CHAPTER 5: MAINTENANCE SCHEDULE

WARNING:

Hydraulic oil is FLAMMABLE.
Refrain from servicing system without proper training, or if comfort of skill level is exceeded.
Disregarding proper safety procedures, correct operating instructions or maintenance could result in equipment damage and personal injury.

Please note that in military or commercial applications where mission profiles or duty cycles are defined, the standard maintenance schedule intervals indicated in this document may or may not apply. Contact Quantum for application specific maintenance recommendations.

Section 1: Hull Units

With the exception of regular greasing, the QC-Series of stabilizers is relatively maintenance free during normal operation. Refer to the chart at the end of this chapter for maintenance requirements.

For a new installation and after overhaul, the following inspections and adjustments should be made after the first 100hrs:

- Check that all hydraulic fittings are tight.
- Check all hoses for chaffing, and ensure they are not in contact with any moving parts.
- Grease upper and lower bearings. Refer to the Hull Unit Chapter for greasing instructions.
- Inspect hydraulic cylinder rods and gland seals for damage, leaking, or scratches.

When the vessel is hauled out a thorough inspection of the exterior components, detailed on next page, is to be undertaken. See Fin chapter for important securing procedures and safety precautions when working on or around the system.

- The fins are to be manually swung through their full travel and a visual inspection of the shaft is to be conducted. In order to release the hydraulic pressure on the cylinders and allow the fin to move freely, it is first necessary to open the bypass valve on the stabilizer manifold block (see the Hydraulic Components chapter of this manual).
- Axial and radial play in the shaft is to be checked at this time; see the table below that details play allowances. A dial indicator is recommended for this procedure.
    - Radial play should be checked with the indicator positioned just below the seal housing between the top of the fin and the underside of the hull.
    - Axial play should be checked with the indicator placed on the underside of the fin. By placing a hydraulic jack under the fin it is possible to apply load to the shaft/fin assembly in an upward direction.

Hull Unit Shaft Radial and Axial Play Allowances

	Shaft Radial Play [mm (“)]		Axial Play [mm (“)]	
	Minimum	Maximum	Minimum	Maximum
QC-1000	0.10 (0.004)	0.32 (0.013)	0.4 (0.016)	1.0 (0.039)
QC-1200	0.10 (0.004)	0.34 (0.013)	0.5 (0.020)	1.2 (0.047)
QC-1500	0.13 (0.005)	0.34 (0.013)	0.7 (0.028)	1.4 (0.055)
QC-1800	0.13 (0.005)	0.35 (0.014)	1.5 (0.059)	3.9 (0.153)
QC-2200	0.13 (0.005)	0.36 (0.014)	0.7 (0.028)	1.7 (0.067)
QC-2400	0.13 (0.005)	0.37 (0.015)	0.8 (0.031)	1.8 (0.071)
QC-2600	0.13 (0.005)	0.37 (0.015)	1.0 (0.039)	2.0 (0.079)
QC-3600	0.13 (0.005)	0.39 (0.015)	1.4 (0.055)	2.9 (0.114)

NOTE
Due to the extensive variations in a vessel’s operating profile, system specifications, conditions of operation and maintenance, it is extremely difficult to accurately predict the anticipated service life of the main shaft bearings. To this end, Quantum recommends that the bearing clearances be checked periodically. Clearance measurements can be taken while the vessel is dry docked.

The intervals indicated in the charts on page 6 are based on both empirical data and calculations. Quantum can affirm that average conditions of operation coupled with proper and timely maintenance will result in acceptable bearing degradation throughout the aforementioned range. Reduced loading through fin

size or average sea states can increase the bearing life. Similarly, usable bearing life can be reduced due to severe operating conditions or lack of maintenance.

Quantum has developed an available Fin Oscillation Simulator (FOS) to assist with the greasing process, and other jobs where it is desirable to cycle the hull unit while being within proximity of the unit. Ensure that no personnel or objects are close to the fin and other safety precautions have been taken before utilizing this device. See Spare Parts List for details.

