

ICC-ES Evaluation Report

ESR-1112

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This report is subject to re-examination in two years.

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DIVISION: 03 00 00—CONCRETE
Section: 03 51 13—Cementitious Wood Fiber Decks

DIVISION: 09 00 00—FINISHES
Section: 09 84 00—Acoustic Room Components

REPORT HOLDER:

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EVALUATION SUBJECT:

**TECTUM I, TECTUM III AND TECTUM E ROOF DECK
 PANELS**

1.0 EVALUATION SCOPE
Compliance with the following code:

 2006 *International Building Code*® (IBC)

Properties evaluated:

- Structural
- Fire resistance

2.0 USES

Tectum I, Tectum III and Tectum E Roof Deck Panels are used for roof deck construction and as acoustical panels and suspended ceiling tiles.

3.0 DESCRIPTION
3.1 Tectum I:

Tectum I panels are composed of wood fibers impregnated and bound together into slab form with mineral cements. The panels vary in thickness from 1 inch (25 mm) to 3 inches (76 mm) and have widths up to 48 inches (1219 mm) and lengths up to 192 inches (4877 mm). Tectum I panels are available as Tectum I planks, Tectum I long-span planks and Tectum I roof tiles. Tectum I planks have 1/2-inch (13 mm) tongues and grooves on the long edges.

Long-span Tectum I planks have tongue-and-groove edges on long edges and incorporate 3/4-inch-deep-by-1/2-inch-wide (19 mm by 13 mm) or 1 1/2-inch-deep-by-1/2-inch-wide (38 mm by 13 mm), No. 16 gage [0.0635 inch (1.65 mm) base-metal thickness] galvanized steel channels that are installed in the groove side of the panel.

Tectum I roof tiles have a 1/2-inch-wide (13 mm) rabbet along the long edge for installation between bulb tees or truss tees, which are attached to the top of, and span between, supporting members as described in Section 4.3.

3.2 Tectum III Panels:

Tectum III panels are composite roof planks consisting of 1 1/2-inch- to 6-inch-thick (17 mm to 152 mm) Dow Chemical Co. Styrofoam Brand 40 polystyrene foam plastic insulation core factory-bonded to facings of minimum 1 1/2-inch-thick (38 mm) Tectum I panels and minimum 7/16-inch-thick (11 mm) oriented strand board (OSB) or minimum 1/2-inch-thick (12.7 mm) plywood complying with DOC PS-2 (UBC Standard 23-3). Tectum III panels are available as Tectum III planks and as Tectum III roof tiles in widths up to 48 inches (1219 mm) and lengths up to 192 inches (4877 mm). Tectum III planks have 1/2-inch-deep (13 mm) tongues and grooves along the long edge in the Tectum layer. See Figure 1 for typical edge details and Figure 2 for typical connections. Tectum III panels are mechanically and adhesively fastened to all support members as noted in Sections 4.1 and 4.4.

Tectum III roof tiles have a 1/2-inch-wide (13 mm) rabbet on the long edge for installation between bulb tees or truss tees attached to the top of, and spanning between, supporting members, as noted in Section 4.4.

3.3 Tectum E Panels and Tectum E Roof Tiles:

Tectum E panels and Tectum E roof tiles are composite roof planks consisting of 3/4-inch- to 6 1/2-inch-thick (19 mm to 165 mm), nominally 1.0-pound-per-cubic-foot-density (16 kg/m³), expanded polystyrene foam plastic insulation core recognized in a current ICC-ES evaluation report and complying with ASTM C 578, Type I. The foam plastic core is factory-bonded to facings of minimum 1 1/2-inch-thick (38 mm) Tectum I panels on the bottom face and minimum 7/16-inch-thick (11 mm) OSB or minimum 1/2-inch-thick (12.7 mm) plywood complying with DOC PS-2 (UBC Standard 23-3) on the top face, with a Type II Class 2 adhesive complying with AC05. Panels are available as Tectum E panels and as Tectum E roof tiles in widths up to 48 inches (1219 mm) and lengths up to 192 inches (4877 mm). Tectum E panels have 1/2-inch-deep (13 mm) tongues and grooves along the long edge in the Tectum layer. Tectum E roof tiles have a 1/2-inch-wide (13 mm) rabbet on the long edge for installation between bulb tees or truss tees attached to the top of and spanning between supporting members as noted in Section 4.4. Tectum E panels and Tectum E roof tiles are mechanically and adhesively fastened to all supporting members, as noted in Section 4.1. See Figure 1 for typical edge details and Figure 2 for typical connections.

