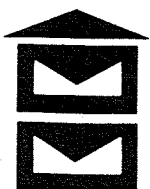
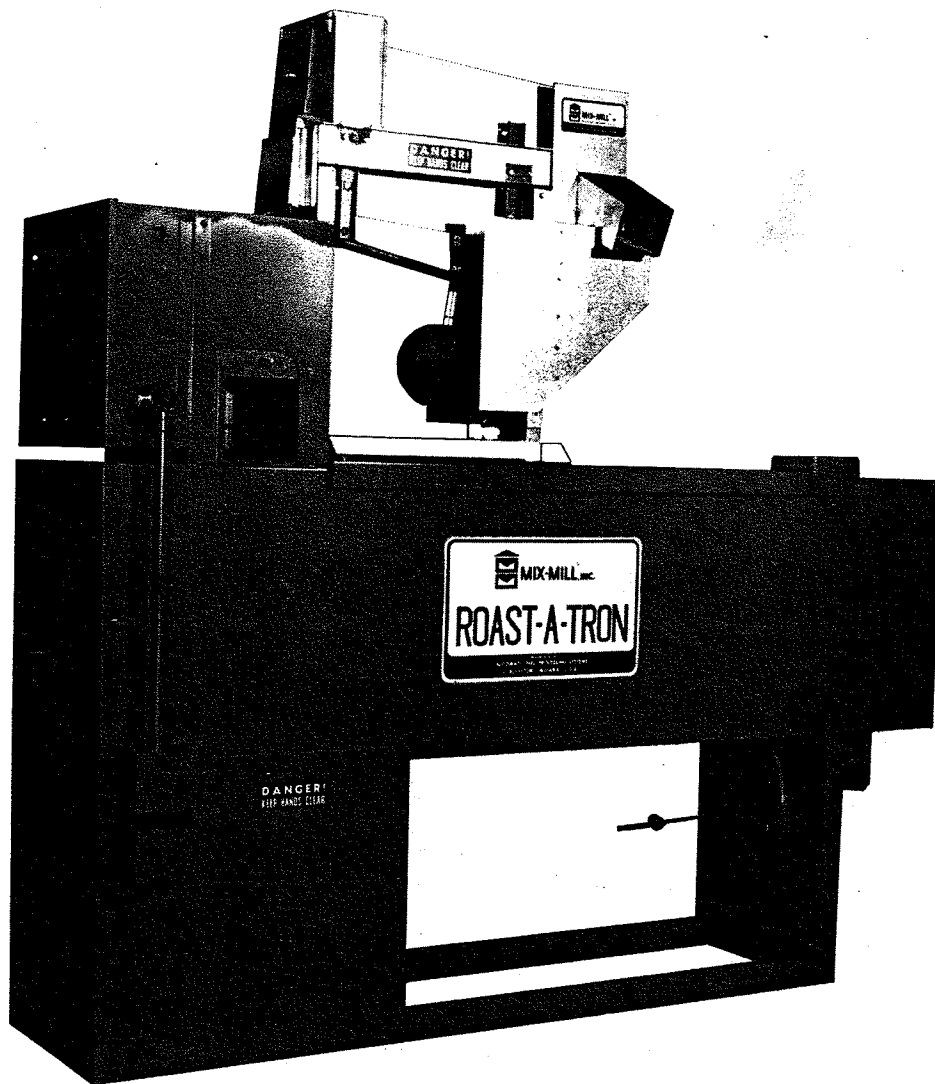


MIX-MILL[®], INC.
GAS ROAST-A-TRON
INSTRUCTION MANUAL



MIX-MILL[®], INC.
Bluffton, Indiana, USA
99960110

BE A SAFE OPERATOR

AVOID ACCIDENTS

Most accidents, whether they occur in industry, on the farm, at home, or on the highway, are caused by the failure of some individual to follow simple and fundamental safety rules or precautions. For this reason most accidents can be prevented by recognizing the real cause and doing something about it before the accident occurs.

Regardless of the care used in the design and construction of any type of equipment, there are many conditions that can not be completely safe guarded against without interfering with reasonable accessibility and efficient operation.

A CAREFUL OPERATOR IS THE BEST INSURANCE AGAINST AN ACCIDENT.

THE COMPLETE OBSERVANCE OF ONE SIMPLE RULE WOULD PREVENT MANY THOUSAND SERIOUS INJURIES EACH YEAR. THAT RULE IS:

NEVER ATTEMPT TO CLEAN, OIL, OR ADJUST A MACHINE WHILE IT IS IN MOTION!

“NATIONAL SAFETY COUNCIL”

MIX-MILL[®], INC. has made every effort to provide safe equipment, however, the following precautions should be carefully observed!

1. Disconnect main service switch before removing any housing covers or electrical boxes or switches.
2. Ground the mill frame to a ground rod driven six (6) feet into moist soil.
3. Ground any augers to feeders where livestock might contact either augers or feeders.
4. Keep all shields and covers in place.



mix-mill[®], incorporated
bluffton, indiana 46714

phone 219-824-3400

automatic feed
processing systems

Dear Mr. Roast-A-Tron Owner/Operator:

Please read this operator's manual entirely before attempting to install and operate your Roast-A-Tron. Once you have read the manual you should be familiar with terms and procedures that should make it easy to follow through step by step to successfully install and operate your machine.

A MIX-MILL Roast-A-Tron is a precisely built machine created to efficiently perform the thermal processing of clean hard surfaced grains. The importance of roasting only clean hard surfaced grains like beans, corn milo, and wheat, which have a firm outer hull, cannot be overemphasized. Grains like oats and barley, which have a soft fibrous hull, should not be run through the machine due to increased fire hazards. Likewise, grain should only be processed with a grain cleaner preceding it to minimize the risk of stalks, straw, and other easily combustible materials entering the machine. The ease with which small particles overheat and collect in the machine can produce a carbonized material which can become a fire hazard.

The quality and condition of the roasted grain is solely the responsibility of the owner/operator. Due to the many variables in grain conditions ranging from moisture content to previous treatments, MIX-MILL can only give general operating recommendations and not warrant or accept responsibility for actual performance in widely varying field conditions. The owner/operator must regularly inspect the quality and quantity of grain being processed to be sure that the machine is doing the required roasting job. Although the machine has many safety features it should not be left unattended for long periods of time. If the machine is regularly inspected, cleaned, and operated per this manual you will enjoy the results of feeding roasted grain.

MIX-MILL, INC.

May 1, 1972

WARRANTY CERTIFICATE

Mix-Mill[®], Incorporated, warrants each new product of its manufacture when purchased from an authorized representative for a period of one year from the date of delivery to the Purchaser-User or 1500 hours of operation, whichever ever occurs first. This warranty shall apply to all parts and workmanship (except products or components not manufactured by Mix-Mill[®]) which shall appear to Mix-Mill[®] to have been defective in manufacture. Mix-Mill[®]'s sole and entire obligation under such warranty shall be satisfied by shipment to the Purchaser-User without charge, (except for transportation costs which shall be paid by Purchaser-User) of the part or parts, returned for inspection and parts intended to replace those acknowledged by Mix-Mill[®] to be defective. This warranty shall not apply and shall be void under the following conditions:

- (1) IF THE PRODUCT IS TRANSPORTED FROM ORIGINAL INSTALLATION SITE.
- (2) IF THE PRODUCT IS INSTALLED OR ASSEMBLED BY OTHER THAN FACTORY TRAINED AUTHORIZED DISTRIBUTOR SERVICE PERSONNEL.
- (3) IF ANY PART OF THE PRODUCT HAS BEEN ALTERED, MODIFIED OR CHANGED, EXCEPT AT MIX-MILL'S FACTORY OR IS AUTHORIZED BY IT IN WRITING.
- (4) IF ATTACHMENTS OR DEVICES UNSUITABLE TO THE PRODUCT HAVE BEEN USED ON OR IN CONJUNCTION WITH THE PRODUCT.
- (5) IF THE PRODUCT HAS NOT BEEN INSTALLED, USED, OPERATED, HANDLED OR SERVICED IN ACCORDANCE WITH THE APPROPRIATE INSTRUCTION MANUAL.

Mix-Mill reserves the right to make changes in design or improvements in its products without any obligation whatsoever to prior Purchaser-User of such products.

Mix-Mill will pass on to a Purchaser-User only such warranty as it shall receive on products or components not of its manufacture from the manufacturer or supplier thereof.

This warranty is expressly in lieu of any other express or implied warranties, including any implied warranty of merchantability of fitness, and of any other obligation on the part of Mix-Mill, and may not be altered, modified or changed in any way except by a writing signed by an officer of Mix-Mill.

Mix-Mill shall not be liable for any loss or damage, directly or indirectly arising from the use of its products or otherwise, or for any special or consequential damages of any nature.

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SHIPPING LISTS

The Roast-A-Tron is shipped as nearly completely assembled as is practical. Only those parts are removed that might be damaged in shipment or would interfere with handling and stocking. The unit is shipped as three separate packages. The packages and their contents are listed below.

1. RT644C2 Roast-A-Tron package consisting of:

- (1) 11196-01 Basic Unit
- (1) 10589-03 Weatherhead
- (1) 11221 Loose parts package (attached in Roast-A-Tron)

Consisting of:

- (1) 9892 Pressure Gauge
- (1) 10530 Grease Cartridge
- (1) 9626 Gas Cock
- (1) 9629 Nipple 4-1/2"x3/8 NPT
- (1) 11186 Door Latch
- (1) 9744 Instruction Manual
- (1) 11218-01 Bag - Misc. Hardware

Consisting of:

- (1) 1643-01 Machine Screw - Hex Hd. 1/4-20x3/4"
- (28) 427 Machine Screw - Hex Hd. S.T. 1/4-20x3/4"
- (5) 3471-01 Machine Screw - Hex Hd. S.T. #8-32x1/4"
- (28) 344 Washer - Lock 1/4"
- (5) 339 Washer - Flat 1/4"
- (2) 10323 Bolt - Cooker Feet
- (2) 3027 Nut - Hex 1/2-13
- (1) 11216-06 Wire Harness Assy.

2. 634A1 Grain Cleaner consisting of:

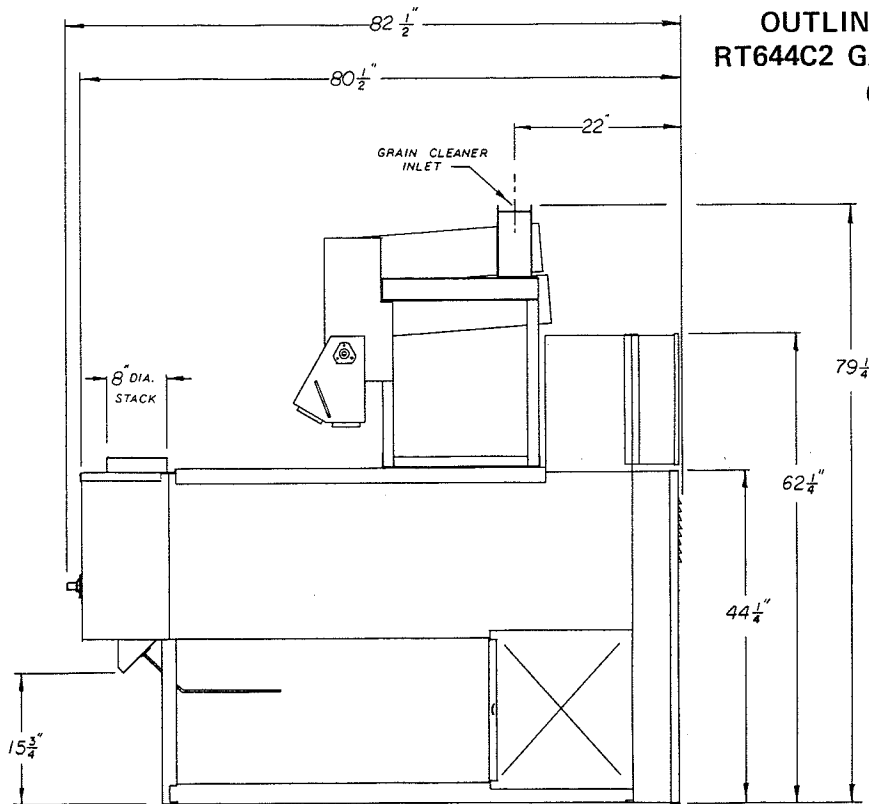
- (1) 10400 Grain Cleaner Assembly
- (1) 10619-03 Screen Assembly 1/2"
- (1) 10619-04 Screen Assembly 7/16"

3. 11362 Weather Cover Package (Optional) consisting of:

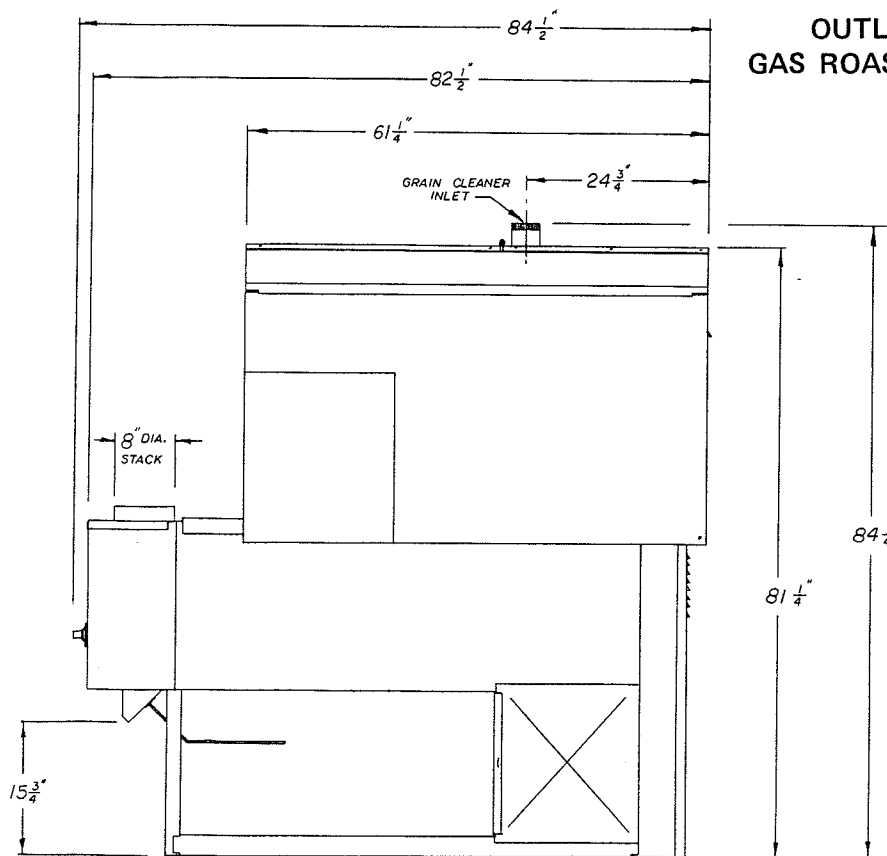
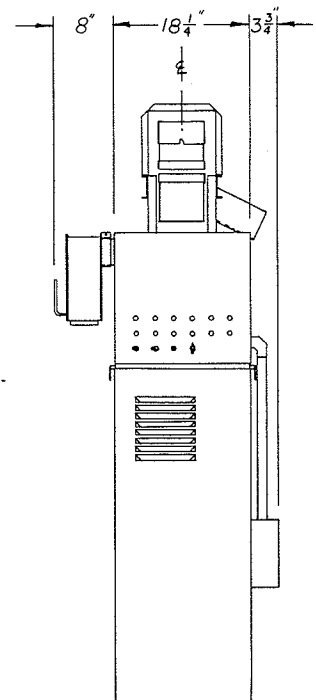
- (1) 11172 Top Plate Front
- (1) 11160 Door Assembly
- (1) 11168 Inlet End Assembly
- (1) 11161 Outlet End
- (1) 11083-01 Top Side
- (1) 11083-02 Top Side
- (1) 11169 Top Plate Rear
- (1) 11112 Side Assembly
- (1) 11087 Side - Weather Cover

Upon delivery immediately check and report any shortage to the trucking company and MIX-MILL[®], INC.

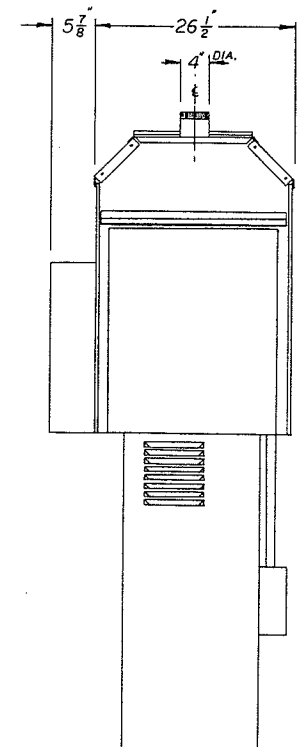
May 1, 1972



OUTLINE DIMENSIONS
RT644C2 GAS ROAST-A-TRON
C-11382



OUTLINE DIMENSIONS --RT644C2
GAS ROAST-A-TRON & WEATHER COVER
C-11383



Specifications:

Burner Size: 300,000 BTU per hour, 3.25 gallons per hour of LP Gas, or 300 cu. ft. per hour of Natural Gas.

Electrical Power: 230 V AC, 60 Cycle Single Phase, 3 Wire, 30 AMP Service.

Maximum Feeding Capacity: 1800 lbs. / hour of clean dry beans or corn.

INSTALLATION INSTRUCTIONS

To properly install a Roast-A-Tron careful consideration should be given to its location. A preferred location would be in a well ventilated metal building close to and between the grain storage and the roasted grain storage. The Roast-A-Tron should not be located in such a place that sparks which might escape from the machine could come in contact with flammable materials. Consideration should be given to locating the machine in an area that may be easily cleaned to prevent the build up of flammable materials such as grain dust. Adequate space around the machine is necessary so that servicing may easily be accomplished. To summarize, the following points must be considered prior to installation:

1. The Roast-A-Tron should be protected from weather by either its weather shield or an adequately ventilated building.
2. The location should be close to the supply of raw grain. The machine may be fed by:
 - a. Overhead storage, where grain will flow by gravity to the grain cleaner inlet (In this case, the hopper top diaphragm switch will not be used).
 - b. A 3-1/2" MIX-MILL[®] auger from a ground level storage bin or tank. The hopper top delay action switch must be used to start and stop the filling auger (See Table 1 for recommended auger speeds).
3. A means of conveying the processed grain to storage must be provided. The best method would be to install the Roast-A-Tron over a large bin or hopper that would hold a production run of roasted grain. The next method would be a slow speed 3-1/2" general purpose auger in a hopper such as a 4814-01 portable auger hopper or a 11363 auger hopper (See Figures 2, 3, and 4 for installation suggestions. See Table 1 for recommended auger speeds). The roasted grain should be discharged into an open hopper to allow the steam to flash off and escape. Do not enclose the Roast-A-Tron to the hopper. Adequate space must be allowed for a natural draft up through the rear of the machine.

