



# Agricultural Animal Confinement Building Heater

Models C80M, C80M X1, C225 and C225 X1

Operation and Maintenance Manual

PNEG-308

Date: 07-30-08





## GENERAL HAZARD WARNING

- Failure to comply with the precautions and instructions provided with this heater, can result in:
  - Death
  - Serious bodily injury or burns
  - Property damage or loss from fire or explosion
  - Asphyxiation due to lack of adequate air supply or carbon monoxide poisoning
  - Electrical shock
- Read this Owner's Manual before installing or using this heater.
- Only properly-trained service people should repair or install this heater.
- Save this Owner's Manual for future use and reference.
- Owner's Manuals and replacement labels are available at no charge. For assistance, contact Cumberland/AP at 217-226-4421.



## WARNING

- Proper gas supply pressure must be provided to the inlet of the heater.
- Refer to dataplate for proper gas supply pressure.
- Gas pressure in excess of the maximum inlet pressure specified at the heater inlet can cause fires or explosions.
- Fires or explosions can lead to serious injury, death, building damage or loss of livestock.
- Gas pressure below the minimum inlet pressure specified at the heater inlet may cause improper combustion.
- Improper combustion can lead to asphyxiation or carbon monoxide poisoning and therefore serious injury or death to humans and livestock.



## WARNING

### Fire and Explosion Hazard

- Not for home or recreational vehicle use.
- Installation of this heater in home or recreational vehicle may result in a fire or explosion.
- Fire or explosions can cause property damage or loss of life.

## CONSIGNES DE SECURITE

Si vous sentez une odeur de gaz:

1. Ouvrez les fenetres
2. Ne touchez pas aux interrupteurs electriques
3. Eteignez toute flamme nue
4. Contactez immediatement votre compagnie de gaz.



## WARNING

### Fire and Explosion Hazard

- Keep solid combustibles a safe distance away from the heater.
- Solid combustibles include wood or paper products, feathers, straw, and dust.
- Do not use the heater in spaces which contain or may contain volatile or airborne combustibles.
- Volatile or airborne combustibles include gasoline, solvents, paint thinner, dust particles or unknown chemicals.
- Failure to follow these instructions may result in a fire or explosion.
- Fire or explosions can lead to property damage, personal injury or loss of life.

## CONSIGNES DE SECURITE

Il es interdit d'utiliser des liquides inflammables ou degageant des vapeurs inflammables, a proximite de tout appareil fonctionnant au gaz.

## FOR YOUR SAFETY

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

## FOR YOUR SAFETY

If you smell gas:

1. Open windows
2. Do not touch electrical switches
3. Extinguish any open flame
4. Immediately call your gas supplier.

# Contents

<b>Chapter 1 Safety</b> .....	<b>4</b>
Safety Guidelines .....	4
General Safety Statement .....	8
General Safety Information .....	9
<b>Chapter 2 Decals</b> .....	<b>10</b>
<b>Chapter 3 Inspection</b> .....	<b>17</b>
<b>Chapter 4 Dimensions</b> .....	<b>18</b>
<b>Chapter 5 Specifications</b> .....	<b>19</b>
<b>Chapter 6 Wiring Diagrams</b> .....	<b>21</b>
<b>Chapter 7 Wiring Harness</b> .....	<b>23</b>
Wiring Harness Assembly .....	23
<b>Chapter 8 Installation</b> .....	<b>24</b>
Installation of Recirculating Type (Indoor) .....	24
Installation of Non-Recirculating Type (Outdoor) Option .....	25
<b>Chapter 9 Start-Up</b> .....	<b>27</b>
Instructions .....	27
Adjustment of Heater Input (Optional for C80M) .....	29
<b>Chapter 10 Maintenance</b> .....	<b>30</b>
General Maintenance Instructions .....	30
<b>Chapter 11 Parts List</b> .....	<b>31</b>
C225 NG/LP Galv Purafire 120V-60 Hz .....	32
C225 X1 NG/LP Galv Purafire 220V-50/60 Hz .....	34
C80M NG/LP Galv Purafire 120V-60 Hz .....	36
C80M X1 NG/LP Galv Purafire 220V-50/60 Hz .....	38
<b>Chapter 12 Troubleshooting Guide</b> .....	<b>40</b>
Troubleshooting Supplement .....	45
<b>Chapter 13 Gas Pressure</b> .....	<b>47</b>
Checking Gas Pressure .....	47
<b>Chapter 14 Pipe Sizing Guidelines</b> .....	<b>48</b>
Regulators .....	48
<b>Chapter 15 Examples</b> .....	<b>50</b>
<b>Chapter 16 Warranty</b> .....	<b>57</b>

## Start-Up Instructions

MODEL # \_\_\_\_\_

SERIAL # \_\_\_\_\_ DATE \_\_\_\_\_

SERVICE TECHNICIAN \_\_\_\_\_

COMPANY \_\_\_\_\_

**NOTE:** *This equipment shall be installed in accordance with the current installation codes and applicable regulations which should be carefully followed in all cases. Authorities having jurisdiction should be consulted before installation occurs.*

### Safety Guidelines

This manual contains information that is important for you, the owner/operator, to know and understand. This information relates to protecting **personal safety** and **preventing equipment problems**. It is the responsibility of the owner/operator to inform anyone operating or working in the area of this equipment of these safety guidelines. To help you recognize this information, we use the symbols that are defined below. Please read the manual and pay attention to these sections. Failure to read this manual and its safety instructions is a misuse of the equipment and may lead to serious injury or death.



**This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.**



**DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



**WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



**CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.



**CAUTION** used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

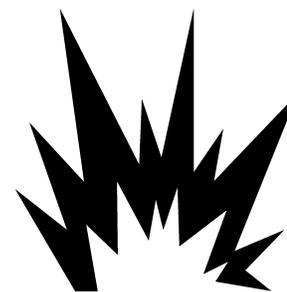


**NOTE** indicates information about the equipment that you should pay special attention.

### Install Properly

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death from the hazards of fire, explosion, burns, asphyxiation, carbon monoxide poisoning and/or electrical shock. Read the Installation, Operating and Maintenance Instruction thoroughly before installing or servicing this equipment. Retain these instruction for future reference.

DO NOT install this heater in a home or recreational vehicle. Installation in home or recreational vehicle could cause fire or explosion, property damage or death.



**Explosion Hazard**



**Fire Hazard**

### Use Correct Gas Pressure

Proper gas supply pressure must be provided to the inlet of the appliance. Refer to rating plate for proper gas supply pressure. Gas pressure in excess of the maximum inlet pressure specified at the appliance can cause fires or explosions, leading to serious injury, death, building damage or loss of livestock.

Likewise, gas pressure below the minimum inlet pressure specified at the appliance inlet may cause improper combustion, leading to asphyxiation, carbon monoxide poisoning and therefore serious injury or death to humans and livestock.



**Breathing Hazard**

## 1. Safety

### Do Not Operate on Base

The air inlet is on the bottom. DO NOT operate this heater while it is sitting on its base.



Electric Shock Hazard

### Keep Area Clean

DO NOT permit feathers, hay, straw, dust or other combustible materials to accumulate in, on, or around the heater. A fire may result. Perform periodic cleaning as necessary.

Never use the heater in spaces which contain or may contain volatile or airborne combustibles, or products such as gasoline, solvents, paint thinner, dust particles or unknown chemicals. Failure to follow these instructions may result in fire or explosion, property damage, personal injury or death.

The surfaces of this heater may be hot. DO NOT touch.



Fire Hazard

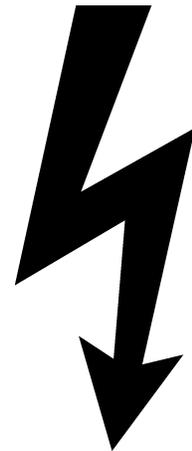


Hot Surface

### Install and Operate Electrical Equipment Properly

Electrical controls should be installed by a qualified electrician and must meet the standards set by the National Electrical Code and all local and state codes.

Disconnect and lock out all power sources before installing wires/cables or servicing equipment.



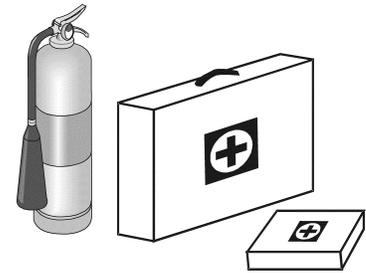
Electric Shock Hazard

## Prepare for Emergencies

Be prepared if fire starts.

Keep a first aid kit and fire extinguisher handy.

Keep emergency numbers for doctors, ambulance service, hospital and fire department near your telephone.



**Keep Emergency Equipment Quickly Accessible**

## Wear Protective Clothing

Wear close fitting clothing and safety equipment appropriate to the job.

Remove all jewelry.

Long hair should be tied up and back.

Safety glasses should be worn at all times to protect eyes from debris.

Wear gloves to protect your hands from sharp edges on plastic or steel parts.

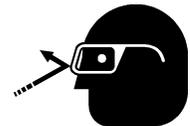
Wear steel toe boots to help protect your feet from falling debris. Tuck in any loose or dangling shoe strings.

A respirator may be needed to prevent breathing potentially toxic fumes and dust.

Wear hard hat to help protect your head.

Wear appropriate fall protection equipment when working at elevations greater than six feet (6').

**Eye Protection**



**Gloves**



**Steel Toe Boots**



**Respirator**



**Hard Hat**



**Fall Protection**



### General Safety Statement

Our foremost concern is your safety and the safety of others associated with grain handling equipment. This manual is to help you understand safe operating procedures and some problems which may be encountered by the operator and other personnel.

As owner and/or operator, you are responsible to know what requirements, hazards and precautions exist and inform all personnel associated with the equipment or in the area. Safety precautions may be required from the personnel. Avoid any alterations to the equipment, which may produce a very dangerous situation, where serious injury or death may occur.

***This heater is designed and approved for use as an Agricultural Animal Confinement Building Heater under AGA Requirement LC-2. The intended use of the heater is to heat well-ventilated animal confinement buildings.***

The products of combustion created by these heaters (i.e. carbon dioxide, nitrogen dioxide, carbon monoxide) are released into the airstream being heated. To properly dilute the combustion products of heater installations which recirculate inside air, at least 4 CFM of fresh air per 1000 BTU's of the heater's rated input are required. Refer to the ventilation requirements found in the Heater Specifications ([See Specifications](#)) of this manual.

Compare the total ventilations requirements of the heating system (Number of recirculating heaters multiplied by the ventilation requirements of each heater) to the overall ventilation requirements of the facility. In most animal confinement buildings, the ventilation required to maintain the proper oxygen content exceeds the ventilation required to properly dilute the combustion products. If the ventilation requirement of the facility is below the requirement of the heating's system, increase the facility's ventilation or change one or more of the recirculating heaters to the non-recirculating type (Intake outside air only).

## General Safety Information

1. Observe all safety, installation, operation and maintenance instructions before placing this heater into service.
2. Installation of the heater(s) must comply with all applicable local, state and national codes.
3. This heater is NOT to be used to heat human living quarters.
4. DO NOT use in unventilated areas. Adequate ventilation is essential to safe operation. When operating this heater, the forming of moisture droplets on cold surfaces or the feeling of nausea or headaches is an indication of improper ventilation. Prolonged exposure to improperly ventilated areas can result in asphyxiation or death.
5. DO NOT use this heater in areas where gasoline or other liquids having flammable vapors, or in heavy dust laden atmospheres (i.e. mills, granaries, etc.). Failure to follow this warning can result in an explosion.
6. DO NOT attach any inlet and/or discharge duct work other than approved accessories to the heater. Excessive static pressure may cause this heater to overheat and/or cause excessive amounts of combustion products to be discharged into the space.
7. Maintain proper clearances to combustible material. See heater nameplate for specific clearance.
8. DO NOT operate this heater with improper fuel. See heater nameplate for fuel specified.
9. DO NOT position fuel cylinder in path of discharge air.
10. This heater will not operate correctly unless the gas supply pressure is properly regulated. Under no circumstance should the gas pressure supplied to the heater be greater than 14" W.C. (1/2 PSI).
11. All gas high-pressure regulators must be vented to the outside of the building with no reduction in size of the vent piping. The vent piping should be designed to prevent the entry of water, insects or other foreign material that could cause blockage.
12. DO NOT connect this heater to the supply gas line unit all piping has been pressure tested and purged. Damage to the gas valve may result.
13. DO NOT grip gas valve body with pipe wrench or vise. Damage may result causing gas leakage. Use inlet or outlet bosses or a special body wrench.
14. The air inlet openings are located on the bottom of the heater. DO NOT operate heater while it is sitting on its base.
15. This appliance is equipped with a three-prong (grounding) plug and should be plugged directly into a properly grounded three-prong receptacle.
16. DO NOT bypass any safety devices. Replace or repair defective components before placing heater into service.
17. Protect the power cord from coming into contact with sharp edges or the base of the heater.
18. DO NOT repair, handle or move unit while hot or operating.
19. Before each use of this heater, an inspection of the heater, power cord, hose assembly (if used), and gas piping is essential to ensure safe and satisfactory heater operation. This inspection should be performed by qualified service personnel at least once a year. Use only the factory specified hose assembly for field replacement. *See Parts List.*
20. The hose assembly shall be visually inspected on an annual basis. If it is evident that there is excessive abrasions or wear, or the hose is cut, it must be replaced prior to the heater being put into operation. The replacement hose assembly shall be that specified by the manufacturer.

## 2. Decals

Please remember, safety signs provide important safety information for people working near equipment that is in operation.

If the safety sign cannot be easily read for any reason, replace it immediately. Additional safety signs may be obtained free of charge from your dealer, distributor or ordered from the factory.

### GSI Decals

1004 E. Illinois St.  
Assumption, IL. 62510  
Phone: 217-226-4421

**NOTE:** *Decals are not shown actual size.*

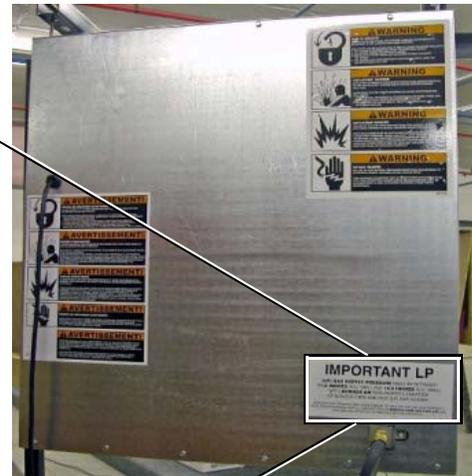
**DC-763** is located on the gas inlet side for  
**Liquid Propane** heaters.

## IMPORTANT LP

**(LP) GAS SUPPLY PRESSURE** MUST BE BETWEEN  
**11.8 INCHES W.C. (MIN.)** AND **14.0 INCHES W.C. (MAX.)**  
WITH **BURNER ON** FOR PROPER OPERATION  
OF MODELS C80M AND C225 (LP) GAS HEATER.

IMPROPER GAS PRESSURE MAY CAUSE DAMAGE OR MALFUNCTION AND VOID WARRANTY.  
READ OWNER'S MANUAL AND ALL INSTRUCTIONS **ON MODELS C80M AND C225 (LP)** GAS  
HEATERS FOR IMPORTANT INFORMATION BEFORE OPERATING.

DC-763



**DC-794** is located on the gas inlet side  
for **Natural Gas** heaters.

## IMPORTANT NG

**(NG) GAS SUPPLY PRESSURE** MUST BE BETWEEN  
**4.9 INCHES W.C. (MIN.)** AND **14.0 INCHES W.C. (MAX.)**  
WITH **BURNER ON** FOR PROPER OPERATION  
OF MODELS C80M AND C225 (LP) GAS HEATER.

IMPROPER GAS PRESSURE MAY CAUSE DAMAGE OR MALFUNCTION AND VOID WARRANTY.  
READ OWNER'S MANUAL AND ALL INSTRUCTIONS **ON MODELS C80M AND C225 (LP)** GAS  
HEATERS FOR IMPORTANT INFORMATION BEFORE OPERATING.

DC-794



**NOTICE**

**THIS GAS VALVE BOX COVER  
MUST BE IN PLACE DURING  
HEATER OPERATION.**

**DC-1099**

DC-1099 is located on the gas valve.

**⚠ WARNING**

**VALVE CONVERTED FOR USE ON  
NATURAL GAS. IMPROPER OPERATION  
COULD RESULT IN DEATH OR SERIOUS  
INJURY.**

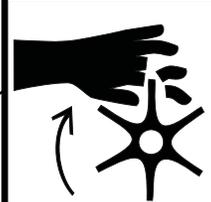
**⚠ MISE EN GARDE**

**SOUPEPE CONVERTIE POUR USAGE  
SURE GAZ NATUREL.  
UN FONCTIONNEMENT INAPPROPRIE  
PEUT PROVOQUER LA MORT OU DES  
BLESSURES GRAVES.**

For natural gas heaters only.



Nameplate is located on the discharge side.



**⚠ WARNING**

**Rotating blower wheel.  
Equipment can start  
automatically. Keep hands  
clear. Can cause serious  
injury. Disconnect power  
before servicing.**

**DC-1272**

DC-1272 is located above the discharge.



**⚠ WARNING**

**SHOCK HAZARD**  
SEVERE PERSONAL INJURY OR PROPERTY DAMAGE COULD RESULT IF EQUIPMENT IS NOT CLEANED AND DRIED PROPERLY.

