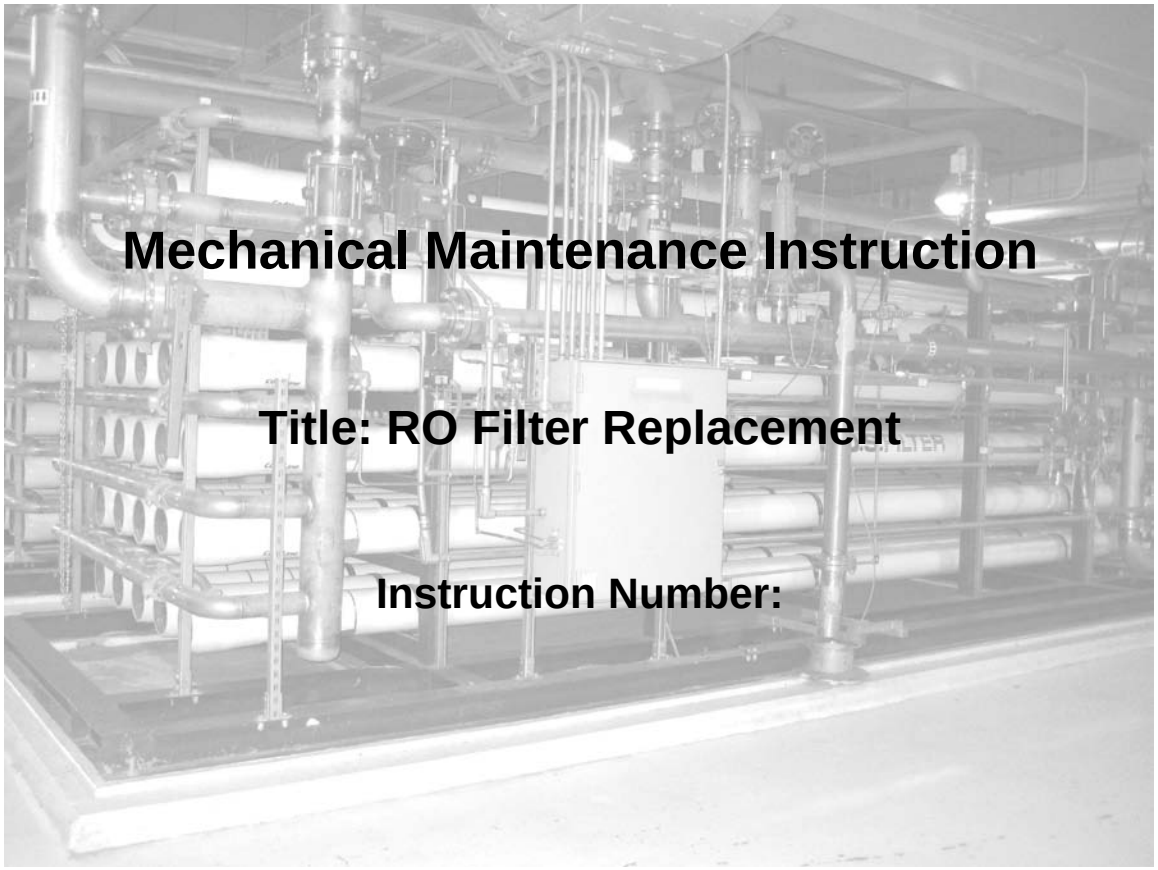


# Mechanical Maintenance Instruction

## Title: RO Filter Replacement

## Instruction Number:

| | | | |
|---|---|---|---|
| **Written By:** | _____ | _____ | _____ |
| | *Print Name* | *Signature* | *Date* |
| **Reviewed By:** | _____ | _____ | _____ |
| | *Print Name* | *Signature* | *Date* |
| **Approved By:** Maintenance Manager | _____ | _____ | _____ |
| | *Print Name* | *Signature* | *Date* |

