

ICC-ES Evaluation Report

ESR-1791

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DIVISION: 06 00 00—WOOD, PLASTICS, AND COMPOSITES
Section: 06 05 73.33—Fire-Retardant Wood Treatment

REPORT HOLDER:

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EVALUATION SUBJECT:

PYRO-GUARD® FIRE-RETARDANT-TREATED WOOD

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:

- Surface-burning characteristics: flame spread, smoke developed index, significant progressive combustion
- Structural
- Corrosion
- Hygroscopicity
- Thermal barrier (roof and floor applications)
- Component of fire-resistance-rated assemblies

2.0 USES

PYRO-GUARD® fire-retardant-treated wood is used in areas not exposed to the weather or wetting where the code permits the use of wood or fire-retardant-treated wood.

3.0 DESCRIPTION

3.1 General:

PYRO-GUARD® fire-retardant-treated wood is lumber and plywood that is pressure impregnated with the fire retardant chemical PYRO-GUARD®. PYRO-GUARD® fire-retardant-treated wood is dried after treatment to 19 percent moisture content (MC) for lumber and 15 percent moisture content (MC) for plywood. PYRO-GUARD® fire-retardant chemical and fire-retardant-treated lumber and plywood are produced in accordance with an approved quality control procedure.

PYRO-GUARD® treated lumber of the following species is recognized as being fire-retardant-treated wood:

Southern pine	Douglas fir
Hem-fir	Spruce-pine-fir (SPF)
Western hemlock	Red spruce
Lodgepole pine	White spruce
Ponderosa pine	Jack pine
Alpine fir	Black spruce
Balsam fir	Engelmann spruce
White fir	

PYRO-GUARD® treated plywood fabricated with face and back veneers of the following species is recognized as being fire-retardant-treated wood:

Southern pine	Douglas fir
Lauan	

3.2 Surface Burning Characteristics:

PYRO-GUARD® fire-retardant-treated wood has a flame-spread index of 25 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E84 or UL 723, and shows no evidence of significant progressive combustion when the test is continued for an additional 20-minute period. Additionally, the flame front does not progress more than 10½ feet (3200 mm) beyond the centerline of the burners at any time during the test. Refer to Section 2303.2 of the IBC and Section R802.1.3 of the IRC.

3.3 Structural Strength:

The effects of the PYRO-GUARD® chemical treatment on the strength of the treated lumber and plywood must be accounted for in the design of the wood members and their connections. Load duration factors greater than 1.6 are not permitted.

The structural performance of PYRO-GUARD® fire-retardant-treated wood has been evaluated using ASTM D5516 for plywood and ASTM D5664 for lumber. Maximum loads and spans for plywood have been developed following ASTM Practice D6305. Design value adjustments for lumber have been developed following ASTM Practice D6841.

3.3.1 Lumber:

The base design values for untreated lumber found in the American Wood Council's National Design Specification (NDS) Supplement: Design Values for Wood Construction,

must be modified by the factors in Table 2 for the applicable species, use and property.

Southern pine and Douglas fir have been evaluated for use in roof framing and must be subjected to the adjustments indicated in Table 2 for roof framing.

Other softwood species noted in Section 3.1 must be subjected to the design adjustments indicated in Table 2 for service temperatures up to 100°F (38°C).

3.3.2 Plywood: Southern Pine and Douglas fir plywood have been evaluated for use as roof sheathing to temperatures of 170°F (77° C) in accordance with ASTM D5516 and ASTM D6305.

Table 1 provides maximum loads and spans which modify the untreated panel spans for roof applications by thickness and construction. The adjusted loads are applicable to the species noted in Section 3.1 of this report.

3.4 Corrosion:

The corrosion rate of aluminum, carbon steel, galvanized steel, copper or red brass in contact with wood is not increased by PYRO-GUARD® fire-retardant treatment when the product is used as recommended by the manufacturer.

3.5 Hygroscopicity:

The moisture content of PYRO-GUARD® fire-retardant-treated lumber and plywood is less than 28 percent when evaluated in accordance with ASTM D3201 at 92 percent relative humidity (Section 2303.2.7 of the 2012 and 2009 IBC, Section 2303.2.4 of the 2006 IBC, Section R802.1.3.7 of the 2012 and 2009 IRC, Section R802.1.3.4 of the 2006 IRC). PYRO-GUARD® wood is suitable for use in interior conditions where sustained relative humidity is 92 percent or less and condensation does not occur.

