Commercial & Industrial Meter Maintenance Guide



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1. Introduction

This document describes how to maintain Commercial & Industrial Meters to include T4000, C4000, F4000, and S2000. The 4000 series meters include some common principles and components while the S2000 meter operates using a different measuring element. Maintenance of any meter involves the removal (when needed), disassembly, cleaning, parts replacement, reassembly and reinstallation (when needed) of the meter.

To successfully maintain a meter, you, the technician, must understand how the meter is assembled and any specific characteristics of the meter. With this understanding, you know how to disassemble the register and meter without causing further damage. You understand how each component is oriented and the location of seals, such as gaskets and O-rings. For reassembly, you understand the order of tightening and amount of torque that must be applied to bolts. Meter repair should never be attempted without this knowledge.



2. Overview

This guide provides details for performing periodic maintenance of your Commercial & Industrial potable cold water meters. Proper maintenance will lengthen the operating life of your meter and yield better accuracy performance over that useful life.

Each meter type will be discussed, along with instructions for critical checks and repair and placement tasks. Refer to AWWA Manual M6 for recommendations on maintenance intervals and the factors unique to the utility which might modify those recommendations.

What these meters have in common

The basic meter components are shown by the diagram below. Users are encouraged to refer to the appropriate specification sheets for details of configuration options and the presence or absence of features on particular size ranges of each model. All these meters are 'top-plate' style. They use magnetic coupling to transfer the measuring element motion to the register gearing. The register gearing is appropriate to the selected engineering units of registration: US gallon, cubic foot, or cubic meter.



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How these meters differ

The 4000 series meters discussed in this guide utilize Woltman horizontal turbine elements. The bypass portions of compound meters (C4000, F4000) are oscillating piston style, positive displacement water meter elements. The turbine elements use a helical vane rotor that water flow causes to rotate. The speed of the water flow determines the speed of rotation. The rotational movement is transferred via gearing then magnetically coupled to a sealed register which contains the appropriate reduction gearing. The C4000 is an AWWA C702 compound meter. The F4000 is and AWWA C703 Type II fire service meter.

The 4000 series meters do not include parts interchangeable with 3000 series meters. Registers, measuring elements, etc. will not retrofit other meter models.

The 4000 series C&I meters range in size from 1.5" to 12" nominal inlet bore, though each model has a particular compliment of available sizes. Inlet and outlet connections are oval flanged for sizes 1.5" and 2", round flanged for larger sizes.

The S2000 model is a single jet type water meter. The measuring element is a rotor set into the meter body. The flow path constricts prior to the water entering the rotor chamber causing a jet of water to strike the rotor. The smaller diameter allows the meter to accurately measure water at lower flow rates. The rotor spins in proportion to the velocity of the water striking it. That motion is transferred via magnetic coupling to the register.

The S2000 ranges in size from 1.5" to 6". The 1.5" and 2" meters are oval flanged while 3" through 6" meter bodies are round flanged.



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Changeover Valve

Turbine Measuring Element

C4000 AWWA C702 Compound Meter

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F4000 AWWA C703 Fire Service Compound Meter



Points of Maintenance

Routine maintenance

Elster's Commercial & Industrial meters are designed for long life. In addition to the robust design, routine maintenance helps ensure accuracy and long life.

Routine maintenance includes:

- Cleaning register lenses and meter bodies
- Checking for leaks
- Checking electrical connections and wires for electronic registers
- Checking for accuracy with a flow/volume test
- Flushing integral or external strainers

Meter accuracy tests are best done in the shop so the flow rate can be controlled and the volume accurately measured. Your installed meter population and available resources to test meters should guide your sample sizing. It is worthwhile doing these tests at regular intervals because many meters deteriorate over time, allowing more water to pass than is actually metered. With many meters in a system, and the quantity of water measured by any one particular C&I meter, the losses add up to significant amounts to a point where it is cost-effective to repair or replace the meters.

It is recommended that you perform an accuracy test as described in the AWWA 6 Manual to ensure correct operation after non-routine maintenance.

Non-routine maintenance

- Damaged register
- Worn rotor
- Damaged internal mechanism
- Cracked top plate
- Deteriorated O-rings
- Cracked meter body
- Stuck or loose changeover valve

In the following sections, these areas of non-routine maintenance will be covered.

It is recommended that you perform an accuracy test as described in the AWWA 6 Manual to ensure correct operation after non-routine maintenance.

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3. Maintaining T4000 Meters

Register replacement

The following procedure should be followed to replace the register in the event that the lens is broken or when it has been determined that the register is malfunctioning.

