

# Why Are There So Many Different Types of Steering?

The great variety of boats dictate this: the steering system which is right for a 14-foot runabout with a 50 H.P. engine, would not be right for a 25-foot offshore fishing boat equipped with two 200 H.P. engines. Marine steering can be divided into three major types:

- **Mechanical (cable) steering**
- **Hydraulic Steering**
- **Power-Assisted Steering**

## Mechanical Steering Designs

**Mechanical cable steering is durable and reliable and comes in two main forms, each of which have advantages in specific applications. They are:**

- **Rotary (cable wraps around a gear)**
- **Rack & Pinion (cable attached to rack gear moved by a pinion)**

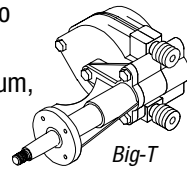
**All mechanical steering systems except Big-T are for single station use only.**

## Rotary Steering (2 types)

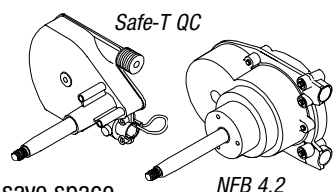
Various Rotary helms are available, each resulting in a different number of lock-to-lock steering wheel turns. All Teleflex helms feature a unique mounting plate that allows installation at several angles to accommodate the many space constraints which occur behind all dashboards. Most versions are available with NoFeedBack (NFB) technology. NFB is recommended for all outboards and stern drives without power-assisted steering. HPS and Safe-T QC are offered for most boats with power-assisted steering. Big-T is a good choice for small inboards, especially those with twin stations. There are two main rotary helm designs:

**Reduction Gear Type:** (one or more gears mesh externally with the drum to move the helical core of the steering cable). This is the best rotary design in terms of strength and efficiency as there are usually only two gears. The one drawback is that the helm shaft must be placed outside the cable drum, resulting in a fairly large round helm behind the dash. These helms often cannot be used in small dashboards.

The original, time-proven Teleflex helms such as Big-T®, Easy-T® and Safe-T® were designed with reduction gears, resulting in simple, efficient gearboxes. With smaller, more crowded dashboards came the need for a more compact helm, thus one with planetary gears to save space.

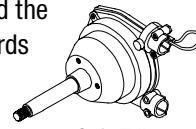


Big-T



Safe-T QC

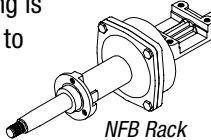
**Planetary Gear Type:** (three or more gears mesh internally with the cable drum to move the helical core of the steering cable). This is an alternative rotary design whose purpose is to take up the least possible space behind the dash, useful in boats with small dashboards and/or instruments clustered right around the wheel. The drawbacks to the planetary gear design are the many wear points and more accumulated backlash (free play or "slop") from four or more gears meshing versus two (typically) in a reduction gear helm. Teleflex does not offer a planetary gear helm for outboard engines larger than V-4.



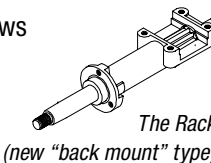
Safe-T II

## Rack and Pinion (1 type)

There is only one kind of Rack and Pinion. A pinion gear hobbled directly into the helm shaft engages a rack gear in a tubular housing. Rack and pinion steering is the most efficient mechanical approach to moving the cable. The major drawback is that it requires a long tubular rack housing and cannot fit behind many dashboards. Teleflex rack mounting allows installation of the rack tube at several different angles, but because it is very long, there is not as much mounting flexibility as with rotary helms. The Rack (without the NFB feature) is offered for most boats with power-assisted steering.



