# ClimaDry® II Modulating Reheat Option Submittal Data

English Language/I-P Units

**Rev.: 19 August, 2011**







ClimateMaster®
Water-Source Heat Pump Systems

***SUBMITTAL DATA***

Unit Designation: _____

Job Name: _____

Architect: _____

Engineer: _____

Contractor: _____

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English Language/S-I Units

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*Document page number is shown next to part number (e.g. LC414 - 3 = page 3). Since not all pages are typically used in the submittals process, the page number in the lower right corner can still be used (page ____of_____).

## Example of TL Series Nomenclature with ClimaDry® II Option

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TL | V | 0 | 9 | 6 | A | H | D | 3 | A | D | B | T | S | |

**Heat Exchanger Options**

| | Non Coated Air Coil | | Coated Air Coil | |
|---|---|---|---|---|
| | Copper | Cupro-Nickel | Copper | Cupro-Nickel |
| ClimaDry Reheat | E | F | D | P |

**Notes:**

1. ClimaDry® II reheat option (Digit 12 - D, E, F or P) must be ordered with original equipment (cannot be field added). Unit must have DXM control. 460 volt models 072 and below require 4 wire power supply with neutral. Not available for units with internal water valve, flow regulator options, or 575Volt. Check unit submittal for limitations and specific requirements.
2. Antifreeze is not required for models listed in Table 1 but may be required due to EWT in heating or other models with orginal ClimaDry® Option on the same loop.
3. ClimaDry® II is not recommended for applications with poor water quality (see water quality guidelines in unit IOM). The copper heat exchanger (Digit 12 - D or E) with cast iron pump are designed for closed loop systems.
4. The cupro-nickel heat exchanger (Digit 12 - F or P) also includes bronze pump, and is required for use with open loop or ground water systems.
5. Max working water pressure for the ClimaDry® II option is 145psig.
6. Available with models listed in Table 1. Check unit submittal data nomenclature for models with ClimaDry® II reheat option.
7. Thermostat must be either:
   A. Thermostat with dehumidification mode (ATP32U04 or similar)
   B. Thermostat and separate humidistat or dehumidistat controller (see Table 2 for DXM DIP settings).
8. ClimaDry® II units must have minimum entering air temperature of 70°F DB / 61°F WB while in the cooling, continuous fan, or dehumidification modes. Minimum entering air temperature while operating in the heating mode (not continuous fan) is the minimum entering air temperature for the standard model (without the ClimaDry® option) in the heating mode. Operating below these minimum entering air temperatures may result in nuisance faults.

**Table 1: ClimaDry® II Availability**

| Model | Configuration | Yes | No |
|---|---|---|---|
| TL | Vertical | X | |
| TT | Vertical Upflow | X | |
| | Vertical Downflow | | X |
| | Horizontal | X | |
| TS | Vertical Upflow | X | |
| | Vertical Downflow | | X |
| | Horizontal | X | |
| TR | Vertical Upflow | X | |
| | Horizontal | X | |

## ClimaDry® II Modulating Reheat Option

ClimateMaster's patented ClimaDry® II Dehumidification option is an innovative means of providing modulating reheat without the complication of refrigeration controls. ClimaDry® II is hot gas generated reheat, which utilizes one of the biggest advantages of a Water-Source Heat Pump (WSHP), the transfer of energy through the water piping system. ClimaDry® II simply diverts condenser water through a water-to-air coil that is placed after the evaporator coil. If condenser water is not warm enough, the internal "run-around" loop increases the water temperature with each pass through the condenser coil (see figure 1, below).

## ClimaDry® II Benefits

ClimaDry® II is like no other reheat option on the market. Proportional reheat is controlled to the desired leaving air temperature setpoint (factory setpoint of 72°F, 22°C), no matter what the water loop temperature is. Since dehumidification operation will occur under less than full load cooling conditions a good percentage of the time, it is important to have a reheat function that provides 100% reheat in the spring and fall when the water loop is cool. Supply air temperature is field adjustable to +/- 3°F [+/- 1.7°C] for even greater flexibility with the optional potentiometer. It is recommended that the ClimaDry® supply air temperature be set to match the space cooling setpoint so that ClimaDry® does not impact room temperature. Competitors without ClimaDry® II typically use an on/off (non-modulating) refrigeration based reheat circuit, typically referred to as "Hot gas reheat" (HGR).

