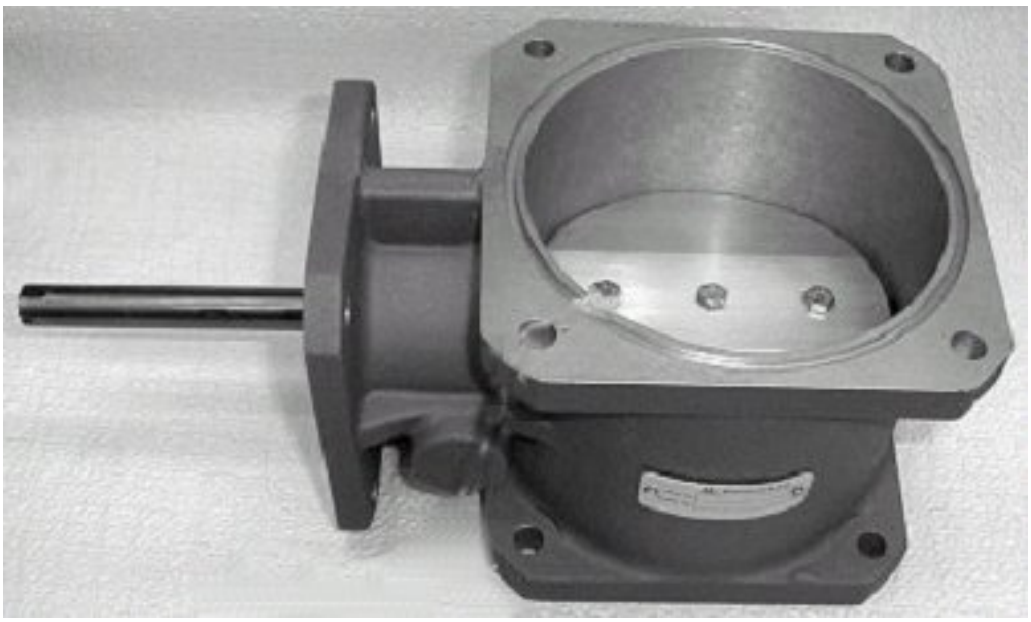
WOODWARD

Product Manual 26459
(Revision A)
Original Instructions



135 mm Throttle Valves (8235-300, 346-8987)

Disassembly and Reassembly Repair Procedure

Repair Manual

General Precautions

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment.

Practice all plant and safety instructions and precautions.

Failure to follow instructions can cause personal injury and/or property damage.

Revisions

This publication may have been revised or updated since this copy was produced. To verify that you have the latest revision, check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, on the *publications page* of the Woodward website:

www.woodward.com/publications

The latest version of most publications is available on the *publications page*. If your publication is not there, please contact your customer service representative to get the latest copy.

Proper Use

Any unauthorized modifications to or use of this equipment outside its specified mechanical, electrical, or other operating limits may cause personal injury and/or property damage, including damage to the equipment. Any such unauthorized modifications: (i) constitute "misuse" and/or "negligence" within the meaning of the product warranty thereby excluding warranty coverage for any resulting damage, and (ii) invalidate product certifications or listings.

Translated Publications

If the cover of this publication states "Translation of the Original Instructions" please note:

The original source of this publication may have been updated since this translation was made. Be sure to check manual *26311* , *Revision Status & Distribution Restrictions of Woodward Technical Publications*, to verify whether this translation is up to date. Out-of-date translations are marked with ⚠. Always compare with the original for technical specifications and for proper and safe installation and operation procedures.

Contents

Warnings and Notices

Important Definitions

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

- **DANGER**—Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- **WARNING**—Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- **CAUTION**—Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- **NOTICE**—Indicates a hazard that could result in property damage only (including damage to the control).
- **IMPORTANT**—Designates an operating tip or maintenance suggestion.

⚠WARNING

Overspeed / Overtemperature / Overpressure

The engine, turbine, or other type of prime mover should be equipped with an overspeed shutdown device to protect against runaway or damage to the prime mover with possible personal injury, loss of life, or property damage.

The overspeed shutdown device must be totally independent of the prime mover control system. An overtemperature or overpressure shutdown device may also be needed for safety, as appropriate.

⚠WARNING

Personal Protective Equipment

The products described in this publication may present risks that could lead to personal injury, loss of life, or property damage. Always wear the appropriate personal protective equipment (PPE) for the job at hand. Equipment that should be considered includes but is not limited to:

- **Eye Protection**
- **Hearing Protection**
- **Hard Hat**
- **Gloves**
- **Safety Boots**
- **Respirator**

Always read the proper Material Safety Data Sheet (MSDS) for any working fluid(s) and comply with recommended safety equipment.

⚠WARNING

Start-up

Be prepared to make an emergency shutdown when starting the engine, turbine, or other type of prime mover, to protect against runaway or overspeed with possible personal injury, loss of life, or property damage.

⚠WARNING

Automotive Applications

On- and off-highway Mobile Applications: Unless Woodward's control functions as the supervisory control, customer should install a system totally independent of the prime mover control system that monitors for supervisory control of engine (and takes appropriate action if supervisory control is lost) to protect against loss of engine control with possible personal injury, loss of life, or property damage.

NOTICE

Battery Charging Device

To prevent damage to a control system that uses an alternator or battery-charging device, make sure the charging device is turned off before disconnecting the battery from the system.

Electrostatic Discharge Awareness

NOTICE

Electrostatic Precautions

Electronic controls contain static-sensitive parts. Observe the following precautions to prevent damage to these parts:

- **Discharge body static before handling the control (with power to the control turned off, contact a grounded surface and maintain contact while handling the control).**
- **Avoid all plastic, vinyl, and Styrofoam (except antistatic versions) around printed circuit boards.**
- **Do not touch the components or conductors on a printed circuit board with your hands or with conductive devices.**

To prevent damage to electronic components caused by improper handling, read and observe the precautions in Woodward manual *82715*, *Guide for Handling and Protection of Electronic Controls, Printed Circuit Boards, and Modules*.

Follow these precautions when working with or near the control.

1. Avoid the build-up of static electricity on your body by not wearing clothing made of synthetic materials. Wear cotton or cotton-blend materials as much as possible because these do not store static electric charges as much as synthetics.
2. Do not remove the printed circuit board (PCB) from the control cabinet unless absolutely necessary. If you must remove the PCB from the control cabinet, follow these precautions:
   - Do not touch any part of the PCB except the edges.
   - Do not touch the electrical conductors, the connectors, or the components with conductive devices or with your hands.
   - When replacing a PCB, keep the new PCB in the plastic antistatic protective bag it comes in until you are ready to install it. Immediately after removing the old PCB from the control cabinet, place it in the antistatic protective bag.

Chapter 1.
General Information

1.1 Scope

The purpose of this document is to provide clear instructions to a field technician who is servicing either the original 135 mm 8235-300 (175-3140) or the double seal 135 mm 346-8987.

This manual covers:
- Valve Inspection and Replacement Requirements
- Valve Rebuild and Replacement

Part Numbers
- 8235-300 135 mm Standalone Throttle Single Seal Design (175-3140)
- 346-8987 135 mm Standalone Throttle Double Seal Design (346-8987)

IMPORTANT **Disassembling the throttle valve will void the warranty.**

IMPORTANT **Woodward will not accept liability for any damages or product malfunction due incorrect installation of valve or non-factory assembly of throttle.**

NOTICE **Improper installation or failure to adhere to this procedure may cause unstable engine performance, or in worst case an air-fuel mixture leak to atmosphere.**

1.2 Requirements

1. Have previously purchased a Woodward:
   - 8235-300 Throttle (175-3140)
   - 346-8987 Throttle
2. Provide Woodward with serial number information to confirm part update and to be added to the serial number notes.
3. Should only be used on units that are no longer under warranty or units that cannot be returned for warranty evaluation.

