MAINTENANCE INSTRUCTIONS

It is recommended that you check the following items at least every six months and at the beginning of every swimming season.

1. Examine the venting system. Make sure there are no obstructions in the flow of combustion and ventilation air.
2. Visually inspect the main burner and the hot surface ignitor. The normal color of the flame is blue. When flame appears yellow, burners should be inspected and cleaned. Check ignitor for damage.
3. Keep the heater area clear and free from combustibles and flammable liquids.

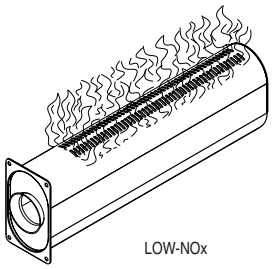


Figure 22.

Pressure Relief Valve

In some installations, a pressure relief valve (PVR) is required on the MiniMax NT Low NOx. To install a PRV, carefully drill a 3/8 in. hole in center of 3/4 in. NPT port (on main header) being careful to drill only thru wall at bottom of 3/4 in. NPT port and no deeper—now thread in the 3/4 NPT PRV. **NOTE:** (A.S.M.E. version varies from illustration. It is of bronze construction, and is supplied with the A.S.M.E. Section IV, pressure relief valve pre-installed at factory.) Test the relief valve at least once a year by lifting up lever.

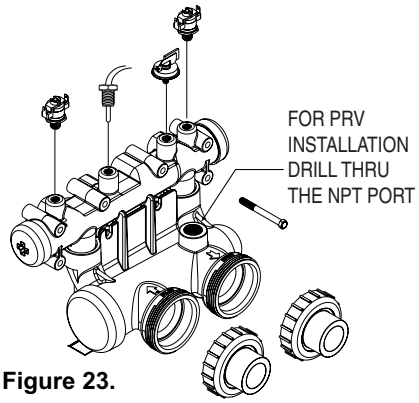


Figure 23.

ENERGY SAVING TIPS

1. If possible, keep pool or spa covered when not in use. This will not only cut heating costs, but also keep dirt and debris from settling in the pool and conserve chemicals.
2. Reduce the pool thermostat setting to 78° F. or lower. This is accepted as being the most healthy temperature for swimming by the American Red Cross.
3. Use an accurate thermometer.
4. When the proper maximum thermostat settings have been determined, tighten the thermostat knob stopper.
5. Set time clock to start circulation system no earlier than daybreak. The swimming pool loses less heat at this time.
6. For pools that are only used on the weekends, it is not necessary to leave the thermostat set at 78° F. Lower the temperature to a range that can be achieved easily in one day. Generally, this would be 10° F. to 15° F., if pool heater is sized properly.
7. During the winter or while on vacation, turn the heater off.
8. Set up a regular program of preventative maintenance for the heater each new swimming season. Check heat exchanger, controls, burners, operation, etc.

SPRING AND FALL OPERATION

If the pool is being used occasionally, do not turn the heater completely off. Set the thermostat down to 65° F. This will keep the pool and the surrounding ground warm enough to bring the pool up to a comfortable swimming temperature in a shorter period of time.

WINTER OPERATION

If the pool won't be used for a month or more, turn the heater off at the main gas valve. For areas where there is no danger of water freezing, water should circulate through the heater all year long, even though you are not heating your swimming pool. The MiniMax NT Low NOx should not be operated outdoors at temperatures below 0° F. for propane and -20° F. for natural gas.

Where freezing is possible, it is necessary to drain the water from the heater. This may be done by opening the drain valve, located at the inlet/outlet header (see Figure 23.), allowing all water to drain out of the heater. It would be a good practice to use compressed air to blow the water out of the heat exchanger. ***(See additional notes under Important Notices in Introduction.)***

CHEMICAL BALANCE

POOL AND SPA WATER

Your Pentair Pool Products pool heater was designed specifically for your spa or pool and will give you many years of trouble-free service, provided you keep your water chemistry in proper condition.

