

ICC-ES Evaluation Report

ESR-2731

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DIVISION: 09 00 00—FINISHES
Section: 09 24 00—Portland Cement Plastering

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EVALUATION SUBJECT
GREATWALL EXTERIOR WALL AND INSULATION STUCCO SYSTEM
1.0 EVALUATION SCOPE
Compliance with the following codes:

- 2006 *International Building Code*® (IBC)
- 2006 *International Residential Code*® (IRC)
- 1997 *Uniform Building Code*™ (UBC)

Properties evaluated

- Structural
- Weathering and durability
- Fire-resistance-rated construction

2.0 USES

The Greatwall Exterior Wall and Insulation Stucco System is an alternative exterior wall covering to those specified in IBC Chapter 25, IRC Section R703 and UBC Chapter 25. The system may be used as a component of a one-hour fire-resistance-rated exterior wall assembly when installed in accordance with Section 4.4 of this report.

3.0 DESCRIPTION
3.1 General:

The Greatwall Exterior Wall and Insulation Stucco System is a proprietary mixture of portland cement, sand, fibers, water and proprietary additives reinforced with a wire fabric or metal lath and applied to substrates of expanded polystyrene (EPS) insulation board, gypsum sheathing, fiberboard or plywood. The system is installed on exterior walls of wood or steel stud construction.

3.2 Materials:

3.2.1 Greatwall Concentrate Exterior Wall and Insulation Stucco System: The stucco is a factory-prepared mixture of Type I or II portland cement complying with ASTM C 150, chopped polypropylene fibers and proprietary additives. The mixture is packaged in 80-pound (36.3 kg) bags. Approximately 5 to 6 gallons (18.9 to 22.7 L) of water and 220 pounds (99.8 kg) of sand complying with Section 3.2.4 are added to each bag in the field and mixed in accordance with the manufacturer's recommendations.

3.2.2 Greatwall Sanded Exterior Wall and Insulation Stucco System: The stucco is a factory-prepared mixture of Type I or II portland cement complying with ASTM C 150, sand complying with Section 3.2.4, chopped polypropylene and proprietary additives. The mixture is packaged in 80-pound (36.3 kg) bags or 2000-pound (907 kg) bulk bags. Approximately 2 gallons (7.6 L) of water are added to each 80-pound bag, or 34 to 45 gallons (129 to 170 L) to each bulk bag in the field, and mixed in accordance with the manufacturer's recommendations.

3.2.3 Field-blended Stucco: This stucco is a field-prepared mixture consisting of one 10-pound (45 kg) bag of chopped polypropylene fibers and proprietary additives, 94 pounds (42.6 kg) of Type I or II portland cement complying with ASTM C 150 and approximately 400 pounds (181 kg) of sand complying with Section 3.2.4. Approximately 6 gallons (22.7 L) of water are added to each field-prepared mixture in accordance with the manufacturer's recommendations. Continuous field inspection, as noted in Section 4.5.1, is required of all batching and mixing operations.

3.2.4 Sand: Sand must be clean and free from deleterious amounts of loam, clay, silt, soluble salts and organic matter. Sampling and testing must comply with ASTM C 144. Sand must be graded within the following limits:

RETAINED ON U.S. STANDARD SIEVE	PERCENT RETAINED BY WEIGHT ± 2 PERCENT	
	Minimum	Maximum
No. 4	—	0
No. 8	0	10
No. 16	10	40
No. 30	30	65
No. 50	70	90
No. 100	95	100

3.2.5 Insulation Board: EPS insulation board must have a nominal density of 1.5 pounds per cubic foot (24 kg/m³), and a flame-spread index of 25 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E 84 (UBC Standard 8-1.) Boards applied directly to framing members must be 1 inch to 1½ inches (25.4 to 38.1 mm) thick and have ⅜-inch-high (9.5 mm) tongues with compatible grooves for horizontal joints. See Figure 2 for joint detail. All boards must be recognized in a current ICC-ES evaluation report.