1.3 Torque Specification

Required Torque:
- 10 ± 2 lb-in (1.1 ± 0.2 N·m)
- 25 ± 5 lb-in (2.8 ± 0.6 N·m)
- 72 ± 5 lb-in (8.1 ± 0.6 N·m)

1.4 Required Tools and Materials

1. Required Hex Drivers:
   - 9/64 inch
   - 3/16 inch
2. Socket:
   - 10 mm Socket with Extension
3. Dead Blow Hammer
4. Flathead Screwdriver
5. Snap-Ring Pliers (3–10 mm)
6. Loctite® 243, or Equivalent Thread Locker
7. Petroleum Jelly
8. Custom Tools (Dimensions in Inches)
   - Woodward Tool: 1007-2174
     - Simplified (Steel Tube: O.D. 1.050-1.100, I.D. 0.900 min)
   - Woodward Tool: 1007-2175
     - Simplified (Steel Tube: O.D. 0.990 – 1.000, I.D. 0.675 – 0.685)
   - Woodward Tool: 1008-4106 (Can also Reuse the 1007-2174)
     - Simplified (Steel Tube: O.D. 1.050-1.100, I.D. 0.900 min)

1.5 Serviceable Items

8235-300 (175-3140) Components			
Description (Material)	**CAT Part Number**	**WW Part Number**	**Quantity**
Screw, .250-20 x .500 Long, Soc HD	8H-0708	188276	4
Screw, #8-32 x .375 Long, Soc HD	6D-3031	190444	2
Screw, M6 x 1, 16 Long, SST Hex HD Lock	6V-8837	1031-1493	3
O-Ring, 2-034, .070 W, 2.114 ID, Viton	151-8670	1355-093	1
O-Ring, 2-022, .070 W, .989 ID, Viton	6V-9178	1355-123	1
Seal, Glyd Ring w/ Backing O-Ring, Ø .813	175-3133	1382-397	1
Bearing, ID .500, OD 1.125, Ball	346-8990	346-8990	1
Bearing, ID 17 mm, OD 40 mm, Ball	5P-6836	180061	1
Retaining Ring, .500 Shaft Dia.	5H-9899	1017-513	1
Retaining Ring, .669 Shaft Dia.	5L-4035	1017-521	1
Spring, Axial Loading	175-3125	1524-037	1
Seat, Spring Seat, 1.562 OD x 1.320 ID	175-3127	1010-997	2
Carrier, Bearing/Spring Carrier	175-3131	3448-135	1
Cap, Top Cap	175-3136	3574-137	1
Housing, Valve Housing	151-8669	4166-747	1
Shaft, Throttle Shaft	175-3129	3538-041	1
Plate, Throttle Plate	151-8673	3254-025	1

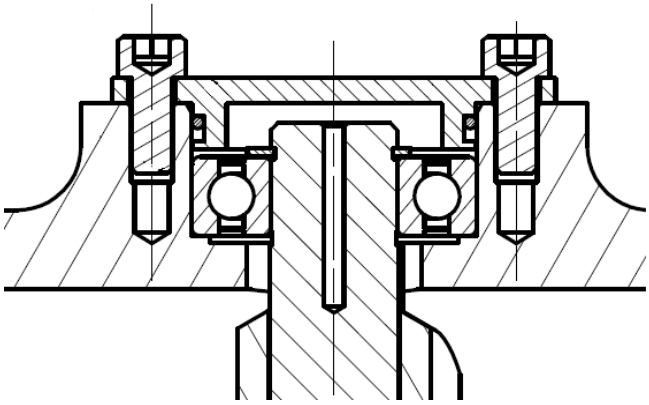
346-8987 Components			
Description (Material)	**CAT Part Number**	**WW Part Number**	**Quantity**
Screw, .250-20 x .500 Long, Soc HD	8H-0708	188276	4
Screw, #8-32 x .375 Long, Soc HD	6D-3031	190444	2
Screw, M6 x 1, 16 Long, SST Hex HD Lock	6V-8837	1031-1493	3
O-Ring, 2-034, .070 W, 2.114 ID, Viton	151-8670	1355-093	1
O-Ring, 2-022, .070 W, .989 ID, Viton	6V-9178	1355-123	1
O-Ring, 2-015, 070 W, .551 ID, Viton	149-2091	1355-109	1
Seal, Glyd Ring w/ Backing O-Ring, Ø .500	354-2661	1382-1086	1
Seal, Glyd Ring w/ Backing O-Ring, Ø .813	175-3133	1382-397	1
Bearing, ID .500, OD 1.125, SST Ball	346-8990	346-8990	1
Bearing, ID 17 mm, OD 40 mm, Ball	5P-6836	180061	1
Retaining Ring, .438 Shaft Dia.	354-2662	1017-355	1
Retaining Ring, .669 Shaft Dia.	5L-4035	1017-521	1
Spring, Axial Loading	175-3125	1524-037	1
Seat, Spring Seat, 1.562 OD x 1.320 ID	175-3127	1010-997	2
Spacer, Bearing Loading Spacer	354-2663	3621-1286	1
Carrier, Bearing/Spring Carrier	175-3131	3448-135	1
Cap, Top Cap	354-2659	3550-1557	1
Housing, Valve Housing	354-2657	4034-1609	1
Shaft, Throttle Shaft	354-2658	3318-1341	1
Plate, Throttle Plate	151-8673	3254-025	1

Chapter 2.
Throttle Inspection and Disassembly

2.1 Identify Unit Part Number

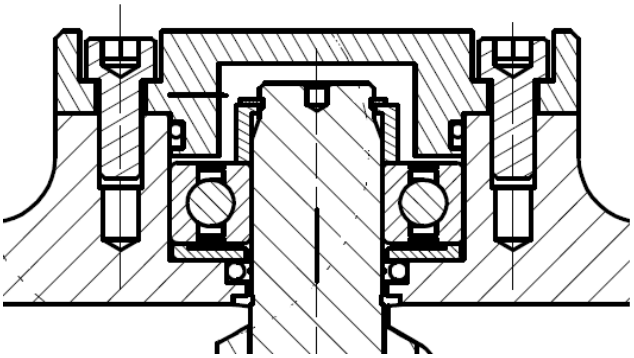
175-3140 (8235-300)

- Original Design



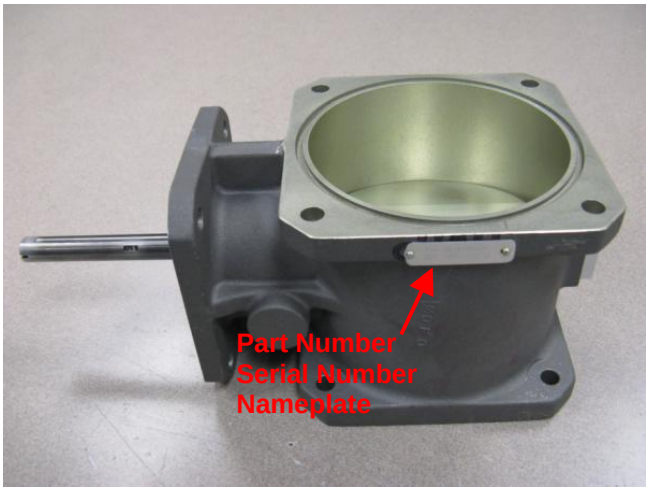
346-8987

- Updated Version of the 346-8987
  - Outboard seal installed to protect bearing from working fluid
  - Internal hardware changed to accommodate new seal
  - External only the top cap has been altered from the original version



2.2 Identify Unit Serial Number

Record serial number and submit with order of replacement components.



2.3 Check for Binding

With the shaft pointing to your left press the plate down and away.
(Note: Valve should turn counterclockwise (CCW), when the shaft is pointing at you.)

- Allowable torque through travel
  - Note: Starting torque required may be greater because the plate is designed to wedge into the bore:
    New Build 7 lb-in (0.8 N·m)
    Field Unit 10–15 lb-in (1.1–1.7 N·m)
- If the valve moves freely and there was no noticeable problems with fuel leaks while the valve was on engine. Then your throttle is likely to be ok.
  - Clean Throttle and reuse
- If binding persists, continue.

2.4 Throttle Teardown

1. Loosen the plate retaining bolts [3x 6V-8837 (1031-1493)]
   [10 mm socket w/ extension required].

   - Leave one screw partially threaded into shaft—this will aid in relieving the spring load.

