

PTM Dual-Tech® Submittal Sheet

JUNE 2021

Description

PTM Dual-Tech® is a pre-fabricated double-layer ducting system with an .032" aluminum jacket (multiple finishes available) that uses Kingspan KoolDuct panels that are UL listed as a Class 1 Air Duct System meeting the standard UL 181. CFC/HCFC-free, using a blowing agent that has zero Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP).

PTM Dual-Tech® has a single install application; eliminating the need to install insulation as a second operation, thus reducing time onsite and improving overall construction schedules through faster installation speeds. PTM Dual-Tech® improves energy efficiency and is backed by a **PTM 20-year** limited warranty.

Recommended Uses

PTM Dual-Tech® is primarily designed for exterior HVAC ducting applications on new construction and existing HVAC upgrades. PTM Dual-Tech® is also suitable for interior applications in lieu of a jacketed insulation system (e.g. exposed ducting in mechanical equipment rooms, gymnasiums, etc.).

PTM Dual-Tech® is the perfect choice for all HVAC Supply, Return, Exhaust, Fresh Air, and Outside Air ducting needs, providing long term energy efficiencies that will also improve the IAQ of the building.

Features and Benefits

- **Fully assembled and factory sealed**
- **Single trade installation**
- Improves installation speed (2x that of sheet metal and insulation)
- Superior strength (double-layer construction)
- **R-16 thermal rating** (greater values available)
- White heat reflective finish standard (others available)
- Low air leakage: Less than 1%
- Inner layer fabricated to **SMACNA 2015 Phenolic Duct Construction Standard**, UL-181 Listed Class 1 Ducting
- Whole life cost savings up to 30% over 30 years
- Eliminates fiber glass from the air stream
- Reduces weight loads (1/3 the weight of sheet metal & insulation), less than 2 lbs. per sq. ft.
- Reduction in CO2 emissions (1.79 lb./sq. ft. of bldg. floor area)
- Ductwork fabricated from the Kingspan KoolDuct system can contribute points towards achieving credits, including pilot credits, in many of the LEED (Leadership in Energy & Environmental Design) rating systems, developed by the USBGC (United States Green Building Council)
- **20 Year Limited Warranty**



General Properties

Mean Air Velocity (Max.)	5000 fpm/ 25.4 m/s
Design Pressure	Positive: 4 in. w.g. / 1000 Pa Negative: 3 in w.g. / 750 Pa
Nominal Density Range of Insulation	3.43-3.75 pcf/55-60 kg/m³
Closed Cell Content	>90%
Specific Heat Capacity of Insulation	0.45 Btu/lb.°F / 1.88 kJ/kg.°C
Minimum Compressive Strength at 10% Compression (BS EN 826: 1996)	29 psi / 200kPa
Thermal Conductivity (k-value) at 50-74°F Mean (ASTM C 518)	0.146 Btu-in/ft²-hr.°F
Thermal Resistance (Material R-Value: Installed & Out of Package) (ASTM C 518)	(2) 1 3/16" layers 16.2 ft²-hr.°F/Btu
Internal Air Temperature	-15 °F to +185°F

Fire & Smoke Performance: The panels successfully pass the Burning Test (UL 181) and do not exceed flame spread / smoke developed indices 25/50 (ASTM E 84 / UL 723).

Dual-Tech®

Patent # 9,371,941

Available only through:

PTM Manufacturing, LLC.

196 Quigley Blvd.

New Castle, DE 19720

Phone (800) 455-1402

www.ptmmanufacturing.com

"Pride Through Manufacturing"

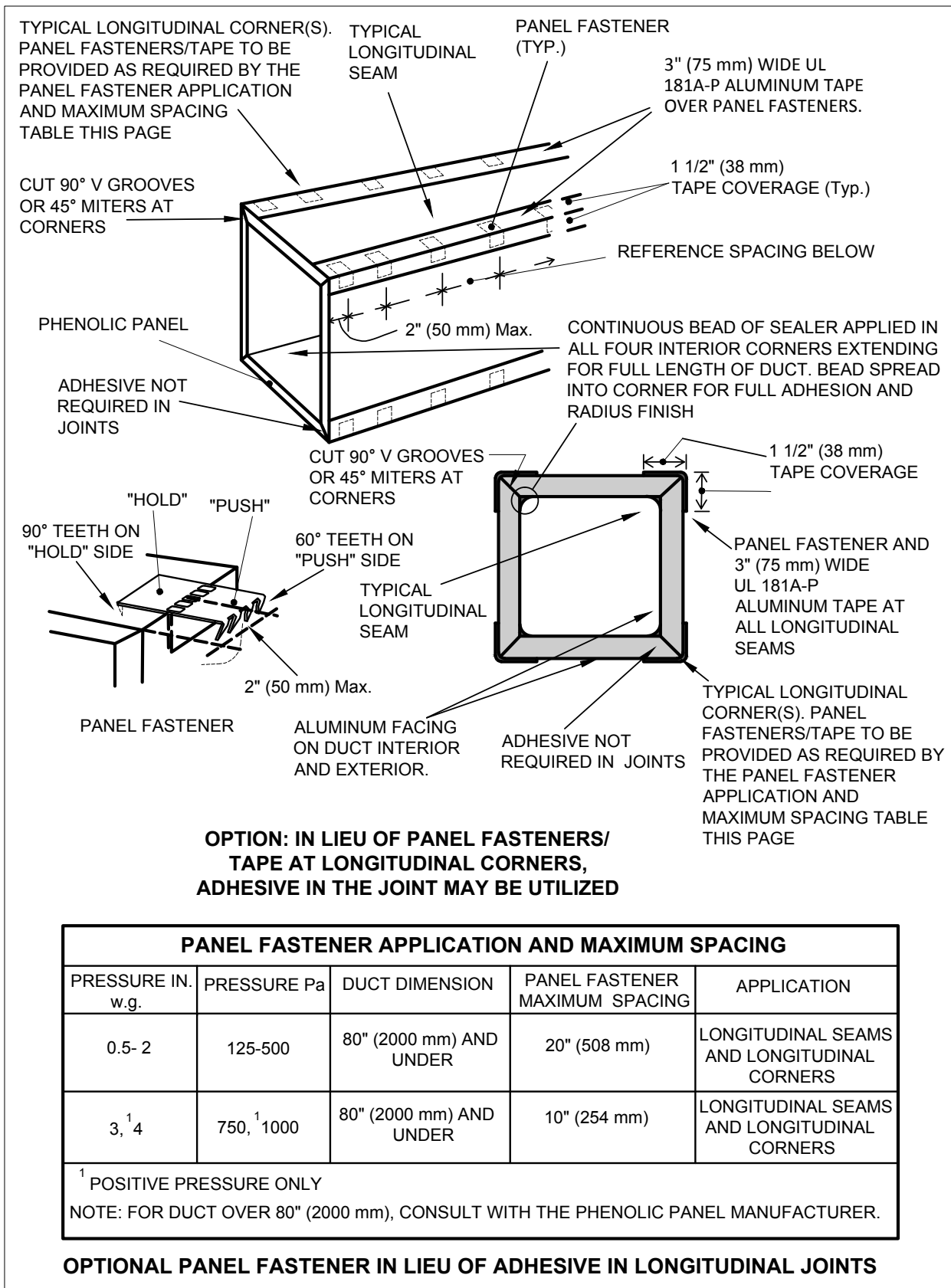


FIGURE 3-2 CLOSURES

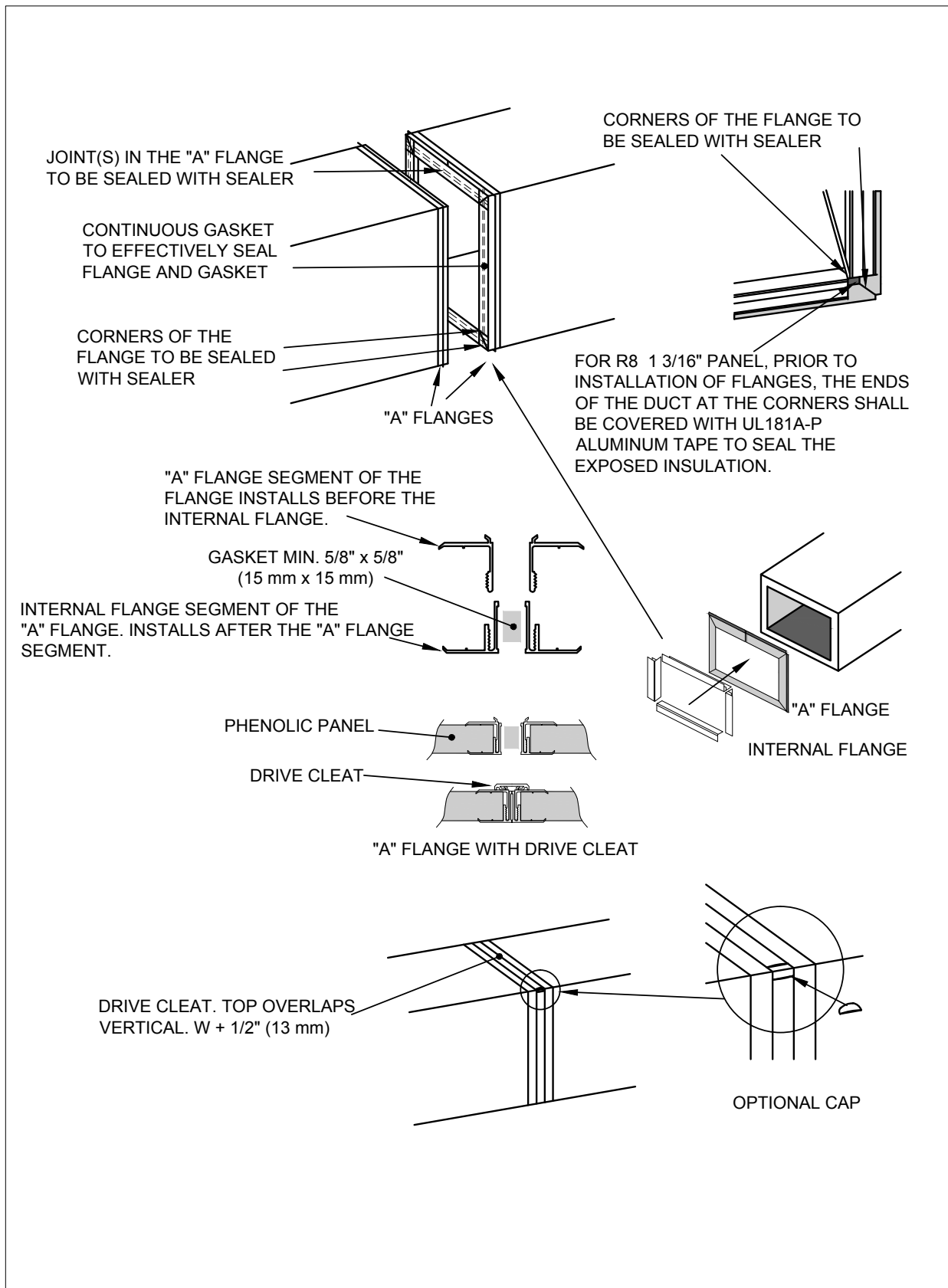


FIGURE 3-7 CLOSURES – “A” FLANGE

TRANSVERSE JOINTS	FIGURE No.	Duct Dimension	Application Notes	in. w.g. / Pa Static				
				Positive or Negative				Pos. Only
				.50	1	2	3	4
				125	250	500	750	1000
Non-Flanged Closure	3-3	60 in. (1500 mm) and Under	NA	X	X	Not Permitted		
Non-Flanged Closure	3-3	44 in. (1100 mm) and Under	NA	X	X	X		
“A” Flange	3-7	80 in. (2000 mm) and Under	NA	X	X	X	X	X
Optional “B/C” Flange	3-8	80 in. (2000 mm) and Under	NA	X	X	X	X	X
4 Bolt Flange	3-9	80 in. (2000 mm) and Under	NA	X	X	X	X	X

LEGEND:

X	Permitted
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Note: For duct over 80 in. (2000 mm), consult with the phenolic panel manufacturer.

