FOR YOUR SAFETY
If you smell gas:

1. **Open windows.**
2. **DO NOT try to light any appliance.**
3. **DO NOT use electrical switches.**
4. **DO NOT use any telephone in your building.**
5. **Extinguish any open flame.**
6. **Leave the building.**
7. **Immediately call your local fuel supplier after leaving the building. Follow the fuel supplier's instructions.**
8. **If you cannot reach your fuel supplier, call the Fire Department.**

⚠ WARNING

Fire Hazard

Keep all flammable objects, liquids and vapors the minimum required clearances to combustibles away from equipment.

Some objects will catch fire or explode when placed close to equipment.

Failure to follow these instructions can result in death, injury or property damage.

⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can result in death, injury or property damage. Read the installation, operation and service manual thoroughly before installing or servicing this equipment.

Installation must be done by a registered installer/ contractor qualified in the installation and service of gas/oil-fired heating equipment or your fuel supplier.

ROBERTS GORDON

Combat® AT-Series

Indirect, Gas/Oil-Fired, Industrial Air Turnover Unit

Installation, Operation & Service Manual

AT 136
AT 148
AT 154
AT 236
AT 242
AT 248
AT 254
AT 260
AT 272

Installer

Please take the time to read and understand these instructions prior to any installation. Installer must give a copy of this manual to the owner.

Owner

Keep this manual in a safe place in order to provide your service technician with necessary information.

NOT FOR RESIDENTIAL USE

C ETL CM US LISTED
Intertek

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www.robertsgordon.com
www.rg-inc.com

P/N 141100NA Orig 12/13

POUR VOTRE SECURITE
Si vous sentez une odeur de gaz:

1. **Ouvrez les fenêtres.**
2. **N'essayez pas d'allumer un appareil.**
3. **N'utilisez pas d'interrupteurs électriques.**
4. **N'utilisez pas de téléphone dans votre bâtiment.**
5. **Eteignez toute flamme nue.**
6. **Quittez le bâtiment.**
7. **Après avoir quitté le bâtiment, appelez immédiatement votre fournisseur local de gaz.**
   Suivez les instructions du fournisseur de gaz.
8. **Si vous ne pouvez pas joindre votre fournisseur de gaz, appelez le service d'incendie.**

⚠ AVERTISSEMENT

Risque d'incendie

Garder tous les objets, liquides ou vapeurs inflammables à la distance minimale de l'unité de chauffage requise avec les matériaux combustibles.

Certains objets prendront feu ou exploseront s'ils sont placés à proximité de l'unité de chauffage.

Le non respect de ces instructions peut entraîner la mort, des blessures corporelles ou des dommages matériels.

⚠ ATTENTION

L'installation, l'ajustement, l'altération, le démarrage ou l'entretien inadéquat peuvent causer la mort, des blessures ou des dégâts matériels. Lire entièrement le manuel d'installation, d'opération et d'entretien avant l'installation ou l'entretien de cet équipement.

L'installation doit être effectuée par un installateur éprouvé/contractant qualifié dans l'installation et la maintenance du système de chauffage par infrarouge activé au gaz.

ROBERTS GORDON

Combat® AT-Series

L'appareil de rotation de l'air à combustion indirecte, au gaz ou à l'huile pour les applications industrielles

Manuel d'installation, d'opération, et d'entretien

AT 136
AT 148
AT 154
AT 236
AT 242
AT 248
AT 254
AT 260
AT 272

Installateur

Prenez le temps de lire et comprendre ces instructions avant toute installation.
L'installateur doit remettre au propriétaire un exemplaire de ce manuel.

Propriétaire

Gardez ce manuel dans un endroit sûr pour fournir des informations au réparateur en cas de besoin.

C ETL CM US LISTED
Intertek

Conçus pour les applications non-résidentielles

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P/N 141100FC Orig 12/13

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Printed in U.S.A.

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SECTION 1: AIR TURNOVER UNIT SAFETY

Your Safety is Important to Us! This symbol is used throughout the manual to notify you of possible fire, electrical or burn hazards. Please pay special attention when reading and following the warnings in these sections.

Installation, service and, at a minimum, annual inspection of air turnover unit must be done by a contractor qualified in the installation and service of gas-fired and/or oil-fired heating equipment.

Read this manual carefully before installation, operation or service of this equipment.

This air turnover unit is designed for heating non-residential indoor spaces. Do not install in residential spaces. These instructions, the layout drawing, local codes and ordinances and applicable standards that apply to fuel piping, electrical wiring, ventilation, etc. must be thoroughly understood before proceeding with the installation.

Protective gear is to be worn during installation, operation and service. Thin sheet metal parts have sharp edges. To prevent injury, the use of work gloves is recommended.

Before installation, check that the local distribution conditions, nature of fuel and pressure and adjustment of the appliance are compatible.

This equipment must be applied and operated under the general concepts of reasonable use and installed using best building practices.

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.

Children should be supervised to ensure that they do not play with the appliance.

For additional copies of the Installation, Operation and Service Manual, please contact Roberts-Gordon LLC.

Gas and oil-fired appliances are not designed for use in atmospheres containing flammable vapors, flammable dust or chlorinated or halogenated hydrocarbons. Recirculated room air may be hazardous if containing flammable solids, liquids, and gases; explosive materials; and/or substances which may become toxic when exposed to heat (i.e. refrigerants, aerosols, etc.).

1.1 Description of Operation

This air turnover unit is an indirect, gas and/or oil-fired, appliance. It is designed for indoor installation. The air turnover unit is factory-tested to fire either with natural gas, LPG and/or fuel oil (check the air turnover unit's rating plate for information on the appropriate fuel). The burner will operate to maintain discharge air temperature, room/space air temperature, or return air temperature depending on the selected controls. *See Page 100, Section 15*. The air turnover unit may be provided with several different controls and options to meet various application requirements. Be sure to read this entire manual before installation and start-up.

1.2 Inspection and Setup

The air turnover unit is shipped in multiple sections based on the configuration selected. The air turnover unit was inspected and operated prior to shipment. Immediately upon receipt of the air turnover unit, check the fuel and electrical characteristics of the air turnover unit and verify that they match the fuel and electrical supply available. Verify that the specifications on the air turnover unit rating plate match your order. Check the air turnover unit for any damage that may have occurred during shipment. If any damage is found, file a claim with the transporting agency. Do not refuse shipment. Check the installation location to ensure proper clearances to combustibles. *See Page 8, Section 3.1*.

Any small options which do not come attached to the air turnover unit (i.e. remote panel or disconnect) will be found inside the air turnover unit.

Larger accessories (i.e. extensions) may either ship with the air turnover unit or separately on another truck. Check the bill of lading for information.

If the air turnover unit must be temporarily stored (i.e. job site is not ready for installation of the air turnover unit), the air turnover unit should be set on 4" x 4" (10 cm x 10 cm) pieces of timber on the ground in a protected area. The air turnover unit should be covered to be protected from the environment.

1.3 Safety Labels and Their Placement

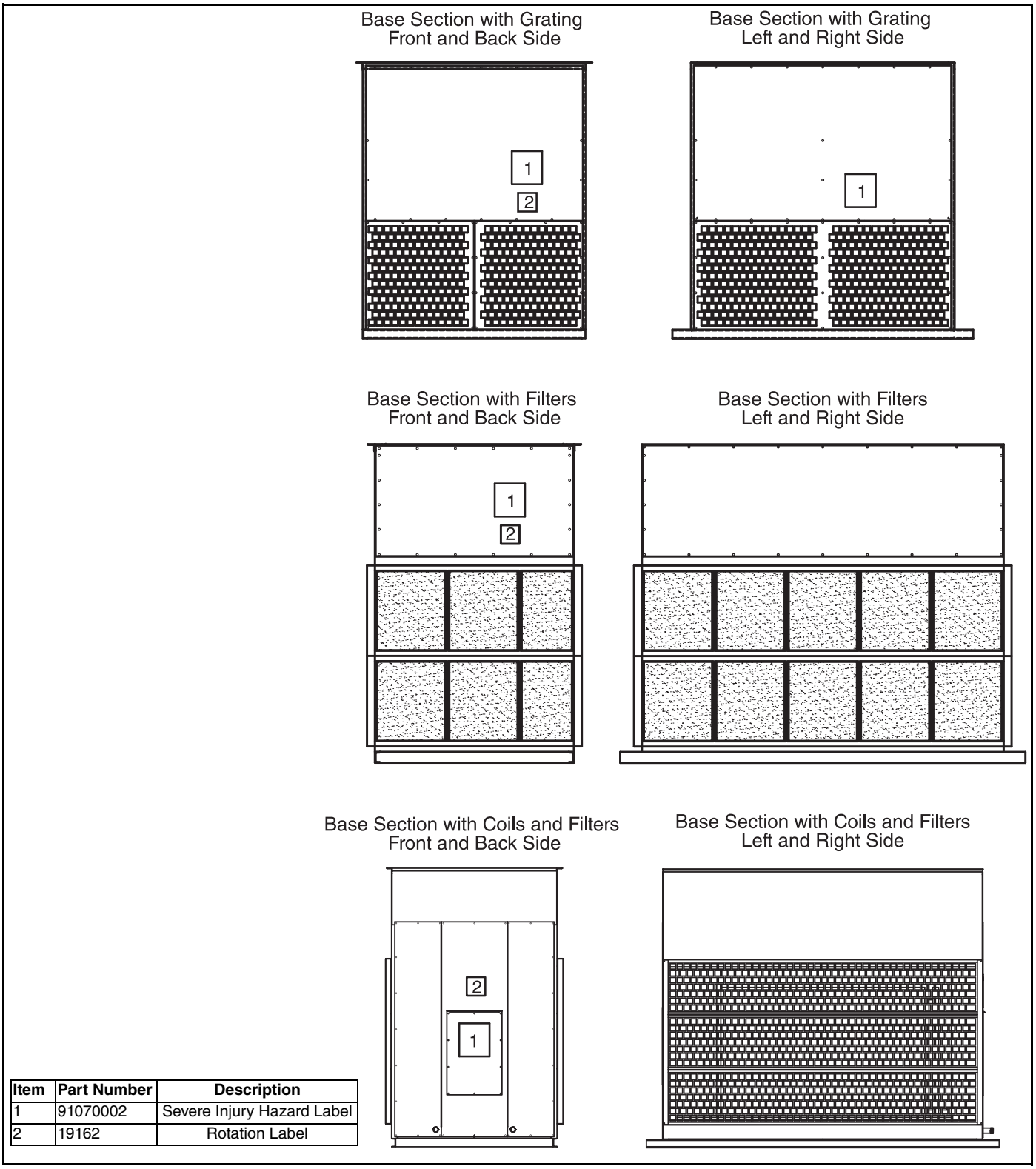
Product safety signs or labels should be replaced by product user when they are no longer legible. Please contact Roberts-Gordon LLC or your ROBERTS GORDON® independent distributor to obtain replacement signs or labels. *See Page 2, Figure 1 through Page 5, Figure 5*.

1.4 California Proposition 65

In accordance with California Proposition 65 requirements, a warning label must be placed in a highly visible location on the outside of the equipment (i.e., near equipment's serial plate). See label placement drawings *on Page 2, Figure 1 through Page 5, Figure 5* for label location. Avoid placing label on areas with extreme heat, cold, corrosive chemicals or other elements. To order additional labels, please contact Roberts-Gordon LLC or your ROBERTS GORDON® independent distributor.

1.5 Label Placement

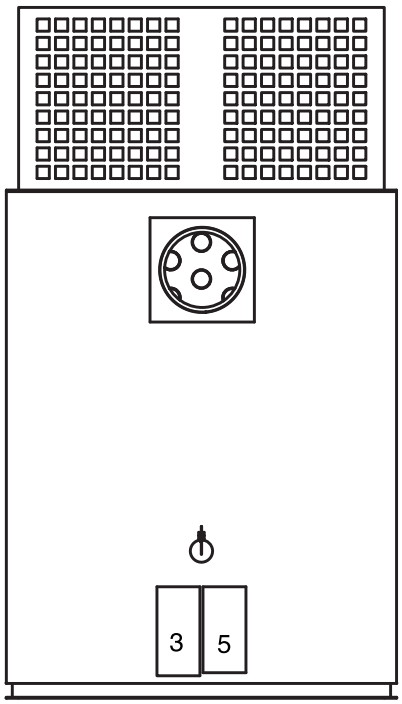
FIGURE 1: Base Section

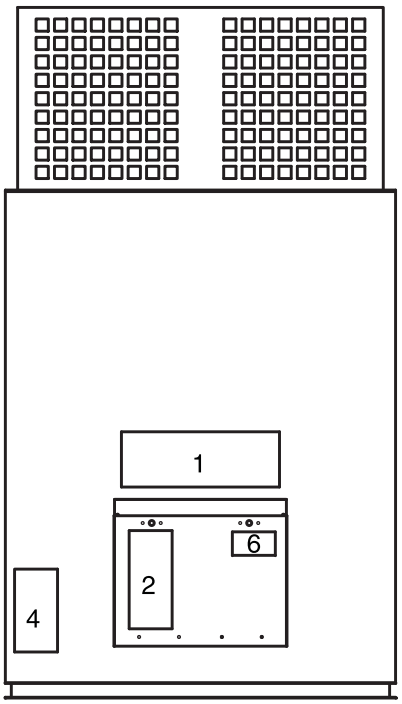


Item	Part Number	Description
1	91070002	Severe Injury Hazard Label
2	19162	Rotation Label

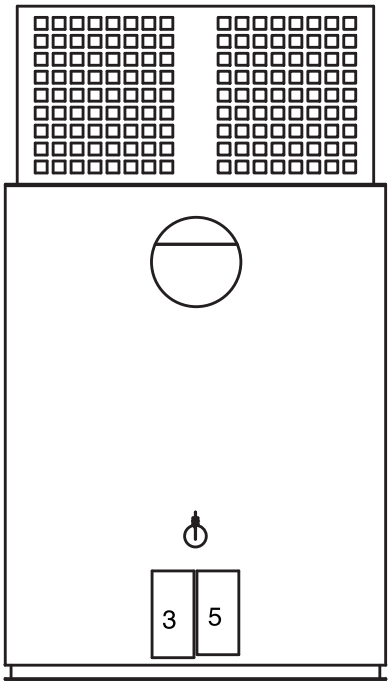
FIGURE 2: Upper Sections

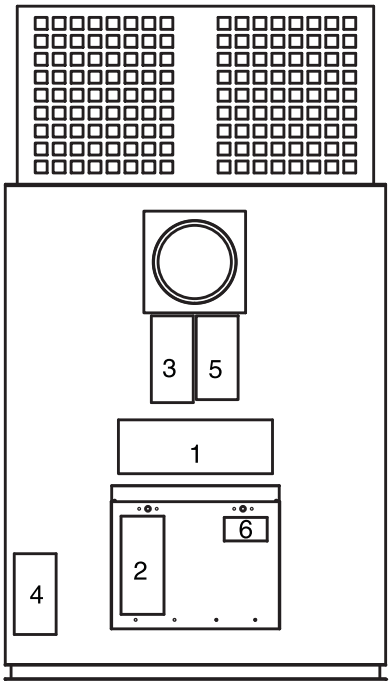
Three-Pass Unit





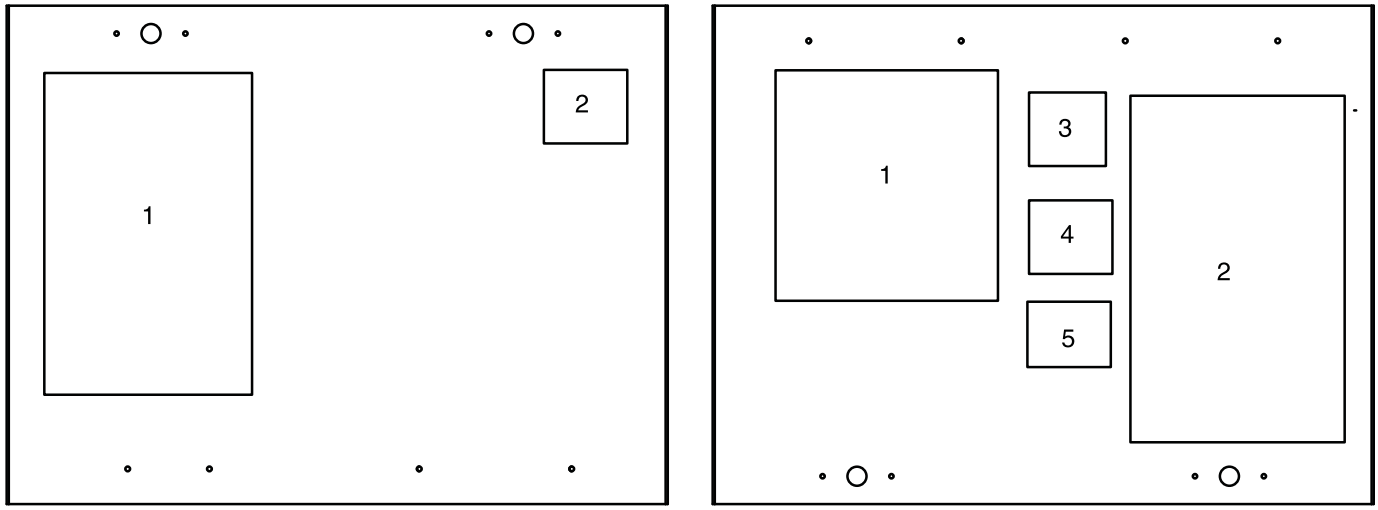
Four-Pass Unit





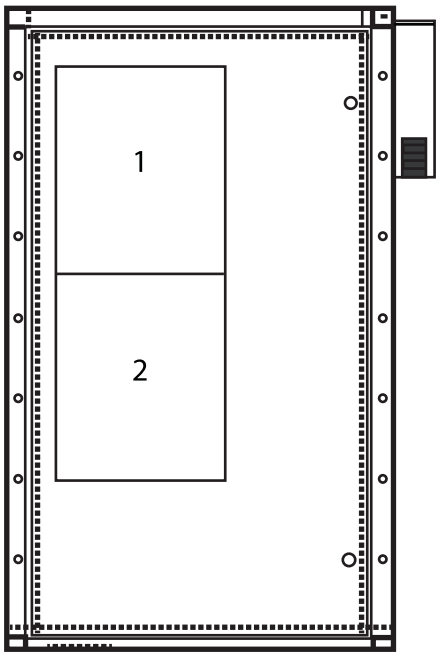
Item	Part Number	Description
1	91040025	Logo Label
2	91070001	Electric Shock Hazard Label
3	91070004	Fire Hazard Label
4	91070005	Fall Hazard Label
5	91070006	Burn Hazard Label
6	14302333	Installation Manual Enclosed Label

FIGURE 3: Control Enclosure



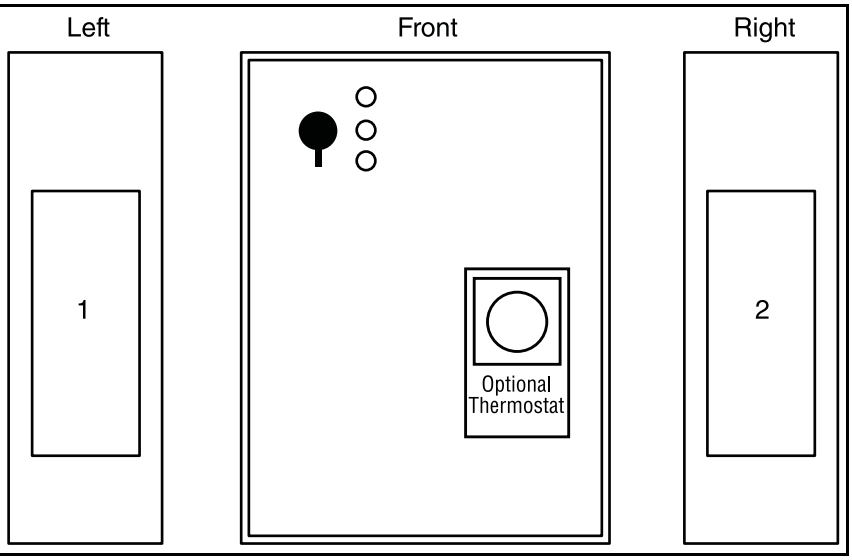
Item	Part Number	Description
1	91070001	Electric Shock Hazard Label
2	14302333	Installation Manual Enclosed Label
3	831-006-36 (Gas-Fired) or 831-006-48 (Oil-Fired) or 831-006-60 (Combo Gas/Oil-Fired)	Serial Data Plate
4	N/A	Electrical Schematic
5	91070016	California Proposition 65 Label
6	N/A	Agency Approval Label (optional)
7	N/A	UL Label (optional)

FIGURE 4: Auxiliary Control Enclosure



Item	Part Number	Description
1	91070032	English/Spanish Electric Shock Hazard Label (mini)
2	91070033	English/French Electric Shock Hazard Label (mini)

FIGURE 5: Remote Panel



Item	Part Number	Description
1	91070032	English/Spanish Electric Shock Hazard Label (mini)
2	91070033	English/French Electric Shock Hazard Label (mini)

SECTION 2: INSTALLER RESPONSIBILITY

⚠ WARNING

Explosion Hazard

Equipment must have access to uncontaminated air at all times.

Failure to follow these instructions can result in death, injury or property damage.

The installer is responsible for the following:

- To install and commission the air turnover unit, as well as the fuel and electrical supplies, in accordance with applicable specifications and codes. Roberts-Gordon LLC recommends the installer contact a local building inspector or Fire Marshal for guidance.
- To use the information given in a layout drawing and in the manual together with the cited codes and regulations to perform the installation.
- To furnish all needed materials not furnished as standard equipment.
- To plan location of supports.
- To provide access to air turnover unit for servicing.
- To provide the owner with a copy of this Installation, Operation and Service Manual.
- To ensure there is adequate air circulation around the air turnover unit and to supply air for combustion, ventilation and distribution in accordance with local codes. The burners used on the air turnover units require pressure-neutral air for proper combustion and performance. A burner's combustion air should not be attempted to be pulled from a negative air pressure environment. To avoid creating a negative pressure environment in a well-sealed space, there should be a fresh air penetration in the wall or roof of the space of a minimum size equivalent to 0.5 sq in (3.2 sq cm) per 1,000 Btu/h (293.1 kW) input capacity of equipment in the space. For information on pulling combustion air from outside of the air turnover unit's immediate vicinity, *see Page 33, Section 10.3*.
- To assemble or install any accessories or associated duct work using best building practices.
- To properly size supports and hanging materials.

2.1 Corrosive Chemicals

⚠ CAUTION

Product Damage Hazard

Do not use equipment in area containing corrosive chemicals.

Refer to appropriate Material Safety Data Sheets (MSDS).

Failure to follow these instructions can result in product damage.

Roberts-Gordon LLC cannot be responsible for ensuring that all appropriate safety measures are undertaken prior to installation; this is entirely the responsibility of the installer. It is essential that the contractor, the sub-contractor, or the owner identifies the presence of combustible materials, corrosive chemicals or halogenated hydrocarbons* anywhere in the premises.

** **Halogenated Hydrocarbons** are a family of chemical compounds characterized by the presence of halogen elements (fluorine, chlorine, bromine, etc.). These compounds are frequently used in refrigerants, cleaning agents, solvents, etc. If these compounds enter the air supply of the burner, the life span of the air turnover unit components will be greatly reduced. An outside air supply must be provided to the burners whenever the presence of these compounds is suspected. Warranty will be invalid if the air turnover unit is exposed to halogenated hydrocarbons.*

2.2 Required Equipment and Materials

When lifting of the equipment is required, the installing contractor is responsible for supplying or arranging for the appropriate lifting equipment so that the air turnover unit and accessories may be placed in a safe manner.

The qualified installing / service technician is responsible for having the appropriate equipment and materials for the safe installation and start-up of an indirect-fired air turnover unit. Tools and materials required to commission the equipment include, but are not limited to, the following:

- Various screwdriver types and sizes
- Various adjustable wrenches
- Torque wrenches
- Pipe wrenches sized appropriately for the gas train components
- Drill motor and various drills
- U-tube manometer 0 to 6" wc (0 to 14.9 mbar)
- Gas pressure gauge 0 to 30" wc (0 to 74.7 mbar)
- Gas pressure gauge to suit building supply pressure conditions
- Oil pressure gauge 0 to 300 PSIG (0 to 20 bar)
- Combustion analyzer
- Stack thermometer
- Oil smoke tester
- Volt meter
- Clamp style ammeter
- Belt tension gauge

SECTION 3: CRITICAL CONSIDERATIONS

⚠ WARNING

Fire Hazard

Keep all flammable objects, liquids and vapors the minimum required clearances to combustibles away from equipment.

Some objects will catch fire or explode when placed close to equipment.

Failure to follow these instructions can result in death, injury or property damage.

3.1 Required Clearances to Combustibles

Clearances are the required distances that combustible objects must be away from the air turnover unit to prevent fire hazards. Combustibles are materials that may catch on fire and include common items such as wood, paper, rubber, fabric, etc. **Maintain clearances to combustibles at all times for safety.**

Check the clearances on each air turnover unit being installed to make sure the product is suitable for your application and the clearances are maintained.

Minimum clearances for all models are as follows:

- 18" (45.7 cm) Above the top of the equipment
- 18" (45.7 cm) Along the sides of the equipment
- 36" (91.4 cm) Around the flue pipe
- 36" (91.4 cm) Around the sight port

Read and follow the safety guidelines below:

- Locate the air turnover unit so that the air intakes are not too close to any exhaust fan outlets, gasoline storage, propane tanks or other contaminants that could potentially cause dangerous situations.
- Keep gasolines or other combustible materials including flammable objects, liquids, dust or vapors away from this air turnover unit or any other appliance.
- Maintain clearances from heat sensitive material, equipment and workstations.

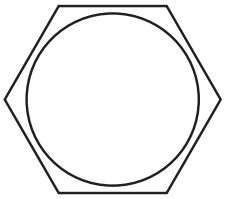
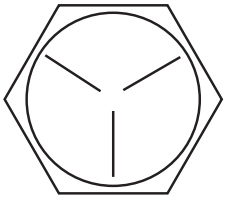
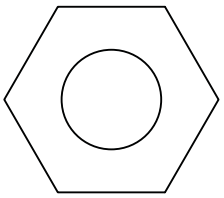
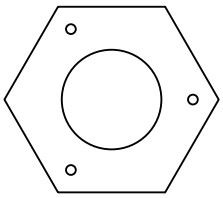
Clearances to combustibles do not denote clearances for accessibility. Minimum clearance for access is 48" (122 cm). Minimum clearance for accessibility applies to the control enclosure, and inlet plenum access panel.

The stated clearances to combustibles represent a surface temperature of 90° F (32° C) above room temperature. Building materials with a low heat tolerance (i.e. plastics, vinyl siding, canvas, tri-ply, etc.) may be subject to degradation at lower temperatures. It is the installer's responsibility to assure that adjacent materials are protected from degradation. Maintain clearances from heat sensitive material, equipment and workstations.

3.2 Hardware

Unless otherwise specified, all hardware must be torqued to settings from *Page 8, Table 1*.

Table 1: Recommended Torque Settings

Bolt Head Grade Marking		
Nut Grade Marking		
Bolt Size	**Grade 2**	**Grade 5**
10-24	27 in•Lb	42 in•Lb
1/4-20	65 in•Lb	101 in•Lb
5/16-18	11 ft•Lb	17 ft•Lb
3/8-16	19 ft•Lb	30 ft•Lb

SECTION 4: NATIONAL STANDARDS AND APPLICABLE CODES

4.1 Fuel Codes

The type of fuel appearing on the nameplate must be the type of fuel used. Installation must comply with national and local codes and requirements of the local fuel company.

United States: Refer to NFPA 54/ANSI Z223.1 - latest revision, National Fuel Gas Code for natural gas and LPG units. Refer to NFPA 31- latest revision, Standard for the Installation of Oil-Burning Equipment for oil units.

Canada: Refer to CSA B149.1 - latest revision, Natural Gas and Propane Installation Code for natural gas and LPG units. Refer to CSA B139 - latest revision, Installation Code for Oil-Burning Equipment for oil units.

4.2 Installation Codes

Installations must be made in accordance with NFPA 90A - latest revision, Standard for the Installation of Air-Conditioning and Ventilation Systems.

4.3 Aircraft Hangars

Installation in aircraft hangars must be in accordance with the following codes:

United States: Refer to Standard for Aircraft Hangars, NFPA 409 - latest revision.

Canada: Refer to Standard CSA B149.1 - latest revision, Natural Gas and Propane Installation Code for natural gas and LPG units. Refer to CSA B139 - latest revision, Installation Code for Oil-Burning Equipment for oil units.

- In aircraft storage and servicing areas, air turnover units shall be installed at least 10’ (3 m) above the upper surface of wings or of engine enclosures of the highest aircraft which may be housed in the hangar. The measurement shall be made from the wing of the engine enclosure (whichever is higher from the floor) to the bottom of the air turnover unit.
- In shops, offices and other sections of aircraft hangars communicating with aircraft storage or servicing areas, air turnover units shall be installed not less than 8' (2.4 m) above the floor.
- Suspended or elevated air turnover units shall be so located in all spaces of aircraft hangars that they shall not be subject to injury by aircraft, cranes, movable scaffolding or other objects. Provisions shall be made to assure accessibility to suspended air turnover units for recurrent maintenance purposes.
- Heating, ventilation and air conditioning plants employing recirculation of air within aircraft storage and servicing areas shall have return air openings not less than 10' (3 m) above the floor. Supply air openings shall not be installed in the floor and shall be at least 6" (152 mm) from the floor measured to the bottom of the opening.
- Personnel should be fully instructed that in the event of a serious gasoline or similar flammable liquid spill on the hangar floor, the fans should be shut off.

4.4 Parking Structures and Repair Garages

Installation in garages must be in accordance with the following codes:

United States: Standard for Parking Structures NFPA 88A - latest revision or the Code for Motor Fuel Dispensing Facilities and Repair Garages, NFPA 30A - latest revision.

Canada: Refer to CSA B149.1 - latest revision, Natural Gas and Propane Installation Code for natural gas and LPG units. Refer to CSA B139 - latest revision, Installation Code for Oil-Burning Equipment for oil units.

- Air turnover units must not be installed less than 8’ (2.4 m) above the floor. Minimum clearances to combustibles must be maintained from vehicles parked below the air turnover unit.
- When installed over hoists, minimum clearances to combustibles must be maintained from the upper most point of objects on the hoist.

4.5 Electrical

Electrical connection to air turnover unit must be in accordance with the following codes:

United States: Refer to National Electrical Code®, NFPA 70 - latest revision. Wiring must conform to the most current National Electrical Code®, local ordinances, and any special diagrams furnished.

Canada: Refer to Canadian Electrical Code, CSA C22.1 Part 1 - latest revision.

4.6 Venting

This air turnover unit must be vented in accordance with the requirements within this manual and with the following codes and any state, provincial or local codes which may apply:

United States: Refer to NFPA 54/ANSI Z223.1- latest revision, National Fuel Gas Code for natural gas and LPG units. Refer to NFPA 31 - latest revision, Standard for the Installation of Oil-Burning Equipment for oil units.

Canada: Refer to CSA B149.1 - latest revision, Natural Gas and Propane Installation Code for natural gas and LPG units. Refer to CSA B139 - latest revision, Installation Code for Oil-Burning Equipment for oil units.

4.7 High Altitude

These air turnover units are approved for installations up to 2000' (609.6 m) (US), 4500'(1371.6 m) (Canada) without modification. Consult factory if US installation is above 2000' (609.6 m) or Canadian installation is above 4500’(1371.6 m).

SECTION 5: SPECIFICATIONS

The legend below is a list of abbreviations used in this section and applies to *Page 11, Figure 6 through Page 17, Figure 9*.

Table 2: Legend

DA = Discharge Air	RA = Return Air

NOTES: (apply to all drawings in this section)

- All dimensions are in inches.
- All dimensions are subject to change without notice.
- Due to height of unit, additional support is recommended on top of the unit.
- Dimension "F" is flue diameter. Flue located on left side of unit for 1,000 MBH heat exchanger and smaller; flue located on right side of unit for 1,250 MBH heat exchanger and larger.
- Dimensions "D" and "F" may vary within a model depending on heat exchanger size (ex. 45 = 450 MBH heat exchanger).
- For cooling applications, consult factory for weight information as base unit weights do not account for inclusion of cooling coils or exclusion of heat exchanger.

FIGURE 6: Heating Unit (All Models)

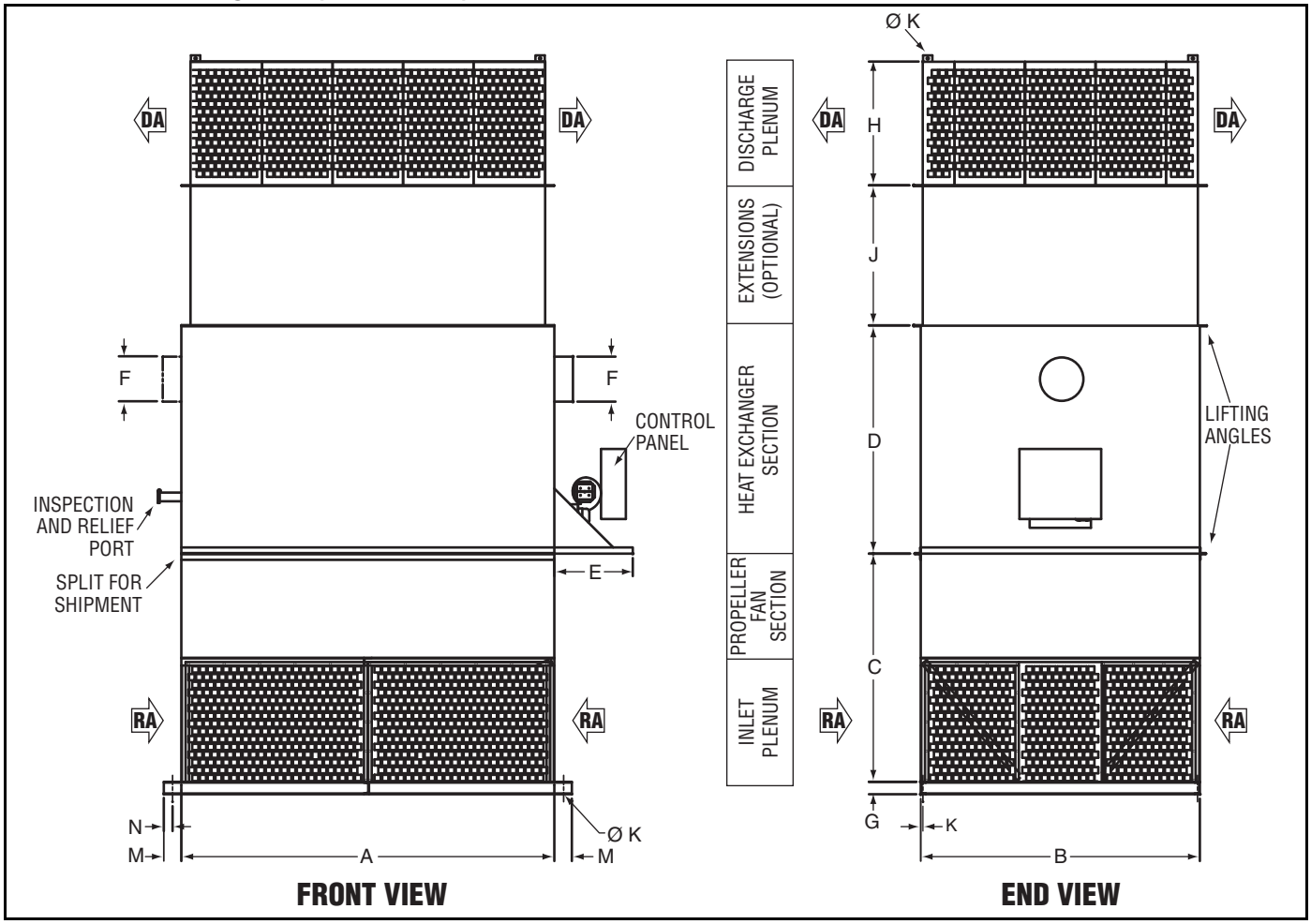


Table 3: Heating Unit Dimensions (All Models)

Model		A	B	C	D	E	F	G	H	J	K	L	M	N
136	(in)	60	50	75	53	35	45/75 - 6, 100 - 8	3	24	48	.75	.75	6	3
	(cm)	152.4	127.0	190.5	134.6	88.9	45/75 - 15.2, 100 - 20.3	7.6	60.9	121.9	1.9	1.9	15.2	7.6
148	(in)	72	60	75	53	35	45/75 - 6, 100 - 8	3	24	48	.75	.75	6	3
	(cm)	182.9	152.4	190.5	134.6	88.9	45/75 - 15.2, 100 - 20.3	7.6	60.9	121.9	1.9	1.9	15.2	7.6
154	(in)	85	72	86	65	35	45/75 - 6, 100 - 8, 125 - 10	3	36	48	.75	.75	6	3
	(cm)	215.9	182.9	218.4	165.1	88.9	45/75 - 15.2, 100 - 20.3, 125 - 25.4	7.6	91.4	121.9	1.9	1.9	15.2	7.6
236	(in)	90	50	60	53	35	45/70 - 6, 100 - 8	3	24	48	.75	.75	6	3
	(cm)	228.6	127.0	152.4	134.6	88.9	45/70 - 15.2, 100 - 20.3	7.6	60.9	121.9	1.9	1.9	15.2	7.6
242	(in)	100	55	66	75/100 - 53, 125 - 72	35	75 - 6, 100 - 8, 125 - 10	3	30	48	.75	.75	6	3
	(cm)	254.0	139.7	167.6	75/100 - 134.6, 125 - 182.9	88.9	75 - 15.2, 100 - 20.3, 125 - 25.4	7.6	76.2	121.9	1.9	1.9	15.2	7.6
248	(in)	116	60	66	75/100 - 53, 125/150/175 - 72	35	75 - 6, 100 - 8, 125 - 10, 175 - 12	3	30	48	.75	.75	6	3
	(cm)	294.6	152.4	167.6	75/100 - 134.6, 125/150/175 - 182.9	88.9	75 - 15.2, 100 - 20.3, 125 - 25.4, 175 - 30.5	7.6	76.2	121.9	1.9	1.9	15.2	7.6
254	(in)	145	72	72	90	35	175/225 - 12, 300 - 14	4	36	48	.75	.75	6	3
	(cm)	368.3	182.9	182.9	228.6	88.9	175/225 - 30.5, 300 - 35.6	10.1	91.4	121.9	1.9	1.9	15.2	7.6
260	(in)	160	84	72	96	35	300 - 14, 450 - 16	4	36	48	.75	.75	6	3
	(cm)	406.4	213.4	182.9	243.8	88.9	300 - 35.6, 450 - 40.6	10.1	91.4	121.9	1.9	1.9	15.2	7.6
272	(in)	165	90	76	96	35	300 - 14, 450 - 16	4	40	48	.75	.75	6	3
	(cm)	419.1	228.6	193.0	243.8	88.9	300 - 35.6, 450 - 40.6	10.1	101.6	121.9	1.9	1.9	15.2	7.6

Table 4: Heating Unit Performance Information

Model	Airflow		Motor Size		Output (MBH) Minimum	Output (kW) Minimum	Output (MBH) Maximum	Output (kW) Maximum	Tempera-ture Rise Range (°F)	Tempera-ture Rise Range (°C)	Base Unit Weight (lbs)	Base Unit Weight (kg)
	(CFM)	(m^3/h)	(HP)	(kW)								
136	4,500	7,645	1 (1 motor)	.75 (1 motor)	240	70.3	240	70.3	49 to 49	27.1 to 27.1	2,225	1,009.2
	9,000	15,291	2 (1 motor)	1.5 (1 motor)	240	70.3	450	131.9	25 to 46	13.8 to 25.5	2,280	1,034.2
	12,000	20,388	3 (1 motor)	2.2 (1 motor)	240	70.3	450	131.9	19 to 35	10.5 to 19.4	2,305	1,045.5
148	10,000	16,990	3 (1 motor)	2.2 (1 motor)	240	70.3	450	131.9	22 to 42	12.1 to 23.3	3,255	1,476.4
	16,000	27,184	3 (1 motor)	2.2 (1 motor)	240	70.3	750	219.8	14 to 43	7.7 to 23.8	3,300	1,496.9
154	14,000	23,786	3 (1 motor)	2.2 (1 motor)	240	70.3	450	131.9	16 to 30	8.8 to 16.6	3,880	1,759.9
	22,000	37,378	5 (1 motor)	3.7 (1 motor)	240	70.3	750	219.8	10 to 32	5.5 to 17.7	3,940	1,787.2
	30,000	50,970	7.5 (1 motor)	5.6 (1 motor)	520	152.4	1,000	293.1	16 to 31	8.8 to 17.1	4,115	1,866.5
	30,000	50,970	7.5 (1 motor)	5.6 (1 motor)	560	164.1	1,250	366.3	17 to 39	9.4 to 21.6	4,220	1,914.2
236	9,000	15,291	1 (2 motors)	.75 (2 motors)	240	70.3	450	131.9	25 to 46	13.8 to 25.5	3,945	1,789.4
	18,000	30,552	2 (2 motors)	1.5 (2 motors)	240	70.3	750	219.8	12 to 39	6.6 to 21.6	3,990	1,809.8
	24,000	40, 0776	3 (2 motors)	2.2 (2 motors)	520	152.4	1,000	293.1	20 to 39	11.0 to 21.6	4,115	1,866.5
242	21,000	35,679	2 (2 motors)	1.5 (2 motors)	240	70.3	750	219.8	11 to 33	6.0 to 18.3	4,990	2,263.4
	31,000	52,669	3 (2 motors)	2.2 (2 motors)	520	152.4	1,000	293.1	16 to 30	8.8 to 16.6	5,115	2,320.1
	31,000	52,669	3 (2 motors)	2.2 (2 motors)	560	164.1	1,250	366.3	17 to 37	9.4 to 20.5	5,240	2,376.8
248	22,000	37,378	3 (2 motors)	2.2 (2 motors)	240	70.3	750	219.8	10 to 32	5.5 to 17.7	5,990	2,717.0
	35,000	54,465	5 (2 motors)	3.7 (2 motors)	520	152.4	1,000	293.1	14 to 26	7.7 to 14.4	6,145	2,787.3
	45,000	76,455	5 (2 motors)	3.7 (2 motors)	560	164.1	1,250	366.3	12 to 26	6.6 to 14.4	6,270	2,844.0
	45,000	76,455	5 (2 motors)	3.7 (2 motors)	560	164.1	1,500	439.6	12 to 31	6.6 to 17.2	6,270	2,844.0
254	40,000	67,960	5 (2 motors)	3.7 (2 motors)	560	164.1	1,750	512.9	13 to 41	7.1 to 22.7	7,670	3,479.1
	60,000	101,940	7.5 (2 motors)	5.6 (2 motors)	600	175.8	2,250	659.4	9 to 35	4.9 to 19.4	8,060	3,656.0
	65,000	110,435	7.5 (2 motors)	5.6 (2 motors)	600	175.8	2,500	732.7	9 to 36	4.9 to 19.9	8,310	3,769.4
260	54,000	91,746	5 (2 motors)	3.7 (2 motors)	600	175.8	2,916	854.6	10 to 50	5.5 to 27.7	10,870	4,930.5
	61,000	103,639	7.5 (2 motors)	5.6 (2 motors)	720	211.0	3,294	965.4	11 to 50	6.0 to 27.7	11,135	5,050.8
	74,000	105,726	7.5 (2 motors)	5.6 (2 motors)	720	211.0	4,000	1,172.3	9 to 50	4.9 to 27.7	11,135	5,050.8
272	62,000	105,338	5 (2 motors)	3.7 (2 motors)	600	175.8	3,000	879.2	9 to 45	4.9 to 24.9	11,720	5,316.1
	88,000	149,512	10 (2 motors)	7.5 (2 motors)	720	211.0	4,500	1,318.8	8 to 47	4.4 to 26.0	12,185	5,527.0
	100,000	169,901	10 (2 motors)	7.5 (2 motors)	720	211.0	4,500	1,318.8	7 to 42	3.8 to 23.3	12,185	5,527.0

