Meggitt Fuelling Products
Avery-Hardoll
Whittaker Controls

2½, 3 and 4 inch microswitch operated preset valve CMMY620/630 and CMMY640 series

Maintenance manual with spare parts catalogue

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AMENDMENT RECORD

AMENDMENT NO.	CHAP/ PAGE	DESCRIPTION	DATE
I**ssue 2**		**Differences from Issue 1 – Amendment 1**	March 2005
	Chap 1 Page 1	Zone changed to ATEX Category	
	Page 3	Fig 1.3 Microswitch and Linkage diagram shows ATEX approved switches	
	Chap 2 Page 2	Electrical Solenoid Valve specification change	
	Chap 3 Page 1	Zone changed to ATEX Category	
	Chap 4 Page 2	Needle Valve O Ring added	
	Chap 5 Page 2	Needle Valve O Ring added	
	Page 4	O Ring added to Bill of Materials	
	Page 12	Illustration revised	
	Page 13	Bill of Materials revised	
	Page 14	Illustration and Bill of Materials revised	

Avery-Hardoll

It is the aim of Avery-Hardoll to maintain a policy of continuous progress and for this reason reserve the right to modify specifications without notice. This manual provides the information required to install, service and overhaul the equipment. Although every effort has been made to ensure absolute accuracy, Avery-Hardoll does not hold itself responsible for any inaccuracies that may be found.

HEALTH AND SAFETY AT WORK ACT 1974

REFERENCE: CHAPTER 37, PART 1, SECTION 6

Avery-Hardoll take every care to ensure that, in accordance with the above Act, our products, as far as is reasonably practical in an industrial environment, are when operated and maintained in accordance with the appropriate manual, safe without risk to health.

PRODUCT SAFETY

In the interest of safety it is strongly recommended by Avery-Hardoll that the following details receive strict attention.

For the Purpose of Definition, the word PRODUCT applies to any product sold by Avery-Hardoll.

1 The Product is used only with fluids stated as acceptable by Avery-Hardoll.

2 The Product, whilst in service, must not be subjected to pressures greater than the Maximum Working Pressure or tested to pressures greater than the Test Pressure as specified in the manual.

3 The Product must only be coupled/connected to equipment considered acceptable by Avery-Hardoll.

4 The Product must be handled using the lifting handles where fitted, or in accordance with the manual.

5 The Product must not be misused or handled in any way liable to cause damage.

6 The Product must be inspected for any signs of damage prior to use e.g. cracks, damaged seals, seized or tight operating mechanisms.

7 The Product must be subjected to a regular maintenance programme, either in accordance with the manual or as agreed with Avery-Hardoll.

8 Only technically competent personnel should repair or maintain the Product and only parts supplied by Avery-Hardoll may be used.

9 Products covered by warranty may not be modified in any way without prior written permission of Avery-Hardoll.

10 Products not in service, must be stored in a clean area, and should not be subjected to excessive temperature, humidity, sunlight, or strong artificial light. Products should be protected to prevent damage or the ingress of foreign matter.

11 Where applicable, attention should be drawn to dangers resulting from the generation of static electricity in product flow lines. We strongly recommend account is taken of BS5958 parts 1 and 2.

CONTENTS

Preliminary material

Chapters

Chapter 1

TECHNICAL DESCRIPTION

CONTENTS

1 GENERAL INFORMATION

1.1 The $2^1/_2$" /3" /4" microswitch operated preset valve is a development of the well established Avery–Hardoll mechanical in-line preset valve. The design has been changed to allow solenoid operation either from microswitch or from Masterload 2.

1.2 The valve is approved for use in **Category 2 (Zone 1) Hazardous Area** and is available in 3 pipeline sizes, $2^1/_2$", 3" and 4" with bodies of SG Cast Iron & in steel (4" only). All are similar in construction and identical in function.

1.3 The design of the body places the main valve assembly at an angle of approximately 40 degrees to the vertical in order to reduce the pressure drop across the valve.

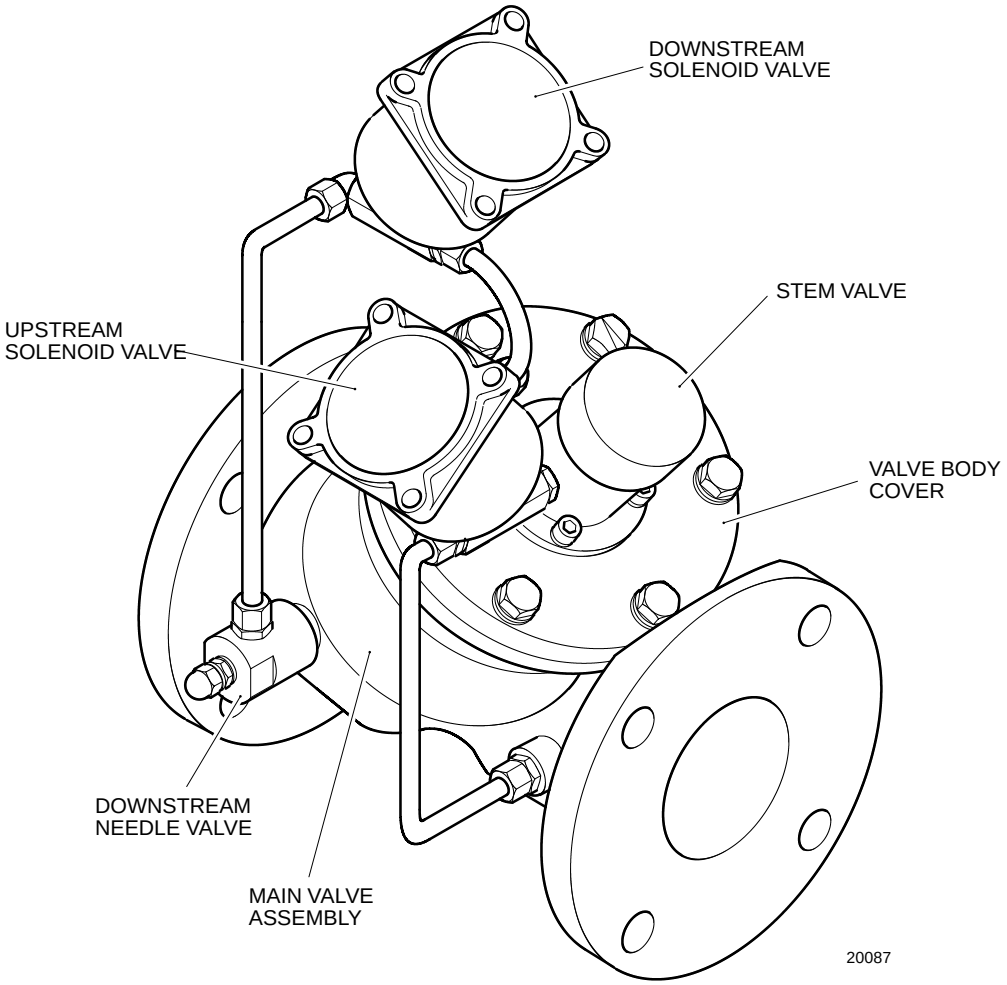

FIG 1.1 Valve – Main Components

2 TECHNICAL DESCRIPTION

2.1 The Valve comprises:

- A Valve Body
- Main Valve Assembly
- Valve Body Cover
- External Pipework and Connections
- Upstream Solenoid Valve
- Downstream Solenoid Valve
- Downstream Needle Valve
- Stem Valve Assembly

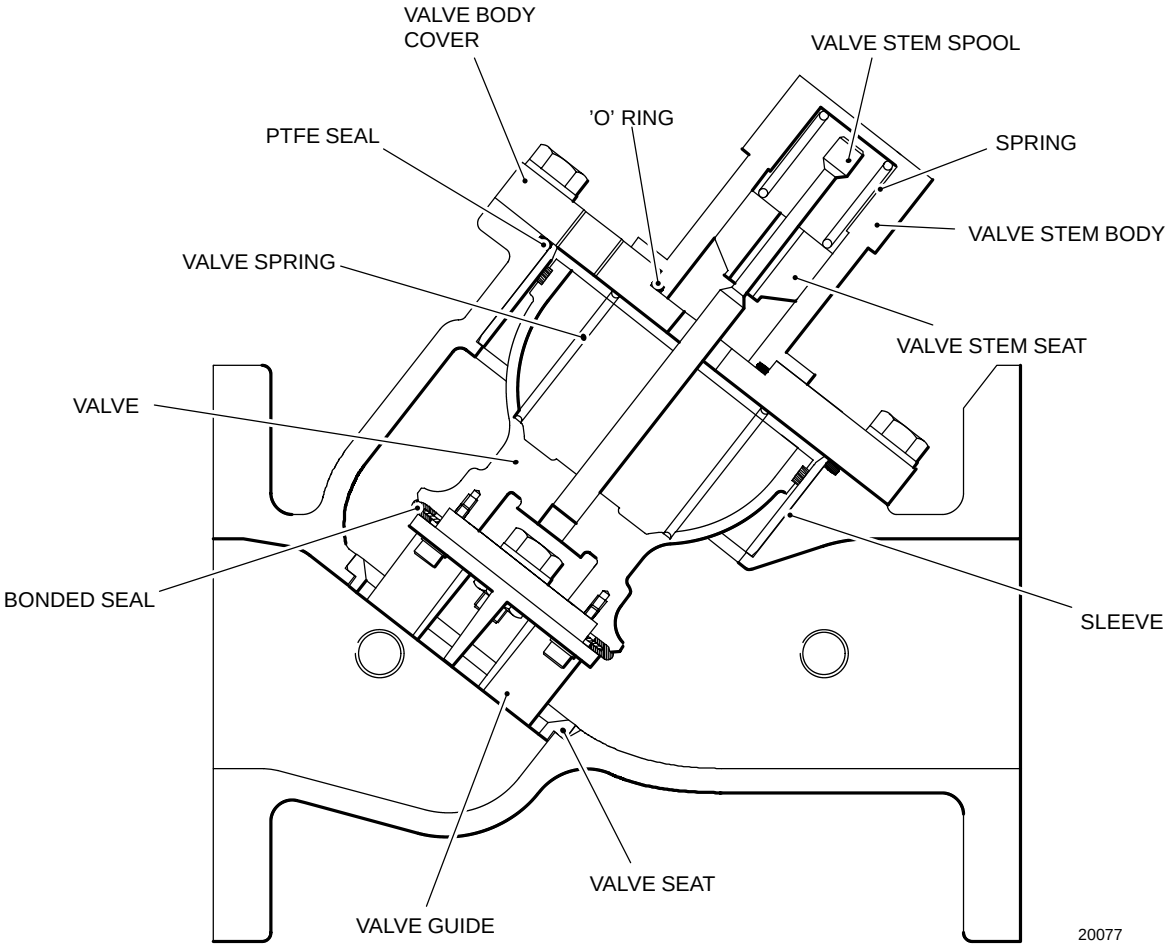

FIG 1.2 Valve – Component Parts

2.2 The body is drilled and threaded on the upstream and downstream side to accept needle valve and solenoid pipework connections. A valve seat and sleeve are fitted inside the body, the sleeve forms a bore in which the upper part of the main valve (designed as a piston) operates.

