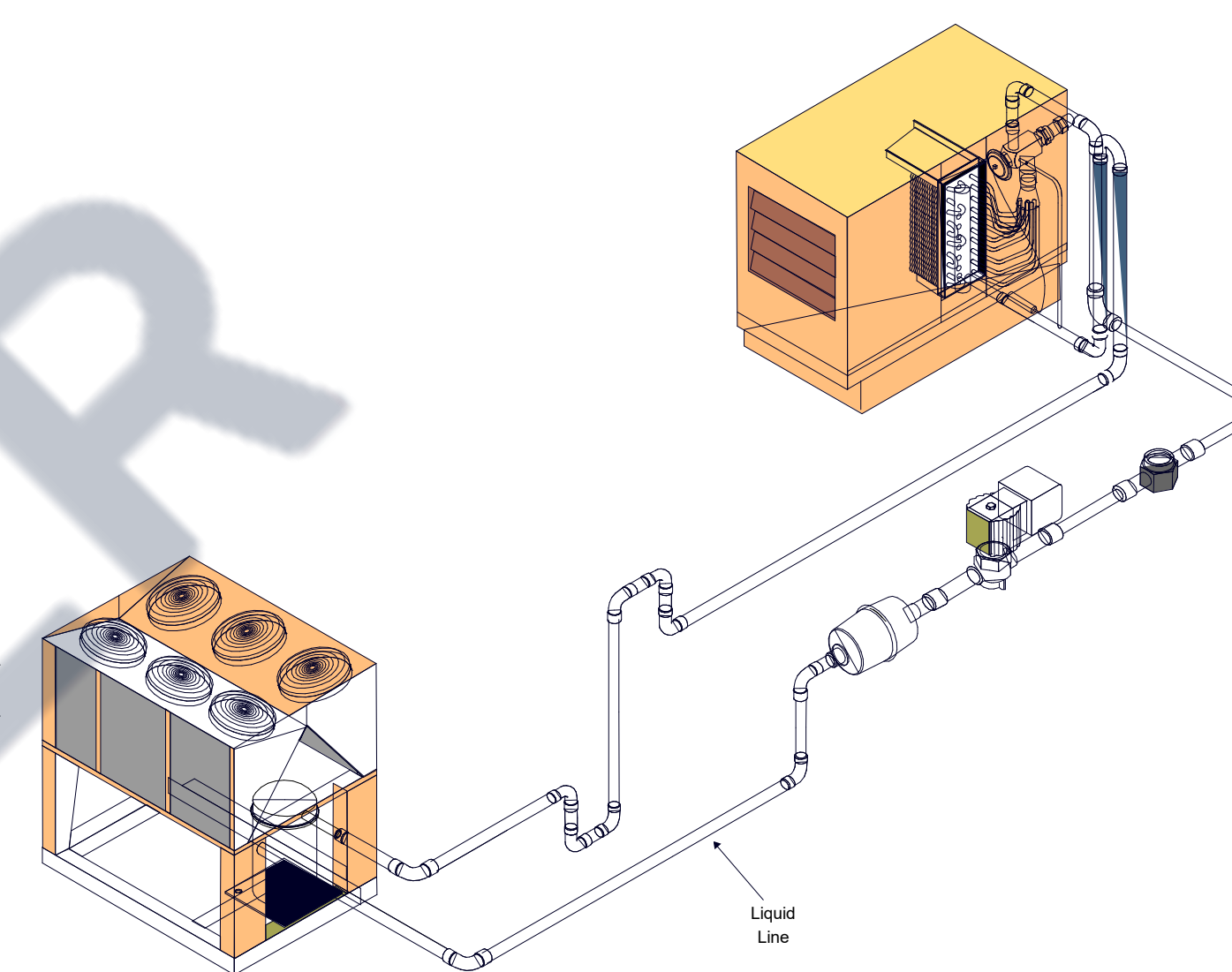
The liquid line is composed of the following elements:

- 22 ft (6.7 m) of 1-3/8 inch (35 mm) piping
- 7 long radius elbows
- 1 filter drier
- 1 sight glass
- 1 globe type isolating valve

To determine the equivalent length for the refrigerant accessories use Table 5 and Table 6).

Item	Quantity	Dimension, ft (m)	Total, ft (m)
Long radius elbow	7	2.3 (0.70 m)	16.1 (4.90 m)
Filter-drier	1	35 (10.70 m)	35 (10.70 m)
Sight glass	1	2.5 (0.76 m)	2.5 (0.76 m)
Globe valve	1	38 (11.58 m)	38 (11.58 m)
Piping	1	22 (6.70 m)	22 (6.70 m)
<b>Total</b>			<b>113.6 (34.64 m)</b>

REFRIGERANT PIPING ROOF PENETRATION CURB DETAIL 12" = 1'-0"



## Oil Return in Suction and Discharge Risers

Table 10 on page 45 through Table 18 on page 49 show minimum capacity oil return for suction and discharge risers. When unloading capability exists, risers should be checked to verify that the minimum capacity allows for acceptable oil return. For air conditioning applications that contain less than 100 feet (30.5 m) of piping and no more than 33% capacity reduction per circuit, a properly sized riser should be found. It may be necessary to use a smaller pipe diameter for the riser, which creates a higher than desired pressure drop at full capacity, for optimal oil movement. To compensate, a larger diameter pipe may be used for horizontal runs to minimize the total pressure drop.

