

WALL: BRICK VENEER DESIGN A

BRICK VENEER- CAVITY- CONTINUOUS INSULATION
AIR & VAPOR BARRIER- SHEATHING- STEEL STUD BACK UP WALL

DETAIL AT ROOF EDGE	SK-A1
DETAIL AT PARAPET	SK-A2
DETAIL AT FLOOR SLAB	SK-A3
DETAIL AT PENETRATION	SK-A4
DETAIL AT WINDOW HEAD	SK-A5
DETAIL AT WINDOW JAMB	SK-A6
DETAIL AT WINDOW SILL	SK-A7
DETAIL AT FOUNDATION	SK-A8
DETAIL AT SHINGLE ROOF	SK-A9
DETAIL AT METAL ROOF	SK-A10

DETAIL	TABLE OF CONTENTS: BRICK VENEER DESIGN A	SKETCH NUMBER
ENERGY CODE: CONCEPTUAL DETAILS FOR EDUCATIONAL PURPOSES ONLY	Date: 10/18/2001 Scale: 1-1/2"=1'-0" Drawn: ---	SK-A0 1 OF 11

**Boston Society of Architects
Building Envelope Committee
52 Broad Street
Boston, MA 02109**

**Building Envelope Designs meeting the requirements of the new Massachusetts
Energy Code 780 CMR 13
*For Educational Purposes Only***

Acknowledgments:

Process: The BSA Building Envelope Committee was approached by the Board of Building Regulations and Standards to develop building envelope details demonstrating compliance with the new energy code. Richard Keleher AIA, chairman and founder of the BSA building envelope committee appointed a task force to develop a narrative and details to demonstrate compliance with the new energy code. The task force developed the details and narrative below, which were then reviewed by the building envelope committee members.

The BSA was under contract with the Peregrine Energy Group, a contractor to the Board of Building Regulations and Standards to deliver pdf format drawings and a narrative of the system alternatives. Shepley Bulfinch Richardson and Abbott, Architects, Boston, acted as prime consultant to the BSA to develop the deliverables.

The task force decided to select, review, verify and edit some of the designs from the “Architects Guide to The New Energy Code”, by Mark Kalin, available in hard copy and in electronic form as publication No. 263 from the BSA.

The following task force members contributed their time and knowledge in the development of these designs:

Wagdy Anis AIA	Shepley Bulfinch Richardson and Abbott, Task force chair.
Mark Kalin FAIA, FCSI	Kalin Associates Inc.
Jeff Wade AIA, CSI	ADD Inc
Lance Robson AIA	Building Envelope Technologies Inc.
Steven Rigione	HKT Architects Inc.

In addition to reviews by the subcommittee members, the following members of the BSA's Building Envelope Committee performed very helpful reviews of the details before publishing:

Len Anastasi, CSI	Lennel Specialties
Vince Camalleri AIA	Simpson Gumpertz and Heger
Ken Crocco AIA	ArchiTech Consulting Inc., Chicago Chapter AIA
Richard Keleher AIA, CSI	Shepley Bulfinch Richardson and Abbott
Don Klema AIA	Kallmann McKinnell and Wood Architects
Joseph Lstiburek, PhD. P. Eng.	Building Science Corporation
Ned Lyon P.E.	Simpson Gumpertz and Heger
Fred Nashed AIA	Architectural Consulting Services
Oscar Padjen AIA	Padjen Architects, Inc.
Allan Schmaltz	Unerectors Inc.

The designs must be reviewed by a design professional before applying them for applicability to a specific project, including the limitations imposed by the interior and exterior environment of a building. Some designs are more durable than others, and cost is also a variable. The designs are based on a maximum of 35% interior relative humidity in the winter and normal exterior conditions in Massachusetts. Some of the designs fail if the interior RH is higher, and should be modified. Any misapplication or misinterpretation of these designs is the sole responsibility of the user.

In all of the designs below, continuity of the air barrier from foundations to roof is a focus, including closure of all penetrations. None of the designs have been reviewed by a structural engineer. The structural support of the air barrier is taken into consideration to withstand positive and negative air pressures, but should be reviewed by a structural engineer for transfer to the backup wall and structure. The systems and anchorages normally designed by specialty engineers such as light-gage steel studs, stone and precast concrete connections have also not been engineered. Alternatives within each design are discussed below.

Roof:

No attempts to vary the low-slope roofing design were made. Remember that the new energy code establishes a relationship of 10 times less permeable for the roof membrane than the vapor barrier in the roof assembly. Roof membranes vary from 2 to 0.03 perms, therefore the vapor barrier should be from 0.1 to 0.003, based on the roof membrane permeability.

Design A shows a pitched shingle roof and a metal roof. The concept of tying the roof air barrier to the wall air barrier is demonstrated. The shingle roof is ventilated due to the shingle manufacturer's warranty requirements. If the metal roofing standing seams are sealed, then it too should be ventilated. Otherwise the metal roof assembly is non-ventilated roof and takes advantage of the code roof ventilation exception for air-tight roof assemblies.

Design A also shows a penetration conceptually. The concept of air-tightening all penetrations should carry through all the designs.

Also in design A is an enlarged detail of a window connection, as an example of connecting a window-frame to the wall air-barrier. This is applicable to all the designs. Window crack perimeter sealants should be used that are compatible with polyethylene, such as low or ultra-low-modulus silicone. For small windows up to 5' or 6', one-part spray polyurethane foam may be used. A membrane, properly connected with compatible sealants and termination bars to window and membrane may also be used. The same tie-in location is true of louvers, metal door frames and store fronts. Curtain wall is tied in at the tube face of the glazing pocket.

- **Design A**

Description:

Brick, 2" Cavity, Continuous Insulation, Air/Vapor Barrier, Sheathing, Steel Stud Backup Wall and Gypsum Drywall Interior Finish.

Advantages & Disadvantages:

This wall type has a layer of continuous insulation, making it energy efficient. It is easy to build, because the air and vapor barrier and the insulation are continuous. The steel stud back-up wall is always kept above the dew-point of the winter indoor air, which promotes durability. The air and vapor barrier on the warm side of the insulation also works as the drainage plane, handling liquid water, water vapor in the winter and reverse vapor drive, keeping the back-up wall always dry. The year-round stable temperature of the air and vapor barrier promotes its durability. It is also well structurally supported, especially if the insulation is mechanically fastened rigid insulation and/or if the membrane is a peel-and-stick.

