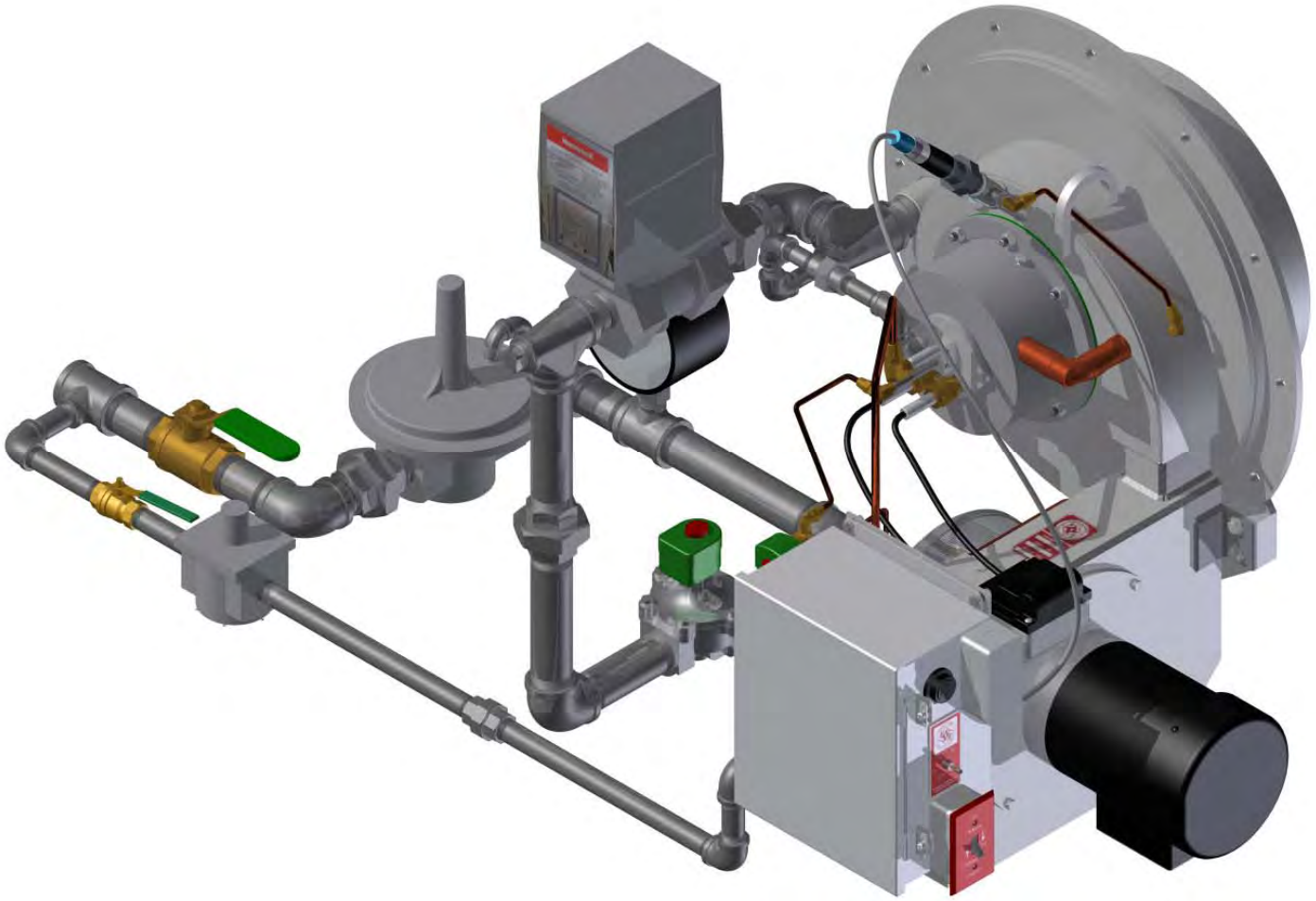
OPERATION AND SERVICE MANUAL



MODELS 400
COMBINATION BURNERS

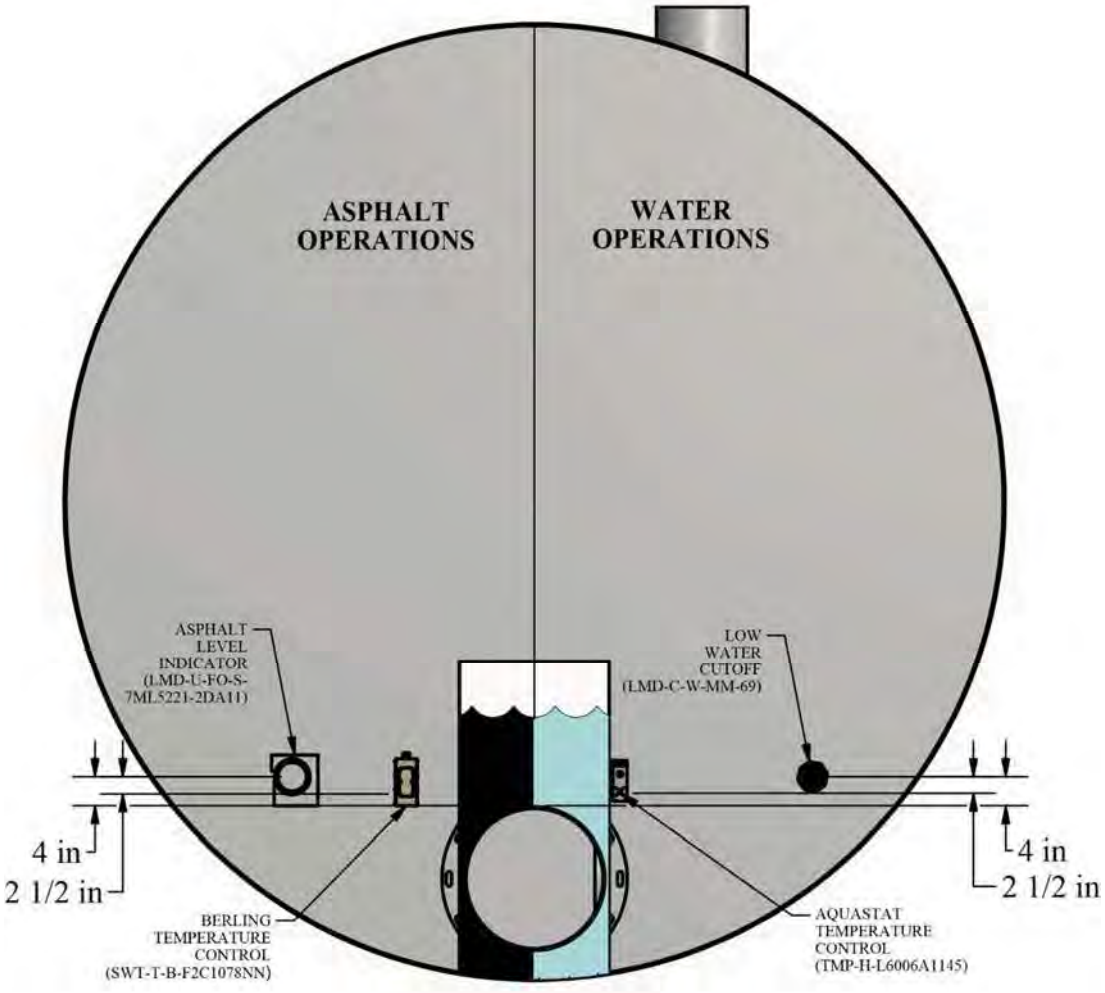
TABLE OF CONTENTS

1
SAFETY

RECOMMENDED SAFETY CONTROLS FOR IMMERSION HEATERS

The combustion tube and controllers must be covered with liquid at all times when burner is operating.

When draining the tank, the burner must be turned off one hour prior to opening the drain valve.



FAILURE TO FOLLOW THESE GUIDELINES MAY RESULT IN AN EXPLOSION AND CATASTROPHIC FAILURE MAY OCCUR

IMPORTANT NOTES ON THE FIRETUBE

It is the customer's responsibility to ensure their firetube is in good shape prior to new burner installation.

- The Firetubes provided with new Infern-O-Therm tanks are made from seamless, standard schedule pipe.
- For burner retro-fits, the customer should fully inspect their firetube for any damage before installing the new burner.
- Firetubes should be free of cracks and excessive corrosion.
- Firing Infern-O-Therm burners that are not structurally sound should not be fired. Doing so can result in catastrophic failure.

WARNING

This product should only be operated or serviced by trained and authorized personnel. Operators and service personnel must always consult the owner's manual supplied with this product and be conversant and knowledgeable of its contents.

Always read and understand the information contained in this manual before operating your equipment. If you have any Questions or find any omissions, contact Meeker Equipment immediately before operating your equipment.

Allow only trained and authorized persons to operate or service your equipment. **Uninformed operators or improper operation can result in accidents, injuries, or death.** Unauthorized service may void your equipment warranty, lead to equipment damage, and jeopardize your safety and that of others.

When in doubt, always read the manual.

SAFETY DISCLAIMER

THE FOLLOWING INFORMATION FOUND IN THIS MANUAL IS NOT INTENDED TO COVER EVERY POSSIBLE SAFETY HAZARD THAT COULD OCCUR AT A FACILITY.

MEEKER EQUIPMENT, INC. DOES NOT REPRESENT THAT THIS INFORMATION IS COMPLETE AND ALL INCLUSIVE IN TERMS OF SAFETY WARNINGS.

IT IS THE SOLE RESPONSIBILITY OF THE PLANT OWNER AND/OR MANAGEMENT TEAM TO ONLY EMPLOY PROPERLY TRAINED, EXPERIENCED AND AUTHORIZED PERSONNEL TO OPERATE, CLEAN, ADJUST, MAINTAIN, AND OR MODIFY COMPONENTS OF THE COMBUSTION SYSTEM.

IT IS THE PLANT FOREMAN'S RESPONSIBILITY TO ENSURE THAT ALL EMPLOYEES READ AND UNDERSTAND THE COMPONENTS OF THIS MANUAL AND ALL OTHER INSTRUCTIONS RELATED TO THE OPERATION.

SAFETY

Safety is a matter of common sense. Established safety rules must be enforced at all times. Plant personnel must understand that written rules and procedures cannot be developed for every element of asphalt production. It is therefore the responsibility of all plant personnel continuously improve their knowledge of safety procedures and requirements, by attending required safety schools and meetings.

Follow these six basic rules at all times:

1. Prior to beginning any inspection, maintenance, or repair of any component, energy isolating devices are mandatory, as well as lockout/tag out procedures to prevent unexpected start-up and/or the releasing of stored energy.
2. Never attempt to clean, lubricate, or adjust any machine while it is in motion.
3. Never employ personnel who have not completed all safety training for maintenance, inspection, and/or operation of any asphalt equipment.
4. Always stand clear of all components while they are operating. Never place any part of your body in a location which may cause personal injury from entanglement, pinching, crushing, etc.
5. Be sure all personnel dress properly in accordance to the OSHA manual.
6. Be sure all personnel wear OSHA approved eye protection.

SAFETY WARNING

EMPLOY ONLY LICNSED ELECTRICIANS TO WORK ON ELECTICAL EQUIPMENT, MOTOR CONTOL CENTERS AND ANY ELECTRICAL APPARATUS.

Never allow any personnel that are not licensed electricians to inspect, troubleshoot, repair or service any electrical components.

Never allow any plant personnel to remove cover panels from motor control centers for purposes of inspection, repair, or replacement of basic components.

Be sure personnel is aware of the location of primary power feed shut offs for motor control centers. Always lockout the motor control main disconnect when it is shut off.

Failure to shut off and lockout the motor control center main disconnect is a critical mistake that may cause injury or death to plant or service personnel working in or around the machine.

2

INSPECTION AND WARRANTY

INSPECTION UPON RECIEVING

WHEN EQUIPMENT ARRIVES

When equipment arrives, inspect the equipment prior to unloading. Care should be taken to inspect all parts and components. If damage is found, follow these instructions:

1. Notify the transportation company immediately of any damage to the equipment.

2. Write on the bill of lading any damage to the equipment BEFORE the unit gets unloaded.

3. Phone Meeker Equipment Co., Inc. at 1-888-333-0323 immediately and identify the damage to a Meeker Equipment Co., Inc. representative.

4. Take any photographs of the damaged equipment prior to unloading the equipment.

Failure to follow these procedures will nullify any warranty on the equipment and the damage will be considered the responsibility of the end-user.

EQUIPMENT DATA SHEET

DO NOT REMOVE!

This sheet contains important information about your equipment.

Please refer to information below when contacting us for assistance.

JOB INFORMATION

Customer Name:

Customer Location:

Meeker Job #:

Model #:

Serial #:

Description:

Ship Date:

Meeker Equipment Company, Inc.
1440 Industry Road

Hatfield, PA 19440
(PH) 215-361-2900
(FX) 215-361-1725

Meeker Equipment Company, Inc.
5602 State Route 655
Belleville, PA 17004
(PH) 717-667-6000
(FX) 717-667-6730

==========

MEEKER EQUIPMENT
Infern-O-Therm Burner
Operation and Service Manual

SERIAL NUMBER IDENTIFICATION

THE TAG SHOWN BELOW WILL BE LOCATED ON THE FAN HOUSING OF EVERY MODEL BURNER.

DO NOT REMOVE PRODUCT TAG FROM EQUIPMENT

P.O. BOX 925 LANSDALE, PA 19446 ph. 610-277-4258 fax 215-361-1725

New Equipment Standard Limited Warranty

Warranties and Limitations of Remedies. All equipment and material not manufactured or designed by Seller shall receive only such warranty, if any, as is given by the manufacturer thereof. **Seller warrants that each item of equipment or part(s) manufactured or designed for integration into a product by Seller, except "used equipment"** sold hereunder, shall be free from defects in material and fabrication **for a period of six (6) months from the date of shipment.** Seller makes no other express warranty (except such express warranties, **if any, as may be made in any written proposal to Buyer, or in any separate written warranty delivered to Buyer**, and then only when such proposal or separate warranty is signed by a duly authorized officer of the Seller) and makes no implied warranties with respect to such equipment. THE FOREGOING EXPRESS WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. If the equipment herein sold is air pollution equipment, the Seller shall not be liable for damages caused by abrasion, corrosion, excessive temperature, condensation of moisture, chemical attack, fire, explosion, improper operation contrary to the instructions issued by Seller, insufficient maintenance, circumstances beyond the control of Seller or operation of the equipment under substantially different conditions than those stated in the specifications. BUYER'S SOLE AND EXCLUSIVE REMEDY FOR BREACH OF ANY WARRANTY MADE, INCLUDING ANY SUBSEQUENTLY MADE WRITTEN WARRANTY, SHALL BE THE RIGHT TO REQUIRE SELLER TO REPAIR AT PLACE OF SHIPMENT OR, AT SELLER'S OPTION, TO REPLACE F.O.B. PLACE OF SHIPMENT, ANY DEFECTIVE EQUIPMENT. **Buyer will pay for the cost of disassembling and returning the allegedly defective equipment or parts** to Seller's place of business for such repair or replacement. Buyer will be responsible for freight to return alleged defective equipment or parts to factory for inspection, and/or freight to ship replacement parts to buyer's place of business. **In the event that buyer requests Service Personnel to replace alleged defective parts, buyer agrees to pay, in full, costs for Service Personnel 30 days from date of invoice**. In the event that buyer requests seller to ship replacement parts for allegedly defective parts, **buyer agrees to pay all freight costs 30 days from date of invoice.** In the event that repair or replacement is an ineffective remedy, Buyer's sole and exclusive additional remedy is the right to recover an amount not to exceed the amount paid to the Seller for the allegedly defective item of equipment upon the return of the defective item of equipment to Seller at Buyer's cost, if so requested by Seller. Written notice is required specifying in what particular manor the item of equipment is considered to be defective. **Notice of warranty claims must be made by the Buyer in writing to Meeker no later than fourteen (14) calendar days following the warranty's expiration date.** Notice must specify in what particular manor the item of equipment is considered to be defective.

Buyers Absolute Release of Incidental and/or Consequential Damages

IN NO EVENT SHALL SELLER BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, AS DEFINED BY THE UNIFORM COMMERCIAL CODE OR FOR THE LOSS OF PROFITS OR REVENUE, OR FOR LOSS OF USE, OR FOR ACTUAL LOSSES OR FOR LOSS OF PRODUCTION OR PROGRESS OF CONSTRUCTION, WHETHER RESULTING FROM DELAYS IN SHIPMENT, DELIVERY OR PERFORMANCE, OR FOR SELLER'S BREACH OF ANY WARRANTY. In the event Buyer repairs or alters the equipment without Seller's prior written consent, then Seller's warranty shall terminate at the time of such repairs or alterations. If trade-in equipment is made by the Buyer hereunder to pay part of the purchase price, Buyer hereby represents and warrants to the Seller that the equipment traded-in to Seller is owned by the Buyer in his sole name, that the equipment is free and clear of all liens and encumbrances and that the Buyer has the right to, and does hereby, convey all of his rights, title, and interest in the equipment to the Seller.

3
INSTALLATION

FUEL OIL LINE INSTALLATION

1-Two Pipe System: This method is preferred because any air in fuel line will self-vent.

a) By pass plug must be installed.
b) Refer to fuel pump instructions for connections.

2-One Pipe Installation: This method is acceptable but should be done in the following manner.

a) By-pass plug must be installed.
b) Install a flare tee in the supply line three of four feet before fuel pump.
c) Connect supply line to either inlet port.
d) Connect third port to tee and bottom of return port.

Note: This installation will not self-vent air but will sufficiently cool the oil pump.

This method can only be used when the bottom of the fuel tank is higher than the burner.

USE ONLY 1/2" OD COPPER LINE AND ONLY FLARE FITTINGS FOR OIL SUPPLY. Compression fitting may cause air leaks.

Refer to fuel pump instruction sheet.

INSTALLATION FOR OIL FIRED HOT WATER SYSTEM

1. Standard for Infern-O-Therm burner is 115 volt single phase power to burner enclosure.
2. Fuel pump hook up to use ½" OD copper with all connections flared.
   Fuel filter recommended, Two Pipe fuel pump hook up is recommended (follow fuel pump instruction sheet.
3. Water inlet system operates independently of burner operation, power is 115 volt. High water cutoff is wired through solenoid valve to allow water to flow through copper water inlet manifold when the water level in tank drops. (Follow wiring and piping schematics)
4. Infern-O-Therm burner will not operate until water level is 4" above highest point of firetube,
5. After above procedures have been done, turn burner switch on and reset Fireye control by pushing reset button, (Power must be on the reset Fireye control)
6. Oil Flow rate and Pressure Data

MODEL NUMBER	BTU INPUT	NOZZLE SIZE	OIL PRESSURE	PROPANE PILOT
48/13	310,500	2.25 GPH	100 PSI	NO
48/100	414,000	3.00 GPH	100 PSI	NO
150	621,000	4.50 GPH	100 PSI	NO
200	828,000	6.00 GPH	100 PSI	NO
300	1,380,000	10.00 GPH	100 PSI	YES
400	2,760,000	15.00 GPH	180 PSI	YES

7. Model 300 & 400 burners require propane ignition, a 100# propane tank is recommended with a GTP-R-F-R632A-CFF regulator and a GTP-A-P-ME-1669-12 Pig Tail Adapter. The table below shows the recommended pilot pressures.

MODEL NUMBER	PILOT GAS PRESSURE	
	PROPANE	NATURAL GAS
300	11" WC	14" WC
400	11" WC	14" WC

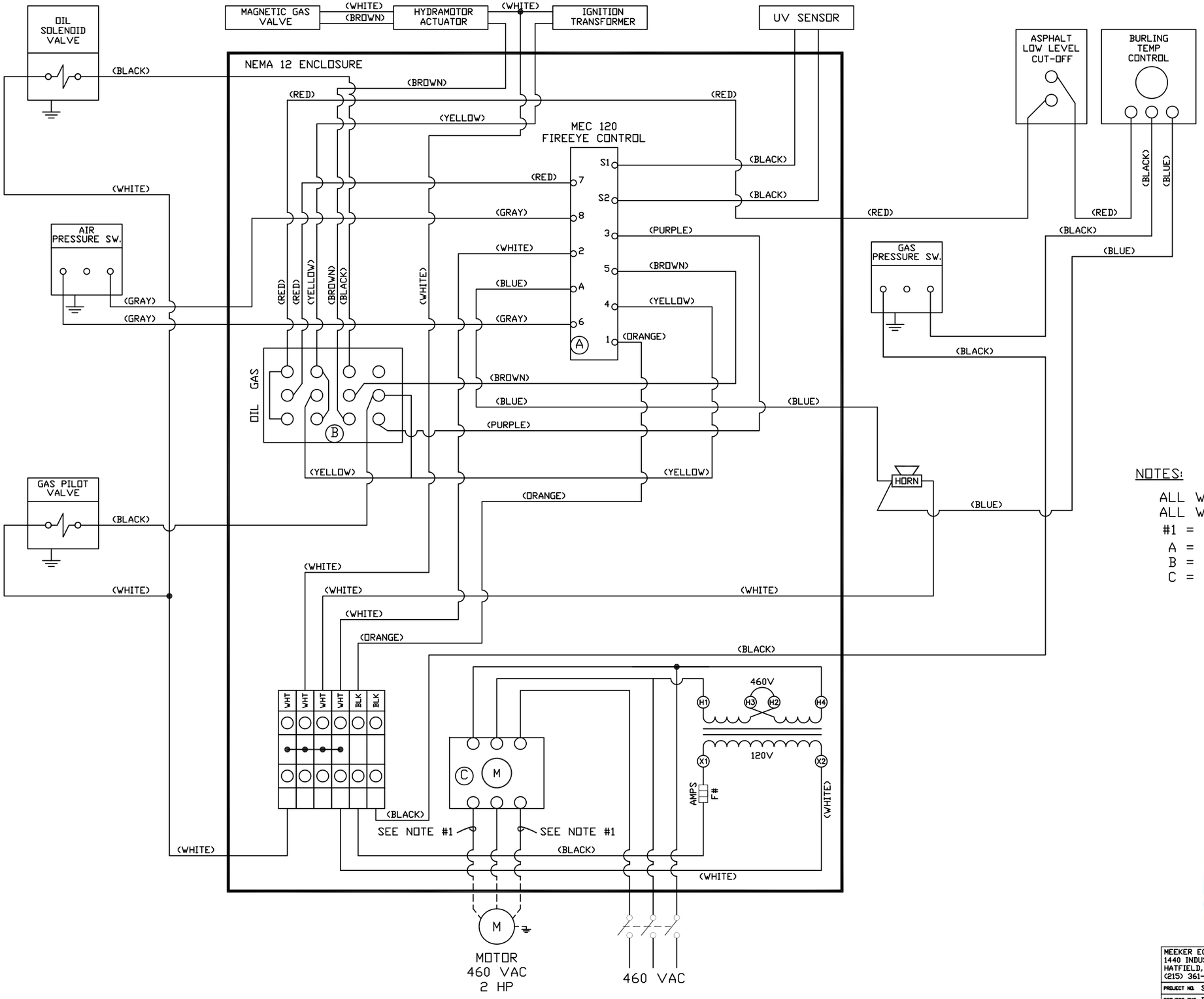
4
CONTROLS

MEP230H PROGRAMMER MODULE DIPSWTICH SETTINGS

THE PICTURE BELOW SHOWS HOW THE DIPSWITCHES SHOULD BE SET FOR INFERN-O-THERM BURNERS RUNNING ON GAS. (ALL OPEN)

DIPSWITCH GUIDE

SWITCH						FUNCTION	
6	5	4	3	2	1		
				C	C	7	PURGE TIME SECONDS
				C	O	30	
				O	C	60	
				O	O	90	
			C			DISABLED	POST* PURGE
			O			15 SECONDS	
		C				5	PTFI TIME
		O				10	
	C					DISABLE	PROVE AIR FLOW
	O					ENABLE	
C						RECYCLE	
O						NON-RECYCLE	



NOTES:

CUSTOMER SUPPLIED DEVICE
FIELD WIRING

NOTES:

ALL WIRES TO BE 16 AWG EXCEPT AS FOLLOWS:
ALL WIRES COLOR CODED AS INDICATED
#1 = USE 12 AWG WIRE
A = MEC-120 FIREYE CONTROL
B = GAS - OIL SWITCH
C = MOTOR CONTRACTOR

MEEKER

REV.	REV. DATE	DRAWN BY	CHK'D BY	APPR. BY	DESCRIPTION OF REVISION
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
0	1/31/14	BKM	BKM	BKM	-

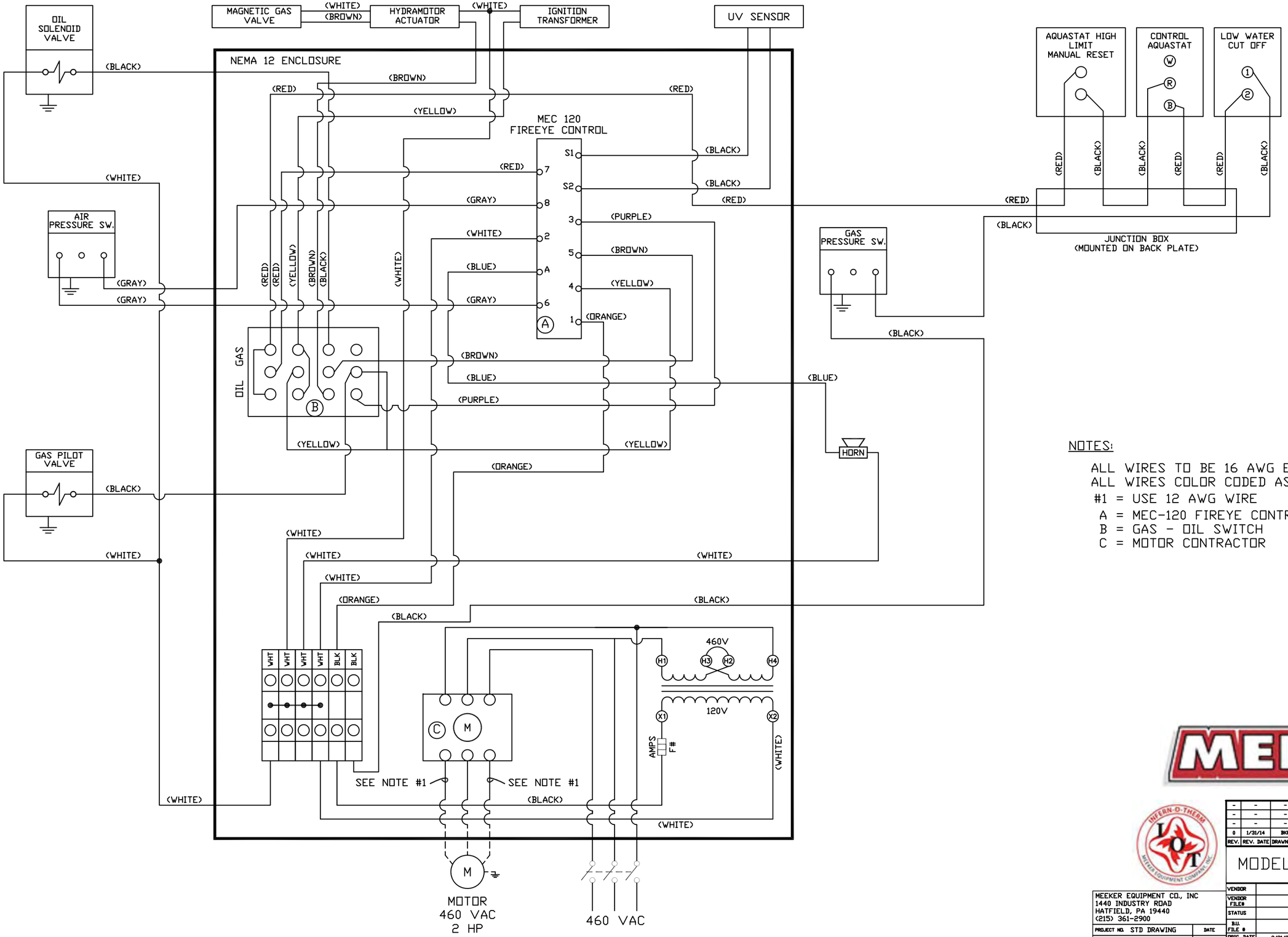
MODEL 400 460 VAC

MEEKER EQUIPMENT CO., INC
1440 INDUSTRY ROAD
HATFIELD, PA 19440
(215) 361-2900

		DATE
PROJECT NO.	STD DRAWING	
PROJECT ENG.	B. MATTIS	1/24/14
CHECKED	B. MATTIS	1/24/14

VENDOR	MEEKER EQUIPMENT
VENDOR FILE#	INFERN-O-THERM CORP
STATUS	ASPHALT TANK COMBINATION BURNER
B.U. FILE #	WIRING SCHEMATICS
DRIG. DATE	2/21/2012
DRIG. BY	B. MATTIS
SCALE:	AS NOTED

DOCUMENT NUMBER	SHT/OF	REV
MODEL 400 460 VAC	1 1	0



NOTES:

ALL WIRES TO BE 16 AWG EXCEPT AS FOLLOWS:
ALL WIRES COLOR CODED AS INDICATED
#1 = USE 12 AWG WIRE
A = MEC-120 FIREYE CONTROL
B = GAS - OIL SWITCH
C = MOTOR CONTRACTOR

MEEKER

REV.	REV. DATE	DRAWN BY	CHK'D BY	APPR. BY	DESCRIPTION OF REVISION
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
0	1/31/14	BKH	BKH	BKH	-

MODEL 400 460 VAC

MEEKER EQUIPMENT CO., INC
1440 INDUSTRY ROAD
HATFIELD, PA 19440
(215) 361-2900

PROJECT NO.	STD DRAWING	DATE	
PROJECT ENG.	B. MATTIS	1/24/14	
CHECKED	B. MATTIS	1/24/14	

VENDOR	MEEKER EQUIPMENT
VENDOR FILE#	INFERN-O-THERM CORP
STATUS	WATER TANK COMBINATION BURNER
B.U. FILE #	WIRING SCHEMATICS
DRIG. DATE	2/21/2012
DRIG. BY	B. MATTIS
SCALE:	AS NOTED

DOCUMENT NUMBER	SHT/OF	REV
MODEL 400 460 VAC	1 / 1	0

5
START-UP

SEQUENCE OF OPERATIONS

MODEL 300

OIL:

1. With power on, and a call for heat, the burner motor is energized.
2. 30 second pre-purge period.
3. After 30 second pre-purge, oil valve and ignition transformer are energized.
4. When flame is detected, ignition transformer is de-energized.
5. When temperature control is satisfied, burner shuts off.

GAS:

1. With power on, and a call for heat, the burner motor is energized.
2. 30 second pre-purge period.
3. After 30 second pre-purge, gas pilot valve and ignition transformer are energized.
4. When flame is detected, the valve actuator is energized. The actuator opens fully in 30 seconds. Main flame is now established. Ignition Transformer is de-energized.
5. When temperature control is satisfied, burner shuts off.

Note: Burner Must be energized to reset Fireye Control.

GAS FIRED BURNER STARTUP DETAILS

1. Installer must install gas regulator, sized to handle gas pressure from gas main to proper water column inches according to burner size (see chart on next page).

2. Install Monometers on gas line before the Main Fire Maxitrol and in tee located under gas pressure switch.

3. Pilot Maxitrol – set adjustment screw 7/8" of the way in.

4. Main Fire Maxitrol – Set adjustment screw in about 1 1/2" to start.

5. Check Monometer reading against gas chart with burner in off position. Adjust main regulator installed by owner to achieve proper setting.

6. Close the ball valve on the main gas line and open the ball valve on the pilot line.

7. Start burner to make sure the burner fires and pilot is working properly. (Approx. 2 minutes)

8. **Slowly** open the main gas line ball valve until completely open and let the burner run for another 2 minutes.

9. Adjust Maxitrol Regulator for best fire (see chart on next page).

10. Turn the burner off and attempt a normal start-up, if successful, allow the burner to run for 4 minutes.

CAUTION: On Gas/Oil Combination burner fuel pump must have two oil lines, suction and return or the pump coupling must be removed when burning gas.

GAS PRESSURE INFORMATION

- **INFERN-O-THERM RECOMMENDS FISHER MODEL CS400 OR CS800 REGULATORS TO BE INSTALLED UPSTREAM OF THE BURNER GAS TRAINS.**

- **THESE REGULATORS ARE NOT INCLUDED WITH THE BURNER GAS TRAIN AND YOUR SALESMAN SHOULD BE CONSULTED FOR REGULATOR SELECTION.**

- **THE TABLE BELOW SPECIFIES THE GAS PRESSURES AND FLOW RATES REQUIRED FOR EACH BURNER. THE "OFF" COLUMN IS THE PRESSURE SHOULD COME FROM FISHER REGULATOR TO GAS TRAIN. THE "ON" COLUMN IS WHAT THE MAXITROL REGULATOR SHOULD BE SET TO.**

MODEL NUMBER	BTU INPUT	NAT GAS CFH	PROPANE CFH	GAS PRESSURE		IGNITION
				OFF	ON	
48/13	310,500	300	120	10" WC	3-6" WC	ELECTRIC
48/100	414,000	400	160	10" WC	3-6" WC	ELECTRIC
150	621,000	600	240	10" WC	4-6" WC	ELECTRIC
200	828,000	800	320	10" WC	6-8" WC	ELECTRIC
300	1,380,000	1350	540	14" WC	6-10" WC	ELECTRIC
400	2,760,000	2700	1080	14" WC	8-10" WC	ELECTRIC

ALL GAS INSTALLATIONS SHOULD BE PERFORMED BY A TRAINED PROFESSIONAL.

IMPORTANT HOT WATER OPERATION NOTES

- All start-up procedures must be performed by a qualified service technician.

- Follow fuel pump hook up instructions, failure to do so will damage the pump.

- Set Aquastat control to desired water temperature (190 Degrees Max). Set Aquastat high limit 15 Degrees higher. (This control has red reset button).

- Combustion test must be performed and recorded upon start up to insure equipment warranty.

- If the burner is a gas/oil combination burner and the fuel pump is not piped to a two pipe fuel oil system, the pump to fan coupling must be removed, the fuel pump cannot be run dry.

- Install stack muffler when running on gas only.

MANUAL START-UP AFTER EXTENDED SHUT DOWN ON ASPHALT SYSTEMS

Although the Infern-O-Therm heating system operates automatically, manual start-up is necessary after an extended shutdown period where the Asphalt temperature has fallen below 100 Degrees F. The manual start-up procedure is outlined below.

The Burner should be MANUALLY cycled ON and OFF for a period of approximately two hours in the following manner:

1st Hour

1. **ON** for 5 minutes.
2. **OFF** for 10 minutes.

2nd Hour

1. **ON** for 10 minutes.
2. **OFF** for 5 minutes.

This above cycling schedule will liquefy the asphalt surrounding the Heat Exchange Tube and allow the metal to expand normally. After this two-hour manual cycling period, the heating system may be returned to automatic operation.

DO NOT DRAW PRODUCT LEVEL BELOW TOP OF FIRETUBE,
EXPLOSION MAY OCCUR

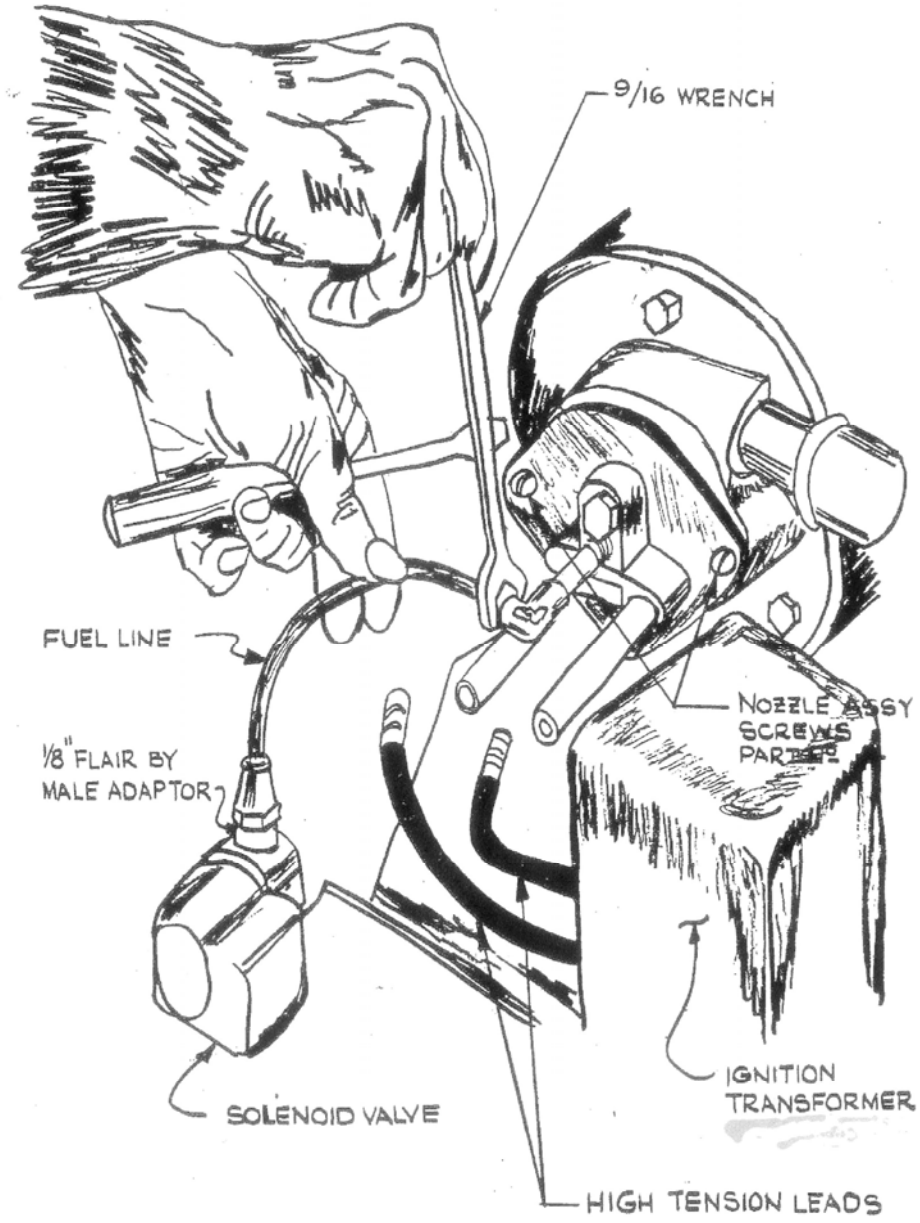
Permanent Damage to heat transfer tube may result if this start-up procedure is not followed exactly.

6

SERVICE AND TROUBLESHOOTING

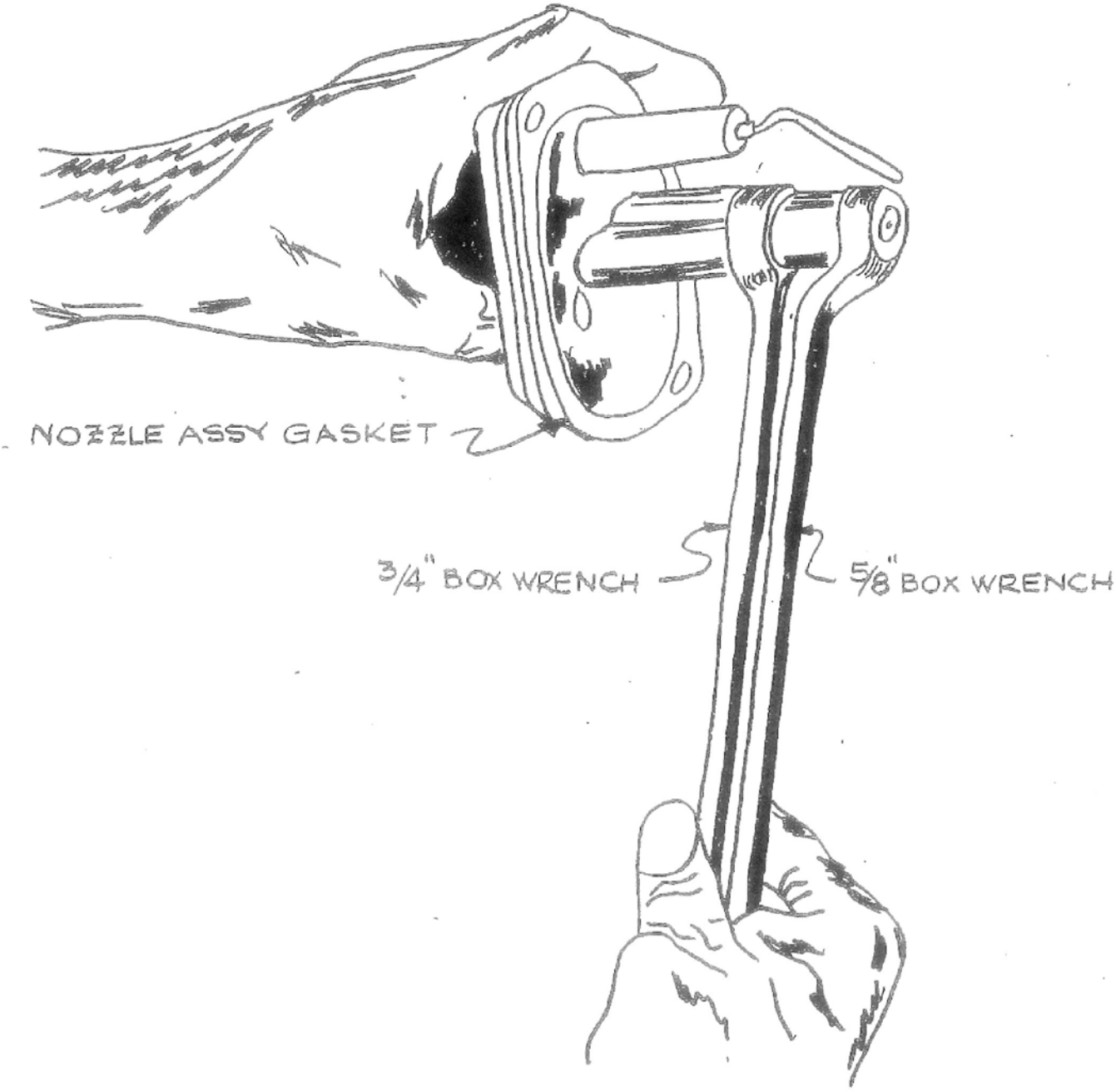
SERVICING THE NOZZLE

REMOVE NOZZLE ASSEMBLY



DISCONNECT ELECTRODE WIRES, REMOVE OIL LINE, REMOVE GAS LINE, AND REMOVE BOTHE SCREWS

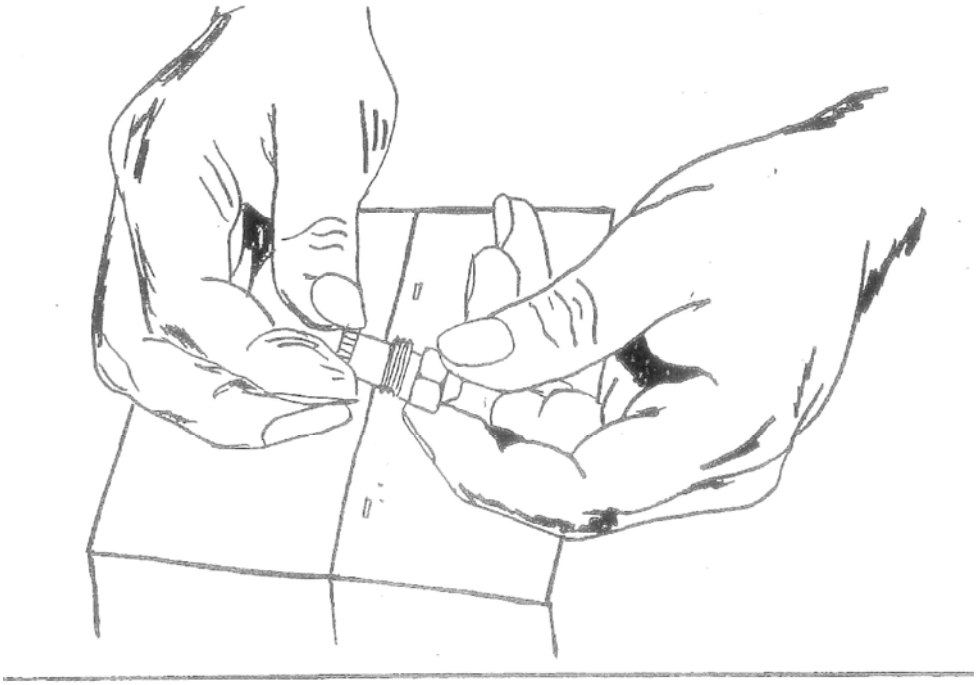
REMOVE NOZZLE FROM NOZZLE ADAPTER

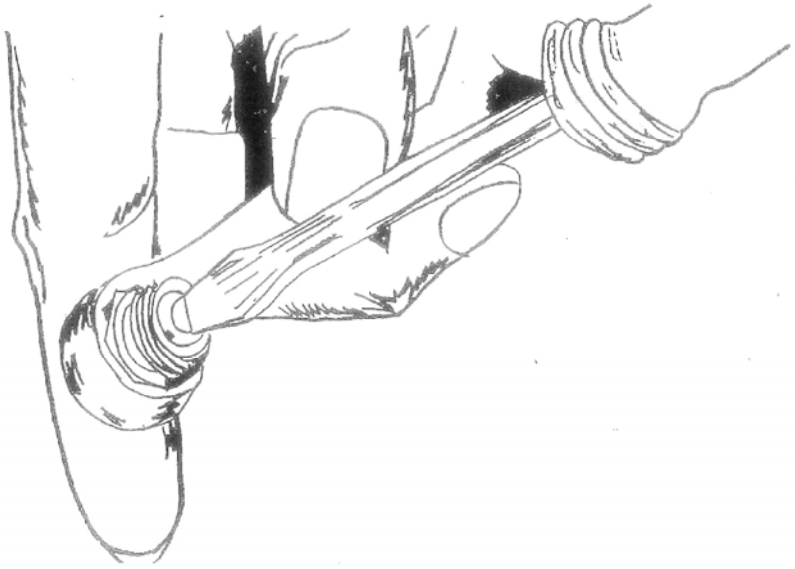


PLACE ¾" BOX WRENCH ON NOZZLE ADAPTER.
PLACE 5/8" BOX WRENCH ON NOZZLE
REMOVE NOZZLE BEING CAREFULE NOT TO BEND OR DISTORT FUEL LINE

CLEANING THE NOZZLE

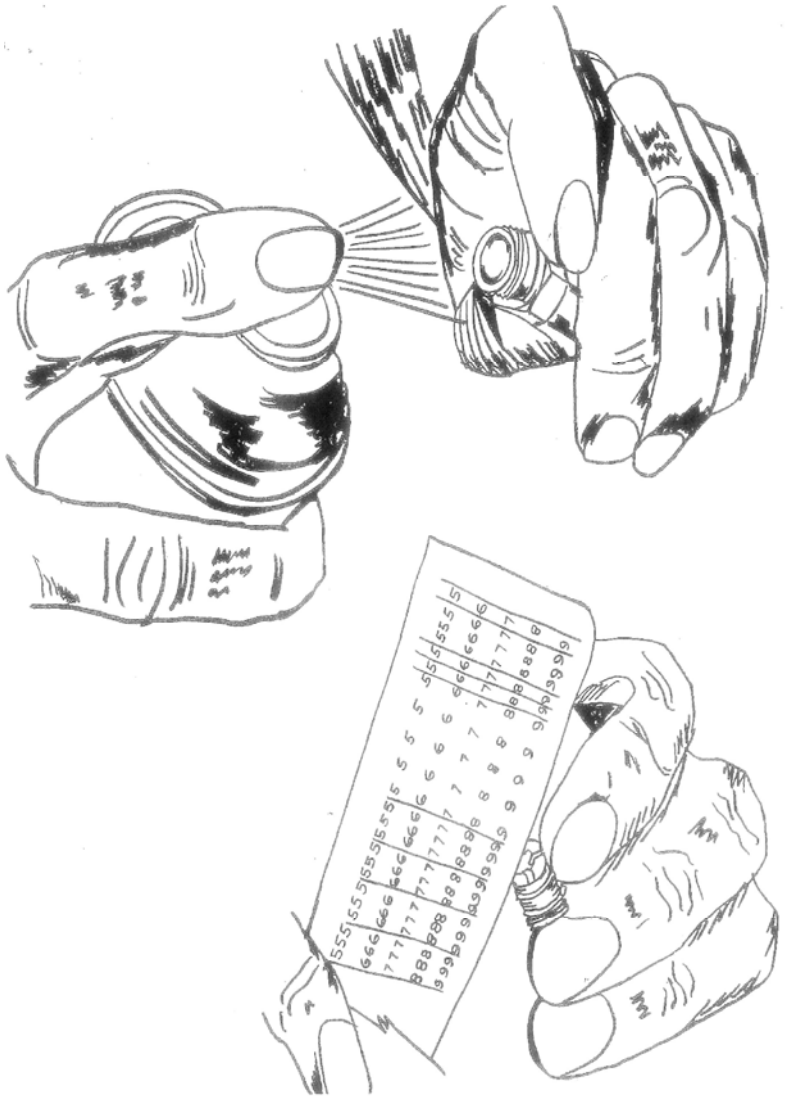
REMOVE INTERNAL NOZZLE SCREEN USING FINGER PRESSURE





REMOVE NOZZLE INTERNAL DISTRIBUTER USING CARE NOT TO RAISE BURRS (BE SURE LIGHT CAN BE REFLECTED FROM ALL BRIGHT SURFACES)

AFTER NOZZLE IS DISASSEMBLED, USE CLEANER FOR NOZZLE PARTS, ZIP CLEANER OR FREON CLEANER. DO NOT, UNDER ANY CIRCUMSTANCES, INSERT ANYTHING INTO THE NOZZLE HOLE EXCEPT A SOFT WOOD TOOTHPICK FOR ANYTHING HARDER WILL DESTROY ITS WALLS AND RUIN ITS ATOMIZATION.



TO CLEAN SLOTS IN NOZZLE INTERNAL DISTRIBUTOR, USE PAPER OR BUSINESS CARD. SINCE THE SLIGHTEST SPECK OF DIRT WITHIN THE NOZZLE WILL AFFECT THE FLAME. THE CLEANING MUST BE THOROUGH.

SETTING THE ELCTRODE GAP

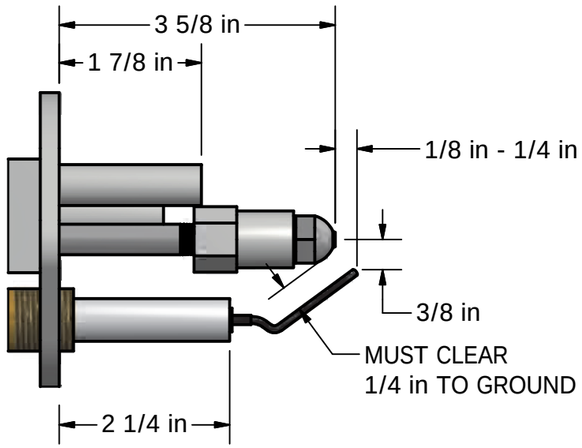
1. Remove the nozzle assembly, as shown in the previous section.

2. To adjust electrodes, loosen set screw on mounting plate.

3. Set electrode gap according to the measurement on the drawing on the next page. Electrode tips are generally slightly forward of nozzle by 1/8”. Center of nozzle tips is 3/8” and the gap between the tips should be 3/16”

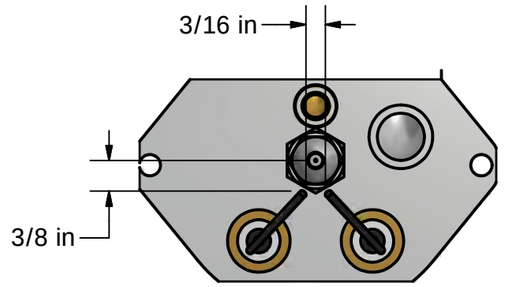
4. Be sure to mark nozzle tube with file or other sharp object before changing its position.

5. Nozzle tube should be 7/16” back from the nozzle orifice plate.



COMBINATION BURNER NOZZLE

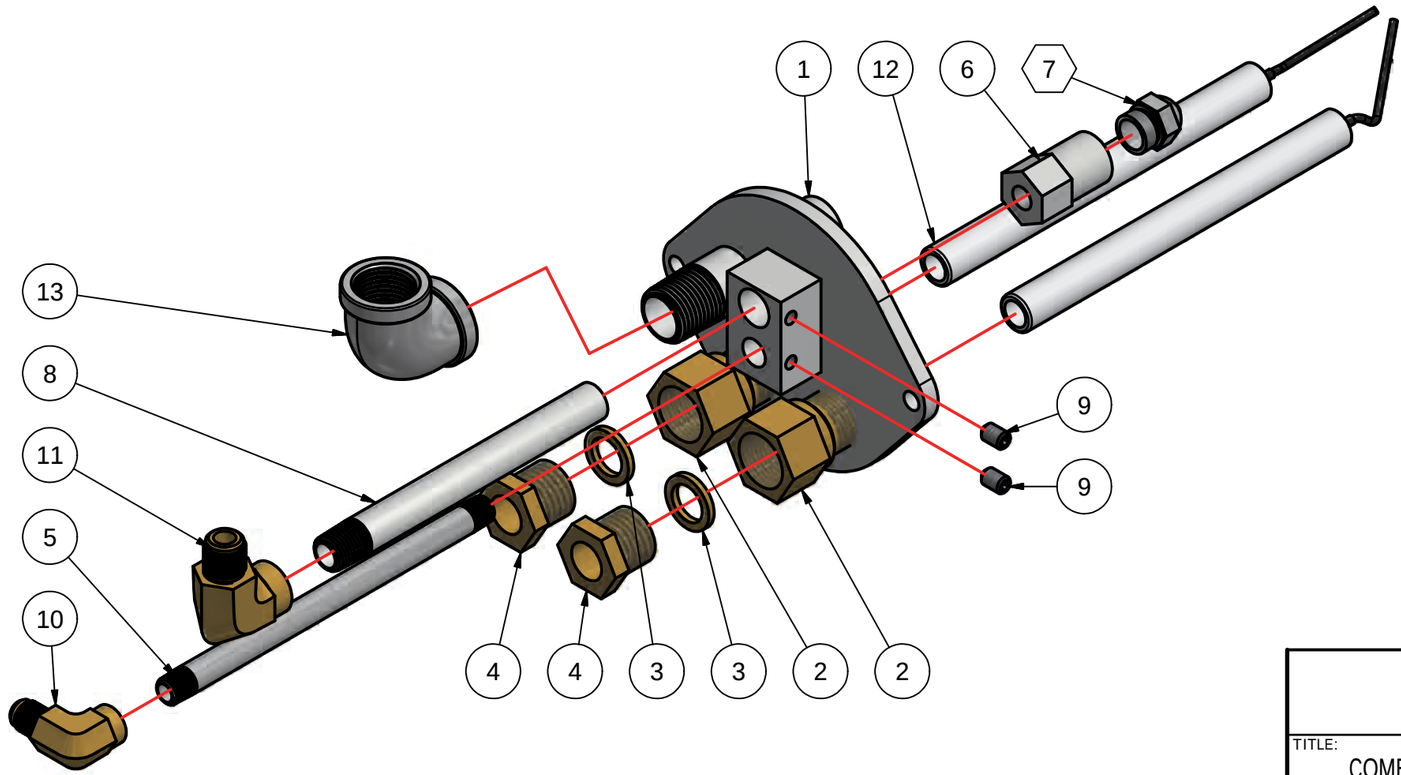
POSITION OF THE ELECTRODE ENDS IN RELATION TO THE NOZZLE ARE CRITICAL



COMBINATION BURNER NOZZLE

POSITION OF THE ELECTRODE ENDS IN RELATION TO THE NOZZLE ARE CRITICAL

Parts List	
ITEM	PART NUMBER
1	BNR-IOT-112-C
2	BNR-IOT-111-C
3	BNR-IOT-111-D
4	BNR-IOT-111-E
5	NP-SS-304-40-.125X6
6	BNR-IOT-117
7	SEE NOZZLE SELECTION TABLE
8	NP-CS-40-.25X5
9	BNR-IOT-111-B
10	BNR-IOT-116-A
11	BNR-IOT-111-K
12	BNR-IOT-113
13	ELB-G-40-.5



COMBINATION BURNER NOZZLE

EXPLODED DETAILS

NOZZLE SELECTION TABLE		
MODEL	NOZZLE PART NUMBER	FLOW (GPH)
48/13	BNR-IOT-118-2.25	2.25
48/100	BNR-IOT-118-3.00	3
150	BNR-IOT-118-4.50	4.5
200	BNR-IOT-118-6.00	6
300	BNR-IOT-118-10.0	10
400	BNR-IOT-118-15.0	15

MEEKER EQUIPMENT
BELLEVILLE, PA

TITLE: COMBINATION BURNER NOZZLE EXPLODED VIEW AND CRITICAL DIMENSIONS

SIZE: B | JOB #: N/A

DRAWN BY: RMS | DATE: 5/15/2014

SCALE: AS NOTED | CHECKED BY: | DATE:

MEEKER EQUPMENT CO., INC.
1440 INDUSTRY ROAD
HATFIELD, PA 19440

DWG NO: COMBINATION BURNER NOZZLE

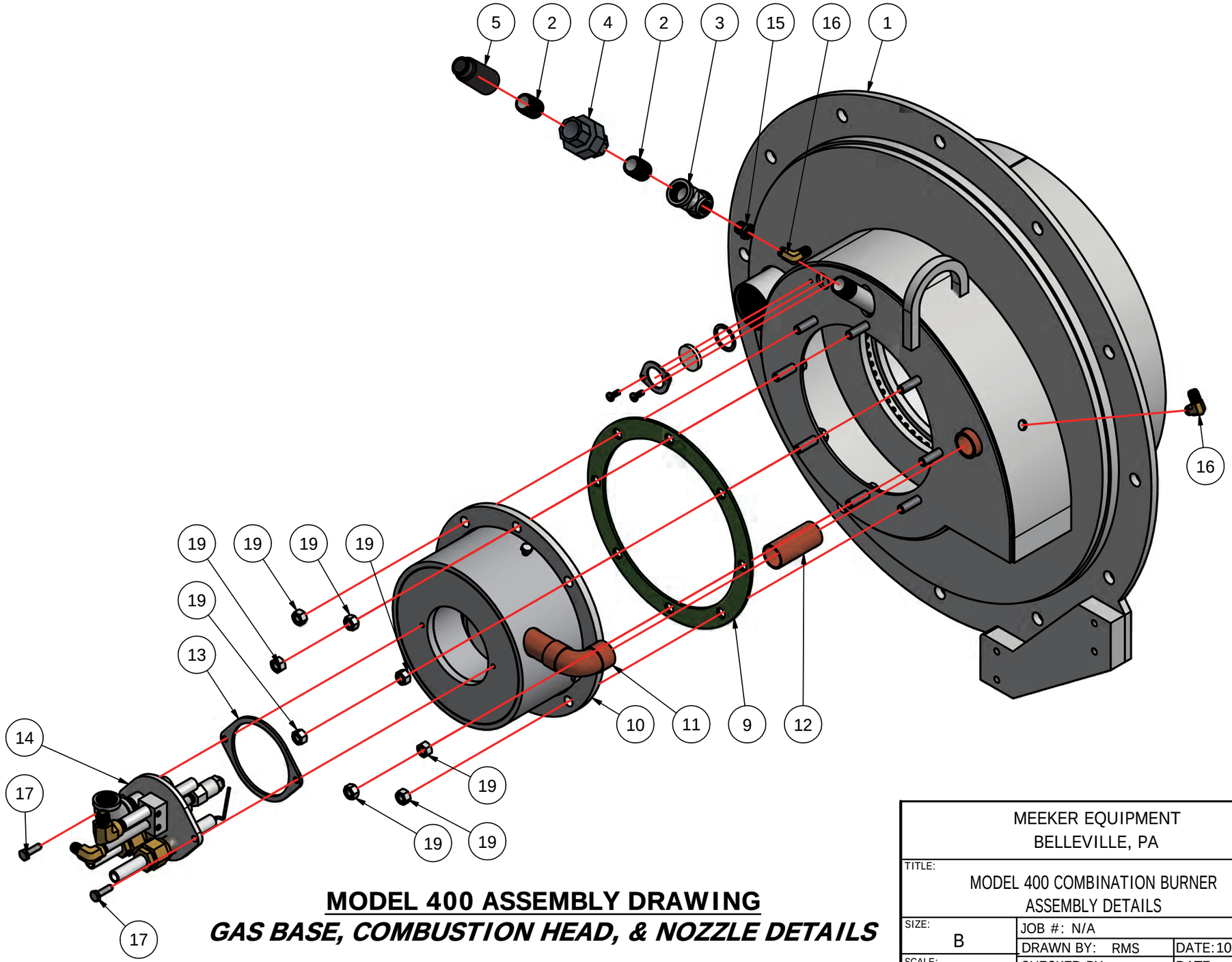
SHEET 1 OF 1

INFERN-O-THERM TROUBLE SHOOTING GUIDE

ELECTRICAL CIRCUITS AND TROUBLE SHOOTING:		
SERVICE PROCEDURE	**PROBLEM**	**CAUSE**
1. Check power at fuse box.	No Power	Blown Fuse
2. Check Power at terminal block.	No power at terminal block, (black and white terminals.) No power at terminal block, (white and red terminals.)	Open wire in line or loose connection or defective switch. Operating control relay will not pull in loose connection in 2 x 4 junc. Box at temp. control or open wire in control circuit.
POWER AT FUSE BOX AND TERMINAL BLOCK OKAY:		
3. Check power at motor.	No power at Motor.	Open wire at burner motor or defective motor.
4. Check power at Solenoid Valve.	No Power at Solenoid Valve.	Open wire at terminal block #3 from fireye control or defective solenoid valve.
MOTOR RUNS AND SOLENOID OPENS:		
5. Check spark from transformer (remove both wires from electrodes and keep a gap)	No Spark at transformer.	Open wire from terminal block #4 (yellow) at fireye control or defective transformer.
MOTOR RUNS, SOLENOID OPENS, AND TRANSFORMER HAS SPARK:		
6. Check fuel supply, Make sure there is fuel by opening bleeder on side of fuel pump.	No fuel Supply.	Clogged oil line, filter, or fuel pump screen as a result of dirty oil.
7. Check electrode setting and nozzle.	No spark or ignition.	Electrodes & nozzle setting may be off or parts may be dirty.
8. Recheck current from transformer.	No sufficient spark at transformer.	Transformer may be weak and spark may be blown away from electrodes.
BURNER LIGHTS, BUT WILL NOT STAY ON:		
9. Recheck fireye controls.	Fireye control can't see ultraviolet and relay will not hold in.	Quartz lens may be dirty, improper oil pressure, open wire to flame scanner, defective fireye control, defective scanner, or defective quartz lens.
10. Check Volage to flame scanner (connect DC volt meter to test jacks set on 25 volt DC scale). Initiate a normal startup. When flame is present, test meter should read 4 volts DC. It is normal for the meter fluctuate, if the meter bends backwards, reverse the leads.	Voltage may be in-correct.	
BURNER LIGHTS BUT BACKFIRES:		
11. Recheck controls.	Firing rate off.	Electrode setting off.

7

BURNER DRAWINGS AND PARTS LIST



Parts List	
ITEM	PART NUMBER
1	BNR-IOT-E-100-G-400
2	NP-G-40-.5XCL
3	TEE-RED-G-40-.5X.5X25
4	BNR-FE-60-1257
5	BNR-FE-35-69
6	BNR-IOT-101-D
7	BNR-IOT-101-E
8	BNR-IOT-101-F
9	BNR-IOT-E-101-C
10	MODEL 300 & 400 COMBUSTION HEAD
11	ELB-CO-40-90-1
12	TB-CO-.75
13	BNR-IOT-111-A
14	BNR-IOT-111-F
15	BSH-G-ST-.25X.125
16	BNR-IOT-E-121-A
17	BNR-IOT-E-111-B
18	BNR-IOT-101-G
19	BNR-E-IOT-101-B

MODEL 400 ASSEMBLY DRAWING

GAS BASE, COMBUSTION HEAD, & NOZZLE DETAILS

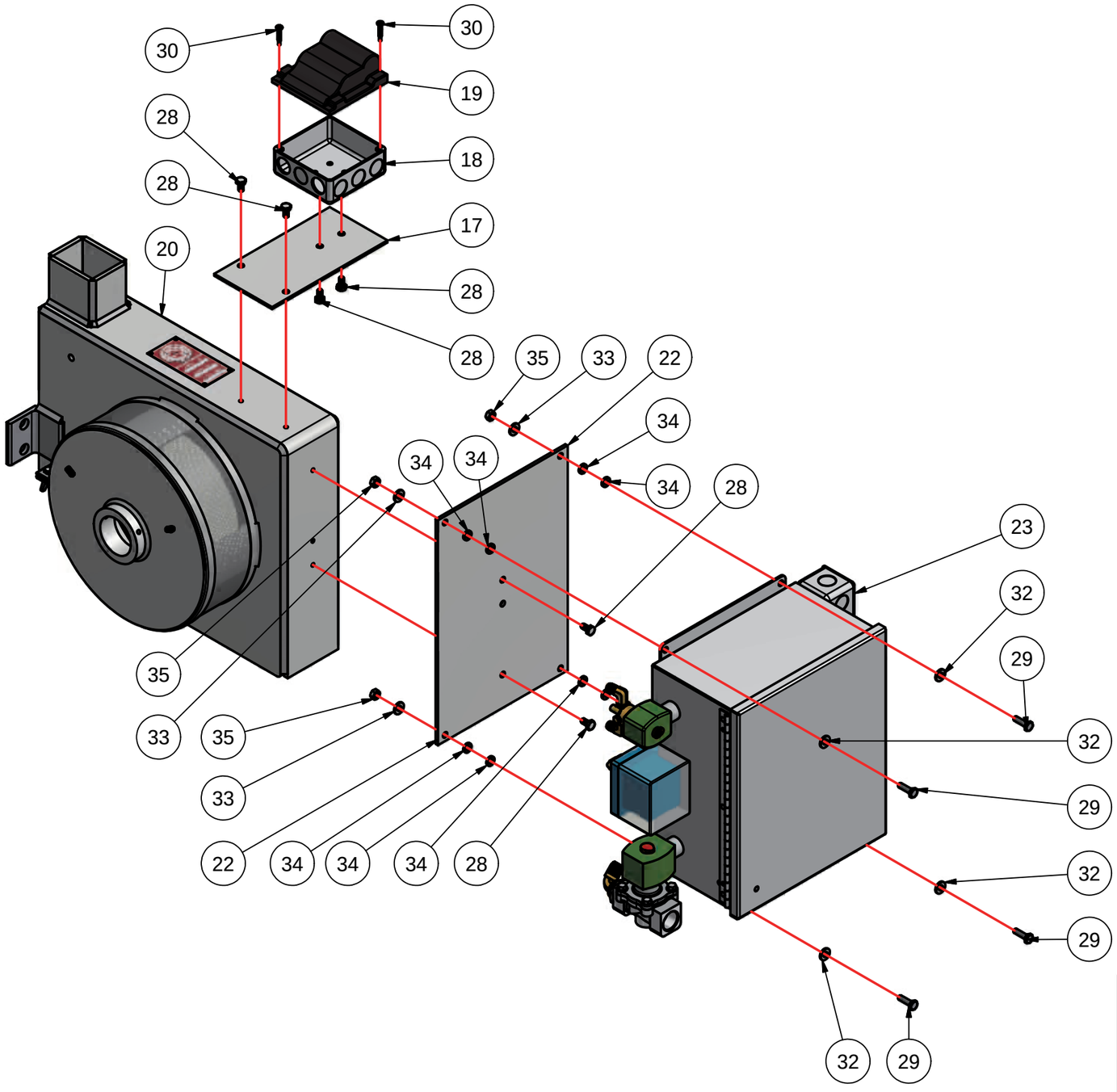
MEEKER EQUIPMENT
BELLEVILLE, PA

TITLE:
MODEL 400 COMBINATION BURNER
ASSEMBLY DETAILS

SIZE: B	JOB #: N/A	
	DRAWN BY: RMS	DATE: 10/16/2014
SCALE: AS NOTED	CHECKED BY:	DATE:

MEEKER EQUPMENT CO., INC.
1440 INDUSTRY ROAD
HATFIELD, PA 19440

DWG NO:
MODEL 400 ASSEMBLY DRAWING



MODEL 400 ASSEMBLY DRAWING

PANEL BOX & FAN HOUSING

Parts List	
ITEM	PART NUMBER
15	BSH-G-ST-.25X.125
16	BNR-IOT-E-121-A
17	BNR-IOT-114-A
18	MEC-EN-4X4X2.125
19	BNR-IOT-114
20	BNR-IOT-E-102-400
21	LBL-IOT-MTL-MFG TAG
22	BNR-IOT-139-C
23	BNR-IOT-E-139-A-460-C
24	BNR-IOT-E-126
25	BSH-G-ST-.75X5
26	ELB-B-90-.375 FLR X .5 MPT
27	RVT-AL-POP-.125
28	BLT-CS-HX-GR5-ZC-.25X.5
29	BLT-CS-HX-GR5-ZC-.25X.875
30	SCW-CS-PH-ZC-8-32X1
31	BNR-IOT-E-122-B
32	WSH-CS-FLAT-ZC-.25
33	WSH-CS-LK-ZC-.25
34	WSH-RU-FLAT-.25
35	NUT-CS-HX-GR5-ZC-.25

MEEKER EQUIPMENT
BELLEVILLE, PA

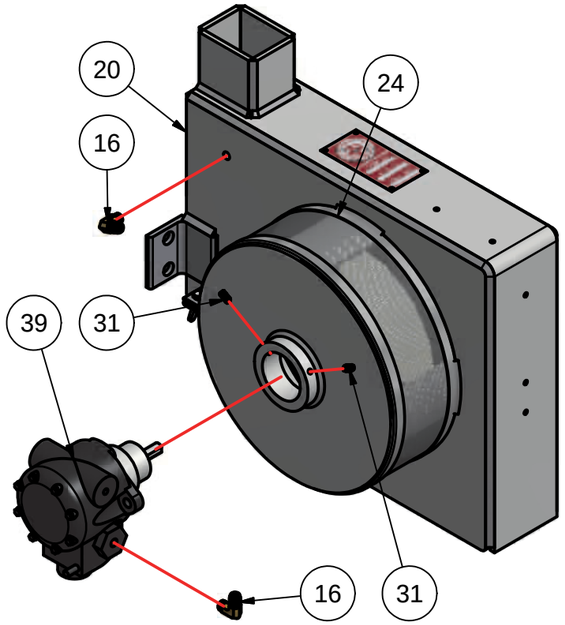
TITLE:
MODEL 400 COMINATION BURNER
ASSEMBLY DETAILS

SIZE: B | JOB #: N/A
DRAWN BY: RMS | DATE: 10/16/2014
SCALE: AS NOTED | CHECKED BY: | DATE:

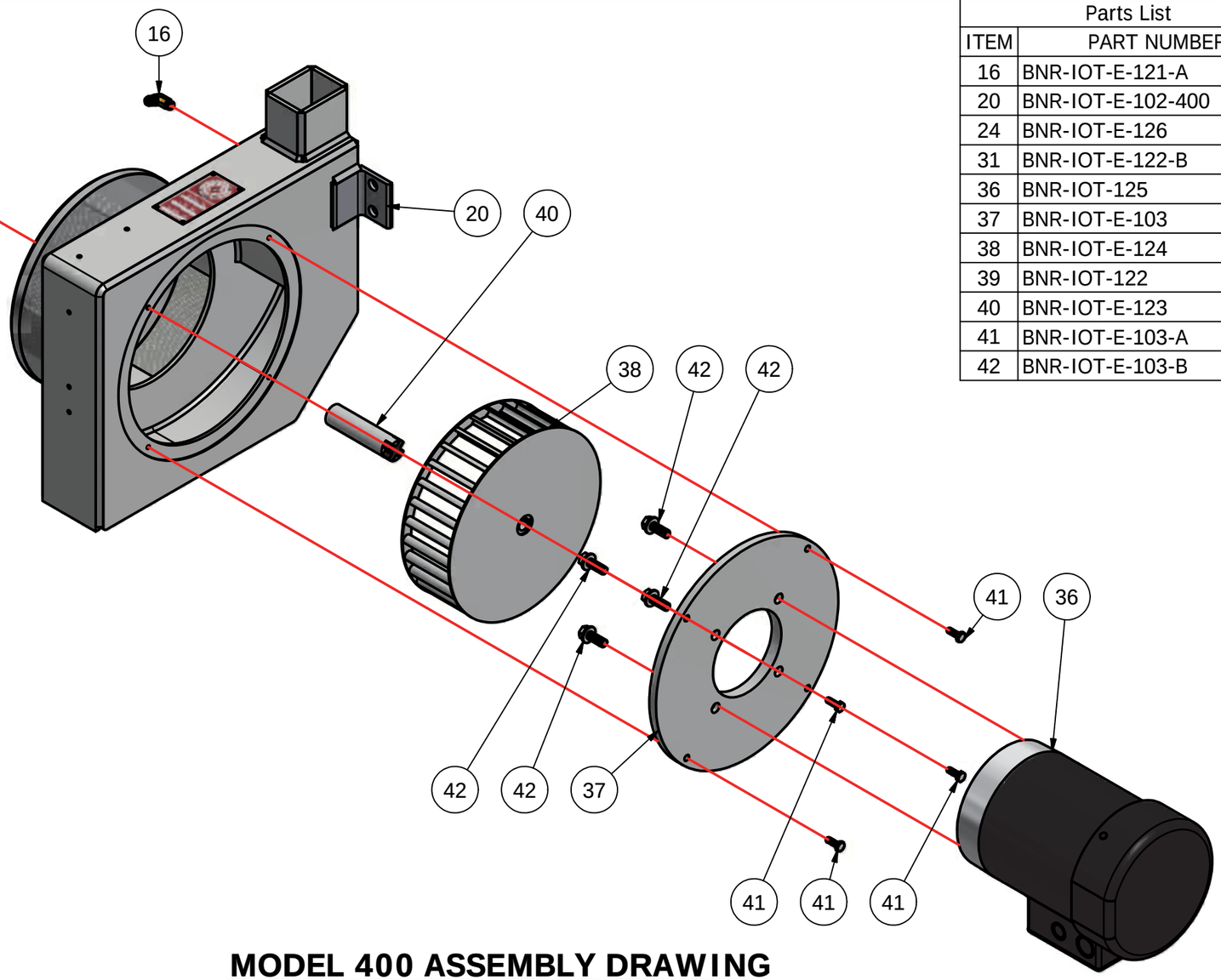
MEEKER EQUIPMENT CO., INC.
1440 INDUSTRY ROAD
HATFIELD, PA 19440

DWG NO: MODEL 400 ASSEMBLY DRAWING

Parts List	
ITEM	PART NUMBER
16	BNR-IOT-E-121-A
20	BNR-IOT-E-102-400
24	BNR-IOT-E-126
31	BNR-IOT-E-122-B
36	BNR-IOT-125
37	BNR-IOT-E-103
38	BNR-IOT-E-124
39	BNR-IOT-122
40	BNR-IOT-E-123
41	BNR-IOT-E-103-A
42	BNR-IOT-E-103-B



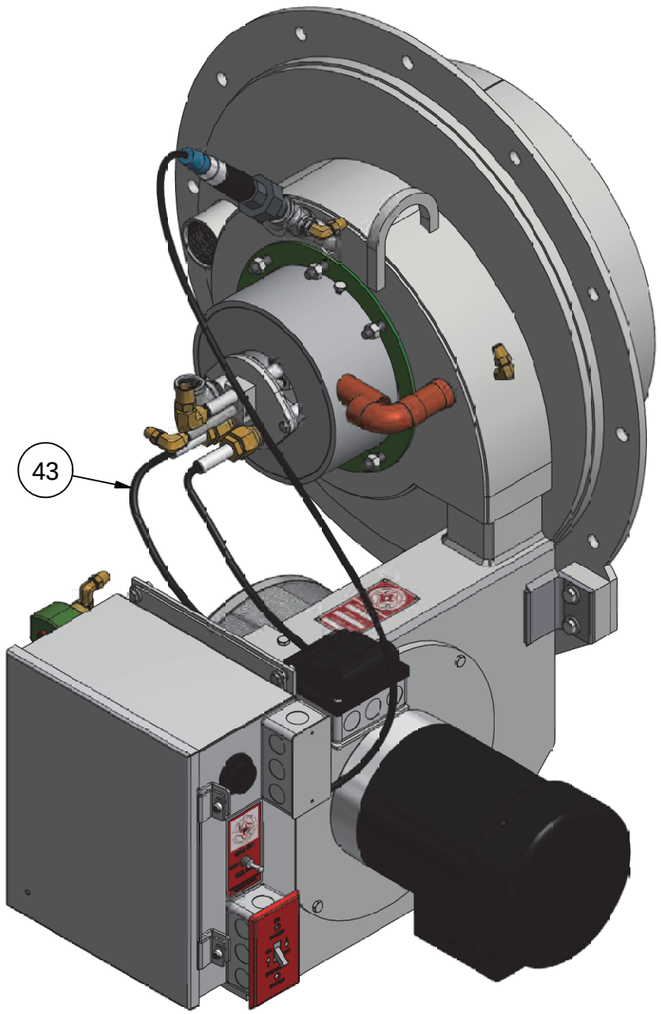
MODEL 400 ASSEMBLY DRAWING
MOTOR, FAN, AND OIL PUMP



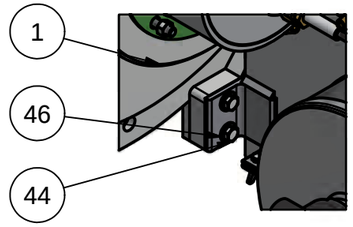
MODEL 400 ASSEMBLY DRAWING
MOTOR, FAN, AND OIL PUMP

MEEKER EQUIPMENT BELLEVILLE, PA			MEEKER EQUPMENT CO., INC. 1440 INDUSTRY ROAD HATFIELD, PA 19440
TITLE: MODEL 400 COMBINATION BURNER ASSEMBLY DETAILS			NOTICE: THE INFORMATION CONTAINED HEREIN IS PROPRIETARY OF MEEKER EQUIPMENT CO., INC. AND SHALL NOT BE REPRODUCED OR DISCLOSED IN WHOLE OR IN PART, NOR USED FOR ANY DESIGN OR MANUFACTURING PURPOSE UNLESS AUTHORIZED IN WRITING BY MEEKER EQUIPMENT CO., INC.
SIZE: B	JOB #: N/A		DWG NO: MODEL 400 ASSEMBLY DRAWING
SCALE: AS NOTED	DRAWN BY: RMS	DATE: 10/16/2014	
	CHECKED BY:	DATE:	SHEET 3 OF 4

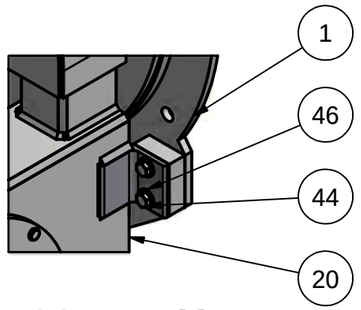
Parts List	
ITEM	PART NUMBER
1	BNR-IOT-E-100-G-400
20	BNR-IOT-E-102-400
43	BNR-IOT-E-115
44	BNR-IOT-E-102-A
46	BNR-IOT-E-102-C



MODEL 400 ASSEMBLY DRAWING
FULL ASSSEMBLY



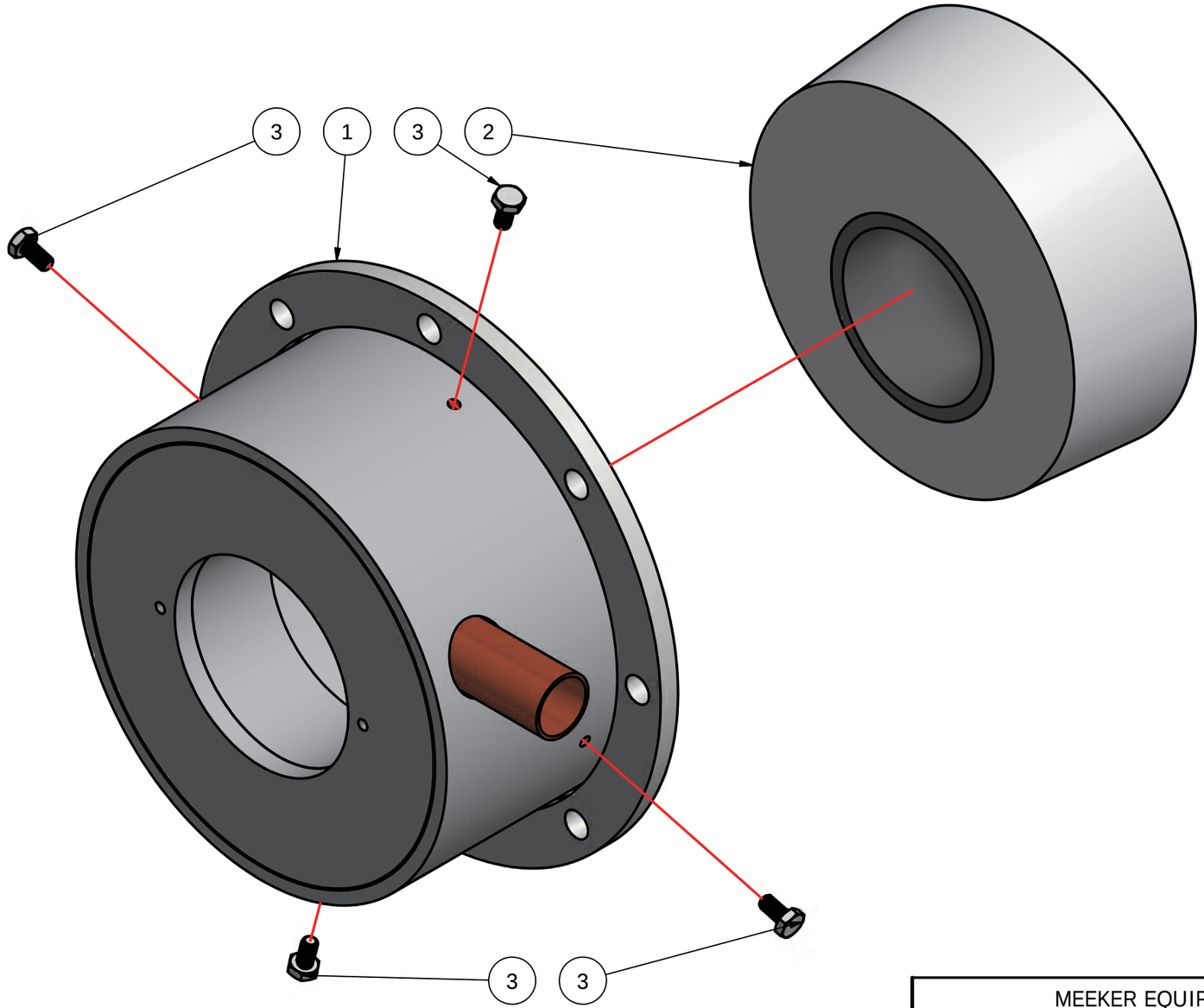
MODEL 400 ASSEMBLY DRAWING
FAN HOUSING & GAS BASE



MODEL 400 ASSEMBLY DRAWING
FAN HOUSING & GAS BASE

MEEKER EQUIPMENT BELLEVILLE, PA			MEEKER EQUPMENT CO., INC. 1440 INDUSTRY ROAD HATFIELD, PA 19440
TITLE: MODEL 400 COMBINATION BURNER ASSEMBLY DETAILS			NOTICE: THE INFORMATION CONTAINED HEREIN IS PROPRIETARY OF MEEKER EQUIPMENT CO., INC. AND SHALL NOT BE REPRODUCED OR DISCLOSED IN WHOLE OR IN PART, NOR USED FOR ANY DESIGN OR MANUFACTURING PURPOSE UNLESS AUTHORIZED IN WRITING BY MEEKER EQUIPMENT CO., INC.
SIZE: B	JOB #: N/A		DWG NO: MODEL 400 ASSEMBLY DRAWING
SCALE: AS NOTED	DRAWN BY: RMS	DATE:10/16/2014	
	CHECKED BY:	DATE:	SHEET 4 OF 4

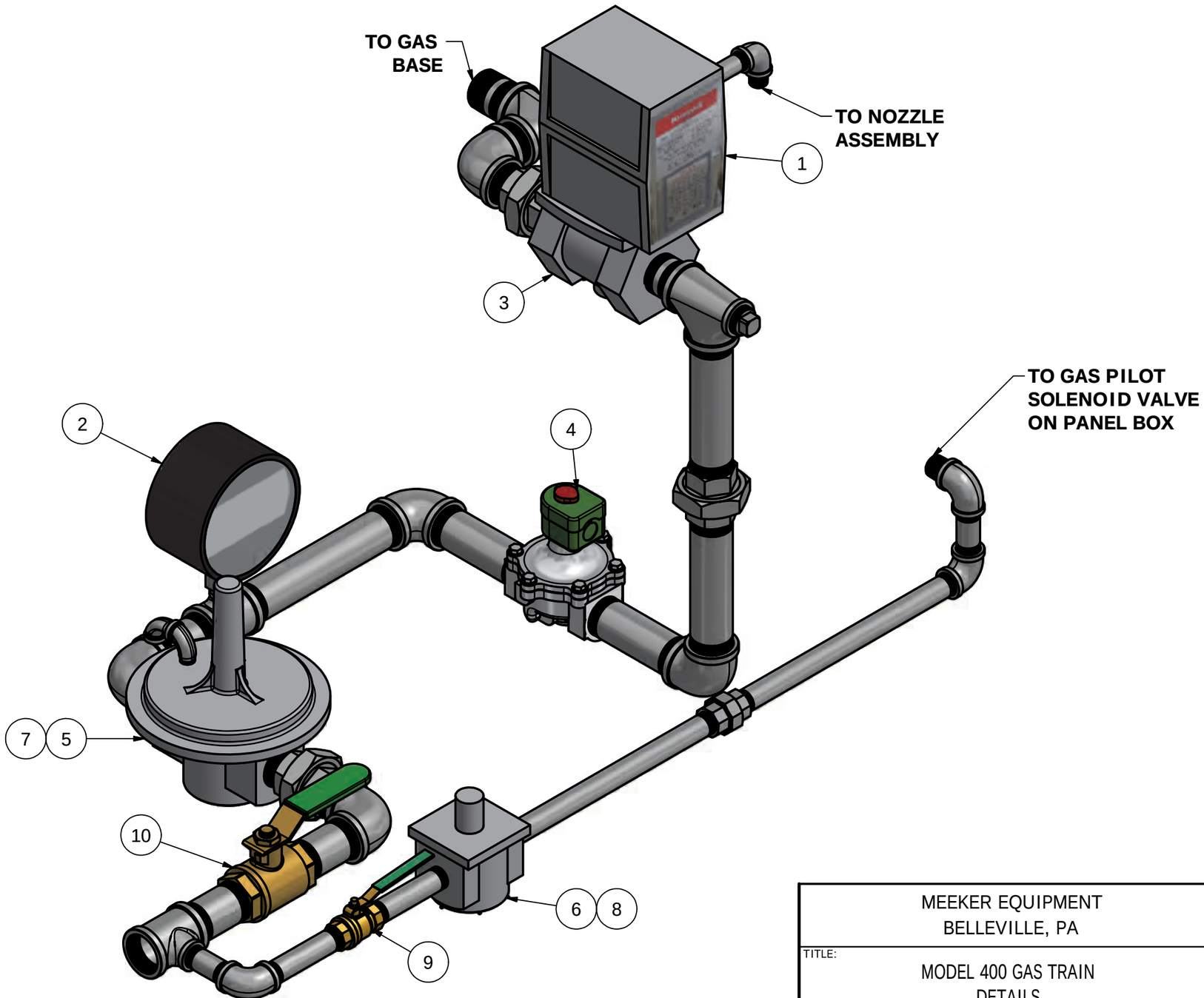
Parts List	
ITEM	PART NUMBER
1	BNR-IOT-E-101
2	BNR-IOT-130
3	BNR-IOT-E-130-A



MODEL 300 & 400 COMBUSTION HEAD
ASSEMBLY DETAILS

MEEKER EQUIPMENT BELLEVILLE, PA			MEEKER EQUPMENT CO., INC. 1440 INDUSTRY ROAD HATFIELD, PA 19440
TITLE: MODEL 300 & 400 COMBUSTION HEAD ASSEMBLY DETAILS			NOTICE: THE INFORMATION CONTAINED HEREIN IS PROPRIETARY OF MEEKER EQUIPMENT CO., INC. AND SHALL NOT BE REPRODUCED OR DISCLOSED IN WHOLE OR IN PART, NOR USED FOR ANY DESIGN OR MANUFACTURING PURPOSE UNLESS AUTHORIZED IN WRITING BY MEEKER EQUIPMENT CO., INC.
SIZE: B	JOB #: N/A		DWG NO: MODEL 300 & 400 COMBUSTION HEAD
SCALE: AS NOTED	DRAWN BY: RMS	DATE: 6/25/2014	
	CHECKED BY:	DATE:	SHEET 1 OF 1

Parts List	
ITEM	PART NUMBER
1	BNR-IOT-800
2	BNR-IOT-801
3	BNR-IOT-814
4	BNR-IOT-815
5	BNR-IOT-812
6	BNR-IOT-813
7	GTP-R-MX-R9110-515
8	GTP-R-MX-R5310-412
9	V-BL-BRS-SH-.75
10	V-BL-BRS-SH-2



MODEL 400 GAS TRAIN

GAS TRAIN PART IDENTIFICATION

MEEKER EQUIPMENT BELLEVILLE, PA			MEEKER EQUPMENT CO., INC. 1440 INDUSTRY ROAD HATFIELD, PA 19440
TITLE: MODEL 400 GAS TRAIN DETAILS			NOTICE: THE INFORMATION CONTAINED HEREIN IS PROPRIETARY OF MEEKER EQUIPMENT CO., INC. AND SHALL NOT BE REPRODUCED OR DISCLOSED IN WHOLE OR IN PART, NOR USED FOR ANY DESIGN OR MANUFACTURING PURPOSE UNLESS AUTHORIZED IN WRITING BY MEEKER EQUIPMENT CO., INC.
SIZE: B	JOB #: N/A		DWG NO: MODEL 400 GAS TRAIN
	DRAWN BY: RMS	DATE: 6/25/2014	
SCALE: AS NOTED	CHECKED BY:	DATE:	SHEET 1 OF 1

COMPREHENSIVE PARTS LIST FOR MODELS 300 AND 400 BURNERS.

