

INSTALLATION INSTRUCTIONS

INDIGO ELECTRONICS AT-4T THERMOSTAT KIT ATOMIC 4 - MECHANICAL FWC

This Indigo Thermostat Kit is designed for use with those engines converted to Fresh Water Cooling (FWC) with an electric antifreeze pump. Two thermostats are available. The 160°F version is NAPA THM38 and the 180°F version is NAPA THM138. **A .050" hole has been drilled in the flange of the thermostat as a continuous air vent and to insure stable operation. If you purchase a replacement thermostat from NAPA, you will need to drill this hole yourself. A 1/16" drill bit can be used.**

There are 6 main components to this installation process:

1. Removal of the existing thermostat.
2. Installation of new Thermostat Housing.
3. Installation of new tee in antifreeze circuit.
4. Installation of the re-circulation hose.
5. Installation of the heat exchanger hose.
6. Filling and testing.

For Customer convenience, an Installation Hardware Package is available which provides all of the fittings for the Thermostat Kit. Pricing is available at www.atomic4.com/thermostat.htm

NOTE: When operating the A4 at 180°F, it is strongly recommended that the spark plugs be the original Champion RJ8C or equivalent. A hotter plug will be too hot at this operating temperature.

Antifreeze Pump Impeller Caution

With this thermostat kit installed, the antifreeze being pumped by the flexible impeller pump will be quite warm, about 130F. The impellers manufactured by GLOBE become too pliable at this temperature and do not pump properly. **DO NOT USE A GLOBE IMPELLER.**

Engine Temperature Observations

During the development and testing phase of this Thermostat Kit, an interesting and pertinent observation was made regarding the engine temperature as indicated by the temperature sensor located in the head (the traditional Late Model location). The temperature indicated is from 1°F to 10°F hotter than the actual coolant, depending on load. With the original thermostat arrangement, you have no way of seeing or determining this as there is a great mixing of coolant at the exit from the original thermostat housing. Since this new Thermostat Kit has the thermostat positioned where the coolant exits the exhaust manifold, the temperature of the coolant entering the thermostat housing can readily be measured. Since the coolant at this point has now passed through the exhaust manifold, it was my expectation that the temperature would be a few degrees higher than that indicated on the head sensor. This was not the case. At idle, they were about the same but at full load, there is about a 10°F spread. The reason for this appears to be the fact that the head sensor is being heated not only by the coolant but by heat being transferred through the metal of the head directly from the #1 combustion chamber.

Based on testing of this kit, it is recommended that a tee be installed where the coolant exits the manifold and the new thermostat housing be mounted on the leg of the tee pointing away from the manifold. The other leg of the tee would then receive the temperature sensor traditionally mounted in the forward end of the head. See image below.



The traditional sensor opening in the head is now an excellent place to install a high temperature alarm such as the Cole Hersee Model COL-M40177BP.

Engine Preparation

Drain the antifreeze from the engine. Place battery disconnect switch in “Off” position.

Thermostat Removal

1. Remove the existing thermostat from its housing on the forward end of the engine. The bypass hose which runs from the antifreeze inlet on the side of the engine to the thermostat housing is no longer needed as all antifreeze will now pass through the engine. The bypass can be eliminated in one of two ways:
 - a) The 90° fitting on the thermostat housing can be plugged with a 1/8” NPT socket head pipe plug by removing the existing 90° fitting and installing the new fitting with pipe plug (Provided in Kit). In this manner, the hose is left in place but no flow can pass through it. Replace gasket under thermostat housing.
 - b) The 90° inlet fitting on the original thermostat housing can be removed and the opening plugged with a 3/8” NPT pipe plug. Replace gasket under thermostat housing. The tee fitting on the side plate of the engine can then be removed. This requires removal of the

side plate as there is most likely a diverter cap on the inside which directs the coolant flow aft within the block. With the plate removed, remove the diverter cap fitting and then the external tee. Replace the tee with the 90° fitting removed from the thermostat housing and re-install the diverter fitting being sure that the opening points aft and slightly downward. Replace the side plate using a suitable sealant on the plate (such as Permatex Form-a-Gasket).

