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8

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SeaStar[®]

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TTI **Teleflex**[®]
Teleflex Canada

INSTALLATION INSTRUCTIONS

AND OWNERS MANUAL

www.seastarsteering.com




SeaStar[®]

POWER STEERING FOR INBOARD
POWERED VESSELS

*Before you do it your way,
please try it our way*

Notice to Boat Manufacturer or Installer

Throughout this publication, Warnings and Cautions (accompanied by the International Hazard Symbol ) are used to alert the manufacturer or installer to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly.

Observe Them Carefully!

These “safety alerts” alone, cannot eliminate the hazards that they signal. Strict compliance to these special instructions when performing the installation and maintenance plus “common sense” operation are major accident prevention measures.

 DANGER	 WARNING	 CAUTION	NOTICE
Immediate hazards which WILL result in severe personal injury or death.	Hazards or unsafe practices which COULD result in severe personal injury or death.	Hazards or unsafe practices which COULD result in minor injury or product or property damage.	Information which is important to proper installation or maintenance, but is not hazard-related.

WARNING

Cleaning fluids containing ammonia, acids or any other corrosive ingredients MUST NOT be used for cleaning any part of this Hydraulic Steering System. Failure to comply will cause serious damage to the steering system, resulting in possible loss of steering, causing property damage, personal injury and/or death.

Introduction

The SeaStar open center Power Steering system has been designed to steer commercial and pleasure boats, requiring a maximum output force of 6000 lbs_f or 26,700 Newtons, or a maximum torque of 46,800 in-lbs or 5,270 Newton meters. If uncertain of your application, or you have special requirements, refer to the SeaStar power steering brochure or consult the factory.

All power steering system components have been designed to the highest standards possible. Please ensure that components not purchased from Teleflex are of the highest quality possible, and are compatible with Teleflex equipment.

NOTICE

Before proceeding with the installation, read these instructions thoroughly. Teleflex cannot accept responsibility for installations where instructions have not been followed, where substitute parts have been used, or where modifications have been made to our products.

Index

System Diagram.....	1
Tools	2
Cylinder Mounting.....	6
Power Pump Installation	9
Cooler Installation	11
Reservoir Installation	12
Filter Installation	12
Mounting the Helm.....	13
Tube and Hose Installation.....	17
Autopilot Installation.....	21
Filling and Purging	23
Maintenance	28
Trouble Shooting Guide.....	28
Technical Information	31
Parts List	32
Statement of Limited Warranty	37
Return Goods Procedure.....	37

HOW IT WORKS

SeaStar hydraulic power steering uses the ships engine(s) to provide the “POWER” for the power steering system, via an engine or electric motor driven hydraulic pump.

A manual hydraulic steering system consisting of a standard Seastar helm and a hydraulic steering cylinder, (fitted with an integral servo cylinder and a power steering valve) supplies the “control” portion of the power steering system.

Under normal conditions, with engines running, a hydraulic oil supply is in a stand-by mode, ready to be directed to the steering cylinder as dictated by the steering wheel, servo cylinder and power steering valve.

Turning the steering wheel left or right causes the power system to go from ‘stand-by’ into ‘operating’ mode and moves the steering cylinder accordingly.

In the event of a power source failure, hydraulic oil is automatically pumped directly from the steering helm into the servo **and** steering cylinder, providing the helmsman with manual back-up steering.

An engine room mounted oil reservoir allows easy system fill and assists the in-line oil cooler in cooling the hydraulic oil. An in-line oil filter helps protect the steering system components against contaminants.

System Diagram

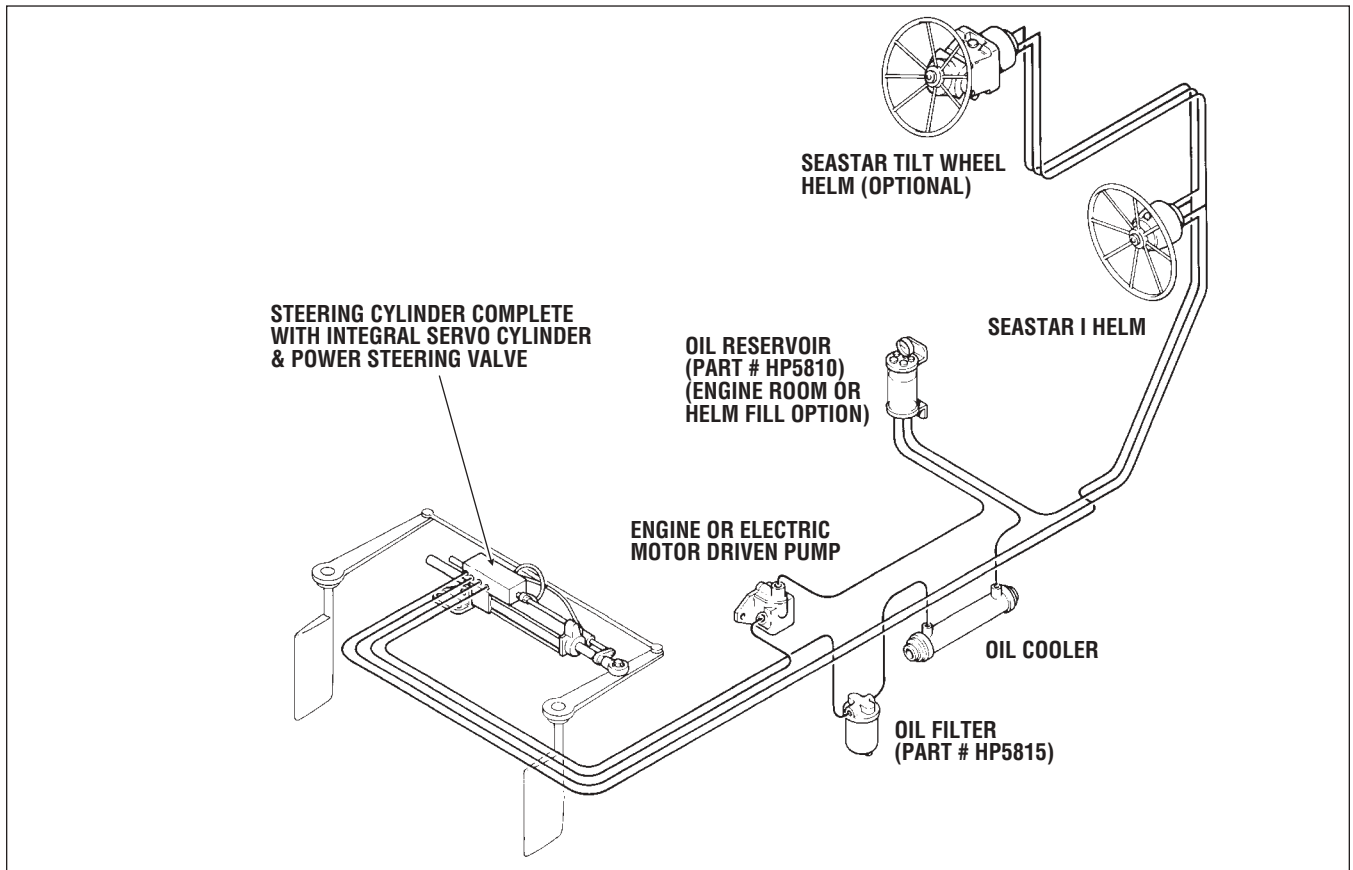


Figure 1

Tools

- $\frac{3}{8}$ " dia. Drill
- $\frac{5}{8}$ ", $\frac{3}{4}$ ", $\frac{15}{16}$ " Open End type Wrench/Spanner

Standard Helm Mount

- 3" (77mm) diameter Hole Saw or Key Hole Saw and a
- $\frac{5}{16}$ " (8mm) dia. Drill
- $\frac{7}{16}$ ", $\frac{9}{16}$ ", $\frac{5}{8}$ " and $\frac{3}{4}$ " Open End type Wrench/Spanner
- $\frac{15}{16}$ " Socket

Optional Helm Mount

- Square Bezel Backmount, HA5418, 4 $\frac{1}{2}$ " (115 mm) Hole Saw
- Round Bezel Backmount, HA5417, 4 $\frac{3}{8}$ " (112mm) Hole Saw
- Rearmount Helm, HH5261/62, $\frac{13}{16}$ " (21mm) Drill
- Tilt Helms 4 $\frac{1}{2}$ " (115mm) Hole Saw

20° Mount Wedge

- Key Hole or Sabre Saw
- $\frac{5}{16}$ " (8mm) dia. Drill
- $\frac{1}{2}$ " Wrench/Spanner, Box or Open End type
- $\frac{7}{16}$ " Socket and Drive

Before Starting

Study the installation schematic carefully, and familiarize yourself with all components and their intended or required mounting location.

Determine that adequate space is available for installation of components, hydraulic lines and service access.

Read all bold printed text, notes and cautions. Reading them now may help to prevent unexpected surprises during the installation.

Confirm that all required parts are available to complete the installation, including steering system components, mounting hardware, hoses, tubing and fittings, pipe thread sealant such as Loctite P.S.T., all necessary tools and hydraulic oil.

Things You Need To Know

Not all of the steering system components may have been purchased from Teleflex, such as power steering pump, oil cooler, filter and hose, tube and fittings. Components purchased from Teleflex require hose or tube connection and fittings as follows:

- SeaStar Helm Pump – fitted with $\frac{1}{4}$ " NPT ports
- Power Steering Cylinder – fitted with $\frac{1}{4}$ " NPT ports
- Reservoir, fitted with $\frac{1}{4}$ " NPT & $\frac{3}{8}$ " NPT ports
- Oil Cooler, fitted with $\frac{3}{8}$ " NPT ports and 1" hose fitting
- Oil Filter, fitted with $\frac{3}{4}$ " NPT ports
- Power Steering Pump (Vicker's) fittings (see page 7 & 8)

NOTICE

See page 18 for fittings available from Teleflex.

In order to accommodate same size hose or tube fittings for the entire steering system, $\frac{3}{8}$ " to $\frac{1}{4}$ " and $\frac{3}{4}$ " to $\frac{1}{2}$ " NPT adapter bushings are required. Pumps, oil cooler and filter purchased from other sources may be fitted with different size fitting ports.

NOTICE

Mounting hardware is not supplied for power steering pumps, oil cooler and filter, due to the many variations in mounting preference. Make sure you have what you need before starting the installation.

