

A
MODERN

AUDEL'S

**OIL
BURNER
GUIDE**



**INSTALLING
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REPAIRING**

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General Electric Inverted Oil Burner and Control.—

The various controls necessary for proper operation must be brought into action according to a properly timed cycle and this is accomplished by the master or primary control.

THE GENERAL ELECTRIC METHOD OF BURNING OIL

On all models of G-E oil-fired units the fuel oil is drawn from the storage tank through a SCREEN VALVE

into a MOTOR COMPRESSOR unit by a ROTARY OIL AND AIR PUMP which discharges oil and air into a SUMP under pressure

OIL goes through an ELECTRIC VALVE and mixes with COMPRESSED AIR in a BURNER NOZZLE

The oil burns in a COMBUSTION CHAMBER

cushioned on the AIR introduced from the bottom of the furnace and gasses pass

through a SECONDARY HEAT TRANSFER SURFACE to the bottom of the unit.

and out through a CHIMNEY CONNECTION

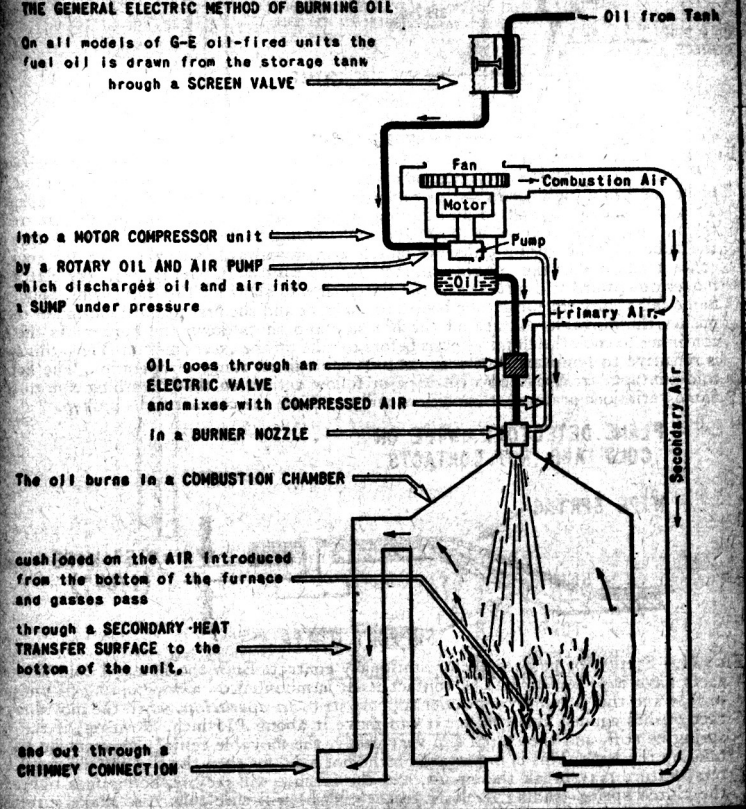


Fig. 9—Diagram showing essential parts of General Electric inverted oil burner of the automatic heating equipment shown in the accompanying illustrations.

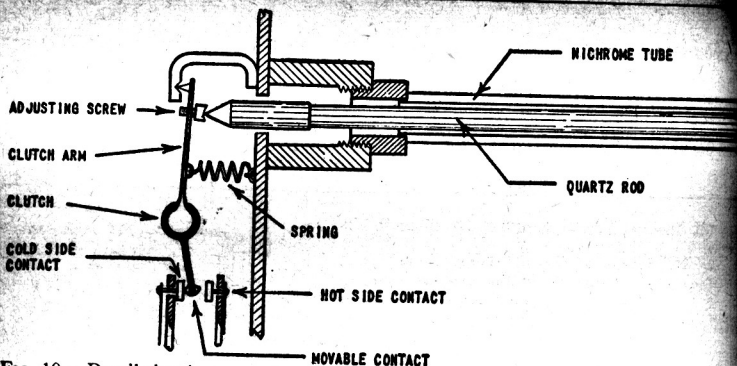


FIG. 10.—Detail showing operation of General Electric thermal switch flame detector type CR 786502. The sensitive element is made up of a nichrome tube and a quartz rod. The nichrome has a high coefficient of expansion, the quartz has practically zero expansion. This difference is translated into motion of the contacts. *In operation*, as heat strikes the tube and the spring pulls the clutch arm downward, which breaks the cold side contact and makes the hot side contact. As the tube continues to heat, the clutch arm moves downward still farther and the clutch slips to allow for this movement. Should the flame fail at any time, the tube begins to contract and the first upward motion of the tube pushes the movable contact off the hot side and shuts down the burner. As the tube continues to cool, the clutch slips as before to take up the excess motion. Thus, this switch is sensitive to temperature change at any point in its range of operation. The hot and cold contacts are provided with wipe or follow action, so that breathing due to slight flame variations or draught conditions will not cause the contact to be broken.

