

INSTALLATION INSTRUCTIONS

INDIGO ELECTRONICS AT-4CE FRESH WATER COOLING – ELECTRIC PUMP ATOMIC 4

Engine Preparation

Performance and reliability of the Atomic 4 can be enhanced during the fresh water cooling conversion by addressing three areas:

- Cooling water passages
- Existing water pump
- Existing water hoses

Cooling water passages suffer from corrosion and salt build up when sea water is used to cool the engine directly. If no serious cooling problems have occurred, a minor cleaning of the passages should be sufficient. This would include removing both the plate on the starboard side of the block where cooling water is introduced to the block and the thermostat housing. With these removed, the exposed areas can be mechanically cleaned of loose rust and scale. Back flushing with pressurized fresh water through the thermostat opening is also recommended to promote flushing rust and scale and also to verify that the cooling passages between block and head are open. Back flush the exhaust manifold as well by introducing pressurized fresh water into the discharge fitting on the aft end of the manifold. If the above recommendations do not yield unobstructed water flow, it may be necessary to conduct more extensive cleaning such as a Muriatic Acid Flush. To begin this process, remove the thermostat and pinch off the bypass hose (the one that runs from the clean out plate on the alternator side of the block to the thermostat housing) with vise grip pliers or similar. Then, mix a solution of 1/3 gallon of Muriatic Acid to 5 gallons of water and then filling the block, head and manifold with the mixture by running a hose from the original water pump suction to the bucket of diluted acid and running the engine. Once the engine cooling passages are full of the mixture, stop the engine and allow the mixture to work on the engine for 30 minutes. Then flush with fresh water and repeat one or more times until the mixture has little reaction within the engine. Restore thermostat unless installing and Indigo Temperature Control System.

New Antifreeze Pump

With any Fresh Water Cooling System, there must be a pump for the seawater and a pump for the antifreeze. With this system, the existing pump remains the seawater pump and a new electric pump is installed to circulate the antifreeze. The pump chosen for this system is a Johnson Model CM30P7-1 and was designed specifically for circulating hot antifreeze. It is a centrifugal pump of a low pressure, high flow design. For this system on the Atomic4, it is recommended that several hose and fitting changes be made to allow for the highest flow of antifreeze. (**NOTE:** If the seawater in your area stays below 70F at all times and you DO NOT elect to install an Indigo Temperature Control System, the existing hoses and fittings will be satisfactory).

These recommended changes are:

- a. Replace the hose and fittings between the thermostat housing and the exhaust manifold. Currently the hose is 1/2" ID. It should be replaced with a 5/8" ID hose. This will require replacement of the hose barb fitting at the thermostat housing and the hose barb fitting at the exhaust manifold. Fittings and hose are provided in the kit.
- b. Replace the discharge hose and fitting on the exhaust manifold with 5/8" ID hose. It may already be 5/8" ID.

The **existing water pump** will remain the seawater pump with the discharge hose re-routed to the Heat Exchanger. The pump should be opened and the impeller inspected. If any vanes are torn or show signs of distress, the impeller should be replaced. It is best to replace the cover gasket to prevent a future leak.

NOTE: The original style pumps (both Oberdorfer and Sherwood) do not have bearings. The shaft is positioned by the pump housing itself and as such, will cause the lip

seal to leak seawater as the pump housing wears. Moyer Marine Inc. (www.moyermarine.com) now offers a **replacement pump** which does have bearings and is a far superior replacement pump.

Any **existing water hoses** that do not get replaced as a part of this installation should be replaced if more than a year or two old.

Heat Exchanger

Note: If an Indigo Electronics Temperature Control Valve was **not** purchased at this time, it is a good idea to leave room at the end of the upper "leg" on the heat exchanger when locating it for possible later installation of the TCV. About 7" of space is necessary.

1. Determine an appropriate location for the heat exchanger. Vertical mounting is preferred but it can be mounted at up to 45 degrees off vertical with the fill cap being at the highest point. When choosing a location, consider the following:

- The Heat Exchanger should be as close to the engine as possible to keep hose runs to a minimum. Elevation of the Heat Exchanger relative to the engine should preferably be such that the fill cap is at the highest point.
- The coolant level will require checking periodically so access to the pressure cap should be considered. An automotive type coolant recovery kit is provided to aid in this periodic check.
- A consumable anode is installed in the heat exchanger which must be accessible for annual replacement. Orient heat exchanger for access.
- Four hose connections will be made (two seawater, two antifreeze). Consider these when orienting Heat Exchanger.