THIS HEATER MAY BE CLEANED ONLY IF THE FOLLOWING RULES ARE FOLLOWED:

1. THE HEATER IS DISCONNECTED FROM THE ELECTRICAL SUPPLY.
2. ALL ACCESS PANELS ARE SECURELY CLOSED
3. WATER SPRAY NOZZLE SHALL NOT DISCHARGE WITHIN 6' (1.83 M) OF THE HEATER.
4. THE HEATER IS NOT RECONNECTED TO ELECTRICAL SUPPLY UNTIL THE HEATER IS COMPLETELY DRY.

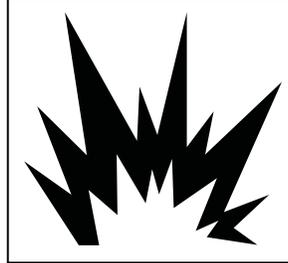


**⚠ WARNING**

**EXPLOSION HAZARD**  
IMPROPER CLEANING OF THE HEATER COULD CAUSE SEVERE PERSONAL INJURY OR PROPERTY DAMAGE DUE TO WATER AND/OR CLEANING SOLUTION.

AVOID USING WATER AND/OR CLEANING SOLUTIONS ON OR NEAR THE FOLLOWING:

1. IN ELECTRICAL COMPONENTS, CONNECTIONS AND WIRES, WHICH CAN CAUSE ELECTRICAL SHOCK OR COMPONENT FAILURE.
2. ON GAS CONTROL COMPONENTS, WHICH CAN RESULT IN A GAS EXPLOSION AND FIRE.



**⚠ WARNING**

**EXPLOSION HAZARD**  
FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN FIRE, EXPLOSION, PROPERTY DAMAGE, PERSONAL INJURY OR LOSS OF LIFE.

KEEP SOLID COMBUSTIBLES SUCH AS BUILDING MATERIALS, PAPER, CARDBOARD, FEATHERS, STRAW, AND DUST A SAFE DISTANCE AWAY FROM THE HEATER AS RECOMMENDED IN THE INSTRUCTIONS. NEVER USE THE HEATER IN SPACES WHICH CONTAIN OR MAY CONTAIN VOLATILE OR AIRBORNE COMBUSTIBLES SUCH AS GASOLINE, SOLVENTS, PAINT THINNER, DUST PARTICLES, OR UNKNOWN CHEMICALS.



**⚠ WARNING**

**SHOCK HAZARD**  
FAILURE TO USE PROPERLY-GROUNDED RECEPTACLE COULD RESULT IN ELECTRICAL SHOCK, PERSONAL INJURY, AND/OR DEATH.

THIS EQUIPMENT IS EQUIPPED WITH A THREE-PRONG (GROUNDING) PLUG FOR YOUR PROTECTION AGAINST SHOCK HAZARD AND MUST ONLY BE PLUGGED DIRECTLY INTO A PROPERLY GROUNDED THREE-PRONG RECEPTACLE.

DC-775

DC-775 is located on the discharge side.





## ⚠️ AVERTISSEMENT!

**RISQUE DE DÉCHARGE ÉLECTRIQUE!**  
LE NON-RESPECT DE LA RÉGLEMENTATION PEUT AVOIR POUR RÉSULTAT DES BLESSURES GRAVES OU FATALES.

MODE D'EMPLOI, POUR LE NETTOYAGE, LE SÉCHAGE, ET L'ENTRETIEN DE LA MACHINE:  
1. POUR ÉVITER UN CHOC ÉLECTRIQUE, DÉBRANCHEZ TOUTES LES SOURCES D'ÉLECTRICITÉ AVANT L'ENTRETIEN DE LA MACHINE.  
2. FERMEZ TOUS LES PANNEAUX D'ACCÈS AVANT LE NETTOYAGE DE LA MACHINE.  
3. NE BRANCHEZ PAS LA PRISE DE COURANT AVANT QUE TOUS LES ÉLÉMENTS SOIENT SECS.  
4. NE PROJETEZ PAS D'EAU DIRECTEMENT SUR LES ÉLÉMENTS DE CHAUFFAGE.  
MAINTENEZ UNE DISTANCE MINIMALE DE 1.83 MÈTRES (6 PIEDS) ENTRE LE JET ET LA MACHINE.



## ⚠️ AVERTISSEMENT!

**RISQUE D'EXPLOSION!**  
L'USAGE INCORRECT DES PRODUITS DE NETTOYAGE PEUT AVOIR POUR RÉSULTAT DES BLESSURES GRAVES OU FATALES.

POUR ÉVITER LE RISQUE DE CHOC ÉLECTRIQUE, D'EXPLOSION DE GAZ, DE BLESSURES GRAVES OU DE DÉGÂTS MATÉRIELS:  
L'EAU, LES PRODUITS DE NETTOYAGE, LES PRODUITS DE DÉGRAISSAGE, ET LES PRODUITS CHIMIQUES NE DOIVENT PAS ENTRER EN CONTACT DIRECT AVEC DES FILS ÉLECTRIQUES, PRISES DE COURANT, ÉLÉMENTS ÉLECTRIQUES, ÉLÉMENTS INTERNES, TUYAUX DE GAZ OU ROBINETS DE GAZ. LE NON-RESPECT DE CETTE RÉGLEMENTATION PEUT AVOIR POUR RÉSULTAT DES CHOC ÉLECTRIQUES, DES BLESSURES GRAVES OU FATALES, DES DÉGÂTS MATÉRIELS, OU L'EXPLOSION DU GAZ.



## ⚠️ AVERTISSEMENT!

**RISQUE D'EXPLOSION!**  
LE NON-RESPECT DE CETTE RÉGLEMENTATION PEUT AVOIR POUR RÉSULTAT UN INCENDIE, UNE EXPLOSION, DES DÉGÂTS MATÉRIELS OU DES BLESSURES GRAVES OU FATALES.

TENEZ À DISTANCE DU RADIATEUR TOUTES LES SUBSTANCES COMBUSTIBLES, LES MATIÈRES CHIMIQUES, LES MATÉRIEAUX DE CONSTRUCTION, LE PAPIER, LE BOIS, LES PLUMES, LES POUSSIÈRE, LA PAILLE, LE FOIN SEC, TOUTES LES SUBSTANCES POUDREUSES, LES SUBSTANCES VOLATILES, LES CARBURANTS (ESSENCE, HUILE,...), LES VAPEURS DE SOLVANT (TÉRÉBENTHINE, DÉCAPANTS), POUSSIÈRES ATOMISÉES ET TOUTES AUTRES SUBSTANCES CHIMIQUES INCONNUES. N'UTILISEZ JAMAIS LE RADIATEUR DANS UN ESPACE CLOS OU SANS UN SYSTÈME DE VENTILATION SUFFISANT.



## ⚠️ AVERTISSEMENT!

**RISQUE DE DÉCHARGE ÉLECTRIQUE!**

INSTRUCTIONS POUR MISE À TERRE ÉLECTRIQUE. CET APPAREIL EST ÉQUIPÉ PAR UNE FICHE À TROIS PATTES (POUR MISE À TERRE), POUR VOTRE PROTECTION CONTRE LES CHOC ÉLECTRIQUES CETTE FICHE DOIT ÊTRE INSÉRÉE DIRECTEMENT DANS UNE PRISE DE COURANT À TROIS PATTES CORRECTEMENT MISE À TERRE.

## ⚠️ AVERTISSEMENT!

RASSUREZ-VOUS QUE LES GRILLAGES D'ENTRÉE D'AIR, LES VOLETS ET LES DÉFLECTEURS SOIENT RÉGULIÈREMENT INSPECTÉS ET LIBRES DE TOUTES SALETÉS, POUSSIÈRES, NEIGE, GLACE, GIVRE OU TOUT AUTRE PRODUIT ÉTRANGER, AFIN QUE L'AIR PUISSE CIRCULER LIBREMENT ET FOURNIR LE VOLUME ADEQUAT REQUIS AUX BESOINS DE VENTILATION ET DE COMBUSTION.

POUR ASSURER UNE BONNE OPÉRATION SÉCURITAIRE DE VOTRE GRANGE, IL FAUDRA PROCURER UNE VENTILATION COMBINÉE (NATURELLE/MÉCANIQUE) SUPÉRIEURE À 1/4 P.C.M.S. (PIED CUBE PAR MINUTE, STANDARD) PAR ANIMAL.

DC-775F

DC-775F is located on the discharge side.



**! WARNING**



**Hot Surfaces**  
Panels are hot during  
equipment operation;  
may cause severe burns.  
**DO NOT TOUCH**

DC-658

DC-658 are located above the discharge.



**! WARNING**

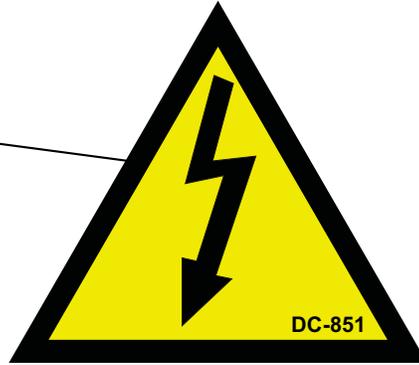
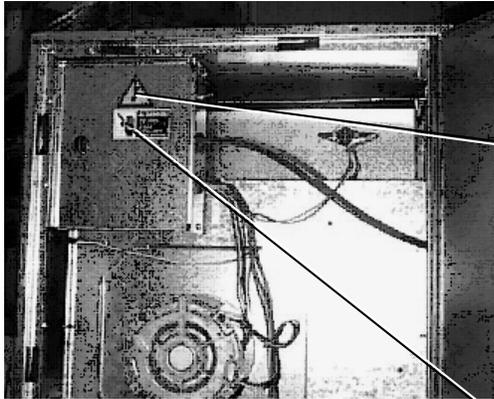


Flame and pressure beyond  
door. Do not operate with  
door removed or open. Keep  
head and hands clear. Can  
cause serious injury.

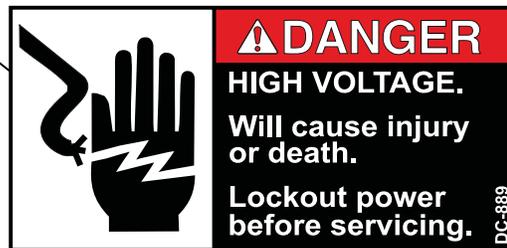
DC-1271

DC-1271 is located on each access door.

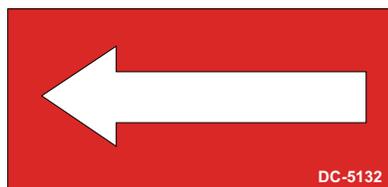
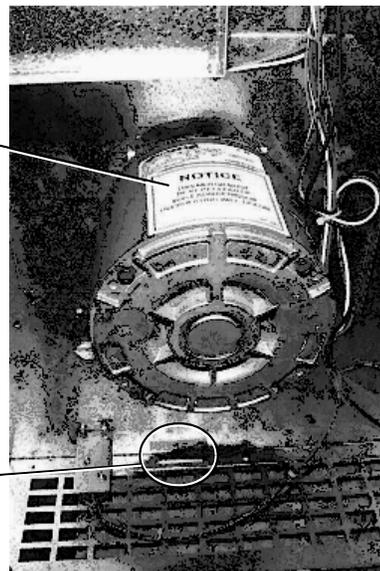




DC-851 and DC-889 are located on the electrical enclosure.

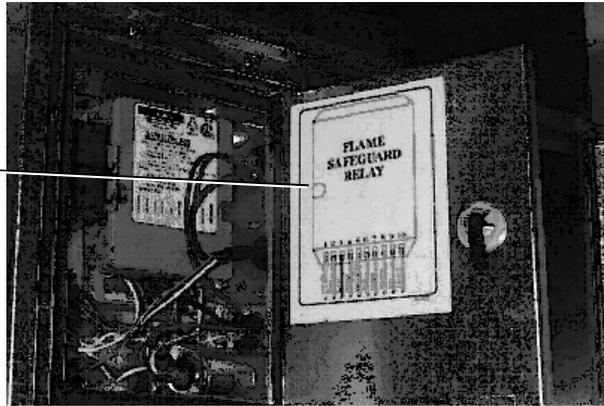
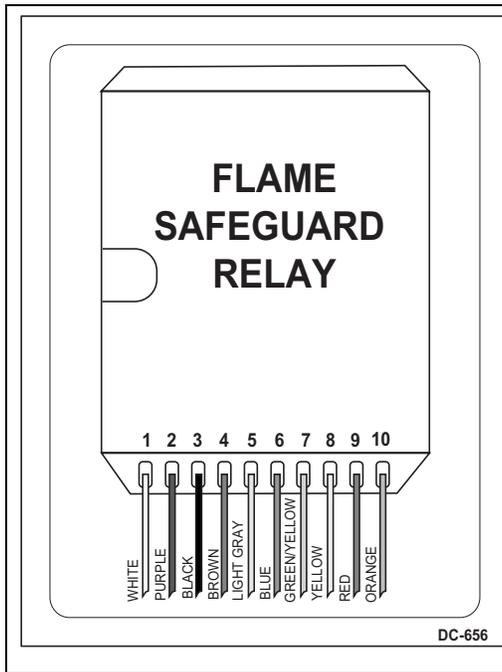


DC-841 is located on the motor.

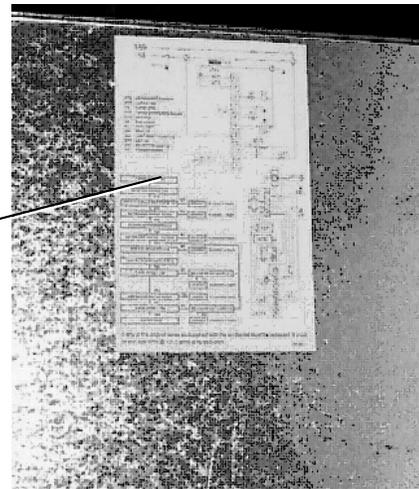
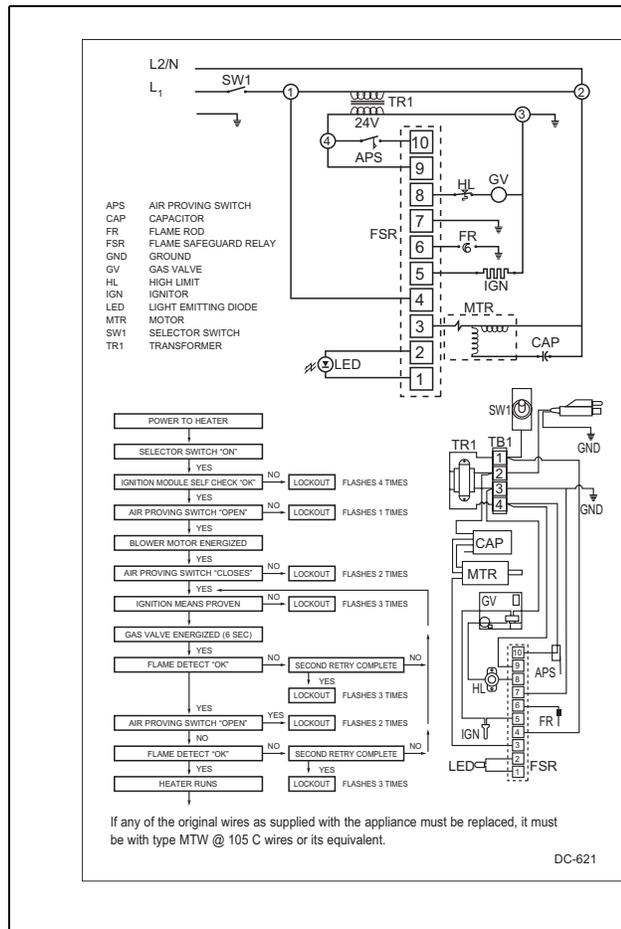


DC-5132 is located next to the air proving switch.

## 2. Decals



DC-656 is located on the inside of the electrical enclosure.



DC-621 is located on the inside of the motor-side access door.

After unpacking the unit, carefully inspect it to make sure no damage has occurred during shipment and that associated hardware has been received.

1. Check heater housing for significant dents.
2. Make sure that the two (2) bolts which secure the burner to the firebox are intact.
3. Check to see that all access panels are secure.
4. Make sure the electrical power cord is not cut or frayed.
5. Check to see that blower wheel turns freely.
6. Verify that manual shut off valve is included.

