

Attaching the solenoid to the fish tank platform

Correct use of clearance holes.

ME 121

The solenoid valves are attached to the fish tank platform by machine screws. The bottom of the solenoid has two threaded brass inserts. As depicted Figure 1, the machine screws pass through clearance holes in the mounting board and into the brass inserts.

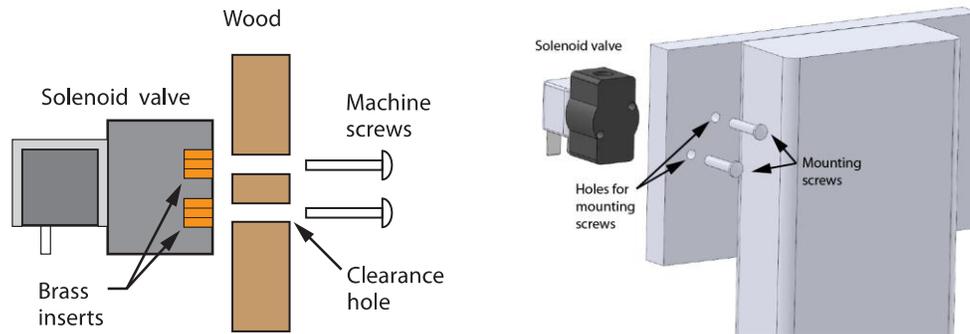


Figure 1. Exploded views of the solenoid attachment.

The through-holes in the wooden mounting board should be large enough that the machine screws can pass through with *no resistance*. As shown in Figure 2, there should be a radial gap or *clearance* between the outer diameter of the machine screw threads and the inner diameter of the through-hole. This type of hole is called a *clearance hole* for the screw. The hole makes for an intentionally loose fit to allow for errors in locating the clearance hole with respect to the brass inserts in the bottom of the solenoid valve.

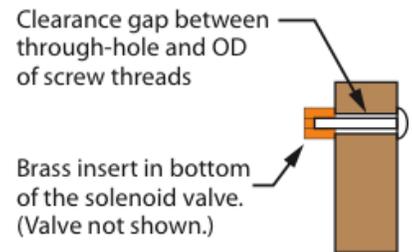


Figure 2. Correct clearance gap.

The distance between the two brass inserts in the bottom of the solenoid is fixed. As depicted in Figure 3, if the through-holes for the screws are not precisely located, *and* if there is no clearance gap in the through-holes, then it may not be possible to thread the machine screws into the brass inserts. Any lack of accuracy in the location of the clearance holes should not introduce any side load on the threaded joint between the machine screws and the brass inserts.

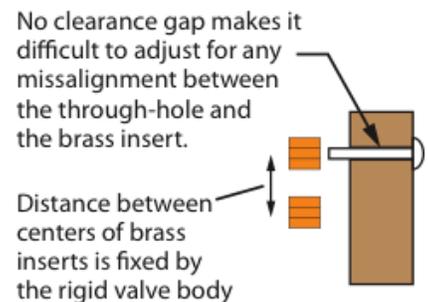


Figure 3. Incorrect clearance gap.

The solenoid is secured to the mounting board by the tension in the machine screws. That tension causes a clamping force between the surface of the board and the bottom of the solenoid valve. There will be shear load on the screws caused by the weight of the solenoid. That shear is reduced to the degree that the clamping force creates static friction between the base of the solenoid and the mounting board. Any shear carried by the machine screws does not require precision in the clearance hole or tightness of fit between the machine screws and the mounting board. Therefore, there is no need to locate the screws in tight-fitting holes.

Finally, the location and orientation of the solenoid is not crucial to the operation of the fishtank. The orientation of the solenoid is important only in that by aligning the solenoid with true vertical, reservoir attached to the top of the solenoid will be level. Slight deviations from true level of the reservoir will not affect its ability to provide a water supply for the solenoid.