



Installation Instructions

The MOD series
modulating hot water air handler

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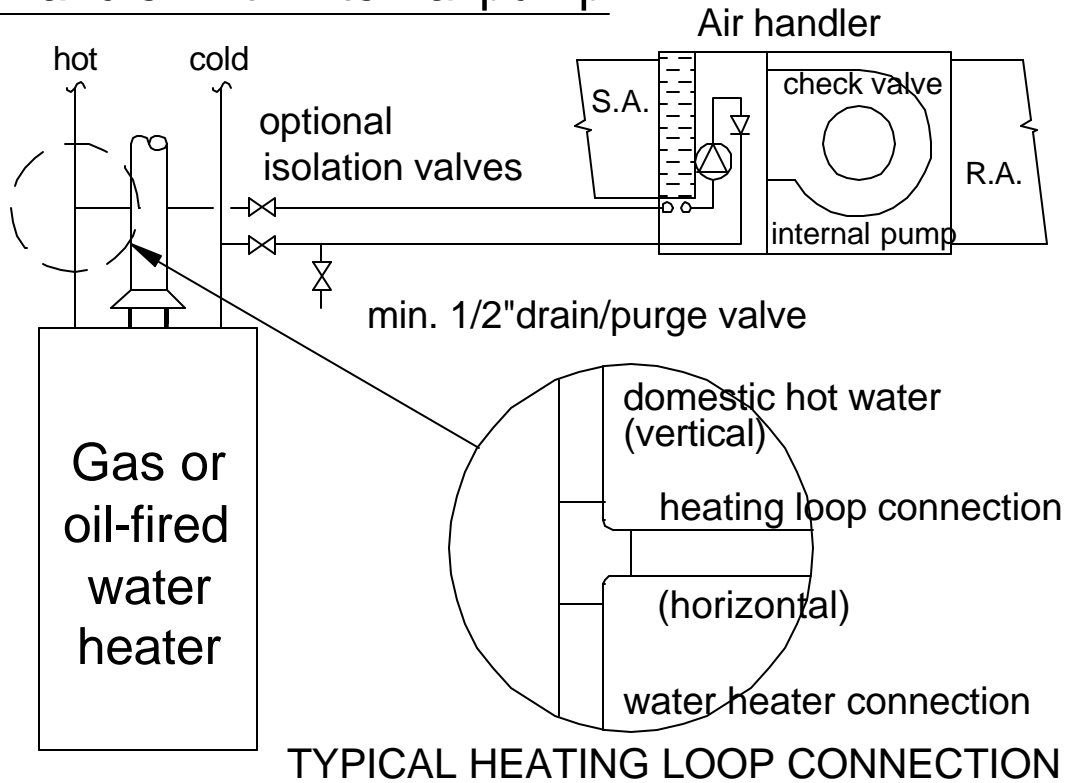
FOR THE INSTALLER