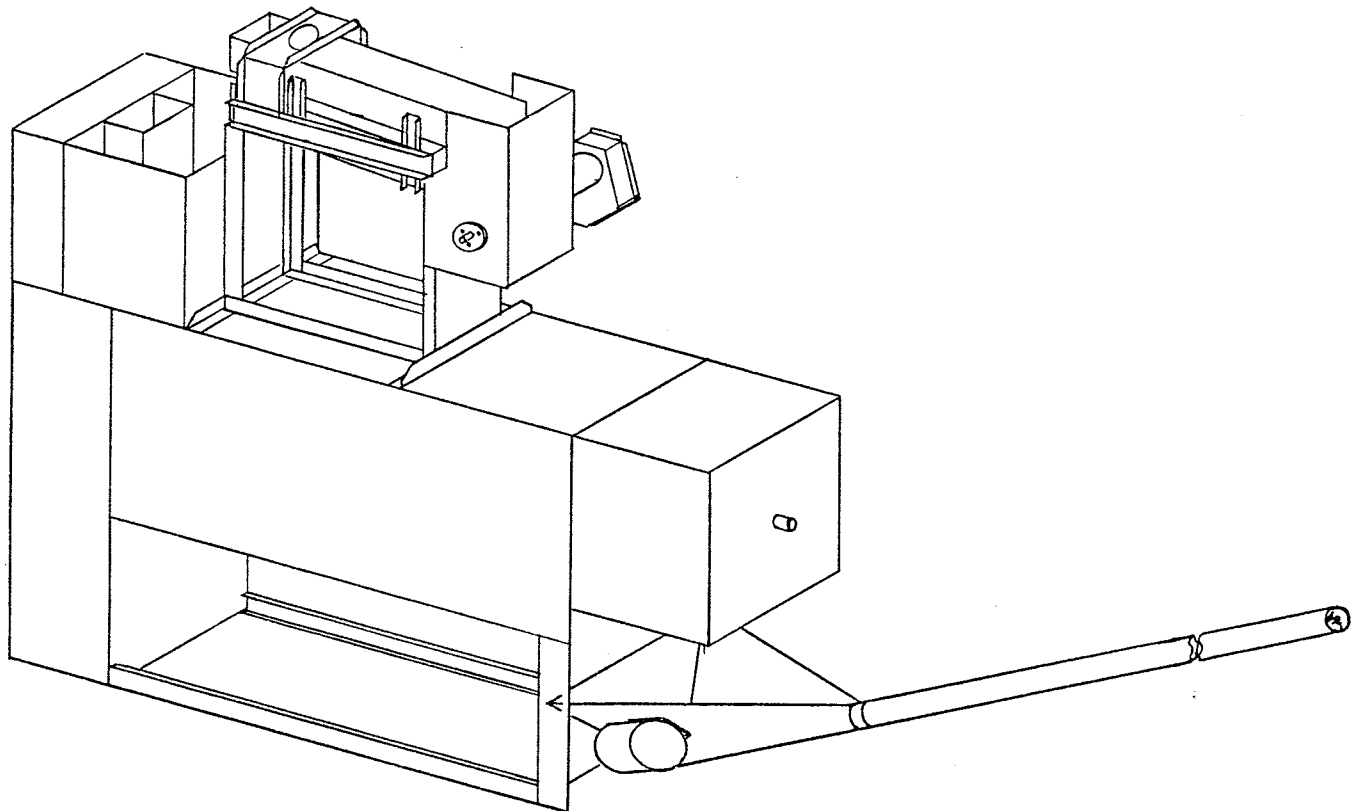


FIGURE #1 ROAST-A-TRON WITH PORTABLE AUGER FOR GRAIN REMOVAL
AND 4814-01 HOPPER

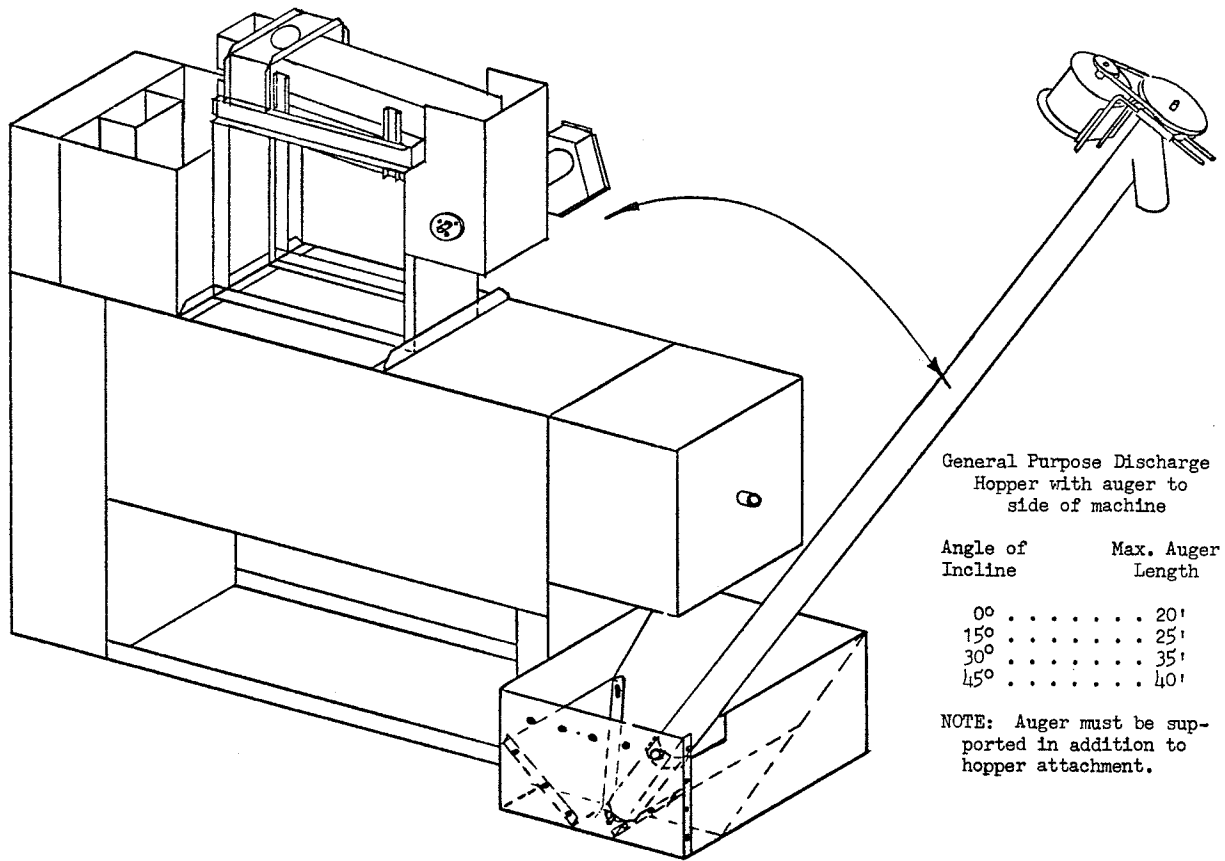


FIGURE #2 ROAST-A-TRON WITH 3 1/2 GP AUGER AND 11363 HOPPER

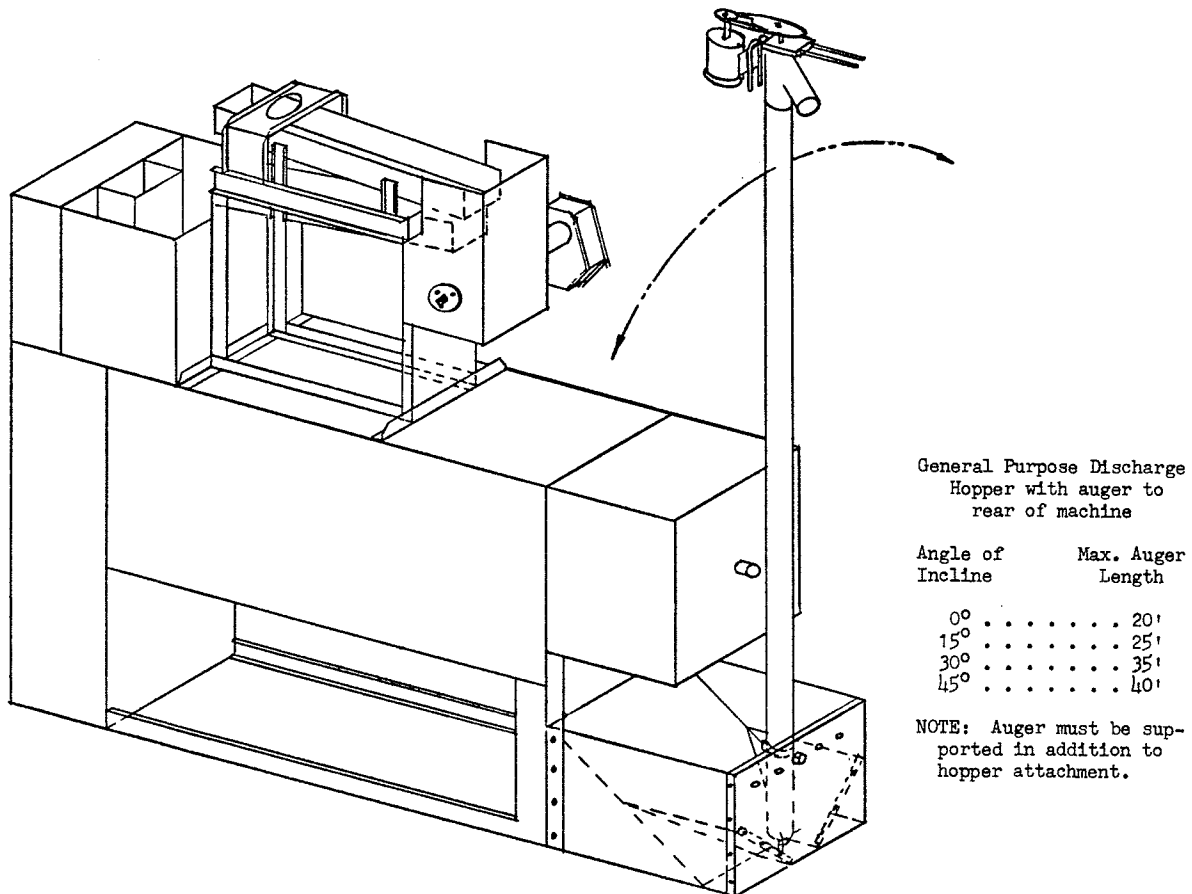


FIGURE #3 ROAST-A-TRON WITH 3 1/2 GP AUGER AND 11363 HOPPER

Table #1

3-1/2" AUGER SPEEDS FOR GAS ROAST-A-TRON

Angle	Speed	Motor Drive	Motor Pulley Size		Auger Driven	Max. Length	HP
			Jack Shaft Driven	Drive			
0 (Horiz.)	94	2	8	3	14	150'	3/4
30	118	2-1/2	8	3	14	80'	3/4
45	140	3	8	3	14	40'	1/2
60	190	3	8	3	10	30'	1/2
90 (Vert.)	250	2	0	0	14	20'	1/2

4. The roasted grain storage should be large enough to hold several day's feed requirements. Especially when roasting soybeans it is desirable to allow the beans to collect hot in the bin and further cook to completely insure that the beans are chemically deactivated. If a large bin is used or the roasted grain is going to be stored for long periods of time, good aeration practices should be followed to prevent hot spots developing from moisture migration and then grain spoilage. An aeration system that pulls the air down through the grain and exhausts it out the bottom is recommended to prevent moisture condensation on the bin roof and upper side walls.

SETTING UP THE MACHINE

1. Once the location is determined, set the RT644C2 package in place and finish removing the crating and wooden skids from under the machine.

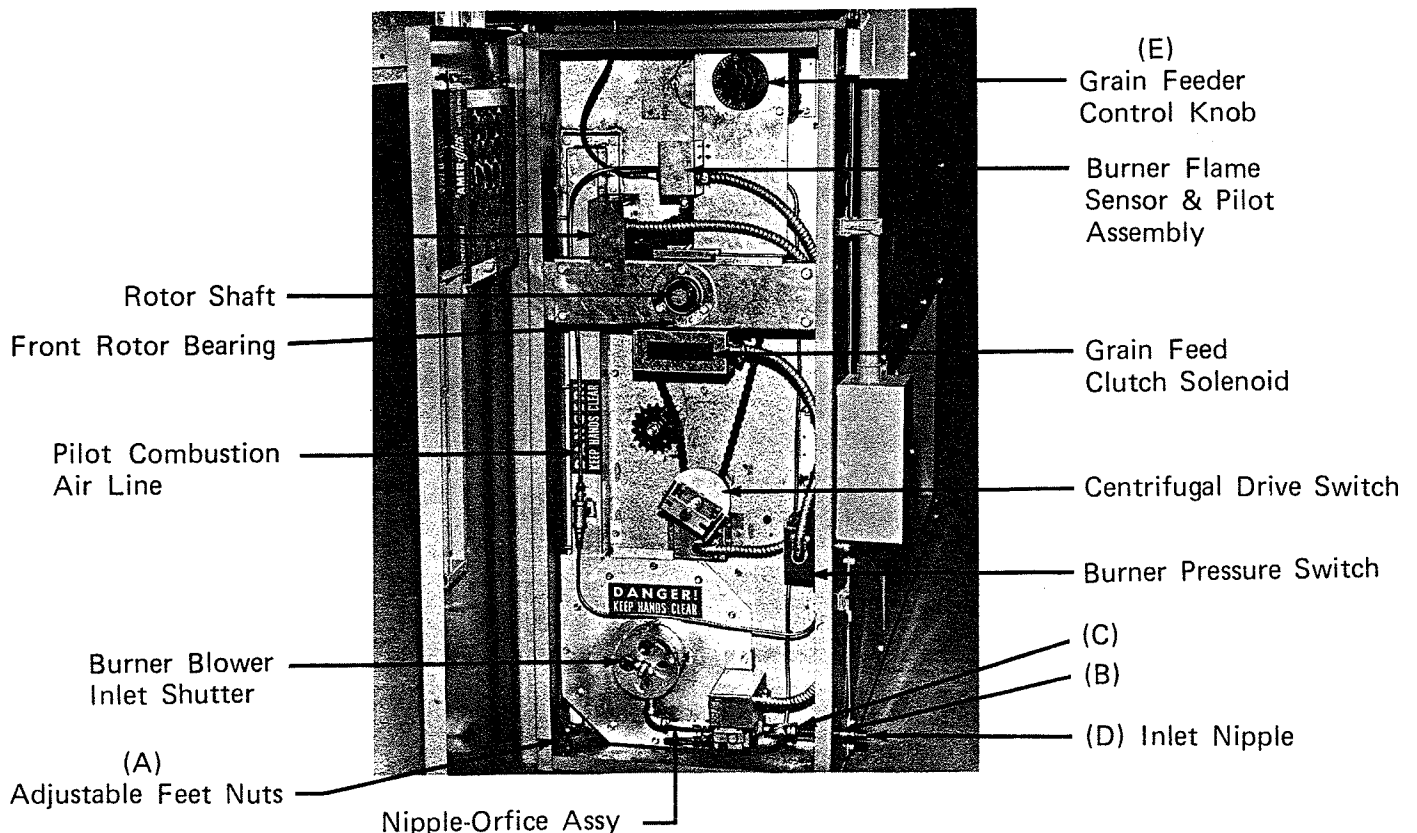


FIGURE #4 DRIVE HOUSING

2. Prop up the control panel end of machine with a skid turned edgewise. Turn 3027 nut on 10323 bolt cooker feet to within 1/2 inch of the head (2 bolts). Insert cooker feet from underside and turn into nuts (Item A, Figure 4) welded inside drive housing. Adjust leveling screws so that inlet end of machine is raised approximately 1-1/2" after removal of skid. Final adjustment of the machine slope will be described later and should be done after all other installation.
3. Remove four bolts in top cover of Roast-A-Tron and set grain cleaner in location. Fasten cleaner in place by replacing four bolts. Connect the grain cleaner wiring by attaching 11216-06 Wire Harness Assembly from the cleaner motor into the top 7/8" diameter hole in the right side of the control panel. Connect two leads into terminals T₁₁ and T₁₂. Wire motor for 230 Volt - clockwise rotation per plate on the motor terminal box.
4. If optional weather shields are used, they should now be installed by setting the outlet end panel, 11161, in place and fastening to the top of the Roast-A-Tron with two (2) 1/4-20x3/4" self tapping screws. Next, attach the inlet end panel, 11168, in place with four (4) self tapping screws through brackets and into four (4) holes in upper sides of drive housing. Now attach right and left diagonal roof pieces, 11083-01 and 11083-02, with four (4) 1/4-20x3/4" self tapping bolts at four (4) upper corners (Mount with group of three (3) holes along top edge to the front). Attach front and rear top plates, 11172 and 11169, with ten (10) 1/4-20x3/4" self tapping screws. Mount the two (2) side panels, 11087 and 11112, in place by hooking top edge to diagonal roof members. Finally, install eight (8) 1/4-20x3/4" self tapping screws into lower corners of diagonal roof members and side panel.
5. Install spouting from supply bin or auger. If 3-1/2" supply auger is used, connect motor wiring to terminals T₁₁ and T₁₂. Terminals T₁₁ and T₁₂ can be used as a 230 V power source to run a single phase fractional horsepower supply auger motor. To slow augers, use 10783-01 drive kit. It may be necessary to modify auger speed by a pulley change.
6. Connect grain take away system. If an auger take away system is used and driven by a fractional horsepower motor its power may be supplied by the 230 V between terminals B₈ and B₉. There is power to these terminals whenever the rotor in the machine is turning. If a 3-1/2" auger is used it should be slowed down with a 10783-01 drive kit to prevent excessive speed and auger wear.

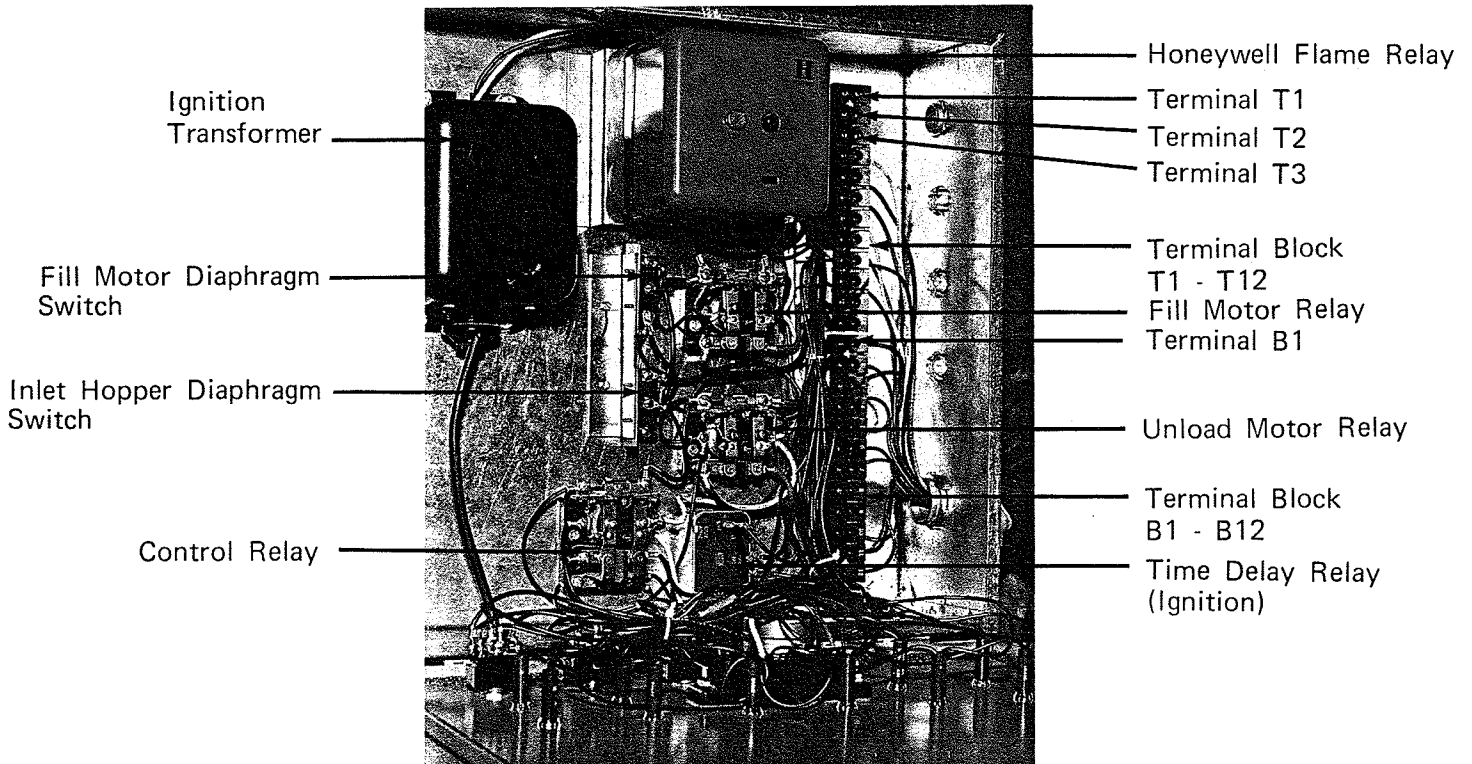


FIGURE #5 CONTROL PANEL INTERIOR

7. Connect the electrical power to the control panel. The unit requires a 30 amp, 3 wire, single phase, 230 V AC, 60 cycle service. Power should be supplied through either a 30 amp fused disconnect or 30 amp circuit breaker. This circuit protection should be located at the farm service load center, which is located away from the Roast-A-Tron. It should not be in the immediate area of the Roast-A-Tron so that in an emergency it might be turned off without personal exposure in the machine area. The service run from the disconnect to the machine should be #10 wire or larger. The connection should be made with the neutral on terminal T₂ and the two hot wires on T₁ and T₃.

IMPORTANT: The neutral must be connected because a portion of the control circuit is on 120 V. The service should be run in either conduit or with heavy rubber covered cord.

8. Remove hole cap from hole in lower right hand side of drive housing and pipe plug from pipe tee near bottom inside of drive housing (See Figure 4, Items B and C). Apply pipe dope to ~~9629~~ pipe nipple (4-1/2x3/8 NPT) and screw into pipe tee through above hole (See Figure 4, Item D). Care must be used to prevent pipe dope from getting to inside of pipe. Attach 9626 gas cock (the pipe plugs in the side of the gas cock should be installed next to the above nipple or on the downstream side of the cock). Mount the cock with the handle forward and one of the plugs in the up position. Remove the up plug and install 9892 pressure Gauge.

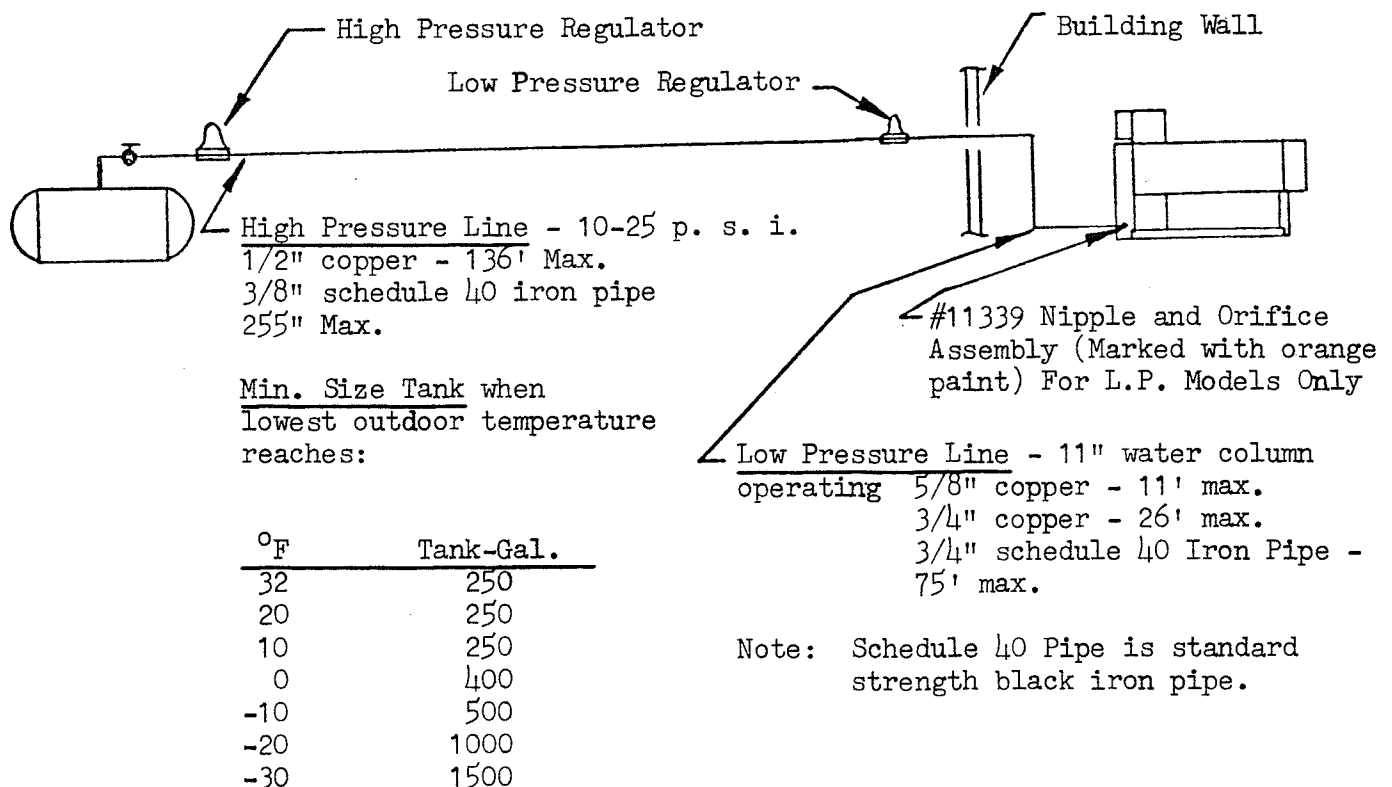


FIGURE #6 LP GAS PLUMBING

9. If LP gas is used, install plumbing per Figure 6. If natural gas is used, install plumbing per Figure 7. NOTE: After plumbing is completed, bleed air from line by removing plug from bottom of gas cock and opening cock until gas is smelled. Replace plug before again closing the gas cock.

May 1, 1972

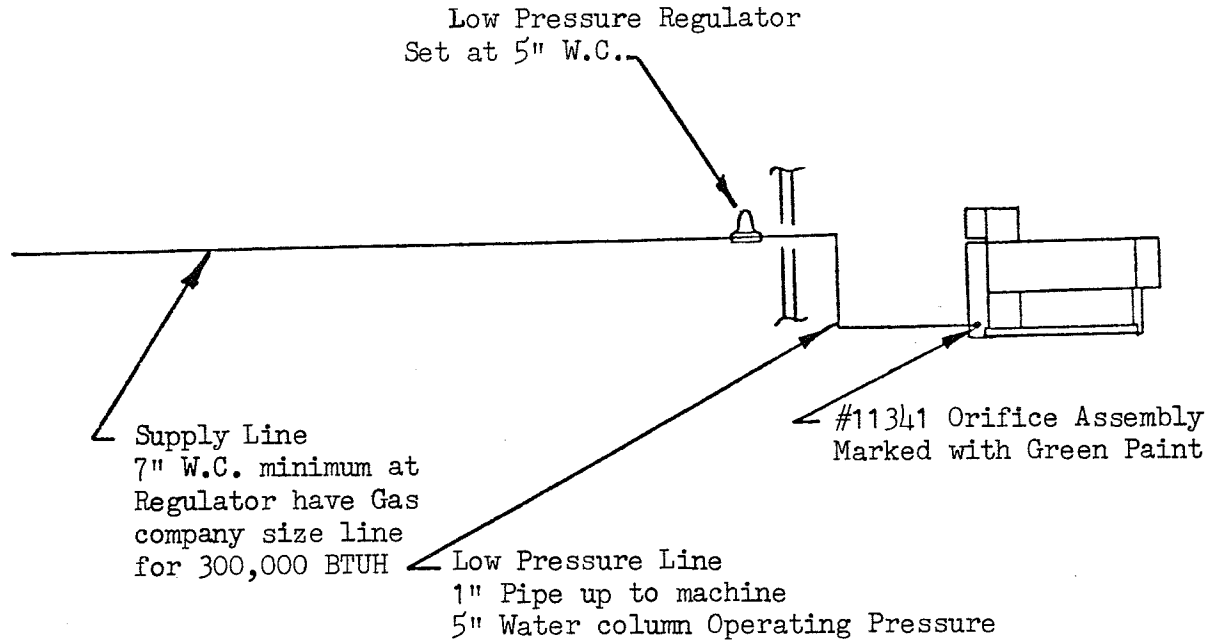


FIGURE #7 NATURAL GAS PLUMBING

10. An exhaust stack must be provided to carry away the combustion gases from the machine. This duct should be made of standard 8 inch round furnace duct. The duct must be straight and vertical and extend 36" above the roof. In the event of an outside weather shielded installation a minimum stack length of 96" must be used. The stack should then be equipped with a 10589-03 weatherhead. In unusual installations, such as between silos and buildings, it may be necessary to use considerably longer stacks to get adequate draft.

11. The last installation step is to make the final adjustment of the operating slope of the machine. The normal operation slope of the machine is 1-5/8" per 60". The machine is provided with two adjusting screws in the base of the drive housing. Turn the screw down so that the control panel end of the machine is raised about 1-1/2". Due to floor irregularities, the final check to obtain proper slope is to use a level. Be sure the level is adjusted properly by placing it on a reasonably level surface and checking the distance the bulb is from the center. Reverse the level end for end and recheck. The bubble should be the same distance from center if the level is properly adjusted. Place the level lengthwise on the top of the machine and raise by shims the end of the level nearest the discharge end of the machine by the following amounts:

<u>Length of Level-Inches</u>	<u>Raise End-Inches</u>
18	1/2
24	21/32
28	3/4
36	31/32
48	1-5/16
60	1-5/8

Adjust machine leveling screws until bubble centers. The machine is now at correct operating slope. Alternate leveling method is to use plumb bob mounted inside the drive housing. Set the slope so that the end point is even with bottom door frame when hanging free and pointing lengthwise of the machine.

START UP PROCEDURE

1. Turn electric power on to the machine by closing main disconnect switch. "Power On" light on panel should be lit (See Figure 8).
2. Turn "Grain Feed Switch" to OFF position (See Figure 8).
3. Turn "Burner Switch" to OFF position (See Figure 8).