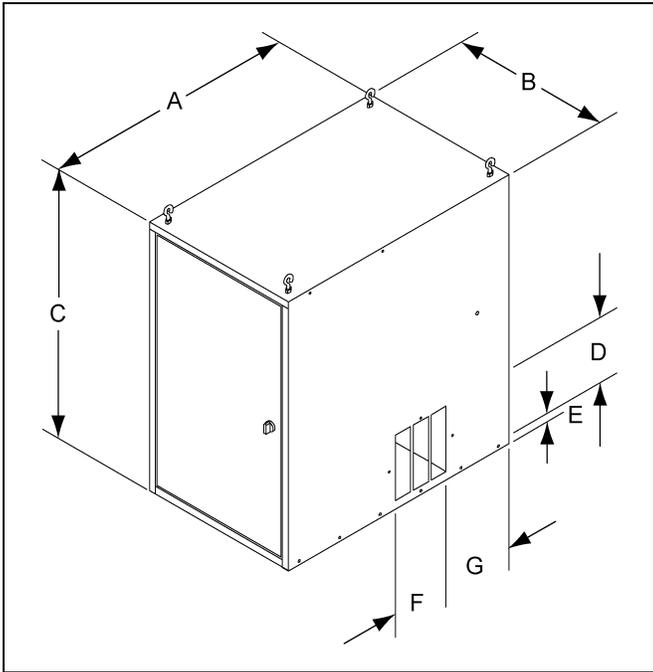


Figure 4A

Dimension	Model	
	C80M	C225
A	20-1/2"	27"
B	13"	20"
C	21-3/4"	28"
D	5-1/8"	7-5/8"
E	3/4"	1"
F	4-1/2"	7-3/4"
G	6"	5-1/2"

**C80M Purafire  
Agricultural Animal Confinement Building Heater**

Specifications		
Input Rating	LP Gas Usage	Natural Gas Usage
80000 BTU/Hr	31.80 CuFt/Hr *	80 CuFt/Hr
20160 KCal/Hr	0.91 CuM/Hr *	2.29 CuM/Hr
31.44 HP	3.71 Lbs/Hr	
23.40 KW	1.68 Kg/Hr	
	0.87 Gal/Hr	
	3.29 L/Hr	
	*=vapor state	
40000 BTU/Hr	15.90 CuFt/Hr *	40 CuFt/Hr
10080 KCal/Hr	0.45 CuM/Hr *	1.14 CuM/Hr
15.72 HP	1.86 Lbs/Hr	
11.7 KW	0.84 Kg/Hr	
	0.44 Gal/Hr	
	1.65 L/Hr	
	*=vapor state	

Minimum Input Pressure		Maximum Input Pressure	
LP	Natural Gas	LP	Natural Gas
11.4 in/w.c.	4.4 in/w.c.	14 in/w.c.	14 in/w.c.
6.59 oz/sq. in.	2.54 oz/sq. in.	8.09 oz/sq. in.	8.09 oz/sq. in.
28.96 cm/w.c.	11.18 cm/w.c.	35.56 cm/w.c.	35.56 cm/w.c.
2838 Pascals	1096 Pascals	3485 Pascals	3485 Pascals
28.38 Millibars	10.96 Millibars	34.85 Millibars	34.85 Millibars

Electrical Requirements	C80M 120 VAC/60 Hz Single Phase Only	C80M X1 220 VAC/50/60 Hz Single Phase Only
Motor Current	1.50 Amps	0.63 Amps
Motor Power	0.127 HP	0.110 HP
	0.09474 KW	0.08206 KW

Air Delivery	520 CuFt/Min	Fresh Air Required	320 CuFt/Min
	891 CuM/Hr		496 CuM/Hr

Dimensions	Length	Width	Height
Inches	20.50	13.00	21.75
Centimeters	52.00	33.00	55.25

<b>Shipping Weight:</b> 57 Lbs / 25.86 Kg
<b>Ignition Type:</b> 24 VAC Hot Surface

## 5. Specifications

### C225 Purafire Agricultural Animal Confinement Building Heater

Specifications		
Input Rating	LP Gas Usage	Natural Gas Usage
225000 BTU/Hr	89.43 CuFt/Hr *	225 CuFt/Hr
56700 KCal/Hr	2.56 CuM/Hr *	6.43 CuM/Hr
88.43 HP	10.42 Lbs/Hr	
65.93 KW	4.71 Kg/Hr	
	2.45 Gal/Hr	
	9.27 L/Hr	
	*=vapor state	

Minimum Input Pressure		Maximum Input Pressure	
LP	Natural Gas	LP	Natural Gas
11.8 in/w.c.	4.9 in/w.c.	14 in/w.c.	14 in/w.c.
6.82 oz/sq. in.	2.83 oz/sq. in.	8.09 oz/sq. in.	8.09 oz/sq. in.
29.97 cm/w.c.	12.45 cm/w.c.	35.56 cm/w.c.	35.56 cm/w.c.
2939 Pascals	1220 Pascals	3485 Pascals	3485 Pascals
29.39 Millibars	12.2 Millibars	34.85 Millibars	34.85 Millibars

Electrical Requirements	C225 120 VAC/60 Hz Single Phase only	C225 X1 220 VAC/50/60 Hz Single Phase only
Motor Current	4.7 Amps	2.5 Amps
Motor Power	0.33 HP	0.42 HP
	0.246 KW	0.313 KW

Air Delivery		Fresh Air Required	
	1100 CuFt/Min		900 CuFt/Min
	1886 CuM/Hr		1543 CuM/Hr

Dimensions	Length	Width	Height
Inches	27.00	20.00	28.00
Centimeters	68.58	50.80	71.12

<b>Shipping Weight:</b> 110 Lbs / 49.9 Kg
<b>Ignition Type:</b> 24 VAC Hot Surface

120V Models

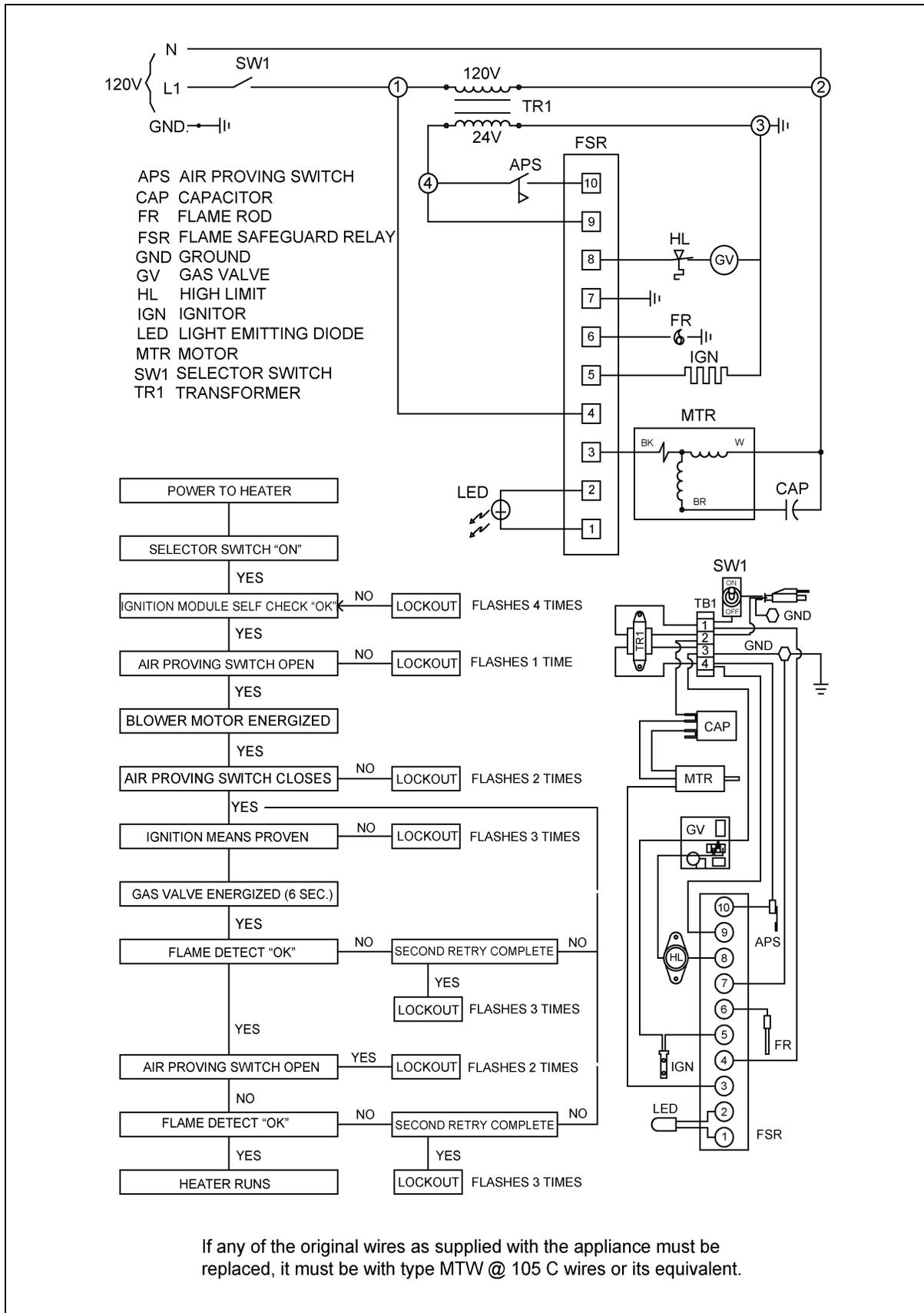
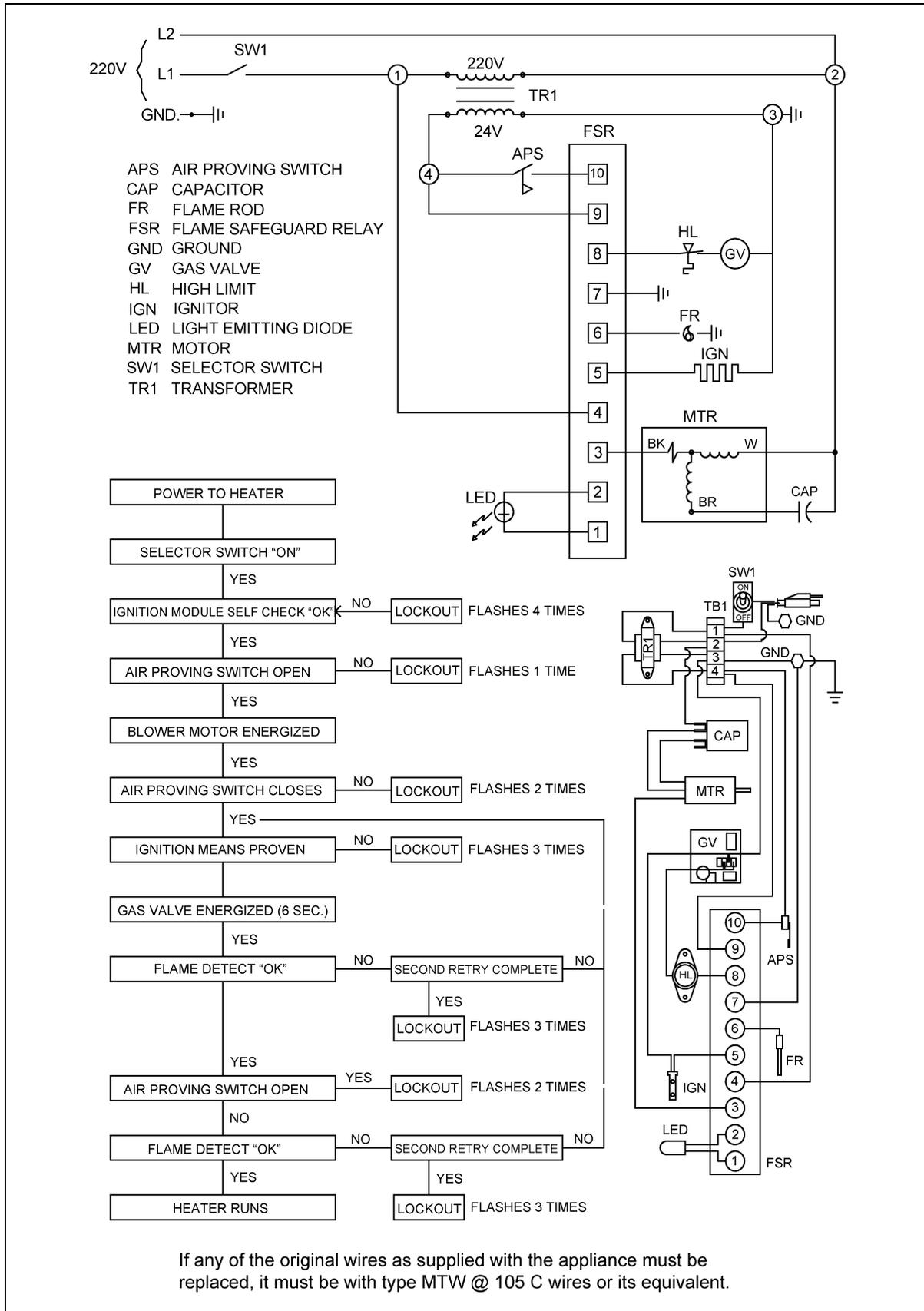


Figure 6A

220V Models



If any of the original wires as supplied with the appliance must be replaced, it must be with type MTW @ 105 C wires or its equivalent.

Figure 6B

# Wiring Harness Assembly

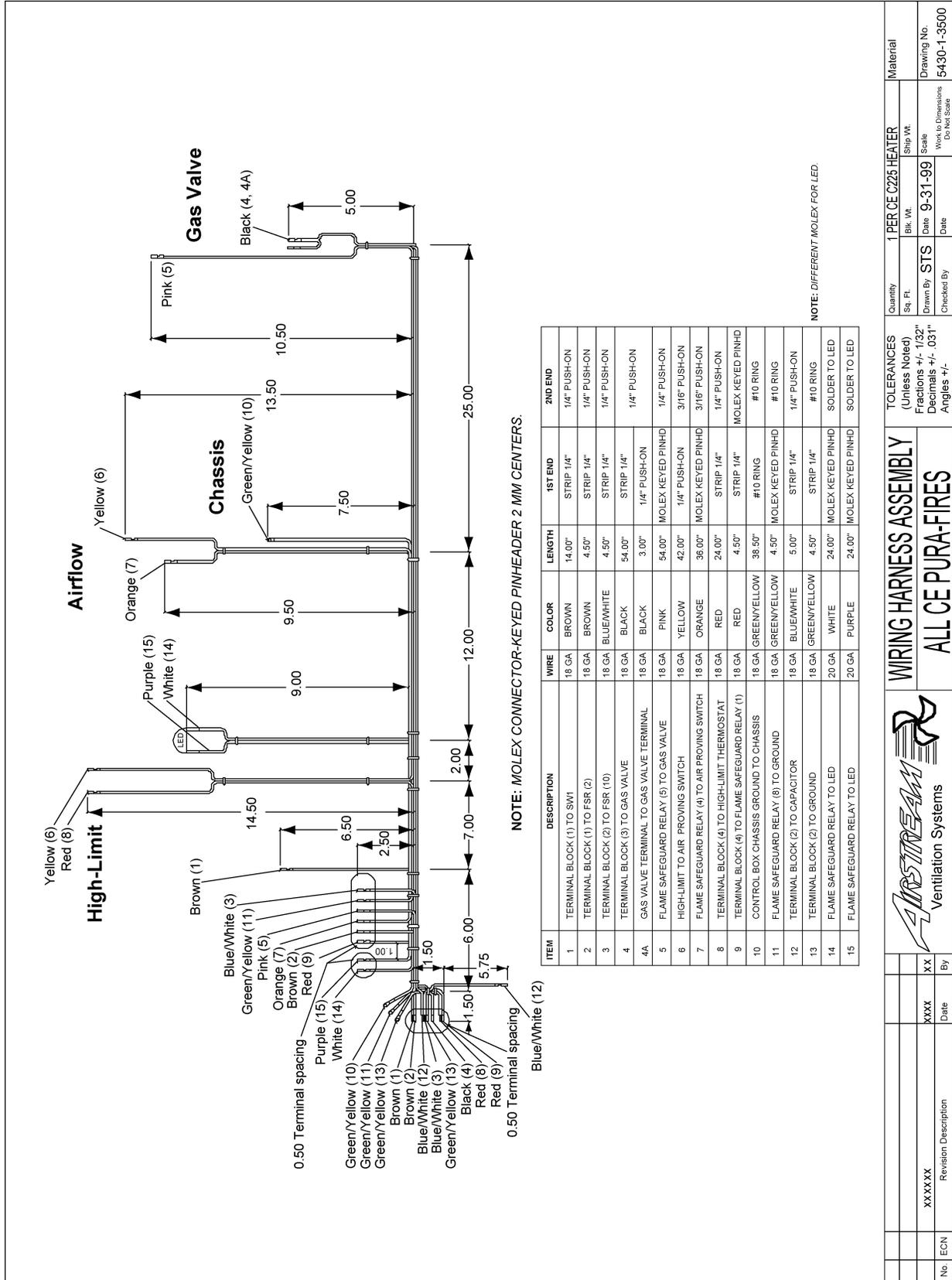


Figure 7A

## 8. Installation

1. Before proceeding with installation, verify feasibility of the heater location, such that the heater, electrical cord or gas piping will not be accessible to livestock. Allow for convenient access and serviceability of equipment.

**NOTE:** *DO NOT attach any inlet and/or discharge ductwork other than approved accessories to the heater. Excessive static pressure may cause this heater to overheat and/or cause excessive amounts of combustion products to be discharged into the space.*

2. Maintain a minimum clearance from combustibles of 12" from the top, bottom and sides of the heater. Combustible material must be a minimum distance of 6' from the discharge air outlet of the heater.

**NOTE:** *If the heater is located in a high-traffic area, mount the heater so as not to create a human bump hazard; however, the minimum clearance for the combustibles must be maintained.*

3. To protect the heater from livestock, this heater must be installed a minimum of 24" from the ground in poultry applications and minimum of 48" from the ground in hog confinement. Verify that the bottom air intake is not restricted in any manner.



**Gas supply pressure exceeding 14" W.C. (1/2 PSI) can cause damage to the automatic gas valve, the heater's components and/or personal and property damage due to fire or explosion.**

### Installation of Recirculating Type (Indoor)

1. Locate the four (4) eye bolts and jam nuts supplied with the suspension kit. Thread one (1) jam nut onto each eye bolt. Thread eye bolts with jam nuts into each top corner of the heater. Screw the eye bolt down until it stops. Tighten the jam nut against the heater's housing. This will prevent the eye bolt from backing out during heater operation.
2. Attach the "S" hook and chain to each eye bolt previously installed on the heater.
3. Secure the mounting hardware to adequate support members so that the heater support chains are located at an angle that minimizes swaying motion. Verify that the heater is securely fastened and that it is hanging level. (Check with a level in both the lengthwise and crosswise directions.)
4. Install the gas piping and the electrical wiring in accordance with local codes, or, in the absence of local codes, with the National Electrical Code and ANSI/NFPA 70-1993 and the standard for the storage and handling of liquefied petroleum.
5. Install a manometer to the gas valve to verify that the gas pressure is within the range specified on the heater's nameplate.
6. Check all gas connections for leaks, using a leak detector solution. Repair any gas leak before test firing or placing this heater into service.
7. Install a sediment trap and a manual shut off cock to the heater's gas inlet.