The register, with register housing, can be replaced without having to remove the meter in most cases.

Register and housing removal

A small plastic lock pin holds the register housing securely in place and helps prevent tampering from those who are not familiar with it. This pin is located below the lid hinge on the register housing.

 Use a small punch or drift pin and a small hammer to gently tap and push the plastic pin into the housing. (Recommended tool part #2005019)



2. Next, use the special removal tool (#2005002) to remove the register and housing. Note the gaps in the circular rim of the tool. Align the narrower gap over the hinge of the closed register lid. Using both hands on each end of the tool crossbar, firmly press down on the register housing and rotate it about 30 degrees counter-clockwise to free it. Now the register and housing can be lifted straight up and away from the meter body.



Register and housing replacement

The procedure for mounting the replacement register is the exact reverse of the removal process.

Recall that the old register and housing was rotated about 30 degrees counter-clockwise to free in from its mount. Therefore, the new register and housing must be placed on the mounting ring at the same angle so it can be rotated clockwise to lock it in place.

- 1. Place the new register and housing onto the mounting ring at about 30 degrees counter-clockwise to its final locked position.
- 2. Ensure that the register and housing are resting securely in the mounting ring.
- 3. Use the special mounting tool to press down on the register and housing then rotate it clockwise to the final locked position.
- 4. Insert a new tamper-resistant plug into the register housing in the hole located below the hinge on the housing and gently tap into place. It must be flush with the housing.



Top plate removal

The following are maintained by removing the top plate:

- Internal mechanism inspection
- Internal mechanism cleaning
- Body O-ring replacement
- Internal mechanism replacement

The top plate of C&I meters is made removable to gain access to the internal workings of the meter. The top plate of the meter can be removed with the meter installed inline as long as there is ample room to work with a torque wrench. If there is not room to work, the meter must be removed. Follow the instructions in the Meter Replacement procedure section.

Top plate removal

- 1. Ensure that the main water line to the meter has been turned off. Open the line to relieve pressure.
- 2. Note that there are a number bolts holding the top plate in place. Use the proper size box-end wrench, or socket, to break the bolts loose.
- 3. After each bolt is broken loose, remove each in any order.
- 4. If the top plate does not lift free, gently tap on an edge of the plate with the side of a wrench or small hammer. Do not damage the rim of the meter body itself.

Internal mechanism inspection

After removing the top plate, inspect the entire internal mechanism, looking for:

- 1. Cracks
- 2. Broken rotor blades
- 3. Seized rotor
- 4. Damaged rotor assembly components
- 5. Debris
- 6. Deposits

Internal mechanism cleaning

If dirt, debris, mineral deposits or the like are found on the element, remove the material. Heavy build up of mineral deposits may be removed with a bottlebrush.



Top Plate Attachment

- 1. Place the body O-ring into the ring lip in the body
- 2. Seat the internal mechanism into the meter body ensuring the direction of flow arrows on the top plate and body match
- 3. Ensure the O-ring is not pinched or misaligned
- 4. Tighten the top plate bolts in crossing fashion to 22 +/- 1 Ft*lb

Body O-ring replacement

If the body O-ring shows evidence of cracking, brittleness, or deformity, replace it before reassembly of the internal mechanism onto the meter.

Internal Mechanism Replacement

Elster AMCO Water, LLC recommends the use of pretested replacement internal mechanisms which include top plate and measuring element. The internal mechanism may be supplied with or without a new register and housing. Use of pretested internal mechanisms ensures accurate measurement of the large volume, typically high revenue accounts serviced with C&I meters. When installing the new internal mechanism, follow the steps listed above for top plate attachment.

Meter replacement

Bodies or flanges exhibiting cracks or similar damage indicate need for a replacement meter. Follow the Installation instructions to remove the meter and install a new one.





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4. Maintaining C4000 Meters

Register replacement

Use the same procedure presented earlier at the beginning of Section 3. Take care that the proper register is placed in the bypass or mainline position.

Top Cover Assembly

The C4000 design consists of a top plate assembly to which the bypass assembly, measuring element, changeover valve assembly and mainline register are attached. The serviceable components include the measuring element attached to the top plate to form the internal mechanism

The following are maintained by removing the top plate:

- Internal mechanism cleaning
- Body O-ring replacement
- Internal mechanism replacement
- Changeover valve assembly replacement

The top plate of the meter can be removed with the meter installed inline as long as there is ample room to work with a torque wrench. If there is not room to work, the meter must be removed. Follow the instructions in the Meter Replacement procedure section.

