INDUSTRIAL
COMMERCIAL
EQUIPMENT
I.C.E. (US), INC.

140 AIRPORT LANE, BOLIVAR TENNESSEE 38008

BMA-BMR / DMA / IMA-IMR / OSD INSTALLATION, OPERATION AND MAINTENANCE MANUAL

READ MANUAL THOROUGHLY BEFORE INSTALLING OR OPERATING UNIT.

DIRECT GAS FIRED INDUSTRIAL HEATER

MODEL # _____

SERIAL # _____

UNIT TAGS: _____

INSTALLER AND SERVICE CONTRACTOR

WARNING: IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE OR MAINTENANCE CAN CAUSE PROPERTY DAMAGE, INJURY OR DEATH. READ THE INSTRUCTION, OPERATING AND MAINTENANCE INSTRUCTIONS THOROUGHLY BEFORE INSTALLING OR SERVICING THIS EQUIPMENT. SERVICE AND STARTUP OF EQUIPMENT MUST BE CONDUCTED BY QUALIFIED TECHNICIANS ONLY.

NAME: _____

ADDRESS: _____

TELEPHONE: _____

FACSIMILE: _____

FOR YOUR SAFETY

IF YOU SMELL GAS -OPEN WINDOWS

DO NOT TOUCH ELECTRICAL SWITCHES AND CALL GAS SUPPLIER IMMEDIATELY.

FOR YOUR SAFETY

THE USE AND STORAGE OF GASOLINE AND OR OTHER FLAMMABLE VAPORS AND LIQUIDS IN OPEN CONTAINERS IN THE VICINITY OF THIS APPLIANCE IS HAZARDOUS.

THESE INSTRUCTIONS ARE TO BE USED AS A GUIDE ONLY. UNIT DESIGN IS SPECIFIC TO EACH ORDER AND ALL INFORMATION MAY NOT APPLY TO ALL UNITS. DATA IS SUBJECT TO CHANGE WITHOUT NOTICE. SAVE THESE INSTRUCTIONS FOR REFERENCE AND MAINTAIN IN LEGIBLE CONDITION.

RECEIVING AND WAREHOUSE NOTES:

- INSPECT THE UNIT UPON ARRIVAL FOR ANY SHIPPING DAMAGE. IF ANY PARTS ARE MISSING OR DAMAGE, MARK BILL OF LADING AS TO DAMAGE AND NOTIFY CARRIER IMMEDIATELY. IF THE UNIT CANNOT BE INSTALLED IMMEDIATELY, STORE IT AND ALL ACCESSORIES IN A CLEAN DRY PLACE.

- DO NOT ATTEMPT TO HANDLE OR SUSPEND UNIT UNLESS YOU ARE EXPERIENCED IN RIGGING SUCH EQUIPMENT. DO NOT HANDLE THE UNIT ATTATCHING HOOKS, JACKS OR CHAINS TO THE UNIT CASING OR COMPONENTS. SPREADER BARS ARE REQUIRED WHEN PAKING SINGLE POINT LIFTS. SEE RIGGING AND INSTALLATION NOTES.

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DIRECT GAS FIRED PERFORMANCE CHECK LIST

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

ELECTRICAL CHECKLIST

Entering voltage: _____ v/ _____ PH 60 HZ
Secondary voltage at transformer:
_____ v/ _____ PH 60 HZ
Voltage at gas valve
_____ v/ _____ PH 60 HZ

_____ Check tightness of all gas and Electrical Connections,
_____ Check field wiring for correct connections
_____ Remote Station Function & Wire leads w/no's
_____ Flame rod voltage Fireye DC: _____
Honeywell micro amp: _____
_____ Amperage reading on blower motor
3 PH motor leg #1 _____ #2 _____ #3 _____
1 PH motor leg #1 _____ #2 _____
_____ Check all fuses: _____
_____ Blower motor RPM's: _____
_____ Blower RPM's: _____
_____ Belt Size: _____ QTY _____ TYPE _____
_____ Sheave Center to Center: _____ IN.
_____ Belts Aligned: _____
_____ High Pot Test: _____ Volts _____ Seconds
Dynamic Rebalance Req'd _____ Yes _____ No
Re-Balance (In/Sec) Horizontal Vertical Axial
(If frequent)
Drive Side
Other Side

MECHANICAL CHECK LIST

_____ Dampers open freely: _____
_____ Damper linkage adjustment: _____
_____ Belt tension: _____
_____ Blower rotation: _____
_____ Blower wheel centered & tight: _____
_____ Blower shaft centered & tight: _____
_____ Gas supply pressure: _____
_____ Set pilot flame: _____
_____ Set low fire to minimum stable flame
_____ Set High Fire for temp. rise stamped on rating plate:
_____
_____ Check main gas valve operation (visually): _____
_____ Pressure drops across profile plate;
Factory Test: _____ in. W.C.
On Site: _____ in. W.C.
_____ Pressure switch sensing tubes clear and unobstructed:
_____
_____ Sensing Bulbs in proper location: _____
Inlet Air Controller Setting:
(OPTIONAL) _____ deg. F
Discharge Air Controller Setting:
_____ deg. F
Outside Air Temperature:
Discharge Air Temperature:
_____ Check High limit operation: _____
_____ Sheaves Tight: _____

Replace all electric covers and control covers. Insure all access doors are in place and all latches and screws are secure. Job area should be left in neat and tidy condition.

Service technician notes and
recommendations: _____

Technician's Signature: _____ Contractor or Owner's
Signature _____

Distribution: One copy retained by distributor or agent. One copy to building owner (suggest this be kept with the maintenance manual) One copy to be mailed back to I.C.E. (U.S.) INC., Attn: Service Department, 140 Airport Lane, Bolivar, Tennessee 38008

1.0 GENERAL INFORMATION

1.1 GENERAL NOTICES

NOTE: RECIRCULATION OF ROOM AIR MAY BE HAZARDOUS IN THE PRESENCE OF FLAMMABLE SOLIDS, LIQUIDS & GASES

-EXPLOSIVE MATERIALS (grain dust, coal dust, gunpowder, etc.)
-SUBSTANCES WHICH MAY BECOME TOXIC WHEN EXPOSED TO HEAT (i.e. refrigerants, aerosols, etc.)

NOTE: RECIRCULATION IS NOT RECOMMENDED IN UNINSULATED BUILDINGS

LOW LIMIT WARNING

A LOW TEMPERATURE LIMIT SHOULD BE INSTALLED ON UNITS INSTALLED IN AREAS WHERE FREEZE PROTECTION IS NEEDED IN THE EVENT OF BURNER FAILURE OR LOCKOUT.

WHEN UNIT IS OPERATED IN MINIMUM 20% OUTSIDE AIR MODE, CARE MUST BE TAKEN TO ENSURE THAT A MINIMUM OF 4 CFM OF OUTSIDE VENTILATION AIR IS INTRODUCED FOR EVERY 1000 BTUH OF RATED INPUT.

THE INSTALLATION AND WIRING MANUALS ARE LOCATED IN THE WEATHERHOUSING OF OUTDOOR UNITS AND IN THE BURNER COMPARTMENT OF INDOOR UNITS. REMOVE AND READ THE MATERIAL PRIOR TO INSTALLING THE UNIT.

1.2 INSTALLATION AND SERVICE INSTRUCTIONS

THE INFORMATION PROVIDED IS A GUIDE TO THE PROPER INSTALLATION, OPERATION AND TROUBLESHOOTING OF THE UNIT. RETAIN THE MANUAL AS A REFERENCE FOR OPERATING AND FOR MAINTENANCE PERSONNEL.

SHOULD CONTACT WITH THE FACTORY BE NECESSARY, CONTACT YOUR LOCAL REPRESENTATIVE AND HAVE HIM (HER) CONTACT OUR SERVICE DEPARTMENT. PROVIDE THEM THE UNIT MODEL NUMBER AND THE UNIT SERIAL NUMBER. THE SERIAL NUMBER CAN BE FOUND ON THE RATING LABEL OF THE UNIT.

INSTALL AND WIRE THE EQUIPMENT IN ACCORDANCE TO THE APPLICABLE NATIONAL AND LOCAL GOVERNING BODIES' CODES. REFER TO CURRENT NEC, NFPA, ANSI AND NATIONAL GAS CODES.

AUTHORITIES HAVING JURISDICTION SHOULD BE CONSULTED BEFORE MAKING THE INSTALLATION. LOCAL CODES MAY REQUIRE ADDITIONAL SAFETY CONTROLS AND OR INTERLOCKS.

1.3 LOCATING THE UNIT

PRIOR TO LOCATING THE UNIT CHECK WITH THE AUTHORITIES HAVING JURISDICTION.

THE UNIT SHOULD BE LOCATED WITH MINIMUM CLEARANCES AS STATED ON THE RATING PLATE WITH ADDITIONAL CLEARANCE TO OPEN ACCESS DOORS AND TO REMOVE FILTERS. INSURE THAT THE UNIT IS INSTALLED LEVEL. PROVIDE ADEQUATE CLEARANCE ON EITHER SIDE OF THE UNIT TO SERVICE THE BLOWER, BEARINGS, MOTORS, DRIVES AND FILTERS.

NOTE: THE HEATER IS DESIGNED TO DISCHARGE AIR AT TEMPERATURES UP TO 120 F FOR BMA UNITS, UP TO 160 F FOR BMR UNITS. AVOID DIRECTING AIR UPON PEOPLE WHO MAY BE OCCUPYING THE SPACE. INTRODUCE THE HEATED AIR AT SUFFICIENT HEIGHTS TO AVOID DIRECT DISCHARGE ON PEOPLE IN THE AREA.

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.

1.4 LOCATING THE ACCESSORIES

THE REMOTE PANEL WILL BE SHIPPED IN THE BURNER SECTION (INDOOR UNITS) AND THE WEATHERHOUSING (OUTDOOR UNITS). REMOVE THE PANEL AND HAVE ELECTRICAL CONTRACTOR INSTALL.

1.5 FACTORY TESTING & STARTUP CHECKLIST

ALL SHIPMENTS ARE MADE F.O.B. THE FACTORY. THE UNIT IS SECURELY STRAPPED OR BLOCKED TO HELP PREVENT SHIPPING DAMAGE AND EACH SHIPMENT INSPECTED PRIOR TO LEAVING THE PLANT. ALL PARTS, WHERE FEASIBLE, ARE STRAPPED TO OR INCLUDED IN THE UNIT. UPON RECEIPT OF GOODS, CHECK THE SHIPMENT AGAINST THE BILL OF LADING TO INSURE ALL ITEMS HAVE BEEN RECEIVED. CAREFULLY CHECK THE UNIT FOR PHYSICAL DAMAGE IN THE PRESENCE OF THE CARRIER'S REPRESENTATIVE. SHOULD PARTS BE MISSING OR DAMAGE NOTED, FILE A CLAIM IMMEDIATELY WITH CARRIER. ICE DOES NOT ASSUME RESPONSIBILITY FOR THE HANDLING OF THE GOODS IN TRANSIT AND IS NOT RESPONSIBLE FOR THE INITIATION OF FREIGHT CLAIMS.

NOTE: IF QUESTIONS ARISE OR INSTALLER / SERVICE PERSONEL ARE IN DOUBT PLEASE CONTACT ICE (US) INC.

2.0 INSTALLATION

2.1 GENERAL ASSEMBLY INSTRUCTIONS

SMALLER UNITS SIZE 109 THRU 136 (MAY VARY) ARE SHIPPED WITH BURNER SECTION AND BLOWER SECTION FACTORY ASSEMBLED AND READY FOR INSTALLATION.
ON LARGER UNITS THE BURNER AND BLOWER SECTIONS ARE SEPERATED FOR SHIPMENT AND MUST BE ASSEMBLED IN THE FIELD. THE BLOWER SECTION IS TO BE BOLTED TO THE BURNER SECTION WITH FASTENERS SUPPLIED BY THE FACTORY. THE BURNER AND BLOWER SECTIONS MAY BE PREDRILLED FOR ATTACHMENT WITH FACTORY SUPPLIED BOLTS, NUTS, & WASHERS MOUNTED ON ONE SECTION. ON OTHER UNITS SELF TAPPING DRIVE SCREWS ARE SUPPLIED BY THE FACTORY FOR FAST INSTALLATION. GASKETING MUST BE INSTALLED BETWEEN EACH SECTION. BEFORE SLIDING TOGETHER GASKETS SUPPLIED BY THE FACTORY MAKE SURE THAT THE HOLES ARE ALIGNED. PUT BOLTS IN AND LEAVE NUTS LOOSE UNTIL ALL ARE INSTALLED, THEN TIGHTEN. OUTDOOR UNITS REQUIRE THAT THE SEAM BE CAULKED TO PREVENT MOISTURE ENTERING THE UNIT.

INLET HOODS USUALLY SHIP LOOSE FOR ALL OUTDOOR UNITS AND IF SO WILL REQUIRE FIELD ASSEMBLY. THE HARDWARE TO BOLT OR SCREW THE HOOD(S) ON IS PROVIDED. DO NOT POINT INLET HOOD INTO INLET WIND WHENEVER POSSIBLE. IF HIGH WINDS ARE PRESENT CUSTOMER MAY BE REQUIRED TO INSTALL A WIND BLOCKING DEVICE. ALSO, V-BANK FILTER SECTIONS MAY BE SHIPPED SEPERATELY AS AN ACCESSORY. THE CONTRACTOR IS RESPONSIBLE FOR ATTACHING THE FILTER BANK TO THE UNIT AND CAULKING AND GASKETING THE JOINT.

WHEN A DISCHARGE DAMPER IS FURNISHED, THE INSTALLING CONTRACTOR MAY HAVE TO ATTACH THE DAMPER AT THE BLOWER DISCHARGE. THE DAMPER MOTOR LINKAGE MUST THEN BE ATTACHED TO THE DAMPER ROD. THE DAMPER IS TO THEN BE WIRED TO THE UNIT TERMINAL BLOCK. MOUNT DAMPER MOTOR UPWARD WITH LID ON TOP FOR PROPER WEATHERHOUSING.

2.2 CLEARANCE

MINIMUM CLEARANCE FROM THE UNIT TO COMBUSTIBLE CONSTRUCTION IS CLEARLY NOTED ON THE RATING PLATE ATTACHED TO THE UNIT. THE CLEARANCE MUST BE OBSERVED BY THE INSTALLING CONTRACTOR.

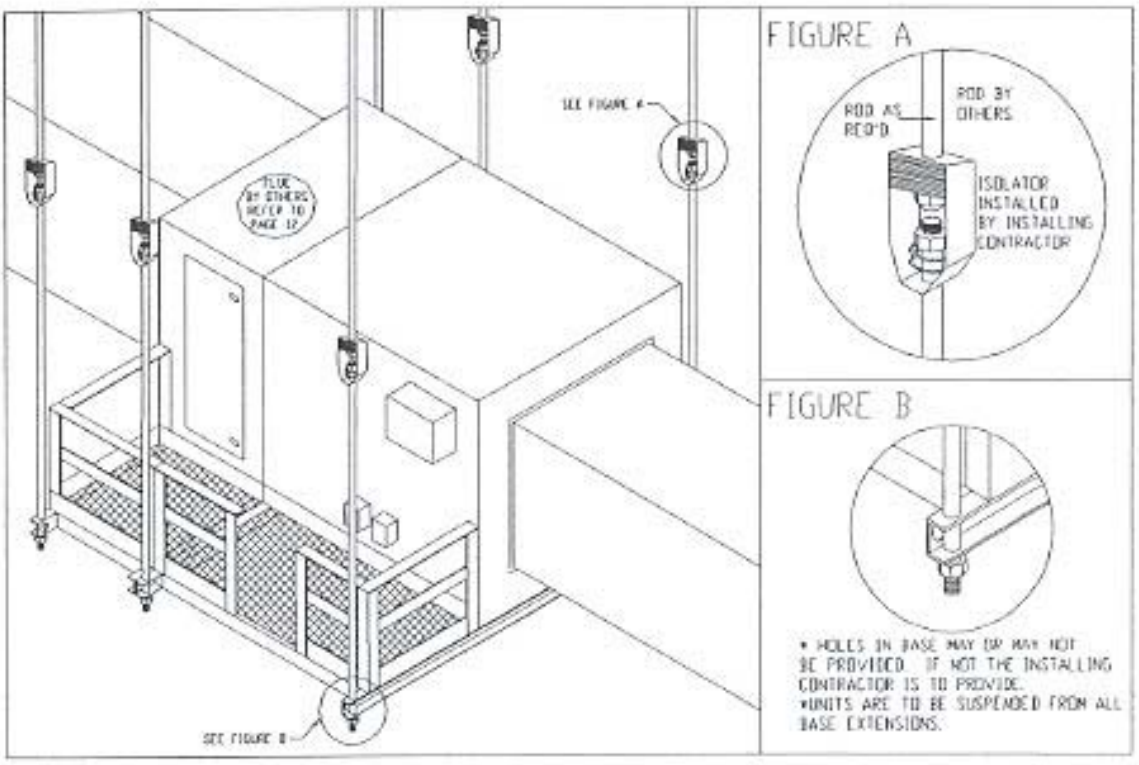
2.3 RIGGING AND HANDLING

THE EQUIPMENT HAS BEEN DESIGNED FOR LIFTING AND HANDLING FROM THE LIFTING EYES AND/OR HOLES PROVIDED IN THE BASE FRAME CHANNEL. ALL LIFT OPERATIONS MUST UTILIZE THE LOAD SPREADER WITH SUFFICIENT WIDTH TO INSURE THAT THE LIFTING CABLES CLEAR THE SIDES OF THE UNIT. IF A SPREADER IS NOT AVAILABLE, INSERT WOOD STRIPS BETWEEN THE UNIT AND THE CABLES WHERE NECESSARY. UTILIZE ALL LIFTING EYES OR CHANNEL HOLES SIMULTANEOUSLY WHEN LIFTING A SECTION.

DURING SHIPMENT, UNLOADING AND INSTALLATION OF THE UNIT, NUTS AND BOLTS MAY HAVE BEEN LOOSENED. IT IS RECOMMENDED THAT PRIOR TO RIGGING, INSTALLING OR STARTING THE UNIT, ALL FASTENERS BE CHECKED AND TIGHTENED WHERE NECESSARY. TURN BLOWER SHAFT MANUALLY TO INSURE THAT THE BLOWER TURNS FREELY WITHOUT RUBBING OR BINDING. INSPECT THE TERMINALS AND WIRING CONNECTIONS IN THE UNIT CONTROL BOX TO INSURE THAT ALL CONNECTIONS ARE TIGHT.

INDOOR SUSPENDED UNITS

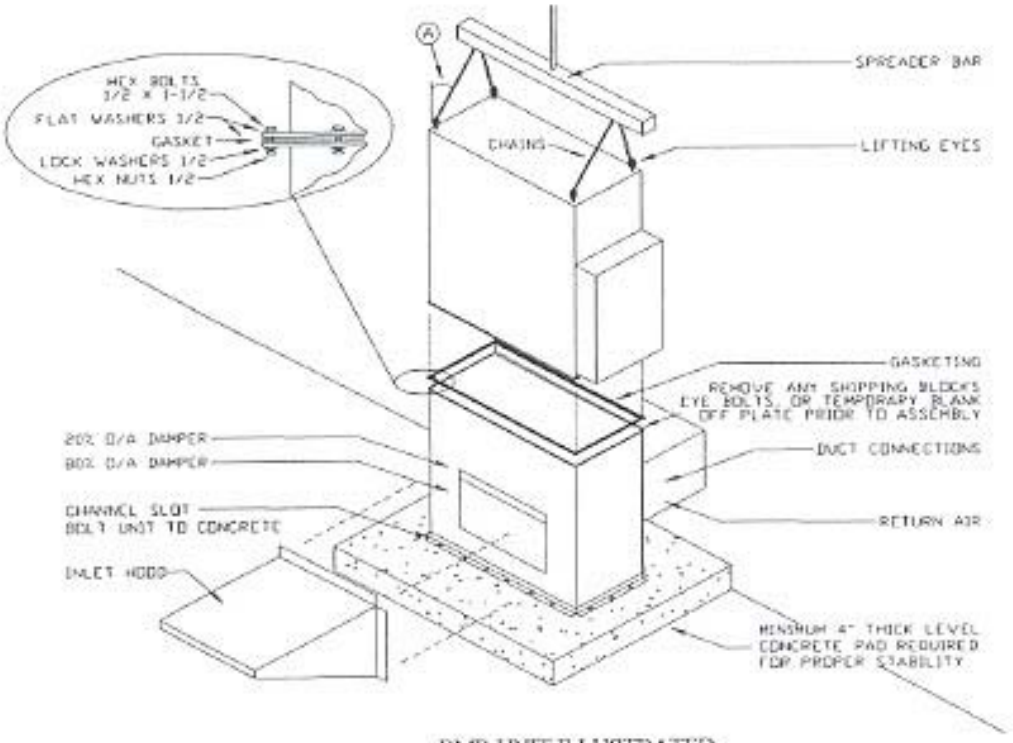
UNIT MUST BE LIFTED EVENLY FROM THE LIFTING HOLES PROVIDED AT EACH END OF THE BASE CHANNEL WHEN SUSPENDING FROM THE ROOF STRUCTURE. IF UNITS ARE TO BE LIFTED FROM THE BOTTOM FOR MOUNTING ON A PLATFORM (AS WITH A FORK LIFT), UNIT MUST BE SUPPORTED WITH TIMBERS, BEAMS OR TEMPORARY PLATFORM.



NOTE: INFORMATION FOR INSTALLATION OF HEATERS IN AIRPLANE HANGARS SHOULD BE IN ACCORDANCE WITH ANSI/NFPA 409.
ALSO NOTE: INFORMATION FOR INSTALLATION OF HEATER IN PUBLIC GARAGES SHOULD BE IN ACCORDANCE WITH THE STANDARD FOR PARKING STRUCTURES, ANSI/NFPA 88A, OR THE STANDARD FOR REPAIR GARAGES, ANSI/NFPA 88B.

DO NOT LIFT CABINET WITHOUT ADEQUATE SUPPORT.

RIGGING INSTRUCTIONS



BMR UNIT ILLUSTRATED

NOTE: THE MAXIMUM ANGLE PERMITTED FOR A VERTICAL LIFT IS 30 DEGREES
NOTE: KEEP SNOW AWAY FROM INLET. AVOID PLACEMENT OF HOOD INTO PREVAILING WINDS, IF AT ALL POSSIBLE.
NOTE: FAILURE TO RIG AND SUPPORT AS DESCRIBED MAY RESULT IN METAL FATIGUE, FAILURE, PROPERTY DAMAGE, INJURY OR DEATH.