Three major items that can cause problems with your pool heater are: improper pH, disinfectant residual, and total alkalinity. These items, if not kept properly balanced, can shorten the life of the heater and cause permanent damage.

⚠CAUTION

Heat exchanger damage resulting from chemical imbalance is not covered by the warranty.

WHAT A DISINFECTANT DOES

Two pool guests you do not want are algae and bacteria. To get rid of them and make pool water sanitary for swimming - as well as to improve the water's taste, odor and clarity - some sort of disinfectant must be used.

Chlorine and bromine are universally approved by health authorities and are accepted disinfecting agents for bacteria control.

WHAT IS A DISINFECTANT RESIDUAL?

When you add chlorine or bromine to the pool water, a portion of the disinfectant will be consumed in the process of destroying bacteria, algae and other oxidizable materials. The disinfectant remaining is called chlorine residual or bromine residual. You can determine the disinfectant residual of your pool water with a reliable test kit, available from your local pool supply store.

You must maintain a disinfectant residual level adequate enough to assure a continuous kill of bacteria or virus introduced into pool water by swimmers, through the air, from dust, rain or other sources.

It is wise to test pool water regularly. Never allow chlorine residual to drop below 0.6 ppm (parts per million). The minimum level for effective chlorine or bromine residual is 1.4 ppm.

pH - The term pH refers to the acid/alkaline balance of water expressed on a numerical scale from 0 to 14. A test kit for measuring pH balance of your pool water is available from your local pool supply store; see Table 3.

Table 3. **pH Chart**

Strongly Acid							Neutral					Strongly Alkaline			
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	

Muriatic Acid has a pH of about 0. Pure water is 7 (neutral). Weak Lye solution have a pH of 13-14.

RULE: 7.4 to 7.6 is a desirable pH range. It is essential to maintain correct pH, see Table 4.

If pH becomes too high (over alkaline), it has these effects:

1. Greatly lowers the ability of chlorine to destroy bacteria and algae.
2. Water becomes cloudy.
3. There is more danger of scale formation on the plaster or in the heat exchanger.
4. Filter elements may become blocked.

If pH is too low (over acid) the following conditions may occur:

1. Excessive eye burn or skin irritation.
2. Etching of the plaster.
3. Corrosion of metal fixtures in the filtration and recirculation system, which may create brown, blue, green, or sometimes almost black stains on the plaster.
4. Corrosion of copper in the heater, which may cause leaks.
5. If you have a sand and gravel filter, the alum used as a filter aid may dissolve and pass through the filter.

CAUTION: Do not test for pH when the chlorine residual is 3.0 ppm or higher, or bromine residual is 6.0 ppm or higher. See your local pool supply store for help in properly balancing your water chemistry.

RULE: Chemicals that are acid lower pH. Chemicals that are alkaline raise pH.

Table 4. **pH Control Chart**

6.8 7.0	7.2	7.4 7.6	7.8	8.0 8.2 8.4
Add Soda, Ash or Sodium Bicarbonate	Marginal	Ideal	Marginal	Add Acid

ALKALINITY High - Low:

"Total alkalinity" is a measurement of the total amount of alkaline chemicals in the water, and control pH to a great degree. (It is not the same as pH which refers merely to the relative alkalinity/acidity balance.) Your pool water's total alkalinity should be 100 - 140 ppm to permit easier pH control.

A total alkalinity test is simple to perform with a reliable test kit. You will need to test about once a week and make proper adjustments until alkalinity is in the proper range. Then, test only once every month or so to be sure it is being maintained. See your local pool dealer for help in properly balancing the water chemistry.

NORMAL OPERATION SEQUENCE

(Refer to Figure 21 of Pentair Temperature Controller 7800 keyboard)

The heater features a fully automated firing start-up and shutdown sequence under the control of the MiniMax NT Low NOx Pentair Temperature Controller 7800.