A Quick Check List

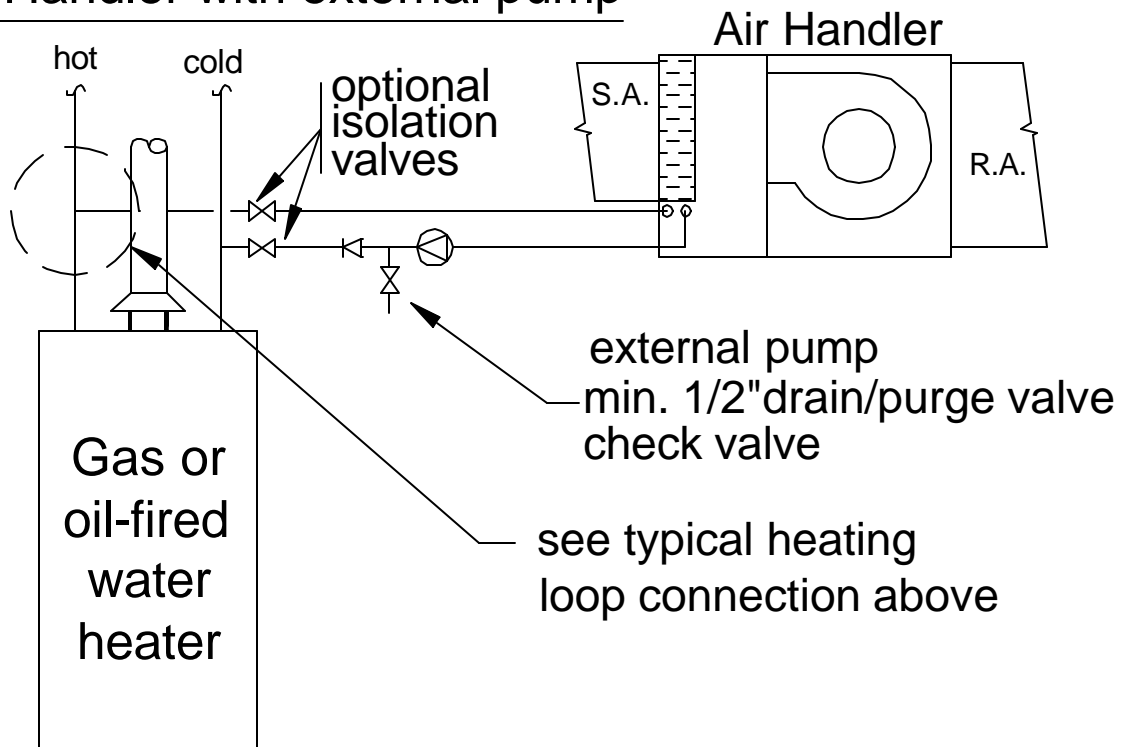
1. Are the water connections to the water heater made horizontally to avoid trapping air? (for combo systems only) See diagram on next page.
2. Is the purge valve installed on the return line from the air handler upstream from the isolation valve?
3. Is the water hot? The blower will not run until the coil is 120°F (49°C).
4. Is the air handler hung and isolated to avoid transmitting vibration through framing and duct work?
5. Are the isolation valves full-port? Restrictive valves will limit performance.
6. Use standard 4 conductor thermostat wire.
7. Is outdoor cooling unit wired to output (yellow & green wires) on controller to provide hard-start protection?
8. Are Thermostat connections correct, including cooling and continuous run connections?
9. Is the unit accessible? Are there clearances for service and component replacement?