**Effective Date:** _____

**Next Review Date:** _____

## Table of Contents

## 1.0 PURPOSE

1.1. This instruction provides the guidelines to open/close the RO vessel and unload/load the filter elements.

## 2.0 REFERENCES

2.1. DOW – Tech Manual Excerpt – FILMTEC Membranes – Loading of Pressure Vessels: Element Unloading

2.2. DOW – Tech Manual Excerpt – FILMTEC Membranes – Loading of Pressure Vessels: Preparation & Element Loading

2.3. DOW – Tech Manual Excerpt – FILMTEC Membranes – Loading of Pressure Vessels: Shimming Elements

2.4. Code Line Pentair Water User's Guide – 80A Series

## 3.0 DEFINITIONS AND ACRONYMS

3.1. Definitions – N/A

3.2. Acronyms – N/A

## 4.0 MATERIAL, SPECIAL TOOLS AND EQUIPMENT

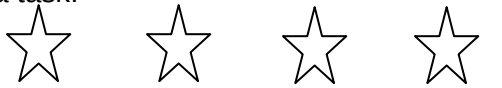
4.1. Reference Appendix "A" for recommended tools and materials required to remove and replace the RO filter elements.

## 5.0 PRECAUTIONS AND LIMITATIONS

5.1. **IF** these work instructions cannot be performed as written,
**THEN** stop work and notify Supervision.

5.2. **IF** abnormal conditions are encountered,
**THEN** stop work, inform personnel in the area that may be affected, and notify Supervision.

5.3. Incorporate the STAR self-checking technique before and immediately after performing a task:



**STOP** **THINK** **ACT** **REVIEW**

5.3.1. **STOP** - Pause before performing a task to enhance attention to detail. This is the most important step of any self-checking technique. The simple act of stopping increases the likelihood of performing the task correctly. Attempt to eliminate current or potential distractions.

5.3.2. **THINK** - Understand specifically what is to be done before working on any component. Identify the correct component, train, unit, etc., before taking any action.

5.3.3. **ACT** - Perform the intended action

5.3.4. **REVIEW** - Verify that the actual response is the expected response. If an unexpected response is obtained, take action as previously determined.

5.4. **HOLD POINTS** may be used in this procedure. If a Hold Point is encountered, do **NOT** continue to the next step without contacting supervision. Supervision is responsible to review the work, initial the Hold Point, and authorize work to continue.

5.5. **NOTE**, **CAUTION**, **WARNING**, and **CRITICAL STEP** boxes may be used throughout this procedure to provide information that must be considered prior to the performance of a step, or series of steps.

5.6. During the performance of this procedure, general housekeeping rules will be in effect.

5.7. Hoses are kept off the walking surface in an elevated position or ramped over to eliminate tripping hazards.

## 6.0 PREREQUISITES

6.1. Prior to start of work, **VERIFY** all work permits are obtained and filed per ConEd-COP-5-1-2 Work Permit Procedure.

6.2. **VERIFY** Section 5.0 - Precautions and Limitations has been read and understood.

6.3. **VERIFY** personnel performing these activities are qualified/certified or work under supervision of personnel that are qualified/certified.

**CAUTION:** Skin irritation may result from exposure to the RO water. **ENSURE** proper PPE is worn during the filter removal and vessel cleaning stages.

Mandatory PPE for filter element removal and vessel cleaning are:

1. Water-proof suit.
2. Nitrile gloves at a minimum, and if preferred, work gloves over the nitrile gloves.
3. N95 respirator with face shield;

   **OR**
4. Half-face organic vapor cartridges with face shield;

   **OR**
5. Depending on any vapors/fumes, full-face organic vapor cartridges with **NO** face shield.
6. Hard hat, safety glasses, hearing protection, safety shoes, and cotton clothing.

Once the vessel is emptied and cleaned, PPE can be downgraded to:

1. Nitrile gloves with work gloves over.
2. Hard hat, safety glasses, hearing protection, safety shoes, and cotton clothing.

