SEAKEEPER SPHERE REMOVAL GUIDE - 104

PRODUCT SEAKEEPER SERIES MODELS

PURPOSE

To provide a guide on the disassembly and reassembly of Seakeeper 2, 3, 5, 6, 9, 18, 26, 35, and 40 model stabilizers for the purpose of removing and reinstalling the enclosure and gimbal shaft assemblies.

BACKGROUND

There is a need for generic procedural steps for Seakeeper frame disassembly and reassembly for access to components and for sphere removal for replacement or refit installation. This procedure may be used in part or in whole to access components of the Seakeeper for maintenance or installation.

TOOLS/SUPPLIES REQUIRED

- Moisture–curing polyether-based sealant, Sili-Thane™ 803 or similar
- Loctite #243, or similar
- Nickel anti-seize
- Rags or towels
- AW46 Hydraulic Fluid
- 50/50 Glycol mixture
- Black moly grease
- Cable ties
- Bucket for glycol drainage
- Screwdriver, Phillips Head, #2
- Screwdriver, Straight-slot
- Awlgrip® Snow White (F8063)
- Dead blow hammer
- Small pry bar
- 7/16, 1/2, and 1-1/8 in. wrench
- Metric & SAE Allen set
- 3/8” or 1/2” barbed hose plugs, qty 3
- Torque wrenches
- 10, 12, 13, 17, 19, and 24 mm wrench
- Spreader bar for model
  - Seakeeper 2 & 3: P/N 11766
  - Seakeeper 6/5: P/N 80067
  - Seakeeper 9/7HD: P/N 11015
  - Seakeeper 16/18: P/N 80061
  - Seakeeper 26/35/40: P/N 81638
- Seakeeper hydraulic hand pump service kit (P/N: 10384)
- Brake Bushing Service Tool Kit
  - Seakeeper 2, 3, 3DC/5(EM), 5/6, – P/N: 11367
  - Seakeeper 9, 16/18, 26 – P/N: 10449
  - Seakeeper 35/40 – P/N: 11401

REFERENCES

SWI-094, Seakeeper AC Motor Drive Replacement

SWI-103, Seakeeper Brake Service

SWI-107, Seakeeper Glycol Service

SWI-108, Seakeeper Angle Sensor Calibration

SWI-109, Seakeeper Brake Bushing Service

SB-90624, Seakeeper Vacuum Sensor Elimination

SB-90638, Seakeeper 6 Lower Rod End Pin Access

Applicable model Installation Manual and drawings (manuals.seakeeper.com)

PRECAUTIONS

1. **PERSONNEL INJURY MAY RESULT** if Seakeeper is NOT locked and at zero RPM before removing covers or accessing unit for service.
2. **PERSONNEL INJURY MAY RESULT** if attempting to perform maintenance on Seakeeper without removing flywheel motor power and applying lockouts due to remote start capabilities.
3. **PERSONNEL SHOCK HAZARD EXISTS** in Motor Drive Box (MDB) when flywheel rotating OR at zero speed for minimum of ten minutes.
4. **PERSONNEL INJURY MAY RESULT** if rigging material used is not rated for weight of enclosure/sphere. [Enclosure weights/dimensions can be found in **Attachment 2**.
5. **SEAKEEPER ENCLOSURE DAMAGE MAY OCCUR** if lifted without use of lifting bar or long straps from enclosure lifting eyes.
6. **SEAKEEPER DAMAGE MAY OCCUR** if dropped or mechanically shocked in transport.
7. **BRAKE CYLINDER LEAKAGE MAY RESULT** from scratched/damaged cylinder rods.
8. **DAMAGE TO MOTOR POWER CABLE FEED-THROUGH MAY OCCUR** if enclosure rested on lower water jacket.

DISASSEMBLY PROCEDURE

1. **ENSURE** following**:**

   a. **ENSURE** low current DC breaker is ON at ships service panel.

      i **IF** Seakeeper on pallet,
      THEN ALIGN DC power source (of appropriate voltage) to DC INPUT Deutsch connector.

   b. **ENSURE** Seakeeper is at zero RPM at display or MFD app for minimum of ten minutes.

2. **TURN OFF** high current power breaker to Seakeeper.

3. **REMOVE** cover panels from Seakeeper.

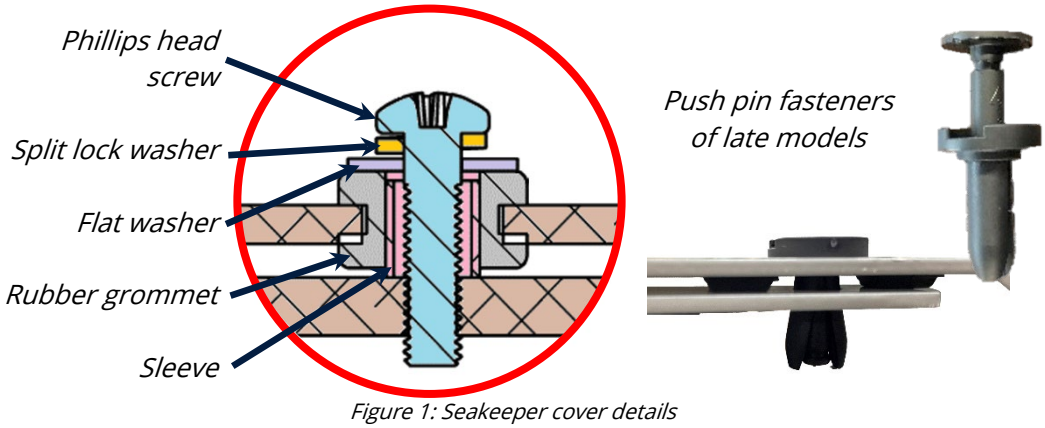


Figure 1: Seakeeper cover details

4. **SAVE** all fasteners and hardware removed for reassembly.

5. **ACTIVATE** brake override.

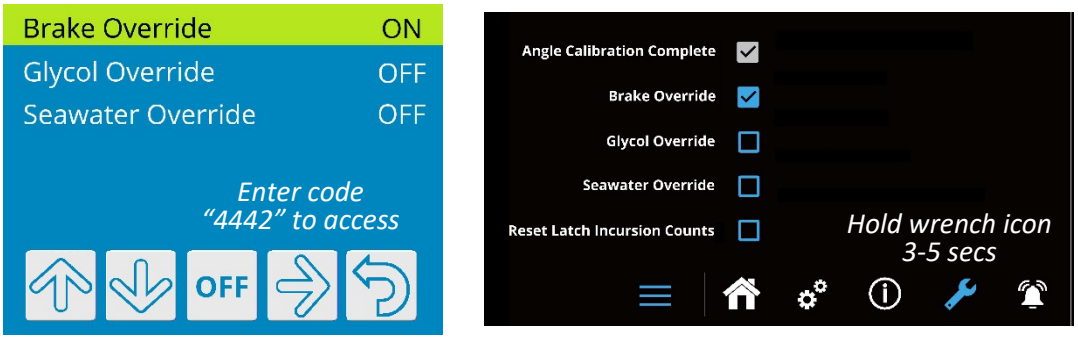


Figure 2: Service page details

6. **TAKE** photos of Seakeeper wire harness routing to note location of all cable ties on foundation and guide bands for reference during reassembly.

7. **REMOVE** angle sensor:

   a. **DISCONNECT** 3-pin Deutsch connector to angle sensor.

Figure 3: Deutsch DTM06-3S face

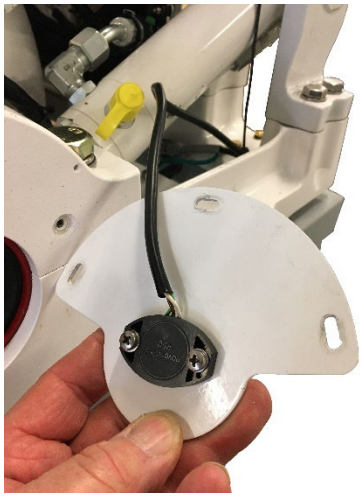


Figure 4: Angle sensor mounting detail

   b. **CUT** cable ties restraining sensor cable.

   c. **REMOVE** angle sensor mounting plate.

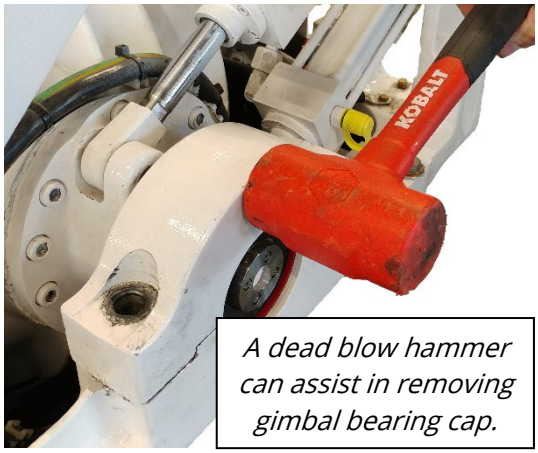
   d. **SAVE** all hardware for reassembly.

8. **REMOVE** brake cylinders rod end pins as follows:

   a. **IF** Seakeeper has lock wired gimbal cap screws, **THEN REMOVE AND DISCARD** lock wire.

> **NOTE:**
>
> Some models have a slot in gimbal cap mating surface for small pry bar to assist in removal of gimbal cap.

   b. **REMOVE** gimbal cap(s) at brake cylinders.



A dead blow hammer can assist in removing gimbal bearing cap.

Figure 5: Gimbal cap removal

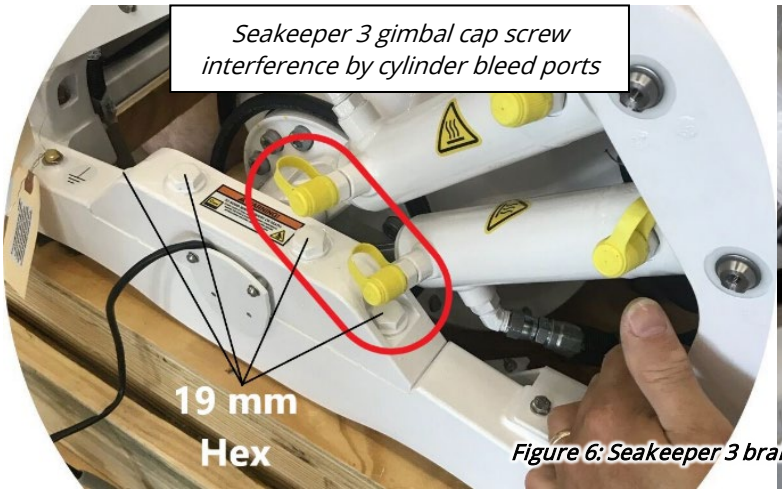
Disassembly, Step 8 continued

c. **IF** Seakeeper 3 (S/N 3-0494 or earlier),
THEN REMOVE brake-side gimbal bearing cap as follows:

i **LOOSEN** two front M12-1.75 hex head screws of gimbal bearing cap.

ii **REMOVE** four M10-1.5 hex head cylinder brace screws and washers.

iii Holding rear of cylinder brace, **LIFT** up and forward to give clearance for wrench to loosen rear gimbal cap screws.



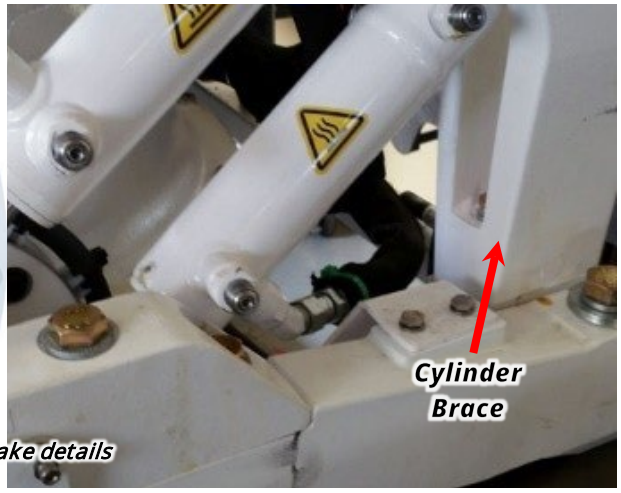


Figure 6: Seakeeper 3 brake details

iv **REMOVE** rear two M12-1.75 hex head screws of gimbal bearing cap.