Top plate removal

- 1. Ensure that the main water line to the meter has been turned off. Open the line to relieve pressure.
- 2. Note that there are a number bolts holding the top plate in place. Use the proper size box-end wrench, or socket, to break the bolts loose.
- 3. After each bolt is broken loose, remove each in any order.
- 4. If the top plate does not lift free, gently tap on an edge of the plate with the side of a wrench or small hammer. Do not damage the rim of the meter body itself.







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Internal mechanism inspection

After removing the top plate, inspect the entire internal mechanism, looking for:

- Cracks
- Broken rotor blades
- Seized rotor
- Damaged rotor assembly components
- Debris or obstructions
- Deposits

Internal mechanism cleaning

If dirt, debris, mineral deposits or the like are found on the element, remove the material. Heavy build up of mineral deposits may be removed with a bottle brush.

Top plate attachment

- 1. Place the body O-ring into the ring lip in the body
- 2. Seat the internal mechanism (including valve assembly) into the meter body ensuring the direction of flow arrows on the top plate and body match
- 3. Ensure the O-ring is not pinched or misaligned
- 4. Tighten the top plate bolts in crossing fashion using the sequence given

Body O-ring replacement

If the body O-ring shows evidence of cracking, brittleness, or deformity, replace it before reassembly of the internal mechanism onto the meter.

Internal Mechanism Replacement

Elster AMCO Water, Inc. recommends the use of pretested replacement internal mechanisms which include top plate and measuring element. The internal mechanism may be supplied with or without a new register and housing. Use of pretested internal mechanisms ensures accurate measurement of the large volume, typically high revenue accounts serviced with C&I meters. When installing the new internal mechanism, follow the steps listed above for top plate attachment.



Valve Assembly Replacement

Inspect the changeover valve chamber for dirt, debris, excessive wear, cracks, or other signs of damage.

Exercise the valve to ensure there is no excessive play or sticking. If replacement is needed due to wear, follow these steps:

- 1. Remove the bolts from top cover underneath the bypass assembly
- 2. Remove valve chamber from top plate and mech assembly
- 3. Remove chamber mask
- 4. Remove mask gasket
- 5. Remove valve







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- 1. Replace valve element, ensuring it is fully seated in chamber
- Place mask gasket over valve assembly
 Place mask over mask gasket
- 4. Secure mask
- 5. Torque mask allen screws
 - Á. 2" 1.8 2.2 Ft*lbs.
 - B. 3" & 4" 5.9 6.6 Ft*lbs.





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- 6. Install mask seal in groove
- 7. Ensure dowel pins are set in valve chamber
- 8. Align valve chamber pins with top cover and mech assembly and fit together
- 9. Insert bolts through top cover underneath bypass assembly
- 10. Tighten screws with 6mm allen wrench to 13.3 +/- 1.5 Ft*lbs in cross pattern
- 11. Ensure Bypass check valve is seated in cover





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- 12. Ensure valve chamber O-ring is seated in groove
- 13. Assemble top cover / internal mechanism to body
- 14. Tighten top cover bolts and studs to 22.5 +/- .5 Ft*lbs in the sequence given







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Bypass Assembly

The bypass assembly consists of a housing threaded to the top cover. The housing holds the oscillating piston positive displacement measuring chamber. Pretested bypass assemblies are available for purchase with or without register.



Changeover Valve Assembly

The changeover valve assembly is available as a complete chamber or as a replacement valve with gasket and mask.



Meter replacement

Bodies or flanges exhibiting cracks or similar damage indicate need for a replacement meter. Follow the Installation instructions to remove the meter and install a new one.



5. Maintaining F4000 Meters

Register replacement

Use the same procedure presented earlier at the beginning of Section 3. Take care that the proper register is placed in the bypass or mainline position. For bronze register housings, use a torx head screwdriver to remove the tamper-proof torx screw.

Strainer Assembly

The strainer protects the measuring elements, valve assembly, and downstream system components from damage from dirt and debris in the water supply line. Periodic cleaning is necessary to remove debris accumulated in the strainer.