SeaStar System Layout: Single Cylinder Single Pump

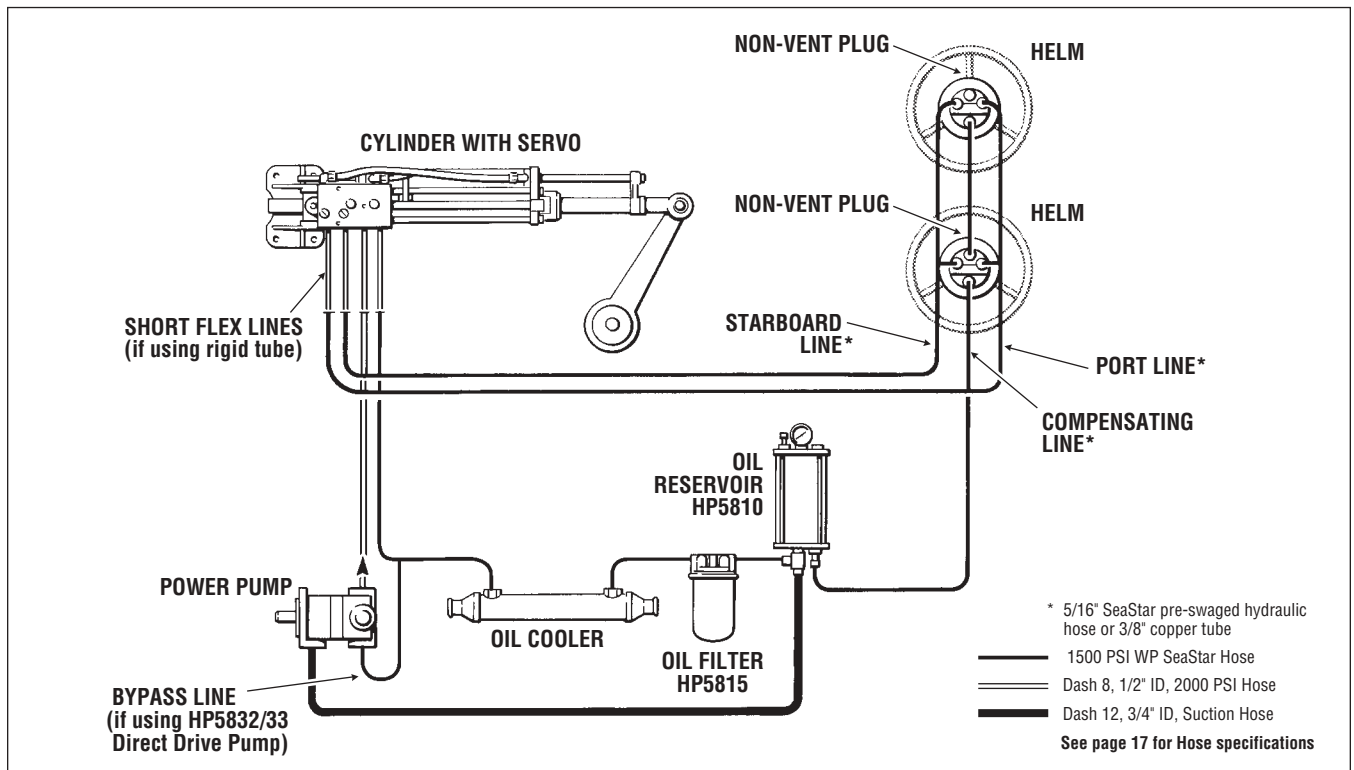


Figure 2

SeaStar System Layout: Twin Cylinder Twin Pump

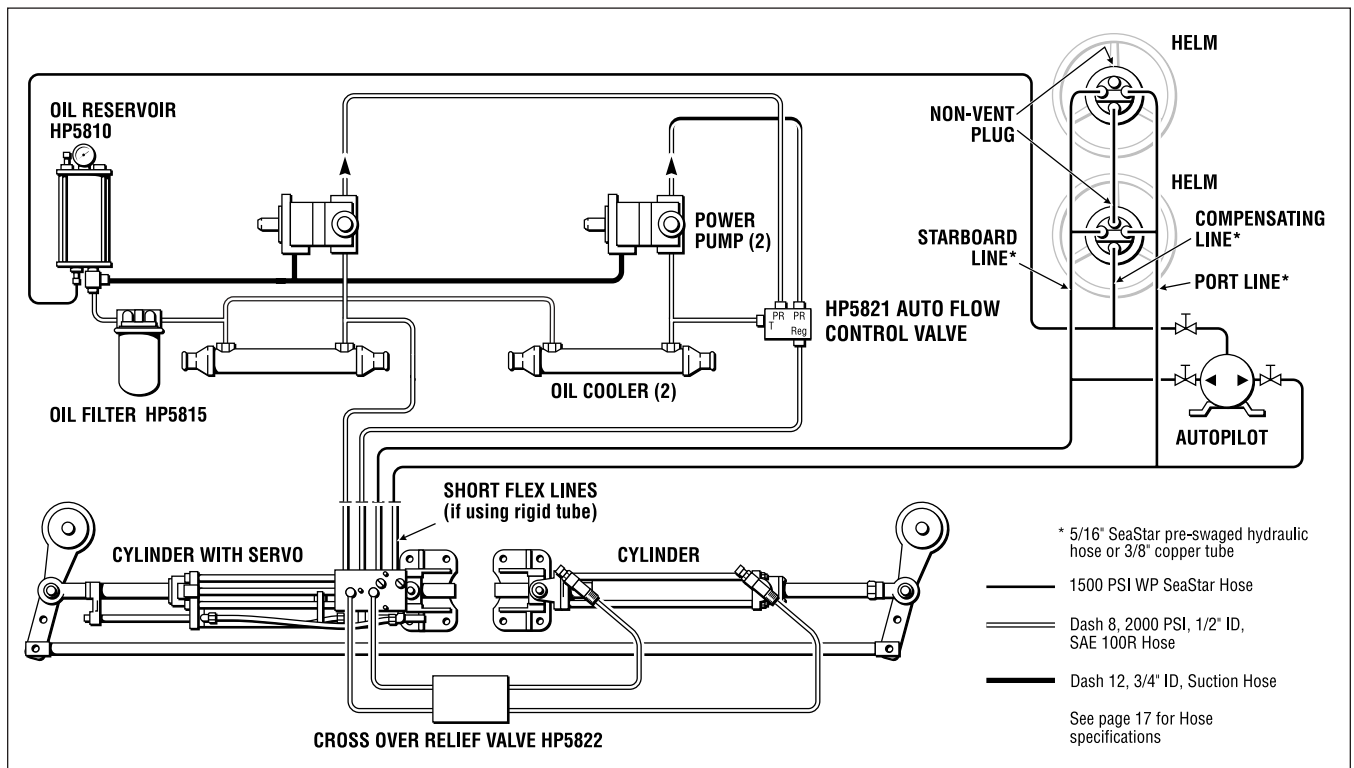


Figure 3

SeaStar System Layout: Twin Cylinder, Reservoir and Power Pump with Autopilot

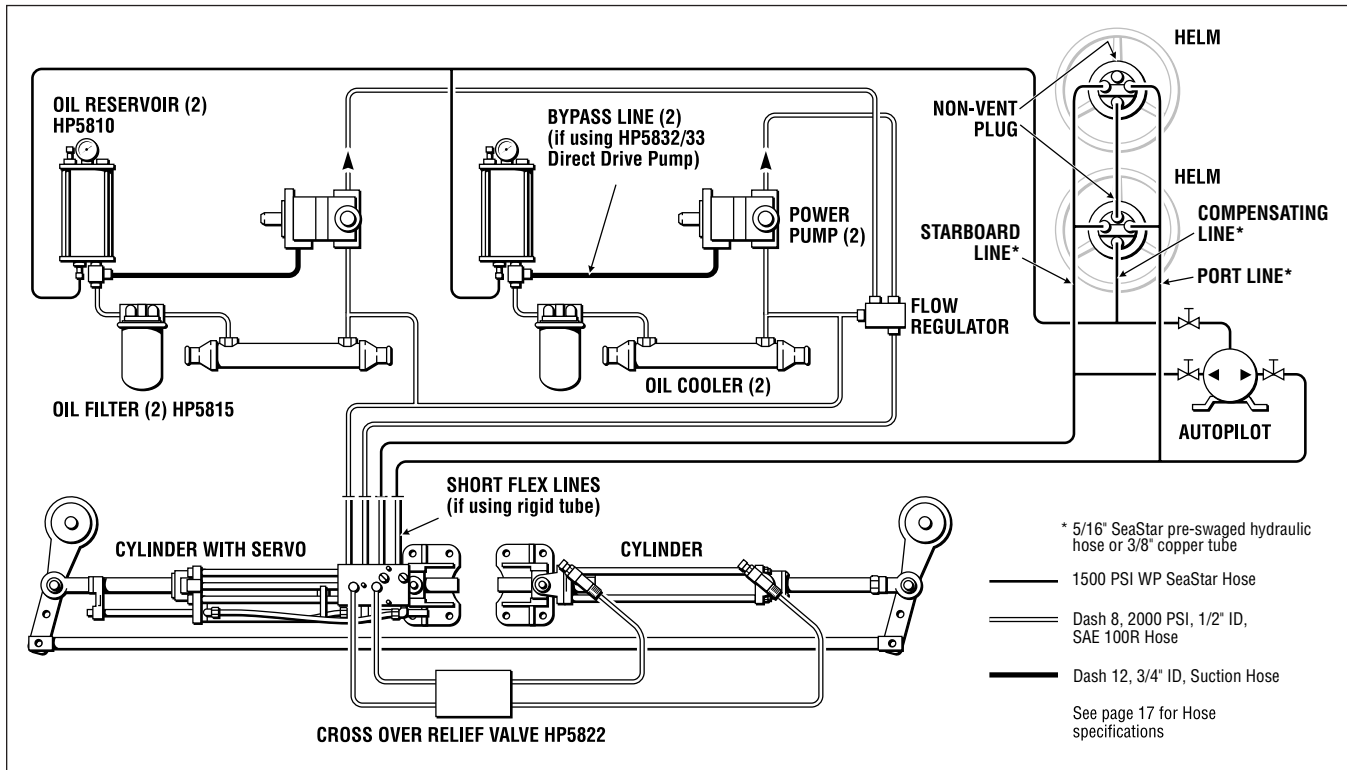


Figure 4

SeaStar System Layout: Twin Cylinder Twin 4GPM Pumps

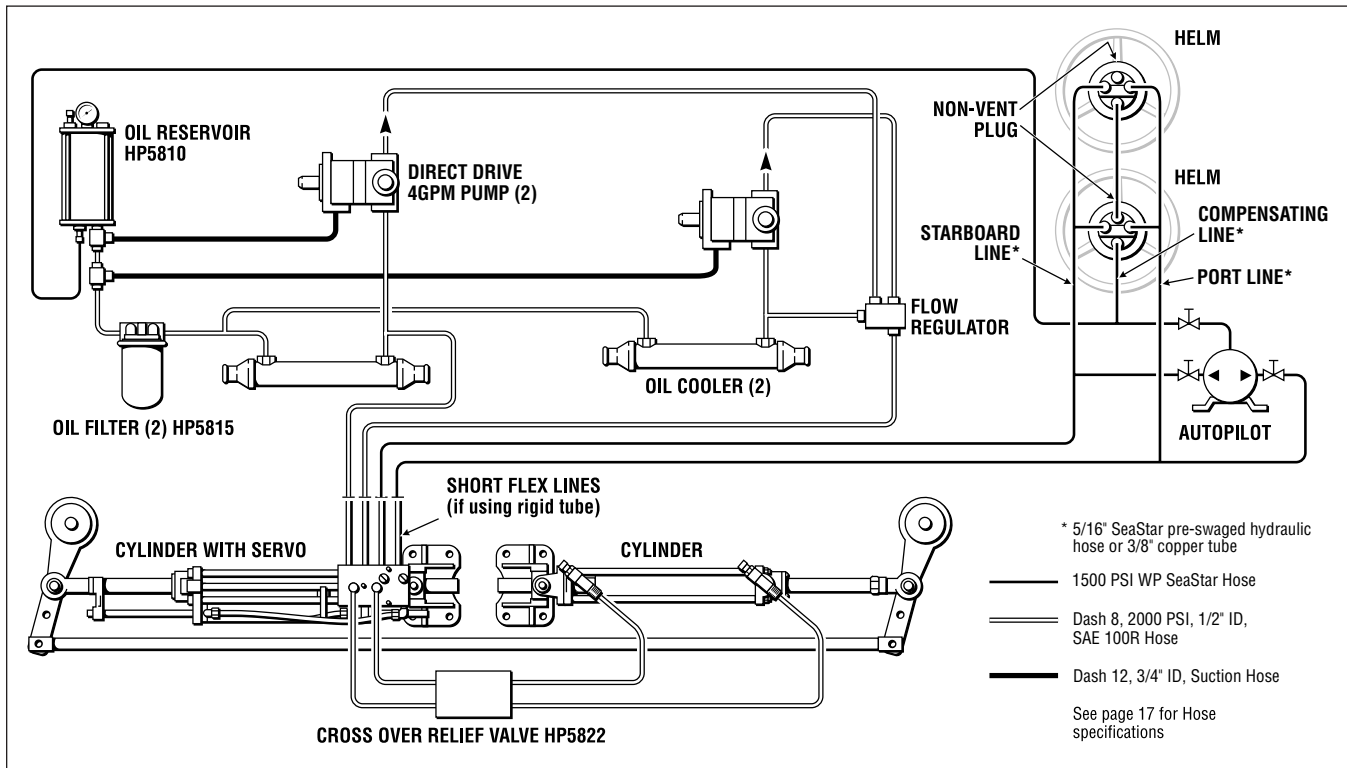


Figure 5

System Installation Notes

NOTICE

Do Not use a bypass line with a belt driven pump.

Installation of twin 2 GPM engine driven power pumps requires the installation of outlet checks (HP5820) at the outlet of both power pumps.

Installation of twin 4 GPM engine driven pumps requires the use of the flow control valve HP5821.

Twin steering cylinder installations require the use of a 4 GPM engine driven power pump. Connect the oil coolers to the return circuit in parallel. Single pump installations use Dash 8, 1/2" I.D. hose to pipe the return circuit. Dual or twin pump installations use Dash 10, 5/8" I.D. hose to pipe the return circuit.

Single steering cylinder installations require the use of the twin 2 GPM engine driven power pumps. Pipe the return circuit using Dash 8, 1/2" I.D. hose and connect the coolers in series.

Applications using Mann diesels, where the engine is driving the power pump at 1.26 times the engine speed, use 2 GPM pumps for single or twin cylinder installations.

CYLINDER MOUNTING

General

Proper cylinder installation is the key to the successful operation of the hydraulic steering system. An incorrectly installed cylinder is subject to rapid seal and bearing wear and non-repairable damage.

Minimum side loading of cylinder rod and maximum cylinder performance can be achieved as illustrated below.

An imaginary line drawn through the tiller arm hole at both hard-over positions will create the cylinder centre line.

With tiller arm at hard-over positions, angle X and Y should be the same.

⚠ CAUTION

Ensure HC5801/5803 power rams are mounted such that the servo cylinder can shift.

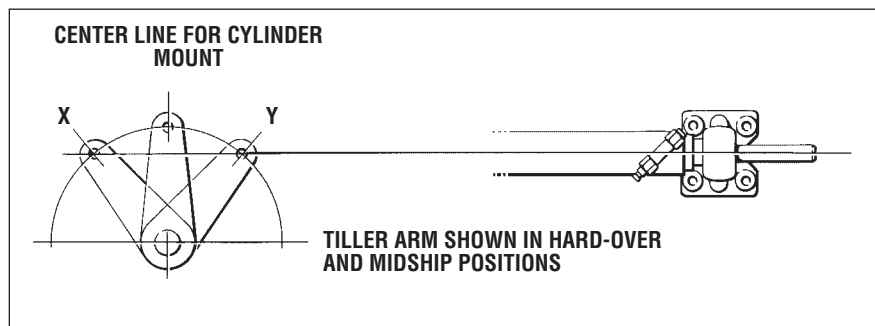


Figure 6

Select the diagram and dimensional data that corresponds with your cylinder model.

NOTICE

Not all possible cylinder mounting configurations are shown, however, all necessary dimensions are shown.

⚠ WARNING

Cylinders should always be secured with thru bolts, not with lag screws. (Where applicable).

Cylinder ports for hose connection should always be in the uppermost position. If this is absolutely not possible, cylinder should be left unmounted until the steering system is filled and purged free of air, while leaving cylinder ports in an uppermost position to assist air removal from the cylinder(s), then mount.

Protect cylinder rods from nicks and scratches, which can cause cylinder to leak, and result in loss of steering.

All parts used are corrosion resistant, however with extended operation under extremely corrosive conditions, corrosion may occur and affected parts should be replaced.

Upon completion of cylinder installation to tiller arm, move the rudder(s) – cylinder(s) from 'hard over' to 'hard over' to ensure total unrestricted movement.

Refer to pages 33-34 for bolt attachment of cylinder to tiller arm. Cylinder rod end bolt must always engage the Nylok™ nut fully beyond nylon ring by at least 2 full threads.

Shoulder pins c/w cotter pins are not recommended.

⚠ WARNING

Failure to ensure Cylinder Shafts are protected from gel coat, paint or any other form of debris or foreign substance will void warranty

HC5801 (9" stroke) & HC5803 (11" stroke) Cylinder With Servo

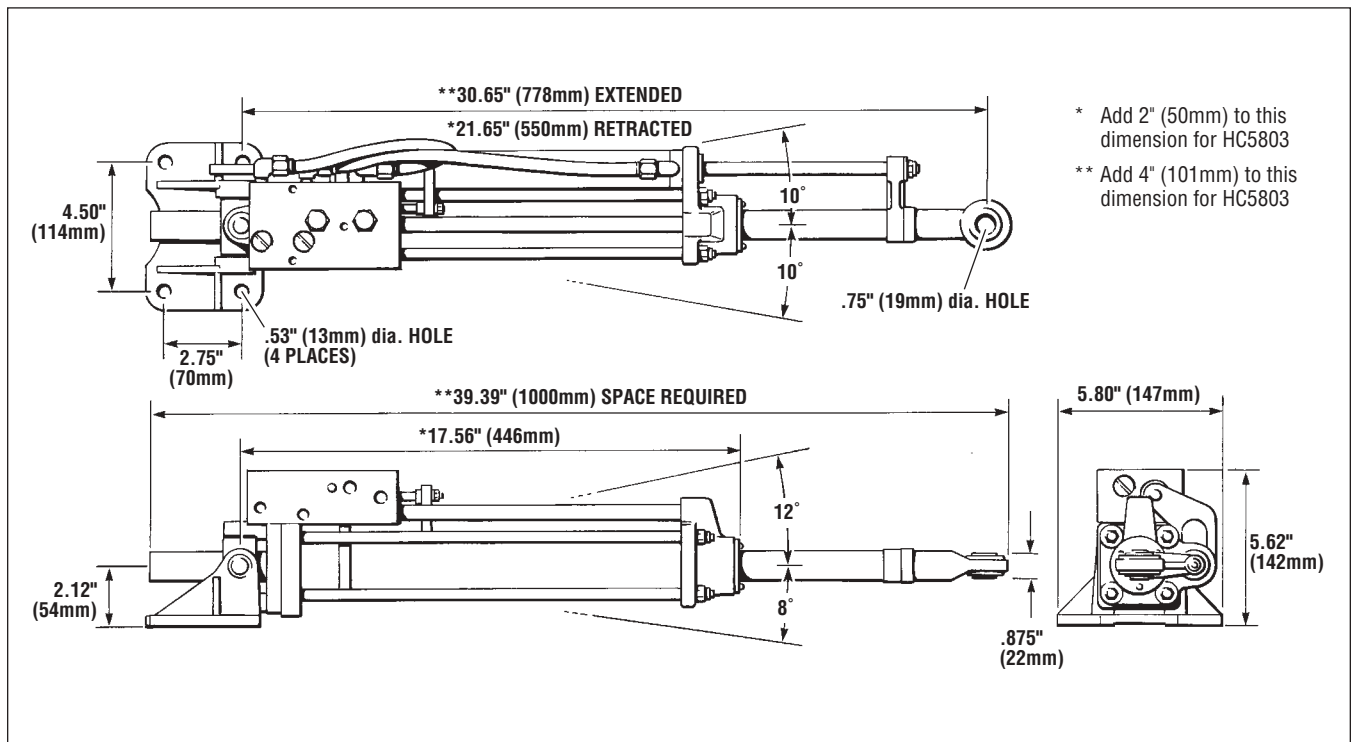


Figure 7

HC5802 (9" stroke) & HC5804 (11" stroke) Cylinder Without Servo

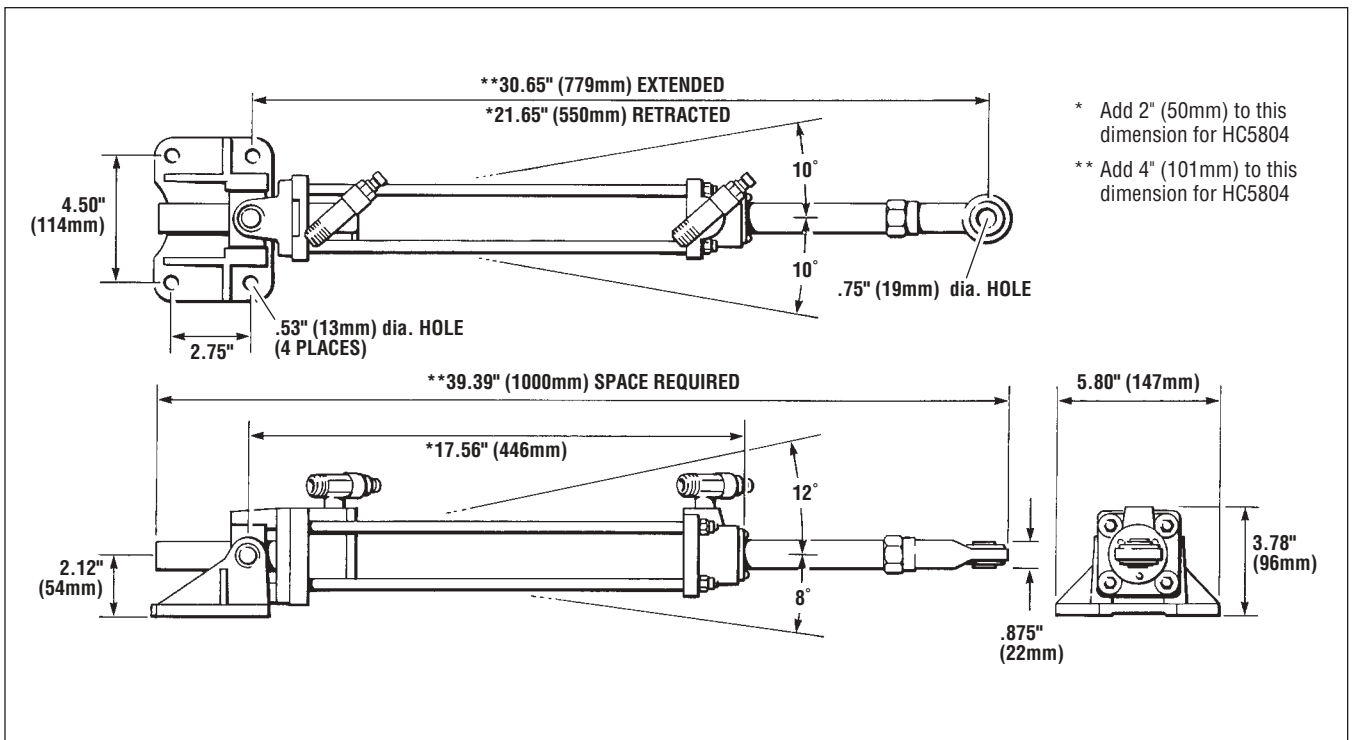
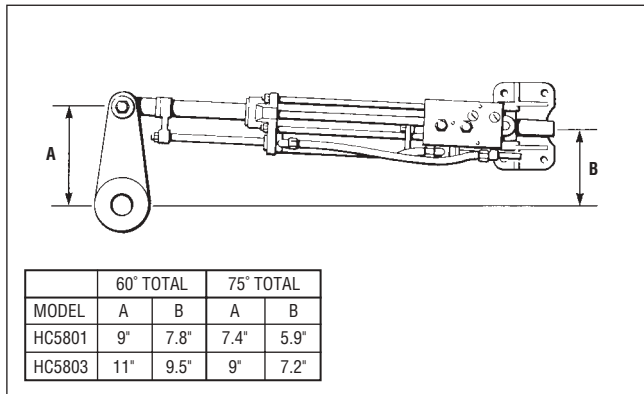
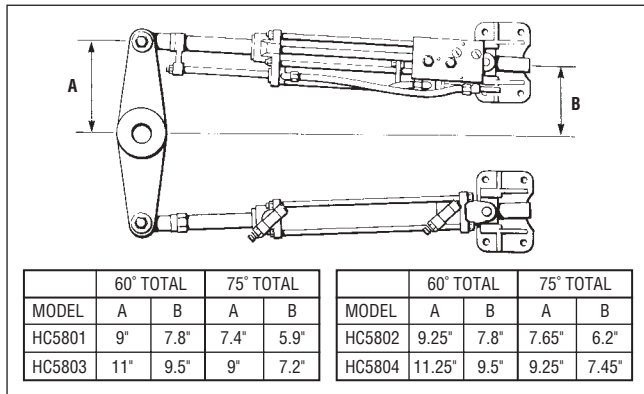