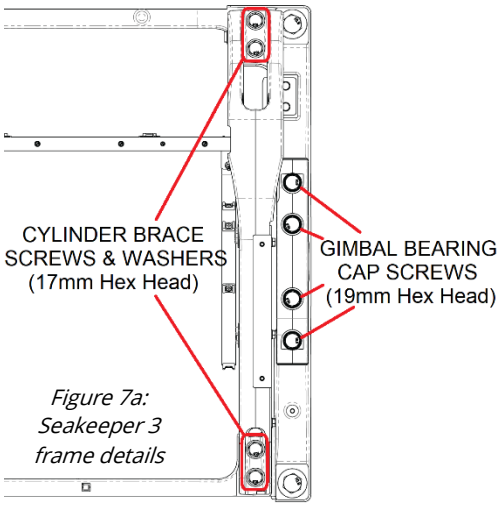


Figure 7a: Seakeeper 3 frame details

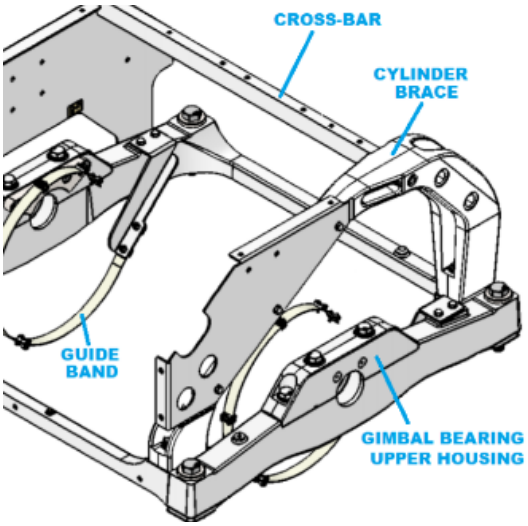


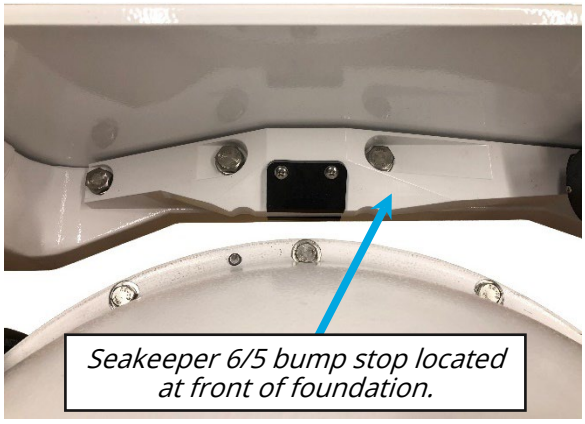
Figure 7b: Seakeeper 3 frame components

Disassembly, Step 8 continued

d. **REMOVE** gimbal cap screws and gimbal cap from foundation.

e. **IF** Seakeeper 3DC/5/6,
THEN:

Figure 8: Seakeeper 6/5 bump stop location



i **REMOVE** glycol pump bracket from front cover.

ii **REMOVE** four hex head screws of mechanical bump stop at front of foundation (Use 17 mm wrench for Seakeeper 6/5; use 9/16-in. wrench for Seakeeper 5/3DC (EM), (See SB-90638 for Seakeeper 6/5).

iii **REATTACH** glycol pump bracket to front cover, if desired.

f. **PRECESS** sphere to access each cylinder rod-end pin.

g. **REMOVE** protective plastic caps of rod-end pins and outer trunnions. (See fig. 9)

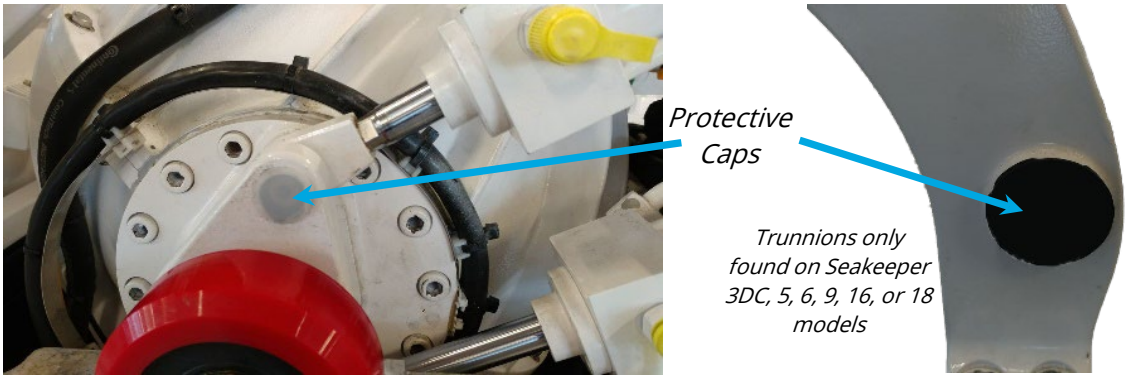


Figure 9: Protective cap locations

Disassembly, Step 8 continued

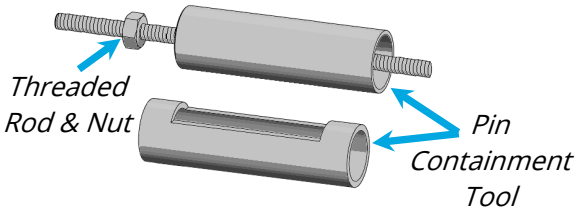
WARNING!

EYE INJURY MAY RESULT from snap ring dislodging from pliers.

h. **REMOVE** internal retaining rings and spacers of rod-end pins.

i. **REMOVE** cylinder rod-end pins (See fig. 11 and **ATTACHMENT 1** brake details):

i **INSTALL** threaded rod of bushing kit into rod-end pin.



Brake Bushing Service Tool Kit (appropriate kit for model serviced)
- *Seakeeper 1 & 2 (11901)*
- *Seakeeper 3, 5/3DC, & 6 (P/N: 11367)*
- *Seakeeper 9/7HD, 16/18/12HD & 26/20HD (P/N: 10449)*
- *Seakeeper 35/30HD/40 (P/N: 11401)*

Figure 10: Bushing tool details

ii **INSTALL** pin containment tool of choice from bushing kit.

iii **THREAD** nut onto rod **AND TURN** nut CLOCKWISE to draw pin into containment tool.

iv **CAPTURE** delrin plastic washers as pin is removed.

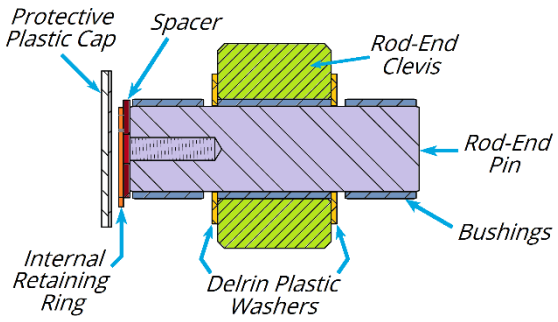


Figure 11: Brake rod end pin details

Disassembly, Step 8 continued

j. **REMOVE** cylinder brace mounting screws.

k. **ATTACH** cylinders to cylinder brace(s) with cable ties.

i **IF** Seakeeper 3DC/5 (EM) through 18 models, **THEN:**

1 **REMOVE** outer cylinder brace(s).

2 **ATTACH** cylinders to inner brace(s) with cable ties. (fig.12)

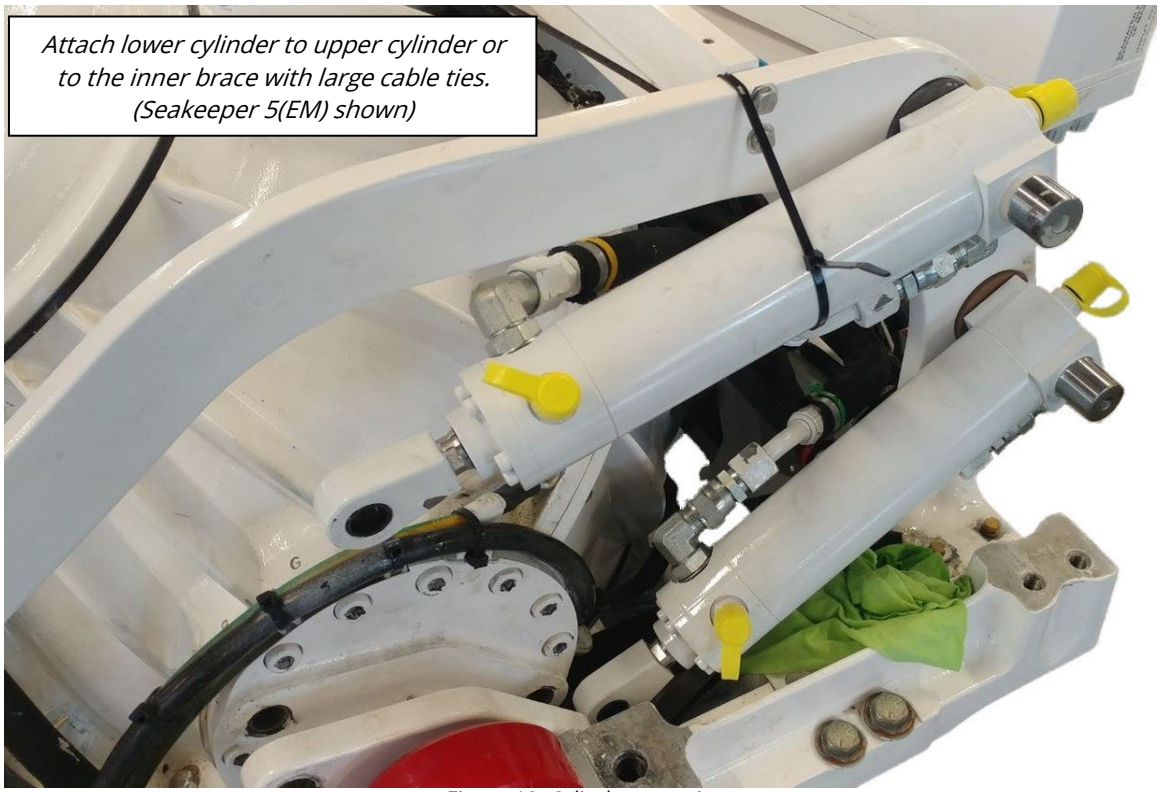


Figure 12: Cylinder restraint

9. **DISCONNECT** following connectors to Seakeeper:
    - DC INPUT
    - SW PUMP IN (only equipped in later models)
    - SW PUMP OUT (only equipped in later models)

10. **DISCONNECT** electrical power cables:

    a. For Seakeeper 3DC/5 and above, **PERFORM** following:

        i **REMOVE** ten M4 Phillips head screws from MDB cover.

        ii **REMOVE** MDB cover.

        iii **PERFORM** following:

Figure 13: MDB cover shown

WARNING:

PERSONNEL SHOCK/BURN HAZARD MAY RESULT from contact with energized wire.

1 **ENSURE** AC power breaker OFF to Seakeeper.

2 With multimeter, **VERIFY** zero voltage at AC INPUT terminals.

3 **DISCONNECT** motor power leads from MOTOR terminals and ground lug.

4 **REMOVE** motor power cable gland nut on exterior of MDB.

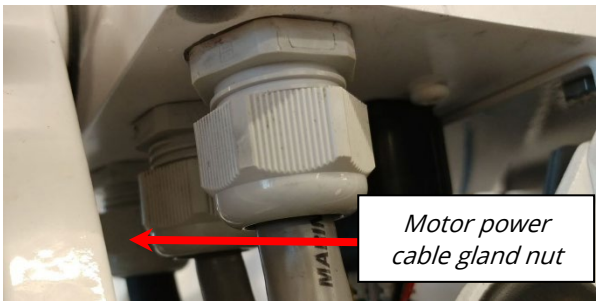


Figure 15: Motor power cable gland

Figure 14: MDB motor leads

Disassembly, Step 10.a.iii continued

5 **CUT** cable-ties securing motor power cable between MDB and foundation Guide Band.

6 **PULL** flywheel motor power cable free of MDB.

iv **IF** removing unit from vessel,
THEN:

1 **CUT** cable-ties holding AC INPUT and SW PUMP power cables.

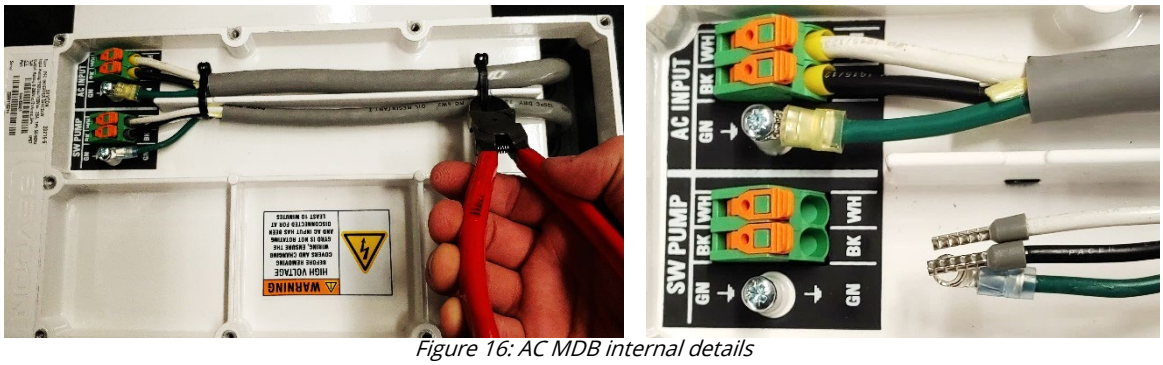


Figure 16: AC MDB internal details

2 **DISCONNECT** AC INPUT and, if equipped, SW PUMP leads and ground wires from terminals.

