

Because all walls, their applications, the site conditions, and other variables differ per project, the following provides typical installation procedures for demonstration purposes only. A professional engineer, contractor, or architect should determine each specific project design and installation. Truline defers to your local engineer for specific design recommendations.

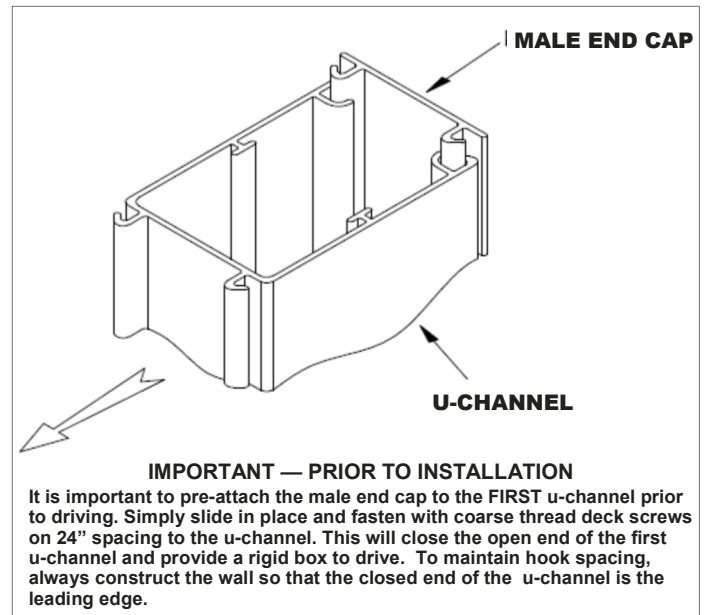
Preparation for Installation

The soil properties, site conditions, and driving depth will determine the type of equipment needed and the number of Truline u-channels that can be driven at one time. Conventional methods and equipment used for pile driving are appropriate for installing Truline. Vibratory hammers, plate compactors, drop hammers, jackhammers, water jets, air jets or excavator bucket pressure may be used individually or in combination. In firm/very firm cohesive soils, a steel mandrel may be required. Some contractors have chosen to fabricate a custom driving head or "T-block" to increase efficiencies in the installation process.

Installation Steps: Installing the Wall

1. Install a driving guide to establish the front of the wall and the proper elevation. A string line can be used to assist in setting a temporary wooden template using 2x6 boards attached to 4x4 posts. If setting a new wall in front of an existing wall, attach the guide board to the existing wall after removing or cutting back flush the existing top cap.
2. Prior to driving the first part, pre-attach the Truline male end cap to the Truline u-channel prior to driving as shown at right. Slide the parts in place and fasten with coarse thread deck screws at 24" spacing to the Truline u-channel. This will close the open end of the first u-channel and provide a rigid box to drive. To maintain hook spacing, always construct the wall so that the closed end of the u-channel is the leading edge.

If standard 90° returns are needed, please see "*Installation Steps: Installing Corner or Radius Returns*" below, which will explain how to attach the return using the Truline male end cap.

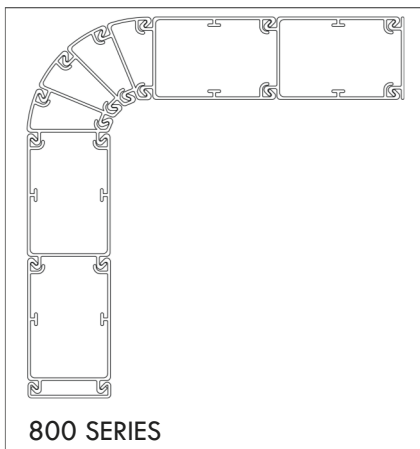
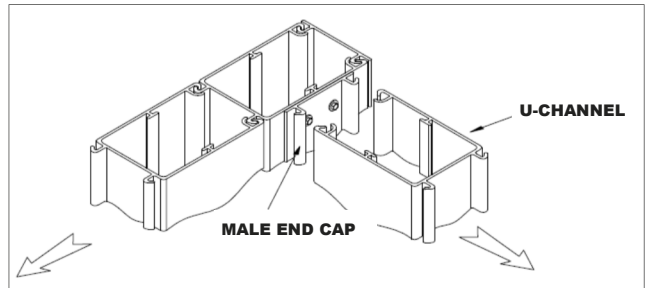


3. Set the first Truline u-channel into position, oriented in the direction shown above. The arrow indicates the direction in which subsequent u-channels will be installed, with the closed end as the leading edge. Drive the Truline u-channel to the required depth. As with all sheet piling, **it is important to stay plumb** in all directions, as each u-channel will serve as a vertical driving guide for the next u-channel.
4. Set the next Truline u-channel's dual interlocks into the prior u-channel's dual interlocks and drop the piles into place, continuing to drive with equipment to required depth. If corner/radius parts are needed to navigate any radius or angle, the same procedure applies.
5. When driving the final Truline u-channel, pre-attach the Truline female end cap to the u-channel using the same method as described in Step 2 for the first u-channel. Set into place and drive to the required depth.
6. Top Cap: Install the top cap as designed. Formed concrete caps, treated wood or composite lumber/decking materials may be used. In addition, commercially available stock size aluminum caps can also be used.

7. **Backfill:** Backfill with a clean and free draining backfill compacted in level layers 1 – 2 ft. making sure there are no voids.
8. Remove the temporary guideboard template.