2.3 The main valve assembly comprises a valve guide, renewable bonded seal and main valve. A PTFE seal is fitted around the piston section of the main valve to form a compression ring and a valve spring fitted between the top of the main valve and the valve body cover retains the valve in the closed position. The valve body cover is drilled and threaded to take pipework connections and the stem valve assembly.

2.4 The pipework, needle valve, stem valve assembly and solenoid valves form the pressure sensing and control system of the valve. The needle valve is fully adjustable under its nut cover and is used to set up the valve to the system on installation. The two solenoid valves are designed to be fully open or fully closed depending upon on the solenoids being energised or de-energised. With the solenoids de-energised the upstream valve is fully open and the downstream valve fully closed. Electrical control of the solenoids is either by mechanical microswitches on the preset register or by a simple automation system; the interconnecting wiring is by conventional three core cable.

2.5 The Stem Valve assembly controls the slow (second stage) flowrate by balancing the flow of the product into and out of the space above the piston. The valve height and therefore the second stage flowrate are adjustable at the stem valve adjusting screw.

2.6 Sealing of the valve is achieved by ‘O’ ring seals and gaskets.

3 MICROSWITCH LINKAGE

3.1 If a microswitch or switches are required to be controlled by the preset unit, either for controlling solenoid operated preset valves or for other duties required by the customer, the switches are operated by levers and links.

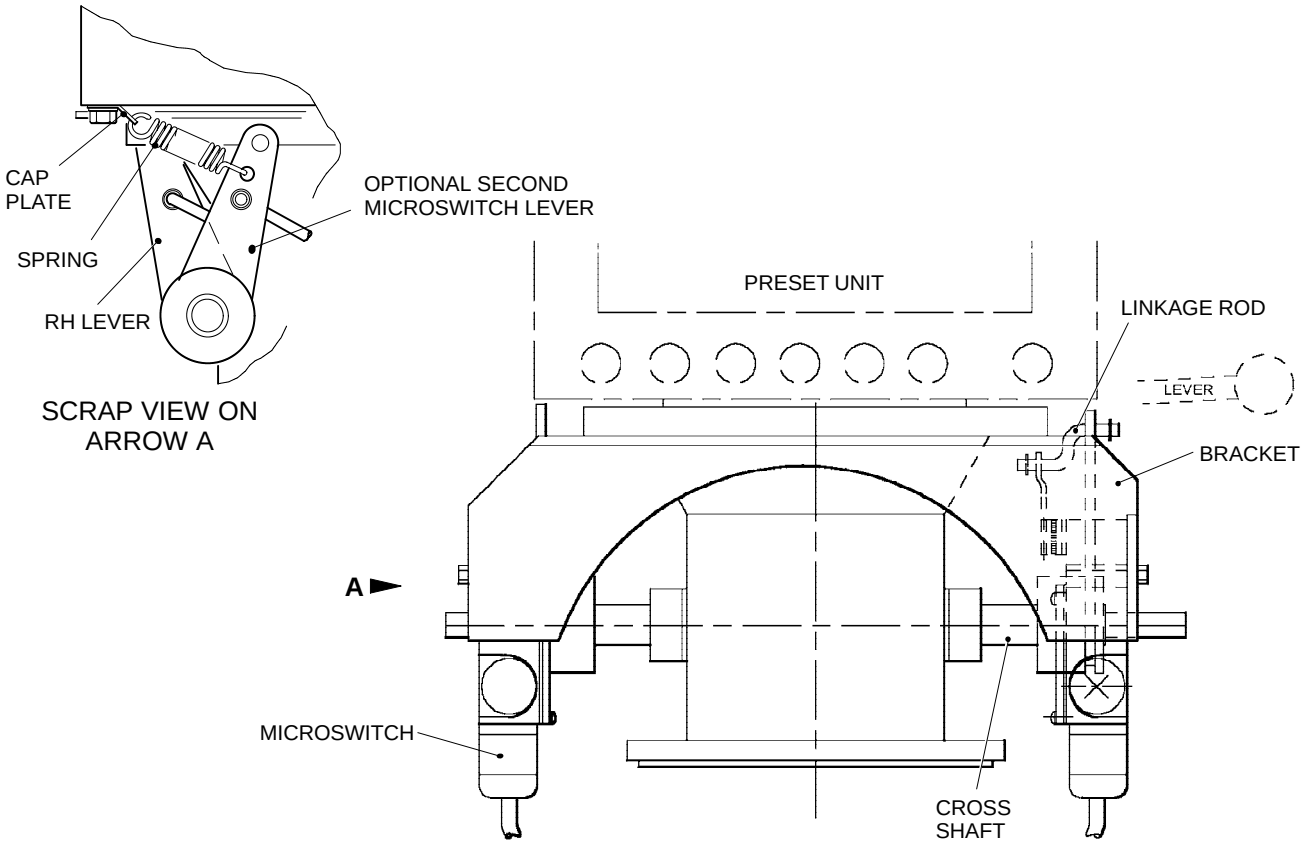

Fig 1.3 Microswitch and linkage

3.2 One or two levers are secured to the cross shaft as shown in Fig 1.3. These can be in place of or additional to the preset operating lever.

3.3 The micro switches are mounted on brackets secured to the unit mounting and connection is made between the levers and switches by link rods which locate through holes and are secured by split pins.

3.4 Dual microswitches have a spring fitted between the left hand lever and the mounting bolt of the register to ensure the switches return to the off position at the end of the delivery.

Chapter 2

SPECIFICATION

CONTENTS

1 VALVE SIZES

1.1 The Solenoid Operated Preset Valve is available in three sizes; 2 1/2" ,3" and 4".

2 MATERIALS

2.1 The valve body is of:
SG cast iron BS2789 Grade 420/12 or Cast Steel BS1504-161 grade 480. (4" only)

2.2 Seat is Stainless Steel BS970 416S21 P or 41 S41 P

2.3 Pipework and fittings are Stainless Steel.

2.4 Seals are fluorocarbon & nitrile material and the sliding seal is P.T.F.E.

3 FLANGE DETAILS

3.1 2½" Valve: 4 holes diameter 0.75" (19.05mm) equispaced on 5.5" (139.7mm) P.C.D.

3.2 3" Valve: 4 holes diameter 0.75" (19.05mm) equispaced on 6" (152.4mm) P.C.D.

3.3 4" Valve: 8 holes diameter 0.75" (19.05mm) equispaced on 7.5" (190.5mm) P.C.D.

3.4 Valves are available with flat or raised face flanges.

3.5 Flange connections:
ANSI 150FF or RF

4 PRESSURES AND OPERATING TEMPERATURES

4.1 Maximum Working Pressure: 150 p.s.i.

4.2 Test Pressure: 300 p.s.i.

4.3 Temperature: -10 deg C to +50 deg C

5 ELECTRICAL

5.1 Power Supply: 110/220/240V AC

5.2 Solenoid Valves:

ASCO,	BASEEFA No.73229	Exd IIB T4 waterproof to IP65.
LUCIFER	ATEX 94/9/CE	EExd IIC T4 waterproof to IP65.
RED DRAGON	ATEX 94/9/CE	EExd IIC T6 waterproof to IP67.

6 SUITABILITY

6.1 The Solenoid Operated Preset Valves are compatible with Preset registers with pre & final close microswitches. Avery–Hardoll brand Masterload System may be used to control the valve, however the Masterload functions are reduced and the Solenoid Operated Multistage Preset Valve is recommended for this type of set up.

The valve allows:-

- Two Stage Opening (timer required).
- 2 stage Closure Pre close switch should be set at 100 litres (2½ & 3") and 200 litres (4").
- Precise Final Closure (within 1 litre).
- Safety and Error Interlocked Operation.

7 VISCOSITY

7.1 Maximum Viscosity: 150 cSt.

8 STORAGE LIFE

8.1 The storage life is two years, when stored in cool dry conditions (limited only by the deterioration of the seals).

Chapter 3

INSTALLATION & OPERATION

CONTENTS

WARNING

PRIOR TO CARRYING OUT ANY WORK ENSURE THAT ALL LOCAL AND COMPANY SAFETY PROCEDURES HAVE BEEN COMPLIED WITH.

1 RECEIPT

1.1 The preset valve will be delivered in a suitable container. Upon receipt the container should be inspected for signs of external damage which must be reported to the carrier immediately.

1.2 When unpacking the valve, inspect for any signs of damage or for missing components, which must be reported to Meggitt Fuelling Products, Avery–Hardoll immediately.

2 INSTALLATION

WARNING

ENSURE THAT ALL LOCAL REGULATIONS REGARDING THE USE OF EQUIPMENT IN CATEGORY 2 (ZONE 1) HAZARDOUS AREAS ARE COMPLIED WITH.