Figure 8

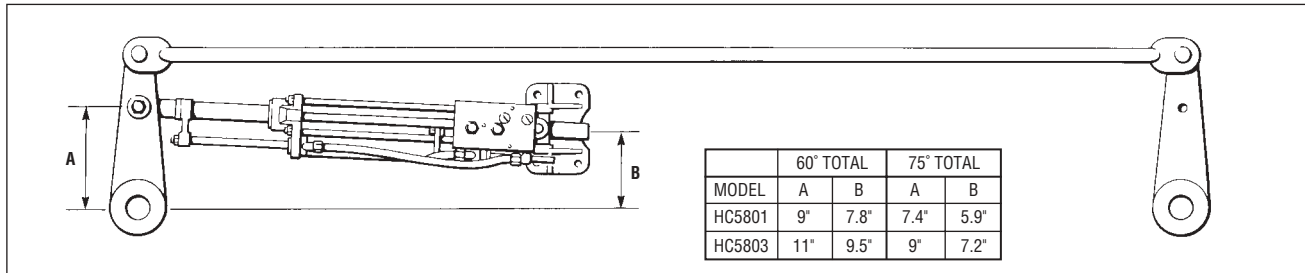
Mounting Configurations



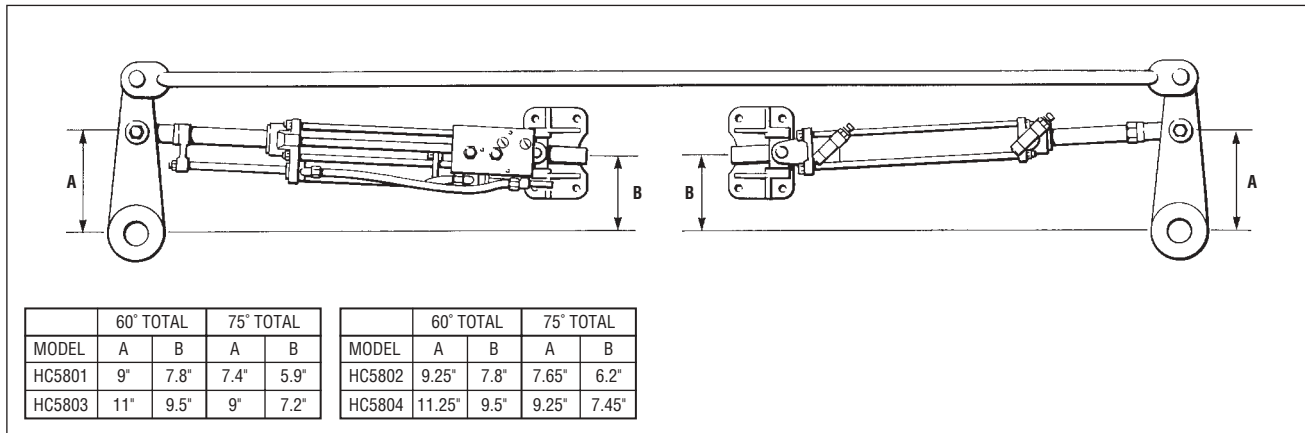
Configuration A1



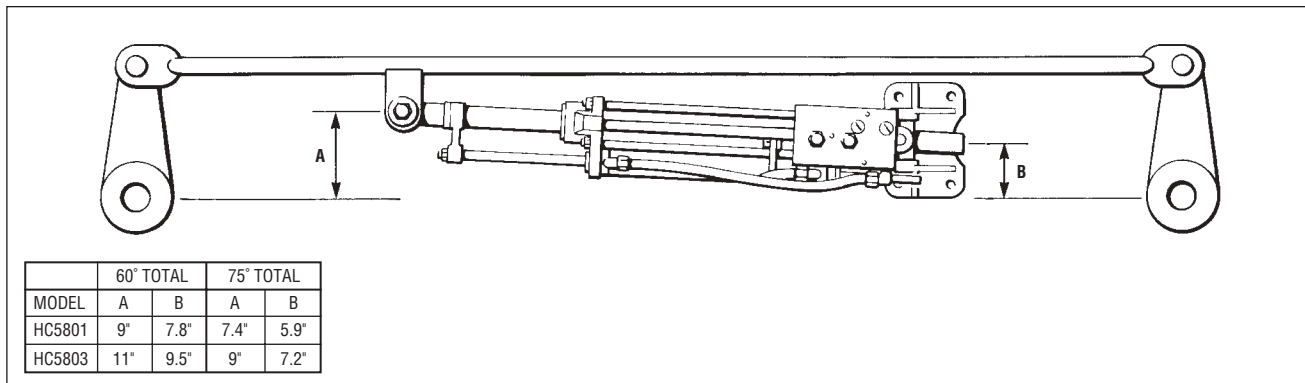
Configuration A2



Configuration B



Configuration C



Configuration D

Figure 9

POWER PUMP INSTALLATION

ZF-Pump Adapters HA5828 & HA5827

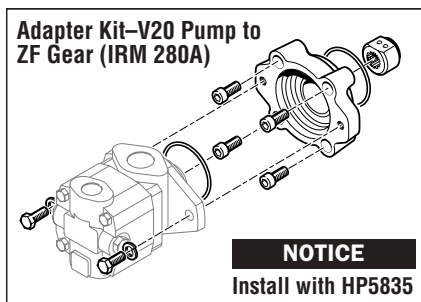


Figure 10 - Pump part # HA5828

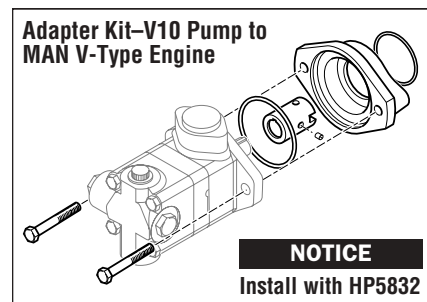


Figure 11 - Pump part # HA5827

When installing your Teleflex power pump, always ensure that your pump has the required rotation for your engine.

These pumps develop the specified rated flow at 1200 RPM, the excess flow at higher RPM is circulated back to tank via the integral flow control valve.

Pressure reliefs are preset and integral.

⚠ CAUTION

If using two pumps, outlet check valves (part # HP5820) are required on each pump and a cross-over relief (part # HP5822) is required for twin pump applications.

HP5830 (R.H. rotation, 4 GPM)

HP5831 (L.H. rotation, 4 GPM)

When selecting a pulley for the HP5830 or 31, make sure the ratio between the engine pulley is 1 to 1 or such that the pump will operate at a maximum RPM of 2800.

$$\frac{\text{ENGINE MAX. RPM}}{\text{PUMP MAX. RPM}} \times \text{ENGINE PULLEY DIAMETER} = \text{PUMP PULLEY DIAMETER}$$

Mount the pump on a suitable bracket with provision for alignment and tensioning of the belt.

Make sure the ports are not obscured when mounting the pump.

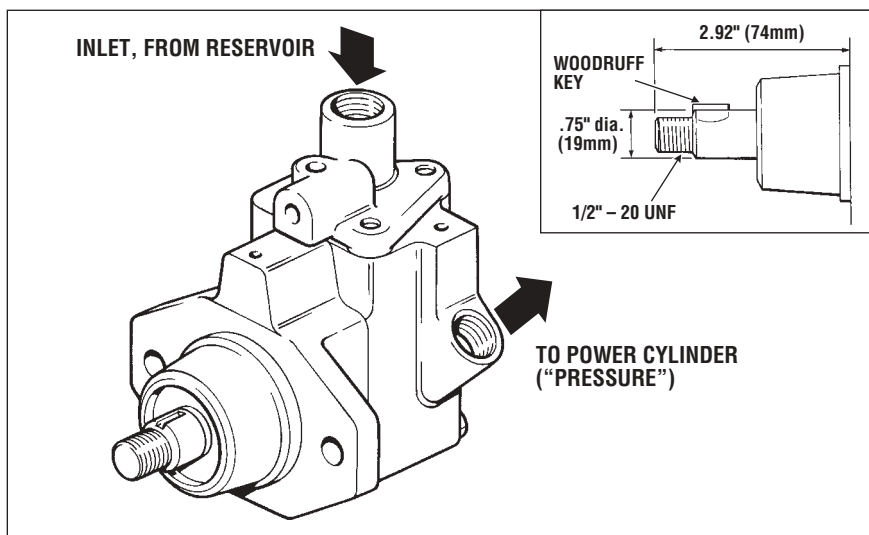


Figure 12 - Pump part #HP5830, #HP5831

Inlet Port $\frac{3}{4}$ " NPT, **Power Port** $\frac{3}{4}$ " - 16 O-Ring Boss Port

HP5832 (4 gpm)
($\frac{3}{4}$ " keyed shaft right rotation)

HP5833 (4 gpm)
(11 tooth splined shaft right rotation)

HP5834 (2 gpm)
(Key/nut right rotation)

HP5837 (4 gpm)
(Direct Drive, Right Rotation, 9 Tooth splined shaft)

HP5838 (2 gpm)
(Direct Drive, Right Rotation, 11 Tooth splined shaft)

HP5839 (2 gpm)
(V10-F, 9 Tooth splined shaft)

HP5844 (2 gpm)
(6S, right rotation)

HA5827 Adapter kit required for "MAN" Engines

CAUTION

When driving off an electric motor it is best to use a flexible Spider coupling to compensate for misalignments, which may cause premature wear.

These pumps are meant to run off a PTO with the correct rotation and RPM. Ensure clearance exists for the pump.

Consult your engine manufacturer's manual for mounting locations. If driving off an electric motor; use 3Hp @ 1800 RPM, #182 Frame, 'C' Face 'Y' connection. Consult Teleflex for part # of pump required.

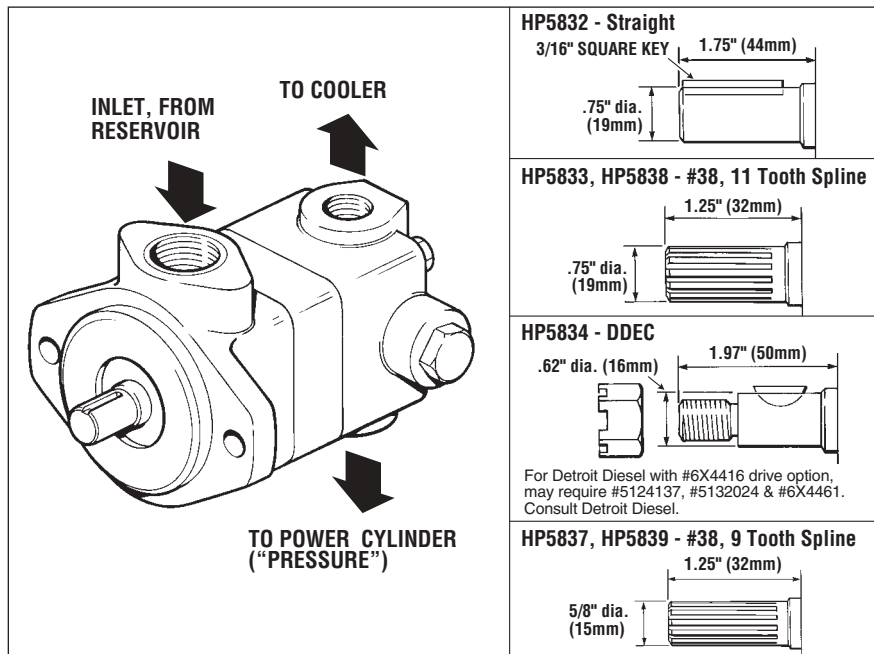


Figure 13 - Pump part #HP5832, HP5833, HP5834, HP5837, HP5838, HP5839

Inlet Port 1" NPT, **Power Port** $\frac{3}{4}$ " – 16 O-Ring Boss Port, **Cooler Port** $\frac{1}{2}$ " NPT, **Flange** SAE 'A'

HP5835

Adapter kits required:

HA5823 for "Twin Disc" #5050 Transmission

HA5824 for "Twin Disc" #5061 Transmission

HA5828 for "ZF gear"

If adapting this to Twin Disc or other drives, adapter flanges may be necessary. Consult Teleflex.

On some engines this pump can be PTO driven, provided it accepts an SAE 'B' flange and SAE 'B' spline of 13 teeth.

A "Heavy duty" pump with extra bearings to support overhung loads.

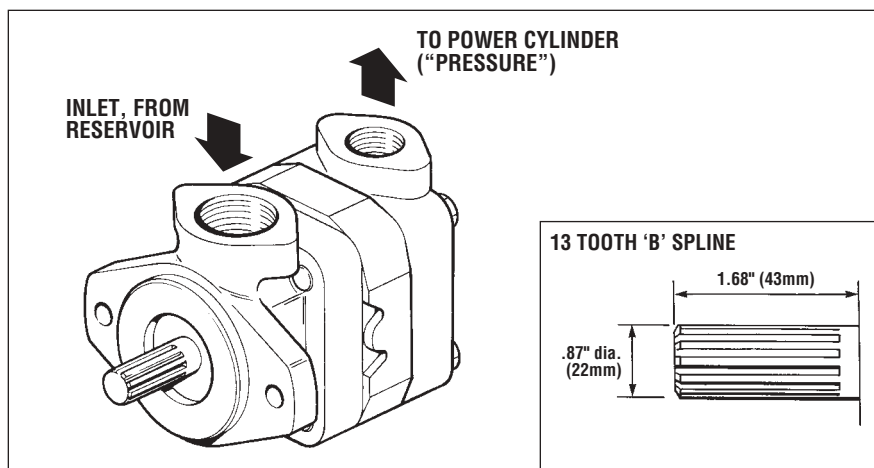


Figure 14 - Pump part #HP5835

Inlet Port 1 $\frac{5}{8}$ " – 12 O-Ring Boss Port, **Power Port** $\frac{3}{4}$ " – 16 O-Ring Boss Port, **Flange** SAE 'B'

COOLER INSTALLATION

⚠ CAUTION

Always ensure that the cooler receives a minimum of 3.5 US gpm water flow for adequate cooling.

If running a parallel circuit from the coolant ports on your engine, consult the manufacturer for locations and possible warranty concerns.

NOTICE

Specific engine connection details by manufacturer and model can be found in your engine owners manual.

Once all fittings are secure, attach the cooler to a bulkhead using saddle clamps or copper straps. Be sure not to deform the heat exchanger bundle.

It is best to run a parallel circuit on the feed side of the engine to cool the hydraulic oil most efficiently.

If running the cooler in series ensure that the cooler does not restrict your flow too much. The HP5825 will create a 3.5 psi pressure drop @ 35 gpm and the HP5826 will create 3.5 psi pressure drop @ 100 gpm.

NOTICE

Supply water for cooler must be raw water and not recirculated.

Note: On systems with 2 gpm pumps and twin 1" coolers the coolers should be piped in series. Systems using twin 4 gpm pumps the heat exchangers should be piped in parallel. Twin pumps are used so full flow can be maintained with only one engine.

NOTICE

Ensure oil cooler is drained when winterizing your vessel for storage

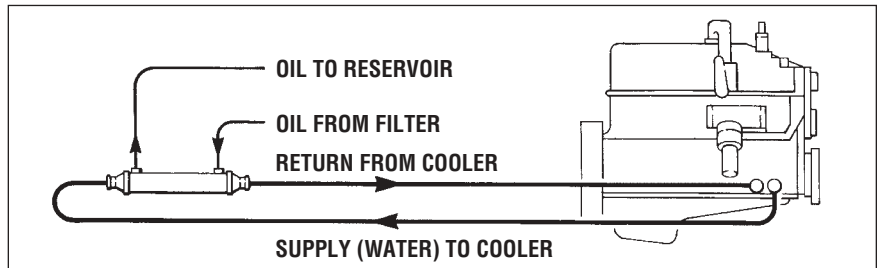


Figure 15

HP5825 1" Outlet 2.25kW

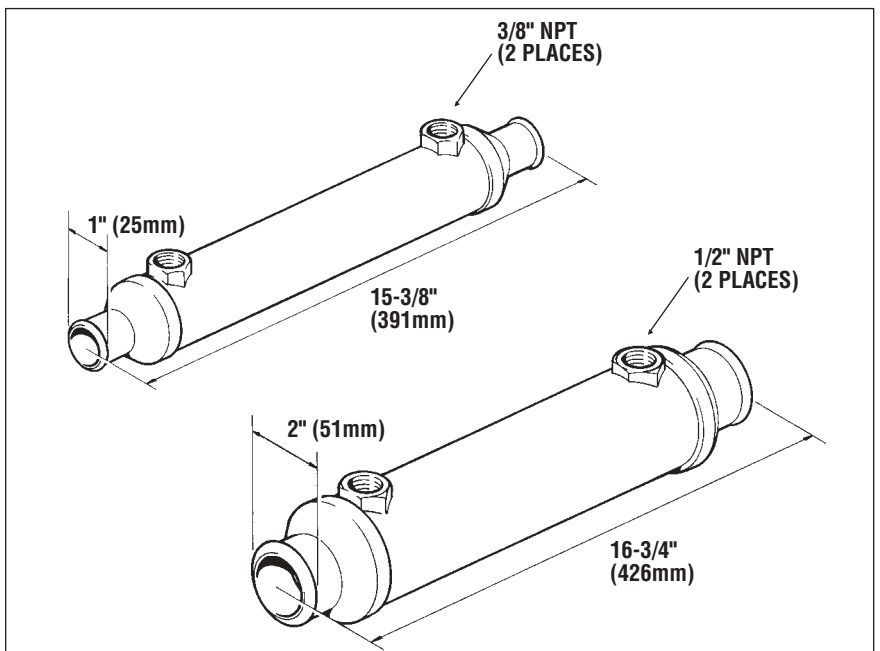


Figure 16

HP5826 2" Outlet 6.25kW

RESERVOIR INSTALLATION

Mount in a position that allows easy access to fill port and gauge.
Install fittings into bottom of reservoir using loctite "PST".

An extra 1/4" NPT port is supplied should it be needed for auxiliary equipment or hose routing considerations.

⚠ CAUTION

Do not use "tape" sealers such as teflon tape. These may damage the system.

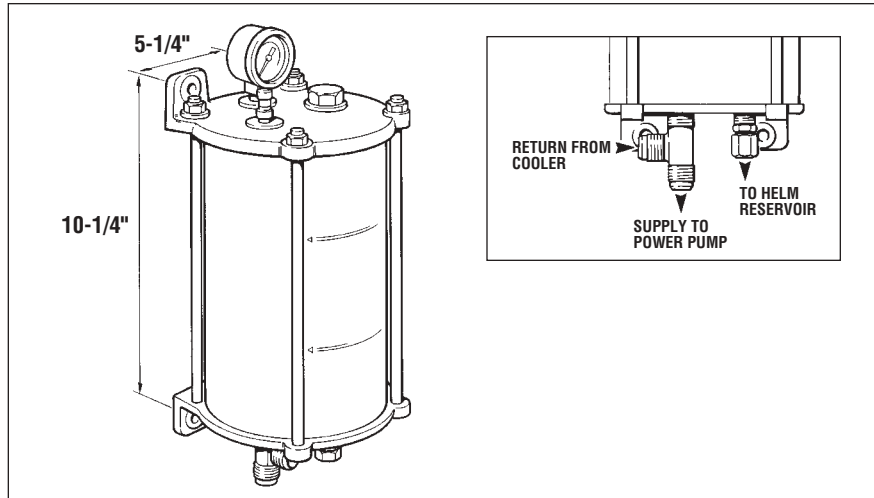


Figure 17 - Oil Reservoir (HP5810)

FILTER INSTALLATION

Install the fittings into the 3/4" NPT ports.

Plugged ports are provided (1/8" NPT) If you want to install 0 - 100 psi gauges on the filter.

Find a mounting location that allows easy routing of hoses and sufficient room to replace the screw-on filter element.

Ensure that the flow → on the top of the filter points in the direction of flow to the reservoir.

NOTICE

Ensure oil filter is installed properly and the filter element is threaded onto the base securely prior to purging. Failure to do so may result in the loss of steering fluid.

