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Setting Standards for Safer Boating

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*BayStar*TM

*Capilano*TM

and

SeaStar[®]

ARE MANUFACTURED BY

Teleflex[®]
Teleflex Canada

INSTALLATION INSTRUCTIONS

AND OWNERS MANUAL

www.seastarsteering.com




*Capilano*TM

1250V, 1275V & 1350

HYDRAULIC 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 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 Capilano helms are the smoothest and most efficient hydraulic steering systems available. They have been designed for normal pleasure and commercial boat use where standard rigging arrangements are used.

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.

This precision built product may not function properly if dirt or contamination are introduced into the system.

NOTICE

Due to a small amount of internal oil 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.

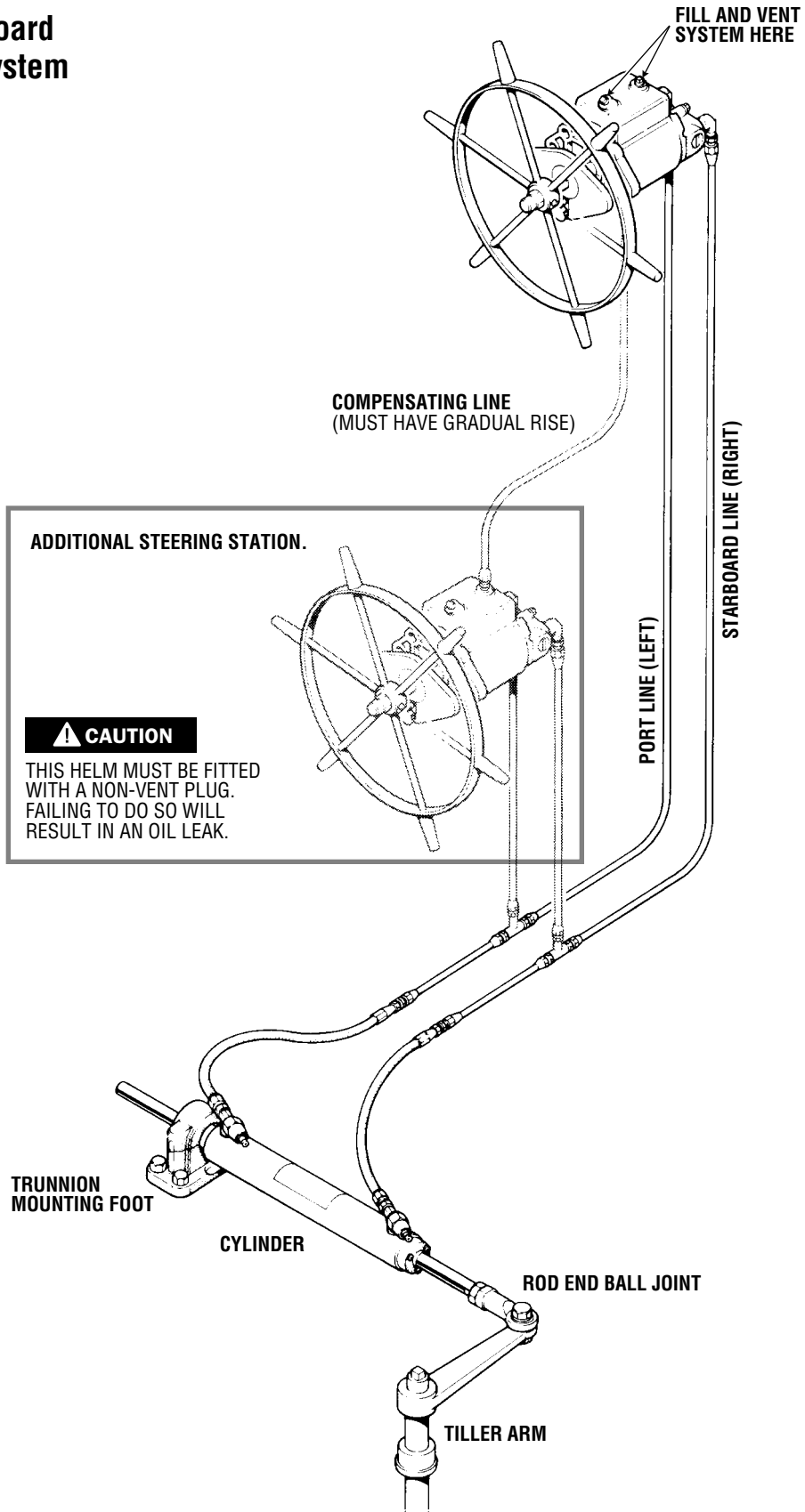
NOTICE

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

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Typical Inboard Steering System



HYDRAULIC STEERING

1250V, 1275V & 1350

Tools

You will need the following tools to complete your installation.

For 1250V & 1275V Systems:

- Helm Mounting Bolt Holes
13/32" (10mm) dia. drill
- Helm Mount Holes
2-1/8" (540mm) drill
3/4" (190mm) drill
Keyhole Saw
- 1/2"-5/8" Copper Tube Flaring Tool
- 1/2"-5/8" Copper Tube Cutter
- 1/2"-5/8" Flare Nut Wrenches

For 1350 Systems:

- Helm Mounting Bolt Holes
3/8" (10mm) dia. drill
- Helm Dashboard Hole
2-1/4" (60mm) dia. drill
- 5/8"-3/4" Copper Tube Flaring Tool
- 5/8"-3/4" Copper Tube Cutter
- 5/8"-3/4" Flare Nut Wrench

⚠ CAUTION

A high quality Teflon pipe thread sealant must be used on all pipe threads. Use Loctite P.S.T. (Pipe Sealant with Teflon) or equivalent.

Tubing & Fittings

The use of copper tubing is recommended. There is no performance substitute for rigid tubing. Flexible hose, no matter what quality, will degrade your steering systems performance to some extent. If flexible hose is required, use a hose that has a minimum 1000 PSI (70 bar) operating pressure rating, a burst pressure rating of minimum 5000 PSI and the lowest available volumetric expansion factor, such as Aeroquip No.2651 or equivalent.

Use seamless soft annealed refrigeration copper tubing, type L.

For 1250V systems use 1/2" O.D.

For 1275V systems use 5/8" O.D.

For 1350 systems use 5/8" O.D. for runs under 20 ft. (6m)

For 1350 systems use 3/4" O.D. for runs over 20 ft. (6m)

SAE 45° flare fittings should be used.

Fitting kits for 1250V & 1275V systems are available from Teleflex/Flexatrol and contain brass SAE 45° flare fittings.

HF5590 fitting kit, single station, for 1/2" copper tube.

HF5591 fitting kit, additional station.

HF5592 fitting kit, single station, for 5/8" copper tube.

HF5593 fitting kit, additional station.

Fitting kits for 1350 systems are not available from Teleflex.

Cylinder Hose Kits

Single Cylinder Installation 1250V & 1275V systems.

Two 18" (460mm) hoses are available from Teleflex. Specify part no. HA5731.

WARNING

Do not connect copper tube directly to cylinder fittings. Short sections of flexible hose are required to allow for cylinder movement when the tiller arm travels through its arc.

Twin Cylinder Installation 1250V & 1275V systems.

To handle the various mounting configurations of twin cylinders, the following cylinder hoses are available:

- HA5732, one hose, 2 feet (0.6m) long.
- HA5733, one hose, 3 feet (0.9m) long.
- HA5734, one hose, 4 feet (1.2m) long.
- HA5735, one hose, 5 feet (1.5m) long.
- HA5736, one hose, 6 feet (1.8m) long.

NOTICE

All cylinder hoses are supplied with SAE 1/2" female flare swivel nuts.

NOTICE

Twin cylinder installations require four (4) hoses for connections to port and starboard delivery lines. Refer to Hose Kit Connections, on page 6.

Twin Cylinder Installation 1350 system.

- HA0733, hose kit 7004, dual cylinder parallel mount.
- HA0734, hose kit 7005, dual cylinder in-line mount.
- HA0884, hose kit 7010, c/w 15 feet (4.5m) long hose and fittings, for parallel or in-line mount.

NOTICE

Above kits for 1350 system include manifold and fittings for connection to 5/8" copper or steel tubing.

MOUNTING THE HELM

Helms can be mounted with the helm shaft horizontal, vertical or any angle in between.

The helm pumps must always be mounted with the fill port in the uppermost position.