- 1. Shut down water system and lock out if possible.
- 2. Loosen vent screw in lid slowly to ensure system pressure has been relieved.
- 3. Loosen and remove all inspection port bolts and remove lid and gasket
- 4. Remove strainer screen.
- 5. Clean debris from screen and strainer body.
- 6. Inspect screen for damage. Replace if necessary.
- 7. Reattach strainer top cover. Tighten bolts to 28 ft*pounds torque

Meter Assembly

The F4000 design consists of a top plate to which the measuring element and mainline register are attached. The serviceable components include the measuring element attached to the top plate to form the internal mechanism The following are maintained by removing the top plate:

- Internal mechanism cleaning
- Body O-ring replacement
- Internal mechanism replacement

The top plate of the meter can be removed with the meter installed inline as long as there is ample room to work with a torque wrench. If there is no room to work, the meter must be removed. Follow the instructions in the Meter Replacement procedure section.



Top plate removal

- 1. Ensure that the main water line to the meter has been turned off. Open the line to relieve pressure.
- 2. Note that there are a number bolts holding the top plate in place. Use the proper size box-end wrench, or socket, to break the bolts loose.
- 3. After each bolt is broken loose, remove each in any order.
- 4. If the top plate does not lift free, gently tap on an edge of the plate with the side of a wrench or small hammer. Do not damage the rim of the meter body itself.

Internal mechanism inspection

After removing the top plate, inspect the entire internal mechanism, looking for:

- Cracks
- Broken rotor blades
- Seized rotor
- Damaged rotor assembly components
- Debris or obstructions
- Deposits

Internal mechanism cleaning

If dirt, debris, mineral deposits or the like are found on the element, remove the material. Heavy buildup of mineral deposits may be removed with a bottle brush.

Top plate attachment

- 1. Place the body O-ring into the ring lip in the body
- 2. Seat the internal mechanism into the meter body
- 3. Ensure the O-ring is not pinched or misaligned
- 4. Tighten the top plate bolts in crossing fashion to 28 foot pounds

Body O-ring replacement

If the body O-ring shows evidence of cracking, brittleness, or deformity, replace it before reassembly of the internal mechanism onto the meter.



Bypass Meter Assembly

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The bypass meter assembly of the F4000 consists of isolating ball valves, bypass piping, and a fire service positive displacement measuring unit specific to the F4000 design. The bypass meter may not be replaced by a standard utility customer service C700 water meter.

Maintenance of the bypass meter is covered under C700 maintenance instructions.

To remove the bypass meter from service, perform the following:

- 1. Close the bypass isolating ball valves.
- 2. Loosen the connector nuts.
- 3. Remove the C700 meter.
- 4. Reconnect the C700 after maintaining the meter.
- 5. Tighten the connector nuts.
- 6. Open both ball valves.

Valve Assembly

Inspect the knuckle valve chamber for dirt, debris, excessive wear, cracks, or other signs of damage.

Exercise the valve to ensure there is no excessive play or sticking.

Valve Assembly Replacement

If replacement is needed due to wear, follow these steps:

- 1. Shut down water system and lock out if possible.
- 2. Loosen vent screw in lid slowly to ensure system pressure has been relieved.
- 3. Loosen and remove all inspection port bolts and remove lid and gasket from valve.
- 4. Install proper size clapper retainer clip (see figure 1). Be sure clip is pushed to within 1/2" of linkage.
- 5. Loosen equally the two knuckle joint mounting bolts, until assembly is free. As bolts are loosened linkage will release slightly and lock clapper retainer clip in place.
- 6. Remove knuckle joint from body assuring clapper retainer clip is not disturbed, as preloaded knuckle joint springs have considerable tension in this position.
- Bolt the knuckle joint to the outside of the body using the new 3/8" bolts supplied with the new knuckle joint (see figure 2).









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- 8. Push on clapper plate to release clapper retainer clip, remove and slowly release tension on clapper. Unbolt knuckle joint assembly from outside of body.
- 9. Bolt replacement knuckle joint assembly to body.
- 10. Push on clapper plate to extend springs and install clapper retainer clip, making sure springs are seated on pins. Unbolt knuckle joint assembly from body bolt hole.
- 11. Insert two new 3⁄8" mounting bolts and washers through mounting holes in the body. Position knuckle joint in place inside body, and finger tighten both bolts.
- 12. Torque knuckle joint mounting bolts to 60 inch-pounds.
- 13. Replace old gasket with new. Reattach valve assembly top cover.

Meter Replacement

Bodies or flanges exhibiting cracks or similar damage indicate need for a replacement meter. Follow the Installation instructions to remove the meter and install a new one.



6. Maintaining S2000 Meters

Register Replacement

The S2000 has been produced with multiple variants of register and furniture design. In order to be sure you have the correct repair or replacement parts at hand, be sure to provide complete information on the meter configuration to your Elster contact. Such detailed information could include meter serial number, Elster part number, order number, or a digital image of the subject product.