2. Mount Heat Exchanger with brackets provided. Mount angle iron bracket to vertical or angled surface selected for Heat Exchanger location. Fasteners will be required (not supplied in kit) to attach bracket to

vessel as so many possibilities exist that a standard package is impractical. Stainless steel 1/4" through bolts with lock washer and nut are recommended. The two large circular clamps fit around the 3.2" diameter part of the Heat Exchanger about 6" apart. Be sure to orient the Heat Exchanger for optimum location of hose connections. It may be necessary to obtain and install brass 1/2" nipples and 90° elbows to obtain desired orientation. Using 1/2" open or box end wrenches, attach each circular bracket to angle iron bracket using 5/16 x 1 1/2" bolts, lock washers, and nuts (provided in kit). The larger diameter holes in the bracket are used with each 5/16 x 1 1/2" bolt passing through both "ears" on the circular bracket and then through the hole in the angle iron bracket before receiving the lock washer and nut. Tighten 5/16" bolts to lock Heat Exchanger in position.

New Antifreeze Pump Installation

Shown below are two possible configurations of pump installation. The most basic is the single pump configuration. For convenience a 3/4 x 1/2 hose barb connector is supplied to facilitate installation.



Single Pump Configuration

For redundancy and complete piece of mind with regard to the electric pump, a dual pump series

configuration is shown. In this case, both pumps are permanently installed but only one is running at a time. If the first pump should fail, the second can readily be wire in and operated.



Dual Series Pump Configuration

3. The new antifreeze pump can easily be mounted “in line” between the lower antifreeze fitting on the Heat Exchanger and the coolant inlet to the block on the side clean-out plate. The suction and discharge connections on the new pump are both sized to accommodate 3/4” ID hose. Location of the pump should be such that the hose runs are as short as possible and the wiring on the motor can readily reach the ignition coil. It may be necessary to extend the length of the power leads.

4. If hose routing permits, install a 1/2 NPT x 3/4 hose fitting (provided in kit) into the lower heat exchanger connection using pipe dope on threads. If routing is a problem, provide and install appropriate fittings to facilitate routing. **Be sure to hold back on the hex portion of the female connection on the Heat Exchanger when tightening fittings.**

5. Once a location has been identified for the pump, a piece of 3/4” ID heater hose should be run from the Heat Exchanger fitting previously installed to the suction connection on the end of the new pump

(opposite the end where the wiring enters the motor). Then a piece of 3/4” ID heater hose will be run from the pump discharge (connection on pump that is 90° from the other connection) over to the 1/2” ID hose that currently runs from the seawater pump to the block inlet tee. A special 3/4” x 1/2” reducing hose barb fitting is provided to connect the two hoses.

6. The new pump itself does not need to be attached to anything other than the hoses.

CAUTION The hose runs to and from the new pump must be “fair” in that there can be no kinks or sharp bends that will cause a restriction in the hose.

The pump can be oriented either horizontally or vertically. If horizontal orientation is chosen, the discharge can be oriented any way that is convenient. If vertical orientation is chosen, the motor must be up.

7. Once the pump has been located and connected, the wiring must be connected. The Red Lead should be attached to the “+” stud on the ignition coil. This is the preferred location such that power is supplied to the pump only when the ignition switch is in the “ON” position. The Black Lead is the “-“ or ground and should be landed under one of the ignition coil bracket bolts. Be sure the bolt chosen is clean and the area on the bracket and under the bracket is also clean so a good ground will be established. A stainless steel bolt is provided in the kit. The Red and Black leads have terminals attached to suit the preferred landing locations. These leads can be extended if needed.

Thermostat

8. Proper functioning of the thermostat is critical to maintaining proper operating temperatures with your new fresh water cooling system. When the thermostat housing is removed for cleaning of the head, examine the thermostat carefully and check it for proper operation by immersing in a container of heated water. It should cycle at about 140F. Additionally, carefully examine the housing itself for excessive corrosion of the control surfaces. The housing is designed with a “boss” at the top on the inside which connects to the bypass hose coming from the tee on the water inlet plate on the side of

the block. The lower-most machined surface on this “boss” is designed to be about 3/8” above the top surface of the thermostat when installed. In this manner, the housing “boss” plays a major role in temperature regulation in that opening of the thermostat closes off some of the bypass coolant flow thus forcing more flow through the block. Historically, the “boss” quickly gets corroded away in salt water, leaving a gaping hole above the thermostat thus allowing bypass coolant to flow unchecked. Such a condition will cause the engine to run too hot as there will be insufficient coolant flow through the block. A new bronze housing is available from Moyer Marine Inc. (www.moyermarine.com)