CAUTION

Dirt and foreign matter introduced into the steering system during installation or during the filling and purging may cause malfunction. Cleanliness is extremely important. If installation is interrupted, prevent dust and dirt entry into component fitting ports etc.

Determine desired mounting location(s) for the helm pump(s). Check for adequate space behind dash for the helm pump, fittings and line connections.

NOTICE

Provision should be made for proper filling and air removal of the system. Fill and vent plug kit part no. HA5450 will provide a through dash fill and vent capacity. Refer to Filling & Purging the system on page 13.

WARNING

Do not drill into the helm when pre-drilling holes for helm pump bezel.

Use the relevant helm mounting template for your application, drill and cut out as indicated.

Mount the helm pump, bezel and adjusting knob, as required.

Remove all red plastic shipping plugs from the helm pump.

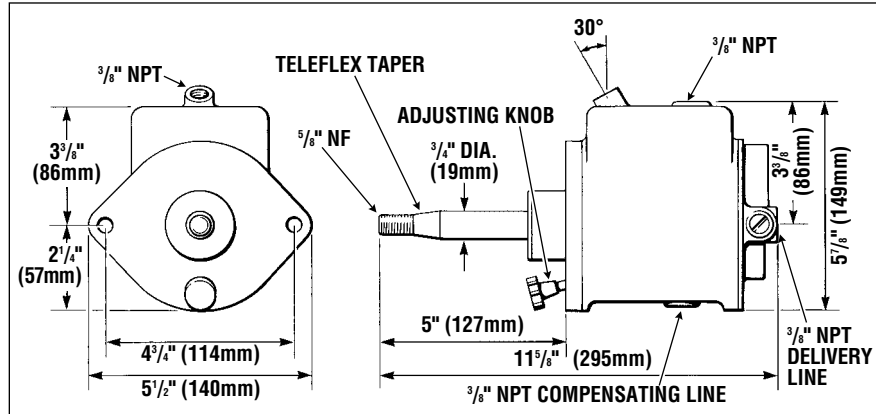
See warning on page 13.

WARNING

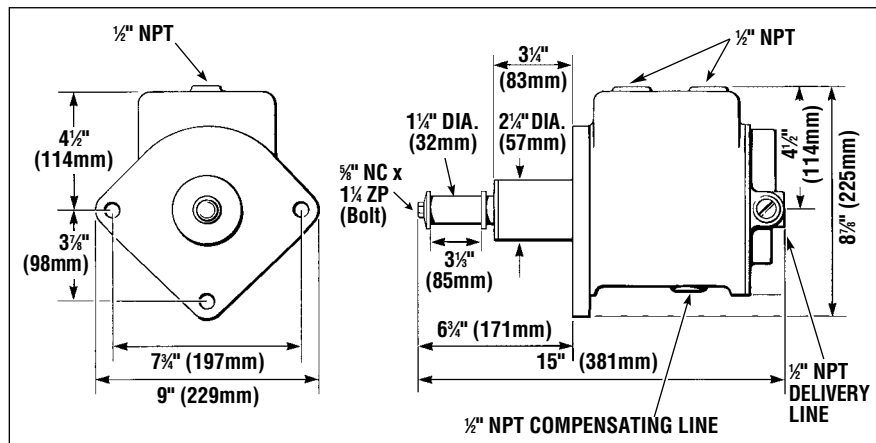
Use self-locking type fasteners only; substituting non-self locking fasteners can result in loosening or separation of equipment and loss of steering control.

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

1250V & 1275V HELM



1350 HELM



CYLINDER INSTALLATION

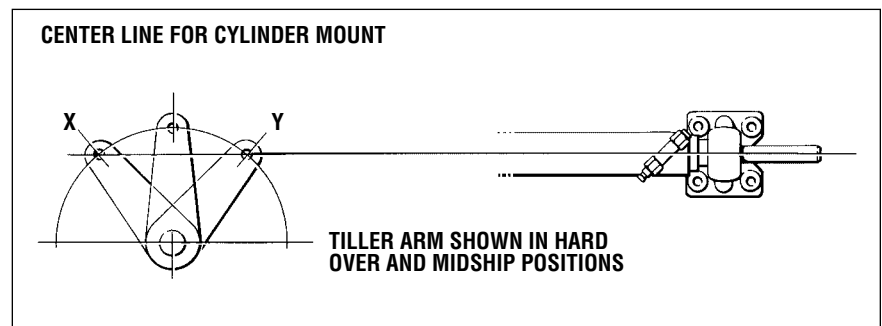
General Notes

Capilano cylinders are engineered and manufactured for heavy duty marine usage and are suitable for commercial and pleasure boat applications. Capilano cylinders are also designed to meet A.B.S., Lloyds and D.N.V. specifications.

⚠ CAUTION

Please read these instructions thoroughly before attempting installation. Teleflex Canada Limited Partnership cannot accept responsibility for installations where instructions have not been followed, where substitute parts are used, or where modifications have been made to our product.

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 the cylinder rod and maximum cylinder performance can be achieved as follows.



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.

Select the diagram and dimensional data that corresponds with your cylinder model. Note, not all possible cylinder mounting configurations are shown, however, all necessary dimensions are shown regardless of mounting configurations.

Mount the tiller arm(s) to rudder post(s). All slack or free play must be eliminated.

Connect the cylinder ball joint or clevis to the tiller arm. With the tiller arm in midship position and with the cylinder rod extended to its center position determine the anchoring position of the cylinder mounting foot. A mounting bracket may be required.

Swing rudder to ensure free movement of cylinder and tiller arm.

Refer to page 10 for 1350 cylinder diagrams.

Cylinder ports for hose connection should always be in the uppermost position. If this is absolutely not possible, cylinder should be left disconnected 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 reconnect.

⚠ WARNING

Cylinders should always be secured with through bolts, not with lag screws. Lag screws may come loose due to vibration.

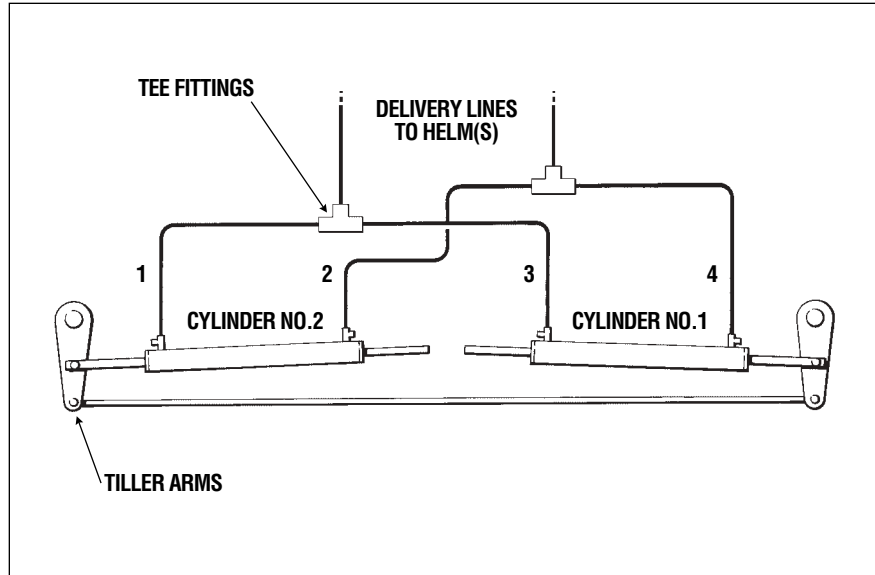
Hose Kit Connections

Refer to the following diagrams for twin cylinder hose connection.

1250V and 1275V systems hose kit connection for:
Twin cylinders. In-line and parallel mount.

⚠ 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.

