



Powering Business Worldwide

Aerospace Group
Conveyance Systems Division
Carter® Brand Ground Fueling Equipment

SM44646
October 2009

Applicable additional manuals:

SM61428 NOZZLE
SM61429 NOZZLE
SM64200 NOZZLE
SM64201 NOZZLE
SM64348 NOZZLE
SM64349 NOZZLE

Maintenance Manual

Hose End Regulator
To Mate 61428, 64348, 61429, 64349, 64200 & 64201 Nozzles

Model 44646

TABLE OF CONTENTS

	<u>PAGE</u>
1.0 INTRODUCTION.....	3
2.0 EQUIPMENT DESCRIPTION	3
3.0 TABLE OF OPTIONS.....	3
4.0 SAFETY INSTRUCTIONS	3
5.0 SPECIAL TOOLS	3
6.0 DISASSEMBLY	4
7.0 INSPECTION	5
8.0 REASSEMBLY	5
9.0 TEST	6
10.0 ILLUSTRATED PARTS CATALOG.....	7
FIGURE 1 - PARTS BREAKDOWN	8
FIGURE 2 - TYPICAL LAPPING JIG.....	9
FIGURE 3 - CONTINUITY CLIP INSTALLATION	10
FIGURE 4 - 61656 BLOCKOUT DEVICE.....	11

Maintenance, Overhaul & Test Instructions Carter® Model 44646 Hose End Regulator

1.0 INTRODUCTION

This manual furnishes detailed instructions covering the maintenance and overhaul of Eaton's Carter Model 44646 Hose End Regulator designed to provide a relatively fixed pressure at its outlet. Three pressure settings (35, 45, and 55 psi) are available and are procured

by specifying the pressure setting as the dash number to the basic model number, e.g. 44646-45 is a Regulator with a 45 psi spring. When the Regulator is obtained as an integral part or an option to a Nozzle it is specified as noted in paragraph 3.0.

2.0 EQUIPMENT DESCRIPTION

Carter Model 44646-* Hose End Regulator is designed to be used as a part of Carter's 64348, 64348, 64200 or 64201 Nozzles to provide a maximum pressure at its outlet ("nozzle pressure") to control the flow of fuel into the aircraft. In addition the unit responds to increases in pressure within the aircraft fuel manifold caused by closure of the aircraft's tank level control valves to either maintain the desired maximum pressure or to close to prevent an excessive "surge"

pressure from being sensed within the aircraft. The unit is a direct acting spring loaded regulator which will control pressure at its outlet in accordance with the spring force provided therein. A double ended piston of different areas is balanced against the spring and atmospheric pressure to provide the control. The smaller end of the piston is vented to the atmosphere through a screened breather to provide an atmospheric pressure reference point.

3.0 TABLE OF OPTIONS

The Unit is available with three different spring settings, 35, 45 and 55 psi. When ordering as an integral part of Carter Model 64348, 64349, 64200 or 64201 Nozzles, the basic option letter to be included in the nozzle part number is "F" and the spring setting must be specified as either a "3, 4 or 5" appended to the "F" option as a part of the nozzle part number, e.g. 64200F46H is a nozzle with standard handle grips, 45 psi Regulator and 2 1/2" NPT QD inlet.

Refer to the appropriate nozzle service manual for more details. The various Units utilize the same Housing Assy (29) and there is no external way of distinguishing between them. The older 55 psi Units were identified by either being completely yellow in color or by a yellow stripe around the body. This was discontinued at the request of the major user. The individual springs are color coded as explained in a later section of this manual.

4.0 SAFETY INSTRUCTIONS

The subject Regulator incorporates a fairly highly loaded spring that moves the piston against the pressure during operation. It is worth noting that one should take care in disassembly so as not to be injured by the spring loaded piston.

The smaller end of the piston is vented to the atmosphere through a breather. Due to the fact that the piston is sealed with a sliding Teflon seal there is always a minute amount of leakage from the pressure side of the piston to the chamber behind the piston. As the amount of fuel increases in this cavity, it will be forced out of the breather with each stroke of the piston. This small leakage is normal, however as wear on the seal and piston

become more with use the leakage will become more significant and the parts should be replaced. Care should be exercised such that the breather is not pointed toward the operator during operation to prevent fuel from coming into contact with sensitive areas of the body. Newer units have a breather designed to direct any possible fuel spray away from the operator. **The breather port should not be plugged at any time.** This will make the Unit inoperable. The swivel joints in the mating nozzles allow the rotating of the Regulator into any 360° position.

