

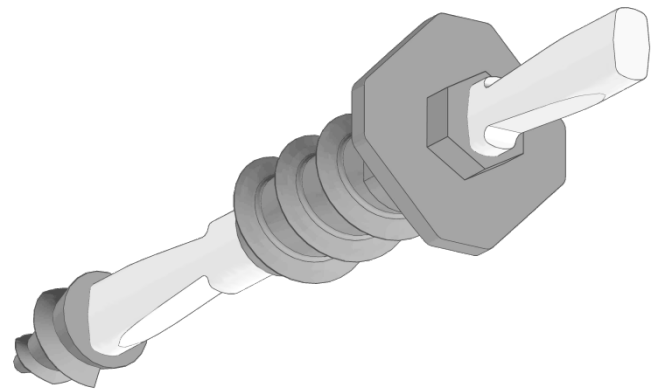
For use with: SYSTEM NC featuring MS-T series connectors

Introduction

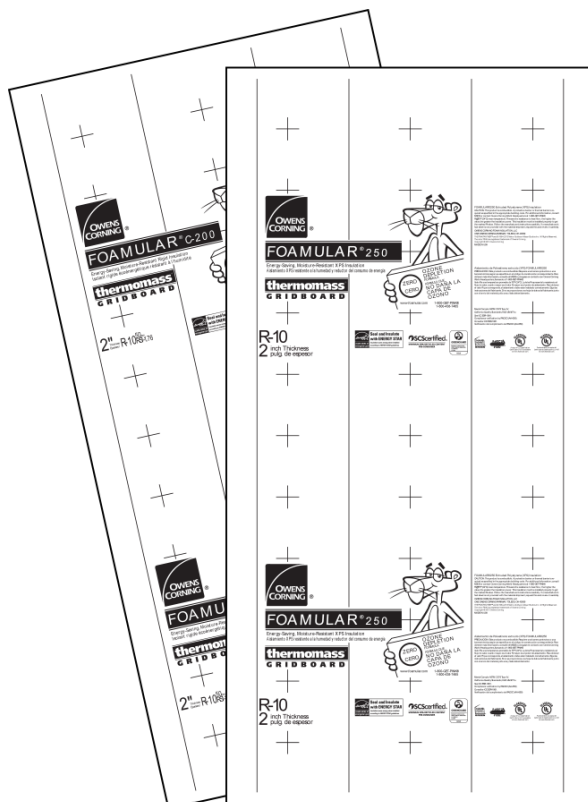
These procedures focus on the installation of Thermomass SYSTEM NC featuring MS-T series wythe connectors in the construction of non-composite tilt-up (site-precast) or plant-precast panels. This document is not a construction specification. The information presented is based on the most recent, appropriate, industry standards and methods. The qualified designers, specifiers, suppliers and contractors retained by the owner must confirm all information.

Definitions

MS-T series wythe connectors: The MS-T connector is a standard MS series connector specially modified to be installed (driven) into the insulation without the use of pre-punched holes. The connector has two distinct ends—one with a typical dovetail and the other with a threaded tip. The serrated, molded body of the MS series has been replaced by molded threads, and the top of the molded collar now features a hexagon end necessary for installation.

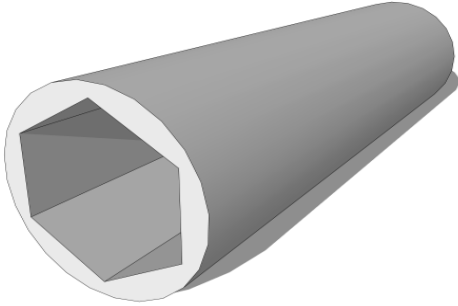


Gridboard: Supplied exclusively with MS-T connectors, Gridboard insulation is marked with a pattern to aid in the systems installation. Gridboard insulation has cross hatches at 8 in. o.c. (200 mm) longitudinally and 16 in. o.c. (400 mm) transversely. Additionally, Gridboard insulation has continuous, longitudinal lines spaced at 4 in. (100 mm) and 16 in. (300 mm) from each edge.