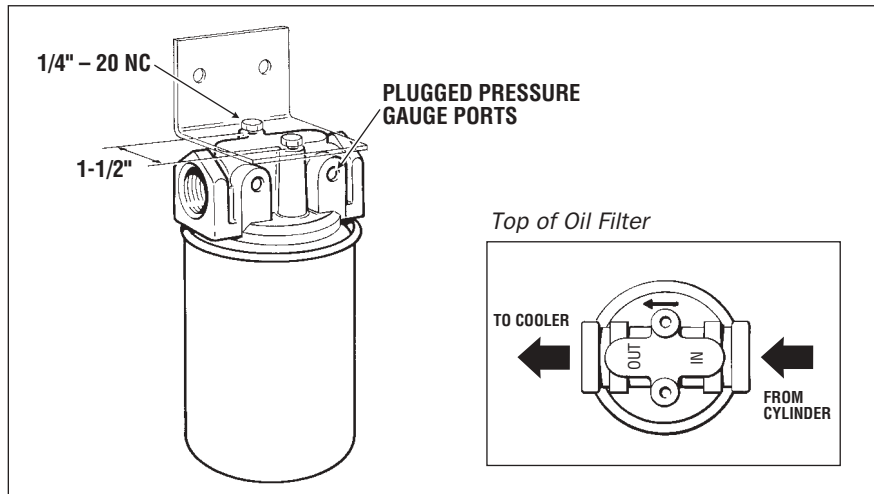


Figure 18 - Oil Filter (HP5815)

MOUNTING THE HELM

Mount the SeaStar helm to the dash board as required for your model-application. Refer to figures 21-25 and use appropriate mounting template.

The helm may be mounted with the helm shaft horizontal, vertical or any angle in between.

The filler plug must always be in the uppermost position.

⚠ CAUTION

The SeaStar Power Steering System is a pressurized system where all steering stations require the use of a non-vent plug. Teleflex part number HA5432.

Determine desired mounting position. Ensure that the steering wheel will not interfere with other functional equipment. Check for adequate space behind dash for fitting and line connections.

⚠ CAUTION

If a 20° mounting wedge is used, cut out dash as per mounting wedge template and mount helm directly to the 20° wedge.

⚠ WARNING

Use self-locking type fasteners only; substituting non-self-locking fasteners can result in loosening or separation of equipment and loss of steering control.

Do not exceed 110 in.-lbs. (12 Nm) torque on helm and wedge nuts and bolts.

Install elbow fittings supplied with helm to ports marked S and P. Note ports marked R are for the connection of additional helm and auto pilot compensating lines. Straight connectors may be substituted.

Use a pipe sealant such as Loctite P.S.T. or equivalent on all pipe threads. Do not use "tape" sealers.

Mount helm to dashboard or console and lightly **grease taper of helm shaft**.

Mount steering wheel to helm.

Tighten steering wheel shaft nut before filling and purging the steering system. Tighten nut to 150 in.-lbs. (17 Nm). Do not exceed 200 in.-lbs. (22 Nm).

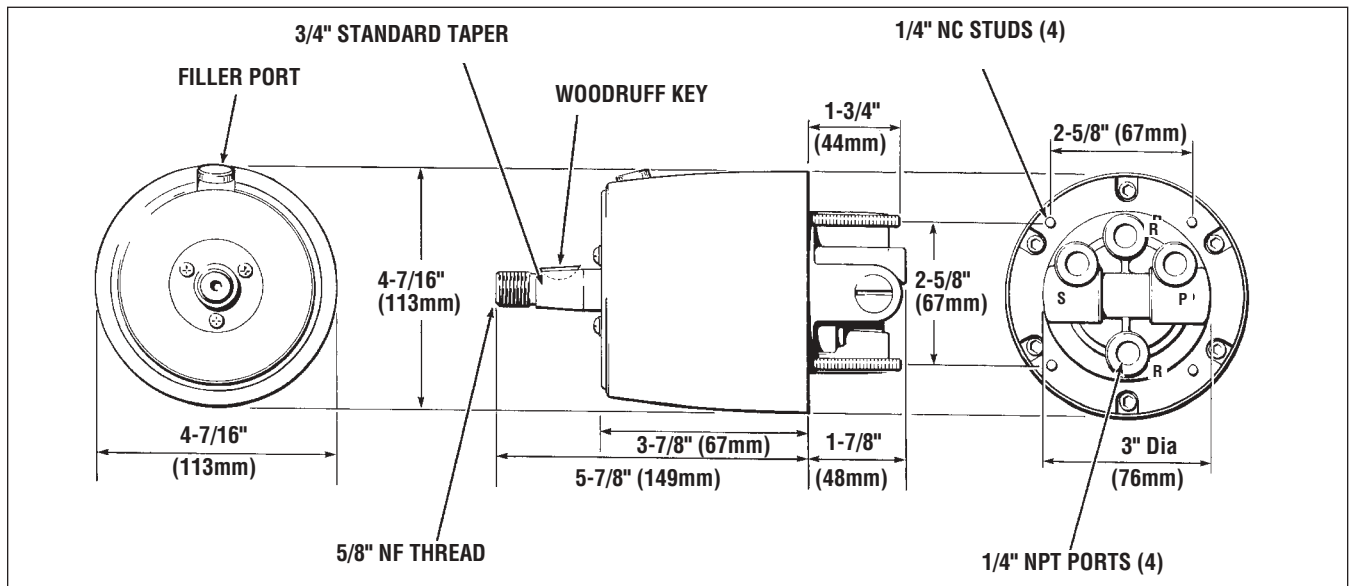


Figure 19

Standard Helm Mounting Configuration (part # HH5271)

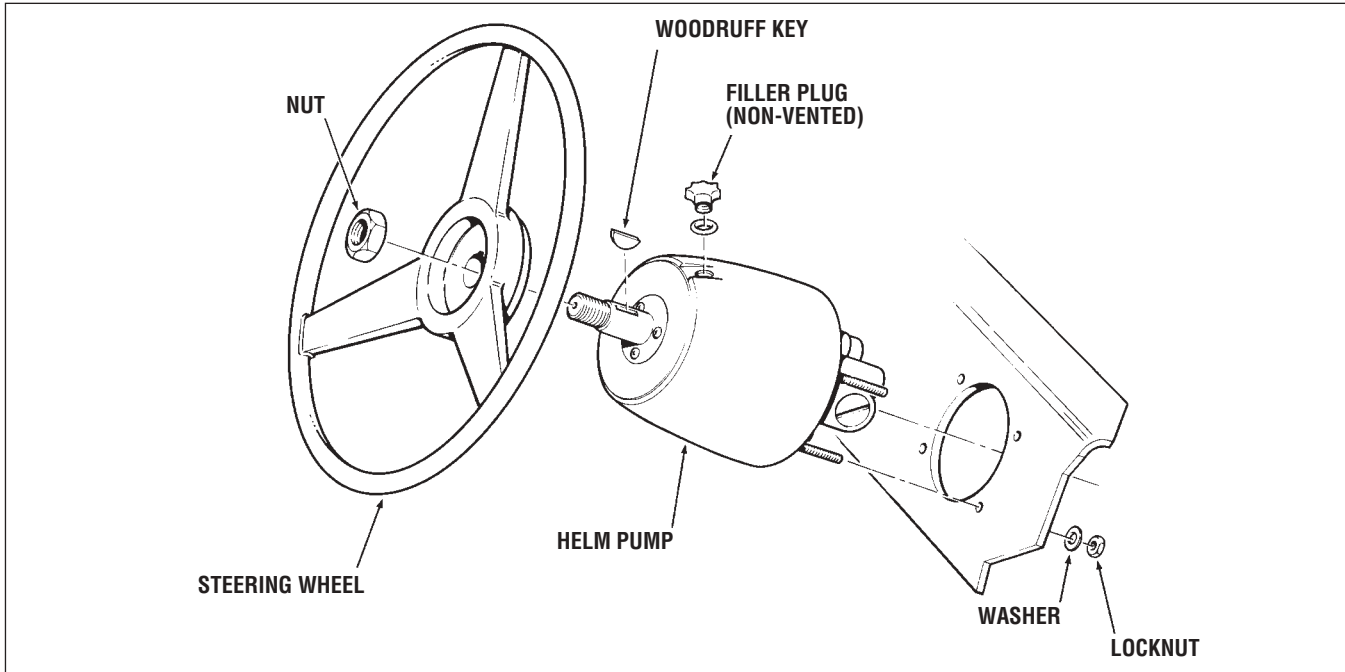
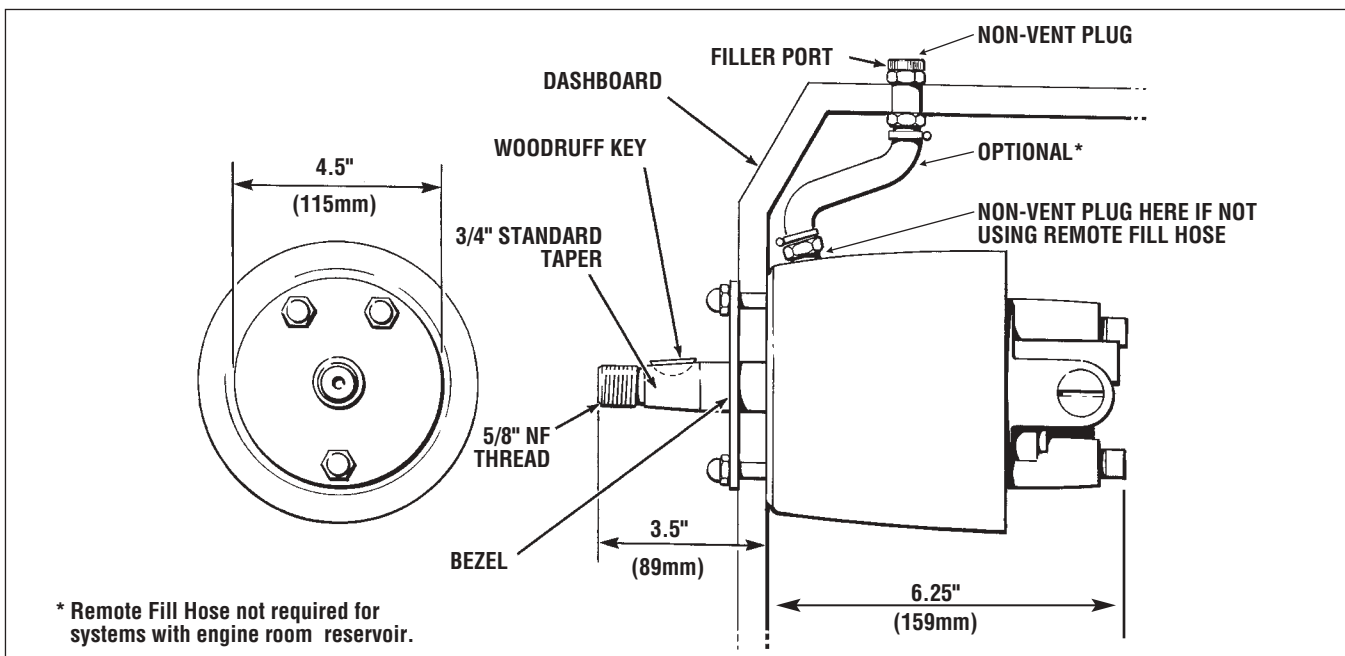


Figure 20

Rear Mount Helm Configuration (part # HH5261, HH5281 (1" shaft))



* Remote Fill Hose not required for systems with engine room reservoir.

Figure 21

Back Mount Kits

- Used to retrofit a new Seastar standard helm in the old 4.5" (115mm) diameter hole.
- or reduce the helm protrusion from the dash by the thickness of the dash.
- or retrofit new Seastar standard helm into hole cutouts for mechanical and hydraulic steering as per chart.

STEERING MANUFACTURER	HELM MODEL TYPE	SYSTEM	BACKPLATE KIT REQ
TELEFLEX	SAFE-T	MECHANICAL	YES
	BIG-T	MECHANICAL	YES
	ROTARY	MECHANICAL	YES
	RACK & PINION	MECHANICAL	NO
	SYTEN	HYDRAULIC	YES
MORSE	ROTARY	MECHANICAL	NO
	RACK & PINION	MECHANICAL	NO

Back Mount Kit Square Configuration (part # HA5418)

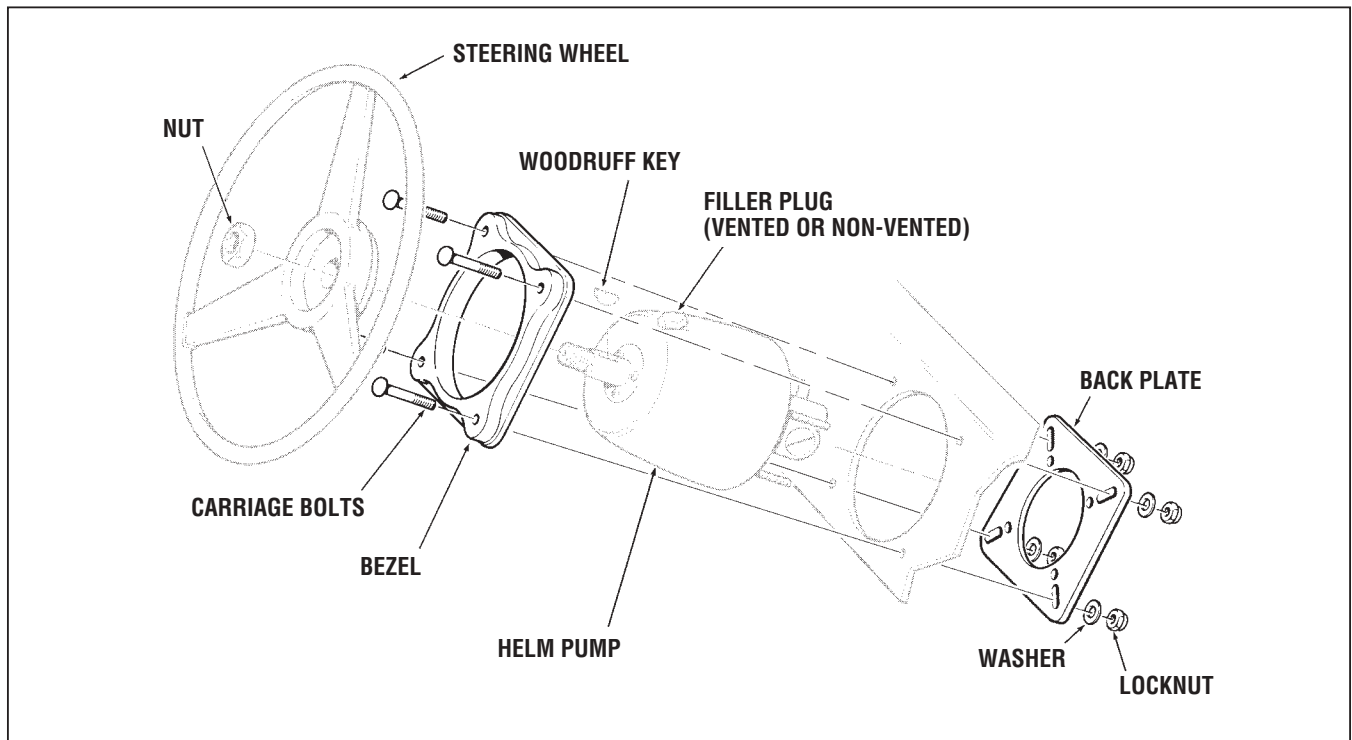


Figure 22

Back Mount Kit Round Configuration (part # HA5417)

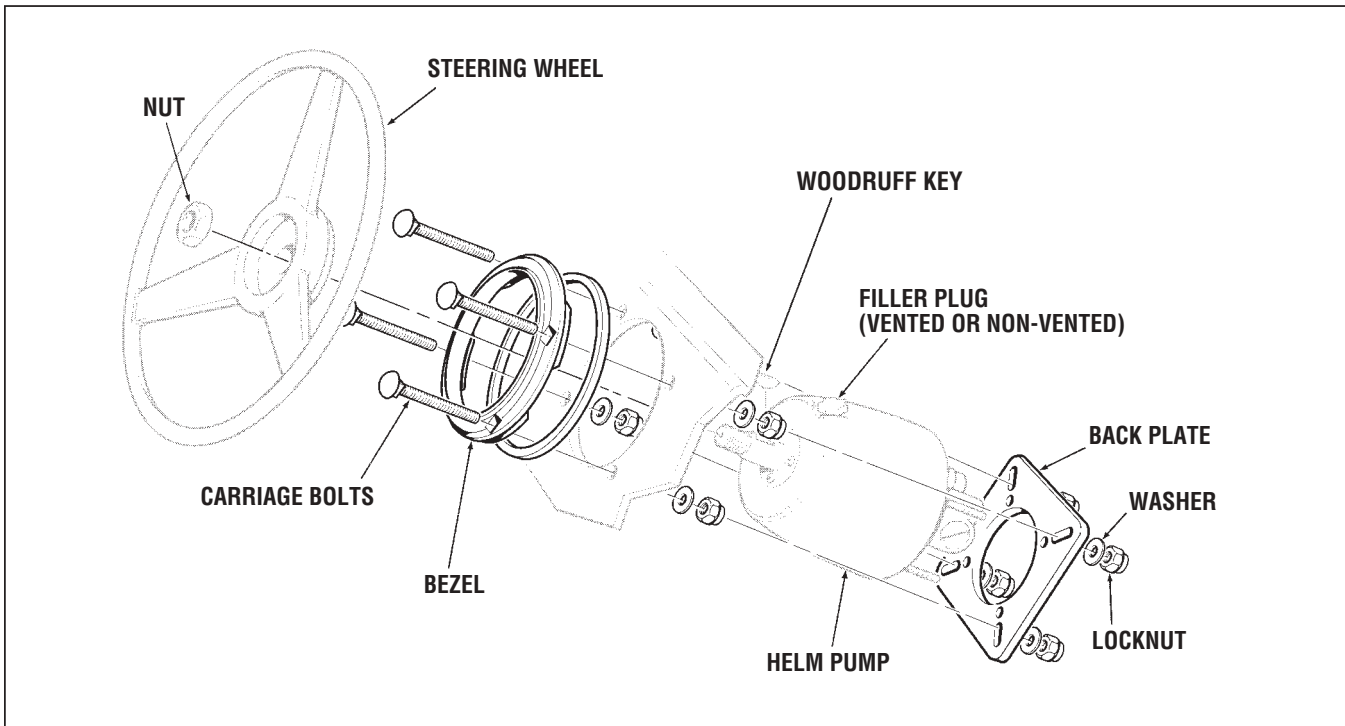


Figure 23

20° Wedge (part # HA5419 & HA5408 c/w Drain Kit)

This kit is designed to mount the helm at a 20° angle to the mounting surface. Four possible mounting configurations are available.