FLAME DETECTOR: WIPE ON COLD AND HOT CONTACTS

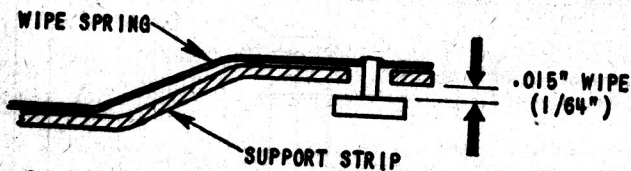
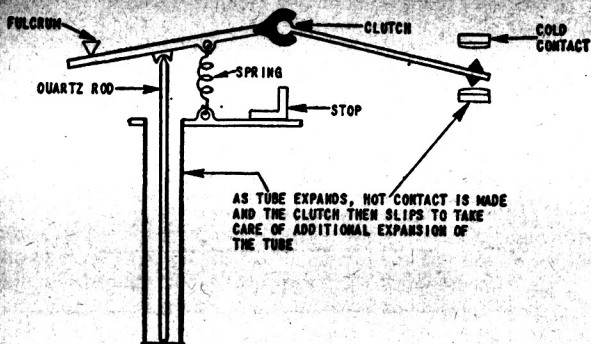
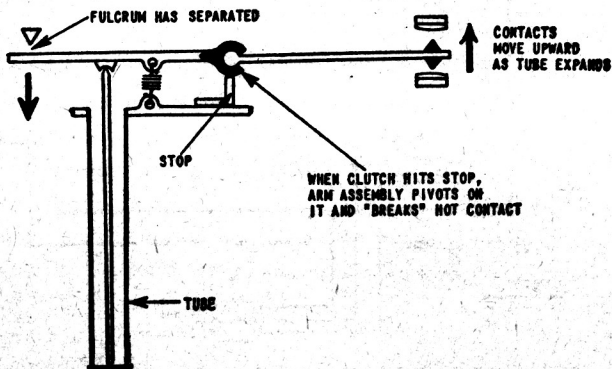


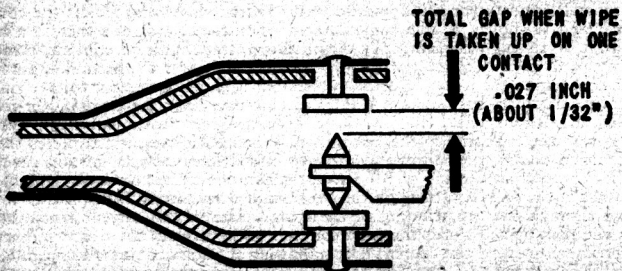
FIG. 11.—Section of flame detector stationary contact. Both the hot and cold side contacts have *wipe* or *follow*. The contact itself is mounted on a wiper spring of phosphor bronze and this is held by a heavier support strip. *In operation*, when the movable contact pushes against this contact it can move it about .015 inch. However, if the wiper spring be stiff, and the clutch slip very easily, the movable contact may not be able to take up the wipe. This is important on the hot side, for then the slightest fluctuation in temperature may break the circuit, and the furnace will recycle. Sometimes tightening the clutch spring (sliding it closer to the clutch) will cure this. Also make sure there is no grease on the clutch. Dirt or corrosion behind the contact may also cause insufficient wipe by limiting the movement. Wipe is also lost if the wiper spring become bent so that the contact stays back against the support strip and therefore has no movement.



12.—Normal flame detector action.



13.—Pivoting of flame detector after clutch strikes stop.



14.—Flame detector contact adjustment.

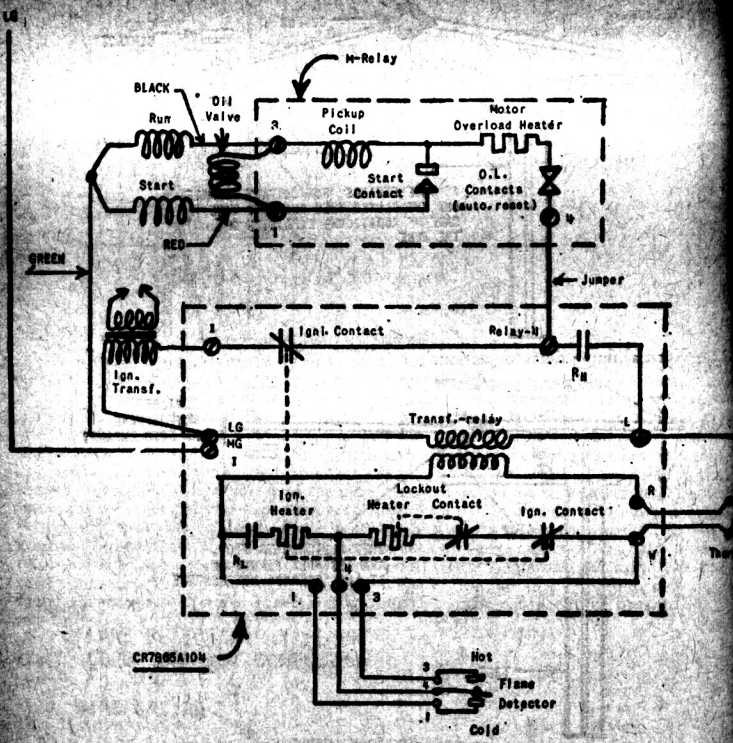
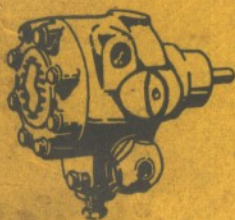
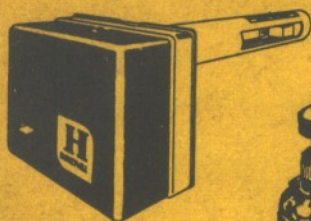