Table 3-2 Transverse Joint Pressure Table

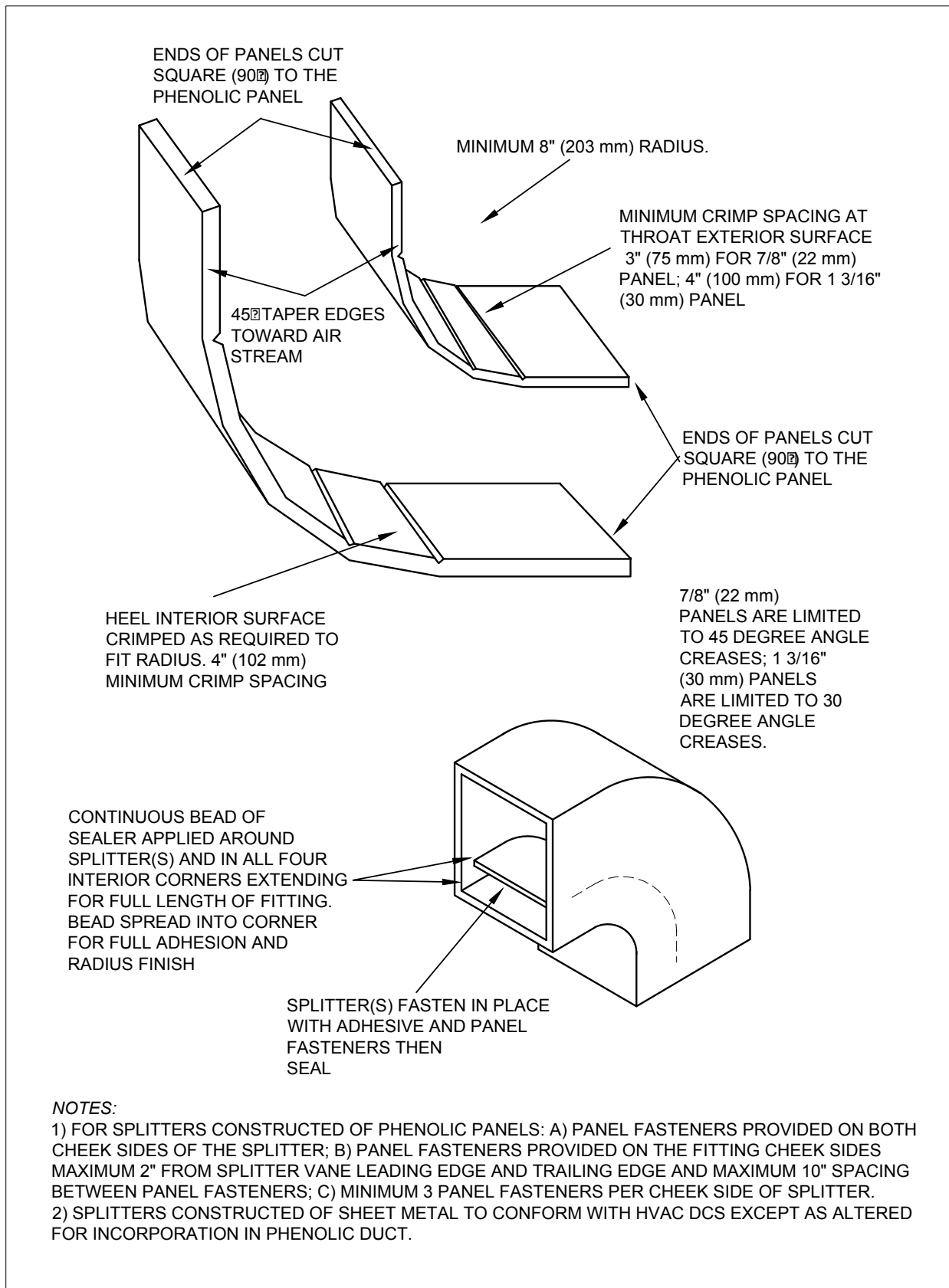
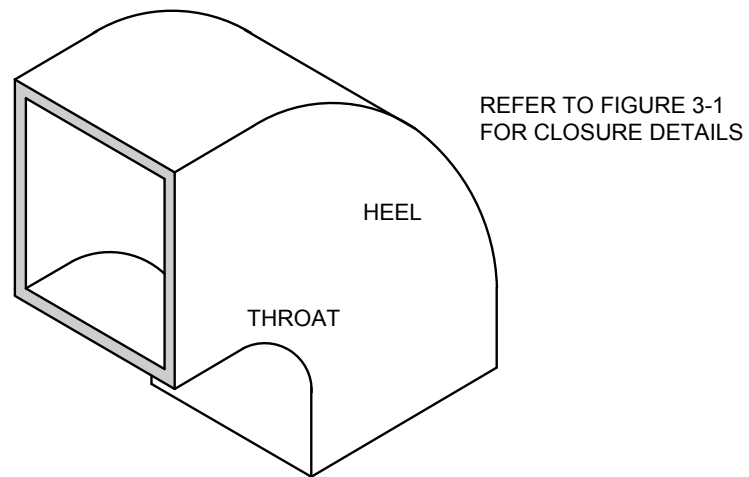
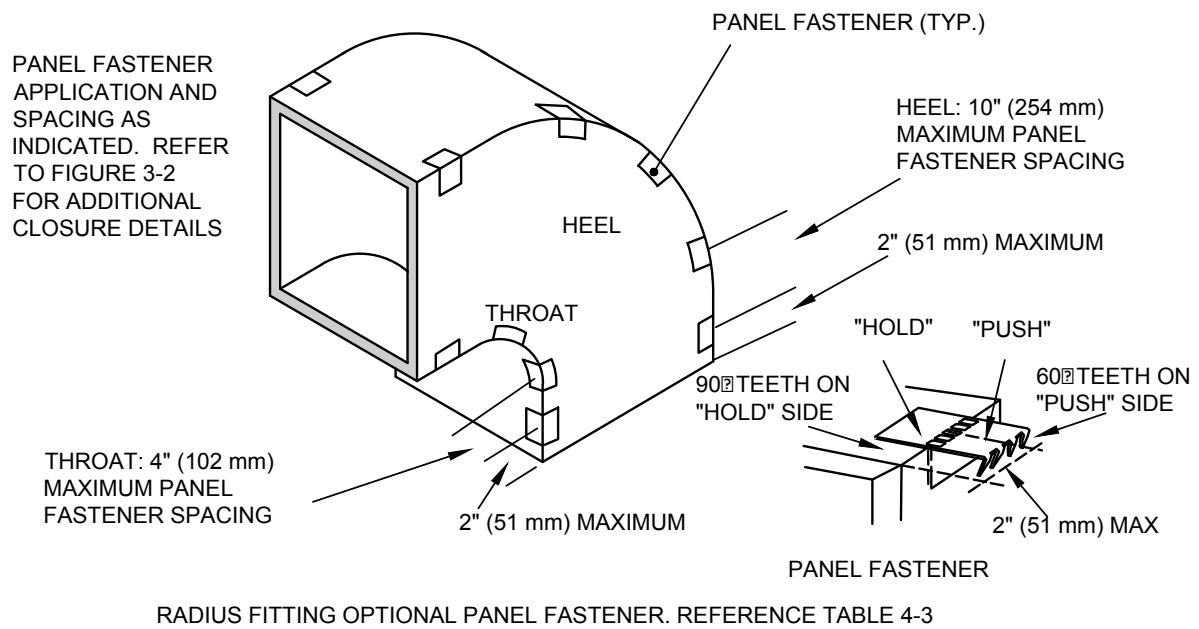


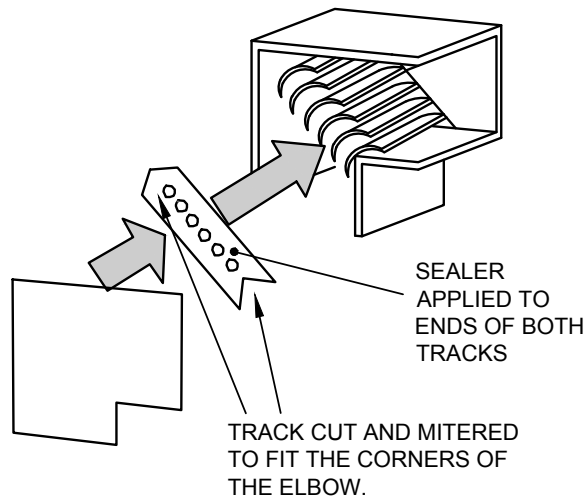
FIGURE 4-6 ELBOW - SYMMETRIC - ASYMMETRIC



RADIUS FITTING ADHESIVE IN LONGITUDINAL SEAMS/CORNERS. REFERENCE TABLE 4-3

FIGURE 4-7 ELBOW CLOSURE SPACING

APPLICABLE TO MAXIMUM
2 IN. W.G. PRESSURE CLASS
AND 24" (610 mm)
DUCT SIZE



APPLICABLE TO ALL PHENOLIC
DUCT PRESSURE CLASSES.

- OPTION 1 (SHOWN) - 24
GA (.7 mm), 1" (25 mm)
WIDE MINIMUM
METAL STRIP FASTENED TO
BOTH TRACKS. SCREW/
RIVET 6" (150 mm)
MAXIMUM SPACING,
MINIMUM THREE
FASTENERS
- OPTION 2 - 3.5" (90 mm)
REINFORCED
WASHERS AT EACH SCREW/
RIVET. SCREW/RIVET 6"
(150 mm) MAXIMUM
SPACING, MINIMUM THREE
FASTENERS