Section 2: Fins

It is recommended that a thorough inspection of the fins be performed when the vessel is hauled out for maintenance. During this inspection particular attention should be paid to the seal provided by the cover plates that seal the fin mounting bolt cavity and the oil expansion port cavity (if fitted).

Section 3: Hydraulics

The pressure filters require periodic element changes and the gas charge in the accumulators and noise suppressors will need occasional charging as per the maintenance schedule. The valves and manifolds are to be inspected regularly for external damage. To avoid corrosion and deterioration, a water inhibitor such as WD-40 should be applied to the valves and fittings immediately after wash-down of the equipment. Contact Quantum technical support should a concern of stabilizer valve operation arise.

Section 4: ARC/SMC Control System

With the exception of maintaining clean and damage-free electrical connections, maintenance is essentially not required for the electrical components. All electrical equipment should be periodically checked to ensure an absence of mechanical damage, loose wires or water build-up.

Section 5: Power Unit

The power unit and its associated components require maintenance and replacement, as indicated within the charts in the next section.

The hydraulic oil integrity must be checked as per the schedule by extracting a sample from the system for analysis. The hydraulic oil sample can then be processed to check for cleanliness and evidence of soluble water. Check that the system meets ISO cleanliness specifications; if oil does not meet standards take corrective action. Refer to Hydraulic Power Unit Chapter.

If the boat sits for extended periods of time without stabilizer operation, the saltwater side of the coolers should be flushed with fresh water or a white vinegar solution followed by fresh water to remove growth.

If the hydraulic power unit motor(s) are stored unused for extended periods, their output shafts should be manually rotated every 3 months. The rotor weight in an idle motor disperses grease from between the bearing surfaces with time. Periodic shaft rotation will help resist any bearing oxidation that may occur as a result of motor inactivity.

As per the electric motor manufacturer recommendation, should the hydraulic power unit motor be started after a storage period in excess of 6 months, or it has been exposed to an environment of elevated moisture, the resistance of the stator winding insulation must be checked. Use a megohmeter to measure the resistance of the windings. If the measured resistance is lower than 10 megohms the windings should be dried by either one of the following methods:

1. Heat in an oven at a temperature not to exceed 90ºC (194ºF) until the insulation resistance becomes constant.

2. Lock the rotor and apply low voltage. Gradually increase current through the windings until a maximum temperature of 90ºC (194ºF) is measured with a thermometer.

Lubricate HPU motor bearings every 20,000 hours as per Work Instruction WI0008 which is supplied within this manual.

Section 6: Lubricants

Quantum suggests that any hydraulic oil used in our systems has the following characteristics:

- Mineral based HLP hydraulic oil per DIN 51524-2
- Viscosity between ISO-VG 32cSt to 46cSt at 40ºC (piston or vane pumps)
- Viscosity of ISO-VG 46cSt at 40ºC (radial piston pumps)

Quantum suggests that any grease used in our systems has the following characteristics:

- The grease should always be compatible with Polyoxymethylene (POM) also known as Acetal/Delrin, polyacetal and polyformaldehyde.
- The NGLI class should be 2.
- The grease should contain no acids (and preferably also no bases).
- The grease should not be based solely on Calcium or Calcium soap (Calcium/Lithium soap is allowed).
- The grease should contain no significant quantities of graphite or MoS_2.
- The grease should preferably contain no EP additives.

Lubricants must meet or exceed regulations for waters in which the vessel sails.

Section 7: Preventative Maintenance Schedule

The maintenance schedules in this section indicate the recommended preventative maintenance intervals for equipment supplied by Quantum. Components utilized in Quantum systems but not supplied by Quantum are not included in the maintenance schedule or under any Quantum-backed warranty.

The maintenance intervals are listed in hours of operation. Maintenance is to be performed according to this schedule utilizing time or hour intervals, whichever comes first with the chart on this page as a guide. The maintenance schedule incorporates the minimum required maintenance to ensure correct operation of the system. Should these guidelines not be followed, the Quantum-backed warranty for those items will be void.

