

J - M A T E O P E R A T I N G M A N U A L

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CAUTION!

Combustion materials such as oily sludge, paper waste, rags, etc., must not be placed in the J-Mate due to the threat of fire in the machine.

Do not place any foreign objects (anything other than metal hydroxide sludge) larger than 1/8 inches in diameter in the J-Mate. J-Mate must be installed in a fully enclosed area and at an ambient temperature range of 55 deg. F to 120 Deg. F for storage or operation.

Testing performed by JWI has indicated that thermal de-watering equipment used to dry trivalent chrome-bearing sludge at elevated temperatures can create a leachable hexavalent chrome compound. Hexavalent chrome compounds may need to be further stabilized before BDAT standards are met.

WARNING! USER/OPERATOR SHOULD WEAR AN APPROVED RESPIRATOR CERTIFIED BY NIOSHA, MIOSHA.

J - M A T E S A F E T Y

READ AND UNDERSTAND THIS SECTION BEFORE ATTEMPTING ANY OPERATION OF THE J-MATE!

After reading, if you have any questions regarding the safe operation of the J-Mate, contact JWI before attempting any operation.

The J-Mate has been designed specifically to dry non-combustible metal hydroxide sludges from metal finishing operations. A properly-operated wastewater treatment system in a metal finishing plant should produce only non-combustible metal hydroxide sludge.

The J-Mate uses electrical or gas infrared energy which dries and reduces the volume of the sludge.

The following Safety measures have been designed into the J-Mate. Unit functions are electrically interlocked so that the specified sequence of operation must be followed. A safely-located control console and provisions for venting released moisture and capturing any dust allow for safe operation of the machine. It is critical that no modifications be made to the unit to bypass any of the safety design features.

The following guidelines should be adhered to at all times:

1. Never load flammable materials into the J-Mate; fire can result.
2. Stand clear of the dumping assembly when in operation.
3. Disconnect power at the main disconnect before doing any maintenance on the unit.
4. Do not attempt any maintenance on the heater elements or gas burner unless they are at room temperature and power is disconnected at the main disconnect.
5. Do not place hands or feet in the extruder or conveyor unless power is disconnected at the main disconnect.
6. Do not open the power control cabinet unless power is disconnected at the main disconnect.
7. Do not operate the unit without properly venting wet scrubber exhaust and gas heater vent lines.

8. Do not attempt any maintenance on drive components while unit is in operation. (See Maintenance Section for lubrication.)
9. Assure that all operators are properly trained in use of the unit.
10. Do not open main disconnect to shut down system, except in an emergency.
11. Do NOT use alternate sources of gas fuel for this unit - use only Natural Gas for the "G" models & propane gas for the "P" models. If there is any doubt as to your gas fuel call the factory for assistance.
12. Assure that all operators wear respirators approved by NIOSHA, MIOSHA.

IF YOU HAVE ANY QUESTIONS REGARDING SAFE OPERATION OF THE J-MATE, CONTACT JWI, INC.

J - M A T E I N S T A L L A T I O N

Receipt of Unit:

Upon receipt of the machine, make a thorough inspection for any possible damage which might have occurred in transit. If there is any evidence of such damage, do not remove the machine from the carrier, but proceed as follows:

1. Notify the transportation company and file claim with them before accepting the machine.
2. Write on the Bill of Lading "Received in damaged condition". You and the driver should sign the Bill of Lading before unloading. By following this procedure, you will protect yourself against paying for damage incurred by the cargo carrier.
3. A packing list is enclosed with the shipment. All parts not attached to the machine are listed and packing list should be immediately checked before storage.

Unloading the Unit:

The J-Mate is designed to be moved by fork-lift truck. Do not sling the main assembly since this could cause damage to the machine.

Mechanical Installation:

Refer to the J-Mate layout drawing.

Move the machine assembly to the area chosen for installation. Set the unit on the floor or other foundation capable of supporting the unit. Check overhead clearance and required maintenance clearances around the machine (refer to J-Mate layout drawing for suggested clearances). Be sure that the area chosen for installation is close to required source of electrical power and/or gas, a vent for the scrubber air discharge line and a drain for the scrubber water line.

Using the mounting pads at the corners of the unit as a template, mark the location for anchor bolts and move the machine so that the anchor bolts can be installed. After installing suitable anchor bolts, set the machine in place.

Connect the scrubber to the J-Mate and to an outside exhaust vent using the shortest length possible. Do not restrict the exhaust vent line through a reduced diameter line or an excessively long exhaust line. This will cause the J-Mate to operate at excessively high temperatures. MINIMUM EXHAUST LINE DIAMETER FOR THE J-MATE IS SIX (6) INCHES. (Refer to the "Dust Collector Vent" sketch for a typical vertical run exhaust connection.) The wet scrubber must be plumbed to a water source at the connections marked (refer to the specifications page for water supply and drain required). Water supplied can be from clarifier supernate. (Refer to Recirculation Drawing).

NOTE: Vent on scrubber drain should be left open, and discharge should be piped to gravity drain.

Optional Loading Mechanical Installation:

Bolt the support feet to the sludge-dumping assembly. Assemble the forks to the dumping mechanism by placing them in position and installing the two (2) pivot pins. Install the retaining rings provided on the pivot pins when in position. Attach lift to machine (see illustration on Page 6 of this Section).

The hydraulic unit is filled prior to shipment; check the fluid level in the reservoir and fill, if necessary, with hydraulic fluid. Normal oil level is 1/2-inch below top of tank with cylinders retracted. See Component Data Section for recommended hydraulic fluid.

Gas Installation:

A suitable gas (Natural gas on "G" models & Propane gas on "p" models) supply line must be connected to the unit. This connection should be made at the coupling marked "Gas Inlet" (refer to the Component Data and Specifications page for gas requirements). A pipe sizing table has been provided to aid in sizing your gas run. See chart following.

Adjacent to the gas inlet fitting are two small fittings marked "Vent". This is to vent the gas valve and regulator and must be piped to an open air area, preferably outdoors.

The J-Mate is designed for operation with 440 volt (according to order), 3-phase, 60 Hertz power supply. If your plant is supplied with another voltage, a suitable transformer should be installed so that the J-Mate is supplied with the proper power supply. (See VOLTAGE TAG on panel door for required voltage.)

Gas Installation:

A suitable gas supply line must be connected to the unit. This connection should be made at the coupling marked "Gas Inlet" (refer to the Component Data and Specifications page for gas requirements). A pipe sizing table has been provided to aid in sizing your gas run. See chart following.

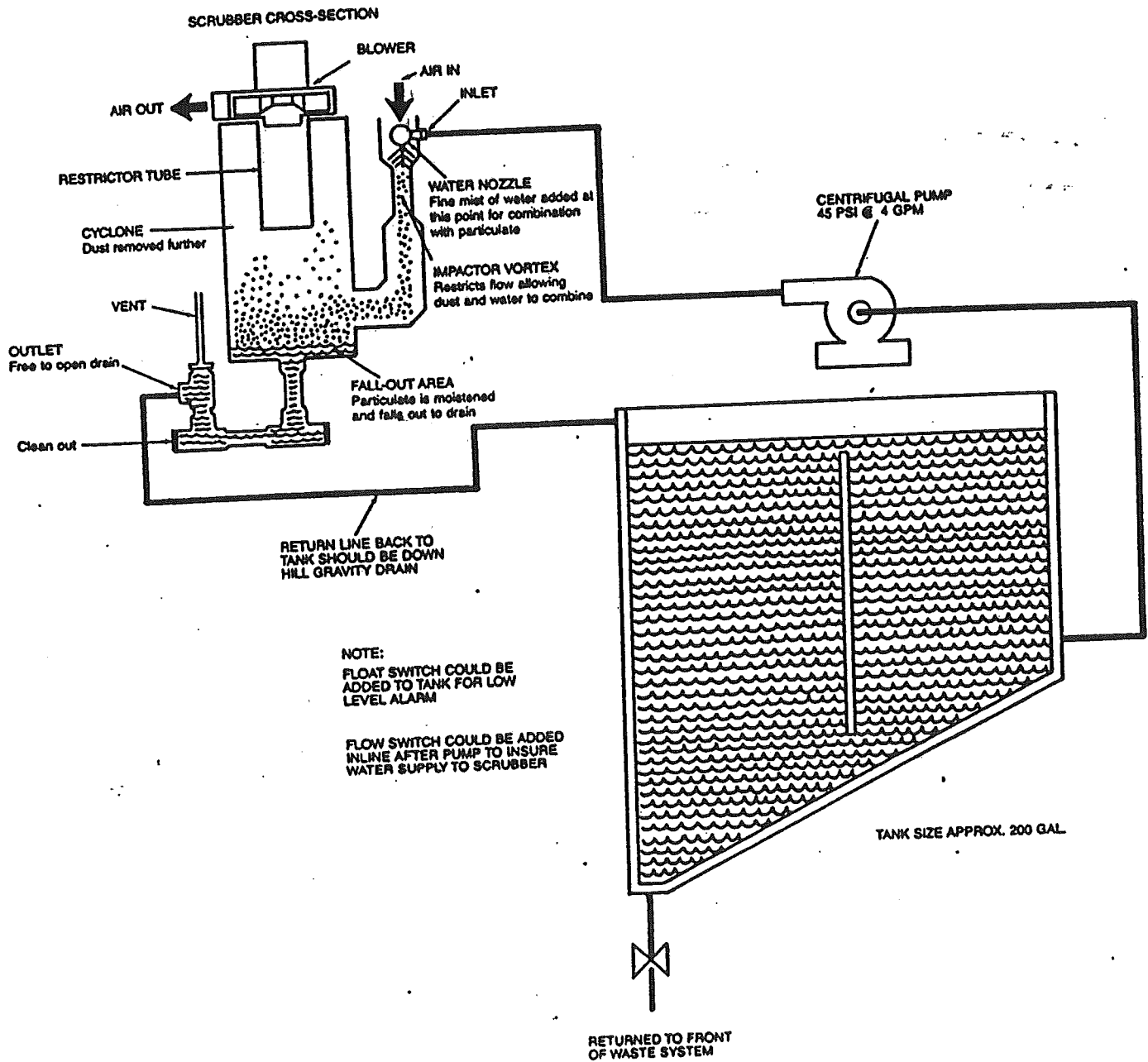
Adjacent to the gas inlet fitting are two small fittings marked "Vent". This is to vent the gas valve and regulator and must be piped to an open air area, preferably outdoors.

PIPE CHART FOR CORRECT SIZING

SIZING IRON PIPE (SCHEDULE 40) IN RELATION TO CUBIC-FOOT-PER-HOUR REQUIRED

	50 ft ³ /hr.	100 ft ³ /hr.	150 ft ³ /hr.	200 ft ³ /hr.	400 ft ³ /hr.
DIAMETER					
1 inches	244	173	141	122	86
1 1/4 inches	537	380	310	268	189
1 1/2 inches	832	588	480	416	294
2 inches	1680	1188	970	840	594
2 1/2 inches	2754	1952	591	1379	974
3 inches	5018	3549	2896	2509	1774
4 inches	10510	7410	6020	5170	3340

SCRUBBER RECYCLE



Clean clarifier overflow can be used to supply scrubber, or a tank can be used to clarify and recycle scrubber effluent.

J - M A T E P R E - S T A R T C H E C K L I S T

(Gas model)

- * All necessary adjustments must be made by qualified personnel.
 - * The following steps should be completed after the necessary connections have been made to the machine (electrical power, gas line piping, water piping).
1. Remove side panel to expose gas train components.
 2. Turn unit on and check for correct rotation of all motors scrubber fan; (Photograph #16/Section 3, conveyor motor (Photograph #14/ Section 3, extruder motor (Photograph #14/Section 3, and gas blower.
 3. Fill drain trap on scrubber with water (see Diagram #2, Section 3.
 4. Before igniting burners, check air pressure, drop across scrubber with scrubber fan running and water on to the scrubber (correct pressure range is 5" to 8" W.C.).

When pressure drop does not fall within this range, consult factory.
 5. To check for proper gas pressure to J-Mate, use the following procedure: With manual gas valve closed, connect one side of a manometer to the gas pressure test plug located upstream of gas clock. Note: The other side of the manometer must be open to atmosphere when taking this reading. Manometer is located on control panel or scrubber. Range is 10" to 24" W.C. (Install gas pressure regulator to achieve this range if necessary.)
(Note: These readings should be taken under flow.)
 6. Open manual gas valve. Now you are ready for trial ignition.

7. When ignition has taken place, observe burners from rear of machine to assure that burners are ignited.
8. After a sufficient check has been made of gas pressure remove manometer and test port valve; then, reinstall pipe plug at test point on gas train. Test port valves are for test purposes only. Pipe plug should be reinstalled.
9. Now you are ready to dry sludge. With sludge in the feed hopper, start extruder and begin feeding sludge on the belt. The amount of sludge on the belt will affect the exhaust temperature. Recommended running temperature is 550 deg. - 600 deg. F.

J - MATE® MODEL J - 120 (Gas)

Capacity: 47 pounds water removal per hour
3/4 - 1.0 cubic feet per hour

Dimensions: Length: 160 inches
Height: 78 inches
Width: 46 inches (approximate) with wet scrubber, without loading mechanism (see drawings for detailed width dimensions)

Weight: 3,400 pounds

NOTE: For loading mechanism, add 60 inches to width and/or length.

- Wet Scrubber: 304 Stainless steel
Water usage: 1 GPM @ 35 PSI
Scrubber gravity drain
Exhaust air (CFM): 250-275
Exhaust air temperature: 160-200° F.

Hopper: Carbon steel
11 cubic feet (Optional: 25 cubic feet)

Power Requirements:

Gas: 460, 3 Phase, 60 Hz, approximately 10 amps (full draw)
230, 3 Phase, 60 Hz, approximately 20 amps (full draw)

Motor Description:

Conveyor:	1/2 HP, TEFC
Extruder:	1/2 HP, TEFC
Gas Blower:	1/6 HP, TENV
Scrubber:	1 HP, TEFC
Cooling Blower:	1/20 HP, Open
Dump-Lift Mechanism:	1 1/2 HP, TEFC

Optional:

1. Hydraulic drum-loading assembly, 55-gallon drum cart included.
2. Hydraulic dumpster-loading assembly, dumpster included.

Heat Source:

Gas: Burner rating: 120,000 BTU per hour
Natural Gas Consumption: 120 CFH
Propane Consumption: 1.3 GPH

J - M A T E[®] M O D E L J - 1 8 0 (Gas)

C a p a c i t y : 94 pounds water removal per hour
 1.5 - 3 cubic feet per hour

D i m e n s i o n s : Length: 160 inches
 Height: 78 inches
 Width: 52 inches (approximate) with wet
 scrubber, without loading mechanism (see
 drawings for detailed width dimensions)

W e i g h t : 3,600 pounds

N O T E : For loading mechanism, add 60 inches to width and/or length.

W e t S c r u b b e r : 304 Stainless steel
 Water usage: 1 GPM @ 35 PSI
 Scrubber gravity drain
 Exhaust air (CFM): 250-275
 Exhaust air temperature: 160-200° F.

H o p p e r : Carbon steel
 13 cubic feet (Optional: 29 cubic feet)

P o w e r R e q u i r e m e n t s :

G a s : 460, 3 Phase, 60 Hz, approximately 10 amps (full draw)
 230, 3 Phase, 60 Hz, approximately 20 amps (full draw)

M o t o r D e s c r i p t i o n :

C o n v e y o r :	1/2 HP, TEFC
E x t r u d e r :	3/4 HP, TEFC
G a s B l o w e r :	1/6 HP, TENV
S c r u b b e r :	1 HP, TEFC
C o o l i n g B l o w e r :	1/20 HP, Open
D u m p - L i f t M e c h a n i s m :	1 1/2 HP, TEFC

O p t i o n a l :

1. Hydraulic drum-loading assembly, 55-gallon drum cart included.
2. Hydraulic dumpster-loading assembly, dumpster included.

H e a t S o u r c e :

G a s : Burner rating: 200,000 BTU per hour
 Natural Gas Consumption: 200 CFH
 Propane Consumption: 2.2 GPH

GENERAL SPECIFICATIONS FOR ALL GAS CONTINUOUS MODELS

Dust Scrubber:

The U-Tube manometer requires the use of Dwyer Instruments red manometer oil, having a specific gravity of 0.826. This oil is available from JWI.

SCRUBBER MANOMETER READINGS

Model	Manometer Reading*	Water Flow Rate	Approx. AirFlow
J-120	5-8 inches	1 GPM	250-275 CFM
J-180	5-8 inches	1 GPM	250-275 CFM
J-360	5-8 inches	2-4 GPM	250-300 CFM

*(Pressure drop across scrubber cold.)

Hydraulic Oil:

Operating Viscosity: 180-350 SUS
Recommended Brands: Mobile DTE 24,
DTE 25, DTE 26; Amoco Rykon #46 or
equal.

Grease:

Any good grade of general purpose grease
such as Lubriplate #930-2 may be used.

Chain Lubricant:

Spray-on grease such as Kar Products #74870
penetrating grease or equal.

Water Requirement:

J-120G: 4-6 GPM @ 45-55 PSI
J-180G: 4-6 GPM @ 45-55 PSI
J-360G: 6-8 GPM @ 45-55 PSI

Gas:

Gas piping must be sized to allow for
enough volume and pressure at the BTU
rating of the unit. (Pressure should
be a minimum of 7" W.C.) Your HVAC
contractor will be best suited to help
you with gas installation.

J - M A T E O P E R A T I O N
S E Q U E N C E O F O P E R A T I O N

LOADING (IF MACHINE IS EQUIPPED WITH LOADING MECHANISM)

- * Roll dumpster on forks or strap in barrel.
- * Pull out emergency stop button. (See photograph #1 in the section)
- * Push lift operator switch to up positions hold. (See photograph #2 in this section.)
- * When dumpster or barrel is empty select down position hold until dumpster or barrel returns to floor. (See photograph #3.)

OPERATION OF DRYER:

- * Push toggle switch to "run" position. Wait for start ready light to come on. (See photograph #4 in this section.)
- * Once light comes on. Push to start position. Hold (see photograph #5 in this section.)
- * Once ignition is achieved the heat light will come on and the purge light will go out, you now can release toggle.
- * Set conveyor speed to 16 inches per minute or approximately 11:00 position on control panel. (See photograph #6 in this section.)
- * Extruder speed and heat input are controlled by a programmable controller. (See photograph #7 in this section.)
- * Note this unit must be tuned to Customer Product by JWI technician prior to normal operation.
- * Temperature is displayed (in degree of) on LED panel shown in photograph #8.

* To set desired control temperature, push scroll to CTRL mode then push down arrow twice (see photograph #10 in this section), you now can set temperature that you wish to maintain.

* For further instructions on controller, See controller manual in section #4 - Component Data.

SHUT DOWN

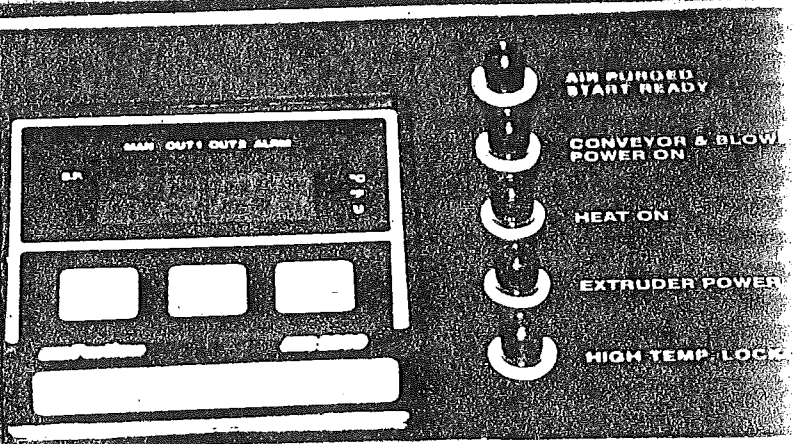
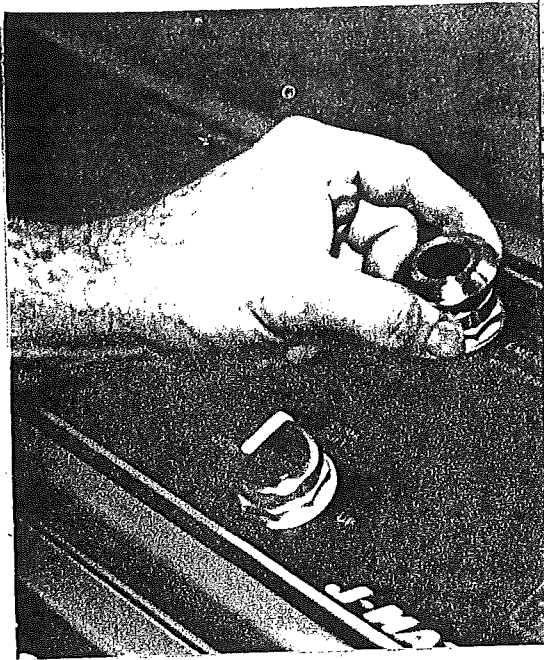
* To shut down machine, push toggle to off position. This will put the machine into cool down cycle for 30-40 minutes. (See photograph #11 in this section.)

* Power may now be turned off by pushing emergency stop down.

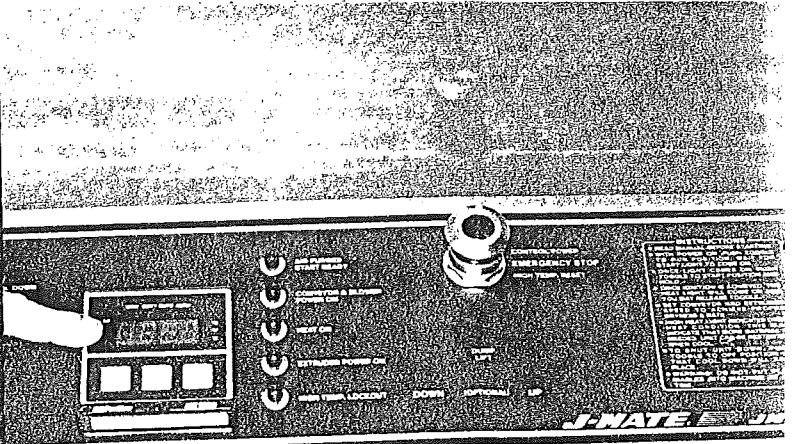
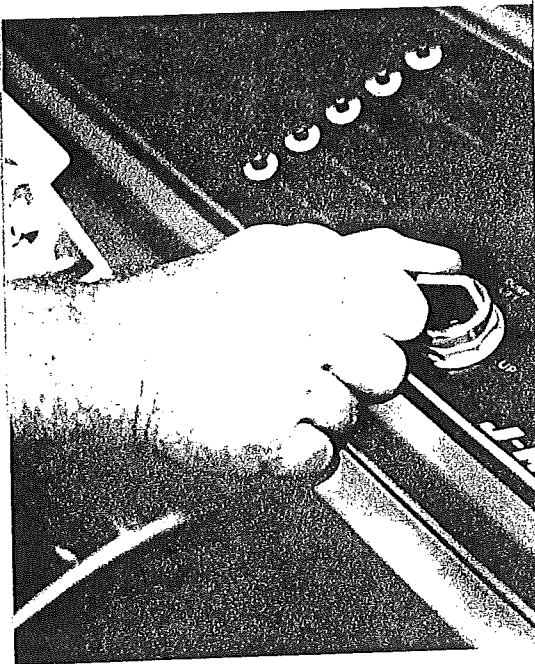
REVERSING TOGGLE SWITCHES:

* Location of these switches are on the side of control panel; conveyor and extruder. These switches are for an emergency and are not part of normal operation. The unit may have one of two types of switches. Old style - two position spring loaded reversing. To use reversing switches, turn speed switch to 0. Hold reverse switch and increase speed. These switches are momentary contact so that they cannot be left in reverse position. New style - three position with off in the center of switch. This switch is not spring loaded and will not return to original position without operator doing it. It is still the best to slow the drive down to change switch position.

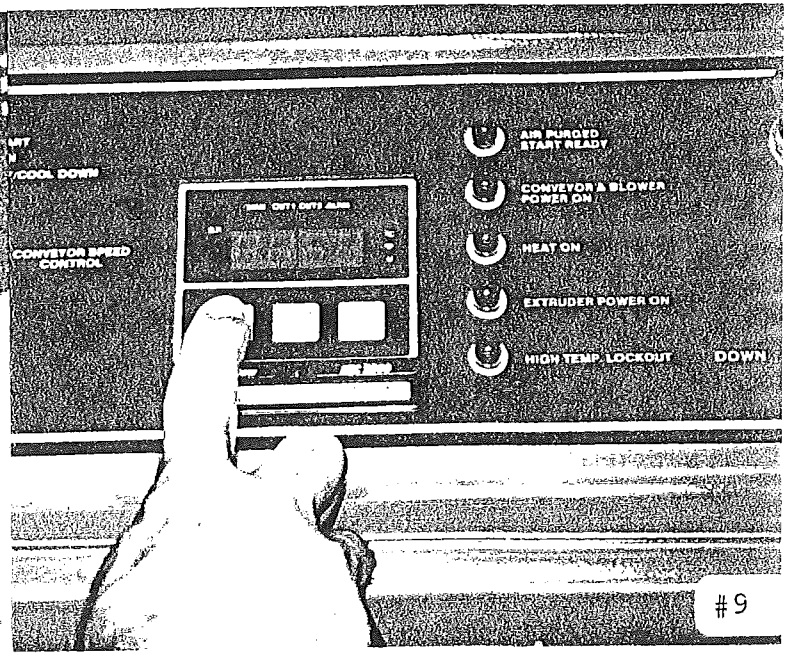
* To return to normal direction turn speed switch to 0, release toggle, and reset speed.



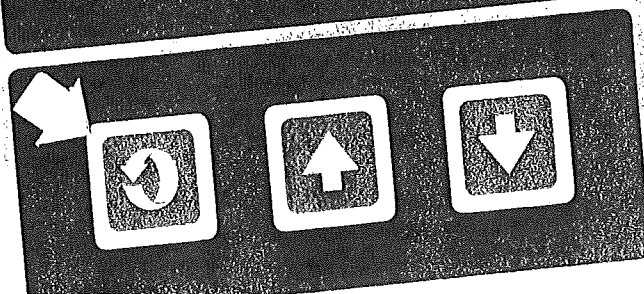
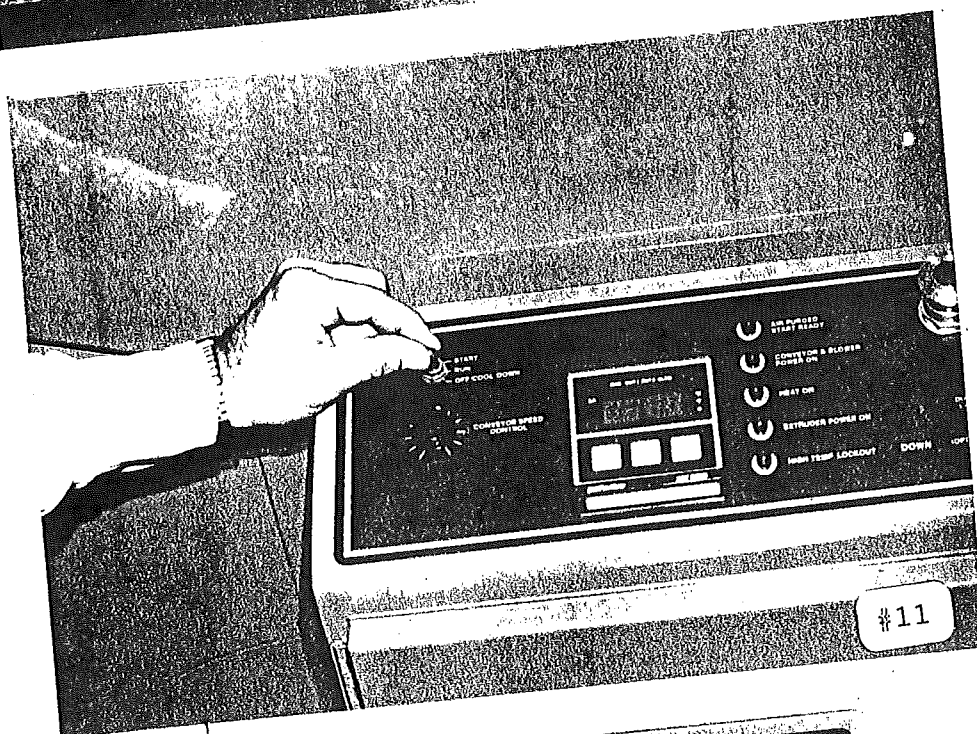
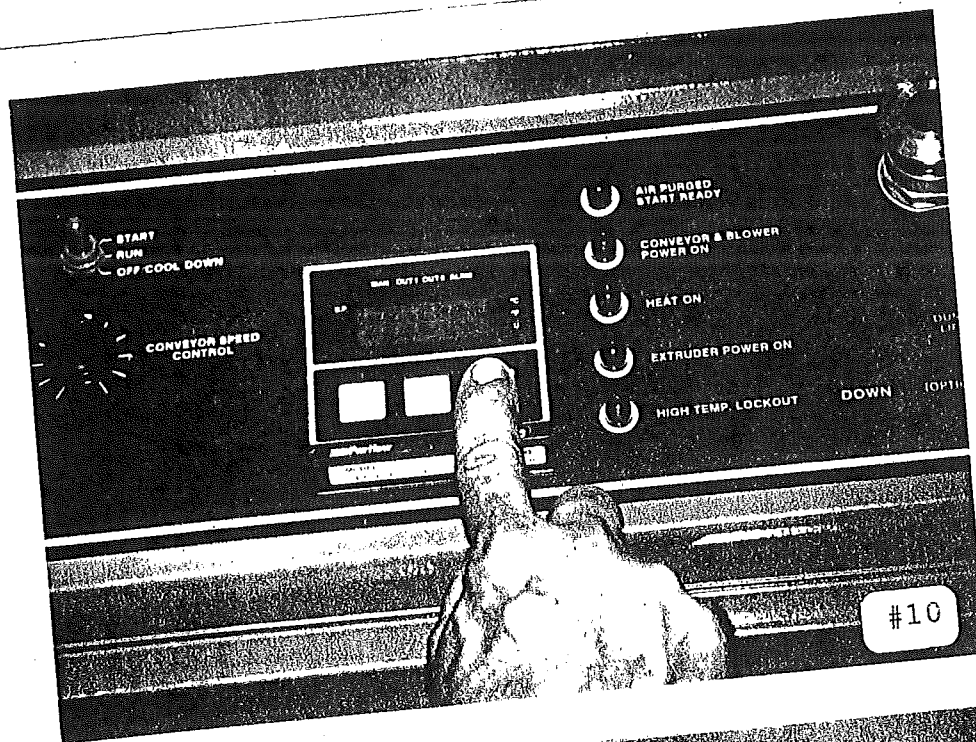
#7



#8



#9



J - M A T E O P E R A T I O N

D E S C R I P T I O N O F C O N T R O L S

C O N T R O L P O W E R , E M E R G E N C Y S T O P , A N D H I G H T E M P . R E S E T B U T T O N :

C O N T R O L P O W E R :

Brings power to control panel ("up" position of button).

E M E R G E N C Y S T O P :

Shuts off power to controls for emergency stop ("down" position).

H I G H T E M P . R E S E T :

Button must be shut off ("down" position) and pulled on ("up" position) to restart after overheat lockout and temperature must be below set point of overheat.

S T A R T , R U N , O F F / C O O L
D O W N T O G G L E :

R U N :

This position of toggle switch starts the conveyor, blowers (scrubber, gas, and housing blowers) and activates water solenoid.

S T A R T :

The toggle must be held in this position to activate ignitor to light burners and start extruder.

O F F / C O O L - D O W N :

This position cuts power to extruder and shuts off burners. After 30-40 minutes (cool-down period), conveyor, scrubber blower, gas blower and housing blower will also shut down.

C O N V E Y O R S P E E D C O N T R O L : This dial regulates speed of conveyor.

A I R P U R G E S T A R T
R E A D Y L I G H T :

This light indicates when purge cycle is complete, and operator may proceed to start unit.

C O N V E Y O R & B L O W E R
" P O W E R O N " L I G H T :

Indicates that power has been supplied. Conveyor and blower should be activated. (Optional hour meter could be activated).

"HEAT ON" LIGHT:

"EXTRUDER ON" LIGHT:

"HIGH TEMP." LOCKOUT:

This light indicates that the burners are on.

This light indicates power has been supplied to extruder drive and it should be running.

Indicates an overheat situation.
Burners have been shut down for safety.