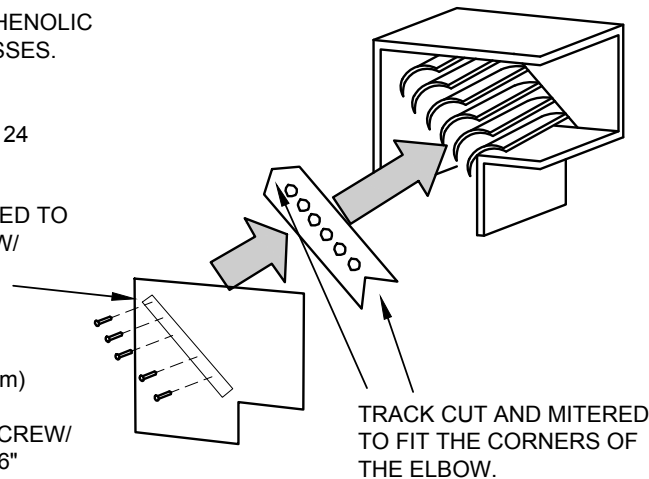


FIGURE 4-20 TURNING VANES

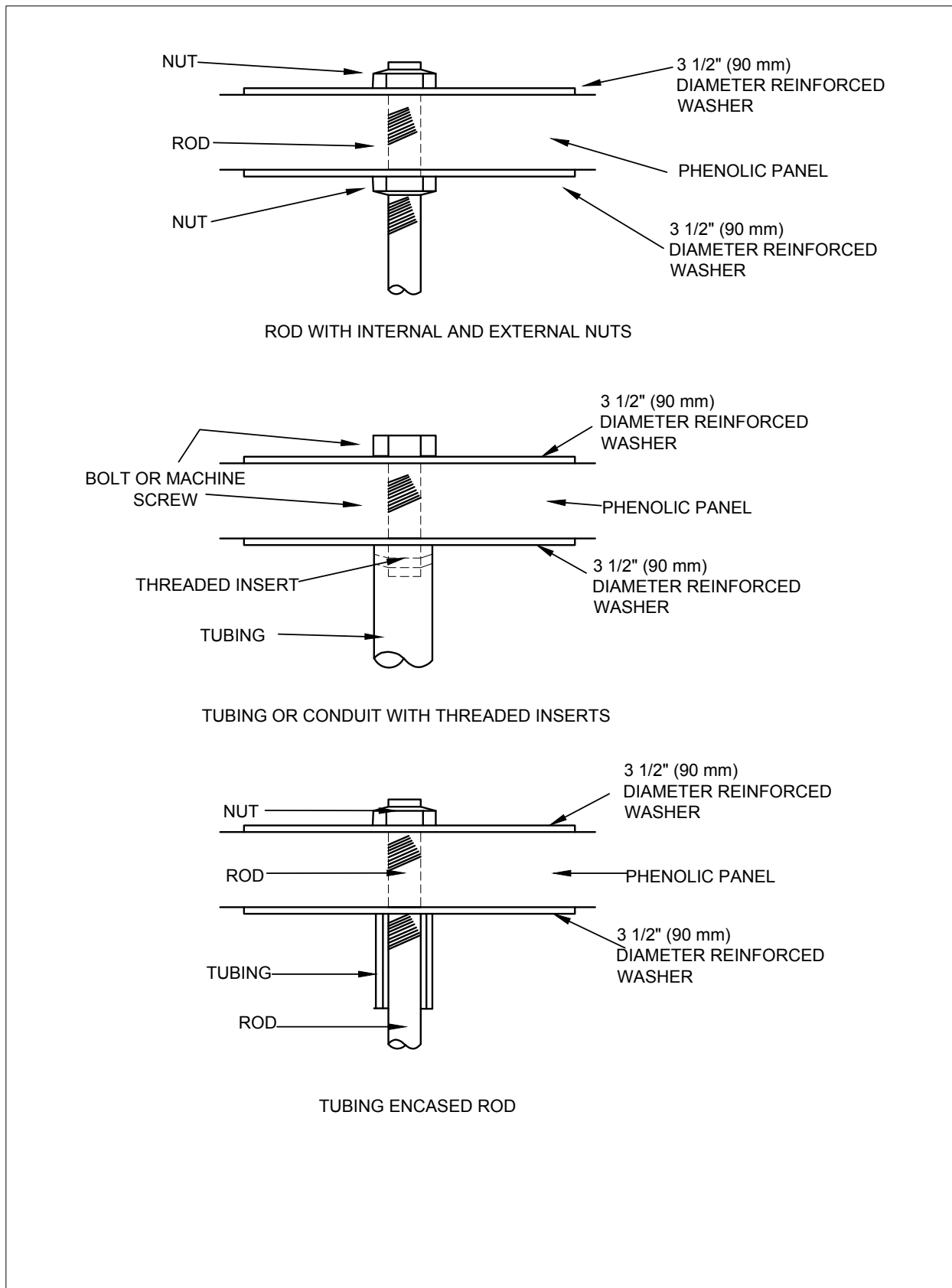


FIGURE 5-1 TIE ROD ATTACHMENTS

Dual-Tech® Measurement Guidelines

Dual-Tech® Measurement Guidelines:

- Pieces are fabricated based off I.D. dimensions.
- Straights can be fabricated up to 98.5" (8'-2 1/2") long not greater than 38" in width or height (ID).
- Straights can be fabricated up to 46.5" (3'-10 1/2") long greater than 38" in width or height (ID).
- Fittings (Elbows, Radius Elbows, Offsets, Etc.) are fabricated with a 6" leg on each side
- Radius elbow / radius 45° throat radius minimum of 8" to I.D.
- Typical transitions are fabricated with a 6" leg on each side, typically 24-36" total length (based on transition severity).
- Shoe taps min. length 15" from O.D. of ductwork
- **DUCT ORIENTATION IS REQUIRED WITH A CLEARLY MARKED "TOP" AS TO FABRICATE THE PROPER WATERSHED.**

Support Notes:

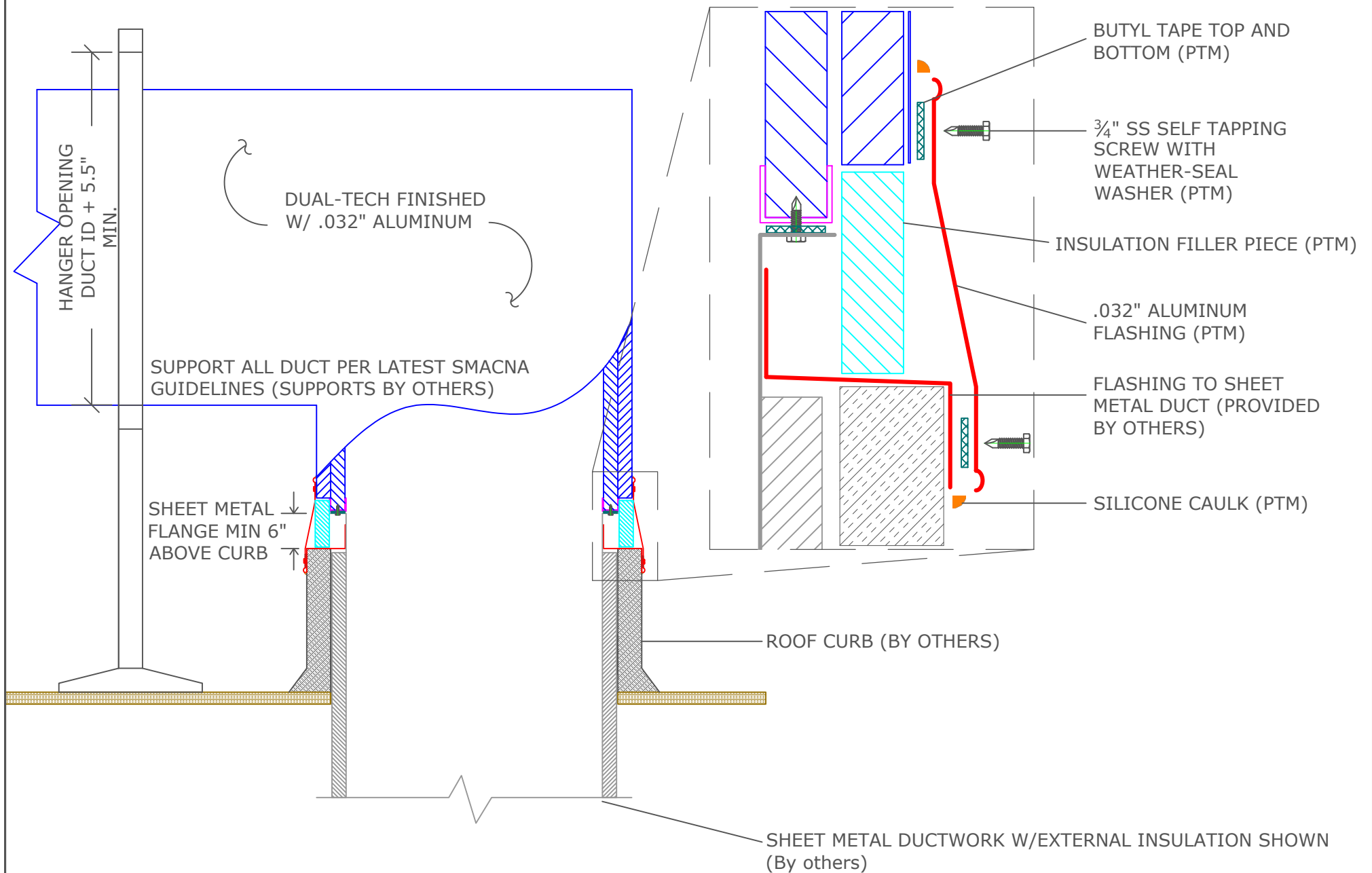
- See SMACNA's "HVAC Duct Construction Standards – Metal and Flexible".
- Hanger/support type per specifications and/or SMACNA's "HVAC Duct Construction Standard – Metal and Flexible".

General Notes:

- **Customer to provide layout drawings and piece list for fabrication.**
- Dual-Tech® material must be protected from the elements until installation.
- Opposed blade dampers if required to be supplied by the customer for PTM installation. If the use of opposed blade dampers was not noted on the bid drawings used, then an additional charge may apply.
- **Ductwork will be fabricated per SMACNA's "Phenolic Duct Construction Standards", Kingspan Insulation certified fabrication standards, and strict PTM Manufacturing guidelines.**
- [>Field Installation Video Link<](#)

Delivery:

- Based on size of duct, approximately 150 pieces maximum can be delivered via one 53' tractor trailer.



