

**CHOKE VALVE
INSTALLATION & MAINTENANCE MANUAL**

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CHOKE VALVE INSTALLATION & MAINTENANCE MANUAL

1. INTRODUCTION

This installation and maintenance covers the 4" class 2500 angle style choke valve supplied to BP Exploration for use on the Hoton platform, Tag No. HCV-0016. The choke comprises of a Duplex stainless steel angle type body configuration with a bolted bonnet and manufactured with 6" Techlok end connections.

The design incorporates an Energy Dissipating (ED) disk stack enabling the valve to handle high-pressure drop conditions associated with this application. The disk stack prevents the occurrence of high velocities, noise and excessive vibration.

The existing Rotork IQML11F10 actuator will be fitted at site by BP Exploration. The actuator stroke length will need to be increased from the existing 57 mm to 100mm.

Note: Tungsten Carbide is a very hard and abrasion resistant material but is susceptible to fracture and so must be handled with extreme care

2. SIGNIFICANT EQUIPMENT DETAILS

- 2.1. The Mitech angle choke valve uses a top entry design to allow for easy trim inspection and if necessary the valve internals can be accessed without having to remove the valve from the line.
- 2.2. The choke valve will have a dual packing system comprising of a S112 ECOPA EK set in conjunction with a graphite packing set and stem wiper.
- 2.3. The design uses a bolted bonnet arrangement in conjunction with a high integrity body / bonnet spiral wound gasket.
- 2.4. The choke valve incorporates an Energy Dissipating (ED) disk stack and is designed to be flow "over the plug".
- 2.5. The disk stack, plug and seat utilise solid tungsten carbide components in conjunction with duplex stainless steel substrate materials.
- 2.6. The plug design includes a pressure balance system incorporating a K007 ECOPUR seal.
- 2.7. The choke design is based on a linear rising stem configuration and has a travel of 100 mm.
- 2.8. The choke was designed and manufactured to fit with the existing Rotork IQML11F10 electric actuator.



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3. INSTALLATION GUIDELINES

3.1. Slinging and lifting

- The valve can be supported and lifted by inserting a shackle through the 4 extra holes in the bonnet flange.
- Care must be taken not to damage the actuator during the installation or removal processes.
- As indicated previously the trim components are constructed in solid Tungsten carbide and **care must be taken** not to drop the valve or cause any significant impact

3.2. Flow Direction

- The flow direction for this choke valve is “over the plug” i.e.: side inlet and bottom outlet.
- A flow arrow is cast on the body to indicate the correct flow direction

3.3. Orientation

- The preferred orientation for the valve is with the actuator vertical in the upright position

3.4. Actuator Installation

- The actuator should be mounted onto the valve with the valve/actuator stem coupling removed and the valve in the closed position. Following fitting of the stem coupling the actuator should be manually operated to lift the plug away from the seat and the plug stem rotated anti-clockwise $\frac{1}{4}$ turn. This will ensure that the valve is seated when the actuator is driven to the closed position

4. ROUTINE MAINTENANCE

Refer to general arrangement drawing (Appendix 1) to identify the component numbers

The valve does not normally require any routine maintenance or adjustments. The stem seal arrangement uses a dual packing system in conjunction with a stem wiper seal. After installation and pressurisation of the system the gland can be adjusted to eliminate any leakage. This would be undertaken by tightening the gland flange nuts (18), until the leaking ceases from the gland flange. Never over tighten the gland flange nuts as this may shorten the life of the packing gland and also have an effect on the smooth operation of the valve. The gland flange (16) must be tightened evenly and checked to ensure that it is central before operating the valve.

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5. DISASSEMBLY OF THE CHOKE VALVE

Refer to general arrangement drawing (Appendix 1) to identify the component numbers

Should it become necessary to disassemble the valve, the following steps should be followed:

Warning: Depressurise the line to atmospheric pressure, isolate the valve and drain all line fluids before working on the valve. Failure to do so can result in serious injury. We strongly recommend removing the valve from the line before any maintenance work be started. (Except to adjust the gland flange)