Since this wall can function without a vapor barrier, a less expensive version can use an extruded polystyrene insulation with spun-bonded polyolefin air barrier and no vapor barrier.

Yet a less expensive version, omits the air and vapor barrier membrane and the gypsum sheathing, turning the extruded polystyrene into the air barrier by taping it with a durable peel-and-stick tape. Disadvantages of doing this are that the tape is on the cold side of the wall, and therefore, probably less durable.

Insulation Alternatives:

Care should be taken to prevent convection currents from occurring between the cavity and the air and vapor barrier. This can be achieved by mechanically fastening the insulation, or by embedding the insulation in sealant or mastic or an insulation adhesive.

This design is based on extruded polystyrene insulation, but numerous insulation alternatives (requiring further professional evaluation) are possible to achieve the required code minimum R-7 continuous insulation:

- extruded polystyrene.
- polyisocyanurate
- medium Density two-part Spray Polyurethane Foam.
- expanded polystyrene (needs vapor barrier)
- semi-rigid rockwool (needs vapor barrier).
- semi-rigid glass fiber (needs vapor barrier)

Based on ASHRAE recommendations, extruded polystyrene and polyisocyanurate insulations have an aged R-value of 5 and 5.5 per inch respectively.

Extruded polystyrene is waterproof. It can help reduce the reverse vapor drive, as can spray polyurethane foam and polyisocyanurate. Rockwool is fireproof, hydrophobic and conforms to the back-up wall. Glass-fiber, carefully specified, has similar qualities. Both rockwool and semi-rigid glass fiber need the higher quality air and vapor barriers, such as peel-and-stick, as does expanded polystyrene.

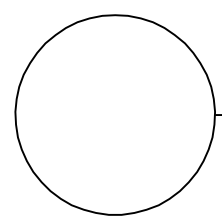
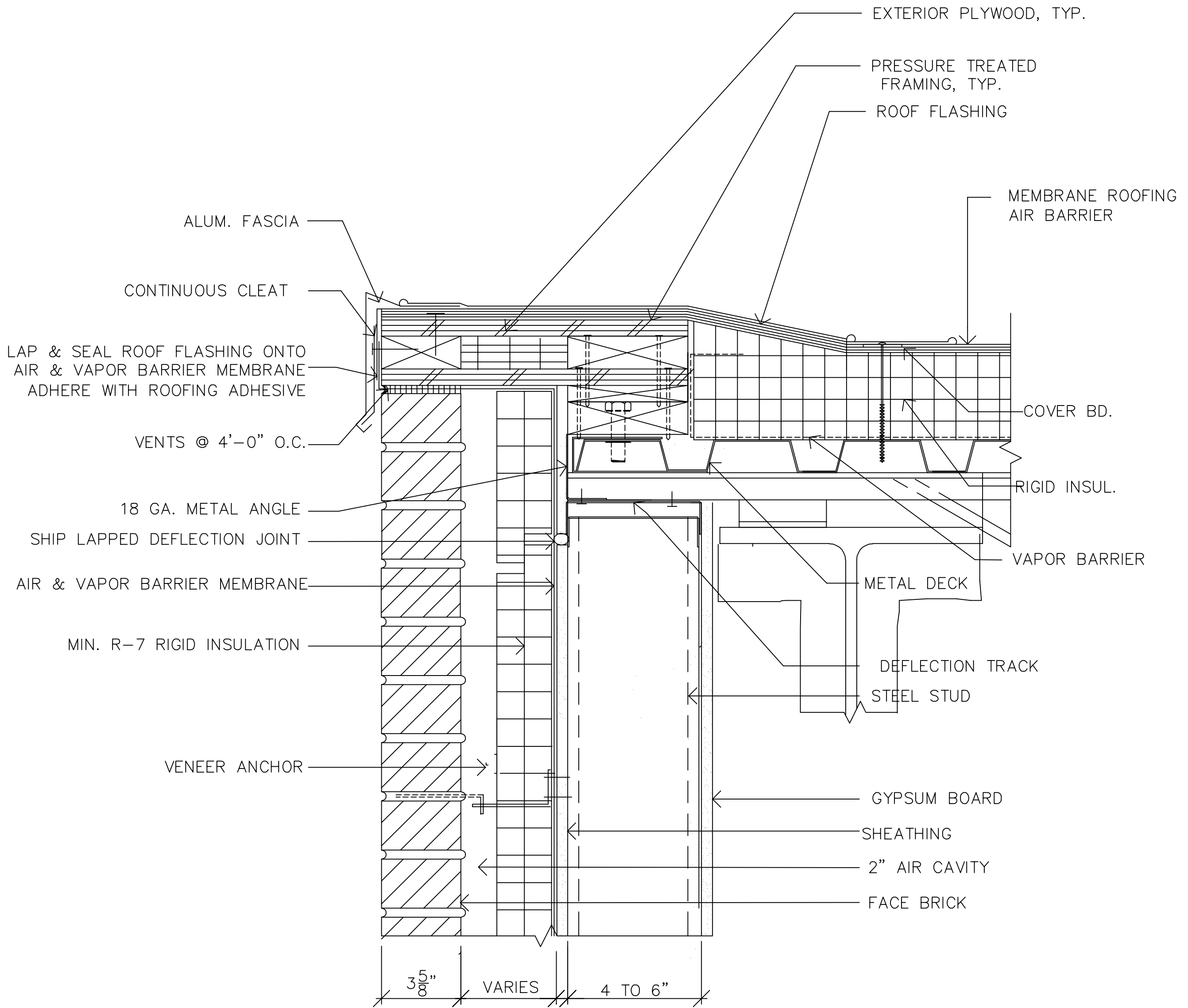
Air & Vapor Barrier Alternatives:

- In the case of spray polyurethane foam insulation, all it needs is membrane transition sheets and taping the sheathing joints.

- Peel-and stick modified asphalt/polyethylene membrane.
- Liquid-applied spray-on or trowel-on air/vapor barrier. (caution that asphalt damp-proofing is not considered to be flexible enough to be durable). Liquid-applied air and vapor barrier membrane may double an insulation adhesive as well.