The Gridboard cross hatches provide guidance when installing connectors in the recommended spacing of 16 in. o.c. (400 mm) each way (or 3 columns with 6 connectors per column) in a 4 x 8 insulation sheet.

Intermediate cross hatches in the longitudinal direction are intended to help ensure accurate placement of any additional connectors dictated by the panel design, specified by the wall panel engineer, or listed below in the connector placement rules. The Gridboard lines serve as alignment aids when placing or cutting insulation sheets in panel forms with openings, penetrations or sloping edge conditions. Gridboard is available in both extruded polystyrene and polyisocyanurate insulation.



Socket for MS-T: The MS-T collar is designed with a metric (SI), hexagon shank so it may be driven with any 6 or 12 point, **12 mm**, 2 ½ in. deep well socket (63mm). A kit including a 3/8 inch, 6-point, 12 mm socket (shown at left) and a 1/4 inch driver-socket adapter is taped inside each box of MS-T connectors. Use the socket and adapter in combination with any motorized driver-drill for fast and simple installation.

Application Guidelines

MS-T series connectors have an embedment of $2 \frac{3}{16}$ in. (55 mm) in the fascia concrete and a 1 ½ in. (40 mm) embedment in the interior concrete; therefore **we recommend that the gross thickness of the fascia concrete be 2 ½ in. (63 mm) or greater** so adequate anchorage of the connector end is achieved. Reveal depths for the 2 ½ in. (63 mm) fascia should be limited to ½ in. (12 mm). Reveal depths for the 2 ½ in. (63 mm) fascia should be carefully coordinated to avoid the connector locations.

Typical spacing for MS-T connectors is 16 in. o.c. (400 mm) each way. Special spacing may be specified depending on panels' dimensions and loading conditions. The insulations' cross hatches and lines help to ensure accurate placement of any unique connector spacing specified by the panel engineer.

