

# INSTALLATION MANUAL STERN TUBE TYPE ST SERIES SHAFT SYSTEMS



# STERN TUBE (ST) SERIES SEATORQUE SHAFT SYSTEM General Installation

# **INTRODUCTION**

This Manual covers the "ST" series of shaft system. ST stands for Stern-tube and is designed to fit vessels that exit the shafts through a hull tube or in a full length (Deadwood) Keel installation.

The manual is provided as a step by step procedure for the correct method of installation, the assumption is made that the thrust bulkhead and stern tube structure is already in place as per the supplied engineering drawings for the system ordered and therefore only addresses the system installation.

## Deadwood Keel/Stern Tube Installation





ST System in Engine Room Showing Thrust and Isolator Housing Assemblies, Cardan Shaft, Transmission Adapter and Oil Tank System

# Seat@rque

## INSTALLATION MANUAL CONTINUED

# ST - SERIES SHAFT SYSTEM

# SECTION 1

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Specification Reference Sheets

Please take the time to read this manual thoroughly before attempting any work on the shaft system. Do not change the recommended order of installation as certain components may only be successfully installed in the manner described.

## INSTALLATION MANUAL CONTINUED

# Section 2. <u>APPROACHES TO INSTALLATION</u>

**NOTE:** Dirt is the enemy of a reliable machine, practice cleanliness at all times, keep all components stored in clean areas, sealed bags or wrapped in clean protective material prior to and during installation. Keep all components in heat shrink packaging until ready to install. Examine each component for dirt contamination prior to installation, clean before installation as needed.

# WHAT YOU WILL NEED TO BEGIN INSTALLATION.

# Please make sure you have the following items prior to the installation of your system to ensure a smooth process.

- 1) Seatorque Shaft System Installation Manual.
- 2) Engineering Drawings prepared by Seatorque for the Specific Vessel and shaft system (to verify measurements and placements).
- 3) Seatorque supplied bolting pattern drawing template.
- 4) For aligning the strut to the shaft line, a suitable Length of Schedule 40 Aluminum or PVC pipe, equal to the diameter of the shaft casing of the system being installed. (this should become a permanent installation fixture for future use).
- 5) Torque Wrench see attached fastener application/tool requirement guide for size.
- 6) Allen Wrenches– see attached fastener application/tool requirement guide for size.
- 7) Socket set, Open/Ring or Combination Wrenches/spanners assorted Metric and Imperial Sizes.
- 8) Straight edge & set square to Check Alignment of U-Joints and Strut.
- 9) Loctite<sup>TM</sup> RED # 271 or BLUE #2701 or equivalent for Propeller Seal Carrier Bolts.
- 10) 3M- 5200<sup>™</sup> Regular Cure Urethane Marine Adhesive Sealant for Isolator Mounting and Strut/stern tube Injection. (See Footnote).
- 11) SCS Full Synthetic Gear Oil 75w-90, API-GL5. OR Optional SCS SAE 150 Fully Biodegradable, Eco-friendly Shaft lubricant (Shipped with system).

## Footnote:

3M-5200 Fast Cure #06520 Polyurethane Marine Adhesive is specified because it attains a 60 Shore A Durometer when cured which closely matches the performance of the main shaft isolators and can support the weight of the system. Do not substitute for other brands or faster cure versions as this degrades the cured Durometer rating to approximately half. (Please Refer to the "Use of 5200" Page at the back of this manual).

## INSTALLATION MANUAL CONTINUED

## Section 3. <u>COMPONENT ASSEMBLY IDENTIFICATION</u>

The SEATORQUE shaft system is composed of pre-assembled components. These assemblies are designed to make the installation of the system as simple and straight forward as possible, do not try to open any assembly unless instructed to do so within this manual. To preserve the Factory Warranty these components are sealed ready for installation to the vessel. To ensure a successful installation, please take care to install these components in the order outlined in this manual.



## INSTALLATION MANUAL CONTINUED

# Section 4. - STRUT (BRACKET) PRE-INSTALLATION AND ALIGNMEMNT.

In all cases where a strut is used aft of the hull stern tube, the strut should be pre-set prior to system installation. Again it is assumed in this manual that all mounting preparation work has already been undertaken and that the thrust bulkhead and Stern Tube have already been prepared for system installation. It should be noted that traditional methods of identifying shaft Center Line is not necessary for the simple installation of a Seatorque shaft system.

Ensure that <sup>1</sup>/<sub>4</sub> inch (6mm) injection holes are drilled in both sides of the strut barrel or stern tube on centerline on center with the strut barrel or within 3 inches of the end of the stern tube or in accordance with the SCS supplied installation drawings.



The tool used to align the strut is a length of Schedule 40 pipe the same size as the casing of the shaft system being installed and long enough to span through the strut barrel and through the Stern tube past the face of the Thrust Bulkhead. (Please refer to the Shaft & Casing specification page for the relevant ANSI pipe size used for each system).

Place strut in position on hull, insert one bolt on each side of strut palm to attach strut loosely to hull. Slide the section of pipe through the strut barrel and complete length of the Stern tube. Referring to illustration of **"proper strut alignment"**, note that the objective is to make the pipe lie flat along the bottom surface of the strut barrel and be parallel with the hull stern tube. Verify that the pipe is perpendicular (90 degrees) to the thrust bulkhead face in both the horizontal and vertical plane with a suitable square. Install the 4 set screws (if fitted) in the threaded holes of the strut palm to allow the strut to be fine adjusted and permanently positioned without losing shaft alignment.

Remove pipe from strut, lower strut from hull and apply bedding compound as per normal mounting practice and re-install strut to hull. Insert all bolts up through strut and through hull structure. Snug bolts until 4 set screws contact the mounting surface. Slide alignment pipe back into position and final check alignments, make any final adjustments necessary to achieve the correct parameters.

Remove alignment pipe and allow strut to set permanently. Clean up bedding around strut palm and once set, remove the 4 set screws. Fair strut palm to hull, providing that all conditions in "strut alignment drawing" have been met, the strut is now successfully installed.

## INSTALLATION MANUAL CONTINUED

# Section 5. – PREPARATION OF THE SYSTEM FOR INSTALLATION

All Seatorque shaft systems are delivered "dry" assembled as a unit. After removal of the system from the shipping crate, certain pre-assembled components must be removed. These are described step by step below. Remove all hardware boxes; they are individually identified, the contents being outlined on the master packing list included with each shipment. Please verify that components and all hardware are complete as listed, also please note carefully if any component is back-ordered which might affect scheduled installation of the system.

All systems are now delivered with all O-ring seals in place ready for installation, spare O-rings are packed in the shipment incase of any damage.

- 1) Remove the protective shrink plastic from thrust bearing end of the shaft system taking care not to damage the cosmetic finish of the housing surface.
- 2) Make sure that at the propeller end of the shaft is secured and cannot slide out of the casing. The shaft and casing is assembled in a dirt free environment and it is important that the shaft remains inside the casing during installation. Should it be necessary to remove the shaft for any reason, care must be exercised to keep the components free from contamination, dust or debris before reassembly.



