WOODWARD

Application Note 51299
Original Instructions

Gas Fuel Control Valve (GFCV) O-ring Field Replacement Procedure

IMPORTANT

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.

DEFINITIONS

- **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

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.

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.

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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.

NOTICE

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.

NOTICE

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*.

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Gas Fuel Control Valve (GFCV) O-ring Field Replacement Procedure

Scope

The purpose of this document is to describe the steps necessary to replace the pilot sleeve O-ring and diverging sleeve O-ring on GFCV Gas Fuel Control Valves in the field.

O-ring repair kit part numbers have been assigned that include replacement O-rings or lip seals, O-ring/seal lubricant, diverging sleeve mounting screws and washers, spare helicoil inserts for the diverging sleeve mounting holes in the valve body, identification plate and tie, replacement inlet and discharge flange gaskets, and temperature indication strips.

Refer to the table in the Appendix to ensure that the correct seal repair kit is being used. If the valve part number being repaired is not listed in the Appendix, contact Woodward product engineering (**tkraus@woodward.com**).

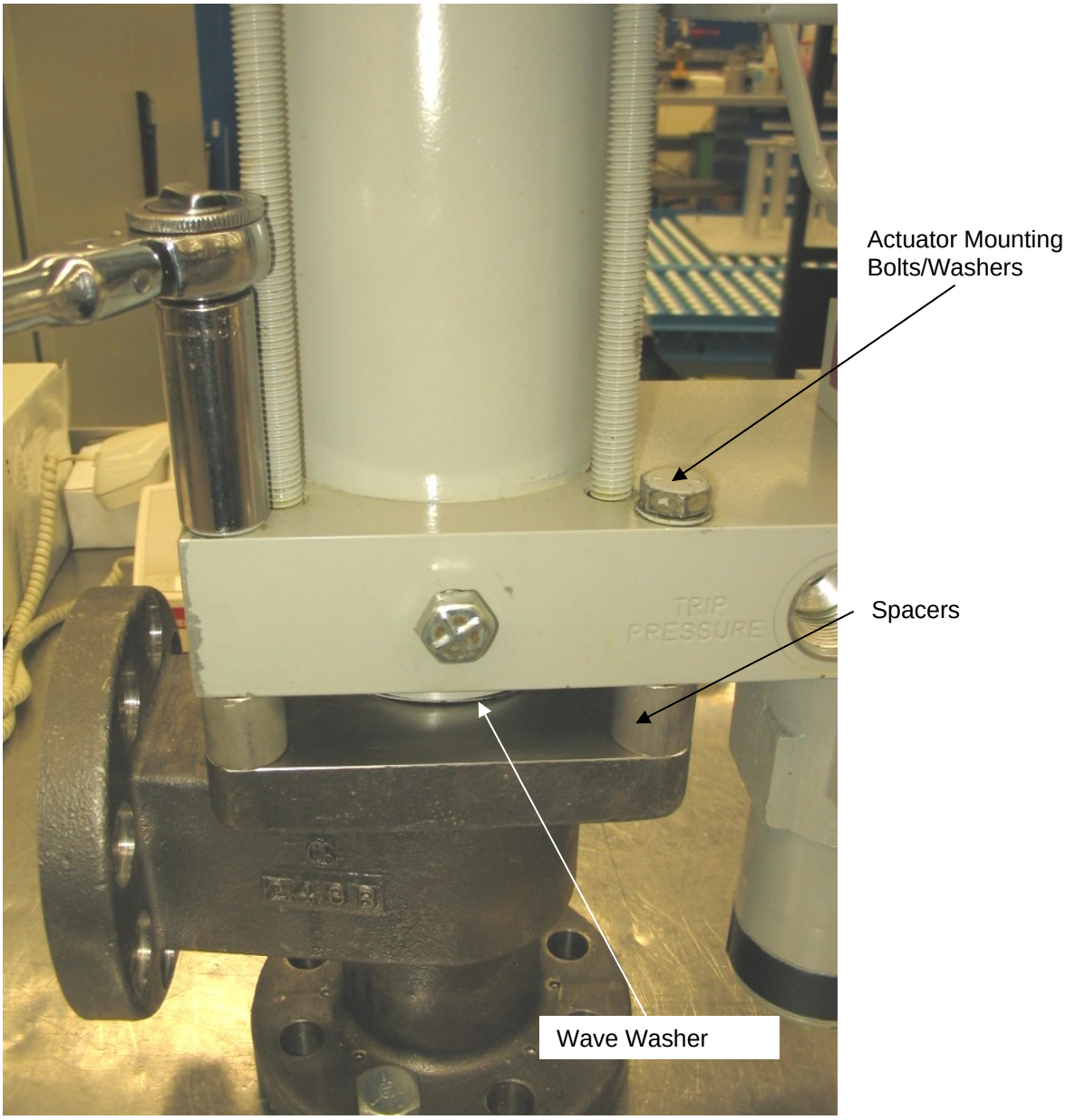
Tools and Supplies Required

- 3/4” and 15/16” hex sockets, 3/8” drive
- 3/8” drive ratchet
- 3/8” drive torque wrench capable of 124 lb-ft torque
- 5/32”, 3/16”, and 1/4” hex T-handle wrenches
- 5/32”, 3/16”, and 1/4” hex drivers, 3/8” drive
- 3/8” drive torque wrench capable of 100 lb-in torque
- abrasive cloth (320 grit or finer)
- clean, lint-free paper towels
- wire pick
- 10-32, 1/4-20, and 5/16-18 helicoil insertion tools

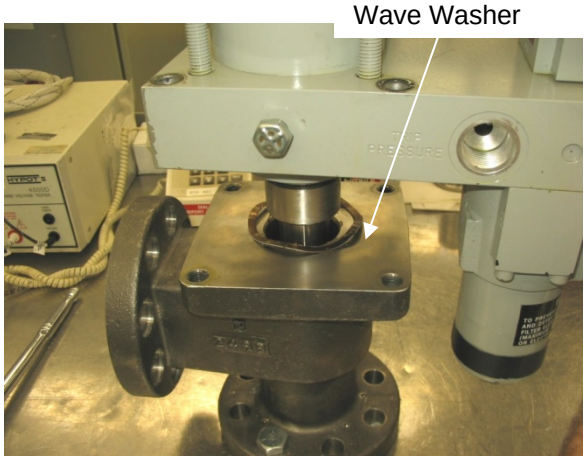
Procedure

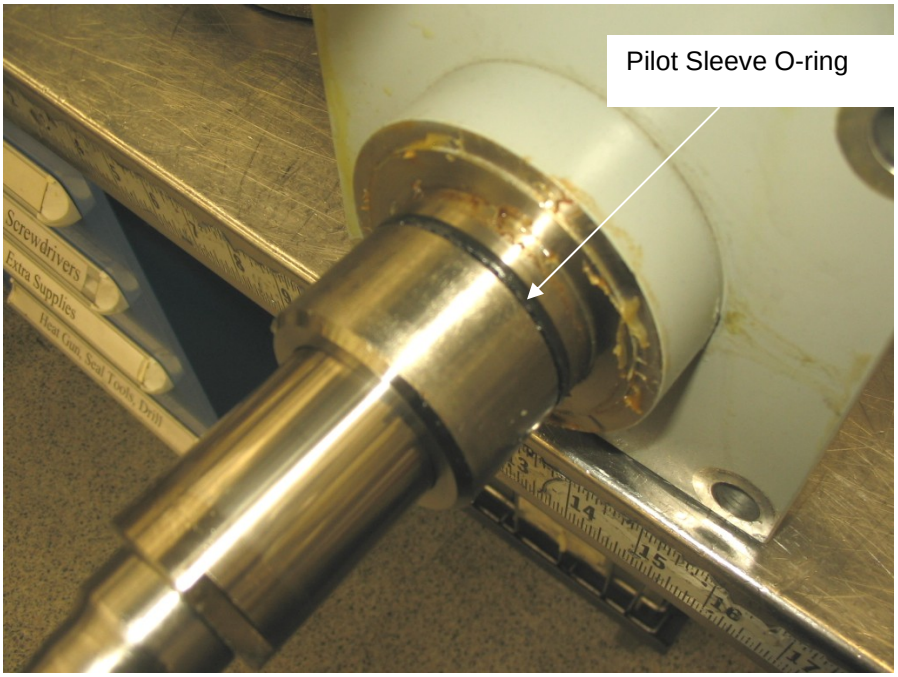
1. Remove the valve from the fuel module. It should be positioned upright resting on the discharge flange.