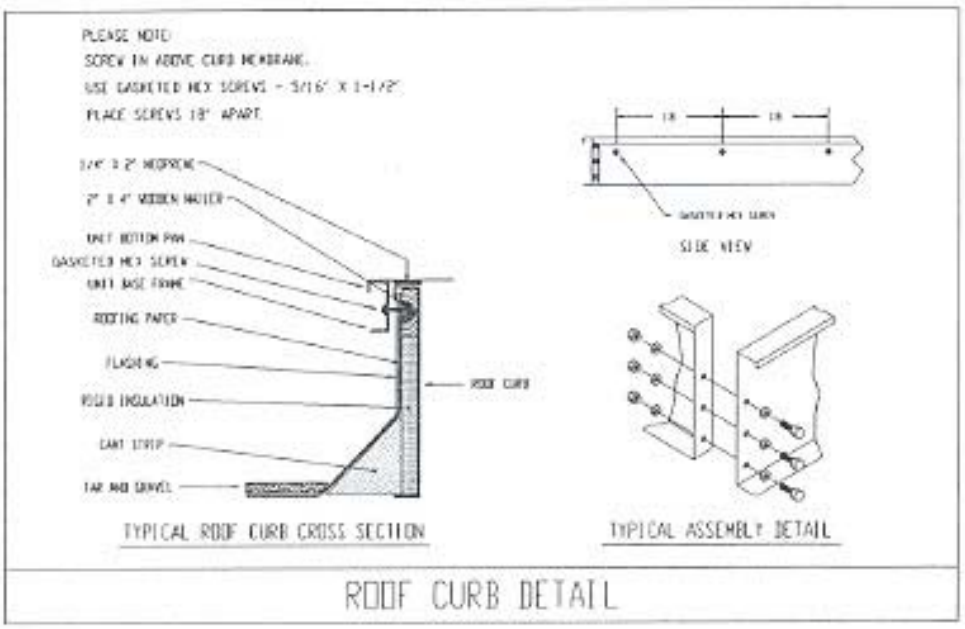
- **STACK UNIT FROM LOWEST SECTION UPWARD**
- **FACTORY SUPPLIED GASKETING MUST BE INSTALLED IN FIELD BY CONTRACTOR /INSTALLER BETWEEN ALL SECTIONS.**
- **LIFTING EYES AND CHANNEL SLOTS ARE DESIGNED TO BE LIFTED STRAIGHT UP VERTICALLY**
- **OUTDOOR UNITS MUST BE FIELD CAULKED WEATHER TIGHT AT ALL JOINTS, DUCT CONNECTIONS, GAS CONNECTIONS, ETC.**
- **ALL BOLTS MUST BE UTILIZED**

2.3.1 ROOF CURB ASSEMBLY & INSTALLATION

ALL ROOFTOP UNITS ARE AVAILABLE WITH AN OPTIONAL FULL PERIMETER ROOF CURB. THIS ROOF CURB IS AVAILIABLE IN 14", 24" OR SLOPED HEIGHTS.

THE ROOF CURB IS SHIPPED IN MULTIPLE PIECES FROM THE FACTORY. REFERING TO CURB ASSEMBLY DRAWINGS, ASSEMBLE THE CURB, THEN PROVIDE BOLTS FOR FASTENING AND TIGHTENING.ONCE THE ROOF CURB HAS BEEN ASSEMBLED AND FASTENED TO THE ROOF STRUCTURE INSURE THE FOLLOWING:

1. INSTALL CURB LEVEL AND SQUARE.
2. RUN ROOF FLASHING UP UNDER FACTORY PROVIDED "DRIP LIP" AND NAIL IT TO FACTORY PROVIDED WOOD NAILER.
3. BEFORE LOWERING UNIT ONTO ROOF CURB INSTALL GASKETING TO TOP OF ROOF CURB.
4. REFER TO FOLLOWING ROOF CURB DETAIL.
5. INSTALL INSULATION ON THE EXTERIOR OF ROOF CURB IN A SLOPED FASHION TO ALLOW WATER RUNOFF WHENEVER POSSIBLE



ROOF CURB DETAIL

2.4 CONNECT DUCTWORK

2.4.1 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 FIG. 1) PROVIDE OUTLET SCREEN ON DISCHARGE OF DUCT GRILLE OR THE BLOWER DISCHARGE FOR SAFETY WHEN UNIT IS NOT DUCTED.

IMR RETURN AND SUPPLY AIR CONNECTIONS

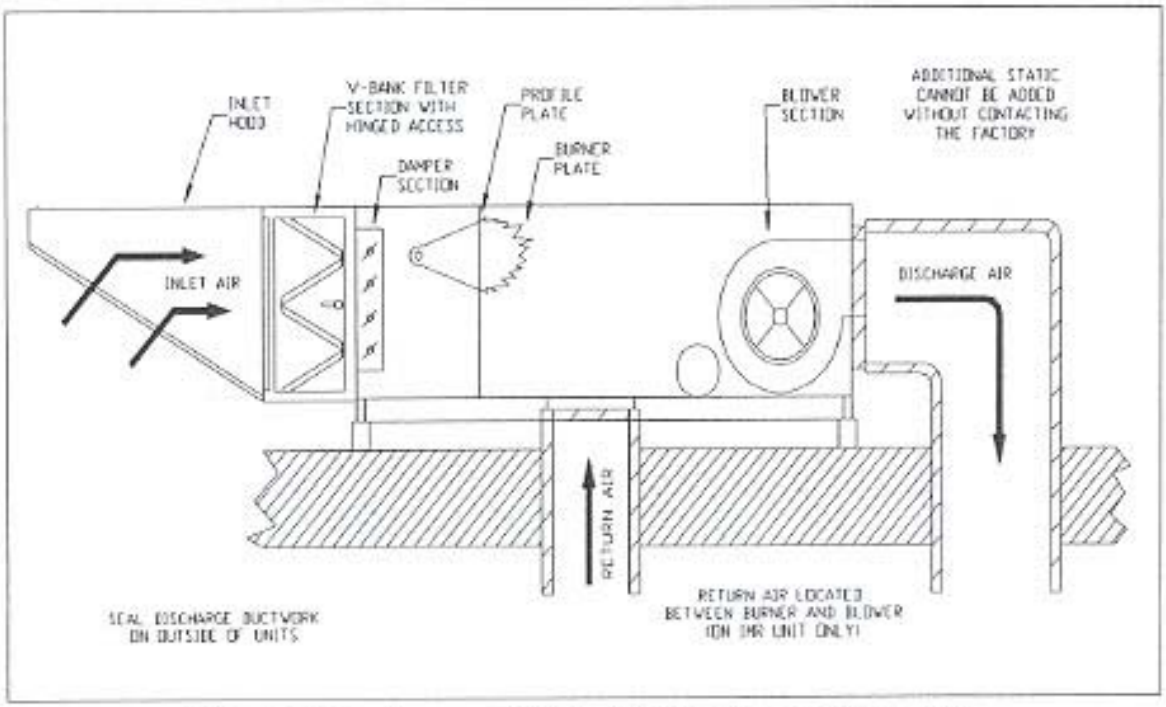


FIGURE 1 - IMR INSTALLATION

2.4.2 INDOOR UNITS MAY BE INSTALLED DIRECTLY AGAINST THE WALL OR DUCTED DIRECTLY TO A WALL LOUVRE.

- **MAKE REQUIRED OPENINGS IN WALL AND LINE WITH STEEL FRAME, PRIOR TO POSITIONING UNIT OR ATTATCHING OUTSIDE AIR HOOD TO WALL EXTERIOR. THIS WILL PREVENT CRUMBLING OF WALL BRICK.**
- **INSERT INSULATED FRESH AIR "COLLAR" THROUGH OPENING WITH FLANGES TURNED OUT TO PROVIDE RIGIDITY.**
- **ANCHOR INTAKE HOOD WITH BIRDSCREEN TO WALL.**
- **CAULK PERIMETER OF OPENING TO MAKE RAIN TIGHT.**

2.6 EXHAUST INTERLOCK

AN EXHAUST AIR FLOW PROVING SWITCH MAY BE USED TO INTERLOCK THE UNIT AND EXHAUST FAN(S). THE UNIT WILL THEN BE ENERGIZED ONLY WHEN THE FAN(S) ARE OPERATING. (REFER TO THE EXHAUST INTERLOCK WIRING DIAGRAMS PROVIDED WITH THE UNIT.)

2.6.1 THE UNIT'S TOTAL OUTDOOR AIR CAPACITY SHALL NOT EXCEED 110% OF THE RATED CFM FOR THE BUILDING EXHAUST SYSTEM. FOR APPLICATIONS INVOLVING MAKE-UP DIRECTLY INTO A BOOTH, THE TOTAL UNIT CAPACITY SHALL NOT EXCEED THE DISCHARGE CAPACITY OF THE BOOTH EXHAUST SYSTEM.

2.6.2 IT IS RECOMMENDED THAT THE EXHAUST AIR PROVING SWITCH BE SET TO OPEN WHEN THE EXHAUST VOLUME IS REDUCED BY MORE THAN 10% DUE TO BLOCKAGE IN THE EXHAUST, EXHAUST FAN BELT SLIPPAGE, ETC.

2.6.3 CONNECT GAS SUPPLY

2.6.4 RUN CORRECTLY SIZED GAS LINE TO UNIT. REFER TO NATIONAL FUEL CODE AND NATIONAL FIRE PROTECTION STANDARDS FOR PIPING INSTRUCIONS. INSTALL AN APPROVED MANUAL SHUT-OFF VALVE, PLUG-COCK TYPE. NOTE: MINIMUM GAS LINE PRESSURE WHEN UNIT IS AT FULL INPUT IS AT LEAST 8" W.C. REFER TO UNIT RATING PLATE. ALSO REFER TO UNIT RATING PLATE FOR MAXIMUM GAS INPUT.

2.6.5 INSTALLING CONTRACTOR SHALL INSTALL BLEED AND VENT LINES IN ACCORDANCE TO THE APPLICABLE PIPING CODES.

2.6.6 CHECK MINIMUM AND MAXIMUM GAS INLET PRESSURE BEFORE CONNECTING GAS LINE TO UNIT. CHECK THE GAS LINE SUPPLY PRESSURE WITH A MANOMETER OR A GUAGE TO INSURE THE MAXIMUM INLET PRESSURE INDICATED ON UNIT RATING PLATE IS NOT EXCEEDED.
ALSO, REFER TO THE UNIT RATING PLATE TO DETERMINE THE MINIMUM GAS INLET PRESSURE REQUIRED TO OPERATE THE UNIT AT FULL FIRE. A PRESSURE READING OF THE GAS SHOULD BE TAKEN AT THE TEST PORT PROVIDED. ALSO, CHECK THE UPSTREAM PILOT LINE TEST PORT. INSURE THE UPSTREAM MAIN GAS MANUAL SHUT-OFF VALVE IS FULLY OPEN WHEN CHECKING PILOT LINE GAS PRESSURE. DO NOT EXCEED MAXIMUM INPUT FOR THE HEATER AS STATED ON THE RATING PLATE OF THE UNIT.

2.6.8 REFER TO MANIFOLD DRAWING FOR VENTING INSTRUCTIONS, IF REQUIRED. ON REGULATORS LARGER THAN 1-1/4" IN. DIA. A LEAK LIMITER IS NOT PROVIDED. ALL REGULATORS NOT SUPPLIED WITH A LEAK LIMITER MUST BE VENTED OUTDOORS. ALL FIELD VENTING MUST BE CONDUCTED ACCORDING TO NFPA AND NATIONAL GAS CODE.

2.6.9 WEATHERPROOFING INSTRUCTIONS:

WEATHERPROOFING IS BASICALLY THE SAME AS STANDARD CONSTRUCTION, EXCEPT ALL ROOF JOINTS ARE SEALED WITH DRIVE ROOF SEAM CAPS, AND WITH SPECIAL ATTENTION GIVEN TO CAULKING AND SEALING ALL SEAMS.

NEOPRENE GASKETING IS TO BE USED BETWEEN UNIT SECTIONS AT THE TOP, BOTTOM AND SIDES WHERE SECTIONS MEET. FLANGES SHOULD BE CLAMPED TOGETHER BEFORE SCREWING SECTIONS TOGETHER. IT IS SUGGESTED THAT SCREWS ARE TO BE PLACED APPROXIMATELY 8 INCHES APART. (SEE SECTION JOINING DETAIL)

ONCE SECTIONS ARE SCREWED TOGETHER AS SAID ABOVE, JOINT CAPS CAN THEN BE ATTACHED. CAULK FLANGES ON BOTH SECTIONS BEFORE ATTACHING JOINT CAPS. SIDE CAPS ARE TO BE ATTACHED FIRST. BE SURE NOT TO SCREW THE 3 INCH FLANGE AT THE TOP OF THE SIDE CAP. THIS WOULD NOT ALLOW THE TOP CAP TO SIT FLAT. THE TOP CAP IS ATTACHED IN THIS SAME MANNER. THE TOP CAP WILL LAP IN THE CENTER BY APPROXIMATELY 2 INCHES. THIS LAP SHOULD ALSO BE CAULKED. SCREWS ARE TO BE PLACED APPROXIMATELY 8 INCHES APART. (SEE JOINT CAP DETAIL)

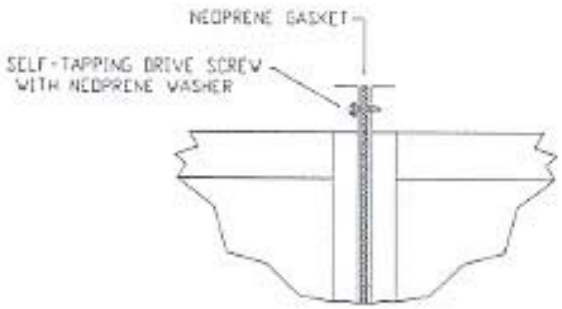
ALL SCREWS MUST BE EQUIPPED WITH NEOPRENE WASHERS

TYP. ROOF JOINT

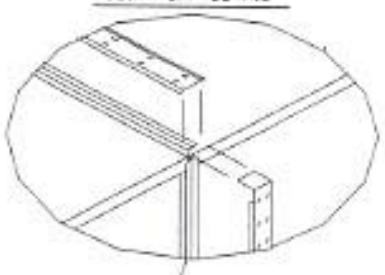
WEATHERPROOF UNITS REQUIRE ROOF SEAM CAP.

NOTE TO INSTALLING CONTRACTOR:

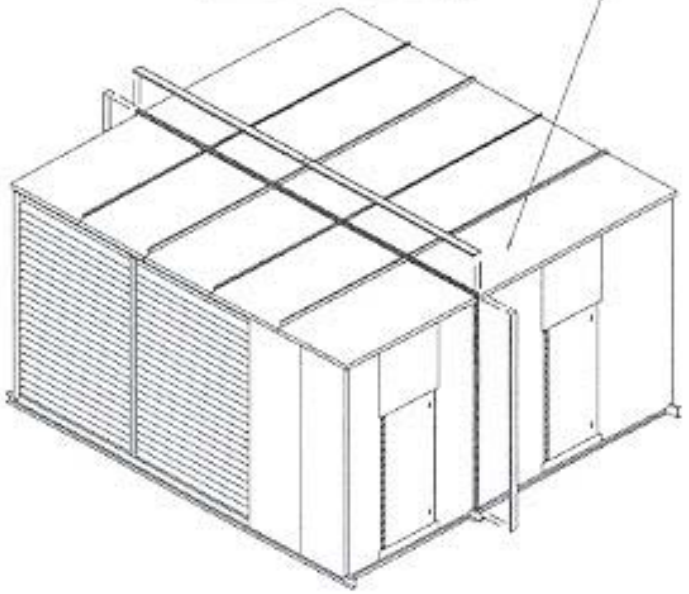
ALL DUCTWORK, DAMPERS AND OTHER ACCESSORIES TO BE WEATHERPROOFED, SEALED, CAULKED OR GASKETED AS REQUIRED.



JOINT CAP DETAIL



SECTION JOINING DETAIL



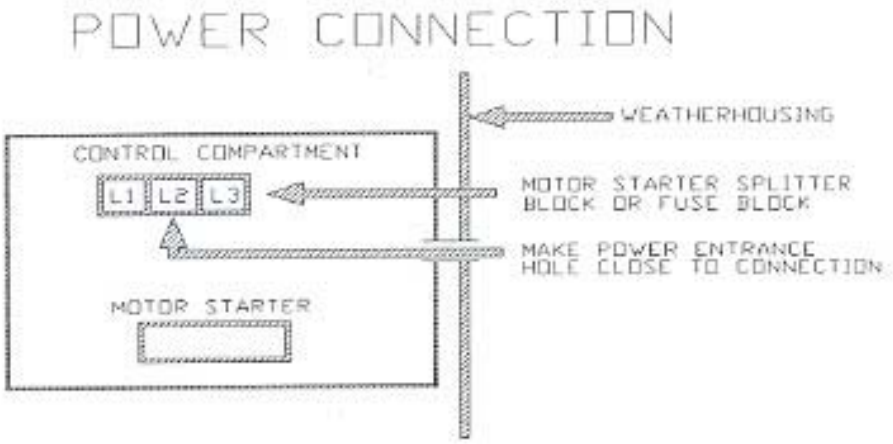
3.0 START UP AND SERVICE INSTRUCTIONS

3.1 FIELD WIRING

3.1.1 POWER CONNECTION

IF A DISCONNECT HAS NOT BEEN SUPPLIED WITH THE UNIT, INSTALL AN ELECTRIC DISCONNECT SWITCH WITH ADEQUATE AMPACITY (REFER TO THE UNIT RATING PLATE) ACCORDING TO ARTICLE 430 OF THE NATIONAL ELECTRIC CODE, ANSI\NFPA 70-1987.

ON INDOOR UNITS A HOLE IS TO BE MAKE IN THE CONTROL COMPARTMENT SIDE PANEL TO BRING POWER LINES IN. THE HOLE SHOULD BE LOCATED NEAR THE MOTOR STARTER SPLITTER BLOCK OR FUSE BLOCK, IF FACTORY INSTALLED.



ON OUTDOOR UNITS A HOLE MUST BE FIRST MADE THROUGH THE WEATHERHOUSING, AND THEN INTO THE CONTROL COMPARTMENT.

IMPORTANT: - TERMINATION OF THE CONDUIT FOR THE POWER SUPPLY MUST BE IN THE CONTROL COMPARTMENT NOT THE WEATHERHOUSING.

(NOTE: COVER MOTOR STARTER AND RELAYS IF DRILLING IN AND AROUND CONTROL PANEL TO AVOID DEBRIS CONTAMINATION.

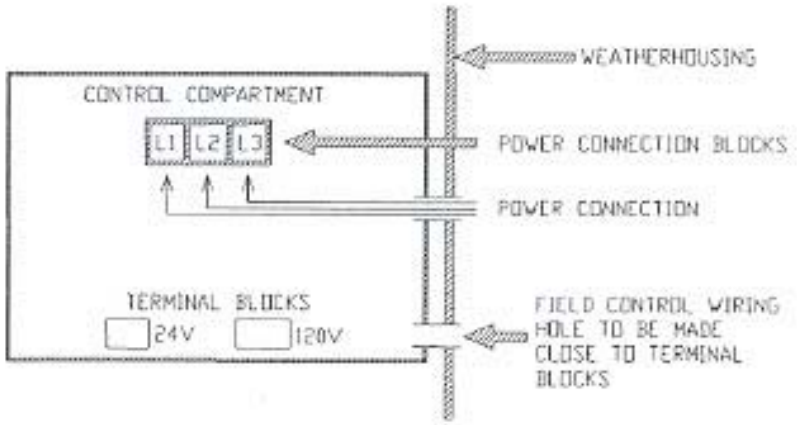
3.2 CONTROL WIRING CONNECTIONS

COMPLETE ALL WIRING TO ACCESSORIES (INTERLOCKS) ACCORDING TO THE WIRING DIAGRAMS PROVIDED WITH THE UNIT.

FOR INDOOR UNITS, MAKE AN ACCESS HOLE IN THE CONTROL CABINET TO BRING THE CONTROL WIRING TO THE TERMINAL STRIP. LOCATE THE HOLE AS CLOSE TO THE TERMINAL STRIP AS POSSIBLE TO PREVENT EXCESS UNSECURED WIRING COMING IN CONTACT WITH OTHER CONNECTIONS. ONE SIDE OF THE TERMINAL STRIP WILL BE LEFT FOR FIELD CONNECTIONS. IF 24V FIELD CONNECTIONS ARE TO BE MADE, A SEPARATE 24V TERMINAL STRIP AS MARKED IS PROVIDED.

FOR OUTDOOR UNITS, MAKE AN ACCESS HOLE FIRST IN THE WEATHERHOUSING AND THEN INTO THE CONTROL COMPARTMENT.

CONTROL WIRING CONNECTIONS



FIELD WIRING MAY BE REQUIRED ON UNITS SPLIT FOR SHIPMENT. REFER TO UNIT WIRING DIAGRAM. ALWAYS FULLY RUN AND TEST ALL FIELD CONTROL WIRING RE: CONNECTIONS.

INSTALL REMOTE PANEL IN DESIRED LOCATION, PROVIDED IT IS NOT A HAZARDOUS LOCATION OR SUBJECT TO FLAMMABLE VAPORS OR GASES.

COMPLETE FIELD WIRING TO SUPERVISOR PANEL AS INDICATED ON THE DRAWINGS PROVIDED WITH THE UNIT.

(USE A SEPARATE CONDUIT OR SHIELDED WIRE WHEN REMOTE CONTROLS CONTROLS OPERATE ON mA or Vdc, CONTROL SIGNALS.

3.21 SUPPLY PRESSURE TESTING

DISCONNECT GAS PIPING TO THE UNIT AND MAIN SHUT-OFF VALVE WHEN PRESSURE TESTING GAS SUPPLY SYSTEMS OVER ½ PSIG.

THE UNIT CAN BE ISOLATED FROM THE GAS SUPPLY SYSTEM BY CLOSING THE INDIVIDUAL MANUAL SHUTOFF VALVE DURING ANY PRESSURE TESTING OF THE GAS AND SUPPLY SYSTEM OF ½ PSIG AND BELOW.
REFER TO THE HEATER RATING PLATE FOR DETERMINING THE MINIMUM GAS SUPPLY PRESSURE FOR OBTAINING THE MAXIMUM GAS CAPACITY FOR WHICH THE HEATER IS SPECIFIED.