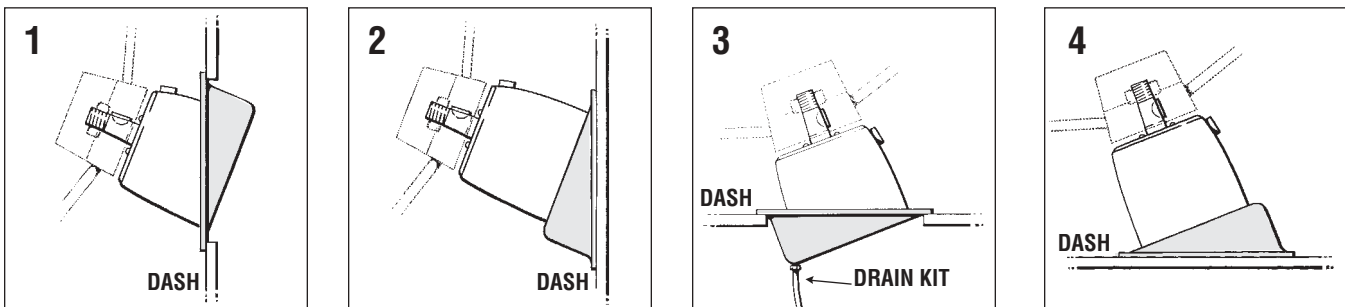


Figure 24

▲ For this configuration use HA5408

NOTE: Configuration mount No. 3 may result in water being trapped in wedge. Use wedge with drain pipe, part No. HA5408.

TUBE & HOSE INSTALLATION

General

WARNING

Do not allow nylon tubing to contact, or come too close to hot engine. Extreme heat will lower burst pressure or melt nylon tubing. In either case instant loss of steering may occur.

CAUTION

Route the tubing so that it will not interfere with hatchways or other types of functional equipment.

Do not allow tubing to kink or collapse while routing through vessel. Any piece of tubing that has collapsed, must be replaced or spliced with a union coupling fitting.

Tie down tubing at regular intervals, using non-metallic type ties.

Do not allow the tubing to rest or chafe against a sharp or abrasive surface.

Teleflex can not be responsible for any consequences resulting from the use of a substitute tube or hose. (See page 18 for hose and tube specifications.)

Autopilot

An autopilot designed for use with hydraulic steering may be tied into your Seastar steering system at any convenient point in the helm lines.

Installing shut-off valves in hydraulic lines running from autopilot pump set to steering system lines will simplify trouble shooting and servicing at a later time if necessary.

Autopilot selection must be compatible with oil used in your Seastar steering system.

Autopilot power pack shaft seal must be able to withstand 30 psi. Contact Teleflex for compatibility information.

Refer to page 21 for additional information.

System Connection

This section covers the tube nut and tube connections ($\frac{3}{8}$ " copper and $\frac{5}{16}$ " ID hose) to helm(s) and cylinder.

Refer to system diagram for general system connection and for identification of components.

Tube nuts supplied with components and fitting kits are suitable for use with $\frac{3}{8}$ " OD copper tube and Seastar $\frac{3}{8}$ " OD nylon tubing.

A quality Teflon base thread sealer should be used on all pipe threads, such as Loctite P.S.T. or equivalent. Failing to use a thread sealant could result in leaks.

Do not use pipe sealant on tube nut portion of fitting.

Screw elbow fittings into helm ports marked 'S' and 'P'.

Ensure that elbow fittings are finally oriented in desired position, for connection to tubing.

In a multi-steering station system a compensating line must run from helm port 'R' to helm port 'R'. The compensating line must always be connected from the bottom 'R' port on the highest helm, to the top 'R' port on the lowest helm.

WARNING

Never attach copper tubing or any rigid tube or pipe directly to cylinder(s). Cylinders articulate during the hard-over to hard-over movement and require a flexible hose to compensate for the articulation.

HYDRAULIC STEERING

TUBE INSTALLATION

SeaStar Systems (Manual Circuit)

Use $\frac{5}{16}$ " ID nylon tube or $\frac{5}{16}$ " ID SeaStar hose minimum. Any larger size can also be used.

NOTICE

SeaStar $\frac{3}{8}$ " OD nylon tube can be used for single station boats, with short tube runs. Pressure drop through this small tubing can make the steering feel slightly heavy in all but the shortest tube runs.

SeaStar Systems (Power Circuit)

Use $\frac{3}{8}$ " ID hose or $\frac{1}{2}$ " ID hose for the power circuit.
 $\frac{1}{2}$ " copper tube is also acceptable, if short flexible lines are used at the power cylinder.

Suction line from power pump to reservoir should be $\frac{3}{4}$ " ID. (length not exceeding 12 feet). If length is 6' or less $\frac{1}{2}$ " ID hose may be substituted.

All hoses for power circuit should meet SAE 100R1.

NOTICE

Suction line hose used should meet SAE 100R1 or be able to withstand 200 psi vacuum without collapsing.

SeaStar Systems (Cooling Circuit)

Use Heater Hose meeting SAE 30R7 specifications of the appropriate size for the water circuit.

Fittings

All necessary fittings for the manual circuit are supplied with a single steering station system. Fitting Kit, Part No. HF5502 is required for each additional steering station and or autopilot interface. Fittings for Cooler/Filter/Power Pump, customer supplied.

Standard

Seastar Fittings are Available as Follows:

280327Tube Nut, for $\frac{3}{8}$ " Nylon and Copper Tube, 1 ea. only
280929Union Coupling Ftg., Tube to Tube, 1 ea. only
287129Connector Ftg., Tube to $\frac{1}{4}$ " NPT Male, 1 ea. only
113124Elbow Ftg., Tube to $\frac{1}{4}$ " NPT Male, 1 ea. only
018023Tee Ftg., 3 x Tube, 1 ea. only
285020Tee Ftg., Ends Tube & $\frac{1}{4}$ " NPT Male, Center Tube, 1 ea. only
280524Connector Ftg., Tube to $\frac{3}{8}$ " NPT Male, 1 ea. only
284826Tee Ftg., Ends Tube, Center $\frac{1}{4}$ " NPT Female, 1 ea. only
280421Elbow Ftg., Tube to $\frac{3}{8}$ " NPT Male, 1 ea. only
286624Elbow Ftg., Tube to $\frac{1}{4}$ " NPT Female, 1 ea. only
718725Cap Plug Nut

45° Flare

826828Tee – 8 Flare Both Ends, $\frac{3}{8}$ " NPT Side
288529Elbow – 6 Flare, $\frac{1}{4}$ " NPT
828427Connector – 8 Flare, $\frac{1}{4}$ " NPT Male
288225Tee – 8 Flare

**Nylon or Copper Tube
(compression fitting)**

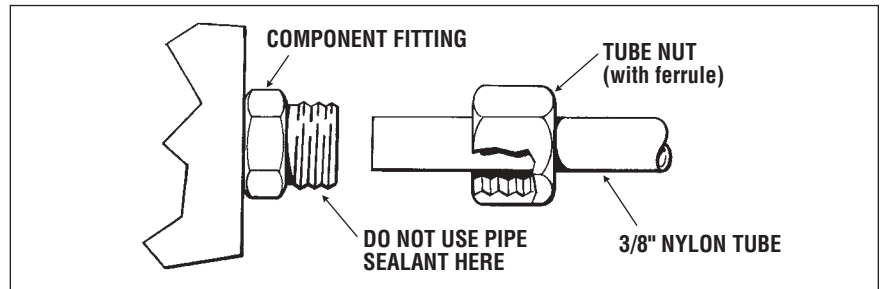


Figure 25

Slide tube nut over tubing.

Push tubing into bottom of component fittings.

Hand tighten tube nut, ensuring that tube is bottomed against fitting, while tightening tube nut.

After hand tightening tube nut, tighten nut an additional one and a half turns with a $\frac{5}{8}$ " wrench.

**Copper Tube
(flare fitting)**

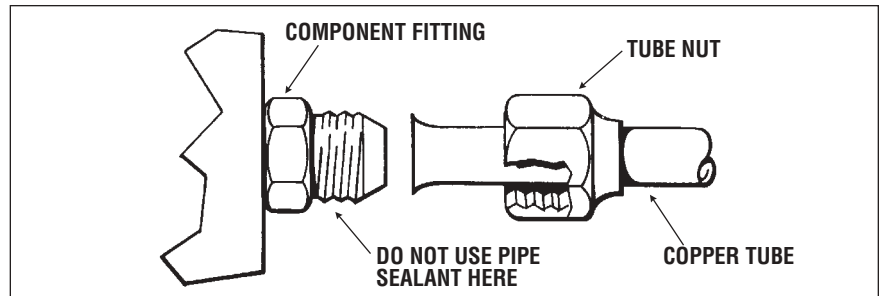


Figure 26

Slide tube nut over tubing.

Flare tubing with SAE 45° flaring tool then continue as above.

Hydraulic Fluid

Acceptable and recommended oils for your steering systems are:

SEASTAR 1.7, 2.0, 2.4 in³/rev.

- Seastar Hydraulic Fluid,
(part # HA5430 – 1 quart, HA5440 – 1 US gal.)
- Texaco HO15
- Shell Aero 4
- Esso Univis N15 or J13

- Chevron Aviation Fluid A
- Mobil Aero HFA
- Fluids meeting Mil H5606C specifications

CAUTION

Never use brake fluid. Any non-approved fluid may cause irreparable damage, loss of steering, and cancellation of warranty.

Automatic transmission fluid Dexron II may be used in an emergency.

In cases of extreme emergency any non-toxic, non-flammable fluid may provide temporary steering.

Seastar hydraulic oil is not available from your local gas station. Order a spare bottle from your Teleflex/Seastar dealer.

SEASTAR 1250V, 1275V

Dexron II Automatic Transmission Fluid or equivalent

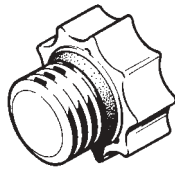
HYDRAULIC STEERING

TUBE INSTALLATION

Non-Vent Plug (part #HA5432)

⚠ CAUTION

If using a pressurized reservoir there must be a non-vent or pipe plug in ALL helm filler ports.



- This non-vent plug is supplied with additional station fitting kit no. HF5501 and HF5502.
- Actual size shown.
- Colour: black

Figure 27

Helm to Cylinder Connections

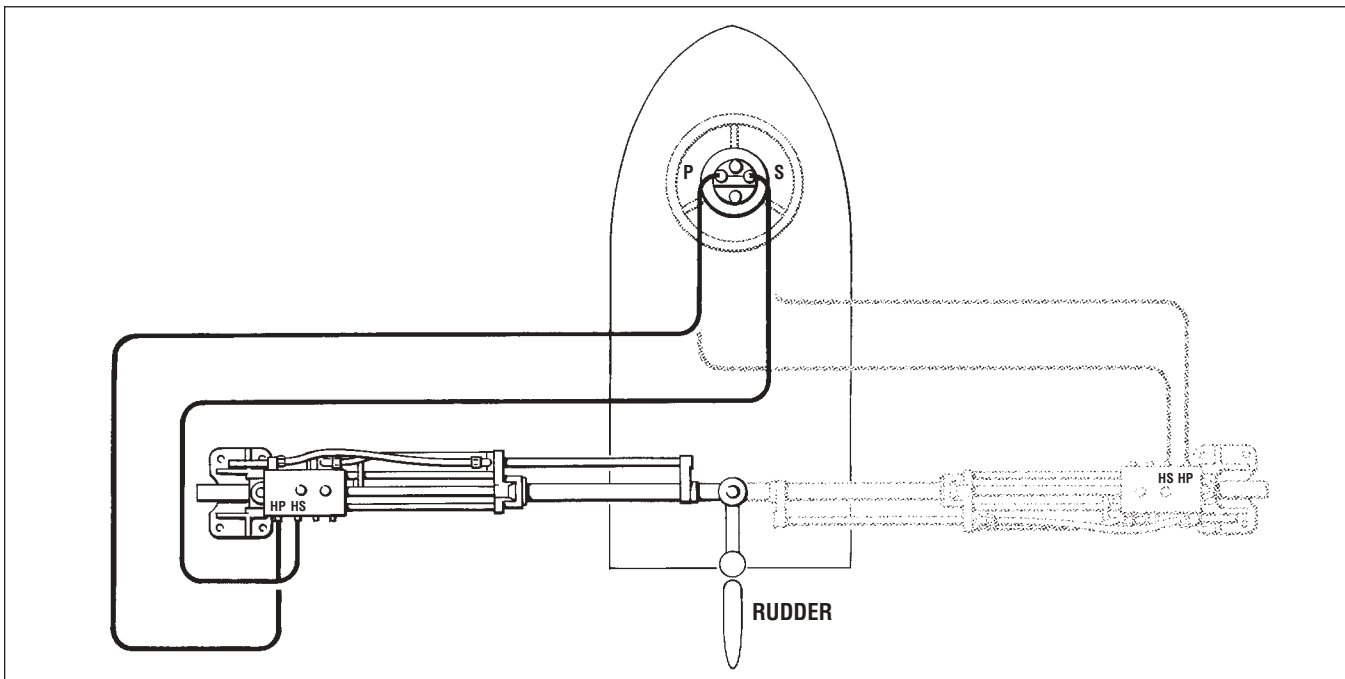


Figure 28

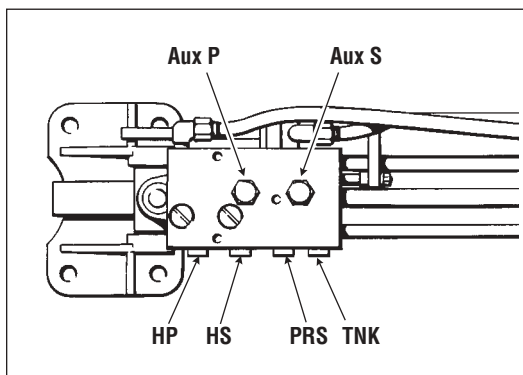


Figure 29 - Cylinder with Servo: Connection Ports

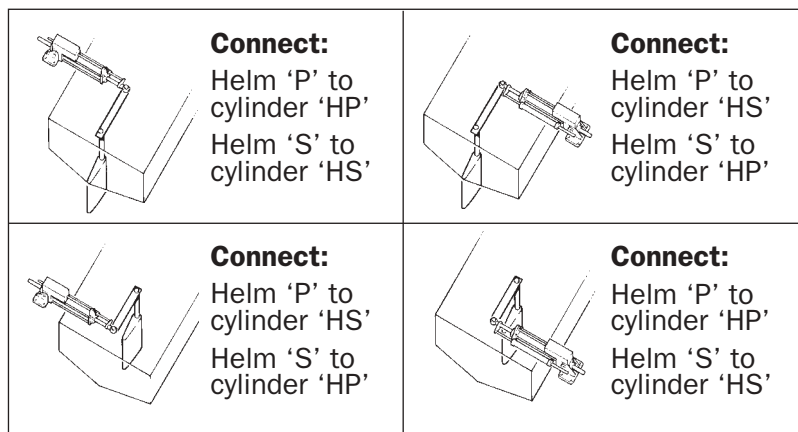


Figure 30

AUTOPILOT INSTALLATION

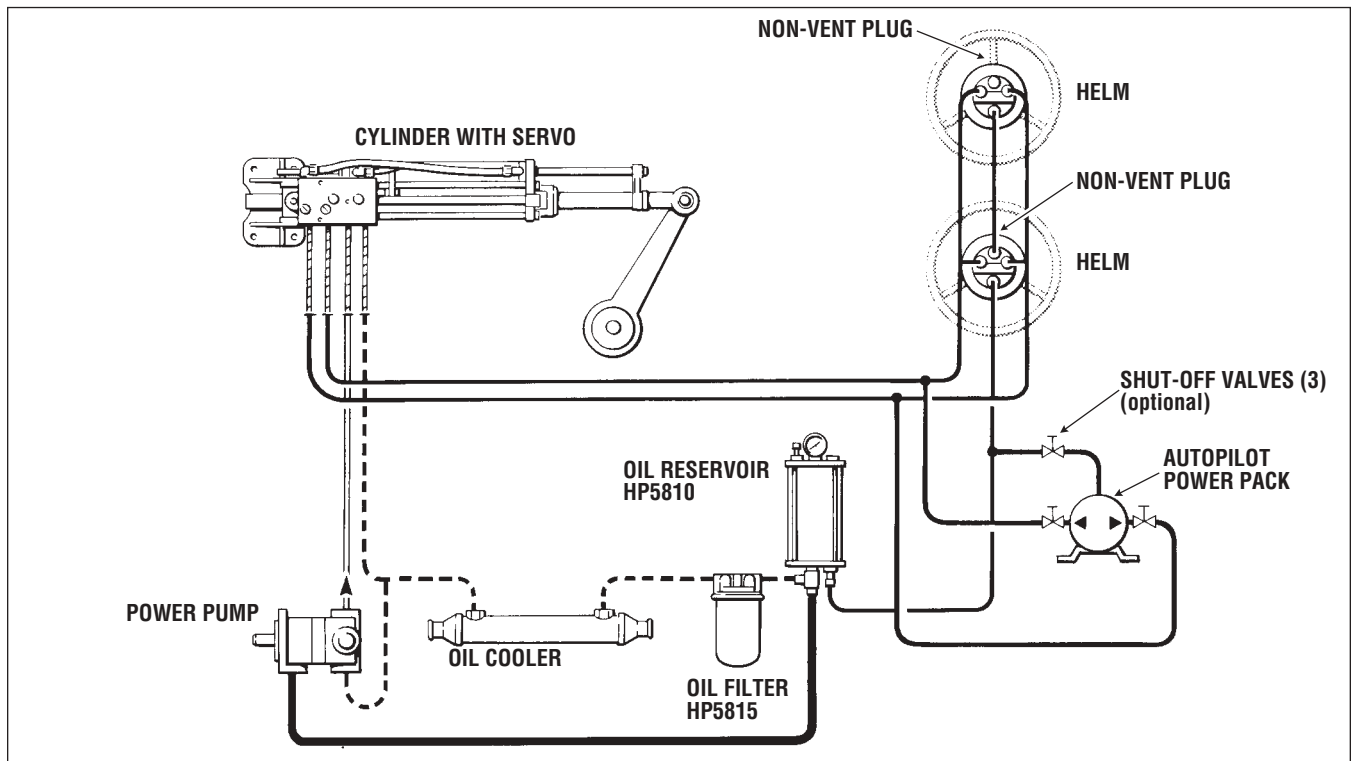


Figure 31 - System Layout Including Autopilot

An autopilot compensating line may be teed into an existing compensating line between two helms or directly into a bottom R port on the Seastar helm. Connector fittings for compensating line are supplied with fitting kit HF5502.