5.0 SPECIAL TOOLS

The following special tools are recommended for proper repair and or overhaul of the hose end control valve:

- 61607 Ball (27) Assembly Tool.
- 61656 Blockout device.
- No part number - Seal run-in tool - See Figure 2.

- WL4680 Torque Wrench or Standard torque wrench is required for some disassembly and re-assembly. WL4680 includes several sockets for special usage on Carter products.

6.0 DISASSEMBLY

- 6.1 Remove the Regulator from the Nozzle as detailed in the appropriate service manual paragraph for the nozzle on hand.
- 6.2 Remove the Swivel Quick Disconnect from the inlet of the Regulator as instructed in the appropriate service manual paragraph for the nozzle on hand. If present, be careful not to lose the continuity Pin (31) and Spring (30). Later units utilize Clip (31) to replace these two items. These items are utilized to assure that a maximum resistance of 10 ohms is achieved across the various parts of the Unit and the mating parts. If electrical continuity is not considered necessary these parts may be discarded.
- 6.3 Depress piston (2) with the use of an arbor press or equivalent in order to remove the Retaining Ring (1) from its groove in the Housing Assy (29).

WARNING

Piston (2) is under an initial spring load of approximately 65 pounds. Use care in disassembly to avoid serious injury to personnel and equipment.

- 6.4 Slowly release the load from the Arbor Press and allow the Piston Spring (6), (6A), or (6B) to push the piston assembly out of the Housing Assy (29). It is now possible to remove the Outer Piston (2), the Screw (4), the "Stat-O-Seal" (5) and the Inner Piston (3) as an assembly. Screw (4) should be removed and discarded at this time. **Reusing this screw is not recommended.**
- 6.5 The Regulator is supplied with one of three Springs (6) that are rated to produce a controlled pressure at the nozzle of 35, 45 or 55 psig. The springs can be identified as shown in the following table.

Rated Pressure PSI	Spring Color Coding
35	White (older springs were orange or yellow on ends only).
45	Red or blue(latest design that assures limitation of pressure to 50 psi maximum during decreasing flow rates with 90 psi inlet pressure). (Older springs were black or natural stainless steel [brownish to gray to silver]). The red spring replaces the blue one in production to improve high flow capacity. Unless one is experiencing a flow restriction using the blue spring there is no need to replace it with a newer red one.
55	Yellow (inside diameter only). (Older springs were forest green)

- 6.6 Screws (9) are self-locking type screws that utilize a nylon insert in the threads to affect the

resistance required to provide the locking. They are designed to be reused a number of times before losing their locking effectivity. Using a torque driver, remove Screw (9) and Washer (10), measuring the torque during removal. If the torque is less than 1.5 in lbs (0.017 m kg) discard the screw and replace it with a new one during reassembly. This permits the remainder of the parts, Quad Ring (15), Seal Spacers (16), Seal (17), O-Ring (18), O-Ring (12), Ball (13) and Spring (14), to be removed. Note on newer units, two Seals (17) and only one Spacer (16) may be present. This change was made to reduce the external leakage from the breather port. Be careful not to lose the small Ball (13). There have been cases reported that during certain conditions during defueling of an aircraft, Spring (14) has allowed the Ball (13) to be wedged inside the end coil. The Spring (14) has been redesigned to prevent this from happening and replaced with the part number shown. Since the two springs are very small it is not possible to distinguish between the old and new. It is recommended, therefore, unless it is known for certain that the new part number is being used, that the Spring (14) be replaced at each overhaul.

- 6.7 Carefully remove the Outer Piston Seal (7) and O-Ring (8) from their groove in the outlet of the Housing Assy (29).
- 6.8 The Teflon Seal (19) and O-ring (20) should only be removed if the Seal (19) is damaged. The O-ring is a fluoro-silicone compound and is not affected by age. To remove it use an "O-ring pick" being careful not to damage the Housing Assy (29). Once removed, the Seal (19) must be replaced as well as the O-ring (20).
- If the Wear Rings (29B or 29C) are present and appear to need replacing due to apparent wear carefully remove them from both ends. Be careful while removing them to not damage the adjoining sealing surfaces. If they are not worn then do not remove them.
- 6.9 Older units incorporate a Breather Assembly (21) that was built up from a basic plug, a piece of screen and a retaining ring. The outlet of the unit was directed straight outward from the body. Newer units incorporate a solid appearing plug, however the plug, when inspected, contains an internally mounted sintered metal filter and two bleed holes that direct any flow back toward the body. It is not necessary to remove the Breather Assembly (21) unless the filter or screen is clogged and requires cleaning. In this case, remove the Assembly (21) and flush it vigorously in clean solvent. If the part remains dirty or clogged, then replacement of the entire assembly will be necessary.
- 6.10 Remove O-ring (28) from groove in Housing Assy (29) .

