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**SEASTAR**<sup>™</sup>

# OPERATING INSTRUCTIONS

## AND OWNER'S MANUAL



**SEASTAR**<sup>™</sup>  
**PAA**


Hydraulic Power Assist Autopilot  
(SeaStar PAA)

for SeaStar Steering Systems






*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 <b>WILL</b> result in severe personal injury or death.	Hazards or unsafe practices which <b>COULD</b> result in severe personal injury or death.	Hazards or unsafe practices which <b>COULD</b> 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. Use of these products may lead to component damage resulting in loss of steering control, which may lead to unpredictable boat behavior and/or ejection from boat causing property damage, personal injury and/or death.**

## NOTICE

*Help protect your boating environment by ensuring that all used fluid is disposed of properly.*

## ***Don't compromise performance... use genuine SeaStar parts only!***

- SeaStar Helms
- SeaStar Hoses
- SeaStar Cylinders
- SeaStar Marine Steering Fluid

Substituting non SeaStar parts in any part of the SeaStar hydraulic steering system, may seriously compromise system performance.

***Please ensure this manual is left on board the boat for future reference.***

# INTRODUCTION

Before proceeding with the installation, read these instructions thoroughly. SeaStar Solutions cannot accept responsibility for installations where instructions have not been followed, where substitute parts have been used, or modifications have been made to our products. Warranty may be void if products other than SeaStar Solutions products are used with this system.

## WARNING

**DO NOT use a wire coil type trim switch with a hydraulic steering system. Wire coil can wind up tight around the steering wheel shaft & prevent further steering!**

## NOTICE

*Due to a small amount of internal hydraulic slip, a 'master spoke' or 'centered' steering wheel cannot be maintained with a Hydraulic Steering System. For best results, use an equal distance spoke steering wheel.*

## NOTICE

*This installation manual covers the entire SeaStar PAA Series. Notes are made, when required, to cover any differences between the part numbers.*

**PRO Trim** offers fingertip trim or jackplate control with a column-mounted switch, enabling you to keep both hands on the steering wheel and concentrate on your driving. PRO Trim PT1000-1B controls trim or jackplate only. PRO Trim Dual PT2000-1B controls both functions.

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The following Power Assist units are covered in this Installation Manual: PA6010, PA6020, PA7010, PA7020.

# BEFORE OPERATING YOUR BOAT

## WARNING

**The SeaStar Power Assist Autopilot (PAA) unit has been designed and tested for use with Marine Hydraulic Steering ONLY. It is not recommended for any other use. Not complying with this warning may result in property damage and/or personal injury or death.**

Ensure that the following check list is carried out

- 1 With the SeaStar Power Assist Autopilot (PAA) unit “OFF” (ignition off) perform a system pressure test by turning the helm all the way to hard over and then forcing the helm another one quarter to one half turn past the stop point.

Inspect the following areas:

- Inspect helm fittings
- Inspect Power Assist/Autopilot interface and PAA fittings
- Inspect cylinder and cylinder bleed fittings
- Inspect hoses

Look for evidence of a leak. This test is to be done in BOTH directions. Any leak that is noticed will need to be repaired before operating the boat.

- 2 **Confirm that extruded nylon tubing has NOT been substituted for SeaStar Hydraulic Steering hose.**
- 3 Confirm that there is no interference between the steering cylinder and the transom, splashwell or jackplate or any combination of these parts by performing these simple steps:
  - If installed on an outboard engine, turn steering wheel in both directions while watching for interference with any other object and/or functional equipment, jackplates and transom areas. This test must be completed with the engine in ALL trim/tilt positions and throughout the steering articulation. If interference is present it MUST be rectified prior to operation.
  - Confirm that the hydraulic hoses are not subjected to chafing or rubbing.

## WARNING

**Failure to comply with the above may lead to loss of fluid, separation components or damage to parts, which may result in loss of steering control leading to unpredictable boat behavior and/or ejection from boat causing property damage, personal injury and/or death.**

## Things You Need To Know!

**⚠ WARNING**

SeaStar Steering hoses **CANNOT** be cut. Cutting hoses will render them useless. Failing to comply may lead to loss of steering control which may result in unpredictable boat behavior and/or ejection from boat causing property damage personal injury and/or death.

**⚠ CAUTION**

**DO NOT** use SeaStar, extruded nylon tubing with the PAA unit other than to plumb the compensating line. Failure to adhere to this warning may result in tubing failure causing loss of steering control. Loss of steering control may lead to unpredictable boat behavior and/or ejection from the boat causing property damage, personal injury and/or death.

**⚠ WARNING**

Stretched, kinked or chafed hoses will fail over a period of time resulting in loss of steering control. Loss of steering control may lead to unpredictable boat behavior and/or ejection from the boat causing property damage, personal injury and/or death. Check hoses on a frequent basis.

**⚠ CAUTION**

Take **EXTREME** care not to allow any foreign material or contamination to enter the hydraulic system. Contamination is the main cause for a hydraulic system to wear and or fail. Keep protective caps on hose ends until ready to install onto the fitting.

**⚠ CAUTION**

**BEFORE** beginning with this installation, confirm that **ALL** components required to complete the installation (helms, cylinders, hoses, fitting kits, tubing and pipe sealants are purchased and ready for use). **NEVER** use Teflon tape, **ONLY** use a “liquid”, Teflon based pipe sealant.

**⚠ CAUTION**

The SeaStar PAA has a fuse and electronic current limiter to protect the electronics from overheating. If either of these devices is triggered, the steering will revert back to manual steering, requiring substantially more force to turn the wheel.

**⚠ WARNING**

If it is necessary to replace the fuse for the PAA unit, the PAA unit **MUST** have the power turned **OFF**.

**⚠ WARNING**

When working in an area where fumes from fuel are present, allow the fumes to disperse completely **BEFORE** doing any electrical connection to the battery. Failure to do so may result in an explosion and/or fire.

**NOTICE**

*The SeaStar Power Assist Pump will automatically recognize the power source output (12/24 volt). If connecting the SeaStar PAA directly to the battery, the connection **MUST** be fused in compliance with ABYC specifications.*

**⚠ WARNING**

Failure to fuse any link to the battery may result in a fire and/or explosion, leading to property damage, personal injury and/or death.

**⚠ CAUTION**

If power to the unit is lost, the PAA will revert to manual steering, requiring substantially more effort to turn the wheel.

# HOW THE SYSTEM WORKS

SeaStar PAA (Power Assist Autopilot) steering uses an electronically controlled hydraulic pump to provide “Power” for your SeaStar Hydraulic Steering system.

The SeaStar PAA system is comprised of two circuits: a hand operated manual system, which is the control element, and a hydraulic power pump, which is the working element.

The manual system consists of a helm pump with internal relief and check valves, as well as a built in reservoir. Two steering lines and a compensating line provide a routing for fluid to transmit through the system, and a steering cylinder moves the steering device on the boat from side to side.

The power system, is an electronically controlled hydraulic pump that boosts the fluid being sent from the helm pump to the steering cylinder (this will result in much easier effort at the wheel—even when under heavy loads). A compensating line connects the PAA unit to the helm pump, allowing the PAA unit to share fluid with the helm reservoir.

The SeaStar PAA includes an integrated, reversible, Autopilot pump which is compatible with most Autopilot controllers.

In the event of a PAA power loss or failure the hydraulic system will automatically revert to a manual hydraulic system.

*Typical installations shown (please refer to you cylinder installation manual for proper hose installation diagrams).*

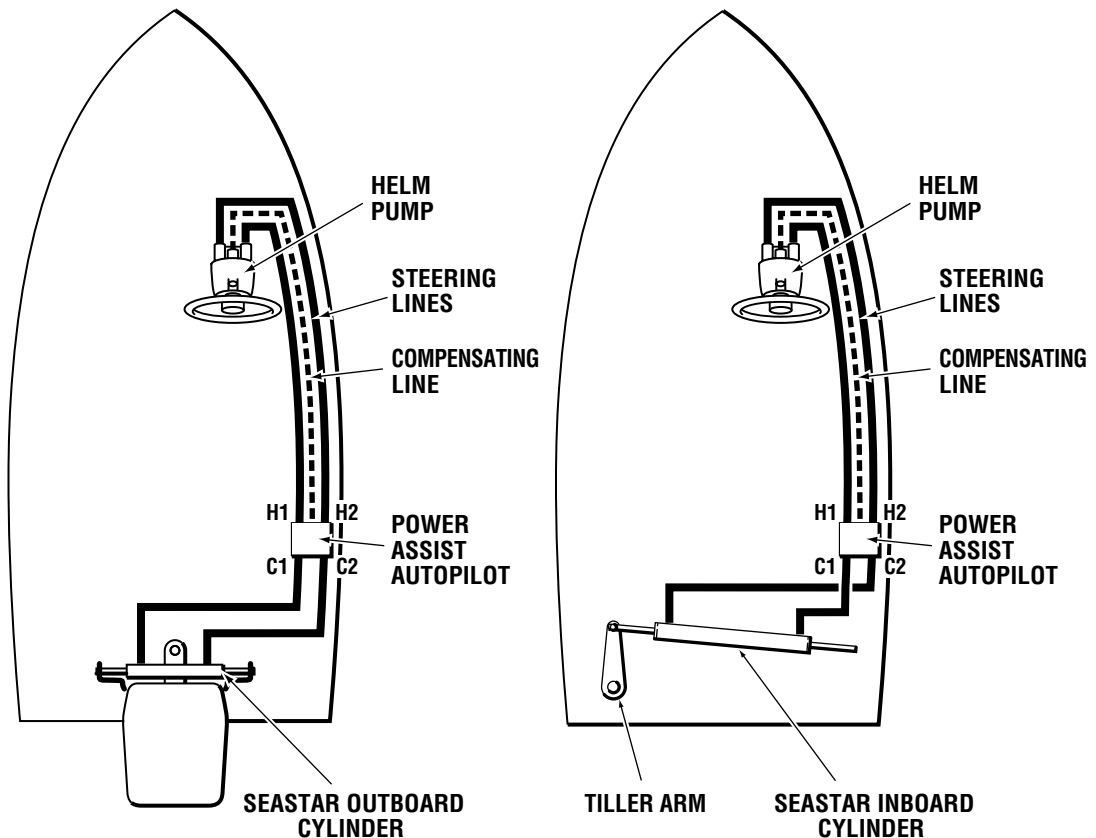


Figure 1.