FIGURE 7: Heating Unit with Filtration (All Models)

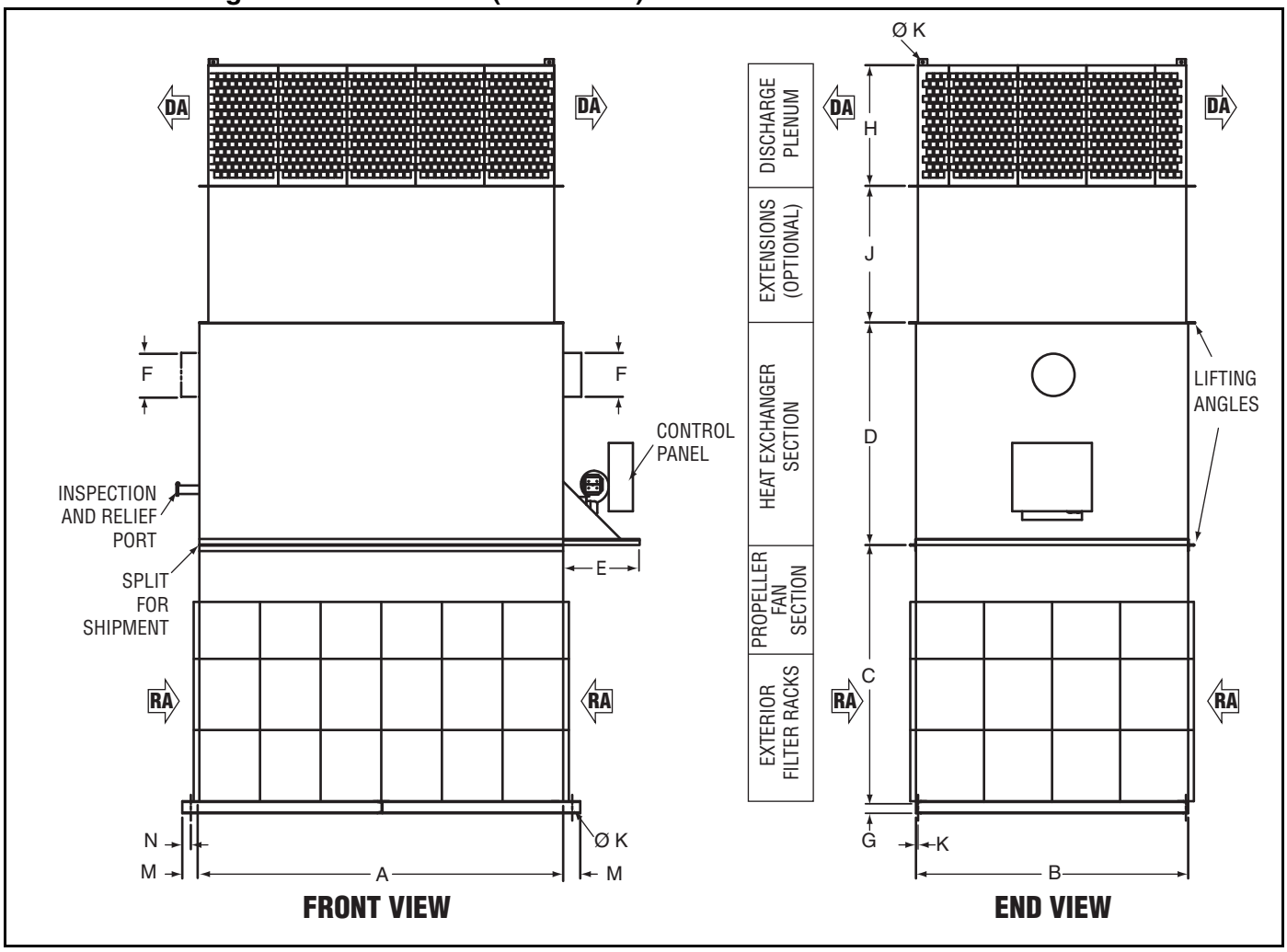


Table 5: Heating Unit with Filtration Dimensions (All Models)

Model		A	B	C	D	E	F	G	H	J	K	L	M	N
136	(in)	60	50	75	53	35	45/75 - 6, 100 - 8	3	24	48	.75	.75	6	3
	(cm)	152.4	127.0	190.5	134.6	88.9	45/75 - 15.2, 100 - 20.3	7.6	60.9	121.9	1.9	1.9	15.2	7.6
148	(in)	72	60	75	53	35	45/75 - 6, 100 - 8	3	24	48	.75	.75	6	3
	(cm)	182.9	152.4	190.5	134.6	88.9	45/75 - 15.2, 100 - 20.3	7.6	60.9	121.9	1.9	1.9	15.2	7.6
154	(in)	85	72	86	65	35	45/75 - 6, 100 - 8, 125 - 10	3	36	48	.75	.75	6	3
	(cm)	215.9	182.9	218.4	165.1	88.9	45/75 - 15.2, 100 - 20.3, 125 - 25.4	7.6	91.4	121.9	1.9	1.9	15.2	7.6
236	(in)	90	50	60	53	35	45/70 - 6, 100 - 8	3	24	48	.75	.75	6	3
	(cm)	228.6	127.0	152.4	134.6	88.9	45/70 - 15.2, 100 - 20.3	7.6	60.9	121.9	1.9	1.9	15.2	7.6
242	(in)	100	55	66	75/100 - 53, 125 - 72	35	75 - 6, 100 - 8, 125 - 10	3	30	48	.75	.75	6	3
	(cm)	254.0	139.7	167.6	75/100 - 134.6, 125 - 182.9	88.9	75 - 15.2, 100 - 20.3, 125 - 25.4	7.6	76.2	121.9	1.9	1.9	15.2	7.6
248	(in)	116	60	66	75/100 - 53, 125/150/175 - 72	35	75 - 6, 100 - 8, 125 - 10, 175 - 12	3	30	48	.75	.75	6	3
	(cm)	294.6	152.4	167.6	75/100 - 134.6, 125/150/175 - 182.9	88.9	75 - 15.2, 100 - 20.3, 125 - 25.4, 175 - 30.5	7.6	76.2	121.9	1.9	1.9	15.2	7.6
254	(in)	145	72	72	90	35	175/225 - 12, 300 - 14	4	36	48	.75	.75	6	3
	(cm)	368.3	182.9	182.9	228.6	88.9	175/225 - 30.5, 300 - 35.6	10.1	91.4	121.9	1.9	1.9	15.2	7.6
260	(in)	160	84	72	96	35	300 - 14, 450 - 16	4	36	48	.75	.75	6	3
	(cm)	406.4	213.4	182.9	243.8	88.9	300 - 35.6, 450 - 40.6	10.1	91.4	121.9	1.9	1.9	15.2	7.6
272	(in)	165	90	76	96	35	300 - 14, 450 - 16	4	40	48	.75	.75	6	3
	(cm)	419.1	228.6	193.0	243.8	88.9	300 - 35.6, 450 - 40.6	10.1	101.6	121.9	1.9	1.9	15.2	7.6

Table 6: Heating Unit with Filtration Performance Information

Model	Airflow		Motor Size		Output (MBH) Minimum	Output (kW) Minimum	Output (MBH) Maximum	Output (kW) Maximum	Temperature Rise Range (°F)	Temperature Rise Range (°C)	Base Unit Weight (lbs)	Base Unit Weight (kg)
	CFM	m^3/h	Motor (HP)	Motor (kW)								
136	4,500	7,645	1 (1 motor)	.75 (1 motor)	240	70.3	240	70.3	49 to 49	27.1 to 27.1	2,425	1,100.0
	9,000	15,291	3 (1 motor)	2.2 (1 motor)	240	70.3	450	131.9	25 to 46	13.8 to 25.5	2,505	1,136.2
	12,000	20,388	5 (1 motor)	3.7 (1 motor)	240	70.3	450	131.9	19 to 35	10.5 to 19.4	2,520	1,143.1
148	10,000	16,990	3 (1 motor)	2.2 (1 motor)	240	70.3	450	131.9	22 to 42	12.1 to 23.3	3,455	1,567.2
	16,000	27,184	5 (1 motor)	3.7 (1 motor)	240	70.3	750	219.8	14 to 43	7.7 to 23.8	3,470	1,574.0
154	14,000	23,786	3 (1 motor)	2.2 (1 motor)	240	70.3	450	131.9	16 to 30	8.8 to 16.6	4,080	1,850.7
	22,000	37,378	5 (1 motor)	3.7 (1 motor)	240	70.3	750	219.8	10 to 32	5.5 to 17.7	4,140	1,877.9
	30,000	50,970	10 (1 motor)	7.5 (1 motor)	520	152.4	1,000	293.1	16 to 31	8.8 to 17.1	4,210	1,909.6
	30,000	50,970	10 (1 motor)	7.5 (1 motor)	560	164.1	1,250	366.3	17 to 39	9.4 to 21.6	4,420	2,004.9
236	9,000	15,291	1 (2 motors)	.75 (2 motors)	240	70.3	450	131.9	25 to 46	13.8 to 25.5	4,145	1,880.1
	18,000	30,552	3 (2 motors)	2.2 (2 motors)	240	70.3	750	219.8	12 to 39	6.6 to 21.6	4,240	1,923.2
	24,000	40, 0776	5 (2 motors)	3.7 (2 motors)	520	152.4	1,000	293.1	20 to 39	11.0 to 21.6	4,270	1,936.8
242	21,000	35,679	3 (2 motors)	2.2 (2 motors)	240	70.3	750	219.8	11 to 33	6.0 to 18.3	5,240	2,376.8
	31,000	52,669	5 (2 motors)	3.7 (2 motors)	520	152.4	1,000	293.1	16 to 30	8.8 to 16.6	5,270	2,390.4
	31,000	52,669	5 (2 motors)	3.7 (2 motors)	560	164.1	1,250	366.3	17 to 37	9.4 to 20.5	5,445	2,469.8
248	22,000	37,378	3 (2 motors)	2.2 (2 motors)	240	70.3	750	219.8	10 to 32	5.5 to 17.7	6,190	2,807.7
	35,000	54,465	5 (2 motors)	3.7 (2 motors)	520	152.4	1,000	293.1	14 to 26	7.7 to 14.4	6,345	2,878.0
	45,000	76,455	7.5 (2 motors)	5.6 (2 motors)	560	164.1	1,250	366.3	12 to 26	6.6 to 14.4	6,575	2,982.4
	45,000	76,455	7.5 (2 motors)	5.6 (2 motors)	560	164.1	1,500	439.6	12 to 31	6.6 to 17.2	6,730	3,052.7
254	40,000	67,960	5 (2 motors)	3.7 (2 motors)	560	164.1	1,750	512.9	13 to 41	7.1 to 22.7	7,870	3,569.8
	60,000	101,940	10 (2 motors)	7.5 (2 motors)	600	175.8	2,250	659.4	9 to 35	4.9 to 19.4	8,310	3,769.4
	65,000	110,435	10 (2 motors)	7.5 (2 motors)	600	175.8	2,500	732.7	9 to 36	4.9 to 19.9	8,560	3,882.8
260	54,000	91,746	5 (2 motors)	3.7 (2 motors)	600	175.8	2,916	854.6	10 to 50	5.5 to 27.7	11,070	5,021.1
	61,000	103,639	7.5 (2 motors)	5.6 (2 motors)	720	211.0	3,094	965.4	11 to 50	6.0 to 27.7	11,335	5,141.5
	74,000	105,726	10 (2 motors)	7.5 (2 motors)	720	211.0	4,000	1,172.3	9 to 50	4.9 to 27.7	11,385	5,164.1
272	62,000	105,338	5 (2 motors)	3.7 (2 motors)	600	175.8	3,000	879.2	9 to 45	4.9 to 24.9	12,160	5,515.7
	88,000	149,512	10 (2 motors)	7.5 (2 motors)	720	211.0	4,500	1,318.8	8 to 47	4.4 to 26.0	12,385	5,617.7
	100,000	169,901	15 (2 motors)	11.2 (2 motors)	720	211.0	4,500	1,318.8	7 to 42	3.8 to 23.3	12,515	5,676.7

FIGURE 8: Cooling Unit with Filtration (All Models)

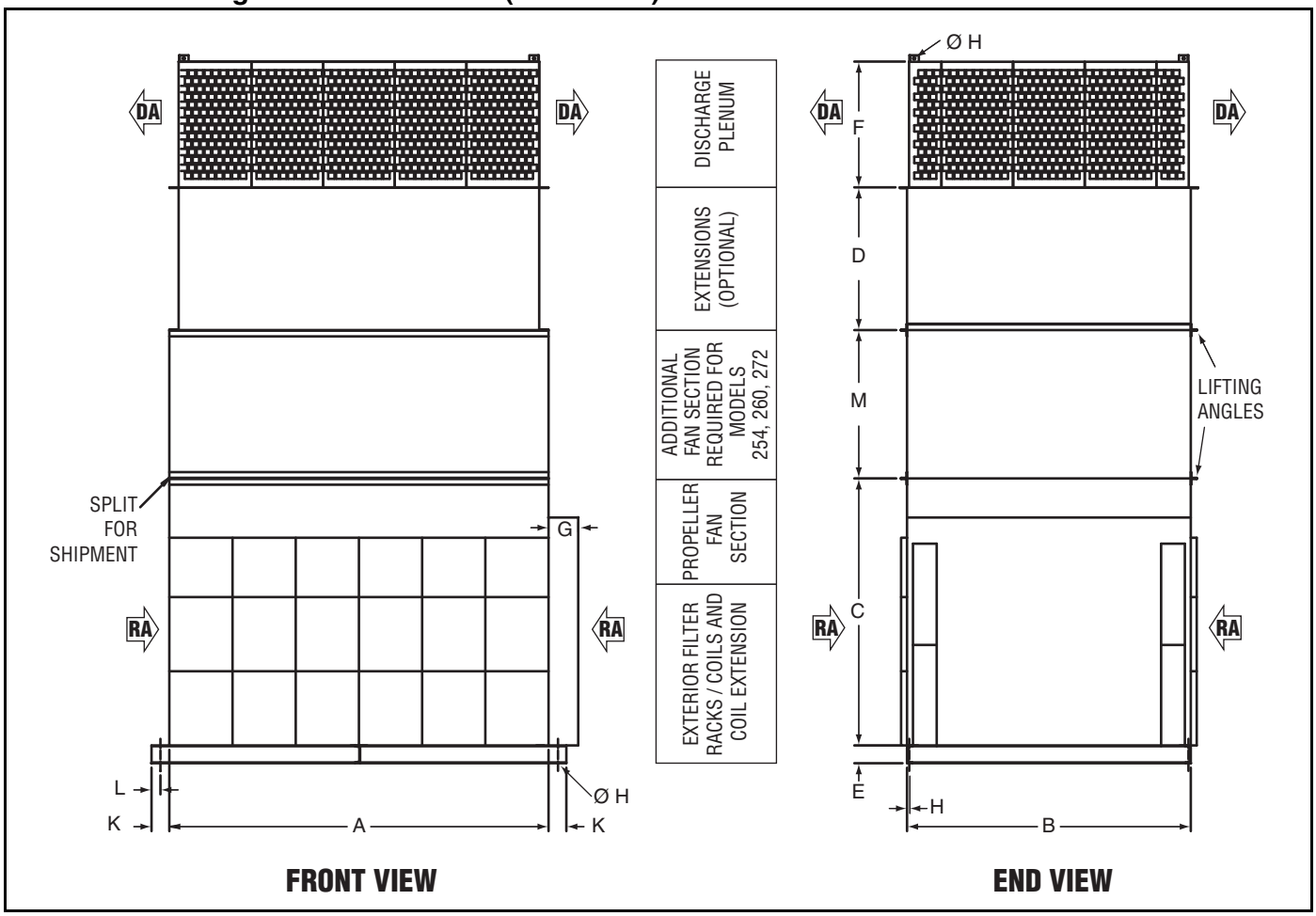


Table 7: Cooling Unit with Filtration Dimensions (All Models)

Model		A	B	C	D	E	F	G	H	J	K	L	M
136	(in)	60	50	75	48	6	24	N/A	.75	.75	6	3	N/A
	(cm)	152.4	127.0	190.5	121.9	15.2	60.9		1.9	1.9	15.2	7.6	
148	(in)	72	60	85	48	6	24	N/A	.75	.75	6	3	N/A
	(cm)	182.9	152.4	215.9	121.9	15.2	60.9		1.9	1.9	15.2	7.6	
154	(in)	85	72	95	48	6	36	10	.75	.75	6	3	N/A
	(cm)	215.9	182.9	241.3	121.9	15.2	91.4	25.4	1.9	1.9	15.2	7.6	
236	(in)	90	50	85	48	6	24	10	.75	.75	6	3	N/A
	(cm)	228.6	127.0	215.9	121.9	15.2	60.9	25.4	1.9	1.9	15.2	7.6	
242	(in)	100	55	85	48	6	30	16	.75	.75	6	3	N/A
	(cm)	254.0	139.7	215.9	121.9	15.2	76.2	40.6	1.9	1.9	15.2	7.6	
248	(in)	116	60	95	48	6	30	6	.75	.75	6	3	N/A
	(cm)	294.6	152.4	241.3	121.9	15.2	76.2	15.2	1.9	1.9	15.2	7.6	
254	(in)	145	72	90	48	6	36	N/A	.75	.75	6	3	50
	(cm)	368.3	182.9	228.6	121.9	15.2	91.4		1.9	1.9	15.2	7.6	127.0
260	(in)	160	84	90	48	6	36	N/A	.75	.75	6	3	50
	(cm)	406.4	213.4	228.6	121.9	15.2	91.4		1.9	1.9	15.2	7.6	127.0
272	(in)	165	90	90	48	6	40	10	.75	.75	6	3	50
	(cm)	419.1	228.6	228.6	121.9	15.2	101.6	25.4	1.9	1.9	15.2	7.6	127.0

Table 8: Cooling Unit Performance Information

Model	Airflow		Motor Size		Base Unit Weight (lbs)	Base Unit Weight (kg)
	CFM	m^3/h	Motor (HP)	Motor (kW)		
136	4,500	7,645	1 (1 motor)	.75 (1 motor)	2,425	1,100.0
	9,000	15,291	3 (1 motor)	2.2 (1 motor)	2,505	1,136.2
	12,000	20,388	5 (1 motor)	3.7 (1 motor)	2,520	1,143.1
148	10,000	16,990	3 (1 motor)	2.2 (1 motor)	3,455	1,567.2
	16,000	27,184	5 (1 motor)	3.7 (1 motor)	3,470	1,574.0
154	14,000	23,786	3 (1 motor)	2.2 (1 motor)	4,080	1,850.7
	22,000	37,378	5 (1 motor)	3.7 (1 motor)	4,140	1,877.9
	30,000	50,970	10 (1 motor)	7.5 (1 motor)	4,210	1,909.6
	30,000	50,970	10 (1 motor)	7.5 (1 motor)	4,420	2,004.9
236	9,000	15,291	1 (2 motors)	.75 (2 motors)	4,145	1,880.1
	18,000	30,552	3 (2 motors)	2.2 (2 motors)	4,240	1,923.2
	24,000	40,776	5 (2 motors)	3.7 (2 motors)	4,270	1,936.8
242	21,000	35,679	3 (2 motors)	2.2 (2 motors)	5,240	2,376.8
	31,000	52,669	5 (2 motors)	3.7 (2 motors)	5,270	2,390.4
	31,000	52,669	5 (2 motors)	3.7 (2 motors)	5,445	2,469.8
248	22,000	37,378	3 (2 motors)	2.2 (2 motors)	6,190	2,807.7
	35,000	54,465	5 (2 motors)	3.7 (2 motors)	6,345	2,878.0
	45,000	76,455	7.5 (2 motors)	5.6 (2 motors)	6,575	2,982.4
	45,000	76,455	7.5 (2 motors)	5.6 (2 motors)	6,730	3,052.7
254	40,000	67,960	5 (2 motors)	3.7 (2 motors)	7,870	3,569.8
	60,000	101,940	10 (2 motors)	7.5 (2 motors)	8,310	3,769.4
	65,000	110,435	10 (2 motors)	7.5 (2 motors)	8,560	3,882.8
260	54,000	91,746	5 (2 motors)	3.7 (2 motors)	11,070	5,021.1
	61,000	103,639	7.5 (2 motors)	5.6 (2 motors)	11,335	5,141.5
	74,000	105,726	10 (2 motors)	7.5 (2 motors)	11,385	5,164.1
272	62,000	105,338	5 (2 motors)	3.7 (2 motors)	12,160	5,515.7
	88,000	149,512	10 (2 motors)	7.5 (2 motors)	12,385	5,617.7
	100,000	169,901	15 (2 motors)	11.2 (2 motors)	12,515	5,676.7

FIGURE 9: Heating and Cooling Unit with Filtration (All Models)

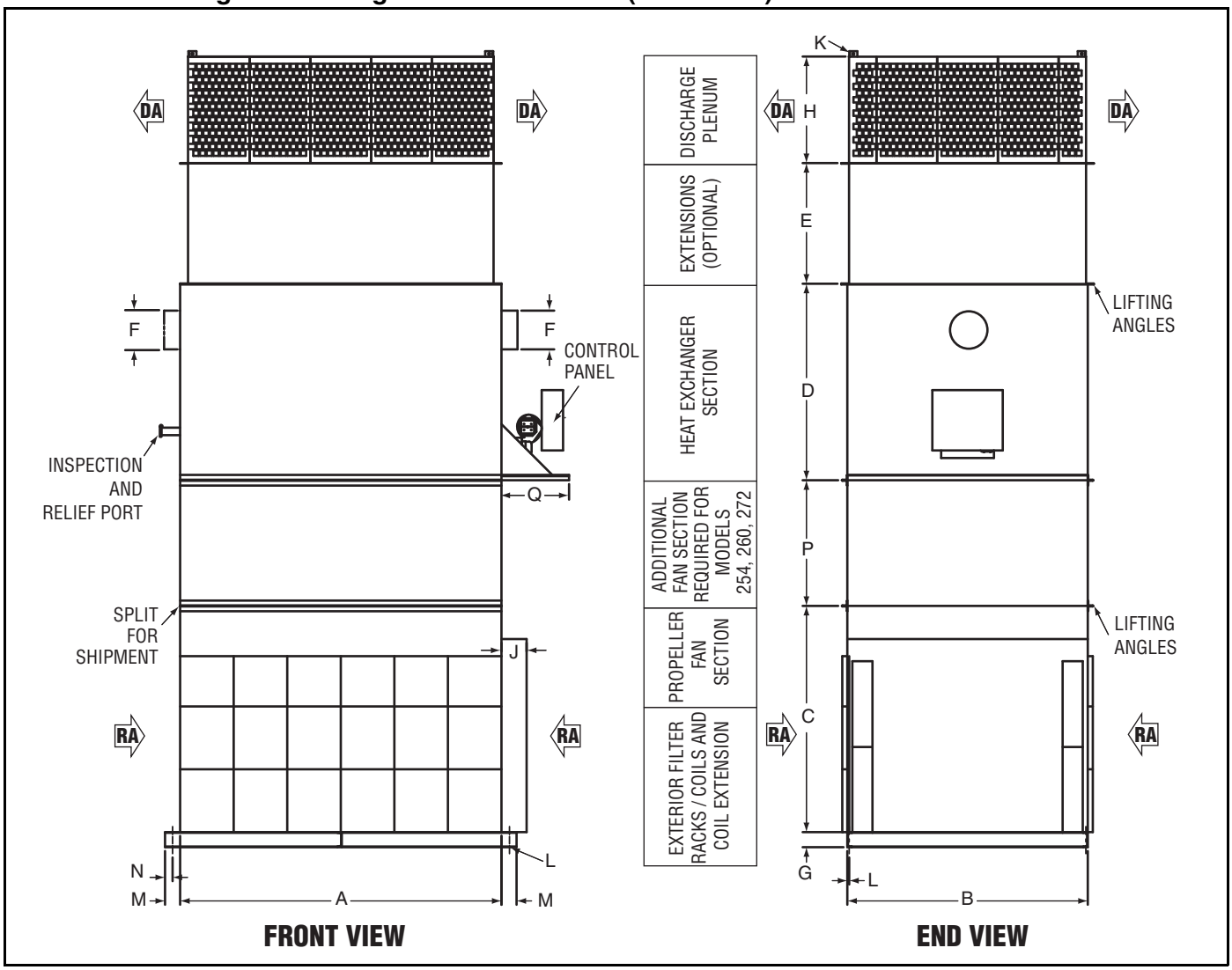


Table 9: Heating and Cooling Unit with Filtration Dimensions (All Models)

Model		A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
136	(in)	60	50	75	53	48	45/75 - 6, 100 - 8	6	24	N/A	.75	.75	6	3	N/A	35
	(cm)	152.4	127.0	190.5	134.6	121.9	45/75 - 15.2, 100 - 20.3	15.2	60.9		1.9	1.9	15.2	7.6		88.9
148	(in)	72	60	85	53	48	45/75 - 6, 100 - 8	6	24	N/A	.75	.75	6	3	N/A	35
	(cm)	182.9	152.4	215.9	134.6	121.9	45/75 - 15.2, 100 - 20.3	15.2	60.9		1.9	1.9	15.2	7.6		88.9
154	(in)	85	72	95	65	48	45/75 - 6, 100 - 8, 125 - 10	6	36	10	.75	.75	6	3	N/A	35
	(cm)	215.9	182.9	241.3	165.1	121.9	45/75 - 15.2, 100 - 20.3, 125 - 25.4	15.2	91.4	25.4	1.9	1.9	15.2	7.6		88.9
236	(in)	90	50	85	53	48	45/75 - 6, 100 - 8	6	24	10	.75	.75	6	3	N/A	35
	(cm)	228.6	127.0	215.9	134.6	121.9	45/75 - 15.2, 100 - 20.3	15.2	60.9	25.4	1.9	1.9	15.2	7.6		88.9
242	(in)	100	55	85	75/100 - 53, 125 - 72	48	75 - 6, 100 - 8, 125 - 10	6	30	16	.75	.75	6	3	N/A	35
	(cm)	254.0	139.7	215.9	134.6, 182.9	121.9	75 - 15.2, 100 - 20.3, 125 - 25.4	15.2	76.2	40.6	1.9	1.9	15.2	7.6		88.9
248	(in)	116	60	95	75/100 - 53, 125/150/175 - 72	48	75 - 6, 100 - 8, 125 - 10, 175 - 12	6	30	6	.75	.75	6	3	N/A	35
	(cm)	294.6	152.4	241.3	134.6, 182.9	121.9	75 - 15.2, 100 - 20.3, 125 - 25.4, 175 - 30.5	15.2	76.2	15.2	1.9	1.9	15.2	7.6		88.9
254	(in)	145	72	90	90	48	175/225 - 12, 300 - 14	6	36	N/A	.75	.75	6	3	50 127.0	35
	(cm)	368.3	182.9	228.6	228.6	121.9	175/225 - 30.5, 300 - 35.6	15.2	91.4		1.9	1.9	15.2	7.6		88.9
260	(in)	160	84	90	96	48	300 - 14, 450 - 16	6	36	N/A	.75	.75	6	3	50 127.0	35
	(cm)	406.4	213.3	228.6	243.8	121.9	300 - 35.6, 450 - 40.6	15.2	91.4		1.9	1.9	15.2	7.6		88.9
272	(in)	165	90	90	96	48	300 - 14, 450 - 16	6	40	10	.75	.75	6	3	50 127.0	35
	(cm)	419.1	228.6	228.6	243.8	121.9	300 - 35.6, 450 - 40.6	15.2	101.6	25.4	1.9	1.9	15.2	7.6		88.9

Table 10: Heating and Cooling Unit with Filtration Performance Information

Model	Airflow		Motor Size		Output (MBH) Minimum	Output (kW) Minimum	Output (MBH) Maximum	Output (kW) Maximum	Temperature Rise Range (°F)	Temperature Rise Range (°C)	Base Unit Weight (lbs)	Base Unit Weight (kg)
	CFM	m^3/h	Motor (HP)	Motor (kW)								
136	4,500	7,645	1.5 (1 motor)	1.1 (1 motor)	240	70.3	240	70.3	49 to 49	27.1 to 27.1	2,425	1,100.0
	9,000	15,291	5 (1 motor)	3.7 (1 motor)	240	70.3	450	131.9	25 to 46	13.8 to 25.5	2,505	1,136.2
	12,000	20,388	5 (1 motor)	3.7 (1 motor)	240	70.3	450	131.9	19 to 35	10.5 to 19.4	2,520	1,143.1
148	10,000	16,990	5 (1 motor)	3.7 (1 motor)	240	70.3	450	131.9	22 to 42	12.1 to 23.3	3,455	1,567.2
	16,000	27,184	7.5 (1 motor)	5.6 (1 motor)	240	70.3	750	219.8	14 to 43	7.7 to 23.8	3,470	1,574.0
154	14,000	23,786	5 (1 motor)	3.7 (1 motor)	240	70.3	450	131.9	16 to 30	8.8 to 16.6	4,080	1,850.7
	22,000	37,378	7.5 (1 motor)	5.6 (1 motor)	240	70.3	750	219.8	10 to 32	5.5 to 17.7	4,140	1,877.9
	30,000	50,970	10 (1 motor)	7.5 (1 motor)	520	152.4	1,000	293.1	16 to 31	8.8 to 17.1	4,210	1,909.6
	30,000	50,970	10 (1 motor)	7.5 (1 motor)	560	164.1	1,250	366.3	17 to 39	9.4 to 21.6	4,420	2,004.9
236	9,000	15,291	1.5 (2 motors)	1.1 (2 motors)	240	70.3	450	219.8	25 to 46	13.8 to 25.5	4,145	1,880.1
	18,000	30,582	5 (2 motors)	3.7 (2 motors)	240	70.3	750	219.8	12 to 39	6.6 to 21.6	4,240	1,923.2
	24,000	40,776	5 (2 motors)	3.7 (2 motors)	520	152.4	1,000	293.1	20 to 39	11.0 to 21.6	4,270	1,936.8
242	21,000	35,679	5 (2 motors)	3.7 (2 motors)	240	70.3	750	219.8	11 to 33	6.0 to 18.3	5,240	2,376.8
	31,000	52,669	7.5 (2 motors)	5.6 (2 motors)	520	152.4	1,000	293.1	16 to 30	8.8 to 16.6	5,270	2,390.4
	31,000	52,669	7.5 (2 motors)	5.6 (2 motors)	560	164.1	1,250	366.3	17 to 37	9.4 to 20.5	5,445	2,469.8
248	22,000	37,378	5 (2 motors)	3.7 (2 motors)	240	70.3	750	219.8	10 to 32	5.5 to 17.7	6,190	2,807.7
	35,000	59,465	7.5 (2 motors)	5.6 (2 motors)	520	152.4	1,000	293.1	14 to 26	7.7 to 14.4	6,345	2,878.0
	45,000	76,455	10 (2 motors)	7.5 (2 motors)	560	164.1	1,250	366.3	12 to 26	6.6 to 14.4	6,575	2,982.4
	45,000	76,455	10 (2 motors)	7.5 (2 motors)	560	164.1	1,500	439.6	12 to 31	6.6 to 17.2	6,730	3,052.7
254	40,000	67,960	5 (2 motors)	3.7 (2 motors)	560	164.1	1,750	512.9	13 to 41	7.1 to 22.7	7,870	3,569.8
	60,000	101,940	10 (2 motors)	7.5 (2 motors)	600	175.8	2,250	659.4	9 to 35	4.9 to 19.4	8,310	3,769.4
	65,000	110,435	15 (2 motors)	11.2 (2 motors)	600	175.8	2,500	732.7	9 to 36	4.9 to 19.9	8,560	3,882.8
260	54,000	91,746	7.5 (2 motors)	5.6 (2 motors)	600	175.8	2,916	854.6	10 to 50	5.5 to 27.7	11,070	5,021.3
	61,000	103,639	10 (2 motors)	7.5 (2 motors)	720	211	3,294	965.4	11 to 50	6.0 to 27.7	11,335	5,141.5
	74,000	125,726	15 (2 motors)	11.2 (2 motors)	720	211	4,000	1,172.30	9 to 50	4.9 to 27.7	11,385	5,164.1
272	62,000	105,338	7.5 (2 motors)	5.6 (2 motors)	600	175.8	3,000	879.2	9 to 45	4.9 to 24.9	12,160	5,515.7
	88,000	149,512	15 (2 motors)	11.2 (2 motors)	720	211	4,500	1,318.80	8 to 47	4.4 to 26.0	12,385	5,617.7
	100,000	169,901	15 (2 motors)	11.2 (2 motors)	720	211	4,500	1,318.80	7 to 42	3.8 to 23.3	12,515	5,676.7

Table 11: Estimated Shipping Weights (All Models)

Gas Burner	**Input MBH** **Input kW**		**300 - 625** **87.9 - 183.2**	**626 - 938** **183.3 - 274.9**	**939 - 1,250** **275.0 - 366.3**	**1,251 - 1,875** **366.4 - 539.5**	**1,876 - 2,500** **539.6 - 732.7**	**2,501 - 3,125** **732.8 - 915.8**	**3,126 - 5,000** **915.9 - 1,465.4**
	Weight	**(lb)** **(kg)**	155 70.3	190 86.2	230 104.3	290 131.5	300 136.1	340 154.2	340 154.2
#2 Oil Burner	**Input GPH** **Input LPH**		**2.5 - 4.5** **9.5 - 17.0**	**4.6 - 6.7** **17.1 - 25.4**	**6.8 - 8.9** **25.5 - 33.7**	**9.0 - 13.4** **33.8 - 50.7**	**13.5 - 17.9** **50.8 - 67.8**	**18.0 - 22.0** **67.9 - 83.3**	**22.1 - 36.0** **83.4 - 136.3**
	Weight	**(lb)** **(kg)**	125 56.7	125 56.7	220 99.8	220 99.8	310 140.6	360 163.3	385 174.6
Combination Gas / #2 Oil Burner	**Input MBH** **Input kW**		**300 - 625** **87.9 - 183.2**	**626 - 938** **183.3 - 274.9**	**939 - 1,250** **275.0 - 366.3**	**1,251 - 1875** **366.4 - 539.5**	**1876 - 2,500** **539.6 - 732.7**	**2,501 - 3,125** **732.8 - 915.8**	**3,126 - 5,000** **915.9 - 1,465.4**
	Input GPH **Input LPH**		**2.5 - 4.5** **9.5 - 17.0**	**4.6 - 6.7** **17.1 - 25.4**	**6.8 - 8.9** **25.5 - 33.7**	**9.0 - 13.4** **33.8 - 50.7**	**13.5 - 17.9** **50.8 - 67.8**	**18.0 - 22.0** **67.9 - 83.3**	**22.1 - 36.0** **83.4 - 136.3**
	Weight	**(lb)** **(kg)**	200 90.7	240 108.9	270 122.5	360 163.3	400 181.4	450 204.1	500 226.8

To determine total unit weight, add the appropriate burner weight to the appropriate base unit weight (as listed in performance information tables).

SECTION 6: LIFTING AN AIR TURNOVER UNIT

⚠ WARNING

Crush Hazard

Use proper lifting equipment and practices.

Failure to follow these instructions can result in death, injury or property damage.

The air turnover unit must be installed in compliance with all applicable codes. The qualified installer or service technician must use best building practices when installing the air turnover unit and any optional equipment. Before installation, check local distribution condition, nature of fuel and fuel pressure, and the current state of adjustment of the appliance are compatible.

6.1 Lifting an Air Turnover Unit

6.1.1 Preparing to Lift the Air Turnover Unit:

Prior to lifting the air turnover unit, the following steps must be performed.

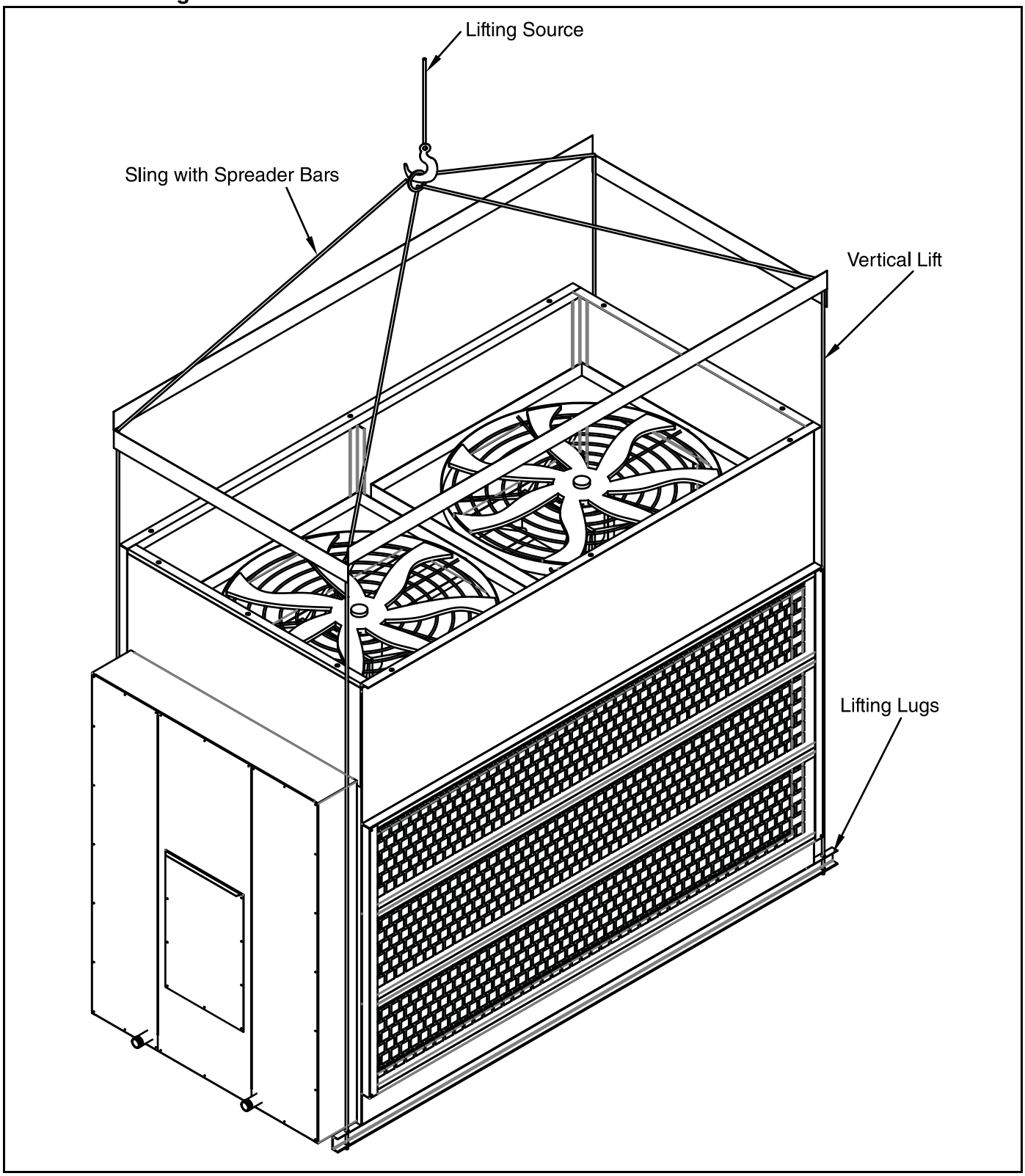
1. Remove all packaging or blockers.
2. Remove all of the accessories or packages that were shipped on a skid, inside the air turnover unit or inside the control enclosure.
3. Inspect the air turnover unit to:
   - Verify that there is no damage as a result of shipping.
   - Ensure that it is appropriately rated for the utilities available at the installation site.
   - Verify that the lifting lugs are intact, undamaged and secured to the air turnover unit.
   - Ensure factory-installed hardware is torqued as specified.
4. Prepare the installation location to be ready to accept the air turnover unit.
5. Verify that the lifting equipment can handle the air turnover unit's weight and the required reach.

6.1.2 Lifting an Air Turnover Unit

Lift the air turnover unit into place by installing appropriate hardware (supplied by others) into all four 0.75" (1.9 cm) diameter lifting lugs holes. Use spreader bars to ensure that the lifting cables clear the sides of the air turnover unit. *See Page 21, Figure 10*. Use caution as the load may be unbalanced. The air turnover unit must be kept level during the lift to prevent tipping, twisting or falling. If lifted improperly, product damage may occur.

Lift each piece separately and then assemble. *See Page 22, Section 7* for assembly instructions. Refer to the applicable portions of *Page 21, Section 10* for assembly and mounting instructions for specific accessories.