BEFORE WIRING UP THE VALVE ENSURE POWER SUPPLIES TO THE AUTOMATION SYSTEM UNIT ARE ISOLATED.

2.1 The valve is designed to be mounted downstream of the bulkmeter in either the vertical or horizontal position but the following must be checked:

The Valve is fitted the correct way round, with the angled top face facing upstream.

The solenoid valves are fitted with the normally closed valve downstream and the normally open valve upstream of the main valve.

2.2 Remove solenoid cover. Inside the solenoid housing is a terminal block for live/neutral (AC) or +/– (DC) connections. Orientation is not important.

2.3 An earthing screw is located in the base of the solenoid housing.

2.4 Wiring to the solenoids is by 3-core cable, connection should be made by a suitably qualified electrician in accordance with BS5345. See Diagram 3.2 for suggested wiring.

2.5 Diagram 3.3 shows a typical Masterload installation, Avery–Hardoll advise the use a Solenoid Operated Multistage Preset Valve for this type of installation.

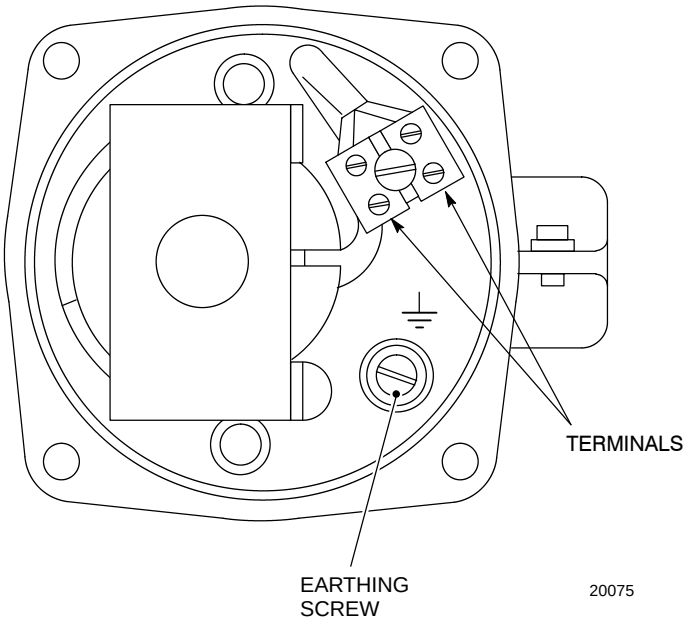

Fig 3.1 Solenoid wiring

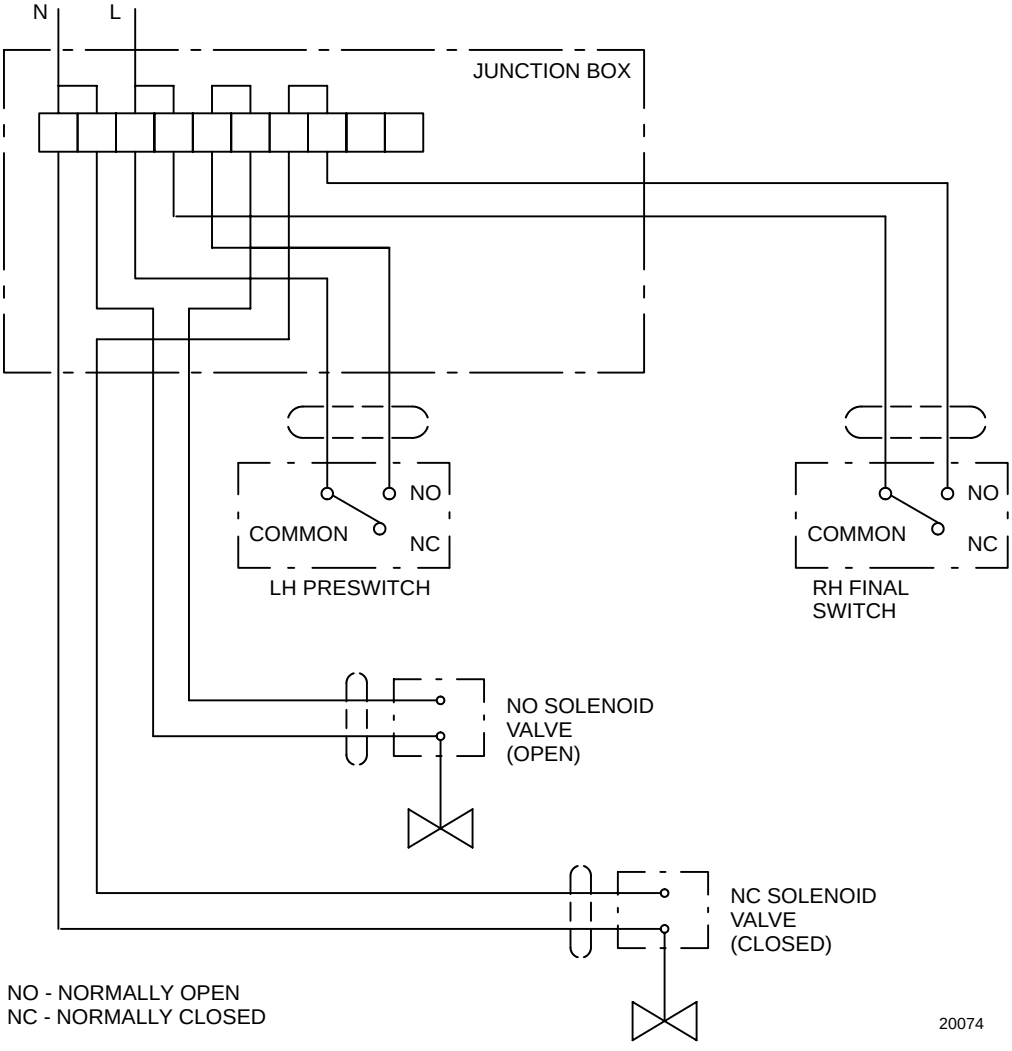

Fig 3.2 Wiring Diagram for electro–mechanical preset counter

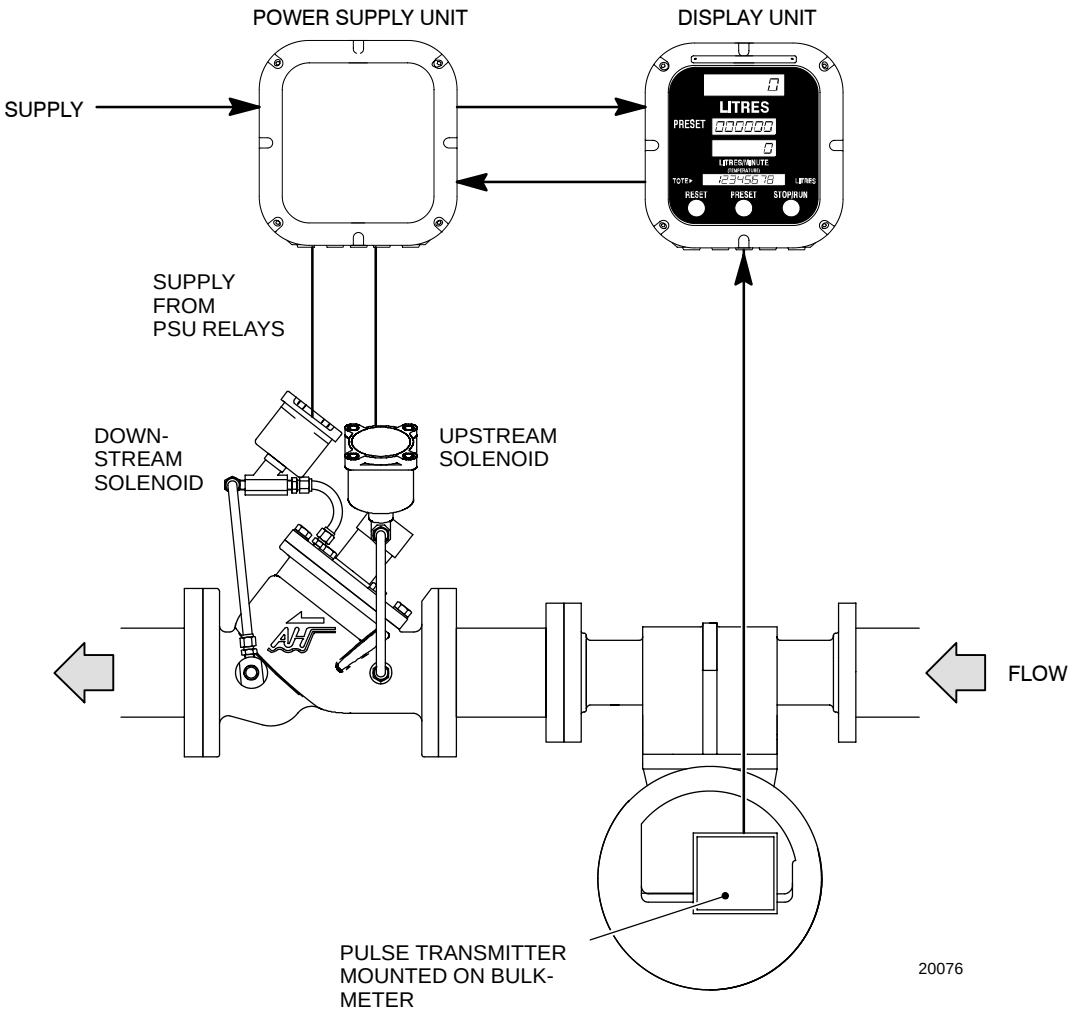

Fig 3.3 Typical valve / Masterload installation

3 OPERATION

3.1 The $2^1/_2$" /3" /4" microswitch operated preset valves make use of upstream and downstream pressures, sensed each side of the main valve and acting on the piston crown to open and close the main valve. Solenoid Valves control the pressure on the piston by closing or opening the upstream and downstream sensing points as commanded.

3.2 **In a standby, non-operational state,** with no pressure in the system the main valve is held closed by spring pressure and both solenoids de-energised. The upstream Solenoid Valve is normally closed

3.3 **On pressurising the system,** the main valve is held closed under spring pressure aided by upstream pressure acting on the top of the main valve.