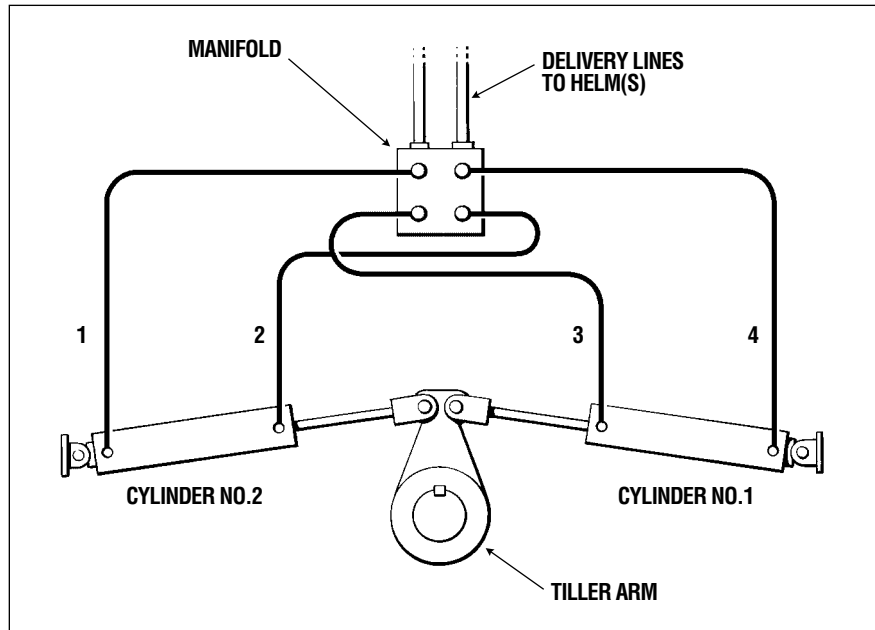


Tee fitting part numbers.

For 1/2" copper tube HF5561. For 5/8" copper tube HF5562.

1350 system hose kit connection for:

Twin cylinders. In-line and parallel mount.



Cylinder Model Information

Cylinder models with letters BA are balanced and are normally used as a single unit. (If space permits, balanced cylinders may be used in pairs as an alternative to unbalanced cylinders). The absence of the letters BA indicates that the cylinder is unbalanced and must be used in pairs only. Using a single unbalanced cylinder will result in very stiff and hard steering in one direction.

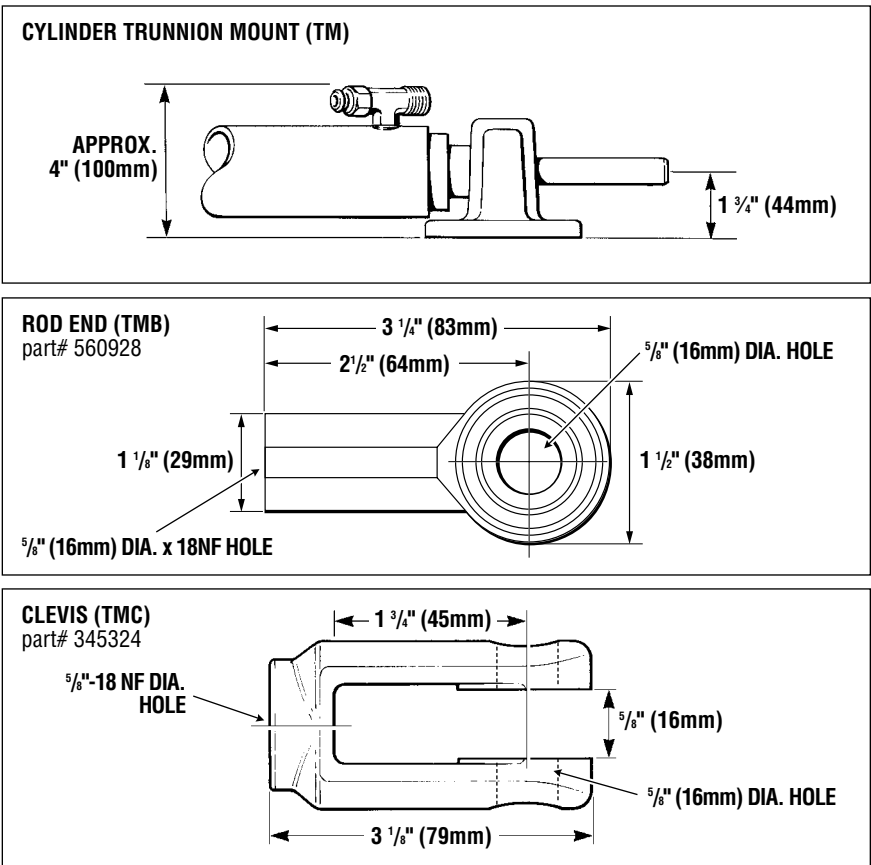
PART#	CYLINDER MODEL	CYLINDER VOLUME
HC5349.....	BA 150 - 7TM	10.2 cu. in (167 cu. cm)
HC5350.....	BA 175 - 7TM	13.7 cu. in (225 cu. cm)
HC5351.....	BA 200 - 7TM	18.9 cu. in (310 cu. cm)
HC5357.....	BA 200 - 7TM	23.0 cu. in (377 cu. cm)
HC5373.....	BA 175 - 9TM	17.7 cu. in (290 cu. cm)
* HC5373HY.....	BA 175 - 9TM	17.7 cu. in (290 cu. cm)
* HC5373HYC.....	BA 175 - 9TM (Clevis Assembly).....	17.7 cu. in (290 cu. cm)
HC5359.....	BA 200 - 11TM	29.5 cu. in (483 cu. cm)

** Supplied without fittings. Fittings must be purchased separately.*

The letters TMB indicate a trunnion mount, ball joint rod end type. This cylinder can articulate in two (2) planes (axis) to a total of 16°.

The letters TMC indicate a trunnion mount, clevis rod end type. This cylinder can articulate in one (1) plane (axis) only to 16°.