FIGURE 10: Lifting an Air Turnover Unit Base Section



SECTION 7: AIR TURNOVER UNIT ASSEMBLY

⚠ WARNING			
			
Crush Hazard	**Falling Hazard**	**Severe Injury Hazard**	**Cut/Pinch Hazard**
Use proper lifting equipment and practices.	**Use proper safety equipment and practices to avoid falling.**	**Use proper lifting practices and equipment.** **Equipment and accessories are heavy.**	**Wear protective gear during installation, operation and service.** **Edges are sharp.**
Failure to follow these instructions can result in death, injury or property damage.			

The air turnover unit is shipped in multiple sections that require field assembly. The base section must first be fastened to the concrete slab or floor before the remaining sections are mounted.

To attach the base section to a concrete slab, it must be secured with the use of studs embedded in the concrete. Studs (provided by others) must be installed in the slab, one for each 3/4"(19.1 cm) hole drilled through the flanges located on the bottom of the base section. *See Page 23, Figure 11*. Fasten the base section to the slab with four hex nuts and lock washers (provided by others).

Lift the remaining sections, as applicable, into place. *See Page 21, Figure 10*. To assemble, use the supplied hardware and bolt the sections together through the pre-drilled holes. Supplied hardware must be torqued to recommended specifications *on Page 8, Table 1*. For details, *See Page 24, Figure 12 and Page 25, Figure 13*.

Because of the height of the air turnover unit, it is highly recommended to secure the top of the air turnover unit to the structure's ceiling support beams for stability. This is mandatory whenever the optional discharge extensions are used.

FIGURE 11: Base Section Mounting

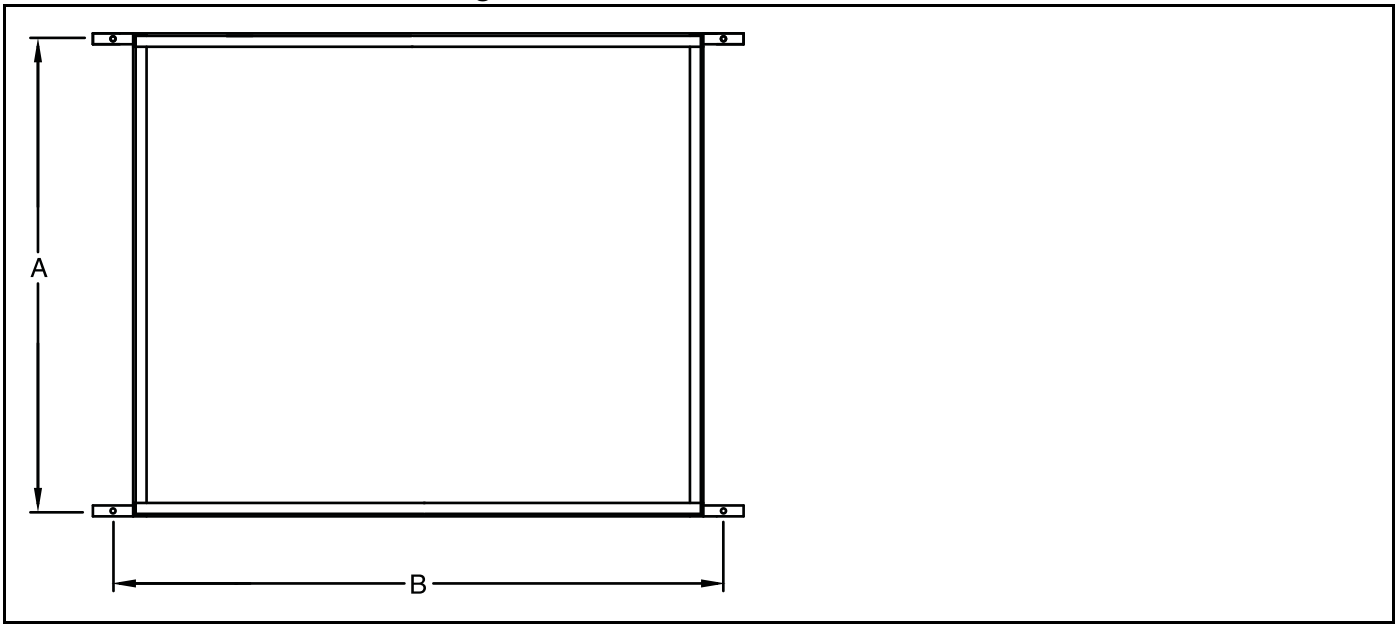


Table 12: Base Section Mounting Dimensions

Model		A	B
136	**(in)**	48.75	66
	(cm)	123.8	167.6
148	**(in)**	58.75	78
	(cm)	149.2	198.1
154	**(in)**	70.75	91
	(cm)	179.7	231.1
236	**(in)**	48.75	96
	(cm)	123.8	243.8
242	**(in)**	53.75	106
	(cm)	136.5	269.2
248	**(in)**	58.75	122
	(cm)	149.2	309.9
254	**(in)**	70.75	151
	(cm)	179.7	383.5
260	**(in)**	82.75	166
	(cm)	210.2	421.6
272	**(in)**	88.75	171
	(cm)	225.4	434.3

FIGURE 12: Air Turnover Unit Sections Schematic

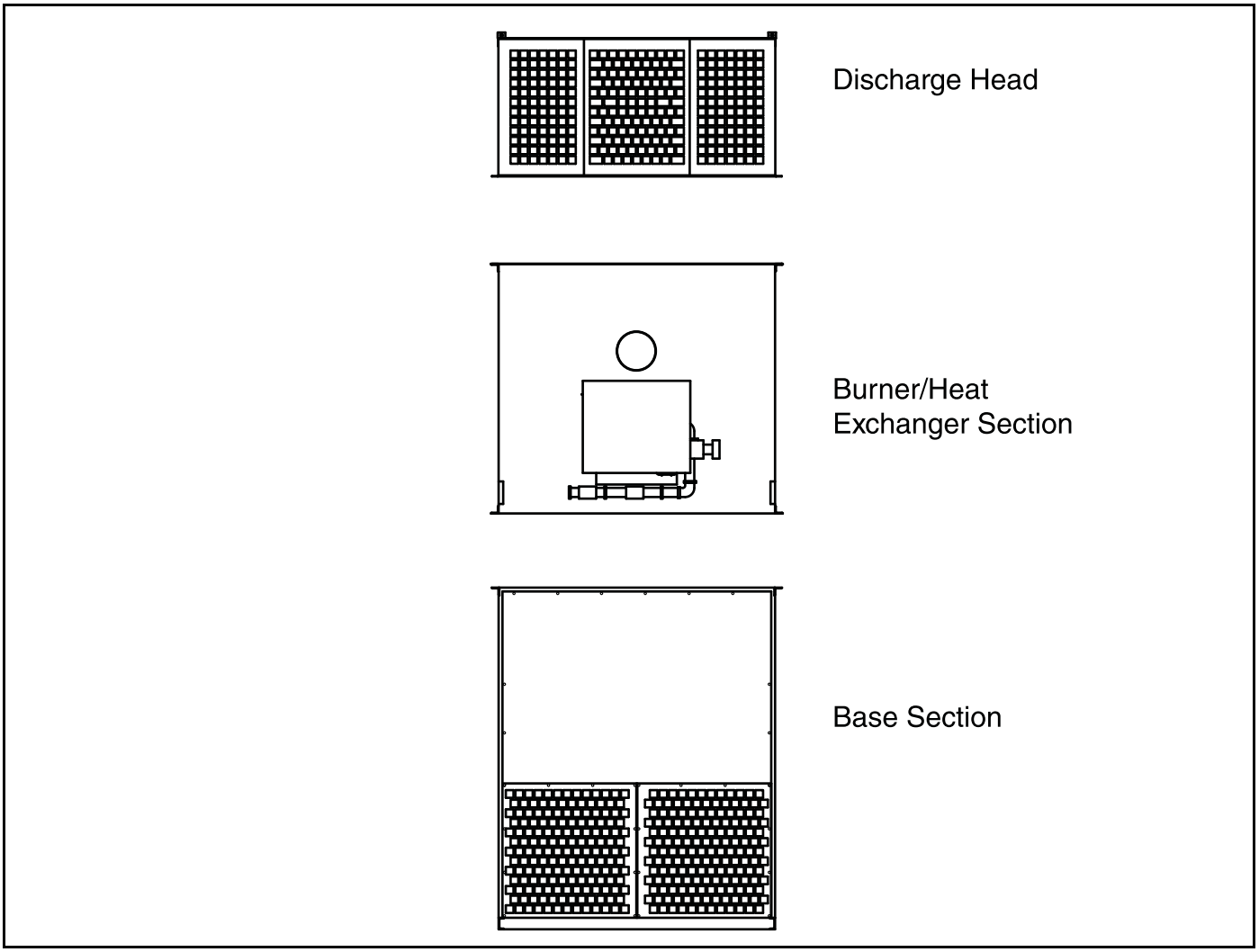
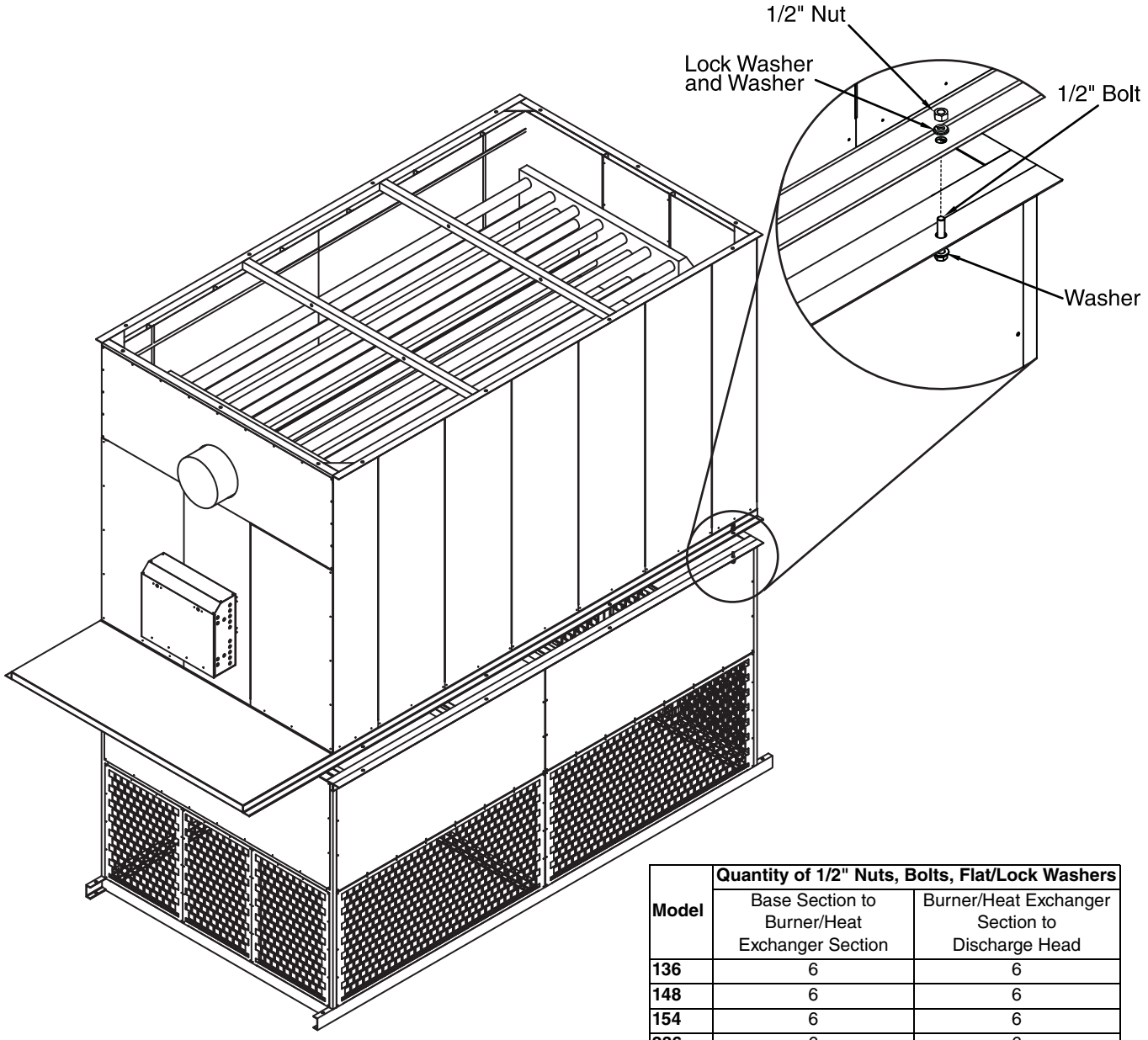


FIGURE 13: Air Turnover Unit Assembly



Model	Quantity of 1/2" Nuts, Bolts, Flat/Lock Washers	
	Base Section to Burner/Heat Exchanger Section	Burner/Heat Exchanger Section to Discharge Head
136	6	6
148	6	6
154	6	6
236	6	6
242	6	6
248	6	6
254	6	6
260	8	8
272	8	8

SECTION 8: DISCHARGE EXTENSIONS

⚠ WARNING

			
Crush Hazard	**Falling Hazard**	**Severe Injury Hazard**	**Cut/Pinch Hazard**
Use proper lifting equipment and practices.	**Use proper safety equipment and practices to avoid falling.**	**Use proper lifting practices and equipment.** **Equipment and accessories are heavy.**	**Wear protective gear during installation, operation and service.** **Edges are sharp.**
Failure to follow these instructions can result in death, injury or property damage.			

8.1 Discharge Extension Assembly

The discharge extensions are shipped broken down. They must be assembled before installing.

Step 8.1.1

The discharge extension consists of two identical welded frames (top and bottom), side panels and end panels. Each section will be assembled from the bottom up. Position one of the frames on a suitable work surface with the flange facing up; this will be the bottom frame. Position the side panels and end panels around the frame with flanges facing up.

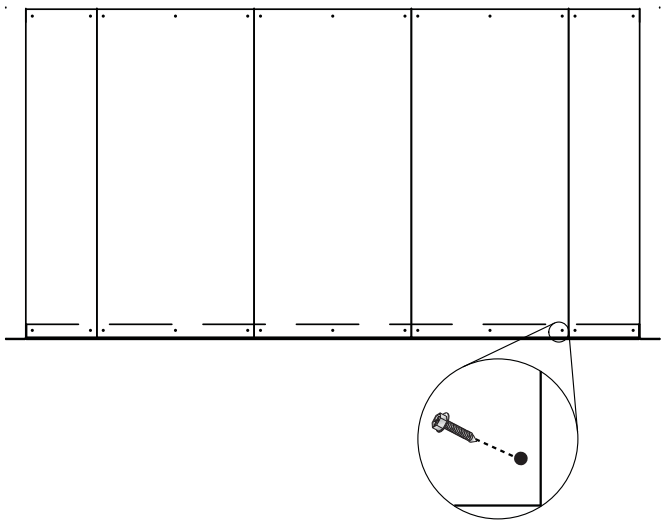
Step 8.1.2

Attach the side panels to each other using supplied drill screws through the pilot holes. Repeat on the opposite side.

Model	Quantity of Drill Screws
136	94
148	113
154	131
236	120
242	132
248	149
254	184
260	207
272	220

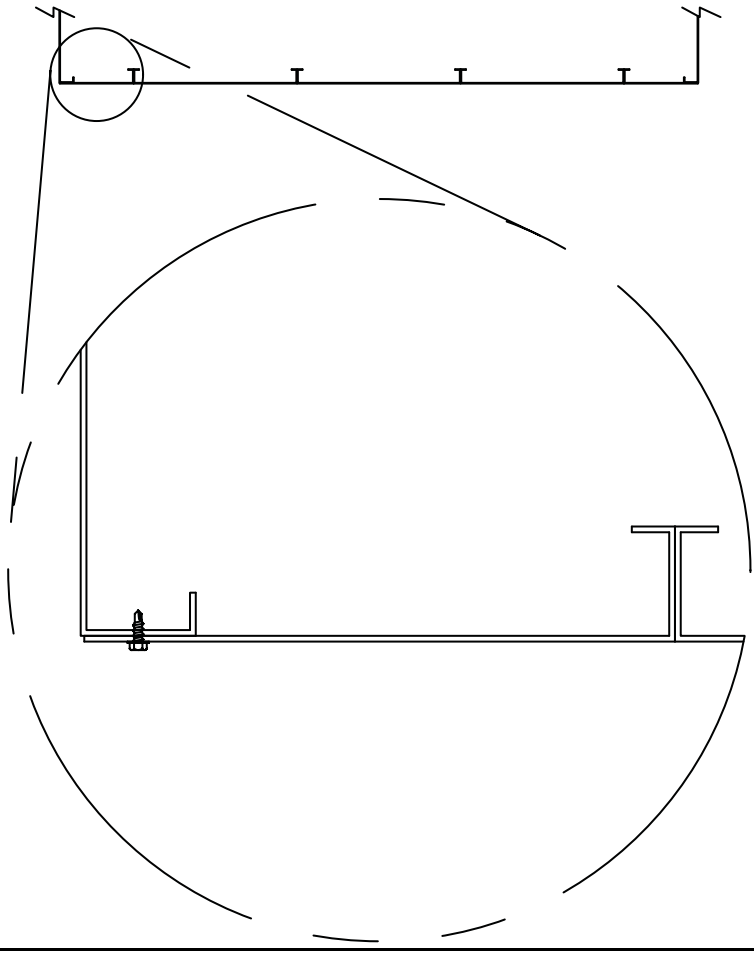
Step 8.1.3

Attach the side panel assemblies to the bottom frame using supplied drill screws through the pilot holes. Repeat on the opposite side.



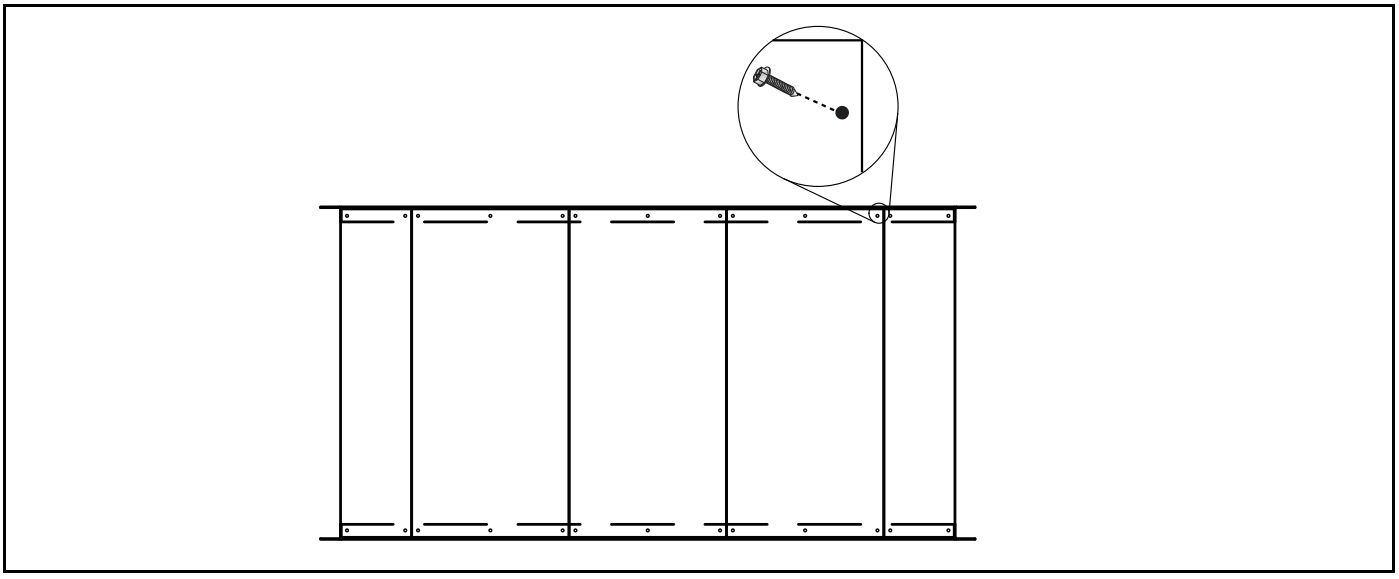
Step 8.1.4

Attach the end panels to each other using supplied drill screws through the pilot holes. Repeat on the opposite side. Attach the end panel assemblies to the frame using drill screws through the pilot holes. Repeat on the opposite side. Attach the end panels to the side panels with supplied drill screws.



Step 8.1.5

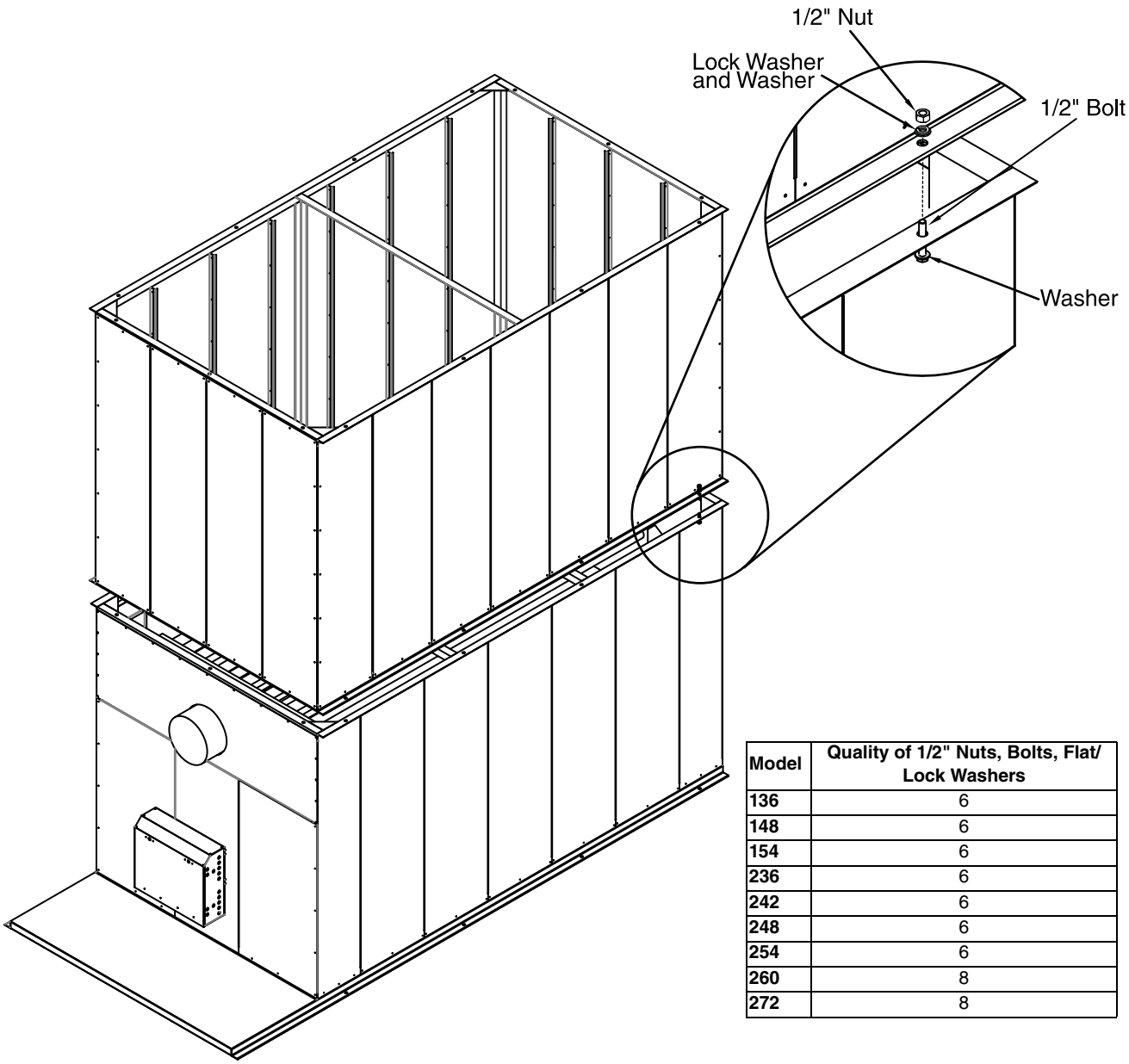
With assistance, take the remaining frame and turn it so the flange is pointed down and insert into the assembled duct extension. Screw the side panels and end panels to this frame using the supplied drill screws.



8.2 Discharge Extension Installation

The discharge extensions are designed for mounting to the cabinet of the air turnover unit, each other and the discharge plenum. The discharge extensions have four outward-turned flanges on the top and bottom. To install the extensions, lift in place using spreader bars. Bolt the extensions in place as required with the supplied hardware. *See Page 29, Figure 14*.

FIGURE 14: Discharge Extension Installation



Model	Quality of 1/2" Nuts, Bolts, Flat/ Lock Washers
136	6
148	6
154	6
236	6
242	6
248	6
254	6
260	8
272	8

SECTION 9: VENTING

⚠WARNING

Carbon Monoxide Hazard

Air turnover unit must be vented.

Air turnover unit must be installed according to the installation manual.

Failure to follow these instructions can result in death or injury.

9.1 General Venting Requirements

This air turnover unit must be vented in accordance with the rules contained in this manual and with the following national codes and any state, provincial or local codes which may apply:

United States: Refer to NFPA 54/ANSI Z223.1-latest revision, National Fuel Gas Code for natural gas and LPG units. Refer to NFPA Article 31 - latest revision, Standard for the Installation of Oil-Burning Equipment for oil units.

Canada: Refer to CSA B149.1 - latest revision, Natural Gas and Propane Installation Code for natural gas and LPG units. Refer to CSA B139 - latest revision, Installation Code for Oil-Burning Equipment for oil units.

9.2 Recommended Flue Venting Practices

All indirect-fired air turnover units are shipped without flue/vent pipe components. It is the responsibility of the installer to supply the venting components.

All indirect fired air turnover units must be vented. Each air turnover unit must have an individual vent pipe and vent terminal.

Termination of the vent pipe must be located so that the combustion fumes can not be drawn back into the air turnover unit or into any other outside air intakes.

Vent pipe diameter must match the diameter of the air turnover unit's flue pipe extension. Recommended vent pipe is a minimum 26 gauge galvanized steel or stainless steel for units with 6" (15.2 cm) flue pipe extensions; minimum 16 gauge galvanized steel or stainless steel for units with 8" (20.3 cm) or larger flue pipe extensions. The installer must provide a rain cap or weather cap. All joints must be sealed. Type "B" vents are not acceptable.

Do not support the weight of the vent pipe on the equipment's flue pipe extension. Vent pipe must be self supporting.

On equipment with a high turndown burner, it is recommended to insulate single wall vent pipes.

Insulation must have a minimum temperature rating of 1000° F (537.8° C).

Maximum vent pipe length (horizontal or vertical) is 40' (12.2 m). A total equivalent vent pipe length can be calculated using equivalent straight pipe lengths for tees and elbows reducing the maximum vent pipe length by 6' (1.8 m) for each sweep elbow, 2.5' (.7 m) for the termination tee, and 10' (3.0 m) for each short radius elbow.

The vent pipe should be fitted with a drip leg with a clean out and a drain plug in the bottom. The vent pipe shall be constructed so that any water or condensate that collects in the vent will remain in the drip leg and not drain back into the air turnover unit. Be sure the drip leg is constructed in a way that water or condensate will not fall on air turnover unit's controls when drain plug is removed on gas-fired air turnover units only. Pitch horizontal vents downward 1/4" (.6 cm) per foot toward outlet for condensate drainage. On oil-fired and combination gas-fired/oil-fired air turnover units, pitch horizontal vents downward 1/4" (.6 cm) per 1' (.3 m) towards the air turnover unit for drainage. Support horizontal runs as required to prevent sagging.

Do not install dampers or other restrictive devices in the vent pipe.

The vent pipe should not be installed in such a manner that access to the components is obstructed.

Maximum clearances to combustibles around the vent pipe are significantly higher than for the air turnover unit.

The vent pipe shall have a minimum of at least 36" (91.4 cm) clearance to combustibles, and be guarded to protect personnel from coming in contact.

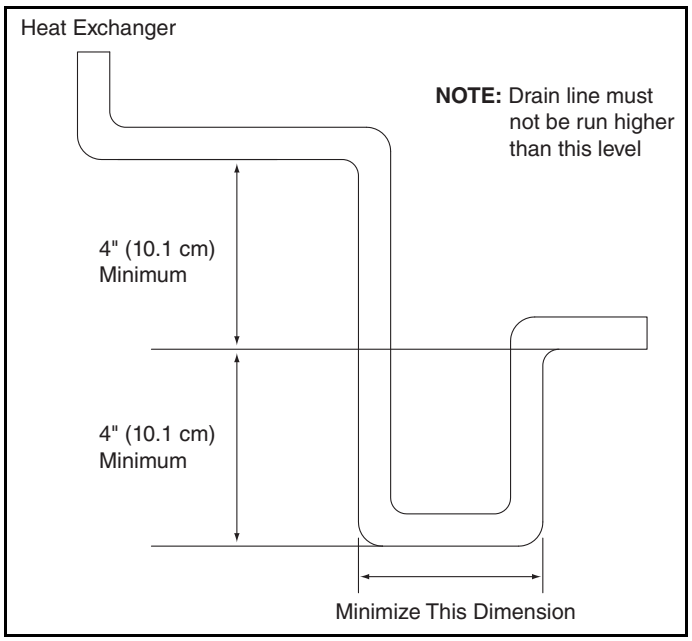
Approved listed thimble is to be used wherever the vent pipe passes through a combustible wall or ceiling/roof.

9.3 Heat Exchanger Condensate Drain Connection

Air turnover units are provided with a male NPT condensate drain connection. Refer to the air turnover unit drawings for the exact location. This connection must be extended away from the air turnover unit for proper drainage. Use pipe, preferably stainless steel or similar material that will be non-corrosive and can handle the high heat.

A P-Trap is preferred and should be constructed using *Page 31, Figure 15* as a guideline.

FIGURE 15: Condensate Drain



The condensate should be piped into the building drainage system. The drain line should be pitched away from the unit at a minimum of 1/8" (.32 cm) per foot. Refer to local codes for additional requirements. Sealed drain lines require venting to assure proper condensate flow.

SECTION 10: BURNERS

⚠WARNING

Explosion Hazard

Leak test all components of gas/oil piping before operation.

Gas/oil can leak if piping is not installed properly.

Do not high pressure test gas/oil piping with air turnover unit connected.

Failure to follow these instructions can result in death, injury or property damage.

10.1 Principle of Operation

The burner is a self-contained unit comprised of a blower assembly, firing head, igniter and flame monitoring system. Gas burners use multiple orifices with venturi operation for proper combustion.

Oil burners use pressure atomization for proper combustion.

The "Type J" burner is used on gas-fired air turnover units with an input of 300 - 2,200 MBH (87.9 - 644.8 kW). *See Page 32, Figure 16*. The "Type C" burner is used on all oil-fired air turnover units and on gas-fired air turnover units with an input of 2,201 - 5,625 MBH (644.9 - 1648.5 kW). *See Page 33, Figure 17*.

For more information on the burner provided in a specific air turnover unit, refer to the manufacturer's documentation with the air turnover unit.

Air for combustion is furnished by an integrally mounted, motor-driven combustion air fan and is controlled by a multi-louvered damper assembly. The combustion air then discharges into the burner blast tube assembly. High turbulence flow is controlled by means of an adjustable fan diffuser system.

The different modes of operation are achieved by using appropriate control valves and fuel/air actuators. Burners are available with on/off, high/low/off and full modulating modes. The air/fuel ratio is established at the time of start-up and proven with combustion test equipment to provide the lowest practical emissions with a clean flame. *See Page 112, Section 16.9 through Page 113, Section 16.10* for proper procedures and emission levels.

FIGURE 16: Typical "Type J" Burner

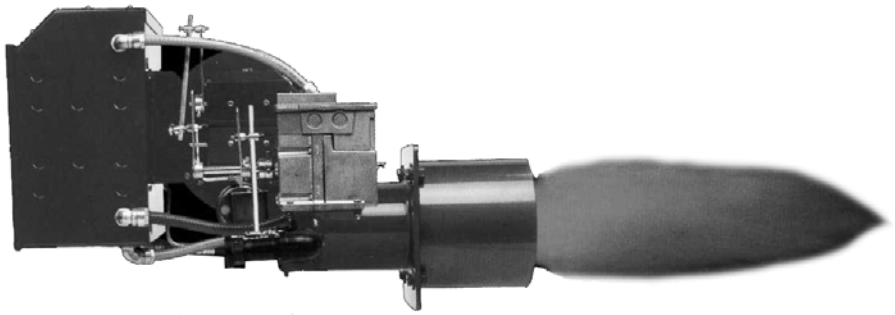
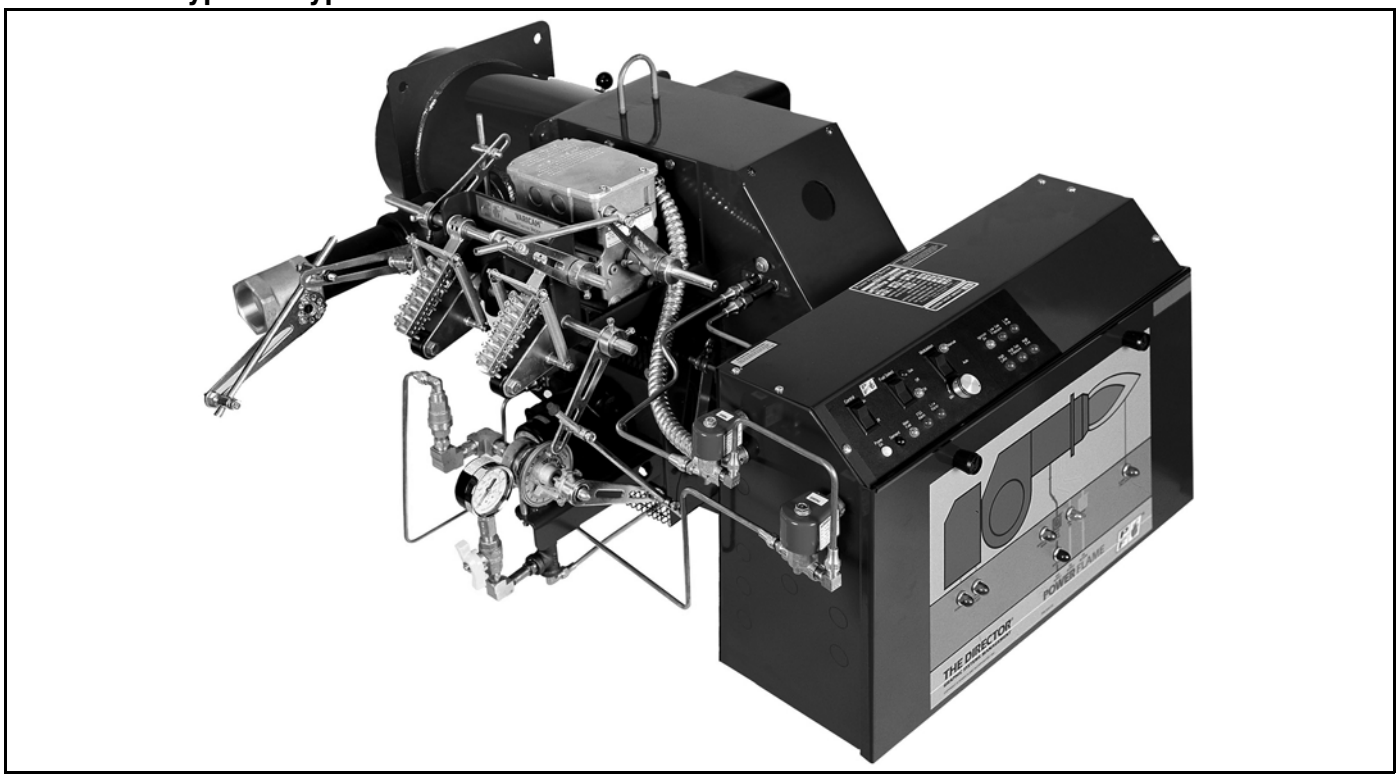


FIGURE 17: Typical "Type C" Burner

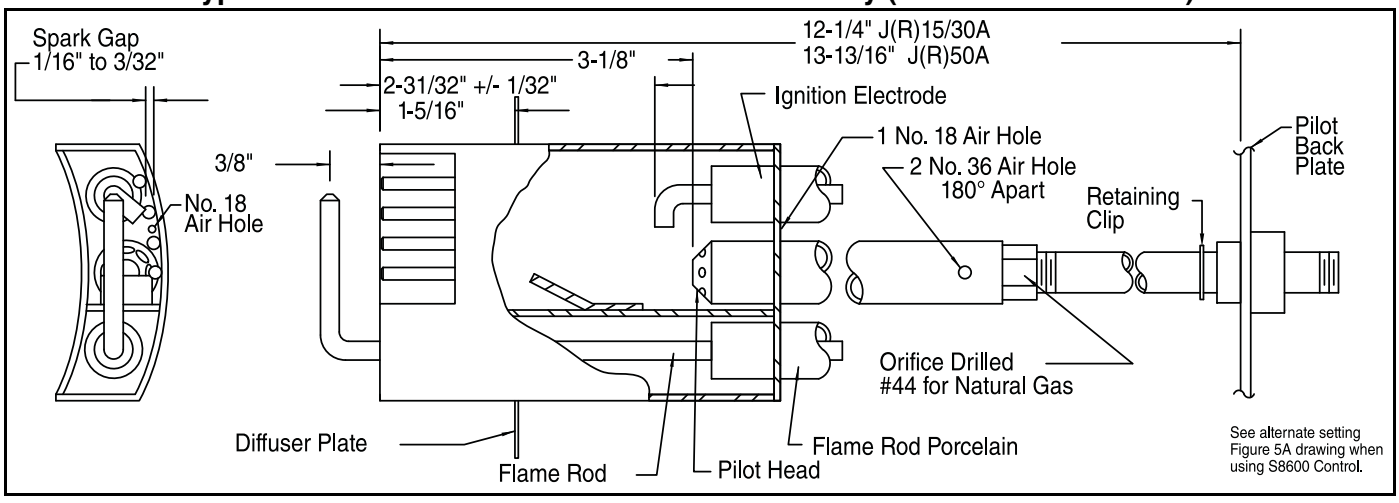


10.2 Burner Pilot Assemblies

"Type J" burners on the air turnover units can utilize either a flame rod (natural gas only) or a ultraviolet scanner. On/Off, High/Low/Off and 3:1 modulating natural gas "J" burners use a flame rod as standard. 8:1 and 10:1 modulating natural gas "J" burners and all LPG "J" burners use a ultraviolet scanner as standard.

All "Type C" burners use an ultraviolet scanner. All burners are preset at the factory for proper operation and firing rate. If field re-adjustment of ignition electrodes or flame rod is required refer to *Page 33, Figure 18 through Page 36, Figure 21* for the proper pilot assembly set-up.

FIGURE 18: "Type J" Burner with Flame Rod - Natural Gas Only (Not for use with LPG)



10.3 Combustion Air Intake Collar

A burner can be factory-fitted with an optional combustion air intake collar, thereby allowing the burner to pull its combustion air from outside of the unit's immediate vicinity. This collar adapts the square combustion air intake of the burner to a round duct connector or converts it to a square duct flange.

See Page 34, Table 13 for standard burner collar diameter / flange size. Consult factory for non-standard burners as collar diameters / flanges may vary.

Table 13: Combustion Air Duct Collar Sizing

Type	Size - Outer Dimensions		Burner Type: Gas Max Input	Gas Max Input	Oil and Gas/Oil Max Input	Oil and Gas/Oil Max Input
	(in)	(cm)	(MBH)	(kW)	(MBH)	(kW)
Round	6.0	15.2	1075	315	1360	398.6
Round	8.0	20.3	2200	644.8	2200	644.8
Square	8.0	20.3	5250	1538.6	5250	1538.6
Square	12.0	30.5	5600	1641.2	5600	1641.2

When ducting outside combustion air to the burner air inlet, several considerations must be taken in account:

- Temperature variations when using outside fresh air: Changes in air temperature affect density of the air and the volume of air delivered to the combustion process. This must be taken in account when performing combustion performance. For example: For each 30° F (33.3° C) change in the air temperature, a 1% change in the oxygen reading will be experienced.
- Condensation in the fresh air duct: A drain connection is required in the lowest point of the duct or the duct must be pitched a minimum of a 0.25" (.6 cm) per foot (30.5 cm) away from the burner for condensate drainage.
- Duct Sizing: Size the fresh air duct to provide a minimum of 20 CFM (34 m^3/h) per 10,000 Btu/hr (2,931 kW) of input firing rate. The velocity of the air must not exceed 1000 FPM (5.0 m/s) and cause less than 0.1" wc (<.25 mbar) pressure drop, including all screens, filters and fittings. The inlet to this duct must be protected from weather (rain, snow and/or ice) and must have an inlet screen to protect from pest and debris.