If this kind of air and vapor barrier is used trim-work at windows, and transitions needs to be made with a compatible sheet membrane, usually an asphalt peel-and-stick.

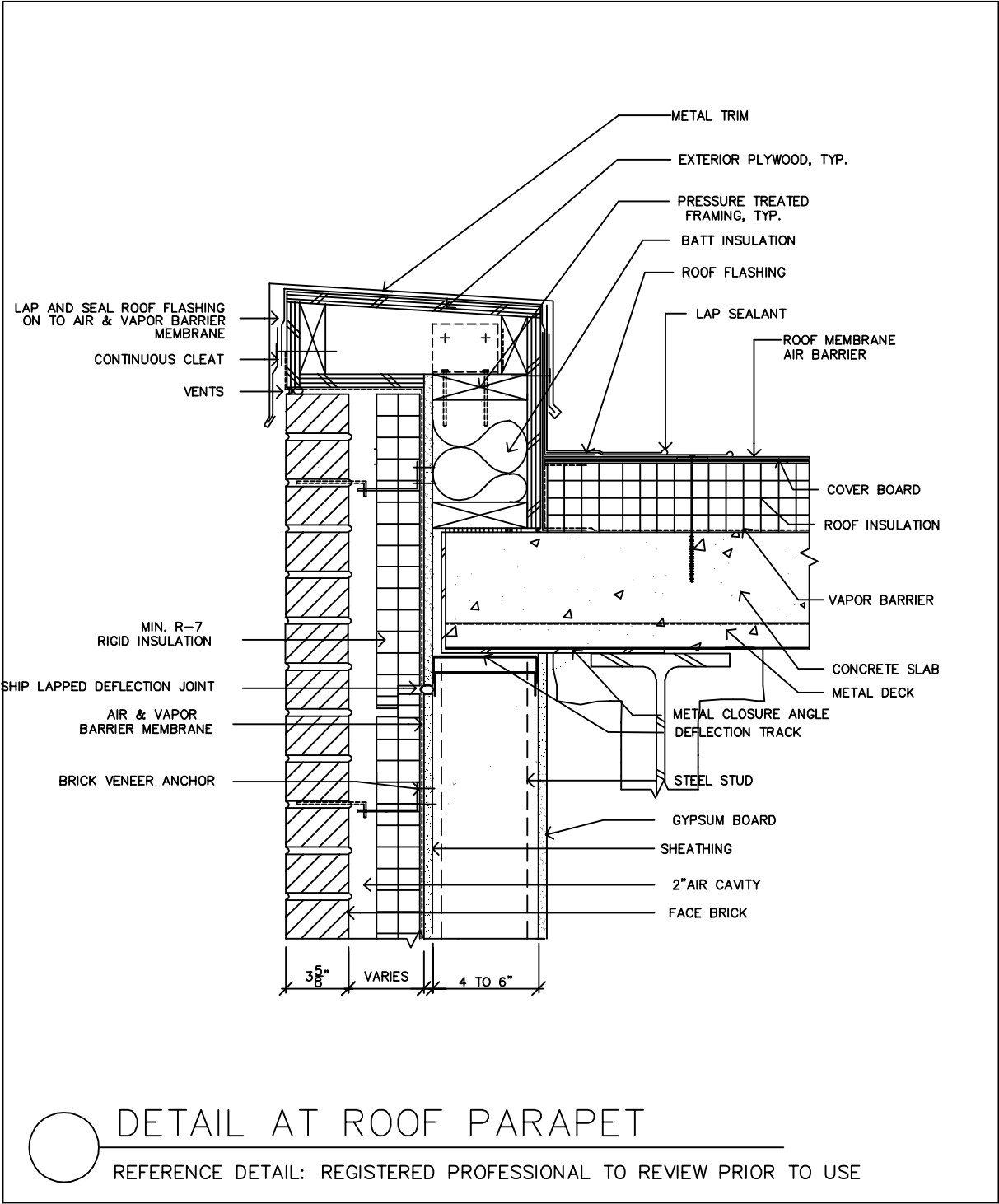
- Thermofusible modified asphalt membrane.
- Reinforced polyethylene sheet. Tape all joints with a compatible durable tape such as peel-and stick, and trim all openings and transitions with membrane.
- Reinforced aluminum foil air/vapor barrier, with taped joints and membrane transitions.
- Spun-bonded polyolefin air barrier (with rigid insulation).



