

Lightweight Hot Tap Operational Procedure

Operational Characteristics:

The Lightweight Hot Tap System is designed for tapping in mild steel hull plating up to 1" thick. The TAP machine has the capability of tapping a 5 1/2" hole through a 6" knife valve; however, the most practical size of Tap is either a 2 5/8" hole through a 3" full port ball valve or a 3 1/2" hole through a 4" full port valve.

The flange/valve assembly, through which the Tap is accomplished, is available in two configurations: a flat surface plate and a contour forming plate. The flat plate is 12" in diameter with a 12-bolt hole pattern on a 10" bolt circle. This plate is used for flat shell or tank top applications. The contour forming plate has a 12" by 4" base with serrated tabs perpendicular to the base. These tabs can be formed to the contour of the hull.

The flange valve assembly is attached to the hull using self-drilling/tapping hexagonal head bolts driven by a hydraulically operated DL 9 drill. Other drills may be used in different operations, however, the hydraulic drill allows for use underwater.

A Model 9 Hydraulic Power Unit (HPU) (2000 psi, 12 gpm) is used to drive the drill. This same power unit and drill also drives the Hot Tap Tool. The Model 2 HPU can also be used to drive the drill and the Hot Tap Tool.

The Hot Tap Machine is a small unit that attaches to the flange/valve assembly using Cam Lock fittings. The drill drives the pilot bit and cutter head and the feed is controlled manually using the handles on the Hot Tap. The Tap is accomplished through the open valve; when the hole is completed, the cutter is extracted by turning the handles counter clockwise. The pilot bit retains the coupon (hole center). The valve is closed before disconnecting the Hot Tap from the flange/valve assembly.

Hoses, pumps, probes, air and other tools may be attached to the valve assembly 4" or 6" male Cam Lock fitting for offload operations.

Flange Attachment Procedure:

1. Select the area to be hot tapped using the following criteria: **Note, the flange is attached to the hull independently and the valve installed after attachment. Magnetic support systems are supplied to assist in holding the flange/ valve assembly in place for drilling.**
 - a. Area should be relatively flat, not overly wash boarded, and provide enough space to operate the Hot Tap. Take into consideration the surrounding space, considering that a pump and hose may need to be attached.
 - b. Hull plate is not more than 1" and of mild steel.
 - c. The area in which the flange will be attached needs to be thoroughly cleaned. All floor coverings, terrarazo, barnacles and loose paint need to be removed and the steel surface scraped or wire brushed to a smooth surface that will allow the gasket to seal.

- d. After locating the area on the tank to be tapped, sound the area with a hammer to locate any hard spots such as frames and doublers that may interfere with the flange attachment. You only want to drill thru the shell plate and not into a frame or doublers.
2. Glue the gasket to the flange (Note, this may be done earlier so the glue dries). Flanges are painted yellow so they stand out against darker surfaces. If the hull section is yellow you may want to change the color.
3. Prepare the bolts. The 5/16" self-tapping self-drilling (Note, the self-tapping self-drilling bolts are to be used on plate 1/2" thick or less. When drilling thru plate thicker than 1/2", this requires a 5/16" self-tapping bolt, using blind drilling. Example, if the plate is 1" thick you would only drill 3/4" into the plate not penetrating all away thru the plate) bolts need to be wrapped with Teflon tape on the thread portion of the bolt. Wrap by holding the free end of the tape over the top of the bolt and turning the bolt by hand as if you were tightening it. Two wraps are sufficient. Place the O-ring over the bolt and slide it all the way up to the head.
4. Set up the Model 9 HPU and connect to the drill. Bolt driving usually requires 2000 psi and 6 gpm from the HPU. If using another HPU, note that a Flow Restrictor is provided with the drill and is placed inline on the inlet side of the drill.
5. Using the 5/16 self-tapping bolts provided and the flange/valve assembly as a template, bolt the flange to the hull plate. At least 6 bolts must be driven, equally spaced around the flange. Drive the bolts with the drill until the gasket compresses slightly. A lever arm drill press, which uses a high strength magnet as the pivot point is provided to assist in the drilling operation. A constant moderate pressure is required for the self-tapping screws. Practice this operation on a sacrificial plate beforehand to get the feel. **Do not over tighten the bolts with the drill.** Using the torque wrench, **torque all bolts to 15 foot pounds using a diagonally opposing pattern.**
6. **Note: On tanks that are "pressed" or under pressure, wrap the bolt threads with Teflon tape before driving. Always drive thru the gasket material, as it will disperse the air or spray that will escape when the bolt penetrates. Operator must wear protective clothing and face protection for flange attachment to a pressurized tank.**
7. The **Contour Flange** mounting procedures are basically the same as those specified for the flat plate flange assembly. The contour flange may be pre bent to the contour using the provided contour gage to establish the required bend radius. The flange may be hammered into the approximate contour and pulled to the final shape with the bolts. **At least 8 bolts are required in the contour flange, 6 in the solid wings and at least 1 in each of the remaining serrated wings.**
8. Torque all bolts, in a diagonal pattern to **15** foot- pounds.

Hot Tap Procedure:

1. Read the instructions in the Hot Tap Kit. These are fairly concise but need amplification based on lessons learned.
2. Select the size cutter to be used. Note that the 3 1/2" cutter is the largest that will safely pass thru the 4" valve. Attach the pilot bit to be used, **note that these bits have a coupon retaining wire in the end.**
3. Attach the pilot bit and cutter head to the Boring bar, **making sure that all threads are coated with non-permanent Lock tite and are tight. The pilot bit must extend a sufficient distance beyond the cutter to fully penetrate the plate and retain the coupon.** Verify that the pilot bit

is extended sufficiently by placing a straight edge across the teeth of the blade and ensuring that the small coupon retaining wire projects beyond the edge of the cutting teeth.

4. Verify that the valve you are using opens and closes relatively easy. Work the valve before installing on the flange.
5. **NOTE: The following procedure should be accomplished with each valve topside before accomplishing the actual Hot Tap to insure that the valve opens and closes freely and the pilot drill/saw blade does not interfere with the opening/closing of the valve.** Retract the boring bar to its full “out” position. After verifying that the **white TEFLON** Cam Lock gasket is in place, offer the Hot Tap assembly up to the Cam Lock fitting on the attached flange/valve assembly. Dog the Cam locks down and lock them in place with the pins that are attached. **Fully** open the ball valve. Using the handles on the Hot Tap, screw the boring bar in until the pilot drill hits the vessel tank shell plating. Then **back off at least one complete turn so as to take the bit away from the shell plate.**
6. **Start the HPU, set the pressure to 2000 PSI and the flow rate to 6GPM.**
7. Using the deep-well socket attachment on the drill, offer the drill to the drive end of the Hot Tap. Start the drill and by hand (turning clockwise) slowly advance the pilot drill/cutter into the hull.
8. **Advance the cutter slowly, you will feel the pilot bit break through. Once you are sure that the pilot is thru, stop the drill and feed the cutter until the cutter stops at the hull plate. Back off 1 turn and start drilling again, feeding slowly as the cutter engages the hull. Drilling requires a “feel” of the cutter’s progress. Should the cutter bind up, stop the drill, back the cutter out a turn and start again.**
9. You will feel the cutter break through, keep going for at least 15 seconds to ensure you are all the way thru. The cutter advance should be easy at this point.
10. Remove the drill from the shaft and back the cutter all the way out by turning the Hot Tap Handles counter clockwise until they can go no further. **Close the Valve.**
11. You can now remove the Hot Tap and attach fittings, hoses and pumps as required.