FIG. 15.—General Electric master control and M relay wiring diagram. *Cycle of operation.* 1. The room thermostat or the domestic water switch closes and makes the connection between R and W shown. 2. The flame detector is on the cold side so there is a complete circuit from W through the normally closed low voltage ignition contact, through normally closed lockout contact, through the lockout heater to terminal 4, through cold side contacts of the flame detector to terminal 1, through the low voltage side of transformer relay and back to R. 3. This circuit energizes the transformer-relay causing R_L and $R_{\bar{L}}$ to close. R_L provides a holding circuit while the flame detector travels from the cold side to the hot side. 4. When $R_{\bar{L}}$ closes, it completes the circuit to the ignition transformer through normally closed line voltage ignition contact, the spark is generated. Closing of $R_{\bar{L}}$ also completes the circuit through the motor load contact of the M relay, through the overload heater, through the pickup coil of relay and through the run winding of the motor. The inrush current through the winding and pickup coil closes the start contacts and energizes the start winding. As the motor comes up to speed the current drops allowing the start contacts to open. 5. The valve coil is connected to 1 and 3 of the M relay. This puts it across the start and run windings of the motor. The oil valve coil is energized and the needle picks up when

rt circuit is de-energized. Flame is not established until a short instant after the
tor compressor starts. 6. When flame is established, the flame detector leaves the cold
e and starts moving toward the hot side. When it leaves the cold side, the current in
e secondary of the transformer relay must flow through RL, through the ignition heater
d also through the lockout heater, the lockout contacts and ignition contacts. If the
rent flow through the lockout heater for more than 28 seconds it will cause the lock-
t contacts to open and stop the burner. These contacts must be reset manually if they
en. The flame detector will normally get over to the hot side in 5 to 10 seconds. When
reaches the hot side it provides a low resistance path in parallel with the lockout heater.
e current will flow through this low resistance and not through the heater. Assuming
e flame detector has reached the hot side in less than 28 seconds, everything is normal.
Current started through the ignition heater when the flame detector left the cold side.
ty seconds later this heater causes both ignition contacts to open. Current continues
flow through the ignition heater as long as the burner is operating. When the thermo-
st or domestic water switch is satisfied everything shuts down and the ignition heater
ols off. Sixty seconds later both ignition contacts will close. This period then is a scav-
ing period at the end of the heating cycle. The burner cannot start up again until this
od is over.

Sid Harvey's
**TROUBLE
SHOOTING
GUIDE**



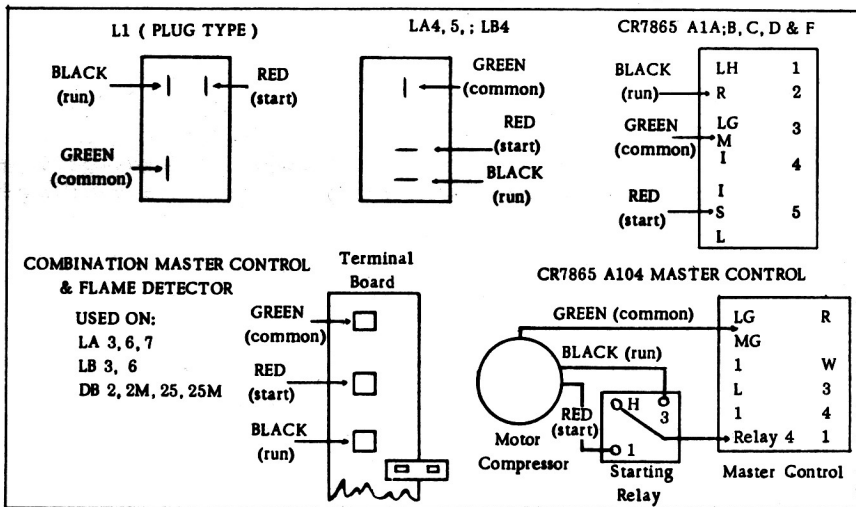
Revised April 1966

**PRACTICAL
SERVICE & INSTALLATION
INFORMATION ON
DOMESTIC OIL BURNERS**

Fifty Cents

G-E COMPRESSOR TEST PROCEDURE

WIRING HOOK-UPS FROM G-E COMPRESSORS TO 5 DIFFERENT TYPES OF G-E MASTER CONTROLS.



1. Disconnect oil valve coil leads from Master Control to prevent oil from being accidentally discharged in the firebox.
2. **SUMP PRESSURE TEST:** Remove 1/8" pipe plug from the air outlet tee on compressor and install pressure gage. Start unit (see *below). Pressure gage will show sump pressure (see page 51 for sump pressure on different units). Adjust pressure regulating valve if necessary.
3. **VACUUM TEST:** Disconnect oil suction line to compressor. Remove 1/8" pipe plug from suction line tee on compressor and install vacuum gage. Vacuum can only be checked with empty sump. To empty sump, loosen oil line fitting to nozzle. Start unit (see *below). Oil will flow out of loosened fitting (catch in can). When oil stops flowing, hold finger over inlet port of tee. Read vacuum which should be 19" or more. Tighten oil line fitting.
4. **BACK PRESSURE TEST** to check float setting. Remove pressure gage. Run a short length of tubing (about 3 feet) from suction port to a can of fuel oil (quart can is enough). Start unit (see *below) and allow compressor to pull as much oil from can it will take (this will take about 30 seconds). Then hold finger over air outlet port. Air should bubble out of suction line in can, indicating a back pressure in suction line.

★ TO START UNIT FOR TEST PURPOSES

WHEN UNIT HAS A1F2 MASTER CONTROL (telechron type)

- Open line switch.
- Open thermostat and domestic hot water control contacts.
- Disconnect oil valve coil.
- Install jumper between "L" and "R" terminals.
- Compressor will now start and stop from line switch.

NOTE: The Master Control is also the starting switch for the compressor. When the line switch is closed, the starting contacts in the Master Control must be closed manually for a few seconds, to start the unit.

WHEN UNIT HAS A104 MASTER CONTROL (new type)

- Open line switch.
- Open thermostat and domestic hot water control contacts.
- Disconnect oil valve coil.
- Install jumper between "L" and "Relay 4" terminals.
- Compressor will now start and stop from line switch.