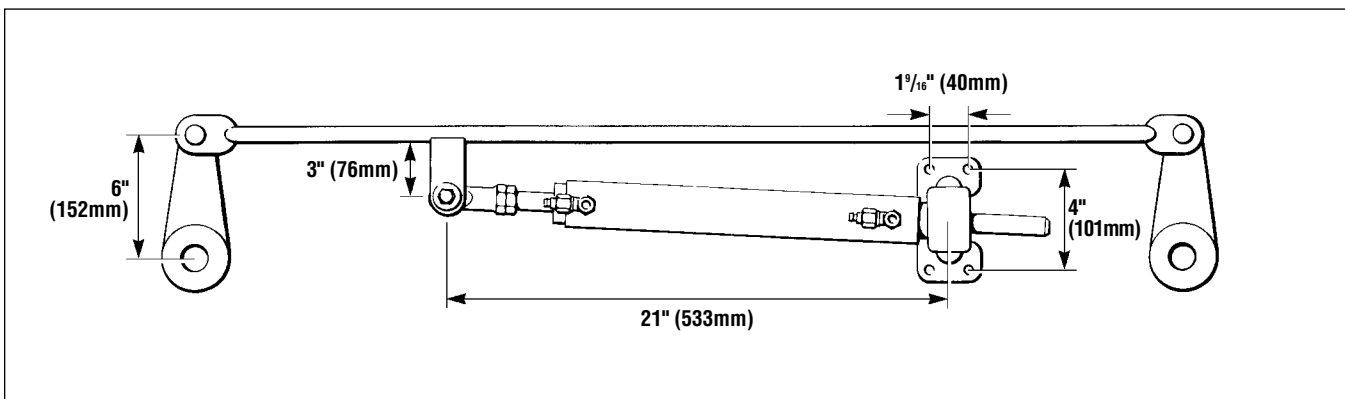
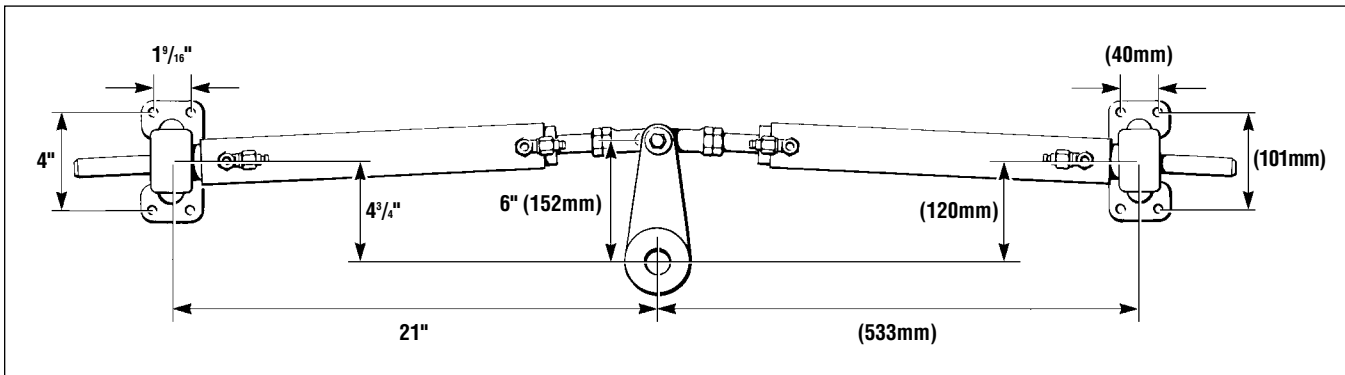
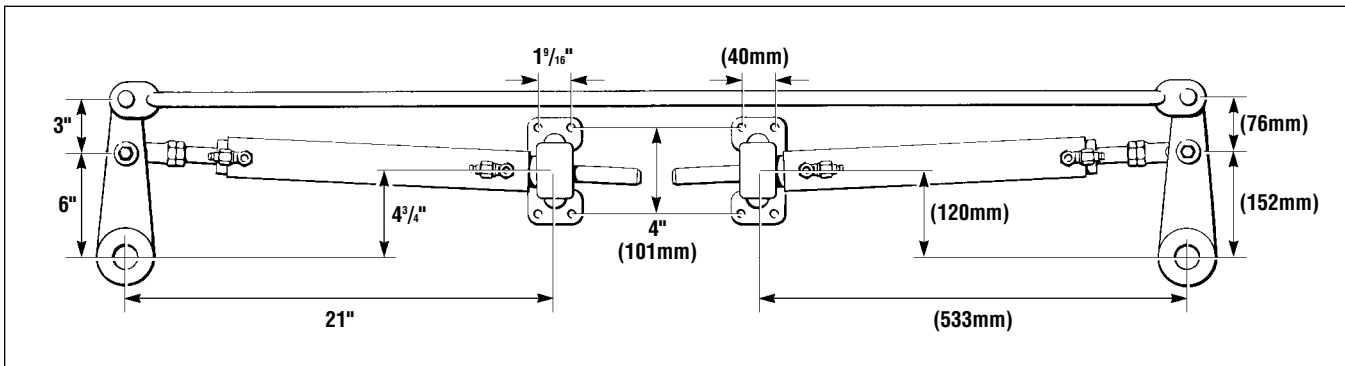
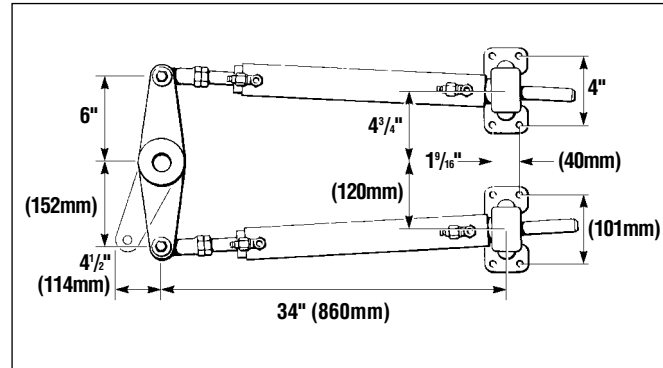
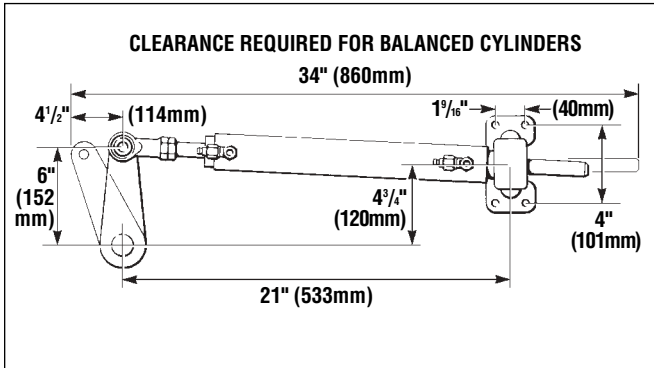
Cylinder Mounting Dimensional Data
1250V & 1275V Systems



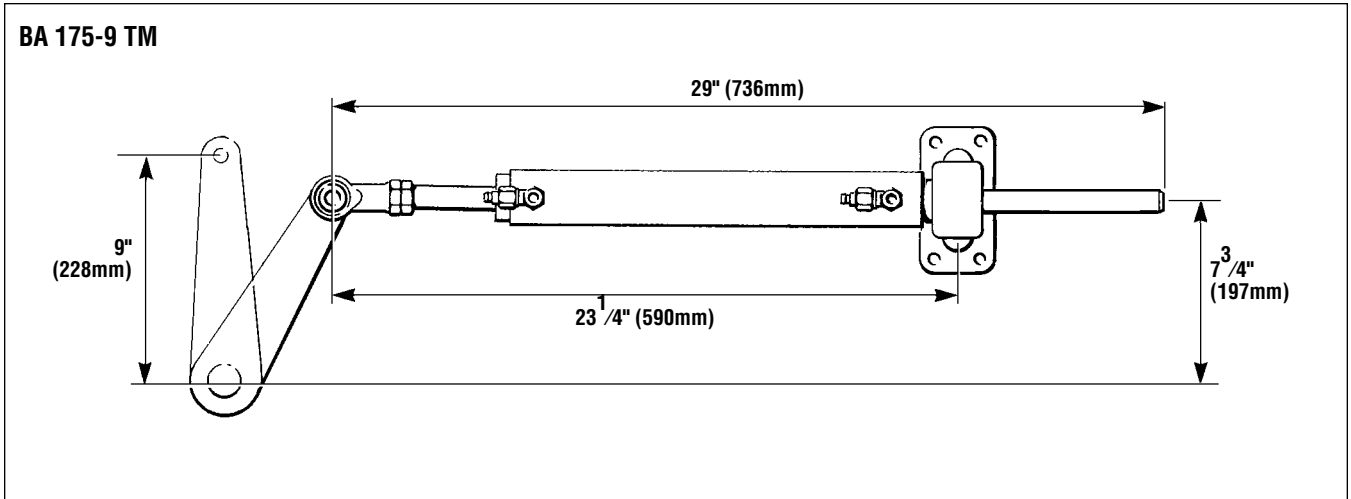
HYDRAULIC STEERING

CYLINDER INSTALLATION

7" models



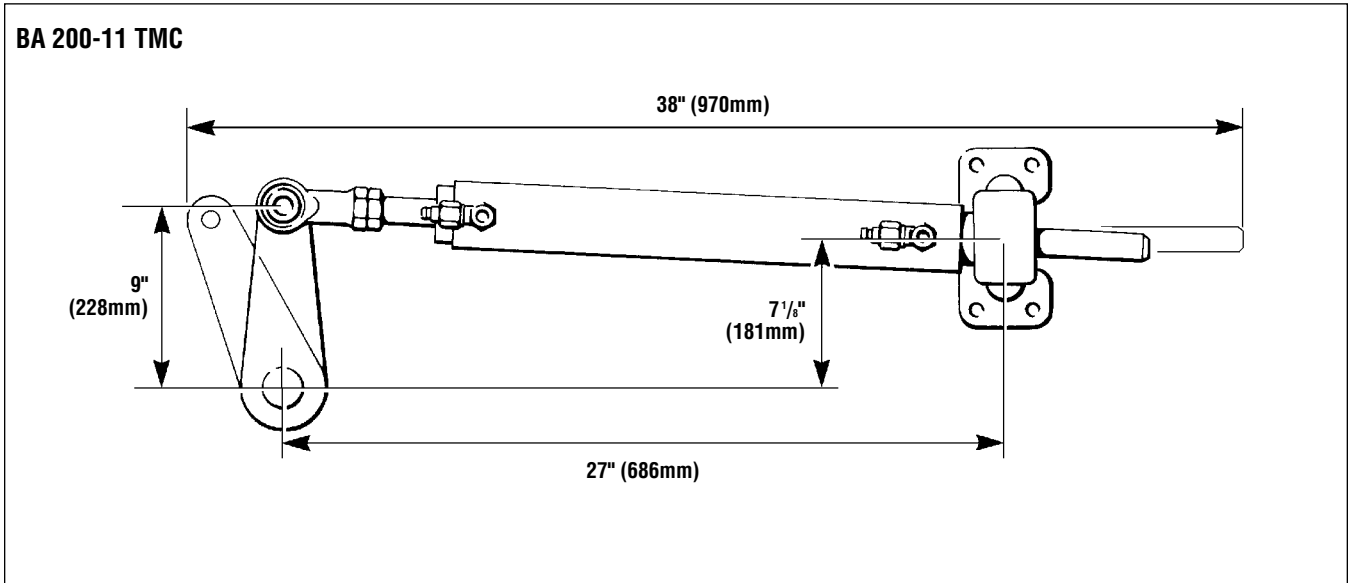
9" models



NOTICE

Fittings are NOT supplied with HC5373HY or HC5373HYC and must be purchased separately.