Good News An entirely new design temperature control system is now available from **Indigo Electronics**. It consists of a thermostatic mixing valve and all necessary fittings which are installed on the heat exchanger. This system eliminates the current thermostat and bypass hose going from the side plate to the thermostat housing and controls the temperature of the antifreeze coming from the engine. All coolant flows through the engine all of the time yielding much more uniform temperatures within the engine, faster warm up, and more precise temperature controls. The temperature is also adjustable from about 120° F to 180° F for those times when you may want to cool the engine down before shutdown on a hot summer day. Sketches of the valve and system arrangement are enclosed, including a configuration for use with domestic hot water. Also, photos are included to show different configurations of the valve mounted on the Heat Exchanger.

Hose Installation

9. Install a 3/8 NPTx5/8 Hose fitting in the existing pump **discharge** (**inboard** hose fitting) connection. Install a 5/8” ID piece of hose between this pump fitting and the sea water hose bib connection on the Heat Exchanger that is **closest** to the fill cap. The seawater connections are the hose bib connections made into the Heat Exchanger near the top clean out. Secure hose at each end. (Hose clamps provided in kit). It is best to “tie down” this hose to something stationary and not on the engine itself as vibration

from the engine may weaken the hose bib connection on the Heat Exchanger over time.

10. Install a 5/8" ID hose between the heat exchanger sea water discharge and the existing fitting to which the sea water discharge from the exhaust manifold connects. It may be necessary to provide a new fitting to accommodate the 5/8" ID hose. Secure hose at each end (Hose clamp provided in kit for heat exchanger end).

11. If the existing hose barb fitting in the 90° fitting in the coolant discharge connection on the aft end of the exhaust manifold (currently the seawater discharge connection) is not for 5/8” ID hose, install a 1/2 NPT x 5/8 hose barb fitting in the 90° fitting using pipe dope on threads.

12. Install a piece of 5/8” ID heater hose between the new hose barb fitting on the exhaust manifold and the upper 1/2” NPT (antifreeze) connection on the end of the “leg” of the Heat Exchanger. If hose routing permits, screw a 1/2” NPT x 5/8” hose fitting (provided in kit) into the Heat Exchanger connection using pipe dope on threads. If routing is a problem, provide and install appropriate fittings to facilitate routing. **Be sure to hold back on the hex portion of the female connection on the Heat Exchanger when tightening fittings.** Secure hose at each end (hose clamps provided in kit).

13. Check all hose routing to insure that hoses are clear of all sources of damage such as the propeller shaft, coupling, and the exhaust piping. Secure out of harms way as necessary.

14. Fill the Heat Exchanger with a 50/50 mixture of antifreeze. It will be necessary to add more 50/50 mixture as the coolant fills all of the internal passages. Fill the Heat Exchanger completely full. Turn on the ignition switch to start the new antifreeze pump. Add more coolant as necessary to fill the system. The antifreeze pump should purge any air from the system. Install the cap and turn off the ignition switch.

15. A coolant recovery bottle is provided to recover antifreeze when the system heats up. It can be mounted at whatever elevation is convenient relative to the engine. It may be necessary to purchase an

additional piece of hose if the clear plastic one provided is not sufficiently long. Connect the coolant bottle hose to the small piece of tubing just beneath the fill cap on the heat exchanger.

16. Start the engine (don't forget to open the sea water hull valve) and ascertain seawater is coming out of the exhaust. Operate engine to bring it to operating temperature. When hot, check for and correct any leaks.

17. Conduct a sea trial and determine operating temperature at cruising speed. Optimum engine performance is obtained at about 180° F at cruise speed.

Troubleshooting

High Temperature

Note: Even small antifreeze leaks can lead to serious overheating as the quantity of antifreeze within the system is rather small and can be quickly depleted by even a 10 drop per minute leak.

- Insure that seawater hull valve is open.
- Verify sufficient antifreeze in Heat Exchanger.
- Verify proper seawater flow in exhaust. If not sufficient, check for:
 - Obstruction in seawater hose.
 - Obstruction in seawater strainer.
 - Obstruction in seawater hull valve.
 - Obstruction in seawater side of Heat Exchanger or fitting in Heat Exchanger.
 - Failed seawater pump impeller.
- Verify proper antifreeze flow. Check for:
 - Failed antifreeze pump.
 - Loss of power to antifreeze pump.
 - Loose or bad wiring connection in antifreeze pump wiring.