3.21.1 START-UP PROCEDURE

3.3.1 REMOVE SHIPPING BLOCKS FROM BLOWER OR VIBRATION ISOLATORS:

A. REMOVE THE GLASS COVER AND SHIPPING SCREWS FROM THE GAS PRESSURE LIMIT SWITCHES, IF FURNISHED.

B. CHECK THAT THE DAMPERS OPEN FREELY, REMOVE WIRE TIES.

3.3.2 INSURE THAT MAIN FIRING VALVE IS CLOSED, BUT THAT GAS IS AVAILABLE IN THE SERVICE LINE.

3.3.3 CHECK INLET AIR CONTROLLER SETTING (TC-02) . THE NORMAL FACTORY SETTING IS 65 F. WHEN THE OUTDOOR AIR TEMPERATURE REACHES 65 F, THE BURNER WILL BE LOCKED OUT AND THE BLOWER WILL CONTINUE TO OPERATE. IF UNIT IS TO BE TESTED WHEN OUTSIDE TEMPERATURE EXCEEDS 65 F, JUMPER THE CONTROL OUT OF THE CIRCUIT. INSURE THAT WHEN THE TEST IS COMPLETED THAT THE JUMPER IS REMOVED.

3.3.4 INSURE THAT A DIFFERENTIAL OF A LEAST 5 DEGREES F IS MAINTAINED BETWEEN THE INLET AIR CONTROLLER SETTING AND THE SETTING OF THE DISCHARGE AIR CONTROLLER.

3.3.5 CLOSE THE MAIN DISCONNECT SWITCH.

3.3.6 IF EQUIPPED, INSURE LOCAL ON/OFF POSITION IS IN CORRECT POSITION. IF AN EXHAUST FAN SWITCH HAS BEEN FURNISHED, INSURE THAT THE SWITCH IS IN THE ON POSITION AND THE FAN IS POWERED. LIGHTS WILL INDICATE EXHAUST FAN ON AND UNIT ON.

3.3.7 WITH THE SWITCH IN THE ON POSITION AND THE EXHAUST INTERLOCK MADE, THE INLET DAMPER MOTOR WILL BE POWERED OPEN. WHEN THE APPROPRIATE DAMPER IS FULLY OPENED, A CIRCUIT THROUGH THE END SWITCH WILL ENERGIZE THE BLOWER MOTOR STARTER. A LITE IN THE PANEL WILL INDICATE THE BLOWER IS OPERATIONAL.

STARTER CONTACTS SHOULD PULL IN AND HOLD WITHOUT CHATTERING (3 PHASE UNITS). IF THEY DO NOT OPERATE QUIETLY CHECK TO INSURE THAT THE PROPER VOLTAGE IS SUPPLIED TO THE UNIT.

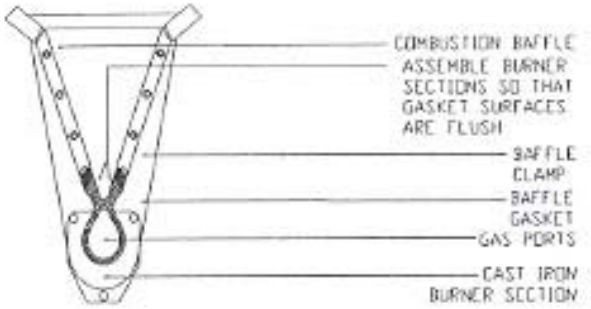
3.3.8 IF EQUIPPED INSURE LOCAL BURNER SWITCH IS IN THE CORRECT POSITION. WITH THE SUMMER-WINTER SWITCH IN THE WINTER POSITION, THE PILOT CIRCUIT WILL BE ENERGIZED. IF THIS IS NOT THE CASE CHECK TO INSURE THAT THE MANUAL HIGH LIMIT CONTROL IS SET.

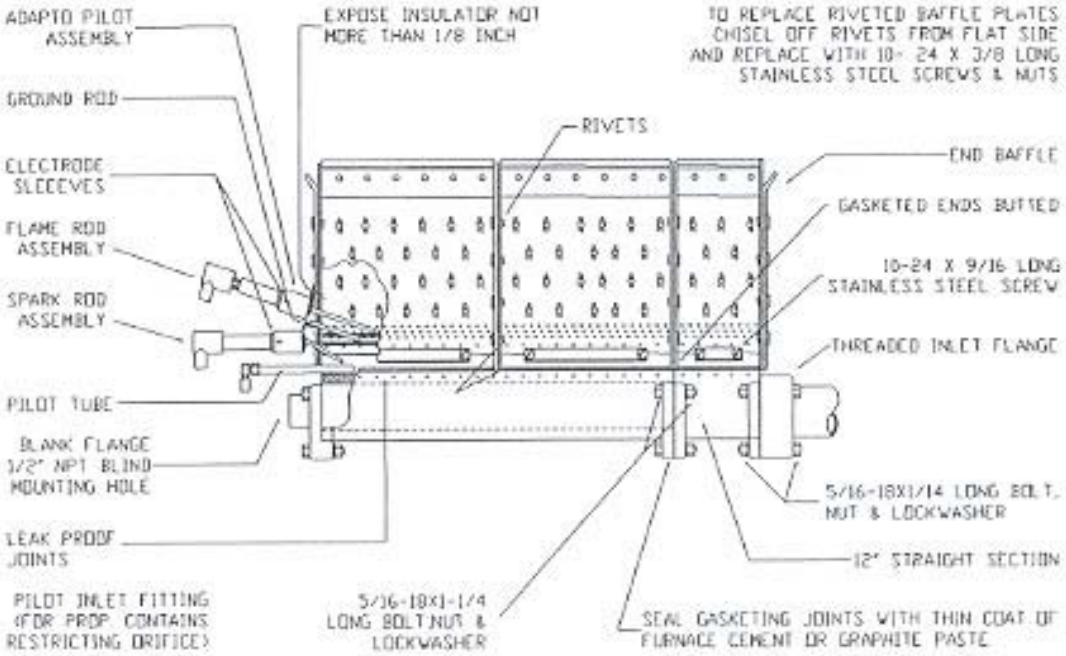
3.3.9 PILOT - THE FLAMESAFEGUARD MONITORS THE PILOT FLAME THROUGH THE FLAMEROD. A MINUTE CURRENT IS SENT FROM THE RELAY THROUGH THE FLAME ROD, AND THROUGH THE PILOT FLAME TO "GROUND". THE RELAY DETECTS THE CURRENT FLOW AND IN TURN OPENS THE MAIN GAS SAFETY VALVE. IF NO FLAME IS PRESENT, CURRENT WILL NOT FLOW AND THE RELAY WILL NOT ALLOW THE VALVE TO OPEN. THE CURRENT FLOW IS DEPENDENT ONLY ON FLAME CONTACT ON THE ROD; TEMPERATURE OF THE ROD IS OF NO IMPORTANCE.

THE FLAME ROD IS A CURRENT-CARRYING CONDUCTOR, THEREFORE MUST BE FREE OF ANY CONTACT WITH CONDUCTIVE PARTS OF THE PILOT BURNER. THE 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 AT THE POINT OF FLAME CONTACT. CHECK FOR CORROSION OR LOSS OF METAL AND THAT IT IS SUFFICIENTLY TIGHT IN THE INSULATOR TO MAINTAIN POSITION. WHEN SERVICING, DO NOT OVER TORQUE OR THE INSULATOR MAY CRACK AND MUST BE REPLACED.

PROPER OPERATION OF THE FLAME ROD CAN BE CHECKED BY MEASURING THE FLAME RODS CURRENT. IF A MICROMETER IS NOT AVAILABLE, A CHECK CAN BE MADE BY OPERATING BURNER THROUGH ALL ITS NORMAL PHASES. RELAY RESPONSE SHOULD BE PROMPT WITH NO CHATTERING OR DROP OUT. AN OPTIONAL ULTRA-VIOLET SCANNER MAY ALSO DETECT FLAME.

THE SPARK ROD PRODUCES A HIGH TENSION ARC AT THE CORRECT LOCATION FOR LIGHTING THE PILOT. IGNITION TRANSFORMER MUST BE RATED FOR 6,000 VOLTS, 20 MILLIAMPERE SECONDARY, MINIMUM.





CLEANING AND MAINTENANCE OF BURNER:

PERIODIC MAINTENANCE WILL INSURE CONTINUED TROUBLE-FREE OPERATON OF YOUR BURNER. AT LEAST A YEARLY INSPECTION IS RECOMMENDED FOR HEATED INSTALLATIONS AND MORE OFTEN IF IN CONSTANT USE. YOUR OWN EXPERIENCE IS THE BEST GUIDE FOR DETEMINING FREQUENCY OF INSPECTION, BUT AS A MINIMUM THE FOLLOWING PROCEDURE SHOULD BE FOLLOWED:

- **SHUT DOWN SYSTEM TOTALLY, DISCONNECTING OR LOCKING OUT POWER SUPPLY SO THERE CAN BE NO ACCIDENTAL START-UP DURING INSPECTION.**
- **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. IF ANY BURNER PORTS ARE PLUGGED (EVEN PARTIALLY) CLEAR THEM WITH A PIECE OF WIRE OR A DRILL BIT MATCHING THE DRILL SIZE FOR YOUR APPROPRIATE BURNER TYPE.**

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 FASTENERS.

- 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.
- OBSERVE FLAME PATTERN AND, IF NECESSARY, TAKE STEPS TO CORRECT VELOCITY AND / OR AIR DISTRIBUTION PROBLEMS

3.3.10 IF PILOT TRIES FOR IGNITION, BUT LOCKS OUT, INSURE THE LOW AIR PROVING SWITCH THAT IS MOUNTED ACROSS THE PROFILE PLATE IS MADE. IF NOT, FIRST CHECK THAT THE BLOWERS ARE RUNNING IN THE PROPER DIRECTION. THE CHECK MAY BE VISUAL OR PLACE A DIFERENTIAL GUAGE ACROSS THE PROFILE PLATE OF THE BURNER SECTION. THE PRESSURE DROP IS MARKED ON THE RATING PLATE ATTACHED ON THE UNIT. IF PRESSURE DROP IS BETWEEN .30" W.C. AND .95" W.C., THESE SWITCHES SHOULD BE MADE, THEN CHECK PILOT TO INSURE PROPER FLAME. CHECK INSTRUCTION SHEET FOR FLAME SAFEGUARD SYSTEM.

PILOT ADJUSTMENT SCREW IS IN THE THERMAX SHUT-OFF VALVE. WHEN SETTING, ADJUST FOR THE BEST READING, WITH THE OPEN PILOT SET SCREW.

3.3.12 GRADUALLY OPEN FIRING VALVE TO START MAIN FLAME. CHECK FOR FLAME OVER ENTIRE BURNER LENGTH.

3.3.13 FOR UNITS PROVIDED WITH A JOHNSON CONTROLLER ADJUST LOW-FIRE SET SCREW ON THE BUTTERFLY VALVE. TURN THE DISCHARGE CONTROLLER TO THE 0 POSITION FOR LOW FIRE ADJUSTMENT. TO SET FOR HIGH FIRE, DISCONNECT LINKAGE FROM MODULATING MOTOR, OPEN BUTTERFLY VALVE BY HAND TO GET "FULL-FIRE". ADJUST PRESSURE REGULATOR SO THAT PRESSURE GAUGE ON BURNER MANIFOLD MATCHES NAMEPLATE READING, WHILE ADJUSTING UNIT IN WARM WEATHER; DO NOT RUN AT FULL FIRE FOR MORE THAN ONE MINUTE AT A TIME OR DAMAGE TO THE DISCHARGE CONTROLLER MAY RESULT. RECONNECT LINKAGE TO MOTOR SHAFT. ADJUST GAS VALVE ACTUATOR FOR PROPER STROKE WITHOUT BINDING.

3.3.14 CHECK LIMIT CONTROL AND GAS PRESSURE SWITCH SETTING. CYCLE UNIT ON LIMIT TO CONFIRM PROPER OPERATION ONSITE.

LIMIT CONTROL . . . . . (BMR=185 F) (BMA=150 F)
HIGH PRESSURE GAS SWITCH . . . . 6" W.C. SETPOINT
LOW PRESSURE GAS SWITCH . . . . 2" W.C. SETPOINT

NOTE: THE HIGH AND LOW GAS PRESSURE SWITCHES MAY BE THE MANUAL RESET TYPE ON SOME UNITS.

3.3.15 FOR MAXITROL TEMPERATURE CONTROL SYSTEMS
REFER TO PAGES 39 THRU 49 OF THIS MANUAL.

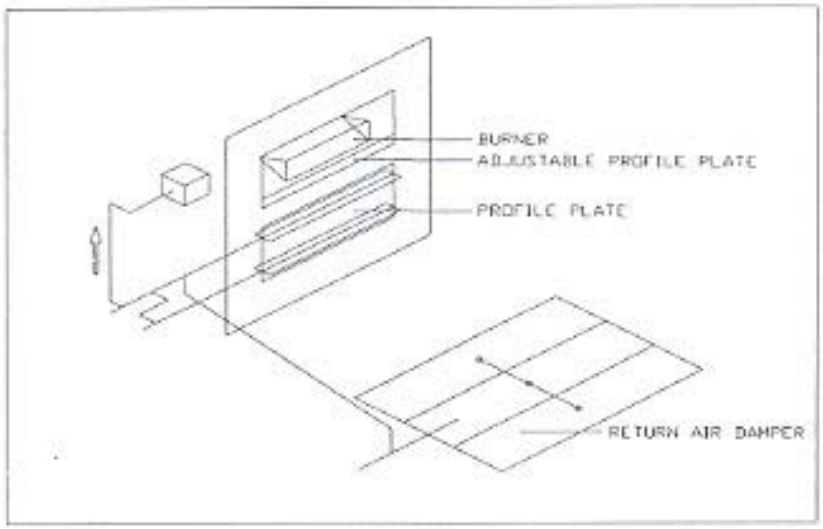
3.3.16 FLAME SUPERVISION CHECK:

THE FLAME SUPERVISION RELAY 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. THE UNIT SHOULD LOCK OUT.

CHECK THE MAIN SAFETY VALVE FOR GAS SEAL BY PLACING A MANOMETER IN THE MANIFOLD BETWEEN THE SAFETY 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, REPLACE THE SAFETY VALVE.

3.3.17 CFM

THE UNIT DEPENDS UPON AN ADEQUATE SUPPLY OF AIR FOR GOOD COMBUSTION AND OPERATION. CARE SHOULD BE TAKEN TO INSURE THAT PROPERLY SIZED INLET HOOD AND DUCTWORK ARE INSTALLED AND THAT THE UNIT IS DISCHARGING THE DESIGN CFM.



NOTE: RECIRCULATION IS NOT RECOMMENDED IN UNINSULATED BULDINGS WHERE OUTSIDE TEMPERATURES FALL BELOW 32 DEGREES FAHRENHEIT (0 DEGREES CELCIUS)

IMR R/A & PROFILE DAMPER ILLUSTRATED ABOVE.

BMR SERIES 80/20 RECIRCULATION OPTION

WHEN UNIT IS EQUIPPED WITH THE 80/20 OPTION UP TO 80% RETURN AIR MAY BE RECIRCULATED FROM THE SPACE. WHEN THE BURNER IS OPERATING A MINIMUM OF 20% FRESH AIR IS REQUIRED.
RETURN AIR IS RECIRCULATED BACK THROUGH THE BURNER PER ANSI STANDARDS. THE MIXBOX 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.

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:

- 0-135 OHM MANUAL POTENTIOMETER
- DWYER NULL FLOATING BUILDING PRESSURE CONTROLLER
- 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
- COMBINATION OF MANUAL POTENTIOMETER AND OTHER CONTROLLER

IMPORTANT: FRESH AIR DAMPER MUST NEVER BE ADJUSTED OR REPOSITIONED TO ALLOW LESS THAN 20% FRESH AIR WHEN BURNER IS OPERATING.

FIGURE F1 ILLUSTRATES THE MIXBOX SECTION FOR A BMR 80/20 UNIT.

SEQUENCE. UPON UNIT START-UP THE TWO POSITION DAMPER ACTUATOR OPENS ALLOWING 20% FRESH AIR THROUGH THE OUTSIDE DAMPER. A DAMPER CONTROLLER ACTUATES THE 0-80% F/A & R/A DAMPERS TO MAINTAIN THE DESIRED POSITION.

NO DAMPER ADJUSTMENT SHOULD BE REQUIRED. CHECK TO ENSURE OUTSIDE AIR DAMPER MAINTAINS A MINIMUM OF 20% FRESH AIR WHILE BURNER IS OPERATING. 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; 0.65 in. W.C. TO 0.85 in. W.C. 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.

- THE MAXIMUM BURNER FIRING RATE SHOULD BE ADJUSTED TO VALUE STATED ON THE RATING PLATE (MAXIMUM 4.5 in. ON HIGH FIRE.) THIS VALUE CAN BE OBTAINED WHILE THE TEST FIRING VALVE IS OPENED AND THE UNIT IS ON HIGH FIRE. (MAXITROL MODELS #4 WIRE TEMPORARILY REMOVED.) REFER TO MAXITROL OPERATING INSTRUCTIONS BEGINNING ON PAGE 39 OF THIS MANUAL.

PRECAUTIONS INVOLVING THE DIRECT FIRED BURNER:

- WHEN THE BURNER OPERATES OUTSIDE THE 0.65-0.85 IN W.C. PROFILE PRESSURE DROP, IT CAN PRODUCE DANGEROUSLY HARMFUL LEVELS OF CARBON MONOXIDE, NITROGEN DIOXIDE AND ALIPHATIC ALDIHIDES.

- ALWAYS CHECK THAT THE BURNER IS NOT FIRING IN EXCESS OF THE UNIT NAMEPLATE MAXIMUM FIRING RATE VALUE.

BMR SERIES 80/20 RECIRCULATION OPTION

- ALWAYS CHECK THAT THE BURNER IS COMPLETELY LIT ACROSS THE ENTIRE LINE BURNER UNDER LOW FIRE CONDITION. IF THE BURNER IS NOT COMPLETELY LIT ACROSS ITS LENGTH A DANGEROUS CONDITION RESULTS IN WHICH RAW GAS MAY PASS INTO THE SUPPLY AIR OF THE UNIT.
- 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.

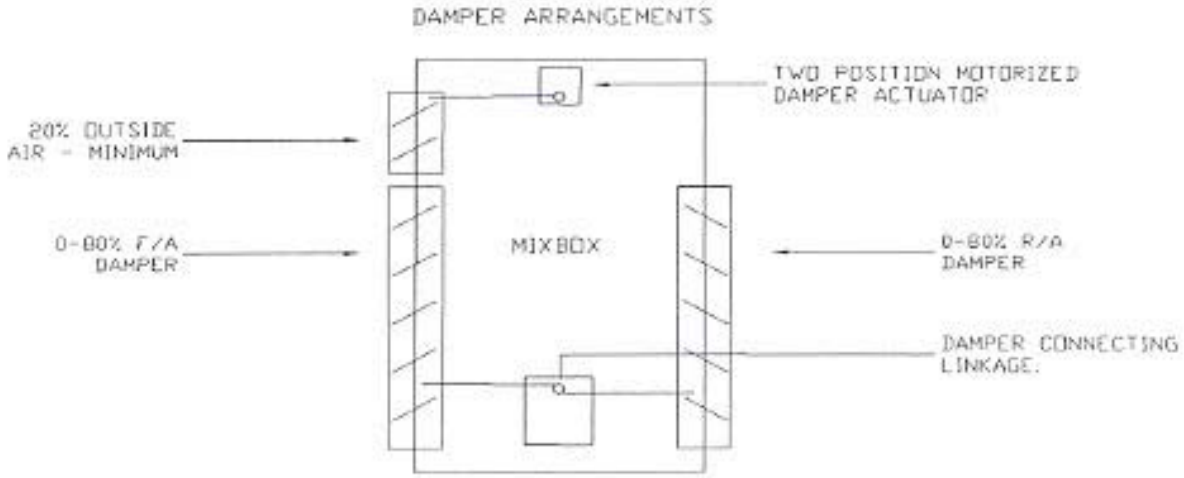


FIGURE: F1

SOME GENERAL GUIDELINES:

MANUAL: FRESH AIR AND RETURN AIR PROPORTIONS MAY BE ADJUSTED TO ANY VALUE AS REQUIRED. UNDER ALL CONDITIONS DO NOT ADJUST FRESH AIR DAMPER LESS THAN 20% OPENED.

TWO POSITION ACTUATOR: FRESH AIR AND RETURN AIR POSITIONS MAY BE ADJUSTED TO ANY VALUE AS REQUIRED. WHEN UNIT SHUTS DOWN NORMALLY OUTSIDE AIR DAMPER IS ADJUSTED TO CLOSE OFF COMPLETELY TO PREVENT OUTDOOR AIR MIGRATION. UNDER ALL CONDITIONS DO NOT ADJUST FRESH AIR DAMPER LESS THAN 20%, WHILE UNIT IS OPERATING.

MODULATING DAMPER ACTUATOR:

**BUILDING PRESSURE CONTROL METHOD*: A TWO POSITION ACTUATOR OPENS OUTSIDE AIR DAMPER TO A MINIMUM OF 20% FRESH AIR. A MODULATING ACTUATOR THEN VARIES IN RESPONSE TO THE PRESSURE SENSOR CONTROLLING 0-80% RETURN AIR QUANTITY.

**MANUAL POTENTIOMETER:* A UNIT MOUNTED POTENTIOMETER IS FACTORY SET AT 20% OUTSIDE AIR MINIMUM POSITION WHEN UNIT IS OPERATING. A REMOTE POTENTIOMETER THEN VARIES THE OUTSIDE AIR AND RETURN AIR DAMPERS FROM 20-100% AND 0-80% RESPECTIVELY ON DEMAND.

DDC OR PRESSURE TRANSMITTER OPERATION (4-20 MA OR 0-10VDC):

THE 20% MINIMUM OUTSIDE AIR REQUIRED IS DIALED INTO THE "ZERO" POINT OF THE ACTUATOR INTERFACE MODULE. ALSO THE 80% RETURN AIR POSITION IS DIALED INTO THE "SPAN" POINT OF THE MODULE. THE ACTUATORS THEN VARY FROM 0-80% RETURN AIR AND 20-100% OUTSIDE AIR IN RESPONSE TO PROPORTIONAL SIGNAL.