3.4 **The main valve is opened** by energising both solenoids, this action causes the upstream solenoid valve to close and the downstream to open. The pressure on top of the piston is released to the downstream level allowing upstream pressure under the piston to open the valve and allow product to flow. The pressure drop across the valve maintains the opening action.

3.5 **When the preset remaining has reduced to 100-200 litres** (set at the preset register), a microswitch on the register de-energises the upstream solenoid valve, which opens (being a normally open valve). Product now flows from upstream into the space above the piston at a rate which exceeds that flowing out to downstream. The main valve therefore closes gradually.

3.6 **The rate of valve closure** is adjusted by the needle valve. This controls the rate that product flows out to downstream. Reducing this rate (closing the valve) increases the rate of valve closure, increasing this rate (opening the valve) reduces the rate of valve **closure.**

3.7 **When the flowrate has reduced to 100-150 lpm,** the stem valve which moves down with the main valve, closes until the inflow into the space above the piston balances the outflow, holding the valve in a steady partially open position. This flow rate can be controlled by adjusting the stem valve adjusting screw which raises or lowers the stem valve seat.

3.8 At the end of the batch, the second microswitch on the register de-energises the downstream solenoid valve, which closes. Pressure above the piston increases to the upstream level and, aided by the spring, the main valve closes.

MAIN VALVE STATE	UPSTREAM Vv POSITION	DOWNSTREAM Vv POSITION	UPSTREAM SOLENOID STATE	DOWNSTREAM SOLENOID STATE
Closed (Standby)	OPEN	Closed	D	D
Opening	Closed	OPEN	E	E
1st Stage Closure	OPEN	OPEN	D	E
2nd Stage Closure	OPEN	Closed	D	D

Table 3.1 Preset valve operation

D = De-Energised
E = Energised

4 COMMISSIONING

4.1 Check that the valve opens and successfully reaches maximum flow rate.

4.2 When the preset quantity remaining reduces to 200 litres (4") or 100 litres ($2^1/_2$" and 3"), the preset register should return to the slow flow latch and the pre-close microswitch will open, disconnecting power to the upstream solenoid. The flow rate should reduce to 70-150 lpm with 20-50 litres still remaining.

4.3 When the preset quantity is completed, the preset register should return to the closed position and the final close microswitch will open, disconnecting power to the downstream solenoid. The valve will now close.

4.4 The valve has been set up at the factory to achieve these values, but different conditions (line pressure or product viscosity) may require the settings to be changed. Adjustments can be made to achieve these values as follows:

Valve closes too quickly (more than 50 litres remaining at slow flow):
open downstream needle valve.

Valve closes too slowly (less than 20 litres remaining at slow flow):
close downstream needle valve.

Note These adjustments will affect the slow flow rate slightly, they should be completed before making any adjustment to the slow flow rate.

If the slow flow rate needs adjusting, follow the procedure below:

Stop the flow while adjusting.
Adjust the stem valve 'in' to increase , or 'out' to decrease the flow rate.
Observe the flow rate with the power disconnected to the upstream solenoid (register on slow flow latch) so that the valve goes straight into slow flow.
A flow rate higher than 150 lpm is permissible provided that the preset overrun at final shut off is acceptable.

Chapter 4

MAINTENANCE AND OVERHAUL

CONTENTS

1 ROUTINE MAINTENANCE

1.1 Minimum maintenance is required to be carried out on the preset valve and is confined to keeping the unit clean, checking the security and condition of cables and connections. At two yearly intervals an internal inspection should be carried out and seals renewed.

2 DISASSEMBLY

WARNING

WORK MUST ONLY BE CARRIED OUT BY QUALIFIED PERSONNEL.

PRIOR TO COMMENCING WORK, ENSURE THAT ALL AIRPORT/COMPANY SAFETY PROCEDURES HAVE BEEN COMPLIED WITH.

ALL POWER SUPPLIES ARE TO BE ISOLATED BEFORE DISCONNECTING SOLENOIDS.

ENSURE THE SYSTEM IS DRAINED BEFORE DISCONNECTING ANY PIPEWORK.

2.1 Remove the solenoid covers and, ensuring they are clearly identified for reconnection, disconnect the three wires from each solenoid.

2.2 Disconnect the pipe couplings and remove the solenoid valves (44, 45) and needle valve (32). Disconnect the pipework from the valve body cover and the upstream and downstream side of the body.

2.3 Support the weight of the valve and remove the flange bolts, nuts and washers, lift the valve clear and place on a suitable working surface. Remove and discard gaskets (46).

WARNING

FLUOROCARBON. DO NOT HANDLE O-RINGS/SEALS IF THEIR MATERIAL APPEARS CHARRED, GUMMY OR STICKY. USE TWEEZERS AND WEAR NEOPRENE OR PVC GLOVES. DO NOT TOUCH ADJACENT PARTS WITH UNPROTECTED HANDS. NEUTRALIZE ADJACENT PARTS WITH A SOLUTION OF CALCIUM HYDROXIDE. IF THE DEGRADED MATERIAL OR ADJACENT PARTS TOUCH THE SKIN, DO NOT WASH OFF WITH WATER, SEEK IMMEDIATE MEDICAL AID FOR POSSIBLE CONTAMINATION WITH HYDROFLUORIC ACID. HYDROFLUORIC ACID IN CONTACT WITH SKIN HAS DELAYED SYMPTOMS OF CONTAMINATION. IT IS EXTREMELY TOXIC.

2.4 Remove the stem valve body (22) complete with stem valve seat (23) and spring (26) by removing the screws (29) and washers (30). Discard the ‘O’ ring (28). With the stem valve body removed, remove the dome nut (36), washers (35) and locking nut (34). Depress the stem valve seat against its spring and screw the adjusting screw (25) fully in and remove from inside the stem valve body. Remove the stem valve seat and the spring.

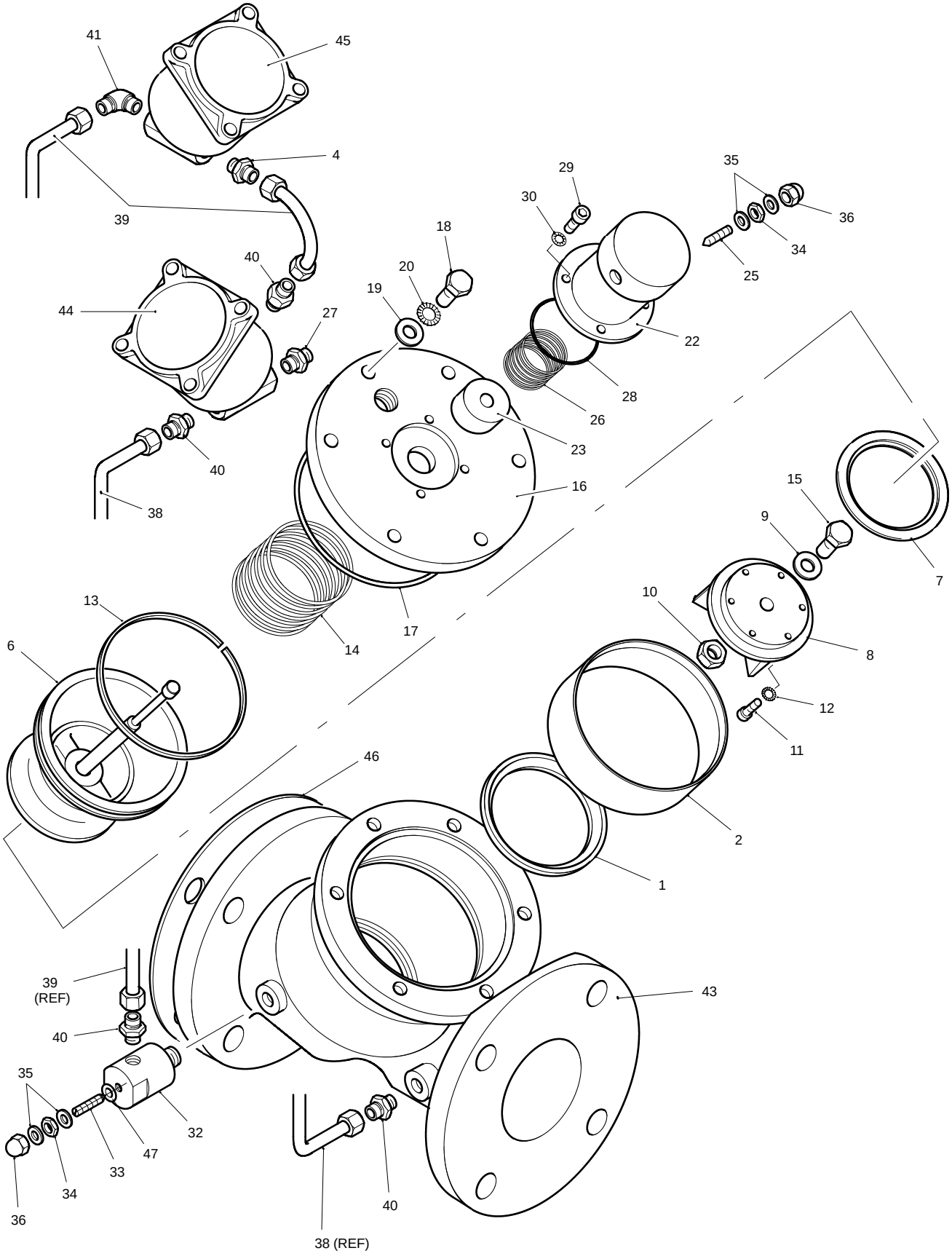

Fig 4.1 Valve components

2.5 To remove the main cover (16), relieve spring tension by slackening off evenly on the cover bolts (18), remove the bolts (18) and washers (19, 20) and lift off the valve body cover. Remove and discard the 'O' ring seal (17).

2.6 Remove and retain the valve spring (14) and withdraw the main valve assembly (6) from the body (43), taking care to retain the PTFE strip (13).