NOTICE

Fitting kit, part no. HF5502 is required for additional steering helm(s) or for an autopilot connection.

⚠ CAUTION

Fitting kit, part no. HF5502 also contains a solid non-vent plug, which must be used on all helms including the highest helm in a steering system with a pressurized engine reservoir.

When choosing a power pack, consult the autopilot manufacturers literature for an appropriate power pack to give the required hard-over time.

NOTICE

When sizing the power pack, you should size it for the volume of the servo cylinder.

MODEL	VOLUME OF SERVO CYLINDER
HC5801	6.07 cu. in. (99.5cc)
HC5803	7.42 cu. in. (121.5cc)

NOTICE

When setting up your autopilot note that there is approx. 1/8" valve shift in either direction. Consult autopilot manufacturer to ensure your adjustments are correct.

HYDRAULIC STEERING

AUTOPILOT INSTALLATION

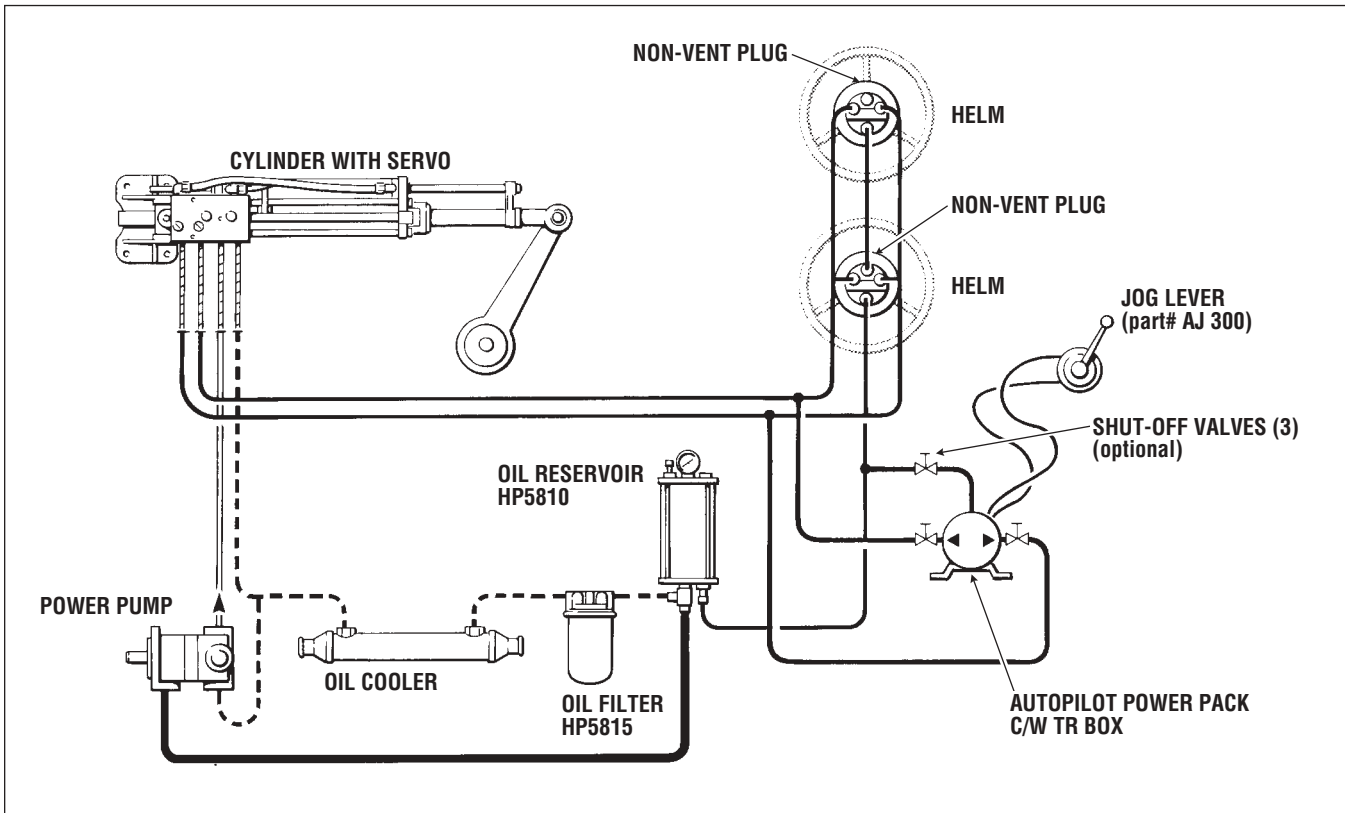


Figure 32 - System Layout Including Autopilot and Jog Lever

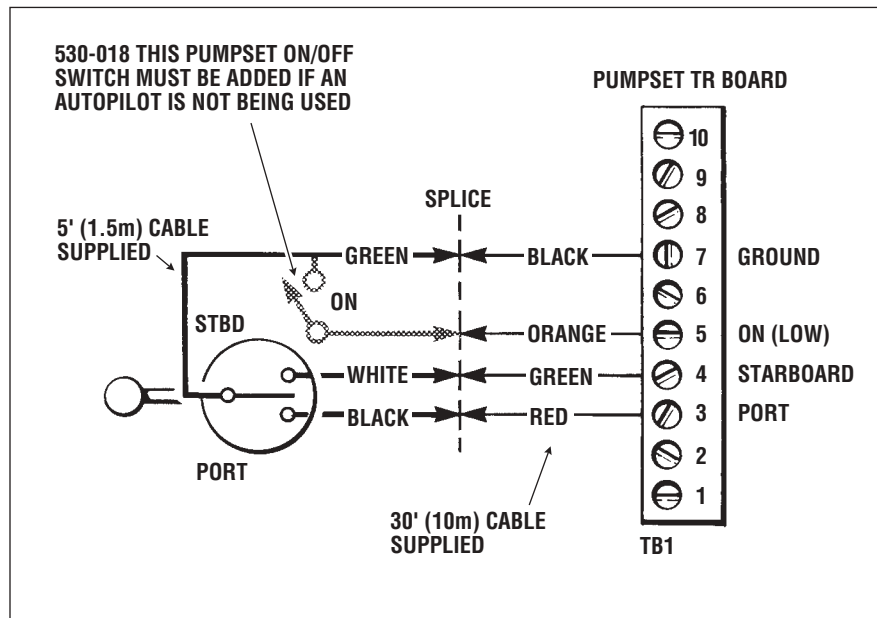


Figure 33 - System Layout Including Autopilot and Jog Lever

FILLING AND PURGING THE SYSTEM

Read First

These instructions show how to fill and purge a Single Station One Cylinder System. For twin station and/or twin cylinder filling and purging instructions read instructions on page 26.

NOTICE

This procedure requires two people. One person may not be able to remove all the air from the system which will result in spongy, unresponsive steering.

During the entire filling procedure, oil **must** be above minimum mark on reservoir. **Do not** allow the oil level to fall below the minimum mark, as this may introduce air into the system and increase your filling time.

Hydraulic Oil Requirements

2 bottles HA5440 (1 US gal. each) for single station and single cylinder systems.

1 additional bottle HA5430 (1 quart) for each additional helm, cylinder, or auto pilot.

NOTICE

These instructions will result in hydraulic oil flushed in and out of the system. Oil can be re-used if filtered through a fine mesh screen such as used for gasoline. If unable to filter oil, an additional bottle of oil is required.

NOTICE

“Bleeder” refers to cylinders fitted with bleed tee fittings. If fitted with bleed tee fitting, open bleeder by unscrewing bleed nipple nut two turns.

If cylinder is not fitted with bleed tee fittings, disconnect hydraulic line from the cylinder fitting. Loosening the hose or tube fitting only, may not cause sufficient oil flow to purge the system.

Single Station One Cylinder

Step 1

- Open the hex fill plug on the top of the reservoir.
- Fill the reservoir to the top and replace the plug.
- Using a bicycle pump or similar, pressurize reservoir to 30 psi.
- Refill and pressurize until the level does not drop below the **maximum level** marked on the front of the reservoir.

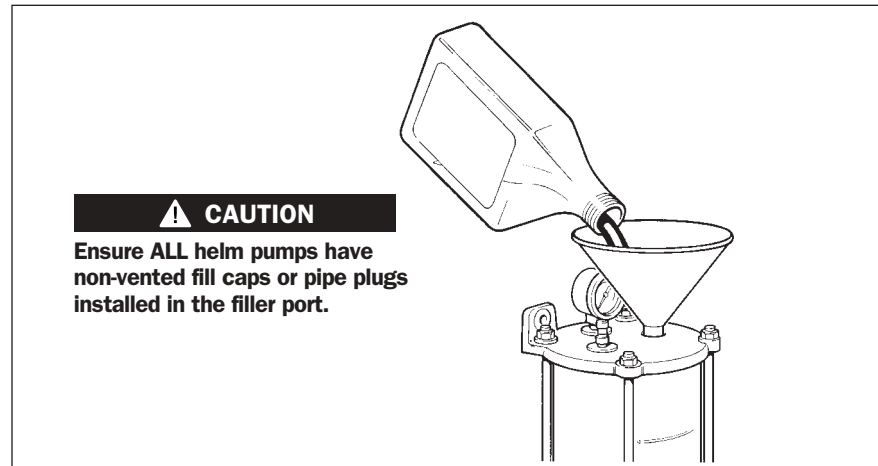


Figure 34

Step 2

- Turn the helm station steering wheel clockwise until the cylinder shaft is fully extended or retracted (depending on installation geometry, this will vary).
- Open the left side bleeder.

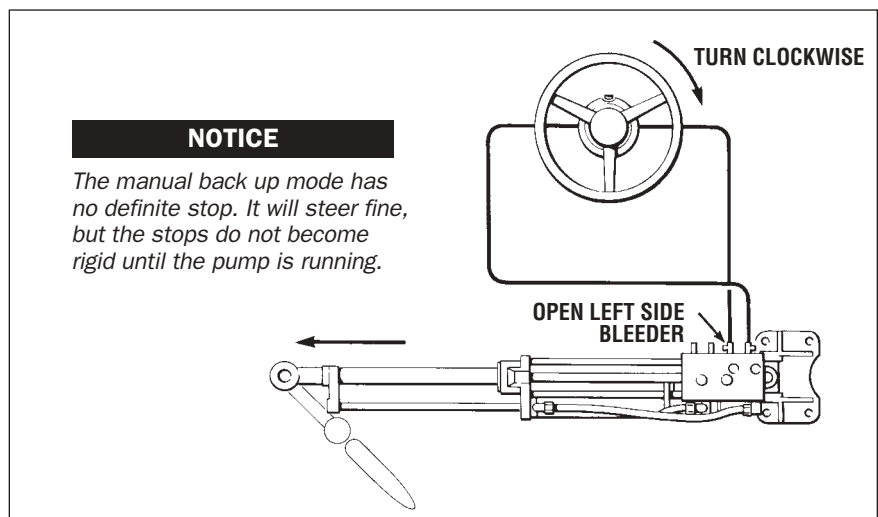


Figure 35

Step 3

- Making sure the cylinder shaft does not retract into the cylinder, turn the steering wheel counter-clockwise until a steady stream of air free oil comes out of the bleeder.
- While continuing to slowly turn the wheel, close the left side bleeder.

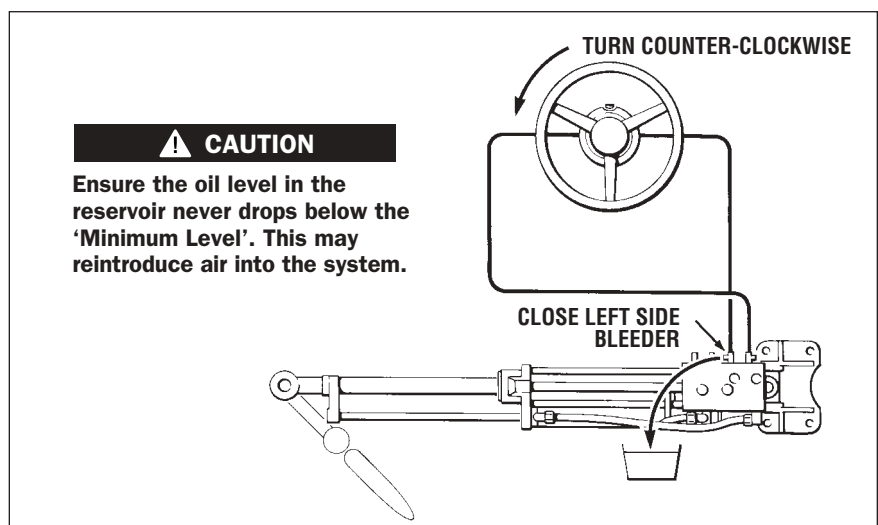


Figure 36

Step 4

- Continue to turn the steering wheel counter-clockwise until the cylinder shaft is fully extended or retracted (depending on installation geometry, this will vary).
- Open the right bleeder.

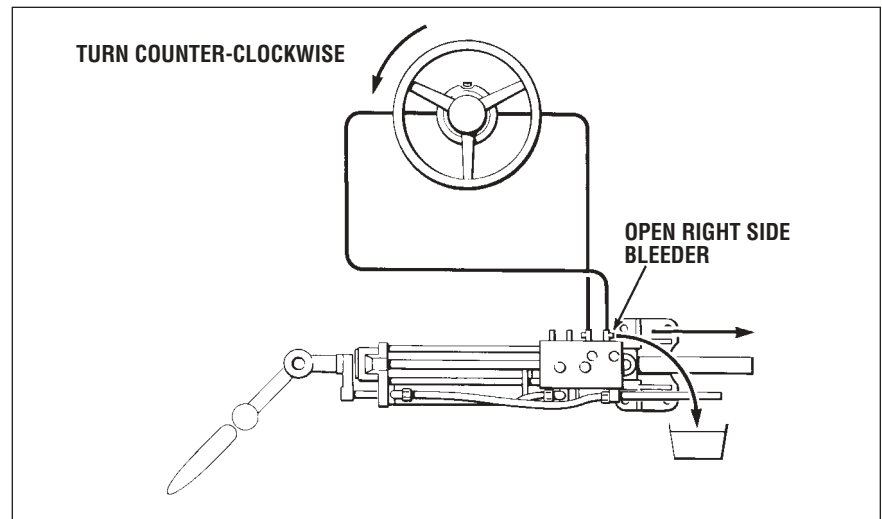


Figure 37

Step 5

- Making sure the cylinder shaft does not retract into the cylinder, turn the steering wheel clockwise until a steady stream of air free oil comes out of bleeder.
- While continuing to turn the wheel, close the right side bleeder and let go of the cylinder rod.
- Check the level in your reservoir and fill to maximum level and repressurize to 30 psi.

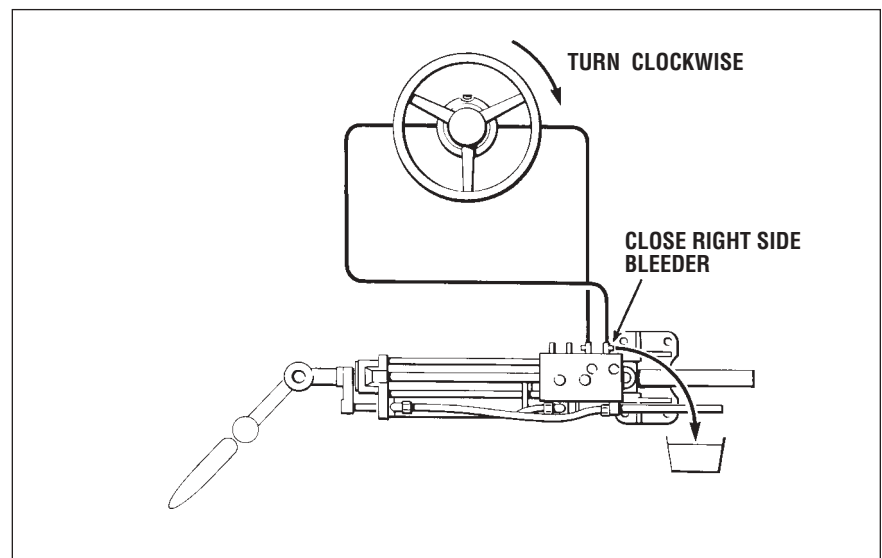


Figure 38

NOTICE

Most of the air is now purged and you are ready to purge the power circuit.

Twin Station Single Cylinder

- Repeat steps 1 through 5 on station one then 1 through 5 on station two.

NOTICE

If you have an add-on power cylinder, this will be purged in the power circuit (see page 27).

CAUTION

If using a pressurized reservoir there must be a non-vent or pipe plug in ALL helm filler ports.

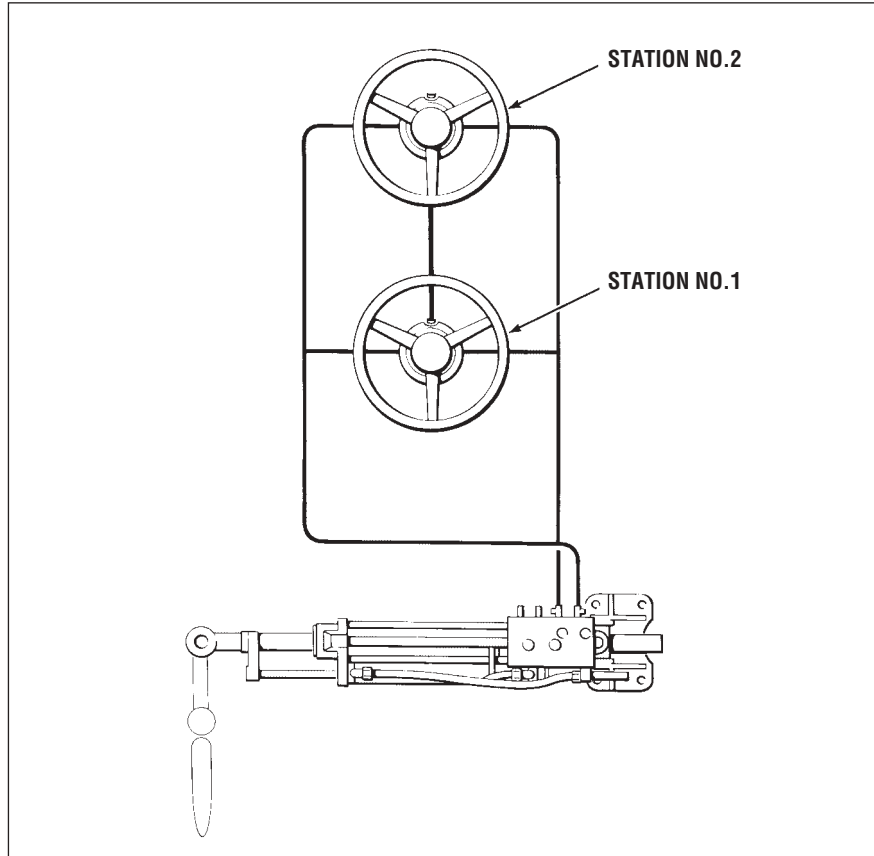


Figure 39

NOTICE

Most of the air is now purged and you are ready to purge the power circuit.