When installed over solid backing, as described in Section 4.3, the insulation boards must have ¼-inch-wide-by-⅛-inch-deep (6.4 mm by 3.2 mm) vertical grooves spaced a maximum of 12 inches (305 mm) on the back face of the board. As an alternate to the vertical grooves on the foam plastic board, flat-faced insulation boards over solid sheathing must incorporate the Tyvek® StuccoWrap® or Tyvek® DrainWrap™ water-resistive barriers recognized in [ESR-2375](#).

3.2.6 Lath:

3.2.6.1 Wire Fabric Lath: Wire fabric lath must comply with the ICC-ES Acceptance Criteria for Metal Plaster Bases (Lath) (AC191). Minimum No. 20 gage [0.035 inch (0.89 mm)], 1-inch-opening (25.4 mm), galvanized steel, woven-wire fabric must be used. Lath must be furred over all substrates. Furring must comply with the following requirements:

1. When maximum total coating thickness is ½ inch (12.7 mm) or less, the body of the lath must be furred a minimum of ⅛ inch (3.2 mm) from the substrate after installation.
2. When total coating thickness is greater than ½ inch (12.7 mm), No. 17 gage [0.058 inch (1.47 mm)] by 1½-inch (38 mm) woven-wire fabric or 2-inch-by-2-inch (50.8 mm by 50.8 mm), No. 16 gage welded-wire lath must be used. The body of the lath must be furred a minimum of ¼ inch (6.4 mm) from the substrate after installation.

Metal lath, described in Section 3.2.6.2, may be used as an alternative to No. 20 gage woven-wire fabric lath.

3.2.6.2 Metal Lath: Metal lath must comply with AC191 and IBC Table 2507.2, IRC Section R703.6 or UBC Table 25-B. Furring and self-furring requirements are as set forth in Section 3.2.6.1 for wire fabric lath.

3.2.7 Gypsum Board: Gypsum sheathing board must be water-resistant core gypsum sheathing complying with ASTM C 79 or ASTM C 1396. Gypsum wallboard must comply with ASTM C 36 or ASTM C 1396.

3.2.8 Fiberboard: Fiberboard must be minimum ½-inch-thick (12.7 mm), asphalt-impregnated fiberboard complying with ASTM C 208, Type IV wall sheathing in accordance with IBC Section 2303.1.5.

3.2.9 Wood Structural Panels: Wood structural panels must be minimum ⅝-inch-thick (7.9 mm) plywood with exterior glue for studs spaced 16 inches (406 mm) on center, and minimum ⅜-inch-thick (9.5 mm) plywood with exterior glue for studs spaced 24 inches (610 mm) on center. Plywood must be exterior-grade or Exposure 1 complying with U.S. Department of Commerce Product Standard PS-1 or UBC Standard 23-2, as applicable.

3.2.10 Caulking: Caulking must be acrylic latex caulking material complying with ASTM C 834.

3.2.11 Weather Protection:

3.2.11.1 Water-resistive Barrier: A water-resistive barrier is required and must comply with IBC Section 1404.2, IRC Section R703.2 or UBC Section 1404.1, as applicable.

Minimum No. 15 asphalt nonperforated felt complying as Type I in accordance with ASTM D 226 (IBC or IRC); minimum Grade D kraft building paper complying with UBC Standard 14-1; asphalt-saturated rag felt complying with UL Standard 55A (UBC); or material recognized in a current evaluation report as complying with the ICC-ES Acceptance Criteria for Water-Resistive Barriers (AC38), is required. When applied over wood-based sheathing, the barrier must be one of the following:

1. A minimum of two layers of Grade D kraft building paper as set forth in IBC Section 2510.6, IRC Section R703.6.3 or UBC Section 2506.4, or an equivalent recognized in a current evaluation report.
2. One layer of EPS insulation board, having horizontal tongue-and-groove edges as described in Section 3.2.5 of this report, over one layer of Grade D kraft building paper having a minimum water-resistance rating of 60 minutes or a water-resistive barrier recognized in a current ICC-ES evaluation report with a minimum water-resistance rating of 60 minutes.

When Tyvek® StuccoWrap® or Tyvek® DrainWrap™, recognized in [ESR-2375](#), is used as the water-resistive barrier, grooved insulation board described in Section 3.2.5 is not required. The Tyvek® StuccoWrap® or Tyvek® DrainWrap™ must be installed as described in [ESR-2375](#).