Thermostat Housing Installation

As received, the Thermostat Housing is loosely assembled with the thermostat that you specified installed inside. The nuts which hold the two halves together are only slightly tightened for shipping purposes. The cover gasket is in place. **NOTE: The top piece can be installed either as shipped or rotated 180°.**

The preferred location for the new Thermostat Housing is to attach it to a 1/2” elbow or tee (NOT supplied in Kit) screwed into the forward (flywheel end) of the exhaust manifold. In order to accommodate this location, the existing hose routing from the original thermostat housing to the exhaust manifold will have to be changed. This will require a longer hose running from the original thermostat housing to the existing hose barb fitting screwed into the aft (transmission) end of the exhaust manifold. This fitting will have to be rotated about 180° to accommodate the new hose routing. Be sure this new hose makes a nice smooth curve as it sweeps aft (no kinks).

There are two main reasons for locating the new thermostat housing on the forward end:

- The forward end is normally much more accessible than the aft end (except on a V-Drive model). This greatly facilitates installation and any maintenance required.
- Some evidence suggests that by having the coolant enter the exhaust manifold at the aft end (which is traditionally lower than the forward end) there is less chance for any air

being trapped in the forward end of the manifold and thus potentially cause corrosion inside the manifold.

2. Remove the upper half of the Thermostat Housing and the Thermostat itself.
3. Attach the bottom half of the new Thermostat Housing to the new 1/2" elbow or tee on the forward end of the manifold utilizing a 1/2" close nipple (Provided in Kit) screwed into both pieces. There are two 1/2" NPT connections on the bottom half housing. Use the one on the flat surface with an "I" (for Inlet) cast into it near the connection. Be sure to seal the pipe threads with Teflon tape or pipe dope.

If another location is more convenient for your particular installation, then by all means utilize that location. Three possibilities are: Attached to the aft end of the exhaust manifold, attached to the heat exchanger, or mounted on a vertical surface.

Hose Routing Summary:

1. **Re-circulation hose runs from bottom half "R" connection on new thermostat housing to a tee installed between the "cold" connection on heat exchanger and antifreeze pump inlet (suction).**
2. **Hot antifreeze hose runs from top half "E" connection on new thermostat to the "hot" connection on the heat exchanger.**

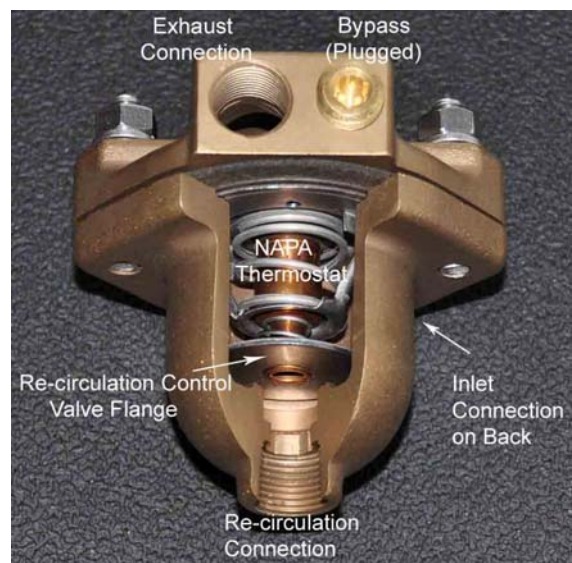
Configuration/Installation of Re-Circulation Hose

One of the remarkable features of this new Thermostat Kit is its ability to re-circulate all or some portion of the coolant. During warm-up, all of the coolant is re-circulated (bypassing the heat exchanger) which speeds warm-up and helps keep temperatures within the engine more uniform. Once the thermostat is controlling the engine temperature, some portion of the coolant is still re-circulated (depending on engine load and raw water temperature), again helping to keep engine temperatures more uniform. With the engine temperature gauge reading 180° F, the coolant entering the side cleanout plate is at about 140° F as opposed to being at or close to raw water temperature.