Purging the Power Circuit

- **Before starting engines or electric motor, ensure that all hoses and connections are tight and installed correctly.**
- Start engines and idle at 600 to 800 RPM.
- Start turning either helm one revolution to the left then back to center and then one revolution to the right.
- Continue to do this adding one revolution each time until you are steering from hard-over to hard-over.
- Bring your engine speed to 1200 RPM and count the number of turns. From hard-over to hard-over the standard number of turns should be 3 ½ to 3 ¾ turns. Consult table for your system.

SYSTEM	HC5801	HC5803
SSI SSII 1250V	3.6 turns 2.5 turns 3.6 to 1.75 turns	4.4 turns 3.1 turns 4.4 to 2.2 turns

- If your turns are not within ¼ of a turn of these, **stop engines.**
- Turn your wheel to the right and continue to turn for 10 to 15 revolutions. You will be able to turn through hard-over because the engine is not running.
- Turn your wheel to the left for 10 to 15 turns.
- Start your engines and your turns should be correct. If not, repeat.

NOTICE

If using a 1250V helm, it may be necessary to open the uppermost filler plug in the top helm to allow the trapped air to escape.

Oil Level & System Check

- Check to ensure the oil level in reservoir is at the maximum level. Re-pressurize to 30 psi if required.
- The maximum level allows sufficient room for thermal expansion.
- Check all fittings and components for leaks. Tighten loose fittings. If you find oil on a component, wipe it down thoroughly. If no more oil appears after a few minutes it is probably spilled oil.

MAINTENANCE

Inspection of the following items is required two times per year, by a qualified marine mechanic:

- Check the oil level in the reservoir and ensure the pressure is 25 to 35 psi.
- Change oil filter after first 50 hours and every 2 years or 300 hours thereafter.
- Check all linkages, bolts and hose connections. Tighten if loose.
- Check for leaks.
- Check hoses and tubing for chafing/rub marks. Replace if required.
- Check the servo cylinder and ensure it shifts $\frac{1}{8}$ " minimum each way when moving the steering wheel $\frac{1}{4}$ turn each way.
- Grease sliding joints.

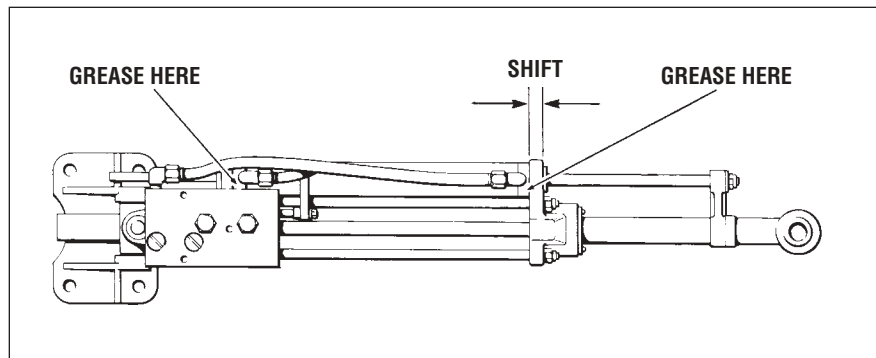


Figure 40

TROUBLE SHOOTING GUIDE

! WARNING

Whenever a solution calls for removal from vessel and/or dismantling of steering system components, such work must only be carried out by a qualified marine hydraulic mechanic. Teleflex offers the following as a guide only and is not responsible for any consequences resulting from incorrect dismantling repairs.

Seastar hydraulic steering will provide years of safe reliable performance with a minimum of service if properly installed with correct cylinder.

Seastar steering systems have been designed with protection against over-pressure situations, by a pressure relief valve, to minimize the possibility of total loss of steering.

Most faults occur when the installation instructions are not followed and usually show up immediately upon filling the system. Provided on the following pages, are the most common faults encountered and their likely cause and solution.

Sometimes when returning the wheel from a hard-over position, a slight resistance may be felt and a clicking noise may be heard. This should not be mistaken as a fault, as it is a completely normal situation caused by the releasing of the lockspool in the system.

FAULT

1. During filling, the helm becomes completely jammed.

CAUSE

- Blockage in the line between the helm(s) and the cylinder(s).

SOLUTION

- Make certain that tubing has not collapsed during installation. If so, the collapsed section must be removed and re-fitted with a new piece with the aid of tube connectors. Check fittings for incomplete holes. Fittings with incomplete holes, however, are not common.
- Ensure check valves or shut-off valves are installed correctly.

2. Steering is stiff and hard to turn, even when the vessel is not moving.

- Rudder post glands are too tight or rudder post is bent, causing mechanical binding. The same applies to tiller arm and linkage on outdrives.
- Restrictions in hose, copper tubing, piping or fittings.
- Air in system.
- Wrong oil has been used to fill steering system, like A.T.F. (automatic transmission fluid, or any other oil with a high viscosity factor).

- To test, disconnect cylinder(s) from the tiller arm and turn the steering wheel. If it turns easily, correct above-mentioned problems. Please note that excessively loose connections to tiller arm or tie-bar can also cause mechanical binding.
- Find restriction and correct. **Note:** Collapsing of copper tubing during bending is enough to cause restrictions.
- See filling instructions supplied with helm units.
- Drain system and fill with recommended oils.

3. Steering is hard to turn under way and at dock.

- Components are mechanically preventing servo valve from shifting or limiting shift.
- Helm tubing to cylinder assembly too small. This causes pressure drop making system feel heavy.
- Power pump not running.

- Move components to allow free movement of servo cylinder.
- Use $\frac{5}{16}$ " ID minimum tube size.
- Check for proper rotation of pump

HYDRAULIC STEERING

TROUBLE SHOOTING

FAULT	CAUSE	SOLUTION
4. Steering is easy to turn at the dock, but becomes hard to turn when vessel is under way.	<ul style="list-style-type: none">• Incorrectly designed or adjusted rudders, causing binding on rudder post and/or tie bar at cruising speeds.• Drive belt on power pump slipping under load.	<ul style="list-style-type: none">• Seek professional help. Have experienced, qualified marine mechanic correct problem.• Tighten belt or replace if necessary.
5. Rudder drifts to port or starboard while vessel is under way, even when wheel is not being turned.	<ul style="list-style-type: none">• Dirt in helm check valves.	<ul style="list-style-type: none">• Remove check valve plugs. These are the larger plugs on either side on rear of helm. Clean ball seats and balls and re-assemble. Note: Be prepared to lose a certain amount of oil during this procedure. Have a small can available. Refill system when check balls have been re-assembled.
6. Turning one wheel causes second steering wheel to rotate.	<ul style="list-style-type: none">• See fault No. 5.	<ul style="list-style-type: none">• See fault No. 5.
7. Worn seals.	<ul style="list-style-type: none">• If the shaft seals are leaking, have them replaced by a qualified marine mechanic.	<ul style="list-style-type: none">• Note: Shaft seals can be replaced by removing rod end and mounting foot. The cylinder does not have to be completely disassembled.• See pages 33 to 37 for seal kit part numbers.
8. Power pump is noisy.	<ul style="list-style-type: none">• Starving the inlet.• Rotation of pump incorrect	<ul style="list-style-type: none">• Minimize suction hose length and maximize suction hose ID.• Ensure pump is supposed to rotate in the same direction as the engine.
9. Loss of pressure fluid in reservoir.	<ul style="list-style-type: none">• Leak in system.	<ul style="list-style-type: none">• Check all connections and seals, repair as necessary.
10. No definite stops at hard-over (with engine running).	<ul style="list-style-type: none">• Air in system <u>or</u>• belt drive power pump not pumping.	<ul style="list-style-type: none">• Ensure compensating line to the helm is connected to the lowest port in the back of the helm.• Ensure that belt in pump is not slipping. Tighten or replace if necessary.

TECHNICAL INFORMATION

Bolt Torque Specifications

Values are stated in: **in/lbs (N.m)**

Bolt Size	18-8SS	Brass
2-56	2.5 (.282)	2.0 (.226)
2-64	3.0 (.338)	2.5 (.282)
3-48	3.9 (.440)	3.2 (.361)
3-56	4.4 (.497)	3.6 (.407)
4-40	5.2 (.587)	4.3 (.486)
4-48	6.6 (.740)	5.4 (.610)
5-40	7.7 (.869)	6.3 (.712)
5-44	9.4 (1.06)	7.7 (.869)

These are the recommended maximum torque values for reusable dry bolts. Bolts should be torqued to this value +0% -20%. For lubricated bolts, multiply the dry bolt torque values by .75.

Bolt Size	18-8SS	Brass
6-32	9.6 (1.08)	4.9 (.554)
6-40	12.0 (1.35)	9.9 (1.12)
8-32	20.0 (2.25)	16.0 (1.81)
8-36	22.0 (2.48)	18.0 (2.03)
10-24	23.0 (2.59)	19.0 (2.14)
10-32	32.0 (3.61)	26.0 (2.94)
1/4"-20	75.0 (8.47)	62.0 (7.01)
1/4"-28	94.0 (10.6)	77.0 (8.70)

Bolt Size	18-8SS	Brass
5/16"-18	132.0 (14.91)	107.0 (12.10)
5/16"-24	142.0 (16.04)	116.0 (13.11)
3/8"-16	236.0 (26.66)	192.0 (21.71)
3/8"-24	259.0 (29.20)	212.0 (23.97)

Values are stated in: **ft/lbs (N.m)**

Bolt Size	18-8SS	Brass
7/16"-14	31.0 (42.00)	26.0 (35.25)
7/16"-20	33.0 (44.74)	27.0 (36.61)
1/2"-13	43.0 (58.30)	35.0 (47.45)
1/2"-20	45.0 (61.01)	37.0 (50.17)
9/16"-12	57.0 (77.28)	47.0 (63.72)
9/16"-18	63.0 (85.42)	51.0 (69.15)

Bolt Size	18-8SS	Brass
5/8"-11	93.0 (126.09)	76.0 (103.04)
5/8"-18	104.0 (141.00)	85.0 (115.24)
3/4"-10	128.0 (173.55)	104.0 (141.00)
3/4"-16	124.0 (168.12)	102.0 (138.29)
7/8"-9	194.0 (236.03)	159.0 (215.58)
7/8"-14	193.0 (261.67)	158.0 (214.22)

Bolt Size	18-8SS	Brass
1"-8	287.0 (389.12)	235.0 (318.62)
1"-14	259.0 (351.16)	212.0 (287.43)

NOTICE Torque values for 18-8 stainless steel and brass bolts are taken from a torque guide by ITT Harper. All results correspond well with basic bolt equations, using a bolt factor of 0.2 and a factor of 3/4 for a reusable connection.

Helm Pump

	SEASTAR I	SEASTAR II
DISPLACEMENT	1.7 cu.in. (27.8 cc)	2.4 cu.in. (39.3 cc)
RELIEF VALVE	1000 PSI (70 Bar)	1000 PSI (70 Bar)
PORTS	1/4" NPT	1/4" NPT

Helm Pump Shaft

SEASTAR I	SEASTAR II
3/4" Standard Taper	3/4" Standard Taper
1" Per ft. 5/8" NF Threads	1" Per ft. 5/8" NF Threads
3/16" Key	3/16" Key

Cylinder

	PART#	DISPLACEMENT	STROKE	OUTPUT FORCE	MAX. TORQUE (35° from centre)
Single 9" Cylinder c/w Servo	HC5801	21.25 cu.in (348cc)	9" (229mm)	2946 lbs _f (13,090 N)	18,900 in-lbs (2130 Nm)
Single 11" Cylinder c/w Servo	HC5803	26.00 cu.in (426cc)	11"(280mm)	2946 lbs _f (13,090 N)	23,140 in-lbs (2610 Nm)
Twin 9" Cylinder	HC5802	42.50 cu.in (697cc)	9" (229mm)	5892 lbs _f (26,190 N)	37,800 in-lbs (4260 Nm)
Twin 11" Cylinder	HC5804	52.00 cu.in (853cc)	11" (280mm)	5892 lbs _f (26,190 N)	46,280 in-lbs (5220 Nm)

Fittings

SeaStar cylinder and all other fittings are 3/8" compression type fittings. Threads are 9/16" x 24 extra fine. A brochure on all SeaStar fittings is available from Teleflex Canada.

SeaStar I, II Hose

- SeaStar I, II hose inside diameter – 5/16" (8mm)
- Other recommended hose is Aeroquip 2651 or equivalent. Inside diameter should not be smaller than 5/16"

PARTS LIST

HC5801 (9" stroke) & HC5803 (11" stroke) CYLINDER WITH SERVO

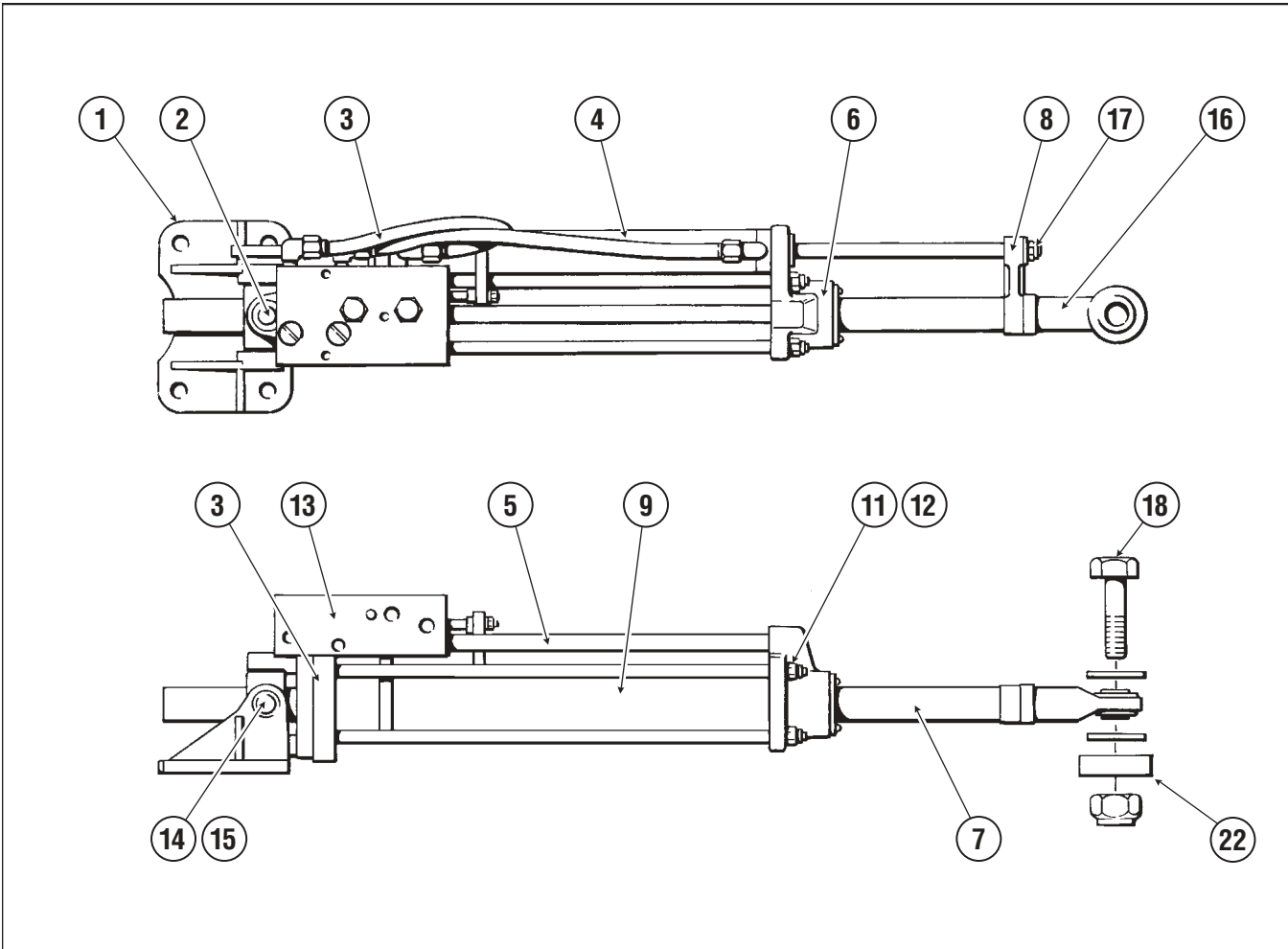


Figure 41

ITEM	PART#	QTY	DESCRIPTION
HC5801 9" STROKE CYLINDER			
1	820228	1	Mounting Foot
2	820425	1	Clevis Bracket
*3	823122	2	Hose Assembly
*4	821324	1	Assembly Servo Cylinder
*5	823226	1	Tube Valve/Ram
6	820622	1	Gland – Rod End
*7	947801	1	Shaft – Drive Cylinder
8	820820	1	Rod Bracket
*9	822026	1	Barrel – Drive Cylinder
*10	821926	4	Tie Rod
11	025421	4	Nut 3/8" NC SS
12	025525	4	Lock Washer 3/8" SS
13	822929	1	Valve Assembly
14	822721	4	Journal Stub
15	822825	4	Screw 1/2" x 1" SS

ITEM	PART#	QTY	DESCRIPTION
16	082020	1	Rod End 3/4" NF SS
17	113021	1	Nut 5/16" NC Nylok
18	HA5819	1	Tiller Bolt Kit SS
19	HS5196	1	Valve Seal Kit
20	HS5197	1	Servo Cylinder Seal Kit
21	HS5198	1	Drive Cylinder Seal Kit
22	-	-	Tiller Arm
* FOR HC5803 11" STROKE CYLINDER SUBSTITUTE			
*3	948224	2	Hose Assembly
*4	948328	1	Assembly Servo Cylinder
*5	947720	1	Tube Valve/Ram
*7	947803	1	Shaft – Drive Cylinder
*9	947823	1	Barrel – Drive Cylinder
*10	947927	4	Tie Rod