3.2.11.2 Vapor Retarder: Protection against condensation must be provided in accordance with IBC Section 1403.2. A vapor retarder must be provided in accordance with IRC Section R318.1, unless its omission is permitted under the exceptions in IRC Section R318.1.

3.2.11.3 Flashing: Flashing complying with IBC Section 1405.3, IRC Section R703.8 or UBC Section 1404.2, as applicable, must be provided. Where membrane flashing is used, it must be a self-adhering, flexible rubberized asphalt and polyethylene material complying with the ICC-ES Acceptance Criteria for Flexible Flashing Materials (AC148), and must be shingle-lapped with the water-resistive barrier. Rigid flashings must be sloped towards the exterior, with upturned legs on the interior side and at the ends. Flashing must extend beyond the surface of the exterior wall.

3.2.11.4 Trim and Accessories: All trim, screeds and corner reinforcement must be galvanized steel or approved plastic.

4.0 INSTALLATION

4.1 General:

The exterior cementitious coating is applied by troweling in one coat to a minimum ⅜-inch (9.5 mm) thickness. Nominal thickness around penetrations is ⅜ inch (9.5 mm), backed by framing or blocking. The lath must be embedded in the minimum coating thickness and therefore cannot be exposed. Flashing, corner reinforcement, metal trim and weep screeds must be installed as shown in Figure 1. The coating is applied at ambient air temperatures ranging from 40°F to 110°F (4.4°C to 43.3°C) by applicators approved by IMASCO Minerals Inc. An installation card, as noted in Figure 3, must be on the jobsite with the name of the applicator and the product to be used, before any water-resistive barrier or exterior sheathing is installed. Also see Section 5.5 of this report.

4.2 Application over Open Framing: EPS Insulation Board:

The water-resistive barrier must be placed, as set forth in Section 3.2.11.1 of this report, over open studs spaced a maximum of 24 inches (610 mm) on center. The EPS insulation board, described in Section 3.2.5, must be

placed horizontally with tongues facing upward, and must be temporarily held in place with galvanized staples or roofing nails. Vertical butt joints must be staggered a minimum of one stud space from adjacent courses and occur directly over studs. The lath must be applied tightly, with 1¹/₂-inch (38 mm) end laps and side laps, over the EPS insulation board, and must be fastened through the EPS insulation board and water-resistive barrier to wood studs, sills and plates. Fasteners are No. 11 gage galvanized roofing nails with 1/2-inch-diameter (12.7 mm) heads, spaced 6 inches (152 mm) on center, or No. 16 gage [0.065-inch leg diameter (1.65 mm)] galvanized staples with a minimum crown width of ¹⁵/₁₆ inch (23.8 mm), spaced 6 inches (152 mm) on center. Fasteners must penetrate wood framing at least 1 inch (25.4 mm). Care must be taken to avoid overdriving fasteners.

The Greatwall Exterior Stucco System may also be applied over minimum No. 20 gage [0.0396 inch base-metal thickness (0.91 mm)] steel studs spaced 16 inches (406 mm) on center. The wire fabric lath is applied tightly over the insulation board and is fastened through the insulation board and water-resistive barrier to the metal studs, using minimum No. 8, corrosion-resistant, self-drilling tapping screws having 0.40-inch-diameter (10.2 mm) wafer heads, at 6 inches (152 mm) on center, to all studs and tracks. Screws must penetrate the studs and tracks a minimum of 1/2 inch (12.7 mm).

Wall bracing in accordance with IBC Section 2308.9.3 or 2308.12, IRC Section R602.10 or R602.11, or UBC Sections 2320.11.3 and 2320.11.4 is required. Outside wall corners and parapet corners must be covered with extra metal corner reinforcement attached to the framing members with approved fasteners spaced a maximum of 18 inches (457 mm) on center. Weep screeds must comply with, and be installed at the bottom of the wall in accordance with, IBC Section 2512.1.2, IRC Section R703.6.2.1 or UBC Section 2506.5. Galvanized metal, 1³/₈-inch (35 mm), J-shaped trim pieces must be installed at other areas where insulation board is exposed. At windows and doors, flashing described and installed in accordance with IBC Section 1405.3, IRC Section R703.8 or UBC Section 1402.2, butting J-trim metal edges, must be caulked. Holes for hose bibs, electrical panels and other penetrations of substrate surfaces, except those caused by fasteners, must be caulked. The coating is applied as described in Section 4.1.