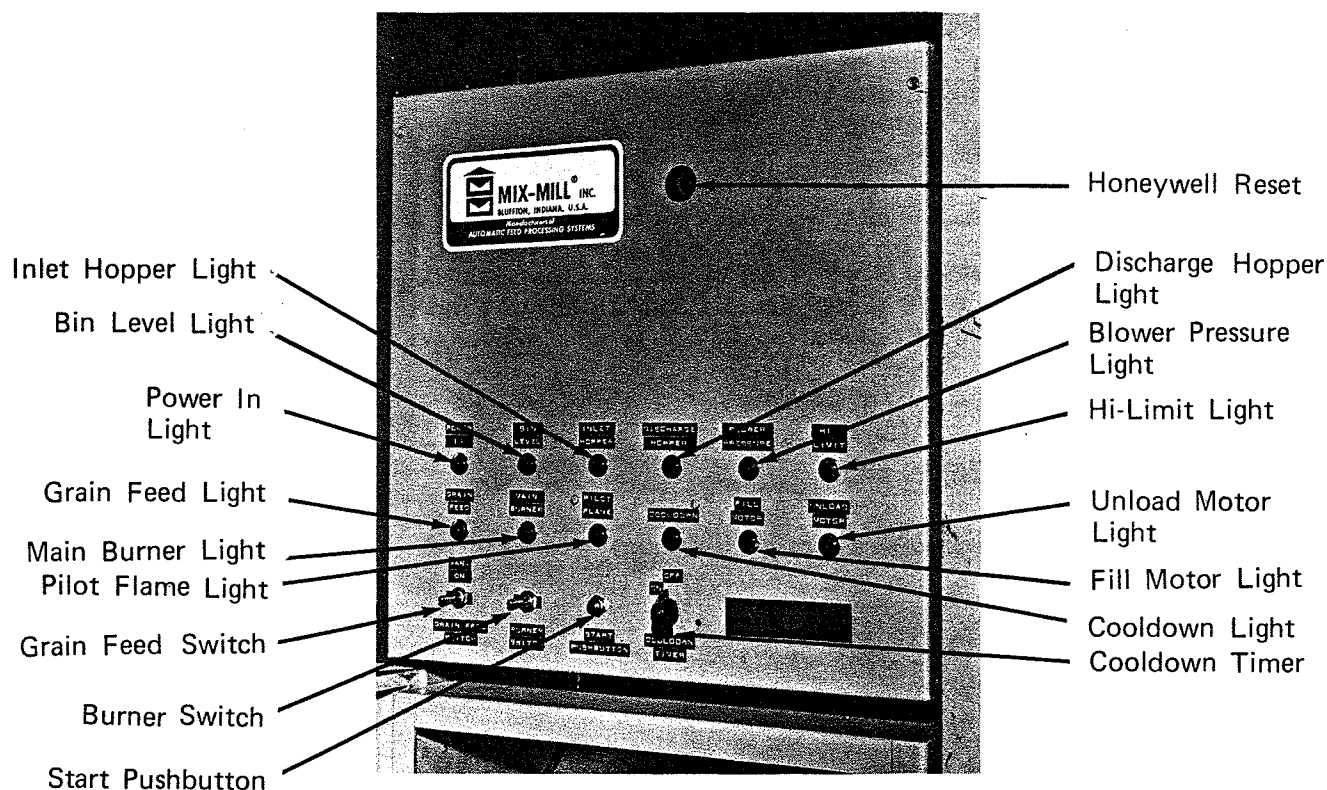


FIGURE #8 CONTROL PANEL FACE

4. Turn "Cooldown Timer" to ON position (See Figure 8).
5. Push "Start Pushbutton" (See Figure 8). The machine main drive motor and rotor, the loading auger, unloading auger, and the grain cleaner should start running.
6. Start grain flowing into loading auger. Observe grain feeding rate at auger outlet to be sure auger is not delivering grain faster than the grain cleaner is handling it. If it is, slow the auger by changing pulleys.
7. Watch feeder hopper fill and be sure that cleaner and loading auger shut off when the hopper is full and diaphragm switch is covered.
8. Turn vapor valve on at LP gas tank or main natural gas supply valve and then open gas cock at machine. Check gas pressure at gauge. For LP gas it should be 11 to 15 inches of water. Natural gas should measure 5 to 7 inches of water.
IMPORTANT: DO NOT attempt to start machine when A GAS ODOR IS PRESENT. Check IMMEDIATELY for gas leak and correct. Thoroughly ventilate area before starting machine.
9. The machine is now ready to fire by turning the "Burner Switch" to the ON position and pushing and holding the "Start Pushbutton" until the "Pilot Flame" light comes on. When the pilot flame is established, then the "Main Burner" light and main gas solenoid will automatically open to establish main burner flame. If the pilot flame is not established within 10 seconds, the pilot ignition, solenoid valve, and light will turn off. If the pilot flame light does not come on within 15 seconds of pushing the "Start Pushbutton" it will be necessary to push the Honeywell reset button. It will also be necessary to push the Honeywell reset button after failure to establish flame and before trying to restart the burner.

Oct 15, 1987

10. Within 120 seconds after the main burner light comes on, turn the "Grain Feed Switch" to the ON position. For soybeans wait the full 120 seconds to allow the machine to adequately warm up to be sure that the first beans through are completely roasted. For other grains that do not require the first kernels through to be completely roasted, the Grain Feed Switch may be turned on immediately.
11. Turn the "Feeder Control" knob to desired setting (See Figure 4, Item E). Until the setting is learned that does the required roasting job, start with a setting of about "12". After the temperature of the roasted grain has stabilized, adjust the grain flow rate by turning the knob to a higher setting for a faster grain flow rate and lowering final grain temperature or to a lower setting for a slower grain flow rate and higher final grain temperature.
12. Check gas pressure at gauge on side of gas cock with machine burner operating. Adjust gas pressure by adjusting the low pressure regulator (See Figures 6 and 7) so that with the burner operating the pressure on the gauge is 11 inches of water for LP gas and 5 inches of water for natural gas.
13. After the unit has run at least 15 minutes and the temperature has stabilized, adjust the Hi Limit Thermostat (located inside the control panel). Slowly reduce the temperature setting until the unit shuts off. Turn the dial back clockwise approximately 20-40 degrees. Set the High Limit at a temperature as low as possible without causing nuisance shutdowns

IMPORTANT: Do not set the Hi Limit any higher than necessary to avoid losing its safety protection.

CAUTION: Do Not Shut Down Without Cooling Cycle Due To The Potential Fire Hazard Caused By Hot Metal Parts And Residual Grain In Machine.

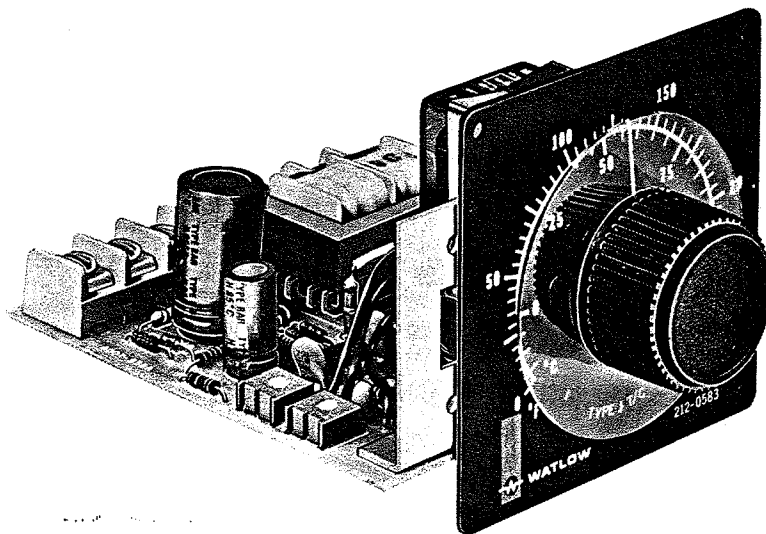


FIGURE #9 ADJUSTING HI LIMIT THERMOSTAT

14. Check grain from grain cleaner into hopper and screenings. The purpose of the cleaner is to maintain uniform particle size going through the machine by first removing the large materials that might cause feeding problems and be of an easily combustible nature. The second purpose is to remove fines that would be overheated and possibly burnt. Both extra large particles and fines present a fire hazard to the use of the machine. There are extra screens furnished and it may be necessary to change screens to maintain uniform particle size and prevent excessive screenings.

GENERAL OPERATING PROCEDURE

Basically the machine is very simple to operate with only one operating control to adjust; the Grain Feeder Control Knob. The function of this control is to control the rate grain is fed into the machine. The higher the numerical setting, the faster the grain will be fed into the machine. Since the machine has a constant heat input, the faster grain is fed through the machine, the lower the final grain temperature and hence, the lower the degree of roasting. Due to the many variables in grain characteristics there are not any precise final grain temperatures known that can be used as the point for optimum roasting results. Roughly, for soybeans, the temperature ranges from 235° to 265° F and for corn, 250° to 300° F. The final grain roasted condition is the responsibility of the operator.

One of the measures of roasting is the final grain temperature. To determine final grain temperature, use a wide mouth thermos bottle and a candy thermometer. First catch a thermos full of a sample of grain coming out the rear of the machine to warm up the thermos and thermometer. After several minutes dump the first sample and immediately catch a new sample. Watch the candy thermometer to determine the maximum temperature the thermometer reads. This maximum temperature is the final grain temperature. It is suggested that the operator check with the local county agent or agricultural college to determine the latest recommended roasting temperatures and data. A visual check of roasting may be made by observing the degree of grain surface browning, cracking, and kernal popping. It must be recognized that beginning grain moisture contents and temperatures will significantly vary operating capacities.

SOYBEAN ROASTING TEST

Visual

1. Shell of every bean is split open or cracked.
2. Color is darker than raw beans.
 - A. Yellow straw color - raw
 - B. Light brown - partially heated in machine - may require storing to complete heating.
 - C. Medium brown - completely heated in machine.
 - D. Dark brown - completely heated in machine.
 - E. Black - burned.
3. Steam will be seen coming off beans. Beans will lose 4 to 5 per cent of their moisture during heating. Cooked beans tend to get darker when they stand for a few hours.

Aroma

1. Beans have a definite "nutty" aroma when cooking.

Sound

1. Beans can be heard popping at rear of machine, or in an open container.

Taste

1. Beans taste good and have a "peanut" flavor. Raw beans are bitter.

Feel

1. Beans coming out of machine will be too hot to handle with bare hands.
2. Temperature will be 235° to 265° F, depending on flow rate. Temperature can be measured by inserting a candy thermometer into a wide mouth thermos bottle filled with beans. The thermometer and bottle should be prewarmed with beans and should stabilize before reading.

May 1, 1972

Chemical

Urease Test

1. Large mouth jar with screw cover. A pint or 1/2 pint fruit jar is satisfactory.
2. Urea - A pound or two of urea in dry powder form can be obtained from most fertilizer plants.
3. Supply of warm water.
4. Measures - 1/2 cup size
1/2 teaspoon size

Procedure:

Place half cup of ground beans in jar, and mix in 1/2 teaspoon of urea. Cover with warm water and seal jar. Beans can be ground in a meat grinder or in a coffee mill, After 15 minutes remove cap and sniff for ammonia. If ammonia can be smelled, beans are not cooked.

CAUTION: Partially cooked beans sometimes require longer than 15 minutes to develop ammonia, sometimes as long as several hours.

NOTE: Even well cooked beans may develop the ammonia smell after 24 hours. The beans are sufficiently roasted if no ammonia smell develops in three hours.

OPERATING PROCEDURE SUMMARY

Start:

1. Power on - Close disconnect switch.
2. Burner Switch - Off.
3. Turn "Cooldown Timer" to ON position.
4. Push "Start Pushbutton" and fill feeder hopper.
5. Open tank or gas supply valve.
6. Open gas cock.
7. Turn "Burner Switch" to ON position.
8. Push and hold "Start Pushbutton", Pilot Flame light should come on after several seconds. If it doesn't, push Honeywell reset button.
9. Release "Start Pushbutton: when "Main Burner" light comes on and Pilot Flame light goes off.
10. Within 120 second warm up time turn "Grain Feed Switch" to ON position.
11. Set Grain Feeder Control knob.
12. Check roasted grain and adjust grain feed rate to get desired roasting.

DO NOT LEAVE MACHINE UNATTENDED FOR LONG PERIODS OF TIME!

Shutdown:

1. Turn "Burner Switch" off.
2. Turn "Grain Feed Switch" off.
3. Close gas cock.
4. After 20 minute cooldown period and unit automatically turns off, open disconnect switch.

SECTION II TROUBLE SHOOTING

Control Functions: See Figure 8 - control panel face.

1. "Power On" light: This light is connected to the main load terminals T_1 and T_3 . It should be on whenever the disconnect switch is closed and electrical power is supplied to the machine.
2. "Bin Level" light: This light is the first indicator light in the series connected burner control circuit and indicated that the bin level switch is closed. To check any of the series connected controls, it is necessary to push and hold the "Start" button. The bin level switch is an optional accessory to monitor when the roasted grain bin is full. To use this feature remove the wire jumper between terminals B_4 and B_5 and install a 7920 diaphragm switch in top of the roasted grain bin and wire between terminals B_4 and B_5 . If the light will not come on check the centrifugal switches and the bin switch.
3. "Inlet Hopper" light: This light is the second light in the burner control circuit and monitors the lower level diaphragm switch in the feeder hopper. If this light is off and the bin level light is on, then there is either insufficient grain in the feed hopper to operate the switch or a malfunction of the switch and its wiring. The inlet hopper switch is connected between terminals B_5 and B_6 .
4. "Discharge Switch" light: This light, the third light in the burner control circuit, monitors the discharge chute switch at the rear of the machine. The purpose of this switch is to monitor the take away system and turn the machine off before grain can back up into the rotor. If this light is off and the two preceding lights are on, the discharge chute circuit is open. Correct by checking discharge chute and switch operation. Adjust counterbalance weight and switch arm so that the switch is closed with grain sliding down chute and then opens when grain backs up and begins to lay in chute. The discharge hopper switch is connected between terminals B_6 and B_7 .
5. "Blower Pressure" light: This fourth light in the burner control circuit monitors the combustion air supply to the burner. If this light is off and the preceding three lights are on there is not sufficient combustion air pressure to operate the burner. Items to check to correct this problem are:
 - a. Blower drive system: Check belt tightness and pulley set screws and keys.

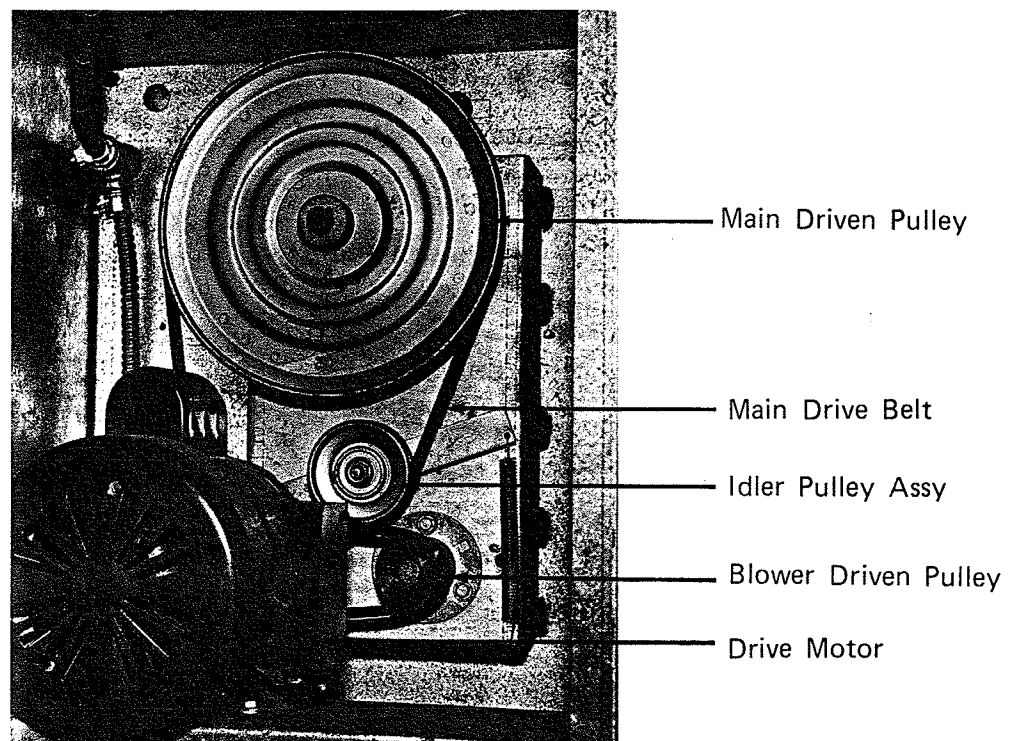


FIGURE #10 MAIN DRIVE

- b. Burner manifold pressure: Check by attaching a manometer into the pilot combustion air line to the burner pilot assembly. Adjust the burner pressure switch to operate at about 1-1/2 inches of water pressure by changing the pressure with the burner blower inlet shutter. Finally, set burner manifold pressure at 2 inches of water with the burner blower inlet shutter and with the burner off. This pressure changes when the burner is on. The burner pressure switch is connected between B₇ and B₆.

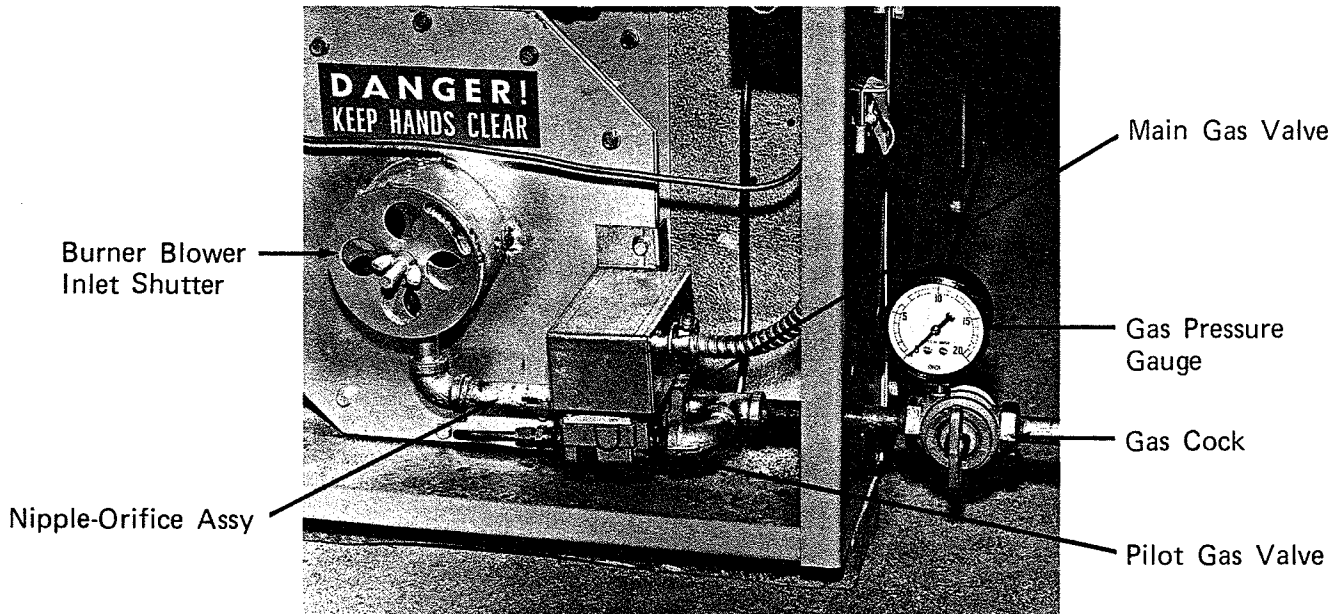


FIGURE #11 GAS VALVE ASSY

6. "Hi Limit" light: This light, fifth light in the burner control circuit, monitors the Hi Limit thermostat. The Hi Limit is a thermostat monitoring the temperature of the outside surface of the cylinder. Its purpose is to turn the burner off if there should be a grain feeding problem or some other problem that causes an extra high temperature. If the Hi Limit light is off, and the preceding four lights are on, check the Hi Limit and its wiring. (See Page 13, Section I of Start Up Procedures for Hi Limit setting). The Hi Limit thermostat is connected between terminals T₉ and T₁₀.
7. "Burner Switch": The burner switch is the next control in the series connected burner control circuit and controls the Honeywell flame relay.
8. "Honeywell Flame Relay": The flame relay is the primary burner controller. Its function is to control and monitor the starting and operation of the burner. When the burner relay receives power through the preceding control circuit, it will automatically turn the ignition transformer on, making a spark in the burner pilot assembly and supply power to open the pilot gas valve. When a pilot flame is established, the burner flame sensor (an ultra violet light cell) will see the pilot flame and signal the relay to open the main gas valve. The pilot gas valve will remain open for about 10 seconds and then close. If the main burner is not lit and hence the flame sensor does not see the main flame, the reset on the Honeywell relay will open after 15 seconds (See Honeywell RA890G sheet in back for relay check out).

May 1, 1972

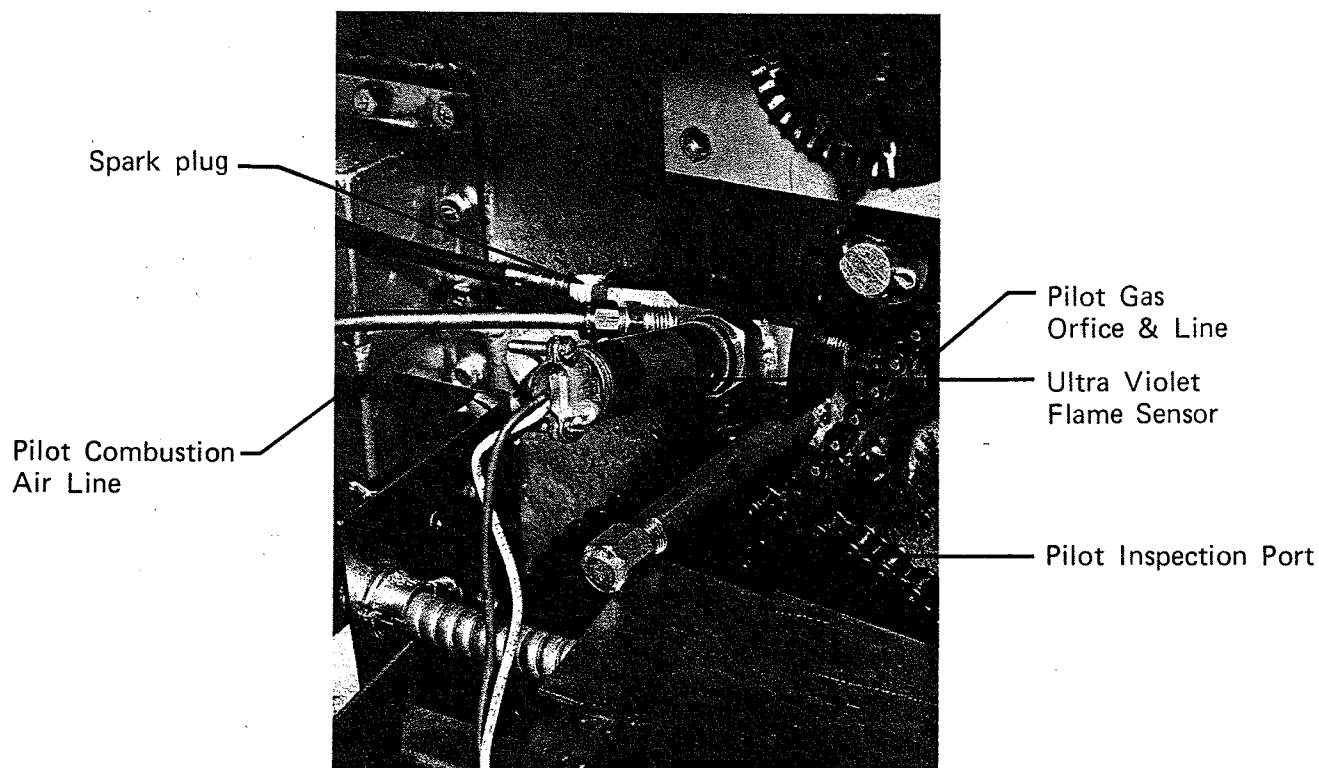


FIGURE #12 BURNER PILOT ASSY

9. "Pilot Flame" light: This light is connected in parallel with the ignition transformer and pilot gas valve to indicate their operation. If the Hi Limit light is on and the Burner Switch is on, then within several seconds the Pilot light should come on for 10 seconds. If it does not come on, push the Honeywell reset button.
10. "Main Burner" light: This light, connected in parallel with the main gas valve, indicates when the main gas valve is open. If the pilot light is on for 10 seconds and the main burner light does not come on, the problem is that the pilot flame is not established. Check gas supply pressure and bleed the gas line to remove trapped air. Check the pilot gas valve to see that it is opening by disconnecting the pilot gas line and checking for flow while pilot gas light is on. Check spark at the spark plug by removing the spark plug wire and holding the end near a metal side and observing the spark. Check spark plug gap. It should be .030 inches. If the burner light comes on for several seconds and then goes off, the problem is main burner flame is not being established. Check the main gas valve by observing gas pressure drop at the instant the light comes on and valve opens. If pressure does not drop, check out the valve by removing four screws around the base of the coil and remove and clean the seats. Check out burner combustion air setting per 5b above, by adjusting the burner blower inlet shutter to correct gas/air ratio.
11. "Grain Feed Switch" and light: The Grain Feed Switch controls the grain feed into the rotor by operating the grain clutch solenoid. Electric power to the solenoid disengages the clutch and stops the feed. When the switch is in the off position with the rotor operating, the solenoid should have 115 V across its terminals. If it has power, but does not disengage the clutch, replace the solenoid. The light is only an indicator of the Grain Feed Switch position.
12. "Cooldown Timer" and light: The Cooldown Timer contacts are connected in the main drive motor circuit and will permit the motor to run in any position except the "Off" position. Hence, the Timer must be in an "On" position for the main drive motor to run. The Cooldown Timer will run whenever the main drive motor is running and the burner is off. The Cooldown light is wired in parallel with the Cooldown Timer and is lit whenever the Timer is running. The Timer light and Timer will be off whenever the burner is operating. Whenever the burner stops, the Cooldown Timer starts and will continue to run the main drive motor for the remaining time on the Timer.