TYPICAL PLUMBING CONNECTIONS

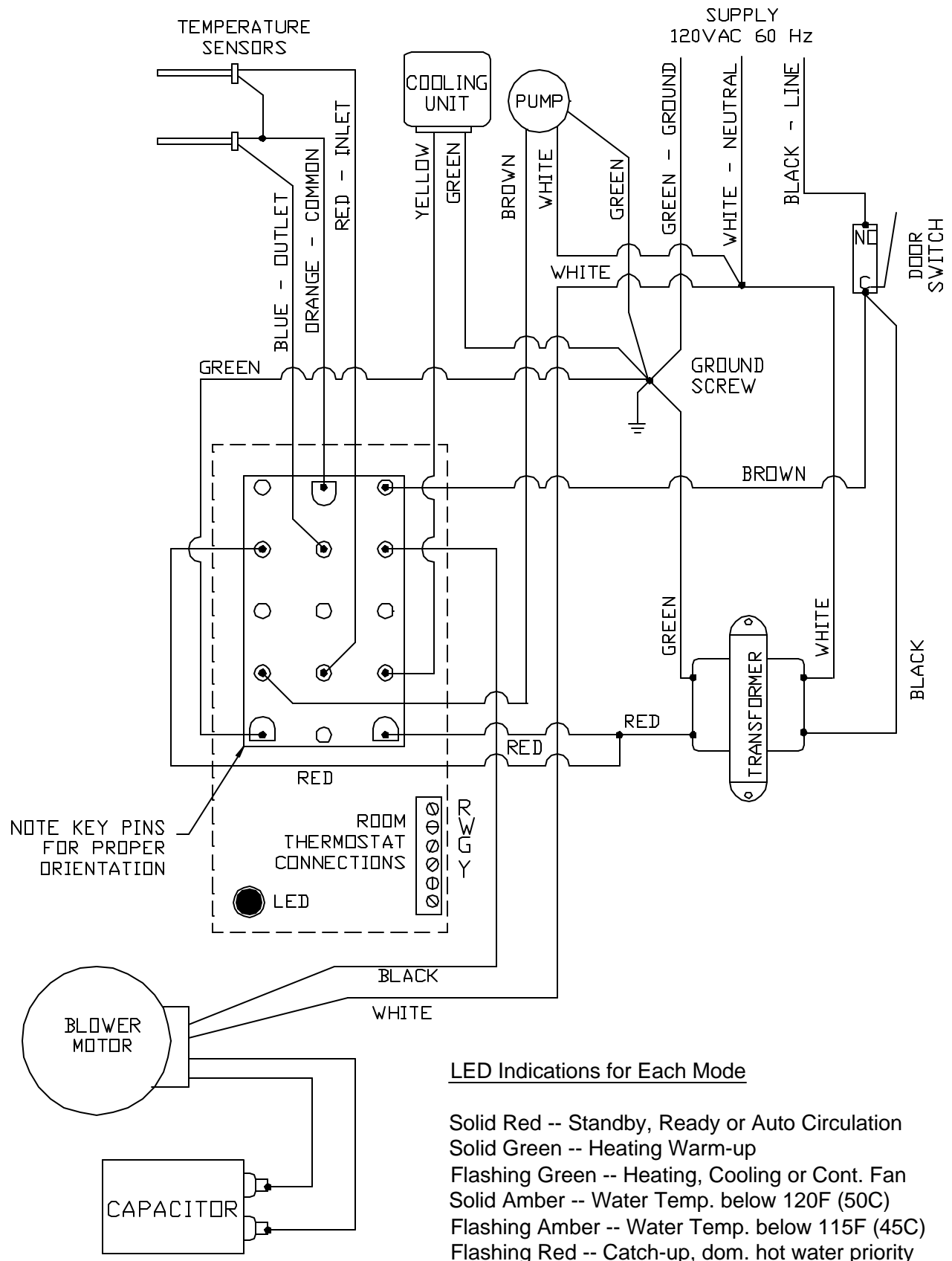
Air Handler with internal pump



Air Handler with external pump



ELECTRICAL WIRING DIAGRAM



INTRODUCTION

The **MOD** series of air handlers are specifically designed for use in residential hydronic (boiler) systems or combination space and water heating systems (Combo Systems). Combo heating systems use the home's water heater to provide both the space heating and domestic hot water, eliminating the need for a furnace.

Combo heating systems are ideally suited for single family homes, townhouses and apartments where the cost of a furnace does not make sense or space requirements are limited. They are also great for additions, renovation and finished basements as a replacement for, or in addition to the existing heating system. Our air handlers are the smallest units available in their capacity range.

At the heart of the MOD Series Air Handler (**MOD**) control is an 8-bit microprocessor. The controller uses fuzzy logic that allows the pump and blower to act intelligently. The blower responds to intelligent decisions based on changing household demands and outdoor conditions. The pump modulates taking in to account varying blower speed as well as varying inlet water temperatures.

Combo systems using the MOD Series Air Handler will realize the following benefits:

- Higher space heating efficiency because return temperatures are lower.
- Lower operating cost from higher efficiency and lower electrical consumption.
- Quiet operation because blower speeds are reduced.
- More homeowner comfort from warmer air, less velocity and better mixing.
- More homeowner comfort – fan does not start for heating until coil is warm.
- Stable delivered hot water temperature due to smart flow control.
- Continuous flow control – no field installed flow setting valve required.
- Built in domestic hot water priority – no field installed low temperature cut out required.
- Automatic periodic circulation – no field installed circulation timer required.
- Costs less to install – eliminates costly add-on components and commissioning.
- Easier to install – no commissioning required - just turn it on.
- Easier to size – self adjusting – impossible to oversize air handler for water heater.
- Longer cooling unit life thanks to built in soft-start feature.