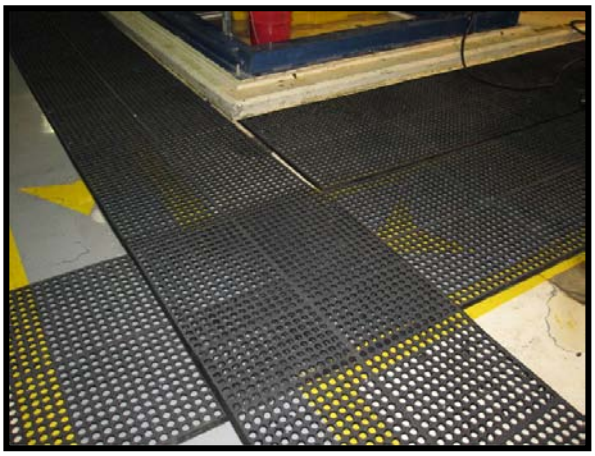
## 7.0 PROCEDURE

| | |
|---|---|
| **NOTE:** | If any out-of-scope work or negative inspection results is identified during the performance of this procedure, or if the equipment produces results inconsistent with the intent of this procedure, consult your supervisor prior to commencing any troubleshooting or repair activities. |

7.1. **VERIFY** Precautions, Limitations, and Prerequisites, Sections 5.0 and 6.0 have been performed and/or understood before beginning performance of actual work instructions.

7.2. **CHECK** the applicable RO bank.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| _____ | 1401 | _____ | 1402 | _____ | 1403 | _____ | 1404 | _____ | 1405 |
| _____ | 1406 | _____ | 1407 | _____ | 1408 | _____ | 1409 | _____ | 1410 |



7.3. **OPEN** the pressure vessel.

7.3.1. **LAY** mats around the pressure vessel to prevent slipping.

7.3.2. **VERIFY** that system pressure is fully relieved from the vessel.

7.3.3. **DISCONNECT** all of the Victaulic couplings from the downstream end.

a. **REMOVE** fasteners and coupling halves.

b. **POSITION** the seal above the pipe split.

7.3.4. **REMOVE** the retaining rings from the downstream heads.

a. **LOOSEN** any deposits from the groove with a wire brush and/or a medium-grade piece of Scotchbrite.


b. **LIFT** the retaining ring out of the groove using pliers.

c. **RUN** your finger behind the retaining ring as it continues to exit the groove.

7.3.5. **IF** the retaining ring will not release from the groove, **THEN**

a. **APPLY** a penetrating fluid (WD-40 or LPS-1) to the groove

**NOTE:** Exercise care to avoid any contamination to the filter element.

b. **TAP** the retaining ring with a screwdriver handle or similar tool to release the bond.

c. **REPEAT** step 7.3.3

7.3.6. **REMOVE** the downstream heads.

**NOTE:** Start removing the heads from the bottom row (1st stage) and work towards the top (2nd stage).

a. **PULL** straight outward to remove the head.

b. **IF** the head will not release from the shell, **THEN** carefully rock the head assembly to release the seal.

**CAUTION:** Apply only light upward or downward movement to avoid any damage to the plastic head fitting.

c. **REMOVE** the square cut port seal.

d. **REPEAT** steps 7.3.3 and 7.3.5 for the remaining 29 downstream heads.

7.3.7. **REMOVE** the retaining rings from the upstream (feed end) heads. Reference step 7.3.3.

7.3.8. **REMOVE** the upstream heads.

