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Aerospace Group
Conveyance Systems Division
Carter® Brand Ground Fueling Equipment

SM47013

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Applicable addition manuals:

SM64348 Nozzle

SM64015 Ball Valve

SM64200 Nozzle

Maintenance & Repair Manual

Hose End Regulator

To Mate Models 64200 & 64348 Nozzles and Model 64015 Ball Valves

Model 47013

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Maintenance, Overhaul & Test Instructions Model 47013 Hose End Regulator

1.0 INTRODUCTION

This manual furnishes detailed instructions covering the maintenance and overhaul of Carter brand Model 47013 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, i.e. 47013-45 is a regulator with a 45 psi spring. When the regulator is obtained as an integral part or as an option to a nozzle it is specified as noted in paragraph 3.0.

2.0 EQUIPMENT DESCRIPTION

Model 47013-* Hose End Regulator is designed to be used as a part of Eaton's Carter brand Model 64200 or 64348 nozzle 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. The unit is also available as an integral part or option of the 64200 or 64348 nozzle when the 64015 ball valve option is also specified. In this case 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. 64348F43H is a nozzle with 45 psi regulator, ball valve with 2-1/2" NPT inlet. Refer to SM64200 or SM64348 for more details. All units use the same Housing (29) and there is no external method of determining which unit is in use. 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. The breather port should not be plugged at any time. This will make the unit inoperable. The swivel joints in the 64348 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 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 SM64348, paragraph 6.3 or or SM64200, Paragraph 6.2.

6.2 Remove the ball valve from the inlet of the unit as instructed in SM64015.

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 (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 (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 either 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 table below.

Rated press. psi	Spring Color Coding
35	White (older springs were either 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. (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, O-ring (15), Seal Spacers (16), Seal (17), O-Ring (18), Quad-ring (12), Ball (13) and Spring (14), to be removed. Be careful not to lose the small Ball (13).

6.7 Carefully remove the Outer Piston Seal (7) and O-Ring (8) from their groove in the outlet of the Housing (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 (29). Once removed, the Seal (19) must be replaced as well as the O-ring (20).

If the Wear Ring (29B) is present and appears to need replacing due to apparent wear carefully remove it from the unit. Be care full while removing it to not damage the adjoining sealing surfaces. If it is not worn then do not remove it.

6.9 It is not necessary to remove the Breather Assembly (21) unless the filter 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.

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
8	O-Ring	18	O-Ring
12	O-Ring	26	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 end of the Housing (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 Corp., 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.

7.3 On newer units with Wear Ring (29B) inspect the ring for wear. Replace if 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), Quad-ring (12) or O-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 (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 the Loctite well before using). The Screw (4) shall be tightened to a torque limit of 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 Quad-ring (12) into hole in Housing (29).

8.6 Install O-ring (15) into the Housing (29) and using the four Screws (9) and Washers (10) reassemble the Seal Retainer (11) making sure that the bleed hole is correctly aligned with the Ball (13).

8.7 The remainder of the parts may be re-installed.

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

8.9 If Wear Ring (29B) was removed replace it. Do not use the unit without this ring if it was 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 minutes, then reduce pressure to zero. If pressure is applied only to the inlet of the nozzle, the use of Block Out Device Model 61656 shall be used to assure that the regulator piston is maintained in an open position. 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. 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 (19) 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 (19), 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 new block out device, Model 61656, that does not introduce fuel into the ambient chamber and therefore overcomes the continuous bleed flow from the Breather Assembly (19). 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 (19) 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

