

REZNOR®

DFCH / DFCV SERIES DIRECT GAS FIRED MAKE-UP AND INDUSTRIAL HEATERS INSTALLATION, OPERATION AND MAINTENANCE MANUAL

(Suitable for Operation from 20% to 100% Outside Air)

READ MANUAL CAREFULLY BEFORE INSTALLING, OR OPERATING THE HEATER

FOR YOUR SAFETY

If you smell gas follow these instructions

- 1) Open Windows.
- 2) Do not touch electrical switches.
- 3) Extinguish any open flame.
- 4) Call the gas supplier immediately

FOR YOUR SAFETY

The use and storage of gasoline or other flammable vapors and liquids in open containers in the vicinity of this appliance is hazardous

Unit Model: _____

Serial #: _____

Factory Job #: _____

Installation Date: _____

WARNING: Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment.

***THIS UNIT IS TO BE SERVICED BY QUALIFIED PERSONNEL ONLY*
DO NOT TAMPER WITH THE UNIT OR CONTROLS**

WARNING: Install, operate and maintain unit in accordance with manufactures instructions to avoid exposure to fuel substances from incomplete combustion which can cause death or serious illness. The state of California has determined that these substances may cause cancer, birth defects or other reproductive harm.

INSTALLER'S RESPONSIBILITY

Installer please note: This equipment has been test fired and inspected. It has been shipped free from defects from our factory. However, during shipment and installation, problems such as loose wires, leaks or loose fasteners may occur. It is the installer's responsibility to inspect and correct any problems that may be found. Factory Authorized parts available at parts@ice-us.com

Installer / Service Contractor

Name: _____

Address: _____

Telephone: _____

Contact: _____





WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in serious injury, death or property damage.

Be sure to read and understand the installation, operation and service instructions in this manual.

Improper installation, adjustment alteration, service or maintenance can cause serious injury, death or property damages.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance
- WHAT TO DO IF YOU SMELL GAS
 - Do not try to light any appliance.
 - Do not touch any electrical switch; do not use any phone in your building.
 - Leave the building immediately.
 - Immediately call you gas supplier from a phone remote from the building. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department or 911.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier

WARNING: Fire or Explosion hazard can cause property damage, severe injury or death. Ensure that all air taken into the unit is free from the presence of:

- a) Flammable solids, liquids and gases.
- b) Explosive materials. Example: grain dust, coal dust, gun powder etc.
- c) Substance which may become toxic when exposed to heat or passing through a gas flame.

These Instructions are to remain with the equipment for servicing. The heater shall be serviced monthly (or more frequently if bearing and filter service is necessary).

305 Van Buren Road, Bolivar TN 38008
Tel: 731-658-7000

TABLE OF CONTENTS

	<u>PAGE</u>
FIRE OR EXPLOSION WARNING	2
RECEIVING AND WAREHOUSING	4
HANDLING AND SUSPENSION	4
GENERAL INSTALLATION	5
LOCATING THE UNIT	5
ELECTRICAL CONNECTIONS	7
FIELD WIRING	8
GAS PIPING	9
GAS VENTS	9
GENERAL OPERATING INSTRUCTIONS	9
START UP PROCEDURES	10-13
SHUTDOWN	13
EMERGENCY SHUTDOWN	13
SERVICE SHUTDOWN	13
TROUBLE SHOOTING GUIDE	13
MAINTENANCE	15-18
DRAINS AND TRAPS	18
PRINCIPLES OF DIRECT FIRED BURNER	18-20
80/20 DAMPER OPERATION	
BMR 80/20	21
BUILDING PRESSURE CONTROL	23
VARIABLE AIR VOLUME	23
MAXITROL TEMPERATURE ADJUSTMENT	24
EVAPORATIVE COOLING	32-34
CLEANING BURNERS	34-35
DIRECT FIRED PERFORMANCE CHECK LIST	36
WARRANTY	37

RECEIVING AND WAREHOUSING

Shipments are made F.O.B. factory in Bolivar, Tennessee by truck. The unit is securely strapped or blocked to prevent shipping damage and each shipment inspected prior to leaving the plant. All parts, where feasible, are strapped to or included in the unit. Inspect the unit upon arrival for any shipping damage. If there is any visible damage have the carrier's agent place a notation on your freight bill before you sign acceptance. Keep your bill of lading, it is a contract, and you will need it if it is necessary to file a claim. If any part is missing or damaged, notify the carrier at once.

If the unit cannot be installed immediately, store it and its accessories in a clean and dry place.

Only return damaged articles to factory with prior approval as they are the property of the transportation company and the freight company will usually advise disposition of damaged equipment. . Factory does not assume responsibility for the handling of the goods in transit and is **not responsible for the initiation of freight claims.**

HANDLING AND SUSPENSION

Typically the unit is designed and shipped in one piece where shipping limitations allow. During transit, unloading and setting of the unit nuts and bolts may loosen especially the pillow block bearings and fan assemblies. It is recommended that all bolts be tightened. Additionally turn shaft by hand to make sure the blower does not rub against the housing and tighten wheel and bearing set screws.

Do not handle the unit by attaching hooks, jacks or chains to the unit casing or any other component. Spreader bars are recommended when making single point lifts.

Horizontal indoor units may be handled and suspended using the lugs on the base frame. Horizontal rooftop units are provided with base frame lugs. All lifting lugs are to be utilized simultaneously and evenly, both for lifting, and for suspending.

Vertical up flow units and vertical down flow models are provided with eye bolts to ease handling. Check that all eye bolts are tight, and have not loosened during shipping, prior to lifting.

IMPORTANT: Lift and install modules of unit separately as received. Flange connections for field-attached components are not structural, and damage will occur if any attempt is made to lift these sections together with other parts of the unit. Refer to as built dimensional prints for section weight and to determine proper orientation of each component.

For some models, the heating and blower sections are shipped separately. (refer to as built assembly drawing in unit information packet). Assemble all unit sections by aligning the pre-drilled flanges and securing the assembly with the fasteners provided. Use gasket material to prevent infiltration at all joints. Some sheet metal section accessories will require drilling of Tek screws to secure section to the unit casing, line up these components to provide proper fit. Vertical units are shipped with iron flanges and slotted bolt holes for lining up and securing sections together. Belts may have to be installed on the motor and limit and discharge controls may have to be mounted and/or wired. **NOTE:** On roof top units each joint will have to be caulked to prevent rain from entering the unit refer to instruction sheet detail on page 30.

Optional sections such as mixing boxes may be shipped separately. Some accessories may require field mounting and/or assembly. A list of these, along with any other unit components that have been shipped separately from the unit, are included with the as built drawings in the unit information packet. The "as built" drawings include data specifications, unit dimensional drawing, curb drawing -if applicable, unit wiring diagram, field wiring diagram, sequence of operation and gas manifold diagram.

Outdoor units may be furnished with an optional roof curb. All curbs are shipped unassembled, refer to curb drawing for assembly of parts. Bolts and nuts are provided for assembly. Ensure the roof curb is assembled properly and fitted squarely and level before lifting and setting unit. Use a bubble level to confirm roof curb is level. The curb assembly should be bolted or welded to the roof trusses. Provide and install perimeter gasket material on all top curb flanges to properly seal unit bottom to curb. Make sure roof curb is properly flashed into the roof prior to setting unit.

Warning: To ensure a proper unit lift, suspend unit off the ground only 24 inches and verify proper center of gravity and tensions on all lifting cables or straps before setting. To avoid dropping the unit, reposition lifting point if unit is not level. Failure to properly lift unit could result in death or serious injury or property and unit damage.

GENERAL INSTALLATION NOTES:

Installation must be made in accordance with local codes, or in absence of local codes, with current ANSI Standard Z223.1 / (N.F.P.A. No 54) “National Fuel Gas Code”, or the latest edition of. All ANSI and NFPA Standards referred to in these installation instructions are the ones that were applicable at the time the design of this appliance was certified. The ANSI Standards are available from the American Gas Association, 1515 Wilson Boulevard, Arlington, Virginia 22209. The NFPA Standards are available from the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269. The heaters are designed for use in airplane hangers when installed in accordance with ANSI/NFPA No. 409 and in public garages when installed in accordance with the NFPA No. 88A and NFPA No. 88B. If heater is installed in a garage, it shall be installed with a minimum clearance above the floor of 18 in. (457mm).

This unit must be installed in accordance with the Natural Gas and Propane Installation Code current standard CAN/CSA/1-B149.1 or CAN/CSA/1-B149.2. Refer to installation codes for gas burning appliances and equipment, and/or the applicable provincial regulations for the class, which should be carefully followed in all cases. All electrical connections must be in accordance with Canadian Electric Code, Part 1, CSA Standard C22.1. Authorities having jurisdiction should be consulted before installations are made.

LOCATING THE UNIT

In advance of locating the unit, authorities having jurisdiction should be consulted to confirm proper installation is being made. All ventilation air for the heater must be ducted directly from outside. The heater inlet shall be located in accordance with the applicable building code provisions for ventilation air. Field constructed intake accessories must intake shall be designed and located to prevent snow, rain, flammable gas, toxic gases and other deleterious materials from entering the unit. (Less than 500 F.P.M. is an accepted velocity.) Remove filters during winter operation to prevent freezing up of inlet.

The ventilation inlet should never be blocked, inspect after snowstorms and periodically to ensure it is unblocked. Adequate building relief must be provided for the unit to operate properly. When the unit is operating at rated capacity the unit cannot be allowed to over pressurize the building. Typically, infiltration rates in a standard building construction will allow for proper operation, and when necessary add relief opening(s) and/or exhaust system; or by a combination of these methods.

Recirculating operation is not recommended in un-insulated buildings where outside temperatures fall below 32 °F (0°C). Excessive recirculation or insufficient ventilation air, which results in inadequate dilution of the combustion products generated by the heater, may create hazardous concentrations of carbon dioxide, carbon monoxide, nitrogen dioxide, and other combustion products in the heated space. If gas forks or other fossil fuel powered equipment are utilized in the conditioned area, additional ventilation requirements for the facility must be addressed separately.



WARNING: On heaters which recirculate room air, outside ventilation air must be provided in accordance with the information shown on the heater name plate.

If the failure or malfunction of this heater creates a hazard to other fuel burning equipment in the building (e.g., when the heater is providing the make-up air to a boiler room), the unit shall be interlocked with a failsafe to open inlet air dampers or other such devices. If in doubt regarding the location and operation of the unit and the application, consult the heater manufacturer.

Caution: Do not install unit in corrosive or flammable atmospheres! The unit must not be operated in the presence of chlorinated vapors. When such vapors mix with the products of combustion, highly corrosive compounds result that will cause the premature failure of the unit and other components, voiding the warranty.

CLEARANCES

MODEL	100% OA and RECIRCULATING DIRECT FIRED UNITS	Clearances to Combustible Construction (inches)		
		FLOOR	WALLS	CEILING
DFCH		0	6	6
DFCV		0	6	6

For service, it is advisable to maintain a minimum 36-inch clearance around the perimeter of the unit.

Ducts connected to the make-up unit or heater shall have removable access panels on both the upstream and downstream sides of the unit. The covers for the openings shall be attached in such a manner as to prevent leaks. The DFC Series are used to provide make-up air to satisfy an exhaust system within a building and are recirculating gas fired industrial air heaters for commercial and industrial use.

The sequence of operation and “as built” wiring diagram are located in the weather housing on outdoor units and control compartment on indoor units. The information provided is a guide to the proper installation, operation and troubleshooting of the unit.

The unit should be located with clearance to open access doors and remove filters. Ensure that the unit is installed level. Provide adequate clearance on either side of the unit to service blower, bearings, motors, drives and filters. Ensure that the position of the heater relative to support beams is correct, so as to provide adequate support for the equipment. For roof mounted units, check the spacing of the roof structure beams to avoid interference with air ducts.

Should contact with the factory be necessary, provide the unit model number and serial number. Install and wire the equipment in accordance to the applicable national and local governing bodies codes. Authorities having jurisdiction should be consulted before making the installation. Local codes may require additional safety controls and/or interlocks. On indoor suspended units, when necessary to provide working clearance beneath the unit, the installation shall be made at a suitable height above the floor.

LOCATION OF ACCESSORIES

The remote panel will be shipped as a separate package. Mount the panel and have an electrical contractor install wiring.

CONNECT DUCTWORK

All ventilation air for the heater must be ducted directly from outside.

1. On indoor units, install fresh air duct to inlet of unit. Install intake hood or louvers with screen.
 - a) Make required opening in wall and line with angle frame inside. Should be completed before outside is started to avoid crumbling.
 - b) Insert insulated fresh air “collar” through opening with flanges turned out to provide rigidity.
 - c) Anchor intake hood with bird screen to wall.
 - d) Caulk perimeter of opening to make rain tight.

2. Connect discharge air duct or discharge grille to unit outlet. If unit is installed on a roof, be sure that the duct going through the roof is adequately flashed and sealed to prevent leakage. (see figure 1).
3. Where a ductwork system or other enclosure is directly connected to the inlet or outlet of the heater is such a way as to cause a possible gas trap and accumulation of a flammable mixture, a pre-purge cycle shall be incorporated to provide not less than 4 complete air changes of the duct work or enclosure by volume prior to an ignition.
4. Where additional automatically operated inlet or discharge air louvers are used, they shall be electrically interlocked to ensure the maximum designed opening before either starting or running circuits may be energized.

FIRE DAMPER

Fire dampers installed in inlet or outlet duct systems shall be interlocked to shut down the unit in case of fire in the duct work and should be arranged so that the unit will only be electrically energized when in the wide open position.

ELECTRICAL CONNECTIONS

Warning: Open all disconnects switches and ensure power to unit is off before wiring unit. Failure to ensure power is cut off to unit may result in personal injury or death from electrical shock.

All electrical connections must conform to the current edition of: ANSI/NFPA No. 70 National Electrical Code and applicable state and local codes. An electric disconnect switch having adequate ampacity (refer to unit nameplate for voltage and ampacity), if not provided as part of the heater, shall be installed in accordance with NEC, ANSI/NFPA 70. When installed, the appliance must be electrically grounded in accordance with local codes or in the absence of local codes, with the National Electrical Code, ANSI/NFPA 70, and/or the Canadian Electrical Code, CSA C22.1.

For Canadian installations: **NOTE:** This unit has been examined and tested for compliance with CSA C22.2 No. 0 and CSA C22.2 No. 3. All electrical work must conform to the requirements of the current CSA standard C22.1 Canadian Electric Code Part 1 and local ordinances.

