Tank Farm Plant Operating Procedure
Effluent Treatment Facility

USQ Not Required – ETF is a < Hazard Category 3 Radiological Facility

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<tr>
<td>A-6</td>
<td>01/14/2019</td>
<td>DOE-0359 Implementation</td>
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<td>A-5</td>
<td>12/11/2018</td>
<td>Standardization Agreement Change</td>
<td>Update procedure to ETFS standards (update record section, removal of signature sheet, Clarify sections for flexibility, etc.) Updated Rad Con Statement.</td>
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<td>08/08/2018</td>
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<td>Added general information about a deviation, added special instructions to clarify nomenclature, updated component identification, and revised datasheets for use in field.</td>
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<td>A-3</td>
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<td>Add step to clear Degas blower discharge line of liquid.</td>
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<td>A-2</td>
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<td>Added PPE direction associated with inspecting and disposing of contaminated PPE. Updated Records requirements to current ETF standard.</td>
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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides instructions for flushing, cleaning, and sanitizing banks in the RO System.

1.2 Scope

This procedure provides instructions for periodic cleaning and layup of RO membranes. Sections are performed dependent on the cleaning/sanitizing needs identified per process memo or SOM direction.

2.0 INFORMATION

2.1 Terms and Definitions

- CIP – Clean-in-Place
- MTT – Main Treatment Train
- O/S – Out of Service
- RO – Reverse Osmosis
- SOV – Solenoid Operated Valve.
2.2 General Information

2.2.1 Personnel should be aware of temperature in CIP tank. If temperature reaches 122°F, logic will shut down system. The system cannot be restarted until temperature drops.

2.2.2 CIP pump suction valve 60F-315 must be closed before draining CIP tank. Draining CIP tank with 60F-315 open will require re-priming of CIP pump before restarting.

2.2.3 Do not store pH probe AE-60F-450 in verification water or high pH solutions. The electrode membrane will lose strength quickly. The pH probe should be drained at the completion of membrane cleaning and laid up in 4 pH buffer within 48 hours.

2.2.4 The feed flow rate for 1st RO 1st array bank should be 60 to 80 gpm; for 1st RO 2nd array flow rate should be 30 to 40 gpm; and for 2nd RO bank, flow should be 55 to 60 gpm. At higher flow rates, excessive pressure drop may result in re-depositing dirt on the membrane. If flow meter FIT-60F-301 is not operational, flow is considered adequate based upon CIP pump 60F-P-4 output pressure of 25 to 52 psig and confirmation of the valve lineup per Data Sheet 1 – 3-Way Valve Lineup.

2.2.5 When switching from MANUAL to AUTO, control valve setpoints will take on the current process value (i.e., equal to output value) of the controller while the system is in MANUAL. After returning the controller to AUTO, it is necessary to re-enter the normal operating setpoint for AUTO operation.

2.2.6 Dash placement in valve numbers is not consistent and may differ dependent on whether the user is looking at the valve in the field or on the MCS. See approved deviations in TFC-ENG-STD-12, Tank Farm Equipment Identification Numbering and Labeling Standard.
3.0 PRECAUTIONS AND LIMITATIONS

3.1 Personnel Safety

**WARNING** - MC-4 and Kleen ENV911 are corrosive to eyes and skin and causes respiratory tract irritation.

**WARNING** - MC-1 and MemChem MCT201 causes eye, skin, and respiratory tract irritation.

**WARNING** - Sulfamic Acid causes severe eye, skin damage, and respiratory tract irritation.

**WARNING** - Muriatic Acid causes severe eye, skin damage, and respiratory tract irritation.

**WARNING** - Tetra-Sodium EDTA causes eye, skin, and respiratory tract irritation.

**WARNING** - Terg-A-Zyme causes eye, skin, and respiratory tract irritation.

**WARNING** - MP-4 and Betz Dearborn RN DCL32 causes eye, skin, and respiratory tract irritation.

**WARNING** - Minncare causes burning to the eyes and is a skin and respiratory tract irritant.

3.1.1 Upon completion of any portion of this procedure which requires PPE, personnel must inspect their PPE for caustic residue or other contaminates. If caustic residue or other contaminates are found or suspected, dispose of the PPE compliant with ETF waste management processes in accordance with ETF-65D-003, Package Waste.
3.1 - Personnel Safety (Cont.)

3.1.2 All work will be performed in accordance with DOE-0359, Hanford Site Electrical Safety Program.

3.1.3 Operation of Circuit Breakers, Electrical disconnect Switches, and Similar Switching Equipment shall be performed by a qualified person.

3.1.4 Component operation requires completion of an Electrical Risk Assessment (ERA).

3.1.5 When the clean and inspects are current on the electrical equipment (breaker, switchgear, disconnects, motor starters, etc.), the ERA for normal operating condition is applicable, for those workers interacting with electrical equipment.

3.1.5.1 Use safety glasses and leather gloves when manipulating electrical components per the normal ERA.

3.1.6 When the clean and inspects are delinquent, the ERA for non-normal operating condition is applicable, for those workers interacting with electrical equipment.

3.2 Equipment Safety

CAUTION - CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

CAUTION - Membrane damage will occur if pH of cleaning solution exceeds 12.0.

CAUTION - Membranes should be cleaned before sanitizing to prevent membrane damage.

CAUTION - pH of disinfecting solution must not exceed 4.0 or membrane damage will occur.

CAUTION - Membrane damage will occur if Minncare disinfecting solution is at greater than 77°F when contacting membranes.

3.2.1 Chemicals (MC-1, MemChem MCT201, MC-4, Kleen ENV911, Sulfamic Acid, Muriatic Acid, Tetra-Sodium EDTA, Terg-A-Zyme, MP-4, Betz Dearborn RN DCL32, Minncare) contacting each other in membrane vessels could result in membrane damage.

3.2.2 To prevent damage to the heating element, turn off heater before draining CIP tank.
3.3 Radiation and Contamination Control

3.3.1 When this procedure is worked in radiological areas, an approved radiological work permit (RWP) is required. If radiological conditions or work performed falls outside the scope of the RWP, all work activities must be discontinued until a new or revised RWP has been issued in accordance with TFC-ESHQ-RP_RWP-C-03.

3.3.2 CIP tank draining and subsequent membrane flushing can result in a high foam level in Sump Tank 2. This high foam level can cause unexpected radioactive contamination of the sump hatch area.

3.3.3 When disconnecting, breaching or opening systems or system components that currently contain or previously contained radioactive material, the following actions apply:
- HPT coverage is required
- Pre-job and post-job HPT surveys are required
- Contamination controls shall be implemented in accordance with ETF-02-001, until radiological verifications have been performed.

3.4 Environmental Compliance

3.4.1 In the event of a spill/leak/release, notify the SOM/FWS and respond per ETF-ERP-85B-003, Emergency Spill or Release at ETF.
4.0 PREREQUISITES

4.1 Special Tools, Equipment, and Supplies

The following supplies may be needed to perform this procedure:

- Two buckets
- Minncare 1% test strips
- pH meter
- Portable two-way radio
- 1 liter (or smaller) open-topped container
- Verification water or lab demin water for 1-liter container
- Dip sampler
- Step ladder
- Cleaning supplies:
  - MC-1 (MSDS/SDS #0040428)
  - MemChem MCT201 (GHS/SDS #075499)
  - MC-4 (MSDS/SDS #040427B)
  - Kleen ENV911 (GHS/SDS #075500)
  - Sulfamic Acid (MSDS/SDS #041948A)
  - Muriatic Acid (MSDS/SDS #066257)
  - Tetra-Sodium EDTA (MSDS/SDS #060663)
  - Terg-A-Zyme (MSDS/SDS #056080)
  - MP-4 (MSDS/SDS #044692B)
  - Betz Dearborn RN DCL32 (GHS/SDS #075501)
  - Minncare – (MSDS/SDS #056706)

The following PPE is required when handling chemicals:

- Face shield
- Rubber or nitrile gloves (nitrile for Sulfamic Acid)
- Chemical goggles
- Protective apron.
4.2 Performance Documents

The following documents may be needed to perform this procedure:
- ETF-20B-001, Sump Tank/Pump System Operation
- ETF-60-002, Integrated MTT Operation
- ETF-60F-003, Degas/Reverse Osmosis System Operation.
- ETF-65D-003, Package Waste.

4.3 Field Preparations

4.3.1 WHEN adding verification water to CIP tank, ENSURE verification tank (60H-TK-1A) [60H-TK-1B] {60H-TK-1C} is in VERIFYING OPERATION mode.

4.3.2 CONFIRM nearest safety shower/eyewash station has been verified to be operable and accessible.
5.0 PROCEDURE

Special Instruction

Sections 5.3 through 5.11 in this procedure may be worked in any logical order.

Section 5.13 may be performed at any time where setpoint needs to be adjusted.

The use of ( ), [ ], and { } indicate components with the same function on a parallel system: Example - Three verification tanks (A), [B], {C} or RP Stage (1st)[2nd].

NOTE - To avoid excessive foaming in Sump Tank 2 in Section 5.2, the RO/filter cleaning switch is toggled ON to maintain sump tank level between 40 and 50%.

5.1 Valve Lineup Determination

5.1.1 (SOM) DETERMINE which valve lineup Checklists/Data sheets need to be performed.

5.1.2 (SOM) IF valves are known to be in the required position and do not require verification, INITIAL/DATE AND DOCUMENT reason in the comments section of the Checklist/Data Sheet.

5.1.3 (SOM) IF valves are not in the required position because of an existing process (i.e., LOTO, Caution Tag, Work Package, Administrative Lock, Facility Tag or Status Seals), MARK N/A on the Checklist/Data Sheet AND INITIAL/DATE AND DOCUMENT reason in the comments section of the Checklist/Data Sheet.
5.2 Prestart Verification and Valve Lineup

5.2.1 With Degas blower in SHUTDOWN, CYCLE (OPEN and CLOSE) Valve 60E-021 two or three times to clear Degas blower discharge line of liquid.

5.2.2 ENSURE SOVs on bank being flushed/cleaned/sanitized are closed per Data Sheet 3 – Solenoid Operated Valve Lineup.

5.2.3 DON PPE per appropriate ERA listed in Section 3.1.

5.2.4 ON MCC-4, ENSURE CIP pump 60F-P-4 disconnect is ON.

5.2.5 ON MDP-3, ENSURE breaker 9, CIP tank heater, is ON.

5.2.6 POSITION manual valves per Data Sheet 2 – CIP Tank Valve Lineup.

5.2.7 CLOSE 60F-209, 2nd RO feed tank re-circulation valve.

5.2.8 PLACE FCV182, 1st RO brine flow controller, in MANUAL, with output of 0%.

5.2.9 PLACE FCV262, 2nd RO brine flow controller, in MANUAL, with output of 0%.

5.2.10 ON graphic Sump Tank, SELECT RO/filter cleaning switch to ON.
5.3 Circulating Verification Water through RO Banks

NOTE - Section 5.3 is performed when circulating water through RO banks during shut down of MTT.

5.3.1 ADD verification water to CIP tank as follows:

5.3.1.1 THROTTLE valve 60F-052 ½ to ⅔ OPEN.

5.3.1.2 ON graphic 2nd RO,

OR

ON group 25, OBSERVE LT-60F303, CIP tank level.

5.3.1.3 WHEN LT-60F303 indicates 90% (Hi alarm setpoint), CLOSE valve 60F-052.

5.3.2 CONFIRM valves for bank(s) being circulated are positioned for flush/clean/sanitize per Data Sheet 1.

5.3.3 POSITION 3-way valve 60F-311 for flow to CIP tank.

5.3.4 OPEN valve 60F-315.

5.3.5 POSITION 60F-318 to ⅓ OPEN.

5.3.6 IF circulating 1st RO stage, OPEN valves 60F-055 and 60F-057.

5.3.7 IF circulating 2nd RO stage, OPEN valves 60F-056 and 60F-058.

5.3.8 ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, START VD235466, CIP pump.

CAUTION

CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

5.3.9 SLOWLY AND FULLY OPEN 60F-318.
5.3 Circulating Verification Water through RO Banks (Cont.)

NOTE - AH-60F-307, CIP high temperature alarm (122°F), stops CIP pump.

5.3.10 ON graphic 2nd RO, TI-60F307,

OR

LOCALLY ON TIT-60F-307, CHECK that temperature is less than 122°F.

5.3.11 ON graphic 2nd RO, TI-60F307,

OR

LOCALLY ON TIT-60F-307, CIRCULATE water until temperature is greater than 80°F.

5.3.12 ALLOW verification water to circulate for approximately 60 minutes.

5.3.13 IF circulating other RO banks, CHANGE RO banks as follows:

CAUTION

CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - CIP pump will automatically shut down if discharge pressure PIT-60F-304 exceeds 52 psi or drops below 25 psi.

5.3.13.1 SLOWLY POSITION 60F-318 until pressure as locally indicated on PIT-60F-304 is 45 to 50 psig.

5.3.13.2 OPEN concentrate and permeate CIP valves on RO bank to be cleaned per Data Sheet 1.

5.3.13.3 OPEN the following CIP feed and return valves for RO bank (1st) [2nd] to be cleaned:
   • (60F-055 and 60F-057)
   • [60F-056 and 60F-058].

5.3.13.4 CLOSE the following CIP feed and return valves for RO bank (1st) [2nd] not being cleaned:
   • (60F-055 and 60F-057)
   • [60F-056 and 60F-058].
5.3 Circulating Verification Water through RO Banks (Cont.)

5.3.13.5 CLOSE concentrate and permeate CIP valves on cleaned RO bank per Data Sheet 1.

**CAUTION**

CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

5.3.13.6 SLOWLY AND FULLY OPEN 60F-318.

5.3.14 IF additional RO banks need to be circulated, REPEAT steps 5.3.10 through 5.3.13 for each RO bank.

5.3.15 ON graphic 2nd RO, P4 (60FP4)

**OR**

ON group 25, STOP VD235467, CIP pump.

**Special Instructions**

CIP pump suction valve 60F-315 must be closed before draining CIP tank or the CIP pump will need re-priming before restarting.

5.3.16 DRAIN CIP tank to sump as follows:

5.3.16.1 CLOSE valve 60F-315.

5.3.16.2 OPEN valve 60F-314.

5.3.16.3 OBSERVE liquid level in CIP tank.

5.3.16.4 WHEN CIP tank is fully drained, THROTTLE HALF TO FULL OPEN valve 60F-052 to flush all chemical residues from CIP tank.

5.3.16.5 WHEN at least five minutes has elapsed, CLOSE 60F-052.

5.3.16.6 WHEN CIP tank is fully drained, CLOSE valve 60F-314.
5.4 Flushing RO Banks with Verification Water

Special Instructions
Membranes should be flushed with verification water at the following appropriate interval(s):

- Before adding MC-4, Kleen ENV911, MC-1, or MemChem MCT201 Sulfamic Acid, Muriatic Acid, Tetra-Sodium EDTA, or Terg-A-Zyme chemicals for cleaning
- Between MC-4, Kleen ENV911, MC-1, MemChem MCT201 Sulfamic Acid, Muriatic Acid, Tetra-Sodium EDTA, and Terg-A-Zyme cleaning cycles
- Before sanitizing with MP-4 or Betz Dearborn RN DCL32
- Before disinfecting with Minncare
- Before placing in service.

