SECTION 03 46 13 – CONCRETE SANDWICH PANEL CONSTRUCTION

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*This document is intended as a stand-alone specification in CSI 3-Part format ("MasterFormat") or as a resource for supplementing a broader-scope specification for traffic coatings.*

*Specifier should* *[enable](#Hidden_On" \o "File>Options>Display>Always Show On Screen (check \"Hidden Text\")) "Hidden Text" feature while editing and* *[disable](#Hidden_Off" \o "File>Options>Display>Printing Options (uncheck \"Hidden Text\")) feature before printing. Hidden text displays in* blue *and gives guidance to the specifier ("Editor's Notes").*

*Bold text in brackets* [**sample**] *indicates a choice to be made; refer to editor's notes for guidance.*

*Metric units are in red font and in parentheses* (sample)*; these may be retained or deleted.*

*For specification questions, email:* [Specifications@DaytonSuperior.com](mailto:Specifications@DaytonSuperior.com)

*For technical assistance, contact Dayton Superior Technical Services: (866) 329-8724*

[www.DaytonSuperior.com](http://www.daytonsuperior.com/)

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Double-click the icons below for additional technical information on P24 Delta Tie:

 

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles and/or numbers may vary.

1. GENERAL
   * + 1. SUMMARY
          1. Section includes thermally improved, reinforced polymer resin structural wythe connectors and insulation materials for constructing insulated sandwich panels for [**tilt-up**] [**precast**] concrete walls.

Select either composite or non-composite action below. Degree of composite action depends on connector type and spacing. See Dayton Superior's *P24 Delta Tie* Technical Data Sheet for guidance.

* + - * 1. Wythe connectors specified herein are intended to provide [**composite**] [**non-composite**] action between wythes under lateral loading.
      1. RELATED SECTIONS

Edit below list to reflect Project specifications data location.

* + - * 1. The following Sections contain information related to this Section:

Section 03 20 00 – Concrete Reinforcing: Structural reinforcement for sandwich panel construction.

Section 03 30 00 – Cast-in-Place Concrete: General requirements for forming, reinforcing, placing, curing, and finishing concrete slabs, including sampling, testing, and placing procedure requirements.

Section 03 40 00 – Precast Concrete: General requirements for plant precast concrete panels.

Section 03 47 13 – Tilt-Up Concrete: General requirements for site cast tilt-up concrete panels.

* + - 1. REFERENCES
         1. American Society of Testing and Materials (ASTM):

ASTM C 209 – Standard Test Methods for Cellulosic Fiber Insulating Board.

ASTM C 518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

ASTM C 578 – Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

ASTM C 881 – Standard Specification for Epoxy-Resin-Bonding Systems for Concrete.

ASTM C 1289 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

ASTM D 5930 – Standard Test Method for Thermal Conductivity of Plastics by Means of a Transient Line-Source Technique.

ASTM D 7705 – Standard Test Method for Alkali Resistance of Fiber Reinforced Polymer (FRP) Matrix Composite Bars used in Concrete Construction.

ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials.

ASTM E 119 – Standard Test Methods for Fire Tests of Building Construction and Materials.

ASTM E 488 – Standard Test Method for Strength of Anchors in Concrete and Masonry Elements.

* + - * 1. National Fire Protection Association (NFPA):

NFPA 285 – Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

* + - 1. PREINSTALLATION MEETINGS
         1. Preinstallation Conference: Conduct conference at [**Project site**] <**Insert location**>.

Edit list of conference participants if necessary.

* + - * 1. Review concrete slab mix design and placing and finishing procedures, and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with concrete slab work to attend, including the following:

Contractor’s superintendent.

Concrete subcontractor/finisher.

Wythe connector/insulation installer, if different from concrete subcontractor.

Architect's and/or Owner's representative (at their option).

Edit list of conference topics, if necessary.

* + - * 1. Review the following, at a minimum:

Schedule

Extent of Work.

Materials to be installed.

Wythe connector spacing.

Insulation thicknesses.

Installation methods and sequencing.

Material storage and staging.

Cleanup and disposal of waste materials.

* + - 1. ACTION SUBMITTALS
         1. General: Submit the following for approval. Do not proceed with work involving any action submittal until approval is obtained.
         2. Shop Drawings: Indicate wythe connector type, spacing, and orientation for each panel type. Use panel type indications and/or individual panel identification codes that match those used elsewhere in the Construction Documents.
         3. Product Data: Include material physical characteristics, storage and application instructions, precautions and safety data, cleanup, and maintenance information.

Polymer resin wythe connectors.

Insulation.

Repair material.