3 **REMOVE** gland nuts and cable grommets from AC INPUT and if equipped, SW PUMP cables on exterior of MDB.

4 **CUT** cable-ties securing the AC cable(s) along Seakeeper frame.

5 **REMOVE** AC INPUT and SW PUMP cable(s) from MDB.

Figure 17: AC MDB external details

v **REINSTALL** ground lug screw(s).

vi **REINSTALL** MDB cover with ten M4 Phillips head screws.

Disassembly, Step 10 continued

b. For Seakeeper 2 and 3, **PERFORM** following:

> **WARNING:**
>
> PERSONNEL SHOCK/BURN HAZARD EXISTS from contacting energized wire.

i **ENSURE** High Current DC breaker OFF.

ii With multimeter, **ENSURE** no voltage present at DC INPUT terminals.

iii **REMOVE** motor terminal cover of motor power cable leads with T20 bit.

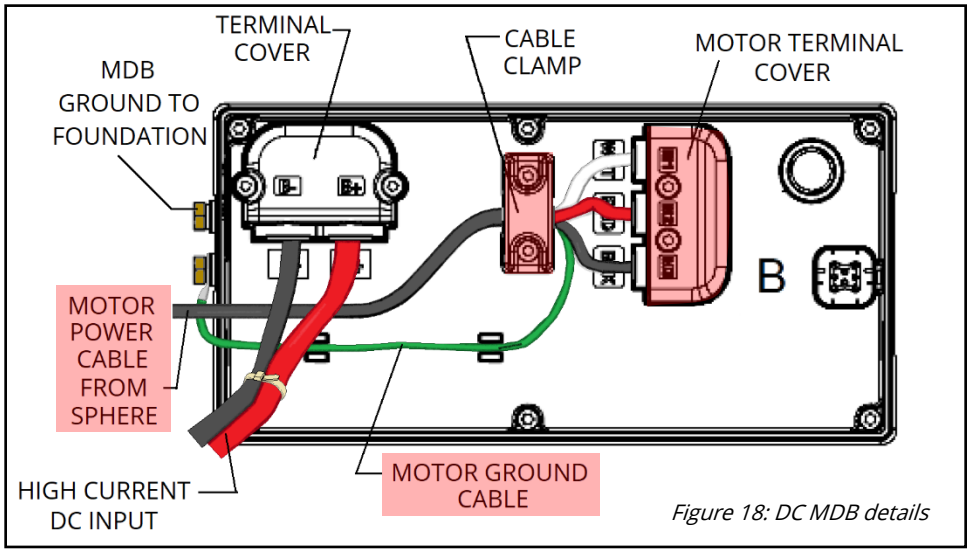


Figure 18: DC MDB details

iv **REMOVE** motor cable clamp. (highlighted in fig. 18)

v **DISCONNECT** motor leads from motor terminals. (highlighted in fig. 18)

vi **DISCONNECT** motor ground cable lead from side of MDB. (fig. 18)

vii **CUT** cable-ties securing motor power cable from MDB to foundation Guide Band.

viii **REINSTALL** cable clamp, motor terminal cover and motor cable ground screw.

Disassembly, Step 10.b continued

ix **IF** removing unit from vessel,
THEN:

1 **REMOVE** battery terminal cover from MDB. (fig. 19)

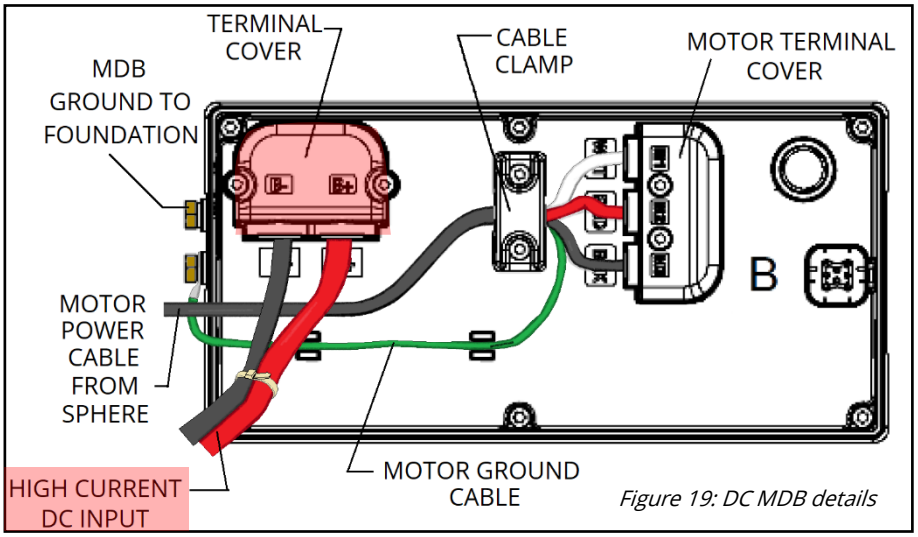


Figure 19: DC MDB details

2 **DISCONNECT** battery leads from DC Input terminals of MDB.

3 **REINSTALL** MDB battery terminal cover.

11. **DISCONNECT** following ground cables at Seakeeper foundation frame:

- heat exchanger
- MDB
- enclosure

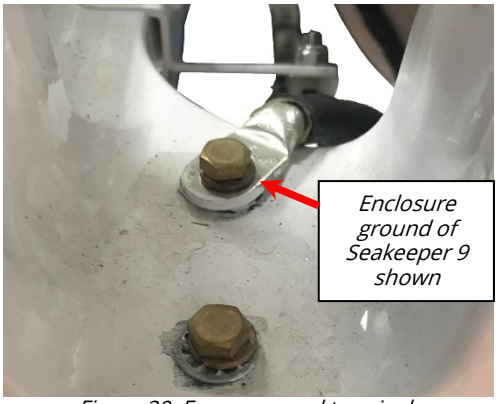


Figure 20: Frame ground terminals

12. **DISCONNECT** enclosure coolant hoses as follows:

    a. **PLACE** one gallon (2 L) catch beneath lower cooling jacket hose connection.

    b. **DISCONNECT** glycol hose from guide band to lower cooling jacket connection to drain coolant from hoses and jackets.

    c. **PLUG** end of glycol hose with barbed hose plug.

    d. **DISCONNECT** glycol hose from guide band to upper cooling jacket.

    e. **PLUG** glycol hose with barbed hose plug.

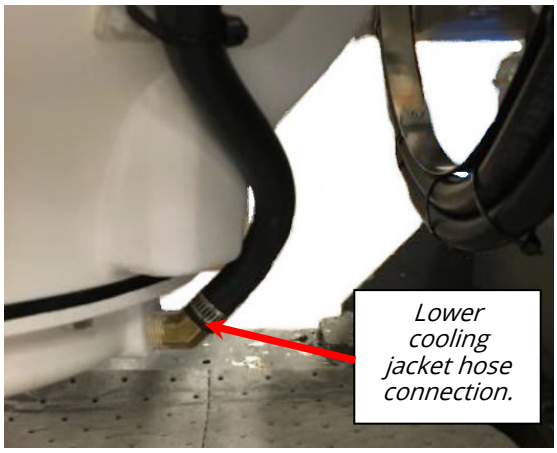


Figure 21: Lower jacket hose connection

NOTE:

- Some late-model Seakeepers will not have enclosure sensors installed.
- Only AC models have separate enclosure ground cable.

13. **DISCONNECT** electrical connectors on enclosure sphere:
    - Enclosure vacuum sensor
    - Upper and lower bearing temperature sensors
    - Sphere ground wire (routed with motor drive cable)

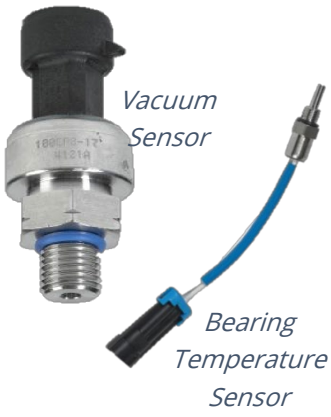


Figure 22: Enclosure sensors of earlier models

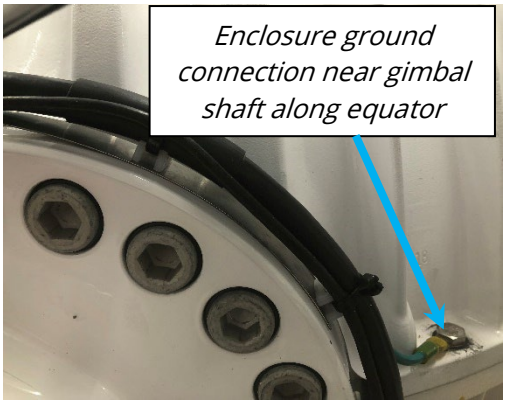


Figure 23: AC Seakeeper enclosure ground cable

14. **CUT** cable ties holding cables and hoses on guide bands and on enclosure where applicable: wire harness, motor cable, enclosure ground cable, and glycol hoses.

15. **DISCARD** cut cable ties.

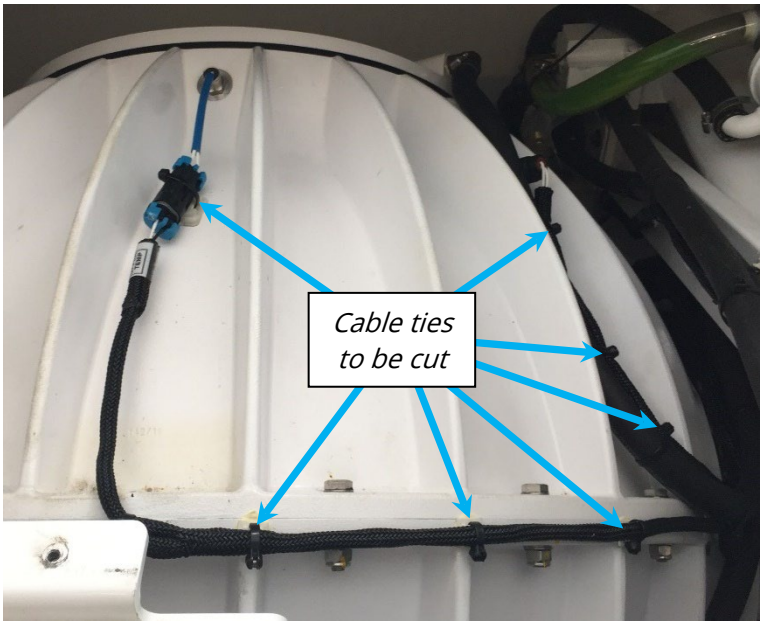


Figure 24: AC Seakeeper enclosure sensor cable tie locations

16. **[OPTIONAL] REMOVE** foundation crossbar (crossbar supports MDB and brake manifold on most models).

NOTE:

This step is to lighten the upper foundation assembly and make it less awkward to transport through a boat.

17. **[OPTIONAL]** For Seakeeper 26/35/40 models:

    a. **REMOVE** brake manifold from crossbar.

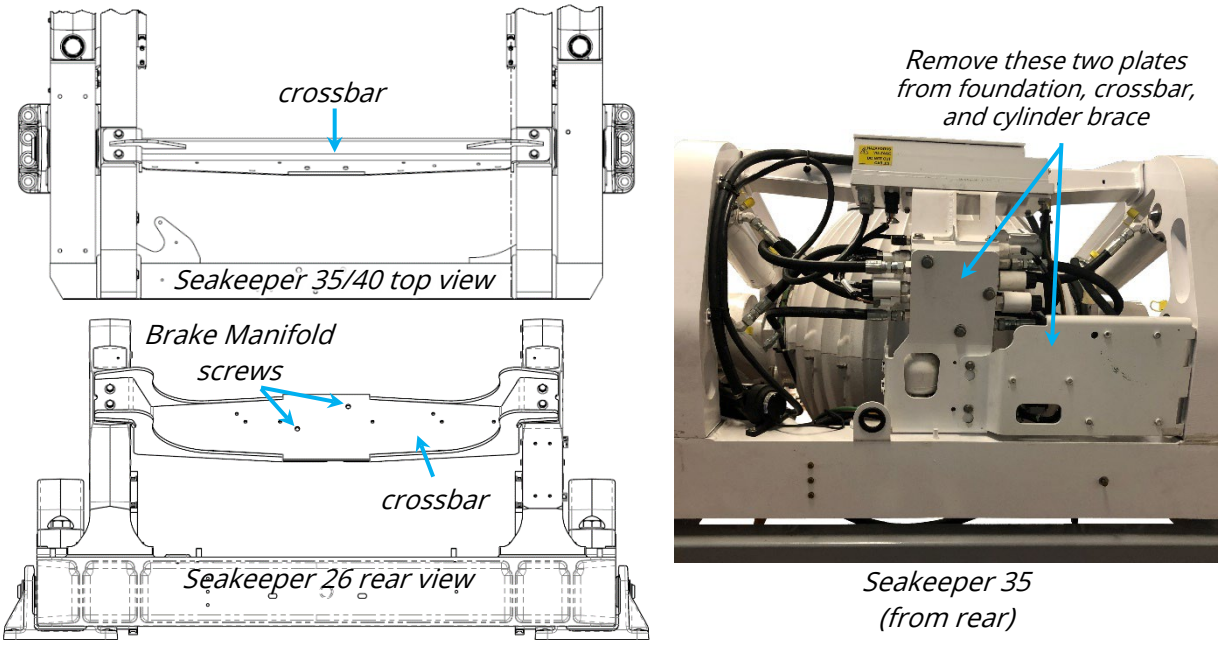


Figure 25: Seakeeper 26/35/40 crossbar and foundation components

    b. **CUT** all associated wire harness and coolant hose cable ties.

    c. **REMOVE** crossbar from cylinder braces. (fig. 25)

    d. **DISCONNECT** glycol pump(s) harness connector.

    e. **REMOVE** rear brake cylinder pins to allow moving cylinders with manifold and brake hoses.