2. Remove top cap Screws [2x 6D-3031 (190444)]
   [9/64 inch hex driver required]
   o 346-8987, shown below, procedure is the same for the 8235-300

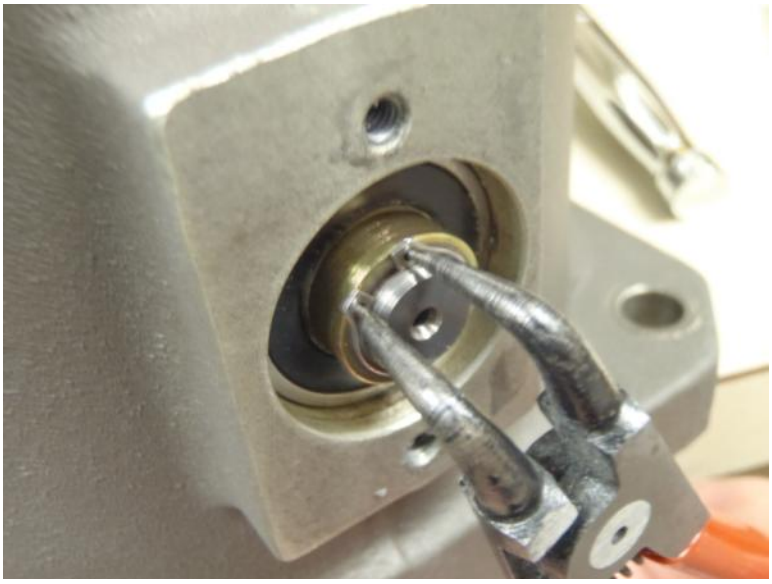
3. Remove top cap.
   - Rotate 90° and pull

4. Inspect top cap sealing O-ring and sealing surface
   [1x 6V-9178 (1355-123), 8535-300 1x 175-3136 (3574-137), 346-8987 1x 354-2659 (3550-1557)]
   - o 346-8987, shown below, procedure is the same for the 8235-300

- Replace if torn or surface imperfections are evident.
- Remove O-ring and inspect cap sealing groove.
- Woodward recommends to replace O-ring regardless of visual condition.

5. Remove small retaining ring on shaft that was under the top cap
   [8535-300 1x 5H-9899 (1017-513), 346-8987 1x 354-2662 (1017-355)]
   - Verify one of the plate bolts is still threaded into the shaft before you remove retaining ring.

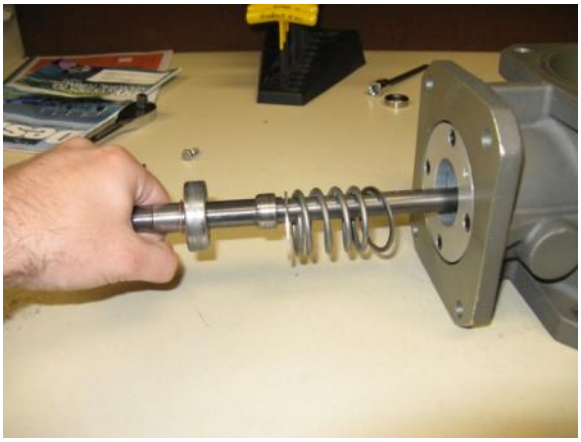
⚠WARNING **If bolt is not in place, spring pressure will shoot the shaft out of the assembly.**



- Woodward recommends replacing the retaining ring. The retaining ring can be distorted easily and may not reassemble correctly.

6. Remove the bearing loading spacer [346-8987 1x 354-2663 (3621-1286)].

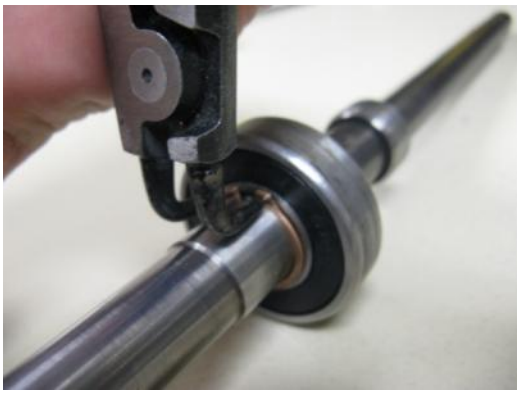
7. Hold shaft firmly compressing the spring, remove remaining plate bolt and slowly remove shaft from unit.



Parts that will be removed

- Shaft [8535-300 1x 175-3129 (3538-041), 346-8987 1x 354-2658 (3318-1341)]
- Bearing [1x 5P-6836 (180061)]
- Retaining Ring [1x 5L-4035 (1017-521)]
- Spring Seat [2x 175-3127 (1010-997)]
- Spring [1x 175-3125 (1524-037)]

8. Remove retaining ring from shaft [1x 5L-4035 (1017-521)].



9. Remove bearing from shaft [1x 5P-6836 (180061)].

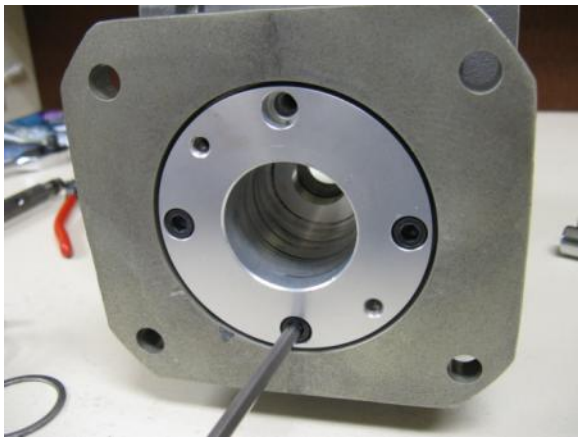
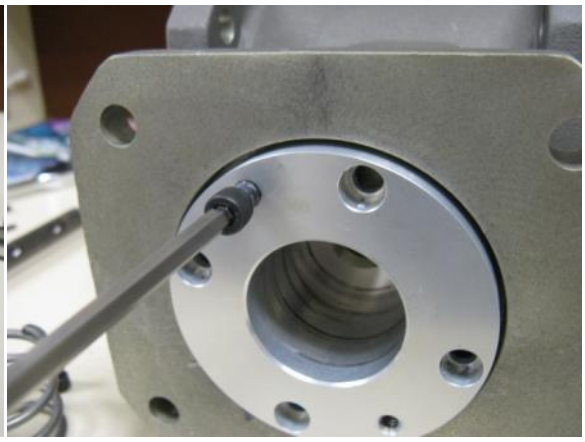
10. Inspect spring for cracking or other abnormalities [1x 175-3125 (1524-037)].

11. Inspect shaft sealing surfaces and threaded holes
    [8535-300 1x 175-3129 (3538-041), 346-8987 1x 354-2658 (3318-1341)].
    - The 8235-300 only has one sealing surface on the inboard side.

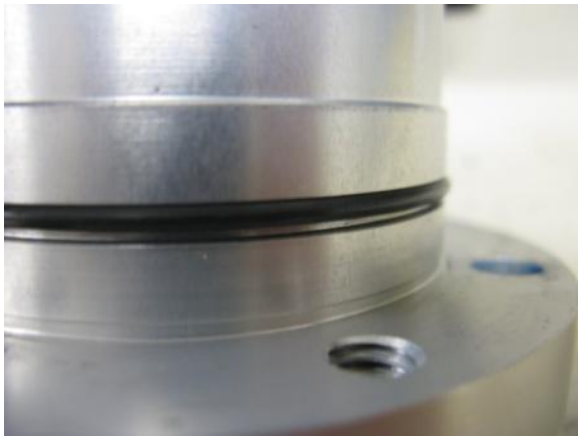
Left: Inboard Sealing Surface, Right: Outboard Sealing Surface (346-8987 only)

- Inspect sealing surface for any barbs or dents that may damage the seal during reassembly.
- Inspect threads in shaft for any damage that may hinder reassembly

12. Remove the Carrier from the housing [1x 175-3131(3448-135)].
    - Remove Screws [4x 8H-0708 (188276)]
      [9/64 inch hex driver required]
    - The two threaded holes on the carrier can be used to remove it from the housing. Use 0.250-20 x 0.750 long (or longer) screws.

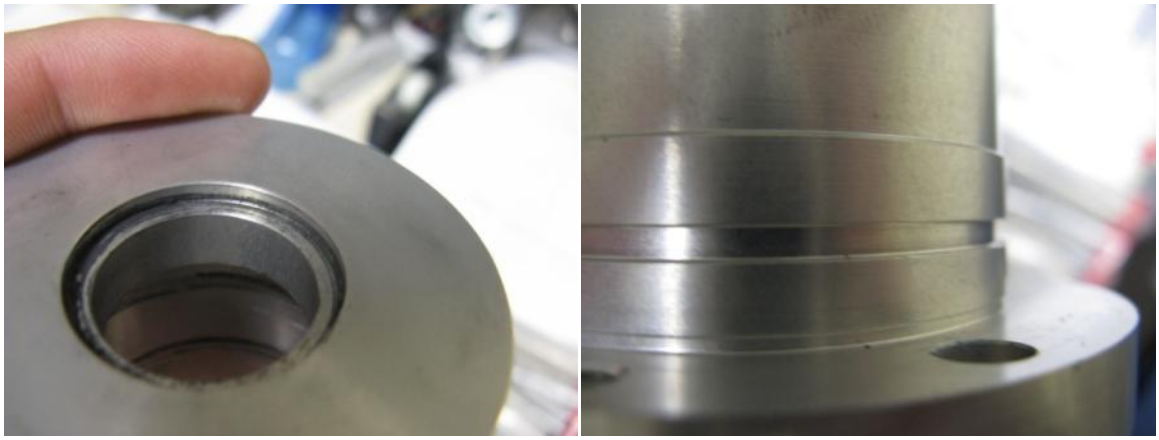
13. Remove O-ring and Glyd Ring seal from carrier and inspect.