5.4.1 ENSURE prestart verification and valve lineup is complete per Section 5.2.

5.4.2 ADD verification water to CIP tank as follows:

5.4.2.1 THROTTLE valve 60F-052 ½ to ⅗ OPEN.

5.4.2.2 ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, OBSERVE LT-60F303, CIP tank level.

5.4.2.3 WHEN LT-60F303 indicates 90% (HI Alarm setpoint), CLOSE valve 60F-052.

5.4.3 CONFIRM valves for bank(s) being flushed are positioned for flush/clean/sanitize per Data Sheet 1.

5.4.4 IF flushing 1st RO stage, OPEN valves 60F-055 and 60F-057.

5.4.5 IF flushing 2nd RO stage, OPEN valves 60F-056 and 60F-058.

5.4.6 POSITION 3-way valve 60F-311 for flow to sump.

5.4.7 POSITION 3-way CIP feed valve for bank being flushed to CIP feed.

5.4.8 OPEN valve 60F-315.

5.4.9 THROTTLE 60F-318 to ⅛ OPEN.
5.4 Flushing RO Banks with Verification Water (Cont.)

5.4.10 ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, START VD235466, CIP pump.

CAUTION

CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

5.4.11 SLOWLY POSITION 60F-318 to maintain PIT-60F-304, CIP pump discharge pressure, above 25 psi.

NOTE - To avoid foam overflow during flushing after MC-4, Kleen ENV911, Terg-A-Zyme, or Tetra-Sodium EDTA, inspection of Sump Tank 2 and RO system drip trays is performed during flushing. A second operator may be required to observe Sump Tank 2 for foaming.

- Foaming in Sump Tank 2 is excessive when a level of foam is within three feet of the sump hatch.

5.4.12 IF chemical to be flushed is MC-4, Kleen ENV911, Terg-A-Zyme, or Tetra-Sodium EDTA, PERFORM inspection for excessive foaming as follows.

5.4.12.1 OPEN Sump Tank 2 hatch inspection lid to observe for foam level.

5.4.12.2 IF foam appears to be excessive, OPEN 60H-070 to knock down foam in Sump Tank 2.

5.4.12.3 CLOSE 60H-070.

5.4.12.4 INSPECT for foam backup in the drip trays under the following:
- CIP tank
- 1st RO banks
- 2nd RO banks
- 2nd RO feed tank.
5.4 Flushing RO Banks with Verification Water (Cont.)

NOTE - TAH-60F-307, CIP high temperature alarm (122°F) stops CIP pump.

5.4.13 ON graphic 2nd RO, TI-60F307,

OR

LOCALLY ON TIT-60F-307, CHECK that temperature is less than 122°F.

5.4.14 FLUSH solution from membranes as follows:

5.4.14.1 THROTTLE 60F-052 to maintain CIP tank level above 10%.

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

5.4.14.2 SLOWLY POSITION 60F-318 to maintain PIT-60F-304, CIP pump discharge pressure, above 25 psi and CIP tank level above 10%.

5.4.14.3 CONTINUE flushing for ten minutes, or as directed by process memo.

5.4.14.4 IMMEDIATELY BEFORE terminating flush, SLOWLY AND FULLY OPEN 60F-318.

5.4.14.5 ALLOW flow reading on FIT-60F-301 to stabilize.

5.4.14.6 ON Data Sheet 9 – Verification Water Flush, RECORD the following:

- RO stage/array/bank(s) flushed
- Date of verification water flush
- Time of verification water flush
- CIP flush flow (indicated by FIT-60F-301, record near end of flushing).

a. IF FIT-60F-301 is out of service, RECORD O/S.
5.4 Flushing RO Banks with Verification Water (Cont.)

5.4.15 IF flushing membranes to remove Minncare disinfecting solution, RECORD the following on Data Sheet 10 – Minncare Disinfection:
- Date of verification water flush
- Time of verification water flush.

5.4.16 IF flushing other RO banks, CHANGE RO banks as follows:

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - CIP pump will automatically shut down if discharge pressure PIT-60F-304 exceeds 52 psi or drops below 25 psi.

5.4.16.1 SLOWLY POSITION 60F-318 until pressure as locally indicated on PIT-60F-304 is 45 to 50 psig.

5.4.16.2 OPEN concentrate and permeate CIP valves on RO bank to be cleaned per Data Sheet 1.

5.4.16.3 OPEN the following CIP feed and return valves for RO bank (1st) [2nd] to be cleaned:
- (60F-055 and 60F-057)
- [60F-056 and 60F-058].

5.4.16.4 CLOSE the following CIP feed and return valves for RO bank (1st) [2nd] not being cleaned:
- (60F-055 and 60F-057)
- [60F-056 and 60F-058].

5.4.16.5 CLOSE concentrate and permeate CIP valves on cleaned RO bank per Data Sheet 1.
5.4  Flushing RO Banks with Verification Water (Cont.)

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

5.4.16.6  SLOWLY POSITION 60F-318 to maintain PIT-60F-304, CIP pump discharge pressure, above 25 psi and CIP tank level above 10%.

5.4.16.7  RETURN to step 5.4.14 to flush other RO banks.

5.4.17  IF chemical cleaning/flushing/sanitizing/disinfecting is complete, ON graphic 2nd RO, P4 (60FP4)
OR

ON group 25, STOP VD235467, CIP pump.

5.4.18  WHEN flushing of RO banks is complete, POSITION 60F-311 to CIP.

5.4.19  CLOSE 60F-052.

5.4.20  IF flushing in preparation for cleaning with MC-4 or Kleen ENV911, RECORD on Data Sheet 4, RO stage/array/bank(s) flushed.

5.4.21  IF flushing in preparation for cleaning with MC-1 or MemChem MCT201, RECORD on Data Sheet 5, RO stage/array/bank(s) flushed.

5.4.22  IF flushing in preparation for cleaning with Sulfamic Acid, RECORD on Data Sheet 11, RO stage/array/bank(s) flushed.

5.4.23  IF flushing in preparation for cleaning with Tetra-Sodium EDTA, RECORD on Data Sheet 6, RO stage/array/bank(s) flushed.

5.4.24  IF flushing in preparation for cleaning with Terg-A-Zyme, RECORD on Data Sheet 7, RO stage/array/bank(s) flushed.

5.4.25  IF flushing in preparation for sanitizing, RECORD on Data Sheet 8, RO stage/array/bank(s) flushed.

5.4.26  IF flushing in preparation for disinfecting, RECORD on Data Sheet 10, RO stage/array/bank(s) flushed.

5.4.27  IF flushing in preparation for cleaning with Muriatic Acid, RECORD on Data Sheet 12, RO stage/array/bank(s) flushed.
5.4 Flushing RO Banks with Verification Water (Cont.)

Special Instructions

CIP pump suction valve 60F-315 must be closed before draining CIP tank or the CIP pump will need re-priming before restarting.

5.4.28 IF cleaning and flushing cycles are complete, DRAIN CIP tank and pH probe to sump as follows:

5.4.28.1 CLOSE valve 60F-315.

5.4.28.2 OPEN valve 60F-314.

5.4.28.3 OBSERVE liquid level in CIP tank.

5.4.28.4 WHEN CIP tank is fully drained, CLOSE valve 60F-314.

5.4.28.5 ENSURE the following CIP feed and return valves are CLOSED:
- 60F-055
- 60F-057
- 60F-056
- 60F-058.

5.4.28.6 CLOSE valve 60F-326.

CAUTION

The pH electrode membrane will lose strength quickly if stored in verification water or high pH solutions.

5.4.28.7 DO NOT STORE pH probe AE-60F-450 in verification water or high pH solutions.

5.4.28.8 OPEN 60F-454 and 60F-452 to drain pH probe.

5.4.28.9 CLOSE 60F-454 and 60F-452.

5.4.28.10 ON graphic Sump Tank, SELECT RO/filter cleaning switch to OFF.
5.4 Flushing RO Banks with Verification Water (Cont.)

Special Instructions

Maintenance has 48 hours to lay up the probe or the probe will fail. The SOM must confirm layup is complete.

5.4.28.11 (SOM) REQUEST Maintenance lay up pH probe AE-60F-450 in 4 pH buffer.

5.4.28.12 (SOM) CONFIRM Maintenance has performed probe layup.

5.4.28.13 REQUEST RadCon survey Sump Tank 2 area and 2nd RO feed tank drip tray to ensure no foam overflow or backup has occurred.

5.4.29 IF flushed banks are to be cleaned with MC-4 or Kleen ENV911, GO TO Section 5.5.

5.4.30 IF flushed banks are to be cleaned with MC-1 or MemChem MCT201, GO TO Section 5.6.

5.4.31 IF flushed banks are to be cleaned with Sulfamic Acid, GO TO Section 5.7.

5.4.32 IF flushed banks are to be cleaned with Muriatic Acid, GO TO Section 5.8.

5.4.33 IF flushed banks are to be cleaned with Tetra-Sodium EDTA, GO TO Section 5.9.

5.4.34 IF flushed banks are to be cleaned with Terg-A-Zyme, GO TO Section 5.10.

5.4.35 IF flushed banks have been cleaned and are to be laid up more than 72 hours, GO TO Section 5.10.

5.4.36 IF flushed banks are to be laid up less than 72 hours and do not require sanitizing, POSITION 3-way valves for flushed bank to standby per Data Sheet 1.

5.4.37 IF flushed banks are to be disinfected with Minncare, GO TO Section 5.11.

5.4.38 IF no additional cleaning/sanitizing is required, GO TO step 5.4.39.
5.4 Flushing RO Banks with Verification Water (Cont.)

NOTE - FCV182 is typically set at a scalar of 10 to 25. Desired water recovery rate will be covered by process memo.

5.4.39 IF preparing to operate flushed membranes, PERFORM the following:

5.4.39.1 PLACE FCV182 in AUTO.

5.4.39.2 PLACE FCV262 in AUTO.

5.4.39.3 OPEN valve 60F-209.

5.4.39.4 GO TO ETF-60-002 to flood the membranes in preparation for startup,

OR

GO TO ETF-60F-003 to start up RO.

5.5 Cleaning RO Banks with MC-4 or Kleen ENV911

NOTE - MC-4 or Kleen ENV911 is used to remove organic contaminants, biogrowth and particulate matter from RO membranes. MC-4 and Kleen ENV911 are not effective at removing inorganic foulants from the RO membranes.

5.5.1 CONFIRM RO banks to be cleaned have been flushed with verification water per Section 5.4.

5.5.2 ON Data Sheet 4, RECORD date of MC-4 or Kleen ENV911 cleaning.

5.5.3 IF CIP tank level is less than 67%, ADD verification water to CIP tank as follows:

5.5.3.1 THROTTLE HALF TO FULL OPEN valve 60F-052.

5.5.3.2 ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, OBSERVE LT-60F303, CIP tank level.

5.5.3.3 WHEN LT-60F303 indicates 67%, CLOSE valve 60F-052.
5.5 Cleaning RO Banks with MC-4 or Kleen ENV911 (Cont.)

5.5.4 IF CIP tank level is more than 67%, DRAIN verification water from CIP tank as follows:

5.5.4.1 IF CIP pump is ON, PERFORM the following:
   a. POSITION valve 60F-311 to Sump Tank 2.
   b. ON graphic 2nd RO, P4 (60FP4)

   OR
   ON group 25, ENSURE CIP pump is ON.

   c. WHEN CIP tank level is 67%, POSITION valve 60F-311 to CIP tank.
   d. GO TO step 5.5.5.

5.5.4.2 IF CIP pump is OFF, PERFORM the following:
   a. ON graphic 2nd RO, P4 (60FP4)

   OR
   ON group 25, ENSURE CIP pump is OFF.

   b. OPEN valve 60F-314.

   c. WHEN CIP tank level is 67%, CLOSE valve 60F-314.

5.5.5 POSITION valves for bank(s) being flushed for flush/clean/sanitize per Data Sheet 1.

5.5.6 ENSURE the following CIP feed and return valves for RO stage (1st) [2nd] to be cleaned are OPEN:
   • (60F-055 and 60F-057)
   • [60F-056 and 60F-058].

5.5.7 ENSURE the following CIP feed and return valves for RO stage (1st) [2nd] not being cleaned are CLOSED:
   • (60F-055 and 60F-057)
   • [60F-056 and 60F-058].

5.5.8 CHECK 3-way valve 60F-311 for flow to CIP tank.
5.5 Cleaning RO Banks with MC-4 or Kleen ENV911 (Cont.)

5.5.9 ENSURE valve 60F-315 is OPEN.

**CAUTION**

CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

5.5.10 SLOWLY POSITION 60F-318 to ½ OPEN.

5.5.11 ON graphic 2nd RO, P4 (60FP4)

**OR**

ON group 25, ENSURE CIP pump is ON.

**CAUTION**

CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - The feed flow rate for 1st RO, 1st array bank should be 60 to 80 gpm and for 1st RO, 2nd array flow rate should be 30 to 40 gpm. At higher flow rates, excessive pressure drop may result in re-depositing dirt on the membrane. If flow meter FIT-60F-301 is O/S, the feed flow rate is considered adequate based upon CIP pump 60F P-4 output pressure of 25 to 52 psig and confirmation of the valve lineup per Data Sheet 1.

5.5.12 SLOWLY POSITION 60F-318 to achieve desired feed flow rate noted above.

NOTE - TAH-60F-307, CIP high temperature alarm (122°F) stops CIP pump.

5.5.13 ON graphic 2nd RO, TI-60F307,

**OR**

LOCALLY ON TIT-60F-307, CHECK that temperature is less than 122°F.

5.5.14 IF setpoint needs to be adjusted, PERFORM Section 5.13.
5.5 Cleaning RO Banks with MC-4 or Kleen ENV911 (Cont.)

5.5.15 ON graphic 2nd RO, TI-60F307, OR

LOCALLY ON TIT-60F-307, CIRCULATE water until temperature is greater than 80°F.

5.5.16 USE Table 1 AND DETERMINE amount of MC-4 or Kleen ENV911 to add.

**WARNING**

MC-4 and Kleen ENV911 are corrosive to eyes and skin and causes respiratory tract irritation.

5.5.17 DON the following PPE:

- Face shield
- Rubber or nitrile gloves
- Chemical goggles
- Protective apron.

NOTE - MC-4 or Kleen ENV911 is added slowly (approximately two minutes) to ensure proper mixing.

5.5.18 SLOWLY ADD MC-4 or Kleen ENV911 to CIP tank.

5.5.19 ALLOW CIP tank to circulate for at least ten minutes, or time directed by SOM.

5.5.19.1 IF SOM direction provided, RECORD in ETF Control Room Logbook.
5.5 Cleaning RO Banks with MC-4 or Kleen ENV911 (Cont.)

5.5.20 DETERMINE pH for cleaning solution.

5.5.20.1 IF using in-line pH instrument, OBTAIN pH reading from AI-60F-450.

5.5.20.2 IF using sampling method, PERFORM the following:

a. SLOWLY OPEN 60F-327 or 60F-455.

b. PURGE 0.1 liter (100 ml) of liquid through valve, into a container.

c. OBTAIN sample.

d. IF sample cannot be obtained from 60F-327 or 60F-455, DIP SAMPLE CIP tank contents.

e. CHECK sample with pH meter.

f. RINSE pH meter with clean water.

g. EMPTY any residual liquids into Sump Tank 1 or Sump Tank 2.

5.5.21 IF solution is less than 10.5 pH, ADD MC-4 or Kleen ENV911 in 0.5 lb (0.6 liter) batches by repeating steps 5.5.17 through 5.5.20 until pH is 10.5 to 12.5.