COMBUSTION HEAD ASSEMBLIES & PARTS	
BNR-IOT-E-101-AA	MODELS 300 & 400 COMBUSTION HEAD ASSEMBLY
BNR-IOT-E-101	MODELS 300 & 400 COMBUSTION HEAD
BLT-CS-HX-GR5-ZC-.25X.625	COMBUSTION HEAD SCREW
BNR-IOT-130	ORIFICE BRICK
NOZZLE ASSEMBLIES & PARTS	
BNR-IOT-111	MODELS 48/13-300 NOZZLE ASSEMBLY (OIL ONLY)
BNR-IOT-111-F	MODELS 48/13-400 NOZZLE ASSEMBLY (COMBO)
BNR-IOT-111-G	MODELS 48/13-400 NOZZLE ASSEMBLY (GAS ONLY)
BNR-IOT-111-A	NOZZLE ASSEMBLY GASKET
BNR-IOT-111-B	NOZZLE ASSEMBLY SET SCREW
BNR-IOT-111-C	ELECTRODE COMPRESSION SHELL
BNR-IOT-111-D	ELECTRODE COMPRESION RING
BNR-IOT-111-E	ELECTRODE COMPRESSION NUT
BNR-IOT-111-J	NOZZLE ASSEMBLY MOUNTING NUT
BNR-IOT-111-K	GAS PILOT ADAPTER
BNR-IOT-112-C	MODELS 48/13-400 NOZZLE MOUNTING PLATE (GAS/COMBO)
BNR-IOT-112-O	MODELS 48/13-400 NOZZLE MOUNTING PLATE (OIL ONLY)
BNR-IOT-116-A	OIL NOZZLE TUBE ADAPTER
BNR-IOT-113	ELECTRODE PORCELAIN ASSEMBLY, SET OF 2
BNR-IOT-117	STANDARD NOZZLE ADAPTOR
BNR-IOT-118-12	OIL NOZZLE (12 GPH)
BNR-IOT-118-15	OIL NOZZLE (15 GPH)
ELB-G-40-.5	1/2" GALVANIZED ELBOW
NP-CS-40-.25X5	1/4" X 5" LONG NIPPLE
NP-SS-304-40-.125X6	1/8" X 6" LONG NIPPLE
PANEL BOX PARTS	
BNR-IOT-E-139-A-110-C	CONTROL PANEL FOR COMBO/OIL BURNERS (MODELS 300)
BNR-IOT-E-139-A-460-C	CONTROL PANEL FOR COMBO/OIL BURNERS (MODELS 400)
BNR-IOT-E-139-A-110-G	CONTROL PANEL FOR GAS BURNERS (MODELS 300)
BNR-IOT-E-139-A-460-G	CONTROL PANEL FOR GAS BURNERS (MODELS 400)
BNR-FE-61-3060	FIRE-EYE WIRING BASE
BNR-FE-MEC120	FIRE-EYE MICRO M CHASSIS
BNR-FE-MEP560	FIRE-EYE PROGRAMMER MODULE
BNR-FE-MEUV4	FIRE-EYE MICROM AMPLIFIER
BNR-IOT-121	OIL SOLENOID VALVE
BNR-IOT-127-A	EMERGENCY SWITCH COVER 2X4

BNR-IOT-E-127-AA	EMERGENCY SWITCH COVER 4X4
BNR-IOT-127-B	GAS OIL-HESITATION SWITCH
BNR-IOT-127-C	GAS-OIL HESITATION SWITCH TAG
BNR-IOT-128	ALARM
BNR-IOT-802	GAS PRESSURE SWITCH
BNR-IOT-806	GAS PILOT SOLENOID VALVE
MEC-EN-4X1.5X2.125	2 X 4 HANDY BOX
MEC-EN-4 X 2.125-BLKCVR	2 X 4 HANDY BOX BLANK COVER
MEC-EN-4X4X2.125	4 X 4 JUNCTION BOX
MEC-E-XTCE009B10A	3 PH MOTOR CONTACTOR
MEC-E-XTOB004BC1	OVERLOAD FOR 3 PH CONTACTOR
MEC-FS-ATQR2	2 AMP FUSE
MEC-FS-TRM6.25	6 1/2 AMP FUSE
MEC-EN-4X2.125-BLKCVR	HANDY BOX COVER
MEC-EN-SCE-12106CHNF	12 X 10 PANEL BOX (EMPTY)
MEC-EN-SCE-12P10	12 X 10 PANEL BOX BACK PLATE
MEC-EN-SCE-141206CHNF	14 X 12 PANEL BOX (EMPTY)
MEC-EN-SCE-14P12	14 X 12 PANEL BOX BACK PLATE
MEC-TB-SE-9080MHA10	SCREW-ON END CLAMP
MEC-TB-SE-AB1AC24	TERMINAL STRIP BLOCK END
MEC-TB-SE-AB1ALN210	TERMINAL BLOCK JUMPER
MEC-TB-SE-AB1VV235U	TERMINAL STRIP BOX LUG
MEC-TB-SE-AM1DE200	DIN RAIL
SCW-CS-FH-ZC-10-32X.5	PANEL BOX SCREW
SWT-W-AH7810UD	3 PHASE TOGGLE SWITCH
BURNER PARTS	
BLT-CS-HX-GR5-ZC-.25X.5	1/4" X 1/2" LONG HEX HEAD MACHINE SCREW
BLT-CS-HX-GR5-ZC-.25X.75	1/4" X 3/4" LONG HEX HEAD MACHINE SCREW
BLT-CS-HX-GR5-ZC-.25X.875	1/4" X 7/8" LONG HEX HEAD MACHINE SCREW
BLT-CS-HX-GR5-ZC-.375X875	3/8" X 7/8" LONG HEX HEAD MACHINE SCREW
BLT-CS-HXWSH-GR8-ZC-.375X1	3/8" X 1" LONG HEX WASHER HEAD MACHINE SCREW
BLT-CS-ZC-8-32 X .5	#8-32 X 1/2" LONG SLOT/SQUARE HEAD MACHINE SCREW
BNR-FE-35-69	FIRE-EYE HEAT INSULATOR
BNR-FE-60-1257	FIRE-EYE UNION WITH QUARTZ WINDOW
BNR-FE-UV1A3	FIRE EYE ULTRA-VIOLET SCANNER WITH 3 FT FLEX
BNR-IOT-101-D	COMBUSTION HEAD GLASS PEEPHOLE
BNR-IOT-101-E	GASKET COMBUSTION HEAD PEEPHOLE
BNR-IOT-101-F	FRAME COMBUSTION HEAD
BNR-IOT-114	IGNITION TRANSFORMER
BNR-IOT-114-A	IGNITION TRANSFORMER MOUNTING PLATE
BNR-IOT-114-B	IGNITION TRANSFORMER MOUNTING SCREWS
BNR-IOT-122	OIL PUMP
BNR-IOT-122-B	OIL PUMP SET SCREW
BNR-IOT-125	MODELS 48/100-300 MOTOR
BNR-IOT-139-C	PANEL BOX MOUNTING PLATE

BNR-IOT-E-100-300	MODEL 300 OIL BASE
BNR-IOT-E-100-400-26	MODEL 400 OIL BASE (26 INCH)
BNR-IOT-E-100-400-30	MODEL 400 GAS BASE (30 INCH)
BNR-IOT-E-100-G-300	MODEL 300 GAS BASE
BNR-IOT-E-100-G-400-26	MODEL 400 GAS BASE (26 INCH)
BNR-IOT-E-100-G-400-30	MODEL 400 GAS BASE (30 INCH)
BNR-IOT-E-102-300	MODEL 300 FAN HOUSING
BNR-IOT-E-102-400	MODEL 400 FAN HOUSING
BNR-IOT-E-103	MODELS 300 & 400 MOTOR MOUNTING PLATE
BNR-IOT-E-105-300	MODEL 300 GAS AND COMBO BURNER GASKET
BNR-IOT-E-105-300-O	MODEL 300 OIL BURNER GASKET
BNR-IOT-E-105-400-26	MODEL 400 GAS AND COMBO BURNER GASKET (26 INCH)
BNR-IOT-E-105-400-30	MODEL 400 GAS AND COMBO BURNER GASKET (30 INCH)
BNR-IOT-E-105-400-26-O	MODEL 400 OIL BURNER GASKET (26 INCH)
BNR-IOT-E-105-400-30-O	MODEL 400 OIL BURNER GASKET (30 INCH)
BNR-IOT-E-115	MODELS 300 & 400 IGNITION CABLES (SET OF 2)
BNR-IOT-E-123	PUMP TO FAN COUPLER
BNR-IOT-E-124	MODELS 300 & 400 IMPELLER
BNR-IOT-E-125	MODELS 400 MOTOR (2 HP)
BNR-IOT-E-126	MODELS 300 & 400 AIR INTAKE SCREEN
BNR-IOT-E-139-B	MODEL 400 PANEL BOX MOUNTING PLATE
ELB-B-90-.25 FLR X .125 MPT	1/4" FLARED ELBOW
ELB-B-90-.375 FLR X .5 MPT	3/8" FLARED ELBOW
ELB-CO-40-90-.75	3/4" COPPER ELBOW
LBL-IOT-MTL-MFG TAG	INFERN-O-THERM BURNER SN TAG
MEC-EN-4X4X2.125	4 X 4 JUNCTION BOX
NP-G-40-.5-CLS	1/2" CLOSE NIPPLE
NUT-BRS-FLR-.25	1/4" FLARE NUT
NUT-BRS-FLR-.5	1/2" FLARE NUT
NUT-CS-HX-GR5-ZC-.25	PANEL BOX MOUNTING NUT
NUT-CS-HX-ZC-10-32	IGNITION TRANSFORMER LEAD NUT
SCW-CS-PH-ZC-8-32X1	IGNITION TRANSFORMER SCREW
WSH-CS-SAE-ZC-.25	1/4" FLAT WASHER
WSH-CS-SAE-ZC-.375	COMBUSTION HEAD WASHER
WSH-RU-FLAT-.25	1/4" RUBBER WASHER
GAS TRAIN PARTS	
GTP-IOT-1.5-300	MODELS 300 GAS TRAIN
GTP-IOT-2.0-400	MODELS 400 GAS TRAIN
BNR-IOT-800	GAS VALVE ACTUATOR
BNR-IOT-801	GAS PRESSURE SWITCH
BNR-IOT-809	1 1/2" ACTUATING GAS VALVE
BNR-IOT-810	1 1/2" MAIN GAS SOLENOID VALVE
BNR-IOT-812	1 1/2" MAIN GAS REGULATOR
BNR-IOT-813	3/4" PILOT GAS REGULATOR
BNR-IOT-814	2" ACTUATING GAS VALVE

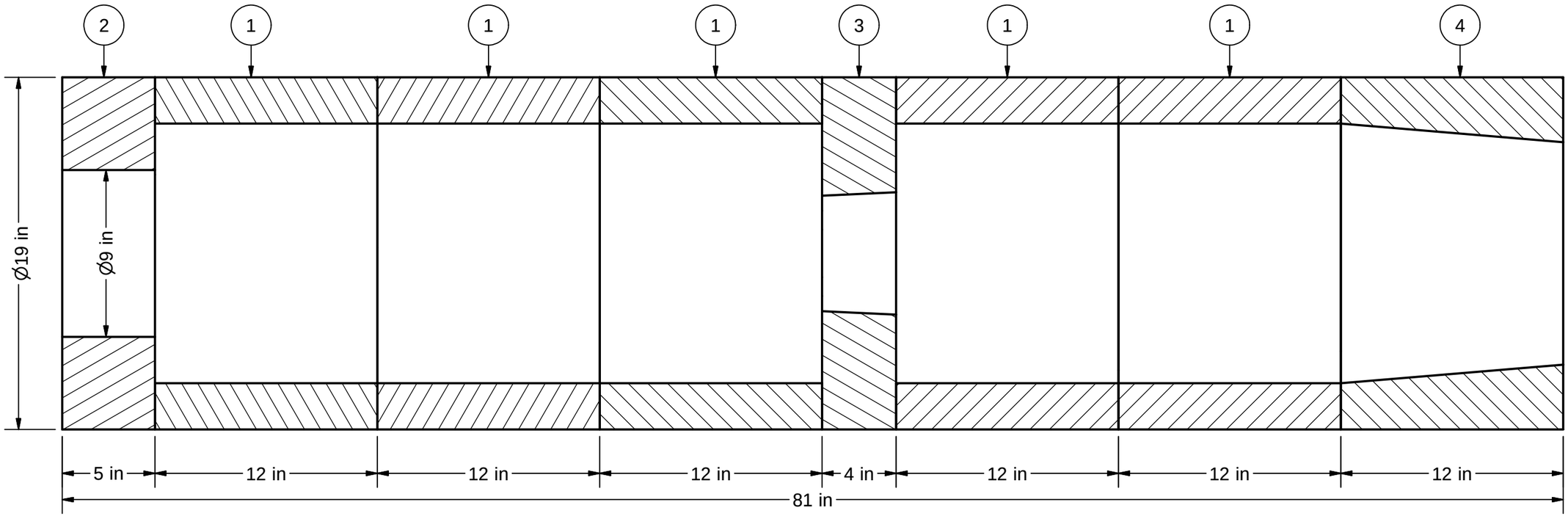
BNR-IOT-815	2" MAIN GAS SOLENOID VALVE
BNR-IOT-816	2" MAIN GAS REGULATOR
V-BL-BRS-SH-.75	3/4" BALL VALVE
V-BL-BRS-SH-1.5	1 1/2" BALL VALVE
V-BL-BRS-SH-2	2" BALL VALVE
GTP-R-MX-R5310-412	4-12" WC SPRING FOR RV53 REGULATOR
GTP-R-MX-R8110-515	5-15" WC SPRING FOR RV81 REGULATOR
GTP-R-MX-R9110-515	5-15" WC SPRING FOR RV91 REGULATOR
FIRE TUBE REFRACTORIES	
BNR-IOT-E-511-S	MODEL 300 STARTER LINER (OIL ONLY)
BNR-IOT-E-511	MODEL 300 LINER
BNR-IOT-E-512	MODEL 300 CLOVER LEAF
BNR-IOT-E-511-1B	MODEL 300 ASPHALT CONE
BNR-IOT-E-511-S-400	MODEL 400 STARTER LINER (OIL ONLY)
BNR-IOT-E-511-400	MODEL 400 LINER
BNR-IOT-E-512-400	MODEL 400 CLOVER LEAF
BNR-IOT-E-511-400-1C	MODEL 400 ASPHALT CONE

8

REFRACTORY CHAMBER DRAWINGS

NOTE:
1) STARTER REFRACTORY IS USED FOR OIL ONLY BURNERS.
2) GAS AND COMBINATION BURNERS DO NOT USE A SEPARATE STARTER BRICK BECAUSE IT IS BUILT INTO THE BURNER.

Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	5	BNR-IOT-E-511-400	MODEL 400 20" FIRETUBE REFRACTORY CHAMBER
2	1	BNR-IOT-E-511-400-S	MODEL 400 20" FIRETUBE STARTER REFRACTORY (OIL ONLY)
3	1	BNR-IOT-E-512-400	MODEL 400 20" FIRETUBE CLOVERLEAF REFRACTORY
4	1	BNR-IOT-E-511-400-1C	MODEL 400 20" FIRETUBE ASPHALT CONE REFRACTORY



BNR-IOT-E-510-400-ASPHALT

FRONT - SCALE 1 / 6

REVISION HISTORY			
REV	DESIGNER	DATE	DESCRIPTION
	RMS		

MEEKER EQUIPMENT
BELLEVILLE, PA

TITLE:
MODEL 400 20" FIRETUBE FOR ASPHALT TANKS
COMBUSTION CHAMBER

SIZE: B	JOB #: N/A	
SCALE: AS NOTED	DRAWN BY: RMS	DATE: 10/16/2014
	CHECKED BY:	DATE:

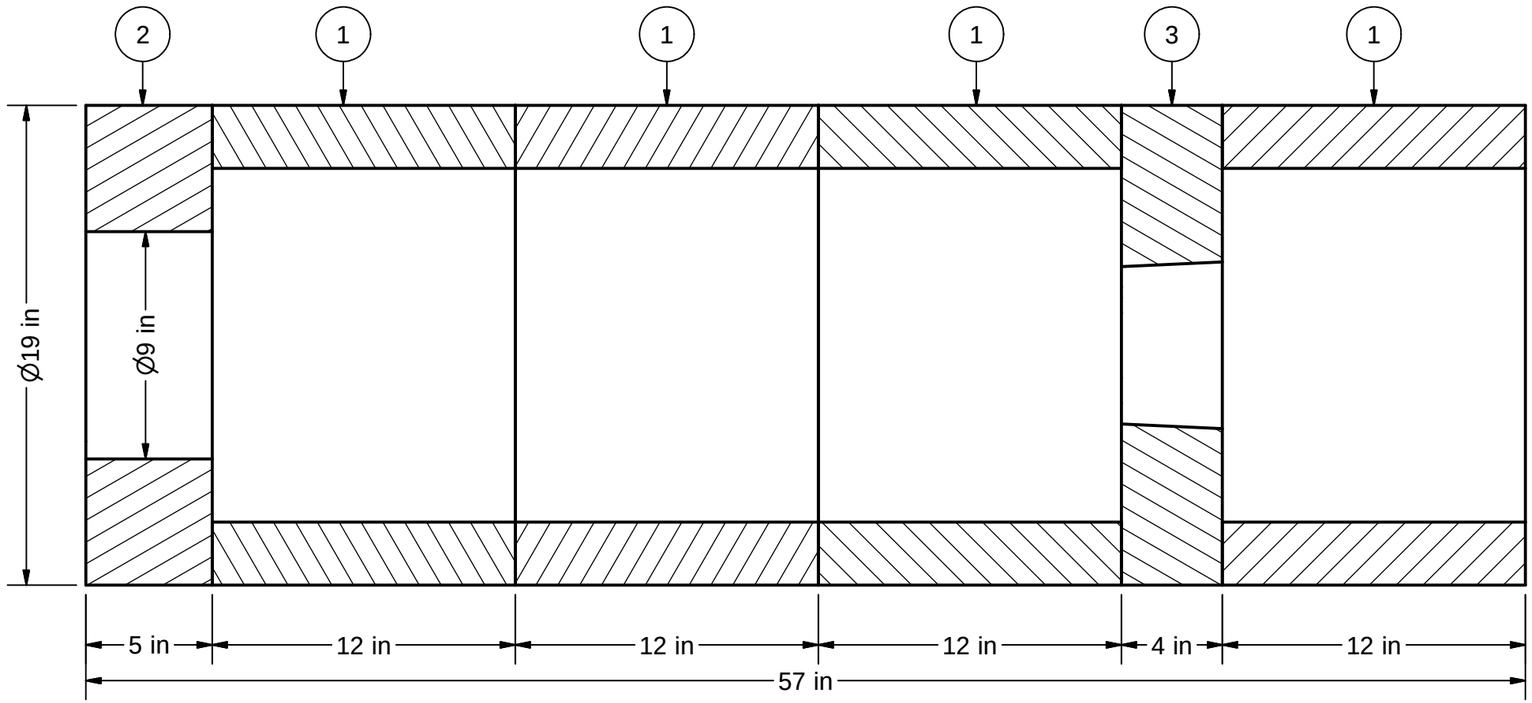
MEEKER EQUPMENT CO., INC.
1440 INDUSTRY ROAD
HATFIELD, PA 19440

DWG NO: BNR-IOT-E-510-400-ASPHALT

SHEET 1 OF 1

NOTE:
1) STARTER REFRACTORY IS USED FOR OIL ONLY BURNERS.
2) GAS AND COMBINATION BURNERS DO NOT USE A SEPARATE STARTER BRICK BECAUSE IT IS BUILT INTO THE BURNER.

Parts List			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	BNR-IOT-E-511-400	MODEL 400 20" FIRETUBE REFRACTORY CHAMBER
2	1	BNR-IOT-E-511-400-S	MODEL 400 20" FIRETUBE STARTER REFRACTORY (OIL ONLY)
3	1	BNR-IOT-E-512-400	MODEL 400 20" FIRETUBE CLOVERLEAF REFRACTORY



BNR-IOT-E-510-400-WATER

FRONT - SCALE 1 / 6

REVISION HISTORY			
REV	DESIGNER	DATE	DESCRIPTION
	RMS		

MEEKER EQUIPMENT
BELLEVILLE, PA

TITLE:
MODEL 400 20" FIRETUBE FOR HOT WATER TANKS
COMBUSTION CHAMBER

SIZE: B	JOB #: N/A	
SCALE: AS NOTED	DRAWN BY: RMS	DATE: 8/12/2013
	CHECKED BY:	DATE:

MEEKER EQUPMENT CO., INC.
1440 INDUSTRY ROAD
HATFIELD, PA 19440

DWG NO: BNR-IOT-E-510-400-WATER

SHEET 1 OF 1

9
THIRD PARTY LITERATURE

MEUV1, MEUV4,MEUVS1, MEUVS4,MEIR1,MEIR4, MERT1,MERT4, MECD1 and MECD4

AMPLIFIER MODULES FOR USE WITH THE FIREYE® MODULAR MicroM™ CONTROL

c UL us LISTED

FM APPROVED

Year 2000 Compliant in accordance with BSI document DISC PD2000-I:1998

DESCRIPTION

The Fireye MEUV1, MEUV4, MEUVS1, MEUVS4, MERT1, MERT4, MEIR1, MEIR4, MECD1 and MECD4 are Amplifier Modules used with the Fireye Modular MicroM control. These amplifier modules provide flame scanning capabilities using any of the Fireye standard ultraviolet scanners, self-check scanners, infrared scanners, cadmium sulfide scanners, flame rods, and photocells. The Flame Failure Response Time (F.F.R.T.) of the control is determined by the selection of the amplifier module (see Ordering Information). Test jacks are provided on the amplifier modules to permit flame signal measurement during operation and is a uniform 0-10 vdc for all models.

After scanner selection, the proper amplifier module **must** be used in the Modular MicroM chassis (see Ordering Information). The amplifier module incorporates a plug-in design for ease of installation.

The programmer module determines the operational characteristics of the control (e.g. relight, purge timing, etc.).

For proper and safe application of this product, you must refer to bulletin MC-5000 for a detailed description of the operation of the Modular MicroM control, including installation instructions, operating sequences for the programmer modules, etc. Also follow the scanner installation and wiring instructions found in bulletins MC-5000 for proper flame scanning operation.

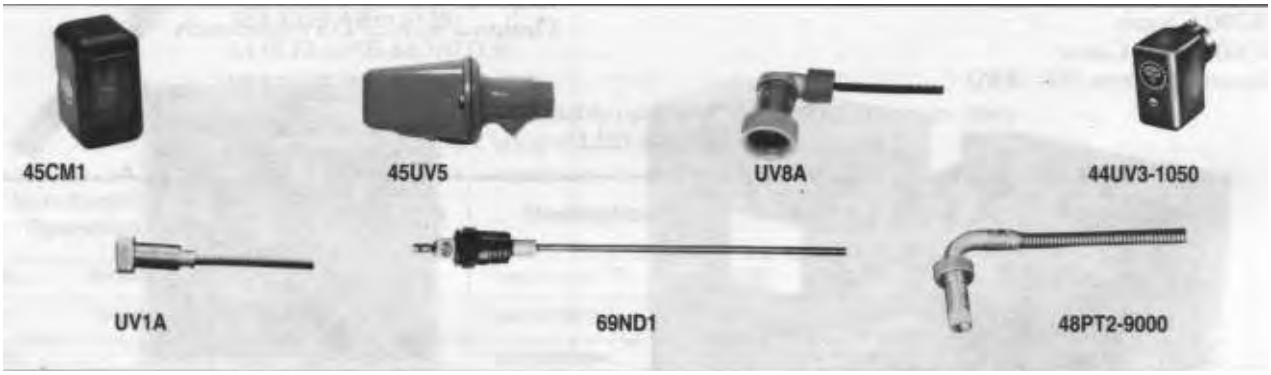
WARNING: Selection of this control for a particular application should be made by a competent professional, licensed by a state or other government agency. Inappropriate application of this product could result in an unsafe condition hazardous to life and property. Installation should not be considered complete until pilot turndown and other appropriate performance tests have been successfully completed.

ORDERING INFORMATION

Flame Amplifier Selection:

MicroM Amplifier Models:	
MEUV1	UV amplifier,0.8 second FFRT, uses UV1A, UV2, UV8A and 45UV3-1050 scanners.
MEUV4	UV amplifier, 3 second FFRT, uses UV1A, UV2, UV8A and 45UV3-1050 scanners.
MEUVS1	UV Self-Check amplifier,0.8 second FFRT, uses 45UV5-1009 scanner.
MEUVS4	UV Self-Check amplifier, 3 second FFRT, uses 45UV5-1009 scanner.
MERT1	Flame Rod / Photocell amplifier,0.8 second FFRT, uses 69ND1 or 45CM1.
MERT4	Flame Rod / Photocell amplifier, 3 second FFRT, uses 69ND1 or 45CM1.
MEIR1	Infrared amplifier0,.8 second FFRT, uses 48PT2 scanner.
MEIR4	Infrared amplifier, 3 second FFRT, uses 48PT2 scanner.
MECD1	Cadmium sulfide amplifier,0.8 second FFRT, uses CS1A5 scanner.
MECD4	Cadmium sulfide amplifier, 3 second FFRT, uses CS1A5 scanner.

FLAME SCANNERS



CAUTION: The UV1, UV2, UV8A and 45UV3 ultra-violet flame scanners and associated amplifier modules are non self-checking UV systems and should be applied only to burners that cycle often (e.g.: a minimum of once per 12 hours) in order for the safety checking circuit to be exercised. If component checking is required during burner operation for constantly fired burners, utilize the self-checking ultra-violet flame scanners (45UV5) with associated amplifier module (MEUVS1, MEUVS4) or the infrared flame scanner (48PT2) with associated Auto Check amplifier (MEIR1, MEIR4).

UV SCANNERS:		BULLETIN
UV1A3	1/2" NPT connector, 3 ft. (914mm) flexible cable, non self-checking.	SC-102
UV1A6	1/2" NPT connector, 6 ft. (1828mm) flexible cable, non self-checking.	SC-102
UV2	3/8" NPT connector, 3ft. (914mm) flexible cable, non self-checking.	SC-102
UV8A	1/2" NPT 90° head, 6 ft. unshielded leads.	SC-102
45UV3-1050	3/4" sleeve/set screw mount. Non self-checking.	SC-102
45UV5-1009	UV self-check scanner 8 ft. (2400mm) leads. 1" NPT threads. 120 VAC shutter. Use with MEUVS type amplifier.	SC-101

FLAME DETECTORS:		BULLETIN
45CM1-1000	Photocell with filter.	SC-103
45CM1-1000Y	Photocell without filter.	SC-103
69ND1-1000K4	12 inch flame rod, 1/2" NPT connector.	SC-103
69ND1-1000K6	18 inch flame rod, 1/2" NPT connector.	SC-103
69ND1-1000K8	24 Inch flame rod, 1/2" NPT connector.	SC-103

INFRARED SCANNERS:		BULLETIN
48PT2-1003	Infrared scanner 8 ft. (2400mm) shielded cable, straight head.	SC-103
48PT2-1007	Infrared scanner 4 ft. (1200mm) shielded cable, straight head.	SC-103
48PT2-9003	Infrared scanner 8 ft. (2400mm) shielded cable, 90° head.	SC-103
48PT2-9007	Infrared scanner 4 ft. (1200mm) shielded cable, 90° head.	SC-103
48PT2-9007W	Infrared scanner 4 ft. (1200mm) shielded cable, 90° head, water repellent.	SC-103

CADMIUM SULPHIDE:	
CS1A5	Cadmium sulfide 5', with mounting bracket

Parts and Accessories

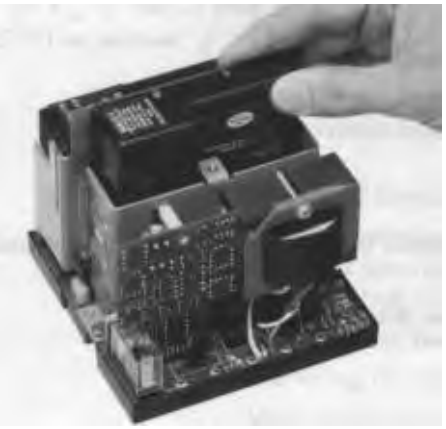
Part Number	Description
4-230	Phototube - 922 for 45AM1-45CM1.
4-263-1	Firetron cell for 48PT2 only.
4-314-1	UV tube for 45UV5-1005-1009, 45UV2, 45UV3.
10-88	Set of 3 orifice plugs ($^1/_{16}$", $^1/_8$", $^3/_{16}$") for 48PT1, 48PT2.
19-30	Pyrex window for 60-801 union.
35-69	Heat insulator, $^1/_2$" connection for 48PT, UV1A.
35-75	Water cooled adapter for 48PT, UV1A.
35-127-1	Heat insulator. 1" NPT for 45UV5.
46-38	Replacement lens (1.25" dia.) for 45UV5,.
46-56	Quartz magnifying lens for 45UV3, (1" dia.).
46-58	Quartz (1"dia.) lens for 60-1290 union.
60-302	Swivel mtg. adapter, $^1/_2$" NPT for 48PT1, 48PT2, UV1A.
60-801	$^1/_2$" union with Pyrex window for 48PT1, 48PT2.
60-1199	Union with quartz window, 1" NPT for 45UV2, 45UV3, 45UV5.
60-1257	Union with quartz window, $^1/_2$" NPT for UV1A.
60-1290	Union with quartz lens, $^1/_2$" NPT for UV1A.
60-1664-3	Swivel mount adapter, 1" NPT for 45UV5 scanners.
61-436	Lens cap (standard) for 48PT scanners.
61-2914	Shutter and bracket assembly only for 45UV5-1009.
61-3263	Shutter, bracket and lens assembly with lens holder and gasket for 45UV5-1005-1009, 1105 (includes a 61-2914).
82-95	Lens holder for 45UV5 scanner.
92-45	Quartz window used in 45UV3-1050 and 60-1237 union.
92-48	Quartz window used in 60-1199 union.
124-13	"O" Ring used in 60-1199 union.
124-14	"O" Ring used in 60-801, 60-1257, 60-1290.

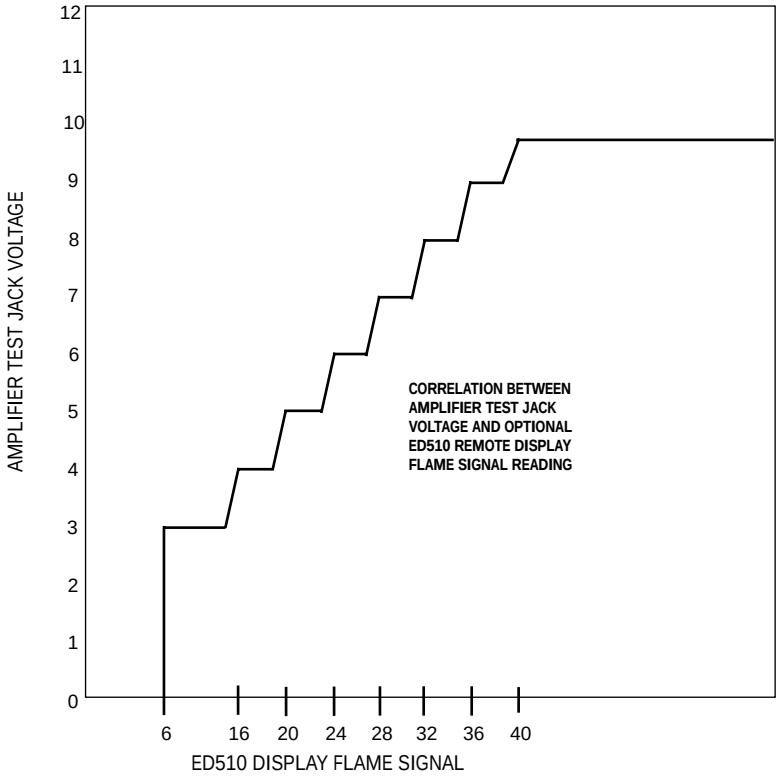
Remove power from the control and remove the control from its wiring base before proceeding.

INSTALLATION

The amplifier modules are used with the Fireye Modular MicroM Base Chassis (P/N MEC120, MEC120C, MEC120R, MEC120D, MEC120RC for 120VAC, P/N MEC230, for 230VAC). They are installed in the chassis by grabbing hold of the amplifier module by the edges of its printed circuit board, aligning the module with the guide slots on the opening in the middle of the chassis, and inserting the module into the pin connectors.

The amplifier modules are designed to fit in the proper slot only. **DO NOT FORCE THEM.**





WARRANTIES

FIREYE guarantees for *one year from the date of installation or 18 months from date of manufacture* of its products to replace, or, at its option, to repair any product or part thereof (except lamps, electronic tubes and photocells) which is found defective in material or workmanship or which otherwise fails to conform to the description of the product on the face of its sales order. **THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES AND FIREYE MAKES NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED.** Except as specifically stated in these general terms and conditions of sale, remedies with respect to any product or part number manufactured or sold by Fireye shall be limited exclusively to the right to replacement or repair as above provided. In no event shall Fireye be liable for consequential or special damages of any nature that may arise in connection with such product or part.

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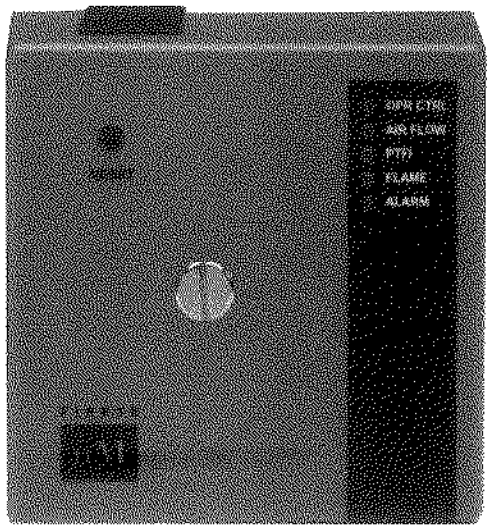
Derry, New Hampshire 03038 USA
http://www.fireye.com

MAMP-1
JANUARY 2000
Supersedes Nov. 1998



FIREYE MODULAR MicroM

FLAME SAFEGUARD CONTROLS

c UL US LISTED FM APPROVED

WARNING: Selection of this control for a particular application should be made by a competent professional, licensed by a state or other government agency. Inappropriate application of this product could result in an unsafe condition hazardous to life and property.

DESCRIPTION

The Fireye MicroM Series Flame Safeguard Control is a compact, microprocessor based, modular burner management system designed to provide automatic ignition and continuous flame monitoring for commercial sizes of heating and process equipment firing any type of fuel.

The MicroM is designed to be backward compatible with existing TFM, UVM and M-Series II controls. The MicroM MEC120 and MEC230 chassis with the appropriate MEP100, MEP200 and MEP500 series programmers provide operation similar to its predecessors and is usually directly interchangeable. The MEC320 and MEC480 chassis with the appropriate MEP300, MEP400 and MEP600 series programmers provide additional enhancements such as early spark termination, pilot proving, and interrupted pilot.

The advantages of the MicroM are zero dependence on discrete components previously used for timing functions. The MicroM, through the use of micro-controller technology, incorporates smart diagnostic LED's, smart reset function for multi-burner applications, optional alpha-numeric display output (ED510), and serial communications via a Modbus or E500 Communication Interface. The MicroM system also provides additional amplifier selections. Along with the standard UV and Flame Rod amplifiers are UV self-check, Infrared, Cadmium Sulfide and a dry contact amplifier for use with the Fireye Phoenix scanner. All amplifiers are available with flame failure response times of 0.8 seconds or 3 seconds nominal (4 second maximum) and each provide a set of test jacks with a uniform range of 0-10 VDC for the measurement of flame signal intensity.

A complete MicroM system includes the appropriate flame detector, plug-in amplifier and programmer modules which connect into a standard chassis and wiring base. Interchangeable programmer and amplifier modules allow for complete versatility in selection of control function, timing and flame scanning means. Functions such as relight, recycle, non-recycle, two stage capability, non-recycle air flow, proof of air flow open at start, purge timing, early spark termination, pilot proving and pilot cutoff are determined by the appropriate programmer module. Type of flame scanner (UV, Repetitive UV Self-Check, Flame Rod, IR or Cadmium Sulfide or dry contact) and the flame failure response time (FFRT) are determined by the amplifier module. Optional plug-in daughter boards provide additional features such as remote reset, alpha-numeric display and serial communications.

The MicroM programmers are micro-controller based modules that control the sequence of operation and also interface with plug-in amplifiers, meter boards, display drivers and external communication devices. The programmers are available in an assortment of configurations necessary to resolve the application requirement. Current families of programmers for use with the MEC120 and

MEC230 type chassis include the MEP100, MEP 200 and MEP500 series. Programmers for use with the MEC320 and MEC480 type chassis include the MEP300, MEP400 and MEP600 series.

Some programmer modules are equipped with a series of dipswitches to select Purge Timing, Pilot Trial for Ignition (PTFI) timing, Proof of Air flow open at start, Post Purge, Recycle and Non-Recycle operation. LED indicators on the programmer modules indicate the current operating status of the control and during a lockout condition displays the fault as a coded sequence, simplifying the troubleshooting of a shutdown.

In the event of pilot ignition failure, or following a safety shutdown, the control locks out, activating an alarm circuit and displays the cause of lockout on the integrated LED's and on the optional ED510 display. Unless otherwise specified, manual reset is required. Remote reset is available on the MEC120R, MEC120RC, MEC320RD, MEC230RC, MEC320R, MEC320RC and MEC320RD chassis. A detailed description of the various programmer, amplifier and chassis modules is found later in this document. A "run-check" switch, provided to assist in testing size, position and stabilization of the pilot, is provided on some specific models and all MEP500 and MEP600 series programmers.

Modular MicroM controls incorporate a safety checking circuit that is operative on each start. If flame (real or simulated) is detected prior to a start or during purge, the fuel valves will not be energized and the unit will lock out.

The modular MicroM controls use the same wiring base as the Fireye UVM, TFM and M- Series II controls and are designed to be interchangeable with most models with little or no rewiring. See INSTALLATION OF CONTROL, SCANNERS AND FLAME DETECTORS (page 8 and 47) for temperature and wiring requirements.

NOTE: The individual MicroM modules, i.e. MEC chassis, MEP programmers and amplifiers are not interchangeable with M-Series II modules, i.e. MC chassis, MP programmers and amplifiers.

SPECIFICATIONS

Supply: 120 VAC (min. 102, max. 132) 50/60 Hz. (MEC1XX, MEC3XX)
230 VAC (min. 196, max. 253) 50/60 Hz. (MEC2XX, MEC4XX)

Power Consumption: 12 VA (Operating)

Shipping Weight (Approx): 3 lbs (1.4 kg)

Operating Temperature: -40°F (-40°C) to 140°F (60°C)

Table 1: **AMBIENT TEMPERATURE LIMITS**

	MAXIMUM		MINIMUM	
Control	140°F	60°C	- 40°F	- 40°C
Scanner UV1A, UV2, UV8A, 45UV3, UV90	200°F	93°C	- 40°F	- 40°C
45UV5-1007, 45UV5-1009; 55UV5-1007, -1009	200°F	93°C	- 40°F	- 40°C
Photocell 45CM1 (OBSOLETE)	165°F	74°C	- 40°F	- 40°C
Flame Rod (Tip 2460 F)	1500°F	816°C	- 40°F	- 40°C
48PT2	140°F	60°C	-40°F	-40°C
CSIA5	140°F	60°C	-40°F	-40°C

Table 2: **LOAD RATINGS: All Ratings are 120V, 60 Hz**

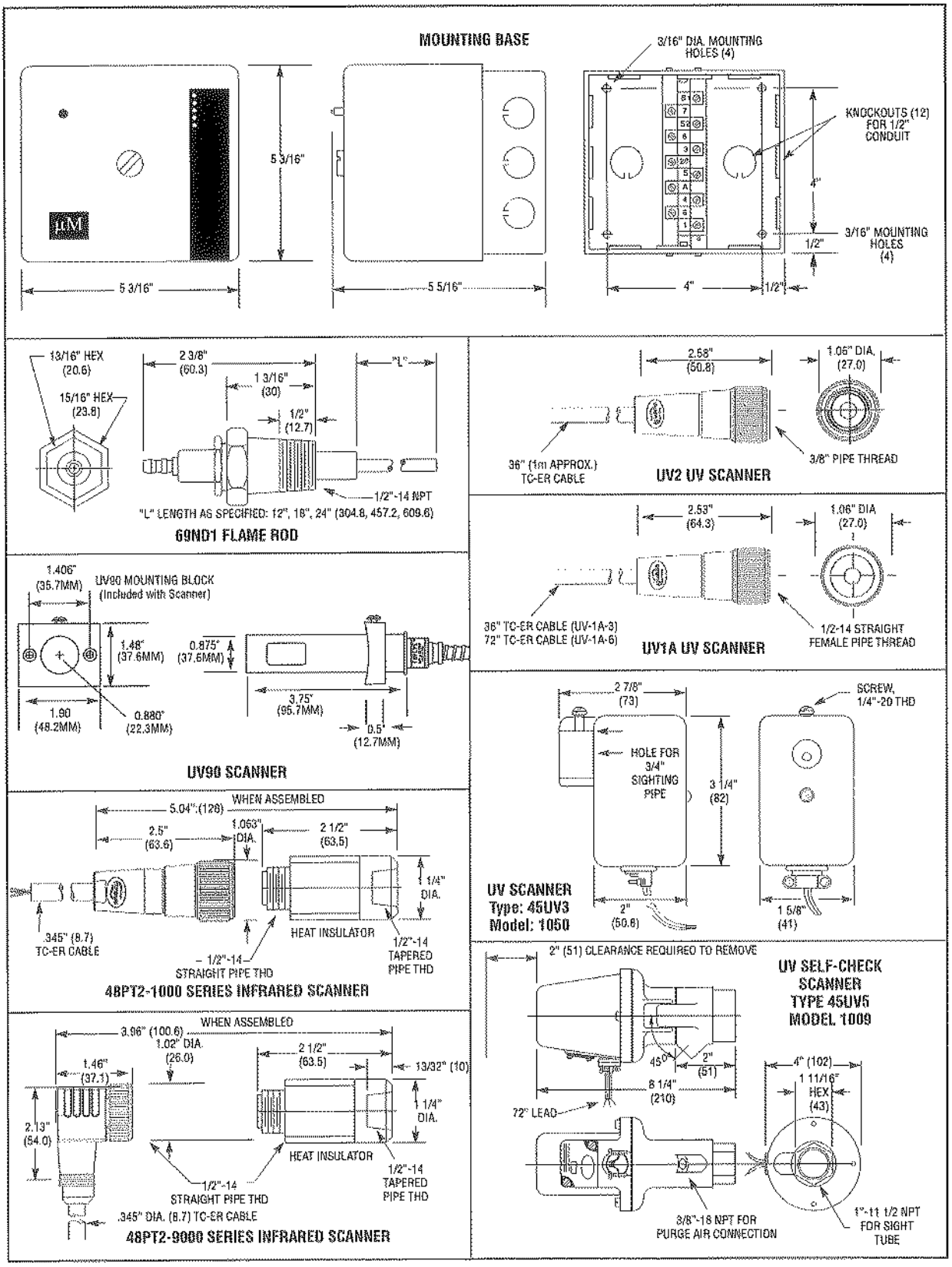
Fireye Terminal	Typical Load	Maximum Rating @120V 60 Hz
3 or 4 Individual or combined	Pilot valve(s) Solenoid valve Ignition Transformer	125 VA pilot duty (solenoid valve) plus 250 VA (Transformer)
5	Main Fuel Valve(s)	125 VA pilot duty (solenoid) or 25 VA pilot duty (solenoid) and 400 VA (opening) motorized, 250 VA hold
8	Motor or contactor	Terminal 8 rated to energize and de-energize 9.8 FLA, 58.8 LRA on safety lockout.
A	Alarm	125 VA, pilot duty
Minimum load requirement = 100mA		

Table 3: **ALTERNATIVE LOAD RATINGS:**

COMBINATION NUMBER	PILOT FUEL TERMINAL 3	IGNITION TERMINAL 4	MAIN VALVE TERMINAL 5
1	C	NO LOAD	E
2	B	NO LOAD	E
3	NO LOAD	NO LOAD	E
4	E	A	E
5	NO LOAD	A	E
6	D	A	E
7	D	A	D
8	NO LOAD	A	D

Table 4: **COMPOSITION OF EACH COMBINATION**

A	B	C	D	E
4.5A Ignition	50 VA Pilot Duty plus 4.5A ignition	180 VA Ignition plus motor valves with: 600VA inrush., 360 VA open, 250 VA hold	2A Pilot Duty	65 VA Pilot Duty plus Motor valves with: 3850 VA in rush., 700 VA open, 250 VA hold



All dimensions in inches (millimeters in parentheses).

WARNING: This equipment is a Class B digital apparatus which complies with the Radio Interference Regulations, CRC c.1374.

CAUTION: Published load ratings assume that no control be required to handle inrush current more often than once in 15 seconds. The use of control switches, solenoids, relays, etc. which chatter will lead to premature failure. It is important to run through a test operation (with fuel shut off) following the tripping of a circuit breaker, a blown fuse, or any instance of chattering of any external current consuming devices.

APPROVALS

Underwriters Laboratories Inc.:

MCCZ File MP 1537
Controls, Primary Safety - Listed
MCCZ2 File MP1537
Controls, Primary Safety - Component
MCCZ7 File MP1537
Controls, Primary Safety Certified for Canada
MCCZ8 file MP1537
Controls, Primary Safety Certified for Canada - Component

Factory Mutual System (FM) Approved

UL approval does not apply to 230VAC operations.

WARNING: Selection of programmer and amplifier type for a particular application should be made by a competent professional, such as a Boiler/Burner technician licensed by a state or government agency, engineering personnel of the burner, boiler or furnace manufacturer (OEM) or in the performance of duties based on the information from the OEM.

WARNING: This equipment generates and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user, at his own expense, will be equipped to take whatever measures that may be required to correct the problem.

In order for the MicroM to gather and retain statistical and historic data such as burner hours, burner cycles, system hours and average flame signal, it is necessary that Terminal 1 be powered at all times. Removing power from Terminal 1 at the end of the firing cycle causes all data gathered during the previous 16 hours or last 9 cycles to be lost. For conversions or upgrades from older TFM or M-Series II controls that use MART1 amplifiers, it is necessary that Terminal 1 be directly powered with 120 VAC.

ORDERING INFORMATION

MicroM Chassis Types (For use with MEP1XX, MEP2XX, and MEP5XX, includes dust cover)	
MEC120	120 VAC input with standard plug-in board.
MEC120R	120 VAC input with remote reset capability.
MEC120D	120 VAC input with alpha-numeric display interface to ED510.
MEC120RD	120 VAC input with alpha-numeric display interface to ED510 and remote reset capability.
MEC120C	120 VAC input with interface to E500 Communication Interface and Modbus capability.
MEC120RC	120 VAC input with remote reset capability, alpha-numeric display interface to ED510, interface to E500 Communication Interface and Modbus capability.
MEC230	230 VAC input with standard plug-in board.
MEC230RC	230 VAC input with remote reset capability, alpha-numeric display interface to ED510, and Modbus capability.

MicroM Chassis Types (For use with MEP3XX, MEP4XX, and MEP6XX, includes dust cover)	
MEC320	120 VAC input with standard plug-in board.
MEC320R	120 VAC input with remote reset capability.
MEC320D	120 VAC input with alpha-numeric display interface to ED510.
MEC320RD	120 VAC input with alpha-numeric display interface to ED510 and remote reset capability.
MEC320C	120 VAC input with interface to E500 Communication Interface and Modbus capability.
MEC320RC	120 VAC input with remote reset capability, alpha-numeric display interface to ED510, interface to E500 Communication Interface and Modbus capability.
MEC320TS	120 VAC input with display interface to ED510, Modbus interface and auxiliary relay output with dry contact for controller interface (MED8).
MEC480	230 VAC input with standard plug-in board.
MEC480RC	230 VAC input with remote reset capability, alpha-numeric display interface to ED510, and Modbus capability.

MicroM Programmer Models (For use with MEC120 and MEC 230 Chassis)	
MEP100	Relight operation, 10 sec. PTFI.
MEP101	Relight operation, allow flame signal until 60 seconds after interlock closed.
MEP102	Non-recycle on flame fail, 5 second PTFI.
MEP103	Fixed 10 second SISP*, 10 second MTFI, re-try once on igniter failure, fixed 30 second post purge.
MEP104	Non-recycle on flame fail, 10 second PTFI.
MEP105	Non-recycle on flame fail, lockout on air-flow open with flame present, 10 second PTFI.
MEP106	Same as MEP100. 12 second pre-purge, added reset from lockout via line voltage.
MEP107	Same as MEP100. Force 5 minute purge delay after main flame fail.
MEP108	Same as MEP100 with 0 second purge, 15 second PTFI, non-recycle on flame fail. Not FM approved.
MEP109	Immediate ignition and pilot, 10 second fixed PTFI, 10 second MTFI, intermittent pilot, non-recycle on flame fail.
MEP100P	Relight operation, 10 sec PTFI, fixed 15 second post purge.
MEP130	Same as MEP100, 30 second PTFI. Not FM approved.
MEP230	Selectable purge timing (7, 30, 60, 90 sec.) 10 sec PTFI timing, recycle/non-recycle, post purge, prove air open at start.
MEP230H	Same as MEP230 with 8 second pilot stabilization.
MEP235	Same as MEP230 with lockout on air flow open 10 seconds after the start of a cycle, selectable recycle/nonrecycle lockout on air flow open after flame is proven and dedicated lockout after loss of flame.
MEP236	Same as MEP230 with additional 6 second igniter on time with main fuel. To be used with intermittent pilot only.
MEP237	Same as MEP230 with fixed PTFI timing and check/run switch. Used with MEDC2 amplifier to provide operation with 85 Series (Phoenix) and 95 Series (InSight) scanners.
MEP238	Same as MEP230. Ignition de-energized 3 seconds after pilot flame detected. Provides 8 second pilot stabilization period.
MEP290	Same as MEP230 except selectable post purge is 0 or 90 seconds.
MEP560	Same as MEP230H, 10 second main trial for ignition, run-check switch.
MEP561	Same as MEP560 without 8 second pilot stabilization. Selectable purge time of 7s, 10s, 15s, 30s.
MEP562	Same as MEP560, lockout on loss of air flow, non-recycle operation only.
MEP564	Same as MEP560. Selectable purge time of 7s, 30s, 60s, 240s.
MEP536	Same as MEP230, 10 second main trial for ignition, run-check switch, will not lockout on air flow open during purge.
MEP537	Same as MEP536 except provides one recycle on main flame failure.

*Spark Igniter Sensing Period

MicroM Programmer Models (For use with MEC320 and MEC 480 Chassis)	
MEP300	Relight operation, 10 sec. fixed PTFI, 5 sec.pilot proving period, 5 second MTFI. lockout on flame fail during PTFI, pilot proving and MTFI. Recycle on air flow open. No post purge. Reset on line voltage.
MEP304	Non-recycle on flame fail, 5 sec. purge, 10 sec.fixed PTFI, 5 sec. pilot proving, 10 sec.MTFI, interrupted pilot, early spark termination.
MEP335	Non-recycle on flame fail, 30 second purge, 35 second hot surface ignition on terminal 4, 3 second PTFI on terminal 3, 5 second pilot proving period, intermittent pilot, 15 second post purge. Manual reset only.
MEP397	Recycle on main flame fail, 15 sec. purge, 7 second fixed PTFI, 5 sec. pilot proving 5 sec. MTFI, early spark termination and interrupted pilot. Recycle on air flow failure. No post purge, run/check switch. Reset on line voltage.
MEP437	Recycle once on main flame failure, selectable 5 or 10 sec. fixed PTFI, selectable interrupted or intermittent pilot, 5 sec. MTFI, selectable purge time to 240 seconds, main valve proof of closure, 15 sec. post purge. Reset on line voltage.
MEP696	Provides 30 sec. pre-purge, lockout on airflow after 10 sec., 10 sec. PTFI, 5 sec. pilot proving, early spark termination, 5 sec. MTFI, interrupted pilot, selectable recycle/non-recycle on flame fail, 60 sec. post purge, selectable baud rate for communications, output for external controller operation.
MEP697	Provides dip-switch selectable pre-purge, selectable air flow proving at startup, selectable post purge, selectable 5/10 sec. PTFI, 5 sec. pilot proving early spark termination, 5 sec. MTFI, interrupted pilot, selectable recycle/non recycle on flame fail, output for external controller operation.

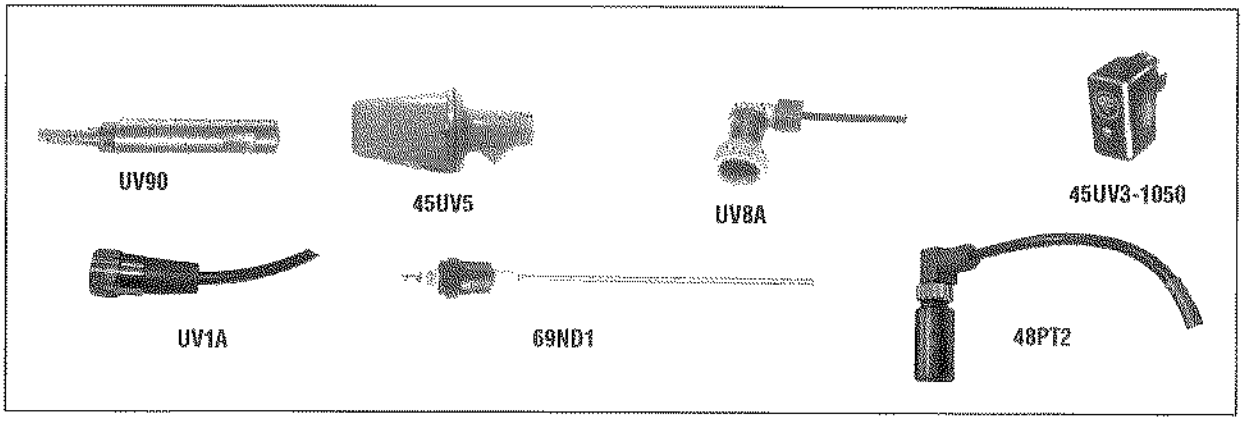
MicroM Amplifier Models:	
MEUV1	UV amplifier, 0.8 second FFRT, uses UV1A, UV2, UV8A, UV90 and 45UV3-1050 scanners.
MEUV4	UV amplifier, 3 second FFRT, uses UV1A, UV2, UV8A, UV90 and 45UV3-1050 scanners.
MEUVS1	UV Self-Check amplifier, 0.8 second FFRT, uses 45UV5-1009 scanner.
MEUVS4	UV Self-Check amplifier, 3 second FFRT, uses 45UV5-1009 scanner.
MERT1	Flame Rod amplifier, 0.8 second FFRT, uses 69ND1.
MERT4	Flame Rod amplifier, 3 second FFRT, uses 69ND1.
MEIR1	Infrared amplifier, 0.8 second FFRT, uses 48PT2 scanner.
MEIR4	Infrared amplifier, 3 second FFRT, uses 48PT2 scanner.
MECD1	Cadmium sulfide amplifier, 0.8 second FFRT, uses CS1A5 scanner.
MECD4	Cadmium sulfide amplifier, 3 second FFRT, uses CS1A5 scanner.
MEDC2	Contact input amplifier for use with MEP237 to provide operation with 85 Series (Phoenix) and 95 Series (InSight) scanners

Optional Plug-In Board Modules:	
MED1	Standard local reset switch.
MED2	Same as MED1 with display output.
MED3	Same as MED1 with remote reset.
MED4	Same as MED1 with display output and remote reset.
MED5	Same as MED1 with display output and RS485 communications.
MED6	Same as MED1 with display output, remote reset and RS485 communications.
MED7	Same as MED1 with RS485 communications.
MED8	Same as MED1 with display output, RS485 Modbus interface and auxiliary relay output with normally closed dry contact for controller interface.
MED9	Same as MED1 with display output, RS485 Modbus interface and auxiliary relay output with normally open dry contact for controller interface.

Wiring Base (Common for all Controls):	
61-3060	Closed wiring base, surface mounting.
61-5042	Open wiring base, cabinet mounting.

Accessories	
ED510	Two line by 16 character, back lit LCD display with keypad.
ED580-2, -4, -8	Remote display cable with RJ45 connection in 2, 4 or 8 foot long lengths. To be used with the appropriate daughter board.
EC485	RS232 to RS485 converter with power supply and RJ12 jack.
UC485	USB to RS485 converter. Supplied with USB cable.
SMDK-1004	Serviceman's display kit used for diagnosing MicroM system. Consists of ED510 equipped with back plate, MED daughter board and ED580-4.
129-145-1, -2, -3	ED510 remote display mounting kit with 4', 8' or 2' cable respectively. Provides NEMA 4 protection.
IT1000	Monitoring device using cellular networks. Provides various reporting methods

FLAME SCANNERS



CAUTION: The UV1A, UV2, UV8A, UV90 and 45UV3 ultra-violet flame scanners and associated amplifier modules are non self-checking UV systems and should be applied only to burners that cycle often (e.g.: a minimum of once per 12 hours) in order for the safety checking circuit to be exercised. If component checking is required during burner operation for constantly fired burners, utilize the self-checking ultra-violet flame scanners (45UV5) with associated amplifier module (MEUVS1, MEUVS4) or the infrared flame scanner (48PT2) with associated AutoCheck amplifier (MEIR1, MEIR4).

For a complete system, choose one of each of the following:

- Chassis
- Programmer Module
- Amplifier Module
- Flame Detector
- Wiring Base

WARNING: Installer must be trained and qualified. Follow the burner manufacturer's instructions, if supplied. Otherwise, proceed as follows:

INSTALLATION OF CONTROL, SCANNERS AND FLAME DETECTORS

Wiring Base

Mount the wiring base on the burner or on a panel. The location should be free from excessive vibration and within the specified ambient temperature rating. The base may be mounted in any angular position.

All wiring should comply with applicable electrical codes, regulations and local ordinances. Use moisture resistant wire suitable for at least 90 degrees C. Good electrical wiring practice should be followed to ensure an adequate ground system. Refer to Fireye Service Note SN-100 separately and General Grounding Rules later in this document for grounding methods.

A good ground system should be provided to minimize the effects of AC quality problems. A properly designed ground system meeting all the safety requirements will ensure that any AC voltage quality problems, such as spikes, surges and impulses have a low impedance path to ground. A low impedance path to ground is required to ensure that large currents involved with any surge voltages will follow the desired path in preference to alternative paths, where extensive damage may occur to equipment.

Circuit recommendations are found on pages 38 through 43. Consult the factory for assistance with non-standard applications.

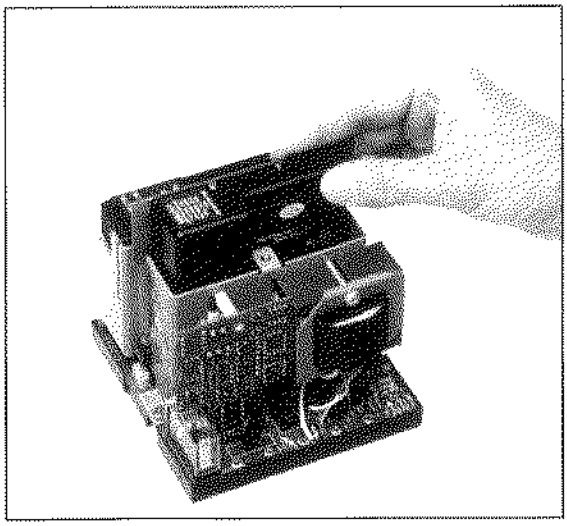
WARNING: Controls require safety limits utilizing isolated mechanical contacts. Electronic limit switches may cause erratic operation and should be avoided.

Care must be taken to NOT route the high energy ignition wire in close proximity to the flame sensor wiring, particularly when using MERT amplifier.

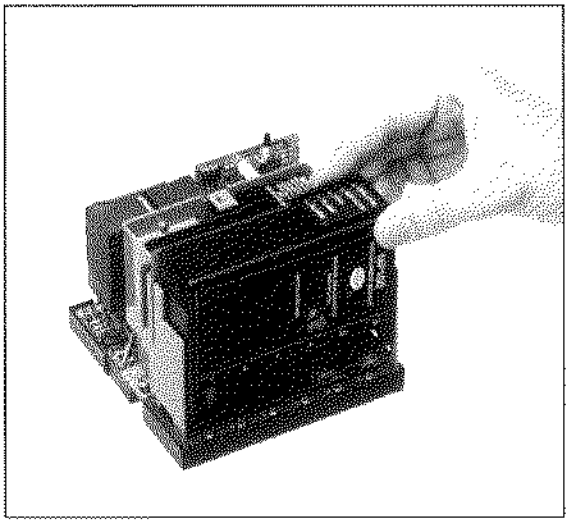
INSTALLING THE PROGRAMMER AND AMPLIFIER MODULES

WARNING: Remove power from the control before proceeding.

FIGURE 1.



AMPLIFIER



PROGRAMMER

Select the appropriate programmer and amplifier modules for your application. Remove the dust cover from the chassis. Insert the amplifier module into the slot in the corner of the chassis and gently push the module into position. Insert the programmer module into the slot at the right side of the chassis and gently push the module into position.

NOTE: Refer to programmer dipswitch settings on page 11 for the proper setting of the dipswitches for those programmers with this feature.

WARNING: Turn off the power when installing or removing the control.

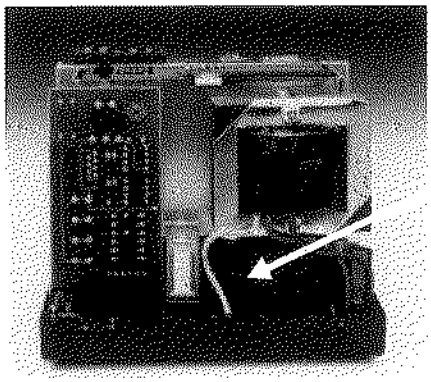
Replaceable Fuse

The chassis modules are designed with a field replaceable fuse. The fuse is located on the printed circuit board below the transformer. In the event the fuse becomes OPEN, the Operating Control, PTFI, and Flame LED's will light. However, KL or KF (Wiring Arrangements section on pages 33 through 38) will not be energized and the control will lock out and indicate Lockout, Check Blown Fuse. The fuse will blow as a result of an overload condition on Terminals 3, 4, or 5. To replace the fuse, remove power from the system and using a small screwdriver or similar tool, install a Fireye replacement fuse (P/N 23-197).

FOR MEC230, ORDER FIREYE REPLACEMENT FUSE P/N 23-198 .

WARNING: Disconnect power before servicing.

FIGURE 2.



Replaceable
Fuse Location

PROGRAMMER DIPSWITCH SETTINGS

NOTE: The dipswitch settings become permanently stored within the programmer's eeprom memory after 8 hours of continuous electrical operation.

The first 8 hours of continuous operation is determined from the value of system hours being accumulated by the MicroM. System hours are stored to memory (eeprom) automatically every 1,000 minutes or at the occurrence of a lockout. Therefore, any lockout that occurs during the first 8 hours will cause the system hour value to become the time when the last lockout occurred. If power is removed and restored, the continuous 8 hours feature will be reduced by the time when the lockout occurred.

This allows sufficient opportunity to make the appropriate selection, test and checkout the system. Once stored, the settings cannot be altered.

The MEP200 and MEP500 series programmers have a series of 6 dipswitches (see Figure 3) which allow the user to program the purge timing, trial for ignition timing, enable post purge, enable proof of air flow open at start and select recycle/non-recycle operation.

MicroM Programmer Dip Switch Configuration

(see bulletin MC-3200 for MEP696 settings)

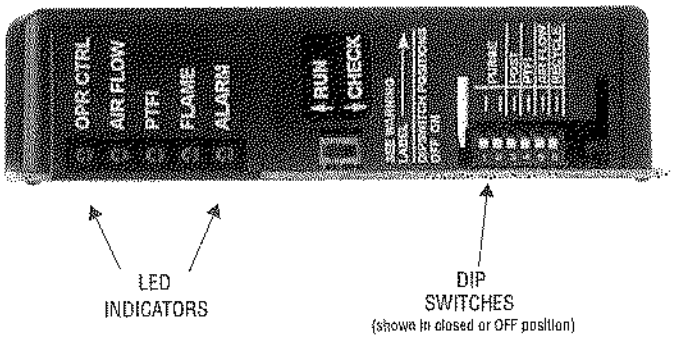
<table>
<tr><th colspan="6">SWITCH</th><th colspan="3">FUNCTION</th><th>NOTES</th></tr>
<tr><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>STD</td><td>MEP561</td><td>MEP564</td><td rowspan="5">PURGE TIME SECONDS</td></tr>
<tr><td colspan="4" rowspan="4"></td><td>C</td><td>C</td><td>7</td><td>7</td><td>7</td></tr>
<tr><td>C</td><td>O</td><td>30</td><td>10</td><td>30</td></tr>
<tr><td>O</td><td>C</td><td>60</td><td>15</td><td>60</td></tr>
<tr><td>O</td><td>O</td><td>90</td><td>30</td><td>240</td></tr>
<tr><td colspan="3" rowspan="2"></td><td rowspan="2">C
O</td><td colspan="2" rowspan="2"></td><td>DISABLED</td><td colspan="2" rowspan="2">POST* PURGE</td><td rowspan="2">* The MEP290 Programmer module has selectable post purge of 90 seconds.</td></tr>
<tr><td>15 SECONDS</td></tr>
<tr><td colspan="2" rowspan="2"></td><td rowspan="2">C
O</td><td colspan="3" rowspan="2"></td><td>5</td><td colspan="2" rowspan="2">PTFI TIME</td><td rowspan="5"></td></tr>
<tr><td>10</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">C
O</td><td colspan="4" rowspan="2"></td><td>DISABLE</td><td colspan="2" rowspan="2">PROVE AIR FLOW OPEN AT START</td></tr>
<tr><td>ENABLE</td></tr>
<tr><td>C</td><td colspan="5" rowspan="2"></td><td colspan="3">RECYCLE</td></tr>
<tr><td>O</td><td colspan="3">NON-RECYCLE</td></tr>
</table>

Note: C refers to switch closed position, closed position is when the switch is toward the printed circuit board. O refers to switch open position or when the switch is moved away from the printed circuit board. Indicating arrow on top of programmer cover points toward closed position.

Once the switches are set, they become permanently stored after 8 hours of continuous operation or they can be manually set through the use of the optional ED510 display. Refer to the section using the optional ED510 display for detailed information.

Where applicable, each MicroM programmer is shipped with dip-switch 6 set to non-recycle on flame fail, dipswitch 4 set to 5 second PTFI time, and dipswitches 1 & 2 set to the longest purge time.

FIGURE 3.



Dipswitch Definitions

Purge Time: Begins after power is detected on Terminal #7 (limit control) and Terminal #6 (running interlock switch) and no flame (real or simulated) is detected.

Post Purge: If enabled, Terminal #8 (blower motor or contactor) will remain energized for 15 seconds after terminal #7 or Terminal #6 is detected as open.

PTFI Time: The maximum length of time that Terminal #3 and Terminal #4 will be energized after the pre-purge period to detect pilot flame. For all programmers, the MicroM forces a 3 second delay before advancing to the next logic module (Stabilization, MTFI or Auto) after flame is detected during the PTFI period. This is to allow establishment of a pilot and stabilization of the fuel flow.

Prove Air Flow Open: After power is detected on Terminal #7 (limit control) and before energizing Terminal #8 (blower motor or contactor) no power must be detected on Terminal #6 (running interlock switch). If power is detected on Terminal #6, the MicroM will hold for 60 seconds after which safety lockout will occur. On recycle operation, if this is enabled, Terminal #8 will be de-energized to allow Terminal #6 to open.

Recycle / Non-Recycle: Applies to flame failure during the Run condition. If a flame failure occurs, the control will de-energize Terminals #3 and #5 and if Recycle is selected a new prepurge period will begin. Lockout will occur immediately and the alarm will energize 15 seconds after flame failure if Non-Recycle is selected. Unless otherwise stated (see Programmer Description), the MicroM recycles on all occurrences of air flow failure. The MEP235 and MEP562 will always initiate a lockout on flame failure.

LED INDICATOR LIGHTS

All MicroM Programmer Modules have 5 LED lights to indicate the operating status of the control and also to display the coded sequence under locked out conditions. The function of the lights under a normal operating condition is:

Operating Control: This LED is energized whenever the burner control switch and all other various limit switches are closed and power is applied to Terminal #7.

Interlock or Air Flow: This LED is illuminated whenever power is detected on Terminal #6, indicating the air flow switch or other running interlock is closed. If the operating control is closed and the running interlock switch remains open, this LED will flash at a 1 second rate indefinitely for the MEP100 and MEP200 family. Lockout will occur if the switch remains open for 10 minutes in the MEP500 family. This LED will blink when configured as a flame switch and flame detected.

PTFI: This LED is illuminated only during the pilot trial for ignition period and the stabilization period when so equipped.

Flame: This LED is on whenever a flame signal is detected, and the control is not in a locked out state.

Alarm: This LED flashes when an alarm condition is detected and is used as an address indicator (see communication).

During an alarm condition, the Alarm LED is made to flash at approximately a 1 second rate. The remaining four LEDs are illuminated as a coded sequence identifying the reason for the lockout. For instance, for a LOCKOUT - FLAME FAIL- PTFI, the INTERLOCK, PTFI and FLAME LED's will all be lit steady, with the Alarm LED flashing. This remains true if power is removed and then restored in a locked out condition.

While in the Idle or Off state, the LEDs are made to flash sequentially to show the operational status of the control every minute. The LEDs can be tested by pressing and releasing the Reset push button, while in the Idle or Off state.

LOCKOUT CODES

MSGN		DESCRIPTION	OP CTRL	AIRFLOW INTLCK	PTFI	FLAME	ALARM
DEC	HEX						
6	6	Lockout Line Frequency Noise Detected	●	○	○	●	✱
7	7	Lockout Flame Fail - PTFI	○	●	●	●	✱
15	0F	Lockout Fault Unknown	●	●	●	●	✱
16	10	Lockout Amplifier High Count Fail	○	○	○	○	✱
19	13	Lockout Flame Fail - MTFI	○	○	●	●	✱
20	14	Lockout False Flame - STANDBY	○	●	○	○	✱
21	15	Lockout Intrlck Open	●	●	●	○	✱
22	16	Lockout Intrlck Closed	○	●	●	○	✱
24	18	Lockout Chassis Opto	●	●	○	●	✱
37	25	Lockout Flame Fail - AUTO	○	●	○	●	✱
39	27	Lockout Fuel Valve State Change	○	○	○	●	✱
54	36	Lockout Check Chassis	○	○	○	●	✱
55	37	Lockout Check Programmer	○	○	●	○	✱
56	38	Lockout Check Amplifier	●	○	○	○	✱
58	3A	Lockout Amplifier Auto Check Fail	●	○	●	○	✱
59	3B	Lockout Check BLOWN FUSE	●	○	●	●	✱
76	4C	Lockout Check Scanner	●	●	○	○	✱
N/A	N/A	System Error	✱	✱	✱	✱	●

○ = **NOT LIGHTED**
● = **LIGHTED**
✱ = **FLASHING**

All LED's Flashing indicates defective programmer.

All MicroM chassis are shipped with a convenient peel off label that can be applied to any surface (inside cover) for future reference.

DIAGNOSTIC MESSAGES - TROUBLESHOOTING GUIDE

	POSSIBLE CAUSE	SOLUTION
Check Programmer	Voltage on Terminal 5 at improper time.	Inspect wiring to main fuel valve
	Welded watchdog relay	Replace MEC chassis
	Internal diagnostic failure	Replace MEP programmer
Check Chassis	Voltage on Terminal 3 or 4 at improper time.	Inspect wiring to pilot valve and igniter.
	Welded watchdog relay	Replace MEC chassis
Chassis Opto	Opto-Coupler(s) short circuited	Replace MEC chassis
Amplifier High Count Fail	Amplifier signal level high	Replace Amplifier module
Amplifier Auto Check Fail	Flame signal too high	Use orifice in sight pipe
	Internal Amplifier diagnostic fault	Replace Amplifier module
Check Scanner	Defective shutter	Inspect scanner wiring, replace scanner
	UV tube false firing	Replace UV tube or scanner
Check Blown Fuse	No power detected on terminal 3	Inspect defective pilot valve or igniter
	Defective fuse	Replace fuse
Line Frequency Noise Detected	Spikes detected on AC mains	Check for SCR motors or DC drives
		Inspect ground system
Fuel Value State Change	Terminal 5 (main fuel) detected on during PTFI	Check external wiring or replace MEC chassis
Check Amplifier	Amplifier not passing diagnostic tests	Replace Amplifier module
System Error	Noise transient	Check high energy ignition noise location. Be sure it is not arcing to chassis or wrapped with scanner wiring.

PROGRAMMER DESCRIPTION

For replacement of UVM, TFM and M-II type controls, refer to the cross-reference provided at the end of this section.

MEP100 SERIES

MEP100 and MEP101

These programmers provide relight operation, in the event of a flame failure, pilot trial for ignition is reinitiated. The MEP101 will not lock out if flame signal is present during the Idle or Off cycle. With flame signal present, lockout will occur 60 seconds after the start of a cycle and the air flow switch is closed.

Pilot Ignited Burners

Refer to typical wiring arrangement beginning on page 38.

Normal Operation

With power applied and the limit operating control circuit (1-7) closed, the Operating Control LED illuminates, the burner motor circuit is energized (Terminal 8).

After the air flow proving switch (7-6) closes, the interlock (air flow) LED is illuminated and a short time delay period (3-5 seconds) begins.

At the expiration of the safe start check period, a 10 second pilot trial for ignition (PTFI) period is initiated, illuminating the PTFI Led. Power is applied to Terminal 3, energizing the pilot gas valve and to Terminal 4, energizing the spark ignition.

At the detection of pilot flame, the FLAME LED is illuminated, and the programmer holds that position for 3 seconds to allow the to pilot stabilize.

Power is then applied to Terminal 5 energizing the main fuel valve and removing power from Terminal 4, turning off the spark igniter.

When the operating control opens, the control de-energizes Terminal 3 and Terminal 5 and the programmer reverts back to an Idle state.

Safety Shutdown

In the event pilot flame is not detected at the end of the 10 second PTFI period, the pilot gas valve and spark ignition are de-energized. A safety lockout occurs which de-energizes the burner motor and energizes the lockout alarm relay circuit, lighting the Alarm LED, 15 seconds after the safety lockout occurs. Manual reset is required.

In the event of a flame failure during a firing period, the main fuel valve is de-energized (Terminal 5) and the spark ignition is re-energized (Terminal 4), the PTFI period begins again as described above under Normal Operation.

In the event of the interlock switch opening, the main fuel valve and pilot valve are de-energized. The control reverts back to the Idle state and begins again a new cycle starting with the safe start check period.

Direct Spark Ignited Burners

Refer to typical wiring arrangement illustrated on pages 40 and 41.

Normal Operation

With power applied and the limit operating control circuit (1-7) closed, the Operating Control LED illuminates, the burner motor circuit is energized (Terminal 8).

The interlock proving switch (7-6) closes, the INTRLCK LED is illuminated and a short time delay period (3 seconds) begins (safe start check period).

At the expiration of the safe start check period, a 10 second PTFI period is initiated. The PTFI Led is illuminated, power is applied to Terminal 3, energizing the main fuel valve and to Terminal 4, energizing the spark ignition.

At the detection of main flame, the FLAME LED is illuminated, and the programmer holds that position for 3-5 seconds to allow the main flame to stabilize.

Power is then removed from Terminal 4, turning off the spark igniter.

When the operating control opens, the control de-energizes Terminal 3 and Terminal 5 and the programmer reverts back to an Idle state. Terminal 8 is immediately de-energized.

Safety Shutdown

In the event the main flame is not detected at the end of a 10 second PTFI period, the main fuel valve and spark ignition are de-energized. A safety lockout occurs which de-energizes the burner motor and energizes the lockout alarm relay circuit, lighting the Alarm LED, 15 seconds after the safety lockout occurs. Manual reset is required.

In the event of a flame failure during a firing period, the secondary fuel valve (if used) is de-energized and the spark ignition is re-energized, the PTFI period begins again as described above under Normal Operation.

In the event of the interlock switch opening, the main fuel valve and pilot valve are de-energized. The control reverts back to the Idle state and begins again a new cycle starting with the safe start check period.

MEP102 & MEP104

The MEP102 and MEP104 programmers operate the same as the MEP100, except the PTFI time is limited to 5 seconds and 10 seconds respectively, the relight feature is eliminated and instead, the control will enter safety lockout on flame failure. Recycle to the start of safe start check period to begin a new cycle will occur on air flow switch opening.

MEP103

The MEP103 programmer implements a fixed 10 second spark igniter sensing period (SISP) used to detect spark, followed by a 10 second main trial for ignition (MTFI). Safety lockout occurs on flame failure during the main firing period (AUTO). Recycle occurs on air flow switch opening. If spark is not detected during the spark igniter sensing period the control makes one attempt to establish pilot

following a post purge of 30 seconds and a safe start check. Failure to ignition spark on the second attempt results in safety lockout.

MEP100P

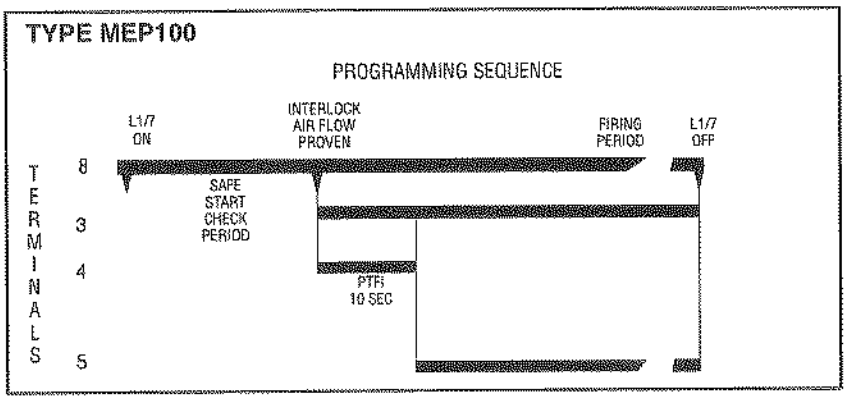
The MEP100P programmers provides a fixed 15 second post purge period upon detection of the operating Control (1-7) or Air Flow switch (7-6) opening.

MEP100 as FLAME SWITCH (refer to Figure 11)

For systems that require flame switch operation, that is, relay KF will toggle on with flame signal and off without flame signal, the MicroM provides this function when equipped with an MEP100 programmer. To operate as a flame switch, Terminals 1 and 6 **MUST** be powered with 120 VAC while Terminal 7 **MUST** be left unpowered. Terminals 3, 4, and 5 will provide an isolated (KL relay not energized) set of contacts with Terminal 3 being the common input, Terminal 4 will be normally closed and Terminal 5 will be normally open. **If Terminal 7 is powered or if Terminal 6 is non-powered and a flame signal is present, the MicroM will lockout after 1 minute and Terminals 4 and 5 will no longer switch with flame signal.** Refer to Figure 11 for configuration wiring. Air Flow LED will blink while flame is detected.

TIMING CHART

TYPE MEP100



Terminal #5 is energized 3 seconds after flame is detected.
Re-ignited PTFI on flame fail after Terminal 5 energized.
Recycle on loss of interlock (air flow) after flame proven.

MEP101

Same as MEP100 but will tolerate flame signal during "Off" cycle.

MEP102

PTFI time limited to 5 seconds, lockout on flame fail.

MEP104

PTFI time limited to 10 seconds, lockout on flame fail.

MEP200 SERIES

The MEP200 Series programmers come equipped with a bank of dipswitches that allow user selectable prepurge timing, selectable PTFI timing, selectable post purge, selectable air flow proven open at start, and selectable recycle/non-recycle operation. Refer to PROGRAMMER DIPSWITCH SETTINGS for detailed information.

Recycle operation refers to flame failure during the main (AUTO) firing period. In the event of a main flame failure, power is removed from Terminal 3 and Terminal 5. If selected by the dipswitch, the control will enter a post purge period for 15 seconds and revert back to the Idle state where the pre-purge period begins.

If non-recycle operation is selected, in the event of a main flame failure, power is removed from Terminal 3 and Terminal 5. The control will enter a forced post purge period of 15 seconds, after which the Alarm LED is illuminated and the alarm relay is energized putting power on Terminal A.

The MEP230H programmer operates the same as the MEP230 with the exception of an additional 8 second pilot stabilization. After flame is detected during the trial for ignition period, the powering of Terminal 5 is delayed for eight (8) seconds. Terminal 4 remains powered during the stabilization period. This function is offered primarily for two-stage light oil burners, to assure a specific delay between light off of the first and second stage, and to provide additional ignition timing to improve flame stabilization.

The MEP290 programmer operates the same as the MEP230 with the exception that post purge is selectable from 0 to 90 seconds.

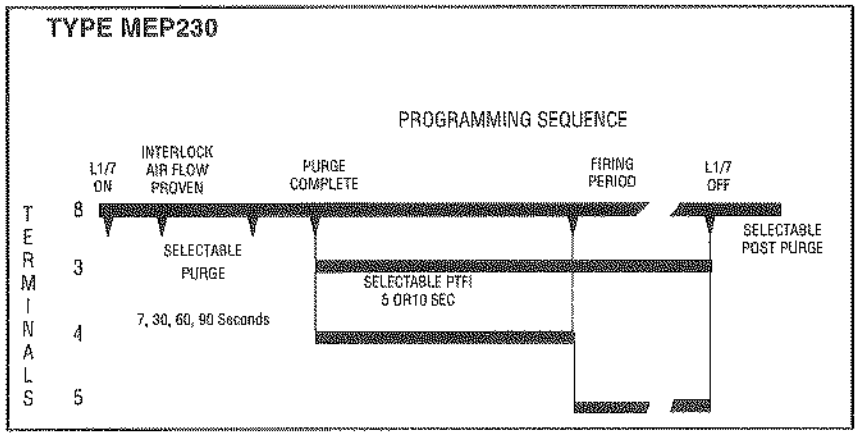
MEP235

The MEP235 programmer operates the same as the MEP230 except flame failure during the firing period causes lockout. Dipswitch #6 refers to Recycle/Non-Recycle on a loss of air flow (Terminal 6) after flame is proven. The running interlock circuit (Terminal 6) must be proven closed within 10 seconds after start of a cycle.

MEP236

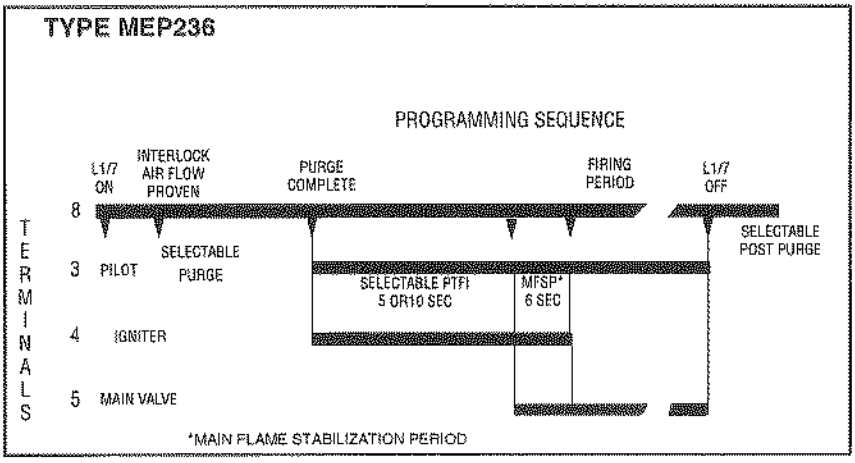
The MEP236 programmer provides a 3 second main flame stabilization period by keeping Terminal #4 (igniter) energized while the main fuel valve (Terminal #5) opens. The MEP236 is to be used on an intermittent pilot only.

TIMING CHARTS



Terminal #5 is energized 3 seconds after flame is detected.
Selectable Recycle/Non-Recycle operation on loss of flame after Terminal 5 energized.
Recycle on loss of interlock (air flow) after flame proven.
Selectable air flow (interlock circuit) proven at start.

Selectable purge times are 7, 30, 60 and 90 seconds.



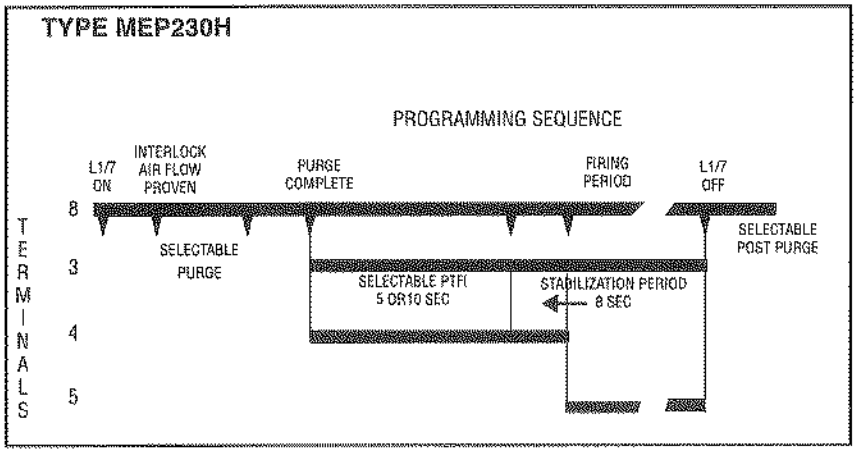
Terminal #5 is energized 3 seconds after the flame is detected.

Selectable Recycle/Non-Recycle operation on loss of flame after flame is proven.

Igniter remains on for 6 seconds after main valve opened.

Intermittent pilot only.

For interrupted pilot, use MEP536



Pilot Stabilization timing begins as soon as flame is proven.

Selectable Recycle/Non-Recycle operation on loss of flame after Terminal 5 is energized.

Selectable air flow (interlock circuit) proven at start.

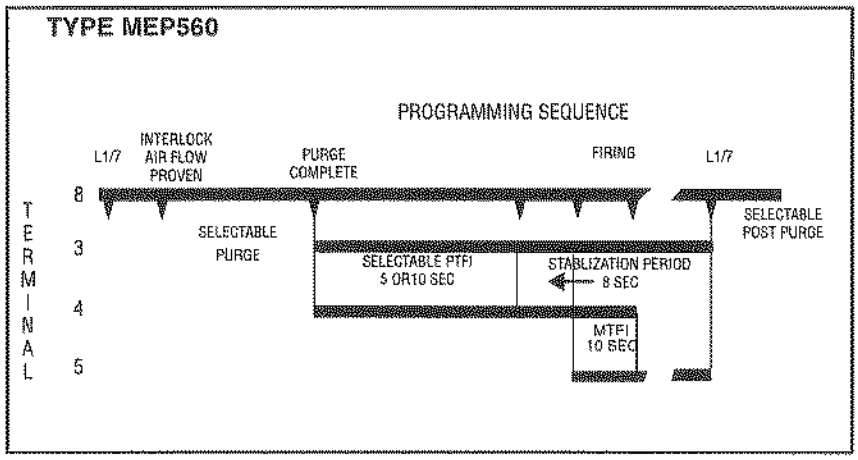
MEP500 SERIES

Refer to typical wiring arrangement illustrated on page 40.

The MEP500 Series Programmers provide an additional relay used to control Terminal 4 separately. This allows the implementation of a pilot stabilization period as well as main trial for ignition period. They also come equipped with a bank of dipswitches that allow the user selectable prepurge timing, selectable PTFI timing, selectable post purge, selectable air flow proven open at start, and selectable recycle/non-recycle operation. Refer to PROGRAMMER DIPSWITCH SETTINGS for detailed information.

A "run-check" switch is also provided to assist in testing size, position and stabilization of pilot in conjunction with the flame detector,

For the MEP560 and MEP562, after pilot flame is detected, the control enters an 8 second pilot stabilization period with Terminal 3 and Terminal 4 energized. At the expiration of the stabilization period, Terminal 5 is energized.

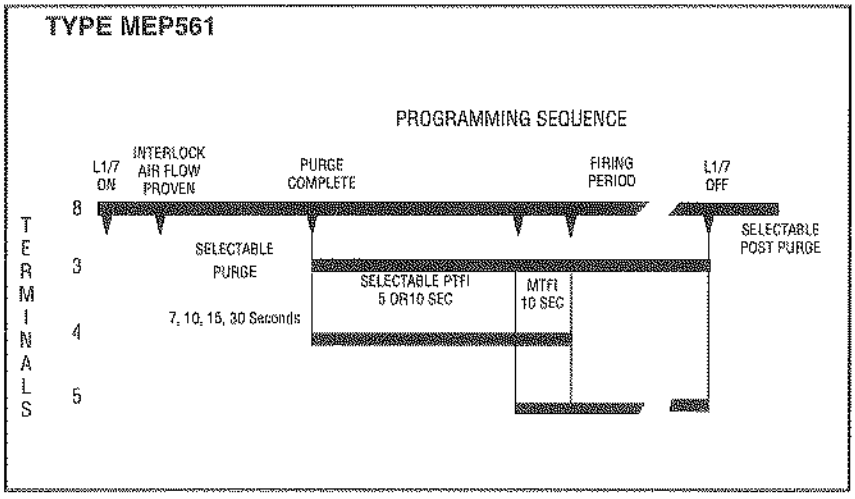


Pilot Stabilization timing begins as soon as flame is proven.

Selectable Recycle/Non-Recycle operation on loss of flame after Terminal 5 is energized.

Selectable air flow (interlock circuit) proven at start.

Recycle on loss of air flow (interlock circuit) after flame is proven.



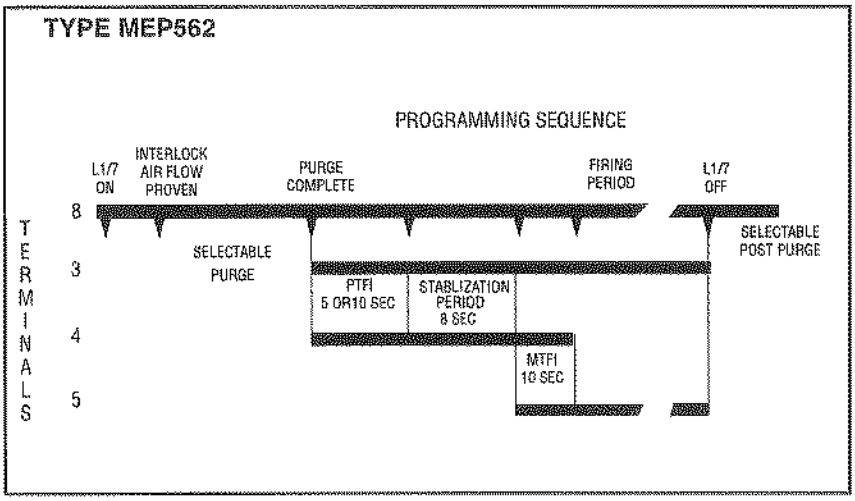
Selectable purge times are 7, 10, 15 and 30 seconds.

10 second timing begins 3 seconds after flame is proven.

Selectable Recycle/Non-Recycle operation on loss of flame after Terminal 5 is energized.

Selectable air flow (interlock circuit) proven at start.

Recycle on loss of air flow (interlock circuit) after flame is proven.



Pilot stabilization timing begins as soon as flame is proven.
Lockout on loss of air flow (interlock circuit) after flame is proven.
Lockout on flame fail.

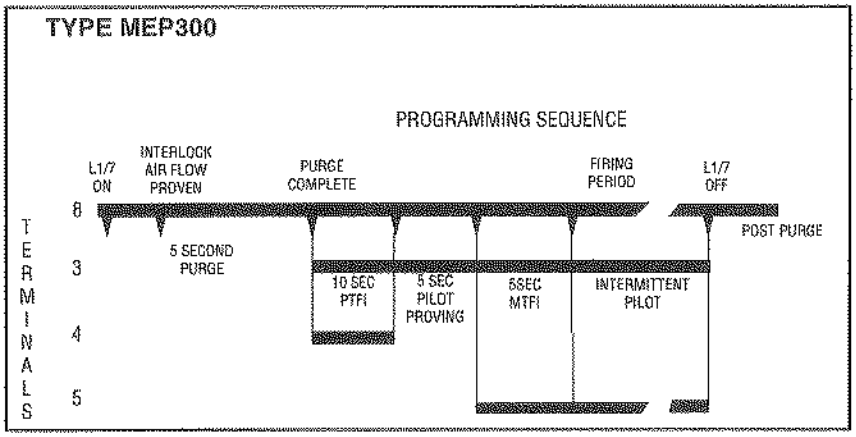
MEP300/MEP600 SERIES

This programmer type must be used with the MEC320 or MEC480 type chassis. Refer to typical wiring arrangement illustrated on page 41.

