

**ICC-ES Evaluation Report****ESR-1461**

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**DIVISION: 06 00 00—WOOD, PLASTICS AND  
COMPOSITES****Section: 06 50 00—Structural Plastics****Section: 06 53 00—Plastic Decking****Section: 06 63 00—Plastic Railings****REPORT HOLDER:****MASTER MARK PLASTIC PRODUCTS****210 AMPE DRIVE****PAYNESVILLE, MINNESOTA 56362****(320) 845-2111**[www.mastermark.com](http://www.mastermark.com)[ndemuth@mastermark.com](mailto:ndemuth@mastermark.com)**EVALUATION SUBJECT:****MASTER MARK RHINO COMPOSITE DECKING (ALSO  
KNOWN AS ALL SEASON, ARMADILLO, WOODLAND,  
SEASONS, NORTH DEX AND WEST STAR); MASTER  
MARK RHINO RAILING SYSTEMS****1.0 EVALUATION SCOPE****Compliance with the following codes:**

- 2012, 2009 and 2006 *International Building Code*® (IBC)
- 2012, 2009 and 2006 *International Residential Code*® (IRC)

**Properties evaluated:**

- Structural
- Durability
- Surface-burning characteristics

**2.0 USES**

The Master Mark Rhino Composite Decking Boards described in this report are limited to exterior use as deck boards for balconies, porches, stair treads and decks for buildings of Type V-B (IBC) construction, and dwellings constructed in accordance with the IRC. The Master Mark Rhino Railing Systems described in this report are limited to exterior use as guards for balconies, porches, and decks. The products described in this report are used in exterior applications in (1) any occupancy group in buildings of Type V-B (IBC) construction and other types of construction in applications where untreated wood is permitted by IBC Section 1406.3, exception 2; and (2) dwellings constructed in accordance with the IRC.

**3.0 DESCRIPTION****3.1 General:**

Master Mark Rhino Composite Decking boards and Master Mark Rhino Railing Systems are made from a

manufactured composite material that consists of at least 50 percent wood fibers by weight, with the remainder of the material being a thermoplastic polymer plastic. The deck boards and railing are manufactured by an extrusion process in accordance with the approved quality control manual, to produce comparable lumber-sized members and railing components. Master Mark Rhino Composite Decking board (other than Armadillo), and Master Mark Rhino Railing are manufactured in acorn brown, adobe, barnwood gray, earth, chestnut, sand and slate colors. The Armadillo deck boards are made from the same materials as the other Rhino Composite Decking Boards except that a 0.03 inch-thick (0.8 mm) layer of cap stock is applied around the exterior of the board. The Armadillo deck boards are available in painted desert, canyon gray, driftwood and Sedona colors.

**3.2 Deck Board:**

**3.2.1 General:** The Master Mark Rhino deck board is manufactured in nominal dimensions as noted in Table 1. Figure 1 provides dimensioned cross-sectional profiles of the boards.

**3.2.2 Durability:** When subjected to weathering, insect attack, and other decaying elements, material used to manufacture the Master Mark Rhino deck boards described in this report is equivalent in durability to code-complying preservative-treated or naturally durable lumber when used in locations described in Section 2.0 of this report. Master Mark products have been evaluated for structural performance when exposed to temperatures ranging from 20°F (29°C) to 125°F (52°C).

**3.2.3 Surface-burning Characteristics:** When tested in accordance with ASTM E84, the Master Mark Rhino deck boards described in this report have a flame-spread index of no greater than 200.

**3.3 Guards:**

**3.3.1 General:** Master Mark Rhino Railing Systems are guards consisting of post sleeves and caps, top and bottom rails, a top-rail reinforced with a T6061 aluminum stiffener, balusters, and a bottom-rail support block. The Master Mark Rhino Railing System components are wood thermoplastic composite lumber (WTCL) as described in Section 3.1.

**3.3.2 Master Mark Rhino Deck Railing:** The height of the railing assembly is 42 inches (1067 mm) above the walking surface. The top rails are 3<sup>1</sup>/<sub>4</sub> inches (83 mm) wide by 2<sup>7</sup>/<sub>16</sub> inches (62 mm) deep. The bottom rails are 3<sup>5</sup>/<sub>16</sub> inches (84 mm) wide by 2<sup>3</sup>/<sub>8</sub> inches (60 mm) deep. The Master Mark Rhino balusters have a solid 1<sup>3</sup>/<sub>16</sub>-inch-square (30 mm) profile, and are 43 inches (1092 mm) long,

spaced  $4\frac{3}{4}$  inches (121 mm) on center. The Post Sleeves are nominally 4 inches (102 mm) square and have a wall thickness of 0.125 inch (3.2 mm). Refer to Figure 2 for dimensioned profiles of the post sleeves, top and bottom rails and balusters.