# SPECIFICATIONS

**⚠ WARNING**

**DO NOT** exceed peak operating pressure. 1000psi.

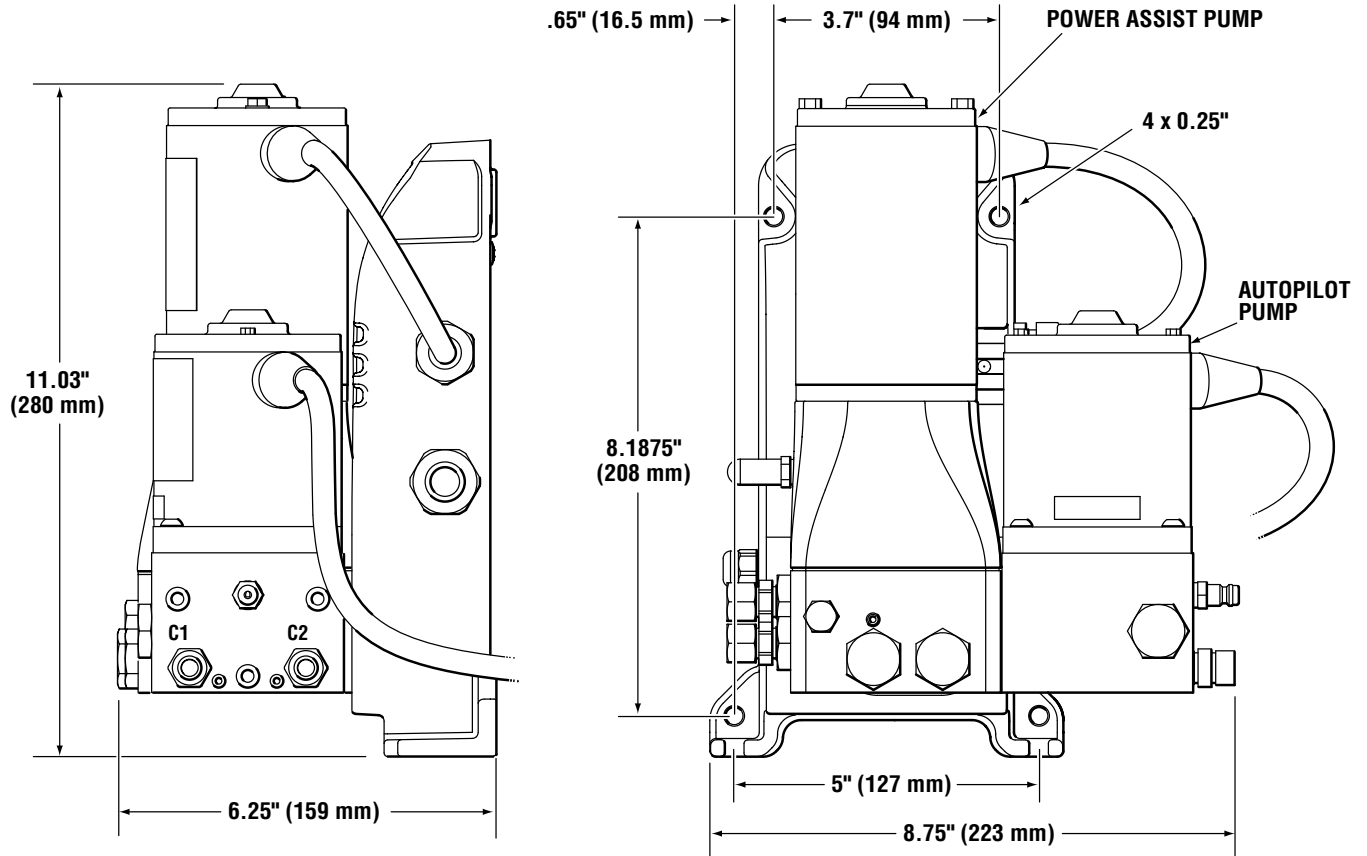


Figure 2.

## SEASTAR PAA 12/24 VOLT

- 12/24 Volts (Automatically Recognized)
- 1000 psi MAX system peak pressure (500 psi working load)
- PEAK current draw = 60 amps
- MAX current draw = 40 amps
- Purple ignition wire MAX. current draw = 1 amp
- Typical current draw:  
Single outboard ~ 3 amps, average  
Twin Rudder inboard ~ 8 amps, average

## 12V AUTOPILOT SPECIFICATIONS

- 12 Volts
- 1000psi MAX system pressure
- Flow Rate (No-Load): Type 1: 60in<sup>3</sup>/min / Type 2: 100in<sup>3</sup>/min
- Typical current draw (up to 300 psi): Type 1: 4–8A / Type 2: 5–11A
- Cylinder Capacity: Type 1: 4.9–12.5in<sup>3</sup> / Type 2: 12.5–21in<sup>3</sup>

## 24V AUTOPILOT SPECIFICATIONS

- 24 Volts
- 1000psi MAX system pressure
- Flow Rate (No-Load): Type 1: 60in<sup>3</sup>/min / Type 2: 100in<sup>3</sup>/min
- Typical current draw (up to 300 psi): Type 1: 2–4A / Type 2: 3–6A
- Cylinder Capacity: Type 1: 4.9–12.5in<sup>3</sup> / Type 2: 12.5–21in<sup>3</sup>

# SYSTEM INSTALLATION

## Before Starting

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Study this manual and all other manuals provided with your SeaStar Steering system carefully to thoroughly familiarize yourself with all of the components and their intended or required mounting locations. Ensure there is adequate space available for installation of all components, hydraulic lines, and easy access for service. It is good practice to mount all components first, before running hoses. This allows port to port connection with less chance of an error. If you must run hoses first, a system of marking the various lines must be used. ALL hose ends must be closed with tape or similar material to prevent contamination. **Contamination is the most common cause of system failure.**

Read ALL bold print text, notes and cautions. Reading them now will help prevent unexpected surprises during the installation.

These instructions have been made as complete as possible, but as brief as practical. If you have any questions, contact your Distributor or SeaStar Solutions.

## SeaStar PAA Compatibility

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### NOTICE

*Use ONLY SeaStar Solutions products with the PAA unit as with ALL SeaStar systems. Failure to do so may void your warranty.*

The PAA is designed for use in recreational marine applications in conjunction with SeaStar Hydraulic Steering. Optimal performance will be obtained when used with SeaStar 1.4, 1.7 and 2.0 cu in (1000psi) helm pumps.

### ⚠ WARNING

**SeaStar extruded nylon tubing may ONLY be used for the compensating line. DO NOT use SeaStar extruded nylon tubing ANYWHERE else within the system. Failure to comply may result in loss of steering causing property damage and/or personal injury or death.**

## Tools

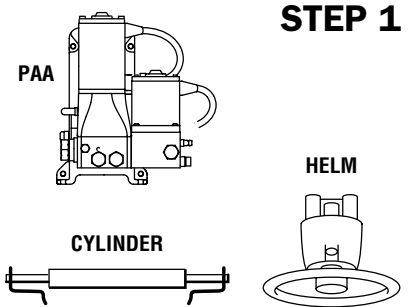
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You will need the following tools to complete your installation.

- 1/2" and 3/4" open end wrench
- Electrical cut and crimp pliers.
- All other tools noted with your Helm Pump and Steering Cylinder installation instructions.



# Overview

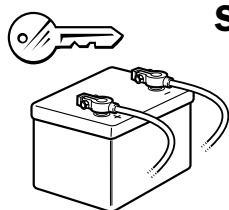


## STEP 1 Mounting & Plumbing

- Install SeaStar helm pump(s) using installation instructions provided with your helm pump.
- Install steering cylinder(s) into boat using the installation manual instructions provided with your steering cylinder.
- Install PAA as per instructions on page 6.
- Install steering hoses using diagrams noted on page 7 through page 11, using your specific application.

### NOTICE

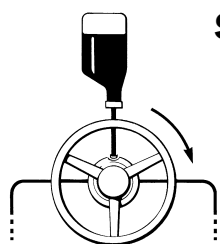
*Due to the different cylinder options available with SeaStar Steering, be sure that you choose the correct installation diagram noted in this book.*



## STEP 2 Electrical Connections

- Refer to page 12 through page 15 of this manual for electrical connections.

**NOTICE** *The SeaStar Power Assist will automatically recognize the voltage level once it is connected to an onboard power source (refer to page 12 for electrical connections).*



## STEP 3 Filling and Purging

- Refer to page 16 for filling and purging of the steering system.

**CAUTION** **DO NOT run the PAA unit until the SeaStar Steering System has been bled free of air. Failure to do so may result in non-repairable damage to the PAA unit.**

## STEP 4 Final Purge and System Check

- Turn ignition ON and continue with the filling and purging instructions step 3.2.6 page 20 and page 22 of this manual.

# Step 1 Mounting and Plumbing

## 1.1 Install Helm Pump(s)

- Install SeaStar Helm pump(s) using the instructions provided with your helm(s).

## 1.2 Install Steering Cylinder(s)

- Install SeaStar steering cylinder(s) using the instructions provided with your cylinder(s).

## 1.3 SeaStar PAA Mounting

### NOTICE

To assist installation, mounting templates are provided on page 27 and page 29.

### NOTICE

Hoses from cylinder to the PAA, or from the PAA to the helm pump, must be a minimum of **6 feet** in length.

### NOTICE

The PAA will make a noise similar to common Autopilot pumps; this should be taken into consideration if mounting the PAA unit into a center console and/or in an area where noise is preferred to be limited.

### ⚠ WARNING

The PAA motors may be **HOT** to the touch. **DO NOT** mount the PAA in an area where it may come in contact with fabrics, such as life vests, blankets, linens or any other flammable materials. Failure to adhere to this warning may result in a fire leading to property damage, personal injury and/or death.

- Using the four (4) holes in the mounting bracket, mount the PAA in your desired location. Prior to drilling, confirm that there is sufficient room to allow for hose connections and tightening of these hoses.
- For floor mount, use the supplied bracket and screws to secure foot of unit.
- Mount the PAA as close to the cylinder as possible, in a cool and dry location avoiding high heat areas such as engine manifolds and areas that collect moisture. Hoses **MUST** be at least 6' in length.
- Install the PAA in a vertical position (refer to figure 3). **DO NOT** mount the unit in a horizontal position.

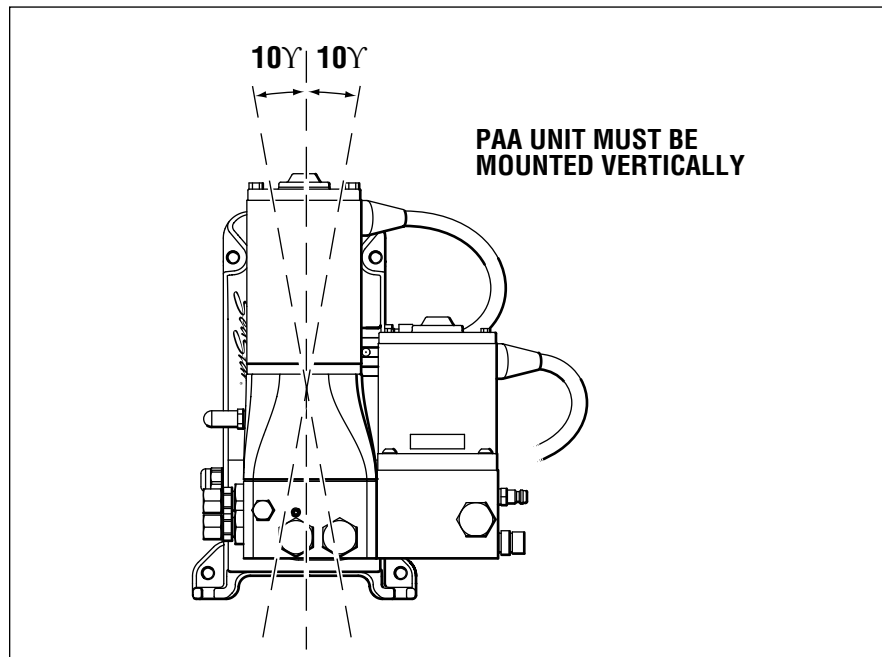


Figure 3.

### NOTICE

Due to various mounting configurations, mounting hardware is not supplied with the SeaStar PAA, make sure you collect the appropriate mounting screws before getting started (refer to Specifications on page 3 for mounting hole size).

### 1.4 Plumbing the SeaStar PAA

**Outboard Front Mount**

**Cylinders:**

- HC5345-3    HC5347-3
- HC5358-3    HC5348-3
- HC6345-3    HC6358-3
- HC6845/S    HC6850

**I/O Cylinder:**

HC5332-2

HELM PUMP MODEL & DISPLACEMENT	WHEEL TURNS
1.7 cu.in. per revolution	5
2.0 cu.in. per revolution	4
2.4 cu.in. per revolution	3.5

**⚠ CAUTION**

All SeaStar hose connections must be torqued to 15 ft-lbs.

**NOTICE**

Hoses *MUST* be at least 6' in length from the power assist to the helm pump, and, from the power assist to the cylinder(s).

**⚠ WARNING**

**DO NOT** run the wires or hoses in areas where they may come in contact with battery acid or excessive heat, i.e. engine exhaust, manifolds or any other area that may damage the wires or hoses.

Hose connection is as follows.

- Helm to PAA = S (helm) to H1 (PAA), P (helm) to H2 (PAA), lower R port (helm) to R (PAA).
- PAA to cylinder = C2 (PAA) to starboard side (cylinder), C1 (PAA) to port side (cylinder).