The MEP300/MEP600 Series Programmers provide additional relays used to control Terminals 3 and 4 separately. This allows the implementation of early spark termination, pilot proving period and interrupted pilot operation. The MEP397, MEP696 and MEP697 programmers contain a "run-check" switch to assist in testing size, position and stabilization of pilot in conjunction with the flame detector.

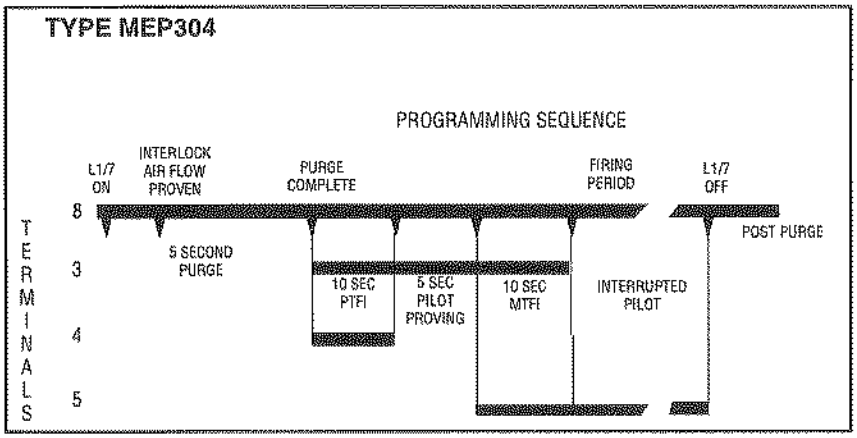
The MEP696 and MEP697 provide a control line used to energized and de-energize a relay located on the MED8 and MED9 daughter boards.

TIMING CHARTS



0 Second post purge on operating control open.
15 Second post purge on flame fail during PTFI, Proving and MTFI.
Lockout on flame fail during PTFI, Proving and MTFI.
Relight operation on main flame fail.
Recycle operation on air flow failure.
Reset from lockout from pushbutton or line voltage.

TYPE MEP304

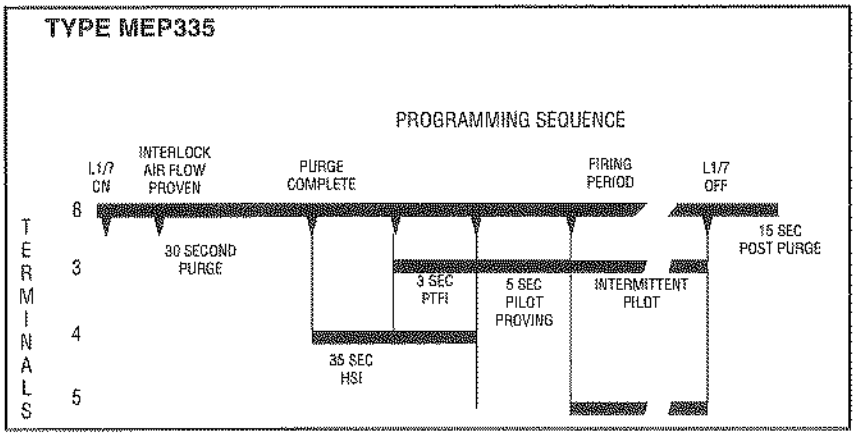


0 Second post purge on operating control open. 15 Second post purge on flame fail.

Non-recycle operation on flame fail.

Recycle operation on air flow failure.

TYPE MEP335



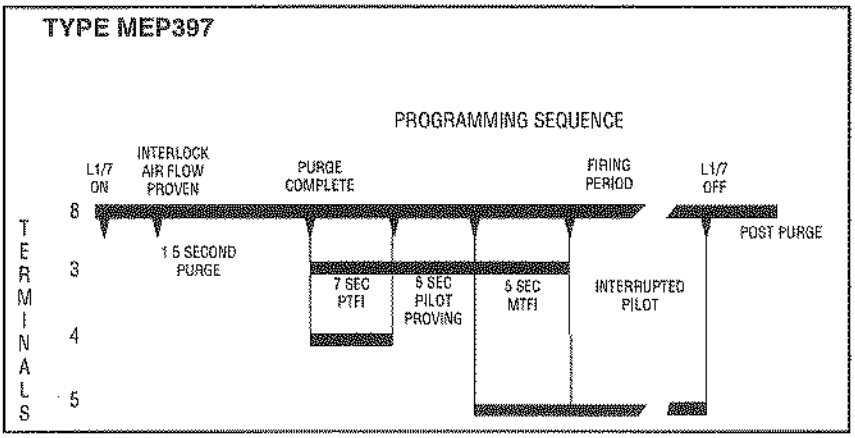
15 Second post purge

Non-recycle operation on flame failure.

Recycle operation on air flow failure.

Reset from lockout from pushbutton.

TYPE MEP397



0 Second post purge on operating control open.

15 Second post purge of flame fail during PTFI, Proving and MTFI.

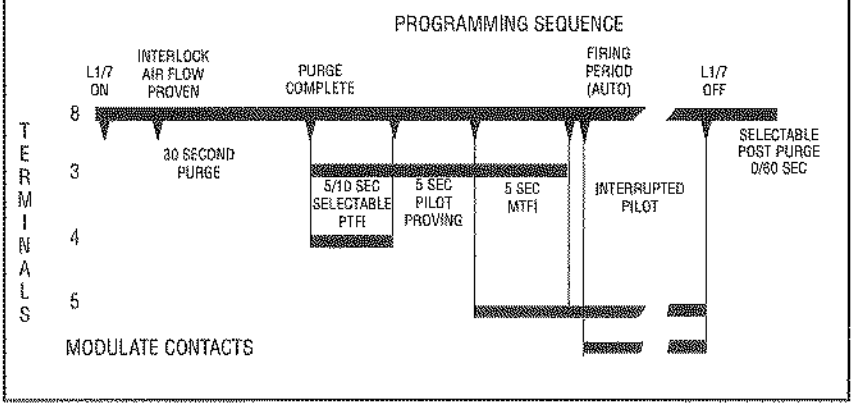
Lockout on flame fail during PTFI, Proving and MTFI.

Relight operation on main flame fail.

Recycle operation on air flow failure.

Reset from lockout from pushbutton or line voltage.

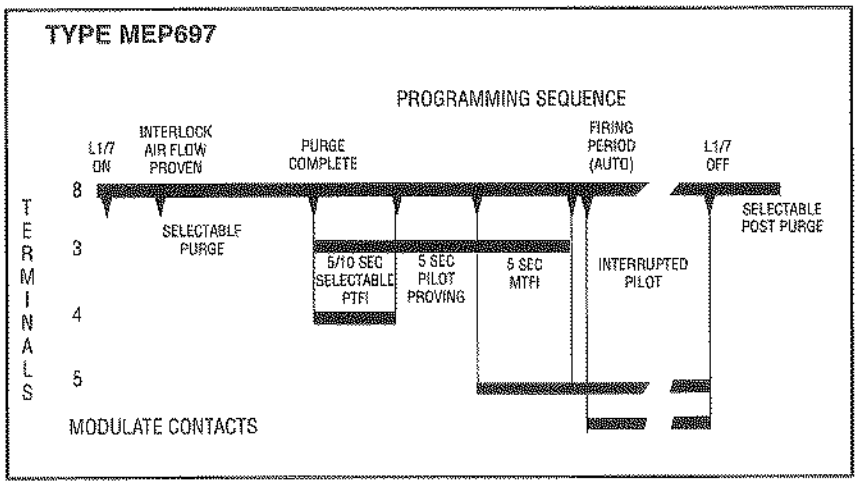
TYPE MEP696



Lockout on flame fail.

Lockout occurs if air flow terminal 6 is not proven 10 seconds into purge.

Modulate contacts on daughter board change state 1 second into Auto.



Lockout on flame fail.

Lockout on air flow switch opening while main flame energized.

Recycle/Non-recycle dipswitch controls lockout on air flow switch not closing 10 seconds into purge.

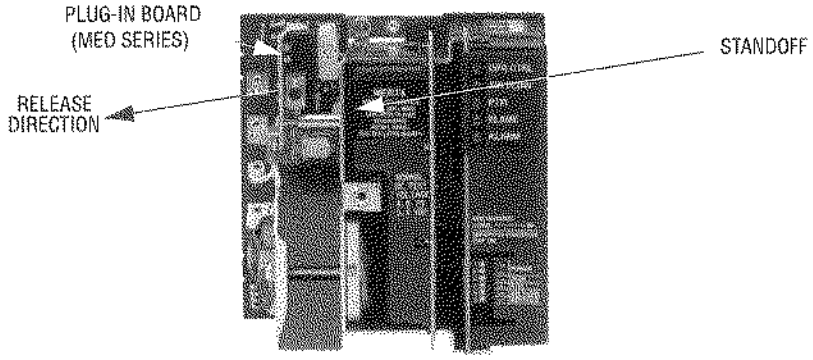
Modulate contacts on daughter board change state 5 seconds into Auto.

OPTIONAL PLUG-IN BOARDS

Description

A family of optional plug-in boards are available separately for the MicroM chassis to provide remote reset, remote alpha-numeric display and serial communications as a stand alone or in combination. Refer to ORDERING INFORMATION for MicroM Chassis types for units that have pre-installed functions.

FIGURE 4. PLUG -IN BOARD LOCATION AND INSTALLATION



Installation

WARNING: Remove power when servicing the control.

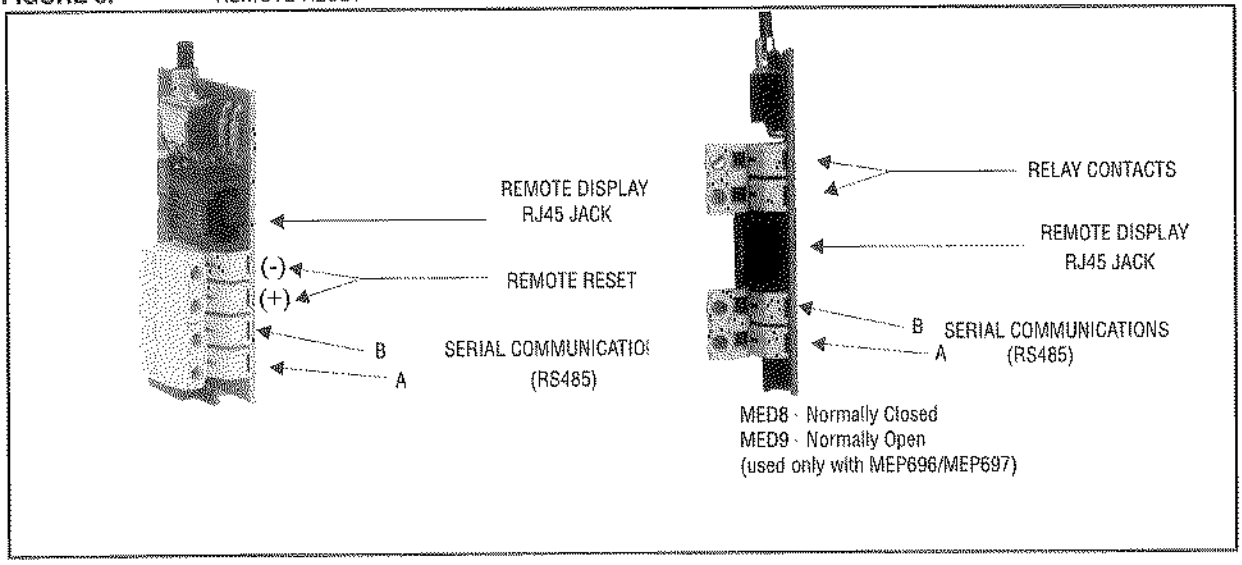
For upgrading standard units or for replacing the installed plug-in board, grasp plug-in board at the top and pull away from the chassis, freeing the unit from the retaining standoff. Lift plug-in board up and away from connector located on chassis board. Guide new plug-in board into the same connector and push onto standoff.

Function

Any MicroM chassis type with the appropriate plug-in board installed provides remote reset capabilities in the event of a lockout condition. A remote reset switch consists of a dry contact such as a remote momentary push-button wired to the two (2) terminals located on the plug-in board as shown in Figure 5. The reset switch will also force the MicroM to recycle if depressed and released during the purge or run period.

A plug-in board (MED8) is pre-installed in the MEC320TS chassis to provide local reset, remote alpha-numeric display, serial communications and normally closed relays.

FIGURE 5. REMOTE RESET



CAUTION: Remote reset is recommended only on a control solely for proved ignition programming (pilot ignited burner) or a control for use only with applications in which unburned fuel cannot accumulate and that is intended for installation in inaccessible locations such as open-flame, ceiling-suspended gas heaters. The remote reset location must be within sight and sound of the fired equipment.

ADVANCED RESET FUNCTIONS

Multiple functions have been integrated into the reset push button located on the MicroM and provided by way of the remote reset terminals. Among these are reset/recycle, reset from lockout only, recycle only and set unit address. **The functions of the switch is determined by the length of time the push button is depressed and released.**

The MicroM allows the connection of the remote resets to be connected together, usually in a multi-burner system where multiple MicroM's are mounted in a common panel. The reset push button located on the MicroM daughter board is in parallel with the remote reset terminals when provided by the other MED daughter boards.

Normal Operation
If the push button is depressed and released for greater than 1/2 second but less than 3 seconds, the MicroM will either reset if in lockout, or shutdown and revert back to the start of the cycle. If the MicroM is in the Idle state, this action will cause the LED's to sequence from the bottom to top and serves as a LED test.

Smart Reset
If the push button is depressed and released greater than 3 seconds but less than 5 seconds, the

MicroM will reset from the lockout state only. This is especially useful where, through the use of remote reset daughter boards, all reset inputs can be connected together to a common reset pushbutton or intelligent device (PLC). If the push button is depressed as described above it will only cause the unit that is in lockout to reset and not effect any other units.

Smart Recycle
If the push button is depressed and released greater than 5 seconds but less than 7 seconds, all connected MicroM units will recycle back to the beginning of purge. All units that are in lockout will remain in lockout.

Address Mode
If the unit is in the Idle or Standby mode and the push button is depressed and released for greater than 10 seconds, the unit address of the MicroM will be displayed on the LED's in a binary format. The range of the address is 0 to 31 and is used for Modbus or E500 communications. Because the default address is 0 and since address 0 would mean no LED's would be lit; the ALARM LED is made to flash when the address is 0. The OP CTRL LED is the least significant bit while the FLAME relay is the most significant bit. The ALARM LED is used to indicate if the address is greater than or less than 16. If the ALARM LED is flashing, the address is less than 16 and conversely if the ALARM LED is solid, the unit address is greater than 16. This only applies to the address. To increment the address on the control, depress and release the RESET push button and observe the LED pattern. If the RESET switch is untouched for 30 seconds, the current address displayed will be stored to memory and the MicroM will automatically exit the address mode.

	LED	BINARY VALVE
OP CNTRL	○	1
INTRLCK	○	2
PTFI	○	4
FLAME	○	8
ALARM	○	16
The ALARM LED flashes for addresses less than 16.		
The ALARM LED is solid for addresses greater than 15.		

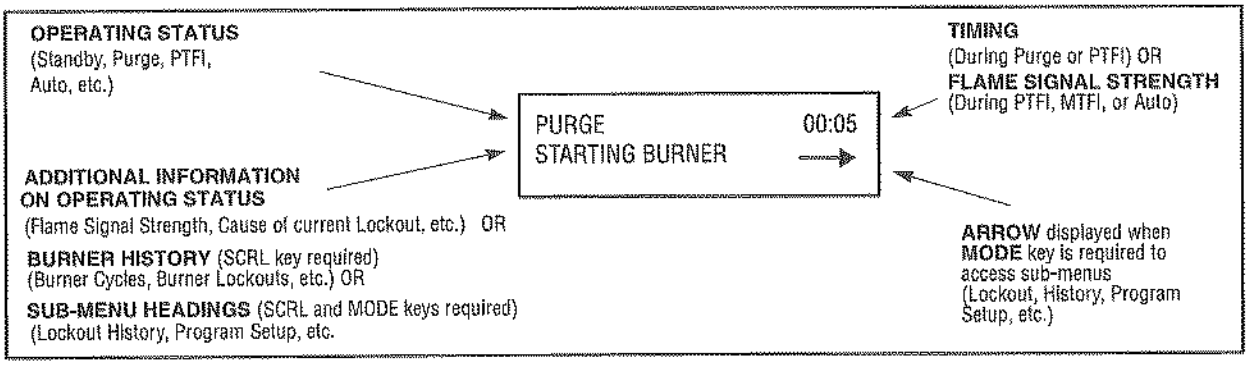
REMOTE DISPLAY

The MicroM provides an interface to the optional ED510 display module. The ED510 connects to the MicroM through the plug-in board using a ED580 cable. The ED580 cable is available in 2, 4, or 8 foot lengths. Part number 129-145 -1 (4 ft.), -2 (8 ft.), -3 (2 ft.) is available for remote mounting the ED510 Display Module and to provide NEMA 4 protection.

The ED510 Display Module is a backlit, 2 line by 16 character LCD display with keypad to provide both current operation and historical information of the MicroM. The ED510 contains a keypad consisting of three push keys, SCRL, RESET and MODE. Remote reset is available through the ED510 Keypad.

The ED510 displays current burner status, first out annunciation in the event of a lockout condition, historical burner information, detailed lockout information of the last six (6) lockout conditions and programmer configuration information. Through the display the ability to program the unit address for communications, as well as resetting the stored information (cycles, hours, and lockouts) to zero is provided.

Depending on the information being displayed, data is displayed on the ED510 screen in the following locations:



At any time the MicroM is powered, the SCRL key is used to scroll through and display the total number burner hours, burner cycles, burner lockouts and system hours on the bottom line of the ED510 display. The top line will continue to show the current run mode of the control (e.g. PURGE, AUTO, etc.) Following the historical information, the SCRL key will display three (3) sub-menus providing the following information and/or functions:

- Lockout History (with burner cycle and burner hour time stamp).
- Program Setup (to display programmer type, purge timing, switch configuration, etc.)
- System Information (values of average pilot and main flame signal, and reset burner history).

The system sub-menus require the MODE key to gain access to the information associated with each sub-menu. An arrow is displayed in the lower right hand corner of the display to indicate a system sub-menu is available. Once within the sub-menu, pressing the SCRL key displays the next item within the sub-menu, and pressing the MODE key will exit the sub-menu and return the display to the top of the main menu.

AUTO 40 BNR HOURS 673	Number of burner operating hours. (Terminal #5 energized).
AUTO 40 BNR CYCLES 2784	Number of burner cycles.
AUTO 40 BNR LOCKOUTS 21	Number of burner lockouts.
AUTO 40 SYS HOURS 1386	Number of hours the control has been powered.
AUTO 40 LOCKOUT HISTORY →	Sub-menu to display the cause of the last 6 lockouts. The MODE key is required to display the actual lockouts.
AUTO 40 PROGRAM SETUP →	Sub-menu to display various operating parameters of the programmer and amplifier. The MODE key is required to enter the sub-menu.
AUTO 40 SYSTEM INFO →	Sub-menu to display information pertaining to the operation of the control. The MODE key is required to enter the sub-menu

LOCKOUT HISTORY

The sub-menu "LOCKOUT HISTORY" will display the last six (6) lockouts, along with the burner cycle and burner hour when the lockout occurred. When the MODE key is pressed, the screen will display the most recent lockout condition and the number of that lockout (e.g. LO #127 represents the 127th lockout of that control). The SCRL key will display the Burner Hour, followed by the Burner Cycle when the lockout occurred. The SCRL key will advance to the next lockout, and repeat the sequence listed above. The MODE key will exit the sub-menu.

PRESS	SCREEN DISPLAYS	DESCRIPTION
SCRL	AUTO 45 LOCKOUT HISTORY	Scrolling through the historical information.
MODE	LO #127 PTFI FLAME FAIL	The latest (most recent) lockout condition. This is the 127th lockout of the control. History indicates the lockout occurred during PTFI.
SCRL	LO #127 PTFI @ BNR HOURS 136	The last lockout occurred after 136 hours of burner operation.
SCRL	LO #127 PTFI @ BNR CYCLE 744	The last lockout occurred at burner cycle 744.
SCRL	LO #126 PURGE AIR FLOW OPEN	The second latest lockout condition. This is the 126th lockout of the control. History indicates the lockout occurred during purge.
MODE	AUTO 45 FLAME SIGNAL	Screen has returned to the normal run message.

PROGRAM SETUP

The sub-menu "PROGRAM SETUP" allows the user to review the various operational settings of the programmer module (e.g. programmer type, purge timing, etc.). The MODE key is used to enter the "PROGRAM SETUP" sub-menu, and the SCRL key is used to advance through the sub-menu.

MODE	AUTO 45 PROGRAMR MEP230	Programmer Type is an MEP230.
SCRL	AUTO 45 ENGR CODE NO. 5	Software Engineering code of the programmer module is code 5.
SCRL	AUTO 45 AMP. TYPE= MEUV	Amplifier module is an EUV1 or an ERT1.
SCRL	AUTO 45 FLAME FAIL TIME = 3s	Flame Failure Response Time (FFRT) is 3 seconds.
SCRL	AUTO 45 PURGE TIME = 7s	Purge timing (selected by the dipswitches) is 7 seconds.
SCRL	AUTO 45 PROVE 7-6 OPEN = N	Prove 7-6 open to start is disabled (selected by dipswitches).
SCRL	AUTO 45 POST PURGE = 0s	Post purge time is 0 seconds (selected by dipswitches).
SCRL	AUTO 45 TYPE RECYCLE	Control recyeles on flame fail (selected by dipswitches).
SCRL	AUTO	Unit Address is 00. Refer to section on communications.

	UNIT ADDRESS 00		
SCRL	PRESS RESET TO ACCEPT SETTINGS		Force storage of dipswitch settings before 8 hours time-out.
MODE	AUTO	45	Mode key returns to normal run message.

SYSTEM INFO

The sub-menu "SYSTEM INFO" allows the user to review information pertaining to the operation of the control (e.g. average main flame signal strength, status of the high fire and low fire end switches, etc.). The MODE key is used to enter the "SYSTEM INFO" sub-menu, and the SCRL key is used to advance.

Press	Screen Displays		Description
SCRL	AUTO SYSTEM INFO >	45	SCRL key advances through the historical information until "System Info" is displayed. Pressing and releasing the MODE Key enters the sub-menu.
MODE	AUTO AVG. PILOT FLM 22	45	The average flame signal strength of the pilot flame = 22
SCRL	AUTO AVG. MAIN FLM 40	45	The average flame signal strength of the main flame = 40.
SCRL	PRESS RESET TO CLEAR HISTORY		Historical data will be cleared to 0. Must be done while terminal I-7 is open.
MODE	AUTO FLAME SIGNAL	45	Mode key returns to run message.

COMMUNICATIONS

The protocol to be used is Modbus RTU. This is implemented by the master (PC, PLC, etc.) issuing a poll to the slave (MicroM) and the slave responding with the appropriate message.

A typical format of a poll request is as follows:

DST	FNC	ADR HI	ADR LO	DAT HI	DAT LO	CRC LO	CRC HI

DST refers to the logical address of the slave set but using reset pushbutton or ED510.

FNC is the function being requested. FNC 03 is a read request.

ADR is the message number or register number of the data being requested. In Modbus, register addresses begin at 40001 but is interpreted as address 00.

DAT is the number of words being requested. A word is an integer consisting of 2 bytes.

The normal response from a slave is as follows:

DST	FNC	DBC	DATA.... Hi/Lo	CRC LO	CRC HI

DBC is the data byte count being returned. It must be two times the DAT number from the poll request.

DATA is the data returned and is always a series of 2 byte integers. If 4 words were requested then DBC would be 8 and there would be 8 data bytes or 4 data words containing the requested data.

The format of the data is 4800, N, 8, 1 meaning 4800 baud, no parity, and 1 stop bit.

Below is a table of currently available messages provided by the MicroM programmers, followed by a description where necessary.

MESSAGE ADDRESS	WORDS REQUESTED	RESPONSE	VALUE
00	1-6	STATUS	83 (053H) = RUN; 202 (0CAH) = LOCKOUT
01	1	MSGN	Current message being displayed (see Table 3)
02	1	GSTAT	Defines Timer Type
03	1	TIMER	Time, Flame, Address
04	1	FLAME	Flame Signal
05	1-3	LOGSTAT	Current logic module, PURGE, PTFI, AUTO (See Table 1)
06	1	INPUTS	Input limits state
07	1	OUTPUTS	Output relays state
08	2, 4 or 8	SYSMINS	System on minutes
10	2 or 4	BNRMINS	Burner on minutes
12	2	CYCLES	Completed Burner Cycles
14	1	LOCKOUT COUNT	Stored Lockout Count
15	1-6	LOCKOUT HISTORY	Last 6 Lockouts, first word is most current lock-out
21	1-2	DEVTYP	Programmer device type, 5=EP, 6=EPD, 7=MicroM
22	1	AMPTYP	Amplifier Type; MECD=080H; MEUV=090H; MEIR=0A0H; MERT=0B0H; MEUVS=0C0H
23	1	PROGTYP	Programmer Type (See Table 2)
24	2	FLAME SIGNAL AVERAGES	PTFI and Auto Flame Signal Averages
26	1-9	Combined Status	See Description Below
35	6	Most Recent Lockout Data	Returns complete lockout description of stored lockout history. Includes lockout message, lockout module, @ burner hours, and @ burner cycles
41	6	2nd Most Recent Lockout Data	
47	6	3rd Most Recent Lockout Data	
53	6	4th Most Recent Lockout Data	
59	6	5th Most Recent Lockout Data	
65	6	6th Most Recent Lockout Data	

Messages 00, 05, 08, 10, 15, 21 and 26 are unique in that a limited number of successive registers can be combined with these requests. For example, a request to message 00 can contain up to 6 data words. The response to this would contain STATUS, MSGN, GSTAT, TIMER, FLAME and LOGSTAT. If the requested data word count (DAT) were to be 2 then the response would contain STATUS and MSGN only. Message 15, last 6 lockouts, can return data ranging from 1 to 6, with 1 referring to the most recent lockout.

Message 26 returns the current operating status as well as stored burner hours and burner cycles as a snapshot of the entire MicroM system. When all 9 words are requested, the data returned consists of STATUS, MSGN, FLAME, INPUTS, OUTPUTS, BNRMINS, and BNRCYCS.

The MSGN being transmitted is a numerical value and must be interpreted by the communicating device, which actually is an advantage since this can be made to be whatever message text the end user wants. In other words, it allows for programming custom messages without actually changing the message in the programmer.

The MicroM stores its burner on time (Terminal 5 powered) and system on time (L1 powered) in minutes. Internally, the programmer converts this to hours for display purposes, however the result is rounded down. The information being supplied by Modbus will be the actual time in minutes and it is up to the communicating device to do the conversion. Since the maximum value stored in the MicroM is 9,999,999 minutes, the maximum value in hex therefore, is 98967FH and comprises of two data words. The maximum cycle count is 999,999 decimal or 0F423FH, still two data words. As an example, the System on Minutes data is transmitted from the MicroM to the interface as high word / low word as shown below:

MESSAGE ADDRESS 8		MESSAGE ADDRESS 9	
HIGH WORD		LOW WORD	
HIGH BYTE	LOW BYTE	HIGH BYTE	LOW BYTE
0	98H	96H	7FH

Note: Data from address 9 cannot be accessed directly.

All values are represented in a HEX or base 16 format.

GSTAT determines the type of value TIMER represents. TIMER can be a running timer such as is used in purge, a flame signal or meaningless. Only the lower nibble of GSTAT has any value. If this value is 0 then the TIMER value has no meaning. The value in TIMER is a background minute timer in the MicroM and should be ignored. If GSTAT is between 4 and 7, the TIMER represents the current value flame signal. If GSTAT is a 1, 2, or 3 then TIMER represents a running timer value.

The baud rate of the MicroM is fixed at 4800 bits per second. The format of the data is 8 data bits, no parity and 1 stop bit. Due to the RS485 format, the communication format is considered half-duplex. That is, only one user is permitted on the communication lines at a time.

The information contained in INPUTS and OUTPUTS represents the status of the interlocks and relays respectively. For the INPUTS, a 1 in the interlock position defines the interlock as being on or energize where the 1 in any bit position in the OUTPUT register signifies the relay as being energized.

INPUTS

			Term 5	Term 3	Term 6	Term 7	
Reset	Scrl	Mode	RF	Pilot	Intrlck	OpCntrl	Ref

Reset, Scrl and Mode represent the keypad located on the ED510 display. A '0' in any of these positions indicates the switch is depressed. A '1' in the opto-coupler position indicates the opto-coupler is on or interlock closed.

OUTPUTS

			Term 8	Term A	Term 3	Term 5	Term 4
N/A	N/A	N/A	Blower	Alarm	Pilot	Main Fuel	MTFI

A '1' in any terminal position indicates the relay is energized. Term 4 indicates the state of K1 relay, located in the MEP500 series programmers.

It is suggested that repeated polling interval not be less than 200 mSec per request. Requesting data such as burner minutes, system minutes and burner cycles be kept at a minimum due to the amount of processing time required to gather that data.

Table 1: Logic Dispatch

LOGIC DISPATCHER		
VALUE		MicroM
HEX	DEC	
45H	69	MPOSTIDLE
46H	70	MPREPURGE1
47H	71	MPURGE
48H	72	MTFI
49H	73	MSTABLE
4AH	74	MTFMF
4BH	75	MAUTO
4CH	76	MSHTDWN1
4DH	77	MSHTDWN2
4EH	78	MIDLE

Logstat represents the current software module the Flame-Monitor is currently executing. They are named as close to the logic module the actual burner sequence is in. For instance, in the Flame-Monitor, MPURGE represents High Fire Purge where MPOSTPURGE represents low fire start purge. MSHUTDWN1 represents the post purge period after a complete cycle or the cool down period after a lockout.

MIDLE or STANDBY is the period of time where the operating control is open or the control is in lockout waiting for reset. On instances of false flame during the purge period, the control algorithm forces the control back to STANDBY until false flame ceases or lockout occurs.

MPREPURGE1 is the period of time prior to PURGE where the control checks the status of the air flow interlocks or in the case of the Flame-Monitor, high fire proving switch (D-8). If found open, the control will remain in this state until the respective switch closes or lockout occurs.

MTFI represents the pilot ignition stage of a burner sequence. MTFMF represents the main trial for ignition period where main fuel is introduced along with pilot.

MAUTO is the run period of the burner sequence.

MPOSTIDLE and MSHTDWN2 are small periods of time where certain internal tests are conducted and general cleanup before and after a cycle is performed.

PROGTYP is represented by 1 data word. The upper byte identifies the family and the lower byte represents the programmer type within the family. The data represented by PROGTYP can be used to guard against the wrong programmer being installed in a system.

Table 2: Program Module Identification

Programmer Module	Identifier
MEP100	0H, 01H
MEP101	0H, 02H
MEP102	0H, 03H
MEP103	0H, 04H
MEP100P	0H, 05H
MEP109	0H, 06H
MEP130	0H, 08H
MEP104	0H, 09H
MEP105	0H, 0AH
MEP106	0H, 0BH
MEP107	0H, 0CH
MEP108	0H, 0DH
MEP230	1H, 01H
MEP230H	1H, 02H
MEP235	1H, 04H
MEP236	1H, 05H
MEP290	1H, 06H
MEP238	1H, 09H
MEP237	1H, 0AH
MEP560	2H, 01H
MEP561	2H, 02H
MEP562	2H, 03H
MEP536	2H, 04H
MEP537	2H, 05H
MEP300	0H, 01H
MEP304	0H, 09H
MEP397	0H, 0DH

Table 3: Message Description

DEC	HEX	MicroM Message
1	1	L1-7 OPEN
2	2	FALSE FLAME
3	3	STARTING BURNER
4	4	
5	5	INTRLCK OPEN
6	6	LOCKOUT LINE FREQUENCY NOISE DETECTED
7	7	LOCKOUT FLAME FAIL - PTFI
8	8	UNIT ADDRESS
9	9	MTFI
10	0AH	IGNITION TIMING
11	0BH	
12	0CH	FLAME SIGNAL
13	0DH	CYCLE COMPLETE
14	0EH	OFF
16	10H	LOCKOUT AMPLIFIER HIGH COUNT FAIL
19	13H	LOCKOUT FLAME FAIL – MTFI
20	14H	LOCKOUT FALSE FLAME – STANDBY
21	15H	LOCKOUT INTRLCK OPEN
22	16H	LOCKOUT INTRLCK CLOSED
23	17H	INTRLCK CLOSED (PROVING AIR FLOW OPEN AT START)
24	18H	LOCKOUT OPTO FAILURE
30	1EH	FALSE FLAME
37	25H	LOCKOUT FLAME FAIL - AUTO
39	27H	FUEL VALVE STATE CHANGE
40	28H	AIR FLOW CLOSED
49	31H	LOCKOUT FLAME FAIL - PTFI
54	36H	LOCKOUT CHECK CHASSIS
55	37H	LOCKOUT CHECK PROGRAMMER
56	38H	LOCKOUT CHECK AMPLIFIER
58	3AH	LOCKOUT AMPLIFIER AUTO CHECK FAIL
59	3BH	LOCKOUT CHECK BLOWN FUSE
76	4CH	LOCKOUT CHECK SCANNER

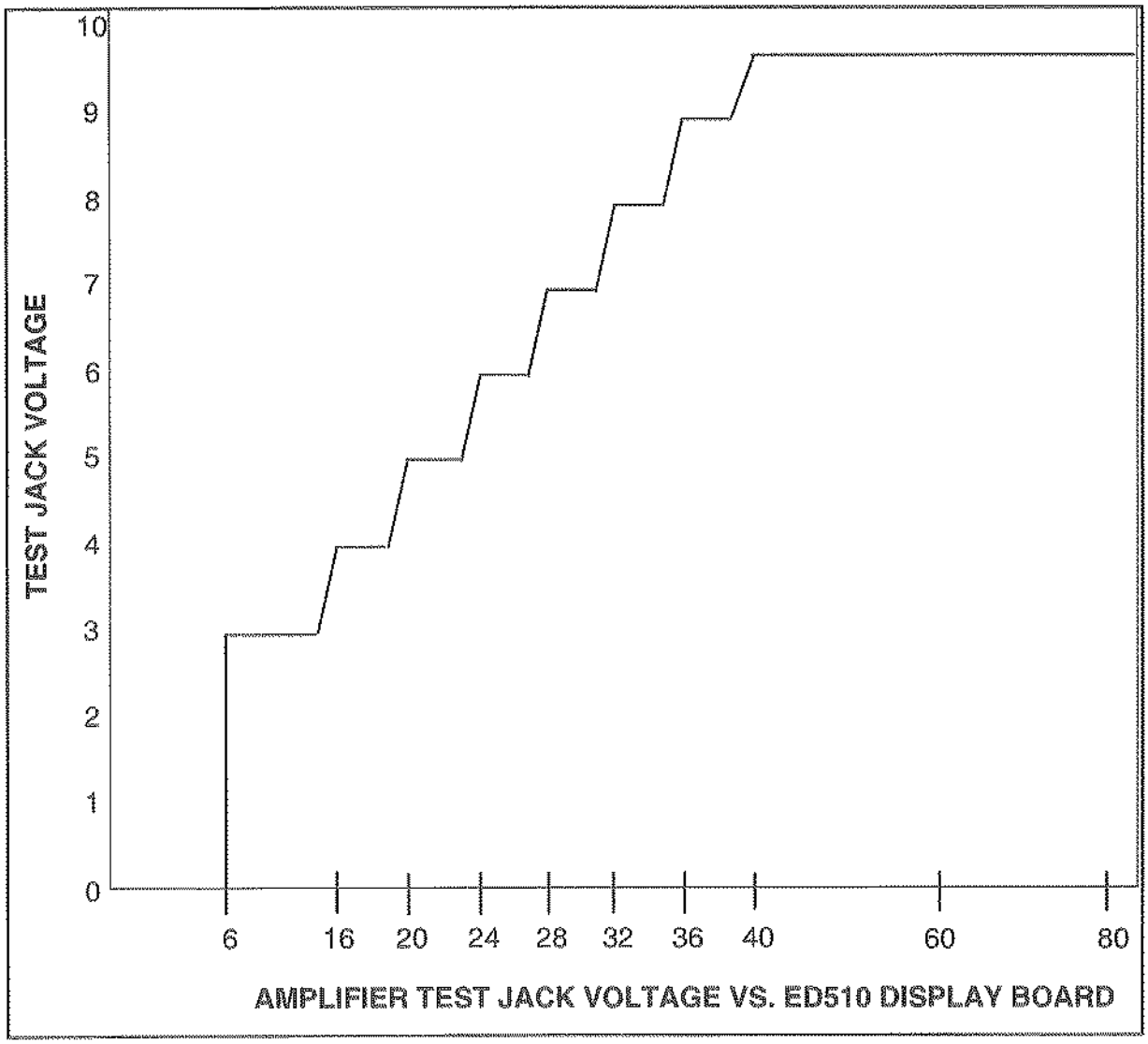
Addressing Modes

For communication in a multi-burner or multi-control environment, each MicroM must have a unique address. The range of address allowed within the MicroM is 0 to 31 allowing for a possible 32 units to be connected in a single multi-drop node. As shipped the default address is 0. The address of the MicroM may be set using two methods. Using the ED510 display, it is necessary is SCRL to the PROGRAM SETUP menu and enter that submenu with the MODE key. SCRL down until the display indicates UNIT ADDRESS with the actual address of the MicroM being displayed on the top

line of the display. Pressing and releasing the RESET key will cause the address to increment. The address after 31 is 0. The second method is to use the local reset located on the plug-in board. It is first necessary to open the operating control (L1-7) to have the MicroM in the IDLE or STANDBY position. Depressing the reset switch for greater than 10 seconds will cause the address of the MicroM to be displayed in a binary format on the LEDs located on the programmer board. Because the default is address 0, and since address 0 would mean no LEDs would be lit; the ALARM LED is made to flash when the address is 0. The OP CTRL LED is the least significant bit while the ALARM relay is the most significant bit. To increment the address counter, depress and release the RESET push button and observe the LED pattern. If the RESET switch is untouched for 30 seconds the current address displayed will be stored to memory and the MicroM will automatically exit the address mode.

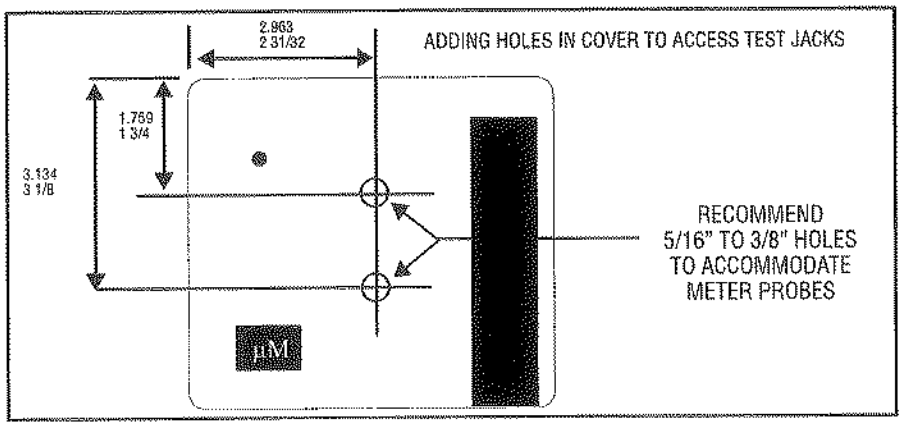
TEST JACK VOLTAGE

For all amplifiers, the MicroM provides a uniform 0-10 volt signal to represent the flame signal strength. A signal reading greater than 4 volts is considered sufficient to provide reliable operation. This same signal is also available in a numerical format on the ED510 display. The chart below correlates the test jack voltage to the numerical value. The signal clamps at 10 volts at a numerical value greater than 42 and the numerical value clamps at 80.



EXTERNAL METER CONNECTIONS

The test jacks are located on the amplifier card. If external access is desired for a panel meter the shown below will assist you in locating the position to drill through on the front cover. The hole sizes should be large enough to accommodate the body of the meter probes. The tests accept meter probes up to .080" or 2mm diameter.



INSTALLATION TESTING

Use of Test Meter (All Controls)

Testing the Fireye MicroM Controls requires the use of a test AC/DC multimeter, with a minimum 1000 ohm/volt AC scale and 20,000 ohm/volt DC scale.

With the test meter on the DC scale, and the test meter leads inserted into the test jacks on the amplifier (Red for positive (+) polarity, Black for minus (-) polarity), a DC voltage reading of 4.0 to 10 volts for all amplifier types should be obtained when the control is detecting flame and 0 volts when no flame is present. Wildly fluctuating readings are an indication of an unstable flame or flame sensor requiring maintenance. Inadequate flame signal may be improved by:

1. Assuring that the flame detector and wiring installations have followed the instructions beginning on page 46.
2. Assuring that the flame detector is clean and within the ambient temperature limits.
3. Assuring that the flame is sufficiently large to detect.
4. Assuring that the flame quality (fuel to air ratio, combustion air velocity) is satisfactory.
5. Trying a shorter sight pipe or increasing the sight pipe diameter. **(The burner manufacturer should be consulted before mechanical changes are made).**

When using a flame rectification amplifier, a micro-ammeter may be connected in series with the wire to Terminal S2. Normal flame will produce a meter reading between 4 and 10 micro-amps.

With the test meter on the AC scale, line and load voltages may be measured at the identified test points on the chassis.

WARNING: Before making a pilot flame test, manually shut off the fuel supply to the main burner.

Normal Pilot Flame Test (Programmers with Run/Check Switch)

1. At pilot trial for ignition (PTFI) place the Run/Check switch in the Check position.
2. During the pilot flame test and adjustment period, if flame is not detected within 30 seconds, the control will lock out and require manual reset to initiate another cycle.

3. Observe the pilot flame signal on the test meter or the ED510 display. If the flame signal is below 4.0 volts DC or a reading of 10 on a remote display, re-adjust the pilot flame or realign the flame detector.

WARNING: DO NOT TOUCH a flame rectification rod with power applied.

4. When using UV detection, a test is required to verify that UV radiation from the ignition spark is not being detected. To accomplish this, manually shut off both the pilot and main fuels. Initiate a normal start-up. Observe the test meter which should read no more than 1/2 volt DC. If higher levels are observed, realign the UV scanner, and/or shield the spark from the scanner's view.
5. Move the Run/Check switch to the Run position, check pilot flame response time by manually shutting off the pilot fuel and initiate a normal start-up. With no pilot flame present, the control will de-energize the pilot assembly at the end of the trial for ignition interval (selectable by dipswitch #4) and go into safety shutdown.

WARNING: The minimum pilot test must be accomplished by a trained and qualified burner technician.

Minimum Pilot Test

This test assures that the flame detector will not sense a pilot flame too small to light a the main flame reliably. It must be made on every new installation as well as following the repositioning or replacement of the flame detector. This procedure should not be used on a direct spark burner.

1. Manually shut off the fuel to the main burner.
2. Place the Run/Check switch in the Check position. (MEP500 Series Programmers only).
3. Connect a test meter to the test jacks on the Amplifier Module or observe the reading on the ED510 display.
4. Initiate a normal start-up.
5. Reduce the fuel to the pilot until the DC voltmeter reads 4.0 volts. This is the minimum pilot. For flame rectification the flame signal for minimum pilot varies depending on the application. See WARNING below.
6. Return the Run/Check switch to the Run position (MEP500 Series Programmers only).
7. Slowly turn on the main fuel and insure the main flame lights off promptly and normally.

WARNING: If light off is delayed, shut off the power to the installation. Realign the flame detector so a larger pilot flame is required before flame is detected. Repeat this test until the main flame lights reliably with minimum pilot.

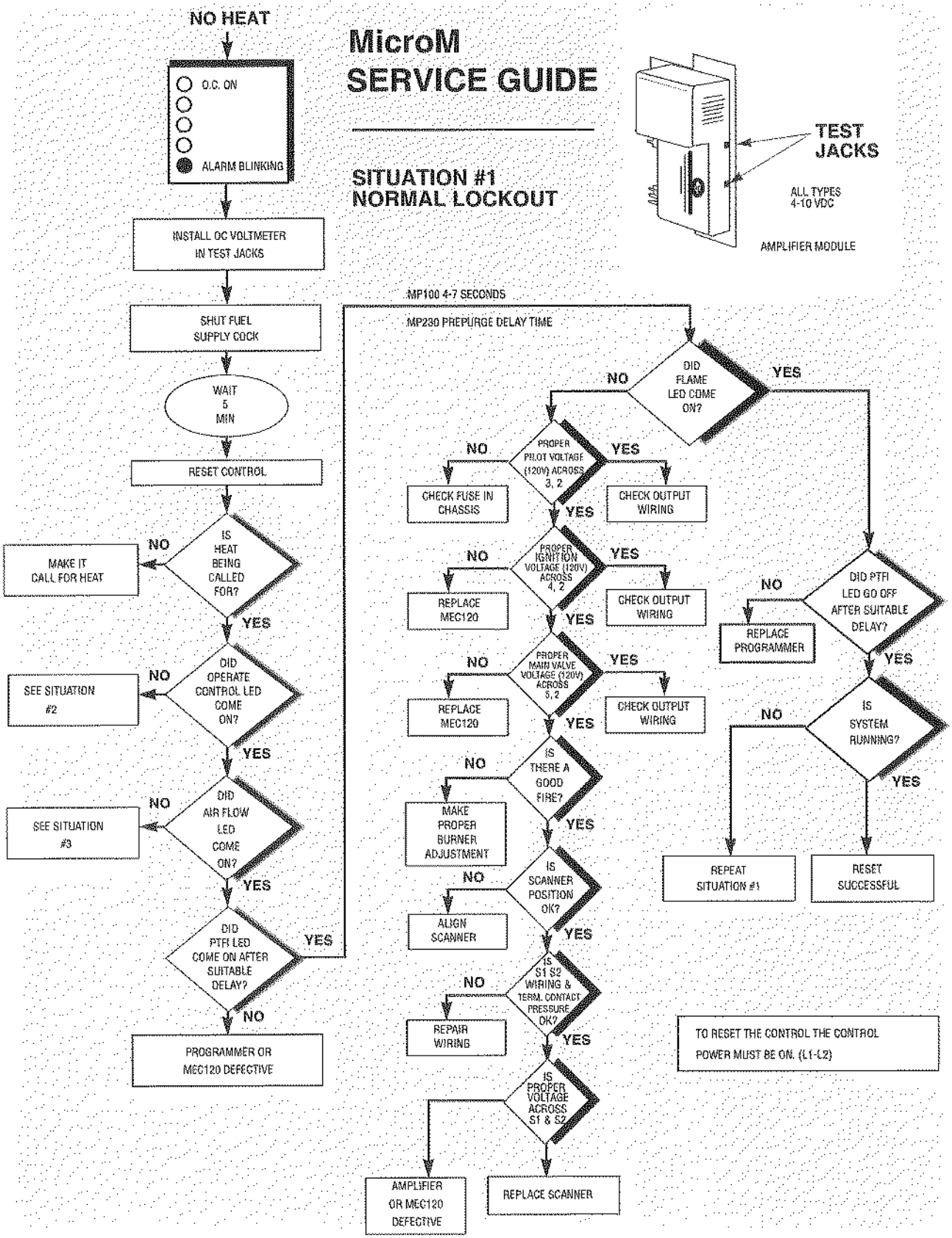
Flame Failure Test

1. Temporarily connect spark ignition and pilot to Terminal #3.
2. Initiate a normal start-up.
3. Manually shut off all fuel and observe the loss of flame signal on the test meter.
4. If flame signal does not reduce to zero within the flame failure response time of the control (FFRT determined by the selection of the amplifier), verify the UV flame detector is not actuated by the ignition spark. If spark is detected, a metallic shield or relocation of the UV detector is required.

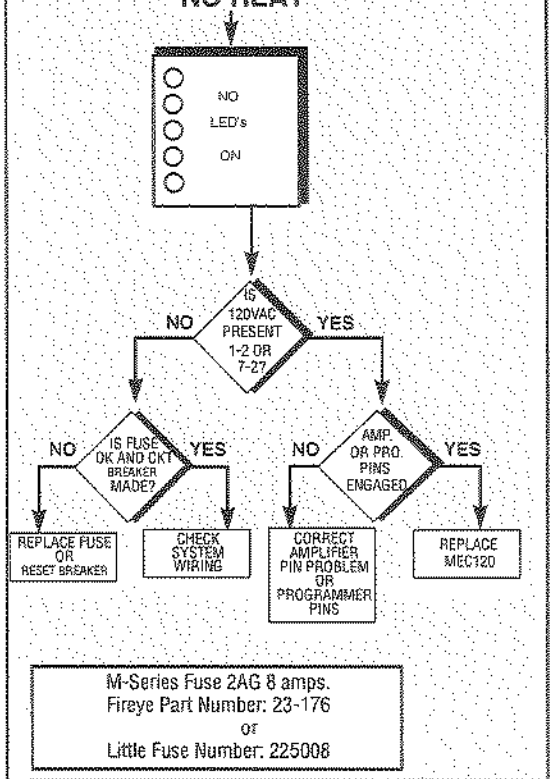
5. **IMPORTANT: When the test is completed, reconnect the spark ignition to Terminal #4.**

MicroM SERVICE GUIDE

SITUATION #1 NORMAL LOCKOUT

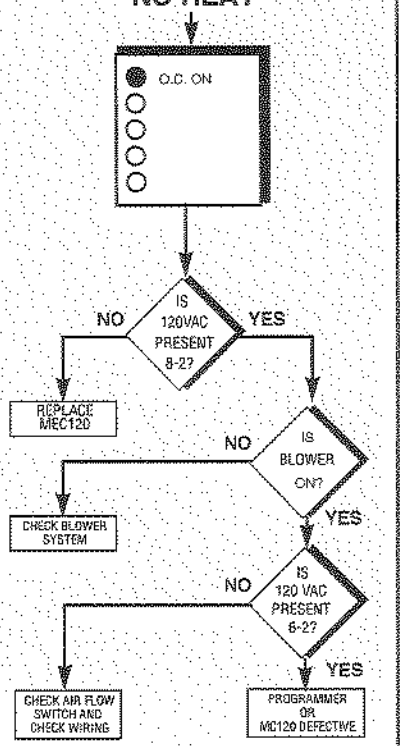


SITUATION #2

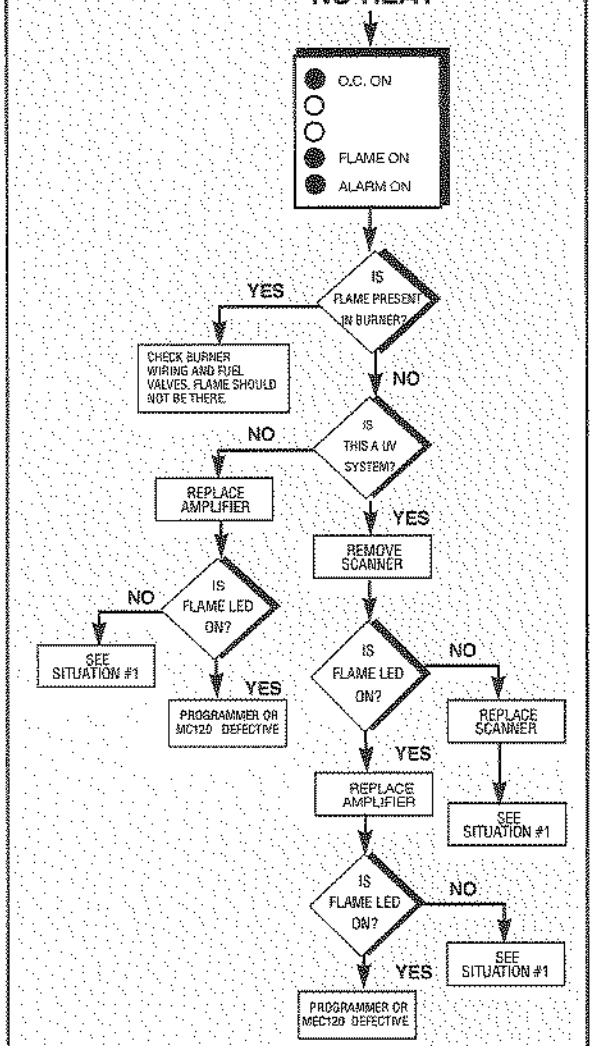


M-Series Fuse 2AG 8 amps.
Fireye Part Number: 23-176
or
Little Fuse Number: 225008

SITUATION #3



SITUATION #4



TROUBLESHOOTING TIPS

1. Verify that there is a solid earth ground wire brought to the panel that the Fireye base is mounted to.
2. In a rectification system, verify that terminal S1 is solidly earth grounded, and confirm that the flame rod is aligned so it doesn't droop near the ignition spark.
3. Confirm that there is no measurable voltage present between the ground screw and terminal 2 (neutral).
4. Confirm that the 120 volt AC supply has its neutral leg earth grounded at the supply, (floating isolation transformers can cause problems).
5. Confirm that the ignition transformer's secondary winding is solidly earth grounded. The grounding method is usually through the transformer case. Dirt, paint, loose mounting hardware, etc., can all be factors.
6. There may be a problem with transients in the main power supply. If you think this may be the problem, you may want to run a ground wire directly from the pilot assembly back to the electrical panel where the Fireye control is mounted.

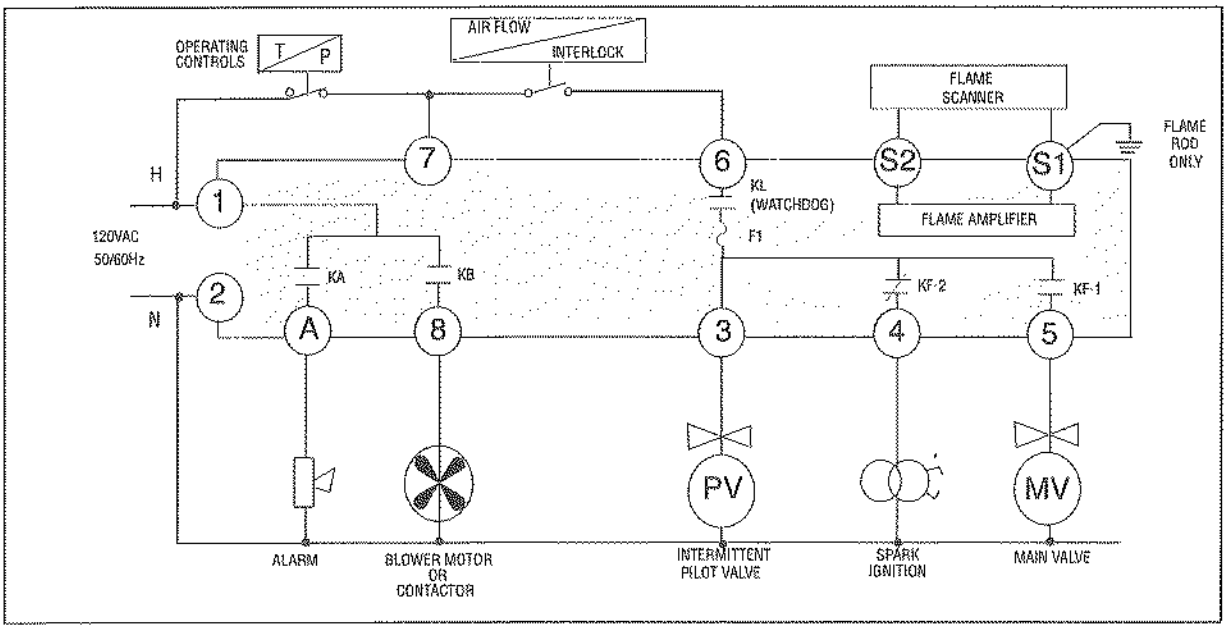
Wiring Arrangements

IMPORTANT: Use moisture resistant wire rated 90°C minimum.

CAUTION: When powered, 560 VAC across S1, S2 with MEUV4, MEUV1, MEUVS4 and MEUVS1; 260 VAC across S1, S2 with MERT4 and MERT1.

CAUTION: Control wiring procedures which deviate from those shown in the diagrams may bypass safety functions designed in the control. Check with the Fireye Representative before deviating from the recommended wiring diagrams.

FIGURE 6. WIRING ARRANGEMENT FOR PILOT IGNITED BURNERS USING MEP100 AND MEP200 SERIES PROGRAMMERS



* For intermittent ignition, connect to terminal 3

FIGURE 7. WIRING ARRANGEMENT FOR PILOT IGNITED BURNERS AND PROVISION FOR MAIN FLAME STABILIZATION USING MEP236 SERIES PROGRAMMERS

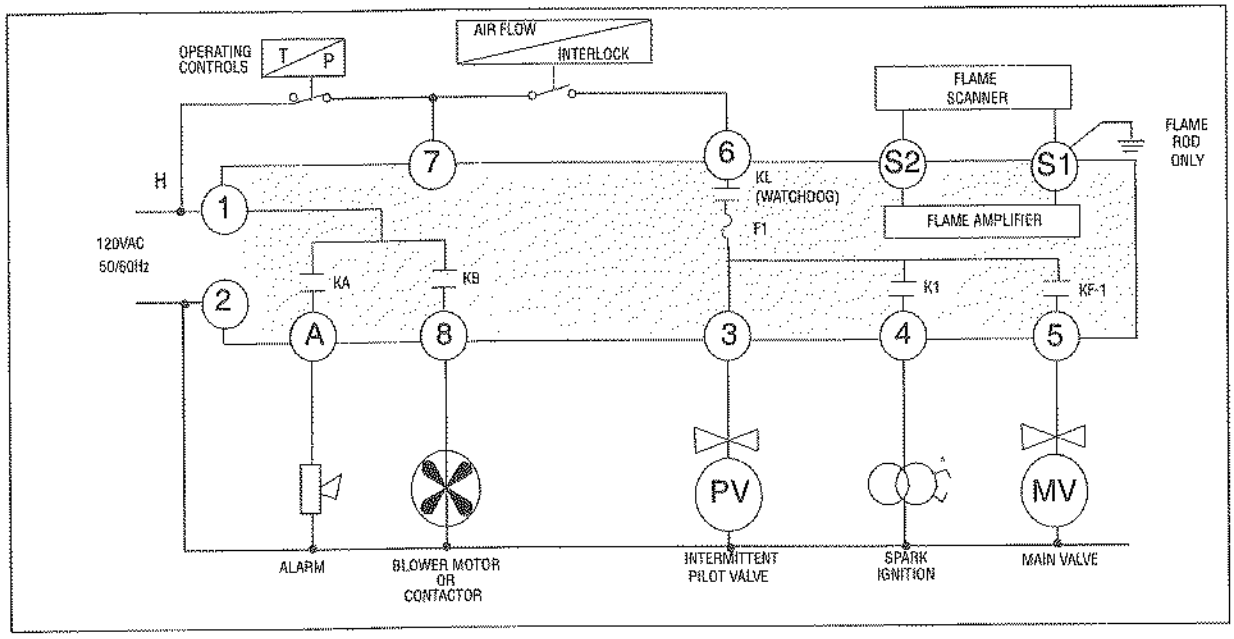
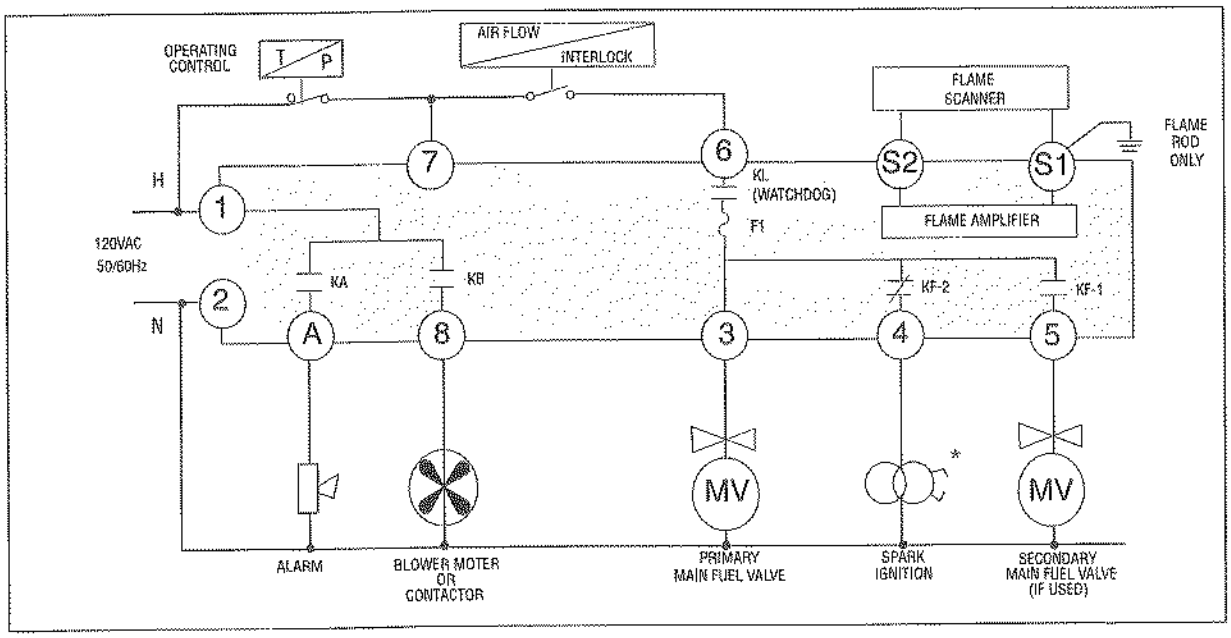


FIGURE 8. WIRING ARRANGEMENT FOR DIRECT SPARK IGNITED BURNERS, TWO STAGE OPERATION USING MEP100 AND MEP200 SERIES PROGRAMMERS



* For intermittent ignition, connect to terminal 3

FIGURE 9. WIRING ARRANGEMENT FOR PILOT IGNITED BURNERS AND INTERRUPTED PILOT USING MEP500 SERIES PROGRAMMERS

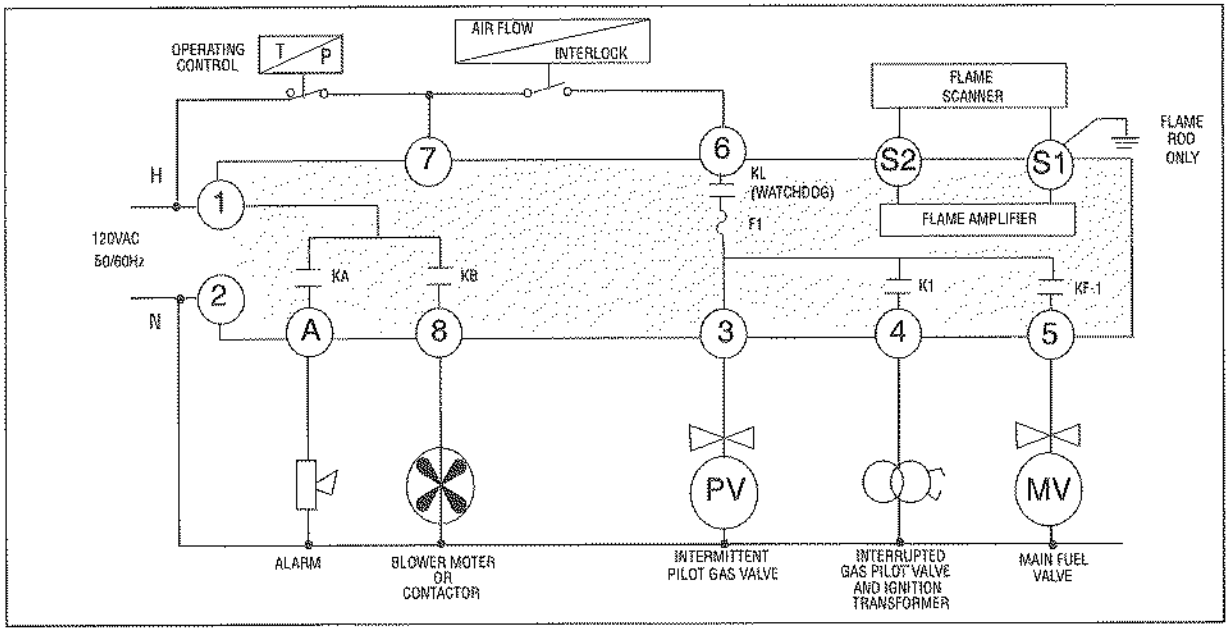
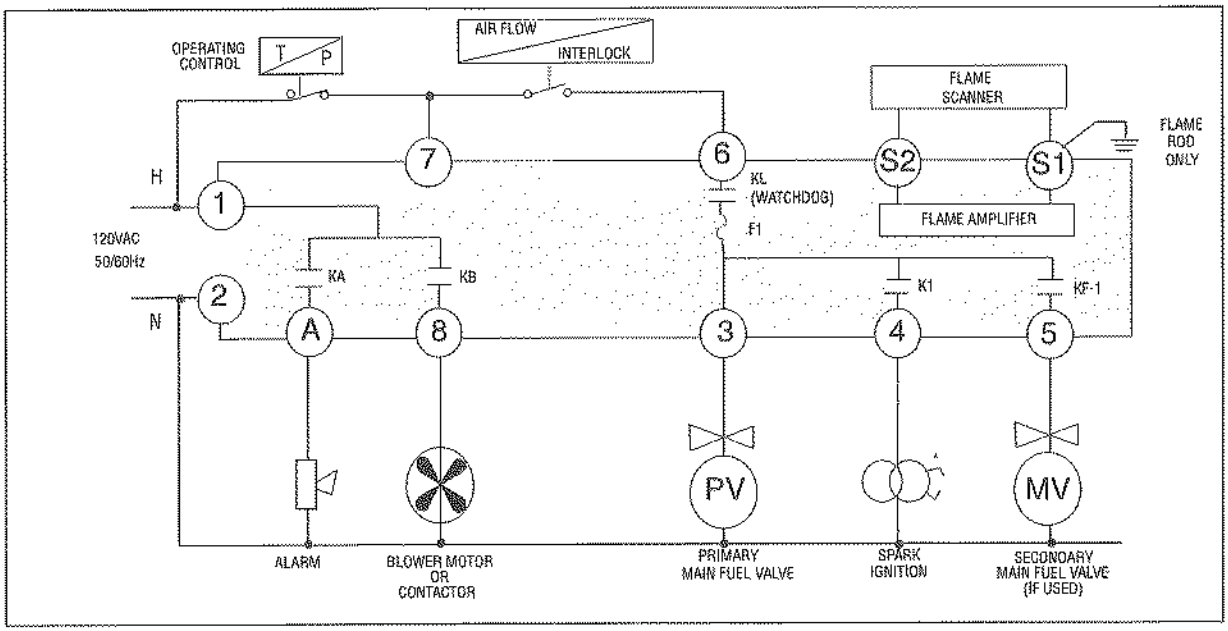
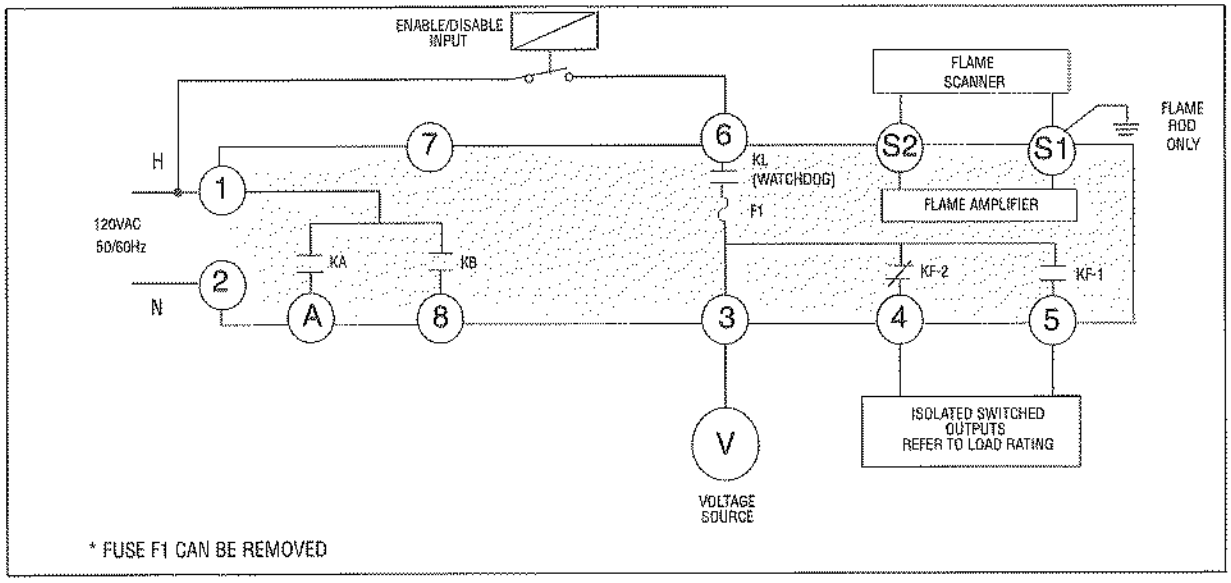


FIGURE 10. WIRING ARRANGEMENT FOR DIRECT SPARK IGNITED BURNERS AND INTERRUPTED IGNITION USING MEP500 SERIES PROGRAMMERS



* For intermittent ignition, connect to terminal 3

FIGURE 11. WIRING ARRANGEMENT FOR FLAME SWITCHES USING MEP100 PROGRAMMERS



NOTE: Air Flow LED will blink while flame is detected and KF relay is energized.

FIGURE 12. WIRING ARRANGEMENT FOR PILOT IGNITED BURNERS USING MEP300, MEP400 AND MEP600 SERIES PROGRAMMERS.

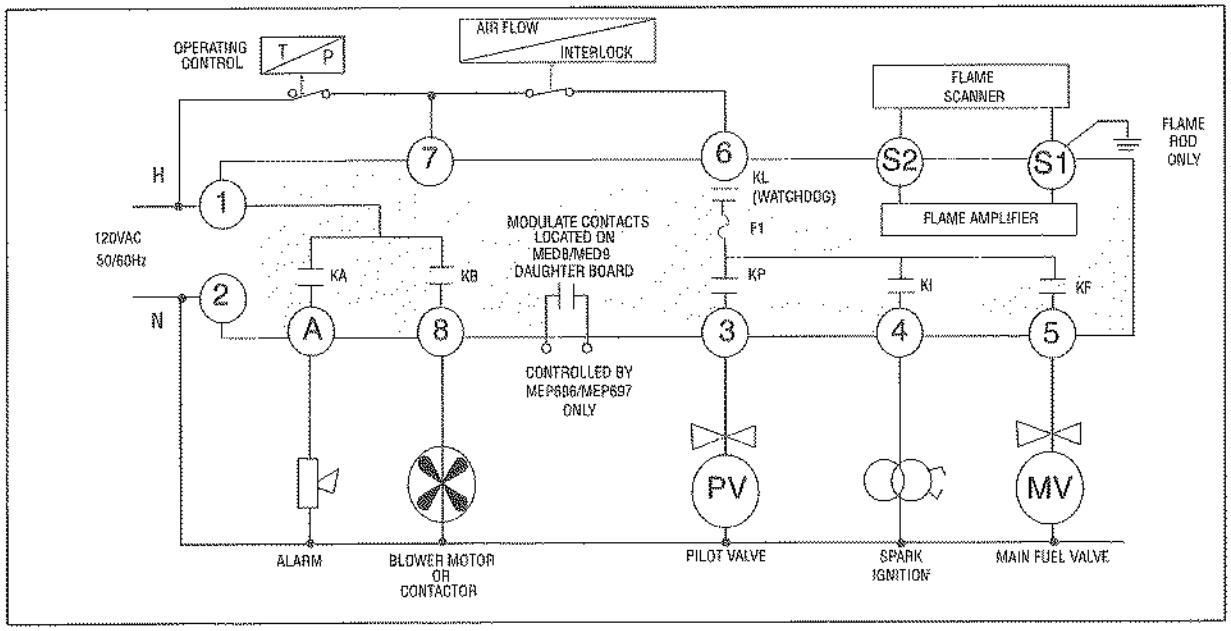
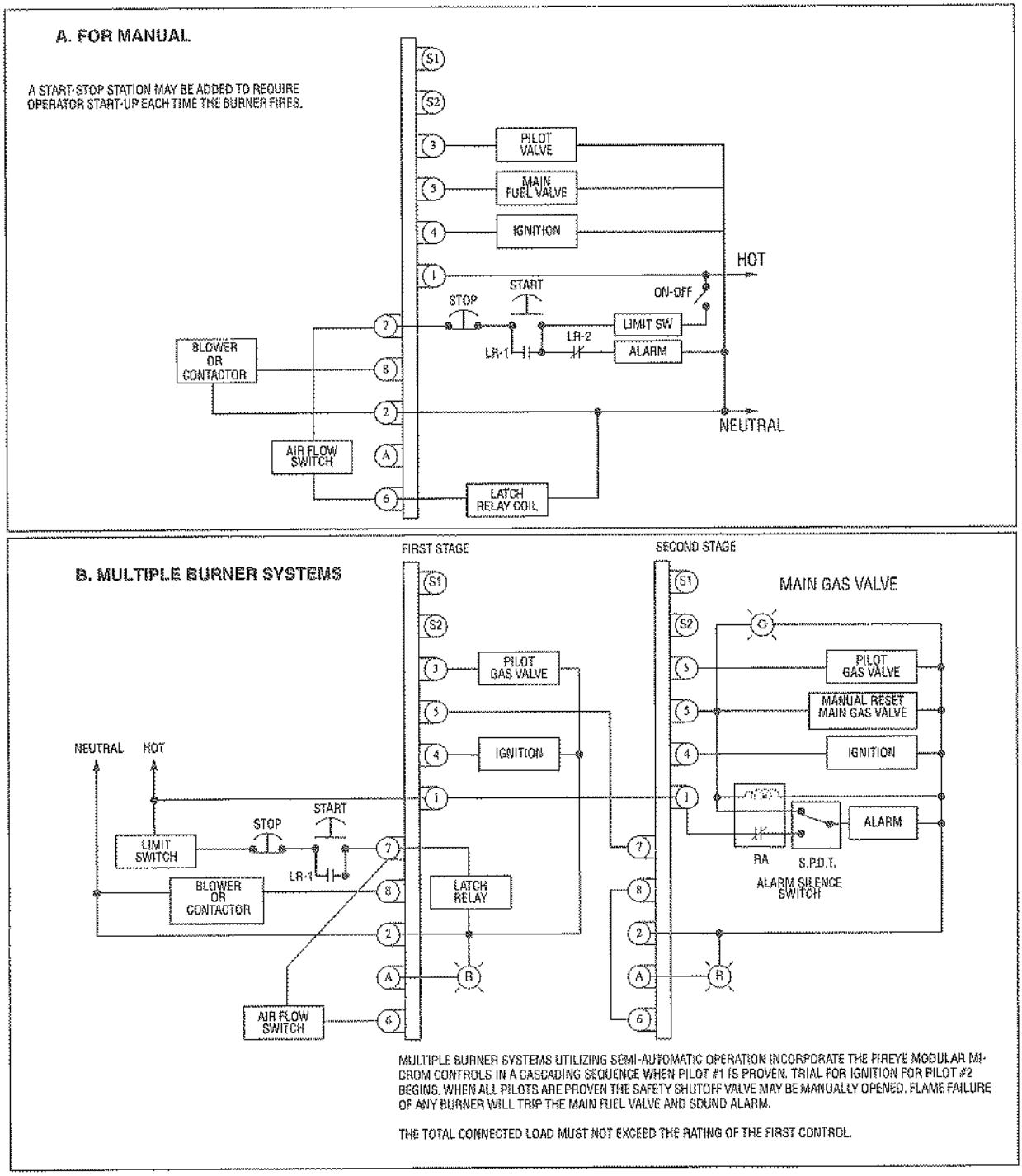
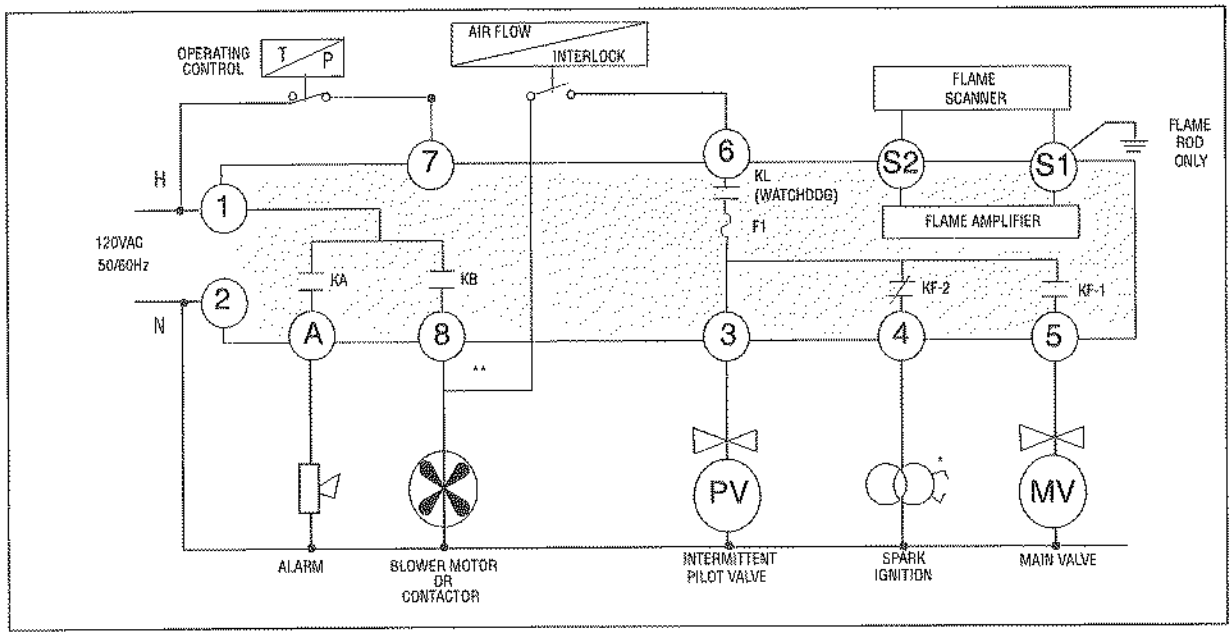


FIGURE 13. ALTERNATE WIRING ARRANGEMENT FOR MEP CONTROLS



IMPORTANT: Use moisture resistant wire rated 90°C minimum.

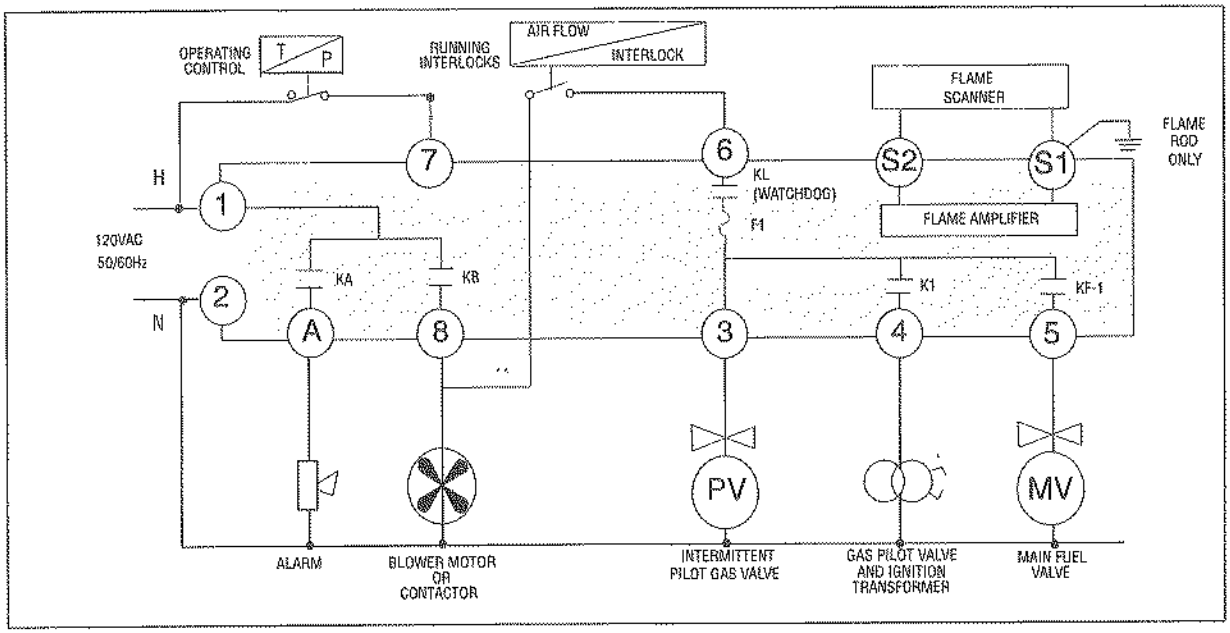
FIGURE 14. BACKWARD COMPATIBLE WIRING USING MEP100 AND MEP200 SERIES PROGRAMMERS (PILOT IGNITED BURNERS).



* For intermittent ignition, connect to terminal 3

** Combined current from Terminal 8 must not exceed 9.8 Amps

FIGURE 15. BACKWARD COMPATIBLE WIRING USING MEP500 SERIES PROGRAMMERS (PILOT IGNITED BURNERS)



* For intermittent ignition, connect to terminal 3

** Combined current from Terminal 8 must not exceed 9.8 Amps

SUGGESTED GROUNDING RULES

The MicroM system, being microprocessor based, requires a ground system that provides a zero-voltage reference. The voltage measured from L2 to all other terminals except L1 should be 0 volts.

1. The most effective ground is to run the ground wire in the same raceway as the hot and neutral from the main distribution service panel (not intermediate sub-panels) to the burner control panel and insure that this ground wire is well bonded to the control panel.
2. The wiring base of the MicroM must have earth ground providing a connection between the sub-base and the control panel or the burner.
3. The earth ground wire must be capable of conducting the current to blow the 20A fuse in event of an internal short circuit. A number 14 AWG copper conductor is adequate, wide straps or brackets are preferred rather than lead wires.
4. The ground path needs to be low impedance (less than 1 ohm) to the equipment frame which in turn needs a low impedance to earth ground. For a ground path to be low impedance at RF frequencies, the connection must be made with minimum length conductors having maximum surface areas.
5. All connections should be free of nonconductive coatings and protected against rust.
6. Utilizing conduit as a means of providing a ground must be avoided.
7. Installing ground rods at the burner control panel defeats the purpose of a single point ground as described above and could also present a safety hazard.

INSTALLATION

Do not run high voltage ignition transformer wires in the same conduit with flame detection wiring.

Do not run scanner wires in a conduit with line voltage circuits.

Ensure the frame of the ignition transformer is securely connected to control panel frame or preferably the burner frame.

The MicroM chassis (MEC120) contains a transient suppressing device connected internally across hot and neutral and then to the internal bracket. For this to be effective the chassis must be screwed securely into the wiring subbase.

REMOTE DISPLAY

When the ED510 is to be remotely mounted on the front of the control panel, the ED580 cable must contain a ferrite core, currently supplied by Fireye with the cable. The cable end with the ferrite core must be mounted at the control end. High frequency currents flow more to the surface of the conductor. The 60 Hz ground system, properly designed, has sufficient low-impedance at 60 Hz to maintain all metal surfaces at the same ground reference. But, this same system is unable to provide this at higher frequencies, because of the increased impedance caused by the 'skin effect'. The purpose of the ferrite core is to provide a low-impedance at these higher frequencies and absorb this unwanted energy.

Care must be taken not to route the ED580 cable in close proximity to any starter motor contactors located in the control panel or across any high voltage ignition wires. Refer to Fireye bulletin E-8002 for proper installation.

COMMUNICATIONS

When interfacing Fireye controls to a communication system, be it an E500, PLC or other microprocessor based device, ferrite cores should also be utilized. Proper twisted shielded pair cable must be utilized. In a multi-drop system, the shields should be tied together within a cabinet and not to any ground point. The shield at the source end of the cable of the multi-drop connection can then be terminated to ground. Source end is defined as the originating end of the communication system

Care must be taken not to route communication cables in close proximity to any starter motor contactors located in the control panel or across any high voltage ignition wires. Refer to Fireye bulletin E-8002 for proper installation.

SCANNERS

The armored cable supplied with the Ultra-Violet and Infrared scanners should be connected to equipment by means of a good mechanical connection such as a conduit fitting. It may be necessary to utilize heat insulator (P/N 35-69) to isolate the sensing end of the scanner from boiler ground. Care must be taken not to route the scanner cable across the high voltage ignition cable. The high energy ignition cable should be checked periodically for cracking, connections and aging.

In applications using flame rod units and the MERT amplifier, it may be beneficial to route a separate return wire from the S1 terminal to the flame rod assembly. This will minimize the effects of transient currents flowing into the MicroM.

In all cases, scanner wires should be routed in separate conduit and not joined with any high voltage AC or ignition cables.

MAINTENANCE

Periodically, the spark electrode should be inspected for proper gapping and cracked ceramics. At ignition time, the high energy from the ignition transformer will attempt to conduct to the point of least resistance and with an improper spark gap, where the conduction takes place will no longer be controlled.

The VA rating of the control transformer must be sized to handle the inrush currents of the pilot solenoid and ignition transformer at PTFI and then the inrush currents of the main fuel valve assembly at MTFI time.

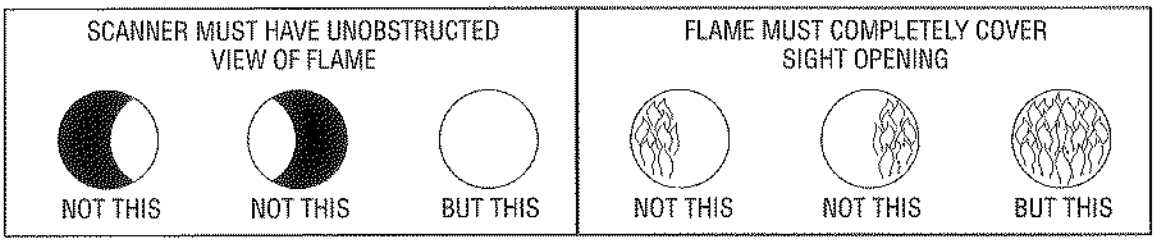
Inspect neatness of wiring in junction boxes and cabinets. It is best to have connections short and direct and also not having wires bunched up and tied off. Also, connections should be periodically inspected for tightness and corrosion.

INSTALLATION - UV SCANNERS

Where possible, obtain the burner manufacturer's instructions for mounting the scanner. This information is available for most standard burners. The scanner mounting should comply with the following general instructions:

1. Position the UV1A, UV2 scanner within 30 inches of the flame to be monitored; the 45UV5 within 72 inches, closer if possible.
2. Select a scanner location that will remain within the ambient temperature limits of the UV Scanner. If cooling is required, use an insulating coupling (Fireye P/N 35-69 for UV1A, UV2 Scanners, P/N 35-127-1 for 45UV5) to reduce conducted heat.
3. The UV1A, UV2, 45UV5 Scanners are designed to seal off the sight pipe up to 1 PSI pressure. Higher furnace pressures should be sealed off. To seal off positive furnace pressure up to 100 PSI for UV1A, UV2 Scanners, install a quartz window coupling (#60-1257) For 45UV5 Scanners, use #60-1199 coupling. Add cooling air to reduce the scanner sight pipe temperature.
4. Install the scanner on a standard NPT pipe (UV1A: 1/2", UV2: 3/8", 45UV5: 1") whose position is rigidly fixed. If the scanner mounting pipe sights through the refractory, do not extend it more

than halfway through. Swivel flanges are available if desired (#60-302 for UV1A, UV2 Scanners, #60-1664-3 for 45UV5). The sight pipe must permit an unobstructed view of the pilot and/or main flame, and both pilot and main flames must completely cover the scanner field of view.

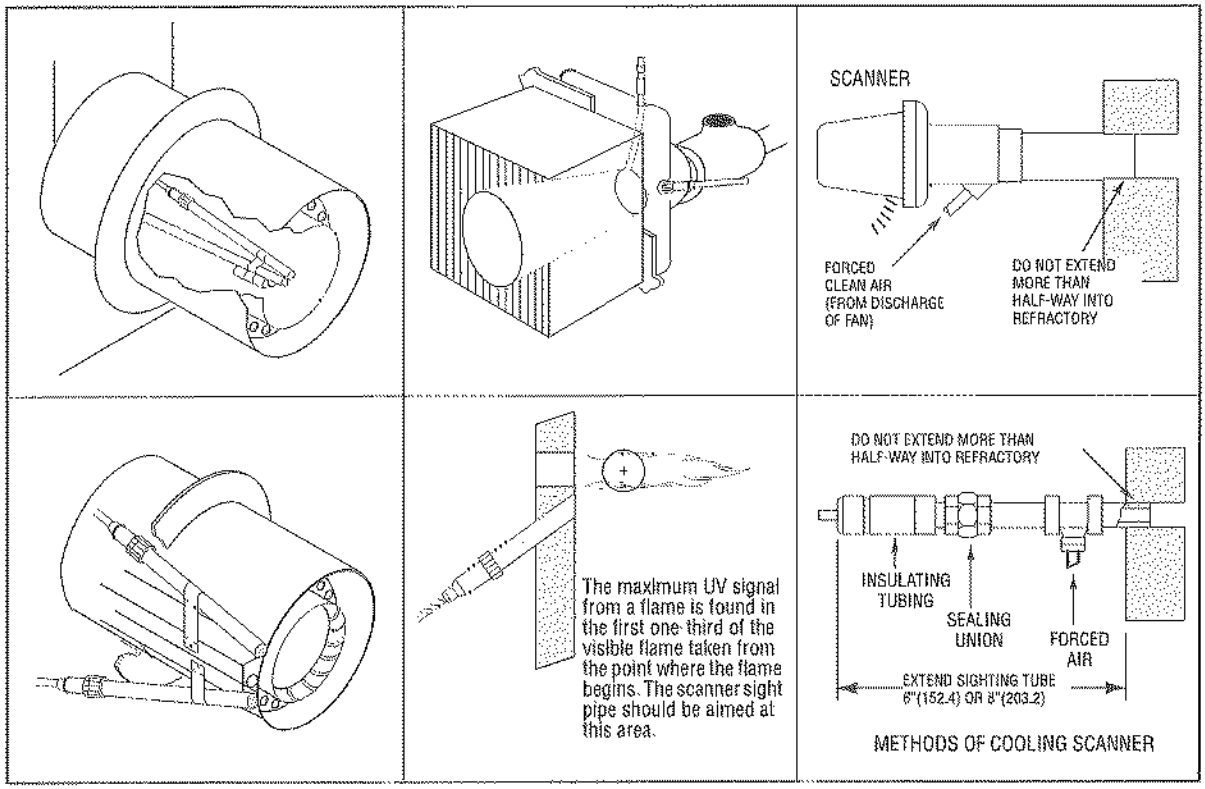


5. Smoke or unburned combustion gases absorb ultraviolet energy. On installations with negative pressure combustion chambers, a small hole drilled in the UV1A, UV2 sight pipe will assist in keeping the pipe clean and free from smoke. For positive pressure furnaces, provide clean air to pressurize the sight pipe, if necessary.
6. Two UV1A or UV2 Scanners may be installed on the burner if it is necessary to view two areas to obtain reliable detection of the flame. They should be wired in parallel. Only one repetitive self- checking 45UV5 Scanner may be installed on a burner.