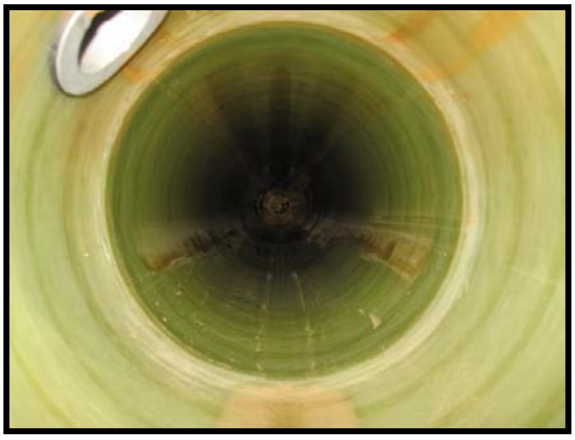
**NOTE:** Start removing the heads from the bottom row (1st stage) and work towards the top (2nd stage).

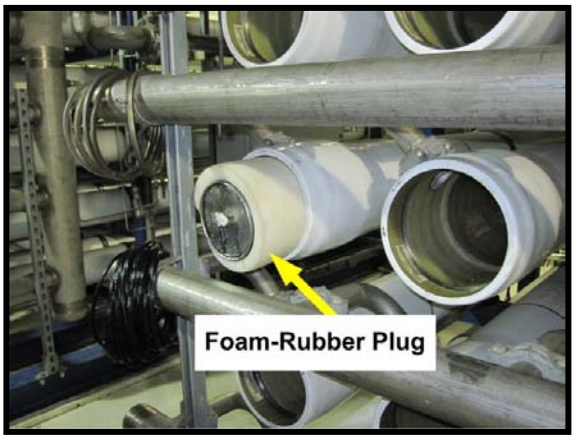
a. **PULL** straight outward to remove the head.

b. **IF** the head will not release from the shell, **THEN:**
- Thread a 1" ID pipe approximately 1 ft. long into the permeate port.
- Carefully rock the head assembly to release the seal.

c. **REMOVE** the square cut port seal.

d. **REMOVE** the shim(s).






7.4. **CLEAN** and **INSPECT** RO components.

7.4.1. **CLEAN** the vessel

a. **INSPECT** the interior surface for any corrosion deposits or any foreign matter.

b. **IF** any deposits or matter is found, **THEN** clean surface up to 8 inches in from each end with medium or fine grade Scotchbrite.

c. **CLEAN** the retaining ring groove.

**NOTE:** It is highly recommended to use a sponge ball wrapped in a towel and soaked in a 50% solution of glycerin and water. The sponge ball can be pushed through the vessel using a piece of 2 inch PVC pipe with a PVC flange attached to the end.

**CAUTION:** Be sure to avoid scraping the pipe along the vessel surface.

d. **RINSE** the interior surface with clean water.

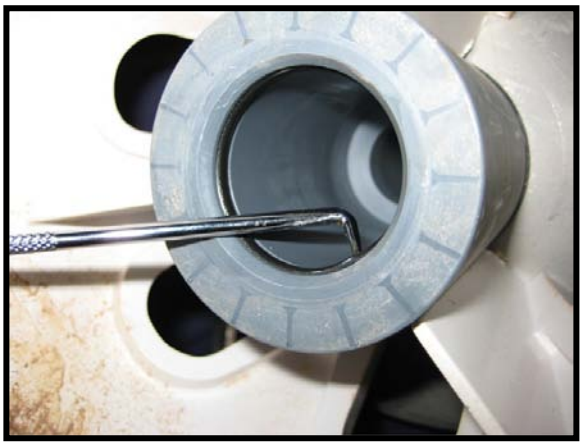
7.4.2. **INSPECT** the vessel interior surface for scratches or other damage which would cause leaks.

7.4.3. **INSPECT** the filter elements.

a. **VERIFY** the elements are free of cracks, gouges, or defects.

b. **VERIFY** the U-cup brine seal is properly seated and installed.
- **INSPECT** for any cuts or defects.
- **ENSURE** open side of the seal is facing upstream

7.4.4. **ORGANIZE** several rows of seven (7) elements in front of the vessels.