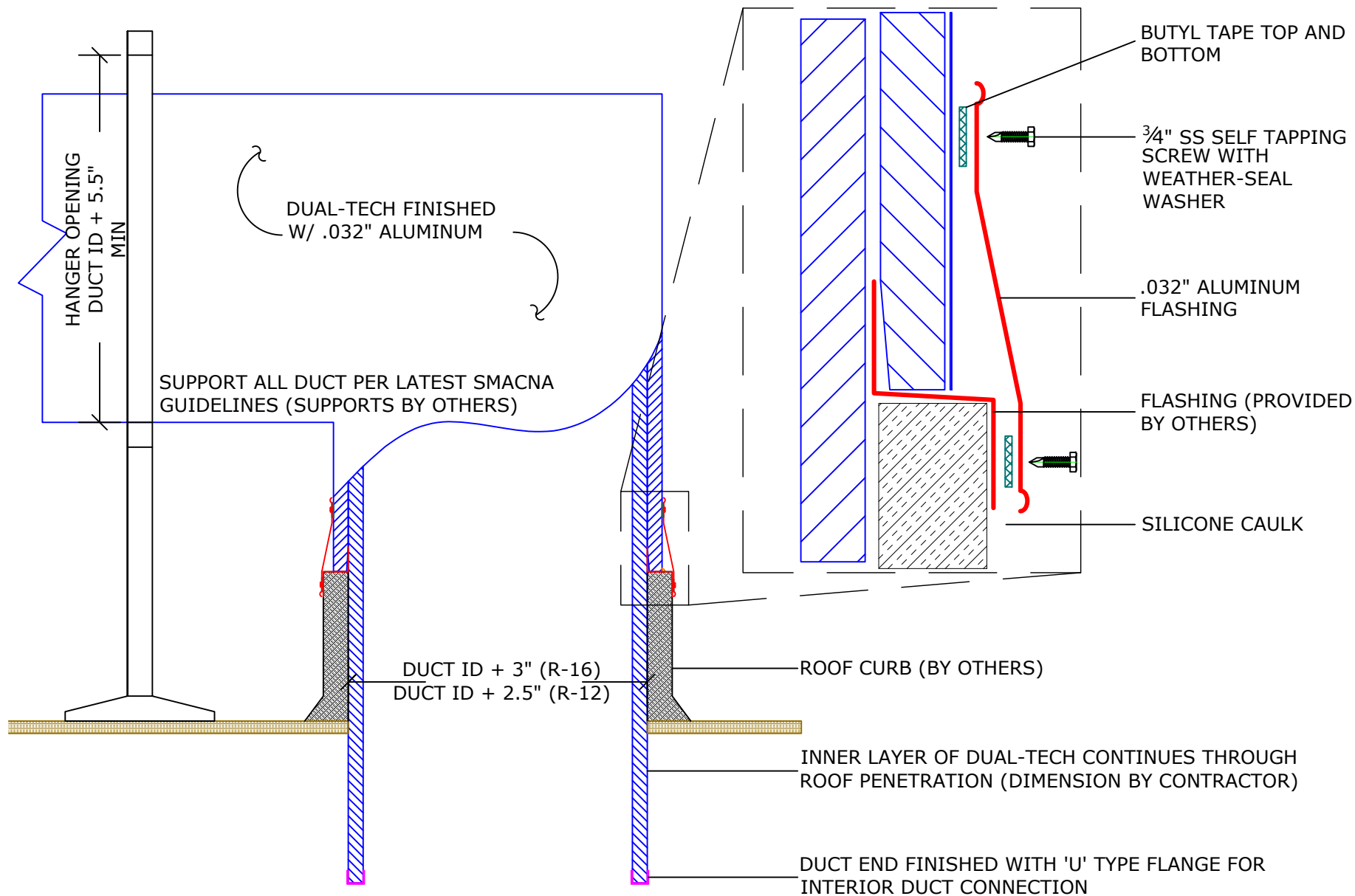
NOTE: MATERIALS SUPPLIED BY PTM MANUFACTURING UNLESS NOTED OTHERWISE

Dual-Tech Curb Detail

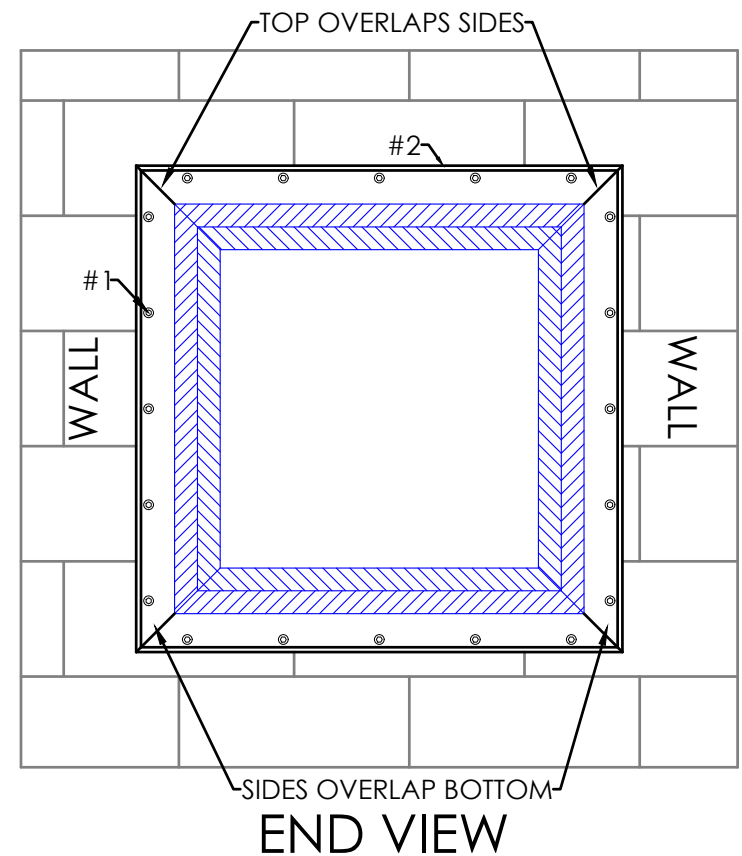
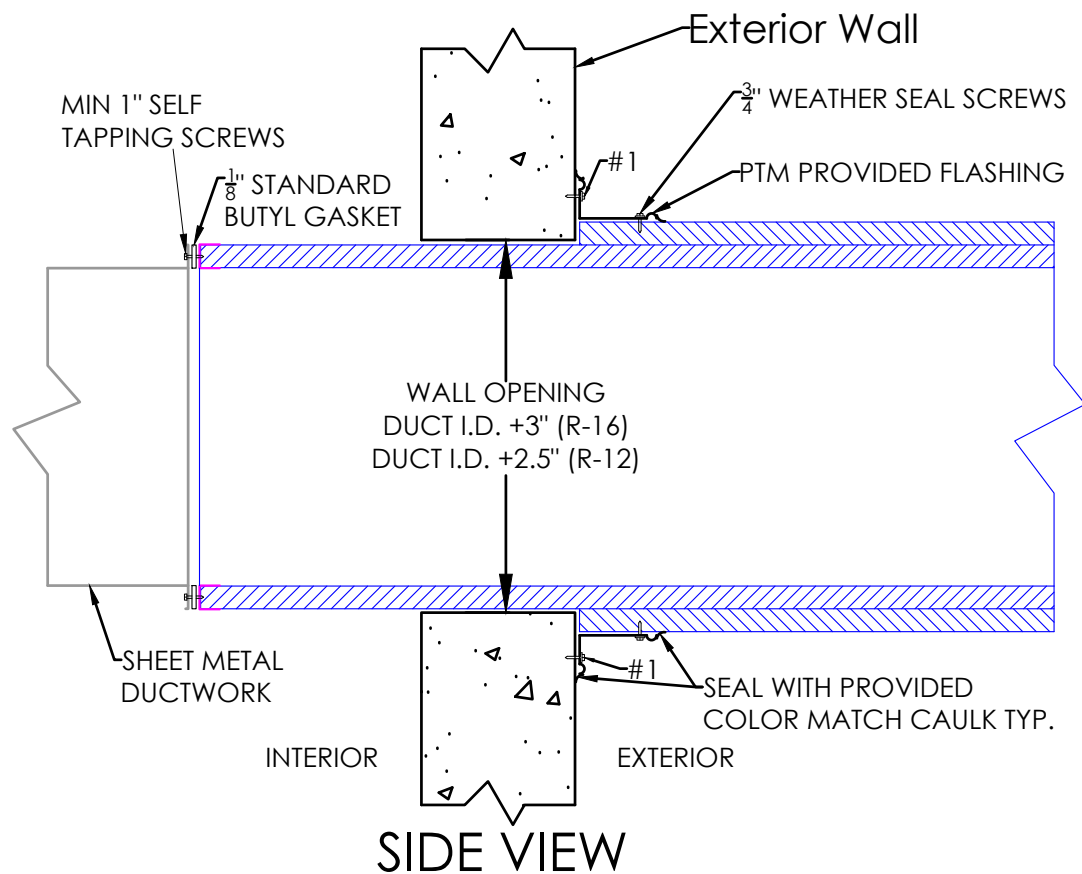
PTM Manufacturing, LLC - 196 Quigley Blvd. New Castle, DE 19720
PH: 302-455-9733 PH: 800-455-1402 FX: 302-454-9021

REV.	DATE	COMMENT
0	2015-04	No Scale
1	2018-05	Flange Above Curb Option

DT-02



NOTE: MATERIALS SUPPLIED BY PTM MANUFACTURING UNLESS NOTED OTHERWISE



NOTES:

#1: INSTALLER SHALL UTILIZE APPROPRIATE FASTENERS FOR SUBSTRATE

#2: BEADED FLASHING (PTM PROVIDED) TO BE INSTALLED IN A WATERSHED FASHION PER PTM GUIDELINES

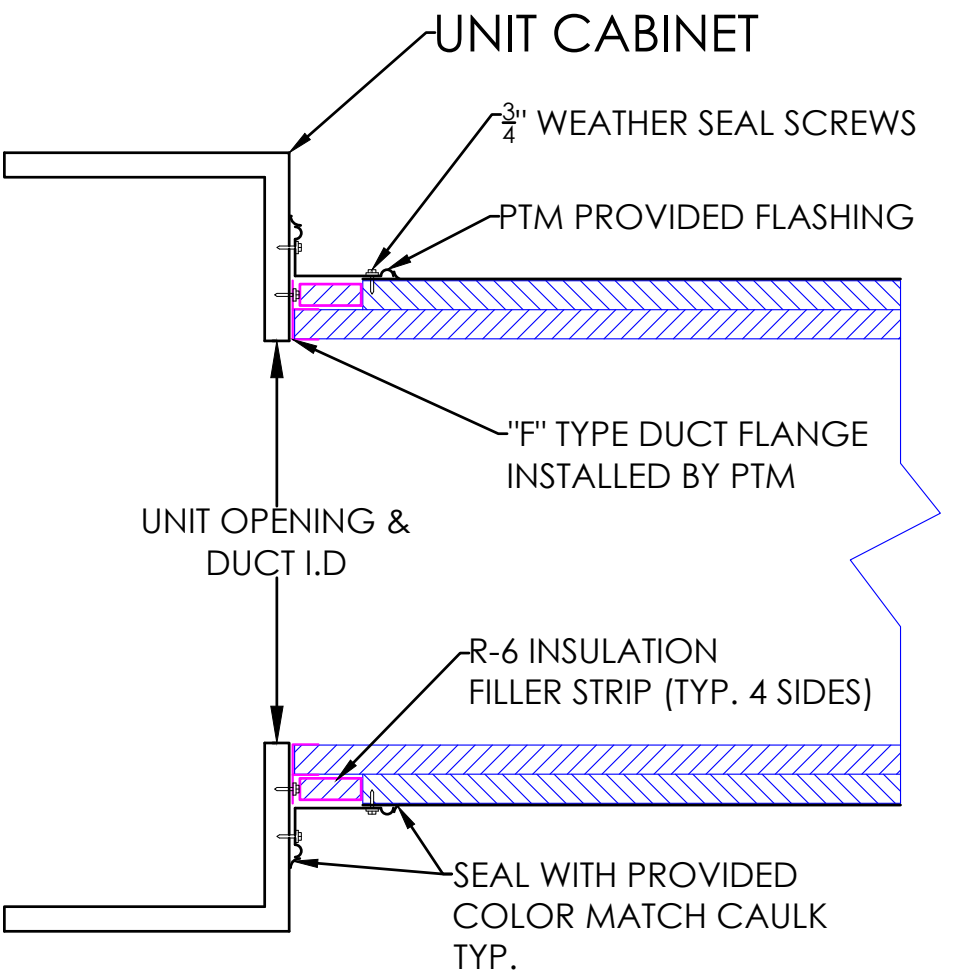
DUAL-TECH WALL PENETRATION DIAGRAM



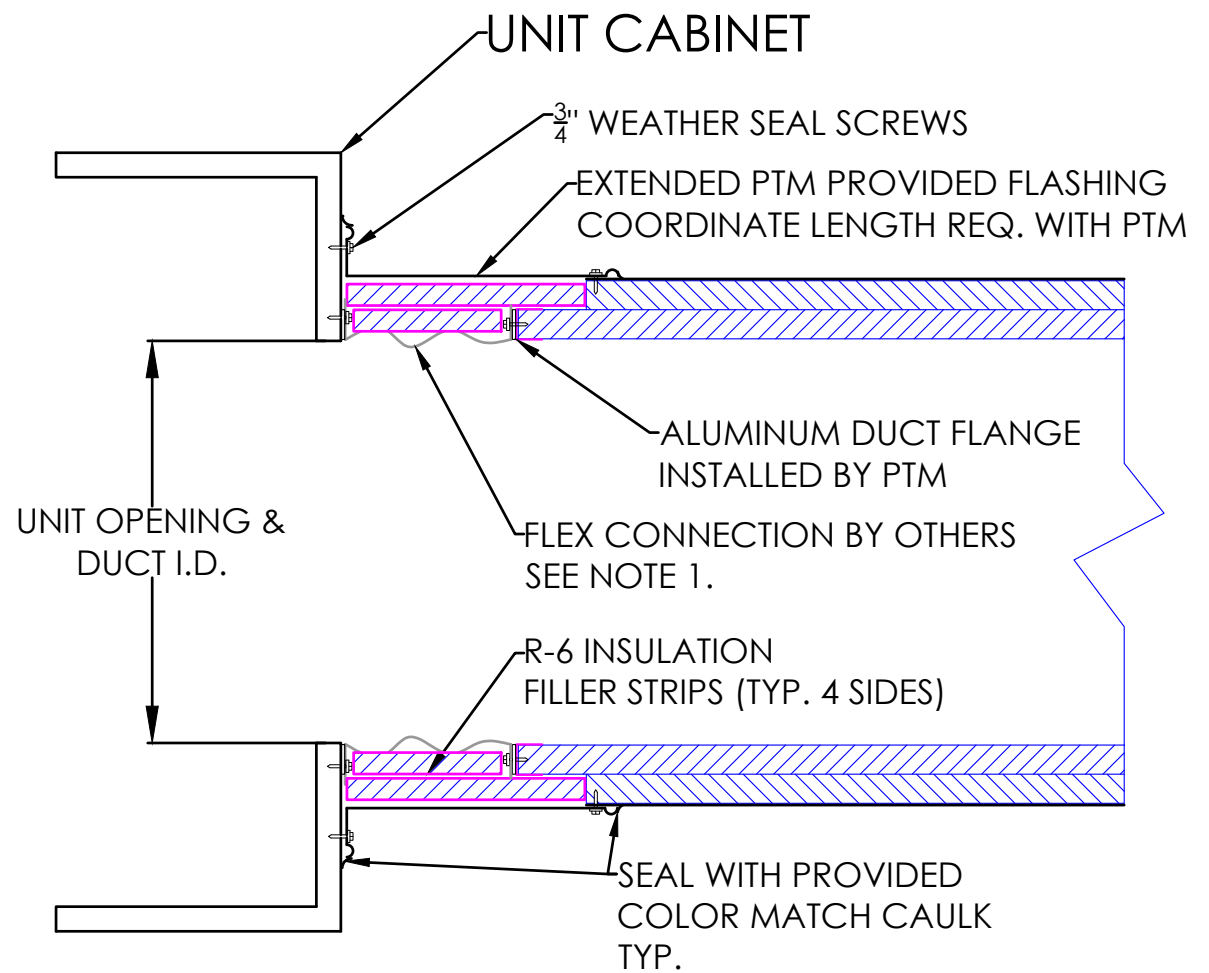
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Rev. 4/20/2021

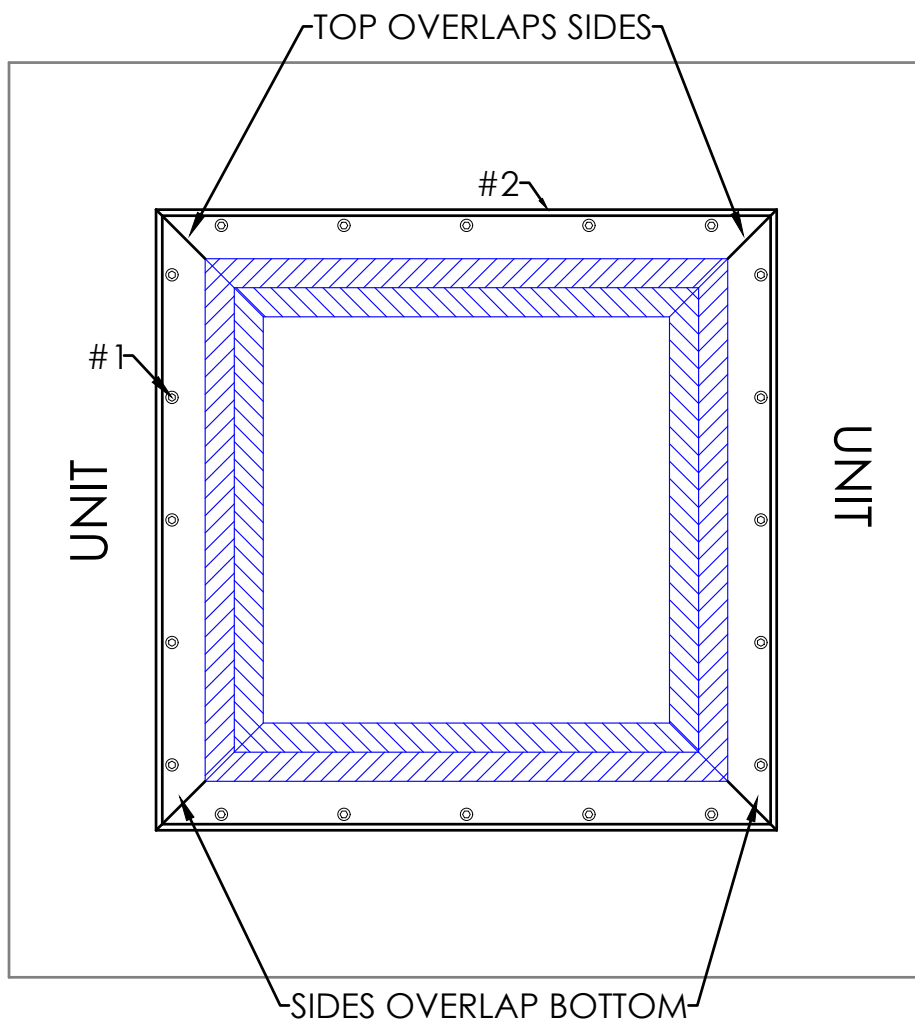




**SIDE VIEW
HARD CONNECTION TO UNIT**




**SIDE VIEW
FLEX CONNECTION TO UNIT**

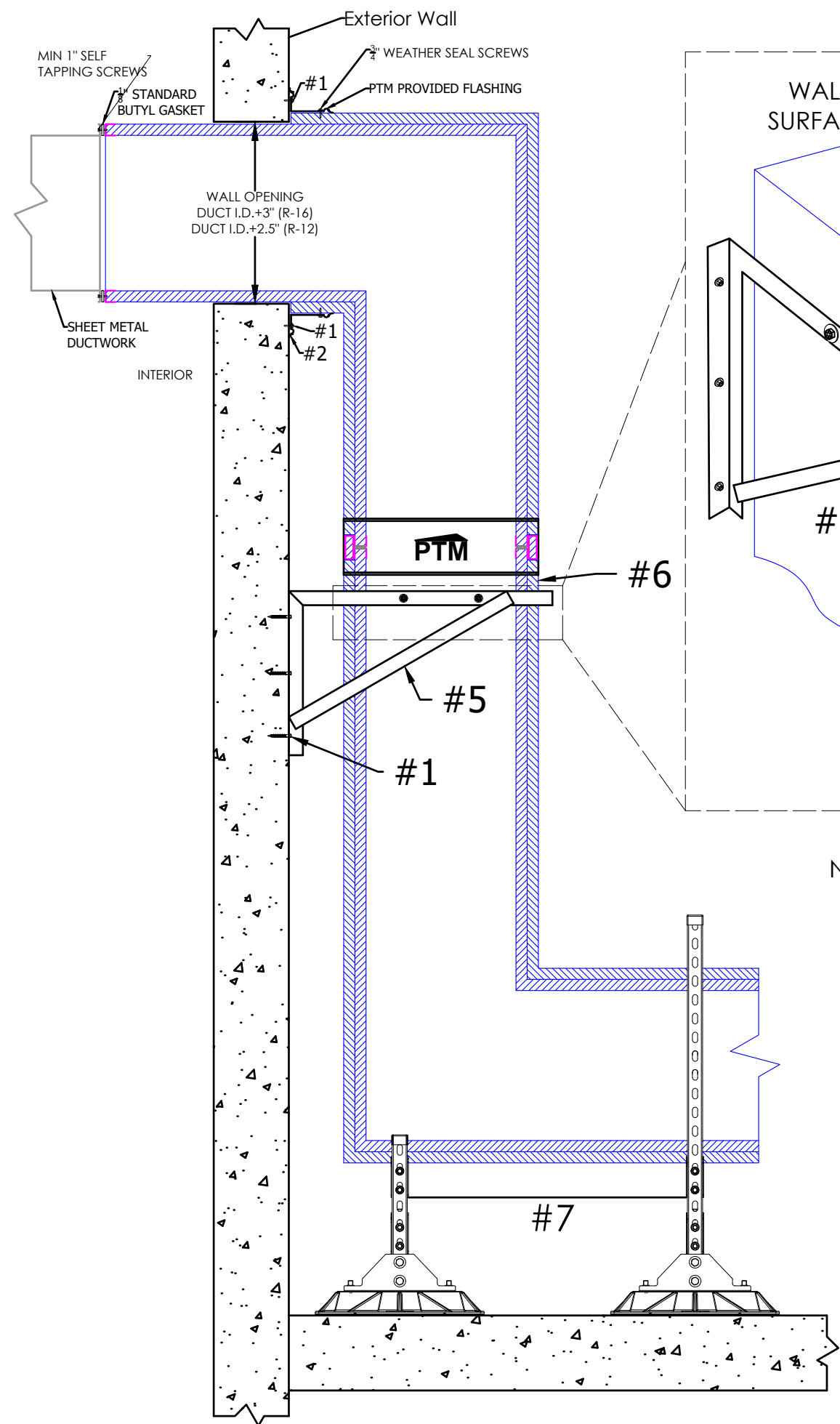


END VIEW

- NOTES:
- #1: FLEX CONNECTION (BY OTHERS) TO HAVE TDC FLANGE ENDS. BUTYL GASKET SHALL BE USED BETWEEN DUAL-TECH AND TDC FLANGE.
 - #2: BEADED FLASHING (PTM PROVIDED) TO BE INSTALLED IN A WATERSHED FASHION PER PTM GUIDELINES