2.7 Remove the screws (11) and washers (12) securing the valve guide (8) to the valve (6), separate the valve and guide and remove the bonded seal (7).

3 CLEANING AND INSPECTION

3.1 Thoroughly clean all components using approved cleaning methods and materials. Inspect for damage or excessive wear. Renew components as necessary, renew 'O' rings and seals.

4 ASSEMBLY

4.1 Fit a new 'O' ring seal (17) to the top face of the valve body (43).

4.2 Fit a new bonded seal (7) to the main valve (6) and secure the valve guide (8) to the valve with the screws (11) and washers (12). Fit the PTFE strip (13) (renew if worn or damaged) to the valve assembly (6), and fit the main valve into the body.

4.3 Fit the spring (26) and valve stem seat (23) into the valve stem body (22). Wrap some PTFE sealing tape around the stem adjusting screw (25), press the valve stem seat against the spring and fit the adjusting screw into the stem valve body from the inside. Attach the locknut (34), washers (35) and dome nut (36) to the adjusting screw. Fit a new 'O' ring (28) to the stem valve body and attach to the main body cover (16) with the four screws (29) and washers (30).

4.4 Fit the valve spring (14) into the top of the valve assembly (6) and fit the valve body cover (16) ensuring that the cover and stem valve seat are concentric with the stem valve . Secure the cover with the bolts (18) and washers (19, 20) tighten down the securing bolts evenly.

4.5 Fit new gaskets (46) and refit the valve to the system.

4.6 Refer to the Asco Instruction Sheet to change solenoid valve seals. Refit pipework, needle valve (32) and solenoid valves (44, 45). Ensure the solenoid valves are fitted in the correct positions.

Note:

Sealing of elbows and male connectors etc. Where male and female threads are sealed to each other, a suitable thread sealant such as Loctite 572 should be used.

4.7 Reconnect the wiring to the solenoids and fit solenoid covers.

5 FAULT FINDING

5.1 The following paragraphs provide a guide only to faults that may occur, their possible causes and remedy. They may not cover all possible faults. If a fault cannot be traced or rectified, please contact us for advice.

5.2 Faults occurring with the Microswitch Solenoid Operated Preset Valve will in most cases show as:
Incorrect quantity of product passed
Failure of valve to open
Failure of valve to close
Incorrect opening and closing times causing sluggish response or pressure surges and shock.

5.3 Faults may also occur in the system in which the valve has been installed. Operation and Maintenance procedures correctly carried out should keep faults to a minimum.

5.4 The following table is a guide for possible faults and causes, with remedies that can be carried out by maintenance staff.

5.5 If the fault cannot be cured by the remedies listed, advice should be sought from Meggitt Fuelling Products, Avery–Hardoll.

6 FAULT FINDING TABLES

TABLE 4.1

Fault	Possible Cause	Remedy
No flow - Solenoids inoperative.	No Permissive Feed.	Check Permissive Feed supply.
	Wiring fault.	Check Power Supply and Solenoids wiring. Check wiring run for damage.
	Automation System.	Refer to System Manual.
No Flow- but Solenoids 'Cllck' when flow is initiated.	Only one Solenoid operating.	Check Wiring.
One Solenoid fails to energise.	Fuse Blown in Power Supply.	Renew Fuse after eliminating cause.
	Wiring Fault.	Check Power Supply and Solenoids wiring. Check wiring run for damage.
Over delivery of product.	Valve not shutting off correctly	Check Valve, dismantle as necessary, Refer to Para 2.
	Leakage past main valve seat	Check Valve, dismantle as necessary, Refer to Para 2.
	Closing speed too slow	Adjust, Refer to Chapter 3.
	Second stage flow rate too fast	Adjust, Refer to Chapter 3.
	Automation System.	Refer to System Manual.

Fault	Possible Cause	Remedy
Sluggish response on opening.	Downstream Needlevalve not opened sufficiently. Blockage in pipework, main valve sticking.	Turn Downstream Needlevalve counter-clockwise. Check pipework and valve, dismantle as detailed in Para 2.
Sluggish response on closing.	Sticking solenoid valves Main Valve sticking. Closing speed too slow	Check Valves, dismantle as necessary, Refer to Asco instruction sheet Check Valve, dismantle as detailed in Para 2. Adjust, Refer to Chapter 3.
Closing action too fast causing shock.	Sticking Stem or Main Valve assembly Closing speed too fast	Check Valve, dismantle as necessary, Refer to Para 2. Adjust, Refer to Chapter 3.
Product permanently leaking through valve	Downstream Solenoid valve-seat contaminated. Main valve seal contaminated.	Strip and check valve-seat Strip valve, inspect. and replace parts as necessary

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Chapter 5

SPARE PARTS

CONTENTS

1 GENERAL INFORMATION

1.1 When ordering spare parts please quote the following information:

- Model number and serial number of equipment.
- Publication number and issue.
- Figure number.
- Reference number.
- Part number.
- Description.

2 SPARE PARTS DETAILS

2.1 '+' in the Fig/Ref No. column indicates Item is not illustrated.

2.2 '*' in the Part No. column indicates Item is recommended to be held as a spare part.