HGR needs higher condensing temperatures to work well, typically 85°F [29°C] entering water temperature (EWT). With HGR, cooler water temperatures produce cooler supply air temperatures, which could overcool the space, requiring additional space heating from another source or a special auto-change-over relay to allow the unit to switch back and forth between reheat and heating. Rarely does HGR provide 100% reheat, like ClimaDry® II. ClimaDry® II has a simple and easy to troubleshoot refrigerant circuit. No switching valves or hard to diagnose leaky check valves are utilized. No unusual refrigerant pressures occur during the reheat mode. The ClimaDry® II refrigerant circuit is like every other ClimateMaster unit (without reheat), so everything the technician already knows applies to troubleshooting the ClimaDry® II refrigeration circuit. Plus, the water loop portion of the ClimaDry® II option is easy to understand and diagnose.

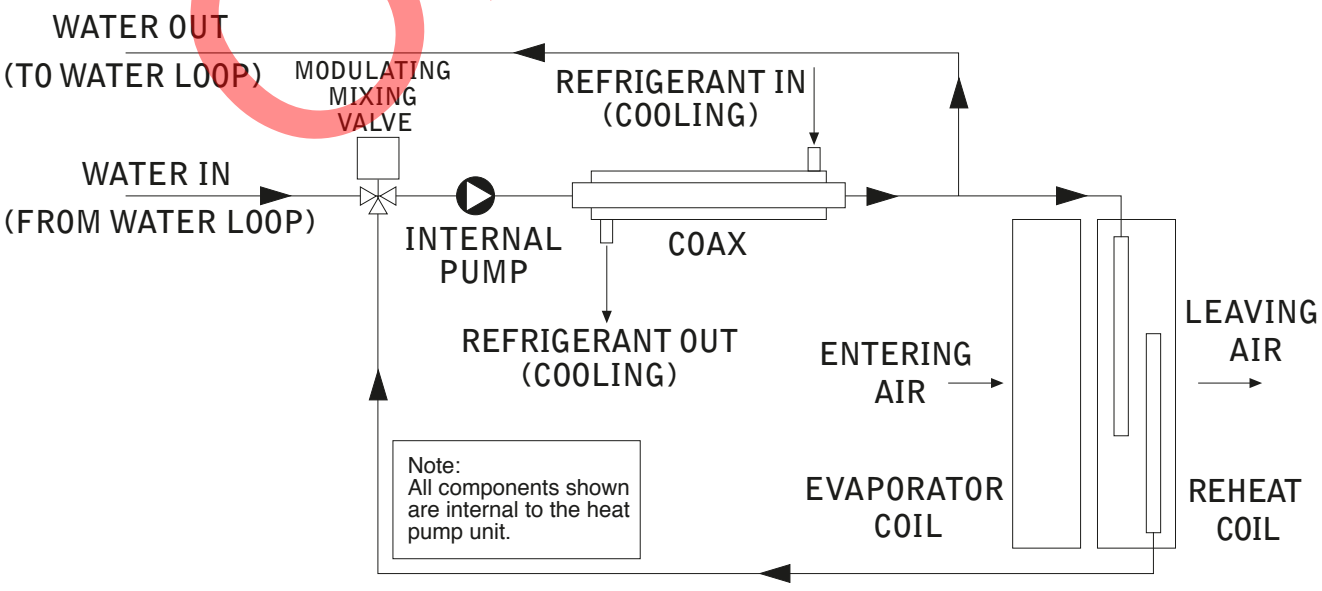
## ClimaDry® II Applications

ClimaDry® II can be applied to a number of common applications, such as:

- Classrooms.
- Condominiums.
- Apartments.
- Computer rooms.
- Spaces with high latent loads like auditoriums, theaters, convention centers, etc.
- Most applications where humidity is a problem. **(Note: ClimaDry® is not for use in high fraction outdoor air applications or in applications with corrosive atmospheres, such as pool rooms.)**



**Figure 1: ClimaDry® II Schematic**



## Options, Benefits, and Applications

With the ClimaDry® II option, return air from the space is cooled by the air-to-refrigerant (evaporator) coil, and then reheated by the water-to-air (reheat) coil to dehumidify the air, but maintain the same space temperature (thus operating as a dehumidifier).

The moisture removal capability of the heat pump is determined by the unit's latent capacity rating. Latent capacity equals Total capacity minus Sensible capacity. Using unit performance data from submittals (http://www.climatemaster.com/) select the correct model, use your maximum entering water temperature (EWT) and flow rate to select TC and SC. For example, at 80°F [26.7°C] EWT and 15 GPM, the moisture removal capability (latent capacity) of a ClimateMaster TLV120 is 30.4 Mbtuh [8.8kW] as shown in figure 2.