Carefully check the unit rating plate to confirm supply voltage prior to connecting. Control voltage is as indicated on the rating plate. The maximum voltage variation should not exceed +/- 10%. Phase voltage unbalance must not exceed 2%.

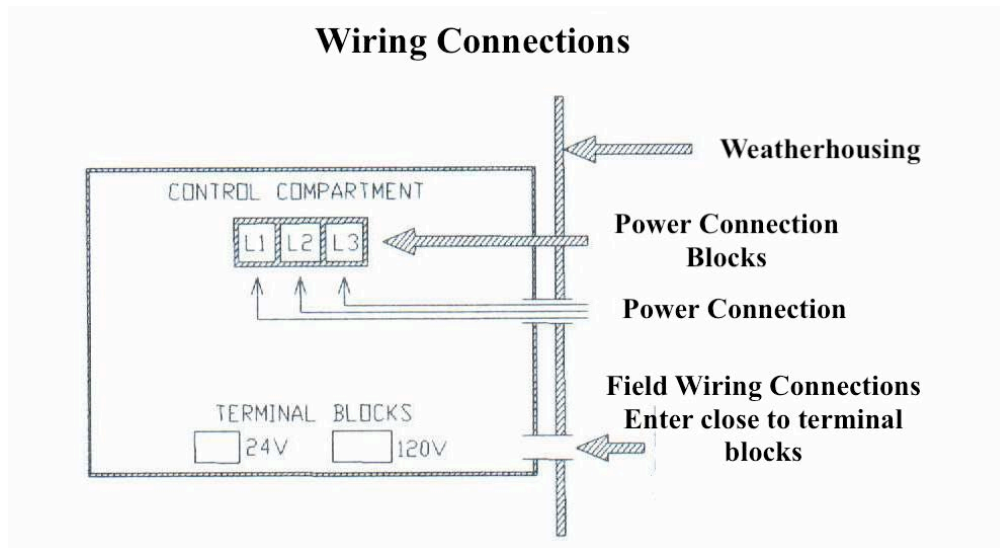
Follow the “as built” wiring diagram supplied with the unit. This type of unit is available with a variety of fuel control schemes. Please ensure that you are using the correct wiring diagram for installation or troubleshooting. If any of the original wire as supplied with the unit must be replaced, it must be replaced with type TEW 105 Degrees Celsius or its equivalent except where noted. **NOTE:** Because bolts and setscrews may become loose during unit shipment, such fasteners should be tightened upon installation. Inspect all wire terminals and terminations to ensure all connections are tight.

If a space thermostat is used with the furnace, locate the thermostat so that cold drafts and hot discharge air streams do not affect its performance. Do not mount the thermostat on the casing on the unit, as it will be affected by radiated and conducted heat. Refer to the instructions furnished with the thermostat for further details.

Temperature controllers, limit controllers, remote selector switches, door switches or any other auxiliary electrical items must be connected to the terminals provided and shown on the wiring diagram. The installation is to be adjusted to obtain a temperature rise within the range specified on the unit heater rating plate.

For units shipped in two or more sections, electrical connections between sections are to be made by installer in the field. Install disconnect switch (furnished by contractor) if unit not equipped from factory. Complete all wiring to accessories (interlocks) as per “as built” control and remote field wiring diagram.

Field wiring to be done by the installer is denoted by dotted lines on the wiring diagram. Solid lines on the wiring diagram indicate factory wiring by the manufacturer. Install remote panel if equipped.



FIELD WIRING

Refer to "as built" field and control panel wiring for connections required.

NOTE: For Maxitrol electronic sensors, DDC wiring, and other low voltage temperature controls all must not be run close to or inside conduit with power or ignition wires. Doing so may cause the unit to function erratically or may destroy the electronic amplifier. If shielded wires are used, shield must be insulated and grounded at the amplifier location only. If control wiring is inside conduit with line voltage wiring, use shielded cable up to 100 ft. For best results up to 200 ft, run control wiring in separate conduit.

NOTE: If the optional low temperature limit was not furnished with the heater, a low temperature limit control should be installed by the installing contractor in regions where freeze protection is needed in the event of burner shutdown. The low temperature limit should be set @ 45 Deg F and the bypass timer @ 3 minutes.

NOTE: For furnace only sections, it is the responsibility of the installing contractor to ensure the furnace is interlocked to a blower, and that proper design airflow is circulating prior to energizing burner section. When equipment is furnished with direct digital control (DDC) interface it is the responsibility of the installing contractor and control contractor to provide interlock and ensure proper airflow is present to operate burner. Additionally, that the burner is never operated outside of design operating temperature parameters.

WARNING: Fire or explosion hazard can cause property damage, severe injury, or death. Check for gas leaks with rich soap and water solution or electronic gas detector any time that work is done on a gas line. NEVER use an open flame to detect gas leaks.

EXHAUST INTERLOCK

- a) When a DFC unit is operating as a make up unit in Canada it shall be electrically interlocked so that it will operate only when the associated exhaust system(s) is functioning. An exhaust airflow-proving switch shall be used (Refer to sheet exhaust interlock) for typical application, and (wiring diagram) for electric hookup.
- b) The total air discharge capacity of the unit cannot exceed by more than 10% the total discharge capacity of the exhaust systems in conjunction with which it is used. Where the tempered air is discharged directly into a booth, the total air discharge capacity of the booth.
- c) The exhaust air proving switches should be set as to open when the volume of exhaust drops by more than 10% (dirty exhaust filters, etc.).

GAS PIPING

All gas piping must be in accordance with the requirements outlined in the National Fuel Gas Code –ANSI Z223.1 and the regulations of local authorities having jurisdiction. It is necessary to have a ground union installed next to the unit manifold for easy servicing. A drip leg and filter should be provided upstream of the unit's inlet gas connection. An additional shut-off must be located external to the unit's enclosure when required by local code. Install manual shut off valve plug-cock type approved for the application.

For Canadian Units: All gas piping should be in accordance with CAN/CSA/1-B149 and the regulations of local authorities having jurisdiction. Emergency manual shut down valve should be provided upstream of piping to unit and should be labeled for quick identification. Color-coding of gas piping is also recommended.

Warning: To avoid damage or potential personal injury, do not connect gas piping to this unit until a supply line pressure test has been conducted. Connecting the unit prior to leak test may damage the unit gas valve and/or regulator and result in a fire hazard.

Carefully check the unit rating plate for fuel type and supply pressure.

*The appliance and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of the system at pressures in excess of ½ psi (3.5 kPa). The appliance must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply system at test pressures equal to or less than ½ psi (3.5 kPa). This safety shutoff valve leak test ensuring tightness of valves must be conducted at least on an annual frequency.

*A minimum 1/8 inch NPT plugged tapping, accessible for test gauge connection, must be installed immediately upstream of the gas supply connection to the appliance.

*Locate the high-pressure regulator, if required, at least five feet from the unit.

*Gas lines must not be located in such a way as to hinder access to the unit

*A tee shall be installed in the supply line at the same elevation as the gas inlet connection. The tee must be equipped with a nipple and pipe cap to serve as a condensate collector.

*Test for tightness of gas connections after installation. The safety check valves shall be leaked tested at least once a year as described in the Initial Start up and Adjustment section on Page 10-13 of this manual.

*The gas line pressure must be as shown on unit rating plate when unit is operating at full input.

GAS VENTS

High gas pressure regulator (if required), low pressure regulator, pilot pressure regulator, gas pressure switch (if supplied), and normally open vent valve (if supplied) must be vented outside of building for an indoor unit. (Check with authorities having jurisdiction). Periodic cleaning of the screens for the vent terminals must be conducted. Never use pipe sizes smaller than the factory vent size as this will cause a restriction. Point vent lines downward to limit the possibility of rain or snow from entering the pipe. Each vent line should be run separately do not combine vents. Never run a vent line near a potential ignition source.

GENERAL OPERATING INSTRUCTIONS

WARNING: Fire or explosion hazard can cause property damage, severe injury, or death. Check for gas leaks with rich soap and water solution or electronic gas detector any time that work is done on a gas line. NEVER use an open flame to detect gas leaks.

FACTORY TESTING AND START-UP CHECKLIST

All units are factory fired and tested prior to shipping. Each unit is shipped with the tester's report and a start-up checklist. Complete the start-up checklist and return one copy to the factory.

GAS-FIRED UNITS

Refer to the rating plate for fuel input and supply pressures.

DO NOT ATTEMPT TO START THE BURNER IF THE UNIT IS FULL OF VAPOR OR GAS.

DO NOT USE THIS UNIT TO BURN GARBAGE OR PAPER.

DO NOT LEAVE COMBUSTIBLE MATERIALS NEAR THE UNIT.

SHUT OFF THE MANUAL FUEL SUPPLY VALVE IF THE BURNER IS SHUT DOWN FOR AN EXTENDED PERIOD OF TIME.

ENSURE ALL ACCESS DOORS ARE SECURED BEFORE STARTING THE BURNER AND/OR BLOWER.

START-UP PROCEDURES

Remove any shipping blocks straps from blower and/or vibration isolation. Check that modulating discharge temperature controller and high limit control are mounted, wired and installed in the blower airstream.

This equipment has been electrically and fire tested prior to shipment. However, during transit, miss adjustment of controls and loose wires could develop. Do not assume a control is defective until it and its associated wiring is checked.

This equipment has many items supplied to us by outside vendors. Information sheets accompany this manual on most of the major items, which should be referred to for detailed service information.

PRECAUTIONS & SETUP

1. Ensure the main disconnect switch is in the "off" position.
2. Ensure the burner on-off switch is in the "off" position.
3. Check all electrical connections and tighten if necessary.
4. Check main fans (by rotating fan shaft by hand), bearing setscrews and pulley set screws.
5. Make sure the manual main firing valve is closed preventing gas from entering manifold, but that gas is available in the service line.
6. Check to ensure exhaust fans interlock switches are installed and wired to the control panel.
7. Familiarize yourself with the sequence of operation and "as built" wiring diagrams. This will give you information as to how the unit operates, what time delays are provided, and any interlocks that may be required to power burner circuit.
8. Check voltage to ensure it matches the voltage stamped on the unit rating plate, and all wires are connected between unit and remote panel.
9. Check that the high limit is set for 165 Deg F.
10. Check all fuse blocks to determine that all fusing is installed.
11. Set the operating controls (eg. thermostat, remote panel switches) so as to allow heating operation of the unit when the burner section is powered up in initial start-up and adjustment section on page 11 of this manual.
Note: At this time keep the burner section on/off switch off, so the burner is still locked out.

12. Reset the primary flame safeguard by pushing the reset button or lever.
13. Check supply motor starter thermal overload protection and compare it to the rating plate value. Reset blower motor starter by pushing the reset button on starter contacts.
14. Check building system gas supply and be sure all lines to unit are purged of air.
15. Check building system gas supply pressure.

CAUTION - GAS UNITS

At maximum input the gas pressure must fall within the range specified on the unit rating plate. Optional high and low gas pressure switches (if supplied) must be reset.

16. Service personnel shall perform a gas leak check during heater start-up and on an annual basis. Check all piping for tightness and correct any signs of leaks. Check the piping for leaks. Check gas tightness of main and pilot safety shut off valves by connecting a pressure gauge to the pressure tap located between the safety shut-off valve and the test firing valve. When the test firing valves are closed and the manual shut-off valves are opened, no pressure rise should show on the pressure gauge. Additionally another check is to turn off main shut-off valve and pilot valve (refer to as built manifold diagram), then turn on the gas pressure to the gas supply line and observe the meter test dial. There should be no movement of the dial hand for at least five minutes on a half-foot dial (proportionally longer on larger dials). All other gas appliances must, of course, be completely shut off during this test. If a leak is detected it should be located with a soap suds test and corrected. If air or inert gas (do not use oxygen) under pressure is used for leak detection, do not subject the main and pilot valves or regulators to pressure readings exceeding ½ PSI (disconnect piping to prevent damage during high pressure leak testing).

WARNING: Fire or explosion hazard can cause property damage, severe injury, or death. Check for gas leaks with rich soap and water solution or electronic gas detector any time that work is done on a gas line. NEVER use an open flame to detect gas leaks.

START-UP

1. Review the “as built” control and field wiring diagrams. Refer to factory test report for correct settings that are to be checked on the unit.
2. Turn unit disconnect “on”, and locate and turn “on” the system switch. Keep summer/winter switch in “summer” mode to keep burner circuit “off” at this time. If unit interlocks make such as an exhaust interlock and low limit if equipped is bypassed the damper motor will receive power. The damper motor will open making an end switch. (On units with recirculation the inlet damper may only open 20%), however the end switch will still make and the supply blower will be energized
3. Check for proper blower rotation, and that the unit is operating in correct full load amp range. If incorrect rotation turn off disconnect and change two of the supply motor leads to line side of the motor starter to provide correct rotation.
4. Ensure that both manual pilot and manual main test firing valves are closed. Turn the summer/winter switch into the “winter” mode. The Fireye or Honeywell flame safeguard relay will energize (provided there is a call for heat) and then the pilot solenoid valve will open and the igniter will spark to try and establish a pilot flame. Since the pilot manual firing valve is closed and there is no gas to the pilot the unit should lockout on flame failure.

FLAME SUPERVISION CHECK

- a) The flame supervision should be checked periodically to insure that the controls are operational. With the unit on full operation and firing, close the main manual firing valve and pilot manual firing valve. This should lock out the unit.
- b) The units with more than 3 feet of burner from the point of supervision have dual flame rod and a delay timer for main flame supervision. Closing the main firing valve should lock out the safety relay and the unit should shut-down.
- c) The main safety valve should be checked for gas tightness by placing a manometer in the manifold between the safety valve and the manual firing valve (a 1/8” plug is provided for this). If there is a build up of pressure with the unit locked out and the manual valve closed, the safety valve should

- be replaced.
- d) The complete gas line and manifold should be checked for gas tightness.
5. If the flame safeguard functioned properly, the next step is to establish a pilot flame. Reset the flame safeguard relay and open the manual pilot firing valve. This time when the unit tries for pilot ignition the pilot flame should be established. (Repeat a couple of times if necessary as there may be a little air in the line).

