

	TECHNICAL INFORMATION BULLETIN	OPT-TIB-435-01
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INSTRUCTIONS FOR REBUILDING CAMERON CONTROLS SOLENOID VALVE

FAMILY 435

Exhibit No. 3798
Worldwide Court
Reporters, Inc.

1. PURPOSE

To provide instructions for rebuilding Cameron Controls solenoid valves.

2. SCOPE

This bulletin applies to Cameron Controls solenoid valves.

3. RESPONSIBILITY

It is the responsibility of the sub-sea engineer to review this document and to ensure that these procedures are followed when rebuilding Cameron Controls solenoid valves.

4. FILING

File one copy of this Bulletin in the rig's Bulletin Binder.

5. REBUILD PROCEDURES

5.1 Resources

1. Repair kit 223290-63-00-99
2. Snap ring pliers
3. Cleaning solutions (Ospho works very well)
4. O-ring cone to apply small O-rings
5. 24 vdc adjustable power supply
6. Multimeter
7. Megger
8. Solenoid test box
9. Dental tool or scribe
10. Allen wrench set
11. Ultrasonic cleaner
12. Drawing of solenoid valve sk-066290-63
13. Lubriplate
14. Lint-free cloth

5.2 Solenoid Overhaul

1. Disassemble the valve section of the solenoid by removing Items (4) out end plate, (6) out seal plate, (3) in end plate, (5) in seal plate, and (8) shear seal tube.
2. Once (8) the shear seal tube is removed remove the old shear seal rings and (13) spring and place the shear seal tube in cleaning solution.

Note: O-ring installation cone is strongly recommended.

3. Prepare the new (7) shear seal rings by adding the (31) O-ring and (32) backup rings make sure the back up rings concave surface aligns with the O-ring. The back up ring is closest to the sealing area. (The O-ring cone is the easiest way to get the O-ring on the shear seal ring.) Apply an ultra light coat of lubriplate to the O-ring and backup ring.

4. Once the shear seal rings are prepared remove the shear seal tube from cleaning solution, rinse with water, and dry with a clean rag. Place newly prepared shear seal ring into one end of the tube pushing it in to the top of the back up ring. A scribe or dental tool may be used here to get the back up ring inside the tube with out cutting it. Once it is in, place (13) the spring in the other end of the tube and insert the 2nd shear seal ring pushing it in the top of the back up ring. Use dental tool if necessary.
5. Once the shear seal tube is assembled, using 2 fingers squeeze the shear seal rings into the tube and release until the 2 shear seal rings are sticking out the same distance on both ends. Once you accomplish this place the tube assembly into an ultra clean solution of 100% BOP fluid.

Caution: Cleaning solution may cause skin irritation.

6. Remove the lower valve body from the upper coil body and remove all O-rings. Then place in a bucket of cleaning solution. (Ultrasonic bath is optimum choice.)
7. Remove O-rings from end plates and place in cleaning solution.
8. Soak, clean, rinse with water, and dry all of these stainless components. The cleaner the better.
9. Next is preparing the seal plates Items 5 and 6.
10. Take your lint-free cloth and vigorously wipe both seal plate sealing surfaces until shiny. There is a packaging film on the seal plate that needs to be removed.
11. Take (2) from the cleaning solution and make sure that is clean, rinsed off, and dry for re-assembly.
12. Install (6) the outlet seal plate first. To determine the inlet and outlet, hold the lower assembly to your chest with the seal test port closest to your body. The right side is the inlet and the left is the outlet. You can also look at another valve to double check. Turn the lower valve body so that the outlet hole is facing up. Install the seal plate so that the outlet hole is towards the upper half of the valve body. If you hold the bottom of the valve body and look through the inlet hole, the outlet seal plate should be towards the top.
13. Take (4) the outlet flange and put the (29) O-rings and (30) back up ring on per the drawing, use the dental tool or scribe for easy installation. Apply ultra light coat of clean lubriplate to O-rings and back up ring. Install (23) O-ring on the end of outlet flange.