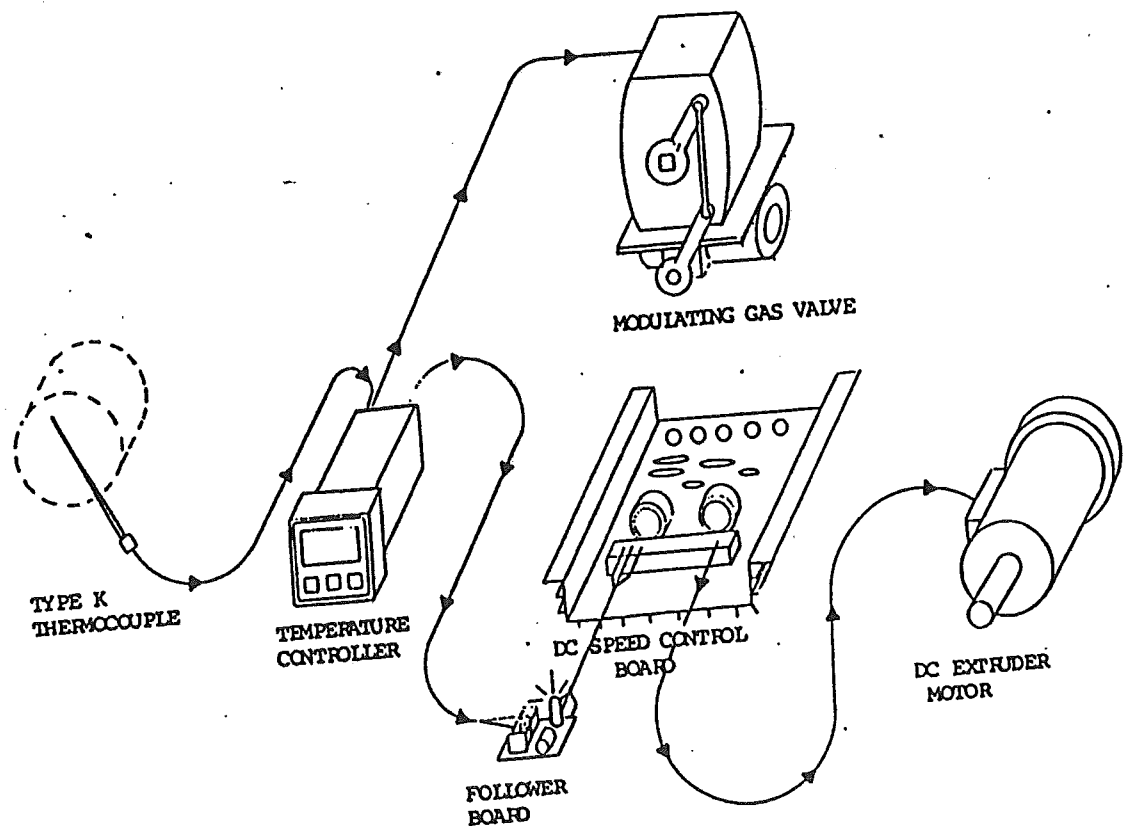
MODULATING EXTRUDER AND MODULATING GAS CONTROL SYSTEM

(Optional on 180G & 120G Models)

FUNCTION:

To automatically control the amount of material extruded and heat input in relation to the exhaust gas temperature. A temperature sensed below set point would decrease extruder speed and increase heat input. A temperature sensed above would increase extruded speed and decrease heat input.

HOW THE MEC/MGC SYSTEM WORKS



THERMOCOUPLE:

Reads exhaust temperature and sends millivolt signal to controller.

TEMPERATURE CONTROLLER:

Converts millivolt signal to temperature and compares it to set point or desired running temperature. Controller then generates an output signal 4-20 MA DC and sends signal to the current follower, and gas valve motor.

CURRENT FOLLOWER:

Adjust control signal current from motor controller in proportion to signal received from temperature controller.

MOTOR CONTROLLER:

Converts AC-DC and controls voltage to extruder motor.

MODULATING GAS VALVE:

4-20 MA stepping motor with butterfly valve. Adjust heat in put by cutting down the amount of gas and air mixture supplied to burner.

J - M A T E M A I N T E N A N C E

D a i l y M a i n t e n a n c e :

- * Check that wet scrubber drain line flows freely. (See Diagram #2)
- * Infrared Gas Burners: Visually inspect to confirm that all burners are lit and have a uniform color across the entire length of the grid surface. All burners should be the same dark-red-to-orange color. If burners radiate a blue flame, they should be inspected for incorrect gas mixture. If a burner radiates a long flame (approximately 2-4 inches), it should be inspected for grid damage. (See Diagram #3)
- * Check extruder screen efficiency, clean as necessary.

W e e k l y M a i n t e n a n c e :

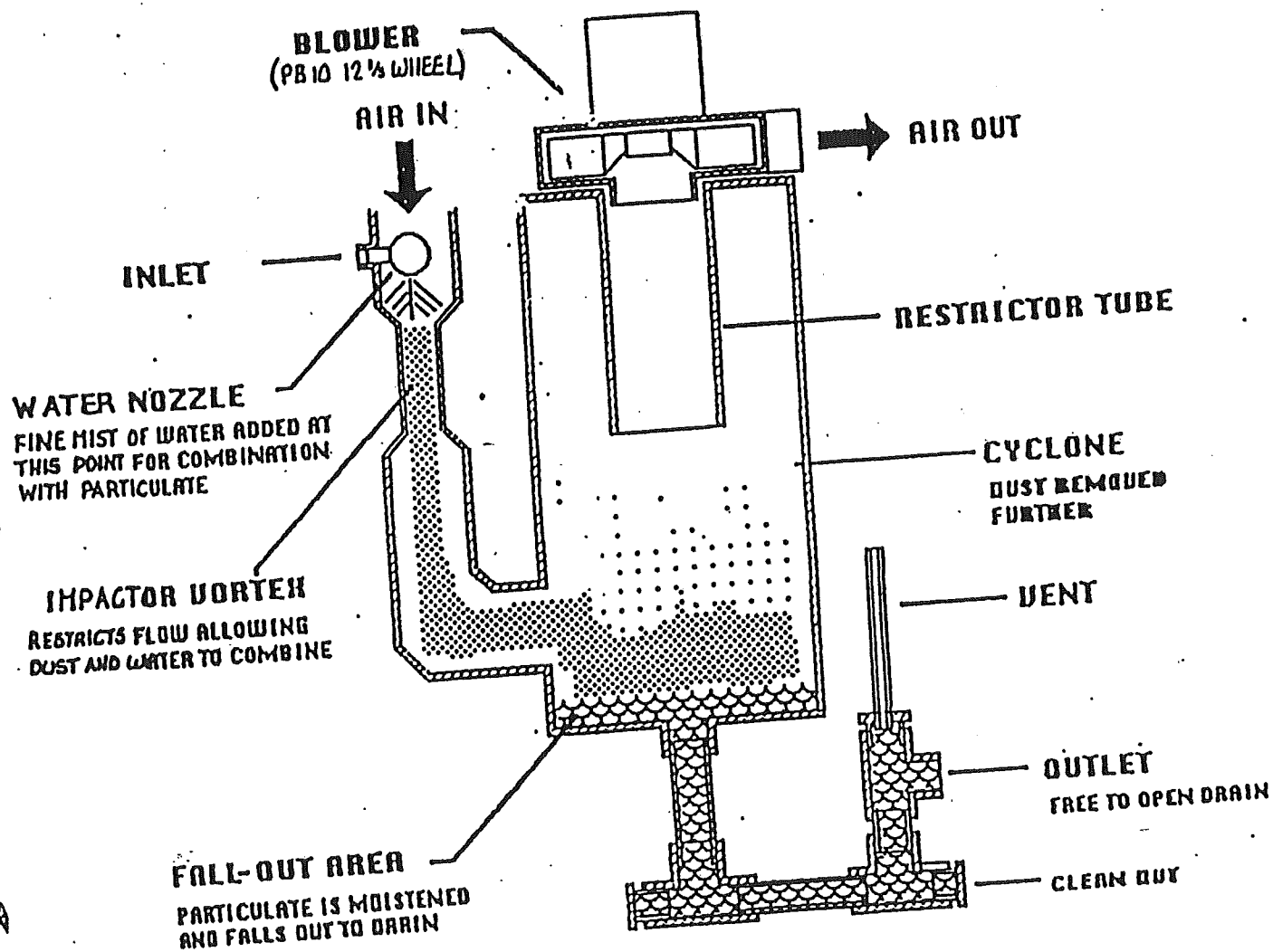
- * Lubricate cake breaker chain with a suitable lubricant such as Kar Products #74870 penetrating grease spray. (See Photograph #12 in this section.)
- * Check air filter.

M o n t h l y M a i n t e n a n c e :

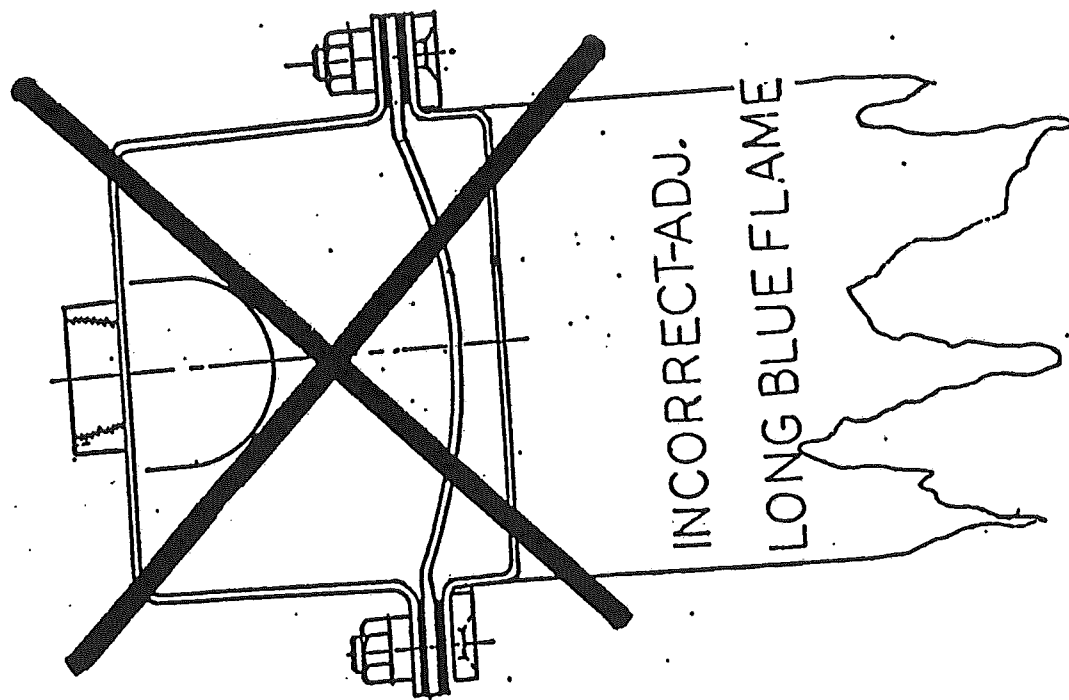
- * Lubricate all bearings. Grease fittings are mounted external to the unit. (See Photographs #13, #14 and #15 in this section.) Use multi-purpose grease such as Lubriplate #930-2.
- * Check and fill fluid levels in the hydraulic unit reservoirs and gear reducers. Recommended hydraulic oil for hydraulic reservoirs is Mobile DTE 24, 25, or 26. (For recommended gear oils and capacities, see Table I and Table II. Also, refer to Diagram #1 in this section.)
- * Clean air filter.

DIAGRAM 12

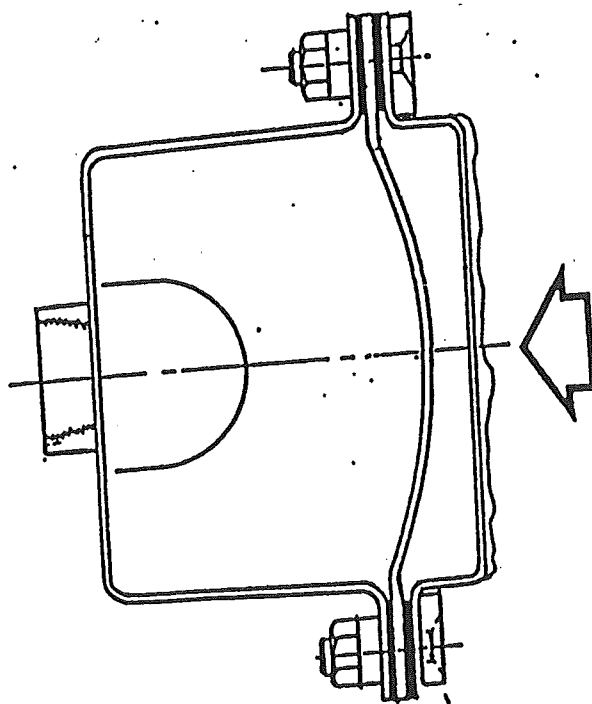
SCRUBBER CROSS-SECTION



- MODEL JW-400'S (120G & 180G Models)
- Venturi Type
- 600° F Inlet Gas Temp
- 6"-8" Pressure Drop
- 2-4 Gallon/Minute at 45 PSI
Water Consumed
- 0-100% Recycleable Depending on
End User
- 160°-180° EXHAUST TEMP
- 300-325 SCFM EXHAUST AIR

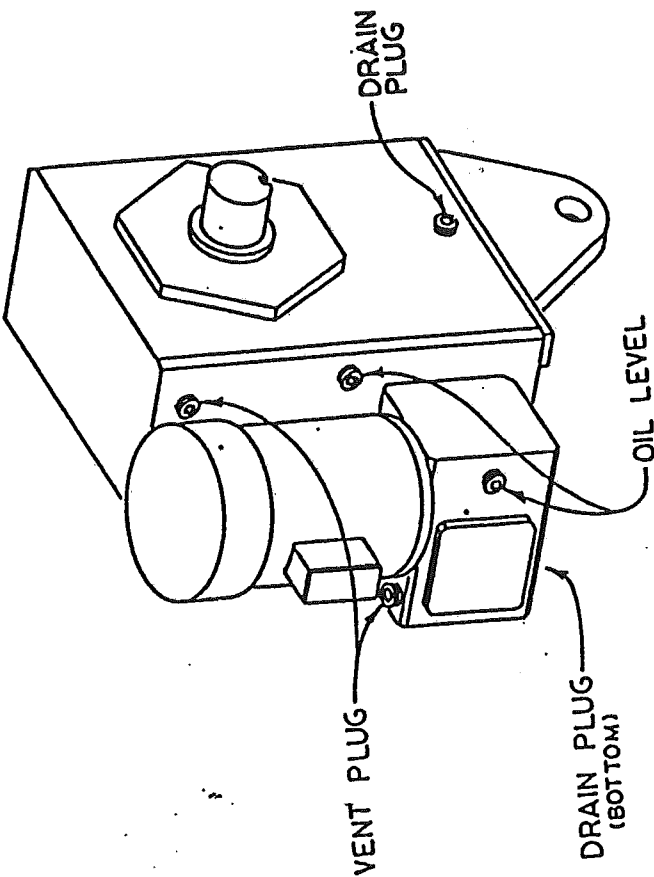


INCORRECT-ADJ.
LONG BLUE FLAME



CORRECT-ADJ.
ORANGE FLAME CLOSE TO
BURNER

EXTRUDER DRIVE



CONVEYOR DRIVE

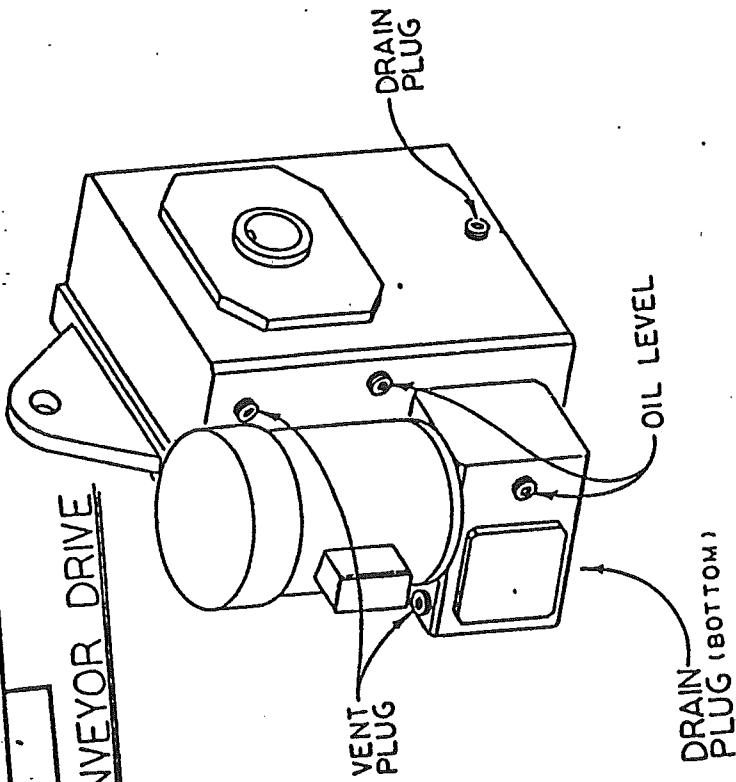


DIAGRAM # 1

ITEM	QTY.	PART NO.	DESCRIPTION	MAT'L	WT. EA.
SCALE ~ DATE 6-1-87 SUPP'D. BY CHECKED REV. TITLE GEAR DRIVE PLUG LOC. DWG. NO.					
DATE 6-1-87 SUPP'D. BY DATE 6-1-87 SUPP'D. BY					
DO NOT SCALE					

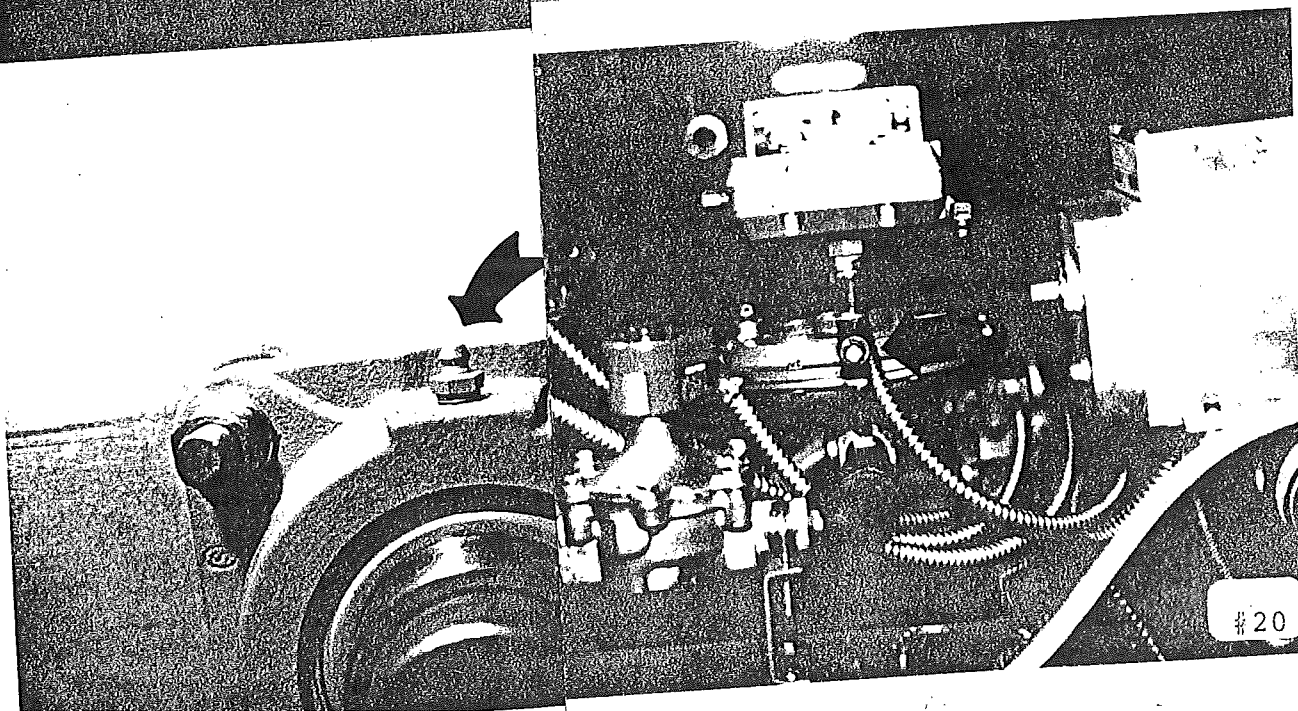
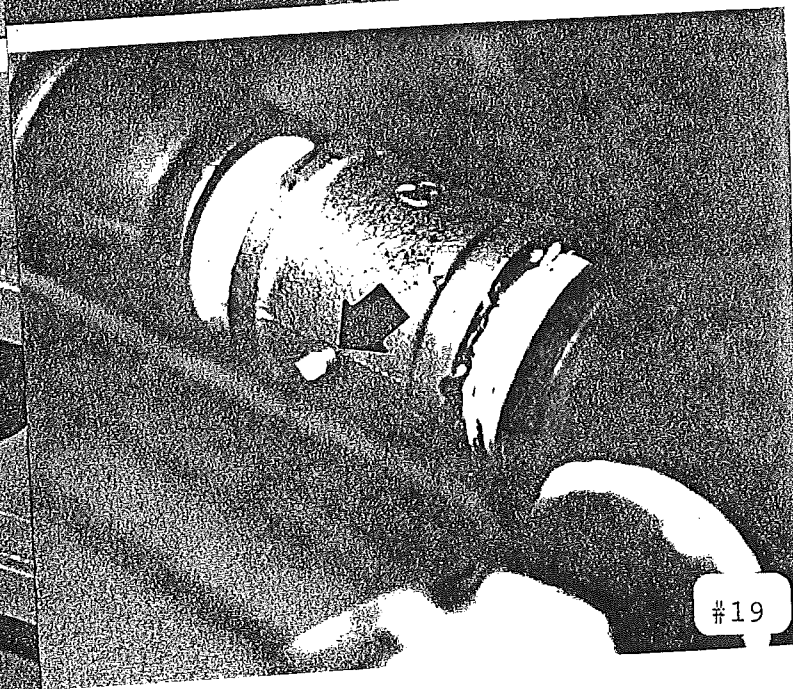
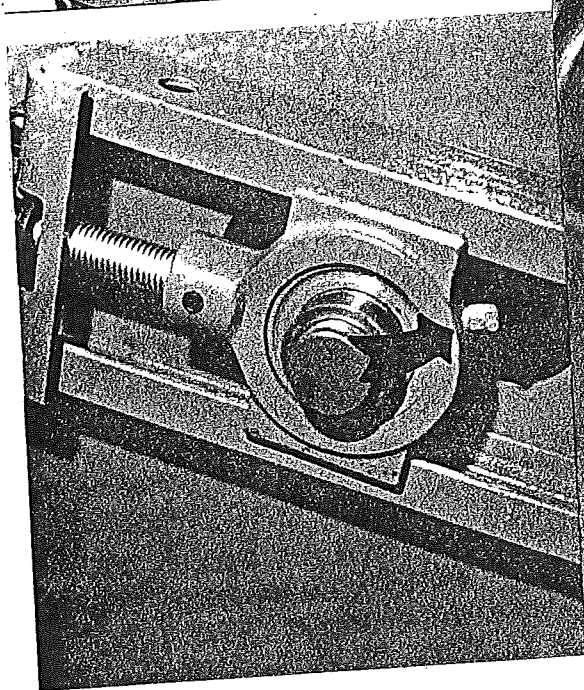
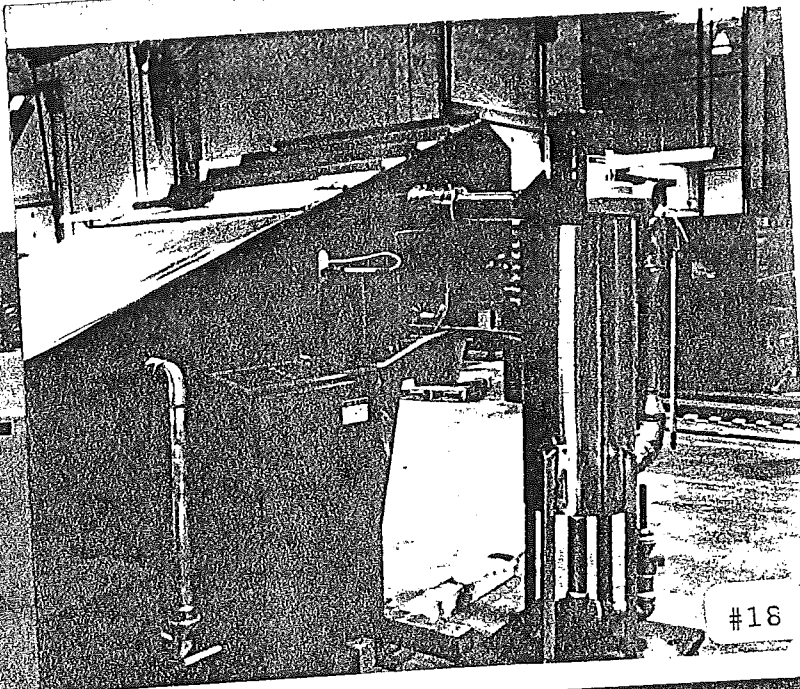
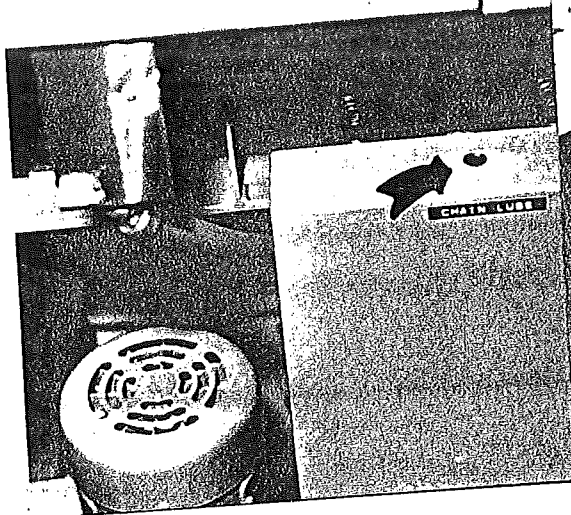


TABLE I

50° - 125° F. Ambient Temperature

<u>Manufacturer</u>	<u>AGMA Compounded No. 8</u>
Amoco Oil Company	Cylinder Oil #680
Chevron USA, Inc.	Cylinder Oil #680X
Exxon Company USA	Cyclesstic TK-680
Gulf Oil Company	Senate 680D
Mobile Oil Corporation	Extra Hecla Super
Shell Oil Company	Valvata Oil J680
Sun Oil Company	Gear Oil 8C
Texaco	650T Cylinder Oil
Union Oil Company of California:	Worm Gear Lube 140

TABLE II

OIL CAPACITIES

MODEL	<u>Conveyor Drive</u>		<u>Extruder Drive</u>	
	<u>Primary</u>	<u>Secondary</u>	<u>Primary</u>	<u>Secondary</u>
J-120	1 pt.	4 1/2 pts.	1 1/2 pts.	11pts.
J-180	1 pt.	4 1/2 pts	1 1/2 pts.	11 pts.

*Check tension on conveyor belt and adjust the take-up bearings as required. The following steps should be taken for adjustment:

1. Conveyor chain should be adjusted when machine is "cold", not operating. Tools needed for adjustment are an 1 1/2-inch combination wrench and a 3/4-inch combination wrench.
2. Gear motor stabilizers should be loosened. (See Photograph #14 in this section.)
3. Use tape measure to adjust both take-up bearings evenly as shown in figure 1. Adjust tensioner to remove all slack from conveyor chain. Do not over tension. (See Photograph #15.)

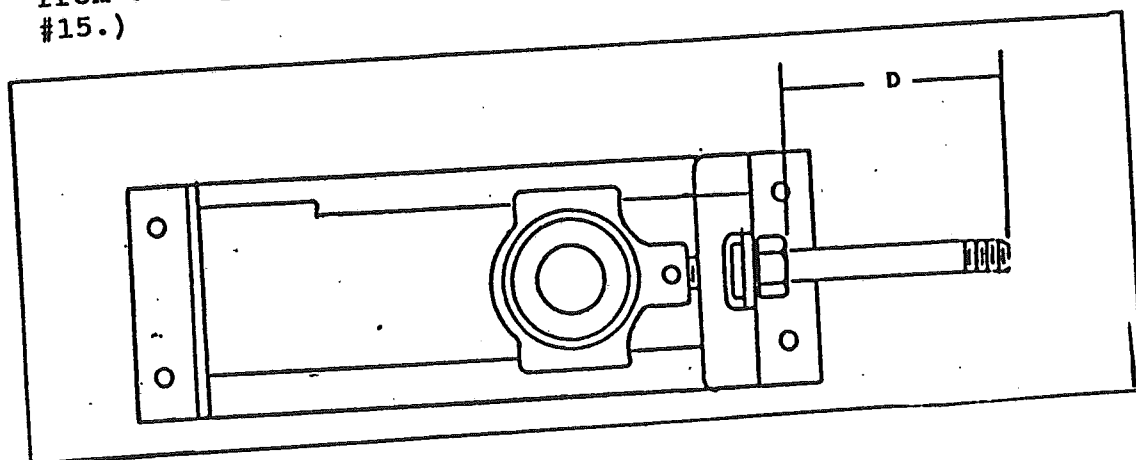


Figure 1

4. After machine has been operating for at least four (4) hours, check belt tension for excessive slack; if slack is found, tighten slightly.

* Visually inspect the following:

- | | |
|--------------|-------------------|
| 1. Sprockets | 3. Conveyor chain |
| 2. Chains | 4. Limit switches |

Repair or replace any item showing excessive wear.

Note: Inspect chain and conveyor belt and adjust if necessary after the first two (2) cycles of the machine to allow for initial break-in of drive train and conveyor belt.

M a i n t e n a n c e a s N e e d e d :

- * Replacement of extruder paddles
- * Replacement of bridge-breaker paddles
- * Replacement of wobble arms
- * Replacement of air cleaner

MAINTENANCE INSPECTION CHECK LIST

MODEL: _____

SER#: _____

DATE: _____

CUSTOMER: _____

CITY/STATE: _____

Page 1	WEEKLY *	MONTHLY **	SEMI ***	YEARLY ****	AS NECESSARY
--------	-------------	---------------	-------------	----------------	-----------------

BEARINGS (GREASE)

Extruder	CHECK	*				
	DONE					
Bridge Breaker Bearings	CHECK	*				
	DONE					
Conveyor Drive Bearings	CHECK	*				
	DONE					
Conveyor Discharge Bearings	CK-only			***		
	no grease REPLACE				****	

FILTERS

Air Filters	CHECK					
	BLOW OUT	*				
	REPLACE			***		
Water Filter Screen	CHECK	*				
	BLOW OUT		**			
	REPLACE				****	
Conveyor Chain Tension	CHECK	*				
	ADJ					

(Initial and Date Item, as completed)

This is a suggested time table under medium use and comparatively clean/non-corrosive environmental conditions. For heavy use and not so clean/corrosive environments extra maintenance may be required.

J-MATE 1/25/90

Page 2	WEEKLY *	MONTHLY **	SEMI ***	YEARLY ****	AS NECESSARY
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HOPPER AREA

Bridge Breaker Seals to Hopper	CHECK	*				
	TIGHTEN					
	REPLACE					
Bridge Breaker Bar Paddle (Rubber)	CHECK	*				
	TIGHTEN					
	REPLACE			***		
Wobble Arms & Rollers	CHECK	*				
	ADJ					
	REPLACE			***		
Extruder Paddles	CHECK	*				
	ADJ					
	REPLACE			***		
Extruder Screens	CHECK	*				
	CLEAN	*				
	REPLACE					
Seal Between Hopper & Extruder	CHECK	*				
	REPLACE					

Page 3	WEEKLY *	MONTHLY **	SEMI ***	YEARLY ****	AS NECESSARY
--------	-------------	---------------	-------------	----------------	-----------------

SCRUBBER

Trap	CHECK	*				
	CLEAN		**			
Manometer Piping	CHECK	*				
	CLEAN					
Manometer Oil	CHECK	*				
	ADD					
Water Nozzle	CHECK	*				
	CLEAN		**			
Scrubber Orifice	CHECK	*				
	CLEAN		**			
Water Solenoid	CHECK	*				
	CLEAN					

Page 4	WEEKLY *	MONTHLY **	SEMI ***	YEARLY ****	AS NECESSARY
--------	-------------	---------------	-------------	----------------	-----------------

GAS TRAIN

Gas Pressure To Unit	CHECK		**			
	ADJ					
Gas Mixture (Refer to Diagram)	CHECK		**			
	ADJ					
Manifold Pressure	CHECK		**			
	ADJ					
Manifold Pressure Mod. GAS	CHECK		**			
	ADJ					
Max Reading 5.0"WC Hi-Fire						
Min Reading 2.5"WC Lo-Fire						
Burner Piping Fittings	CHECK		**			
	TIGHTEN					
Burners Discolor Disfigure Screen	CHECK	*				
	REPLACE					
Igniter Spark Plug	CHECK	*				
	REPLACE				****	

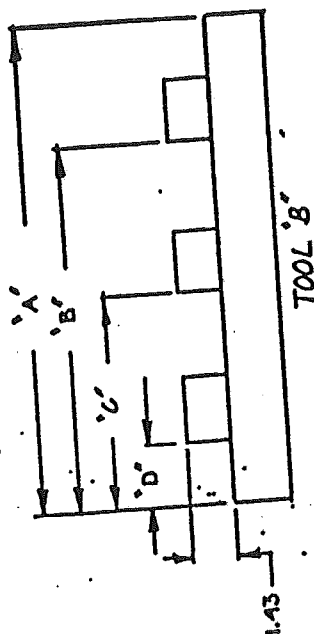
Page 5	WEEKLY *	MONTHLY **	SEMI ***	YEARLY ****	AS NECESSARY
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ELECTRICAL

Control Panel	CLEAN	*				
Conveyor DC Board	CHECK	*				
	ADJ					
Extruder DC	CHECK	*				
	ADJ					
Fire Eye Reading UV/3-5DCV	CHECK	*				
	CLEAN		**			
Flame Rod 5 - 20 Milli-Amps	CHECK	*				
	CLEAN		**			
Gear Box Conveyor Oil Level	CHECK	*				
	ADD					
Gear Box Extruder Oil Level	CHECK	*				
	ADD					

1/25/90

TOOL, B, PT. N°	HATCH SIZE USED ON	A	B	C	D
10742401	120	15.50	11.50	6.75	2.00
10742402	180	21.50	17.50	9.75	2.00
10742403	360	39.50	35.50	18.75	2.00



1. WITH EXTRUDER SCREEN REMOVED AND THE EXTRUDER RESTING ON SURFACE-A (FOR MFL ASSEMBLY) PLACE TOOL "B" ON THE CENTER OF THE EXTRUDER HOUSING.
2. WITH RUBBER PADDOLES EXTENDING 1" PAST HUB ARM.
3. ROTATE EXTRUDER HUB AND ADJUST HUB ARM, SO THE RUBBER PADDOLES TOUCH THE TABS ON TOOL "B".
(NOTE - RUBBER PADDOLES MUST BE MOUNTED WITH REINFORCING WEBBING NEXT TO HUB ARM)
4. TIGHTEN 5/16 BOLTS TO 11 FT LBS EACH
5. ROTATE EXTRUDER HUB FOLLOW STEPS 2 AND 3 FOR REMAINING ARMS.