Dividing the latent capacity by 1,069 BTU/LB of water vapor at 80°F DB and 67°F WB [26.7°C DB and 19.4°C WB] moist air enthalpy, converts the amount of moisture removal to pounds per hour (multiply pounds per hour by 0.4536 to obtain kg/hr). Calculations are shown in figure 2.

Most ClimateMaster heat pumps have a sensible-to-total (S/T) ratio of 0.72 to 0.82. Therefore, approximately, 25% of the cooling capacity is dedicated to latent cooling capacity (moisture removal). When selecting a unit with ClimaDry® II, the space sensible and latent loads should be calculated. If the unit will be used for space cooling, a unit with at least enough capacity to satisfy the building sensible load should be selected. If the latent cooling load is not satisfied by the selection, a larger unit with enough latent capacity will be required. If the unit will be used for dehumidification purposes only, the latent capacity is the only consideration necessary. In this case, sensible load is immaterial.



**Figure 2: Example TLV120 Performance**

**LC = TC - SC = 115.4 - 85.0 = 30.4 Mbtuh**

**30,400 Btuh ÷ 1069 = 28.4 lbs/hr (12.9 kg/hr)**

4000 CFM Nominal Airflow Heating & Cooling

| WATER/BRINE | | | | Cooling - EAT 80/67°F | | | | | Heating - EAT 70°F | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EWT °F | FLOW gpm | PD psi | PD ft. | TC | SC | kW | HR | EER | HC | kW | HE | LAT | COP |
| 80 | 15.00 | 1.1 | 2.4 | 115.4 | 85.0 | 9.0 | 145.9 | 12.9 | 160.5 | 9.4 | 128.2 | 106.6 | 5.0 |
| | 22.50 | 3.3 | 7.6 | 119.6 | 87.0 | 8.5 | 148.5 | 14.1 | 169.1 | 9.6 | 136.2 | 108.6 | 5.1 |
| | 30.00 | 6.4 | 14.7 | 121.8 | 88.1 | 8.2 | 149.9 | 14.8 | 173.8 | 9.8 | 140.5 | 109.7 | 5.2 |
| 85 | 15.00 | 1.1 | 2.4 | 111.9 | 83.5 | 9.4 | 143.8 | 12.0 | 169.9 | 9.7 | 136.8 | 109.0 | 5.1 |
| | 22.50 | 3.2 | 7.4 | 116.2 | 85.5 | 8.9 | 146.4 | 13.2 | 174.6 | 9.5 | 142.0 | 110.6 | 5.4 |
| | 30.00 | 6.3 | 14.4 | 118.3 | 86.5 | 8.6 | 147.7 | 13.8 | 177.2 | 9.5 | 144.8 | 111.4 | 5.5 |
| 90 | 15.00 | 1.0 | 2.3 | 108.5 | 81.9 | 9.8 | 141.7 | 11.1 | 179.4 | 10.0 | 145.3 | 111.4 | 5.3 |
| | 22.50 | 3.2 | 7.4 | 112.7 | 83.9 | 9.2 | 144.2 | 12.2 | 180.0 | 9.4 | 147.8 | 112.5 | 5.6 |
| | 30.00 | 6.2 | 14.3 | 114.9 | 84.9 | 9.0 | 145.5 | 12.8 | 180.5 | 9.2 | 149.1 | 113.1 | 5.8 |
| 100 | 15.00 | 0.9 | 2.2 | 102.1 | 79.3 | 10.7 | 138.5 | 9.6 | Operation Not Recommended | | | | |
| | 22.50 | 3.1 | 7.2 | 106.1 | 80.9 | 10.1 | 140.5 | 10.5 | | | | | |
| | 30.00 | 6.0 | 13.9 | 108.2 | 81.8 | 9.8 | 141.6 | 11.0 | | | | | |
| 110 | 15.00 | 0.9 | 2.0 | 96.1 | 77.2 | 11.7 | 136.1 | 8.2 | | | | | |
| | 22.50 | 3.0 | 6.9 | 99.7 | 78.4 | 11.1 | 137.5 | 9.0 | | | | | |
| | 30.00 | 5.8 | 13.4 | 101.7 | 79.1 | 10.8 | 138.4 | 9.5 | | | | | |
| 120 | 15.00 | 0.8 | 1.9 | 90.6 | 76.0 | 12.9 | 134.7 | 7.0 | | | | | |
| | 22.50 | 2.9 | 6.7 | 93.8 | 76.6 | 12.2 | 135.4 | 7.7 | | | | | |
| | 30.00 | 5.6 | 13.0 | 95.5 | 77.0 | 11.8 | 135.9 | 8.1 | | | | | |