7.0 INSPECTION

7.1 It is recommended that the following parts be replaced at each overhaul:

Item No.	Description	Item No.	Description
4	Screw	15	Quad-ring
7	Outer Piston Seal	17	Inner Piston Seal (2 ea)
8	O-ring	18	O-ring
12	O-ring	26	O-ring
14	Spring	28	O-ring

- 7.2 Inspect all metal parts for dings, gouges, abrasions, etc. Use 320 grit paper to smooth and remove sharp edges. Replace any part with damage exceeding 15% of local wall thickness. Use alodine 1200 to touch up bared aluminum. On older units that do not have the replaceable wear rings, carefully check the edges of the ball races in both ends of the Housing Assy (29) for excessive wear or burrs. This part is dry film lubricated. If the ball groove is shiny the part should be replaced or the dry film lubricant be reapplied. An easily used aerosol can of Perma-silk G dry film lubricant can be obtained from 3M Corporation, 6940 Farmdale Ave., North Hollywood, CA 91605. Any burrs should be removed with abrasive. Excessive burring may result in hanging up of the part within the Nozzle
- Body making it impossible to disassemble in the future.
- On newer units with Wear Rings (29B and 29C) inspect the rings for wear. Replace is wear is apparent.
- 7.3 Inspect the outer diameters of both the Inner (3) and Outer Pistons (2) for scratches. This part must be smooth and free of imperfections to prevent excessive leakage. If the unit exhibits continual leakage through the Breather Assembly (21) during operation, either the Inner Piston (3) or its Seal (17) or O-ring (18) are the cause. If the unit exhibits too great of pressure increase upon closure the fault can lie with either the Outer Piston (2), its Seal (7), O-ring (8), O-ring (12) or Quad-ring (15).

8.0 REASSEMBLY

- Reassemble in reverse order of disassembly, noting the following:
- 8.1 **Do not lubricate any seals or o-rings with the exception of items 12, 19 & 20.** These may be lubricated for ease of installation. Lubrication of the other seals may tend to cause leakage or pressure creep.
- 8.2 Install O-ring (8) into the outside groove of Seal (7). This sub-assembly can be installed into the groove in the Housing Assy (29). Install Body (29) into a vise with the outlet accessible. Insert the lapping tool described in Figure 2 into a variable speed hand drill. Insert the modified Outer Piston on the tool into the Seal (7). Lubricate the seal and tool liberally with alcohol to prevent the seal from turning during the lapping operation. Start the drill at a medium speed (about 1,000 rpm) and move the tool up and down staying in the seal for at least one minute. Remove tool and clean seal and tool with alcohol.
- 8.3 Two drops of Loctite 222, 242 or 271 shall be applied to the threads of the Screw (4) prior to its being inserted into the assembly. (Shake Loctite well before using). Assemble Screw (4), Washer (5), Inner Piston (3) to Outer Piston (2). The Screw (4) shall be tightened to a torque limit 18 to 20 in-lbs (0.207 to 0.230 kg-m).
- 8.4 On older units, only one each O-ring (18) and Seal (17) were used with two Spacers (16). It is recommended that this be changed to agree with the illustrated Figure I. O-ring (18) is installed in the groove in Seal (17) prior to inserting into Housing Assy (29). Be sure that the first Seal (17) is inserted into the Housing Assy (29) first, followed by a Spacer (16) then the other Seal (17). If only a single Seal (17) is used, a Spacer (16) is inserted on either side of the Seal (17).
- 8.5 Insert Spring (14), Ball (13) and O-ring (12) into hole in Housing Assy (29) .
- 8.6 Install O-Ring (15) into the Housing Assy (29) and using the four Screws (9) and Washers (10) reassemble the Seal Retainer (11). Torque Screws (9) to 13 in-lbs. (0.015 m-kg).
- 8.7 The remainder of the parts may be re-installed. If the electrical continuity Clip (31A) is required be sure that it is installed before connecting the Unit onto a quick disconnect. See Figure 3 for installation instructions. Note that older 61428/61429 nozzles utilized Pin (31) and Spring (30) for this application. It is highly recommended that these two items be replaced with Clip (31A) to assure that the continuity is maintained and that the parts are not easily lost.
- 8.8 If Seal (19) and O-ring (20) were removed, replacement of both is required. Install O-ring (20) in the groove, then carefully force Seal (19) onto Housing Assy (29) and into the larger ball groove. Carefully start the Seal (19) into the o-ring groove

