

Hydraulic Steering Maintenance and Repair

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Hydraulic steering has found almost universal acceptance in modern vessels due to its relatively simple installation, smooth operation, and remarkable reliability. In fact, hydraulic steering is so reliable that fishermen too often think hydraulic steering systems are maintenance-free, and treat them accordingly. Then, when the system does malfunction, they don't know how to repair it because they have never worked on it.

The Basics

Hydraulic steering systems are either power assisted or manual, and manual systems are either pressurized or non-pressurized. Most vessels over about 30 feet with autopilots have power-assisted steering, with power supplied by a hydraulic pump driven by a main engine. The power supply may also operate the anchor winch, gurdies, reels, and other deck equipment. The steering system may be teed off that hydraulic circuit with a selector valve, or the vessel may have separate hydraulics for steering and deck machinery. Vessels without an autopilot may or may not have power steering.

In either case, the system works pretty much the same way: the steering wheel drives a helm pump which forces a non-compressible fluid through lines to cylinders, where the pressure forces out a ram attached to steering linkages. In the simplest systems that's all there is to it—one helm pump actuates one cylinder, and the only additional component is a small reservoir, usually contained within the helm unit, providing a constant supply of fluid to the pump. Some makes use a separate reservoir. Most are non-pressurized, which means that the fluid is supplied to the pump solely by atmospheric pressure, assured

by a vented cap in the reservoir; but a few, such as Hynautic, use a sealed reservoir in which air pressure is added via a device such as a bicycle pump.

Obviously, multiple helms, multiple rudders, and multiple cylinders on each rudder all add to the complexity, but the system is the same. If the system has power assist or an autopilot or both, the helm pump and the cylinder assembly are about the same; but between them is a set of valves and solenoids which introduce the pressurized oil from the power pump into the lines going to the cylinders. Although this additional complexity adds to the potential for failure, in practice these systems are so well engineered that they tend to be just as reliable as the basic steering system, assuming they are sized and installed correctly.

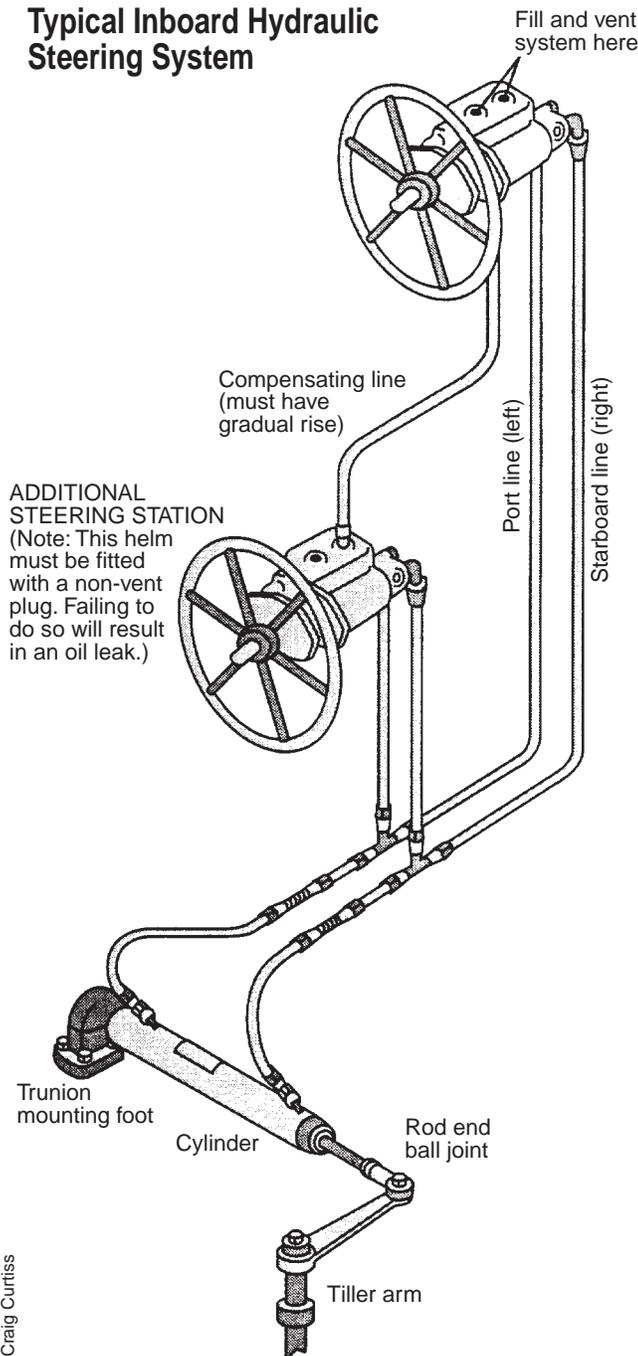
Installation

Therein lie the first two keys to steering reliability: ensure that you are buying the right unit for your boat, and install it in strict compliance with the manufacturer's instructions. Teleflex puts it succinctly on the cover of its owner's manual: "Before you do it your way, please try it our way."