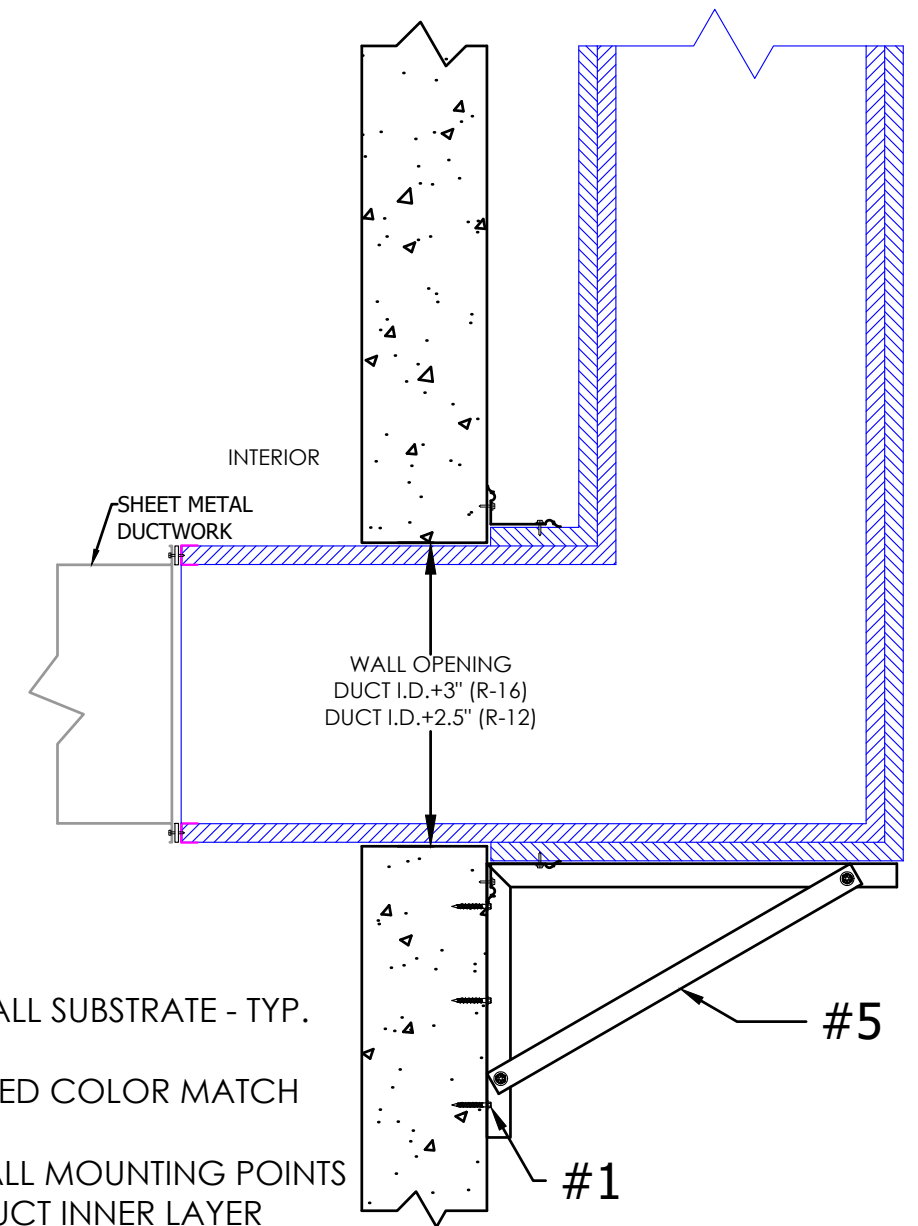


DUAL-TECH UNIT TIE-IN DIAGRAM	
	196 Quigley Blvd. New Castle, DE 19720 (302) 455-9733
	Rev. 4/20/2021



NOTES:

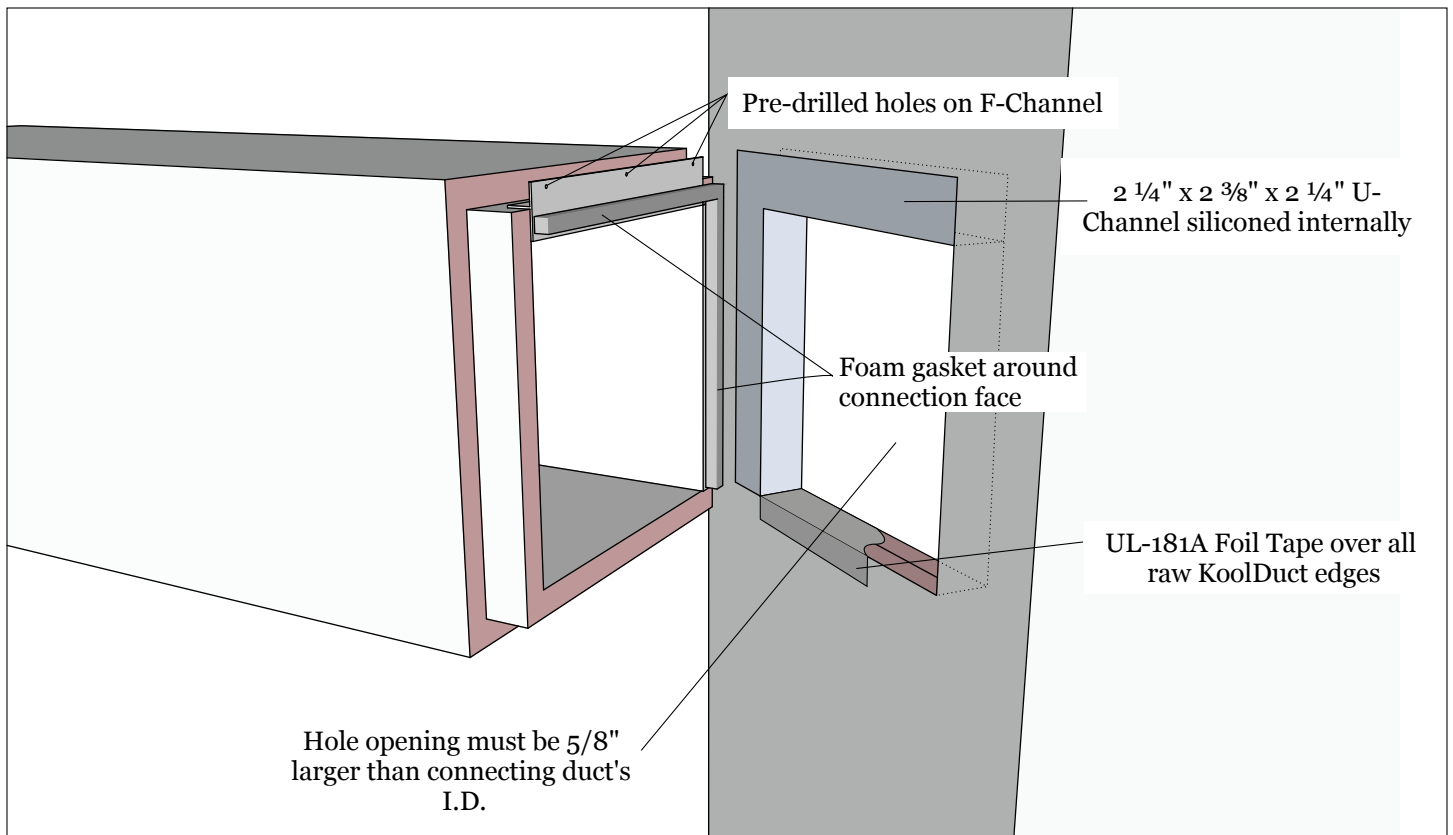
- #1. INSTALLER SHALL UTILIZE APPROPRIATE FASTENERS FOR WALL SUBSTRATE - TYP. ALL MOUNTING POINTS
- #2. SEAL ALL BAND AND FLASHING EDGES WITH PTM PROVIDED COLOR MATCH CAULK (TYP.)
- #3. MIN 3/8"-16, 3-1/2" LONG HEX BOLT WITH WASHERS TYP. ALL MOUNTING POINTS
- #4. .050" AL PLATE WITH CORNERS BENT TO BITE INTO KOOLDUCT INNER LAYER
- #5. MIN 1-1/2" X 1-1/2" WELDED ANGLE STEEL PER SMACNA
- #6. POSITION SUPPORT TO LAND JUST BELOW DUCT CONNECTION TO BE ABLE TO REACH THROUGH BOLTS FOR .050" AL PLATE INSTALLATION (SEE NOTE #4)
- #7. NON-PENETRATING SUPPORTS SIMILAR TO MIRO INDUSTRIES DS SERIES. SPACING AS REQUIRED BY SMACNA HVAC DUCT CONSTRUCTION STANDARDS
- #8. WELDED ANGLE SUPPORT TO ENCLOSE DUCT ON ALL 3 SIDES. SEE NOTE 5 FOR SIZING.



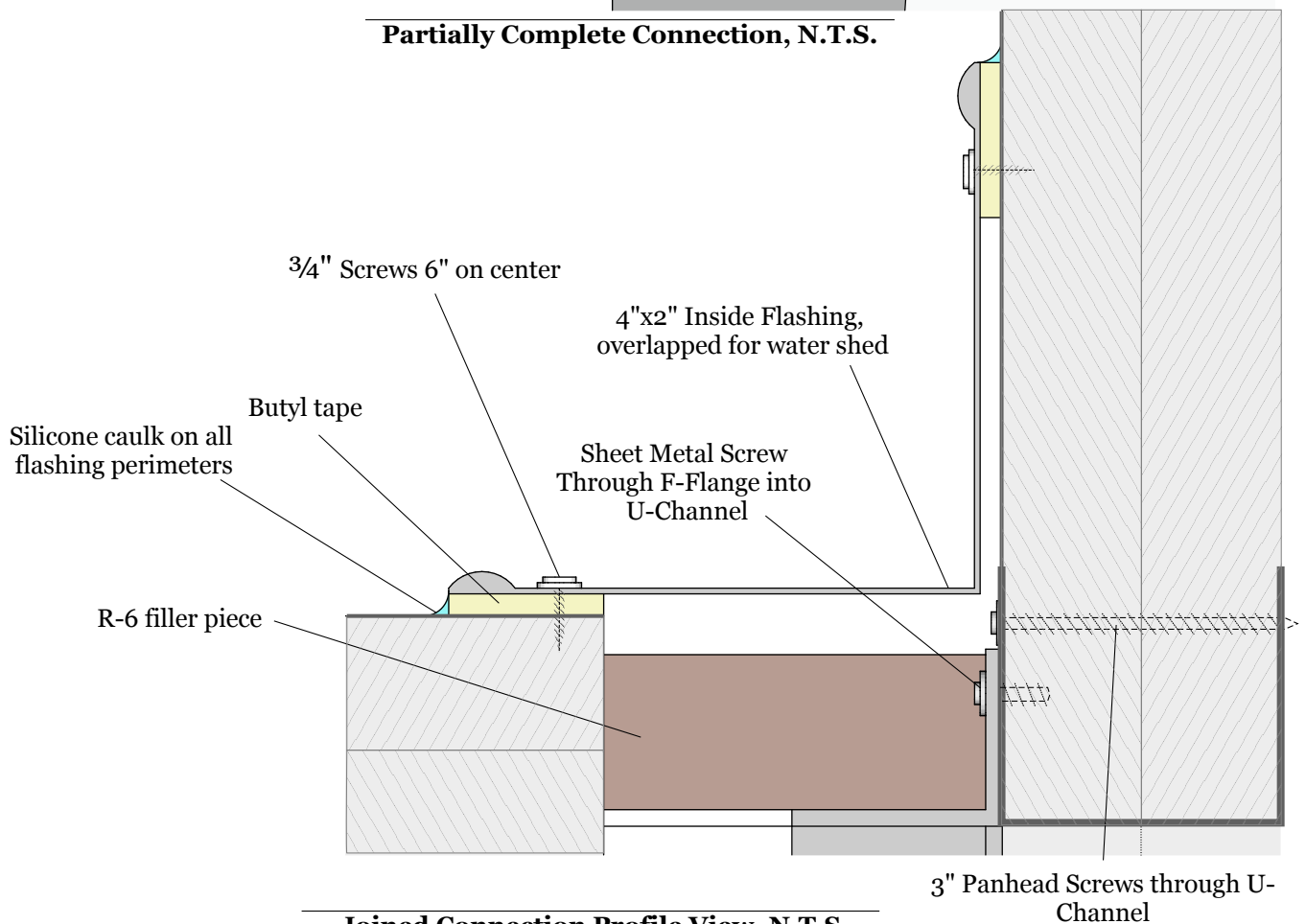
DUAL-TECH EXTERIOR RISER DIAGRAM



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Partially Complete Connection, N.T.S.