Now that the heater has been properly installed and wired for either remote operation or local operation, and you have setup the Pentair Temperature Controller 7800 temperature setpoints as described earlier in manual in Thermostat section, the following is the normal operating sequence when the heater turns on the and the thermostat calls for heat for the pool or spa.

1. The fan will start beginning the heater's safety prepurging cycle which lasts for 2 minutes. If at anytime during the prepurge cycle the Pentair Temperature Controller 7800 detects that a safety control is not working due to either a safety control malfunction or other unsafe condition the firing sequence will stop until the unsafe condition is removed— "the fault icon related to the problem will illuminate".

2. After proper completion of the prepurge cycle, the hot surface ignitor (glow coil) will turn on (preheat) for 40 seconds. Once the 40 seconds is passed, the main gas valve will open. At this time, if flame is not safely established and is dectected by the flame sensing curcuit, the ignition module and Pentair Temperature Controller 7800 will shut down and will display an ignition fault and luminate the red service light. *Please note that on initial firing of heater when gas supply piping is full of air or after long period of non-operation of the heater it is normal for the first ignition attempt to not complete.* To clear the fault condition power to the Pentair Temperature Controller 7800 must be cycled to reset system. If heater continues to fail to light have heater inspected by a qualified service person before placing heater back in service.

   Insufficient waterflow (pump icon displays), excessive water temperature (high limit icon) cause a "soft-lockout" of the firing sequence—which means if the cause of the problem clears by itself (or with human intervention ie., turning on pump, etc.) such as a slow to prime water pump finally pumping adequate waterflow causing the water pressure (safety) switch to close, the ignition sequence automatically restarts again.

   The other category of fault conditions lead to a "hard lockout" of the firing sequence which require a qualified service person to correct before the heater is returned to service. In "hard lockout" the heater must be manually reset (by toggling power to Pentair Temperature Controller 7800) after correction of the fault condition.

   Examples of causes of "hard lockouts" include inadequate gas supply pressure and/or failure of fan or fan pressure switches, which all appear as air/gas pressure faults illuminating "blower fan" fault icon and RED "service required" LED.

3. After normal firing of the heater (main burners) the heater will continue to operate until the temperature setpoint is reached (thermostat satisfied). As the pool/spa loses heat the heater will refire and continue to operate cycling automatically to maintain the selected temperature setpoint for either the pool or spa. ***If at anytime during the firing of the heater an unsafe condition is detected the heater will stop firing and an automatic safe shutdown sequence will begin. Investigate and have corrected the cause of the abnormal firing termination before placing heater back in operation.***

Please Note: During the firing of the heater, you decide to change to the pool or spa selection by depressing the selector key for "POOL" or "SPA", the heater will first acknowledge the new selection by flashing the new selection's corresponding selection LED "POOL" or "SPA", however, the heater will first complete a safe shutdown sequence before automatically switching to the new selected setting and safely initiating a new firing sequence using the the new temperature setpoint. During this automatic crossover sequence the keyboard on the Pentair Temperature Controller 7800 will not accept any further keying until the cycle completes—the exception is you may still stop the heater with the "OFF" key.

