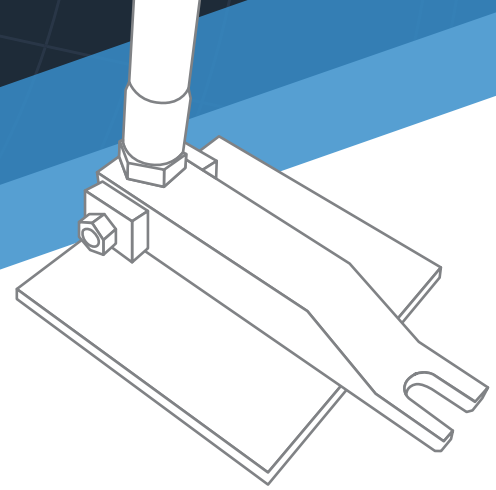


ST Tie On-Site Pull Testing



Read all Quality Assurance Instructions online
hkties.com/quality-assurance



To ensure proper concrete anchorage consolidation around the tip of the HK Standard (ST) tie, we suggest using the HK pull tester tool.

Please request a field pull tester from the HK team and follow the instructions below for testing.

When to test

The concrete in the exterior wythe must reach **at least 25 percent of its 28-day strength** before using the pull tester. Primary factors affecting concrete strength gain include time and ambient temperature. Typically a wall panel reaches necessary strength for testing after 24-48 hours.

Refer to ST Tie Installation Instructions (Step 7) for more guidance.

Epoxy holes

If testing a tie that was installed using epoxy as instructed in the ST Alternate Tie Installation instructions, wait to test the tie until epoxy has properly cured as per the epoxy manufacturer recommendations (typically 24 hours).

How to operate the pull tester

Step 1 – While holding the handle of the pull tester, place the square base down flat against the rigid insulation next to the tie to be tested. The tool is designed to fit into tied reinforcement to allow for tie testing.

Slide the base and hooked attachment gently but firmly around the head of the tie until it makes contact with all 3 sides of the hooked attachment.

Step 2 – The tool is operated just like a torque wrench. With the base firmly planted and hooked around the head of a connector tie, pull back on the handle until you hear a clicking sound.

The pull tester comes pre-calibrated to test the tie at 260 lbs.

Figure 1 – The proper way to place the pull tester around a tie to be tested



ST Tie On-Site Pull Testing

Visual inspection

Each installed HK Standard (ST) tie should be visually examined for proper embedment and consolidation in the concrete face.

If any of the tie installation conditions displayed here occur, it may not be possible to use the HK pull tester tool to test the tie. In these situations, please follow the ST Tie Alternate Installation Instructions.

■ Raised tie

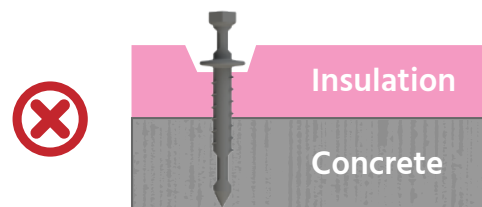
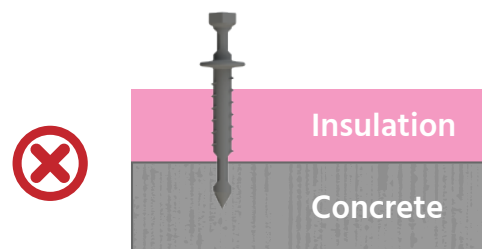
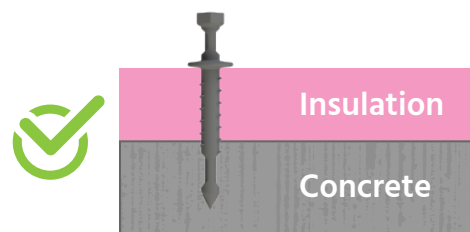
If a tie collar is 1/4 inch proud or greater from the insulation, follow the Alternate Tie Installation Instructions to install an additional tie nearby.