Installation Steps: Installing Corner or Radius Returns

1. **For standard 90° returns,** pre-attach a Truline male end cap to the back face of the wall using stainless steel bolts, nuts, and flat washers at 24" centers, as shown at right. Set and drive the u-channels. Attach the Truline female end cap to the last u-channel of the return as described in Step 5 above.
2. **For radius returns,** use Truline radius parts. Set and drive the radius parts to the desired depth as you would a u-channel part, as shown below. With this design, do not pre-attach the female end cap onto the last u-channel of the wall face as described in Step 5 above. Instead, attach the female end cap to the final u-channel of the return.



Installation Steps: Considerations as Required by the Project Engineer

1. **Wales:** If the project engineer requires it, wales should be applied to the exterior face of the Truline wall so that the entire bearing surface of the wale is pushing on the wall. The wale is attached to the wall via connection to tie rods that extend through the wale and through both walls of the Truline wall, terminating at the deadman. The wale can be temporarily attached to the wall using deck screws driven either 1) through the wall from behind if the wale is close enough to the top to allow access or 2) in a toe nail fashion from the front of the wall if access from behind is not possible. If the wale is a material that cannot be fastened via screws, (i.e. concrete), jacks should be fastened to the face of the wall for the wale to rest on until it is permanently fastened with the tie rods.
2. **Tie Rods & Deadman/Anchor Systems:** As designed and required per the project engineer, install tie rods & deadman or anchor systems. In the case where the top cap is a structural member made from reinforced concrete, the tie rods are embedded into the top cap and anchored to a bearing plate that is placed behind the rebar in the top cap. The tie rods are above the top of the piling and do not actually pass through the sheet piling.

Placing the tie rod through the wall: The design engineer may determine a point at which the tie rod connects to the wall below the top elevation of the piling. An example of this may be a mid-wale design where a support wale is placed laterally along the wall at an elevation below the top of the wall. In this case, a hole should be drilled through the structural member and both walls of the Truline sheet so that the tie rod can be inserted through the whole assembly. Deadman, generally made from reinforced concrete, are buried in the soil, beyond its natural failure plane, well behind the Truline wall. Tie rods will be fastened to the deadman in similar to embedding in the concrete top cap. The engineer may elect to use other materials for deadman such as round piling of different materials in which case the manufacturer of those materials may advise best practice for fastening.

Note: Cantilevered walls do not have tie rods or deadman. The wall is held vertical by the portion of the sheet that is embedded in the ground, similar to how a fence post stands.

3. **Weep Holes:** Weep holes should be installed as required and designed by the project engineer. Hydrostatic pressure occurs when rain water, tidal and storm surges become trapped behind a retention structure, such as sea-walls, regardless of the type of wall material used. The added load from this pressure is a common cause of failure as typical retaining walls are not designed to withstand them. To prevent wall failure due to hydrostatic pressures, Truline recommends that your wall be designed with a weep hole/drain system. Once weep holes are installed, they should be maintained periodically to ensure that they do not become clogged. One system that Truline suggests is the 2 1/2" dia. ABS Jet Filter System (www.jetfiltersystem.com) which is mounted onto the face of the wall then joined with a PVC pipe sleeve to extend through the Truline wall. This should be installed prior to filling the Truline sheet panel. It utilizes a cartridge filter that can be removed and cleaned from the front of the wall. Jet Filter recommends that you do not cover the opening on the land side of their filter system with filter fabric. Please refer to the Jet Filter website for more information and installation instructions.
4. **Removing Soil Below the Mud Line:** If it is deemed necessary to remove the soil below the mud line from a Truline u-channel, a diaphragm type trash pump can be used. Water must be pumped into the cell to create pump-able slurry of approximately 30% solids, which can then be easily pumped out with the trash pump. The manufacturer or owner or the trash pump may advise best practice for use of this equipment. (See *Soil Plug Behavior* sheet)
5. **Fill:** Fill the Truline u-channel cells with concrete material by placing from the top of the cell via free fall if the cell is dry, or by placing from the bottom of the cell via tremie pour or pumpline method if the cell contains water.

The wall design engineer will provide specifications for the type of concrete to be used. Standard concrete pumping equipment is used. The wall design engineer may deem that other fills such as stone, recycled concrete, sand, etc. are suitable based on the project specifications and material availability.
6. **Steel Reinforcement:** The wall design engineer will provide specifications for size and placement of rebar with each cell of the wall. Because 97-98% of the strength of the completed wall results from its reinforced concrete fill, it is imperative that this be performed to the engineer's specifications for the wall to perform as designed.
7. **Expansion Joints:** If the design of the top cap for the wall specifies expansion joints you then should design in corresponding expansion joints into the Truline wall at the same locations. The expansion joints in the wall are made by ending a run of continuously engaged u-channel hooks with a female end cap with a male end cap attached prior to installation and then starting a new run of u-channels onto the male end cap.

Suggested Method:

1. Fasten together, using 1-1/4 #6 deck screws, one male and one female end cap in the arrangement shown.
2. Install this assembly on the u-channel of a section of continuously hooked pieces.
3. Remove all screws above the mud line except for those that are close enough to the top that they can be removed later after the other u-channels are installed.
4. Install the next u-channel on to the hooks of the male end cap and proceed with the remainder of the wall.
5. Prior to pouring the top cap, remove all remaining screws holding the male and female end caps together to allow for unrestricted movement above the mud line between these parts. While the screws fastening the end caps together remain in place below the mud line, this will not inhibit the movement of the joint. The pullout strength of the small screw is easily exceeded when the wall contracts stripping the threads which allows the wall to move.
6. Prior to backfilling, place filter fabric behind the wall at each expansion joint to prevent soil from entering the joint when it opens up.