**3.3.3 Durability:** When subjected to weathering, insect attack, and other decaying elements, the material used to manufacture Master Mark Rhino Composite Railing is equivalent in durability to code-complying, preservative-treated or naturally durable lumber when used in locations described in Section 2.0 of this report. Master Mark Rhino Railing has been evaluated for structural performance when exposed to temperatures ranging from  $-20^{\circ}\text{F}$  ( $-29^{\circ}\text{C}$ ) to  $125^{\circ}\text{F}$  ( $52^{\circ}\text{C}$ ).

**3.3.4 Surface-burning Characteristics:** When tested in accordance with ASTM E84, Master Mark Rhino Railing has a flame-spread index of no greater than 200.

## 4.0 DESIGN AND INSTALLATION

### 4.1 General:

Installation of the Master Mark Rhino Composite Decking and Master Mark Rhino Railing Systems described in this report must comply with this report and the manufacturer's published installation instructions. The manufacturer's published installation instructions must be available at the jobsite at all times during installation. When the manufacturer's published installation instructions differ from this report, this report governs.

### 4.2 Deck Boards:

**4.2.1 General** The Master Mark Rhino Composite Decking deck boards must be installed with a minimum board edge spacing (gap between the sides of the boards) of  $\frac{3}{16}$  inch (4.8 mm), and a minimum deck board end spacing of  $\frac{1}{16}$  inch (1.6 mm) for every 16-foot (4.88 m) length of board for every  $20^{\circ}\text{F}$  ( $11^{\circ}\text{C}$ ) temperature difference between the temperature at time of installation and the maximum temperature that can be expected.

**4.2.2 Allowable Spans:** Table 1 lists allowable spans for Master Mark Rhino decking installed perpendicular to the support framing. Table 2 lists the Master Mark Rhino deck boards permitted to be used as stair treads provided the maximum span does not exceed 11 inches (279 mm).

**4.2.3** Deck boards must be attached to the framing with No. 8 by  $2\frac{1}{2}$ -inch (64 mm) stainless steel screws for the nominal 2-by-4 and 2-by-6 boards, and No. 8 by  $2\frac{1}{4}$ -inch (57 mm) for nominally 5/4-by-5.5 solid core boards. Screws must be placed a minimum of  $2\frac{3}{4}$  inches (70 mm) from the end of each deck board and  $\frac{3}{4}$  inch (19 mm) from edges. For the groove deckboards, one screw must be installed at each supporting framing member at 16 or 24 inches (406 or 610 mm) along the outer edge of each deck board. The inner edge of each deck board must be fastened using a Rhino Vision Clip and a No. 7 by  $2\frac{1}{2}$ -inch-long (64 mm) screw attached to the edge groove at each supporting member. For driven fasteners having a diameter equal to 0.148 inch (3.8 mm) or less, Master Mark Plastic Products recommends pre-bored holes. For driven fasteners having a diameter greater than 0.148 inch (3.8 mm), pre-bored holes are required. The diameter of the bored hole must not exceed 90 percent of the fastener diameter.

**4.2.4 Deck Boards Used as Stair Treads:** Master Mark Rhino nominally 5/4-by-5.5 solid core deck boards meet the code-prescribed concentrated load of 300 lbf (1.33 kN) when installed at a maximum center-to-center spacing of 11 inches (279 mm), and must have a minimum of two continuous spans over three supports.

### 4.3 Guards:

**4.3.1 General:** Refer to Table 3 and Figure 3 for installation details concerning the Master Mark Rhino Railing Systems.

**4.3.2 Structural:** Master Mark Rhino Railing Systems resist the loads specified in Section 1607.8.1 of the 2012 IBC, Section 1607.7.1 of the 2009 and 2006 IBC and Table R301.5 of the IRC, when installed as prescribed in Table 2.

**4.3.3 Installation:** Each vertical baluster must be secured at the top to a horizontal baluster with a No. 8 by  $2\frac{1}{4}$ -inch-long (57 mm) wood screw. The top rail is designed to have the horizontal baluster fit tight in the groove on the bottom of the rail. The bottom of each baluster must be secured to the bottom rail with a No. 8 by  $2\frac{1}{4}$ -inch-long (57 mm) screw. The top and bottom rail support brackets are attached to the support posts with  $\frac{5}{16}$ -inch-by-4-inch-long (8 mm by 102 mm) screws and the rails are attached to the support brackets with No. 8 by-2 inch-long (51 mm) screws, per manufacturer's installation instructions.