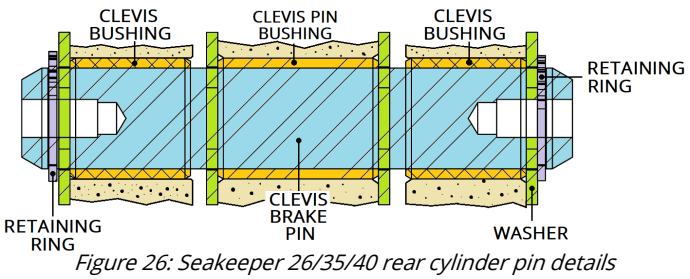


Figure 26: Seakeeper 26/35/40 rear cylinder pin details

18. **DISCONNECT** guide bands from enclosure:

    a. **REMOVE** all hoses and cabling of guide bands near gimbal shaft.

    b. **REMOVE** two M4 pan-head Phillips screws on guide bands (see image to right). (fig. 27)

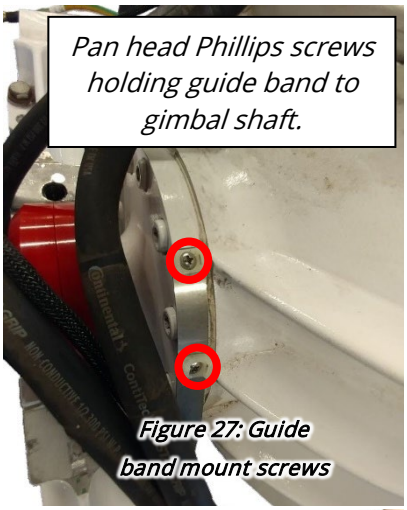


Figure 27: Guide band mount screws

19. **[OPTIONAL] REMOVE** front panel as follows:

    a. **ENSURE** all associated cable ties have been cut on front panel (Seakeeper 2 through 18 models).

    b. If applicable for model, **DISCONNECT** glycol pump harness connection installed on front panel.

    c. **REMOVE** glycol pump from rubber mount brace, if installed on front panel.

20. **[OPTIONAL] REMOVE,** right-side (non-brake side panel on Seakeeper 2 through 9) panel:

    a. On Seakeeper 2 through 18 models, **REMOVE** heat exchanger mounting screws.

    b. **REMOVE** screws holding sides of panel and crossbar with 10 mm socket.

    c. **CUT** cable ties along inside panel.

    d. **LOOSEN** screws at bottom of side panel to allow panel to slide up and off foundation with 13 mm socket.

    e. **LIFT** panel free from foundation.

Front panel screws of Seakeeper 9

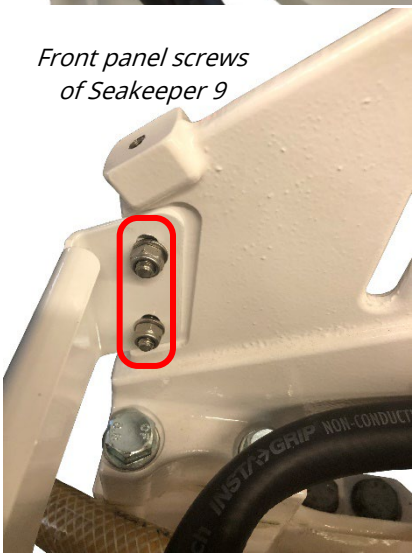


Figure 28: Seakeeper 9 front panel mounting

21. **ENSURE** all side panel bottom foundation screws are loosened.

22. **IF** Seakeeper equipped with ConnectBox,
THEN:

    a. **IF** connected to MFD,
    THEN DISCONNECT ethernet adapter cable from ConnectBox.

    b. **IF** connected to optional 5-inch display,
    THEN DISCONNECT CAN cable to 5-inch display from harness T-adapter.

    c. **DISCONNECT** NMEA2000 drop cable from ConnectBox.

23. With two people, **LIFT** upper assembly (cylinder braces, brake system, side panels and crossbar, as applicable) as one assembly from foundation. (fig. 29)

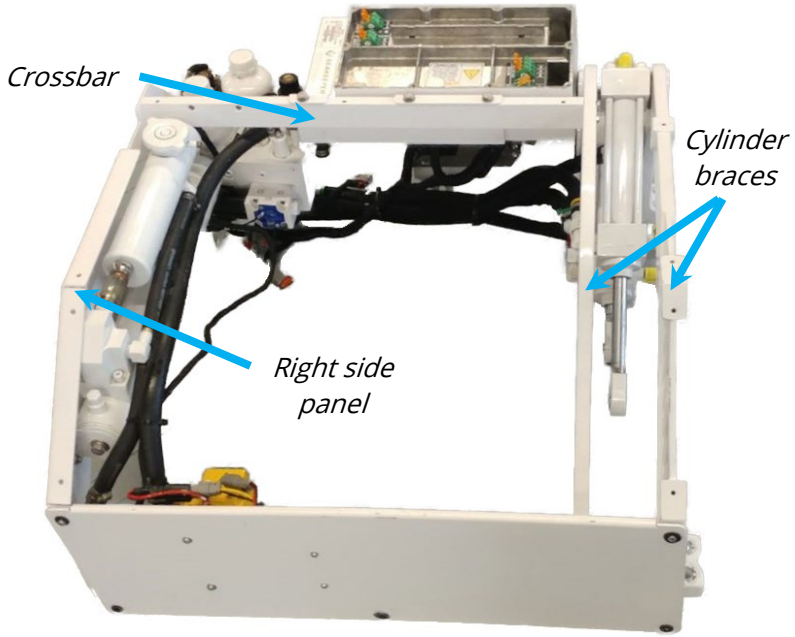


Figure 29: The upper foundation assembly of a Seakeeper

24. **ATTACH** motor power cable to enclosure with tape.

25. **REMOVE** remaining gimbal cap, if installed, per **step 8.b**.

CAUTION!

ENCLOSURE DAMAGE MAY RESULT if lifted with short straps.

26. **REMOVE** enclosure sphere from foundation assembly as follows:

    a. **OBTAIN** properly sized spreader bar or greater than 7 ft length of lifting strap.

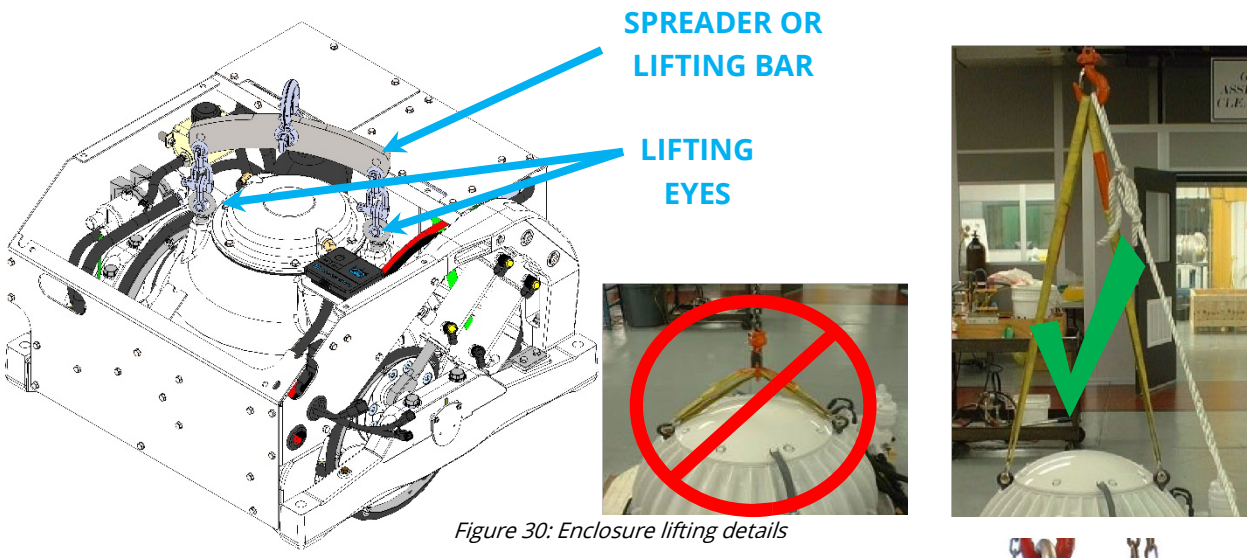


Figure 30: Enclosure lifting details

    b. **ATTACH** spreader bar or strap to enclosure lifting eye bolts.

    c. **ENSURE** all components disconnected from enclosure (i.e., grounds, harness wires, coolant hoses, motor cable disconnected from MDB).

    d. **SLOWLY LIFT** enclosure sphere from foundation and move to required location using crane or chain fall(s).

Figure 31: Seakeeper 5 (EM) enclosure suspended by chain hoist

NOTE:

- Removing gimbal shaft assemblies will reduce weight and width of enclosure for restrictive accesses through which it must be transported.
- Seakeeper 26, 35, and 40 gimbal shaft assemblies contain bolts near rod-end pin housings covered by plastic caps.

27. **[OPTIONAL] REMOVE** gimbal shaft assemblies:

    a. **MARK** gimbal shaft locations with marker for correct orientation on re-assembly.

    b. **REMOVE** gimbal shaft screws.

28. **APPLY** tape around circumference of gimbal bearing isolation bushing. (fig. 33)

29. **IF** replacing sphere enclosure,
THEN REMOVE gimbal bearing retainer plates from each gimbal shaft for installation on replacement sphere enclosure.

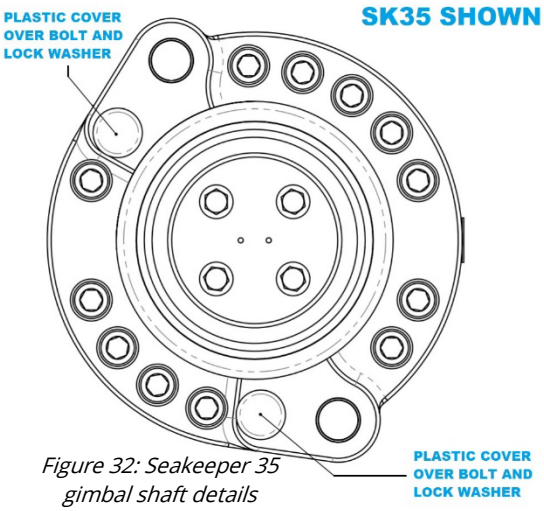


Figure 32: Seakeeper 35 gimbal shaft details

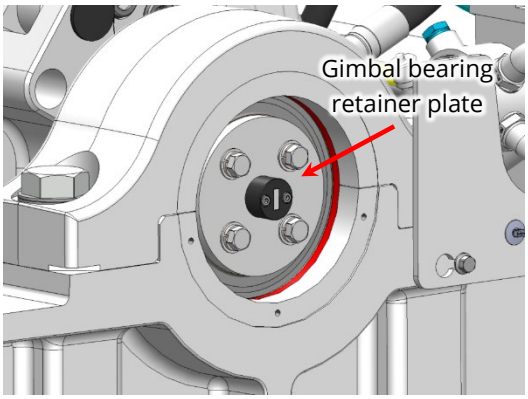


Figure 34: Gimbal bearing retainer plate shown

Figure 33: Gimbal shaft bearing isolation bushings taped

REASSEMBLY PROCEDURE

1. **POSITION** Seakeeper foundation assembly per model Installation Manual if installing in vessel.