5.5.22 REMOVE PPE.

5.5.23 ON Data Sheet 4, RECORD cleaning solution pH and amount of MC-4 or Kleen ENV911 added.

5.5.24 ON Data Sheet 4, RECORD CIP recirculation flow, as indicated by FIT-60F-301.

5.5.24.1 IF FIT-60F-301 is out of service, RECORD O/S.
5.5 Cleaning RO Banks with MC-4 or Kleen ENV911 (Cont.)

NOTE - Membrane soak cycle may be performed while cleaning other banks. For example, 2nd RO Array A may be soaking while 2nd RO Array B is in recirculation.

5.5.25 IF cleaning other RO banks, CHANGE RO banks as follows:

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - CIP pump will automatically shut down if discharge pressure PIT-60F-304 exceeds 52 psi or drops below 25 psi.

5.5.25.1 SLOWLY POSITION 60F-318 until pressure as locally indicated on PIT-60F-304 is 45 to 50 psig.

5.5.25.2 OPEN concentrate and permeate CIP valves on RO bank to be cleaned per Data Sheet 1.

5.5.25.3 OPEN the following CIP feed and return valves for RO bank (1st) [2nd] to be cleaned:
   - (60F-055 and 60F-057)
   - [60F-056 and 60F-058].

5.5.25.4 CLOSE the following CIP feed and return valves for RO bank (1st) [2nd] not being cleaned:
   - (60F-055 and 60F-057)
   - [60F-056 and 60F-058].

5.5.25.5 CLOSE concentrate and permeate CIP valves on cleaned RO bank per Data Sheet 1.
CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - The feed flow rate for 1st RO, 1st array bank should be 60 to 80 gpm and for 1st RO, 2nd array flow rate should be 30 to 40 gpm. At higher flow rates, excessive pressure drop may result in re-depositing dirt on the membrane. If flow meter FIT-60F-301 is O/S, the feed flow rate is considered adequate based upon CIP pump 60F P-4 output pressure of 25 to 52 psig and confirmation of the valve lineup per Data Sheet 1.

5.5.25.6 SLOWLY POSITION 60F-318 to achieve desired feed flow rate noted above.

5.5.25.7 ON Data Sheet 4, RECORD what time 1st (2nd) [3rd] MC-4 or Kleen ENV911 cleaning cycle was completed.

5.5.26 PERFORM a second cleaning cycle, unless otherwise directed by process memo.

5.5.26.1 DON PPE per step 5.5.17.

5.5.26.2 REPEAT steps 5.5.20 through 5.5.25.

5.5.27 PERFORM a third cleaning cycle, unless otherwise directed by process memo.

5.5.27.1 DON PPE per step 5.5.17.

5.5.27.2 REPEAT steps 5.5.20 through 5.5.25.

5.5.28 IF cleaning cycle is complete, ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, SHUT DOWN VD235467, CIP pump.
5.5 Cleaning RO Banks with MC-4 or Kleen ENV911 (Cont.)

**Special Instructions**

CIP pump suction valve 60F-315 must be closed before draining CIP tank or the CIP pump will need re-priming before restarting.

NOTE - To avoid foam overflow, inspection of Sump Tank 2 and RO system drip trays is performed during CIP tank draining.

5.5.29 **DRAIN** contents of CIP tank to sump as follows:

5.5.29.1 **CLOSE** valve 60F-315.

5.5.29.2 **OPEN** valve 60F-314 to approximately \( \frac{1}{4} \) OPEN.

5.5.29.3 **OBSERVE** liquid level in CIP tank decreasing.

NOTE - Foaming in Sump Tank 2 is excessive when a level of foam is within three feet of the sump hatch.

5.5.29.4 **PERFORM** inspection for excessive foaming as follows.

a. **OPEN** Sump Tank 2 hatch inspection lid to observe for foam level.

b. **IF** foam appears to be excessive, **OPEN** 60H-070 to knock down foam in Sump Tank 2.

c. **CLOSE** 60H-070.

d. **INSPECT** for foam backup in the drip trays under the following:
   - CIP tank
   - 1st RO banks
   - 2nd RO banks
   - 2nd RO feed tank.

e. **IF** foam backup is observed, **THROTTLE CLOSE** 60F-314 until foam is backed down.
5.5 Cleaning RO Banks with MC-4 or Kleen ENV911 (Cont.)

5.5.29.5 WHEN CIP tank is fully drained, THROTTLE HALF TO FULL OPEN valve 60F-052 to flush all chemical residues from CIP tank.

5.5.29.6 PERFORM inspection for excessive foaming per step 5.5.29.4.

5.5.29.7 WHEN at least five minutes has elapsed, CLOSE 60F-052.

5.5.29.8 WHEN CIP tank is fully drained, CLOSE valve 60F-314.

5.5.29.9 GO TO Section 5.4 AND FLUSH banks with verification water.

5.6 Cleaning RO Banks with MC-1 or MemChem MCT201

NOTE - MC-1 and MemChem MCT201 are used to remove inorganic compounds (e.g., metals and salts) from RO membranes. MC-1 and MemChem MCT201 are not effective at removing organic or biological foulants from the RO membranes.

5.6.1 CONFIRM RO banks to be cleaned have been flushed with verification water per Section 5.4.

5.6.2 ON Data Sheet 5, RECORD date of MC-1 or MemChem MCT201 cleaning.

5.6.3 IF CIP tank level is less than 80%, ADD verification water to CIP tank as follows:

5.6.3.1 THROTTLE HALF TO FULL OPEN valve 60F-052.

5.6.3.2 ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, OBSERVE LT-60F303, CIP tank level.

5.6.3.3 WHEN LT-60F303 indicates 80%, CLOSE valve 60F-052.
5.6 Cleaning RO Banks with MC-1 or MemChem MCT201 (Cont.)

5.6.4 IF CIP tank level is more than 80%, DRAIN verification water from CIP tank as follows:

5.6.4.1 IF CIP pump is ON, PERFORM the following:

a. POSITION valve 60F-311 to Sump Tank 2.

b. ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, ENSURE CIP pump is ON.

c. WHEN CIP tank level is 80%, POSITION valve 60F-311 to CIP tank.

d. GO TO step 5.6.5.

5.6.4.2 IF CIP pump is OFF, PERFORM the following:

a. ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, ENSURE CIP pump is OFF.

b. OPEN valve 60F-314.

c. WHEN CIP tank level is 80%, CLOSE valve 60F-314.

5.6.5 CONFIRM valves for bank(s) being cleaned are positioned for flush/clean/sanitize per Data Sheet 1.

5.6.6 ENSURE CIP feed and return valves for RO stage (1st) [2nd] to be cleaned are OPEN:

• (60F-055 and 60F-057)
• [60F-056 and 60F-058].

5.6.7 ENSURE CIP feed and return valves for RO stage (1st) [2nd] not being cleaned are CLOSED:

• (60F-055 and 60F-057)
• [60F-056 and 60F-058].
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5.6 Cleaning RO Banks with MC-1 or MemChem MCT201 (Cont.)

5.6.8 CHECK 3-way valve 60F-311 for flow to CIP tank.

5.6.9 ENSURE valve 60F-315 is OPEN.

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

5.6.10 SLOWLY THROTTLE 60F-318 to 1/2 OPEN.

5.6.11 ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, ENSURE CIP pump is ON.

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - The feed flow rate for 1st RO, 1st array bank should be 60 to 80 gpm and for 1st RO, 2nd array flow rate should be 30 to 40 gpm. At higher flow rates, excessive pressure drop may result in re-depositing dirt on the membrane. If flow meter FIT-60F-301 is O/S, the feed flow rate is considered adequate based upon CIP pump 60F P-4 output pressure of 25 to 52 psig and confirmation of the valve lineup per Data Sheet 1.

5.6.12 SLOWLY POSITION 60F-318 to achieve desired feed flow rate noted above.

NOTE - TAH-60F-307, CIP high temperature alarm (122°F) stops CIP pump.

5.6.13 ON graphic 2nd RO, TI-60F307,

OR

LOCALLY ON TIT-60F-307, CHECK that temperature is less than 122°F.
5.6 Cleaning RO Banks with MC-1 or MemChem MCT201 (Cont.)

5.6.14 ON graphic 2nd RO, TI-60F307,

OR

LOCALLY ON TIT-60F-307, CIRCULATE water until temperature is greater than 80°F.

5.6.15 USE Table 1 AND DETERMINE amount of MC-1 or MemChem MCT201 to add.

WARNING
MC-1 and MemChem MCT201 causes eye, skin, and respiratory tract irritation.

5.6.16 DON the following PPE:
- Face shield
- Rubber or nitrile gloves
- Chemical goggles
- Protective apron.

NOTE - MC-1 or MemChem MCT201 is added slowly (approximately two minutes) to ensure proper mixing.

5.6.17 SLOWLY ADD MC-1 or MemChem MCT201 to CIP tank.

5.6.18 ALLOW CIP tank to circulate for at least ten minutes, or time directed by SOM.

5.6.18.1 IF SOM direction provided, RECORD in ETF Control Room Logbook.
5.6 Cleaning RO Banks with MC-1 or MemChem MCT201 (Cont.)

5.6.19 DETERMINE pH for cleaning solution.

5.6.19.1 IF using in-line pH instrument, OBTAIN pH reading from Al-60F-450.

5.6.19.2 IF using sampling method, PERFORM the following:
   a. SLOWLY OPEN 60F-327 or 60F-455.
   b. PURGE 0.1 liter (100 ml) of liquid through valve, into a container.
   c. OBTAIN sample.
   d. IF sample cannot be obtained from 60F-327 or 60F-455, DIP SAMPLE CIP tank contents.
   e. CHECK sample with pH meter.
   f. RINSE pH meter with clean water.
   g. EMPTY any residual liquids into Sump Tank 1 or Sump Tank 2.

5.6.20 IF MC-1 or MemChem MCT201 solution is greater than 3.5 pH, ADD MC-1 or MemChem MCT201 in 1.0 lb (0.3 liter) batches by repeating steps 5.6.17 through 5.6.19 until pH is 2.0 to 3.5.

5.6.21 REMOVE PPE.

5.6.22 ON Data Sheet 5, RECORD cleaning solution pH and amount of MC-1 or MemChem MCT201 added.

5.6.23 ON Data Sheet 5, RECORD CIP recirculation flow, as indicated by FIT-60F-301.

5.6.23.1 IF FIT-60F-301 is out of service, RECORD O/S.
5.6 Cleaning RO Banks with MC-1 or MemChem MCT201 (Cont.)

NOTE - Membrane soak cycle may be performed while cleaning other banks. For example, 2nd RO Bank A may be soaking while 2nd RO Bank B is in recirculation.

5.6.24 IF cleaning other RO banks, CHANGE RO banks as follows:

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - CIP pump will automatically shut down if discharge pressure PIT-60F-304 exceeds 52 psi or drops below 25 psi.

5.6.24.1 SLOWLY POSITION 60F-318 until pressure as locally indicated on PIT-60F-304 is 45 to 50 psig.

5.6.24.2 OPEN concentrate and permeate CIP valves on RO bank to be cleaned per Data Sheet 1.

5.6.24.3 OPEN the following CIP feed and return valves for RO bank (1st) [2nd] to be cleaned:

- (60F-055 and 60F-057)
- [60F-056 and 60F-058].

5.6.24.4 CLOSE CIP feed and return valves for RO bank (1st) [2nd] not being cleaned:

- (60F-055 and 60F-057)
- [60F-056 and 60F-058].

5.6.24.5 CLOSE concentrate and permeate CIP valves on cleaned RO bank per Data Sheet 1.
5.6 Cleaning RO Banks with MC-1 or MemChem MCT201 (Cont.)

**CAUTION**

CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - The feed flow rate for 1st RO, 1st array bank should be 60 to 80 gpm and for 1st RO, 2nd array flow rate should be 30 to 40 gpm. At higher flow rates, excessive pressure drop may result in re-depositing dirt on the membrane. If flow meter FIT-60F-301 is O/S, the feed flow rate is considered adequate based upon CIP pump 60F P-4 output pressure of 25 to 52 psig and confirmation of the valve lineup per Data Sheet 1.

5.6.24.6 SLOWLY POSITION 60F-318 to achieve desired feed flow rate noted above.

5.6.25 ON Data Sheet 5, RECORD what time 1st (2nd) {3rd} MC-1 or MemChem MCT201 cleaning cycle was completed.

5.6.26 PERFORM a second cleaning cycle, unless otherwise directed by process memo.

5.6.26.1 DON PPE per step 5.6.16.

5.6.26.2 REPEAT steps 5.6.19 through 5.6.24.5.

5.6.27 PERFORM a third cleaning cycle, unless otherwise directed by process memo.

5.6.27.1 DON PPE per step 5.6.16.

5.6.27.2 REPEAT steps 5.6.19 through 5.6.24.5.

5.6.28 IF cleaning cycle is complete, ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, SHUT DOWN VD235467, CIP pump.
5.6 Cleaning RO Banks with MC-1 or MemChem MCT201 (Cont.)

Special Instructions

CIP pump suction valve 60F-315 must be closed before draining CIP tank or the CIP pump will need re-priming before restarting.

5.6.29 DRAIN CIP tank to sump as follows:

5.6.29.1 CLOSE valve 60F-315.

5.6.29.2 OPEN valve 60F-314.

5.6.29.3 OBSERVE liquid level in CIP tank.

5.6.29.4 WHEN CIP tank is fully drained, THROTTLE HALF TO FULL OPEN valve 60F-052 to flush all chemical residues from CIP tank.

5.6.29.5 WHEN at least five minutes has elapsed, CLOSE 60F-052.

5.6.29.6 WHEN CIP tank is fully drained, CLOSE valve 60F-314.

5.6.30 GO TO Section 5.4 to flush banks with verification water.
5.7 Cleaning RO Banks with Sulfamic Acid

NOTE - Sulfamic Acid is used to remove inorganic compounds (e.g., metals and salts) from RO membranes. Sulfamic Acid is not effective at removing organic or biological foulants from the RO membranes.

5.7.1 CONFIRM RO banks to be cleaned have been flushed with verification water per Section 5.4.

5.7.2 ON Data Sheet 11, RECORD date of Sulfamic Acid cleaning.

5.7.3 IF CIP tank level is less than 80%, ADD verification water to CIP tank as follows:

5.7.3.1 THROTTLE HALF TO FULL OPEN valve 60F-052.

5.7.3.2 ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, OBSERVE LT-60F303, CIP tank level.

5.7.3.3 WHEN LT-60F303 indicates 80%, CLOSE valve 60F-052.

5.7.4 IF CIP tank level is more than 80%, DRAIN verification water from CIP tank as follows:

5.7.4.1 IF CIP pump is ON, PERFORM the following:

a. POSITION valve 60F-311 to Sump Tank 2.

b. ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, ENSURE CIP pump is ON.

c. WHEN CIP tank level is 80%, POSITION valve 60F-311 to CIP tank.

d. GO TO step 5.7.5.
5.7 Cleaning RO Banks with Sulfamic Acid (Cont.)

5.7.4.2 IF CIP pump is OFF, **PERFORM** the following:

a. ON graphic 2nd RO, P4 (60FP4)

**OR**

ON group 25, **ENSURE** CIP pump is OFF.

b. OPEN valve 60F-314.

c. WHEN CIP tank level is 80%, CLOSE valve 60F-314.