4.0 DESIGN AND INSTALLATION

4.1 General:

Structural systems that include PYRO-GUARD® fire-retardant-treated lumber or plywood must be designed and installed in accordance with the applicable code using the appropriate lumber design value adjustment factors and plywood spans from Tables 1 and 2 of this report. The use of non-vented roof systems with PYRO-GUARD® fire-retardant-treated lumber and plywood is not permitted.

The design value adjustment factors and plywood spans in Tables 1 and 2 of this report are applicable under elevated temperatures resulting from cyclic climatic conditions in the continental United States. They are not applicable under continuous elevated temperatures resulting from manufacturing or other processes which must require special consideration in design. Such conditions are outside the scope of this report.

All of the wood species listed in Section 3.1 of this report have been evaluated for structural performance for interior applications where the service temperature does not exceed 100°F (38°C). Southern pine and Douglas fir lumber have been evaluated for structural performance for roof framing applications [150° F (66°C)] as indicated in Table 2 of this report. Southern pine and Douglas fir plywood have been evaluated for roof structural performance for roof sheathing application [170° F (77°C) maximum temperatures] and are permitted for structural applications limited to the spans and loads indicated in Table 1 of this report.

The treated wood should not be exposed to precipitation during storage or installation. If the material does become wet, it must be replaced or permitted to dry (maximum

19 percent moisture content for lumber and 15 percent moisture content for plywood) prior to covering or enclosure by wallboard or other construction materials (except for protection during construction).

4.2 Thermal Barrier:

4.2.1 Roof applications: PYRO-GUARD® plywood, when used to separate foam plastic insulation from the interior of a building, must be a minimum of $1\frac{1}{32}$ thickness category (refer to Table 1) and be installed in accordance with Section 2603.4.1.5 of the 2012, 2009 and 2006 IBC, Section R316.5.2 of the 2012 and 2009 IRC, and Section R314.5.2 of the 2006 IRC, as applicable.

4.2.2 Floor Applications: PYRO-GUARD® plywood, when used to separate foam plastic insulation from the interior of a building, must be a minimum of $1\frac{1}{2}$ thickness category (refer to Table 1) and be installed in accordance with Section 2603.4.1.14 of the 2012 IBC.

4.3 Use as a Component of Fire-resistance-rated Wall Assemblies:

4.3.1 Two-hour Exterior Wall Assembly: In Type III, Type IV and Type V construction, the exterior wall assemblies must be constructed of PYRO-GUARD® treated wood studs and plywood. The design values for the studs must be adjusted in accordance with Table 2 for service temperatures to 100°F (38°C). The allowable spans for the plywood sheathing must be in accordance with the spans given in Table 1 for Pyro-Guard Wall/Subfloor.

When the fire-resistance rating is required from only the interior side, the wall must be constructed in accordance with Figure 3.

4.3.2 One-hour Exterior Wall Assembly: In Type III, Type IV and Type V construction, the exterior wall assemblies must be constructed of PYRO-GUARD® treated wood studs and plywood. The design values for the studs must be adjusted in accordance with Table 2 for service temperatures to 100°F (38°C). The allowable spans for the plywood sheathing must be in accordance with the spans given in Table 1 for Pyro-Guard Wall/Subfloor.

When the fire-resistance rating is required from the exterior side and the interior side, the wall must be constructed in accordance with Figure 4.

When the fire-resistance rating is required only from the interior side, the wall must be constructed in accordance with Figure 5.

4.4 Fasteners:

Fasteners used in PYRO-GUARD® fire-retardant-treated wood must be in accordance with 2012, 2009 and 2006 IBC Section 2304.9.5, 2012 and 2009 IRC Section R317.3 and 2006 IRC Section R319.3, or must be of other corrosion-resistant materials that are manufactured from materials listed in Section 3.4 of this report.

When PYRO-GUARD® fire-retardant-treated wood products are used and installed in code-compliant interior enclosed dry applications not exposed to dampness or wetting, uncoated carbon steel fasteners are permitted.

Design adjustment factors and minimum size for fasteners are indicated in Table 1 and Table 2 of this report.

4.5 Plywood Diaphragms and Shear Walls:

Wood-frame Diaphragms must be constructed in accordance with Section 2306.2 of the IBC.