13. "Fill Motor" light: This light is wired in parallel with the filling auger relay that controls the grain cleaner and filling auger. It is on whenever this equipment should be running. The relay is controlled by the centrifugal switches on the rotor and the top diaphragm switch in the feeder hopper.
14. "Unload Motor" light: This light is wired in parallel with the unloading auger relay and is on whenever the rotor is turning.
15. "Feeder Control" knob: The Feeder Control knob controls the speed the feeding auger turns and the rate grain is fed into the cylinder and rotor. On the inside behind the knob is a double cam mechanism that controls the percentage of each revolution of the drive sprocket that the drive pawls engage the auger ratchet. If the unit is not feeding properly, check the following items:
 - a. Check chain drive and slip clutch. If the slip clutch is hammering, indicating a blockage in feeding auger remove the grain and cover over auger in feeder hopper and clean.
 - b. Grain not feeding into feeding auger - remove grain in feeder hopper and clean opening under auger and check auger operation.
 - c. Feeding auger not turning - remove four bolts around feeder control knob and remove knob assembly to check drive pawls and ratchet gear. Check set screws in auger under cover in feeder hopper.
 - d. Slip clutch is not tight enough - Tighten slip clutch by removing front main rotor shaft bearing and adding 1-1/16" I.D. flat washers to spring length to increase the clutch pressure. Reinstall main rotor bearing.

IMPORTANT: DO NOT ADD ANY MORE WASHERS THAN NECESSARY TO KEEP CLUTCH FROM SLIPPING. CHECK TO SEE THAT CLUTCH WILL SLIP AFTER BEARING IS REINSTALLED.

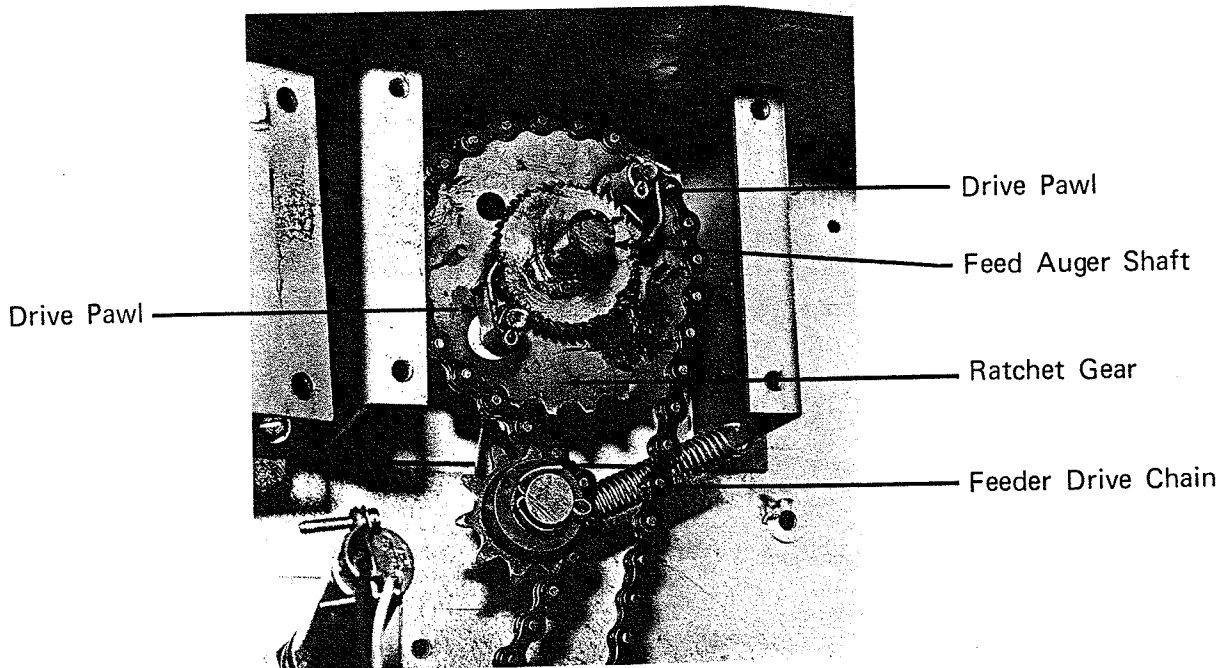


FIGURE #13 FEEDER CONTROL MECHANISM

16. Main rotor is rubbing or binding during operation: Remove outer and inner end plates on rear of machine and inspect with a flashlight the rotor and cylinder to find interference. Remove rotor assembly by removing drive bolt through tube and drive shaft at rear end and slide rotor off of shaft. Straighten interference spot and reassemble.

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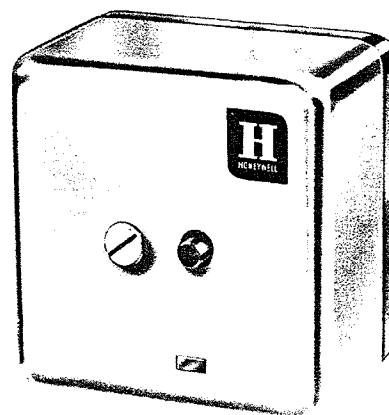
Residential Div. Form Number

The RA890G Protectorelay control provides solid state electronic safeguard protection for industrial and commercial gas, oil, or combination gas-oil burners. It is designed for interrupted ignition with intermittent pilot for gas burners, and for interrupted or intermittent ignition on oil burners.

The RA890G can only be used with a C7027 or C7035 Minipeeper Ultraviolet Flame Detector. On-Off control of the system must be provided by a low voltage automatic or manual controller. Connecting the controller to other than the T-T terminals will cause safety lockout.

- Solid state circuitry eliminates warmup and increases resistance to vibration.
- Push-to-reset safety switch button is in dust-resistant enclosure.
- Safe start check prevents start if flame or flame simulating failure is present.
- Automatic safety shutdown if flame fails on start or if flame is not re-established after a flame failure.
- Test jack permits direct reading of the flame signal.
- Easy mounting and removal through use of captive mounting screws. Mounting base is made of practically unbreakable thermoplastic.

PROTECTORELAY PRIMARY CONTROL



RA890G

SPECIFICATIONS

TRADELINE MODELS

Tradeline models are selected and packaged to provide ease of stocking, ease of handling, and maximum replacement value. Tradeline model specifications are the same as those of standard models except as noted below:

TRADELINE MODELS AVAILABLE: RA890G
Protectorelay Primary Control; 120v ac, 50/60 Hz.

ADDITIONAL FEATURES:

- Tradeline pack with cross reference sheet listing proper replacement for all RA890's.

STANDARD MODELS

MODEL: RA890G Protectorelay Primary Control.

VOLTAGE AND FREQUENCY: 120, 208, 220, 240 volt; 50/60 Hz.

ELECTRICAL RATING:

TERMINAL	ELECTRICAL LOAD	120V AC	240V AC
3	Burner Full load	5.2 amp	2.6 amp
	Motor Locked rotor	31.2 amp	15.6 amp
	Ignition ^a	3.0 amp	1.5 amp
4	Pilot Fuel Valve ^b	25 va	25 va
	Ignition ^a	3.0 amp	1.5 amp
5	Gas Valve	125 va	125 va
	Alternate Rating: 25 va pilot duty plus 1 or more motorized valves with total rating 400 va opening, 200 va holding.		

^aIf ignition and motor are connected to terminal 3, terminal 4 cannot be used. This is to prevent overloading relay 1K.

^bIgnition and pilot or fuel valve can be transferred to terminal 5 by the R482D or R488F for cutoff service, see Fig. 5.

Alarm contacts—4.0 amp at 24v ac, or 1.0 amp at 120v ac in suitable wiring enclosure.
Control circuit (T1-T2)—0.16 ampere.

VOLT-AMPERE RATING: 60 Hz—12 va max., 7.1 va standby; 50 Hz—14.0 va max., 11.5 va standby.

POWER CONSUMPTION: 60 Hz—8.5 watts max., 1.7 watts standby; 50 Hz—9 watts max., 3.2 watts standby.

FLAME RESPONSE: 0.8 second or 3 seconds (nominal; separate models). 3 second response time recommended for nonrecycling cutoff system.

SAFETY SWITCH TIMING: 15 seconds.

DIMENSIONS (in inches—including subbase): Approximately 5 x 5 x 4-3/4.

AMBIENT TEMPERATURE RATING:

MODEL	MIN.	MAX.	
		60 HZ	50 HZ
Without alarm	-20	125 F	115 F
With alarm	-20	115 F	105 F

ALARM CONTACTS (optional): Isolated spdt contacts. Alarm terminals are male quick-connects (female quick-connects included for field installation). See rating above.

FLAME DETECTOR: C7027 or C7035 Ultraviolet Flame Detector.

LISTING BODIES: Factory Mutual; Underwriters' Laboratories, Inc. listed—file no. MP268, guide no. MCCZ.

MOUNTING: Q270A Universal Mounting Base (order separately).

ACCESSORIES:

1. Microammeter—W136A.
2. Flame Simulator—no. 123514B.
3. Meter Connector Plug—no. 117053.
4. FSP 1535—Test Panel, for operational check of RA890E, F, G, and H or the R4795.
5. Cover assembly, with reset button—part no. 131891A.
6. Cover assembly, without reset button—part no. 129136A.

ORDERING INFORMATION

WHEN ORDERING REFER TO THE TRADELINE CATALOG OR PRICE SHEETS FOR COMPLETE ORDERING SPECIFICATION NUMBER, OR...

SPECIFY—

1. MODEL NUMBER; SPECIFY TRADELINE, IF DESIRED.
2. VOLTAGE AND FREQUENCY.
3. FLAME RESPONSE TIME.
4. ALARM CONTACTS, IF DESIRED.
5. ACCESSORIES, IF DESIRED.

ORDER FROM—

1. YOUR USUAL SOURCE, OR
2. HONEYWELL
1885 DOUGLAS DRIVE NORTH
MINNEAPOLIS, MINNESOTA 55422
(IN CANADA—HONEYWELL CONTROLS LIMITED
740 ELLESMERE ROAD
SCARBOROUGH, ONTARIO)
INTERNATIONAL SALES AND SERVICE OFFICES
IN ALL PRINCIPAL CITIES OF THE WORLD.

INSTALLATION

CAUTION

Only a trained, experienced flame safeguard control serviceman should attempt to install or connect this device.

Follow the burner manufacturer's instructions, if supplied. Otherwise proceed as follows.

MOUNT SUBBASE

Locate subbase where maximum ambient temperature is within the specified rating.

Mount subbase in the desired position. See Fig. 1.

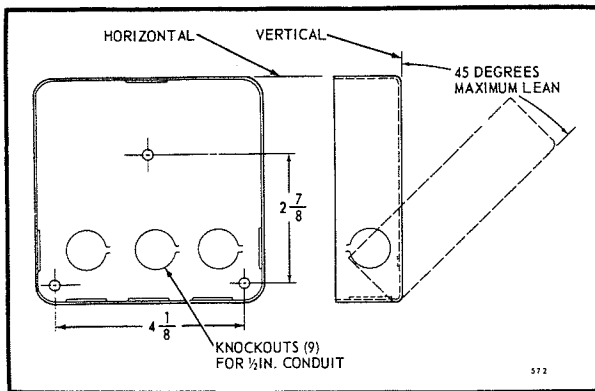


FIG. 1—MOUNTING BASE.

WIRE SUBBASE

CAUTION

Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.

All wiring must comply with applicable electrical codes and ordinances.

All system wiring to terminals on the subbase must be NEC Class I.

Number 14 TW moisture resistant wire is recommended for normal installations.

For high temperature installations, use Honeywell Spec. No. R1298020 wire rated at 400 F (continuous duty) or equivalent for all but the ignition lead; for the ignition use Honeywell Spec. No. R1061012 ignition wire rated at 350 F (continuous duty) or equivalent. The flame lead must be either No. 14 TW wire for normal installations or Spec. R1298020 for high temperature installations.

NOTE: High voltage ignition transformer wires should not be run in the same conduit with the flame sensor wiring.

HOOKUPS

Hookups for typical systems are shown in the following figures. Note that the low voltage controller must be connected to terminals T - T. (Interrupting the hot line to terminal 6 with a line voltage controller will cause safety lockout.)

IMPORTANT

With the limit control connected in the hot line to terminal 6 as shown in the wiring diagrams, Figs. 2-5, 7, safety lockout will occur on limit action.

This will prevent the system from cycling off the high limit and insure that troubles are noticed and corrected as soon as possible. If the limit is connected in the hot line to terminal 1 as shown in the optional hookup in Fig. 7, safety lockout will not occur. This location is for applications requiring a recycling limit. It is not recommended.

IMPORTANT

The C7027 and C7035 flame detector leads are color coded blue and white. The blue lead must be connected to the F terminal and the white lead to the G terminal. The circuit is dc and the UV tube is polarity sensitive. Reversing the leads, even momentarily, can damage or destroy the UV tube.

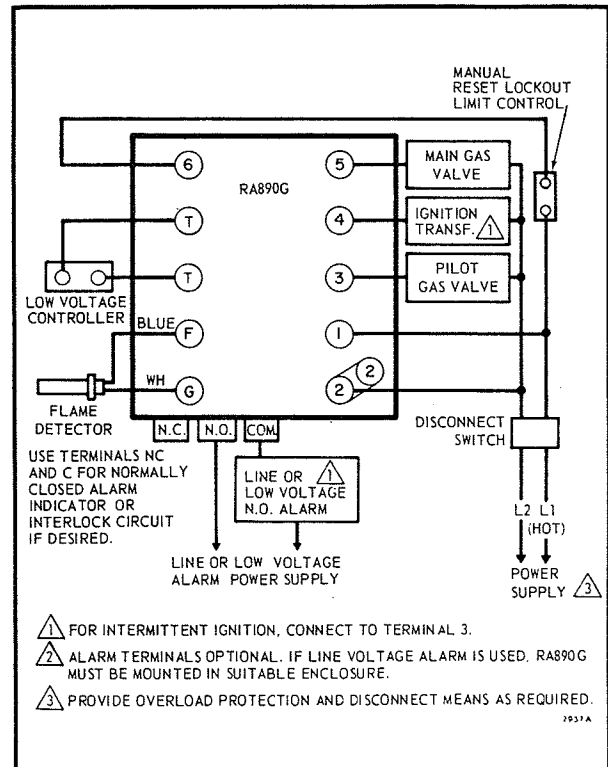


FIG. 2—GAS SYSTEM WITH INTERRUPTED IGNITION.

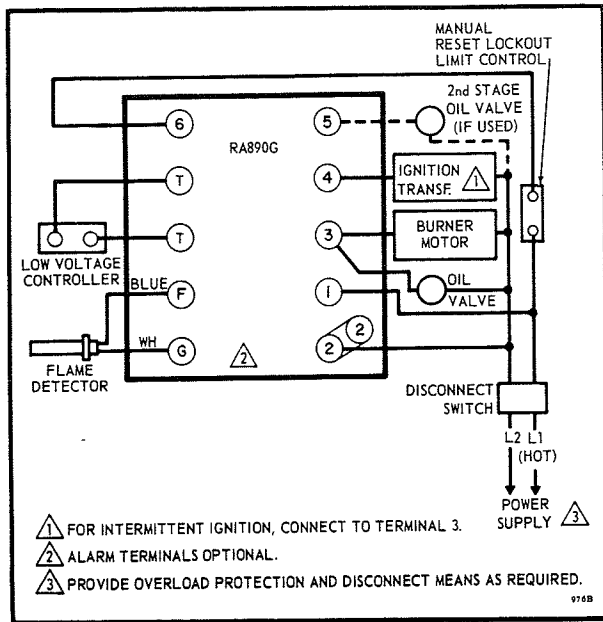


FIG. 3—OIL FIRED SYSTEM WITH INTERRUPTED IGNITION.

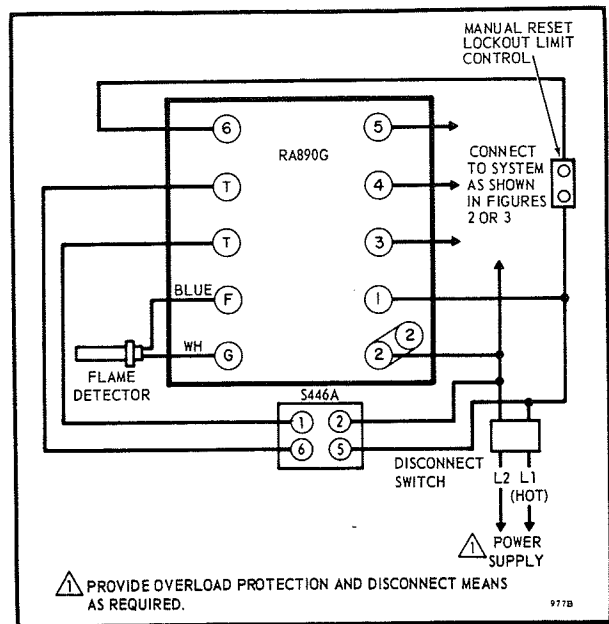


FIG. 4—OIL OR GAS SYSTEM USING S446A START-STOP STATION.

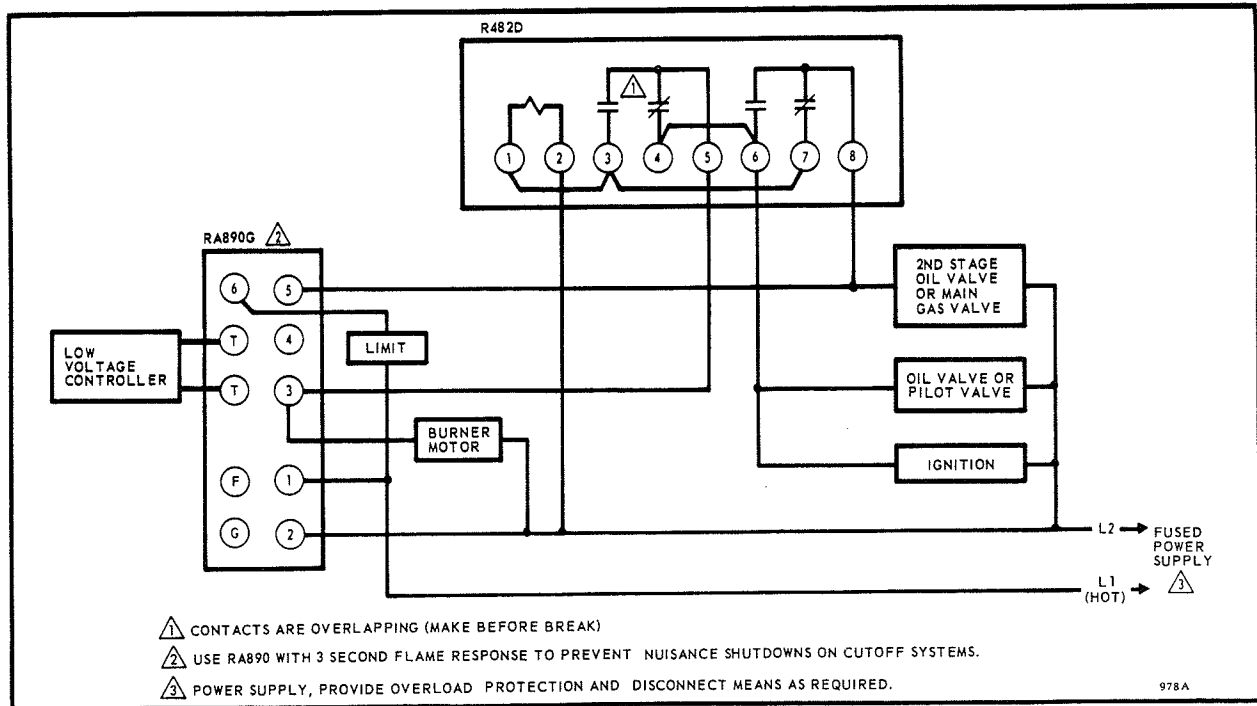


FIG. 5—GAS OR OIL CUTOFF SYSTEM USING SWITCHING RELAY WITH OVERLAPPING CONTACTS.

MOUNT RA890G

Check that the power is off.

Remove relay cover, see Fig. 6, and position the RA890G over the Q270A Universal Mounting Base. Start all 10 mounting screws—tighten uniformly. These screws complete electrical circuits as well as hold the RA890G to the subbase.

As shipped from the factory, the RA890G is suitable for use with interrupted or intermittent systems.

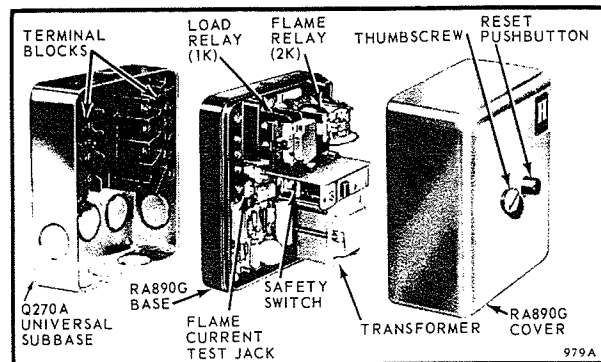


FIG. 6—RA890G AND Q270A SUBBASE.

OPERATION AND CHECKOUT

CAUTION

Only a trained, experienced flame safeguard control serviceman should attempt to check out this device.

NORMAL OPERATION SUMMARY

Normal control operation is summarized below. Refer to Fig. 7 for the internal schematic of the control.

1. Call for heat—Load relay pulls in after a slight delay (flame relay must be out), ignition starts, pilot valve or burner motor powered. Safety switch heats.

2. Flame proved—Flame relay pulls in, safety switch heater de-energized, main valve powered, ignition cut off (if used for interrupted ignition).

3. Call for heat satisfied—Load relay drops out, fuel valves close, burner motor stops, flame relay drops out.

NOTE: The pull-in of the load relay is delayed by a thermistor with a nominal delay time of 3-5 seconds. The thermistor is affected by ambient temperature. The delay time may be as little as 2 seconds when the temperature is high and as long as 30 seconds when the temperature is low. As the thermistor warms up, the 1K relay may hum slightly before it pulls in. This is normal and not relay "chatter".

PRELIMINARY CHECKS

Before placing the system in operation complete the following preliminary checks:

1. Check through wiring. Use a meter to check the continuity of all circuits.
2. Check flame detector installation.
3. Check burner adjustments.
4. Purge gas piping thoroughly.
5. Reset the safety switch by pushing in and then releasing the purple safety switch button.

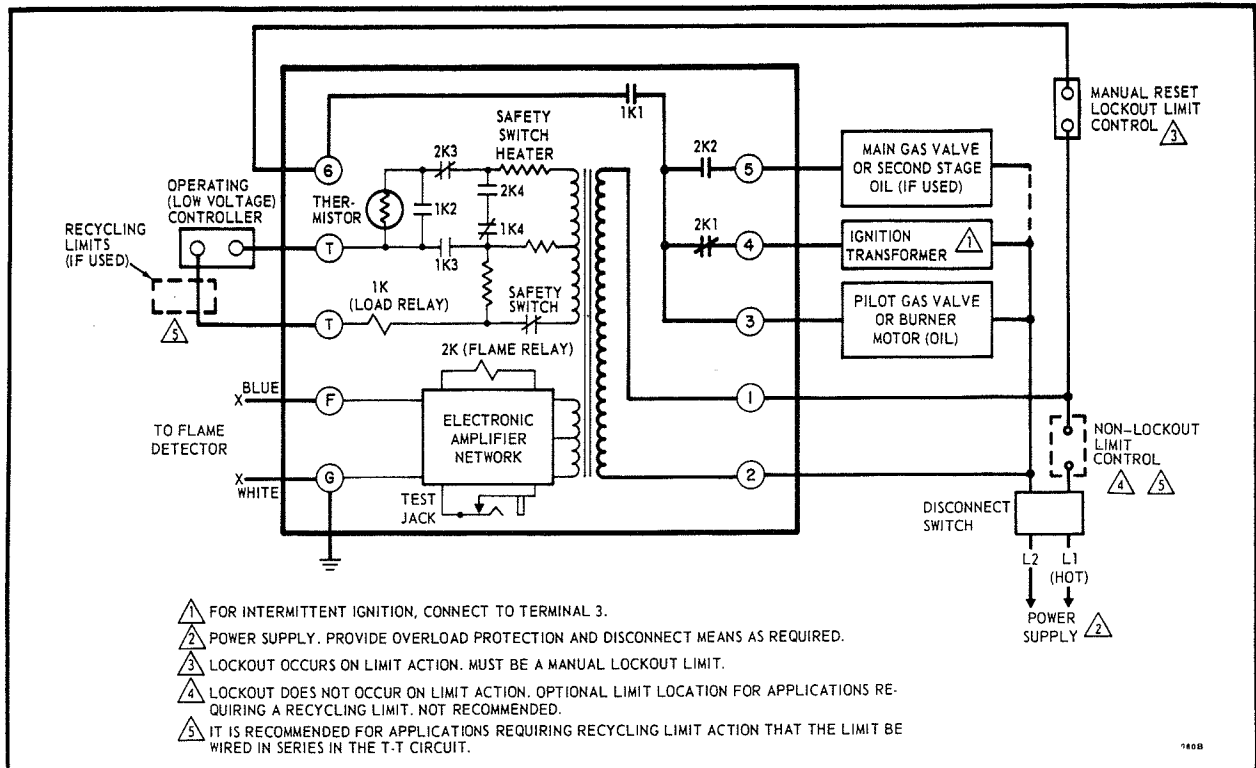


FIG. 7—INTERNAL SCHEMATIC OF THE RA890G (TYPICAL EXTERNAL CONNECTIONS INCLUDED).