- 5.1. Open the valve fully using the actuator in order to release the pressure on the plug and seat and to ensure the plug is out of the disk stack area.
- 5.2. Remove the stem clamp (22) and the M10 x 50 bolts (20) that attach the electric actuator to the mounting flange (12) and remove actuator from the valve.
- 5.3. Remove all bonnet nuts (9) according to the conventional 8-pass system. Ensure that the bonnet flange (8) is released evenly.
- 5.4. Remove bonnet flange(8), bonnet(7) and plug(2) as a **complete assembly** by lifting the plug stem using lifting gear to ensure that the assembly is withdrawn along its axis. **It should be noted that the first 100mm of travel/lift of the stem should be carefully controlled to ensure that the plug engages on the underside of the bonnet, without undue impact.** To ensure that the pressure-balance sleeve(5) does not lift with the other components during removal of the bonnet assembly the bonnet flange and pressure balance sleeve should be eased apart during the initial part of the lift. Refer to footnote reference pressure balance sleeve removal.
- 5.5. In order to check the plug thoroughly, loosen the gland flange nuts (18).
- 5.6. Withdraw the plug from the bottom of the bonnet.
- 5.7. Remove the gland flange nuts and flange (17).
- 5.8. Remove the guide packing by using a dowel with a diameter of 31mm. The guides and packing must be removed through the top of the bonnet. Take note of the arrangement and material of packing and guides.
- 5.9. Remove the pressure-balanced sleeve (5) if still in place and disk stack (5) through the bonnet bore. The pressure balance sleeve is provided with two drilled and tapped (M8 x 15mm deep) holes for assisting removal, using either threaded bar or lifting eyes. Each disk is numbered and should be identified so that the sequence and orientation can be maintained on assembly.
- 5.10. Remove seat ring (1) and both the bonnet (6) and seat gasket (4).
- 5.11. Plug disassembly (if required) would be undertaken by the following:
 - Loosen and remove grub screw
 - Remove pressure balance retaining ring
 - Remove old pressure balance seal (28)

Notes:

- A) In the unlikely event that the pressure balance sleeve cannot be separated, the whole assembly may be removed.
- B) All old gaskets and seals must be discarded

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6. COMPONENT INSPECTION

The valve body (3), pressure balance cylinder (5) and bonnet (7) should be examined for damage. In addition, the plug assembly (2), seat (1) and ED disk stack (5) should also be inspected for damage. The particular areas of these components to be inspected includes the following

Component	Criteria		
	Erosion	Corrosion	Galling
Body (3)	x	X	
Bonnet (7)	x	x	
Pressure Balance Sleeve (5)	x	x	x
Plug Assembly (2)	x	x	x
Seat (1)	x	x	
ED Disk Stack (5)	x	x	x

Any significant area of damage should be reported to Valve Solutions Ltd or Mitech directly

7. REASSEMBLY OF THE CHOKE VALVE

Refer to general arrangement drawing (Appendix 1 & 2) to identify the component numbers

Notes:

On reassembly the following parts must be replaced:

- Gland packing (26)
- Bonnet gaskets (6) – 2 off
- Seat gasket (4)
- Plug stem seals (26 & 27)
- Pressure balance seal (28)
- Plug stem wiper seal

N.B. Under no circumstances should the spiral wound gasket be re-used

The valve must be built from the body up and in the vertical position.

The valve body must be secured to prevent movement during assembly.

All parts must be clean.

7.1. Plug assembly (if required) would be undertaken by the following.

- Place the new pressure balance seal (28) onto the plug (2). The pressure will be from the bottom and the seal must be fitted as the picture ie larger diameter away from stem
- Screw pressure balance retaining ring against shoulder retaining the seal.



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- Insert grub screw into retainer and tighten.
- 7.2. Insert new seat gasket (4) on the seat ring recess in the body.
 - 7.3. Position a new bonnet gasket (6) into the body recess.
 - 7.4. Position the second bonnet gasket (6) in the pressure balanced sleeve recess



- 7.5. Assemble ED disk stack (5) with pressure-balanced retainer and seat ring (1) prior to refitting into valve. The disks are marked with a number and the original sequence and orientation must be kept. Once the stack is assembled, the slots in each disk should all line up with those in the other disks. Two pins in each disk are used to assist with the alignment.

- 7.6. Using the special lifting tool insert the disk stack assembly (including the pressure balanced sleeve) into the valve. **Take extreme**

care not to damage the components.

- 7.7. Apply a light film of grease to the bore of the pressure balance sleeve.
- 7.8. The arrangement for the stuffing box is as follows: See appendix 3

- Lower Guide (13)
- S112 ECOPAЕК set (27)
- Packing spacer (25)
- Graphite packing rings (26)
- Upper Guide with liner (14+15)

First fit lower guide and the ECOPAЕК packing set into the bonnet bore. Insert packing spacer and whilst holding this down with a suitable tube to ensure that the packing set does not push up beyond the shoulder gently insert the plug stem from the bottom of the bonnet. Remove tool and fit graphite packing braid followed by the upper guide assembly.