3) Remove the Bolt CCW in the center of the shaft coupling.



4) Remove the coupling from the splined shaft end, place in a <u>clean</u> area and cover ready for re-installation.



- 5) Remove all nuts & washers holding the thrust housing to the Isolator Housing Mounting Flange and pull the thrust housing off the end of the splined shaft. Wrap the housing in a protective cover and place in a clean area until required, precision roller bearings are located inside the housing and therefore attention to cleanliness is imperative.
- 6) Unthread and remove the Isolator Housing assembly completely from the shaft casing. (Please note that this is a factory assembled unit, under compression and therefore sealed for safety. No attempt should be made to take this unit apart).

## INSTALLATION MANUAL CONTINUED

# Section 6. STEP BY STEP INSTALLATION OF SYSTEM

1) Slide the casing and shaft assembly through the pre-installed strut/bracket and through the stern tube until the propeller housing contacts the aft end of the strut/bracket barrel.

NOTE: The following steps are done from inside the engine room of the vessel.

2) Inside the boat, if the SCS installation drawing has been followed, the threaded end of the casing will have passed through the bulkhead approximately 2 <sup>1</sup>/<sub>2</sub> inches.



3) Apply 3M-5200<sup>™</sup> Standard Cure Urethane Marine Adhesive to casing threads on the splined end of the shaft/casing assembly. Spread the 5200 evenly over the surface of the threads completely through 360 Degrees.

Note: Casing has a machined nose with flat face finish designed to

mate with a seat in the isolator Housing providing a positive seal when tightened, an O-ring is also included to ensure a permanent seal.

The 5200 is necessary to seal threads against water intrusion and possible crevice corrosion.





4) Thread Isolator housing onto casing CW until it bottoms out against the casing seat and tighten as hard as possible.

**Note:** Do not remove 5200 bead that will appear at the back of the housing, this will ensure a positive seal with the threads against water intrusion and possible corrosion.

5) Apply a thick continuous bead of 3M-5200<sup>TM</sup> Urethane Marine Adhesive to the face of the Isolator Housing as well as the Thrust Bulkhead around the perimeter of the mounting flange and around the center hole as well as each of the mounting bolt holes. Note: This is the main sealing point of the system to the hull, if not bedded sufficiently, the installation will leak water.



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#### INSTALLATION MANUAL CONTINUED

## Section 6. Continued

6) Slide the system back until the mounting flange is close to the thrust bulkhead. Lift the system to center it and align the mounting bolt holes to the pre-drilled holes in the thrust bulkhead. With the flat surface of the mounting flange level horizontally, slide the system all the way back against the Thrust Bulkhead. Install the mounting bolts through the thrust bulkhead and install oversize (fender) washers, split washers and nuts (not supplied). Torque bolts tightly. Clean up excess bedding. Note: If a tapping plate is used instead of through bolting, the tapping plate thickness should be two times the diameter of the mounting bolts to achieve maximum thread strength.



7) <u>Check point:</u> Verify that the Thrust Housing rear O-ring seal is in place in the groove machined at the rear of the thrust housing as shown. (A spare O-ring is included in the Hardware package if needed).

8) <u>Check point:</u> Verify the Oil Impeller O-ring is installed in the groove provided inside the bore of the bearing housing as shown.

(A spare O-ring is included in the Hardware package if needed).







9) Pre-oil spline and shoulder of shaft thoroughly with Shaft Oil; also making sure that the bore of the Thrust housing and O-ring are well lubricated.

## INSTALLATION MANUAL CONTINUED

## **Section 6. Continued**



- 10) With the oil ports aligned to the top, slide the Thrust Housing Assembly onto the shaft, the mounting studs will slide through the holes in the Isolator Adapter Flange, push housing firmly up against the flange making sure that rear main O-ring
  seal is correctly seated (a very small gap will be visible between the isolator flange and the thrust housing, this is due to the O-ring projection, and will close up once the nuts and washers are installed (see 11. below).
- 11) install the Stainless steel spring washers and Jamb Nuts Onto the studs supplied with the system. Pre-tighten all nuts by hand, final tighten all nuts CW firmly with an open end wrench making sure that the slight gap between the flange and housing disappear.

Do Not Use Loctite.





12) **Check point**, Verify that the coupling O-ring is installed in the groove provided inside the housing end of the coupling. (A spare O-ring is included in the Hardware package if needed).



## INSTALLATION MANUAL CONTINUED

## **Section 6. Continued**

13) Lubricate the internal and external splines of coupling and shaft with shaft oil.





- 14) Oil the outside of the Shaft Coupling barrel surface where the oil seal rides, carefully engage the shaft/coupling splines and push Shaft Coupling firmly home against bearings in Thrust Housing Assembly.
- 15) Lubricate the threads of the Main Coupling Bolt with shaft oil and install Shaft Bolt and Coupling Washer to end of shaft. Hand tighten bolt until it is snug against the coupling.

Do Not Use Loctite







16) CAUTION, <u>tighten the bolt CW to the correct</u> <u>Pre Torque and then Final torque settings using</u> <u>a properly maintained & Calibrated Torque</u> <u>wrench</u>. Torque Settings are listed at the back of this manual on the Shaft Torque specification page. It is important that the correct torque setting for the Coupling bolt is applied exactly as Listed, not enough torque will de-rate the shaft system, and too much torque, may cause internal damage.

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## INSTALLATION MANUAL CONTINUED

## Section 7. SETTING THE CASING TO STRUT OR STERN TUBE (DEADWOOD KEEL)

If the strut barrel is provided with threaded jacking points and set screws, jack up casing until it is centered in the barrel. Radial clearance should be equal all around the barrel front and rear and approximately 3/16 to a 1/4 of an inch. If no jacking points are provided then use a small appropriately dimensioned spacer at one end of the strut barrel. This should be positioned so that it can easily be removed once the injection process has been completed.

Insert a length of appropriately sized Rubber O-ring stock into the clearance between casing and strut barrel or stern tube. Start at the top of the barrel or stern tube and by stretching the O-Ring material to reduce its diameter push into gap all around the casing until it meets the other end. Cut the O-Ring material leaving a small gap between the ends. (Repeat this at the other end on a Strut barrel).

Through two ¼ inch holes drilled either side of the strut barrel at the mid point or within 3 inches of the end of the stern tube, inject with 3M-5200 Fast Cure #06520. Start injecting on one side until 5200 appears at either end or injection hole on opposite side. As this occurs, plug off areas where bedding can escape and inject from opposite side injection point. Keep injecting until satisfied that all air in the barrel has been displaced or until at least 12 inches of the stern tube has been filled.

It is important to leave strut to post cure or until Adhesive (5200) has set before removing jacking screws or spacers (usually 12 hours to set and 24 hours for full cure). For safety allow at least one week for full cure before removing jacking screws. NOTE: Jacking screws must not be left in place permanently as they will cause wear and ultimate damage to the casing during routine operation of the vessel as well as create excess noise and vibration.