The intervals given in the Maintenance Schedule are expressed in operating hours. Use the table below to find the approximate representative equivalent time period. The values recorded below are based on typical usage experienced by Quantum customers.

Underway		Zero Speed ™	
Time	**Hours**	**Time**	**Hours**
1 month	200hrs	1 month	300hrs
6 months	1500hrs	6 months	2000hrs
1 year	3000hrs	1 year	4000hrs
3 years	9000hrs	3 years	12000hrs
4 years	12000hrs	4 years	16000hrs
5 years	15000hrs	5 years	20000hrs

To perform this maintenance, replacement parts may need to be purchased. Refer to the recommended spares list and/or drawings for associated part numbers. The schedules refer to the chapters of this manual where the maintenance instructions can be found with the following symbols:

LEGEND

① See Hull Unit chapter of this manual for **IMPORTANT** lubrication details. The service life of the bearings can be greatly preserved and extended with greasing performed at the recommended intervals. Failure to service the bearings can lead to greatly reduced service life or possible premature failure. A potentially costly and unscheduled haul out will be necessary to correct the situation and possibly restore the water tight integrity of the hull unit shaft.

② See Fin chapter of this manual for details.

③ See Hydraulics chapter of this manual for details.
④ Accumulators must be inspected and recertified every few years. Consult your applicable survey authority for details.
⑤ Power-up VFD annually if the system is not used in a year or more.
⑥ See Power Unit Chapter of this manual for details.
☎ Contact a Quantum technician.
⚐ See section 12.0 of the AC Tech Manual or section 7.4 of the WEG manual.
⑦If analysis of the scheduled oil sample indicates an elevated level of brass particles in the hydraulic system, the pumps should be replaced or overhauled as soon as possible. Delay in component removal and system flushing will lead to contamination problems throughout the hydraulic system. Erratic component operation may be a symptom of hydraulic fluid contamination. Replace pumps at 10,000 hours regardless of oil sample analysis results.
⑧The suppressor contains a small gas volume and operates within a narrow pressure range. Fairly frequent recharging is not uncommon. Please follow the indicated maintenance interval, but if overall system noise increases between suppressor checks, inspect suppressor charge as required. Failure to recharge suppressor will not impact stabilizer system performance.
⑨Regardless of the number of operating hours, Quantum recommends replacement of barnacle ring and shaft seals due to natural deterioration of the rubber once exposed to salt water. Do not exceed five years between replacements.
⑩Certain smaller models of hull units have cylinders that are not serviceable and must be replaced. Contact Quantum for further details.
⑪2000 operating hours or annually, whichever occurs first.

The data in the table below is provided to assist the vessel in scheduling the appropriate service staff and coordination of vessel docking (haul out) for maintenance procedures.

Service Levels*

Level	Description
1	**Onboard maintenance possible at sea No shore support required**
2	**Shore supported maintenance and corrective measures**
3	**Base or supplier personnel Quantum personnel or equivalent**
A	**Vessel must be hauled out to perform task**
B	**Vessel can be in water to perform task**

HULL UNIT

Maintenance Schedule	Service Level*	200hrs	500hrs	2000hrs	4000hrs	8000hrs	12000hrs	When Hauled Out	When Required
Grease Lower Bearing ①	1B	Q							
Grease Upper Bearing ①	1B		Q						
Inspect Main Cylinders for external leakage and spherical bearings	1B			Q					
Inspect Centering Bolts (cylinders for leakage)	1B			Q					
Inspect Stabilizer Manifold	1B			Q					
Inspect Stabilizer Manifold Electrical Connections	1B			Q					
Inspect Fin Angle Sensor Linkages	1B			Q					
Inspect Tiller Area	1B			Q					
Inspect Hydraulic Hoses	1B			Q					
Check Shaft Clearances ☎	3A							Q	
Replace Lower Shaft Seals and Barnacle Ring ⑨ ☎	3A	See NOTE on page 2				Q			Q
Replace Main Shaft Bearings ☎	3A	See NOTE on page 2				Q			Q
Rebuild/Replace Centering Cylinder ⑩	3B						Q		
Replace Hydraulic Hoses	3B						Q		
Adjust Spherical Bearings (QC1500, QC1800, QC2200 QC2400) ☎	1B								Q
Adjust Spherical Bearings (QC2600 and QC3600) ☎	3B								Q
Replace Spherical Bearings and Cylinder Pins	2B				Q				Q
Rebuild/Replace Cylinders (QC1000 to QC2400) ⑩ ☎	3B				Q				Q