* + - 1. INFORMATIONAL SUBMITTALS
         1. General: Submit the following to the Owner for the Owner's information and records. If acceptable, and unless otherwise indicated, Informational Submittals will not be acted upon or returned.
         2. Safety Data Sheets (SDS) for all products used.

Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 014000 "Quality Requirements" and as may be supplemented in "Quality Assurance" Article.

* + - * 1. Qualification Data: For Installer.

Include LEED submittals Paragraph only for LEED projects; coordinate with requirements selected in Part 2 for VOC limits.

* + - * 1. LEED Submittals:

Product Data for Credit MR c4: For products of this Section having pre- and/or post-consumer recycled content.

* + - 1. DELIVERY, STORAGE, AND HANDLING
         1. Deliver materials in manufacturer's new, unopened containers, clearly labeled and dated.
         2. Store and handle materials in strict accordance with manufacturer's instructions.
         3. Store materials in dry conditions, protected from weather.
      2. FIELD CONDITIONS
         1. Environmental Limitations: Comply with industry standard recommendations when performing all concrete work, including work of this Section, in regards to inclement weather and very cold or hot conditions.

1. PRODUCTS
   * + 1. POLYMER RESIN WYTHE CONNECTORS
          1. Wythe Connectors: Two-dimensional (flat), truss-shaped, glass-fiber-reinforced polymeric resin connector.

Manufacturer: Dayton Superior Corporation

1125 Byers Road

Miamisburg, Ohio 45342

(800) 745-3700

<www.DaytonSuperior.com>

Select P24 Delta Tie (5" x 7") for insulation thicknesses up to 4" or P24XL Delta Tie (9" x 11") for insulation thicknesses over 4" up to 8".

Basis-of-Design Product: Dayton Superior "P24 Delta Tie" **["P24XL Delta Tie"**].

Physical Characteristics:

Size: Approx. 5" x 7" (12.7 cm x 17.8 cm)[**9" x 11" (22.9 cm x 28 cm)]**

Resin: Bisphenol A epoxy vinyl ester.

Alkali Resistance: Rated for continuous exposure at up to 180 deg F (82 deg C), per ASTM D 7705.

Reinforcement: Continuous 19% zirconium glass fiber.

Strand Thickness: 1.4 micron

Strand Weight: 2.4 g/m

Tensile Strength: 14 GPa

Performance Characteristics:

Composite Modulus: 8,370,000 psi (57.7 GPa).

Composite Tensile Strength: 167,400 psi (1.16 GPa).

Thermal Conductivity: 0.1447 BTU/hr/F/ft.

R = 0.576/inch (0.227/cm).

Coefficient of Thermal Expansion: 5.5 x 10-6.

Fire Resistance: ASTM E 119, 4 hr.; NFPA 285, passed.

Select one of the following paragraphs; coordinate with Division 1 requirements. If first Paragraph is retained, select appropriate Division 01 Section.

* + - * 1. Requests for substitutions will be considered in accordance with provisions of Section [**01 25 00**] [**01 60 00**].
        2. Substitutions: Not permitted.

Select from the following insulation types or add a new one. Any desired type and brand of square edge insulation may be used with the Dayton Superior Delta Tie wythe connectors. Insulation does not require special preparation. Any insulation thickness up to 8" can be accommodated.

* + - 1. INSULATION
         1. Rigid Extruded Polystyrene Board Insulation: Unfaced extruded expanded polystyrene board insulation, complying with ASTM C 578, Type IV; square edge.

Thermal Resistance: R = 5.0/inch, min. @ 75 deg F (1.97/cm @ 23.9 deg C), per ASTM C 518.

Compressive Strength: 25 psi (172 kPa), per ASTM D 621.

Water Absorption: 0.3%, max., per ASTM C 209.

Water Vapor Permeance: 1.5 perms, max., Per ASTM E 96.

Thickness: As indicated <**Choose Thickness**>.

Coordinate insulation board width with connector spacing/composite action requirements.

Board Width: 24 inches (61 cm) [**48 inches (122 cm)**].

* + - * 1. Faced Rigid Cellular Polyisocyanurate Board Insulation: Polyisocyanurate foam core insulation board with aluminum or composite aluminum/polyester facers on both sides, complying with ASTM C 1289, Type I.

Thermal Resistance: R = 5.6/inch, min. @ 75 deg F (2.2/cm @ 23.9 deg C), per ASTM C 518.

Compressive Strength: 25 psi (172 kPa), per ASTM D 621.

Water Absorption: 0.1%, max., per ASTM C 209.