If Rubber O-ring stock has been used this can be left in place as it provides good protection as well as a decorative finish for the ends of the strut barrel or stern tube. To final finish, remove any tape, plugs and/or spacers, and with a sharp knife slice off any protruding 5200 flush with each end of the strut barrel. Remove jacking bolts and inject jacking locations with 3M-5200<sup>TM</sup> or install stainless steel pipe plugs to final seal holes.



Document Library TS Data Sheet 06520, 05220

Rev: 2 <u>Effective</u>: 04/1/2006 **3M™ Marine Adhesive/Sealant Fast Cure 5200**  Status: Active Supersedes: 07/06/2000

## 3M Part No.(s)

06520 05220 **3M Part Descriptor(s)** 10 cartridge (295 ml) – White 3 fl. oz. tube (90 ml) - White

#### Description

A fast curing, one-part polyurethane that chemically reacts with moisture to deliver strong, flexible bonds with excellent adhesion to wood and fiberglass. Forms watertight, weather-resistant seals on joints and boat hardware above and below the waterline. In addition, its flexibility allows for dissipation of stress caused by shock, vibration, swelling or shrinking.

#### Features

- Tough/flexible polyurethane polymer
- Non-shrinking
- One-part moisture cure
- Non-sagging formula
- Fast cure formula

#### **Typical Physical Properties**

Container	10 fl. oz. (295 ml) cartridge
	3 fl. oz.(90 ml) tube
Base	Polyurethane
Density lbs/Gallon (Appx.)	11.0 lbs/gallon
Color	White
Solids Content (Appx.)	97%
Consistency	Medium paste
Service Temperature - °F	-40°F (-40°C) to 190°F (88°C)
Shore A Hardness (cured)	60
Specific Gravity	1.21
Coverage (10 oz.)	1/8 inch (0.3175 cm) bead = 120 lineal feet (36.6 m)

#### **Performance Properties**

A 1/8 inch (0.3175 cm) dumbbell specimen with a 1/8 inch (0.3175 cm) square cross section was tested at 2.0 inches/minute (5.08 cm/minute).

Relative Humidity	Temperature	Tensile Strength psi (kg/cm <sup>2</sup> )	Elongation (%)
50%	70°F (21°C)	1000 (70.3)	874

#### **Overlap Shear Strength**

One inch (2.54 cm) overlap specimens (0.093 inch (0.2362 cm thickness). Samples cured at 70°F (21°C), 50% Relative Humidity.

Substrate	psi	kg/cm <sup>2</sup>
Wood(s):		
Teak	355	25.0
Pine	543	38.2
Oak	518	36.4
Maple	597	42.0
Fir	600	42.2
Mahogany	407	28.6
Metal(s):		
Steel	316	22.2
Stainless Steel	197	13.8
Aluminum	203	14.3
Brass	184	12.9
Bronze	176	12.4
Copper	182	12.8
Lead	160	11.2
Zinc (Galvanized)	269	18.9
Plastics/Polymers:		
Fiberglass	269	18.9
Gelcoat	600	42.2
Polycarbonate	409	28.7
Acrylic	149	10.5
Nylon	140	9.8
ABS	262	18.4
Polypropylene	66	4.6
Polyethylene	0	0

# **Application Information**

**Directions for Use** 

## **Surface Preparation:**

There are waxes, coatings, sealants, grease, oil and other contaminants used in the marine industry, making it very important to clean all surfaces to be bonded before applying 3M<sup>TM</sup> Adhesive/Sealant Fast Cure 5200. Recommended procedures include cleaning with 3M<sup>TM</sup> General Purpose Adhesive Cleaner\*, P. N. 08984.

#### **Application of Adhesive Sealant:**

Abrading the surfaces with a 180 grit to 220 grit abrasive will enhance the bond strength. Cut tip to desired bead size, puncture seal in nozzle and remove the seal at bottom end of cartridge. Place cartridge in a caulk gun. Apply Fast Cure 5200 to the seam or part to be bonded. Position parts. Tool material to desired appearance. Remove excess with 3M<sup>TM</sup> General Purpose Adhesive Cleaner<sup>\*</sup>, P. N. 08984.

Sealant should be used within 24 hours after inner seal is punctured, as product will start to cure in the cartridge and nozzle.

Cure:

	Relative Humidity	Temperature	Time	Cure Depth
Open Time	50%	70°F (21°C)	1 hour	N/A
Open Time	90%	90°F (32°C)	15 min.	N/A
Full Cure	50%	70°F (21°C)	24 hours	1/8 inch (0.3175
				cm)

#### Cleanup:

For cleaning Fast Cure 5200 before it is cured, use a dry cloth to remove the majority of sealant, followed by a cloth damp with General Purpose Adhesive Cleaner\*, P. N. 08984, toluene or acetone. Cured Fast Cure 5200 can be removed mechanically with a knife, razor blade or sanding.

#### Limitations -

- Alcohol should not be used in preparation for bonding as it will stop the curing process.

- Heat resistance - Maximum 190°F (88°C). Due to the decreased value in bond strength at elevated temperatures, we do not recommend use of this product above 190°F (88°C).

- Do not apply at temperatures below 40°F (4°C) or on frost covered surfaces.

- Fast Cure 5200 is not recommended for use as a teak deck seam sealer. Extended exposure to chemicals (teak cleaners, oxalic acid, gasoline, strong solvents and other harsh chemicals) may cause permanent softening of the sealant.

- 3M<sup>TM</sup> Marine Adhesive/Sealant Fast Cure 5200 is not recommended for the installation of glass, polycarbonate or acrylic windows that are not also mechanically fastened with a system designed by the manufacturer. Inconsistent adhesion of these unprimed substrates, specific design of the window and movement due to thermal expansion and flexing, may cause application failure.

- When using 3M<sup>TM</sup> Marine Adhesive/Sealant Fast Cure 5200 with metals it may be necessary to prime the surface to achieve adequate adhesion and durability of the bond. Scotch-Weld<sup>TM</sup> Structural Adhesive Primer EC-1945 B/A may be used for priming of most metals.

## Applications

Typical bonding and sealing applications include:

- Fiberglass deck to fiberglass hull
- Wood to fiberglass
- Portholes
- Deck fittings
- Moldings
- Trunk joints
- Between struts and planking
- Stern joints and hull planking

Structural bonding and sealing of:

- Wood
- Fiberglass
- Gelcoat
- Primed metal

## INSTALLATION MANUAL CONTINUED

# Section 8. INSTALLING THE PROPELLER SEAL CARRIER

- a) Remove the seal Carrier from its protective shrink wrap.
- b) Make sure both seals are properly aligned in the carrier; the seals are shipped already packed with grease, however visually check that the grease is as illustrated, if not, apply general purpose Synthetic Grease to the space between the two seals ensuring that the grease is level with the lips of the two seals.



c) Lubricate the O-rings with shaft oil on the outside nose of the Seal Carrier.



d) Install the Seal Carrier to the Propeller Housing, aligning the bolt holes to the Housing and making sure that the water injection port is
positioned to the left or right quadrant of the Housing. The water injection port must not face down to the bottom as it can become blocked with silt or mud in shallow water, also the port should not be positioned under the line cutter holder (if fitted) as this will interrupt supply of water to the main seal under way.