NOTE: If too frequent starts and stops are made, overload contacts in starting relay may open, stopping the compressor; contacts will automatically re-set when heater cools. Safety switch on Master Control may open, push re-set button before leaving the job.

G-E MOTOR COMPRESSOR STATORS

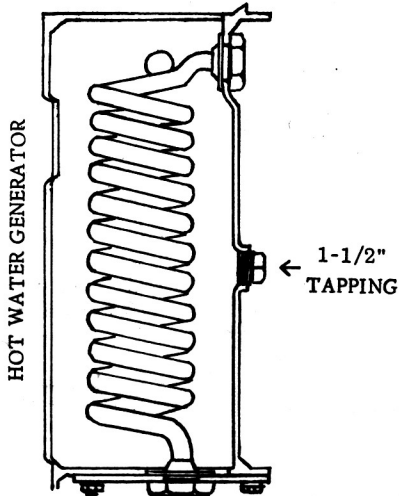
Stators on G-E Motor Compressors usually burn out because of a defect in the Master Control or starting relay. A bound compressor pump will not cause the stator to burn out, if the Master Control is operative. The Master Control will go on safety before a stator will burn out. However, the Master Control can have a defect that will show up only once a week or even less frequently, and not show up in the field test. Therefore, it is recommended that the starting relay or Master Control be replaced along with a burned out stator or motor compressor with burned out stator.

G.E. INFORMATION

TO REPLACE DEFECTIVE DOMESTIC HOT WATER BELLOWS IN THE MASTER CONTROL ON LA4 & 5 STEAM OR HOT WATER UNITS

A defective domestic hot water bellows in the Master Control cannot be replaced with a new bellows, it must be replaced with a replacement hot water control, either immersion or strap-on type. Use Harvey Package **NO. C293** immersion hot water control or Harvey Package **NO P513-1** strap-on hot water control with bracket. In either case the defective bellows does not have to be removed, however, the domestic hot water contacts in the Master Control must be held open for the replacement hot water control to function. To do this, turn the bellows adjusting screw, located over the inoperative bellows, all the way down.

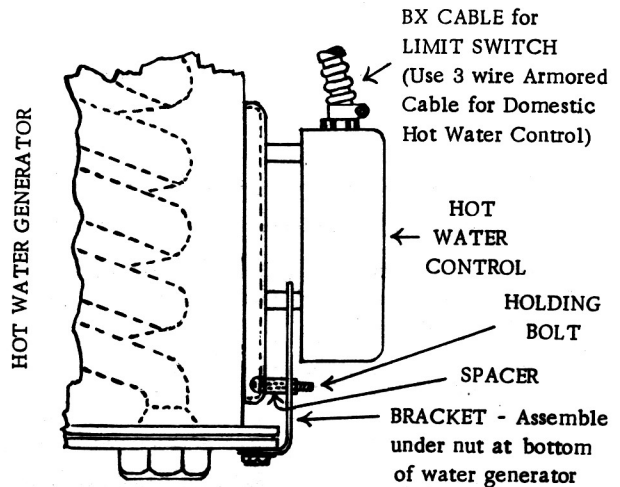
Immersion Type



Install replacement immersion hot water control in 1-1/2" tapping in the back of the hot water generator as shown above.

Use 1-1/2" close nipple and a 1/2" x 1-1/2" reducing coupling, to mount replacement immersion hot water control.

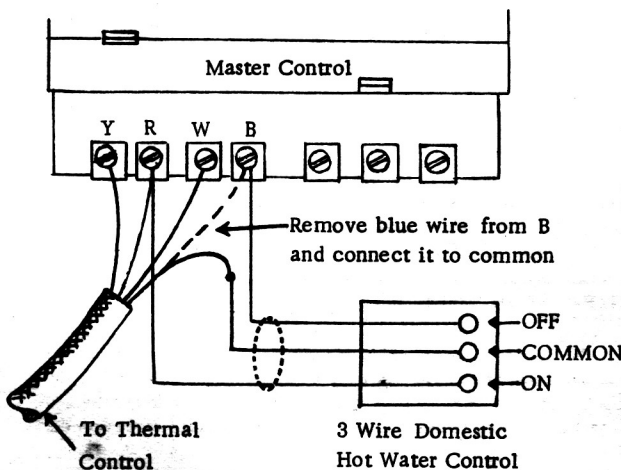
Strap-On Type



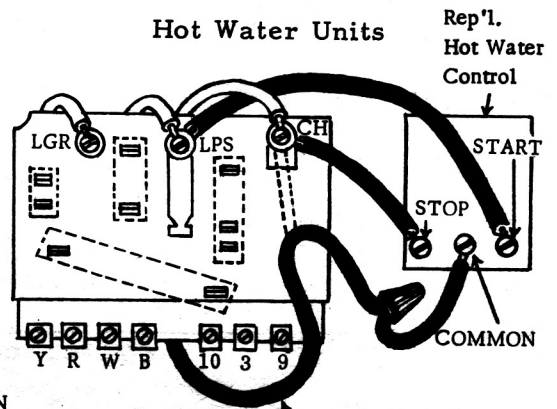
Install replacement strap-on hot water control w/bracket on lower section of the domestic hot water generator, located in back of boiler. Use lower bolt on generator to fasten bracket.

HOW TO CONNECT A REPLACEMENT HOT WATER CONTROL TO A MASTER CONTROL

Steam Units



Hot Water Units



Disconnect "A" relay coil lead from C-H terminal and connect to common (terminal) of replacement hot water control.