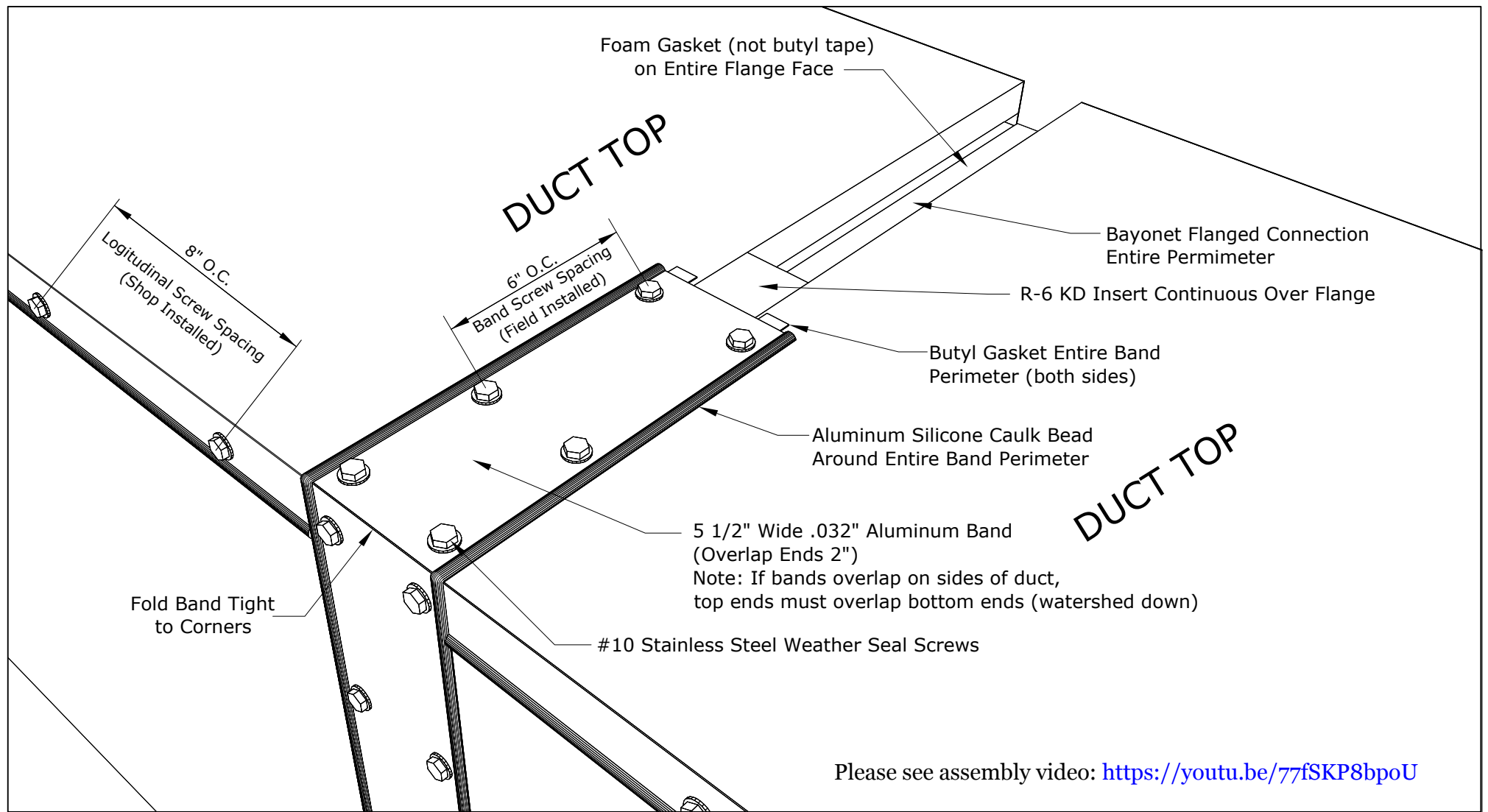
Joined Connection Profile View, N.T.S

Dual-Tech Tap-In Detail

PTM Manufacturing, LLC - 401 Bellevue Road - Newark, DE 19713
 PH: 302-455-9733 TF: 800-455-1402 FX: 3602-454-9021

REV.	DATE	COMMENT
0	2014-12	No Scale
1	2017-11	No Scale

DT-01



DualTech Isometric Diagrams/988.png PTM MANUFACTURING, LLC 401 Bellevue Road Newark, DE 19713 800-455-1402 http://www.ptmmanufacturing.com	Dual-Tech Joint Detail Cut-Away View	REVISIONS	CHECKED BY: JA	DT 1
		YYYY/MM/DD	REMARKS	
		1 2017/10/2	VIDEO LINK UPDATE	

SECTION 23 XX XX
VENTILATION DUCTS
NON-FIBROUS, CLOSED CELL, EXTERIOR DUCTWORK AND INSULATION SYSTEM

PART 1 - PRE-MANUFACTURED DOUBLE LAYER PRE-INSULATED EXTERIOR DUCTWORK (BASIS OF DESIGN)

1.1 SUMMARY

- A. Section Includes:
 - 1. Dual-Tech®, ducts and fittings by PTM Manufacturing LLC. 800-455-1402
www.ptmmanufacturing.com
- B. This section does not include:
 - 1. Air passages rated over a continuous internal static pressure of 4" w.g. positive, 3" w.g. negative.
- C. PTM Manufacturing, LLC may be referred to as "PTM" herein

1.2 REFERENCES

- A. ASTM International (ASTM):
 - 1. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
 - 1. ASHRAE Design Fundamentals Handbook.
 - 2. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. National Fire Protection Association (NFPA):
 - 1. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - 2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - 1. SMACNA HVAC Air Duct Leakage Test Manual
 - 2. 2015 SMACNA Phenolic Duct Construction Standards
 - 3. SMACNA HVAC Duct System Design Manual.
- E. Underwriters Laboratories (UL):
 - 1. UL 181 - Standards for Factory Made Air Ducts and Air Connectors.
 - 2. UL 723 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Physical properties, performance criteria, and product limitations.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- B. Shop drawings: including plans, elevations, sections, components, and attachments to other work including.
 - 1. Duct layout indicating sizes and pressure classes.
 - 2. Elevation of ducts.
 - 3. Dimensions of main duct runs from building grid lines.
 - 4. Fittings.
 - 5. Penetrations through fire-rated and other partitions.
 - 6. Location of internal and external duct components such as dampers, smoke detectors, alarms, etc.

- C. Coordination Drawings: Plans drawn to scale showing coordination of general construction, building components, and other building services.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Dual-Tech® can be installed by competent trained field mechanics who demonstrate competence in the HVAC industry and have been Trained by PTM or a certified PTM sub-distributor on proper installation of Dual-Tech®.

1.5 SPECIFICATION COMPLIANCE

- A. Duct Leakage Class, follow SMACNA Leakage Class 3 or less.
- B. Dual-Tech® shall incorporate a Kingspan KoolDuct® fortified inner layer compliant to UL (C-UL) 181 Standard for Safety Listed, Class 1 system, with included testing and passing the following:
 - 1. Test for Surface Burning Characteristics
 - 2. Flame Penetration Test
 - 3. Burning Test
 - 4. Mold Growth and Humidity Test
 - 5. Low Temperature Test and High Temperature Test
 - 6. Puncture Test
 - 7. Static Load Test
 - 8. Impact Test
 - 9. Pressure Test and Collapse (negative pressure) Test
 - 10. High Temperature and Humidity for 90 days
 - 11. Cone Calorimeter
 - 12. ASTM E2257 Standard Test Method for Room Fire Test of Wall and Ceiling Materials and Assemblies
 - 13. ASTM E 84 tested, Tunnel Test, does not exceed 25 flame spread, 50 smoke developed.
 - 14. DW144, Class B
 - 15. NRTL product approval, (Subpart S of 29 CFR Part 1910, OSHA)
 - 16. ASTM C 423 noise reduction
 - 17. ASTM C 423 noise reduction
 - 18. ASTM E 96/E 96M Procedure A for permeability
 - 19. ASTM C 1071 for erosion
 - 20. ASTM C 518: 2004, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 - 21. UL 723, Test for Surface Burning Characteristics of Building Materials
 - 22. NFPA Compliance:
 - a. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems"
 - b. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems"
 - c. NFPA 255, "Standard Method of Test of Surface Burning Characteristics of Building Materials"
- C. Dual-Tech® outer shell shall be COOLR KYNAR 500® finished .032" thickness aluminum architectural sheet metal. Standard color to be "Regal White" with 25 additional colors available upon request or otherwise specified herein.
 - 1. Aluminum standards:
 - a. ASTM B 209
 - b. 3105-H24 alloy and temper
 - 2. KYNAR Painted Finish Standards:
 - a. ASTM D 968, Method A – Abrasion / Falling Sand
 - b. ASTM D 4587 & ASTM G 154 – Accelerated Weathering
 - c. ASTM D 3359, Method B – Adhesion of Coating by Tape Test
 - d. ASTM D 1308 – Chemical Pollution
 - e. ASTM B 117 – Salt Spray
 - f. ASTM D 5894 – Cyclic Salt Fog UV

- g. ASTM G 7 – Exterior Durability
- h. ASTM D 4145 – Flexibility T-Bend
- i. ASTM D 522 – Formability
- j. ASTM D 4585 – Humidity, Cleveland Condensing
- k. ASTM D 2247 – Humidity
- l. ASTM D 2794 – Impact Resistance
- m. ASTM D 3363 – Pencil Hardness
- n. ASTM D 523 – Specular Gloss
- o. ASTM E 84 – Surface Burning
- p. ASTM D 1735 – Water Resistance of Coating using Fog Apparatus
- q. ASTM D 822, G152 & G153 – Weatherometer

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prevent objectionable aesthetic damage to the outer surface of duct segments during transport and storage.
- B. Store duct segments under cover and protect from excessive moisture prior to installation.

1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by the manufacturer for optimum results. Do not install products under environmental conditions outside of manufacturer's recommended limits.

PART 2 - PRODUCTS

2.1 DUAL-TECH® RECTANGULAR DUCT AND FITTINGS

- A. KoolDuct® Panel Manufacturer:
 - 1. Kingspan Insulation LLC, 2100 Riveredge Pkwy. Suite 175; Atlanta, GA 30328; (800) 241-4402; www.kingspaninsulation.us
- B. Dual-Tech® Ductwork Supplier:
 - 1. PTM Manufacturing, LLC. New Castle, DE 19720. (800) 455-1402. www.ptmmanufacturing.com
- C. Substitutions: Not Permitted.