4. Re-circulation is accomplished by allowing hot antifreeze from the new Thermostat Housing to be introduced into the antifreeze pump suction via a new tee connection. It makes no difference where the new tee is located in the hose from the heat exchanger cold antifreeze connection to the antifreeze pump ... either at the heat exchanger or at the antifreeze circulating pump. Suitable hose barb fittings, a threaded tee, and probably a short pipe nipple will be required
5. The re-circulation path is established by running a hose from the 1/2" NPT connection on the bottom of the Thermostat Housing (there is an "R", for Re-circulation, cast into the housing near this connection) to the new tee just installed. Install a 1/2" NPT x 1/2" hose 90° Hose Barb fitting in this 1/2" NPT connection. Route the hose in the best location to suit your engine compartment and the location of your heat exchanger

Configuration/Installation of Heat Exchanger Hose

6. Install the new Thermostat in the bottom half Thermostat Housing with the **Spring Side Down**. Install the gasket over the studs and place the upper half Thermostat Housing on the lower half. Tighten the two 5/16" nuts with a 1/2" socket or combination wrench to about 10 ft lbs torque.



7. Install a 3/8" NPT x ??? (size to suit hose) Hose Barb fitting in the 3/8" NPT connection on the top half Thermostat Housing (there is an "E", for Exhaust, cast into the housing). Install the 1/4"

NPT pipe plug (Provided in kit) in the Bypass Connection as it will not be utilized for FWC. **This plug does, however, provide an excellent means for venting air out of the system when filling it with antifreeze.** Be sure to seal the pipe threads with Teflon tape or pipe dope.

8. Install a piece of 1/2" ID hose (hose size chosen) between the hose barb fitting installed in Step 7 and the existing hose barb fitting on the hot antifreeze connection on the Heat Exchanger. Be sure to make this a nice smooth run of hose with no kinks.

Installation with Domestic HW Tank

NOTE: Incorporating a HW tank in the antifreeze circuit is only recommended if you are using a mechanical rubber impeller pump for antifreeze circulation.

If a domestic HW tank with a built in heat exchanger is to be used, it should be installed between the discharge of antifreeze from the new Thermostat Housing and the Heat Exchanger. In this location, the heating of the domestic HW and subsequent cooling of the antifreeze will have no impact on the performance of the thermostat. See drawing below.

Filling with Antifreeze

10. Fill the heat exchanger completely full of antifreeze. The heat exchanger fill opening should be higher than the new Thermostat Housing and thus the system will fill completely due to the vent hole in the new Thermostat flange. In the event that the heat exchanger fill opening is lower than the new Thermostat Housing, it will be necessary to open the new Thermostat Housing and fill it completely full of antifreeze and then close it up. It will be necessary to top-off the heat exchanger several times during this process.
11. **Prior to starting the engine, pinch off the re-circulation hose (running from the bottom of the thermostat housing) with a clamp or vise grips.** If there is any air in the block, head or manifold, this action will

prevent the air from re-circulating and causing the engine to overheat. This process will only be necessary the first time after installation of the thermostat and any time the block, head and manifold are drained.

12. Start engine and run for about 1 minute at idle. Stop the engine. Observe the level of coolant in the heat exchanger and top off as necessary. Release the restriction on the re-circulation hose and start engine. **Additionally, loosen the 1/4" pipe plug in the new thermostat housing upper half until antifreeze dribbles out.** Top off the coolant in the heat exchanger as necessary. Install the cap on the heat exchanger, start the engine and continue to warm engine. If the raw water temperature is below about 75° F, engine temperature may not get up to 180° F with the engine in neutral (essentially no load). Once the engine is put in gear and a reasonable load applied, the normal operating temperature of about 180° F will be obtained.
13. If the engine overheats, the most likely cause is air trapped in the coolant system. Repeat Steps 11 and 12 as necessary to fully vent the system.
14. Once fully warmed up, check the system for antifreeze leaks. Correct as necessary.

Thermostat Performance

Engine RPM at Load	2000
Engine Temperature Normal Gauge	186F
Coolant entering Thermostat	175F
Coolant entering Engine	133F

Engine Cool Down Option

Reducing the engine temperature can be a real bonus in the summer time in that the engine temperature can be reduced during the last 30 minutes of motoring on a hot day, thus helping to reduce the residual heat in the engine box when the engine is shut down. Installation of a 3-way valve provides a means of accomplishing this.

1. Obtain a 3 way valve and install it in the re-circulation hose such that the re-circulating coolant can be directed to either the tee at the heat exchanger (normal routing) or to a tee (which

would have to be installed) in the hose that goes from the Thermostat hot outlet to the Heat Exchanger. See last drawing below.

2. By positioning the 3 way valve such that the re-circulating coolant goes to the hot inlet of the heat exchanger, you have essentially bypassed the thermostat and thus substantially reduced the engine temperature.

