INSTALLATION INSTRUCTIONS

INDIGO ELECTRONICS AT-4T THERMOSTAT KIT
ATOMIC 4 - RWC

☑ This Indigo Thermostat Kit is designed for use with Raw Water Cooled (RWC) engines. One 140°F thermostat is available for RWC (NAPA SME18-3551 or Sierra 18-3551). **A 3/32" hole is drilled in the flange of the thermostat as a continuous air vent.** The RWC model also includes an integral re-circulation control valve to give the thermostat double action characteristics as well as a copper alignment sleeve which is added to the thermostat. **If you purchase a replacement thermostat from NAPA or the Sierra Model, you will need to drill this hole yourself. A 3/32" drill bit can be used. See image on Page 8 Also, you will need to remove the copper sleeve from the old thermostat and install it in the new one.**

There are 8 main components to this installation process:

1. Removal of the existing thermostat.
2. Reconfiguration of the existing raw water bypass circuit.
3. Installation of new Thermostat Housing.
4. Installation of the bypass hose.
5. Installation of a new tee in raw water circuit for re-circulation flow.
6. Installation of the re-circulation hose.
7. Installation of the exhaust hose.
8. 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

Raw Water Strainer – Due to the small size of the bypass orifice, it is **strongly** recommended that a Raw Water Strainer be utilized to prevent the inadvertent obstruction of the bypass orifice and subsequent overheating of the exhaust system.

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 Early and 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 of a Late Model Atomic 4 arrangement

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. A complete alarm kit is available from ***Indigo Electronics*** which includes the necessary pipe fittings, electrical connectors, and instructions. Visit www.atomic4.com/thermostat.htm for more information.

Engine Preparation

Close the raw water thru hull valve. 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 coolant inlet on the side of the engine to the thermostat housing is no longer needed as all coolant will now pass through the engine. The bypass function can be eliminated by removing the 90° inlet fitting on the original thermostat housing and the opening plugged with a 3/8" NPT pipe plug. Replace gasket under thermostat housing. The hose on the raw water inlet tee fitting on the side plate of the engine can then be removed and replaced with a new piece of ½" heater hose of sufficient length to reach to the raw water bypass connection on the new thermostat housing.

Thermostat Housing Installation

As received, the Thermostat Housing is loosely assembled with the 140°F thermostat and re-circulation control valve installed inside. The nuts which hold the two halves together are only slightly tightened for shipping purposes.

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 ½" elbow 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 a ½" elbow screwed into the aft (transmission) end of the exhaust manifold. Relocate the hose barb fitting from the forward end elbow to the aft end elbow. Be sure this new hose makes a nice smooth curve as is 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, gasket, thermostat itself, and the re-circulation control valve and spring.

3. Attach the bottom half of the new Thermostat Housing to the ½" elbow on the forward end of the manifold utilizing a ½" close nipple (Provided in Kit) screwed into both pieces. There are two ½" NPT connections on the bottom half housing. Use the one on the flat surface that has 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. Two possibilities are: Attached to the aft end of the exhaust manifold or mounted on a vertical surface.

Hose Routing Summary:

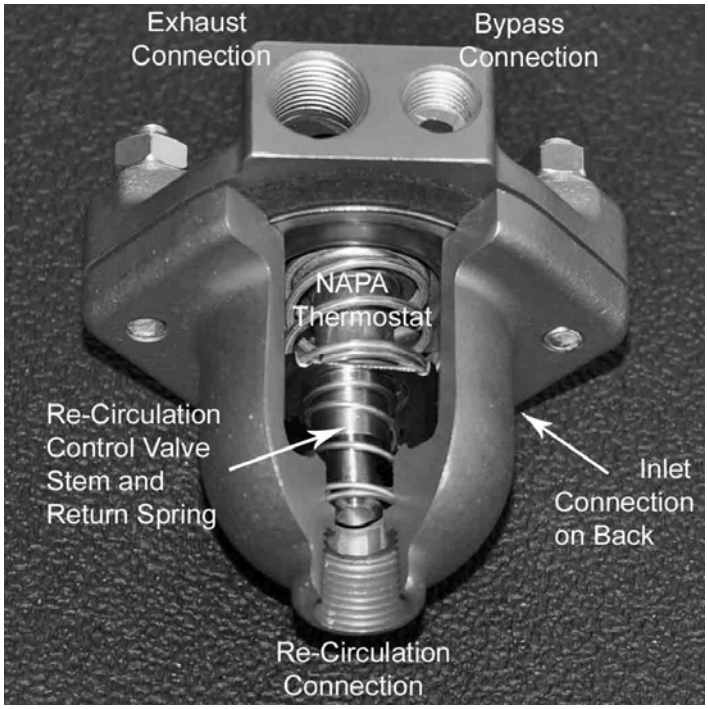
1. Re-circulation hose runs from bottom half "R" connection of new thermostat housing to a tee installed at the raw water pump inlet (suction).
2. Bypass hose runs from the top half "B" connection of new thermostat housing to the former "bypass" hose connection on the side of the engine block at the "clean out plate".
3. Hot raw water hose from top half "E" connection on new thermostat housing to the existing connection on exhaust system for raw water entry into exhaust system.

Configuration/Installation of Raw Water Bypass Hose

One feature of this new Thermostat Kit is that it provides for a controlled flow of raw water to be bypassed around the engine from the raw water pump to the new Thermostat Housing for the purpose of keeping the exhaust temperature below 145°F. A new hose must be installed to establish this bypass flow.

4. As outlined in Paragraph 1 above, prepare a ½" raw water bypass hose.

5. At this time, install the new thermostat upper half housing **only** (no thermostat, spring or re-circulation control valve) and secure in place with the nuts and lock washers provided, just hand tight.



6. On the upper half of the Thermostat Housing are two drilled and tapped openings. The smaller of the two, a ¼" NPT connection is marked with a "B" (for Bypass) cast into the housing. This is the connection which will receive the bypass flow from the raw water pump. Install a ¼ NPT x ½" Hose Barb fitting included in the kit (and other elbows if necessary for proper routing of the hose) in this "B" connection. Be sure to seal the pipe threads with Teflon tape or pipe dope.

7. Run a length of ½" heater hose from the side plate raw water inlet tee fitting to the new hose barb fitting in the "B" connection on the new Thermostat Housing. Route the hose in the best location to suit your engine compartment.

Configuration/Installation of Re-Circulation Hose

One of the remarkable features of this new Thermostat Kit is its ability to re-circulate some portion of the raw water. During warm-up, some of the raw water is re-circulated 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 raw water 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 140°F, the coolant entering the side cleanout plate is between 90°F and 120°F (raw water 52°F – 85°F) as opposed to being at or close to raw water temperature.

8. Install a 3/8" tee fitting in the suction side of the raw water pump. Once the tee is installed, a 3/8 NPT x ½" Hose Barb fitting (and other elbows if necessary for proper routing of the hose) must be installed for a ½" hose that will be run to the new Thermostat Housing. Be sure to seal the pipe threads with Teflon tape or pipe dope.

9. On the bottom half of the Thermostat Housing, there is a ½" NPT connection marked with an "R" (for re-circulation) cast into the housing. This is the connection which will provide the re-circulation flow to the raw water pump. Install a ½" NPT x ½" hose 90 degree fitting in this ½" NPT "R" connection. Be sure to seal the pipe threads with Teflon tape or pipe dope.

10. The re-circulation path is established by running a ½" heater hose from the new hose barb connection on the bottom of the Thermostat Housing to the new hose barb fitting on the tee just installed. Route the hose in the best location to suit your engine compartment.

Configuration/Installation of Exhaust Hose

11. Install a 3/8" NPT x ½" 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) Be sure to seal the pipe threads with Teflon tape or pipe dope.