3.4 Acoustical Board and Suspending Ceiling Tile:

Tectum I panels and tiles used as acoustical board and suspended ceiling tiles are fabricated from 1- to 2-inch-thick (25 to 51 mm) material and are available in various sizes with square, beveled or face-rabbeted edges. Panels with face-rabbeted edges are also available in maximum 3-inch (76 mm) thicknesses. The tiles may be installed between suspended ceiling runners, directly to substrate, to steel subpurlins or to furring strips spaced 24 inches (610 mm) on center on walls or ceilings.

3.5 Thermal Barrier:

Tectum I, III and E panels and roof tiles qualify as thermal barriers for use in separating foam plastic insulation from the interior of a building under IBC Section 2603.4 provided the edges are tongue-and-groove, covered with a 1-inch-thick (25 mm) wood strip, or joints are filled with a solid gypsum cement grout.

3.6 Interior Finish:

Tectum I panels have a flame-spread index of not more than 25 and a smoke-developed index of not more than 450, when tested in accordance with ASTM E 84. The panels are therefore classified as Class A interior finish in accordance with IBC Section 803.

4.0 DESIGN AND INSTALLATION

4.1 General:

The manufacturer's published installation instructions and this report shall be strictly adhered to and a copy of these must be available on the jobsite during installation. The instructions within this report govern if there are any conflicts between the manufacturer's instructions and this report.

All panels must be installed with the plank's long dimension perpendicular to the supports. Fastening to wood framing for all panels must be with screws that penetrate into the framing at least 1 inch (25 mm), unless otherwise noted in this report. Fastening to steel supports for all panels must be with screws long enough to penetrate the steel at least $1/2$ inch (13 mm), unless otherwise noted in this report.

Tectum I panels must be attached to supporting members with screws and must be adhesively attached along tongue-and-groove edge joints and to supports in accordance with Section 4.3. See Figure 1 for typical Tectum panel edge details, and Figure 2 for typical connections. See Table 1 for allowable gravity loads, spans, thicknesses and required support member widths.

The Tectum III panels must be placed over steel, wood or concrete framing on flat or sloped roofs with the OSB side facing up. Maximum spacing of supports with allowable gravity loads is noted in Tables 2 and 3.

On concrete supports, a steel or wood insert must be cast in the concrete for installation. Screws for Tectum I panels must be Construction Fasteners, Inc., Dekfast 14 [0.234-inch-diameter (6 mm) shaft, 0.441-inch-diameter (11 mm) head] screws with 2-inch-diameter (51 mm) Construction Fasteners, Inc., washers. Screws for Tectum III and Tectum E panels must be Dekfast 14 screws with $1/2$ -inch-diameter (38 mm) Construction Fastener, Inc., washers; or SIP screws [0.194-inch-diameter (5 mm) shaft, 0.610-inch-diameter (16 mm) head]. When adhesion is required, a continuous $3/8$ -inch-diameter (10 mm) bead of Miracle Construction adhesive, meeting the requirements of APA Specification AFG-01 and of caulking gun consistency, must be used.

4.2 Tectum I, III and E Screwed/Glued Roof Diaphragm:

Product thickness, fastenings, supports and diaphragm length-to-width ratios are set forth for Tectum I panels in Table 6; and in Table 7 for Tectum I long-span panels, 3-inch Tectum I panels, Tectum III panels and Tectum E panels. Tectum I diaphragms noted in Table 7 require No. 22 gage [0.0336 inch (0.85 mm) base-metal thickness], galvanized steel nailing strips, $1\frac{1}{2}$ inches (38 mm) wide at the periphery and 4 inches (102 mm) wide over supporting subpurlins.

Tectum panels must be laid with the long edge perpendicular to purlins and square-edge supported ends staggered in adjacent rows. Panels at unsupported tongue-and-groove edges between adjacent rows must be adhered to each other with a $3/8$ -inch (10 mm) continuous bead of Miracle Construction adhesive placed in the groove of each panel, and the tongue-and-groove joints driven tight. Each supported end must be butted tight against the adjacent plank. Each supported end and crossing where planks are continuous over purlins must be adhered to the purlins or the diaphragm boundary supports with a $3/8$ -inch (10 mm) continuous bead of adhesive and attached to supports with screws. The minimum length of panel must be sufficient to span three purlins, except for end filler to accommodate staggered joint installation.