4.3 Application over Solid Backing:

4.3.1 Fiberboard: Minimum 1/2-inch-thick (12.7 mm) fiberboard sheathing is installed directly over wood studs spaced a maximum of 24 inches (610 mm) on center. The fiberboard is temporarily held in place with corrosion-resistant staples or roofing nails. A water-resistive barrier must be applied over the fiberboard, as set forth in Section 3.2.11.1 of this report, prior to the installation of the insulation board. When the optional insulation board is used, the foam plastic boards must have grooves as described in Section 3.2.5, or flat-faced foam boards may be used provided the water-resistive barrier is Tyvek® StuccoWrap® or Tyvek® DrainWrap™ as described in Section 3.2.11.1. When grooved foam plastic boards are used, they must be aligned vertically, but may be offset a maximum of 6 inches (152 mm) from adjacent boards. The vertical joints of insulation boards are staggered from adjacent courses a minimum of 3 inches (76 mm). Insulation boards are attached to the framing, but the vertical joints of the insulation boards are not required to align with the framing. The lath must be attached to the studs through the sheathing with fasteners and spacing as described for insulation board in Section 4.2 of this report;

or as described for fiberboard in IBC Table 2304.9.1, IRC Table R602.3 (1) or UBC 23-II-B-1, as applicable; whichever is more restrictive.

Wall bracing in accordance with IBC Section 2308.9.3 or UBC Sections 2320.11.3 and 2320.11.4 is required. When the fiberboard is used as wall bracing, it is to be fastened to the framing in accordance with the requirements of the applicable code, prior to application of the water-resistive barrier and optional EPS insulation board. The lath and optional EPS insulation board are to be fastened in accordance with Section 4.2 of this report. Outside wall corners and parapet corners must be covered with extra metal corner reinforcement attached to the framing members with approved fasteners spaced 18 inches (457 mm) on center. Weep screeds must comply with, and be installed at the bottom of the wall in accordance with, IBC Section 2512.1.2, IRC Section R703.6.2.1 or UBC Section 2506.5, as applicable. Galvanized steel, 1³/₈-inch (35 mm), J-shaped trim pieces must be installed in other areas where insulation board is exposed. See Figure 1 for typical installation details. At windows and doors, butting J-trim metal edges are caulked. Holes for hose bibs, electrical panels and other penetrations of substrate surfaces, except those caused by fasteners, are also caulked. The coating is applied as described in Sections 4.1 and 4.2.

4.3.2 Gypsum Sheathing: Minimum 1/2-inch-thick (12.7 mm) water-resistant core gypsum sheathing must be installed directly over wood studs spaced a maximum of 24 inches (610 mm) on center. Gypsum sheathing is fastened in accordance with ASTM C 1280 (IBC), IRC Table R702.3.5, or UBC Table 25-G, as applicable. The water-resistive barrier, optional EPS insulation board, wire fabric or metal lath and coating are applied as applied as described in Section 4.3.1 for fiberboard. The lath is attached to studs through the sheathing, with fasteners and spacing as described for insulation board in Section 4.2. All walls are braced in accordance with the applicable code. Exposed sheathing edges are protected with screeds. Holes in the substrate surface are caulked, and the coating is applied as described in Sections 4.1 and 4.2.

The gypsum sheathing may be applied to minimum No. 20 gage [0.032 inch base-metal thickness (0.91 mm)] steel studs spaced at a maximum of 16 inches (406 mm) on center, using No. 8 by 0.420-inch-diameter-head (10.7 mm), minimum 1³/₁₆-inch-long (30.2 mm), self-drilling tapping screws spaced at 6 inches (152 mm) on center to secure sheathing to studs. The water-resistive barrier, optional EPS insulation board, wire fabric or metal lath and coating are applied as described in Section 4.3.1 for fiberboard. EPS insulation may be installed over the sheathing and weather-resistive barrier prior to the lath and coating. Lath is secured with No. 8 by 0.420-inch-diameter-head (10.7 mm), minimum 1¹/₄-inch-long (31.7 mm), self-drilling, tapping wafer-head screws spaced 6 inches (152 mm) on center. Screws fastening sheathing, and screws fastening lath, are staggered from each other. Minimum screw penetration must be 1/2 inch (6.4 mm) into the stud. The balance of the system installation must be in accordance with Section 4.2.