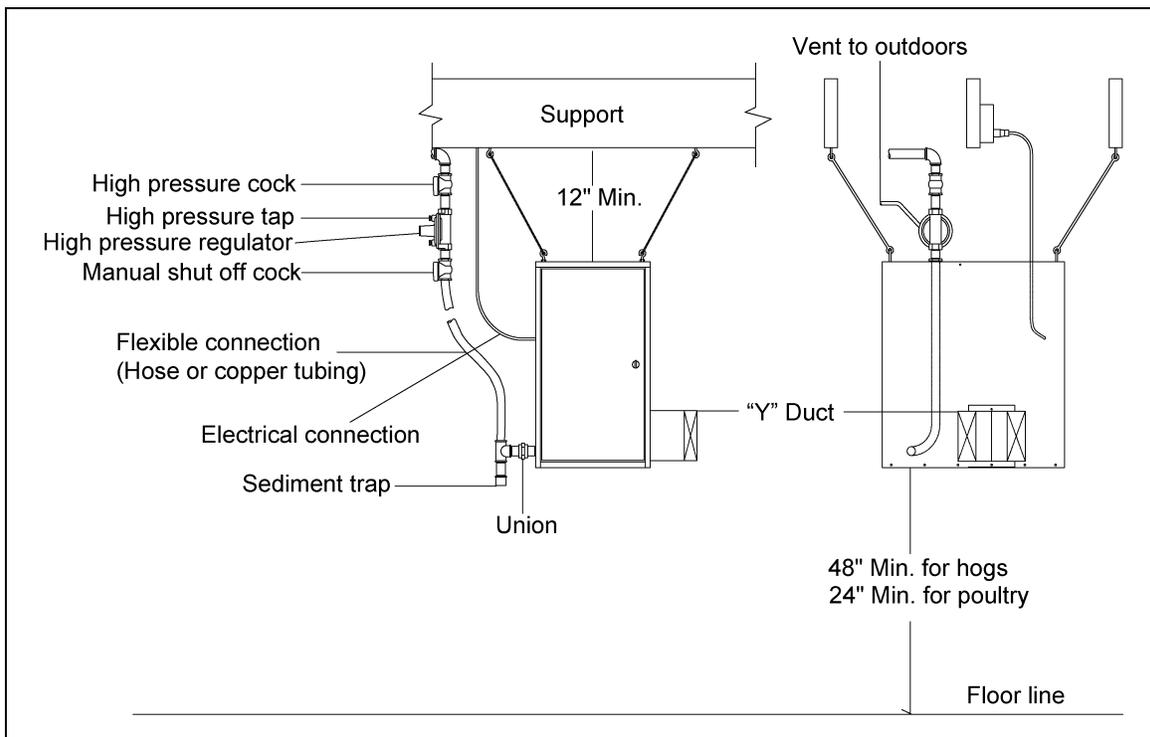


Figure 8A

## Installation of Non-Recirculating Type (Outdoor) Option

1. Before proceeding with installation, verify the stud and electrical raceways within the building's wall do not interfere with the heater's wall mounting brackets, outlet ducting, electrical wiring or gas supply piping.
2. Install the support brackets and outlet ducting per the instructions provided with the optional outdoor kit.
3. This heater must be installed level, and a minimum of 24" from the ground such that the bottom air intake is not restricted in any manner. Check with a level in both the lengthwise and crosswise directions.
4. Install gas piping, electrical supply wiring and optional thermostat wiring in accordance with local codes, or, in absence of local codes, with the National Electrical Code and ANSI/NFPA 70-1993 and the standard for the storage and handling of liquefied petroleum.
5. Install a sediment trap and a manual shut off cock to the heater's gas inlet.
6. Check all gas connections for leaks, using a leak detector solution. Repair any gas leak before test firing or placing this heater into service.
7. Install a manometer to the gas valve to verify that the gas pressure is within the range specified on the heater's nameplate.

## 8. Installation

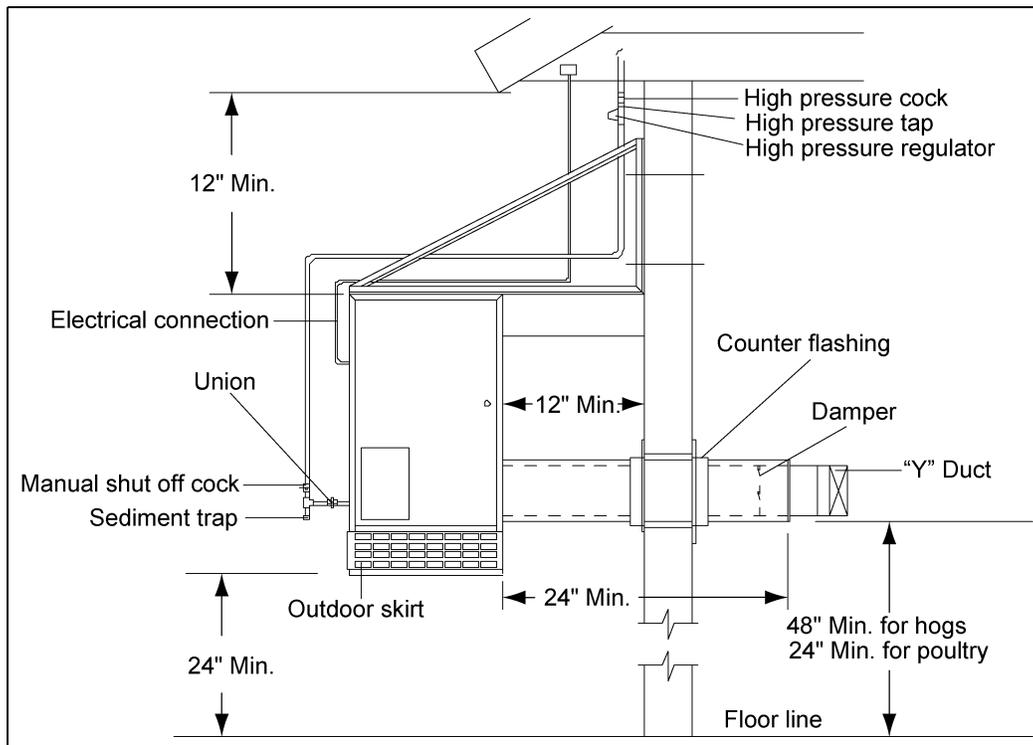


Figure 8B



**Do not use an open flame for leak detection.**

This heater must be installed in accordance with local codes or in the absence to local codes, in accordance with the National Electrical Code, ANSI/NFPA 70-1993.

**NOTE:** The gas supply piping must be properly sized for rated capacities. Refer to [Pages 49-50](#) for instructions and examples of pipe sizing.

**NOTE:** The gas piping must not be used to support the heater. If the installation subjects the heater to movement or vibration, a flexible gas connector may be required. When copper tubing is used for conveying natural gas, the tubing must be internally tinned or equivalently treated to resist sulfur corrosion.

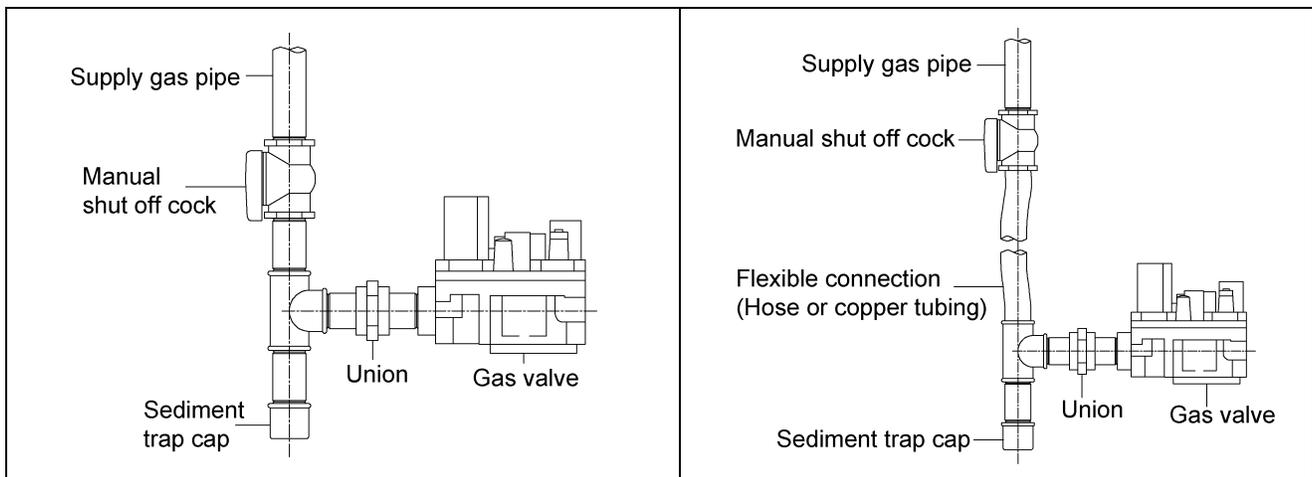


Figure 8C

## Instructions

**NOTE:** Read the following instructions carefully. Any unauthorized modifications to or deviations from these instructions may void warranty.

### Visual Inspection of Heater

1. Check for any physical damage from shipping or installation that could render the heater inoperable.
2. Check for loose components, burner, gas valve, motor, terminal screws, etc., and verify that the blower wheel rotates freely.
3. Verify that field wiring has been performed in accordance with Electrical Code ANSI/NFPA 70-1993.
4. Verify that supply gas line is properly connected and a sediment trap and shut off cock have been provided to the heater's gas inlet. Also verify that the high-pressure regulator, if applicable, has been vented to the outside of the building.
5. Visually inspect the gas hose for excessive abrasion, wear or cuts.
6. Verify that all external accessories have been installed and secured.

### Electrical Supply Voltage

Check electrical supply voltage and verify that it is compatible with the nameplate ratings. Ensure that the heater is properly grounded, and that the polarity is correct.

### Gas Leak Test

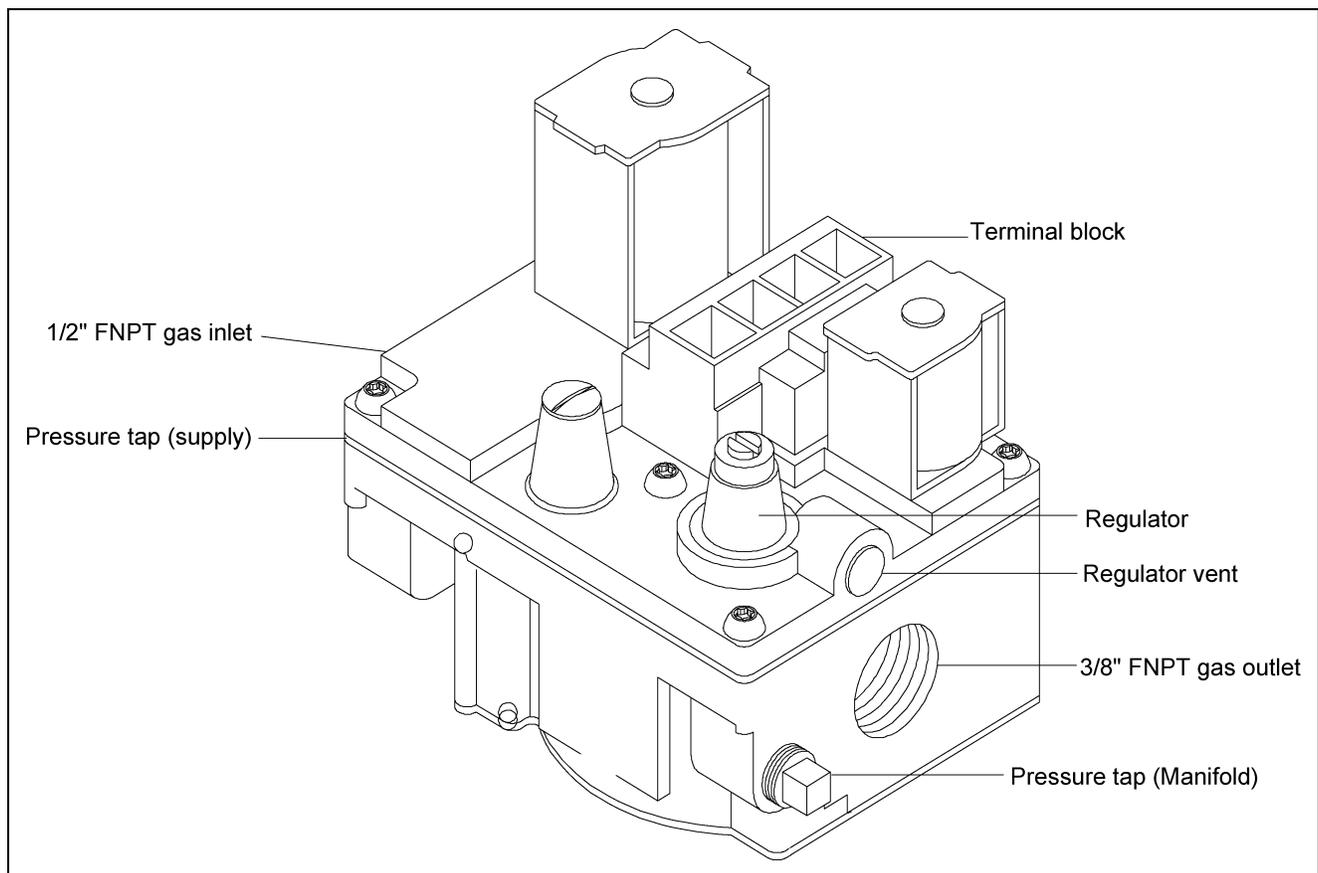
Check all gas connections for leak using a leak detector solution. Repair any gas leaks before test firing the burner or placing this heater into service.

### Adjust Supply Gas Pressure

1. Turn the supply gas OFF at the manual shut off cock upstream of the heater.
2. Remove the 1/8" plug located on the gas valve next to the supply gas inlet ([See Figure 9A on Page 28.](#)) and connect a manometer to the supply pressure tap.
3. Turn the supply gas ON at the manual shut off cock upstream of the heater.

**NOTE:** It may be necessary to bleed off the trapped gas in the manometer line to obtain a proper reading.

4. Turn ON all appliances connected to the gas line.
5. Verify that the supply gas pressure is less than 14" W.C. (1/2 PSI) and greater than that shown on the heater's nameplate for the minimum inlet gas supply pressure for the purpose of input adjustment.
6. Turn the supply gas OFF.



**Figure 9A**

7. Disconnect the manometer and replace the 1/8" plug.
8. Open the door to the burner side of the heater. Remove the 1/8" plug from the manifold side of the valve. Connect manometer as in step 2, then repeat step 3 and 4 when the solenoid engages to ignite the gas valve the reading on the gauge should read **a maximum of 11" W.C. for LPG, and 3.5" W.C. for NG. This reading is the manifold pressure for the unit and is the most important reading for actual heater output.** To adjust manifold pressure, remove the gas valve cover and slotted brass screw that covers the regulator. (See Figure 9A.) Turn the nylon regulator screw clockwise to increase pressure and counterclockwise to decrease pressure. When pressure is set, replace all covers and repeat steps 6 and 7.
9. Turn the supply gas ON.

**NOTE:** Each gas valve is set at the factory for NG or LPG use. To convert a unit already in field service to a different gas, the proper conversion kit must be purchased. The manifold pressure is set at the factory on an individual heater basis. This setting must be checked after field installation.

## Burner Operation

1. Set the operating thermostat (optional) to its highest setting.
2. Verify that inlet and discharge air are not restricted.
3. Place the selector switch located on the electrical control enclosure to the “ON” position.

**NOTE:** *The ignitor warm-up cycle is approximately 10 seconds prior to the automatic gas valve being energized. The automatic gas valve will remain energized for a maximum of 6 seconds during the ignition cycle. If a burner fails to ignite, the automatic gas valve will close. However, the blower will remain ON, purging the heater of any gas vapors. After 8 seconds of purging, the burner will again try for ignition. If the burner fails to ignite on the third try for ignition, the blower will purge the heater of any gas vapors, shut down and go into a lockout mode. The heater must be turned OFF for 3 seconds and then turned back ON to reset the lockout mode. Pre-purging of the gas line is required to avoid nuisance lockout.*

4. Verify the burner operation by checking that the flame is evenly spread.
5. Place the selector switch to the “OFF” position.
6. Repeat steps 3 through 5 several times to ensure proper ignition and burner operation.
7. Depending on when the heater is to be placed in service, follow the LIGHTING and/or SHUT DOWN instructions as applicable.

## Adjustment of Heater Input (Optional for C80M)

The model C80M is supplied with a manual modulating valve on the outlet of the automatic gas valve, prior to the orifice elbow, to permit the adjustment of the heating input between the minimum of 40000 BTU/Hr and the maximum input of 80000 BTU/Hr.

### General Maintenance Instructions

General maintenance should be performed before each use and at least annually by a qualified service agency.

**NOTE:** *Heater must be kept clear and free from combustible materials, gasoline and other flammable vapors and liquids.*

**NOTE:** *Periodic cleaning to be performed, as necessary.*

### Outside Casing Washdown

1. Disconnect electrical supply and turn OFF the gas supply to the heater.
2. Close and secure all access panel.
3. Spray the heater down with water only. DO NOT use cleaning solution.
4. Allow at least one (1) hour for the heater to completely dry before reconnecting the power cord to the electrical supply.