Figure 13 shows the traditional method for reducing the pipe diameter for suction and discharge risers. This approach will prevent oil from being trapped in the horizontal portion of the pipe.

Figure 14 shows a preferred method for RCS Condensing Units. It replaces 90° elbows at "X" and "Y" with 45° elbows to minimize the oil collection in the trap and replaces the vertical reducer "Z" with an eccentric horizontal reducer.

Figure 14: Preferred Reduction Fittings for Risers

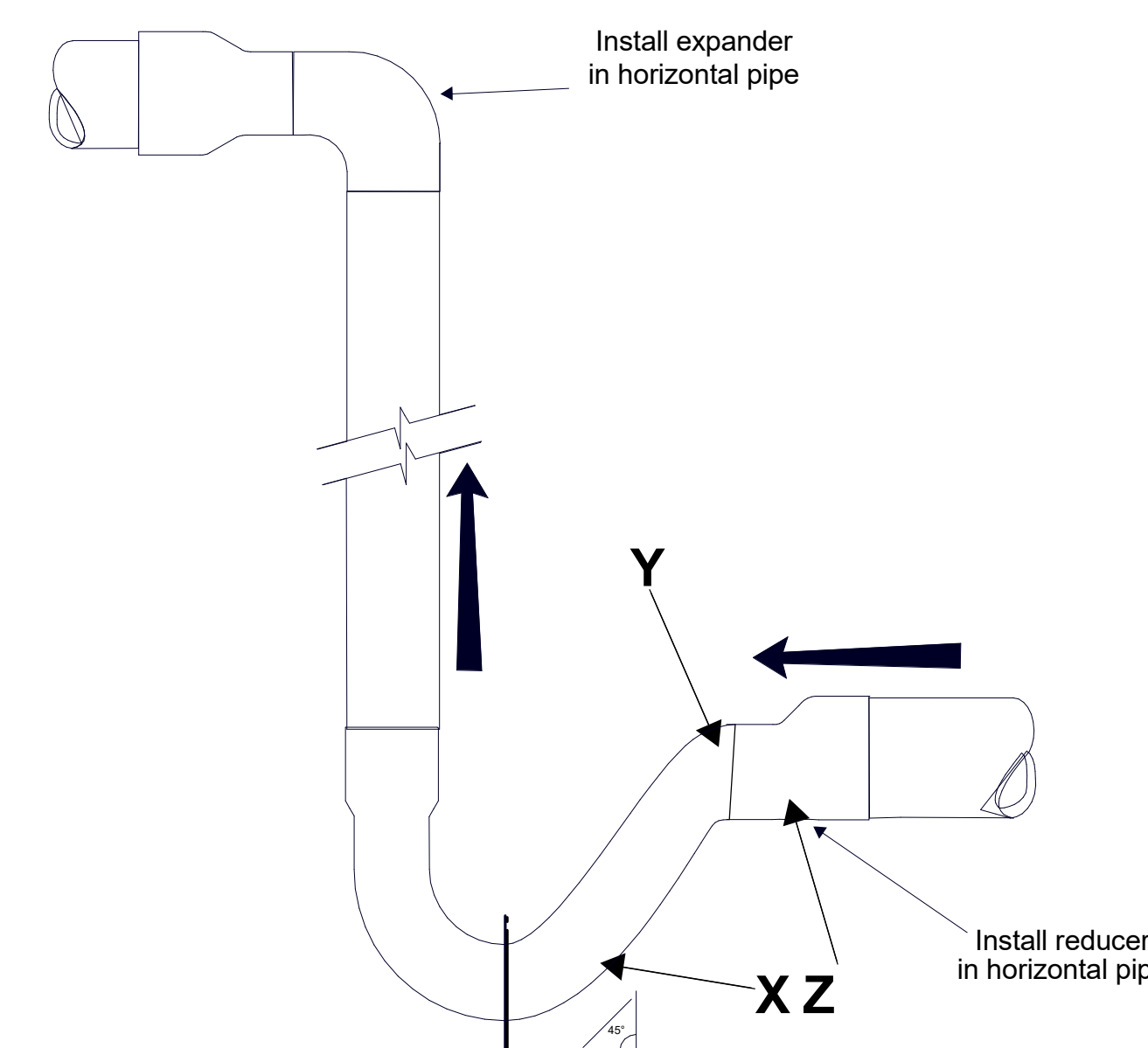
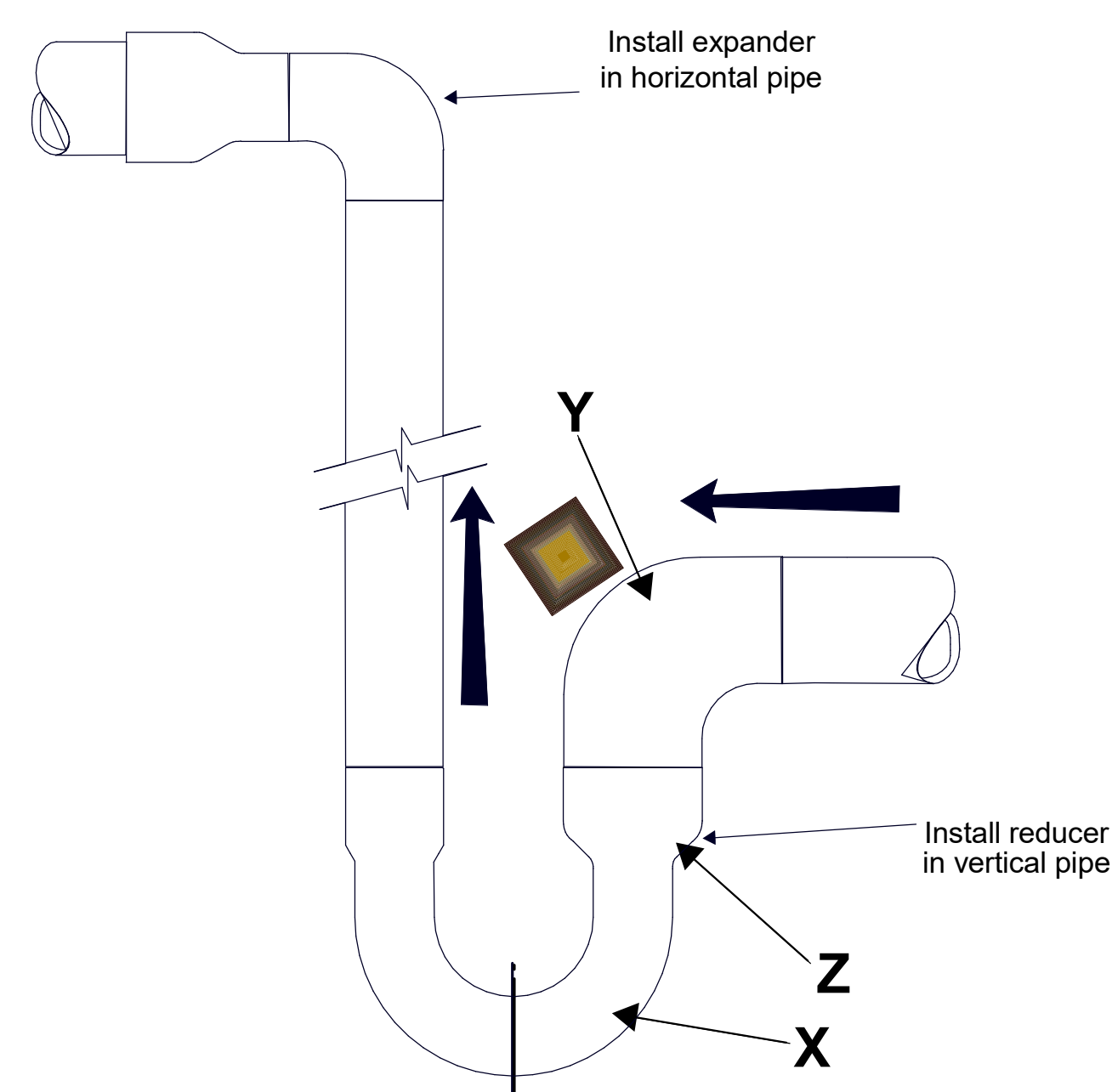
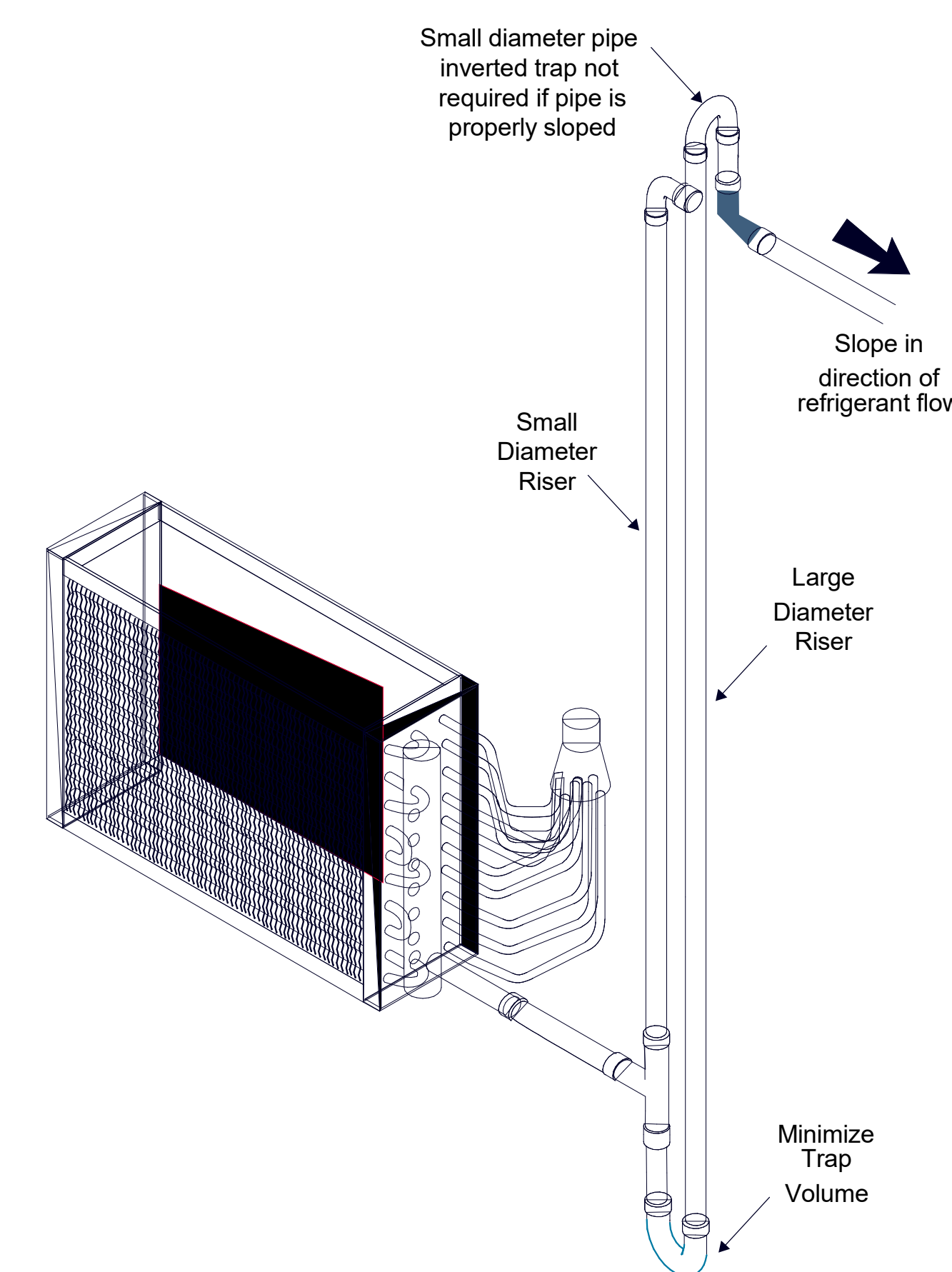