IMR SERIES 80/20 RECIRCULATION OPTION

WHEN UNIT IS EQUIPPED WITH THE 80/20 OPTION UP TO 80% RETURN AIR MAY BE RECIRCULATED FROM THE SPACE. WHEN THE BURNER IS OPERATING A MINIMUM OF 20% FRESH AIR IS REQUIRED.
RETURN AIR IS RECIRCULATED AFTER THE BURNER PER ANSI STANDARDS. THE BURNER PROFILE (FREE AREA AROUND THE BURNER) IS SET UP TO PROVIDE A CONSTANT 20% FRESH AIR FOR PROPER COMBUSTION. THIS FREE AREA AROUND THE BURNER IS DESIGNED INTO THE UNIT FROM THE FACTORY, AND NO ADJUSTMENT OF THE OPENING IS REQUIRED. A PROFILE DAMPER AND RETURN AIR DAMPER THEN PROVIDE THE BALANCE OF AIR.

DAMPER ARRANGEMENTS

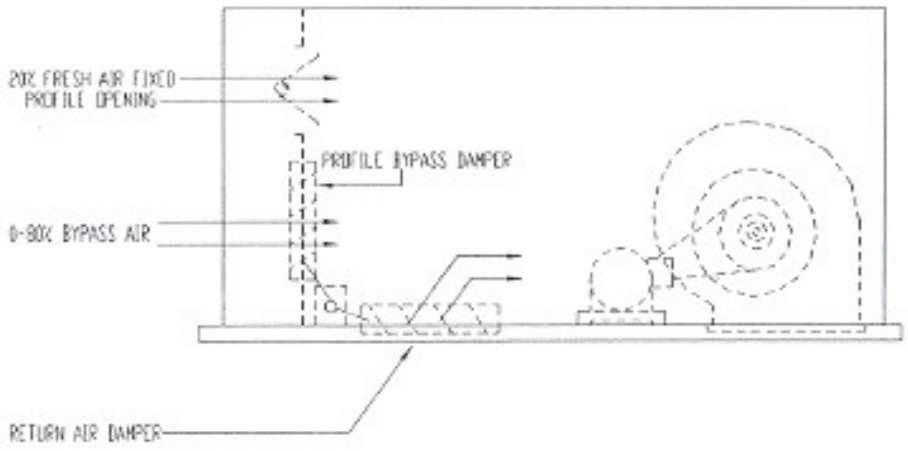
THE RETURN AIR CAN BE MODULATED ANYWHERE FROM 0 TO 80%. THE THREE MOST COMMON METHODS OF CONTROL ARE:

1.) **MANUAL QUADRANT ADJUSTMENT. THE DAMPER LINKAGE IS MANUALLY ADJUSTED AND THEN LOCKED IN 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. COMMON APPLICATIONS INCLUDE INTERLOCKING UNIT TO A TIME CLOCK, EXHAUST AIR PROVING SWITCH OR DOOR SWITCHES.**

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:**

- **0-135 OHM MANUAL POTENTIOMETER. THIS ALLOWS FOR MANUAL REMOTE PANEL SELECTION OF THE AMOUNT OF FRESH AIR BEING INTRODUCED INTO THE BUILDING.**
- **DWYER "NULL" FLOATING POINT BUILDING PRESSURE CONTROLLER. THIS OPTION ALLOWS FOR AUTOMATIC BUILDING PRESSURE CONTROL TO MAINTAIN AN ADJUSTABLE SETPOINT. UNDER TYPICAL SPACE HEATING APPLICATIONS THE RECOMMENDED BUILDING PRESSURE LEVEL IS +0.05 IN W.C.**
- **DWYER MAGNAHELIC TRANSMITTER GAUGE –4 TO 20 MA OR 0-10 VDC SIGNAL. THIS IS A MORE SOPHISTICATED CONTROL WHICH MAY BE USED IN CONJUNCTION WITH BUILDING MANAGEMENT SYSTEM.**
- **DDC INTERFACE I.E. 4 TO 20 MA OR 0-10VDC SIGNAL BY OTHERS**
- **COMBINATION OF MANUAL POTENTIOMETER AND OTHER CONTROLLER**



IMR SERIES 80/20 RECIRCULATION OPTION

IMR 80/20 DAMPER SET-UP AND ADJUSTMENT

THE IMR SERIES RECIRCULATION OPERATES OFF PRESSURE. THIS PRESSURE MUST BE ADJUSTED TO CONTROL FRESH AIR AND RETURN AIR MIXTURE AND MORE IMPORTANTLY COMBUSTION FOR THE BURNER. THE BURNER IS SITUATED INSIDE AN ORIFICE IN THE AIRSTREAM CALLED THE PROFILE OPENING. FOR BEST COMBUSTION THE BURNER OPERATES AT APPROXIMATELY 0.65 IN W.C. PROFILE PRESSURE DROP WHILE ON HIGH FIRE. TO OPERATE UNIT ON HIGH FIRE FOR SET UP PURPOSES REFER TO SECTION ON MAXITROL TEMPERATURE CONTROL OR LOOK THROUGH ADDITIONAL PAMPHLET IF INCLUDED.

ADJUSTING THE BURNER COMBUSTION AND THE 80/20 OPERATION:

1.) THE PROFILE PRESSURE DROP OF THE BURNER SHOULD BE WITHIN THE FOLLOWING LIMITS; 0.65 IN. W.C. TO 0.85 IN. W.C. THIS VALUE CAN BE OBTAINED WITH A MANOMETER FROM THE LAST PRESSURE PORT ON THE GAS TRAIN WHILE THE MANUAL TEST FIRING VALVE IS CLOSED AND THE BLOWER IS RUNNING. IT IS IMPORTANT TO CHECK THE PRESSURE DROP THROUGH THE ENTIRE STROKE FROM 0-80% RETURN AIR.
   - START WITH A REFERENCE POINT, PREFERABLY RETURN AIR TOTALLY CLOSED. IF YOUR PROFILE PRESSURE DROP IS NOT BETWEEN 0.65 IN. W.C. TO 0.85 IN.W.C. THE PROFILE BYPASS DAMPER MUST BE OPENED TO REDUCE THE PRESSURE OR CLOSED TO INCREASE THE PRESSURE.
   - ONCE THE PROFILE PRESSURE DROP HAS BEEN SET UP IN 100% OUTSIDE AIR RETIGHTEN THE INTERLOCKING LINKAGE TO THE RETURN AIR DAMPER. NOW STROKE THE PROFILE BYPASS DAMPER CLOSED, THIS CAUSES THE RETURN AIR DAMPER TO OPEN. NOTE THE RETURN AIR DAMPER MAY NOT OPEN ALL THE WAY. IN SOME INSTANCES THE DAMPER MAY ONLY OPEN A FRACTION OF THE WAY DEPENDING ON THE CAPACITY OF YOUR UNIT. WITH THE PROFILE BYPASS DAMPER COMPLETELY CLOSED AND THE RETURN AIR DAMPER OPEN RETAKE YOUR PROFILE PRESSURE DROP READING. WITH THE PROFILE BYPASS DAMPER REMAINING CLOSED, OPENING THE RETURN AIR DAMPER WILL REDUCE AND CLOSING THE RETURN AIR DAMPER WILL INCREASE THE PROFILE PRESSURE DROP.
2.) THE BURNER FIRING RATE SHOULD BE ADJUSTED TO VALUE STATED ON THE RATING PLATE. (MAXIMUM 4. 5 IN. ON HIGH FIRE.) THIS VALUE CAN BE OBTAINED USING A MANOMETER ON THE LAST TEST PORT EXCEPT THE READING IS TAKEN WHILE THE TEST FIRING VALVE IS OPENED AND THE UNIT IS ON HIGH FIRE. (MAXITROL MODELS #4 WIRE TEMPORARILY REMOVED –REFER TO MAXITROL OPERATING INSTRUCTIONS.)

PRECAUTIONS INVOLVING THE DIRECT FIRED BURNER:

- ALWAYS CHECK BURNER PROFILE PRESSURE DROP. IF THE BURNER IS OPERATING OUTSIDE THE 0.65 - 0.85 IN. W. C. PROFILE PRESSURE DROP IT CAN PRODUCE DANGEROUSLY HARMFUL LEVELS OF CARBON MONOXIDE, NITROGEN DIOXIDE AND ALIPHATIC ALDIHIDES.
- 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 UNDER LOW FIRE CONDITION. IF THE BURNER IS NOT COMPLETELY LIT ACROSS ITS LENGTH A VERY DANGEROUS CONDITION RESULTS IN WHICH RAW GAS MAY PASS INTO THE SUPPLY AIR OF THE UNIT.
- ALWAYS VISUALLY INSPECT FOR ANY SHIPPING DAMAGE TO THE GAS MANIFOLD AND THE LINE BURNER. USE A GAS SNIFTER OR WATER SOAP SOLUTION TO CONFIRM NO GAS LEAKS.

6.0 TYPICAL TEMPERATURE CONTROLS, ELECTRICAL SCHEMATICS AND PANELS

SYSTEM 100M: FEATURES MAXITROL SERIES 14 ELECTRIC TEMPERATURE CONTROL. BURNER FIRING RATE IS MODULATING TO MAINTAIN A CONSTANT DISCHARGE TEMPERATURE. THE DISCHARGE TEMPERATURE IS SET BY REMOTE TEMPERATURE SELECTOR (RTS) LOCATED IN THE REMOTE PANEL. AN OPTION AVAILABLE TO THE SYSTEM IS AN OUTDOOR RESET THERMOSTAT. IN RESPONSE TO OUTDOOR TEMPERATURE CHANGES, THE THERMOSTAT RESETS THE DISCHARGE TEMPERATURE UNIVERSELY TO THE AMBIENT TEMPERATURE SENSED. COMPONENTS INCLUDE

*MP-14 DISCHARGE TEMP. SELECTOR *RE-03 LO-FIRE START RELAY (if over 1000mbh)
*RE-14 ELECTRONIC TEMP. CTRL RELAY *TS-14 DISCHARGE TEMP. SENSOR
*VG-05 CAPACITY CTRL VALVE

SYSTEM 200M: FEATURES MAXITROL SERIES 14 ELECTRONIC TEMPERATURE CONTROL. IN ADDITION TO THE RTS, A SPACE THERMOSTAT IS FURNISHED. IF THE THERMOSTAT SETTING IS NOT SATISFIED, THE DISCHARGE TEMPERATURE IS INCREASED UNTIL THE THERMOSTAT IS SATISFIED. THE DEGREE OF OVERRIDE CAN BE ADJUSTED AT THE RTS. OPTION AVAILABLE IS AN OUTDOOR RESET STAT. COMPONENTS INCLUDE

*MP-14 DISCHARGE TEMP. SELECTOR *RE-03 LO-FIRE START RELAY (if over 1000mbh)
*RE-14 ELECTRONIC TEMP. CTRL RELAY *TS-14 DISCHARGE TEMP. SENSOR
*VG-05 CAPACITY CTRL VALVE *TC-15 ROOM OVERRIDE THERMOSTAT

SYSTEM 300M: FEATURES THE MAXITROL SERIES 44 ELECTRONIC CONTROL SYSTEM. THE BURNER FIRING RATE IS MODULATING IN RESPONSE TO AN AMPLIFIED SIGNAL FROM A ROOM MOUNTED THERMOSTAT. THE DISCHARGE TEMPERATURE IS MAINTAINED WITHIN PRESET MAXIMUM AND MINIMUM SETTINGS ON THE AMPLIFIER. THE CONTROL PACKAGE INCLUDES A THERMOSTAT SELECTOR MOUNTED EITHER ON THE REMOTE PANEL OR IN THE SPACE. COMPONENTS INCLUDE

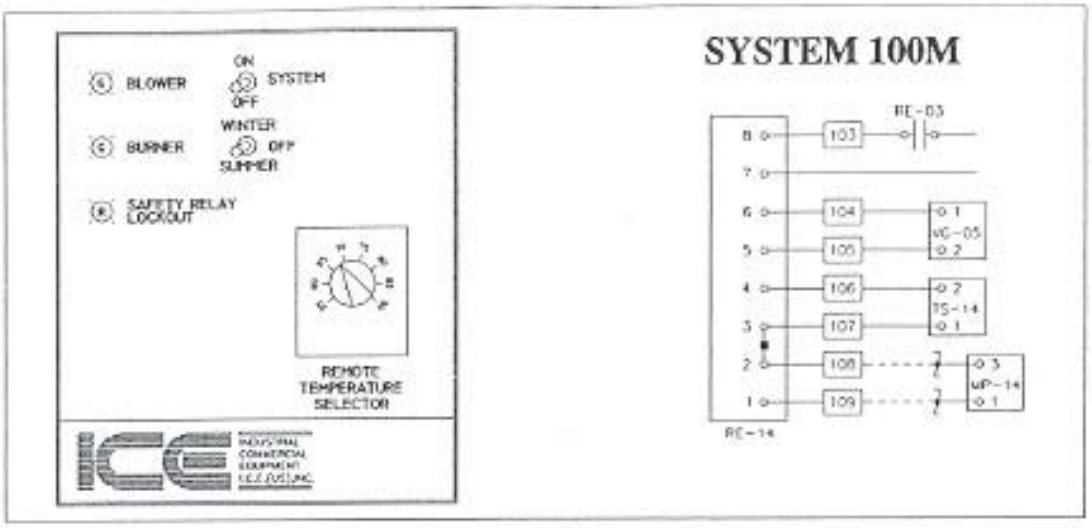
*RE-03 LO-FIRE START RELAY (if over 1000mbh) *RE-44 ELECTRONIC TEMP. CTRL RELAY
*TC-44 ROOM TEMPERATURE CONTROLLER *TS-44 DISCHARGE TEMPERATURE SENSOR
*VG-05 CAPACITY CONTROL VALVE

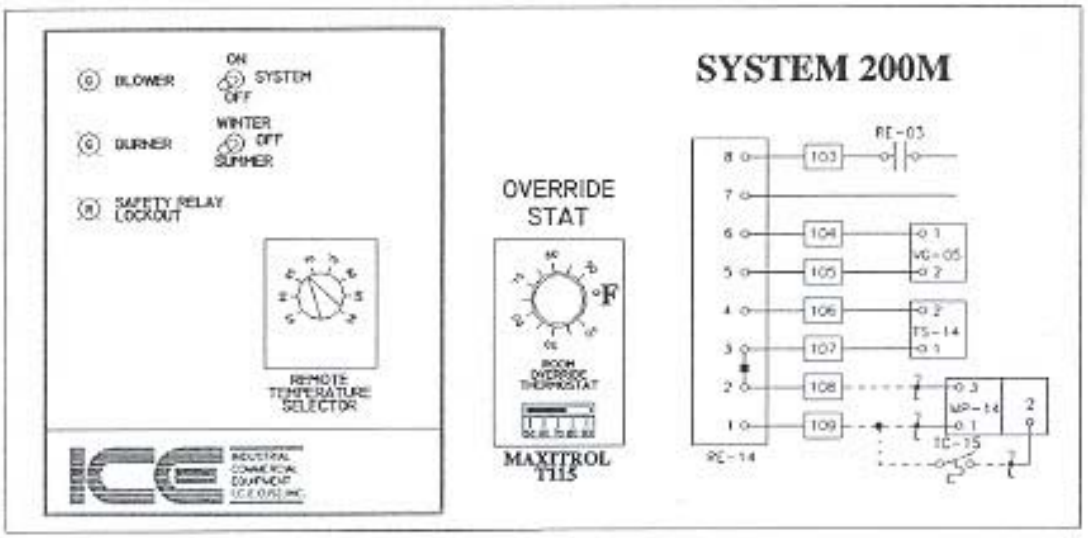
OPTIONAL CONTROL OPTIONS

FREEZE PROTECTION (REFER TO ITEMS TAGGED RE-07, TC-07 & TD-07) SPECIFIED TO PROTECT AGAINST UNTEMPERED AIR ENTERING THE SPACE. THE FREEZE STAT IS LOCATED IN THE DISCHARGE AIR AND WIRED IN PARALLEL WITH A TIME DELAY RELAY. IN THE EVENT THE DISCHARGE AIR TEMPERATURE IS NOT ABOVE THE FREEZE STAT SETTING WITHIN A PRESET TIME DURING START UP AND UNDER NORMAL OPERATION, THE UNIT WILL SHUT DOWN.

INLET AIR CONTROLLER (REFER TO ITEM TAGGED TC-02.)
FEATURES AN ADJUSTABLE THERMOSTAT WHICH MONITORS OUTDOOR AIR TEMPERATURE. WHEN THE TEMPERATURE EXCEEDS THE SETTING OF THE STAT, THE BURNER WILL NOT OPERATE EVEN WHEN THE UNIT IS IN THE WINTER MODE.

NIGHT SETBACK (REFER TO ITEM LABELED TC-11.)
BY LOWERING THE DISCHARGE AIR TEMPERATURE REQUIREMENTS DURING UNOCCUPIED PERIODS, THE OWNER CAN REALIZE OPERATING ECONOMIES AND STILL PROVIDE HEAT TO THE SPACE AS REQUIRED. DURING THE OCCUPIED CYCLE, THE UNIT WILL BE BROUGHT ON THROUGH AN INTERLOCK, TIMELOCK OR SWITCH. DURING THE UNOCCUPIED PERIOD, THE TIMELOCK PROVIDED SWITCHES THE SYSTEM CONTROL TO A SINGLE STAGE THERMOSTAT SET AT THE DESIRED UNOCCUPIED TEMPERATURE. THE UNIT WILL THEN BE STARTED INTERMITTENTLY TO PROVIDE HEAT TO MAINTAIN THE SPACE AT THE NIGHT SETPOINT.


SYSTEM 100M
BLOWER
ON
SYSTEM
OFF
BURNER
WINTER
OFF
SUMMER
SAFETY RELAY LOCKOUT
REMOTE TEMPERATURE SELECTOR
RE-03
RE-14
103
104
105
106
107
108
109
VG-05
TS-14
VP-14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ROOM OVERRIDE THERMOSTAT
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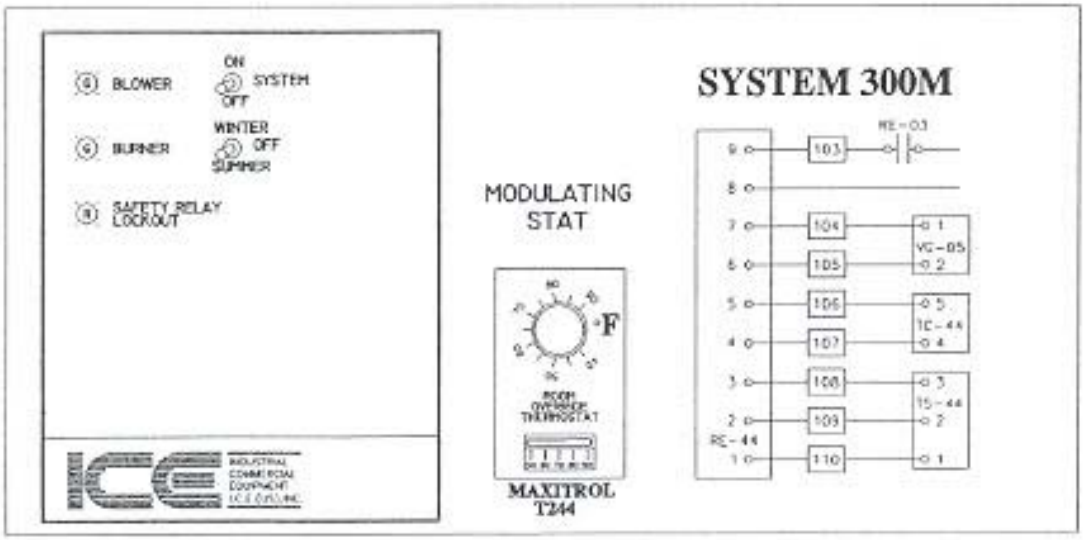
TC-15


SYSTEM 300M
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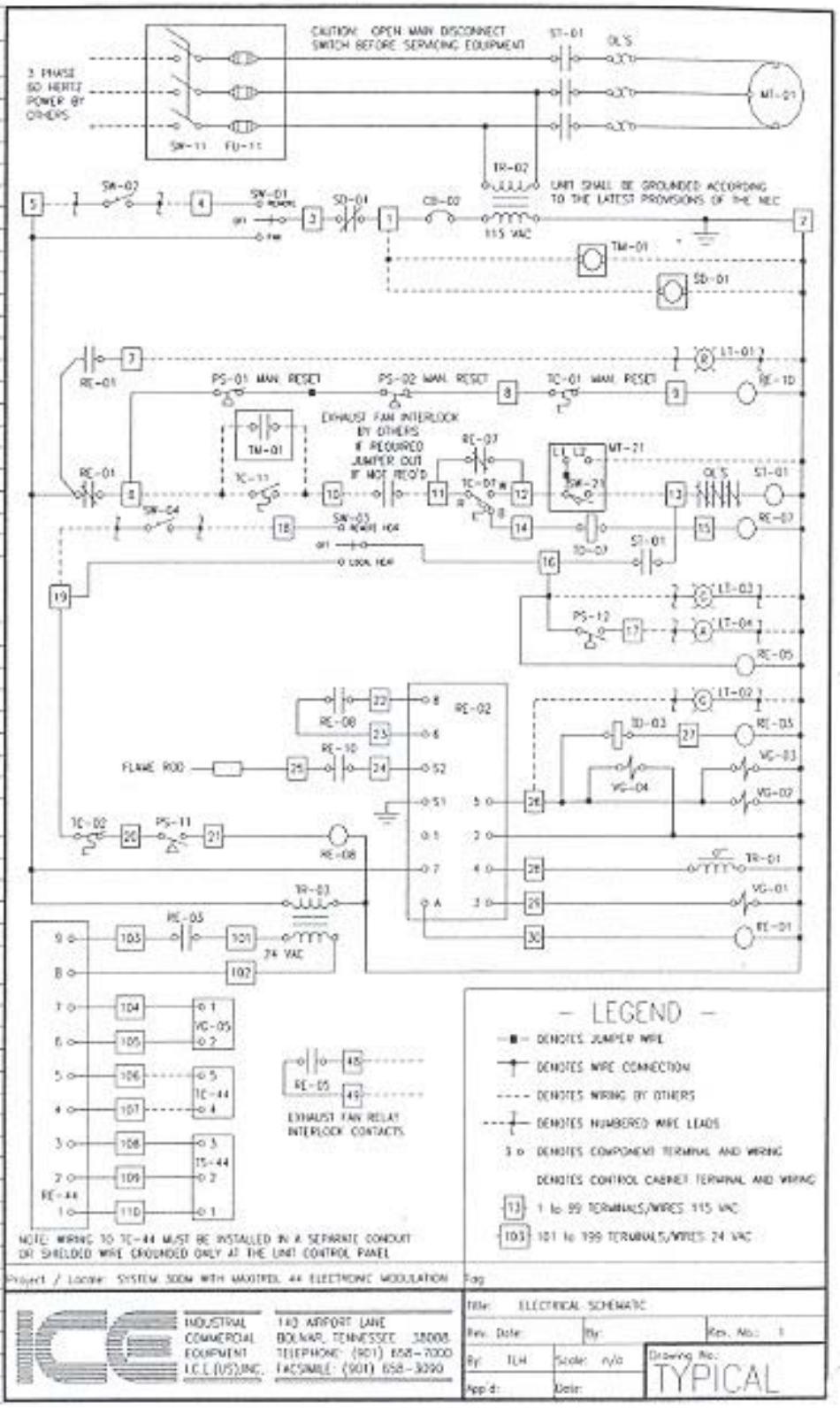
ROOM OVERRIDE THERMOSTAT
MAXITROL T244
RE-03
RE-44
103
104
105
106
107
108
109
110
VG-05
TC-44
TS-44