5.7.5 **CONFIRM** valves for bank(s) being cleaned are positioned for flush/clean/sanitize per Data Sheet 1.

5.7.6 **ENSURE** CIP feed and return valves for RO stage (1st) [2nd] to be cleaned are **OPEN**:

• (60F-055 and 60F-057)
• [60F-056 and 60F-058].

5.7.7 **ENSURE** CIP feed and return valves for RO stage (1st) [2nd] not being cleaned are **CLOSED**:

• (60F-055 and 60F-057)
• [60F-056 and 60F-058].

5.7.8 **CHECK** 3-way valve 60F-311 for flow to CIP tank.

5.7.9 **ENSURE** valve 60F-315 is OPEN.

**CAUTION**

CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

5.7.10 **SLOWLY POSITION** 60F-318 to ½ OPEN.

5.7.11 ON graphic 2nd RO, P4 (60FP4)

**OR**

ON group 25, **ENSURE** CIP pump is ON.
5.7 Cleaning RO Banks with Sulfamic Acid (Cont.)

**CAUTION**
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - The feed flow rate for 1st RO, 1st array bank should be 60 to 80 gpm and for 1st RO, 2nd array flow rate should be 30 to 40 gpm. At higher flow rates, excessive pressure drop may result in re-depositing dirt on the membrane. If flow meter FIT-60F-301 is O/S, the feed flow rate is considered adequate based upon CIP pump 60F P-4 output pressure of 25 to 52 psig and confirmation of the valve lineup per Data Sheet 1.

5.7.12 SLOWLY POSITION 60F-318 to achieve desired feed flow rate noted above.

NOTE - TAH-60F-307, CIP high temperature alarm (122°F), stops CIP pump.

5.7.13 ON graphic 2nd RO, TI-60F307,

OR

LOCALLY ON TIT-60F-307, CHECK that temperature is less than 122°F.

5.7.14 ON graphic 2nd RO, TI-60F307,

OR

LOCALLY ON TIT-60F-307, CIRCULATE water until temperature is approximately 77°F.

5.7.15 USE Table 1 AND

DETERMINE amount of Sulfamic Acid to add.

**WARNING**
Sulfamic Acid causes severe eye, skin damage, and respiratory tract irritation.

5.7.16 DON the following PPE:
- Face shield
- Nitrile gloves
- Chemical goggles
- Protective apron.
5.7 Cleaning RO Banks with Sulfamic Acid (Cont.)

NOTE - Sulfamic Acid is added slowly (approximately two minutes) to ensure proper mixing.

5.7.17 SLOWLY ADD Sulfamic Acid to CIP tank.

5.7.18 ALLOW CIP tank to circulate for at least five minutes, or time directed by SOM.

5.7.18.1 IF SOM direction provided, RECORD in ETF Control Room Logbook.

5.7.19 DETERMINE pH for cleaning solution.

5.7.19.1 IF using in-line pH instrument, OBTAIN pH reading from AI-60F-450.

5.7.19.2 IF using sampling method, PERFORM the following:

   a. SLOWLY OPEN 60F-327 or 60F-455.
   b. PURGE 0.1 liter (100 ml) of liquid through valve, into a container.
   c. OBTAIN sample.
   d. IF sample cannot be obtained from 60F-327 or 60F-455, DIP SAMPLE CIP tank contents.
   e. CHECK sample with pH meter.
   f. RINSE pH meter with clean water.
   g. EMPTY any residual liquids into Sump Tank 1 or Sump Tank 2.

5.7.20 IF Sulfamic Acid solution is greater than 3.0 pH, ADD Sulfamic Acid in 2.0 lb batches by repeating steps 5.7.17 through 5.7.19 until pH is 1.5 to 3.0.

5.7.21 REMOVE PPE.

5.7.22 ON Data Sheet 11, RECORD cleaning solution pH and amount of Sulfamic Acid added.
5.7 Cleaning RO Banks with Sulfamic Acid (Cont.)

5.7.23 ON Data Sheet 11, RECORD CIP recirculation flow, as indicated by FIT-60F-301.

5.7.23.1 IF FIT-60F-301 is out of service, RECORD O/S.

NOTE - Membrane soak cycle may be performed while cleaning other banks. For example, 2nd RO Array A may be soaking while 2nd RO Array B is in recirculation.

5.7.24 IF cleaning other RO banks, CHANGE RO banks as follows:

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - CIP pump will automatically shut down if discharge pressure PIT-60F-304 exceeds 52 psi or drops below 25 psi.

5.7.24.1 SLOWLY POSITION 60F-318 until pressure as locally indicated on PIT-60F-304 is 45 to 50 psig.

5.7.24.2 OPEN concentrate and permeate CIP valves on RO bank to be cleaned per Data Sheet 1.

5.7.24.3 OPEN the following CIP feed and return valves for RO bank (1st) [2nd] to be cleaned:
   • (60F-055 and 60F-057)
   • [60F-056 and 60F-058].

5.7.24.4 CLOSE the following CIP feed and return valves for RO bank (1st) [2nd] not being cleaned:
   • (60F-055 and 60F-057)
   • [60F-056 and 60F-058].

5.7.24.5 CLOSE concentrate and permeate CIP valves on cleaned RO bank per Data Sheet 1.
5.7 Cleaning RO Banks with Sulfamic Acid (Cont.)

**CAUTION**

CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - The feed flow rate for 1st RO, 1st array bank should be 60 to 80 gpm and for 1st RO, 2nd array flow rate should be 30 to 40 gpm. At higher flow rates, excessive pressure drop may result in re-depositing dirt on the membrane. If flow meter FIT-60F-301 is O/S, the feed flow rate is considered adequate based upon CIP pump 60F P-4 output pressure of 25 to 52 psig and confirmation of the valve lineup per Data Sheet 1.

5.7.24.6 SLOWLY POSITION 60F-318 to achieve desired feed flow rate noted above.

5.7.24.7 ON Data Sheet 11, RECORD what time 1st (2nd) {3rd} Sulfamic Acid cleaning cycle was completed.

5.7.25 PERFORM a second cleaning cycle, unless otherwise directed by process memo.

5.7.25.1 DON PPE per step 5.7.16.

5.7.25.2 REPEAT steps 5.7.19 through 5.7.24.

5.7.26 PERFORM a third cleaning cycle, unless otherwise directed by process memo.

5.7.26.1 DON PPE per step 5.7.16.

5.7.26.2 REPEAT steps 5.7.19 through 5.7.24.

5.7.27 IF cleaning cycle is complete, THEN ON graphic 2nd RO, P4 (60FP4)

**OR**

ON group 25, SHUT DOWN VD235467, CIP pump.
5.7 **Cleaning RO Banks with Sulfamic Acid (Cont.)**

**Special Instructions**

CIP pump suction valve 60F-315 must be closed before draining CIP tank or the CIP pump will need re-priming before restarting.

5.7.28 **DRAIN** CIP tank to sump as follows:

5.7.28.1 **CLOSE** valve 60F-315.

5.7.28.2 **OPEN** valve 60F-314.

5.7.28.3 **OBSERVE** liquid level in CIP tank.

5.7.28.4 **WHEN** CIP tank is fully drained, **THROTTLE HALF TO FULL OPEN** valve 60F-052 to flush all chemical residues from CIP tank.

5.7.28.5 **WHEN** at least five minutes has elapsed, **CLOSE** 60F-052.

5.7.28.6 **WHEN** CIP tank is fully drained, **CLOSE** valve 60F-314.

5.7.29 **GO TO** Section 5.4 to flush banks with verification water.
5.8 Cleaning RO Banks with Muriatic Acid

NOTE - Muriatic Acid is used to remove inorganic compounds (e.g., metals and salts) from RO membranes. Muriatic Acid is not effective at removing organic or biological foulants from the RO membranes.

5.8.1 CONFIRM RO banks to be cleaned have been flushed with verification water per Section 5.4.

5.8.2 ENSURE Sump Tank 2 has been pumped down to a minimum level and placed in MANUAL per ETF-20B-001.

5.8.3 ON Data Sheet 12, RECORD the date of the Muriatic Acid cleaning.

5.8.4 DRAIN CIP tank as follows:

5.8.4.1 ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, ENSURE CIP pump is OFF.

5.8.4.2 ENSURE 60F-315 is CLOSED.

5.8.4.3 OPEN valve 60F-314.

5.8.4.4 WHEN CIP tank is completely drained, CLOSE valve 60F-314.

5.8.5 ADD 4% NaOH to CIP tank, THEN ADD to Sump Tank 2 as follows:

5.8.5.1 ENSURE 60F-314 is CLOSED.

5.8.5.2 OPEN valve 65C-310 to start NaOH flow.

5.8.5.3 WHEN CIP tank level is 5%, CLOSE valve 65C-310.

5.8.5.4 OPEN valve 60F-314.

5.8.5.5 WHEN CIP tank is completely drained, CLOSE valve 60F-314.
5.8 Cleaning RO Banks with Muriatic Acid (Cont.)

5.8.6 **RINSE AND REFILL** CIP tank as follows:

5.8.6.1 **THROTTLE HALF TO FULL OPEN** valve 60F-052.

5.8.6.2 **WHEN** CIP tank level is 20%, **CLOSE** valve 60F-052.

5.8.6.3 **OPEN** valve 60F-314 to drain tank to Sump Tank 2.

5.8.6.4 **WHEN** CIP tank is completely drained, **CLOSE** valve 60F-314.

5.8.6.5 **THROTTLE HALF TO FULL OPEN** valve 60F-052.

5.8.6.6 **WHEN** CIP tank level is 80%, **CLOSE** valve 60F-052.

5.8.7 **CONFIRM** valves for bank(s) being cleaned are positioned for flush/clean/sanitize per Data Sheet 1.

5.8.8 **ENSURE** CIP feed and return valves for RO stage (1st) [2nd] to be cleaned are **OPEN**:

- (60F-055 and 60F-057)
- [60F-056 and 60F-058].

5.8.9 **ENSURE** CIP feed and return valves for RO stage (1st) [2nd] not being cleaned are **CLOSED**:

- (60F-055 and 60F-057)
- [60F-056 and 60F-058].

5.8.10 **CHECK** 3-way valve 60F-311 for flow to CIP tank.

5.8.11 **ENSURE** valve 60F-315 is **OPEN**.

---

**CAUTION**

CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

5.8.12 **SLOWLY POSITION** 60F-318 to ½ **OPEN**.

5.8.13 **ON** graphic 2nd RO, P4 (60FP4)

**OR**

**ON** group 25, **ENSURE** CIP pump is **ON**.
5.8 Cleaning RO Banks with Muriatic Acid (Cont.)

**CAUTION**

CIP valve 60F-318 must be opened slowly to prevent pressure surge damage to RO membranes.

NOTE - The feed flow rate for 1st RO, 1st array bank should be 60 to 80 gpm and for 1st RO, 2nd array flow rate should be 30 to 40 gpm. At higher flow rates, excessive pressure drop may result in re-depositing dirt on the membrane. If flow meter FIT-60F-301 is O/S, the feed flow rate is considered adequate based upon CIP pump 60F P-4 output pressure of 25 to 52 psig and confirmation of the valve lineup per Data Sheet 1.

5.8.14 **SLOWLY POSITION** 60F-318 to achieve desired feed flow rate noted above.

NOTE - TAH-60F-307, CIP high temperature alarm (122°F) stops CIP pump.

5.8.15 **ON** graphic 2nd RO, TI-60F307,

**OR**

**LOCALLY ON** TIT-60F-307, **CHECK** that temperature is less than 122°F.

5.8.16 **ON** graphic 2nd RO, TI-60F307,

**OR**

**LOCALLY ON** TIT-60F-307, **CIRCULATE** water until temperature is approximately 77°F.

5.8.17 **USE** Table 1 **AND**

**DETERMINE** amount of Muriatic Acid to add.

**WARNING**

Muriatic Acid causes severe eye, skin damage, and respiratory tract irritation.

5.8.18 **DON** the following PPE:

- Face shield
- Rubber or nitrile gloves
- Chemical goggles
- Protective apron.
5.8 Cleaning RO Banks with Muriatic Acid (Cont.)

NOTE - Muriatic Acid is added slowly (approximately two minutes) to ensure proper mixing.

5.8.19 **SLOWLY ADD** Muriatic Acid to CIP tank via funnel on top of tank.

5.8.20 **POUR** additional (one to two gallons) clean water into funnel to rinse it out.

5.8.21 **ALLOW** CIP tank to circulate for at least five minutes, or time directed by SOM.

5.8.21.1 **IF** SOM direction provided, **RECORD** in ETF Control Room Logbook.

5.8.22 **DETERMINE** pH for cleaning solution.

5.8.22.1 **IF** using in-line pH instrument, **OBTAIN** pH reading from AI-60F-450.

5.8.22.2 **IF** using sampling method, **PERFORM** the following:
   a. **SLOWLY OPEN** 60F-327 or 60F-455.
   b. **PURGE** 0.1 liter (100 ml) of liquid through valve, into a container.
   c. **OBTAIN** sample.
   d. **IF** sample cannot be obtained from 60F-327 or 60F-455, **DIP** SAMPLE CIP tank contents.
   e. **CHECK** sample with pH meter.
   f. **RINSE** pH meter with clean water.
   g. **EMPTY** any residual liquids into Sump Tank 1 or Sump Tank 2.

NOTE - Additional amounts of Muriatic Acid should not be added at this time.

5.8.23 **DO NOT ADD** additional amounts of Muriatic Acid.

5.8.24 **REMOVE** PPE.
5.8 Cleaning RO Banks with Muriatic Acid (Cont.)

5.8.25 ON Data Sheet 12, RECORD cleaning solution pH and amount of Muriatic Acid added.

5.8.26 ON Data Sheet 12, RECORD CIP recirculation flow, as indicated by FIT-60F-301.

5.8.26.1 IF FIT-60F-301 is out of service, RECORD O/S.

NOTE - Membrane soak cycle may be performed while cleaning other banks. For example, 2nd RO Array A may be soaking while 2nd RO Array B is in recirculation.

5.8.27 IF cleaning other RO banks, CHANGE RO banks as follows:

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - CIP pump will automatically shut down if discharge pressure PIT-60F-304 exceeds 52 psi or drops below 25 psi.

5.8.27.1 SLOWLY POSITION 60F-318 until pressure as locally indicated on PIT-60F-304 is 45 to 50 psig.

5.8.27.2 OPEN concentrate and permeate CIP valves on RO bank to be cleaned per Data Sheet 1.

5.8.27.3 OPEN the following CIP feed and return valves for RO bank (1st) [2nd] to be cleaned:
   • (60F-055 and 60F-057)
   • [60F-056 and 60F-058].

5.8.27.4 CLOSE the following CIP feed and return valves for RO bank (1st) [2nd] not being cleaned:
   • (60F-055 and 60F-057)
   • [60F-056 and 60F-058].

5.8.27.5 CLOSE concentrate and permeate CIP valves on cleaned RO bank per Data Sheet 1.
5.8 Cleaning RO Banks with Muriatic Acid (Cont.)

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - The feed flow rate for 1st RO, 1st array bank should be 60 to 80 gpm and for 1st RO, 2nd array flow rate should be 30 to 40 gpm. At higher flow rates, excessive pressure drop may result in re-depositing dirt on the membrane. If flow meter FIT-60F-301 is O/S, the feed flow rate is considered adequate based upon CIP pump 60F P-4 output pressure of 25 to 52 psig and confirmation of the valve lineup per Data Sheet 1.