Figure 13: Traditional Reduction Fittings for Risers



REFRIGERANT PIPING ROOF PENETRATION CURB DETAIL 12" = 1'-0"

Figure 15: Double Suction Riser Detail



Tip: For most air conditioning applications, a single pipe riser will work. In this case, it may be necessary to undersize the riser pipe by one pipe size to provide better oil management.

REFRIGERANT PIPING ROOF PENETRATION CURB DETAIL 12" = 1'-0"

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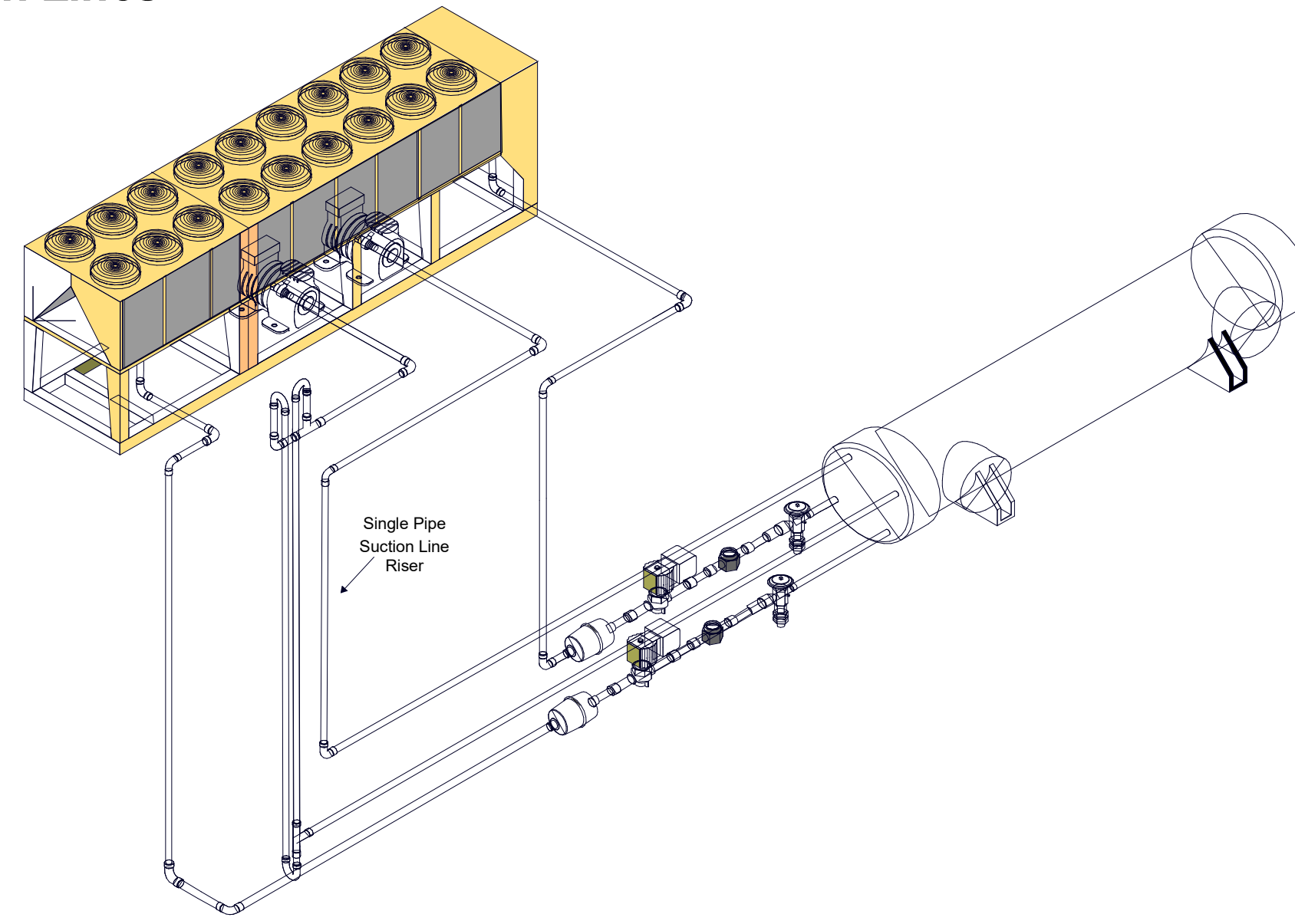
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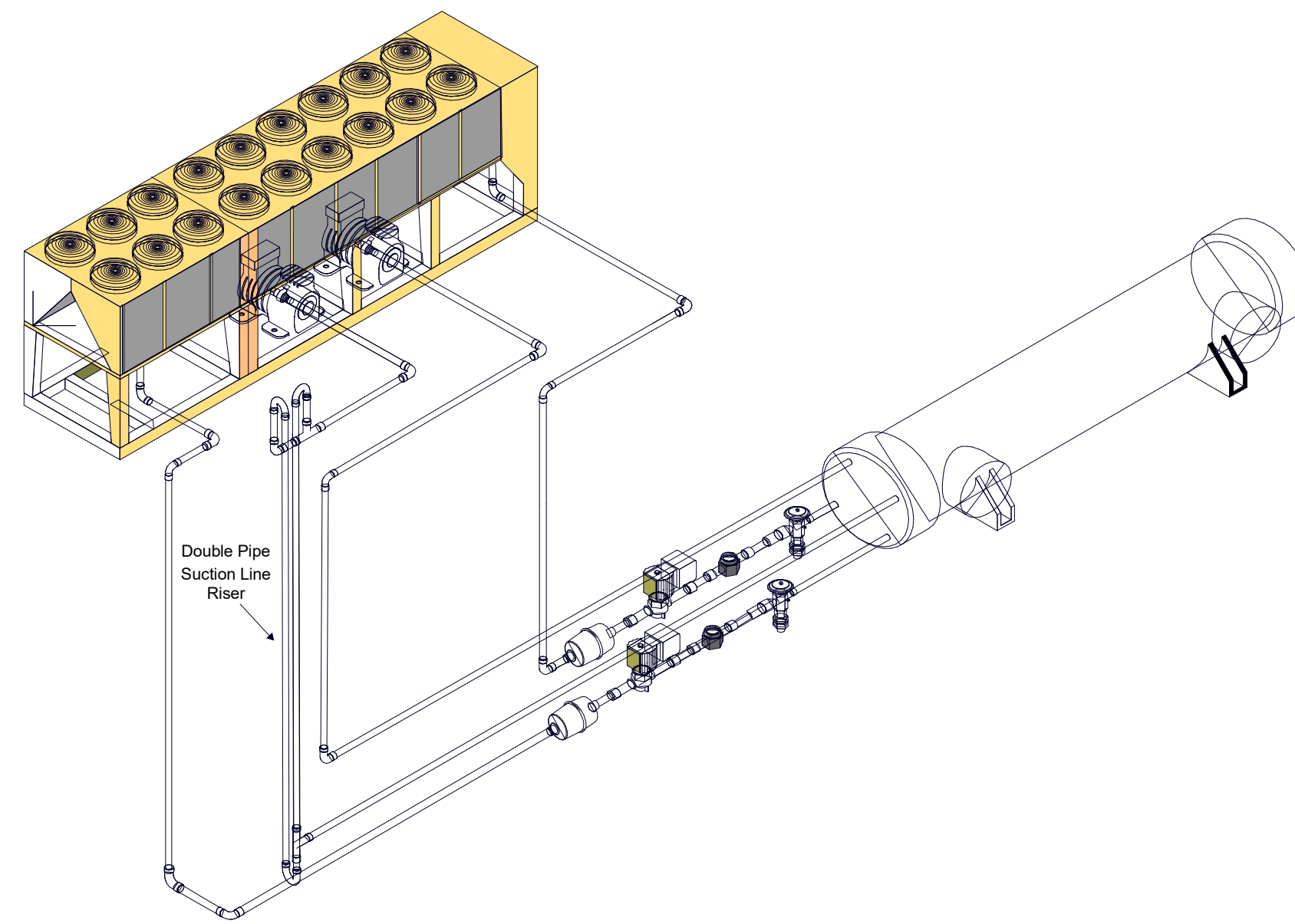