PILOT and FLAME SAFEGUARD RELAY

- a) The flame safeguard relay monitors the pilot flame through the flame rod. A minute current is sent from the relay through the flame rod, and through the pilot flame to “ground”. The relay detects the current flow and acts to open the safety valve as required. A UV scanner may also be provided for flame detection. When no flame exists, current cannot flow and the relay acts to close the valve. Current flow depends only on flame contact on the rod: temperature of the rod is of no importance.
- b) Since the flame rod is a current-carrying conductor, it must be free of any contact with conductive parts of the pilot burner. Insulator must be clean, dry and free from cracks. While the flame rod is made of a heat resistant alloy it may, after long service, deteriorate to the point of flame contact. Check for serious corrosion or loss of metal. It must be tight enough in the insulator to maintain its position. Do not use too much force or the insulator may crack.
- c) Measuring the flame rod current can check proper operation of the flame rod; refer to flame safeguard instruction sheet with unit. Lacking a micrometer, a check can be made by operating the burner through all its normal phases. Relay response should be prompt with no chattering or drop out.
- d) The spark rod refer to Midco and Maxon burner details, produces a high-tension arc at the correct location for lighting the pilot. Ignition transformer must be rated for 6000 Volts, 20 Miliampers secondary, minimum.
- e) The spark rod or spark ignitor, must be free of contact with conductive parts of the pilot burner. Insulator must be clean, dry and free of cracks. Check the spark rod for serious corrosion or loss of metal. It must be held tightly enough in the insulator to maintain its position.
- f) Gap must be 1/16” to 3/32” refer to Midco and Maxon burner details. Successfully cycling the pilot can also check for proper settings. Ignition must be prompt and positive. Do not allow careless positioning to cause arc of flame rod; serious relay damage can result.
- g) If the spark ignitor shows deterioration of ignitor points the complete spark ignitor should be replaced.
6. If pilot tries for ignition, but locks out, the air proving switches (high and low) that are mounted across the profile plate, should be checked to make sure that the proper amount of air is flowing through the unit. Placing a differential gauge across the profile plate of the burner section can check for proper pressure drop. If the pressure drop is between .30” W.C., and .95” W.C., these switches should be made, then check pilot to ensure proper flame. Check instruction sheet for flame safeguard system.
7. Once pilot flame has been established, adjust pilot regulator to get best signal to the flame safeguard. Now it is time to establish main flame. With the pilot established, gradually open the main manual test-firing valve. Main flame will light and flame will run the entire length of the burner. Use the cabinet view port to confirm the flame runs the entire length of the burner. Place unit on high fire by sending call for full heat or removing the Maxitrol amplifier wire #4, if unit so equipped. (On Maxitrol modulating units, read the Maxitrol literature for setting the high fire and low fire). Adjust the main pressure regulator to obtain full fire manifold pressure as stated on the unit rating plate (a manometer must be installed on the 1/8” NPT pressure port after test firing valve as indicated on the “as built” manifold piping diagram). On high fire the flame should be nice and blue with long orange tips, typically the flame length will be 15 to 16” off ends of burner baffles, however this can vary depending on capacity of the unit and burner.

MAIN FLAME SUPERVISION

- a) With units that have longer burners from point or supervision, a second flame rod will be installed on the main burner. This switching is done with a time delay relay (see “as built wiring” diagram). This can be disconnected for testing for pilot, or you have to ensure main flame by opening up the firing valve within 15 seconds after pilot solenoid is powered. As supervision will switch from pilot to main flame in that time. Check to ensure the unit will lock out, in the event of main flame failure, on low-fire by closing main test firing valve.

8. Place unit in low fire by satisfying the call for heat. On Maxitrol modulating units this can be achieved by removing the #2 wire from the amplifier. On low fire, the burner must be completely lit all the way across the length of the burner. The flame length should be 1-1/2 inches in length, adjust low fire accordingly as indicated in the Maxitrol information.
9. Check gas pressure switch setting if unit is so equipped.

High pressure gas switch	6" W.C.
Low pressure gas switch	2" W.C.

NOTE: The high and low gas pressure switches may be the manual reset type on some units.

10. This unit depends on an adequate supply of air for good combustion and operation. Care should be taken to ensure that the unit is discharging the right amount of CFM.

SHUT DOWN

EMERGENCY SHUT DOWN

1. Set disconnect switch to "off" position.
2. Close the manual main fuel valve.
3. Set the burner on-off switch to "off" position.

SERVICE SHUT DOWN

1. Set the system switch to "off" position.
2. Close the manual main fuel valve. Set summer/winter switch to "summer" position.
3. Set the operating controls (eg. thermostat, remote panel switches) so as to prevent heating operation.

TROUBLESHOOTING GUIDE

The following is an obvious list of items that could cause field problems; however, it does not cover all problems encountered and is meant to be used as a guide only.

On start up, if the unit will not operate properly. It may be an electrical mix up in the wiring from the unit to the control panel (see "as built" control and field wiring diagrams).

For troubleshooting, it is recommended you have a volt meter AC/DC, and a differential pressure gauge 0" - 2" (magnehelic) and a gas pressure gauge 0" - 12".

WARNING: Fire or explosion hazard can cause property damage, severe injury, or death. Check for gas leaks with rich soap and water solution or electronic gas detector any time that work is done on a gas line. NEVER use an open flame to detect gas leaks.

1. **If inlet damper fails to open when system switch is turned "on".**
 - a) Check to see if power runs through supply starter overloads (1 OLS-1), high limit, low limit and circuit breaker. If none of the safety interlocks are preventing power getting to the damper actuator then the flame safe guard relay may need to be reset.
2. **If blower does not energize after the damper has opened up.**
 - a) Check setting of the damper actuator end-proving switch. The switch may require a screwdriver adjustment to the travel potentiometer. The inlet damper needs to open all the way, for BMR industrial heaters only 20% of the inlet damper will open, however, it has a separate actuator and the end switch can be adjusted to prove 100% open.
3. **If blower starts up but after three minutes shuts down again.**

- a) Check the low limit switch setting if the switch should be made, the low limit may require replacement. The time delay should be set for three minutes and temporarily bypasses the low limit to allow the unit time to deliver warm air. The low limit should be set @ 45 Deg F.
- 4. Burner summer winter switch is turned to “winter”, but the heat is locked out.**
- a) Check differential air pressure drop over burner. The burner differential pressure drop must be a minimum of 0.30 in w.c. to pull in the low air proving switch.
 - b) Check high air proving switch, differential air pressure drop cannot exceed 0.95 in w.c. or the switch breaks power and will lockout the flame safety relay.
- 5. Flame safeguard powers pilot valve and solenoid, but locks out after trial for ignition.**
- a) Check pilot solenoid valve has power and opens. The pilot gas should register on your manometer when placed on the pilot test firing port.
 - b) Check ignition transformer is generating spark. The spark should be viewable from the cabinet view port.
 - c) Check flame rod, if dirty clean, if isolator is cracked –replace.
 - d) Check strength of pilot flame, refer to Fireye or Honeywell flame safety relay literature provided. The DC voltage should be reviewed as the flame safety relay tries for ignition. If pilot flame signal is weak, turn the gas pressure regulator up or down to increase strength.
- 6. Flame safeguard powers main valves but no main flame.**
- a) Check that both main solenoid valves are opening. If unit is equipped with only one main valve it will have a valve seal over travel switch, confirm the switch is making.
 - b) If main flame comes on but then abruptly goes out, it may be because the low air pressure switch has a borderline setting. The main flame dramatically heats the air in the unit cabinet, this rapid expansion of air means less air for the differential proving switch to make. Refer to DIFFERENTIAL AIR PRESSURE ADJUSTMENT section, and adjust burner profile plate accordingly.
 - c) Check filters, they may be loaded causing the unit to go off on low air proving switch.
- 7. Main flame is on but temperature controller is not modulating properly.**
- a) Refer to Maxitrol temperature control and modulation literature. If unit is controlled by a building management system, verify proper voltage and signal is going to the Maxitrol A200 or SC series signal conditioner.

TYPICAL SEQUENCE OF OPERATION MAKE-UP AIR

WARNING: for actual unit sequence of operation, please consult “as built” drawings.

With Supervisor remote panel

SUMMER OPERATION:

1. When exhaust interlock contacts close, the damper opens.
2. Exhaust light indicates exhaust on.
3. Damper interlock closes, powering blower motor starter.
4. Blower motor auxiliary contacts close.
5. High limit switch is closed.
6. “Fan” lights indicate that blowers are running.

WINTER OPERATION:

1. Exhaust system interlock contacts must be closed.
2. Exhaust light indicates exhaust on.
3. Interlock circuit on safety relay is closed.
4. When damper is open, end-switch contacts close and energize the blower motor starter.
5. Blower motor starter auxiliary contact closes.
6. Air flow proving switch closes (low).
7. “Fan lights indicate that blowers are running.

8. Summer-winter switch, "on".
9. Combustion control is energized.
10. Pre-purge timer (optional) is energized and contacts close after predetermined purge period.
11. High gas pressure switch, low gas pressure switch, optional contacts are normally closed.
12. High temperature limit switch is normally closed. Switch must be manually reset if air temperature has exceeded set point.
13. Outdoor thermostat contacts close when outside air temperature falls below set point (optional).
14. Limit circuit to primary safety control is complete.
15. Ignition transformer is energized and sparks provided.
16. Pilot gas valve opens and pilot is proved.
17. Main gas valve(s) is energized.
18. "Burner" lights indicate that gas valve(s) is energized.
19. Presence of flame is proved by flame rod. Ignition is de-energized and main gas valve remains open.
20. (Optional) Low limit light stays on indicating that air temperature exceeds setting of low limit switch. Manual start push button may be disengaged.
21. Modulating temperature control maintains discharge air temperature at a set-point with 30-1 turn- down ratio.
22. Alarm light indicates flame failure of burner or failure of air proving switch.

NOTE: Sequence of operations is the same on units with summer-off winter switch except that the indicating lights show blower on and burner switch in the winter position.

MAINTENANCE

Regular maintenance is necessary to ensure the efficient operation and long life of this unit. This maintenance should be performed by, or supervised by, qualified service personnel. A maintenance schedule should be prepared for the unit based on its application and location.

RECOMMENDED MONTHLY MAINTENANCE

1. Check for loose connections in the wiring.
2. Check the voltage at the unit while it is in operation.
3. Check motor amperage draws against rating plate values.
4. Inspect all contactors to ensure that they are clean and making good contact.
5. Check all fittings, valves and lines for leaks.
6. Check the burner; clean and adjust if necessary. **WARNING: Never enlarge burner ports or performance may be drastically affected.**
7. Check the flame sensor; clean if necessary.
8. Check the fuel supply pressure to the unit.
9. On gas fired units, check the manifold pressure.
10. Clean or replace air filters if necessary. Replace filters only with type equivalent to those supplied with the unit by the factory.
11. Check all damper, linkages and damper actuators; adjust and tighten as required.
12. Check all belts; adjust or replace as necessary.
13. Check operation of all safety controls.

RECOMMENDED YEARLY MAINTENANCE

1. Perform the monthly maintenance recommended.
2. Inspect blower wheels and housing; clean if necessary.
3. Inspect all set screws on blower wheels and pulleys to ensure that they are secured to their respective shafts.
4. Check ignition spark and adjust gap if necessary.
5. Inspect and clean ignition electrodes and pilot assembly.
6. Check flame supervisor relay. **WARNING: Never enlarge burner ports or performance may be drastically affected.**
7. Inspect all operating and safety controls; clean and replace if necessary.
8. Clean the burner. (Refer to Midco and Maxon burner clean reference page).

NOTE: Refer to manufacturer literature provided for maintenance requirements of optional equipment.

BEARING INSTALLATION AND MAINTENANCE

NOTE: To prevent premature failure – please ensure greasing instructions below are applied. As well, tighten bearing set screws, collars, and wheel lugs every four to six months.

ENGINEERING – BALL & ROLLER BEARINGS LUBRICATION

For bearings that are equipped with a hydraulic grease fitting threaded into the housing for ease of lubrication, the proper amount of lubricant in the bearing is important. Both excessive and inadequate lubrication may cause failure. The bearings should be re-lubricated while they are rotating (if it is safe to do so, only a qualified service technician should perform this task); the grease should be pumped in slowly until a slight bead forms around the seals. The bead in addition to acting as an indicator of adequate re-lubrication provides additional protection against the entry of foreign matter and helps flush out contaminants in the bearing.

By the time the slight bead is formed, it will be noticed that the bearing temperature will rise. It is not uncommon for the temperature to rise as much as 30 degrees Fahrenheit after re-lubrication. If necessary to re-lubricate while the bearing is idle, refer to the recommended re-lubrication grease chart tables on the following page for various sizes of the bearings.

Lubricant-Standard Bearings:

All bearing units are pre-lubricated at the factory with a lithium soap grease, which is compatible with multi-purpose grease readily available from local suppliers. The lubricant selected for factory lubrication uses a highly refined mineral oil with a high viscosity index, thickened with lithium soap to conform to NLGI grade 2 consistency. A suitable additive package is added to protect the highly polished rolling contact surfaces from corrosion and oxidation of the lubricant. The lubricant is satisfactory for an operating temperature range of -30 F to +250 F.

Select standard industrial grade greases that conform to the following specification for optimum bearing performance:

General Duty Ball & Roller;	Premium Duty Ball & Roller;	Heavy Duty Roller Bearing;
58-75 SUS @ 210 F	68-75 SUS @ 210 F	82 SUS @ 210 F
450-750 SUS @ 100 F	600-750 SUS @ 100 F	886 SUS @ 100 F

NOTE: For heavy loaded roller bearing applications, grease with EP additives are often recommended for optimum performance.

Table 1. Recommended Lubrication

Ball Bearings		Roller Bearings	
Shaft Size (inches)	Grease Charge (ounces)	Shaft Size (inches)	Grease Charge (ounces)
1/4 to 3/16	0.03	1-3/16 to 1-1/4	0.1
1/2 to 3/4	0.1	1-3/8 to 1-7/16	0.22
1-1/4 to 1-1/2	0.15	1-1/2 to 1-11/16	0.32
1-11/16 to 1-15/16	0.2	1-3/4 to 2	0.5
2 to 2-7/16	0.3	2 to 2-3/16	0.55
2-1/2 to 2-15/16	0.5	2-1/4 to 2-1/2	0.65
3 to 3-7/16	0.85	2-11/16 to 3	0.85
3-1/2 to 4	1.5	3-3/16 to 3-1/2	1.25
-	-	3-15/16 to 4	2.5

Frequency of re-lubrication depends upon operating conditions. The bearing operating temperature is the best index for determining a re-lubrication schedule. The following chart gives the frequency of re-lubrication based upon

continuous operation for various operating temperatures and can be used as a satisfactory guide for determining when bearings should be re-lubricated.