PRODUCT DESCRIPTION

cabinet

All cabinet panels have a tough, durable low maintenance pre-painted finish.

Cabinet dimensions are designed to provide maximum installation flexibility. Refer to installation requirements for more details.

heating coils

All heating coils are potable water grade copper suitable for use in plumbing systems. No lead solder is used in any component construction. All coils and internal piping conform to ASTM B68 or ASTM B88 standards.

High density aluminum fins provide maximum heat transfer for small coil surface. Lower air flow and higher fin density equals warmer, more comfortable air with much less fan noise than other air handlers.

fan

All fans are wide body dynamically balanced for extra quiet operation.

Multi-directional sleeve bearing motors allow mounting in any direction for maximum installation flexibility.

circulating pump

Air handlers can come with internally mounted pumps for ease of installation.

check valve

Check valves serve two purposes:

- protect against back-flow of water to avoid short circuiting around the water heater during domestic water use.

- protect against thermal siphoning.

Thermal siphoning is flow of water through the space heating circuit while the circulating pump is not operating due to hot water rising by natural convection. This phenomenon is of little consequence during winter months, but during the summer this will cause overheating, interfere with air conditioning and waste energy.

All MOD series air handlers come supplied with spring loaded, vertical lift check valves. These check-valves have been tested and proven to resist thermal siphoning for installations where the air handler elevation does not exceed the distance above the water heater shown in table I.

Table I Check Valves

valve size	Maximum elevation
1/2"(12mm)	25 feet (8 metres)
3/4"(20mm)	50 feet (15 metres)

water heater

Any properly sized gas or oil fired water heater will work in a combo heating system. Make sure the water heater being used is approved for combo applications. (Most manufacturers' heaters are approved.) Warranties are not affected by using a water heater in combo applications.

boiler

All MOD SERIES air handlers are compatible for use with boilers or instantaneous water heaters.

EQUIPMENT SELECTION AND SIZING

Proper sizing of system components is crucial for proper operation of the system. However, over-sizing of the air handler is not possible with the MOD series air handler since it automatically and continuously adjusts its output to match the heat loss of the space being heated. Therefore, the water heater does not need to be sized to match the air handler but to match the heat loss of the space being heated.

Make sure a proper room by room heat loss and heat gain for the dwelling is calculated using HRAI, ASHRAE or other approved sizing method.

If using a boiler system, select the air handler that meets or exceeds the heating requirements of the dwelling at the inlet water temperature of the boiler system.

Select a boiler that has an output that meets or exceeds the heat loss of the space being heated. If additional loads are being met by the boiler, size the boiler to meet the total combined load.

For combo heating systems, use an approved sizing method such as the Unified Combo Guidelines published by HRAI.

In areas where the UCG or a local sizing code is not applicable, use the following method for sizing combo systems:

1. Select an air handler that meets or exceeds the calculated heat loss at the water heater operating temperature (130F/55C or 140F/60C).
2. Select a water heater with an output that is at least 120% of the heat loss.

INSTALLATION

The installer must adhere strictly to all local and national code requirements pertaining to the installation of this equipment.

Detailed instructions are shipped with all accessory items and should also be followed in detail.

air handler mounting

The MOD series air handler can be installed in any direction. The compact dimensions of the smaller MOD A3-05 even allow for installation between joists. Some precautions must be observed for some of the possible mounting positions. For installations where the access door faces up or down, select an air handler with an external pump to avoid the pump being mounted with its shaft vertical. The

pump shaft must be mounted horizontally to avoid damage during operation.

For installations where the access door is facing up, loosen the band holding the fan motor in place. Rotate the motor to ensure the oil port on the motor faces above the horizontal, then tighten the holding band. Note: no field adjustment is required for upflow, downflow, horizontal left or right configurations.