Wood-frame shear walls must be constructed in accordance with Section 2306.3 of the IBC.

When PYRO-GUARD® treated plywood is used, the plywood thickness is increased by $\frac{1}{8}$ inch (3.2 mm) for the tabulated allowable shear values contained in Section 4.2 or 4.3 of AFPA SDPWS or as shown in the tables referenced in Sections 2306.2 and 2306.3 of the IBC.

5.0 CONDITIONS OF USE

The PYRO-GUARD® fire-retardant-treated wood described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 Strength calculations must be subject to the design value adjustment factors and span ratings shown in Tables 1 and 2 of this report.
- 5.2 The design value adjustment factors and span ratings given in this report must only be used for unincised dimensional lumber and plywood of the species noted in this report.
- 5.3 PYRO-GUARD® treated wood must not be used in contact with the ground where it will be exposed to precipitation, direct wetting or regular condensation, or in an unvented roof (unvented attic assemblies and unvented enclosed rafter assemblies).
- 5.4 PYRO-GUARD® treated plywood may be cut or ripped in any direction
- 5.5 PYRO-GUARD® treated lumber must not be ripped or

milled: End cuts, holes, and joints (such as tongue and groove), bevel, scarf and lap may be used.

- 5.6 Treatment is at the facilities of Hoover Treated Wood Products, Inc., in Thomson, Georgia; Pine Bluff, Arkansas; Milford, Virginia; Detroit, Michigan; and Winston, Oregon; under a quality control program with inspections by Timber Products Inspection Inc. (AA-696) and UL LLC (AA-668).

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Fire-retardant-treated Wood (AC66), dated June 2012.

7.0 IDENTIFICATION

Lumber and plywood treated with PYRO-GUARD® fire-retardant chemicals must be identified by the structural grade mark of an approved agency. In addition, all treated lumber and plywood must be stamped with the name of the inspection agencies [UL LLC. (AA-668) and Timber Products Inspection Inc. (AA-696)]; the Hoover Treated Wood Products, Inc., or listee, name and treatment location; labeling information in accordance with Section 2303.2.4 of the 2012 and 2009 IBC and Section 2303.2.1 of the 2006 IBC, Section R802.1.3.4 of the 2012 and 2009 IRC and Section R802.1.3.1 of the 2006 IRC; and the evaluation report number (ESR-1791).

**TABLE 1—MAXIMUM LOADS AND SPANS FOR PYRO-GUARD® TREATED PLYWOOD
APPLICABLE AT SERVICE TEMPERATURES UP TO 170° F (77° C)**

PLYWOOD PERFORMANCE CATEGORY	UNTREATED ROOF/SUBFLOOR SPAN RATING	PYRO-GUARD® ROOF SHEATHING MAXIMUM LIVE LOAD (psf)				PYRO-GUARD® WALL/SUBFLOOR Span (inches)
		Span (inches)	Climate Zone			
			1A	1B	2	
¹⁵ / ₃₂ , ¹ / ₂	32/16	24	19	30	43	16
¹⁹ / ₃₂ , ⁵ / ₈	40/20	24	42	64	87	20
		32	20	32	45	20
²³ / ₃₂ , ³ / ₄	48/24	32	34	51	71	24
		48	10	18	27	24
⁷ / ₈	—	48	12	20	30	—
¹ / ₈	—	48	21	33	47	48

For SI: 1 inch = 25.4 mm, 1 psf = 48 N/m² (Pa).