CHECKOUT REQUIRED

Before the installation is complete all checkout tests indicated below must be satisfactorily accomplished:

FLAME CURRENT CHECK (all installations).

PILOT TURNDOWN TEST (all installations that require proof of pilot before main fuel valve is opened).

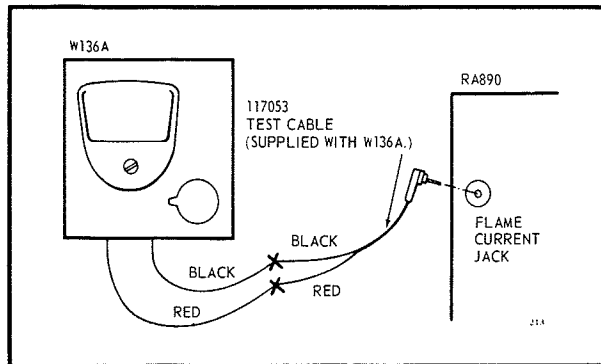
SAFE SHUTDOWN CHECKS—Flame failure, power failure, limit action (all installations).

IGNITION SPARK RESPONSE TEST (all installations).

FLAME CURRENT CHECK

The flame current check is the best indicator of proper flame detector application. The check should be done at the time of installation, at any time service is done on the system, and at least once a month, or more often, while the system is in operation. This will prevent shutdowns due to poor flame signal.

The test is done by connecting a W136A (or equivalent) microammeter in series with the flame detector, and reading the flame signal while the burner is operating.



Insert a 117053 Test Cable, wired color to color to the W136A leadwires, into the test jack on the RA890G. This automatically puts the microammeter in series with the flame detector.

When reading the flame current, insure that two criteria are met:

1. The flame current must be steady; meter should not vary more than a needle width.
2. The flame current must be at least 1.5 microamperes for an ultraviolet type detector such as is used with the RA890G.

If a satisfactory reading is not obtained, check the power source for the proper line voltage, the fire size, and the detector for proper sensing.

Directions for obtaining a steady current reading are included in the instruction sheet packed with the C7027 or C7035 Ultraviolet Flame Detector.

NOTE: Flame current cannot be measured by putting a microammeter in the F lead.

PILOT TURNDOWN TEST

On systems that prove a pilot before the main fuel valve can be opened, perform a pilot turndown test to prove that the main burner can be lighted by the smallest pilot that will hold in the flame relay. A flame current check should be performed before and after the pilot turndown test.

CAUTION

The pilot turndown test should be performed only by qualified personnel, and the instructions should be followed carefully.

1. Open the main power switch.
2. Shut off the fuel supply to the main burner only by closing the manual main burner shutoff cock. Do not shut off the fuel supply to the pilot valve.
3. Restore power to the relay.
4. Start system by raising the set point of the controller (or pressing the start button). The pilot will light and pull in the flame relay.
5. Reduce the size of the pilot flame to the turndown condition by slowly closing the manual valve on the pilot gas line. At the turndown condition the pilot will be small enough to just barely hold in the flame relay (2K).
 - a. Turn down the pilot until relay 2K drops out.
 - b. Turn the pilot back up slowly just until relay 2K pulls back in.
 - c. Again turn the pilot down slightly, but not enough so the relay drops out.

If the relay drops out again simply turn the pilot up and try again. The closer the pilot is to the dropout condition the more conclusive the test will be.

6. Check that the pilot is lit and relay 2K is pulled in.
7. Open the manual main burner shutoff cock. Main flame should light smoothly within one second. If the burner does not light within one second close the shut-off cock and shut off power to the relay. Proceed to Step 9.
8. If the burner lights, repeat Step 7 two or three times to verify smooth lightoff.
9. If the lightoff is unsatisfactory, readjust the flame detector to require a larger pilot flame to hold in the flame relay. This usually requires resighting the detector farther out on the axis of the pilot flame.
10. Repeat the entire turndown test until the flame is established promptly in Step 7.
11. Turn the pilot up to full flame at the completion of the test. A flame current check should be performed before leaving the job.

CAUTION

If the pilot needs to be adjusted and rechecked, allow five minutes for the purge of unburned gases in the firebox before proceeding to the next step.

IGNITION SPARK RESPONSE TEST

The flame relay should not respond (pull in) to ignition spark. To determine flame detector sensitivity to ignition spark, perform the following steps:

1. Shut off pilot and main fuel valves.
2. Start system by raising controller set point or pressing start button. This should energize the ignition transformer so ignition spark is produced between electrode and ground.

3. Check flame relay (2K). The relay should not pull in.
4. If the relay pulls in, relocate the flame detector or ignition electrode.

SAFE SHUTDOWN CHECKS

LIMIT ACTION

Lower the high limit control setting below the furnace temperature or pressure. The system should shut down and will lock out within safety switch timing. Restore recommended limit control setting before lockout occurs. Burner should start.

FLAME FAILURE

With the burner operating, close the manual fuel valves to simulate a flame failure. System should

lock out within safety switch timing (15 seconds). After the safety switch has cooled, open the manual valves and reset the safety switch, and the burner should restart.

POWER FAILURE

With the burner operating, open and then immediately close the line switch to simulate a power failure. Burner should shut down. After a short delay for component check, burner should restart and operate normally.

NOTE: At the completion of all CHECKOUT tests, make sure that the RA890 is not on safety lockout, the pilot is turned up to its normal level, and all limit settings are correct. Operate the system through one normal cycle before leaving the installation.

SERVICE

CAUTION

1. Only a trained, experienced flame safeguard control serviceman should attempt to service or repair this device.
2. Under certain conditions, a capacitor within the RA890G can remain charged even after power has been disconnected and the device has been removed from the mounting base. To avoid the hazard of electrical shock, use a screwdriver with an insulated handle and avoid touching the RA890G electrical contacts.

GENERAL

1. Do all checks required under the CHECKOUT section on page 5 when replacing the RA890, or when relighting or restoring power to the system after shutdown.
2. The captive mounting screws carry current; always disconnect power before loosening or tightening the mounting screws.
3. On each service call check the controller for approximately correct calibration and differential; insure that it is mounted securely (see controller instructions).
4. Never use oil on any part of the RA890G.
5. When cleaning the burner, clean the flame detector lens.
6. DO NOT PUSH IN THE RA890 RELAYS MANUALLY. This may damage the relays and it is an unsafe

practice in that it overrides the protective features of the relay. Clean relay contacts only as instructed below.

PERIODIC MAINTENANCE

The specific maintenance schedule set up will depend on a number of factors including type of equipment being controlled, operating conditions (dirt and heat especially), the cost of a nuisance shutdown, etc. The following should be included in any program.

Perform a flame failure check and pilot turndown test whenever the burner is serviced, and at least annually.

Inspect and clean the detector and any viewing windows as often as required by soot accumulation and heat conditions at the detector.

Do a flame current check at least monthly and more often where a shutdown may be costly.

Clean contacts only when required by failure to operate properly.

CONTACT CLEANING

The relay contacts on the RA890 should be cleaned only when required and then only with Honeywell contact cleaner, part number 132569. The contact cleaner comes in pressurized spray cans; directions for its use are printed on the can.

Do not use other commercial contact cleaners. Most cleaners tested have been found to leave deposits on the contact surfaces or to attack RA890 chassis parts.

TROUBLESHOOTING

If trouble occurs in the heating system and its cause is not immediately apparent, the serviceman can apply the following step by step checkout to locate the cause of most problems.

TEST STANDBY OPERATION

1. Set controller not to call for heat.
2. Reset the safety switch by pushing in and then releasing the purple safety switch reset button.

3. Close the line switch.
4. Check for line voltage at terminals 1 and 2.
 - a. Voltage must be within +10 to -15 percent of the rated voltage.
 - b. If voltage is zero, check the power supply line for blown fuses, open circuit, or open disconnect switch. If a non-lockout, limit control (Fig. 7) is used, check contacts for continuity.

5. Check the position of the flame relay.
 - a. If the flame relay is out, proceed to step 6.
 - b. If the flame relay is in, check for flame simulating condition. (Control will be locked out.)
 - (1) Break the flame circuit by inserting the plug end of a flame simulator or 117053 Test Cable into the RA890G test jack.
 - (2) If the flame relay remains in, replace the RA890G.
 - (3) If the flame relay now drops out, trouble is in the flame detector or external circuit. Check for stray UV signal reaching the detector, defective wiring, or short in the circuit; refer to the detector sheet for a list of UV sources.

TESTING STARTING EQUIPMENT

6. Set the controller to call for heat.
7. Observe load relay for pull-in; relay should pull in to light the pilot and start the burner motor.
 - a. If load relay pulls in to light pilot and start burner, proceed to step 11.
 - b. If load relay doesn't pull in, proceed to step 8.
 - c. If load relay pulls in but burner doesn't start and pilot doesn't light, proceed to steps 9 and 10.
8. Check the low voltage controller by jumpering T-T.
 - a. If this causes the load relay to pull in, check the controller and its circuit.
 - b. If the load relay still doesn't pull in, clean all relay contacts. Replace the RA890 if the trouble is not corrected.
9. Check the limits by jumpering terminals 1-6.
 - a. If this starts the burner or lights the pilot check the limit contacts and the wiring from 1 to 6.
10. Check voltage at terminals 3-2 and 4-2 with the load relay pulled in.
 - a. If zero voltage, clean all relay contacts. Replace the RA890G if terminals 3 and 4 cannot be powered.
 - b. If normal line voltage at terminals 3 and 4, check burner motor, ignition, and valve circuits as applicable.

Check wiring, burner adjustment, ignition system including electrode spacing and location, oil quality, character and efficiency of oil atomization, fuel supply pressure, flame pattern, flame character and quality, pilot location with respect to main burner, flame detector, or other conditions that may delay light-off.

TESTING FLAME DETECTING FUNCTION

11. Observe the flame relay (right hand relay) for pull-in when flame is established.
 - a. Flame relay pulls in; proceed to step 13.
 - b. Flame relay doesn't pull in; proceed to step 12.
12. Check the flame relay with a 123514B Flame Simulator, if available (follow the instructions with the simulator) or check the following:
 - a. Perform a flame current check. (Refer to page 6.)
 - b. If the current is satisfactory, replace the RA890.
 - c. If the current is not satisfactory, check items listed on page 6.

OBSERVE SEQUENCING OPERATION

13. Observe the second stage oil valve or main gas valve for opening when flame relay pulls in.
 - a. If valve doesn't open, check for line voltage at terminals 2-5.
 - (1) Normal voltage—check valve and valve circuit.
 - (2) Zero voltage—clean relay contacts. Replace the RA890 if cleaning contacts does not correct problem.
14. Observe ignition for cutoff when flame relay pulls in if connected to terminal 4.
 - a. If ignition stays on and wiring checks out, replace the RA890.

MISCELLANEOUS PROBLEMS

RELAY CHATTER

Load relay chatter may result from extreme low voltage (notify power company) or from a loose connection (tighten).

Flame relay chatter may result from improper combustion (adjust burner) or soot or carbon on flame detector (clean, and correct cause).

REPEATED LOCKOUTS OR CONTROL FAILURES

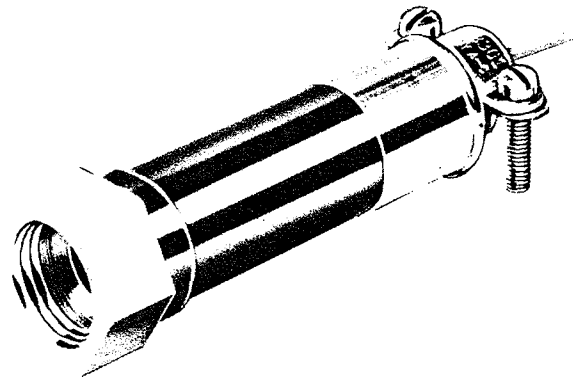
The most common causes of repeated failures of the control or flame detector, or of repeated lockouts are:

- a. High ambient temperatures—over 125 F. Subtract 10 degrees for alarm contacts and 10 degrees for 50 Hz operation.
- b. Supply voltage variation greater than +10 to -15 percent.
- c. Electrical overloading of the contacts.
- d. Marginal microamp signal.
- e. Frequent cycling with high ambient temperatures.

MINIPEEPER ULTRAVIOLET FLAME DETECTOR

The C7027A detects the ultraviolet radiation emitted from all flames. It is to be used with a R4150/R7259A or R4795/R7290 Flame Safeguard Sequencer or RA890G Protectorelay Control or R7023C Flame Detector Relay to provide supervision for gas, oil, or combination gas-oil burners. The UV sensing tube of the C7027A is not field replaceable.

- Detector mounts on a 1/2-inch sighting pipe with integral mounting nut.
- Compact size makes the C7027 particularly useful for blast tube mounting.
- Properly installed, the device is sealed against pressures as high as 5 psi.
- Simplified design permits use on economical throw-away basis.



C7027A

SPECIFICATIONS

MODEL: C7027A Ultraviolet Sensing Head.

DETECTION: Detects ultraviolet radiation only.

DIMENSIONS (inches):

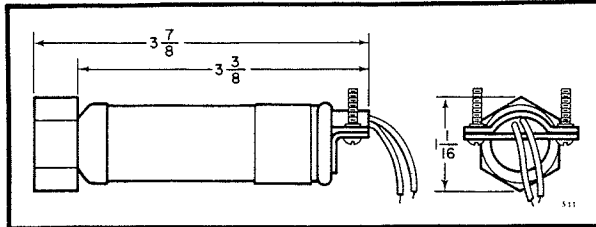


FIG. 1—INSTALLATION DIMENSIONS OF C7027A.

MOUNTING MEANS: Integral nut with standard 1/2-inch NPT internal threads.

TEMPERATURE RATING: 0 F to 215 F or -40 F to 215 F depending on model.

WIRING CONNECTIONS: Two six-foot lead wires, color coded, NEC class 1.

LISTING BODIES: Factory Mutual; C. S. A.; Underwriters' Laboratories, Inc. listed, file number MP 268, guide number 167 E10.

REPLACEMENT PARTS: Flange gasket—Honeywell part No. 129685. (NOTE: The UV sensing tube is not field replaceable.)

INSTALLATION

BASIC REQUIREMENTS FOR ULTRAVIOLET DETECTOR INSTALLATIONS

Every flame produces ultraviolet radiation, invisible to the eye but detected by the UV sensing tube. There are two important factors in UV detector installation:

1. The detector must have line of sight view of the flame.
2. The detector must not be exposed to other sources of ultraviolet radiation. The most common of these is ignition spark, but a number of others are listed below.

Since it is necessary for the detector to actually "see" the flame, it is desirable to locate the detector as close to the flame as physical arrangements and temperature restrictions will permit.

Sighting requirements for different types of flame supervision are as follows:

1. Pilot flame only—sighting must be along the axis of the pilot flame. The smallest pilot flame that can be sighted must be capable of igniting the main burner (see pilot turndown test).

2. Main flame only—sighting line must be at the most stable part of the flame for all firing rates.

3. Pilot and main flame—sighting must be at the junction of both flames.

OTHER RADIATION SOURCES SENSED BY THE UV DETECTOR

The following list includes sources of ultraviolet, x-ray, and gamma-ray radiation that could trigger the UV detector. Although these sources usually do not cause problems with flame detectors, the serviceman should be aware of them when installing or maintaining the detectors.

1. Hot refractory (above 2500F)
2. Spark
 - a. Ignition transformers
 - b. Welding arcs
 - c. Lightning
3. Gas lasers
4. Sun lamps
5. Germicidal lamps
6. Diffraction analyzers
7. Electron microscopes
8. Radiographic x-ray machines
9. High-voltage vacuum switches and condensers
10. Defective television sets
11. Radioisotopes

(Continued on page 3)

ORDERING INFORMATION

WHEN ORDERING — REFER TO THE TRADELINE CATALOG OR THE PRICE SHEET FOR COMPLETE ORDERING SPECIFICATION NUMBER, OR . . .

SPECIFY—
A. MODEL NUMBER
B. TEMPERATURE RANGE

ORDER FROM—
1. YOUR USUAL SOURCE, OR
2. HONEYWELL
1885 DOUGLAS DRIVE NORTH
MINNEAPOLIS, MINNESOTA 55422
(IN CANADA—HONEYWELL CONTROLS LIMITED
740 ELLESMERE ROAD
SCARBOROUGH, ONTARIO)

INSTALL SIGHTING PIPE

The location of the sighting pipe is the most critical part of the installation. Since no two situations are likely to be the same, length and sighting angle of the pipe must be determined at the time and place of installation. Generally, it is desirable to have the sighting pipe tilting downward to prevent soot or dirt build up.

If the C7027A is to be used for a blast tube installation its location should be determined by the burner manufacturer; contact him before making any modifications to the installation.

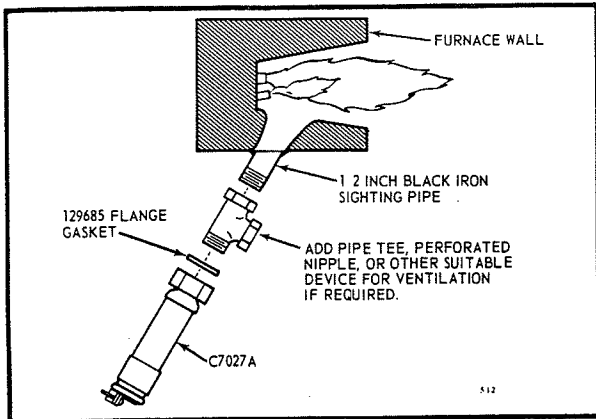


FIG. 2—CUTAWAY OF A C7027A INSTALLED ON A FURNACE (VIEWED FROM ABOVE).

PREPARE HOLE IN FURNACE WALL

Punch or drill hole in furnace wall for 1/2-inch pipe. Flare the hole to give room for small adjustments of the sighting angle.

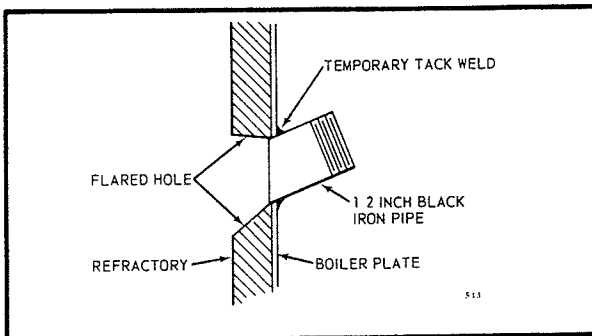


FIG. 3—SIGHTING PIPE INSTALLATION.

PREPARE SIGHTING PIPE

Thread one end of a piece of 1/2-inch black iron pipe and cut to desired length (as short as practical). Do not use stainless steel or galvanized pipe because they reflect light internally and complicate aiming the pipe. Do not tack weld the sighting pipe in place until the preliminary sensor sighting operation below is complete.

If vapors or oil mist impede the sensor view of the flame, some suitable method of ventilating the sighting pipe should be devised. For negative pressure applications, drill a few small holes in the sighting tube. For positive pressure burners, tap the sighting tube and provide a supply of pressurized air from the burner blower.

WIRING

Disconnect power supply before making connections to the control.

All wiring must be NEC Class 1 and conform to local codes and ordinances. If lead wires aren't long enough to reach the primary control, splices must be made in a junction box. Lead wire length should be as short as practical.

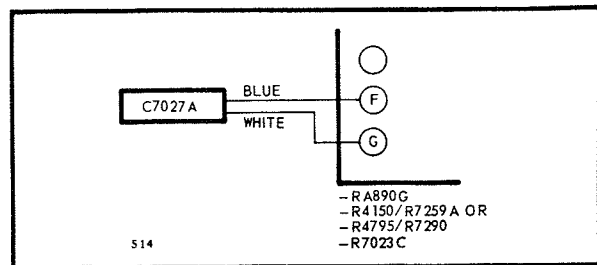


FIG. 4—C7027A TO R4150, R4795, RA890G OR R7023C WIRING DIAGRAM.

WARNING

The blue lead of the C7027 must be connected to the F terminal, the white lead to the G terminal. This circuit is DC and the tube is polarity sensitive; reversing the leads even momentarily may destroy the UV tube.

SIGHTING SENSOR

NOTE: Honeywell Test Unit No. 129B is available for simplifying the installation. It consists of a flame detector with microammeter attached for evaluating the flame signal while adjusting the viewing angle. When the best position has been determined, the test unit is removed and the C7027A is installed. Instructions are packed with the 129B Test Unit.

If test units is not used, follow steps below:

1. Connect C7027A to a R4150, R4795 or RA890G as shown in Fig. 4.
2. Plug a Honeywell W136A Microammeter, or equivalent, into the test jack of the primary control.
3. Manually close off the fuel supply to the main burner only. Screw the detector onto the sighting tube. Hold the tube in approximately the correct position while starting the burner.
4. Sight the detector on the pilot flame while observing the meter; try to get the largest steady signal possible.
5. When the detector sighting of the pilot appears to be satisfactory, open the manual fuel valve and allow the main burner to light. Observe the meter reading as the tube is sighted on both pilot and main flame. The best location will produce the strongest steady flame detector signal.
6. Continue the sighting procedure until the best location is determined. Note that this is a trial and error procedure. If the relay locks out on safety, allow a few minutes for the safety switch to cool and then restart the system and continue the procedure. DO NOT hold in the flame relay manually to prevent the control from locking out.

7. When the detector is sighted, tack weld the sighting pipe; proceed through the CHECKOUT section below before welding the sight pipe in its final position.

NOTE: If a window is installed between the C7027A and the flame, it must be quartz glass. Ordinary glass filters out ultraviolet radiation.

CHECKOUT

Before welding the sighting tube in its final location, complete the checkout of the entire system including the following checks:

IGNITION SPARK RESPONSE TEST

The flame relay should not respond (pull-in) to ignition spark. To determine flame detector sensitivity to ignition spark, perform the following steps:

1. Shut off pilot and main fuel valve.
2. Start system by raising controller set point or pressing start button.
3. Energize the ignition transformer so ignition spark is produced between electrode and ground.
4. Check flame relay on primary control. The relay should not pull in. It should lock out after the safety switch trips.

5. If the relay pulls in, relocate the flame detector or ignition electrode.

PILOT TURNDOWN TEST (FOR PILOT PROVING APPLICATIONS ONLY)

If the flame detector is used to prove a pilot, a turndown test must be done before establishing the final flame detector location.

The exact procedures for the test are contained in instructions for the primary control used.

FINAL CHECKOUT

When system operation is normal, with proper signal current, disconnect power, remove test unit or C7027A, and permanently weld sighting pipe in place.

With the system operating, observe all controls through at least one complete cycle to be sure of satisfactory burner control.

MAINTENANCE

After initial installation, the C7027A requires no adjustment or maintenance. If system malfunctions, use a W136A Microammeter to check the flame de-

tor signal. Clean the detector if the signal is reduced. Replace the detector if trouble persists.