TYPICAL ELECTRICAL SCHEMATIC AND LEGEND

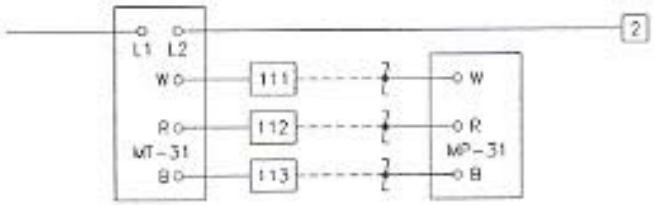
ID	DESCRIPTION
CONTROL PANEL	
CB-02	CONTROL CIRCUIT CIRCUIT BREAKER
TR-01	IGNITION TRANSFORMER
TR-02	CONTROL TRANSFORMER
TR-03	TEMP. CONTROL TRANSFORMER
RE-028	FLAME SAFEGUARD CHASSIS
RE-0281	FLAME SAFEGUARD PROGRAMMER
RE-0282	FLAME SAFEGUARD AMPLIFIER
RE-0283	FLAME SAFEGUARD ENCLOSED BASE
RE-44	ELECTRONIC TEMP. CONTROL RELAY
FU-11	600V FUSE
ST-01	STARTER
OL'S	OVERLOADS
SW-01	CONTROL CIRCUIT SERVICE SWITCH
SW-03	HEATING CIRCUIT SERVICE SWITCH
RE-01	FLAME FAILURE RELAY
RE-03	LOW FIRE START RELAY
RE-05	EXHAUST INTERLOCK RELAY
RE-07	LOW TEMPERATURE RELAY
RE-08	HEATING RELAY
RE-10	LOCK-OUT RELAY
TD-03	IN LINE TIME DELAY
TD-07	LOW TEMP. IN LINE TIME DELAY
REMOTE SUPERVISORY STATION	
LT-01	FLAME FAILURE LIGHT - RED
LT-02	BURNER LIGHT - GREEN
LT-03	BLOWER LIGHT - GREEN
LT-04	LOADED FILTER LIGHT - AMBER
SW-02	REMOTE STATION UNIT ON SWITCH
SW-04	REMOTE STATION HEAT ON SWITCH
	LEXAN FACEPLATE
	REMOTE STATION 10 x 12 x 4
SHIP SEPERATE	
SD-01	SMOKE DETECTOR
SD-01A	SMOKE DETECTOR SAMPLING TUBE
TM-01	TIME CLOCK
TC-11	NIGHT SETBACK THERMOSTAT
TC-44	ROOM TEMPERATURE CONTROLLER
UNIT MOUNT	
TS-44	DISCHARGE TEMPERATURE SENSOR
TS-44A	DISCHARGE TEMP. SENSOR TUBE
MT-01	SUPPLY FAN MOTOR
MT-21	SHUT OFF DAMPER ACTUATOR
SW-21	PART OF MT-21
MB-21	DAMPER MOTOR BRACKET
VG-01	PILOT SHUTOFF SOLENOID VALVE
VG-02	MAIN GAS VALVE
VG-03	AUXILIARY GAS VALVE
VG-04	NORMALLY OPEN VENT VALVE
VG-05	CAPACITY CONTROL VALVE
SW-11	MAIN DISCONNECT - FUSED
PS-01	HIGH GAS PRESSURE SWITCH
PS-02	LOW GAS PRESSURE SWITCH
PS-11	AIR FLOW PROVING SWITCH
PS-12	LOADED FILTER SWITCH
TC-05	HIGH TEMPERATURE LIMIT SWITCH
TC-02	ON/OFF INLET DUCTSTAT
TC-07	LOW TEMPERATURE DISCHARGE STAT



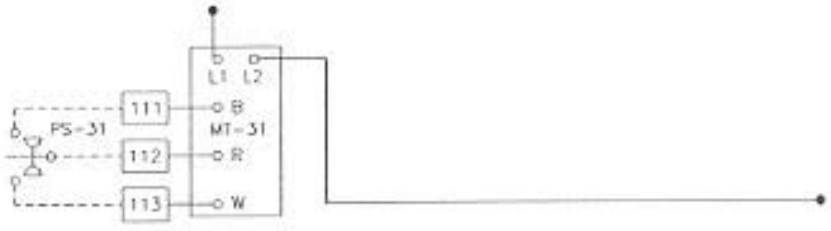
7.0 DAMPER CONTROLS

INLET / DISCHARGE DAMPER ACTUATOR
TWO-POSITION DAMPER ACTUATOR
MT-21 DAMPER ACTUATOR
SW-21 DAMPER END SWITCH

IMR UNIT 80/20
MODULATING ACTUATOR WITH POTENTIOMETER
MT-31 MODULATING DAMPER ACTUATOR
MP-31 POTENTIOMETER



IMR UNIT 80/20
MODULATING ACTUATOR WITH PRESSURE "NULL" SWITCH
MT-31 DAMPER ACUTUATOR
PS-31 BUILDING PRESSURE SENSOR

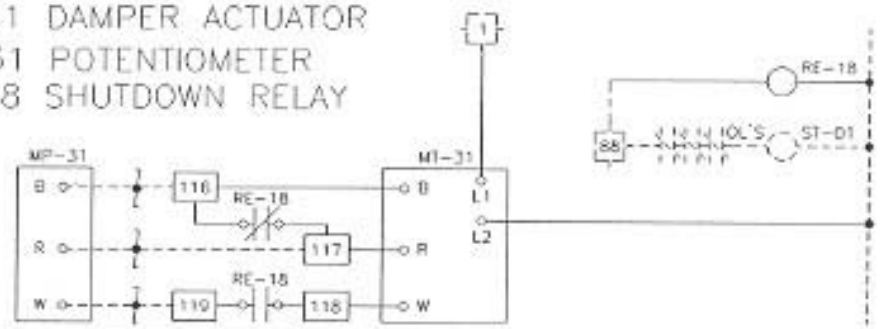


7.0 DAMPER CONTROLS (continued)

BMR UNIT 80/20

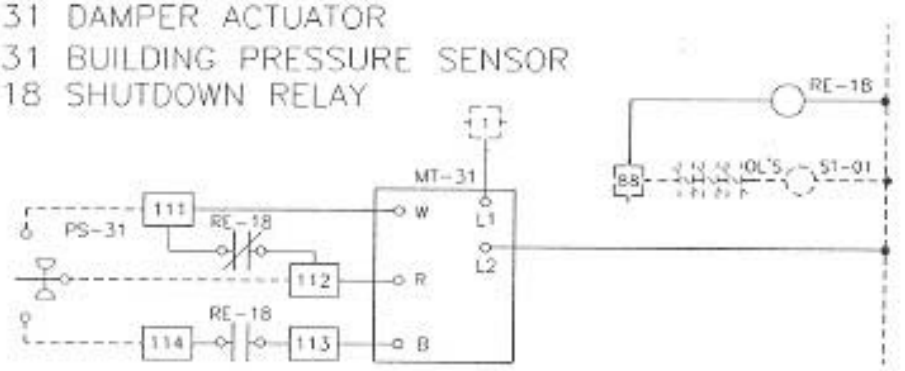
MODULATING ACTUATOR WITH POTENTIOMETER

MT-31 DAMPER ACTUATOR
MP-31 POTENTIOMETER
RE-18 SHUTDOWN RELAY

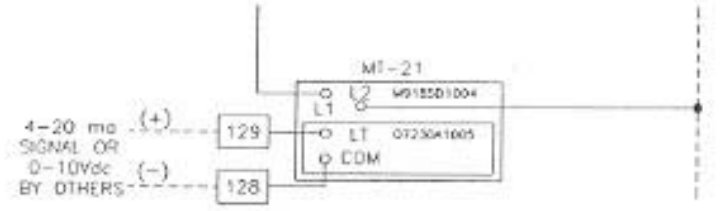


MODULATING ACTUATOR WITH BUILDING PRESSURE SENSOR

MT-31 DAMPER ACTUATOR
PS-31 BUILDING PRESSURE SENSOR
RE-18 SHUTDOWN RELAY



BMR/IMR UNIT WITH DDC INTERFACE
MODULATING ACTUATOR WITH PRESSURE "NULL" SWITCH
MT-21 DAMPER ACUTUATOR
INTERFACE CARD



8.0 EVAP COOLER SETUP

WATER VALVES OUTSIDE UNIT: (SET FOR NORMAL OPERATION.)

- SUMP TANK DRAIN VALVE: CLOSED TO ALLOW TANK TO FILL
- OVERFLOW DRAIN VALVE: OPEN TO ALLOW BLEED WATER TO DRAIN.
- SUPPLY WATER VALVE: OPEN TO ALLOW FLOAT VALVE TO FILL TANK.
- SUPPLY WATER LINE DRAIN VALVE IF USED: CLOSED TO ALLOW WATER TO TANK

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 EVAP MEDIA WITH THE AIR FLOW. TO SET, UNIT MUST BE OPERATING; THE WATER CIRCULATING PUMP MUST BE OPERATING, GO INSIDE UNIT, 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.

FILL AND DRAIN VALVES: (SOLENOID VALVES PROVIDED ONLY AS AN OPTIONAL FILL AND DRAIN KIT) (MANUAL VALVES, PIPE AND PIPE FITTINGS SUPPLIED AND INSTALLED BY OTHERS)
THE PURPOSE HERE IS TO DRAIN WATER OUT OF TANK AND LINES TO PREVENT FREEZING

SEQUENCE OF OPERATION:
IN OPERATION

- SUPPLY WATER VALVE — OPEN
- SUPPLY WATER LINE DRAIN VALVE — CLOSED
- SUMP TANK DRAIN VALVE — CLOSED
- OVERFLOW DRAIN VALVE — OPEN

NOT IN OPERATION OR DURING A FREEZING CONDITION

- SUPPLY WATER VALVE — CLOSED
- SUPPLY WATER LINE DRAIN VALVE — OPEN
- SUMP TANK DRAIN VALVE — OPEN
- OVERFLOW DRAIN VALVE — OPEN

AUTOMATIC FILL AND DRAIN KITS
SOLENOID WATER VALVES MAY BE CONTROLLED THERMOSTATICALLY OR MANUALLY SWITCHED.

- Y-STRAINERS ARE RECOMMENDED UPSTREAM OF SOLENIOD VALVES

WARNING: MAINTAIN WATER IN SUMPS BY PROPER MICROBICIDAL 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.

INSTALLER'S RESPONSIBILITY

INSTALLER PLEASE NOTE: THIS EQUIPMENT HAS BEEN TESTED 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 MY BE FOUND.

8.1 EVAPORATIVE MAINTENANCE

WARNING: OPEN ALL DISCONNECT SWITCHES AND SECURE IN THAT POSITION BEFORE SERVICING UNIT. FAILURE TO DO SO MAY RESULT IN PERSONAL INJURY OR DEATH FROM ELECTRICAL SHOCK.

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 BECAUSE THE MINERAL CONTENTS OF THE WATER IS TOO HIGH. INCREASE THE WATER FLOW OVER THE 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 BETWEEN 6 AND 8.MAINTAIN SUFFICIENT BLEED-OFF RATE.

C.) PREVENTING ALGAE IN THE EVAPORATIVE PADS:

ALGAE NEEDS 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 BILOLGICAL 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.

MAINTENANCE SCHEDULE
REGULAR MAINTENANCE IS THE KEY TO SUCCESSFUL SERVICE FROM YOUR EVAPORATIVE COOLER. USE THE FOLLOWING SCHEDULE AS A GUIDE TO MAINTAIN YOUR UNIT:

MAINTENANCE REQUIREMENTS	ANNUAL START-UP	ANNUAL SHUT DOWN
CHANGING MEDIA	AT BEGINNING OF 6TH YEAR IF PASSAGES ARE BLOCKED	
CLEANING WATER PUMP	√	
CLEANING AND TOUCH UP		√
ADJUSTING BLEED-OFF	√	
PERIODIC INSPECTION	DURING COOLING SEASON	DURING COOLING SEASON
WASHING DOWN MEDIA WITH HOSE		AS REQUIRED DURING SEASON
WASHING INLET FILTER WITH HOSE	√	√
DRAIN UNIT.		√

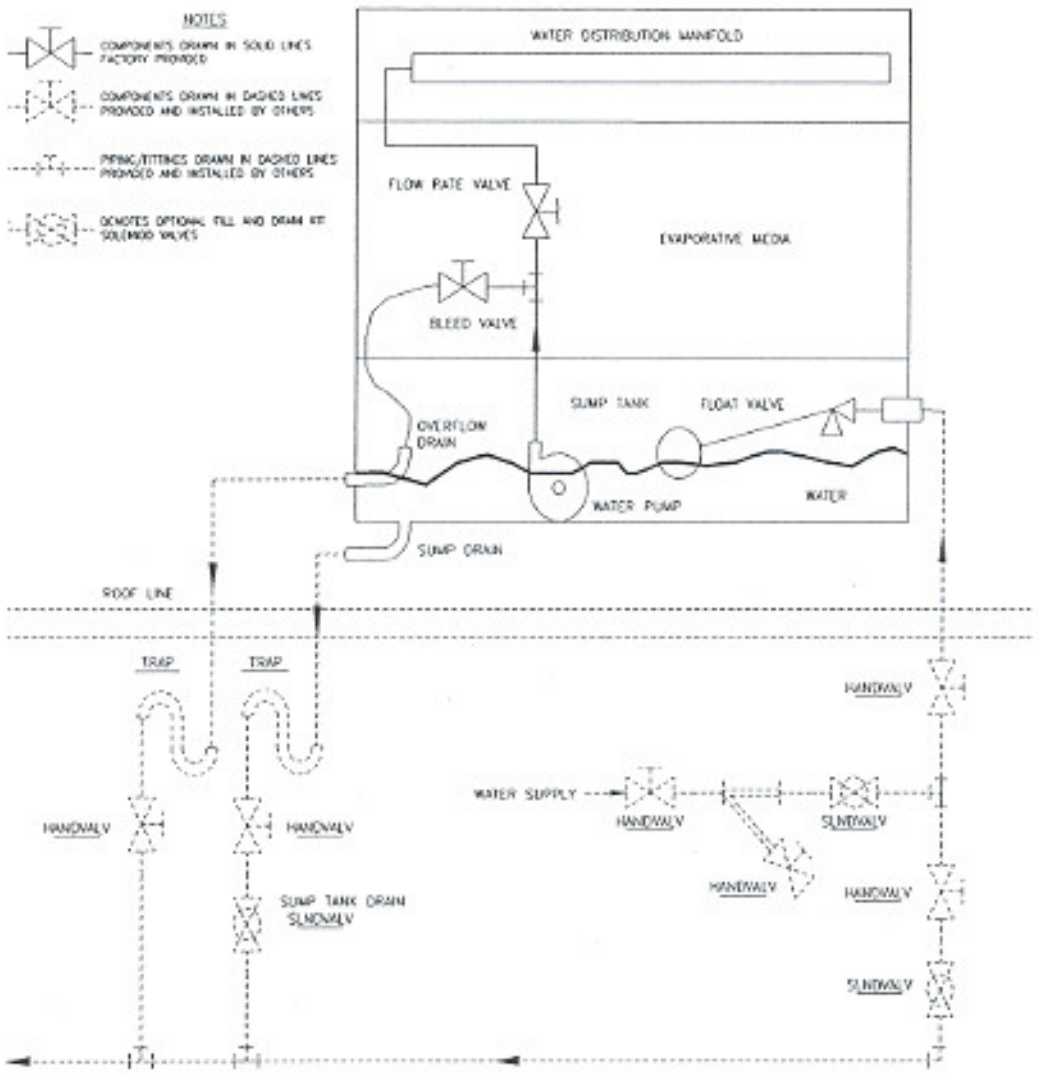
FOLLOWING ARE EXPLANATIONS OF THE PROCEDURES OUTLINED IN THE ABOVE SCHEDULE.
CHANGING THE MEDIA.THIS SHOULD BE DONE EVERY 5 YEARS OR IF PASSAGES BECOME BLOCKED.

1. **REMOVE FILTER\FRAME ASSEMBLIES.**
2. **DISCONNECT THE WATER HOOD PANEL FROM THE TOP PANEL BY REMOVING SCREWS.**
3. **SNAP OUT WATER DISTRIBUTION SYSTEM.**
4. **REMOVE TOP MEDIA DISTRIBUTION PAD.**
5. **LIFT OUT MEDIA SECTIONS. NOTE POSITION OF MEDIA**
6. **REPLACE WITH NEW MEDIA IN SAME POSITION AS OLD MEDIA.**
7. **WHEN RE-INSTALLING MEDIA, BE SURE ALL MEDIA SECTIONS ARE INSTALLED IN THE PROPER DIRECTION.**
8. **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)

1. **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.**
2. **USING A STIFF BRUSH, LIGHTLY BRUSH INTAKE EDGES OF MEDIA. IT REMOVES ANY HARDENED SCALE.**
3. **OCCASIONALLY, THERE WILL BE A BUILD UP OF ALGAE OR ODORS. THE**
4. **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.**
5. **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.**

EVAP COOLING TYPICAL PIPING



9.0 COIL INFORMATION

1.) NEVER INSTALL A DX COIL UPSTREAM OF A DIRECT FIRED BURNER DUE TO HAZARDOUS GAS POTENTIAL IF LEAK OCCURS.

2.) WHEN USING A WATER COIL --FREEZE PROTECTION MUST BE PROVIDED IN THE FIELD. ENSURE CHILLED WATER COILS ARE DRAINED PRIOR TO FREEZING CONDITIONS.

3.) COMPLY TO COIL MANUFACTURERS GUIDELINES FOR OPERATION AND MAINTENANCE. CIRCUITING IS LABELED ON THE COIL BY THE COIL MANUFACTURER BY DESIGNATIONS SUCH AS CIRCUIT 1, CIRCUIT 2, CIRCUIT A AND CIRCUIT B, ETC..

4.) CAUTION MUST BE USED WHEN PIPING TO RECOMMENDED CIRCUITING DIAGRAMS AS NOT TO SHORT CIRCUIT OR CROSS CONTAMINATE CIRCUITS AS STATED BY COIL MANUFACTURERS.

FOLLOWING ARE DRAWINGS OF CONNECTIONS FOR DIRECT EXPANSION COILS WITH SINGLE AND DUAL CIRCUIT COILS., AND DUAL STACKED DUAL CIRCUIT COILS TO DUAL CIRCUIT CONDENSING UNIT CONNECTION.