FIGURE 19: "Type J" Burner with Ultraviolet Scanner - Natural Gas or LPG

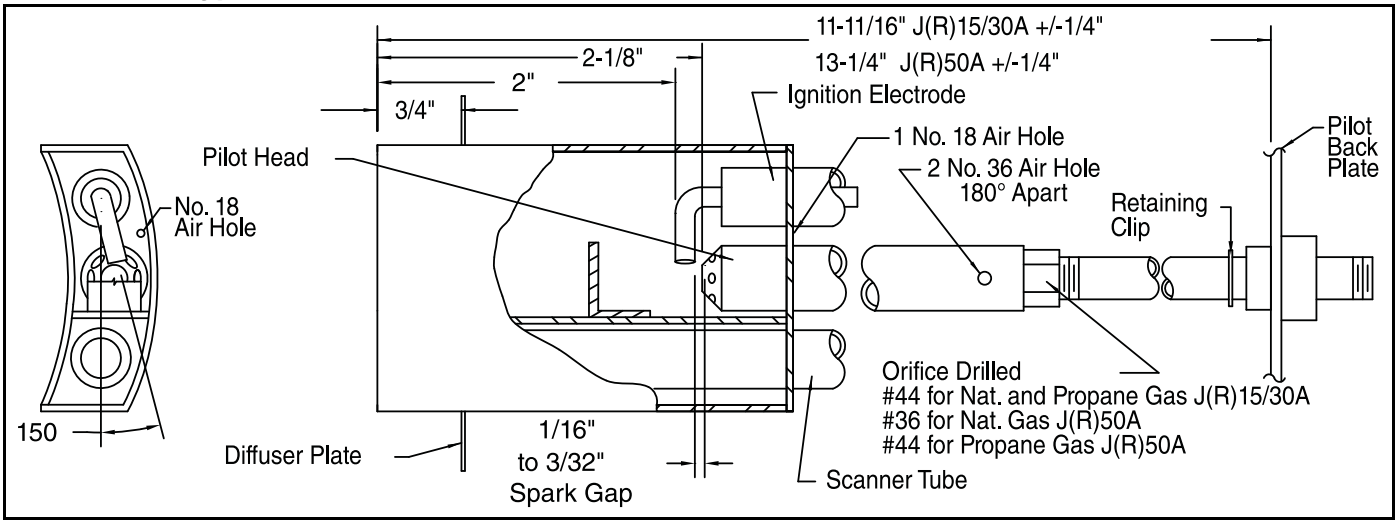
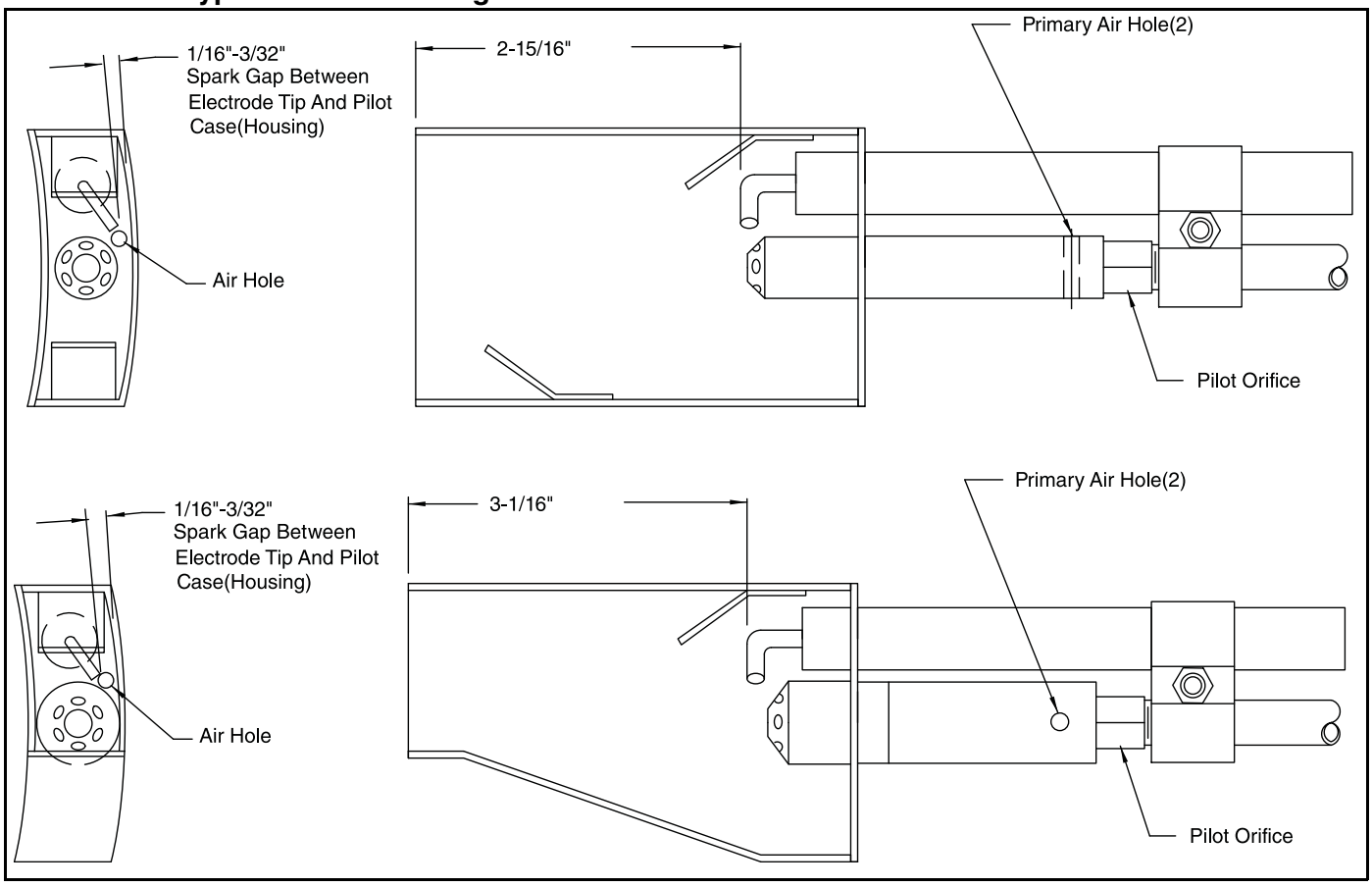
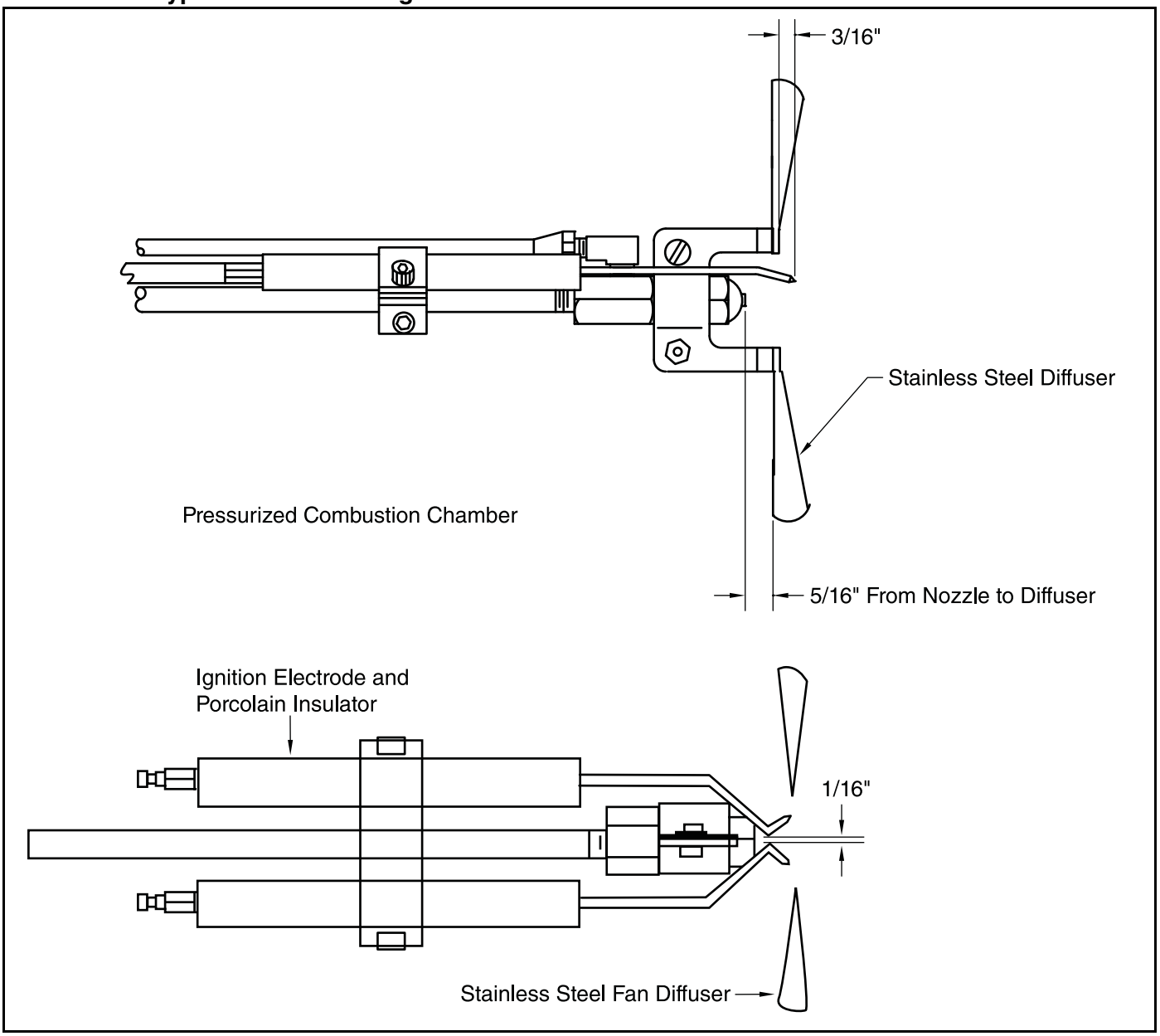


FIGURE 20: "Type C" Burner with Ignition Electrode - Natural Gas or LPG



NOTE: "Type C" Gas Burner - The arc from the electrode tip should jump from the tip to the body of pilot housing and should be lined up with the hole in the backside of pilot housing, so that the blower air passing through this hole will cause the arc to flag or move around. Normal spark gap should be 1/16" (1.6 mm) - 3/32" 2.4 mm). Electrode should not be moved so far forward that the pilot flame will impinge on the porcelain insulator. This condition will cause the porcelain to crack and break off at the point of flame impingement.

FIGURE 21: "Type C" Burner with Ignition Electrode - Oil



SECTION 11: GAS PIPING FOR GAS-FIRED AIR TURNOVER UNITS

⚠WARNING

Explosion Hazard

Leak test all components of gas/oil piping before operation.

Gas/oil can leak if piping is not installed properly.

Do not high pressure test gas/oil piping with air handler connected.

Failure to follow these instructions can result in death, injury or property damage.

11.1 Gas Manifolds

All gas piping to the air turnover unit must comply with:

United States: Refer to NFPA 54/ANSI Z223.1-latest revision, National Fuel Gas Code for natural gas and LPG units. Refer to NFPA Article 31 - latest revision, Standard for the Installation of Oil-Burning Equipment for oil units.

Canada: Refer to CSA B149.1 - latest revision, Natural Gas and Propane Installation Code for natural gas and LPG units. Refer to CSA B139 - latest revision, Installation Code for Oil-Burning Equipment for oil units.

The air turnover units are available with two different types of manifolds:

- Factory Mutual (FM)/Underwriters Laboratories (UL) Compliant
- XL Insurance (former Industrial Risk Insurers[IRI]) Compliant

11.2 Gas Piping and Pressures

The air turnover unit is equipped with a gas manifold suitable for connection to supply pressure of up to 1 PSIG (68.9 mbar). When gas supply exceeds this maximum gas pressure, an additional high pressure gas regulator will be required to insure that the correct gas pressure is supplied to the regulator. Pressure should be measured between the high pressure gas regulator and safety shut off valve.

For minimum inlet gas pressures refer to *Page 38, Table 14*.

Table 14: Gas Manifold Size

Model	Minimum Heat Input		Maximum Heat Input		Gas NPT Connection	Minimum Inlet Gas Pressure
	MBH	kW	MBH	kW	in	in wc
136	300	88	563	165	1.00	7.0
148	300	88	630	185	1.00	7.0
	631	186	938	275	1.00	10.0
154	300	88	630	185	1.00	7.0
	631	186	938	275	1.00	10.0
	939	276	1,250	366	1.25	8.0
	1,251	367	1,565	459	1.50	10.0
236	300	88	630	185	1.00	7.0
	631	186	938	275	1.00	10.0
	939	276	1,250	366	1.25	8.0
242	300	88	630	185	1.00	7.0
	631	186	938	275	1.00	10.0
	939	276	1,250	366	1.25	8.0
	1,251	367	1,565	459	1.50	10.0
248	300	88	630	185	1.00	7.0
	631	186	938	275	1.00	10.0
	939	276	1,250	366	1.25	8.0
	1,251	367	1,875	550	1.50	10.0
254	700	205	938	275	1.00	10.0
	939	276	1,250	366	1.25	8.0
	1,251	367	1,875	550	1.50	10.0
	1,876	551	3,125	916	2.00	10.0
260	750	220	938	275	1.00	10.0
	939	276	1,250	366	1.25	8.0
	1,251	367	1,875	550	1.50	10.0
	1,876	551	3,125	916	2.00	10.0
	3,126	917	5,000	1,465	2.50	8.0
272	750	220	938	275	1.00	10.0
	939	276	1,250	366	1.25	8.0
	1,251	367	1,875	550	1.50	10.0
	1,876	551	3,125	916	2.00	10.0
	3,126	917	5,000	1,465	2.50	12.0
	5,001	1,466	5,600	1,641	2.50	15.0

FIGURE 22: Manifold Diagram for Gas-Fired Air Turnover Unit with any FM-Compliant Manifold/XL-Compliant Manifold Rated for Less Than 1,000 MBH (293 kW) and with On/Off or High/Low/Off Burners

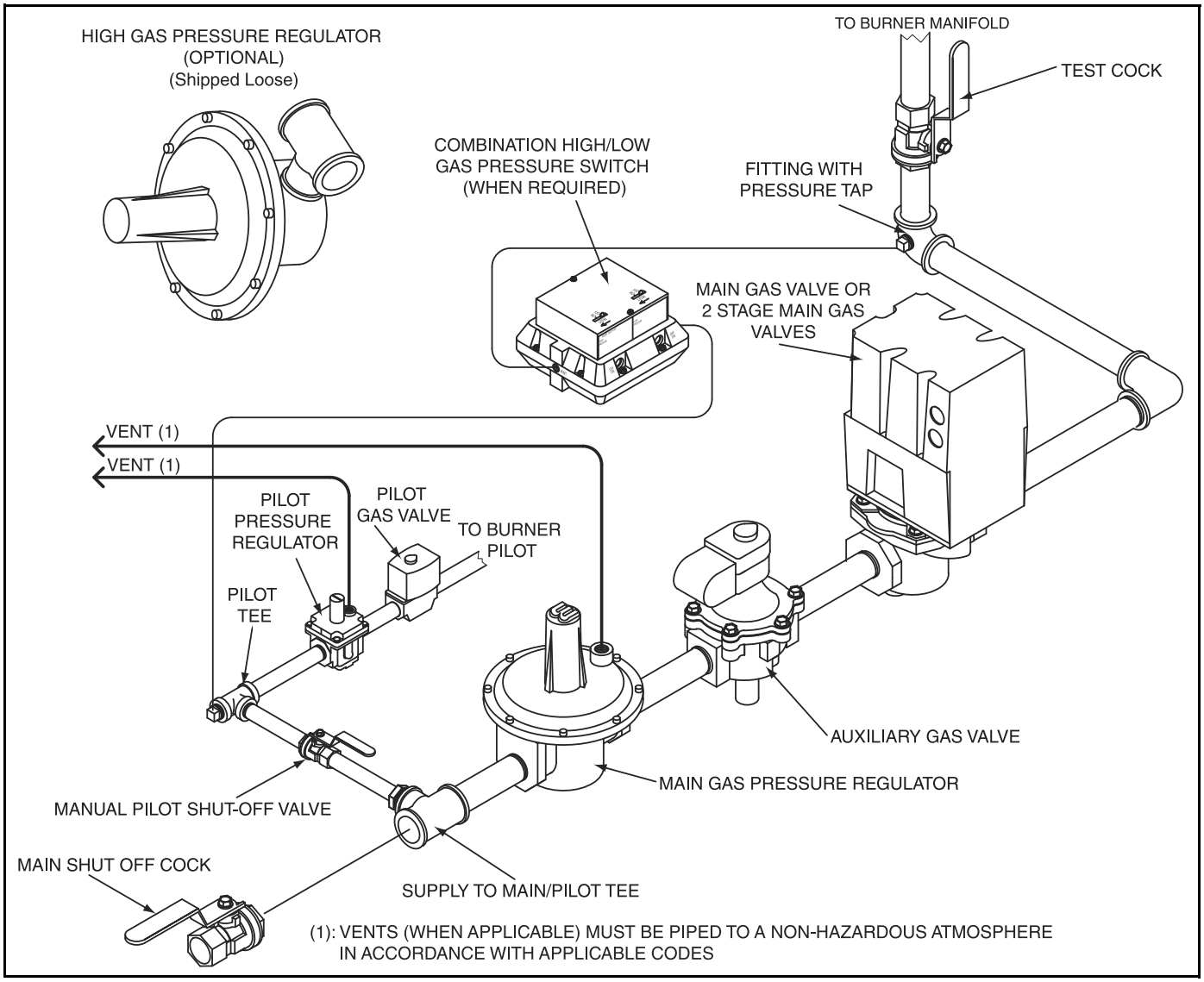


FIGURE 23: Manifold Diagram for Gas-Fired Air Turnover Unit with any FM-Compliant Manifold/XL-Compliant Manifold Rated for Less Than 1,000 MBH (293 kW) and with Modulating Burner

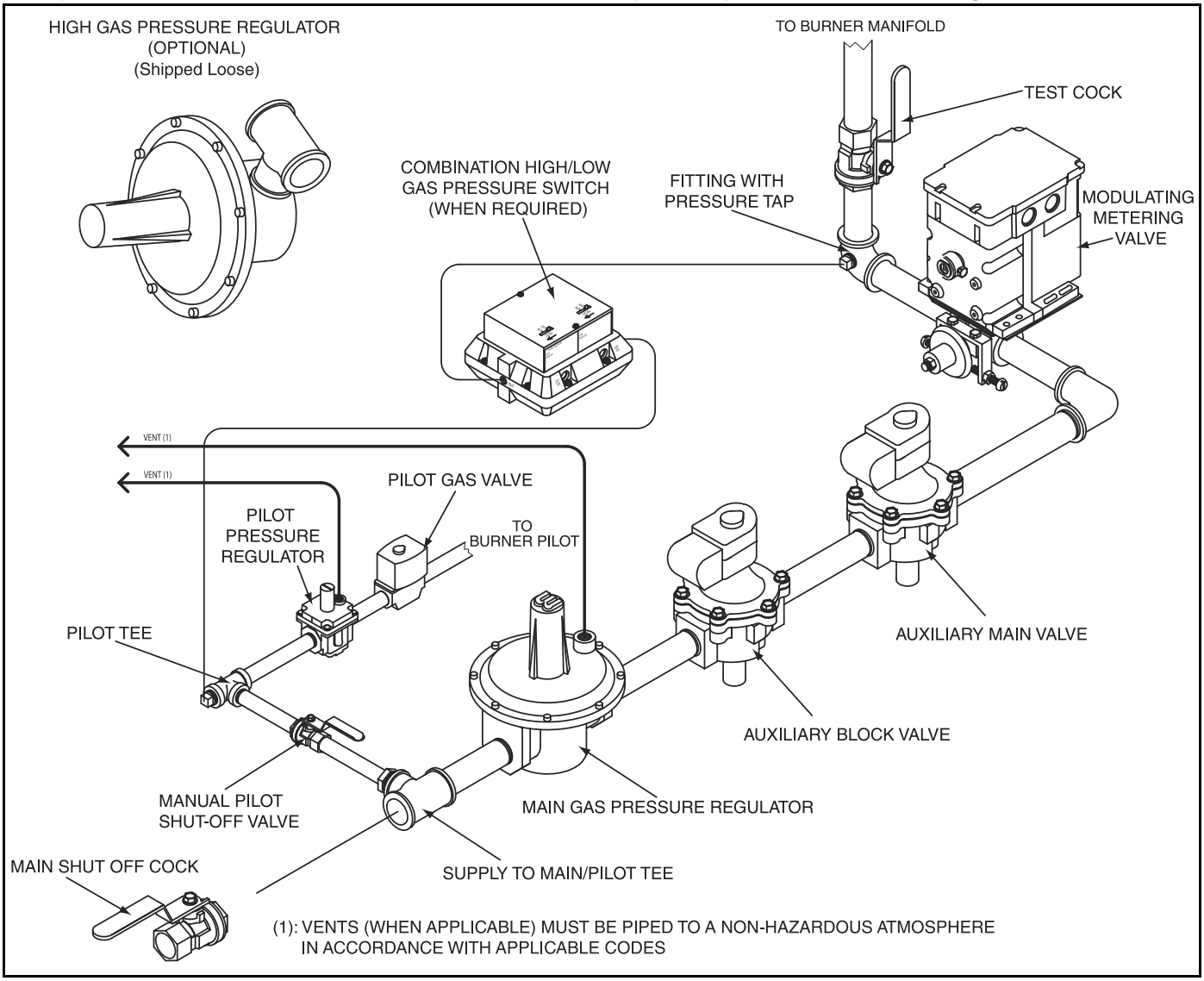


FIGURE 24: Manifold Diagram for Gas-Fired Air Turnover Unit with XL-Compliant Manifold Rated for More Than 1,000 MBH (293 kW) and with On/Off or High/Low/Off Burner

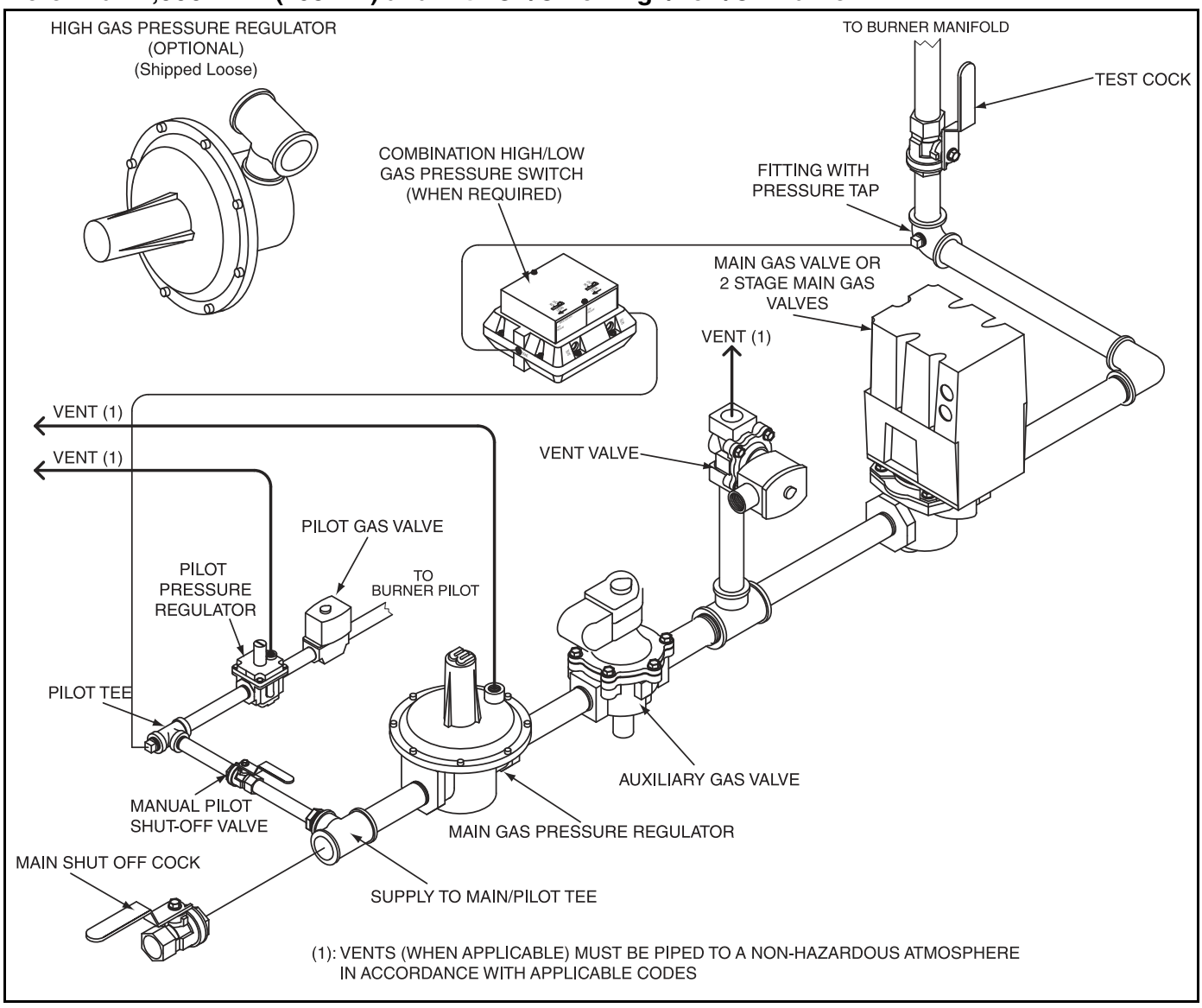
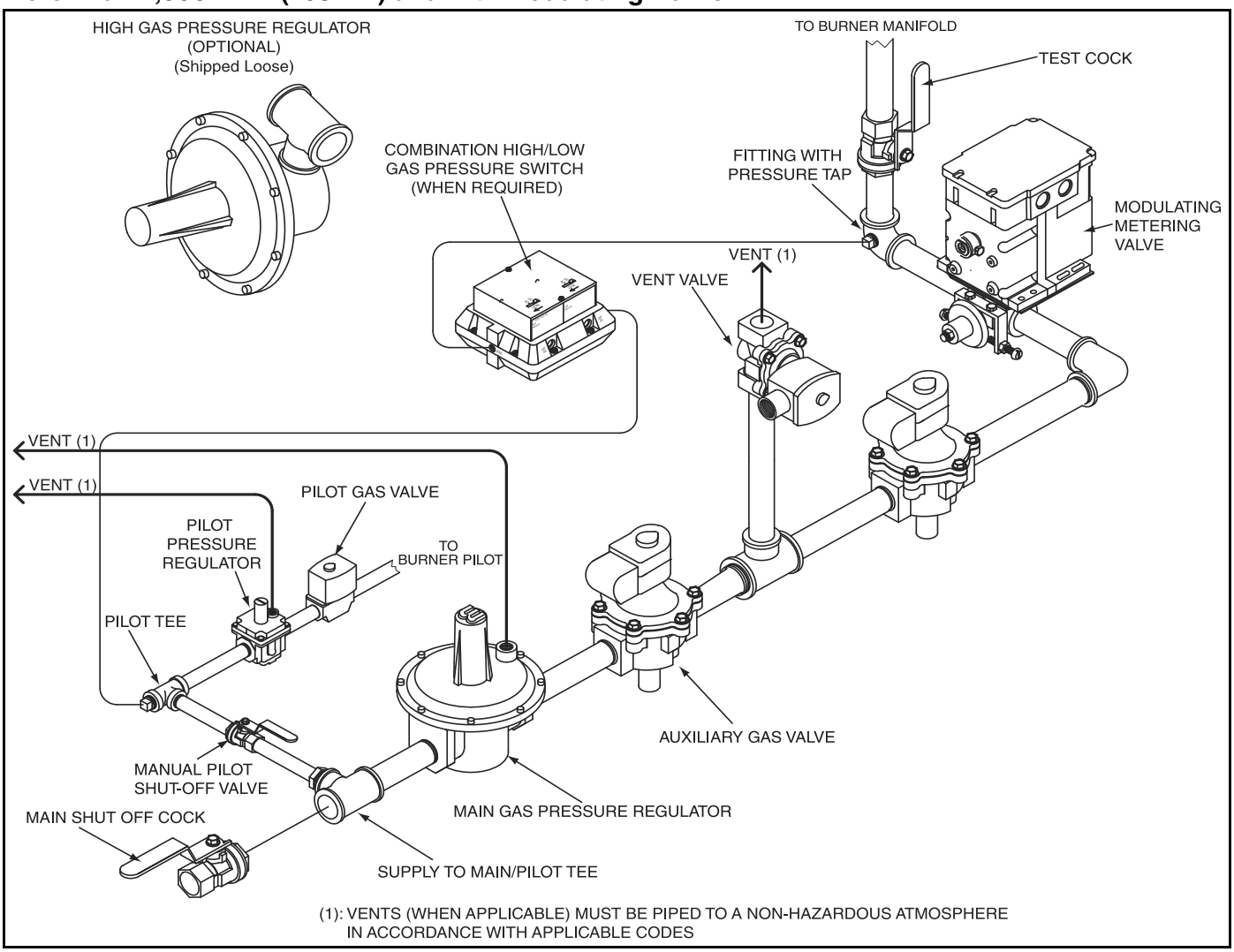


FIGURE 25: Manifold Diagram for Gas-Fired Air Turnover Unit with XL-Compliant Manifold Rated for More Than 1,000 MBH (293 kW) and with Modulating Burner



11.3 Gas Manifold Venting

Vent valves fitted on XL-compliant manifolds must be piped to the atmosphere outside the structure. This is the responsibility of the installer.

11.3.1 Main Gas Regulator Venting

The main regulator used on 1¼" NPT and larger manifolds must be piped to the atmosphere outside the structure. This is the responsibility of the installer.

11.3.2 Vent Line Installation

The following may be used as a guideline for installation, but all applicable codes and regulations must be followed.

- Natural gas and LPG are toxic and flammable substances. They must be released where they will not cause personal injury or property damage. The end of the vent line must be located where it is safe to release gas.
- Pipe the vent line outside the structure.
- Use as short a vertical run of pipe as possible.
- Do not run pipe from a high point to a lower point to avoid obstacles.
- Use a minimum number of bends.
- Do not downsize the pipe from the origination point (must be same size or larger).
- Make sure vent line is free from obstructions.
- Do not group lines together into a common header.
- The outside termination must have a weatherproof cap or be directed downward for protection from the elements and must be screened to prevent the entry of any objects.

11.4 Gas Piping

The factory piping terminates with a female pipe connection in the pilot take off tee. The manual main gas shutoff valve is shipped loose for field installation. Be sure that the fuel supply pipe connected at this point is large enough to ensure the proper gas flow and line pressure at the inlet of the unit. The piping must comply with:

United States: Refer to NFPA 54/ANSI Z223.1 - latest revision, National Fuel Gas Code.

Canada: Refer to CSA B149.1 - latest revision, Natural Gas and Propane Installation Code.

Gas supply piping must conform to best building practices and local codes. During installation of the gas piping, be sure that no piping restricts accessibility to the air turnover unit or its removable access doors.

Lockable manual shut-off valve must be added by the installer in compliance with Occupational Safety and Health Administration (OSHA) regulations.

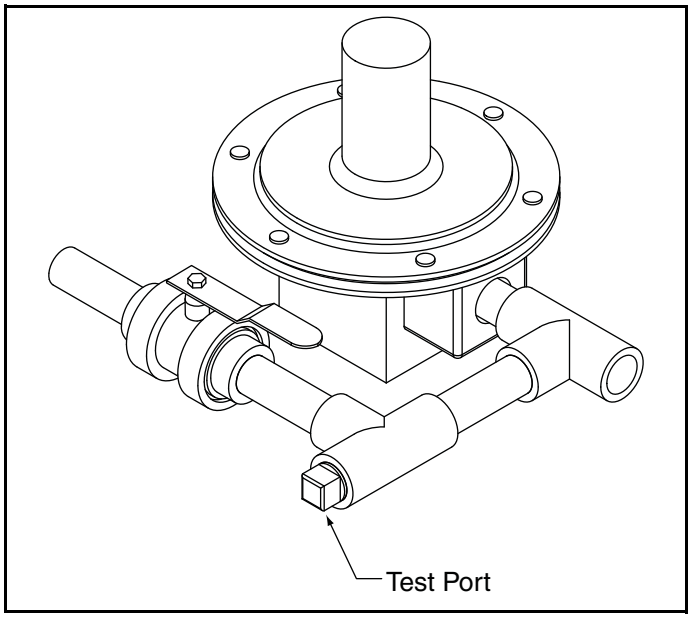
11.5 Pressure Test Ports

There are 3/8" NPT and 1/4" NPT pressure test ports located on the manifold. The test ports are available to measure the manifold inlet gas pressure and the burner gas pressure during burner setup.

11.5.1 Manifold Inlet Gas Pressure - 3/8" NPT

The pressure test port for measuring manifold inlet pressure is located on the pilot tee which is located on the manifold inlet tee. Refer to the air turnover unit rating plate for the acceptable inlet gas pressure. *See Page 43, Figure 26*.

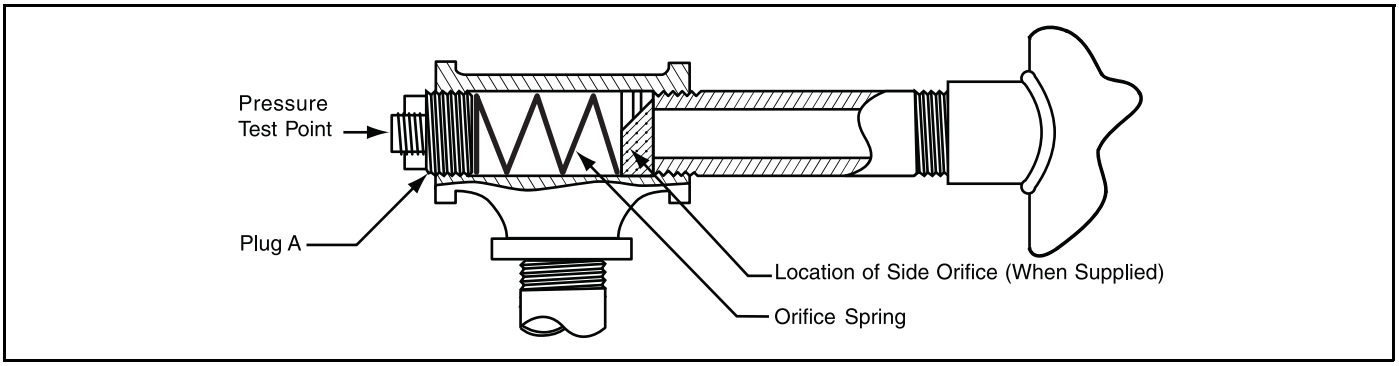
FIGURE 26: Test Port Location



11.5.2 Burner Gas Pressure - 1/4" NPT

The pressure test port for measuring burner gas pressure is located at the burner inlet orifice tee. Refer to the air turnover unit rating plate for the burner pressure required for high fire. *See Page 44, Figure 27*.

FIGURE 27: Location of Side Orifice



11.6 Line Pressure Test - Leak Testing

The air turnover unit and its individual shut-off valve must be disconnected from the gas supply piping systems during any pressure testing of that system at test pressures in excess of 1 PSIG (68.9 mbar). The air turnover unit must be isolated from the gas supply piping system by closing its individual manual gas valve that is located immediately upstream of the safety shut-off gas valve.

SECTION 12: OIL PIPING FOR OIL-FIRED AIR TURNOVER UNITS

⚠WARNING

Explosion Hazard

Leak test all components of gas/oil piping before operation.

Gas/oil can leak if piping is not installed properly.

Do not high pressure test gas/oil piping with air turnover unit connected.

Failure to follow these instructions can result in death, injury or property damage.

All oil piping to the air turnover unit must comply with:

United States: Refer to NFPA 31 - latest revision, Standard for the Installation of Oil Burning Equipment.

Canada: Refer to CSA B139 - latest revision, Installation Code for Oil Burning Equipment.

The air turnover units are available with two different types of manifolds:

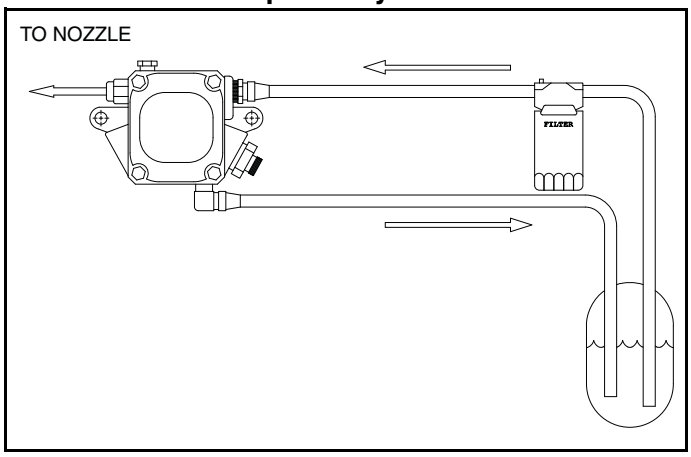
- Factory Mutual (FM)/Underwriters Laboratories (UL) Compliant
- XL Insurance (former IRI) Compliant

12.1 Oil Piping and Pressures

Do not use any sealant whether paste or tape that contains Teflon™ on the pipe or fittings. Teflon™ will cause valves to fail and block nozzles.

The burners utilized on the air turnover unit are designed for a two-pipe oil system for Number 1 and 2 fuel oil. *See Page 45, Figure 28*. Systems designed for a two-pipe system can not be used with a one-pipe system.

FIGURE 28: Two-Pipe Oil System



The maximum pressure allowable on the suction side of the pump is 3 PSIG (137.9 mbar) static and 2 PSIG (206.8 mbar) operating. The maximum vacuum allowable on the suction side of the pump is 10" HG.

There is no factory piping for the suction line or return line for the oil supply as they are located on the burner's pump. *See Page 46, Figure 29 through Page 46, Figure 30*. The size of the suction line is dependent on the type of oil, amount of lift, length of suction line and the pump capacity. On single air turnover unit installations, the return line should be the same size as the suction line. On multiple air turnover unit installations, each unit must have its own individual suction line, but one return line may be used if it is appropriately sized to handle the flow of all the air turnover units.

A hand shut off valve must be provided by others in the suction line near the burner along with a filter. Shut-off valves must not be installed in the return line unless required by a specific code and even then, only if an automatic relief valve is installed across this shut-off valve to allow oil to bypass directly back to the tank if the valve is inadvertently left in the closed position. Use copper tubing with flare fittings or iron pipe on all installations.

The piping must comply with:

United States: Refer to NFPA 31 - latest revision, Standard for the Installation of Oil Burning Equipment.

Canada: Refer to CSA B139 - latest revision, Installation Code for Oil Burning Equipment.

Oil supply piping must conform to best building practices and local codes. During installation of the oil piping, be sure that no piping restricts accessibility to the air turnover unit or its removable access doors.

12.2 Line Pressure Test - Leak Testing

The air turnover unit and its individual shut-off valve must be disconnected from the oil supply piping systems during any pressure testing of that system at test pressures. The air turnover unit must be isolated from the oil supply piping system by disconnecting the supply and return pipe from the pump. Only use air or nitrogen to leak test the piping.

FIGURE 29: Suntec Two Step Pump

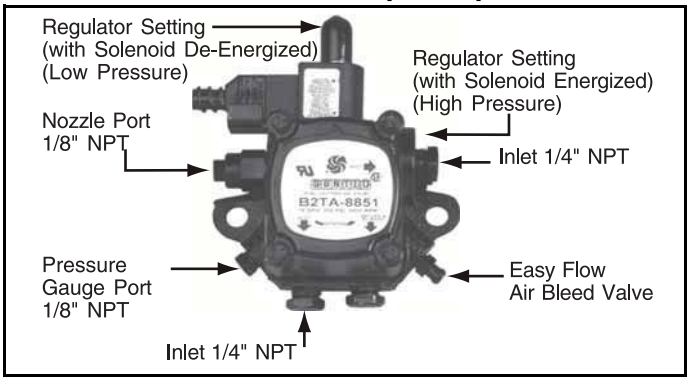
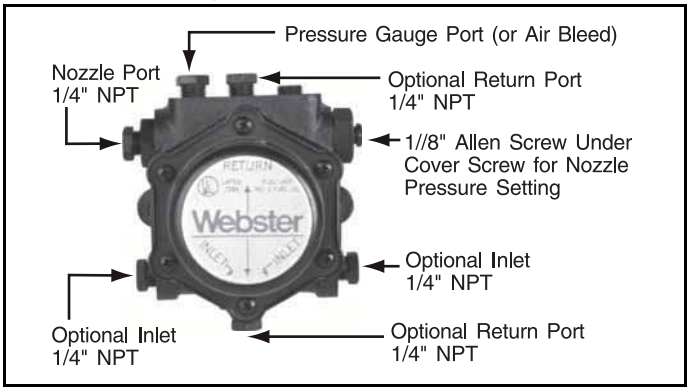


FIGURE 30: Webster 3450 RPM Blower Motor Driven Oil Pump



12.3 Pressure Test Ports

There are pressure test ports located on the burner's pump. The test ports are available to measure the nozzle pressure and bypass pressure (if so equipped). *See Page 46, Figure 29 through Page 46, Figure 30*. The Suntec pump is typically used for On/Off and High/Low/Off burners up to 23 GPH (87.1 LPH). The Webster pump is typically used for On/Off and High/Low/Off burners above 23 GPH (87.1 LPH) and all fully-modulating burners.