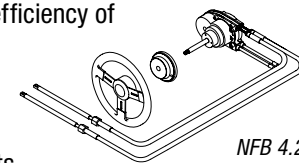
NFB Rack



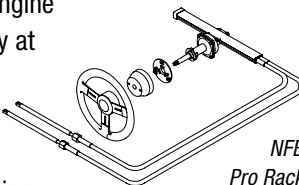
The Rack  
(new "back mount" type)

## Dual (Twin) Cable Systems

All mechanical steering systems rely on a push-pull cable to do the work of moving the engine or rudder. The efficiency of the system depends on the efficiency of the cable. By virtue of their design, all cables have some backlash or lost motion. While this is acceptable for most boats, some high performance boat/engine combinations develop instability at high speed. Instability becomes more prevalent in boats faster than 50 MPH. Dual cable (or twin cable) steering is recommended by Teleflex and engine makers for these boats. Dual cable steering allows adjustment at the engine of one steering cable versus the other to remove most of the backlash (free play) inherent in even the best mechanical systems. This reduction of backlash helps minimize engine flutter and the resulting handling instability.



NFB 4.2  
Dual Cable



NFB  
Pro Rack  
Dual Cable

## Hydraulic Steering Designs

A SeaStar® hydraulic system is the most comfortable and efficient approach to steering a boat. It is durable and reliable, with a smooth, positive response at the wheel.

Several helm displacements and cylinder options are available (except for SeaStar PRO®), allowing a choice in the number of steering wheel turns to suit boat handling characteristics and individual driving preferences.

All hydraulic systems exceed A.B.Y.C. safety standards and ISO/I.M.C.I./N.M.M.A. certification requirements and are constructed with high quality corrosion-resistant materials.

## Hydraulic steering comes in two main forms:

- **Manual (helm pump moves cylinder directly).** These are available in two line systems (SeaStar) and three-line systems (Hynautic). The advantage of a three-line system is remote fill; the drawback is a more complicated installation and maintenance. The advantage of a SeaStar 2-line system is incredible reliability and simplicity; the drawback is that you have to be really careful not to spill when you add oil because you fill at the helm.

(Manual) SeaStar Pro: Some high performance boats/engine combinations develop instability at high speed. Instability becomes more prevalent in boats faster than 50 MPH. SeaStar PRO (or dual-cable mechanical steering systems) are recommended by Teleflex and engine makers for these boats. SeaStar PRO features special helm valving to maintain equivalent line pressures, which reduces the free-play (or deadband) at the wheel, reducing steering instability at high speeds.

- **Power Assist (mechanical cable or hydraulic helm moves servo, which directs pressurized fluid from a pump to the steering cylinder).** Power assisted steering is the easiest to operate. It is essential in many larger boats. The hydraulic helm type is preferred as it offers unmatched reliability, an easy autopilot interface and superior manual back-up steering. SeaStar Power Steering is a hydraulic helm type of system which is designed for larger vessels.

Document # M-2402002

©2002 Teleflex Marine, a Division of Teleflex, Inc. (USA)

PO Box 5048

640 North Lewis Road

Limerick, PA 19468-5048

[www.teleflexmorse.com](http://www.teleflexmorse.com)



# Why Replace Steering with Original Equipment?

**Simple answer: peace of mind.**

As a general rule, the original equipment brand and type, if currently available, should be used. This approach will avoid most problems such as drilling/cutting extra holes and issues with fit or function.

Steering system performance and integrity can be severely compromised by "mixing and matching" steering parts from different manufacturers.

Original equipment replacement steering insures that the boat performs as originally designed by the builder.

**When replacing a component of a steering system, replace it with one from the correct manufacturer. If that cannot be done, replace the entire system.**

Off-brand parts may not function as well as the original equipment did and will void the warranty on the remaining original components.

When replacing an entire system, consider Teleflex.

All Teleflex Marine steering systems exceed A.B.Y.C. safety standards as well as ISO/I.M.C.I./N.M.M.A. certification requirements, and feature corrosion-resistant materials.

Teleflex is the most trusted name in steering. That's why virtually every major boat builder installs Teleflex steering as original equipment.