Push the seal carrier home firmly against the face of the propeller housing.

e) Install the Stainless Steel Allen head bolts with Red Loctite 271 (or Blue 2701) and tighten firmly.





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## INSTALLATION MANUAL CONTINUED

## Section 9. INSTALLATION OF OIL RESERVOIR TANKS AND COOLERS

## **Oil Tank and hose Installation:**

The oil tank is supplied complete with the correct length and diameter of hoses and fittings. Location of the tank should be as close to the thrust housing as possible with the bottom of the tank above the connection ports on the thrust housing. Wherever possible the bottom of the tank should be approximately 12 inches (300mm) to 36 Inches (900mm) above DWL (displacement waterline), this provides good positive pressure to the shaft system and oil seals. Hoses may be connected to either port in the bottom of the tank (direction of flow reverses with change in shaft rotation).

It is important that the correct oil flow is maintained to the oil tank as the volume and surface area of the tank forms a part of the shaft oil cooling capacity during operation.

The tank system flow is designed with two 4 foot hose runs (supplied as one 8 foot long piece) **4 foot** is the **maximum** recommended length for the hose diameter and flow characteristics. Location of the tank should be kept within this hose length.

For installations where this is not possible please contact Seatorque factory for application assistance and plumbing alternatives.

## NOTE:

Liquid sealant such as Hydraulic Loctite should be used on all NPT pipe threads on the oil tank.

**<u>Do Not</u>** use sealant on JIC flare fittings on the Thrust Housing ports.

**<u>Do Not</u>** over tighten JIC flare fittings or they will leak.

**<u>Do Not</u>** use Teflon or PTFE pipe tape on any connections as pieces of tape can get trapped under shaft seals causing leakage and/or their premature failure.

**DO NOT SUBSTITUTE THE SUPPLIED HOSE WITH ANOTHER TYPE.** The supplied hose is Parker "Pushlok" type 801 hose and is compatible with Seatorque Full synthetic Shaft Oil or optional Seatorque Fully Biodegradable Oil.

**DO NOT USE HOSE CLAMPS** or any other type of clamps or clips on the supplied barbed fittings. "Pushlok" hose, fittings are designed to be leak free and withstand pressures of 250 PSI without the use of hose clamps. **Use of clamps will cause leaks and ultimate failure of the hose system.** 

**Maximum Bend Radius** is 15 times the hose diameter. Be careful not to install the hoses with less Bend radius than recommended or restrictions within the hose system will result in inadequate oil flow.

## **<u>Oil Cooler Installation</u>**:

Oil coolers are **REQUIRED** on all ST style shaft systems. If not installed the systems may overheat and warranty will be voided. The cooler should be installed in-line with the hose from the thrust housing oil output port to the tank. Warning: Do not install the cooler in the return line from the oil tank to the housing, this will place excessive suction on the line and will affect system oil flow.

## INSTALLATION MANUAL CONTINUED

## **Oil Cooler Installation - Continued**

On all shaft installations, when facing the thrust housing, in right hand or Clockwise rotation, the left port is the output port and Left hand or Counter Clockwise, the right port is the output port.

Water supply to the cooler may be taken from the engine primary raw water cooling circuit or other suitable source. Supply to the cooler is <sup>3</sup>/<sub>4</sub>" (19mm) and the direction of water flow through the cooler must be against the oil flow direction (See fig 4 below).

Maximum water flow should not exceed 20 Gallons Per Minute.



# Fig. 4 – OIL COOLER CONNECTIONS

# NOTE:

On 400 systems and larger, the 2 oil ports are located front and rear, the rear port is the Output and should be connected to the oil cooler, the front port is the return Port and should be connected direct to the oil tank.

## INSTALLATION MANUAL CONTINUED

#### Section 10. INSTALLATION OF TRANSMISSION ADAPTER, ALIGNMENT AND CARDAN SHAFT

The transmission adapter is bolted to the output flange of the marine gear and adapts the gear output flange to mate with the Cardan Shaft Universal Joint assembly. The Adapter is made to order to suit the make and model of transmission fitted to the vessels main propulsion engines. Please verify that the adapter is a match to the transmission output coupling.



Remove the Nyloc self locking nuts and flat washers from the studs of the adapter. Align the mounting studs to the bolt pattern on the gears output flange, push home far enough to install the flat washers and Nyloc Nuts on the back side of the flange. Once nuts are in place push firmly home. The adapter is a precision machined component designed to mate with high accuracy to the pilot or mating ring on the output flange. Due to machining tolerances this will sometimes mate together very easily and in other cases it will require tightening the nuts at the rear of the flange to pull the adapter into place. Once this is achieved the faces of the adapter and flange will be flush against each other with no measurable gap between them. Tighten the nuts as tight as possible.

Note: <u>Do Not use Loctite</u> on the nuts and studs, self locking Nylon type lock nuts as supplied require flat washers only, spring type washers should not be used.





#### INSTALLATION MANUAL CONTINUED

## Section 10. Continued:

Alignment of the Seatorque shaft system will take approximately 20 minutes or less to complete if the following parameters are met. The terminology "**Co-Planar**" must be understood to mean that coupling faces are completely parallel to each other, i.e. Parallel lines in three-dimensional space are Co-planar, but skew lines are not.

**Deflection** is the angular degree at each end of the Driveline which allows for an offset dimension relative to shaft centerline and transmission shaft centerline. (See drawing of deflection below).

## The following conditions must be met for a successful alignment:

- a) A double universal joint driveline or Cardan Shaft is installed between the engine and propeller shaft in a "Z" configuration; (a "W" configuration cannot be used when the engines are mounted on flexible rubber isolators).
- b) Both companion flange and output coupling must be **co-planar**, (i.e. both faces are parallel to each other).
- c) Deflection must be present, this allows both universal joints to cycle and lubricate themselves. (The recommended deflection figure is outlined on the enclosed chart. This is not the maximum permissible deflection, but a mean static setting, which will allow for full movement of the main engines during operation of the vessel in poor sea conditions).
- d) A slip joint of minimum 1 inch (25mm) must be included in the driveline to take up fore and aft movement of the main propulsion engines. A rigid connection will allow the engines to "lean" against the shaft resulting in possible damage to the thrust bearing assembly, vibration and noise transmission within the vessel.
- e) Universal driveline assembly should be installed in a near mid slip condition. (The central point between fully collapsed length and fully extended length).
- f) A correctly rated series of universal assembly and correct coupling adaptors must be installed.