Left: [1x 175-3131(3448-135)], Right: [1x 175-3131(3448-135)]

- Glyd Ring seal is made from two pieces, the seal and a backing O-ring.
  - o Remove O-ring from seal and inspect for imperfections individually.
- Replace if torn or surface imperfections are evident.
- Woodward recommends to replacing both regardless of visual condition.

14. Inspect carrier sealing surfaces [1x 175-3131(3448-135)].



Left: O-ring groove, Right: Seal Countersink

- Inspect sealing surface for any barbs or dents that may damage the seal during reassembly.

15. Remove outboard bearing [1x 346-8990 (346-8990)].
    [Flathead screwdriver and dead-blow hammer required or bearing puller]
    - Place screwdriver in bore of valve through the shaft opening. Set flat of screwdriver against the bearing inner race and tap lightly with the dead blow hammer alternating sides until bearing comes out of valve.
    - Using the screwdriver will damage the bearing and require it to be replaced.

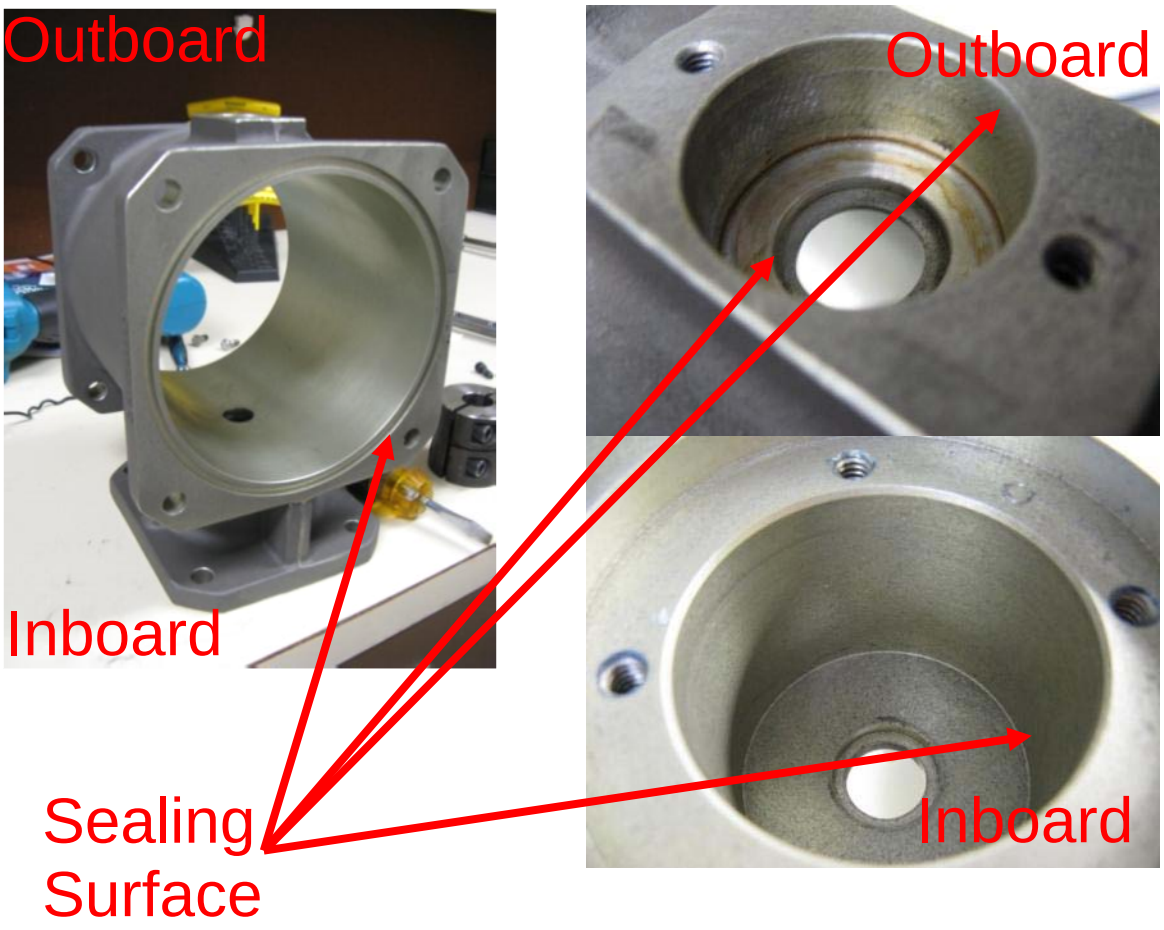
- This process can also damage the outboard seal on the 346-8987. Be mindful of the seal's location in the bore.

16. Remove bearing loading washer [346-8987 1x 354-2663 (3621-1286)].

17. Remove outboard Glyd Ring seal and inspect [346-8987 1x 354-2663 (3621-1286)].

- Glyd Ring seal is made from two pieces, the seal and a backing O-ring
  - o Remove O-ring from seal and inspect for imperfections individually
- Woodward recommends to replacing regardless of visual condition

18. Inspect valve housing sealing surfaces and bore [8535-300 1x 151-8669 (4166-747), 346-8987 1x 354-2657 (4034-1609)].



- Sealing surfaces and lead-ins should be free of burrs or defects that could potential damage seals.
- Inspect bore:
  - If there is build-up, the throttle requires cleaning.
  - If there is significant corrosion, the throttle should be replaced.
  - Witness marks from the plate rubbing in the bore are not a problem.

Chapter 3.
Throttle Rebuild

3.1 Bill of Material

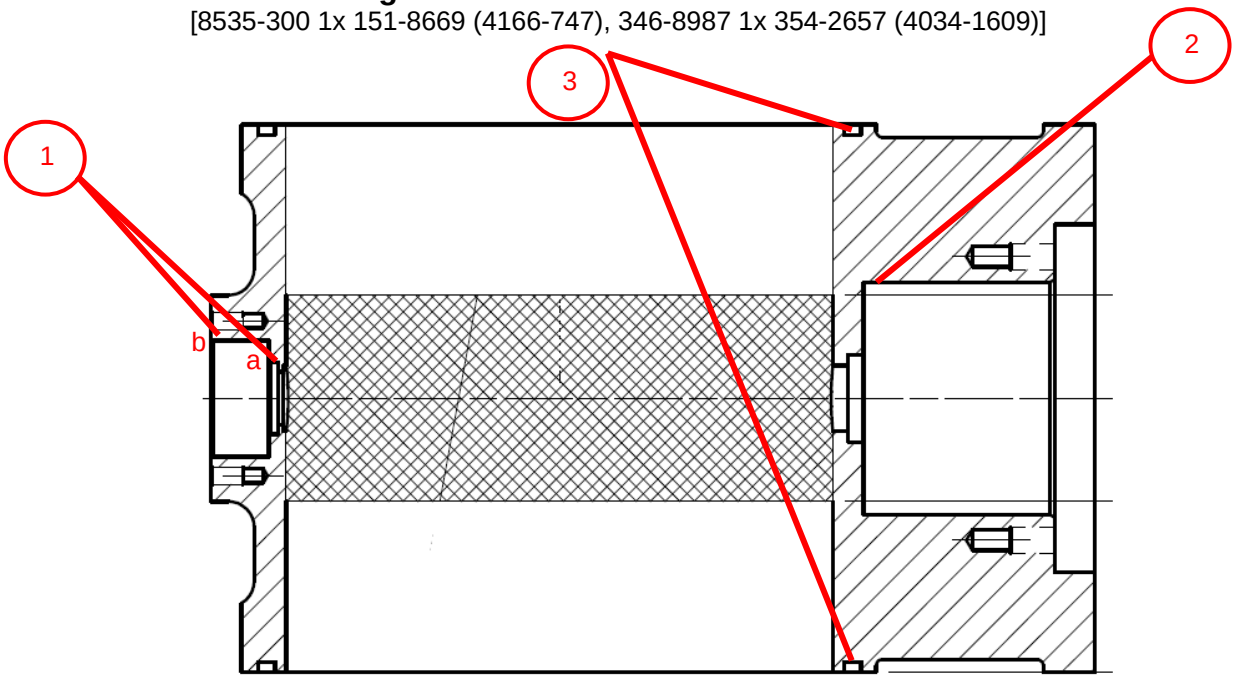
8235-300 (175-3140) and 346-8987 Common Components			
Description (Material)	**CAT Part Number**	**WW Part Number**	**Quantity**
Screw, .250-20 x .500 Long, Soc HD	8H-0708	188276	4
Screw, #8-32 x .375 Long, Soc HD	6D-3031	190444	2
Screw, M6 x 1, 16 Long, SST Hex HD Lock	6V-8837	1031-1493	3
O-Ring, 2-034, .070 W, 2.114 ID, Viton	151-8670	1355-093	1
O-Ring, 2-022, .070 W, .989 ID, Viton	6V-9178	1355-123	1
Seal, Glyd Ring w/ Backing O-Ring, Ø .813	175-3133	1382-397	1
Bearing, ID 17 mm, OD 40 mm, Ball	5P-6836	180061	1
Bearing, ID .500, OD 1.125, SST Ball	346-8990	346-8990	1
Retaining Ring, .669 Shaft Dia.	5L-4035	1017-521	1
Spring, Axial Loading	175-3125	1524-037	1
Seat, Spring Seat, 1.562 OD x 1.320 ID	175-3127	1010-997	2
Carrier, Bearing/Spring Carrier	175-3131	3448-135	1
Plate, Throttle Plate	151-8673	3254-025	1
8235-300 (175-3140) Unique Components			
Description (Material)	**CAT Part Number**	**WW Part Number**	**Quantity**
Retaining Ring, .500 Shaft Dia.	5H-9899	1017-513	1
Cap, Top Cap	175-3136	3574-137	1
Housing, Valve Housing	151-8669	4166-747	1
Shaft, Throttle Shaft	175-3129	3538-041	1
346-8987 Unique Components			
Description (Material)	**CAT Part Number**	**WW Part Number**	**Quantity**
Retaining Ring, .438 Shaft Dia.	354-2662	1017-355	1
O-Ring, 2-015, 070 W, .551 ID, Viton	149-2091	1355-109	1
Seal, Glyd Ring w/ Backing O-Ring, Ø .500	354-2661	1382-1086	1
Spacer, Bearing Loading Spacer	354-2663	3621-1286	1
Washer, Seal/Bearing Loading Washer	No CAT Item	1010-5323	1
Cap, Top Cap	354-2659	3550-1557	1
Housing, Valve Housing	354-2657	4034-1609	1
Shaft, Throttle Shaft	354-2658	3318-1341	1