**Boat Builders Specify Teleflex as Original Equipment**

# Steering You Right

## A Factual Survival Guide for Marine Steering

*This guide provides an overview of marine steering for those who use, sell and service marine steering.*

*There are many steering systems from which to choose. We hope this guide will help you to make the right choice.*



*The Most Trusted Name in Steering*

# Replacing With the Same... or Thinking of Upgrading?

*When Replacing Steering, Try to Retain the Type Originally Installed*

Generally, it is a good practice to replace a steering system with one of the same type: rotary with rotary (i.e. Safe-T®), rack with rack (i.e. The Rack™), hydraulic with hydraulic (i.e. SeaStar®), etc. Use a steering system with the same number of steering wheel turns lock-to-lock as the original system.

This insures the boat continues to perform in maneuvers as designed and makes installation of the replacement system as simple as possible.

Changing the type of steering on a boat requires some careful consideration. Your steering system was selected by the boat builder based on the following criteria:

- **Fit:** steering components accommodate dash design and splashwell dimensions
- **Performance:** meets manufacturer's performance specifications
- **Value:** quality products supplied by a reliable, experienced company that stands behind them

Any change from the original steering system may affect the handling and feel of the boat. In addition, installation may be further complicated by modifications needed to accommodate components for which the boat was not originally designed.

*Steering Technology Has Improved!*

With systems such as Teleflex mechanical No-FeedBack (NFB™) High Performance Steering (HPS®) and the hydraulic SeaStar® and SeaStar Pro®, marine steering technology has advanced significantly compared to the available options of just a few years ago.

Upgrading the system to NFB or SeaStar is recommended for all non-power-assisted outboards. SeaStar Pro is recommended for all high speed single outboards (55-75 MPH). Upgrading to HPS or SeaStar is recommended for small boats with power-assisted steering. The same general rule applies: replace rotary with rotary, rack with rack, hydraulic with hydraulic, etc.

For that reason, Teleflex offers many different NFB and SeaStar systems: there is one to match the type and number of turns for nearly every marine steering system ever made (except rope and pulley, of course).

*What if The Driver Wants Easier (or More Responsive) Steering..?*

A driver may want faster response or lower steering effort. NFB, SeaStar and HPS offer **upgrade paths** to either increase steering response or reduce steering effort. When changing steering, **water test the boat after installation** to ensure safe, dependable operation. Using caution, the driver should gradually become familiar with the new steering system as some handling characteristics of the boat may change.

*Steering Response vs. Effort:*

Steering wheel effort is directly proportional to the number of wheel turns lock-to-lock. The number of wheel turns lock-to-lock is dependent on these factors:

**Mechanical systems:**

- The gear ratio of the helm. Numerically higher gear ratio = more wheel turns with less effort. Lower gear ratio = less wheel turns with higher effort.

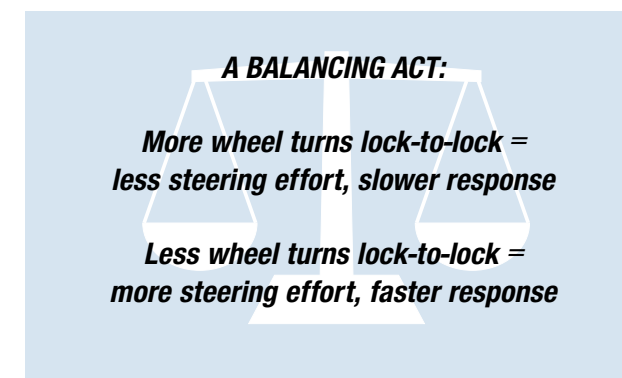
**Hydraulic systems:**

- The displacement of the helm pump. Higher helm displacement = less wheel turns/faster response with more effort. Less displacement = more wheel turns.
- The volume of the cylinder. More cylinder volume = more wheel turns with less effort. Less volume = less wheel turns with higher effort.