Note: Torque on $5/16"$ – 18 UNC 14Nm

$1/4"$ – 20 UNC 20Nm

14. Install outlet flange into the lower valve body making sure the dowell pin is lined up properly. Once installed, put the cap screws in and tighten.
15. Turn the lower body so that the inlet port is facing up.
16. Install (11) lower piston into the lower valve body so that the hole is aligned with the inlet and outlet ports.

17. Take the assembled shear seal tube (step 5), shake off until only lightly coated and place into the inlet port through the hole in the lower piston until it rests on the outlet seal plate. Do not force this into place or press it down.
 18. Place (5) inlet seal plate into the inlet port seal face downward until it rests on the shear seal ring. Do not force or press this into place.
 19. Take the inlet flange out of cleaning solution clean, dry, and install the O-rings and back up ring per step 13. Install flange into the lower body inlet port and do not let it spring back out. Hold in place until you can get the cap screws installed and tightened down.
 20. Turn lower valve body so that the lower piston is vertical make sure the piston does not move or turn. Install (24.3) and (28) O-rings into place after applying an ultra light coat of lubriplate.
 21. Install (14) spring into the end of the lower piston.
 22. Install (25) O-rings into place after applying an ultra light coat of lubriplate.
23. Place upper body onto the lower body making sure that the spring and O-rings fall into place. Put cap screws into place and tighten.

Note: Torque on $\frac{5}{16}$ " – 18 UNC 14Nm
 $\frac{1}{4}$ " – 20 UNC 20Nm

Note: Assemble manifold so that the vent ports are independent, you can isolate the manifold from the main supply, and put a gauge that will read the manifold pressure when it is isolated. Make sure that your vents will vent to a desired place in case of leaks.

Test Procedure

Seal Test

For this test, use DC-200, 100 centistokes, in a clean hand pump, eg Enerpack pump. Apply and hold 1400 psi to seal test ports (see attached drawing for port location). Pressure drop in 5 minutes must be less than 40 psi.

For this test use a regulated water/Stack magic supply from the BOP HPU. Mount the valve on a test manifold and plug the output port. Apply 500psi to the vent port. Pressure drop in 5 minutes must be less than 40 psi.

Electrical Tests

Resistance Test

Measure and record the resistance of each coil. For coil A measure across pins 1&2, coil B across pins 3&4

Acceptance criteria is 46-50 Ohms for 223290-15

Acceptance criteria is 38-43 Ohms for 223290-63

Insulation Test

Measure and record the insulation resistance from,
Pin 1 to body
Pin 3 to body
Pin 1 to pin 3

Insulation Test Voltage = 500VDC
Acceptance is >20MΩ

Break in

Use a regulated water/Stack magic supply from the BOP HPU.
With the valve mounted on the test manifold, apply 3,000 psi to the supply port. The output port should be open. Function the valve open/close for 25-30 cycles.

Function Test

Use a regulated water/Stack magic supply from the BOP HPU.
With the valve mounted on the test manifold, apply 3,000 psi to the supply port. The output port should be plugged

Connect a 24VDC supply to both coils, positive to pins 1&3, negative to pins 2 & 4. Verify the valve shifts position. If a valve fails to shift, although it works on either A or B coil individually, this indicates the coil is not correctly wired to the cable.

Apply 24VDC \pm 0.5VDC to pins 1&2. Measure and record coil current
Decrease the voltage until the valve moves to the closed position.
Slowly increase the applied voltage until the valve moves to the open position. Record pull in voltage

Apply 24VDC \pm 0.5VDC to pins 3&4. Measure and record coil current.
Decrease the voltage until the valve moves to the closed position.
Slowly increase the applied voltage until the valve moves to the open position. Record pull in voltage

Acceptance criteria is 400-600 mA for 223290-15
Acceptance criteria is 468-702 mA for 223290-63
Pull in voltage 20 VDC or less.