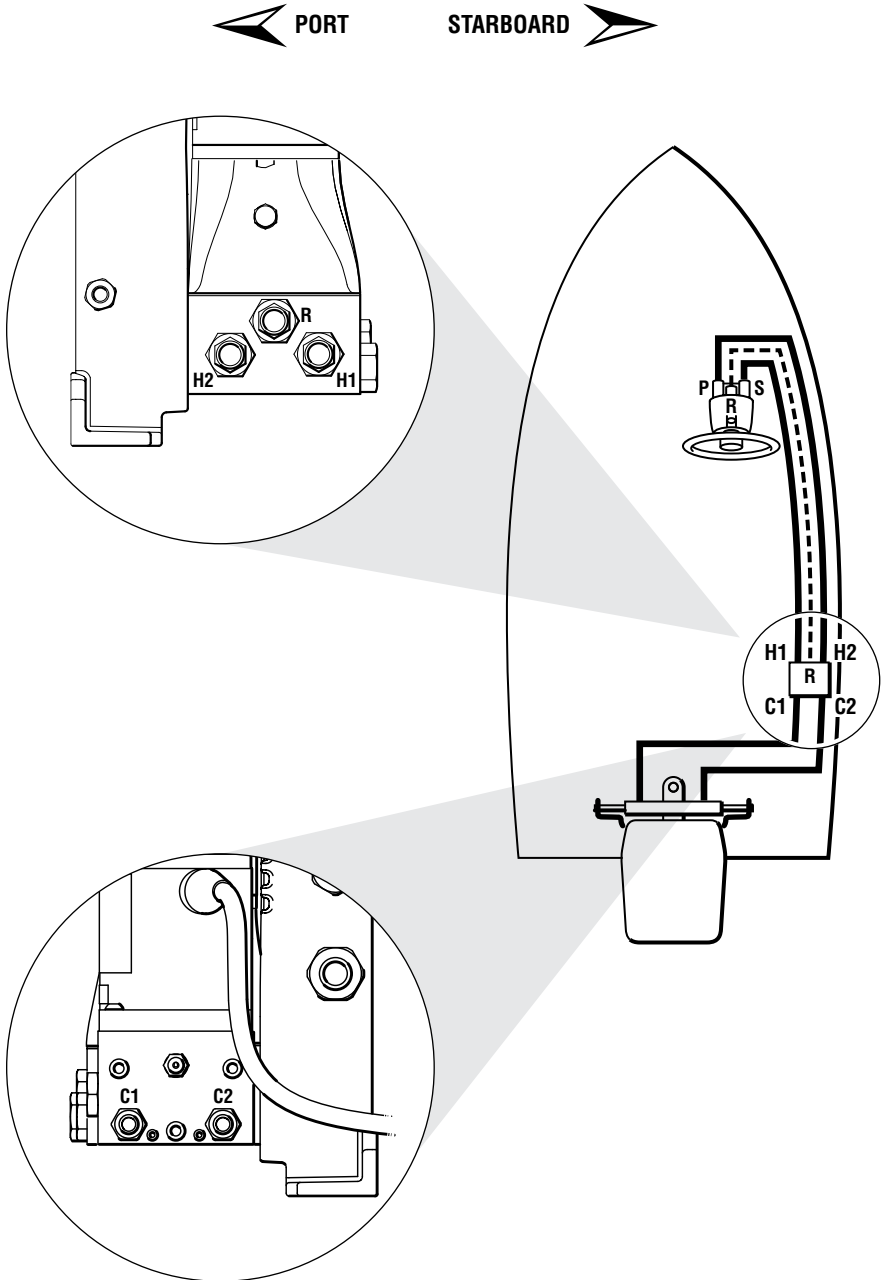
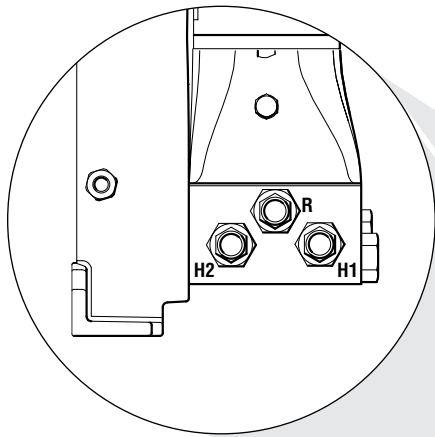


Figure 4.

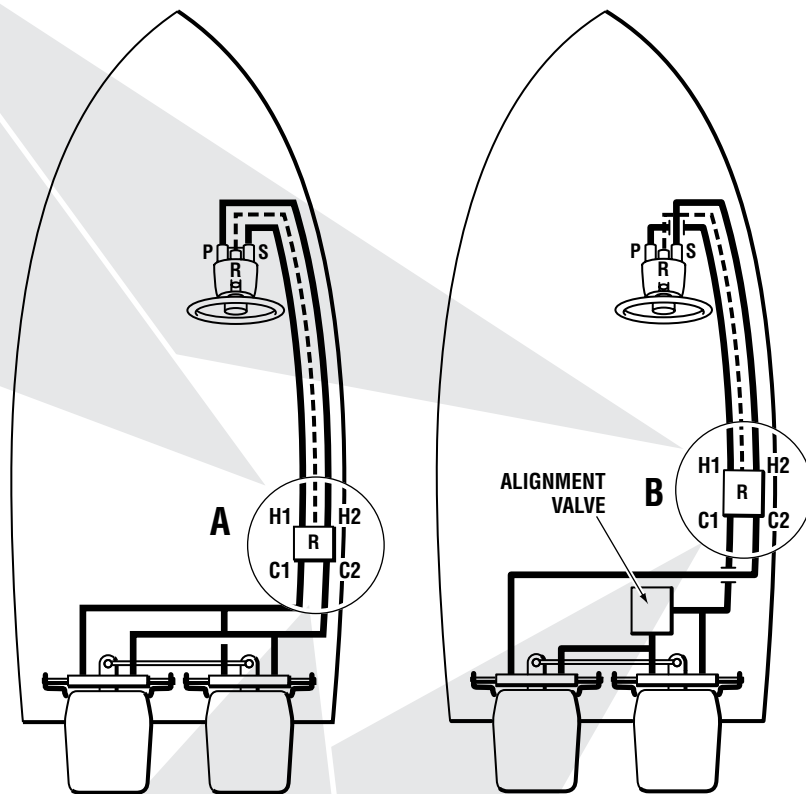
### ⚠ CAUTION

All SeaStar hose connections must be torqued to 15 ft-lbs.

HELM PUMP MODEL & DISPLACEMENT	WHEEL TURNS CONFIG. A 'PARALLEL'	WHEEL TURNS CONFIG. B 'SERIES'
1.7 cu.in. per revolution	10	5
2.0 cu.in. per revolution	8	4
2.4 cu.in. per revolution	6	3.5



PORT STARBOARD



### NOTICE

Hoses **MUST** be at least 6' in length from the power assist to the helm pump, and, from the power assist to the cylinder(s).

### ⚠ WARNING

**DO NOT** run the wires or hoses in areas where they may come in contact with battery acid or excessive heat, i.e. engine exhaust, manifolds or any other area that may damage the wires or hoses.

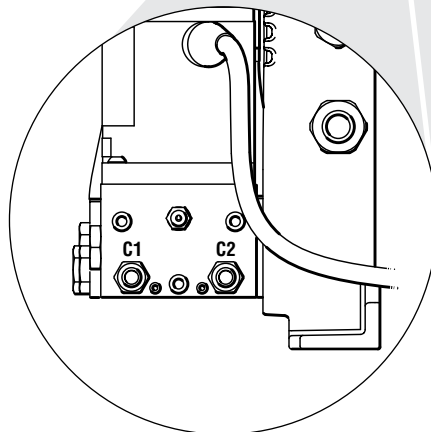
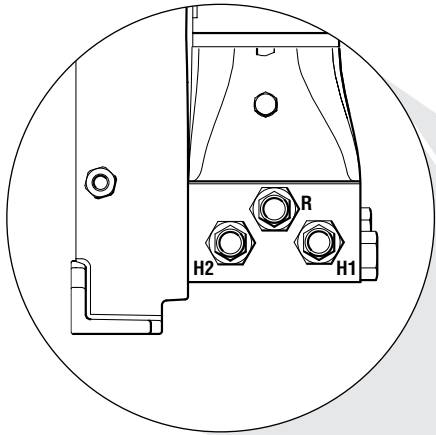


Figure 5.

**⚠ CAUTION**

All SeaStar hose connections must be torqued to 15 ft-lbs.

HELM PUMP MODEL & DISPLACEMENT	WHEEL TURNS CONFIG. C 'PARALLEL'	WHEEL TURNS CONFIG. D 'SERIES'
1.7 cu.in. per revolution	14.5	10
2.0 cu.in. per revolution	12.5	8
2.4 cu.in. per revolution	10.3	6



PORT STARBOARD

**NOTICE**

Hoses *MUST* be at least 6' in length from the power assist to the helm pump, and, from the power assist to the cylinder(s).

**⚠ CAUTION**

DO NOT run the wires or hoses in areas where they may come in contact with battery acid or excessive heat, i.e. engine exhaust, manifolds or any other area that may damage the wires or hoses.

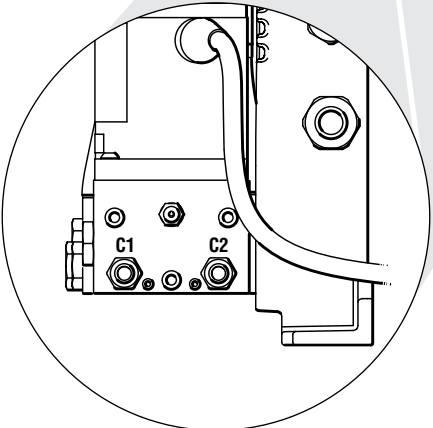
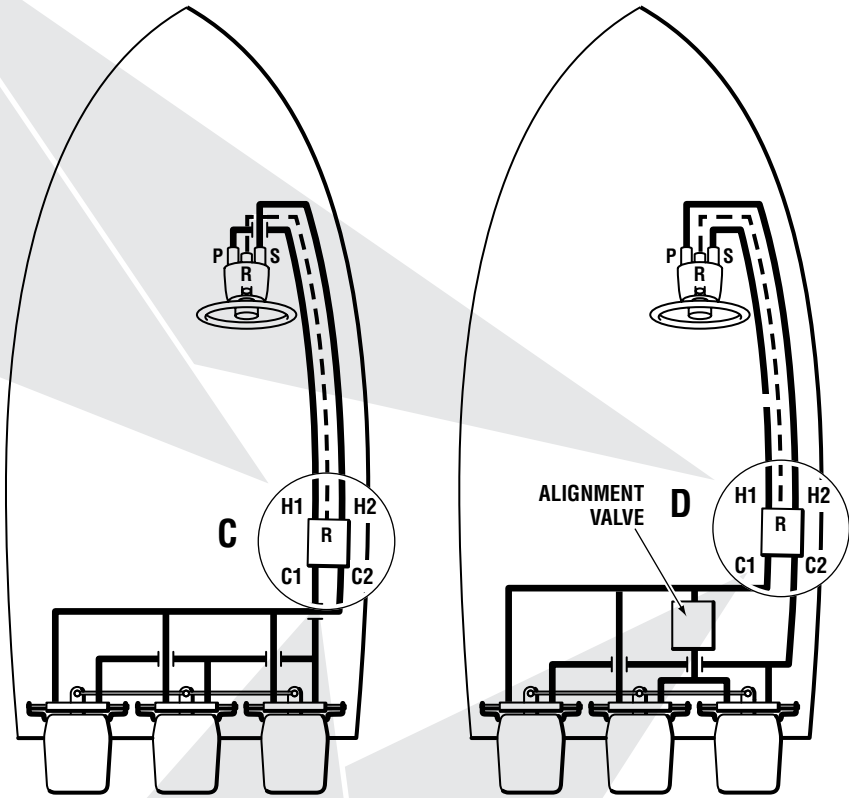


Figure 6.

**Side Mount Cylinder:** HC5370-3

**Splashwell Cylinder:** HC5380-3

Hose connection is as follows.

- Helm to PAA = S (helm) to H1 (PAA), P (helm) to H2 (PAA), lower R port (helm) to R (PAA).
- PAA to cylinder = C1 (PAA) to starboard side (cylinder), C2 (PAA) to port side (cylinder).

### NOTICE

*Unbalanced cylinder will result in unequal wheel turns.*

### ⚠ CAUTION

**All SeaStar hose connections must be torqued to 15 ft-lbs.**

### NOTICE

*Hoses MUST be at least 6' in length from the power assist to the helm pump, or, from the power assist to the cylinder(s).*

### ⚠ WARNING

**DO NOT** run the wires or hoses in areas where they may come in contact with battery acid or excessive heat, i.e. engine exhaust, manifolds or any other area that may damage the wires or hoses.