HULL UNIT (continued)

Maintenance Schedule	Service Level*	200hrs	500hrs	2000hrs	4000hrs	8000hrs	12000hrs	When Hauled Out	When Required
Rebuild/Replace Main Cylinders (QC2600 to QC3600) ☎	2B					Q			Q
Replace Main Cylinders (QC1000 to QC2400) ☎	2B					Q			Q
Replace the Fin Angle Sensor	1B								Q
Service Stabilizer Servo Valve ⑦	3B						Q		Q

FINS

Maintenance Schedule	Service Level*	200hrs	500hrs	2000hrs	4000hrs	8000hrs	12000hrs	When Hauled Out	When Required
Inspect Fin Surfaces	1A							Q	
Replace O-Rings and Bolts ②	2A					Q		Q	

HYDRAULIC POWER UNIT

Maintenance Schedule	Service Level*	200hrs	500hrs	2000hrs	4000hrs	8000hrs	12000hrs	When Hauled Out	When Required
Inspect the Dirt Indicator of the return filter, replace when required	1B		Q						
Inspect Flexible Hoses	1B		Q						
Inspect Suction Hoses	1B		Q						
Inspect Cooling Pump	1B		Q						
Inspect Noise Suppressor Nitrogen Pressure, fill if necessary ⑥⑧	1B		Q						Q

HYDRAULIC POWER UNIT (continued)

Maintenance Schedule	Service Level*	200hrs	500hrs	2000hrs	4000hrs	8000hrs	12000hrs	When Hauled Out	When Required
Inspect and Clean Oil Cooler Tubes	1B		Q						
Inspect Pump Drive Coupling	1B		Q						
Inspect Motor and Frame Mounts	1B		Q						
Inspect Electrical Connections	1B			Q					
Inspect Accumulator Nitrogen Pressure, fill if necessary ③④	1B			Q					Q
Inspect or Replace Desiccant Air Breather	1B								Q
Replace Kidney Loop Filter Element	1B			Q					Q
Test Hydraulic Oil Quality by means of taking sample ⑪	2B				Q				
Replace Return Filter Element	1B			Q					
Replace Pressure Filter Element ③	1B			Q					
Clean/Replace Suction Strainer	1B					Q			Q
Change Oil	1B					Q			Q
Replace Drive Coupling Element	3B					Q			
Replace Unloader Valve	3B					Q			Q
Replace VFDs (WEG brand only)	2B						Q		Q
Rebuild/Replace Noise Suppressor ⑥	3B				Q				
Rebuild/Replace Cooling Pump	3B					Q			Q
Replace Hydraulic Hoses	3B						Q		Q

HYDRAULIC POWER UNIT (continued)

Maintenance Schedule	Service Level*	200hrs	500hrs	2000hrs	4000hrs	8000hrs	12000hrs	When Hauled Out	When Required
Replace Oil Cooler (Sendure type)	3B				Q				
Replace Oil Cooler Tube Stack (Bowman type)	3B					Q			
Replace Oil Cooler (Universal Hydraulik type)	3B					Q			
Replace Hydraulic Pumps ⑦	3B				See text on page 7				Q

XT™ HYDRAULIC POWER UNIT

Maintenance Schedule	Service Level*	200hrs	500hrs	2000hrs	4000hrs	8000hrs	12000hrs	When Hauled Out	When Required
Functional Inspection (observe sounds, smells, vibrations, leaks, oil level, gauges, dials, unit cycle, etc. Refer to *XT*™fin chapter)	1B			Q					
Inspect Electrical Connections	1B			Q					
Inspect Frame Mounts	1B			Q					
Inspect Accumulator Nitrogen Pressure and fill up if necessary❸	1B			Q					Q
Test Hydraulic Oil Quality by means of taking sample ⑪	2B			Q					
Clean 40 micron Pressure Filter Screen Cartridge	1B			Q					
Change Oil	1B					Q			Q
Replace Unloader Valve	3B								Q
Replace Hydraulic Pumps	3B								Q