12. Install a piece of ½" heater hose (between the hose barb fitting installed in Step 11 and the existing hose barb fitting on the exhaust system). Be sure to make this a nice smooth run of hose with no kinks. **If the existing hose to the exhaust connection is 5/8", you will need to substitute a 3/8" NPT x 5/8" hose barb fitting for the one mentioned in Paragraph 11.**

Operational Test

13. **REMOVE THE PREVIOUSLY INSTALLED UPPER HALF THERMOSTAT HOUSING. FILL THE COOLING PASSAGES IN THE BLOCK, HEAD AND MANIFOLD WITH CLEAN WATER BY SLOWLY POURING WATER INTO THE LOWER HALF THERMOSTAT HOUSING.** Once full, install the re-circulation control valve and spring. **Exercise the re-circulation control valve up and down to be sure it does not stick**. Install the thermostat itself (**being sure that the copper alignment sleeve is in position)** with the **Spring Side Down**. Install the gasket on the studs and land the upper half Thermostat Housing on the lower half. **NOTE: There is a slight pre-load on the re-circulation control valve spring. If necessary, hold down on the thermostat flange with a knife blade laid flat on the flange to compress the spring and insure that the thermostat is seated in its recess. Install the upper half housing, withdrawing the knife as the two housing halves come together.** Tighten the two 5/16" nuts with a ½" socket or combination wrench to about 10 ft lbs torque.

14. **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 boat is taken out of the water or the block, head and manifold are drained.

15. Open the thru hull valve, start engine and observe all newly established connections for leaks. Once you have established a good flow throughout the system and a reasonable amount coming out of the exhaust, release the clamp on the re-circulation hose.

16. If the raw water temperature is below about 75° F, engine temperature may not get up to 150° F with the engine in neutral (essentially no load). Once the engine in put in gear and a reasonable load applied, the normal operating temperature of about 150° F will be obtained.

17. Once fully warmed up, check the system for raw water leaks. Correct as necessary.

18. Perform a dock trial or sea trial with the engine under load and observe both the engine temperature and the water cooled portion of the exhaust system. The engine should hold steady at about 150°F and the exhaust should remain below 145°F at all times

Normal Maintenance

- **Since your engine continues to be raw water cooled, there is an ongoing potential for flakes of corrosion byproducts to be broken loose from the block, head and manifold. They will most likely be caught in the new Indigo Thermostat. As a preventive maintenance practice, it is recommended that the thermostat be opened at least annually to clean out any debris which has accumulated in the thermostat housing. A replacement gasket is available through NAPA Auto Parts under their number 1068-ST**

Winter Lay Up

The best method for laying up the engine in preparation for freezing temperatures is to fill the entire cooling system with RV antifreeze. With the Indigo Thermostat Kit, you have to be careful to insure that the thermostat itself does not give a false sense of security by simply re-circulating a mixture of antifreeze and raw water. To insure complete filling with antifreeze, it is recommended that the thermostat within the new thermostat housing be removed temporarily during the antifreeze filling process. By doing so, the antifreeze being introduced into the raw water pump will both re-circulate and leave the head on its way to the exhaust system. By running the engine long enough to see a steady stream of antifreeze coming out with the exhaust, one can be assured that the raw water system is full of antifreeze. When finished with this antifreeze filling process, replace the thermostat being careful to hold it in place with a knife blade while getting the upper half housing into position and secured with nuts and lock washers.

Troubleshooting

If during initial start-up after installation or Winter Lay-up, the engine overheats immediately the **MOST PROBABLE** cause is that the block, head and manifold are not full of coolant. This will cause the water pump to lose suction as it will simply try to suck air from the engine via the re-circulation loop. Remove the upper half of the Indigo Thermostat housing and the thermostat itself. Fill the block, head and manifold with water. 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. Re-start the engine.

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.

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

1. The thermostat is stuck in the open position
    a. Remove thermostat and verify that it is closed when cool. Replace as necessary
2. Chunks of rust and scale have entered the thermostat housing and have accumulated at the re-circulation opening, restricting the re-circulation valve.
    a. Remove the thermostat and inspect the re-circulation control valve stem and surrounding area for debris. Clean as necessary.
2. The re-circulation control valve spring is broken.
    a. Remove the thermostat and inspect the re-circulation control valve stem spring. Replace as necessary