HELM PUMP MODEL & DISPLACEMENT	WHEEL TURNS HC5370	WHEEL TURNS HC5380
1.7 cu.in. per revolution	4.8/5.7	5.5/6.5
2.0 cu.in. per revolution	4.0/4.8	4.6/5.5
2.4 cu.in. per revolution	3.5/4.0	3.9/4.6

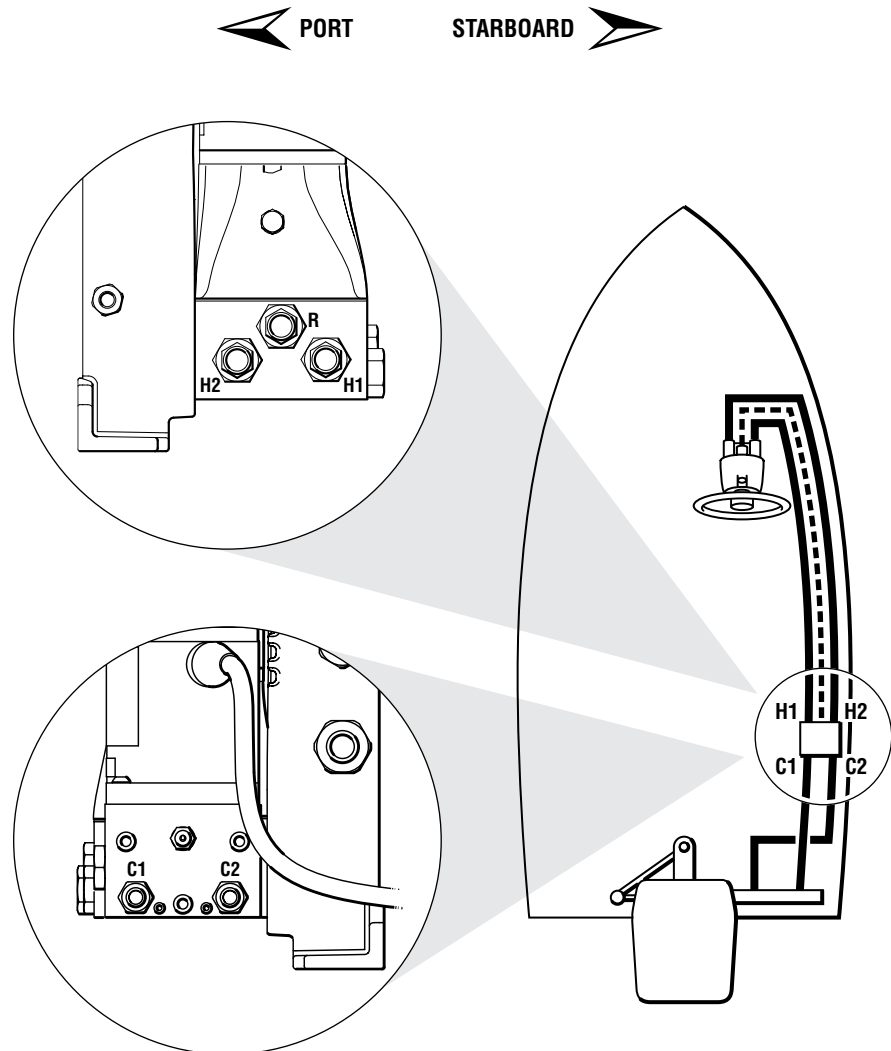


Figure 7.

**All Inboard & Sterndrive**  
Except: HC5332-2

Hose connection is as follows.

- Helm pump to PAA = S (helm) to H1 (PAA), P (helm) to H2 (PAA), lower R port (helm) to R (PAA).
- PAA to cylinder = C1 (PAA) to starboard side (cylinder), C2 (PAA) to port side (cylinder).

**NOTICE**

*Unbalanced cylinder will result in unequal wheel turns.*

**CAUTION**

**All SeaStar hose connections must be torqued to 15 ft-lbs.**

**NOTICE**

*Hoses MUST be at least 6' in length from the power assist to the helm pump, or, from the power assist to the cylinder(s).*

**WARNING**

**DO NOT** run the wires or hoses in areas where they may come in contact with battery acid or excessive heat, i.e. engine exhaust, manifolds or any other area that may damage the wires or hoses.

HELM PUMP MODEL & DISPLACEMENT	WHEEL TURNS				
	HC5312-2	HC5313	HC5314	HC5318	HC5319
1.7 cu.in. per revolution	4.2	5	6	6	8
2.0 cu.in. per revolution	3.6	4	5	5	6.8
2.4 cu.in. per revolution	3	3.5	4.2	4.2	5.7

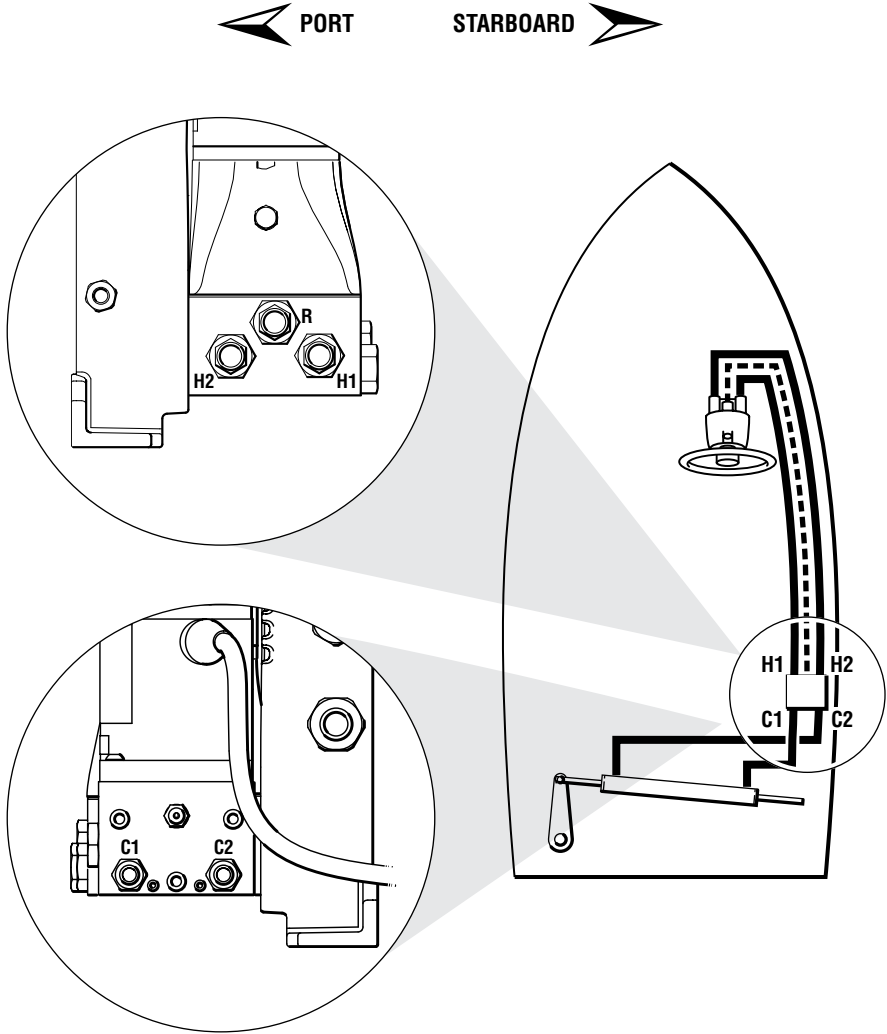


Figure 8.

## Step 2 Electrical Connections

**⚠ WARNING**

**BEFORE** making any electrical connections of any kind, **CONFIRM** that the area in which the connections are being made is **FULLY** vented free of fumes. Failure to adhere to this warning may result in a fire and/or explosion leading to property damage, personal injury and/or death.

### 2.1 Wiring Diagram

**⚠ WARNING**

**ALWAYS** use ABYC compliant components in electrical installations of the Power Assist Autopilot and any other electrical device being installed on board the vessel. Failure to do so may result in a fire and/or explosion leading to property damage, personal injury and/or death.

**⚠ WARNING**

If connecting to a battery is required, there **MUST** be an overcurrent protection as per ABYC E11.12 **OVERCURRENT PROTECTION**. Failure to do so may result in a fire and/or explosion leading to property damage, personal injury and/or death.

**NOTICE**

*The Power Assist wiring may be cut to length as per your installation.*

- Refer to wiring diagram on page 13 of this manual.
- Connect Red wire (+ positive) to the positive (+) supply
- Connect Black wire (– negative) to the negative (–) supply
- Connect purple wire (Power) to the ignition of the boat.

**NOTICE**

*SeaStar Solutions recommends the use of a fuse protected ON/OFF switch to allow the Power Assist to be turned OFF in the case of limited power or power loss.*

**NOTICE**

*Always use appropriate wiring terminals as per ABYC requirements.*

**⚠ WARNING**

**Overcurrent protection MUST be used to connect the SeaStar Power Autopilot Assist in a distribution panel or to a battery. The overcurrent may be:**

- An ABYC compliant, 50AMP rated circuit breaker, or
- An in-line MAXI fuse, SeaStar Solutions part # HA1206
- An in-line, MRB Fuse, SeaStar Solutions Part # HA1207
- If the location of the SeaStar Power Assist Autopilot is within 72” of the battery, the main over-current protection (fuses) within the Power Assist Autopilot itself will meet ABYC requirements.

**NOTICE**

*If applicable, complete the wiring from the distribution panel to the boat battery in accordance to ABYC E-11.10 load calculation and E-11.16 system wiring.*

**⚠ CAUTION**

**Reduce fire risks by only using wires of good quality. ANY wire showing ANY sign of damage MUST be replaced.**

**⚠ CAUTION**

**Refer to page 15 of this manual for the Autopilot pump electrical connections. Failure to do so may result in damage to the Power Assist Autopilot and/or the Autopilot interface.**



**NOTICE**

For multiple engine applications it is advisable to install a Dual Ignition Control Kit (part# HA1201). This kit will enable the Power Assist Autopilot to work in the event an engine(s) may not be running. Refer to page 14 for details.

**⚠ WARNING**

DO NOT run the wires or hoses in areas where they may come in contact with battery acid or excessive heat, i.e. engine exhaust, manifolds or any other area that may damage the wires or hoses.

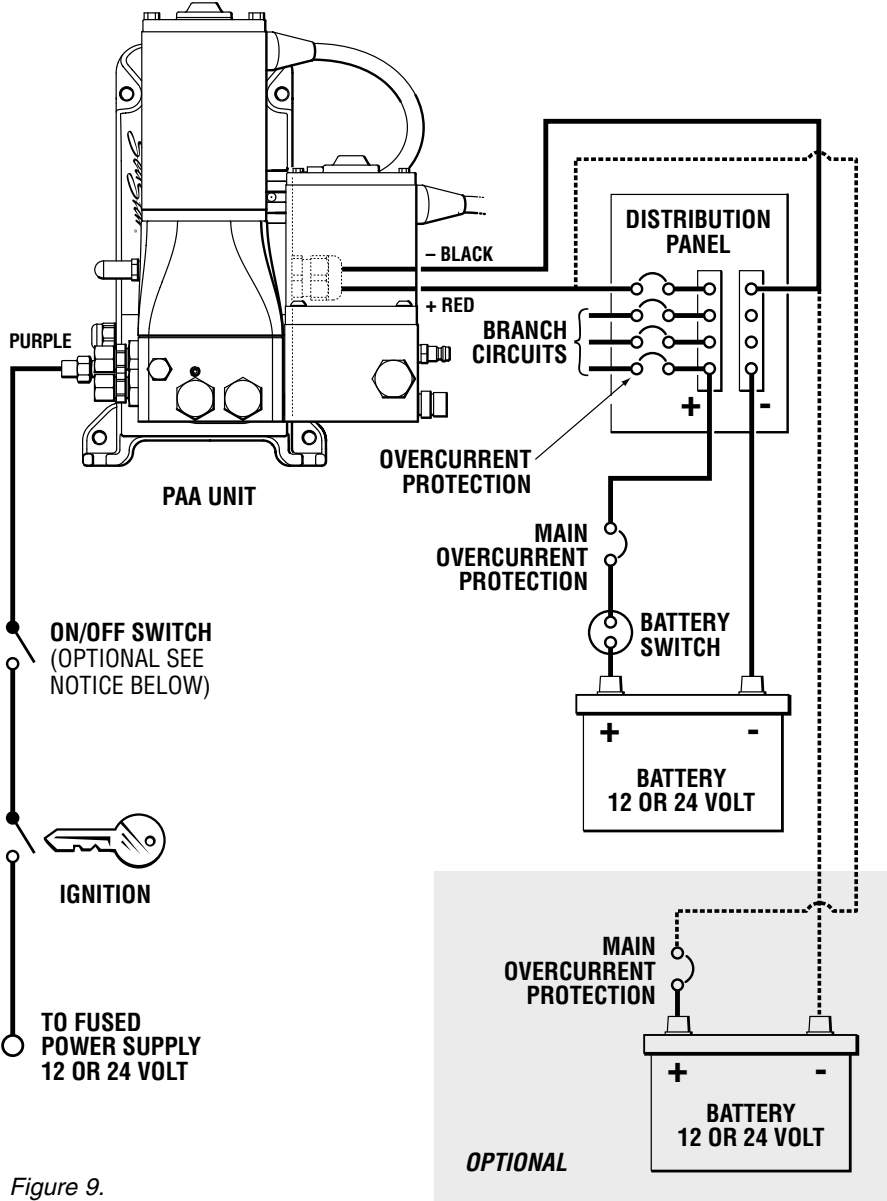


Figure 9.