UNLESS OTHERWISE NOTED
TOLERANCES TO BE:

DEC.	.000	± .01
	.000	± .004
	.000	± .0006

PRAAG. 2 1/2
 ANGLE 2 1/2
 DO NOT SCALE

ITEM	QTY.	PART NO.	DESCRIPTION	MAT'L
			 EXTRUDER ASS'M INSTR. B - 107424TB	
			TOOL DATE 11-16-88 SUPP'S BT E.C.N. DATE QTY. OF PARTS	

FLAME ROD CLEANING

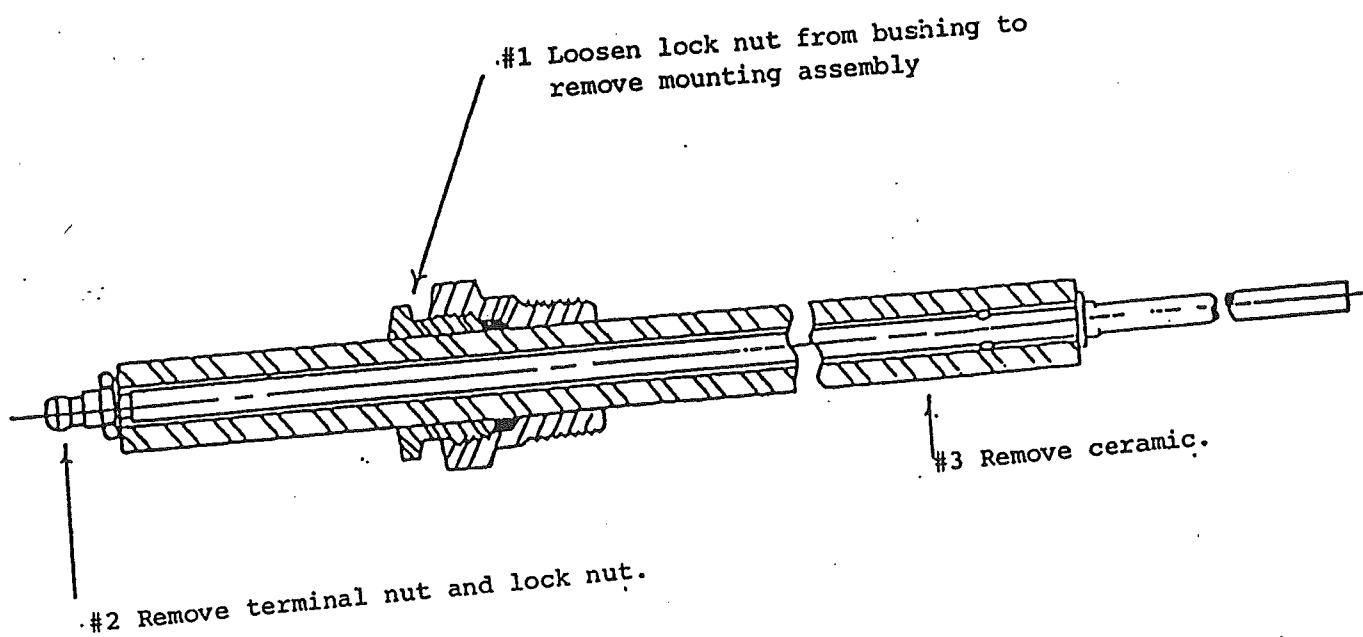
The Flame Rod is very critical to the operation of the J-Mate and may need periodic cleaning. Without periodic cleaning, the Flame Rod may become contaminated.

To Clean the Flame Rod:

1. Remove Flame Rod (Flame Rod must be cool before removing).
2. Disassemble Flame Rod completely.
3. Clean Rod with steel wool.
4. Scrub ceramic and Rod with Boraxo or Comet cleanser.
5. Mix up a solution of Nitric Acid and water - 50/50 and soak ceramic for 1/2 hour (cover top of container).
6. After removing the ceramic from the acid, re-wash with soap and water. Also re-wash the Rod. (Use same cleanser as before, rinse thoroughly).
7. Reassemble.

*NOTE: If ceramic has a hair line crack, the Flame Rod can no longer be used.

DRAWING B



"Should we make a mistake"

JWI DIRECT RETURNS POLICY

To ensure proper handling of your return, please take a moment to read the following:

ALL returns require a **RETURN GOODS AUTHORIZATION (RGA) NUMBER**. We are unable to process your return or issue proper credit without an approved **RGA** number.

ALL returns must be **COMPLETE**, including all original warranties, manuals, documentation and packaging.

ALL product must be received within 20 days of issuing an **RGA** number.

HOW TO RETURN PRODUCT

You must have an **RGA** number before you send any product back. To obtain this number, call 616-772-9011 and ask for Customer Service. Be sure to have available the following information:

- your order number
- your customer number
- the JWI product serial number
- the part number and description of the product
- the reason for the return

IMPORTANT

THE RETURN GOODS AUTHORIZATION NUMBER MUST BE WRITTEN CLEARLY ON ALL BOXES BEING RETURNED. NON-COMPLIANCE CAN RESULT IN THE PRODUCT BEING REFUSED AND RETURNED BACK TO YOU. C.O.D. SHIPMENTS WILL NOT BE ACCEPTED

The logo for JWI, consisting of the letters "JWI" in a bold, italicized, sans-serif font, with a registered trademark symbol (®) to the right.

JWI, Inc. / 2155 112th Avenue / Holland, Michigan 49424 U.S.A. / 616-772-9011 / FAX 616-772-4516

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RECOMMENDED J - MATE SPARE PARTS
MODEL J - 180 G

QUANTITY	PART #	DESCRIPTION
2	10474200	Burner (Quantity of 4 or more) (Quantity of 8 or more)
8	10474201	Burner to frame gasket
1	10361000	Thermocouple
2	10689300	Hesitation Switch
2	10434502	Bridge Breaker Shaft Seals (2 per set)
1	10447600	Extruder Paddle Set (4 per set)
2	10353801	Extruder Bearing
1	10451601	Wobble Arm Set (2 per set)
1	10454400	Bridge Breaker Paddle Set (5 per set)
2	10609301	DC Speed Controller ("Dart")
1	10591903	UV Eye
2	10474800	Hopper Bearing (non-drive side)
1	10294516	Hopper Bearing (drive side)
2	10474701	Upper Belt Bearing (1000°)
2	10465002	Lower Belt Bearing
1	10592502	Air Filter
1	10465102	Bearing Frame
1	10474500	Igniter

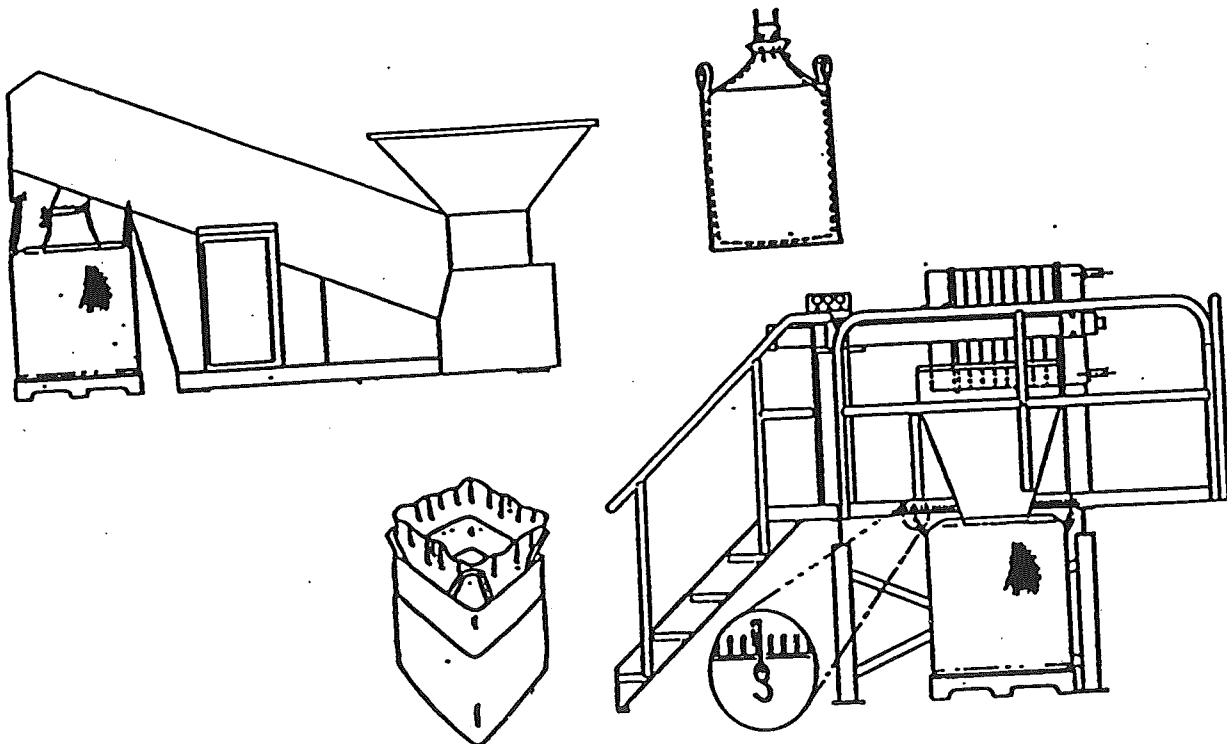
NOTE: 10% discount if complete Recommended Spare Parts kit is purchased.

ONE-WAY DISPOSABLE BAGS

We at JWI would like to introduce you to the newest and best way to store and dispose of your sludge. The DOT approved one way bag is undoubtedly the best way to go. This 35" X 35" X 35" bag comes in two styles; Spout top which has a 14" diameter neck which is 18" tall for use with the J-Mate Dryer, also duffle top with water proofing inner liner for use with the J-Press. Both bags are fitted with 5,000 lb. test, polyester web lift straps for ease of handling with lift truck, and hooks supplied with the J-Mate and J-Press Platform.

THINK OF THE BENEFITS!

- .. One bag holds the approximate capacity of 4 to 5 drums.
- .. 20 unused bags can be stored in the same space as one drum.
- .. No more searching for used drums to save money.
- .. No more expensive dumpster rental fees.
- .. Less mess--J-Mate & J-Press dump directly into bag.



Spout-top

10396200

\$33 ea

Duffle-top

10366201

\$36 ea

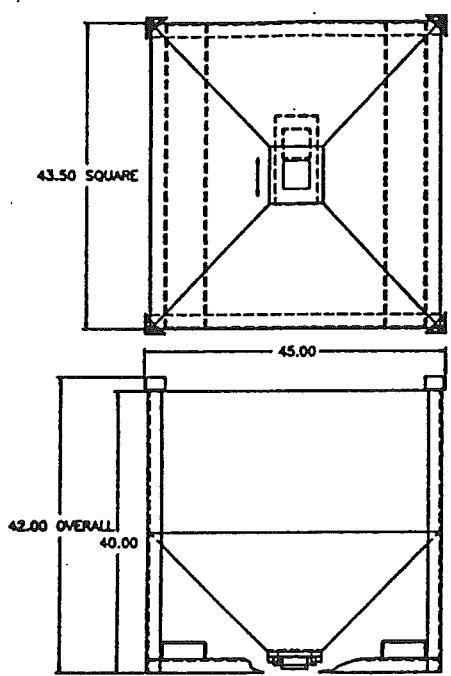


Inc. 2155 112th Avenue, Holland, MI 49424 U.S.A. Telephone (616) 772-9011 FAX (616) 772-4516

NEW JWI MOBILE HOPPERS

The JWI Mobile Hoppers are the best way to handle the sludge that may be too hot to directly dump into a one way bag. Oily and organic sludge have a tendency to stay hot long after being discharged from the J-Mate. We recommend discharging directly from the J-Mate into the Mobile Hopper, then setting it aside for a few hours to cool, then after the sludge has properly cooled dumping into a one way bag.

The Mobile Hoppers may serve many uses other than the handling of dry sludge. Any dry bulk material can be stored and transported, such as plastic pellets, sand blast sands and foundry sands.



- 30 CUBIC FOOT CAPACITY
- DIMENSIONS 44" X 44" X 42"
- 4 STACKING PADS
- ALL STEEL CONSTRUCTION
- 4" SQUARE DISCHARGE AT BOTTOM
- LOCKING SHUTOFF SLIDE GATE
- (STAINLESS STEEL) WITH UHMW RUNNERS,
- 2" STUB ADAPTER BELOW SLIDE GATE
- FORK TRUCK LIFT CHANNELS
- PAINTED "JWI BLUE"

PRICE \$990.00 each

OPTIONS:

- 2 piece hinged cover \$175.00 per hopper
- Swivel Casters (2 locking 2 free). \$160.00 per hopper
- Non standard color \$ 45.00 per hopper

The above hopper would ship common carrier/freight collect FOB Holland, MI. Shipment could be made within 3-4 weeks after receipt of order. TERMS: Net 30 days.

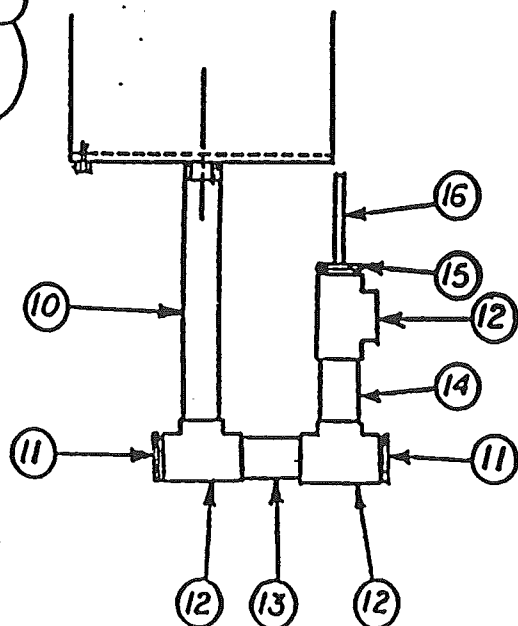
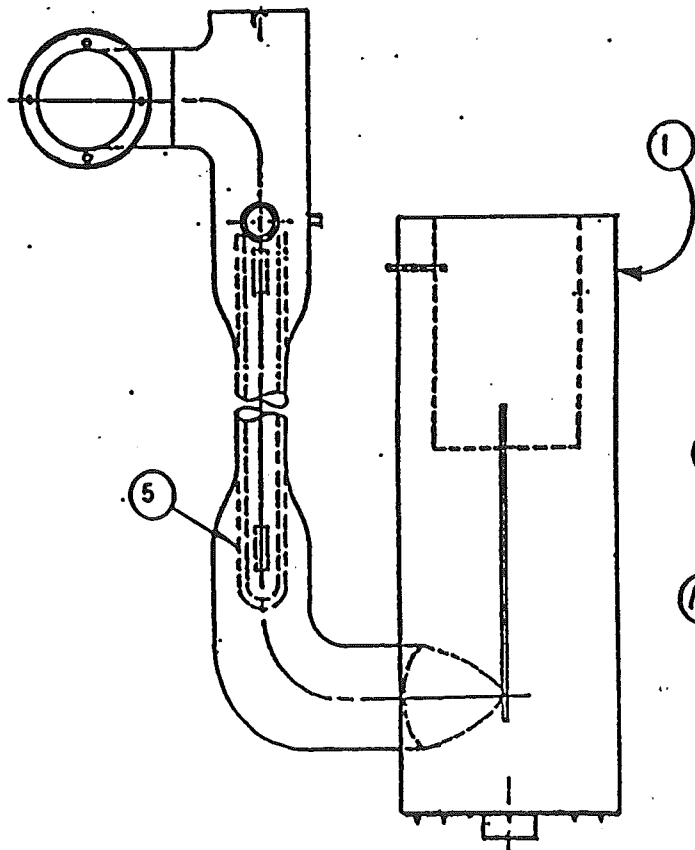
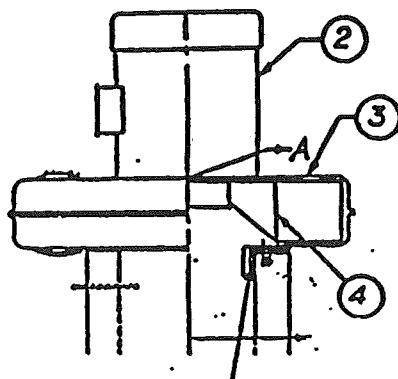
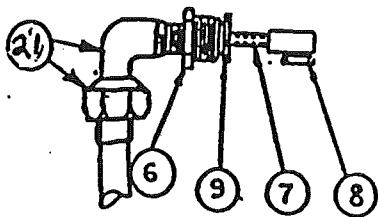
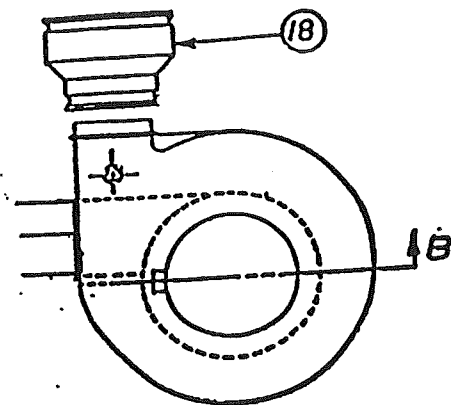
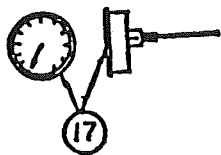
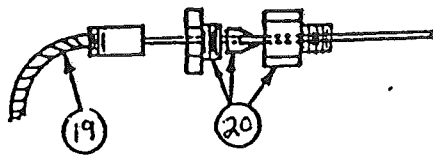
J-MATE® MODEL J-120 EXTRUDER

ITEM	QTY	JWI PART#	DESCRIPTION	UNIT PRICE
1	1	10860000	Extruder Housing	1000.00
2	1	10481000	Hub Assembly(items 8-16)	629.00
3	2	10353808	Bearing, Painted	99.00
4	2	10853601	Seal Plate, .1250	37.00
5	2	10855600	Seal Plate, .2500	22.00
6	2	10856300	Seal Plate, .0625	37.00
7	4	10854500	Spacer Plate	10.00
8	1	10479900	Hub Weldm't	250.00
9	4	10481200	Hub Arm Backers	5.00
10	4	10481100	Rubber Paddle	6.60
11	4	10480900	Hub Arm	15.00
12	24	10057502	Screw, 5/16-18x3/4 ss	.35
13	24	10038102	Lockwasher, 5/16 ss	.10
14	48	10038302	Flatwasher, 5/16 ss	.10
15	12	10043300	Nut, 5/16 ss	.35
16	12	10057504	Screw, 5/16-18x1.5 ss	.60
17	1	10446801	End Plate	155.00
18	1	10873602	Quick-Release Screen Ass'y	410.00

MAINTENANCE PARTS

10873602	Extruder Screen, 42% open	145.00
10936701	Packing Felt, .38" x 10'	15.00
10707403	Gasket, Closed Cell .125"x1"x10'	16.00
10809501	Clamp (Extruder Screen)	39.20

120 - 180 J-MATE® SCRUBBER

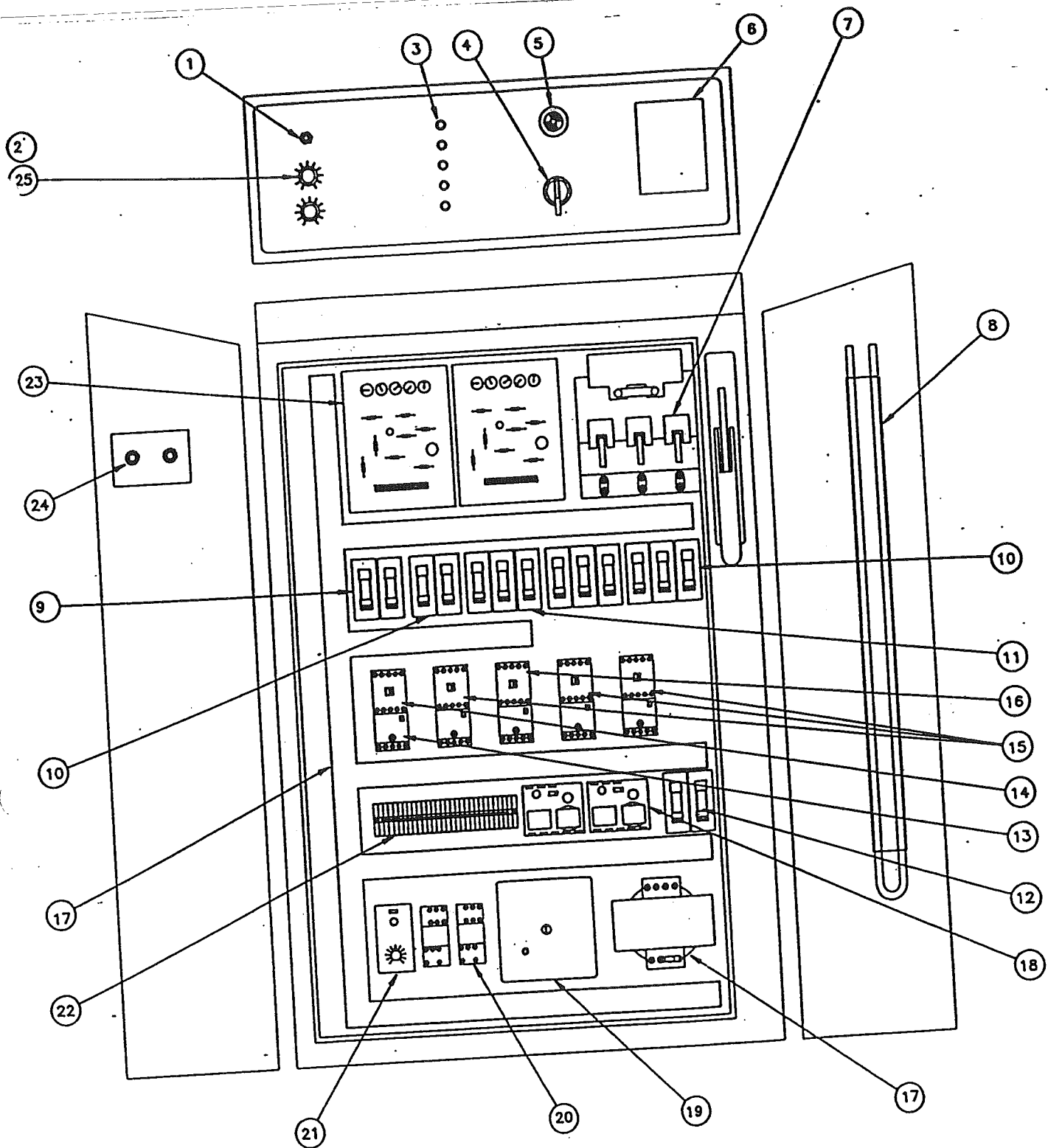


120 - 180 J-MATE® SCRUBBER

ITEM	QTY.	PART NO.	DESCRIPTION	PRICE
1	1	10922801	COMPLETE SCRUBBER JW200S	\$ 4800.00
2	1	10489400	MOTOR 1hp 3ph 3450rpm	225.00
3	1	10574200	BLOWER HOUSING (TOP)	200.00
	1	10472200	BLOWER HOUSING (BOTTOM)	200.00
4	1	10504100	BLOWER WHEEL 11½"	200.00
5	1	10364700	MANOMETER	30.00
6	1	10449899	DOUBLE TAP BUSHING	10.00
7	1	10414821	NIPPLE SS .125 X 2.00	3.50
8	1	10415003	SPRAY NOZZLE	35.00
9	1	10574804	BUSHING REDUCER .50 X .125	8.50
10	1	10414804	NIPPLE 2" X 12" SS	45.00
11	2	10502400	PLUG 2" CPVC	12.50
12	2	10502600	TEE 2" CPVC	22.50
13	1	10502301	NIPPLE 2" X 5" CPVC	8.25
14	1	10502301	NIPPLE 2" X 5" CPVC	8.25
15	1	10502500	BUSHING 2" X ½" CPVC	14.25
16	1	10026809	NIPPLE ½" X 8" PVC	1.30
17	1	10504200	TEMPERATURE GAUGE	86.50
18	1	10371803	RUBBER COUPLING	40.00
19	1	10361000	THERMOCOUPLE	125.00
20	1	10364600	COMPRESSION FITTING	18.50
21	1	10046501	WATER FITTING	8.25

J-MATE® J-120/180 GAS, CONTROL PANEL

ITEM	QTY	JWI PART#	DESCRIPTION	UNIT PRICE
1	1	10474101	Start/Stop/Cool-Down Switch	20.00
2	1	10475100	Knob	4.00
3	5	10475000	Indicator Lights	5.25
4	1	10241400	Dump Lift Switch	90.75
5	1	10238500	On/Emergency Off Switch	143.00
6	1	10396901	Overlay	36.50
7	1	10490200	Power Disconnect	343.00
8	1	10364700	Manometer	18.25
9	2	10239918	Fuse, FRN-R-3	7.75
10	8	10239923	Fuse, FRN-R-5	7.75
11	3	10239917	Fuse, FRN-R-2.5	8.50
12	2	10239904	Fuse, FRN-R-2	7.75
13	5	10503300	Motor Contactors	38.10
14	1	10503301	Relay, CT4-1.8A	44.25
15	3	10503302	Relay, CT4-4A	44.20
16	1	10503303	Relay, CT4-6A	41.30
17	1	10356001	Transformer	169.00
18	2	10355450	Temp. Control	65.00
19	1	10591905	Fireye Control	545.00
20	2	10023203	Relay Switch	14.85
21	1	10320200	Timer	172.00
22	30	10355700	Terminal Blocks	2.95
23	2	10609301	D.C. Motor Control Board	147.00
24	2	10474100	Toggle Switch, Motor Direction	11.85
25	2	10609303	Potentiometer	5.35



J-120/180 GAS CONTROL PANEL

J-MATE® GAS TRAIN & BURNER LAYOUT - 120

ITEM	QTY	JWI PART#	DESCRIPTION	UNIT PRICE
1	1	10431000	120 Manifold	135.00
2	10	10500601	¾ Copper Flare Fitting	8.50
3	5	10474200	Burner, Infra-red	412.50
4	10	10500701	¾ Copper Flare Nut	4.30
5	3	10012505	¾ Plug	2.00
6	1	10489500	Cooling Blower	133.00

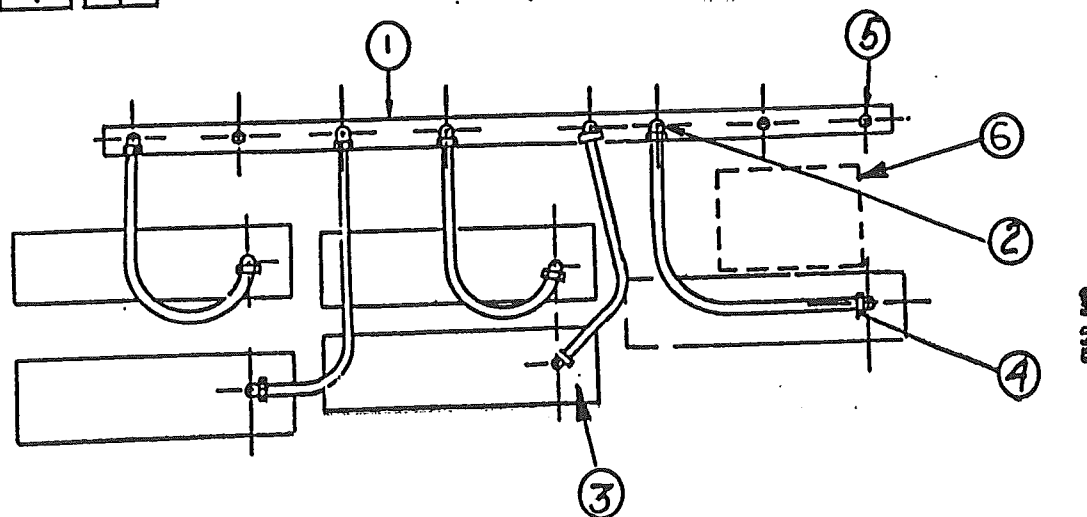
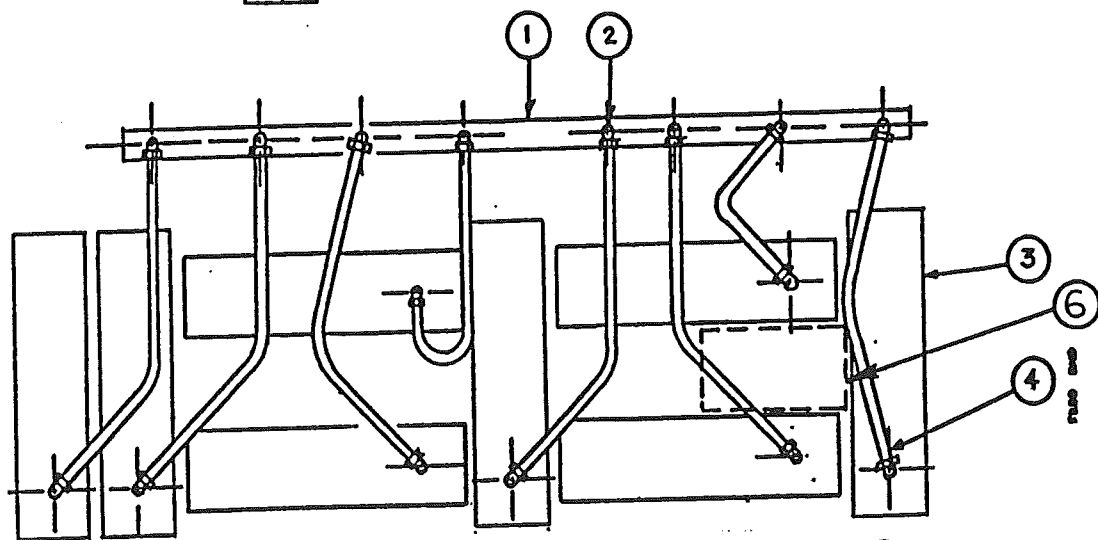
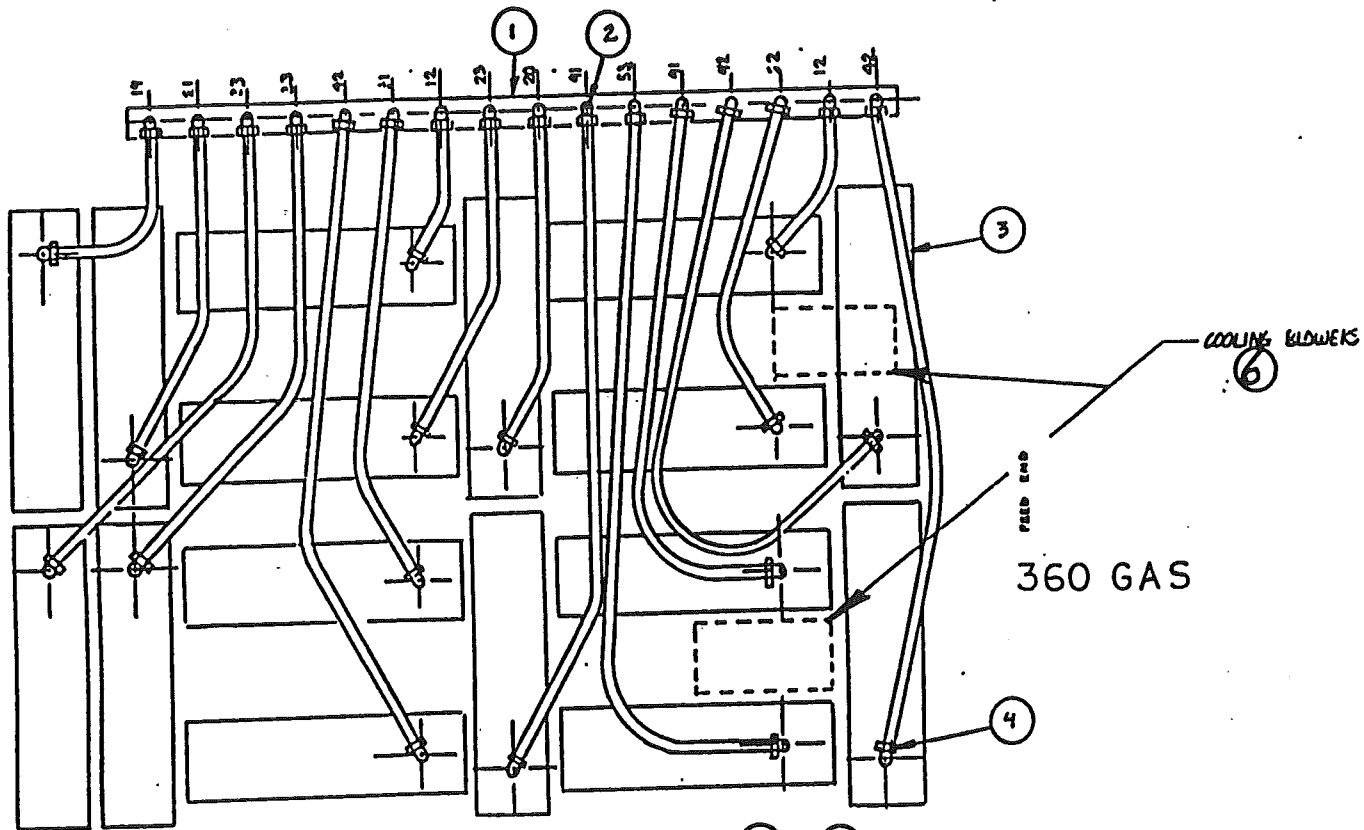
J-MATE® GAS TRAIN & BURNER LAYOUT - 180

ITEM	QTY	JWI PART#	DESCRIPTION	UNIT PRICE
1	1	10431000	180 Manifold	135.00
2	16	10500601	¾ Copper Flare Fitting	8.50
3	8	10474200	Burner, Inra-red	412.50
4	16	10500701	¾ Copper Flare Nut	4.30
6	1	10489500	Cooling Blower	133.00

J-MATE® GAS TRAIN & BURNER LAYOUT - 360

ITEM	QTY	JWI PART#	DESCRIPTION	UNIT PRICE
1	1	10480700	360 Manifold	170.00
2	32	10500601	¾ Copper Flare Fitting	8.50
3	16	10474200	Burner, Infra-red	412.50
4	32	10500701	¾ Copper Flare Nut	4.30
6	2	10489500	Cooling Blower	133.00

GAS TRAIN + BURNER LAYOUT



J - M A T E Q U E S T I O N S & A N S W E R S

1. Q: How is gas air mixture set and where, and at what should it be set?

A: Maximum gas air mixture is set at factory at Model 120G - 150,000 BTU/hr., Model 180G - 240,000 BTU/hr.