Seawater leak at sea water pump

- Check for failed pump seal. Seawater will be leaking from drain hole at bottom of pump.
- Check for loose hose clamps at pump connections

Maintenance

Sacrificial Anode- In order to prevent electrolytic deterioration of the sea water side of the heat exchanger, a special aluminum anode is provided in the heat exchanger. It is located on the top of the long leg (looks like a hex head pipe plug) and should be replaced on an annual basis to provide ongoing protection. The anode is a special “pencil” type with a 3/8 pipe plug on the end. The anode itself is 1/2” in diameter and extends 1 1/4” beyond the end of the plug. It has a steel wire in the center to prevent the anode from falling off before all of the sacrificial portion has been consumed. It is best replace this anode with this special type to prevent possible obstruction of the sea water cooling path.

NOTE: It has been found that a conventional pencil zinc will be consumed prematurely in the area of the threads on the brass pipe plug. When this happens, a “blob” of zinc will fall off. Once it breaks free from the brass plug, all galvanic protection stops. After several seasons of this zinc failure, the sea water flow path can become sufficiently obstructed to cause overheating of the system.

Winter Lay-up – If freezing temperatures will be encountered during periods of inactivity, precautions **MUST** be taken to prevent raw water in the raw water loop from freezing and damaging the raw water pump, the heat exchanger, and hoses or fittings. The preferred method for accomplishing this is to suck antifreeze (preferably the kind sold for RVs as it is non-toxic) into the system via the raw water suction line. On my own boat, I close the thru hull for the raw water supply, open the raw water strainer at the strainer basket access, and then run the engine at a very slow idle while pouring antifreeze into the strainer. A gallon is more than sufficient.

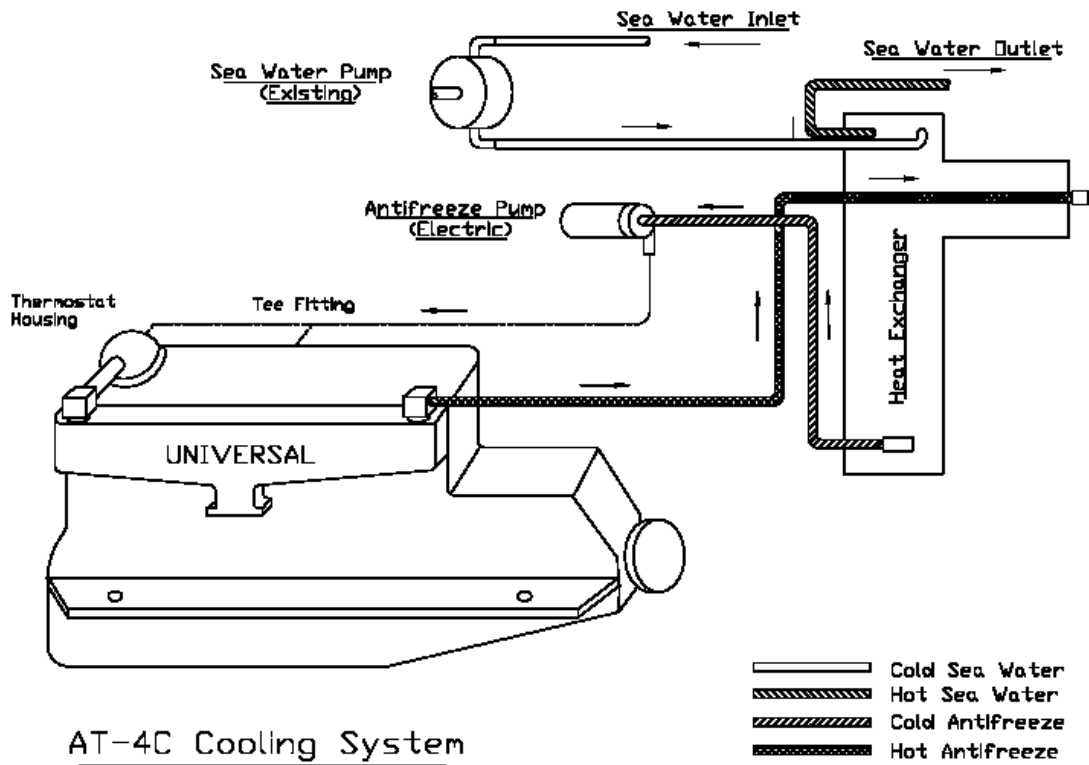
If you want to drain the heat exchanger, **you have to loosen the center bolt on the bottom clean out**

plate on the long leg of the heat exchanger. There is no need to fully remove the plate. Once