■ Depressed tie

If a tie collar is depressed into the insulation 1/4 inch or greater, follow the Alternate Tie Installation Instructions to install an additional tie nearby.

■ Skewed tie

If a tie is skewed from the insulation greater than 15°, follow the Alternate Tie Installation Instructions to install an additional tie nearby.



Mark incorrectly installed ties

Many tie installers and testing inspectors find it helpful to use spray paint, a Sharpie marker or similar means of highlighting any ties that have installation conditions that need to be addressed. This helps when a tie installer returns to the panel to fix any issues.

Other tie installers choose to fix improperly installed ties immediately as they are testing the panel. Use a method that works best for your installation and testing processes.

ST Tie On-Site Pull Testing

Testing pattern

We recommend testing a minimum of 25% of all ties on each panel.

Focus on these testing locations:

- a. Panel Perimeter
- b. Panel Openings (doors, windows, etc.)
- c. Panel Field

One easy testing pattern to follow is to test the bottom row of the panel then proceed to test every 4th row as you move up the panel.

Test the top 2 rows of the panel. As a panel is raised to a vertical position, the top of the panel receives more stress than the rest of the panel.

See Figure 2 for suggested test locations.

Panel openings

Be sure to test panel openings that required tie adjustments such as shifting the ties from the original placement as instructed on Page 5 of the ST Tie Installation Instructions.

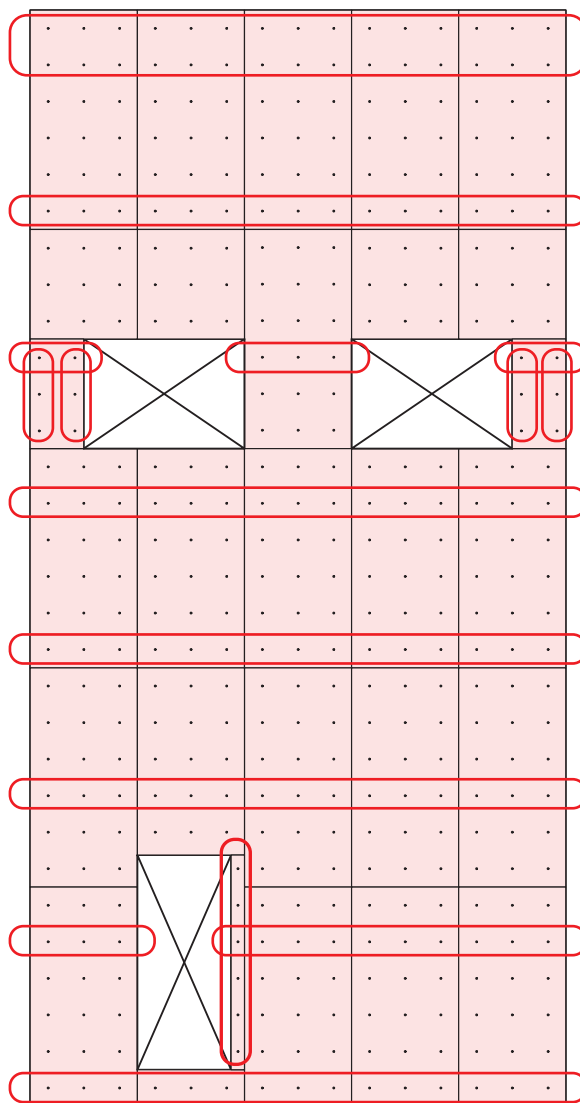
See the vertical oriented red highlights in Figure 2 for example areas near panel openings where ties were shifted to maintain the required distance ties need to be installed from openings and panel edges.

As a reminder, HK Standard (ST) ties should be installed no closer than 4 inches (100 mm) and no further than 10 inches (250 mm) from openings or the panel edges.

If additional ties were required during the installation phase, they should not be installed closer than 2 inches to existing preformed holes.

See Page 5 of the ST Tie Installation Instructions for more information about tie spacing and adjustments near panel edges and openings.