4.3 Tectum I Roof Tile Diaphragm:

Tectum I roof tiles, 2 inches (51 mm) or more in thickness and $31\frac{1}{2}$ inches (800 mm) wide, must be grouted with gypsum concrete (ASTM C 317 Class A) between truss tees of a minimum size of 000-5-14-2. The truss tees must be welded to steel structural supports using a 1-inch (25 mm) fillet weld on each side of the tee at each support. The supports must be spaced a maximum of 96 inches (2438 mm) on center. Tile ends must be attached with two screws per panel end and glued using a $3/8$ -inch (10 mm) bead of construction adhesive. The perimeter of the diaphragm must be attached using a $3/8$ -inch (10 mm) bead of Miracle Construction adhesive and screws with 2-inch (51 mm) diameter washers spaced at $10\frac{1}{2}$ inches (267 mm) on center. Screws must be minimum No. 11 gage [0.200 inch (5.08 mm)] and the adhesive must meet the requirements of APA Specification AFG-01. Allowable shear value is 280 pounds per linear foot (4086 N/m).

4.4 Tectum III and Tectum E Roof Tile Diaphragm:

Tectum III and Tectum E roof tiles, $3\frac{1}{2}$ inches (89 mm) or more in thickness and $47\frac{1}{2}$ inches (1206 mm) wide, must be grouted between truss tees of a minimum size of 000-3-14- $3\frac{1}{2}$. The truss tees must be welded to steel structural supports using a 1-inch (25 mm) fillet weld on each side of the tee at each support. The supports must be spaced a maximum of 96 inches (2438 mm) on center. Tile ends must be attached with three screws with $1\frac{1}{2}$ -inch-diameter (38 mm) washers per tile end, and must be glued using a $3/8$ -inch-diameter (10 mm) bead of construction adhesive. The boundary of the diaphragm must be attached to supports using a $3/8$ -inch-diameter (10 mm) bead of Miracle Construction adhesive and screws with $1\frac{1}{2}$ -inch-diameter (38 mm) washers spaced at 12 inches (305 mm) on center. Screws must be a minimum of No. 14 gage [0.240 inch (6.10 mm)] and the adhesive must meet the requirements of APA Specification AFG-01. Allowable shear value is 310 pounds per linear foot (4553 N/m).

4.5 Wind Uplift:

Uplift resistance for Tectum I, III and E panels fastened with screws is noted in Tables 4 and 5.

4.6 Special Inspection:

Special inspection in accordance with IBC Chapter 17 is required where diaphragm construction incorporates adhesives. The special inspector must verify adhesive type, placement, and curing. Special inspections for seismic resistance must comply with IBC Section 1707.

5.0 CONDITIONS OF USE

The Tectum I, Tectum III and Tectum E Roof Deck Panels described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 The Tectum I, Tectum III and Tectum E Roof Deck Panels are recognized for use in combustible construction or in Type I and II construction where fire-retardant-treated wood is allowed in accordance with IBC Section 603.1(1). When use is as an alternative to fire-retardant-treated wood, the allowable spans for Tectum III and Tectum E must be limited to the spans of Tectum I noted in Table 1.
- 5.2 Tectum decks with a 1³/₄-inch (44 mm) minimum thickness may be used as a roof deck in applications where heavy timber construction is allowed. Decking must be a minimum of 20 feet (6 m) above the floor immediately below
- 5.3 Structural calculations must be submitted to the code official. Calculations and drawings must be prepared, signed and sealed by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed

5.4 For use as diaphragms, structural calculations must be submitted to the code official. Calculations and drawings must be prepared, signed and sealed by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed

5.5 The panels must be covered with an approved roof covering immediately after installation and must not be left exposed to the weather.

5.6 For applications in accordance with the IBC, panels with a maximum allowable load of less than 50 psf must be limited to applications that are not subject to the concentrated live loads specified in IBC Table 1607.1 Item 30.

5.7 The products must be manufactured at the Tectum, Inc., plant located in Newark, Ohio, or the Lamit Industries plant located in Columbus, Ohio, with follow-up inspections by PFS Corporation (AA-652).