Troubleshooting

If the engine begins to run hotter than usual, there are several possible causes:

1. **MOST PROBABLE** - Chunks of rust and scale have entered the thermostat housing and are restricting the water flow.
 - a. Remove the upper half of the thermostat housing and inspect and clean the internals of the housing.

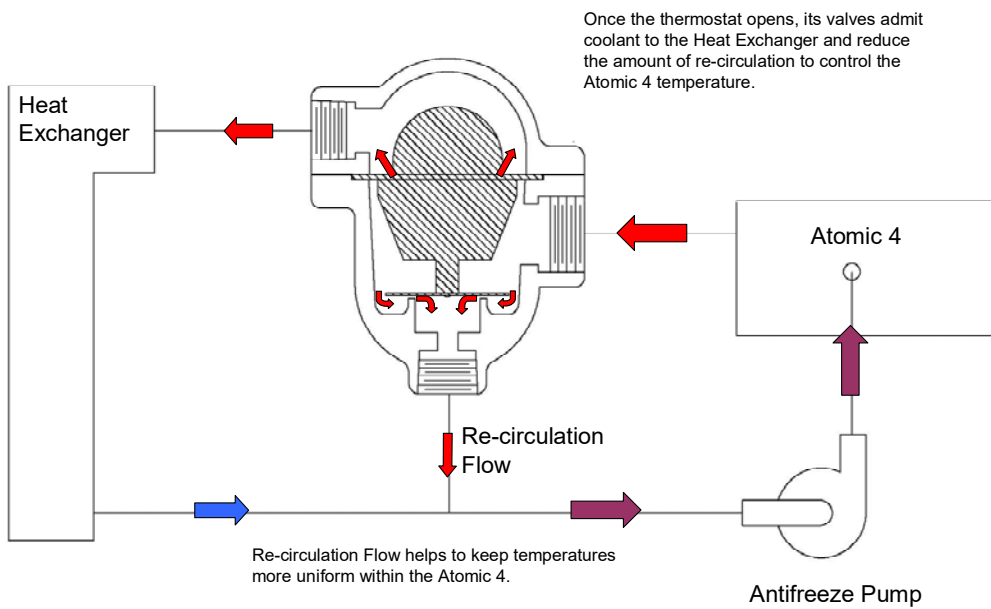
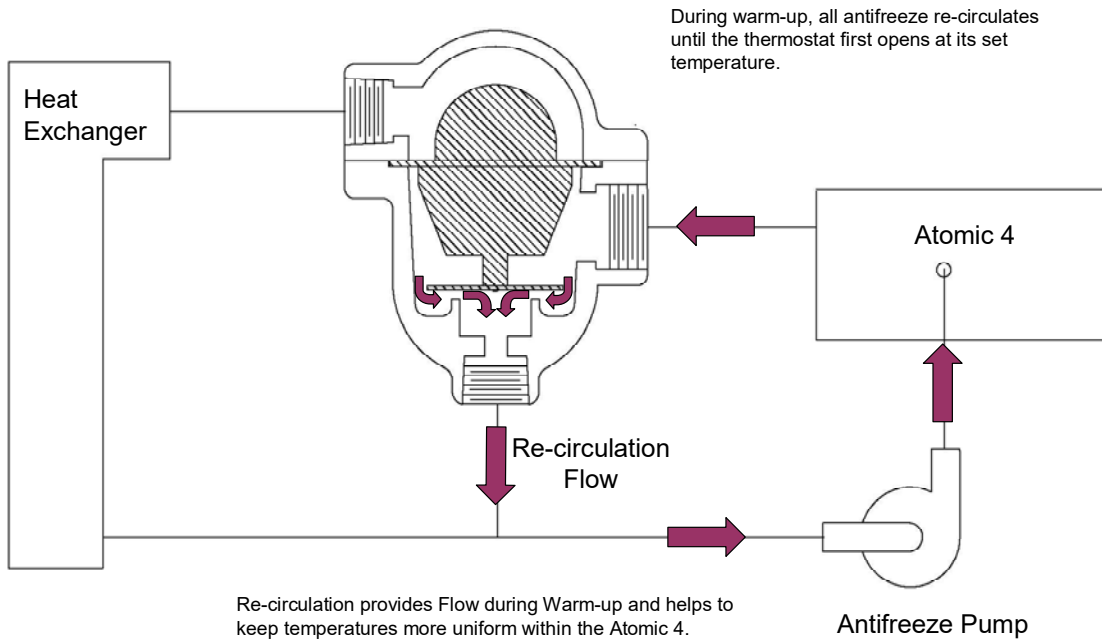
2. The raw water flow path is restricted.
 - a. Check all hoses for kinks and obstruction.
 - b. Check the raw water strainer and clean as necessary.
3. The raw water pump is operating abnormally.
 - a. Check impeller for damage. Replace as necessary
4. **GLOBE** Impeller in Antifreeze Pump