2. **CLEAN** following components of residual marine sealant with scraper or wire brush:
   - all hardware
   - cylinder braces
   - foundation mating surfaces
   - gimbal caps

3. **IF** gimbal shafts have been removed,
   THEN:

   a. **ENSURE** gimbal shaft O-rings and counterbores are clean and free of debris.

   b. **ENSURE** gimbal shaft screw O-rings intact.

   c. **IF** gimbal shaft O-rings or gimbal shaft screw O-rings are damaged,
   THEN REPLACE items from Seakeeper Partner Center or email support@seakeeper.com.

   d. **APPLY** Loctite #243 to screw threads.

   e. **IF** Seakeeper 2, 3, or 6/5,
   THEN APPLY small bead of marine sealant beneath heads of gimbal shaft screws.

   f. **RE-INSTALL** gimbal shaft assemblies to enclosure sphere with gimbal shaft screws.

   g. In star pattern, **TORQUE** gimbal shaft screws per **Attachment 2**.

      i. For Seakeeper 3 gimbals, **TORQUE** gimbal shafts in two increments: first to **30 ft-lbs** (**40.5 Nm**) and secondly to **50 ft-lbs** (**68 Nm**).

4. **REMOVE** tape from gimbal shaft bearing isolation bushings.

5. **RIG** sphere into position above foundation

6. **LOWER** enclosure sphere onto foundation.

7. **VERIFY** gimbal bearing isolation bushings are not pinched in foundation.

8. **IF** gimbal bearing retainer plates removed from sphere, **THEN INSTALL** gimbal bearing retainer plates on replacement enclosure.

9. **APPLY** thin bead of marine sealant to outer mating surfaces of cylinder braces on foundation.

10. **LOWER** complete upper assembly onto foundation **AND TIGHTEN** fasteners finger tight.

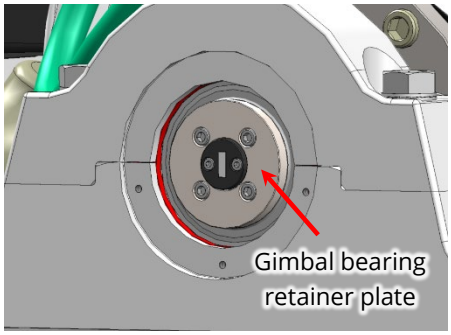


Figure 35: Gimbal bearing retainer plate shown

11. **IF** upper foundation crossbar removed, **THEN INSTALL** crossbar loosely until finished tightening cylinder braces later.

12. **APPLY** Loctite #243 to threads of pan head Phillips screws of guide band.

13. **ATTACH** guide bands to enclosure gimbal shafts with pan head Phillips screws. (fig. 36)

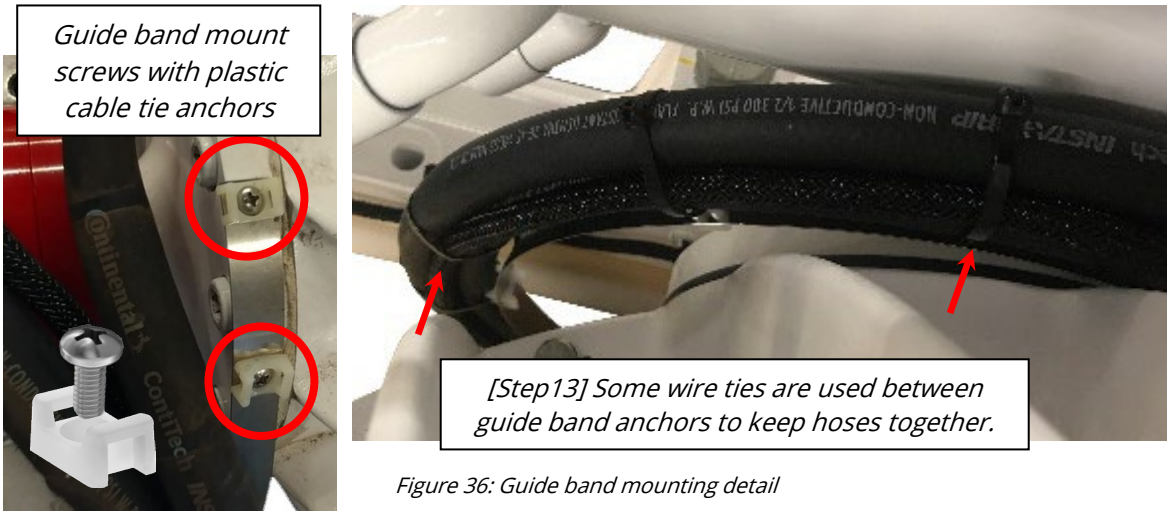


Figure 36: Guide band mounting detail

14. **ROUTE AND ATTACH** all hoses and wiring on guide bands.

    a. **IF** replacement Seakeeper 9, 18 or 26 FRB sphere, **THEN ENSURE** new hoses provided with enclosure sphere due to new hoses being longer.

15. Referencing photos taken before disassembly, **APPLY** new cable ties to all anchor points of guide bands.

16. **TRIM** excess cable tie ends.

17. **IF** model equipped with vacuum sensor plug (fig. 37), **THEN SEE** SB-90624 for details concerning plug.

18. **RECONNECT** electrical connections on enclosure:

    - Enclosure vacuum sensor
    - Upper and lower bearing temperature sensors
    - Enclosure ground wire (routed with motor drive cable on AC-powered models)

Figure 37: Vacuum sensor plug

19. **FASTEN** all enclosure wiring to anchor points with cable ties.

20. **TRIM** excess cable tie ends.

21. **RECONNECT** MDB connections, as necessary:

    a. For Seakeeper 5 and above:

        i. **REMOVE** ten M4 Phillips head screws from MDB cover.

        ii. **REMOVE** motor power cable gland nut and grommet from exterior of MDB.

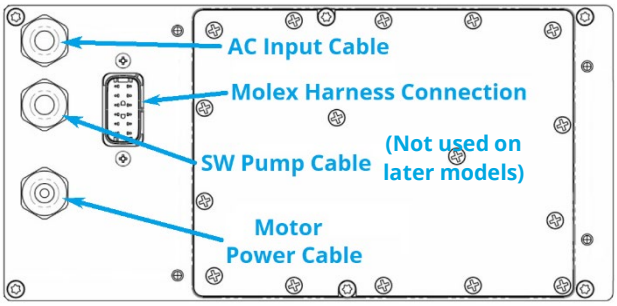


Figure 38: MDB bottom view

        iii. **SLIP** motor drive gland nut over motor drive cable with threads facing end of cable.

REASSEMBLY, Step 21.a continued

iv. **FEED** motor power cable through gland at MDB opening at MOTOR terminal.

v. **SLIDE** cable grommet down into gland fitting.

vi. **CONNECT** motor power cable leads to appropriate colored terminals [WH (U), RD (V), and BK (W)].

vii. **CONNECT** motor power cable ground to ground lug. (fig. 39)

viii. **TIGHTEN** motor power cable gland nut to MDB.

Figure 39: Motor ground lug

ix. **REMOVE** AC INPUT and SW PUMP gland nuts, if applicable, from exterior of MDB.

NOTE:

Late Seakeeper models 5 through 18 and Seakeeper 40 use a DC seawater pump powered through wire harness.

x. **SLIP** gland nut(s) over AC INPUT and SW PUMP cable(s).

xi. **FEED** AC INPUT and, if equipped, SW PUMP cables through gland fittings of MDB openings at appropriate terminal glands.

xii. **SLIDE** grommets over cables down into gland fitting(s).

xiii. **CONNECT** AC INPUT and SW PUMP cable leads to appropriate terminals.

xiv. **CONNECT** AC INPUT and SW PUMP cable grounds to appropriate ground lugs.

Figure 40: AC INPUT and SW PUMP terminals

REASSEMBLY, Step 21.a continued

xv. **ATTACH** AC INPUT and SW PUMP cables to MDB interior with cable-ties.

xvi. **TIGHTEN** gland nuts of AC INPUT cable and SW PUMP cable.

xvii. **CONNECT** wire harness to MDB.

xviii. **INSTALL** MDB cover with ten M4 Phillips head screws.

xix. **TORQUE** MDB cover screws to **19 in-lbs** (**2.2 Nm**).

Image of late model Seakeeper 5 through 18 MDB internals with NO AC SW PUMP cable

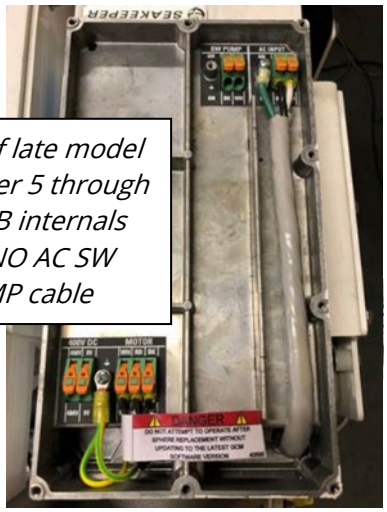


Figure 41: MDB internals

Figure 42: Torquing AC MDB cover screws

xx. **RECONNECT** cables to foundation cable-tie anchors.

xxi. **TRIM** excess cable tie ends.

REASSEMBLY, Step 21 continued

b. For Seakeeper 2 and 3:

i. **REMOVE** motor terminal cover and cable clamp from beneath MDB with T20 bit. (fig. 43)

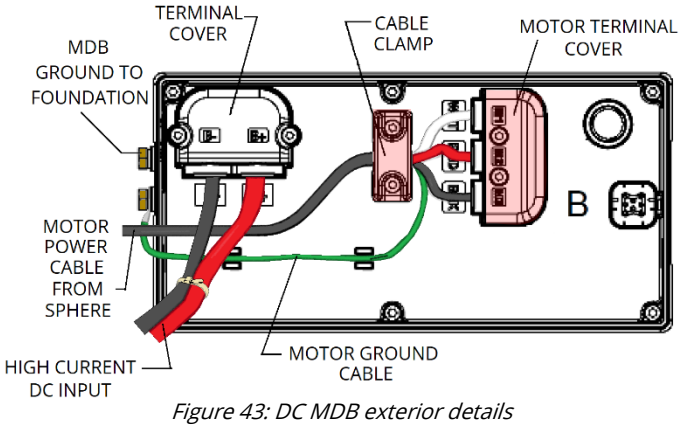


Figure 43: DC MDB exterior details

ii. **ROUTE** motor power cable to motor lead terminals.

iii. **ROUTE** motor power cable ground lead to side ground lug.

iv. **ATTACH** motor leads to appropriately colored terminal [WHT (U), RED (V) and BLK (W)].

v. **TORQUE** terminal screws to **29 in-lbs** (**3.3 Nm**) with 8 mm socket.

vi. **INSTALL** motor terminal cover.

vii. **INSTALL** cable clamp over motor power cable.

viii. **INSERT** ground lead wire into channels provided on MDB exterior. (fig. 44)

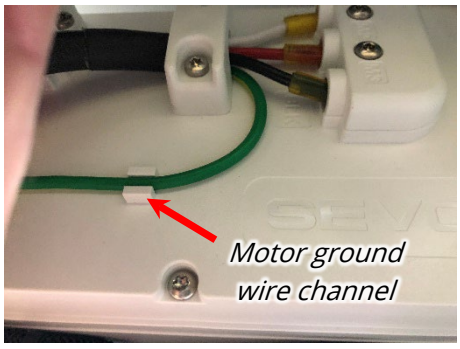


Figure 44: DC MDB ground routing

REASSEMBLY, Step 21.b continued

ix. **ATTACH** motor ground wire to ground lug on side of MDB with 10 mm wrench. (fig. 45)

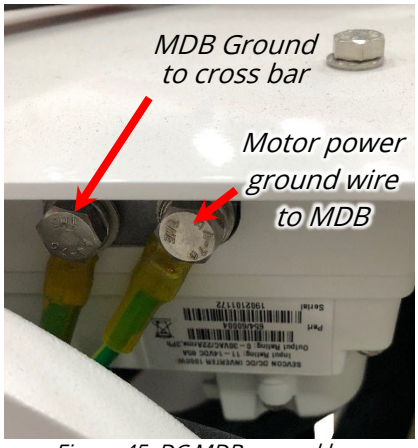


Figure 45: DC MDB ground lugs

x. **REMOVE** battery terminal cover of MDB with T20 bit. (fig. 46)

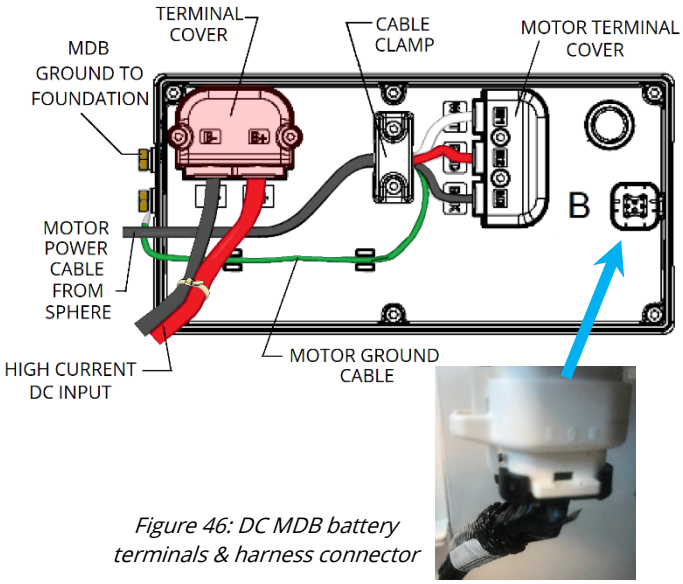


Figure 46: DC MDB battery terminals & harness connector

xi. **ROUTE** High-current DC cables to DC Input terminals.

xii. **CONNECT** high-current DC input cables with 13 mm socket.

xiii. **TORQUE** terminal screws to **97 in-lbs** (**11 Nm**).

xiv. **INSTALL** battery terminal cover of MDB.

xv. **ENSURE** wire harness connected to MDB. (fig. 46)

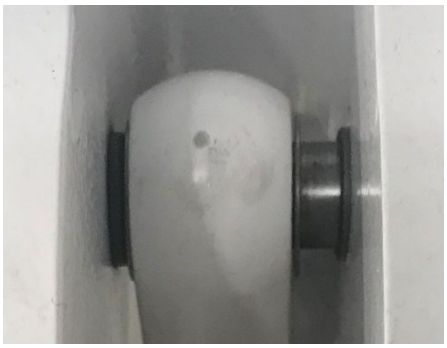
22. **REATTACH** glycol hoses from guide band to upper and lower cooling jackets.