Table 2. Lubrication Frequency

Speed	Temperature	Cleanliness	Greasing Interval
100 RPM	Up to 120 F	Clean	5 months
500 RPM	Up to 130 F	Clean	2 months
1000 RPM	Up to 210 F	Clean	2 weeks
1500 RPM	Over 150 F	Clean	Weekly
Any speed	Up to 150 F	Dirty	1 week to 1 month
Any speed	Over 150 F	Dirty	Daily to 1 week
Any speed	Any temperature	Very dirty	Daily to 1 week
Any speed	Any temperature	Extreme conditions	Daily to 1 week

TENSIONING V-BELT DRIVES

1. Ideal tension is the lowest tension at which the belt will not slip under peak load conditions.
2. Check tension frequently during the first 24-48 hours of operation.
3. Over-tensioning shortens the belt and bearing life.
4. Keep belts free from foreign material that may cause slip.
5. Make V-drive inspection on a periodic basis. Tension when slipping. Never apply belt dressing as this will damage the belt and cause early failure.

Check and tighten belt tension. The following procedure is recommended for tightening belts:

- a) Measure span "X" shown in Figure A.
- b) At the center of span length "X", apply a force perpendicular to the span and large enough to deflect belt 1/64" for each inch of span length. Example- the required deflection for a 40" span would be 40/64" or 5/8".
- c) Compare the force applied with the values given in Table III. If force is between the minimum and maximum range shown, the drive tension should be satisfactory. A force below the minimum value indicates an under tightened belt and force that exceeds the maximum value indicates an over tightened belt.

FIGURE A

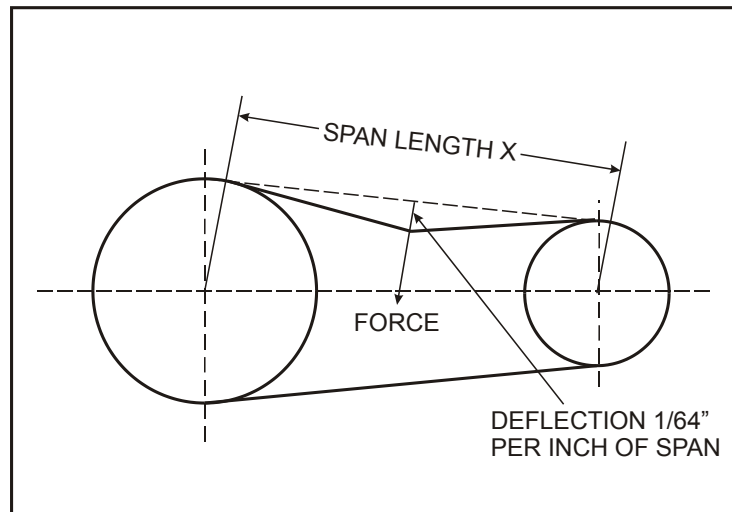
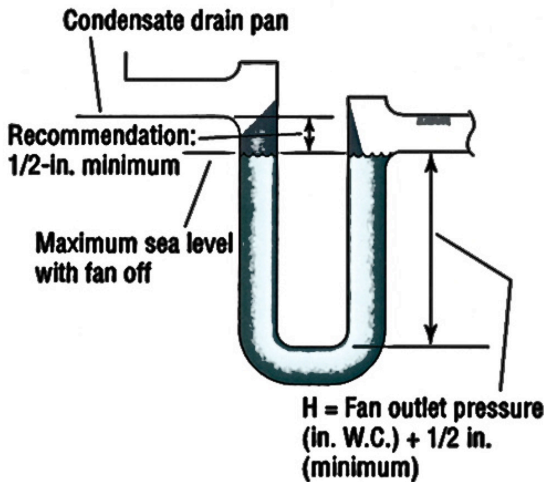


TABLE III

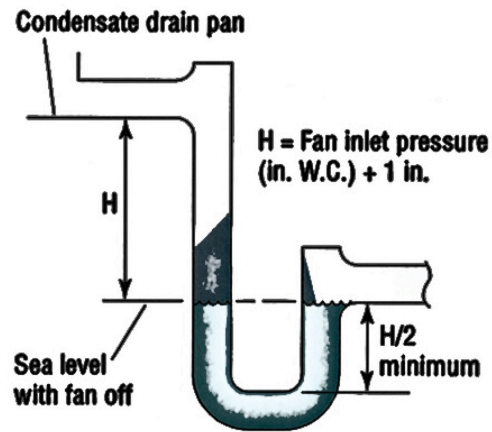
BELT CROSS SECTION (Marked on Belt)	MOTOR PULLEY PITCH DIAMETER	DEFLECTION FORCE	
		MINIMUM	MAXIMUM
A	3.0" - 3.6"	2.62lbs.	3.25lbs.
	3.8" - 4.8"	3.0lbs.	4.0lbs.
	5.0" - 7.0'	3.25lbs.	5.0lbs.
B	3.4" - 4.2"	3.0lbs.	5.0lbs.
	4.4" - 5.6'	4.0lbs.	5.87lbs.
	5.8" - 8.6"	5.25lbs.	7.87lbs.

DRAINS AND TRAPS

CHILLED WATER AND DIRECT EXPANSION COOLING COILS



Blow through coil arrangement



Draw through coil arrangement

Some units are equipped with cooling coils and have condensate drain connections. **Never install a DX coil upstream of a direct fired burner, due to hazardous gas potential if a leak occurs.** When the coil is supplied downstream of the blower the arrangement is a blow through type. If the cooling coil is upstream of the blower it is a draw through arrangement. Make sure the proper type and size of condensate P-trap is installed, otherwise unit may leak condensate out of the casings. On start-up it may be necessary to prime the P-trap manually after the unit is operating properly a small amount of water will be held in the trap and prevent air from bypassing the trap and preventing it from working properly.

A chilled water coil must be drained before freezing conditions are present. The cooling coil drain pans and condensate lines must also be thoroughly drained to prevent freezing of the pipes. The cooling coil collects dirt over the months and years of service. A Clean filter prevents the cooling coil from soiling quickly. In time, however, the cooling coil will still collect dirt. This dirt reduces airflow and insulates the coil reducing its ability to absorb heat. To avoid this problem, check your cooling coil every year and clean as necessary. Occasionally pass a stiff wire brush through the unit's drain connection and clean out the P-trap. Periodically the cooling coil, drain pan and condensate drain line need to be cleaned to prevent microbiological growth. The coil should be professionally inspected, cleaned and disinfected yearly.

OPERATING PRINCIPLES OF THE RAW GAS BURNER

The raw gas burner is designed to operate in a duct of flowing fresh air. Fuel gas is fed directly to the burners; kinetic energy of the air stream furnishes combustion air. The burner must be installed to fire with, and parallel to,

the airflow. By virtue of velocity impact and suction generated by the diverging shape of the combustion baffles, air is induced into the air ports in the combustion zone. The air supply is constant though only that, which mixes with the gas flowing from the burner ports, takes part in combustion.

When a very small quantity of gas is admitted to the burner, sufficient mixing takes place in the low fire slot within the burner, casting and combustion takes place in this zone. Since the low fire zone is contained within the burner casting it is effectively shielded from fire disrupting uncontrolled air entry.

As the gas is increased to the burner the flame progresses into the intermediate fire zone where an additional supply of air is available. High or full capacity, mixing occurs at the larger air ports of the high fire zone augmented by air spilling over the end of the baffles.

On a reduction of gas supply the reverse sequence takes place. The flame recedes to a location of lesser air supply until the low fire zone is reached. The system above is suitable for a turn down range of approximately 30 to 1.

With the suction by the blower there is a pressure in the gas manifold of less than zero at low fire. Therefore, when checking the manifold pressure you will find that the pressure will range from approximately 4" W.C. to less than zero, when the unit is modulating from high to low fire.

EXAMPLE FOR CALCULATING CFM

Example for Calculating The Amount of Air and Gas in a Direct Fired Make-Up Air Unit

YOU WILL NEED: A differential pressure gauge (Manometer) and Thermometer -30°F to 200 °F.

All units are factory set with a profile opening around to burner sized for 2950 F.P.M. velocity. Due to more or less external static pressure the velocity may not be within this range on start up of unit. The pressure drop should be checked to insure the unit is operating around this velocity. A pulley adjustment or change should be done to bring the velocity within operating range. If an air balance has been done and the C.F.M. verified to be correct as stamped on the rating plate and the velocity across the burner is not correct the profile area should be adjusted.

If velocity is higher than 2950 FPM then the profile area should be increased. This can be achieved by readjusting the top and bottom profile plates. The profile area is stamped on the rating plate, but to get to the free area you will have to deduct the space taken up by the burner. If Midco burner is used deduct .65 sq. feet for each 1-foot section, or .33 sq. feet for each 6" section. If Maxon burner is used deduct .45 sq. feet for each 1-foot section, or .23 sq. feet for each 6" section.

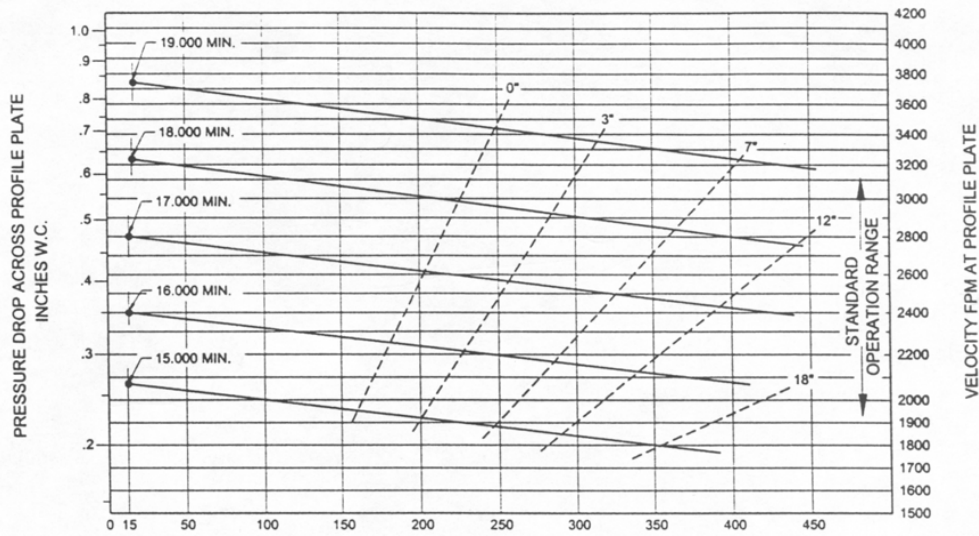
DIFFERENTIAL BURNER PROFILE AIR PRESSURE DROP

Using a magnehelic differential gauge across the burner profile will give you the pressure drop and using the burner capacity chart will tell you what velocity you have through the profile. If the unit is operating between .45 W.C. and .65 W.C. it is considered to be within operating range, as the low air switch is factory set to make at .30 W.C. and the high profile switch is set to open at .95 W.C. If the differential air pressure drop is too low. Adjust the profile plates above and below the burner slightly inward equally. You may have to adjust them just an inch or so and the velocity pressure drop will increase quite dramatically.

If the differential pressure drop is too high, you will want to move the profile plates away from the burner, again probably an adjustment of an inch both top and bottom will make a dramatic drop in pressure. This procedure may have to be repeated a few times to get the desired 0.45 to 0.65 in w.c. pressure drop. Then it is considered to be within operating range.

This should allow for a wide leeway before the unit will lock out due to low air / high air velocity across the profile plate. Under normal servicing the tubes from the air switch should be checked to insure they are free of any moisture or dirt as this could cause the burner to lockout on the flame safeguard relay as both switches are in the lockout circuit. Care must be taken to insure that they will operate to shut down the unit if the velocity is out of the operating set points.

BURNER CAPACITY



CAPACITY 1000'S BTU PER HOUR PER FOOT OF BURNER
 NAT GAS APPROXIMATE 100° RISE
 FIGURE A CAPACITY & FLAME LENGTH WITH VARIOUS AIR FLOWS

TABLE I

Btu/hr. Required for Each 1,000 C.F.M. of Fan Rating (at 70° F.)

SUPPLY TEMP.	LOWEST EXPECTED OUTSIDE TEMPERATURE (°F)										
	-20°	-15°	-10°	-5°	0°	5°	10°	15°	20°	25°	30°
70°F	99,000	94,000	88,000	82,000	77,000	71,000	66,000	61,000	55,000	49,000	44,000
75°F	104,000	98,000	93,000	87,000	82,000	76,000	71,000	66,000	60,000	54,000	49,000
80°F	108,000	103,000	98,000	92,000	87,000	81,000	76,000	70,000	65,000	59,000	54,000
85°F	113,000	107,000	102,000	96,000	91,000	85,000	80,000	75,000	69,000	64,000	59,000
90°F	117,000	111,000	106,000	101,000	96,000	90,000	85,000	80,000	74,000	69,000	64,000
95°F	121,000	116,000	111,000	105,000	100,000	94,000	89,000	84,000	79,000	73,000	68,000
100°F	125,000	120,000	115,000	109,000	104,000	99,000	94,000	89,000	83,000	78,000	73,000

LIMIT OF TOXIC VAPORS AND GASES

DURING NORMAL OPERATION OF THE HEATER, THE CONTENT OF TOXIC VAPORS AND GASES IN THE TEMPERED AIR AT THE POINT OF DISCHARGE INTO THE BUILDING MUST BE SUCH THAT NO IRRITATING EFFECTS ARE EVIDENT. THE INSTALLATION SHALL NOT BE CONSIDERED ACCEPTABLE IF THE DISCHARGE OF TOXIC PRODUCTS IS KNOWN TO EXCEED THE LIMITS SET OUT IN THE FOLLOWING TABLE.

SUBSTANCE	PERCENT	PPM	SUBSTANCE	PERCENT	PPM
Acetaldehyde	.001	10	Formaldehyde	.000025	0.25
Carbon Dioxide	.250	2500	Nitrogen Dioxide	.0001	1
Carbon Monoxide	.001	10	Sulfur Dioxide	.00005	0.5

DFC SERIES 80/20 RECIRCULATION OPTION

When unit is equipped with the 80/20 option up to 80% return air may recirculate from the space. When the burner is operating a minimum of 20% outside air is required. The mix box section controls the amount of fresh air and return air upon demand. Canadian units are not permitted to recirculate air unless it is a process like a paint booth, which the OSD series is specifically designed for.

Important: Outside air damper must never be adjusted or repositioned to allow less than 20% outside air when burner is operating.

Sequence. Upon unit start-up the two position damper actuator opens allowing 20% outside air through the outside damper. A damper controller actuates the 0-80% O/A and R.A dampers to maintain the desired position. No damper adjustment should be required. The pressure drop across the burner will remain constant independent of damper position.