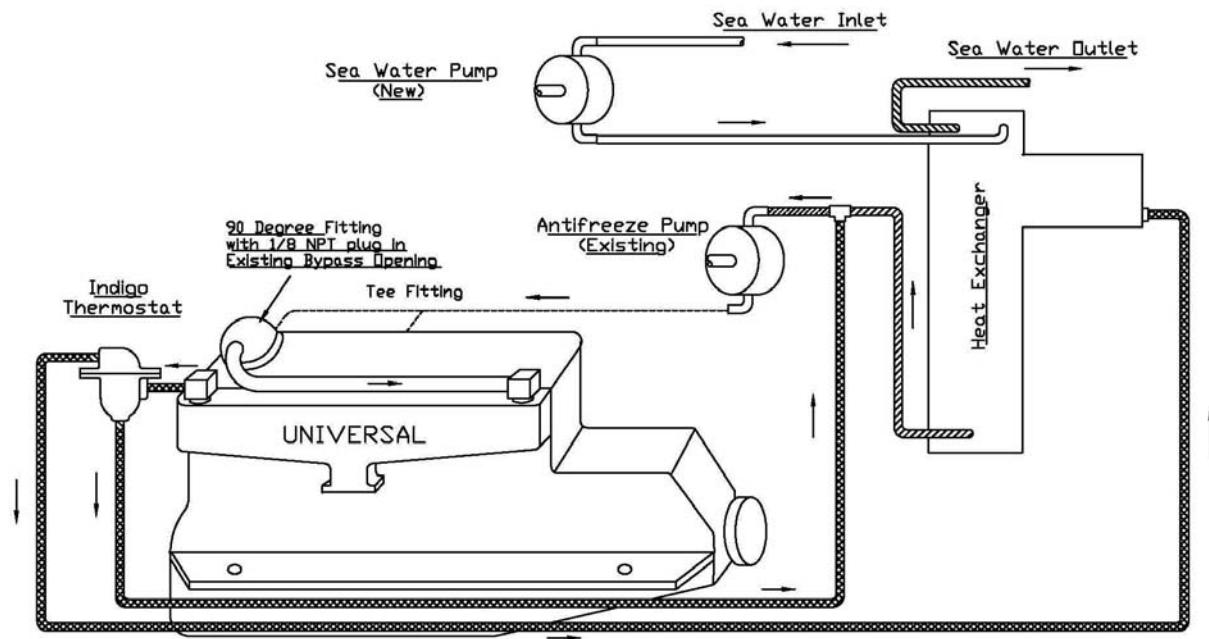
If the engine begins to run cooler than usual or oscillates, check the following:

1. The thermostat is:
 - a. Stuck Open - remove thermostat and replace as necessary.
 - b. Blocked with rust and scale. Clean as necessary.