For meter produced with standard register housing, follow the register procedures from section 3.

For S2000 that include the large shroud and lid, known as the robust register platform, follow the instructions below.

1. Remove the screw under the lid hinge



3. Remove the shroud and lid assembly





2. Remove the front screw

4. Remove screw cap (x3)





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5. Remove screw cap (cont)



7. Attach replacement register assembly



9. Screw in register ring



6. Remove register screws and register assembly



8. Align register ring pin with top plate notch



10. Align register shroud using ring pin and notch





11. Seat register shroud



12. Attach shroud screws



For additional questions regarding register furniture attachment, contact the Elster Repair Service Center.

Top plate removal

The following are maintained by removing the top plate:

- Internal mechanism inspection
- Internal mechanism cleaning
- Body O-ring replacement
- Rotor replacement

The top plate of C&I meters is made removable to gain access to the internal workings of the meter. The top plate of the meter can be removed with the meter installed inline as long as there is ample room to work with a torque wrench. If there is not room to work, the meter must be removed. Follow the instructions in the Meter Replacement procedure section.

Top plate removal

- 1. Ensure that the main water line to the meter has been turned off. Open the line to relieve pressure.
- 2. Note that there are a number bolts holding the top plate in place. Use the proper size box-end wrench, or socket, to break the bolts loose.
- 3. After each bolt is broken loose, remove each in any order.
- 4. If the top plate does not lift free, gently tap on an edge of the plate with the side of a wrench or small hammer. Do not damage the rim of the meter body itself.

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Internal mechanism inspection

After removing the top plate, inspect the entire internal mechanism, looking for:

- Cracks
- Broken rotor blades
- Seized rotor
- Damaged rotor assembly components
- Debris
- Deposits

Internal mechanism cleaning

If dirt, debris, mineral deposits or the like are found on the element, remove the material. Heavy buildup of mineral deposits may be removed with a bottlebrush.

Top Plate Attachment

- 1. Place the body O-ring into the ring lip in the body
- 2. Ensure the O-ring is not pinched or misaligned
- Tighten the top plate bolts in crossing fashion to 22 +/-1 Ft*lb.

Body O-ring replacement

If the body O-ring shows evidence of cracking, brittleness, or deformity, replace it before reassembly of the top plate onto the meter.

Rotor Replacement

Elster AMCO Water, LLC recommends the return of single jet meter requiring rotor replacement. Our service facility can replace the rotor and ensure all adjustments are made to provide accurate meter performance.

Lower rotor plate replacement

- 1. Place the lower rotor plate into the body
- 2. Attach using lower plate screws
- 3. Torque to 2.0 +/- 0.2 Ft*Lbs.

Rotor replacement

- 1. Place the rotor assembly into the lower rotor plate
- 2. Ensure the rotor spins freely
- 3. Attach top plate per instructions above

Meter replacement

Bodies or flanges exhibiting cracks or similar damage indicate need for a replacement meter. Follow the Installation instructions to remove the meter and install a new one.

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Elster AMCO Water Repair Service Center

The Elster AMCO Water Repair Service Team can be contacted during the following hours:

Monday - Friday – 8:00 AM to 5:00 PM EST, excluding holidays You can reach the Repair Service Team by calling:

1-352-368-4620

Elster AMCO Water Customer Service

The Elster AMCO Water Customer Service Team can be contacted during the following hours:

Monday - Friday – 8:00 AM to 5:00 PM EST, excluding holidays You can reach the Customer Service Team by calling:

1-866-896-8858

Elster AMCO Water Technical Support

Elster AMCO Water Technical Support Specialists are a highly skilled group of individuals who have been selected for their dedication to customer satisfaction. The Technical Support Team is on call during the following hours:

Monday - Friday – 8:00 AM to 5:00 PM EST, excluding holidays You can reach the Technical Support Team by calling:

1-866-896-8879

Please note: If you are calling after hours, or a technical support person is not immediately available, you will be directed to a voice mailbox. Please leave your name and number along with your question or a brief description of the issue. A tech support person will return your call as quickly as possible.

Email: techsupport@us.elster.com

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About Elster AMCO Water, LLC

Located in Ocala, Florida, Elster AMCO Water is part of Elster, the world's largest metering and smart metering system solutions company. Elster AMCO Water is an industry leader in the development and implementation of innovative metering and system solutions and is committed to delivering superior customer service, quality products, solutions and services to the water utility industry.

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Revision History

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1	Initial Release	02/29/12

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