- 7.9. Insert the reassembled plug/bonnet assembly into the pressure balance retainer. With a mallet, lightly tap the top of the plug while slowly rotating the plug. Push the plug till it seats in order to align the disk stack and to centre the seat ring .
- 7.10. Fit bonnet flange(8)
- 7.11. Replace bonnet flange nuts (9) and hand tighten.
- 7.12. Place Gland flange (16) and locate nuts (18) onto gland flange studs (17).
- 7.13. When building these valves the plug must be carefully moved (preferably by hand) throughout its stroke to align the disk stack initially with the plug and then with the seat ring. The seat ring is free for radial movement but the weight of the disk stack on top will restrict this. Take care during initial assembly to align the components as accurately as possible.
- 7.14. Gradually and uniformly tighten the bonnet nuts – checking regularly for parallelism of the bonnet flange (8) to the body. Move the plug up and down regularly to ensure freedom of movement.
- 7.15. Tighten the body nuts to 460 Nm according to the conventional 8 – pass system. Measure the gap between the body and the pressure balance sleeve all the way around the valve. All measurements must be 9.40mm within 0.05mm of each other. Tighten the bonnet flange nuts to achieve this.
- 7.16. Once the bonnet is fully tightened into the body, replace the actuator mounting bars (11) and actuator flange (12). Tighten the actuator mounting flange cap screws (21).

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- 7.17. Fit the actuator (19) onto the mounting flange using M10 x 50 bolts (20).
- 7.18. Ensure that both the valve plug and actuator stem are in the fully closed position. Attach the stem clamp (22) onto the plug and actuator stems. Following fitting of the stem coupling the actuator should be manually operated to lift the plug away from the seat and the plug stem rotated anti-clockwise ¼ turn. This will ensure that the valve is seated when the actuator is driven to the closed position.
- 7.19. Stroke valve checking that the plug movement is smooth and no contact between the plug head and disk bores can be detected.

8. TESTING

- 8.1. Service leak testing and pressure testing to be carried out in accordance with normal BP operating procedures.

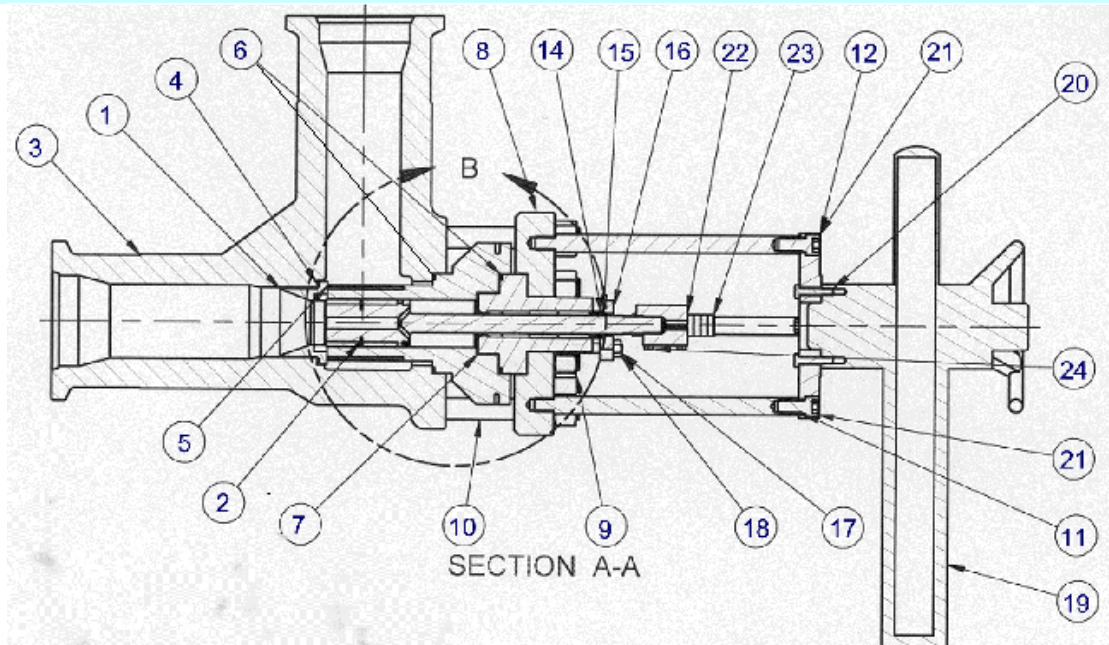
9. CONTROL VALVE TROUBLE SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Valve operation not smooth	Gland Flange over tightened Plug head touching disk stack or pressure balance sleeve bore Alignment of actuator stem and Plug. Actuator faulty	Loosen Gland Flange Nuts and re tighten just over finger tight. Strip valve and check plug and retainer bore for signs of galling and foreign matter Check actuator tight on mounting flange. Refer to Rotork manual
Valve passing excessive product when closed	Calibration out Plug not achieving full travel Incorrect flow direction Damaged Seat or Plug surfaces	Position valve on seat Check plug travel against indicator plate Check flow corresponds with direction on valve. Check Plug and Seat (See section 6)
Valve not opening fully	Calibration out Plug not achieving full travel	Check actuator settings. Check plug travel against indicator plate.
Poor Control	Speed and accuracy of response	Check that the speed of response and the position of the plug correspond with signal changes.