2. Remove the four hex head cap screws from the actuator base that mount the actuator to the valve body. Once the screws are removed, there are four one-inch long spacers that fit between the actuator and the valve housing, and a wave washer that fits between the pilot sleeve and the valve body. Be sure to collect these items and save for installation.


Actuator Mounting
Bolts/Washers
Spacers
Wave Washer
TRIP
PRESSURE

3. Using the two lifting lugs located on the top of the actuator, carefully lift the actuator up high enough so the metering plug clears the valve body. Be careful not to damage the metering plug.





4. Remove the pilot sleeve O-ring; clean any debris, corrosion, and old O-ring lubricant from the O-ring groove. Abrasive cloth (no courser than 320 grit), or an abrasive pad such as Scotchbrite (Type A1 “very fine”), is acceptable.

5. Lubricate the new O-ring with a light coating of Parker Super-O-Lube (for MSDS: **www.parker.com/o-ring/static/english/faq/msds.slube.pdf**) supplied in the retrofit kit. Do not use petroleum jelly such as Vaseline, or any kind of high-temperature fluorinated grease such as Unifluor or Krytox. Install the new O-ring into the groove of the pilot sleeve; remove any twists in the O-ring by running a pick underneath the O-ring one rotation around the pilot sleeve.

6. Clean the mating bore in the valve housing, removing any burnt debris, corrosion, or old O-ring lubricant from the metal surface. Abrasive cloth (no courser than 320 grit), or an abrasive pad such as Scotchbrite (Type A1 “very fine”), is acceptable.

   If corrosion of the valve bore is severe enough to result in pitting or surface discontinuities that cannot be removed, this can jeopardize the ability of the O-ring to provide a proper seal. If this is the case, the field upgrade may not be possible and the valve may have to be returned to Woodward for repair.

7. Lubricate the bore of the housing with a light coating of Super-O-Lube. This will help prevent the O-ring from twisting as the actuator is re-installed into the housing.

8. With the actuator still removed from the valve body, rotate the valve body so the diverging sleeve is upright and accessible. Remove the socket head cap screws and washers that secure the diverging sleeve to the valve body; remove the diverging sleeve along with the O-ring.

   As the screws are removed, the helicoil from the valve body may come out with the screws—if this occurs, use the appropriate helicoil insertion tool to install new helicoil inserts into the valve body using the spare inserts from the repair kit. For any new inserts that are installed, make sure to remove the tang from the bottom of the insert. This can be done by pushing back and forth on the tang with a flat blade screwdriver.

9. Remove the damaged diverging sleeve O-ring and clean any old lubricant or dirt from the diverging sleeve O-ring groove

10. Install the new Teflon lip seal into the groove of the diverging sleeve.

IMPORTANT **Do not apply any additional sealant in this area. The operating temperature in this area is beyond the capabilities of most sealants.**

11. Clean any old lubricant, dirt, or corrosion from the mating surface of the valve housing. Abrasive cloth (no courser than 320 grit), or an abrasive pad such as Scotchbrite (Type A1 “very fine”), is acceptable. Clean the housing using a circular motion—avoid scuffing the surface in the radial direction. The surface in the valve body must be restored to a bright, shiny, polished appearance.

    If corrosion of the valve mating surface is severe enough to result in pitting or surface discontinuities that cannot be removed with the abrasive cloth, this can jeopardize the ability of the lip seal to provide a proper seal. If this is the case, the field upgrade may not be possible and the valve may have to be returned to Woodward for repair.

12. Carefully re-install the diverging sleeve and lip seal back into the valve housing. Make sure the lip seal does not come out of the groove during installation and become pinched between the sleeve and body.

13. Re-install the socket head cap screws along with new washers. Visually center the sleeve in the valve body as the screws are tightened. Torque the screws to the value listed in Table 1. After the screws are torqued, loosen each screw one-half turn; this will allow the diverging sleeve to float in the housing so that it re-centers itself with the plug when the actuator is re-installed. Rotate the valve body back to its original, upright position.