6.0 EVIDENCE SUBMITTED

6.1 Reports of tests for vertical load, full-scale diaphragm load capacity, flame-spread, roof-covering classification, finish rating, and wind uplift; and reports of room fire tests in accordance with UBC Standard 26-3

6.2 Quality documentation.

7.0 IDENTIFICATION

Labels attached to stacks, skid loads, and crates of the Tectum products bear the Tectum, Inc., name, product name, evaluation report number (ESR-1112) and the name of the inspection agency (PFS Corporation).

TABLE 1—ALLOWABLE ROOF DECK SPANS FOR TECTUM I PANELS

TECTUM NOMINAL THICKNESS (inches)	WEIGHT (psf)	ALLOWABLE SPANS (inches) ²			
		4-inch-wide Purlins			3-inch-wide Purlins
		35 psf Design Load ¹	40 psf Design Load ¹	45 psf Design Load ¹	50 psf Design Load ¹
1½	2.4	---	---	---	24
2	3.5	42	40	38	36
2½	4.5	48	46	44	42
3	5.3	54	52	50	48
2 long span	3.8	60	---	---	48
2½ long span	4.7	66	---	---	60
3 long span	5.5	---	---	---	72

For **SI**: 1 inch = 25.4 mm, 1 psf = 0.0479 kPa.

¹The tabulated design load is the total permitted and does not include the weight of the Tectum plank.

²Center to center of supports.

TABLE 2—ALLOWABLE ROOF DECK SPANS FOR TECTUM III PANELS¹

TECTUM III NOMINAL THICKNESS (inches)	WEIGHT (psf)	ALLOWABLE SPANS ³ (inches)		
		30 psf Superimposed Design Load	50 psf Superimposed Design Load	60 psf Superimposed Design Load
3½	4.4	---	72 ⁴	---
4	4.6	---	72 ²	---
5	5.0	96 ²	---	72 ²
8	5.5	---	96 ²	---

For **SI**: 1 inch = 25.4 mm, 1 psf = 0.0479 kPa.

¹Values limited to a maximum deflection of $L/240$ where L is the span in inches.

²Support conditions require a minimum 4-inch bearing width.

³Center to center of supports.

⁴Support conditions require a minimum 2½-inch bearing width.

TABLE 3—ALLOWABLE ROOF DECK SPANS FOR TECTUM E PANELS^{1,2}

TECTUM E NOMINAL THICKNESS (inches)	WEIGHT (psf)	ALLOWABLE SPANS ³ (inches)	
		40 psf Superimposed Design Load	50 psf Superimposed Design Load
2¾	4.4	---	48
4	4.6	72	60
5	5.0	---	72
6	5.2	---	84
8½	5.5	---	96

For **SI**: 1 inch = 25.4 mm, 1 psf = 0.0479 kPa.

¹Values limited to a maximum deflection of $L/240$ where L is the span in inches.

²Support conditions require a minimum 4-inch bearing width.

³Center to center of supports.

TABLE 4—UPLIFT RESISTANCE FOR TECTUM I DECKS IN POUNDS PER SQUARE FOOT^{1,2,3}

PANEL WIDTH (inches)	SPAN (inches)	SCREWS PER JOIST	UPLIFT RESISTANCE FOR 1-INCH PENETRATION IN WOOD	UPLIFT RESISTANCE FOR ATTACHMENT TO STEEL OR 1.5-INCH PENETRATION IN WOOD
31	24	2	110	130
47	24	2	73	86
31	36	2	74	87
47	36	2	49	57
47	36	3	73	86
31	42	2	63	74
47	42	2	42	49
47	42	3	63	74
31	48	2	55	65
31	48	3	83	98
47	48	2	37	43
47	48	3	55	65
31	60	2	37	44
31	60	3	55	65
31	72	2	30	35
31	72	3	46	54

For **SI**: 1 inch = 25.4 mm, 1 psf = 0.0479 kPa.

¹Screws are Dekfast No. 14 screws with a 2-inch-diameter washer described in Section 4.1.

²Values are based on screws acting alone and panels installed in a two-span condition.

³Wood framing must have a minimum specific gravity of 0.50.

TABLE 5—UPLIFT RESISTANCE OF TECTUM III AND TECTUM E DECK IN POUNDS PER SQUARE FOOT¹

PANEL WIDTH (inches)	SPAN (inches)	SCREWS PER JOIST	UPLIFT RESISTANCE FOR 1-INCH PENETRATION IN WOOD ²	UPLIFT RESISTANCE FOR ATTACHMENT TO STEEL ³
47	48	2	50	69
47	48	3	75	104
47	60	3	60	83
47	60	4	79	110
47	72	3	50	69
47	72	4	66	92
47	84	3	43	59
47	84	4	57	79
47	96	3	37	52
47	96	4	50	69

For **SI**: 1 inch = 25.4 mm, 1 psf = 0.0479 kPa.