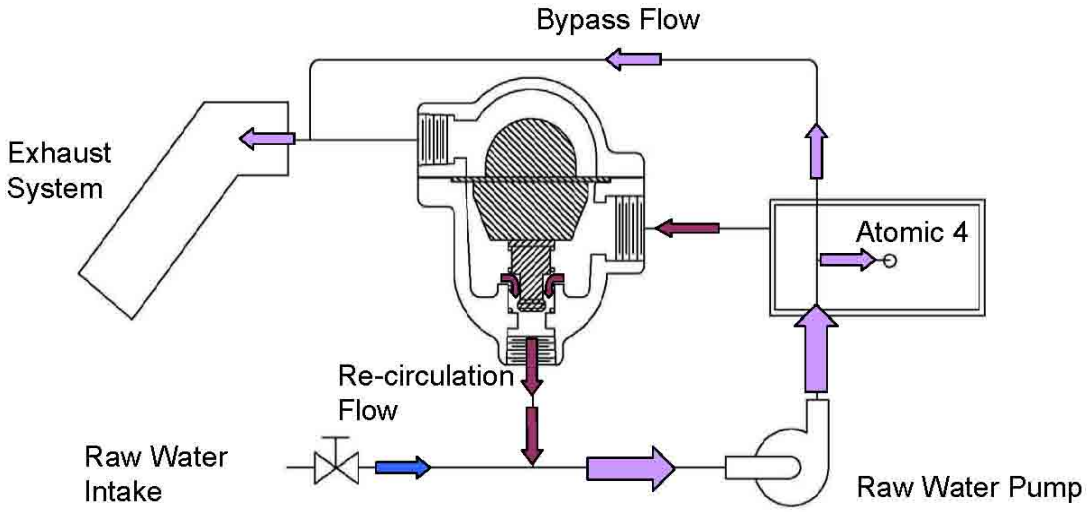
Vent Hole Modification to stock NAPA 18-3551 Thermostat

Copper Sleeve added to Thermostat **Vent Hole to be drilled in Flange**

Parts List

Part No.	Quantity	Description
		PARTS INCLUDED WITH KIT
1	1	New Thermostat Housing
2	1	New Thermostat –140F (NAPA/Sierra 18-3551 with 3/32" vent hole)
2.1	1	Copper Alignment Sleeve .612" OD, .545" ID, .74" Long
3	1	Re-circulation Control Valve
4	1	Re-circulation Control Valve Spring
5	1	New Thermostat Housing Gasket (Suitable Replacement NAPA # 1068-ST)
6	2	5/16” – 18 X 1 1/2” Stud
7	2	5/16” – 18 Nut
8	2	5/16” Lock washer
9	1	Old thermostat housing gasket
10	1	3/8” NPT pipe plug for installation in bypass connection on existing thermostat housing
11	1	¼” NPT x ½” hose barb fitting – bypass connection on thermostat
12	1	½” Close Nipple to attach Thermostat to existing ell fitting
		PARTS NEEDED
1	1	½” Nipple of sufficient length to suit other installation location
2	1	3/8” Tee, nipple and 3/8 NPTx1/2” hose barb fittings to be installed in raw water pump suction for re-circulation
3	1	3/8 NPT x ½” hose barb fitting for exhaust connection on Thermostat Housing
4	1	90 Degree hose barb fitting - ½ NPT x ½ hose - re-circulation connection on new Thermostat Housing
5		Suitable heater hose to make up to connections
6		Suitable hose clamps for all connections