IMPORTANT **The diverging sleeve screws’ sole purpose is to retain the diverging sleeve in the valve housing prior to the valve being installed into the skid piping. Once the pipe flanges are bolted to the valve body, the diverging sleeve will be secured between the flange and the valve housing by the flange bolts, and the diverging sleeve screws carry no load.**

Table 1. Diverging Sleeve Mounting Screw Torque

Valve Size	Diverging Sleeve Mounting Screws	Quantity	Torque (lb-in)
2 inch	10-32 x 0.625 long	6	75
3 and 4 inch	1/4-20 x 0.750 long	6	100
6 inch	5/16-18 x 0.625 long	8	100

14. Center the wave washer on the housing bore. Carefully lower the actuator assembly back down into the valve body, making sure the metering plug centers properly into the diverging sleeve. Make sure the wave washer is located properly in the recessed step of the pilot sleeve.

15. Re-install the four spacers and the four bolts into the actuator, and thread into the valve body. Tighten the bolts in a criss-cross pattern, only a small amount at a time, so the actuator is pulled evenly down into the valve body.

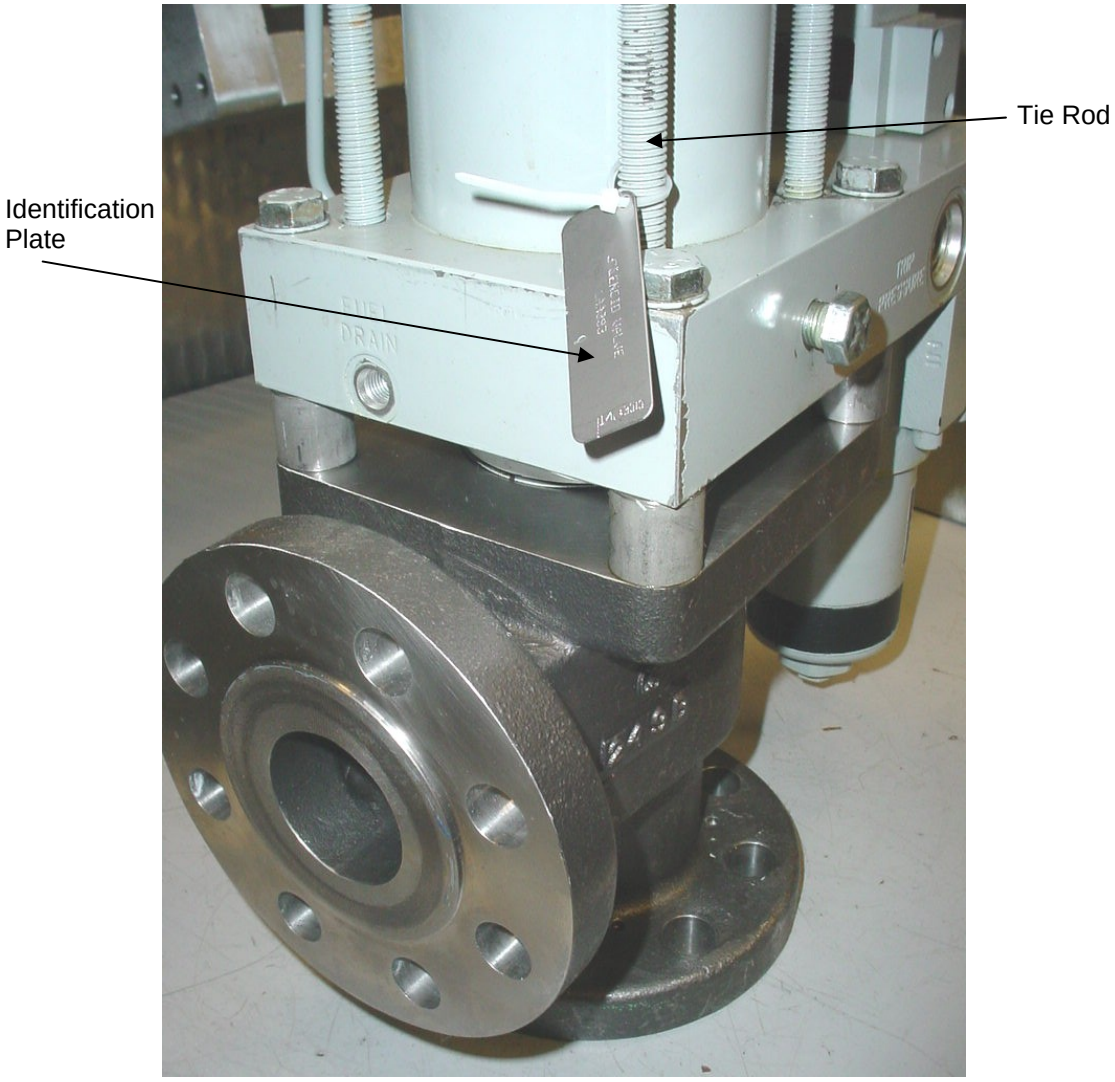
16. Torque the four actuator bolts to the values listed in Table 2 below.