Gas mixture is set by cubic feet of gas through a multi-flo mixer.

B: Air is set at flow mixer at a ratio of 10:1 air:gas to achieve an air-gas mixture for proper combustion.
2. Q: How and what are the air switches set at?

A: Set air switches with a screwdriver with light across switch with blowers running.

Gas air blower switch: 12 inches.
Scrubber blower switch: 1 inch.
3. Q: What are the gas pressure safety switch settings?

A: 28-inch WC - high gas cut out.
8-inch WC - low gas cut out.
4. Q: How many burners are in the unit?

A: Model 120G - Five (5), 25,000 BTU burners.
Model 180G - Eight (8), 25,000 BTU burners.
5. Q: What is the high-heat, cut-out temperature and where is it monitored?

A: Before scrubber: 650° - 750° F.
After scrubber: 230° F.

Monitored at scrubber exhaust duct with controller after scrubber with Thermologic.

6. Q: Where is the flame rod or UV Scanner located?

A: Half-way down right side of the unit next to the scrubber.

7. Q: What is the minimum required DC voltage from UV scanner?

A: 4 to 5 DCV UV scanner. Refer to fireye component sheet.

8. Q: Where are the igniters located?

A: At the first burners, extruder end.

9. Q: What gas pressure should be supplied?

A: 10-inch WC minimum 24-inch WC maximum with enough volume to maintain proper BTU's.

10. Q: What water pressure should be supplied?

A: 45-55 PSI regulated.

11. Q: How is the conveyor chain adjusted? How much deflection?

A: Conveyor chain is adjusted at the extruder end with conveyor take-up adjusters.

Adjust to eliminate slack between conveyor sprocket and drag pan; conveyor chain must be "cold", i.e. before adjusting chain.

HOW TO PROGRAM YOUR MEC - MGC CONTROLLER

(OPTIONAL ON 120G & 180G MODEL)

Go to control mode by depressing scroll key until ctrl is displayed.

Press down arrow to access set point review indicated by green light at side of LED. Once set point review has been reached, desired set point may be entered by pressing down or up arrows holding longer than two seconds. This will increase or decrease the setpoint respectively. The longer the key is held the faster it will change.

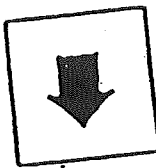
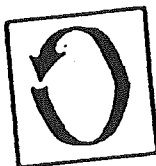
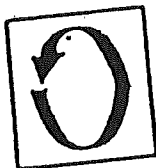
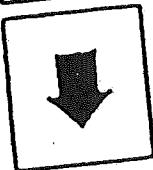
Go to tune mode by depressing scroll key repeatedly until tune appears.

Press down arrow to access parameter codes. The first parameter code is PAL in tune mode.

Press scroll again for setting of PAL.

Other parameters and parameter settings can be accessed by pressing scroll key once for each parameter or setting.

Settings may be altered by pressing up or down arrow for longer than two seconds. This will increase or decrease.



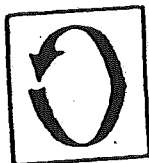
Enter the following settings to parameter in tune mode.

<u>PARAMETERS</u>	<u>SETTINGS</u>
SPrd	0
PAL	750
dAL	N/A
dbAL	N/A
Pb 1	875
Pb 2	50
rSET	0
ArSt	0.0
rAtE	0.0
- Ct 1	N/A
Ct 2	N/A
SEns	N/A
FoP	-600 deg. F

FoP of -600 deg. F is the start point only, the same as 0 starting point. If unit is overheating enter more -FoP, if unit is controlling under set point enter setting of decrease negative FoP or +FoP.



Go to program (ProG) mode by first pressing up arrow. Make sure you are in a parameter first.

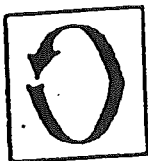


Press scroll key repeatedly until program mode is reached.



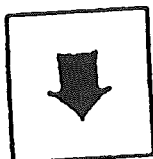
Press down arrow to access parameter codes in program mode. The first parameter in program mode is inPS.

Press scroll for setting of inPS.



Other parameters and settings can be reached by pressing scroll key once for each.

Now enter the following setting for program parameter codes.



Settings may be changed by pressing up or down arrows for longer than two seconds. This will increase or decrease the setting respectively.

Enter the following settings to parameters in program mode.

<u>PARAMETERS</u>	<u>SETTINGS</u>
InPs	3
Icor	0
out 1	5
o1PL	100
out 2	6
o2PL	100
out 3	1
rLyA	3
rLyb	0
rLyC	3
dISP	2
dPOS	0
Euu	N/A
EuL	N/A
HySt	0
rSP	N/A
rSPu	N/A
rSPL	N/A
SPL	800
AtFr	0
PFF	1

<u>PARAMETERS</u>	<u>SETTINGS</u>
dFF	1
FScn	N/A
Prnd	N/A
Colr	N/A
Co2r	N/A
Pout	N/A
Pou	N/A
Pol	N/A
SPrr	N/A
CCon	N/A
CbS	N/A
CAd	N/A

J - M A T E T R O U B L E S H O O T I N G

P O S S I B L E C A U S E

S O L U T I O N

' P R O B L E M

Dust coming out of the scrubber.

1. Not enough water flow to the scrubber.
2. Nozzle is plugged..

1. Increase water flow.
2. Unplug nozzle.

Extruder will not run.

1. Check fuses.
2. NO signal from controller.
3. Lid limit not made.
4. No power to contactor.

1. Replace as specified.
2. Check programming.
3. Shut lid or adjust limit switch.
4. Check circuit.

Conveyor will not run.

1. Check fuses.
2. Conveyor speed set too low.
3. Defective timer relay.
4. No power to contractor.

1. Replace as specified.
2. Increase conveyor speed.
3. Replace defective part.
4. Check circuit.

Gas Blower or scrubber blower will not run.

1. Check Fuses.
2. No power to relay.
3. Defective time relay.

1. Replace as specified.
2. Check circuit.
3. Replace.

J - M A T E T R O U B L E S H O O T I N G

S O L U T I O N

P O S S I B L E C A U S E

' P R O B L E M

Unit will not
purge

1. Gas not on.
2. Air switch not made.

3. Gas switch not made.
4. Defect in fireye control.
5. Bad timing card in fire eye solution.

Unit will not
light.

1. Ignitor out of adjustment.
2. Ignitor ceramic insulator cracked.
3. Ignitor grounding out.
4. Ignitor wire shorting out.
5. No power to ignitor transformer.

Gas burners will
not stay lit.

1. Incorrect gas pressure.
2. UV scanner out of adjustment.
3. Lens on scanner dirty.

Unit shuts down on
high temperature.

1. No material or not enough.

Motors running
reverse.

Water blowing out of
scrubber.

2. Too high of set point.
3. No water to scrubber.
4. Extruder screen plugged.
1. Leads reversed.
2. New Style Switch.
1. Plugged drain line.
2. No water in trap.
3. Too much air flow through.

1. Turn on gas supply.
2. Check setting; reset to 2".
3. If correct, check blower rotation.

4. Check gas pressure.
5. Check fireye circuit.
6. Replace timing card.

1. Adjust ignitor 1/4" from reverb screen on burner, see diagram.
2. Replace ignitor.

3. Adjust/remove foreign object.
4. Replace ignitor wire.
5. Trace electrical circuit.

1. Re-adjust gas pressure.
2. Fireye manual component data section.
3. Clean lens.

1. Make sure material is supplied and extruder is operating.

2. Set point not to exceed 650 F.
3. Check water supply.
4. Remove screen and clean.
1. Re-connect leads for proper rotation.

2. Change position of switch.
1. Remove restriction.
2. With unit off, pour water in vent near trap.
3. Check water supply to scrubber and correct pressure drop.

Enable Mode Configuration Procedures

Step	Description	Display Code	Procedure	Factory Setting	Your Setting
A	Mode Select	"EnAb"	Display will change to "EtSt" when the keys are released.	"OFF"	"OFF"
B	Test Mode	"EtSt"	Depressing the Scroll key will review the condition of the test mode.	"OFF"	"OFF"
C	Calibration Mode	"ECAL"	Depress the Scroll key to review the condition of the Calibration mode.	"on"	"OFF"
D	Program Mode	"EPro"	Depress the Scroll key to review the condition of the Program Mode. Use the Down key to change the display to "oFF" (disabled). Use the Scroll key to review the tune mode.	"on"	"on"
E	Tune Mode	"Etun"	Depress the Scroll key to review the condition of the Tune Mode. Use the Down key to change the display to "oFF" (disabled). Use the Scroll key to review the Standby Mode.	"on"	"OFF"
F	Standby Mode	"ESbY"	Depress the Scroll key to review the condition of the Standby Mode. Use the Down key to change the display to "oFF" (disabled). Use the Scroll key to review the Setpoint Select mode.	"on"	"OFF"
G	Setpoint Select Mode	"SPS"	Depress the Scroll key to review status of mode. Use Up key to change display to "on". Use Scroll to review next mode.	"on"	"OFF"
H	Setpoint Changes	"ESPC"	Depress the Scroll key to review the condition Setpoint Changes. Use the Down key to change the display to "oFF" (disabled). Use the Scroll key to return to the beginning of the Enable Mode. If all selections have been made, depress the Up key with "EtSt" displayed to exit the Enable Mode. Highlighted areas will show the reason for setting.	"on"	"on"

Step	Description	Display Code	Procedure	Factory Setting	Your Setting
A	Mode Select	"Prog"	Use the Down key to enter the Program mode.	1	3
B	Input Select	"InPS"	Depress the Scroll key to view the Input Select setting, or use the Down key to proceed to the next parameter. Use the Up and Down keys to select the desired code as shown below: 0 = J T/C DEGREES C 11 = E T/C DEGREES F 1 = J T/C DEGREES F 12 = B T/C DEGREES C 2 = K T/C DEGREES C 13 = B T/C DEGREES F 3 = K T/C DEGREES F 14 = N T/C DEGREES C 4 = T T/C DEGREES C 15 = N T/C DEGREES F 5 = T T/C DEGREES F 16 = C T/C DEGREES C 6 = R T/C DEGREES C 17 = C T/C DEGREES F 7 = R T/C DEGREES F 20 = RTD DEGREES C 8 = S T/C DEGREES C 21 = RTD DEGREES F 9 = S T/C DEGREES F 30 = 0 TO 5 Vdc 10 = E T/C DEGREES C 31 = 1 TO 5 Vdc 32 = 0 TO 50 mVdc 33 = 10 to 50 mVdc 34 = 0 to 25 mVdc	0	0
C	Input Correction	"ICor"	Depress the Scroll key to view the setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; -300 to 300 units (-100 to 100 units on older models) Depress the Scroll key to proceed to the next parameter.		

Step	Description	Display Code	Procedure	Factory Setting	Your Setting
D	Output 1	"out1"	Depress the Scroll key to view the Output 1 setting, or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired code as shown below. 0 = None 1 = On-Off Direct 2 = On-Off Reverse 3 = Time Proportioning Direct 4 = Time Proportioning Reverse 5 = Current Proportioning Direct 6 = Current Proportioning Reverse 7 = Position Proportioning (Open) 8 = Position Proportioning * Direct 9 = On-Off Latched * Reverse (* Relays latch in the open position) Depress the Scroll key to proceed to the next parameter. Depress the Scroll key to view the setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; 0 to 100%. Depress the Scroll key to proceed to the next parameter.	1	5
E	Output 1 Percent Limit	"o1PL"	Depress the Scroll key to view the Output 2 setting, or use the Down key to proceed to the next parameter. Depress the Scroll key to view the setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired code as shown below: 0 = None (Position Proportioning Direct - Closed) 1 = On-Off Direct 2 = On-Off Reverse 3 = Time Proportioning Direct 4 = Time Proportioning Reverse 5 = Current Proportioning Direct 6 = Current Proportioning Reverse 7 = Position Proportioning Reverse Closed Depress the Scroll key to proceed to the next parameter.	100	100
F	Output 2	"out2"		0	0

Step	Description	Display Code	Procedure	Factory Setting	Your Setting
G	Output 2 Percent Limit	"o2PL"	Depress the Scroll key to view the setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; 0 to 100%. Depress the Scroll key to proceed to the next parameter.	100	0
H	Output 3 or Alarm	"out3"	Depress the Scroll key to view the output 3 setting, or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired code as shown below: 0 = None 1 = Process Alarm Direct 2 = Process Alarm Reverse 3 = Deviation Alarm Direct 4 = Deviation Alarm Reverse 5 = Deviation Band Alarm Open Within Band 6 = Deviation Band Alarm Closed Within Band Depress the Scroll key to proceed to the next parameter.	0	1
I	Relay A Assignment	"rLyA"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired code as shown below: 0 = Not assigned 1 = Assigned to Output 1 2 = Assigned to Output 2 3 = Assigned to Output 3 Depress the Scroll key to proceed to the next parameter.	1	0
J	Relay B Assignment	"rLyb"	Same as Relay A selection	2	0
K	Relay C Assignment	"rLyC"	Same as Relay A selection	3	3

Step	Description	Display Code	Procedure	Factory Setting	Your Setting
L	Display Select	"dISP"	Depress the Scroll key to view the Display setting, or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired code as shown below: 1 = Process value only 2 = Process value/Setpoint 3 = Deviation only 4 = Deviation and Setpoint 5 = Setpoint only Depress the Scroll key to proceed to the next parameter.	1	2
M	Decimal Position	"dPoS"	Depress the Scroll key to view the Decimal setting, or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired code as shown below. 0 = None 1 = One Decimal point 2 = Two 3 = Three <i>RTD and Thermocouple inputs are limited to either 0 or 1 decimal place.</i> Depress the Scroll key to proceed to the next parameter.	0	2
N	Engineering Units Upper Value	"EuU"	Depress the Scroll key to view the setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; -9999 to 9999 units. Depress the Scroll key to proceed to the next parameter.	1000	
O	Engineering Units Lower Value	"EuL"	Depress the Scroll key to view the setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; -9999 to 9999 units. Depress the Scroll key to proceed to the next parameter.	0	

Step	Description	Display Code	Procedure	Factory Setting	Your Setting
P	Hysteresis for On-Off outputs	"HySt"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; 0 to 300 units Width of Hysteresis Band. Depress the Scroll key to proceed to the next parameter.	3	0
Q	Remote Setpoint	"rSP"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired code; 0 = None 1 = 1 to 5Vdc 2 = 0 to 5Vcd 3 = Contact Closure Sensing for SP=Pv (EA option)	0	
R	Remote Setpoint Upper Value	"rSPu"	Depress the Scroll key to proceed to the next parameter. Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; -9999 to 9999 units. Depress the Scroll key to proceed to the next parameter.	1400	
S	Remote Setpoint Lower Value	"rSPL"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; -9999 to 9999 units. Depress the Scroll key to proceed to the next parameter.	0	
T	Setpoint Upper Limit	"SPL"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; -9999 to 9999 units. Depress the Scroll key to proceed to the next parameter.	1400	700

Step	Description	Display Code	Procedure	Factory Setting	Your Setting
U	Automatic Transfer	"ATF"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired code; 0 = No Auto Transfer 1 = Transfer when the process goes below the setpoint 2 = Transfer when the process goes above the setpoint. Depress the Scroll key to proceed to the next parameter.	0	0
V	Process Filter Factor	"PFF"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; 1 to 20 (Number of scans averaged) 1 = No filtering Depress the Scroll key to proceed to the next parameter.	1	1
W	Display Filter Factor	"dFF"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; 1 to 20 (Number of scans averaged) 1 = No filtering Depress the Scroll key to proceed to the next parameter.	1	1

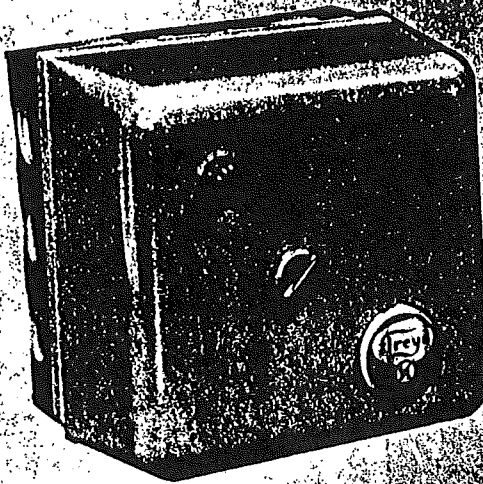
Step	Description	Display Code	Procedure	Factory Setting	Your Setting
A	Mode Select	"tune"	Use the Down key to enter the Tune Mode.		
B	Spread (Second Output Position)	"Sprd"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; -1000 to 1000 units Depress the Scroll key to proceed to the next parameter.	0	
C	Process Alarm Alarm type shown is dependent upon setup in Program mode of "out3".	"PAL"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; -9999 to 9999 Depress the Scroll key to proceed to the next parameter.	0	700°
D	Deviation Alarm 1	"dAL"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; -3000 to 3000 units. Depress the Scroll key to proceed to the next parameter.	0	
E	Deviation Band Alarm Alarm type shown is dependent upon configuration in Program mode of "out3"	"dbAL"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; 1 to 3000 units Depress the Scroll key to proceed to the next parameter.	1	
F	Proportional band Output 1	"Pb1"	Depress the Scroll key to view the current setting or use the down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; 1 to 3000 units Depress the Scroll key to proceed to the next parameter.	100	875

Step	Description	Display Code	Procedure	Factory Setting	Your Setting
G	Proportional Band Output 2	"Pb2"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; 1 to 3000 units Depress the Scroll key to proceed to the next parameter.	100	
H	Manual Reset	"rSEt"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; -1500 to 1500 units Depress the Scroll key to proceed to the next parameter.	0	
I	Automatic Reset	"ArSt"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; 0.0 to 100.0 Repeats per minute Depress the Scroll key to proceed to the next parameter.	0.0	
J	Rate	"rAtE"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; 0.0 to 10.0 minutes Depress the Scroll key to proceed to the next parameter.	0.0	
K	Cycle Time Output 1 This parameter is also used to input rotation time for Position Proportioning Control	"Ct1"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; 1 to 240 seconds Depress the Scroll key to proceed to the next parameter.	30	

Step	Description	Display Code	Procedure	Factory Setting	Your Setting
L	Cycle Time Output 2	"Ct2"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; 1 to 240 seconds Depress the Scroll key to proceed to the next parameter.	30	
M	Position Proportioning Sensitivity	"SEnS"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; 0 to 50.0% Depress the Scroll key to proceed to the next parameter.	1.0	
N	First Output Position	"FOP"	Depress the Scroll key to view the current setting or use the Down key to proceed to the next parameter. Use the Up and Down keys to enter in the desired value; -1000 to 1000 units. Depress the Scroll key to proceed to the next parameter.	0	0 to start with.



UVM and TFM Flame Safeguard Controls



Fireye M Series Controls



45CM1 Photocell

69ND1 Flame Rod



UV-1A



UV8A

UV-2

UV SCANNERS

DESCRIPTION

Fireye UVM and TFM Controls provide automatic ignition and flame safeguard control for commercial sizes of heating and process burners using gas and/or light oil fuels.

Flame monitoring is accomplished by miniature UV scanners with UVM units or Flame Rod/Photocell detectors with TFM units.

M Series Models provide five basic styles of function: RELIGHT (M1), RECYCLE with prepurge (M2), NON-RECYCLE with prepurge (M3), NON-RECYCLE with prepurge and two stage capability (M3H), NON-RECYCLE with prepurge, two stage capability and pilot cutoff (M5). The controls monitor both pilot and main flames and with pilot ignited burners prevent the main fuel valve from being energized until the pilot flame is proved. With spark ignited burners, trial for ignition of the main flame is safely limited to 10 seconds, STD (4 seconds available M2, M3, M3H, M5 Units.)

Plug-in purge timer cards for use with M2, M3, M3H and M5 provide selectable 7-30-60-90 second prepurge. A circuit is provided, for an air flow switch to prove air flow during the prepurge and throughout the entire firing cycle.

In the event of ignition failure, or following a safety shutdown, the lockout switch trips, activating an alarm circuit. Manual reset is required. A detailed description of each control's function may be found on Pages 8 and 9. Test jacks are provided to permit flame signal measurement during operation.

M Series 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 the purge, the fuel valves will not be energized, and the unit will lockout.

CAUTION: While all controls in the M Series are mechanically interchangeable in that they mate with a common wiring base, you should select the correct model for your application. Inappropriate application of a control could result in an unsafe condition hazardous to life and property. Selection of a control for a particular application should be made by a competent professional, such as a boiler/burner service technician licensed by a state or other governmental agency.

SPECIFICATIONS

Supply:

120V (min. 102, max. 132) 50/60 Hz.

Ambient Temperature Limits:

	Max.	Min.
Control UVM-TFM	125F	-40F
Scanner UV1A, UV2, UV8A, 45UV3	200F	-40F
Photocell 45CM1	165F	-40F
Flame Rod (Tip 2460F)	1500F	-40F

Flame Failure Response Time

UVMID-TFMID	8 seconds maximum
All other Units	4 seconds maximum
Trial for Ignition	10 seconds STD (4 Seconds Available M2, M3, M3H, M5 Units)

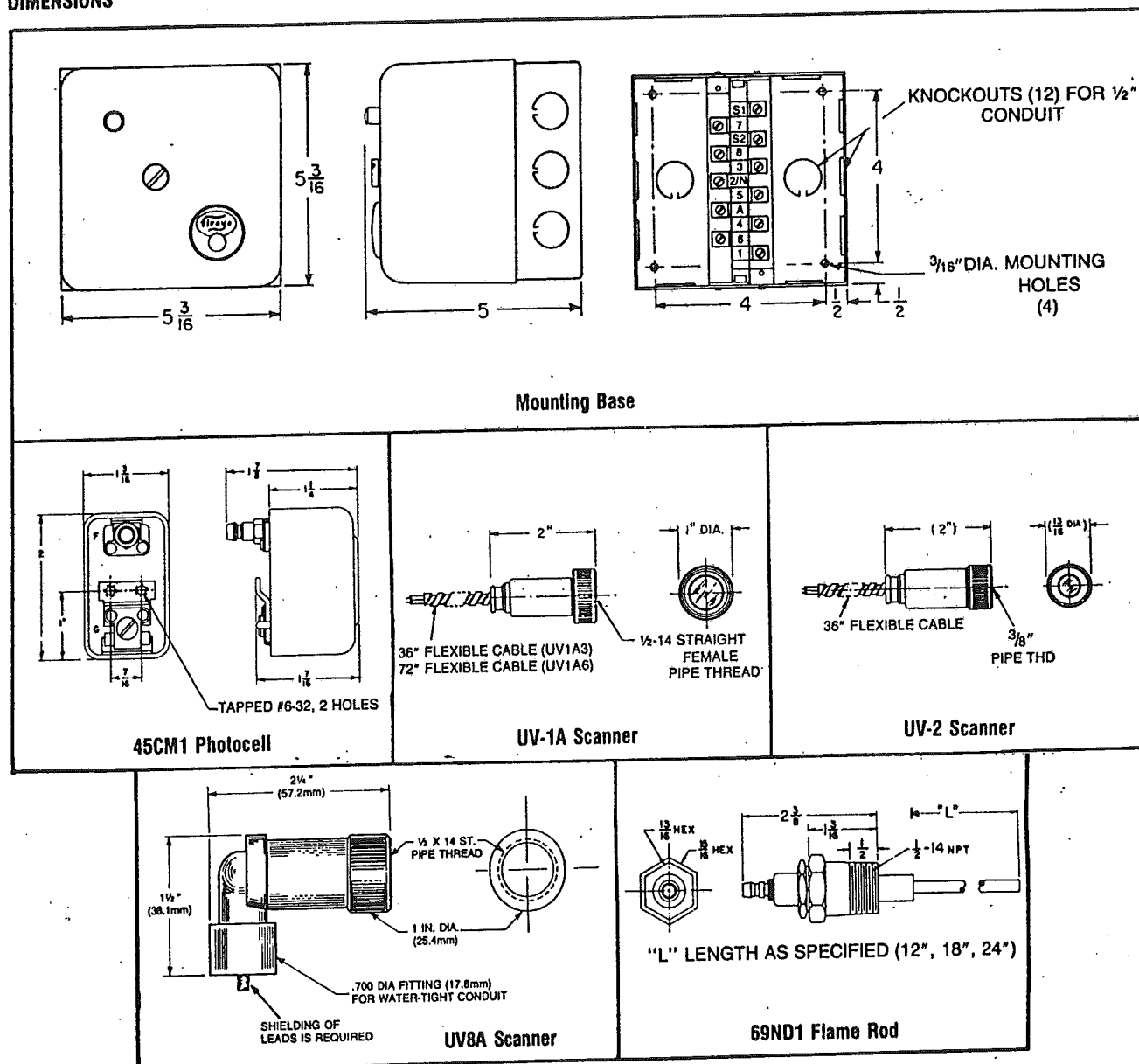
Power Consumption
5.4VA (Operating)

Shipping Weight (Approx.)
5 lbs.

LOAD RATINGS

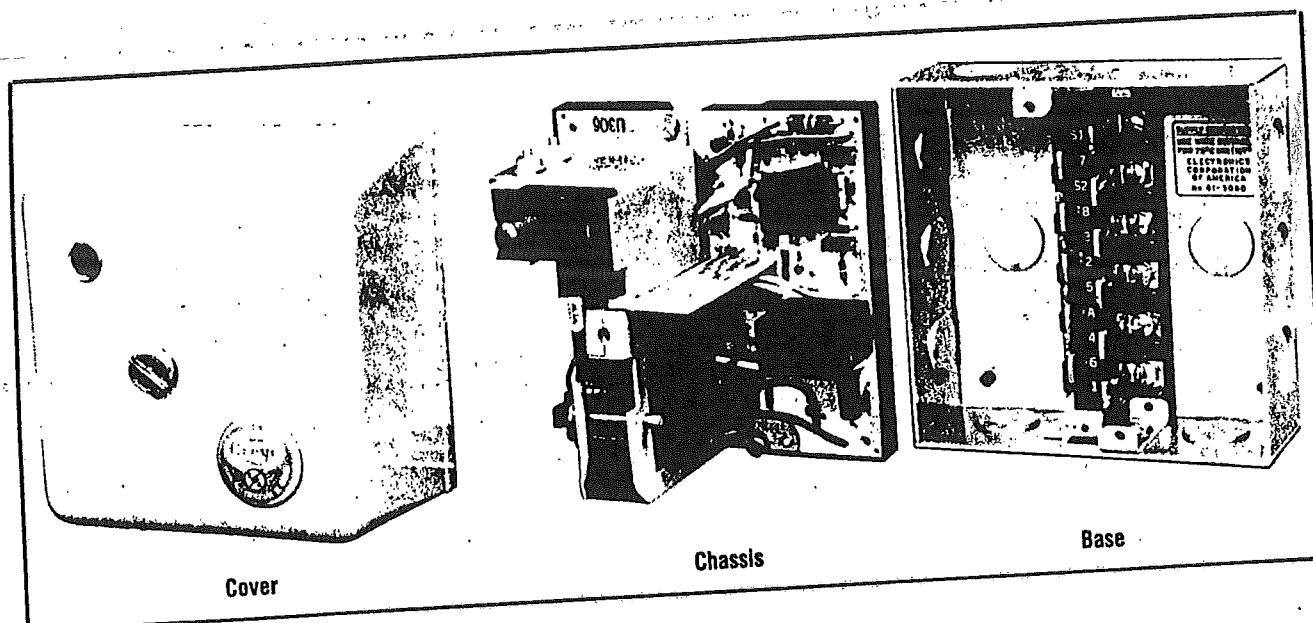
Fireye Terminal	Typical Load	Maximum Rating at 120V 60 HZ
3	Solenoid valve, ignition transformer	125 VA pilot duty plus 250VA
4	Ignition transformer	250VA
5	Main fuel valve(s)	125VA pilot duty (solenoid) or 25VA pilot duty (solenoid) and 400VA (opening) motorized
8	Motor or contactor	Motor normally energized and deenergized by the operating control whose rating must be suitable. Terminal 8 rated to de-energize 9.8 FLA, 58.8 LRA, on safety lockout.
A	Alarm	50VA, pilot duty

FIREFYE PRODUCTS

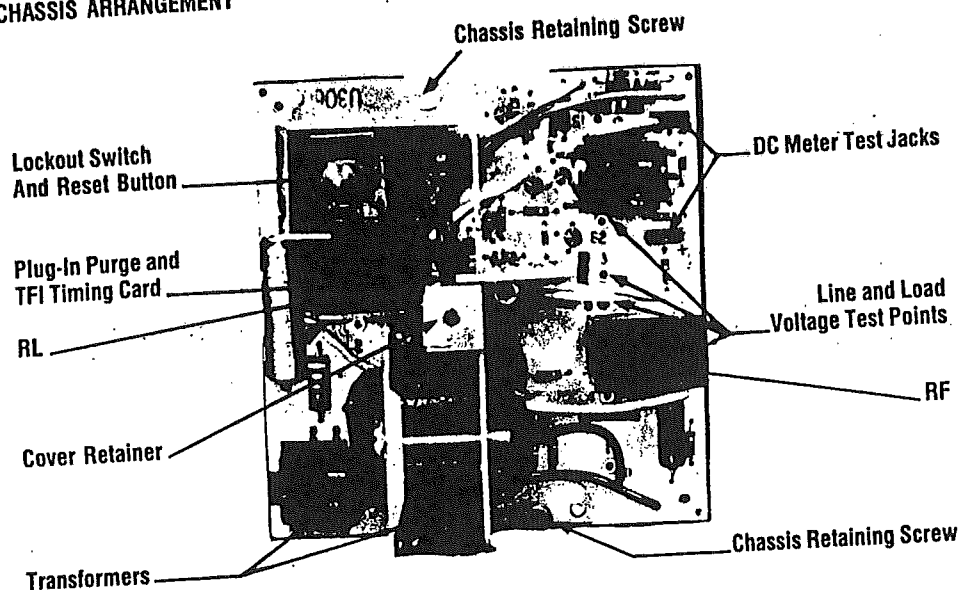


ORDERING INFORMATION

UV SYSTEM	RECTIFICATION SYSTEM
Control UVM1D or UVM1F (Relight) UVM2 (Recycle) UVM3 or UVM3H (Non-recycle)	Control TFM1D or TFM1F (Relight) TFM2 (Recycle) TFM3 or TFM3H (Non-recycle)
Purge Timing Card for M2, M3 or M5 MT 55 (5 second purge, 5 second trial for ignition) MT 74 (7 second purge, 4 second trial for ignition) MT 304 (30 second purge, 4 second trial for ignition) MT 710 (7 second purge, 10 second trial for ignition) MT 904 (90 second purge, 4 second trial for ignition) MT 3010 (30 second purge, 10 second trial for ignition) MT 6010 (60 second purge, 10 second trial for ignition) MT 9010 (90 second purge, 10 second trial for ignition)	Purge Timing Card for M2 or M3 MT 55 (5 second purge, 5 second trial for ignition) MT 74 (7 second purge, 4 second trial for ignition) MT 304 (30 second purge, 4 second trial for ignition) MT 710 (7 second purge, 10 second trial for ignition) MT 904 (90 second purge, 4 second trial for ignition) MT 3010 (30 second purge, 10 second trial for ignition) MT 6010 (60 second purge, 10 second trial for ignition) MT 9010 (90 second purge, 10 second trial for ignition)
UV Scanner UV1A3 - ½" mount, 3' cable UV1A6 - ½" mount, 6' cable UV8A- 1/2" mount 6' unshielded cable UV2 - ¾" mount, 3' cable 45UV3-1050 - ¾" mount, cast alum. housing, 8'	Flame Detectors 45CM1-1000 Photocell with filter 45CM1-1000Y Photocell without filter 69ND1-1000K4 12" Flame Rod 69ND1-1000K6 18" Flame Rod 69ND1-1000K8 24" Flame Rod
Wiring Base 61-3060	Wiring Base 61-3060



M2, M3, M3H, M5 CHASSIS ARRANGEMENT



INSTALLATION—CONTROLS AND UV-EYE SCANNERS

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

Control

Mount the control base on the burner or on a panel. The location selected 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. Circuit recommendations are provided on Pages 6, 7. Consult the factory for assistance with non-standard applications.

The control chassis is retained on the base with two screws which should be securely tightened.

Caution: Turn off the power when installing or removing the control chassis.

Wiring of UV Scanners

The UV-1A scanner is supplied with 36" or 72" of flexible cable. The UV-2 Scanner is supplied with 36" of flexible cable. If it is necessary to extend the scanner leads, the following instructions apply:

Caution: Scanners without armor cable must be wired using metal cable or conduit.

1. Selection of wire

- Use #14, 16 or 18 wire with 75C, 600 volt insulation for up to 200 foot distance (approximately 20% signal loss at 100 feet, 40% loss at 200 feet.)
- Use shielded wire (Belden 8254-RG-62 Coax Cable or equal) for each scanner wire up to 500 feet (max).
- Asbestos insulated wire should be avoided.
- Multiconductor cable is not recommended without prior factory approval.

2. Installation of extended wiring

- For runs up to 10 feet (max.) the scanner leads may be run in a common conduit with other wires.
- For runs over 10 feet the scanner leads must be installed in a separate conduit.
- Multiconductor cable is not recommended without prior factory approval.

3. Multiple scanner installations

- The wiring from multiple UV scanners may be installed in a common metallic conduit.
- Multiconductor cable is not recommended without prior factory approval.
- High voltage ignition wiring should not be installed in the same conduit with flame detector wires.