**NOTICE**

2 x 40 amp ATO/ATC fuses are located inside the rear panel of the PAA Electronics box.

**NOTICE**

It is recommended that a two position switch is purchased to allow the PAA unit to be turned off to help conserve battery power in a situation where battery power is limited. In order to prevent accidental PAA shut down, SeaStar Solutions recommends the use of a 12-Volt, 15 amp, ON/OFF, rocker style or push button style switch. ON/OFF switches are not available from SeaStar Solutions.

## 2.2 Dual Ignition Control Kit Part# HA1201

If you are installing the PAA in an application with twin engines, it is advisable to install the Dual Ignition Control Kit so that the PAA will remain ON if only one of the ignitions are turned ON.

### Installation Procedure

#### NOTICE

If your boat is equipped with triple engines, you will need to purchase two (2) of the HA1201 Ignition Switches. Refer to figure inset.

- Connect “purple” ignition wire from the PAA unit to the PAA location on the switch.
- Connect ENG. A to the one ignition switch.
- Connect ENG. B to the other ignition switch.
- Mount dual ignition control switch to the underside of the dash and away from the elements.

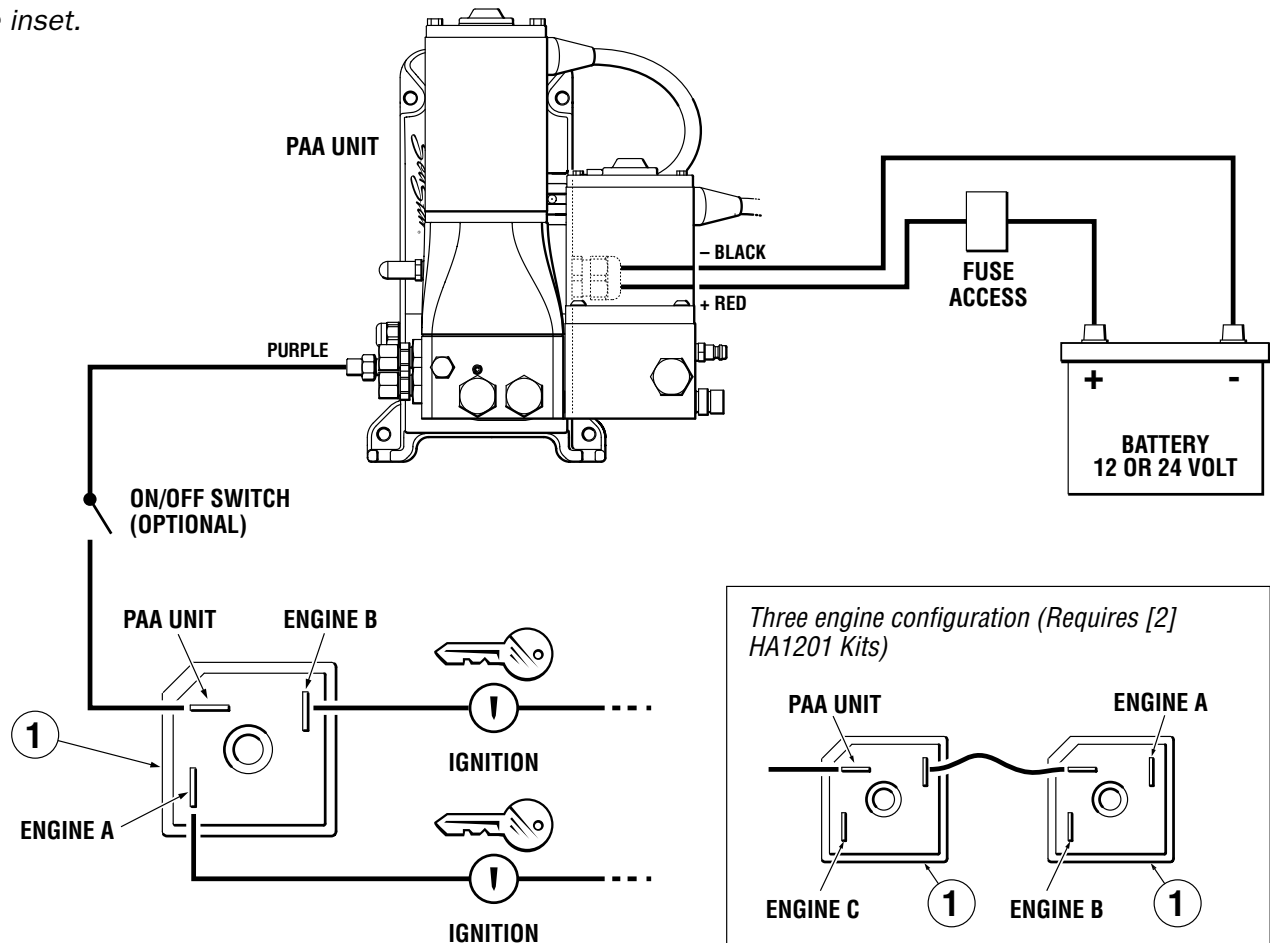


Figure 10.

ITEM	PART #	QTY	DESCRIPTION
1	799100	1	Dual Ignition Control Switch

## 2.3 Autopilot Electrical Connections

Connect the Red (+) and Black (-) wires of the Autopilot pump to the controller as per the Autopilot manufacturers recommendations.

The polarity may need to be reversed on some controllers in order to operate correctly.

When extending wire leads, marine best practices must be followed. Solder and shrink wrap are highly recommended. Appropriately sized and properly installed crimp connections with shrink wrap protection are also acceptable. A MIN of 12AWG wiring should be used for any extension of the Autopilot leads.

Lead wires should be kept as short as possible.

### NOTICE

*Refer to the Autopilot controller manufacturer for EMC wire guidelines, installation manuals and ALL notices, cautions and warnings.*

### ⚠ WARNING

**ONLY use approved electrical connectors or junction boxes with the correct power rating.**

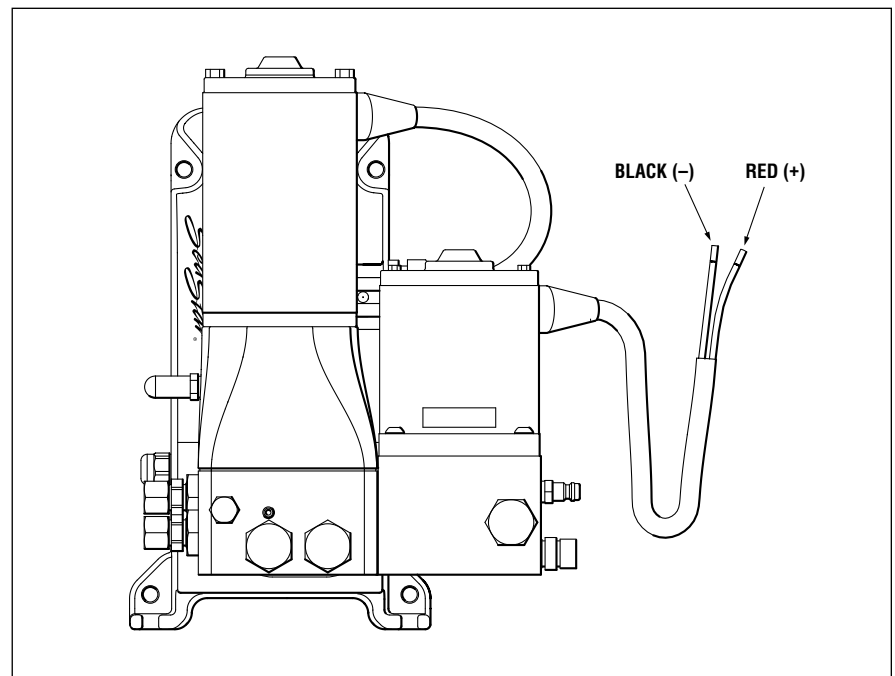


Figure 11.

## Step 3 Filling & Purging the System

**NOTICE**

*If system is plumbed as shown in Config. B (page 8), C (page 9) or D (page 9), please contact SeaStar Solutions for specific bleeding details.*

**3.0.1 Read First**

These instructions show how to fill and purge a SeaStar Steering System with the PAA unit installed. The same steps apply to ALL cylinders with the exception of which bleed fitting to open and close and the direction the cylinder rod moves. These variations are shown in inset diagrams at each step. For multiple steering stations, start with the lowest station while going through Steps 3.2.2 – 3.2.6, repeat at each higher station until complete.

The use of a Power Purge kit (HA5445-2) is highly recommended and will improve the speed and quality of the purge procedure. Refer to page 17, steps 3.1.1 through 3.1.3 for bleeding with Power Purge Units.

**⚠ CAUTION**

**DO NOT turn ON PAA unit until manual portion is completed.**

**Manual bleeding 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, fluid **MUST** be visible in the filler tube. **DO NOT** allow fluid level to disappear into the helm pump, as this may introduce air into the system and increase your filling time.

**3.0.2 Hydraulic Fluid Requirements**

2 bottles (2 quarts or liters) for single station and single cylinder systems. One additional bottle for each cylinder or helm added to the system.

Recommended fluids for your steering system are:

SeaStar Hydraulic Fluid, Part # HA5430 (1 quart), HA5440 (1 US gallon). and fluids meeting MIL H5606 Specifications.

Automatic transmission fluid, Dextron II may be used in an emergency.

**⚠ CAUTION**

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

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

**NOTICE**

*Fluid can be re-used if filtered through a fine mesh screen such as that used for gasoline. If unable to filter fluid, an additional bottle of fluid is required.*

**NOTICE**

*“Bleeder” refers to cylinder or PAA unit fitted with bleed fittings. Bleed fittings can be opened by unscrewing bleed nipple nut two turns.*

**NOTICE**

*Protect your boating environment by ensuring that all used fluid is disposed of properly.*

### 3.1 Power Purge Filling and Purging

#### NOTICE

*BEFORE bleeding the main steering system (helm, hoses and cylinders) the RETURN line will need to be purged.*

#### 3.1.1 Removing Air from Return Lines

#### ⚠ CAUTION

**Refer to your Power Purge installation manual for important Warnings and Notices while using the Power Purge Units.**

- Install the helm adapter into the helm pump and attach the helm hose from the power purge unit.
- Connect one of the fluid return hoses (cylinder lines) from the Power Purge Unit to the Power Assist reservoir bleed fitting and the other fluid return hose (cylinder lines) to the Autopilot pump reservoir bleed fitting (refer to figure 12 on page 18 of this manual for bleed fitting location).
- OPEN both reservoir bleed fittings 1 full turn.
- Turn ON the Power Purge Unit and continue to run until NO air is visible leaving the Power Assist pump or Autopilot pump reservoir bleed fitting. Turn off Power Purge unit.
- Close both the Power Assist pump and Autopilot pump reservoir bleed fittings.
- Torque all bleed fittings to 180 in-lbs.