To increase scanner sensitivity with UV1A, UV2 Scanners, a quartz lens permits location of the scanner at twice the normal distance. Use 1/2" x 1 1/2" pipe nipple between UV1A Scanner and the coupling. Use 3/8" pipe nipple and a 1/2" x 3/8" bushing on UV2 installations.

7. Request the assistance of any Fireye field office for recommendations of a proper scanner installation on a non-standard application.

TYPICAL SCANNER INSTALLATIONS



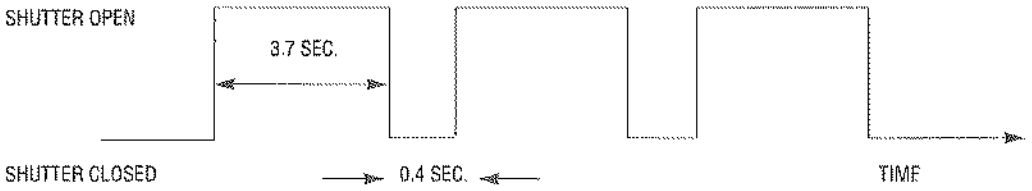
OPERATION — 45UV5 SELF-CHECKING UV SCANNER

Self-checking ultraviolet scanners should be used in applications where burner firing operation is continuous or where the burner is on for long periods of time without recycling. In addition, ultraviolet self-checking systems are mandatory in some locations.

The operation of this type of system consists of maintaining the flame scanning capability at all times while also proving that the ultraviolet tube is firing properly. This is done periodically by mechanically closing off the sight of the UV tube and checking to make sure that the flame signal goes away. A shutter assembly in the 45UV5 scanner performs this function. The diagram below explains the process further.

If the shutter assembly in the scanner fails, the tube is faulty, or there is insufficient power to the scanner, the MicroM will LOCKOUT and display the following message LOCKOUT CHECK SCANNER. The ultraviolet tube is replaceable (P/N 4-314-1).

A lockout will result if a minimum signal is detected for three consecutive shutter closed periods.



WIRING - UV SCANNERS

To connect the scanner to the control, the UV1A Scanner is supplied with 36" or 72" of flexible cable.

The 45UV5 is supplied with four 72 inch lead wires. Install them in a suitable length of flexible armor cable and connect it to the control. A conduit connector is supplied with the scanner. Connect black wires (shutter) to terminals L1, L2; red wires (UV tube) to terminals S1, S2.

If it is necessary to extend the scanner wiring, the following instructions apply:

Scanner wires should be installed in a separate conduit. The wires from several scanners may be installed in a common conduit.

1. Selection of Wire
   a. Wiring: For extended scanner wiring up to 500 feet, and for shorter lengths to reduce signal loss, use a shielded wire (Belden 8254-RG62 coaxial cable, or equal) for **each scanner wire** of UV1A, UV2 and **each red wire** of the 45UV5. **The ends of the shielding must be taped and not grounded.**
   b. Asbestos insulated wire should be avoided.
   c. Multiconductor cable is not recommended without prior factory approval.
2. High voltage ignition wiring should not be installed in the same conduit with flame detector wires.

INSTALLATION—INFRARED SCANNER TYPE 48PT2

Where possible, obtain the burner manufacturer's instructions for mounting the scanner, otherwise proceed as follows:

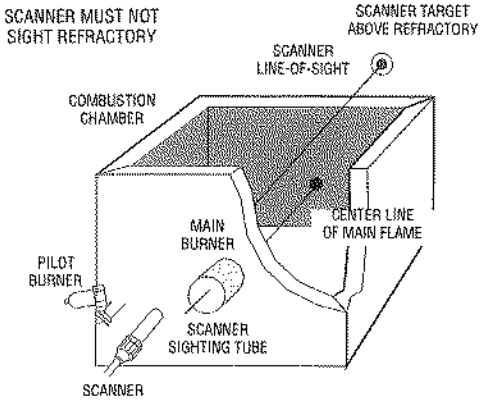
A single scanner is used to detect both pilot and main flames. The sight pipe on which the scanner mounts must be aimed so that the scanner sights a point at the intersection of main and pilot flames.

Proper scanner positioning must assure the following:

1. Reliable pilot flame signal.
2. Reliable main flame signal.
3. A pilot flame too short or in the wrong position to ignite the main flame reliably, must not be detected.
4. Scanner must have an unobstructed view of flame being monitored.
5. Flame being monitored must completely cover the scanner field of view.
6. To avoid nuisance shutdowns, it is important to avoid sighting hot refractory and to keep scanner temperature low (below 125° F) (50°C).

When the proper position has been established, drill a hole through the furnace wall and install a 4" to 8" length of threaded 1/2" black iron pipe on which to mount the 48PT2 scanner.

7. When satisfactory sighting position has been confirmed by operating tests, the sight tube should be firmly welded in place.



Wiring

Attach the cable supplied with the scanner to a junction box. Splice the cable wires to a pair of wires not smaller than #18. Install the complete run in a separate conduit to the control. **Continuous conduit bonding between scanner and the control is mandatory!** Scanner may be located up to 100 feet from control. Do not pass scanner wiring through any junction box containing other wires. Do not run other wires through scanner conduit. Asbestos insulated wire should be avoided.

Keeping the Scanner Cool

The Infrared Scanner (Temperature Limit 125° F) should never get too hot to grasp comfortably in the hand. Keep the scanner cool by one or more of the following methods.

1. Use 6" to 8" length of pipe between scanner and hot furnace front plate.
2. Use insulating tube (P/N 35-69) on the end of the iron pipe.
3. Force air into sighting tube. Use Fireye Sealing Union (P/N 60-801).
4. Make sure sighting tube does not extend more than halfway into refractory wall.

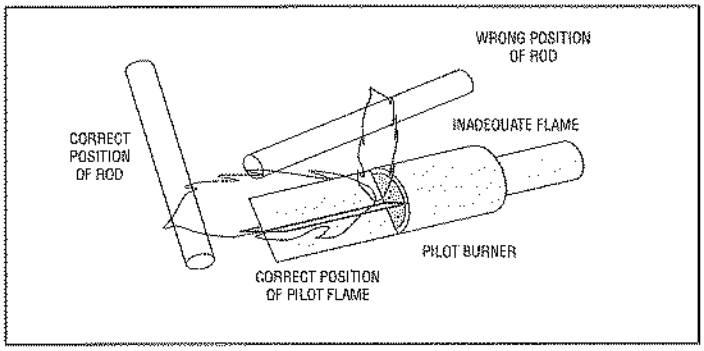
INSTALLATION - 69NDI FLAME ROD

The 69NDI flame rod proves a gas pilot flame and/or main gas flame. It is a spark plug type unit consisting of 1/2" NPT mount, a KANTHAL flame rod, a glazed porcelain insulating rod holder and a spark plug connector for making electrical connections. The 69ND1 is available in 12", 18" or 24" lengths.

The flame rod may be located to monitor only the gas pilot flame or both the gas pilot and main gas flames. It is mounted on a 1/2" NPT coupling.

The following instructions should be observed:

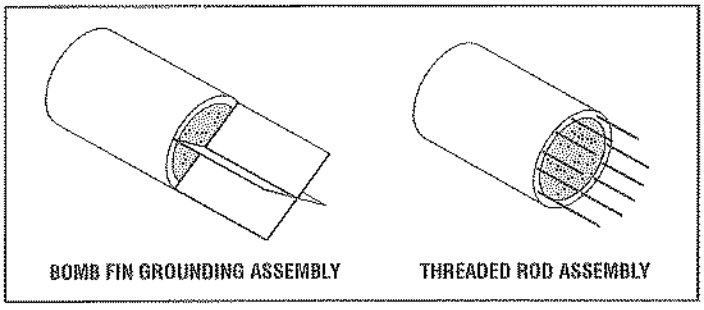
1. Keep flame rod as short as possible.
2. Keep flame rod at least 1/2" from any refractory.
3. Flame rod should enter the pilot flame from the side so as to safely prove an adequate pilot flame under all draft conditions.
4. If the flame is nonluminous (air and gas mixed before burning), the electrode tip should extend at least 1/2" into the flame, but not more than halfway through.



5. If the flame is partly luminous, the electrode tip should extend only to the edge of the flame. It is not necessary to maintain absolutely uninterrupted contact with the flame.
6. It is preferable to angle the rod downward to minimize the effect of sagging and to prevent it from coming in contact with any object.
7. An adequate grounding surface for the flame must be provided. The grounding surface in actual contact with the flame must be at least four times greater than the area of the portion of the flame rod in contact with the flame. It is essential to adjust the flame rod and ground area ratio to provide a maximum signal reading.

NOTE: Interference from the ignition spark can alter the true signal reading by adding to, or subtracting from it. This trend sometimes may be reversed by interchanging the primary wires (line voltage) to the ignition transformer. This interference can also be reduced by the addition of grounded shielding between the flame rod and ignition spark.

8. Proven types of flame grounding adapters, as shown below, may be used to provide adequate grounding surface. High temperature stainless steel should be used to minimize the effect of metal oxidation. This assembly may be welded directly over the pilot or main burner nozzle.



MAINTENANCE

Type 48PT2 Infrared and Type UV1A, UV2 and 45UV5 Ultraviolet Scanners

The viewing area of the scanner must be kept clean. Even a small amount of contamination will reduce the flame signal reaching the detector by a measurable amount. Wipe the viewing area routinely using a soft cloth dampened with concentrated detergent.

— Type 48PT2 Scanners include a replaceable #4-263-1 Firetron cell.

— Type 45UV5 Scanners include a replaceable #4-314-1 UV tube.

Type 69ND1 Flame Rod

The flame rod and its insulator should be kept clean by washing routinely with soap and water. Rods should be routinely replaced as they oxidize.

Flame Signal Strength

Routine observation of the flame signal strength will forewarn any deterioration in the capability of the flame detector or its application.

Contacts

There are no accessible contacts in the MicroM. Where contacts are used, their design assures long trouble-free life when the load circuits are maintained within the published load ratings.

Humidity

In areas of high humidity, the control chassis should be removed and placed in a dry atmosphere when the system is expected to be out of service for an extended period.

Periodic Safety Check

It is recommended that a procedure be established to test the complete flame safeguard system at least once a month. This test should verify the proper operation of all limit switches and safety interlocks as well as flame failure protection and fuel safety shutoff valve tightness.

Rotation

It is recommended that control and scanner units purchased as spares be installed periodically to ensure proper operation.

FIGURE 16. Mounting 45UV5 Scanner

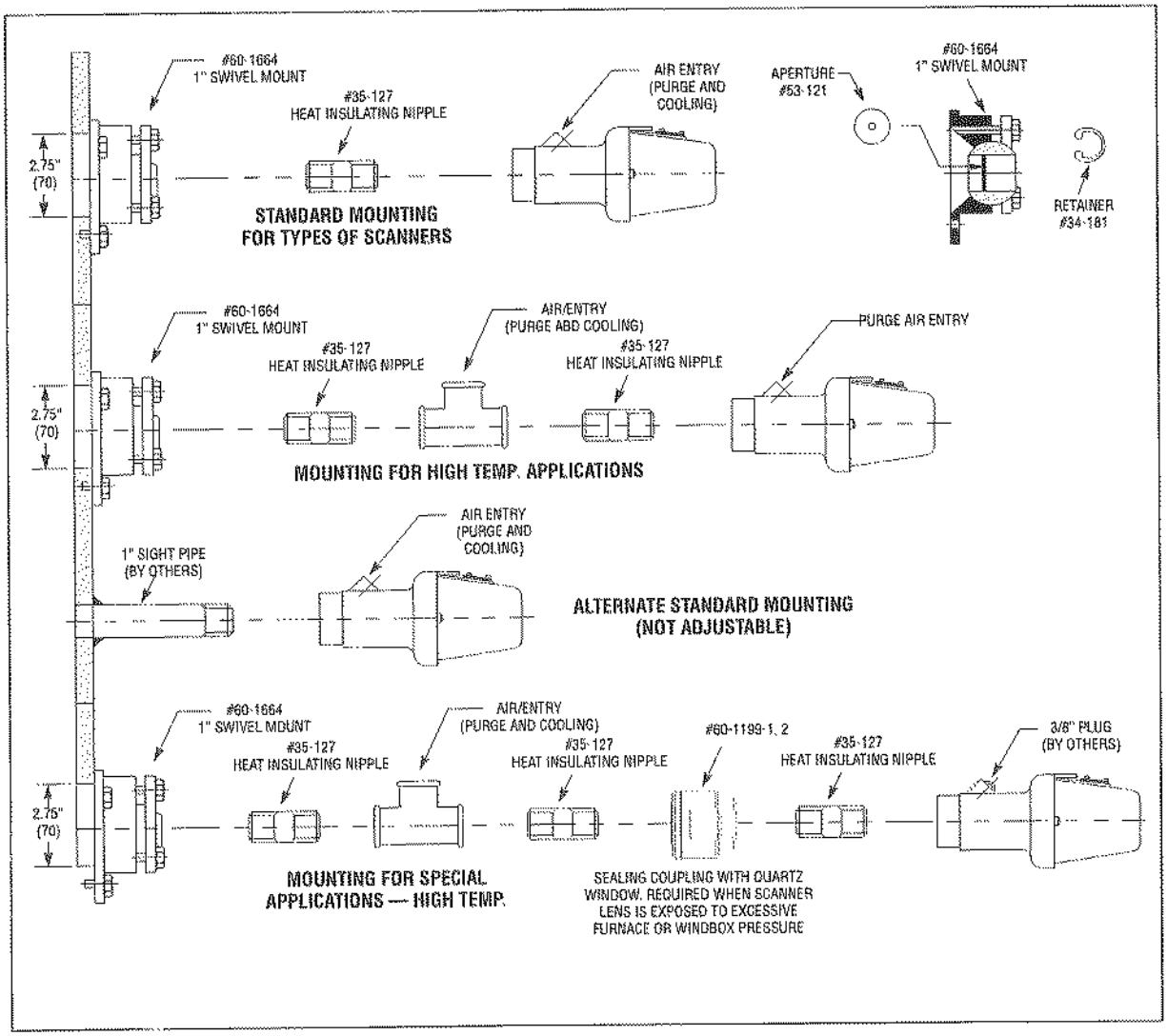
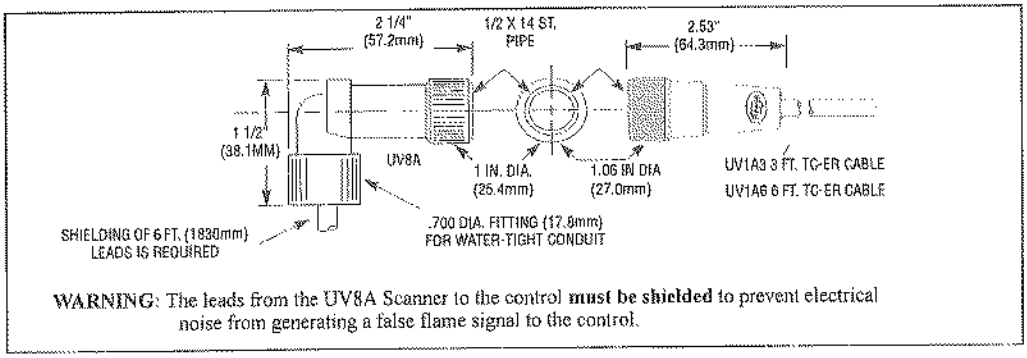
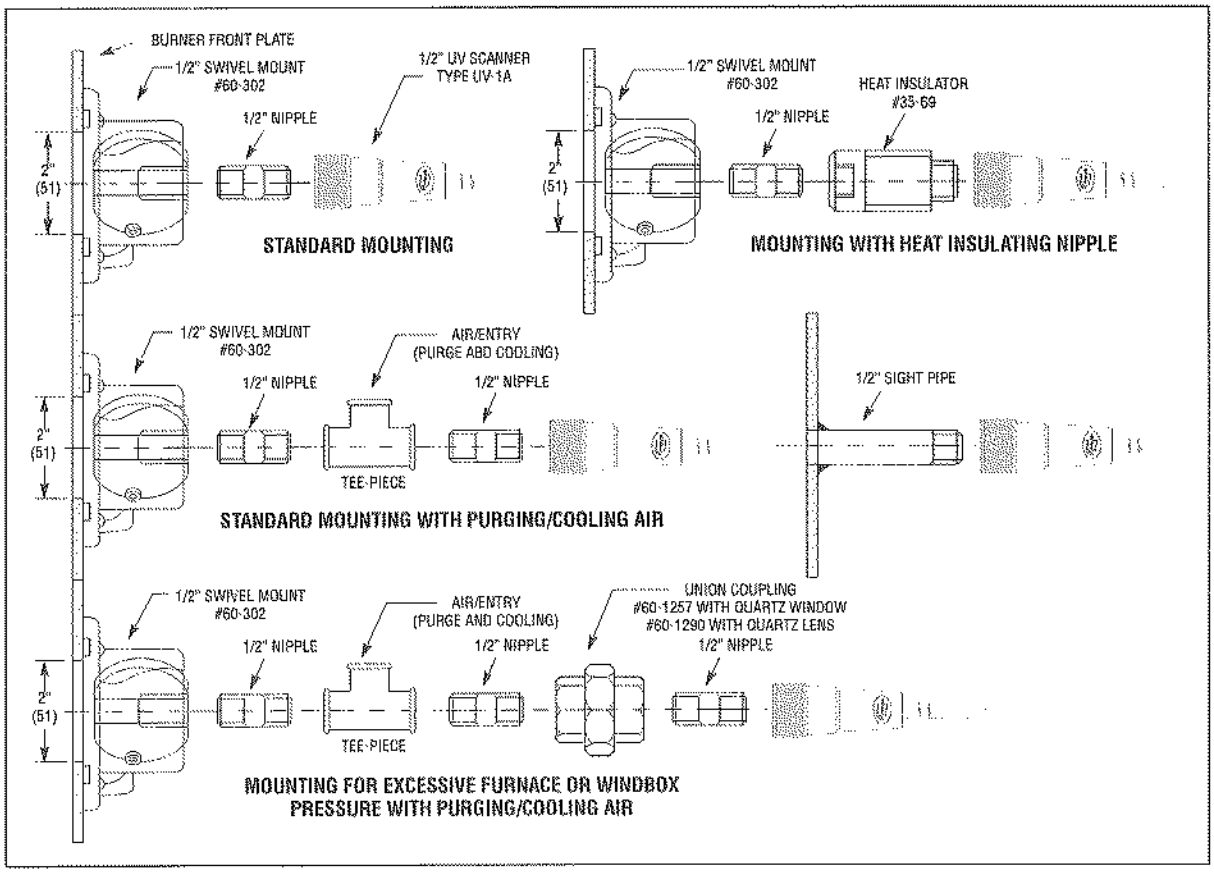


FIGURE 17. UV8A Scanner



WARNING: The leads from the UV8A Scanner to the control **must be shielded** to prevent electrical noise from generating a false flame signal to the control.

FIGURE 18. Mounting UV1A/UV1B Scanners



M-SERIES TO M-SERIES II TO MICROM CROSS REFERENCE LISTING

M-SERIES	M-SERIES II REPLACEMENT MODULES				MicroM REPLACEMENT MODULES			
Part Number	Chassis	Amplifier	Programmer	Programmer Dipswitch #8	Chassis	Amplifier	Programmer	Programmer Dipswitch #6
UVM1D	MC120	MAUV1T	MP100	N/A	MEC120	MEUV1	MEP100	N/A
UVM1F	MC120	MAUV1	MP100	N/A	MEC120	MEUV4	MEP100	N/A
TFM1D	MC120	MART1T	MP100	See Note #1	MEC120	MERT1	MEP100	N/A
TFM1F	MC120	MART1	MP100	See Note #1	MEC120	MERT4	MEP100	N/A
UVM2	MC120	MAUV1	MP230	OFF	MEC120	MEUV4	MEP230	C
TFM2	MC120	MART1	MP230	OFF	MEC120	MERT4	MEP230	C
UVM3	MC120	MAUV1	MP230	ON	MEC120	MEUV4	MEP230	O
TFM3	MC120	MART1	MP230	ON	MEC120	MERT4	MEP230	O
UVM3H	MC120	MAUV1	MP230H	ON	MEC120	MEUV4	MEP230H	O
TFM3H	MC120	MART1	MP230H	ON	MEC120	MERT4	MEP230H	O
UVM5	MC120	MAUV1	MP560	ON	MEC120	MEUV4	MEP560	O
UVM6	MC120	MAUV1	MP560	See Note #2	MEC120	MEUV4	MEP560	C
- N/A — Not Applicable - Programmer Dipswitches apply to MP230H, and MP560 only. - Dipswitch #8 sets Recycle / Non-Recycle Operation. - MP560 Programmer Module has "Check-Run" Switch. - Note #1: For Standing Pilot, clip out red jumper on MP100. - Note #2: Dipswitch #8 ON when red jumper of UVM6 is clipped.					- N/A — Not Applicable - Programmer Dipswitches apply to MEP200, and MEP500 Series Programmers - Dipswitch #6 sets Recycle / Non-Recycle Operation. (O = Non-Recycle, C = Recycle) - MEP500 Series Programmer Module has "Check-Run" Switch			

PURGE	PTFI	M-Series II PROGRAMMER DIPSWITCH SETTINGS							MicroM PROGRAMMER DIPSWITCH SETTINGS		
TIME	TIME	#1	#2	#3	#4	#5	#6	#7	#1	#2	#4
7	5	ON	OFF	OFF	OFF	OFF	ON	OFF	C	C	C
7	5	OFF	ON	OFF	OFF	OFF	ON	OFF	C	C	C
30	5	OFF	OFF	ON	OFF	OFF	ON	OFF	O	C	C
7	10	OFF	ON	OFF	OFF	OFF	OFF	ON	C	C	O
90	5	OFF	OFF	ON	ON	OFF	ON	OFF	O	O	C
30	10	OFF	OFF	ON	OFF	OFF	OFF	ON	O	C	O
60	10	OFF	OFF	OFF	ON	OFF	OFF	ON	C	O	O
90	10	OFF	OFF	ON	ON	OFF	OFF	ON	O	O	O
- Dipswitches #1 through #5 set Purge Timing - Dipswitches #6 and #7 set TFI Timing									- Dipswitches #1 through #2 set Purge Timing - Dipswitch #4 sets TFI Timing		

M-SERIES TIMING CARDS	PURGE TIME	PTFI TIME
MT55	5	5
MT74	7	4
MT304	30	4
MT710	7	10
MT904	90	4
MT3010	30	10
MT6010	60	10
MT9010	90	10

NOTICE

When Fireye products are combined with equipment manufactured by others and/or integrated into systems designed or manufactured by others, the Fireye warranty, as stated in its General Terms and Conditions of Sale, pertains only to the Fireye products and not to any other equipment or to the combined system or its overall performance.

WARRANTIES

FIREYE guarantees for *one year from the date of installation or 18 months from date of manufacture* of its products to replace, or, at its option, to repair any product or part thereof (except lamps and photocells) which is found defective in material or workmanship or which otherwise fails to conform to the description of the product on the face of its sales order. **THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES AND FIREYE MAKES NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED.** Except as specifically stated in these general terms and conditions of sale, remedies with respect to any product or part number manufactured or sold by Fireye shall be limited exclusively to the right to replacement or repair as above provided. In no event shall Fireye be liable for consequential or special damages of any nature that may arise in connection with such product or part.

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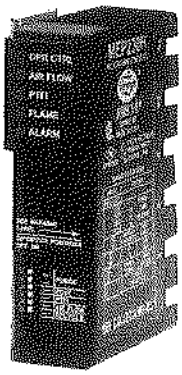
MC-5000
MARCH 28, 2013
Supersedes June 27, 2011



MEP230, MEP230H, MEP235, MEP236, MEP237, MEP238, and MEP290 PROGRAMMER MODULES

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FOR USE WITH THE FIREYE® MODULAR MicroM™ CONTROL TO BE USED WITH WITH MEC120 AND MEC230 CHASSIS

DESCRIPTION

The Fireye MEP230, MEP230H, MEP235, MEP236, MEP237, MEP238 and MEP290 Programmer Modules are used with the Fireye Modular MicroM control. The operational characteristics of the control are determined by the selection of the programmer module. The programmer module incorporates a plug-in design for easy installation.

These programmer modules are equipped with a series of dipswitches to select Purge Timing, Pilot Trial for Ignition (PTFI) Timing, Air Flow Proven, Open at Start, and Recycle or Non-Recycle operation. LED indicator lights are on all programmer modules, indicating the operating status of the control as well as providing diagnostic codes during lockout.

Flame Failure Response Time (FFRT) is determined by the selection of the amplifier module. Test jacks are also provided on the flame amplifier module to permit flame signal measurement during operation. For proper and safe application of this product, you must refer to Fireye bulletin MC-5000 for a detailed description of the various programmer modules, including installation instructions, amplifier selection, operating sequences for each programmer module, etc.

WARNING: Selection of this control for a particular application should be made by a competent professional, licensed by a state or other government agency. Inappropriate application of this product could result in an unsafe condition hazardous to life and property. Installation should not be considered complete until pilot turndown and other appropriate performance tests have been successfully completed.

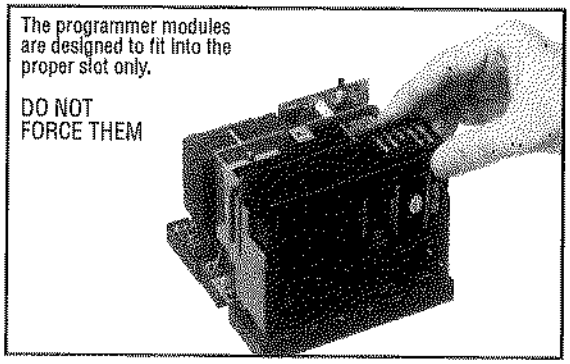
PROGRAMMER MODULE SELECTION

MicroM Programmer Models (For use with MEC120 and MEC 230 Chassis)	
MEP230	Selectable purge timing (7, 30, 60, 90 seconds) PTFI timing, recycle/non-recycle, post purge, prove air open at start.
MEP230H	Same as MEP230 with 8 second pilot stabilization.
MEP235	Same as MEP230 with lockout on air flow open 10 seconds after the start of a cycle, selectable recycle/nonrecycle lockout on air flow open after flame is proven and dedicated lockout after loss of flame.
MEP236	Same as MEP230 with additional 6 second igniter on time with main fuel. To be used with intermittent pilot only.
MEP237	Same as MEP230 with check/run switch. Provides operation with 85UVF4-1WR Phoenix scanner and MEDC2 amplifier.
MEP238	Same as MEP230. Ignition de-energized 3 seconds after pilot flame detected. Provides 8 second pilot stabilization period.
MEP290	Same as MEP230 except selectable post purge is 0 or 90 seconds.

WARNING: Remove power from the control and remove the control from its wiring base before proceeding.

INSTALLATION

The Programmer Modules are used with the Fireye modular MicroM Chassis (P/N MEC120, MEC120RC, MEC120R, MEC120D, MEC120RD and MEC120C for 120VAC and MEC230 for 230 VAC). They are installed in the chassis by grabbing hold of the programmer module by the ridged finger grips on the side on the module, aligning the module with the guide slots on the opening farthest from the transformer, and inserting the module into the pin connectors.



PROGRAMMER DIPSWITCH SETTINGS

NOTE: The dipswitch settings become permanently stored within the programmer's eeprom memory after 8 hours of continuous electrical operation. This allows sufficient opportunity to make the appropriate selection, test and checkout the system. Once stored, the settings cannot be altered.

The MEP200 series programmers have a series of 6 dipswitches which allow the user to program the purge timing, trial for ignition timing, enable post purge, enable proof of air flow open proven and start and select recycle/non-recycle operation.

MicroM Programmer Dip Switch Configuration

SWITCH						FUNCTION	
6	5	4	3	2	1		
				C	C	7	PURGE TIME SECONDS
				C	O	30	
				O	C	60	
				O	O	90	
			C			DISABLED	POST* PURGE
			O			15 SECONDS	
		C				5	PTFI TIME
		O				10	
	C					DISABLE	PROVE AIR FLOW
	O					ENABLE	
C						RECYCLE	
O						NON-RECYCLE	

* The MEP290 Programmer module has selectable post purge of 90 seconds.

Note: C refers to switch closed position, and closed position is when the switch is toward the printed circuit board. O refers to open switch position or when the switch is moved away from the printed circuit board.

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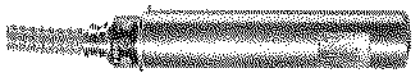
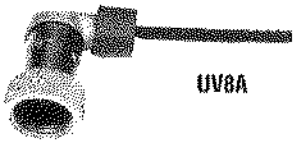
MP-5201
APRIL 3, 2013
Supersedes April 2004


UV90


UV1A


UV8A


45UV3

FIREYE®
FLAME SCANNERS

UV non self-checking Scanner Models: UV1A3, UV1A6, UV8A, UV2, UV2A6, 45UV3, UV90-3, UV90-6, UV90-9

For UV self-check Scanners refer to SC-101
For Infrared Photocell Scanners refer to SC-103

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DESCRIPTION

The UV1A3/6, UV2/UV2A6, 45UV3, UV90-3/6/9 Scanners are used with the M-Series, M-Series II, MicroM, FlameWorx, MB-2 and D-Series controls as well as the Fireye FLAME-MONITOR™, BurnerLogix and Nexus System. The UV1A3/6 scanners come with 3 ft. and 6 ft. cables rated for Tray Cable - Exposed Run (TC-ER) and complies with the crush and impact requirements of the standard for metal clad cable, UL 1569. The UV2 (36 inch) and UV2A6 (72 inch) are fitted with a 3/8" NPT female to 1/2" NPT male adapter fitted into the 1/2" threaded coupling of the UV1A3/6 respectively. The UV90-3/6/9 is available with 3 ft., 6 ft. and 9 ft. shielded flexible cables.

The UV8A Scanner is a 90° right angle ultraviolet flame scanner used in conjunction with the M-Series, M-Series II, MicroM, FlameWorx, MB-2 and D series controls as well as the Fireye® FLAME-MONITOR™, Burner Logix and the Nexus System. It is available only with 72 inch (1830mm) unshielded lead wires.

The 45UV3 Scanner has a rugged cast housing that mounts on a 3/4 inch pipe with sleeve and set-screw. The replaceable UV tube is mounted in a vertical position for greater sensitivity. Non self-checking.

The UV90 Series Scanners are designed for front and lateral (90°) mounting which, in some applications allow the scanners to obtain a clearer view of the flame. The UV90, with its exclusive snug-fit mounting block, eliminates the need for a threaded sight pipe.

The UV tube is made of quartz and is filled with a gas that ionizes when struck by UV radiation from the flame. In the absence of UV radiation, the gas acts as an insulator between two electrodes which are mounted inside the tube. These electrodes are energized continuously by a high voltage. During combustion, UV radiation ionizes the gas, causing current pulses to flow between the electrodes. These current pulses result in a flame signal which is transmitted to the amplifier in the control, where it is processed to energize or hold in the flame relay.

WARNING: When installing or replacing UV scanners, a minimum pilot turndown test on pilot ignited burners and a spark pickup test on all burners must be performed. Refer to bulletins E-1101, C-4000, MC-5000 or BurnerLogix for recommended procedures.

APPLICATION

UV scanners are recommended for detecting flames from standard fuel gases, some waste gases and light oil fuels such as No. 2 oil. Flames from heavier oils can be detected with UV scanners but the unburned fuel shroud and/or atomization shroud can block passage of the UV from the flame zone to the UV tube, causing nuisance burner/boiler trips. Infrared detection is recommended for fuel oil heavier than No. 2, and some installations where waste gases are burned together with natural gas as a main flame.

NOTE: Certain safety codes and regulations require the use of self-checking ultraviolet scanners. For information on self-checking UV scanners, refer to Bulletin SC-101.

SPECIFICATIONS

Operating Voltage: (S1-S2): 560 VAC @120V (230V) 50/60 Hz applied

Operating Temperature Limits: Maximum: 200° F (94° C)
Minimum: -40° F (-40° C)

Humidity: 85% RH maximum non-condensing

UV1A3:	$^1/_2$" NPT, 36" (915mm) shielded leads
UV1A6:	$^1/_2$" NPT, 72" (1830mm) shielded leads
UV8A:	$^1/_2$" NPT, 72" (1830mm) unshielded leads, 90° right angle mount
UV2:	$^3/_8$" NPT, 36" (915mm) shielded leads
UV2A6:	$^3/_8$" NPT, 72" (1830mm) shielded leads
45UV2-1020	1" NPT mount 60 Hz, 72" (1830mm) unshielded leads - **OBSOLETE**
45UV3-1050	$^3/_4$" Sleeve/setscrew mount, 72" (1830mm) unshielded leads
UV90-3	36" (915mm) shielded leads
UV90-6	72" (1830mm) shielded leads
UV90-9	108 " (3660mm) shielded leads

For scanner dimensions refer to Figures 2 and 4.
Consult factory for custom lead lengths.

IMPORTANT NOTE

The information provided in this bulletin is directed to assist boiler and combustion service technicians who are experienced in the installation and operation of Fireye Flame Safety equipment. Persons not familiar with Fireye products should contact the nearest Fireye representative or other qualified service group.

The UV1A, UV2, UV8A, 45UV3 and UV90 as well as all other Fireye scanners, are designed to be used exclusively with the appropriate Fireye Flame safeguard and Burner Management controls. The application of these scanners to other than Fireye equipment should be reviewed for approval by Fireye.

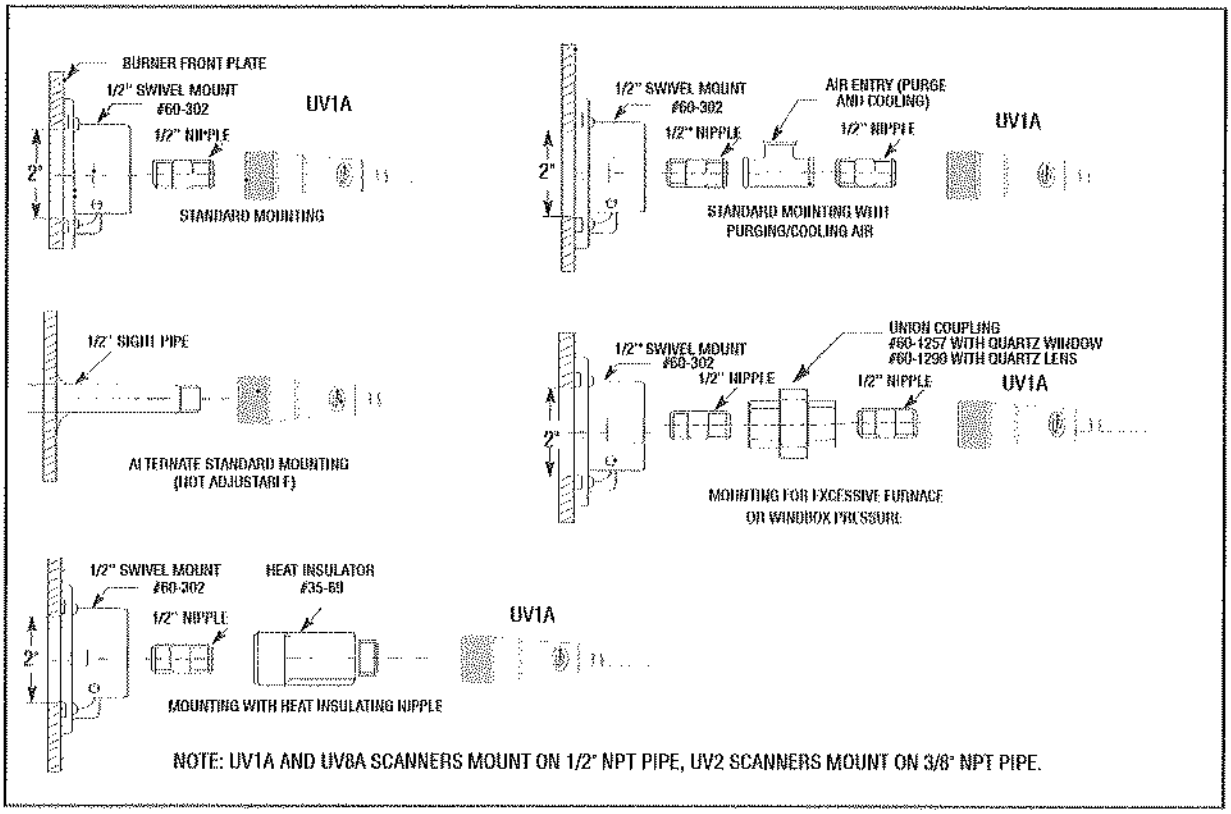
APPLICATION REFERENCE

UV1A, UV2, UV8A, 45UV3 and UV90 can be used only with the following FIREYE flame safeguard controls.

FIREYE FLAME-MONITOR	MB-2 SERIES	MicroM & M-SERIES II	D SERIES	PFM ADAPTOR KITS	FLAMEWORX	NEXUS	BURNERLOGIX
To be used with EUV1 Amplifier Card	Use with 61-3359 UV Amplifier	MAUV1 MAUV1T MEUV1 MEUV4	All D-Series using 72DUV1 Amplifier	PFM2UV PFM3UV	MBUV-300D MBUV-310D	NX3000 NX3100 NX4000 NX4100	YB110UV YB230UV

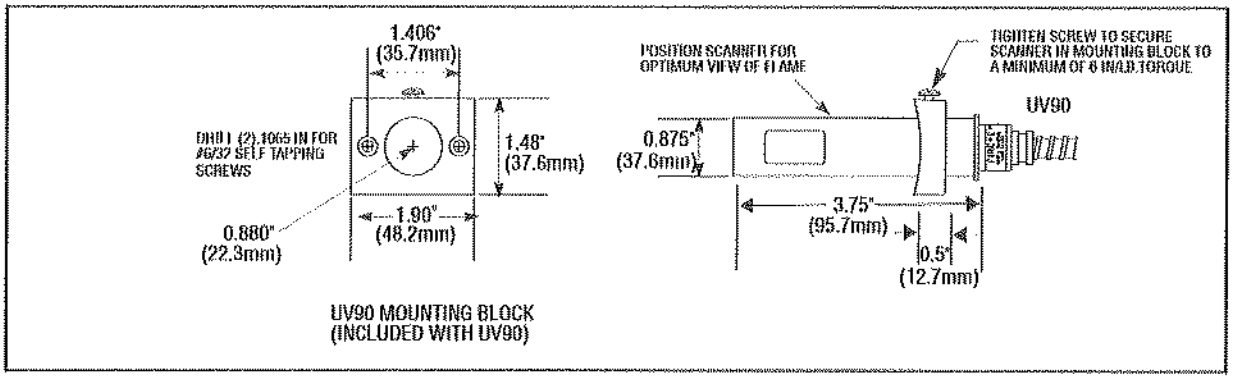
CAUTION: The UV1A, UV2, UV8A, 45UV3 and UV90 ultra-violet flame scanners and associated amplifier modules are non-self checking UV systems and should be applied only to burners that cycle often (e.g.: a minimum of once per 12 hours) in order for the safety checking circuit to be exercised. If component checking is required during burner operation for constantly fired burners, utilize the self-checking ultra-violet flame scanners (45UV5) with associated amplifier module (EUVS4), (MEUVS, (MBUVS) or YB110UVSC or the infrared flame scanner (48PT2) with associated Auto Check amplifier (E1R1, E1R2, E1R3, MEIR1, MEIR4, YB110IR).

FIGURE 1. TYPICAL SCANNER MOUNTING



NOTE: UV1A AND UV8A SCANNERS MOUNT ON 1/2" NPT PIPE, UV2 SCANNERS MOUNT ON 3/8" NPT PIPE.

FIGURE 2. SCANNER MOUNTING FOR UV90



UV90 MOUNTING BLOCK (INCLUDED WITH UV90)

ACCESSORIES

PART NUMBER	DESCRIPTION
60-302	$^1/_2$" Swivel Union
35-69	Heat Insulator $^1/_2$" NPT threads each end, (male x female).
60-1257	$^1/_2$" NPT Union with quartz window
60-1290	$^1/_2$" NPT Union with quartz lens to increase sensitivity
4-314-1	Replacement UV tube for 45UV3

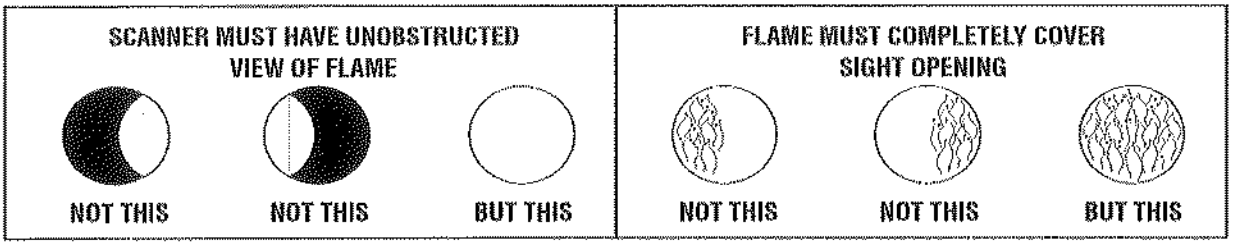
INSTALLATION OF UV1A, UV2, UV8A, 45UV3, UV90 SCANNERS

WARNING: THE LEADS FROM THE UV8A SCANNER TO THE CONTROL MUST BE SHIELDED TO PREVENT ELECTRICAL NOISE FROM GENERATING A FALSE FLAME SIGNAL TO THE CONTROL.
Where possible, obtain the Burner Manufacturer's Instructions for mounting the scanner. This information is available for most standard burners. The scanner mounting should comply with the following General Instructions:

The following UL standards have been revised and now allow the use of TC-ER rated cable on Commercial boilers and burners:

- UL 295: Commercial - Industrial Gas Burners – Sections 10.1.6, 10.1.9, and 11.2.2.
- UL 296: Oil Burners – Sections 31.1.8, 31.1.11, and 32.2.2.
- UL 726: Oil fired Boiler Assemblies – Sections 15.1.6, 15.1.9, and 16.1.6.
- UL 795: Commercial - Industrial Gas Heating Equipment – Section 12.5.

1. The quartz UV tube is brittle. Care must be exercised to avoid dropping or otherwise striking the scanner with force. Keep the scanner protected until mounted.
2. Position the UV scanner within 36 inches of the flame to be monitored.
3. Select a scanner location that will remain within the ambient temperature limits of the UV Scanner (200°F). If cooling is required, use an insulating coupling (Fireye P/N 35-69).
4. The UV Scanners are designed to seal off against pressures up to 1 PSI. To seal against higher pressures, install a union coupling with quartz window (P/N 60-1257). Add cooling air to reduce the scanner sight pipe temperature. (Not applicable to UV90).
5. Install the scanner on a standard 1/2 in. NPS (3/8 in. for UV2/UV2A6, 3/4 in. NPT for 45UV) pipe whose position is rigidly fixed. If the scanner mounting pipe sights through the refractory, do not extend it more than halfway through. Swivel flanges are available if desired (P/N 60-302). The sight pipe must permit an unobstructed view of the pilot and/or main flame, and both pilot and main flames must completely cover the scanner field of view. Oil and gas flames radiate more ultraviolet energy from the base of the flame than from further out in the flame. This fact should be considered when installing the scanner sight pipe.



6. Since the radiated energy from an electric spark igniter is very rich in the UV region, the field of view should be aimed so that it does not see an electric spark igniter nor any reflector that is close to the spark.

CAUTION: The unprotected leads must be run in electrical conduit in order to eliminate pickup of electrical noise which could present an unsafe condition.

To prevent spark pickup by the UV detector, close and/or disconnect all pilot and main fuel valves. Operate the control through a burner startup cycle to determine that ignition spark cannot be detected. Burner will not ignite if spark is detected.

7. Avoid running the scanner cables or conduit in close proximity to hot surfaces at the burner.
8. Avoid running the scanner conduit in close proximity to high energy ignition wires.
9. Smoke or unburned combustion gases absorb ultraviolet radiation. On installations having negative pressure combustion chamber, a small hole drilled in the scanner sight pipe will assist in keeping the pipe clean and free of smoke. For positive pressure furnaces, provide clean air to pressurize the sight pipe, if necessary.
10. Two UV Scanners may be installed on one burner if it is necessary to view two areas to obtain reliable detection of the flame. They should be wired in parallel.
11. To increase scanner sensitivity with the UV Scanners, a quartz lens permits location of the scanner at twice the normal distance. (Union w/quartz lens P/N 60-1290).
12. Request the assistance of any Fireye Field Office for recommendations of a proper scanner installation on a non-standard application.

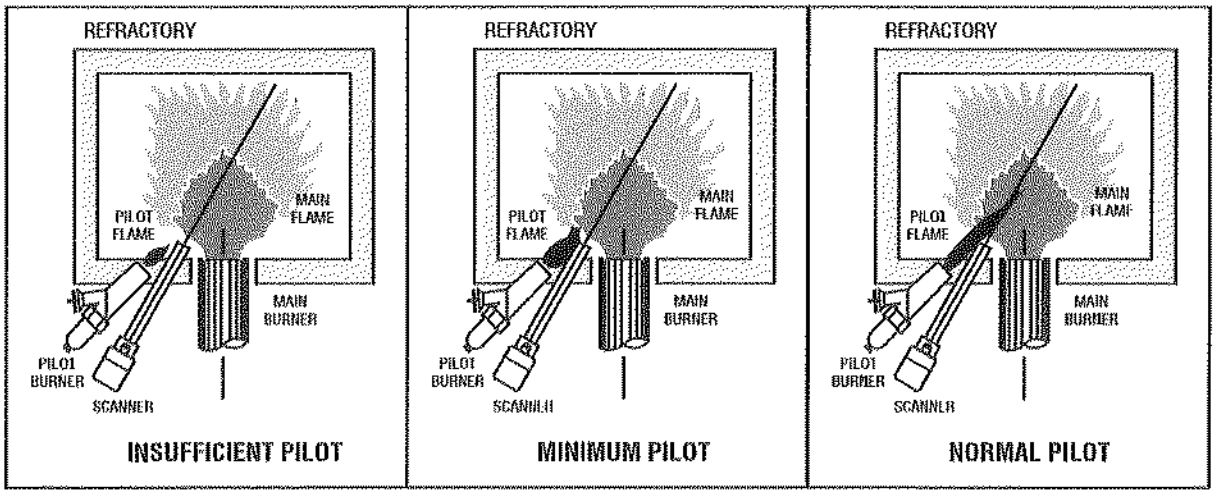
CAUTION: Ultra-violet tubes can simulate flame when exposed to high levels of "X" and GAMMA radiation. The table below indicates the maximum dose of radiation that a UV tube can be exposed to safely.

SOURCE	MAXIMUM DOSE	
Cobalt 60 (CO_{60})	7.5mR/Hr	
Iridium 192 (IR_{192})	1.0mR/Hr	
X-Ray	4mR/Hr	150kV @ 0.2mA
X-Ray	1mR/Hr	150kV @ 5mA

Minimum Pilot Test

This test assures that the flame detector will not detect a pilot flame too small to reliably light off the main flame. The test should be made on every new installation and following any repositioning of the flame detector. THE MINIMUM PILOT TESTS MUST BE ACCOMPLISHED BY A TRAINED AND QUALIFIDED BURNER TECHNICIAN.

FIGURE 3.



SPARK REJECTION TEST. CAUTION: The scanner must not sight the ignition spark directly or any part of the burner that can reflect the spark back to the scanner; the scanner must not see a a pilot flame that is too small to reliably ignite the main flame. Test procedures vary according to the control used. See procedures as described in the technical bulletin for the control being installed.

WIRING - UV SCANNERS

To connect the scanner to the control, the UV1, UV2 and UV90 Scanners are supplied with up to 96" of flexible cable. Consult factory for custom lead lengths.

Wiring Instructions:

Wire the black and red wires (18 AWG) on the UV1A / UV2 flame scanner to terminals S1 and S2 on the Fireye flame safeguard control. **There is no polarity associated with the wire colors. Either wire (red or black) can be wired to either terminal (S1 or S2).**

Shield and Drain Wire:

The scanner provides a shield and drain wire that are internally bonded to the metal threaded ½" NPT coupling nut. This allows a conduit clamp to provide an electrical ground around the exposed shield when entering a metal junction box or control cabinet, or connect the drain wire to a suitable ground connection when using a non-metalic (or metallic) junction box or control cabinet.

Conduit required:

On those applications where conduit is required for the UV1A/UV2 scanner, Fireye recommends the Thomas and Betts 449-TB (or suitable) fitting which is used to couple 3/8" flexible metal conduit to 1/2" EMT conduit. The set screw on the fitting bites into the plastic on the UV1A / UV2 scanner and seats onto the metal casing below, providing a secure connection.

The 45UV3 is supplied with 72 in. (1830mm) lead wires. Install them in a suitable length of flexible armor cable and connect it to the control. A conduit connector is supplied with the scanner. Connect black wires (UV tube) of the 45UV3 to terminals S1 & S2 of the appropriate P-Series.

If it is necessary to extend the scanner wiring, the following instructions apply:
Scanner wires should be installed in a separate conduit. The wires from several scanners may be installed in a common conduit.

The voltage applied to UV scanners is nominally 560 VAC with no flame present.

Selection of Wire

1. Use #14, 16, or 18 wire with 75° C, 600 volt insulation for up to 100 foot distances (signal loss approximately 20% at 100 feet).
2. For extended scanner wiring up to 500 feet, or for shorter lengths to reduce signal loss, use a shielded wire (Belden 8254, RG-62/U coaxial cable, or equal) for *each* scanner wire. The ends of the shielding must be taped and **not** grounded.
3. Asbestos insulated wire should be avoided.
4. Multiconductor cable is not recommended.
5. High voltage ignition wiring should **not** be installed in the same conduit with flame detector wires.

CAUTION: Keep scanner leads well clear of ignition high voltage wiring or any other high voltage or high current wiring in order to prevent false signal pickup in the scanner leads.

WARNING: Protective filtered lenses should be worn when viewing flame. Infrared and ultraviolet energy can be damaging to the eyes.

MAINTENANCE

Ultraviolet Scanners

The viewing area of the scanner must be kept clean. Even a small amount of contamination on the lens will reduce the flame signal reaching the detector by a measurable amount. Wipe the viewing area routinely using a soft cloth dampened with concentrated detergent, then wipe dry.

Flame Signal Strength

Routine observation of the flame signal strength will forewarn any deterioration in the capability of the flame detector or its application.

Periodic Safety Check

It is recommended that a procedure be established to test the complete flame safeguard system at least once a month,. This test should verify the proper operation of all limit switches and safety interlocks as well as flame failure protection and fuel safety shutoff valve tightness.

Rotation

It is recommended that control and scanner units purchased as spares be installed periodically to ensure proper operation.

TROUBLESHOOTING NON SELF-CHECKING UV SCANNERS

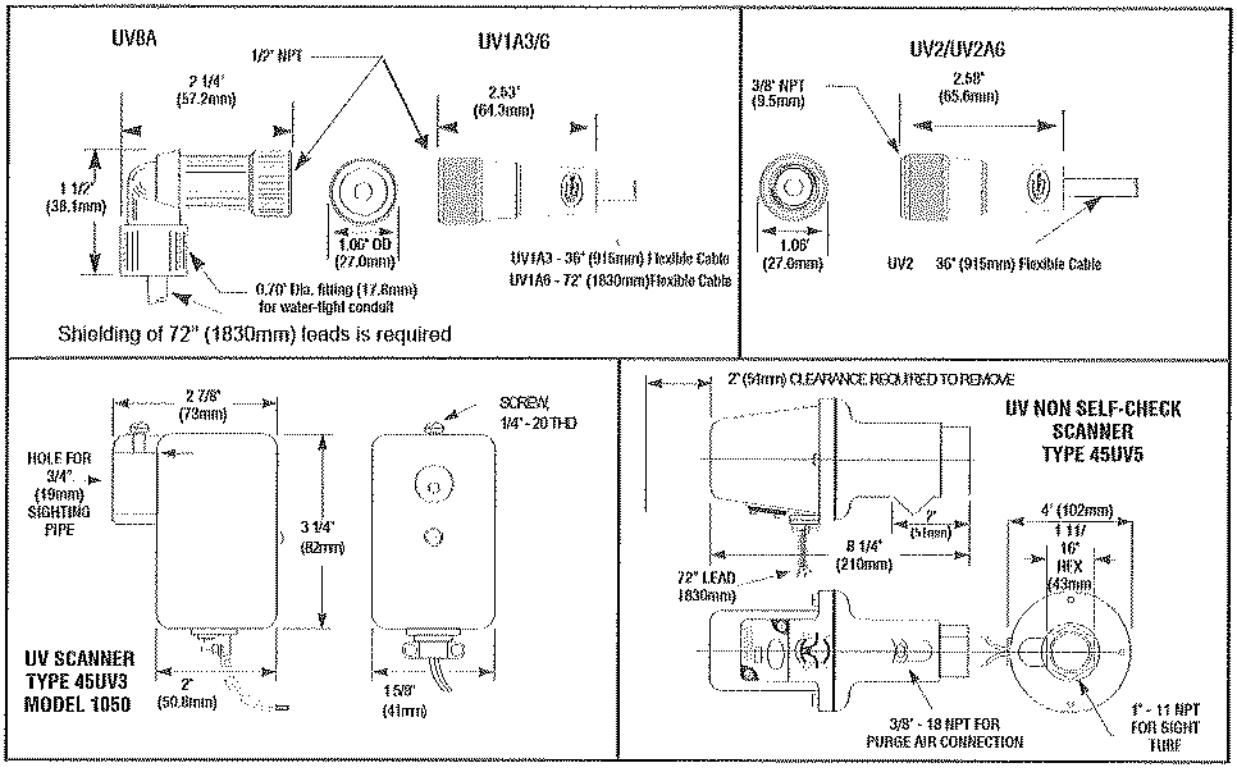
ZERO OR LOW FLAME SIGNAL

1. Zero volts at test jacks on control.
   - Make sure scanner has good view of the first $^1/_3$ of flame. Reposition scanner for best flame signal. If no signal . . .
2. Check for approximately 560 VAC across S1-S2 on control, with no flame present, as follows:
   - Use meter with 20k ohms/volt sensitivity.
   - Deenergize control.
   - Close and secure all fuel valves.
   - Energize control and measure voltage across S1-S2.
3. If voltage across S1-S2 is acceptable . . .
   - With control energized, remove scanner from burner and bring it to within a few inches of a UV source such as a gas lighter or propane torch.
   - Check for flame signal at control.
4. If no flame signal . . .
   - Make sure scanner lens is clean and dry.
   - Deenergize control and check continuity of leads between scanner and control.
   - Replace scanner
   - Replace amplifier or control.
5. If voltage across S1-S2 is low, check L1-L2 for proper line voltage. If line voltage is good:
   - Deenergized control, remove scanner lead wires from terminals S1 and S2.
   - Energize control and recheck for proper voltage across S1 and S2.
   - If voltage across S1 and S2 is good, replace scanner or lead wires.
   - If voltage across S1 and S2 is low, replace amplifier or control.

FALSE FLAME SIGNAL

1. Control will not start burner.
   - Check control wiring, all limits and interlocks.
   - Verify flame signal at test jacks upon energizing control.
2. Flame signal appears at test jacks when no flame is in combustion chamber.
   - Deenergize control to remove scanner leads from S1-S2.
   - Close and secure all fuel valves.
   - Energize control.
   - Check for induced voltage pickup to amplifier.
3. Burner starts up with scanner removed from S1-S2.
   - Deenergize control and connect scanner to S1-S2.
   - Energize control.
   - Check scanner for runaway condition. Look for a blue glow in the UV tube.
   - If glow is present, replace scanner.
   - If no glow is present, check to see that scanner leads are well clear of ignition or other noise carrying lines.
4. Burner does not start up even with scanner removed from S1-S2.
   - Check control wiring, all limits and interlocks.
   - Replace control/amplifier.

FIGURE 4. UV SCANNER OUTLINE DIMENSIONS



WARNING: The leads from the UV1A, UV8A and UV90 Scanners to the control must be shielded to prevent electrical noise from generating a false flame signal to the control.

NOTICE

When Fireye products are combined with equipment manufactured by others and/or integrated into systems designed or manufactured by others, the Fireye warranty, as stated in its General Terms and Conditions of Sale, pertains only to the Fireye products and not to any other equipment or to the combined system or its overall performance.

WARRANTIES

FIREYE guarantees for *one year from the date of installation or 18 months from date of manufacture* of its products to replace, or, at its option, to repair any product or part thereof (except lamps, electronic tubes and photocells) which is found defective in material or workmanship or which otherwise fails to conform to the description of the product on the face of its sales order. **THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES AND FIREYE MAKES NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED.** Except as specifically stated in these general terms and conditions of sale, remedies with respect to any product or part number manufactured or sold by Fireye shall be limited exclusively to the right to replacement or repair as above provided. In no event shall Fireye be liable for consequential or special damages of any nature that may arise in connection with such product or part.

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PREFACE

This manual was assembled with the service person and technician in mind. Our objective was to give procedures and guidelines for efficient and successful fuel pump installation and service. Many technical manuals contain the necessary information; finding it is the problem.

This manual is divided into four major sections:

Sales-- What models to use and how they are identified

Installation-- How to install the model selected

Piping-- Good practice piping installations and how to cope with non-recommended piping found in previous installations.

Service-- How to test and service new and existing installations.

We have addressed situations found in the field which are not good practice, but since they have been in use, we must contend with them.

If you have problems which you cannot answer, please contact Suntec's field service department at 800-367-7116. We, at Suntec, appreciate your support and look forward to many more years of working with you.

TABLE OF CONTENTS

LINE SIZING

SERVICE

SUNTEC PERFORMANCE-PROVEN FUEL UNITS AND VALVES

. . . for residential and commercial applications

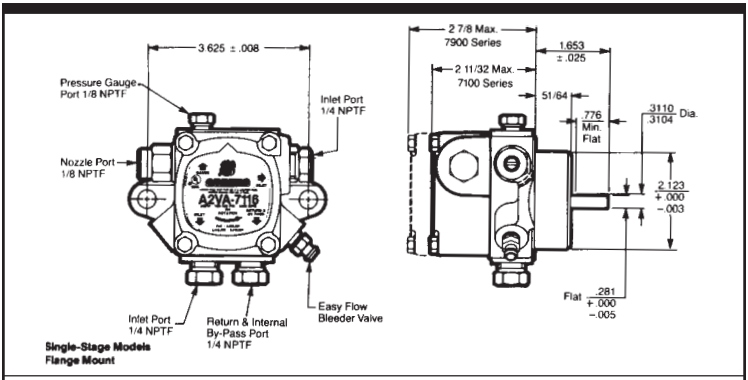
SUNTEC, THE INDUSTRY LEADERS • *BUILT ON OUR COMMITMENT*

Knowing the industry's needs and responding to them with the right products and services is one of the responsibilities of leadership. Over the years, Suntec has been committed to being involved, asking questions, listening and providing answers. Today, as the industry leaders, our involvement is as strong as ever. We still work hard to earn your trust in us as the experts in our field. You shouldn't have to settle for less.

MODEL A-7000 • *SINGLE-STAGE FUEL UNITS*

- Single-pipe installations to 6" hg. vacuum
- Two-pipe installations to 12" hg. vacuum
- Lift or gravity feed applications with 10 psi maximum inlet/return pressure
- Choice of 1725, 2850, 3450 rpm
- Suitable for no. 2, no. 1 fuel oil, or kerosene
- Mounting in any position
- Factory-set at 100 psi
- Adjustable range 100-150 psi at 3450 rpm, 100-135 psi at 1725 rpm. Models available to 200 and 300 psi.

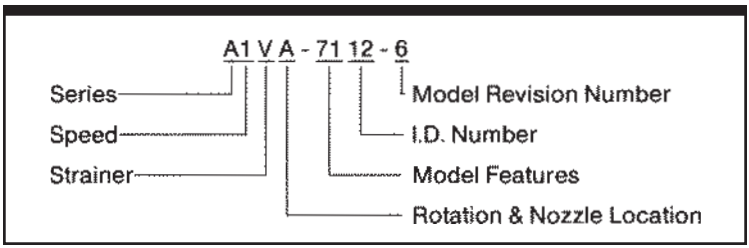
SPECIFICATIONS/ORDERING INFORMATION*



Model Number	RPM	Rotation[1]	Nozzle Port Location[1]	Strainer & Nozzle Rating at 100 psi	Special Features
A1VA-7112	1725	R.H.	R.H.	3 gph	--
A1VB-7113	1725	R.H.	L.H.	3 gph	--
A1VC-7114	1725	L.H.	L.H.	3 gph	--
A1VD-7741	1725	LH.	R.H.	3 gph	3-bolt mtg. hub
A1YA-7912	1725	R.H.	R.H.	7 gph	--
A2VA-7142	2850	R.H.	R.H.	2.25 gph	--
A2VA-7116	3450	R.H.	R.H.	3 gph	--
A2VB-7117	3450	R.H.	L.H.	3 gph	--
A2VC-7118	3450	L.H.	L.H.	3 gph	--
A2VA-7416	3450	R.H.	R.H.	3 gph	Solenoid dumping fuel unit
A2YA-7916	3450	R.H.	R.H.	7 gph	3 gph at 200 psi
A2YA-7430	3450	R.H.	R.H.	7 gph	Solenoid dumping fuel unit
A2VD-7519	3450	L.H.	R.H.	3 gph	Solenoid dumping fuel unit 32mm hub
A2RA-7736	3450/1725	R.H.	R.H.	2.5/2.5** gph	Waste oil application
A2RA-7737	3450/1725	R.H.	R.H.	2.5/2.5** gph	10-20 psi waste oil application
A1RA-7738	1725	R.H.	R.H.	2.5	Waste oil application

*Also apply to "-6" model numbers (shown on fuel unit).
For example: "7916-6," etc. [1]Viewed from shaft end.
**Use gage port for rated flow @ 1725 rpm, no cut off.
Note: All ports shown in diagram are reversed for left-hand nozzle fuel units.

Typical Model Number Nomenclature (Model A & Model B):*

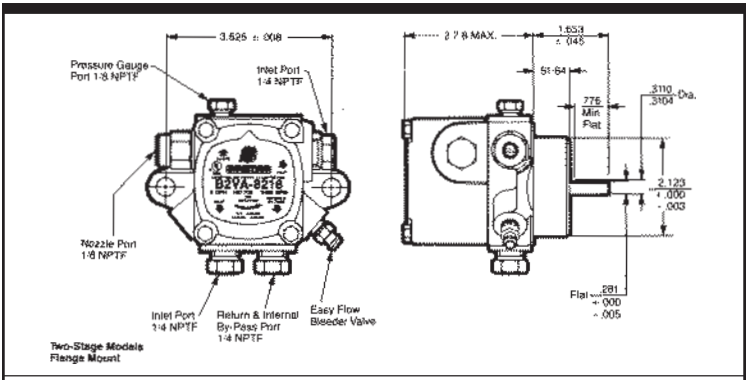


*The model number appears on the fuel unit label.

MODEL B-8000 • *TWO-STAGE FUEL UNITS*

- Two- pipe installations up to 17" hg. vacuum
- Lift or gravity feed applications with 10 psi maximum inlet/return pressure
- Capacities to 7 gph, except boost pumps
- Factory-set at 100 psi
- Pressure adjustable from 100 to 150 psi at 3450 rpm, 100 to 135 psi at 1725 rpm. Models available to 200 and 300 psi
- Choice of 1725, 2850, 3450 rpm
- Suitable for no. 2, no. 1 fuel oil, or kerosene
- Mounting in any position except upside down.

SPECIFICATIONS/ORDERING INFORMATION*



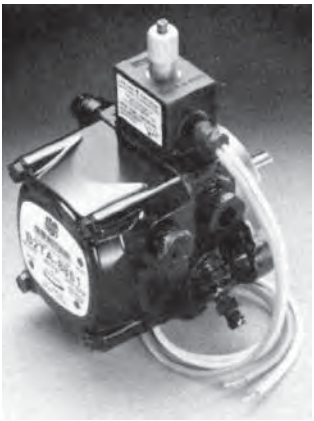
Model Number	RPM	Rotation[1]	Nozzle Port Location[1]	Strainer & Nozzle Rating at 100 psi	Special Features
B1VA-8212	1725	R.H.	R.H.	3 gph	--
B2VA-8216	3450	R.H.	R.H.	3 gph	--
B2YA-8916	3450	R.H.	R.H.	7 gph	3 gph at 200 psi
B2VA-8416	3450	R.H.	R.H.	3 gph	Solenoid dumping fuel unit
B2VA-8241	3450	R.H.	R.H.	--	Boost pump, 20 gph at 10-20 psi
B2VA-8242	2850	R.H.	R.H.	2.25 gph	--

*Also apply to "-8" model numbers (shown on fuel unit).
For example: "8212-6," etc.

[1]Viewed from shaft end.

MODEL B-8200 • *TWO-STAGE HIGH CAPACITY HIGH PRESSURE (NOT PICTURED) AND*
MODEL B-8800 • *TWO-STEP TWO-STAGE*

- Two-pipe installations up to 17" hg. vacuum
- Lift or gravity feed applications with 10 psi maximum inlet/return pressure
- Adjustable manual or automatic high/low firing
- High efficiency burner applications
- Capacities to 23 gph
- Pressure adjustable (100 to 200 psi low fire, 200-300 psi high fire)
- For no. 2 fuel oil. For other fuels, consult factory
- Two-bolt flange mounting in any position except upside down.



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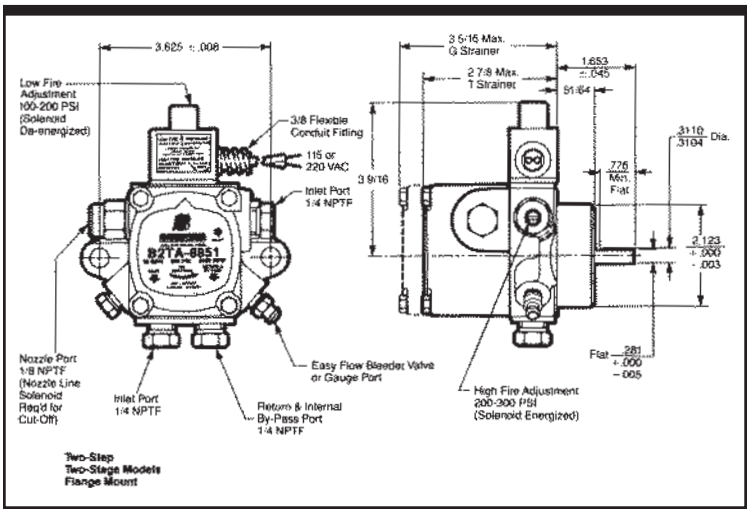


SPECIFICATIONS/ORDERING INFORMATION*

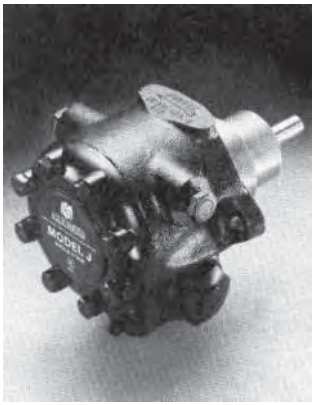
Model Number	RPM	Rotation[1]	Nozzle Port Location[1]	Strainer & Nozzle Rating at 300 psi
High-Capacity Units				
B2VA-8243	3450	R.H.	R.H.	3 gph[2]
B2TA-8245	3450	R.H.	R.H.	16 gph
B2TA-8248	3450	R.H.	R.H.	8 gph[3]
High-Capacity Units				
B2TA-8850	3450	R.H.	R.H.	10 gph
B2TA-8851	3450	R.H.	R.H.	16 gph
B2GA-8852	3450	R.H.	R.H.	23 gph

* Also apply to "-8" model numbers (shown on fuel unit).
For example: "8850-8," etc.

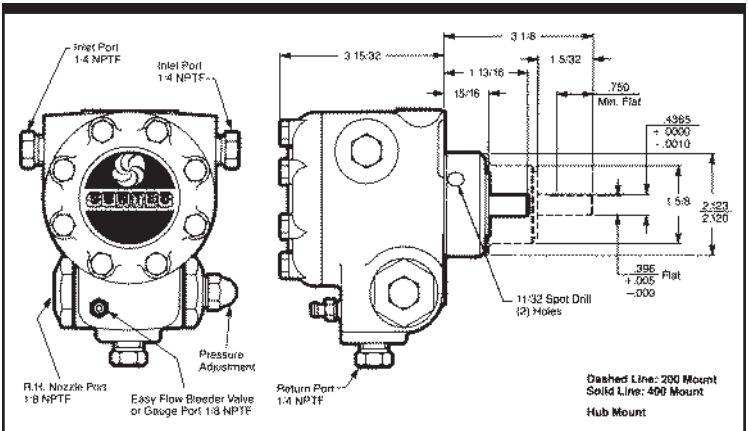
[1]Viewed from shaft end. [2]At 130 psi. [3]At 150 psi.

MODEL J • *SINGLE-STAGE FUEL UNITS*

- Single-pipe gravity feed installations
- Two-pipe lift installations to 12" hg. vacuum
- Lift or gravity feed applications with 10 psi maximum inlet/return pressure
- Capacities to 60 gph
- Six pressure options, 10 to 300 psi*
- For no. 4 and lighter fuel oils (gasoline and JP fuels, special)
- Hub and flange mounting in any position.



SPECIFICATIONS/ORDERING INFORMATION*



Model Number[1]	Piston Type	Maximum Firing Rate* (gph)			
		1725 rpm		3450 rpm	
		100 psi	300 psi[2]	100 psi	300 psi[3]
JJ2	Std.	--	--	3	--
JA2	Std.	--	--	7	--
JB2	Std.	--	--	10	--
J2	Std.	3	--	16	--
J3	Std.	7	--	20	--
	G	8	--	24	10
	N	9	--	26	14
J4	Std.	11	--	30	17
	N	13	--	33	23
J5	Std.	17	--	40	28
	N	19	5	46	32
J6	Std.	24	7	55	40
	N	26	10	60	45

*Special Pressure Spring Choices:

A = 20-40 psi C = 150-300 psi E = 10-20 psi

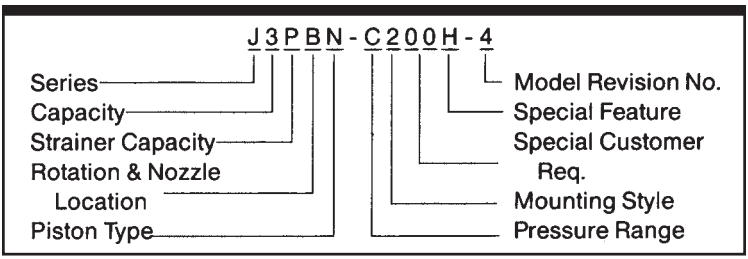
B = 75-200 psi D = 40-80 psi

[1]Do not adjust J2 and 3450 rpm - only models (JA, JB, JJ) to higher than 100 psi.

[2]Requires C spring (100-300 psi range).

[3]Requires C spring and hardened gear.

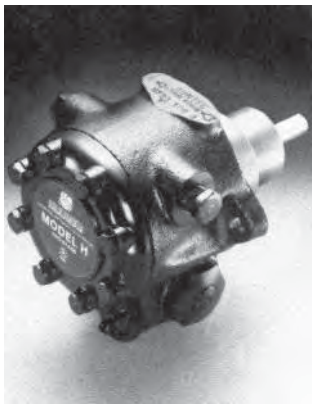
Typical Model Number Nomenclature (Model J & Model H):*



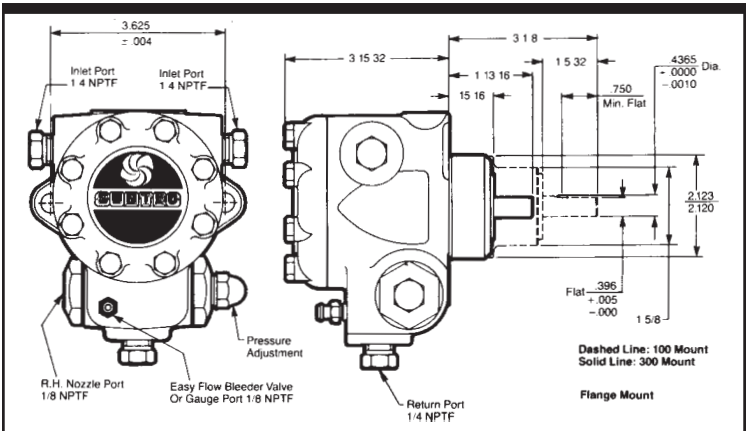
*The model number appears on the top of the fuel unit.

MODEL H • *TWO-STAGE FUEL UNITS*

- Two-pipe high lift installations to 17" hg. vacuum
- Capacities to 83 gph
- Lift or gravity feed applications with 10 psi maximum inlet/return pressure
- Six pressure options, 10 to 300 psi*
- For no. 4 and lighter fuel oils (gasoline and JP fuels, special)
- Three hub and flange mounting options: Model H may be mounted with the valve horizontal at either the top or bottom. Valve may be mounted vertical provided the adjusting screw is at the top of CW rotation--left nozzle and CCW rotation--right nozzle models, or adjusting screw at bottom on CW rotation--right nozzle and CCW rotation--left nozzle models.



SPECIFICATIONS/ORDERING INFORMATION*



Model Number[1]	Piston Type	Maximum Firing Rate* (gph)			
		1725 rpm		3450 rpm	
		100 psi	300 psi[2]	100 psi	300 psi[3]
HA2	Std.	--	--	7	--
H2	Std.	3	--	16	--
H3	Std.	7	--	20	--
	G	8	--	24	10
	N	9	--	26	14
H4	Std.	11	--	30	17
	N	13	--	33	23
H5	Std.	17	--	40	28
	N	19	5	46	32
H6	Std.	24	7	55	40
	N	26	10	60	45
H7	Std.	40	17	--	--
	N	42	20	--	--
H8	Std.	80	47	--	--
	N	83	55	--	--

*Special Pressure Spring Choices:

A = 20-40 psi C = 150-300 psi E = 10-20 psi

B = 75-200 psi D = 40-80 psi

[1]Do not adjust H2 and 3450 rpm - only models (HA, HB, HH) to higher than 110 psi.

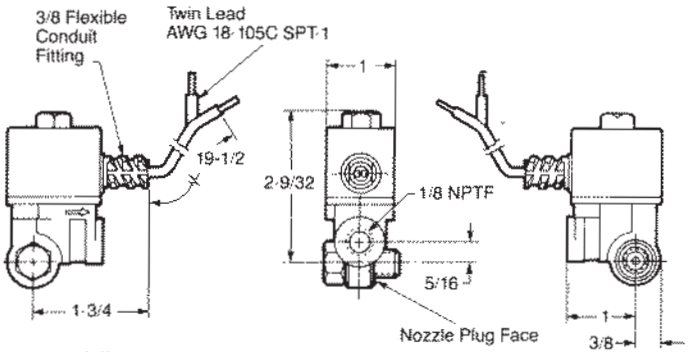
[2]Requires C spring (100-300 psi range).

[3]Requires C spring and hardened gear.

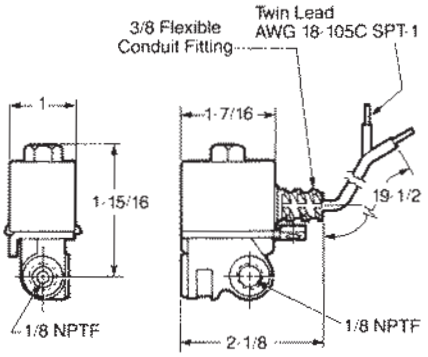
MODEL R & C • *SHUT-OFF VALVES*

- For instantaneous, redundant cutoff of fuel supply
- Provides back-up protection
- Closes when current to solenoid coil is interrupted
- Blocks oil flow to nozzle
- Delay or non-delay opening
- Two model choices: Model R mounts to fuel unit; Model C mounts to burner or other remote locations
- Easy installation
- Use with any fuel unit rated up to 16 gph
- Suitable for no. 2, no. 1 fuel oil or kerosene
- Mount in any position.

SPECIFICATIONS/ORDERING INFORMATION



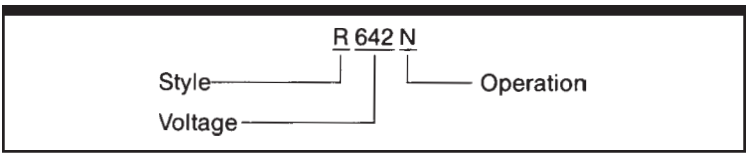
Model R



Model C

Valve Model No.		Opening Response	Voltage (50/60 Hz.)	Maximum Operating Pressure	Color Code	
Pump Mount	Burner Mount				Coil	Lead Wires
R642N	C642N	Non-Delay	115	300 psi	Black	Orange/White
R641D	C461D	Delay	115	150 psi	Grey	Orange/White
R753N	C753N	Non-Delay	220	300 psi	Black	Red/White
R261N	C261N	Non-Delay	24	300 psi	Green	Blue/Brown/ Yellow & Green

Typical Model Number Nomenclature (Model R & Model C):*



*The model number appears on the valve label.

FOR A-7000 SINGLE-STAGE AND B-8000 TWO-STAGE FUEL UNITS
MODELS A1 & B1
FOR 1725 RPM, BLACK LABEL
MODELS A2 & B2
FOR 3450 RPM, WHITE LABEL

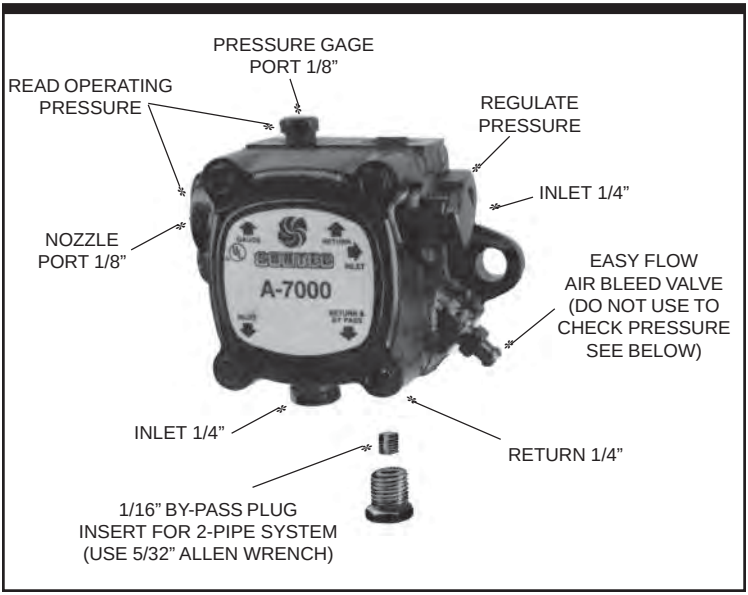


FIGURE 1

GENERAL INFORMATION • *ALL SYSTEMS*

IMPORTANT INFORMATION Long or oversized inlet lines may require the pump to operate dry during initial bleeding period. In such cases, the priming may be assisted by injecting fuel oil into the pump gearset. Under lift conditions, oil lines and fittings must be air tight. To assure this, "pipe dope" may be applied to both the used and unused inlet and both return fittings. DO NOT USE TEFLON TAPE!! DO NOT USE COMPRESSION FITTINGS!!

MOUNTING POSITION Model "A" Single-Stage Fuel Unit may be mounted in any position. Model "B" Two-Stage Fuel Unit may be mounted in any position except upside down (1 /8" ports pointed down).

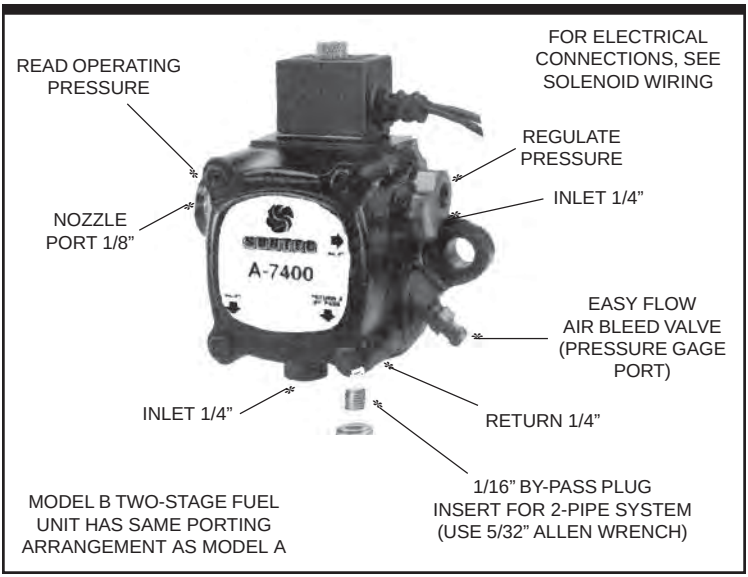


FIGURE 2

VACUUM CHECK A vacuum gage may be installed in either of the 1/4" inlet ports or in the 1/8" return port (on single-pipe installations), whichever is most convenient. The Model "A" pump should be used where the vacuum does not exceed 6" hg. single-pipe and 12" hg. two-pipe. The Model "B" should be used where vacuum does not exceed 17" hg. Remember, running vacuum is the total of all pressure drops (ΔP) in the system from tank to inlet of pump.

PRESSURE CHECK If a pressure check is made, use GAGE PORT OR NOZZLE PORT. DO NOT USE EASY FLOW BLEED VALVE PORT FOR THE 7000 SERIES. The easy flow bleed valve port contains pressure higher than operating pressure. Setting pump pressure with gage in the easy flow bleed valve port results in WRONG operating pressure. The 7400 is an exception (see Figure 2).

CUTOFF PRESSURE Average cutoff pressure for A and B fuel units is 80 psig. To check cutoff pressure, install pressure gage in nozzle port. Run burner for short period of time. Shut burner off. Gage shows cutoff pressure.

CAUTION

Pressurized or gravity feed installations must not exceed 10 P.S.I. on inlet line or return line at the pump. A pressure greater than 10 P.S.I. may cause damage to the shaft seal.

SOLENOID WIRING

DISCONNECT POWER SUPPLY BEFORE WIRING TO PREVENT ELECTRICAL SHOCK OR EQUIPMENT DAMAGE. Lead wires on these devices are long enough to reach the junction box on most burner installations. Wire solenoid in parallel with burner motor (see Figure 3). All electrical work should be done according to local and national codes. (Solenoid 115V, 0.1A, 60 Hz.)

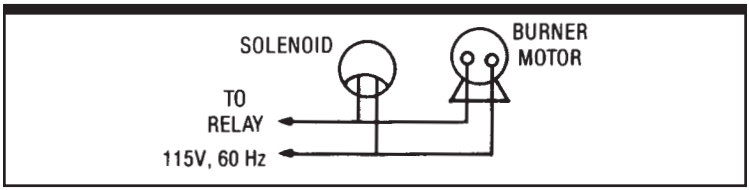


FIGURE 3

ONE-PIPE SYSTEM

DO NOT INSTALL BY-PASS PLUG! Connect inlet line to pump inlet. Start burner. Arrange primary burner control for continuous operation during purging. Open easy flow bleed valve 1 turn CCW. Bleed unit until all air bubbles disappear -- HURRIED BLEEDING WILL IMPAIR EFFICIENT OPERATION OF UNIT. Tighten easy flow bleed valve securely (Figure 4). For additional information, see Single-Pipe Installation Section, page III-1 of this manual.

The SUNTEC MODEL "A" - 70 FUEL UNIT may be installed ONE-PIPE with gravity feed or lift.

The maximum allowable lift is 8 feet (see Figure 4).

IMPORTANT: One-pipe installations must be absolutely airtight or leaks or loss of prime may result. Bleed line and fuel unit completely. **Bleed for 15 seconds after last air is seen from easy flow to be certain lines are air free.**

L=Line Length in Feet H=Head in Feet Q=Firing Rate in GPH

$$\text{3/8" Line } L = \frac{6 - .75H}{.0086\,Q} \qquad \text{1/2" Line } L = \frac{6 - .75H}{.00218\,Q}$$

If tank is above pump, change - to +. Fittings, valves, and filters will reduce total length allowed.

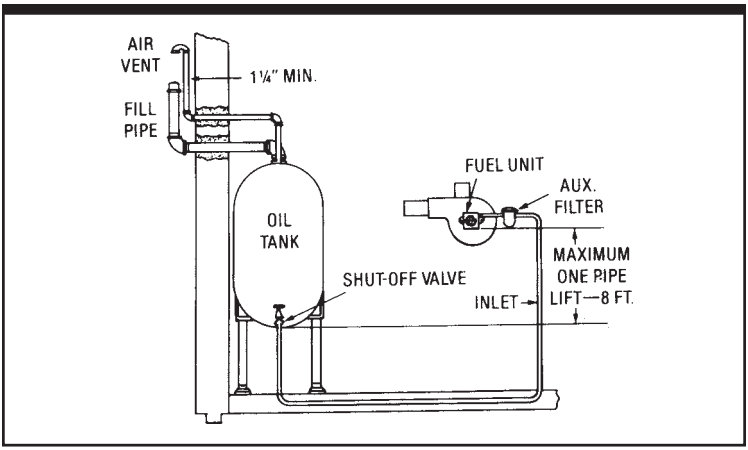


FIGURE 4

TWO-PIPE SYSTEM

REMOVE 1/16" BY-PASS PLUG FROM PLASTIC BAG ATTACHED TO UNIT. Remove 1/4" plug from return port. Insert by-pass plug (see Figure 1 or 2). Attach return and inlet lines. Start burner -- air bleeding is automatic. Opening easy flow air bleed valve will allow a faster bleed, if desired. Return line must terminate 3-4" above supply line inlet (see Figure 5). Failure to do this may introduce air into the system and could result in loss of prime. For additional information, see Two Pipe Installation Section, page III-3 of this manual.

Always terminate return line as shown in Figure 5. Line lengths include both vertical and horizontal lengths.

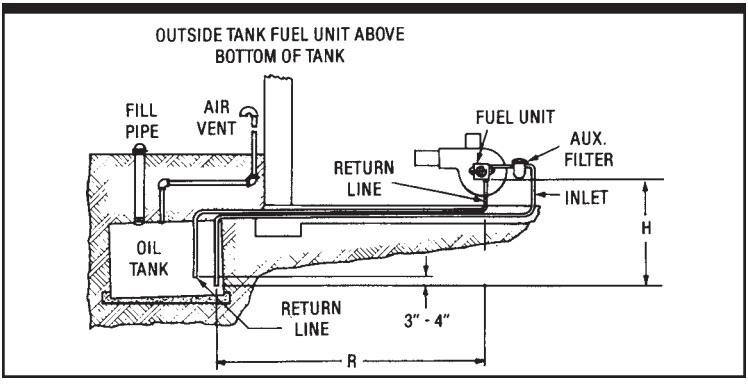


FIGURE 5

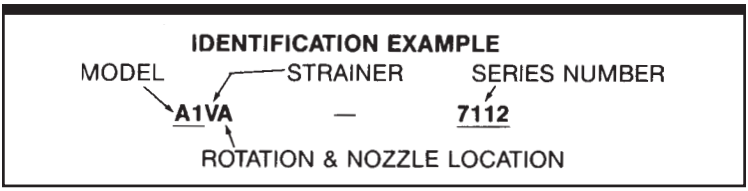
A. SINGLE-STAGE • TWO-PIPE MAXIMUM LINE LENGTH (H + R)

Lift "H" Figure 5	1725 RPM		3450 RPM			
	3/8" OD Tubing	1/2" OD Tubing	3/8" OD Tubing		1/2" OD Tubing	
	3 GPH	3 GPH	3 GPH	7 GPH	3 GPH	7 GPH
0'	86'	100'	84'	71'	100'	100'
1'	80'	100'	78'	66'	100'	100'
2'	75'	100'	73'	62'	100'	100'
3'	70'	100'	68'	57'	100'	100'
4'	64'	100'	63'	53'	100'	100'
5'	59'	100'	57'	48'	100'	100'
6'	54'	100'	52'	44'	100'	100'
7'	49'	100'	47'	39'	100'	100'
8'	43'	100'	42'	35'	100'	100'
9'	37'	100'	36'	31'	100'	100'
10'	32'	100'	31'	27'	100'	100'
11'	26'	100'	26'	22'	100'	87'
12'	21'	85'	21'	18'	83'	70'
13'	--	63'	--	--	62'	52'
14'	--	42'	--	--	41'	35'

B. TWO-STAGE • TWO-PIPE MAXIMUM LINE LENGTH (H + R)

Lift "H" Figure 5	1725 RPM				3450 RPM			
	3/8" OD Tubing		1/2" OD Tubing		3/8" OD Tubing		1/2" OD Tubing	
	3 GPH	7 GPH	3 GPH	7 GPH	3 GPH	7 GPH	3 GPH	7 GPH
0'	100'	91'	100'	100'	93'	80'	100'	100'
2'	100'	83'	100'	100'	85'	73'	100'	100'
4'	89'	75'	100'	100'	77'	66'	100'	100'
6'	80'	67'	100'	100'	69'	59'	100'	100'
8'	70'	59'	100'	100'	60'	52'	100'	100'
10'	61'	51'	100'	100'	52'	45'	100'	100'
12'	51'	43'	100'	100'	44'	38'	100'	100'
14'	41'	35'	100'	100'	36'	31'	100'	100'
16'	32'	27'	100'	100'	27'	24'	100'	93'
18'	22'	--	88'	74'	--	--	76'	65'

PUMP USAGE IDENTIFICATION



A.		
Model	**Max. Nozzle Capacity (GPH) At 100 PSI**	**RPM**
A1V-7100	3	1725
A2V-7100	3	3450
A2V-7400	3	3450
A1Y-7900	7	1725
A2Y-7900	7	3450

B.		
Model	**Max. Nozzle Capacity (GPH) At 100 PSI**	**RPM**
B1V-8200	3	1725
B2V-8200	3	3450
B1Y-8900	7	1725
B2Y-8900	7	3450

Strainer Type	UL Strainer Rating (GPH)*
	#2 Fuel Oil
V	3
Y	7
T	16
G	23

Strainer	Type
A	RH/RH
B	RH/LH
C	LH/LH
D	LH/RH

*Maximum firing rate not to exceed maximum nozzle capacity or strainer rating, whichever is less. A greater firing rate requires a suitable external strainer.

ALL INSTALLATIONS SHOULD BE MADE IN ACCORDANCE WITH LOCAL AND NATIONAL CODES.