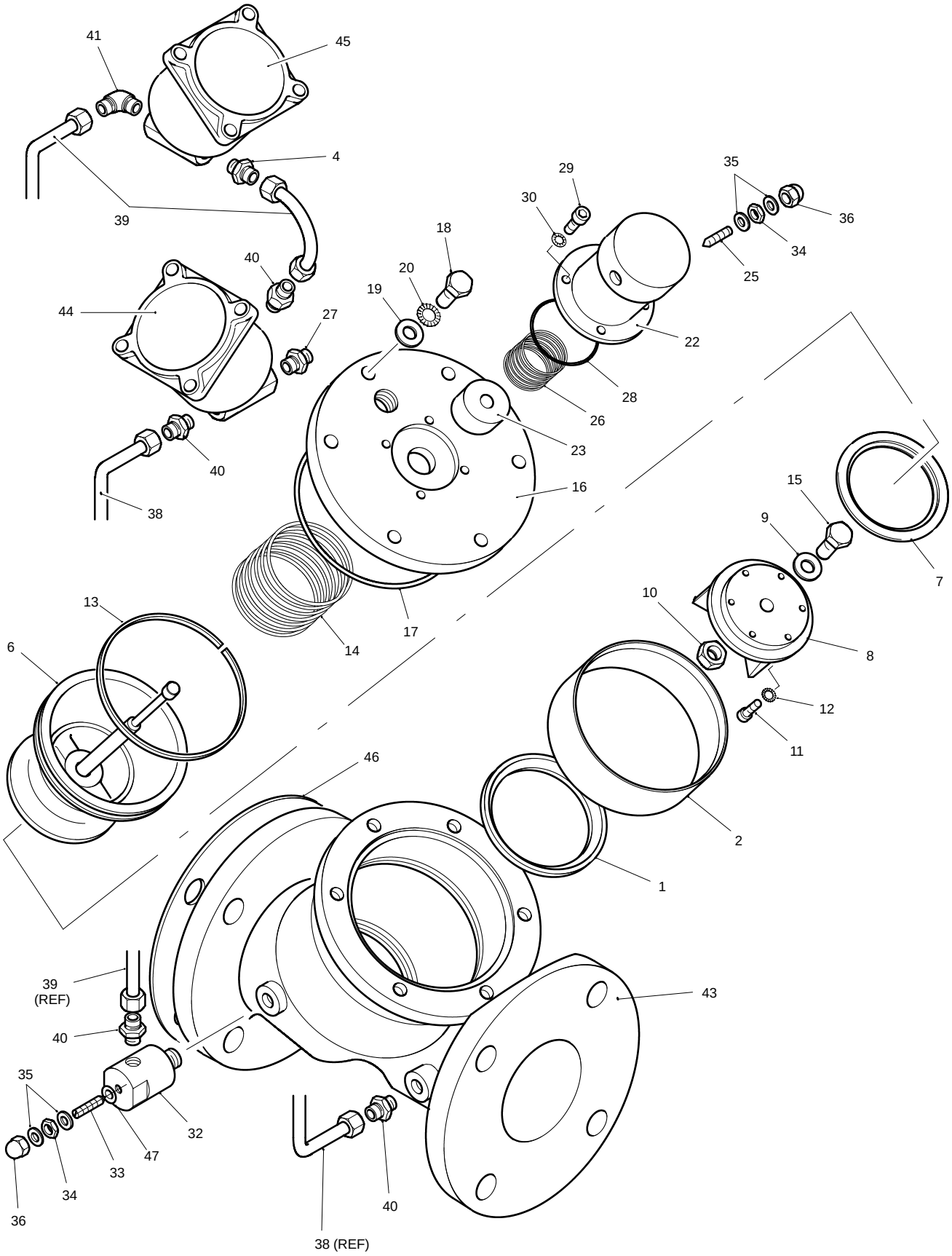

Fig 5.1 Valve components

Fig/ Item No.	Part No.	Description	2.5" Valve Qty	3" Valve Qty	4" Valve Qty
5.1					
1	BESZ1309	Valve Seat	1	1	-
	BESZ1304	Valve Seat	-	-	1
2	BEBZ1310	Sleeve	1	1	-
	BEBZ1303	Sleeve	-	-	1
6	BEMS1437	Valve Assembly	1	1	-
	BEMS1438	Valve Assembly	-	-	1
7	BMRZ19324-1	Bonded Seal	1	1	-
	BMRZ16764-1	Bonded Seal	-	-	1
8	BEAZ1307	Valve Guide	1	1	-
	BEAZ1306	Valve Guide	-	-	1
9	ZMMZ0135-8	Dowty Seal	1	1	1
10	ZN2201M10A	Nut M10	1	1	1
11	ZS3225M05020A	Valve Guide Bolt	6	6	6
12	ZW8205M05A	Washer Shakeproof	6	6	6
13	BMPZ33194	PTFE Strip	1	1	-
	BMPZ33184	PTFE Strip	-	-	1
14	ZASZ0001-11	Spring Main	1	1	-
	BMSZ1979	Spring Main	-	-	1
15	ZS3228M10025A	Screw M10	1	1	1
16	BESZ1425	3" Cover	1	1	-
	BESZ1426	4" Cover	-	-	1
17	ZO22E246139A	'O' Ring Cover	1	1	-
	ZO22E259139A	'O' Ring Cover	-	-	1
18	ZS3228M10025A	Screw M10	6	6	-
	ZS3228M12030A	Screw M12	-	-	7
19	ZW2201M10A	Plain Washer	6	6	-
	ZW2201M12A	Plain Washer	-	-	7
20	ZW8205M10A	Washer Shakeproof	6	6	-
	ZW8205M12A	Washer Shakeproof	-	-	7
22	BESZ1386	Valve Stem Body	1	1	1
23	BEAZ1387	Valve Stem Seat	1	1	1
25	BESZ1391	Adjust Screw (Stem)	1	1	1
26	BMSZ2143	Spring	1	1	1
27	ZASZ0305-36	Hex Nipple	1	1	1
28	ZO22M042530A	'O' Ring	1	1	1
29	ZS3225M06012A	Screw	4	4	4
30	ZW8206M06A	Shake Proof Washer	4	4	4
32	BESZ1370	Needle Valve Body	1	1	1
33	BESZ1399	Needle Valve	1	1	1
34	ZN2201E08A	Nut	2	2	2
35	ZAFZ0010-12	Fibre Washer	4	4	4
36	BMCZ3608	Dome Nut	2	2	2
38	S4680-6	Tube Upstream	1	1	-
	BESZ1427	Tube Upstream	-	-	1
39	BMSZ33200	Tube Downstream	1	1	-
	BMSZ33193	Tube Downstream	-	-	1
40	ZACZ0305-18	Male Connector	5	5	5
41	ZACZ0305-12	Male Elbow	1	1	1
43	Not Spared	Main Body	Ref	Ref	Ref

Fig/ Item No.	Part No.	Description	2.5” Valve Qty	3” Valve Qty	4” Valve Qty
44	SEE TABLE 5.1	Solenoid Valve Normally Open	1	1	1
45	SEE TABLE 5.1	Solenoid Valve Normally Closed	1	1	1
46	BMFZ1423	Gasket Flange	2	2	-
	BMDZ1994	Gasket Flange (4” Valve only)	-	-	2
47	18817	’O’ Ring (Fluorocarbon)	1	1	1

* = Suggested spare part

+ = Item not illustrated

TABLE 5.1 SOLENOID VALVE VARIANTS (ITEMS 44 & 45 FIG 5.1)

ITEM 44 – NORMALLY OPEN		**ZEMZ0177-19**	**ZEMZ0177-21**	**ZEMZ0177-23**	**BEMZ1341**
ITEM 45 – NORMALLY CLOSED		**ZEMZ0177-20**	**ZEMZ0177-22**	**ZEMZ0177-24**	**BEMZ1418**
2.5 INCH PRESET VALVE ASSY CAST IRON, RAISED FACE **CCMY620-**		**240V**	**110V**	**220V**	**24V**
240	240V	1 of each type			
110	110V		1 of each type		
220	220V			1 of each type	
24	24V				1 of each type
CAST IRON, FLAT FACE **CCMY621-**		**240V**	**110V**	**220V**	**24V**
240	240V	1 of each type			
110	110V		1 of each type		
220	220V			1 of each type	
24	24V				1 of each type
3 INCH PRESET VALVE ASSY CAST IRON, RAISED FACE **CCMY630-**		**240V**	**110V**	**220V**	**24V**
240	240V	1 of each type			
110	110V		1 of each type		
220	220V			1 of each type	
24	24V				1 of each type
CAST IRON, FLAT FACE **CCMY631-**		**240V**	**110V**	**220V**	**24V**
240	240V	1 of each type			
110	110V		1 of each type		
220	220V			1 of each type	
24	24V				1 of each type
4 INCH PRESET VALVE ASSY CAST IRON, RAISED FACE **CCMY640-**		**240V**	**110V**	**220V**	**24V**
240	240V	1 of each type			
110	110V		1 of each type		
220	220V			1 of each type	
24	24V				1 of each type
CAST IRON, FLAT FACE **CCMY641-**		**240V**	**110V**	**220V**	**24V**
240	240V	1 of each type			
110	110V		1 of each type		
220	220V			1 of each type	
24	24V				1 of each type

TABLE 5.1 SOLENOID VALVE VARIANTS (ITEMS 44 & 45 FIG 5.1 continued)

ITEM 44 – NORMALLY OPEN		**ZEMZ0177-19**	**ZEMZ0177-21**	**ZEMZ0177-23**	**BEMZ1341**
ITEM 45 – NORMALLY CLOSED		**ZEMZ0177-20**	**ZEMZ0177-22**	**ZEMZ0177-24**	**BEMZ1418**
4 INCH PRESET VALVE ASSY CAST STEEL, RAISED FACE **CCMY642–**		**240V**	**110V**	**220V**	**24V**
240	240V	1 of each type			
110	110V		1 of each type		
220	220V			1 of each type	
24	24V				1 of each type

CAST STEEL, FLAT FACE **CCMY644–**		**240V**	**110V**	**220V**	**24V**
240	240V	1 of each type			
110	110V		1 of each type		
220	220V			1 of each type	
24	24V				1 of each type

TABLE 5.2 ADAPTOR/CONTROL HANDLES- SHORT PRESET DRIVE (USED WITH MICROSWITCHES) (REFER TO FIG 5.2)

CALIBRATION MECHANISM (Mk2A/Mk3)	PART NUMBER		
	DRIVE ASSEMBLY	BASE ADAPTOR SUB-ASSY	PRIMARY DRIVE SUB-ASSY
SINGLE MICROSWITCH ASSEMBLIES			
Mk2A (READOUT)			
Imp. gal	BMMZ30297	BMMZ30294	BMMZ1869
Litres	BMMZ30297-1	BMMZ30294-1	BMMZ1869-1
U.S. gal	BMMZ30297-2	BMMZ30294-2	BMMZ1869-2
Decalitres/m3	BMMZ30297-3	BMMZ30294-3	BMMZ1869-3
Unit drum	BMMZ30297-6	BMMZ30294-6	BMMZ24923
Mk3 (ALL READOUTS)	BMMZ30297-5	BMMZ30294-5	BMMZ12219
Vol/Wt Adaptor Mk2A & Mk 3 (ALL READOUTS)	BMMZ30297-7	BMMZ30294-7	BMMZ31431
DOUBLE MICROSWITCH ASSEMBLIES			
Imp. gal	BMMZ30297-8	BMMZ30294-8	BMMZ1869
Litres	BMMZ30297-9	BMMZ30294-9	BMMZ1869-1
U.S. gal	BMMZ30297-10	BMMZ30294-10	BMMZ1869-2
Decalitres	BMMZ30297-11	BMMZ30294-11	BMMZ1869-3
Mk3 (ALL READOUTS)	BMMZ30297-12	BMMZ30294-12	BMMZ12219
Vol/Wt Adaptor Mk2A & Mk 3 (ALL READOUTS)	BMMZ30297-13	BMMZ30294-13	BMMZ31431

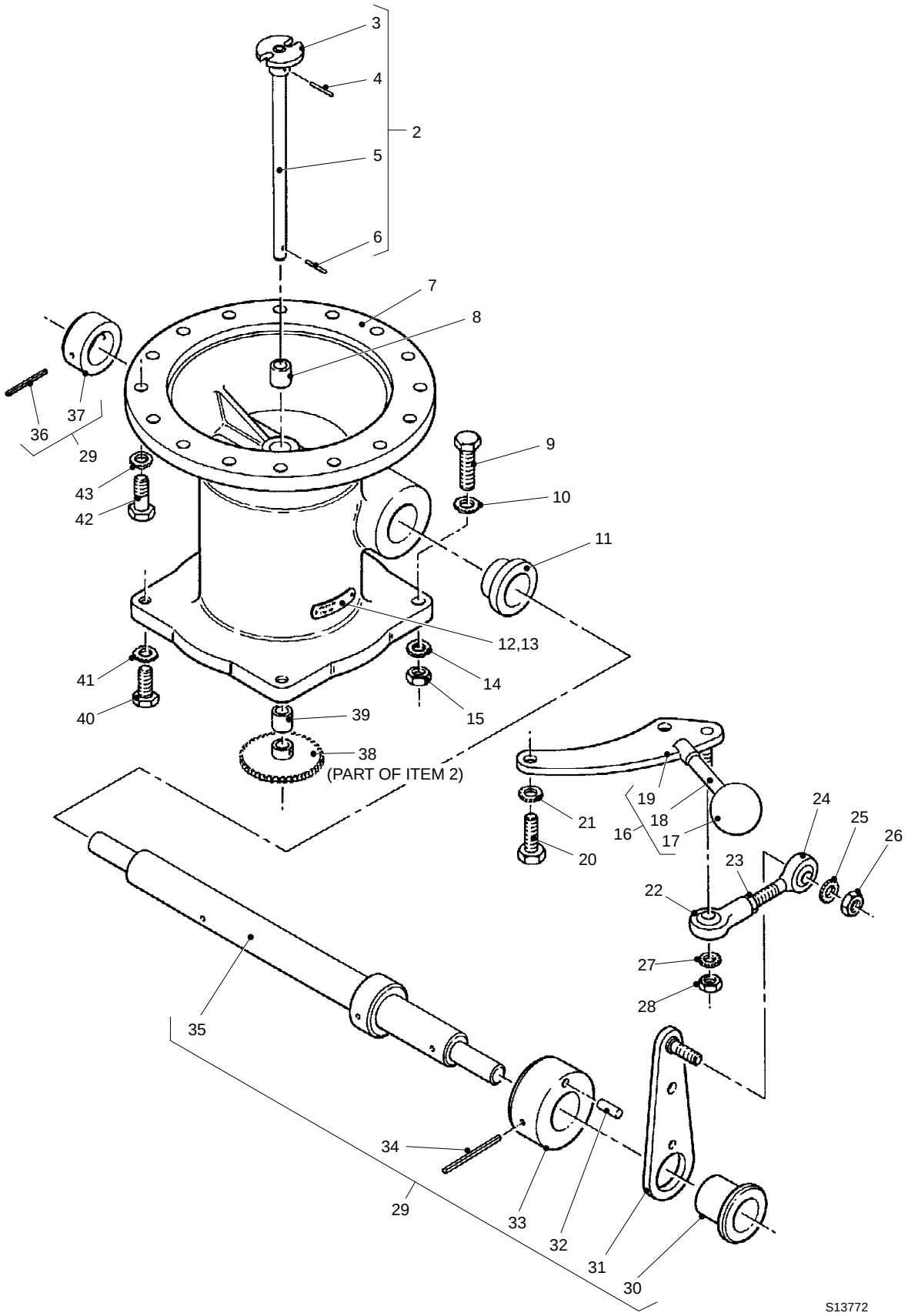

Fig 5.2 Adaptor/control handle – short preset drive (used with microswitches)