Table 2. Actuator Bolt Torque

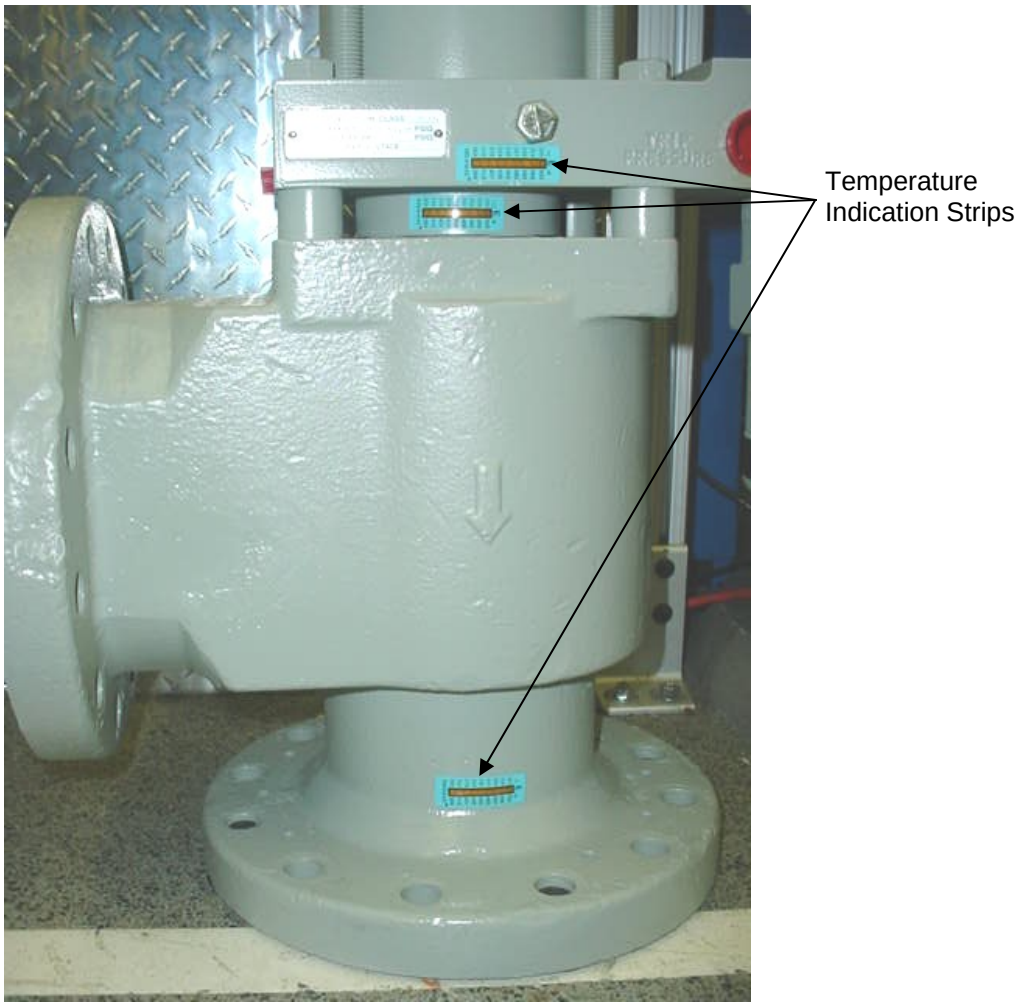
Valve Size	Actuator Mounting Bolts	Torque (lb-ft)
2 and 3 inch	0.500-13 x 3.500 long	62
4 and 6 inch	0.625-11 x 4.000 long	124

17. Verify that the spacers are all tightly held between the actuator manifold and valve body.

18. Using the zip tie, install the identification plate to one of the actuator cylinder tie rods. This plate identifies the valve as having been repaired with the appropriate seal repair kit.