HONEYWELL
MINNEAPOLIS, MINN 55408

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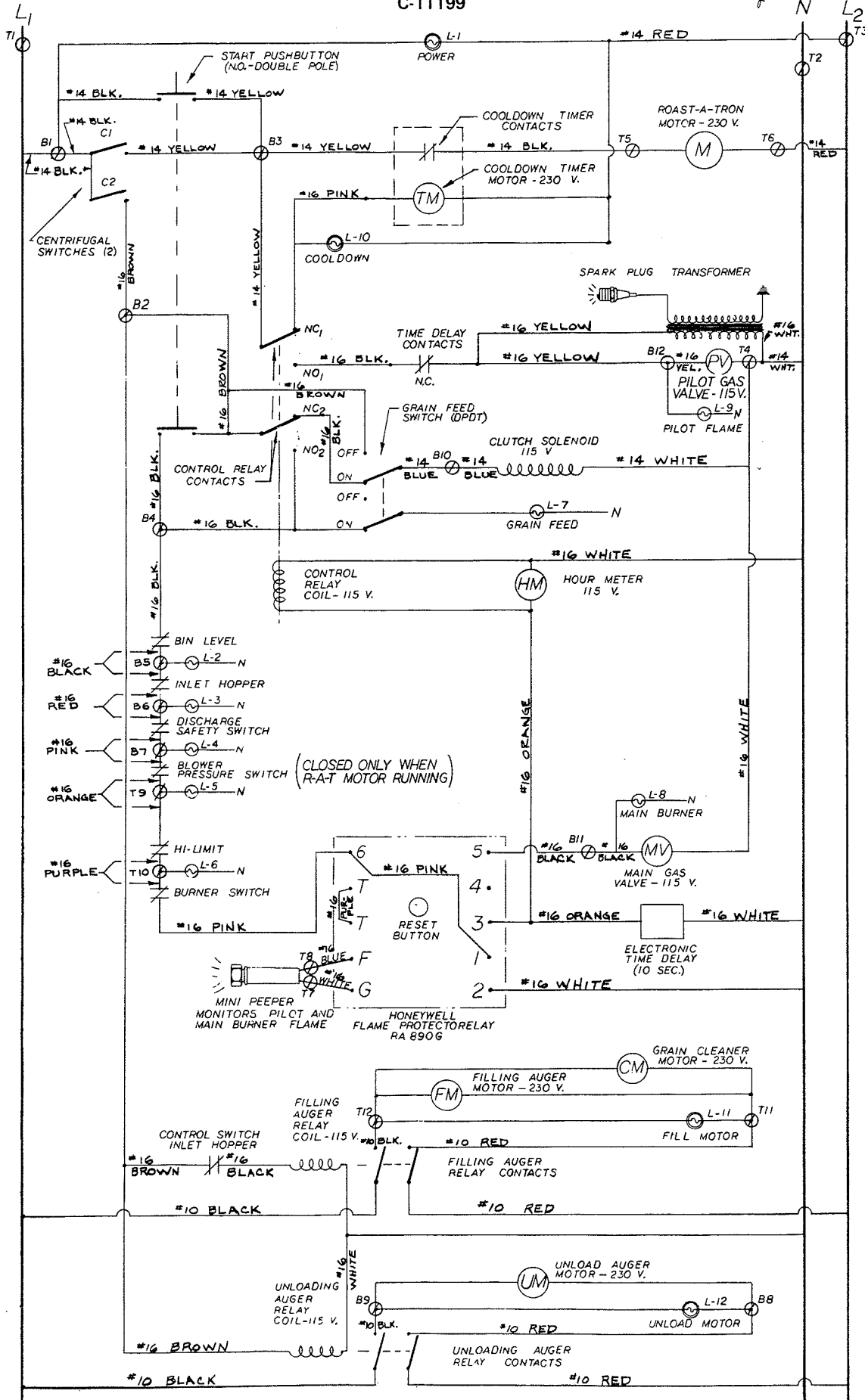
SECTION III

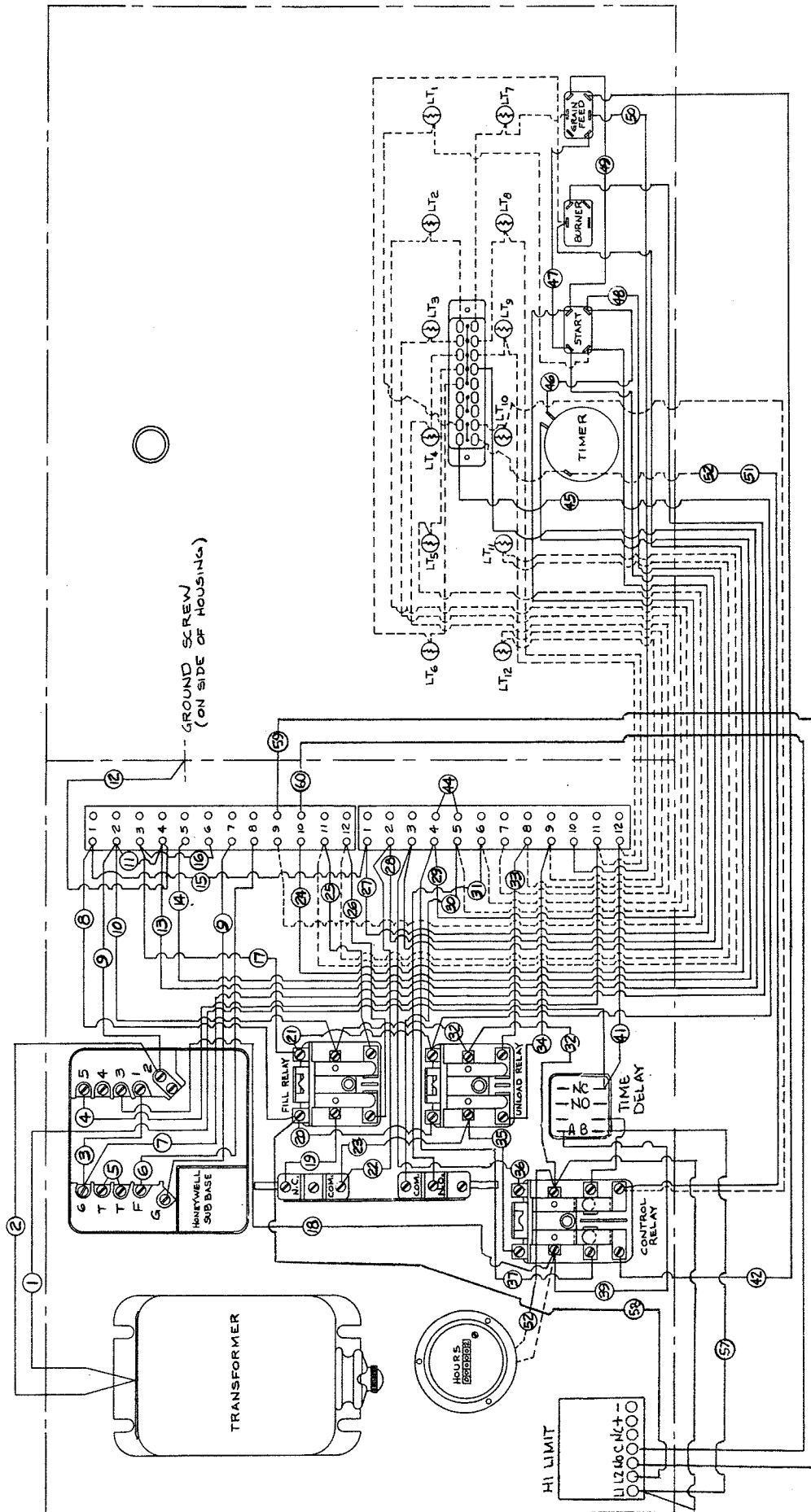
SCHEMATICS and PARTS LIST

"C2" GAS R-A-T / SOLENOID CLUTCH
 SCHEMATIC WIRING DIAGRAM

C-11199

2 4X241
 2536M1
 2500

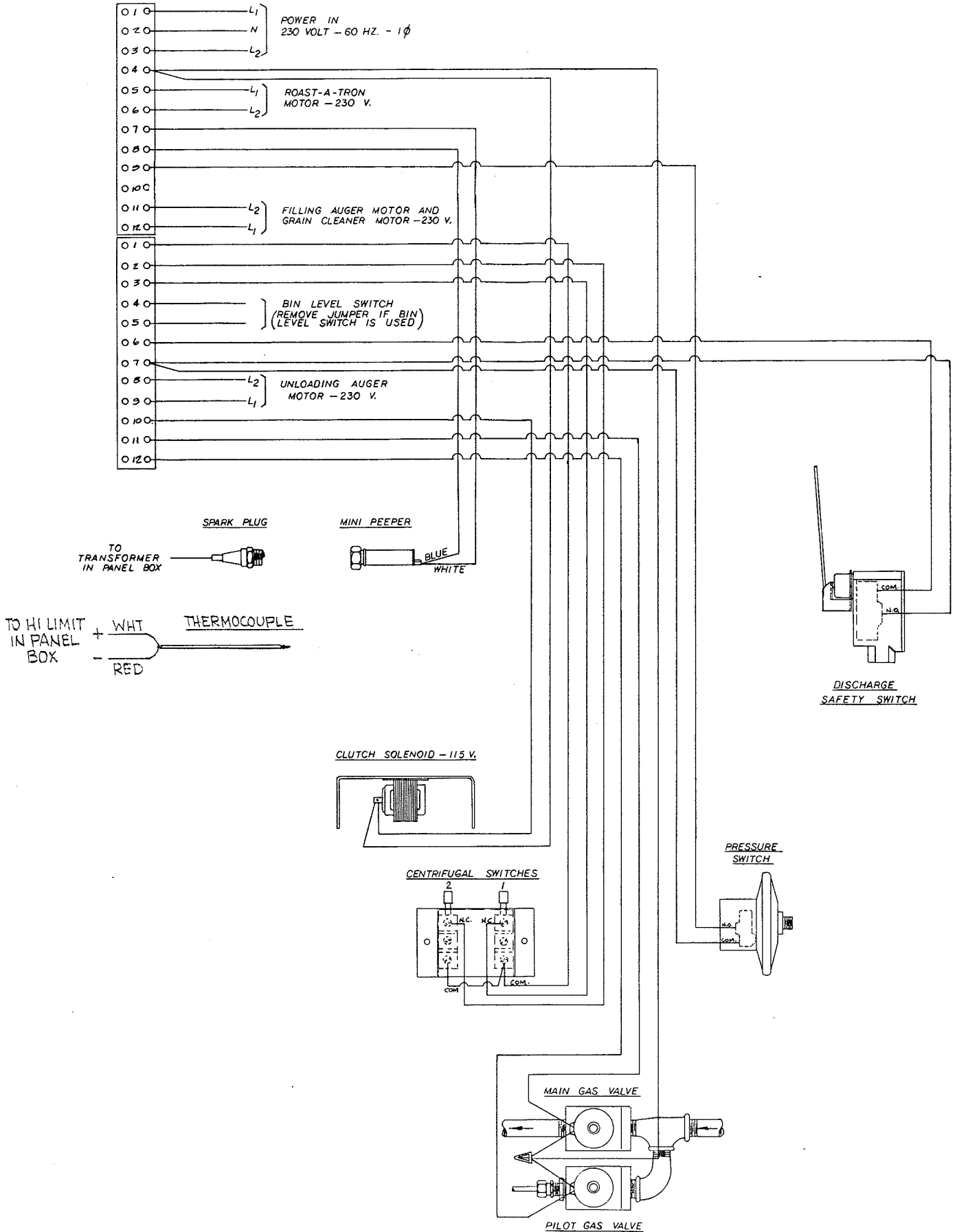




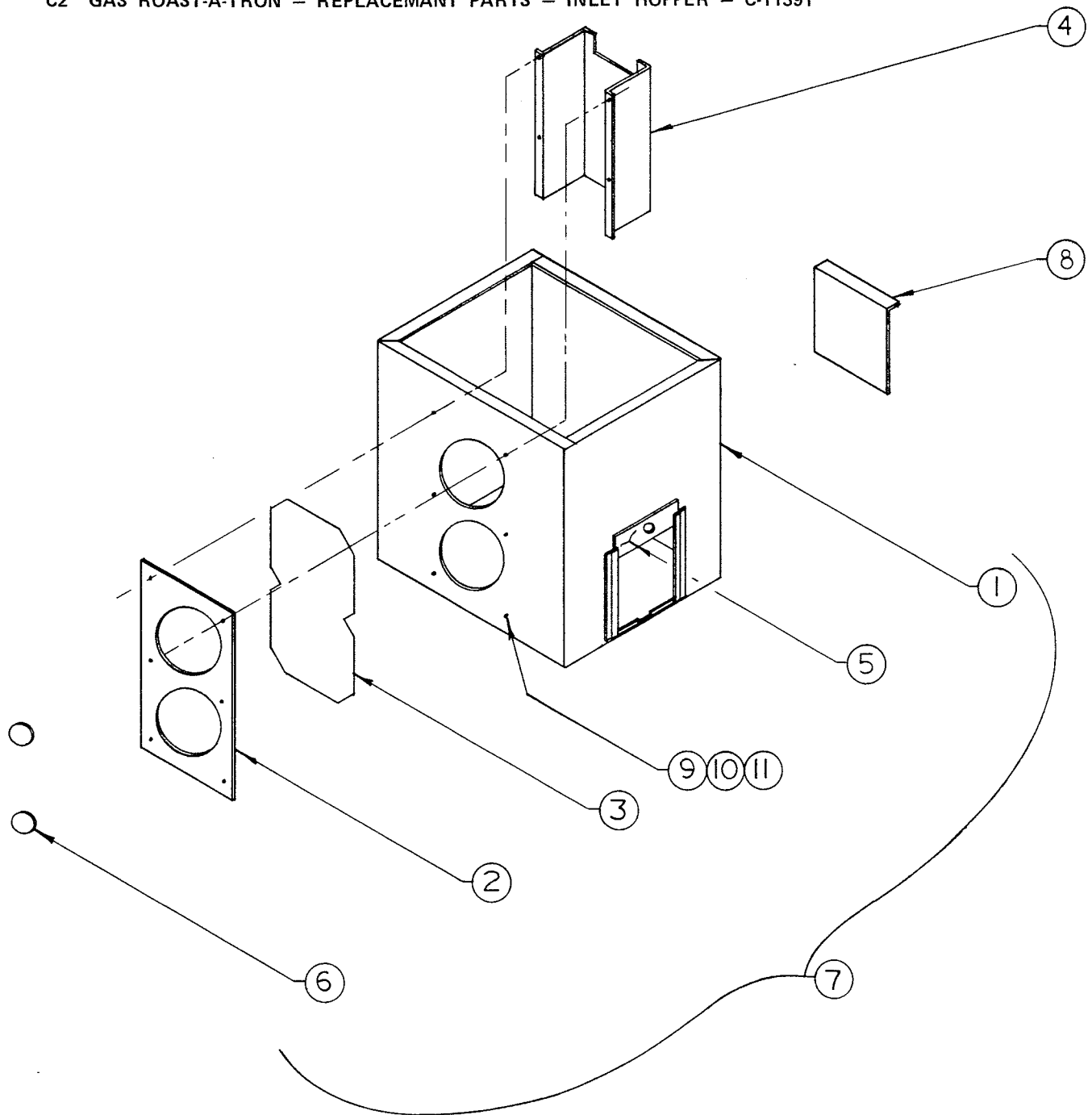
"C" GAS ROAST-A-TRON - PANEL ASSY. COMPLETE - C-91000041

"C2" GAS ROAST-A-TRON
 HOUSING WIRING DIAGRAM
 C-11198

TERMINAL BLOCKS
 IN PANEL BOX



"C2" GAS ROAST-A-TRON - REPLACEMENT PARTS - INLET HOPPER - C-11391



Item No.	Description	Qty.	Part No.
1	Hopper Assy. - Welded	1	11208
2	Plate	1	11077
3	Diaphragm Assy.	1	10004
4	Deflector	1	9758
5	Slide Plate	1	11135
6	Disk	2	7929
7	Inlet Hopper Assy. - Complete	7	11194-01
8	Valve Plate	1	10048-01
9	Machine Screw - R. Hd. S.T. #8-32x1/2"	9	323-02
10	Washer - Lock #8	6	1524
11	Nut - Hex #8-32	6	348

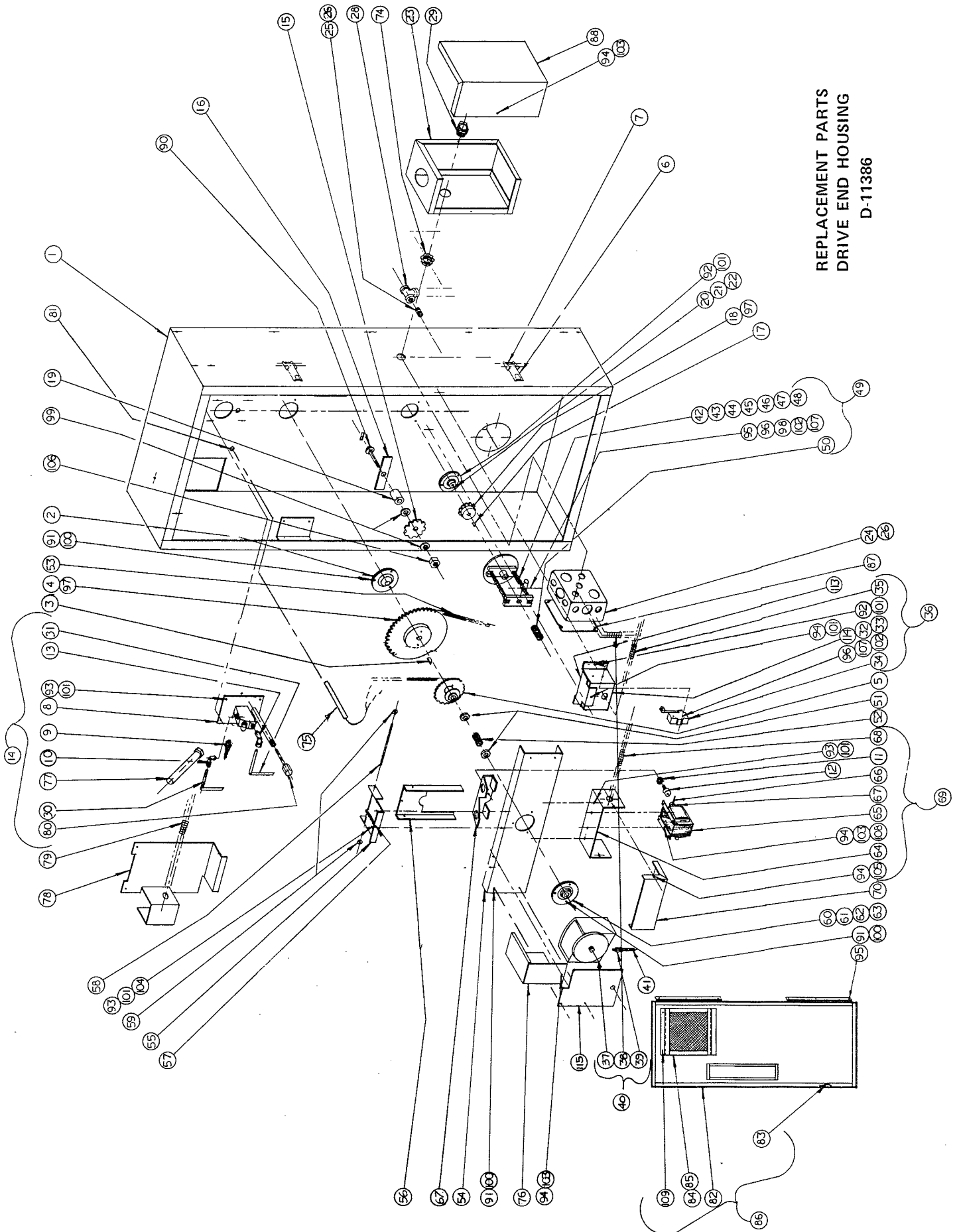
Oct 15, 1987

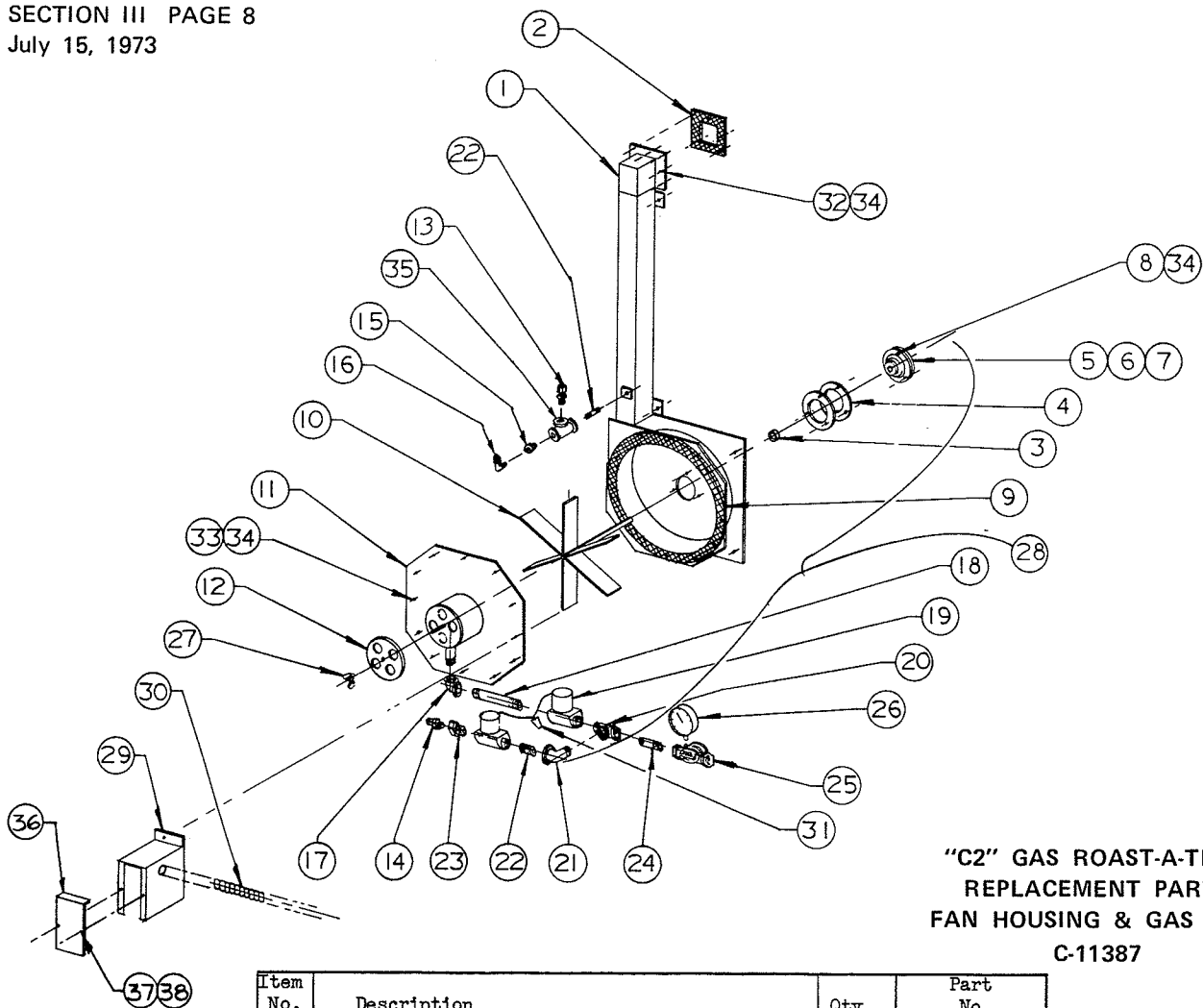
"G2" GAS ROAST-A-TRONREPLACEMENT PARTS - DRIVE END HOUSING

Item No.	Description	Qty.	Part No.	Item No.	Description	Qty.	Part No.
1	Drive End Housing	1	11041	58	Pivot Rod	1	3044-13
2	Bearing Assy. - 1" Sleeve	1	10462-01	59	Pushon Fastener	2	9797
3	Key - Woodruff - 1/4"	1	9527-02	60	Bearing - Hi Temperature	1	9981
4	Sprocket - Main Drive	1	11243	61	Lock Collar	1	10392
5	Sprocket - Proportioner Drive	1	11241	62	Stamping with Grease Zerk	1	11219-01
6	Latch	2	6277	63	Stamping	1	11219-02
7	Pop Rivet	4	6687-01	64	Bracket - Solenoid	1	11274
8	Pilot Block - Welded	1	11584	65	Solenoid - 115V.	1	10523
9	Spark Plug	1	11224	66	Spring Pin - 3/16"	1	9900
10	Brass Fitting	1	11588	67	Clutch Actuator Adaptor	1	11574
11	Lock Nut	1	4710	68	Wire Harness	1	11215-01
12	Thumb Screw	1	9664	69	Solenoid Bracket Assy.	1	11076
13	Fitting & Orifice Assy.	1	11587	70	Cover - Solenoid	1	11276
14	Pilot Block Assy.	1	11585	71		1	
15	Idler Sprocket	1	9520	72		1	
16	Spacer Plate	1	9668	73		1	
17	Key - Woodruff - 3/16"	1	9527-01	74	Lock Nut	1	2121
18	Sprocket - 10 tooth	1	9518	75	Thermocouple	1	31009507
19	Idler Spacer	1	9513	76		1	
20	Bearing Assy.	1	1459	77	Mini-Peeper	1	9891
21	Lock Collar	1	1460	78	Chain Guard	1	11128
22	Stamping	2	1461	79	Wire Harness	1	11216-03
23	Junction Box - Welded	1	11119	80	Cap Assembly	1	11149
24	Outlet Box - 4"	1	11050	81	Ceramic Insulator	1	10509
25	Nipple - 1/2"	1	10498	82	Door - Welded	1	11212
26	Nut - Lock - 1/2"	2	1188	83	Polyurethane Tape	156"	4265
27	Close Nipple - 1/2"	1	1187	84	Filter	1	9640
28	Pipe Tee - 1/2"	1	11124	85	Filter Retainer	1	9863-02
29	Bushing - 3/4"	1	11229	86	Door Assembly	1	11195
30	Tubing - 3/8"	1	11594-01	87	Cover - 4" Box	1	11051
31	Tubing 1/4"	1	11175-02	88	Cover - Junction Box	1	11120
32	Centrifugal Switch Box	1	11105	89	Bolt - Feet	2	10323-01
33	Insulation	1	11106-02	90	Carriage Bolt	1	9559-01
34	Micro Switch	2	9895	91	Machine Screw	10	475
35	Wire Harness	1	11215-02	92	Machine Screw	5	427
36	Centrifugal Switch Box Assy.	1	11062-01	93	Machine Screw	327	327
37	Pressure Switch	1	11222	94	Machine Screw	3471-02	3471-02
38	Wire Harness	1	11216-04	95	Machine Screw	8	3471-01
39	Connector - Compression - 1/8"	1	11225	96	Machine Screw	6	373-02
40	Pressure Switch Box Assy	1	11142	97	Set Screw	3	336
41	Tubing - 3/16"	1	11174-02	98	Set Screw	1	4738-01
42	Front Bar	1	11107	99	Lock Washer	2	6761
43	Chain	2	11109	100	Lock Washer	10	345
44	Weight	2	9655	101	Lock Washer	344	344
45	Rear Bar	1	11108	102	Lock Washer	6	343
46	Disc	1	11110	103	Lock Washer	1524	1524
47	Bushing	1	259	104	Flat Washer	2	339
48	Roll Pin - 1/8"	4	11217	105	Flat Washer	2	4104
49	Centrifugal Mechanism	1	11111	106	Hex Nut	3	3027
50	Spring - Centrifugal Mechanism	1	9660	107	Hex Nut	6	347
51	Thrust Washer	2	133	108	Hex Nut	2	348
52	Spring - Clutch Actuator	1	9561	109	Wing Nut	2	319
53	Chain - Main Drive	1	9522	110	Wire Nut	11	8478
54	Bearing Channel	1	11047	111	Grommet - 1/2" hole	1	1322
55	Pivot Plate	1	11278	112	Wire Nut	1	1065
56	Actuator - Clutch	1	11277	113	Cover	1	11103
57	Spring - Return	1	11048	114	Insulation	1	11106-01
				115	Mounting Bracket	1	11191260