4.3.3 Wood Structural Panel Sheathing: Plywood sheathing is applied directly to wood studs under the conditions set forth in Section 3.2.9 and either IBC Table 2308.9.3(3), IRC Table 602.3(3), or UBC Table 23-IV-D-1 and Table 23-II-B-1, as applicable. The water-resistive barrier, optional EPS insulation board, wire fabric or metal lath and coating are applied as described in Section 4.3.1 for fiberboard. The system may also be installed over plywood attached to minimum No. 20 gage [0.0396 inch base-metal thickness (0.91 mm)] steel studs spaced a

maximum of 16 inches (406 mm) on center as described in Section 4.3.1 for fiberboard. The sheathing is temporarily held in place with self-tapping screws. The water-resistive barrier and coatings are applied as described for fiberboard in Section 4.3.1. The lath is applied over the plywood as set forth in Section 4.2.

4.4 One-hour Fire-resistance-rated Assembly:

4.4.1 Interior Face: One layer of $\frac{5}{8}$ -inch-thick (16 mm), Type X gypsum wallboard, water-resistant backerboard or veneer base is applied parallel or at right angles to the interior face of nominally 2-by-4 wood studs spaced a maximum of 24 inches (610 mm) on center. The wallboard is attached with 6d coated nails, $1\frac{7}{8}$ inches (47.8 mm) long with $\frac{1}{4}$ -inch-diameter (6.4 mm) heads, at 7 inches (178 mm) on center to studs, plates and blocking. All wallboard joints must be backed with minimum nominally 2-by-4 wood framing, taped and treated with joint compound. Fastener heads must also be treated with joint compound in accordance with ASTM C 84 or GA-216.

4.4.2 Exterior Face: One layer of minimum $\frac{5}{8}$ -inch-thick (16 mm), Type X water-resistant core-treated gypsum sheathing, 48 inches (1.22 m) wide, must be applied parallel to studs with No. 11 gage galvanized roofing nails, $1\frac{3}{4}$ inches (44.5 mm) long with $\frac{7}{16}$ -inch- or $\frac{1}{2}$ -inch-diameter (11.1 or 12.7 mm) heads at 4 inches (101.6 mm) on center at board edges and 7 inches (178 mm) on center at intermediate studs. The sheathing is nailed to top and bottom plates at 7 inches (178 mm) on center. A weather-resistive barrier is required over the sheathing. The wire fabric lath and wall coating are then applied as described in Section 4.2, with or without foam plastic insulation.

4.4.3 Axial Design: The wood stud axial design stress for the wall assembly, calculated in accordance with Sections 3.6 and 3.7 of ANSI AF&PA NDS-05 (IBC and IRC) or ANSI/NFoPA NDS-91 (UBC), is limited to $0.78 F_c$, and the maximum stress must not exceed $0.78 F_c$ at a maximum l_e/d ratio of 33.

4.5 Miscellaneous:

4.5.1 Inspection Requirements: Building department inspection is required on lath installation prior to application of the coating, as noted in the applicable code. The Greatwall Stucco System requires special inspections, in accordance with IBC Section 1704 or UBC Section 1701, for field-batching and mixing of components. As an alternative, when approved by the code official, continuous field inspection of all batching and mixing operations, by an authorized inspector trained and approved by IMASCO Minerals Inc., may be used. The authorized inspector must be independent of the plastering contractor. A declaration, such as that shown in Figure 4, must be completed and signed in duplicate, for presentation to the building owner and the code official with the plastering contractor's installation card.

4.5.2 Control Joints: Control joints must be installed as specified by the architect, designer, builder or exterior coating manufacturer, in that order. In the absence of other details, conventional three-coat plastering details must be used.