Figure 2 – Sample panel diagram demonstrating recommended pull tester locations to test installed ties to check for proper consolidation with the concrete.



ST Tie On-Site Pull Testing

Pull test results

If the tie is loose when using the pull tester but doesn't pull out completely, leave the tie in place (even if the tie is raised or skewed). Follow the ST Tie Alternate Installation instructions to determine proper alternate tie installation location. And follow the instructions below to test surrounding ties.

If the tie pulls out, do NOT re-use the same hole location for installing the tie. Follow the ST Alternate Tie Installation instructions to determine alternate tie installation location. And follow the instructions below to test surrounding ties.

Ensure any holes are plugged as instructed in Step 4 of the ST Tie Alternate Tie Installation Instructions.

Test ties adjacent to ties that fail tests

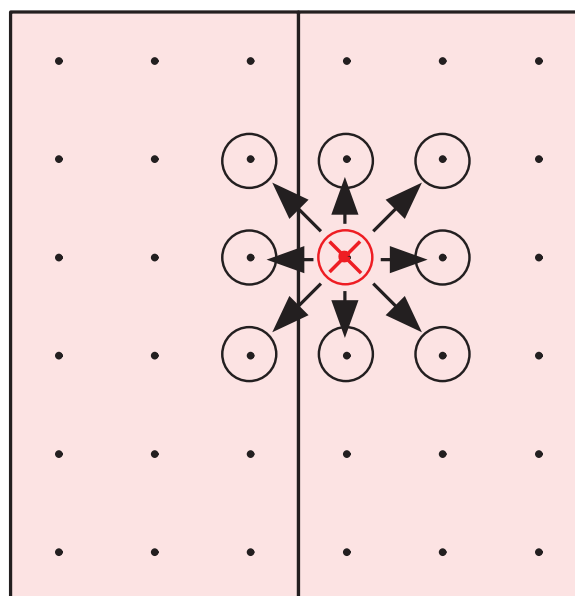
If a tie is deemed to be improperly installed after a failed pull test (tie is loose or pulls out) or a failed visual inspection (raised, depressed or skewed), more testing in that area of the panel is required.

Using Figure 3 as a guideline, use the HK pull tester tool to pull test each tie adjacent the tie that failed a pull test or visual inspection.


If any of the adjacent ties fail the pull test, mark the tie in question (to return and fix according to the ST Tie Alternate Installation Instructions) and continue testing the ties surrounding that marked tie.

Continue this outward expanding pull test sequence until all adjacent ties pass the pull tests.

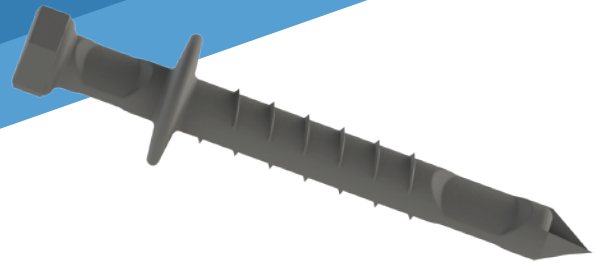
Figure 3 – Expanded example showing how to test ties adjacent to a tie that fails a pull test or visual inspection.



 = Tie failed visual tests or pull test

 = Ties adjacent to failed tie need to be tested

ST Alternate Tie Installation



If tie installation has been determined to be insufficient per the ST Tie Installation Instructions (Step 3 – Visual Inspection) or per the On-Site Pull Testing instructions, please use the following Alternate Tie Installation instructions.