Note: Minimum entering air temperature of 70°F DB / 61°F WB

Dividing the latent capacity by 1,069 BTU/LB of water vapor at 80°F DB and 67°F WB [26.7°C DB and 19.4°C WB] moist air enthalpy, converts the amount of moisture removal to pounds per hour (multiply pounds per hour by 0.4536 to obtain kg/hr). Calculations are shown in figure 2.

## Sequence of Operation

**ClimaDry® II Sequence of Operation -** A heat pump equipped with ClimaDry® II can operate in three modes; cooling, cooling with reheat (dehumidification), and heating. The cooling/heating modes are like any other ClimateMaster WSHP. The reversing valve ("O" signal) is energized in cooling, along with the compressor contactor(s) and blower relay. In the heating mode the reversing valve is de-energized. Almost any thermostat will activate the heat pump in heating or cooling modes. The DXM microprocessor board, which is required with the ClimaDry® II option, will accept either heat pump (Y,O) thermostats or non-heat pump (Y,W) thermostats. The reheat mode requires either a separate humidistat/ dehumidistat or a thermostat that has an integrated dehumidification function for activation. The DXM board is configured to work with either a humidistat or dehumidistat input to terminal "H". Upon receiving an "H" input, the DXM board will activate the cooling mode and engage reheat. Table 4 shows the relationship between thermostat input signals and unit operation. There are four operational inputs for single stage units and six operational inputs for dual stage units:

-Fan Only
-1st Stage Cooling
-2nd Stage Cooling
-1st Stage Heating
-2nd Stage Heating
-Reheat Mode

Fan Only: A (G) call from the thermostat to the (G) terminal of the DXM control board will bring the unit on in fan only mode.

1st Stage Cooling: A simultaneous call from (G), (Y1), and (O) to the (G), (Y1), (O/W2) terminals of the DXM control board will bring the unit on in 1st Stage Cooling.

2nd Stage Cooling: A simultaneous call from (G), (Y1), (Y2), and (O) to the (G), (Y1), (Y2), and (O/W2) terminals of the DXM control board will bring the unit on in 2nd Stage Cooling. When the call is satisfied at the thermostat the unit will continue to run in 1st Stage Cooling until the 1st Stage Cooling call is removed or satisfied, shutting down the unit. **NOTE: Not all units have two-stage cooling functionality.**



**Table 2: Humidistat/Dehumidistat Logic and DXM (2.1, 2.2., 2.3) DIP Settings**

| Sensor | 2.1 | 2.2 | 2.3 | Logic | Reheat (ON) - H | Reheat (OFF) - H |
|---|---|---|---|---|---|---|
| Humidistat | OFF | OFF | OFF | Reverse | 0 VAC | 24 VAC |
| Dehumidistat | OFF | ON | OFF | Standard | 24 VAC | 0 VAC |

**Table 3: ClimaDry® II Operating Modes**

| Mode | Input | | | | | Output | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | O | G | Y1 | Y2[3] | H | O | G | Y1 | Y2[3] | Reheat |
| No Demand | ON/OFF | OFF | OFF | OFF | OFF | ON/OFF | OFF | OFF | OFF | OFF |
| Fan Only | ON/OFF | ON | OFF | OFF | OFF | ON/OFF | ON | OFF | OFF | OFF |
| Cooling 1st Stage | ON | ON | ON | OFF | OFF | ON | ON | ON | OFF | OFF |
| Cooling 2nd Stage | ON | ON | ON | ON | OFF | ON | ON | ON | ON | OFF |
| Cooling & Dehumidistat[1] | ON | ON | ON | ON/OFF | ON | ON | ON | ON | ON/OFF | OFF |
| Dehumidistat Only | ON/OFF | OFF | OFF | OFF | ON | ON | ON | ON | ON | ON |
| Heating 1st Stage | OFF | ON | ON | OFF | OFF | OFF | ON | ON | OFF | OFF |
| Heating 2nd Stage | OFF | ON | ON | ON | OFF | OFF | ON | ON | ON | OFF |
| Heating & Dehumidistat[2] | OFF | ON | ON | ON/OFF | ON | OFF | ON | ON | ON/OFF | OFF |

[1]Cooling input takes priority over dehumidify input.
[2]DXM is programmed to ignore the H demand when the unit is in heating mode.
[3]N/A for single stage units; Full load operation for dual capacity units.
[4]ON/OFF = Either ON or OFF.