on top of O-ring (20) at one point only. Holding the Seal (19) in this position use a .250 inch (6 mm) diameter nylon rod as a tool. Place the rod in the ball groove underneath the Seal (19) at the point where it has been started into the o-ring groove. Push the Seal (19) into its final position by moving the rod slowly around the part in the ball groove.

8.9

Carter part number 23620 Bearing used on the 60427 can be used for this purpose.

If Wear Rings (29B or 29C) were removed replace them. Do not use the unit without these rings if they were present when the unit was disassembled.

9.0 TEST

9.1 The reassembled Unit may be tested as a component of a complete Nozzle.

9.2 Test conditions

Test media shall be JP-4, Jet A or odorless kerosene, commercial solvent 140.

9.3 Functional Test

Note: If the Unit is tested as a part of the nozzle, the nozzle should be attached to a Carter 6958CG or CH and maintained in an open position during any test subjecting the assembly to 300 psi.

9.3.1 Simultaneously apply 300 psi fluid pressure to the inlet and outlet of the Unit for 2 minute, then reduce pressure to zero. During the second minute of pressurization, check the regulator for external leakage, distortion or any other damage to any part of the regulator. There shall be no evidence of distortion or damage to any part of the regulator. Formation of a free-falling drop of test fluid from the ambient vent port during the second minute of pressurization shall be cause for rejection. New regulators shipped from the factory since 1995 are not allowed to have any leakage or wetting at all. Leakage from this port can be caused by the seals of the Inner Piston (3) or the sealing surface of the piston itself.

9.3.2 The Unit shall be installed in a test setup that provides a flow rate of 500 cc/min with gauges (0-100 psi) mounted upstream and downstream. Fill the Unit with test fluid, ensuring that all air is purged from the assembly. Apply 15 ± 3 psig above the regulator spring rating to the inlet of the Unit and establish a flow of 500 ± 50 cc/min. and read the outlet pressure. The outlet pressure shall not exceed 5 psig above the pressure rating of the regulator.

9.4 System Test - The Hose End Regulator controls pressure by creating a restriction in response to the pressure at its outlet. If the refueling system utilizes a secondary control valve it will be necessary to override the Regulator to determine if the secondary is functioning properly. Naturally, one can remove the Regulator. The better choice is to utilize a Block Out Device. There are two possible choices of Block Out Devices available on the market.

- One such device consists of two fittings on a short hose that will connect the Regulator breather port to a nozzle port. This will deactivate the Regulator by routing the nozzle pressure into the

ambient sense port (breather port). The regulator will therefore stay open. The refueling system may be fully checked out independently from the regulator. This type of device has a large disadvantage. Fuel injected within the ambient cavity of the regulator must be drained. This is difficult and the fuel will continue to be pushed out of the Breather Assembly (21) for days after such a use. With such bleed flow one can't determine whether the unit is simply purging itself or whether there is a main seal leak.

Hose Type Block Out Devices are commercially available to fit all Carter Nozzles and Regulators. These units provide a quick disconnect fitting to replace the Breather Assy (21), a dry break fitting to fit into one of the nozzle ports and the hose assembly with the mating male disconnect fittings. The special fittings provided for the regulator and nozzle can remain installed at all times.

One device is manufactured by Warner Lewis, Jr., Industrie-Filter GmbH, Fasanenweg 5, D-65451 Kelsterbach, Germany, (fax) 49-6107-6003.

- Carter has a Block Out Device, part number 61656, that does not introduce fuel into the ambient chamber and therefore overcomes the continuous bleed flow from the Breather Assembly (21). This Block Out Device, shown in Figure 4, can be used on the majority of all Carter regulators. There are some old units in service that will require the use of the hose method described above. On these units the hole at the bottom of the Breather Assembly (21) port is not large enough to accept the 61656. The instructions for use of the 61656 are included on the unit.