3.2 Cleaning

- All Components that are being reused during unit repair/overhaul should be cleaned before attempting assembly.
- Clean all parts with isopropyl alcohol and a non-abrasive material.
- There are several critical surfaces that require cleaning.

3.2.1 Housing Critical Surfaces

[8535-300 1x 151-8669 (4166-747), 346-8987 1x 354-2657 (4034-1609)]



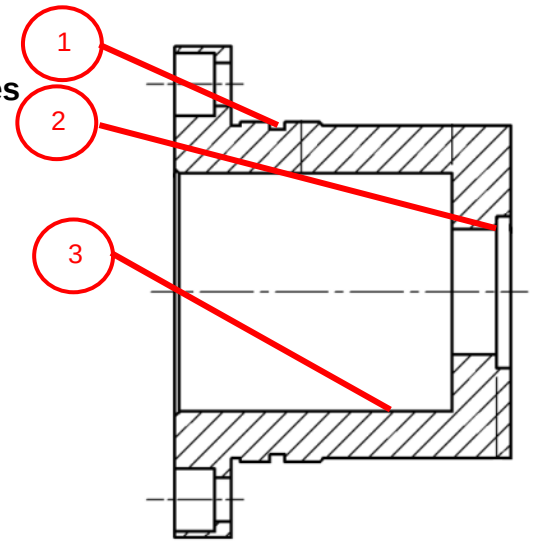
1. Top Bearing Bore
   - Seal Seat (a) (**354-2657 only**)
   - O-ring Sealing Surface (b)

2. Carrier Bore
   - O-ring Sealing Surface

3. Flanges
   - O-ring Grooves
   - Flange Surface

3.2.2 Carrier Critical Surfaces

[1x 175-3131(3448-135)]

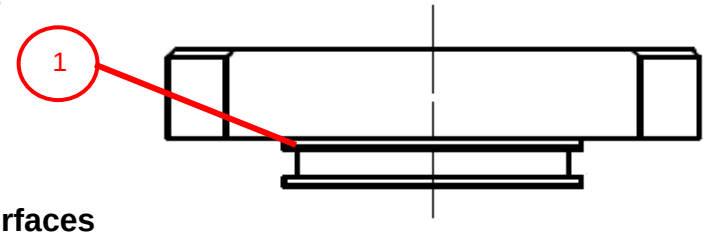


1 Snap Ring Groove
2 Seal Seat
3 O-ring Sealing Surface

3.2.3 Cap Critical Surfaces

[8535-300 1x 175-3136 (3574-137), 346-8987 1x 354-2659 (3550-1557)]

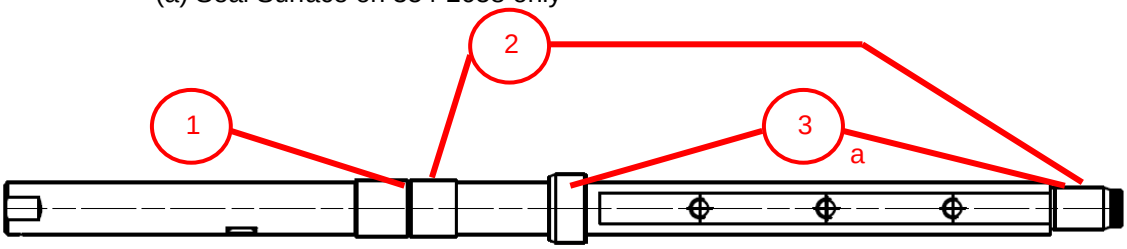
1 O-ring Sealing Surface



3.2.4 Shaft Critical Surfaces

[8535-300 1x 175-3129 (3538-041), 346-8987 1x 354-2658 (3318-1341)]