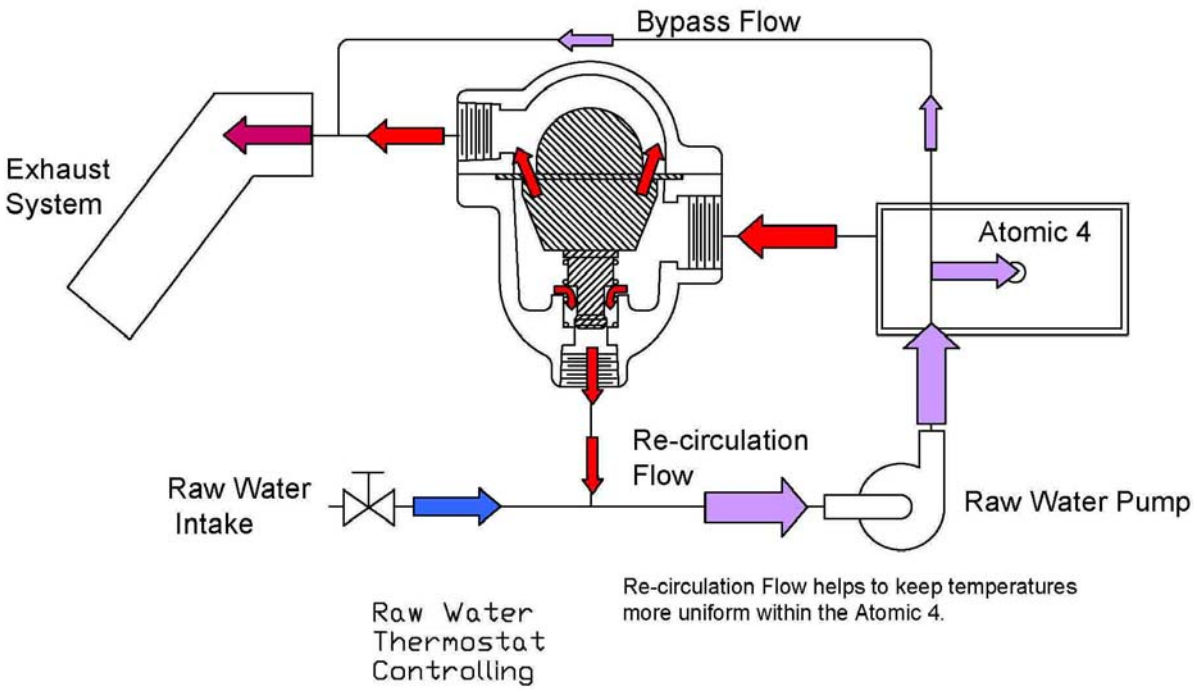
During warm-up, part of the Raw Water re-circulates and part bypasses the Atomic 4 until the thermostat first opens at its set temperature. The Bypass Flow ensures that the Exhaust System always remains below 140F.



Re-circulation Flow helps to keep temperatures more uniform within the Atomic 4.

Raw Water Warming Up

Once the thermostat opens, its valves admit water to the Exhaust System (where it mixes with the Bypass Flow) to help keep the exhaust system below 140F and at the same time reduce the amount of re-circulation flow and control the Atomic 4 temperature.