Parts List

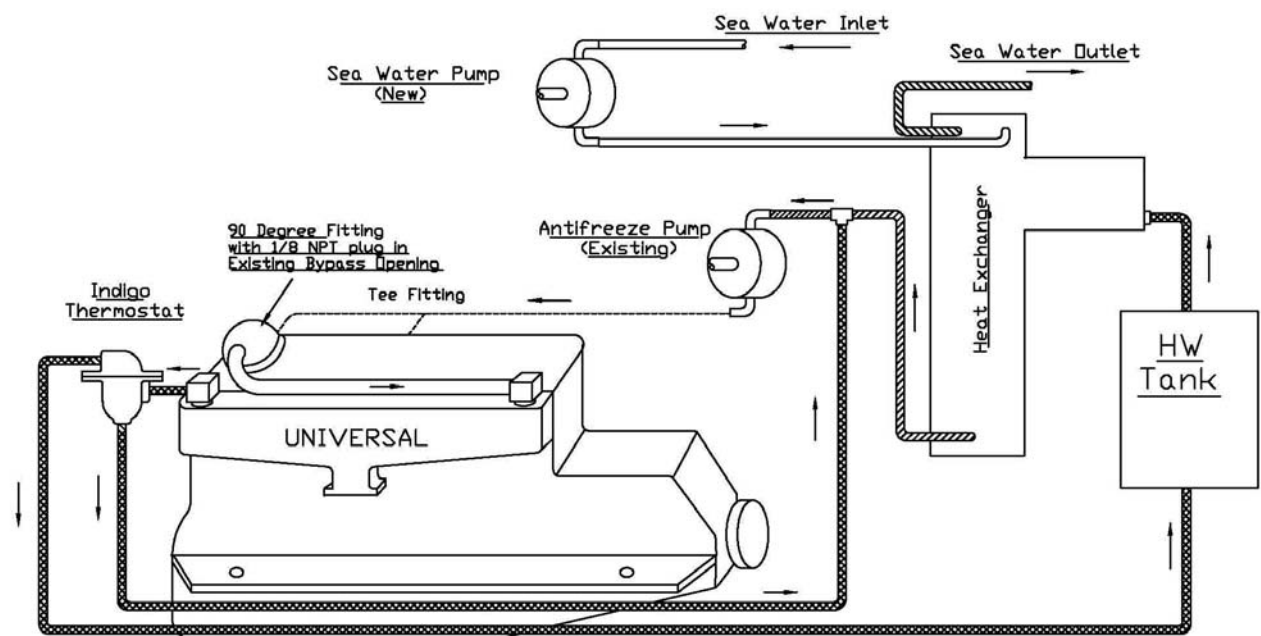
<u>Part No.</u>	<u>Quantity</u>	<u>Description</u>
PARTS INCLUDED WITH KIT		
1	1	New Thermostat Housing
2	1	New Thermostat – Either 160F or 180F
3	1	New Thermostat Housing Gasket
4	2	5/16 – 18 X 1” Stud
5	2	5/16 – 18 Nut
6	2	5/16 Lock washer
7	1	Old thermostat housing gasket
8	1	90 Degree hose barb fitting – 3/8 NPT x 1/2 hose with 1/8 NPT plug installed in hose barb end – original bypass connection on original Thermostat Housing.
9	1	1/2” Close Nipple to attach Thermostat to new ell or tee fitting
10	1	1/4" Socket Head Pipe Plug (Bypass connection on Housing)
PARTS NEEDED		
1	1	1/2” Nipple to attach new ell or tee to manifold
2	1	1/2” ell or tee for installation of thermostat housing on manifold
3	1	Tee, nipple and hose barb fittings to be installed in Cold Antifreeze hose for re-circulation
4	1	3/8"NPT x ? hose barb fitting for heat exchanger connection on Thermostat Housing
5	1	90 Degree hose barb fitting – 1/2 NPT x 1/2 hose - re-circulation connection on new Thermostat Housing.
6	1	Suitable heater hose to make up to connections
7		Suitable hoses clamps for all connections





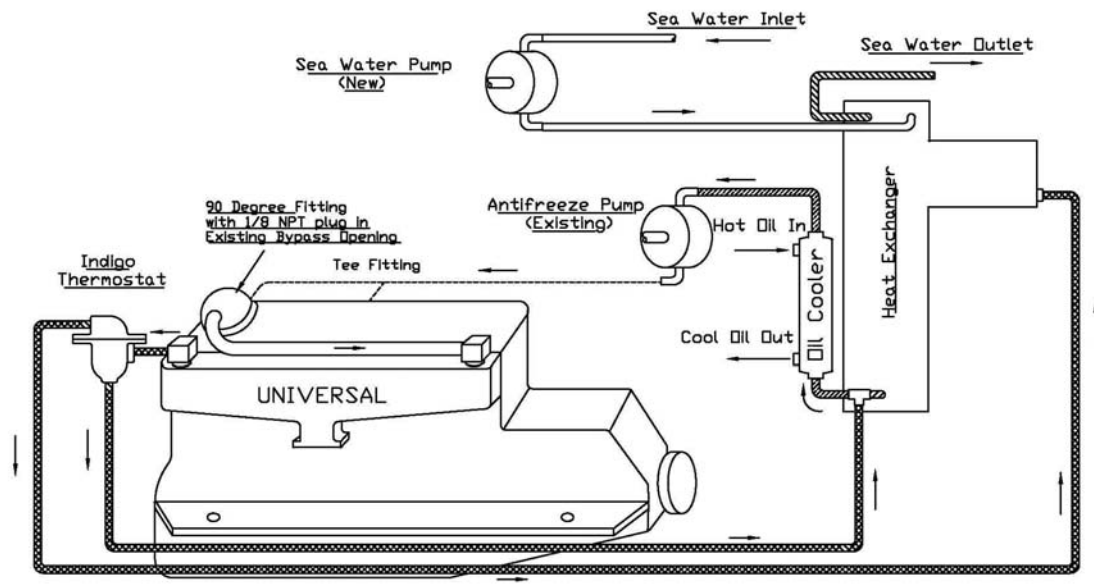
AT-4 Mechanical FWC with
External Indigo Thermostat