12.4 Oil Manifolds

FIGURE 31: FM or XL-Compliant Manifold for Air Turnover Units with Suntec Pump and On/Off Burner

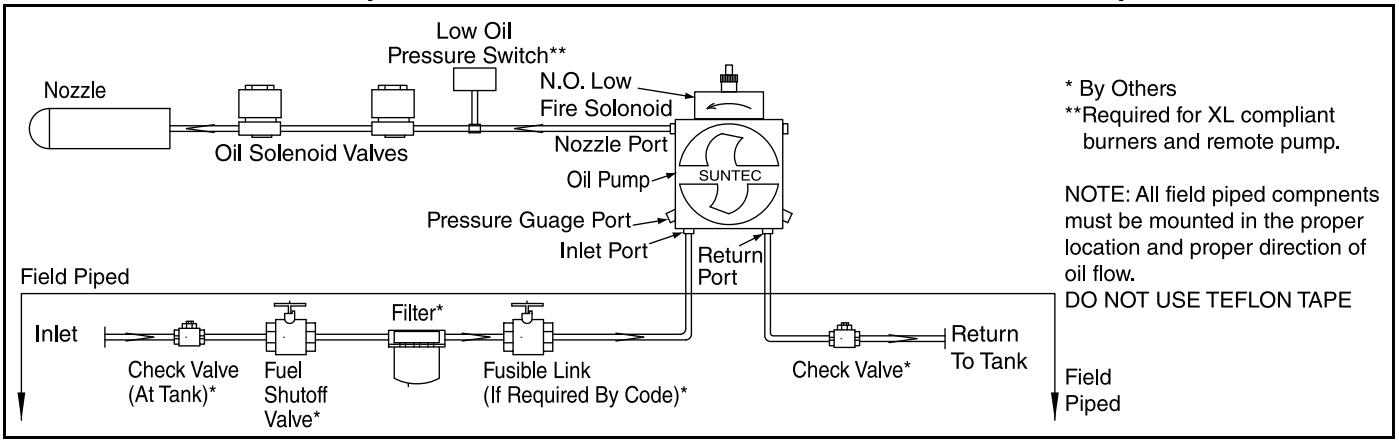


FIGURE 32: FM or XL-Compliant Manifold for Air Turnover Units with Suntec Pump and High/Low/Off Burner

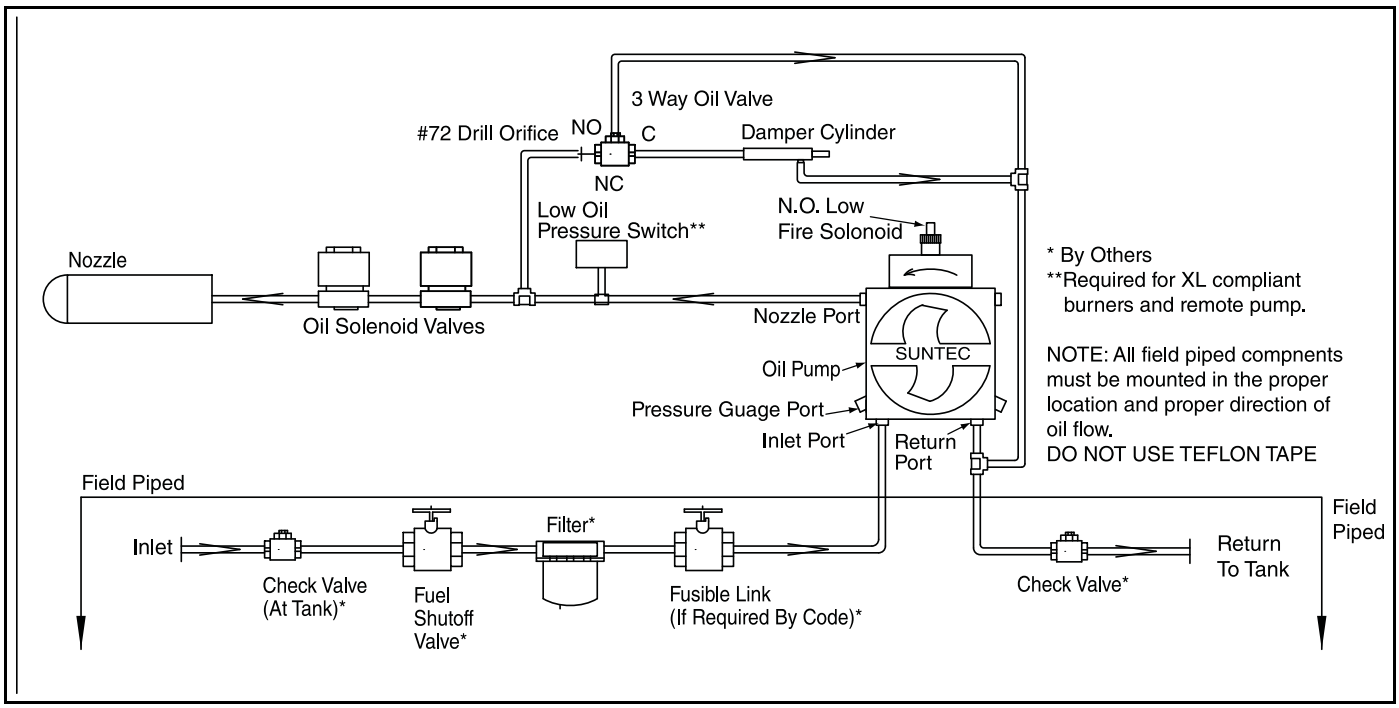


FIGURE 33: FM or XL-Compliant Manifold for Air Turnover Units with Webster Pump and High/Low/Off Burner

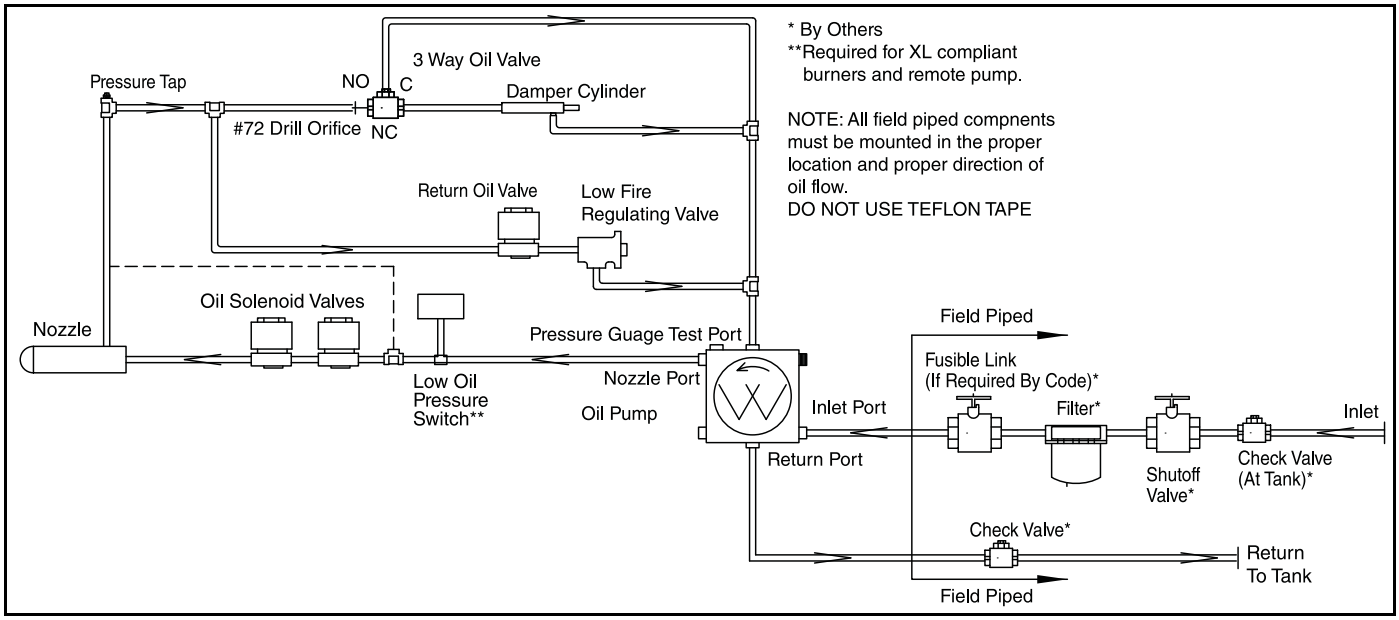
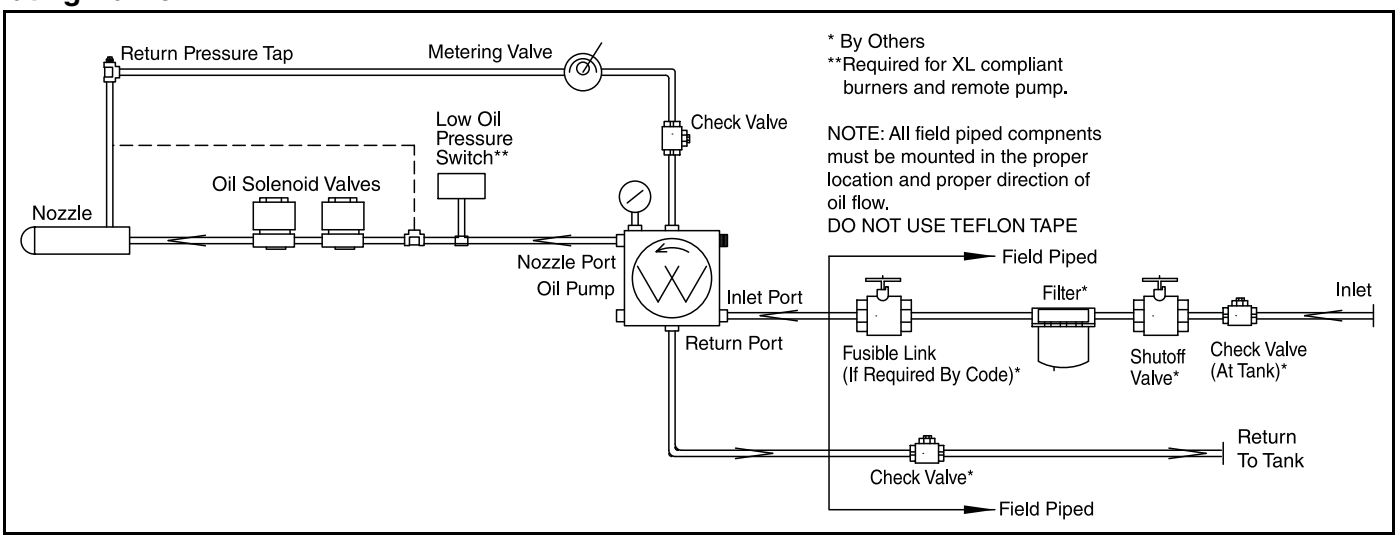


FIGURE 34: FM or XL-Compliant Manifold for Air Turnover Units with Webster Pump and Fully-Modulating Burner



SECTION 13: COMBINATION GAS AND OIL BURNERS

⚠WARNING

Explosion Hazard

Leak test all components of gas/oil piping before operation.

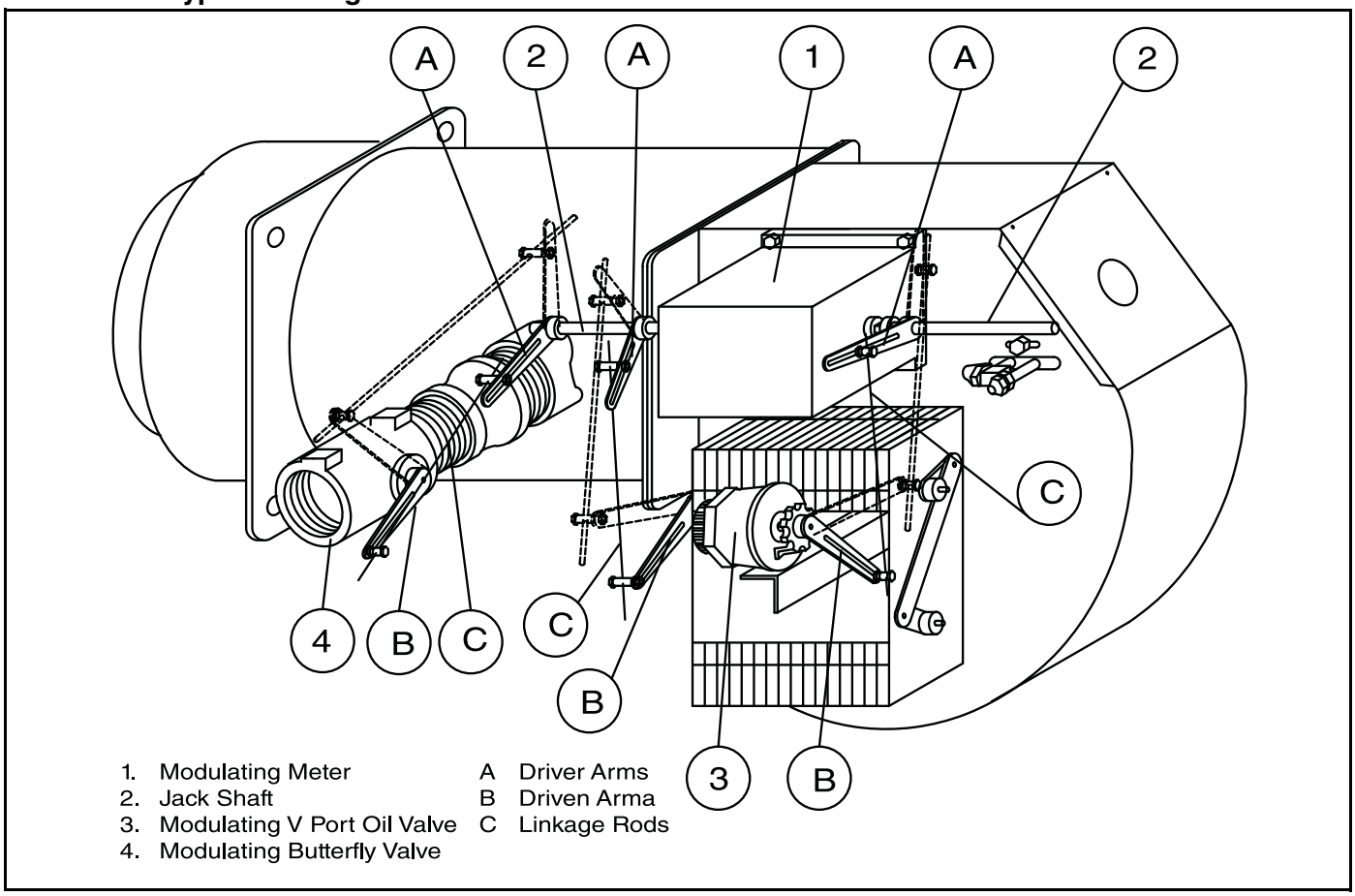
Gas/oil can leak if piping is not installed properly.

Do not high pressure test gas/oil piping with air handler connected.

Failure to follow these instructions can result in death, injury or property damage.

Burners are available that burn both natural gas/LPG and oil. They have an independent manifold and ignition system for each fuel. They share the flame safeguard control and control linkage - *See Page 49, Figure 35*.

FIGURE 35: Typical Linkage for a Combination Gas/Oil Burner



13.1 Switching Between Fuels

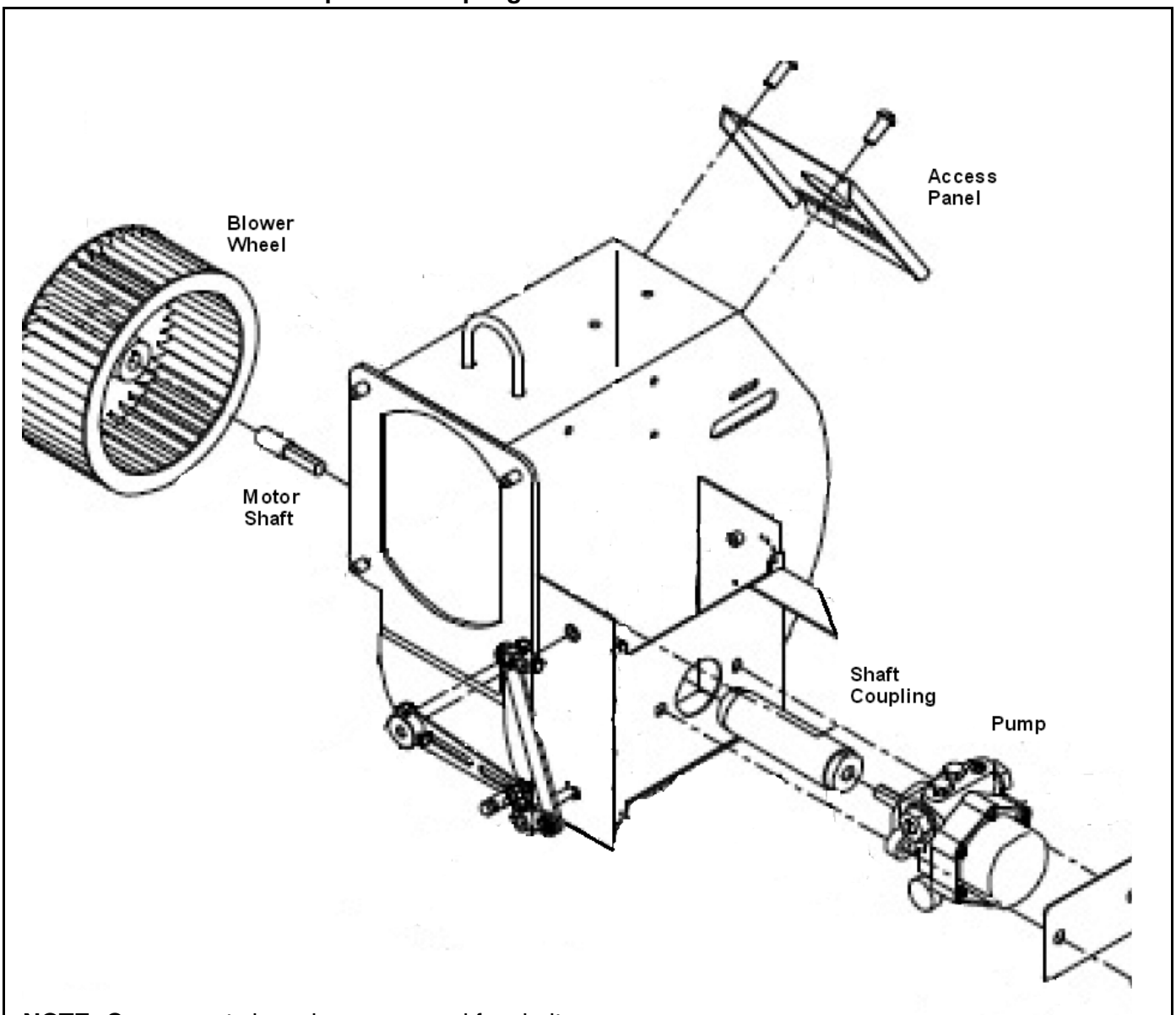
There are two methods of switching between natural gas/LPG and oil. The first method is the semi-automatic changeover (standard equipment offering) and the second is fully automatic changeover (optional equipment offering).

13.2 Semi-Automatic Change Over

In this standard method, a fuel transfer switch (located on the burner) will energize the appropriate manifold and ignition systems. Because proper oil flow to the pump can not be guaranteed, the pump must either be manually connected in the burner (when switching from gas to oil) or disconnected (when switching from oil to gas). Failure to do this can result in pump failure. To connect/disconnect the pump, the connection coupling is located inside of the burner and connects the input shaft of the pump to the output shaft of the burner blower motor. *See Page 50, Figure 36*.

To disable the oil pump, access the coupling through the access panel of the burner. Using a 1/8" Allen wrench, loosen the screws (located one at each end) holding the coupling to the shafts. Slide the coupling towards the pump, which removes it from the blower shaft. Retighten the screw holding it to the pump shaft. Reverse the procedure to reconnect the pump.

FIGURE 36: Burner Oil Pump Shaft Coupling Location



NOTE: Components have been removed for clarity.

13.3 Fully-Automatic Change Over

In this optional method, a fuel transfer switch (located on the burner) will energize the appropriate manifold and ignition systems. The oil pump, mounted remotely from the burner and equipped with its own drive motor, does not require manual connection/ disconnection. *See Page 51, Figure 37*. This pump assembly is mounted adjacent to the burner and is factory piped to the burner assembly.

FIGURE 37: Remote Oil Pump

SECTION 14: ELECTRICAL

⚠ DANGER

Electrical Shock Hazard

Disconnect electric before service.

More than one disconnect switch may be required to disconnect electric from equipment.

Equipment must be properly grounded.

Failure to follow these instructions can result in death or electrical shock.

Each air turnover unit is equipped with a wiring diagram which will vary depending on the type of controls and options supplied.

Note: Spark testing or shorting of the control wires by any means will render the transformers inoperative.

14.1 Wiring and Electrical Connections

All electrical wiring and connections, including electrical grounding, must comply with;

United States: Refer to National Electrical Code®, NFPA 70 - latest revision. Wiring must conform to the most current National Electrical Code®, local ordinances, and any special diagrams furnished.

Canada: Refer to Canadian Electrical Code, CSA C22.1 Part 1 - latest revision.

Check rating plate on air turnover unit for supply voltage and current requirements.

If any of the original control wire supplied with the air turnover unit must be replaced, replace it with type THHN 221° F (105°C), 600 V, 16 gauge wire or equivalent. For all other wires, replace with the equivalent size and type of wire that was originally provided with the air turnover unit.

14.2 Remote Panel

All power supply and motor wiring must be type THWN - or equivalent, minimum with a 167° F (75° C) temperature rise. For wire gauge sizes, *See Page 52, Table 15*.

14.2.1 Remote Panel Mounting Distance

If the interconnection wiring between the remote panel and the air turnover unit control enclosure is run in a single conduit, the wire run can be as long as 200' (60.9 m). For longer wire runs, consult the factory. Care should be used to avoid running the interconnect wiring near large industrial loads or high voltage wire runs as that may further limit the length of the interconnect wire run.

Table 15: Control Voltage Wiring For All Control Systems

VOLTS	WIRE GAUGE	WIRE FEET
120	18	150
120	16	250
120	14	350

NOTE: Wiring for temperature controls must be run in shielded cable as indicated on the wiring diagram.

14.2.2 Low Voltage Control Wiring

Low voltage (24V - AC/DC) control wiring in excess of 100' (30.5 m) in length should be in its own separate conduit run to prevent interference.

14.3 Motor Current Draw

For current requirements of the motor, see rating plate located on the blower motor.

14.4 Control Current Draw

The maximum current draw for an air turnover unit's controls and accessories is 4.5 A.

14.5 Safety Systems

Safety systems are required for proper performance of the air turnover unit. The air turnover unit shall not be permitted to operate with any safety system disabled. If a fault is found in any of the safety systems, then the system shall be repaired only by a contractor qualified in the installation and service of indirect fired heating equipment, using only components that are sold and supplied by Roberts-Gordon LLC. *See Page 53, Table 16* for a brief description of each safety device, its location and its switching voltage.

Table 16: Safety Systems

Safety Controls	Location	Voltage
Fan / Limit Switch	Air Turnover Unit Control Enclosure	120
Auxiliary Manual Reset High Temperature Limit Switch	Air Turnover Unit Control Enclosure	120
Cabinet Airflow Switch	Air Turnover Unit Control Enclosure	120
Gas Pressure Switches	Air Turnover Unit/ Gas Train	120
Flame Control	Air Turnover Unit Control Enclosure	120

14.5.1 Fan / Limit Switch

The fan / limit switch acts as a fan control and a high temperature control. It combines the function of a high temperature limit control with that of a fan controller. It has two control relays: one controls the air turnover unit's fan(s) and the other acts as a high temperature controlling relay. The fan relay has two settings or set points - one for turning on the air turnover unit's fan(s) and one for turning it off. The limit's relay only has one set point.

The fan portion of the switch has its set point set at 120° F (48.8° C). After the air surrounding the heat exchanger reaches set point, the fan relay(s) close(s) and power is supplied to the air turnover unit's fan motor starter coil(s), which turn(s) the fan motor(s) on if it is not already running. If the sensor for the fan relay(s) cools down below its set point (based on the second set point), it will open shutting down the air turnover unit's fan(s) if required. The second set point for the fan portion of the switch is labeled "HYS" which stands for Hysteresis. This is the degrees below the fan set point at which the relay will open. A setting of 15° F (8.3° C) is recommended for this equipment.

***Note**: This feature of the fan/limit switch could cause the air turnover unit's fan(s) to cycle on and off a number of times after a heating cycle ends to cool down the heat exchanger. This could continue even with other controls turned off. Only turning off the main power disconnect will disable the feature.*

The limit portion of the switch has its set point set at 200° F (93.3° C). After the air surrounding the heat exchanger reaches set point, the limit relay(s) will open the circuit to the burner system and discontinue all burner functions. Restarting of the burner can only be accomplished after the sensor for the limit has cooled down below its set point.

14.5.2 Auxiliary Manual Reset High Temperature Limit Switch

If for any reason, the temperature of the air surrounding the heat exchanger reaches the limit set point of 250° F (121.1° C), the high temperature limit switch will open the circuit to the air turnover unit's control system and shut it down. Restarting of the burner can only be accomplished after the limit has cooled down and the reset button on the switch is depressed.

14.5.3 Pressure Switches

14.5.4.1 Cabinet Airflow Switch

The cabinet airflow switch monitors the airflow through the fan section of the air turnover unit; its function is to protect the air turnover unit and downstream components from improper low airflow conditions. The burner is allowed to function via the warm-up bypass timer contacts even though the fan(s) may not be running. Once the air turnover unit's fan(s) are turned on, the air turnover unit's airflow switch closes and the warm-up bypass timer completes its time out cycle, removing the bypass circuit. This only allows the burner to function as long as airflow is present throughout the air turnover unit (except during warm-up).

This airflow switch is adjusted by turning the adjustment screw clockwise, till the screw is two turns from flush of its housing.

14.5.5.2 Gas Pressure Switches

Gas pressure switches are standard on certain models (UL & FM compliant gas trains above 2,500 MBH and XL compliant gas trains above 400 MBH) and are also available as an option on the others. The version used combines the function of both into one component.

The function of the gas pressure switches is to protect against insufficient, lack of gas pressure and excessive pressure in the system.

On the low gas pressure switch side, this switch opens its internal switch which shuts the burner down and prevents its operation due to insufficient gas pressure.

On the high gas pressure switch side, its internal switch will open, shutting down the burner due to excessive gas pressure passing through the gas train.

The settings of the gas pressure switches are field adjustable. The one monitoring the incoming gas

pressure is the low gas pressure switch. The low gas pressure switch must be set to the minimum required gas pressure as indicated on the data plate.

The high gas pressure switch must be set to 1" wc (2.5 mbar) above the high fire setting established during commissioning.

If either switch senses a pressure which is lower (low gas pressure switch) or higher (high gas pressure switch) than its set point, then the switch will open and lock out, shutting the burner down. The switch will have to be reset manually, once the condition has been corrected.

14.5.6 Flame Control

This device will check for both pilot flame and main flame (main flame only on oil fired equipment) within the burner. When a flame signal from the pilot flame is available (on gas-fired equipment), it will allow the main gas valve to open.

If the pilot flame (gas-fired) or the main flame signal (oil-fired) is not present, the electrical signal cannot be continued so the pilot valve (gas-fired) or main valve (oil-fired) will close. If ignition does not occur, the flame safeguard relay will lockout, and must be manually reset. (See the Trouble-Shooting Guide - *Page 135, Section 19.6*)

14.5.7 Discharge Temperature Sensor

This device senses the discharge temperature of the air turnover unit. The discharge temperature sensor reports the discharge temperature to the burner control device. Should this system fail, the automatic and manual high temperature limit switches will turn the burner off. DDC-ready air turnover units do not come equipped with this sensor and must be field-supplied.

FIGURE 38: Wiring Diagram Key

NOTES:

1.) DRAWING ONLY PROVIDED TO SHOW FIELD WIRING REQUIRED BETWEEN ELECTRICAL COMPONENTS THAT ARE SHIPPED LOOSE AND AIR HANDLER CONTROL PANEL

2.) THIS DRAWING IS NOT INTENDED TO SHOW ELECTRICAL RECONNECT BETWEEN AIR HANDLER SECTIONS. SOME RECONNECT MAYBE REQUIRED BETWEEN SECTIONS SPLIT FOR SHIPMENT.

3.) INSTALLER OF FIELD WIRING AND GROUNDING TO COMPLY WITH ALL LOCAL AND NATIONAL ELECTRICAL CODE REQUIREMENTS.

4.) USE ONLY COPPER CONDUCTORS FOR FIELD WIRING. CONDUCTORS MUST BE RATED 167° F (75° C) OR GREATER.

5.) TERMINALS #60 AND ABOVE ARE DESIGNATED AS LOW VOLTAGE. ALL FIELD WIRING FOR LOW VOLTAGE ARE TO BE RUN IN SEPARATE CONDUIT(S).

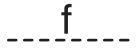
6.) CONDUCTOR TIGHTENING TORQUE REQUIREMENT.
A.) CONTROL TERMINALS @ 12 in/lbs
B.) POWER DISTRIBUTION BLOCK
LINE SIDE- WIRE SIZE:
#2/0 - #6 @ 120 in/lbs
#8 @ 45 in/lbs
#10 - #14 @ 35 in/lbs
LOAD SIDE- WIRE SIZE:
#4 - #14 @ 35 in/lbs

KEY:

● TERMINAL LOCATED ON MAIN PANEL

▲ TERMINAL LOCATED ON REMOTE PANEL

 TERMINAL LOCATED ON COMPONENT



FIELD WIRING

 SHIELDED WIRE GROUNDED

* LOCATED ON REMOTE PANEL

** SHIPPED LOOSE FOR FIELD INSTALLATION

FIGURE 39: Wiring Diagram for Gas-Fired, Single Propeller Fan Air Turnover Unit with FM-Compliant Manifold and On/Off Burner with Input Less Than 1,566 MBH (458.9 kW)

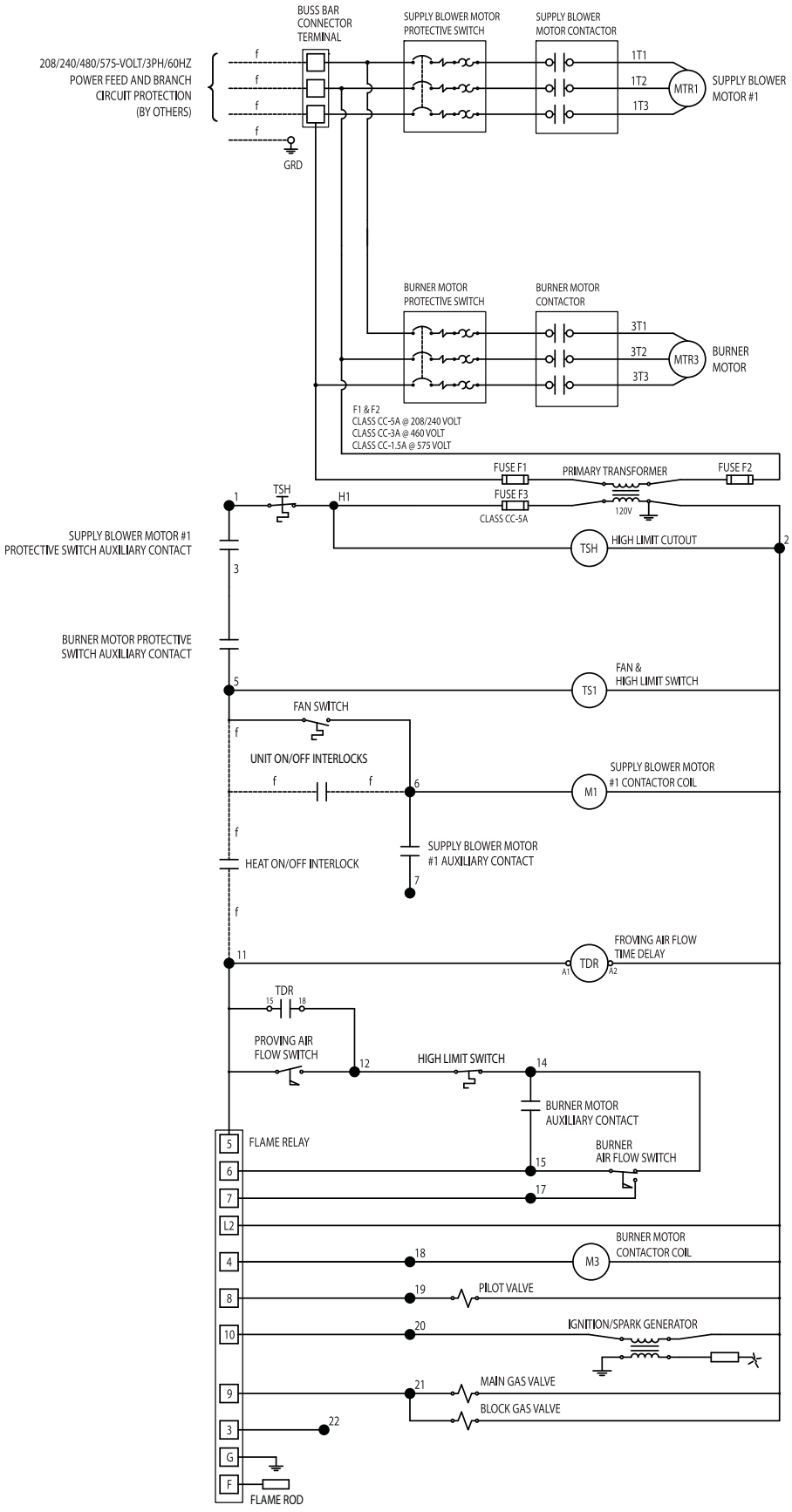


FIGURE 40: Wiring Diagram for Gas-Fired, Single Propeller Fan Air Turnover Unit with FM-Compliant Manifold and High/Low/Off Burner with Input Less Than 1,566 MBH (458.9 kW)

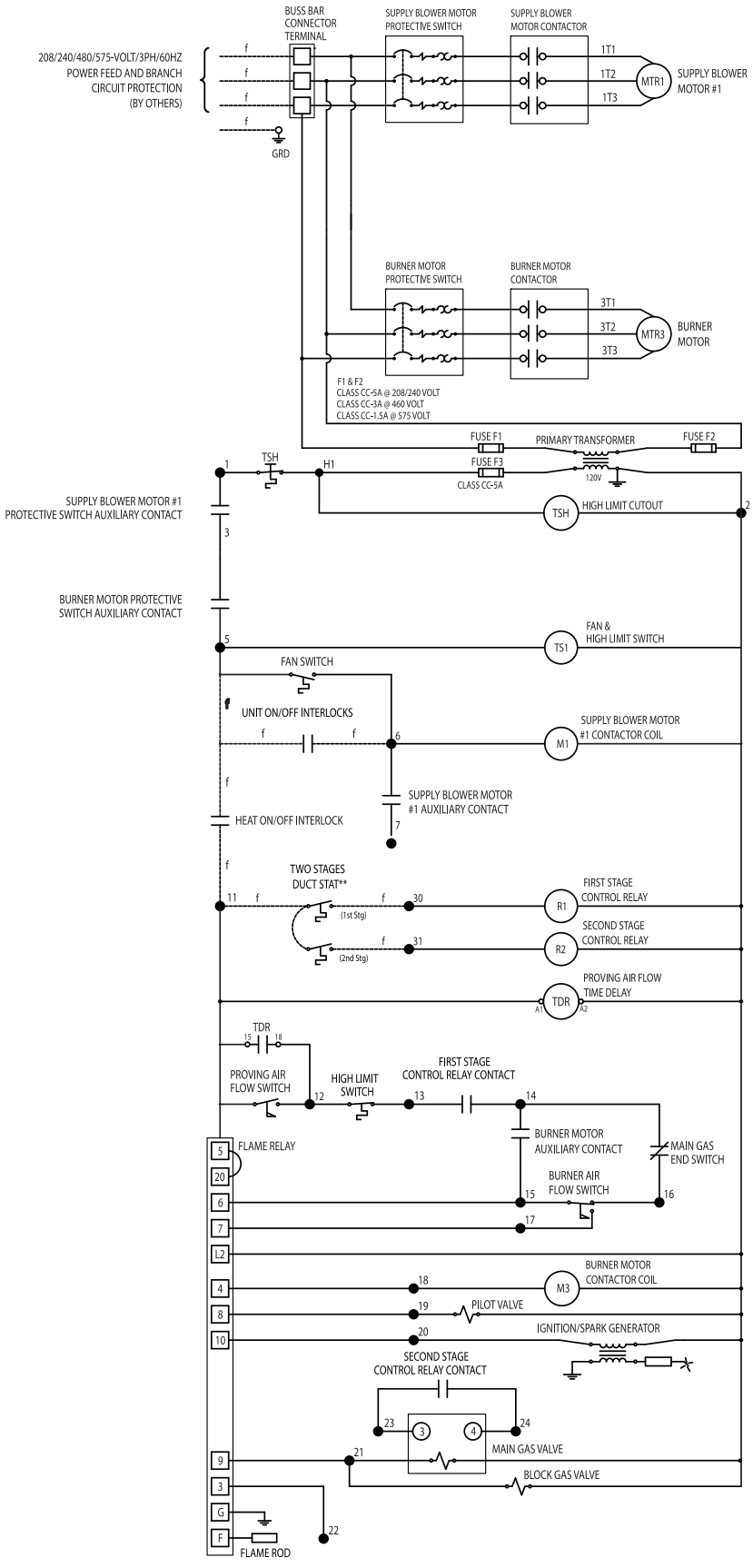


FIGURE 41: Wiring Diagram for Gas-Fired, Single Propeller Fan Air Turnover Unit with FM-Compliant Manifold and Fully-Modulating Burner with Input Less 1,566 MBH (458.9 kW)

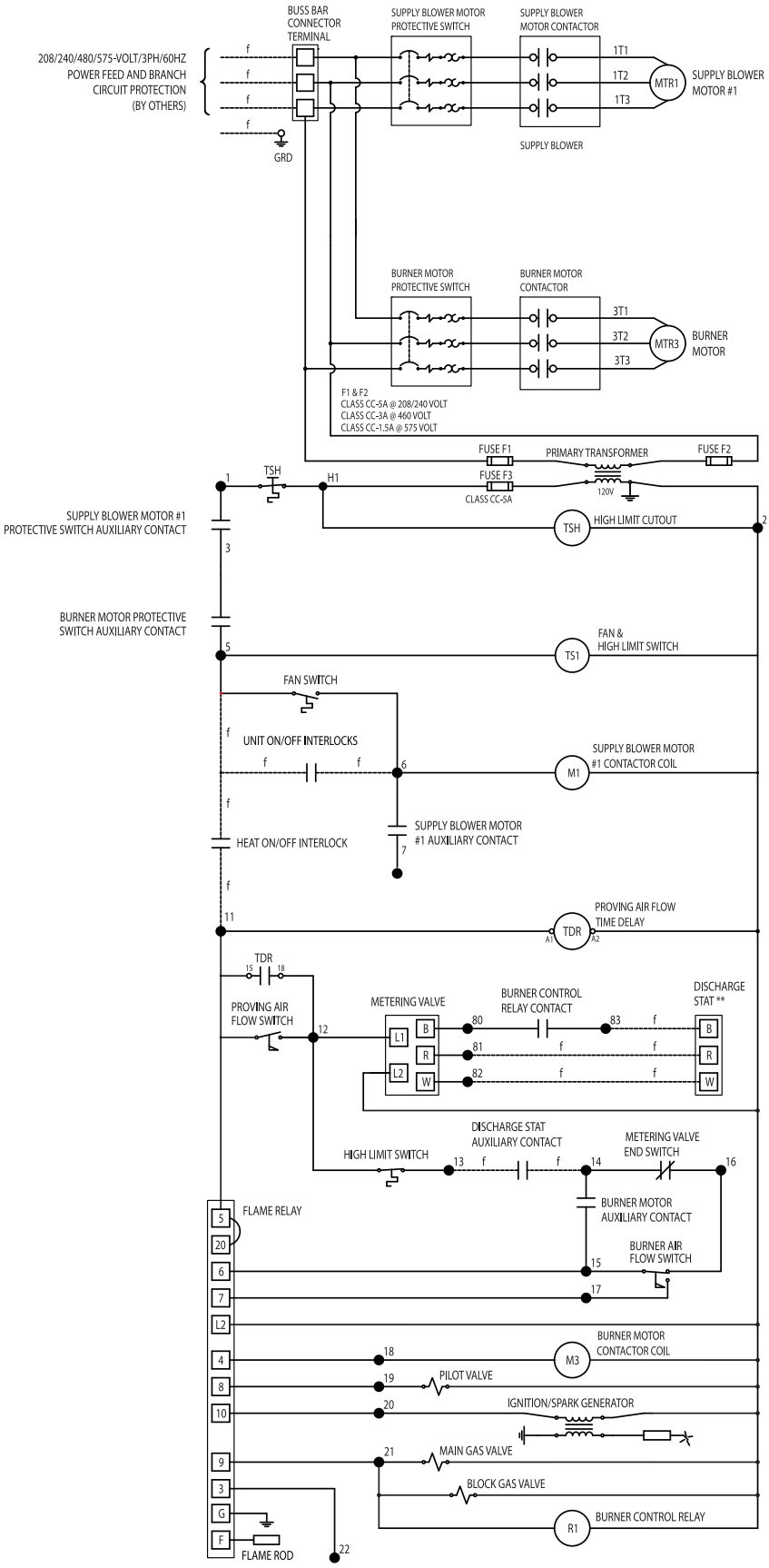


FIGURE 42: Wiring Diagram for Gas-Fired, Single Propeller Fan Air Turnover Unit with XL-Compliant Manifold and On/Off Burner with Input Less Than 1,000 MBH (293.1 kW)

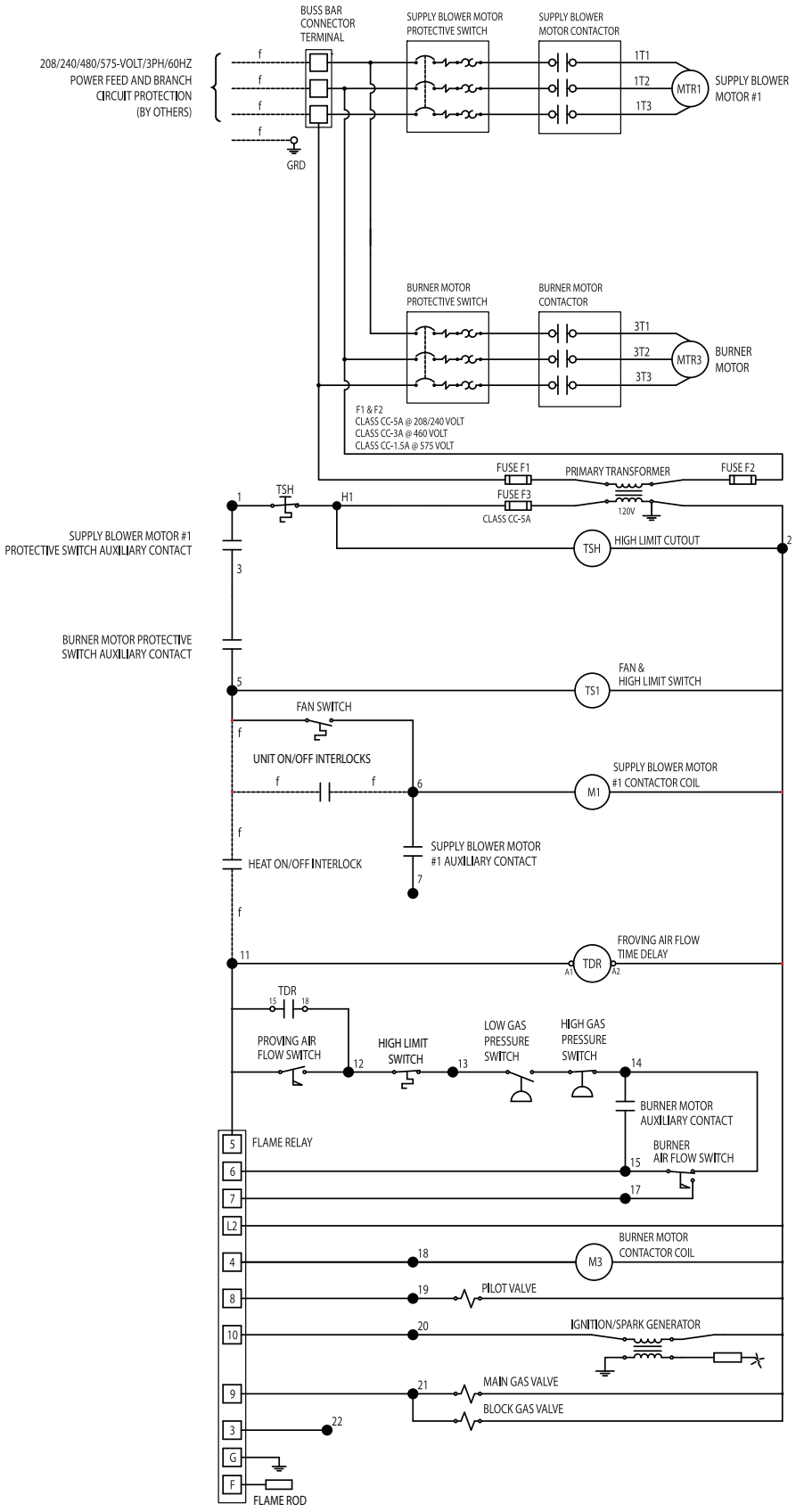


FIGURE 43: Wiring Diagram for Gas-Fired, Single Propeller Fan Air Turnover Unit with XL-Compliant Manifold and On/Off Burner with Input 1,000 to 1,566 MBH (293.1-458.9 kW)