UV Scanner Mounting

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

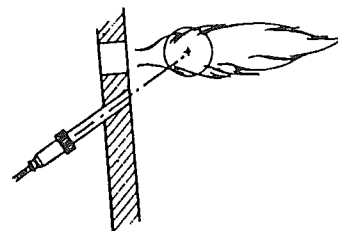
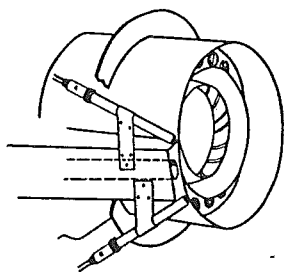
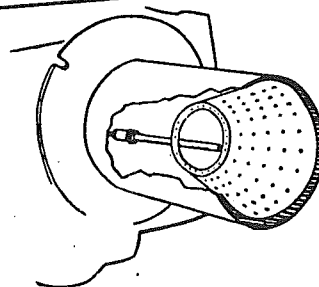
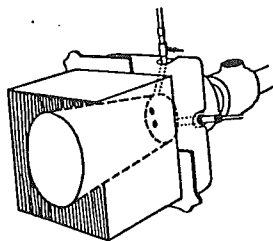
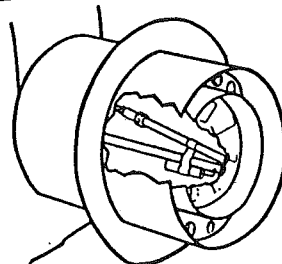
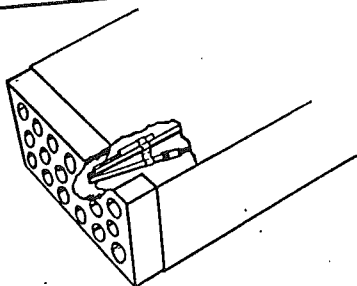
1. Locate the scanner within 18 inches of the flame to be monitored, closer if possible.
2. Select a scanner location that will remain within the ambient temperature limits of the UV-eye scanner (212°F). If cooling is required, use (a) an insulating coupling (Fireye part #35-69) to reduce conducted heat; (b) a window coupling (Fireye part #60-1257) to seal off furnace or burner pressure; (c) cooling air to reduce the scanner sight pipe temperature.
3. Mount rigidly a short length (4" to 8") of 1/2" or 3/8" black iron pipe in a position that permits an unobstructed view of the pilot and/or main flame.
4. **Caution:** The scanner must not sight the spark directly on any part of the burner that can reflect the spark back to the scanner.
5. The maximum UV signal from a flame is found in the first one-third of the visible flame taken from the point where the flame begins. The scanner sight pipe should be aimed at this area.
6. A correct scanner application will not see a pilot flame that is too small to ignite the main flame reliably. Note particularly the test for minimum pilot that is described on Page 9.

7. On installations having negative pressure combustion chambers, a small hole (1/8" or 3/16") drilled in the sight pipe will assist in keeping the pipe clean and free from smoke.
8. Two 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.
9. The UV-eye scanner is designed to seal off the sight pipe up to pressures of 1 psi when the scanner lock nut is firmly tightened. Pressures in excess of 1 psi should be blocked from the scanner. A quartz lens coupling (Part #60-1290) or quartz window coupling (Part #60-1257) may be used. Each is rated from -3 to +100 psi max.
10. To increase scanner sensitivity, a quartz lens coupling (Part #60-1290) may be used. The quartz lens permits location of the UV-eye at twice the distance noted in Item B-1. Use 1/2" x 1 1/2" nipple between UV1A or UV1B scanner and union. Use 3/8" x close nipple and 1/2" by 3/8" bushing on UV-2 applications.

General Requirements

1. As close as possible — 18" or closer.
2. As cool as possible — Not over 212°F.
3. Avoid sighting the spark — Resight scanner, shield between spark and scanner, or orifice to reduce reflected signal from spark.
4. Must see pilot and/or main flame — Scanner view must be unobstructed.
5. Minimum pilot test — See Page 9.

TYPICAL UV-EYE INSTALLATIONS



Select the scanner location (A or B) which gives best view of the pilot flame.

The maximum UV signal from a flame is found in the first one-third of the visible flame taken from the point where the flame begins. The scanner sight pipe should be aimed at this area.

INSTALLATION — PHOTOCCELL SCANNER AND FLAME ROD

Installation—45CM1 Photocell Scanner

The 45CM1 photocell scanner with #922 photocell and Rajah stud terminal is designed for use in the blast tube on conventional pressure atomizing oil burners. Two typical applications are shown in Figure 1.

45CM1 — INTERNAL MOUNT

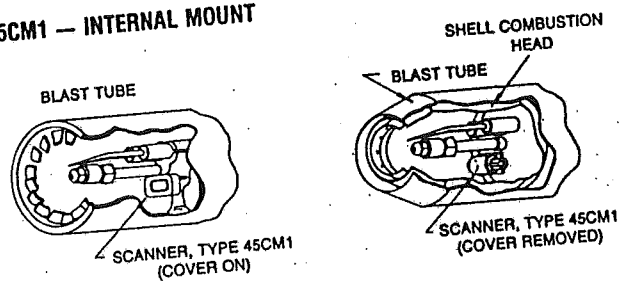


Figure 1

69ND1 Flame Rod

The 69ND1 flame rod proves a gas pilot flame and/or main gas flame.

It is a "spark plug" type unit consisting of a 1/2" N.P.T. mounting base, a KANTHAL flame rod, a glazed porcelain insulating rod holder and a spark plug connector for making electrical connection. The 69ND1 is available in 12", 18" or 24" lengths.

Follow the burner manufacturer's instructions, if available, otherwise, proceed as follows.

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 in a 1/2" N.P.T. coupling. The following instructions should be observed:

1. Keep the 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 half way through.
5. If the flame is partly luminous, the electrode tip should extend only to the edge of 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 pilot 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 minimum meter reading of 14 VDC.

Note: Interference from the ignition spark can alter the true testmeter 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, and may be made ineffective by the addition of grounded shielding between the flame rod and ignition spark.

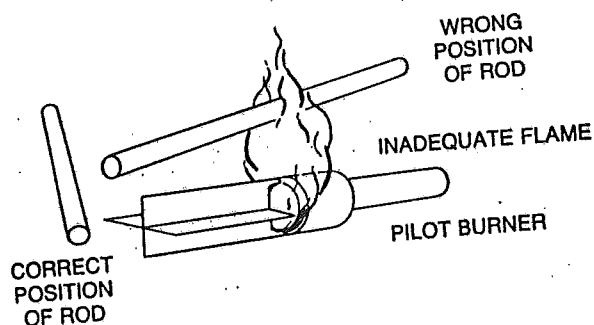


Figure 2

8. Two proven types of flame grounding adapters as shown in Fig. 3 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 flame burner nozzle.

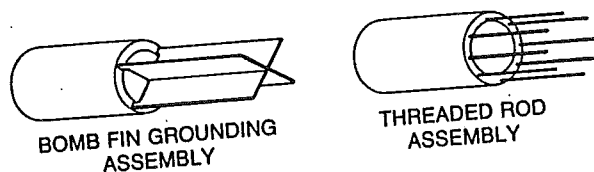


Figure 3

APPROVALS

Underwriters Laboratories Inc.
Listed Guide MCCZ-File MP 1537

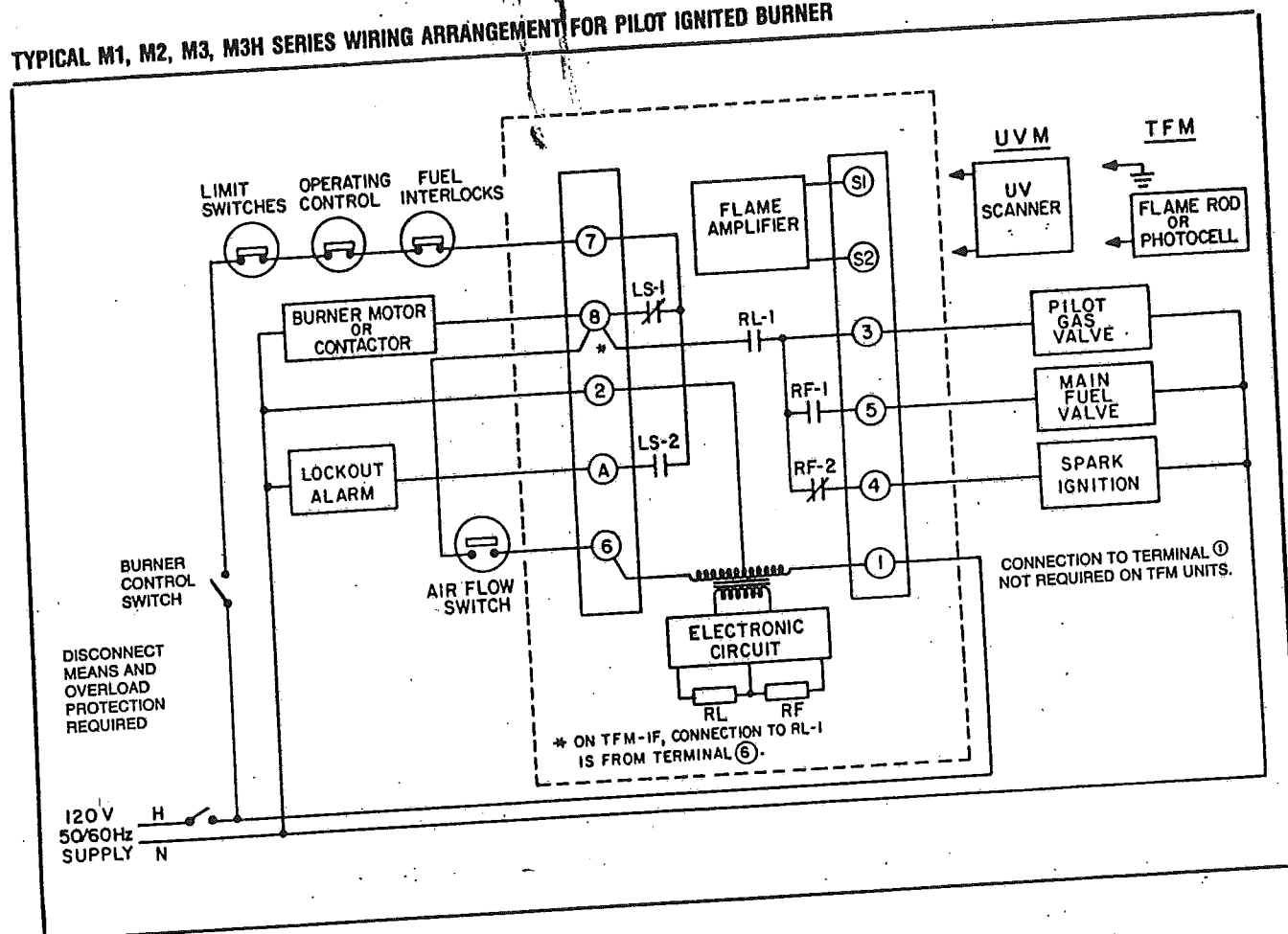
Underwriters Laboratories Inc.
Recognized Component Guide MCCZ-File MP 1537
All UVM and TFM Controls

Canadian Standards Association
Guide 300-1-.2 Class 2642 Oil File 7989
Guide 140-A-2 Class 2632 Gas File 7989
UVM3H-TFM3H

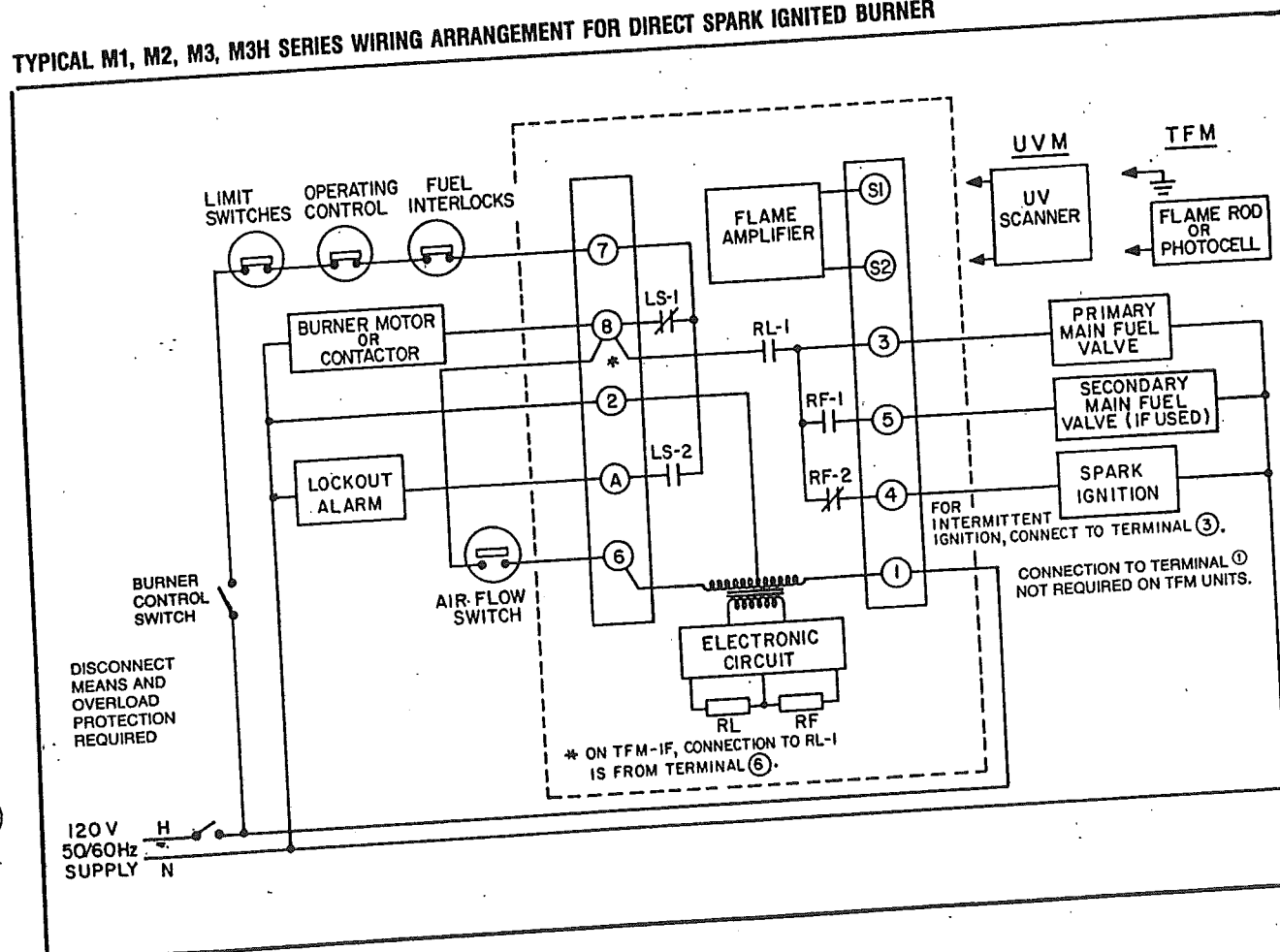
Factory Mutual System
Report #27856
UVM3H-TFM3h

American Gas Association
Certified #20-1A
ANSZ21.20 Automatic Ignition Systems
UVMID, UVM IF
TFMID, TFMIF
TFM3

TYPICAL M1, M2, M3, M3H SERIES WIRING ARRANGEMENT FOR PILOT IGNITED BURNER

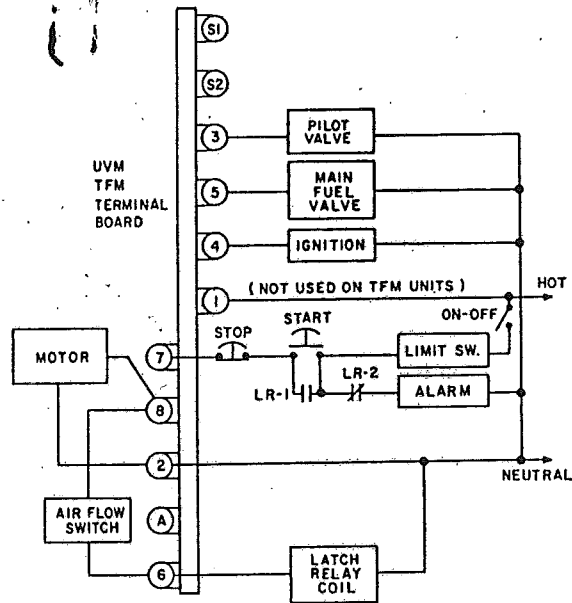


TYPICAL M1, M2, M3, M3H SERIES WIRING ARRANGEMENT FOR DIRECT SPARK IGNITED BURNER

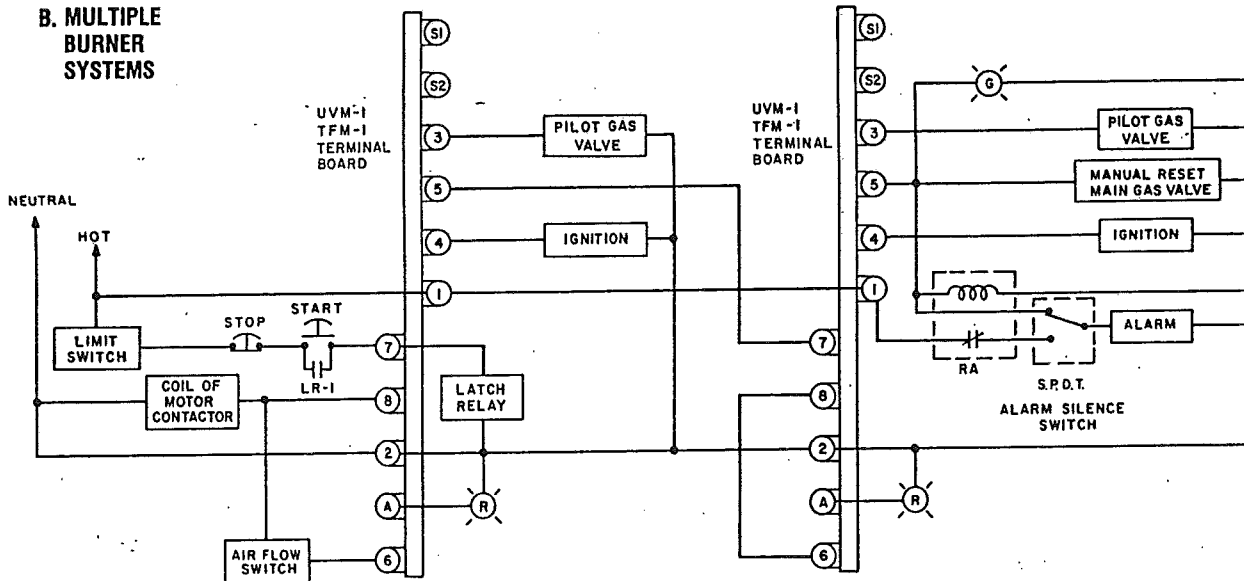


A. FOR MANUAL START

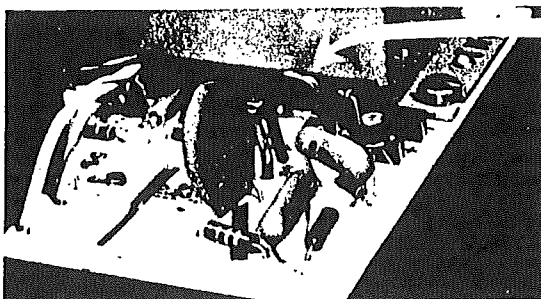
A START-STOP STATION MAY BE ADDED TO REQUIRE OPERATOR START-UP EACH TIME THE BURNER FIRES.



B. MULTIPLE BURNER SYSTEMS



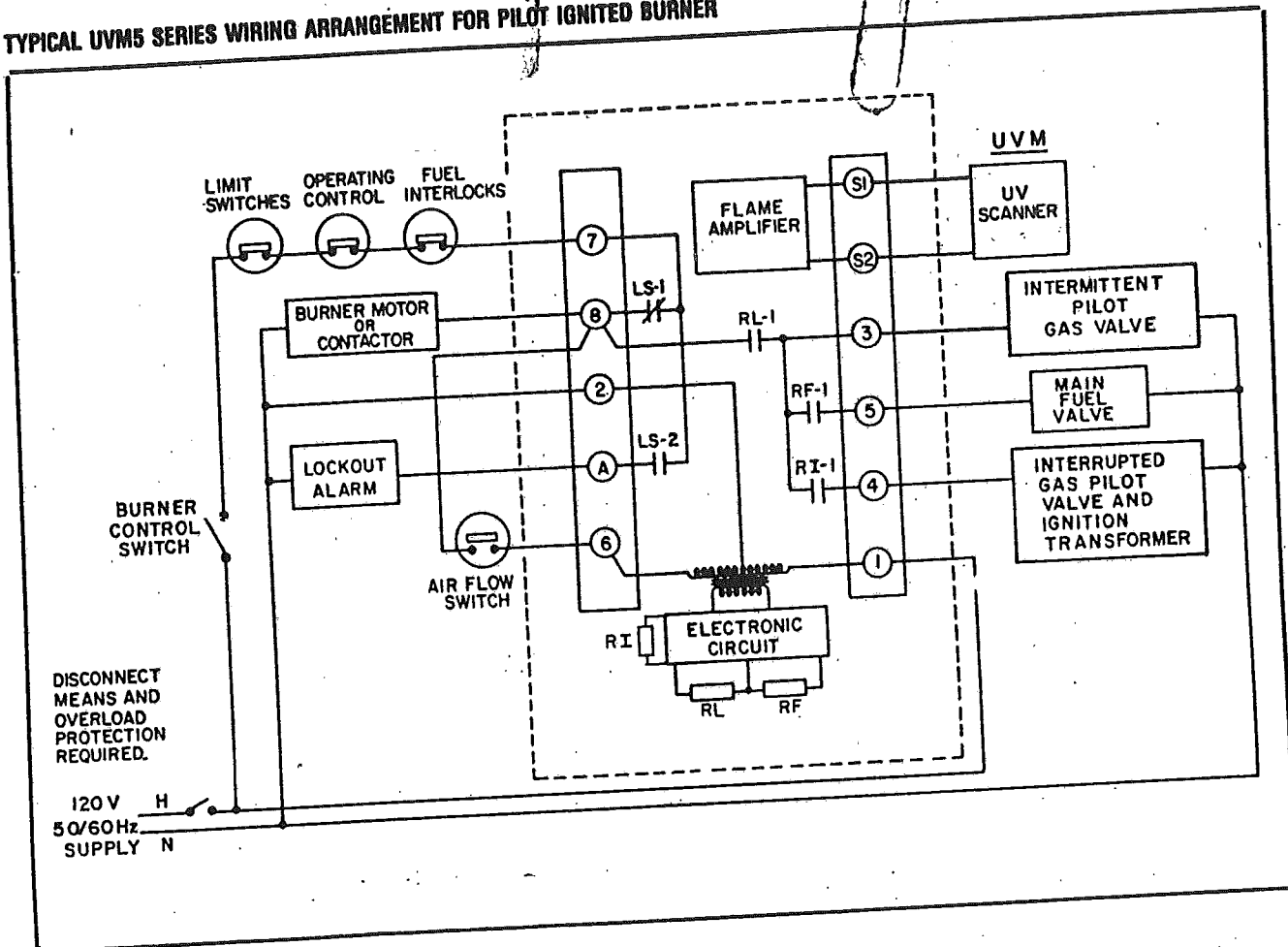
MULTIPLE BURNER SYSTEMS UTILIZING SEMI-AUTOMATIC OPERATION INCORPORATE THE UVM & TFM CONTROLS IN A CASCADING SEQUENCE. WHEN PILOT #1 IS PROVEN, TRIAL FOR IGNITION FOR PILOT #2 BEGINS. WHEN ALL PILOTS ARE PROVEN THE SAFETY SHUTOFF VALVE MAY BE MANUALLY OPENED. FLAME FAILURE OF ANY BURNER WILL TRIP THE MAIN FUEL VALVE AND SOUND ALARM. THE TOTAL CONNECTED LOAD MUST NOT EXCEED THE RATING OF THE FIRST CONTROL.



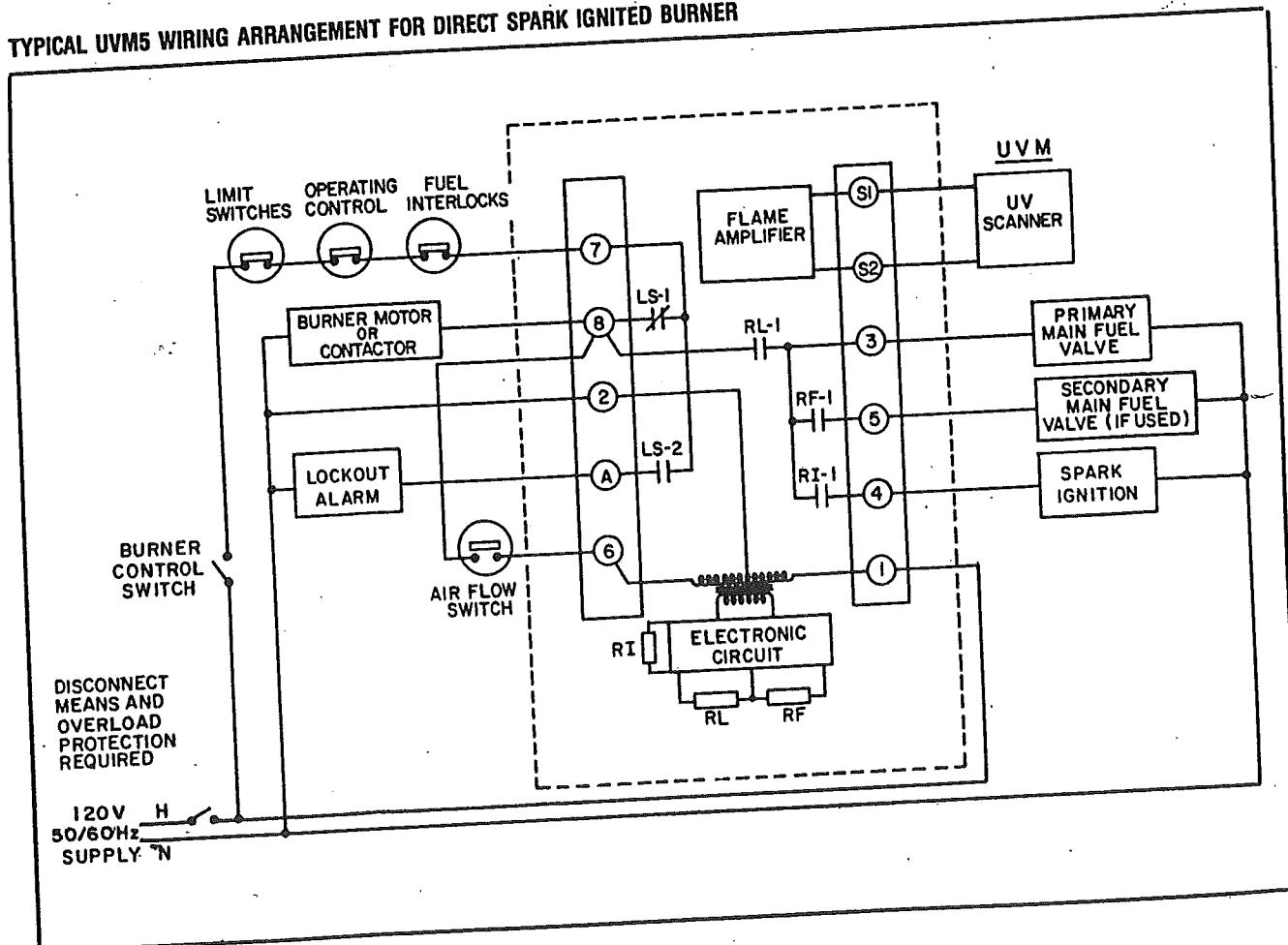
Note: When using TFM1D, F with a burner having a standing pilot, clip out the red wire loop close to the circuit board. This eliminates pilot proving where the main burner is off and requires pilot flame proving during the subsequent start-up.

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

TYPICAL UVM5 SERIES WIRING ARRANGEMENT FOR PILOT IGNITED BURNER



TYPICAL UVM5 WIRING ARRANGEMENT FOR DIRECT SPARK IGNITED BURNER



APPLICATION AND FUNCTION — UVM1D, UVM1F, TFM1D, TFM1F

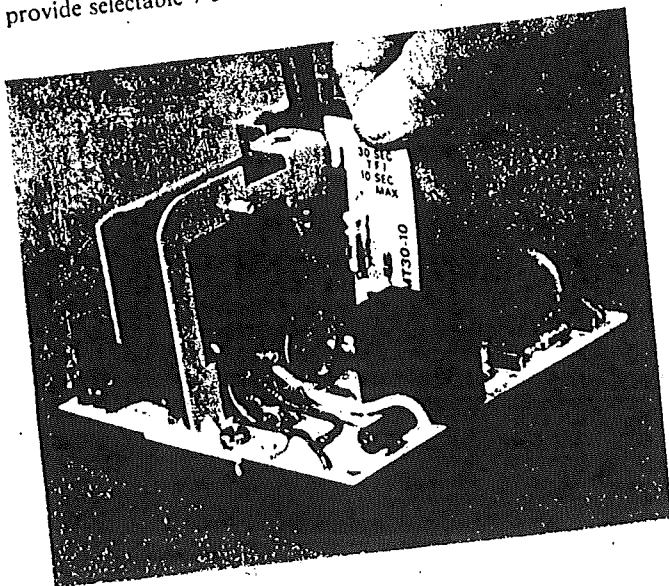
Fireye M1 Series, "relight" controls, provide ignition and Flame Safeguard for heating or process light oil or gas fired burners. UVM1D, F controls use UV flame detection. TFM1D, F controls use flame rod or photocell flame detection. UVM1D-TFM1D controls have .8 sec. flame failure response. UVM1F, TFM1F have 4 sec. (max.) flame failure response, and 10 sec. trial for ignition.

The typical wiring arrangement illustrated on Page 6 for pilot ignited burners provides the following function:

1. With power applied, and the limit-operating control circuit closed, the burner motor circuit is energized. The air flow switch circuit closes.
2. Following a short-time delay (2 to 5 sec.), RL-1 closes, energizing terminal 3 which powers the pilot gas valve, and terminal 4 which powers the spark ignition. A 10 sec. trial for ignition is initiated.
3. When pilot flame is detected, RF-1 closes, energizing terminal 5 which powers the main fuel valve, RF-2 opens, de-energizing terminal 4 which shuts off the spark ignition.
4. When the operating control opens its circuit, or if a power failure occurs, the entire system is de-energized.
5. In the event the pilot flame is not detected by the end of the trial for ignition 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 circuit.
6. In the event of a flame failure during a firing period, the main fuel valve is de-energized and the spark ignition re-energized. A 10 sec. relight trial for ignition is initiated. If flame is detected during the trial for ignition period, the main fuel valve is re-energized and the spark ignition de-energized. If flame is not detected during the trial for ignition 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 circuit.

APPLICATION AND FUNCTION — UVM2, TFM2

Fireye M2 Series, "recycle" controls provide prepurge, ignition and flame safeguard for heating and process light oil or gas fired burners. UVM2 controls use UV flame detection. TFM2 controls use flame rod or photocell flame detection. M2 controls have a 4 sec. (max.) flame failure response and 10 sec. trial for ignition (4 seconds available). Plug-in circuit cards provide selectable 7-30-60-90 second prepurge.



7. Manual reset is required following any safety lockout.

The typical wiring arrangement illustrated on Page 6 for direct spark ignited burners provides the following function:

1. With power applied, and the limit-operating control circuit closed, the burner motor circuit is energized. The air flow switch circuit closes.
2. Following a short-time delay (2-5 sec.) RL-1 closes, energizing terminal 3 which powers the primary main fuel valve and terminal 4 which powers the spark ignition. A ten sec. trial for ignition is initiated.
3. When main flame is detected, RF-1 closes, energizing terminal 5 which powers the secondary main fuel valve (if used), RF-2 opens de-energizing terminal 4 which shuts off the spark ignition.
4. When the operating control opens or if a power failure occurs, the entire system is de-energized.
5. In the event that main flame is not detected by the end of the trial for ignition period, the primary main fuel valve and the spark ignition are de-energized. A safety lockout occurs, which de-energizes the burner motor and energizes the lockout alarm circuit.
6. In the event of a flame failure during a firing period, the secondary main fuel valve (if used) is de-energized and the spark ignition is re-energized. A 10 sec. re-light trial for ignition is initiated. If flame is detected, the secondary main fuel valve (if used) is re-energized and the spark ignition de-energized. If flame is not detected during the trial for ignition period, the primary main fuel valve and the spark ignition are de-energized. A safety lockout occurs, which de-energizes the burner motor, and energizes the lockout alarm circuit.
7. Manual reset is required following any safety lockout.

The typical wiring arrangement illustrated on Page 6 for pilot ignited burners provides the following function:

1. With power applied, and the limit-operating control circuit closed, the burner motor circuit is energized. The air flow circuit closes.
2. Following the selected prepurge period, RL-1 closes, energizing terminal 3 which powers the pilot gas valve and terminal 4 which powers the spark ignition. A 10 sec. trial for ignition is initiated (4 seconds available).
3. When pilot flame is detected, RF-1 closes, energizing terminal 5 which powers the main fuel valve, RF-2 opens de-energizing terminal 4 which shuts off the spark ignition.
4. When the operating control opens its circuit, or if a power failure occurs, the entire system is de-energized.
5. In the event the pilot flame is not detected by the end of trial for ignition 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 circuit.
6. In the event of a flame failure during a firing period, the pilot and main fuel valves are de-energized. Following the prepurge period, with proven air flow, the pilot gas valve and spark ignition are re-energized and a 10 sec. trial for ignition is initiated (4 seconds available). If pilot flame is detected, the main fuel valve is energized, the spark ignition is de-energized. If the pilot flame is not detected during the trial for ignition period, the pilot gas valve and spark

10
ignition are de-energized. A safety lockout occurs which de-energizes the burner motor and energizes the lockout alarm switch.

7. Manual reset is required following any safety lockout.

The typical wiring arrangement illustrated on Page 6 for direct spark ignited burners provides the following function:

1. With power applied, and the limit-operating control circuit closed, the burner motor circuit is energized. The air flow switch circuit closes.
2. Following the selected prepurge period, RL-1 closes, energizing terminal 3 which powers the primary main fuel valve, and terminal 4 which powers the spark ignition. A ten second trial for ignition is initiated (4 seconds available).
3. When pilot flame is detected, RF-1 closes, energizing terminal 5 which powers the main fuel valve, RF-2 opens, de-energizing terminal 4 which shuts off the spark ignition.