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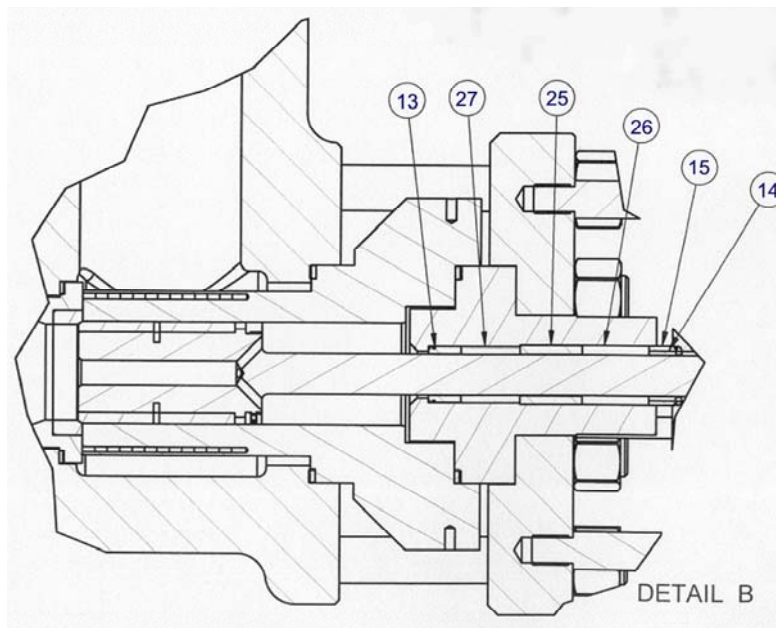
Appendix 1

GENERAL ARRANGEMENT DRAWING



Appendix 2

STUFFING BOX ARRANGEMENT DRAWING



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Appendix 3 –

PARTS IDENTIFICATION

GA1890

100mm #2500 AGCV + EDD + TECHLOCK ENDS

ITEM	DESCRIPTION	QTY	PART	CODE	MATERIAL
1	SEAT RING 100mm #2500 SD65 CC	1	P3805	.888	T/CARBIDE
2	PLUG 100mm #2500 SD65 CC PB	1	P3804	.888	T/CARBIDE
3	BODY ANGLE 4" #2500 457 F/F TEC	1	P3798	.141	DUPLEX S/S
4	GASKET SEAT CB100 #1500	1	P3213	.846	S/S / GRAFOIL
5	DISK ED STACK 100 #2500 Cv80 FO	1	P3797	.888	T/CARBIDE
6	GASKET BONN CB100 #1500	2	P3212	.846	S/S / GRAFOIL
7	BONNET STD 100mm #2500 EDD	1	P3875	.141	DUPLEX S/S
8	BONN FLG STD 100mm #1500	1	P3800	151	304 S/S
9	NUT 1.25" - 8UNC GRADE 2H	8	P2485	.150	316 S/S
10	STUD 1.25" - 8UNC - 240 LONG - B7	8	P3806	.150	316 S/S
11	MTG BAR CA100	4	P1327	.151	304 S/S
12	MTG FLANGE 7ML	1	P3843	.130	E.N.P. ON MILD STL.
13	GUIDE 80/100mm SOLID 38 O/D	1	P3877	.825	STELLITE NO. 6
14	GUIDE LINER 80/100mm NEW	1	P3354	.927	25 GLASS PTFE
15	GUIDE RETAINER 80/100 GRAFOIL	1	P1195	.141	DUPLEX S/S
16	GLAND FLANGE CB100 #2500	1	P3841	.150	316 S/S
17	GLAND FLG STUDM14 x 120	2	P3842	.150	316 S/S
18	NUT M14	2	M4176	.151	304 S/S
19	ROTORK M7 ACTUATOR	1			
20	BOLT (SET) M10 x 50	4	M1149	.151	304 S/S
21	CAPSCREW M20 x 40	4	M5920	.151	304 S/S
22	STEM CLAMP M16 - 1" UNF 240PCD	1	P3852	.130	E.N.P. ON MILD STL.
23	IND PLATE CA100 100ST	1	P2468	.150	316 S/S
24	BOLT (SET) M8 x 50	4	P1384	.151	304 S/S
25	PACKING SPACER 100mm #2500	1	P3840	.141	DUPLEX S/S
26	MARLO GRAPH. SEAL KIT	1	X2238	999	GRAPHITE BRAID
27	SEAL KIT S211 ECOPAK	1	P3891	999	POLYURETHANE
28	PB SEAL K007H - ECOPUR	1	X2239	999	POLYURETHANE
30	STEM WIPER	1	M5990	999	BUNA N