MODEL A SINGLE-STAGE TWO STEP
MODEL B TWO-STAGE, TWO-STEP
FUEL UNITS AND
MODEL B TWO-STAGE, HIGH-PRESSURE
FUEL UNITS

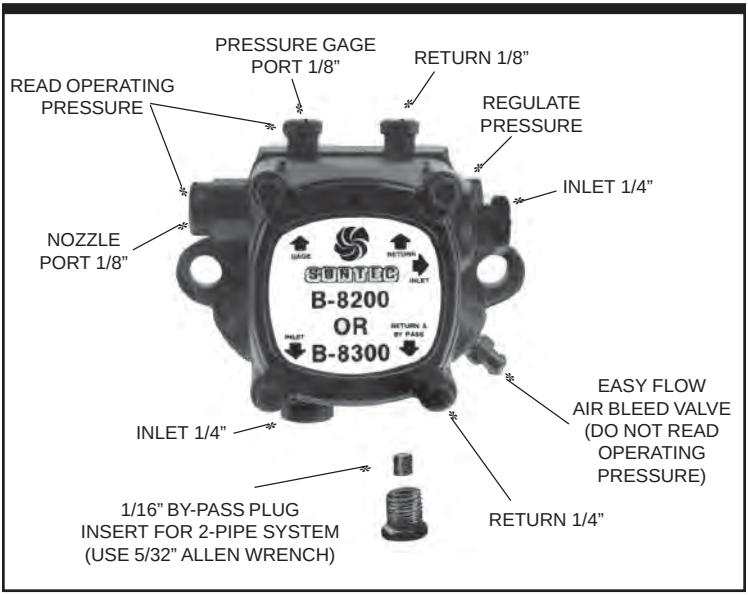


FIGURE 1

GENERAL INFORMATION • *ALL SYSTEMS*

IMPORTANT INFORMATION Long or oversized inlet lines may require the pump to operate dry during initial bleeding period. In such cases, the priming may be assisted by injecting fuel oil into the pump gearset. Under lift conditions, oil lines and fittings must be air tight. To assure this, "pipe dope" may be applied to both the used and unused inlet and both return fittings. DO NOT USE TEFLON TAPE!! DO NOT USE COMPRESSION FITTINGS!!

MOUNTING POSITION Model "A" Single-Stage Fuel Unit may be mounted in any position. Model "B" Two-Stage Fuel Unit may be mounted in any position except upside down (1/8" ports pointed down).

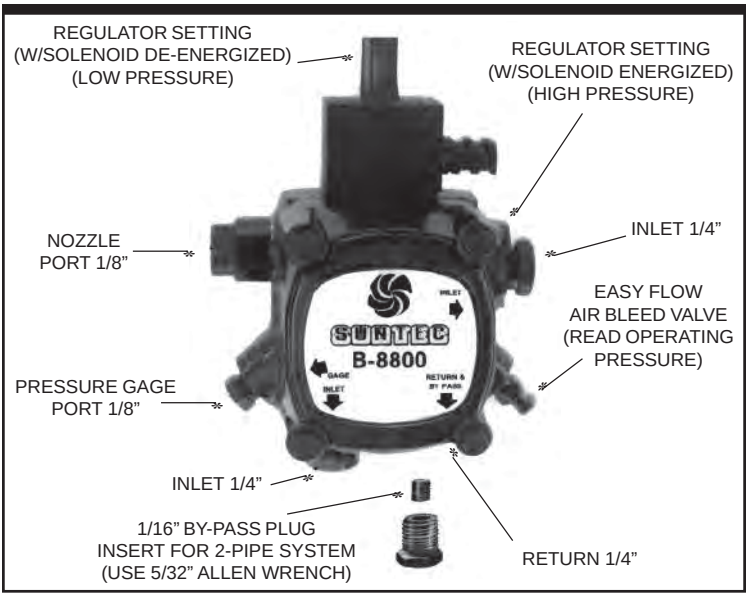


FIGURE 2

VACUUM CHECK A vacuum gage may be installed in either of the 1/4" inlet ports or in the 1/8" return port (on single-pipe installations), whichever is most convenient. The Model "A" pump should be used where the vacuum does not exceed 6" hg. single-pipe and 12" hg. two-pipe. The Model "B" should be used where vacuum does not exceed 17" hg. Running vacuum is the total of all pressure drops ($\triangle P$) from the tank to the inlet of the pump.

CAUTION

Pressurized or gravity feed installations must not exceed 10 P.S.I. on inlet line or return line at the pump. A pressure greater than 10 P.S.I. may cause damage to the shaft seal.

TWO-STEP PUMPS • *FIGURE 2*

MODEL SHOWN IS RIGHT-HAND ROTATION; ALL PORTS ARE REVERSED FOR LEFT-HAND ROTATION.

SOLENOID WIRING Refer to burner manufacturer's manual for instructions.

REGULATOR SETTING Install pressure gage in gage port (remove after adjustment); proper nozzle in nozzle line.

- Low Fire -- With solenoid de-energized, adjust low-fire regulator to desired pressure. (Range 100 to 200 PSI)
- High Fire -- With solenoid energized, adjust high-fire regulator to desired pressure. (Range 200 to 300 PSI)

NOTE: EXTERNAL CUTOFF VALVE IS REOUIRED.

ONE-PIPE SYSTEM • FIGURE 3

DO NOT INSTALL BY-PASS PLUG! Connect inlet line to pump inlet. Start burner. Arrange primary burner control for continuous operation during purging. Open easy flow bleed valve 1 turn CCW. Bleed unit until all air bubbles disappear -- HURRIED BLEEDING WILL IMPAIR EFFICIENT OPERATION OF UNIT. Tighten easy flow bleed valve securely. For additional information, see Single-Pipe Installation Section, page III-1 of this manual.

ONE-PIPE SYSTEM • MODEL A

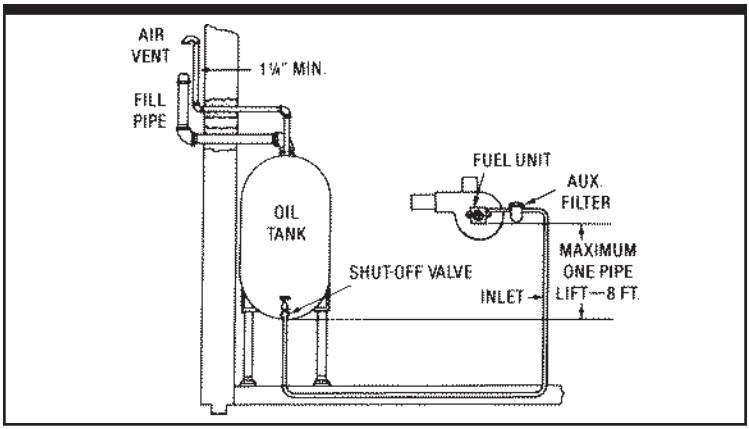


FIGURE 3

The SUNTEC MODEL “A”-70 FUEL UNIT may be installed ONE-PIPE with gravity feed or lift.

The maximum allowable lift is 8 ft. -- see Figure 3.

IMPORTANT: One-pipe installations must be absolutely airtight or leaks or loss of prime may result. Bleed line and fuel unit completely. **Bleed for 15 seconds after last air is seen from easy-flow to be certain lines are air free.**

L=Line Length in Feet H=Head in Feet Q=Firing Rate in GPH

$$\text{3/8" Line } L = \frac{6 - .75H}{.0086\ Q} \qquad \text{1/2" Line } L = \frac{6 - .75H}{.00218\ Q}$$

If tank is above pump, change - to +. Fittings, valves, and filters will reduce total length allowed.

TWO-PIPE SYSTEM • FIGURE 4

REMOVE 1/16" BY-PASS PLUG FROM PLASTIC BAG ATTACHED TO UNIT. Remove 1/4" plug from return port. Insert by-pass plug (see Figure 1 or 2), tighten plug. Attach return and inlet lines. Start burner -- air bleeding is automatic. Opening easy flow air bleed valve will allow a faster bleed if desired. Return line must terminate 3-4" above supply line inlet (see Figure 4). Failure to do this may introduce air into the system and could result in loss of prime.

For additional information, see Two-Pipe Installation Section, page III-3 of this manual.

TWO-PIPE SYSTEM • MODEL A AND B

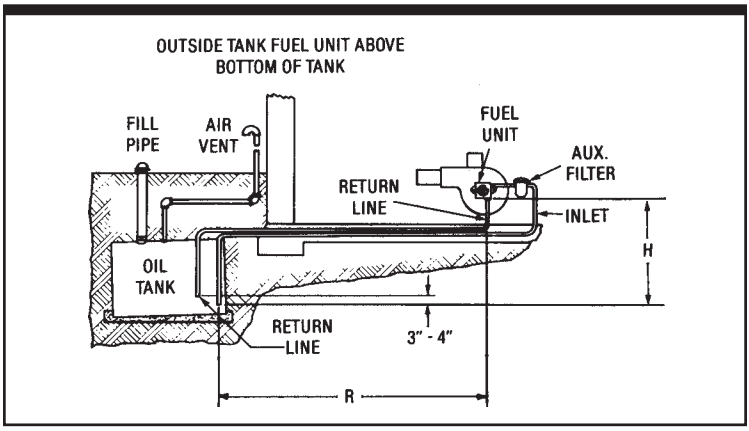


FIGURE 4

Always terminate return line as shown in Figure 4. Line lengths include both vertical and horizontal lengths.

ALL INSTALLATIONS SHOULD BE MADE IN ACCORDANCE WITH LOCAL AND NATIONAL CODES.

MODEL A SINGLE-STAGE TWO-STAGE • TWO-PIPE MAXIMUM LINE LENGTH (H + R)

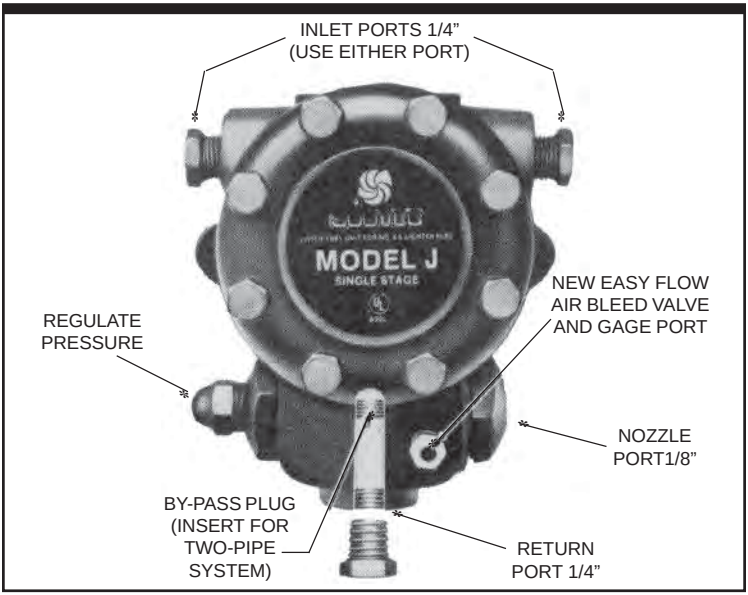
Lift "H" Figure 4	3450 RPM					
	3/8" OD Tubing		1/2" OD Tubing			5/8" OD Tubing
	10 GPH	16 GPH	10 GPH	16 GPH	23 GPH	23 GPH
0'	33'	29'	100'	100'	72'	100'
1'	31'	27'	100'	100'	66'	100'
2'	28'	25'	100'	98'	59'	100'
3'	25'	23'	100'	89'	53'	100'
4'	23'	20'	92'	80'	46'	100'
5'	21'	18'	82'	72'	40'	100'
6'	18'	16'	72'	63'	34'	100'
7'	16'	14'	62'	55'	27'	88'
8'	13'	12'	52'	46'	20'	72'
9'	11'	9'	43'	37'	14'	56'
10'	--	--	33'	29'	8'	39'

MODEL B TWO-STAGE TWO-STEP AND TWO-STAGE HIGH-PRESSURE • TWO-PIPE MAXIMUM LINE LENGTH (H + R)

Lift "H" Figure 4	3450 RPM					
	3/8" OD Tubing		1/2" OD Tubing			5/8" OD Tubing
	10 GPH	16 GPH	10 GPH	16 GPH	23 GPH	23 GPH
0'	70'	60'	100'	100'	100'	100'
2'	64'	55'	100'	100'	100'	100'
4'	58'	50'	100'	100'	100'	100'
6'	52'	44'	100'	100'	100'	100'
8'	45'	39'	100'	100'	100'	100'
10'	39'	34'	100'	100'	100'	100'
12'	33'	28'	100'	100'	94'	100'
14'	27'	23'	100'	91'	76'	100'
16'	21'	18'	81'	70'	59'	100'
18'	--	--	57'	49'	41'	100'

*Maximum firing rate not to exceed maximum nozzle capacity or strainer rating, whichever is less. A greater firing rate requires a suitable external strainer.

SUNTEC ROTA-ROLL® FUEL UNITS MODEL J SINGLE-STAGE AND MODEL H TWO-STAGE



GENERAL INFORMATION • *ALL SYSTEMS*

1. Oil lines should not be smaller than 1/2" O.D. copper tubing. See line sizing charts in this section or check line sizing on page III-7 of this manual.

2. Oil lines must be airtight. Check all connections and fittings. Do not use teflon tape. Do not use compression fittings.

3. During initial start-up or on a dry system, prime the pump with clean lubricating oil or motor oil.

4. Return line pressure must never exceed 10 PSI. Higher pressures can damage the seal or cause leaks.

5. **Mounting Position** -- J pumps can be mounted in any position. H pumps can be mounted with the piston chamber (regulating valve) horizontal at either the top or bottom.

ONE-PIPE SYSTEM

Do not install by-pass plug! Connect inlet line to pump inlet. Start burner. Open easy flow bleed valve one turn CCW. Bleed unit until all air bubbles disappear. Tighten easy flow bleed valve. Figures 1 and 2 show typical one-pipe installations. J and H pumps are not recommended for lifts (H) above two feet or 2 inches mercury inlet vacuum with the exception of the J2XXF pump.

For additional information, see Single-Pipe Installation Section, page III-1 of this manual. Figures 1 and 2 are typical one-pipe systems.

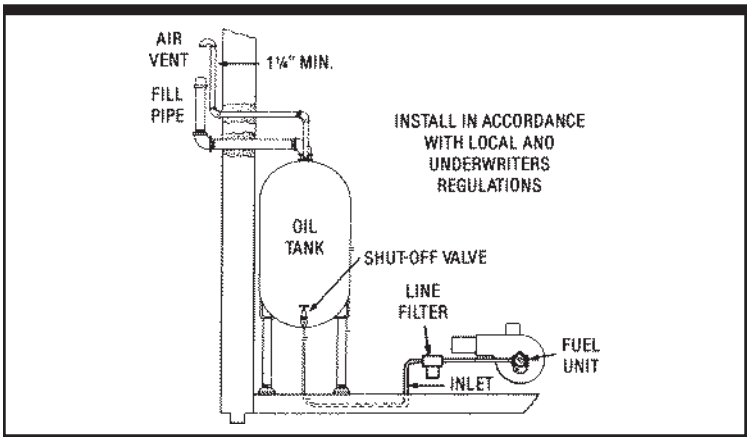


FIGURE 1

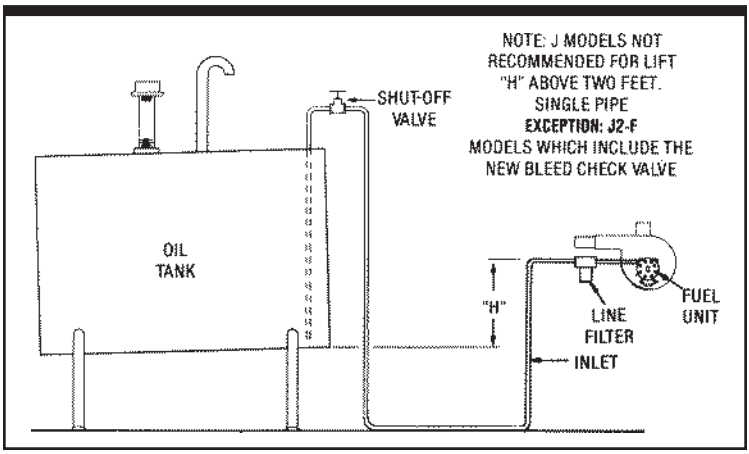


FIGURE 2

L=Line Length in Feet H=Head in Feet Q=Firing Rate in GPH

$$\text{3/8" Line } L = \frac{2\text{-}.75H}{.0086\ Q} \qquad \text{1/2" Line } L = \frac{2\text{-}.75H}{.00218\ Q}$$

If tank is above pump, change - to +. Fittings, valves, and filters will reduce total length allowed.

TWO-PIPE SYSTEM

Install by-pass plug inside the return port of the pump, using an allen wrench and making sure it is tight. (See illustration at the beginning of this section.) On a connected two-pipe, the fuel pump is selfpriming. Model J can be used two-pipe to 12-inch mercury vacuum; Model H can be used to 17-inch mercury vacuum. For additional information, see Two-Pipe Section, page III-3 of this manual. Figures 3 and 4 are illustrations of typical two-pipe installations.

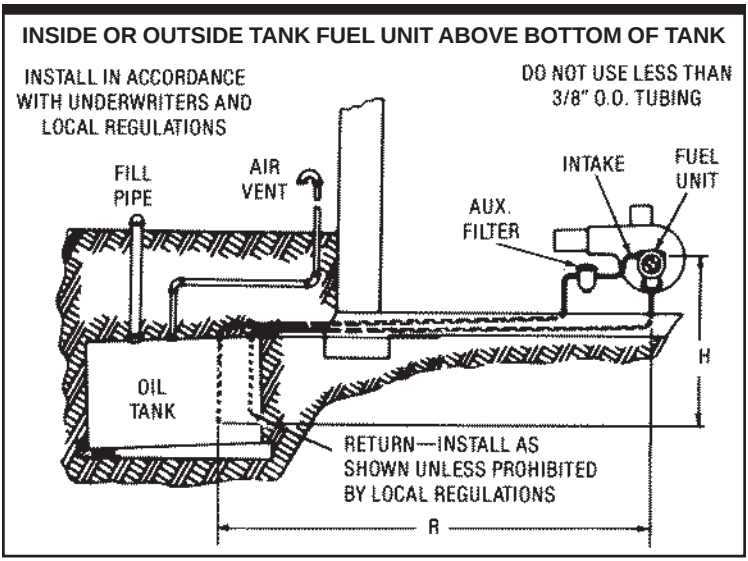


FIGURE 3

Maximum recommended horizontal run for suction or return. For conditions longer than the charts, please contact factory. Although there is a chart for 3/8" copper lines, it is recommended that you not use less than 1/2" copper tubing. On all installations, running vacuum and return line pressure should be checked before leaving any installation.

LIFT CONDITION • MAXIMUM LINE LENGTH (H + R)

Lift "H" Figure 3	3/8' O.D. Tubing (1725 RPM)									
	J_2	J_3	J_4	J_5	J_6	H_2	H_3	H_4	H_5	H_6
0'	78'	78'	63'	48'	37'	100'	90'	75'	65'	55'
2'	68'	68'	55'	42'	32'	100'	83'	70'	60'	51'
4'	58'	58'	47'	36'	28'	92'	76'	64'	55'	47'
6'	49'	49'	39'	30'	23'	84'	70'	58'	50'	42'
8'	39'	39'	32'	24'	18'	76'	63'	53'	45'	38'
10'	29'	29'	24'	18'	14'	68'	56'	47'	40'	34'
12'	19'	19'	16'	--	--	60'	49'	41'	36'	30'
14'	--	--	--	--	--	52'	43'	36'	31'	26'
16'	--	--	--	--	--	43'	36'	30'	26'	22'
18'	--	--	--	--	--	35'	29'	24'	21'	--

LIFT CONDITION • MAXIMUM LINE LENGTH (H + R)

Lift "H" Figure 3	1/2" O.D. Tubing (1725 RPM)											
	J_2	J_3	J_4	J_5	J_6	H_2	H_3	H_4	H_5	H_6	H_7	H_8
0'	100'	100'	100'	100'	100'	100'	100'	100'	100'	100'	100'	94'
2'	100'	100'	100'	100'	100'	100'	100'	100'	100'	100'	100'	87'
4'	100'	100'	100'	100'	100'	100'	100'	100'	100'	100'	100'	80'
6'	100'	100'	100'	100'	91'	100'	100'	100'	100'	100'	100'	73'
8'	100'	100'	100'	95'	73'	100'	100'	100'	100'	100'	93'	66'
10'	100'	100'	94'	71'	55'	100'	100'	100'	100'	100'	83'	59'
12'	77'	77'	62'	48'	36'	100'	100'	100'	100'	100'	73'	52'
14'	39'	39'	31'	24'	18'	100'	100'	100'	100'	100'	63'	45'
16'	--	--	--	--	--	100'	100'	100'	100'	87'	53'	38'
18'	--	--	--	--	--	100'	100'	97'	83'	70'	43'	31'

FIGURE 3

(Figure 3 continued on next page)

LIFT CONDITION • *MAXIMUM LINE LENGTH (H + R)*

Lift "H" Figure 3	1/2" O.D. Tubing (1725 RPM)							
	JJ_2	JA_2	JB_2	J_2	J_3	J_4	J_5	J_6
0'	100'	100'	100'	100'	100'	100'	92'	71'
2'	100'	100'	100'	100'	100'	100'	80'	62'
4'	100'	100'	100'	100'	100'	89'	69'	53'
6'	91'	91'	91'	91'	91'	75'	57'	44'
8'	73'	73'	73'	73'	73'	60'	46'	35'
10'	55'	55'	55'	55'	55'	45'	34'	27'
12'	36'	36'	36'	36'	36'	30'	23'	18'
14'	18'	18'	18'	18'	18'	--	--	--

LIFT CONDITION • *MAXIMUM LINE LENGTH (H + R)*

Lift "H" Figure 3	1/2" O.D. Tubing (3450 RPM)							
	HH_2	HA_2	HB_2	H_2	H_3	H_4	H_5	H_6
0'	100'	100'	100'	100'	100'	100'	98'	84'
2'	100'	100'	100'	100'	100'	100'	90'	77'
4'	100'	100'	100'	100'	100'	93'	81'	69'
6'	100'	100'	100'	100'	94'	83'	72'	62'
8'	100'	100'	100'	96'	83'	73'	64'	54'
10'	100'	97'	90'	83'	72'	63'	55'	47'
12'	89'	82'	76'	70'	60'	53'	46'	40'
14'	72'	67'	62'	57'	49'	43'	38'	32'
16'	56'	51'	48'	44'	38'	33'	29'	25'
18'	39'	36'	33'	30'	26'	23'	20'	--

FIGURE 3

(Figure 3 continued on next page)

LIFT CONDITION • *MAXIMUM LINE LENGTH (H + R)*

Lift "H" Figure 3	5/8" O.D. Tubing (3450 RPM)							
	JJ_2	JA_2	JB_2	J_2	J_3	J_4	J_5	J_6
0'	100'	100'	100'	100'	100'	100'	100'	100'
2'	100'	100'	100'	100'	100'	100'	100'	100'
4'	100'	100'	100'	100'	100'	100'	100'	100'
6'	100'	100'	100'	100'	100'	100'	100'	100'
8'	100'	100'	100'	100'	100'	100'	100'	98'
10'	100'	100'	100'	100'	100'	100'	96'	74'
12'	100'	100'	100'	100'	100'	83'	64'	49'
14'	51'	51'	51'	51'	51'	41'	32'	25'

LIFT CONDITION • *MAXIMUM LINE LENGTH (H + R)*

Lift "H" Figure 3	5/8" O.D. Tubing (3450 RPM)							
	HH_2	HA_2	HB_2	H_2	H_3	H_4	H_5	H_6
0'	100'	100'	100'	100'	100'	100'	100'	100'
2'	100'	100'	100'	100'	100'	100'	100'	100'
4'	100'	100'	100'	100'	100'	100'	100'	100'
6'	100'	100'	100'	100'	100'	100'	100'	100'
8'	100'	100'	100'	100'	100'	100'	100'	100'
10'	100'	100'	100'	100'	100'	100'	100'	100'
12'	100'	100'	100'	100'	100'	100'	100'	100'
14'	100'	100'	100'	100'	100'	100'	100'	89'
16'	100'	100'	100'	100'	100'	92'	80'	69'
18'	100'	100'	92'	85'	73'	64'	56'	48'

FIGURE 3

INSIDE OR OUTSIDE TANK FUEL UNIT BELOW BOTTOM OF TANK

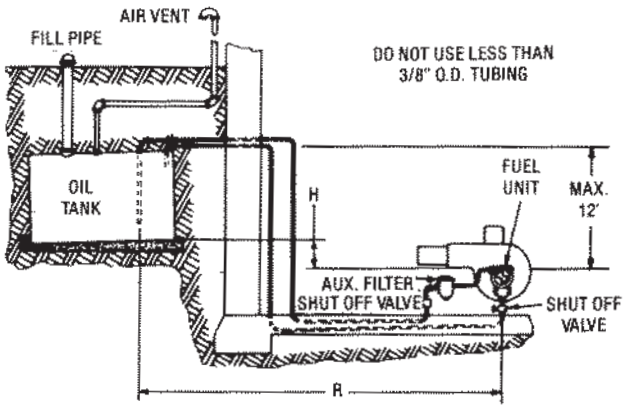


FIGURE 4

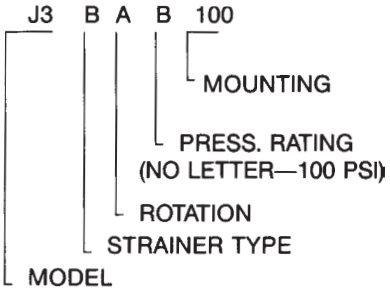
GRAVITY FEED • *MAXIMUM LINE LENGTH (H + R)*

Distance "H" Fig. 4	3/8" O.D. Tubing (1725 RPM)											
	J_2	J_3	J_4	J_5	J_6	H_2	H_3	H_4	H_5	H_6	H_7	H_8
0'	64'	64'	53'	41'	31'	75'	75'	70'	60'	51'	30'	20'
1'	69'	69'	57'	45'	34'	78'	78'	72'	62'	52'	31'	21'
2'	74'	74'	61'	48'	36'	80'	80'	75'	64'	54'	32'	22'

Distance "H" Fig. 4	3/8" O.D. Tubing (3450 RPM)															
	JJ_2	JA_2	JB_2	J_2	J_3	J_4	J_5	J_6	HH_2	HA_2	HB_2	H_2	H_3	H_4	H_5	H_6
0'	31'	31'	31'	31'	31'	25'	19'	15'	25'	25'	25'	25'	25'	23'	20'	17'
1'	33'	33'	33'	33'	33'	27'	21'	16'	26'	26'	26'	26'	26'	25'	22'	18'
2'	35'	35'	35'	35'	35'	29'	23'	17'	27'	28'	28'	28'	29'	26'	23'	19'

Distance "H" Fig. 4	1/2" O.D. Tubing (3450 RPM)															
	JJ_2	JA_2	JB_2	J_2	J_3	J_4	J_5	J_6	HH_2	HA_2	HB_2	H_2	H_3	H_4	H_5	H_6
0'	100'	100'	100'	100'	100'	99'	77'	59'	100'	100'	100'	100'	100'	94'	81'	69'
1'	100'	100'	100'	100'	100'	100'	83'	63'	100'	100'	100'	100'	100'	99'	85'	72'
2'	100'	100'	100'	100'	100'	100'	89'	68'	100'	100'	100'	100'	100'	100'	89'	76'

PUMP USAGE IDENTIFICATION • EXAMPLE



Strainer Type	UL Strainer Rating (GPH)*
	#2 Fuel Oil
B	7
P	Unlimited

J PUMP

Model	Max. Nozzle Capacity (GPH) at Rated Pressure		Rated Pressure (PSI)
	1725 RPM	3450 RPM	
JA2B	0	7	100
JB2B	0	10	100
JJ2B	0	3	100
J2B	3	16	100
J2BF	3	16	100
J3B	7	20	100
J3B-B	0	14	200
J3P-B	0	14	200
J4P	10	30	100
J5B	16	40	100
J5P	16	40	100
J6B-B	15	50	200
J6B	20	55	100
J6B-C	7	40	300
J6K	20	55	100

H PUMP

Model	Max. Nozzle Capacity (GPH) at Rated Pressure		Rated Pressure (PSI)
	1725 RPM	3450 RPM	
HA2B	0	7	100
HA2P	0	7	100
HH2B	0	3	100
H2B	3	16	100
H2P	3	16	100
H3B-B	0	14	200
H3B	7	20	100
H3B-C	0	7	300
H3P	7	20	100
H3P-B	0	14	200
H3P N-C	0	14	300
H4P-C	0	16	300
H4P	10	30	100
H4P N-C	15	20	300
H5P	16	40	100
H6B-C	7	40	300
H6P	20	55	100
H6P-C	7	40	300
H6P N-C	10	45	300
H7P-B	30	80	200
H7P	40	N/A	100
H8P	80	N/A	100
H8P N-C	55	N/A	300

*Maximum firing rate not to exceed maximum nozzle capacity or strainer rating, whichever is less. A greater firing rate requires a suitable external strainer.

WASTE OIL PUMPS

Waste oil pumps are designed to supply oil up to 1500 centistokes to remote tanks or heaters.

Line sizing listed below is calculated for multi-weight oils such as 10W-30W maintained at 32◦F minimum, and straight-weight oils such as 40W, 50W, 90W and heavier gear lubes maintained at 50◦F minimum.

Pump Model No.	RPM	Delivery Pressure	Flow GPH	Maximum Operating Vacuum	Horsepower	
					<1000CST	>1000CST
J3NBN-A132B	1725	20-40 psi	18 Max.	20 In. Hg.	1/6 HP	1/4 HP
A2RA-7736	1725	30 psi**	2.5 GPH	*	1/8 HP	1/8 HP
	3450	0-100 psi	2.5 GPH	*	1/7 HP	1/7 HP
A2RA-7737	1725	10-20 psi	2.5 GPH	*	1/8 HP	1/8 HP
	3450	10-20 psi	2.5 GPH	*	1/7 HP	1/7 HP
A1RA-7738	1725	100-150 psi	2.5 GPH	*	1/8 HP	1/8 HP

*20 In. Hg. for fuels more viscous than #2 fuel oil; 10 In. Hg. for #2 fuel oil and lighter.
**Use alternate nozzle port.

INLET OR SUPPLY LINES

Pump Model Number	Inlet Line Size I.D.	Inlet Line (L) Maximum
J3NBN-A132B	3/4 in.	20 ft.
J3NBN-A132B	1 in.	60 ft.
A2RA-7736 (7737, 7738)	1/2 in.	20 ft.
A2RA-7736 (7737, 7738)	3/4 in.	90 ft.

Waste oil pumps are designed for one-pipe or single-line installation. Do not install the by-pass plug. Do not use teflon tape. Use J.I.C. flare or pipe fittings only. Do not exceed 10 psi (manufacturer) or 3 psi (NFPA) when supplying to inlet of pumps. It can cause seal damage.

FILTERS

Waste oil pumps have an internal secondary 30 x 30 mesh strainer. An external primary 50 x 50 mesh strainer is required. This is supplied by the burner/furnace manufacturer. For transfer systems, this must be supplied by installer/user.

TYPICAL TANK INSTALLATIONS

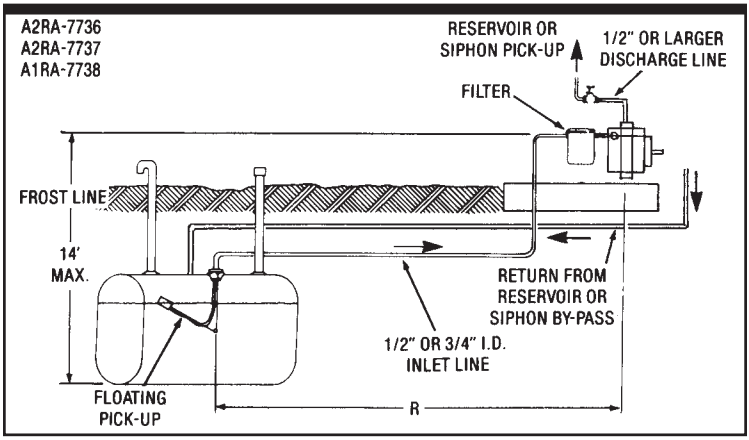


FIGURE 1 TYPICAL TANK INSTALLATION

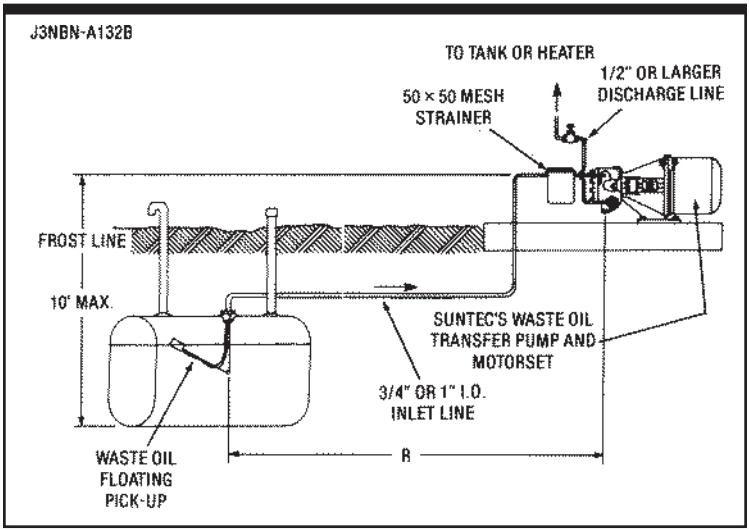


FIGURE 2 TYPICAL TANK INSTALLATION

Floating pickups are manditory for all waste oil systems. They must be a comparable line size with the rest of the inlet line.

If ambient temperatures to oil supply lines are lower than recommended, strip heaters should be installed.

PUMP CONNECTIONS

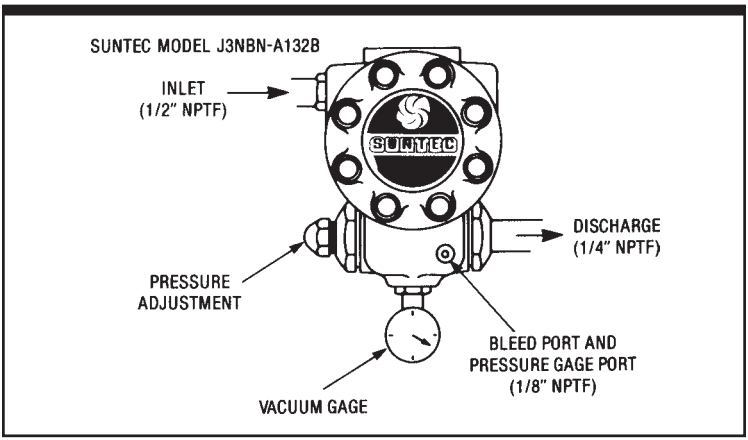


FIGURE 3

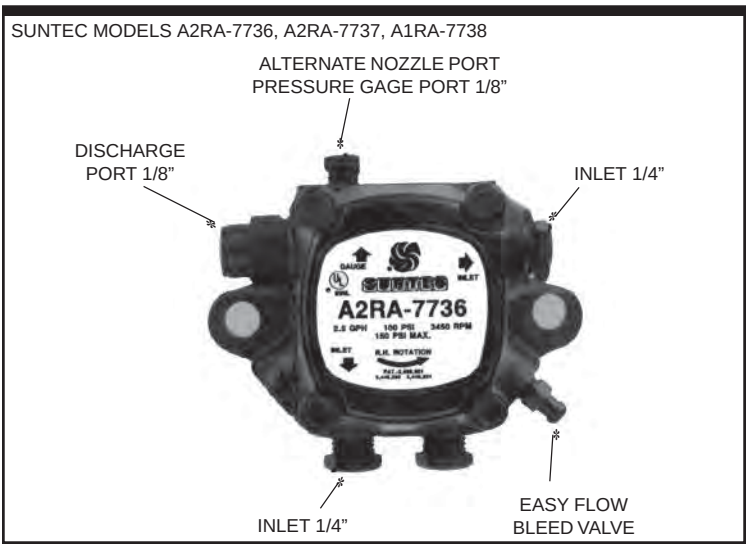


FIGURE 4

Install a vacuum gage in the inlet line close to the pump or in an unused inlet port. During operation, vacuum must not exceed the operating vacuum previously listed in this section.

PRIMING PROCEDURE

It is advisable on initial start-up to prefill the pump with clean, room temperature oil through the inlet port. Start pump and open bleed valve. Bleed pump for several minutes or until air-free oil is observed flowing from bleed port.

BOOST PUMPS
LIFT PUMPS
TRANSFER PUMPS
CENTRAL SYSTEMS

It is easier to push fuel oil to a given location than to pull it to the same location. This is easily understood when you consider the forces available. Fuel oil starts to separate or boil at vacuum levels as low as 10 in. hg. This is equivalent to a pressure differential of 4.9 psi. If you push the oil, you have pressure differentials of up to 300 psi available with no separation or boiling of the oil. Simplified, this means that having the pump lift oil, you are limited to about 15 feet of vertical lift. With a pressure of only 100 psi, the oil can be pushed or pumped up more than 200 feet.

IMPORTANT POINTS TO REMEMBER:

1 . A boost pump is a fuel oil pump subject to the same restrictions as any other fuel pump.
2. Install a boost pump as close to the supply of fuel oil as economically and physically possible.
3. All burner pumps being supplied by a boost pump should be installed single-pipe, even if they are two-stage pumps.

MODELS AND SELECTIONS

BOOST PUMP

Item		Includes Pump Model	Pump Rotation (from shaft end)	Delivery -- GPH @ RPM
Complete Boost Pump Assembly: (Including Motor)	BB-1020M BH-1030M BH-1070M	B2VA-8241-5 H3BA-E100B H6BA-E100B	R.H. R.H. R.H.	20 30 70
Boost Pump Assembly Less Motor	BB-1020R BH-1030R BH-1070R	B2VA-8241-5 H3BA-E100B H6BA-E100B	R.H. R.H. R.H.	20 30 70
Pressure Switch		P/N 128117	40VA & 150 psi Max.	
Adapter for 48N Motor		P/N 134462		

Boost pump assemblies are supplied with or without drive motors. The pump has an internal valve regulator (standard 10-20 psi range). The valve regulates pressure and provides a check against loss of head during shut downs. This eliminates the need for an external check valve. Standard assemblies are capable of pushing oil to 35 feet vertical height. For higher applications, a simple spring change can meet your specific requirements.

To select the correct boost pump, find the total firing rate of all the burners being supplied and select a GPH rating higher.

Example 1:

We have four burners with the following nozzle capacities or firing rates:

1 = .8 GPH
2 = .75 GPH
3 = 1.35 GPH
4 = 2.25 GPH

Total = 5.15 GPH required

Select a BB1020M which will supply 20 GPH.

Remember: The firing rates are determined by the nozzle size and pressure of the burner pump.

Example 2:

We have five burners with the following firing rates:

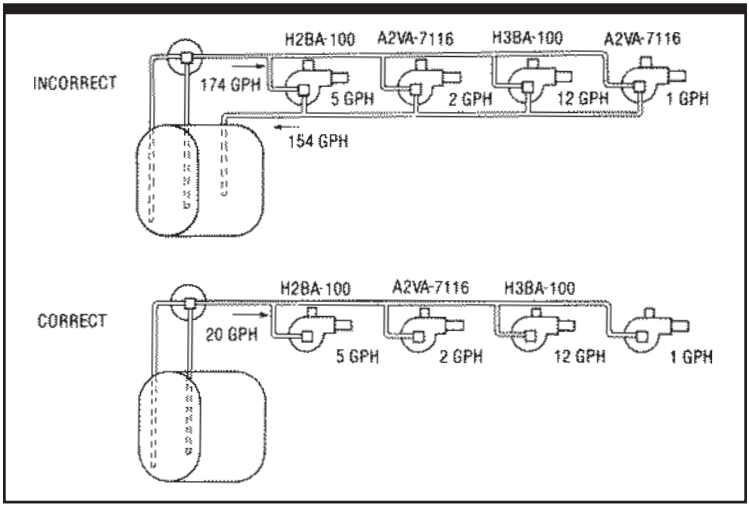
1 =	1. 5	GPH Nozzle @ 150 psi =	1. 8	GPH
2 =	3. 0	GPH Nozzle @ 300 psi =	5. 2	GPH
3 =	12. 0	GPH Nozzle @ 100 psi =	12. 0	GPH
4 =	5. 0	GPH Nozzle @ 125 psi =	5. 6	GPH
5 =	1. 25	GPH Nozzle @ 100 psi =	1. 25	GPH
		Total =	25. 85	GPH

Select a BH1030 which will supply 30 GPH.

Remember:

1. The boost pump is installed two-pipe with a by-pass plug installed and a return line.
2. The burner pumps are installed single-pipe, no by-pass plug installed and no return line. If a pump is installed two-pipe, its return line will demand its gearset capacity. If you had the smallest pump made, this would be 20 GPH. Installed single-pipe, the pump only demands its firing rate which is determined by the size of the nozzle in the burner.

Example:



INSTALLATION INSTRUCTIONS

Note: Install in accordance with the National Board of Fire Underwriters' requirements, local codes, and ordinances where applicable.

INLET OR SUCTION SIDE OF BOOST PUMP:

Figure 1 illustrates the installation of the inlet or suction side of the boost pump and its return line. Boost pumps should be installed two-pipe for air removal and self-priming. (Two-pipe requires installation of the by-pass plug for proper operation.) In Figure 1, "H" is the vertical lift from the bottom of the tank to the center line of the boost pump. "R" is the horizontal run or distance in feet from the tank to the boost pump.

Table 1 gives limits not to exceed in the installation of the inlet line to the boost pump.

PRESSURE OR SUPPLY SIDE:

There are two common systems used: the loop system and the pressurized system. Use of an auxiliary tank is a form of the loop system. There are other piping configurations which are not recommended, but are in use, and will be discussed.

LOOP SYSTEM:

Figure 2 illustrates a single-loop system. It offers the advantage of only needing to keep the manifold full of oil supplied at a rate greater than the total firing rate of all the burners being supplied by the system. Table

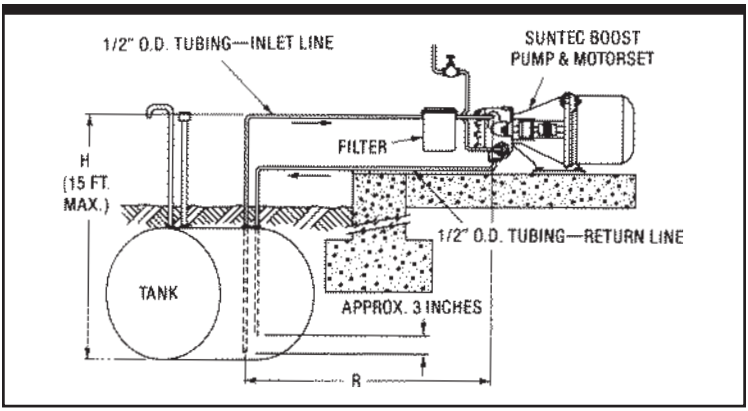


FIGURE 1 LOW PRESSURE SIDE INSTALLATION

Line Size		1/2" O.D. Tubing			5/8" O.D. Tubing			1/2" Pipe		
Lift		0-7'	10'	15'	0-7'	10'	15'	0-7'	10'	15'
Pump Model	B	100'	100'	100'						
	H3	64'	49'	24'	100'	100'	65'	100'	100'	100'
	H6	44'	34'	17'	100'	95'	48'	100'	90'	65'

TABLE 1 MAXIMUM INLET LINE LENGTH

2 lists the maximum horizontal runs not to be exceeded. These are calculated for standard boost pumps with the 10-20 psi spring. For higher boosts or longer runs, call the factory and get prompt help to install your system.

FOR A TROUBLE-FREE LOOP SYSTEM, USE THE FOLLOWING GUIDELINES:

1. The manifold is to be above all the pumps being supplied.
2. The manifold should be level at worst case. A slight rise in the system will aid in air-purging.
3. A 2-ft. riser or kick at the end of the run will insure the manifold fills.
4. A large return line is necessary to prevent siphoning of the manifold and/or overflowing of the vent.
5. Pumps on burners supplied by the boost pump should be connected or installed single-pipe. No by-pass plug and no return lines on the burners.

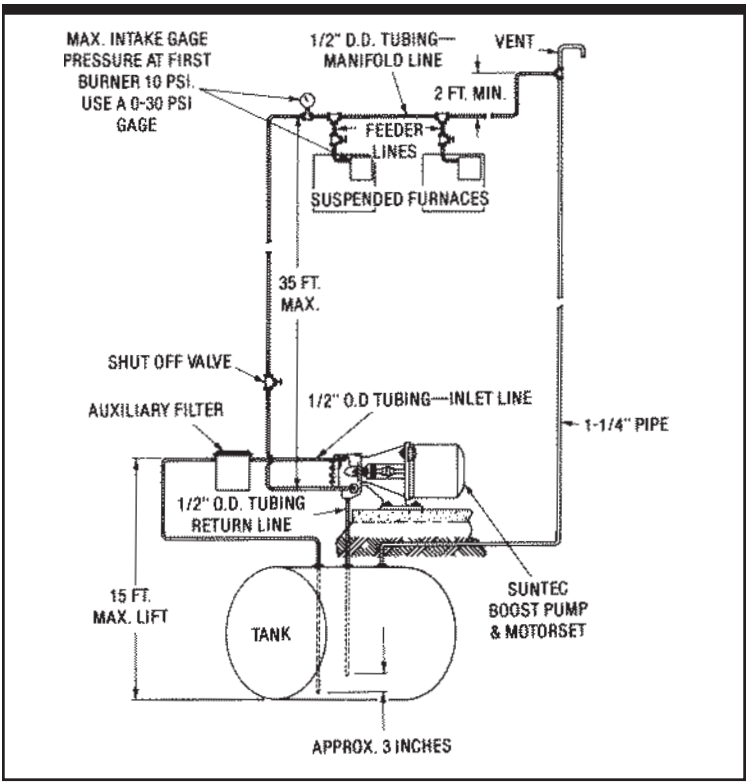


FIGURE 2 LOOP SYSTEM INSTALLATION

Boost Pump	1/2" Tube	1/2" Pipe	3/4" Pipe
B	300'	500'	2500'
H3	175'	300'	1800'
H6	50'	100'	600'

*TABLE 2 MAXIMUM HORIZONTAL LINE LENGTH**
(10-20 PSI SPRING, FACTORY PRESET AT 10 PSI)

*For longer runs, contact the factory.

6. Maximum pressure at the inlet port to any of the burner pumps is 10 psi by design. However, N.F.P.A. states that maximum allowed is 3 psi. Use the lowest number per applicable codes. If the pressure is going to be higher than permissible, a pressure reducing and/or a vacuum valve must be installed to reduce inlet pressure to the pump.

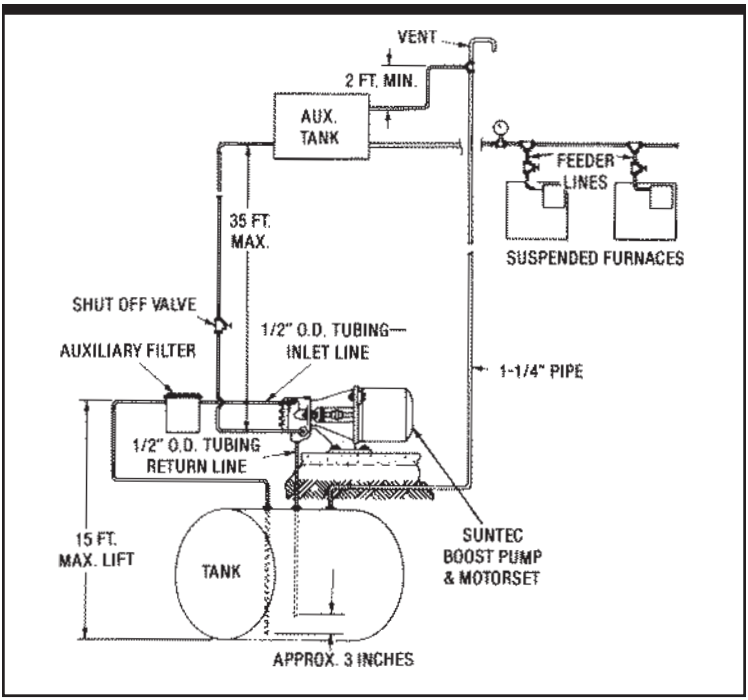


FIGURE 3 AUXILIARY TANK INSTALLATION

AUXILIARY TANK

Figure 3 illustrates a typical auxiliary tank installation. It is a form of the loop system, and subject to the same installation requirements. In addition, local ordinances governing auxiliary tanks should be complied with.

The auxiliary tank doesn't need to be more than a few gallons in capacity. Its advantages are:

1. Allows loop to be completed in close proximity to the main supply tank.
2. Eliminates line surges and race conditions.

PRESSURIZED SYSTEM

Figure 4 illustrates a pressurized system. Although it is the least common installation, it can be used where space and distance limitations preclude using a loop system.

WHEN INSTALLING THIS SYSTEM:

1. The pressure in the manifold must not exceed 10 psi when the boost pump is running and no burners are firing.

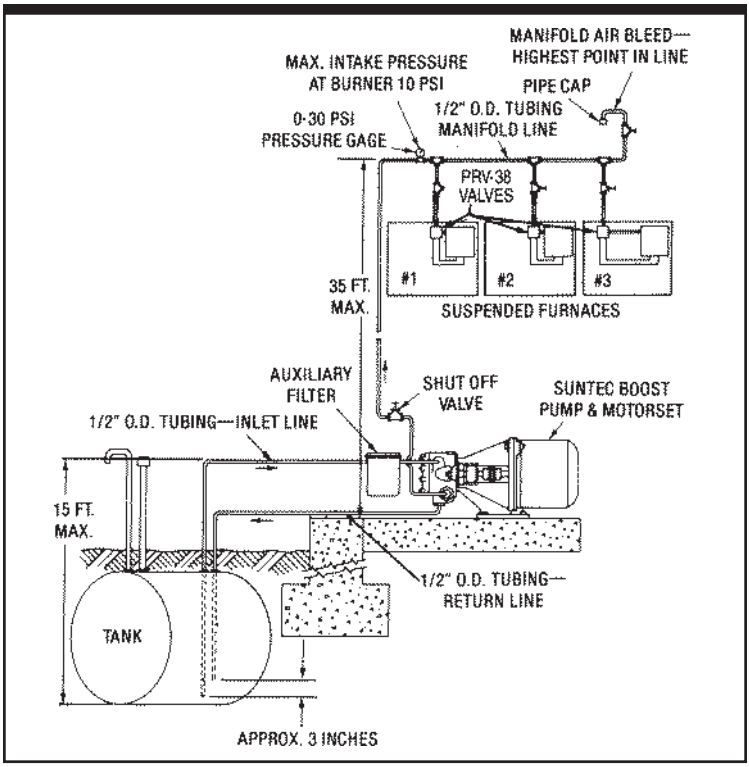


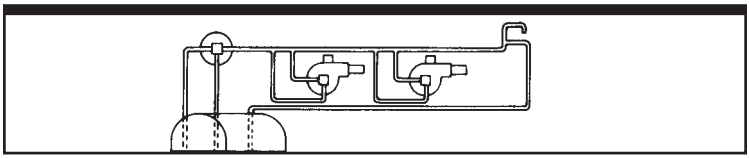
FIGURE 4 PRESSURIZED SYSTEM INSTALLATION

2. The pressure in the manifold must not exceed 10 psi nor less than zero when the boost pump is running and all burners are firing.

3. The burner pumps must have vacuum valves on their inlets.

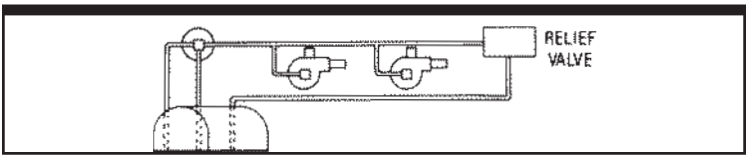
4. The maximum horizontal run of the manifold line must be matched with selections from Table 2.

Other configurations which are not recommended:



PSEUDO TWO-PIPE

The intent is to gain the advantages of a two-pipe operation, while not causing the boost pump to supply burner pump gearset demand. Actually, the pump already does this internally without the external plumbing. This system includes unnecessary piping and fittings which are possible sources of problems.



PRESSURIZED LOOP

The intent is to have a full loop without vent and large manifold return. Problems are:

1. Requires boost pump pressure to be set higher than recommended to prevent oscillations between pump valve and manifold valve.
2. Possible plugging of manifold valve, putting too high pressure in manifold.

WIRING INSTRUCTIONS

Wiring the system depends upon the operation desired: constant or intermittent.

A. CONSTANT OPERATION

A voltage switch between the power source and the boost pump motor is used for simple ON/OFF operation. Figure 5 illustrates this circuit.

B. INTERMITTENT OPERATION

A pressure switch (Suntec part number 128117) is connected in the gage port of each heater's fuel unit. Figure 6 shows the switch's installation in the circuit.

Operation is simple. Pressure developed by the oil burner fuel unit closes the low-voltage switch connected to the fuel unit. This causes the switch relay to energize the boost pump, which starts and stops automatically with the oil burner, For initial start-up, the switch relay may be held in manually, or a manual ON/OFF switch may be connected across the low-voltage wire leading from the switch relay to the pressure switch. With the manual switch in the ON position, the boost pump runs continuously.

START UP

1. Start boost pump manually.
2. Set boost pump pressure in manifold to 10 psi or less at closest burner to the boost pump.

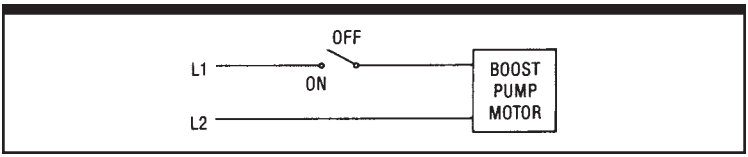


FIGURE 5 WIRING FOR CONSTANT OPERATION

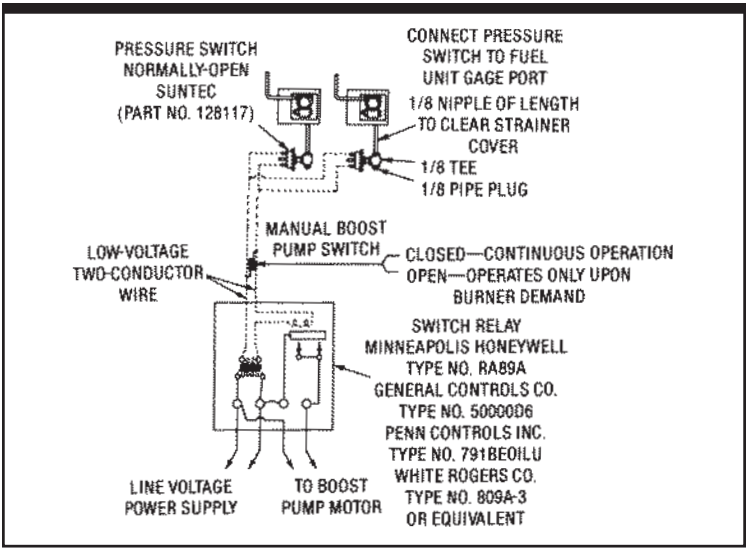


FIGURE 6 WIRING FOR INTERMITTENT OPERATION

3. Pressurized system -- bleed manifold of all air.
4. All systems -- bleed pumps starting with one closest to boost pump and proceeding to furthest away.
5. System should be ready for normal service.

SERVICE

1. Check periodically for water accumulation.
2. Change filter (external) as needed.
3. Check pump strainer.
4. Periodically check for manifold pressure.

TROUBLE SHOOTING

PROBLEM	SOLUTION
Boost Pump doesn't run	Check electrical connections and supply; check for discharge and return line blockages.
Boost Pump runs, but doesn't supply oil	Measure inlet vacuum. If too high, check inlet line, filter and valves
	Check to see that by-pass plug is properly installed.
	Check to see that inlet line has no air leaks.
Boost Pump supplies oil but burners do not fire	Check capacity of boost pump to see that it exceeds total burner requirements.
	Check to see that pressure rating of boost pump isn't exceeded by head requirements.
	In loop system, check to see if oil is passing through the stand pipe or riser.
Burner pump seals leaking	Check inlet line pressure to burner pumps

PIPING

Correct piping is critical to long-term operation of any fuel oil system. Improper line sizing will not only cause present and future service problems, but can also cause premature failure of the components supplied by it.

SINGLE-PIPE OR ONE-LINE SYSTEM

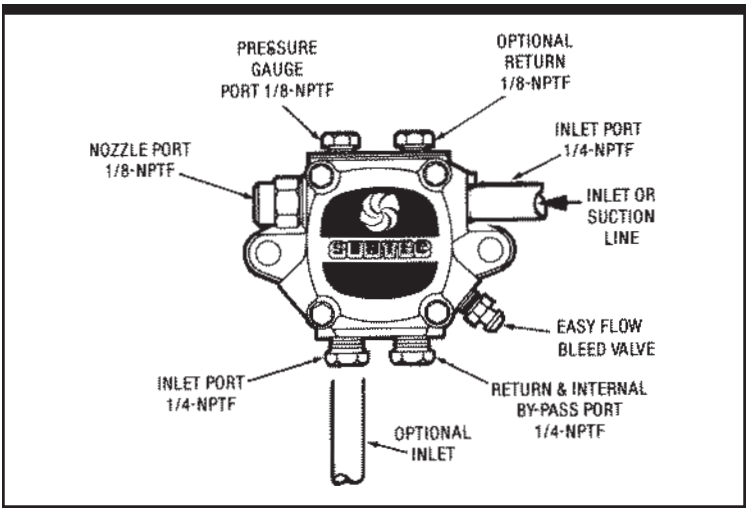


FIGURE 1

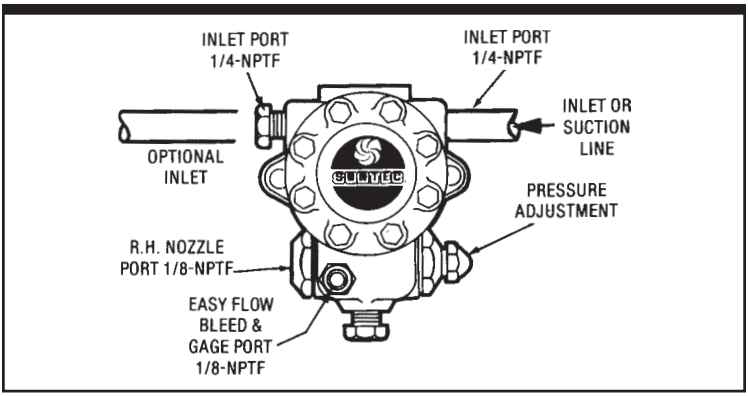


FIGURE 2

DO NOT

- Install by-pass plug. (Will damage seal.)
- Use compression fittings. (Will eventually leak.)
- Use teflon tape. (Will void warranty.)
- Use check valves. (Especially on gravity feed systems.) See Thermal Expansion, page III- 12.
- Exceed 10 psi (manufacturer) or 3 psi (NFPA) inlet line pressure.
- Exceed 6" hg. running vacuum (for Suntec “A” and “B” fuel units) or 2" hg. running vacuum (for Suntec “J” and “H” fuel units).

DO

- Use 37° JIC flare fittings.
- Use a non-hardening thread sealing compound.
- Prefill (prime) the pump on long runs to reduce dry running time.
- Check all unused pump fittings for tightness.
- Bleed system. Open bleed port approximately one turn. Bleed for 15 seconds after clear oil begins flowing out of port. Close bleeder valve tightly
- See page IV-1 if pump fails to prime or deliver.

TANK ABOVE THE PUMP OR GRAVITY FEED

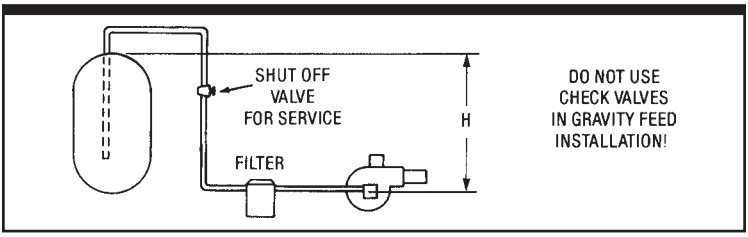


FIGURE 3

NOTES FOR FIGURE 3

1. H =vertical distance from top of tank to centerline of pump.
2. “H” must not exceed 27 feet to be within manufacturer’s 10 psi inlet pressure limit, or 8 feet to be within NFPA’s 3 psi inlet pressure limit.
3. See page II-3 for line sizing.

TANK BELOW THE PUMP OR LIFT FEED

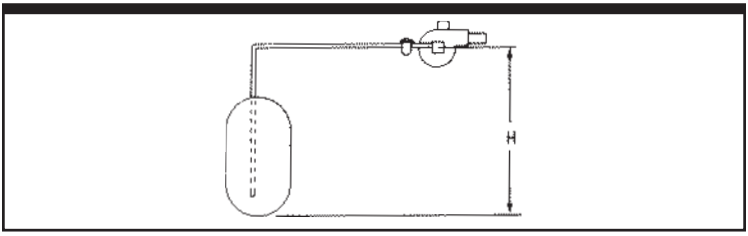


FIGURE 4

NOTES FOR FIGURE 4

1. H = vertical distance from bottom of tank to centerline of pump.
2. “H” must not exceed 8 feet for Suntec Model A and Model B fuel units or 2 feet for Suntec Model J and Model H fuel units.
3. See page II-3 for line sizing.

Even though pumps are capable of higher vacuums, good practice dictates that initial installation of Model A and B pumps and J and H pumps with an “F” piston do not exceed 6 inches of mercury vacuum on initial installation when installed single-pipe. J and H pumps without an “F” piston should not exceed 2 inches of mercury vacuum on initial installation when installed single-pipe.

TWO-PIPE OR TWO-LINE SYSTEM

DO NOT

- Use compression fittings. (Will eventually leak.)
- Use teflon tape. (Will void warranty.)
- Exceed 10 psi (manufacturer) or 3 psi (NFPA) inlet and return line pressures.
- Use check valves in gravity feed systems.

DO

- Connect inlet or suction line to the fuel unit inlet port.
- Install the by-pass plug as shown. Failure to do so will cause improper fuel unit operation.

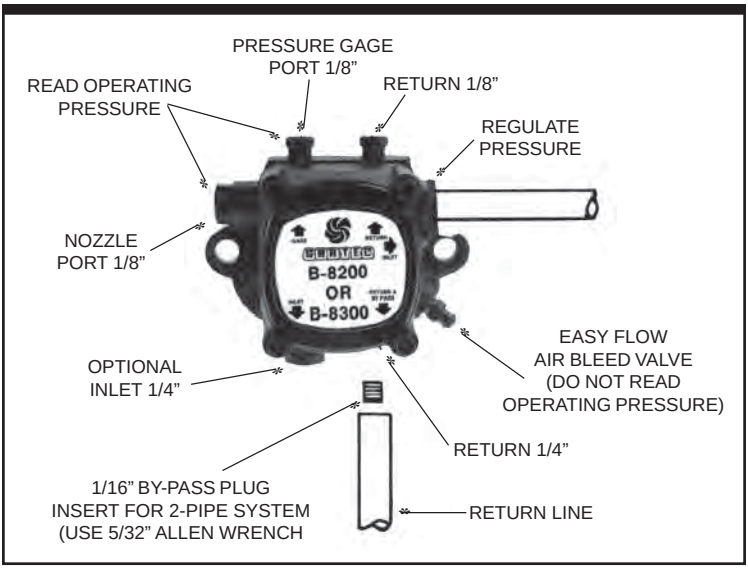


FIGURE 5

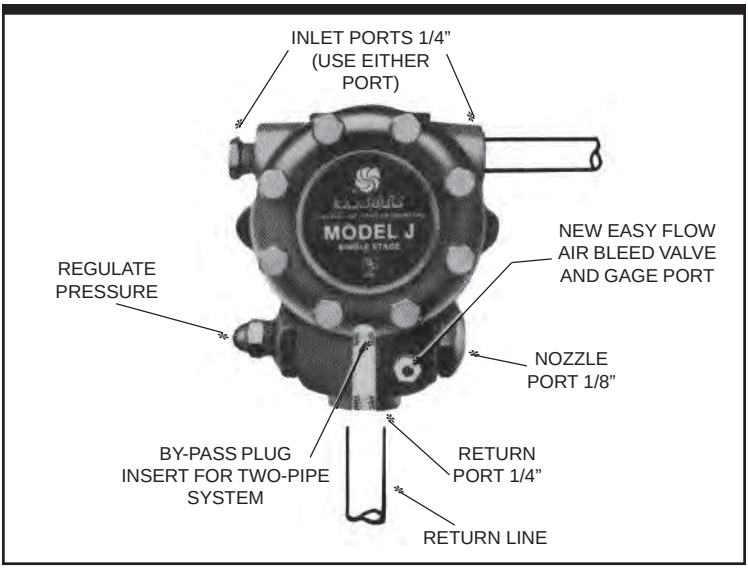


FIGURE 6

- Connect the return line to the fuel unit return port.
- Use 37° JIC flare fittings.
- Use a non-hardening thread sealing compound.
- Prefill (prime) the pump on long runs to reduce dry running time.
- Start fuel unit without bleeding (a properly-installed two-line system is self-priming).
- See page IV-1 if pump fails to prime or deliver.

NOTE

A two-pipe or two-line system has three lines connected to the fuel pump. They are the inlet or suction line, return line and nozzle line.

TANK ABOVE THE PUMP OR GRAVITY FEED

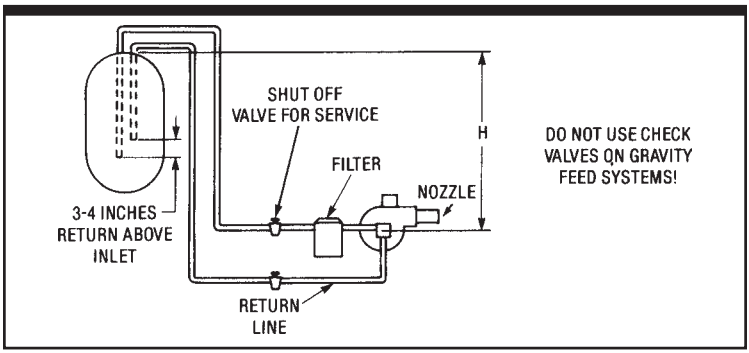


FIGURE 7

NOTES FOR FIGURE 7

1. H = vertical distance from top of tank to centerline of pump.
2. "H" must not exceed 27 feet to be within manufacturer's 10 psi inlet pressure limit, or 8 feet to be within NFPA's 3 psi inlet pressure limit.
3. See page III-7 for line sizing.
4. **IMPORTANT** -- Single-pipe installation is recommended for gravity feed systems. It produces lower inlet line flow and longer filter life. For example: an "A-70" fuel unit firing 1 gph single-pipe has 1 gph flowing through the filter; an "A-70" pump firing 1 gph two-pipe has 19 gph flowing through the filter.

TANK BELOW THE PUMP OR LIFT FEED

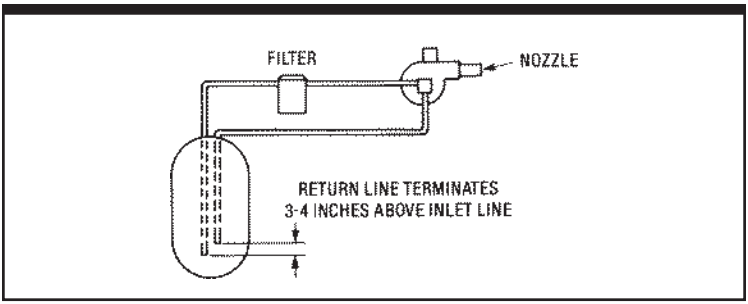


FIGURE 8

NOTES FOR FIGURE 8

1. H = vertical distance from bottom of tank to the centerline of the pump.
2. "H" must not exceed 12 feet for single-stage fuel units, or 18 feet for two-stage fuel units.
3. **IMPORTANT** -- "H" distance allowed is reduced by the number of fittings, filters and valves installed in the line. If the fuel lines extend higher than the centerline of the fuel unit, they should not exceed 24 feet above the bottom of the tank or the fuel unit will not prime (boost pump would be required). See page II-23.
4. System running vacuum should not exceed 12 in. hg. for single-stage fuel units or 17 in. hg. for two-stage fuel units.
5. **IMPORTANT** -- Vacuum requirements are not limited by fuel unit capability. Fuel oil will boil or de-gas at vacuums as low as 10 in. hg. These bubbles can get into the nozzle line and cause a smoky or unstable flame. Suntec two-stage pumps are designed to prevent this with vacuums up to 17 in. hg.
6. See page III-7 for line sizing.

LINE SIZING • TWO-PIPE SYSTEMS

NEW INSTALLATIONS FOR NEW LINES

NOTE: The formulas in this section are set up to keep new installations within practical design limits for fuel pumps. Viscosity used for calculations is 57 saybolt secs. universal = 8.04 centipoise = 9.6 centistokes. Calculated lengths do not include valves, filters and an unusual number of 90° elbows.

Installations should avoid putting fuel oil where it is exposed to temperature extremes. The pour point limit for #1 and #2 fuel oils not seasonally-adjusted is 0° F and 20° F, respectively

GEARSET/INLET LINE FLOW • GALLONS PER HOUR

Suntec Model No.	A 7*** 3 GPH	A 7*** 7 GPH	B 82** 3 GPH	B 89** 7 GPH	B 8850	B 8851	B 8852	J2 J3	J4	J5	J6	H2 H3	H4	H5	H6	H7	H8
Flow at 1725 rpm	16	--	18	--	--	--	--	18	22	29	38	26	31	36	42	69	98
Flow at 3450 rpm	17	20	21	25	28	33	39	38	46	60	78	61	69	79	93	--	--

LENGTH OF RUN (L)

The length of piping from tank to fuel unit is calculated using the following formulae which are based on flow properties for a given tubing size.

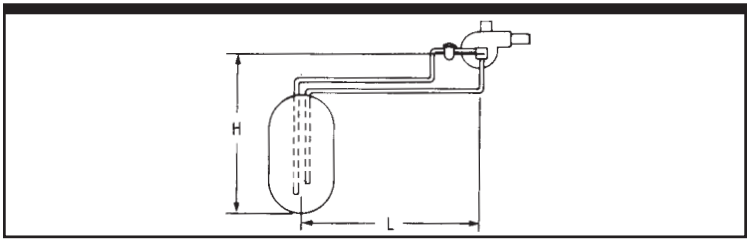


FIGURE 9

L = Horizontal run in feet from tank to fuel unit.
H = Vertical distance in feet from bottom of tank to centerline of pump.
Q = Gearset (or line) flow in gallons per hour (gph).
V = Vacuum in inches of mercury (in. hg.).

EXISTING INSTALLATIONS

The following formula can be used to determine what the vacuum should be on various line lengths of different size line tubing. The resulting figures

may be used to determine if the configuration of an existing installation could cause system performance problems.

Tube Size O.D. (inches) (.035" wall)	Tank Below Pump		Tank Above Pump	
	Single-Stage	Two-Stage	Single-Stage	Two-Stage
3/8	L = 12-(.75H) / .0086Q	L = 17-(.75H) / .0086Q	L =12+(.75H) / .0086Q	L = 17+(.75H) / .0086Q
1/2	L = 12-(.75H) / .00218Q	L = 17-(.75H) / .00218Q	L = 12+(.75H) / .00218Q	L = 17+(.75H) / .00218Q
5/8	L = 12-(.75H) / .000785Q	L = 17-(.75H) / .000785Q	L =12+(.75H) / .000785Q	L = 17+(.75H) / .000785Q

Tube Size O.D. (inches) (.035" wall)	Vacuum*	
	Tank Below Pump	Tank Above Pump
3/8	V = L (.0086Q) + .75H	V = L (.0086Q) - .75H
1/2	V = L (.00218Q) + .75H	V = L (.00218Q) - .75H
5/8	V = L (.000785Q) + .75H	V = L (.000785Q) - .75H

*Does not include valves, filters, etc., in the line.

NOTES

1. Kinks or sharp bends in lines will increase vacuum.
2. Return line pressure should not exceed 10 psi (manufacturer) or 3 psi (NFPA).
3. The installation instructions supplied with each Suntec fuel unit shows line lengths based on calculations from the above formula.
4. If the system configuration causes operation outside the recommended limits, consider the following options:
   a. Reconfigure the system.
   b. Install a boost pump system.
   c. Contact the Suntec Factory Service Department.

ADD-ONS AND MULTIPLE UNITS

When adding or installing new fuel units to an existing system, good practice is to have separate lines for each system. If running separate lines is difficult, impractical and/or impossible, it may be necessary to tie a new system into an old one.

Before tying into an existing system, consider:

1. What the running vacuum of the present system is. (See Vacuum Testing, page IV-9.)
2. What the extra distance will be to the new fuel unit.

If a new identical fuel unit will be installed side-by-side with the existing unit, its addition will **at least** double the vacuum with both units running.

Line Sizing. Lines should be sized to have a **small enough** inside diameter to allow complete purging of air during priming or bleeding, and **large enough** to not cause excessive pressure drop or line losses which would cause the pump to operate with too high a vacuum.

Priority Controls. Relays which give operating preference to a specific unit, can be used to assure that only one fuel unit is operating at a time. For example, priority is usually given to a hot water heater rather than a furnace or boiler.

INSTALLING PRIORITY CONTROLS

Two options exist:

1. Less than ideal: Priority controls controlled by low voltage from the thermostat. Disadvantage: If the primary unit locks out on “safety,” the secondary system cannot automatically operate.
2. Preferred: Use a power relay to establish priority based on line voltage demand. Advantage: Allows the line voltage to be available to the secondary unit if a fault occurs in the primary unit. (Should be installed by a qualified electrician.)

SERVICING NON-RECOMMENDED EXISTING INSTALLATIONS

Occasionally, you will find existing installations which do not conform to good practice or proper installation. The correct procedure is to replace these piping configurations with correct piping. However, in the real world, this is sometimes impractical or financially impossible. The following information will help you identify and work with these types when you encounter them in the field.

MULTIPLE UNITS WITH UNDERSIZE OR OVERSIZE INLET MANIFOLDS • SINGLE-PIPE (TANK ABOVE OR BELOW FUEL UNITS)

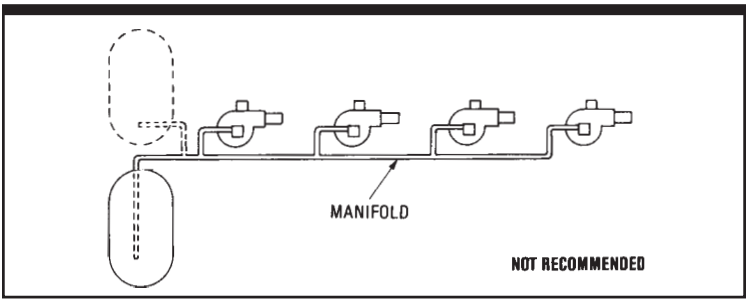


FIGURE 10

Line Sizing. The manifold or supply line must be sized to accommodate the total **firing rate** of all units connected to the manifold (A + B + C + D as shown above). See Installation Section for specific model, for single-line calculation formula.

Priming. Bleed or prime units beginning with the unit closest to the tank and working outward. Since priming this type of system would require extended operation of the fuel units with dry gear sets, the fuel unit should be filled with oil before beginning.

Recommendation. This type of system should be supplemented with a boost pump system to provide the proper oil supply to the fuel units. See Boost Pumps or Transfer Pumps, page II-23.

TWO-PIPE • *(TANK ABOVE OR BELOW FUEL UNITS)*

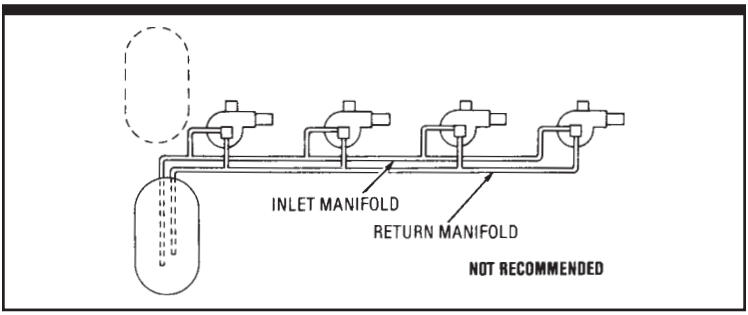


FIGURE 11

Line Sizing. The manifolds or supply lines must be sized to accommodate the total **gear set capacity** (not firing rate) of all units connected to the manifold (A + B + C + D, as shown above). See Line Sizing, page III-7, for fuel unit gear set capacities. If lines are undersized, they must be replaced, or use priority controls.

Return line manifold piping and input manifold piping must be the same size.

Priming. Return line must terminate below the surface of the oil in the tank to maintain prime.

Start or prime units beginning with the unit closest to the tank and working outward. Since priming this type of system would require extended operation of the fuel units with dry gear sets, the fuel unit should be filled with oil before starting.

DRAWBACKS

a. Problems with one unit affects all units.
b. Line sizes are a compromise.
c. Troubleshooting is more complicated.
d. Making and keeping system air-free is time-consuming.

RECOMMENDATIONS

a. Install individual lines to multiple units, or
b. Incorporate a boost pump system to supply adequate fuel to the multiple units. See Boost Pumps or Transfer Pumps, page II-23.

CHECK VALVES, OTHER VALVES AND THERMAL EXPANSION

Check Valves. A properly-installed fuel oil heating system does not require check valves for proper operation.
However, check valves are often used to compensate for deficiencies in oil line piping. For example:

a. Not having the return line submerged in the oil in the tank.
b. Having vacuum leaks in the line due to using compression fittings, bad flare fittings, porous fittings, loose fittings or leaky lines.

Disadvantages:
Check valves increase the amount of vacuum the fuel unit must overcome to supply oil to the system and reduce the distance supply lines can be run.

When installed near the fuel unit, check valves cause turbulence and stripping of air from the oil, resulting in dirty and/or noisy combustion.

Do not use check valves in gravity feed (tank above pump) single-pipe systems, or in a system supplied by a boost or transfer pump. Thermal expansion can cause serious problems.

Thermal Expansion. Thermal expansion is a phenomenon in which a fluid increases in volume when heated.

When fuel oil is heated from 40° F to 70° F, it will increase in volume by 1-1/2%. Since oil will only compress at a rate of 1/10%, thermal expansion will greatly increase the oil pressure in a closed system.

In a typical single-pipe system, an air pocket within the pump serves as a cushion against changes in pressure. In a gravity feed-or boost pump-supplied system, the air cushion is eventually absorbed, creating a hydraulically “hard” or closed system which is unable to absorb pressure increases.

EFFECTS OF THERMAL EXPANSION:

a. Leaks at pipe joints and fittings.
b. Broken pressure gages.
c. Leaks at filters.
d. Leaks at fuel unit seals.

CONDITIONS WHERE THERMAL EXPANSION CAN CAUSE PROBLEMS:

a. In single-pipe, dual-fuel systems (during alternate fuel operation).
b. Where ambient temperature around the supply line is higher than the fuel temperature (ceilings of industrial /commercial buildings, boiler rooms, mobile home enclosed furnace vestibules).

PREVENTION OF THERMAL EXPANSION PROBLEMS:

a. Install relief valves in problem areas (see Figure 14).
b. Do not use check valves.
c. Install an accumulator in the line.

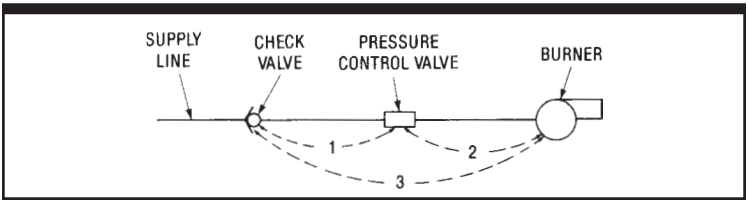


FIGURE 12 CLOSED OIL SYSTEMS

1. A closed system will occur between the check valve and the pressure control valve during burner off-cycle.
2. A closed system will occur between the pressure control valve and the burner pump since the regulating valve in the pump is also a positive shut-off valve.
3. Since the regulating piston in the pump is also a positive shut-off valve, a closed system will occur during burner off-cycle even without the vacuum safety valve installed.

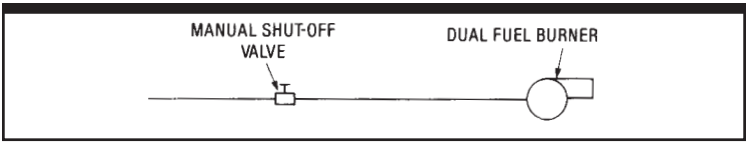


FIGURE 13 CLOSED OIL SYSTEM, DUAL-FUEL BURNER

1. A closed circuit will occur between the manual valve and the burner if the valve is closed during alternate fuel operation.

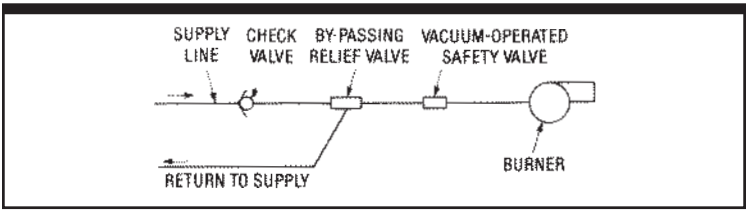


FIGURE 14 BY-PASSING RELIEF VALVE INSTALLATION

NOTE: All installations should be in compliance with local and national codes. Typical installation diagrams contained in this Technical Service Manual are for reference only.

SERVICE

Service on fuel units should not be attempted without the aid of good vacuum and pressure gages. Many system problems can be detected with the aid of these gages.

Service falls into two categories: routine and trouble.

ROUTINE • *ANNUAL OR OTHER CHECK OUT*

Check line filter and pump strainer for amount of contaminate. If close to needing service, replace to prevent a call-back in near future. If using inlet into the side of the pump, it isn't necessary to remove cover to check the strainer. Remove inlet line and view strainer through inlet opening. If it's clean there, it will be clean the rest of the way around.

If strainer is plugged, remove cover and clean strainer with a brush and clean fuel. Replace cover gasket before reinstalling.

System running vacuum should be checked as part of routine.

Running vacuum should not exceed:

- ✓ 6 inches mercury for single-stage one-pipe.
- ✓ 12 inches mercury for single-stage two-pipe.
- ✓ 17 inches mercury for two-stage two-pipe.
- ✓ Check and adjust system pressure, if necessary.
- ✓ Check CO_2 or O_2 and system draft.
- ✓ Check for smoke and adjust to a trace. Zero smoke is unclear as to where you are in adjustment.
- ✓ Check for leaks at fittings and filters. Correct any leaks that are found.

TROUBLE CALL

In response to a trouble call, approach the problem in a logical and systematic sequence. Jumping to a conclusion can sometimes temporarily fix the problem, but not uncover the root cause of the problem. An example is if there is water in the fuel, which causes the pump to fail and you replace the pump only. You will eventually be called back to replace the new pump.

In addition to the mechanical tools required, you also must have gages (pressure and vacuum) and suitable combustion analyzers.

LARGER PAGE THAN THESE

LARGER PAGE THAN THESE

FUEL PUMP • *TROUBLESHOOTING GUIDE*

CAUSE	REMEDY
NO OIL FLOW AT NOZZLE	
Oil level below intake line in supply tank	Fill tank with oil.
Clogged strainer or filter	Remove and clean strainer. Replace filter element.
Clogged nozzle	Replace nozzle.
Air leak in intake line	Tighten all fittings in intake line. Tighten unused intake port plug. Check filter cover and gasket.
Restricted intake line (high vacuum reading)	Replace any kinked tubing and check any valves in intake line. Check form 440100 for line sizes.
A two-pipe system that becomes airbound	Check for and insert by-pass plug. Make sure return line is below oil level in tank.
A single-pipe system that becomes airbound	Loosen gage port plug or easyflow valve and bleed oil for 15 seconds after foam is gone in bleed hose. Check intake line fittings for tightness. Check all pump plugs for tightness.
Slipping or broken coupling	Tighten or replace coupling.
Rotation of motor and fuel unit is not the same as indicated by arrow on pad at top of unit	Install fuel unit with correct rotation. See form no. 440100.
Frozen pump shaft	Return unit to approved service station or Suntec factory for repair. Check for water and dirt in tank.

CAUSE	REMEDY
OIL LEAK	
Loose plugs or fittings	Dope with good quality thread sealer. Retighten.
Leak at pressure adj. screw or nozzle plug	Washer may be damaged. Replace the washer or o-ring.
Blown seal (single-pipe system)	Check to see if by-pass plug has been left in unit. Replace fuel unit.
Blown seal (two-pipe system)	Check for kinked tubing or other obstructions in return line. Replace fuel unit.
Seal leaking	Replace fuel unit.
Cover	Tighten cover screws or replace damaged gasket.
NOISY OPERATION	
Bad coupling alignment	Loosen fuel unit mounting screws slightly and shift fuel unit in different positions until noise is eliminated. Retighten mounting screws.
Air in inlet line	Check all connections. Use only good flare fittings.
Tank hum on two-pipe system and inside tank	Install return line hum eliminator in return line.
PULSATING PRESSURE	
Partially clogged strainer or filter	Remove and clean strainer. Replace filter element.
Air leak in intake line	Tighten all fittings.

CAUSE	REMEDY
PULSATING PRESSURE (cont'd.)	
Air leaking around cover	Be sure strainer cover screws are tightened securely. Check for damaged cover gasket.
LOW OIL PRESSURE	
Defective gage	Check gage against master gage or other gage.
Nozzle capacity is greater than fuel unit capacity	Replace fuel unit with unit of correct capacity. See form no. 2100 for GPH, psi and R.P.M.

IMPROPER NOZZLE CUT-OFF

To determine the cause of improper cut-off, insert a pressure gage in the nozzle port of the fuel unit. After a minute of operation, shut burner down. If the pressure drops from normal operating pressure and stabilizes, the fuel unit is operating properly and air is the cause of improper cut-off. If, however, the pressure drops to 0 psi, fuel unit should be replaced.

NOTE: The A-70 pump circuitry is designed to give a high cut-off of superb quality. Never use the amount of pressure drop as an indication of the quality or speed of cut-off.

Filter leaks	Check face of cover and gasket for damage.
Strainer cover loose	Tighten four screws on cover.
Air pocket between cut-off valve and nozzle	Run burner, stopping and starting unit, until smoke and after-fire disappears.
Air leak in intake line	Tighten intake fittings. Tighten unused intake port and return plug.
Partially clogged nozzle strainer	Clean strainer or change nozzle.
Leak at nozzle adaptor	Change nozzle and adaptor.

FIELD TESTING FUEL UNITS

INTRODUCTION

Fuel units are sized to an application based on their pressure, vacuum and flow ratings.

With today's high efficiency furnaces and boilers, it is extremely important to check these parameters when the initial installation is made and also during later service calls to assure that high efficiency operation is being maintained.

It is also important to check fuel unit pressure and vacuum levels during trouble calls to help differentiate pump problems from system problems.

VACUUM TEST • FOR FUEL UNITS AND INLET LINES

FUEL UNIT -- SINGLE-PIPE SYSTEM

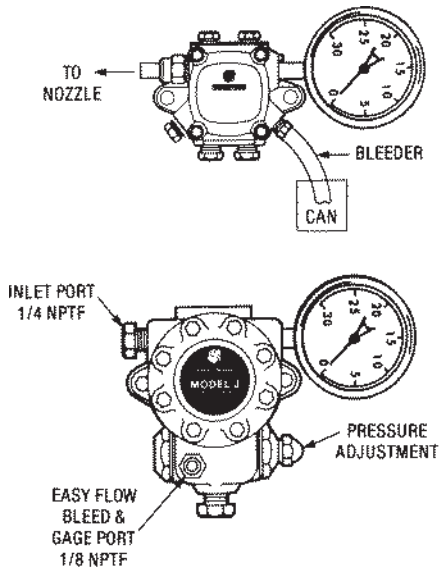


FIGURE 1 VACUUM GAGE LOCATION FOR SINGLE-PIPE SYSTEM

Step 1. Remove inlet line from fuel unit and install vacuum gage in the inlet port (see Figure 1). If unit has been running dry, pour oil into pump prior to testing.
Step 2. Turn burner ON and open bleed.
Step 3. When vacuum reaches 15 in. hg.*, close bleed port.
Step 4. Turn burner OFF. Pump should hold vacuum level for five minutes*.

***NOTE:** If fuel unit cannot attain 15 in. hg. or hold that vacuum level for five minutes, it should be repaired or replaced.

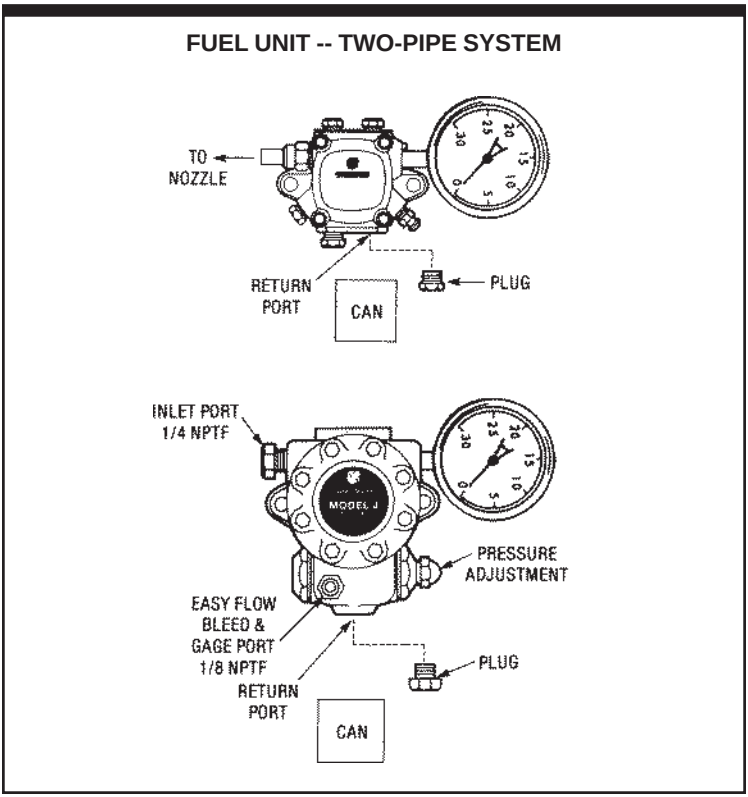


FIGURE 2 VACUUM GAGE LOCATION FOR TWO-PIPE SYSTEM

Step 1. Remove inlet line from fuel unit and install vacuum gage in the inlet port (see Figure 2).
Step 2. Remove return line.

Step 3. Turn burner ON.
Step 4. When vacuum reaches 15 in. hg.*, plug return port and turn burner OFF.
Step 5. Pump should hold vacuum level for five minutes*.

***NOTE:** If fuel unit cannot attain 15 in. hg. or hold that vacuum level for five minutes, it should be repaired or replaced.