4. When the operating control opens its circuit, or if a power failure occurs, the entire system is de-energized.

5. In the event the pilot flame is not detected by the end of the trial for ignition 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 circuit.

6. In the event of a flame failure during a firing period, all fuel valves are de-energized. Following the prepurge period, with proven air flow, the primary main fuel valve and spark ignition are re-energized and a ten second trial for ignition period is initiated (4 seconds available). If flame is detected, the secondary main fuel valve (if used) is energized. The spark ignition is de-energized. If flame is not detected during the trial for ignition period, the primary main fuel valve and spark ignition are de-energized. A safety lockout occurs, de-energizing the burner motor and energizing the lockout alarm circuit.

7. Manual reset is required following any safety lockout.

APPLICATION AND FUNCTION — UVM3-TFM3

Fireye M3 Series "non-recycle" controls, provide prepurge, ignition, and flame safeguard for heating and process light oil or gas fired burners. UVM3 controls use UV flame detection. TFM3 controls use flame rod or photocell flame detection. M3 controls have a 4 second (max.) flame failure response and 10 second trial for ignition (4 seconds available). Plug in circuit

cards provide selectable 7-30-90 second prepurge.

The function of the M3 series controls is the same as described for the M2 Series except that the M3 series provide non-recycle operation and will lockout following any flame failure.

APPLICATION AND FUNCTION — UVM3H-TFM3H

Fireye M3H is similar to the M3 Series. All installations, wiring, functions, testing instructions for the M3 are applicable to the M3H.

The M3H provides an additional function whereby the powering of Terminal 5 is delayed for five (5) seconds after flame is detected, and Terminal 4 remains powered during the

five (5) second delay.

This additional function is offered primarily for two-stage light oil burners, to assure a specific delay between the light off of the first and second stage, and to provide additional ignition timing to improve flame stabilization.

APPLICATION AND FUNCTION—UVM5

Fireye UVM5 Controls provide prepurge (selectable 7-30-60-90 second), ignition and flame safeguard for heating and process light oil or gas fired burners, using ultraviolet flame detection.

Flame establishing trial for ignition period is electronically

timed, (selectable 4 or 10 seconds). Ignition flame must be proved prior to energizing the main fuel valve. A five second pilot stabilization period is provided. The pilot is deenergized 10 seconds after the main fuel valve is energized.

Note: Recommended wiring arrangements on Page 8.

OPERATION TEST

CAUTION: Before testing the control operation on the boiler, close the manual main fuel supply. Failure to do this may cause injury or property damage.

STEP 1: Close the manual main shut-off fuel valve.

STEP 2: Recheck all limit circuit wiring for proper operation and correct connection.

STEP 3: Confirm that the automatic main fuel valves are wired to terminal "5".

STEP 4: Power the control and electrically check the proper sequence of operation according to page 9 in this bulletin.

STEP 5: After assuring yourself that all interlocks and valves are properly wired and that the sequence of operation is correct, open the manual main shut-off fuel valve and proceed cautiously through the boiler light off process. Check all safety interlocks for proper shut down off the boiler.

INSTALLATION TESTING

Use of Test Meter

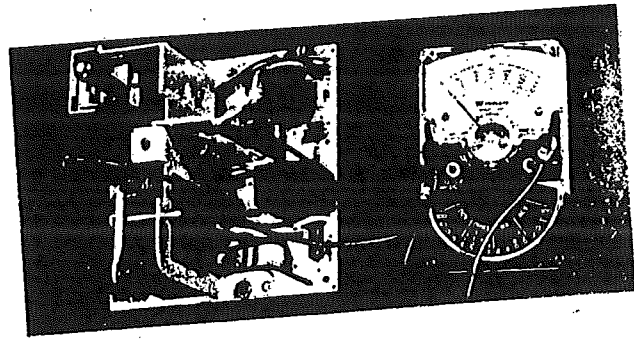
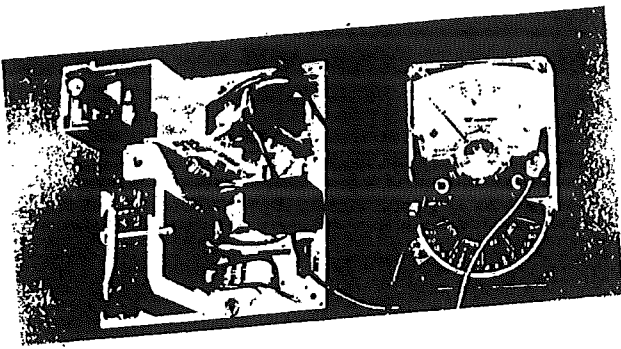
Testing UVM and TFM controls requires the use of a test AC-DC multimeter, with a 20,000 ohm/volt DC rating, or a digital meter with 500K input impedance or greater.

With the test meter leads inserted into the test jacks, a steady DC voltage reading of 4.0-5.5 volts (UVM) and 14 to 17 volts (TFM) should be obtained when the controls are detecting flame,

and zero volts when no flame is present.

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

On the TFM controls, a microammeter may be connected in series with the wire to Terminal S2. Normal flame will produce a meter reading between 4 and 10 microamps.



Flame Signal Testing

1. Manually shut off the main fuel valve, for a pilot ignited burner or the secondary main fuel valve for a direct spark ignited burner.
2. Set the test meter on the DC scale and insert the meter leads into the test jacks. (If the meter reads backwards, reverse the meter leads.)
3. Initiate a normal startup.
4. When flame is established, the test meter reading should be normal.

Minimum Pilot Test

This test insures that the detector will not sense a pilot flame too small to light the main flame reliably. It must be made by a trained and qualified person on each new installation and following repositioning of the flame detector.

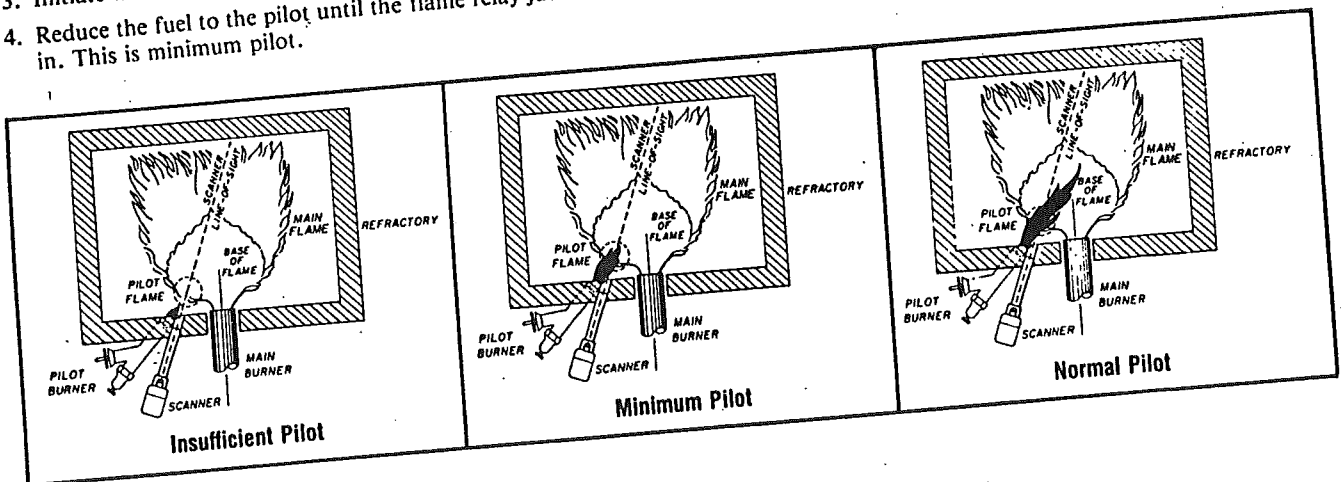
1. Manually shut off the fuel to the main burner.
2. Connect test meter to test jacks.
3. Initiate a normal start-up.
4. Reduce the fuel to the pilot until the flame relay just holds in. This is minimum pilot.

5. Inadequate flame signal may be improved by:
 - a. Assure that the flame detector and wiring installation have followed the instructions on Pages 3,4,5.
 - b. Assure that the flame detector is clean and within the ambient temperature limits.
 - c. Assure that the flame is sufficiently large to detect.
 - d. If a UV scanner is used, try a shorter sight pipe, or increase the sight pipe diameter.

5. Slowly turn on the main fuel and insure that the main flame lights off promptly and normally.

Caution: If lightoff is delayed, shut off the power to the installation. Realize the detector is that pilot flame. If it does not require a large pilot flame. Repeat this test until main flame lights reliably with minimum pilot.

7. After the minimum pilot test is completed satisfactorily, increase the pilot flame to normal size.



Flame Failure Test

1. Temporarily connect spark ignition 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, verify that the UV flame detector is not actuated by the spark. If spark is detected, a metallic shield or relocation of the UV scanner

sight pipe, is required.

5. When test is completed, reconnect the spark ignition to Terminal 4.

Recommendation

Periodic Safety Check: Test the complete flame safeguard system at least one a month. This test should verify flame failure safety shutdown and positive fuel cutoff when the fuel valve is de-energized.

MAINTENANCE

Photocell: Type 922 (E.C.A. Part #4-230) must be kept clean. Use a clean cloth with detergent as often as operating conditions require. Annual replacement recommended.

Flame Rod: Type 69ND1 — Replace as necessary. Routine

cleaning of the rod and insulator with soap and water or solvent recommended.

UV-eye Scanner: The UV tube must be kept clean. Use a clean cloth with detergent as often as operating conditions require.

ROTATION

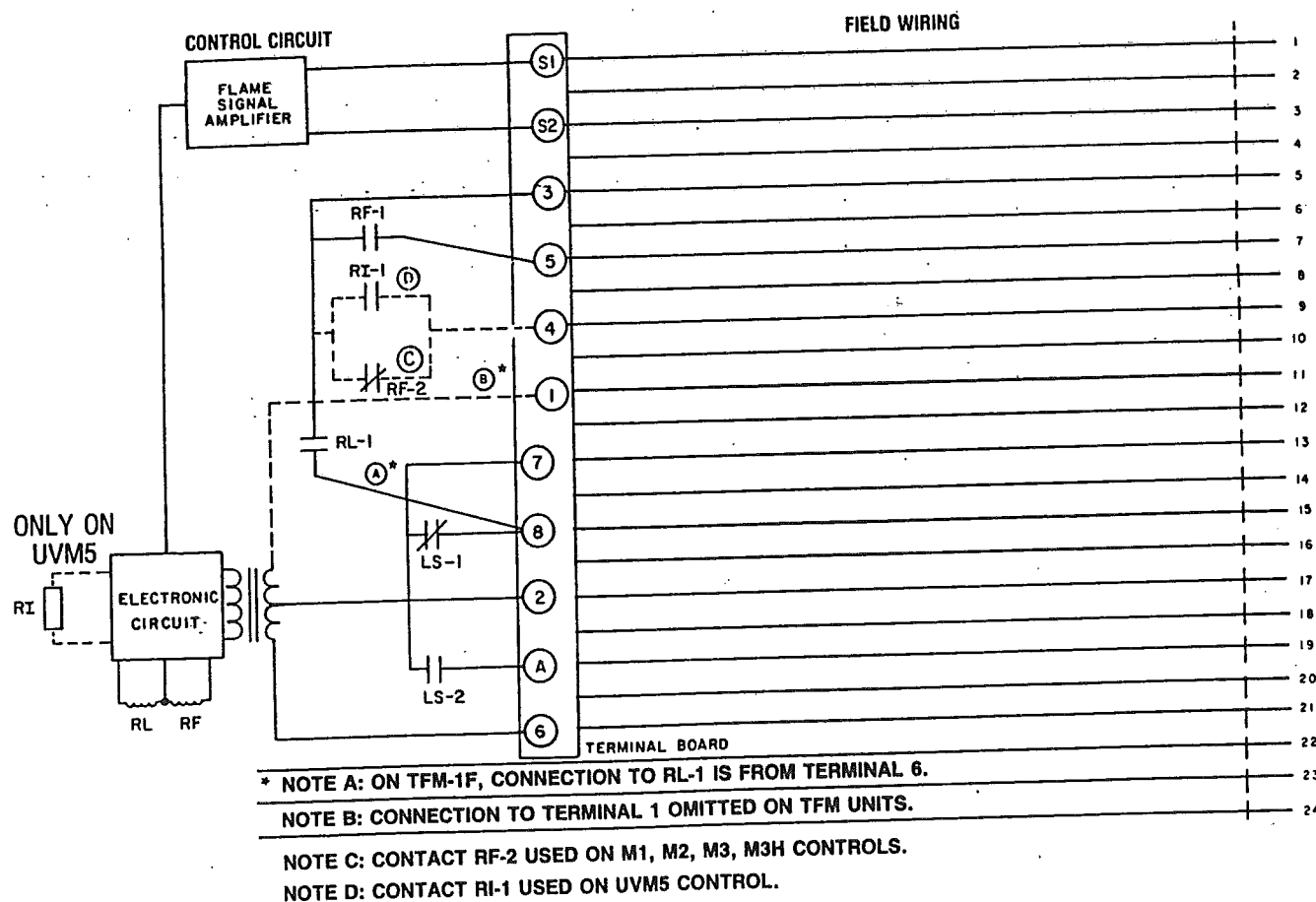
It is recommended that units purchased as spares be rotated periodically, so that each unit will be placed in operation at least every 90 days.

WARRANTIES, EXCLUSIVE REMEDIES, AND LIMITATION OF DAMAGES

ECA guarantees for one year from date of shipment, to replace or at it's 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 the sales order.

The foregoing is in lieu of all other warranties and ECA makes no warranty of merchantability or any other warranty, express or implied.

Except as specifically stated, remedies with respect to any product or part manufactured or sold by ECA shall be limited exclusively to the right to replace or repair F.O.B. Point of Shipment as above provided, in no event shall ECA be liable for consequential or special damages of any nature which may arise in connection with such product or part.



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FIREYE PRODUCTS
265 Winter Street, Waltham, MA 02154

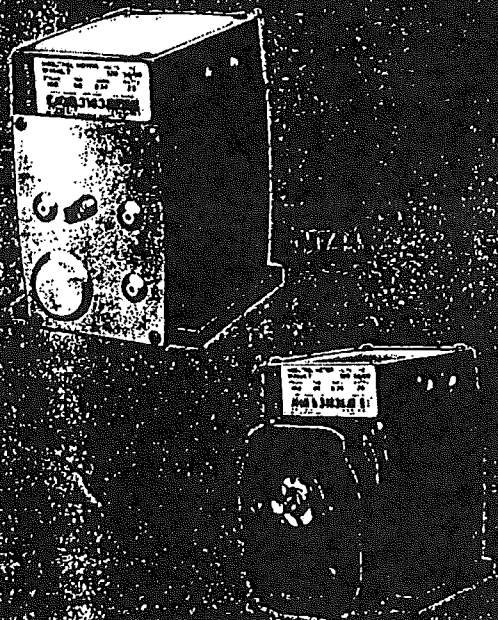
Bulletin C-400
November 1988
Supersedes May 1988

Honeywell

M744 AND M745 MODUTROL MOTORS ARE LINE VOLTAGE MOTORS USED TO CONTROL VALVES AND DAMPERS. THESE MOTORS ACCEPT A CURRENT SIGNAL FROM A PROPORTIONAL CONTROLLER. MOTOR POSITIONS THE VALVE OR DAMPER (WITH SUITABLE LINKAGE) AT ANY POINT BETWEEN FULL OPEN OR FULL CLOSED AS DETERMINED BY THE INPUT FROM THE CONTROLLER.

- ☐ M744 motors are normally closed, nonspring-return motors. When power fails, these motors will retain their last position.
- ☐ M745 motors are normally closed spring-return motors. On a power loss motor will spring return to full closed position.
- ☐ M744S and M745S models accept a 4-20 mA input signal from the controller.
- ☐ M744T and M745T motors include two auxiliary switches (spdt) and accept a 4-20 mA signal.
- ☐ M744Y and M745Y motors include two auxiliary switches (spdt). These motors accept 4-20 mA signal and incorporate adjustable zero and span for split range applications.
- ☐ Drive up to 6 motors in unison without the addition of resistor kit.
- ☐ Sequence up to 6 M744Y/M745Y motors without adding resistor kit.
- ☐ Stroke is fixed at 90° or 160°.
- ☐ Direct drive feedback potentiometer provides accurate motor positioning.
- ☐ Oil immersed gear train for long life.
- ☐ Internal transformer included for 120 Vac power supply.
- ☐ Weatherproofing kit and explosion-proof housing are available.
- ☐ Uses standard Modutrol motor accessories, including damper and valve linkages.

MODUTROL MOTORS



M744S,T,Y
M745S,T,Y

SPECIFICATIONS

MODELS:

- M744S—line voltage, proportional, nonspring-return, without auxiliary switches.
- M744T—line voltage proportional, nonspring-return, with two auxiliary switches.
- M744Y—line voltage, proportional, nonspring-return, with two auxiliary switches and adjustable zero and span.
- M745S—line voltage, proportional, spring-return, without auxiliary switches.
- M745T—line voltage, proportional, nonspring-return, with two auxiliary switches.
- M745Y—line voltage, proportional, spring-return, with two auxiliary switches and adjustable zero and span.

ELECTRICAL RATINGS:

- Voltage and Frequency—120 Vac, 50/60 Hz.
- Electrical Consumption—
- M744: 23 W, 0.24 A.
- M745: 28 W, 0.28 A.

CONTROLLER: These motors can be used with any electronic controller that provides a stable noise-

free proportional current output as specified by the model designation.

M744/M745S,T,Y models accept 4-20 mA.

M744/M745S,T—maximum controller current is 25 mA.

M744/M745Y—maximum controller current is 50 mA.

INPUT RANGE:

M744/M745S,T—4-20 mA nominal.

M744/M745Y—4-20 mA adjustable.

Zero (motor closed)—0.8 to 18 mA.

Span—1.8 to 20 mA (adjustable).

INPUT IMPEDANCE: 100 ohms.

MOTOR ROTATION: Normally closed. The closed position is the limit of the counterclockwise rotation as viewed from the power end of the motor. See Figure 2. Motor opens clockwise as viewed from the power end.

STROKE: Fixed, 160° or 90° stroke.

TIMING:

30 sec at 90° stroke.

60 sec at 160° stroke.

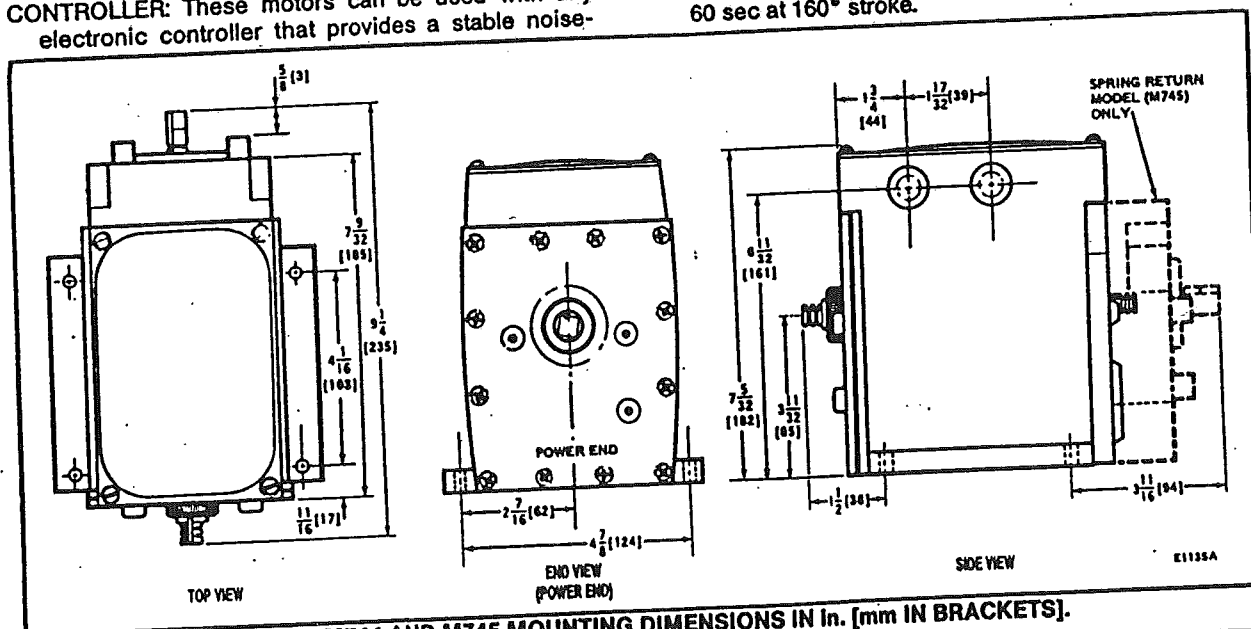


FIG. 1—M744 AND M745 MOUNTING DIMENSIONS IN IN. [MM IN BRACKETS].

WHEN PURCHASING REPLACEMENT AND MODERNIZATION PRODUCTS FROM YOUR LOCAL HONEYWELL SALES OFFICE, WHOLESALE OR DISTRIBUTOR, REFER TO THE TRADELINE OR PCD CATALOG FOR COMPLETE ORDERING NUMBER AND SPECIFY—

1. Order number.
2. Accessories, if desired.

IF YOU HAVE ADDITIONAL QUESTIONS, NEED FURTHER INFORMATION, OR WOULD LIKE TO COMMENT ON OUR PRODUCTS OR SERVICES, PLEASE WRITE OR PHONE:

1. HONEYWELL PROCESS CONTROL DIVISION, FT. WASHINGTON, PA 19034.

2. RESIDENTIAL DIVISION CUSTOMER SERVICE
HONEYWELL INC.
1885 DOUGLAS DRIVE NORTH
MINNEAPOLIS, MN 55422-4386 (612)542-7500

(IN CANADA—HONEYWELL LIMITED/HONEYWELL LIMITEE, 740 ELLESMERE ROAD, SCARBOROUGH, ONTARIO M1P 2V9). INTERNATIONAL SALES AND SERVICE OFFICES IN ALL PRINCIPAL CITIES OF THE WORLD.

BRAKE: Electromechanical; holds motor position when motor winding is de-energized and releases when motor winding is energized. On spring-return motors the brake releases when power is removed from the motor, and motor closes mechanically.

TORQUE:

M744: 150 lb.-in. [17 N-m].

M745: 50 lb.-in. [5.7 N-m].

DEADWEIGHT LOAD ON SHAFT:

Power End—200 lb. [90.7 kg] maximum.

Auxiliary End—

M744: 100 lb. [45.4 kg] maximum.

M745: 10 lb. [4.5 kg] maximum.

AMBIENT TEMPERATURE:

Maximum—130 F [54 C] at 25% duty cycle.

Minimum—M744: -40 F [-40 C].

M745: -35 F [-37 C].

CRANKSHAFT: Double-ended, 3/8 in. [9.5 mm] square.

DIMENSIONS: Refer to Fig. 1.

WIRING TERMINATION: 1/4 in. quick connect. 7640PU Screw Terminal Adaptor is included.

ACCESSORIES:

ES-840-117, ES-850-118, DHE-84 Explosion-proof Housings enclose the motor for use in explosive atmospheres. Not for use with Q618, Q601, and Q445 linkages.

7640JS Weatherproof Kit for M744S,T,Y.

7640JT Weatherproof Kit for M745S,T,Y.

7616BR Motor Crank Arm—included with Q605 but not with motor.

Q607 Auxiliary Switch—controls auxiliary equipment as a function of motor position.

Q605 Damper Linkage—connects motor to damper, includes motor crankarm.

Q618 Linkage—connects Modutrol motor to water or steam valve.

Q601 Linkage—connects Modutrol motor to water or steam valve.

Q100 Linkage—connects Modutrol motor to butterfly valve.

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 completed, check out product operation as provided in these instructions.

CAUTION

1. Disconnect the power supply before connecting the wiring to prevent electrical shock or equipment damage.
2. Mount the motor with the crankshaft in the horizontal position.
3. Do not attempt to turn the motor shaft by hand or with a wrench; damage to the gear train will result.

LINKAGES

For detailed instructions on the assembly of specific linkages, refer to the instruction sheet packed with each linkage.

When planning and installing a motor and linkage, check the following points of operation:

1. Attach the linkage to the motor shaft so the motor crank arm travels through its full range while the valve or damper moves through its full distance.
2. The motor must be stopped at the end of its stroke by the limit switch and must not be stalled by the damper or valve.
3. Do not exceed the load and torque ratings in any application.
4. Best control is achieved with maximum damper opening of about 60°.

LOCATION

Install the motors in any location except where acid fumes or other deteriorating vapors might attack the metal parts, or in atmospheres of explosive vapors.

If located outdoors, use weatherproofing kit; see Accessories.

MOUNTING

Install the motor with the crankshaft horizontal. Mounting flanges extending from the bottom of the motor housing have clearance holes for 1/4 inch machine screws or bolts.

These motors are supplied without crank arms. A crank arm is included in the Q605 linkage, or it may be ordered separately (see Accessories). The motor is supplied with the shaft in the full closed (counterclockwise position). The angle between full closed and full open position is 90° through 160°. Refer to Fig. 2.

Attach crank arm to motor so that it will be free to turn through the full stroke without interfering with the mounting surfaces.

WIRING

Disconnect the power supply before connecting wiring to prevent electrical shock and equipment damage. All wiring must comply with applicable local codes, ordinances, and regulations.

Make sure that the power requirements stamped on the motor correspond to the characteristics of the power supply.

Motor terminals are quick-connect, located on the top of the printed circuit board. Refer to Fig. 3. To gain access to the terminals for wiring, remove screws on the top of the motor and remove the cover. A screw terminal adapter is supplied with the motor to convert quick-connect terminals to screw terminals. See Fig. 4.

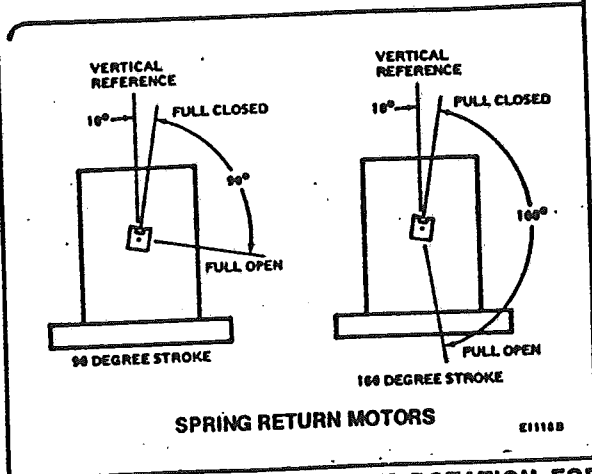
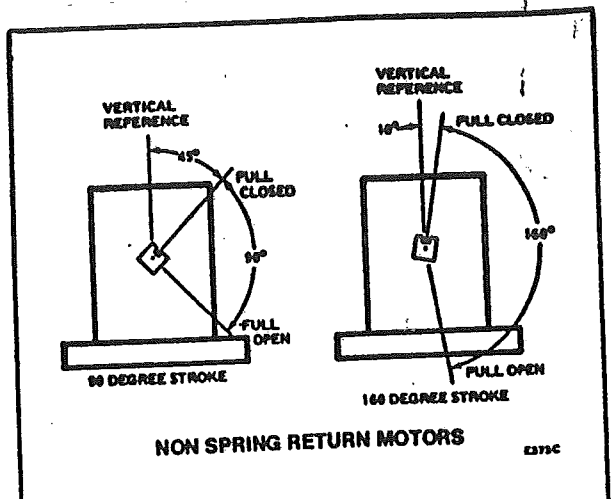


FIG. 2—LIMITS OF CRANK ARM ROTATION FOR M744, M745 MOTORS, VIEWED FROM POWER END.

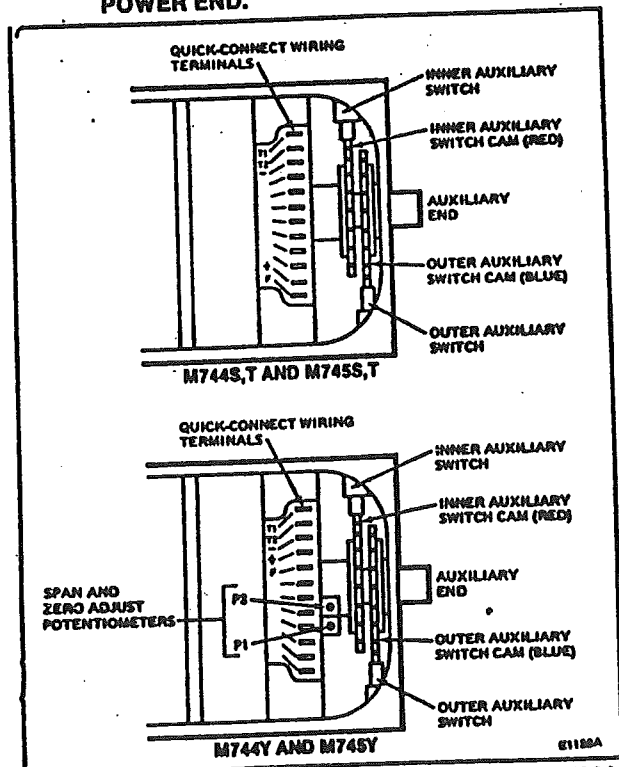


FIG. 3—M744S,T,Y AND M745S,T,Y TERMINAL LOCATIONS.

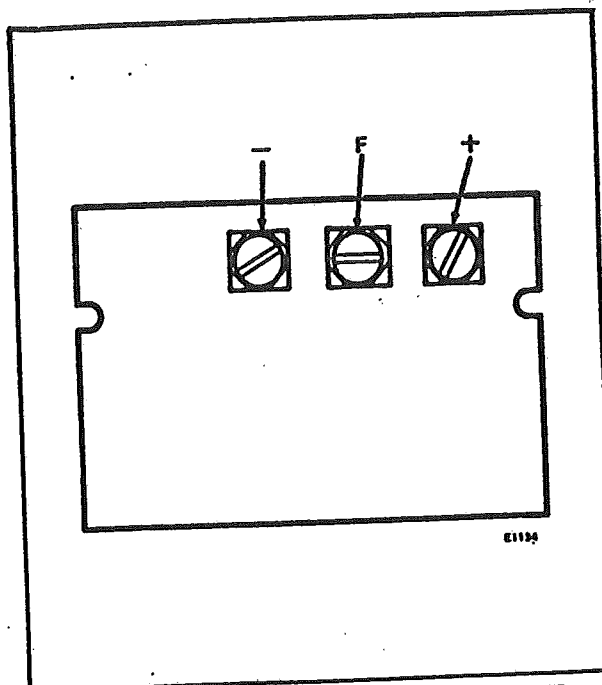


FIG. 4—7640PU SCREW TERMINAL ADAPTER.

CONNECTION DIAGRAMS

These motors are designed to be used in a current proportioning control circuit. Connect the positive terminal of the controller to the positive motor terminal and the negative terminal to the negative motor terminal. The motor will be closed at the zero end of the operating span. As the current increases to the full operating span, the motor will drive open (to clockwise limit). Drive the motor full open by connecting terminal F to either the positive or negative motor terminal. Refer to Fig. 6. The internal wiring of these motors is shown in Fig. 5. Refer to Figs. 6 and 7 for connecting a controller to one or more motors.

CAUTION

Modutrol motors with electronic circuits are designed to ignore the presence of electrical pickup (unwanted input signals) and will work with standard wiring used with other Modutrol motors. However, there may be rare cases in which very large pickup is present, such that motor performance may be affected. This may happen when the motor wires are run near conductors carrying large electrical currents (to large motors). Reroute controller wires away from these conductors or use twisted cable (Belden type 8443-3, or equivalent) to ensure proper control. If shielded cable is used, the shield must not be grounded.

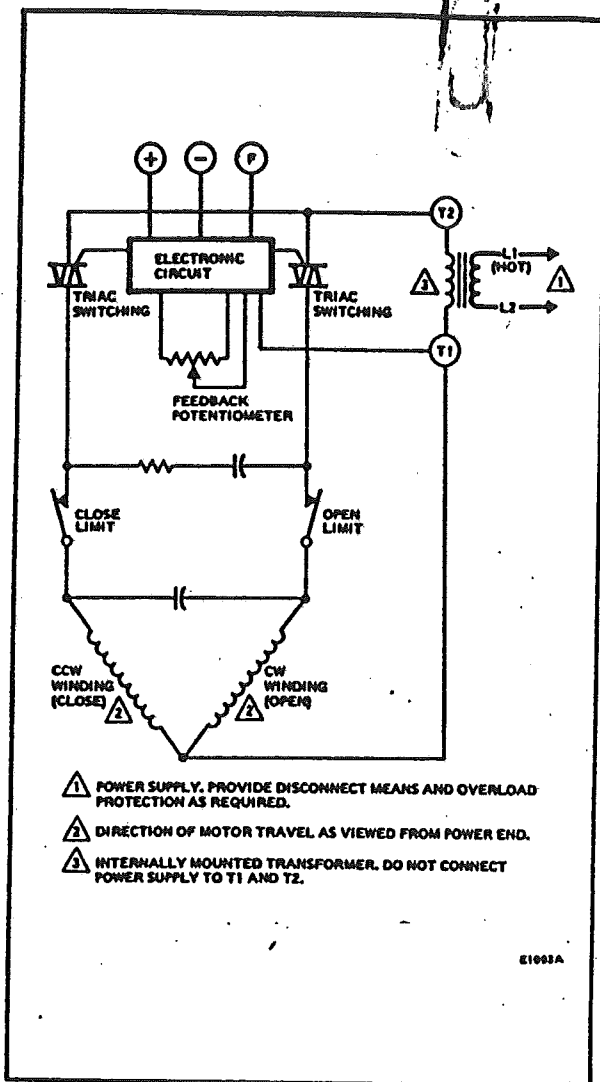


FIG. 5—INTERNAL SCHEMATIC OF M744S,T,Y AND M745S,T,Y MOTORS.