7.4.5. **INSTALL** a new o-ring in the adaptors

a. **REMOVE** the old o-rings.

b. **APPLY** a very light film of silicone lubricant to the new o-rings.

7.4.6. **SIGN OFF** required for completion of Section 7.5 **CLEAN** and **INSPECT** RO components.

**Completed By:** _____ _____ _____

*Print Name* *Signature* *Date*

**STOP** **THINK** **ACT** **REVIEW**

7.5. **INSTALL** the filter elements.

7.5.1. **VERIFY** a brine seal is installed on the element.

**NOTE:** Always start from the upstream end of the vessel when loading the elements.

7.5.2. **LOAD** the first element into vessel

a. **APPLY** a light film of silicone lubricant to the adaptor end o-rings.

b. **INSERT** the end adaptor into the element.

**NOTE:** Shim rings should **NOT** be installed on either end of the adaptor.

c. **INSTALL** the filter element into the vessel.

d. **ENSURE** the element projects from the vessel.

e. **APPLY** a light film of silicone lubricant to the element connector o-rings.

f. **INSERT** the connector into the element.

g. **APPLY** a light film of glycerin based lubricant to the brine seal.

7.5.3. **LOAD** the second element into the downstream end of the vessel

a. **ALIGN** the element with the connector.

| **NOTE:** | Housekeeping tasks only take a few seconds if done immediately. Remember that a safe workplace depends on each and every employee taking responsibility for good housekeeping — to prevent fires, falls, and other accidents. |
|---|---|

7.6. **VERIFY** the following housekeeping tasks have been performed during and after job completion:

7.6.1. **RETURN** any support materials to the proper storage location.

7.6.2. **CLEAN** and **ARRANGE** work areas to preclude the creation of tripping, slipping, and fire hazards.

7.6.3. **STORE** materials so as **NOT** to obstruct access to fire protection equipment (including sprinkler heads), control valves, fire doors, alarm devices or panels, electrical panels, and motor control centers (MCCs).

7.6.4. **STORE** hoses either stacked or placed in an orderly manner so as to prevent sliding, falling, or collapse.

7.7. Signoffs

7.7.1. The signatures below validates that all steps within this procedure have been completed and the results confirm the RO bank is in an **OPERATIONAL** / **INOPERABLE** (circle one) condition.

| | | | |
|---|---|---|---|
| **Completed By:** *Maintenance Mechanic* | _____ *Print Name* | _____ *Signature* | _____ *Date* |
| **Independent Verification:** *Maintenance Supervisor* | _____ *Print Name* | _____ *Signature* | _____ *Date* |

## 8.0 ATTACHMENTS

**Attachment "A" – Recommended Tools, M&TE, and Rigging**

## Attachment "B" - 1st and 2nd Stage Discharge Completion Checklist and Signoff

The following checklist and signoff is used to verify the steps to replace the 2nd and 1st stage discharge RO filter end caps have been properly performed and the system is ready to install the filter elements.

**CHECK** the applicable RO bank.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| _____ | 1401 | _____ | 1402 | _____ | 1403 | _____ | 1404 | _____ | 1405 |
| _____ | 1406 | _____ | 1407 | _____ | 1408 | _____ | 1409 | _____ | 1410 |

| Meets requirements | | | What to look for: | Comments / Corrective actions |
|---|---|---|---|---|
| N/A | No | Yes | | |
| | | | End Cap Installation | |
| ☐ | ☐ | ☐ | ▪ VERIFIED retaining ring grooves are clean and dry? | |
| ☐ | ☐ | ☐ | ▪ APPLIED a lubricant to the head seals and adaptor o-rings? | |
| ☐ | ☐ | ☐ | ▪ INSTALLED head seals and adaptor o-rings properly? | |
| ☐ | ☐ | ☐ | ▪ APPLIED a lubricant to the leading edge of the heads? | |
| ☐ | ☐ | ☐ | ▪ INSTALLED retaining rings properly? | |
| ☐ | ☐ | ☐ | ▪ INSTALLED Victaulic couplings? | |
| ☐ | ☐ | ☐ | ▪ VERIFIED ball valves are in "as-found" position? | |