23. **IF** model Seakeeper 2, 3, 26, 35, or 40 **AND** cylinders removed,
THEN INSTALL brake cylinders to cylinder braces by installing rear clevis pins as follows:

    a. **COVER** rear clevis pins with thin film of black moly grease.

    b. **ALIGN** rear clevis pin openings with washers.

    c. **DRIVE** pivot pins into rear clevis pin holes using brass punch.



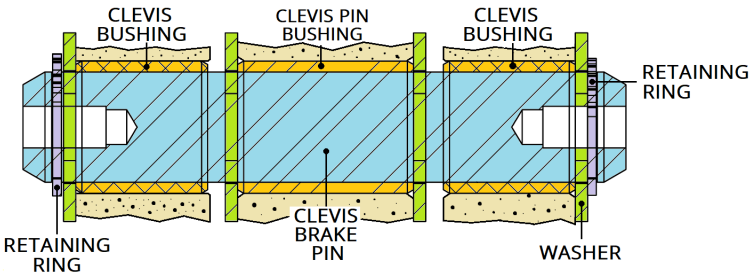


Figure 47: Rear clevis pin assembly

NOTE:

Properly installed snap rings rotate easily in their groove.

WARNING!

- EYE INJURY MAY RESULT from snap ring dislodging from pliers.
- PERSONNEL OR SEVERE EQUIPMENT DAMAGE MAY RESULT if pin hardware not installed correctly.

    d. **INSTALL** pin external snap or spiral retaining ring.

Figure 48: Rear clevis pin retainer ring

24. **IF** models Seakeeper 3DC/5(EM), 5, 6, 9, or 16/18 **AND** cylinders removed, **THEN ATTACH** brake cylinders to cylinder braces by aligning rear trunnion shafts as follows:

    a. **COVER** rear trunnion shafts of brake cylinders with thin film of black moly grease.

    b. **PLACE** thrust washers (Seakeeper 9, 16, & 18 models only) on trunnion shafts with chamfer facing inward, as shown.

    c. **INSTALL** rear trunnion bushings on trunnion shafts with thrust washers.

    d. **ALIGN** rear trunnion shafts with associated openings of inner cylinder brace(s).

    e. **INSTALL** outer cylinder brace(s).

    f. After trunnion shaft insertion into cylinder braces, **INSTALL** plastic caps with BHD tape (P/N 40413) over each trunnion shaft to minimize corrosion. (fig. 50)

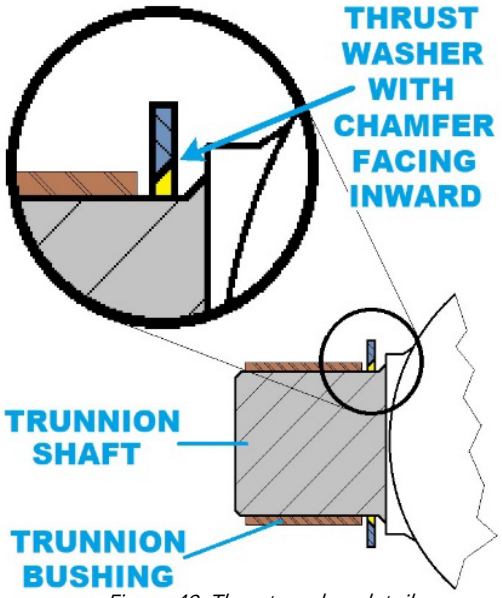


Figure 49: Thrust washer detail

Figure 50: Trunnion cover

    g. **TIGHTEN** cylinder brace mounting screws hand tight.

25. **INSTALL** rod-end pins to gimbal shaft assembly(s) as follows:

    a. **COVER** pins with thin film of black moly grease.

CAUTION:

INABILITY TO REMOVE PIN may result if pin inserted with threaded hole facing inward.

WARNING!

PERSONNEL OR SEVERE EQUIPMENT DAMAGE MAY RESULT
if pin hardware not installed correctly and pin comes loose.

    b. **ALIGN** rod-end pin openings with Delrin plastic washers.

    c. With pin threaded hole facing out, **DRIVE** rod-end pins through gimbal shaft and rod end clevis with brass punch. [See **ATTACHMENT 1** for details]

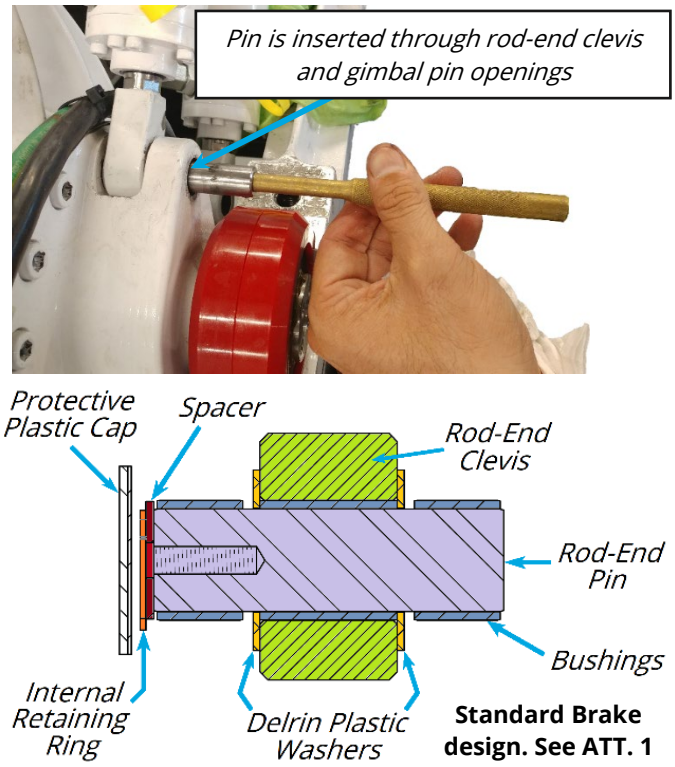


Figure 51: Rod end pin details

REASSEMBLY, Step 25 continued

NOTE:

Properly installed snap rings should be able to rotate easily in their groove.

WARNING!

EYE INJURY MAY RESULT from snap ring dislodging from pliers.

d. **INSTALL** spacer shims and retaining rings into rod-end pins.

e. **INSTALL** protective plastic covers on rod-end pins.

Figure 52: Rod end pin installed

26. **CLEAN** mating surfaces of gimbal cap and foundation.

27. **APPLY** bead of marine sealant to edges of gimbal cap mating surfaces as shown in figure 53.

Figure 53: Gimbal cap surfaces

28. **IF** gimbal cap screws were originally lock-wired,
THEN REPLACE screws with new screws and wedge lock washers. [See **ATTACHMENT 2**]

29. **CLEAN** threads of gimbal cap screws.

30. **INSTALL** wedge lock washers on gimbal cap screws.

31. **PLACE** gimbal bearing caps over gimbal bearings.
32. **APPLY** light film of nickel anti-seize to bottom one-third of threads of screws.
33. **APPLY** light film of marine sealant to bottom of wedge lock washers.
34. **TORQUE** gimbal cap screws per **ATTACHMENT 2**.
35. **WIPE** any excess sealant from mating surfaces.
36. **CLEAN** threads of angle sensor mounting screws.
37. **APPLY** Loctite #243 to angle sensor mounting screws.
38. **INSTALL** gimbal angle sensor.
39. **CONNECT** angle sensor cable to harness 3-pin Deutsch connector.
40. **INSTALL** cable ties to secure angle sensor lead to foundation/sensor mounting bracket.

Figure 54: Gimbal cap screw

Figure 55: DTM06-3S

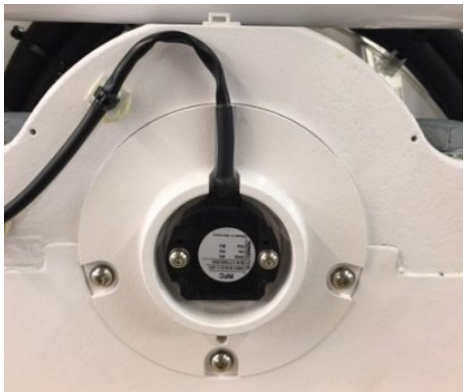


Figure 56: Seakeeper 9 angle sensor

41. **CALIBRATE** gimbal angle sensor per **SWI-108, Seakeeper Angle Sensor Calibration**.

42. **PERFORM** following to tighten cylinder brace(s):

    a. **INSTALL** brake kit cylinder vent lines on each cylinder vent.

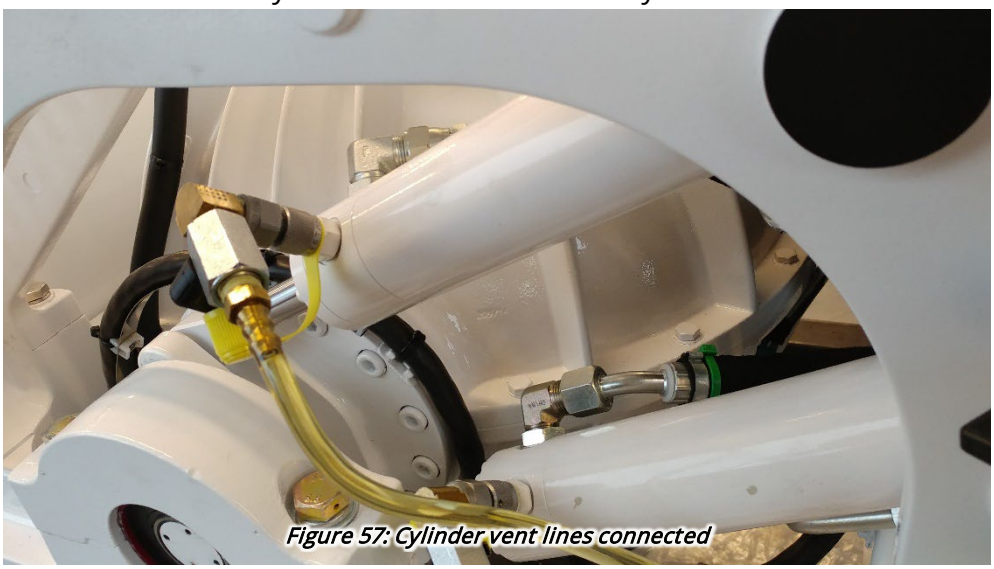


Figure 57: Cylinder vent lines connected

    b. **CONNECT** vent line end(s) to waste oil bottle and cap.

    c. **OPEN** all cylinder vent line valves.

    d. While manually precessing enclosure, **ALIGN** cylinder braces.

    e. **ENSURE** enclosure moves freely and cylinders remain centered in brace(s).

    f. **APPLY** bead of sealant around mating surfaces of cylinder braces with finger.

    g. **PREPARE** cylinder brace screws, one at a time, as follows:

        i. **APPLY** sealant under wedge-lock washers of cylinder brace screws.

        ii. **IF** Seakeeper 2, 3, or 18
        THEN APPLY nickel anti-seize to threads of cylinder brace screws.

        iii. **IF** Seakeeper 5/6, 9, 26, 35, or 40,
        THEN APPLY Loctite #243 to cylinder brace screw threads.

Figure 58: Cylinder brace screw

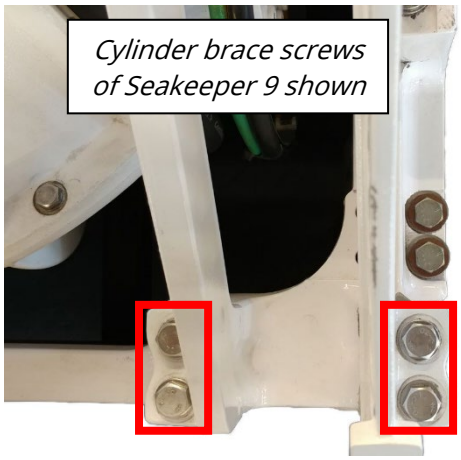
REASSEMBLY, Step 42 continued

h. **TORQUE** cylinder brace screws per **ATTACHMENT 2**.

i. **INSTALL** glycol pump into rubber brace, if removed in disassembly.

j. **RE-CONNECT** glycol pump electrical lead to harness 2-pin Deutsch connector (fig. 60).