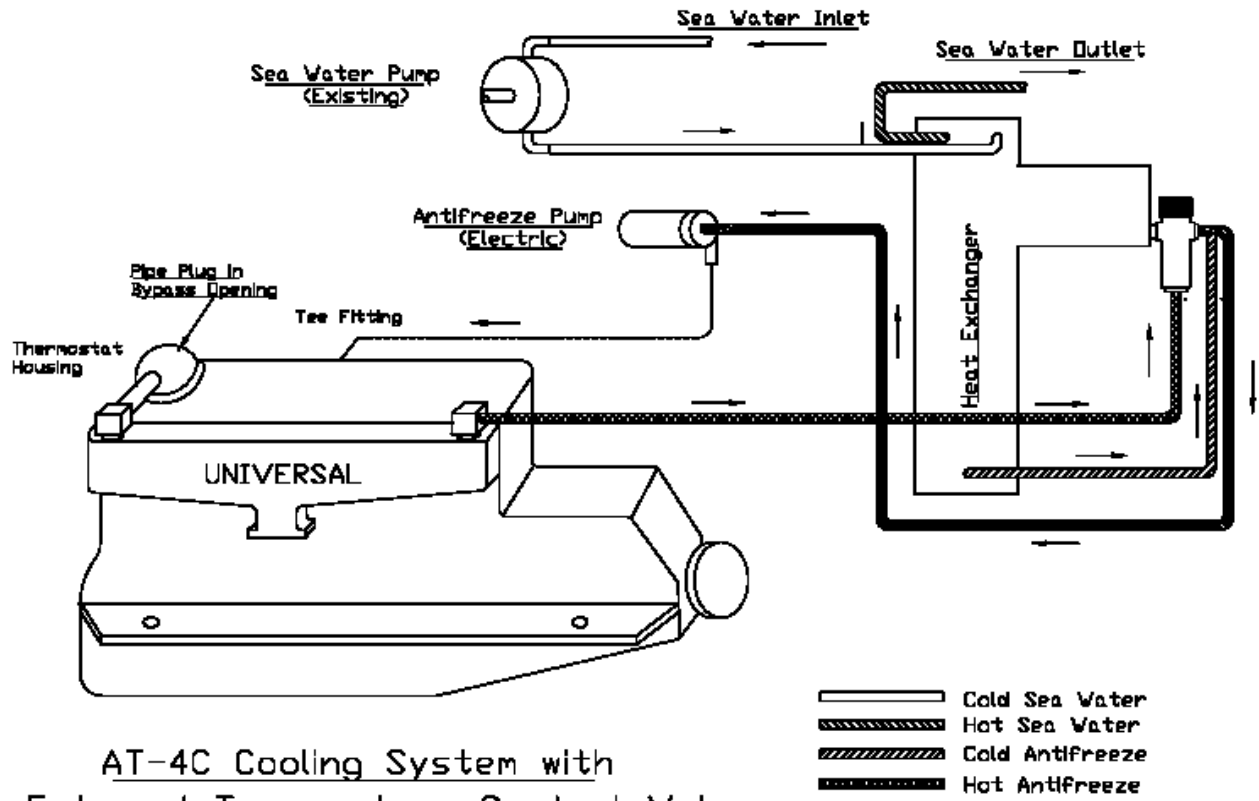
sufficiently loosened, sea water will begin to leak out of the heat exchanger until it is empty.