The air handler can be hung by securing straps through any of the existing screw holes in the cabinet. When the existing screw is too short for securing a mounting strap, a longer screw can be used provided care is taken not to damage any internal components.

When fastening straps using screws other than those supplied with the cabinet, special care should be taken in the vicinity of the coil to avoid tube puncture.

The cabinet is designed so that the return air can be located on either side of the cabinet, through the bottom of the cabinet, or from the back. Position the filter rack so that the filter is readily accessible.

Install the air handler with the door firmly screwed in place to make sure the cabinet is hung without racking.

Provide at least 2 feet (0.75 metres) of access clearance in front of the access panel of the air handler. Zero clearance is acceptable on all other faces.

domestic water piping

A 1/2"(12mm) sediment faucet for use as a drain/purge valve must be installed. The drain valve must be located downstream of the pump and check valve, and upstream of the isolation valve (if isolation valve is present). With this arrangement, any air trapped in the system can easily be flushed out following the instructions in the *Start-up & Troubleshooting* sections.

Isolation valves are recommended, but not required. Installing isolation valves facilitates easy servicing and ensures positive purging of the system during start-up.

For combo systems all joints in copper pipe must be lead-free solder. All piping must be suitable for potable water use.

Maximum pipe lengths for all MOD series air handlers should be as shown in Table V below. Pipe lengths indicated are actual lengths. Allowance has been made for a reasonable number of valves and fittings.

Table V maximum pipe lengths

Pipe size	Maximum length
1/2" (12mm)	25 feet (9 metres)
3/4" (20mm)	125' (45 metres)

When both top and side connections are provided on the water heater, the side connections should be used for the space heating loop.

When the space heating loop connections are made to the domestic water connections:

- the heating loop connections should be positioned horizontally in a vertical section of the domestic water line for both inlet and outlet. Refer to the piping schematic for details.
- connect the heating loop to the domestic water connections as close to the water heater as possible.

Avoid sections of pipe in the heating loop that can trap air where possible.

It is usually impossible to install a system without having at least one part of the system or heating coil able to trap air. This will not be a problem if the connection to the domestic water lines is made properly, and the system is properly purged on set-up:

- The circulating pump is capable of removing small amounts of entrained air from the heating loop.
- Following the flushing procedures in the *Start-up* section will ensure that there is no air in the system after initial set-up.
- Proper connections between the domestic water lines and the heating loop will ensure that any air that collects in the water tank, does not make its way into the heating loop.

If connected to a water heater, air bleed valves at high points of the heating system are not required and NOT recommended.

anti-scald valve

Anti-scald valves are not required for normal operation, but may be used for installations where the home owner wishes a lower domestic water temperature than 140F (60C). It is not recommended that anti-scald valves be installed unless required. If an anti-scald device is to be installed, it must comply with ASSE standards no. 1016 and 1017.

Boiler piping

Use a primary, secondary piping arrangement to de-couple the flow through the boiler from the flow through the air handler. Make the supply and return connections for the air-handler heating loop are not more than 1 foot apart in the boiler heating loop. Make sure the supply connection is upstream of the return connection for boilers operating at or

below 160F (71C). Maximum length of piping in the air handler piping loop shall be as shown in table V above.

water heater or boiler

Follow the manufacturer’s instructions for installation and start-up of the water heater or boiler. Make sure the heating device is turned off during air handler installation and service. Ensure system has been refilled, and all air is purged from the system before turning on the heating device.

duct work

To minimize fan noise in the living space, it is recommended that the first three feet of supply and return air duct be lined with acoustic insulation.

Return and supply air duct work should be the same size as the air handler openings up to the first branch, fitting or transition.

ELECTRICAL

Warning! - Make sure unit is properly grounded. Locate air handler on a separate electric circuit, or, if a power vented water heater is used, use the same circuit as the water heater.

All air handlers operate on 110v/1ph/60hz line voltage. All control circuits are 24 volt.

thermostat

The MOD series air handlers are compatible with any standard heat/cool, heat pump, “electric heat”, “gas heat”, set-back or electronic thermostat.