Figure 60: Deutsch DT06-2S



43. **IF** crossbar removed/loosened, **THEN:**

a. **IF** Seakeeper 2 through 6 models, **THEN:**

i. **APPLY** Loctite #243 to crossbar screw threads.

ii. **TORQUE** screws to **72 in-lbs** (**8.1 Nm**).

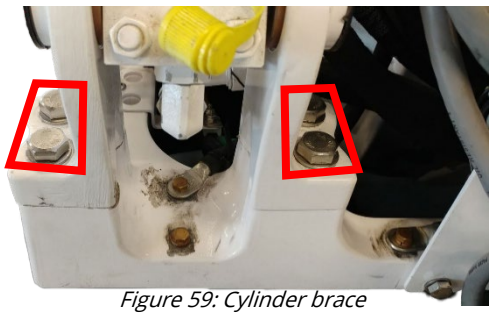


Figure 59: Cylinder brace screws on Seakeeper 9

b. **IF** Seakeeper 9 through 40 models, **THEN:**

i. **APPLY** marine sealant under crossbar screw heads.

ii. **APPLY** Loctite #243 to crossbar screw threads.

iii. **TORQUE** crossbar screws to:

- **72 in-lbs** (**8.1 Nm**) on Seakeeper 9 and below
- **120 in-lbs** (**13.5 Nm**) on Seakeeper 18
- **335 in-lbs** (**37.8 Nm**) on Seakeeper 26 through 40

44. Referencing photos taken earlier, **SECURE** wire harness with cable ties at all anchor points along foundation of unit.

45. **CUT** excess cable tie ends.

46. **INSTALL** grounds to Seakeeper foundation from following components:
    - Heat exchanger
    - MDB
    - Enclosure (AC-powered models only)
    - Vessel ground system to foundation

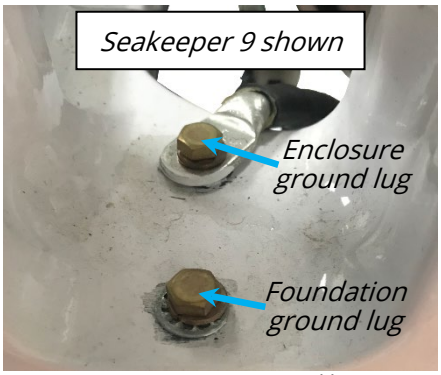


Figure 61: Frame ground lugs

47. **ALIGN** power as follows:

    a. **ATTACH** vessel DC input cable to harness DC Input connector.

    b. **CLOSE** high-current power breaker.

    c. **CLOSE** low-current DC power breaker.

    d. **IF** Seakeeper equipped with DC seawater pump, **THEN:**

        i. **ATTACH** independent seawater connectors from breaker and to seawater pump.

        ii. **CLOSE** DC seawater pump breaker.

48. **CONNECT** seawater supply and discharge lines to heat exchanger.

49. **IF** model equipped with ConnectBox, **THEN CONNECT** wire harness communication cable (from T-adapter), NMEA drop cable and ethernet adapter cable to ConnectBox.

Figure 62: ConnectBox connections on rear panel

50. **PERFORM** brake bleeding procedure to restore brake system pressure per **SWI-103, Seakeeper Brake Service**.

51. **PERFORM** glycol coolant system fill and vent per **SWI-107, Seakeeper Glycol Service**.

52. **APPLY** Awlgrip® Snow White paint to any chipped paint.

53. **REINSTALL** cover panels with fasteners saved from disassembly.

54. **START** Seakeeper.

55. **SPOOL** Seakeeper for minimum of 5 minutes to verify operability.

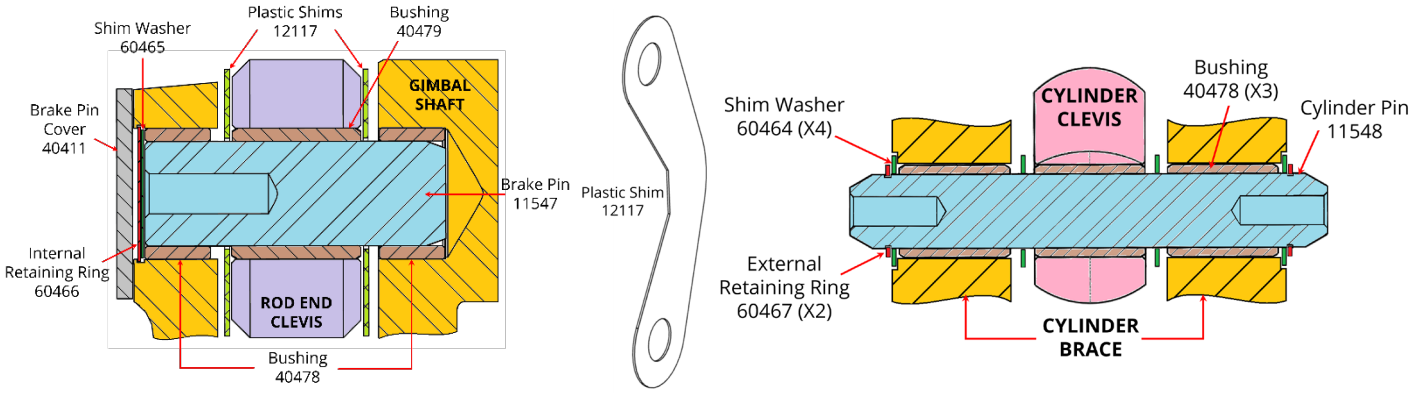
    a. **IF** alarm(s) received,
    THEN TROUBLESHOOT per **SWI-106, Seakeeper Troubleshooting Guide**.

56. **STOP** Seakeeper.

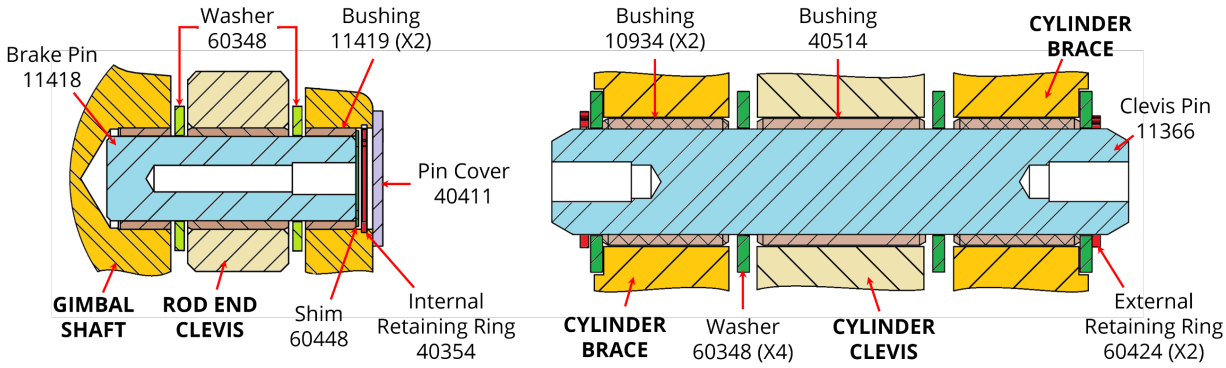
********** END **********

Revision	Description	Approval	Date
5	Use of stainless steel mounting fasteners no longer permitted. Corrected sphere weights. Replaced brake detail images of Attachment 1. Minor edits throughout document to meet standards.	A Patricio	01AUG2024
6	Corrected gimbal cap torques in attachment 2. Minor corrections and edits throughout procedure.	A Patricio	09MAY2025