1 Snap Ring Groove
2 Bearing Ride Surfaces
3 Sealing Surface
(a) Seal Surface on 354-2658 only

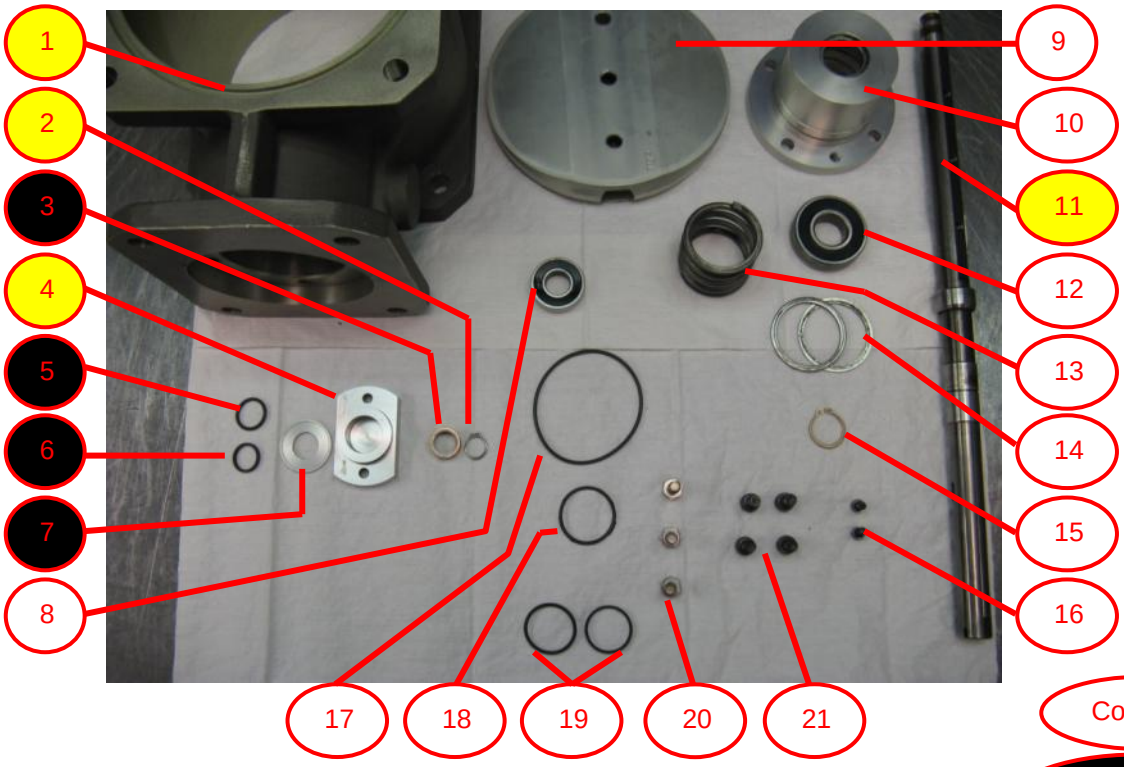


3.3 Build Prep

3.3.1 Chemicals Required during Assembly

- Loctite® 243, Thread Locker, or equivalent
- Petroleum Jelly

3.3.2 Lay Out Assembly Components

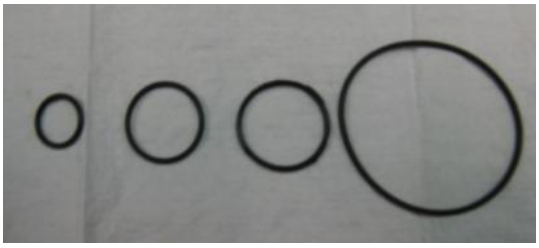


1	151-8669	**5**	149-2091	**11**	175-3129	**16**	6D-3031
	354-2657	**6**	354-2661		354-2658	**17**	151-8670
2	5H-9899	**7**	1010-5323	**12**	5P-6836	**18**	6V-9178
	354-2662	**8**	346-8990	**13**	175-3125	**19**	175-3133
3	354-2663	**9**	151-8673	**14**	175-3127	**20**	6V-9178
4	175-3136	**10**	175-3131	**15**	5L-4035	**21**	8H-0708
	354-2659						

IMPORTANT **Woodward recommends laying out all of the components required to complete the assembly to verify that all parts are accounted for and that there are no parts left over at the end of assembly.**

3.3.3 O-ring Preparation

- Apply light coat of petroleum jelly to O-rings [346-89871x 149-2091 (1355-109), 1x 175-3133 (1382-397) O-ring only, 1x 6V-9178 (1355-123), 1x 151-8670 (1355-093)]



3.3.4 Screw Preparation

- Apply small drop of Loctite 243 to fasteners [4x 8H-0708 (188276), 2x 6D-3031 (190444)]

3.4 Throttle Build

3.4.1 Glyd Ring Seal Assembly

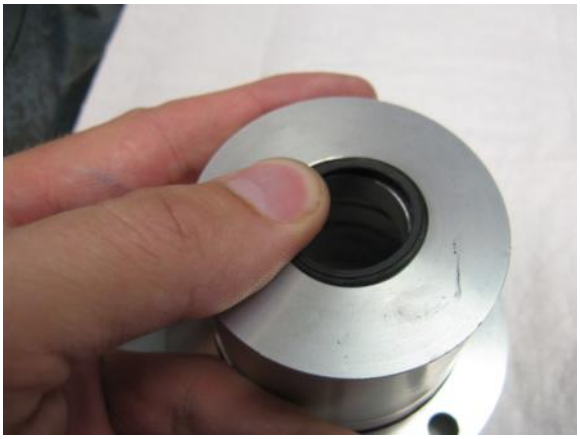
Carrier Assembly			
Description	**CAT Part Number**	**WW Part Number**	**Quantity**
Seal, Glyd Ring w/ Backing O-Ring, Ø .813	175-3133	1382-397	1
O-Ring, 2-015, 070 W, .551 ID, Viton	149-2091	1355-109	1
Seal, Glyd Ring w/o Backing O-Ring, Ø .500	354-2661	1382-1086	1

1. Place lubricated backing O-rings into grooves of the Glyd Ring seals.

3.4.2 Carrier Assembly

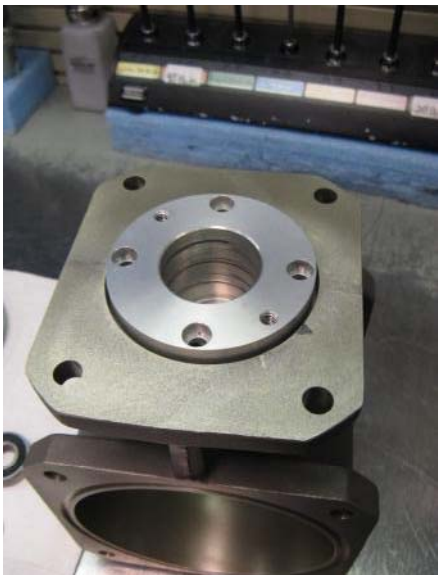
Carrier Assembly			
Description	**CAT Part Number**	**WW Part Number**	**Quantity**
Carrier, Bearing/Spring Carrier	175-3131	3448-135	1
Seal Glyd Ring w/ backing O-ring	175-3133	1382-397	1
O-Ring, 2-034, .070 W, 2.114 ID, Viton	151-8670	1355-093	1

1. Place lubricated O-ring 151-8670 (1355-093) onto carrier 175-3131 (3448-135).
2. Place Glyd Ring seal with backing O-ring 175-3133 (1382-397) into seal seat on carrier.
   - Smooth seal into place with petroleum jelly.

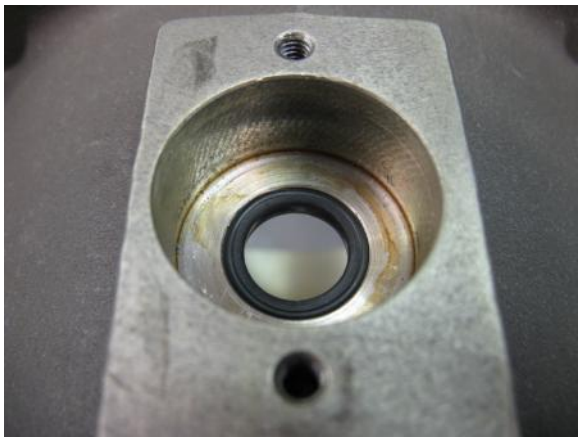


3.4.3 Valve Assembly

1. Install Carrier Assembly
   - Place housing on table with mounting flange facing up [8535-300 1x 151-8669 (4166-747), 346-8987 1x 354-2657 (4034-1609)]
     - o Place carrier assembly (Step 3.4.2) into valve housing
     - o Align with threaded holes in housing
     - o Press firmly (figure pressure only) on carrier to seat O-ring
   - Secure carrier assembly using screws [4x 8H-0708 (188276)] [3/16 inch hex driver required, torque 25 ± 5 lb-in]

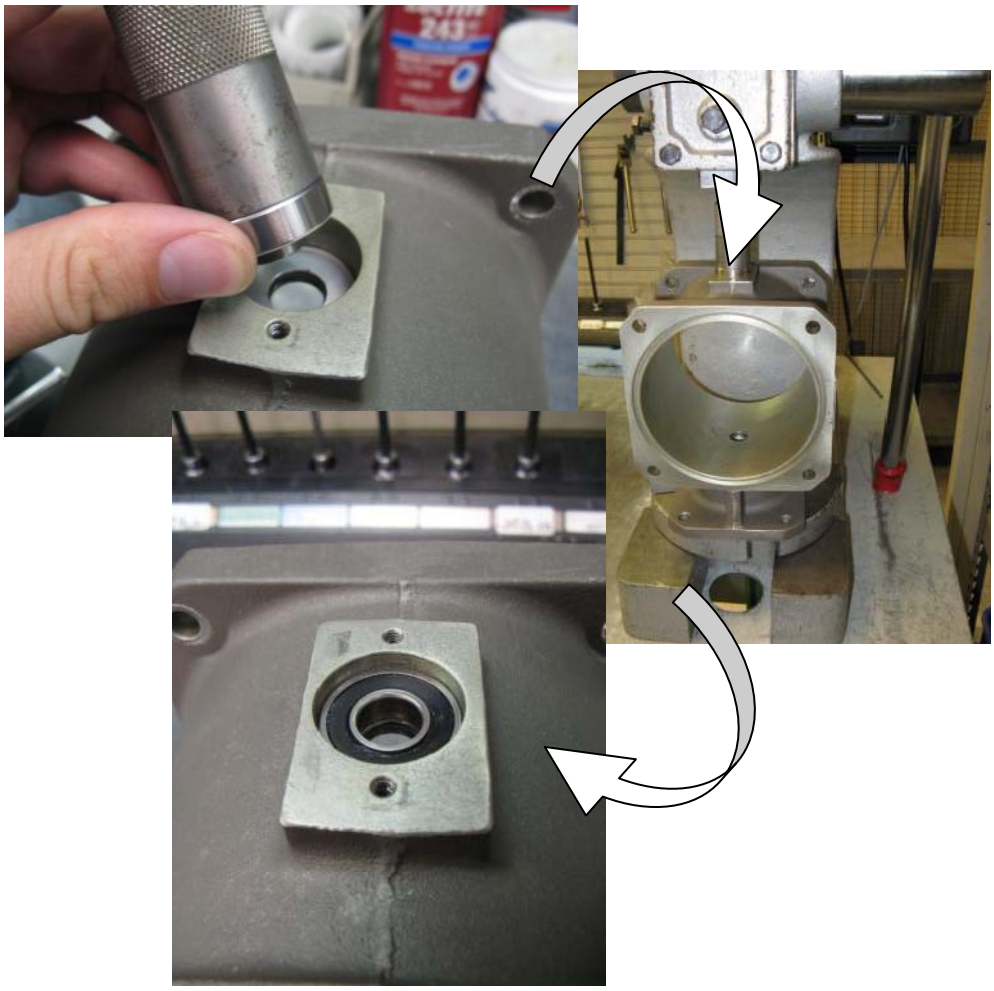


2. (346-8987 Only) Install outboard seal into valve housing [1x 149-2091 (1355-109), 1x 354-2661 (1382-1086), Assembled in Step 3.4.1]
   - Turn housing 180° place on mounting flange on table
   - Place seal assembly into seal seat and work into place with thumb
     - Move thumb in a circle around seal to seat evenly