G-E INFORMATION

TO REPLACE DEFECTIVE LIMIT BELLOWS IN THE MASTER CONTROL ON THE LA4 & 5 STEAM OR HOT WATER UNITS

A defective limit bellows in the Master Control cannot be replaced with a new bellows, it must be replaced with a replacement pressure control on steam units and a replacement limit control on hot water units. It is not necessary to remove the defective bellows. However, the limit contact of the Master Control must be held closed for the replacement limit or pressure controls to function. To do this, turn the limit bellows adjusting screw all the way out, counter-clockwise. If the limit bellows is leaking the flexible part of the bellows must be cut off (without unscrewing) and the small hole in the heavy brass body filled with solder.

ON STEAM UNITS

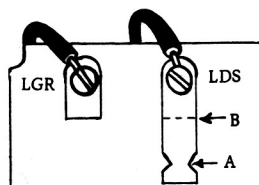
On steam units a replacement pressure control, Harvey Package NO. C354 may be installed in the upper side tapping of the domestic hot water generator in back of boiler. Use wiring diagram below.

ON HOT WATER UNITS

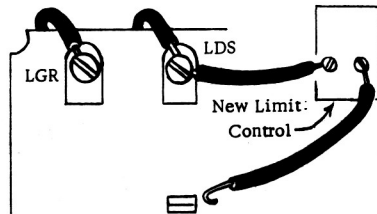
On hot water units the same upper side tapping may be used to install a replacement hot water limit control, Harvey Package NO. C290, or a strap-on hot water limit control Harvey Package NO. P513-1.

See illustration on previous page for method of attaching the strap-on control. Use wiring diagram below.

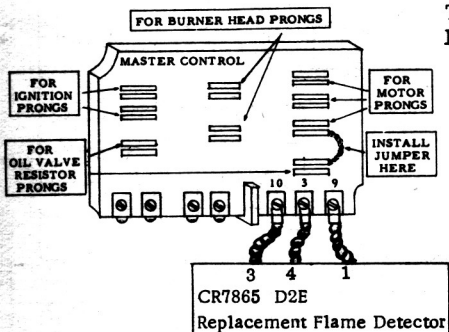
HOW TO CONNECT A REPLACEMENT PRESSURE OR LIMIT CONTROL TO THE MASTER CONTROL



Grip bottom of LDS terminal bar at "A" with pliers and pull out of socket. Cut off at "B" and discard bottom piece.

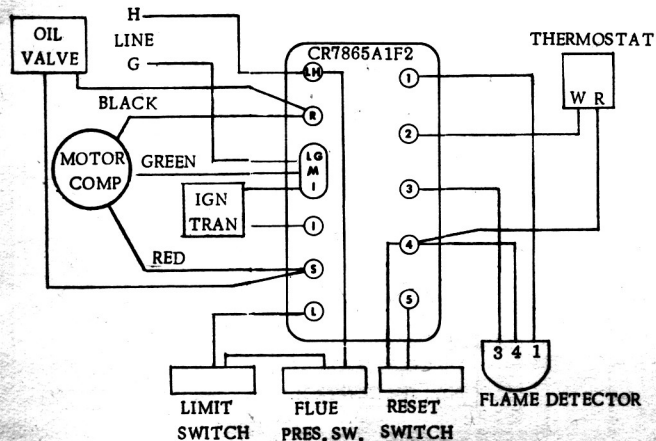


1. Connect one lead from replacement limit control to screw at LDS terminal.
2. Skin 1-1/2" of second lead from replacement limit control and bend to form a "U", 3/4" long, insert in socket from which bar was removed.
3. Set limit control to proper setting.



TO REPLACE OLD STYLE FLAME DETECTOR ON LA4 & 5 UNITS WITH HARVEY PACKAGE NO. P521 (CR7865 D2E Flame Detector with Bracket)

1. Install a jumper of 2" bare wire in Master Control, between the lowest opening for the motor prong and the opening for oil valve resistor prong, directly below it. Do this before the motor and oil resistor leads are plugged in. The CR7865 Flame Detector has a wiping action on the cold contacts and the jumper prevents them from opening before the required four second delay.
2. Wire CR7865 D2E flame detector to the Master Control as shown in diagram.



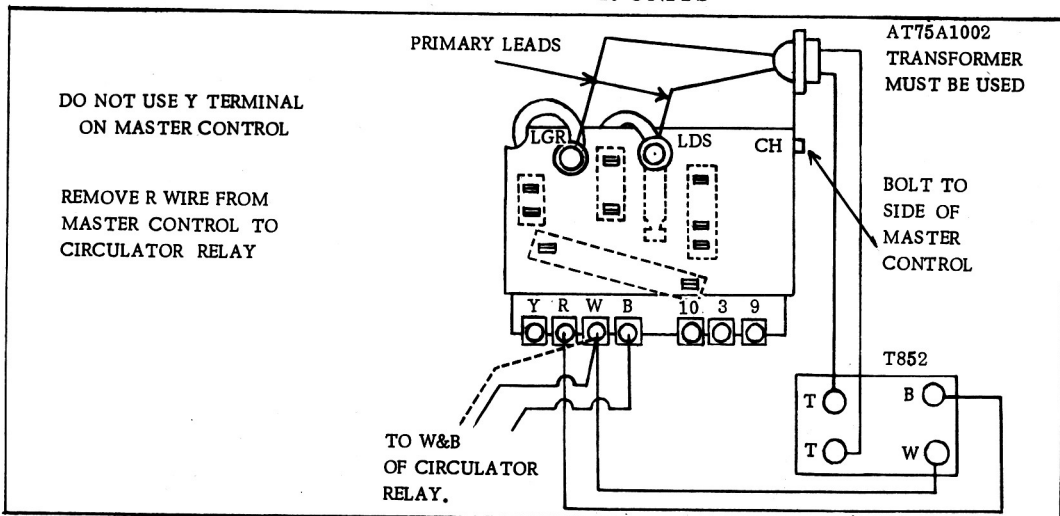
TO REPLACE THE G-E 104 SEALED MASTER CONTROL WITH THE A1F2

Discard the starting relay and use the diagram shown at left.