- All loads are based on two-span condition with panels 24 inches wide or wider, strength axis perpendicular to supports.
- Fastener size and spacing must be as required in the applicable building code for untreated plywood of the same thickness; except that roof sheathing must be fastened with (1) minimum 8d common or 8d deformed shank nails spaced a maximum 6 inches o.c. at edges and a maximum of 12 inches o.c. at intermediate supports for panels on 24- and 32-inch spans and spaced a maximum of 6 inches o.c. on all supports for panels on a 48-inch span, or (2) other fasteners with comparable withdrawal and lateral load capacities at the same maximum spacings. The use of staples to attach roof sheathing to framing is not permitted. For ¹/₈- performance category roof sheathing panels, minimum 10d common or deformed shank nails must be used.
- Roof spans and loads apply to roof systems having the minimum ventilation areas required by the applicable building code. Fifty percent of required vent area must be located on upper portion of sloped roofs to provide natural air flow.
- For low-sloped or flat roofs with membrane or built-up roofing having a perm rating less than 0.2, use rigid insulation having a minimum R value of 4.0 between sheathing and roofing, or use next thicker panel than tabulated for the span and load (e.g., ¹⁹/₃₂ for 24 inches, ²³/₃₂ for 32 inches); and use a continuous ceiling air barrier and vapor retarder with a perm rating less than 0.2 on the bottom of the roof framing above the ceiling finish.
- For unblocked roof diaphragms, panel edge clips are required for roof sheathing: one midway between supports for 24-inch and 32-inch spans, two at ¹/₃ points between supports for 48-inch span. Clips must be specifically manufactured for the plywood thickness used.
- Tabulated loads for Zone 1A are based on a duration of load adjustment for 7-day (construction) loads of 1.25. Tabulated loads for Zone 1B and Zone 2 are based on a duration of load adjustment for snow of 1.15. All values within the table are based on a dead load (DL) of 8 psf. If the DL is less than or greater than 8 psf, the tabulated live load may be increased or decreased by the difference. Applicable material weights, psf: asphalt shingles - 2.0, ¹/₂- performance category plywood - 1.5, ⁵/₈- performance category plywood - 1.8, ³/₄- performance category plywood - 2.2.
- Climate Zone definition:
 - Minimum design roof live load or maximum ground snow load up to 20 psf:
 - A - Southwest Arizona, Southeast Nevada (area bounded by Las Vegas-Yuma-Phoenix-Tucson)
 - B - All other qualifying areas of the continental United States
 - Minimum ground snow load over 20 psf
- PYRO-GUARD® treated plywood must not be used as roof sheathing if a radiant shield is used beneath the roof sheathing.
- The ¹⁹/₃₂- and ⁵/₈- performance category are limited to performance rated 4-ply or 5-ply. ²³/₃₂- and ³/₄- performance category are limited to performance rated 5-ply or 7-ply.
- Subfloor applications are limited to 100 psf maximum live load, except ¹/₈- performance category on 48-inch span limited to 65 psf total load.
- Deflection of roof sheathing at tabulated maximum live load is less than ¹/₂₄₀ of the span, and under maximum live load plus dead load is less than ¹/₁₈₀ of the span.
- Staples used to attach asphalt shingles must be minimum ¹⁵/₁₆-inch crown and minimum 1-inch leg, or otherwise comply with the applicable code, with the quantity of fasteners adjusted in accordance with Table 2 of this report.
- The use of PYRO-GUARD® on exterior walls requires a water-resistive barrier on the outside of the wall and installation of the barrier to provide protection during construction.
- For diaphragm and shear wall design increase the minimum nominal panel thickness required for untreated plywood by a minimum of ¹/₈ inch when PYRO-GUARD® treated plywood is used.

TABLE 2—DESIGN VALUE ADJUSTMENT FACTORS FOR PYRO-GUARD® TREATED LUMBER

PROPERTY	PYRO-GUARD® WALL/FLOOR SERVICE TEMPERATURE TO 100°F/38°C			PYRO-GUARD® ROOF FRAMING, SERVICE TEMPERATURE TO 150° F/66° C,					
	Douglas fir	Southern pine	Other species	Douglas fir			Southern pine		
				Climate Zone			Climate Zone		
				1A	1B	2	1A	1B	2
Extreme fiber stress in bending, F_b	0.97	0.91	0.88	0.90	0.93	0.96	0.80	0.85	0.89
Tension parallel to grain F_t	0.95	0.88	0.83	0.80	0.87	0.93	0.80	0.84	0.88
Compression parallel to grain, F_c	1.00	0.94	0.94	0.94	0.98	1.00	0.94	0.94	0.94
Horizontal shear F_v	0.96	0.95	0.93	0.95	0.95	0.96	0.92	0.93	0.94
Modulus of elasticity, E	0.96	0.95	0.94	0.96	0.96	0.96	0.95	0.95	0.95
Compression perp. to grain F_{cz}	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Fasteners/connectors	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90