XT™ FINS

Maintenance Schedule	Service Level*	200hrs	500hrs	2000hrs	4000hrs	8000hrs	12000hrs	When Hauled Out	When Required
Inspect Hydraulic Cylinder	3A					Q		Q	
Rebuild/Replace Cylinder	3A					Q		Q	Q
Replace Hydraulic Hoses	3A					Q		Q	Q
Inspect/Replace Grounding Cable	3A					Q		Q	
Inspect Electrical Connections	3A					Q		Q	
Replace Inspection Plate O-rings	3A					Q		Q	
Inspect Anode(s)	3A/B					Q		Q	Q
Inspect Entire Fin and Components	1/3 A/B					Q		Q	Q
Check Foil for Proper Operation (cycle)	1/3 A/B					Q		Q	Q

CONTROL SYSTEM

Maintenance Schedule	Service Level*	200hrs	500hrs	2000hrs	4000hrs	8000hrs	12000hrs	When Hauled Out	When Required
Clean the Cooling Fan of the VFD or One Speed Drive ⑤	1/3B			Q					
Test the Emergency Stop Button	1/3B				Q				
Check Line Reactor, VFD, OSD pwr cable to terminal connection	1/3B			Q					Q

Section 8: Corrective Maintenance

SYSTEM FAILS TO POWER UP – CORRECTIVE MAINTENANCE

Possible Causes	Rectification
24VDC Power Supply unavailable	Check DC supply panel breaker
24VDC Power Supply off	Check AC voltage to power supply
Control Head faulty	Replace control head
Control cabinet green power button not turned on (SMC4000 systems only)	Turn on control cabinet green power button
Touch screen has no power supply (SMC4000 systems only)	Check for 24VDC supply to touch screen

SYSTEM POWERS UP BUT CANNOT SELECT ANY UNDERWAY OR ZERO SPEED™ MODE CORRECTIVE MAINTENANCE

Possible Causes	Rectification
Auto centering switches not engaged	Check auto centering switches for proper operation

LOSS OF STABILIZATION – CORRECTIVE MAINTENANCE

Possible Causes	Rectification
Mechanical	
Missing or damaged fin	Repair or replace fin
Fin spun on shaft	Reinstall fin
Main shaft bearings seized or damaged	Repair or replace bearings
Cylinder spherical bearings seized or damaged	Repair or replace bearings
Cylinder rod damaged or broken	Repair or replace cylinder
FAS linkage arm missing or damaged	Repair or replace FAS linkage arm
Hydraulic	
Hydraulic Pump(s) not operating	Check AC and DC breaker
	Check suction valve
	Check pump switch on motor control box is ON
	Check hydraulic oil level in tank
	Check VFD or One Speed Drive for operation
	Check coupling(s)

LOSS OF STABILIZATION – CORRECTIVE MAINTENANCE (CONTINUED)

Possible Causes	Rectification
System valve(s) closed	Check all pressure and tank line isolation valves are open
Stabilizer valve not functioning properly	Check for contamination
	Check for power supply
	Check for physical damage
Bypass valve open	Check for system operating valve position
Solenoid operated pressure blocking valve malfunctioning	Check for 24VDC supply to valve
	Check for contamination
	Check for physical damage
Solenoid operated pilot valve malfunctioning	Check for 24VDC supply to valve
	Check for contamination
	Check for physical damage

LOSS OF STABILIZATION – CORRECTIVE MAINTENANCE (CONTINUED)