Setting up the burner:

Profile pressure drop. The static pressure drop of the burner should be within the following limits; **0.45 in. w.c. to 0.65 in. w.c. (correct velocity)** this value can be obtained from the last pressure port on the gas train while the manual test firing valve is closed and blower is running. If pressure drop is lower than 0.45 in w.c. adjust the steel baffles both above and below the burner towards the burner by 1in. equally and retest. Repeat this procedure until the correct pressure drop is obtained. If the velocity is too high, adjust the steel plates away from the burner both above and below by 1 in. to reduce velocity.

The maximum burner firing rate should be adjusted to value stated on the rating plate (never more than 4.5 in. on high fire for natural gas units.) This value can be obtained from the manifold test port on the gas manifold while the test firing valve is opened and the unit is in high fire. (On Maxitrol models obtained with #4 wire temporarily removed.) Refer to Maxitrol operating instructions.

Always check burner profile pressure drop. If the burner is **operating outside** the 0.45 - 0.65 in. w.c. ideal profile pressure drop range, it can produce dangerously harmful levels of carbon monoxide, nitrogen dioxide and aliphatic aldehydes.

Always check that the burner is not firing in excess of the unit nameplate maximum firing rate value.

Always check that the burner is completely lit across the entire line burner in low fire condition.

Always visually inspect for any shipping damage to the gas manifold and the line burner. Use a gas sniffer or water soap solution to confirm no gas leaks.

80/20 RETURN AIR DAMPER CONTROL

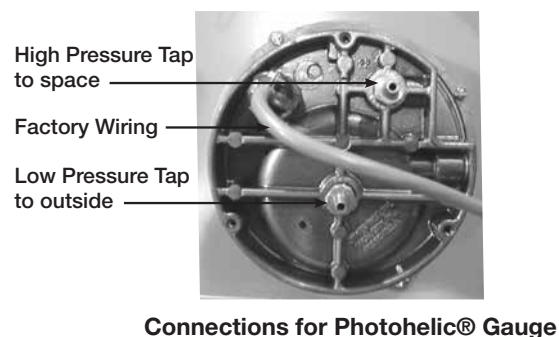
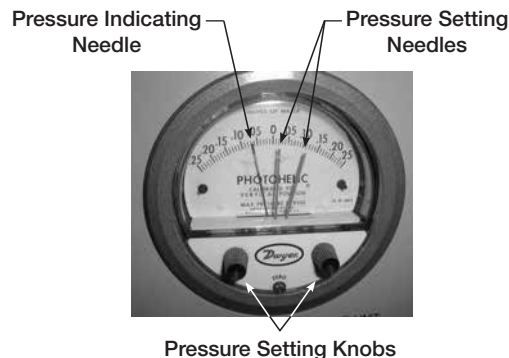
The mix box section controls the amount of fresh air and return air upon demand. The three most common methods are:

1. Manual quadrant adjustment. The damper linkage is manually adjusted and then locked into place with a quadrant.
2. Two position motor actuator. Typically this option operates for the unit in two different modes. From one position the dampers are actuated to the other. Usually in response to an exhaust in the building.
3. Modulating or proportional control. Dampers are infinitely stroked from one position to the other. Position of the modulating actuator can be controlled by the following:
 - Manual potentiometer
 - Dwyer null floating building pressure controller or other space sensor such as Neptronic.
 - Dwyer magnahelic transmitter gauge 4 to 20 ma or 0-10 vdc signal
 - DDC interface i.e. 4 to 20 ma or 0-10 vdc signal by others
 - ADFM44E –Maxitrol Temperature Control
 - CO2 detector (set to engage more ventilation, refer to page 33)
 - Unit mounted PLC controller, available with BACnet communication.

BUILDING PRESSURE CONTROL

80/20 OPERATION:

The 80/20 industrial heater is often used to control building pressure. A photohelic gauge, or other space sensor such as a Neptronic is placed in the space and typically set for +0.05 in w.c. positive pressure. Keeping the building at a slight positive pressure reduces infiltration. The control has two pressure taps, the low pressure tap is run outside for atmospheric pressure reference. The high pressure tap senses the indoor pressure.





Using the bracket provided, mount the pressure sensor outside the building. The sensor must be mounted out of prevailing winds, and away from supply, or exhaust fans, this will ensure accurate readings.

The controller modulates the return air and outside air proportions to hold desired set point. The controller has a lower pressure limit (usually set at 0 in w.c.) and a high set point (usually set at +0.1 in w.c.) that can be adjusted on the control using the pressure setting knobs. When these limits are reached relays control the dampers in the unit to act accordingly. When the unit is equipped with a PLC, or controlled by a building management system other pressure controllers or transducers might be used.

VARIABLE AIR VOLUME:

The direct fired make up unit is often used with a variable frequency drive to vary supply air in to a space. The photohelic, Neptronic controller or PLC transducer described above once again holds a set point and the variable speed drive varies supply air to maintain pressure. Often a building management system will send a proportional signal (4-20mA or 0-10 Vdc) to the VFD to control the volume of air. The VFD is factory set for a low point, which equates to 50% of airflow.

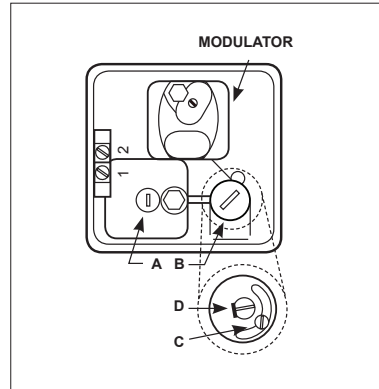
Inside the direct fired unit there is a burner modulating profile damper. When the speed of the VFD is reduced, the burner modulating damper closes proportionally to maintain a consistent velocity of air over the burner. Usually a photohelic gauge is used to provide set points for the high and low range the burner will operate. The set points are the same as described in the section on setting up the burner for proper combustion. The low pressure on the photohelic will be 0.45 in w.c., and the high pressure is set at 0.65 in w.c. Make sure the burner operates within these set points as the signal is varied to the VFD throughout the full range of signal. Note: if the unit has a PLC it may use a pressure transduced instead of the photohelic to sense burner profile pressure drop.

MR 212 VALVE

High Fire Manifold Adjustments:

1. Disconnect wires from amplifier terminal 4 (see page 4, *A1014R Model Amplifier*.) This causes the valve to call for continuous high fire.
2. Remove seal cap (A), and turn regulator pressure adjusting screw to obtain desired manifold pressure. (Clockwise rotation increases pressure.)
3. Reconnect the wires to amplifier terminal 4.

NOTE: If low fire bypass is on maximum, the desired high fire outlet pressure may not be achieved.



MR212 Valve Adjustments

Low Fire or Bypass Adjustments:

1. Disconnect wire from amplifier terminal 8 (see page 4, *A1014R Model Amplifier*.) This causes the valve to call for continuous low fire.
2. Remove cap (B), and loosen lock screw (C). Turn (D) to desired low fire adjustment. (Clockwise rotation reduces minimum flow rate.)
3. Tighten set screw (C), replace cap (B) and reconnect wire to amplifier terminal 8.

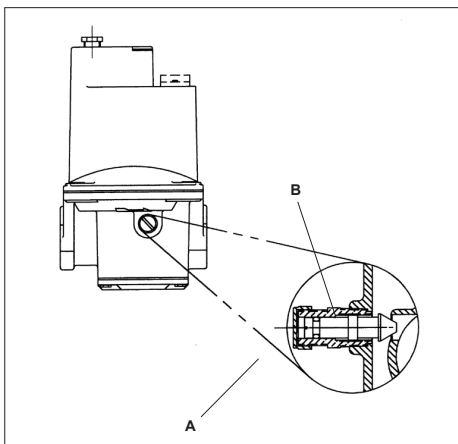
M411, 511, 611 VALVE

High Fire Manifold Adjustments:

1. Disconnect wires from amplifier terminal 4 (see page 4, *A1014R Model Amplifier*.) this causes the valve to call for continuous high fire.
2. Adjust the pressure regulator to obtain the desired manifold pressure (7" w.c. maximum).
3. Reconnect the wires to amplifier terminal 4.

Low Fire or Bypass Adjustments:

1. Disconnect wire from amplifier terminal 8, this causes the valve to call for continuous low fire.
2. Remove cap (A), and turn adjusting screw (B) to desired low fire adjustment. (Clockwise rotation reduces minimum flow rate.)
3. Replace cap (A), and reconnect wire to amplifier terminal 8.



M411, 511, 611 Valve Adjustments

Maxitrol Series #14

Make-up Applications.
RTS typically set @ 65 °F

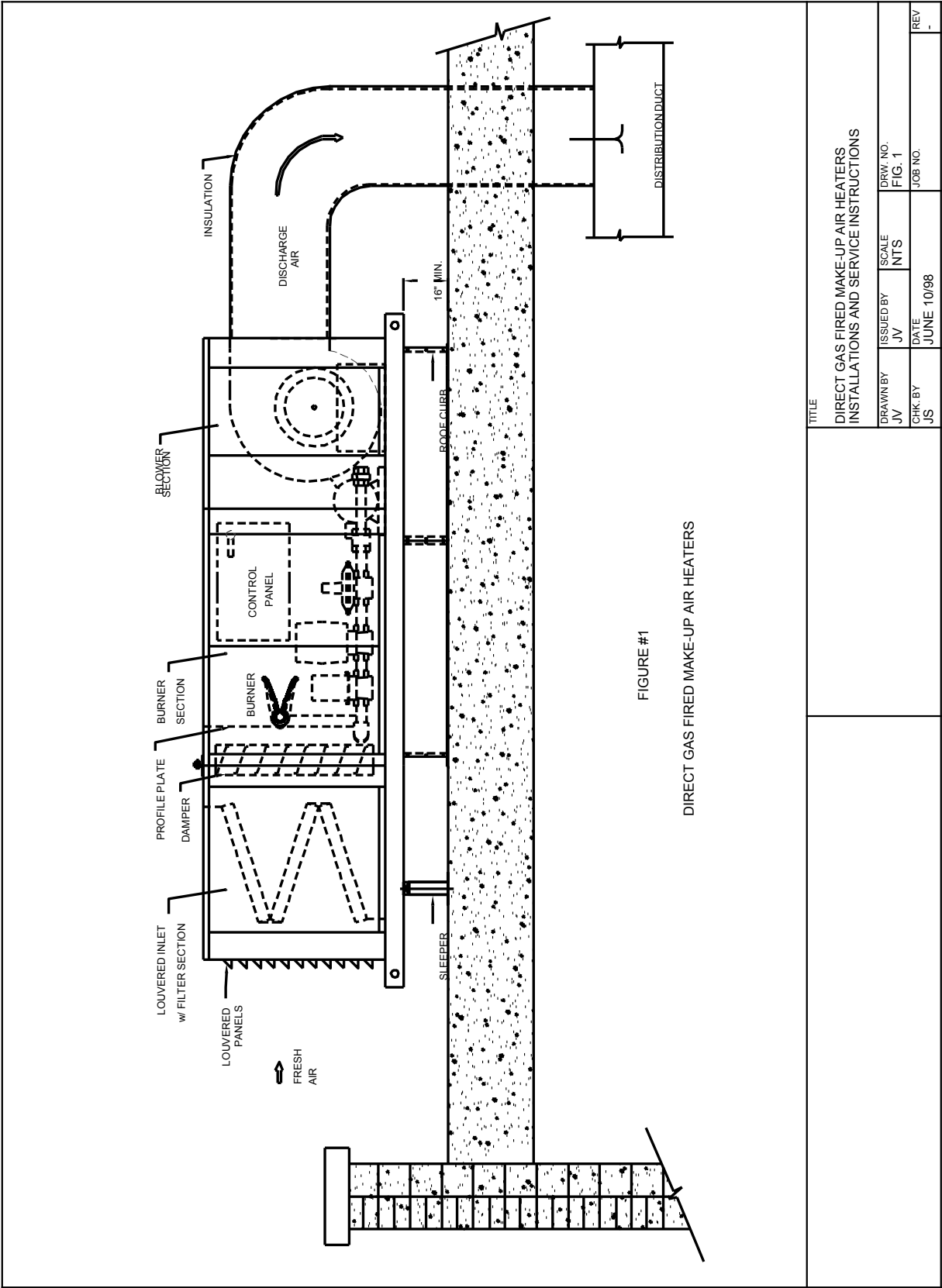
Maxitrol Series # 14 w/ override room stat

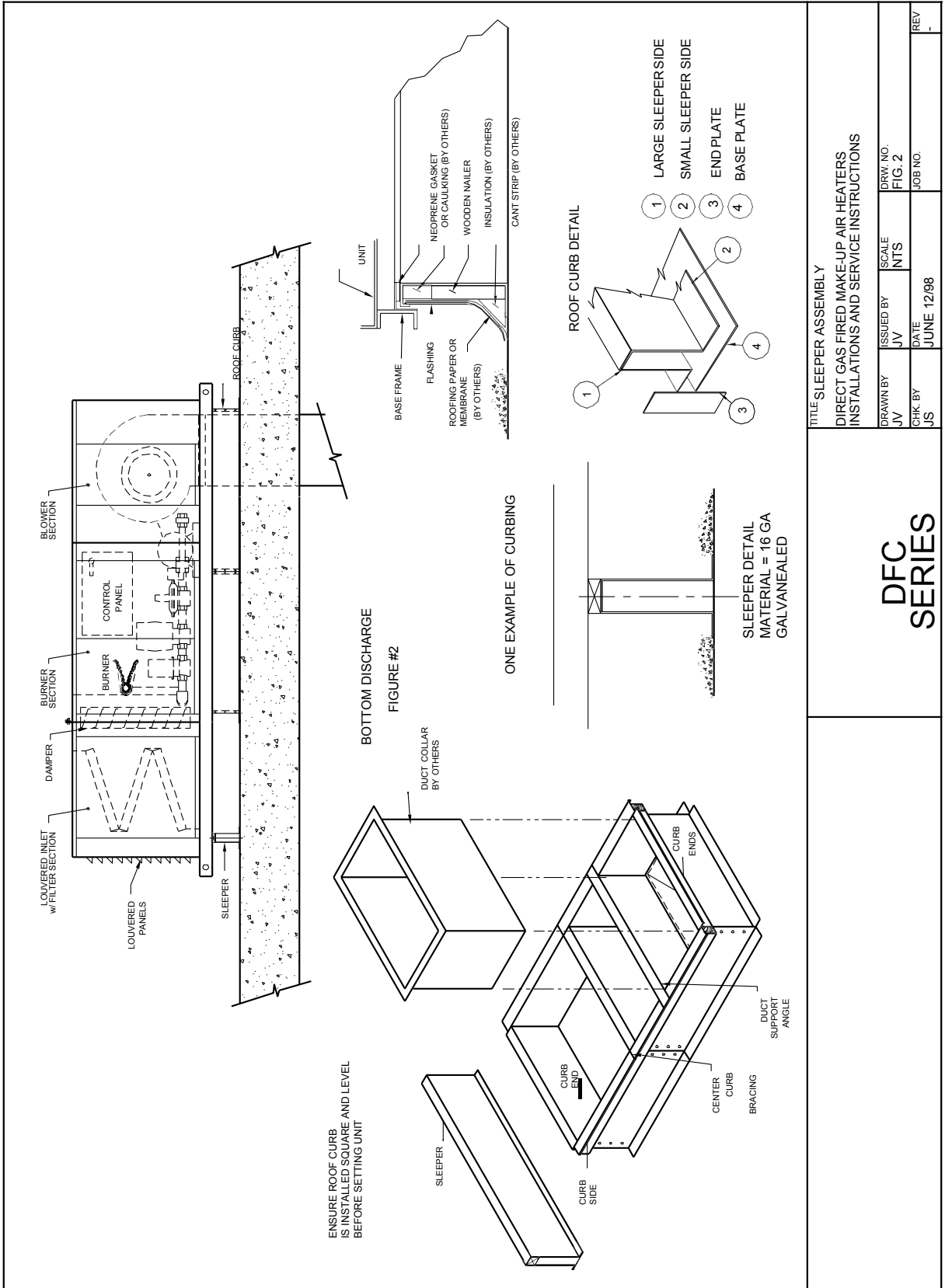
for make-up w/ space heating.
RTS @ 65 °F stat set @ 60 °F

