

Chapter 2

SWIVEL PIPE UNIT (WITH SHUTTLE VALVE)

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ILLUSTRATION

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<i>Swivel pipe unit (with shuttle valve)</i>	1
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LEADING PARTICULARS

<i>Fluid</i>	<i>Oil, OM-15 (34B/9100572)</i>
<i>Lubricant</i>	<i>Grease, XG-315 (34B/9100519)</i>

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Introduction

1. These swivel pipe units are attached to a specific main undercarriage jack to carry a normal or emergency supply of fluid for the extension of the jack. Sealed swivel joints permit movement of the jack during operation and each unit incorporates a shuttle valve

which seals off the inoperative pipe line. A basic type is described in the chapter and the variants are given in appendices.

Description

2. The units each consist of two pairs of pipes, each pair joined at a centre swivel joint,

comprising a swivel post rotating in a coupling body and retained by a collar and split pin. At the outer ends, swivel connections are formed integral with pipe adapters, and are drilled for attachment to the airframe. A shuttle valve housing, in which a swivel post of one pair of pipes rotates, receives the spigoted end of a swivel post of the other pair of pipes. The housing is formed with a spigot connection through which fluid passes to the jack and the swivel post is provided with lugs and bolted to the housing. The spigots are grooved for sealing rings and backing rings to prevent the leakage of fluid. The pipes are soldered into the relevant posts and coupling bodies.

3. A hole through each coupling post, sealed by a screwed plug soldered in position, is linked by radial holes to an annular groove in the post, which coincides with an annular groove in the coupling body. Additional grooves in the body house sealing rings and backing rings to prevent the leakage of fluid.

4. A sleeve is fitted in the shuttle valve housing and the cylindrical shuttle operates in the bore of the sleeve. The shuttle is grooved to accommodate a spring ring encircled by a split sealing ring, and has a rubber seat bonded to each end.

Operation of shuttle valve

5. During normal operation, the shuttle is seated at one end of the housing to close the emergency fluid supply line. Fluid passes into the opposite end of the housing and flows through the spigot connection to the jack.

6. In the event of failure of the normal supply, the pressure of emergency fluid will force the shuttle along the housing to close the normal supply line and allow emergency fluid to pass through the spigot connection to the jack.

SERVICING

Leakage

7. External seepage will indicate a faulty seal which must be renewed. Leakage past the shuttle may be due to dirt between the