2.2 PRE-INSULATED DUAL-TECH® HVAC DUCTWORK SYSTEM

- A. Pre-Insulated double layer HVAC Ductwork System: Provide PTM Dual-Tech® Ductwork System for supply, return, fresh, and exhaust air ductwork as shown on the Drawings. System shall include panels, fabrication methods, coupling systems, and accessories to provide a complete system to meet the following performance criteria:
 - 1. Classification: UL Listed as a Class 1 Air Duct, to UL 181, NFPA 90A and NFPA 90B
 - 2. 2015 SMACNA Phenolic Duct Construction Standards
 - 3. Fire and Smoke Performance when tested in accordance with ASTM E84 or UL 723:
 - a. Flame Spread: <=25
 - b. Smoke Developed: <=50
 - 4. Materials: CFC/HCFC free, zero Ozone Depletion Potential (ODP), fiber-free rigid thermoset phenolic insulation core faced with 1 mil low vapor permeability aluminum foil reinforced with glass scrim. Foil is branded on inside of duct and plain on the outer facing.
 - 5. Nominal Density: 3.4 to 3.75 pcf (55 to 60 kg/m3).
 - 6. Permeability: 0.00 perms maximum when tested according to ASTM E 96/E 96M, Procedure A.
 - 7. Closed Cell Content: minimum 90 percent
 - 8. Compressive Strength: Minimum 29 psi (200 kPa) at 10 percent compression.
 - 9. Air Leakage: SMACNA Air Leakage Class 3.

10. Mean Air Velocity: Maximum 5000 fpm (25.4 m/s) with all joints sealed.
 11. Design Pressures:
 - a. Positive Pressure: Maximum 4-inch w.g. (1000 Pa).
 - b. Negative Pressure: Maximum 3-inch w.g. (750 Pa).
 12. Noise-Reduction Coefficient: 0.05 minimum when tested according to ASTM C 423, Mounting A.
 13. Commissioning Pressures - As designed, max commissioning 4-inch w.g. (1000Pa.).
 14. Temperature Range: Internal air temperature range -15 to 185 deg. F (-26 to 85 C) during continuous operation, inside ducts or ambient surrounding temperature.
 15. Thermal Resistance of individual KoolDuct® panels used in Dual-Tech® construction:
 - a. 7/8 inch (22 mm) thick, R 6.0 square feet per hour F/Btu (1.047 square meter K/W).
 - b. 1-3/16 inch (30 mm) thick, R 8.1 square feet per hour F/Btu (1.428 square meter K/W).
 16. Thermal Conductivity: at 50 to 74 deg. F (10 to 23 deg C), mean 0.146 Btu inch per square foot per hour deg. F (0.021 W/m K) per ASTM C518.
 17. Dual-Tech® Configuration: Rectangular.
 18. The standard assembly is an inner layer of R-8.1 at 1 3/16" Kingspan KoolDuct® panel with a second layer of R-8.1 insulation material. Total thickness approximately 2 1/2" at R-16.2 thermal rating shall be utilized unless indicated otherwise on drawings or schedules.
- B. Available Dual-Tech® Ductwork R-Values:
- a. 1 3/4" Double layer: R-12
 - b. 2 3/8" Double layer: R-16.2
 - c. 2 7/8" Triple layer: R-20
 - d. 3 1/2" Triple layer: R-24
 - e. Elastomeric foam liner available upon request
- C. Air stream Duct Construction:
1. Ductwork to be fabricated per SMACNA 2015 "Phenolic Duct Construction Standards" in combination with Kingspan Insulation certified fabrication standards.
 2. Duct Connections.
 - a. Factory Manufactured all Aluminum Grip Flange.
 - 1) Grip flange
 - 2) F-flange
 - 3) H-flange
 - 4) U-flange
 - b. All flanged connections shall have a continuous strip of Kingspan foam gasket material as per installation guidelines.
- D. Weathertight Triple Seal Joint System: to be installed per PTM installation guidelines.
1. Step #1) All aluminum grip coupling systems shall have a continuous strip of foam gasket material as per installation guidelines. Foam to be overlapped a minimum of 1" to ensure a complete seal.
 2. Step #2) Insulation filler piece field cut to length, 6" wide beaded flashing enclosure field cut to length, Attach 3/4" x 1/8" Butyl Gasket to 6" beaded flashing closure on full lengths parallel to bead, both sides.
 3. Step #3) Fasten 6" wide beaded flashing utilizing #10 304 Stainless Steel self-tapping screws painted to match jacket color with weather seal washers installed on 6" centers. Screw placement to be per PTM installation manual. RTV Silicone Sealant to be used on all circumferential and vertical seams.

NOTE: All joint system components shall be colored to match duct jacket color.

- E. Outdoor Cladding
 - 1. Dual-Tech® pre-installed outer shell shall be COOLR KYNAR 500® finished or approved equal to .032" thickness aluminum architectural sheet metal. Standard color to be "Regal White" with 20 additional colors available upon request or otherwise specified herein.
- F. Weight
 - 1. Dual-Tech® shall provide low weight stresses on the building framing and support members. Assembled Dual-Tech® shall have a standard weight of 2 lbs. per square foot per R-16.2 value.

2.3 ACCESSORIES

- A. Fittings: In accordance with SMACNA Phenolic Duct Construction Standards or the ASHRAE Design Fundamentals Handbook Chapter 35 or the SMACNA HVAC Duct Systems Design Manual.
- B. Coupling Systems:
 - 1. Aluminum Grip Coupling System.
- C. Dampers:
 - 1. Volume control dampers per 2015 SMACNA Phenolic Duct Construction Standards. Per SMACNA, dampers in any ductwork greater than 12" in either dimension are required to be an opposed blade damper.
 - 2. Fire dampers.
- D. Access Doors:
 - 1. Metal insulated access doors.
- E. Turning Vanes:
 - 1. Where indicated, turning vanes shall be used in fittings to optimize airflow characteristics.
 - 2. Turing vanes shall be 2" double wall construction 26-gauge galvanized steel mounted on corresponding 2" rail.
- F. Reinforcement Systems:
 - 1. Kingspan Reinforcement system. Spacing requirements per 2015 SMACNA Phenolic Duct Construction Standards.
 - 2. ½" or ¾" EMT conduit reinforcements. Spacing requirements per 2015 SMACNA Phenolic Duct Construction Standards.
- G. V-Groove sealant:
 - 1. Kingspan KoolDuct® sealant shall be used.
- H. Tape
 - 1. Comply with UL 181A.
 - 2. Product: Pressure-sensitive aluminum foil tape imprinted with manufacturer with UL markings, manufacturer name, and date.
 - 3. Minimum Width: 3 inch
 - 4. Water, mold, and mildew resistant.
- I. Self-Adhesive Gaskets
 - 1. Aluminum Grip Coupling System
 - a. 15mm x 15mm gasket material as directed by Kingspan shall be used when joining duct segments together.
- J. Duct Connections
 - 1. Factory Manufactured all Aluminum Grip Flange available profiles*
 - a. Grip flange*
 - b. F-flange*
 - c. H-flange*
 - d. U-flange*

*NOTE: All aluminum grip coupling systems shall have a continuous strip of foam gasket material as per installation guidelines. Foam to be overlapped a minimum of 1" to ensure a complete seal.

2.4 SHOP FABRICATION

A. Certification:

1. Ducts shall be detailed and fully factory manufactured by an authorized Dual-Tech® manufacturing facility.

B. Fabrication:

1. Fabricated joints, seams, transitions, reinforcement, elbows, branch connections, access doors and panels, along with any damage repairs must be in accordance to manufacturer's written and detailed instructions in combination with 2015 version of SMACNA Phenolic Duct Construction Standards, Kingspan Insulation's certified fabrication standards, and PTM Manufacturing, LLC patented Dual-Tech® construction methods.
2. Both positive and negative ductwork and fittings shall be constructed to incorporate a UL Listed as a Class 1 air duct to Standard for Safety UL 181 liner with an exterior cladding for permanent protection against water intrusion.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean ductwork surfaces thoroughly to ensure proper adhesion of joint system prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 DUAL-TECH® INSTALLATION

- A. Dual-Tech® can be installed by competent trained field mechanics who demonstrate competence in the HVAC industry and have been Trained by PTM or a certified PTM sub-distributor and has received a certificate of competency from PTM Manufacturing, LLC
- B. Prior to Installation
 1. Protect duct interiors from the moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."
 2. Coordinate duct layout and orientation per PTM Manufacturing, LLC "Dual-Tech® Measurement Guidelines" and standards.
 3. Duct orientation shall be strictly adhered to maintain weathertight installation.
- C. During installation
 1. A strippable film may be pre-installed to protect the finished surface during shipping, handling, and fabrication. This protective film shall be removed immediately after duct segment installation, and prior to Triple Seal Joint Flashing installation.
 2. Unit Tie-ins, Tie-ins to existing ductwork, Wall penetrations, Roof curb penetrations, Tap-ins, Boot-taps, etc. in compliance with PTM guidelines and direction.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Contractor to ensure that the ductwork system is properly and adequately supported as per SMACNA's Latest Edition of Duct Construction Standards, Metal and Flexible.
- B. Ductwork shall be supported at changes of direction, at branch duct connections, tee fittings, parallel under turning vanes and all duct accessories such as dampers, etc.
- C. The load of such accessories to the ductwork shall be neutralized by the accessory support.
- D. At no time should the exterior jacket be penetrated other than as detailed in PTM's Installation manual.

- E. Vertical runs shall be supported per SMACNA guidelines and local requirements. Coordinate with PTM to ensure warranty compliance.

3.5 FIELD QUALITY CONTROL

- A. Inspection: Arrange for manufacturer's representative to inspect completed installation and provide written report that installation complies with manufacturer's written instructions.
 - 1. Remove, replace, or repair duct system where inspection indicates that it does not comply with specified requirements.
- B. Perform additional testing and inspecting, at the Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

3.6 TESTING, ADJUSTING, AND BALANCING

- A. SECTION INCLUDES
 - 1. Testing, adjustment, and balancing of air systems as they apply to Dual-Tech®
 - 2. Manufacturer approved sealant product
 - 3. Transverse hole and repair procedure
- B. SUBMITTALS
 - 1. Once balancing agency has been selected, submit name and contact information of balancing agency to PTM Manufacturing.
- C. QUALIFYING TESTING PROCEDURE
 - 1. On projects where air quantity measurements shall be taken via Pitot tube transverse of entire cross-sectional area of duct, PTM Manufacturing approved transverse hole repair and plugging procedures shall be followed.
- D. SEALANT PRODUCT
 - 1. Polyurethane expanding foam similar to "Dow® Great Stuff™ Insulating Foam Sealant" for gaps up to 1" with UL 20/20 rating.
- E. DUCTWORK TESTING PORTS REPAIR PROCEDURE
 - 1. Prepare field created holes due to balancing testing for repair by removing loose insulation material debris.
 - 2. Insert dispensing straw of polyurethane expanding foam product no more than 2" into hole to be repaired.
 - 3. SLOWLY dispense product to fill hole and draw straw outwards as the hole is filled to ensure a complete fill.
 - 4. Immediately following fill, re-plug the filled hole with the existing balancers cap.
 - 5. If testing ports are located on the side of ductwork rather than underneath, please contact PTM Manufacturing for proper weatherproofing suggestions.

3.7 DUCT SCHEDULE

- A. Outdoor Ducts and Fittings:
 - 1. Dual-Tech® Rectangular Ducts and Fittings:
 - a. Standard duct thickness: R-16.2, 2-3/8"
 - b. Standard cladding: Dual-Tech® outer shell shall be COOLR KYNAR 500® finished .032" thickness aluminum architectural sheet metal. Standard color to be "Regal White".

END OF SECTION