HC5802 (9" stroke) & HC5804 (11" stroke) CYLINDER WITHOUT SERVO

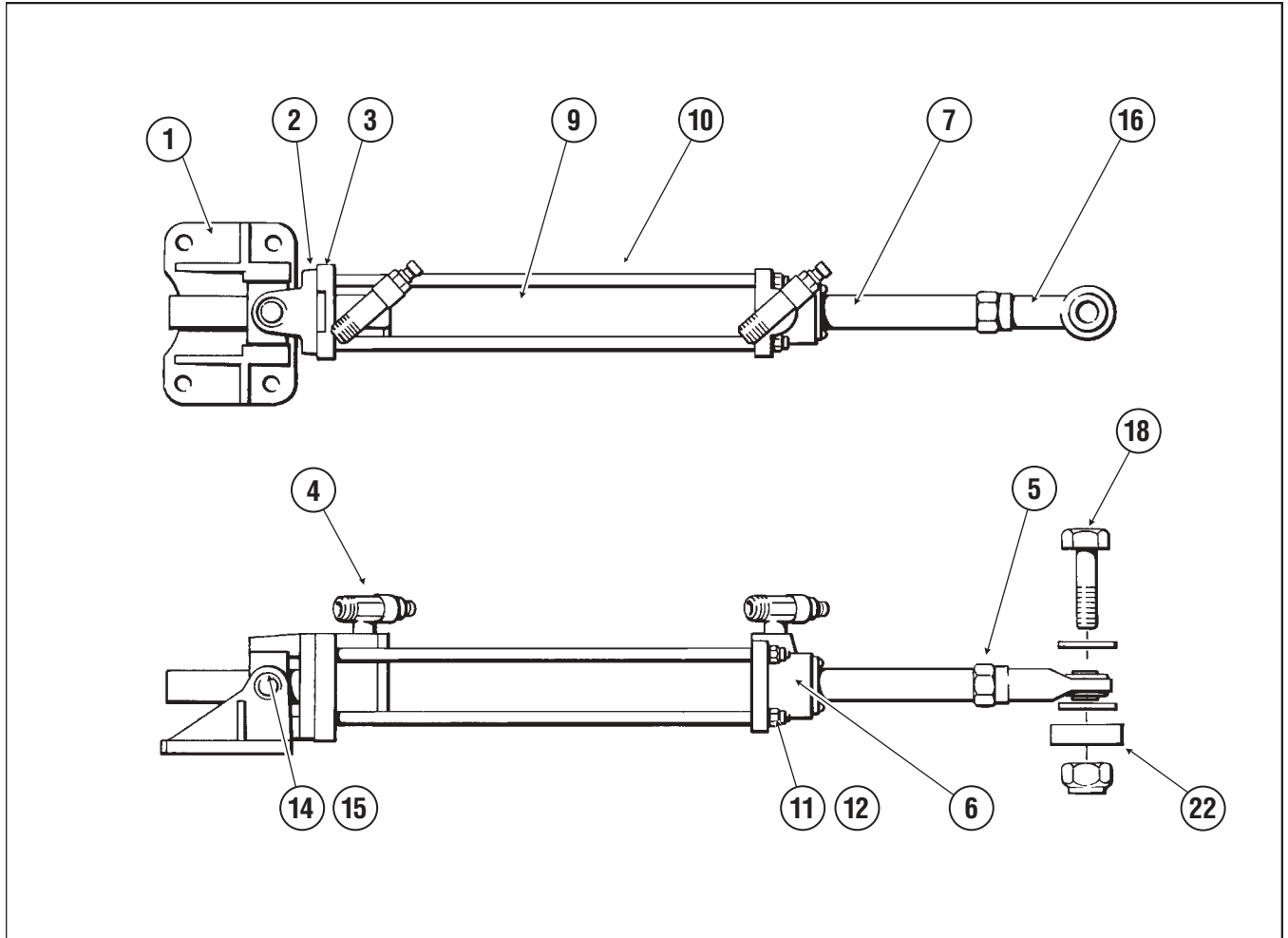


Figure 42

ITEM	PART#	QTY	DESCRIPTION
HC5802 9" STROKE CYLINDER			
1	820228	1	Mounting Foot
2	820425	1	Clevis Bracket
3	826920	1	Gland Rear
4	462922	2	Bleed Tee
5	025238	1	Jam Nut $\frac{3}{4}$ "
6	827020	1	Gland – Rod End
*7	821822	1	Shaft – Drive Cylinder
8	820820	1	Rod Bracket
*9	822026	1	Barrel – Drive Cylinder
*10	821926	4	Tie Rod
11	025421	4	Nut $\frac{3}{8}$ " NC SS
12	025525	4	Lock Washer $\frac{3}{8}$ " SS
13	822929	1	Valve Assembly
14	822721	4	Journal Stub
15	822825	4	Screw $\frac{1}{2}$ " x 1" SS

ITEM	PART#	QTY	DESCRIPTION
16	082020	1	Rod End $\frac{3}{4}$ " NF SS
17	113021	1	Nut $\frac{5}{16}$ " NC Nylok
18	HA5819	1	Tiller Bolt Kit SS
19	HS5196	1	Valve Seal Kit
20	HS5198	1	Drive Cylinder Seal Kit
22	–	–	Tiller Arm
* FOR HC5804 11" STROKE CYLINDER SUBSTITUTE			
*7	947626	1	Shaft – Drive Cylinder
*9	947823	1	Barrel – Drive Cylinder
*10	947927	4	Tie Rod

PARTS LIST

HP5810 OIL RESERVOIR

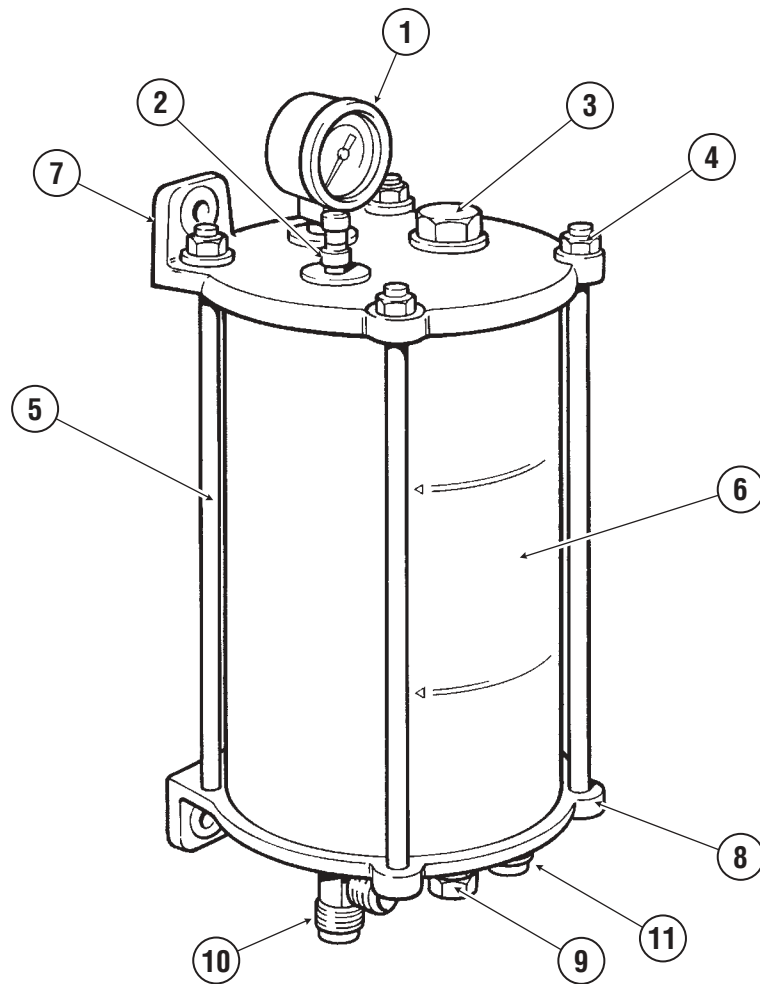


Figure 43

ITEM	PART#	QTY	DESCRIPTION
1	825128	1	Gauge 0-60
2	168625	1	Air Valve
3	330315	1	Fill Plug
4	113021	4	Nut $\frac{5}{16}$ " NC Nylok
5	826624	4	Tie Rods SS
6	404429	1	Tank Housing
7	826328	1	Top Cap
8	826421	1	Bottom Cap
9	430122	1	Fitting $\frac{3}{8}$ " Tube
10	289820	1	Tee - 8, 45° Flare
11	600602	1	Fitting $\frac{3}{8}$ " Straight Compression

ITEM	PART#	QTY	DESCRIPTION
SEAL KIT #HS5199			
Seals only.			

HP5815 OIL FILTER, HP5825 (1") OIL COOLER & HP5826 (2") OIL COOLER

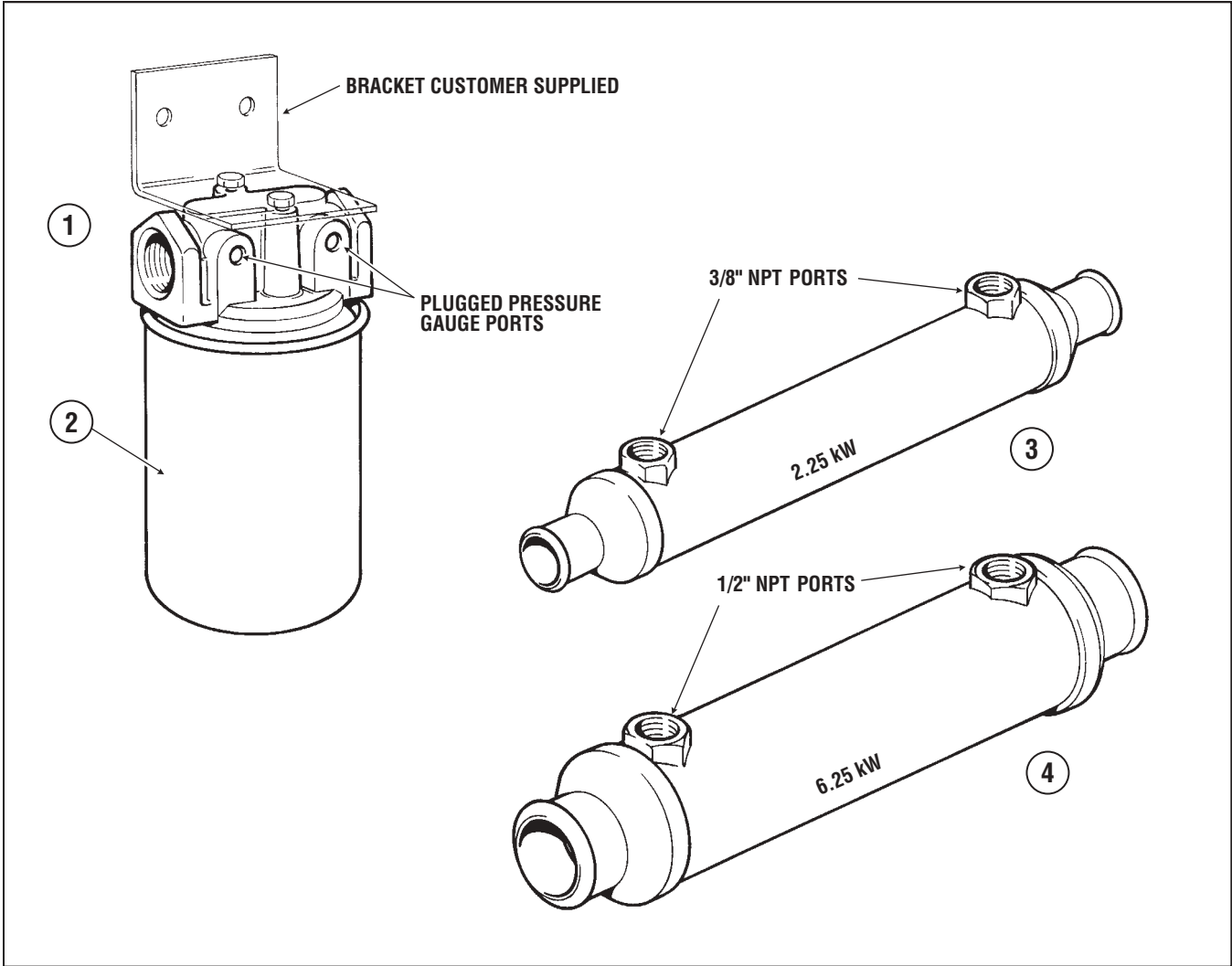


Figure 44

ITEM	PART#	QTY	DESCRIPTION
1	HP5815	1	Oil Filter Assembly
2	821723	1	Filter Element
3	HP5825	1	1" Outlet Oil Cooler
4	HP5826	1	2" Outlet Oil Cooler

ITEM	PART#	QTY	DESCRIPTION

PARTS LIST

HP5830, HP5831, HP5832, HP5835, HP5836, HP5837 & HP5838 POWER STEERING PUMPS

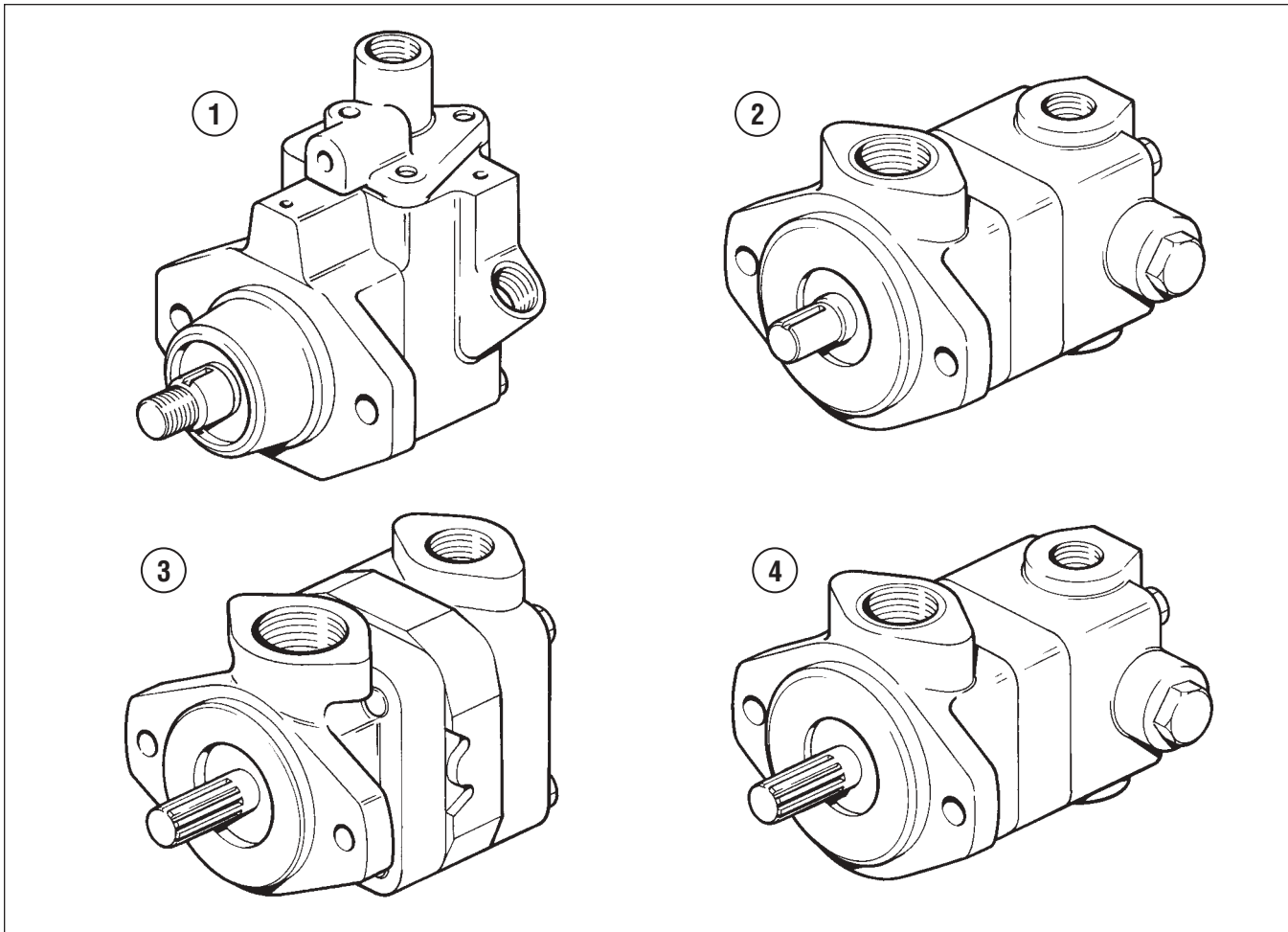


Figure 45

ITEM	PART#	QTY	DESCRIPTION
1	HP5830	1	R.H. Rotation Pump
1	HP5831	1	L.H. Rotation Pump
2	HP5832	1	R.H. Keyed Shaft pump
2	HP5833	1	R.H. Splined Shaft Pump
3	HP5835	1	Heavy Duty Pump
4	HP5838	1	R.H. Rotation 11Tooth Splined Shaft Pump
	HP5837	1	R.H. Rotation 9 Tooth Splined Shaft Pump
	HP5836	1	R.H. Rotation Threaded Keyed Shaft Pump

ITEM	PART#	QTY	DESCRIPTION

Statement of Limited Warranty

We warrant to the original retail purchaser that **Teleflex Canada Limited Partnership** products have been manufactured free from defects in materials and workmanship. This warranty is effective for two years from date of purchase, excepting that where **Teleflex Canada Limited Partnership** products are used commercially or in any rental or income producing activity, then this warranty is limited to one year from the date of purchase.

We will provide replacement product without charge, for any **Teleflex Canada Limited Partnership** product not meeting this warranty, which is returned (freight prepaid) within the warranty period to the dealer from whom such product were purchased, or to us at the appropriate address. In such a case **Teleflex Canada Limited Partnership** products found to be defective and covered by this warranty, will be replaced at **Teleflex's** option, and returned to the customer.

The above quoted statement is an extract from the complete **Teleflex Canada Limited Partnership** products warranty statement. A complete warranty policy is available in our **Teleflex Canada Limited Partnership** products catalogue.

Return Goods Procedure

Prior to returning product to **Teleflex Canada Limited Partnership** under warranty, please obtain a *Return Goods Authorization number* (claim number).

Be sure to label the goods with:

- a) the name and address of the sender, and
- b) the return goods authorization number (claim number)

Please address the returned goods as follows:

From U.S.A.

RGA # ?
Teleflex Canada
c/o Panalpina
#8 – 14th Street
Blaine, WA 98230

From Canada

RGA # ?
Teleflex Canada
3831 No.6 Road
Richmond, B.C.
Canada V6V 1P6