11" models



NOTICE

BA200-11 TMC Cylinder dimensional data is the same as BA200-7 TMC with these exceptions

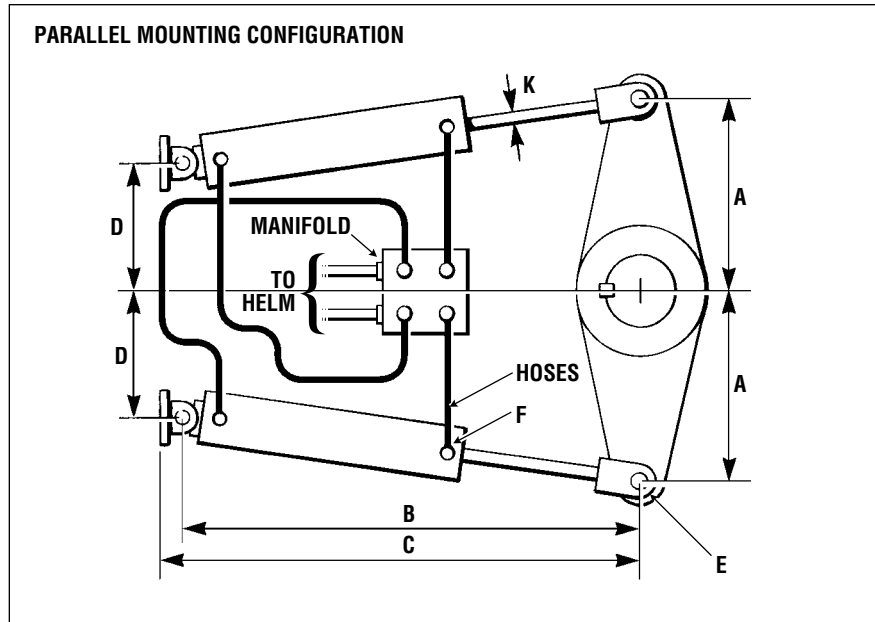
HYDRAULIC STEERING

CYLINDER INSTALLATION

Cylinder Mounting Dimensional Data 1350 Systems

Hose kit Part # HA0733

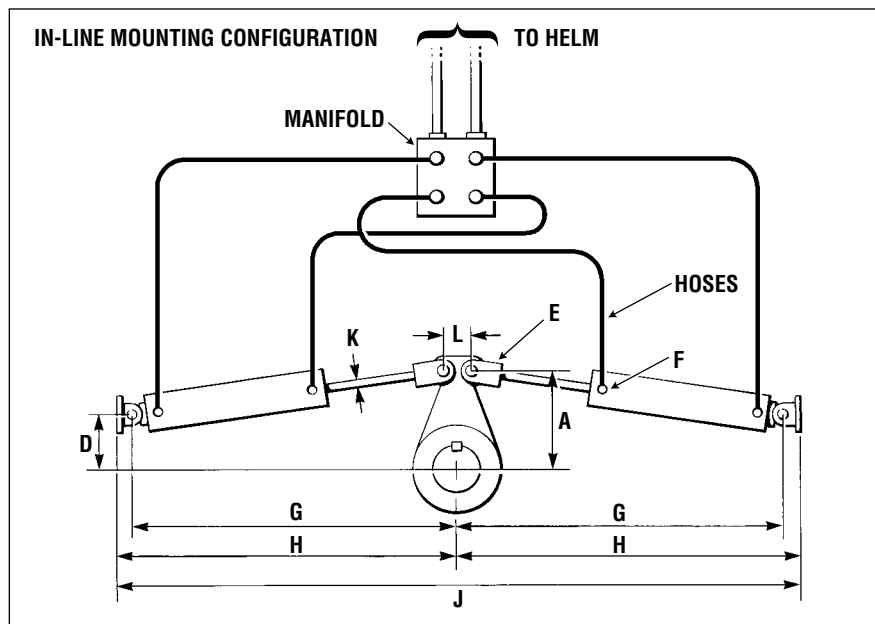
Required for parallel mount, all models.



MODEL	MAX. OUTPUT TORQUE lb. inches (Nm)	CYLINDER		TOTAL DISP. (cu. inches)	USE WITH HELM	TOTAL WHEEL TURNS	DIMENSIONS (inches)										
		BORE	STROKE				A	B	C	D	E	F	G	H	J	K	L
175-11	28,890 (3264)	1 3/4	11	45	1350	5.5	9	30	32 1/2	7 7/8	3/4	1/2 NPT TAPER	31 1/4	33 3/4	67 1/2	1	2 1/2
200-11	39,160 (4425)	2	11	61	1350	7.5	9	30	32 1/2	7 7/8	3/4	1/2 NPT TAPER	31 1/4	33 3/4	67 1/2	1	2 1/2
225-11	52,000 (5875)	2 1/4	11	81	1350	10	9	30 1/4	32 3/4	7 7/8	1	1/2 NPT TAPER	31 1/2	34	68	1	2 1/2
250-11	62,900 (7107)	2 1/2	11	98	1350	12	9	30 1/4	32 3/4	7 7/8	1	1/2 NPT TAPER	31 1/2	34	68	1 1/4	2 1/2

Hose kit Part # HA0734

Required for in-line mount, all models.



TUBING INSTALLATION

Route the tubing so that it will not interfere with hatch ways or other functional equipment.

Do not allow tubing to kink or collapse while routing through vessel. Any piece of tubing that has collapsed must be replaced.

In multi steering station systems helm pump reservoirs must be connected via a compensating line. The compensating line must run from the top of the lowest helm, to the bottom of the next highest helm, etc.

The purpose of the compensating line is to prevent an air lock in lower station helms and to supply oil to lower station helms. Compensating lines must be installed with a continuous rise to enable air to rise from a lower helm up to a higher helm and to allow oil to run from a higher helm down to a lower helm.

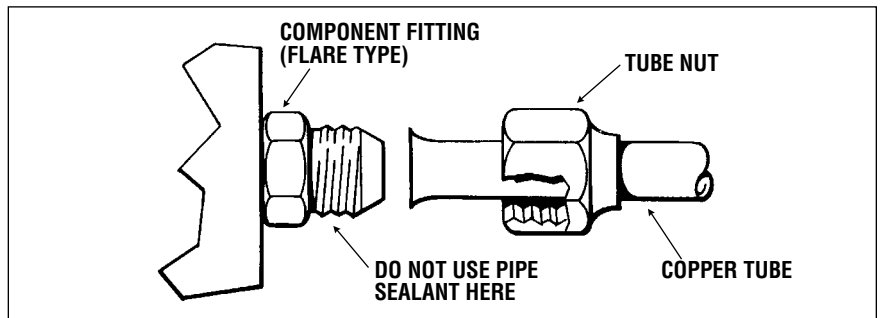
NOTICE

If a compensating line cannot be installed with a continuous rise, provision must be made at the lower helm(s) to allow periodic air bleeding during filling and purging. This can be accomplished by installing a tee fitting on top of the lower station helm pump. Connect the compensating line to one end and an automotive type petcock valve to the branch end of the tee fitting. (See page 16.)

NOTICE

The compensating line is not subjected to steering load pressures. Any oil resistant type hose-tubing will do. The inside diameter of the compensating line should be close to that of the system tubing, to facilitate oil flow during filling and purging.

Copper Tube (flare fitting)



Slide tube nut over tubing.