## 5.0 CONDITIONS OF USE

The Master Mark Rhino Composite Decking and Railing 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 Master Mark Rhino Composite Decking described in this report is limited to exterior use as deck boards for balconies, porches, stair treads, and decks for buildings of Type V-B (IBC) construction, and dwellings constructed in accordance with the IRC; and the Master Mark Rhino Railing Systems described in this report is limited to exterior guards (1) any occupancy group in buildings of Type V-B (IBC) construction and other types of construction in applications where untreated wood is permitted by IBC Section 1406.3, Exception 2, and (2) dwellings constructed in accordance with the IRC.
- 5.2** Master Mark Rhino deck boards must be directly fastened to supporting construction. Where required by the code official, engineering calculations and construction documents consistent with this report must be submitted for approval. The calculations must verify that the supporting construction complies with the applicable building code requirements and is adequate to resist the loads imparted upon it from the products and systems discussed in this report. The documents must contain details of the attachment to the supporting structure consistent with the requirements of this report. The documents must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.3** Adjustment factors outlined in the AF&PA *National Design Specification for Wood construction* and applicable codes must not apply to the allowable capacity and maximum spans for Rhino deck boards.
- 5.4** The compatibility of the fasteners with the supporting construction, including chemically treated wood, is outside the scope of this report.
- 5.5** Master Mark Rhino deck boards must be gapped to permit adequate drainage in accordance with Section 4.2.1 and the manufacturer's instructions.
- 5.6** Master Mark Rhino deck boards must not be attached to any solid surface or watertight flooring system, such as sheathing, waterproof membranes, concrete, roof decks, or patios.

- 5.7 Master Mark Rhino deck boards must be fastened directly to floor joists having adequate strength and stiffness in accordance with the applicable code.
- 5.8 The use of wood posts, with or without post sleeves, is outside the scope of this report.
- 5.9 Evaluation of the deck boards and guardrail systems for resistance to Formosan termites is outside the scope of this report.
- 5.10 The products are produced by Master Mark Plastic Products, Inc., at their facility located in Paynesville, Minnesota, under a quality control program with inspections by ICC-ES.

**6.0 EVIDENCE SUBMITTED**

Data in accordance with the ICC-ES Acceptance Criteria for Deck Board Span Ratings and Guardrail Systems (Guards and Handrails) (AC174), dated January 2012.

**7.0 IDENTIFICATION**

Each piece of product must be identified by a stamp or nonremovable label noting the name of the product and the manufacturer (“Master Mark Plastic Products”); the evaluation report number (ESR-1461).

**TABLE 1—DECK BOARD SPAN RATINGS<sup>1,2</sup>**

NOMINAL DIMENSIONS (inches)	Maximum Span (in)	Allowable Capacity (lbf/ft <sup>2</sup> )
5/4-by-5.5 Solid Core	16	100
5/4-by-5.5 Vision Groove	16	100
2-by-4 Solid Core	24	100
2-by-6 Solid Core	24	100
5/4-by-5.5 Armadillo Solid	16	100
5/4-by-5.5 Armadillo Groove	16	100

For **SI**: 1 inch = 25.4 mm, 1 psf = 47.9 Pa.

<sup>1</sup>Maximum span is measured center-to-center perpendicular of the supporting construction.

<sup>2</sup>Maximum allowable capacity is adjusted for durability. No further increases are permitted.

**TABLE 2—MAXIMUM STAIR TREAD SPANS**

DECK BOARD USED AS STAIR TREAD	MAXIMUM SPAN (in) <sup>1,2</sup>
Master Mark Rhino solid deck board (5/4-by-5.5)	11.0
Master Mark Rhino Armadillo solid deck board (5/4-by-5.5)	11.0

<sup>1</sup>Maximum span is measured center-to-center of the support framing.

<sup>2</sup>Based on minimum two-span installation.

**TABLE 3—MAXIMUM GUARDRAIL SYSTEM SPANS<sup>1</sup>**

PRODUCT NAME/COMPONENT	APPLICABLE BUILDING CODE <sup>2</sup>		MAXIMUM SPAN <sup>3,4</sup> (ft-in)
	IBC	IRC	
Master Mark Rhino Railing Systems	Yes	Yes	6 -0