Anticipator Setting	0.0 amps
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Thermostat wire from the thermostat is connected to the four screw terminals located on the control board inside the air handler. They should be connected as follows:

- R – power (24vac)
- W – heating
- Y – cooling (if present)
- G – continuous run fan (if present on thermostat)

Thermostat Heat	
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electrical information

Air handler wiring diagrams are located on the inside of the access panel for easy reference during installation and servicing.

Nameplate data is located on the side of the unit.

Cooling unit

Connect the cooling unit relay to the yellow and green (ground) wires labeled "cooling unit relay" for a five minute delay before the cooling compressor and main blower starts.

START-UP PROCEDURES

Do not start the air handler, boiler or water heater until ALL air has been purged!

1. Fill the boiler loop or water heater with water, but do not start it.
2. Purge all air for the water lines by opening faucets at the remote parts of the plumbing system (for combo systems).
3. Purge all air from the space heating loop by closing the isolation valve on the return leg of the loop and open the drain to purge air. Open the return leg isolation valve and then close the drain valve. If no isolation valves are installed, open drain fully to purge air and let run for at least 30 seconds.
4. On Grundfos pumps vent the air from the pump chamber by loosening the large screw plug on the front of the pump motor until water appears. Hold a rag underneath to catch drops.
5. If a water heater is used as the heat source, start it according to the manufacturer's instructions. Set the desired water temperature (at least 140°F/60°C) and wait for the tank to shut off. If a boiler is used, refer to manufacturer's start-up procedures.
6. Turn on the power to the air handler and set the room thermostat for heat to energize the fan and pump. If a gurgling sound is present, it should subside within one minute. If noise is still present after one minute, repeat step 3 to purge air as necessary.
7. Check pipes for heating to make sure there is flow and feel the pump motor to see if it is running hot.

CONTROL LOGIC & SEQUENCE OF OPERATION

General

The strategy for MOD series control optimizes performance for glass-lined, non-condensing water heaters and boilers. It achieves this by maintaining an ideal water temperature drop across the hot water coil, regardless of blower speed. Controlling temperature drop across the heating coil eliminates excessive water flow rates through the heat source. In the case of water heaters, this reduces blending and maintains an ample supply of hot water at the top of the tank. This leads to more rapid response from the tank thermostat and a stable water temperature delivered from the tank. The outcome is better fan coil performance and better domestic hot water supply.

When connected to a boiler system, the air handler pump will modulate to maintain approximately 25°F (14°C) temperature drop across the space heating water loop regardless of inlet water temperature or air flow rate.

The blower is run as slowly as possible in order to increase comfort and reduce noise. This effectively modulates the space heating output to match the heat-loss of the building. During non-peak periods, the blower will run longer, run more quietly, airflow rates will be reduced and delivered air temperatures will be warmer. This will virtually eliminate complaints of cool delivered air common to Combo Systems. Longer run times will increase air mixing and reduce stratification of house air.

The controller is designed to use an ordinary wall-mounted thermostat. An ideal on-time is compared to actual time required to satisfy the thermostat. The program has been developed to lower the blower speed the next time there is a call for heat if the room thermostat is satisfied in less than the ideal time. The blower speed will not be effected if the room thermostat is satisfied within the ideal range. The blower speed is increased if the room thermostat is not satisfied within the ideal time until the room thermostat is satisfied. The next heating cycle will see the blower speed increased by one increment.

domestic hot water priority

When inlet water temp drops to below 120°F (49°C), the blower is brought to speed 3 of 8 (40% power) and the LED will be solid amber. If inlet temperature drops to below 115°F (46°C) the blower is interrupted, the pump goes to low speed (40% power), the LED goes to flashing amber and a five minute timer is initiated. If the supply water temperature does not return to 120°F (49°C) within 5 minutes, the unit goes into “catch-up” mode. The pump and blower will not run for 10 minutes and the LED goes to flashing red.

call for heating

When there is a call for heat by the room thermostat, continuous run mode is suspended (if selected) and the pump comes on at 75% power. When the outlet water temperature reaches 120°F (49°C) the blower comes on at the normal speed for that cycle. If 120°F (49°C) is not

attained within 10 minutes, “catch-up” mode is initiated as above.

call for cooling

When there is a call for cooling by the room thermostat, continuous run mode is suspended (if selected) and the compressor contactor will close (if soft start timer has timed out). 15 seconds after the compressor starts, the blower runs on speed 8 of 8 (full power).