**How to Size Suction Lines**



1 REFRIGERANT PIPING ROOF PENETRATION CURB DETAIL 12" = 1'-0"

**How to Size a Suction Line Double Riser**



2 REFRIGERANT PIPING ROOF PENETRATION CURB DETAIL 12" = 1'-0"

**Thermal Expansion Valves**

Expansion valves are used to modulate refrigerant flow to the evaporator. There are several types of expansion valves including:

- Fixed area restrictor (capillary and orifice types)
- Automatic (constant pressure)
- Thermal expansion (TX)
- Electronic

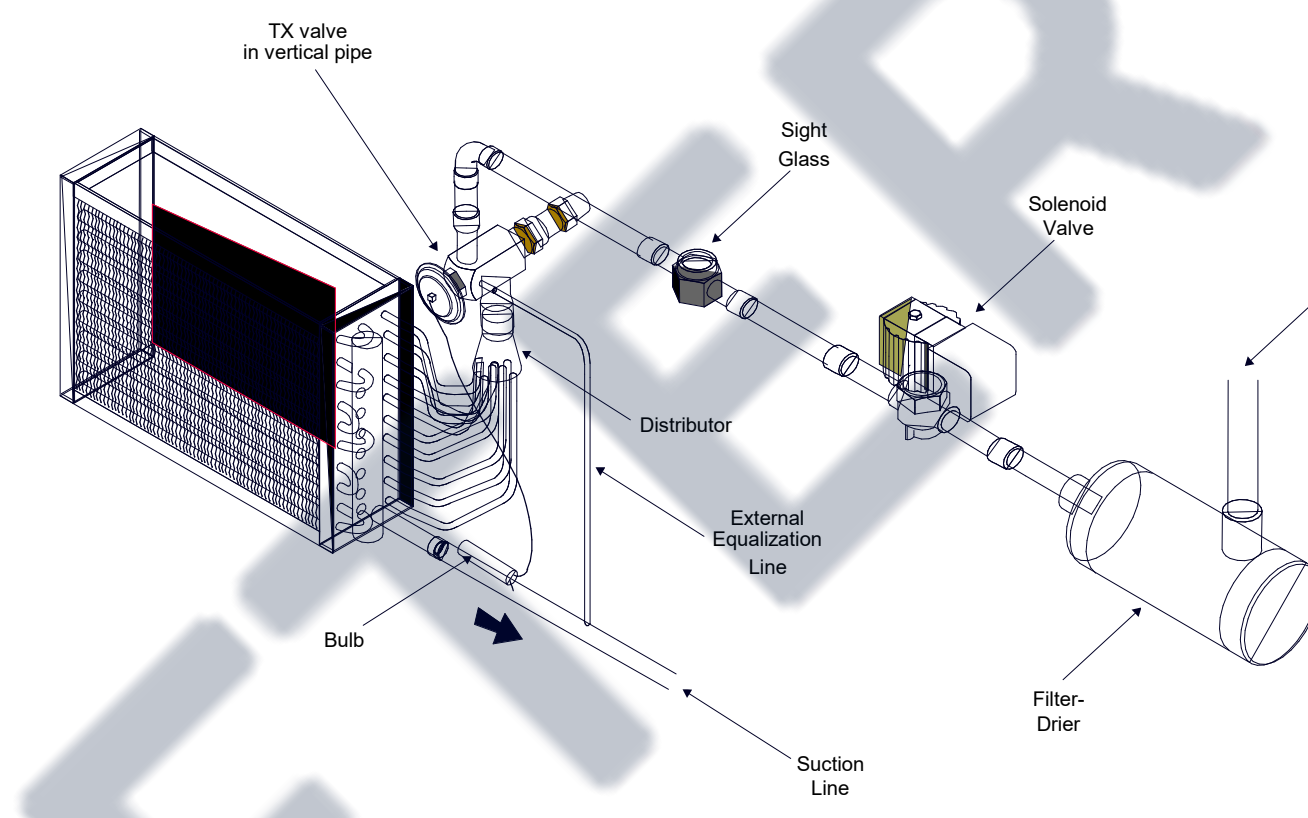
For field-piped systems, the TX and electronic types are commonly used. Electronic valves require significant controls to operate and normally are used if they were included as part of the original equipment.