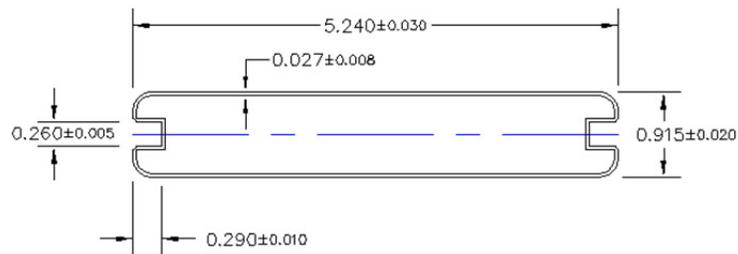
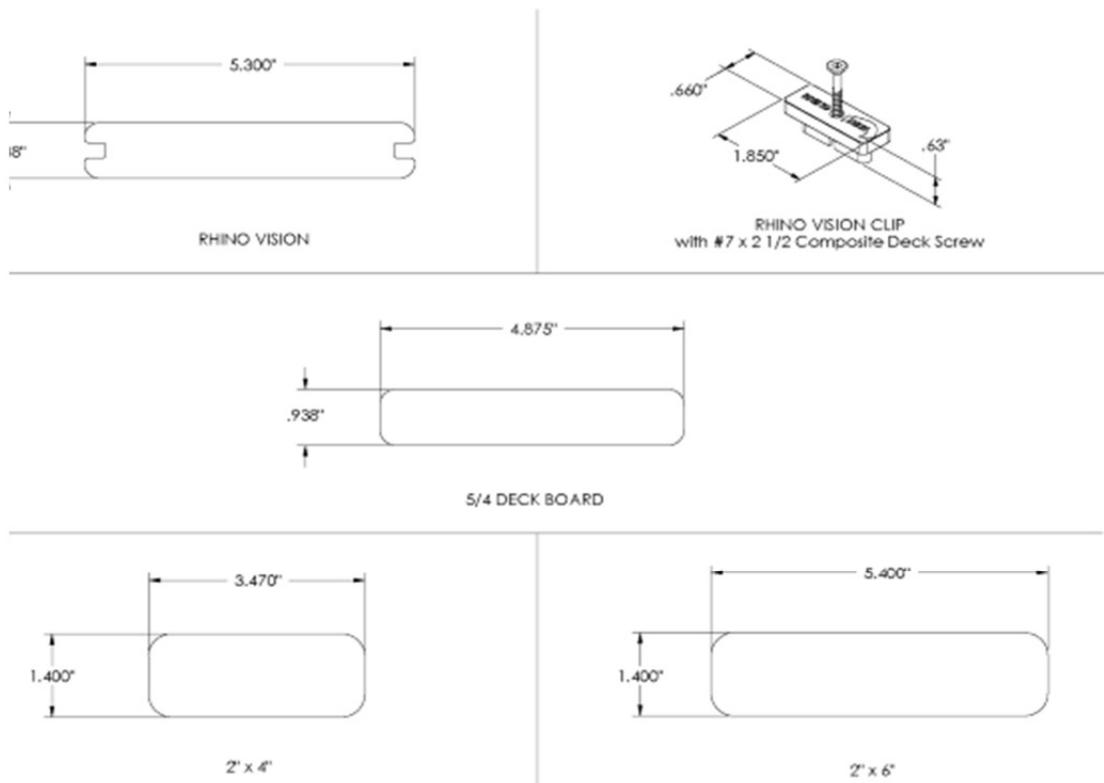
For **SI**: 1 inch = 25.4 mm; 1 ft = 305 mm.

<sup>1</sup>The ability of the supporting construction to resist the reactionary loads must be justified to the satisfaction of the code official.

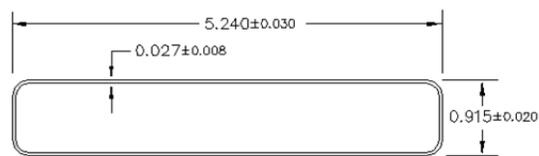
<sup>2</sup>Indicates compliance with the respective building codes.

<sup>3</sup>Maximum span is measured from inside-to-inside of the posts or from edge-of-building to inside-of-post or edge-of-building where the rail is supported directly by the building.

<sup>4</sup>Maximum allowable span has been adjusted for durability. No further increases are permitted.