AT-4C Parts List
W/O TCV

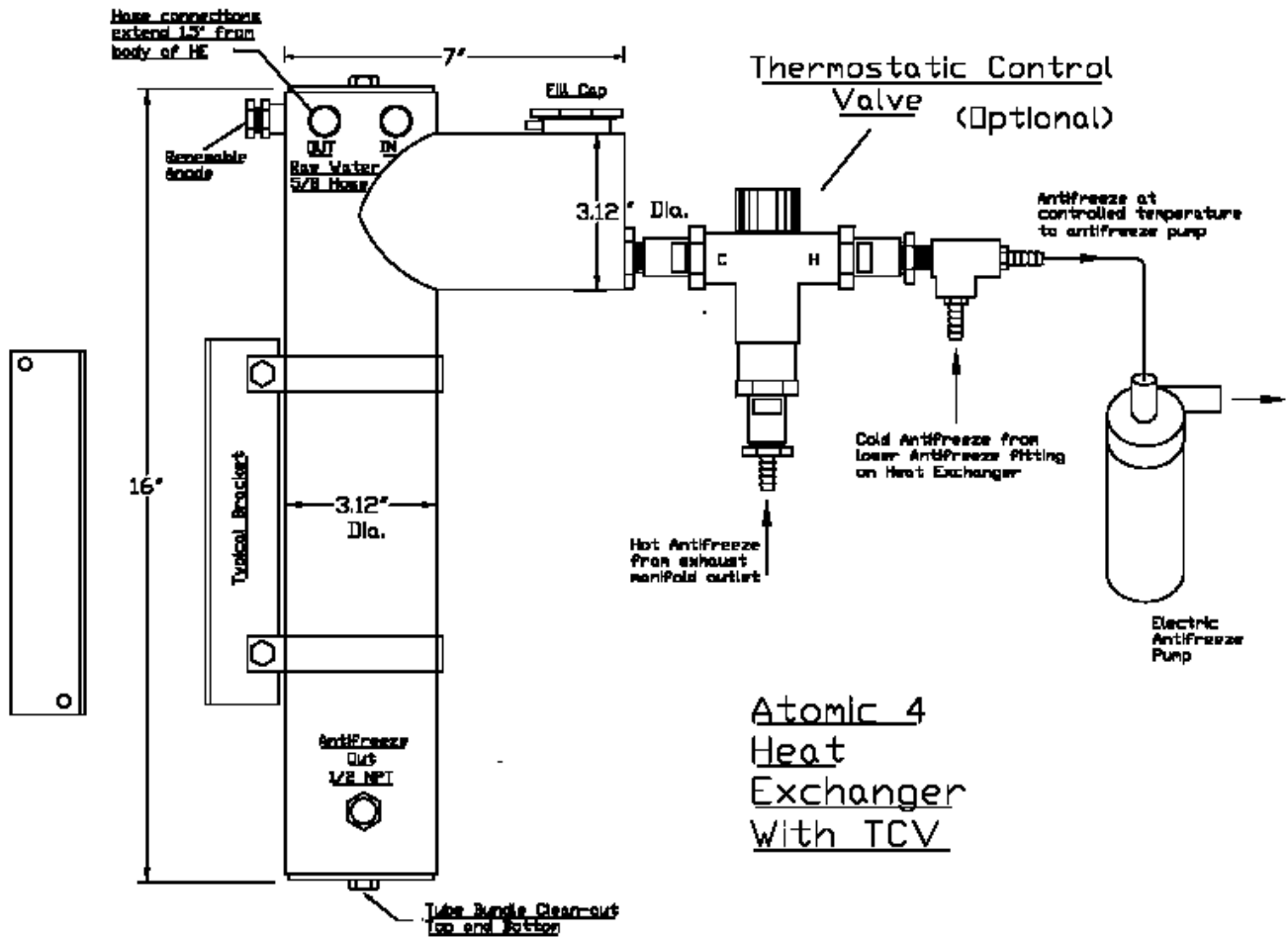
<u>Description</u>	<u>Quantity</u>
Monitor Heat Exchanger	1
Mounting Bracket (Primed only)	1
Mounting Clamps	2
Bolt, nut, washer for clamp	2
1/2 NPT x 3/4 Hose Fitting	1
1/2 NPT x 5/8 Hose Fitting	2
3/8 NPT x 5/8 Hose Fitting	2
Hose Clamp	10
Pump - Johnson Model CM30P7-1	1
3/4 Hose x 1/2 Hose Fitting	1
5/16" Bolt & lockwasher for Ground	1
Coolant Recovery Bottle with Hose	1



AT-4C Cooling System



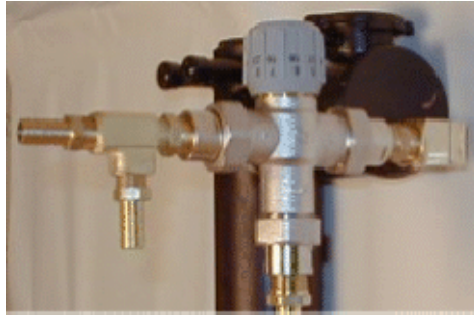
AT-4C Cooling System with External Temperature Control Valve



Different configurations for mounting the Indigo Temperature Control Valve



TCV mounted in line with female NPT fitting on Heat Exchanger



TCV mounted 90 degrees to female NPT fitting on Heat Exchanger



TCV mounted 180 degrees to female NPT fitting on Heat Exchanger