### Internal Components Cleaning

1. Check blower wheel for accumulation of dust on the concave side of the blades. Blades may be cleaned using bottle brush and compressed air. Check to ensure the flow of ventilation and combustion air is not restricted.
2. Check the burner and orifice. These parts should be kept clean and free from dust and carbon build-up. DO NOT touch the hot surface ignitor. Handling the ignitor could cause damage or premature failure. Remove the burner casting and clean out internally, using compressed air to remove dust and debris that may have accumulated during the off season (i.e. spider webs, wasp nests, feathers, etc.). Inspect the burner orifice for blockage. If necessary remove and clean reinstall burner.
3. Check the air proving switch for accumulation of dust or debris. Clean with a dry brush or cloth.

### Safety Inspection

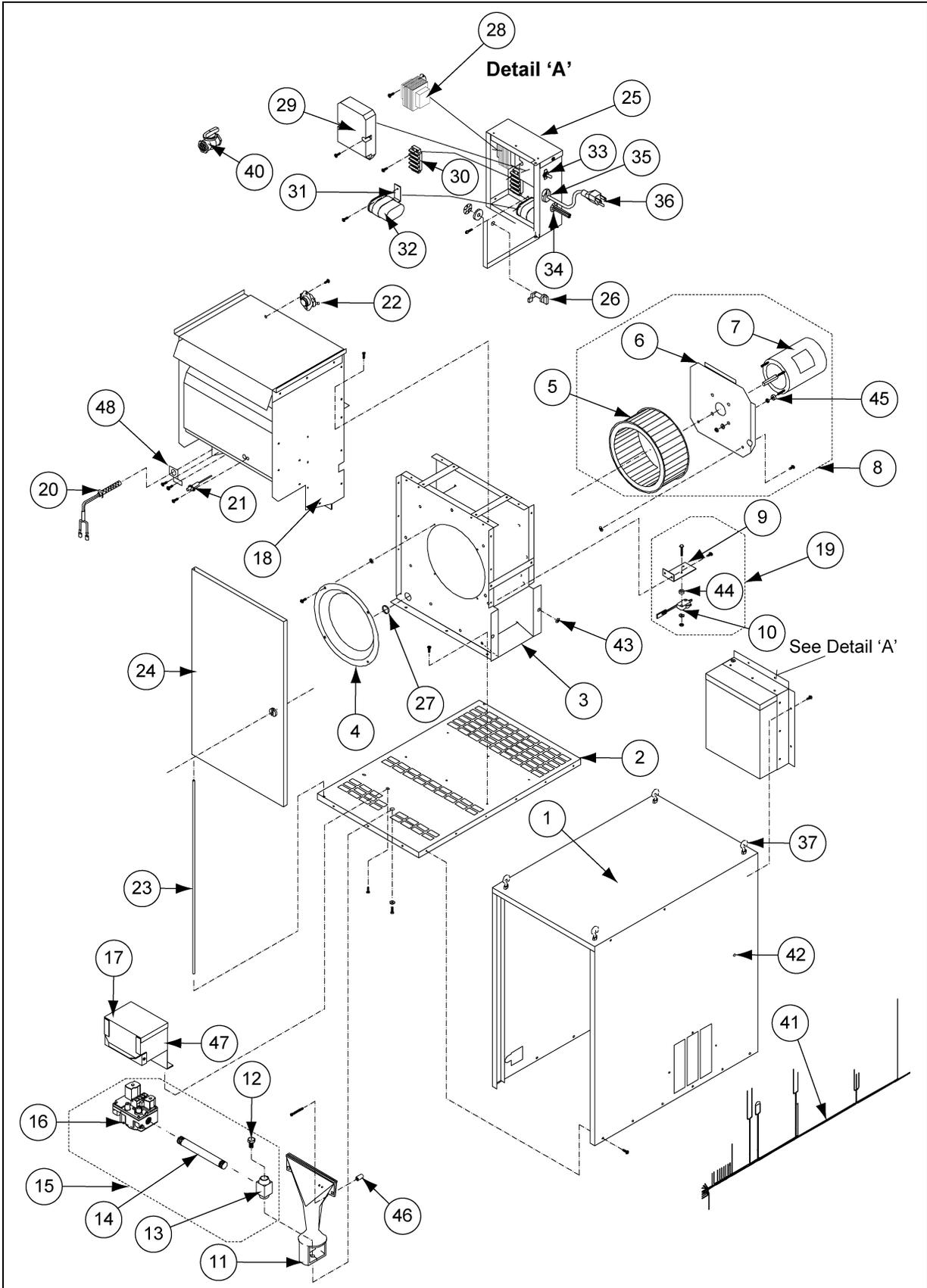
1. Inspect the heater for damage that could render the heater inoperable.
2. Inspect the mounting hardware to ensure that it is properly secured.
3. Inspect the power cord and hose assembly for cuts, abrasions or excessive wear. If the power cord or hose assembly is cut, it must be replaced prior to putting the heater in service.
4. Check all gas connections using leak detector solution.

1. C225 NG/LP Galv Purafire 120V-60 Hz
2. C225 X1 NG/LP Galv Purafire 220V-50/60 Hz
3. C80M NG/LP Galv Purafire 120V-60 Hz
4. C80M X1 NG/LP Galv Purafire 220V-50/60 Hz

For replacement parts contact  
your local dealer or contact  
Cumberland/AP at:

1004 E. Illinois St.  
Assumption, IL 62510  
Ph: 217-226-4421

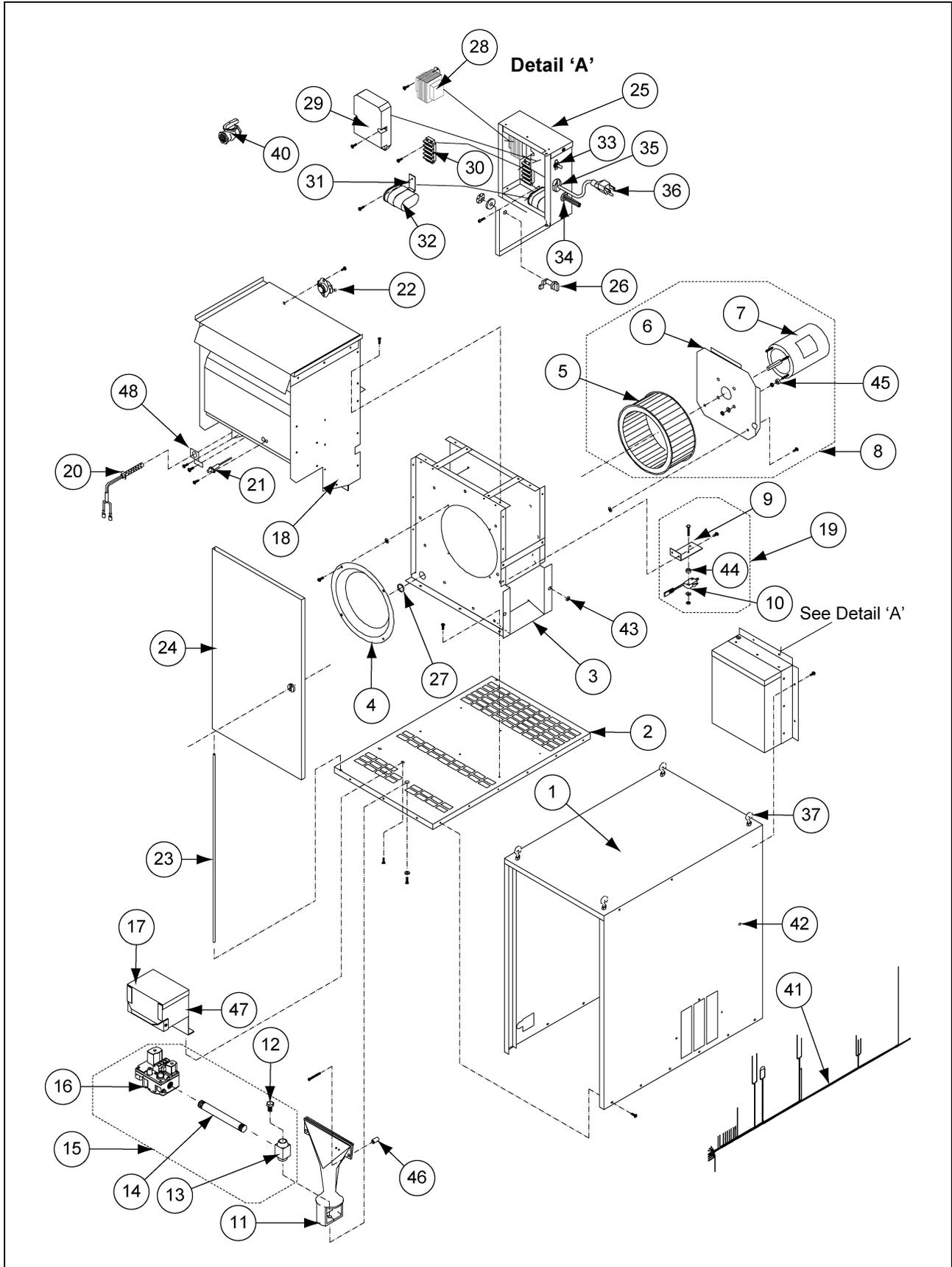
# C225 NG/LP Galv Purafire 120V-60 Hz



## C225 NG/LP Galv Purafire 120V-60 Hz

Ref #	Part #	Description
1	5430-1-914	Outer Wrap
2	5430-1-109	Base Panel
2	41-0211	Modulation Base Panel
3	5430-1-901	Scroll Assembly
4	20-5111	Blower Inlet Ring
5	20-5110	Blower Wheel
6	5530-1-106	Motor Mounting Plate
7	20-5099	Motor 1/3 HP, 120V/60 Hz
8	5430-0-902	Motor Assembly
9	5420-1-123	Air Proving Switch Bracket
10	20-6016	Air Proving Switch
11	20-5098	Main Cast Burner
12	20-5020	LP Orifice (#18 Hole)
12	20-5019	NG Orifice (19/64" Hole)
12	20-5020M	LP Orifice (#18 Hole) Modulation
12	20-5019M	NG Orifice (11/32" Hole) Modulation
13	20-5095	Orifice Elbow
14	20-5112	3/8" x 5-5/8" Blk Nipple
14	20-5112M	3/8" x 4-1/4" Blk Nipple
15	5430-0-905	LP Gas Valve/Orifice Assembly
15	5434-0-905	NG Gas Valve/Orifice Assembly
16	20-5025	LP Main Gas Valve
16	20-5026	NG Main Gas Valve
17	5420-1-128	Gas Valve Cover
18	5430-0-909	Firebox Assembly
19	5430-1-904	Air Proving Switch Assembly
20	20-5047M	24 Volt Ignitor (all models) Metal
21	20-5045	Flame Probe
26	20-5033	Latch
27	20-5007	Plastic Bushing
28	20-5036	Transformer 120V/24V
29	20-5001	Flame Safeguard Relay
30	20-5038	Terminal Block (4 Post)
31	5420-1-125	Capacitor Bracket
32	20-5037	Capacitor 7.5 MFD/370V
33	20-5060	Toggle Switch
34	20-5061	Plastic Bushing
35	20-5032	Strain Relief Bushing
36	20-5052	18/3" x 10' Cordset
37	20-5049	1/4"-20 x 2-5/8" Eye Bolt
40	20-5065	1/2" x 1/2" Gas Ball Valve
41	20-5430-1	Wiring Harness
42	20-505-5	LED Lens Assembly
43	20-5006	J-Type #8 Speed Nut
44	20-5015	#6 x 0.25" Tubular Spacer
45	20-5012	0.25" x 0.188" Tubular Spacer
46	20-5154	0.25" x 0.938" Tubular Spacer
47	20-5066	LP Modulation Valve
47	20-5067	NG Modulation Valve
48	41-9020	NG Metal Ignitor Bracket

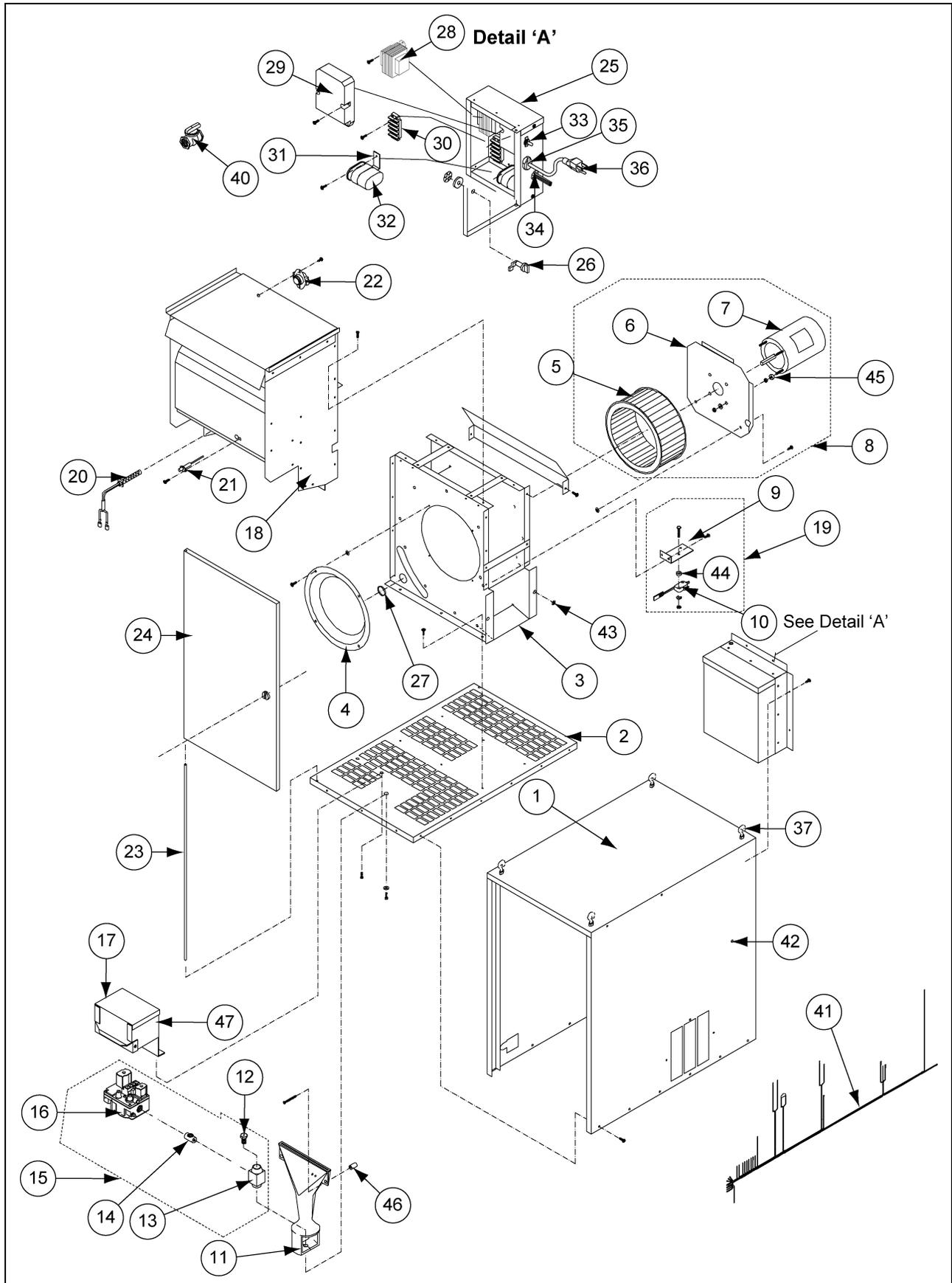
# C225 X1 NG/LP Galv Purafire 220V-50/60 Hz



## C225 X1 NG/LP Galv Purafire 220V-50/60 Hz

Ref #	Part #	Description
1	5430-1-914	Outer Wrap
2	5430-1-109	Base Panel
3	5430-2-901	Scroll Assembly
4	20-5111X	Blower Inlet Ring
5	20-5011X	Blower Wheel
6	5530-1-106	Motor Mounting Plate
7	20-5099X	Motor 1/3 HP, 220V/50 Hz
8	5430-2-902	Motor Assembly
9	5420-1-123	Air Proving Switch Bracket
10	20-6016	Air Proving Switch
11	20-5098	Main Cast Burner
12	20-5020	LP Orifice (#18 Hole)
12	20-5019	NG Orifice (19/64" Hole)
13	20-5095	Orifice Elbow
14	20-5112	3/8" x 5-5/8" Blk Nipple
15	5430-0-905	LP Gas Valve/Orifice Assembly
15	5434-0-905	NG Gas Valve/Orifice Assembly
16	20-5025	LP Main Gas Valve
16	20-5026	NG Main Gas Valve
17	5420-1-128	Gas Valve Cover
18	5430-0-909	Firebox Assembly
19	5430-1-904	Air Proving Switch Assembly
20	20-5047M	24 Volt Ignitor (all models) Metal
21	20-5045	Flame Probe
22	20-5046	High-Limit Switch
23	20-5092	Door Hinge Rod
24	5430-1-913	Door Assembly
25	5430-2-910	Control Enclosure Assembly
26	20-5033	Latch
27	20-5007	Plastic Bushing
28	20-5036X	Transformer 220V/24V
29	20-5001	Flame Safeguard Relay
30	20-5038	Terminal Block (4 Post)
31	5420-1-125	Capacitor Bracket
32	20-5037X	Capacitor 10.0 MFD/370V
33	20-5060	Toggle Switch
34	20-5061	Plastic Bushing
35	20-5032	Strain Relief Bushing
36	20-5052	18/3" x 10' Cordset
37	20-5049	1/4"-20 x 2-5/8" Eye Bolt
40	20-5065	1/2" x 1/2" Gas Ball Valve
41	20-5430-1	Wiring Harness
42	20-505-5	LED Lens Assembly
43	20-5006	J-Type #8 Speed Nut
44	20-5015	#6 x 0.25" Tubular Spacer
45	20-5012	0.25" x 0.188" Tubular Spacer
46	20-5154	0.25" x 0.938" Tubular Spacer
48	41-9020	NG Metal Ignitor Bracket