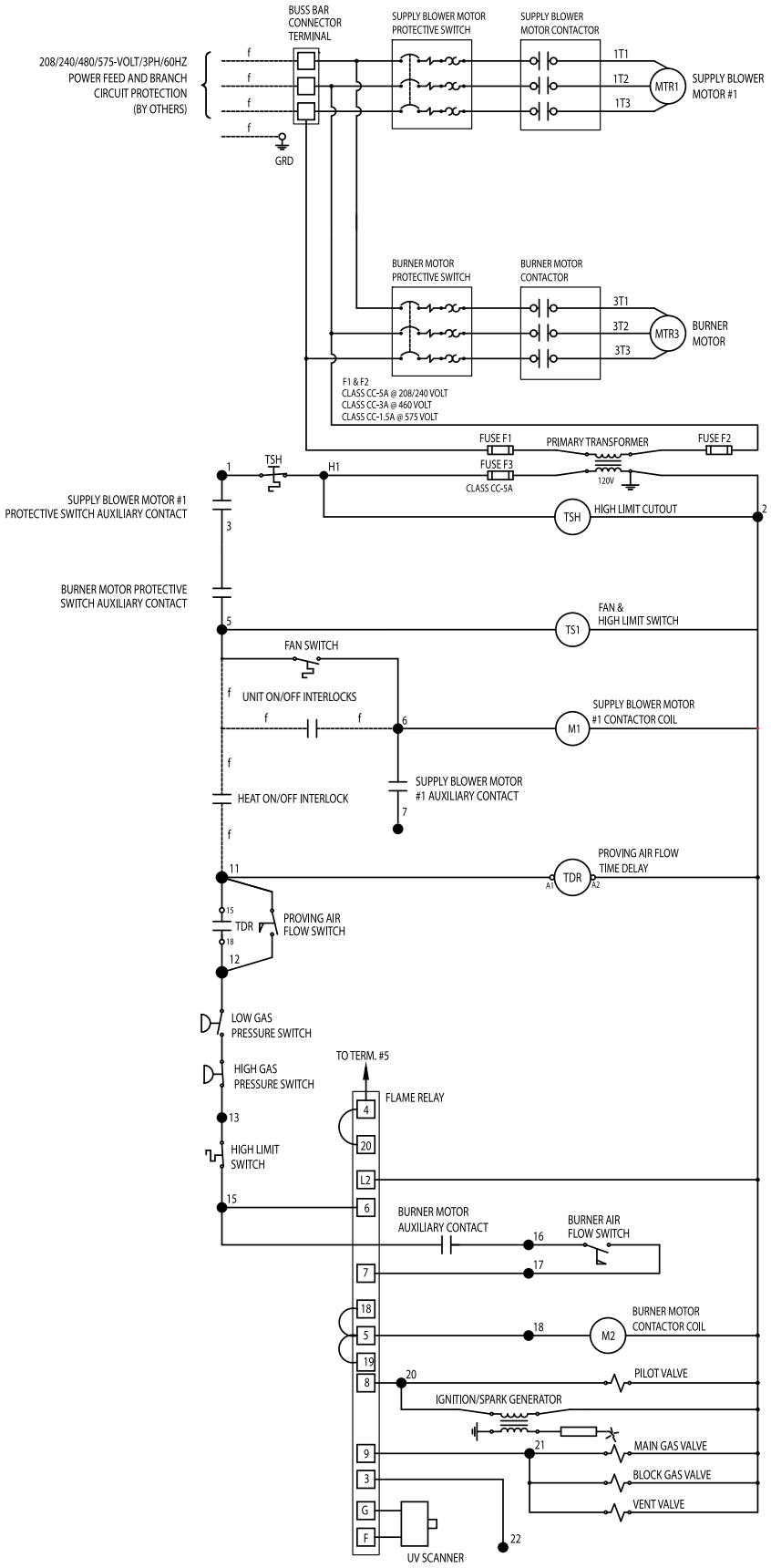


FIGURE 44: Wiring Diagram for Gas-Fired, Single Propeller Fan Air Turnover Unit with XL-Compliant Manifold and High/Low/Off Burner with Input Less Than 1,000 MBH (293.1 kW)

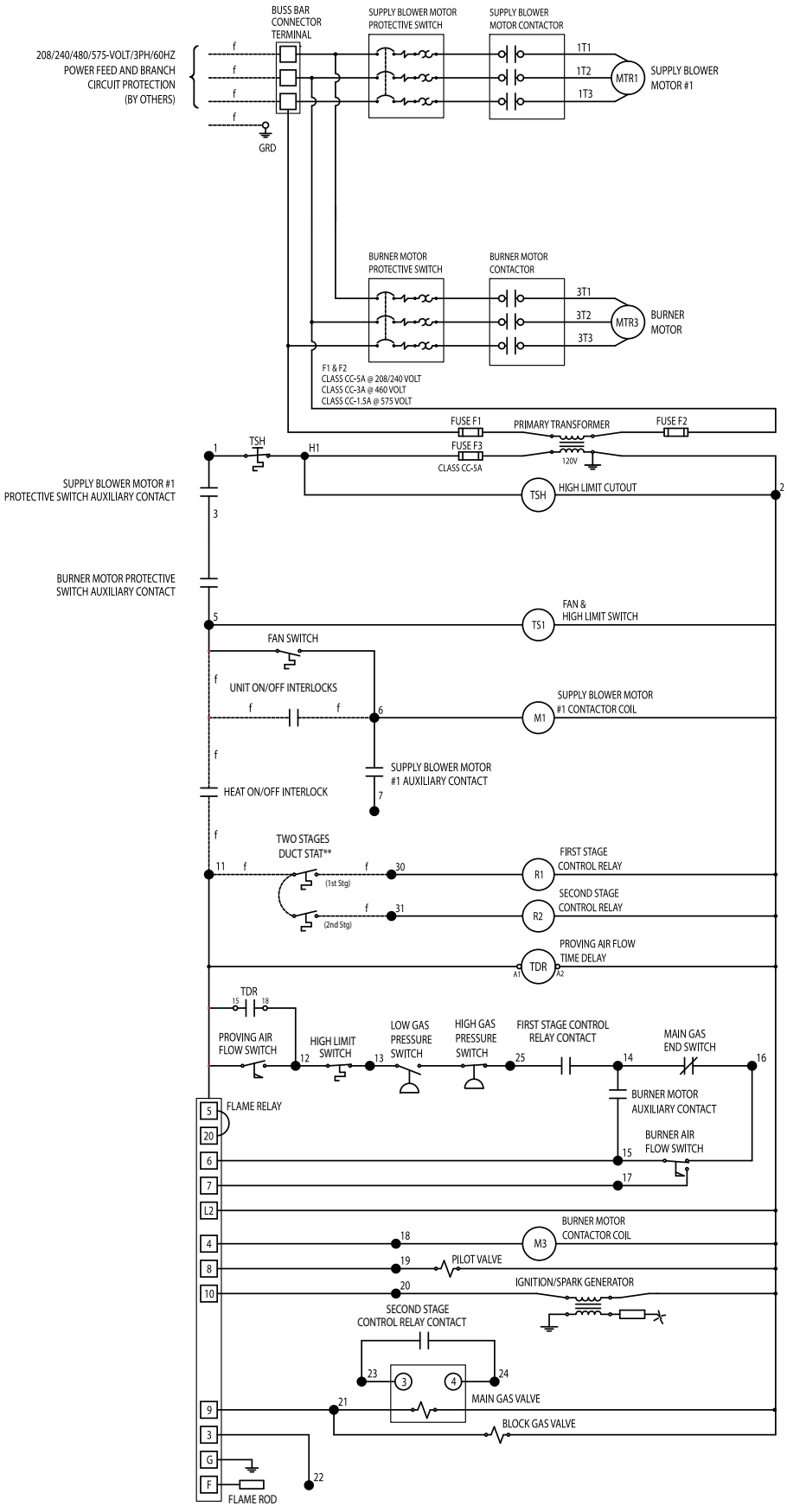


FIGURE 45: Wiring Diagram for Gas-Fired, Single Propeller Fan Air Turnover Unit with XL-Compliant Manifold and High/Low/Off Burner with Input 1,000 to 1,566 MBH (293.1-458.9 kW)

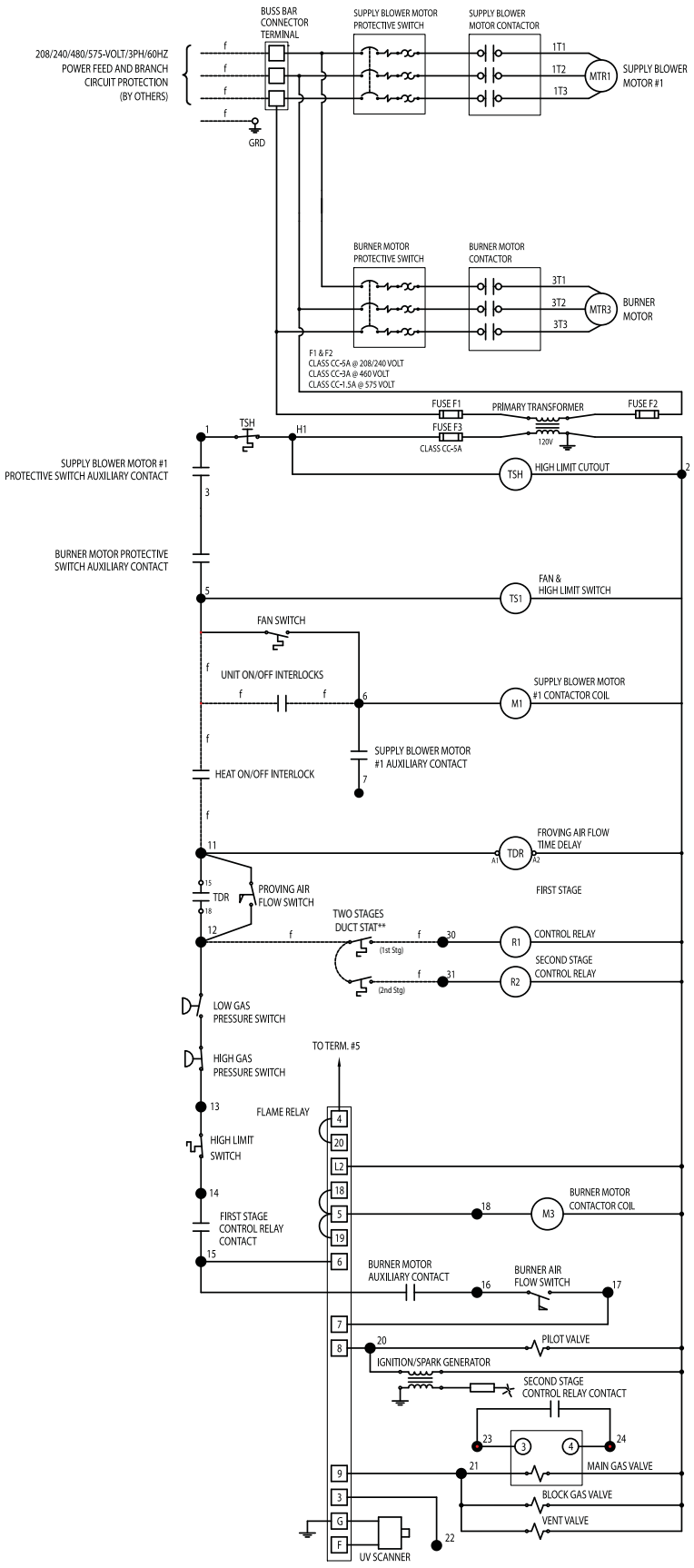


FIGURE 46: Wiring Diagram for Gas-Fired, Single Propeller Fan Air Turnover Unit with XL-Compliant Manifold and Fully-Modulating Burner with Input Less Than 1,000 MBH (293.1 kW)

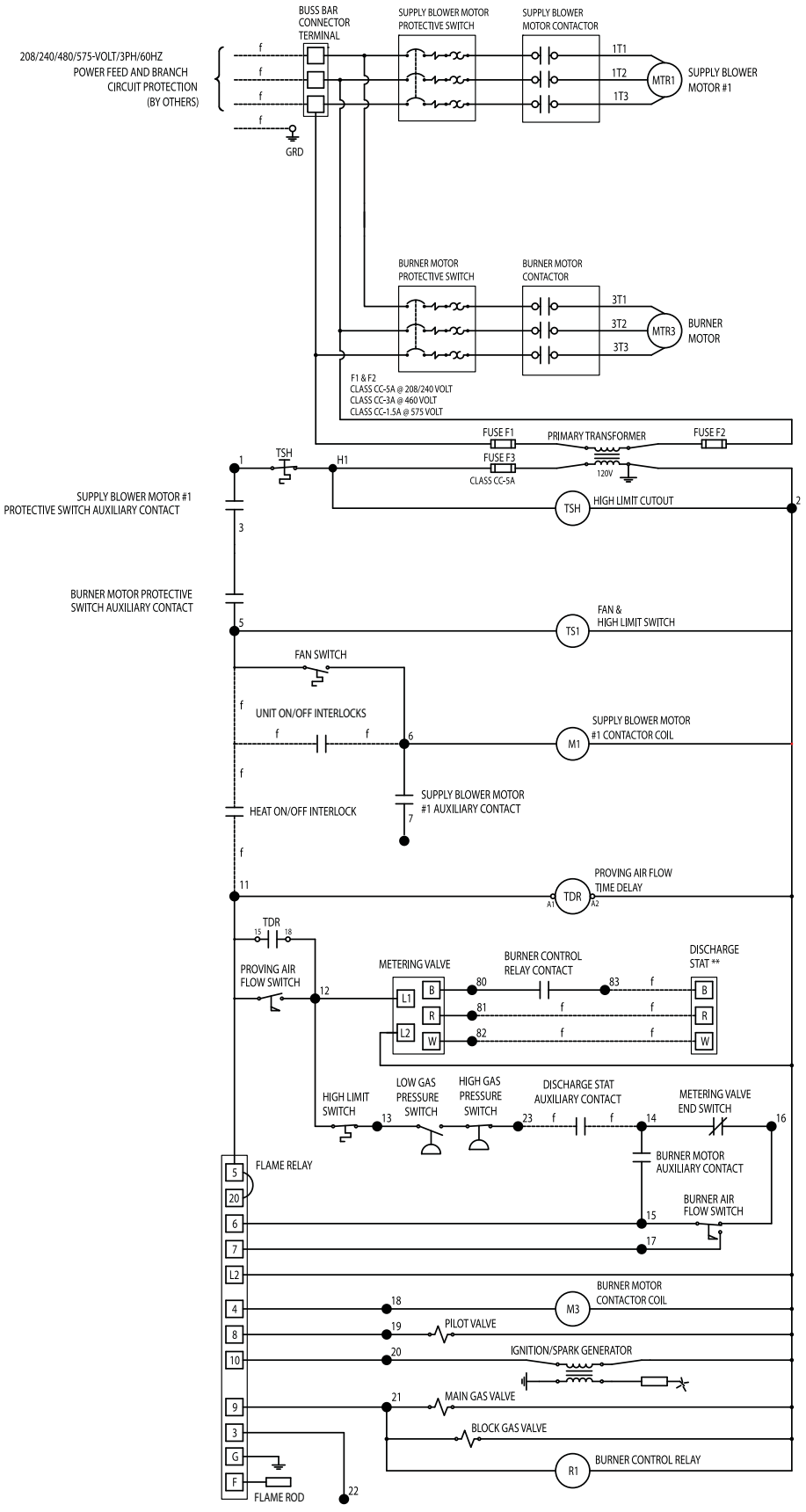


FIGURE 47: Wiring Diagram for Gas-Fired, Single Propeller Fan Air Turnover Unit with XL-Compliant Manifold and Fully-Modulating Burner with Input 1,000 to 1,566 MBH (293.1-458.9 kW)

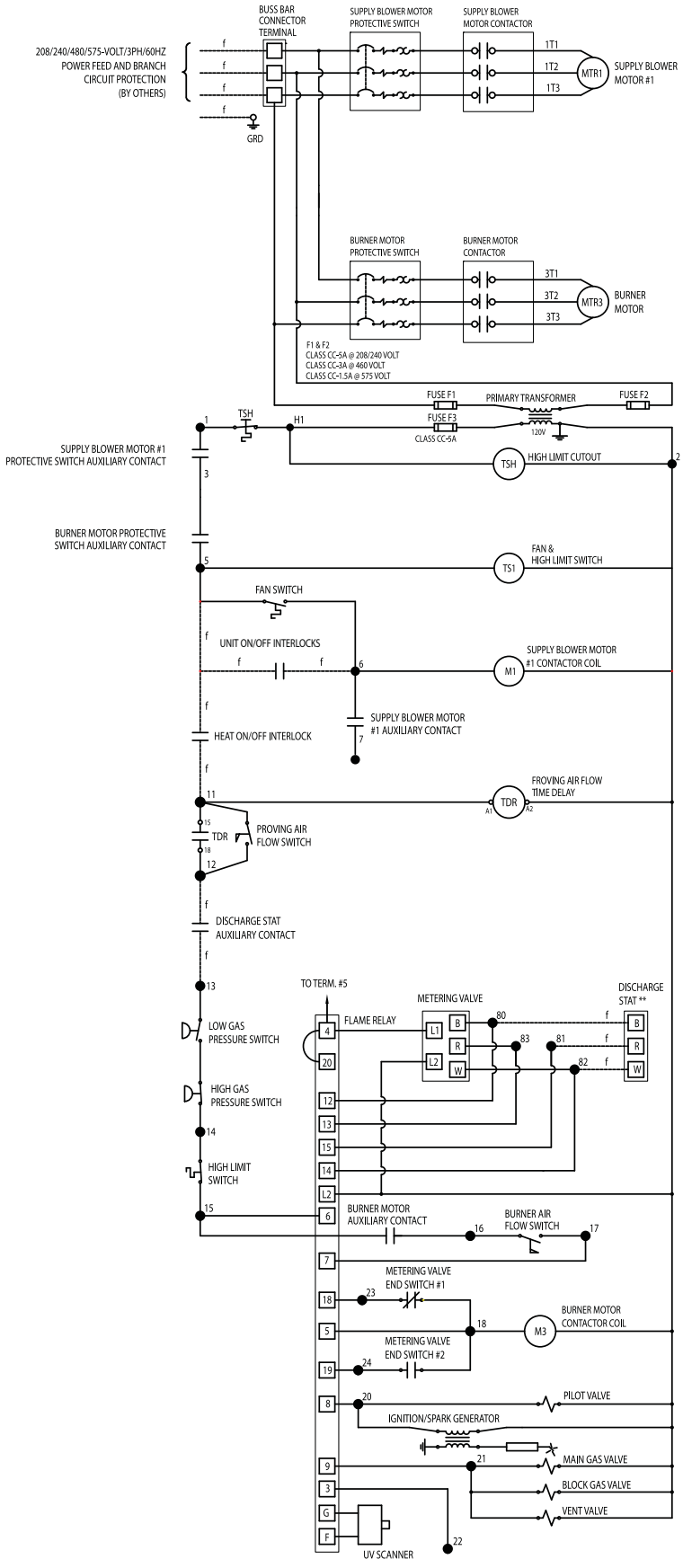


FIGURE 48: Wiring Diagram for Gas-Fired, Dual Propeller Fans Air Turnover Unit with FM-Compliant Manifold and On/Off Burner with Input Less Than 2,500 MBH (732.7 kW)

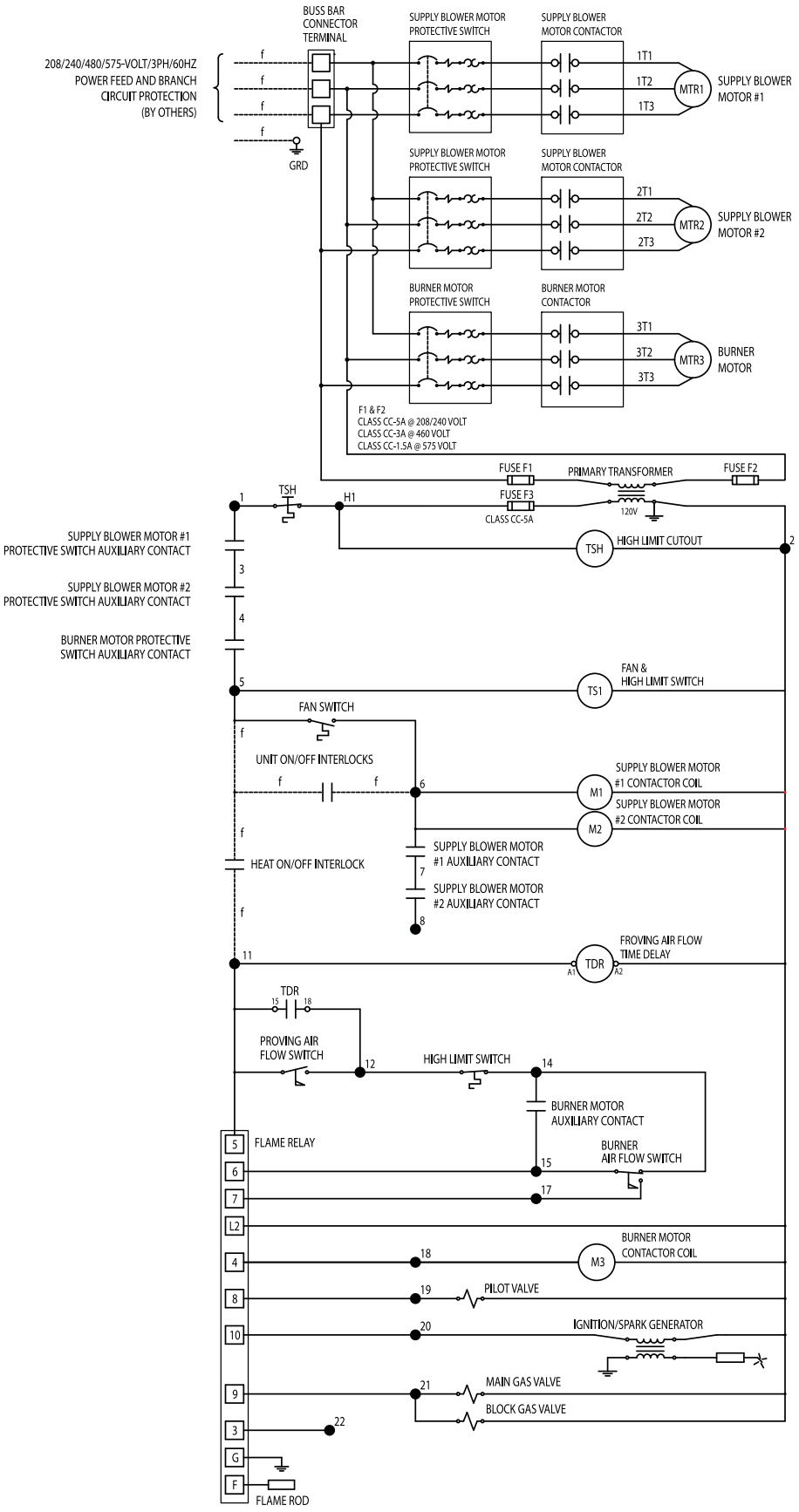


FIGURE 49: Wiring Diagram for Gas-Fired, Dual Propeller Fans Air Turnover Unit with FM-Compliant Manifold and High/Low/Off Burner with Input Less Than 2,500 MBH (732.7 kW)

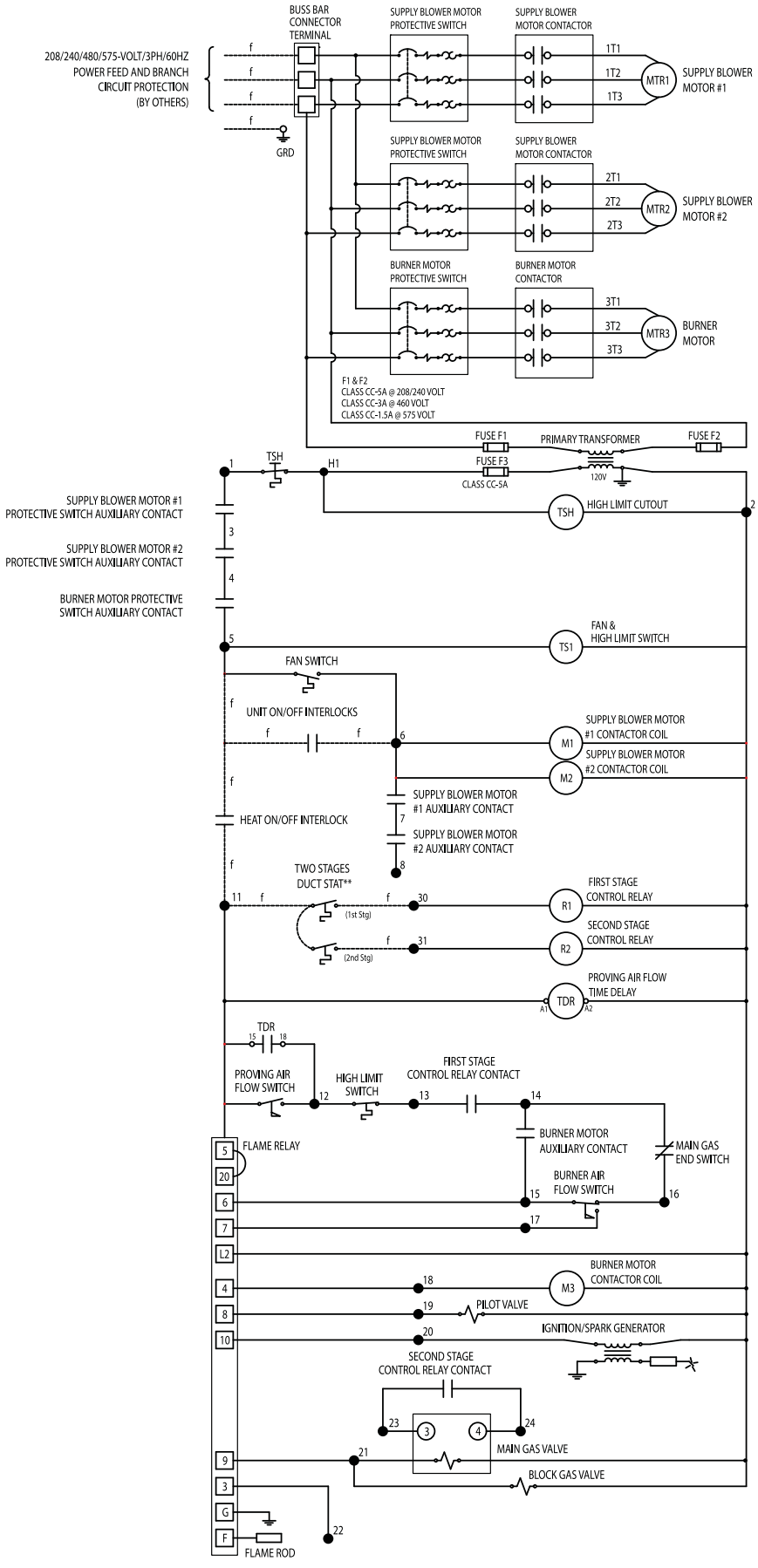


FIGURE 50: Wiring Diagram for Gas-Fired, Dual Propeller Fans Air Turnover Unit with FM-Compliant Manifold and High/Low/Off Burner with Input 2,500 to 5,000 MBH (732.7-1465.4 kW)

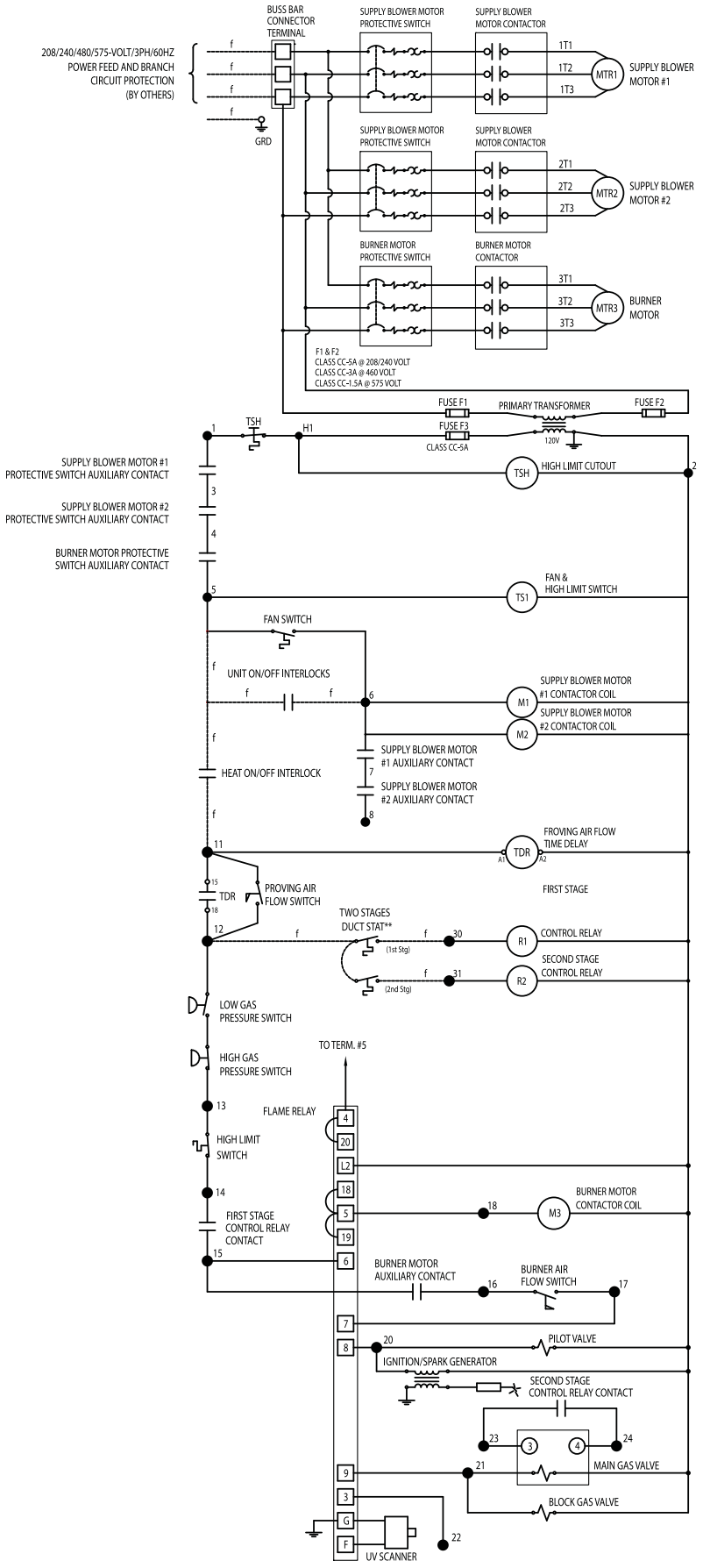


FIGURE 51: Wiring Diagram for Gas-Fired, Dual Propeller Fans Air Turnover Unit with FM-Compliant Manifold and High/Low/Off Burner with Input More Than 5,000 MBH (1465.4 kW)

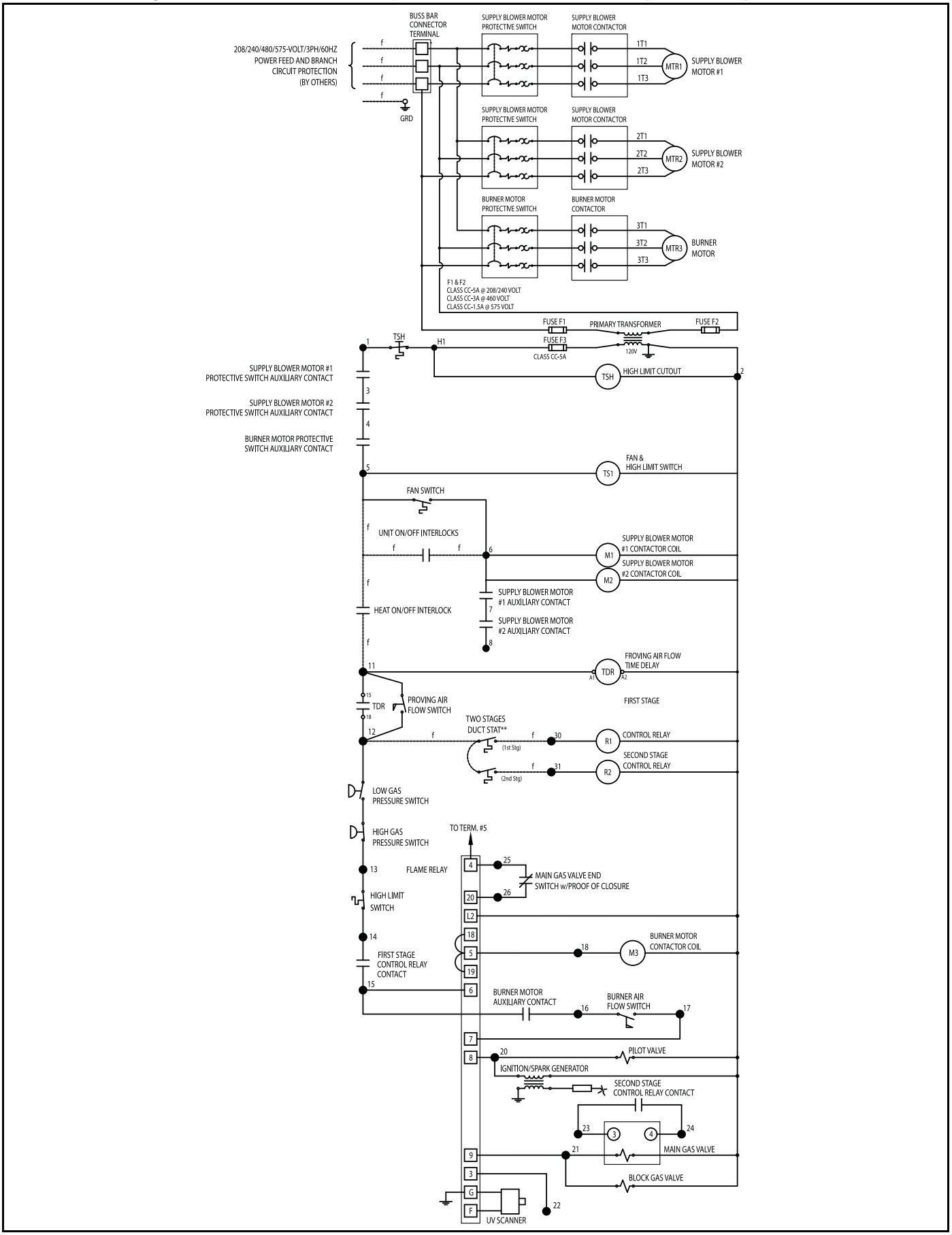


FIGURE 52: Wiring Diagram for Gas-Fired, Dual Propeller Fans Air Turnover Unit with FM-Compliant Manifold and Fully-Modulating Burner with Input Less Than 2,500 MBH (732.7 kW)

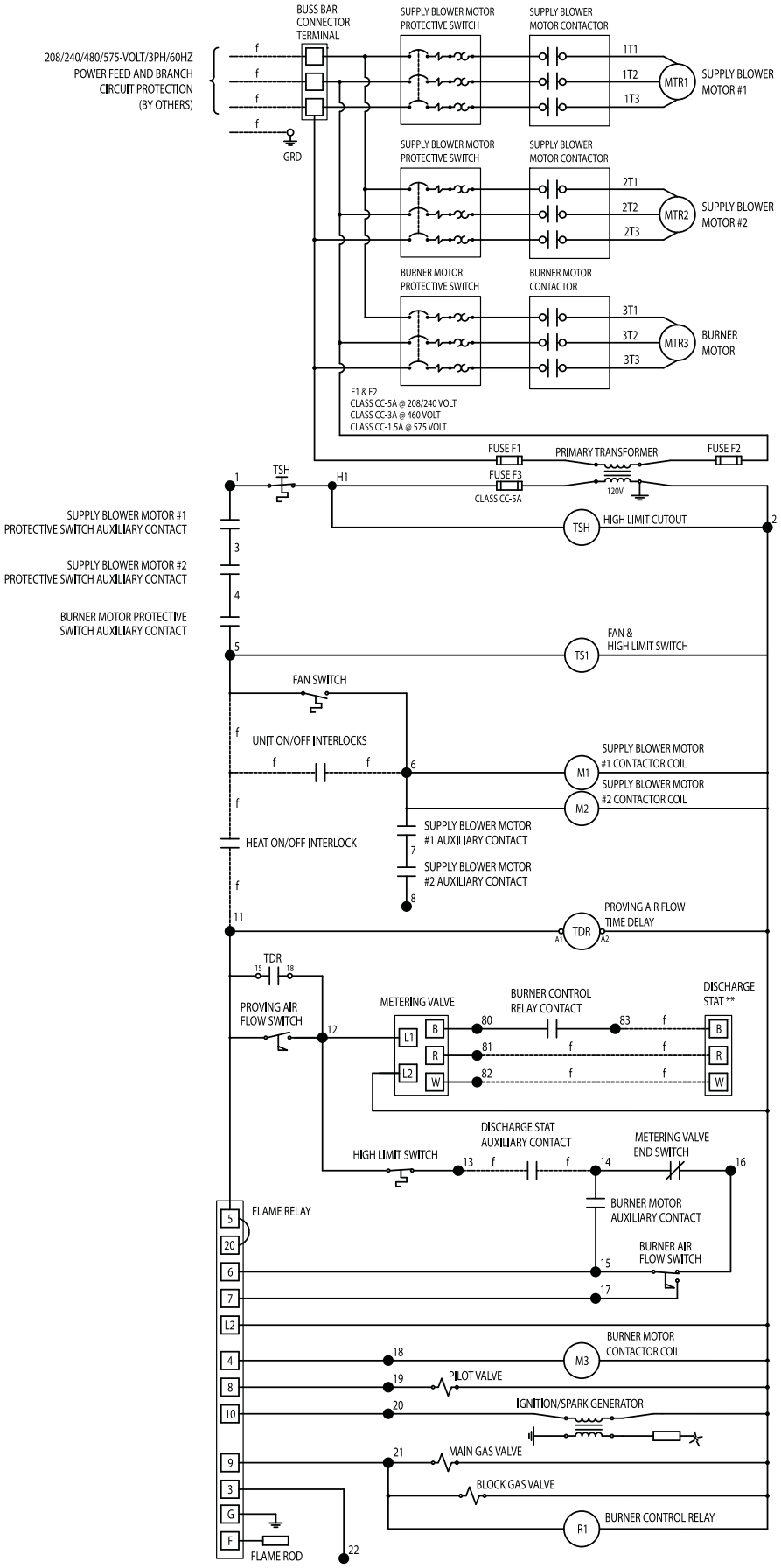


FIGURE 53: Wiring Diagram for Gas-Fired, Dual Propeller Fans Air Turnover Unit with FM-Compliant Manifold and Fully-Modulating Burner with Input 2,500 to 5,000 MBH (732.7-1465.4 kW)