1. Climate Zone definition:
 - 1 - Minimum design roof live load or maximum ground snow load up to 20 psf:
 - A - Southwest Arizona, Southeast Nevada (area bounded by Las Vegas-Yuma-Phoenix-Tucson)
 - B - All other qualifying areas of the Continental United States
 - 2 - Minimum ground snow load over 20 psf
2. Duration of load adjustments for snow loads, 7-day (construction) loads, and wind loads given in the National Design Specifications for Wood Construction apply.
3. Where lumber decking serves as both exposed ceiling and roof sheathing, extreme fiber in bending adjustments of 0.84, 0.83, and 0.89 must be used for southern pine in zones 1A, 1B, and 2, respectively; 0.92, 0.92, and 0.96 must be used for Douglas fir in zones 1A, 1B, and 2, respectively; except that where insulation having a minimum R value of 4.0 is installed above the decking, extreme fiber in bending adjustments of 0.91 for southern pine and 0.97 for Douglas fir are permitted in all zones.
4. Modulus of elasticity values apply to all treated lumber decking.
5. Roof framing adjustment factors apply to roof systems with minimum ventilation areas per applicable code. Locate 50 percent of required vent area on upper portion of sloped roofs to provide natural air flow.
6. Other species - species other than southern pine and Douglas fir listed in Section 3.1 of this report.