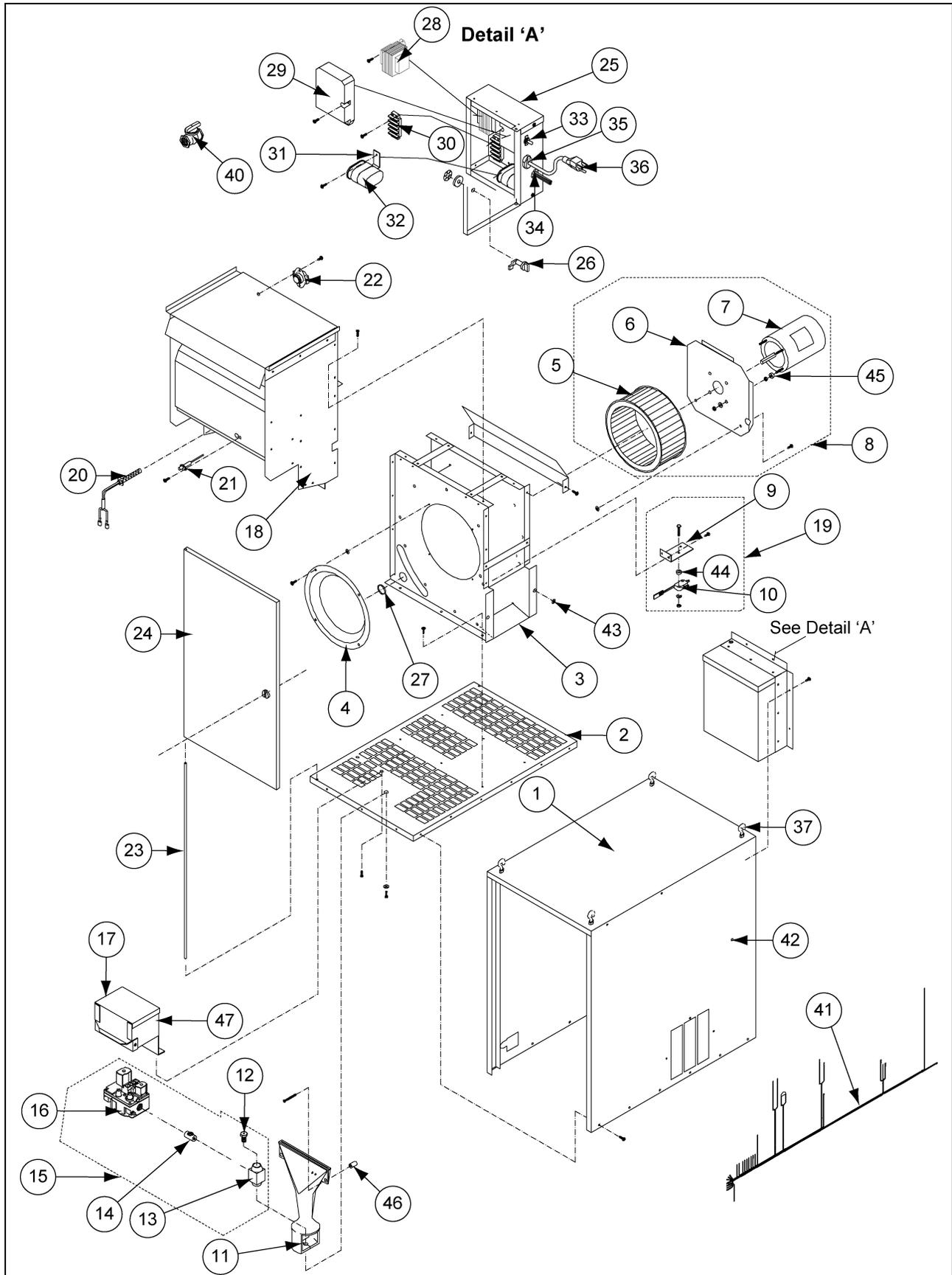
# C80M NG/LP Galv Purafire 120V-60 Hz



## C80M NG/LP Galv Purafire 120V-60 Hz

Ref #	Part #	Description
1	5420-1-914	Outer Wrap
2	5420-1-108	Base Panel
3	5420-0-901	Scroll Assembly
4	20-5005	Blower Inlet Ring
5	20-5008	Blower Wheel
6	5420-1-107	Motor Mounting Plate
7	20-5009	C80M Motor 1/8 HP, 120V, 60 Hz
8	5420-0-902	Motor Assembly
9	5420-1-123	Air Proving Switch Bracket
10	20-6016	Air Proving Switch
11	20-5010	Main Cast Burner
12	20-5137	LP Orifice (#38 Hole)
12	20-5136	NG Orifice (#14 Hole)
13	20-5022	Orifice Elbow
14	20-5028	LP Modulating Valve
14	20-5029	NG Modulating Valve
15	5424-0-905	LP Gas Valve/Orifice Assembly
15	5425-0-905	NG Gas Valve/Orifice Assembly
16	20-5025	LP Main Gas Valve
16	20-5026	NG Main Gas Valve
17	5420-1-128	Gas Valve Cover
18	5420-0-909	Firebox Assembly
19	5420-1-904	Air Proving Switch Assembly
20	20-5047M	24 Volt Ignitor (all models) Metal
21	20-5045	Flame Probe
22	20-5046	High-Limit Switch
23	20-5044	Door Hinge Rod
24	5420-1-913	Door Assembly
25	5420-0-910	Control Enclosure Assembly
26	20-5033	Latch
27	20-5007	Plastic Bushing
28	20-5036	Transformer 120V/24V
29	20-5001	Flame Safeguard Relay
30	20-5038	Terminal Block (4 Post)
31	5420-1-125	Capacitor Bracket
32	20-6007	Capacitor 5.0 MFD/370V
33	20-5060	Toggle Switch
34	20-5061	Plastic Bushing
35	20-5032	Strain Relief Bushing
36	20-5052	18/3" x 10' Cordset
37	20-5049	1/4"-20 x 2-5/8" Eye Bolt
40	20-5065	1/2" x 1/2" Gas Ball Valve
41	20-5430-1	Wiring Harness
42	20-505-5	LED Lens Assembly
43	20-5006	J-Type #8 Speed Nut
44	20-5015	#6 x 0.25" Tubular Spacer
45	20-5012	0.25" x 0.188" Tubular Spacer
46	20-5058	0.25" x 0.75" Tubular Spacer

# C80M X1 NG/LP Galv Purafire 220V-50/60 Hz



## C80M X1 NG/LP Galv Purafire 220V-50/60 Hz

Ref #	Part #	Description
1	5420-1-914	Outer Wrap
2	5420-1-108	Base Panel
3	5420-0-901	Scroll Assembly
4	20-5005	Blower Inlet Ring
5	20-5008	Blower Wheel
6	5420-1-107	Motor Mounting Plate
7	20-5009X	C80M Motor 0.11 HP, 220V, 50 Hz
8	5420-2-902	Motor Assembly
9	5420-1-123	Air Proving Switch Bracket
10	20-6016	Air Proving Switch
11	20-5010	Main Cast Burner
12	20-5137	LP Orifice (#38 Hole)
12	20-5136	NG Orifice (#14 Hole)
13	20-5022	Orifice Elbow
14	20-5028	LP Modulating Valve
14	20-5029	NG Modulating Valve
15	5424-0-905	LP Gas Valve/Orifice Assembly
15	5425-0-905	NG Gas Valve/Orifice Assembly
16	20-5025	LP Main Gas Valve
16	20-5026	NG Main Gas Valve
17	5420-1-128	Gas Valve Cover
18	5420-0-909	Firebox Assembly
19	5420-1-904	Air Proving Switch Assembly
20	20-5047M	24 Volt Ignitor (all models) Metal
21	20-5045	Flame Probe
22	20-5046	High-Limit Switch
23	20-5044	Door Hinge Rod
24	5420-1-913	Door Assembly
25	5420-2-910	Control Enclosure Assembly
26	20-5033	Latch
27	20-5007	Plastic Bushing
28	20-5036X	Transformer 220V/24V
29	20-5001	Flame Safeguard Relay
30	20-5038	Terminal Block (4 Post)
31	5420-1-125	Capacitor Bracket
32	20-6007	Capacitor 5.0 MFD/370V
33	20-5060	Toggle Switch
34	20-5061	Plastic Bushing
35	20-5032	Strain Relief Bushing
36	20-5052	18/3" x 10' Cordset
37	20-5049	1/4"-20 x 2-5/8" Eye Bolt
40	20-5065	1/2" x 1/2" Gas Ball Valve
41	20-5430-1	Wiring Harness
42	20-505-5	LED Lens Assembly
43	20-5006	J-Type #8 Speed Nut
44	20-5015	#6 x 0.25" Tubular Spacer
45	20-5012	0.25" x 0.188" Tubular Spacer
46	20-5058	0.25" x 0.75" Tubular Spacer

## 12. Troubleshooting Guide

Indicator	Possible Cause	Corrective Action
LED ON	Normal operation.	No problem.
LED OFF	Unit does not operate.	See #1 of the Troubleshooting Guide.
LED FLASH		
1. One (1) flash	1. Air proving switch contacts closed before blower operation was initiated.	1. See #6 of Troubleshooting Guide.
2. Two (2) flashes	2. Air proving switch contacts did not close or air proving switch opened after flame has been detected.	2. See #3, #5 and #7 of Troubleshooting Guide.
3. Three (3) flashes	3. Burner does not light and/or does not stay lit.	3. See #9 and #10 of Troubleshooting Guide.
4. Four (4) flashes	4. Flame signal interrupted during ignition trial, or defective flame safeguard relay module (FSR).	4. See #13 of Troubleshooting Guide. Replace the FSR module.

Possible Cause	Corrective Action
<b>1. Unit does not operate (no LED indication).</b>	
<ol style="list-style-type: none"> <li>1. No power to heater.</li> <li>2. Thermostat open or malfunction.</li> <li>3. Toggle switch open or malfunction.</li> <li>4. 24 Volt transformer.</li> <li>5. Flame safeguard relay module (FSR).</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and repair electrical supply.</li> <li>2. Reset or replace thermostat.</li> <li>3. Turn toggle switch to the "ON" position or replace.</li> <li>4. Check 24 volt power output of transformer across terminals #3 and #4 of terminal block. If no output voltage is detected, replace the transformer.</li> <li>5. Check 24 volt power input to terminal #9 on FSR. If power is not detected, replace the red wire going to terminal #4 of the TB1. If power is detected at terminal #9 on FSR, replace the FSR module.</li> </ol>
<b>2. Motor does not run (with LED indication).</b>	
<ol style="list-style-type: none"> <li>1. Air proving switch closed (one (1) flash).</li> <li>2. Air providing switch does not close (two (2) flashes).</li> <li>3. Motor tripped on overload protector (two (2) flashes).</li> <li>4. Motor malfunction (two (2) flashes).</li> <li>5. Burner fails to light (three (3) flashes).</li> <li>6. Flame safeguard relay module (FSR) malfunction (four (4) flashes).</li> </ol>	<ol style="list-style-type: none"> <li>1. See symptom #6 of the Troubleshooting Guide.</li> <li>2. See symptom #7 of the Troubleshooting Guide.</li> <li>3. See symptom #4 of the Troubleshooting Guide.</li> <li>4. Replace motor.</li> <li>5. See symptom #9 and #10 of the Troubleshooting Guide.</li> <li>6. See symptom #13 of the Troubleshooting Guide or replace the FSR module.</li> </ol>
<b>3. Motor does not start, but hums or runs slowly (two (2) flashes).</b>	
<ol style="list-style-type: none"> <li>1. Blower wheel binding.</li> <li>2. Motor binding.</li> <li>3. Capacitor inoperative.</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove obstruction, realign and secure the blower wheel or replace damaged blower wheel.</li> <li>2. Replace the motor.</li> <li>3. Replace the capacitor.</li> </ol>
<b>4. Motor trips on thermal overload (two (2) flashes).</b>	
<ol style="list-style-type: none"> <li>1. Low voltage.</li> <li>2. Low gas flow.</li> <li>3. High motor Amps (with burner operating).</li> <li>4. Weak motor capacitor.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check power input with heater running at terminals #1 and #2 of TB1. Voltage should be that specified on the nameplate. If not correct values, check power source to determine if wiring to heater has excessive voltage drop.</li> <li>2. See symptom #13 of the Troubleshooting Guide.</li> <li>3. Replace motor.</li> <li>4. Replace capacitor.</li> </ol>
<b>5. Motor starts, then stops.</b>	
<ol style="list-style-type: none"> <li>1. Air proving switch contacts do not close (two (2) flashes).</li> <li>2. Burner does not light and/or does not stay lit (three (3) flashes).</li> <li>3. Motor trips on thermal protector (two (2) flashes).</li> </ol>	<ol style="list-style-type: none"> <li>1. See symptom #7 of the Troubleshooting Guide.</li> <li>2. See symptom #9 and #10 of the Troubleshooting Guide.</li> <li>3. See symptom #4 of the Troubleshooting Guide.</li> </ol>

## 12. Troubleshooting Guide

Possible Cause	Corrective Action
<b>6. Air proving switch does not open (one (1) flash).</b>	
1. Air proving switch binding.	1. Adjust the air switch to move freely or replace the air proving switch.
2. Air proving switch malfunction.	2. Replace the air proving switch.
<b>7. Air proving switch does not close (two (2) flashes).</b>	
1. Obstruction or flapper arm bent.	1. Remove obstruction, or adjust the air proving switch to move freely, or replace the air proving switch.
2. Low air flow.	2. Check for inlet and/or discharge obstruction and clean blower wheel. Check for loose or misaligned blower wheel. Realign and secure. Replace damaged blower wheel.
3. Motor does not run.	3. See symptom #2 of the Troubleshooting Guide.
4. Motor tripped on thermal protector.	4. See symptom #4 of the Troubleshooting Guide.
5. Loose or broken wire.	5. Repair or replace wire.
<b>8. High-Limit open (three (3) flashes).</b>	
1. High-Limit tripped.	1. Reset the High-Limit and review additional possible cause shown in (2) through (5).
2. Low air flow.	2. Check for inlet and/or discharge obstructions. Clean blower wheel. Realign and secure. Replace damaged blower wheel. Replace weak capacitor or replace weak motor, as applicable.
3. Over firing.	3. Check gas type (LP or NG). Check supply gas pressure. Check manifold gas pressure. Check burner orifice size.
4. Malfunction High-Limit.	4. Replace the High-Limit.
5. Burner flame does not shut off.	5. See symptom #14 of the Troubleshooting Guide.
<b>9. Burner lights, but will not stay lit (three (3) flashes).</b>	
1. Unit not properly grounded.	1. Check tightness of ground wires at the blower and ground screws in the electrical control enclosure.
2. Oxidation/corrosion on the flame rod.	2. Sand off oxidation/corrosion.
3. Flame rod not sensing flame.	3. Replace the flame rod. Flame rod grounded.
4. Low gas flow.	4. See symptom #13 of the Troubleshooting Guide.
<b>10. Burner will not light (three (3) flashes).</b>	
1. No fuel to heater.	1. Check gas supply. Check all manual shut off cocks in the supply line.
2. Low gas flow.	2. See symptom #13 of the Troubleshooting Guide.
3. Ignitor does not light burner.	3. See symptom #11 of the Troubleshooting Guide.
4. Automatic gas valve not opening.	4. See symptom #12 of the Troubleshooting Guide.