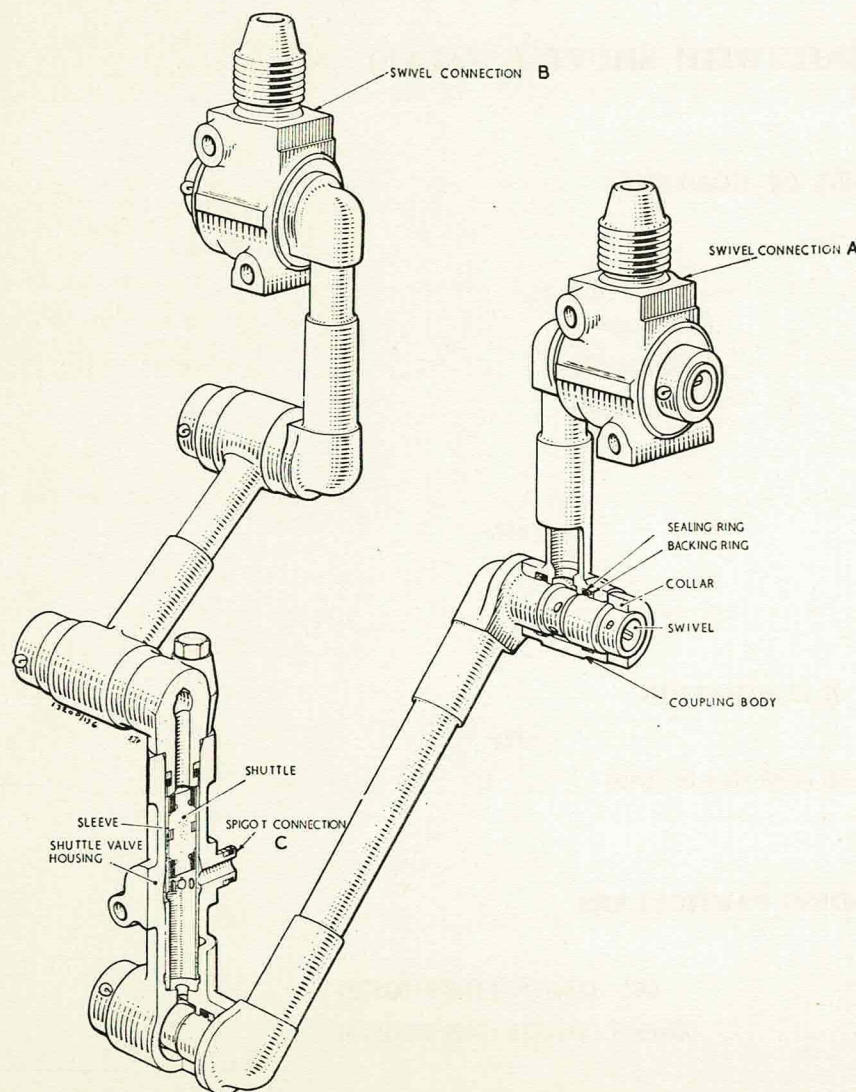


Fig. 1. Swivel pipe unit (with shuttle valve)

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bonded rubber rings and the seats in the shuttle bore, or by scored seats. If the bonded rubber seats are damaged or worn, the complete shuttle must be renewed. Leakage past the central sealing ring of the shuttle will necessitate a new ring.▶

TABLE 1
Special tool

Ref. No.	Part No.	Description
◀27Q/24015	03025TA01	Test adapter▶

Dismantling

8. (1) Remove the split pins and collars from the swivel joints and withdraw the swivel posts from the coupling bodies.

Note . . .

The screwed plugs are soldered in position and must not be removed.

- (2) Remove the sealing rings and backing rings from the coupling bodies, and

the sealing ring and backing ring from the spigot connection of the shuttle valve housing.

- (3) Unscrew the bolts and withdraw the spigot of the swivel post from the shuttle valve housing. Remove the sealing ring and backing ring from the spigot.

◀(4) Withdraw the shuttle from the sleeve and, if necessary remove the sealing ring and spring ring. The rubber seats are bonded and must not be removed. Withdraw the sleeve from the housing.▶

Assembling

9. All sealing rings are to be lightly coated with Grease XG-315 before being assembled in the unit.

(1) Fit the sealing rings and backing rings to the coupling bodies, and the sealing ring and backing ring to the spigot connection of the shuttle valve housing. The rough faces of the backing rings are to be adjacent to the sealing rings.

- ◀(2) Locate the sleeve in the bore of the shuttle valve housing with *the internal chamfer of the sleeve outermost*.

Note . . .

Duplicate inspection is required for the above assembling operation.

- (3) Fit the spring ring in the groove of the shuttle, followed by the split sealing ring. If a new sealing ring is fitted it must be cut through radially before assembly. Insert the shuttle in to the bore of the sleeve.

(4) Fit the sealing ring and backing ring to the spigot of the relevant swivel post, with the rough face of the backing ring adjacent to the sealing ring.

(5) Insert the spigoted end of the swivel post into the shuttle valve housing and secure the post to the housing with the bolts.

(6) Insert the swivel posts into their respective coupling bodies and secure the assemblies with the collars and split pins.▶

1. The first part of the report is a general introduction to the subject of the study.

2. The second part of the report is a detailed description of the methods used in the study.

3. The third part of the report is a discussion of the results of the study.

4. The fourth part of the report is a conclusion and a list of references.

5. The fifth part of the report is a list of appendices.

6. The sixth part of the report is a list of figures and tables.

7. The seventh part of the report is a list of footnotes.

8. The eighth part of the report is a list of references.

9. The ninth part of the report is a list of appendices.

10. The tenth part of the report is a list of figures and tables.

11. The eleventh part of the report is a list of footnotes.

12. The twelfth part of the report is a list of references.

13. The thirteenth part of the report is a list of appendices.

14. The fourteenth part of the report is a list of references.

15. The fifteenth part of the report is a list of appendices.

16. The sixteenth part of the report is a list of figures and tables.

17. The seventeenth part of the report is a list of footnotes.

18. The eighteenth part of the report is a list of references.

19. The nineteenth part of the report is a list of appendices.

Appendix 1

SWIVEL PIPE UNIT (WITH SHUTTLE VALVE)

◀Type No. 1.00676.003
1.00676.004▶

◀Introduction

1. These swivel pipe units are identical to the type described in the chapter. Type No. 1.00676.003 is the port side unit and Type No. 1.00676.004 is for the starboard side, the units being handed by the spigot connection of the shuttle valve housing.▶

TESTING

Test requirements

2. For testing the swivel pipes a static hydraulic test rig is required, together with the test adapter quoted in Table 1.
3. For testing the shuttle valve, a combined hand and power pump test rig, fitted with a selector valve and a by-pass valve, is required.