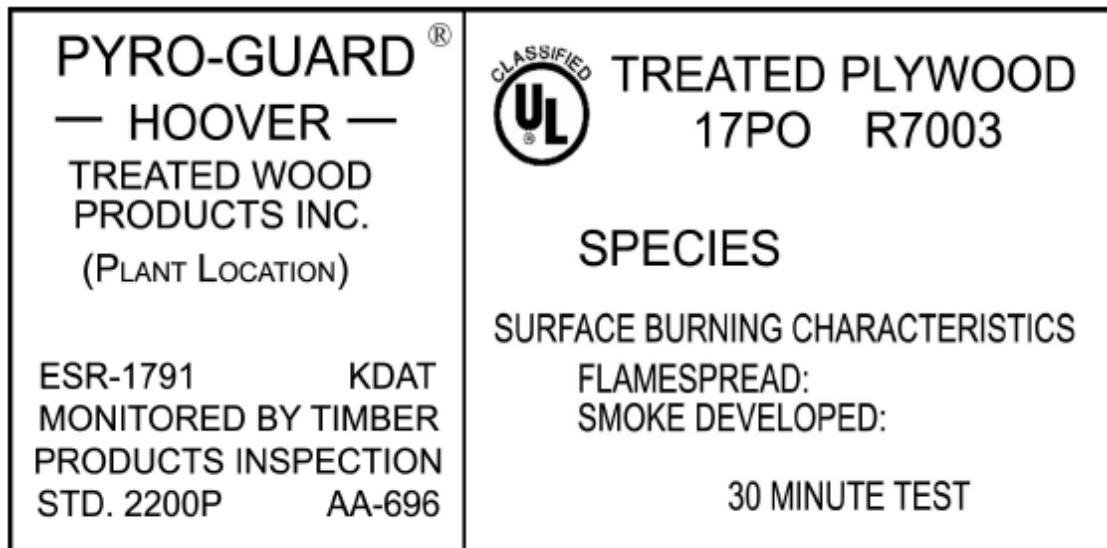


FIGURE 1—PLYWOOD STAMP

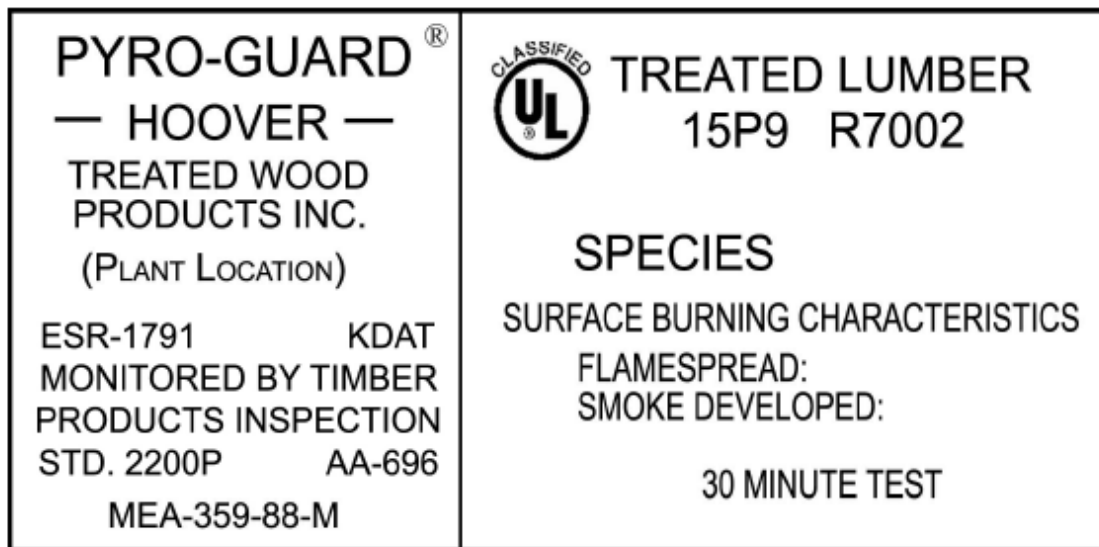


FIGURE 2—LUMBER STAMP

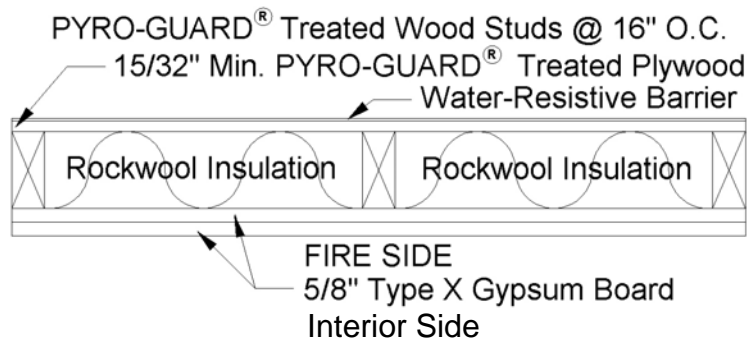


FIGURE 3—2-HOUR FIRE-RESISTANCE-RATED EXTERIOR WALL ASSEMBLY
 Use where wall is required to be fire-resistance-rated from the interior side only
 Load-bearing, 100% of Calculated Design Load
 (ESR-1791 2-HR-Interior Only)

INTERIOR SIDE: Base layer ⁵/₈-inch (15.9 mm) Tpe X gypsum wallboard applied parallel to studs with 1¹/₄-inch-long Type S steel screws spaced 12 inches (304.8 mm) o.c. Face layer ⁵/₈-inch (15.9 mm) Type X gypsum wallboard applied at right angles to studs with 2-inch-long Type S steel screws spaced 8 inches (203.2 mm) o.c. at edges and 12 inches (304.8 mm) o.c. at intermediate studs. All joints in face layer staggered with joints in base layer. All vertical joints must be located over the studs. All exposed joints and screw heads must be covered with tape and joint compound in accordance with ASTM C840 or GA216. (LOAD-BEARING, 100% of Calculated Design Load)

STUD CAVITY: Spaces between the studs are completely filled rockwool or slag mineral wool batts weighing not less than 3.3 pounds per cubic foot (1 pound per square foot of wall surface).

EXTERIOR SIDE: Pyro-Guard Treated Plywood minimum ¹⁵/₃₂-inch thick fastened at 6 inches on center at edges and 12 inches (304.8 mm) on center in the field and covered with a water-resistive barrier.

EXTERIOR FINISH: Three-coat stucco or minimum 4-inch-thick nominal brick veneer complying with Sections 1404 and 1405 of the IBC, or Chapter 7 of the IRC.

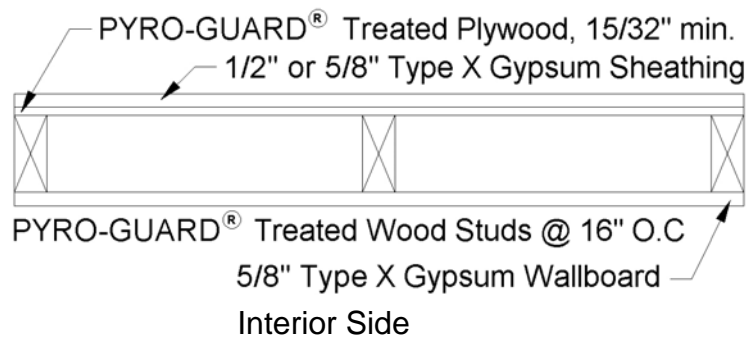


FIGURE 4—1-HOUR FIRE-RESISTANCE-RATED EXTERIOR WALL ASSEMBLY
 Use where wall is required to be fire-resistance-rated from the exterior and interior sides.
 (ESR-1791 1-HR)