Maxitrol Series # 44 w/ space thermostat

for space heating applications.
Space sensor set @ 65 °F
Amplifier: 60 °F Low & 100 °F High

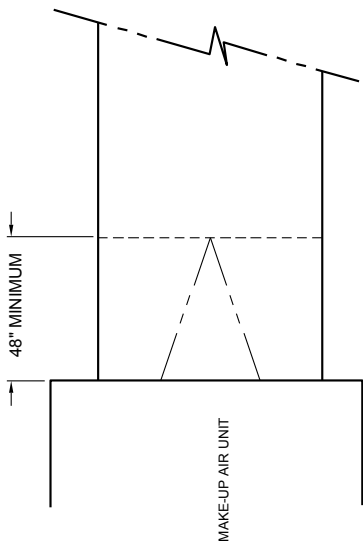




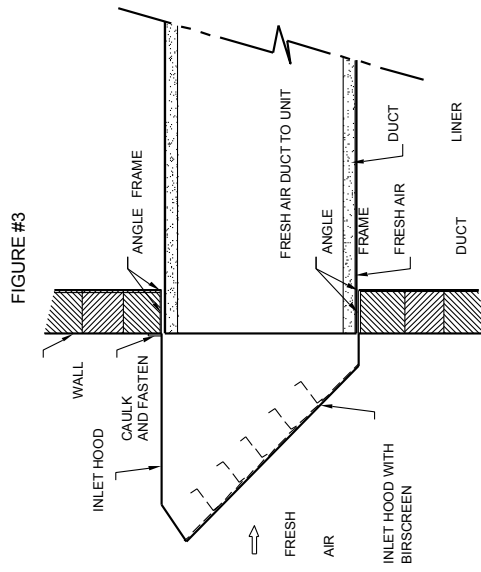
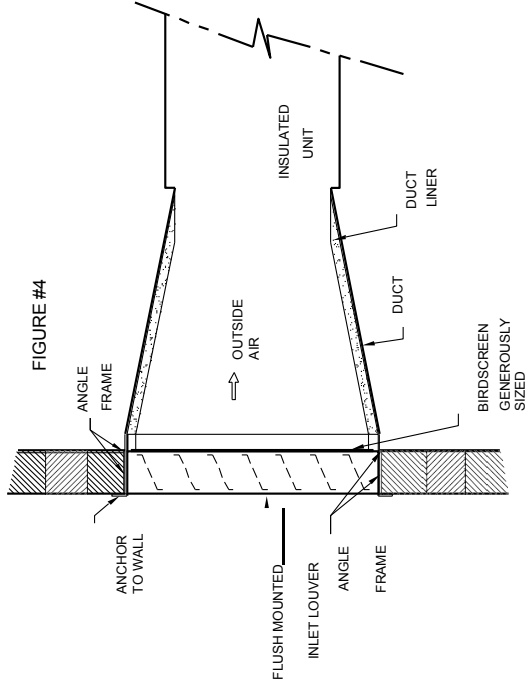


TITLE SLEEPER ASSEMBLY			
DIRECT GAS FIRED MAKE-UP AIR HEATERS INSTALLATIONS AND SERVICE INSTRUCTIONS			
ISSUED BY	SCALE	DRW. NO.	REV
JV	NTS	FIG. 2	-
CHK BY	DATE	JOB NO.	
JS	JUNE 12/08		

**DFC
SERIES**

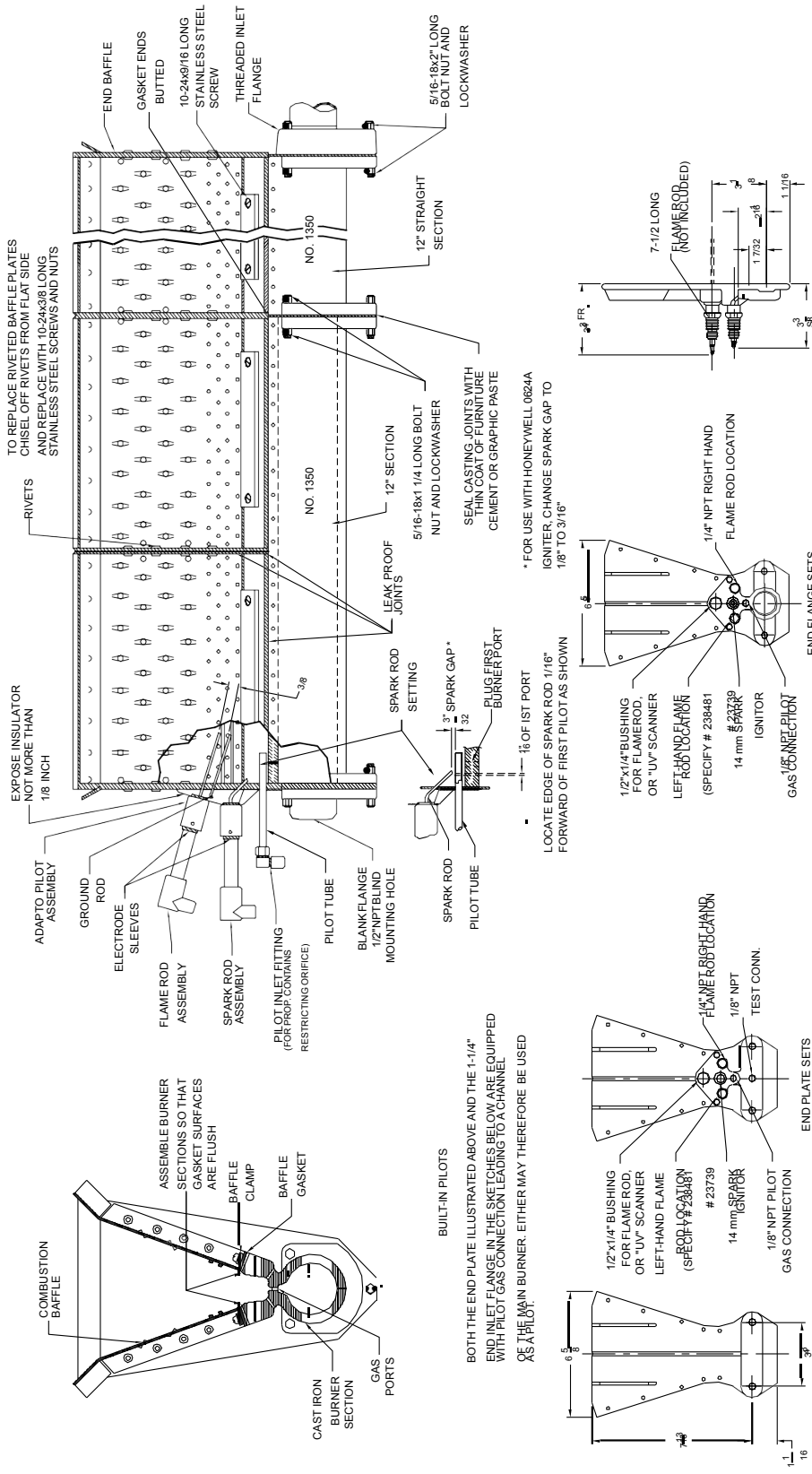


ON ALL TWIN BLOWERS UNIT WITH DUCT A STUB DISCHARGE DUCT MUST BE INSTALLED WITH A MINIMUM LENGTH OF 48".



TITLE		DIRECT GAS FIRED MAKE-UP AIR HEATERS INSTALLATIONS AND SERVICE INSTRUCTIONS	
		ISSUED BY JV	SCALE NTS
DRAWN BY JV		DATE JUNE 10/98	JOB NO.
CHK BY JS		DATE	REV
DFC SERIES		DRW. NO. FIG. 3 & 4	-
		DATE	-

MIDCO DIRECT FIRED GAS BURNER PILOT ARRANGEMENT WITH FLAME ROD AND IGNITOR



TO REPLACE RIVETED BAFFLE PLATES CHISEL OFF RIVETS FROM FLAT SIDE AND REPLACE WITH 10-24x3/8 LONG STAINLESS STEEL SCREWS AND NUTS

RIVETS

EXPOSE INSULATOR NOT MORE THAN 1/8 INCH

ADAPTO PILOT ASSEMBLY

GROUND ROD

ELECTRODE SLEEVES

FLAME ROD ASSEMBLY

SPARK ROD ASSEMBLY

PILOT INLET FITTING (FOR CRIP) CONTAINS RESTRICTING ORIFICE)

PILOT TUBE

BLANK FLANGE 1/2 NPT BLIND MOUNTING HOLE

SPARK ROD

PILOT TUBE

SPARK GAP 3"

PLUS FIRST BURNER PORT

1/8 OF IST PORT

LOCATE EDGE OF SPARK ROD 1/16" FORWARD OF FIRST PILOT AS SHOWN

LEAK PROOF JOINTS

5/16-18x1 1/4 LONG BOLT NUT AND LOCKWASHER

SEAL CASTING JOINTS WITH THIN COAT OF FURNITURE CEMENT OR GRAPHIC PASTE

NO. 1350

12" SECTION

NO. 1350

12" STRAIGHT SECTION

5/16-18x2 1/2 LONG BOLT NUT AND LOCKWASHER

* FOR USE WITH HONEYWELL 0624A IGNITER, CHANGE SPARK GAP TO 1/8" TO 3/16"

7-1/2 LONG (NOMINATED)

3/8"

1.732"

1.1016"

3/8"

1/2"x1/4" BUSHING FOR FLAME ROD, OR "UV" SCANNER LEFT-HAND FLAME (SPECIFY # 23739)

14 mm # 23739 SPARK IGNITOR

1/4" NPT RIGHT HAND FLAME ROD LOCATION

1/8" NPT TEST CONN.

END FLANGE SETS

62-23898 STRAIGHT-RH HAND LHS FR.

62-23739 END PLATE SETS

62-23898 STRAIGHT-LH HAND LHS FR.

BUILT-IN PILOTS

BOTH THE END PLATE ILLUSTRATED ABOVE AND THE 1-1/4" END INLET FLANGE IN THE SKETCHES BELOW ARE EQUIPPED WITH PILOT GAS CONNECTION LEADING TO A CHANNEL AS A BURNER. EITHER MAY THEREFORE BE USED

COMBUSTION BAFFLE

ASSEMBLY BURNER SECTIONS SO THAT GASKET SURFACES ARE FLUSH

BAFFLE CLAMP

BAFFLE GASKET

CAST IRON BURNER SECTION

GAS PORTS

1/2"x1/4" BUSHING FOR FLAME ROD, OR "UV" SCANNER LEFT-HAND FLAME (SPECIFY # 23739)

14 mm # 23739 SPARK IGNITOR

1/8" NPT PILOT GAS CONNECTION

END PLATE SETS

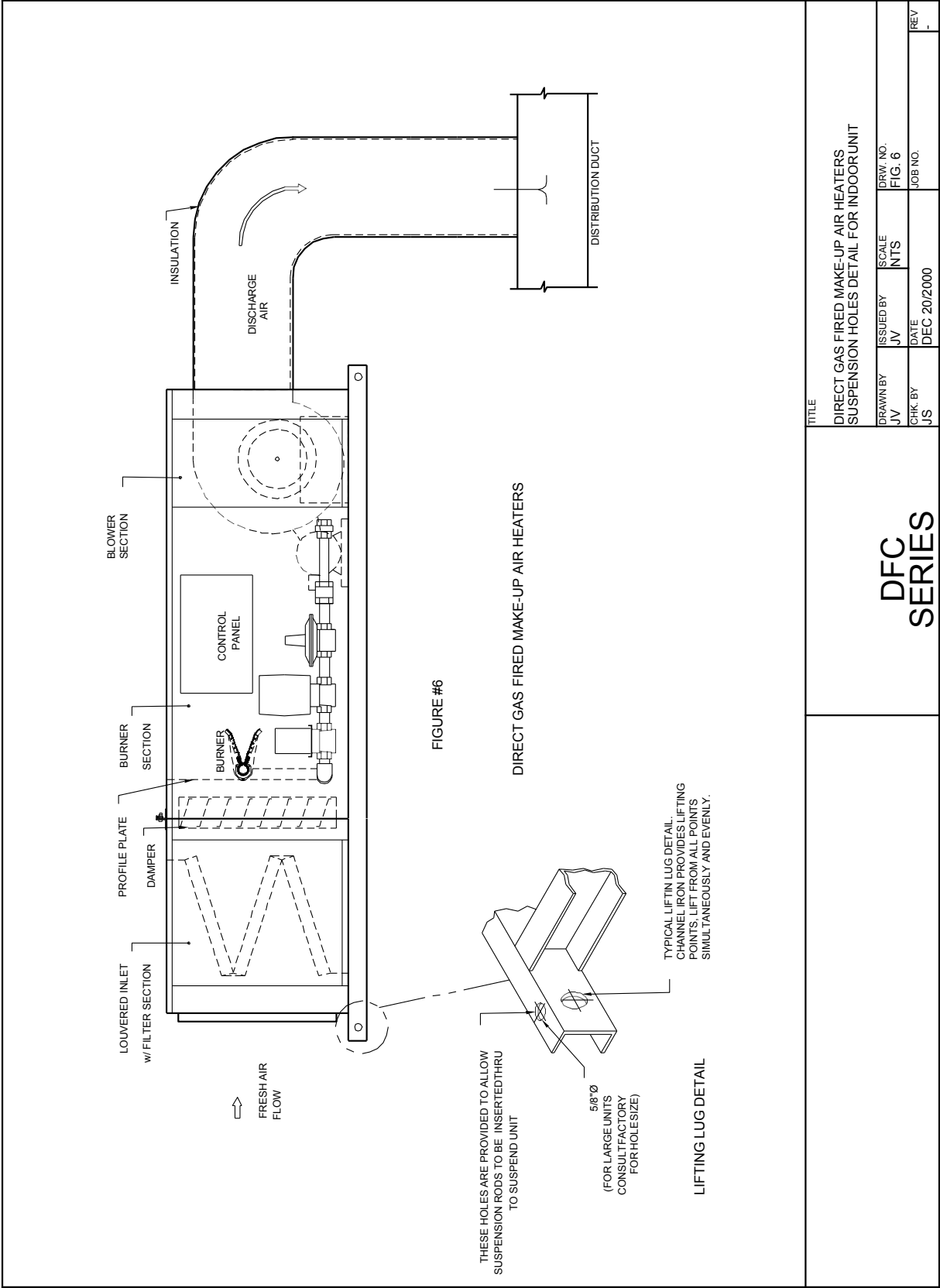
62-23898 STRAIGHT-RH HAND LHS FR.