CAUTION

Do not refuel an aircraft with the Block Out Device in place. The Hose End Regulator will not be operative, therefore the primary control system will not function.

After using the hose type Block Out Device, cycle the system several times to force residual fuel out of the Breather Port of the regulator.

Another use for the block out device would occur should a pressure defueling of the aircraft be required and the pressure anticipated at the nozzle would be greater than 30 psi. The device is not normally required on suction defueling.

10.0 ILLUSTRATED PARTS CATALOG

Table 1.0 tabulates the parts and sub-assemblies comprising the 44646 Hose End Regulator. The item numbers of the table are keyed to the exploded views of the regulator diagramed in Figure 1.

TABLE 1.0

Item	Part Number	Description	Units/ Assy	Nozzle Option	Spares/10 Units/Yr
1	RRT-268-S	Retaining Ring	1	-	-
2	23889	Outer Piston	1	-	-
3	24096	Inner Piston	1	-	-
4	LP526C1024R8	Screw	1	-	-
5	600-001-10	Stat-O-Seal	1	-	3
6	27014	Spring, 35 psi (White) – orange on older units	1	F3	-
6A	23892	Spring, 45 psi (Red) - black or blue on older units	1	F4	-
6B	28443	Spring, 55 psi (Yellow)	1	F5	-
	210145	Spring, 55 psi (Green - obsolete)	1	F5	-
7	23893	Seal, Outer Piston	1	-	10
8	MS29513-147	O-Ring	1	-	10
9	LP515-8R7	Screw	4	-	15
10	GF960-8	Washer	4	-	2
11	23890	Seal Retainer	1	-	2
12	220724-007	Quad-Ring (Note 3)	1	-	10
13	GF19060-1012	Ball	1	-	2
14	210189	Spring	1	-	3
15	MS29513-229	O-Ring (Note 3)	1	-	10
16	24059	Spacer (Note 4)	1	-	1
17	24085	Seal (Note 4)	2	-	20
18	MS29513-126	O-Ring (Note 4)	2	-	20
19	207807	Seal	1	-	5
20	M25988/1-040	O-Ring	1	-	5
21	40427	Breather Assy	1	-	-
22-24	Left intentionally blank.				
25	47118	Screw Assy, Dog Point	1	New units	-
	220484	Screw, Dog Point	1	Older units	-
	209827	Screw, Cap	1	Older units	-
26	MS29512-03	O-ring	1	New units	10
	MS29513-013	O-ring	1	Older units	10
27	82123	Bearing, Ball	39	-	-
28	M25988/1-235	O-Ring	1	-	10
29	47254	Housing Assy (Note 5)	1	-	-
29A	209793	Housing (Note 5)	1	-	-
29B	220894	Outer Wear Ring	1	-	2
29C	220893	Inner Wear Ring	1	-	2
30	82153	Spring (replaced by 31A)	1	-	-
31	D5-187	Pin (replaced by 31A)	1	-	-
31A	209853	Clip, Continuity	1	-	1
	KD44646-1	Seal Kit contains items 4, 5, 7, 8, 9, 12, 15, 16, 17, 18, 19, 20, 25, 26, 28 & 31A. (Note 4).			

- Notes: 1. All part numbers beginning with "GF" are interchangeable with those beginning with either "AN" or "MS". If the "GF" is followed by three numbers it is interchangeable with and "AN" part, otherwise it is interchangeable with an "MS" part of the same number.
2. The recommended spare parts shown above are the number required to support 10 Units for one year or each overhaul whichever is sooner. These quantities do not include replacement spares for intermediate replacement of parts required by abuse or misuse of the equipment. The recommended quantities are based on the ratio of spare parts sold for each unit during a one year period of time. The actual quantity required will vary from location to location.

3. Both items (12) and (15) are current production parts that replaced NAS1594-007 O-ring and 210174-229 Quad-ring respectively. These change were made as design improvements. The older parts can continue to be used until the newer parts are available. When ordered, the older parts will automatically be replaced with the new parts.
4. Older units will have 1 each items (17) and (18) and 2 of item (16). Kits delivered from the factory after March 1, 1996 will have the correct number of these items. If kit has only the original amount designed for older units, it is acceptable to use them until the next overhaul.
5. Older units will not have items (29B or 29C) Wear Rings. Item (29), on older units is 209793 and is replaced by 47254 with wear rings installed.