## Sequence of Operation

1st Stage Heating: A simultaneous call from (G) and (Y1) to the (G) and (Y1) terminals of the DXM control board will bring the unit on in 1st Stage Heating.

2nd Stage Heating: A simultaneous call from (G), (Y1), and (Y2) to the (G), (Y1), and (Y2) terminals of the DXM control board will bring the unit on in 2nd Stage Heating. When the call is satisfied at the thermostat the unit will continue to run in 1st Stage Heating until the call is removed or satisfied, shutting down the unit. **NOTE: Not all units have two-stage heating functionality (e.g. TLV084-150 units).**

Reheat Mode: A call from the Humidistat/Dehumidistat to the (H) terminal of the DXM control board will bring the unit on in Reheat Mode if there is no call for cooling at the thermostat. When the Humidistat/ Dehumidification call is removed or satisfied the unit will shut down. **NOTE: Cooling always overrides Reheat Mode. In the Cooling mode, the unit cools and dehumidifies. If the cooling thermostat is satisfied but there is still a call for dehumidification, the unit will continue to operate in Reheat Mode.**

**Note: Care must be taken when using a humidistat to operate ClimaDry®. When the DIP switch on the DXM controller is set for 'humidistat' it reverses the control logic so that an "open" control circuit initiates a ClimaDry® run cycle. If a humidistat is not connected, or if a manual switch on the humidistat is set to "off", ClimaDry® will see the open circuit and call for dehumidification.**

**ClimaDry® II Component Functions**

The ClimaDry® II option consists of the following components:
Motorized Valve/Proportional Controller
Supply Air Sensor
Loop Pump
Hydronic Coil
Low Pressure Switch

The Proportional Controller operates on 24 VAC power supply and automatically adjusts the water valve based upon the Supply Air Sensor. The Supply Air Sensor senses supply air temperature at the blower inlet providing the input signal necessary for the proportional control to drive the motorized valve during the reheat mode of operation. The Motorized Valve is a proportional actuator/three-way valve combination used to divert the condenser water from the coax to the hydronic reheat coil during the reheat mode of operation. The proportional controller signals the motorized valve based on the supply air temperature of the supply air sensor.

The Loop Pump circulates condenser water through the hydronic reheat coil during the reheat mode of operation. In this application, the loop pump is only energized during the reheat mode of operation. The Hydronic Coil is utilized during the reheat mode of operation to reheat the air to the setpoint of the proportional controller. Condenser water is diverted by the motorized valve and pumped through the hydronic coil by the loop pump in proportion to the control setpoint. The amount of reheating is dependent on the setpoint and how far from setpoint the supply air temperature is. The factory setpoint is 72°F [22°C], generally considered "neutral" air.

**ClimaDry® II Application Considerations**
The reheat coil adds a small amount of resistance to the air stream. In some cases the high static option may be required for applications with higher static ductwork. Consult the submittal data or the Installation/Operation/ Maintenance (I.O.M.) manual for the specific heat pump to review blower tables.

Unlike most hot gas reheat options, the ClimaDry® II option will operate over a wide range of EWTs. Special flow regulation (water regulating valve) is not required for low EWT conditions.

**Water-source heat pumps with ClimaDry® II should not be used as make-up air units. These applications should use equipment specifically designed for make-up air.**

**Notes:**

**Notes:**

## Revision History

| Date: | Item: | Action: |
|---|---|---|
| 08/19/11 | Example of TL Series Nomenclature with ClimaDry® II Option | Revised 460 neutral wire to only 072 and lower. |
| 01/03/11 | Format - All Pages | Updated |
| 10/15/10 | ClimaDry® II Notes | Updated |
| 10/04/10 | ClimaDry® II Benefits | Updated |
| 10/04/10 | ClimaDry® II Availability & Notes | Updated - Added TR |
| 06/11/10 | Format - All Pages | Updated |
| 06/11/10 | Engineering Specifiations | Updated |
| 05/28/10 | ClimaDry® II Availability | Added TT & TS |
| 10/09/09 | First Published | |