**Figure 16: Thermal Expansion Valve**

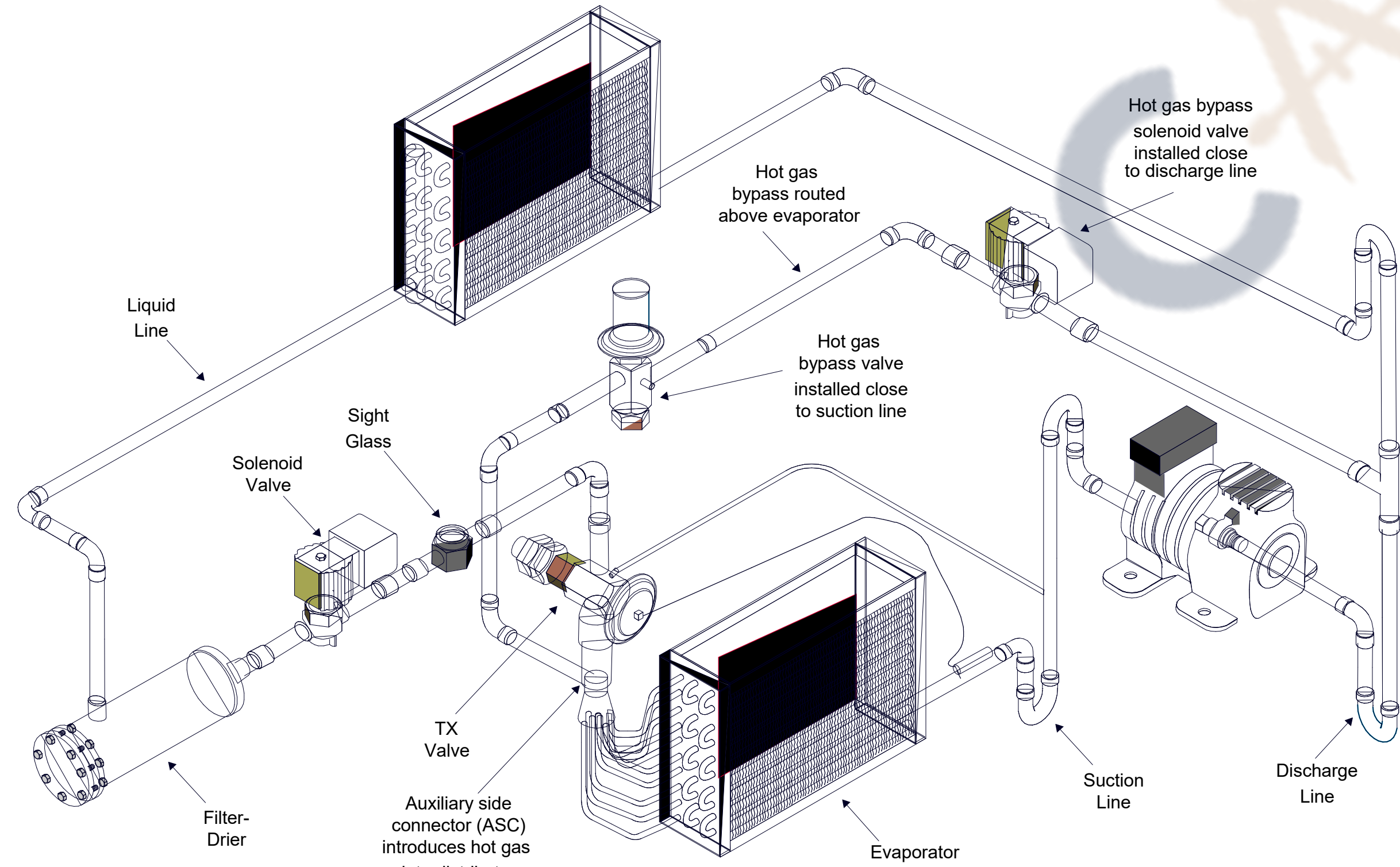


Photo courtesy of Sporlan Division – Parker Hannifin Corporation  
4 REFRIGERANT PIPING ROOF PENETRATION CURB DETAIL 12" = 1'-0"