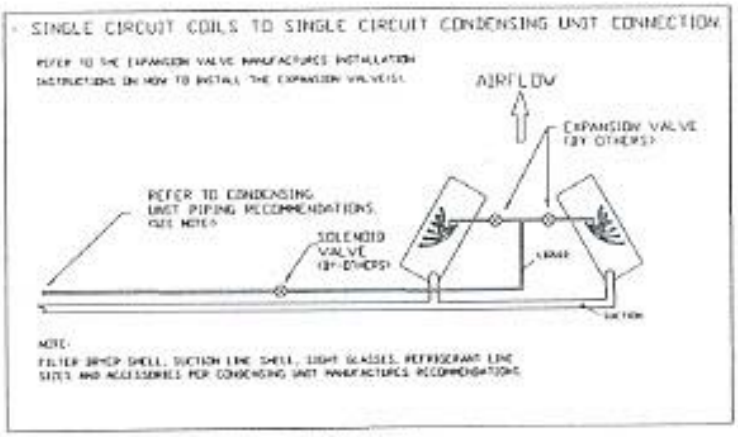


FIGURE 1

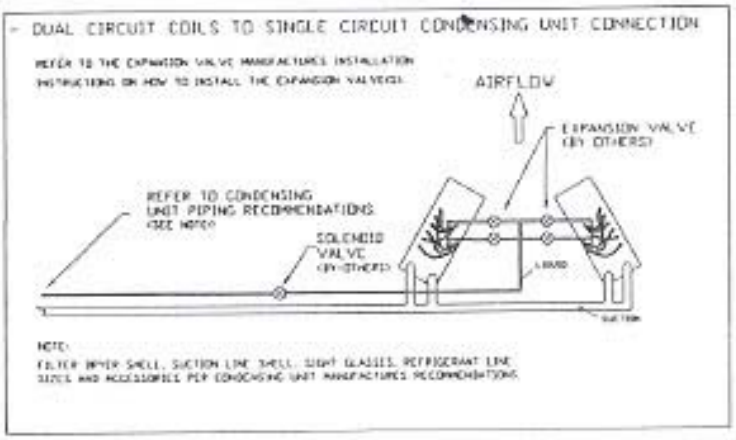


FIGURE 2

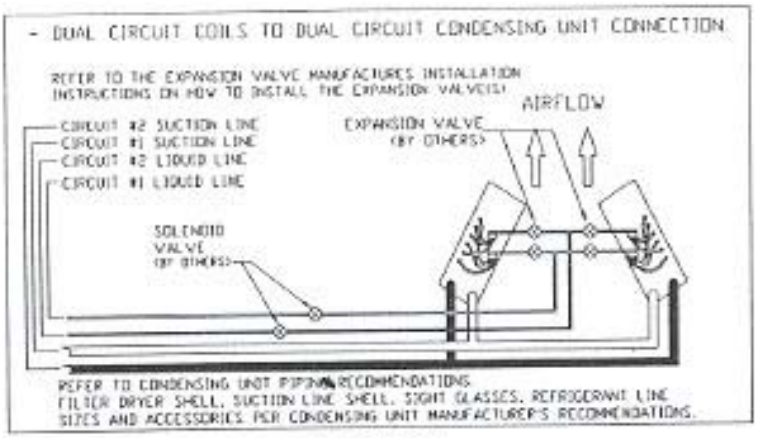


FIGURE 3

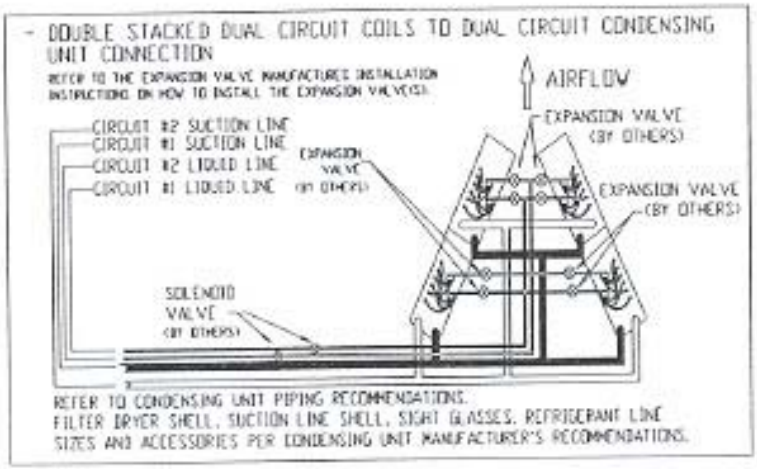


FIGURE 4

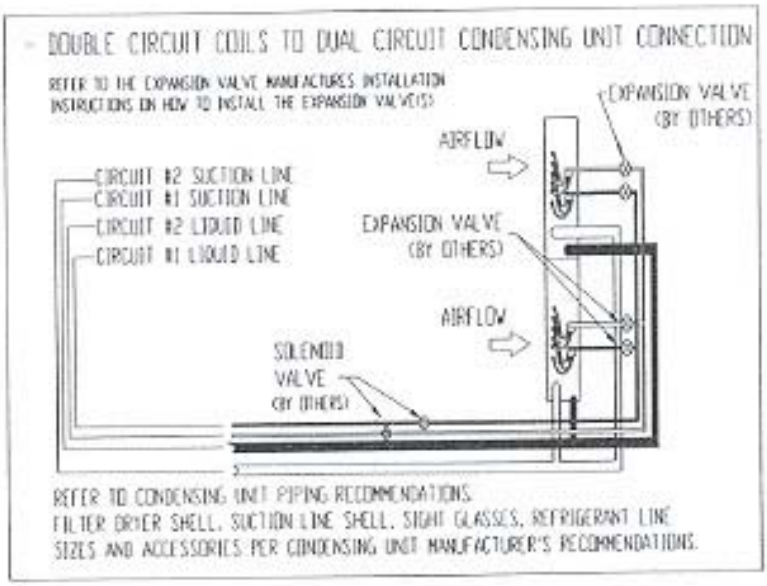


FIGURE 5

10.0 SEQUENCE OF OPERATION

10.1 SUMMER OPERATION:

WHEN EXHAUST INTERLOCK CONTACTS CLOSE, THE INLET DAMPER OPENS.

EXHAUST LIGHT INDICATES EXHAUST ON. (IF INCLUDED)

DAMPER END SWITCH CLOSES, POWERING BLOWER MOTOR STARTER.
(INLET OR DISCHARGE DAMPER IS OPTIONAL)

BLOWER MOTOR AUXILIARY CONTACTS CLOSE.

FAN LIGHT INDICATES THAT THE BLOWER IS RUNNING.

PROFILE AND RETURN AIR DAMPERS ARE POSITIONED BY A SIGNAL FROM THE SPACE CONTROLLER OR MANUAL POTENTIOMETER (IF FURNISHED).

10.2 WINTER OPERATION:

EXHAUST SYSTEM INTERLOCK CONTACTS MUST BE CLOSED.

EXHAUST LIGHT INDICATES EXHAUST ON. (IF INCLUDED)

INTERLOCK CIRCUIT ON SAFETY RELAY IS ENERGIZED.

WHEN DAMPER IS FULLY OPEN, END-SWITCH CONTACTS CLOSE AND ENERGIZE THE BLOWER MOTOR STARTER.

BLOWER MOTOR STARTER AUXILIARY CONTACTS CLOSE.

AIR FLOW PROVING SWITCH CLOSES.

FAN LIGHT INDICATES THAT THE BLOWER IS RUNNING.

SUMMER – WINTER SWITCH, WINTER POSITION; COMBUSTION CONTROL IS ENERGIZED.

PRE-PURGE TIMER (OPTIONAL) IS ENERGIZED AND CONTACTS CLOSE AFTER PRE-DETERMINED PURGE PERIOD.

HIGH GAS PRESSURE SWITCH CONTACTS ARE NORMALLY CLOSED.

HIGH TEMPERATURE LIMIT SWITCH IS NORMALLY CLOSED. SWITCH TO MANUALLY RESET IF AIR TEMPERATURE HAS EXCEEDED SET POINT.

OUTDOOR THERMOSTAT CONTACTS CLOSE WHEN OUTSIDE AIR TEMPERATURE FALLS BELOW SET POINT.

LIMIT CIRCUIT TO PRIMARY SAFETY CONTROL IS COMPLETE.

IGNITION TRANSFORMER IS ENERGIZED AND SPARK PROVIDED.

PILOT GAS VALVE OPENS AND PILOT IS PROVED.

PILOT LIGHT ON.

MAIN GAS VALVE(S) IS ENERGIZED.

BURNER LIGHT INDICATES GAS VALVE(S) IS ENERGIZED.

PRESENCE OF FLAME IS PROVEN BY FLAME ROD, IGNITION TRANSFORMER IS DE-ENERGIZED AND MAIN GAS VALVE REMAINS OPEN.

(OPTIONAL) LOW LIMIT LIGHTS STAY ON INDICATING THAT AIR TEMPERATURE EXCEEDS SETTING OF LOW LIMIT SWITCH.

MODULATING TEMPERATURE CONTROL MAINTAINS DISCHARGE AIR TEMPERATURE AT SET POINT.

ALARM LIGHTS INDICATE FLAME FAILURE OF BURNER OR FAILURE OF AIR PROVING SWITCH.

NOTE: SEQUENCE OF OPERATION IS THE SAME ON UNITS WITH SUMMER-OFF-WINTER SWITCH.

11.0 TROUBLESHOOTING

ON START UP, IF THE UNIT WILL NOT OPERATE PROPERLY, IT MAY BE DUE TO INCORRECT WIRING BETWEEN THE UNIT AND THE CONTROL PANEL. TO CHECK FIELD WIRING, MARK EACH WIRE AND REMOVE FROM CONTROL PANEL. PLACE JUMPERS BETWEEN TERMINALS TO CONTROL SWITCHES. IF UNIT STARTS, HAVE AN ELECTRICIAN CHECK FIELD WIRING.

11.1 IF INLET DAMPER FAILS TO OPEN WHEN EXHAUST IS TURNED ON, CHECK THE FOLLOWING:

- MAIN DISCONNECT.
- FUSES – MAIN CONTROL PANEL.
- ON-OFF SWITCH ON CONTROL PANEL AND SUPERVISOR PANEL (IF USED).
- SAFETY RELAY (RESET).
- GAS PRESSURE TO UNIT IF UNIT HAS HIGH AND LOW GAS PRESSURE SWITCHES.
- EXHAUST PROVING SWITCH.
- DAMPER MOTOR LINKAGE.
- LOW LIMIT IF USED.
- CABINET LOW LIMIT CONTROL ON ROOF TOP UNITS.

11.2 IF INLET DAMPER OPENS BUT BLOWER FAILS TO OPERATE, CHECK THE FOLLOWING CONTROLS – VISUALLY OR WITH A TEST LAMP OR JUMPERS:

- END SWITCH ON DAMPERS.
- MAGNETIC STARTER (MANUALLY RESET).
- BLOWER BELTS MAY BE OFF.

11.3 DAMPER OPEN, BLOWER IS RUNNING, BUT PILOT WILL NOT LIGHT; CHECK THE FOLLOWING:

- SUMMER-WINTER SWITCH IN THE WINTER POSITION.
- INLET AIR CONTROLLER SETTING TOO LOW.
- ELECTRIC IGNITION.
- GAS SUPPLY, PILOT SHUT-OFF VALVES.
- PILOT ADJUSTMENT ON SOLENOID VALVES.
- HIGH LIMIT (MANUALLY RESET).
- AUXILIARY CONTACT ON BLOWER STARTER (BLOWER INTERLOCK).
- AIR IN GAS LINE (BLEED).
- TRASH OR FOREIGN MATERIAL IN GAS AND / OR PILOT LINE

11.4 DAMPERS ARE OPEN, BLOWER IS RUNNING, PILOT COMES ON BUT UNIT LOCKS OUT AND SHUTS DOWN; CHECK THE FOLLOWING:

- SAFETY RELAY (MANUALLY RESET).
- LOW AIR PROVING SWITCH ACROSS PROFILE PLATE.
- BLOWER RUNNING BACKWARDS.
- LOW AIR VELOCITY ACROSS PROFILE PLATE INLET OR DISCHARGE IS BLOCKED OR BELTS ARE LOOSE AND SLIPPING, OR THE BLOWER IS NOT MOVING ENOUGH AIR.
- CHECK READINGS ON FLAME SAFEGUARD RELAY.
- IF UNIT HAS MAIN FLAME SUPERVISION, LOW FIRE SET TOO LOW, OR FIRING VALVE IS CLOSED.
- CHECK THAT UNIT FILTERS ARE CLEAN.

11.5 DAMPERS ARE OPEN, BLOWER IS OPERATING, PILOT IS ON, MAIN FLAME LOW FIRE IS ON, BUT UNIT WILL NOT MODULATE – CHECK THE FOLLOWING:

- WIRING OF MOTOR AND DISCHARGE CONTROLLER.
- SETTING OF CONTROLLER.
- CHECK TO ENSURE CONTROLLER BULB IS IN PLACE IN THE BLOWER OR DISCHARGE DUCTWORK.
- LINKAGE ON BUTTERFLY VALVE MAY BE JAMMED OR SLIPPING.
- 24 VOLT TRANSFORMER SUPPLYING POWER TO MODULATING MOTOR.
- IF UNIT HAS A REMOTE CONTORLLER, CHECK TO INSURE CONTROLLER IS WIRED PROPERLY.

11.6 BURNER IS ON BUT DISCHARGE TEMPERATURE IS TOO LOW, CHECK THE FOLLOWING:

- DISCHARGE CONTROLLER DIFFERENTIAL
- INCORRECT GAS FIRING RATE.
- LOW GAS PRESSURE?
- MAIN FIRING VALVE NOT FULLY OPEN.
- TOO MUCH AIR FLOWING THROUGH UNIT. CHECK PRESSURE DROP ACROSS PROFILE PLATE WITH A DIFFERENTIAL GAUGE. IF THE READING IS HIGHER THAN WHAT IS MARKED ON THE RATING PLATE, THE UNIT IS DISCHARGING TOO MUCH AIR. ADD RESISTANCE ON THE INLET OR DISCHARGE, OR REDUCE BLOWER SPEED.

11.7 BLOWER IS RUNNING BUT BURNER IS OFF; CHECK THE FOLLOWING:

- UNIT OFF ON HIGH LIMIT (MANUAL RESET).
- CHECK TO SEE IF MODULATING VALVE IS STUCK OPEN OR IF LINKAGE HAS SLIPPED ON THE BUTTERFLY VALVE.

11.8 UNIT IS HUNTING FROM HIGH TO LOW FIRE:

- THE DISCHARGE CONTROLLER FAULTY. CONTROLLER SHOULD BE REPLACED (CHECK SHEET FOR CALIBRATION INSTRUCTIONS.)

11.9 UNIT RUNS, THEN LOCKS OUT AND SHUTS DOWN COMPLETELY.

- CHECK TO INSURE THAT THE PRESSURE DROP ACROSS THE PROFILE PLATE IS ABOVE .30" W.C.
- CHECK HIGH LIMIT HAS NOT BEEN TRIPPED.
- CHECK LOW LIMIT (IF PROVIDED) HAS NOT BEEN TRIPPED.
- CHECK FOR LOOSE WIRING CONNECTIONS.

11.10 INTERMITTENT START:

- LOOSE WIRING – CHECK TO INSURE ALL WIRING CONNECTIONS ARE SECURE.
- UNSTABLE GAS OR ELECTRICAL SUPPLY
- FAULTY OR DIRTY UV SCANNER OR FLAMEROD (PROPER FLAME SHOULD BE APPROXIMATELY 12-18" INCHES ON HIGH FIRE.)

11.11 SHORT FLAME:

- LOW GAS PRESSURE – ADJUST REGULATOR.
- PROFILE VELOCITY TOO HIGH – INSUFFICIENT SYSTEM RESISTANCE.

11.12 LONG LAZY FLAME:

PROPER FLAME LENGTH ON HIGH FIRE SHOULD BE 12"-18" LONG

- HIGH GAS PRESSURE – ADJUST REGULATOR. MANIFOLD PRESSURE SHOULD NOT EXCEED RATING PLATE.(4.5" W.C. NATURAL GAS OR 1.5" W.C. PROPANE MAXIMUM.)

11.13 GAS FAILS TO SHUT OFF:

- DIRT ON VALVE SEAT – CLEAN
- DEFECTIVE MAIN SAFETY VALVE – REPLACE
- INCORRECT FIELD WIRING RECONNECTION

CHECK OVER AND FULLY TEST ALL FIELD WIRING RECONNECTIONS BETWEEN SECTIONAL UNIT SPLITS AND REMOTE PANELS.

12.0 MAXITROL A 200

SELECTRA A200 SIGNAL CONDITIONER

FOR DIRECT OR INDIRECT FIRED GAS APPLICATIONS

THE TRACK MOUNTED A200 CAN CONVERT A CONTROLLER'S DC OUTPUT SIGNAL OF EITHER 4 TO 20 MILLIAMPS (mA) OR 0-10 VOLTS, TO A 0 TO 20 VOLTS DC SIGNAL. TOGGLING BETWEEN 4-20 Ma or 0-10 V IS ACHIEVED WITH AN ON-BOARD THREE POSITION DIP SWITCH (DIP = DUAL IN LINE PACKAGE) 4-20 Ma – ALL POSITIONS ON / 0-10 V – ALL POSITIONS OFF.

SELECTRA ELECTRONIC GAS FLAME MODULATION IS A SUPERIOR ALTERNATIVE TO METHODS SUCH AS MOTOR DRIVEN BUTTERFLY VALVES. WHEN COMPUTER OR OTHER PROCESS CONTROLS ARE SPECIFIED INSTEAD OF MAXITROL COMPANION ELECTRONIC CONTROLS, THE SIGNAL CONDITIONER PROVIDES COMPATIBILITY WITH MAXITROL MODULATOR / MODULATOR-REGULATOR VALVES.

SIGNAL CONDITIONERS AND M/MR VALVES CAN BE CONFIGURED FOR DIRECT OR INDIRECT FIRED APPLICATIONS. THEY MAY BE FIELD INSTALLED ON EXISTING EQUIPMENT OR SPECIFIED FOR NEW EQUIPMENT INSTALLATION.

MODULATOR AND MODULATOR-REGULATOR VLAVES ARE AVAILABLE UP TO 5 PSI (350 mbar) INLET PRESSURE, 30,000 CFH (850 m3/h) MAXIMUM, AND PIPE SIZES FROM 3/8" TO 4".

A200 OUTPUT TO VALVE: A LOW MILLIAMP/VOLTAGE INPUT CORRESPONDS TO A LOW VOLTAGE OUTPUT.

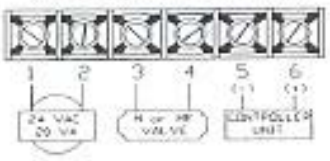
SIGNAL CONDITIONER:
AMBIENT LIMITS.....-40degrees to 150 degrees Fahrenheit (-40degrees to 66degrees C)
SIGNAL CONDITIONER POWER REQUIREMENTS:
24V AC TRANSFORMER, 20 VA CAPACITY (50/60 HZ)
SIGNAL CONDITIONER DIMENSIONS:
4.75"W x 3.38"H x 2.09"D

IMPORTANT – READ PRIOR TO INSTALLATION

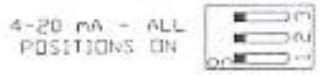
TO AVOID INTERNAL DAMAGE TO THE A200 SIGNAL CONDITIONER FOLLOW THESE GUIDELINES:

1. TRANSFORMER SECONDARY MUST NOT BE GROUNDED IN ANY PORTION OF THE CIRCUIT EXTERNAL TO THE A200 SIGNAL CONDITIONER. IF EXISTING TRANSFORMER IS GROUNDED, A SEPARATE ISOLATED TRANSFORMER MUST BE USED.
2. MULTIPLE A200 SIGNAL CONDITIONERS CONTROLLED BY A SIGNAL SOURCE WITH COMMON OUTPUTS (TERMINALS 5 & 6) REQUIRE SEPARATE TRANSFORMERS FOR EACH A200 SIGNAL CONDITIONER.
3. MULTIPLE A200 SIGNAL CONDITIONERS POWERED BY A SINGLE TRANSFORMER REQUIRE ISOLATED SIGNAL INPUTS (TERMINALS 5 & 6) TO EACH A200 CONDITIONER.

WIRING DIAGRAM



THREE POSITION DIP SWITCH



13.0 MAXITROL 14

SPECIFICATIONS:

POWER REQUIREMENTS:	24 VAC, 50,60 Hz Class II Transformer
AMBIENT LIMITS:	Operating....-40 TO 125 Degrees F /-40 TO 52 Degrees C
	Non-operating..50 TO 185 Degrees F/ -46 TO 85 Degrees C
GASES:	All fuel gases
VENT:	M411, 511, 611...vertical vent outlet 1/8" NPT - 12A06 installed
	MR212... two vents located in upper housing, both equipped with vent limiting means
PRESSURE LIMITS:	
Maximum discharge pressure	(M411 , 511, 611)...7"w.c. / 17 mbar
Static pressure rating	(M411, 511, 611)...5.0 psi / 345 mbar
Maximum operating inlet pressue	(M411, 511, 611) 1 psi / 70 mbar
	MR212...5.0 psi / 345 mbar
Maximum emergency exposure*	(M411, 511, 611) 3.0 psi / 210 mbar
	MR212...12.5 psi / 862 mbar

*may not function properly at this pressure, but will suffer no internal damage

Installation of components

Wiring run: If control wiring is inside conduit with line voltage wiring, use shielded cable upto100ft. For best results up to 200 ft., run control wiring in separate conduit. For longer runs see remote selector note.

Control wires connected to the override stat, discharge air sensor, or remote temperatuer selector must not be close to or inside conduit with power or ignition wires. Doing so may cause the unit to function erratically or may destroy the amplifier. If shielded wires are used, shield must be insulated and grounded
at the amplifier location only.

Amplifier / Amplifier – Selector: contains the wiring in terminals and sensitivity adjustment – install in any conventient location that is protected from the weather and contaminated atmosphere.

Remote or dual Selector: Install in control cabinet or other chosen location. Note : suffix letters must match e.g. TS114A must be used with TD114A. For wiring runs longer than 200 ft. substitute ES261-1/ES261-2 for
TD114. The ES261's are a 2-piece version of the TD114. ES261-1 is a temperature setting dial only, ES261-2 must be mounted at furnace location.

Discharge Temperature Sensor / Mixing Tube Assembly: sensor housed in mixing tube, install in discharge air stream.

Optional:

Dual Temperature Selector: see preceding Remote/Dual selector.
Room Override Stat: mount in heated are not in direct path of discharge air stream.
Inlet Air Sensor: install in convenient location upstream of burner, in intake air duct.

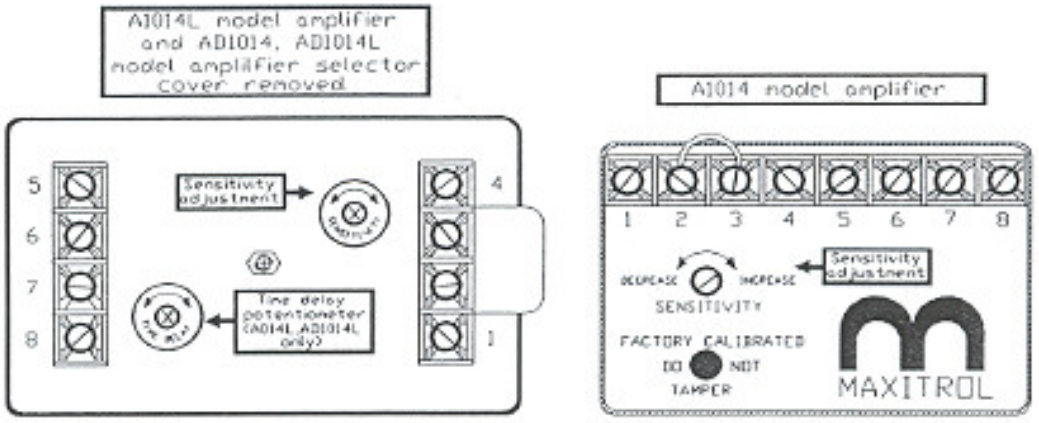
13.1 MAXITROL 14 (CONT)

LOW FIRE START TIME ADJUSTMENT

On a A1014L and AD1014L amplifiers, the low fire start duration is adjustable from approximately 0-30 seconds, and beings timing after the amplifier has been energized.

High fire is delayed, and the M/MR valve remains in the low fire setting position during the delay time period.

Use a small screwdriver to adjust the time delay potentiometer. Turn clockwise (+) to increase low fire start duration, and counter clockwise (-) to decrease low fire start duration.



SENSITIVITY ADJUSTMENT

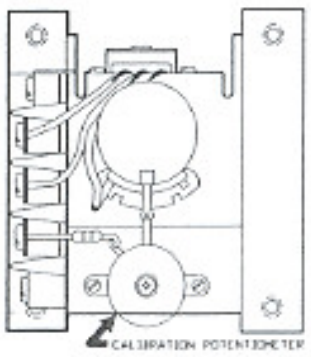
The sensitivity control will allow the user to control the response of the system. Caution should be exercised in the use of this adjustment. Under normal usage the pointer should be located on the mark on the label.

If hunting is encountered (rapid oscillation) rotating the sensitivity control counter-clockwise will dampen the oscillation – stabilizing the flame.