¹Values are based on nails acting alone and panels installed in a two-span condition.

²Screws are SIP screws described in Section 4.1. Wood framing must have a minimum specific gravity of 0.50.

³Screw are Dekfast No. 14 screws described in Section 4.1.

Table 6 notes continued from the previous page.

The diaphragm deflection is determined by the formula:

$$\Delta d = \Delta s + \Delta b = \frac{(F)(Q_{avg})(L)}{2 \times 10^6} + \frac{5wL^4 \times 1728}{384EI}$$

where:

- Δd = Total diaphragm deflection, inches.
- Δs = Shear deflection, inches.
- Δb = Bending deflection, inches.

$$F = \frac{33,000Q_{avg}}{(Qd)^2}$$

(For a diaphragm having a uniform shear distribution across its span)

- Q_{avg} = Average unit shear on diaphragm in pounds per foot between points for which deflection is to be determined. (For a simply supported diaphragm uniformly loaded, "Qavg" is equal to the actual diaphragm shear per foot divided by two.)
- Qd = Allowable diaphragm shear in pounds per foot from table.
- W = Uniform load on diaphragm in pounds per foot.
- L = Diaphragm span, feet.
- E = Modulus of elasticity of diaphragm chord, psi.
- I = Moment of inertia of chords, inches⁴.

²Values may be increased one-fourth if the boundary fastening of the diaphragm has the screw spacing reduced one-half.

³Values must be decreased one-fourth when continuous unblocked joints are parallel to the direction of horizontal forces.

⁴Purlin widths are nominal dimensions.

⁵In addition to screw fastening, all boards must be fastened to one another at tongue-and-groove edge joints and to supports with a 1/4-inch-diameter bead of adhesive.

⁶Minimum thickness of structural steel support must be 0.20 inch.

⁷The planks are oriented to the load and framing as follows:

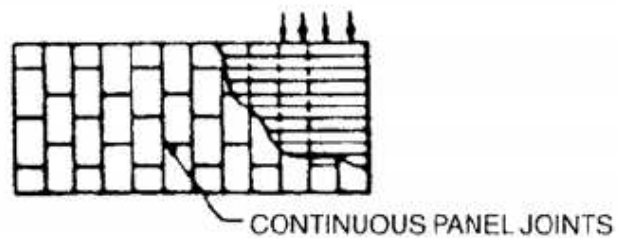
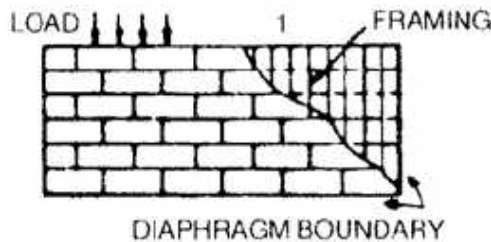


TABLE 7—ALLOWABLE SHEAR FOR WIND OR SEISMIC FORCES IN POUNDS PER FOOT FOR HORIZONTAL ROOF DIAPHRAGMS CONSISTING OF TECTUM III OR E PANELS, TECTUM I LONG-SPAN PANEL AND 3-INCH TECTUM I PANEL^{1,2,3}

ITEM	SCREW SIZE	MINIMUM PENETRATION INTO FRAMING (inches)	MINIMUM TECTUM III/E THICKNESS (inches)	MAXIMUM SUPPORT SPACING (inches)	MINIMUM NORMAL WIDTH OF WOOD/STEEL ⁴ FRAMING MEMBER (inches)	FIELD FASTENER SPACING (inches)	PERIMETER FASTENER SPACING (inches)	UNBLOCKED DIAPHRAGM
Tectum III/E	No. 14 self-tapping with 1 1/2-inch-diameter steel washer	1	3 1/2	60	Steel support only ⁴	18	18	265
			5	72		18	18	230
Tectum III/E	No. 14 self-tapping with 1 1/2-inch-diameter steel washer	1 ⁴	5	48	Steel support only ⁴	16	16	310
Tectum III/E	No. 14 with e-inch-diameter head	2	5	72	4	16	12	320
		2 1/2	3 1/2	60	4	16	12	360
		2 1/2	3 1/2	72	4	16	12	340
Tectum III/E ⁵	No. 14 self-tapping with 1 1/2-inch-diameter steel washer	1	5	72	4	8	6	785
2-inch-thick long-span plank ⁶	No. 14 with 2-inch-diameter washer	1 1/4	2	48	4	16	12	320
2 1/2-inch-thick long-span plank ⁶	No. 14 with 2-inch-diameter washer	1 1/4	2 1/2	60	4	16	10	390
3-inch-thick long-span plank ⁷	No. 14 with 2-inch-diameter washer	1 1/2	3	72	4	16	12	280
3-inch-thick plank	No. 11 with 2-inch-diameter washer	1 5/16	3	48	Steel support only ⁴	10	10 ends 16 length	450