ADAPTOR/CONTROL HANDLE - SHORT PRESET DRIVE (USED WITH MICROSWITCHES)

Fig/ Item No.	Part No.	Description	Qty
5.2-			
+	BMMZ30297- (see Table 5.2)	Adaptor/control handle assy, LH/RH, short preset drive	1
1 +	BMMZ30294- (see Table 5.2)	Preset base adaptor sub-assy, LH/RH (comprising items 2, 9 –15 incl, 21, 29, 40)	1
2 +	BMMZ1869- (see Table 5.2)	Primary vertical drive sub-assy - toothed gear coupling	1
	BMMZ24923 (see Table 5.2)	- bar and pin coupling	
	BMMZ12219 (see Table 5.2)	- plate and pin coupling	
	BMMZ31431 (see Table 5.2)	- fork coupling	
3	BMSZ159	Collar	1
4	ZT8001E0007A	Tension pin, 5/64 in. dia x 7/16 in. lg	1
5	BMSZ1868	Drive spindle	1
6	ZT8001E0007A	Tension pin, 5/64 in. dia x 7/16 in. lg	1
7	BMAZ30292	Register base adaptor	1
8	ZACZ0062-11	Bush, plain, 7/16 in. od x 1/4 in. id x 1/2 in. lg	1
9	ZS3228E0818A	Screw, hex hd, 1/4 in. UNF x 1 1/8 in. lg	2
10	ZW2201G08A	Washer, plain, 1/4 in. id	2
11	ZACZ0062-9	Bearing	2
12	BMAZ3700	Label	1
13 +	ZMMZ0232-8	Hammer drive screw, size 00 x 1/8 in. lg	2
14	ZW8205G08A	Washer, ext s/proof, 1/4 in. id	2
15	ZN2201E08A	Nut, hex, 1/4 in. UNF	2
16	BMMZ24870	Control handle assy	1
17	BMPZ1469	Ball knob	1
18	BMSZ24866	Control handle arm	1
19	BMMZ24869	Control handle plate sub-assy (qty 2 required if Item 16 is in optional position)	1
20	ZS3228E0806A	Screw, hex hd, 1/4 in. UNF x 3/8 in. lg (qty 4 required if Item 16 is in optional position)	2
21	ZW8205G08A	Washer, ext s/proof, 1/4 in. id (qty 4 required if Item 16 is in optional position)	2
22	ZMMZ0249-1	Rod end bearing, UNIBAL, female	1
23	ZN2204M05A	Locknut, hex, M5	1
24	ZMMZ0249-2	Rod end bearing, UNIBAL, male	1

(continued)

* = Suggested spare part

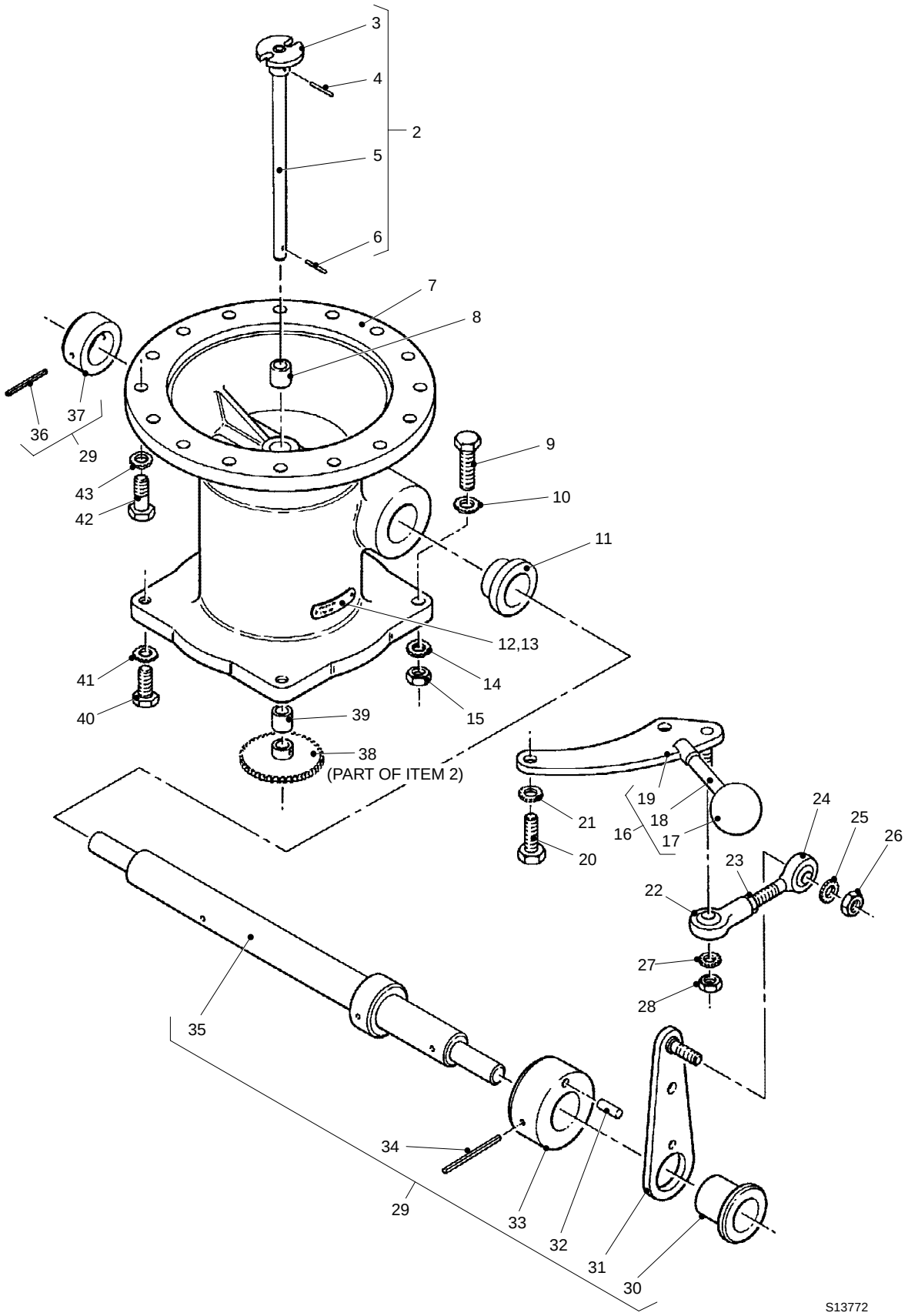

Fig 5.2 Adaptor/control handle – short preset drive (used with microswitches)

ADAPTOR/CONTROL HANDLE - SHORT PRESET DRIVE (continued)

Fig/ Item No.	Part No.	Description	Qty
25	ZW8205M05A	Washer, ext, s/proof, M5	1
26	ZN2201M05A	Nut, hex, M5	1
27	ZW8205M05A	Washer, ext s/proof, M5	1
28	ZN2201M05A	Nut, hex, M5	1
29	BMMZ30274	Shaft sub-assy (single microswitch)	1
	BMMZ30274-1	Shaft sub-assy (double microswitch)	
30	BMSZ30278	Flanged collar (Qty 2 required with double microswitch)	1
31	BMMZ30279	Lever sub-assy (Qty 2 required with double micrswitch)	1
32	ZASZ0104-3	Dowel pin, 3/16 in. dia x 5/8 in. lg. (single microswitch)	1
	ZT8001M0312A	Tension pin, 3 mm dia x 12 mm lg (double microswitch)	2
33	BMSZ30276	Large collar (Qty 2 required with double microswitch)	1
34	ZT8001E0624A	Tension pin, 3/16 in. dia x 1 1/2 in. lg (Qty 2 required with double microswitch)	1
35	BMSZ30275	Shaft	1
36	ZT8001E0418A	Tension pin, 1/8 in, dia x 1 1/8 in. lg	2
37	BMSZ30277	Small collar	2
38	BMCZ1765	Counter drive gear - Imp gal	1
	BMCZ1759	- Litres	
	BMCZ1776	- US gal	
	BMCZ1777	- Decalitres	
+	BMMZ24921	Drive coupling sub-assy - bar and pin (with Item 2 - BMMZ24923)	
+	BMMZ2882	Drive coupling sub-assy - plate and pin (with Item 2 - BMMZ12219)	
+	BMMZ18993	Fork coupling (with Item 2 - BMMZ31431)	
39	ZACZ0062-12	Bush, plain, 1/4 in. id x 7/16 in. od x 3/8 in. lg	1
40	BMSZ2362	Sealing screw	2
41	ZW8205G08A	Washer, ext s/proof, 1/4 in. id	2
42	BMSZ2362	Sealing screw	4
43	ZW8205G08A	Washer, ext s/proof, 1/4 in. id	4