**Other factors that can influence steering effort are:**

- Allowable movement of engine, rudder or drive unit.
- Vessel speed
- Type of engine (outboard, stern drive, inboard)
- Unusual propeller selections
- Hull type (i.e., displacement, planing, etc.)

**All boats should be water tested to ensure safe, dependable operation!**



## All Outboards, Power-Assisted Stern Drives

| OUTBOARDS & POWER-ASSISTED STERN DRIVES |   |  |  |   |  |
|---|---|--|--|---|--|
| CURRENT STEERING TYPE                   | All Non-Power-Assisted Outboard Engines (No FeedBack)   |  |  | Power-Assisted Outboards/ Stern Drives/ Inboards  |  |
|   | Up to V-4 & V-6 50 MPH or less  | Up to V-6 to 55 MPH  | V-6 & Larger (to 300 HP) 60 MPH+                       |   |  |
|   | <b>Rotary Mechanical (cable)</b>  | <b>Safe-T II SS132</b> (up to V-4; 3 turns) or <b>4.2 Rotary Single Cable SS147</b> (up to V-6; 4.2 turns) | <b>4.2 Rotary Dual Cable SS148</b> (4.2 turns)         | <b>Upgrade to SeaStar PRO</b> HK73 or HK74 (no hoses) (4 turns)   | <b>HPS</b> (order by components) or <b>Safe-T QC SS137</b> (3 turns)   |
|   | <b>Rack &amp; Pinion Mechanical (cable)</b>   | <b>No FeedBack Rack Single Cable SS151</b> (up to V-6; 4 turns)  | <b>No FeedBack Pro Rack Dual Cable SS152</b> (4 turns) | <b>No FeedBack Pro Rack Dual Cable SS152</b> (4 turns) or <b>upgrade to SeaStar PRO</b> HK73/HK74 (4 turns) | <b>Non-NFB Rack Single Cable SS141</b> (4 turns) or <b>upgrade to SeaStar Steering</b> (for autopilots) (turns vary) |
| <b>Hydraulic</b>                        | <b>SeaStar HK63/HK64</b> (up to V-6; 4.75 turns) <b>BayStar HK42</b> (outboards to 140 HP; 4.5 turns) | <b>SeaStar HK63 or HK64 (no hoses)</b> (4.75 turns)  | <b>SeaStar PRO HK73 or HK74 (no hoses)</b> (4 turns)   | <b>SeaStar Steering</b> (if installing an autopilot) (turns vary)   |  |

Some high performance boats/engine combinations develop instability at high speed. Instability becomes more prevalent in boats faster than 50 MPH. Dual-cable steering or SeaStar PRO systems are recommended by Teleflex and engine makers for these boats.

**\*Important Note: No FeedBack Steering MUST NOT be used in dual station, power-assisted, or autopilot installations!**

**Outboards (without power steering): No FeedBack™ (NFB™ - mechanical) or SeaStar® (hydraulic) is recommended as replacement steering for all non-power-assisted outboards.** For high performance boats or other applications in which there may be engine flutter or some steering instability, dual cable NFB (4.2/Pro Rack) mechanical systems or SeaStar PRO® hydraulic systems are recommended. **For most rotary steered boats made after 1993, upgrading to NFB can be as simple as a helm change.**

**Stern Drives & Outboards (with power steering): HPS™ High Performance Steering** is recommended for power-steered stern drives and other power-assisted applications. HPS features a unique coated core and special 3-turn helm for minimal backlash at the wheel. Traditional mechanical systems (Safe-T QC® & Back Mount Rack & Pinion) may also be used for power-assisted applications. **SeaStar® is recommended for all vessels using autopilots.**

**Stern Drives (without power steering): SeaStar or NFB 4.2 No FeedBack Steering\*** is recommended for **non-power-assisted** stern drives and small inboards. **SeaStar is recommended for all vessels using autopilots.**