62-23739 END PLATE SETS

62-23898 STRAIGHT-LH HAND LHS FR.

TITLE			
MIDCO DIRECT FIRED GAS BURNER PILOT ARRANGEMENTS w/ FLAME ROD AND IGNITOR			
DRAWN BY	ISSUED BY	SCALE	DRW. NO.
JV	JV	NTS	FIG. 5
CHK. BY	DATE	JOB NO.	REV
JS	JUNE 16/98		

DFC SERIES



TITLE		DRAWN BY		ISSUED BY		SCALE		JOB NO.	
DIRECT GAS FIRED MAKE-UP AIR HEATERS SUSPENSION HOLES DETAIL FOR INDOOR UNIT		JV		JV		NTS		FIG. 6	
REV		CHK BY		DATE		JOB NO.			
-		JS		DEC 20/2000					

Weatherproofing Instructions

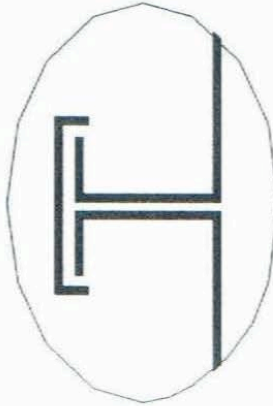
Weatherproofing is basically the same as standard construction. Except all roof joints are covered with roof seam caps and special attention must be given to caulking and sealing the seams.

Neoprene gasket is to be used between unit sections at the top, bottom & sides where sections meet. Flanges should be clamped together before screwing sections together. It is suggested that screws are to be placed every 8 inches along seams.

Once sections are screwed together the joint caps can be attached. Caulk flanges on both side before putting down the joint cap, refer to detail.

All TEK screws must be equipped with neoprene washers.

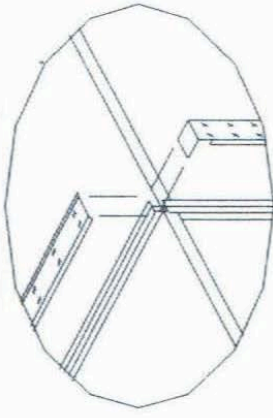
Roof Cap Detail



Weatherproof Units
Require Seam Cap

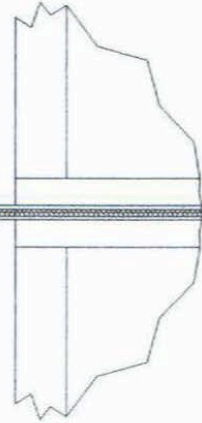
Note: To Installing Contractor
All ductwork, dampers and other accessories to be weatherproofed, sealed, caulked or gasket as required

Joint Cap Detail

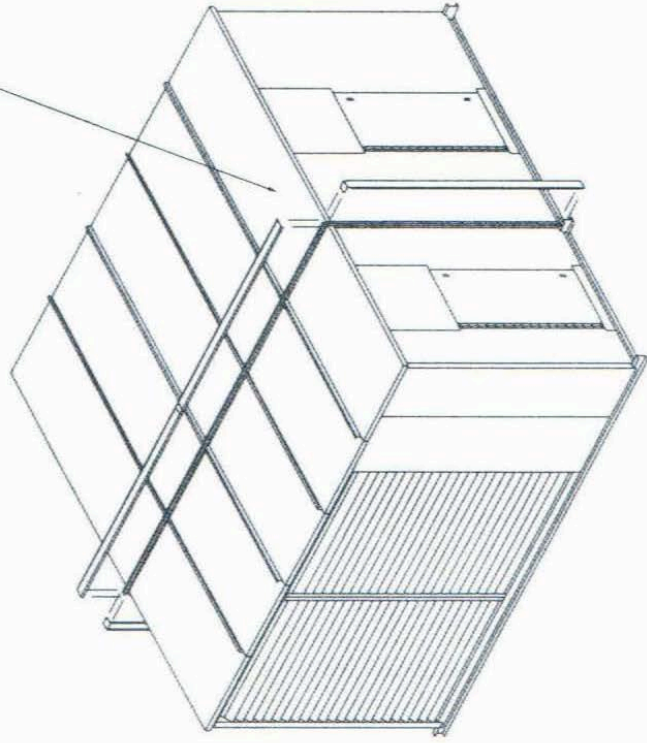


Neoprene Gasket

Self Tapping
TEK screws



Section Joining
Detail



EVAPORATIVE COOLING

DRAIN AND FILL KIT

Water valves outside unit: (set for normal operation.)

- **Sump tank drain valve:** normally open valve, powered closed to allow tank to fill.
- **Overflow drain valve:** open to allow bleed water to drain.
- **Supply water inlet valve:** normally closed valve, powered open to allow float valve to fill tank.
- **Supply water line drain valve:** normally open valve, powered closed to allow water to flow to tank.

NOTE: Installer must provide ambient sensor for freeze prevention, if unit is not equipped. The sensor should be set to allow tank and lines to drain water completely when temperatures fall below 45 Deg F.

Water valves inside unit: (set for normal operation)

Float valve: water should now fill the sump tank. Float should be set to shut the valve with a water level high enough to trip the float switch allowing the water-circulating pump to operate but with a water level that does not dump water out the overflow drain.

Flow rate valve: valve set for maximum water flow possible without water flying off the evaporative media with the air flow. To set, unit must be operating; the water circulating pump must be operating, go inside unit (**make sure burner is locked out and be very careful around the moving parts around blower and motor**), close door(s) and wait to see if water flies off the media if it does, very slowly close the valve until any carry-over stops. (On initial start-up the media may bubble and this may appear to be carry-over, this is normal, resulting from the chemical treatment on the media: allow the unit to operate and go back and reset the valve after it stops bubbling)

Bleed valve: with unit and pump operating, pull the bleed line out of the overflow drain and adjust the valve for a slow steady stream of water put the line back in the overflow drain. Be sure that it is not adjusted too high and water squirts back out into the tank after replacing the line. Also be sure that air is not being sucked back through the overflow drain bringing the bleed water with it; this would indicate that the overflow drain is not trapped properly.

WARNING: maintain water in sumps by proper microbial water treatment to minimize the risks of illness caused by legionella pneumophila (the bacteria that causes legionnaires's disease), and other bacteria. Refer to local codes regarding any additional treatment or restrictions regarding water supplies and usage.

EVAPORATIVE MAINTENANCE

Because of the nature of the evaporative process, algae buildup, biological fouling, scale build-up, and corrosion are distinct possibilities. Proper water treatment and regularly scheduled maintenance will minimize or eliminate most problems.

A. Cooling pad check list:

- Reduce the number of on/off cycles.
- Shade the pads and pump.
- Dry pads out completely once every 24 hours.
- Maintain a suitable water bleed-off rate.
- Drain and disinfect the entire water system quarterly.
- Avoid harmful contaminants, including dust, fumes, harsh cleaners, and water treatment chemical
- Circulate the recommended quantity of water over the pads.
- Avoid dry areas on the pads.
- CLEAN the filters regularly.

B. Controlling algae:

Scale and mineral deposits can form on the cooling pad when the mineral contents of the water are too high. Increase the water flow over the face of the pads. Make certain that the flow of water is even from one end of the distribution pipe to the other end. Clean and flush the distributor pipe regularly; especially if dry areas appear on the pads maintain the ph of the recirculating water is between 6 and 8. Maintain sufficient bleed-off rate.

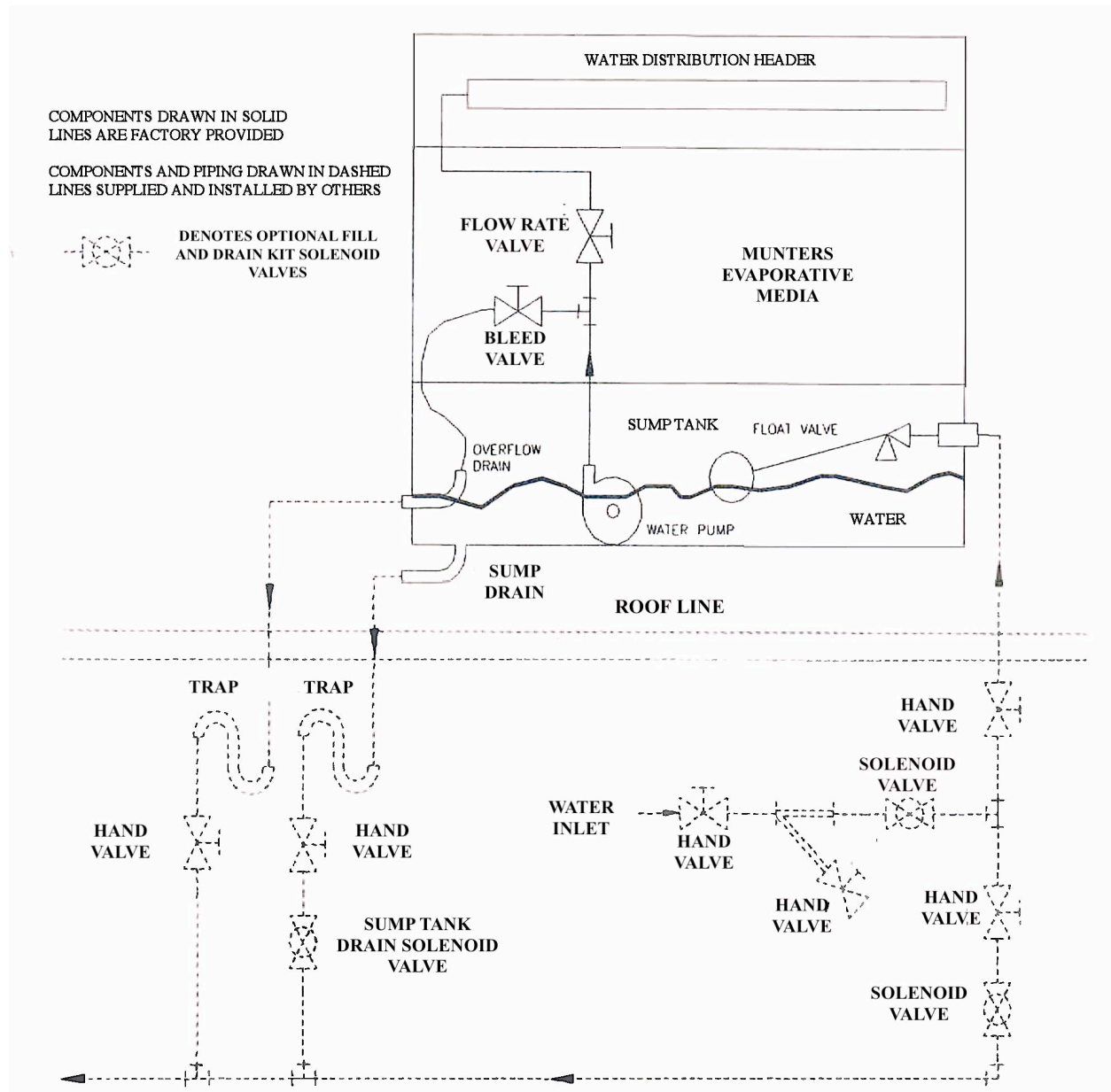
C. Preventing algae in the evaporative pads:

Algae require light, moisture, and nutrients to survive. Eliminating, or reducing, these elements will help to control algae.

D. Biological fouling control:

Uncontrolled growth of organic matter can lead to plugged media, metal deterioration, and biological contamination of the airstream. Whenever the possibility of biological contamination of water in an airstream exists, transmittal of legionnaire's disease should be addressed. While there are no reported cases of legionnaire's disease associated with rigid media type evaporative cooling systems, the legionella pneumophila bacteria, is present in almost all water supplies. However, the mere presence of the bacteria does not create a hazard; the bacteria must be transmitted as an aerosol in sufficient densities to be infectious.

NOTE: it is highly recommended that the services of a water treatment company be retained to advise on the proper treatment of the sump water for biological, scale, and corrosion control



EVAPORATIVE MEDIA MAINTENANCE

Changing the media: This should be done every 5 years or if passages become blocked.

- Remove filter/frame assemblies.
- Disconnect the water hood panel from the top panel by removing screws.
- Snap out water distribution system.
- Remove top media distribution pad.
- Lift out media sections. Note position of media
- Replace with new media in same position as old media.
- When re-installing media, be sure all media sections are installed in
- The proper direction.
- Replace top media distribution pad, water distribution system, water hood panel, and filter/frame assemblies.

Washing the media: This should be done annually (avoid splashing on the blower motor at all times as this could cause electrical problems)

- Scale and dust should be washed off the intake side of the media annually, using a garden hose and nozzle; this will keep media unclogged.
- Using a stiff brush, lightly brush intake edges of media. It removes any hardened scale.
- Occasionally, there will be a build up of algae or odors. The best solution for both of these problems is to allow the pads to dry thoroughly on a regular basis. If cooling is not needed at night during the cooling season, allow the blower to run for a few hours after the pump has been shut-down to dry pads daily.
- During the cooling season, we recommend that the pads be shut down nightly if possible with the blower running to dry the pads out for a few hours before the unit is shut down.