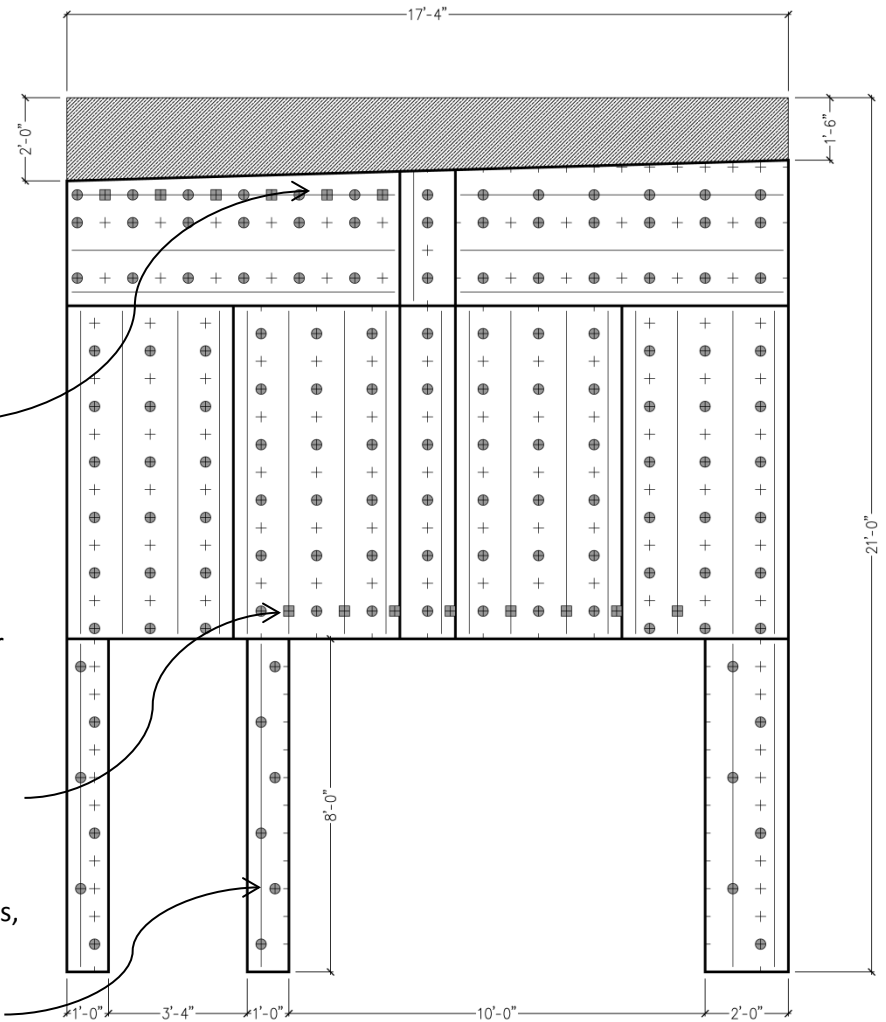
Installation Procedure

1. **Prepare casting surface.** Clean the casting surfaces and place rustication and chamfer strips, as required.
2. **Prepare for exterior wythe concrete placement.** Apply release agent as specified by the release agent manufacturer. Place reinforcing steel or welded wire fabric sheets on proper supports. Use care to minimize marring of the release agent. Again, clean debris from casting surface.
3. **Precut insulation to fit panel forms.** For best results the insulation should be precut to fit the panel forms prior to the day of fascia wythe concrete placement.
4. **Place exterior wythe concrete.** The fascia wythe concrete should be thick enough (per ACI code) to provide sufficient cover for the reinforcement and allow adequate embedment for the connectors.
 - Concrete should be at least 4000 psi so that sufficient strength can be obtained. Cold joints shall not be permitted in an individual panel. Concrete shall have a minimum compressive strength at 28 days as indicated on the project drawings and as required for panel erection, or specified, and tested according to ASTM C39. Minimum strength of panels at time of erection shall be in accordance with the lifting design.

- Slump should be specified in the range of 5 in. to 7 in., out of the tail-gate or the pump. It is necessary that the specified concrete slump, be maintained during installation of the insulation system. This slump may be achieved by adding a mid-range water reducer to the 1 in. to 3 in. slump mix design.
 - Maximum size aggregate shall be ¾ in. (19 mm) for the fascia wythe concrete. This size constitutes an economical mix that can be pumped if desired. Larger size aggregate obstructs placement of the connectors and should be avoided
 - Performance of the MS-T series connector is dependent on properly consolidated concrete around the dovetail anchorage on the connector. If a low slump concrete is placed for the face layer, the concrete will tend to form holes as the connectors are driven through the insulation. It is extremely difficult to force a low-slump concrete to flow back around the dovetail. Even if the connectors are mechanically vibrated after installation, there is a possibility that proper anchorage will not be achieved for all of the connectors.
 - A low-slump concrete becomes even more problematic if used in a high-temperature environment. Under these conditions, a lower slump concrete will reach initial set quite rapidly. It is possible that the concrete will set before the connectors can be vibrated. Please refer to ACI 305 – Specification for Hot Concreting, and ACI 306 – Specification for Cold Weather Concreting.
 - Place concrete in forms and vibrate concrete as necessary. For proper vibration equipment and techniques refer to ACI 309. Use care not to mar bond breaker with stick vibrators. Strike off and level concrete wythe to the specified thickness.
5. **Install insulation.** With the Gridboard pattern facing up, immediately place the individual insulation sheets, edge to edge, from one end of the panel to the other. After the first sheet is in place, set each subsequent sheet on the face of the previous sheet and slide it into position, allowing it to drop in adjacent to the previous sheet. This will minimize the likelihood of concrete slurry being forced into the joints between sheets. Minimize spaces or gaps between edges and forms. *(Full thickness concrete sections at any location on the panels can have serious detrimental effects on the panels.)* Ask Thermomass for more information, if necessary.
6. **Install connectors.** Immediately drive the MS-T series connectors through the insulation at the cross hatches indicating the recommended 16 in. o.c. (400 mm) or 3 columns with 6 connectors per columns in a 4 x 8 insulation sheet. Driving should stop once the connector collar is seated.
- Connectors should be placed no closer than 4 in. (100 mm) and no farther than 12 in. (300 mm) from the edge of the insulation sheet. The spacing of the markings *(cross hatches and lines)* on the Gridboard insulation provide visual cues of relative distance to perform this vital step without the need of a tape measure.

