1. Introduction

1.1. NSR Maintenance Requirement

The NSR heat exchanger tube bundle can be removed and cleaned to maintain proper cooling and flow requirements. The following cleaning procedure should be performed on an as needed basis.

1.2. Tool and Parts Requirement

The tools required to complete this maintenance procedure are the following:

1.2.1. **O-Ring** part number 0C12C979 qty 2

1.2.2. **Lube** part number 0C12E268 or equivalent all purpose, high viscosity lube compatible with rubber, heat resistant up to 204°C (400°F).

1.2.3. **Cleaning Kit** number: 0C12E280 (Includes: **Handle** 0C12E278, **Rod** 0C12E281, **Brush** 0C12E279 and **De-scaler liquid** 5 gal. 0C12E77).

1.2.4. **Coolant** Clarke Fire part number 0C054129 or Cool-Gard II part number TY26575.

2. Preparation

2.1. Lockout the engine

Place the pump controller mode selector in the OFF position, disable the pump controller battery chargers and remove the negative battery cable from each engine battery to prevent the engine from starting.

2.2. Drain the engine coolant

Drain the engine coolant into a proper container for disposal.

2.3. Turn off the raw water supply

Close the manual ball valves on the automatic and bypass side of the cooling loop to prevent raw water from flowing through the cooling system.

3. NSR Tube Bundle Removal

3.1. Remove the Crossover End Cap

3.1.1. Locate the Crossover End Cap (reference image 1-1 item 1)

3.1.2. Remove the Crossover End Cap bolts (qty 5).

3.1.3. Remove the Crossover End Cap (reference image 1-1 item 1)

3.1.4. Remove the rubber O-Ring and dispose.

3.2. Remove the IO (In/Out) End Cap

3.2.1. Locate the IO End Cap (reference image 1-1 item 2)

3.2.2. Remove the IO End Cap bolts (qty 5).

3.2.3. Remove the IO End Cap (reference image 1-1 item 2)

3.2.4. Remove the rubber O-Ring and dispose.

3.3. Remove the tube bundle

3.3.1. Identify the 12 o-clock mark on the tube bundle header plate from the IO side of the assembly and make note of its position.

3.3.2. Remove the tube bundle by sliding it out of the IO side of the assembly. (reference image 1-1 item 3)

4. NSR Tube Bundle Cleaning

4.1. Clean the Tube Bundle

4.1.1. Submerge the tube in de-scaler for 30 minutes to 1 hour.

4.1.2. Inspect the inside of the tubes. If needed, use a cleaning rod and brush to clean the tubes.

4.1.3. Rinse tube bundle thoroughly with fresh water and let dry.

5. NSR Tube Bundle Installation

5.1. Install the Tube Bundle

5.1.1. Install the tube bundle from the IO side of the assembly. (reference image 1-1 item 2)

5.1.2. Ensure the 12 o-clock marking is in the correct position, facing the IO side and not the crossover side.

5.1.3. Ensure the tube bundle is centered in the housing. Measure from the mating surface of the shell assembly to the header plate. This measurement should be equal to the value in table 1. Note: The header plate can float, ensure the header plate is flush with the cup.) Reference image 1-1.

NSR Part Number	Description	Measurement
	Standard Copper (Painted Endcaps)	5.5 mm
	Copper Nickel (Bronze Endcaps)	6.0 mm

Table 1

5.2. Install the End Caps

IMPORTANT: Install the End Caps as described below, ensuring that the bundle does not shift from the centered position. If the bundle moves at any point during end cap installation, remove the end cap and repeat step 5.1.2 and 5.1.3 before attempting again.

5.2.1. Lubricate all surfaces of a new O-Ring (part number 0C12C979).
5.2.2. Install O-ring into Crossover side of the assembly. Ensure the O-ring is fully seated inside the groove.
5.2.3. Place the Crossover End Cap onto the shell assembly and finger tighten the 5 bolts in the assembly.
5.2.4. Lubricate all surfaces of a new O-Ring (part number 0C12C979).
5.2.5. Install O-ring into IO (In/Out) side of the assembly. Ensure the O-ring is fully seated inside the groove.
5.2.6. Place the IO End Cap onto the shell assembly and finger tighten the 5 bolts in the assembly.
5.2.7. Hand tighten the 5 bolts on the Crossover End Cap assembly.
5.2.8. Hand tighten the 5 bolts on the IO End Cap assembly.
5.2.9. Properly torque the Crossover End Cap Bolts and IO End Cap Bolts to 31 FT-LBS in the sequence shown in figure 1-2.

6. Return to Normal Operation

6.1. Refill the engine coolant

Refill the engine coolant using Clarke Fire part number 0C054129 or Cool-Gard II part number TY26575

6.2. Turn on the raw water supply

Return the manual ball valves on the automatic and bypass side of the cooling loop to the normal position. IMPORTANT: Ensure the manual ball valves are in the normal position. Restricting raw water flow to the cooling system will cause the engine to overheat.

6.3. Return the engine to normal operation

Install the negative battery cable on each engine battery, enable the pump controller battery chargers and return the pump controller to automatic mode.

6.4. Run the engine

During filling of the cooling system, air pockets may form. The system must be purged of air prior to being put in service. Caution: Do not overfill cooling system. A pressurized system needs space for heat expansion without overflowing. Install the pressure cap, start and run engine for approximately 5 minutes in order to purge the air from the engine cavities.

6.5. Leave the engine in automatic

Do a final inspection for leaks, coolant level and ensure engine mode selector is set in the automatic mode.

Note: If you suspect there is a leak in the heat exchanger, pressure testing the assembly may be required. For details on pressure testing the NSR please contact Clarke Fire Customer Support.