**Figure 17: Typical TX Valve Installation**

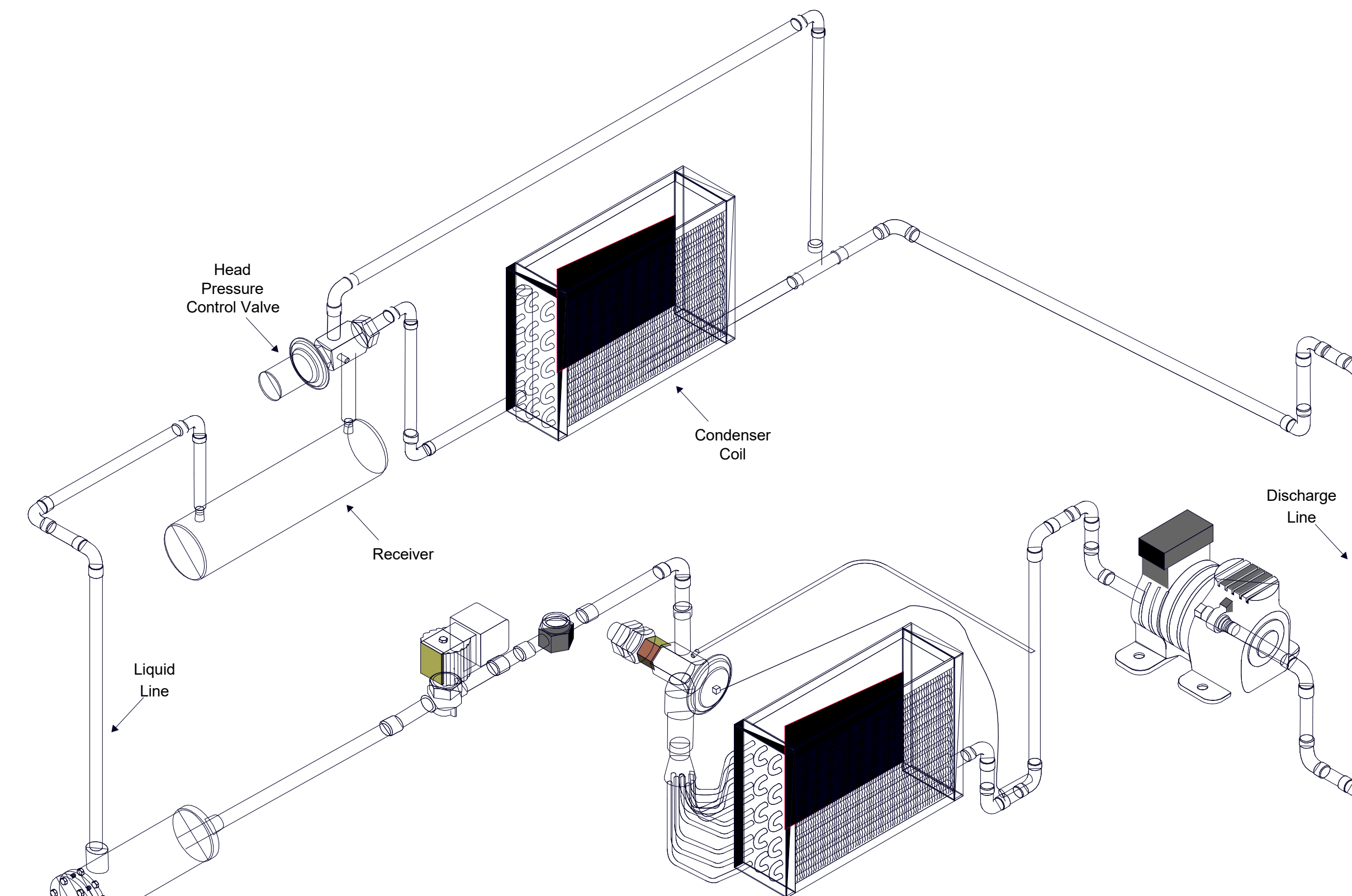


**Figure 18: Typical Hot Gas By-Pass Piping Arrangement — Fin Tube Condensers Only\***



\* Refer to Daikin IM 914 for Micro-channel condensers.  
5 REFRIGERANT PIPING ROOF PENETRATION CURB DETAIL 12" = 1'-0"

**Figure 20: Typical Condenser Flood Back Arrangement**



6 REFRIGERANT PIPING ROOF PENETRATION CURB DETAIL 12" = 1'-0"

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