Testing the swivel pipes

4. (1) Bolt the test adapter over the spigot connection C and connect the supply line of the static hydraulic test rig to the swivel connection A. Apply pressure and fluid should flow freely from the spigot connection C. Disconnect the supply line.
- (2) Connect the supply line to the swivel connection B and apply pressure. Fluid should flow freely from the spigot connection C, indicating that the shuttle has moved along the bore of the shuttle valve housing.

(3) Blank off the test adapter at the spigot connection C and gradually apply a pressure of 6,000 lb/in² at the swivel connection B. Leakage is not permissible. Release the pressure and disconnect the supply line.

(4) Repeat test (3), applying pressure at the swivel connection A.

(5) With the spigot connection C blanked off, apply a pressure of 100 lb/in² at the swivel connection A. Rotate each swivel joint through an angle of 180 degrees and back ten times and through 360 degrees ten times (five clockwise and five counter-clockwise). If a swivel joint is prevented from moving through 360 degrees by the obstruction of other pipes etc., it should be moved as far as possible. Leakage is not permissible.

(6) Repeat test (5), applying pressure at connection B.

(7) Repeat tests (5) and (6), applying a pressure of 4,000 lb/in² and check that the torque required to rotate each swivel joint at this pressure does not exceed 25 lb. in. Release the pressure and disconnect the supply line.

Testing the shuttle valve

5. (1) Connect the unit to the combined hand and power pump test rig. The swivel connections A and B are to be connected

to the pipe lines leading from the test rig selector valve. A short length of pipe should also be connected to the pipe adapter at the spigot connection C for the observation of fluid flow from this connection.

(2) Operate the power pump and adjust the by-pass valve of the rig to control the pressure to 100 lb/in² with the selector valve in the neutral position.

(3) Select pressure to connection A and fluid should flow freely from connection C. Reverse the selection to connection B and fluid should continue to flow freely from connection C.

(4) Repeat test (3) at least three times to ensure that the shuttle is operating freely.

(5) Remove the pipe line from the test adapter at the spigot connection C and blank off the adapter.

(6) Disconnect the test rig pipe line from connection A. Select pressure to connection B and operate the power pump. An initial spurt of fluid from connection A is permissible due to movement of the shuttle. Stop the power pump.

(7) Operate the hand pump and apply a pressure of 300 lb/in², gradually increasing it to 6,000 lb/in². Leakage is not permissible.

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(8) With the test adapter at connection C still blanked off, re-connect the test rig pipe line to connection A and disconnect the pipe line from connection B. Select pressure to connection A and operate the power pump applying a pressure of 100 lb/in². The shuttle should move across the housing which will be shown by a spurt of fluid from connection B and subsequent build up of pressure. Stop the power pump.

(9) Operate the hand pump and apply a pressure of 300 lb/in², gradually increasing it to 6,000 lb/in². Leakage is not permissible. Release the pressure.

(10) Disconnect the test rig pipe line from connection A and re-connect the pipe line to connection B. Select pressure to connection B and operate the power pump applying a pressure of 100 lb/in².

The shuttle should move along the housing which will be shown by a spurt of fluid from connection A and subsequent build up of pressure. Stop the power pump.

(11) Operate the hand pump and apply a pressure of 300 lb/in², gradually increasing to 6,000 lb/in². Leakage is not permissible. Release the pressure.

(12) Repeat the test (8) to (11) alternately three times.

(13) Remove the blanking cap from the test adapter at the spigot connection C and connect the piston head end of any convenient slave jack to the adapter, with the piston in the closed position. Connect the pipe lines from the connections A and B to the opposite ports of the

selector valve. A stop-cock should be fitted in the line to connection A to enable fluid to be trapped at this connection, and a pressure gauge should be fitted in the pipe line from the selector valve to connection B. The shuttle must be in the position to allow fluid to flow from connection A to the test adapter at connection C.