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

Steering Wheel Size Recommendations

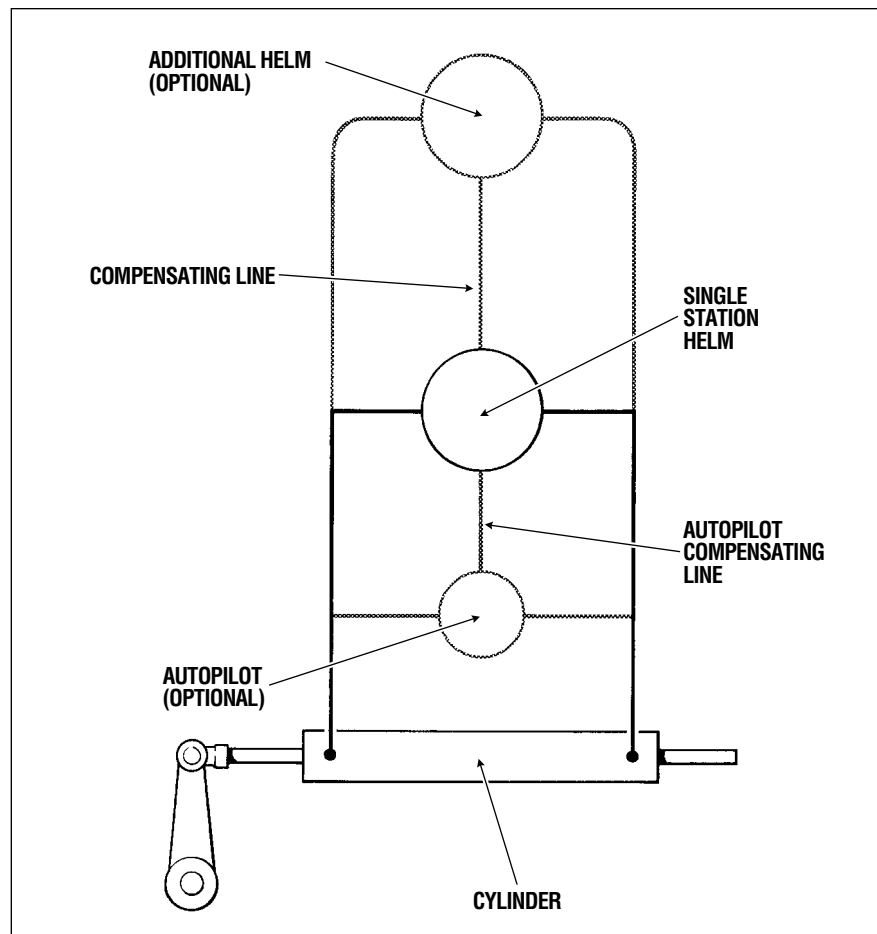
1250V	Min. Dia. 20" (500mm)	Max. Dia. 36" (914mm)
1275V	Min. Dia. 26" (660mm)	Max. Dia. 36" (914mm)
1350	Min. Dia. 30" (760mm)	Max. Dia. 48" (1220mm)

SYSTEM CONNECTION

Refer to system diagrams below and page 1 for general connection of tubing and components.

A quality teflon thread sealer, such as Loctite P.S.T. or equivalent should be used on all pipe threads. Failing to do so could result in leaks. **Do not use tape type thread sealers.**

An autopilot compensating line may be teed into an existing compensating line between two helms or directly into a bottom return helm port.



NOTICE

Refer to page 16 for alternative hydraulic line plumbing, that significantly aids in air removal during the filling and purging procedure for twin steering station systems.

FILLING AND PURGING THE SYSTEM

Read First

1250V, 1275V systems are designed to operate with ATF, automatic transmission fluid type A or Dextron II or III as used in automobiles. 1350 systems are designed to operate with SAE 10 turbine oil.

NOTICE

1350 cylinders are not fitted with bleed fittings. In order to simplify filling and purging, it is recommended that tee fittings complete with bleed-off device (such as a simple ball valve) are installed.

⚠ WARNING

Before proceeding, ensure that all plastic shipping plugs in the helm pump(s) have been replaced with steel or brass pipe plugs. plastic shipping plugs will deteriorate over time.

The filling and purging procedure is best accomplished by two people. One person to fill the steering system and one person to open and close the bleed fittings on the cylinder(s), as required.

During the entire filling and purging procedure, the fill and vent helm (upper helm in multi station systems) must always be full of oil. If the oil level inside the helm is too low, air will automatically be reintroduced into the steering system. This will needlessly prolong the filling procedure.

⚠ CAUTION

On occasion, air purged out of the system may cause a sudden rise or spurting of oil. A funnel or filling container will prevent spillage of oil.

The female thread of the filler-vent plug kit is $\frac{1}{4}$ " NPT (national pipe thread).

Connect a large funnel or filling container to the filler-vent fitting as illustrated on page 14. SeaStar filler kit part # HA5438 may also be used. It is a short piece of vinyl tube with a $\frac{1}{4}$ " NPT male fitting on one end, and a bottle cap that will accept the threaded bottle spout of the plastic type ATF Dextron II automatic transmission fluid bottles. (North America only.)

To fill and purge the system proceed as follows:

Step 1

Fill the helm pump with oil (upper helm on multi station systems). As the system fills with oil and air bubbles rise up into the funnel or filling container add more oil as required.

NOTICE

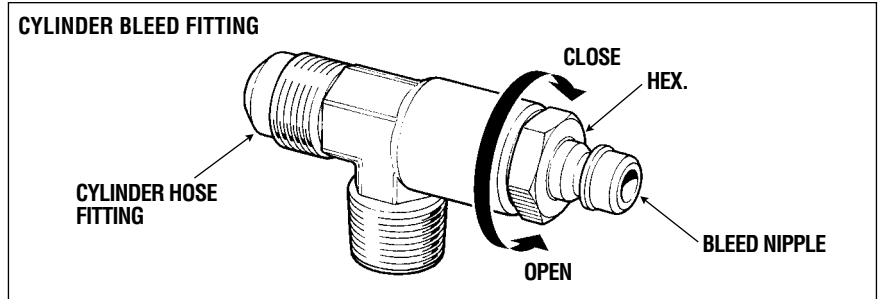
Each helm pump reservoir has an approximate oil capacity of $\frac{3}{4}$ of a quart (0.75 liters).

Slide vinyl bleed tubes onto cylinder bleed fitting nipples and place other end of bleed tube into container. Container should be large enough to hold at least one gallon (4 liters).

Now open starboard bleed fitting nipple by turning bleed nipple by turning hex. $1 \frac{1}{2}$ turns counter clockwise.