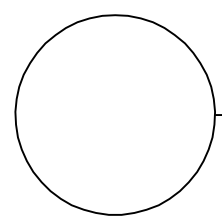
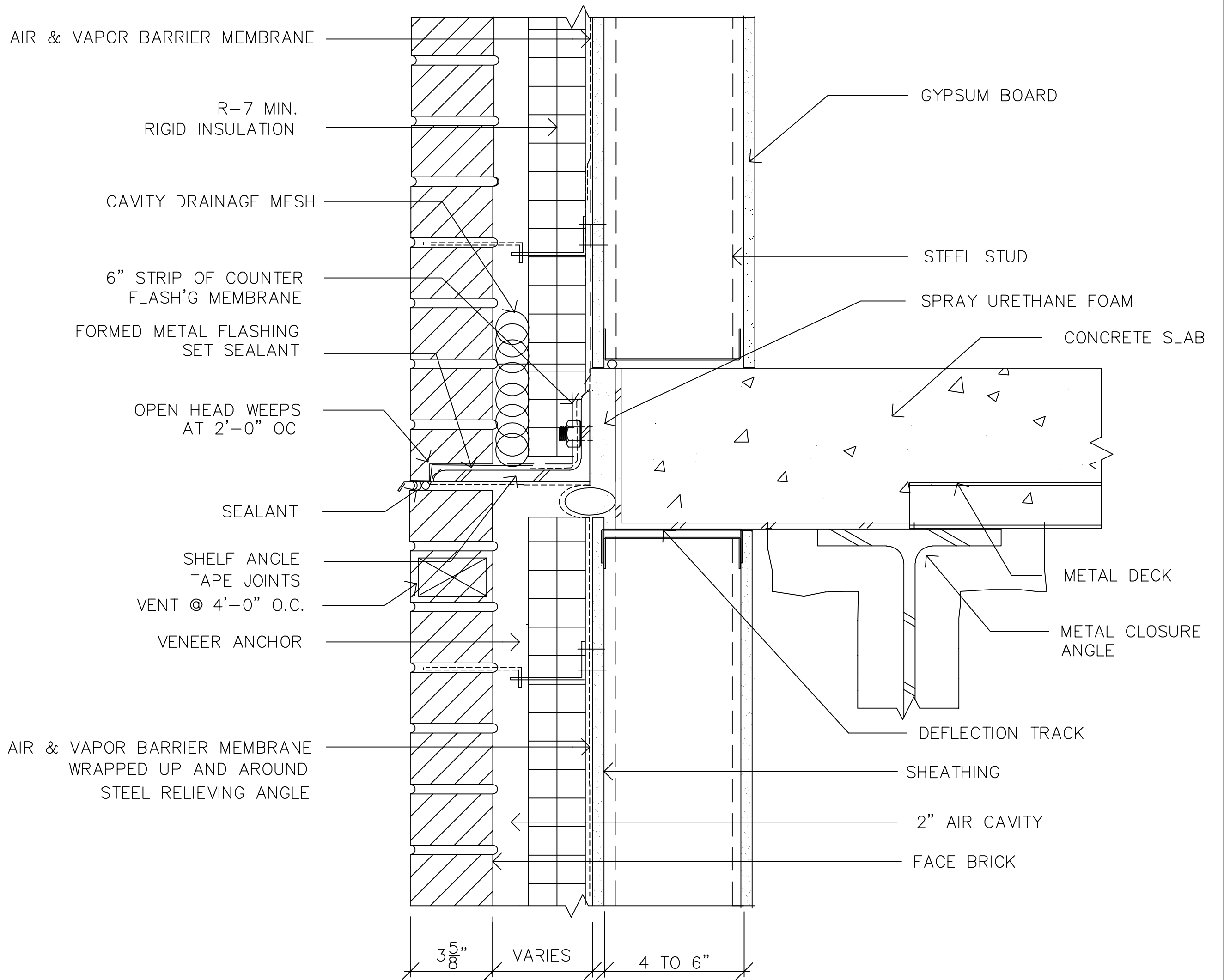
DETAIL AT ROOF EDGE

REFERENCE DETAIL: REGISTERED PROFESSIONAL TO REVIEW PRIOR TO USE

<p>DETAIL</p>	<p>TITLE: ROOF : BRICK VENEER DESIGN A</p>	<p>SKETCH NUMBER SK-A1</p>
<p>ENERGY CODE: CONCEPTUAL DETAILS FOR EDUCATIONAL PURPOSES ONLY</p>	<p>Date: 10/10/2001 Scale: 3"=1'-0" Drawn: SAR</p>	



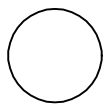
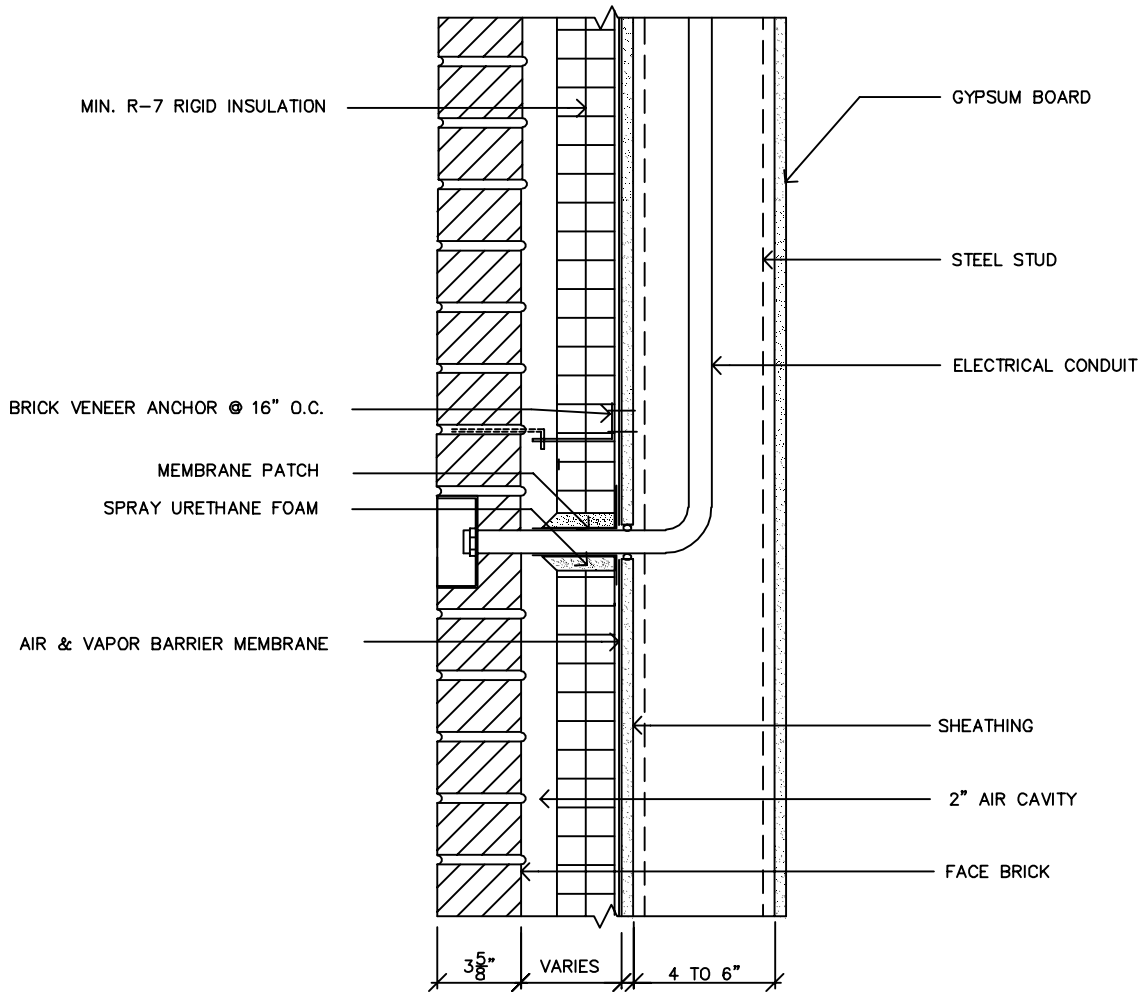
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<p>ENERGY CODE: CONCEPTUAL DETAILS FOR EDUCATIONAL PURPOSES ONLY</p>	<p>Date: 10/10/2001 Scale: 1-1/2"=1'-0" Drawn: ---</p>	<p>SK-A2 3 OF 11</p>