ATTACHMENT 1: BRAKE DETAILS

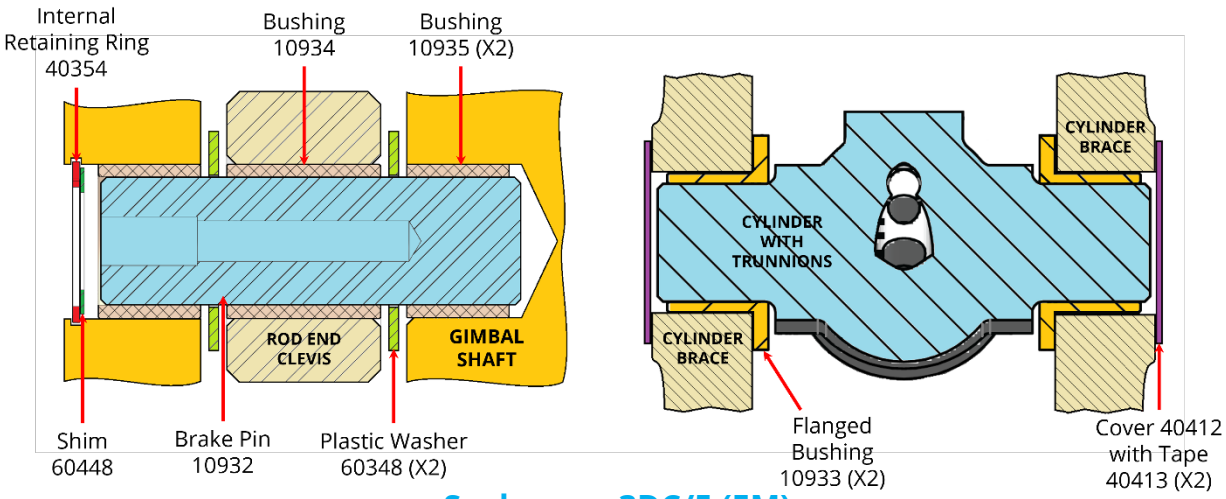


Seakeeper 2 Brake Detail

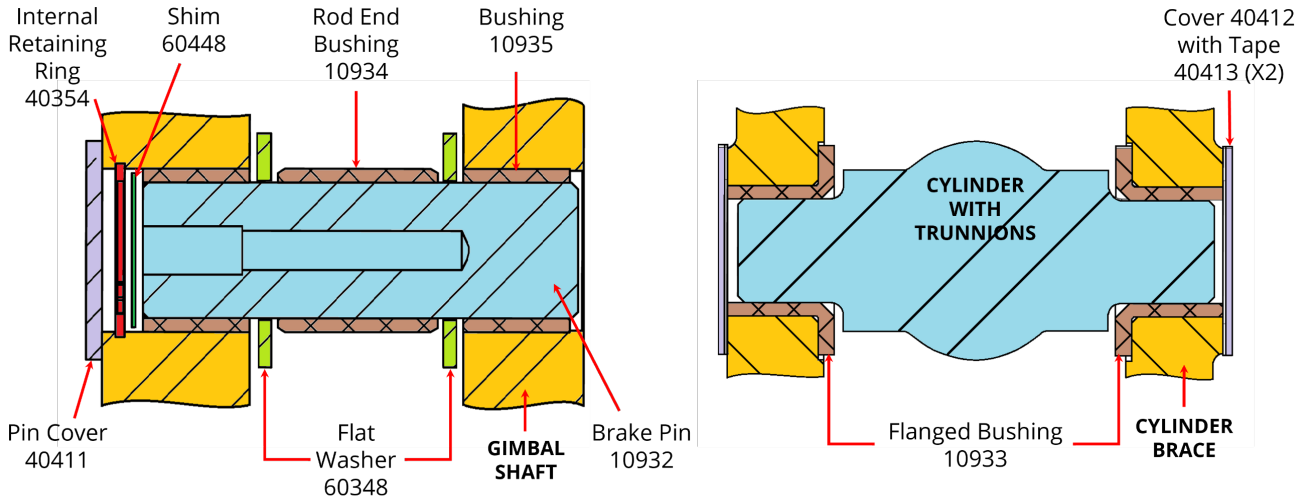


Seakeeper 3 Brake Detail

ATTACHMENT 1 continued

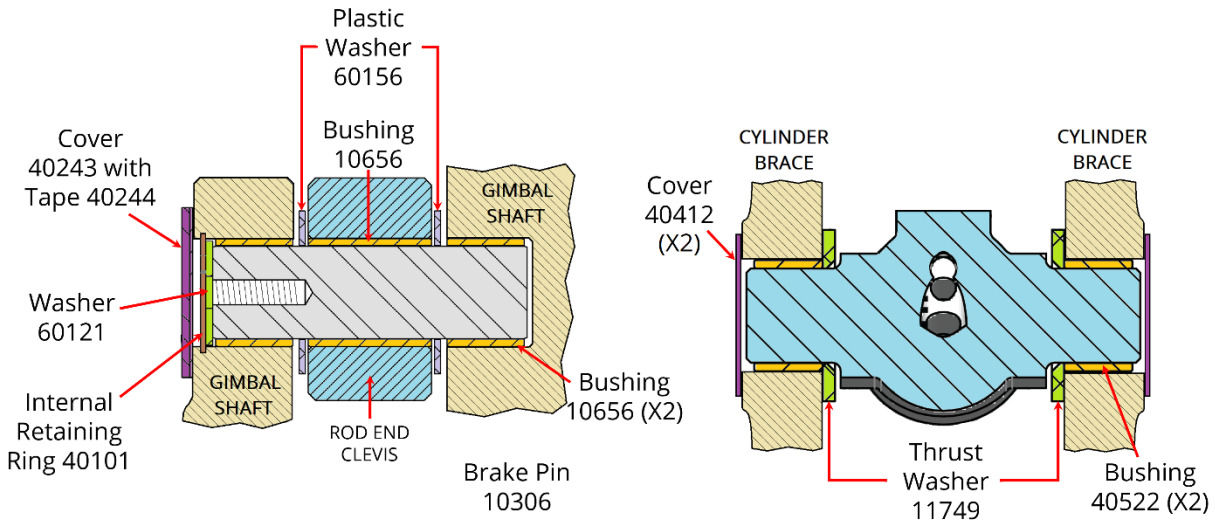


Seakeeper 3DC/5 (EM)
Brake Detail

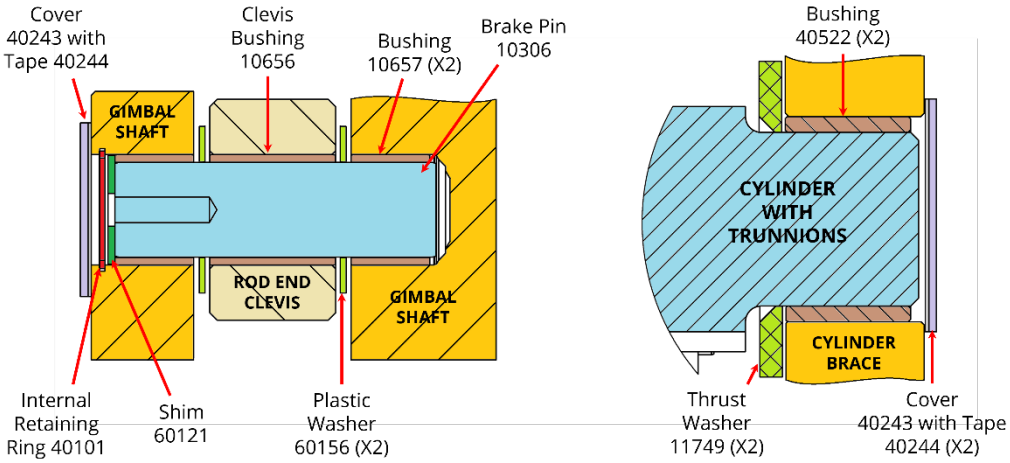


Seakeeper 6 and 5
Brake Detail

ATTACHMENT 1 continued

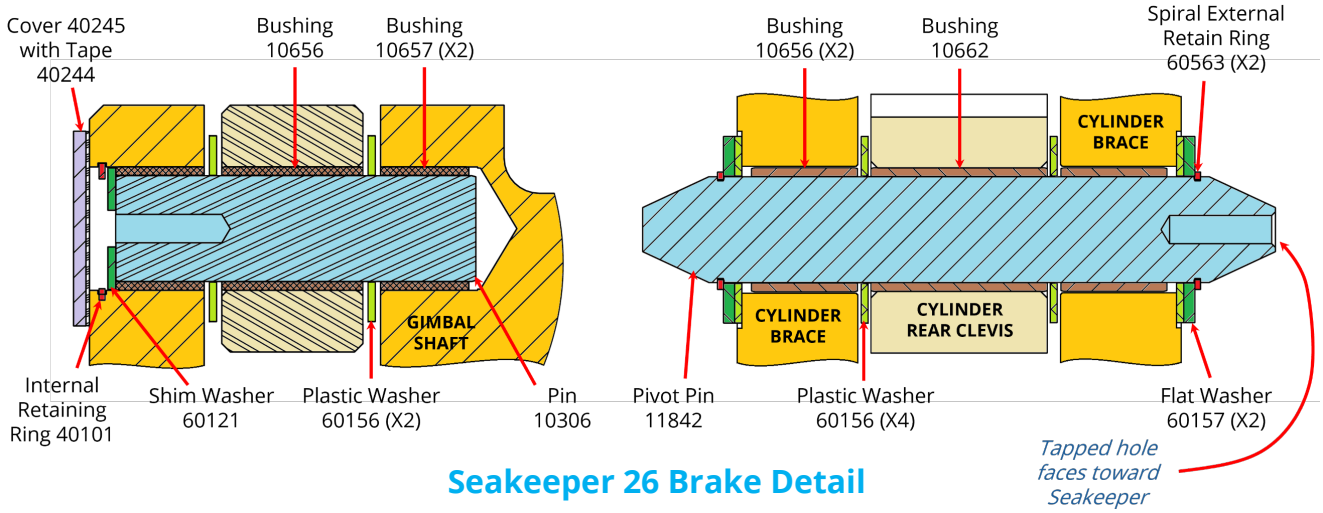


Seakeeper 9 Brake Detail

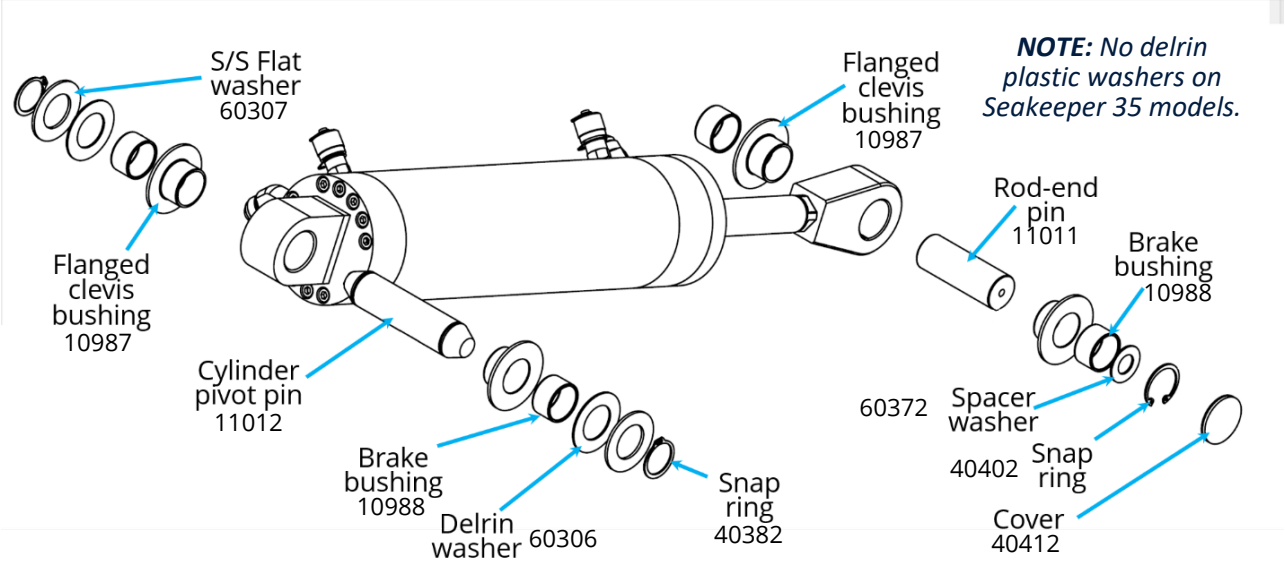


Seakeeper 18/16 Brake Detail

ATTACHMENT 1 continued



Seakeeper 26 Brake Detail



Seakeeper 35/40 Brake Detail

ATTACHMENT 2: TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS - GIMBAL CAP & CYLINDER BRACE			
MODEL	**GIMBAL CAP (ft-lbs/Nm)**	**REPLACEMENT GIMBAL CAP FASTENER P/Ns**	**CYLINDER BRACE TORQUE (ft-lbs/Nm)**
Seakeeper 2	60 / 82	Screw, M10-1.5: • X 80 mm: 60537 • X 90 mm: 60538 Wedge-lock washer: 60531	60 / 82
Seakeeper 3	70 / 95	Screw, M12-1.75: • X 55 mm: 60477 • X 90 mm: 60478 Wedge-lock washer: 60479	
Seakeeper 5/3DC (EM)	160 / 217	Screw, M16-2 X 80 mm: 60579 Wedge-lock washer: 60456	50 / 68
Seakeeper 6/5	140 / 190		
Seakeeper 9/7HD	200 / 272	Screw, ¾-16 X 4”: 60557 Wedge-lock washer: 60558	80 / 109 (Crossbar: 6/8)
Seakeeper 16/12HD/18	200 / 272	Screw, ¾-16 X 4”: 60557 Wedge-lock washer: 60558	80 / 109 (Crossbar: 10/13.5)
Seakeeper 26/20HD (26-0001 thru 26-0251)	400 / 544	SCREW, 1-12 X 3.5": 60614 Wedge-lock washer: 60617	75 / 102 (Crossbar: 28/38)
Seakeeper 26/20HD (26-0252 and after)			60 / 82 (Crossbar: 28/38)
Seakeeper 35/30HD/40 (All serial numbers)	400 / 544	SCREW, 1-12 X 3.5": 60614 Wedge-lock washer: 60617	100 / 136 (Crossbar: 28/38)

ATTACHMENT 2 continued

TORQUE SPECIFICATIONS

Seakeeper Model	Gimbal Bearing Cap ft-lbs (Nm) Socket Size	Gimbal Shafts ft-lbs (Nm) Socket Size	Mounting Screws[1] ft-lbs (Nm) Socket Size	Crossbar in-lbs (Nm) Socket Size	Water Jackets in-lbs (Nm) Socket Size	Bump Stop Screws ft-lbs (Nm) Socket Size	Motor Drive in-lbs (Nm)
2	60 (82)[4] 17mm	30 (41)[2] 6mm Allen	135 (183)[4] 22mm	Wrench tight 10mm	72 (9) 10mm	N/A	Battery Terminal 97 (11) Motor Terminal 29 (3.3)
3	70 (95)[4] 19mm	50 (68)[2] T-50 Torx	155 (210)[4,5] 24mm	72 (9) 10mm	72 (9) 10mm	N/A	
5/6	140 (190)[4] 24mm	50 (68)[2] 8mm Allen	95 (129)[4,6] 19mm	Wrench tight 10mm	72 (9) 10mm	25 (34) 17mm	Cover Screws 19 (2.2)
9	200 (272)[4] 1-1/8"	130 (176) 12mm Allen	100 (136)[4] 22mm	72 (9) 10mm	120 (14) ½"	N/A	
18	200 (272)[4] 1-1/8"	130 (176)[3] 12mm Allen	100 (136)[4] 22mm	120 (13.6) 17mm	120 (14) ½"	N/A	
26	400 (544)[4] 1-1/2"	100 (135)[3] ½" Allen	100 (136) 24mm	335 (37.8)[2] 17mm	120 (14) ½"	N/A	
40	400 (544)[4] 1-1/2"	100 (135)[3] ½" Allen	100 (136) 24mm	335 (37.8)[2] 17mm	120 (14) ½"	N/A	

1. No stainless-steel fasteners to be used. Sourced hardware must meet or exceed fastener criteria set by Seakeeper.
2. Apply marine sealant under screw head and thread locker to threads.
3. Apply thread locker to threads.
4. Apply marine sealant under washer and anti-seize to threads.
5. Seakeeper 3 (3-0001 – 3-3835) 135 ft-lbs (183 Nm)
6. Serial no. 6-0001 – 6-5365 has 65 ft-lbs (88 Nm) torque value

DIMENSIONS

Seakeeper Model	Seakeeper Weight lbs (Kg)	Sphere Only Weight lbs (Kg)	Smallest Sphere Dimension in. (cm)
2	414 (188)	340 (154)	17.38 (44.2)
3	550 (249)	434 (197)	19.125 (48.6)
5/6	870 (395)	702 (318)	20.38 (51.8)
9	1250 (567)	1012 (459)	24 (61)
16	2195 (996)	1835 (833)	29.19 (74.2)
18	2460 (1116)	1890 (857)	29.75 (75.6)
26	3155 (1431)	2482 (1126)	33.25 (84.5)
35	3920 (1778)	3233 (1467)	33.25 (84.5)
40	3976 (1803)	3324 (1508)	33.25 (84.5)

BRAKE HOSE FITTINGS

Seakeeper Model	Cylinder Bleed Ports		Cylinder Fittings		Hose Fittings	
	ft-lbs (Nm)	Wrench	ft-lbs (Nm)	Wrench	ft-lbs (Nm)	Wrench
2 & 3	15-18 (20.3-24.4)	11/16"	26-31 (35.3-42)	11/16"	22 (29.8)	11/16"
6/5 thru 18	17-19 (23-25.8)	11/16"	40 (54.2)	7/8"	40 (54.2)	7/8"
26, 35, & 40	7-8 (9.5-12.2)	5/8"	40 (54.2)	7/8"	40 (54.2)	7/8"