**Inboards:** Big-T®, SeaStar, SeaStar Capilano™, and SeaStar Power Steering are available for various inboard and sail boats. **SeaStar® is recommended for vessels with dual stations and those using autopilots. Big-T is the only mechanical steering system currently offered for twin station boats. Big-T service parts are available or you can upgrade to SeaStar.**

## All Inboards, Non-Power-Assisted Stern Drives

| NON POWER-ASSISTED STERN DRIVES, INBOARDS |  |   |   |   |   |
|---|--|---|---|---|---|
| CURRENT STEERING TYPE                     | Stern Drives (non power-assisted)  | Inboard Powered Boats, including Multiple Stations  |   |   |   |
|   |  | Up to 34 feet (most engines)  | Up to 50 feet (single or dual engines)  | Over 50 feet (most engines)   |   |
|   | <b>Mechanical (cable)</b>  | <b>4.2 Rotary Single Cable SS147</b> (4.2 turns) or <b>NFB Rack Single Cable SS151</b> (4 turns)                      | <b>Big-T (order by components; dual station version avail.)</b> (3 turns)   | —   | —   |
|   | <b>Hydraulic General Purpose (number of turns varies with helm &amp; cylinder)</b> | <b>SeaStar Stern Drive Steering</b> (order system by components; dual station version available; best for autopilots) | <b>SeaStar or Hynautic Inboard Steering</b> (order system by components; dual station version available; best for autopilots) | <b>SeaStar or Hynautic Inboard Steering</b> (order system by components) or <b>upgrade to SeaStar Capilano</b> Inboard Steering (order by components) | <b>SeaStar Power Steering</b> (order system by components)<br><small>NOTE: Boats over 50 feet should have steering loads reviewed by Teleflex. Please call Teleflex Canada tech service for assistance.</small> |
| <b>Hydraulic Heavy Duty (turns vary)</b>  | —  | <b>SeaStar Capilano</b> Inboard Steering  | <b>SeaStar Capilano</b> Inboard Steering or <b>SeaStar Power Steering</b>   | —   |   |

Please use these guides to assist in making your selection, but remember that **the recommendations are general in nature. Any boat/steering system combination should be water-tested by the installer to ensure safe and dependable steering.** If in doubt, please contact Teleflex Technical Service for assistance. **We are happy to help you.** For Teleflex and Morse mechanical product technical support, contact 610-495-7011, FAX 610-495-7688 or on-line at [www.tfxmarine.com](http://www.tfxmarine.com). For Capilano, Hynautic, SeaStar and SyTen product technical support, contact 604-270-6899 or 941-488-6744, FAX 604-270-7172 or on-line a [www.seastarsteering.com](http://www.seastarsteering.com).

**Jet Boats:** Teleflex has supplied many versions of steering for jet boats. *If you are replacing jet boat steering, please refer to the Teleflex catalog or contact Technical Service for assistance. (610-495-7011, FAX 610-495-7688 or on-line at [www.tfxmarine.com](http://www.tfxmarine.com).)*

**Tilt Steering:** You can upgrade to the comfort and convenience of Tilt steering with all Teleflex systems except Capilano.

**Multiple Engine Tie Bars:** Installation of a new steering system may require the replacement of tie bars for dual or triple engines. Please refer to the SeaStar Selection Guide to make sure you order the proper one.

**Will it Fit?**

**MECHANICAL CONSIDERATIONS:** Mounting hardware for NFB 4.2, Safe-T II and HPS helms fits the Safe-T dash cutout. NFB Rack helms fit 1984-date “The Rack” mounting holes. 1996-date “back mount” rack helms use a unique rack cable and will not work with old style rack cables.

**HYDRAULIC CONSIDERATIONS:** SeaStar helms retrofit into most boats. The SeaStar front mount cylinder is best for outboards with 22” splashwells or wider. Side/splashwell mount cylinders are offered, but require more room. *Check splashwell dimensions before ordering outboard cylinders.*