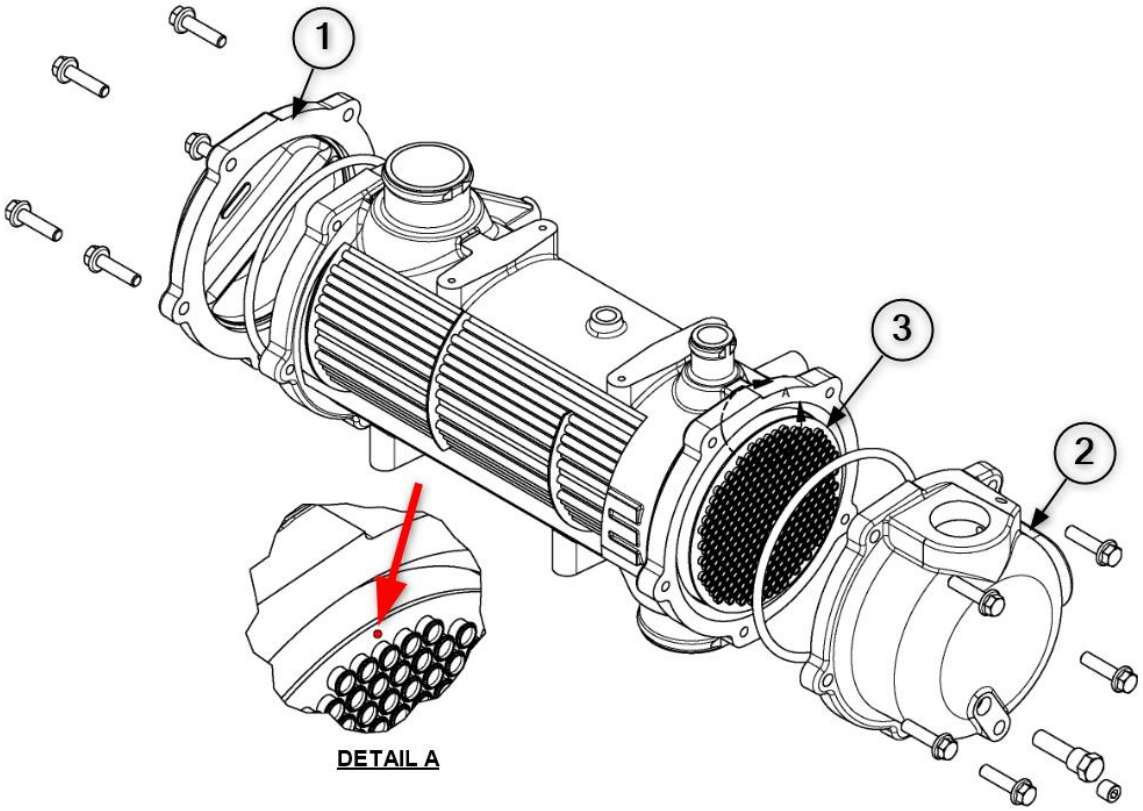

Figure 1-1

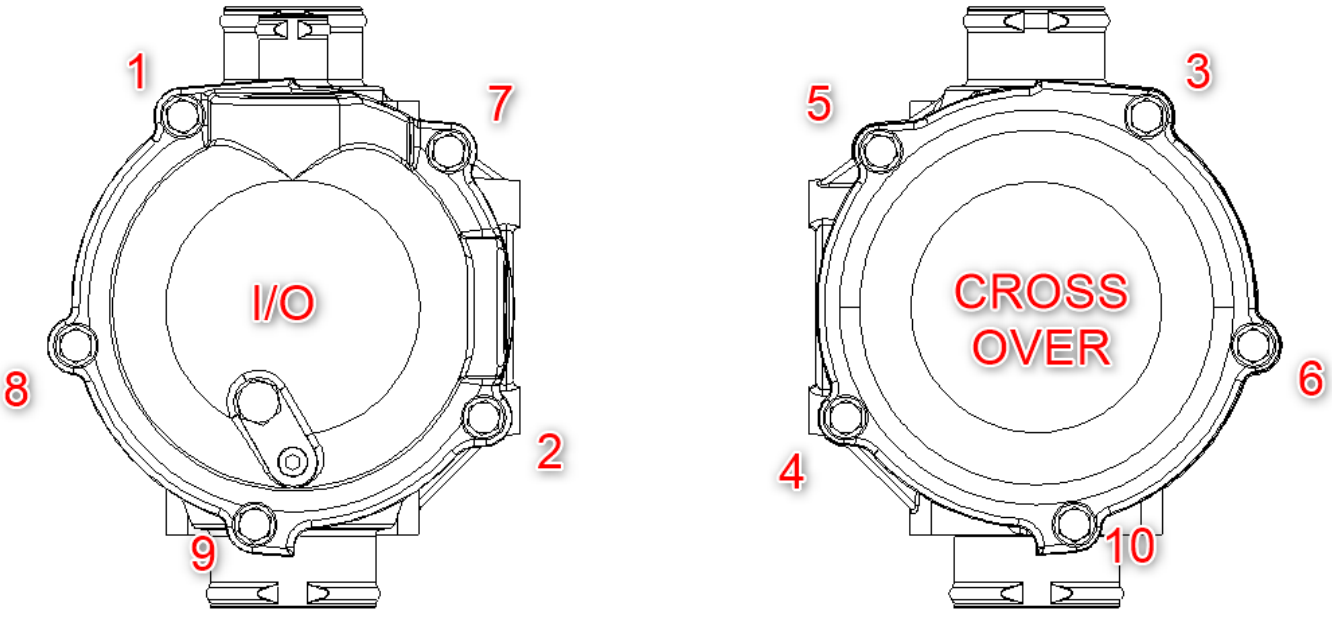

Figure 1-2