(14) Close the stop-cock to trap fluid at zero pressure at connection A. Operate the power pump applying a minimum surge pressure of 200 lb/in² at connection B. The jack should extend and a stable pressure should be registered on the gauge. By means of the stop-cock, open connection A to the return line. Leakage is not permissible, except for a possible initial spurt of fluid through this connection. Release the pressure and repeat this test five times.

Appendix 2

SWIVEL PIPE UNIT (WITH SHUTTLE VALVE)

Type No. 1.00621.001

1.00621.002

Introduction

1. These swivel pipe units are identical, but are improved versions of the type described in the chapter. Port and starboard assemblies are denoted by the suffix numerals 001 and 002 respectively and are handed by the spigot connection of the shuttle valve housing.

TESTING

Test requirements

2. A static hydraulic test rig, together with the test adapter quoted in Table 1 is required for testing the swivel pipe unit.

3. A combined hand pump and power pump test rig is required for testing the shuttle valve. The rig is to incorporate a four way control valve and a by-pass valve and a restrictor, with a 0.015 in. diameter orifice, are to be fitted in the main pressure line and the main return line of the control valve respectively. Pressure gauges X and Y are to be fitted in the pipe lines to the shuttle valve connections A and B respectively and a short pipe line with a shut-off valve is to be connected to the shuttle valve spigot C.

Testing the swivel pipes

4. (1) Bolt the test adapter over the spigot connection C and connect the supply line of the static hydraulic test rig to the swivel connection A. Apply pressure, then fluid should flow freely from the spigot connection C. Disconnect the supply line.
- (2) Connect the supply line to the swivel connection B and apply pressure. Fluid should flow freely from the spigot connection C, indicating that the shuttle has moved along the bore of the shuttle valve housing.
- (3) Blank off the test adapter at the spigot connection and gradually apply a pressure of 6,000 lb/in² at the swivel connection B. Leakage is not permissible. Release the pressure and disconnect the supply line.
- (4) Repeat test (3) applying pressure at the swivel connection A.
- (5) With the spigot connection C blanked off, apply a pressure of 100 lb/in² at the swivel connection A. Rotate each swivel joint through an angle of 180 degrees and

back ten times and through 360 degrees ten times (five clockwise and five anti-clockwise). If a swivel joint is prevented from moving through 360 degrees by the obstruction of other pipes etc., it should be moved as far as possible. Leakage is not permissible.

- (6) Repeat test (5) applying pressure at connection B.
- (7) Repeat tests (5) and (6) applying a pressure of 4,000 lb/in² and check that the torque required to rotate each swivel joint at this pressure does not exceed 25 lb. in. Release the pressure and disconnect the supply line.

Testing the shuttle valve

5. (1) Connect the unit to the combined hand and power pump test rig as detailed in para. 3. Close the shut-off valve at the spigot connection C and select the control valve to apply pressure at connection A.
- (2) Operate the power pump and gradually raise the pressure to 300 lb/in². The flow of fluid from the return line should cease. Release the pressure and open the shut-off valve.

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(3) Select the control valve to neutral, operate the power pump and adjust the by-pass valve to give a pressure of 100 lb/in². Select pressure to connection B and fluid should flow from connection C and possibly from the return line. Adjust the by-pass valve and the shut-off valve to obtain a pressure of 300 lb/in² at the gauge Y. The flow of fluid from the return line should cease.

(4) Close the shut-off valve and operate the pump to a pressure of 6,000 lb/in². Leakage is not permissible. Release the pressure and fully open the shut-off valve.

(5) Select the control valve to neutral, operate the power pump and adjust the by-pass valve to give a pressure of 100 lb/in². Select pressure to connection A and fluid should flow from connection C and possibly from the return line.

Adjust the by-pass valve and the shut-off valve to obtain a pressure of 300 lb/in² at the gauge X. The flow of fluid from the return line should cease.

(6) Close the shut-off valve and operate the pump to a pressure of 6,000 lb/in². Leakage is not permissible. Release the pressure and fully open the shut-off valve.

(7) Repeat tests (3) and (4) and (5) and (6) alternately three times.



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