4.5.3 Curing: Moist curing must be provided for 24 hours after coating application.

4.5.4 Soffits: The system may be applied to soffits, provided the coating is applied over metal lath complying with ASTM C 847 or UBC Table 25-B in lieu of the coating's being applied over wire fabric lath. Metal lath fastening must comply with IBC Section 2510.3, IRC

Section R703.6.1.3.5 or UBC Table 25-C, except the length of the fastener must be increased by the thickness of the substrate.

4.5.5 Sills: The system may be applied to sills at locations such as windows and other similar areas. Sills with depths of 6 inches (152 mm) or less may have the coating and lath applied to any substrate permitted in this report, provided the coating, lath, water-resistive barrier and substrate are installed in accordance with the appropriate section of this report. Sills with depths exceeding 6 inches (152 mm) must have substrates of solid wood or plywood. The substrate must be fastened in accordance with IBC Table 2304.9.1, IRC Section R602.3, or UBC Table 23-II-B-1, and a double layer of a code-complying Grade D water-resistive barrier must be applied over the substrate. The coating, lath, and optional EPS board must be applied in accordance with Section 4.2.

5.0 CONDITIONS OF USE

The Greatwall Exterior Wall and Insulation Stucco System 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** Materials and methods of installation must comply with this report and the manufacturer's published installation instructions. In the event of a conflict between the installation instructions and this report, this report governs. The manufacturer's published installation instructions must be available at the jobsite at all times during installation.
- 5.2** Installation is by contractors approved by Imasco Minerals Inc.
- 5.3** The system is recognized as a one-hour fire-resistance-rated assembly when installed in accordance with Section 4.4.
- 5.4** The interior of the building is separated from the foam plastic boards by a thermal barrier complying with IBC Section 2603.4, IRC Section R314.1.2 and IRC Table R702.3.5 or UBC Section 2602.4 and UBC Table 25-G.
- 5.5** An installation card, such as that shown in Figure 3 of this report, must be completed and left at the jobsite for the owner, and a copy must be filed with the building department.
- 5.6** Inspections must be performed in accordance with Section 4.5.1 of this report.
- 5.7** Foam plastic must not be placed on exterior walls of wood construction located within 6 inches (152 mm) of the ground in areas where hazard of termite damage is very heavy in accordance with IBC 2603.8 or IRC Section R320.5.
- 5.8** The allowable wind load on the system applied to wood studs a maximum of 24 inches (610 mm) on center is 22 psf (1053 Pa) positive and 28 psf (1341 Pa) negative. The allowable wind load on the system applied to metal studs a maximum of 16 inches (406 mm) on center, over solid gypsum sheathing substrate, is 49 psf (2346 Pa) positive or negative. Support framing must be adequate to resist the required wind load.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Cementitious Exterior Wall Coatings (AC11), dated June 2007 (editorially revised April 2008).

7.0 IDENTIFICATION

7.1 The factory-prepared mixes are delivered to the jobsite in water-resistant bags with labels bearing the following information:

- a. Name and address of manufacturer (Imasco Minerals) and the evaluation report number (ESR-2731).
- b. Identification of components.
- c. Weight of packaged mix.

d. Storage instructions.

e. Maximum amount of water and other components that may be added and conditions that must be considered in determining actual amount.

f. Curing instructions.

7.2 Foam plastic insulation boards are identified in accordance with their respective ICC-ES evaluation reports. Additionally, the board density must be noted.