#### 3.1.2

#### NOTICE

**DO NOT OPEN MANUAL BLEED VALVE WHEN USING POWER PURGE UNITS.**

- Ensure the reservoir bleed fittings are closed then remove the hose from the reservoir bleed fittings and connect to the steering cylinder bleeder fittings. Ensure the quick connect is locked onto the fitting.
- Open BOTH Cylinder bleed fittings 1–1/2 turn.
- Turn Power Purge unit ON.
- Fluid should flow into and out of the helm pump. Wait twenty seconds for the helm to fill with fluid.
- Turn the steering wheel clockwise until the cylinder rod is fully extended (you may have to manually push the cylinder rod). SLOWLY continue to turn the wheel to hold the cylinder in this position for approximately 30 seconds. Ensure there are NO air bubbles escaping through the cylinder hoses.
- Turn the steering wheel counter-clockwise until the cylinder rod is fully extended (you may have to manually push the cylinder rod). SLOWLY continue to turn the wheel to hold the cylinder in this position for approximately 30 seconds. Ensure there are NO air bubbles escaping through the cylinder hoses.
- Run Autopilot pump in BOTH directions for at least 30 seconds, or, until NO air bubbles can be seen escaping through the cylinder hoses.
- Turn OFF Power Purge unit.
- Tighten ALL bleed fittings on the steering cylinder(s) and torque to 180 in/lbs.
- Repeat above steps with the Power Assist unit ON.

#### 3.1.3

Continue on with Fluid Level and System Check on page 22.

### 3.2 Manually Filling and Purging

#### NOTICE

If using the SeaStar Power Purge JR/SR please refer to page 17.

The following procedure applies to a single helm and single cylinder installation.

Other configurations will require this procedure plus the additional steps outlined on page 21.

#### NOTICE

*BEFORE bleeding the main steering system (helm, hoses and cylinders), the RETURN line will need to be purged.*

#### 3.2.1

#### NOTICE

Filling the helm full of fluid prior to connecting the filler tube and fluid bottle will decrease purge time.

- Attach fill tube and fluid bottle to helm pump as shown in figure 12.
- Open the manual bleed valve (see figure 12) and reservoir bleed fitting (see figure 12) on the power assist unit. The manual bleed valve should be opened two full turns. DO NOT open Autopilot pump reservoir bleed fitting at this time.
- Fill helm with fluid, then, turn steering wheel clockwise until a steady stream of 'air-free' fluid is seen coming out of the reservoir bleed fitting on the Power Assist pump.
- Close the Power Assist reservoir bleed fitting.
- Open reservoir bleed fitting on the Autopilot pump (see figure 12).
- Turn steering wheel clockwise again until an 'air-free' stream of fluid is seen leaving the Autopilot reservoir bleed fitting.
- Close the Autopilot reservoir bleed fitting.
- Continue to turn steering wheel clockwise another 15 turns after closing both reservoir bleeder fittings and PRIOR to closing the manual bleed valve.
- Close manual bleed valve and continue to steps 3.2.2–3.2.5.
- Torque all bleed fittings to 180 in-lbs.

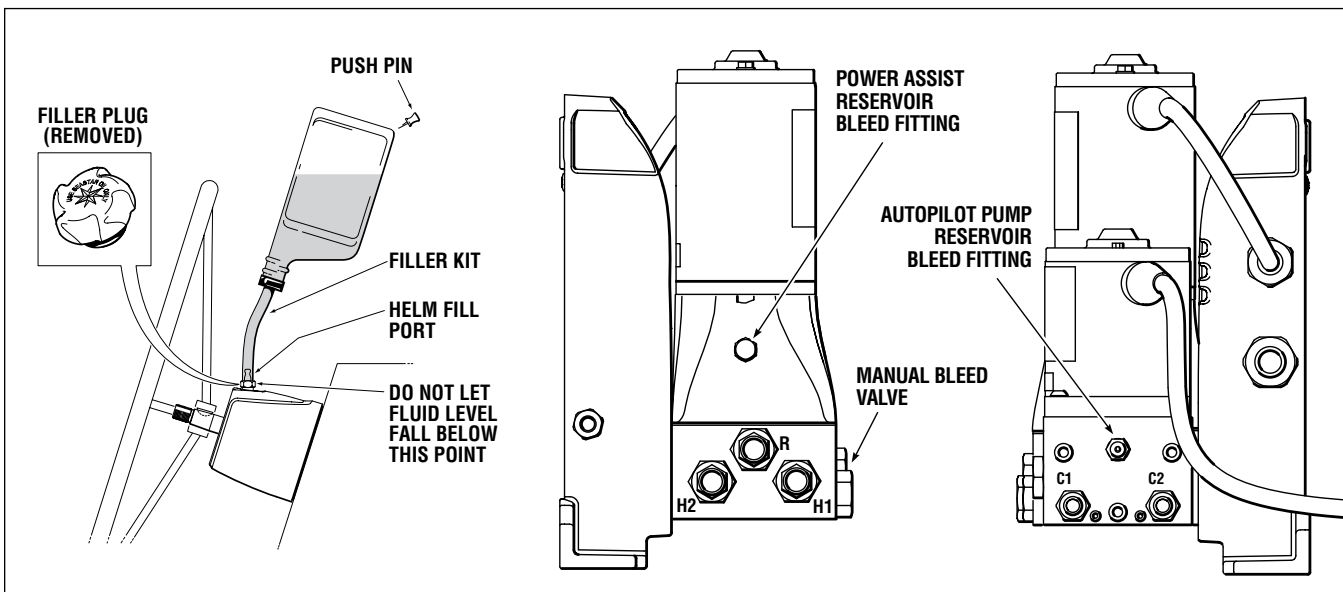
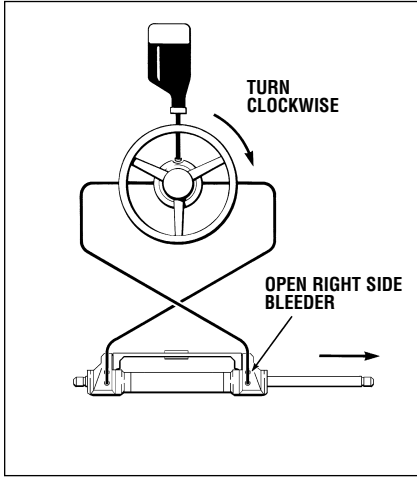


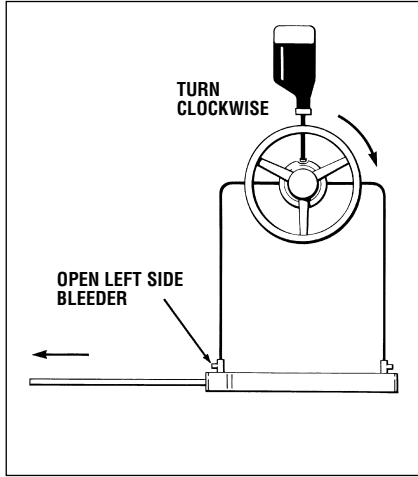
Figure 12.

**3.2.2**

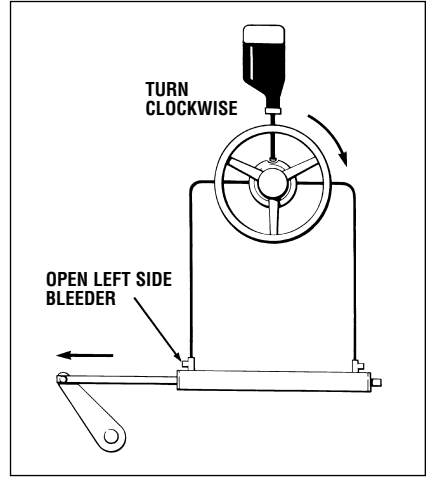
- Turn the steering wheel clockwise until the cylinder rod is fully extended as shown below.
- Open bleed fitting as per your installation as indicated below.



*Outboard Front Mount & HC5332 Cylinder*



*Side Mount / Splashwell Mount Cylinder*



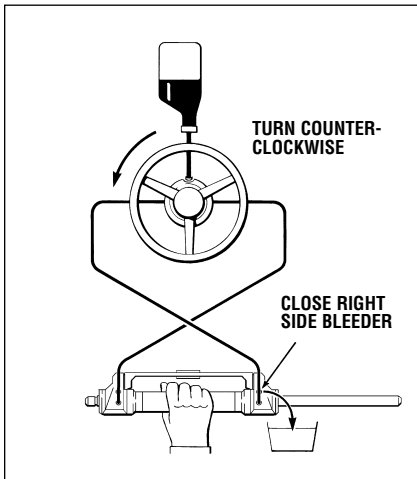
*All Balanced Cylinder. Inboard & Sterndrive Cylinders*

**3.2.3**

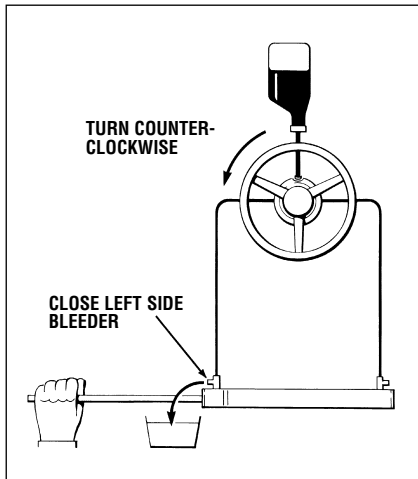
- Holding the cylinder body (Outboard Front Mount cylinder) or rod (Side Mount cylinder) to prevent the body/rod from moving, turn the steering wheel counter-clockwise until a steady stream of air free fluid comes out of the bleeder. (Drain approx. 1/2 bottle of fluid or as required).

**Do not use anything other than your hands to restrain the cylinder body/rod.**

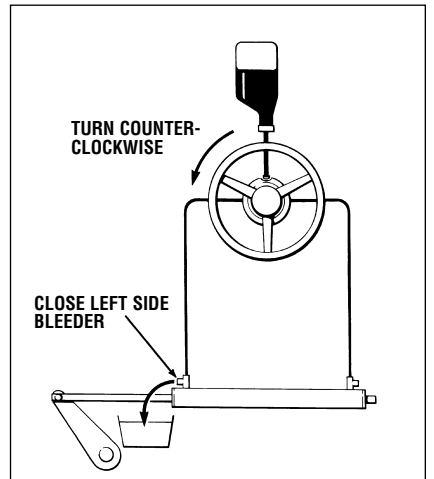
- Run Autopilot pump in the same direction you have been turning for at least 10 seconds.
- While continuing to turn the wheel close the bleed fitting for your installation and let go of the cylinder body/rod.



*Outboard Front Mount & HC5332 Cylinder*



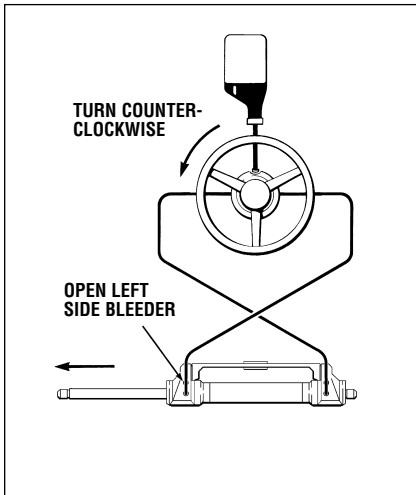
*Side Mount / Splashwell Mount Cylinder*



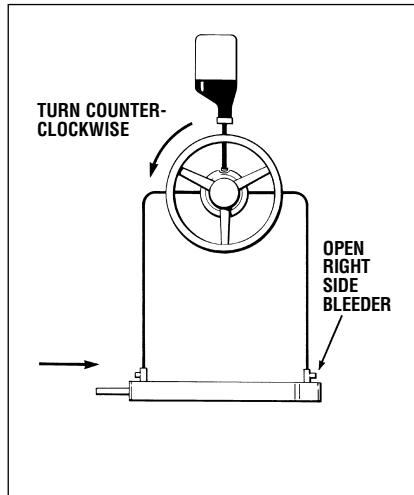
*All Balanced Cylinder. Inboard & Sterndrive Cylinders*

### 3.2.4

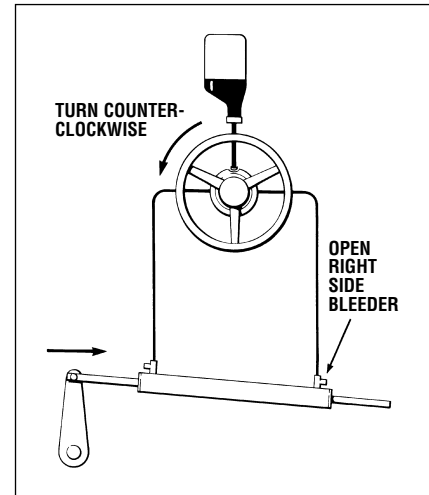
- Continue turning the steering wheel counter-clockwise until the cylinder rod is fully extended as shown below. Steering wheel will come to a stop.
- Open bleed fitting as per your installation.