## Section 10. Continued:

## **Alignment Procedure:**

- 1. Measure the distance between the output adaptor (on the transmission flange) and the shaft coupling face. With both couplings in the vertical position, measure at the outside diameter of the key slot to the same position on the opposite coupling, top and bottom. Turn the couplings to the horizontal position (90 Deg) and measure the same key slot dimension, face to face, left and right. If the flange faces are Co-planar, all dimensions will be equal.
- 2. If the top vertical dimension is greater than the bottom vertical dimension then the front of the engine must be raised (or rear lowered), and vice-versa if the opposite condition is met. Similarly the horizontal side to side dimensions will show if the nose or tail of the engine will need to be moved Port or Starboard to ensure that coupling faces are Co-planar.
- 3. Once satisfied that the arrangement is Co-planar, place a straightedge across both the transmission adapter and the shaft coupling down the fore and aft centerline of the shaft. Push down on the end that is on the higher of the two flanges to raise the other end up, parallel to the shaft centerline. Measure the gap from the straight edge down to the adapter or companion flange (see drawing of deflection). Do this exercise in the vertical as well as the horizontal positions. (The deflection can be in any direction rotated around 360 degrees of the driveline assembly).
- 4. Check the measured gap dimension against the deflection chart to ascertain the actual deflection of the assembly.



Drawing of Deflection

## Shaft Alignment Procedures (CONTINUED).

# Section 10. Continued:

To find the Angular Deflection by use of trigonometry, the following procedure can be used. Using step 3 on page 17; measure the gap between the straightedge and coupling. Measure the installed pivot dimension of the Cardan Shaft (universal joint assembly) and apply the following formula using Arc Tangent or Inverse Tangent:

Where D = Measured Deflection Pd = Pivot Dimension

Angle = ATAN(D/Pd) or on a scientific Calculator Tan-1(D/Pd)

Similarly, the correct deflection can be calculated using the known tangents for 1.5° and 3° as follows:

0.026186 x Pd for 1.5° 0.052407 x Pd for 3.0°

Either Metric or Imperial units can be input to return the angle or deflection on all approaches

## Shaft Alignment Procedures (CONTINUED).

# Section 10. Continued:

Once alignment has been verified as correct and all coupling and adapter bolts are set to their correct torque values, the Universal Joint Driveline or Cardan Shaft can be installed.

This is managed more easily by installing the end of the Cardan assembly to the Shaft Coupling first. When installing or handling the assembly be careful not to pick it up by the bearing caps as these can separate from the spider and risk is possible of losing the needle rollers from inside the bearing caps.

Lift the assembly by the Yoke, and with Shaft coupling and Cardan end oriented vertically, install the bottom bearing cap key into the keyway machined in the coupling face. Swivel the top bearing cap into contact with the coupling and secure the bottom bearing cap with at least one bolt.



In some cases it may be necessary to tap the top bearing cap with a mallet to jump it into the mating ring of the coupling.

Install all remaining bolts and spring washers, snug bearing caps up into position on coupling face. Lift the other end and repeat the procedure.

Cardan Shaft Bolts: Do Not use Loctite.



All bolts should be installed using oil as a lubricant.

Once all bolts are tightened into place by hand, they must be set to the correct torque setting as listed on Page 20 in this manual.

The Splined Slip Joint will need to be extended for the bearing caps to mate with the transmission adapter correctly, once installed the amount of slip can be measured at the expansion joint on the yoke, this measurement should be exactly half of the total slip available (see page 20) for the installation to be correct. Some latitude is available in this measurement but should conditions exceed specifications listed within this manual then please contact Seatorque Factory for help and assistance.

# Section 10. Continued:

						L VILLED
Wing Bearing	Short Duration	Maximum	Swing	Min. Length	Slip	Installed
<b>c</b> •	Torque Ft/lbs	Torque Ft/lbs	Diameter inch	Collapsed inch	<b>.</b>	Length inch
Series	(Nm)	(Nm)	[mm]	[mm]	Length inch [mm]	[mm]
2C	<b>553</b> (750)	<b>1098</b> (1490)	3.34 [85mm]	6.00 [152mm]	0.984 [25mm]	6.492 [165mm]
5C-Short	<b>1950</b> (2650)	<b>4167</b> (5650)	4.84 [123mm]	6.10 [155mm]	0.79 [20mm]	6.495 [165mm]
5C-Long	<b>1950</b> (2650)	<b>4167</b> (5650)	4.84 [123mm]	21.50 [546mm]	4.00 [102mm]	23.50 [597mm]
2	· · · · ·	· · · · ·				
7C-Short	<b>4200</b> (5398)	7892 (10700)	6.22 [158mm]	9.449 [240mm]	1.181 [30mm]	10.60 [269mm]
7C-Long	<b>4200</b> (5398)	7892 (10700)	6.22 [158mm]	19.625 [499mm]	4.00 [102mm]	21.625 [549mm]
-						
8.5C-Short	10320 (14000)	14973 (20300)	6.89 [175mm]	10.827 [275mm]	1.181 [30mm]	11.417 [290mm]
8.5C-Long	<b>10320</b> (14000)	14973 (20300)	6.89 [175mm]	23.00 [584mm]	3.00 [76mm]	24.50 [622mm]
10C-Short	<b>19160</b> (26000)	<b>29281</b> (39700)	8.858 [225mm]	15.551 [395mm]	1.378 [35mm]	16.24 [412mm]
10C-Long	<b>19160</b> (26000)	<b>29281</b> (39700)	8.858 [225mm]	34.00 [864mm]	4.00 [102mm]	36.00 [914mm]
12.5C	41772 (56635)	61070 (82800)	11.023 [280mm]	19.527 [496mm]	3.70 [94mm]	21.377 [543mm]
	I					

## WING BEARING - DIN STANDARD KEYED CARDAN SHAFT DIMENSIONS AND TORQUE VALUES

	Maximum End Angle	Pivot Dimension inch	Min** Recommended Deflection inch	Max** Recommended Deflection inch	Bolt Size	Bolting Torque
Series	Deg	[mm]	[mm] @ 1.5 Deg	[mm] @ 3.0 Deg	(Grade)	FT/Lbs (Nm)
2C	12	5.957	0.156 [4mm]	0.312 [8mm]	5/16-24 UNF (G8)	20 (27)
5C-Short	12	5.157 [131mm]	0.135 [3.5mm]	0.270 [7mm]	3/8-24 UNF (G8)	25 (34)
5C-Long	12	22.165 [563mm]	0.580 [14.7mm]	1.11 [28mm]	3/8-24 UNF (G8)	25 (34)
7C-Short 7C-Long	12 12	8.978 [228mm] 20.00 [508mm]	0.235 [6mm] 0.524 [13.3mm]	0471 [12mm] 1.048 [26.6mm]	1/2-20 UNF (G8) 1/2-20 UNF (G8)	70 (95) 70 (95)
8.5C-Short	12	9.417 [239mm]	0.247 [6.27mm]	0.494 [12.5mm]	1/2-20 UNF (G8)	75 (102)
8.5C-Long	12	22.50 [572mm]	0.589 [15mm]	1.179 [30mm]	1/2-20 UNF (G8)	75 (102)
10C-Short 10C-Long	12 12	13.681 [347.5mm] 33.44 [849.4mm]	0.358 [9.1mm] 0.876 [22.25mm]	0.717 [18.2mm] 1.75 [44.5mm]	5/8-18 UNF (G8) 5/8-18 UNF (G8)	100 (136) 100 (136)
12.5C	15	18.385 [467mm]	0.481 [12.2mm]	0.964 [24.4mm]	M18x1.5 (10.9)	125 (170)

\*\* = Recommended Specifications - Seatorque Control Systems LLC

# 11). Bolts and threads, which require Loctite OR Torque Settings.

Most fasteners are installed at the factory and form a large part of the non serviceable assemblies which therefore require no further attention in the field.