Maintenance Mechanic Initials as 2nd stage complete:

| Element | Initials |
|---|---|
| 14XX-01 | |
| 14XX-02 | |
| 14XX-03 | |
| 14XX-04 | |
| 14XX-05 | |
| 14XX-06 | |
| 14XX-07 | |
| 14XX-08 | |
| 14XX-09 | |
| 14XX-10 | |


STOP THINK ACT REVIEW

## Attachment "B" - 1st and 2nd Stage Intake Completion Checklist

The following checklist and signoff is used to verify the steps to replace the 2nd and 1st stages intake RO filter elements have been properly performed and the system is ready to be placed back into service.

| Meets requirements | | | What to look for: | Comments / Corrective actions |
|---|---|---|---|---|
| N/A | No | Yes | | |
| | | | **Element Pre-loading** | |
| ☐ | ☐ | ☐ | ▪ VERIFIED downstream end cap assembly properly installed? | |
| ☐ | ☐ | ☐ | ▪ INSPECTED elements for damage or defects? | |
| ☐ | ☐ | ☐ | ▪ VERIFIED element U-cup brine seal is properly seated and installed? | |
| | | | **Element Loading** | |
| ☐ | ☐ | ☐ | ▪ LOADED elements from the feed water end? | |
| ☐ | ☐ | ☐ | ▪ APPLIED a lubricant to each brine seal? | |
| ☐ | ☐ | ☐ | ▪ APPLIED lubricant to interconnector o-rings? | |
| ☐ | ☐ | ☐ | ▪ INSTALLED each interconnector securely? | |
| ☐ | ☐ | ☐ | ▪ REDUCED space between the face of the lead element and adaptor hub with shims? | |
| ☐ | ☐ | ☐ | ▪ VERIFIED seven (7) filter elements were installed in each vessel? | |
| | | | **End Cap Installation** | |
| ☐ | ☐ | ☐ | ▪ VERIFIED retaining ring grooves are clean and dry? | |
| ☐ | ☐ | ☐ | ▪ APPLIED a lubricant to the head seals and adaptor o-rings? | |
| ☐ | ☐ | ☐ | ▪ INSTALLED head seals and adaptor o-rings properly? | |
| ☐ | ☐ | ☐ | ▪ APPLIED a lubricant to the leading edge of the heads? | |
| ☐ | ☐ | ☐ | ▪ INSTALLED retaining rings properly? | |

## Attachment "B" - 1st and 2nd Stage Intake Completion Signoff (cont.)

Maintenance Mechanic Initials as 2nd stage complete:

| Element | Initials |
|---|---|
| 14XX-01 | |
| 14XX-02 | |
| 14XX-03 | |
| 14XX-04 | |
| 14XX-05 | |
| 14XX-06 | |
| 14XX-07 | |
| 14XX-08 | |
| 14XX-09 | |
| 14XX-10 | |


Maintenance Mechanic Initials as 1st stage complete:

| Element | Initials | Element | Initials |
|---|---|---|---|
| 14XX-11 | | 14XX-21 | |
| 14XX-12 | | 14XX-22 | |
| 14XX-13 | | 14XX-23 | |
| 14XX-14 | | 14XX-24 | |
| 14XX-15 | | 14XX-25 | |
| 14XX-16 | | 14XX-26 | |
| 14XX-17 | | 14XX-27 | |
| 14XX-18 | | 14XX-28 | |
| 14XX-19 | | 14XX-29 | |
| 14XX-20 | | 14XX-30 | |


**Verified By:**
Maintenance Supervisor

_____ *Print Name*

_____ *Signature*

_____ *Date*

**STOP** **THINK** **ACT** **REVIEW**