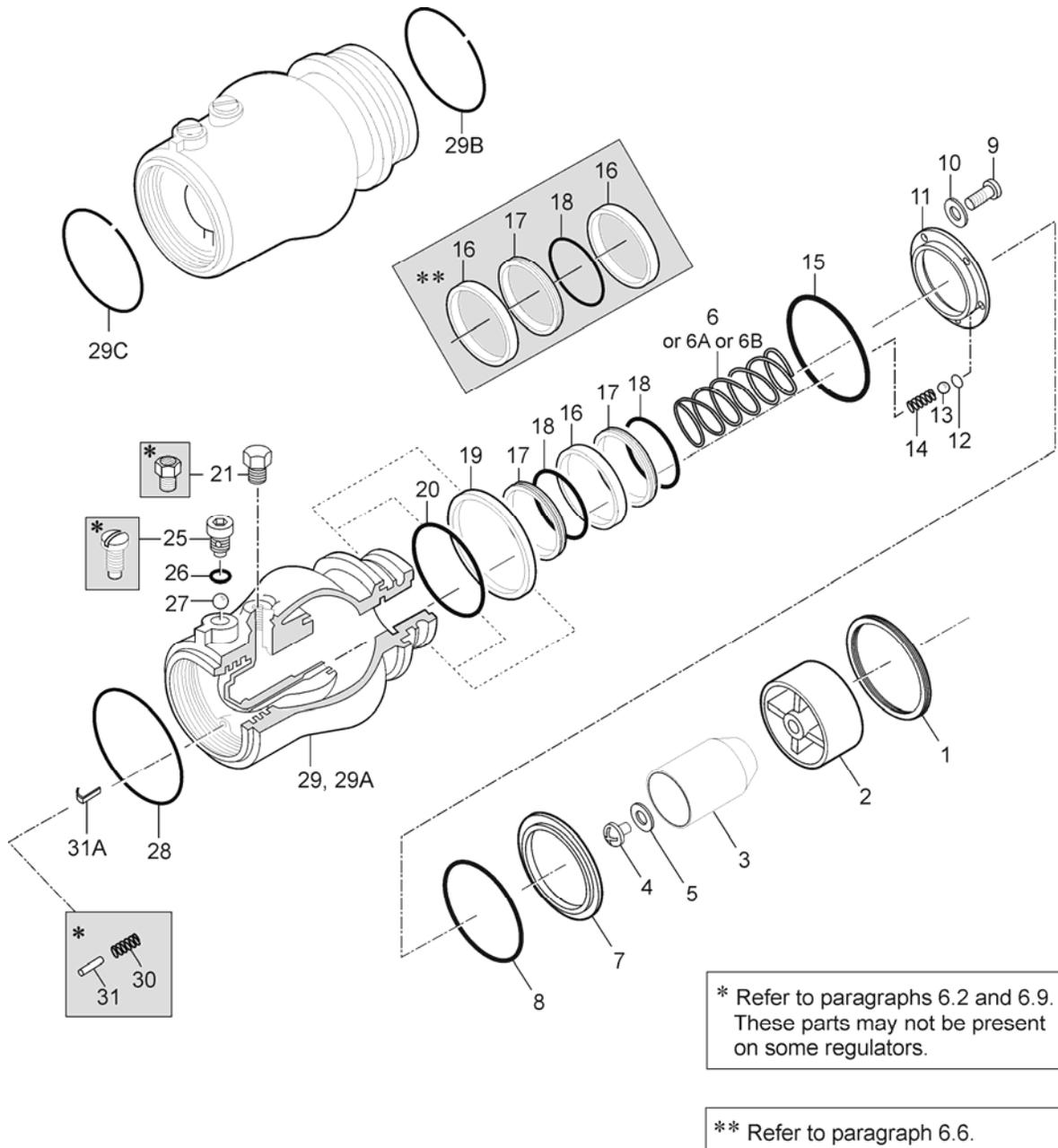
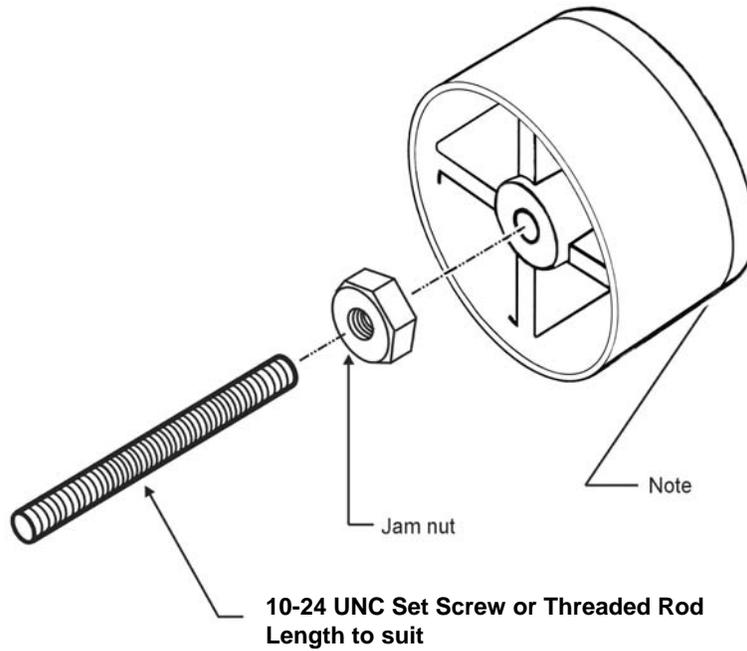