Do not adjust uncless necessary, because decreasing the sensitivity will increase the temperature "droop" of the system.

TEMPERATURE CALIBRATION

Note: The components of this system are individually calibrated and are not a part of a matched set. It is necessary to place an accurate temperature measuring device as near the Discharge Air Sensor as possible. Set the Remote Temperature Selector at least 10 degrees above outside air temp.
If calibrating at the A1014 Amplifier: Ajust calibration potentiometer (a), until temperature reads the same as the set temperature. If the temperature is below the set point, then rotate calibration potentiometer clockwise. If the temperature is above the set point, rotate the potentiometer counter-clockwise.



MAXITROL MR212 VALVE

(NOTE: LOW FIRE ADJUSTMENT SHOULD BE CHECKED WHENEVER THE HIGH FIRE ADJUSTMENT IS CHANGED.)

HIGH FIRE MANIFOLD ADJUSTMENTS

1. DISCONNECT WIRES FROM AMPLIFIER TERMINAL # 4. 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.

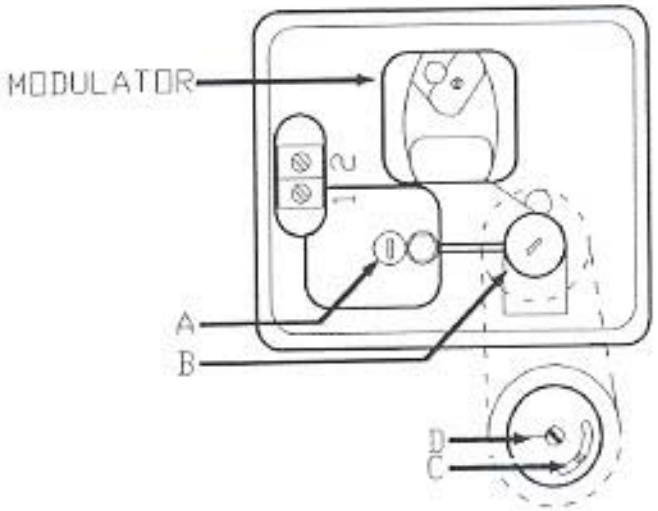
NOTE: IF LOW FIRE BYPASS IS ON MAXIMUM, THE DESIRED HIGH FIRE OUTLET PRESSURE MAY NOT BE ACHIEVED.

LOW FIRE OR BYPASS ADJUSTMENTS:

1. DISCONNECT WIRE FROM AMPLIFIER TERMINAL #8, THIS CAUSES VALVE TO CALL FOR CONTINOUS 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 #8.

REFER TO FOLLOWING DRAWING PAGE FOR LOCATION OF A,B,C AND D.

MR212 VALVE ADJUSTMENT



M411, 511, 611 VALVE

(NOTE: LOW FIRE ADJUSTMENT SHOULD BE CHECKED WHENEVER THE HIGH FIRE ADJUSTMENT IS CHANGED.)

HIGH FIRE MANIFOLD ADJUSTMENTS

1. DISCONNECT WIRES FROM AMPLIFIER TERMINAL #4, THIS CAUSES THE VALVE TO CALLFOR 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 THEN 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.

NOTE: IF LOW FIRE BYPASS IS ON MAXIMUM, THE DESIRED HIGH FIRE OUTLET PRESSURE MAY NOT BE ACHIEVED.

MAXITROL 14 FIELD SERVICE CHECKLIST

SYMPTOM	POSSIBLE CAUSE	FIELD TEST	REMEDY
A. No Gas Flow	1. Modulating valve improperly installed.	1. Arrow on side of valve should point in direction of gas flow.	1. Install properly.
B. Continuous Low Fire (Electronics problem)	2. Short circuit or no voltage to the amplifier. 3. Open circuit in TD114, Remote Temp. Selector circuit or wiring. 4. Short circuit in TS114, Discharge Air sensor or wiring. 5. Faulty amplifier.	2. Check for 24V AC at amplifier terminals 7 and 8. 3. Inspect for loose or broken wires between amplifier terminals 1 and 2 and TD114 termin 1 and 3. 4. Connect test resistor as described in Preliminary Circuit Analysis. Follow procedure outlined. 5. Check items 2,3, and 4.	2. Prove the power source. 3. Tighen connections or replace wiring. 4. If modulating voltages are obtained, check TS114 circuit for shorts. Replace TS114 if necessary. 5. If items 2,3 and 4 check out and modulating voltages are still not obtained, amplifier may be assumed faulty. Replace.
C. Continuous Low Fire, (Electronics OK)	6. Short circuit or open circuit in Modulator Coil 7. Plunger missing, jammed or improperly installed	6. Measure resistance across modulator terminals with connecting wires detached. 7. Inspect. Plunger should be installed per dwg and operate freely in solenoid sleeve.	6. Replace modulator head if not approximately 45-55 ohms for M611 Valve and 60-80 ohms for MR212 Valve. 7. Clean or replace plunger if necessary.
D. Incorrect Minimum Fire. Erratic or Pulsating Flame	8. Incorrect by-pass metering valve adjustment 9. Excessive negative burner pressure	8. See valve adjustments 9. Close main gas supply and measure manifold pressure with blower operating. Reading should be less than 1.5" w.c. negative pressure.	8. Adjust to proper minimum fire. 9. If reading is greater than 1.5" negative pressure, check for clogged filters and or other air restrictions. Consult factory for other solutions.
E. Continuous High Fire (Electronics Problem)	10. Short circuit in TD114 Remote Temp Selector circuit or wiring. 11. Open circuit in TS114/TS10765 Discharge or Inlet Air Sensor Circuit or wiring. 12. Jumper not connected across amplifier terminals 2 and 3.	10. Inspect for shorts at or between Amplifier terminals 1 and 2 or TD114 terminals 1 and 3. 11. Check TS114/TS10765 for open internal circuit. Connect test resistor as described in Preliminary Circuit Analysis. Follow procedure outlined. 12. Inspect.	10. Correct wiring if short exists. 11. If modulating valves are obtained, check TS114/Ts10765 for open circuits. Replace TS114/TS10765. 12. Correct the wiring.
F. Continuous High Fire (Electronics OK)	13. Foreign object holding valve open. 14. Plunger jammed.	13. Remove bottom plate and inspect valve and seat. 14. Inspect. Plunger should be smooth and clean and operate freely in solenoid sleeve.	13. Clean seat. Clean valve or replace if necessary. 14. Clean, or if necessary, replace plunger.
G. Incorrect Maximum Fire	15. Inlet pressure too low. 16. Incorrect outlet pressure adjustment of Pressure Regulator	15. Read pressure at inlet to modulating valve using a manometer with unit operating at full fire. Pressure should be equal to the sum of outlet pressure setting plus pressure drop of the valve. See Maxitrol Capacity Chart. 16. Read manifold pressure using manometer and compare with recommendation of equipment manufacturer.	15. Increase inlet pressure if possible. 16. See valve adjustments.
H. Erratic or Pulsating Flame	17. Hunting 18. Erratic air patterns or improper TS114 location. 19. Wiring is run next to high voltage switching circuits 20. Faulty Amplifier or erratic voltage supply.	17. Adjust sensitivity control counter clockwise. 18. Connect test resistor as described in Preliminary Circuit Analysis. Turn TD114 selector dial so heater goes through its entire modulating range. 19. Temporarily wire each of TD114,TS114, and MR212 externally and observe heater and equipment operation. 20. With test resistor connected (per item #18) and TD114 locally connected (per item #19) turn TD114 selector dial through entire modulating range.Observe D.C. voltage across modulator terminals.	17. If flame stabilizes, adjust sensitivity control to maintain an even flame. 18. If the flame is steady throughout the entire modulating range, the TS114 must be moved. 19. If smooth operation results, isolate effected wiring from souce of induced voltage. 20. If erratic or unstable D.C. voltages are obtained throughout the modulating range, the amplifier may be assumed faulty. Replace. If erratic operation is noted only over a small range of 2 or 3 volts the voltage source may contain surges. Consult Maxitrol.
I. Incorrect Discharge Air Temperature	21. Inlet Air Sensor is used. 22. Incorrect wiring. 23. System out of calibration. 24. Improper TS114 location. 25. Room Override Thermostat circuit closed.	21. Inlet Air Sensor changes 1 degree for each 3.5 degrees, 5 degrees, or 8 degrees outside temperature change from 60 degrees (predetermined - turndown varies with model used). 22. Check wiring diagrams. 23. Sensed temp (thermometer next to TS114) does not correspond to TD114 setting. 24. Sensed temp (thermometer next to TS114) does not represent average discharge air temp. 25. Remove Override Thermostat lead from terminal 2 of TD114.	21. Sensed temperature will vary from TD114 dial settings. This is intentional. 22. Correct wiring. 23. See calibration procedure. 24. Move TS114 to location where average representative temp can be sensed. 25. TD114 dial setting, then check thermostat setting and / or check for wiring shorts.
J. Burned out Transformer	26. Short circuit in modulator coil. 27. Short circuit between amplifier and modulator valve.	26. Measure resistance across modulator terminals with red lead wires disconnected. 27. Inspect wiring.	26. Replace modulator head if less than 40 ohms. 27. Correct wiring short if short is found.
K. Discharge Air Temperature too low when T115 is operative	28. Too low an Override Temperature Setting. 29. Burner capacity may be insufficient.	28. Check "Override Temperature Sensor" of TD114. 29. Check for high fire (Maximum manifold pressure specified for heater.	28. Reset to correct temperature. 29. If on high fire, control can do no more. Heater unable to furnish additional heat to raise temperature.

14.0 MAXITROL 44

SPECIFICATIONS:

PRESSURE ADJUSTMENT RANGES:	(MAXIMUM FIRE)
STANDARD (MR212)	2" TO 5" w.c. / 5 to 12 mbar
STANDARD (MR212-2)	2" TO 5" w.c. / 5 to 12 mbar reduced to 0" to 3" w.c. /0-75mbar
GASES:	All fuel gases
VENT:	M411, 511, 611...vertical vent outlet 1/8" NPT - 12A06 installed MR212... two vents located in upper housing, both equipped with vent limiting means
POWER REQUIREMENTS:	24 Volts, NEC Class II transformer 20VA
PRESSURE LIMITS:	
Maximum discharge pressure	(M411 , 511, 611)...7"w.c. / 17 mbar
MR212 outlet pressure springs:	1" to 3.5"w.c. / 2.5 to 9 mbar, 2" to 5" w.c./ 5 To 12 mbar, and 3" to 8" w.c./7-20 mbar
Static pressure rating	(M411, 511, 611)...5.0 psi / 345 mbar
Maximum operating inlet pressue	(M411, 511, 611) 1 psi / 70 mbar MR212...5.0 psi / 345 mbar
Maximum emergency exposure*	*MR212...12.5 psi / 862 mbar

*may not function properly at this pressure, but will suffer no internal damage

Installation of components

Wiring run: Control wires connected to the Selectrastat, Discharge Air Sensor, Remote Temperatue Selector / Sensor, Amplifier or Valve 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 amplifier. If shielded wires are used, shield must be insulated and grounded at the amplifier location only.

Amplifier / Amplifier – Selector: Install in any conventient location that is protected from the weather and contaminated atmosphere.

Selectrastat: This component selects and senses space temperature. Remove cover to mount in heated area where representative space temperature can be sensed.

Optional:
Remote Temperature Selector: Not temperature sensitive (select space temperature). Remove cover to mount in any convenient location. Note: Temperature selector and sensor
Room Override Stat: mount in heated are not in direct path of discharge air stream.
Inlet Air Sensor: install in convenient location upstream of burner, in intake air duct.

Temperature Calibration

Note: All electronic components are pre-calibrated to a base resistance. This permits field replacement without upsetting system calibration.

Minimum Discharge Air Temp:

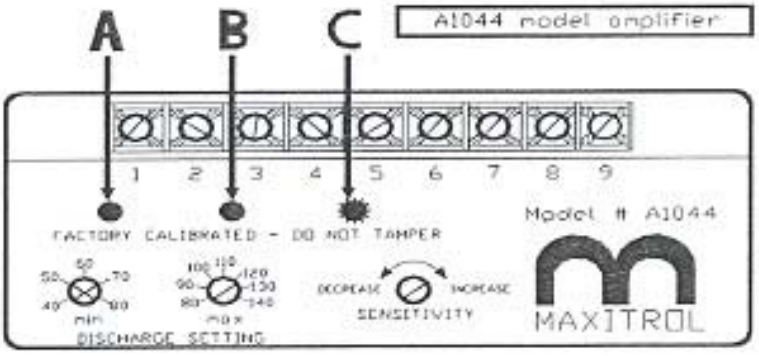
1. Install a thermometer or other temperature measuring device at a point adjacent to the tip of the TS144.
2. Connect a wire jumper between terminals #4 and #5. Be sure min. temperature setting is at least ten degrees higher than outdoor temp.
3. Turn the calibrating potentiometer (a) until the reading of the thermometer adjacent to the TS144 agrees with the min. setting of the Discharge Air Temp. Selector. Clockwise rotation increases temp (A1044L model adjusted from blue side).
4. Remove jumper.

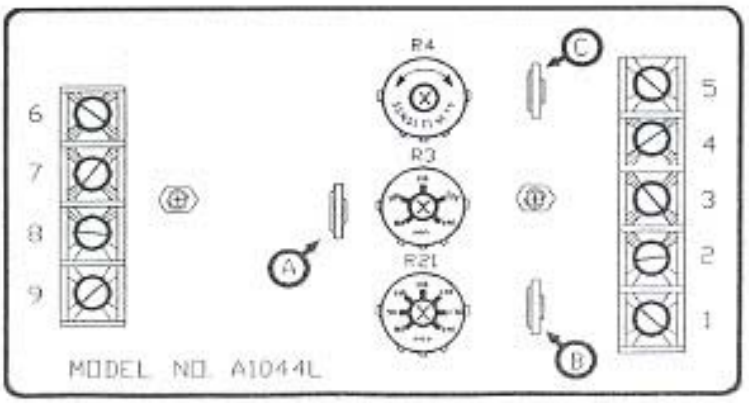
Maximum Discharge Air Temperature:

1. Install a thermometer or other temperature measuring device at a point adjacent to the tip of the TS144.
2. Disconnect wires from terminals #4 and #5. Connect 12K resistor across terminals #4 and #5.
3. Turn the calibrating potentiometer (b), until the reading of the Thermometer adjacent to the TS144 agrees with the maximum setting of the Discharge Air Temperature Selector. Clockwise rotation increases temperature (A1044L model adjusted from blue side) Be sure temperature setting does not exceed the design temperature rise of the heater.
4. Remove resistor and reconnect wires.

Space Temperature:

1. Install a thermometer or other temp. measuring device at a point Adjacent to the T244 or the TS244. Set the T244 or the TD244 (whichever is used) for the desired room temp. Because of the large space being heated, wait at least one half hour* to make certain adjustment is needed.
2. If the temperature reading is different from the temperature setting, turn © clockwisefor an increase in space temperature and counterclockwise for a decrease in temperature. Each increment on ajustment © is approximately 2.5 degrees (A1044L model adjusted from blue side.) After an adjustment has been made, give room temperature at least one half hour* to settle out before rechecking. *one half hour is only a time estimate. Longer or shorter periods may be required for the temperature to stabilize. Be sure space temperature is stabilized before attempting calibration.



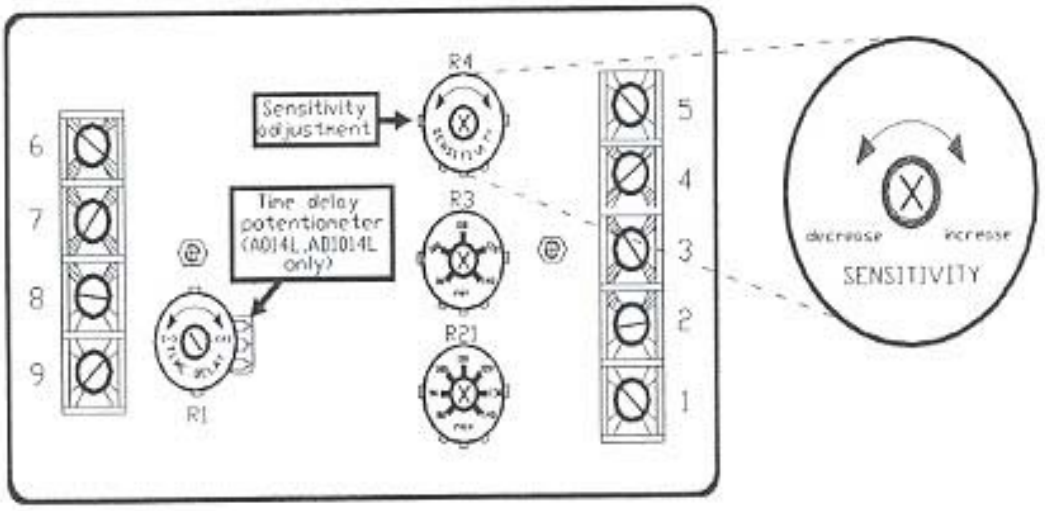


MAXITROL 44
LOW FIRE START TIME ADJUSTMENT

On A1044L (CL, DL, EL) amplifiers, the low fire start duration is adjustable from approximately 0-30 seconds, and abegins timing after the amplifier has been energized. High fire is delayed, and the M/MR valve remains in the low fire setting position during the delay time period.
Use a small screwdriver to adjust the time delay potentiometer.
Turn clockwise (+) to increase low fire start duration, and counter-clockwise (-) to decrease low fire start duration.

SENSITIVITY ADJUSTMENT

The sensitivity control will allow the user to control the response of the system. Caution should be exercised in the use of this adjusment. Under normal usage the pointer should be located on the mark of the label.
If hunting is encountered (rapid oscillation), rotating the sensitivity control counterclockwise may damper the oscillation, stabilizing the flame.
DO NOT adjust unless necessary, because decreasing the sentivity will increase the temperature "DROOP" of the system.



MAXITROL 44 FIELD SERVICE CHECKLIST

SYMPTOM	POSSIBLE CAUSE	FIELD TEST	REMEDY
A. No Gas Flow	1. Valve improperly installed.	1. Arrow on side of valve should point in direction of gas flow.	1. Install properly.
B. Continuous Low Fire. (Electronics O.K.)	2. Open circuit in modulator coil.	2. Remove wires connected to amplifier terminals 6 & 7 and measure resistance. MR212 (50-80 ohms), M811 (45-55 ohms).	2. If proper resistance values are not observed, replace modulator head or repair wiring.
	3. Plunger missing, jammed or improperly installed.	3. Inspect - plunger should be installed (as in figures on page3) and operate freely in solenoid sleeve.	3. Clean or replace plunger if necessary and install
	4. Perplured main or balancing diaphragm.	4. Disassemble valve for inspection of internal parts.	4. Replace diaphragm if ruptured.
C. Continuous Low Fire. (Electronics Problem)	5. No voltage to the amplifier.	5. Check for 24V AC at amplifier terminals 8 &9.	5. Provide 24V AC to amplifier. Refer to item 24.
	6. Short in modulator coil circuit.	6. Measure resistance per item 2.	6. If proper resistance values are not observed, replace modulator head or repair wiring.
	7. Short in TS144 circuit.	7. Remove wires connected to amplifier terminals 1,2,&3. Measure resistance across wires 1 & 3, then 2 & 3. Meter should read greater than 2000 ohms.	7. If readings are incorrect, replace the TS144 or repair wiring
	8. Faulty amplifier.	8. Follow procedures outlined in "PRELIMINARY CIRCUIT ANANLYSIS"	8. If power source and modulator coil check out (items 5 & 6) but proper modulating voltages cannot be obtained, then amplifier may be assumed at fault. Install replacement amplifier.
D. Incorrect Low Fire.	9. Incorrect by-pass metering valve adjustment.	9. See Valve Adjustments - Page 6.	9. Adjust to proper low fire.
	10. Excessive negative burner pressure.	10. Close main gas supply and measure manifold pressure with blower operating. Should be less than 1.5" w.c. negative pressure.	10. If greater than 1.5" negative pressure, check equipment for clogged filters and other inlet air restrictions. For other solutions, consult Maxitrol.
E. Continuous Minimum Discharge Air Temperature	11. Faulty amplifier	11. Follow procedures outlined in "PRELIMINARY CIRCUIT ANALYSIS"	11. If amplifier is proven at fault, install replacement amplifier.
	12. Short in T244 or TS244/TD244 circuit.	12. Remove wires connected to amplifier terminals 4 & 5. Set T244 or TD244 to max. setting. Measure resistance across wires. Meter should read 5000 ohms +1000(T244)if TS244/TD244 are used, meter should read 4500 ohms +1000 (TS244) and 2100 ohms + 150 (TD244).	12. If reading is incorrect, replace the T244, TS244/TD244 or repair wiring.
	13. Incorrect space temperature calibration.	13. Follow procedures outlined in "PRELIMINARY CIRCUIT ANALYSIS"	13. If proper action is obtained, first check item 12. Recalibrate if necessary.
F. Incorrect Max. or Min. Discharge Air Temperature.	14. Improper TS144 location.	14. Compare sensed temp. reading at TS144 with average discharge air temp.	14. Move TS144 to location where average temperature can be sensed.
	15. Incorrect discharge air temperature calibrations.	15. Follow procedures outlined in "PRELIMINARY CIRCUIT ANALYSIS"	15. If proper temperatures are not observed, refer to Discharge Air \Temperature calibration procedures.
G. Continuous High Fire. (Electronics O.K.)	16. Foreign material holding valve open.	16. Remove bottom Plate and inspect valve and seat.	16. Clean, replace valve and/or seat if necessary.
	17. Plunger jammed.	17. Inspect - plunger should be smooth and clean and operate freely in solenoid sleeve.	17. Clean, or if necessary, replace plunger.
H. Continuous High Fire. (Electronics Problem)	18. Oper circuit in TS144.	18. Measure resistance per item 7.	18. If readings are incorrect, replace the TS144 or repair wiring
I. Incorrect High Fire.	19. Inlet pressure too low.	19. Read inlet pressure at valve, using a manometer with heater operating at full fire. Pressure should be at least equal to the sum of: outlet pressure setting and press. drop of the valve (See Maxitrol Capacity Chart Bulletin) plus 1.0" w.c.	19. Increase inlet pressure if possible or change to larger valve. Consult Maxitrol about possibility of using special spring to reduce pressure drop on selected installations.
	20. Incorrect outlet pressure adjustment.	20. Read outlet pressure using manometer and compare with recommendation of equipment manufacturer.	20. See Valve Adjustments
J. Continuous Maximum Discharge Air Temperature	21. Faulty amplifier.	21. Follow procedures outlined in "Preliminary Circuit Analysis"(Sections I & II).	21. If amplifier is proven at fault, install replacement amplifier.
	22. Open circuit in T244 or TS244/TD244.	22. Measure resistance per item 12.	22. If reading is incorrect, replace the T244, TS244/TD244 or repair wiring.
	23. Incorrect space temperature calibration.	23. Follow procedures outlined in "Preliminary Circuit Analysis"(Section IV).	23. If proper action is obtained, first check item 22. Recalibrate if necessary.
K. Burned out Transformer. No Voltage to Amplifier.	24. Short in modulator coil circuit.	24. Measure resistance per item 2.	24. If proper resistances are not observed, replace modulator head or repair wiring.
L. Incorrect Space Temperature.	25. Incorrect maximum discharge air temperature setting (A1044).	25. Check to see if heater is delivering air at maximum discharge air setting.	25. If desired temperature is not reached, increase maximum discharge air temperature setting.
	26. Incorrect minimum discharge air temperture setting (A1044).	26. Check to see if heater is delivering air at maximum discharge air setting.	26. If desired space temperature is not reached, decrease minimum discharge air tmperature setting.
	27. Insufficient burner capacity.	27. Check to see if heater is operating at high fire.	27. If desired space temperature is not reached with heater at high fire, it may be undersized. Consult equipment manufacturer.
		28. Place thermometer next to T244 or TS244. Compare space temperature reading with Y244 or Y5244 dial setting.	28. If temperature reading is incorrect, check items 25, 26, & 27, then recalibrate if necessary.