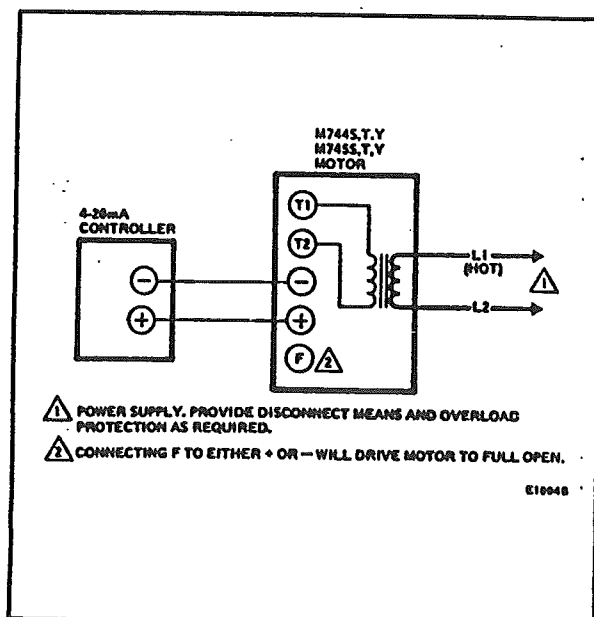


FIG. 6—M744S,T,Y OR M745S,T,Y CONNECTED TO A 4-20 mA CURRENT CONTROL.

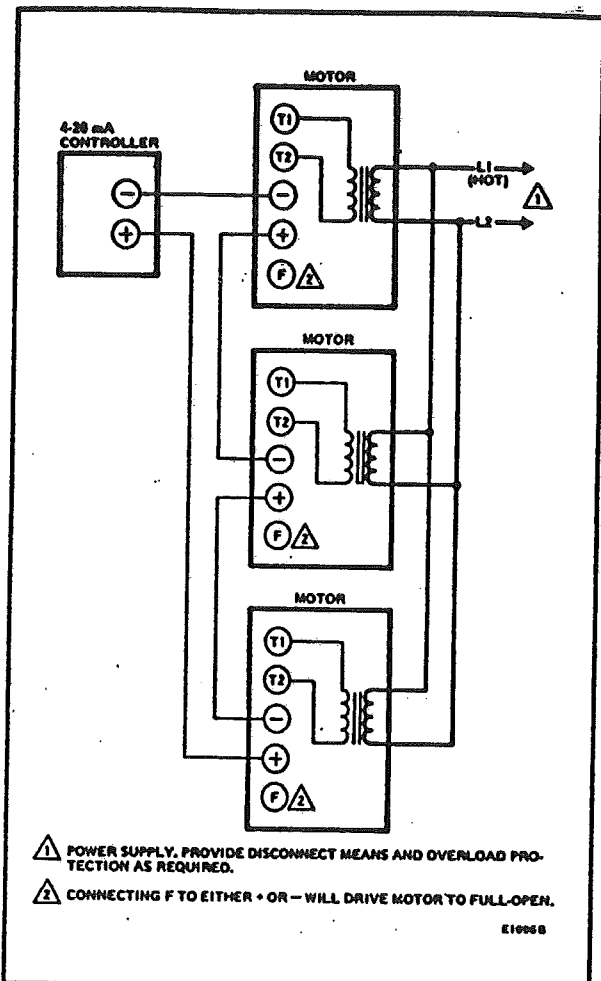


FIG. 7—DRIVE UP TO 6 MOTORS IN UNISON FROM ONE CONTROLLER. M744Y/M745Y MODELS CAN BE DRIVEN SEQUENTIALLY BY ADJUSTING ZERO AND SPAN ADJUSTMENT POTENTIOMETERS.

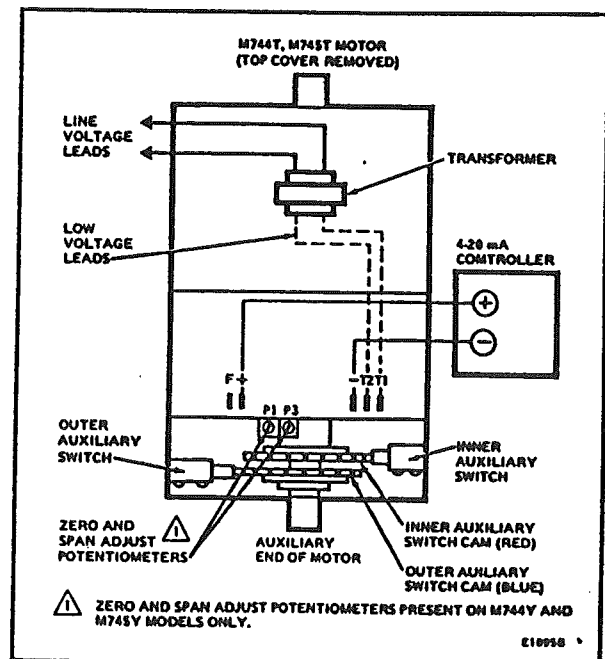


FIG. 8—INTERNAL VIEW OF MOTOR WITH TOP COVER REMOVED.

ADJUSTMENTS

ZERO AND SPAN ADJUSTMENT FOR M744Y/M745Y MOTORS

1. Refer to Fig. 8, adjust the zero potentiometer (P3) fully clockwise (maximum zero) and the span potentiometer (P1) fully counterclockwise (minimum span).

2. Set the controller current to the value required to drive the motor to the closed position.

3. Turn the zero potentiometer (P3) slowly counterclockwise until the motor begins to open. This is defined as the zero setting.

4. Set the controller current to the value required to drive the motor to the full open position. The motor will open.

5. Turn the span potentiometer (P1) clockwise until the motor starts to close. The difference between the full (open) span position current and the zero position current is defined as the operating span.

6. Re-check the zero and readjust the zero potentiometer (P3) if necessary. Turn (P3) clockwise to increase the zero position.

7. Re-check the span and readjust the span potentiometer (P1) if necessary. Turn (P1) clockwise to increase the full span position.

8. For sequential operation (as shown in Fig. 9), repeat above steps for each motor.

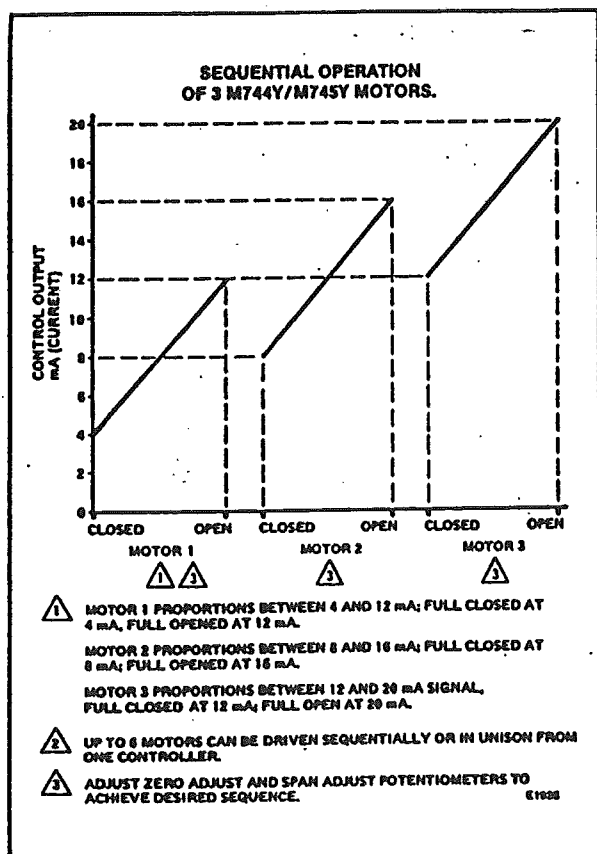


FIG. 9—SEQUENTIAL OPERATION OF 3 M744Y/M745Y MOTORS.

AUXILIARY SWITCHES

The auxiliary switches in M744/M745T,Y motors are actuated by adjustable cams. These cams can be set to actuate the switches at any angle within the stroke of the motor. Also, switch differentials of 1° or 10° can be selected.

Motors are shipped in the closed position with auxiliary cams set to actuate switches 30° from the closed position, and to provide 1° differential. With motor in closed position, auxiliary switch breaks R-B (Fig. 10).

AUXILIARY SWITCH SETTING PROCEDURE (Fig. 10)

1. Remove the four cover screws on the top of the motor and remove the cover to gain access to motor terminals and the cams (Fig. 8).

2. Disconnect the motor from the controller. Connect a current source to the (+) positive and (-) negative motor terminals (Fig. 8).

CAUTION

The brown cam on 90° stroke M745T,Y or two yellow cams on 90° stroke M744T,Y are factory adjusted stroke cams and must not be rotated when setting auxiliary switches.

3. Drive the motor to the desired position where auxiliary equipment is to be switched by adjusting the current source.

4. Insert a 1/8 in. straightedge screwdriver into slot on cam associated with selected auxiliary switch. See Fig. 10 for switches and associated cams. Move top of the screwdriver as far as possible and repeat in successive slots, moving cam until switch contacts make. Direction of cam adjustment depends on selected differential (1° or 10°).

5. For switch differential of 1°, check continuity of auxiliary switch R-B contacts and rotate cam as follows:

- If contacts are open, rotate cam counterclockwise until R-B contacts close.
- If contacts are closed, rotate cam clockwise until R-B contacts open.

6. For switch differential of 10°, check continuity of auxiliary switch R-B contacts and rotate cam as follows:

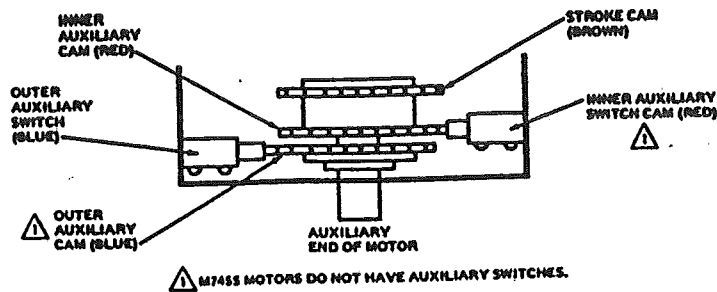
- If contacts are open, rotate cam clockwise until R-B contacts close.
- If contacts are closed, rotate cam counterclockwise until R-B contacts open.

7. Check for proper differential and switching of auxiliary equipment by driving motor through full stroke (in both directions, using the current source. If necessary, repeat differential adjustments.

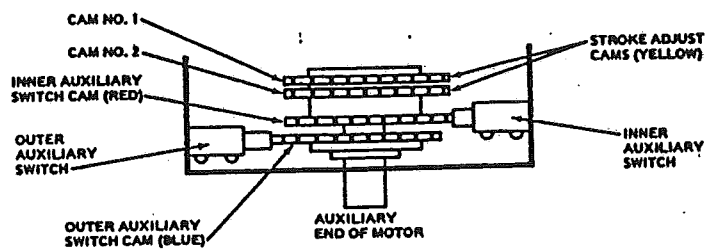
8. Disconnect current source, reconnect controller and replace top cover on motor.

IMPORTANT

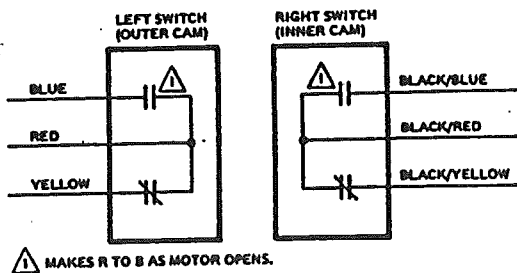
Do not turn motor shaft by hand or with a wrench, as damage to the gear train will result.



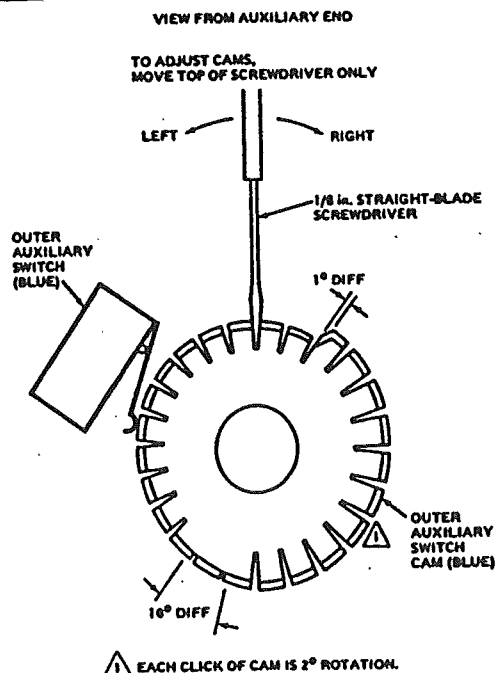
STROKE CAM — SPRING RETURN MOTORS — 90° STROKE ONLY
E1744A



STROKE CAMS — NON-SPRING RETURN MOTORS — 90° STROKE ONLY
E1765A



E1198



VIEW OF CAM FROM AUXILIARY END OF MOTOR

E1119A

FIG. 10—AUXILIARY SWITCH AND STROKE CAM ADJUSTMENT.

OPERATION AND CHECKOUT

The motor feedback potentiometer and control current input circuit form a bridge circuit. As long as the final control element remains at the position proportional to the input current from the controller, the circuit is balanced, and the motor does not run. When the value of the controlled medium changes, the current from the controller changes, and unbalance is amplified to energize the triac switching to run the motor in the proper direction to correct the change in the temperature or pressure. The motor turns the feedback potentiometer to rebalance the circuit and stop the motor.

CHECKOUT

When the motor has been installed and the auxiliary switches have been adjusted, check the motor operation to ensure that the motor operates the valve or damper properly and that the motor responds accurately to the controller signal.

Inspect the motor, linkage and valve or damper to see that all mechanical connections are correct and secure. In damper installations, the pushrods should

not extend more than a few inches past the ball joints. Check to see that there is adequate clearance for linkage to move through its stroke without binding or striking other objects.

Check that cams operate the auxiliary switches, if used, at the desired point of motor operation.

MOTOR OPERATION CHECK

1. To close the motor, open terminals +, -, and F.
2. To open the motor, jumper terminals F to + or F to -

SYSTEM CHECKOUT — HEATING SYSTEM

1. Adjust the set point of the controller above the ambient temperature. The motor should drive toward the open position.
2. Adjust the set point of the controller below the ambient temperature. The motor should drive toward the closed position.

After checkout, adjust the controller to the desired set point for system operation.

If questions arise regarding this product, contact your local distributor or local Honeywell sales office.

DART CONTROLS, INC.

250B SERIES

INSTRUCTION MANUAL VARIABLE SPEED CONTROL

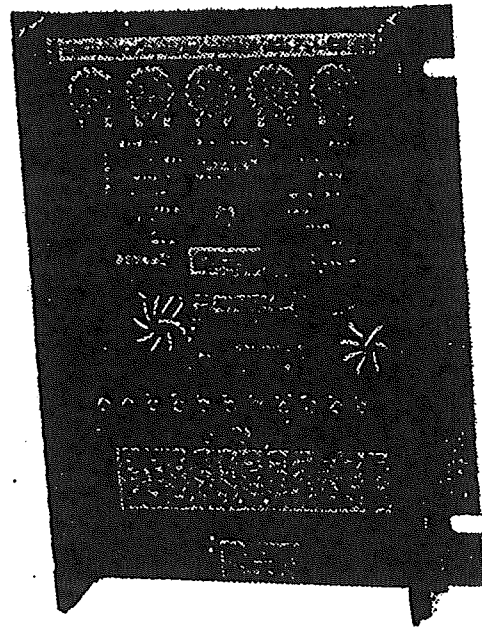
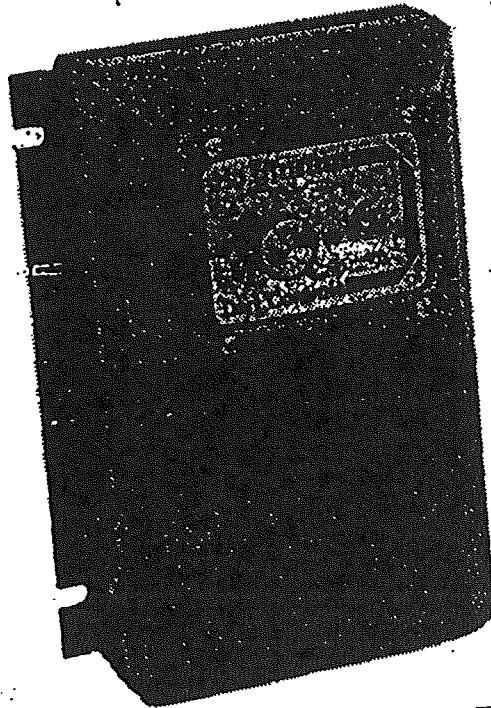


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251B and 253B

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PRINTED IN U.S.A.

250B-IM-0189

INTRODUCTION

- ⇒ The DART CONTROLS 250B SERIES is available in 1/50 thru 1 1/2 HP.
- ⇒ The 251B model is available in a H.P. range of 1/50 thru 1/8 at 120VAC input.
- ⇒ The 253B model has a DUAL VOLTAGE (may accommodate either 120 or 240 VAC) input. It is available in a range of 1/4 thru 1 1/2 horsepower.
- ⇒ The control is designed for DC Permanent Magnet, Shunt Wound, and some Universal (AC/DC) motors in the above horsepower ranges.
- ⇒ Incoming AC voltage is converted to adjustable full wave rectified DC voltage to operate the DC motor. Also, a full wave field voltage is provided for shunt wound motors (see page 17 for voltages).
- ⇒ The control incorporates transient voltage protection with adjustable current limit and an AC fuse for protection. It features adjustable minimum and maximum speeds along with adjustable acceleration and IR compensation. Tach feedback is accomplished thru a connection to a pin (P12) on the printed circuit board.
- ⇒ The Series has a linear acceleration/deceleration ramp.
- ⇒ The DART CONTROLS 250B Series is designed to be used with DART CONTROLS Master/Slave control, the MSC-35.

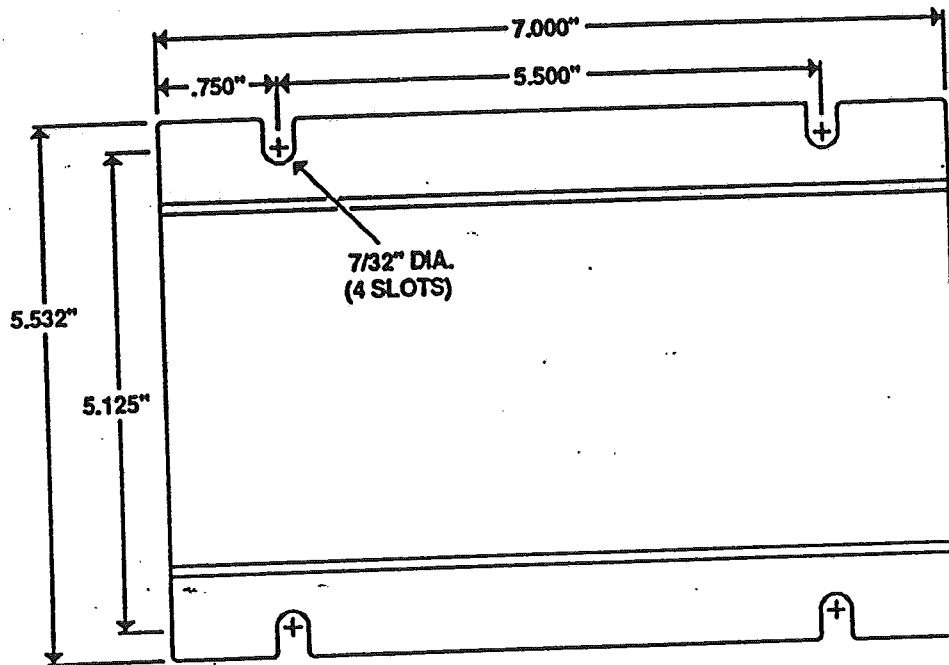
COMMONLY ASKED QUESTIONS

- Q. CAN I RUN TWO OR MORE MOTORS FROM THE SAME DRIVE?**
A. Not recommended. The IR Comp (regulation) would have problems sensing the different load on each motor.
- Q. CAN I CHANGE THE HORSEPOWER OF MY MOTOR AND STILL USE THE SAME CONTROL?**
A. Yes, provided you do not deviate outside the horsepower range for the voltage you are using. The trimpots would need to be readjusted; see TRIMPOT CHART on page 10 for approximate settings.
- Q. CAN I START AND STOP THE 250B SERIES WITHOUT BREAKING AC LINES?**
A. The preferred way is to open and close the lead going to HI on the main speed potentiometer (Use SPDT Switch). Another way is to open and close a SPST switch between +T and Speedpot HI. This enables the control to stop and start fast (HARD). A SPST switch may be connected with the N.O. contact to +T, Common to Speedpot HI, and the N.C. contact to Speedpot HI (other two leads of pot connected normally). With this arrangement the control acceleration will be at the rate selected by the trimpot setting and the deceleration should be fast (HARD).
- Q. CAN I USE THE 250B SERIES TO FOLLOW A VOLTAGE OR AS A TACH FOLLOWER?**
A. Yes, The signal must be ungrounded. See TERMINAL STRIP - page 6.
- Q. CAN I USE THE 250B SERIES AS A CURRENT FOLLOWER?**
A. Yes, There are field installed options (-5 and -7) to do this.
- Q. CAN I USE A MOTOR WITH A 90 VOLT ARMATURE WITH 240 VAC INPUT?**
A. Not recommended. Motor damage could result from peak voltages.
- Q. CAN I USE THE 250B IN A REVERSING APPLICATION?**
A. Yes. See Option -29 and -29B on page 14.

DIMENSIONS

FOR ENCLOSED VERSION: Add $1/2"$ to overall length. Allow $3\ 1/2"$ for height clearance.

FOR CHASSIS VERSION: Allow $1\ 5/8"$ for height clearance.



CAUTION: DO NOT MOUNT CONTROL WHERE AMBIENT TEMPERATURE IS OUTSIDE THE RANGE OF -10°C (15°F) to 45°C (115°F).

MOUNTING

1. Four $7/32"$ slots are provided for control mounting.
2. The chassis of the control can be used as a template.
3. Use standard hardware to mount.
4. The ENCLOSED version has 2 tapped holes provided on one endplate to facilitate wiring. The endplates can be interchanged allowing conduit or wiring to be connected to either the top or the bottom.

CAUTION:

1. BE SURE THE CONTROL HOUSING IS PROPERLY GROUNDING.
2. ARM CONNECTIONS MUST NOT BE SWITCHED OR BROKEN WHILE THE CONTROL IS ON. SERIOUS CONTROL DAMAGE MAY RESULT.
3. FOR NON-SPEEDPOT APPLICATIONS, THE INPUT CONNECTION TO THE LO-WIPER-III MUST NOT BE GROUNDING. SERIOUS CONTROL DAMAGE MAY RESULT FROM A GROUNDING INPUT.

TERMINAL STRIP WIRING

The 250B Series has an 11 position terminal strip for ease of connection.

- P1-1** (SPEEDPOT LO) Connects to Low side (orange wire) of 5k Speedpot (normally the CCW end). This input is raised and lowered by the MIN. trimpot. Electronic speed input (voltage follower) may be referenced to Speedpot LO if the MIN trimpot adjustments are to be active. Otherwise, inputs may be referenced to -ARM, which will bypass the MIN trimpot. INPUT MUST NOT BE GROUNDED!
- P1-2** (SPEEDPOT WIPER) Connects to wiper (red wire) of Speedpot (center lead). For Voltage Follower applications, this INPUT MUST NOT BE GREATER THAN +12V MAXIMUM AND MUST NOT BE GROUNDED!
- P1-3** (SPEEDPOT HI) Connects to high side (white wire) of Speedpot (CW end). This is internal +12 volts. For start-stop applications, the connection between this terminal and Speedpot HI can be opened and closed by a SPST switch. See question #3 in "COMMONLY ASKED QUESTIONS". INPUT MUST NOT BE GROUNDED!
- P1-4** (+ARM) Connect to PLUS (+) Armature wire on motor. 0-90VDC for 120VAC input OR 0-180VDC for 240VAC input. See "SPECIFICATIONS" for output rating.
- P1-5** (-ARM) Connects to MINUS (-) Armature wire on motor. For Voltage Follower applications where MIN trimpot is bypassed, connect (-) of the follower to this terminal.
- P1-6** (+FIELD) DO NOT use for Permanent Magnet Motor. This supplies +Field voltage for a SHUNT WOUND MOTOR. Refer to Field Voltage table. For motors with dual voltage field (i.e. 50/100V or 100/200V), make sure highest value is connected.

FIELD VOLTAGE TABLE		
VAC IN	120	240
VDC FIELD	100	200

- P1-7** (-FIELD) Connect MINUS (-) Field wire of SHUNT WOUND MOTOR.
- P1-8,9** (SPARE AC) - VERY IMPORTANT!!! Refer to "FUSING CHART" on page 4.
 CHASSIS VERSION: Make no connection to P1-8 or P1-9.
 ENCLOSED VERSION: 120VAC - Connect incoming hot AC (black wire) to P1-8 and Neutral (white wire) to P1-9. Connect ground (green wire) to CHASSIS GROUND, as shown in diagram - page 7.
 240VAC - Connect both hot sides, one to P1-8 and one to P1-9. Also connect ground wire to CHASSIS GROUND.
- P1-10,11** (SWITCHED AC)
 CHASSIS VERSION: 120VAC - Connect incoming hot AC (black wire) to P1-10 and Neutral (white wire) to P1-11. Connect ground (green wire) to CHASSIS GROUND.
 240VAC - Connect both hot sides, one to P1-10 and one to P1-11. Connect ground wire to CHASSIS GROUND.
 ENCLOSED VERSION: No connections to P1-10 and P1-11. This is for Switched AC Output. Note "FACTORY WIRING" - page 7. Pilot lights can be connected between these terminals. The voltage present at these terminals is the AC input voltage.

START UP

**ALL POWER MUST BE TURNED OFF
BEFORE PROCEEDING!!**

1. Recheck all wiring. Accidental grounds, loose or pinched wires on armature or speedpot wires may damage the control when power is applied.

2. Check to see that incoming service is of correct voltage.

3. Turn speedpot to zero (fully CCW).

4. Turn power on, and advance speedpot while observing motor.

POWER MUST BE OFF BEFORE STEP 5 CAN BE ACCOMPLISHED!

5. If motor rotation is incorrect, turn power off at external disconnect and reverse +ARM and -ARM connections.

6. Check for satisfactory operation throughout the speed range.

7. If operation is satisfactory, no re-adjustments are needed.

8. If instability or surging is observed, or if maximum speed is higher than desired, proceed to "TRIMPOT ADJUSTMENT" on pages 8 and 9.

9. For other problems, consult page 16, "IN CASE OF DIFFICULTY".

ADJUSTMENTS

The trimpot adjustments, MIN, MAX, IR COMP, and CUR LIM, are checked at the factory using a typical motor at 240VAC input. Use the TRIMPOT CHART on page 10 to adjust the trimpots for the proper setting for your application. The remaining trimpot - ACCEL, is a variable acceleration adjustment and should be set for your particular application.

The trimpot chart is approximate. The chart is valid when using the speedpot or a 0-10/12VDC input signal to control speed.

These adjustments are permanent; periodic readjustment is normally not needed. Operation of the control beyond $\pm 10\%$ of normal line voltage could result in readjustments.

TRIMPOT SETTING CHART

- ✓ THESE SETTINGS APPLY WHEN USING A 5,000 OHM MASTER SPEEDPOT.
- ✓ THEY WILL DIFFER WHEN USING VARIOUS OPTIONS, SUCH AS THE -5 OR THE -7. FOR -17B OPTION,
- ✓ ACCEL / DECEL IS 20 SECONDS WHEN POT IS TURN FULLY CW.
- ✓ THIS TRIMPOT CHART IS APPROXIMATE. USE IT IN CONJUNCTION WITH ADJUSTMENT PROCEDURES.

MIN	MAX	ACCEL	LR.	C.L.	H.P. / VOLTAGE
					1/50- 120VAC
					1/15- 120VAC
					1/8- 120VAC
					1/4 - 120VAC
					1/3 - 120VAC
					1/2 - 120VAC
					3/4 - 120VAC
					1.0 - 120VAC
					1/4 - 240VAC
					1/2 - 240VAC
					3/4 - 240VAC
					1.0 - 240VAC
					1.5 - 240VAC

251B

253B

253B

SPECIFICATIONS

AC INPUT VOLTAGE + or - 10% of Rated Line Voltage
 ACCELERATION5 to 8 Seconds Adjustable (Note option -17B)
 CONTROLLER OVERLOAD CAPACITY 150% for 1 minute
 CURRENT LIMIT TRIMPOT RANGE 1 to 15 Amps
 DECELERATION TIME STANDARD (Dependant on Acceleration Time Setting) Range .06 to .80 Seconds
 DIMENSIONS & WEIGHT :

	WIDTH	LENGTH	DEPTH	WEIGHT	TYPE
ENGLISH	5.530"	7.428"	3.550"	17.50 oz.	Enclosed
	5.530"	7.000"	1.625"	14.25 oz.	Chassis
METRIC	140mm	189mm	91mm	469 grams	Enclosed
	140mm	177mm	41mm	404 grams	Chassis

DRIVE SERVICE FACTOR1.0
 EFFICIENCY 85% Typical
 ELECTRICAL SPECIFICATIONS :

H.P.	MAX AC AMPS	MAX ARM AMPS	MAX AC AMPS	MAX ARM AMPS
1/50	.26	.20	—	—
1/20	.70	.50	—	—
1/8	1.80	1.40	—	—
1/4	3.50	2.70	1.80	1.40
1/3	4.40	3.40	2.20	1.70
1/2	6.50	5.00	3.30	2.50
3/4	9.30	7.20	4.80	3.70
1.0	13.20	10.20	6.50	5.00
1.5	—	—	9.70	7.50

INPUT FREQUENCY 50 or 60 Hertz
 MAXIMUM SPEED TRIMPOT RANGE 66% to 110% of Base Speed
 MINIMUM SPEED TRIMPOT RANGE 0 to 30% of Maximum Speed
 MINIMUM EXTERNAL IMPEDANCE (Pot HI to Pot Lo) 5K Ohms
 POWER DEVICES Packaged Full Wave Bridge
 SHUNT FIELD VOLTAGE 100VDC for 120VAC Input; 200VDC for 240VAC Input (1 Amp Maximum)
 SPEED RANGE 30 : 1
 SPEED REGULATION + or - 1% of Base Speed
 TEMPERATURE RANGE -10 to 45 Degrees C. - Ambient (15 to 115 Degrees F.)
 TRANSIENT PROTECTION G-Mov and Noise Torroid
 TRIGGER Torroid
 TYPE RAMP OF ACCEL / DECEL Linear

ANTUNES CONTROLS

DIVISION OF A.J. ANTUNES & CO.

GAS PRESSURE SWITCHES MODEL-A INSTALLATION INFORMATION

You are installing one of the finest gas pressure switches of its type on the market. Design of these switches is based on the same principles of sensitivity, accuracy, and dependability that have made Antunes Controls Air Flow switches so successful. These switches are fully approved. They are U.L. and C.S.A. listed and approved by Factory Mutual.

Antunes Controls Gas Pressure switches monitor gas pressure. The models are available in high pressure and low pressure single gas switches and also in a double Hi-Lo combination switch. Pressure range varies from 1 inch of water column to 50 inches of water column.

The combination switch provides both high pressure and low pressure units in one switch. This saves wiring and installation space over an interlock system with separate high pressure and low pressure switches.

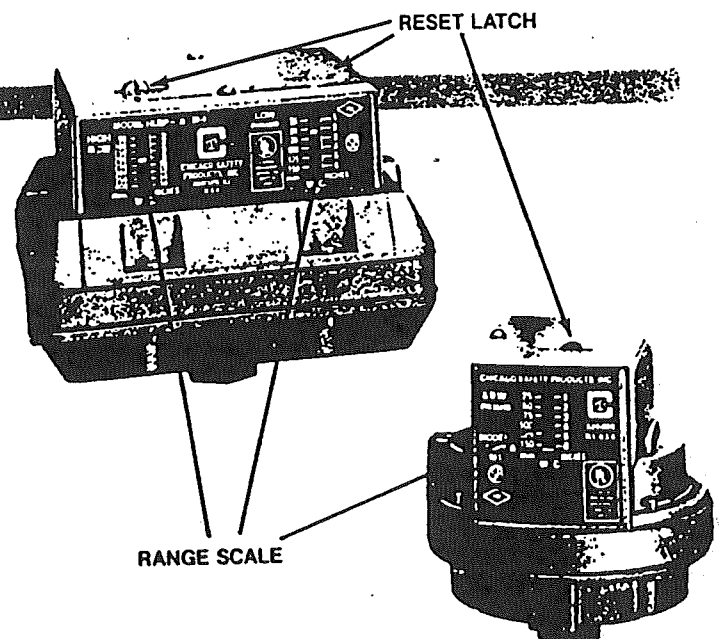
Each switch is adjustable within its range, as shown on the range scale on the front. The latch position in the reset type models, and lever indicator position in the recycle type models shows whether the switch is on or off.

Switches are sturdy. All components are well made. The switch is neat in appearance, in its die-cast aluminum housing. In every way, you will be pleased with the ease of installation and the reliability of Antunes Controls Gas Pressure switches.

Please read this folder carefully to assure correct installation. This equipment must be installed only by a licensed electrician who is experienced with combustion safeguard control systems and understands the functions of interlocking switches such as air and gas pressure switches. Prior to being put into operation in conjunction with combustion safe guard systems, all switches should be tested for proper range setting and proper wiring. Check piping connections and switch housing for leaks with a soap bubble test. All exhaust fans and blowers should be inspected and checked for proper rotation prior to starting up. If you have any problems or questions, phone, wire, or write to the manufacturer, Antunes Controls.

RANGE ADJUSTMENT—All Models

To adjust gas pressure cut-off setting on either high or low pressure units, remove the electrical junction box cover, and adjust indicator up or down to desired setting, as shown on the range scale on front of switch. Use the center of the range indicating tab as a guide for accurate setting. Turn adjusting screw clockwise to lower the set point and counterclockwise to raise the setting. To prevent tampering with setting after adjustment, be sure to replace the junction box cover firmly.



OPERATION RESET MODELS

Low Gas Pressure

Low gas pressure switches break the electrical circuit on pressure drop at the point when gas pressure becomes lower than the indicated set pressure.