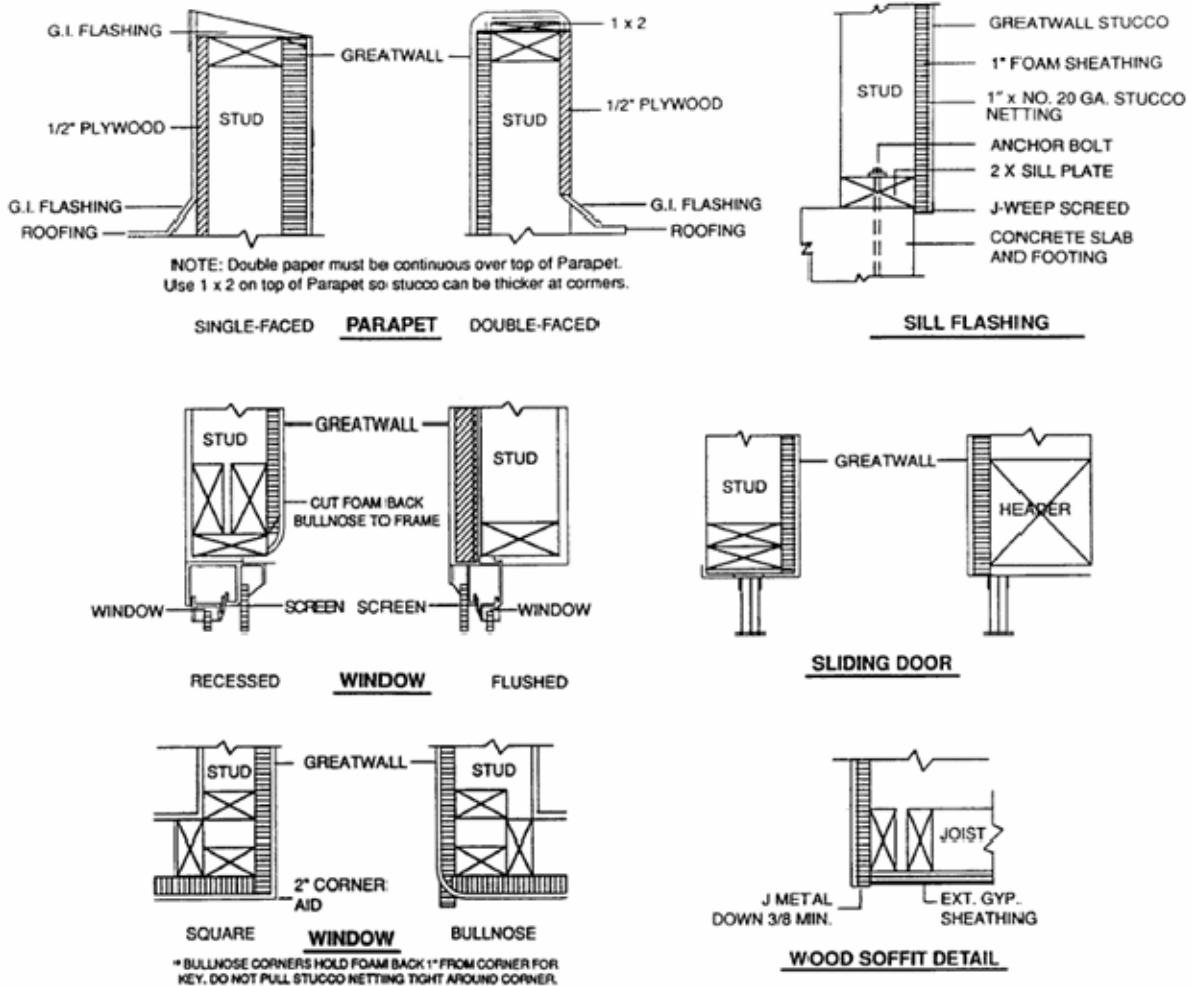


FIGURE 1—TYPICAL DETAILS

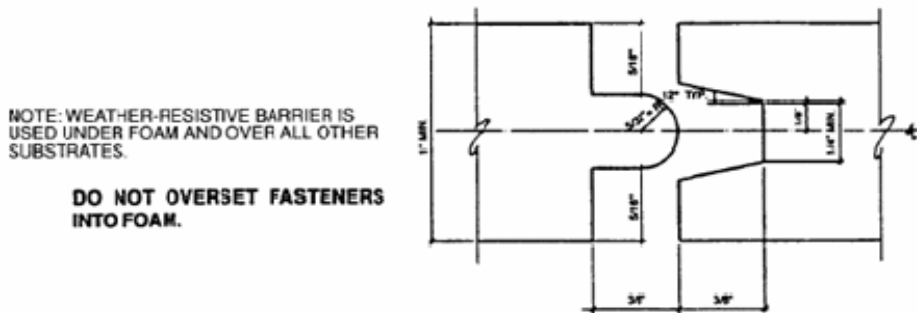


FIGURE 2—TONGUE-AND-GROOVE FOAM