- Cold Sea Water
- ▨ Hot Sea Water
- ▧ Cold Antifreeze
- ▩ Warm Antifreeze
- ▤ Hot Antifreeze



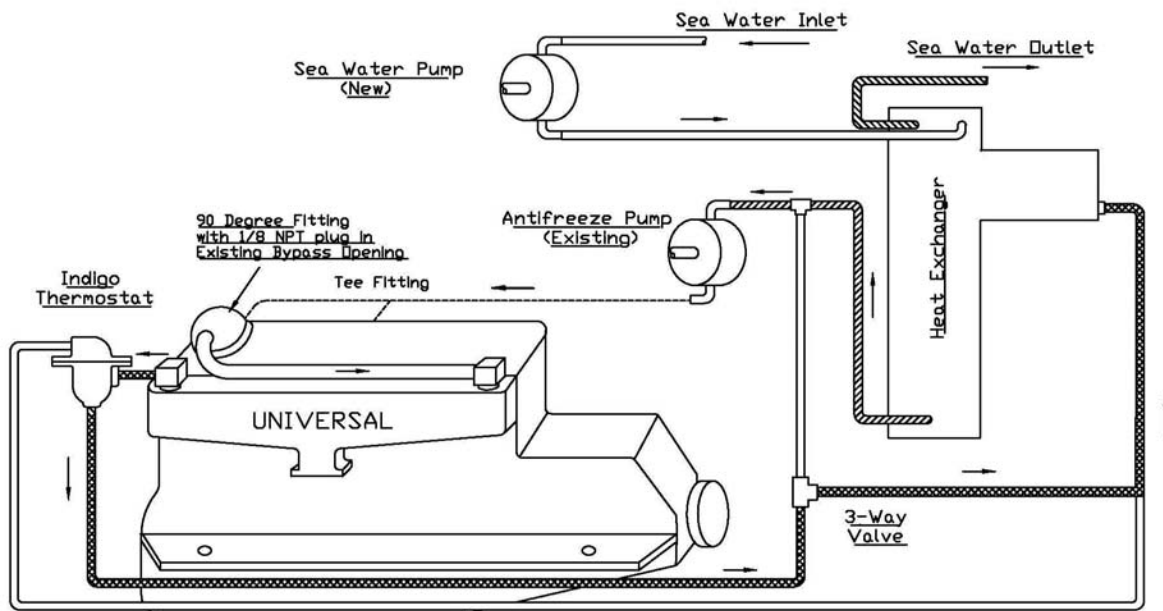
AT-4 Mechanical FWC with
 External Indigo Thermostat
 With Domestic Hot Water Tank

- Cold Sea Water
- ▨ Hot Sea Water
- ▧ Cold Antifreeze
- ▩ Warm Antifreeze
- ⋯ Hot Antifreeze



AT-4 Mechanical FWC with
External Indigo Thermostat

- Cold Sea Water
- ▨ Hot Sea Water
- ▩ Cold Antifreeze
- ▧ Warm Antifreeze
- ⋯ Hot Antifreeze



AT-4 Mechanical FWC with
External Indigo Thermostat
With Cool Down Valve Open

- Cold Sea Water
- ▧ Hot Sea Water
- ▨ Cold Antifreeze
- ▩ Warm Antifreeze
- ⋯ Hot Antifreeze