Possible Causes	Rectification
Low or no system pressure	Check oil level in tank
	Check pressure gauge valve is open
	Check pressure at MC gauge test port on stabilizer manifold
	Check relief valve setting
	Check broken or leaking tubes and hoses
	Check unloader valve
	Check pump rotation
	Check for proper nitrogen charge in accumulator
	Check automatic shutdown
Cylinder piston leakby (bypassing)	Repair or replace cylinder

LOSS OF STABILIZATION CORRECTIVE MAINTENANCE (CONTINUED)

Possible Causes	Rectification
Electrical	
Low or no electrical power	Check AC and DC power supply
Fin/Effector control modules not powered	Check fuse in FCM/ECM
	Check for lit green LED light in FCM/ECM
	Check for 24VDC on terminals 1 and 2 of 5 pin connector in FCM
No voltage at pilot or blocking valve	Check pins 1 and 2 for 24VDC on 10 pin connector in FCM
	Check pins 3 and 4 for 24VDC on 10 pin connector in FCM
	Check DIN plug connections for 24VDC
	Check solenoid for power
No power at stabilizer valve	Check for 24VDC on terminals 1 and 2 of 5 pin connector in FCM
	Check stabilizer valve plug
	Check for 24VDC on terminals 5 and 6 of 10 pin connector in FCM
	Check for 4 to 20 mA signal at pin 7 of 10 pin connector in FCM

LOSS OF STABILIZATION CORRECTIVE MAINTENANCE (CONTINUED)

Possible Causes	Rectification
No feedback signal from FAS	Check for damage to FAS cable
	Check FAS cable connection
	Check for proper voltage at FCM
	Check for proper voltage on pins 8 through 10 of 10 pin connector
No signal from roll sensor	Check for proper installation of roll sensor
	Check roll sensor cable for damage
	Check for lit green LED light in roll sensor

NOISE AND VIBRATION – CORRECTIVE MAINTENANCE

Possible Causes	Rectification
Suppressor Charge Low	Check nitrogen charge in suppressor
Accumulator charge low	Check for proper nitrogen charge in accumulator
Tubing or piping clamps loose or missing	Repair or replace clamps
Worn or out of adjustment spherical bearings	Adjust or replace
Fin oscillating	Gain setting too high, reset
Cavitating Fins	Fin angle too great
	Fin to hull clearance excessive
	Fin damage, repair
	Fin spun on shaft, adjust
Worn motor bearings	Repair or replace
Aerated oil	Low oil in tank
	Suction connection loose

MISCELLANEOUS – CORRECTIVE MAINTENANCE

Possible Causes	Rectification
Water in Oil	Check for damaged or corroded heat exchanger
Water Leaks into Boat	Check chockfast installation and condition, excessive clearances due to worn parts
Grey flakes appear under cylinder bearings	Failing or improperly maintained bearing requires lubricating with Miller-Stevenson MS-122 AD (Teflon Mold Release) lubricant
Threaded portion of cylinder rod backing out of rod end	Check clamping bolts for correct torque
Hull unit shifting with load	Check installation torque
Fins filling with water	Check fin plugs, fin weld seam or plate broken, cover plates and o-rings
Fin stuck at deflected angle	Check for excessive outboard fin deflection, fin to hull clearance, hull to weld bushing alignment, hull fairing
Paint wear on fin or hull close to fin	Check fin to hull clearance, fore and aft fin alignment causing cavitation
Fins do not center	Check system oil pressure, stabilizer valve, fin angle sensor, bypass valve, hose orientation

MISCELLANEOUS - CORRECTIVE MAINTENANCE (CONTINUED)

Possible Causes	Rectification
Fins do not remain centered when system is off	Check bypass valve position and condition, repair/replace actuator cylinders, repair or replace relief valve, repair/replace stabilizer valve
Hull unit operating uncontrollably and not maintaining center position	Check plumbing of A and B hoses,
	Potentiometer installed 180 degrees out of phase, check with multimeter and adjust
System oil pressure is not within proper range	Check accumulator bladder, pump output, relief valve setting
Oil temperature too high	Check cooling water flow, heat exchanger for corrosion, cooling water valves
Greaser alarms	Check grease reservoir level, clogged or defective doser unit, internal damage including wiring or component failure