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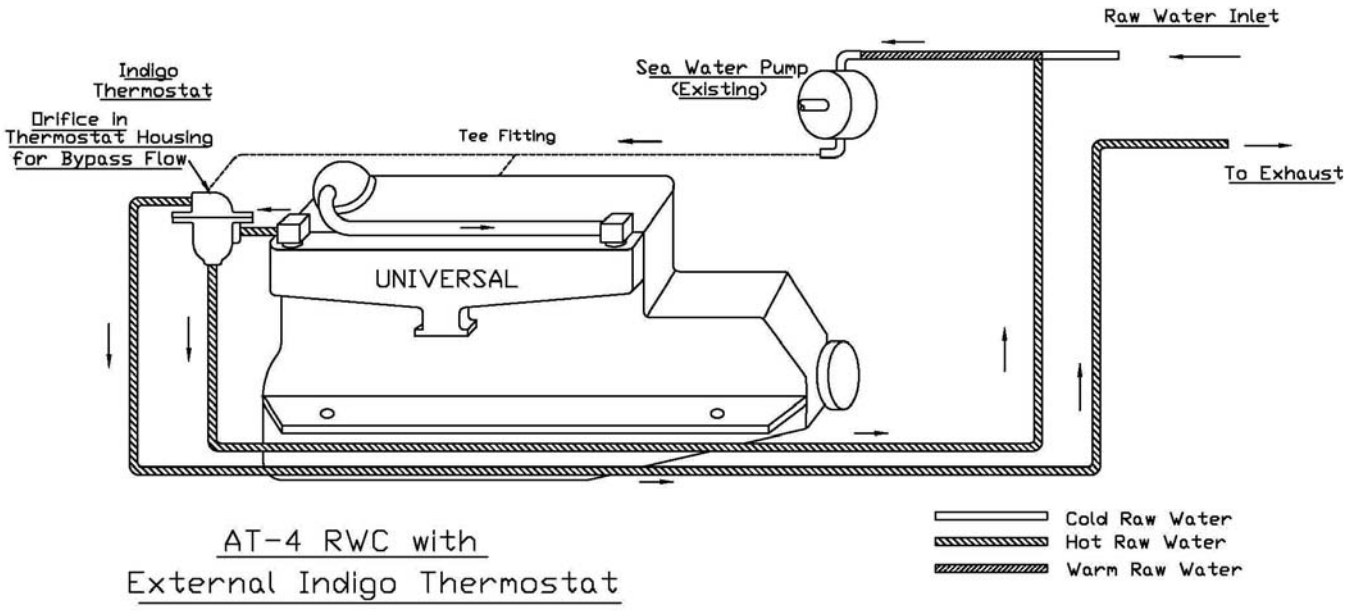
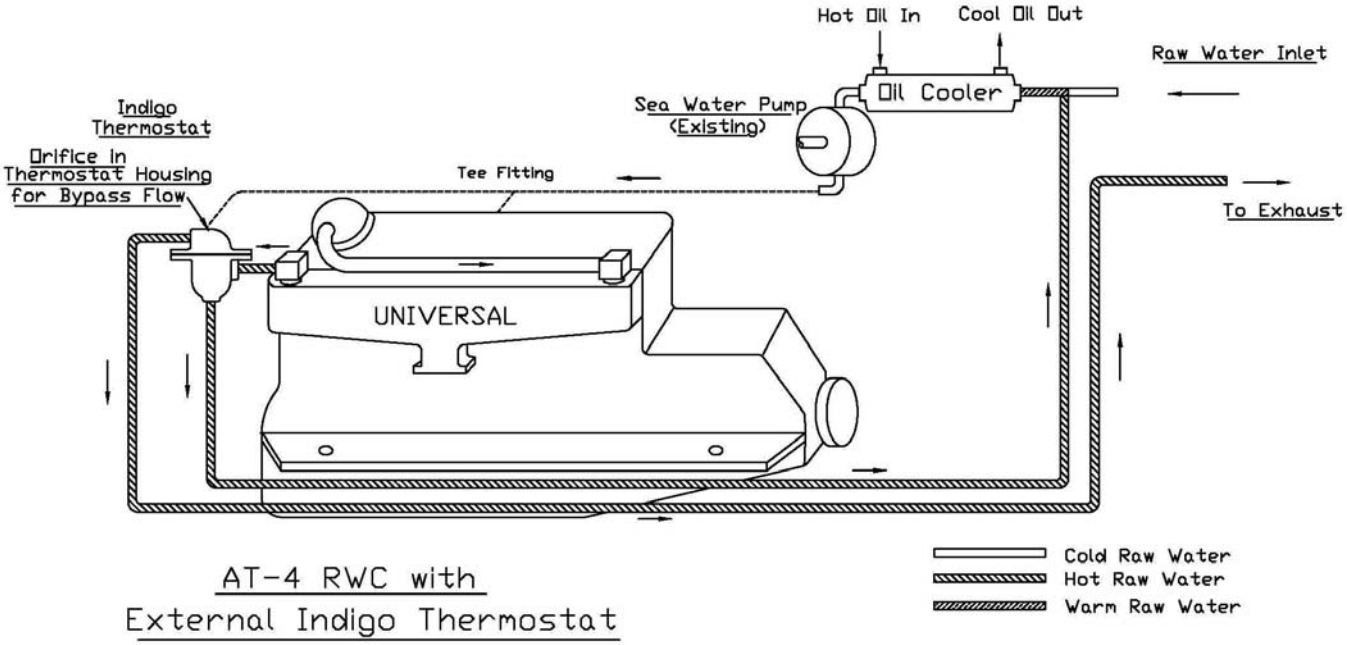


AT-4 RWC with External Indigo Thermostat



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