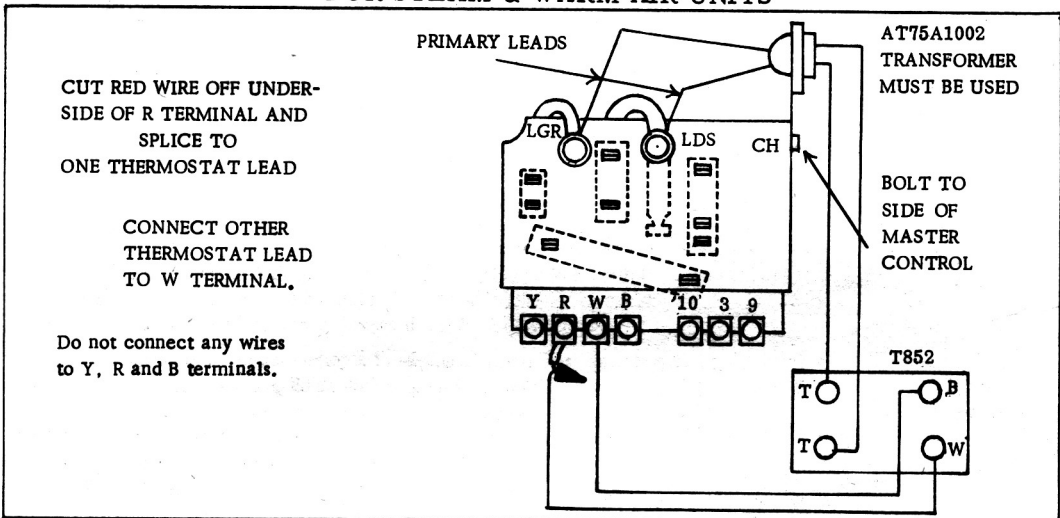
G-E INFORMATION

TO REPLACE THERMAL CONTROL ON LA4 & 5 UNITS WITH M-H T852
THE EXISTING 4 WIRE THERMOSTAT CABLE MAY BE USED

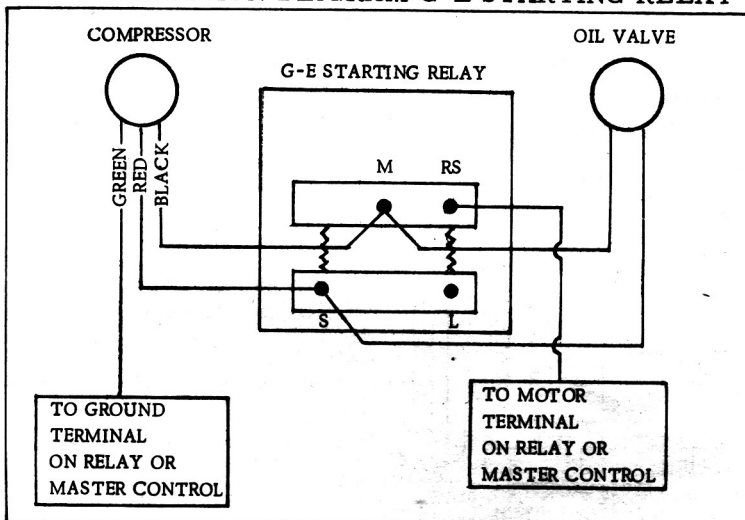
FOR HOT WATER UNITS



FOR STEAM & WARM AIR UNITS



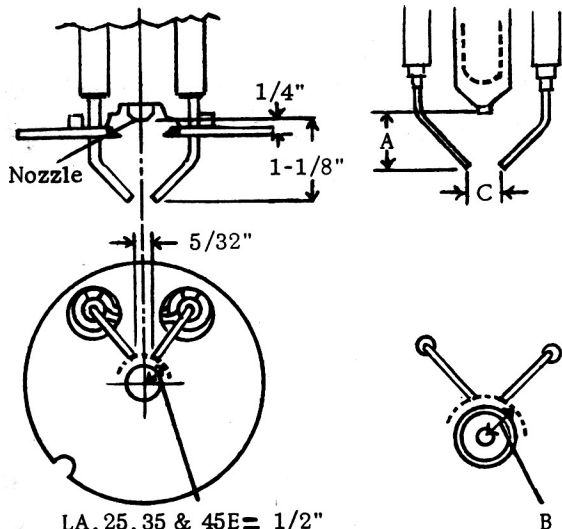
CONNECTION DIAGRAM G-E STARTING RELAY



G-E INFORMATION

IGNITOR SETTINGS

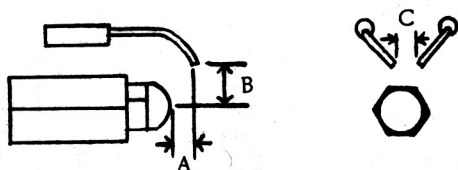
LA Boilers



LA, 25, 35 & 45E = 1/2"
 LA 60 & 70 = 21/32"

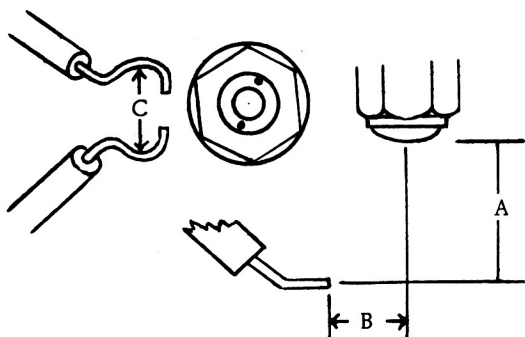
Boiler Model	A	B	C
L1	7/8"	11/16"	1/4"
LA4, 5; LB4	1-1/8"		3/16"
LA3, 6, 7		9/16"	
LA20 to 22		11/16"	
LA32 to 54			