Possible Cause	Corrective Action
<b>11. Ignitor does not light burner (three (3) flashes).</b>	
<ol style="list-style-type: none"> <li>1. High-Limit open.</li> <li>2. Low voltage to ignitor.</li> <li>3. Flame safeguard relay module (FSR) malfunction.</li> <li>4. Low gas flow.</li> <li>5. Ignitor misaligned.</li> <li>6. Ignitor malfunction.</li> </ol>	<ol style="list-style-type: none"> <li>1. See symptom #8 of the Troubleshooting Guide.</li> <li>2. Check 24 volt power output to transformer across terminals 3 and 4 of terminal block. If meter reading is below 24 volts, see symptom #4 (1) of Troubleshooting Guide. If transformer output is zero, but voltage at terminals 1 and 2 of terminal block is of line voltage, replace transformer.</li> <li>3. Check output voltage from terminal #5 (FSR) during trial for ignition to ensure voltage exceeds 24 volts. If not, replace FSR module.</li> <li>4. See symptom #13 of the Troubleshooting Guide.</li> <li>5. Check mounting of ignitor to ensure it is secure.</li> <li>6. Replace ignitor.</li> </ol>
<b>12. Automatic gas valve not opening (three (3) flashes).</b>	
<ol style="list-style-type: none"> <li>1. High-Limit open.</li> <li>2. Flame safeguard relay module (FSR) malfunction.</li> <li>3. Dirt or sediment in automatic gas valve.</li> <li>4. Loose or broken wire.</li> <li>5. Gas valve malfunction.</li> <li>6. Ignition malfunction.</li> </ol>	<ol style="list-style-type: none"> <li>1. See symptom #8 of the Troubleshooting Guide.</li> <li>2. Check voltage output terminal #8 (FSR) during trial for ignition to ensure voltage exceeds 24 volts. If not, replace FSR module.</li> <li>3. Clean and replace all gas supply lines and install a sediment trap at the heater's gas inlet. <b>ALL AUTOMATIC GAS VALVES INSTALLED ON CONTAMINATED SUPPLY LINES WITHOUT SEDIMENT TRAPS MUST BE REPLACED.</b></li> <li>4. Repair or replace wire.</li> <li>5. Replace ignitor.</li> <li>6. Replace ignitor.</li> </ol>

## 12. Troubleshooting Guide

Possible Cause	Corrective Action
<b>13. Low gas flow/low operating pressure (two (2) or three (3) flashes).</b>	
<ol style="list-style-type: none"> <li>1. Air in gas line.</li> <li>2. High-pressure regulator (malfunction).</li> <li>3. Closed or partially closed gas supply cock(s).</li> <li>4. Gas supply piping undersized.</li> <li>5. Improper fuel.</li> <li>6. Improper manifold pressure.</li> <li>7. Blockage between automatic gas valve and orifice.</li> <li>8. Burner flow restriction.</li> <li>9. Orifice alignment.</li> <li>10. Dirt or sediment in automatic gas valve.</li> </ol>	<ol style="list-style-type: none"> <li>1. Purge gas line.</li> <li>2. Check regulator output setting, relief vent blockage, water or ice accumulation, regulator seat sticking or undersized regulator.</li> <li>3. Check gas supply line to ensure all gas cocks are fully open.</li> <li>4. Analyze gas supply distribution system for proper sizing.</li> <li>5. Check heater nameplate for gas type (LP or NG).</li> <li>6. Check automatic gas valve regulator setting for compliance with heater nameplate.</li> <li>7. Check gas way between automatic gas valve and orifice outlet and clean, as required.</li> <li>8. Clean burner passageway.</li> <li>9. Check for proper orifice alignment.</li> <li>10. Clean and replace all gas supply lines and install a sediment trap at the heater's gas inlet. ALL AUTOMATIC GAS VALVES INSTALLED ON CONTAMINATED SUPPLY LINES WITHOUT SEDIMENT TRAPS MUST BE REPLACED.</li> </ol>
<b>14. Burner does not shut off.</b>	
<ol style="list-style-type: none"> <li>1. Dirt or sediment in automatic gas valve.</li> <li>2. Defective automatic gas valve.</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean or replace all gas supply lines and install a sediment trap at the heater's gas inlet. ALL AUTOMATIC GAS VALVES INSTALLED ON CONTAMINATED SUPPLY LINES WITHOUT SEDIMENT TRAPS MUST BE REPLACED.</li> <li>2. Replace automatic gas valve but check supply pressure to insure gas pressure is below 14" W.C. (1/2 PSI).</li> </ol>

## Troubleshooting Supplement

### Summary of Events for Proper Operation

The components of the heater work in conjunction with each other to provide safe and reliable heat when maintained properly. The sequence of events leading to a consistent output of heat are easy to understand and to troubleshoot.

1. Power to the heater is turned ON.
2. Brain box performs self-diagnostic check.
3. Brain box ensures that no current passes through the air proving switch.
4. Power is sent to the blower motor.
5. Air from the motor pushes the air proving switch forward allowing current to pass through it.
6. Brain box ensures that ignitor is functioning properly.
7. Current is sent through the High-Limit thermostat to the gas valve.
8. Flame probe verifies that flame is present.
9. Heater continues to run until power is shut off.

### Troubleshooting Heater

Before attempting to troubleshoot, ensure that all wires are in their proper positions and connected securely. It is important that these steps are completed in the order that they are presented.

**NOTE:** *All testing should be done by a qualified technician.*

1. Plug heater into power supply and turn the heater ON.

If the blower motor does not turn ON, the **LED will flash either 1 or 4 times.**

One (1) flashes: Air proving switch stuck in the closed position. Free or replace switch.

Four (4) flashes: Brain box failed self-diagnostic check. Replace brain box.

2. Using a voltmeter, check the voltage across terminals #1 and #2 on the terminal block. This voltage should be between 210 and 230 VAC on 50 Hz and 105-125 VAC on 60 Hz. If it is not, check the power supply.
3. Check the voltage across terminals #3 and #4 on the terminal block. This voltage should be between 18 and 26 VAC. If it is not, replace the transformer.
4. Turn the heater OFF. Disconnect the orange wire from terminal #10 on the brain box. Attach one (1) lead of the voltmeter to the orange wire and the other lead to ground. Turn the heater ON. When the blower motor forces enough air to close the air proving switch, the voltmeter should read about 24 VAC. If no voltage is read, replace air proving switch. If the motor does not start or runs slowly, check for a dirty blower wheel or bad capacitor.

If the air proving switch does not close after blower motor energizes, the **LED will flash 2 times.**

5. Turn the heater OFF. Reconnect the orange wire to terminal #10 of the brain box. Disconnect the gray wire from terminal #5 of the brain box. Connect one (1) lead of the voltmeter to terminal #5 and the other to ground. Turn the heater ON. About 3 seconds after the air proving switch closes, the voltmeter should read about 24 VAC. If no voltage is read, replace the brain box. If ignitor glows a dull, red-orange color, disconnect ignitor wires and place an ohmmeter across them. The ohmmeter should read between 2 and 6 ohms. If the reading is not within this range, replace the ignitor. **LED will flash 3 times** if ignitor is bad.

### Troubleshooting Heater (Continued)

6. Turn the heater OFF. Reconnect the gray wire to terminal #5 of the brain box. Disconnect the yellow wire from terminal #8 of the brain box. Connect one (1) lead of the voltmeter to terminal #8 and the other to ground. Turn the heater ON. About 9 seconds after the air proving switch closes, the voltmeter should read about 24 VAC. If no voltage is read, replace the brain box.
7. Turn the heater OFF. Reconnect the yellow wire to terminal #8 of the brain box. Connect one (1) lead of the voltmeter to the pink wire on the gas valve and the other to ground. Turn the heater ON. About 9 seconds after the air proving switch closes, the voltmeter should read about 24 VAC. If no voltage is read, check the High-Limit switch. **LED will flash 3 times** if High-Limit switch is open.
8. If voltage is present at the gas valve, but it does not open, it may be pressure-locked. To reset, shut off the gas supply and remove both plugs from the pressure taps from the gas valve. Replace plugs and slowly turn gas ON. (Turning the gas rapidly causes pressure-lock) If the valve is not pressure-locked and still does not allow gas to pass, replace the gas valve. **LED will flash 3 times** if gas valve is not working properly.
9. Turn the heater OFF. Connect one (1) lead of an ohmmeter to the blue wire at the flame probe and the other to ground. The meter should show no continuity. If continuity is shown, check for a short to ground. If no short is found, replace the brain box.

**NOTE:** For this step, you must use a digital voltmeter.

10. Turn the heater ON. Connect one (1) lead of a voltmeter to the blue wire at the flame probe and the other to ground. The voltmeter should read between 35 and 100 VAC. If it does not, remove the flame probe and clean off any corrosion, replace the flame probe and recheck the voltage. If it is still not within the specified range, the brain box may need to be replaced.

**NOTE:** For this step, you can use an analog or digital ammeter.

11. With the heater OFF, connect one (1) lead of the ammeter to the flame probe. Connect the other to the blue wire. Set the meter to the **DC** micro-amp (not milli-amp) range. Turn the heater ON. The ammeter should read at least 1.3 amps. If it does not, remove the bolt that centers the orifice body in the main cast burner. Use a piece of sandpaper or emery cloth to “shine” the bottom of the burner and the sheet-metal base that it contacts. Replace the bolt. Ensure that all electrical grounds are secure. Turn the heater ON. If the ammeter reading does not improve, replace the brain box.
12. If all readings are within the specified range and the heater still does not operate correctly, contact a qualified service representative.

## Checking Gas Pressure

**NOTE:** *All gas appliances must be running while checking gas pressures. Checking one appliance at a time may result in false pressure readings if gas piping is undersized.*

1. Turn the electrical and gas supplies to the heater OFF.
2. Using a 3/16" allen wrench, remove the plug from the gas valve and install a manometer. Reconnect the electrical and gas supply to the heater and turn ON. Adjust regulator to the pressure listed on the heater's nameplate. If nameplate pressure cannot be obtained, contact the local gas company.
3. Turn the heater OFF. The incoming gas pressure at zero flow must be lower than 14" W.C. to prevent the gas valve from pressure locking.
4. Repeat step 1, remove the manometer and replace the plug.
5. Using a 5/16" open-end wrench, remove plug from the gas valve inside the heater. Install the manometer and reconnect the electrical and gas supply. Turn heater ON and observe the manometer's reading. If it is more than 5" W.C. less than the reading taken in step 2, replace the gas valve.

## 14. Pipe Sizing Guidelines

---

All gas appliances require a specific amount of gas to operate properly. The amount is measured in BTU's/Hr and is listed on the appliance's nameplate. It is important that all regulators and supply piping be sized correctly to achieve the proper flow (volume) of gas to the appliance.

### Regulators

Regulators are devices that control the delivery pressure to the appliance. They are designed to take a varying inlet pressure and provide a steady delivery pressure. Every regulator has a maximum pressure rating and volume capacity. Only use regulators that can handle the requirements of the installation. Regulators typically come in two (2) styles: Primary and secondary. The primary regulators typically convert higher pressures down to medium pressures, for example, 50 PSI to 10 PSI. They are usually supplied by the local gas or utility company. Secondary regulators typically convert medium pressures down to low pressures, for example, 10 PSI to 14" of water column. (1 PSI is equal to 2.8" of water column (2.8" W.C.)).

All regulators have a vent that allows the internal diaphragm to "breathe" freely. This vent must be protected from the rain, dirt and insects. A clogged vent will slow the regulator's performance and could result in over firing of equipment or nuisance locking of the gas valve. If regulators are installed inside the building, they must be vented properly to the outdoors unless they are equipped with a vent-limiting device. The vent-limiting device controls the amount of gas that could leak into the atmosphere in case of a punctured diaphragm. However, regulators that are equipped with vent-limiting devices are position sensitive and must be installed according to the manufacturer's recommendations to achieve proper regulator performance. Refer to the regulator's instruction page for more information.

In general, the regulator will perform best when its inlet pressure is near the regulator's maximum rating and is placed as close to the appliance as possible. The gas valve on the heater uses an electric solenoid to open and close the gas flow. Because the solenoid operates much more quickly than the mechanical lever in the regulator, an increase of pressure will occur in the piping between the heater and the regulator when the heater shuts down. This is called the "lock-up pressure". If the lock-up pressure exceeds the gas valve's maximum, the valve will "pressure-lock". This is a condition where the solenoid does not have sufficient power to overcome the pressure to open the valve. If the pressure is relieved, the gas valve will operate normally. The lock-up pressure can be kept to a minimum by increasing the inlet pressure to the regulator, ensuring that the vent is working properly, and by placing the regulator close to the appliance.

When checking and setting pressures, it is important to have ALL gas appliances running. This ensures that the adequate volume of gas will be available under any conditions. If all appliances are not running when pressures are checked, false reading could lead to improper settings. This could cause inefficient combustion and intermittent problems with the heater. It is important to note that propane tanks must be sized to match BTU requirements of an installation. A tank that is not sized correctly will frost up and not provide the proper pressure to the appliance. This often occurs at night when the temperature is lower. The lower temperatures cause the building's heater to run more often. This causes an increase demand on the propane supply. Because the propane tank cannot produce as much pressure when it is cooler (or when the propane level is low), the heaters may not work properly. Contact the local supplier for information concerning tank sizing.

By knowing the BTU requirements of an installation, the proper pipe size can be determined. The amount of gas that can flow in a given pipe size is determined by its pressure. If a large pipe and a small pipe both have the same pressure, the large pipe will deliver a greater amount of gas. Also, increasing the pressure in a pipe will increase the volume of gas that it can carry. However, it is important not to exceed pressure ratings that are listed on regulators, fittings, and gas valves. Because the pipe that supplies the appliance is fixed in size, pressure is used to determine the volume of gas that is available. If the pressure at the orifice is too high, the gas valve could pressure-lock or the High-Limit switch could trip due to excess temperature. If the pressure at the orifice is too low, the heater will not run efficiently and may experience problems lighting or staying lit. Low gas pressure can also increase the regulator's lock-up pressure which can pressure-lock the gas valve. The most frequent cause of low gas pressure is undersized piping. This can occur on both the low and high pressure sides of the regulator.

It is usually more cost efficient to use high pressure (above 1 PSI) on longer lengths of pipe. The higher pressures will allow the use of smaller (less expensive) pipe sizes. In fact, the savings in the cost of the pipe will be more than pay for the cost of additional secondary regulators. The use of multiple secondary regulators will also provide more accurate control of the pressure setting.

To determine the proper size of a gas line, four (4) factors must be known:

1. The type of gas being used. (i.e. Propane or natural gas).
2. The pressure to be maintained in the pipe.
3. The distance from the supply to the appliance that is the farthest away.
4. The BTU requirements of each appliance. Be sure to include any additional appliances that may be added in the future.

Factors (1) and (2) determine which chart to use for the sizing.

Factor (3) determines which line of the chart to use. If the exact distance is not listed on the chart, use the next longest distance. **This is the only line that will be used for the pipe sizing.** Factor (4) will determine the pipe size for each section of the supply piping.

### Instruction for Sizing Pipe

1. Making a sketch of the installation as seen in the examples.
2. Note the maximum demand of each appliance. Be sure to include any appliance that may be added in the future.
3. Label each junction with a letter as seen in the examples.
4. Find the distance from the gas meter, regulator, or tank to the appliance farthest away.
5. Calculate the total BTU demand for each section of piping.
6. Refer to the chart with the desired gas and pressure. (i.e. Propane @ 5 PSI)
7. Find the distance which is equal to **or greater** than the number determined in step #4. *This is the only line that will be used for the pipe sizing.*
8. Determine the smallest pipe which has a BTU capacity equal to **or greater** than the demand for each section.

**NOTE:** *When the required pipe size is larger than the inlet or outlet side of a regulator, use a bell reducer or bushing immediately entering or exiting the regulator.*

## 15. Examples

### Example 1

Determine the pipe sizing for a 2 PSI Natural Gas installation.

Because the appliance near junction N is farthest away from the gas meter, use this distance. Section A-N is 95' long. Use the 100' line on the "Natural Gas @ 2 PSI" chart.

Section	BTU Demand	Pipe Size
A-B	1220	1-1/4"
B-D	305	1"
B-C	915	1-1/4"
C-I	610	1"
I-L	305	1"
L-M	305	1"
M-N	80	1"

**NOTE:** Sections I-K, C-H, and D-F are identical to the section L-N and should also use 1" pipe.

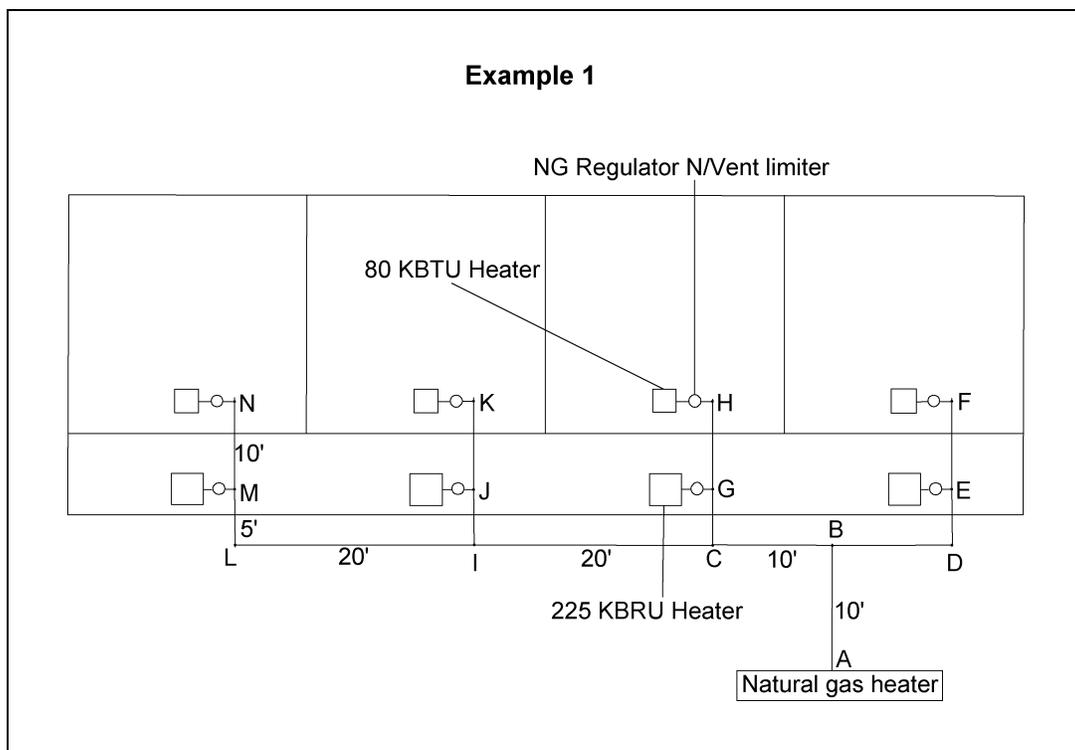


Figure 15A

**Example 2**

Determine the pipe size for a 5 PSI Propane “High Pressure” installation.

Because the appliance near junction E is the farthest away from the LP tank, use this distance. Section A-E is 380' long. Use the 400' line on the “Propane @ 5 PSI” chart.