Oct 15, 1987

REPLACEMENT PARTS
DRIVE END HOUSING
D-11386

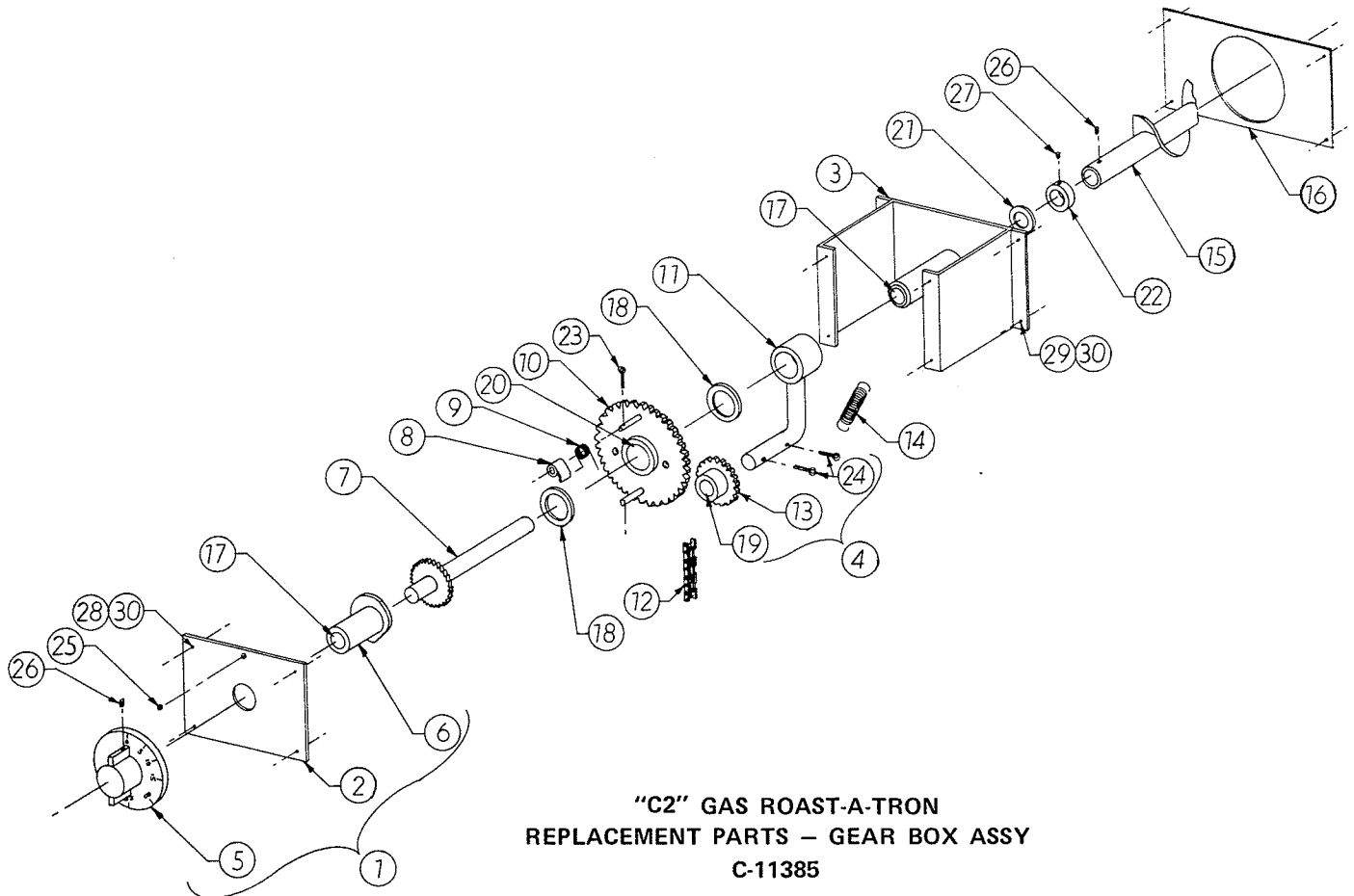




**"C2" GAS ROAST-A-TRON
 REPLACEMENT PARTS
 FAN HOUSING & GAS LINE
 C-11387**

Item No.	Description	Qty.	Part No.
1	Fan Housing - Welded	1	11046
2	Gasket - Manifold	1	11189
3	Thrust Washer	1	49
4	Washer - Retainer	2	6154-02
5	Bearing	1	1459
6	Lock Collar	1	1460
7	Stamping	2	9950
8	Nut 1/4-20	3	367
9	Gasket	1	9485
10	Fan Assembly - Welded	1	9488
11	Cover Assembly - Welded	1	11080
12	Air Inlet Plate	1	11190
13	Connector - Compression	1	11598
14	Connector - Compression 1/4"-1/4"	1	11176
15	Pipe Bushing 3/8" x 1/8"	1	10157
16	90° Compression Connector 3/16" - 1/8"	1	11139
17	Elbow 3/8" x 90°	1	9628
18	Nipple and Orifice Assembly Orange - LP Gas Dark Green - Natural Gas	1	11339 11341
19	Gas Valve - Solenoid	2	9625
20	Service Tee 3/8"	1	9700
21	Street Elbow 3/8" x 90°	1	11236
22	Pipe Nipple 3/8" Close	2	11235
23	Pipe Bushing 3/8" x 1/4"	1	11233
24	Pipe Nipple 3/8" x 4-1/2"	1	9629
25	Gas Cock	1	9626
26	Gas Gauge	1	9892
27	Wing Nut	1	320
28	Fan Housing Assembly	1	11114-01
29	Wrapper - Gas Valve Cover	1	11191280
30	Wire Harness	1	11216-02
31	Wire Nut	3	8478
32	Machine Screw 1/4-20x1"	7	1643-02
33	Machine Screw 1/4-20x1/2"	17	327
34	Lock Washer	24	344
35	Pipe Tee 3/8"	1	10156
36	Front - Gas Valve Cover	1	11191290
37	Machine Screw - #8-32x1/4"	2	3471-01
38	Washer - Flat - #8	2	4104

March 16, 1973



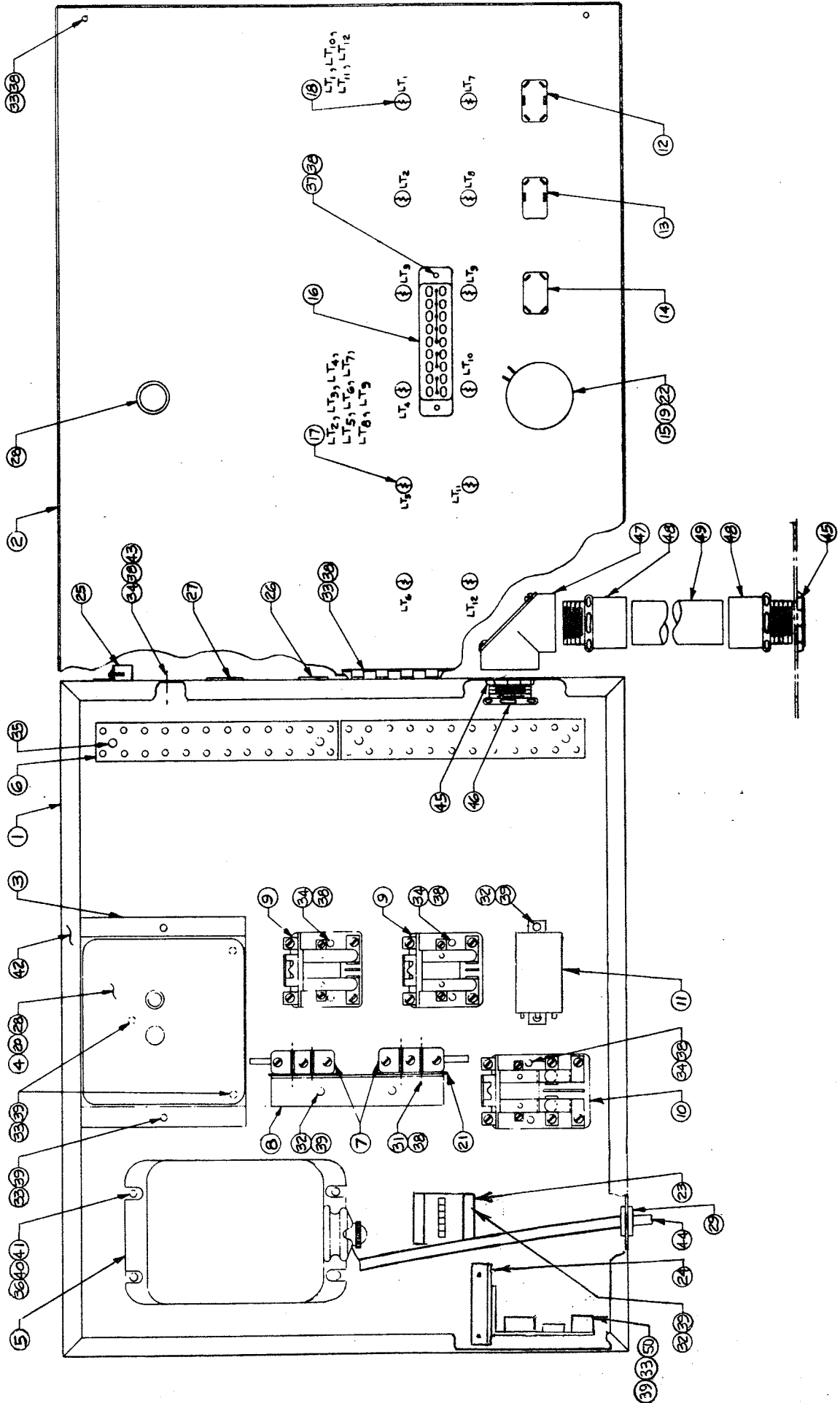
"C2" GAS ROAST-A-TRON
REPLACEMENT PARTS - GEAR BOX ASSY
C-11385

Item No.	Description	Qty.	Part No.
1	Cover Assy. - Complete	1	9578
2	Cover Assy. - Welded	1	9506
3	Wrapper Assy. (including bushings)	1	9508
4	Idler Bar Assy. - Complete	1	9649
5	Knob	1	1
6	Adj. Cam & Tube Assy. (including bushing)	1	34
7	Auger Shaft & Ratchet Assy	1	33
8	Drive Pawl	2	120
9	Spring	2	28
10	Sprocket Assy. (including bushings)	1	9512
11	Idler Bar Assy. - Welded	1	9647
12	Chain	1	11173-01
13	Idler Sprocket Assy. (including bushing)	1	9648
14	Spring	1	9688
15	Auger Assy.	1	11179
16	Gasket	1	9595
17	Bushing	3	259
18	Thrust Washer	2	133
19	Bushing	1	9673
20	Bushing	2	46
21	Thrust Washer	1	49
22	Set Collar	1	5631
23	Cotter Pin	2	313
	Pushon Fastener	2	9797
24	Cotter Pin	2	3368-02
25	Steel Ball	1	138-03
26	Set Screw	2	336
27	Set Screw	1	4738-01
28	Machine Screw S.T. (1/4-20x1/2")	4	327
29	Machine Screw S.T. (1/4-20x3/4")	4	427
30	Washer - Lock 1/4"	8	344

"O" GAS ROAST-A-TRON

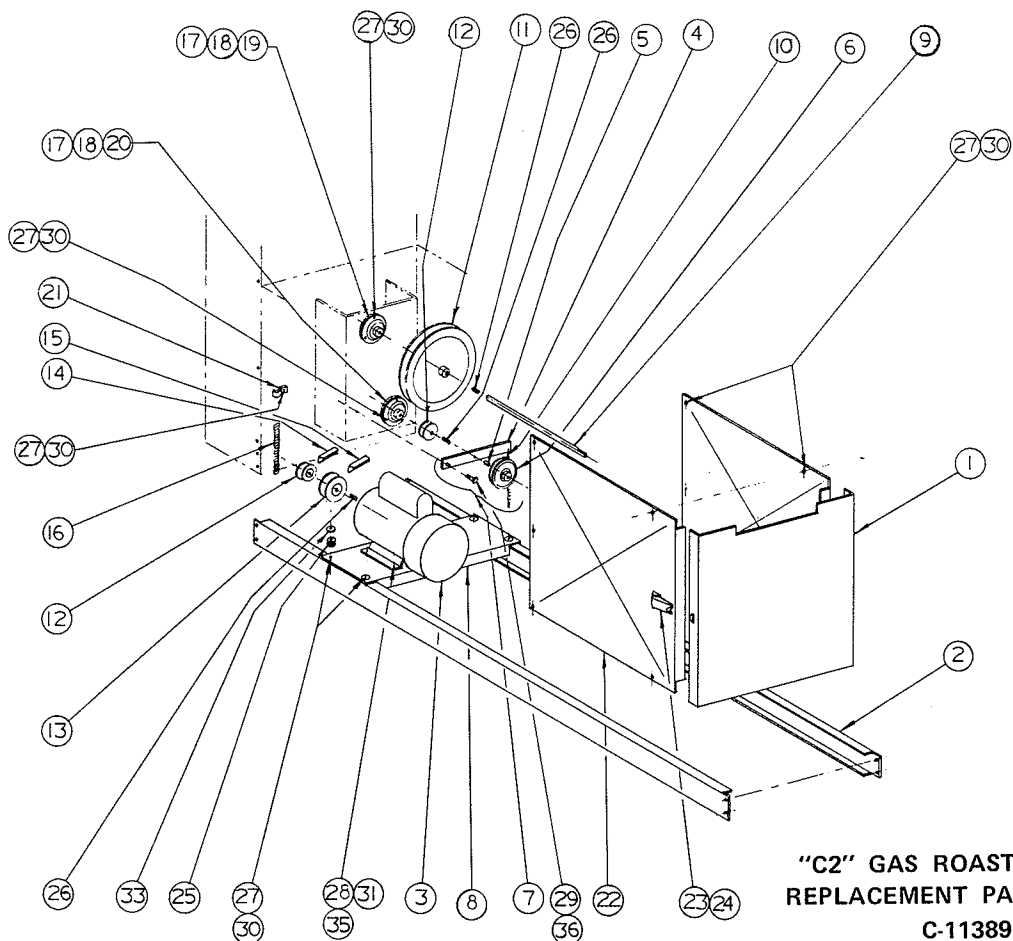
REPLACEMENT PARTS - PANEL HOUSING

Item No	Description		Qty	Part No.
1	Panel Housing	11211	1	11121100
2	Panel Cover - Silk Screened	11143	1	11114300
3	Mounting Plate - Honeywell	11188	1	11118800
4	Sub-Base - Honeywell	9889	1	31012003
5	Transformer	9666	1	10966600
6	Terminal Block	6382	2	31009001
7	Micro Switch	7930	2	10793000
8	Mounting Strip - Micro Switch	11141	1	11114100
9	Relay - DPST - 115 v.	1062	2	31006512
10	Relay - DPDT - 115 v.	9641	1	32321111
11	Electronic Time Delay	11115	1	31010502
12	Switch - DPDT	1932	1	31008007
13	Switch - DPST	1313	1	31008002
14	Switch - Momentary	10139	1	31008013
15	Timer	11122	1	31011003
16	Terminal Block	11125	1	31009003
17	Glo-lite - 115 v.	11220-01	8	31005501
18	Glo-lite - 230 v.	11220-02	4	31005502
19	Knob - Timer	11350	1	31011004
20	Honeywell Protectorelay	9890	1	31012002
21	Insulation - Switch	4246	2	10424600
22	Insulation - Cooldown Timer	11287	1	11128700
23	Hour Meter - 115 v.	7857-01	1	31003502
24	Brkt-Temp. Control		1	11215950
25	Straight Connector	1169	2	31002501
26	Snap-In Blank	1061	1	80010501
27	Snap-In Blank	1694	1	80010502
28	Grommet	6157	4	80005002
29	Grommet	1322	1	80005001
30	Machine Screw - #6-32x3/8"	373-03	3	64681808
31	Machine Screw - #6-32x1"	373-02	4	64681822
32	Machine Screw - #8-32x1/4"	3471-01	6	65482205
33	Machine Screw - #8-32x1/2"	3471-02	12	65482212
34	Machine Screw - #8-32x3/4"	3471-03	7	65482217
35	Machine Screw - #8-32x1-1/4"	323-03	4	64682226
36	Machine Screw - 1/4-20x1/2"	327	4	65483312
37	Nut - Hex - #6-32	347	2	66081800
38	Washer - Flat - #8	4104	21	66402200
39	Washer - Lock - #8	1524	11	66442200
40	Washer - Lock - 1/4"	344	4	66443300
41	Washer - Flat - 1/4"	339	4	66403300
42	Tape - Polyurethane	4265	60"	80014001
43	Nut - Hex - #8-32	348	4	66082200
44	Spark Plug Wire	9680-04	1	10968004
45	Lock Nut - 1" NPT	2885	2	31003264
46	Chase Nipple - 1"	11228	1	31003274
47	Corner Pulling Elbow - 1"	11226	1	31003284
48	Set Screw Connector - 1"	11234	2	31003004
49	Conduit - 1" Thinwall - 22-1/4"	11137-01	1	11113701
50	Hi Limit Temp. Control		1	31009506



REPLACEMENT PARTS — PANEL HOUSING — C-11384

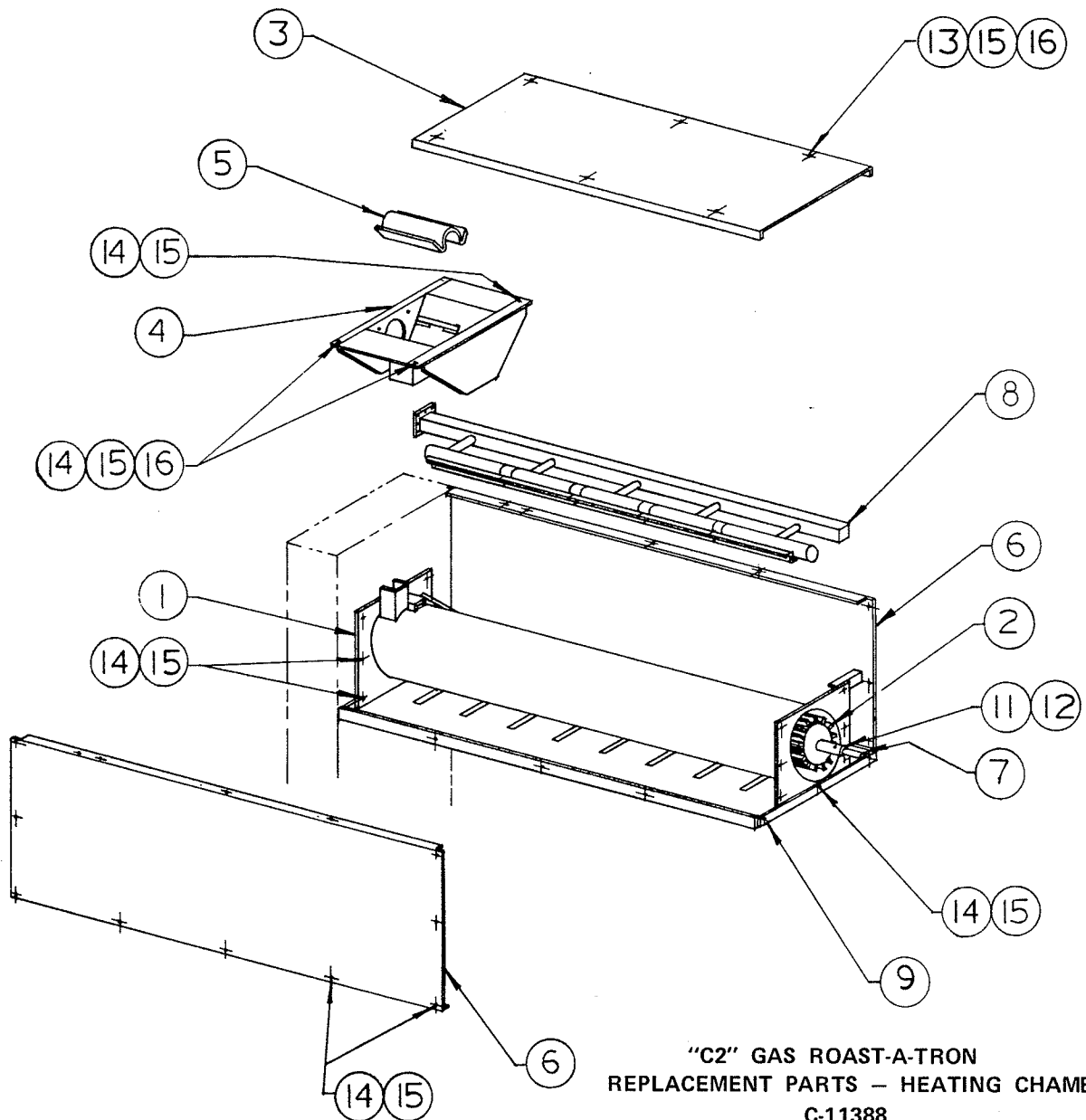
July 15, 1973



"C2" GAS ROAST-A-TRON
REPLACEMENT PARTS - BASE
C-11389

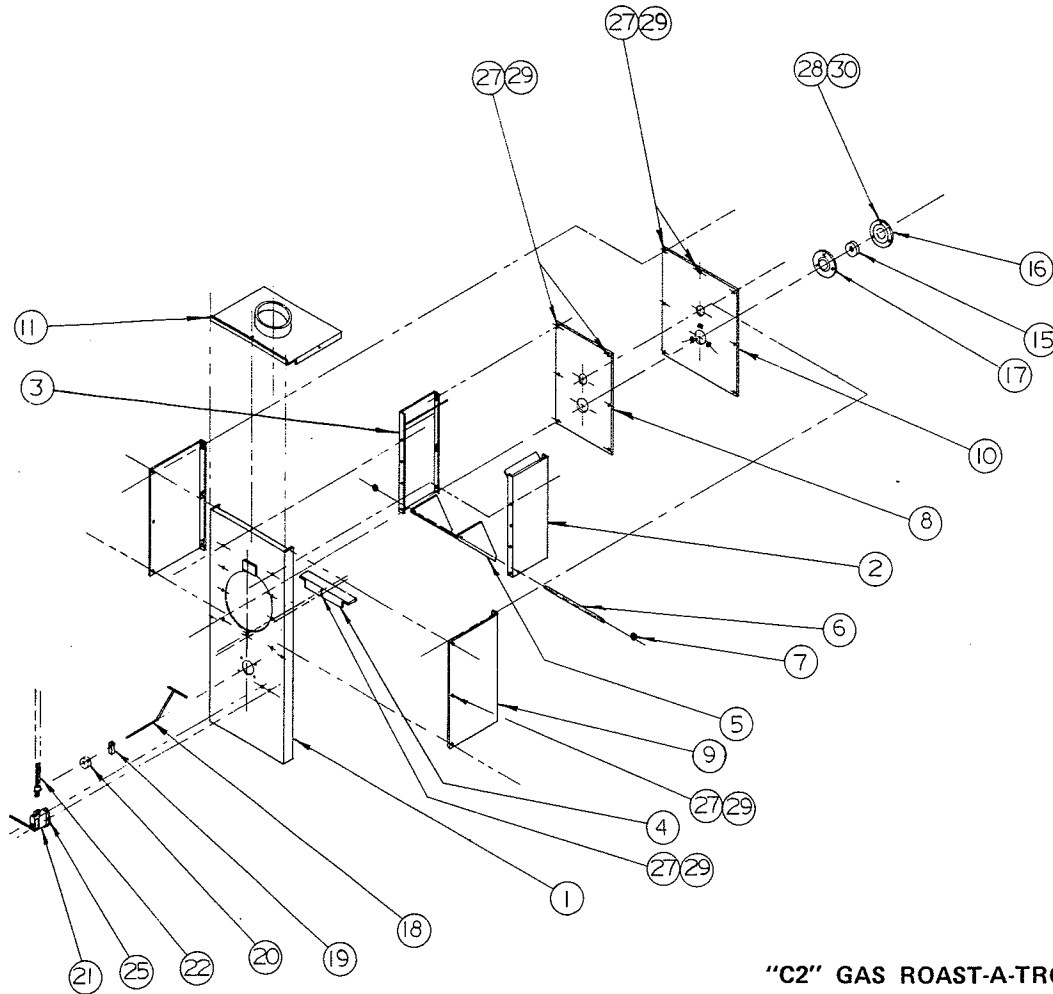
Item No.	Description	Qty.	Part No.
1	Cover - Motor Guard	1	11058
2	Side Rail	2	9460
3	Motor	1	1685
4	Arm and Tube Assy.	1	11280
5	Split Tube	1	7683-02
6	Idler Pulley	1	3334-03
7	Idler Assy.	1	11281
8	Motor Mtg. Plate Assy.	1	11206
9	Jack Shaft	1	11284
10	Spring	1	7233
11	Pulley	1	3303-06
12	Pulley	2	3316-01
13	Pulley	1	3316-14
14	Belt	1	3337-09
15	Belt	1	3337-25
16	Wire Harness	1	11215-03
17	Bearing	2	1459
18	Lock Collar	2	1460
19	Stamping	2	1461
20	Stamping	2	9950
21	Conduit Clamp	1	267
22	Side Assy. - Motor Guard	2	11079
23	Latch	2	6277
24	Pop Rivet	4	6687-01
25	Grommet	4	1741
26	Key	3	3222-01
27	Machine Screw S.T. (1/4-20x3/4")	24	427
28	Machine Screw (5/16-18x1")	4	407
29	Bolt (3/8-16x1-3/4)	2	335-06
30	Washer - Lock 1/4"	23	344
31	Washer - Lock 5/16"	4	345
32	Washer - Lock 3/8"	1	346
33	Washer - Flat 1/4"	4	339
34	Washer - Flat 1/4"	4	4221
35	Washer - Flat 5/16"	4	340
36	Washer - Flat 3/8"	2	341
37	Nut 3/8-16	1	357