DB Burners



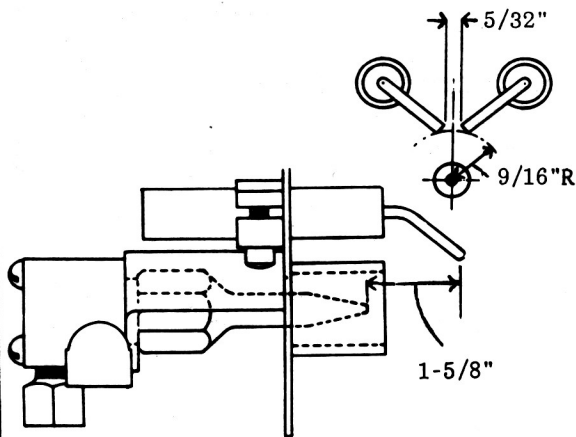
Burner Model	A	B	C
DB2, 20, 25, 26	5/16"	5/8"	5/32"
DB20B, 26B		3/4"	

LB Furnaces



Furnace Model	A	B	C
LB4	See LA4, 5 (LA Boilers)		
LB3 to 6	1-1/4"	9/16"	3/16"
LB22, 32, 34			5/32"
LB22C, 30C			
LB form D	1-5/8"		

LB Furnaces - Form J and JD
 LA Boilers - Form J only



G-E WARM AIR FURNACE BELT REPLACEMENTS TYPE "A" 1/2" V BELTS

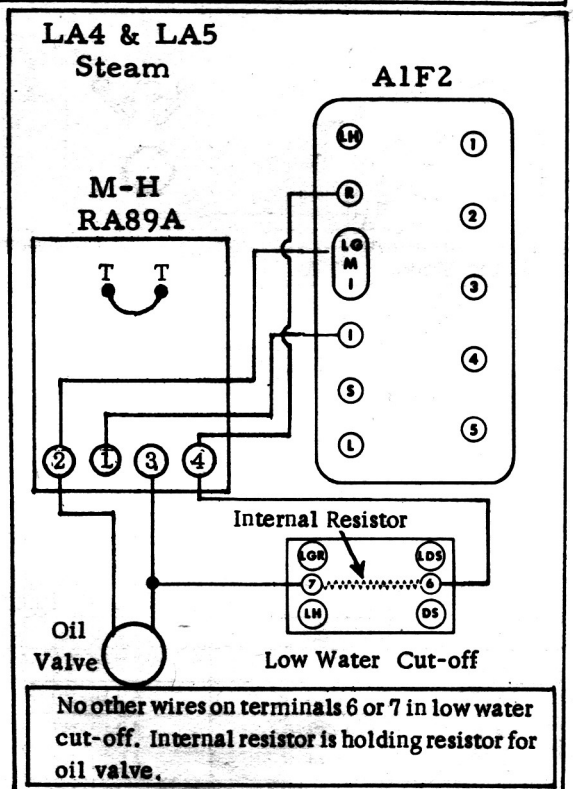
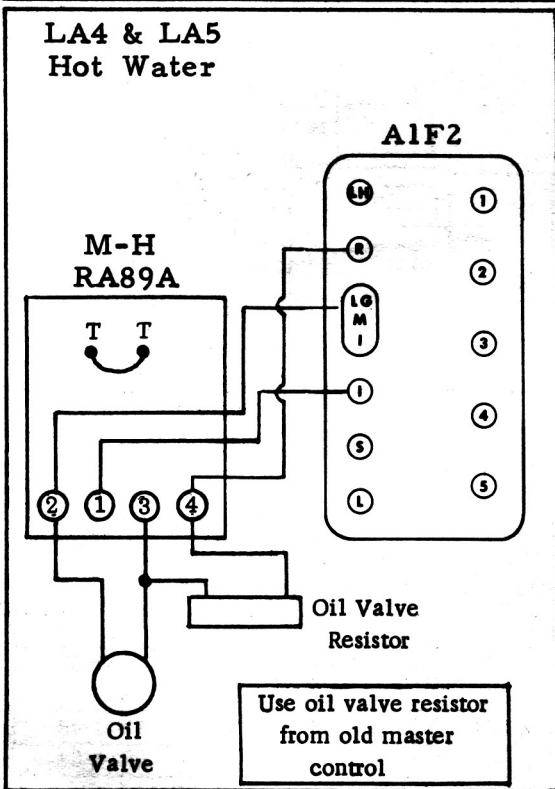
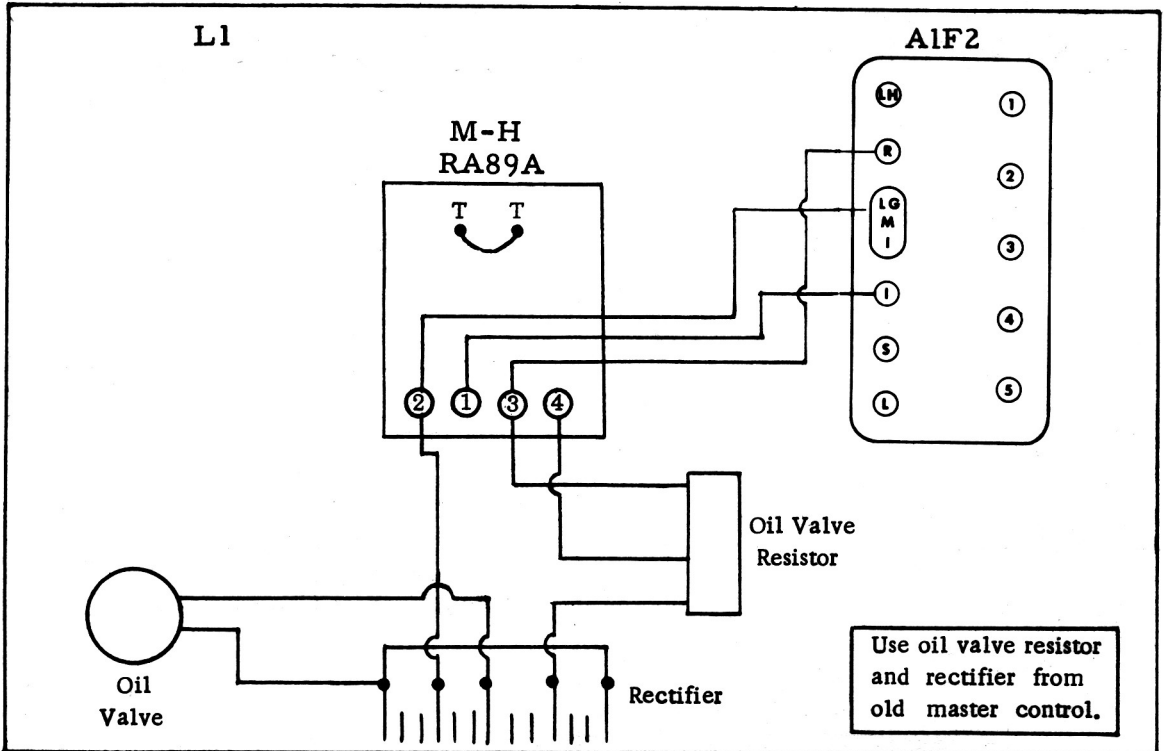
G-E Unit	Belt Length	Use Belt No.
LB3	54	A240-54
LB4	46	A240-46
LB6	54	A240-54
LB15D	39	A240-39
LB20 D1	37	A240-37
LB22	54	A250-54