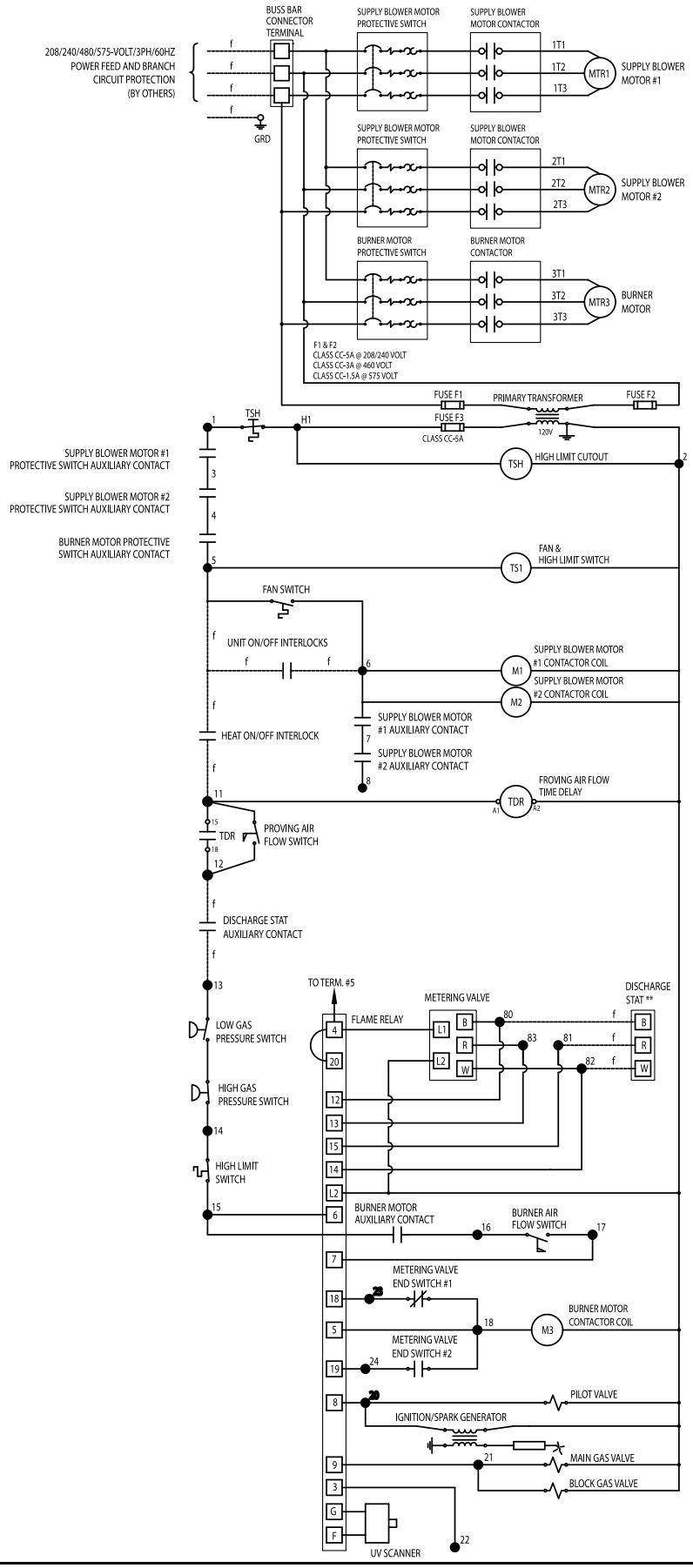


FIGURE 54: Wiring Diagram for Gas-Fired, Dual Propeller Fans Air Turnover Unit with FM-Compliant Manifold and Fully-Modulating Burner with Input More Than 5,000 MBH (1465.4 kW)

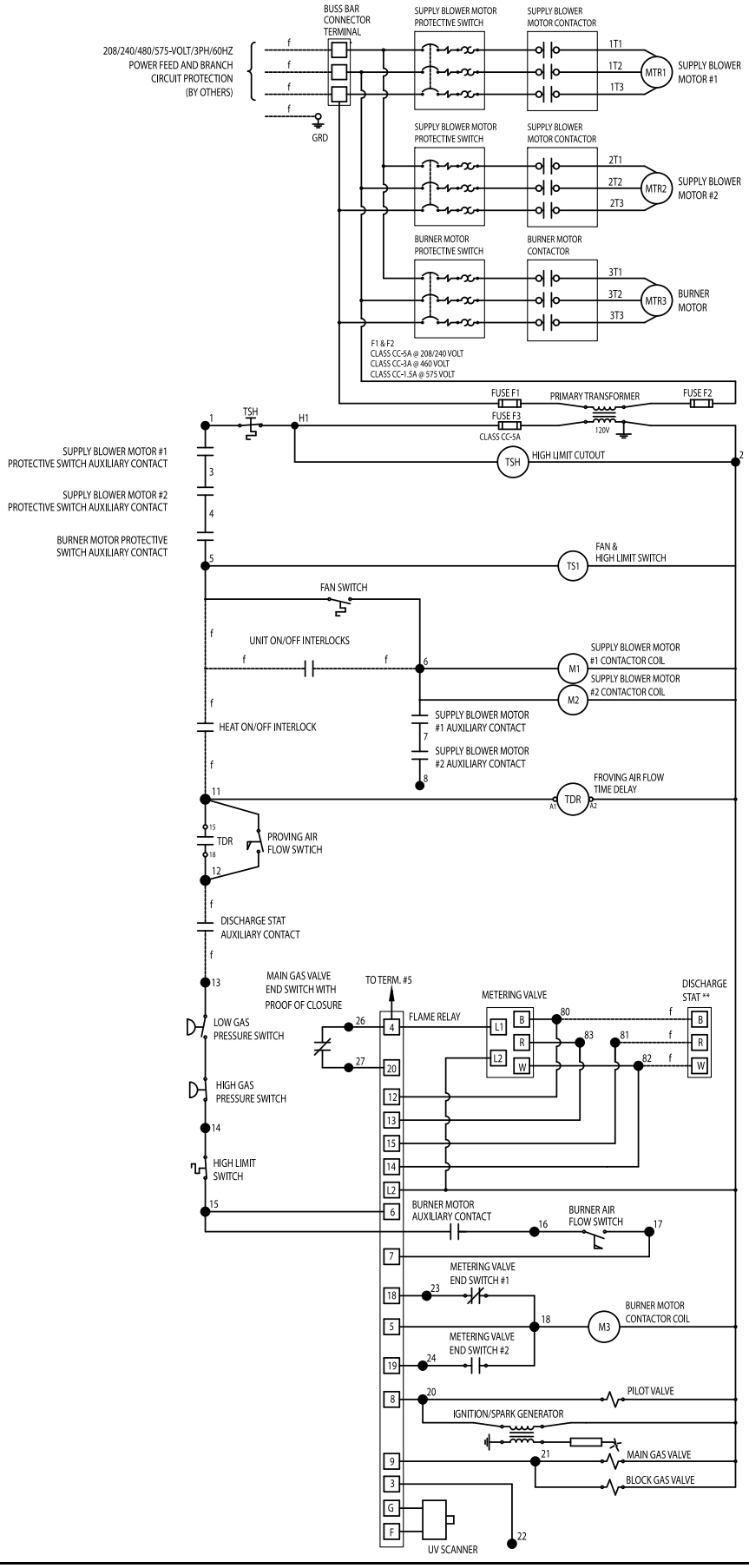


FIGURE 55: Wiring Diagram for Gas-Fired, Dual Propeller Fans Air Turnover Unit with XL-Compliant Manifold and On/Off Burner with Input Less Than 1,000 MBH (293.1 kW)

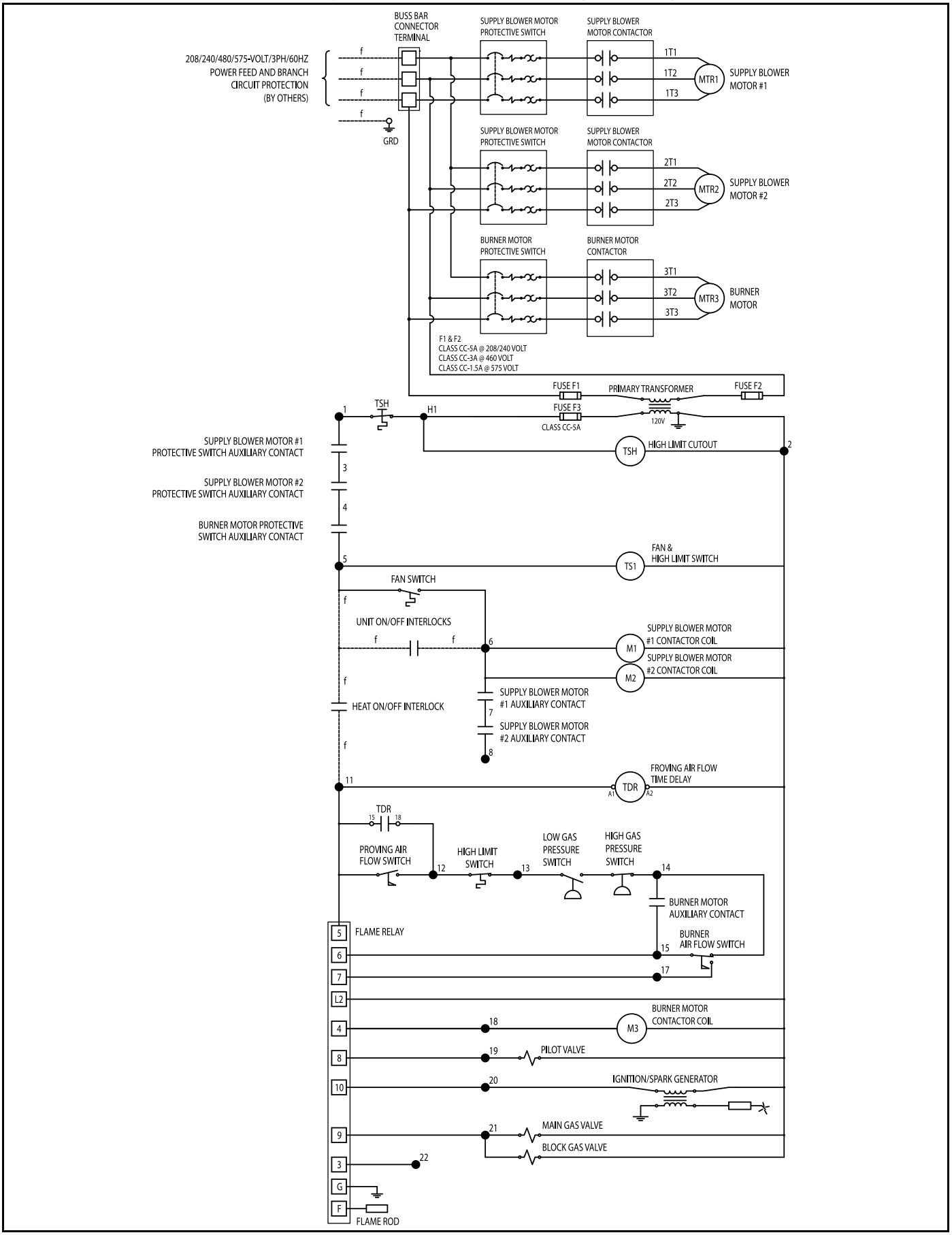


FIGURE 56: Wiring Diagram for Gas-Fired, Dual Propeller Fans Air Turnover Unit with XL-Compliant Manifold and On/Off Burner with Input 1,000 to 2,500 MBH (293.1-732.7 kW)

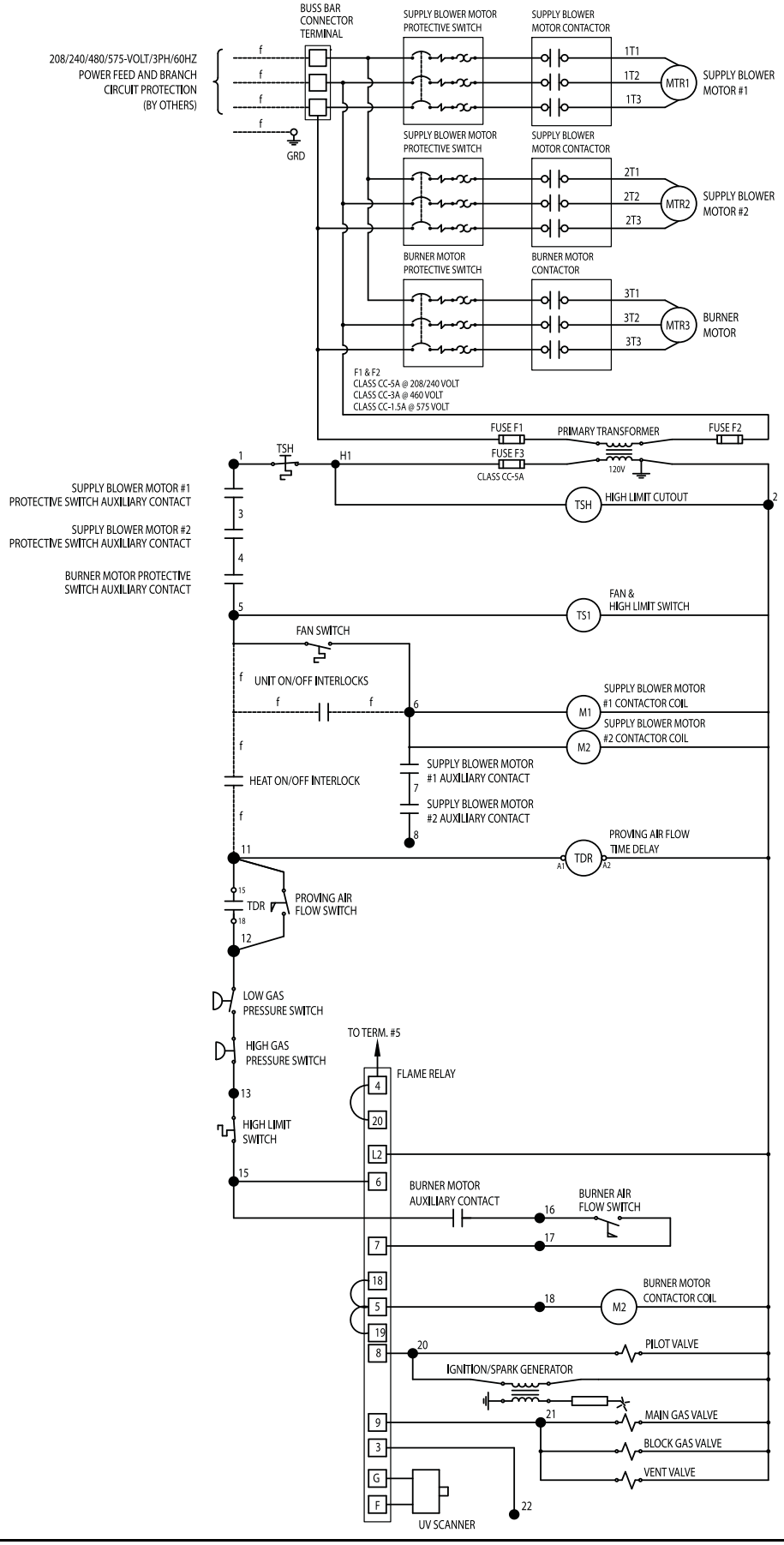


FIGURE 57: Wiring Diagram for Gas-Fired, Dual Propeller Fans Air Turnover Unit with XL-Compliant Manifold and High/Low/Off Burner with Input Less Than 1,000 MBH (293.1 kW)

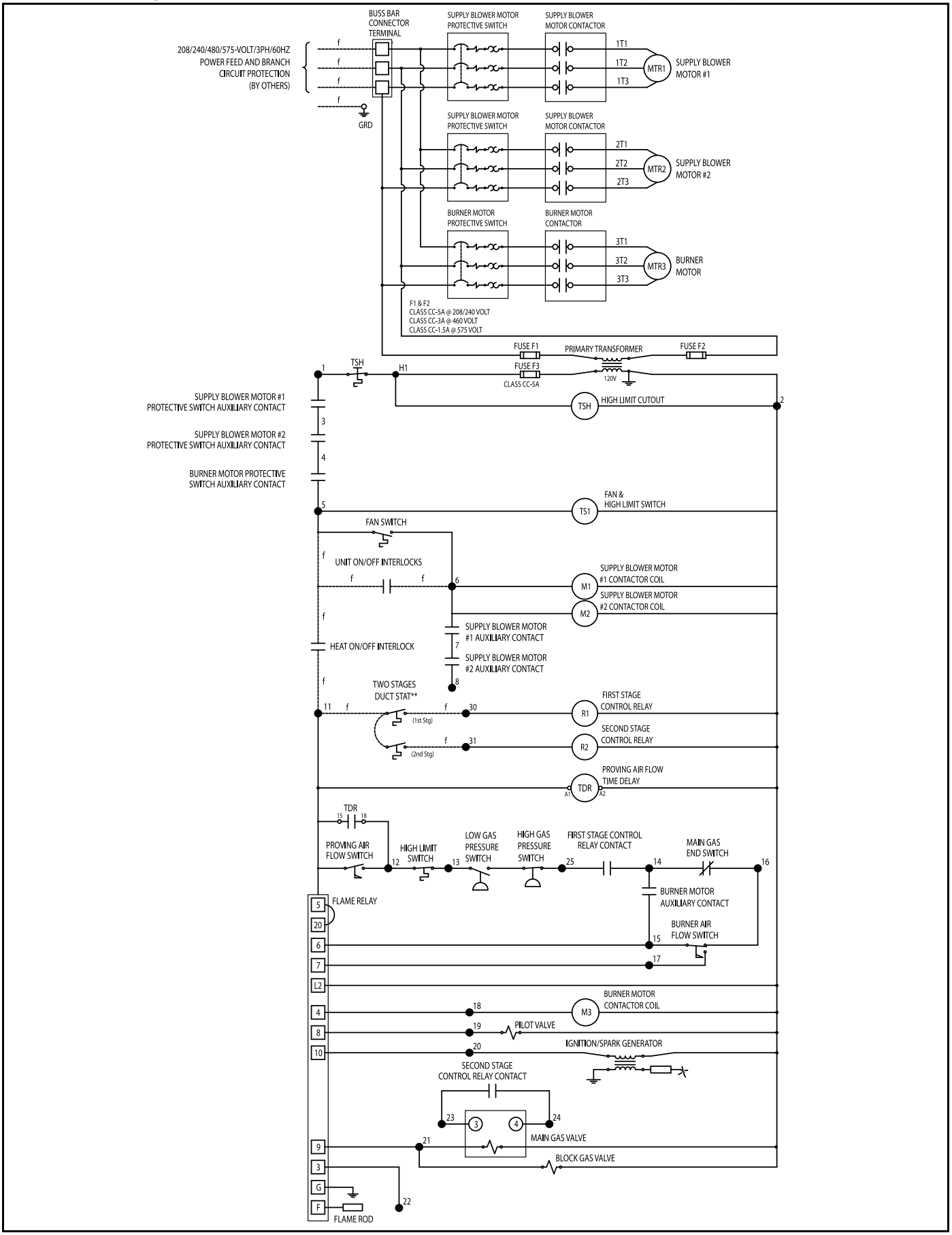


FIGURE 58: Wiring Diagram for Gas-Fired, Dual Propeller Fans Air Turnover Unit with XL-Compliant Manifold and High/Low/Off Burner with Input 1,000 to 5,000 MBH (293.1-1465.4 kW)

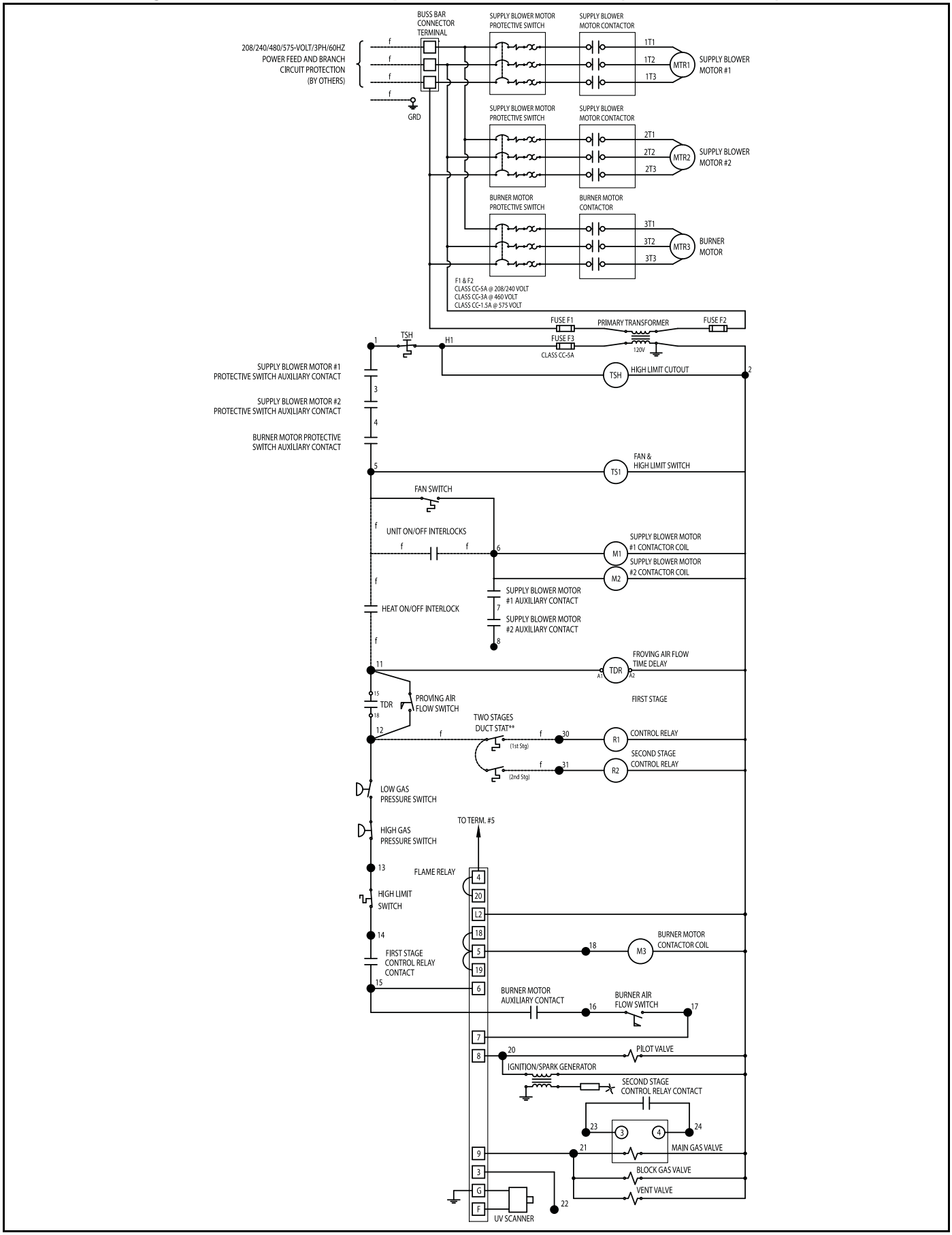


FIGURE 59: Wiring Diagram for Gas-Fired, Dual Propeller Fans Air Turnover Unit with XL-Compliant Manifold and High/Low/Off Burner with Input More Than 5,000 MBH (1465.4 kW)

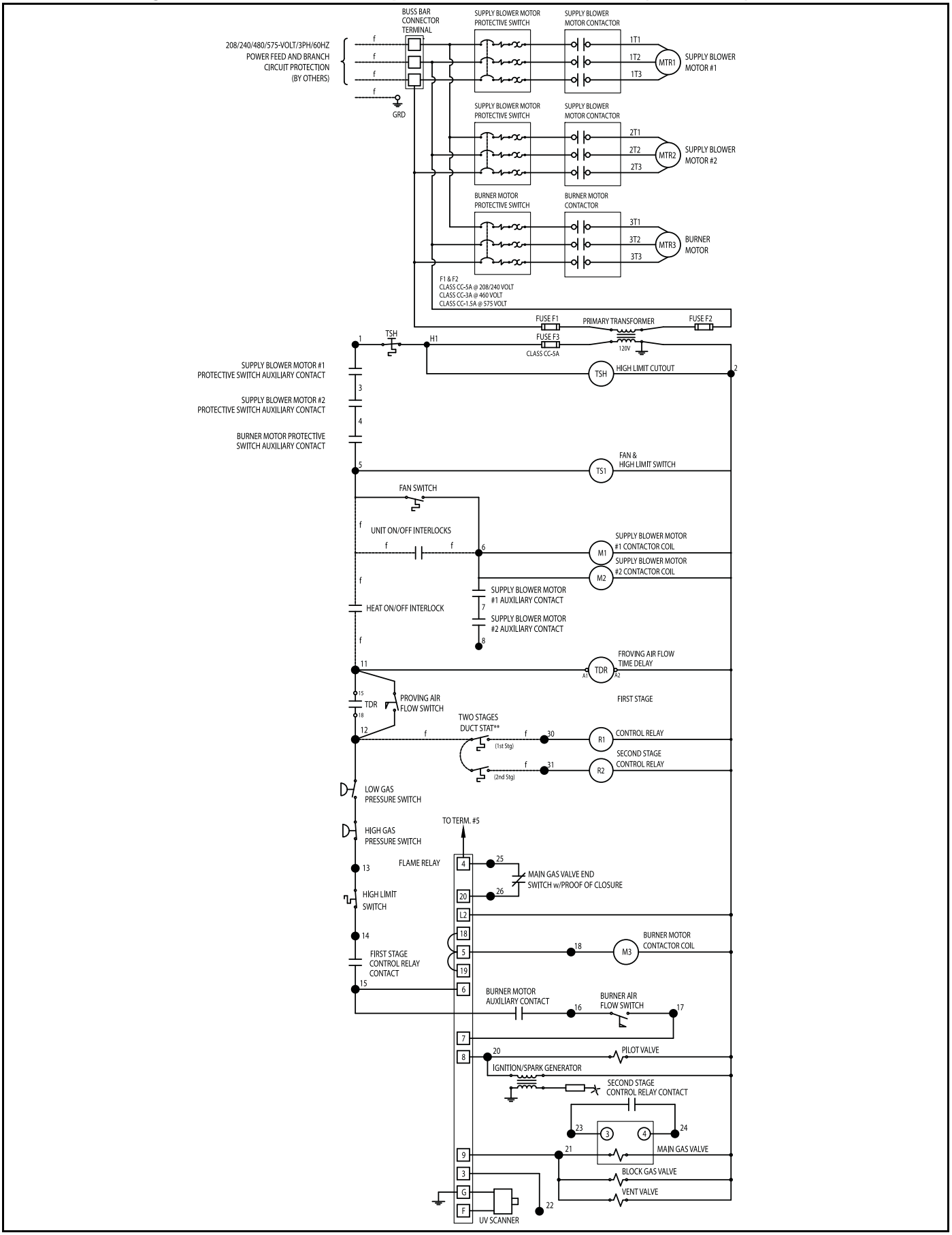


FIGURE 60: Wiring Diagram for Gas-Fired, Dual Propeller Fans Air Turnover Unit with XL-Compliant Manifold and Fully-Modulating Burner with Input Less Than 1,000 MBH (293.1 kW)

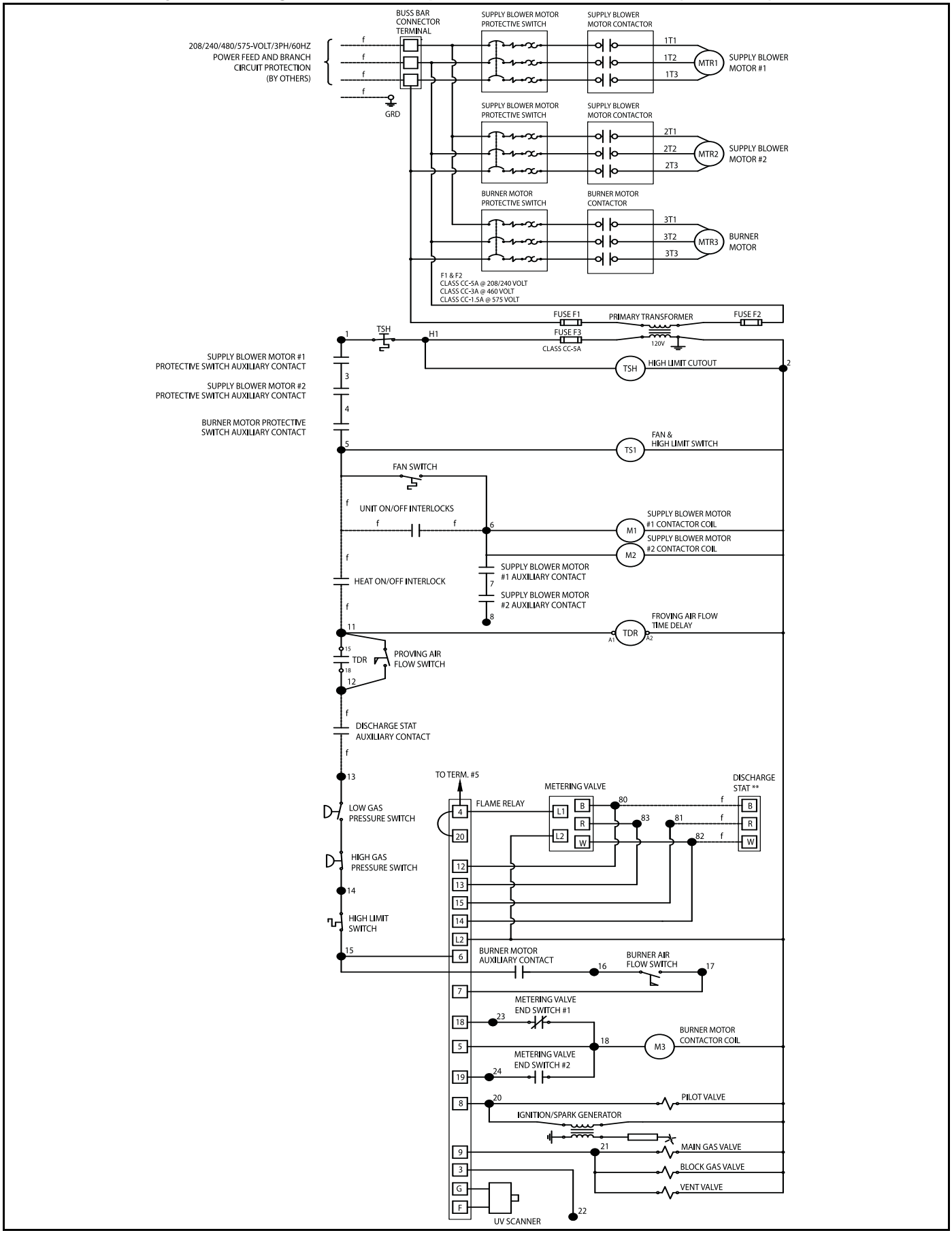


FIGURE 61: Wiring Diagram for Gas-Fired, Dual Propeller Fans Air Turnover Unit with XL-Compliant Manifold and Fully-Modulating Burner with Input 1,000 to 5,000 MBH (293.1-1465.4 kW)

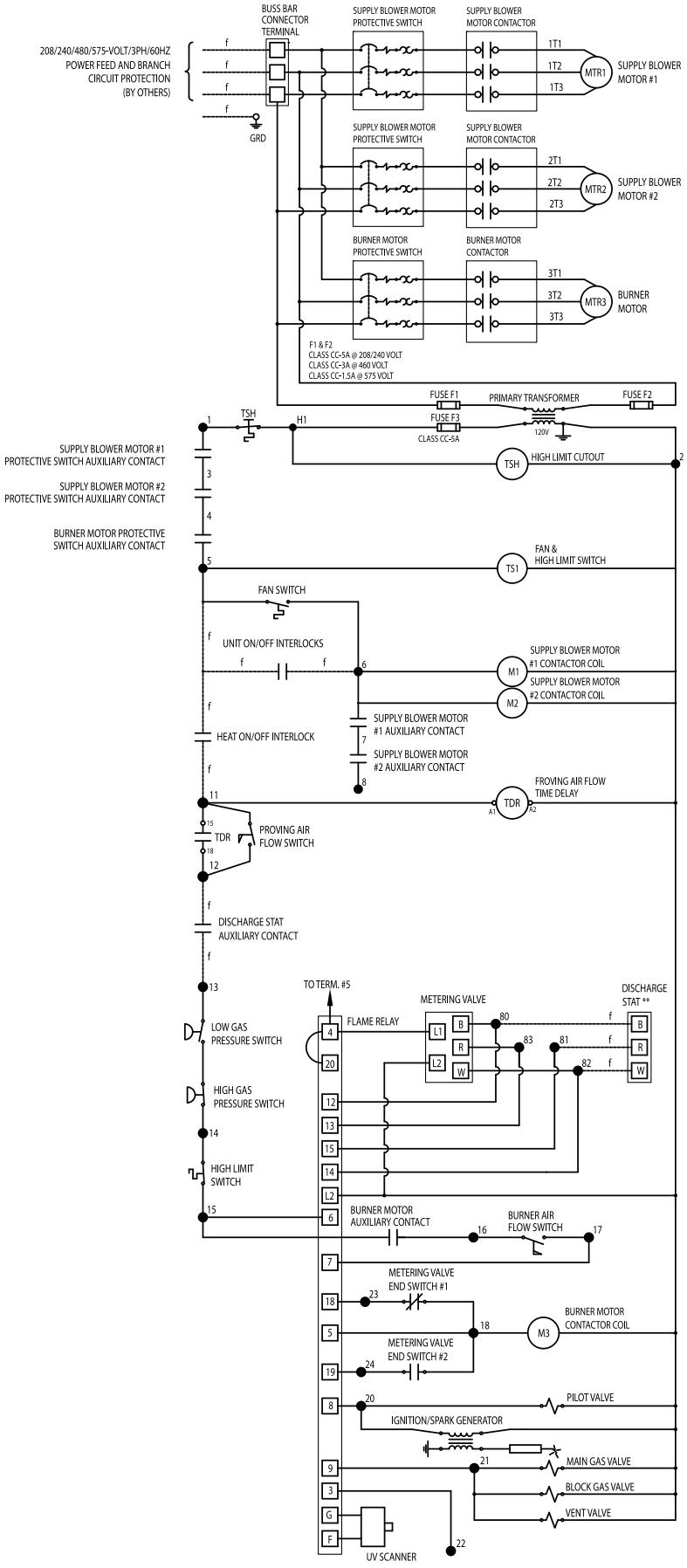


FIGURE 62: Wiring Diagram for Gas-Fired, Dual Propeller Fans Air Turnover Unit with XL-Compliant Manifold and Fully-Modulating Burner with Input More Than 5,000 MBH (1465.4 kW)

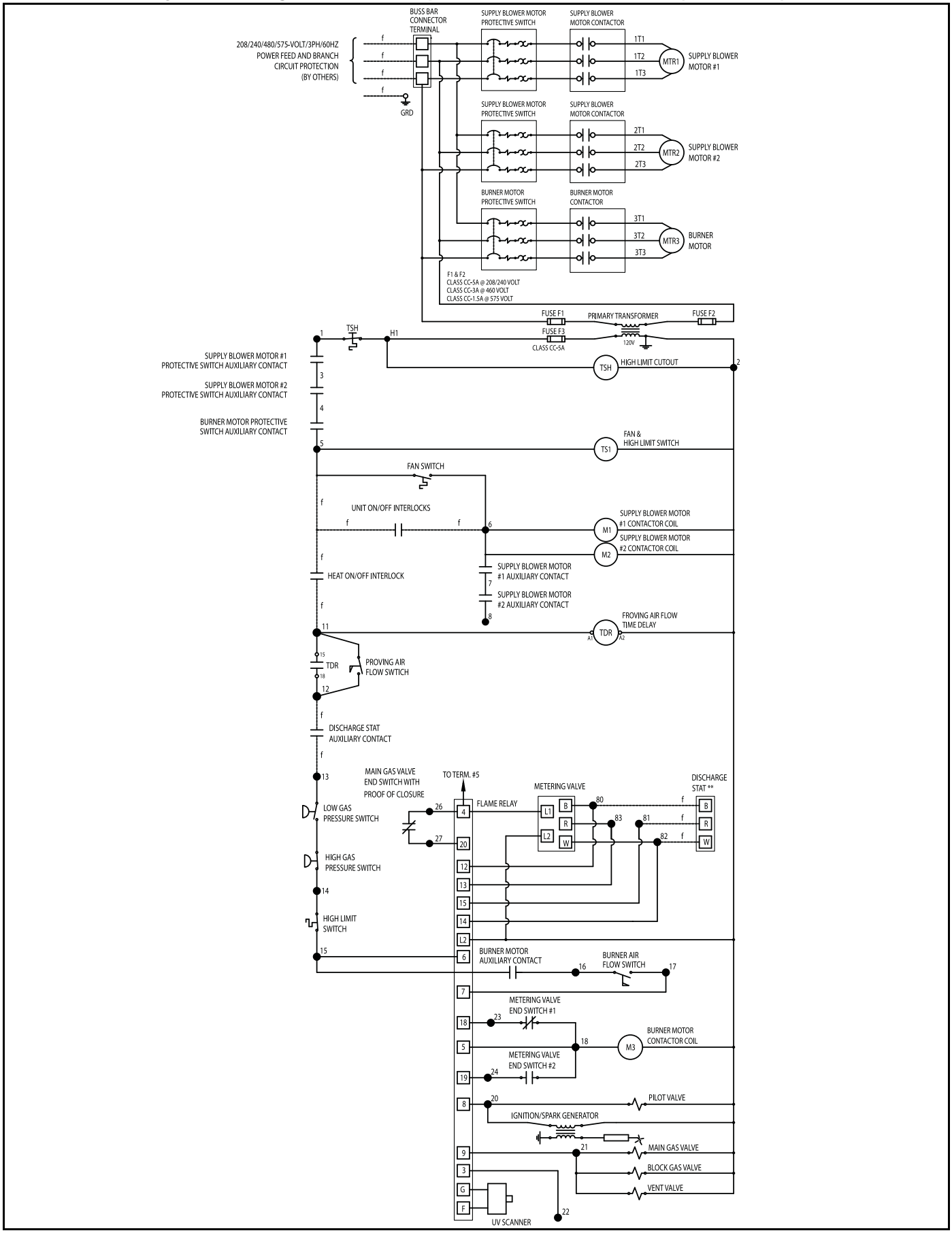


FIGURE 63: Wiring Diagram for Oil-Fired, Single Propeller Fan Air Turnover Unit with FM-Compliant Manifold and On/Off Burner with Input Less Than 1,566 MBH (458.9 kW)

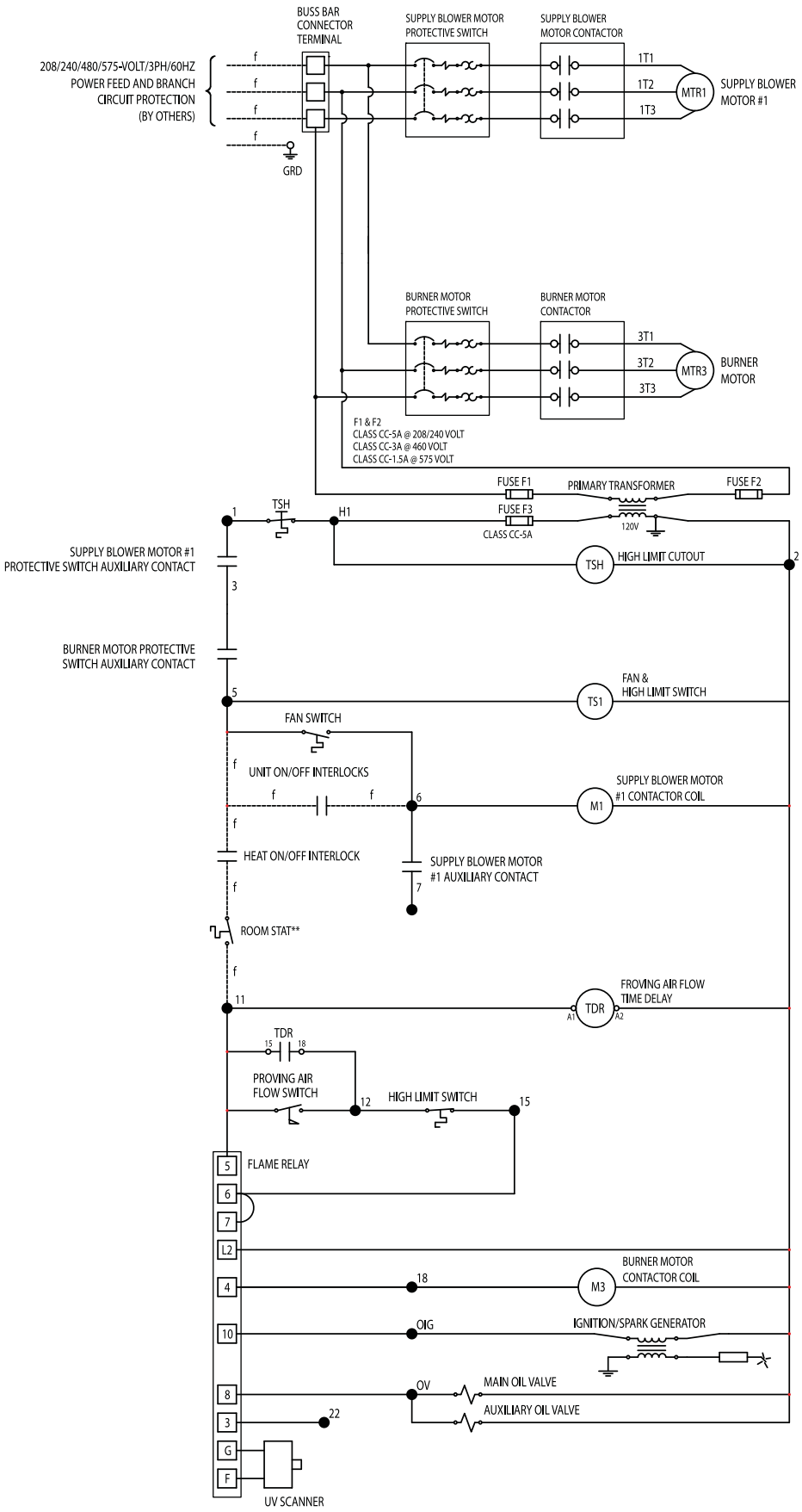


FIGURE 64: Wiring Diagram for Oil-Fired, Single Propeller Fan Air Turnover Unit with FM-Compliant Manifold and High/Low/Off Burner with Input Less Than 1,566 MBH (458.9 kW)