5.8.27.6 SLOWLY POSITION 60F-318 to achieve desired feed flow rate noted above.

5.8.27.7 RECORD, on Data Sheet 12, time 1st (2nd) {3rd} Muriatic Acid cleaning cycle completed.

5.8.28 PERFORM a second cleaning cycle, unless otherwise directed by process memo.

5.8.28.1 DON PPE per step 5.8.18.

5.8.28.2 REPEAT steps 5.8.3 through 5.8.27.

5.8.29 PERFORM a third cleaning cycle, unless otherwise directed by process memo.

5.8.29.1 DON PPE per step 5.8.18.

5.8.29.2 REPEAT steps 5.8.3 through 5.8.27.

5.8.30 IF cleaning cycle is complete, ON graphic 2nd RO, P4 (60FP4) OR ON group 25, SHUT DOWN VD235467, CIP pump.
5.8 Cleaning RO Banks with Muriatic Acid (Cont.)

Special Instructions

CIP pump suction valve 60F-315 must be closed before draining CIP tank or the CIP pump will need re-priming before restarting.

5.8.31 DRAIN CIP tank to sump as follows:

5.8.31.1 CLOSE valve 60F-315.
5.8.31.2 OPEN valve 60F-314.
5.8.31.3 OBSERVE liquid level in CIP tank.
5.8.31.4 WHEN CIP tank is fully drained, THROTTLE HALF TO FULL OPEN valve 60F-052 to flush all chemical residues from CIP tank.
5.8.31.5 WHEN at least five minutes has elapsed, CLOSE 60F-052.
5.8.31.6 WHEN CIP tank is fully drained, CLOSE valve 60F-314.

5.8.32 PLACE Sump Tank 2 in AUTO per EFT-20B-001.

5.8.33 GO TO Section 5.4 to flush banks with verification water.
5.9 Cleaning RO Banks with Tetra-Sodium EDTA Solution

NOTE - Caustic Tetra-Sodium EDTA solution is used when cleaning silica scale and biogrowth from RO membranes. Cleaning with Tetra-Sodium EDTA solution will be performed at direction of SOM or per process memo.

5.9.1 CONFIRM RO banks to be cleaned have been flushed with verification water per Section 5.4.

5.9.2 ON Data Sheet 6, RECORD date of Tetra-Sodium EDTA cleaning.

5.9.3 IF CIP tank level is less than 67%, ADD verification water to CIP tank as follows:

5.9.3.1 THROTTLE HALF TO FULL OPEN valve 60F-052.

5.9.3.2 ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, OBSERVE LT-60F303, CIP tank level.

5.9.3.3 WHEN LT-60F303 indicates 67%, CLOSE valve 60F-052.

5.9.4 IF CIP tank level is more than 67%, DRAIN verification water from CIP tank as follows:

5.9.4.1 IF CIP pump is ON, PERFORM the following:

a. POSITION valve 60F-311 to Sump Tank 2.

b. ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, ENSURE CIP pump is ON.

c. WHEN CIP tank level is 67%, POSITION valve 60F-311 to CIP tank.

d. GO TO step 5.9.5.
5.9 Cleaning RO Banks with Tetra-Sodium EDTA Solution (Cont.)

5.9.4.2 IF CIP pump is OFF, **PERFORM** the following:

a. **ON** graphic 2nd RO, P4 (60FP4)

**OR**

ON group 25, **ENSURE** CIP pump is OFF.

b. **OPEN** valve 60F-314.

c. **WHEN** CIP tank level is 67%, **CLOSE** valve 60F-314.

5.9.5 **CONFIRM** valves for bank(s) being cleaned are positioned for flush/clean/sanitize per Data Sheet 1.

5.9.6 **ENSURE** CIP feed and return valves for RO stage (1st) [2nd] to be cleaned are **OPEN**:

- (60F-055 and 60F-057)
- [60F-056 and 60F-058].

5.9.7 **ENSURE** CIP feed and return valves for RO stage (1st) [2nd] not being cleaned are **CLOSED**:

- (60F-055 and 60F-057)
- [60F-056 and 60F-058].

5.9.8 **CHECK** 3-way valve 60F-311 for flow to CIP tank.

5.9.9 **ENSURE** valve 60F-315 is **OPEN**.

---

**CAUTION**

CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

5.9.10 **SLOWLY POSITION** 60F-318 to ¼ **OPEN**.

5.9.11 **ON** graphic 2nd RO, P4 (60FP4)

**OR**

**ON** group 25, **ENSURE** CIP pump is ON.
5.9 Cleaning RO Banks with Tetra-Sodium EDTA Solution (Cont.)

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - The feed flow rate for 1st RO, 1st array bank should be 60 to 80 gpm and for 1st RO, 2nd array flow rate should be 30 to 40 gpm. At higher flow rates, excessive pressure drop may result in re-depositing dirt on the membrane. If flow meter FIT-60F-301 is O/S, the feed flow rate is considered adequate based upon CIP pump 60F P-4 output pressure of 25 to 52 psig and confirmation of the valve lineup per Data Sheet 1.

5.9.12 SLOWLY POSITION 60F-318 to achieve desired feed flow rate noted above.

NOTE - TAH-60F-307, CIP high temperature alarm (122°F) stops CIP pump.

5.9.13 ON graphic 2nd RO, TI-60F307,

OR

LOCALLY ON TIT-60F-307, CHECK that temperature is less than 122°F.

5.9.14 ON graphic 2nd RO, TI-60F307,

OR

LOCALLY ON TIT-60F-307, CIRCULATE water until temperature is greater than 80°F.

5.9.15 USE Table 1 AND

DETERMINE amount of Tetra-Sodium EDTA to add.

WARNING
Tetra-Sodium EDTA causes eye, skin, and respiratory tract irritation.

5.9.16 DON the following PPE:
- Face shield
- Rubber or nitrile gloves
- Chemical goggles
- Protective apron.
5.9 Cleaning RO Banks with Tetra-Sodium EDTA Solution (Cont.)

NOTE - Tetra-Sodium EDTA is added slowly (approximately five minutes) to ensure proper mixing.

5.9.17 SLOWLY ADD Tetra-Sodium EDTA to CIP tank.

5.9.18 ALLOW CIP tank to circulate for at least ten minutes, or time directed by SOM.

5.9.18.1 IF SOM direction provided, RECORD in ETF Control Room Logbook.

CAUTION
Membrane damage will occur if pH of cleaning solution exceeds 12.0.

5.9.19 DETERMINE pH for cleaning solution.

5.9.19.1 IF using in-line pH instrument, OBTAIN pH reading from AI-60F-450.

5.9.19.2 IF using sampling method, PERFORM the following:
   a. SLOWLY OPEN 60F-327 or 60F-455.
   b. PURGE 0.1 liter (100 ml) of liquid through valve, into a container.
   c. OBTAIN sample.
   d. IF sample cannot be obtained from 60F-327 or 60F-455, DIP SAMPLE CIP tank contents.
   e. CHECK sample with pH meter.
   f. RINSE pH meter with clean water.
   g. EMPTY any residual liquids into Sump Tank 1 or Sump Tank 2.

5.9.20 IF solution is less than 10.0 pH, ADD Tetra-Sodium EDTA solution in 0.5 lb (0.6 liter) batches by repeating steps 5.9.17 through 5.9.19 until pH is 10.0 to 12.0.

5.9.21 REMOVE PPE.
5.9 Cleaning RO Banks with Tetra-Sodium EDTA Solution (Cont.)

NOTE - Membrane soak cycle may be performed while cleaning other banks. For example, 2nd RO Array A may be soaking while 2nd RO Array B is in recirculation.

5.9.22 IF cleaning other RO banks, CHANGE RO banks as follows:

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - CIP pump will automatically shut down if discharge pressure PIT-60F-304 exceeds 52 psi or drops below 25 psi.

5.9.22.1 SLOWLY POSITION 60F-318 until pressure as locally indicated on PIT-60F-304 is 45 to 50 psig.

5.9.22.2 OPEN concentrate and permeate CIP valves on RO bank to be cleaned per Data Sheet 1.

5.9.22.3 OPEN the following CIP feed and return valves for RO bank (1st) [2nd] to be cleaned:
• (60F-055 and 60F-057)
• [60F-056 and 60F-058].

5.9.22.4 CLOSE the following CIP feed and return valves for RO bank (1st) [2nd] not being cleaned:
• (60F-055 and 60F-057)
• [60F-056 and 60F-058].

5.9.22.5 CLOSE concentrate and permeate CIP valves on cleaned RO bank per Data Sheet 1.
5.9 Cleaning RO Banks with Tetra-Sodium EDTA Solution (Cont.)

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - The feed flow rate for 1st RO, 1st array bank should be 60 to 80 gpm and for 1st RO, 2nd array flow rate should be 30 to 40 gpm. At higher flow rates, excessive pressure drop may result in re-depositing dirt on the membrane. If flow meter FIT-60F-301 is O/S, the feed flow rate is considered adequate based upon CIP pump 60F P-4 output pressure of 25 to 52 psig and confirmation of the valve lineup per Data Sheet 1.

5.9.22.6 SLOWLY POSITION 60F-318 to achieve desired feed flow rate noted above.

5.9.22.7 ALLOW CIP tank to circulate for at least ten minutes, or time directed by SOM.
   a. IF SOM direction provided, RECORD in ETF Control Room Logbook.

5.9.22.8 RESAMPLE CIP tank contents per step 5.9.19.

5.9.22.9 ON Data Sheet 6, RECORD cleaning solution pH.

5.9.22.10 ON Data Sheet 6, RECORD CIP recirculation flow, as indicated by FIT-60F-301.
   a. IF FIT-60F-301 is out of service, RECORD O/S.

5.9.23 ON Data Sheet 6, RECORD what time 1st (2nd) {3rd} EDTA cleaning cycle was completed.

5.9.24 PERFORM a second cycle, unless otherwise directed by process memo.

5.9.24.1 DON PPE per step 5.9.16.

5.9.24.2 REPEAT steps 5.9.19 through 5.9.23.
5.9 Cleaning RO Banks with Tetra-Sodium EDTA Solution (Cont.)

5.9.25 **PERFORM** a third cleaning cycle, unless otherwise directed by process memo.

5.9.25.1 **DON** PPE per step 5.9.16.

5.9.25.2 **REPEAT** steps 5.9.19 through 5.9.23.

5.9.26 **IF** cleaning cycle is complete, **THEN ON** graphic 2nd RO, P4 (60FP4)

**OR**

**ON** group 25, **SHUT DOWN** VD235467, CIP pump.

**Special Instructions**

CIP pump suction valve 60F-315 must be closed before draining CIP tank or the CIP pump will need re-priming before restarting.

5.9.27 **DRAIN** CIP tank to sump as follows:

5.9.27.1 **CLOSE** valve 60F-315.

5.9.27.2 **OPEN** valve 60F-314.

5.9.27.3 **OBSERVE** liquid level in CIP tank.

**NOTE** - Foaming in Sump Tank 2 is excessive when a level of foam is within three feet of the sump hatch.

5.9.28 **PERFORM** inspection for excessive foaming as follows.

5.9.28.1 **OPEN** Sump Tank 2 hatch inspection lid to observe for foam level.

5.9.28.2 **IF** foam appears to be excessive, **OPEN** 60H-070 to knock down foam in Sump Tank 2.

5.9.28.3 **CLOSE** 60H-070.

**5.9.28.4 INSPECT** for foam backup in the drip trays under the following:

- CIP tank
- 1st RO banks
- 2nd RO banks
- 2nd RO feed tank.
5.9 Cleaning RO Banks with Tetra-Sodium EDTA Solution (Cont.)

5.9.28.5 WHEN CIP tank is fully drained, THROTTLE HALF TO FULL OPEN, 60F-052 to flush all chemical residues from CIP tank.

5.9.28.6 WHEN at least five minutes has elapsed, CLOSE 60F-052.

5.9.28.7 WHEN CIP tank is fully drained, CLOSE valve 60F-314.

5.9.29 GO TO Section 5.4 to flush banks with verification water.

5.10 Cleaning RO Banks with Terg-A-Zyme

NOTE - Terg-A-Zyme is used to remove organic and biological contaminants from RO membranes. Terg-A-Zyme is not effective at removing inorganic foulants from the RO membranes.

5.10.1 CONFIRM RO banks to be cleaned have been flushed with verification water per Section 5.4.

5.10.2 ON Data Sheet 7, RECORD date of Terg-A-Zyme cleaning.

5.10.3 IF CIP tank level is less than 67%, ADD verification water to CIP tank as follows:

5.10.3.1 THROTTLE HALF TO FULL OPEN valve 60F-052.

5.10.3.2 ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, OBSERVE LT-60F303, CIP tank level.

5.10.3.3 WHEN LT-60F303 indicates 67%, CLOSE valve 60F-052.
5.10 Cleaning RO Banks with Terg-A-Zyme (Cont.)

5.10.4 IF CIP tank level is more than 67%, DRAIN verification water from CIP tank as follows:

5.10.4.1 IF CIP pump is ON, PERFORM the following:

a. POSITION valve 60F-311 to Sump Tank 2.

b. ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, ENSURE CIP pump is ON.

c. WHEN CIP tank level is 67%, POSITION valve 60F-311 to CIP tank.

d. GO TO step 5.10.5.

5.10.4.2 IF CIP pump is OFF, PERFORM the following:

a. ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, ENSURE CIP pump is OFF.

b. OPEN valve 60F-314.

c. WHEN CIP tank level is 67%, CLOSE valve 60F-314.

5.10.5 POSITION valves for bank(s) being flushed for flush/clean/sanitize per Data Sheet 1.

5.10.6 ENSURE CIP feed and return valves for RO stage (1st) [2nd] to be cleaned are OPEN:

- (60F-055 and 60F-057)
- [60F-056 and 60F-058].

5.10.7 ENSURE CIP feed and return valves for RO stage (1st) [2nd] not being cleaned are CLOSED:

- (60F-055 and 60F-057)
- [60F-056 and 60F-058].

5.10.8 CHECK 3-way valve 60F-311 for flow to CIP tank.

5.10.9 ENSURE valve 60F-315 is OPEN.
5.10 Cleaning RO Banks with Terg-A-Zyme (Cont.)

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

5.10.10 SLOWLY POSITION 60F-318 to ½ OPEN.

5.10.11 ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, ENSURE CIP pump is ON.

CAUTION
CIP valve 60F-318 must be opened slowly to prevent pressure surge damage to RO membranes.

NOTE - The feed flow rate for 1st RO, 1st array bank should be 60 to 80 gpm and for 1st RO, 2nd array flow rate should be 30 to 40 gpm. At higher flow rates, excessive pressure drop may result in re-depositing dirt on the membrane. If flow meter FIT-60F-301 is O/S, the feed flow rate is considered adequate based upon CIP pump 60F P-4 output pressure of 25 to 52 psig and confirmation of the valve lineup per Data Sheet 1.

5.10.12 SLOWLY POSITION 60F-318 to achieve desired feed flow rate noted above.

NOTE - TAH-60F-307, CIP high temperature alarm (122°F) stops CIP pump.

5.10.13 ON graphic 2nd RO, TI-60F307,

OR

LOCALLY ON TIT-60F-307, CHECK that temperature is less than 122°F.

5.10.14 ON graphic 2nd RO, TI-60F307,

OR

LOCALLY ON TIT-60F-307, CIRCULATE water until temperature is greater than 80°F.
5.10 Cleaning RO Banks with Terg-A-Zyme (Cont.)