DETAIL AT FLOOR SLAB

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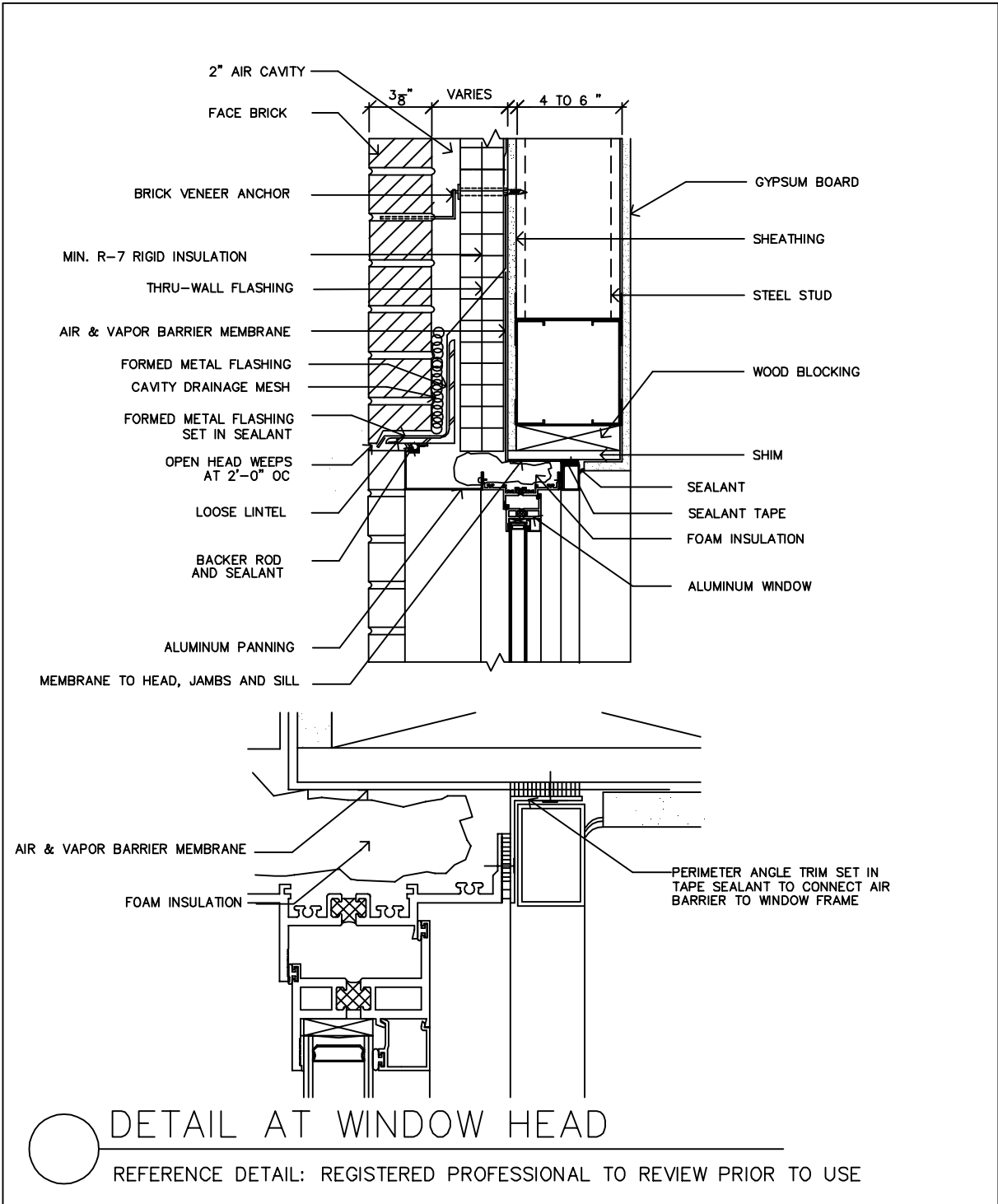
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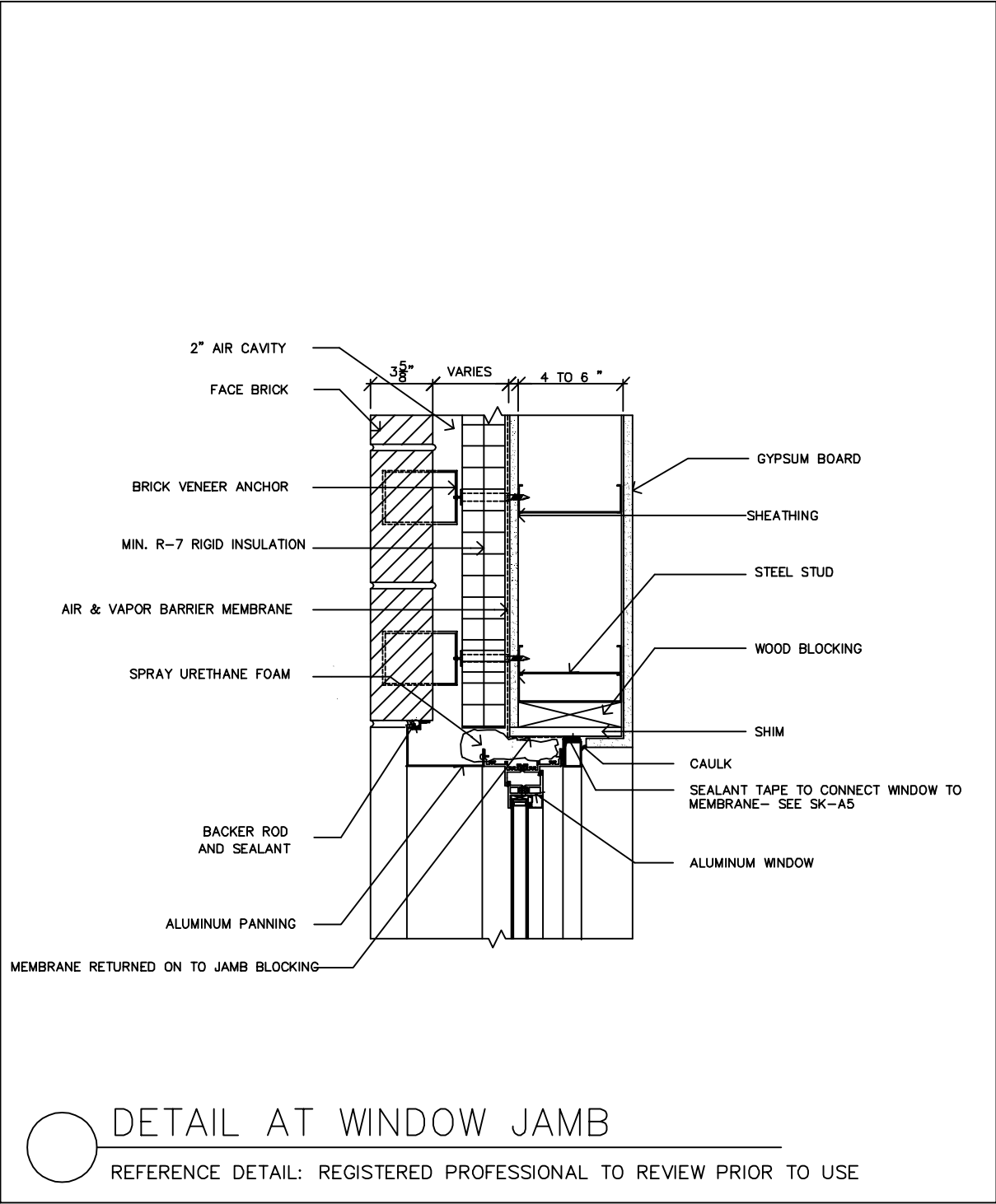