VACUUM TEST • FOR SYSTEM

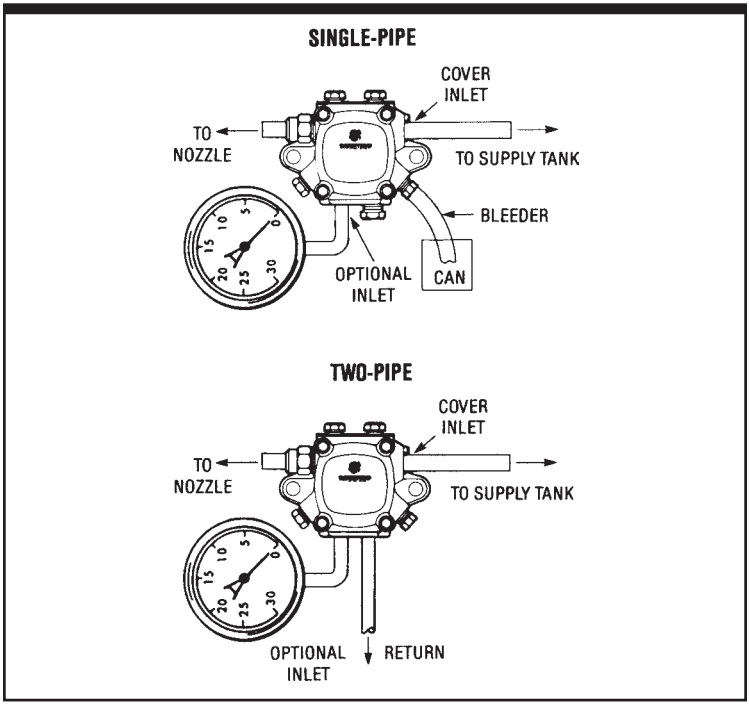


FIGURE 3 VACUUM GAGE LOCATION FOR SYSTEM TEST

Step 1. Install vacuum gage in the optional inlet port or tee into the supply line at the fuel unit. (If the optional inlet is used for the supply line, install the gage in the cover inlet. See Figure 3.)
Step 2. Turn burner ON and bleed the fuel unit (if one-pipe system).
Step 3. Close bleed valve and read gage. Readings should be as follows:

	SINGLE-STAGE		TWO-STAGE	
	Model A	Model J	Model B	Model H
Single-Pipe System	6 in. hg.	2 in. hg.	6 in. hg.	2 in. hg.
Two-Pipe System	12 in. hg.	12 in. hg.	17 in. hg.	17 in. hg.

Step 4. **If the gage reading exceeds the level indicated** for the fuel unit being used, check the piping and the system layout (refer to Suntec installation bulletins for details).

Step 5. **If the lift and run is not excessive for the fuel unit model,** the problem could be caused by:

a. the number and type of bends in the piping (includes kinks and flattening),
b. the number and types of fittings in the piping,
c. the number, type and condition of filters and strainers,
d. the number and type of valves in the system, and/or
e. the level of contaminate build-up on the inside walls of the system piping.

Step 6. **If the vacuum level is NOT excessive,** and there is air in the oil, there is usually a leak in the piping.

To check:

a. Close the tank valve,
b. Pull a vacuum on the system by the fuel unit,
c. Shut the burner OFF System should hold the vacuum level for five minutes. If system is two-pipe, the return line will have to be closed off at shutdown.

PRESSURE TEST • *FOR FUEL UNITS AND SYSTEMS*

SYSTEM PRESSURE WITH SYSTEM OPERATING

Step 1. If fuel unit is on a **positive head system,** shut tank valve OFF before installing gage.

Step 2. Install gage in **gage** port.

Step 3. Turn burner ON if pump is on **single-pipe lift system,** bleed pump at the bleed valve.

Step 4. Observe gage (disregard needle “jiggling”).

Step 5. If reading is high or low, readjust pressure adjustment screw.

NOTE: On Model J or Model H fuel units, there may be some leakage with the acorn nut removed. This will stop when the nut is replaced.

Step 6. Turn burner OFF. The pressure should fall to zero or to the amount of head on the fuel unit.

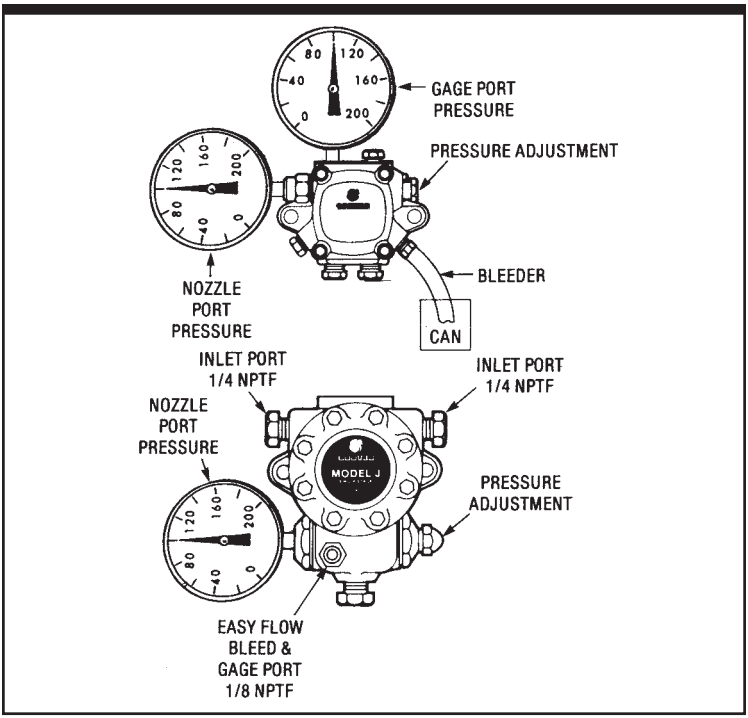


FIGURE 4
PRESSURE GAGE LOCATIONS FOR OPERATING PRESSURE TEST

FUEL UNIT OPERATING AND CUT-OFF PRESSURE

Step 1. Install gage into **nozzle** port.
Step 2. Turn burner ON and observe gage.
Step 3. Adjust pressure, if necessary.
Step 4. Turn burner OFF and observe gage. Pressure should drop to 80% or higher.
Step 5. If pressure drops below 80% or continues to decay, the fuel unit has faulty cut-off and should be repaired or replaced.

NOTE: A and B model pumps could theoretically have a cut-off pressure of less than 80%. The important operation is that it drops to some value and stops.

STRAINERS -- FIELD SERVICE

Fuel unit strainers are intended as a **back-up** to, not a replacement for, proper system filtering.

Clogged strainers restrict oil flow into the gear set, cause fuel units to operate at higher vacuum and eventually fail. To diagnose a clogged strainer before it causes fuel unit failure, it must be removed and visually inspected. If a strainer **looks** clogged, it usually is, and should be cleaned or replaced.

IMPORTANT NOTE: Current regulations on the use of asbestos in gasket materials require that new non-asbestos gaskets be installed any time a fuel unit cover is removed. Make this a common practice to avoid expensive call-backs for that purpose.

STRAINER IDENTIFICATION

MODEL J AND MODEL H FUEL UNITS

Strainer models are designated by the first character following the gear size designation in the fuel unit model number as indicated below:

Examples:

J3PBN-C200H-4	"P" Strainer
JA2BA-100	"B" Strainer

Strainer Model Designation	Nozzle Capacity Rating
A	No strainer (used in certain lube pumps)
B	7 gph (metal frame)
C	4.5 gph (obsolete, use B or N)
N	7 gph (plastic frame)
P	Unlimited (do not use in Models J7, J8, H7, H8)
K	Unlimited (requires spacer between pump body and cover)

MODEL A AND MODEL B FUEL UNITS

Strainer models are designated by the first character following the gear size designation in the fuel unit model number, as indicated below:

Examples:

A2VA-7116-4	"V" Strainer
B2TA-8851-5	"T" Strainer

Strainer Model Designation	Nozzle Capacity Rating
V	3 gph
Y	7 gph
T	16 gph
G	23 gph

IMPORTANT-DO NOT use a strainer which is too long for the cover (indicated by a 1/8" or more cover gap when spring is fully compressed). Forcing would crush the strainer body and allow contaminants to get into the pumping mechanism.

STRAINERS AS A DIAGNOSTIC INDICATOR

What you see in a strainer can be an indicator of what conditions may exist within the system:

a. **Clogged strainer.** Primary filter has failed or is missing.
b. **Sludge on strainer.** Water in the tank, allowing biological growth.
c. **Rust flakes on strainer.** Rusted tank or components.

Field replacement of 3 gph- and 7 gph-rated strainers -- Figure 1. (All models and revisions of Model A70 and Model B80 fuel units.)

To simplify field replacement and improve overall strainer efficiency, only two strainer models are offered for replacement in standard Model A and Model B fuel units. As shown, a spring is required in some instances to compensate for the difference in strainer height and cover depth (see Figure 1).

Model Series	Strainer Designation	Capacity (GPH)	Model Revision*	Data Code	Cover Depth	Strainer Part No.	Spring Part No.
A	V	3	All	All	1.133"	3715732	Not Req.
A	Y	7	--	Y82 & Earlier	1.345"	3715732	3773231 / 3754732
A	Y	7	--	D82 & Later	1.620"	3715744	Not Req.
B	V & Y	3 & 7	-2, -3, -4	All	1.345"	3715732	3773231 / 3754732
B	V & Y	3 & 7	-5	All	1.620"	3715744	Not Req.
B	T	16	All	All	1.620"	3715742	Not Req.
B	G	23	All	All	1.620"	3715746	Not Req.
*Model Revision = last number of model number EXAMPLE: B2VA-8216-5							

FIGURE 1 STRAINER REPLACEMENT

Installation of strainer part no. 3715732 in medium-height covers*

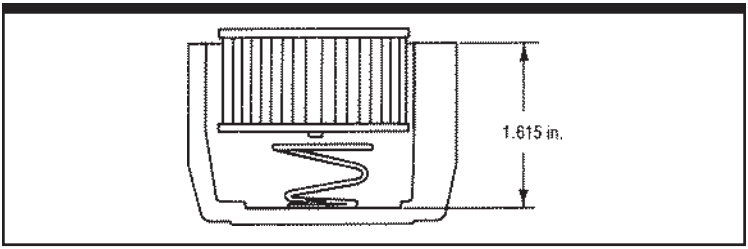


FIGURE 2 STRAINER INSTALLATION

Step 1. Set spring (part no. 3773231 or 3754732) in cover with large coils up.
Step 2. Set strainer (part no. 3715732) on large coil.
Step 3. Install new gasket.
Step 4. Slide cover over gearset.

FILTERS AND FILTRATION

Filters are necessary in all fuel systems to capture contaminants which might develop and create operational problems. They are the first line of defense, while the strainers within a fuel unit serve as a secondary or back-up filter.

Contaminants come in many varieties:

a. **Abrasive.** Accelerate wear on moving parts.
b. **Blocking.** Clog filters, strainers and oil passages.
c. **Corrosive.** Chemically attack metal elements.
d. **Biological.** Cause all of the above.

Relative contaminant size:

a. Smallest particle visible to the human eye = 40 microns.
b. Bacteria = 2 microns.
c. 1 micron = .000039 inch.
d. 100-mesh screen opening = .0059 inch = 149 microns.

Contamination notes:

a. If filters require changing more than once a year, the filter is too small or the fuel system is too dirty.
b. If the fuel system is dirty, it should be pumped out, treated and refilled with clean oil.
c. If moisture is present, it can rust the fuel system and parts, and provide a breeding ground for bacteria.
d. If the fuel tank is treated with a bacticide, use only the recommended amount. Too heavy a concentration can cause the fuel unit to become inoperative.
e. When replacing filter elements, care should be taken to not introduce the contaminant downstream to the fuel unit.
f. If a filter element has collapsed, the fuel unit and lines must be flushed prior to resuming burner operation.
g. If filter has a screen in it, make sure it is non-corroding material. Some are, and some are not.

Field notes:

a. Some filter elements will cause outgassing of fuel oil at low flows and relatively low vacuums (1-2 in. hg.). This usually appears as a loss of prime on one-pipe installations. A field-cure for this is to shut off the tank valve while priming the pump and put as much vacuum as possible on filter. Open the tank valve and resume normal priming.
b. When changing filters, take care not to introduce contaminate from dirty element into down-stream piping and fuel pump.

c. High vacuums across a filter element that appears to be clean can be caused by greasy bridging-type contaminant.

SOLENOID VALVES -- SERVICE

INSTALLATION

Model R valves mount directly into the nozzle port of the fuel unit.

Model C valves mount to the burner chassis or otherwise remote from the fuel unit.

OPERATIONAL CHECK

Step 1. Remove nozzle line at the burner assembly end and place into container (to catch oil).

Step 2. Start burner and watch for oil to run from the open line. If YES, go to Step 9. If NO, go to Step 3.

Step 3. Turn burner OFF.

Step 4. Check for power to the coil. If YES, go to Step 5. If NO, repair electrical supply and recheck.

Step 5. Remove nut which holds the coil into the valve assembly.

Step 6. Remove coil from valve and slide it over an insulated handle screwdriver.

IMPORTANT: to apply power to the coil without a screwdriver (or other magnetic material) in the center hole will cause the coil to overheat, swell and fail.

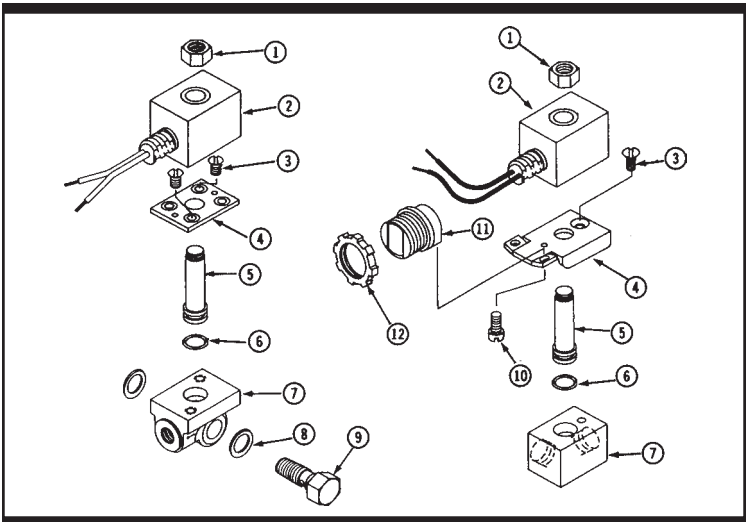
CAUTION: Even though the coil is f ully- insulated, care should be exercised to avoid touching the coil when energized, except with insulated tools.

Step 7. Apply power to the coil. You should feel vibrations and/or magnetic pull on the screwdriver. If YES, go to Step 8. If NO, replace coil and go to Step 2.

Step 8. Replace tube assembly or complete valve assembly.

Step 9. Remove power from coil and start burner Check to see if oil is passing through the valve. If YES, replace tube assembly or valve assembly and go to Step 1. If NO, valve is performing satisfactorily.

VALVE ASSEMBLY PARTS



Item No.	Description	Part Order Number	
		"R" Valve	"C" Valve
1	Coil nut	3753818	3753818
2	Coil for		
	R642N	3713642	--
	R641D	3713809	--
	R753	3713790	--
	C642N	--	3713642
	C641D	--	3713809
	C753	--	3713790
3	Base plate screw (2)	3773421	3773421
4	Base plate	3753762	3753864
5	Tube assembly	3713766	3713766
6	"O" ring	3773461	3773461
7	Valve Body	3723810	3723815
8	Gasket (2)	2779261	--
9	Nozzle Screw	3753835	--
10	Electrical connector	--	3753865
11	Electrical connector	--	--
12	Electrical connector	--	--

WARRANTY AND RETURNED GOODS POLICY

WARRANTY

SUNTEC HEATING PRODUCTS MANUFACTURED BY SUNTEC INDUSTRIES INCORPORATED

Suntec Heating Products are warranted to be free from defects in material and workmanship for the warranty period hereinafter defined when properly installed, maintained and operated under normal use. SUNTEC DISCLAIMS ANY LIABILITY FOR THE FAILURE OF PERFORMANCE OR MALFUNCTION OF THESE PRODUCTS RESULTING DIRECTLY OR INDIRECTLY FROM THE PRESENCE OF WATER, RUST, TEFLON TAPE OR CONTAMINATES IN THE SYSTEM. Components not manufactured by Suntec are warranted only to the extent of and by the original warranty.

Effective with fuel units manufactured March 1, 1987 and later, the warranty period is:

A. 3 years for residential units rated at 7 gph or less,
B. 2 years for units rated over 7 gph,
C. 1 year for waste oil units, and
D. 1 year for solenoid valves and coils.

The warranty is limited to repair or replacement at Suntec's option, either at its factory or a Suntec Approved Service Station, transportation charges prepaid, of products which shall be determined by Suntec or its Approved Service Station upon examination to be defective. In the event in-warranty products forwarded to a Service Station are tested and found not defective, the Service Station is authorized to apply a nominal testing charge.

Service Stations will replace defective products at their option with a new or rebuilt unit.

Suntec shall not be liable for damages for any breach of warranty in any amount exceeding the purchase price of the product found to be defective. In no event shall Suntec be liable for incidental or consequential damages. No agent, dealer, or other person is authorized to give any warranty on behalf of Suntec with respect to any Suntec product. THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ANY OTHER WARRANTIES, WHETHER EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OR MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

PRODUCT DATE CODING

PRIOR TO JANUARY, 1991: THE MONTH INDICATED BY A CODE LETTER. THE YEAR IS INDICATED BY THE LAST TWO DIGITS IN A THREE-DIGIT CODE OR THE TWO MIDDLE DIGITS IN A FOUR- DIGIT

CODE. EXAMPLES OF CODES: THREE-DIGIT--H85, FOUR-DIGIT--C852. REFER TO THE CHART BELOW TO DETERMINE IF PRODUCT IS IN-WARRANTY. THIS SYSTEM WILL APPLY TO ALL PRODUCTS.

CODE:	S	M	T	H	Y	D	R	A	U	L	I	C
MONTH:	JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

AFTER JANUARY, 1991: THE MONTH IS INDICATED BY THE FIRST NUMBER IN A THREE-NUMBER CODE AND THE FIRST TWO NUMBERS IN A FOUR-NUMBER CODE.

THE YEAR IS INDICATED BY THE LAST TWO NUMBERS IN A THREE- OR FOUR-NUMBER CODE.

CODE:	1	2	3	4	5	6	7	8	9	10	11	12
MONTH:	JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC

ALL UNITS DATED AFTER MANUFACTURE.

REPAIRED PRODUCTS RETURNED FROM THE FIELD WILL BE STAMPED IN A SIMILAR MANNER AS ABOVE. THEREFORE, REPAIRED PRODUCTS WILL HAVE AT LEAST TWO DATE CODES STAMPED ON THEM. THE LATEST DATE WILL PREVAIL IN ALL CASES.

RETURNED GOODS

Product should be returned to Suntec prepaid, unless prior written approval has been received from Suntec. In-warranty product will be repaired and returned at no additional cost. If the product is out of warranty, the customer will be notified of the cost to repair it and given the option of having it repaired or having the unrepaired product returned collect.

Suntec DOES NOT issue credit for product being returned for repair, whether the product is or is not in-warranty.

When an unusual situation arises and product must be returned to Suntec, written approval must first be received from Suntec. Upon inspection of the returned product, Suntec will determine if the product is suitable for resale. If it is, the customer will be assessed a 35% restocking charge and the balance credited to the customer's account less any consequential charges incurred.

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Product Information Packet

CL3509

1HP,3450RPM,1PH,60HZ,56C,3520L,TEFC,F1

Part Detail

Revision:	S	**Status:**	PRD/A	**Change #:**		**Proprietary:**	No
Type:	AC	**Prod. Type:**	3520L	**Elec. Spec:**	35WGX964	**CD Diagram:**	
Enclosure:	TEFC	**Mfg Plant:**		**Mech. Spec:**	35T946	**Layout:**	
Frame:	56C	**Mounting:**	F1	**Poles:**	02	**Created Date:**	06-22-2007
Base:	RG	**Rotation:**	R	**Insulation:**	B	**Eff. Date:**	02-18-2013
Leads:	4#16 A PH,2#18 B PH	**Literature:**		**Elec. Diagram:**		**Replaced By:**	

Nameplate NP1256L

CAT.NO.	CL3509						
SPEC.	35T946X964						
HP	1						
VOLTS	115/230						
AMP	11.8/5.9						
RPM	3450						
FRAME	56C	**HZ**	60	**PH**	1		
SER.F.	1.25	**CODE**	K	**DES**	N	**CLASS**	B
NEMA-NOM-EFF	68	**PF**	82				
RATING	40C AMB-CONT						
CC		**USABLE AT 208V**	6.1				
DE	6205	**ODE**	6203				
ENCL	TEFC	**SN**					
	SFA 14/7						

Parts List

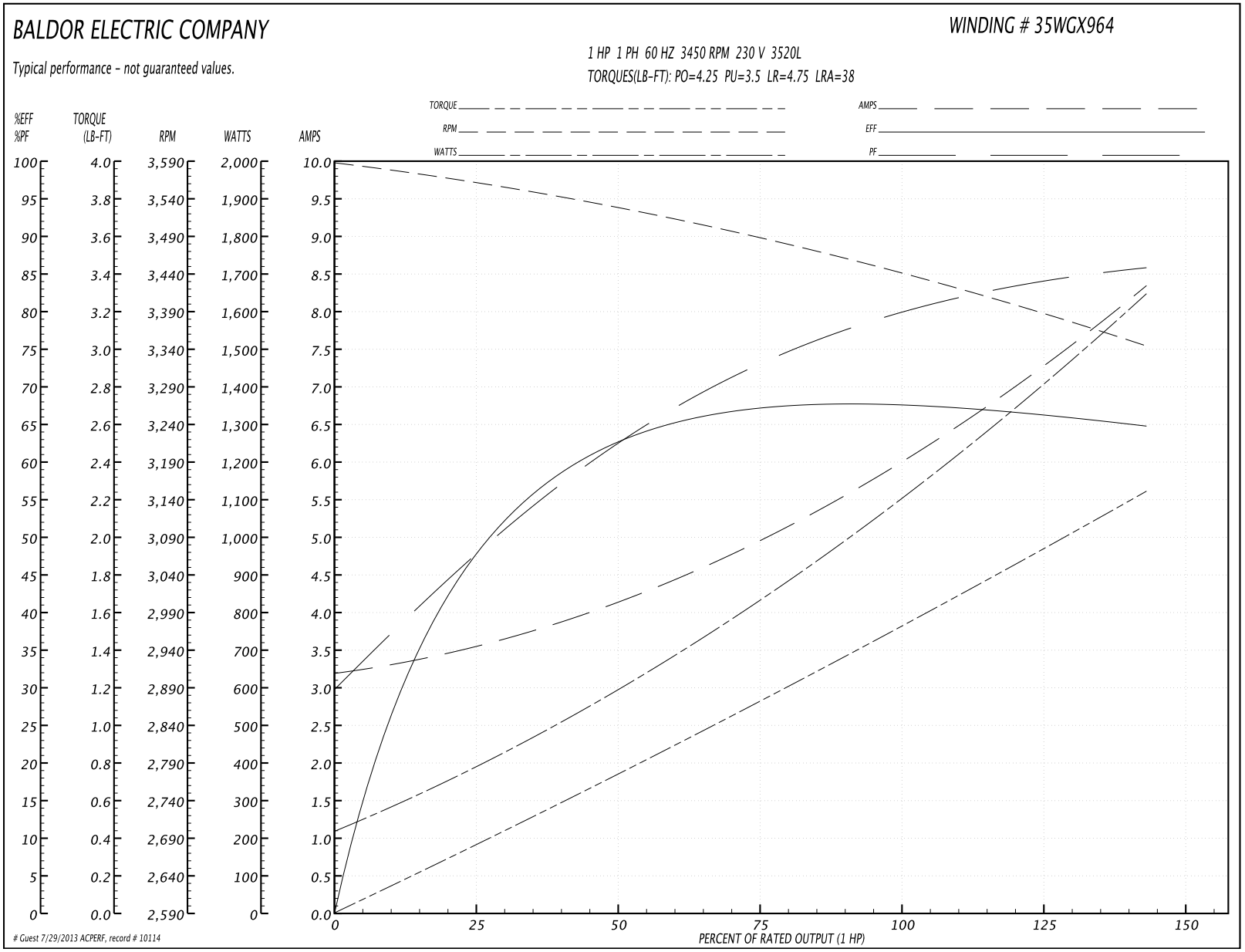
Part Number	Description	Quantity
SA109230	SA 35T946X964	1.000 EA
RA100725	RA 35T946X964	1.000 EA
EC1645A06SP	ELEC CAP, 645-774 MFD, 125V, 2.06D X 4.	1.000 EA
NS2512A01	INSULATOR, CONDUIT BOX X	1.000 EA
35CB3007	35 CB CASTING W/.88 DIA. LEAD HOLE	1.000 EA
36GS1000SP	GASKET-CONDUIT BOX, .06 THICK #SV-330 LE	1.000 EA
51XB1016A07	10-16 X 7/16 HXWSSLD SERTYB	2.000 EA
11XW1032G06	10-32 X .38, TAPTITE II, HEX WSHR SLTD U	1.000 EA
51XW0832A07	8-32 X .44, TAPTITE II, HEX WSHR SLTD SE	2.000 EA
35EP3100M02	FREP TEFC 203 BRG W/O GRSR (RAISED FH MT	1.000 EA
NS2501A01	INSULATOR, CAPACITOR	1.000 EA
51XB1016A05	10-16X5/16HX WA SL SR TYB (F/S)	2.000 EA
HW5100A03SP	WAVY WASHER (W1543-017)	1.000 EA
35EP3300A33	SPL FACE MTD EP -ENCL-205 BRG	1.000 EA
51XN1032A20	10-32 X 1 1/4 HX WS SL SR	2.000 EA
35FN3002A05SP	EXFN, PLASTIC, 6.376 OD, .638 ID	1.000 EA
51XB1214A16	12-14X1.00 HXWSSLD SERTYB	1.000 EA
35FH4005A32SP	IEC FH NO GRSR W/3 HOLES - W/AUTOPHERETI	1.000 EA
51XW1032A06	10-32 X .38, TAPTITE II, HEX WSHR SLTD S	3.000 EA
35CB4521	35 LIPPED CB LID (GALV & PHOSPH)	1.000 EA
35GS1030	35 GS FOR CB LID - LEXIDE	1.000 EA
51XW0832A07	8-32 X .44, TAPTITE II, HEX WSHR SLTD SE	4.000 EA
HW2501D13SP	KEY, 3/16 SQ X 1.375	1.000 EA
HA7000A04	KEY RETAINER 0.625 DIA SHAFTS	1.000 EA

Parts List (continued)

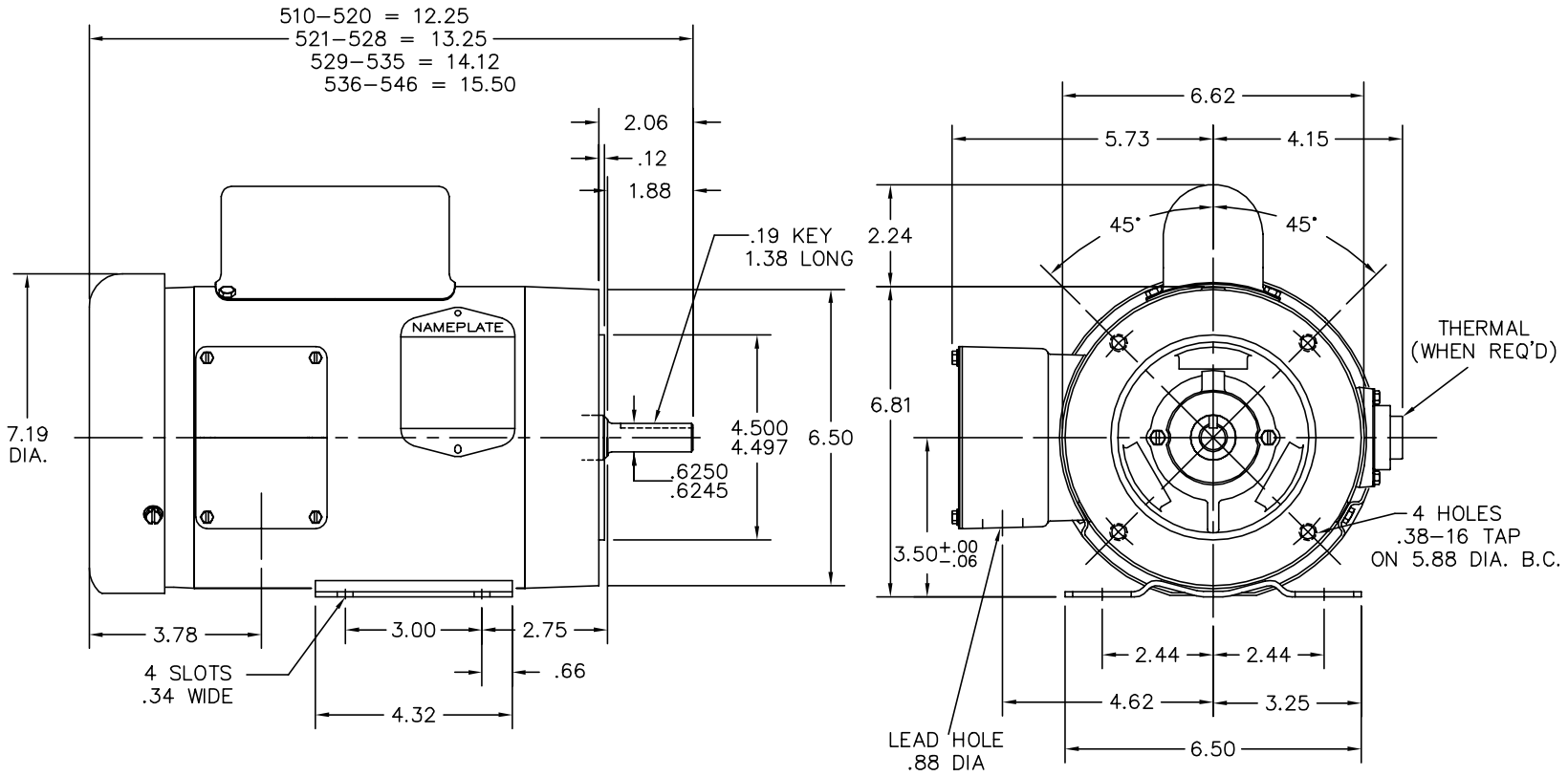
Part Number	Description	Quantity
85XU0407S04	4X1/4 U DRIVE PIN STAINLESS	2.000 EA
WD1000A15	3-520132-2 AMP FLAG (4M/RL NON-CANC/NON-	2.000 EA
MJ1000A75	GREASE, POLYREX EM EXXON	0.050 LB
MG1000G27	PAINT- S9282E CHARCOAL GREY	0.017 GA
SP5055A67	MODEL 35 TYPE L STATIONARY SWITCH	1.000 EA
HA3100A80	THRUBOLT 10-32 X 7.500	4.000 EA
35CB4802A02SP	CAPACITOR COVER, STAMPED X W/AUTOPHORET	1.000 EA
35GS3001A02	GASKET, CA.COVER, 5.38 LONG .06 CS301	1.000 EA
LB1125C01	STD (STOCK) CARTON LABEL BALDOR WITH FLA	1.000 EA
LC0001A01	CONN LABEL / WARNING LABEL (LC0001 / LB1	1.000 EA
NP1256L	ALUM UL CSA CC	1.000 EA
35PA1066	PACKING GROUP COMBINED PRINT	1.000 EA
LB1506	LABEL "AMERICAN MADE" 1.50 X 1.00	1.000 EA

Performance Data at 230V, 60Hz, 1.0HP (Typical performance - Not guaranteed values)							
General Characteristics							
Full Load Torque:	1.5 LB-FT			**Start Configuration:**		DOL	
No-Load Current:	3.2 Amps			**Break-Down Torque:**		4.25 LB-FT	
Line-line Res. @ 25°C.:	2.0 Ohms A Ph / 1.77 Ohms B Ph			**Pull-Up Torque:**		3.5 LB-FT	
Temp. Rise @ Rated Load:	72 C			**Locked-Rotor Torque:**		4.75 LB-FT	
Temp. Rise @ S.F. Load:	90 C			**Starting Current:**		38.0 Amps	
Load Characteristics							
% of Rated Load	**25**	**50**	**75**	**100**	**125**	**150**	**S.F.**
Power Factor:	47.0	64.0	72.0	80.0	84.0	86.0	84.0
Efficiency:	50.0	61.0	67.0	68.0	67.0	64.5	67.0
Speed:	3560.0	3525.0	3485.0	3450.0	3400.0	3340.0	3400.0
Line Amperes:	3.5	4.2	5.0	5.9	7.0	8.4	7.0

Performance Graph at 230V, 60Hz, 1.0HP Typical performance - Not guaranteed values



35LYT946

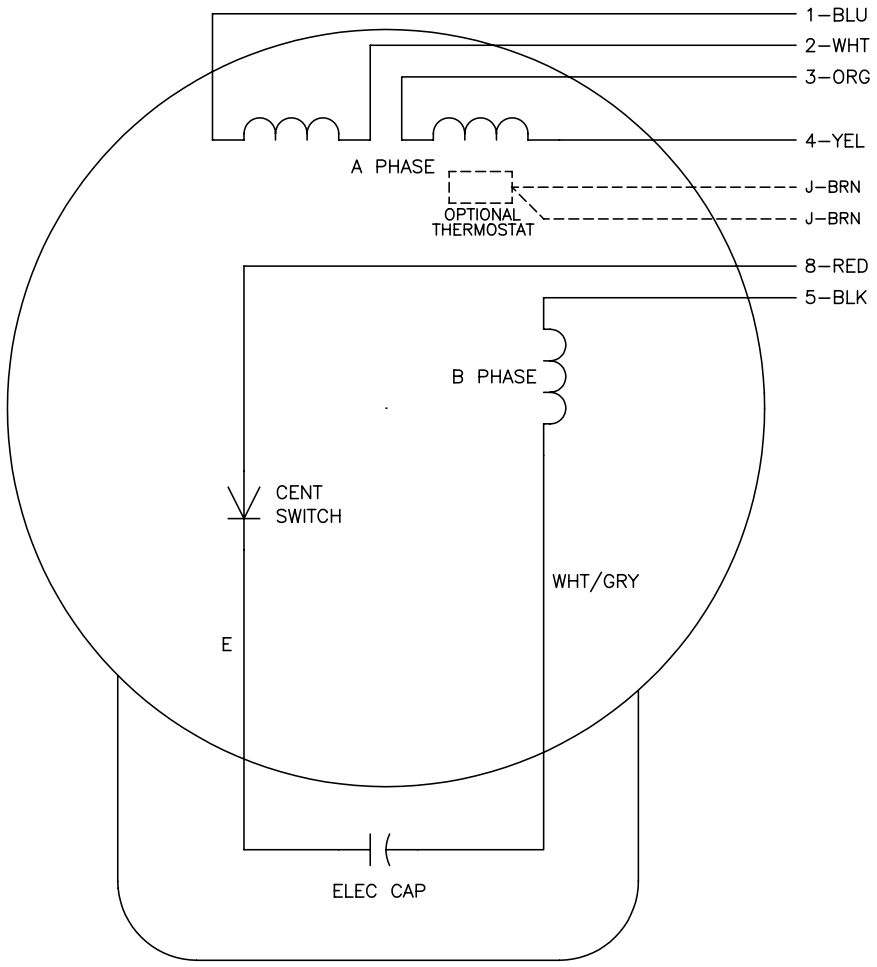


CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT MOTOR PERFORMANCE IS SUITABLE IN THE APPLICATION.

REV. DESC: NEW				BALDOR ELECTRIC Co.
REV. LTR: –	BY: KCT	REVISED: 12:24:47 11/14/2003	TDR: 317575	
35LYT946		FILE: AAA00111242	REF: 35LYT946	STD FACE MTD HORZ 56C TEFC 35L, 2 POLE "W" BASE (35BA4010)
		MTL: –		

35LYT946

CD0001



	LINE A	LINE B	JOIN
HIGH STD	1	4,5	2,3,8
HIGH OPP	1	4,8	2,3,5
LOW STD	1,3,8	2,4,5	–
LOW OPP	1,3,5	2,4,8	–

NOTES:

1. STANDARD ROTATION IS CCW FACING END OPPOSITE SHAFT EXTENSION.
2. OPTIONAL THERMOSTAT IS PROVIDED WHEN SPECIFIED.
3. MULTIPLE CAPACITORS ARE CONNECTED IN PARALLEL UNLESS OTHERWISE SPECIFIED.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

CD0001

REV. DESC: REVISE TO SHOW OPTIONAL COLORS			
REV. LTR: D	BY: JLP	REVISED: 04/08/99 1:16	TDR: 0178636
CD0001		FILE: AAA00007405	MDL: –
		MTL: –	

BALDOR ELECTRIC Co.

TYPE L, DV, REV, 6 LEADS

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Product Information Packet

VEM3555

2HP,3490RPM,3PH,60HZ,56C,3526M,TEFC,F1,N

Part Detail

Revision:	F	**Status:**	PRD/A	**Change #:**		**Proprietary:**	No
Type:	AC	**Prod. Type:**	3526M	**Elec. Spec:**	35WGM774	**CD Diagram:**	
Enclosure:	TEFC	**Mfg Plant:**		**Mech. Spec:**	35J302	**Layout:**	
Frame:	56C	**Mounting:**	F1	**Poles:**	02	**Created Date:**	07-19-2010
Base:	N	**Rotation:**	R	**Insulation:**	F	**Eff. Date:**	01-30-2013
Leads:	9#18	**Literature:**		**Elec. Diagram:**		**Replaced By:**	

Nameplate NP1259L

CAT.NO.	VEM3555						
SPEC.	35J302M774G1						
HP	2						
VOLTS	208-230/460						
AMP	5.3-5/2.5						
RPM	3490						
FRAME	56C	**HZ**	60	**PH**	3		
SER.F.	1.15	**CODE**	M	**DES**	B	**CL**	F
NEMA-NOM-EFF	85.5	**PF**	88				
RATING	40C AMB-CONT						
CC		**USABLE AT 208V**					
DE	6205	**ODE**	6203				
ENCL	TEFC	**SN**					

Parts List

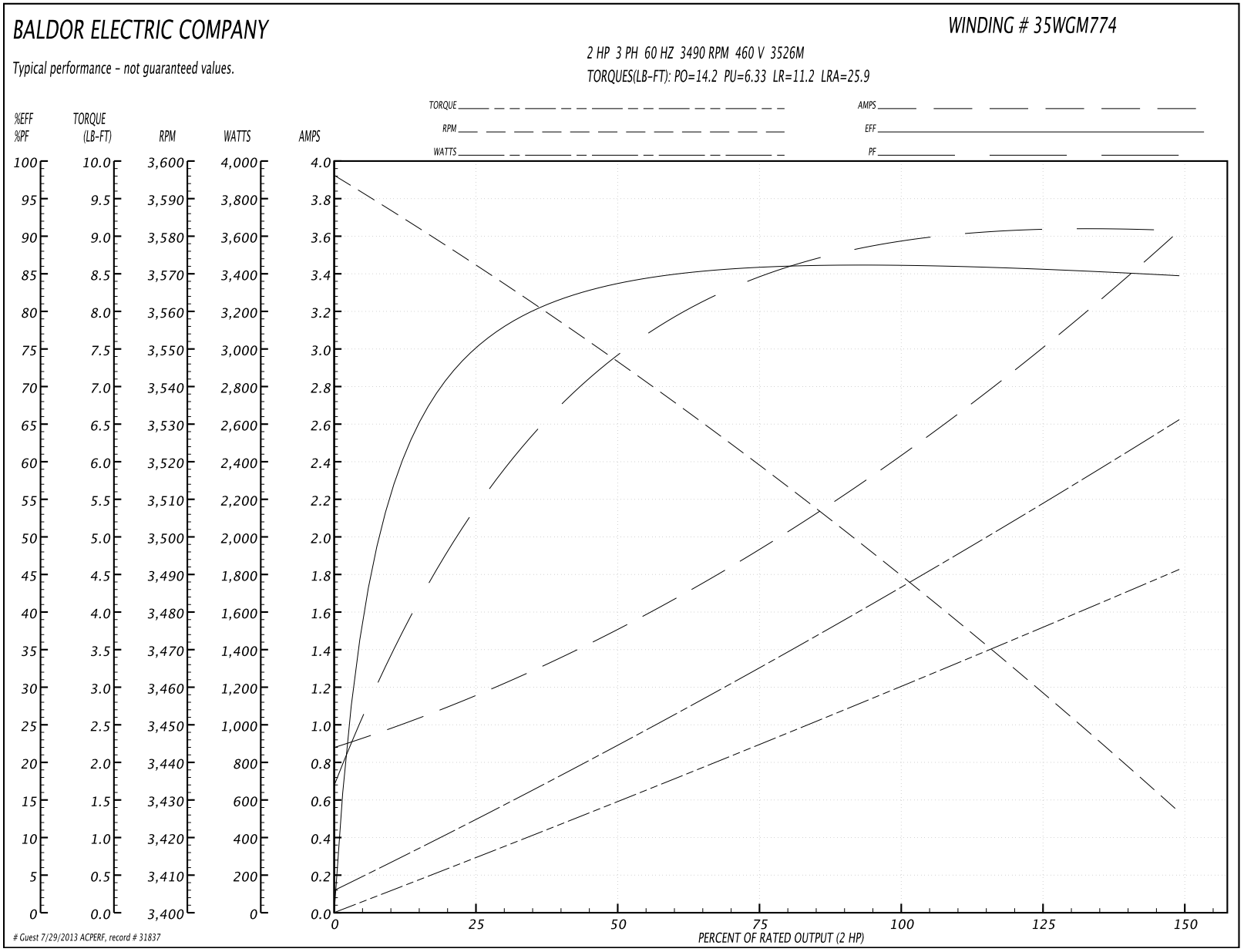
Part Number	Description	Quantity
SA200162	SA 35J302M774G1	1.000 EA
RA187481	RA 35J302M774G1	1.000 EA
S/P107-000-001	SUPER E PROC'S-FS & WS PLTS-POLYREX EM G	1.000 EA
NS2512A01	INSULATOR, CONDUIT BOX X	1.000 EA
35CB3000SP	CONDUIT BOX, CAST, W/.88 DIA. LEAD HOLE	1.000 EA
36GS1000SP	GASKET-CONDUIT BOX, .06 THICK #SV-330 LE	1.000 EA
51XB1016A07	10-16 X 7/16 HXWSSLD SERTYB	2.000 EA
11XW1032G06	10-32 X .38, TAPTITE II, HEX WSHR SLTD U	1.000 EA
HW3001B01	003SS CUP WASHER, FOR #8 SCREW	1.000 EA
MJ1000A75	GREASE, POLYREX EM EXXON	0.050 LB
35EP3100M02	FREP TEFC 203 BRG W/O GRSR (RAISED FH MT	1.000 EA
HW5100A03SP	WAVY WASHER (W1543-017)	1.000 EA
35EP3300A33	SPL FACE MTD EP -ENCL-205 BRG	1.000 EA
51XN1032A20	10-32 X 1 1/4 HX WS SL SR	2.000 EA
51XB1214A16	12-14X1.00 HXWSSLD SERTYB	1.000 EA
35FH4005A32SP	IEC FH NO GRSR W/3 HOLES - W/AUTOPHERETI	1.000 EA
51XW1032A06	10-32 X .38, TAPTITE II, HEX WSHR SLTD S	3.000 EA
35CB4514	35 LIPPED CB LID	1.000 EA
36GS1001SP	GASKET, CONDUIT BOX LID, .06 THICK #SV-3	1.000 EA
51XW0832A07	8-32 X .44, TAPTITE II, HEX WSHR SLTD SE	4.000 EA
HW2501D13SP	KEY, 3/16 SQ X 1.375	1.000 EA
HA7000A01	KEY RETAINER 7/8" DIA SHAFT	1.000 EA
85XU0407S04	4X1/4 U DRIVE PIN STAINLESS	2.000 EA
MG1000Y03	WILKO 689.710 GOLD PAINT SUPER E	0.017 GA

Parts List (continued)

Part Number	Description	Quantity
HA3100A15	THRUBOLT 10-32 X 8.375	4.000 EA
34FN3002A01SP	EXTERNAL FAN, PLASTIC, .637/.639 HUB W/	1.000 EA
LB1125C02	SUPER-E (STOCK CTN LABEL SUPER-E WITH FL	1.000 EA
LC0005E01	CONN.DIA./WARNING LABEL (LC0005/LB1119)	1.000 EA
NP1259L	ALUM SUPER-E UL CSA-EEV CC NEMA PREMIUM	1.000 EA
35PA1066	PACKING GROUP COMBINED PRINT	1.000 EA
PK3082	STYROFOAM CRADLE	1.000 EA
LB1506	LABEL "AMERICAN MADE" 1.50 X 1.00	1.000 EA

Performance Data at 460V, 60Hz, 2.0HP (Typical performance - Not guaranteed values)							
General Characteristics							
Full Load Torque:	2.98 LB-FT			**Start Configuration:**		DOL	
No-Load Current:	0.912 Amps			**Break-Down Torque:**		14.2 LB-FT	
Line-line Res. @ 25°C.:	6.9119 Ohms A Ph / 0.0 Ohms B Ph			**Pull-Up Torque:**		6.33 LB-FT	
Temp. Rise @ Rated Load:	44 C			**Locked-Rotor Torque:**		11.2 LB-FT	
Temp. Rise @ S.F. Load:	52 C			**Starting Current:**		25.9 Amps	
Load Characteristics							
% of Rated Load	**25**	**50**	**75**	**100**	**125**	**150**	**S.F.**
Power Factor:	55.0	75.0	84.0	88.0	90.0	91.0	89.0
Efficiency:	74.3	83.5	85.9	86.4	85.9	84.8	86.1
Speed:	3571.7	3546.5	3520.2	3492.1	3460.7	3425.5	3473.0
Line Amperes:	1.1	1.47	1.93	2.44	3.0	3.61	2.78

Performance Graph at 460V, 60Hz, 2.0HP Typical performance - Not guaranteed values



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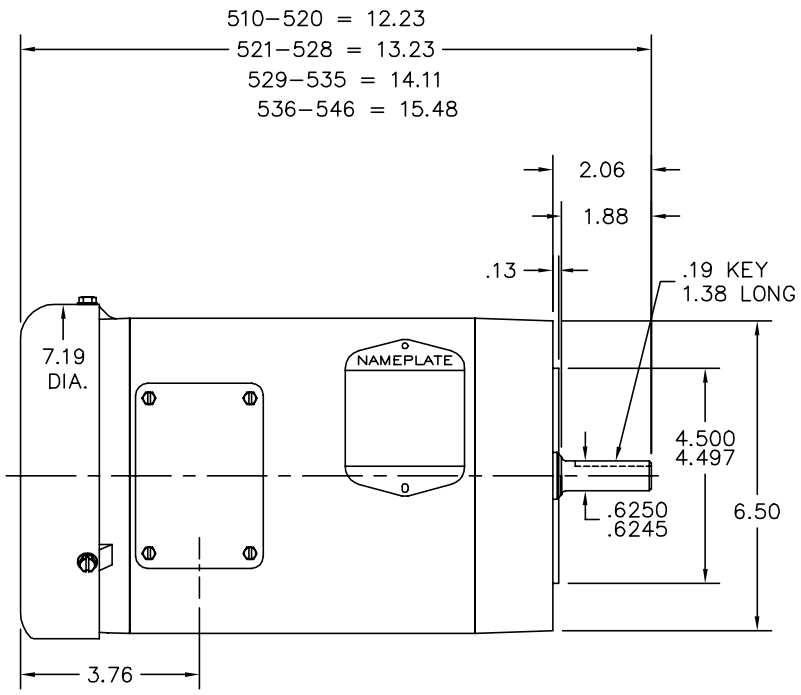
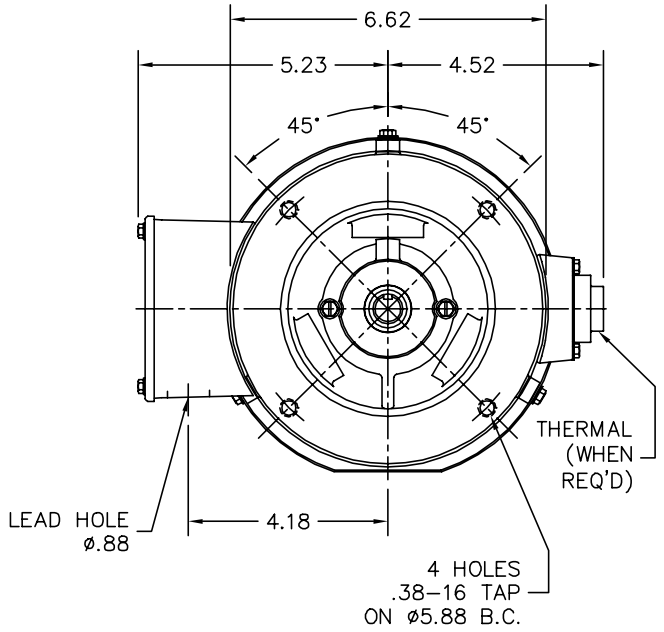


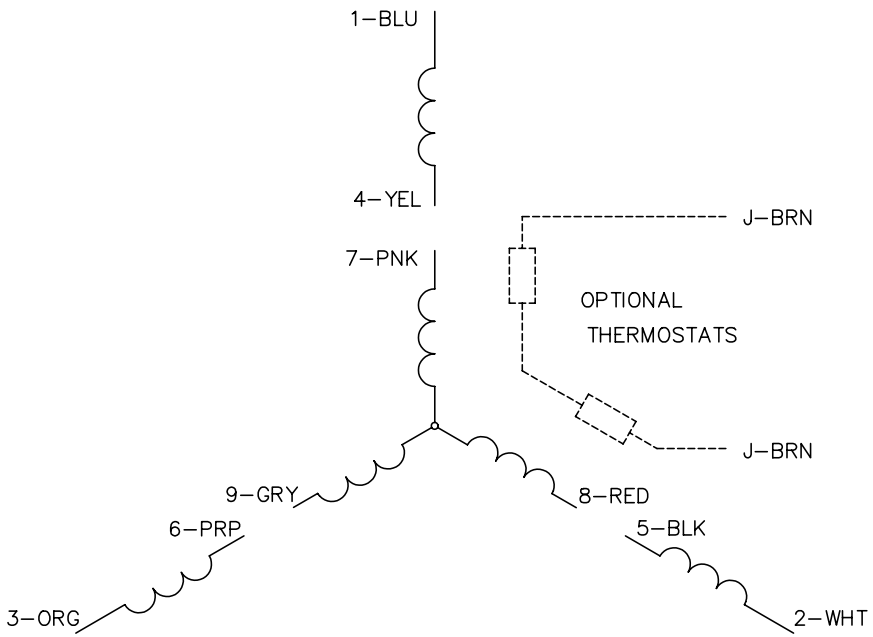


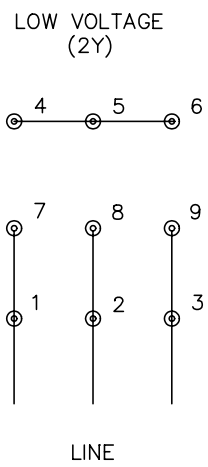
35LYJ302

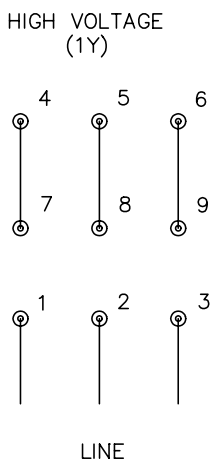
CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT BALDOR'S PRODUCT WILL PERFORM SUITABLY IN THE INTENDED APPLICATION.

REV. DESC: UPDATE DRWG PARTS			BALDOR
REV. LTR: C	VERSION: 02	TDR: 000000738205	
FILE: \AAA\00041\631		REVISED: 02:09:50 03/15/2012	VERT 56C TEFC 35M SUPER-E
MTL: –		BY: ENBENBO	SH 1 of 1

CD0005







NOTES:

1. INTERCHANGE ANY TWO LINE LEADS TO REVERSE ROTATION.
2. OPTIONAL THERMOSTATS ARE PROVIDED WHEN SPECIFIED.
3. ACTUAL NUMBER OF INTERNAL PARALLEL CIRCUITS MAY BE A MULTIPLE OF THOSE SHOWN ABOVE.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

CD0005

REV. DESC: REVISE TO SHOW OPTIONAL COLORS			BALDOR ELECTRIC Co.
REV. LTR: E	BY: JLP	REVISED: 01/19/99 10:15	TDR: 0171435
CD0005		FILE: AAA00005140	MDL: –
		MTL: –	3PH, DV, 9 LEADS

BALDOR
A MEMBER OF THE ABB GROUP

BALDOR • RELIANCE

Product Information Packet

KL3400

.17HP,1725RPM,1PH,60HZ,56C,3408L,TEFC,F1

For Baldor Sales and Support, Please Contact: Walker EMD • http://www.walkeremd.com • Toll-Free: (800) 876-4444 • Phone: (203) 426-7700 • Fax: (203) 426-7800

Part Detail

Revision:	T	**Status:**	PRD/A	**Change #:**		**Proprietary:**	No
Type:	AC	**Prod. Type:**	3408L	**Elec. Spec:**	34WGW020	**CD Diagram:**	
Enclosure:	TEFC	**Mfg Plant:**		**Mech. Spec:**	34C063	**Layout:**	
Frame:	56C	**Mounting:**	F1	**Poles:**	04	**Created Date:**	
Base:	N	**Rotation:**	R	**Insulation:**	B	**Eff. Date:**	10-07-2011
Leads:	6#18	**Literature:**		**Elec. Diagram:**		**Replaced By:**	

Nameplate NP1256L

CAT.NO.	KL3400						
SPEC.	34C63W20						
HP	.17						
VOLTS	115/230						
AMP	3.8/1.9						
RPM	1725						
FRAME	56C	**HZ**	60	**PH**	1		
SER.F.	1.35	**CODE**	M	**DES**	N	**CLASS**	B
NEMA-NOM-EFF	49	**PF**	57				
RATING	40C AMB-CONT						
CC		**USABLE AT 208V**	2.3				
DE	6203	**ODE**	6203				
ENCL	TEFC	**SN**					
	SFA 4.4/2.2						

Parts List

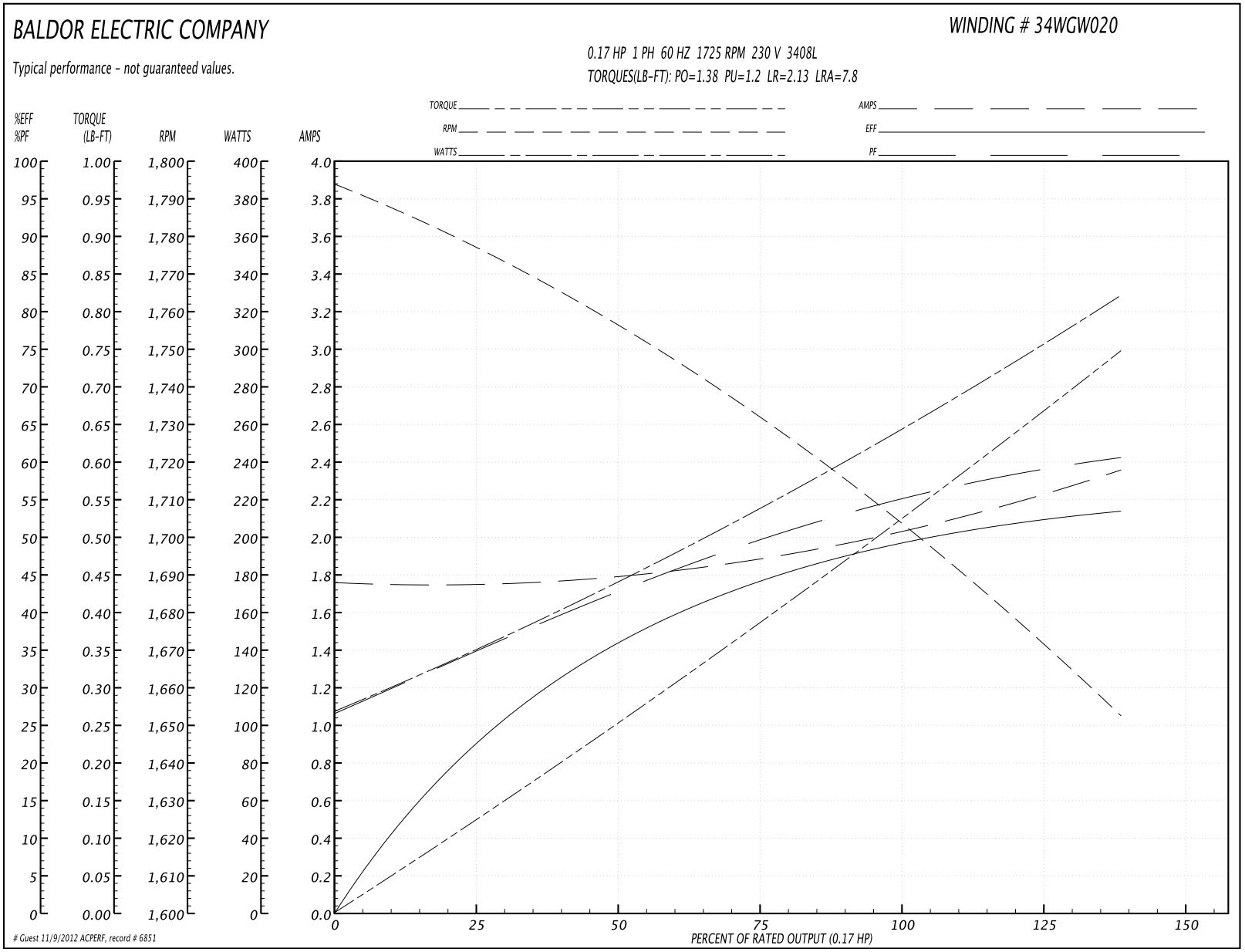
Part Number	Description	Quantity
SA005699	SA 34C63W20	1.000 EA
RA002445	RA 34C63W20	1.000 EA
NS2512A01	INSULATOR, CONDUIT BOX X	1.000 EA
34CB3002A	CB CAST W/.88 DIA HOLE	1.000 EA
34GS1029A01	GASKET, CONDUIT BOX	1.000 EA
51XB1016A07	10-16 X 7/16 HXWSSLD SERTYB	2.000 EA
11XW1032G06	10-32 X .38, TAPTITE II, HEX WSHR SLTD U	1.000 EA
34EP3102A01SP	FR ENDPLATE, MACH	1.000 EA
51XW0832A07	8-32 X .44, TAPTITE II, HEX WSHR SLTD SE	2.000 EA
NS2500A01	INSULATOR, AUTO THER PROT	1.000 EA
34CB4800SP	CAPACITOR COVER, STAMPED	1.000 EA
51XB1016A05	10-16X5/16HX WA SL SR TYB (F/S)	2.000 EA
HW5100A03SP	WAVY WASHER (W1543-017)	1.000 EA
51XN1032A20	10-32 X 1 1/4 HX WS SL SR	2.000 EA
34FN3002A01SP	EXTERNAL FAN, PLASTIC, .637/.639 HUB W/	1.000 EA
34FH4002A01	IEC FH NO GREASER	1.000 EA
51XW1032A06	10-32 X .38, TAPTITE II, HEX WSHR SLTD S	3.000 EA
34CB4517	CB LID 4 MTG HOLES .22 DIA STAMPED, FOR	1.000 EA
34GS1031A01	GASKET, FLAT CONDUIT BOX LID (LEXIDE)	1.000 EA
51XW0832A07	8-32 X .44, TAPTITE II, HEX WSHR SLTD SE	4.000 EA
HW2501D13SP	KEY, 3/16 SQ X 1.375	1.000 EA
HA7000A04	KEY RETAINER 0.625 DIA SHAFTS	1.000 EA
34EP3300A24SP	PU ENDPLATE, MACH	1.000 EA
MG1000G27	PAINT- S9282E CHARCOAL GREY	0.014 GA

Parts List (continued)

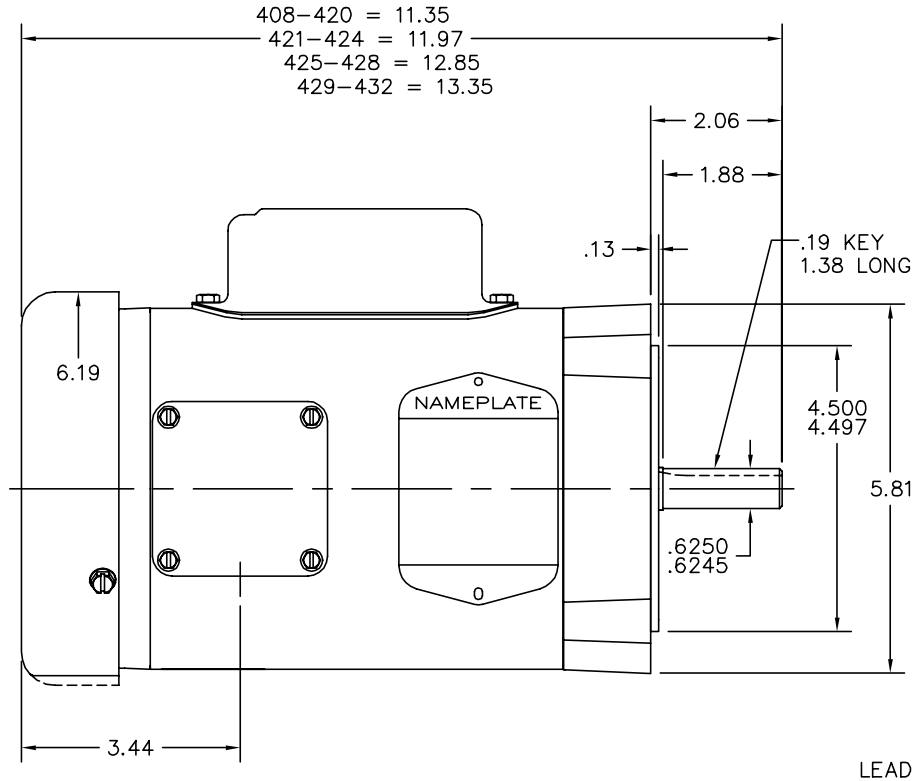
Part Number	Description	Quantity
10XF0440S02	04-40 X 1/8 TYPE F HEX HD STAINLESS STIC	2.000 EA
EC1130A02SP	ELEC CAP, 130-156 MFD, 125V, 1.48D X 3.3	1.000 EA
34GS3000SP	GASKET, CAPACITOR BOX	1.000 EA
SP5056A24	MODEL 34 TYPE L STATIONARY SWITCH WITH L	1.000 EA
HA3100A12	THRUBOLT 10-32 X 7.375	4.000 EA
LB1125C01	STD (STOCK) CARTON LABEL BALDOR WITH FLA	1.000 EA
LC0001A01	CONN LABEL / WARNING LABEL (LC0001 / LB1	1.000 EA
NP1256L	ALUM UL CSA CC	1.000 EA
34PA1002	PACKING GROUP, BALDOR	1.000 EA
PK3083T	STYROFOAM PACKING CRADLE W/TAPE	1.000 EA

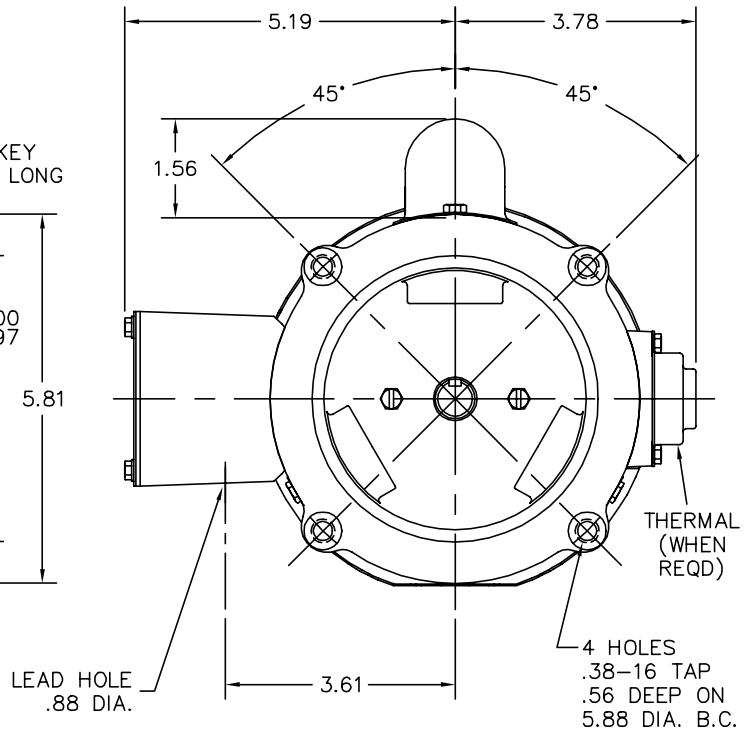
Performance Data at 230V, 60Hz, 0.17HP (Typical performance - Not guaranteed values)							
General Characteristics							
Full Load Torque:	0.5 LB-FT			**Start Configuration:**		DOL	
No-Load Current:	1.75 Amps			**Break-Down Torque:**		1.38 LB-FT	
Line-line Res. @ 25°C.:	13.7 Ohms A Ph / 10.8 Ohms B Ph			**Pull-Up Torque:**		1.2 LB-FT	
Temp. Rise @ Rated Load:	50 C			**Locked-Rotor Torque:**		2.13 LB-FT	
Temp. Rise @ S.F. Load:	61 C			**Starting Current:**		7.8 Amps	
Load Characteristics							
% of Rated Load	**25**	**50**	**75**	**100**	**125**	**150**	**S.F.**
Power Factor:	32.0	41.0	49.0	57.0	63.0	69.0	67.0
Efficiency:	21.0	35.0	45.0	49.0	52.0	53.0	53.0
Speed:	1775.0	1760.0	1730.0	1710.0	1685.0	1650.0	1665.0
Line Amperes:	1.75	1.8	1.9	2.0	2.1	2.4	2.2

Performance Graph at 230V, 60Hz, 0.17HP Typical performance - Not guaranteed values



34LYC063



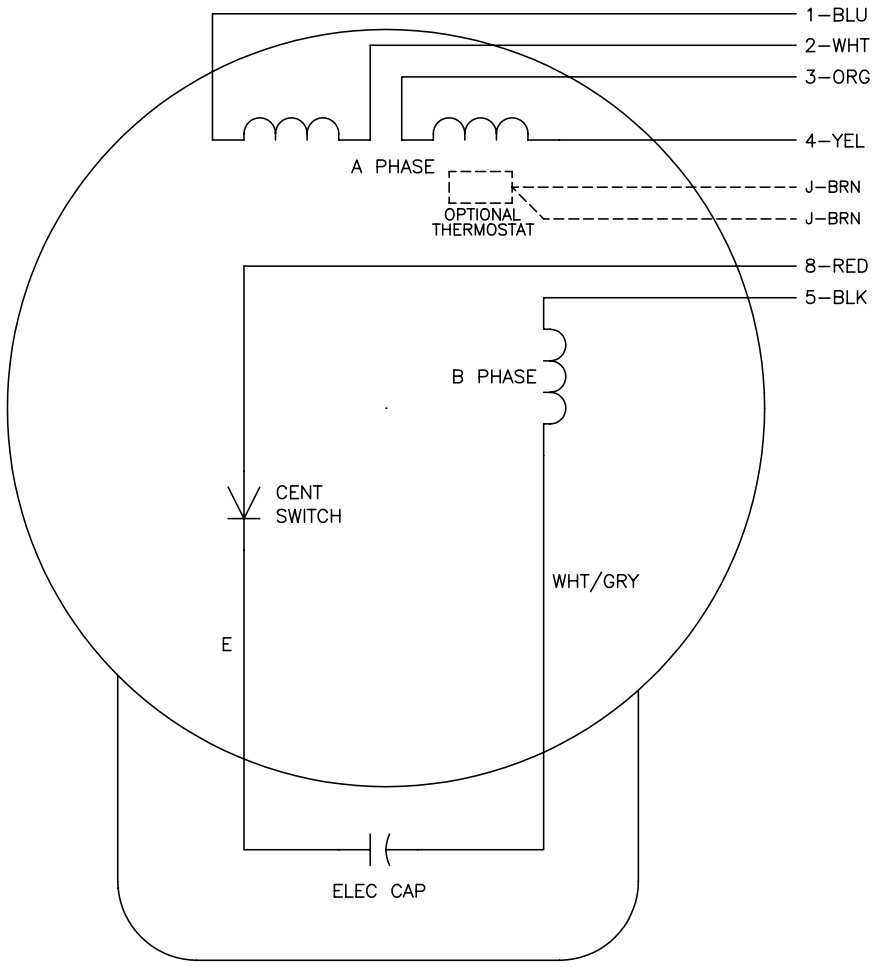


34LYC063

CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT BALDOR'S PRODUCT WILL PERFORM SUITABLY IN THE INTENDED APPLICATION.

REV. DESC: EXTEND CENTER LINE ON RIGHT VIEW, CLEAN UP DIM'S			BALDOR
REV. LTR: L	VERSION: 04	TDR: 000000762603	
FILE: \AAA\00038\920		REVISED: 08:33:13 08/30/2012	STD VERT 34L NEMA 56C TEFC
MTL: –		BY: ENMICW1	SH 1 of 1

CD0001



	LINE A	LINE B	JOIN
HIGH STD	1	4,5	2,3,8
HIGH OPP	1	4,8	2,3,5
LOW STD	1,3,8	2,4,5	–
LOW OPP	1,3,5	2,4,8	–

NOTES:

1. STANDARD ROTATION IS CCW FACING END OPPOSITE SHAFT EXTENSION.
2. OPTIONAL THERMOSTAT IS PROVIDED WHEN SPECIFIED.
3. MULTIPLE CAPACITORS ARE CONNECTED IN PARALLEL UNLESS OTHERWISE SPECIFIED.
4. LEAD COLORS ARE OPTIONAL. LEADS MUST ALWAYS BE NUMBERED AS SHOWN.

REV. DESC: REVISE TO SHOW OPTIONAL COLORS			
REV. LTR: D	BY: JLP	REVISED: 04/08/99 1:16	TDR: 0178636
CD0001		FILE: AAA00007405	MDL: –
		MTL: –	

BALDOR ELECTRIC Co.

TYPE L, DV, REV, 6 LEADS

CD0001

Features

- Lightweight, low-cost valves for air service
- Ideal for low pressure applications
- Provides high flow, Cv up to 138 (Kv 118)
- Air and vacuum service

Construction

Valve Parts in Contact with Fluids	
Body	Aluminum
Seats, Diaphragms, Disc	NBR
Disc-Holder	PA (10.1 and 11.6 watt Normally Open only)
Core Guide	CA
Core Tube	305 Stainless Steel
Rider Rings	PTFE
Core and Plugnut	430F Stainless Steel
Springs*	302 Stainless Steel
Shading Coil	Copper
* For 8040H006, 8040H007, 8040H008, spring material is 17-7 PH	

Electrical

Standard Coil and Class of Insulation	Watt Rating and Power Consumption				Spare Coil Part No.			
		AC			General Purpose		Explosionproof	
	DC Watts	Watts	VA Holding	VA Inrush	AC	DC	AC	DC
F	-	6.1	16	40	238210	-	238214	-
F	11.6	10.1	25	70	238610	238710	238614	238714
B	14.9	-	-	-	-	62691	-	-
F	-	15.4	27	160	99257	-	99257	-
F	-	28.2	50	385	206409	-	206409	-

Standard Voltages: 24, 120, 240, 480 volts AC, 60 Hz (or 110, 220 volts AC, 50 Hz), 6, 12, 24, 120, 240 volts DC. Must be specified when ordering. Other voltages available when required. (Note: 24 volt AC, 60 Hz not available with 28.2 watt coil)

Solenoid Enclosures

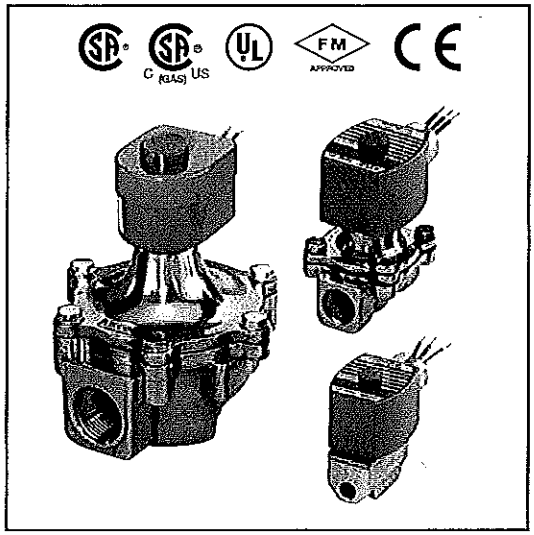
Standard: RedHat II - Watertight, Types 1, 2, 3, 3S, 4, and 4X; RedHat - Type I.

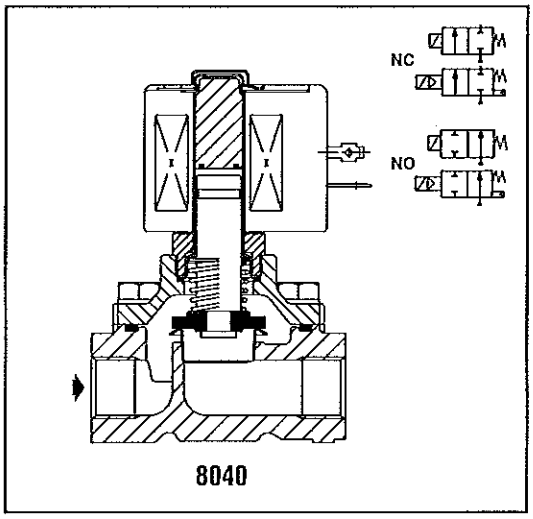
Optional: RedHat II - Explosionproof and Watertight, Types 3, 3S, 4, 4X, 6, 6P, 7, and 9; RedHat - Explosionproof and Raintight, Types 3, 7, and 9. (Except EF8215A40 and EF8215A90, which are suitable for Types 3 and 7 (C and D) only and have a T2B temperature rating code.)
To order, add prefix "EF" to catalog number.

See Optional Features Section for other available options.

Nominal Ambient Temp. Ranges

Series	AC	DC	
	RedHat II/RedHat	RedHat II	RedHat
8040	-40°F to 125°F (-40°C to 52°C)	-	-
8215	32°F to 125°F (0°C to 52°C)	32°F to 104°F (0°C to 40°C)	32°F to 77°F (0°C to 25°C) (104°F/40°C occasionally)
Refer to Engineering Section for details.			





8040

Approvals:

CSA certified to:

8040 Series:

1) Standard C22.2 No. 139 "Electrically Operated Valves," File 10381.
2) Automatic Gas Valves Z21.21 (6.5), File 112872.
3) Automatic Gas Safety Shutoff Valves C/I (3.9), File 112872.

8215 Series Normally Closed:

1) Standard C22.2 No. 139 "Electrically Operated Valves," File 10381.
2) Automatic Gas Valves Z21.21 (6.5), File 112872.

8215 Series Normally Open:

1) Standard C22.2 No. 139 "Electrically Operated Valves," File 10381.

UL listed, as indicated. FM approved (Normally Closed only, except Catalog Numbers 8215A090 and 8215A040). RedHat II meets applicable CE directives.

Refer to Engineering Section for details.

Specifications (English units)

Pipe Size (ins.)	Orifice Size (ins.)	Cv Flow Factor	Gas Capacity Btu/hr ⑥	Operating Pressure Differential (psi) Min.	Max. AC Air-Fuel Gas	Max. DC Air-Fuel Gas	Max. Fluid Temp. °F AC	Max. Fluid Temp. °F DC	Aluminum Body Catalog Number	Const. Rel. AC	Const. Rel. DC	UL ⑤ Listing	Wall Rating/ Class of Coil Insulation ② AC	Wall Rating/ Class of Coil Insulation ② DC
NORMALLY CLOSED (Closed when de-energized)														
1/8	5/16	1.0	53,700	0	15	-	125	-	8040H006	11		O	6.1/F	-
1/4	5/16	1.1	59,000	0	15	-	125	-	8040H007	11		O	6.1/F	-
3/8	5/16	1.2	64,400	0	15	-	125	-	8040H008	11		O	6.1/F	-
3/8	3/4	3.4	183,000	0	50	25	125	104	8215G010	2		O	10.1/F	11.6/F
3/8	3/4	3.5	-	5	125	125	125	104	8215G001 ①	1		O	6.1/F	11.6/F
1/2	3/4	5.4	291,000	0	2	-	125	-	8040G022	13A		O	10.1/F	-
1/2	3/4	4.4	238,500	0	50	25	125	104	8215G020	2		O	10.1/F	11.6/F
1/2	3/4	4.8	-	5	125	125	125	104	8215G002 ①	1		O	6.1/F	11.6/F
3/4	3/4	9.5	512,000	0	2	-	125	-	8040G023	13B		O	10.1/F	-
3/4	3/4	5.1	247,500	0	50	25	125	104	8215G030	4		O	10.1/F	11.6/F
3/4	3/4	5.1	-	5	125	125	125	104	8215G003 ①	3		O	6.1/F	11.6/F
1	1 5/8	21	1,119,000	0	25	25	125	77	8215B050 ③	6	16	O	15.4/F	14.9/B
1 1/4	1 5/8	32	1,730,000	0	25	25	125	77	8215B060 ③	6	16	O	15.4/F	14.9/B
1 1/2	1 5/8	35	1,900,000	0	25	25	125	77	8215B070 ③	6	16	O	15.4/F	14.9/B
2	2 3/32	60	3,251,000	0	25	15	125	77	8215B080 ③	7	17	O	15.4/F	14.9/B
2 1/2	3	117	5,821,000	0	5	-	125	-	8215A090 ⑦	8		O	28.2/F	-
3	3	138	7,430,000	0	5	-	125	-	8215A040 ⑦	8		O	28.2/F	-
NORMALLY OPEN (Open when de-energized)														
3/8	3/4	3.2	172,500	0	125	125	125	104	8215G013	9		●	10.1/F	11.6/F
1/2	3/4	4	206,250	0	125	125	125	104	8215G023	9		●	10.1/F	11.6/F
3/4	3/4	4.6	247,500	0	125	125	125	104	8215G033	10		●	10.1/F	11.6/F
1	1 5/8	22	1,191,750	0	25	15	125	77	8215C053	12	18	●	15.4/F	14.9/B
1 1/4	1 5/8	33	1,793,250	0	25	15	125	77	8215C063	12	18	●	15.4/F	14.9/B
1 1/2	1 5/8	37	1,988,250	0	25	15	125	77	8215C073	13	19	●	15.4/F	14.9/B
2	2 3/32	58	3,100,000	0	25	15	125	77	8215C083	14	20	●	15.4/F	14.9/B
2 1/2	3	117	6,290,000	0	5	-	125	-	8215B093 ④⑦	15		●	28.2/F	-

① Do not use for Fuel Gas.
② On 50 hertz service, the watt rating for the 6.1/F solenoid is 8.1 watts.
③ FM Approved Process Control Valves. *See Engineering Section (Approvals) for details.*
④ Type I enclosure only.
⑤ O = Safety Shutoff Valve; ● = General Purpose Valve. *Refer to Engineering Section (Approvals) for details.*
⑥ 1" W.C. Drop @ 2" W.C. Inlet Pressure, 1,000 Btu/cu.ft. or more, 0.64 Specific Gravity Gas.
⑦ Not available with 24 volt, 60 Hz coil.

Specifications (Metric units)

Pipe Size (ins.)	Drilice Size (mm)	Kv Flow Factor (m3/h)	Gas Capacily Btu/hr ⑥	Operatfng Pressure Ditferentiat (bar) Min.	Max. AC Air-Fuel Gas	Max. DC Air-Fuel Gas	Max. Fluid Temp. °C AC	DC	Aluminum Body Catalog Number	Const. Ref. AC	OC	UL ⑤ Listing	Watt Raling/ Class of Coil Insutalion ② AC	DC
NORMALLY CLOSED (Closed when de-energized)														
1/8	7.9	.86	53,700	0	1.0	-	52	-	8040H006	11		O	6.1/F	-
1/4	7.9	.94	59,000	0	1.0	-	52	-	8040H007	11		O	6.1/F	-
3/8	7.9	1.0	64,400	0	1.0	-	52	-	8040H008	11		O	6.1/F	-
3/8	19	2.9	183,000	0	3.4	1.7	52	40	8215G010	2		O	10.1/F	11.6/F
3/8	19	3.0	-	0.3	8.6	8.6	52	40	8215G001 ①	1		O	6.1/F	11.6/F
1/2	19	4.6	291,000	0	0.1	-	52	-	8040G022	13A		O	10.1/F	-
1/2	19	3.8	238,500	0	3.4	1.7	52	40	8215G020	2		O	10.1/F	11.6/F
1/2	19	4.1	-	0.3	8.6	8.6	52	40	8215G002 ①	1		O	6.1/F	11.6/F
3/4	19	8.1	449,000	0	0.1	-	52	-	8040G023	13B		O	10.1/F	-
3/4	19	4.4	247,500	0	3.4	1.7	52	40	8215G030	4		O	10.1/F	11.6/F
3/4	19	4.4	-	0.3	8.6	8.6	52	40	8215G003 ①	3		O	6.1/F	11.6/F
1	41	18	1,119,000	0	1.7	1.7	52	25	8215B050 ③	6	16	O	15.4/F	14.9/B
1 1/4	41	27	1,730,000	0	1.7	1.7	52	25	8215B060 ③	6	16	O	15.4/F	14.9/B
1 1/2	41	30	1,900,000	0	1.7	1.7	52	25	8215B070 ③	6	16	O	15.4/F	14.9/B
2	53	51	3,251,000	0	1.7	1.0	52	25	8215B080 ③	7	17	O	15.4/F	14.9/B
2 1/2	76	100	5,821,000	0	0.3	-	52	-	8215A090 ⑦	8		O	28.2/F	-
3	76	118	7,430,000	0	0.3	-	52	-	8215A040 ⑦	8		O	28.2/F	-
NORMALLY OPEN (Open when de-energized)														
3/8	19	2.74	172,500	0	8.6	8.6	52	40	8215G013	9		●	10.1/F	11.6/F
1/2	19	3.4	206,250	0	8.6	8.6	52	40	8215G023	9		●	10.1/F	11.6/F
3/4	19	3.9	247,500	0	8.6	8.6	52	40	8215G033	10		●	10.1/F	11.6/F
1	41	19	1,191,750	0	1.7	1.0	52	25	8215C053	12	18	●	15.4/F	14.9/B
1 1/4	41	28	1,793,250	0	1.7	1.0	52	25	8215C063	12	18	●	15.4/F	14.9/B
1 1/2	41	32	1,988,250	0	1.7	1.0	52	25	8215C073	13	19	●	15.4/F	14.9/B
2	53	50	3,100,000	0	1.7	1.0	52	25	8215C083	14	20	●	15.4/F	14.9/B
2 1/2	76	100	6,290,000	0	0.3	-	52	-	8215B093 ④⑦	15		●	28.2/F	-

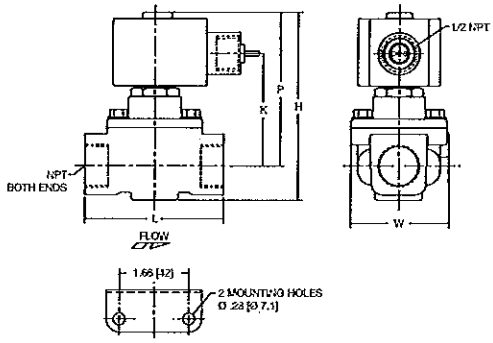
① Do not use for Fuel Gas.
② On 50 hertz service, the watt rating for the 6.1/F solenoid is 8.1 watts.
③ FM Approved Process Control Valves. *See Engineering Section (Approvals) for details.*
④ Type 1 enclosure only.
⑤ O = Safety Shutoff Valve; ● = General Purpose Valve. *Refer to Engineering Section (Approvals) for details.*
⑥ 1" W.C. Drop @ 2" W.C. Intet Pressure, 1,000 Btu/cu.ft. or more, 0.64 Specific Gravity Gas.
⑦ Not available with 24 volt, 60 Hz coil.

Dimensions: inches (mm)

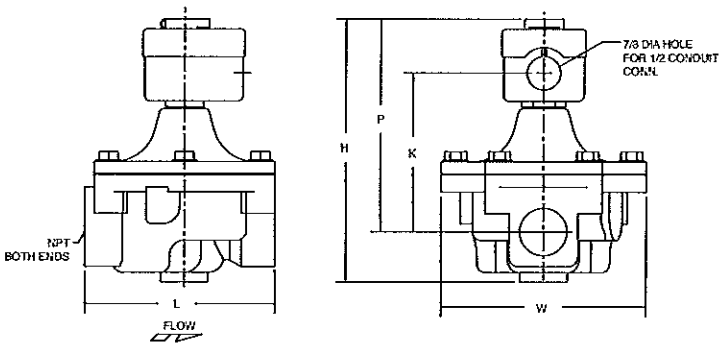
Const. Ref.		H	K	L	P	W
1	ins.	3.42	2.00	2.75	2.87	2.46
	mm	87	51	70	73	63
2	ins	4.02	2.49	2.75	3.46	2.46
	mm	102	63	70	88	63
3	ins.	3.87	2.19	3.31	3.05	2.33
	mm	98	56	84	77	59
4	ins.	4.46	2.68	3.31	3.64	2.33
	mm	113	68	84	92	59
6 ①	ins.	6.84	4.25	5.00	5.59	5.38
	mm	174	108	127	142	137
7 ①	ins.	7.47	4.53	6.09	5.94	6.31
	mm	190	115	155	151	160
8 ①	ins.	10.25	5.75	7.79	7.91	7.94
	mm	260	146	198	201	202
9	ins.	4.42	2.72	2.75	3.86	2.36
	mm	112	69	70	98	60
10	ins.	4.86	2.72	3.31	4.04	2.36
	mm	123	69	84	103	60
11	ins.	2.74	1.44	2.00	2.30	1.69
	mm	69	36	51	58	43
12	ins.	6.84	2.22	5.00	3.63	5.38
	mm	174	56	127	92	137
13	ins.	6.84	2.16	5.00	3.56	5.38
	mm	174	55	127	90	137
13A	ins.	4.05	2.46	2.75	3.44	2.42
	mm	103	63	70	87	62
13B	ins.	4.49	2.65	3.31	3.63	2.39
	mm	114	67	84	92	61
14 ②	ins.	7.44	2.41	6.09	3.81	6.31
	mm	189	61	155	97	160
15 ②	ins.	10.25	3.07	7.80	5.22	7.94
	mm	260	78	198	133	202
16	ins.	7.59	4.03	5.00	6.34	5.38
	mm	193	102	127	161	137
17	ins.	8.19	4.38	6.09	6.69	6.31
	mm	208	111	155	170	160
18	ins.	6.16	2.09	5.00	4.41	5.38
	mm	156	53	127	112	137
19	ins.	7.59	2.03	5.00	4.34	5.38
	mm	193	52	127	110	137
20	ins.	8.19	2.28	6.09	4.59	6.31
	mm	2.08	58	155	117	160

IMPORTANT: Valves may be mounted in any position except all DC constructions and those marked ①, which must be mounted with the solenoid vertical and upright. Constructions marked ② must be mounted with the solenoid vertical and upright or horizontal only.

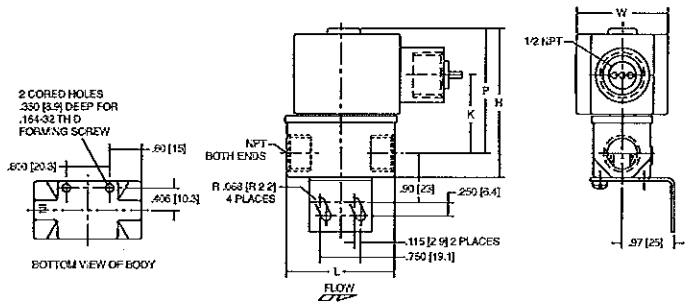
Const. Ref. 1-4, 9, 10, 13A, 13B



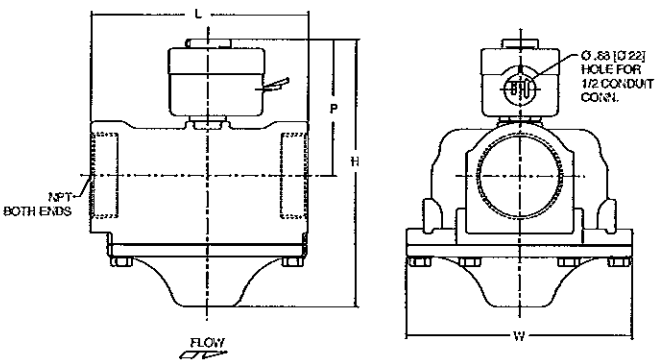
Const. Ref. 6, 7, 8, 16, 17



Const. Ref. 11



Const. Ref. 12-15, 18-20



INSTALLATION & MAINTENANCE INSTRUCTIONS

2-WAY PLASTIC BODY SOLENOID VALVES
NORMALLY CLOSED OPERATION

ASCO®
BULLETIN
8260
Form No. V5676R2

DESCRIPTION
Bulletin 8260 valves are 2-way normally closed solenoid valves having a molded plastic body designed for both food handling and non-food handling service. Standard valves have a TYPE 1 General Purpose Solenoid Enclosure.

OPERATION
Normally Closed: Valve is closed when solenoid is de-energized. Valve opens when solenoid is energized.

METERING DEVICE (Optional)
Valves with Suffix "M" in catalog numbers are provided with a built-in metering device.

METERING DEVICE ADJUSTMENT
Increase Flow: Turn metering stem in counterclockwise direction.
Decrease Flow: Turn metering stem in clockwise direction.

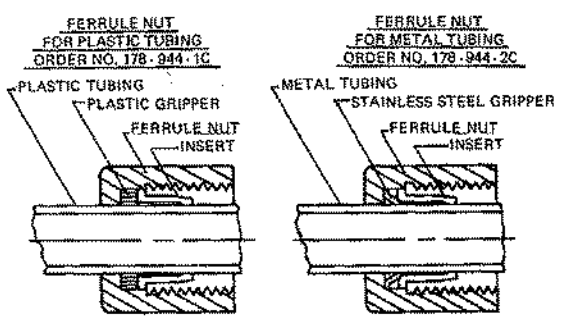
INSTALLATION
Check nameplate for correct catalog number, pressure, voltage and service.

TEMPERATURE LIMITATIONS
Maximum valve ambient temperature is 77°F. Maximum valve fluid temperature is 130°F for continuous exposure and 180°F for intermittent exposure.

POSITIONING
This valve is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the plugnut/core tube sub-assembly area.

MOUNTING
For valve body mounting dimensions, refer to Figure 1.

TUBING OR HOSE CONNECTION
Connect tubing or hose to valve according to markings on valve body. Avoid tubing strain on valve body by properly supporting and aligning tubing. When tightening fittings, do not use valve body or solenoid as a lever. For valves with bib type connections, 1/4-inch O.D. hose or 1/4-inch SAE male flare ends, maximum torque for tubing connection is 25 inch-pounds (2,8 newton-meters). Valves that require compression fittings for 1/4-inch O.D. plastic or metal tubing may be provided with ferrule nuts, an optional feature. There are two different types of ferrule nuts, one for plastic tubing and one for metal tubing. Refer to diagram.



TORQUE REQUIREMENTS FOR FERRULE NUTS

METAL TUBING - 25 TO 30 INCH-POUNDS [2,8 TO 3,4 NEWTON-METERS]

PLASTIC TUBING - 9 TO 10 INCH-POUNDS [1,0 TO 1,1 NEWTON-METERS]

IMPORTANT: To protect the solenoid valve, install a strainer or filter, suitable for the service involved, in the inlet side as close to the valve as possible. Clean periodically depending on service conditions. See Bulletins 8600, 8601 and 8602 for strainers.

WIRING
Wiring must comply with local codes and the National Electrical Code. The solenoid housing has a 7/8-inch diameter hole to accommodate 1/2-inch conduit. On some constructions, a green ground wire is provided. To facilitate wiring, the solenoid enclosure may be rotated 360° by removing the retaining cap before operating.

SOLENOID TEMPERATURE
Coils for Bulletin 8260 valves are designed for continuous duty service. When the solenoid is energized for a long period, the solenoid enclosure becomes hot and can be touched by hand only for an instant. This is a safe operating temperature. Any excessive heating will be indicated by the smoke and odor of burning coil insulation.