The general "rule of thumb" is, if there is a torque specification for a bolt or fastener, Loctite should not be used. All torque values are based on a **lubricated** thread condition.

All other bolts should be locked with Loctite Red 271 High Strength (or Blue 2701). If these are not available then High Strength Permanent thread locking fluid may be used.

Any Bolt or thread that does not carry a Torque setting should be tightened, hand tight (snug) and locked with thread locker fluid, these include:

Propeller seal Carrier, Allen bolts

Threads that require sealant but not Loctite should have 3M-5200 or Sikaflex Urethane Marine Adhesive applied, primarily this refers to the shaft/Casing threaded end to M3 Isolator mount/ST isolator housing.

## 12). Oiling the System.

## SEATORQUE SHAFT OIL<sup>TM</sup>

This specially formulated Full-synthetic, extreme pressure oil has been developed specifically for Seatorque Control Systems<sup>TM</sup>; it contains many specialized additives for marine use and is critical to the maintenance cycle of 3000 hours or 3 years, do not use or accept alternatives (For further information, please refer to the technical service sheet at the back of the owners handbook in the service information section).

Due to the viscosity of the shaft oil it will take an appreciable amount of time for the air to purge from the system. Fill reservoir tank to full mark, oil level will drop quickly initially. As tank approaches the low level, fill to full mark once again. Over the next 24 hours monitor tank level and replenish oil as necessary. The fill time can be accelerated by continuously turning the shaft which will allow the oil impeller in the thrust housing to help the purging process. Once the boat is launched and the boat is under power, if not already achieved, air will purge very quickly. It is important that at least 3 quarts or liters are in the system before the boat is launched.

# 13). Galvanic Bonding of the System.

The system is substantially protected from corrosion and electrolysis, the materials used in submerged areas are balanced together closely on the metals nobility scale and in some cases, as with the shaft casings, can be coated against direct contact with water, and therefore should not require any additional protection from anodic systems installed within the vessel.

It is not recommended that shaft zincs or any other form of anode should be attached to or around the system.

The isolator and thrust housing are provided with clearly marked bonding points. These should be connected with 10 Gauge wire to the standard vessel bonding system.



There are many schools of thought as to the best way to bond equipment; SCS carries no view as to which method may be correct. However, Electrolysis and Galvanic corrosion are two very different and unrelated phenomena.

Electrolysis is the result of leakage of electrical current, sometimes called "stray current", from faulty on-board equipment, electrical system faults or dockside power supplies with poor ground isolation.

Galvanic corrosion is the result of dissimilar metals connected by an electrolyte such as salt water. The SCS system is stable on the metal nobility scale and all components are internally and externally electrically connected. By connecting the SCS system to the vessels main bonding system, practically all instances of galvanic action will be eliminated.

Propellers also commonly show signs of erosion, quite a few of these instances are incorrectly blamed on either Electrolysis or poor bonding. It is very common for propellers to exhibit erosion around the blade roots and tip which are in fact caused by propeller cavitation. This is more a function of propeller design and/or use.





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# Bulletin SCS-CP0211 Suggested Cathodic Protection

# This Bulletin to be used in conjunction with SCS suggested wiring diagram CP-0211-09.

This suggested system is based on Passive Cathodic protection and as such should not be connected to DC negative on the vessels wiring system.

Please note that this suggested approach is based on the Nobility scale found from the recognized Galvanic series of metals with reference levels set from a Silver-Silver Chloride electrode.

Material	Potential Voltage <u>Millivolts [Mv]</u>
Stainless Steel 304/304L/316	0.00 – 10 (passive)
Manganese Bronze	270 - 340
Nickle Aluminum Bronze (NyBrAl). [Propellers]	280 - 360

Measure the voltage in Millivolts between the Anode installed in the hull and the metals to be protected (Cathode) with the boat floating in Salt Water.

Using the highest potential from the chart above add 200 to 250 Millivolts to the reading obtained.

Adjust the size of the Zinc Anode until the reading equals the above result. This will depend on the location and area (size) of the metal to be protected.

Do Not Exceed 1000 Mv, there could be risk of damage to the Anti-Fouling paint used on the hull of the boat.

Derived from the Yacht and Boat Council of America (ABYC) guidelines.

Copyright SEATORQUE CONTROL SYSTEMS LLC - All Rights Reserved	SUGGESTED MET Please refer to C	Zinc Anode
TOLERANCES: 0.00 +/- 0.05 0.000 +/- 0.005 0.0000 +/- 0.0005 Chamfer Ext. Edges to 0.03125 x 45 Deg. Fillet Int. Corners to 0.015625 Unless Otherwise Noted	HOD OF CATHODIC (PASSIVE) PR athodic Protection Bulletin SCS-CP021	Bonding Point
DO NOT SCALE THIS DRAWING THIS DRAWNG (AND THE DATA SHOW THEREON) IS CONTRELITE, AND THE DATA SHOW THEREON IS DE UNED PROPERTIES, NETWORKS THE WAY DRAWNG DE DATA SHOW THEREON TO SERVICE AND THE DES OF THE DRAWNGS AND/OR DATA CONTAINED THEREIN COPYRIGHT SEATORQUE-O-ALL RIGHTS RESERVED	ROTECTION	
SEATORQUE CONTROL SYSTEMS LLC 2779 SE Monroe Street Tu: 772-220-302 Fox: 772-220-301       DRAMME NO: CP-0211-09     DESEMPTION: In: 772-220-302 Fox: 772-220-301       DRAMME NO: CP-0211-09     DESEMPTION: Intersection For any sector Dimension Arms: Intersection Dimension Arms: Intersection SCALE       Revision     DATE:       Revision		

# **POST INSTALLATION NOTES**

After installation is completed and the system has been filled with oil, the system requires a "breakin" period to bed the seals. During this time some residual oil may appear to weep from the system. This is normal, please allow up to 50 hours of operation for the break in process to complete. After the system is installed, or after any service work, and to keep bilges clean, wash the housings front and back with denatured alcohol to wash off any residual oil. Remember to keep caustic chemicals away from housings.

If any weeping oil appears excessive:

1) Monitor the oil level site gauge on the SCS oil reservoir tank for fluid level change;

2) Place an oil absorber product at the location of any accumulated oil;

3) Contact your local Service Center or the SCS Factory Customer Service Department and record a clear and comprehensive report detailing the problem.

## **PAINTING OF SYSTEM**

It is important that the entire Seatorque system is protected from possible corrosion by direct contact with salt water. It is imperative that the shaft system is painted with two part under water primer and at least two coats of high quality Anti-fouling paint. The use of "Prop Speed" type of coatings is discouraged as they do not provide a suitable barrier between the shaft system and Salt water, resulting in possible corrosion as is not painting the system at all.