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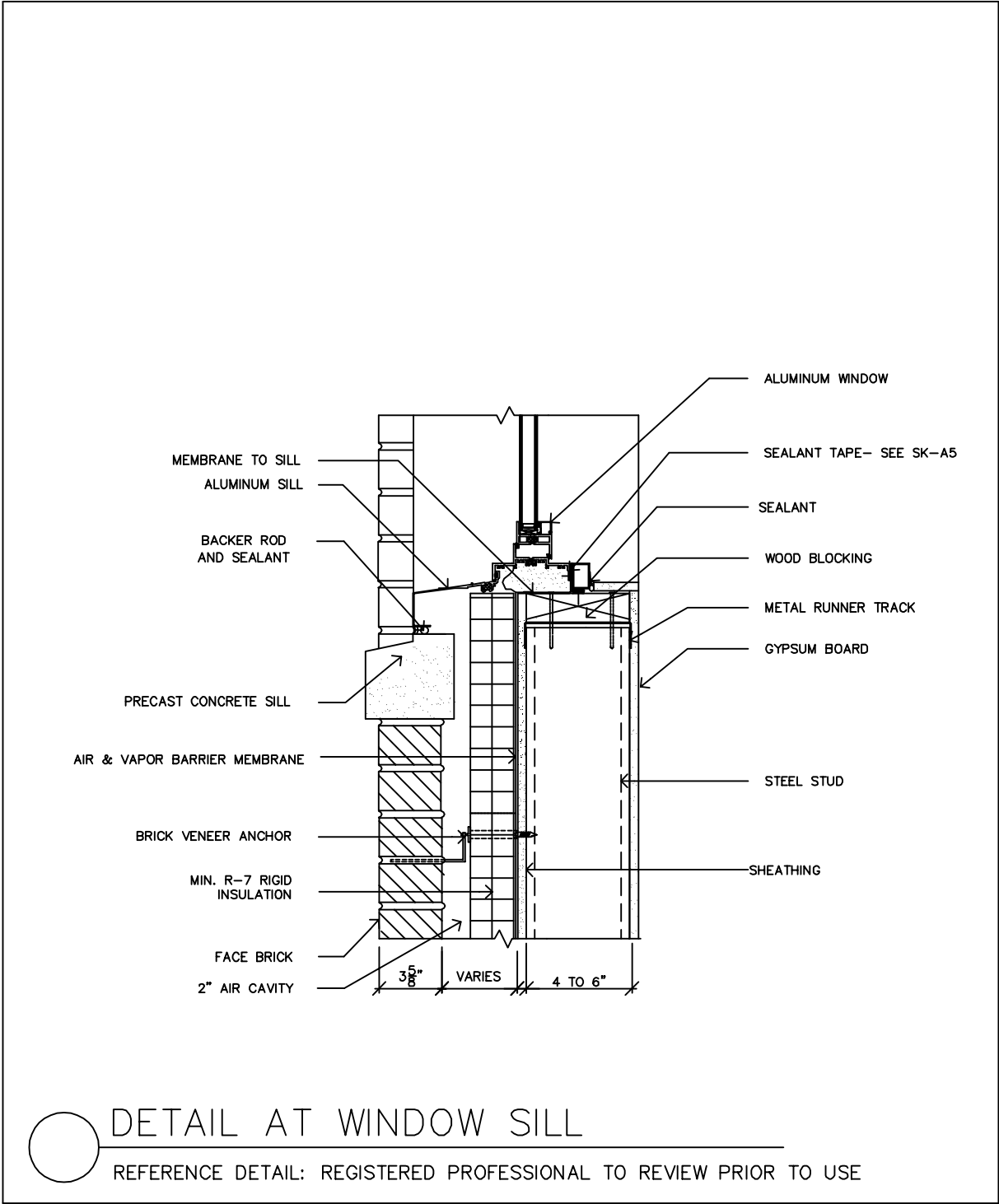
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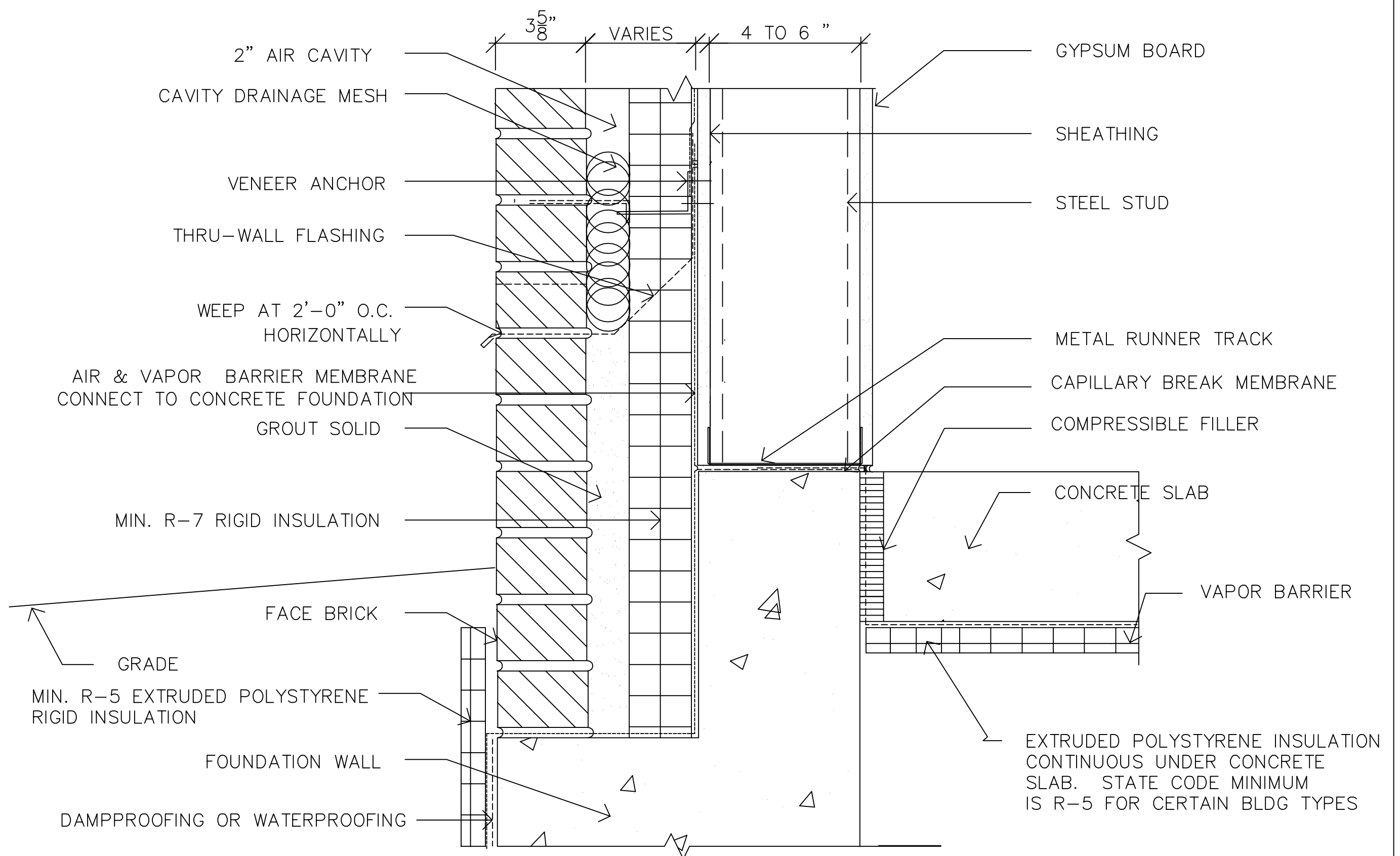
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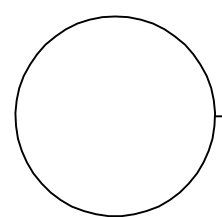
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DETAIL	TITLE: WALL: BRICK VENEER DESIGN A	SKETCH NUMBER SK-A7
ENERGY CODE: CONCEPTUAL DETAILS FOR EDUCATIONAL PURPOSES ONLY	Date: 10/10/2001 Scale: 1-1/2"=1'-0" Drawn: ---	8 OF 11