Before the manual reset latch can be properly latched, gas pressure in the chamber must be higher than the indicated setting. The position of the reset latch on the top cover of the switch shows whether reset latch is in the on or off position. Reset latch must be in "on" position after latching to be properly set.

High Gas Pressure

High gas pressure switches break the electrical circuit when pressure rises above the indicated preset pressure. The reset latch should be latched in the "on" position if the gas pressure in the switch chamber is below the indicated high setting.

RECYCLE MODELS

High and Low Gas Pressure

Recycle models operate automatically and do not need to be reset. Otherwise they are constructed, adjusted, and operate in the same manner as the reset models.

COMBINATION MODELS

The combination unit contains one high pressure unit and one low pressure unit, in the ranges you select. They may be either reset or recycle type. Each unit has on-off indicator, and its own range scale indicator.

MODELS AVAILABLE

Each switch, single or double, is adjustable within the ranges shown. Double combination switches can include any Hi and Lo pressure range shown. Order by model letters and range.

Model Numbers

Reset		Recycle
HLGP-A	Combination Double Unit	RHLGP-A
LGP-A	Single Units, Lo-Pressure	RLGP-A
HGP-A	Single Units, Hi-Pressure	RHGP-A

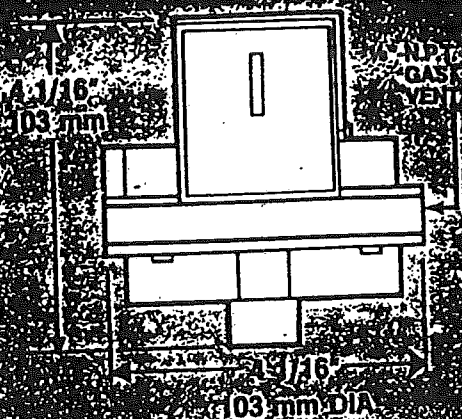
Ranges Available

High Gas Pressure (HGP-A, RHGP-A)	Low Gas Pressure (LGP-A, RLGP-A)
2" to 16" water column	1" to 6" water column
5" to 28" water column	2" to 14" water column
10" to 50" water column	6" to 24" water column
	10" to 50" water column

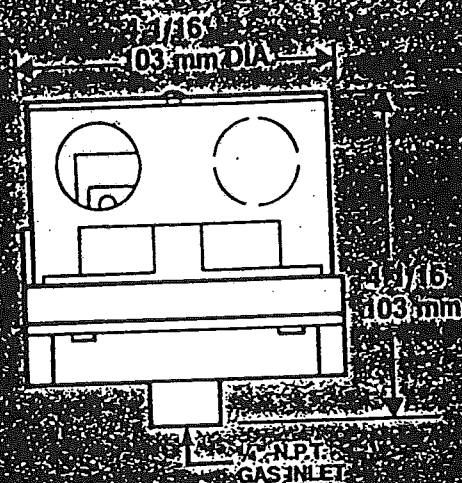
To order: For example, if you wanted a switch with a low pressure cutoff at 4 inches, reset type, you would order Model LGP-A 1-6". If you wanted a combination switch with a high pressure cutoff at 40" w.c. and a low pressure cut off at 8" w.c. in Recycle type, you would order Model RHLGP-A 10-50", 2-14".

PHYSICAL DIMENSIONS

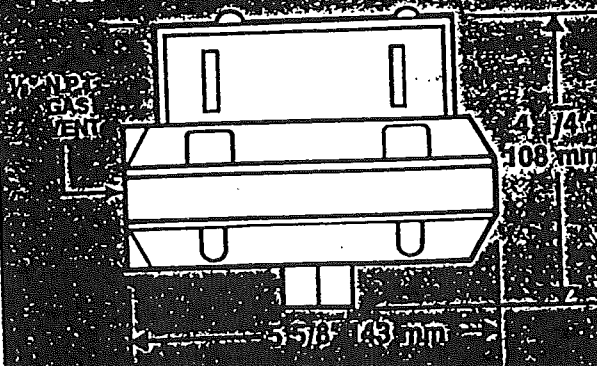
FRONT VIEW



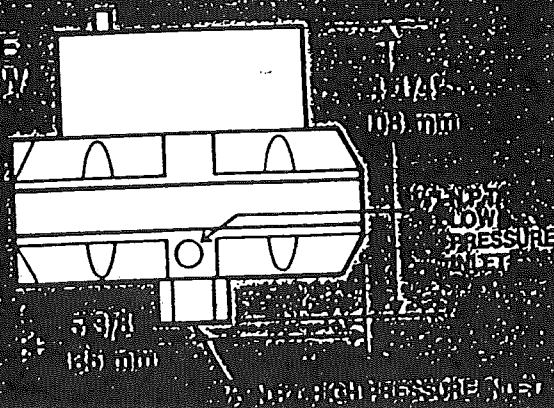
SIDE VIEW



FRONT VIEW



SIDE VIEW



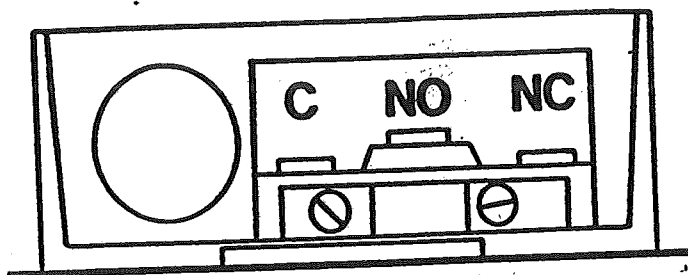
ELECTRICAL INFORMATION

Electrical Ratings—All Models

10A @ 125, 250 or 480 VAC

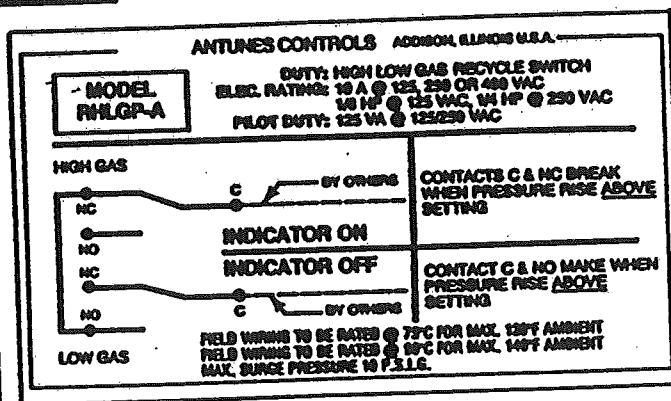
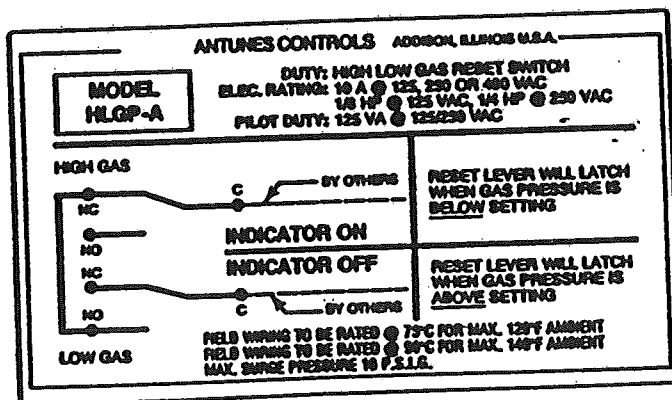
1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC

Pilot Duty—125 VA @ 125/250 VAC



ELECTRICAL WIRING

COMBINATION MODELS



SIMPLE MOUNTING—All Models

All gas pressure switches must be mounted in a horizontal position, with the inlet stem down. Switches should be reasonably leveled but do not require accurate leveling.

Single gas switch models have a 1/4 N.P.T. gas inlet.

Double combination Hi-Lo switches have a 3/8 N.P.T. for high pressure inlet and a 1/8 N.P.T. for low pressure inlet.

Gas vent outlets are 1/8 N.P.T. on all models.

Piping can be either standard black pipe or aluminum tubing.

All switches can be supported by the inlet pipe, but optional mounting brackets are available if needed.

All switches have been factory-calibrated and tested for leaks. However, it is recommended that after the installation is completed, switch, gas pipe inlets, and connections be tested for leaks with soap bubble test.

Maximum surge pressure: 10 PSIG

Max ambient operating temperature: 140°F or 60°C.

Minimum ambient operating temperature: minus 40°F or minus 40°C.

LIMITATION OF LIABILITY. It is understood and agreed that seller's liability whether in contract, in tort, under any warranty, in negligence or otherwise shall not exceed the return of the amount of the purchase price paid by purchaser and under no circumstances shall seller be liable for special,

indirect or consequential damages. The price stated for the equipment is a consideration in limiting seller's liability. No action, regardless of form, arising out of the transactions may be brought by purchaser more than one year after the cause of action has accrued.

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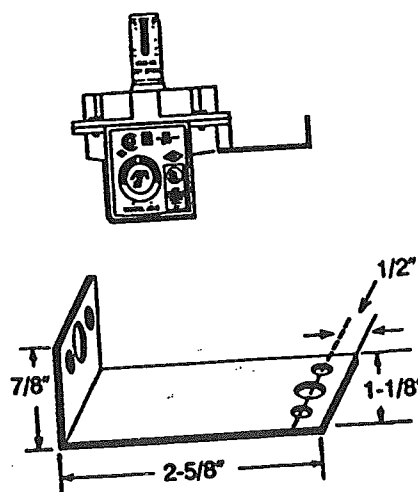
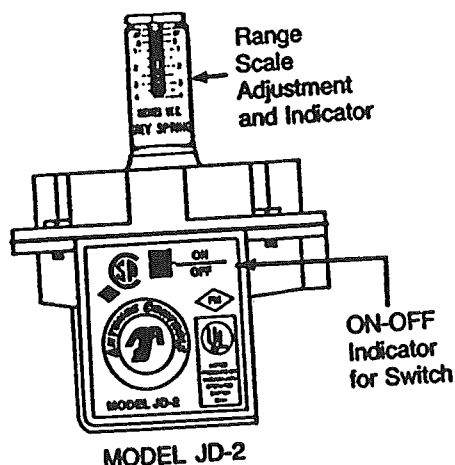
AIR FLOW INTERLOCKING SAFETY SWITCHES

INSTALLATION INFORMATION

You are installing one of the finest switches of its type on the market. You will find this switch has many superior features that insure dependable, accurate, long-life operation. This switch is highly sensitive, fully approved. They are UL and CSA listed and approved by Factory Mutual.

Please read this folder carefully to assure correct installation. This equipment must be installed only by a licensed electrician who is experienced with combustion safeguard control systems and understands the functions of interlocking

switches such as air and gas pressure switches. Prior to being put into operation in conjunction with combustion safe guard systems, all switches should be tested for proper range setting and proper wiring. Check piping connections and switch housing for leaks with a soap bubble test. All exhaust fans and blowers should be inspected and checked for proper rotation prior to starting up. If you have any problems or questions, phone, wire, or write to the manufacturer, Antunes Controls.



NOTE: Model must be mounted horizontally, as illustrated.

MOUNTING

Model JD-2 (spring-adjustable) is always mounted stem up.

OPTIONAL MOUNTING BRACKET

Bracket fastens to bottom section of switch housing with a 5/16" x 18 x 1/2" bolt (supplied with bracket), as shown at right.

ELECTRICAL INFORMATION

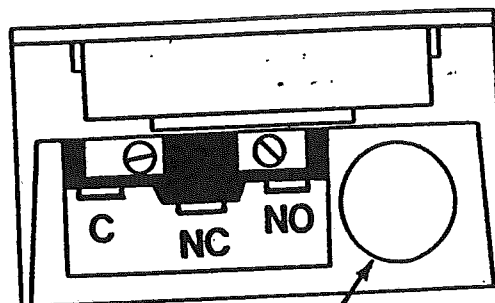
RATINGS

10 Amperes, 1/8 Horsepower, 125 Volts A.C.

5 Amperes, 1/4 Horsepower, 250 Volts A.C.

For Pilot Duty: 125 Volt-Amperes

Field wiring by others must be rated
at 90°C for industrial use.

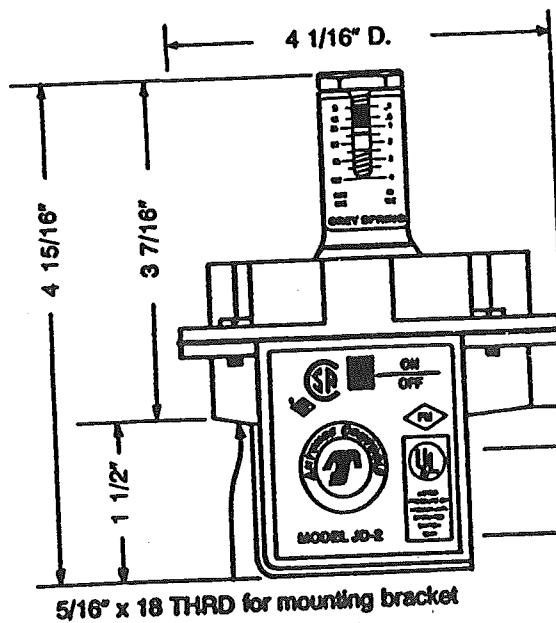


HOLE FOR 7/8" CONDUIT CONNECTION

TERMINAL CONNECTIONS AND PHYSICAL DIMENSIONS

Model JD-2
ALWAYS STEM UP

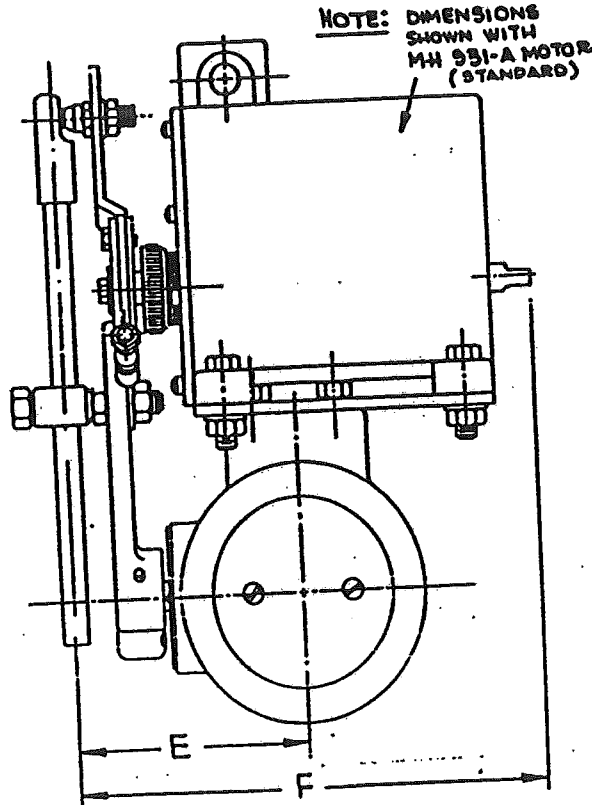
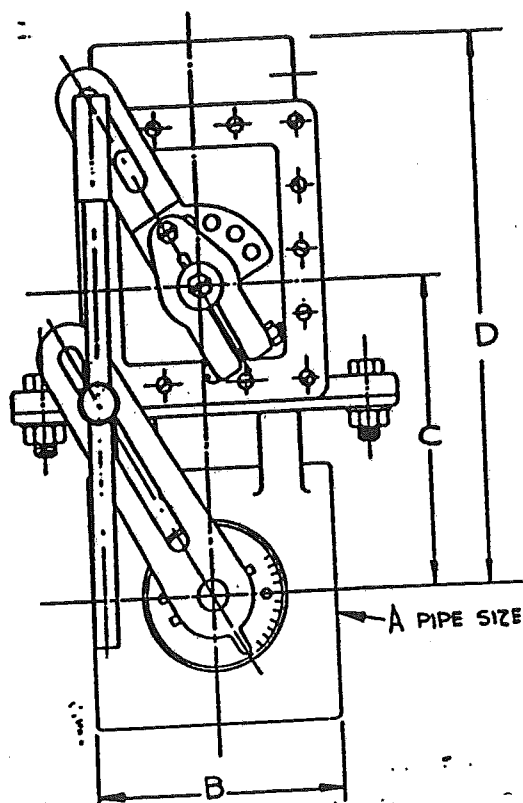
INDICATOR POSITION	TERMINAL
OFF	C and NO open C and NC closed
ON	C and NO closed C and NC open



BUTTERFLY VALVES

DIMENSIONS

BULLETIN 1312
PAGE NO. 2

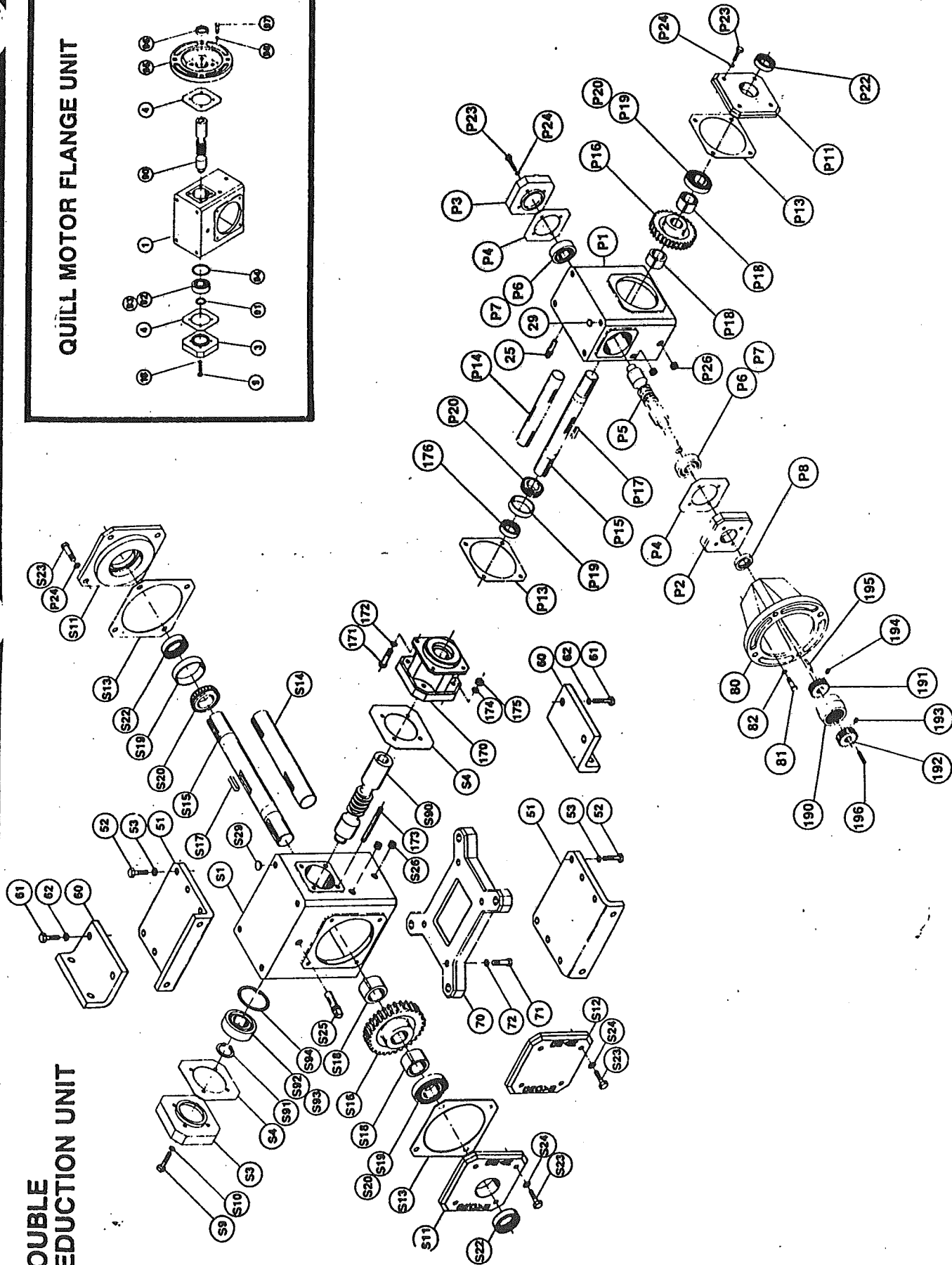


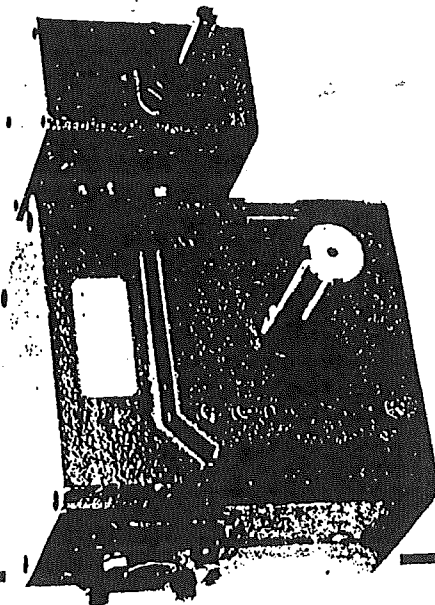
Catalog Number	A Pipe Size	B	C	D	E	F	Wt. in Lb. W/Mtr.	Wt. in Lb. Less Mtr.
8 TBV-M	1	2-3/8	5	8-5/8	2- 7/16	7	13#	4#
10 TBV-M	1-1/4	2-1/2	5-1/4	8-7/8	2- 9/16	7	13#	4#
12 TBV-M	1-1/2	2-5/8	5-1/4	8-7/8	2-11/16	7	14#	5#
16 TBV-M	2	3	5-5/8	9-1/4	2-15/16	7	15#	6#
20 TBV-M	2-1/2	3-1/2	6-1/4	9-7/8	3- 7/16	7	17#	8#
24 TBV-M	3	3-7/8	6-1/2	10-1/8	3- 5/8	7	20#	11#
32 TBV-M	4	4-1/2	7-1/4	10-7/8	4- 3/8	7	26#	17#
48 TBV-M	6	5-1/8	8-1/4	11-5/8	5- 3/4	7	40#	31#

ORDERING INFORMATION

1. Select size and quantity of series TBV-M Butterfly Valves from table above by catalog number.
2. Specify intended control motor when ordering valve assembly only.

DOUBLE REDUCTION UNIT





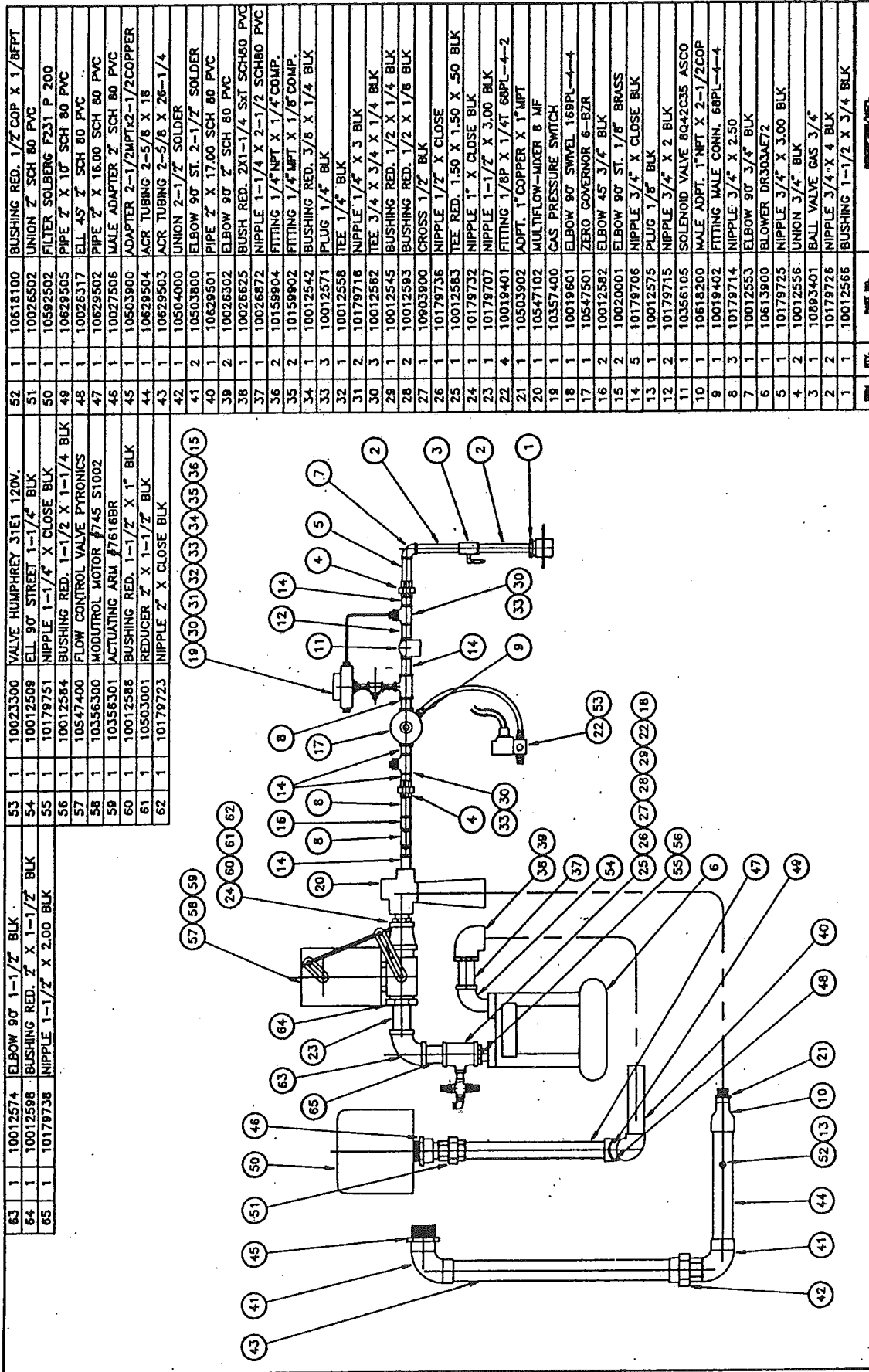
Flexaline® Right Angle Worm Gear Speed Reducers

"Versatility
in Industrial Power Transmission
Applications"

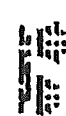
FLEXALINE® GEAR DRIVES PARTS LIST—DOUBLE REDUCTION

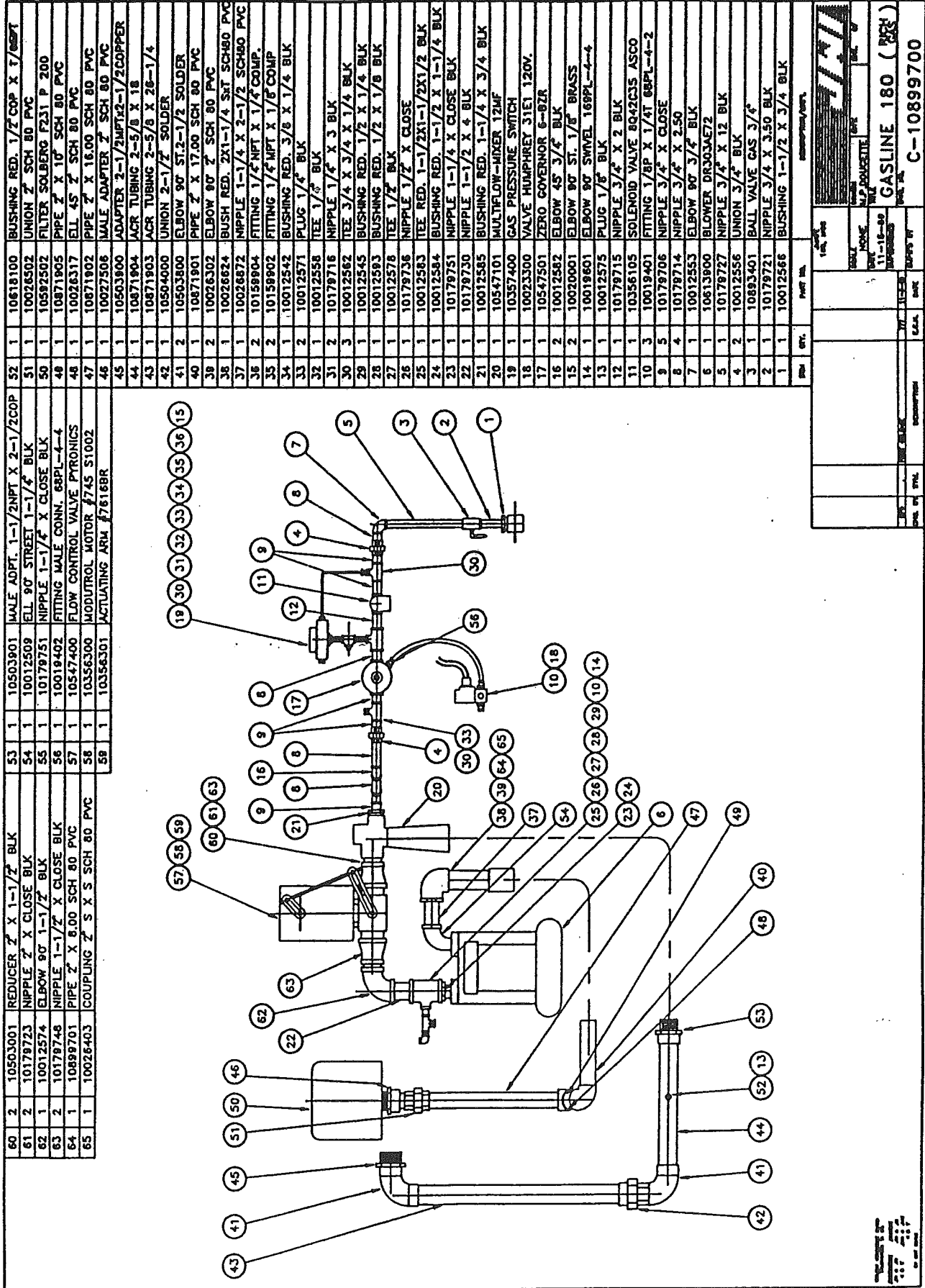
Item No.	Description	Qty.	Item No.	Description	Qty.
P1/S1	Gear Housing	(1)	P90/S90	Quill Motor Flange Unit	(1)
P2/S2	Input Cover (Seal)	(1)	P91/S91	Quill Input Shaft	(1)
P3/S3	Input Cover (Bearing)	(1)	P92/S92	Retaining Ring (Shaft)	(1)
P4/S4	Input Cover Gaskets	(as req'd)	P93/S93	Input Bearing (Cup)	(2)
P5/S5	Input Shaft	(1)	P94/S94	Input Bearing (Cone)	(1)
P6/S6	Input Bearing (Cup)	(2)	P95/S95	Retaining Ring (Housing)	(1)
P7/S7	Input Bearing (Cone)	(2)	P96/S96	Quill Motor Flange	(1)
P8/S8	Input Oil Seal	(1)	P97/S97	Oil Seal	(1)
P9/S9	Hex Head Capscrew	(8)	P98/S98	Hex Head Capscrew	(4)
P10/S10	Lock Washer	(8)		Lock Washer	(4)
P11/S11	Output Cover (Seal)	(1)		Hollow Output Shaft Unit	
P12/S12	Output Cover (Bearing)	(1)	120	Hollow Output Shaft	(1)
P13/S13	Output Cover Gaskets	(as req'd)	121	Worm Gear (Hollow)	(1)
P14/S14	Single Output Shaft	(1)	122	Worm Gear Key	(1)
P15/S15	Double Output Shaft	(1)	123	Worm Gear Spacer	(2)
P16/S16	Worm Gear	(2)	125	Output Shaft Bearing (Cup)	(2)
P17/S17	Gear Key	(2)	126	Output Shaft Bearing (Cone)	(as req'd)
P18/S18	Gear Spacer	(2)	127	Output Gaskets	(2)
P19/S19	Output Bearing (Cup)	(1)	128	Output Cover	(2)
P20/S20	Output Bearing (Cone)	(1)	129	Output Oil Seal	(2)
P22/S22	Output Oil Seal	(8)*	130	Hex Head Capscrew	(8)
P23/S23	Hex Head Capscrew	(8)*	131	Lock Washer	(8)
P24/S24	Lock Washer	(1)	132	Set Screw	(1)
P25/S25	Vent Plug	(2)	140	Torque Bracket	(1)
P26/S26	Pipe Plug	(4)	141	Hex Head Capscrew	(8)
P29/S29	Protective Plug	(4)	142	Lock Washer	(8)
	Vertical Risers Unit			Double Reduction Unit	
51	High and Low Riser Bracket	(2)	170	Double Reduction Adaptor	(1)
52	Hex Head Capscrew	(8)	171	Hex Head Capscrew	(4)
53	Lock Washer	(8)	172	Lock Washer	(4)
	"J" Mount Unit		173	Stud Bolt	(4)
60	"J" Mount Bracket	(2)	174	Lock Washer	(4)
61	Hex Head Capscrew	(4)	175	Hex Head Washer	(4)
62	Lock Washer	(4)	176	Oil Seal	(1)
	Horizontal Base Unit		177	Shaft Bushing	(1)
70	Horizontal Base	(1)	178	Shaft Key	(1)
71	Hex Head Capscrew	(4)		Coupling Kits	
72	Lock Washer	(4)	190	Coupling Sleeve	(1)
	Long Motor Flange Unit		191	Coupling Gear	(1)
80	"C" Face Motor Flange	(1)	192	Coupling Gear	(1)
81	Hex Head Capscrew	(4)	193	Set screw	(1)
82	Lock Washer	(4)	194	Set screw	(1)
			195	Key	(1)
			196	Key	(1)

*1425 Unit has (10) and 1525 Unit has (16).



1/2" INCH		1/2" INCH	
TEST	NONE	TEST	NONE
DATE	11-15-89	DATE	11-15-89
BY	W. J. B. / J. B. B.	BY	W. J. B. / J. B. B.
GASLINE 120 (RGR)		GASLINE 120 (RGR)	
C-10899600		C-10899600	





MODEL NO. 11-18-80 DATE 11-18-80 BY [Signature] CHECKED BY [Signature]	
PART NO. 10899700 DESCRIPTION GASLINE 180 (RCH) C-10899700	