Please take specific note in the case of ST style systems that the shaft casing that is located inside the hull shaft tube is properly painted before installation occurs.

## **ENGINE MOUNT/ISOLATOR SELECTION**

As the Seatorque system eliminates thrust being delivered to the engine/gear, engine mounts will be free to operate fully in the vertical plane. All mounts are correct when the weight of the engine and gear are carried at half the mounts total range of deflection or weight capacity, i.e. the mount will be mid range (1/4") of its total range of travel (usually 1/2"). Mechanically because of this there is no such thing as a "softer mount" unless longer range of travel is considered, longer travel is to be avoided as this can create problems elsewhere on the engine installation such as with exhaust riser connections etc which could be broken or unduly stressed. On the majority of standard mounts, eliminating thrust to the engine allows the vertical range to be freed up by approximately 80% giving that much greater protection from vibration and noise resulting in a softer mounting system. If high performance mounts are desired, SCS will be happy to assist in their selection

## NOTE:

When adjusting engine mounts or isolators be careful to maintain even point loading on all four corners, engine isolators should carry an equal load from left side to right side, front and rear. If this is lost the engine will carry its weight across two of the isolators diagonally from front to rear, this will cause the engine to rock from side to side at certain RPM settings and will in some cases create vibration through the vessels structure.

# FINAL INSTALLATION OEM CHECK AND SIGN-OFF.

During/After Installation of your Seatorque Shaft System, please verify the following "Checkpoints" have been completed and are in compliance with the SCS installation procedures outlined in this manual.

**Please note:** At no time should the shafts be removed from their casings, without SCS factory approval. WARRANTY VOID labels should not be removed or tampered with.

Dated Checked		Initials of Installer
		Verify shafts marked "Port & Starboard" are installed Port & Starboard
		Verify Thrust Bulkhead Bolts are FULLY Tightened (Builder Supplied Bolts)
		Verify Thrust Bearing Housings are positioned with the Oil Ports on top
		Verify All O-rings have been installed correctly:
	1).	Thrust Housing O-ring
	2).	Oil Impeller O-ring
	3).	Coupling O-ring
		Verify Isolators are sealed to shaft casing with 3M-5200 <sup>TM</sup> or equivalent
		Verify coupling bolt is set to correct torque rating per installation manual
		Verify No Loctite was used on coupling bolt
		Verify U-joint bolts are set to correct torque rating per installation manual
		Verify No Loctite was used on U-joint Bolts
		Verify the U-joints are GREASED & installed with the correct slip dimension
		Verify Co-planar alignment of transmission and shaft couplings.
		Verify U-joint driveline deflection is within specified parameters.
		Verify the system is bonded correctly to system bonding points.
		Verify struts have been aligned & injected as per installation manual
		Verify Oil Reservoir Tanks are installed per the manual and are not further Than 4 feet hose run from the Thrust Bearing Housings

# 17). Final installation OEM check and sign-off - continued.

Date Checked	Initials of Installer
	Verify the correct SCS supplied Oil Hose type and fittings have been installed. No Substitutions.
	Verify the system has been completely filled and purged with SCS Shaft Oil
	Verify NO hose clamps or clips are used on supplied push-lock fittings.
	Verify the seals in the seal carriers have been properly and adequately Greased.
	Verify the seal carrier bolts have been installed with Loctite <sup>TM</sup>
	Verify propeller Nuts are correctly installed
	Verify underwater gear has been painted per the manual
	Complete warranty paperwork**

**\*\*** Completion of this Post-Installation checklist is the responsibility of the yard NOT SCS Factory personnel, sales Engineers and/or area representatives.



# SEATORQUE SHAFT SYSTEMS FASTENER APPLICATION AND TOOL REQUIREMENT GUIDE

COUPLING BOLT	ING BOLT Tool Required: Torque Wrench**					
SEE SPECIFIC TORQUE RATINGS IN THE INSTALLATION MANUAL.						
Shaft Size	<b>Bolt Specification</b>	Socket Size				
ST/M3-100	3/8-24	9/16				
ST/M3-175/200/250	5/8-18	15/16				
ST/M3-275/300	3/4-16	1-1/8				
ST/M3-350	1-14	1-1/2				

**\*\*** Torque Wrench Should be Regularly Calibrated For Accuracy

U-JOINT BOLTS	Tool Required: Torque Wr	rench**
SEE SPECIFIC TORQUE RATINGS IN	THE INSTALLATION MANUAL.	
U-Joint Size	<b>Bolt Specification</b>	Socket Size
2c	5/16-24	1/2
5c	3/8-24	9/16
7c/8.5c	1/2-20	3/4
10c	5/8-18	15/16

\*\* Torque Wrench Should be Regularly Calibrated For Accuracy

SEAL CARRIER BOLTS ** SEE BELOW	Tool Required : Allen Key	
Shaft Size	Bolt Specification	<u>Key Size</u>
ST/M3-100	M5	4mm
ST/M3-175/200/250	M6	5mm
ST/M3-275/300/350	M8	6mm
<b>**VERY IMPORTANT - USE RED LOCTIT</b>	E™ 271 or BLUE 2701 ON A	<u>ALL</u>
PROPELLER SEAL CARRIER BOLTS		
TO BE HAND TIGHTENED FIRMLY		

THRUST HOUSING STUD NUTS (ST STYLE	ONLY) Tool Require	ed: Wrench
SEE SPECIFIC TORQUE RATINGS IN THE I	NSTALLATION MANUAL	<u>-</u>
Shaft Size	Nut Specification	Wrench Size
ST/M3-100	M8	13mm
ST/M3-175	M10	17mm
ST/M3-200/250/275/300/350	M12	19mm
SUPPLIED WITH SPRING WASHERS AND	NUTS	
TO BE WRENCH TIGHTENED FIRMLY HAN	D TIGHT	

## TRANSMISSION ADAPTERS

Tool Required: Wrench

MADE TO ORDER AND SUPPLIED WITH STUDS OR BOLTS, LOCK NUTS AND FLAT WASHERS TO BE WRENCH TIGHTENED AS TIGHT AS POSSIBLE

# **Push-Lok 82 Series Assembly Instructions**



- 1. Identify Over All Length (OAL) of hose assembly and the Cut Off Allowance (COA) length of fitting(s) by use of the fitting data table.
- 2. Properly measure and mark hose. Cut hose squarely with a Parker Push-Lok cut-off tool or a sharp knife.
- Lubricate the Push-Lok fitting, hose I.D., or both with light oil or soapy water only - DO NOT USE HEAVY OIL OR GREASE.



- 4. Insert fitting into hose until first barb is in the hose.
- 5. Place end fitting against a flat object such as a work bench of wall. Grip hose approximately one inch from end and push with a steady force until the end of the hose is covered by the yellow plastic cap.

# **Push-Lok 82 Series Disassembly Instructions**



1. Leave fitting in place, and cut hose approximately one inch lengthwise from the yellow plastic cap. IMPORTANT: Be careful not to nick barbs when cutting hose.