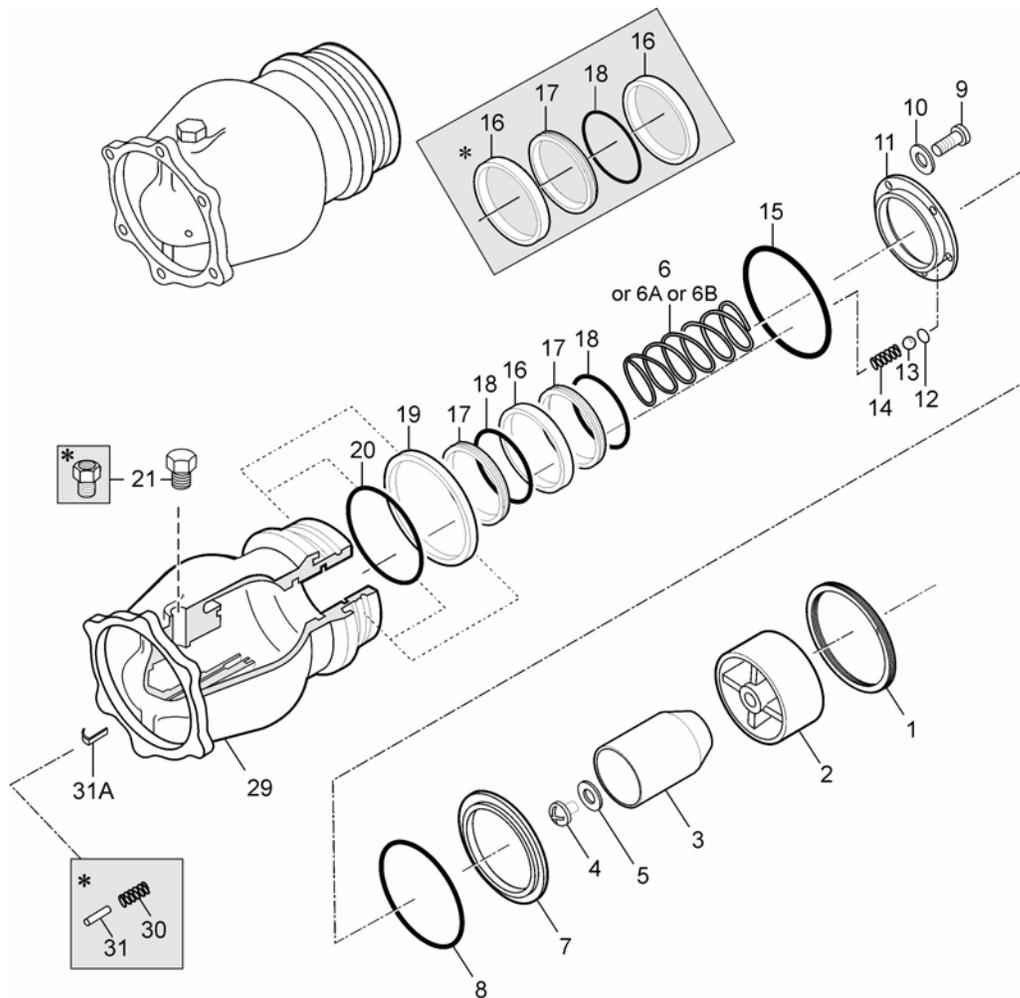
Table 1.0 tabulates the parts and sub-assemblies comprising the 47013 Hose End Regulator. The item numbers of the table are keyed to the exploded views of the regulator diagrammed in Figure 1.

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) – green on older units	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	-	2
15	220723-229	O-Ring (Note 3)	1	-	10
16	24059	Spacer	2	-	1
17	24085	Seal	1	-	20
18	MS29513-126	O-Ring	1	-	20

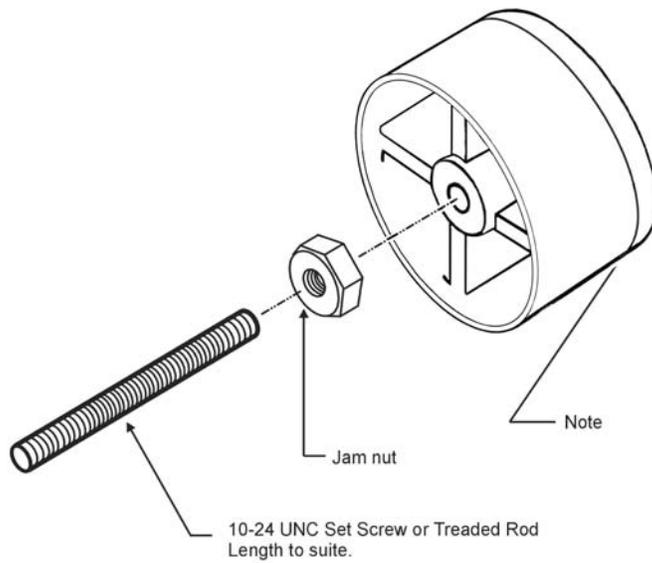
Item	Part Number	Description	Units/ Assy	Nozzle Option	Spares/10 Units/Yr
19	207807	Seal	1	-	5
20	M25988/1-040	O-Ring	1	-	5
21	40427	Breather Assy	1	-	
22-28	Left intentionally blank.				
29	47253	Housing Assy	1	-	
29A	22047	Housing (Older Units – Note 4)	1	-	
29B	220894	Outer Wear Ring (not shown)	1	-	2
30	82153	Spring (replaced by 31A)	1	-	-
31	D5-187	Pin (replaced by 31A)	1	-	-
31A	209853	Clip	1	-	1
--	KD47013-1	Seal Kit to completely overhaul a unit, contains items 4, 5, 7, 8, 9, 12, 15, 16, 17, 18, 19, & 20.			
--	KD47013-2	Seal Kit to convert single small piston seal to dual seal, contains items 4, 5, 7, 8, 9, 12, 15, 16, 17, 18 & 19.			

- 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 an "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 without wear ring (29B) will use 22047 Housing (29A). Newer units with wear ring assembled in place will use 44253.



* on older models

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 emory cloth chamfer the edge of the piston (edge opposite the knife edge) to allow for ease of installation into regulator for lapping. See paragraph 8.2 for lapping instructions.

Figure 2 - Typical Lapping Jig

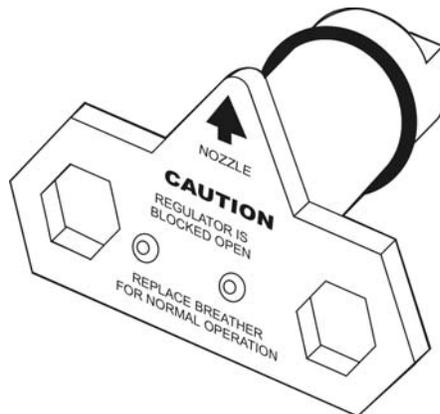


Figure 3 - 61656 Blockout Device

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