

# 2015 Keystone Alpine 3730FB

## Reverse Osmosis System Design and Implementation

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### Goals

Implement a Reverse Osmosis (RO) system for the entire coach with the following requirements:

#### Input Routing:

- Route shore water through filter array, RO membranes, output to freshwater tank
- Route shore water through filter array, bypass RO membranes, output to freshwater tank
- Route shore water through filter array, bypass RO membranes, output to coach water lines
- Bypass both filter array and RO membranes to freshwater tank (as stock)
- Bypass both filter array and RO membranes to coach water lines (as stock)

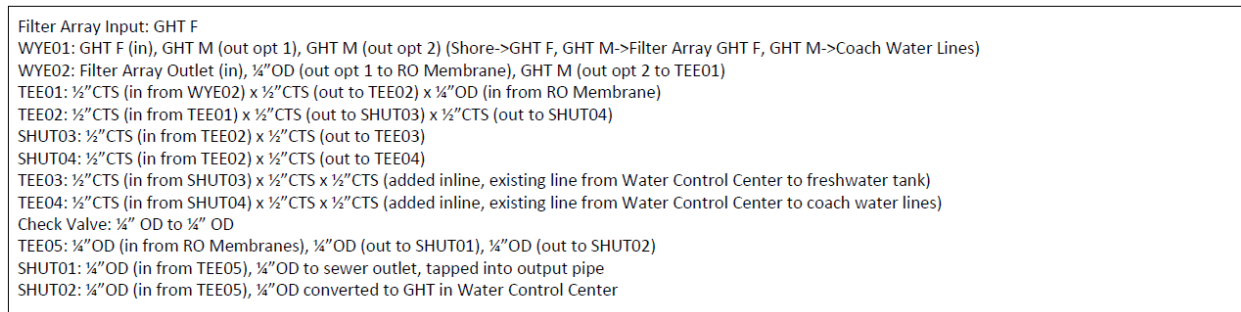
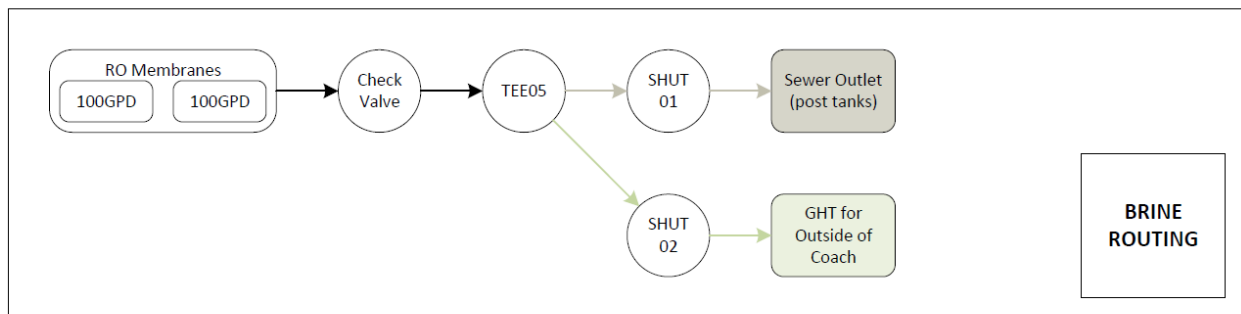
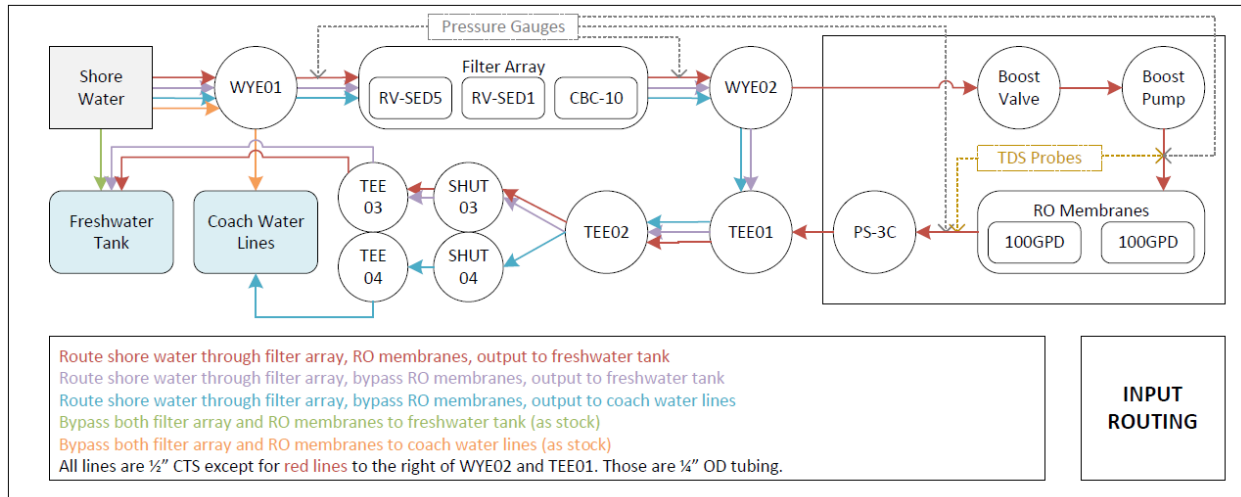
#### Brine Routing:

- Route into sewer outlet post tanks, near where the hose connects
- Route outside of the RV for grounds disposal

#### Monitoring/ Management:

- Monitor filter and membrane health using pressure gauges and TDS probes
- Automatically switch boost pump on/off based on water level in freshwater tank
- Completely disable boost pump via switch in basement storage

## Flow Diagrams



## System Design

Shore water will be connected into the RV Water Control Center as the coach manufacturer designed. However, the hose will be connected to a wye connector (WYE01) instead of directly to the control panel. That wye will determine whether the filter and RO system is bypassed. A potable water hose will run from one side of the tee into the basement storage to the water treatment center. It will be connected to the inlet of the filter array. 1/2" tubing will be used for the bypass at the outlet of the filter array to facilitate proper flow to the coach water lines when the RO membranes are being bypassed. A pair of shutoff valves will determine whether RO bypass water that goes through the filter array is delivered to the freshwater tank or the coach water lines.

If RO is selected, the outlet of the filter array will use ¼” tubing to a boost pump that will increase pressure to push the water through the RO membranes. The outlet of the RO membranes will connect to a polishing filter, then the outlet of the filter will flow through a check valve into the aforementioned pair of shutoff valves. In the event that RO is in use, they should always be configured to send water to the freshwater tank. The boost pump uses sensors in the freshwater tank to activate when the tank is below 20% capacity, and will deactivate when near full.

When RO is selected, brine will be produced that must be dealt with. It will leave the RO membranes and into a check valve to prevent backflow. On the other side of the check valve, two shutoff valves are used to determine whether it flows into sewer outlet (post tanks) or to a ¾” garden hose outlet in the RV Water Control Center.

Four pressure gauges are used to monitor the health of the system. They are placed at input of the filter array, output of the filter array, output of the boost pump, and output of the RO membranes. A large difference between the first and second gauge will indicate a filter issue, and a large difference between the third and fourth gauges will indicate a RO membrane issue. The RO membranes are also monitored by a TDS monitor that displays the PPM of the input and the output side of the RO membranes for comparison. If the output side is reading high, it indicates an issue with the system.

The filter array consists of a five-micron pre-filter (RV-SED5), one-micron filter (RV-SED1), and charcoal filter (CBC-10). A specialized filter (PS-3C) is placed after the RO membranes to raise the PH level of the water. The sediment filters need to be replaced every three to four months, while the charcoal filters need to be replaced every six. The membranes should last two to three years. The specialty filter as needed.

The OEM RV pump is replaced by an Aquajet RV variable speed water pump that can run at up to 5.3 gallons per minute.

## Operating Instructions

### Input Management

#### *Fill freshwater tank without filtering or RO*

- Connect hose to freshwater fill inlet, in RV Water Control Center

#### *Use shore water and completely bypass both filtering and RO*

- BOOST01 toggle switch should be off
- WYE01 left valve should be closed
- WYE01 right valve should be open
- Connect shore input to WYE01

*Use shore water and filter to coach lines, but bypass RO*

- BOOST01 toggle switch should be off
- WYE01 left valve should be open
- WYE01 right valve should be closed
- Turn WYE02 to the left-most position
- SHUT03 should be closed (turn to right)
- SHUT04 should be open (turn to left)
- Connect shore input to WYE01

*Use shore water and filter to freshwater tank, but bypass RO*

- BOOST01 toggle switch should be off
- WYE01 left valve should be open
- WYE01 right valve should be closed
- Turn WYE02 to the left-most position
- SHUT03 should be open (turn to left)
- SHUT04 should be closed (turn to right)
- Connect shore input to WYE01

*Use shore water and filter to freshwater tank, including RO (normal operation)*

- WYE01 left valve should be open
- WYE01 right valve should be closed
- Turn WYE02 to the right-most position
- SHUT03 should be open (turn to left)
- SHUT04 should be closed (turn to right)
- Connect shore input to WYE01
- BOOST01 power switch should be on
- Internal water pump should be on

## Brine Management

*Send brine to sewer outlet*

- SHUT01 should be open (turn to left)
- SHUT02 should be closed (turn to right)

*Send brine to ground disposal*

- SHUT01 should be closed (turn to right)
- SHUT02 should be open (turn to left)