**2.** Grip hose firmly and give it a sharp downward tug away from the fitting for disassembly.

**Caution:** Insert the Push-Lok fitting all the way into the Push-Lok hose until the cut end is concealed by the yellow plastic cap. **Caution:** Sealing integrity may be damaged by use of exterior clamps.

# IF YOU HAVE QUESTIONS CONCERNING THE PRODUCTS OR APPLICATION OF THE PRODUCTS CONTAINED IN THIS CATALOG, PLEASE CALL: PARKER HOSE PRODUCTS DIVISION - TECHNICAL SERVICES DEPARTMENT PHONE: 440-943-5700 FAX: 440-943-3129 www.parkerhose.com





2	kecommen	ded Torque V	alues tor a	II Fasteners	s Used In a	Seatorque	e Systen				
Shaft Model	100	175	200	225	250	275	300	350	400	450	500
Shaft Coupling Bolt (Nr	n) 27	115	115	115	115	136	136	136	203	tba	tba
To Shaft Ft/LI	bs 20	85	85	85	85	100	100	100	150	By applic	ation
(Pretorque to 50%) - Lubricated B4	olt 3/8-24	5/8-18	5/8-18	5/8-18	5/8-18	3/4-16	3/4-16	1-14	1 1/4-12		
Shaft Model	100	175	200	225	250	275	300	350	400	450	500
M3 Isolator (Nr	n) 7	14	20	27	27	22	27	27	34	tba	tba
Stud Nuts Ft/L	bs 5	10	15	20	20	20	20	20	25	By applic	ation
For urethane Mounting Bushings Only	y (Tig	jhten Twice A	t Value She	own - Resu	lting Torqu	e applied	will be dout	le the liste	d value)		
CARDAN SHAFT	DIN N	lodel									
(Universal Joint)	5C	50	7C	8.5C	10C	12.5C					
Bolt (Grad	(8)	(8)	(8)	(8)	(8)	(10.9)					
Diameter	es 5/16-24 U	NF 3/8-24 UNF	1/2-20 UNF	1/2-20 UNF	5/8-18 UNF	M18-1.5					
Pre-Torque Setting	2C	50	7C	8.5C	10C	12.5C					
Lubricated (Nr	n) 19	54	88	88	136	203					
Ft/LI	bs 14	40	65	65	100	150					
Final Torque Setting	2C	5C	2 <i>L</i>	8.5C	10C	12.5C					
Lubricated (Nr	n) 27	68	115	115	203	172					
Ft/LI	bs 20	50	85	85	150	200					
Transmission Adapter											
	SAE				METRIC						
Min/Max Stud Size	e 7/16"	5/8"	3/4"	-1	01M	91M	M18	M20	M22	M24	
Torque (Nm) M	1 54	171	285	269	88	142	190	285	379	522	
Settings	ax 79	244	407	813	47	203	271	407	542	745	
Threads Dry Ft/Lbs M	1 40	126	210	420	54	105	140	210	280	385	
M	ax 58	180	300	600	35	150	200	300	400	550	
<b>PROPELLER NUT TORQUE Recomme</b>	ended For	SAE J755 Sh	aft Tapers	- DRY THRI	EADS						
Shaft Model	100	175	200	225	250	275	300	350	400	450	500
UN)	n) 7	318	436	573	637	662	982	1272	1745	2127	2728
Ft/LI	bs 5	235	322	423	470	590	725	939	1288	1570	2013
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# SYSTEMS LLC SEATORQUE CONTROL



WINNER 4





			0,	SHAFT AN	<b>CASING S</b>	SPECIFICA	TIONS					
Shaft Model		100	175	200	225	250	275	300	350	400	450	500
Diameter	lnch	1.00	1.75	2.00	2.25	2.50	2.75	3.00	3.50	4.00	4.50	5.00
	тт	25.40	44.45	50.80	57.15	63.50	69.85	76.20	88.90	101.60	114.30	127.00
Shaft Model		100	175	200	225	250	275	300	350	400	450	500
Shaft Material		Aqualloy 22 <sup>1</sup>	Μ.									
					Aqualloy 22	HS™						
Rotational	ISd	86,600	70,000									
Sheer	(Kpa)	597	483									
**Shaft Model		100	175	200	225	250	275	300	350	400	450	500
Torque h	=t/Lbs	298	1,292	1,928	2,746	3,764	5,011	6,508	10,340	15,446	21,980	30,131
Capacity	(MM)	405	1,756	2,620	3,731	5,115	6,809	8,843	14,050	20,988	29,867	40,943
Shaft Model		100	175	200	225	250	275	300	350	400	450	500
Casing	Inch	1.66	2.375	2.875	3.5	3.5	4	4	4.5	5.5	5.5	6.5
OD	(mm)	42.16	60.33	73.03	88.90	88.90	101.60	101.60	114.30	139.70	139.70	165.10
ANSI Pipe Size		1 1/4	2	2 1/2	ი	e	3 1/2	3 1/2	4	5	5	9
Shaft Model		100	175	200	225	250	275	300	350	400	450	500
Thrust Bearing	Lbs/F	3,880	6,850	10,400	13,700	13,700	21,600	21,600	25,900	23,700	33,700	65,700
Capacity	Z	17300	30,543	46,371	61,085	61,085	96,309	96,309	115,482	105,673	150,260	292,941
	(Kg/F)	1,732	3,058	4,643	6,116	6,116	9,643	9,643	11,563	10,580	15,045	29,330
** Torque Capacities	s calcu	lated at Safe	ety Factor	of 5								

Recommended lubricant - Seatorque SCS 75W-90 - Full Synthetic, Extreme Pressure, Shock Proof, Extended Marine service. meeting or exceeding, API GL-5, Mil PRF-210SE



# <u>Product Update – 2012</u> <u>Optional Temperature Sensor Kit</u>

The Above product update applies to SCS Shaft Systems From ST/M3-175 Through ST/M3-400 Models supplied after November 2011:

This Product update applies to new equipment shipped with Optional Temperature Sensors after November 2011, no changes are required for units already in service prior to Nov 2011.

Due to design dimensional limitations only the 275, 300 & 350 Systems could be fitted with an internal sensor mounting pocket. This new feature allows all systems produced after November 2011 to install the optional SCS Oil Temperature Sensor Kit.

Sensor Block Attachment point. Fig 1).



Fig 2). Shown with Hi-Accuracy Analog Sensor

Half Fill Sensor Port with Shaft Oil Prior to installing Sensor



All 2012 Series thrust Housing Faceplates - Sensor Block Mounts to <sup>1</sup>/<sub>4</sub>-20 tapped hole as shown in Fig 1).

Optional Sensor block is supplied with mounting hardware and choice of standard analog, Hiaccuracy Analog and Hi-Accuracy Digital temperature probes depending on monitor system and or Gauge panel.

Prior systems already in service without temperature sensor ports can be updated, for further information please contact SCS factory direct or an authorized SCS distributer.

Note – This is not a product re-call.