5.10.15 USE Table 1 AND DETERMINE amount of Terg-A-Zyme to add.

**WARNING**
Terg-A-Zyme causes eye, skin, and respiratory tract irritation.

5.10.16 DON the following PPE:
- Face shield
- Rubber or nitrile gloves
- Chemical goggles
- Protective apron.

NOTE - Terg-A-Zyme is added slowly (approximately two minutes) to ensure proper mixing.

5.10.17 SLOWLY ADD Terg-A-Zyme to CIP tank.

5.10.18 REMOVE PPE.

5.10.19 ON Data Sheet 7, RECORD amount of Terg-A-Zyme added.

5.10.20 ALLOW CIP tank to circulate for at least ten minutes, or time directed by SOM.

5.10.20.1 IF SOM direction provided, RECORD in ETF Control Room Logbook.

5.10.21 ON Data Sheet 7, RECORD CIP recirculation flow, as indicated by FIT-60F-301.

5.10.21.1 IF FIT-60F-301 is out of service, RECORD O/S.
5.10 Cleaning RO Banks with Terg-A-Zyme (Cont.)

NOTE - Membrane soak cycle may be performed while cleaning other banks. For example, 2nd RO Bank A may be soaking while 2nd RO Bank B is in recirculation.

5.10.22 IF cleaning other RO banks, CHANGE RO banks as follows:

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - CIP pump will automatically shut down if discharge pressure PIT-60F-304 exceeds 52 psi or drops below 25 psi.

5.10.22.1 SLOWLY POSITION 60F-318 until pressure as locally indicated on PIT-60F-304 is 45 to 50 psig.

5.10.22.2 OPEN concentrate and permeate CIP valves on RO bank to be cleaned per Data Sheet 1.

5.10.22.3 OPEN the following CIP feed and return valves for RO bank (1st) [2nd] to be cleaned:
  • (60F-055 and 60F-057)
  • [60F-056 and 60F-058].

5.10.22.4 CLOSE the following CIP feed and return valves for RO bank (1st) [2nd] not being cleaned:
  • (60F-055 and 60F-057)
  • [60F-056 and 60F-058].

5.10.22.5 CLOSE concentrate and permeate CIP valves on cleaned RO bank per Data Sheet 1.
5.10 Cleaning RO Banks with Terg-A-Zyme (Cont.)

**CAUTION**

CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - The feed flow rate for 1st RO, 1st array bank should be 60 to 80 gpm and for 1st RO, 2nd array flow rate should be 30 to 40 gpm. At higher flow rates, excessive pressure drop may result in re-depositing dirt on the membrane. If flow meter FIT-60F-301 is O/S, the feed flow rate is considered adequate based upon CIP pump 60F P-4 output pressure of 25 to 52 psig and confirmation of the valve lineup per Data Sheet 1.

5.10.22.6 SLOWLY POSITION 60F-318 to achieve desired feed flow rate noted above.

5.10.23 ON Data Sheet 7, RECORD what time 1st (2nd) {3rd} Terg-A-Zyme cleaning cycle was completed.

5.10.24 PERFORM a second cleaning cycle unless otherwise directed by process memo.

5.10.24.1 DON PPE per step 5.10.16.

5.10.24.2 REPEAT steps 5.10.20 through 5.10.23.

5.10.25 PERFORM a third cleaning cycle unless otherwise directed by process memo.

5.10.25.1 DON PPE per step 5.10.16

5.10.25.2 REPEAT steps 5.10.20 through 5.10.23.

5.10.26 IF cleaning cycle is complete, ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, SHUT DOWN VD235467, CIP pump.
5.10 Cleaning RO Banks with Terg-A-Zyme (Cont.)

**Special Instructions**

CIP pump suction valve 60F-315 must be closed before draining CIP tank or the CIP pump will need re-priming before restarting.

NOTE - To avoid foam overflow, inspection of Sump Tank 2 and RO system drip trays is performed during CIP tank draining.

5.10.27 **DRAIN** contents of CIP tank to sump as follows:

5.10.27.1 **CLOSE** valve 60F-315.

5.10.27.2 **OPEN** valve 60F-314 to approximately \( \frac{1}{4} \) OPEN.

5.10.27.3 **OBSERVE** liquid level in CIP tank decreasing.

NOTE - Foaming in Sump Tank 2 is excessive when a level of foam is within three feet of the sump hatch.

5.10.27.4 **PERFORM** inspection for excessive foaming as follows.

a. **OPEN** Sump Tank 2 hatch inspection lid to observe for foam level.

b. **IF** foam appears to be excessive, **OPEN** 60H-070 to knock down foam in Sump Tank 2.

c. **CLOSE** 60H-070.

d. **INSPECT** for foam backup in the drip trays under the following:

   - CIP tank
   - 1st RO banks
   - 2nd RO banks
   - 2nd RO feed tank.

e. **IF** foam backup is observed, **THROTTLE CLOSE** 60F-314 until foam is backed down.
5.10 Cleaning RO Banks with Terg-A-Zyme (Cont.)

5.10.27.5 WHEN CIP tank is fully drained, THROTTLE HALF TO FULL OPEN valve 60F-052 to flush all chemical residues from CIP tank.

5.10.27.6 PERFORM inspection for excessive foaming per step 5.10.27.4.

5.10.27.7 WHEN at least five minutes has elapsed, CLOSE 60F-052.

5.10.27.8 WHEN CIP tank is fully drained, CLOSE valve 60F-314.

5.10.28 GO TO Section 5.4 AND FLUSH banks with verification water.

5.11 Disinfecting RO Banks with Minncare Solution

NOTE - Minncare is used to disinfect RO membranes. Disinfecting with Minncare kills biological growth present on the membrane. Disinfecting with Minncare solution will be performed at direction of SOM or per process memo.

5.11.1 CONFIRM RO banks to be cleaned have been flushed with verification water per Section 5.4.

5.11.2 TURN OFF CIP heater controller as follows.

5.11.2.1 TURN red switch on JB-60F-300 counterclockwise.

5.11.2.2 CONFIRM “POWER ON” light is not lit.

5.11.3 ON Data Sheet 10, RECORD date of Minncare disinfection.

5.11.4 IF CIP tank level is less than 67%, ADD verification water to CIP tank as follows:

5.11.4.1 THROTTLE HALF TO FULL OPEN valve 60F-052.

5.11.4.2 ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, OBSERVE LT-60F303, CIP tank level.

5.11.4.3 WHEN LT-60F303 indicates 67%, CLOSE valve 60F-052.
5.11 Disinfecting RO Banks with Minncare Solution (Cont.)

5.11.5 IF CIP tank level is more than 67%, DRAIN verification water from CIP tank as follows:

5.11.5.1 IF CIP pump is ON, PERFORM the following:
   a. POSITION valve 60F-311 to Sump Tank 2.
   b. ON graphic 2nd RO, P4 (60FP4)

   OR
   ON group 25, ENSURE CIP pump is ON.

   c. WHEN CIP tank level is 67%, POSITION valve 60F-311 to CIP tank.
   d. GO TO step 5.11.6.

5.11.5.2 IF CIP pump is OFF, PERFORM the following:
   a. ON graphic 2nd RO, P4 (60FP4)

   OR
   ON group 25, ENSURE CIP pump OFF.

   b. OPEN valve 60F-314.
   c. WHEN CIP tank level is 67%, CLOSE valve 60F-314.

5.11.6 POSITION valves for bank(s) being flushed for flush/clean/sanitize per Data Sheet 1.

5.11.7 ENSURE the following CIP feed and return valves for RO stage (1st) [2nd] to be cleaned are OPEN:
   • (60F-055 and 60F-057)
   • [60F-056 and 60F-058].

5.11.8 ENSURE the following CIP feed and return valves for RO stage (1st) [2nd] not being cleaned are CLOSED:
   • (60F-055 and 60F-057)
   • [60F-056 and 60F-058].
Reverse Osmosis Clean-In-Place Operation

5.11 Disinfecting RO Banks with Minncare Solution (Cont.)

5.11.9 CHECK 3-way valve 60F-311 for flow to CIP tank.

5.11.10 ENSURE valve 60F-315 is OPEN.

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

5.11.11 SLOWLY POSITION 60F-318 to ½ OPEN.

5.11.12 ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, ENSURE CIP pump is ON.

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - The feed flow rate for 1st RO, 1st array bank should be 60 to 80 gpm and for 1st RO, 2nd array flow rate should be 30 to 40 gpm. At higher flow rates, excessive pressure drop may result in re-depositing dirt on the membrane. If flow meter FIT-60F-301 is O/S, the feed flow rate is considered adequate based upon CIP pump 60F P-4 output pressure of 25 to 52 psig and confirmation of the valve lineup per Data Sheet 1.

5.11.13 SLOWLY POSITION 60F-318 to achieve desired feed flow rate noted above.

NOTE - TAH-60F-307, CIP high temperature alarm (122°F) stops CIP pump.

5.11.14 ON graphic 2nd RO, TI-60F307,

OR

LOCALLY ON TIT-60F-307, CHECK that temperature is less than 77°F.
Reverse Osmosis Clean-In-Place Operation

5.11 Disinfecting RO Banks with Minncare Solution (Cont.)

5.11.15 IF solution temperature is greater than 77°F, ON graphic 2nd RO, OR

ON group 25, SHUT DOWN VD235467, CIP pump AND

WAIT until solution temperature is less than 77°F before proceeding.

5.11.16 USE Table 1 AND

DETERMINE amount of Minncare to add.

WARNING

Minncare causes burning to the eyes and is a skin and respiratory tract irritant.

5.11.17 DON the following PPE:

- Face shield
- Rubber or nitrile gloves
- Chemical goggles
- Protective apron.

NOTE - Minncare is added slowly (approximately six minutes) to ensure proper mixing.

5.11.18 ADD Minncare to CIP tank as follows.

5.11.18.1 SLOWLY POUR \( \frac{1}{2} \) gallon of Minncare into CIP tank.

5.11.18.2 REPEAT step 5.11.18.1 until specified amount of Minncare has been added to CIP tank.

5.11.19 ALLOW CIP tank to circulate for at least ten minutes, or time directed by SOM.

5.11.19.1 IF SOM direction provided, RECORD in ETF Control Room Logbook.
5.11 Disinfecting RO Banks with Minncare Solution (Cont.)

5.11.20 SAMPLE CIP tank contents.

5.11.20.1 SLOWLY OPEN 60F-327 or 60F-455.

5.11.20.2 PURGE 0.1 L (100 mL) of liquid through valve, into a container.

5.11.20.3 OBTAIN sample.

5.11.20.4 IF sample cannot be obtained from 60F-327 or 60F-455, DIP SAMPLE CIP tank contents.

5.11.20.5 EMPTY any residual liquids into Sump Tank 1 or Sump Tank 2.

NOTE - Minncare 1% test strips will change from a white color to a blue or blue-gray color if the Minncare solution is at the proper concentration of 1%.

5.11.21 CHECK sample with Minncare 1% test strip.

5.11.21.1 IF 1% test strip indicates Minncare is less than 1%, ADD small amount of Minncare (0.1 liter) AND RETURN to step 5.11.19.

5.11.21.2 IF 1% test strip indicates Minncare is 1%, CONTINUE.

5.11.22 DETERMINE pH of solution per AI-60F-450 or by direct sample measurement using hand-held pH instrument.

NOTE - Minncare solution pH will be less than 2.5 only if a gross overdosing of Minncare occurred or if another acid was inadvertently added to the CIP tank.

5.11.23 IF pH is less than or equal to 2.5, IMMEDIATELY STOP work AND NOTIFY SOM.

CAUTION

pH of disinfecting solution must not exceed 4.0 or membrane damage will occur.

5.11.24 IF pH is greater than 4.0, ADD a small amount of Minncare (0.1 liters) to the CIP tank.
5.11 Disinfecting RO Banks with Minncare Solution (Cont.)

5.11.25 ALLOW tank contents to recirculate for ten minutes, or time directed by SOM, AND

REPEAT steps 5.11.22 through 5.11.24 until pH is between 2.5 and 4.0.

5.11.25.1 IF SOM direction provided, RECORD in ETF Control Room Logbook.

5.11.26 REMOVE PPE.

5.11.27 ON Data Sheet 10, RECORD disinfecting solution pH and amount of Minncare added.

CAUTION

Membrane damage will occur if Minncare disinfecting solution is at greater than 77°F when contacting membranes.

5.11.28 ON graphic 2nd RO, TI-60F307,

OR

LOCALLY ON TIT-60F-307, CHECK that solution temperature is less than 77°F.

5.11.29 IF solution temperature is greater than 77°F, ON graphic 2nd RO, P4(60FP4)

OR

ON group 25, SHUT DOWN VD235467, CIP pump AND

WAIT until solution temperature is less than 77°F before proceeding.
5.11 Disinfecting RO Banks with Minncare Solution (Cont.)

NOTE - Membrane soak cycle may be performed while disinfecting other banks. For example, 2nd RO Bank A may be soaking while 2nd RO Bank B is in recirculation.

5.11.30 IF disinfecting other RO banks, CHANGE RO banks as follows:

CAUTION

CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - CIP pump will automatically shut down if discharge pressure PIT-60F-304 exceeds 52 psi or drops below 25 psi.

5.11.30.1 SLOWLY POSITION 60F-318 until pressure as locally indicated on PIT-60F-304 is 45 to 50 psig.

5.11.30.2 OPEN concentrate and permeate CIP valves on RO bank to be cleaned per Data Sheet 1.

5.11.30.3 OPEN the following CIP feed and return valves for RO bank (1st) [2nd] to be cleaned:

- (60F-055 and 60F-057)
- [60F-056 and 60F-058].

5.11.30.4 CLOSE the following CIP feed and return valves for RO bank (1st) [2nd] not being cleaned:

- (60F-055 and 60F-057)
- [60F-056 and 60F-058].

5.11.30.5 CLOSE concentrate and permeate CIP valves on cleaned RO bank per Data Sheet 1.

CAUTION

CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

5.11.30.6 SLOWLY AND FULLY OPEN 60F-318.
Reverse Osmosis Clean-In-Place Operation

5.11 Disinfecting RO Banks with Minncare Solution (Cont.)

5.11.31 ALLOW CIP tank to circulate for at least ten minutes, or time directed by SOM.

5.11.31.1 IF SOM direction provided, RECORD in ETF Control Room Logbook.

CAUTION
Membrane damage will occur if Minncare disinfecting solution is at greater than 77°F when contacting membranes.

5.11.32 IF at any time the disinfecting solution exceeds 77°F, ON graphic 2nd RO, OR

ON group 25, SHUT DOWN VD235467, CIP pump AND

WAIT until solution temperature is less than 77°F before proceeding.

5.11.33 DON PPE per step 5.11.17.

5.11.34 PERFORM steps 5.11.20 through 5.11.25.

5.11.34.1 REPEAT for each bank being cleaned.

5.11.35 REMOVE PPE.

5.11.36 ON Data Sheet 10, RECORD the following parameters:
- Time of Minncare 1st (2nd) {3rd} recirculation
- Disinfecting solution pH
- Disinfecting solution temperature, as indicated by TIT-60F-307
- CIP recirculation flow, as indicated by FIT-60F-301.

5.11.36.1 IF FIT-60F-301 is out of service, RECORD O/S.
5.11 Disinfecting RO Banks with Minncare Solution (Cont.)

5.11.37 ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, SHUT DOWN VD235467, CIP pump.