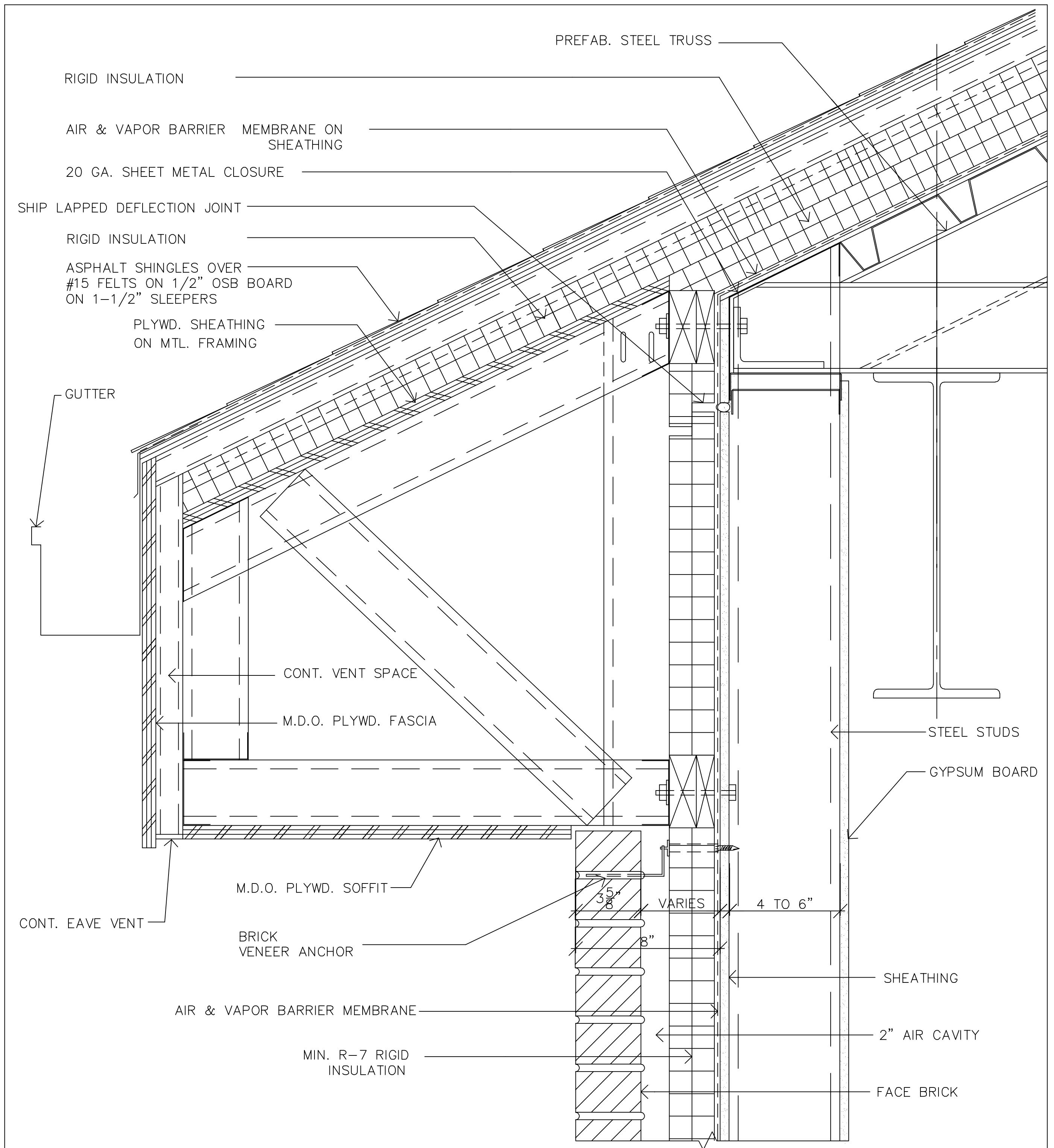


DETAIL AT FOUNDATION



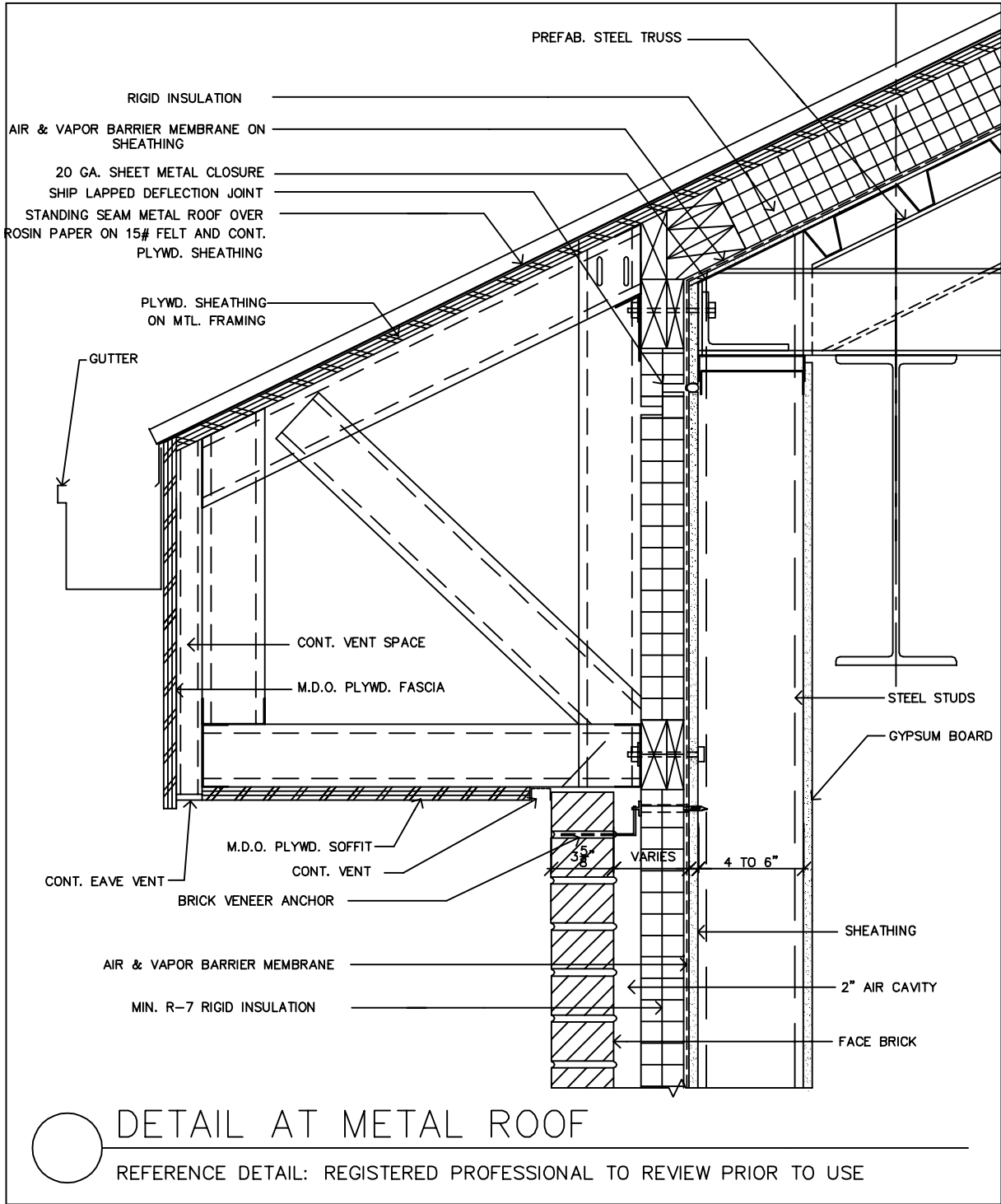
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DETAIL AT BRICK VENEER WALL / ROOF
 REFERENCE DETAIL: REGISTERED PROFESSIONAL TO REVIEW PRIOR TO USE

DETAIL	TITLE: WALL/ROOF: BRICK VENEER DESIGN A	SKETCH NUMBER A-9 10 OF 11
ENERGY CODE: CONCEPTUAL DETAILS FOR EDUCATIONAL PURPOSES ONLY	Date: 10/10/2001 Scale: 3"=1'-0" Drawn: SAR	



<p>DETAIL</p>	<p>TITLE: WALL/ROOF: BRICK VENEER DESIGN A</p>	<p>SKETCH NUMBER SK-A10</p>
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