CO2 DETECTORS

Depending on the application, recirculating units may have been provided with a wall mounted CO2 sensor. The CO2 sensor ensures there is not a build up of contaminants in the space. Refer to the “as built” remote panel and control diagrams. The CO2 detector must be adjusted to 4500 PPM and will open the outside air damper to full position temporarily to flush out the space, if this level is exceeded. The sensor will be a typical NDIR type such as Dwyer CDT series. This will prevent concentrations in the room from exceeding 5000 ppm. When equipped, the recirculating units will have a minimum of one sensor per room served by the heater. Sensor spacing and installation will be per manufacturer instructions. When the room is 10,000 sq ft or less, the sensor will be mounted in the return air opening of the heater. Follow manufacturers instructions to properly calibrate the CO2 sensor, this is to be conducted at least once a year. Do not install the sensor near a CO2 source. When applicable, each heater will have its own dedicated CO2 sensor.

CLEANING THE DIRECT FIRED BURNER

MIDCO

Basic Instructions:

1. Clean the burner plates
2. Clear the burner gas and air ports
3. Inspect the spark rod igniter and replace if required
4. Insure the flame sensor is in good condition.

To clean the burner plates use a stiff wire brush. Scrub both sides of the stainless steel burner plates to remove any soot or other crud, which may be on the burner. All of the burner plate holes must be clear so air can pass through them unrestricted. The holes in the burner plate allow air to mix with the gas in increasing amounts, as the flame gets longer. After the burner plates have been cleaned, inspect them for cracking. Cracks occurring between one or two holes are normal and should be of no concern. If the cracking is more extensive, the affected plates should be replaced. With brush in hand, scrub the rust, soot and other foreign material from the burner orifice area. Clean the burner gas and air ports using a drill bit or piece of wire of the appropriate size. See the chart below for drill size.

After the orifices are drilled to the correct size and using compressed air or a vacuum, remove any debris from the manifold. Debris left in the manifold will prematurely clog the orifices in the future.

Burner Sections	Gas Port Drill Size		Air Port Drill Size	
	Wire Gauge	Decimal	Wire Gauge	Decimal
HMA-1 (Straight)				
1 row				
NATURAL GAS	31	.120	42	.093
PROPANE GAS	45	0.082	42	.093
HMA-2				
NATURAL GAS / PROPANE	1/8"	0.125	43	.089

After the burner plates and orifices have been cleaned inspect the spark rod. The tip should be clean and free of dirt and carbon. The porcelain must be intact. If it's cracked, replace it. While the spark rod is out pull the flame rod or ultraviolet scanner out as well. If the flame sensor is a scanner, clean the lens with a clean damp soft rag. A flame rod's metal rod should be clean and free of dirt and carbon. Like the spark rod igniter, the porcelain on the flame rod must be intact as well. Replace it if it's cracked.

MAXON

Periodic maintenance will insure continued trouble-free operation of your Series NP-LE AIRFLO® Burner system.

At least a yearly inspection is recommended for make-up air heating installations and more frequently for process applications in year-round operation. Your own experience is the best guide in determining frequency of inspection. As a minimum, the following procedure should be followed:

1. Shut the system down totally. Disconnect or lock out power supply so there can be no accidental start-up during inspection.
2. Inspect the burners carefully, including upstream and downstream sides of mixing plates as well as burner body face. Any accumulation of scale or foreign material on either side of the mixing plates should be removed with a wire brush. Check

visually that no holes in the mixing plates are blocked. See next page (5550-S-12) for inspection and maintenance instructions for gas ports.

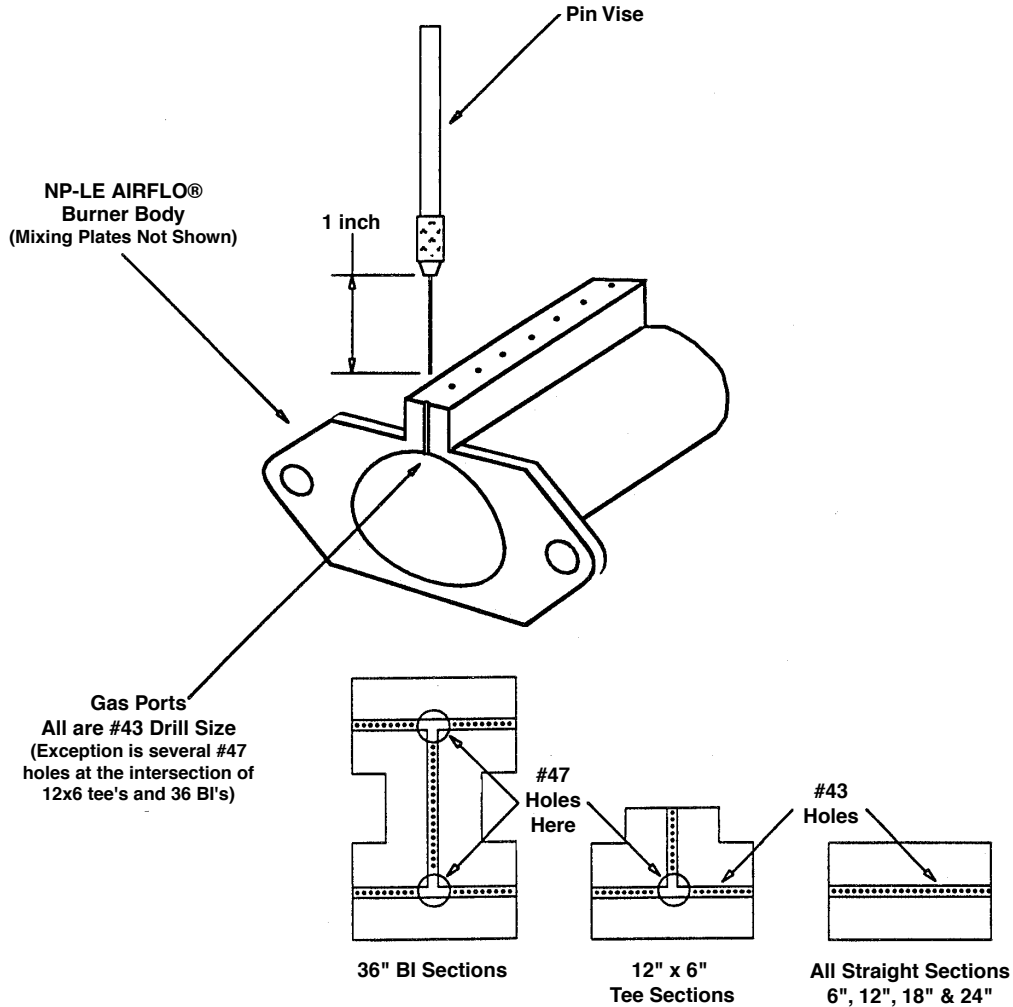
WARNING: Do not enlarge burner ports or performance may be drastically affected.

If any mixing plates are loose or missing fasteners, tighten/replace as necessary. Always use zinc plated or stainless metric fasteners.

3. Put system back into operation and, if possible, view from downstream side while cycling burner through full firing range. This will give a visual check for blocked burner ports.
4. Observe flame pattern and, if necessary, take steps to correct velocity and/ or air distribution problems.

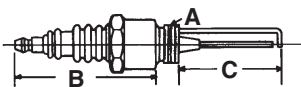
MAXON (CONT'D)

- Conduct initial inspection within the first month after commissioning. Visually check the gas ports of new burner assemblies for any piping scale or debris. Use Pin Vise with drill bit to remove.
- Annual inspections are normally adequate once the initial piping debris is removed. The operating conditions of the burner will determine how frequently maintenance is actually required.
- Use of an electric drill motor is not suggested unless both Pin Vise and Drill (as shown below) can be chucked up in a vari-speed drill unit. Use caution, because it is easy to snap the bits off in a port when using a drill motor. Removal of broken bits from the gas ports is difficult.
- Contact your Maxon representative to answer questions or address any problems.



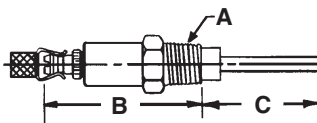
ACCESSORIES / REPLACEMENT ITEMS

14 mm spark ignitor



Dimensions in inches unless stated otherwise		
A	B	C
14 mm thread	2.0	1.5

Flame rod



Dimensions in inches unless stated otherwise		
A	B	C
1/4" thread	2.0	7.125

DIRECT GAS FIRED PERFORMANCE CHECKLIST

JOB NAME: _____ INSTALLATION CONTRACTOR: _____
 JOB ADDRESS: _____ SERVICE TECHNICIAN: _____
 START UP DATE: _____ INSTALLATION DATE: _____
 UNIT MODEL #: _____ SERIAL #: _____ JOB #: _____

ELECTRICAL CHECKLIST

ENTERING VOLTAGE: _____ VOLTS _____ PH 60 HZ
 SECONDARY VOLTAGE: _____ VOLTS _____ 1 PH 60 HZ
 VOLTAGE AT GAS VALVE: _____ VOLTS _____ 1 PH 60 HZ
 _____ CHECK TIGHTNESS OF ALL GAS & ELECTRICAL CONNECTIONS
 _____ CHECK FIELD WIRING FOR CORRECT CONNECTIONS
 _____ REMOTE STATION FUNCTIONS PROPERLY
 _____ FLAME ROD VOLTAGE FIREYE _____ DC
 _____ HONEYWELL _____ mA
 _____ AMPERAGE READING ON BLOWER MOTOR
 _____ 3 PH MOTOR LEG #1/#2/#3/: _____ VOLTS
 _____ 1 PH MOTOR LEG #1/#2/: _____ VOLTS
 _____ CHECK ALL FUSES _____ SIZE
 _____ BLOWER MOTOR RPM'S _____
 _____ BELT SIZE _____ QTY: _____ TYPE: _____
 _____ SHEAVE CENTER TO CENTER _____ INCHES
 _____ BELTS ALIGNED AND PROPER TENSION
 _____ HIGH POT TEST VOLTS: _____ SECONDS: _____

MECHANICAL CHECKLIST

_____ DAMPERS OPEN FREELY
 _____ DAMPER ACTUATOR SWITCHES ADJUSTED
 _____ BLOWER ROTATION CORRECT
 _____ BLOWER WHEEL CENTERED & TIGHT
 _____ BLOWER SHAFT CENTERED & TIGHT
 _____ GAS SUPPLY PRESSURE _____
 _____ PILOT FLAME PRESSURE _____
 _____ LOW FIRE SET (LIT LENGTH OF BURNER)
 _____ HIGH FIRE SET TO VALUE ON RATING PLATE
 _____ HIGH FIRE (in w.c.): _____
 _____ VISUAL AND PRESSURE CHECK OF MAIN & PILOT VALVES
 _____ PRESSURE DROP ACROSS BURNER PROFILE CORRECT
 _____ PROFILE PRESSURE DROP: _____ IN W.C.
 _____ HIGH LIMIT SET @ 165 DEG F & FUNCTIONING
 _____ INLET AIR CONTROLLER (OPTIONAL)
 _____ IAC SETTING: _____ DEG F
 _____ AUTOMATIC LOW LIMIT (OPTIONAL)
 _____ LL SETTING: _____ DEG F
 _____ DISCHARGE TEMPERATURE CONTROLLER MODULATING

_____ EXPLAINED HOW TO ADJUST DISCHARGE AIR TEMPERATURE
 _____ EXPLAINED HOW TO ADJUST SPACE TEMPERATURE
 _____ EXPLAINED HOW TO ADJUST SPACE PRESSURE CONTROL (IF EQUIPPED)
 _____ EXPLAINED IMPORTANCE OF FILTER MAINTENANCE
 _____ EXPLAINED IMPORTANCE OF GREASING BEARINGS

REPLACE ALL ELECTRIC COVERS AND CONTROL COVERS. INSURE ALL ACCESS DOORS ARE IN PLACE AND LATCHES ARE SECURED
 JOB AREA LEFT IN NEAT AND TIDY CONDITION

_____ SERVICE TECHNICIAN _____ SIGNATURE

FOR FACTORY AUTHORIZED PARTS: WWW.ICE-US.COM PARTS@ICE-US.COM

DIRECT FIRED WARRANTY

The warranty on the ICE Manufacturing Direct Gas Fired Make-up Air Units are one (1) year from installation date or (15 months) from date of shipment from our factory.

Our warranty applies for original shipment on all parts and components fabricated by or installed by us with the exception of air filters, flame rods, igniters, and blower belts.

Within the one year warranty, replacement parts will be shipped collect and charged to customer account with credit being issued after receipt of, and examination of the returned parts: freight prepaid to the factory.

This warranty does not include freight, labor, or sales taxes that may be incurred by the purchasers and is subject to the following conditions:

- 1) The unit shall have been installed by a qualified heating contractor; in accordance with the provisions of this service manual.
- 2) The unit shall have been installed in accordance with all national and local codes.
- 3) The unit shall have been subject to only normal use in service and shall not have been misused, neglected, altered or otherwise damaged.
- 4) The unit shall have been operated within its published capacity and with the prescribed fuel.
- 5) All automatic controls shall have been operative at all times.
- 6) The unit has not been allowed to exceed its proper temperature limits due to control malfunction or inadequate air circulation.
- 7) There is no evidence of tampering or deliberate destruction.

No representative of ICE or any of its distributors or dealers is authorized to assume for ICE any other obligations or liability in connection with this product, nor alter the terms of this warranty in anyway. This warranty is limited to the express provisions contained herein and does not extend to liability for labor costs incurred in replacing defective parts.

Authorization to return any alleged defective parts must be obtained from the factory before the part is transported and the owner shall prepay the transportation charges for any alleged defective parts. ICE will not accept charges for parts purchased unless the conditions of this warranty have been satisfied.

The express warranties herein contained are in lieu of any other warranties, expressed or implied, including the warranty of merchantability and of fitness for any particular purpose. ICE shall not be liable for damages, including special, incidental, or consequential damages arising out of or in connection with the performance of the Direct Gas Fired Make-up Air Units and Industrial Heaters, or its use by the owner. ICE liability is limited exclusively to repair and or replacement of the defective part. Parts can be obtained from ICE (US), Inc. www.ice-us.com, for factory authorized parts contact: parts@ice-us.com on the basis that credit will be issued if defective parts returned qualify for replacement pursuant to the terms and conditions of this warranty.