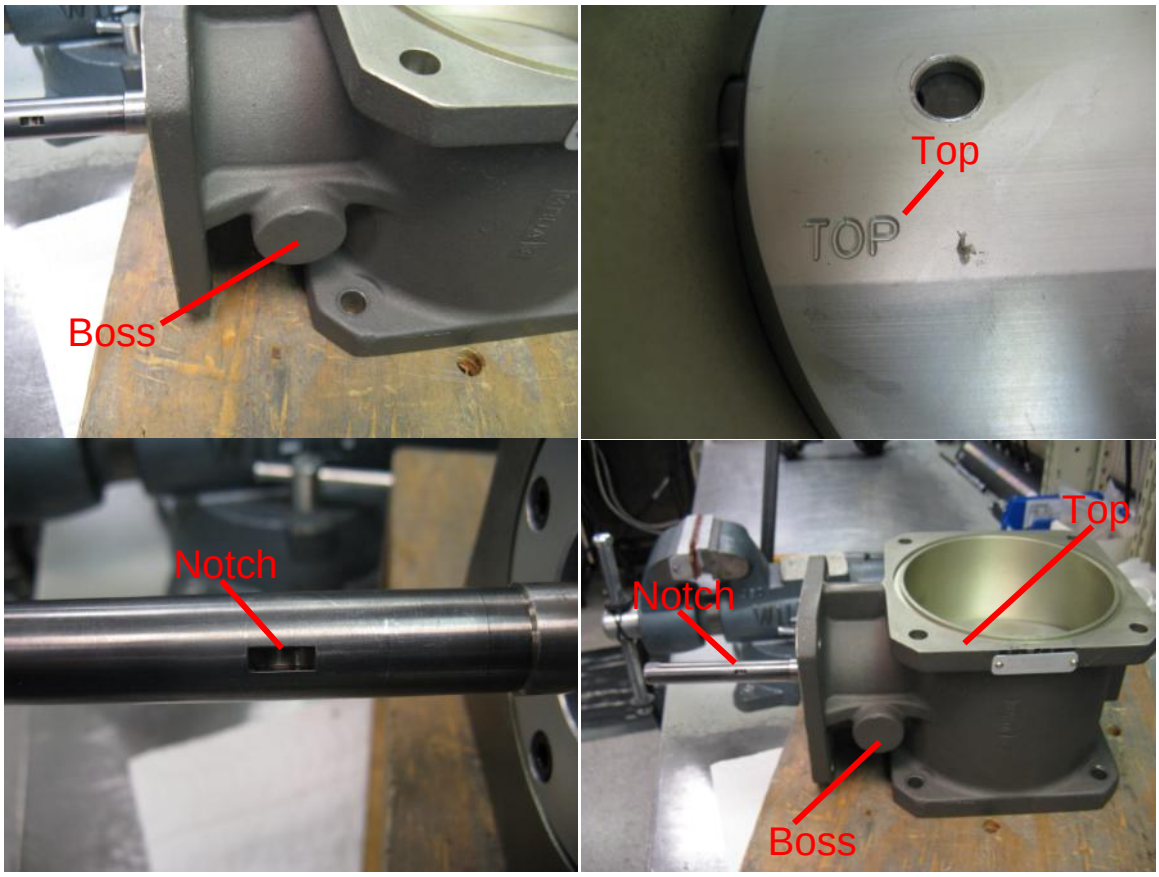

3. (346-8987 Only) Place Bearing Loading Washer on top of newly installed seal with rigid facing upward. [No CAT item number, 1x 1010-5323].


4. Press bearing into housing firmly against loading washer (346-8987) or machined bearing seat (175-3140) [1x 346-8990]
   [Tool: 1007-2174 Simplified (Steel Tube: O.D. 1.050-1.100, I.D. 0.900 min), arbor press].

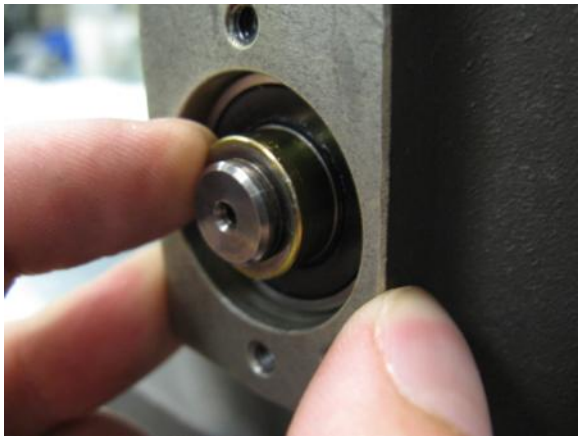


5. Install plate and shaft into valve [1x 151-8973 (3254-025), 8535-300 1x 175-3129 (3538-041), 346-8987 1x 354-2658 (3318-1341)].
   - Place throttle housing on table sealing flange down and alignment boss pointing toward you.
   - Place plate in bore word TOP pointing up and readable, align plate angled down and away from you with the shaft hole in line with the centerline of the valve.
     - Plate has a cut angle so it will jam in bore if misassembled.
     - DO NOT INSTALL PLATE BOLTS .

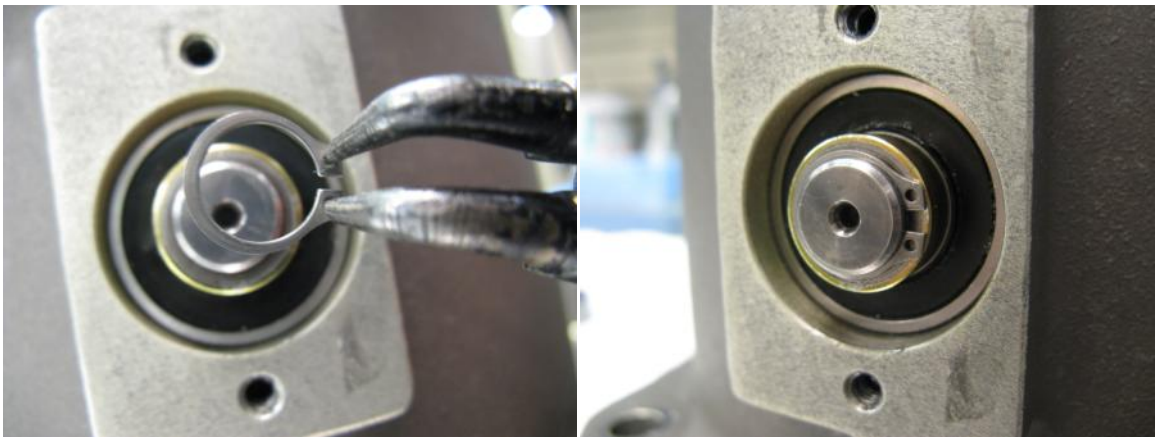
- Place shaft through housing and plate and into the outboard bearing.
  - Align shaft so that the notch on the shaft, the word TOP on the plate, and the boss on the housing are all visible.
  - Press firmly to insure shaft is completely seated.