*Outboard Front Mount & HC5332 Cylinder*



*Side Mount / Splashwell Mount Cylinder*



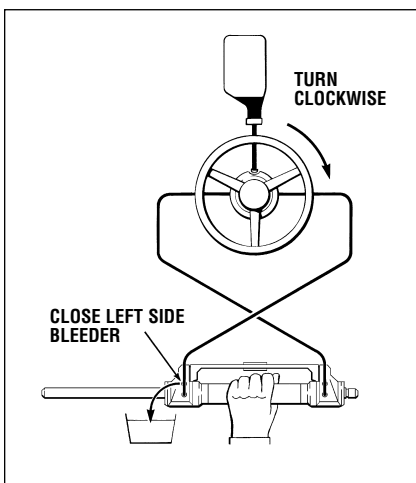
*All Balanced Cylinder. Inboard & Sterndrive Cylinders*

### 3.2.5

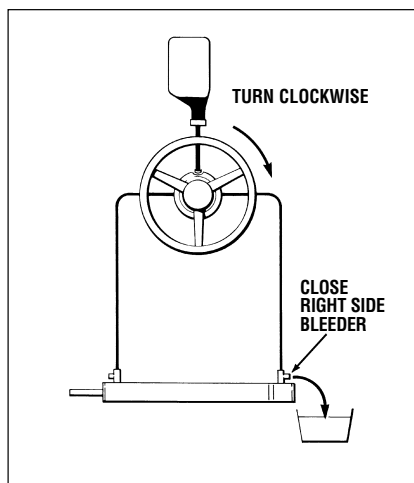
#### ⚠ CAUTION

**Prior to operating system, perform Fluid Level System Check, refer to page 22.**

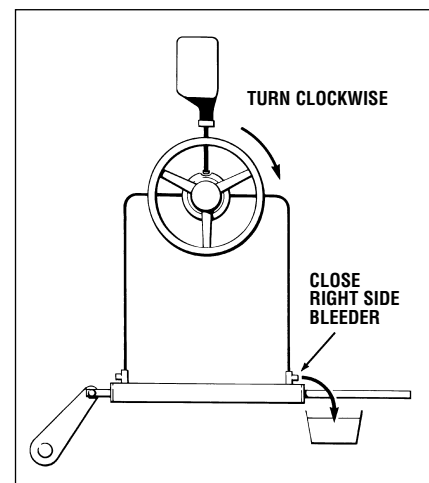
- Holding the cylinder body (Outboard Front Mount cylinder) or rod (Side Mount cylinder) to prevent the body/rod from moving, turn the steering wheel clockwise until a steady stream of air free fluid comes out of the bleeder.
- Run Autopilot pump in the same direction you have been turning for at least 10 seconds.
- While continuing to turn the wheel close the bleed fitting for your application and let go of the cylinder body/rod.



*Outboard Front Mount & HC5332 Cylinder*



*Side Mount / Splashwell Mount Cylinder*



*All Balanced Cylinder. Inboard & Sterndrive Cylinders*

### 3.2.6

- Repeat Steps 3.2.2 through 3.2.5 with the PAA unit 'ON'.
- Torque all cylinder bleed fittings to 180 in-lbs.



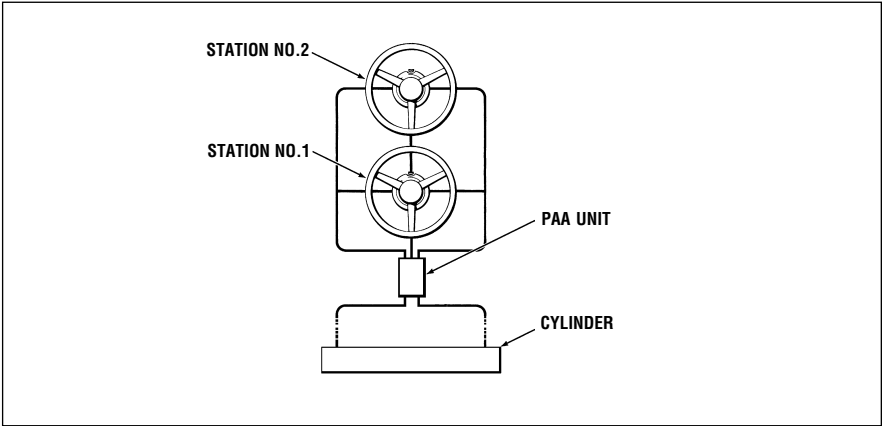
**Step 3.3 Additional Purge Instructions**

**3.3.1**

**Twin Station Single Cylinder**

Perform Steps 3.2.1 – 3.2.6 at station no. 1. Then repeat Steps 3.2.2 – 3.2.5 at station no. 2.

**Note:** Refer to Fluid Level and System Check on page 22.

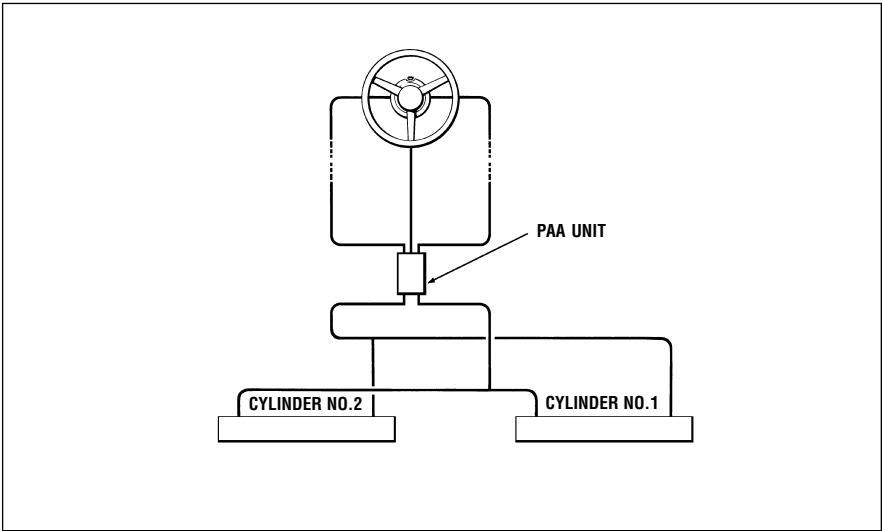


**3.3.2**

**Single Station Twin Cylinder**

When performing Steps 3.2.1 – 3.2.6, perform instructions in each step first on cylinder no. 1 and then on cylinder no. 2, before proceeding to the next step. ie: Perform instructions referring to right side of cylinder first on cylinder no. 1 and then on cylinder no. 2.

**Note:** Refer to Fluid Level and System Check on page 22.

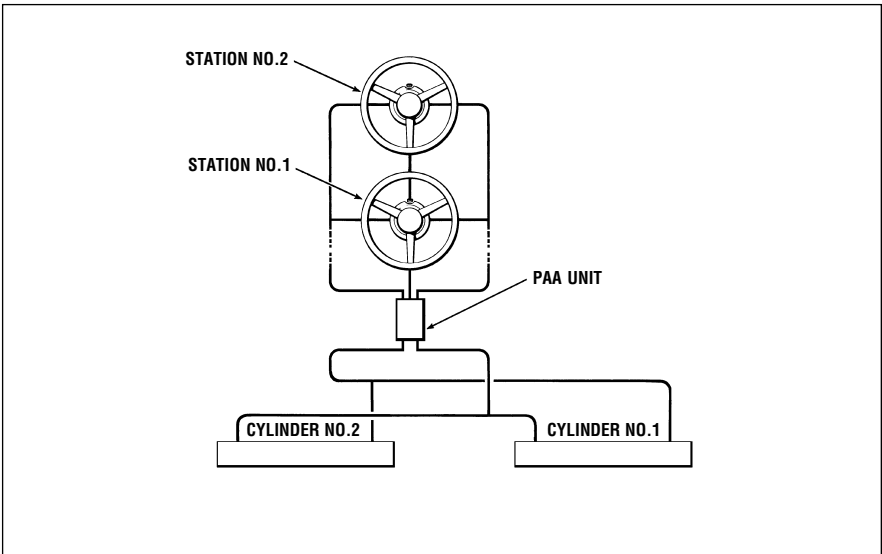


**3.3.3**

**Twin Station Twin Cylinder**

Follow same procedure as instructed for single station-twin cylinders, beginning at station no. 1, and repeat entire procedure at station no. 2.

**Note:** Refer to Fluid Level and System Check on page 22.



## Step 4 System Check

At this time the steering system must be checked for proper hose and fitting connections, possible leaks, and air removal. Please complete the following steps with the PAA OFF.

- Turn steering wheel to hard over, then force the wheel another one quarter to one half turn past the stop point. Check the following areas for evidence of a leak.
  - Inspect helm fittings
  - Inspect Power Assist/Autopilot interface and Autopilot pump fittings
  - Inspect cylinder(s)
  - Inspect hoses and cylinder bleed fittings
- Repeat above steps to the other steering direction.
- Any sign of a leak **MUST** be repaired prior to operating the boat.
- While turning steering wheel observe fluid level in the helm pump. If fluid level drops and rises significantly as the wheel is being turned there is still air in the system. Complete bleeding instructions again until no obvious fluid level change is noticed.

Consult with autopilot controller manual for the remainder of the autopilot check list.

### NOTICE

Helms mounted with the wheel shaft completely horizontal must be filled to the bottom of the filler hole at all times. **DO NOT** allow the fluid level to drop more than one-quarter inch below the filler hole.

### NOTICE

Helms mounted on a 20 degree angle or with the wheel shaft vertical **MUST** have the fluid level within 1/2" of the filler hole, refer to the diagram below.

### ⚠ WARNING

If a leak is noticed, it **MUST** be corrected prior to using the boat. Failure to do so may lead to loss of steering causing property damage, personal injury or death.

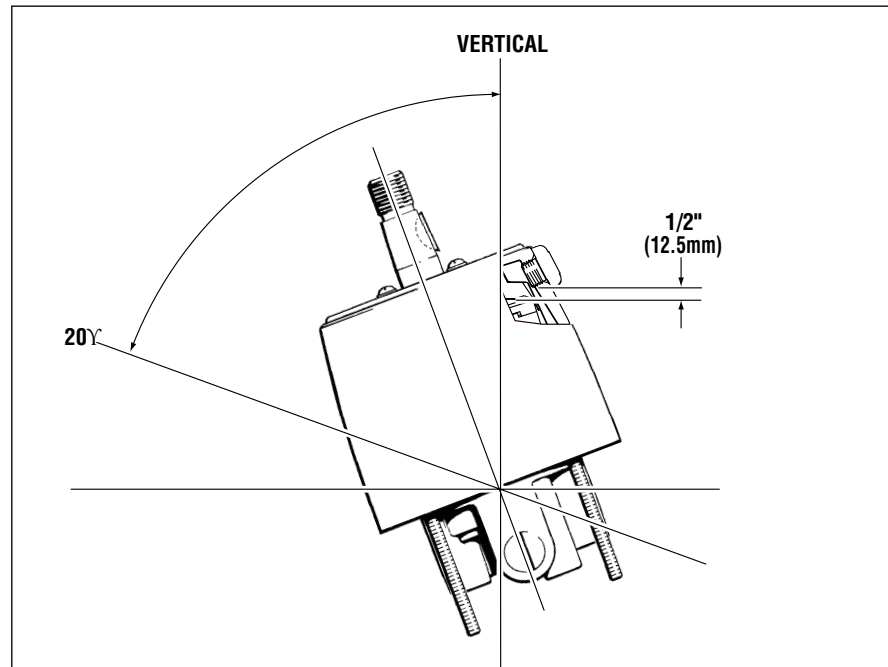


Figure 13.