INTERIOR SIDE: One layer $\frac{5}{8}$ -inch (15.9 mm) Type X gypsum wallboard applied parallel with or at right angles to studs fastened with GWB-54 nails at 8 inches (203.2 mm) o.c. or 8 inches (203.2 mm) o.c. on the edges and double nailed in the field at 12 inches (304.8 mm) o.c. or $1\frac{1}{4}$ -inch (31.75 mm) Type W drywall screws at 16 inches (406.4 mm) o.c. All exposed joints, nail and screw heads must be covered with tape and joint compound in accordance with ASTM C840 or GA216.

STUD CAVITY INSULATION: When used with a $\frac{1}{2}$ -inch (12.7 mm) Type X gypsum layer on the exterior? side, spaces between the studs are completely filled with glass fiber mineral wool batts weighing not less than 2 pounds per cubic foot (0.6 pound per square foot of wall surface) or rockwool or slag mineral wool batts weighing not less than 3.3 pounds per cubic foot (1 pound per square foot of wall surface), or cellulose insulation having a nominal density not less than 2.6 pounds per cubic foot [Reference IBC Table 722.6.2(5)]. When used with a $\frac{5}{8}$ -inch (15.88 mm) Type X gypsum layer, stud cavity insulation is optional.

EXTERIOR SIDE: One layer $\frac{1}{2}$ - or $\frac{5}{8}$ -inch (15.9 mm) Type X gypsum sheathing, 48 inches (1,219.2 mm) wide applied parallel to studs fastened in accordance with manufacturer's recommendations and one layer of Pyro-Guard® treated plywood minimum $\frac{15}{32}$ (11.91 mm) category thickness (refer to Table 1) fastened in accordance with Table 2304.9.1 of the IBC and covered with a water resistant barrier. The order of assembly can be either as shown or with the plywood on the outside.

EXTERIOR FINISH: Material, in the minimum thickness, as required by IBC Table 1405.2 installed in accordance with the manufacturers recommendations. Vinyl Siding must not be used in buildings of Type III or Type IV construction.

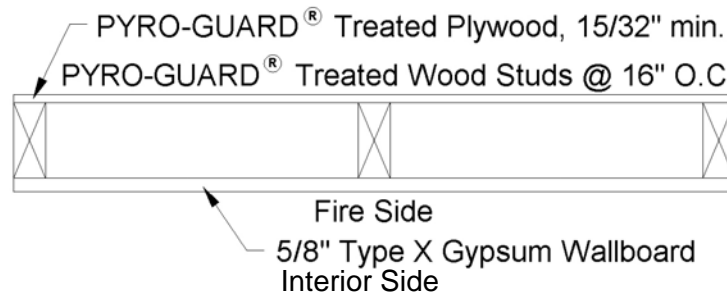


FIGURE 5—1-HOUR FIRE-RESISTANCE-RATED EXTERIOR WALL ASSEMBLY
 Use where wall is required to be fire-resistance-rated from the interior side only
 (ESR-1791 1-HR-Interior Only)

INTERIOR SIDE: One layer $\frac{5}{8}$ -inch (15.9 mm) Type X gypsum wallboard applied parallel with or at right angles to studs fastened with GWB-54 nails at 8 inches (203.2 mm) o.c. or 8 inches (203.2 mm) o.c. on the edges and double nailed in the field at 12 inches (304.8 mm) o.c. or $1\frac{1}{4}$ -inch (31.75 mm) Type W drywall screws at 16 inches (406.4 mm) o.c. All exposed joints, nail and screw heads must be covered with tape and joint compound in accordance with ASTM C840 or GA216.

STUD CAVITY INSULATION (OPTIONAL): Insulation complying with IBC Section 720 and IBC Table 722.6.2(5).

EXTERIOR SIDE: One layer of Pyro-Guard® treated plywood minimum $\frac{15}{32}$ (11.9 mm) thickness category (Refer to Table 1) fastened in accordance with Table 2304.9.1 of the IBC and covered with a water resistant barrier.

EXTERIOR FINISH: Material, in the minimum thickness, as required by IBC Table 1405.2 installed in accordance with the manufacturers recommendations. Vinyl siding must not be used in buildings of Type III or Type IV construction.