Call for continuous run

When there is a call for continuous run blower by the room thermostat, the blower runs on fan speed 4 of 8 (60% power).

LED lights

indication for each operational mode:

Standby – ready, but no action	solid red
Warm up - heating mode coil warm up: Heating:	flashing green
Inlet water temp below 120°F (49°C)	solid amber
Inlet water temp below 115°F (46°C)	flashing amber
Catch up – domestic hot water priority	flashing red
Cooling	flashing green
Continuous run blower	Flashing green
Auto circulation	solid red

Blower speed

expressed as % power:

8	100
7	90
6	80
5	70
4	60
3	50
2	40
1	40

Auto circulation

Every 24 hours the pump runs at full power for 30 seconds. Auto circulation will only operate in the standby and continuous run modes (not while in cooling mode).

compressor hard start protection

On initial power up, or when the call for cooling is stopped by the room thermostat or power interruption, a 5 minute timer counts down to prevent the compressor from starting again within this time period. This will protect the compressor from hard starts due to momentary power outages and thermostat bouncing.

SERVICE AND MAINTENANCE

filter

The MOD series air handler is provided with a reusable, washable filter media. This filter should be inspected monthly and removed and vacuumed or rinsed as required. Use only water to clean the filter. The filter is designed to last for many years, but replacements can be purchased from any hardware store and cut to fit the filter rack.

duct cleaning

If proper filter maintenance is adhered to, duct cleaning will not be required for the life of the equipment.

coils

Air conditioning and heating coils should not require cleaning if the filter maintenance schedule is adhered to. If a filter is damaged or collapses from plugging, the coils may get fouled by dust. If this happens, replace the filter and carefully vacuum the heating coil. The fan may need to be removed to gain access to the face of the heating coil.

air conditioning coil

At the start of each cooling season, check the condensate drain connection to the cooling coil to ensure it is free of debris. An easy way to do this is to blow into the tube to see if there is any obstruction. If a plugged air conditioning coil is suspected, call a service technician for testing and cleaning.

fan and motor

Oil the fan motor bearings every twelve months (two oil ports total; only one drop of oil in each port). Check fan for dust once a year. If dirty, vacuum or wash to remove dust. Keeping the fan blades clean will reduce noise and improve the capacity and efficiency of the heating system. Take care to avoid wetting the motor! Remove the motor if required.

pump

The circulating pump is water lubricated and should require no regular maintenance. If the pump fails to start at the beginning of the heating season, follow the instructions in the *Trouble Shooting* section of this manual below.

TROUBLESHOOTING

pump does not run

In areas where hard water is present the pump may “stick” and fail to run. Often this can be freed by closing the isolation valve on the return leg and opening the drain port so that water flows through the pump. For Grundfos pumps, remove the screw-on cover from the face of the pump, and rotate the shaft one turn with a slotted screw driver. If either method fails to free the pump, removal for cleaning or replacement as necessary. The daily pump exerciser will help prevent pump sticking.

pump is noisy at start-up

Air is present in heating loop. If sound has not diminished within 1 minute, purge air in accordance with the *Start-Up* procedures. If heat source is a water heater, check to make sure branch connections for heating loop are horizontal to prevent the collecting air in the heating loop.

water heater T&P is weeping

A check valve or back-flow preventer may have been installed in the system. Some form of pressure relief may be required. Options are:

- install expansion tank
- install pressure relief valve; locate outlet over laundry tub or floor drain.
- install combination toilet tank/pressure relief valve

insufficient or no heat

- Plugged air filter or coil. Refer to *Maintenance* section for filter care and coil cleaning.
- Air in heating loop; purge system.