6. (346-8987 Only) Place bearing loading spacer onto end of shaft outboard said to sit against the inner race of the bearing [346-8987 1x 354-2663 (3621-1286)]

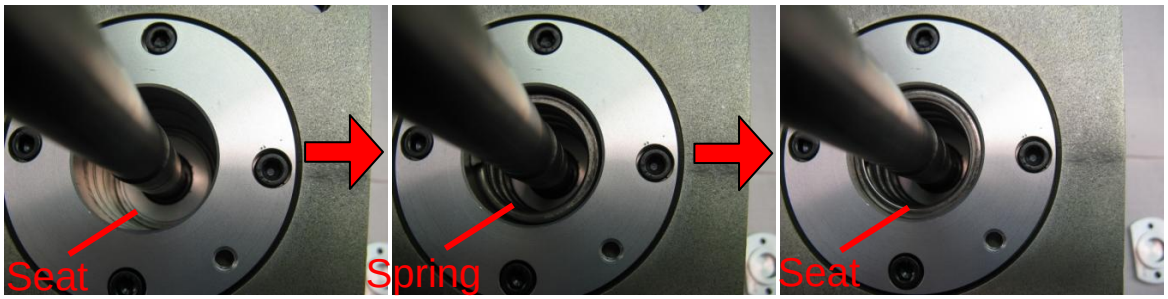


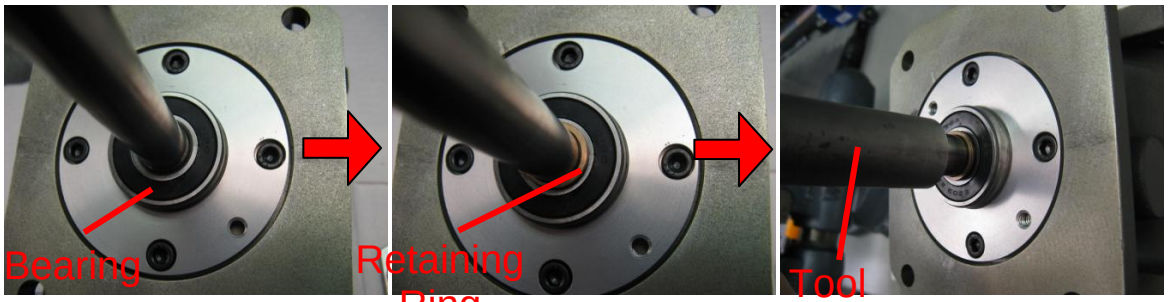
7. Install outboard retaining ring to secure bearing in place and allow loading of the shaft [8535-300 1x 5H-9899 (1017-513), 346-8987 1x 354-2662 (1017-355)].
   - Pull on shaft to ensure retaining is properly seated in groove.



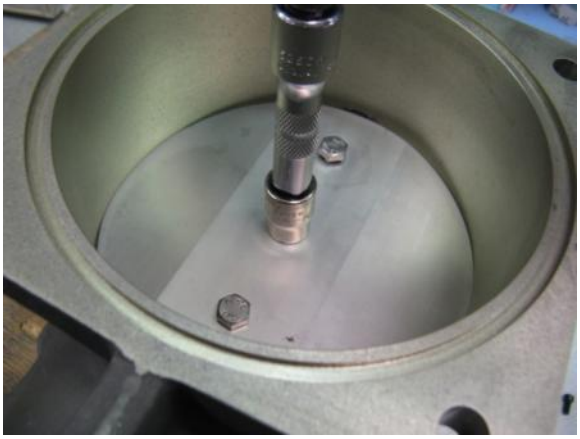
8. Press outboard bearing again to ensure bearing did not shift during prior operations [Tool: 1008-4106 Simplified (Steel Tube: O.D. 1.050-1.100, I.D. 0.900 min), arbor press].

9. Install spring seats, loading spring, lower bearing, and retaining ring [2x 175-3127(1010-997), 1x 175-3125 (1524-037), 1x 5P-6836 (180061), 1x 5L-4035 (1017-521)]
   [Tool: 1007-2175 Simplified (Steel Tube: O.D. 0.990 – 1.000, I.D. 0.675 – 0.685)].
   - Place valve assembly on table with carrier point up.
   - Place one spring seat in carrier bore.
   - Place spring in carrier bore.
   - Place second spring seat in carrier bore.
   - Place bearing onto shaft and slide down so it sits flush with the spring seat.
   - Place retaining ring onto shaft and slide down to rest on inner race of bearing.
   - Use tool to compress stack until retaining ring seats in groove on shaft.





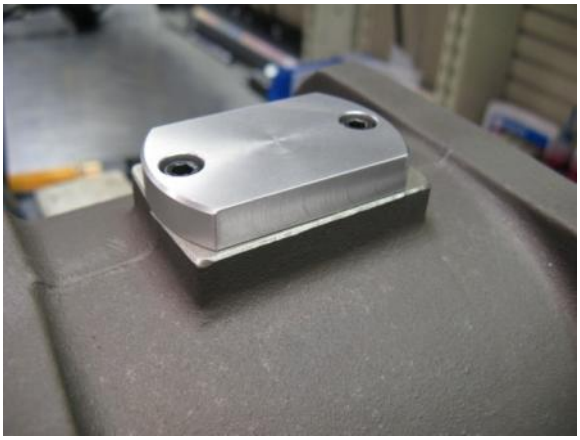
10. Install throttle plate bolts [3x 6D-3031 (190444)].
    - Place throttle plate bolts into shaft and tight so there are only 2 or three threads remaining.
    - Open and close throttle 3-4 times to center plate in bore.
    - Torque bolts all the way down
      [10 mm socket with extension required, torque 72 ± 5 lb-in].



11. Again (Same as step 8) Press outboard bearing to ensure bearing did not shift during prior operations [Tool: 1008-4106 Simplified (Steel Tube: O.D. 1.050-1.100, I.D. 0.900 min), arbor press].
    - Rotate butterfly to ensure throttle opens smoothly.

12. Place O-ring on top cap [1x 6V-9178 (1355-123), 8535-300 1x 175-3136 (3574-137), 346-8987 1x 354-2659 (3550-1557)].

13. Install top cap with O-ring onto valve assembly.
    - Place top cap over outboard end of assembly, in line with threaded holes.
    - Secure cap with screws [2x 6D-3031 (190444)]
      [9/64 inch hex driver required, torque 10 ± 2 lb-in].
      - o Alternate between screws while running screws down to ensure O-ring does not get damaged.

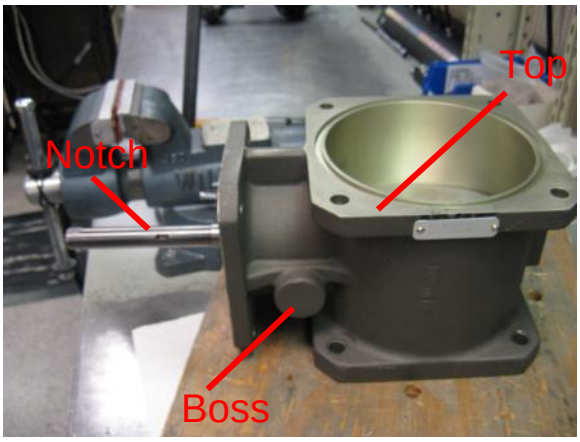


14. Assembly Complete

Chapter 4.
Final Assembly Inspection

4.1 Test Unit Moving Torque and Opening Direction

1. With the shaft pointing to your left, verify the location of the boss on the casting, the notch in the shaft, and the word TOP on the plate.



2. With the shaft pointing to your left, press the plate down and away (Note: Valve should turn counterclockwise (CCW), when the shaft is pointing at you.)

- Allowable torque through-travel
  Note: Starting torque required may be greater because the plate is designed to wedge into the bore.
- Torque can be measured by using a torque watch and a 9/16 inch crows foot across the flat of the shaft:
  New Build 7 lb-in (0.8 N·m)
  Field Unit 10–15 lb-in (1.1–1.7 N·m)

4.2 Leak Test Full Assembly

This process ensures that the throttle leaks less than 15 cm^3/min.

1. Install leak cover on both flanges
   - Top cover should have pressure gage and air inlet

2. Pressurize throttle to 60 psi

3. Allow to sit for 60 minutes
   - Temperature controlled environment is ideal

4. Check final pressure
   - Limit: 2.45 psi (16.9 kPa) pressure loss

We appreciate your comments about the content of our publications.

Send comments to: icinfo@woodward.com

Please reference publication 26459A.

B26459:A

PO Box 1519, Fort Collins CO 80522-1519, USA
1000 East Drake Road, Fort Collins CO 80525, USA
Phone +1 (970) 482-5811 • Fax +1 (970) 498-3058

Email and Website—www.woodward.com

**Woodward has company-owned plants, subsidiaries, and branches,
as well as authorized distributors and other authorized service and sales facilities throughout the world.**

Complete address / phone / fax / email information for all locations is available on our website.

2013/4/Colorado