Connector placement rules:

- If the first row or column of connectors is greater than 24 in. from any fascia edge, i.e. parapet, edge of doors, openings, wing walls, etcetera; then that row or column of connectors shall be spaced at 8 in. o.c.
- A lintel 10 feet or greater in width shall have the first, adjacent row of connectors to that lintel placed at 8 in. o.c. across that opening.
- Legs adjacent to openings, 2 feet in width or less should have at least two columns of connectors placed in a staggered configuration as shown. Standard connector spacing applies to legs greater than 24 in. in width.



- 90° butt returns **typically** are cast without connectors. Please contact Thermomass prior to casting for instructions regarding insulated returns requiring connectors.
- Connectors placed atop reveals or rustication lines limit insertion of the wythe connector and negatively impact anchorage. When this situation is encountered, the connectors shall be relocated to the nearest point that does not affect anchorage.

If any these step are not possible, consult Thermomass for recommendations.

Consolidate the concrete around the embedded ends of the connectors by applying mechanical vibration to each connector using a concrete vibrating screed (*idle setting*) or an air-actuated vibrator available from Thermomass.

7. **Fill exposed joints, gaps, and spaces.** Prior to placing the upper concrete layer, inject all exposed joints, gaps, and spaces greater than $\frac{1}{8}$ in. (3.175 mm) with expanding, foam-in-place polyurethane insulation per manufacturers' specifications.

8. Prepare and place concrete for interior wythe.

- **For Tilt-Up:** In order to install interior wythe reinforcing, inserts, and hardware, it is important that the concrete in the exterior layer reach at least 25 percent of its 28-day strength. Primary factors affecting concrete strength gain include time and ambient temperature. The following time limits can be used. Note that the field-cured cylinder test must reach 25 percent of the 28-day design strength.

Place the second layer of concrete and screed to specified thickness. Finish, cure and protect concrete as required. Please refer to ACI 318 – Building Code Requirements for Structural Concrete.

Ambient Temperature Range (°F)	Minimum time from fascia casting to installation of reinforcing (hrs.)
70 and higher	12
60 to 70	24
40 to 60	36
Below 40	Field-cured cylinder test required

Although not recommended, if you plan to pour interior and exterior concrete wythes within the same work day period (8 hour day), the timing, preparation and placement of the concrete for the interior concrete layer is critical as workers should avoid disturbing the connectors and the insulation layer after the exterior wythe concrete has reached initial set. During this time, the connector anchorage can be negatively affected if the connectors are moved within the exterior wythe of concrete.

- **For Precast:** The timing of the preparation and placement of the concrete for the upper concrete layer is critical. If both concrete layers are to be placed in one day, install upper wythe reinforcing, lifting inserts and other hardware and place the upper wythe concrete before the lower wythe has reached initial set. Workers should avoid disturbing the connectors and the insulation layer after the lower wythe concrete has reached initial set. Place the upper layer of concrete and screed to specified thickness. Finish, cure and protect concrete as required.

Panel Completion

Strip forms and remove excessive concrete slag to minimize thermal bridging across the panel at the edges of the panels. Transport the panels into final position.

Warnings

If your panel casting area is unprotected from the elements, then it will be necessary to protect the fresh concrete should it rain during installation of System NC. Additional water in the casting bed will cause the insulation to float and reduce concrete strength, which will either cause the connectors to pull out of the plastic concrete or weaken the concrete anchorage. See General System NC Installation Instructions for additional information.

Protect hands and eyes. Since fiberglass fibers may be present on the surfaces of the Thermomass connectors, it is recommended that gloves be worn during handling and that eye contact with gloves or hands be avoided.

If you have additional questions or concerns, please call (800) 232-1748 for:

Darryl E. Dixon
Director of Technical Services
ddixon@thermomass.com

-or-

Venkatesh Seshappa P.E. & S.E.
Director of Engineering
vseshappa@thermomass.com