- Inlet and outlet connections to air handler backwards; reverse connections.
- Water heater supply tube (dip tube) is restricted or damaged; check and/or replace.
- Supply water temperature set too low or not calibrated properly; check water temperature. In the case of water heater; If the temperature has been set low because of homeowner preference, it may be necessary to install an anti-scald valve to control the faucet temperature and raise the operating temperature of the water heater.
- Restriction in heating loop; remove restriction, check valve stuck, isolation valves too restrictive, left partially closed after purging or closed valve.
- Water heater supply temperature is unstable or air handler goes to domestic hot water priority mode frequently; check water heater setting and temperature sensors for good contact on coil headers.

cold water at hot faucet

When heat source is a water heater, the most probable cause is reverse flow through the heating loop from a stuck check valve; repair or replace valve.

fan runs for cooling but not heating

- Room thermostat may be connected improperly. Refer to *Electrical* section or wiring schematic on door of air handler for proper installation.
- If pump runs but fan does not start check temperature sensor on return header. See LED indications on page 14.

heating during off cycle

Probable cause is thermal siphoning. See check valve description for details; repair or replace check valve. Check elevation of air handler above water heater to see if motorized valve required for positive shut-off.

Temperature Sensors

On the inlet and outlet headers of the coil are thermistors that provide the controller with the information about water temperatures. The thermistors should be in contact with the headers and insulated from surrounding temperatures.

Thermistors can be checked with an Ohm meter by pulling the 15 pin connector from the printed circuit board and measuring the resistance at the pins. Check for open circuits and short circuits against the copper pipe.

An open circuit or a loose sensor on the supply header will tell the controller that the incoming water is colder than it really is. This will result in the unit going into domestic hot water priority mode. See control logic & sequence of operation on page 13.

A short circuit on the supply sensor will tell the controller that the supply water is hotter than it really is. This will result in the pump running faster than it should. The temperature drop across the coil may be less than 25°F (14°C) and there will be no domestic hot water priority when the water temperature drops to 120°F (49°C).

An open circuit or a loose sensor on the outlet header of the coil will tell the controller that the water is colder than it really is. This will cause the pump to run at

start-up, but the blower will start when the outlet temperature reaches a temperature higher than 120°F (49°C) or not at all.

A short circuit at the sensor on the return header will tell the controller that the water temperature is hotter than it really is. This will result in the blower starting immediately on a call for heat (no delay while hot water floods the coil). The pump will run as slowly as possible resulting in a large temperature drop across the coil.

Nominal Resistance Vs. Temperature

Ohms	°C	°F
6228	20	68
4991	25	77
4026	30	86
3267	35	95
2667	40	104
2189	45	113
1807	50	122
1499	55	131
1250	60	140
1047	65	149
881	70	158
745	75	167
632	80	176

AIR HANDLER PARTS LIST

Description	Model No.
SAH-GL Control Module	ELK001
Mate-N-Lok 15 pin connector and pins	COM001
Thermistor, 5k Ohm	ELT102
Transformer 24VAC, 20 VA with integral fuse	ELT003
Door interlock switch	ELD002
For MOD A3-05	
Capacitor, 5 MFD for 1/4 hp motor	COM002
Motor, 1/4 hp, 1050 rpm, c/w flex bracket	ELM001
Blower, 10x5 DD c/w mounting bracket	BLF105T
Hot Water Coil, 12"x16", 3 row	UC12163
Pump, Taco 006, 1/2" sweat	T006
Check Valve, 1/2" FPT	PLC002
For MOD C3-06	
Capacitor, 7.5 MFD for 1/3 hp motor	COM003
Motor, 1/3 hp, 1050 rpm, c/w flex bracket	ELM002
Blower, 10x8 DD c/w mounting bracket	BLF108
Hot Water Coil, 18"x20", 3 row	UC18203
Pump, Taco 008, 3/4" sweat	T008
Check Valve, 3/4" FPT	PLC001