G-E Unit	Belt Length	Use Belt No.
LB22C	44	A240-44
LB30	47	A240-47
LB30C	44	A240-44
LB32	52	A240-52
LB34	48	A240-48
LB40	54	A240-54

Additional V Belts listed on page 73 in Sid Harvey's Catalog.

G-E INFORMATION**Connection Diagram for Oil Valve on L1, LA4 & LA5 Boilers**

When replacing the original Master Control use an M-H RA89A and a A1F2, the old burner head can be used. Connect oil valve as shown. All other wiring is conventional.



G-E INFORMATION**BURNER SUMP PRESSURES**

FURNACE MODEL	PSI	EXPLANATION
L1, LA4-5; LA3-6-7, LA20-54, LA25-70 LB4, LB3-6, LB22-32-34, LB22C, LB30C	15	Pressures can be plus or minus 2 lbs. Oil rate will vary, but combustion will not be NOTICEABLY AFFECTED.
LB15J, LB15JD	12	
LB20-40J, LB20JD	15	
LB15D (.59 GPH) LB20D (.82 GPH)		Depends on the burnerhead. Set sump pressure to give rated oil rate by actual measurement.
LB30D	7-1/2	For burnerheads 5733051 G6 and G7
LB40D	13	

MODELS DB2-25 & DB20A-26A

OIL RATE GPH	SUMP PRESSURE PSIG			Stamping On Air Tee for Latest Nozzle
	Original DB2-25	Modified DB2-25	BB20-26, or DB2-25 with Latest Nozzle and Air Tee	
1	6	4-1/2	2-1/2	A1
1-1/4			3	
1-1/2			2-1/2	A2
2	9		5	
2-1/2			4	A3
3	12		5-1/2	

MODEL DB20B-26B

OIL RATE GPH	Sump Pressure PSIG	ORIFICES		Air Deflector Inside Diam.	
		Oil	Air		
3/4	3-1/4	5	None	2-1/4"	
1	4	4		Brass (Yellow)	2-1/4" or 3-1/8"
1-1/4	3				
1-1/2	3-1/2				
1-3/4	4-3/4				
2	3-1/4		Plated (Grey)	3-1/8"	
2-1/4	4				
2-1/2	4-3/4				
3	6				

TANKLESS HEATERS

To select the proper Gerstein & Cooper (all copper) tankless heater to supply adequate domestic hot water.

1. Add up the total demand factor required in accordance with chart A.
2. Select proper size tankless heater from chart B based on total demand factor.

CHART A

DOMESTIC HOT WATER REQUIREMENTS	DEMAND FACTOR
HOUSE or APARTMENT with one bath with tub or shower, kitchen sink, laundry tubs.	1
Each additional bathtub	1/2
Automatic dishwasher	1
Automatic clothes washer	1
BARBER SHOP, each chair	3
BEAUTY PARLOR, each operator	4
GOLF or COUNTRY CLUB or FACTORY, each shower	5
OFFICE BUILDING each single office	1
LUNCHEONETTE each 25' of counter space	15
RESTAURANT each 200 people served at peak period	15
ON ANY INSTALLATION each 2 hot water faucets	1
each multiple hot water faucet	1

CHART B

TOTAL DEMAND FACTOR	SIZE TANKLESS in G. P. M.
1	4
2 - 5	6
6 - 12	8
13 - 24	10
25 - 35	12
36 - 50	15
51 - 80	20