MAINTENANCE
NOTE: It is not necessary to remove the valve from the pipeline for repairs.
WARNING: Turn off electrical power supply and depressurize valve before making repairs.

CLEANING
All solenoid valves should be cleaned periodically. The time between cleanings will vary depending on the medium and service conditions. In general, if the voltage to the coil is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. Clean valve strainer or filter when cleaning the valve.

IN-PLACE CLEANING INSTRUCTIONS FOR DISPENSING/VENDING USAGE
1. Wash valve for two (2) minutes with a detergent solution of one (1) ounce of OAKITE® LIQUI-DET® 2 (or equivalent) to two (2) gallons of water at 120 to 140°F.
2. Rinse valve for two (2) minutes with cold water.
3. Sanitize valve for two (2) minutes with a 50 part-per-million solution of chlorine sanitizing agent.

PREVENTIVE MAINTENANCE
1. Keep the medium flowing through the valve as free from dirt and foreign material as possible.
2. While the valve is in service, operate it at least once a month to insure proper opening and closing.
3. Periodic inspection (depending on medium and service conditions) of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace any parts that are worn or damaged.

CAUSES OF IMPROPER OPERATION
1. **Faulty Control Circuit:** Check the electrical system by energizing the solenoid. A metallic "click" signifies that the solenoid is operating. Absence of the "click" indicates loss of power supply. Check for loose or blown fuses, open-circuited or grounded coil, broken lead wires or splice connections.
2. **Burned-Out Coil:** Check for open-circuited coil. Replace coil if necessary. Check supply voltage; it must be the same as specified on nameplate.
3. **Low Voltage:** Check voltage across the coil leads. Voltage must be at least 85% of nameplate rating.
4. **Incorrect Pressure:** Check valve pressure. Pressure to valve must be within range specified on nameplate.
5. **Excessive Leakage:** Disassemble valve (see MAINTENANCE) and clean all parts. Replace worn or damaged parts. However, for best results, replace all parts as supplied with an ASCO Rebuild Kit.

Printed in U.S.A.

ASCO Valves

Automatic Switch Co. 50-56 Hanover Road, Florham Park, New Jersey 07932

COIL REPLACEMENT (Refer to Figure 2.)

WARNING: Turn off electrical power supply. Then proceed as follows:

1. Disconnect coil lead wires and green ground wire (if present).
2. Remove retaining cap, nameplate and cover.
3. Pull yoke containing coil, sleeves, ground wire terminal (if present) and insulating washers off the plugnut/core tube sub-assembly. Insulating washers are omitted when a molded coil is used.
4. Pull coil, sleeves, ground wire terminal (if present) and insulating washers from yoke.
5. Reassemble in reverse order of disassembly. Use exploded view provided for identification and placement of parts.

CAUTION: Solenoid must be fully reassembled because the housing and internal parts complete the magnetic circuit. Place insulating washers (except for molded coils) on each end of coil.

VALVE OISASSEMBLY ANO REASSEMBLY

(Refer to Figure 2.)

Depressurize valve and turn off electrical power supply.

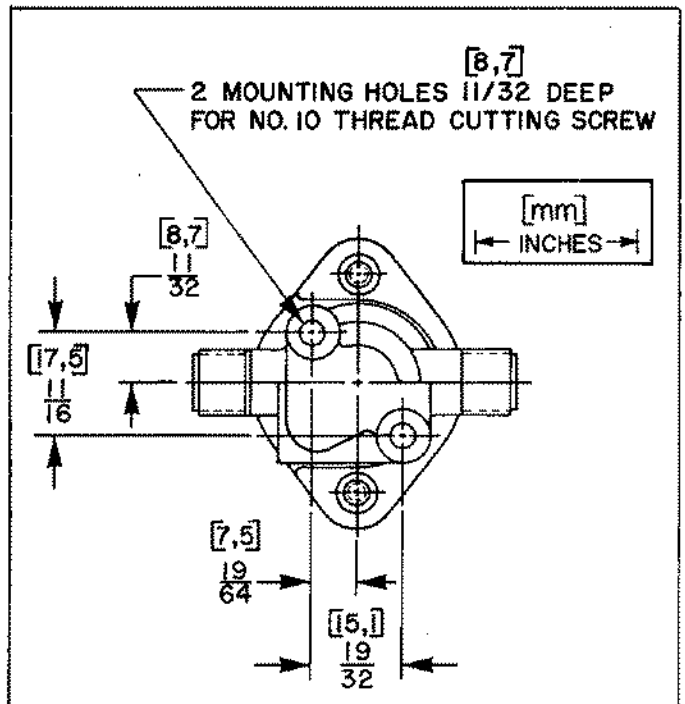
1. Remove retaining cap and pull entire solenoid enclosure off plugnut/core tube sub-assembly. Remove bracket screws (2) and lower bracket.
2. Remove plugnut/core tube sub-assembly with upper bracket and core tube gasket attached.
3. Remove core spring, core assembly and body gasket.
4. For metering device, remove self-tapping screw, retainer and metering stem with stem gasket attached.
5. All parts are now accessible for cleaning or replacement. Replace worn or damaged parts. However, for best results, replace all parts as supplied with a complete ASCO Rebuild Kit.
6. Reassemble in reverse order of disassembly. Use exploded view provided for identification and placement of parts.
7. **IMPORTANT: Tighten the bracket screws (2) evenly to insure proper gasket compression.** Torque screws to 30 ± 5 inch-pounds (3,4 ± 0,5 newton-meters).
8. After maintenance is completed, operate valve a few times to be sure of proper operation.

ASCO REBUILO KITS

Rebuild Kits and Coils are available for ASCO valves.
Parts marked with an asterisk (*) are supplied in Rebuild Kits.

OROERING INFORMATION FOR REBUILD KITS

When Ordering Rebuild Kits or Coils, Specify Valve Catalog Number, Serial Number, Voltage and Frequency.



MOUNTING DIMENSIONS

Figure 1.
Bulletin 8260

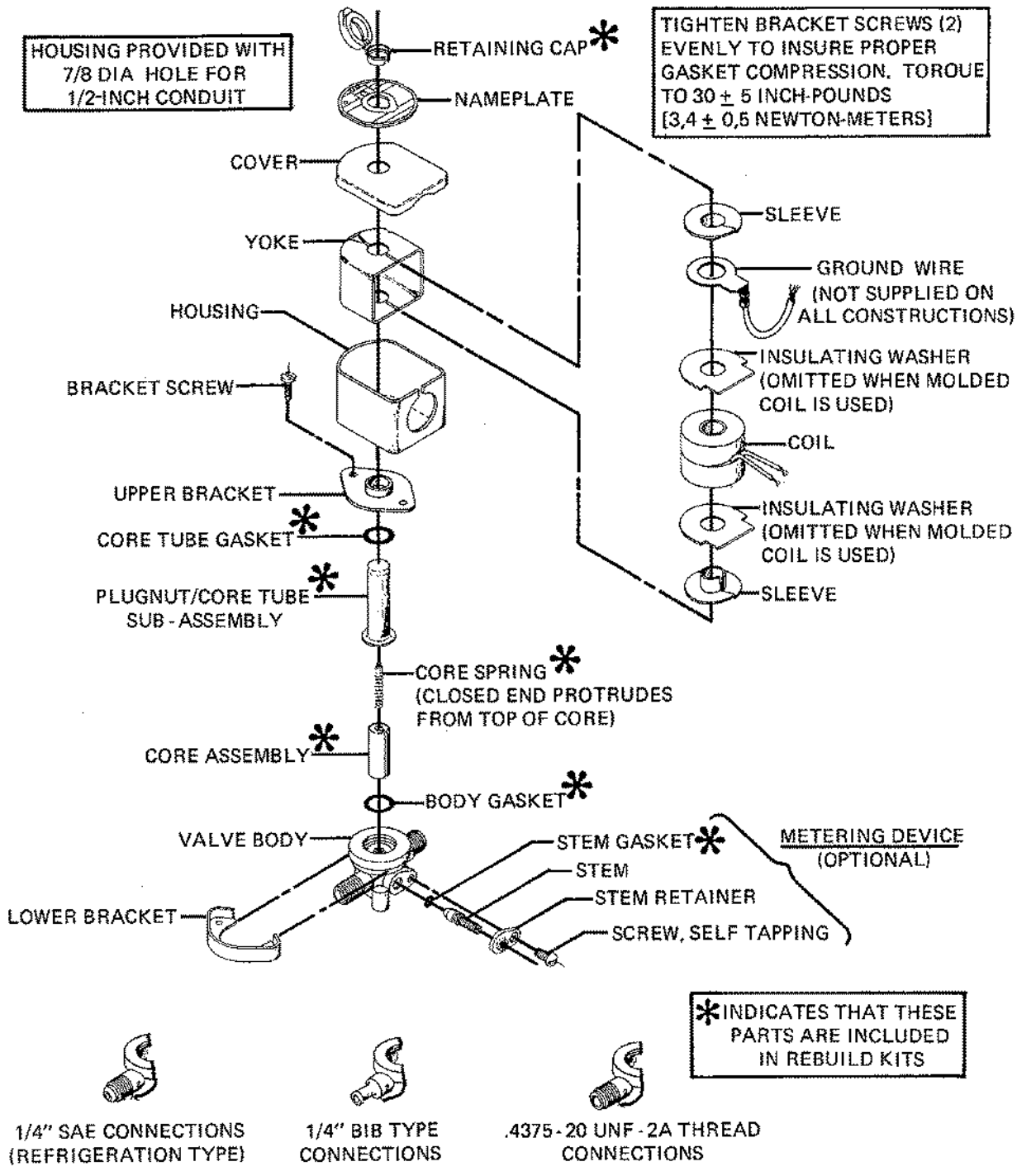
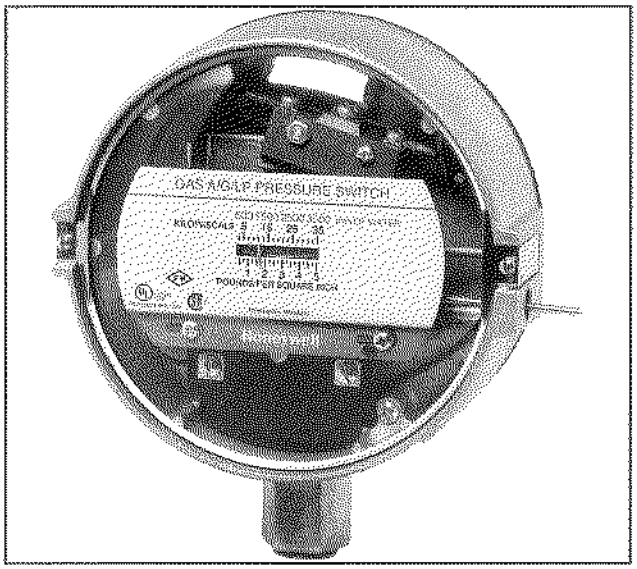


Figure 2.
Bulletin 8260

Honeywell

C437D,E Gas Pressure Switches

PRODUCT DATA



APPLICATION

The C437D,E Gas Pressure Switches are pressure-actuated switching devices used in industrial gas system applications for safety shutoff, pressure control, and differential-pressure control.

All Series 4 models have MicroSwitch™ snap switches to open or close a circuit on pressure rise or drop.

NOTE: Series numbers immediately follow OS numbers, i.e., C437D2003(4).

FEATURES

- C437 models have direct- and reverse-acting (spst) switching.
- Pressure ranges: 1/2 to 5-1/2 in. of water (0.1 to 1.4 kPa); 1 to 26 in. of water (0.5 to 7 kPa); 1/2 to 5 psi (3 to 35 kPa); 1 to 10 psi (5 to 70 kPa).
- Models intended for lockout applications must be manually reset before resuming operation.
- Trip-free mechanism on manual reset models ensures that the limit function of the switch cannot be defeated by jamming the reset lever.
- External manual reset button on side of lockout models.
- Enclosed setting impedes tampering and provides dust-resistant operation.
- Buna-N fiber-reinforced material for increased strength of control diaphragm.
- Two Buna-N fiber-reinforced seal-off diaphragms for added reliability.
- Clear glass cover allows observation of interior mechanism to aid setting and checkout.
- Heavy die-cast case increases durability and resistance to corrosion.
- Main control diaphragm completely enclosed a leak-proof chamber can be vented to a safe area.
- Models with a pressure range of 1 to 26 in. of water (0.5 to 7 kPa) have a restrictive orifice in the inlet pressure channel to compensate for momentary surges in gas pressure.
- Field-addable orifices of various sizes are available.

Contents

68-0286

SPECIFICATIONS

Table 1. Models.

Model Number	Switch Action (Response at Setpoint to Pressure Change)	Manual Reset[a] (Locks Out on Switch Break)
C437D	spst, breaks on rise	Yes
C437E	spst, breaks on fall	Yes

[a] Designated Manual Reset 2; the trip-free reset mechanism does not permit the switch to function as an automatic-reset device when the manual reset lever is held in the Reset position.

Table 2. Switch Ratings (In Amperes).

Voltage	C437D,E		
	Full Load	Locked Rotor	Resistive Load
120 Vac	8.0	48.0	10.0
240 Vac	5.1	30.6	5.0

Switch:
Snap Switch (spst).

Differentials:
Fixed, nominal; measured at pressure indicated in Table 3.

Table 3. Pressure Differentials.

Model Numbers	Pressure Range[a]								Type[a]
	1/2 to 5-1/2 in. (0.1 - 1.4 kPa) Differential Measured at 1/2 in.		1 to 26 in.[b] (0/5 - 7 kPa) Differential Measured at 15 in.		1/2 to 5 psi (3 - 35 kPa) Differential Measurement at midscale		1 to 10 psi (5 - 70 kPa) Differential Measurement		
	in.	kPa	in.	kPa	psi	kPa	psi	kPa	
C437D	—	—	1-3/4	0.44	1/2	3.45	1[c]	6.89[c]	Subtractive[c]
C437E	0.25	0.06	1-1/4	0.31	1/4	1.72	1/2	3.45	Additive[d]

[a] in. = inches of water.

[b] Restrictive orifice in inlet pressure channel to compensate for momentary surges in gas pressure.

[c] Subtractive models: switching action occurs on pressure rise to the setpoint.

[d] Additive models: switching action occurs on pressure fall to the setpoint.

Pressure Ranges (Scale Range):
Specify one:
1/2 to 5-1/2 inches of water (0.1 to 1.4 kPa).
1 to 26 inches of water (0.5 to 7 kPa).
1/2 to 5 lb per sq in. (3 to 35 kPa).
1 to 10 lb per sq in. (5 to 70 kPa).

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Automation and Control Products Sales Office (check white pages of your phone directory).
2. Honeywell Customer Care
   1885 Douglas Drive North
   Minneapolis, Minnesota 55422-4386

In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Toronto, Ontario M1V 4Z9.
International Sales and Service Offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.

Maximum Sustained Operating Pressure: See Table 4.

Table 4. Maximum Sustained Operating Pressure.

Pressure Range	Maximum Pressure	
	psi	kPa
1/2 to 5-1/2 in. of water	3.0	20.7
1 to 26 in. of water	5.0	34.5
1/2 to 5 psi	15.0	103.4
1 to 10 psi	30.0	206.8

Pipe Connections:
Main or High Pressure: 1/2 in. NPT, female.
Vent or Low Pressure: 1/8 in. NPT, female.
Electrical Wiring: Hole tapped for 1/2 in. conduit.

Maximum Ambient Temperature: 125°F (52°C).

Minimum Temperature: 32°F (0°C).

Approvals:
Underwriters Laboratories Inc. Listed: File No. MP2168, Guide No. MFHX.
Canadian Standards Association Certified: File No. LR95329, Certificate No. 1736842.
Factory Mutual Approved: Report No. 3024921.

Replacement Parts:
106729 Cover Glass, 6 in. (152.4 mm) diameter.
118733-21 Retaining Clip.

Accessories:
4074BWK Bag Assembly: Contains two 137755 Mounting Brackets and four self-tapping screws: for surface mounting. Mounting brackets are shown by dashed lines in Fig. 1.
Field-addable Orifices:
124674: 0.011 in. (0.28 mm) diameter.
122160: 0.018 in. (0.46 mm) diameter.

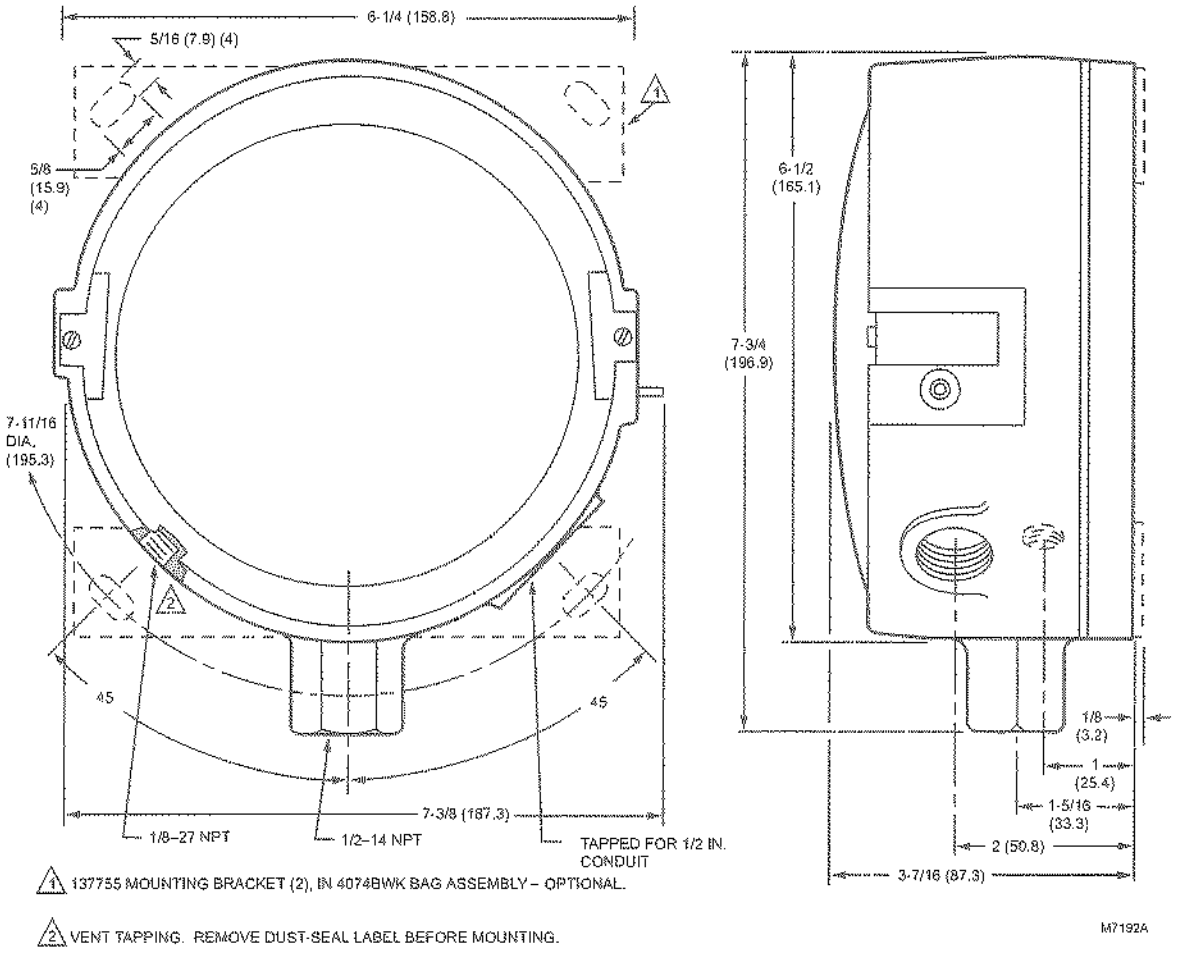


Fig. 1. Installation dimensions of the C437 gas pressure switches, in in. (mm).

RECYCLE NOTICE

If this control is replacing a control that contains mercury in a sealed tube, do *not* place your old control in the trash.

Contact your local waste management authority for instructions regarding recycling and the proper disposal of an old control containing mercury in a sealed tube.

INSTALLATION

When Installing this Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced, flame safeguard control technician.
4. After installation is complete, check out product operation as provided in these instructions.

⚠ WARNING

Electrical Shock Hazard.
Can cause severe injury, death or property damage.
Disconnect all power to the pressure switch before beginning installation to prevent electrical shock and equipment damage.

IMPORTANT

1. *Remove the dust-seal label from the vent tapping before mounting.*
2. *Use pipe compound sparingly to avoid clogging the hole in the pie or diaphragm fitting.*
3. *Do not hand tighten the pressure switch by holding the case.*

Follow local codes or ordinances *in all cases* when different from these recommendations.

Fig. 1 shows the mounting dimensions for the C437 models, and for the accessory mounting bracket. See Fig. 2 for the individual components.

Location

Mount the gas pressure switch downstream from the pressure regulator. Mount low gas pressure switches upstream of any shutoff valve. Mount high gas pressure switches just upstream from the burner.

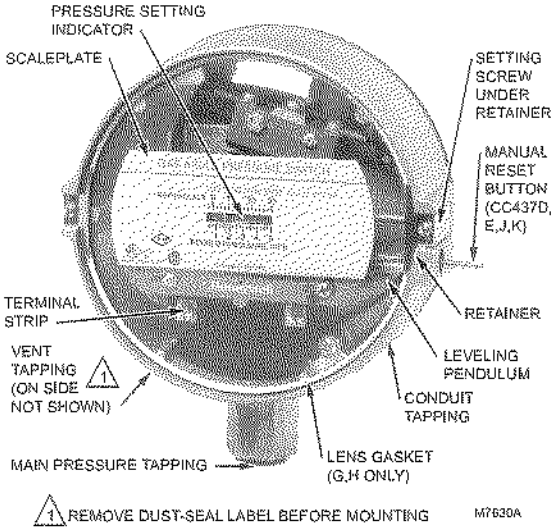


Fig. 2. Principal parts of the gas pressure switch.

Mounting

1. Remove the dust-seal label from the vent tapping.
2. Remove the screws and retainers, and the cover glass.
3. Mount the device on the pipe or nearby vertical surface. Use nipple and T for pipe mounting or the mounting bracket for surface mounting. If a mounting bracket is used, install the bracket before making piping connections. Mount the bracket horizontally with the four 10-24 flathead tapping screws provided.

IMPORTANT

To avoid leaks and case damage, use a parallel jaw wrench on the hexagonal part of the case close to the pipe. Carefully make all connections and test for leakage. Do not tighten the pressure switch by holding the case.

4. Complete the main piping.
5. Connect the piping to the pressure switch. Select the application from the following, and proceed as instructed.
   a. Hazardous-gas applications: Install a 1/8 in. NPT pipe at the vent tapping on all hazardous-gas applications.

⚠ WARNING

Explosion or Fire Hazard.
Can cause severe injury, death or property damage.
The vent must be installed so that any gas leakage is vented into a safe place in event of a diaphragm failure.

   b. Differential-pressure applications:
      (1) Connect the high-pressure side of the system to the 1/2 in. NPT main pressure tapping on the gas pressure switch.
      (2) Connect the low pressure side to the 1/8 in. NPT vent tapping.

⚠ WARNING

Explosion or Fire Hazard.
Can cause severe injury, death or property damage.
No venting is possible in this case. Do not use this device for differential pressure control with the hazardous gases.

   c. Negative-pressure applications: Connect the low pressure side to the 1/8 in. NPT vent tapping.

⚠ WARNING

Explosion or Fire Hazard.
Can cause severe injury, death or property damage.
This application is for use only with nonhazardous gases. Do not use this device for negative-pressure applications with hazardous gases.

6. Install other controls in the system. Connect wiring, and complete setting and checkout before replacing the cover glass and retainers. See Setting and Checkout section.

WIRING

⚠ WARNING

Electrical Shock Hazard.
Can cause severe injury, death or property damage.
Disconnect all power to the pressure switch before connecting wiring to prevent electrical shock and equipment damage.

All wiring must comply with local electrical codes, ordinances, and regulations. Do not exceed the switch ratings given in the Specifications section.

Wiring diagram for the C437D,E is shown in Fig. 3. The switches make or break as indicated in the diagram. Connect the wiring to the screw terminals on the terminal strip after removing the cover glass. Route the wires through the conduit tapping.

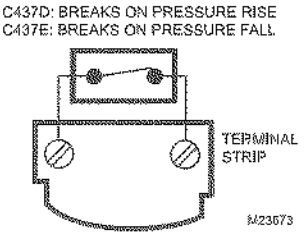


Fig. 3. Wiring diagram for C437D,E.

SETTING AND CHECKOUT

Setting

In the C437D, the differential is subtractive. The upper operating point is determined by the setpoint, while the lower operating point is determined by the setpoint minus the differential. In the C437E, the differential is additive. The lower operating point is determined by the setpoint, while the upper operating point is determined by the setpoint plus the differential. Operating points are shown in Fig. 4.

Remove the retainer and adjust the setpoint for the desired operating pressure (cutout pressure) by turning the setting screw (Fig. 2) clockwise ↷ to increase the setpoint and counterclockwise ↶ to decrease it.

Trip-Free Manual Reset Feature (C437D,E only)

The C437D breaks contact between terminals when the pressure rises to the setpoint. The C437E breaks contact between terminals when the pressure falls to the setpoint. None of these pressure switches will automatically return to their former positions.

To reset one of these pressure switches, wait until the pressure falls to the setpoint minus the differential (C437D), or rises to the setpoint plus the differential (C437E). Then depress the manual reset button (Fig. 2) and release it. The pressure switch will not be reset until you release the manual reset button. This prevents the switch from becoming an automatic-reset device if the reset button is stuck, held in, or tied down.

Checkout

Adjust the setpoint for normal operation and check to see that the gas pressure switch performs as intended. Use a manometer or accurate pressure gauge connected upstream from the switch to measure the actual pressure.

C437D (Subtractive Differential)

1. Put the system into normal operation, and set the pressure switch at the normal setpoint (above the normal operating pressure). Turn the setting screw (Fig. 2) slowly toward a lower pressure setting (counterclockwise ↶) to simulate a pressure increase.
2. When the setpoint is approximately equal to the pressure indicated on the pressure gauge, the C437D should break contact and turn off the controlled equipment; locking out.

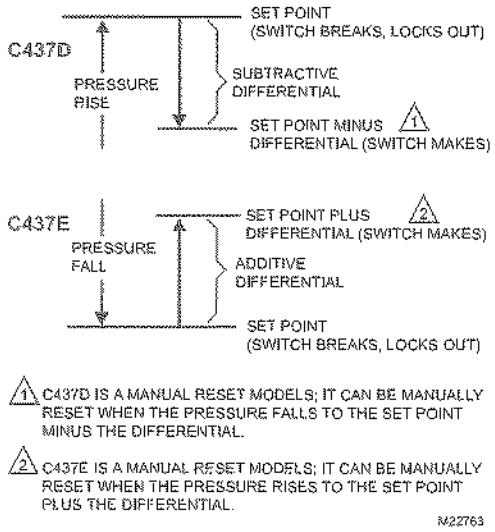


Fig. 4. C437 operating points.

Turn the setting screw toward a high pressure setting (clockwise ↷) to simulate a pressure decrease greater than the differential.

3. Push the manual reset button (Fig. 2) on the C437D; the C437D should make contact.

C437E (Additive Differential)

1. Put the system into normal operation and gradually close the upstream gas shutoff valve to cause a pressure decrease.
2. When the pressure gauge indicates that the pressure is approximately equal to the setpoint, the C437E should break contact and turn off the controlled equipment, locking out.
3. Open the gas shutoff valve to increase the pressure again. When the pressure rises to the setpoint plus the differential, push the manual reset button (Fig. 2) on the C437E; the C437E should make contact.

Completing the Installation

1. Remove the pressure gauge or manometer used for testing. Visually recheck the piping, wiring, and setting.
2. Replace the cover glass and retainers.
3. Return the system pressure to normal.
4. Push the manual reset button (C437D,E only).

Installing a Pressure Orifice (Fig. 5)

To compensate for momentary surges in gas pressure, install a restrictive orifice in the inlet pressure channel of the pressure switch. (Refer to Accessories in the Specification section for the orifice sizes available.)

Align pressure orifice into reset located inside of the main pressure tapping at the bottom. Press orifice into place using 1/8 in. dowel rod.

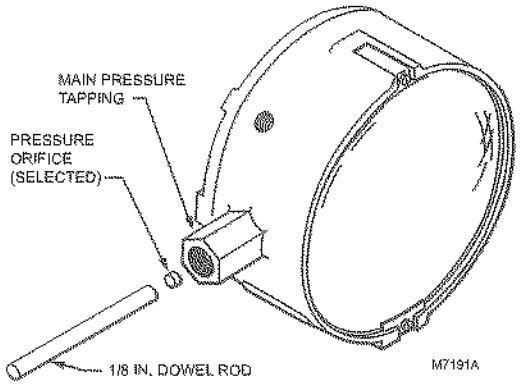


Fig. 5. Installing a pressure orifice to compensate for pressure surges.

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Replace time-consuming switch installations with new, reliable Honeywell C6097 Gas/Air Pressure Switches. The cutting-edge technology will save you time and money. And C6097 Pressure Switches also reduce your inventory, because they can be used with older, stand-alone component valves as well as newer valves, such as the Integrated Gas Valve Train (IVT).

SPECIFICATIONS

Models:

C6097A Pressure Switch:
Breaks a circuit when pressure falls to scale setting.
See Scale Range table.

C6097B Pressure Switch:
Breaks a circuit when pressure rises to scale setting.
See Scale Range table.

Minimum Ambient Temperature:

5° F (-15° C)

Maximum Ambient Temperature:

140° F (60° C)

Connections (Depending on Model):

1/4-18 NPT tapping for main or high-pressure connections.

1/8-27 NPT tapping for vent or low-pressure connection (air only).

Flange mount for connection to Honeywell Integrated Valve Trains (internal vent only, no external connections).

Scale Range:

0.4 to 5" wc (0.10 kPa to 1.25 kPa).
3 to 21" wc (0.75 kPa to 5.23 kPa).
12 to 60" wc (3.0 kPa to 15 kPa).
1.5 to 7" psi (10.3 kPa to 48 kPa).

Approvals:

Underwriters Laboratories: Listed.
Canadian Standards Association: Listed.
Factory Mutual: Approved.
Industrial Risk Insurers: Acceptable.
CSD-1AFB: Acceptable.

Accessories:

32003041-001 C6097
Cover for manual reset models.

32003040-001 C6097
Cover for recycle models.

32003039-001
Position indication Lamp Kit.

To Learn More

For more information please contact your Honeywell Distributor. Or visit **http://customer.honeywell.com.**

Automation and Control Solutions

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May 2007

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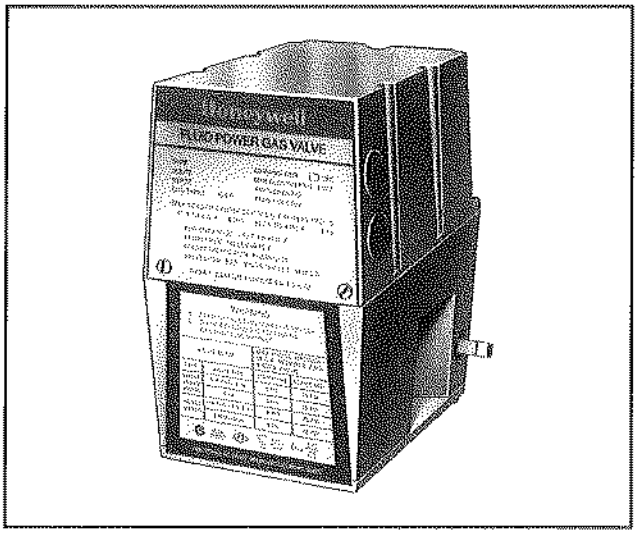
V4055A,B,D,E
On-Off Fluid Power Gas Valve Actuator

PRODUCT DATA



APPLICATION

The V4055 Gas Valve Actuator, in combination with a VE5000[a], V5055 or V5097 Gas Valve, controls the gas supply to commercial and industrial burners.

When replacing a V4034 with a V4055, the V5034 gas valve must also be replaced with a V5055 or V5097 gas valve.

FEATURES

- **The V4055 Actuator, when used with the VE5000[a], V5097 or V5055 Valve, is rated for final safety shutoff service.**
- **The V4055 Actuator can be used with the characterized guide model of the V5055 or V5097 Gas Valve to enhance lightoff smoothness.**
- **The standard model has an opening time of 26 seconds at 60 Hz or 32 seconds at 50 Hz. A fast-opening model is available with timings of 13 seconds at 60 Hz or 16 seconds at 50 Hz.**
- **Maximum closing time is one second, which meets code, standard and insurer requirements.**
- **Models available with damper shaft, with or without spring return; shaft extends out both sides and rides in Teflon-like Delrin bushings; used with standard 7616BR Damper Crank Arm.**
- **Red OPEN indicator attached to actuator stem shows when valve is even slightly open; yellow SHUT indicator on valve stem shows only when gas valve is fully closed.**
- **Models available with adjustable max flow limit switch.**
- **Ambient temperature rating is -40°F to +150°F (-40°C to +66°C) for 60 Hz models and -10°F to +158°F (-23°C to +70°C) for 50 Hz and 50/60 Hz models.**
- **Valve and actuator combinations can be mounted in any position, with the exception of the 220 to 240 Vac, 50/60 Hz models, which are mounted vertically.**
- **Models available with factory-installed single pole double throw (spdt) field-adjustable Auxiliary Switch. Field-addable Auxiliary Switch kits are also available.**
- **Standard enclosure meets NEMA 1 (IP30) requirements; models available with NEMA 4 (IP54) weatherproof enclosure.**
- **V4055D and high pressure V4055E with Proof-of-Closure Switch and V5055/V5097C or E with valve seal overtravel interlock (double seal) to meet specific code, standard and insurer requirements.**

[a] VE5000 is a European manufactured and approved valve for European use only.

Contents

60-2309-11

SPECIFICATIONS

Models:
V4055A Actuator, with V5055, V5097 or VE5000 Gas Valves, provides on-off control of fuel. With proper adapter (see Accessories), it replaces the V4034 Actuator on a V5034 Gas Valve.
V4055B Actuator is a high pressure version of V4055A.
V4055D Actuator is identical to V4055A, except has a Proof-of-Closure Switch. Used with V5055C/V5097C (double seal) for valve seal overtravel interlock.
V4055E Actuator is identical to V4055B, except has a Proof-of-Closure Switch. Used with V5055E/V5097E (double seal) for valve seal overtravel interlock.
NEMA 4 weatherproof models available.

Nominal Opening Time: See Table 1.

Table 1. Nominal Opening Time (seconds).

Model	50 Hz	60 Hz
Standard	32	26
Fast-opening	16	13

Maximum Closing Time: One second when de-energized.

Ambient Operating Temperature Ratings:
60 Hz Models: -40°F to +150°F (-40°C to +66°C).
50 Hz, 50/60 Hz Models: -10°F to +158°F (-23°C to +70°C).

Mounting: V4055 Actuator attaches directly to V5055/V5097 Valve with two sets of screws positioned 90 degrees apart. Combination is multipoise.

NOTE: 220 to 240 Vac, 50/60 Hz models are vertical mount only.

Pressure Ratings: See Table 2.

Table 2. Pressure Ratings of Valve-Actuator Combinations.

Valve	Actuator							
	V4055A,D[a]				V4055B,E[a]			
	Differential[b]		Closeoff[c]		Differential[b]		Closeoff[c]	
	psi	mbar	psi	bar	psi	mbar	psi	bar
V5055/V5097A,C: 3/4 to 3 in.	5	340	15	1	15	1000	15	1
V5055A,C: 4 in.	3	200	15	1	5	340	15	1
V5055/V5097B: 3/4 to 3 in.	5	340	15	1	15	1000	15	1
V5055B: 4 in.	3	200	15	1	5	340	15	1
V5055/V5097D,E: 3/4, 1-1/4, 1-1/2 in.	5	340	75	5	25	1700	75	5
V5055/V5097D,e: 2, 2-1/2, 3 in.	5	340	45	3	15	1000	45	3

[a] Use a V4055D or V4055E (with Proof-of-Closure Switch) with a V5055/V5097C or V5055/V5097E (with double seal) for valve seal overtravel interlock.

[b] Maximum operating pressure differential.

[c] Maximum closeoff pressure without seat leakage. This is the maximum valve pressure drop allowed while fully closed, and is independent of the valve body rating.

Electrical Ratings: See Tables 3 and 4.

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Automation and Control Products Sales Office (check white pages of your phone directory).
2. Honeywell Customer Care
   1885 Douglas Drive North
   Minneapolis, Minnesota 55422-4386

In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Toronto, Ontario M1V 4Z9.
International Sales and Service Offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.

Table 3. V4055A,D Electrical Ratings.

Voltage and Frequency	Opening (Standard)				Opening (Fast)				Holding		
	Inrush	(W)	(A)	VA)	Inrush	(W)	(A)	(VA)	(W)	(A)	(VA)
100/50-60[a]	—	43.0	0.91	91	—	58.0	1.30	130	10.4	0.16	16
100/50-60[b]	—	33.0	0.6	67	—	43.0	0.91	91	8.4	0.14	14
120/60	3.9	50.0	0.94	115	5.4	71.0	1.33	160	9.5	0.12	14
200/50-60[a]	—	68.0	0.79	158	—	88.0	1.10	220	10.6	0.09	18
200/50-60[b]	—	48.0	0.52	104	—	63.0	0.72	144	9.0	0.07	14
220/50	1.6	55.5	0.55	121	3.0	76.0	0.80	176	9.0	0.06	14
240/50	—	81.5	0.79	190	—	95.0	1.00	240	9.1	0.06	14
240/60	2.6	51.0	0.45	115	4.0	71.5	0.68	160	9.2	0.06	14
220-240/50-60[c]	—	—	—	—	—	70.3	0.59	136	7.2	0.07	16
220-240/50-60[d]	—	—	—	—	—	58.6	0.46	106	5.9	0.06	14

[a] 50 Hz power supply.
[b] 60 Hz power supply.
[c] 230 Vac, 50 Hz power supply.
[d] 230 Vac, 60 Hz power supply.

Table 4. V4055B,E Electrical Ratings.

Voltage and Frequency	Opening (Standard)				Opening (Fast)				Holding		
	Inrush	(W)	(A)	(VA)	Inrush	(W)	(A)	(VA)	(W)	(A)	(VA)
120/60	—	60	0.94	115	—	60.0	0.94	115	9.5	0.16	19
220-240/50-60[a]	—	—	—	—	—	68.9	0.58	133	6.7	0.08	18
220-240/50-60[b]	—	—	—	—	—	58.2	0.46	106	5.3	0.06	14

[a] 230 Vac, 50 Hz power supply.
[b] 230 Vac, 60 Hz power supply.

Auxiliary Switch and Proof-of-Closure Switch Ratings: See Table 5.

Table 5. Auxiliary Switch and Proof-of-Closure Switch Ratings (1/2 hp [0.37kW][a]).

Load	120V	240V
Full Load	9.8A	4.9A
Locked Rotor	58.8A	29.4A

[a]Maximum total connected power to both switches (if used) is 1800 VA.

Mounting Dimensions: See Fig. 1 and Table 7.

Damper Shaft: Shaft is 3/8 in. (9.5 mm) square, for use with 7616BR Damper Crank Arm (ordered separately) and with or without damper shaft return spring.

Maximum Damper Shaft Rotation: 52 angular degrees.

Maximum Force: 2-11/16 in. (68.3 mm) radius for 7616BR Damper Crank Arm ordered separately (see Accessories section).

NOTE: Damper shaft drives damper crank arm in one direction only; optional return spring is available on damper shaft to turn damper crank arm in opposite direction. See Table 6.

Table 6. Actuator Torque (With and Without Return Spring).

V4055 Model	-40°F to +20°F (-40°C to -7°C)		20°F to 150°F (-7°C to +66°C)	
	lb	N	lb	N
With return spring	5	22.2	10	44.5
Without return spring	5	22.2	20	89.0

Approvals:
Underwriters Laboratories Inc. Listed: File No. MH1639, Guide No. YIOZ.
Factory Mutual: Approved.
International Approval Services (Joint Venture of the American Gas Association [AGA] and the Canadian Gas Association [CGA]): Certified 60 Hz models only.
Industrial Risk Insurers: Acceptable.
Some V4055 Actuators are approved as Class A valves in accordance with EN161:
When used with V5055 Valves: Pin: CE-0063AR1359.
When used with VE5000 Series Valves: Pin: CE-0063AP3075.

Accessories:
133568 Auxiliary Switch Bag Assembly (not for models with maximum flow limit switch).
133569 Valve-Closed Indication Switch Bag Assembly.

NOTE: Check local codes for acceptance of adding the switch and using the valve seal overtravel V5055C or V5055E valves.

7616BR Damper Crank Arm (damper arm and clip).

Available Models: V4055 with NEMA 4 enclosure (weatherproof).

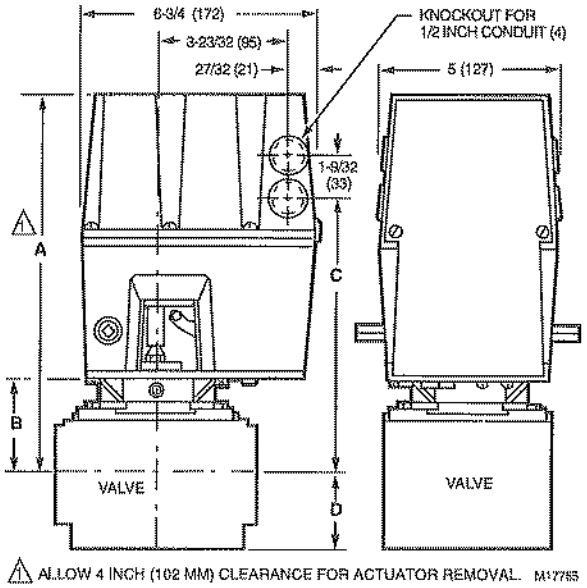


Fig. 1. Approximate mounting dimensions of V4055 Actuators in in. (mm).

Table 7. Approximate Mounting Dimensions of V4055 Actuators with V5055 and V5097 Valves.

Valve Size[a] (in.)		V5055								V5097							
		Dim. A		Dim. B		Dim. C		Dim. D		Dim. A		Dim. B		Dim. C		Dim. D	
		In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
Small Body	3/4	11-1/8	283	2-3/4	70	8-3/16	208	5-3/4	146	11-1/8	283	2-3/4	70	8-3/16	208	2-1/2	64
	1	11-1/8	283	2-3/4	70	8-3/16	208	5-3/4	146	11-1/8	283	2-3/4	70	8-3/16	208	2-/12	64
	1-1/4	11-1/8	283	2-3/4	70	8-3/16	208	5-3/4	146	11-1/8	283	2-3/4	70	8-3/16	208	2-1/2	64
	1-1/2	11-1/8	283	2-3/4	70	8-3/16	208	5-3/4	146	11-1/8	283	2-3/4	70	8-3/16	208	2-1/2	64
	2	11-1/8	286	2-7/8	73	8-5/16	211	8-3/8	213	11-3/4	298	3-3/8	86	8-3/8	213	4	102
Large Body	2	11-3/4	298	3-3/8	86	8-13/16	224	9-1/4	235	1-3/4	298	3-3/8	86	8-3/8	213	4	102
	2-1/2	11-3/4	298	3-3/8	86	8-13/16	224	9-1/4	235	11-3/4	298	3-3/8	86	8-3/8	213	4	102
	3	11-3/4	298	3-3/8	86	8-13/16	224	9-1/4	235	11-3/4	298	3-3/8	86	8-3/8	213	4	102
	4	14-1/8	359	5-13/16	148	11-7/32	285	12-1/2	318	—	—	—	—	—	—	—	—

[a] Valve size using accessory pipe adapter fitting.

INSTALLATION

When Installing This Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced flame safeguard control technician.
4. After installation is complete, check out product operation as provided in these instructions.

⚠ WARNING

Electrical Shock Hazard.
Can cause serious injury or death.
Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.

IMPORTANT

1. *All wiring must comply with all applicable electrical codes, ordinances, and regulations. All wiring must be NEC Class 1.*
2. *Voltage and frequency of the power supply connected to this control must agree with those marked on the device.*
3. *Loads connected to the Auxiliary Switch and/or Proof-of-Closure Switch, if used, must not exceed the ratings given in the Specifications section.*

Install Valve

The actuator is mounted directly on the valve bonnet after the valve is installed in the gas supply line. Refer to the instructions packed with the gas valve for installation details. When installing the gas valve, make sure:

1. Sufficient clearance is left to install and service the actuator.
2. Ambient temperatures at the valve location do not exceed actuator ratings. See Specifications section.
3. Position of the valve permits hookup to the damper if one is controlled.

Install Accessory Switches (If Needed)

An spdt switch can be installed to operate an auxiliary load up to 1/2 hp (0.37 kW). See Table 5. The switch can be adjusted to operate at any point in the valve stroke.

A Proof-of-Closure Switch can also be installed with a V5055/V5097C or E Valve (with double seal) on any V4055 Actuator to provide a valve seal overtravel interlock. The spdt Proof-of-Closure Switch is installed to make or break a circuit when the valve is in the closed position. The switch is not adjustable.

NOTE: Mark the actuator or valve to indicate any changes made.

To install the switches:

1. Remove the actuator faceplate (two screws).
2. Remove the silver-colored barrier to expose the actuator stem.
3. Insert the Auxiliary Switch in the position indicated in Fig. 2. Fasten with two screws through the actuator base.
4. Insert the Proof-of-Closure Switch in the position shown in Fig. 2. The switch mounts against the side of the actuator housing. The mounting holes are spaced to assure mounting the switch in the correct position. Fasten with two screws through the actuator base. (The Proof-of-Closure Switch is not adjustable.)
5. If only one switch is used, install the narrow barrier included with the switch in the unused space.
6. Mount the actuator before making wiring connections and adjustments to the Auxiliary Switch.

Mount Actuator on Valve

1. Check the final position of the valve body to be sure that the actuator is in the proper position when mounted on the valve. This is especially important when the actuator is used to drive a damper.
2. If two smaller sized valves are mounted very closely together, as in an Industrial Risk Insurers approved type of valve train, it may be necessary to mount the actuators off center to provide adequate clearance.

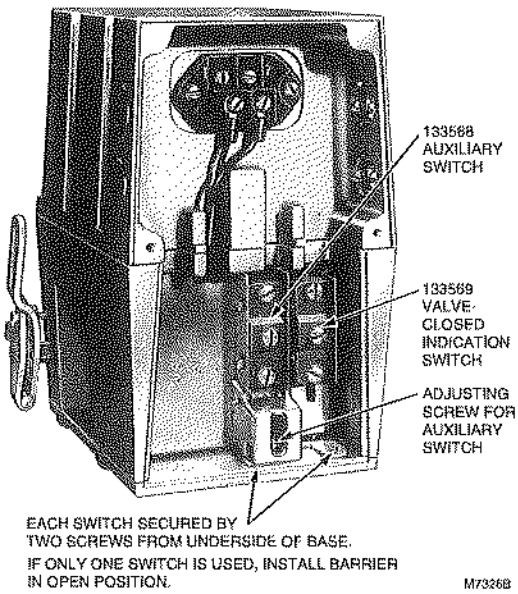


Fig. 2. V4055 Actuator with cover removed.

3. Slip the bottom collar of the actuator over the valve bonnet assembly. Rotate the actuator to the desired position and use a 5/32 in. Allen wrench to securely tighten the two setscrews to 50 to 60 lb-in. (5.7 to 6.8 N•m).
4. Connect the damper linkage, if used. Refer to the instructions packed with the damper arm.

Mount and Adjust 7616BR Damper Crank Arm (If Used)

IMPORTANT

When a damper crank arm is used with a NEMA 4 actuator that is exposed to ice or sleet, a suitable shield must be installed to prevent ice or sleet buildup.

Follow installation and adjustment directions included with damper crank arm. Maximum pushrod travel is 2-5/16 in. (59 mm) through a stroke of 52 degrees. See Fig. 3.

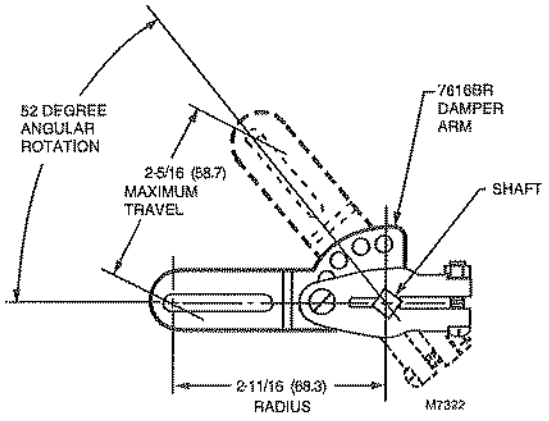


Fig. 3. 7616BR Damper Crank Arm can be attached to actuator shaft to drive a damper when valve is open.

WIRING

⚠ WARNING

Electrical Shock Hazard.
Can cause serious injury or death.
Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.

Wiring must comply with all applicable electrical codes, ordinances and regulations. Wiring to the actuator must be NEC Class 1.

Connect the power supply to terminals 1 and 2 on the V4055 terminal strip. Refer to Fig. 4 for Auxiliary Switch connections and Fig. 5 for Max Flow Limit Switch connections. For typical system hookups, refer to Fig. 6 and to instructions packed with the device used to control the valve.

When all wiring connections are complete, replace the actuator faceplate.

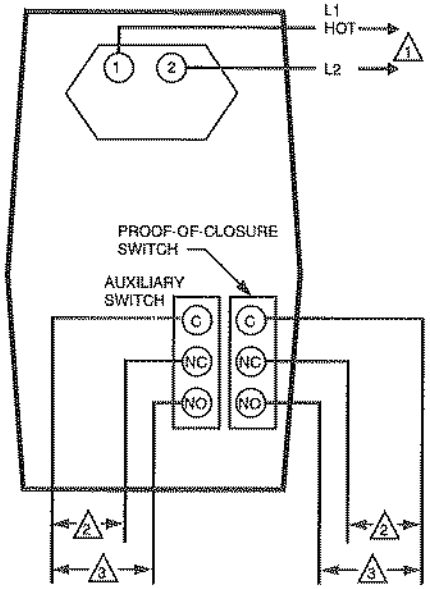
⚠ CAUTION

Operation Hazard.
Improper wiring can cause improper and dangerous operation.
Label all wires prior to disconnection when servicing valves. Wiring errors can cause improper and dangerous operation.

NOTE: Pipe sealant is required on the conduit threads of actuators with NEMA 4 enclosures.

Adjust Auxiliary Switch (If Used)

The Auxiliary Switch is adjustable throughout the stroke of the actuator. With the switch installed in the actuator, turn the adjusting screw (see Fig. 2) clockwise ↷ to cause the switch to operate earlier in the stroke or counter-clockwise ↶ to cause the switch to operate later in the stroke.



1 POWER SUPPLY. PROVIDE OVERLOAD PROTECTION AND DISCONNECT MEANS AS REQUIRED.

2 SWITCH BETWEEN THESE TWO LEADS IS CLOSED WHEN VALVE IS SHUT (DE-ENERGIZED).

3 SWITCH BETWEEN THESE TWO LEADS IS OPEN WHEN VALVE IS SHUT (DE-ENERGIZED).

M7334

Fig. 4. External connections to the V4055 Actuator.

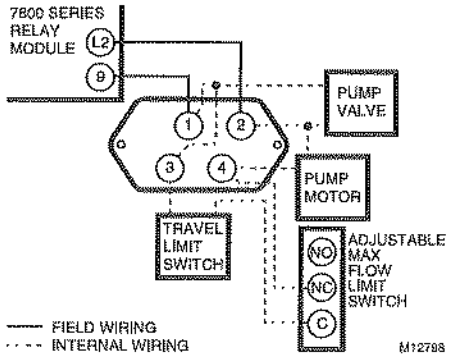


Fig. 5. Connecting the Max Flow Limit Switch to the actuator.

NOTE: The Proof-of-Closure Switch is not adjustable.

Adjust Max Flow Limit Switch (If Used)

The Max Flow Limit Switch is adjustable throughout the stroke of the actuator. With the switch installed in the actuator, turn the adjusting screw clockwise ↷ to cause the switch to operate earlier in the stroke or counter-clockwise ↶ to cause the switch to operate later in the stroke.

CHECKOUT AND SERVICE

⚠ CAUTION

Equipment Damage Hazard.
Unskilled technicians can cause equipment damage.
Only a trained, experienced, flame safeguard technician should check out and service this control.

Checkout

After the installation is complete, cycle the valve several times with the manual fuel shutoff cock closed before testing the system in actual operation.

Service

The actuator is not field repairable except for replacing the Auxiliary Switch, Max Flow Limit Switch or Proof-of-Closure Switch. See Installation section for procedure. Do not disassemble the valve actuator.

If the actuator fails to operate properly, replace it.

1. Turn off the gas supply at the manual shutoff valve located upstream from the valve(s) being serviced.
2. Shut off all electrical power to the valve actuator(s).
3. Mark and disconnect the wires from the actuator terminals. Remove conduit and disengage the damper linkage assembly (if applicable).
4. Loosen the two set screws from the valve to lift off the actuator.
5. If the actuator is to be replaced and it did not leak hydraulic fluid, skip to Step 11.

   NOTE: It is good practice to inspect the inside of the valve whenever the actuator is replaced. To do so, remove the bonnet assembly, inspect the valve and bonnet. If all is well, proceed to Step 7.

6. If the actuator leaked hydraulic fluid onto the valve (the fluid is red), it must be cleaned off from the valve and bonnet assembly.
   a. Wipe off the outer valve body.
   b. Remove the valve bonnet bolts and lift off the bonnet.

   NOTE: V5055/V5097C and E Valves have additional internal springs that will push the bonnet up as the bolts are loosened.

   c. Inspect the inside of the valve.

IMPORTANT

If fluid is present on the inside surfaces of the valve body or bonnet surfaces, the bonnet assembly or entire valve must be replaced. See Table 8 below for the bonnet assembly part number.

   d. If the inside surfaces are clear of hydraulic fluid, clean the bonnet assembly and be sure to remove all hydraulic fluid from the inside and outside of the actuator mounting curb. This is the "cup-like" area around the valve stem. Avoid using a cleaning solution as it may damage the rubber seals used in the valve.

7. If the valve bonnet assembly is in good condition and is not replaced, replace the bonnet seal. Do not reuse the old bonnet seal. See Table 9 below for the seal number.
8. Coat seals with grease provided and position in valve body/bonnet assembly.
9. Carefully seat the bonnet assembly on the valve body. Be sure the seals are in their proper position. On those valves with a spring below the disc, be sure the spring is centered in the indentation on the inside of the valve body.
10. After positioning the bonnet assembly, replace the screws removed earlier.

    NOTE: When replacing the bonnet assembly on the 4-inch valve, draw it evenly into the valve body. Finger-tighten the eight bolts. Draw the bonnet assembly into the valve by tightening, in order, bolts 1, 5, 7 and 3 (two turns each). Repeat until the bonnet assembly is seated. Tighten the remaining bolts. Torque the bolts as follows:

Valve Size	Torque
3/4 in. (19 mm) to 1-1/2 in. (38 mm)	55 in.-lb.
2 in. (51 mm) to 4 in. (102 mm)	75 in.-lb.

11. Remount the actuator on the bonnet assembly. Tighten the two set screws (50-60 inch pounds).
12. Replace the damper crank arm assembly.
13. Re-attach the wires removed from the actuator terminals and turn on the electrical power.
14. With the gas still off, cycle the actuator to check for proper mechanical operation.

⚠ CAUTION

Be sure to perform a bonnet seal and seat leak check after installation.
Be sure to read and follow all instructions that come with the actuators, valves, seal and bonnet kits.

Table 8. Replacement Bonnets for V5055/V5097 Gas Valves.

Replacement Bonnet	Valve		Valve Size (In in.)
133398AA	V5055A	V5097A	3/4, 1, 1-1/4, 1-1/2
133417AA			2, 2-1/2, 3
136911AA	(On-Off)		4
133398BA	V5055B	V5097B	3/4, 1, 1-1/4, 1-1/2
133417BA			2, 2-1/2, 3
136911BA	(Characterized Guide)		4
133398CA	V5055C	V5097C	3/4, 1, 1-1/4, 1-1/2
133417CA			2, 2-1/2, 3
136911CA	(Proof of Closure)		4
136308AA	V5055D	V5097D	3/4, 1, 1-1/4, 1-1/2
136307AA			2, 2-1/2, 3
136308BA	V5055E	V5097E	3/4, 1, 1-1/4, 1-1/2
136307BA			2, 2-1/2, 3

Each replacement assembly contains the bonnet assembly, two rubber seals, and a tube of grease. It must be used only on the type of valve indicated above.

Table 9. Gas Valve Replacement Seals.

Replacement Seal Assy #	Valve Size (In in.)
133393A	3/4, 1, 1-1/4, 1-1/2
133392A	2, 2-1/2, 3
137253A	4

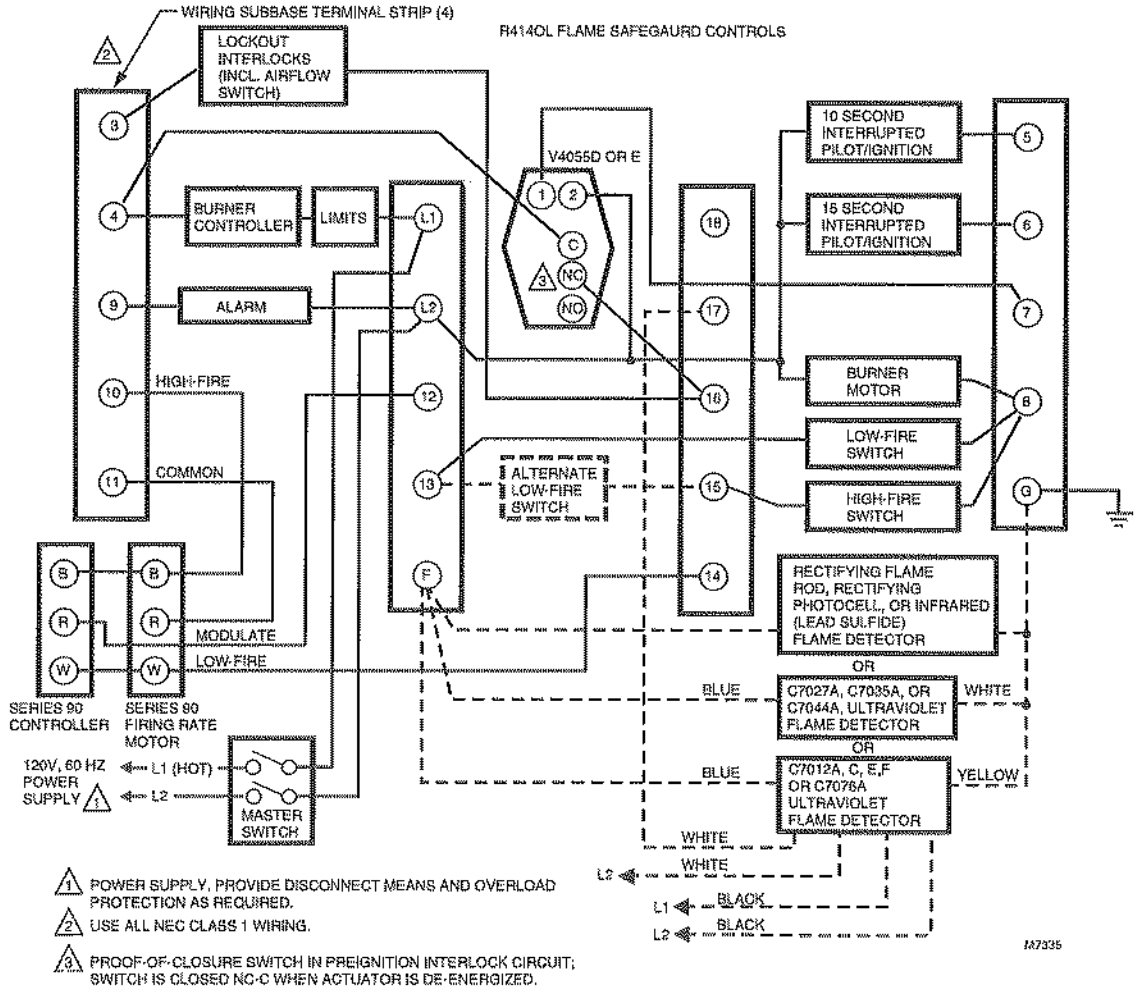


Fig. 6. Typical application of a V4055D/V5055C/V5097D or V4055E/V5055E/V5097E combination to meet Factory Mutual or Underwriters Laboratories Inc. approved requirements for Proof-of-Closure Switch (valve seal overtravel interlock).

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60-2309—11 M.S. Rev. 06-07

Honeywell

Automatic Safety Shutoff Valves

(V5055 / V5097 INDUSTRIAL GAS VALVES; V4055, V4062, AND V9055 ACTUATORS)

SPECIFICATION DATA

APPLICATIONS

The Honeywell family of automatic safety shutoff valves consists of several combinations of fluid power actuators with V5055 / V5097 Industrial Gas Valves. While it is possible to combine any V5055 / V5097 Valve with any V4055, V4062, or V9055 Actuator, a limited range of combinations apply to the applications most often used (see Fig. 1 and Table 1). These valve/actuator combinations are used for large gas burners that require tight closeoff and accurate control of large amounts of fuel. The valve opens when the actuator is energized, and closes to seal off against the rated close-off pressure when power is removed. The actuator determines the method of firing. A V4055 is used for On-Off firing, a V4062 for Hi-Lo-Off firing, and a V9055 for Modulating firing. The V4062 and V9055 Actuators are normally used with the V5055 / V5097B Valve with characterized guide for accurate control and repeatability of low-fire positions. Valve/actuator combinations are available that provide proof-of-closure switch with valve seal overtravel interlock. Note that *high pressure* valves and actuators are normally used only for On-Off firing.

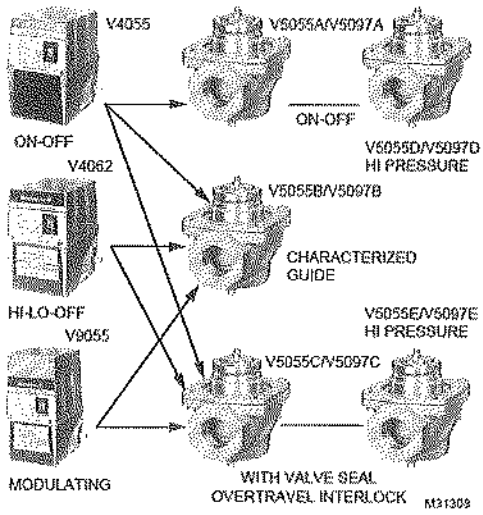


Fig. 1. Safety Shutoff Valve and Actuator combinations (V5055 models shown)

Table 1. Usual Combinations of Fluid Power Actuators and Industrial Gas Valves

Fluid Power Actuators/ Industrial Gas Valves			Standard pressure[a]			High Pressure[a]	
			V5055A, F[b], V5097A	V5055B, V5097B	V5055C, V5097C	V5055D, V5097D	V5055E, V5097E
Type	Model	Pressure Rating[a]	On-Off	Characterized Guide[c]	VSOI[d]	On-Off	VSOI[d]
V4055 On-Off	A, G[e]	Standard	•	•		•	
	B	High	•[f]	•[f]		•	
	D[d]F[d e]	Standard			•		•
	E[d]	High			•[f]		•
V4062 Hi-Lo-Off	A	Standard		•	•		
	B	High		•[f]	•[f]		•
	D[d]	Standard			•		
V9055 Modulating	A	Standard		•			
	D[d]	Standard			•		

[a] Refer to Table 2 for actual pressure ratings of the various combinations of valves and actuators.

[b] V5055F models meet EN161 leakage requirements.

[c] Characterized guide provides a more linear relationship between stem travel and gas flow. Check Honeywell form 70-8311 to verify that flow curve characteristics match application requirements.

[d] Valve Seal Overtravel Interlock. Valve has two shutoff seals, actuator has a proof-of-closure switch.

[e] V4055F, G models include switch for manual control.

[f] These combinations have higher pressure ratings; see Table 2.

V5055/V5097 Industrial Gas Valves

• V5055 / V5097 single-seated, normally closed valves are suitable for service requiring tight shutoff.

- Can be used with natural or liquefied petroleum (LP) gases.
- V5055A / V5097A,C,D,E Valves are for On-Off service.
- V5055 / V5097B Valve has a characterized guide to provide slow opening, Hi-Lo-Off, or Modulating service.
- V5055 / V5097C,E Valves have two seals and when used with the V4055D,E Actuators, the combination provides a proof-of-closure switch and valve seal overtravel interlock.
- V5055 / V5097D,E Valves are for high pressure applications.
- V5055 models feature threaded connections for seven pipe sizes from 3/4- to 3-inch NPT (or parallel BSP); V5055A,B,C are also available in a 4-inch size with flange connections.
- Standard with 1/4-inch upstream and downstream tapping with plug.
- V5097 models are available in small-body size covering 3/4" to 2" pipe size and large-body size covering 2" to 3" size.

Fluid Power GasValve Actuators

- Rated for final safety shutoff service when used with V5055 / V5097 Valves.
- V4055 Actuators are for On-Off service, V4062 Actuators are for Hi-Lo-Off service, and V9055 Actuators are for Modulating service.
- V4055D,E, V4062D, and V9055D Actuators have a proof-of-closure switch to provide valve seal overtravel interlock when used on a V5055 / V5097C,E Valve with a double seal.
- V4055B,E Actuators are for high pressure applications.
- Maximum closing time is one second, which meets approval body requirements.
- Red OPEN indicator attached to the actuator stem will show if the valve is even slightly open; yellow SHUT indicator on the valve stem will show only when the gas valve is fully closed .
- Standard enclosure meets NEMA 1 general purpose requirements; optional enclosure meets NEMA 4 weatherproof requirements.
- Optional damper shaft available with or without spring return; shaft extends out both sides and rides in Teflonlike, Delrin bushings.
- Uses standard damper crank arm, which is readily available from wholesalers.
- Optional, field-adjustable, spdt auxiliary switch is available.
- Low-fire adjustment on V4062 and V9055 Actuators is internal to minimize tampering.
- V9055 Actuator has internal, 24 volt transformer for line voltage connections and a field addable kit is available to provide V9055 acceptance of a 4 to 20 mA dc signal.

Table 2. Pressure Ratings of Valve-Actuator Combinations

Model	Pipe Size	STANDARD PRESSURE ACTUATORS V4055A, D, F, G, V4062A, D, V9055A, D				HIGH PRESSURE ACTUATORS V4O55B, E, V4062B			
		M.O.P.D. [a]		Max. Rated Pressure [b]		M.O.P.D. [a]		Max. Rated Pressure [b]	
STANDARD PRESSURE VALVES V5055A, B, C, F, V5097A, B, C	3/4" to 1-1/2" [c]	5 PSI	340 mbar	15 PSI	1.0 Bar	15 PSI	1030 mbar	15 PSI	1.0 Bar
	2" to 3" [d]	5 PSI	340 mbar	15 PSI	1.0 Bar	15 PSI	1030 mbar	15 PSI	1.0 Bar
	4" flanged [e]	3 PSI	207 mbar	15 PSI	1.0 Bar	5 PSI	340 mbar	15 PSI	1.0 Bar
HIGH PRESSURE VALVES V5055D, E, V5097D, E	3/4" to 1-1/2" [c]	5 PSI	340 mbar	75 PSI	5.0 Bar	25 PSI	1720 mbar	75 PSI	5.0 Bar
	2" to 3" [d]	5 PSI	340 mbar	45 PSI	3.0 Bar	15 PSI	1030 mbar	45 PSI	3.0 Bar

[a] Max Operating Pressure Differential (UL) or Max Operating Pressure (CSA); maximum allowable pressure drop from inlet to outlet for proper operation .

[b] Max Rated Pressure (UL) or Max Close-off Pressure (CSA) ; maximum pressure that the valve can be exposed to without leakage or damage to the valve.

[c] Applies for small-body V5097 valves 3/4" up to 2" pipe size.

[d] Applies for large-body V5097 valves 2" up to 3" pipe size.

[e] V5055A, B, C only.

Valve-actuator Approvals

The following combinations of V5055 / V5097 Valves (3/4 through 4 in.) and V4055, V4062, and V9055 Fluid Power Actuators are approved by the agencies listed:

Industrial Risk Insurers Acceptable and Underwriters Laboratories Inc. Listed:
V4055A,B,D,E/V5055 / V5097A,B,C,D,E
V4062/V5055 / V5097A,B,C,E
V9055/V5055 / V5097A,B,C,E

Factory Mutual Approved :
V4055A/V5055 / V5097A,B V4055E/V5055 / V5097E
V4055B/V5055 / V5097D V4062/V5055 / V5097B,C
V4055D/V5055 / V5097C V9055/V5055 / V5097B,C

Canadian Standards Association File 158158-1205788:
V4055A - V5055A,B / V5097A,B
V4055B - V5055D / V5097D
V4055D - V5055C / V5097C
V4055E - V5055E / V5097E
V4062 - V5055B,C / V5097B,C
V9055 -V5055B,C / V5097B,C

British Gas Corporation and Dutch Gas Institute Approved:
V4055 or V4062 with several V5055 / V5097A and V5055 / V5097B models.
V4055D or V4062D with V5055 / V5097C models with an internal screen.

MAXITROL

Gas Appliance Pressure Regulators

Straight-Thru-Flow Design

RV52, RV53, RV61, RV81, RV91, RV111, and RV131

1/2", 3/4", 1", 1¼", 1½", 2", 2½", 3" & 4"

design certified

Maximum Pressure

CSA Rated (except RV131) ..... 1/2 psi (35 mbar)

Maxitrol Tested*
RV52 & RV53 ..... 1/2 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)

GAS CONTAINMENT EXPOSURE LIMITS*
RV 52 & RV53 ..... 15 psi (1050 mbar)
RV61, RV81, RV91, RV111,
& RV131 ..... 25 psi (1750 mbar)
* Please note that internal damage may occur when exposed to these pressures.

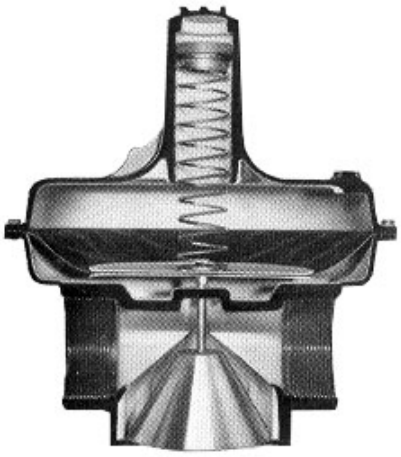
AMBIENT TEMPERATURE LIMITS
RV52, RV53, RV61, RV81,
RV91 & RV111 ..... -40° to 205° F (-40° to 96° C)
RV131 ..... -40 to 125° F (-40 to 52° C)

GASES: Suitable for application in natural, manufactured, mixed gases, liquefied petroleum gases and LP gas-air mixture piping systems.

S-T-F Series

Straight-Thru-Flow Design

RV series



RV52, RV53, RV61, RV81, RV91, RV111, and RV131

FEATURES

- Greater accuracy—higher pressure drop capacity
- Outlet pressures available to 42" w.c.
- Available in full range of pipe sizes from 1/2" to 4"
- All models tapped with NPT vent bosses
- CSA Design Certified (except RV131)

BENEFITS

- Unique conical valve design fills need of combining good regulation with high capacity in low to intermediate pressure range
- Allows more pressure drop to be assigned to piping and valves—permits reduction in manifold size
- Provides accurate, sensitive regulation at inlet pressures as low as 3" w.c.
- RV131 only, provides bonus benefits of high capacity and good performance at pressures of 1 psi or higher
- Ease of installation and replacement

All models except RV131 are CSA design certified for 1/2 psi rated pressure under the ANSI standard for gas pressure regulators; and CSA listed to certify compliance with nationally published safety, construction, and performance standards.

They are main burner only, non-lockup type. They should not be used as a line gas pressure regulator ahead of low pressure controls. Use only where downstream controls can operate at line pressure. Refer to other Maxitrol sales bulletins for proper types.

The RV52, RV53, & RV61 are suitable for multipoise mounting. The RV81, RV91, RV111, & RV131 are recommended for normal horizontal position only.

Maxitrol's original Straight-Thru-Flow design meets your needs for high capacities at low inlet pressures. The basic difference between S-T-F design and other type regulators lies in the conical valve. The cone principal permits gas to flow straight through the regulator without changing directions. Frictional flow resistance is reduced, resulting in greater capacity.

The improved flow pattern provides accurate sensitive regulation at extremely low pressure differentials. The ability of the regulator to handle large capacity appliances with limited supply pressure offers a definite advantage to designers of commercial and industrial gas-fired equipment.
Models up to the three inch pipe size have high strength pressure cast aluminum housings. The RV131 four inch model is of cast iron and steel construction. RV61, RV81, RV91, RV111, & RV131 internal conical valves are coated with Teflon® for long life. Diaphragm material is cut from the finest synthetic coated fabrics available. All other parts are carefully specified corrosion-resistant or plated material.

Pipe sizes of 1/2", 3/4", 1", 1-1/4", 1-1/2", 2", 2-1/2", 3", and 4" are available. Models through the 3" size are threaded, the 4" RV131 is flanged.

At the emergency exposure limits, there may be no regulation, but all models will contain gas. They will suffer no internal damage and will resume regulation when normal pressure is restored.

Straight-Thru-Flow appliance regulators are intended for use with all fuel gases, and may also be used with air or other noncorrosive gases within their pressure limits.

Typical applications include all types of residential, commercial and industrial gas-fired appliances and equipment used on low pressure gas supply. See Maxitrol's "Spring Selection Chart" for part numbers, color and size of springs.

Teflon is a registered trademark of DuPont Corporation.

NOTE: All Maxitrol appliance regulators should be installed in accordance with Maxitrol's "Safety Warning" bulletin.

Capacities and Pressure Drop

CAPACITIES—expressed in CFH (m^3/h)—0.64 sp gr gas

Model Number and Pipe Size		CSA MAX	Pressure DropÑinches w.c. (mbar)												
			0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	2	3	4
RV52	1/2 x 1/2 3/4 x 3/4	450 (12.7)	151 (4.2)	214 (6.1)	262 (7.4)	302 (8.5)	338 (9.5)	370 (10.5)	400 (11.3)	427 (12.1)	453 (12.8)	478 (13.5)	676 (19.1)	828 (23.4)	956 (27.1)
RV53	3/4 x 3/4 1 x 1	710 (20.1)	217 (6.1)	306 (8.6)	375 (10.6)	433 (12.2)	484 (13.7)	530 (15)	573 (16.2)	612 (17.3)	650 (18.4)	684 (19.3)	968 (27.4)	1185 (33.5)	1369 (38.7)
RV61	1 x 1 1-1/4 x 1-1/4	1100 (31.1)	379 (10.7)	536 (15.1)	675 (19.1)	759 (21.5)	848 (24)	929 (26.3)	1004 (28.4)	1073 (30.4)	1138 (32.2)	1200 (34.0)	1742 (49.3)	2134 (60.4)	2464 (69.8)
RV81	1-1/4 x 1-1/4 1-1/2 x 1-1/2	2500 (70.8)	780 (22.1)	1102 (31.2)	1350 (38.2)	1559 (44.1)	1743 (49.5)	1909 (54)	2062 (58.4)	2204 (62.4)	2339 (66.2)	2465 (69.8)	3485 (98.7)	4269 (120)	4929 (139)
RV91	2 x 2 2-1/2 x 2-1/2	3275 (92.7)	1212 (34.3)	1714 (48.5)	2100 (59.4)	2424 (68.6)	2711 (76.7)	2969 (84.1)	3208 (90.8)	3429 (97.1)	3637 (103)	3834 (108)	5422 (153)	6640 (188)	7668 (217)
RV111	2-1/2 x 2-1/2 3 x 3	7500 (212)	2742 (78)	3878 (110)	4750 (134)	5485 (155)	6132 (175)	6718 (190)	7256 (205)	7757 (219)	8227 (233)	8572 (243)	12134 (343)	14862 (420)	17161 (486)
RV131	4 x 4	--	4734 (134)	6695 (190)	8200 (232)	9468 (268)	10586 (300)	11596 (328)	12525 (354)	13390 (380)	14202 (402)	14971 (424)	21172 (600)	25930 (734)	29942 (848)

Sizing Instructions

In order to select the proper size regulator, you must know the available inlet pressure, desired outlet pressure, and the required maximum flow rate.

Example No. 1—To select a regulator of ample capacity to handle flow.

KNOWN:
Pipe size 2-1/2", flow rate 8,000 CFH (0.64 sp gr), inlet pressure 9" w.c., desired outlet pressure 5" w.c.

SOLUTION:

1. Determine differential pressure available:
   Inlet pressure 9" w.c.
   Subtract outlet pressure - 5" w.c.
   Available differential pressure 4" w.c.
2. When determining capacity Maxitrol recommends that the pressure drop not exceed 1/2 of available differential pressure (1/2 of 4" w.c. = 2" w.c.).
3. Check Capacity Chart to determine which regulator has a pressure drop of 2" w.c. or less at a flow rate of 8,000 CFH.
4. The RV111 meets these standards with a flow rate of 12,134 CFH for the 2-1/2" pipe size at 2" w.c. pressure drop. The 2-1/2" RV91 flows 5422 CFH at 2" w.c. pressure drop. Therefore, the RV111—2-1/2" is the correct regulator to use.

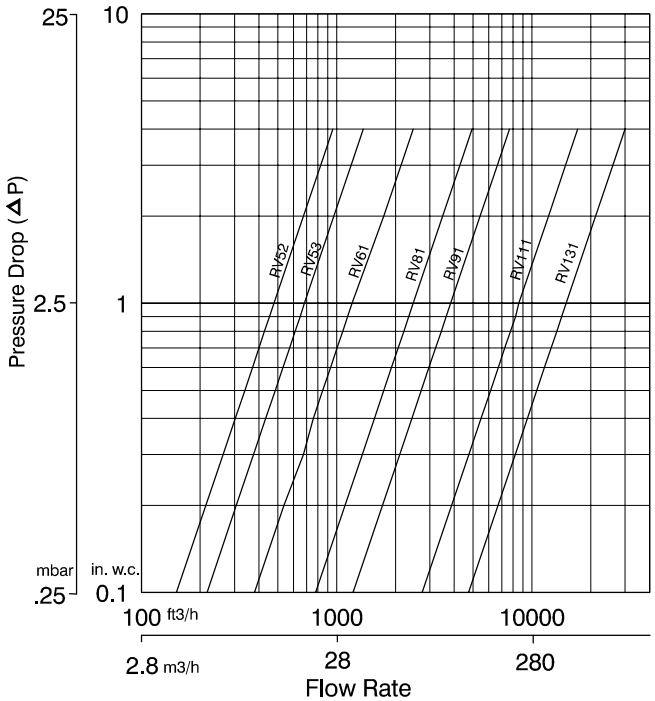
Example No. 2—To determine maximum recommended operating outlet pressure.

KNOWN:
Pipe size 4", flow rate 21,000 CFH, inlet pressure 10" w.c.

SOLUTION:

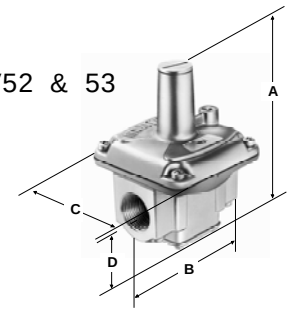
1. Check capacity Chart above for 4" regulator, RV131.
2. Note that at a flow rate of 21,172 CFH the pressure drop is 2" w.c.
3. Multiply this by two to obtain recommended differential pressure (4" w.c.).
4. Subtract 4" differential pressure from 10" w.c. inlet pressure to obtain maximum recommended outlet pressure setting of 6" w.c.

Pressure Drop Chart

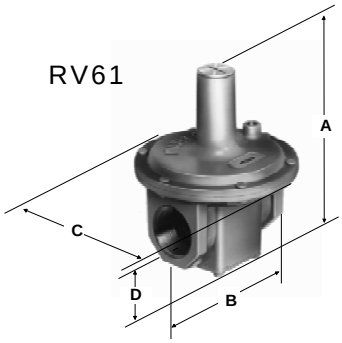


Dimensions and Spring Ranges

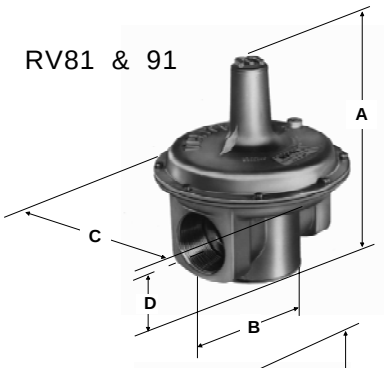
RV52 & 53



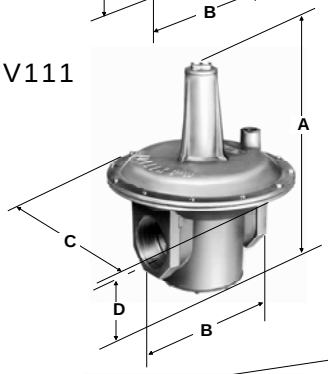
RV61



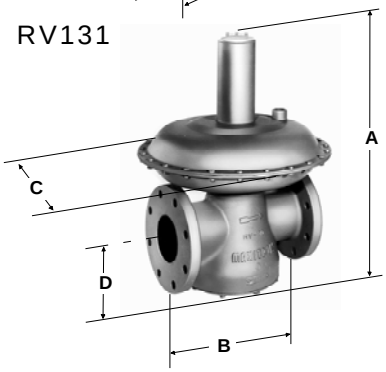
RV81 & 91



RV111



RV131



DIMENSIONS*—inches (millimeters)

Model & Illustration Number	Vent Tap	Swing Radius	Call-Outs			
			A	B	C	D
RV52	1/8" NPT	3.6 (91)	4.9 (124)	3.2 (81)	3.25 (83)	1.25 (32)
RV53	1/8" NPT	3.9 (99)	5.2 (132)	3.75 (95)	3.9 (99)	1.3 (33)
RV61	1/8" NPT	4.8 (122)	6.4 (164)	4.4 (111)	5.4 (138)	1.6 (41)
RV81	3/8" NPT	6.4 (162)	8.4 (213)	6 (153)	7 (178)	2 (51)
RV91 2" pipe	1/2" NPT	8.5 (216)	10.8 (275)	6.5 (165)	9.1 (232)	2.3 (60)
RV91 2.5" pipe	1/4" NPT	8.3 (212)	10.5 (267)	7.1 (181)	9.1 (232)	2.4 (62)
RV111	3/4" NPT	11.5 (284)	15.1 (373)	9 (229)	13.4 (324)	3.5 (89)
RV131	3/4" NPT	18.2 (462)	23.25 (590)	13.9 (353)	18 (458)	5.1 (129)

* *Dimensions are to be used only as an aid in designing clearance for the valve. Actual production dimensions may vary somewhat from those shown.*

SPRING SELECTION CHART—inches w.c. (mbar)

Model Number	CSA Certified Springs			Other Springs Available							
RV52	3 to 6 (7.5-15)	4-8 (10-20)	5-12 (12.5-30)	1-3.5 (2.5-9)	2-5 (5-12.5)	3-8 (7.5-20)	4-12 (10-30)	--	--	--	--
RV53	3 to 6 (7.5-15)	4-8 (10-20)	5-12 (12.5-30)	1-3.5 (2.5-9)	2-5 (5-12.5)	3-8 (7.5-20)	4-12 (10-30)	--	--	--	--
RV61	3 to 6 (7.5-15)	4-8 (10-20)	5-12 (12.5-30)	1-3.5 (2.5-9)	2-5 (5-12.5)	3-8 (7.5-20)	--	--	10-22 (25-55)	--	--
RV81	3 to 6 (7.5-15)	4-8 (10-20)	5-12 (12.5-30)	1-3.5 (2.5-9)	2-5 (5-12.5)	3-8 (7.5-20)	4-12 (10-30)	5-15 (12.5-38)	10-22 (25-55)	--	--
RV91	3 to 6 (7.5-15)	4-8 (10-20)	5-12 (12.5-30)	1-3.5 (2.5-9)	2-5 (5-12.5)	3-8 (7.5-20)	4-12 (10-30)	5-15 (12.5-38)	10-22 (25-55)	--	--
RV111	3 to 6 (7.5-15)	4-8 (10-20)	5-12 (12.5-30)	1-3.5 (2.5-9)	2-5 (5-12.5)	3-8 (7.5-20)	4-12 (10-30)	5-15 (12.5-38)	10-22 (25-55)	--	--
RV131	3 to 6 (7.5-15)	--	5-12 (12.5-30)	--	2-5 (5-12.5)	3-8 (7.5-20)	4-12 (10-30)	--	10-22 (25-55)	15-30 (38-75)	20-42 (50-105)

NOTE: The area within the heavy line indicates CSA certified springs.

MAXITROL

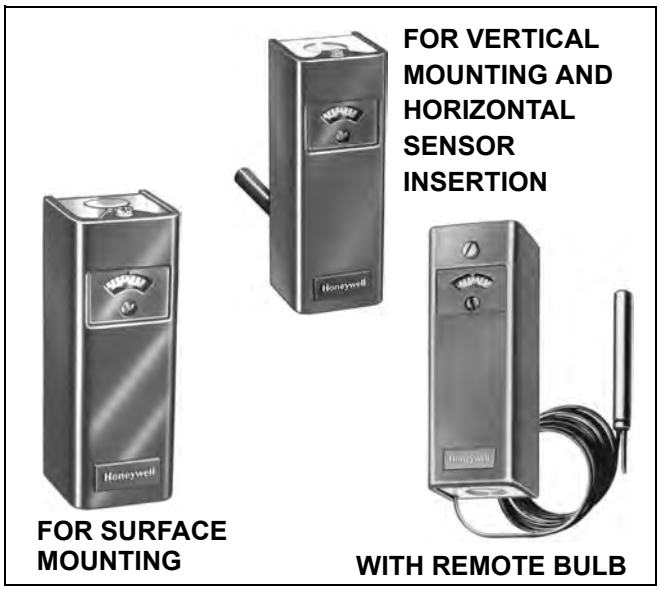
Maxitrol Company
23555 Telegraph Rd., PO Box 2230
Southfield, MI 48037-2230 U.S.A.

RVSTF_MS_EN_03.2008
Replaced MS2056

Honeywell

L4006,7,8; L6006,7,8 Aquastat® Controllers

PRODUCT DATA



GENERAL

Aquastat® Controllers are immersion type devices for limiting or regulating the temperature of liquids in boilers, storage tanks, and other applications where temperature control is required.

FEATURES

- **L4006, 7, and 8 provide Spst switching for high or low limit or circulator control.**
- **L4006G includes two Spst switches that provide high limit and circulator control.**
- **L4006,7; L6006,7 models are available for insertion in: vertical or horizontal immersion well, vertical or horizontal direct immersion, and surface mounting.**
- **L4008, L6008 include remote bulb for mounting controller at a location away from the sensing element.**
- **Totally enclosed Micro Switch™ snap-acting switches operate on temperature rise to set point.**
- **Models calibrated for high limit use are also suitable for low limit control if a separate high limit controller is used.**
- **Visible control point scale and external adjustment screw, permit easy setting.**
- **Remote bulb models may be used to sense air temperature in ducts and in outside air sensing applications.**

Contents

60-2104—10

SPECIFICATIONS

IMPORTANT

The specifications given in this publication do not include normal manufacturing tolerances. Therefore, this unit may not exactly match the listed specifications. Also, this product is tested and calibrated under closely controlled conditions, and some minor differences in performance can be expected if those conditions are changed.

SUPER TRADELINE®/TRADELINE MODELS

SUPER TRADELINE controls offer features not available on TRADELINE or standard models, and are designed to replace a wide range of Honeywell and competitive controls.

TRADELINE models are selected and packaged to provide ease of stocking, ease of handling, and maximum replacement value. Specifications of SUPER TRADELINE and TRADELINE controls are the same as those of standard models except as noted below.

SUPER TRADELINE Model: L6006A Aquastat Controller.

SUPER TRADELINE Features:
SUPER TRADELINE package with cross reference label and special instructions.
Factory-set stop at 240° F (116° C).
Vertical or horizontal mount.
Tube of heat-conductive compound.
Insulation: 1-1/2 in. to 3 in. (38 mm to 76 mm).

TRADELINE Models: L4006A,B,E; L4008E; L6006C; L6008A Aquastat Controllers.

TRADELINE Features Available:
TRADELINE package with cross reference label and special instructions.
Some TRADELINE models include immersion well.
Factory-set stops at 180° F, 240° F, or 250° F (82° C, 116° C, or 121° C).
Vertical or horizontal mount.
Tube of heat-conductive compound.
Insulation depths of 1-1/2 in. or 3 in. (38 or 76 mm).

NOTE: The following specifications are standard. Variances, available as options, are listed in Tables 1 and 2.

Electrical Ratings (A):
Models with 2° F (1° C) fixed differential:

	120 Vac	240 Vac
Full Load	2.6	1.3
Locked Rotor	15.6	7.8

Models with 5° F (3° C) fixed differential or 5° F to 30° F (3° C to 17° C) adjustable differential:

	110/120 Vac	200/240 Vac	277 Vac[a]
Full Load	8.0	5.1	4.2
Locked Rotor	48.0	30.6	25.2
Millivoltage	0.25 at 0.25 to 12 Vdc		

[a] L6008G only.

Switching:
L4006, L4007, L4008: Spst.
L6006, L6007, L6008: Spdt (breaks R-B and makes R-W on temperature rise at setpoint).

Pressure Rating:
Capillary Bulb (Direct Immersion): 200 psi (1379 kPa).
Immersion Well: 255 psi (1758 kPa).

Sensing Bulb Material: Copper.

Sensing Bulb Fill: Liquid—toluene or silicone oil.

Sensing Bulb Dimensions: 2-7/8 in. (73 mm) long, 3/8 in. (10 mm) diameter.

Wiring: Screw terminals.

Maximum Ambient Temperature: 150° F (66° C).

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Automation and Control Products Sales Office (check white pages of your phone directory).
2. Honeywell Customer Care
   1885 Douglas Drive North
   Minneapolis, Minnesota 55422-4386

In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Scarborough, Ontario M1V 4Z9.
International Sales and Service Offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.

Approvals:
Underwriters Laboratories Inc:
Remote bulb devices and well-mounted devices shipped without well are component recognized: File No. MP466, Guide No. MBPR2.
L4006A shipped with well, L4006G, L4007A,B; L6006C for surface mounting, L6006B for direct immersion mounting, and L6007A are listed: File No. MP466, Guide No. MBPR.
L6008G is listed: File No. E4436, Guide No. XAPX.
Canadian Standards Association: File No. LR1620, Guide No. 400-E-O.

ANSI Miswiring: Models with 1/4 in. (6.35 mm) tab terminal meet ANSI Appliance Miswiring Standard.

Mounting:
Horizontal and vertical models mount directly to an immersion well installed in a boiler fitting. L4006H and L6006C contain a bracket and clamp for surface mounting on the pipe or tank. Remote bulb models have three mounting holes in rear of case for screw mounting to a vertical surface. The L6006B direct immersion model also mounts directly to a boiler fitting.

Finish: Gray.

Dimensions:
Installation: (See Figures 1, 2, and 3).
Immersion Well: (See Fig. 4).
Boiler Fitting and Bulb: (See Fig. 5).