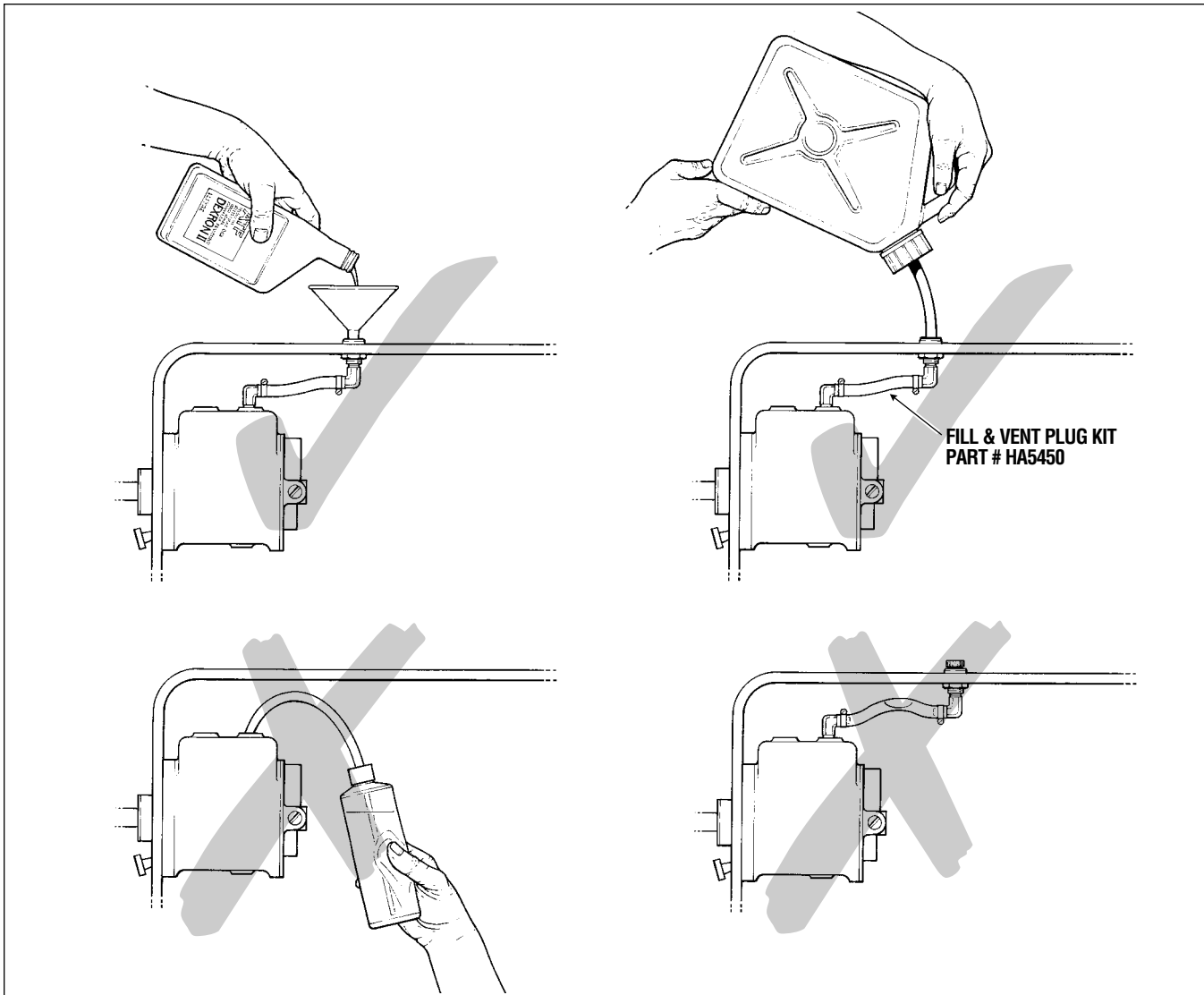
⚠ CAUTION

Before proceeding, make certain that 1250V & 1275V helm pumps are set at their highest displacement. Adjusting knob below helm pump steering wheel shaft must be turned clockwise as far as it will go.



HYDRAULIC STEERING

FILLING & PURGING



Step 2

Turn the steering wheel at upper station helm to starboard (right) until a steady stream of oil comes out of the starboard bleed tube. Then turn the steering wheel to port (left) until a steady stream of oil comes out of the port bleed tube.

For single station steering systems proceed to step 3.

For multi station steering systems repeat step 2 at the next lower helm and again at the lowest helm, if more than two helm stations are installed. An autopilot must also be considered as a steering station. The autopilot hydraulic power pump must be turned on to pump oil out of the cylinder bleed fittings in the correct sequence, depending on where the autopilot power pump is connected into the steering system.

Step 3

Close cylinder bleed fitting nipples by turning bleed nipple hex. clockwise. See diagram on page 13.

Step 4

Starting at the upper steering station turn the steering wheel to hard over starboard (right). With as much force as possible, continue to turn the wheel to starboard and leave it in this position for one minute.

NOTICE

If pressure build up exceeds 1,000 PSI (70 Bar), the steering wheel will slip due to opening of the pressure relief valve. This will not harm the helm pump.

When the steering wheel is forced into the hard over position, air bubbles will once again rise up into the filling container.

Now force the steering wheel hard over to port (left) and leave in this position for one minute.

Alternating between port and starboard, repeat this procedure about 6 to 10 times at the upper station helm.

Step 5

Repeat step 4 at each at each additional helm in multi station steering systems.

Step 6

Check the steering system for complete air removal by forcing the steering wheel into both hard over positions at the upper steering station. If there is no noticeable drop and rise of the oil in the filling container, the steering system is correctly filled and purged. A noticeable drop and rise of the oil level indicates that air is still present in the system. If so repeat steps 4, 5 and 6.

⚠ CAUTION

Do not re-use oil that has been circulated through the system unless it has been properly filtered. Automotive type gasoline, oil type fine mesh funnel filters are acceptable to filter the oil.

Oil Level Setting and System Check

To set the correct oil level in the fill and vent fitting proceed as follows:

- Open starboard bleed nipple on cylinder fitting (only open one on twin cylinder installations).
- Turn steering wheel to starboard until oil level from filling container has reached the fill and vent fitting.
- Now continue to turn the steering wheel to starboard $1\frac{1}{2}$ turns for 1250V helm, 1 turn for 1275V helm and $\frac{1}{4}$ turn for 1350 helm.
- Close starboard bleed fitting.

This procedure will provide for sufficient air space to accommodate fluid expansion.

At this time the steering system should be checked for correct connection of hose, tube and fittings, and possible leaks. To do so, turn steering wheel (any one on multi steering station systems) and pressurize very hard to port. Apply enough force to the wheel to exceed pressure relief valve pressure. You will not harm the helm or system. While pressure is maintained on the steering wheel, check all port (left) fittings and line connections. Repeat procedure by turning wheel to starboard.

If no leaks are obvious, your steering system is ready for use.

⚠ WARNING

If leaks are found, correct before using. Failure to correct a leak can lower the oil level in the system and result in loss of steering

HYDRAULIC STEERING

FILLING & PURGING

Filling & purging improvement for twin station 1250V, 1275 and 1350 hydraulic steering systems

⚠ WARNING

For normal steering bleed valve must be in "CLOSED" position.

Removing the air from the lower helm station reservoir and a non gradual rise compensating line is the most difficult and time consuming part of the purging and filling procedure!

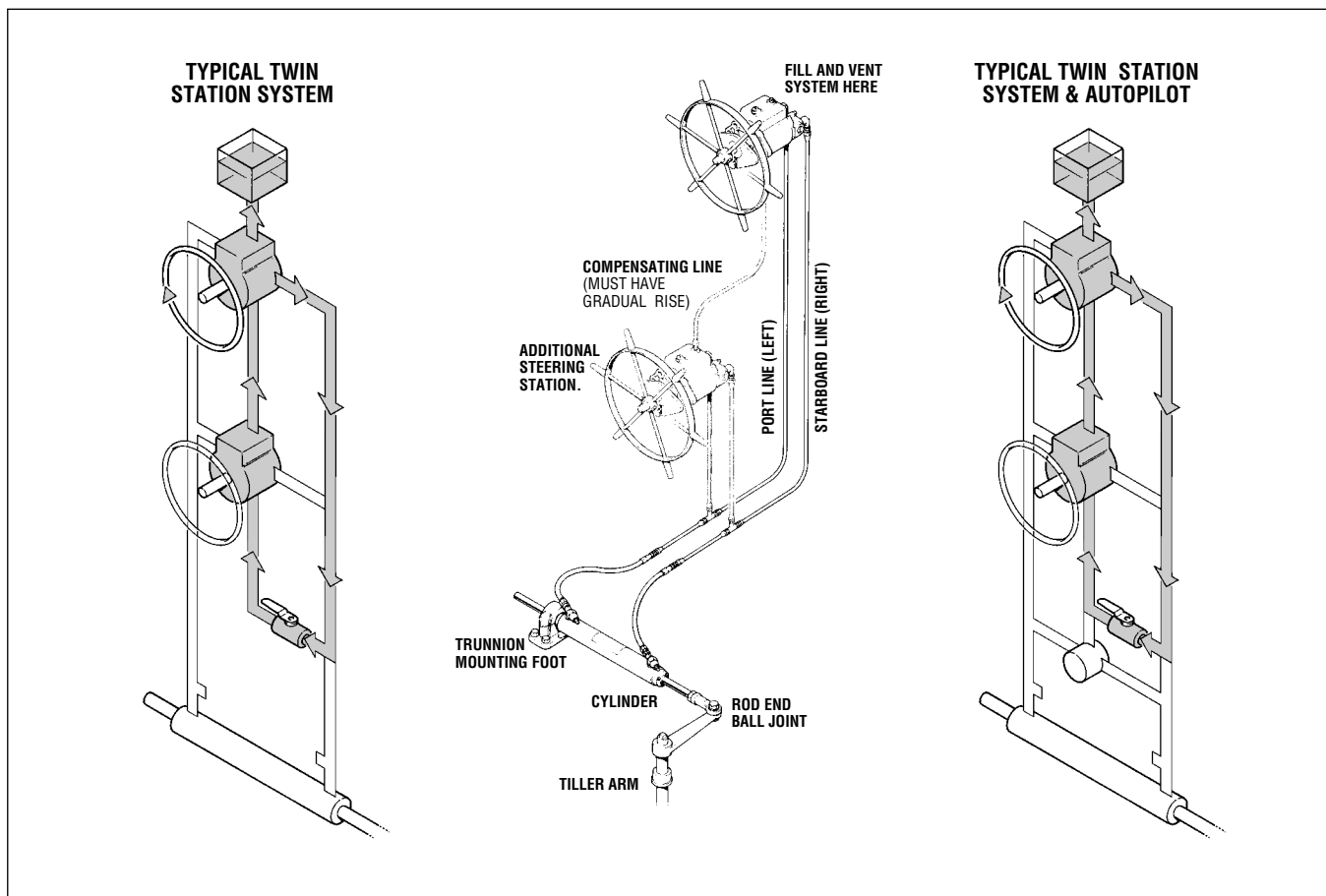
The installation of a ball type bleed valve, as shown below, will aid in the removal of trapped air, quickly and efficiently.