# ROUTINE MAINTENANCE

Following the routine maintenance schedules below, in the time frame noted will ensure years of great service of your SeaStar Steering System, as well as keep you and your passengers safe from the dangers that are present while on the water.

## 1 Prior to Start-Up or Launch.

- Check Fluid level in helm pump (consult page 22 for level setting).
- Hoses – Ensure hoses are in good condition and free of wear, kinks or any other signs of damage.
- Turn steering wheel hard over to hard over to ensure engine(s) are responding to the input at the wheel. If vessel is equipped with multiple steering stations check ALL stations.
- Repeat above steps with Power Assist and Autopilot turned ON.

## 2 Every 100 hours or 3 months (whichever comes first).

- ALL points noted in Step 1.
- Check torque value on ALL fasteners throughout the steering system. Tighten as required.

### WARNING

**Failure to comply with maintenance checks may result in loss of steering control resulting in unpredictable boat behavior and/or ejection from boat leading to property damage, personal injury and/or death. If ANY part is in question, please contact your dealer and/or SeaStar Solutions for advice.**

# TROUBLESHOOTING GUIDE

FAULT	CAUSE	SOLUTION
1. PAA unit does not turn on.	Wrong electrical connections. Blown Fuse/Breaker.	Refer to wiring diagram and location of fuse on page 12. Replace 'external' fuse if blown first. Replace 'internal' fuse if blown second. Or, reset breaker. <b>NOTICE</b> 2 x 40 amp ATO/ATC fuses are located inside the rear panel of the PAA electrical box. <b>WARNING</b> If it is necessary to replace the fuse(s) in the PAA Unit, the PAA unit <b>MUST</b> have the power turned OFF.
2. Turns the wrong way.	Lines reversed.	Review the plumbing diagrams for your system noted on page 7 through page 11, confirm that your hoses are hooked up correctly.

<b>FAULT</b>	<b>CAUSE</b>	<b>SOLUTION</b>
<b>3. Autopilot motor is really hot to the touch.</b>	Partially kinked or collapsed line. Seized Cylinder. Internal damage to PAA unit. Controller settings are incorrect.	Contact SeaStar Solutions Technical Support for advice.  Refer to autopilot controller manual.
<b>4. Autopilot pump steering in wrong direction.</b>	Motor polarity reversed.	Reverse motor leads at Autopilot controller.
<b>5. Autopilot pump will not turn on.</b>	Blown Fuse. Electrical connections are wrong.	Check for blown fuses and bad connections in Autopilot wiring. Refer to page 12.
<b>6. Autopilot pump draws too much current.</b>	Partially kinked or collapsed line. Seized Cylinder. Internal damage to PAA unit. Autopilot not sized properly.	Contact SeaStar Solutions Technical Support for advice.  Review pump Specifications.
<b>7. Autopilot pump hunts/overshoots.</b>	Autopilot not configured properly.	Refer to autopilot controller manual.
<b>8. Wheel is bumpy.</b>	Air in system.	Re-Bleed. Concentrate on remaining air in the PAA compensating line.
<b>9. Helm locks up in both directions.</b>	Hoses installed in the wrong ports.  Kinked or collapsed line.	Review the plumbing diagrams for your system noted on page 7 through page 11, confirm that your hoses are hooked up correctly.  Check ALL lines for sign of a collapsed or kinked line.
<b>10. No Power Assist, Lights are blinking.</b>	Note sequence of blinking lights.	See page 25 for details.
<b>11. Helm only turns in one direction and free wheels in the other</b>	Port or Starboard line is connected to the reservoir R port on the PAA unit.	Review the plumbing diagrams for your system noted on page 7 through page 11, confirm that your hoses are hooked up correctly.
<b>12. Steering is very hard (stiff).</b>	PAA unit is not turned on. Partially kinked or collapsed line. H1, H2 or R port screen filters are plugged with contamination.	See fault #1 Check ALL lines for a sign of a collapsed or kinked line. Remove H1, H2 and R hose and fittings. Clean screens located in the adapter fittings.

FAULT	CAUSE	SOLUTION
<b>13. The power assist unit is really hot to the touch.</b>	Motor operating.	This is a normal occurrence with the Power Assist unit; mount the PAA in an area where it can not easily be touched and away from flammable materials.
<b>14. Lock to lock wheel turns are different with the power assist “off” than with the power assist “on”.</b>	Hitting hard-over causing hose expansion. Power assist is pressurizing system.	This is a normal occurrence when using the power assist system. This is a normal occurrence when using a power assist.
<b>15. Steering response is slow and feels bumpy.</b>	Leak/Air in system.	Repeat system check inspecting system for leaks. Re-Bleed. Concentrate on remaining air in the PAA compensating line.

**⚠ WARNING**

**Whenever a solution calls for the removal from vessel and/or dismantling of steering system components, such work must ONLY be carried out by a qualified marine hydraulic mechanic. SeaStar Solutions offers this information as a guide ONLY and is not responsible for any consequences resulting from incorrect repairs. When in doubt, contact your parts distributor or SeaStar Solutions for assistance.**

**NOTICE**

*The Green and Red lights are used to show the status of the SeaStar Power Assist Units. Below is a quick list as to what the lights refer to. Any fault within the Power Assist Unit will be acknowledged via the RED light flashing in the sequences noted below.*

- **GREEN. Steady (no flash)**  
Normal operation (unit is ON).
- **RED. Two flashes, long pause**  
Standby mode, lack of calibration.  
SOLUTION: Contact SeaStar Solutions.
- **RED. Three flashes, long pause**  
Calibration mode.  
SOLUTION: Turn OFF ignition, after one minute, turn ignition ON. If problem persists, contact SeaStar Solutions.
- **RED. Four flashes, long pause**  
Overvoltage mode.  
SOLUTION: check ignition and battery voltage. MUST be less than 32 Volts, correct as required.

# ACCESSORIES

## SeaStar PAA Dual Ignition Control Kit

Part# HA1201

The Dual Ignition Control Kit is designed to connect the PAA unit's ignition wire to two engines allowing one engine to be turned off and retain power assist control.

## SeaStar Power Purge JR.

Part# HA5445-2

SeaStar®/BayStar™ Power Purge Jr. is the quickest way to bleed a SeaStar®/ BayStar™ system in the field and assure a rock-solid steering feel every time!

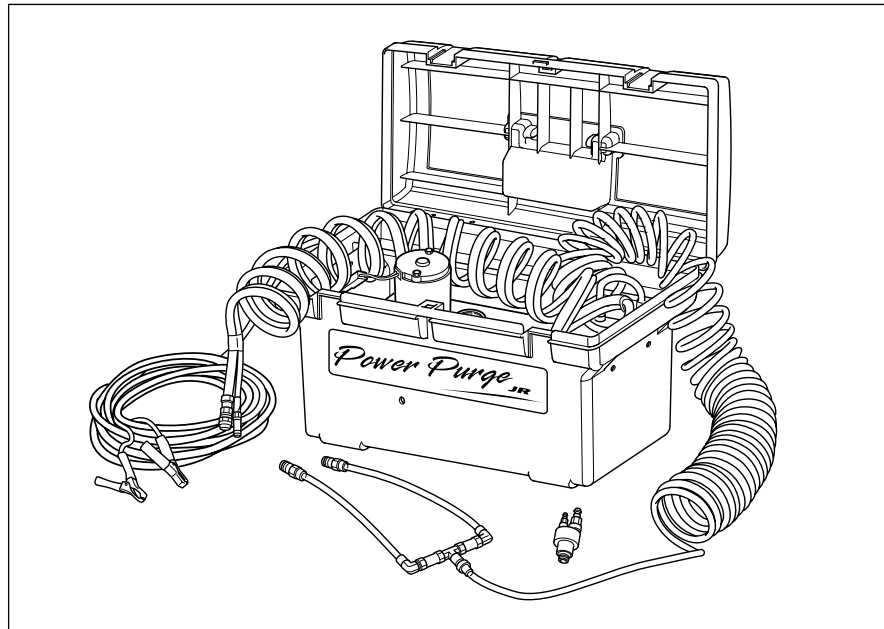
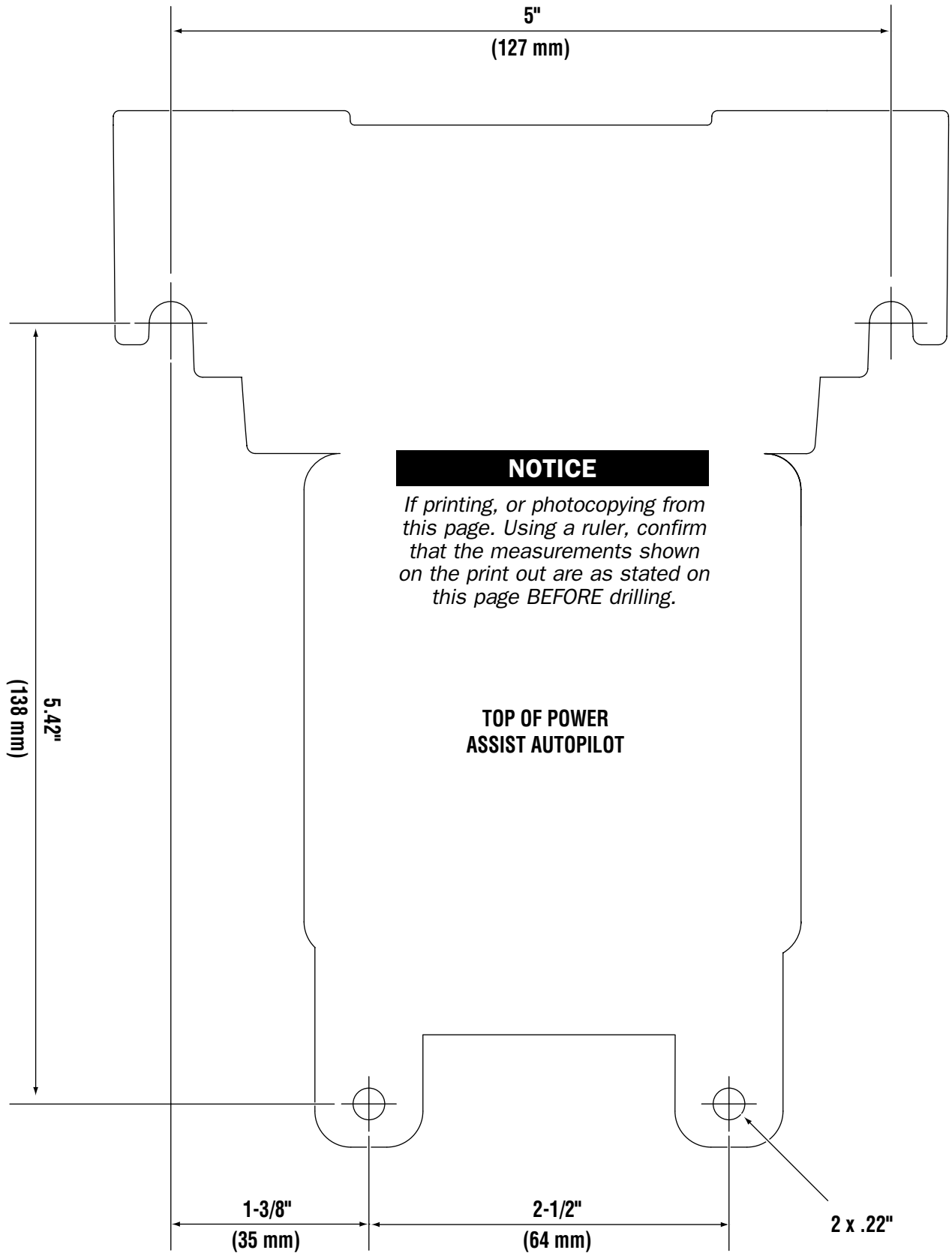


Figure 14.

### Advantages:

- Steering feel is solid every time
- Complete Fill & Purge in 10 minutes or less
- Fast and efficient
- Easy to operate
- Screens contaminants from fluid
- Quick connect fittings
- Convenient portable size
- Convenient electrical hook-up utilizing 12 volt boat battery
- Optional Dual Cylinder Purging Kit HA5461 available
- Optional 50' Hose Extension Kit HA5462, for longer runs

# Floor Mounting Template



# Wall Mounting Template