Accessories and Parts:
137536A Scale Lock Assembly: Includes one 137536-767 Scale Lock and one 80844C-767 Screw, No. 3-48 x 3/16 (5 mm).
Q615A1004 Weatherproof Enclosure (for remote bulb devices only).
107408 Heat-Conductive Compound (4-oz. can).
104488 Spring Clip (stainless steel).
124904 Well Adapter.
Immersion Well Assemblies and Compression Fittings: See form no. 68-0040, Wells and Fittings for Temperature Controllers, for list and ordering information.

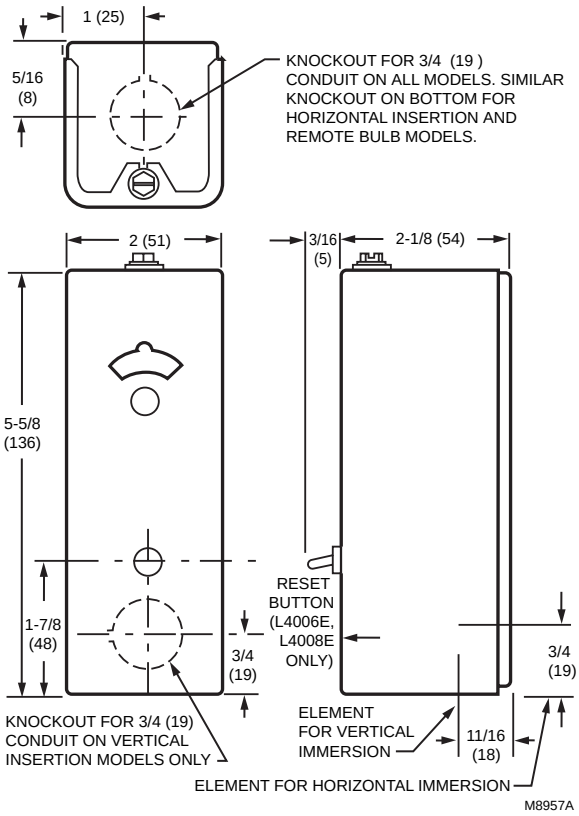


Fig. 1. Approximate case installation dimensions in inches (mm) for direct insertion models.

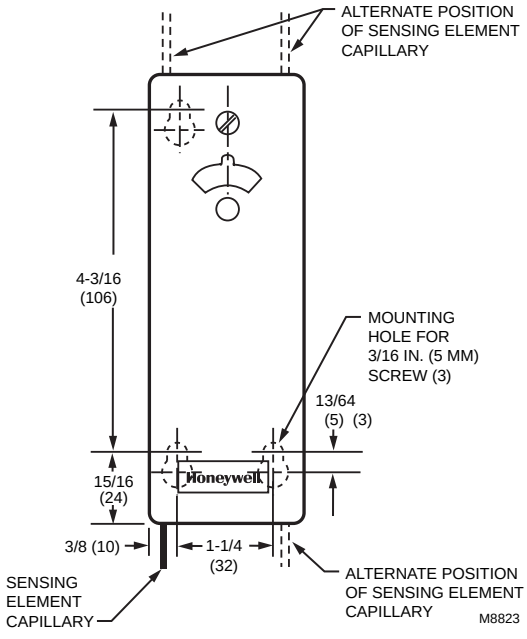


Fig. 2. Approximate installation dimensions in inches (mm) for remote bulb models. Other dimensions are the same as Fig. 1.

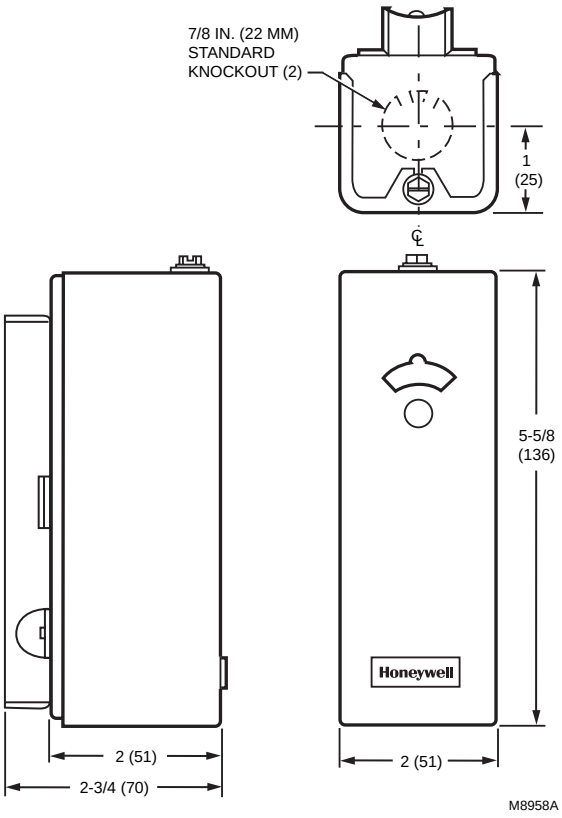


Fig. 3. Approximate installation dimensions in inches (mm) for surface mount models.

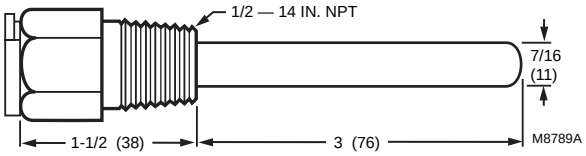


Fig. 4. Approximate immersion well dimensions in inches (mm) for all models except L4006C and L6006B.

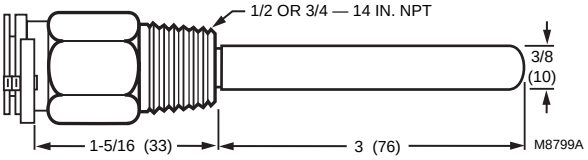


Fig. 5. Approximate boiler fitting and bulb dimensions in inches (mm) for L4006C and L6006B.

Standard Models:
L4006,A,B,C,E,G; L4007,A,B; L4008A,B.E; L6006A,B,C; L6007A, L6008,A,G,H

Table 1. L4006, L4007, L4008 Controller (SPST Switching) Specifications.

Model	Application	Range °F (°C)	Midscale Differential °F (°C)	Insertion[a]	Switching On Temperature Rise	Available Options
L4006A	High or low limit	40° F to 180° F (4° C to 82° C) or 100° F to 240° F (38° C to 116° C)	2° F or 5° F fixed (1° C or 3° C) or 5° F to 30° F adjustable (3° C to 17° C)	Horizontal	Breaks	— TRADELINE models available. — NPT brass spud 1/2 in. or 3/4 in. (13 mm to 19 mm) — Special capillary assembly. — Insertion 3-3/8 in. or 5 in. (86 or 127 mm) — Celsius scale markings. — Factory-set stops at 160°, 180°, 185°, 200°, 220°, or 230° F (71°, 82°, 85°, 93°, 104°, or 110° C). — Insulation depths of 1-1/2 in. , 3 in. or 4 in. (38 mm, 76 mm, or 102 mm). — Screw and mounting brackets. — Plastic tubing over well. — Modified dial with stop. — Special cover and knobs. — With ground screw.
L4006B	Circulator	100° F to 240° F (38° C to 116° C)	5° F (3° C) fixed or 5° F to 30° F (3° C to 17° C) adjustable	Horizontal	Makes	— TRADELINE model available. — Insulation depth 1-1/2 in. or 3 in. (38 mm or 76 mm). — NPT brass spud 3/4 in. (19 mm) — Screw in front of case on dial suitable for Powerpile® control. — Factory-set stop at 240° F (116° C).
L4006C	High or low limit	65° F to 200° F (18° C to 93° C)	3-1/2° F (2° C) fixed	Horizontal direct immersion	Breaks	— TRADELINE model available. — Less cover. — Capillary 10 in. (254 mm). — NPT brass spud 3/4 in. (19 mm).
L4006E[b]	High limit	130° F to 290° F (54° C to 141° C)	Manual reset	Horizontal or vertical	Breaks	— TRADELINE model available. — Insulation depth 1-1/2 in. or 3 in. (38 or 76 mm). — NPT brass spud 1/2 in. (13 mm) — Factory-set stop at 250° F (121° C). — Capillary 8 in. (203 mm).

[a] Some models include copper well or fitting; specify when ordering. Also specify boiler tapping size 1/2 or 3/4 in. (13 to 19 mm) NPT and insulation depth.

[b] Manual reset (trip-free) switch breaks circuit and locks out when controlled medium reaches setpoint. Controlled temperature must drop 20° F (11° C) below setpoint before contacts can be manually reset.

Table 1. L4006, L4007, L4008 Controller (SPST Switching) Specifications. (Cont.)

Model	Application	Range °F (°C)	Midscale Differential °F (°C)	Insertion[a]	Switching On Temperature Rise	Available Options
L4006G	High limit and circulator control	100° F to 200° F (38° C to 93° C)	10° F (6° C) fixed	Horizontal	Two switches break simultaneously	— External adjustment knob. — Insulation depth 4 in. (102 mm). — Factory-set stop at 160° F (71° C). — Celsius scale markings. — Without well.
L4007A	High or low limit	100° F to 240° F (38° C to 116° C)	2° F or 5° F (1° C or 3° C) fixed, 5° F to 30° F (3° C to 17° C) adjustable	Horizontal or vertical	Breaks	— Insulation depth 1-1/2 in. or 3 in. (38 mm or 76 mm).
L4007B	Circulator	100° F to 240° F (38° C to 116° C)	5° F (3° C) fixed or 5° F to 30° F (3° C to 17° C) adjustable	Vertical	Makes	— Celsius scale markings.
L4008A	High or low limit	100° F to 240° F (38° C to 116° C) or 130° F to 270° F (54° C to 132° C)	5° F (3° C) fixed, 5° F to 30° F (3° C to 17° C) adjustable	Remote bulb direct immersion	Breaks	— Remote capillary 5-1/2 ft (1.7 m), 8-1/2 ft (2.6 m) or 10 ft (3.0 m). — Factory-set scale stops at 120°, 170°, or 200° F (49°, 77°, or 93° C) — Celsius scale markings. — Front cover screw.
L4008B	Circulator	100° F to 240° F (38° C to 116° C)	5° F (3° C) fixed or 5° F to 30° F (3° C to 17° C) adjustable	Remote bulb direct immersion	Makes	— Capillary 5-1/2 ft (1.7 m).
L4008E[b]	High limit	40° F to 80° F (4° C to 27° C) or 130° F to 270° F (54° C to 132° C)	Manual reset	Remote bulb	Breaks	— Factory-set scale stops at 140°, 200°, or 250° F (60°, 93°, or 121° C). — Capillary 5-1/2 ft or 20 ft (1.7m or 6.1 m).

[a] Some models include copper well or fitting; specify when ordering. Also specify boiler tapping size 1/2 or 3/4 in. (13 to 19 mm) NPT and insulation depth.

[b] Manual reset (trip-free) switch breaks circuit and locks out when controlled medium reaches setpoint. Controlled temperature must drop 20° F (11° C) below setpoint before contacts can be manually reset.

Table 2. L6006, L6007, L6008 Controller (SPDT Switching) Specifications.

Model	Application	Range °F (°C)	Midscale Differential °F (°C)	Insertion[a]	Available Options
L6006A	Circulator and low limit or high limit	100° F to 240° F (38° C to 116° C) or 100° F to 290° F (38° C to 143° C)	5° F (3° C) fixed or 5° F to 30° F (3° C to 17° C) adjustable	Horizontal	— SUPER TRADELINE model available. — Modified dial with stop. — NPT brass spud 1/2 in. or 3/4 in. (13 mm to 19 mm) — 3-3/8 in. (86 mm) insertion. — Without well. — Adapter for horizontal or vertical mount. — Insulation depth 1-1/2 in. or 3 in. (38 mm or 76 mm).
L6006B	Circulator and low limit or high limit	100° F to 240° F (38° C to 116° C)	5° F (3° C) fixed or 5° F to 30° F (3° C to 17° C) adjustable, or 30° F (17° C) fixed.	Horizontal	— Direct immersion. — Insulation depth 1-1/2 in. (38 mm). — 3/4 in. (19 mm) brass compression fitting.
L6006C	Circulator, low limit, and high limit	65° F to 200° F (18° C to 93° C)	5° F (3° C) fixed or 5° F to 30° F (3° C to 17° C) adjustable	Horizontal or vertical surface mounted	— TRADELINE model available. — Strap-on, surface mount.
L6007A	Circulator and low limit or high limit	40° F to 180° F (4° C to 82° C)	Fixed	Horizontal or vertical	— Insulation depth 1-1/2 in. or 3 in. (38 mm or 76 mm).
L6008A	Circulator and low limit cooling	100° F to 240° F (38° C to 116° C) or -30° F to +70° F (-35° C to +21° C)	5° F (3° C) fixed or 5° F to 30° F (3° C to 17° C) adjustable	Remote bulb	— TRADELINE models available. — Modified dial with stop. — Capillary 5-1/2 ft (1.7 m).
L6008G	Two-stage Aquastat Controller to cycle two-stage gas valve.	130° F to 230° F (54° C to 110° C) or 60° F to 160° F (16° C to 71° C)	3-1/2° F (2° C) fixed	Remote bulb	— Capillary 6 ft (1.8 m). — Adjustable interstage differential; 5° F to 10° F (2° C to 6° C).
L6008H (maximum temperature of element 405° F (207° C))	Low fire Aquastat Controller	150° F to 200° F (66° C to 93° C)	15° F (8° C) fixed	Remote bulb	— Capillary 33 in. (0.8 m).

[a] Some models include copper well or fitting; specify when ordering. Also specify boiler tapping size 1/2 or 3/4 in. NPT and insulation depth.

INSTALLATION

When Installing This Product…

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced service technician.
4. After installation is complete, check product operation as provided in these instructions.

⚠ WARNING

Explosion Hazard.
Can cause serious injury, death or property damage.
This product is intended for use only in systems with a pressure relief valve.

⚠ WARNING

Electrical Shock Hazard.
Can cause serious injury or death.
Disconnect power supply before beginning installation to prevent electrical shock or equipment damage.

⚠ CAUTION

Equipment Damage Hazard.
Use of incorrect device or improper installation can damage the system.
1. Do not replace immersion-type Aquastat Controller with strap-on Aquastat Controller.
2. Do not secure draw nut so tightly that retainer clamp can collapse tubing.

IMPORTANT

1. *Terminals on these Aquastat relays are approved for copper wire only.*
2. *Controller may be used with or without immersion well. If used, well must snugly fit sensing bulb for best thermal response. Insert bulb until it rests against the bottom of the well. Use well of correct length and bend the tubing, if necessary, to provide enough force to hold the bulb against the bottom of the well. Avoid making a sharp bend in the tubing as it can produce a break in the tubing and cause loss of fill. This condition causes the High and Low Limit controls to be made continuously.*
3. *If well does not snugly fit on bulb, use the heat-conductive compound, included with Super Tradeline and Tradeline models, as follows: Fold the plastic bag of compound lengthwise and twist gently. Snip the end of the bag and insert into the well. Slowly pull out the bag while squeezing firmly to distribute compound evenly in the well. Insert the bulb into the well. Bend the tubing, if necessary, to provide force to hold the bulb against the bottom of the well and to hold the outer end of the bulb firmly in contact with the side of the well. Wipe off excess compound.*

The manufacturer usually provides a tapping for insertion of the controller sensing element. This tapping is located at a point where typical water temperature can be measured. Depending on the model, the element is inserted in an immersion well, through a boiler fitting, or directly immersed.

Installation should be made by a qualified service technician. Follow the instructions furnished by the system manufacturer, if available. Otherwise, refer to appropriate procedure listed below.

Mounting Immersion Well and Direct Immersion Models (L4006A,B,C,E,G; L4007A,B; L6006A,B; L6007A)

Installing Immersion Well Models (L4006A,B,E,G; L4007A,B; L6006A; L6007A)

On an existing installation, shut off the power and remove the old control. If the old immersion well appears suitable, and if the adapter clamp on the Aquastat Controller fits the old well spud, this well does not need to be replaced.

To replace the well:

1. If the system is filled, drain the system to a point below the boiler tapping.
2. Remove the old well from the boiler tapping.
3. Install the immersion well included with the controller. If the boiler tapping is greater than 1/2 in. (13 mm), use a reduction fitting to adapt the boiler opening to the 1/2 in. (13 mm) threads that are standard with the well or fitting. Fittings with 3/4 in. (19 mm) threads are also available.
4. Fill the system. Make sure that the well is screwed in tightly enough to prevent leakage. Do not use the case as a handle to tighten the well after the controller is secured to the well.

To install the controller:

1. Loosen the screw (at the top of the case, above the scale setting), and remove the cover. Loosen the two screws that secure the adapter clamp. (See Fig. 6).
2. Insert the sensing element into the immersion well.
3. Fasten the case of the Aquastat Controller to the well with the adapter clamp. Make certain that the clamp is properly positioned over the groove of the well spud. Also, be sure the flange at the opening of the well fits snugly into the opening of the case. The sensing bulb must bottom in the well.

NOTE: Some models include up to 3 in. (76 mm) extra capillary tubing inside the case. In these models, pull out the extra tubing, if needed.

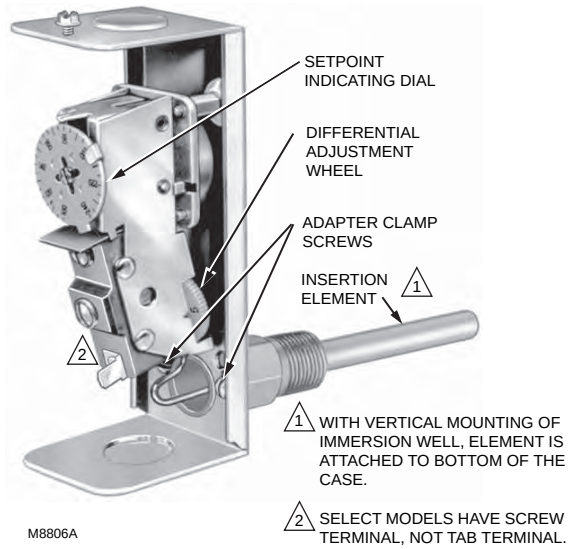


Fig. 6. Internal view of L6006A.

Installing Direct Immersion Models (L4006C, L6006B)

Models that provide for direct immersion of the sensing element into the boiler include a bulb compression fitting assembly instead of an immersion well. Install the fitting in the boiler tapping as follows:

1. Be sure the sealing washer is in place as shown in Fig. 7. Make sure that the spud of the bulb compression fitting is screwed in tightly enough to prevent leaking.

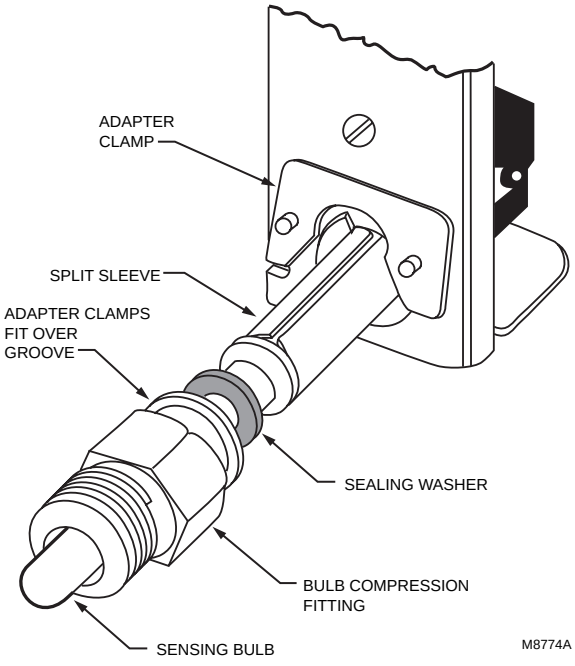


Fig. 7. Direct immersion model with fitting partially removed.

2. Insert the immersion sensing bulb through the bulb compression fitting. Adjust the adapter clamp so that the clamp fits over the groove at the opening of the bulb compression fitting.
3. Tighten the adapter clamp screws so that the Aquastat Controller is firmly attached to the bulb compression fitting.

Mounting Remote Bulb Models (L4008A,B,E; L6008A,G,H)

The remote temperature-sensing bulb can either be installed in an immersion well (See Fig. 8) that extends into the boiler or tank, or it can be directly immersed in the controlled medium (See Fig. 9). For installations that do not use a well, secure the remote bulb with a bulb compression fitting (See Fig. 10), or capillary compression fitting. (See Fig. 11).

Order well, well adapter, bulb compression fitting or capillary compression fitting separately. See form no. 68-0040, Wells and Fittings for Temperature Controllers. If used, well must snugly fit sensing bulb for the best thermal response. Insert bulb until it rests against the bottom of the well. Hold it there while tightening the tubing clamp. (See Fig. 8).

The boiler manufacturer usually provides a tapping for the insertion of the Aquastat Controller sensing element. This tapping should be located at a point where typical water temperature can be measured. Never locate the bulb or protecting immersion well close to a hot or cold water inlet or a steam coil.

If the system is filled, drain system to a point below the boiler tapping, or wherever the sensing bulb is to be installed.

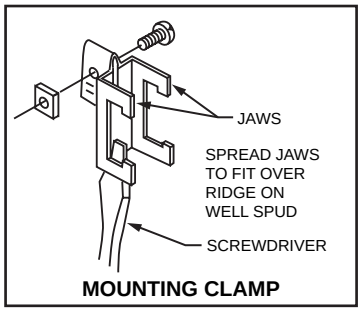
The bulb can also be installed in the supply line of an indirect water heater, in the direct water heater itself, or in the feed riser, about 6 in. (153 mm) above the boiler. If the riser is valved, the bulb can be installed between the boiler and the valve.

NOTE: Do not make sharp bends or kinks in the capillary. Make bends no sharper than 1 in. (25 mm) radius.

After installing the controller, carefully coil the excess capillary at the bottom of the controller case.

Mounting Immersion Well

1. Screw the well into the boiler, tank, or pipe tapping.
2. Insert the bulb in the well, pushing the tubing until the bulb bottoms in the well.
3. Attach the retainer clamp to the end of the well spud. Loosen the draw nut and spread the jaws of the clamp with the screwdriver if necessary. (See Fig. 8).
4. With the retainer clamp attached to the well spud (be sure the jaws of the clamp hook over the ridge at the end of the spud, as shown at points A in Fig. 8), adjust the tubing to fit through the retainer clamp groove, as shown at point B in Fig. 8.
5. Tighten the draw nut so that the retainer clamp is firmly attached to the well spud and the tubing is held securely in place.



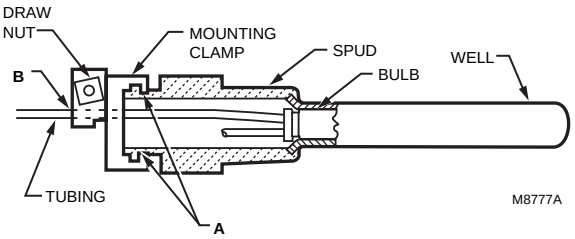


Fig. 8. Immersion well fitting.

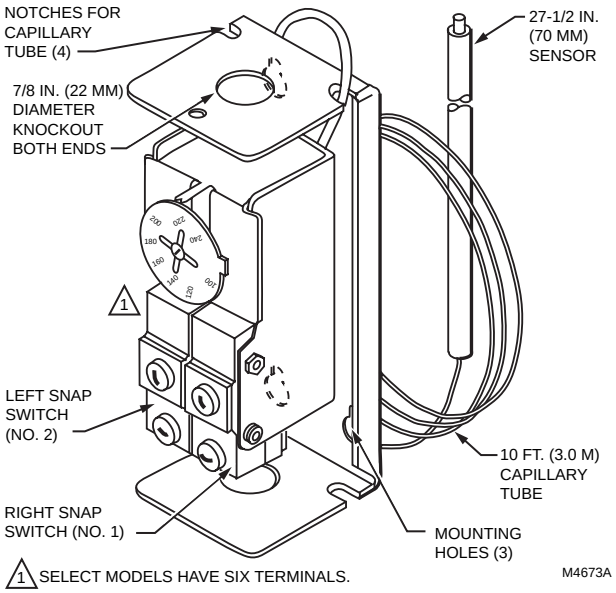


Fig. 9. Internal view of L4008L or L6008G.

Mounting With Bulb Compression Fitting

1. Screw the fitting into the boiler or pipe tapping.
2. Slide the sealing washer onto the bulb.
3. Insert the bulb into the fitting until the bulb bottoms.
4. Slide the split sleeve into the fitting. (See Fig. 10).

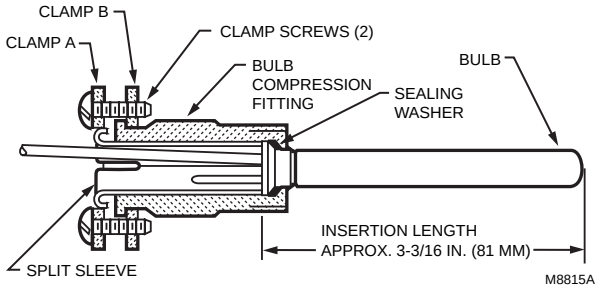


Fig. 10. Bulb compression fitting. Use with L4006A,B; L6008A.

5. Place clamps A and B on the assembly so that the sleeve is drawn into the fitting when the screws are tightened.

NOTE: Make sure that the nub on clamp A engages the space between the sleeve and the clamp.

6. Tighten the clamp screws evenly.

Mounting With Capillary Compression Fitting

1. Screw the fitting into the boiler or pipe tapping.
2. Place the packing nut on the tubing.
3. Slide the bulb completely through the fitting.
4. Place the composition disk and four slotted brass washers on the tubing in the order shown in Fig. 11. Turn the brass washers so the slots are 180 degrees apart.

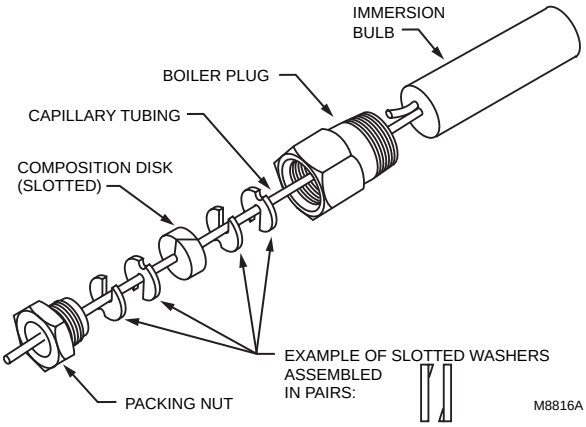


Fig. 11. Capillary compression fitting. Use with L4008.

5. Slide the seal assembly into the fitting and tighten the packing nut.

Duct Mounting

1. Drill a 3/4 in. (19 mm) hole in the duct wall large enough to admit the sensing bulb into the holder.
2. Using the holder as a template, mark and drill holes for the bulb holder mounting screws. (See Fig. 12).

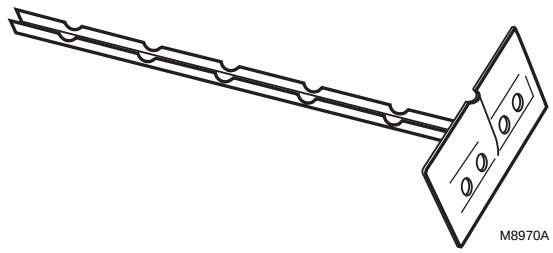


Fig. 12. Bulb support.

3. Break the holder to the desired length. (See Fig. 13).

NOTE: The holder must be long enough to hold the sensing bulb in freely circulating air away from the duct wall. Neatly coil the excess capillary at the controller case or at the bulb holder.

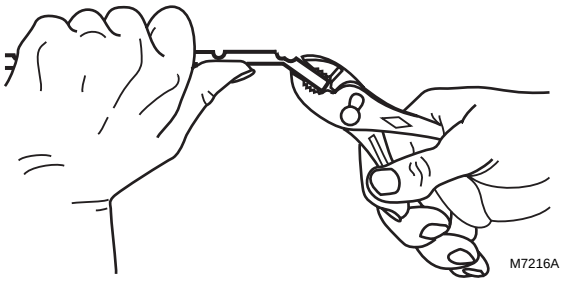


Fig. 13. Removing excess bulb support.

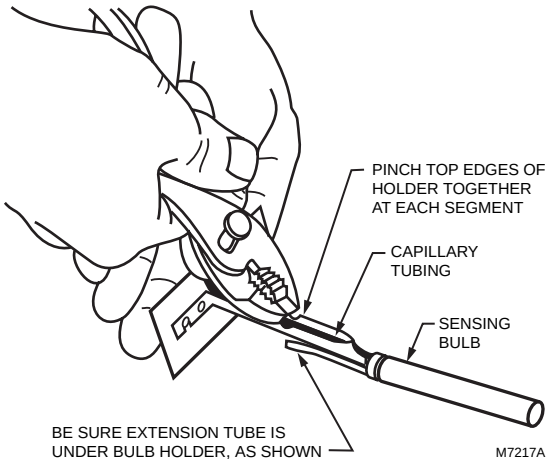


Fig. 14. Securing capillary in bulb holder.

4. Place the capillary in the bulb holder channel. Pinch the top edges of the holder together at each segment. (See Fig. 14).
5. Insert the bulb holder into the controlled area through the hole prepared in step 1.
6. Fasten the bulb holder to the duct wall with the screws provided.

Mounting Remote Bulb Models For Outdoor Air Sensing

These models have a 5 ft (1.5 m) capillary that establishes the maximum distance between the case and the outdoor mounting.

Install the bulb on the outside of the building in the shield provided (See Fig. 15) where it can be exposed to representative air temperature, but not to direct sunlight. Mount the bulb high enough so that accumulated snow, leaves, or other debris cannot obstruct circulation of air around it, and where children cannot reach it. Avoid vents from the building.

Install the case at the indoor location selected, fastening the screws through holes in the back of the case. Bring out the bulb and tubing through a 3/4 in. (19 mm) hole in the outside wall, avoiding sharp bends or kinks. Leave excess tubing coiled near the case. Do not make sharp bends near the case or bulb.

Slip the bulb through the supports in the shield. Pinch the split supporting clip until it holds the bulb firmly in position. If the seal-off tube protrudes from under the shield, bend it under as shown in Fig. 15.

Hold the shield over the mounting position and form a small-radius bend in the tubing. Place the split plug around the tubing and move the shield into the mounting location as a unit. Push the split plug into the hole until it is wedged securely in place. Fasten the shield in place on the wall with the screws provided.

NOTE: If the tubing is properly shaped and the split plug installed as directed, the shield will cover the split plug, and the hole in the wall will be hidden from sight.

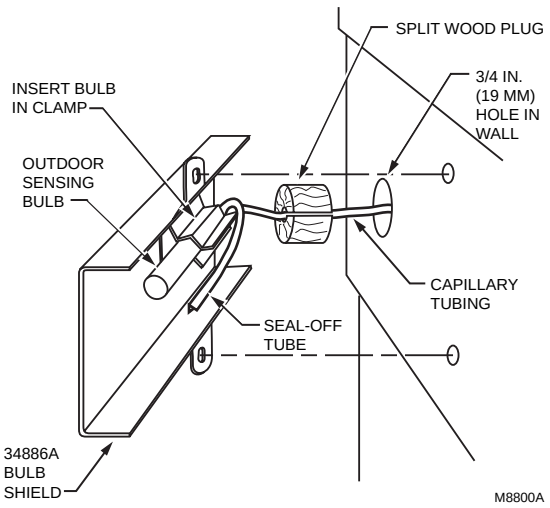


Fig. 15. Mounting bulb in shield outside building.

Mounting L6008A Remote Bulb Controller

Mounting with Guard Bracket

Mount the bulb in the guard bracket as shown in Fig. 16. Locate the bulb and bracket combination, in freely circulating air, in the controlled area. With screws provided, fasten the bracket in place.

Mounting on Suction Line

1. In cooling units with more than one suction line, place the sensing bulb on the common line.
2. Make certain the bulb is at least 2 ft (0.6 m) from the point at which the suction line leaves the cooler. This prevents the outside temperature from being transmitted to the remote bulb through the copper tubing of the suction line.
3. Place the remote sensing bulb on the side of the horizontal suction line between the coil and trap (not on the trap).
4. Attach the sensing bulb to the suction line with clips or straps. (See Fig. 17).
5. Coil the excess length of capillary tubing near the L6008A case.

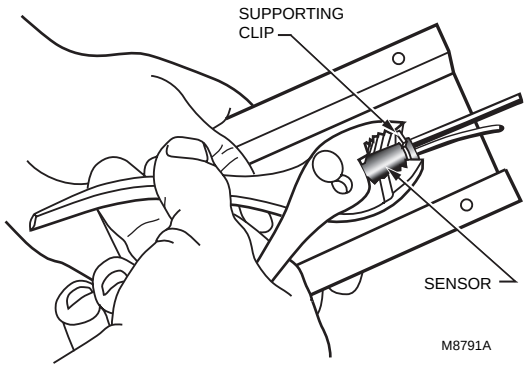


Fig. 16. Securing remote bulb in clip when mounting with guard bracket.

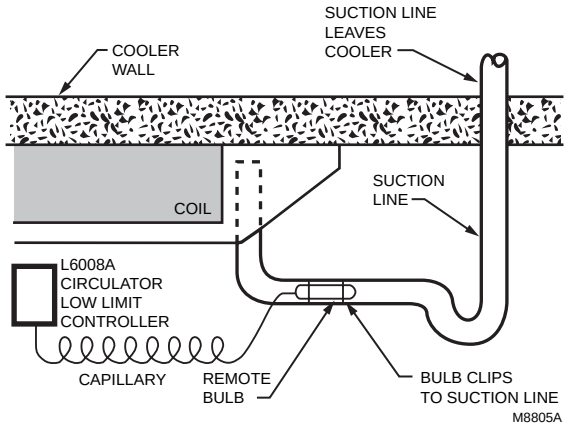


Fig. 17. Attaching remote bulb to horizontal suction line.

Mounting Surface Mount Models

The L4006H and L6006C are designed for surface mounting on piping or tanks. Mount the controller directly on the tank surface using the adjustable mounting bracket as shown in Fig. 18. The controller can be mounted in any position.

When mounting the L4006H or L6006C on piping, the pipe should be 1 in. (25 mm) diameter or larger for accurate temperature sensing. Remove any insulation from the pipe. Thoroughly scrape off all scale, rust, or paint. Mount the controller using adjustable bracket provided. Turn on power.

Wiring

Disconnect power supply before beginning installation to prevent electrical shock or equipment damage.

All wiring must comply with local codes and ordinances regarding wire size, type of insulation, enclosure, etc.

Figures 19 through 28 show typical hookups.

When wiring a switch equipped with a 1/4 in. (19 mm) tab terminal connector, use 18 AWG to 22 AWG (0.8 mm^2 to 0.3 mm^2) gauge wire with an AMP Inc. part no. 2-520129-2 fully insulated flag receptable connector or equivalent.

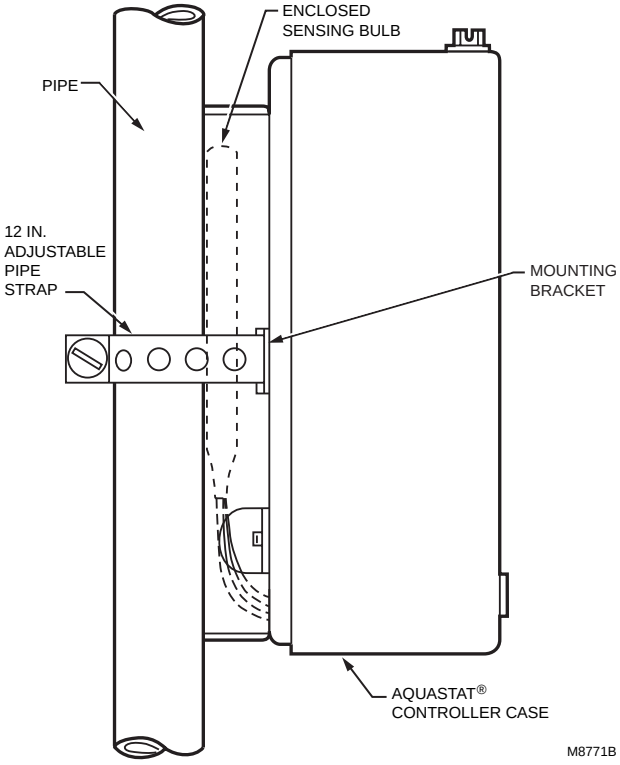


Fig. 18. Mounting L4006H or L6006C directly on surface.

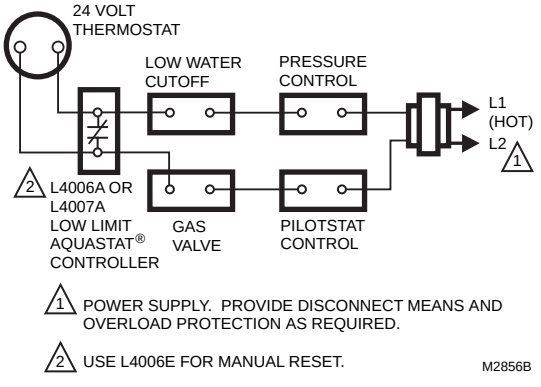


Fig. 19. Typical gas-fired system with domestic hot water.

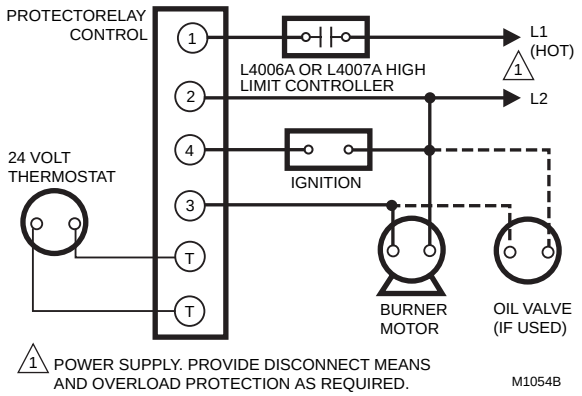


Fig. 20. Typical oil-fired gravity system.

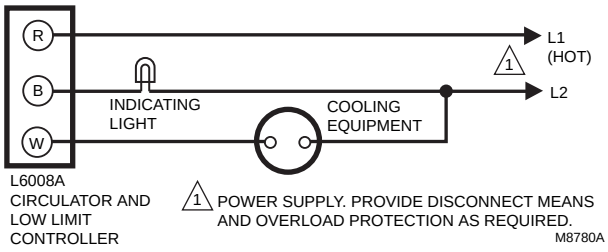


Fig. 21. L6008A used to control cooling equipment and indicating light.

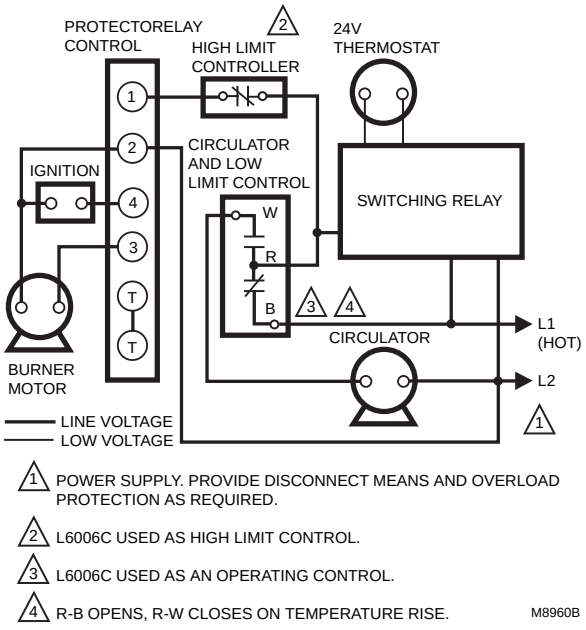


Fig. 22. Typical oil-fired hydronic system with domestic hot water.

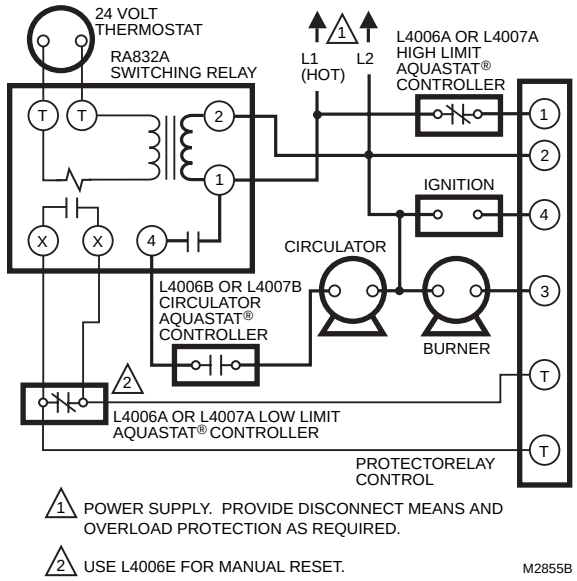


Fig. 23. Typical oil-fired hydronic heating system that provides year-round domestic hot water using RA832A.

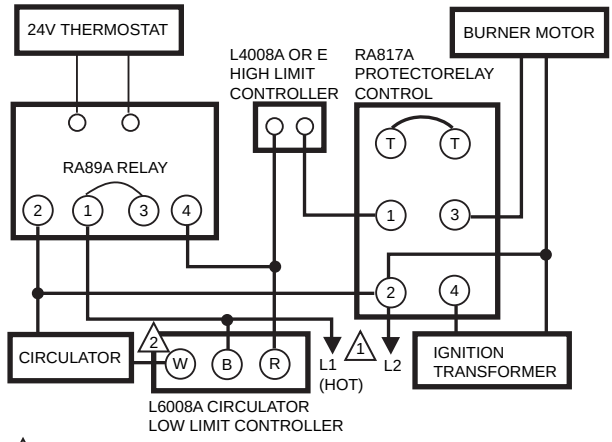


Fig. 24. Typical connection diagram for an oil-fired, hydronic heating system that provides year-round domestic hot water using RA817A.

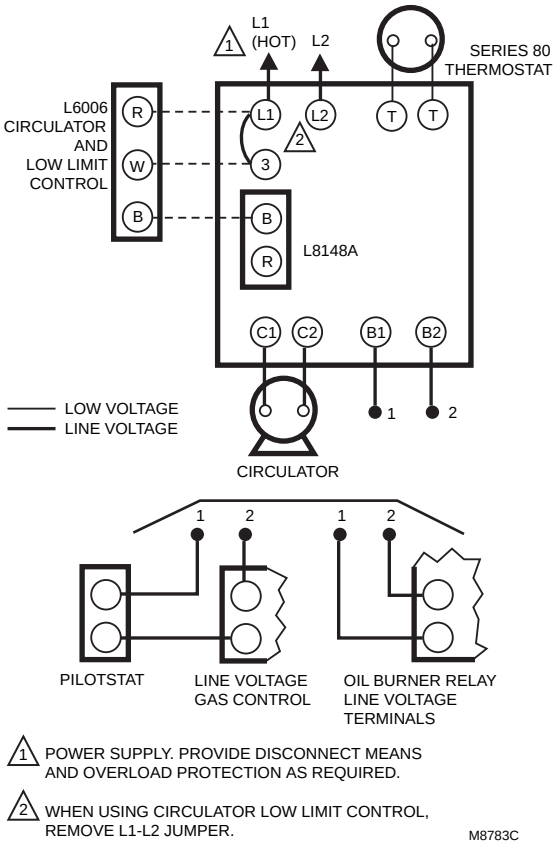


Fig. 25. Typical wiring hookup using L6006 or L6007 with L8148A.

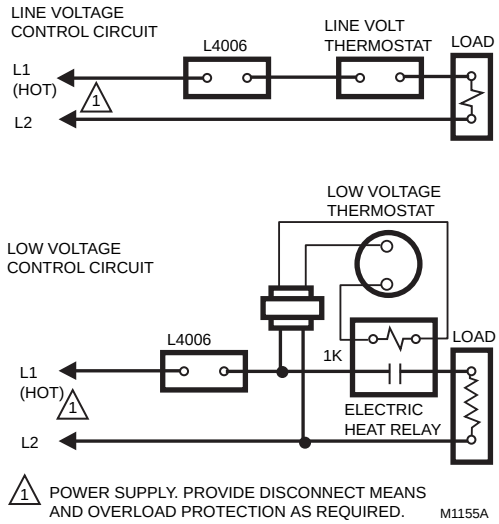


Fig. 26. Typical systems with 120 volt electric heat primaries.

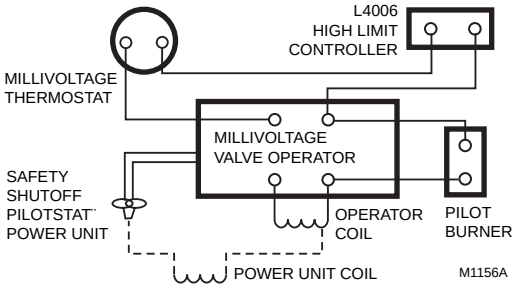


Fig. 27. Typical Powerpile System wiring diagram.

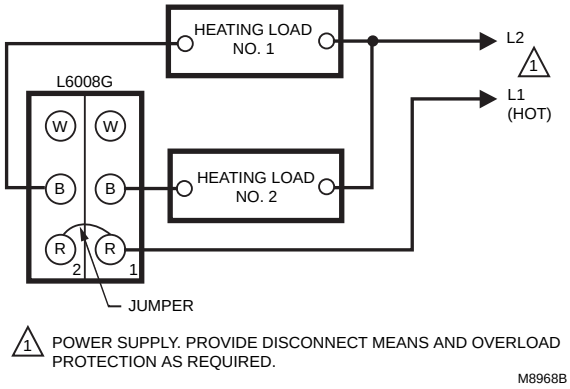


Fig. 28. Typical oil burner installation using L4008G.

OPERATION

For proper selection of settings, follow the boiler manufacturer recommendations.

High Limit Controller

R-B terminals provide high limit switching function (contacts open at set point on temperature rise). (See Figures 30 and 31). R-B terminals shut off burner if water temperature exceeds high limit setting. Burner restarts when temperature drops to high limit setting, less differential.

NOTE: On manual reset models, the reset button on the front of the case must be pushed in to allow the burner to operate after a high limit shutdown.

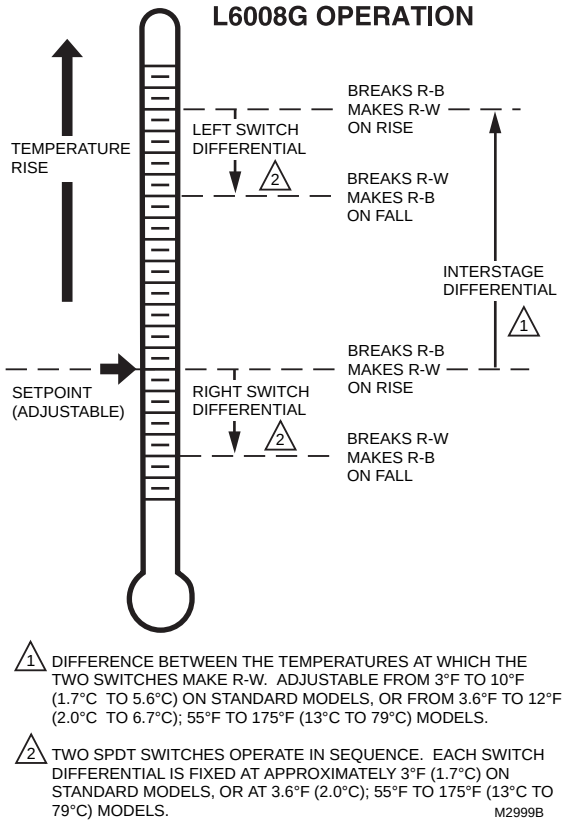


Fig. 29. Operation of L6008G.

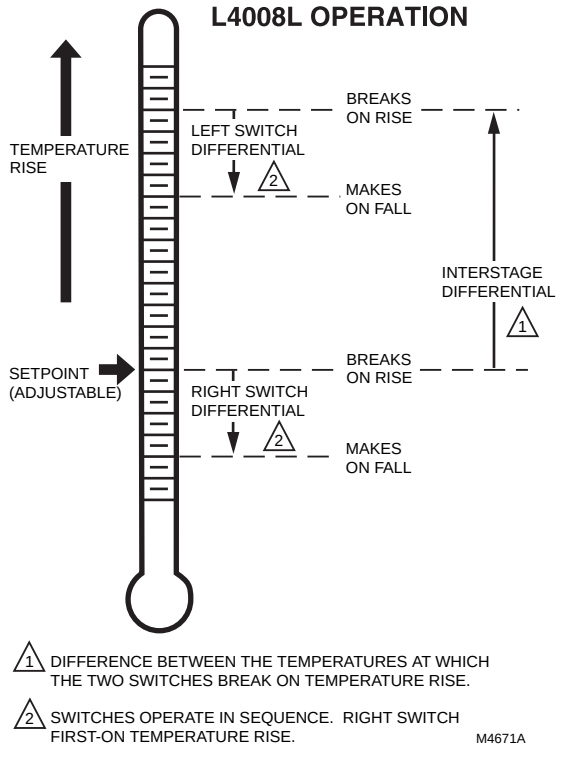


Fig. 30. Operation of L4008L.

Low Limit Controller

R-B terminals provide low limit switching function (contacts open at set point on temperature rise). Maintains minimum boiler temperature for domestic hot water. Turns on boiler at temperature setting, less differential.

Circulator Controller

R-W terminals provide circulation control function (contacts close at set point on temperature rise). Prevents circulation of water that is below the desired heating temperature. Breaks circulator circuit on temperature drop below setting less differential; remakes on rise to setting.

L6008G Adjustable Interstage Differential

When the temperature at the sensing element rises above the set point of the controller, the switch on the right makes R-W. If the temperature continues to rise through the preselected interstage differential of the controller, the switch on the left makes R-W.

Conversely, on a temperature fall, the switch on the left makes R-B, providing first step switching. If the temperature continues to fall, the switch on the right makes R-B to provide sequencing of equipment.

ADJUSTMENTS

Adjusting Differential

Set the differential to correspond with the boiler manufacturer recommendations. To adjust models with adjustable differential, rotate the wheel on the back of the snap switch, (See Fig. 32), until the desired reading is aligned with the V notch in the frame. The wheel provides an adjustment from 5° F to 30° F (3° C to 17° C). Replace the cover on the Aquastat Controller.

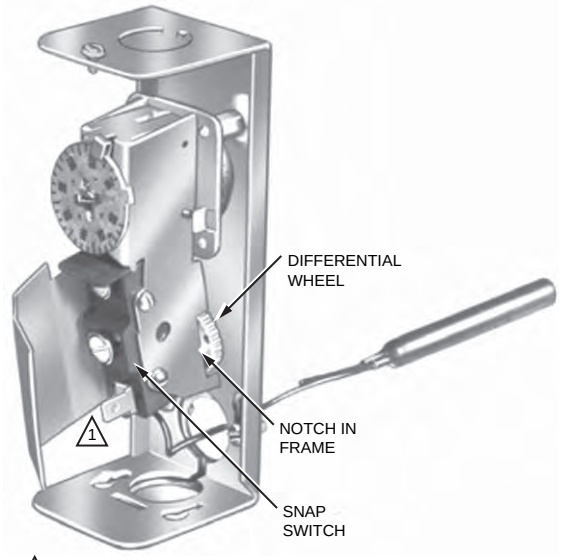


Fig. 31. Adjusting the differential.

Adjust the control point to correspond with the boiler manufacturer recommendations. To adjust, insert a screwdriver in the slotted screw type head located beneath the window in the cover. Turn the scale to the desired control point.

Adjusting L6008G Interstage Differential

The L6008G Controller has an adjustable interstage differential. The set point adjustment knob determines the temperature at which the right switch operates. The left switch can be adjusted to operate from 3° F to 10° F (1.7° C to 5.6° C) above the point of operation of the right switch. See Figure 30 for the operation of the L6008G. The interstage differential is adjusted by turning the star wheel with a narrow screwdriver inserted into the rectangular hole in the chassis. (See Fig. 32).

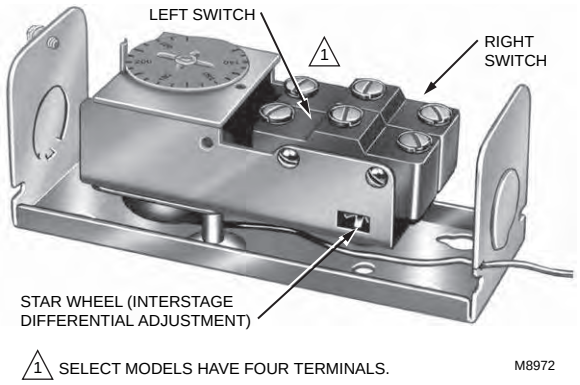


Fig. 32. Interstage differential adjustment on an L6008G.

L6008A Location Differential Calibration

The L6008A1093 is calibrated for applications where the bulb and controller case are located in the same control space.

If the bulb and controller case are located in separate rooms, and if the temperature in the two rooms is different, an adjustment is required. Adjust the dial setting (control space temperature setting) to compensate for the difference in temperature.

1. If the L6008A case is located in a room with a higher temperature than indicated on the dial setting, raise the dial setting the number of degrees listed in Table 3.
2. If the L6008A case is located in a room with a lower temperature than indicated on the dial setting, lower the dial setting the number of degrees listed in Table 3.

Table 3. Temperature Adjustments.

Difference Between Desired Room Temperature and Case Temperature		Reduce Dial Setting	
°F	°C	°F	°C
0	0	—	0
5	3	3/4	0.5
10	6	1-1/2	1
15	8	2	1
20	11	2-3/4	2
25	14	3-1/2	2
30	17	4-1/4	3
35	20	5	3
40	22	5-3/4	4
45	25	6-1/2	4
50	28	7	4
55	31	8	5
60	33	8-1/2	5
70	39	10	6
80	45	11-1/2	7

EXAMPLE:

In the example shown in Fig. 33, the L6008A case is located in a room with a lower temperature than the controlled space. Adjusting the controlled space setting (dial setting) is necessary to compensate for the temperature difference of 35° F (20° C) between the two rooms. Table 3 indicates that the dial setting should be lowered 5° F (3° C) to compensate for the 35° F (20° C) temperature difference.

Manual Reset

If the device includes manual reset (L4006E, L4008E), be sure to press the (red) reset button on the front of the case to make sure that the controller is not locked out on safety. When checking the system, adjust the limit setting low enough so the temperature of the controlled medium reaches the high limit setting. When the limit setting is reached, the Aquastat Controller locks out and the burner shuts down. When the temperature of the controlled medium drops to the high limit setting, less the differential, push the manual reset button to make the system operative again. Reset the control to the proper high limit setting.

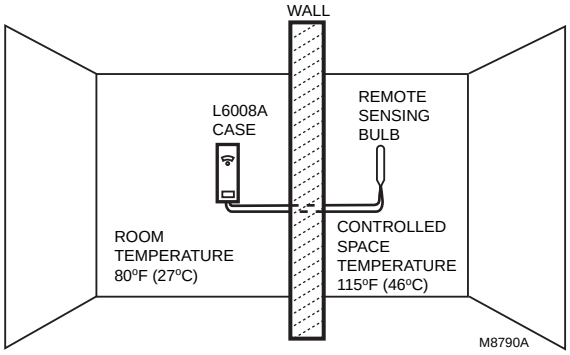


Fig. 33. L6008A calibration.

CHECKOUT

⚠ WARNING

Explosion Hazard.
Can cause serious injury, death or property damage.
This product is intended for use only in systems with a pressure relief valve.

Check to make certain that the Aquastat Controller is properly installed and adjusted. Put the system into operation and observe the action of the controller through several cycles to make certain it provides proper control of the system as described in the OPERATION section. Make any additional adjustments necessary for assuring comfort requirements.

MATERIAL SAFETY DATA SHEET

Section 1. Product And Company Identification

Product Name: Heat Conductive Compound

MSDS ID: DS9021

Synonyms: MS1699

Product Use: Heat conductive material used to enhance contact and heat transfer in temperature sensor applications.

Manufacturer: Honeywell Inc., 1985 Douglas Drive North, Minneapolis, MN 55422.

Date Released: October 8, 1999

NFPA Ratings:
Health 0; Flammability 1; Reactivity 0; Personal Protection B

Section 2. Composition, Information on Ingredients

Ingredient	CAS Number	Percent	PEL	TVL
#2 Lithium Complex Grease (70%):				
Mineral Oil	64742-65-0	35-50	5 mg/m^3	5 mg/m^3
Mineral Oil	64742-62-7	20-25	5 mg/m^3	5 mg/m^3
Lithium Hydrostearate/Sebacate Complex	68815-49-6	4-9	—	—
Zinc Alkyldithiophosphate	68649-42-3	0-2	—	—
Aluminum Paste (30%):				
Aluminum, as Al	7429-90-5	20-25	15 mg/m^3	10 mg/m^3
Aliphatic Petroleum Distillates	8052-41-3	10-15	2900 mg/m^3	525 mg/m^3
Stearic Acid	57-11-4	1-2	—	—
Aromatic Petroleum Distillates	64742-95-6	1-2	5 mg/m^3	5 mg/m^3

Additional Information: Part No. 120650 (0.5 oz tube); Part No. 107408 (4 oz can); Part No. 197007 (5 gallon container). May also contain minute amounts of lithium and molybdenum lubricant compounds.

Section 3. Hazard Identification

Acute Health Effects:

Skin: Excessive contact may cause skin irritation and dermatitis.

Eye: Direct contact with eye will cause irritation.

Inhalation: No adverse effects are expected.

Ingestion: Ingestion of product may cause nausea, vomiting and diarrhea.

Chronic Health Effects:

Existing skin rash or dermatitis may be aggravated by repeated contact.

OSHA Hazard Classifications: None.

Carcinogenicity: Not considered to be a carcinogen by either OSHA, NTP, IARC, or ACGIH.

Section 4. First Aid Measures

Eye Contact: Flush eyes with water for 15 minutes. Remove any contact lenses and continue to flush. Obtain medical attention if irritation develops and persists.

Skin Contact: Remove excess with cloth or paper. Wash thoroughly with mild soap and water. Obtain medical attention if irritation develops and persists.

Ingestion: Contact physician or local poison control center *immediately*.

Inhalation: Remove patient to fresh air and obtain medical attention if symptoms develop.

Section 5. Fire Fighting Measures

Material Flash Point: > 383° F (195° C). Will burn if exposed to flame.

Extinguishing Media: Carbon dioxide, dry chemical or foam.

Special Fire Fighting Procedures: None.

Explosion Hazards: None. Aluminum powder can react with water to release flammable hydrogen gas. In this form of the product, this reaction is not expected.

Section 6. Accidental Release Measures

Scrape up and dispose of as solid waste in accordance with state and federal regulations.

Section 7. Handling and Storage

Store in dry place. Keep container closed when not in use.

Section 8. Exposure Controls and Personal Protection.

Ventilation: No special ventilation is required when working with this product.

Respiratory Protection: None required.

Eye Protection: Not normally required. However, use chemical safety goggles or faceshield if potential for eye contact exists, especially if material is heated.

Hand/Clothing Protection: Not normally required. Protective gloves and clothing are recommended, as material is difficult to remove from skin and clothing.

Other Protective Equipment: None required.

Section 9. Physical and Chemical Properties

Appearance/Odor: Aluminum color, semi-solid material, pleasant odor.

Solubility in Water: Negligible.

Specific Gravity: 0.86.

Section 10. Stability and Reactivity

Stability: Stable.

Reactivity: Hazardous polymerization will not occur.

Incompatibilities: Strong oxidizing agents and halogens.

Hazardous Decomposition Products: Carbon dioxide, carbon monoxide.

Section 11. Toxicology Information.

No data available.

Section 12. Ecological Information

Chemical Fate Information: Hydrocarbon components will biodegrade in soil; relatively persistent in water.

Section 13. Disposal Consideration

Dispose of as solid waste in accordance with local, state and federal regulations.

Section 14. Transportation Information

DOT Classification: Not classified as hazardous.

Section 15. Regulatory Information

SARA Title III Supplier Notification: Include in Section 311/312 inventory reports if amounts exceed 10,000 pounds. Aluminum compounds are subject to the reporting requirements under Section 313 of Emergency Planning and Community Right-To-Know Act of 1986 (40 CFR 372). Ingredients listed in TSCA Inventory.

Section 16. Other Information

This information is furnished without warranty, expressed or implied, except that it is accurate to the best of our knowledge.

Automation and Control Solutions

Honeywell International Inc.
1985 Douglas Drive North
Golden Valley, MN 55422
customer.honeywell.com

Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
Toronto, Ontario M1V 4Z9

Honeywell

60-2104—10 J.I. Rev. 12-06

Australian Gas Association Approved:
Several V5055 / V5097B models.
DIN-DVGW Approved (Germany):
Several V5055/V5097A and V5055/V5097B models.

V4055, V4062 AND V9055 FLUID POWER GAS VALVE ACTUATORS

Voltage And Frequency: 120v, 60 Hz Standard; separate models available for operation at voltages ranging from 100V to 240V, 50/60 Hz.

Auxiliary Switch And Proof-of-closure Switch Ratings:
1/2 hp[a].

Table 3. Load

LOAD	120V	240V
Full Load	9.8A	4.9A
Locked Rotor	58.8A	29.4A

[a] Maximum total connected power to both switches (if used) is 1800 VA.

Nominal Opening Time:
Standard models: 26 sec at 60 Hz; 32 sec at 50 Hz.
Fast-opening models: 13 sec at 60 Hz; 16 sec at 50 Hz.

Closing Time:
One second maximum
Low-fire Adjustment (with respect to V5055 / V5097B Valve):
V4062: 0.17 to 0.64 in. valve stem travel (approximately 20 to 60 percent maximum gas flow).
V9055: 0.14 to 0.65 in. valve stem travel (approximately 5 to 60 percent depending upon valve size).
Refer to form 70-8311 for valve flow (capacity) curves.

Damper Shaft (optional):
3/8 in. (9.5 mm); available with or without spring return.

Maximum Damper Shaft Rotation:
52 angular degrees.

Ambient Operating Temperature Rating:
V4055 and V4062 models: -40° F to 150° F (-40° C to 66° C) 60 Hz models; -10° F to 158° F (-23° C to 70° C) for 50 Hz and 50/60 Hz models.
V9055 models: -40° F to 125° F (-40° C to 52° C) for 60 Hz models; -10° F to 125° F (-23° C to 52° C) for 50 Hz and 50/60 Hz models.

Mounting:
Directly to valve bonnet with two setscrews, positioned 90 angular degrees apart; can be mounted in any position (multipolse).

NEMA 4 Enclosure:
Weatherproof model available.

V5055 / V5097 INDUSTRIAL GAS VALVES

Pipe Size:
3/4, 1, 1-1/4, 1-1/2, 2, 2-1/2, 3, and 4 in. (only V5055A,B,C are available in 4-inch size).

Valve Capacities:
Based on gas with heat content of 1000 Btu/cu ft (37.3 MJ/cu m) and specific gravity of 0.64.
See Fig 2)

Pipe Threads:
National Pipe Threads (NPT) or parallel British Standard Pipe Threads (BSP): Equivalent to ISO R7 and DIN 2999. Available on inlet and outlet of 3/4- to 3-inch valves; 4-inch valves have flange connections.

Upstream Tapping And Plug:
1/4" NPT (1/4" BSP on BSP models).

Downstream Tapping And Plug:
1/4" NPT (None on BSP models).

Ambient Operating Temperature Rating:
-40° F to 150° F (-40° C to 66° C); (to 125° F (52° C) when used with a V9055).

Material:
Die-cast aluminum.

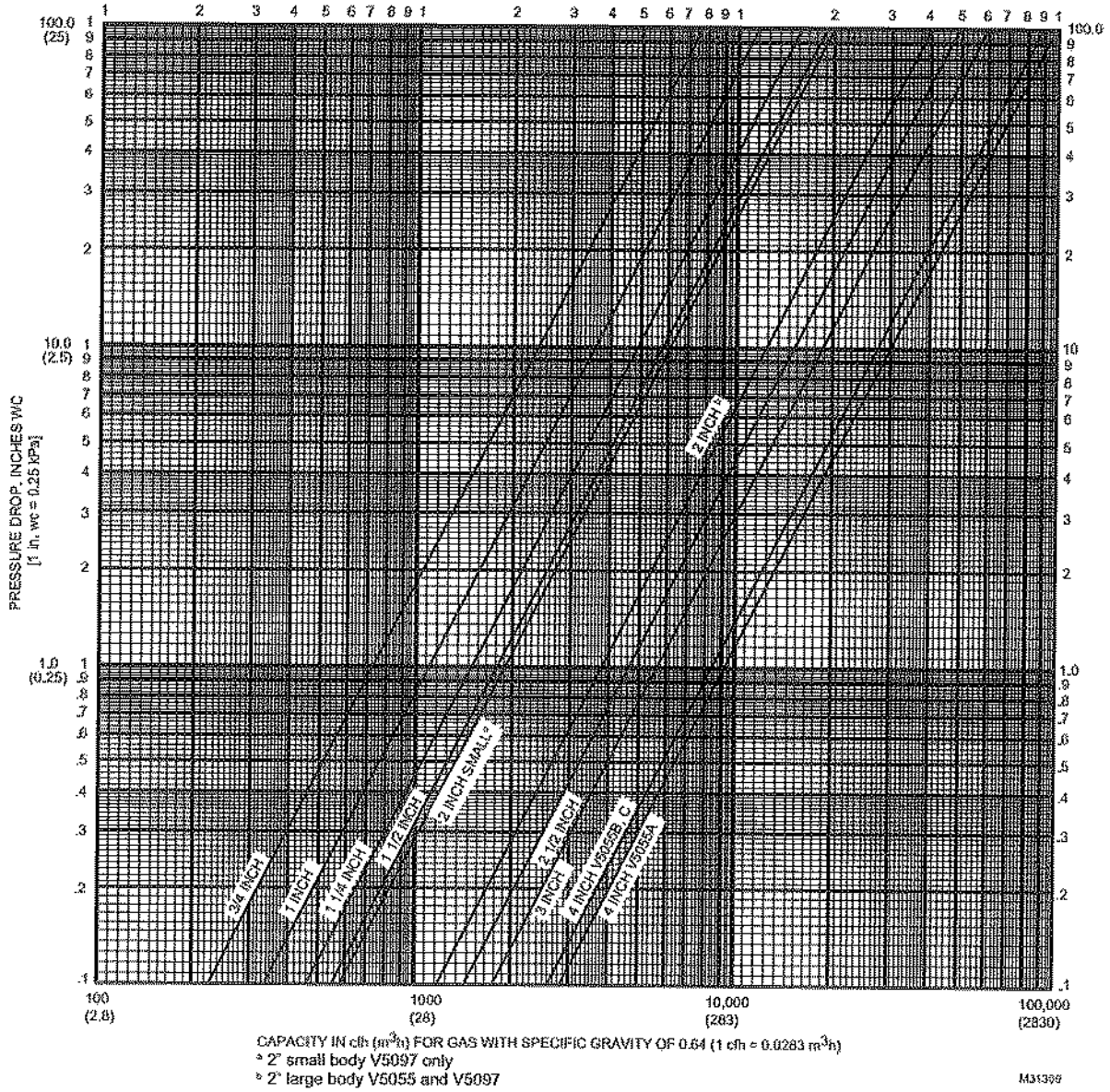


Fig. 2. Flow Curves for V5055 and V5097 Valves

Automation and Control Solutions
Honeywell International Inc.
1985 Douglas Drive North
Golden Valley, MN 55422

Honeywell Limited-Honeywell Limitée
35 Dynamic Drive
Toronto, Ontario M1V 4Z9
customer.honeywell.com

Honeywell

70-8509—01 E.K. Rev. 02-10
Printed in U.S.A.

ITT

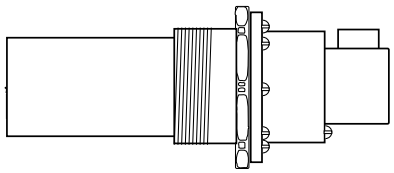
McDonnell & Miller

Installation & Maintenance Instructions
MM-226(A)

Series 69
Low Water Cut-Offs For Steam Boilers

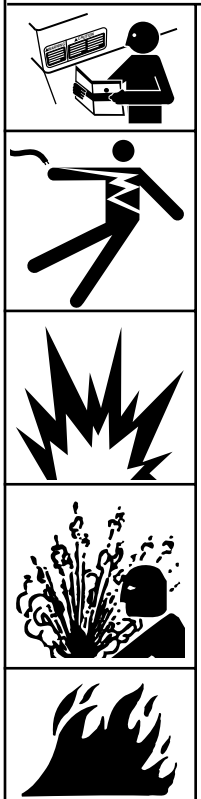
Applications:

For residential and commercial boilers of any steaming capacity.



Series 69

⚠ WARNING



- **Before using this product read and understand instructions.**
- **Save these instructions for future reference.**
- **All work must be performed by qualified personnel trained in the proper application, installation, and maintenance of plumbing, steam, and electrical equipment and/or systems in accordance with all applicable codes and ordinances.**
- **To prevent serious burns, the boiler must be cooled to 80˚F (27˚C) and the pressure must be 0 psi (0 bar) before servicing.**
- **To prevent electrical shock, turn off the electrical power before making electrical connections.**
- **This low water cut-off must be installed in series with all other limit and operating controls installed on the boiler. After installation, check for proper operation of all of the limit and operating controls, before leaving the site.**
- **We recommend that secondary (redundant) Low Water Cut-Off controls be installed on all steam boilers with heat input greater than 400,000 BTU/hour or operating above 15 psi of steam pressure. At least two controls should be connected in series with the burner control circuit to provide safety redundancy protection should the boiler experience a low-water condition. Moreover, at each annual outage, the low water cutoffs should be dismantled, inspected, cleaned, and checked for proper calibration and performance.**
- **To prevent serious personal injury from steam blow down, connect a drain pipe to the control opening to avoid exposure to steam discharge.**
- **To prevent a fire, do not use this low water cut-off to switch currents over 7.2A, 1/3 Hp at 120 VAC or 3.6A, 1/3 Hp at 240 VAC, unless a starter or relay is used in conjunction with it.**

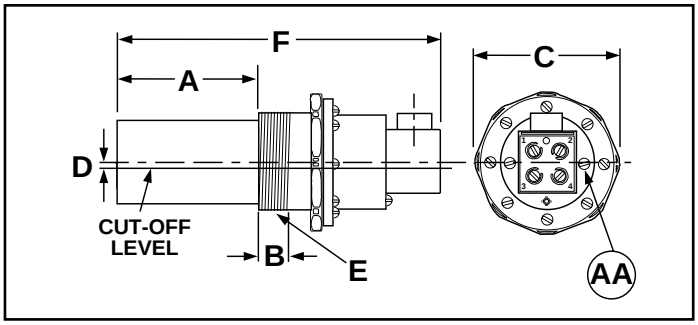
Failure to follow this warning could cause property damage, personal injury or death.

Engineered for life

OPERATION

Maximum Steam Pressure: 20 psi (1.4 kg/cm^2)

The 69 Series Built-in Low Water Cut-Off is furnished with a threaded barrel casting which fits right into a 2 1/2" tapping provided by some boiler manufacturers in the side of the boiler. Selection of the particular model depends upon the insertion length into the boiler (see chart). Order the built-in which provides maximum insertion within the boiler.



Electrical Ratings

Voltage	Motor Switch Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.2	43.2	125 VA at 120 or 240 VAC
240 VAC	3.6	21.6	

NOTE: MV models are rated at 24 VA @ 24 VAC to 120 VAC

Dimensions, in. (mm)

A		B	C	D	E	F
Model	Insertion Length				NPT	
69	4⅛ (105)	1 (25)	4⅛ (105)	⅛ (3)	2½	9½ (241)
169	3⅛ (79)					
269	2¼ (57)					
369	1¾ (45)					
469, 569	1 3/16 (30)					

Based on desired usage, connect wires from low water cut-off to appropriate control/alarm.

Diagram 1

SCHEMATIC OF TWIN SWITCH INTERNAL OPERATION

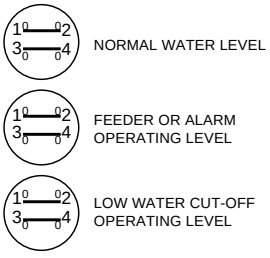


Diagram 2

USED AS MAIN LINE SWITCH

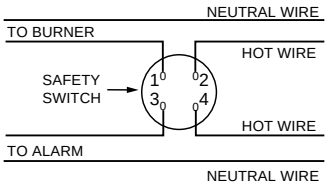


Diagram 3

USED AS PILOT SWITCH IN SERIES WITH HOLDING COIL OF AUTOMATIC STARTER

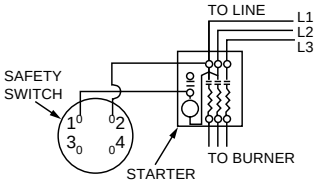
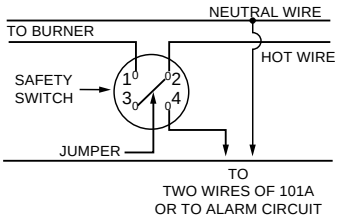


Diagram 4

USED WITH MODEL 101 ELECTRIC WATER VALVE OR IN ALARM CIRCUIT



IMPORTANT: Low water cut-off circuit of the 69 series must be electrically wired in series with all other boiler limit operating controls.

INSTALLATION –

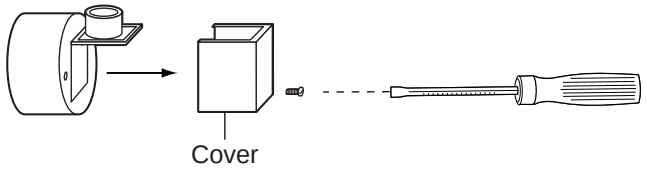
TOOLS NEEDED:
One (1) flathead screwdriver, one (1) level indicator and one (1) pipe wrench.

IMPORTANT: Follow the boiler manufacturer's instructions along with all applicable codes and ordinances for piping, blow down valve and water gauge glass requirements.

The center line on the casting of the Series 69 must be installed above the lowest permissible water level determined by the boiler manufacturer.

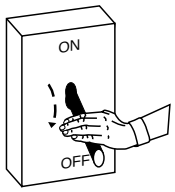
Whether the gauge glass is mounted directly into the boiler or on an independent water column, the cut-off line on the 69 control should be mounted 1/2” (15mm) above the lowest visible point of the gauge glass.

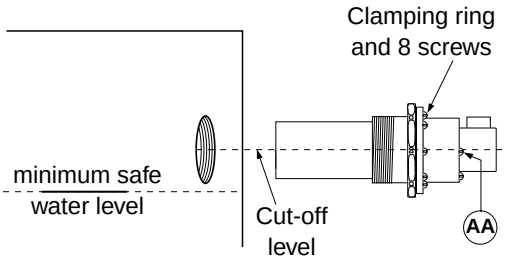
Using a flathead screwdriver, remove the one (1) screw that secures the switch cover.



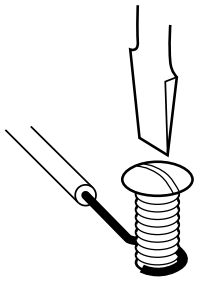
Installation of the Low Water Cut-Off

- Turn the boiler off.
- Drain the water in the boiler to a level which is below the tapping on the boiler. Allow the boiler to cool to 80˚F (27˚C) and allow the pressure to release to 0 psi (0 bar).
- Determine where to install the control. The low water cut-off must be positioned at or above the boiler manufacturer’s minimum safe water level.
- Separate the mounting barrel from the control slightly by loosening the eight (8) slotted screws on the clamping ring. This allows the barrel to be turned into the tapping in the boiler without rotating the whole control. (The barrel may also be completely removed to install easily).
- Apply a small amount of pipe dope or thread sealant to the 2 1/2 NPT and hand screw the barrel into the boiler without rotating the rest of the control. Tighten the barrel securely using a pipe wrench to about 150 ft-lbs. (200 N•m) torque.
- Rotate the control in the barrel to the finished position using a level to set the two (2) conduit housing screws (AA) in a horizontal position. Complete the installation by securing the control onto the barrel by tightening the eight (8) clamping ring screws to 5 ft-lbs (7 N•m) torque. "TOP" on the switch terminal panel MUST be in the up position.





NOTE: To connect wires to the terminals on the water feeder, burner, or low water cut-off, place the bare end of the wire under the terminal screw and tighten the screw with a flathead screwdriver.



Wiring Instructions

⚠ WARNING

- **To prevent electrical shock, turn off the electrical power before making electrical connections.**
- **This low water cut-off must be installed in series with all other limit and operating controls installed on the boiler. After installation, check for proper operation of all of the limit and operating controls before leaving the site.**

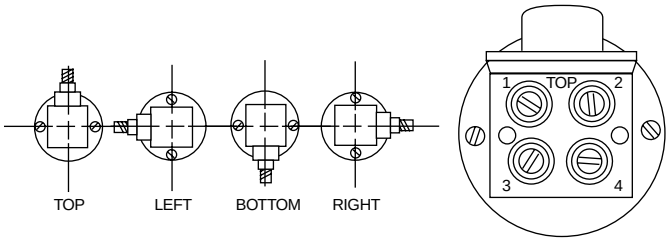
Failure to follow this warning could cause electrical shock, an explosion and/or a fire, which could result in property damage, personal injury or death.

Electrical connector is movable into any one of four positions illustrated, by simply removing two black headed screws and rotating housing.

NOTE: This control should be wired with materials suitable for use at 75˚C.

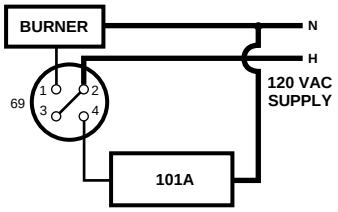
Switch Operation

The No. 11 switch can be identified by a black terminal panel. The switch contains two (2) single pole single throw switches to control the water feeder and the low water cut-off. The low water cut-off switch is between terminals marked “1” and “2”. A second switch is located between terminals marked “3” and “4”. This can be used to operate a low water alarm or a McDonnell & Miller electric water feeder.



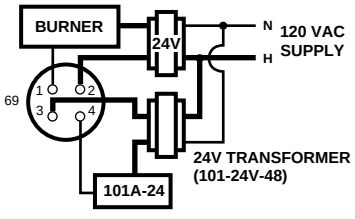
Wiring Diagrams:
Series 69 Low Water Cutoff with M&M Model 101-A Electronic Water Feeders
120V Burner and 120V Feeder

Using a wire nut, connect a wire from the neutral side of the power supply to one of the wires inside the feeder's junction box. (Does not make a difference which one). Connect a wire from the "hot" side of the power supply to terminal 2 of the Series 69 junction box. Connect the neutral side of the power supply to the burner.
Connect the wire from the burner to terminal 1 of the low water cut-off.
Connect a "jumper" from terminal 2 to terminal 3 of the low water cut-off.
Connect a wire from terminal 4 of the low water cut-off to the remaining wire in the 101-A water feeder.



24V Burner and 24V Feeder

Connect the "hot" wire from the boiler transformer to terminal 2 of the low water cut-off. Connect the "hot" side of the water feeder transformer to terminal 3 of the low water cut-off. Connect the neutral side of the boiler transformer to the burner. Using a wire nut, connect the neutral side of the water feeder transformer to the water feeder.
Connect the wire from the burner to terminal 1 of the low water cut-off.
Connect a wire from terminal 4 of the low water cut-off to the remaining wire in the water feeder.

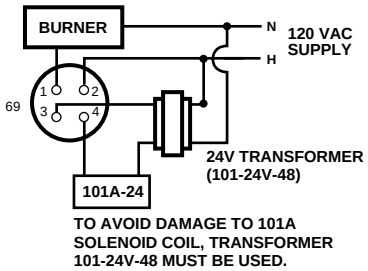


⚠ IMPORTANT

To prevent damage to the water feeder, a McDonnell & Miller transformer Model 101-24V-48 must be used.

Wiring Alternatives - Controls of Different Voltages

For 120V Burner/24V Feeder setups

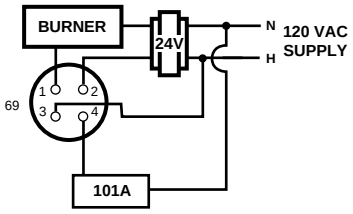


TO AVOID DAMAGE TO 101A SOLENOID COIL, TRANSFORMER 101-24V-48 MUST BE USED.

IMPORTANT

To prevent damage to the water feeder, a McDonnell & Miller transformer Model 101-24V-48 must be used.

For 24V Burner/120V Feeder setups



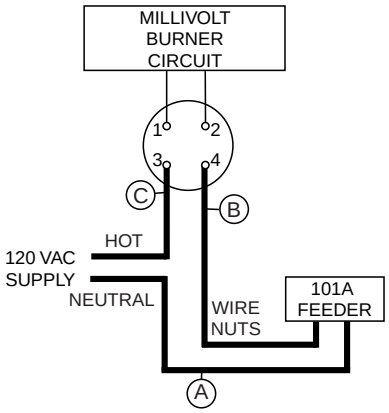
Models 69-MV-P and 369-MV Millivolt Burner Circuit Controls with Water Feeder Millivolt Burner Control and Model 101-A 120V Water Feeder

Wire only terminals 1 and 2 into the millivolt circuit. Do not attach any other wiring to terminals 1 and 2.

Install wire (A) from water feeder to 120 volt Neutral wire.

Install wire (B) from water feeder to terminal 4 of the low water cut-off.

Install wire (C) from terminal 3 of the low water cut-off to 120 volt Hot wire.



Millivolt Burner Control and Model 101-A 24V Water Feeder

Wire only terminals 1 and 2 into the millivolt circuit. Do not attach any other wiring to terminals 1 and 2.

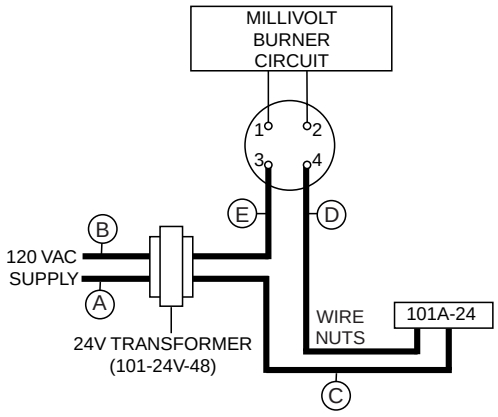
Install wire (A) from 120 volt circuit Neutral wire to the transformer input Neutral terminal.

Install wire (B) from burner circuit Hot wire to the transformer input Hot terminal.

Install wire (C) from transformer output Neutral terminal to the water feeder.

Install wire (D) from the water feeder to terminal 4 on the low water cut-off.

Install wire (E) from terminal 3 on the low water cut-off to the transformer output Hot terminal.



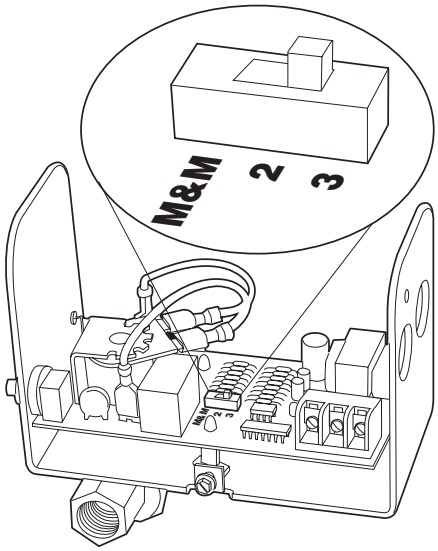
IMPORTANT

To prevent damage to the water feeder, a McDonnell & Miller transformer Model 101-24V-48 must be used.

Wiring Diagrams (continued):
Series 69 Low Water Cut-off with M&M Model WF-2-U Electronic Water Feeders

The Uni-Match® water feeders have a three-position slide switch which initiates a dwell period specific to the position of the switch. If the system condensate raises the boiler water level above the cut-off level during the dwell period, no additional water will be added to the boiler. Once the dwell period has passed, the feeder will be activated and water will be added to the boiler. The feeder will be deactivated when the LWCO reactivates the burner circuit.

The position of the slide switch also sets the length of the dwell period, the length of time valve is open and the number of dwell/feed cycles. The control is set with the slide switch in **position 3** and can be changed in the field after installation. The chart on the right indicates the cycles and length of dwell/feed cycles for each position.

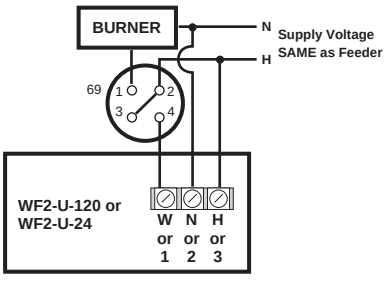


Switch Position	Initial Dwell	Initial Feed	Dwell/Feed Cycles
M&M	60 seconds	60 seconds	Repeats until LWCO reactivates the burner circuit
2	90 seconds	90 seconds	One
3	100 seconds	100 seconds	One

Connect a wire from the "Hot" side of the power supply to the water feeder terminal 3, and low water cut-off terminal 2. Connect a wire from the neutral side of the power supply to the water feeder terminal 2, and to the neutral side of the burner.

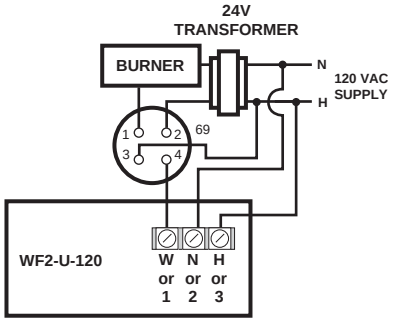
Connect the wire from the burner to terminal 1 of the low water cut-off. Connect a jumper from terminal 2 to terminal 3 of the low water cut-off. Connect a wire from terminal 4 of the low water cut-off to terminal 1 of the water feeder.

120V Burner/120V Feeder
or
24V Burner/24V Feeder

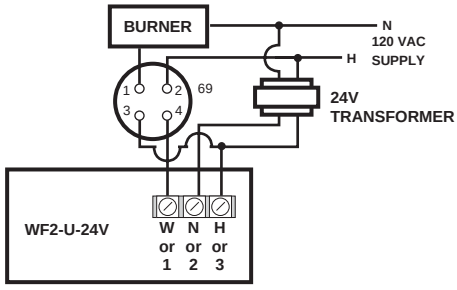


WIRING ALTERNATIVES WHEN USING MIXED VOLTAGES

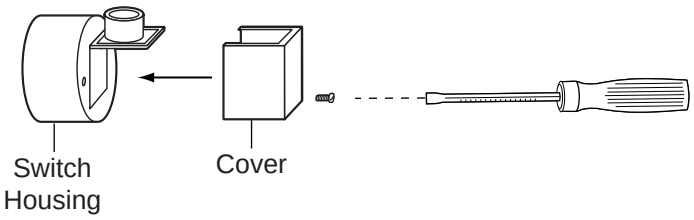
24V Burner/120V Feeder



120V Burner/24V Feeder



Replace the cover on the switch housing and, using a flathead screwdriver, tighten the one (1) screw to approximately 2 ft•lb (2.6 N•m).



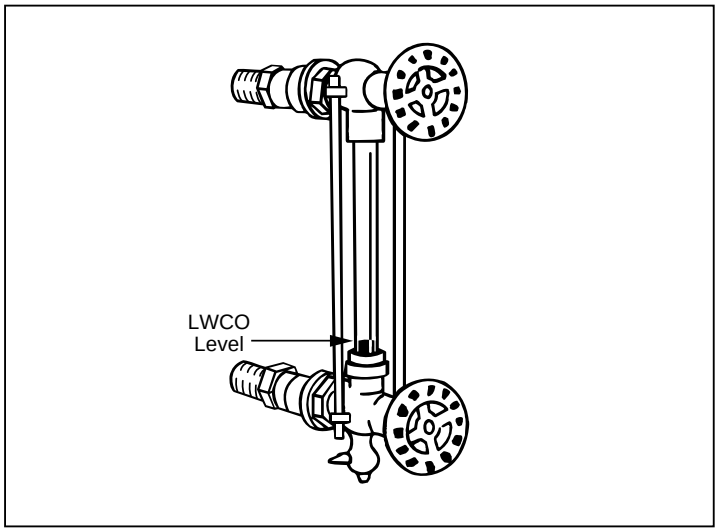
INSTALLATION COMPLETE

TESTING

- Manually fill boiler until water level in the sight glass is above the control.
- Turn on the power to the boiler and water feeder. Activate the burner by raising the thermostat set point.
- Using the sight glass as a reference, slowly drain water from boiler by opening the blow down valve or the boiler drain until the low water cut-off activates the water feeder.

  IMPORTANT: If the water feeder does not activate before the water level reaches the bottom of the sight glass, immediately close any open drain or blow down valve and check controls and piping for proper installation. Correct any problems.
- Continue to drain the boiler slowly. If the burner does not turn off before the water level reaches the bottom of the sight glass, immediately close any open drain or blow down valve. Check control for proper installation. Correct any problems.
- Once the burner turns off on low water, close all boiler drains or blow down valves.
- Using the sight glass as a reference, see that the water feeder activates and fills to approximately 1/2” to 1” (13 - 25mm) above the burner cut-off level of the low water cut-off.

  IMPORTANT: If the water feeder does not turn off once the water level has surpassed the halfway point of the sight glass, immediately turn off the power to the boiler and water feeder and check control for proper installation. Correct any problems.
- Repeat test 2 or 3 times. Restore boiler and controls to normal settings.



TROUBLESHOOTING

Problem:

1. Burner does not shut off on low water.

a. **Cause:** Float shield is loaded with mud or sediment. Shield may be out of position or damaged; bellows folds obstructed.

Test: With water level below the control check if terminals 1 and 2 are open. If not, remove switch and manually test if terminals 1 and 2 can be opened.

Solution: Remove the control and clean. At this time, check for a build-up of scale or sediment between corrugations of the bellows.

b. **Cause:** Contacts are fused together.

Test: Remove switch and operate manually to verify proper switch operation.

Solution: Replace switch. Check electrical load and make sure it is within the ratings of the switch.

2. Electric water feeder does not shut off.

a. **Cause:** Float obstructed or damaged. Build-up of scale or sediment between corrugations of the bellows. Shield may be out of position.

Test: With water level above the control, check if terminals 3 and 4 are open. If not, remove switch and manually test to verify terminals 3 and 4 can be opened.

Solution: Check the clearance of the shield; replace or clean the bellows.

b. **Cause:** Contacts are fused together.

Test: Remove switch and operate manually to verify proper switch operation.

Solution: Replace switch. Check electrical load and make sure it is within the ratings of the switch.

MAINTENANCE

SCHEDULE:

- **Blow down weekly (at least once) when the boiler is in operation.**
- **Disassemble and inspect annually. Replace the low water cut-off if it is worn, corroded, or if components no longer operate properly.**
- **Inspect the shield, float and bellows annually. Remove all sediment and debris.**
- **We recommend replacement when the switch no longer operates properly.**
  If you choose to replace the switch, order the McDonnell & Miller replacement switch and follow the Repair Procedure provided.
- **Replace the low water cut-off every 10 years.**
  More frequent replacement may be required when severe conditions exist such as rapid switch cycling, surging water levels, and use of water treatment chemicals.

PROCEDURE:

⚠ CAUTION

To prevent serious personal injury from steam pipe blow down, connect a drain pipe to avoid exposure to steam discharge.

Failure to follow this caution could cause personal injury.

Test the low water cut-off when the water level is at its normal level and the burner is on. **Slowly** open the boiler drain valve and observe the water level fall in the gauge glass. Close the valve after verifying that the alarm/feeder contacts have closed and the burner shuts off. If this does not happen, immediately shut off the boiler and correct the problem.

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