For S1: 1 inch = 25.4 mm, 1 plf = 14.5939 N/m.

¹In addition to screw fastening, all boards must be fastened to one another at tongue-and-groove edge joints and to supports with a d-inch-diameter bead of adhesive.

²See Footnote 1 to Table 6.

³See Footnote 7 to Table 6.

⁴Minimum thickness of structural steel support must be 0.20 inch.

⁵An overlayment of 1/16-inch OSB must be attached to the top of the panels. Two-inch, No. 16 gauge staples at 4 inches o.c. must be at the perimeter of each overlayment and at 8 inches o.c. at 24 inch intervals. A 1/8-inch bead of adhesive must be applied at the perimeter and at 24-inch intervals. All overlayment joints offset panel joints.

⁶Long-span plank utilizes a 1/2-inch-by-3/4-inch, No. 16 gauge steel channel section along the tongue-and-groove edges.

⁷Long-span plank utilizes a 5/8-inch-by-1 1/2-inch, No. 16 gauge steel channel section along the tongue-and-groove edges.

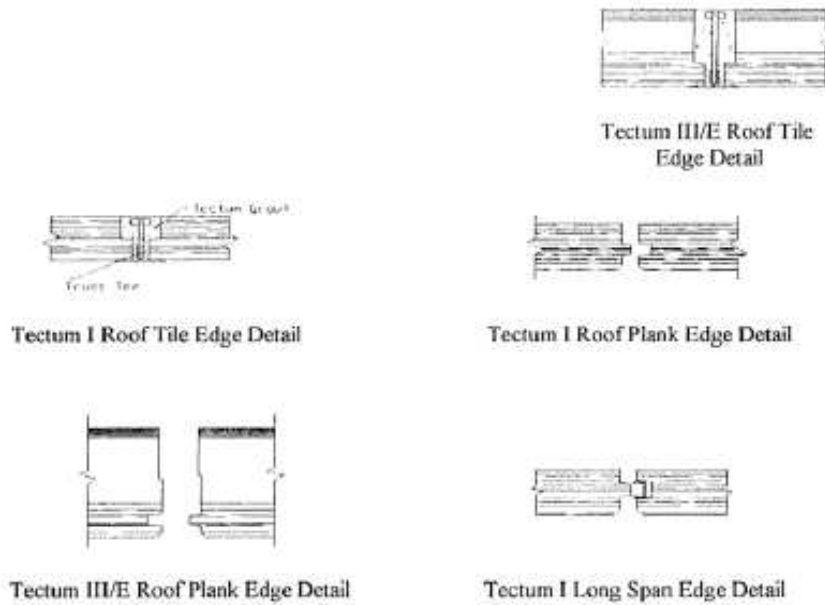


FIGURE 1—TYPICAL EDGE DETAILS

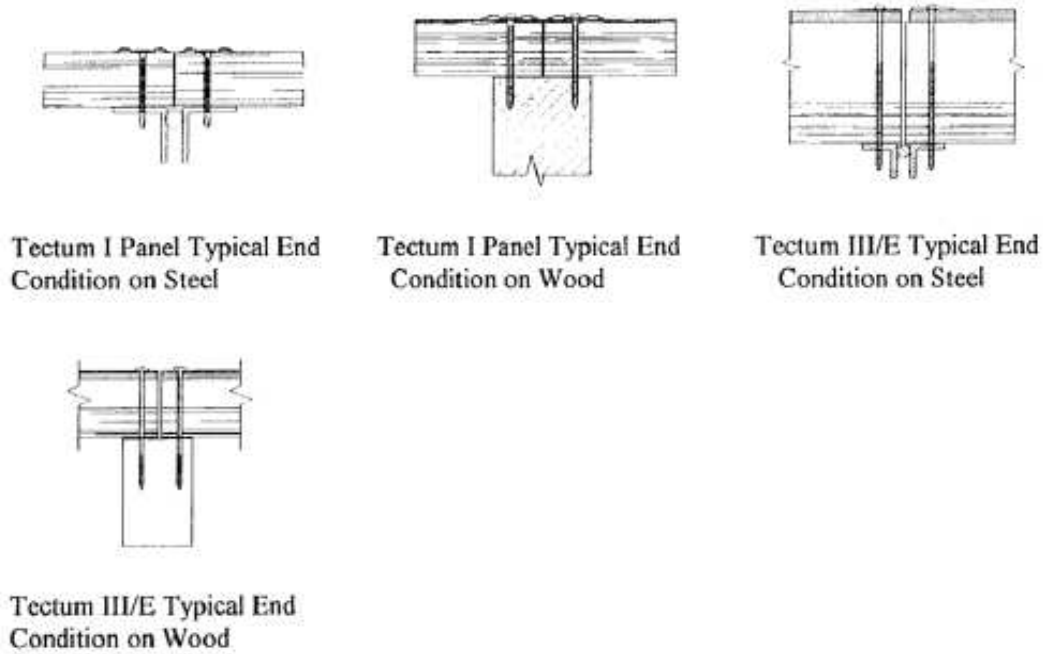
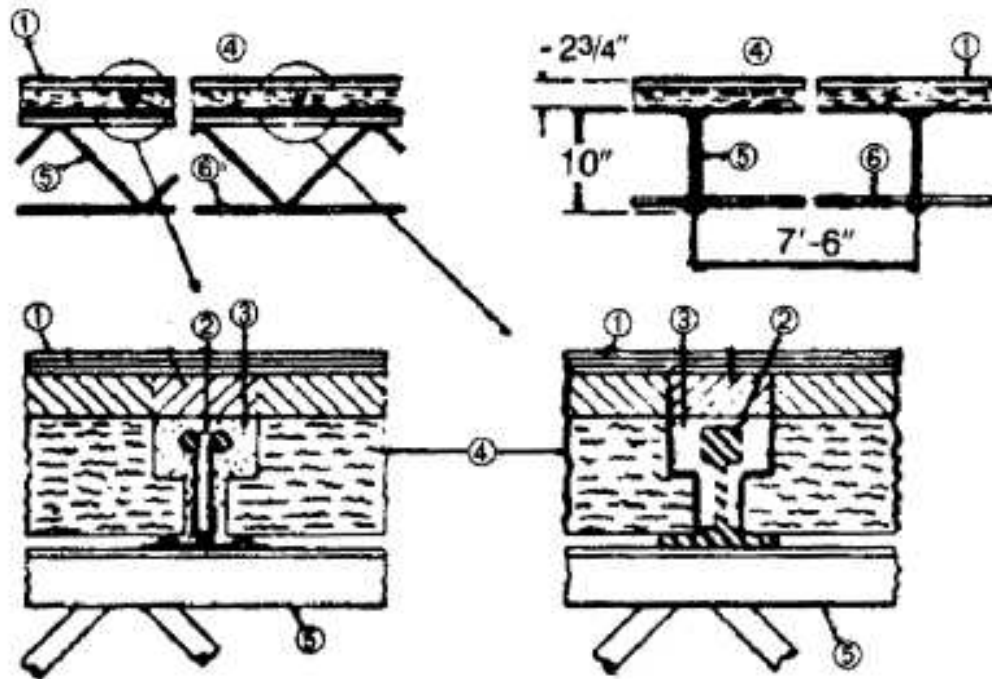


FIGURE 2—TYPICAL END CONDITIONS



1. Built-up roofing
2. Bulb Tee
3. Grout Mixture—Tectum grout shall be used as cementitious mixture between structural cement fiber units and bulb tees.
4. Structural Cement-Fiber Units—Tectum Inc.—Care is to be taken to ensure that units are tightly butted at end joints.
5. Joists
6. Bridging Angle—Bridging angle shall be welded to joists with spacing of bridging in accordance with recommended practice.

FIGURE 3—TYPICAL ROOF CONSTRUCTION