With the valve in the "**OPEN**" position, turning the wheel clockwise at the upper station helm (as shown below) will cause oil to push all trapped air up and into the filling container. A permanently installed valve will simplify servicing the system in the future.

The part # for the Teleflex bleed valve is HA5404.

For reasons of liability, ball bleed valves are supplied with a non-permanently attached handle which must be removed to prevent accidental opening during steering system use.

Instructions are supplied with each kit.



MAINTENANCE

Maintenance requirements will vary with usage and climate.

Inspection by a qualified marine mechanic is required:

- A** A minimum of two times a year.
- B** At the first sign or indication that the steering system is not operating normally or correctly.
- 1** Check the oil level in the helm pump. This should always be within $\frac{1}{2}$ " of the bottom of the filler hole.
- 2** Check mechanical linkages and connections. Tighten loose parts and replace badly worn parts.
- 3** Check for leaks. See page 15 for how to check for leaks.
- 4** Check hoses for chafing/rubbing marks, and replace if required.
- 5** Check cylinder shaft for nicks and scratches. A damaged cylinder shaft can cause seal failure and leaks. Replacing seals to a damaged cylinder shaft will not stop leaks. A damaged cylinder shaft must be replaced immediately.

WARNING

Failure to comply with maintenance checks may result in loss of steering, causing property damage and/or personal injury.

Seal Kits for Worn Seals

Seal kits are available for the replacement of worn seals such as helm pump and cylinder shaft seals.

Description	Part #
1250V and 1275V helm pump seal kit.	HS5161
1350 helm pump seal kit.	HS5171
Cylinder models 150-7 type seal kit.....	HS5182
Cylinder models 175-7 type seal kit.....	HS5183
Cylinder models 175-9 type seal kit.....	HS5183
Cylinder models 200-7 type seal kit.....	HS5184
Cylinder models 200-11 type* seal kit.....	HS5185

*Seal kit usable on cylinder model BA 200-11 TMC only.

For individual shaft seals only.

Description	Part #
1250V and 1275V helm pump shaft seal.	010322
1350 helm pump shaft seal.	210428
Cylinder models 150 shaft seal.....	007320
Cylinder models 175 shaft seal.....	010322
Cylinder models 200 shaft seal.....	010322

TROUBLE SHOOTING GUIDE

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

Capilano 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 below, are the most common faults encountered and their likely cause and solution. The term "Rudder" also applies to stern drives, when applicable.

Sometimes when returning the wheel from a hardover 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.

WARNING

Whenever in the following text, 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.

FAULT	CAUSE	SOLUTION
1. During Filling, the helm becomes completely jammed.	Blockage in the line between the helm(s) and the cylinder(s).	Make certain that hose 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.
2. System is very difficult to fill. Air keeps burping out top of helm even after system appears full.	Cylinder(s) has been mounted upside down. This causes air to be trapped in the cylinder(s). Air in system.	Mount cylinder(s) correctly, according to cylinder installation instruction. Ports should always be kept in uppermost position. Review filling instructions.
3. Steering is stiff and hard to turn, even when the vessel is not moving.	Knurled adjusting nut on tilt tube over tightened. Restrictions in hose, piping or fittings.	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: A kinked hose will cause restriction.

FAULT**CAUSE****SOLUTION****3. Continued**

Cylinder interfering with engine cowling.
Air in oil.

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).

Loose adjusting nut.

See filling instructions supplied with helm units.

Drain system and fill with recommended oils.

4. One helm unit in system is very bumpy and requires too many turns from hardover to hardover.

Dirt in inlet check of helm pump.

Dismantle helm pump and remove contaminant from make-up checks.

5. Steering is easy to turn at the dock, but becomes hard to turn when vessel is underway.

Steering wheel is too small.

Fit larger wheel if possible, see installation instructions. If the problem cannot be rectified by the above mentioned solution, proceed with next cause and solution or consult factory.

Cylinder(s) too small.

Replace with larger cylinder(s).

Incorrect setting of trim tab(s) on stern drive.

Adjust tab(s).

Incorrectly designed or adjusted rudders, causing binding on rudder post and/or tie bar at cruising speeds.

Seek professional help. Have competent, qualified marine mechanic correct problem.

6. Rudder drifts to port or starboard while vessel is underway, even when wheel is not being turned.

Dirt in check valves.

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.

7. Turning one wheel causes second steering wheel to rotate.

See fault No. 6.

See fault No. 6.

8. Seals will sometimes leak if steering system is not vented at uppermost helm.

The Capilano helm has a field replaceable wheel shaft seal which can readily be replaced by removing the steering wheel and seal cover held in place by three small screws. Quad ring no. 210 is found in Capilano helm seal kit HS5151.

NOTE: Seal kits are available for SeaStar cylinders, however, these must only be used by a qualified marine mechanic.

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

	1250V	1275V	1350
DISPLACEMENT	1.7 cu.in. – 3.4 cu.in. (27.8 cc – 55.7cc)	2.7 cu.in. – 5.4 cu.in. (44.2 cc – 88.4cc)	8 cu.in. (131 cc)
RELIEF VALVE	1000 PSI – (70 Bar)	1000 PSI – (70 Bar)	1000 PSI – (70 Bar)
PORTS	3/8" NPT	3/8" NPT	1/2" NPT

Helm Pump Shaft

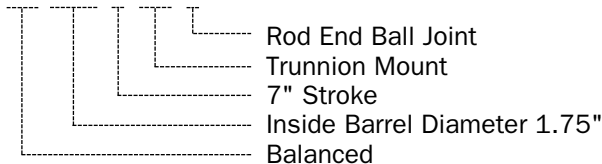
1250V & 1275V	1350
3/4" Standard Taper	1-1/4" (317mm) Dia. Straight
1" Per Ft. 5/8" NF Threads	3/16" Key
3/16" Key	

Cylinder Model Specification

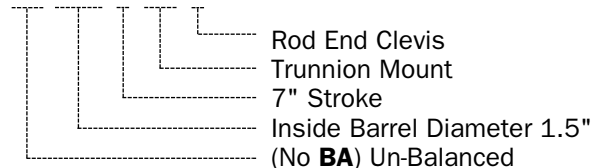
Refer to page 10 for 1350 cylinder specifications.

CYLINDER MODEL	STROKE	VOLUME	TORQUE @ 1000 PSI – 70 BAR @ 35°
BA 150-7 models	7" – 178 mm	10.2 cu.in. (167cc)	7117 in/lbs (81 Kg)
BA 175-7 models	7" – 178 mm	13.7 cu.in. (225cc)	9569 in/lbs (110 Kg)
BA 175-9 models	9" – 229 mm	17.7 cu.in. (290cc)	12600 in/lbs (145 Kg)
BA 200-7 models	7" – 178 mm	18.9 cu.in. (310cc)	13200 in/lbs (151 Kg)
BA 200-11 models	11" – 279 mm	29.7 cu.in. (486cc)	19900 in/lbs (228 Kg)
2X 150-7 models	7" – 178 mm	23.0 cu.in. (377cc)	15800 in/lbs (181 Kg)
2X 175-7 models	7" – 178 mm	31.0 cu.in. (508cc)	21400 in/lbs (245 Kg)
2X 200-7 models	7" – 178 mm	41.0 cu.in. (6720cc)	28700 in/lbs (329 Kg)

BA 175-7 TM B



150-7 TM C



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 Limited Partnership
c/o Panalpina
#8 – 14th Street
Blaine, WA 98230

From Canada

RGA # ?

Teleflex Canada Limited Partnership
3831 No.6 Road
Richmond, B.C.
Canada V6V 1P6