Water Vapor Permeance: 0.03 perms, max., Per ASTM E 96.

Thickness: As indicated <**Choose Thickness**>.

Coordinate insulation board width with connector spacing/composite action requirements.

Board Width: 24 inches (61 cm) [**48 inches (122 cm)**].

* + - 1. MISCELLANEOUS MATERIALS
         1. Epoxy Repair Material: Two-part, 100% solids, high modulus, medium viscosity, epoxy adhesive, complying with ASTM C 881, Type IV, Grade 2.

Basis of Design: Dayton Superior Corporation "Sure Bond J58."

1. EXECUTION
   * + 1. INSTALLATION, GENERAL
          1. Follow all manufacturer's recommendations for installing polymer resin wythe connectors.
          2. It is recommended that protective gloves be worn while handling glass-fiber-reinforced polymer materials.
       2. EXAMINATION
          1. Examine Project conditions, with Installer present, for conditions affecting performance of the Work.
          2. Verify proper placement and finishing of the lower concrete wythe.
       3. PREPARATION
          1. Concrete Conditions: Polymer resin wythe connectors must be installed within the narrow window after concrete placing and finishing, when the concrete remains plastic and prior to its initial set.
          2. Ensure that all materials necessary to install wythe connector/insulation system are readily available at the time of commencement of the installation for each concrete pour.
          3. Pre-cut insulation boards as much as possible to avoid impeding installation.
       4. INSTALLATION
          1. General: Strictly follow all manufacturer's written instructions and follow all precautions, even in case of disparity between such instructions and this specification.
          2. Wythe connector spacing is critical to the proper structural performance of the sandwich panel. Strictly follow shop drawings for spacing of the connectors.

Select spacing in paragraph below, based on engineering requirements. Contact Dayton Superior for more information.

Wythe Connector Spacing: One (1) wythe connector for every [**2**] [**4**] [**6**] [**8**] square feet ([**0.186**][**0.372**][**0.558**][**0.743**] square meters) of panel area, minimum, regularly spaced.

Wythe connectors must be oriented vertically, with respect to final panel orientation; that is, parallel with panel vertical edges.

Alternate dimensions in Paragraph below are for P24XL Delta Tie.

* + - * 1. Wythe connector may be installed horizontally or vertically, with respect to its profile, for insulation thicknesses up to 2 [**6**] inches (5.1 [**15.24**] cm), but must be installed vertically for insulation thicknesses between 2 and 4 inches (5.1 and 10.2 cm) [**6 and 8 inches** (**15.24 and 20.32** **cm**)].
        2. Lay first row of 12-inch (30.5-cm) wide insulation boards, tightly butted.
        3. Press wythe connectors into the plastic concrete. Embed connectors minimum 1-1/2 inches (3.8 cm) deep into concrete. Ensure top of connector protrudes at least 1-1/2 inches (3.8 cm) above top of insulation surface. Ensure concrete is well consolidated around connector web elements.
        4. Space connectors as indicated on shop drawings. With A/E's written approval, connector spacing/insulation board width may be adjusted, so long as the panel-area-per-connector ratio is maintained.
        5. Install next row of insulation boards tight against installed wythe connectors, then install second row of wythe connectors.
        6. First and last connectors in each row must be minimum 12 inches (30.5 cm) from edge of panel.
        7. Connector position may be adjusted slightly to avoid reinforcement or aggregate obstruction, but total number of connectors in panel and minimum embedment depth must be maintained.
        8. Continue installation sequence across panel. Install last row of connectors minimum 12 inches (30.5 cm) from opposite edge of panel.
      1. INSPECTION AND TESTING
         1. After concrete has hardened, manually test every connector's rigidity by pulling upward with a minimum force of 50 lb. (22.7 kg) on each connector. Remove and repair failed connectors.
      2. REPAIRS
         1. Remove dislodged, but rigidly embedded connectors by cutting protruding portion flush with concrete surface.
         2. Connector Replacement Procedure:

Remove insulation material around connector to allow adequate access for repair activities.

Sawcut a 1/4" (6.4 mm) groove, minimum 1-1/2" (3.8 cm) deep, full length of connector (including edge fin) plus 1/2" (13 mm).

Thoroughly clean sawcut groove with nylon bristle brush followed by flushing with compressed air, per epoxy repair material manufacturer's recommendations.

Fill groove with epoxy repair material to within 1/4" (6.4 mm) of surface.

Insert new connector, fin edge up, to ensure minimum 1-1/2" (38 mm) embedment.

Replace insulation tight to connector.

Retest wythe connector after epoxy has set.

END OF SECTION 03 46 13