**Armadillo Groove**



**Armadillo Solid**

**FIGURE 1—RHINO DECK COMPOSITE DECK BOARD**

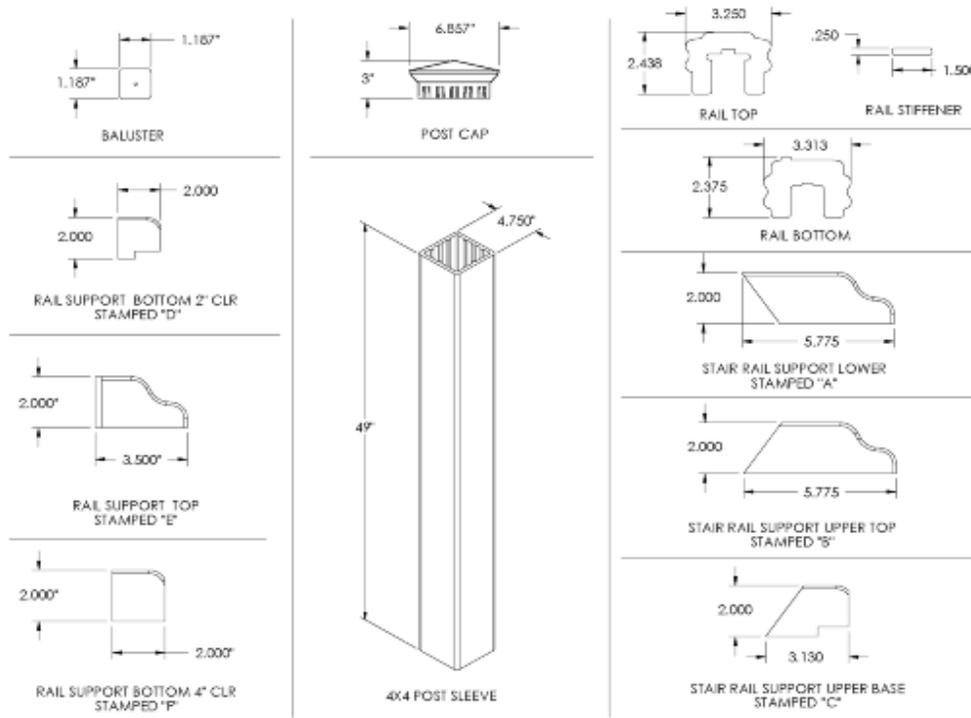


FIGURE 2—SECTIONAL VIEW OF RAIL COMPONENTS

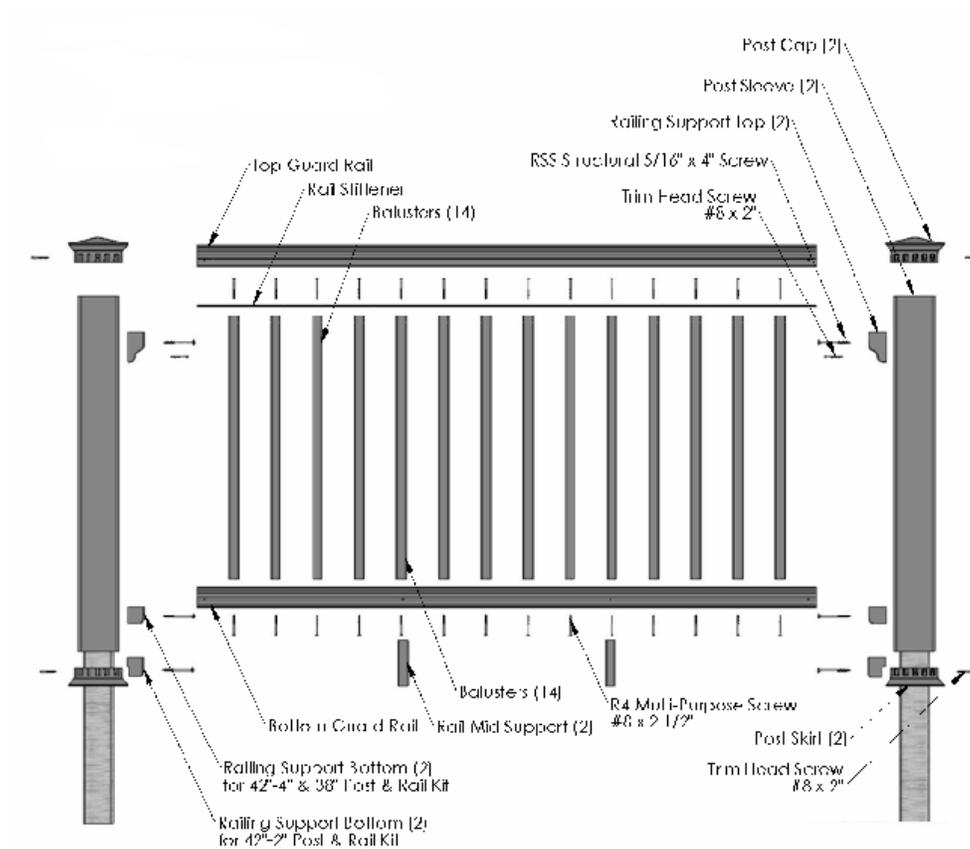


FIGURE 3—RHINO RAILING SYSTEM ASSEMBLY