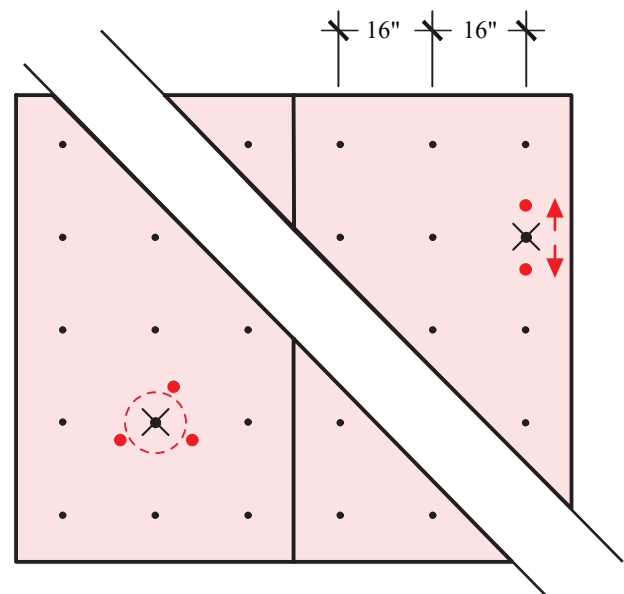
Step 1. Determine Alternate Tie Installation Location

a. Ties next to Panel Edge or Opening

If the tie determined to be installed insufficiently is located along the panel edge or next to an opening (such as a door or window), a 4 inch adjustment is required.

Move in a parallel direction along panel edge or opening from the original location to make the alternate tie installation location. (Figure 1)

Figure 1 – Sample panel detail showing need to install alternate tie at the panel edge. Move 4 inches along the panel edge.



b. Ties in the Field of the Panel

If the tie determined to be installed insufficiently is located in the field of the panel, a 4 inch adjustment is required.

Move any direction in a 4 inch radius from the original location to make the alternate tie installation location. (Figure 2)

Figure 2 – Sample panel detail showing need to install alternate tie in the field of the panel. Move 4 inches in any direction from the original tie.

(installation steps continued on next page)

ST Alternate Tie Installation

Step 2. Prepare Tie Installation Location

- a. Drill the new hole for the alternate tie. The hole should be drilled through the insulation and into the concrete.

The hole should NOT be more than 1/8 inch larger in diameter than the alternate HK tie to be installed. The hole should also NOT be deeper than 1/8 inch longer than the HK tie being installed.

Holes too large in diameter or too long don't allow the epoxy to adhere to the same shear strength. Take caution so the drill bit does not drill through the entire width of the exterior wythe of concrete. Reference Table 1 for drill bit size and hole depth guidance when drilling new holes.

- b. The hole must be blown clean of any debris or water with pressurized air or sucked out with a shop vacuum.

Table 1 – The complete specifications for each respective HK Standard (ST) tie can be found at <https://hkties.com/ST>

The data sheets include each tie diameter and length which will help in determining the drill bit size if drilling holes is required.

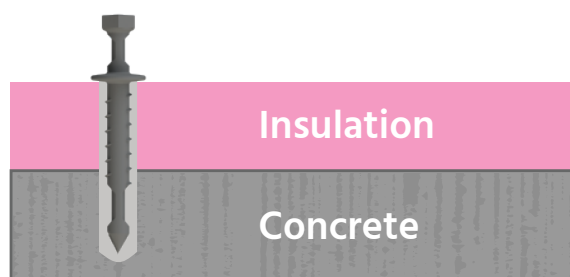
ST Tie	Drill Bit Size	Hole Depth
ST50	5/8 inch	4 inches
ST75	11/16 inch	5 inches
ST100	11/16 inch	6 inches

Step 3. Install Alternate Tie

- a. Inject the hole with approved epoxy:
Hilti Hit-HY200 / Hilti HIT-RE 500 V3
or Simpson ET-HP / SET-XP

Use epoxy per manufacturer instructions.
- b. The tie must be inserted to full depth until the tie stop collar engages the face of the rigid insulation. (Figure 3)

Figure 3 – Diagram of proper alternate tie installation after drilling and epoxy injection.



Step 4. Plug Unused Holes

If any ties were pulled out from their original installation holes or if any alternate tie holes were drilled but not used, the hole must be plugged with expanding “foam-in-place” polyurethane foam insulation per manufacturer specifications.