19. Install temperature indication strips on the hydraulic manifold, valve pilot sleeve OD, and valve discharge flange as shown in the picture below.



20. After the valve is re-installed into the fuel module using the new flange gaskets provided in the kit, perform a static leak test to verify there is no external leakage from valve.

NOTICE

It is critical that after the GFCVs have been re-installed into the fuel module, the insulation blankets surrounding the valve bodies are *not* re-installed. Installation of these blankets can cause the temperatures within the valve assembly to exceed the ratings of the Viton O-ring material, and can lead to premature O-ring failure.

Appendix: Valve P/N to Seal Repair Kit P/N

Valve Size	Woodward Valve Part Number	GE Valve Part Number	Seal Repair Kit P/N
2 inch	9904-1071	381A6160P303	8923-1199
2 inch	9904-540	371A6408P003	8923-1199
2 inch	9904-554	379A9904P002	8923-1199
2 inch	9904-555	379A9904P004	8923-1199
2 inch	9904-585	377A7019P003	8923-1199
2 inch	9904-588	381A6160P103	8923-1199
2 inch	9904-703	N/A	8923-1199
2 inch	9904-704	N/A	8923-1199
2 inch	9904-741	377A7019P103	8923-1199
2 inch	9904-930	379A9904P302	8923-1199
2 inch	9904-931	379A9904P304	8923-1199
2 inch	9907-500	N/A	8923-1199
3 inch	9904-524	381A6160P104	8923-1200
3 inch	9904-545	377A7019P006 371A6408P015	8923-1200
3 inch	9904-556	379A9904P005	8923-1200
3 inch	9904-583	377A7019P005	8923-1200
3 inch	9904-590	377A7019P004	8923-1200
3 inch	9904-595	383A8476P006	8923-1200
3 inch	9904-597	381A6160P106	8923-1200
3 inch	9904-705	N/A	8923-1200
3 inch	9904-712	383A8476P106	8923-1200
3 inch	9904-736	383A8476P806	8923-1200
3 inch	9904-742	377A7019P104	8923-1200
3 inch	9904-755	381A6160P206	8923-1200
3 inch	9904-780	113A7157P306	8923-1200
3 inch	9904-795	113A7157P305	8923-1200
3 inch	9904-925	381A6160P304	8923-1200
3 inch	9904-932	379A9904P305	8923-1200
3 inch	9904-936	381A6160P306	8923-1200
4 inch	9904-525	381A6160P107	8923-1201
4 inch	9904-542	377A7019P008	8923-1201
4 inch	9904-593	377A7019P007	8923-1201
4 inch	9904-598	383A8476P008	8923-1201
4 inch	9904-713	383A8476P108	8923-1201
4 inch	9904-725	383A8476P008	8923-1201
4 inch	9904-726	377A7019P008	8923-1201
4 inch	9904-728	383A8476P108	8923-1201
4 inch	9904-737	383A8476P807	8923-1201
4 inch	9904-738	383A8476P808	8923-1201
4 inch	9904-743	377A7019P107	8923-1201
4 inch	9904-756	381A6160P207	8923-1201
4 inch	9904-937	381A6160P307	8923-1201
4 inch	9904-986	221A3040P001	8923-1201

6 inch	9904-526	381A6160P111	8923-1202
6 inch	9904-582	377A7019P011	8923-1202
6 inch	9904-599	383A8476P011	8923-1202
6 inch	9904-707	377A7019P010	8923-1202
6 inch	9904-714	383A8476P111	8923-1202
6 inch	9904-727	377A7019P011	8923-1202
6 inch	9904-729	381A6160P111	8923-1202
6 inch	9904-730	383A8476P011	8923-1202
6 inch	9904-731	383A8476P111	8923-1202
6 inch	9904-739	383A8476P810	8923-1202
6 inch	9904-757	381A6160P211	8923-1202
6 inch	9904-934	381A6160P311	8923-1202
6 inch	9904-938	381A6160P311	8923-1202

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Please reference publication 51299.

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