FIGURE 1 - PARTS BREAKDOWN



Note: Install set screw into (2) Outer Piston (23889) and fix with the jam nut. Using a hand drill fixed in a vise rotate the assembled tool at maximum speed of the drill. Using a long strip of emery cloth chamfer the edge of the piston (edge opposite the knife edge) to allow for ease of installation into Regulator for lapping. See paragraph 8.3 for lapping instructions.

FIGURE 2 - TYPICAL LAPPING JIG



Fig. 3A
Continuity Clip (31A) Installation

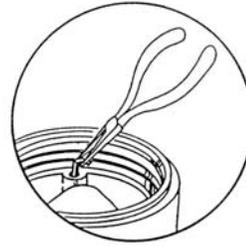
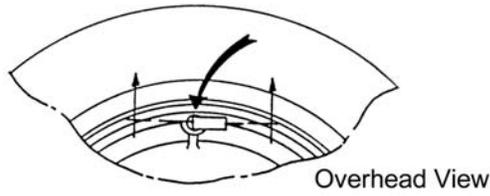


Fig. 3B
Removing Clip



Overhead View

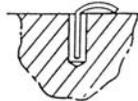


Fig. 3C
Correct Clip (31A) Installation

FIGURE 3 - CONTINUITY CLIP INSTALLATION

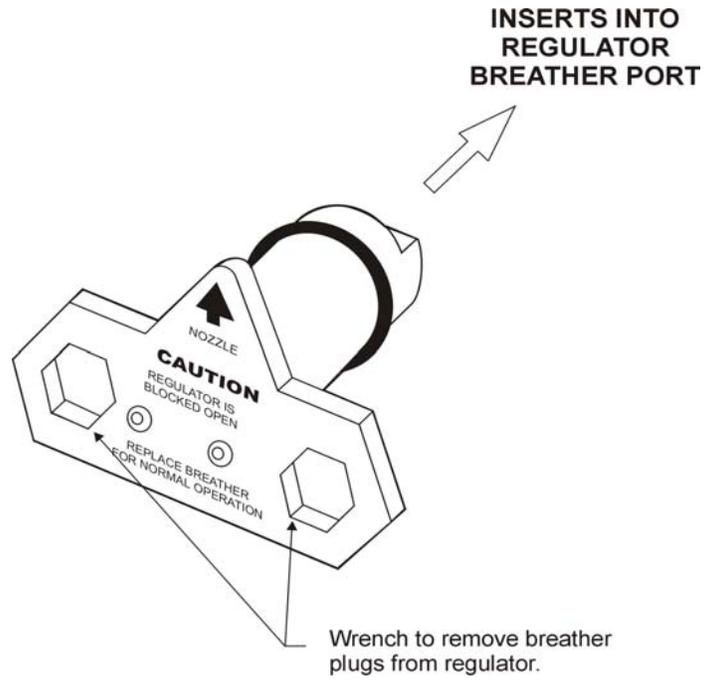


FIGURE 4 - 61656 BLOCKOUT DEVICE

Eaton
Aerospace Group
Conveyance Systems Division
9650 Jeronimo Road
Irvine, CA 92618
Tel (949) 452-9500
Fax (949) 452-9992



Powering Business Worldwide