Section	BTU Demand	Pipe Size
A-B	900	1"
B-C	675	3/4"
C-D	450	1/2"
D-E	225	1/2"

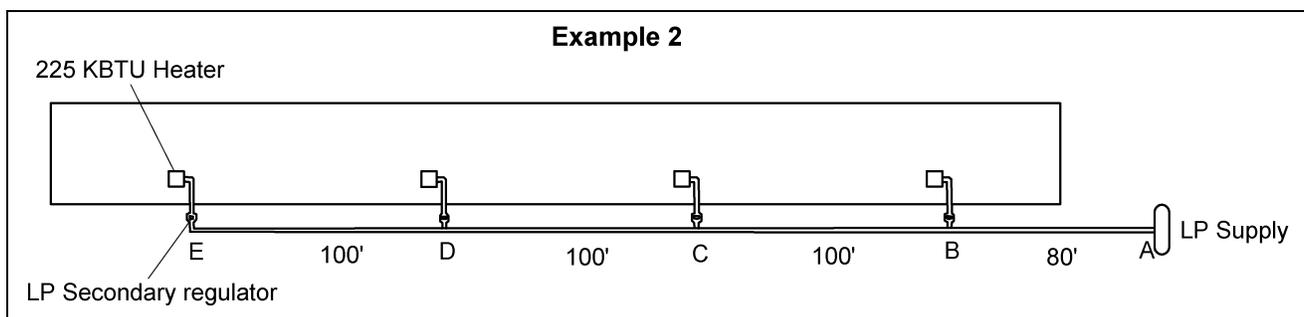


Figure 15B

**Example 3**

Determine the pipe size for an 11" water column “Low Pressure” installation. The primary regulator on the tank is set for 10 PSI delivery pressure.

Because there will be two (2) different pressure ranges, two (2) different charts will be used.

High Pressure line: Section A-B is 30' long. Use the 30' line on the “Propane @ 10 PSI” chart.

Section	BTU Demand	Pipe Size
A-B	900	1/2"

Low Pressure line: Section B-F is 350' long. Use the 350' line on the “Propane @ 11" W.C.” chart.

Section	BTU Demand	Pipe Size
B-C	900	2-1/2"
C-D	675	2"
D-E	450	1-1/2"
E-F	225	1-1/4"

**NOTE:** When the required pipe size is larger than the inlet or outlet side of a regulator, use a bell reducer or bushing immediately entering or exiting the regulator.

## 15. Examples

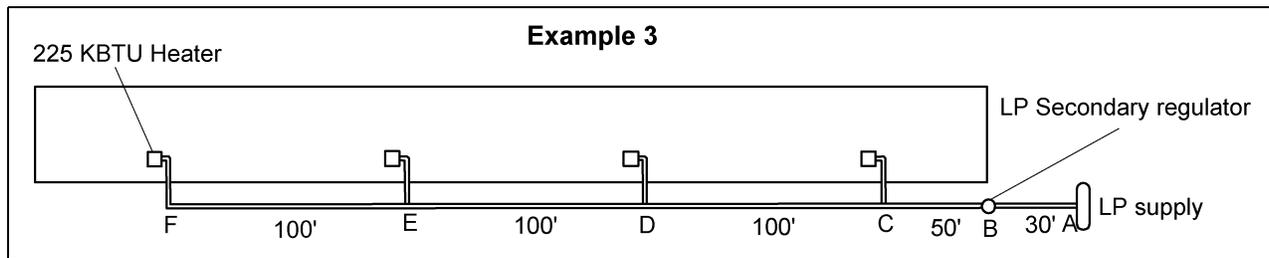


Figure 15C

**Natural Gas (0.60) @ 14" W.C Based on 0.3" Pressure Drop (1000's BTU/Hr)**

Pipe Length (ft.)	Nominal Pipe Size (SCH.40)										
	1/4"	3/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"
10	32	72	132	278	520	1050	1600	3050	4800	8500	17500
20	22	49	92	190	350	730	1100	2100	3300	5900	12000
30	18	40	73	152	285	590	890	1650	2700	4700	9700
40	15	34	63	130	245	500	760	1450	2300	4100	8300
50	14	30	56	115	215	440	670	1270	2000	3600	7400
60	12	27	50	105	195	400	610	1150	1850	3250	6800
70	11	25	46	96	180	370	560	1050	1700	3000	6200
80	11	23	43	90	170	350	530	990	1600	2800	5800
90	10	22	40	84	160	320	490	930	1500	2600	5400
100	9	21	38	79	150	305	460	870	1400	2500	5100
125	8	18	34	72	130	275	410	780	1250	2200	4500
150	8	17	31	64	120	250	380	710	1130	2000	4100
175	7	15	28	59	110	225	350	650	1050	1850	3800
200	6	14	26	55	100	210	320	610	980	1700	3500

Source: Natural Fuel Gas Code 5<sup>th</sup> Edition 8/28/92

**Natural Gas (0.60 SP. GR.): @ 2 PSI Based on 10% Pressure Drop (1000's BTU/Hr)**

Pipe Length (ft.)	Nominal Pipe Size (SCH.40)									
	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	5"	6"
50	1112	2283	3421	6589	10501	18564	27181	37865	68504	110924
100	764	1569	2351	4528	7217	12759	18681	26025	47082	76237
150	614	1260	1888	3636	5796	10246	15002	20899	37809	61221
200	525	1079	1616	3112	4961	8769	12840	17887	32359	52397
250	466	956	1432	2758	4396	7772	11379	15853	28680	46439
300	422	866	1298	2499	3983	7042	10311	14364	25986	42077
400	361	741	1111	2139	3409	6027	8825	12293	22240	36012
500	320	657	984	1896	3022	5342	7821	10895	19711	31917
1000	220	457	677	1303	2077	3671	5375	7488	13547	21936
1500	177	363	543	1046	1668	2948	4317	6013	10879	17616
2000	151	310	465	896	1427	2523	3694	5147	9311	15077

Source: Natural Fuel Gas Code 5<sup>th</sup> Edition 8/28/92

**Natural Gas (0.60 SP. GR.): @ 5 PSI Based on 10% Pressure Drop (1000's BTU/Hr)**

Pipe Length (ft.)	Nominal Pipe Size (SCH.40)									
	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	5"	6"
50	1989	4084	6120	11786	18785	33209	48623	67736	122544	198427
100	1367	2807	4206	8101	12911	22824	33418	46555	84224	136378
150	1098	2254	3378	6505	10368	18329	26836	37385	67635	109516
200	940	1929	2891	5567	8874	15687	22968	31997	57887	93732
250	833	1710	2562	4934	7865	13903	20356	28358	51304	83073
300	755	1549	2321	4471	7126	12597	18444	25694	46485	75270
400	646	1326	1987	3827	6099	10782	15786	21991	39785	64421
500	572	1175	1761	3391	5405	9556	13991	19490	35261	57095
1000	393	808	1210	2331	3715	6568	9616	13396	24235	39241
1500	316	649	972	1872	2983	5274	7722	10757	19461	31512
2000	270	555	832	1602	2553	4514	6609	9207	16656	26970

Source: Natural Fuel Gas Code 5<sup>th</sup> Edition 8/28/92**Natural Gas (0.60 SP. GR.): @ 10 PSI Based on 10% Pressure Drop (1000's BTU/Hr)**

Pipe Length (ft.)	Nominal Pipe Size (SCH.40)									
	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	5"	6"
50	3259	6690	10024	19305	30769	54395	79642	110948	200720	325013
100	2240	4598	6889	13268	21148	37385	54737	76254	137945	223379
150	1798	3692	5532	10655	16982	30022	43956	61235	110782	179382
200	1539	3160	4735	9119	14535	25695	37621	52409	94815	153527
250	1364	2801	4197	8082	12882	22773	33343	46449	84033	136068
300	1236	2538	3802	7323	11672	20634	30211	42086	76140	123288
400	1058	2172	3254	6268	9990	17660	25857	36020	65166	105518
500	938	1925	2884	5555	8854	15652	22916	31924	57755	93519
1000	644	1323	1982	3818	6085	10757	15750	21941	39695	64275
1500	517	1062	1592	3066	4886	8638	12648	17620	31876	51615
2000	443	909	1362	2624	4182	7393	10825	15080	27282	44176

Source: Natural Fuel Gas Code 5<sup>th</sup> Edition 8/28/92

## 15. Examples

### Propane Gas (1.53 SP. GR.): @ 11 W.C. Based on 0.5" W.C. Pressure Drop (1000's BTU/Hr)

Pipe Length (ft.)	Tubing Size (O.D.) Type L						Nominal Pipe Size (SCH.40)								
	3/8"	1/2"	5/8"	3/4"	7/8"	1-1/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"
10	39	92	199	329	501	935	275	567	1071	2205	3307	6221	10140	17990	36710
20	26	62	131	216	346	630	189	393	732	1496	2299	4331	7046	12510	25520
30	21	50	107	181	277	500	152	315	590	1212	1858	3465	5695	10110	20620
40	19	41	90	145	233	427	129	267	504	1039	1559	2992	4778	8481	17300
50	18	37	79	131	198	376	114	237	448	913	1417	2646	4343	7708	15730
60	16	35	72	121	187	340	103	217	409	834	1275	2394	3908	6936	14150
80	13	29	62	104	155	289	89	185	346	724	1086	2047	3329	5908	12050
100	11	26	55	90	138	255	78	162	307	630	976	1811	2991	5309	10830
125	10	24	48	81	122	224	69	146	275	567	866	1606	2654	4711	9613
150	9	21	43	72	109	202	63	132	252	511	787	1496	2412	4281	8736
200	8	19	39	66	100	187	54	112	209	439	665	1282	2038	3618	7382
250	8	17	36	60	93	172	48	100	185	390	590	1138	1808	3210	6549
300	-	-	-	-	-	-	43	90	168	353	534	1030	1637	2905	5927
350	-	-	-	-	-	-	40	83	155	325	491	947	1505	2671	5450
400	-	-	-	-	-	-	37	77	144	303	458	883	1404	2492	5084

Source: Natural Fuel Gas Code 5<sup>th</sup> Edition 8/28/92

### Propane (1.53 SP. GR.): @ 5 PSI Based on 1 PSI Pressure Drop (1000's BTU/Hr)

Pipe Length (ft.)	Copper Tubing Size (O.D.)				Nominal Pipe Size (SCH.40)					
	3/8"	1/2"	5/8"	3/4"	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
10	454	938	1907	3334	2946	6161	11605	23826	35699	68753
20	312	644	1311	2291	2025	4234	7976	16376	24536	47253
30	251	518	1053	1840	1626	3400	6405	13150	19703	37946
40	215	443	901	1575	1392	2910	5482	11255	16863	32477
50	190	393	799	1396	1233	2579	4859	9975	14946	28784
60	172	356	724	1265	1118	2337	4402	9038	13542	26080
70	159	327	666	1163	1028	2150	4050	8315	12458	23993
80	148	304	619	1082	957	2000	3768	7735	11590	22321
90	138	286	581	1015	897	1877	3535	7258	10875	20943
100	131	270	549	959	848	1773	3339	6856	10272	19783
125	116	239	486	850	751	1571	2956	6076	9104	17533
150	105	217	441	770	681	1424	2682	5505	8249	15886
175	97	199	405	709	626	1310	2467	5065	7589	14615
200	90	185	377	659	583	1218	2295	4712	7060	13597
225	84	174	354	619	547	1143	2153	4421	6624	12757
250	80	164	334	584	516	1080	2034	4176	6257	12051
275	76	156	318	555	490	1026	1932	3966	5943	11445
300	72	149	303	529	468	978	1843	3784	5669	10919
350	66	137	279	487	430	900	1696	3481	5216	10045
400	62	127	259	453	400	837	1577	3238	4852	9345

Source: Natural Fuel Gas Code 5<sup>th</sup> Edition 8/28/92

**Propane (1.53 SP. G.R.): @ 10 PSI Based on 1 PSI Pressure Drop (1000's BTU/Hr)**

Pipe Length (ft.)	Copper Tubing Size (O.D.)				Nominal Pipe Size (SCH.40)					
	3/8"	1/2"	5/8"	3/4"	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
10	558	1387	2360	3993	3339	6982	13153	27004	40461	77924
20	383	870	1622	2475	2295	4799	9040	18560	27809	53556
30	309	700	1303	2205	1843	3854	7259	14904	22331	43008
40	265	599	1115	1887	1577	3298	6213	12756	19113	36809
50	235	531	988	1672	1398	2923	5507	11306	16939	32623
60	213	481	896	1515	1267	2649	4989	10244	15348	29559
70	196	443	824	1394	1165	2437	4590	9424	14120	27194
80	182	412	767	1297	1084	2267	4270	8767	13136	25299
90	171	386	719	1217	1017	2127	4007	8226	12325	23737
100	161	365	679	1149	961	2009	3785	7770	11642	22422
125	142	323	601	1018	852	1780	3354	6887	10318	19871
150	130	293	546	923	772	1613	3039	6240	9349	18005
175	118	269	502	843	710	1484	2796	5741	8601	16564
200	111	251	467	790	660	1381	2601	5340	8002	15410
225	104	235	438	740	619	1296	2441	5011	7508	14459
250	90	222	414	700	585	1224	2305	4377	7092	13658
275	89	211	393	664	556	1162	2190	4495	6735	12971
300	89	201	375	634	530	1109	2089	4289	6246	12375
350	82	185	345	584	488	1020	1922	3945	5911	11385
400	76	172	321	543	454	949	1788	3670	5499	10591

Source: Natural Fuel Gas Code 5<sup>th</sup> Edition 8/28/92

---

# NOTES



## Limited Warranty

The GSI Group, LLC. ("GSI") warrants products which it manufactures to be free of defects in materials and workmanship under normal usage and conditions for a period of 12 months after sale to the original end-user or if a foreign sale, 14 months from arrival at port of discharge, whichever is earlier. The end-user's sole remedy (and GSI's only obligation) is to repair or replace, at GSI's option and expense, products that in GSI's judgment, contain a material defect in materials or workmanship. Expenses incurred by or on behalf of the end-user without prior written authorization from the GSI Warranty Group shall be the sole responsibility of the end-user.

**Warranty Extensions:** The Limited Warranty period is extended for the following products:

	Product	Warranty Period
<b>AP Fans and Flooring</b>	Performer Series Direct Drive Fan Motor	3 Years
	All Fiberglass Housings	Lifetime
	All Fiberglass Propellers	Lifetime
<b>Cumberland Feeding/Watering Systems</b>	Feeder System Pan Assemblies	5 Years **
	Feed Tubes (1.75" & 2.00")	10 Years *
	Centerless Augers	10 Years *
	Watering Nipples	10 Years *
<b>Grain Systems</b>	Grain Bin Structural Design	5 Years
<b>Grain Systems Farm Fans Zimmerman</b>	Portable & Tower Dryers	2 Years
	Portable & Tower Dryer Frames and Internal Infrastructure †	5 Years

\* Warranty prorated from list price:  
 0 to 3 years – no cost to end-user  
 3 to 5 years – end-user pays 25%  
 5 to 7 years – end-user pays 50%  
 7 to 10 years – end user pays 75%

\*\* Warranty prorated from list price:  
 0 to 3 years – no cost to end-user  
 3 to 5 years – end-user pays 50%

† Motors, burner components and moving parts not included. Portable Dryer screens included. Tower Dryer screens not included.

GSI further warrants that the portable and tower dryer frame and basket, excluding all auger and auger drive components, shall be free from defects in materials for a period of time beginning on the twelfth (12<sup>th</sup>) month from the date of purchase and continuing until the sixtieth (60<sup>th</sup>) month from the date of purchase (extended warranty period). During the extended warranty period, GSI will replace the frame or basket components that prove to be defective under normal conditions of use without charge, excluding the labor, transportation, and/or shipping costs incurred in the performance of this extended warranty.

### Conditions and Limitations:

THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE LIMITED WARRANTY DESCRIPTION SET FORTH ABOVE. SPECIFICALLY, GSI MAKES NO FURTHER WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE IN CONNECTION WITH: (i) PRODUCT MANUFACTURED OR SOLD BY GSI OR (ii) ANY ADVICE, INSTRUCTION, RECOMMENDATION OR SUGGESTION PROVIDED BY AN AGENT, REPRESENTATIVE OR EMPLOYEE OF GSI REGARDING OR RELATED TO THE CONFIGURATION, INSTALLATION, LAYOUT, SUITABILITY FOR A PARTICULAR PURPOSE, OR DESIGN OF SUCH PRODUCTS.

GSI shall not be liable for any direct, indirect, incidental or consequential damages, including, without limitation, loss of anticipated profits or benefits. The sole and exclusive remedy is set forth in the Limited Warranty, which shall not exceed the amount paid for the product purchased. This warranty is not transferable and applies only to the original end-user. GSI shall have no obligation or responsibility for any representations or warranties made by or on behalf of any dealer, agent or distributor.

GSI assumes no responsibility for claims resulting from construction defects or unauthorized modifications to products which it manufactured. Modifications to products not specifically delineated in the manual accompanying the equipment at initial sale will void the Limited Warranty.

This Limited Warranty shall not extend to products or parts which have been damaged by negligent use, misuse, alteration, accident or which have been improperly/inadequately maintained. This Limited Warranty extends solely to products manufactured by GSI.

Prior to installation, the end-user has the responsibility to comply with federal, state and local codes which apply to the location and installation of products manufactured or sold by GSI.

This equipment shall be installed in accordance with the current installation codes and applicable regulations which should be carefully followed in all cases. Authorities having jurisdiction should be consulted before installations are made.



**1004 E. Illinois St.  
Assumption, IL 62510-0020  
Phone: 1-217-226-4421  
Fax: 1-217-226-4420  
[www.gsiag.com](http://www.gsiag.com)**