Leak test

Mount the valve on the test manifold, and with the solenoid de-energized, apply 3,000 psi. Allow 3 minutes for the system to stabilize. Check for leakage at the vent port.

Close the valve on the output port and energize the solenoid while maintaining the supply pressure. Allow 3 minutes for the system to stabilize. Check for leakage at the vent port.

Acceptance criteria .5 mL (about a 1/10 of a teaspoon) or less in 5 minutes, for each test.

Note: Make sure you log all readings in a table for future reference.

**Description 1/8" Solenoid Valve 3/2 way, Current Rev. B02, 13 July 01
Entry Type Separate Bill of Material (PE41) Status Released**

ITEM	PART NUMBER	QTY	REV	DESCRIPTION S/>>> B/M CATEGORY: 1 COMPONENTS (CO)
001	222800-07	1.00	C04	UPPER BODY SOL.VALVE 3/2 WAY
002	222800-08	1.00	C02	LOWER BODY 70 X 70 X 45
003	222838-02	1.00	B02	INLET FLANGE OD: 34.7 X 20.6
004	222839-02	1.00	B02	OUTLET FLANGE OD: 34.7 X 20.6
005	222835-02	1.00	C01	INLET SEAL PLATE
006	222836-03	1.00	C01	OUTLET SEAL PLATE
007	222840-03	2.00	C01	SEAL RING, DIA. 5.5 X 6.55
008	222810-03	1.00	B01	SEAL TUBE OD 9.5 X 17.2
009	222804-02	1.00	D02	COIL HOUSING OD: 63.4 X 121
010	222808-03	1.00	D01	UPPER PISTON, OD. 58.8 X 60.4
011	222808-02	1.00	C01	LOWER PISTON
013	222846-06	1.00	A02	SPRING, DI=3.8; DA=5.2; LO=9.6
014	222846-17	1.00	A03	SPRING DM=6, D=1.3, LO=23
015	639151-97	1.00	B01	PROTECTIVE COVER
017	041008-02-50-32	1.00	00	RETAINING RING, SPIROLOX- INT F
018	2708921-01	1.00	00	PIN, DOWEL 0.062 X 0.25 SST
021	223290-62	1.00	B01	SOLENOID COIL AND TUBE
022	222843-01	1.00	E01	RECEPTACLE E-CONNECTOR
023	702645-00-71	5.00	00	O RING, SIZE AS-568-007 .145
024	702645-14-11	3.00	00	O RING, SIZE AS-568-141 2.300
025	702645-12-61	1.00	00	O RING, SIZE AS-568-126 1.362
026	702645-11-91	1.00	00	O RING, SIZE AS-568-119 .924
027	702645-12-51	1.00	00	O RING, SIZE AS-568-125 1.299
028	702645-13-21	1.00	00	O RING, SIZE AS-568-132 1.737
029	702645-01-51	4.00	00	O RING, SIZE AS-568-015 .551
030	042000-00-15	2.00	00	BACK-UP RING, SIZE 015 .580 I
031	619027-01-79	2.00	00	O-RING, SIZE-2.57 ID X 1.78 W
032	619027-01-80	2.00	00	BACK-UP RING, ID 3.23 MM X 1.35
033	619010-03-79	8.00	00	SCREW, HEXAGON SOCKET HEAD CAP
034	702505-02-00-20	4.00	00	SCREW, SOC HD CAP .250-20 X 2
035	702505-02-00-06	4.00	00	SCREW, SOC HD CAP .250-20 X
036	710271	2.00	00	SCREW, SOC HD CAP #10-24 X 3
037	702515-21-20-10	1.00	00	SCREW, SOC HD SET .375-16 X
039	702505-04-00-30	2.00	00	SCREW, SOC HD CAP .312-18 X 3
040	204680	2.00	00	PLUG, PIPE-THREADED HEX SOC 1/8



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