5.11.38 WHEN one hour has elapsed, ON graphic 2nd RO,

OR

ON group 25, START VD235466a, CIP pump.

5.11.39 PERFORM a second disinfecting cycle, unless otherwise directed by process memo.

5.11.39.1 DON PPE per step 5.11.17.

5.11.39.2 REPEAT steps 5.11.20 through 5.11.38.

5.11.40 PERFORM a third disinfecting cycle, unless otherwise directed by process memo.

5.11.40.1 DON PPE per step 5.11.17.

5.11.40.2 REPEAT steps 5.11.20 through 5.11.38.

5.11.41 IF Minncare recirculation is complete, ON graphic 2nd RO, P4 (60FP4)

OR

ON group 25, SHUT DOWN VD235467, CIP pump.
5.11 Disinfecting RO Banks with Minncare Solution (Cont.)

Special Instructions

CIP pump suction valve 60F-315 must be closed before draining CIP tank or the CIP pump will need re-priming before restarting.

5.11.42 DRAIN CIP tank to sump as follows:

5.11.42.1 CLOSE valve 60F-315.

5.11.42.2 OPEN valve 60F-314.

5.11.42.3 OBSERVE liquid level in CIP tank.

5.11.42.4 WHEN CIP tank is fully drained, THROTTLE HALF TO FULL OPEN valve 60F-052 to flush all chemical residues from CIP tank.

5.11.42.5 WHEN at least five minutes has elapsed, CLOSE 60F-052.

5.11.42.6 WHEN CIP tank is fully drained, CLOSE valve 60F-314.

5.11.43 WHEN time specified by process memo has elapsed, GO TO Section 5.4 to flush banks with verification water.
5.12 Sanitizing RO Banks for Layup

**CAUTION**

Membranes should be cleaned before sanitizing to prevent membrane damage.

5.12.1 **CONFIRM** RO banks to be cleaned have been flushed with verification water per Section 5.4.

5.12.2 **IF** CIP tank level is less than 67%, **ADD** verification water to CIP tank as follows:

5.12.2.1 **THROTTLE HALF TO FULL OPEN** valve 60F-052.

5.12.2.2 **ON** graphic 2nd RO, P4 (60FP4)

**OR**

**ON** group 25, **OBSERVE** LT-60F303, CIP tank level.

5.12.2.3 **WHEN** LT-60F303 indicates 67%, **CLOSE** valve 60F-052.

5.12.3 **IF** CIP tank level is more than 67%, **DRAIN** verification water from CIP tank as follows:

5.12.3.1 **IF** CIP pump is ON, **PERFORM** the following:

a. **POSITION** valve 60F-311 to Sump Tank 2.

b. **ON** graphic 2nd RO, P4 (60FP4)

**OR**

**ON** group 25, **ENSURE** CIP pump is ON.

c. **WHEN** CIP tank level is 67%, **POSITION** valve 60F-311 to CIP tank.

d. **GO TO** step 5.12.4.
5.12 Sanitizing RO Banks for Layup (Cont.)

5.12.3.2 IF CIP pump is OFF, **PERFORM** the following:

a. **ON** graphic 2nd RO, P4 (60FP4)

**OR**

ON group 25, **ENSURE** CIP pump is OFF.

b. **OPEN** valve 60F-314.

c. **WHEN** CIP tank level is 67%, **CLOSE** valve 60F-314.

5.12.4 **POSITION** valves for bank(s) being sanitized to position for flush/clean/sanitize per Data Sheet 1.

5.12.5 **ENSURE** CIP feed and return valves for RO stage (1st) [2nd] to be cleaned are **OPEN**:

- (60F-055 and 60F-057)
- [60F-056 and 60F-058].

5.12.6 **ENSURE** CIP feed and return valves for RO stage (1st) [2nd] not being cleaned are **CLOSED**:

- (60F-055 and 60F-057)
- [60F-056 and 60F-058].

5.12.7 **CHECK** 3-way valve 60F-311 for flow to CIP tank.

5.12.8 **ENSURE** valve 60F-315 is **OPEN**.

---

**CAUTION**

CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

5.12.9 **SLOWLY POSITION** 60F-318 to ⅛ **OPEN**.

5.12.10 **ON** graphic 2nd RO, P4 (60FP4)

**OR**

ON group 25, **ENSURE** CIP pump is **ON**.
5.12 Sanitizing RO Banks for Layup (Cont.)

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - The feed flow rate for 1st RO, 1st array bank should be 60 to 80 gpm and for 1st RO, 2nd array flow rate should be 30 to 40 gpm. At higher flow rates, excessive pressure drop may result in re-depositing dirt on the membrane. If flow meter FIT-60F-301 is O/S, the feed flow rate is considered adequate based upon CIP pump 60F P-4 output pressure of 25 to 52 psig and confirmation of the valve lineup per Data Sheet 1.

5.12.11 SLOWLY POSITION 60F-318 to achieve desired feed flow rate noted above.

NOTE - TAH-60F-307, CIP high temperature alarm (122°F) stops CIP pump.

5.12.12 ON graphic 2nd RO, TI-60F307,

OR

LOCALLY ON TIT-60F-307, CHECK that temperature is less than 122°F.

5.12.13 ON graphic 2nd RO, TI-60F307,

OR

LOCALLY ON TIT-60F-307, CIRCULATE water until temperature is greater than 80°F.

NOTE - MP-4 or Betz Dearborn RN DCL32 is used to lay-up membranes for long-term storage.

5.12.14 USE Table 1 AND

DETERMINE amount of MP-4 or Betz Dearborn RN DCL32 to add.
5.12 Sanitizing RO Banks for Layup (Cont.)

WARNING
MP-4 and Betz Dearborn RN DCL32 causes eye, skin, and respiratory tract irritation.

5.12.15 **DON** the following PPE:
- Face shield
- Rubber or nitrile gloves
- Chemical goggles
- Protective apron.

NOTE - MP-4 or Betz Dearborn RN DCL32 is added slowly (approximately two minutes) to ensure mixing within CIP tank and RO banks.

5.12.16 **SLOWLY ADD** MP-4 or Betz Dearborn RN DCL32 to CIP tank.

5.12.17 **REMOVE** PPE.

5.12.18 **ALLOW** CIP tank to circulate for at least ten minutes, or time directed by SOM.

5.12.18.1 **IF SOM** direction provided, **RECORD** in ETF Control Room Logbook.

5.12.19 **ON** Data Sheet 8, **CHECK** that sanitizing is complete.

5.12.20 **ON** Data Sheet 8, **RECORD** the following data:
- Date of MP-4 or Betz Dearborn RN DCL32 sanitizing
- Time of MP-4 or Betz Dearborn RN DCL32 sanitizing.
5.12 Sanitizing RO Banks for Layup (Cont.)

5.12.21 IF sanitizing other RO banks, CHANGE RO banks as follows:

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

NOTE - CIP pump will automatically shut down if discharge pressure PIT-60F-304 exceeds 52 psi or drops below 25 psi.

5.12.21.1 SLOWLY POSITION 60F-318 until pressure as locally indicated on PIT-60F-304 is 45 to 50 psig.

5.12.21.2 OPEN concentrate and permeate CIP valves on RO bank to be cleaned per Data Sheet 1.

5.12.21.3 OPEN the following CIP feed and return valves for RO bank (1st) [2nd] to be cleaned:
- (60F-055 and 60F-057)
- [60F-056 and 60F-058].

5.12.21.4 CLOSE the following CIP feed and return valves for RO bank (1st) [2nd] not being cleaned:
- (60F-055 and 60F-057)
- [60F-056 and 60F-058].

5.12.21.5 CLOSE concentrate and permeate CIP valves on cleaned RO bank per Data Sheet 1.

CAUTION
CIP valve 60F-318 must be positioned slowly to prevent pressure surge damage to RO membranes.

5.12.21.6 SLOWLY AND FULLY OPEN 60F-318.

5.12.22 IF RO sanitizing is complete, GO TO step 5.12.26.
5.12 Sanitizing RO Banks for Layup (Cont.)

**WARNING**

MP-4 and Betz Dearborn RN DCL32 causes eye, skin, and respiratory tract irritation.

5.12.23 **DON** the following PPE:
- Face shield
- Rubber or nitrile gloves
- Chemical goggles
- Protective apron.

5.12.24 **OBTAIN** 1.24 kg (2.74 lb, 1.24 L, 0.33 gal) of MP-4 or 3.1 kg (6.9 lb, 2.5 L, 0.7 gal) of Betz Dearborn RN DCL32.

5.12.25 **PERFORM** sanitizing cycle by repeating steps 5.12.16 through 5.12.21.

5.12.26 **IF** sanitizing cycle is complete, **ON** graphic 2nd RO, P4 (60FP4)

**OR**

**ON** group 25, **SHUT DOWN** VD235467, CIP pump.

**Special Instructions**

MP-4 or Betz Dearborn RN DCL32 sanitizers should be flushed from membranes only if membranes will be placed in service within 72 hours.

CIP pump suction valve 60F-315 must be closed before draining CIP tank or the CIP pump will need re-priming before restarting.

5.12.27 **DRAIN** CIP tank to sump as follows:

5.12.27.1 **CLOSE** valve 60F-315.

5.12.27.2 **OPEN** valve 60F-314.

5.12.27.3 **OBSERVE** liquid level in CIP tank.
5.12 Sanitizing RO Banks for Layup (Cont.)

5.12.27.4 WHEN CIP tank is fully drained, THROTTLE HALF TO FULL OPEN valve 60F-052 to flush all chemical residues from CIP tank.

5.12.27.5 WHEN at least two minutes has elapsed, CLOSE 60F-052.

5.12.27.6 WHEN CIP tank is fully drained, CLOSE valve 60F-314.

5.12.28 CLOSE the following valves:
- 60F-055
- 60F-056
- 60F-057
- 60F-058.

5.12.29 IF cleaning and flushing cycles are complete, CLOSE valve 60F-326.

CAUTION
The pH electrode membrane will lose strength quickly if stored in verification water or high pH solutions.

5.12.30 DO NOT STORE pH probe AE-60F-450 in verification water or high pH solutions.

5.12.31 OPEN 60F-454 and 60F-452 to drain pH probe.

5.12.32 CLOSE 60F-454 and 60F-452.

Special Instructions
Maintenance has 48 hours to lay up the probe or the probe will fail. The SOM must confirm layup is complete.

5.12.33 (SOM) REQUEST Maintenance lay up pH probe AE-60F-450 in 4 pH buffer.

5.12.34 (SOM) CONFIRM Maintenance has performed probe layup.
5.13 Change Setpoint on TIC-60F300 and TIC-60F301

**Special Instructions**

Section 5.13 may be performed at any time where setpoint needs to be adjusted.

**NOTE** - All key strokes are performed on TIC-60F300 or TIC-60F301 temp control panel.

- **5.13.1** **HOLD DOWN** reset for longer than three seconds until “LocH” appears in window.
- **5.13.2** **PRESS** RESET once to get “SP” appearing in window.
- **5.13.3** **PRESS** up ▲ or down ▼ push button to change temperature setpoint.
- **5.13.4** **PRESS AND HOLD** reset for more than three seconds to return to operating mode.
5.14 Records

5.14.1 **PERFORM** the following for records identified within this procedure.

5.14.1.1 **RECORD** the number of times the record was generated in applicable column,

OR

5.14.1.2 **PLACE** a check mark (✓) in the N/A column.

5.14.1.3 **SUBMIT** the package for verification of completed records.

<table>
<thead>
<tr>
<th>Records Submittal Checklist</th>
<th>Number of times completed</th>
<th>N/A (✓)</th>
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<td>Data Sheet 4 – MC-4 or Kleen ENV911 Cleaning</td>
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<td>Data Sheet 5 – MC-1 or MemChem MCT201 Cleaning</td>
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<tr>
<td>Data Sheet 8 – MP-4 or Betz Dearborn RN DCL32 Sanitizing</td>
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<td></td>
</tr>
<tr>
<td>Data Sheet 9 – Verification Water Flush</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Sheet 10 – Minncare Disinfection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Sheet 11 - Sulfamic Acid Cleaning</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**FWS/OE/Shift Manager** **SEND** the completed records to the Central Shift Office for records retention.

________________________________________ / __________________________ / __________

Signature                  Print (First & Last)          Date

Shift Manager /OE

The record custodian identified in the company-level Records Inventory and Disposition Schedule (RIDS) is responsible for record retention in accordance with TFC-BSM-IRM_DC-C-02.
## Table 1 – Chemical Makeup Parameters

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Amount of Chemical per 290 gal of Water</th>
<th>Feed Water pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC1</td>
<td>55 lb (25 kg, 4.0 gal, 15.1 L)</td>
<td>2.0 to 3.5</td>
</tr>
<tr>
<td>MemChem MCT201</td>
<td>55 lb (25 kg)</td>
<td>2.0 to 3.5</td>
</tr>
<tr>
<td>Sulfamic Acid</td>
<td>25 lb (11.4 Kg)</td>
<td>1.1 to 3.0</td>
</tr>
<tr>
<td>Muriatic Acid</td>
<td>2 gal (for 327 gal of water)</td>
<td>1.0 to 2.0</td>
</tr>
<tr>
<td>MC4</td>
<td>9.7 lb (4.4 kg, 3.1 gal, 11.6 L)</td>
<td>10.5 to 12.5</td>
</tr>
<tr>
<td>Kleen ENV911</td>
<td>9.7 lb (4.4 kg)</td>
<td>10.5 to 12.5</td>
</tr>
<tr>
<td>MP4</td>
<td>12.1 lb (5.5 kg, 1.45 gal, 5.5 L)</td>
<td>3.0 to 5.0</td>
</tr>
<tr>
<td>Betz Dearborn RN DCL32</td>
<td>30.6 lb (13.9 kg, 2.9 gal, 11.0 L)</td>
<td>3.0 to 5.0</td>
</tr>
<tr>
<td>Minncare</td>
<td>2.5 gal</td>
<td>2.5 to 4.0</td>
</tr>
<tr>
<td>Terg-A-Zyme</td>
<td>25 lb (11.4 kg)</td>
<td>~ 9.5</td>
</tr>
<tr>
<td>*Tetra-sodium EDTA</td>
<td>25 lb (11.4 kg, 2.2 gal, 8.2 L)</td>
<td>10.0 to 12.0</td>
</tr>
</tbody>
</table>

225 gal (852 L), total volume in CIP tank (at 67%)
+65 gal (246 L), total volume in pipes
290 gal (1,098 L) basis
262 gal (992 L), total volume in CIP tank (at 80%)
+65 gal (246 L), total volume in pipes
327 gal (1,238 L) basis

MC-1 solution is made up at 20 grams/L
MemChem MCT201 solution is made up at 20 grams/L
Sulfamic Acid is made up at 10 grams/L (1% by wt)
Muriatic Acid is made up at 0.2 wt%
MC-4 solution is made up at 4 grams/L
Kleen ENV911 solution is made up at 4 grams/L
MP-4 solution is made up at 5 grams/L
Betz Dearborn RN DCL32 solution is made up with approximately 2.9 gal of DCL 32 per 290 gal of water to attain a sodium bisulfite concentration of 5 grams/L
Terg-A-Zyme is made up at 10 grams/L (1% by wt.)
Tetra-Sodium EDTA solution is made up at 10 grams/L (1% by wt.)
Minncare is made up with approximately 1 gal of Minncare per 100 gal of water