* = Suggested spare part

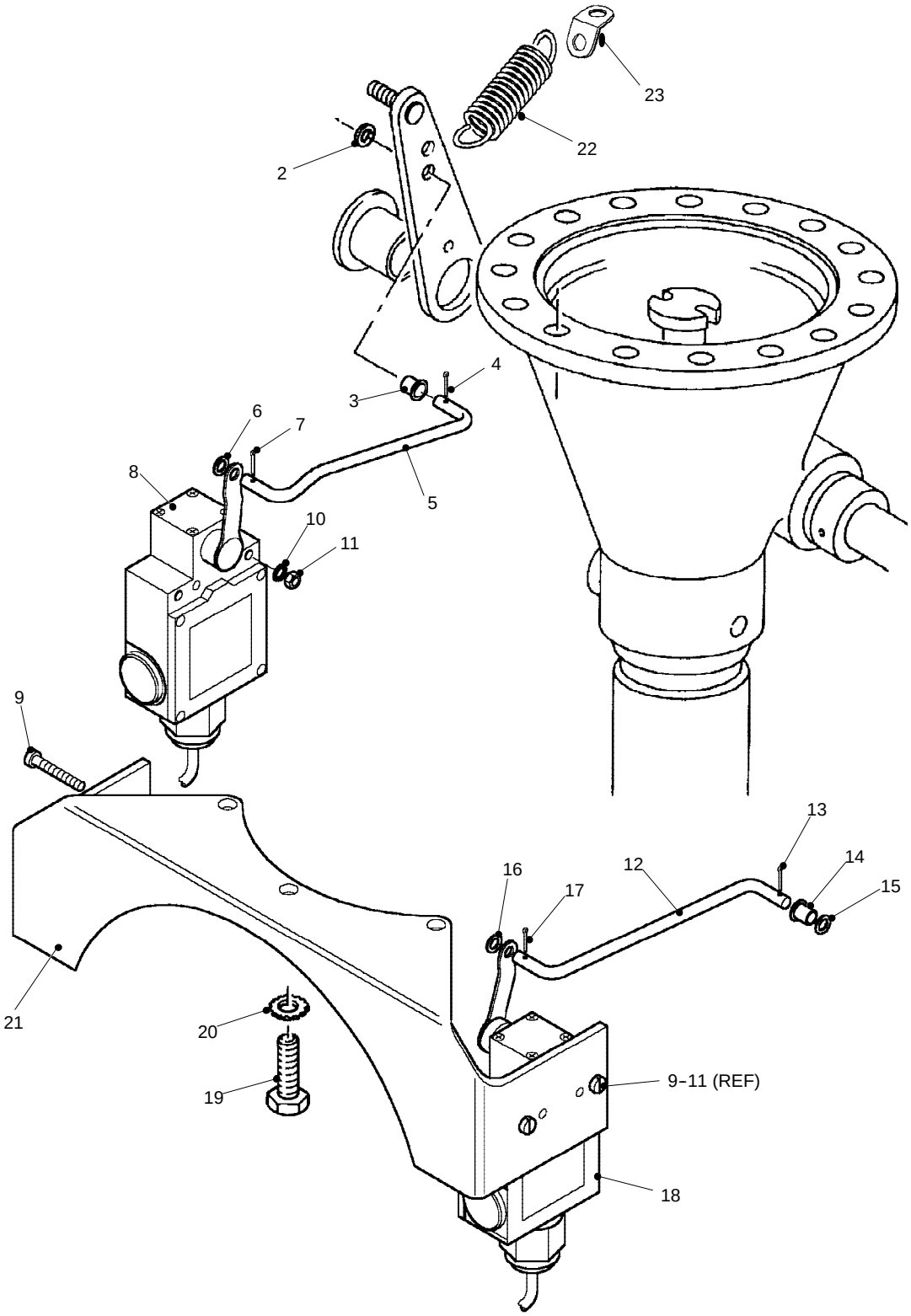

Fig 5.3 Double Microswitch and bracket assembly

DOUBLE MICROSWITCH AND BRACKET ASSEMBLY

Fig/ Item No.	Part No.	Description	Qty
5.3-			
1 +	BMMZ30268-1	Double microswitch assembly, direct mounted or extended drive	1
2	ZW2201G08A	Washer, plain, 1/4 in. id	1
3	BMPZ30271	Bush	1
4	ZT2206E0208A	Split pin, 1/16 in. dia x 1/2 in. lg	1
5	BMSZ33335-1	Link	1
6	ZW2201G06A	Washer, plain, 3/16 in. id	1
7	ZT2206E0208A	Split pin, 1/16 in. dia x 1/2 in. lg	1
8	BMMZ30272-1	Microswitch sub-assy (pre final shutdown)	1
9	ZS2205M04035	Screw, M4 x 35 lg pan hd	4
10	ZW8205M04A	Washer, M4 ext s/proof	4
11	ZN2201M04A	Hex Nut, M4	4
12	BMSZ33335	Link	1
13	ZT2206E0208A	Split pin, 1/16 in. dia x 1/2 in. lg	1
14	BMPZ30271	Bush	1
15	ZW2201G08A	Washer, plain, 1/4 in. id	1
16	ZW2201G06A	Washer, plain, 3/16 in. id	1
17	ZT2206E0208A	Split pin, 1/16 in. dia x 1/2 in. lg	1
18	BMMS30272	Microswitch sub-assy (final shutdown)	1
19	ZS3228E0814A	Screw, hex hd, 1/4 in. UNF x 7/8 in. lg	3
20	ZW8205G08A	Washer, ext s/proof, 1/4 in. id	3
21	BMSZ33334	Bracket	1
22	ZASZ0002-28	Spring, Tension	1
23	HUSZ4340	Cap Plate	1

* = Suggested spare part

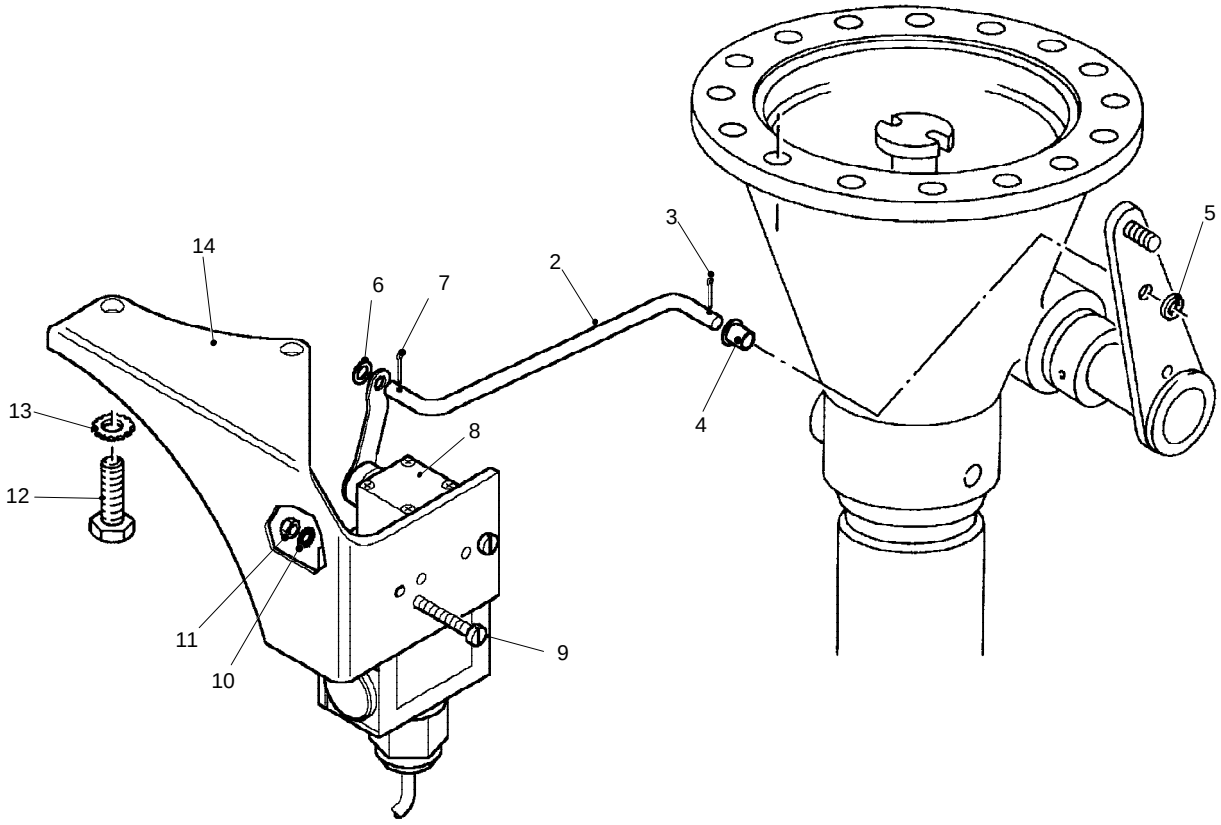

Fig 5.4 Single Microswitch and bracket assembly

Fig/ Item No.	Part No.	Description	Qty
5.4-			
1 +	BMMZ30268	Single microswitch assembly, direct mounted or extended drive (optional alt. to BMMZ30268-1)	1
2	BMSZ33335	Link	1
3	ZT2206E0208A	Split pin, 1/16 in. dia x 1/2 in. lg	1
4	BMPZ30271	Bush	1
5	ZW2201G08A	Washer, plain, 1/4 in. id	1
6	ZW2201G06A	Washer, plain, 3/16 in. id	1
7	ZT2206E0208A	Split pin, 1/16 in. dia x 1/2 in. lg	1
8	BMMS30272	Microswitch sub-assy (final shutdown)	1
9	ZS2205M04035	Screw, M4 x 35 lg pan hd	2
10	ZW8205M04A	Washer, M4 ext s/proof	2
11	ZN2201M04A	Hex Nut, M4	2
12	ZS3228E0814A	Screw, hex hd, 1/4 in. UNF x 7/8 in. lg	2
13	ZW8205G08A	Washer, ext s/proof, 1/4 in. id	2
14	BMSZ33333	Bracket	1

* = Suggested spare part