For example, the helm unit, or the upper helm unit in the case of multiple stations, must have a vented plug. Only self-locking fasteners should be used. Cylinders must be attached with bolts, not lag screws, and ports must be positioned on the top side of the cylinders.

Rigid (copper) tubing is preferable to flexible lines in most installations, and when lines are replaced they must be the same type or more rigid than the others in the system. Rigid tubing must not be connected directly to the cylinders. All lines and tubing must be installed so that there is no friction or chafing against

Typical Inboard Hydraulic Steering System



Craig Curtiss

other materials in the space, and flexible (nylon) tubing must not contact hot surfaces such as engine blocks. Liquid pipe sealant should be used on all connections except under the tube nut, but pipe tape should not be used. Don't over-tighten tube nuts.

Be sure to follow instructions for getting cylinders aligned correctly and properly connected to the steering gear, since a great deal of force is exerted through the ram to the linkage, and both the cylinder and the steering gear can be severely damaged by misalignment.

It is essential that you use the correct type of hydraulic fluid, irrespective of what you have used in the past or what is available locally. Never use brake fluid. Each type of fluid has specific characteristics regarding factors such as freezing, foaming, and lubrication, and the wrong fluid can wreck your system in short order.

In an emergency, automatic transmission fluid can be used temporarily. Teleflex states that, in an extreme emergency, any nonflammable, nontoxic fluid can be used to restore partial steering for a short time.

Fluid Facts

Once you have ensured that size and installation are correct, some minimal maintenance is called for. First, naturally, is the need to check fluid level regularly. Drips and a ratchety feel to the wheel both point to leaks, but because leaking fluid will run down the outside of the lines and drip off the lowest point, you may have a leak and not see the evidence. If the fluid level in the reservoir even briefly falls below the intake of the pump, you will get air in the lines, which will necessitate bleeding the system.

Second, inspect the linkages in the stern, ensuring integrity of nut and bolt connections, and lubricate the moving parts. Inspect the rams for nicks or corrosion, which could cut the seals in the ends of the cylinders. Make sure that nothing is stored in the steering gear compartment that could jam moving parts. Clean and wipe down the rams and cylinders with a rag dipped in oil to prevent corrosion, but don't use grease, which can contain contaminants and abrasives.

Inspect tubing for corrosion that might cause leaks, clean any excessive corrosion, and spray with water-displacing preservatives such as WD-40 or LPS. Ensure that

cylinders and other components are tightly bolted in place and don't have any improper motion.

On power assist systems, check the main hydraulic pump for abnormal smells and noises that may indicate a malfunctioning pump or worn belts. Check fluid temperature—most systems work at 110-150°F. Excessive temperature could indicate a bad pump, constrictions in the lines, or inadequate cooling of the reservoir.

Some systems require an oil cooler. If the reservoir is so hot that you can't hold your hand on it for at least a couple of seconds, it's too hot.

Most people don't realize it, but steering fluid should be changed regularly, just like any other oil. Milky fluid is contaminated with water, and black fluid is contaminated by metal particles. Additives break down as they do in other oils. This is particularly true in power steering systems, where heat and friction break down oils more quickly. Don't forget to change the filter on your power steering system.

Steering should be inspected twice a year and fluids changed at least once every two years. Be sure always to keep a bottle or two of the correct fluid on the boat to replace any lost to leaks or spilled during minor repairs.

Troubleshooting

Despite its inherent reliability, hydraulic steering is subject to malfunction. Some problems are outside the scope of field repairs, such as broken or bent linkages and rams due to backing into solid objects. Broken or ruptured hoses or tubes are usually not field-repairable since internal pressures typically are 200 to 300 psi.

Following are a few troubleshooting tips you can carry out on board:

- Bumpy helm unit operation indicates dirt in the inlet check of the helm unit, which may have to be dismantled for removal.
- If the rudder drifts to one side or another when the wheel is not turned, it may be dirt in check valves. They can be cleaned by removing plugs at the rear of the helm unit.
- Leaks at some locations can be stopped by replacing seals. Usually,

small leaks won't prevent your system from operating, as long as you keep the reservoir topped up, and a lot of seals aren't field-replaceable anyway; but some companies offer wheel shaft-seal kits and other replacement parts for their units.

- Slow or "mushy" steering usually indicates air in the lines and is easily remedied by bleeding. Follow your owner's manual for bleeding instructions.
- Sudden failure of a power assist system can be traced to a slipping or broken drive belt.
- If your power steering fails to operate at the start of the season, particularly if work has been done in the lazarette or engine room during the off season, check for valves that may have been inadvertently closed or switched to a bypass position. Unless you are very familiar with the plumbing of your system, you may want to label all valves and their correct operating positions, and make a diagram so that you can ensure each season that all the settings are correct. ♦