MC-1 density is 1.66 kg/L
Sulfamic Acid density is 2.1 kg/L
Muriatic Acid density 1.1 kg/L
MC-4 density is 0.38 kg/L
MP-4 density is 1.00 kg/L
Betz Dearborn RN DCL 32 is 1.26 kg/L
Tetra-Sodium EDTA density is 0.72 kg/L

* Or equivalent product as identified by Engineering on Process Memos.
## Data Sheet 1 – 3-Way Valve Lineup

<table>
<thead>
<tr>
<th>Valve Number</th>
<th>Valve Name &amp; Location</th>
<th>Required Position</th>
<th>F/C/S</th>
<th>Operate</th>
<th>Standby</th>
</tr>
</thead>
<tbody>
<tr>
<td>60F-101</td>
<td>Bank A, CIP Inlet</td>
<td>CIP feed</td>
<td></td>
<td>1st Array Feed</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-104</td>
<td>Bank A, CIP Concentrate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Concentrate out</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-107</td>
<td>Bank A, CIP Permeate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Permeate out</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-102</td>
<td>Bank B, CIP Inlet</td>
<td>CIP feed</td>
<td></td>
<td>1st Array Feed</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-109</td>
<td>Bank B, CIP Concentrate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Concentrate out</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-112</td>
<td>Bank B, CIP Permeate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Permeate out</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-103</td>
<td>Bank C, CIP Inlet</td>
<td>CIP feed</td>
<td></td>
<td>1st Array Feed</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-114</td>
<td>Bank C, CIP Concentrate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Concentrate out</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-117</td>
<td>Bank C, CIP Permeate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Permeate out</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-133</td>
<td>Bank A, CIP Inlet</td>
<td>CIP feed</td>
<td></td>
<td>2nd Array Feed</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-142</td>
<td>Bank A, CIP Concentrate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Concentrate out</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-182</td>
<td>Bank A, CIP Permeate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Permeate out</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-134</td>
<td>Bank B, CIP Inlet</td>
<td>CIP feed</td>
<td></td>
<td>2nd Array Feed</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-137</td>
<td>Bank B, CIP Concentrate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Concentrate out</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-140</td>
<td>Bank B, CIP Permeate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Permeate out</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-135</td>
<td>Bank C, CIP Inlet</td>
<td>CIP feed</td>
<td></td>
<td>2nd Array Feed</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-147</td>
<td>Bank C, CIP Concentrate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Concentrate out</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-145</td>
<td>Bank C, CIP Permeate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Permeate out</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-221</td>
<td>Bank A, CIP Inlet</td>
<td>CIP feed</td>
<td></td>
<td>2nd RO Feed</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-224</td>
<td>Bank A, CIP Concentrate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Concentrate out</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-228</td>
<td>Bank A, CIP Permeate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Permeate out</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-222</td>
<td>Bank B, CIP Inlet</td>
<td>CIP feed</td>
<td></td>
<td>2nd RO Feed</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-231</td>
<td>Bank B, CIP Concentrate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Concentrate out</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-233</td>
<td>Bank B, CIP Permeate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Permeate out</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-223</td>
<td>Bank C, CIP Inlet</td>
<td>CIP feed</td>
<td></td>
<td>2nd RO Feed</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-238</td>
<td>Bank C, CIP Concentrate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Concentrate out</td>
<td>CLOSED</td>
</tr>
<tr>
<td>60F-240</td>
<td>Bank C, CIP Permeate Outlet</td>
<td>CIP return</td>
<td></td>
<td>Permeate out</td>
<td>CLOSED</td>
</tr>
</tbody>
</table>

Note - Flush/clean/sanitize (F/C/S) position routes flow through flow path for flushing, cleaning, and sanitizing membranes. Operate position routes flow normally through RO. Standby position closes all flow paths to membranes.

Operator Print (First & Last) Date

Operator Print (First & Last) Date

Signature Print (First & Last) Date

SOM Completion Review
### Reverse Osmosis Clean-In-Place Operation

#### Data Sheet 2 – CIP Tank Valve Lineup

<table>
<thead>
<tr>
<th>Valve Number</th>
<th>Valve Name &amp; Location</th>
<th>Required Position</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>60B-156</td>
<td>CIP to Rough Filter</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60B-157</td>
<td>CIP to Fine Filter</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60B-160</td>
<td>CIP Tank Cleaning Filter Recirculation</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60B-161</td>
<td>Cleaning Filter Inlet</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60B-162</td>
<td>Cleaning Filter Outlet</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60F-052</td>
<td>Verif Water to CIP Tank (East end, use ladder)</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60F-055</td>
<td>1st RO CIP Feed</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60F-056</td>
<td>2nd RO CIP Feed (East End)</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60F-057</td>
<td>1st RO to CIP Tank</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60F-058</td>
<td>2nd RO to CIP Tank</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60F-314</td>
<td>CIP Tank Drain to Sump</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60F-315</td>
<td>CIP Pump 60F-P-4 Isolation</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60F-316</td>
<td>PIT-60F304 Isolation</td>
<td>OPEN</td>
<td></td>
</tr>
<tr>
<td>60F-318</td>
<td>CIP to 1st and 2nd RO</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60F-319</td>
<td>CIP Line Drain to Sump</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60F-320</td>
<td>Verif Water to CIP Tank (East end, o/head, use ladder)</td>
<td>OPEN</td>
<td></td>
</tr>
<tr>
<td>60F-322</td>
<td>Pump 60F-P-4 Casing Drain to Sump</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60F-323</td>
<td>PIT-60F304 Drain</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60F-324</td>
<td>CIP Tank Overflow to Sump</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60F-325</td>
<td>CIP Tank Overflow Trap Fill</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60F-326</td>
<td>CIP pH Instrument Isolation</td>
<td>OPEN</td>
<td></td>
</tr>
<tr>
<td>60F-327</td>
<td>CIP Tank Sample</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60F-451</td>
<td>CIP Tank Recirculation Loop Isolation</td>
<td>OPEN</td>
<td></td>
</tr>
<tr>
<td>60F-452</td>
<td>CIP Recirculation Drain</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60F-454</td>
<td>CIP pH Instrument Isolation</td>
<td>OPEN</td>
<td></td>
</tr>
<tr>
<td>60F-455</td>
<td>CIP pH Probe Housing Drain</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>60B-171</td>
<td>CIP to Rough/Fine Filter</td>
<td>CLOSED</td>
<td></td>
</tr>
</tbody>
</table>

**COMMENTS:**

________/________/________/________
NCO Print (First & Last) Initials Date

________/________/________/________
NCO Print (First & Last) Initials Date

________/________/________/________
SOM Completion Review Print (First & Last) Initials Date
# Reverse Osmosis Clean-In-Place Operation

## Data Sheet 3 – Solenoid Operated Valve Lineup

<table>
<thead>
<tr>
<th>Valve Number</th>
<th>Valve Name &amp; Location</th>
<th>Required Position</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1ST RO, 1ST ARRAY, BANK A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOV-60F-331</td>
<td>HS-60F-331, Membrane Vessel 06 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-333</td>
<td>HS-60F-333, Membrane Vessel 06 Permeate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-335</td>
<td>HS-60F-335, Membrane Vessel 12 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-337</td>
<td>HS-60F-337, Membrane Vessel 12 Permeate</td>
<td>CLOSED</td>
</tr>
<tr>
<td><strong>1ST RO, 1ST ARRAY, BANK B</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOV-60F-343</td>
<td>HS-60F-343, Membrane Vessel 04 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-345</td>
<td>HS-60F-345, Membrane Vessel 04 Permeate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-339</td>
<td>HS-60F-339, Membrane Vessel 05 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-341</td>
<td>HS-60F-341, Membrane Vessel 05 Permeate</td>
<td>CLOSED</td>
</tr>
<tr>
<td><strong>1ST RO, 1ST ARRAY, BANK C</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOV-60F-351</td>
<td>HS-60F-351, Membrane Vessel 02 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-353</td>
<td>HS-60F-353, Membrane Vessel 02 Permeate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-347</td>
<td>HS-60F-347, Membrane Vessel 03 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-349</td>
<td>HS-60F-349, Membrane Vessel 03 Permeate</td>
<td>CLOSED</td>
</tr>
<tr>
<td><strong>1ST RO, 2ND ARRAY, BANK A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOV-60F-357</td>
<td>HS-60F-357, Membrane Vessel 09 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-359</td>
<td>HS-60F-359, Membrane Vessel 09 Permeate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-355</td>
<td>HS-60F-355, Membrane Vessel 11 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-361</td>
<td>HS-60F-361, Membrane Vessel 11 Permeate</td>
<td>CLOSED</td>
</tr>
<tr>
<td><strong>1ST RO, 2ND ARRAY, BANK B</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOV-60F-365</td>
<td>HS-60F-365, Membrane Vessel 08 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-367</td>
<td>HS-60F-367, Membrane Vessel 08 Permeate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-363</td>
<td>HS-60F-363, Membrane Vessel 10 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-369</td>
<td>HS-60F-369, Membrane Vessel 10 Permeate</td>
<td>CLOSED</td>
</tr>
<tr>
<td><strong>1ST RO, 2ND ARRAY, BANK C</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOV-60F-371</td>
<td>HS-60F-371, Membrane Vessel 01 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-377</td>
<td>HS-60F-377, Membrane Vessel 01 Permeate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-373</td>
<td>HS-60F-373, Membrane Vessel 07 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-375</td>
<td>HS-60F-375, Membrane Vessel 07 Permeate</td>
<td>CLOSED</td>
</tr>
</tbody>
</table>

(Continued on Next Sheet)
### Data Sheet 3 – Solenoid Operated Valve Lineup (Cont.)

<table>
<thead>
<tr>
<th>Valve Number</th>
<th>Valve Name &amp; Location</th>
<th>Required Position</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2ND RO, 1ST ARRAY, BANK A</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOV-60F-391</td>
<td>HS-60F-391, Membrane Vessel 14 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-397</td>
<td>HS-60F-397, Membrane Vessel 14 Permeate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-399</td>
<td>HS-60F-399, Membrane Vessel 20 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-393</td>
<td>HS-60F-393, Membrane Vessel 20 Permeate</td>
<td>CLOSED</td>
</tr>
<tr>
<td><strong>2ND RO, 1ST ARRAY, BANK B</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOV-60F-405</td>
<td>HS-60F-405, Membrane Vessel 13 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-411</td>
<td>HS-60F-411, Membrane Vessel 13 Permeate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-403</td>
<td>HS-60F-403, Membrane Vessel 16 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-409</td>
<td>HS-60F-409, Membrane Vessel 16 Permeate</td>
<td>CLOSED</td>
</tr>
<tr>
<td><strong>2ND RO, 1ST ARRAY, BANK C</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOV-60F-415</td>
<td>HS-60F-415, Membrane Vessel 15 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-421</td>
<td>HS-60F-421, Membrane Vessel 15 Permeate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-417</td>
<td>HS-60F-417, Membrane Vessel 17 Concentrate</td>
<td>CLOSED</td>
</tr>
<tr>
<td>SOV-60F-423</td>
<td>HS-60F-423, Membrane Vessel 17 Permeate</td>
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Note - Closed Position is indicated by the Hand Switch, HS-XX-XXX toggled to the LEFT.

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SOM Completion Review
### Reverse Osmosis Clean-In-Place Operation

**Data Sheet 4 – MC-4 or Kleen ENV911 Cleaning**

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<td>CIP Recirculation Flow (gpm) Record O/S if out of service</td>
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<td>Time 1st MC-4 or Kleen ENV911 Cleaning Cycle Completed</td>
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<td>Cleaning Solution pH (acceptable range 10.5 to 12.5): Amount of MC-4 or Kleen ENV911 Added</td>
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<td>CIP Recirculation Flow (gpm) Record O/S if out of service</td>
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<td>Time 2nd MC-4 or Kleen ENV911 Cleaning Cycle Completed</td>
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<td>CIP Recirculation Flow (gpm) Record O/S if out of service</td>
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## Reverse Osmosis Clean-In-Place Operation

### Data Sheet 5 – MC-1 or MemChem MCT201 Cleaning

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<td>Amount of MC-1 or MemChem MCT201 Added</td>
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<td>Record O/S if out of service</td>
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<td>CIP Recirculation Flow (gpm)</td>
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<td>CIP Recirculation Flow (gpm)</td>
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<td>Time 3rd MC-1 or MemChem MCT201 Cleaning Cycle Completed</td>
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## Reverse Osmosis Clean-In-Place Operation

### Data Sheet 6 – Tetra-Sodium EDTA

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## Reverse Osmosis Clean-In-Place Operation

### Data Sheet 7 – Terg-A-Zyme Cleaning

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### Reverse Osmosis Clean-In-Place Operation

**Data Sheet 8 – MP-4 or Betz Dearborn RN DCL32 Sanitizing**

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## Data Sheet 9 – Verification Water Flush

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<td>CIP Flush Flow (gpm) Record O/S if out of service</td>
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<td>Date of Verification Water Flush</td>
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<td>Time of Verification Water Flush</td>
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<td></td>
<td>CIP Flush Flow (gpm) Record O/S if out of service</td>
<td>Array/Bank</td>
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<td>Time of Verification Water Flush</td>
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## Reverse Osmosis Clean-In-Place Operation

### Data Sheet 10 – Minncare Disinfection

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<td>5.11.27</td>
<td>Disinfecting Solution pH (2.5 to 4.0)</td>
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Operator Signature: ___________________________  Print (First & Last): ___________________________  Date: ______________

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# Reverse Osmosis Clean-In-Place Operation

## Data Sheet 11 - Sulfamic Acid Cleaning

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<td>Date of Chemical Cleaning</td>
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<td>5.7.23</td>
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<td>Time 2nd Sulfamic Acid Cleaning Cycle Completed</td>
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<td>5.7.21</td>
<td>Cleaning Solution pH (acceptable range 1.1 to 3.0): Amount of Sulfamic Acid Added</td>
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<td>5.7.23</td>
<td>CIP Recirculation Flow (gpm)</td>
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<td>5.7.24.7</td>
<td>Time 3rd Sulfamic Acid Cleaning Cycle Completed</td>
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SOM Completion Review

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# Reverse Osmosis Clean-In-Place Operation

## Data Sheet 12 – Muriatic Acid Cleaning

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<td>5.4.21</td>
<td>RO Stage/Array/Bank(s) Flushed</td>
<td><em><strong>Array/Bank</strong></em></td>
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<td>5.8.3</td>
<td>Date of Chemical Cleaning</td>
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<td>5.8.25</td>
<td>Cleaning Solution pH: Amount of Muriatic Acid Added</td>
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| 5.8.26      | CIP Recirculation Flow (gpm)  
Record O/S if out of service | |
| 5.8.27.5    | Time 1st Muriatic Acid Cleaning Cycle Completed | |
| 5.8.25      | Cleaning Solution pH: Amount of Muriatic Acid Added | |
| 5.8.26      | CIP Recirculation Flow (gpm)  
Record O/S if out of service | |
| 5.8.27.5    | Time 2nd Muriatic Acid Cleaning Cycle Completed | |
| 5.8.25      | Cleaning Solution pH: Amount of Muriatic Acid Added | |
| 5.8.26      | CIP Recirculation Flow (gpm)  
Record O/S if out of service | |
| 5.8.27.5    | Time 3rd Muriatic Acid Cleaning Cycle Completed | |

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