* Control circuits external to the Series 44 can cause burner malfunction. Always check manual valve to be certain gas is on, and check limit controls for normal operation.

15.0 REGULATORS

GAS APPLIANCE PRESSURE REGULATORS / STRAIGHT-THRU–FLOW DESIGN INCLUDING RV-52, RV-53, RV-61, RV-81, RV-91, RV-111, AND RV131

MAXIMUM PRESSURE

• A.G.A. RATED (EXCEPT RV131) MAXITROL TESTED*	½ PSI (35 mbar)
• RV52 & RV53	½ PSI (35 mbar)
• RV61, RV81, RV91, RV111	1 PSI (70 mbar)
• RV131	2 PSI (140 mbar)

*DO NOT USE IF INLET PRESSURE IS MORE THAN 10 TIMES DESIRED OUTLET PRESSURE

EMERGENCY EXPOSURE LIMITS (MAXITROL TESTED)

• RV52 & RV53	3 PSI (210 mbar)
• RV61, RV81, RV91, RV111	5 PSI (350 mbar)
• RV131	15 PSI (1050 mbar)

EMERGENCY EXPOSURE LIMITS *

• RV52 & RV53	15 PSI (1050 mbar)
• RV61, RV81, RV91, RV111 RV131	25 PSI (10750 mbar)

*PLEASE NOTE THAT INTERNAL DAMAGE MAY OCCUR WHEN EXPOSED TO THESE PRESSURES

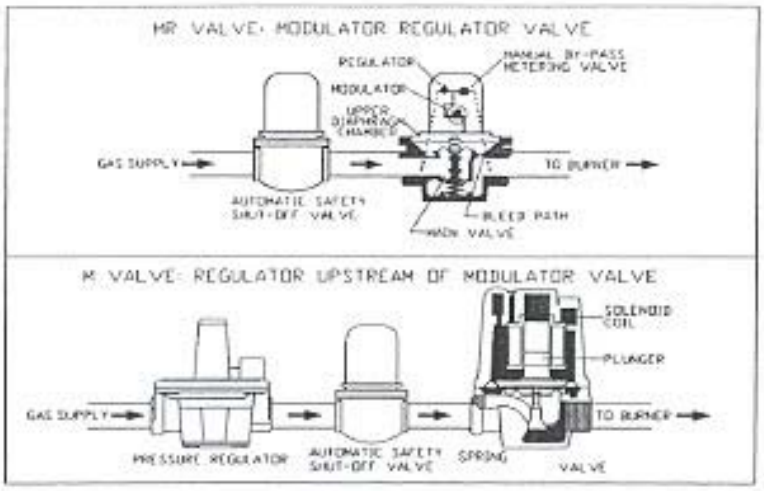
AMBIENT TEMPERATURE LIMITS

• RV52, RV53,RV61, RV81 RV91, RV111	-40 TO 205 F (-40 TO 96 C)
• RV131	-40 TO 125 F (-40 TO 52 C)

GASES: NATURAL, MANUFACTURED, MIXED, LIQUEFIED PETROLEUM, OR LP GAS AIR MIXTURE.

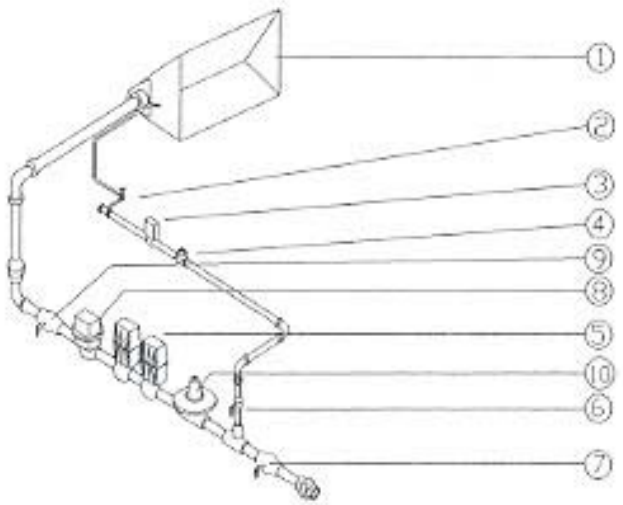
16.0 TYPICAL GAS TRAIN / VALVES

Modulator (M) or Modulator-Regulator (MR) Valve: Mount in upright position in horizontal run of pipe, downstream of other controls – a separate gas pressure regulator must be used with any modulator (M) valve.



STANDARD GAS MANIFOLD CONFIGURATION

ITEM 1	BURNER	ITEM 6	PILOT MANUAL SHUTOFF VALVE
ITEM 2	PILOT FIRING VALVE	ITEM 7	MAIN BURNER TEST FIRE VALVE
ITEM 3	PILOT AUTO SHUTOFF VALVE	ITEM 8	MODULATING GAS VALVE
ITEM 4	PILOT GAS PRESSURE REGULATOR	ITEM 9	MAIN BURNER TEST FIRE VALVE
ITEM 5	MAIN BURNER AUTO SHUTOFF VALVE	ITEM 10	MAIN GAS PRESSURE REGULATOR



17.0 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 THROUGH THE AIR PORTS INTO THE COMBUSTION ZONE. THE AIR SUPPLY IS CONSTANT THROUGH 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 IS CONTAINED WITHIN THE BURNER CASTING IT IS EFFECTIVELY SHIELDED FROM FIRE DISRUPTING UNCONTROLLED AIR ENTRY.

AS THE GAS SUPPLY IS INCREASED THE FLAME PROGRESSES INTO THE INTERMEDIATE FIRE ZONE WHERE AN ADDITIONAL SUPPLY OF AIR IS AVAILABLE. AT HIGHER 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.

WITH 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 A SUCTION GENERATED 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 4.5" W.C. TO LESS THAN ZERO, WHEN THE UNIT IS MODULATING FROM HIGH TO LOW FIRE.

18.0 PROPER COMBUSTION FOR THE DIRECT FIRED BURNER

FOLLOWING ARE INDICATIONS OF PROPER COMBUSTION:

1. BLUEISH FLAME WITH ORANGE TIPS WHEN BURNING NATURAL GAS.
2. STABLE EVEN FLAME NOT PULSATING OR RADICAL PATTERN.
3. ON HIGH FIRE THE FLAME SHOULD RANGE 12-18" IN LENGTH.
4. ON LOW FIRE FLAME SHOULD RUN ALL THE WAY ACROSS THE BURNER AND BE 1-2 INCHES LONG.
5. FLAME SHOULD EMIT LESS THAN 5PPM CO WHEN CHECKED WITH A COMBUSTION ANALYZER.
6. FLAME SHOULD NOT PRODUCE ANY SUBSTANTIAL ODOR.

INSTRUMENTS REQUIRED:
PRESSURE DIFFERENTIAL GUAGE (MANOMETER OR MAGNEHELIC)
THERMOMETER WITH A SCALE –30 + 200F.

REFER TO THE FOLLOWING EXAMPLES TO DETERMINE AIRLOW AND BURNER CAPACITY FOR INSTALLATION.

18.1 EXAMPLE 1
TO DETERMINE THE AMOUNT OF AIR FLOWING THROUGH THE UNIT, CLOSE MAIN FIRING VALVE AND MEASURE PRESSURE DROP ACROSS THE PROFILE PLATE.

ASSUME THAT THE DROP MEASURED WAS 0.5" WC. REFER TO THE BURNER CAPACITY CHART AND LOCATE THE PRESSURE ON THE LEFT. EXTEND THE HORIZONTAL LINE TO READ THE VELOCITY CORRESPONDING TO THE DROP.

VELOCITY = 2900 FPM

ASSUMING THAT THE FREE AREA OF THE PROFILE IS 2.42 FT SQ. CALCULATE THE AIR FLOW THROUGH THE UNIT AS FOLLOWS:

CFM = 2900 x 2.42 = 7,018 CFM

REFER TO TABLE II FOR THE BTU/HR REQUIRED FOR EACH 1000 CFM AT A GIVENTEMPERATURE RISE. ASSUME THAT THE INLET AIR TEMPERATURE IS –20F AND THE DESIRED DISCHARGE IS 80F. THE REQUIRED HEAT INPUT PER 1000 CFM AT A 100F RISE WILL BE 108,000 BTUH.

CAPACITY = 7 x 108,000 = 756,000 BTUH TO HEAT THE AIR THROUGH THE UNIT 100F

THEREFORE THE BURNER MUST HAVE A CAPACITY OF 756,000 BTUH.

18.2 EXAMPLE 2
CLOCK THE AMOUNT OF GAS FLOWING TO THE UNIT. ASSUME THE FLOW TO BE 616FT 3. USING A THERMOMETER CHECK THE DISCHARGE AIR TEMPERATURE. ASSUME IT TO BE 70F WITH AN INLET AIR TEMPERATURE OF –10F.

REFER TO TABLE II TO DETERMINE THE REQUIRED GAS TO HEAT 1000 CFM A TOTAL OF 80F. GAS INPUT REQUIRED IS 88,000 BTUH.

TOTAL INPUT MEASURED = 616,000 BTUH

THEREFORE THE AIRFLOW THROUGH THE UNIT IS

$$\frac{616{,}000}{88{,}000} \times 1000 = 7000 \text{ CFM}$$

18.3 EXAMPLE 3
IF YOU ARE UNABLE TO CLOCK THE INPUT OR SHUT OFF THE MAIN BURNER THE AIR FLOW CAN BE DETERMINED AS FOLLOWS:

ASSUME THAT AN 80F TEMPERATURE RISE IS NEEDED, AND THAT THE UNIT RATING PLATE INDICATES THAT THE AIR VOLUME TO BE 7000 CFM WITH AN INPUT OF 616,000 BTUH. MEASURE THE DROP ACROSS THE PROFILE. ASSUME THAT THE DROP IS .38" W.C. THE BURNER LENGTH IS 2 FEET AND THE PROFILE AREA 2.42 FT.2

GAS CONSUMPTION PER FOOT OF BURNER = 308 FT 3
REFER TO THE BURNER CAPACITY CHART, READING LEFT TO RIGHT. LOCATE THE VALUE 308 THEN FOLLOW THE VERTICAL
LINE TO THE INTERSECTION WITH THE HORIZONTAL LINE CORRESPONDING TO .38" WC. PROCEED UP THE CURVE (OR DRAW A NEW SLOPE PARALLEL TO EXISTING CURVES) AND READ 0.5" WC.
READ ACROSS THE VELOCITY AXIS AND THE VALUE 2900 FPM.

CFM THROUGH THE UNIT = 2900 x 2.42 = 7,018

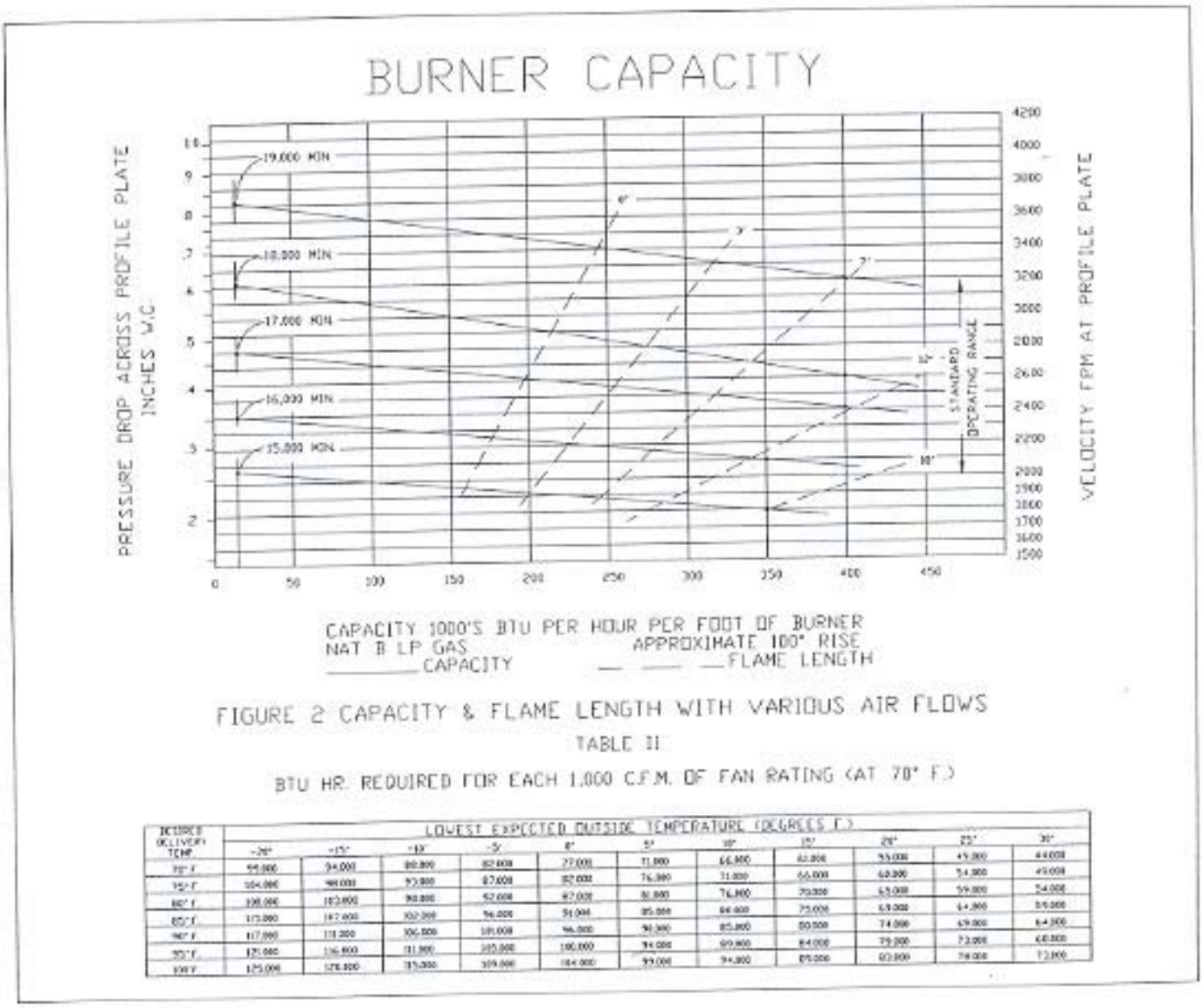


FIGURE 2 CAPACITY & FLAME LENGTH WITH VARIOUS AIR FLOWS

TABLE II

BTU HR. REQUIRED FOR EACH 1,000 C.F.M. OF FAN RATING (AT 70° F.)

INCHES DELIVERY TEMP	LOWEST EXPECTED OUTSIDE TEMPERATURE (DEGREES 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	60,000	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	100,000	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

19.0 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

All Browning Bearings are equipped with a hydraulic grease fitting threaded into the housing for ease of relubrication. The proper amount of lubricant in the bearing is important. Both excessive and inadequate lubrication may cause failure. The bearings should be relubricated while they are rotating (if it is safe to do so); the grease should be pumped in slowly until a slight bead forms around the seals. This bead in addition to acting as an indicator of adequate relubrication provides additional protection against the entry of foreign matter and helps flush out contaminates in the bearing.
By the time the slight grease bead is formed, it will be noted that the bearing temperature will rise. It is not uncommon for the temperature to rise as much as 30 degrees Fahrenheit after relubrication. If necessary to relubricate while the bearing is idle, refer to the recommended relubrication grease chart tables below for various size 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 a lithium soap to conform to NLGIgrade 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 -30F to +250f.

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

General Duty Ball & Roller
- 55-75 SUS @ 210F
- 450-750 SUS @ 100F

Premium Duty Ball & Roller
- 65-75 SUS @ 210F
- 500-750 SUS @ 100F

Heavy Duty Roller Bearing
- 82 SUS @ 210F
- 800 SUS @ 100F

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

Recommended Relubrication
Table No. 1

Ball Bearings		Roller Bearings	
Shaft Size (in.) (inches)	Grease Charge (ounces)	Shaft Size (in.) (inches)	Grease Charge (ounces)
1/2 to 3/4	0.03	1-3/16 to 1-1/4	0.1
1/4 to 3/16	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
1-15/16 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	2.6
		4-7/16 to 4-1/2	3.1

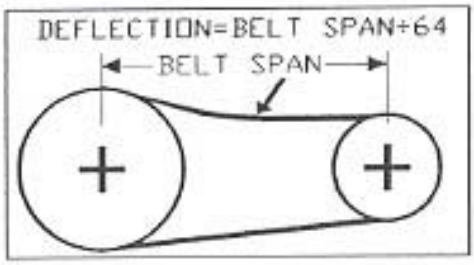
Frequency of relubrication depends upon operating conditions. The bearing operating temperature is the best index for determining a relubrication schedule. The following chart gives the frequency of relubrication based upon continuous operation for various operating temperatures and can be used as a satisfactory guide for determining when Browning bearings should be relubricated.

Lubrication Frequency
Table No.2

Speed	Temperature	Cleanliness	Greasing Interval
500 RPM	Up to 125F	Clean	6 months
500 RPM	Up to 130F	Clean	2 months
1000 RPM	Up to 210F	Clean	2 weeks
1500 RPM	Over 150F	Clean	Weekly
ANY SPEED	Up to 150F	Dirty	1 Week to 1 Month
ANY SPEED	Over 150F	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

20.1 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 belt and bearing life.
4. Keep belts free from foreign material which 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.



20.0 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 their 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.
7.) Check the flame sensor; clean if necessary.
8.) Check the fuel supply pressure at the unit.
9.) Check the manifold pressure.
10.) Check all dampers, linkages and damper actuators; adjust and tighten as required.
11.) Clean or replace filters if necessary. Replace only with equivalent of supplied filter.
12.) Check all belts; adjust or replace as necessary.
13.) Check all bearings and lubricate if necessary.
14.) Check operation of all safety controls

21.0 RECOMMENDED YEARLY MAINTENANCE:

1.) Perform the monthly maintenance recommended.
2.) Inspect blower wheels and housings; 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.
6.) Check flame supervision relay.
7.) Inspect all operating and safety controls; clean and replace if necessary.
8.) Clean the burner.

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

22.0 REPLACEMENT PARTS

To order replacment parts, please provide the following information when contacting your local representative:

- Unit model number
- Unit serial number
- Purchase order number
- Address for replacement part delivery
- Company representative for us to contact should questions arise
- Part Description and model number from your record drawings.

INDUSTRIAL
COMMERCIAL
EQUIPMENT
I.C.E. (US), INC.
•140 AIRPORT LANE, BOLIVAR TENNESSEE 38008

WARRANTY

DIRECT FIRED SERIES WARRANTY

THE WARRANTY ON THE I.C.E. MANUFACTURING DIRECT GAS FIRED MAKE UP AIR UNITS IS 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 OR COMPONENTS FABRICATED BY OR INSTALLED BY US WITH THE EXCEPTION OF AIR FILTERS, FLAME RODS, IGNITORS, AND BLOWER BELTS.

WITHIN THE ONE YEAR WARRANTY, REPLACEMENT PARTS WILL BE SHIPPED COLLECT AND CHARGED TO THE CUSTOMER'S 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 BE INSTALLED BY A QUALIFIED HEATING CONTRACTOR IN ACCORDANCE WITH THE PROVISIONS OF THE SERVICE MANUAL.
2.) THE UNIT SHALL HAVE BEEN INSTALLED IN ACCORDANCE WITH ALL STATE AND LOCAL CODES.
3.) THE UNIT SHALL HAVE BEEN SUBJECT TO ONLY NORMAL USE IN SERVICE AND SHALL HAVE NOT BEEN MISUSED, NEGLECTED, ALTERED OR OTHERWISE DAMAGED.
4.) THE UNIT SHALL HAVE BEEN OPERATED WITHIN ITS RATED 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 I.C.E. NOR ANY OF ITS DISTRIBUTORS OR DEALERS IS AUTHORIZED TO ASSUME FOR I.C.E. ANY OTHER OBLIGATION OR LIABILITY IN CONNECTION WITH THIS PRODUCT NOR ALTER THE TERMS OF THE WARRANTY IN ANY WAY. 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 TRANSPORTATION CHARGES FOR ANY ALLEDGED DEFECTIVE PARTS SHALL BE PREPAID BY THE OWNER. I.C.E. WILL NOT ACCEPT CHARGES FOR PARTS PURCHASED UNLESS THE CONDITIONS OF THE 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. I.C.E. 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 UNIT OR ITS USE BY THE OWNER. I.C.E. LIABILITY IS LIMITED EXCLUSIVELY TO THE REPAIR OR REPLACEMENT OF THE DEFECTIVE PART. PARTS CAN BE OBTAINED FROM I.C.E. (US) INC., IN BOLIVAR, TENNESSEE ON THE BASIS THAT CREDIT WILL BE ISSUED IF DEFECTIVE PARTS RETURNED QUALIFY FOR REPLACEMENT PURSUANT TO THE TERMS AND CONDITIONS OF THIS WARRANTY.