May 1, 1972



"C2" GAS ROAST-A-TRON
REPLACEMENT PARTS - HEATING CHAMBER
C-11388

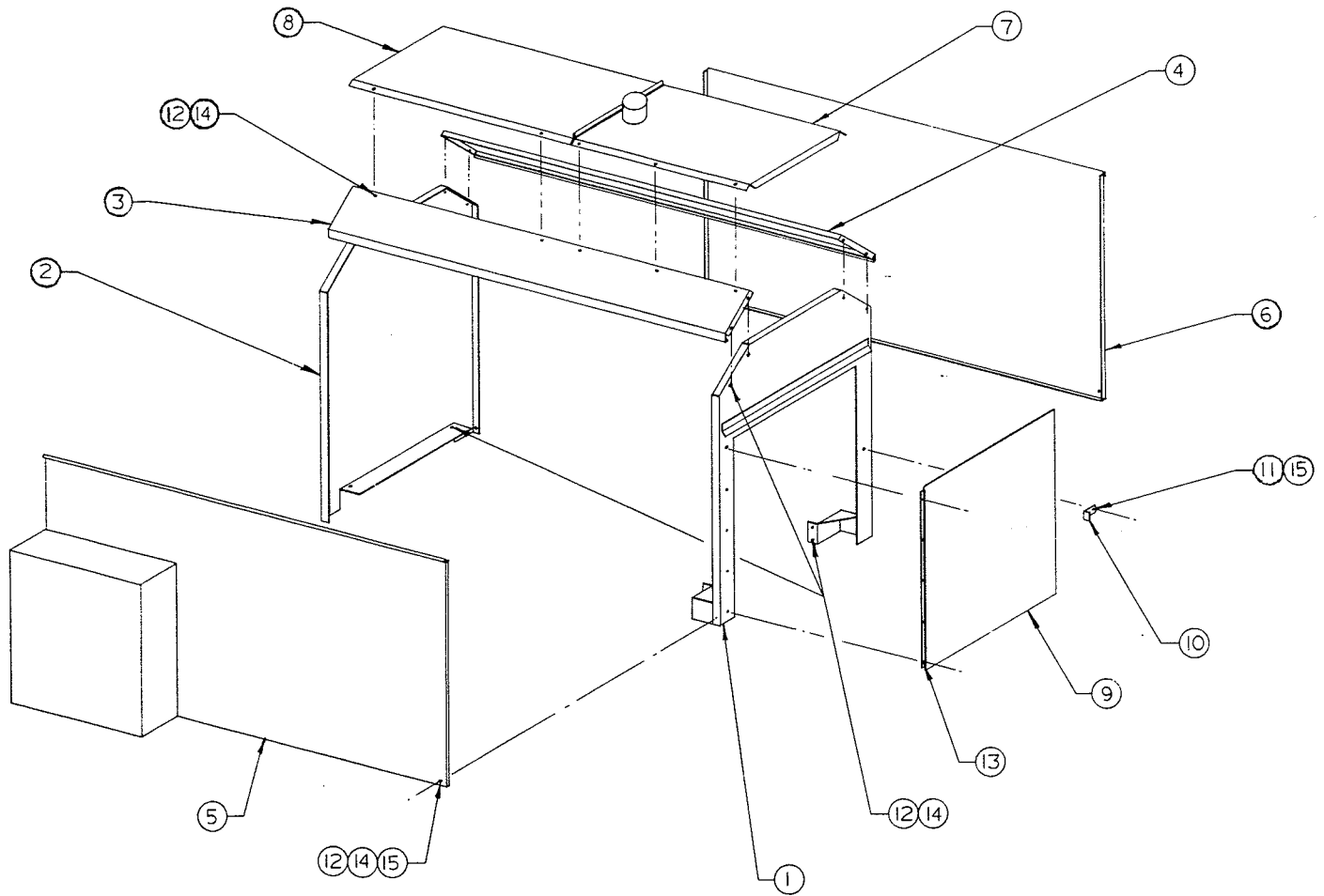
Item No.	Description	Qty.	Part No.
1	Trough Assy.	1	11155
2	Rotor Assy.	1	11203
3	Cover Assy.	1	11131
4	Prop. Hopper Assy.	1	11068
5	Sleeve	1	11069
6	Panel - Side	2	9550
7	Rotor Shaft	1	11204
8	Burner Manifold Assy.	1	11100
9	Panel - Horizontal	1	9504
10	Insulation - Bag	3	9654
11	Machine Screw (3/8-16x1-3/4")	1	335-06
12	Nut - Lock	1	7592
13	Machine Screw (1/4-20x1-1/4")	6	480
14	Machine Screw	44	427
15	Washer - Lock 1/4"	50	344
16	Washer - Flat 1/4"	10	339
17	Nut - Tinnerman	6	9917



"C2" GAS ROAST-A-TRON
 REPLACEMENT PARTS - DISCHARGE END
 C-11390

Item No.	Description	Qty.	Part No.
1	End Plate	1	11145
2	Side Assy. - Shroud	1	11268-01
3	Side Assy. - Shroud	1	11268-02
4	Deflector Angle	1	11282
5	Paddle - Safety Switch	1	11285
6	Pivot Rod (1/4" dia. x 14")	1	3044-11
7	Pushon Fastener	2	9797
8	Cover Plate - Heat Shroud	1	11140
9	Side - Heat Shield	2	11290
10	Cover Assy. - Heat Shield	1	11086
11	Draft Collector	1	11056
12			
13			
14			
15	Bearing Cartridge	1	9981
16	Stamping - Relubricable	1	11219-01
17	Stamping - Relubricable	1	11219-02
18	Actuator Rod Assy.	1	11273
19	Actuator Bar	1	11113
20	Counterweight	1	11289
21	Micro Switch	1	11123
22	Wire Harness	1	11216-05
23	Grease Cartridge	1	10530
24			
25	Sheet Metal Screw #6	2	2609
26	Machine Screw #6-32x7/8" S.T.	2	373-01
27	Machine Screw 1/4-20x3/4" S.T.	32	427
28	Machine Screw 5/16-18x3/4" S.T.	3	475
29	Washer - Lock 1/4"	32	344
30	Washer - Lock 5/16"	3	345
31	Washer - Flat 1/4"	6	339

May 1, 1972



**"C2" GAS ROAST-A-TRON
REPLACEMENT PARTS - WEATHER COVER
C-11392**

Item No.	Description	Qty.	Part No.
1	Inlet End Assembly	1	11168
2	Outlet End	1	11161
3	Top Side - Left	1	11083-01
4	Top Side - Right	1	11083-02
5	Side Assembly - Left	1	11112
6	Side - Cover	1	11087
7	Top Plate Assembly - Front	1	11172
8	Top Plate - Rear	1	11169
9	Door Assembly	1	11160
10	Latch - Door	1	11186
11	Machine Screw 1/4-20x3/4"	1	1643-01
12	Machine Screw 1/4-20x3/4" S.T.	24	427
13	Machine Screw #8-32x1/4"	5	3471-01
14	Washer - Lock 1/4"	24	344
15	Washer - Flat 1/4"	5	339

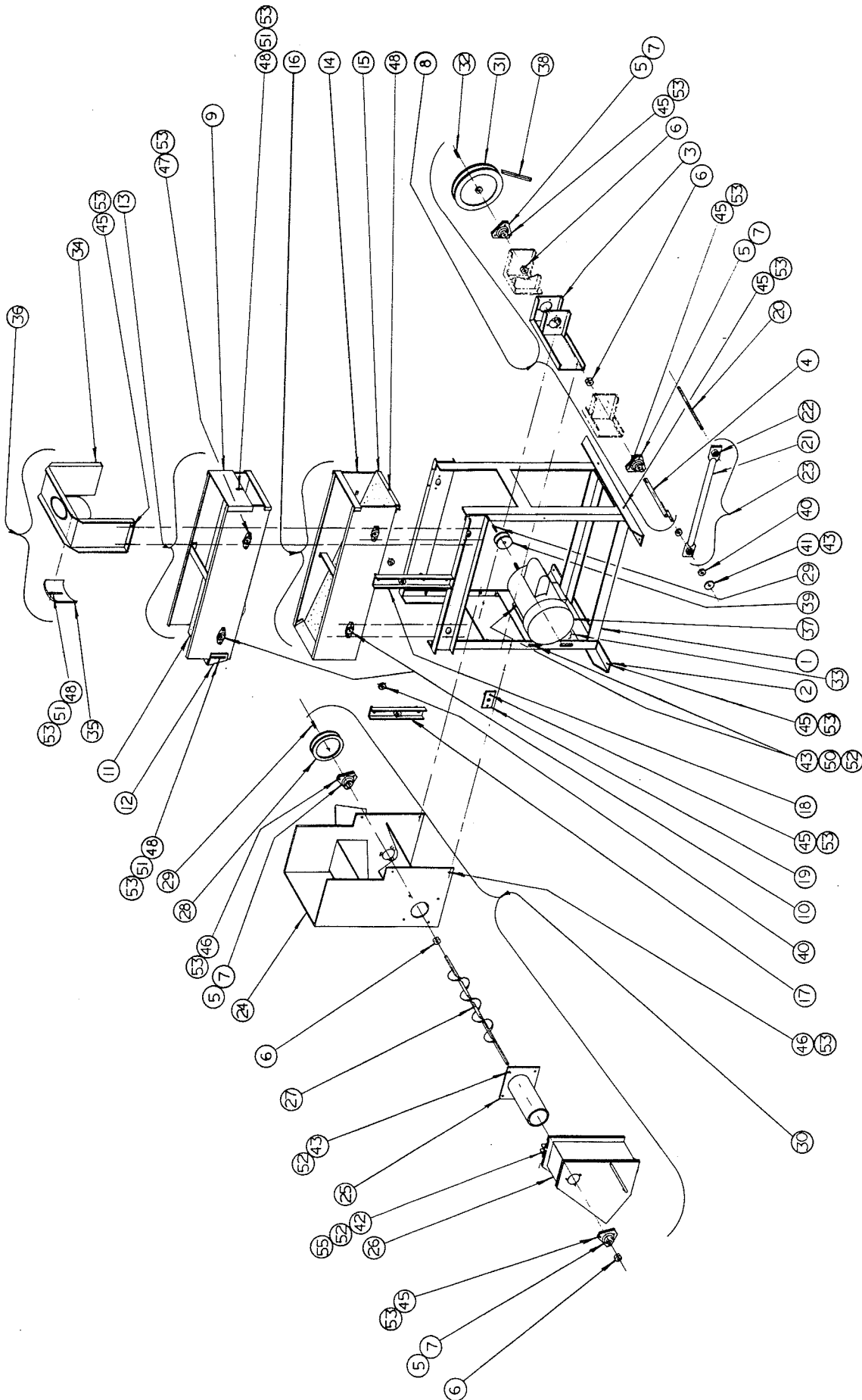
REPLACEMENT PARTS

M634A1 GRAIN CLEANER

Item No.	Description	Qty.	Part No.
1	Frame - Welded Assembly	1	10676
2	Base Angles	2	10678
3	Bracket Assembly	1	10648
4	Shaft Assembly	1	10627
5	Bearing - 5/8" bore	4	10623
6	Lock Collar	4	10622
7	Stamping	8	10621
8	Drive Shaft Assembly	1	10459
9	Trough - Welded Assembly (Top)	1	10669
10	Bearing Assembly	8	10620
11	Screen Assembly - 1/8"	1	111723-04
	Screen Assembly - 3/16"	1	111723-06
	Screen Assembly - 1/4"	1	111723-08
	Screen Assembly - 5/16"	1	111723-10
	Screen Assembly - 3/8"	1	111723-12
	Screen Assembly - 7/16"	1	111723-14
	Screen Assembly - 1/2"	1	111723-16
	Screen Assembly - 5/8"	1	111723-20
12	Support - Screen	1	10787
13	Top Trough Assembly	1	10411
14	Trough - Welded Assembly (Bottom)	1	10798
15	Screen Assembly - 3/16"	1	11723-06
16	Bottom Trough Assembly	1	10416
17	Short Connecting Strap	2	10639
18	Long Connecting Strap	2	10642
19	Bearing Pin Plate	4	10645
20	Bearing Shaft	1	10628
21	Connecting Rod	1	10634
22	Needle Bearing	2	7792
23	Connecting Rod Assembly	1	10636
24	Wrapper - Welded	1	10661
25	Tube and Plate Assembly	1	1593-02
26	Discharge Valve Assembly	1	10792
27	Shaft and Flight Assembly	1	10654
28	Sheave - 5" O.D. x 5/8" bore	1	3303-04
29	Key - 3/16" Sq. x 1"	2	3222-01
30	Discharge Assembly - Complete	1	10522-01
31	Sheave - 8" O.D. x 5/8" bore	1	3303-05
32	Key - 3/16" Sq. x 1-3/8"	1	3222-04
33	Motor Mounting Plate	1	10540
34	Bracket - Inlet	1	10664
35	Baffle	1	10665
36	Inlet Bracket Assembly	1	10502
37	Motor - 1/4 HP	1	10757
	Motor - 1/3 HP	1	1684
38	Vee Belt - 44"	1	3337-03
39	Sheave - 2-1/2" O.D. x 5/8" bore	1	3316-08
40	Thrust Washer	6	49
41	Flat Washer	1	4221
42	Machine Screw - 5/16-18x1-3/4"	1	7372-03
43	Machine Screw - 5/16-18x3/4"	13	361
44	Machine Screw - 5/16-18x1/2" S.T.	4	6764-03
45	Machine Screw - 1/4-20x1/2" S.T.	25	327
46	Machine Screw - 1/4-20x1/2"	7	2411
47	Machine Screw - 1/4-20x3/8"	16	2410
48	Wing Bolt - 1/4-20x1/2"	5	9740
49	Machine Screw - #8-32x1/2" S.T.	2	3471-02
50	Washer - Flat - 5/16"	8	340
51	Washer - Flat - 1/4"	4	339
52	Washer - Lock - 5/16"	18	345
53	Washer - Lock - 1/4"	53	344
54	Washer - Lock - #8	2	1524
55	Nut - Hex - 5/16-18	1	4797

9311 7231

7232



REPLACEMENT PARTS
M634A1 GRAIN CLEANER
D-11393

Calculating the value of roasted soybeans

Economics dictate when to use roasted soybeans in hog rations

by KERRI-SUE LANG

THE DECISION to use roasted soybeans in hog rations is based first on economics, and then on nutritional value," says Jim Morris, co-ordinator of swine research at Ontario's Ridgetown College of Agricultural Technology. Morris, however, believes the value of this high-energy feed is generally underestimated.

Some Ontario hog producers have started to feed roasted home-grown soybeans as a way of adding high-energy soybean oil, plus all or part of the protein requirement to their hog rations, at reduced cost. The beans are roasted to destroy the trypsin inhibitor in raw beans which interferes with protein digestion in the pig.

To make it pay, the price of cash beans must be sufficiently low to warrant the switch.

For 10 months in 1984, Morris says, roasted soybeans were not profitable in Ontario, "at least, not for feeder pigs, but they may have been more economical for breeding herds."

In 1983, Morris measured the feed efficiency, average daily gain, dressing percent, grading fat and index on 96 market hogs fed 10%, 20% and 26% roasted soybeans in rations formulated for 15.4% protein. A control group consumed a regular corn-soybean meal ration. The 26% diet required no supplemental protein.

Average daily gain and feed efficiency responded positively each time Morris added soybeans to the ration. Grading fat and index were negative. Feed conversion topped-out at 3.04 kg feed/kg gain on the 26% ration compared to 3.17 in the control group.

"When the roasted soybean level increased, the pigs responded to the higher energy in the diet," says Morris.

Morris did not research the soybeans' effect on breeding animals, but he says information gleaned from producers indicates high-energy beans may be even more valuable in sow diets than in grower rations.

"Sows fed roasted beans do very well on them," adds Morris. From his experience as a producer, he says, sows fed roasted soybeans appear to deliver larger litters, maintain better body condition and have fewer breeding problems.

The influence on first-litter gilts which have trouble maintaining condition in first lactation seems even more dramatic. "Nursing seems to drag a young gilt down more than an older sow, particularly in winter," he says. In cold weather, gilts often cannot eat enough regular corn-soy ration to keep themselves warm, nurse their piglets, and gain sufficient weight to recycle. Morris blames many rebreeding problems with gilts on the fact they are too thin.

Roasted soybeans are beneficial in this situation, explains Morris,

ROBERT RIVEST'S unbridled enthusiasm for feeding roasted soybeans is infectious. His former herdsman, Gerald Amlin, was so impressed, he quit to start a commercial grain-roasting business.

Rivest operates a 200-sow farrow-to-finish operation in Essex county, Ont. He started feeding roasted soybeans last April and is pleased with the results. The herd's efficiency has improved and he attributes this to the new diet. On the new ration, average birth weights increased to 3.4 pounds from 2.7 pounds, dressing percent rose one point, and days to market were slashed by 5 days. Dry sow consumption also dropped from 6 lb./day/sow to 4½ pounds when he switched to roasted soybeans.

Before Rivest jumped into feeding soybeans, he and Amlin conducted a feeding trial; 33 feeder pigs were separated into 3 lots, and fed a commercial grower ration; soybean meal, corn and premix; or roasted soybeans plus corn and premix. All 3 diets were formulated for 16% protein and all pigs went to market at 220 pounds.

The pigs on roasted soybeans in

A farm opinion

dexed an average 105.4, plus they went to market 5 days sooner and netted \$7.00 more per head than those on the commercial and conventional diets.

Rivest was so impressed, he bought a Roast-a-Tron roaster, made by Mix-Mill Manufacturing Co., to process his own soybeans. He roasts and grinds every day, but never does more than a week's supply for fear the feed may go rancid.

"They're a nice product to handle," says Rivest. The beans do not gum up the equipment and, Amlin adds, "no caking occurs with roasted soybeans like it does with soybean meal."

"The real place for roasted soybeans is in the farrowing room," says Rivest. Rebreeding has not been a problem since he changed rations and, when a miss does occur, it's usually a first-litter gilt with an exceptionally large litter.

Piglet mortality has been cut in half on the roasted soybeans and Rivest says he has no problem with scours in the farrowing room. "The

sows feel good and it shows in everything they do," adds Amlin. "Fifteen minutes after farrowing, they're up and eating."

Amlin has noticed a marked decrease in the need for antibiotics in pigs on the new feed.

Rivest also roasts his corn before it is fed in home-made rations. Pigs under 100 pounds receive roasted corn, roasted soybeans and premix. At least half the corn in the grower ration is roasted. Regular corn is fed to fatten the feeder pigs.

Amlin has a few customers feeding roasted corn who claim they now need fewer drugs to maintain herd health. He speculates this could be due to the sterilization of the feed in roasting.

Amlin does admit to some problems with roasted soybeans, but he believes bad results are often the product of poor processing.

"If a customer doesn't like the results of feeding roasted soybeans, it's because I didn't do my job well enough," he says. "Soybeans must be cooked properly or they will cause more problems than a man wants to think about."

because thin pigs respond best to high-energy, high-protein diets.

From a nutrition standpoint, Morris figures high-energy feeds such as roasted soybeans are generally undervalued, while low-energy ones are overvalued.

That does not mean he gives an unqualified "yes" to the use of roasted soybeans in swine rations. With so many pieces to the puzzle, he avoids blanket recommendations. In his own work, Morris depends on a microcomputer to assess all the variables. His model considers the price of pork, weaner pigs, corn, 44% soybean meal and premix to calculate "what a producer can afford to pay for roasted soybeans to obtain the same profit as with soybean meal."

To calculate a break-even price for beans prior to roasting, Morris adjusts this price for a 3% shrink in handling, 6% in cooking, and subtracts the processing costs. Once the break-even price is calculated, the producer's decision is more clearcut. If he can get the same amount, or more, from the cash market, it makes sense to sell the beans and buy soybean meal. If the cash price is less than the break-even price, he's probably wise to feed the beans.

Morris admits his model has limitations. More economic factors and the management of the farm should be considered, but have not yet been added to the program. The type of pig and different ration formulations also change the outcome, and Morris wants more research on these areas.

Upcoming trials will compare diets with different protein levels. Research indicates protein from roasted soybeans is more available to hogs. If this is true, it may be possible to reduce protein levels in hog rations by using roasted soybeans. Since protein is an expensive part of any ration, this could mean real savings.

From his work to date, Morris believes roasted soybeans can provide faster gains, better feed conversion and a higher dressing percentage in feeder hogs than regular corn-soy rations commonly fed on Ontario farms.

Larry Griffiths, a nutritionist with Co-op Atlantic, is less enthusiastic. When fed at high levels, he says, roasted soybeans produce soft back fat and poor bacon quality. He does not know how packers handle this problem. Morris agrees pigs fed large concentrations of high-energy soybeans are fatter and thus grade lower.

On the other hand, Morris says producers he talks to claim their hogs

Value of roasted soybeans under price situation		
Values	Example A	Example B
Pork/cwt	\$ 70.00	\$ 77.00
Corn/tonne	129.00	155.00
44% Soybean meal/tonne	256.00	350.00
Premix/tonne	456.00	600.00
Roasted soybeans	290.00	377.00
Value of beans before shrink/tonne	263.90	343.07
Cooking costs (6% cooking/3% handling)	-30.00	-30.00
Value of beans before roasting	233.90	313.07
Dollars/bushel	6.37	8.52

Under B, if soybeans are selling for \$8.50/bu. or more, it would be wise to sell them and buy soybean meal. Below \$8.50/bu., it might be more economical to market the soybeans through the hogs.

Feeding results with roasted soybeans				
	Control	10%	20%	26%
Initial wt. (kg)	27.30	27.00	27.10	26.90
Final wt. (kg)	99.00	98.40	98.60	100.90
Average daily gain (kg)	0.79	0.79	0.79	0.82
Feed:Gain (kg)	3.17	3.15	3.05	3.04
Dressing percent	79.90	80.40	81.10	80.90
Grading fat (mm)	32.50	32.60	32.50	35.20
Grading index	104.20	102.50	103.00	101.00

index better when they switch to roasted soybeans. He figures the farmers overcome fat problems by restricting the amount of beans in the ration. "Another explanation is that since they are getting faster gains, they may be getting more pigs in the correct market weight category than before. Thus they are averaging an overall higher index," he says.

Poor processing can cause problems. It is critical that the beans be cooked properly to destroy the trypsin inhibitor and other unwanted factors in raw soybeans.

Morris and Griffiths agree on the importance of processing, but not on the temperature at which it should be done. Morris prefers to heat soybeans to 121°C/250°F to destroy the inhibitor. Griffiths isn't convinced there is an optimum temperature which will guarantee its destruction.

Storage is another concern for anyone thinking about feeding soybeans.

For one thing, storage facilities can be costly. For another, no one knows exactly how long beans will keep. Carl McKinnon, a technician with the P.E.I. Hog Commodity Marketing Board says roasted soybeans have been kept for 5 years in Minnesota with no loss in feed value.

On one point, however, McKinnon is very clear. The beans must be cooled immediately. Otherwise they continue to cook, destroying the protein, and eventually taking on a gelatin-like consistency, "like a big mass of marmalade," explains McKinnon. Aeration is used to cool them.

Many factors must be weighed before roasted home-grown soybeans can be added to the ration on any hog farm, which is why Morris believes the microcomputer is the best machine to evaluate the decision. "If producers want to give me the figures for their farm, I can give them an answer," he says.