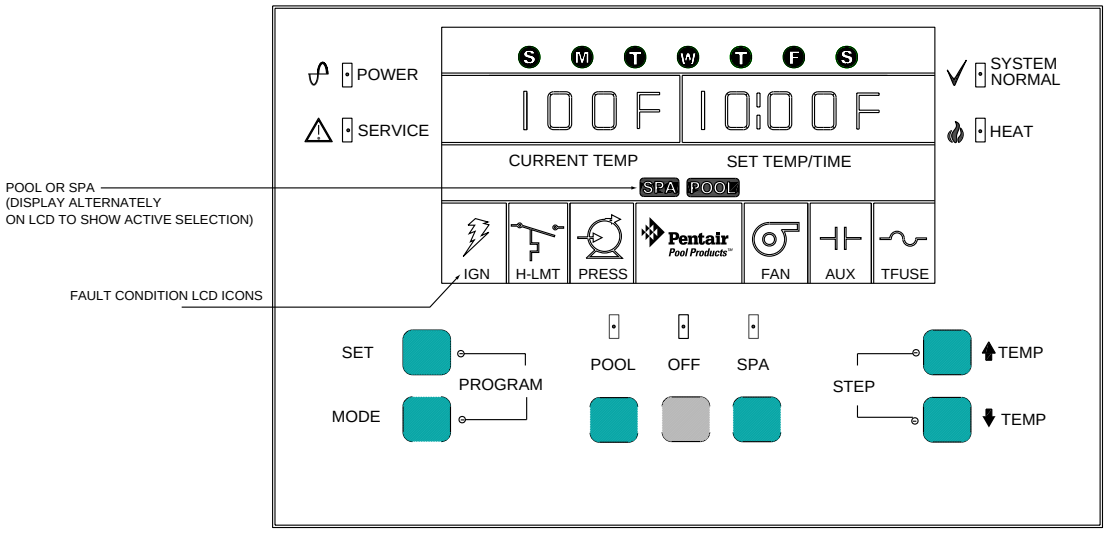
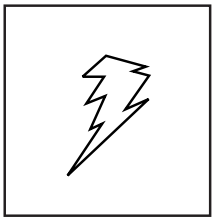


Figure 24.

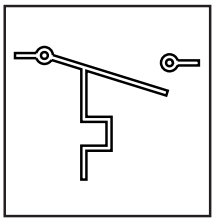
Illustration of Pentair Temperature Controller 7800 with all fault icons displayed for clarity.

LEGEND OF FAULT ICONS AND TYPE OF PROBLEMS FLAGGED



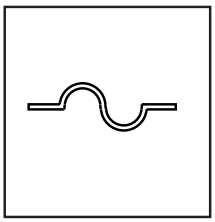
IGN

This fault icon displays whenever there is an unexpected loss of flame. This condition may arise from air in gas supply line or malfunction of flame detection circuit or related hardware.This is a hard lockout condition requiring a manual reset to clear.



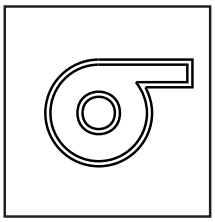
H-LMT

This fault icon displays whenever one or more of safety temperature limit switches open to flag an excessive temperature condition. This is a soft lockout condition and if the condition clears the fault icon will clear and normal operation of heater will procede.



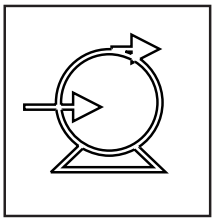
TFUSE

This fault icon displays whenever the thermal fuse has opened due to a flame roll-out or other abnormal condition causing excessive temperatures in the cabinet. The cause of the fault must be corrected and the one-shot fuse replaced before icon can be cleared.



FAN

This fault icon displays whenever there is a failure of either the low gas pressure switch (due to low pressure or switch failure) or additionally the fan and/or air pressure switch circuit has failed resulting in an open safety circuit. The nature of these faults are mission critical for the safe operation of the heater and result in a hard lockout. The cause of the fault must be corrected and the heater will require a manual reset by toggling the power supplied to the 7800 Controller to clear the fault.



PRESS

This fault icon displays whenever insufficient waterflow causes the water pressure switch to fail to close. This is a soft lockout condition and will clear by itself if the waterflow is restored. The icon will then clear and if the heater was attempting to fire the cycle will restart and continue.

SERVICE CHECKS—IGNITION MODULE

Service Checks	
Symptom	**Cause/Cure**
1. Dead	A. Miswired B. Transformer bad C. Fuse/Circuit breaker bad D. Bad control (check LED for steady on)
2. Thermostat on—no ignition	A. Miswired B. Bad thermostat no voltage at terminal W
3. Valve on, no ignitor	A. Defective ignitor B. Miswired C. Bad control (check voltage at ignitor)
4. Ignitor on, no valve	A. Valve coil open B. Open valve wire C. Bad control (check voltage between V1 & V2)
5. Flame okay during TFI, no flame sense (after TFI)	A. Bad ignitor B. Bad S1 wire C. Poor ground at burner D. Poor flame (check flame current)

FLAME SENSOR CURRENT CHECK

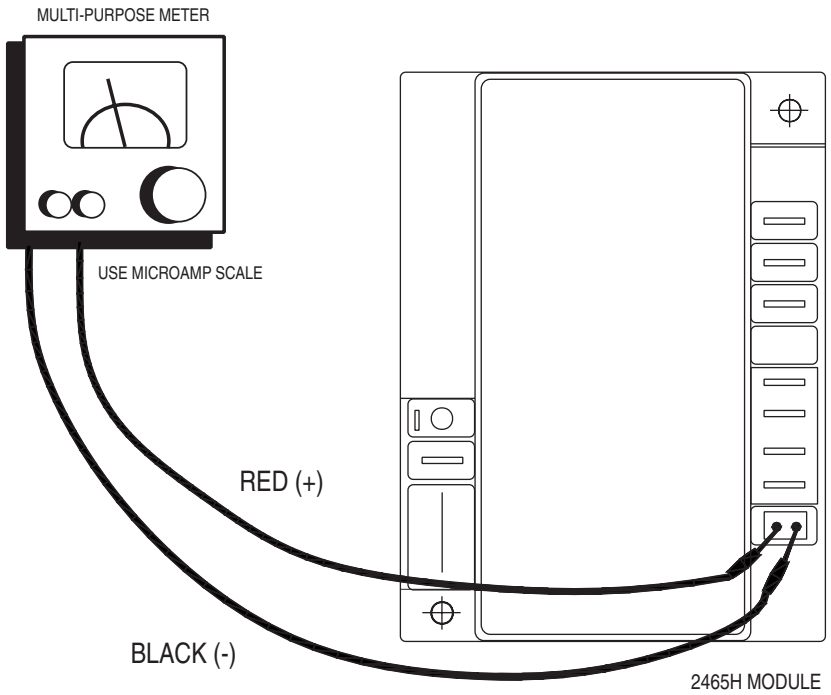


Figure 25.

SERVICE CHECKS

Flame current is the current which passes through the flame from the sensor to ground. The minimum flame current necessary to keep the system from lockout is 0.7 microamps. To measure flame current, connect an analog DC microammeter to the FC1/FC2 terminals per figure. Meter should read 0.7 µA or higher. If meter reads below “0” on scale, meter leads are reversed. Disconnect power and reconnect meter leads for proper polarity.

Troubleshooting - General

Possible Cause	*Remedy*
Heater will not come on	
Automatic ignition system fails	Check if electrical connections are correct and securely fastened – If YES, call serviceperson.
Pump not running	Place pump in operation
Pump air locked	Check for leaks
Filter dirty	Clean filter
Pump strainer clogged	Clean strainer
Defective wiring or connection	Repair or replace wires
Defective pressure switch	Replace switch
Defective gas controls	Call serviceperson
On-Off switch in "OFF" position	Turn switch to "ON"
Heater Short Cycling (Rapid On and Off Operation)	
Insufficient water flow	Clean filter and pump strainer
Defective wiring	Repair or replace wiring
Defective flow valve or out of adjustment	Call serviceperson
Defective hi-limit and/or thermostat	Call serviceperson
Heater Makes Knocking Noises, Make sure all valves on system are open	
Heater operating after pump has shut off	Shut off gas supply and call serviceperson
Heater exchanger scaled	Shut off gas supply and call serviceperson

⚠CAUTION

Please consult the latest edition of the "MiniMax NT Low NOx Service Manual" for complete service and repair instructions. Repairs should only be attempted by properly trained service personnel.