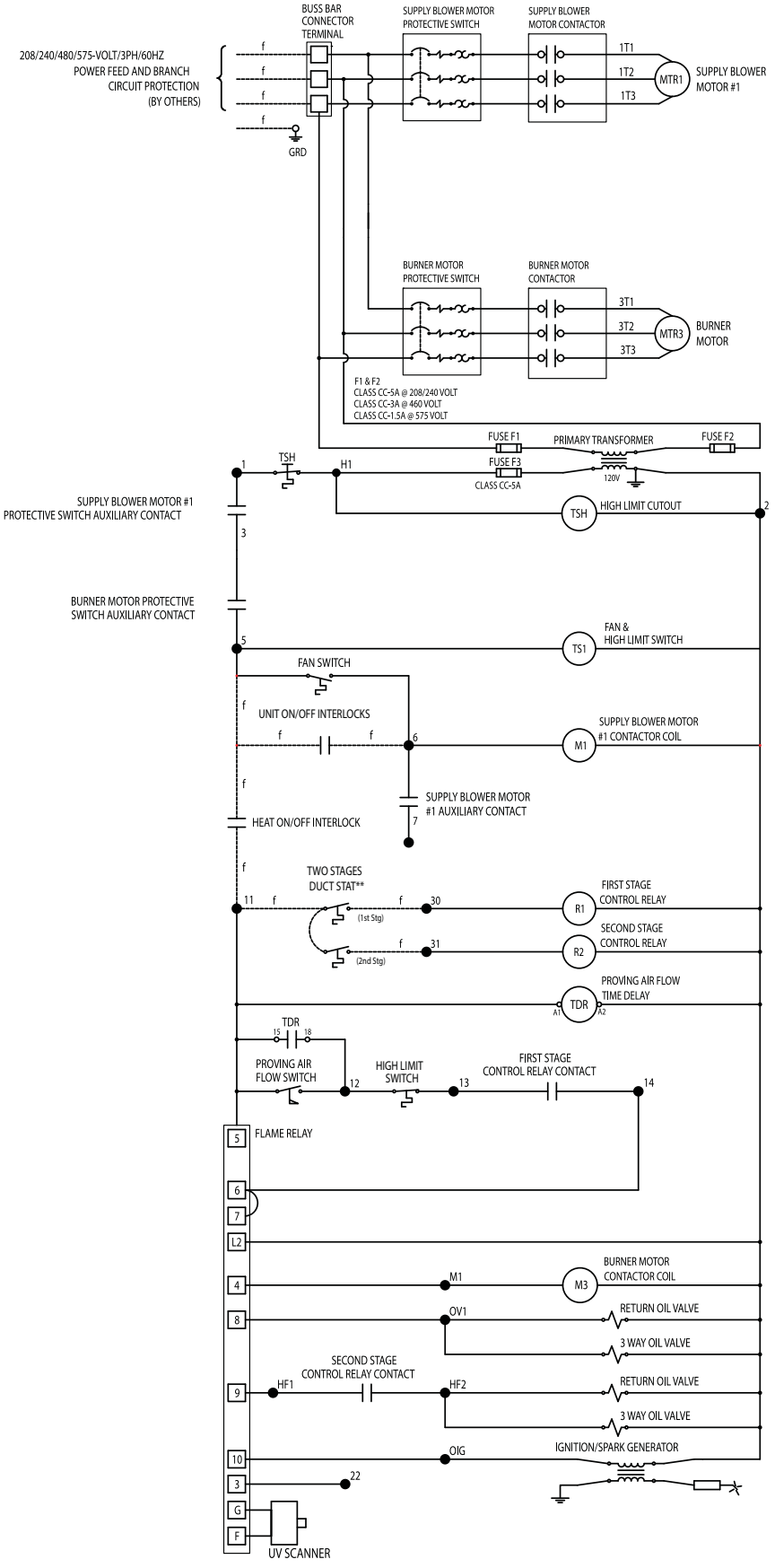


FIGURE 65: Wiring Diagram for Oil-Fired, Single Propeller Fan Air Turnover Unit with FM-Compliant Manifold and Fully-Modulating Burner with Input Less Than 1,566 MBH (458.9 kW)

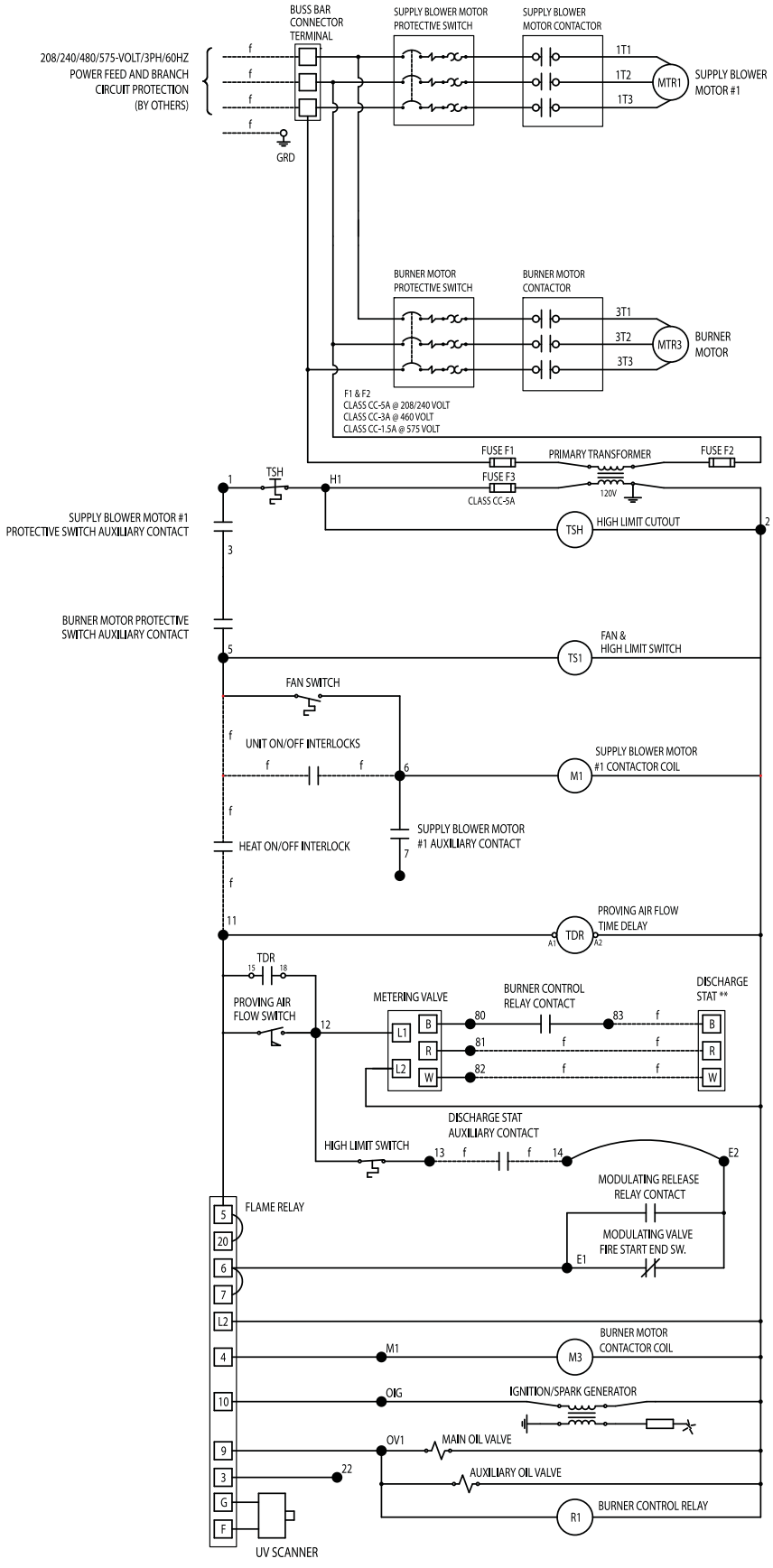


FIGURE 66: Wiring Diagram for Oil-Fired, Single Propeller Fan Air Turnover Unit with XL-Compliant Manifold and On/Off Burner with Input Less Than 1,000 MBH (293.1 kW)

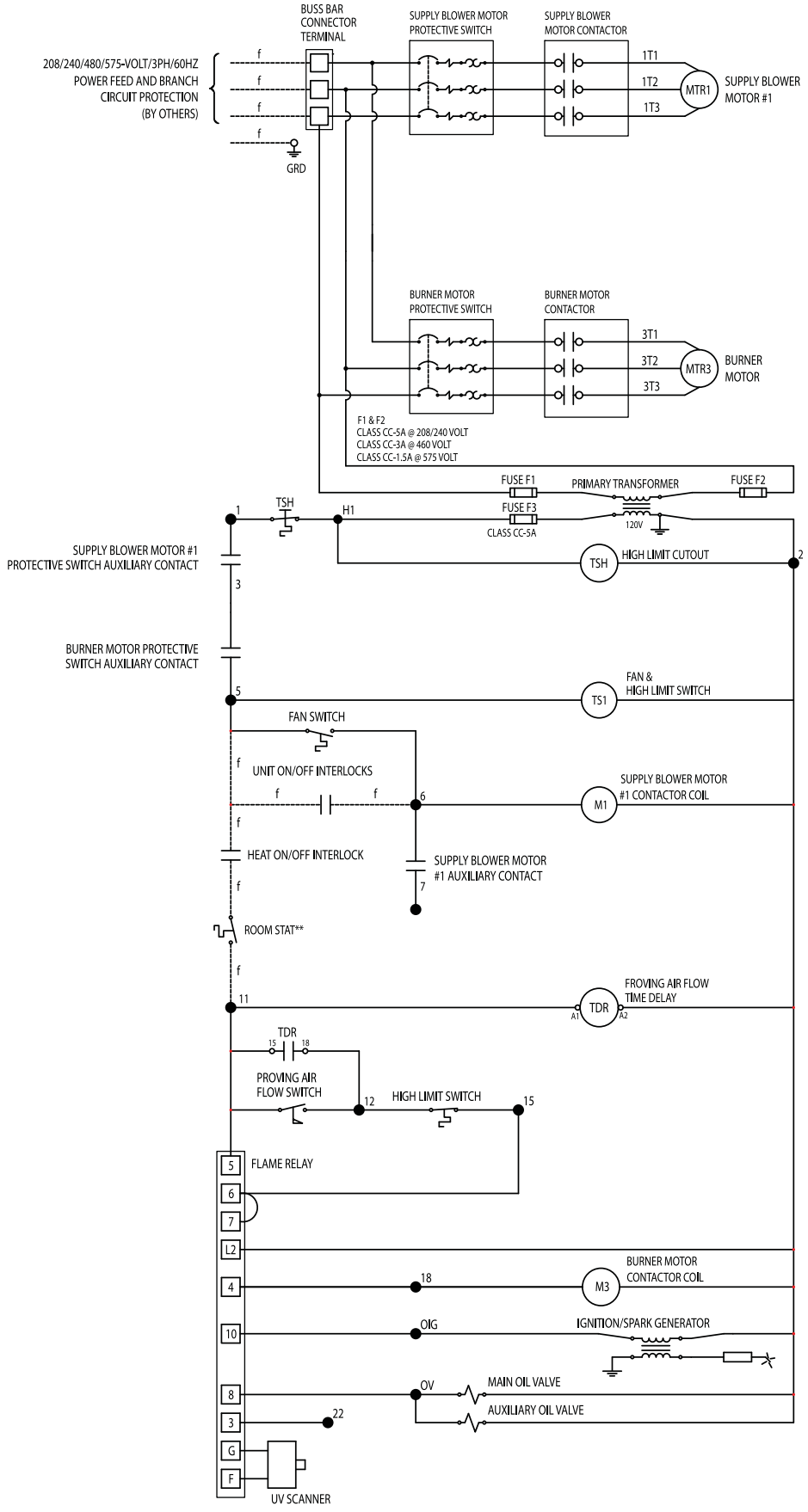


FIGURE 67: Wiring Diagram for Oil-Fired, Single Propeller Fan Air Turnover Unit with XL-Compliant Manifold and On/Off Burner with Input 1,000 to 1,566 MBH (293.1-458.9 kW)

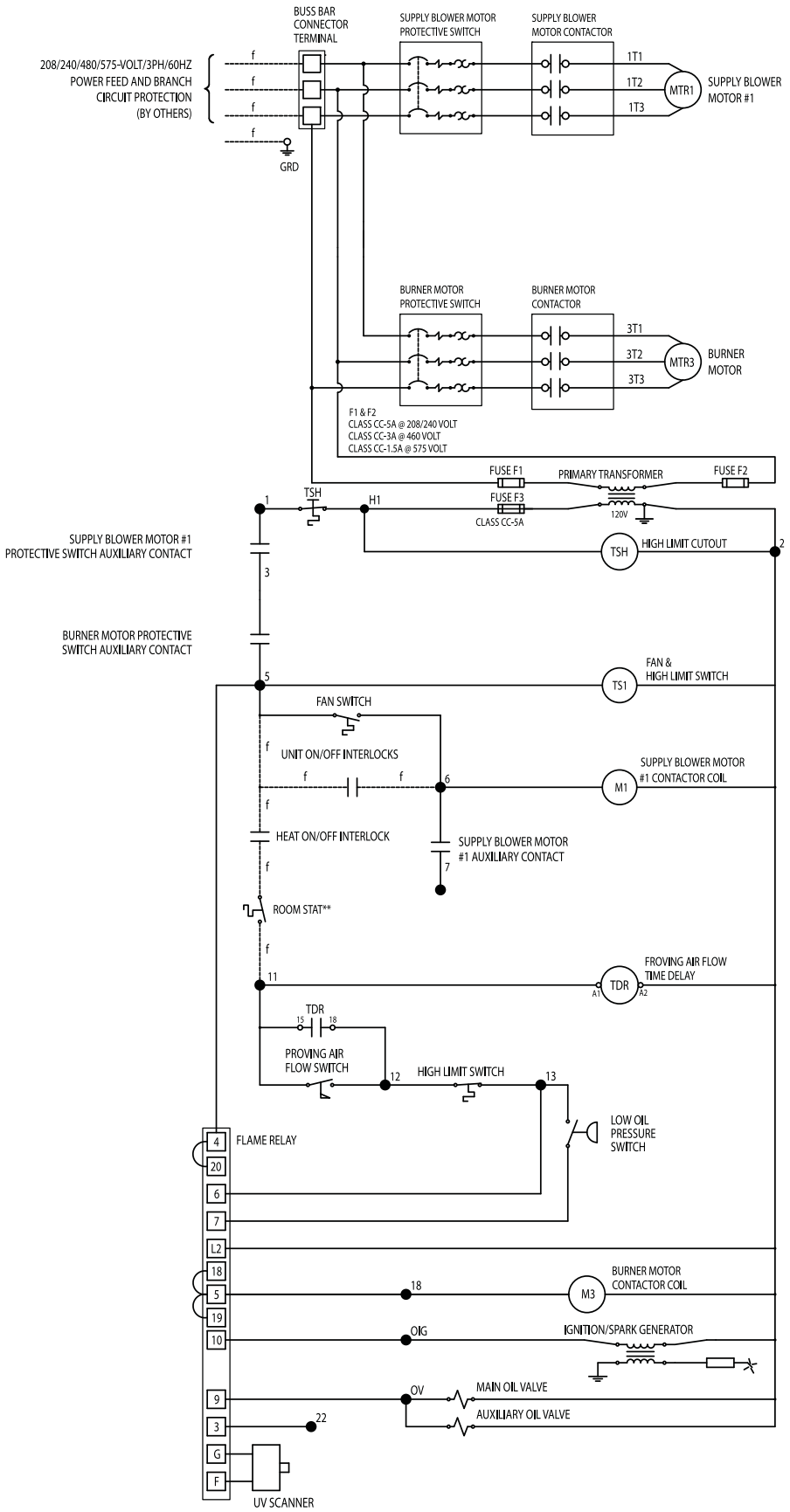


FIGURE 68: Wiring Diagram for Oil-Fired, Single Propeller Fan Air Turnover Unit with XL-Compliant Manifold and High/Low/Off Burner with Input Less Than 1,000 MBH (293.1 kW)

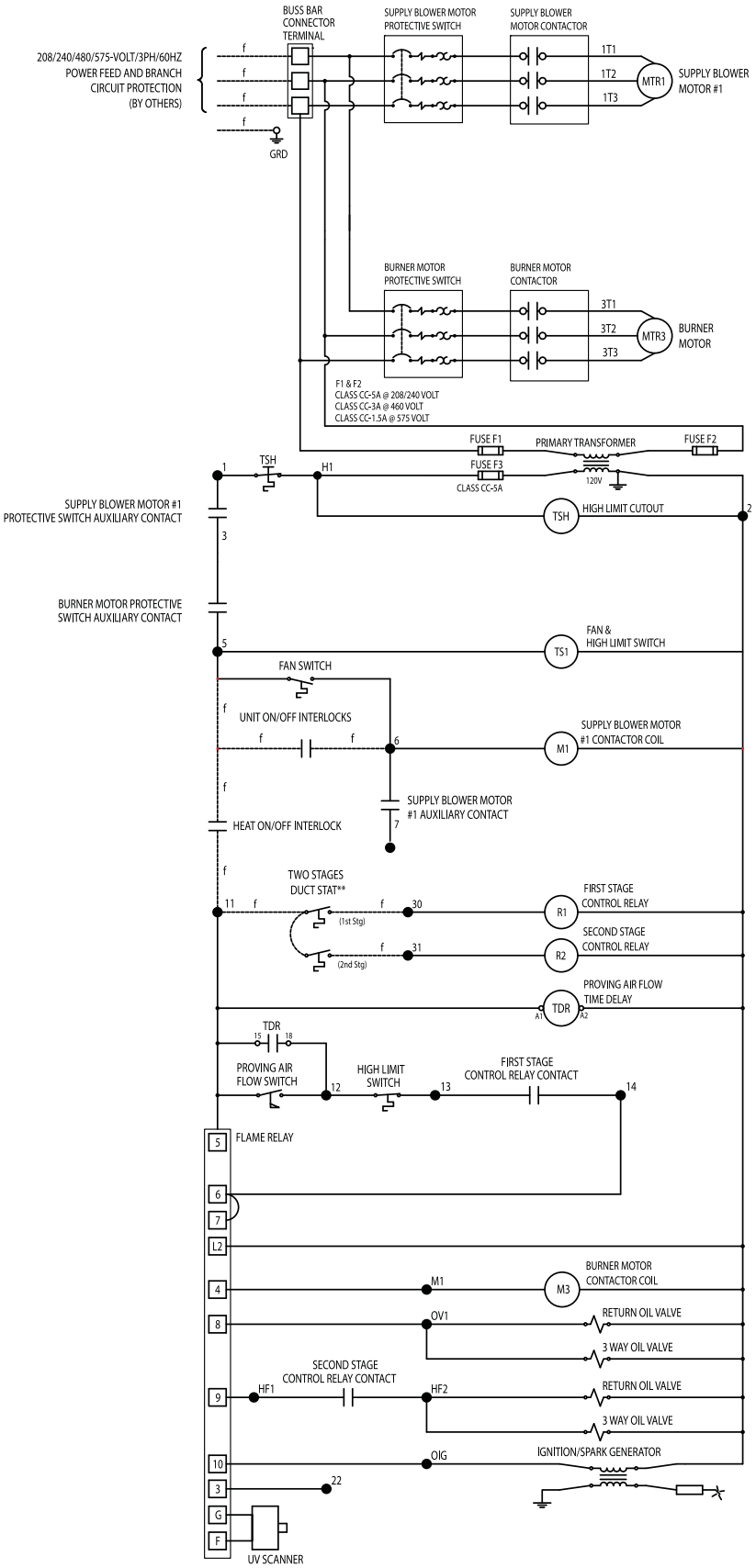


FIGURE 69: Wiring Diagram for Oil-Fired, Single Propeller Fan Air Turnover Unit with XL-Compliant Manifold and High/Low/Off Burner with Input 1,000 to 1,566 MBH (293.1-458.9 kW)

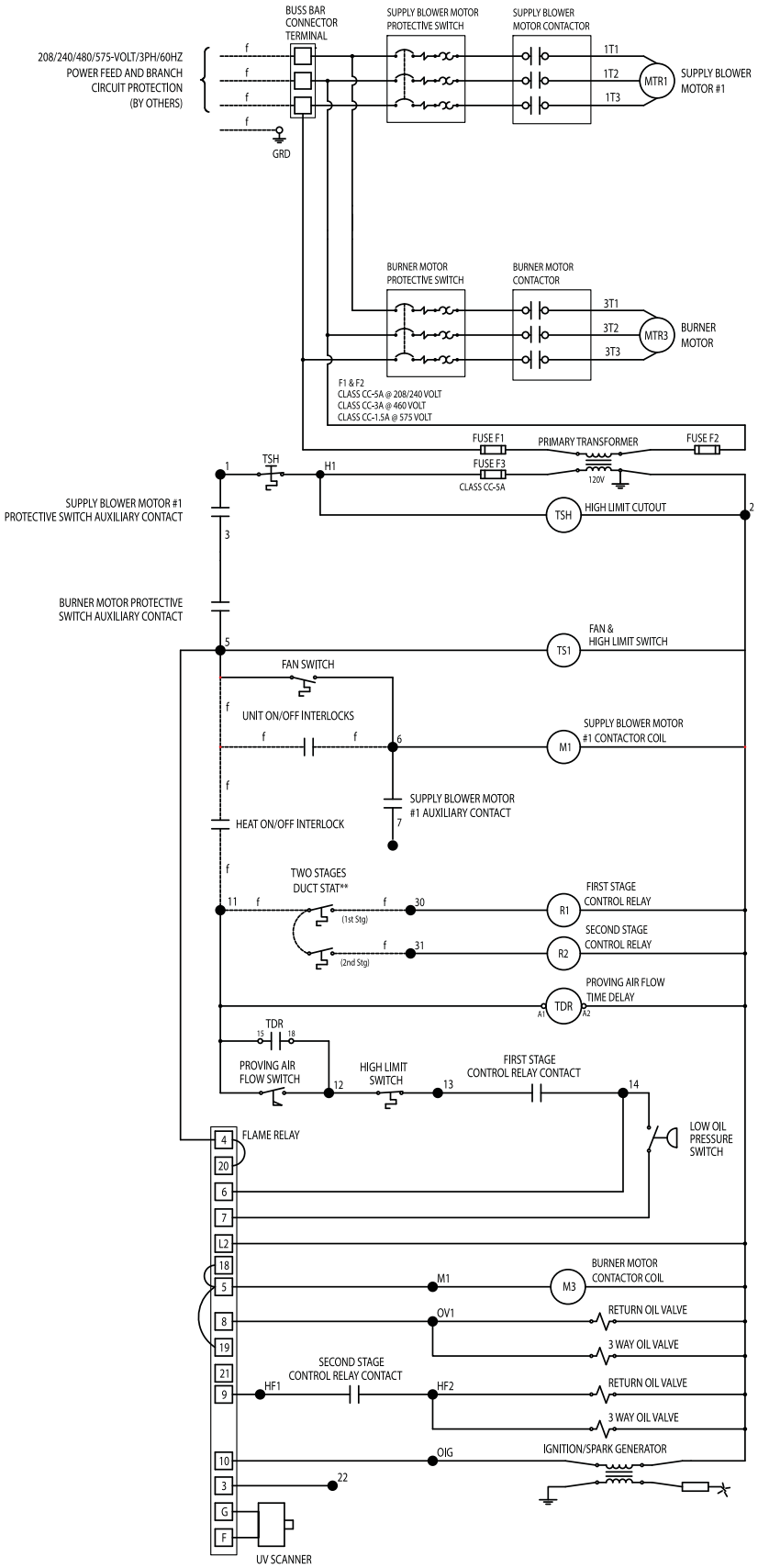


FIGURE 70: Wiring Diagram for Oil-Fired, Single Propeller Fan Air Turnover Unit with XL-Compliant Manifold and Fully-Modulating Burner with Input Less Than 1,000 MBH (293.1 kW)

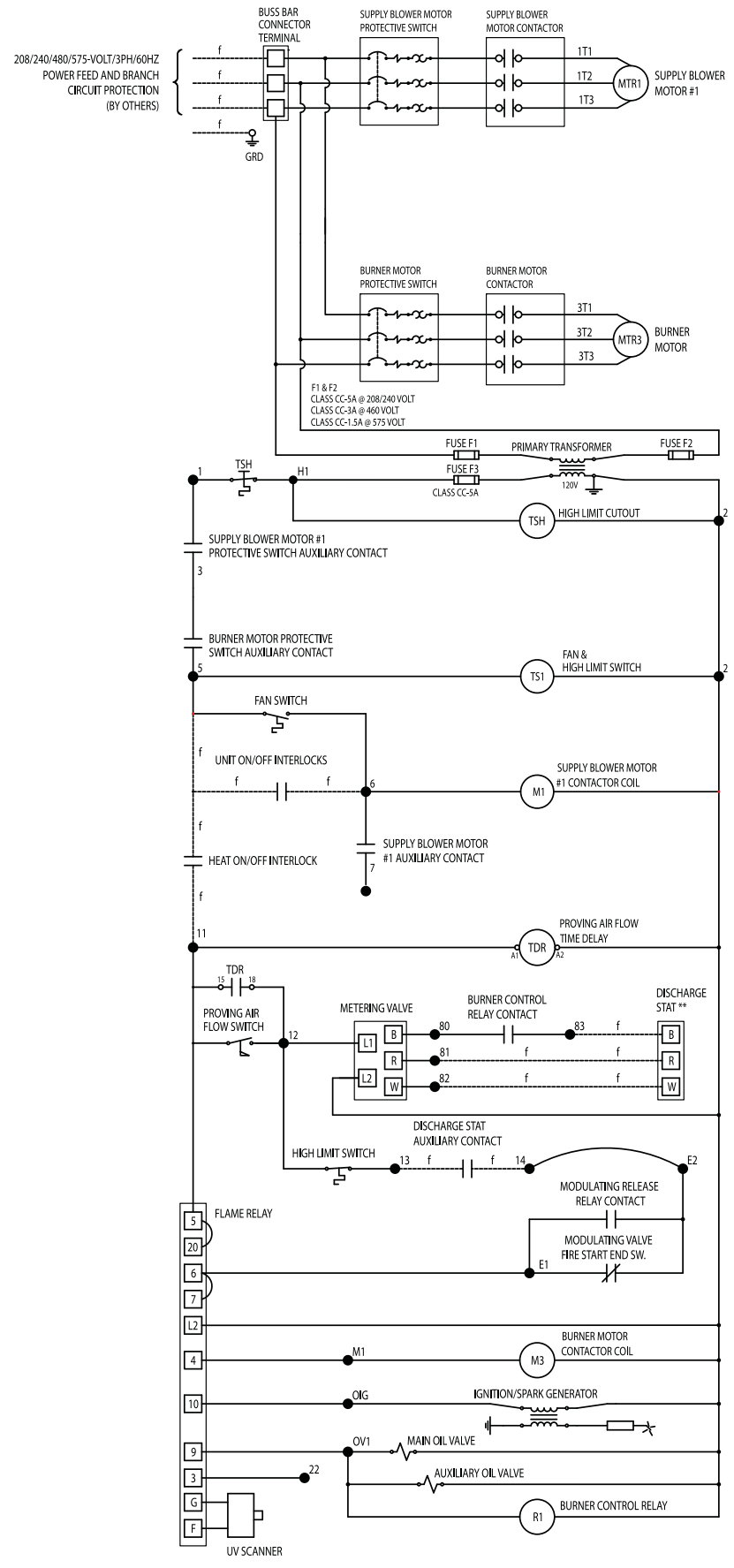


FIGURE 71: Wiring Diagram for Oil-Fired, Single Propeller Fan Air Turnover Unit with XL-Compliant Manifold and Fully-Modulating Burner with Input 1,000 to 1,566 MBH (293.1-458.9 kW)

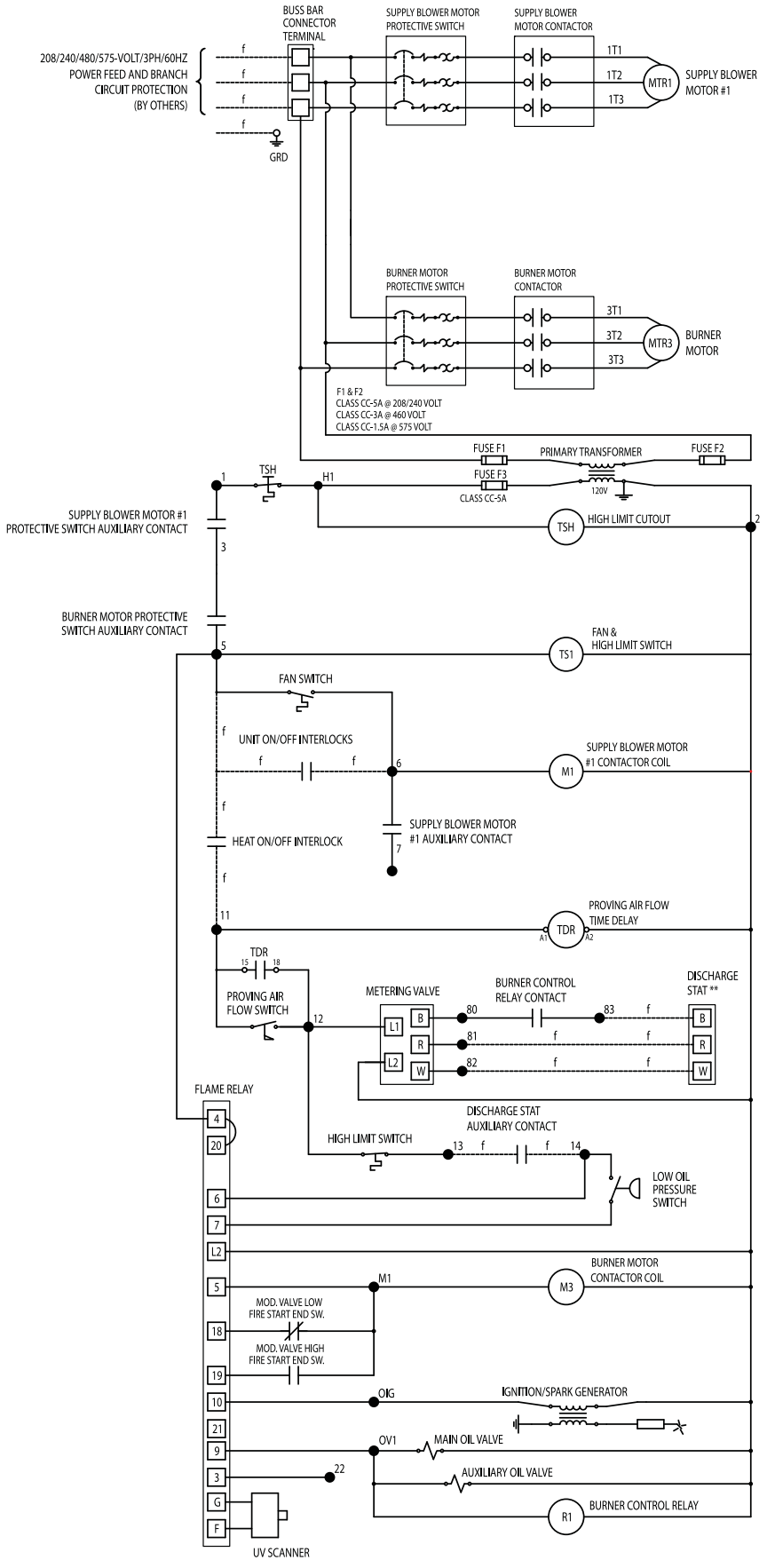


FIGURE 72: Wiring Diagram for Oil-Fired, Dual Propeller Fans Air Turnover Unit with FM-Compliant Manifold and On/Off Burner with Input Less Than 2,500 MBH (732.7 kW)

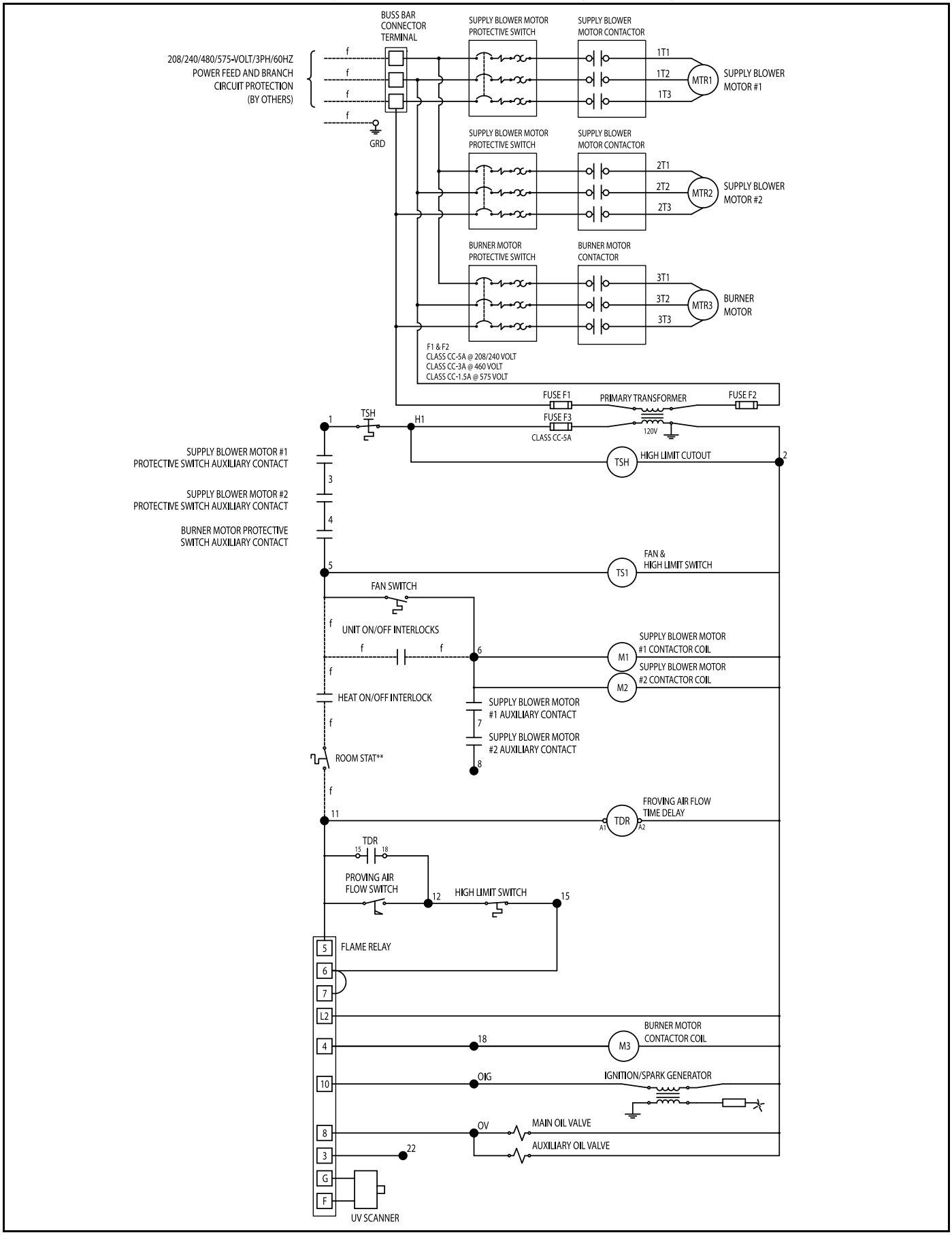


FIGURE 73: Wiring Diagram for Oil-Fired, Dual Propeller Fans Air Turnover Unit with FM-Compliant Manifold and High/Low/Off Burner with Input Less Than 2,500 MBH (732.7 kW)

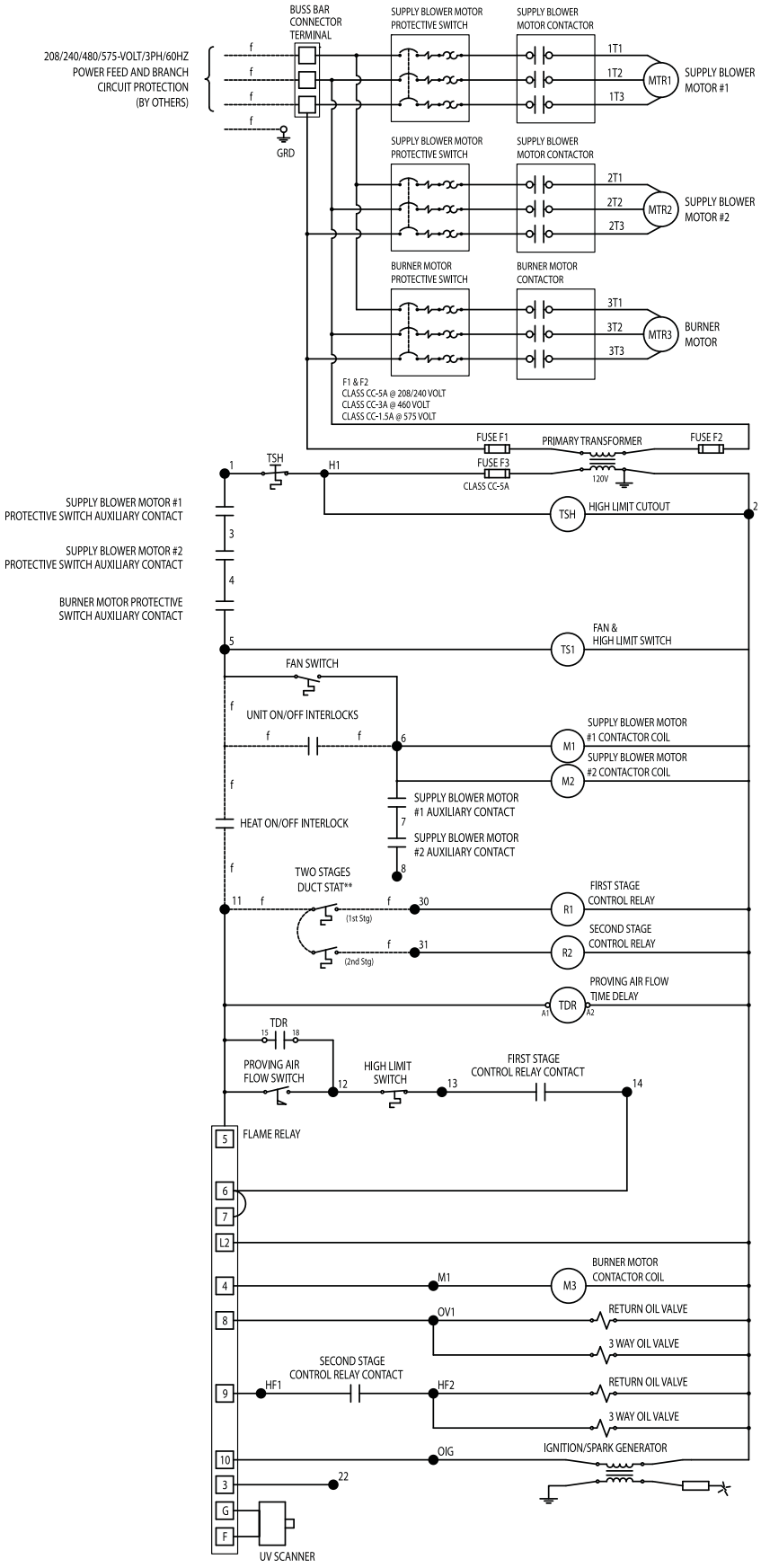


FIGURE 74: Wiring Diagram for Oil-Fired, Dual Propeller Fans Air Turnover Unit with FM-Compliant Manifold and High/Low/Off Burner with Input More Than 2,500 MBH (732.7 kW)

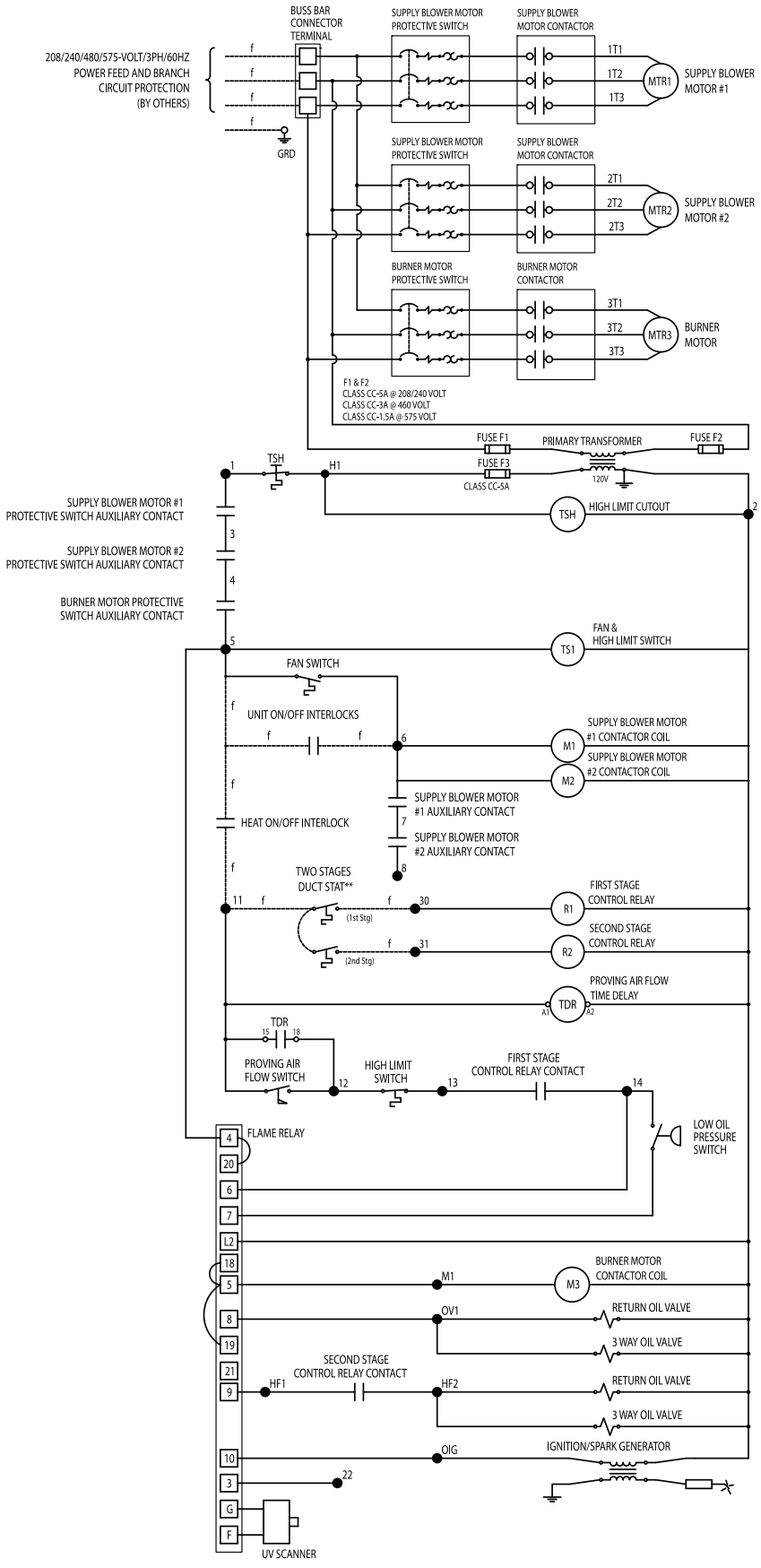


FIGURE 75: Wiring Diagram for Oil-Fired, Dual Propeller Fans Air Turnover Unit with FM-Compliant Manifold and Fully-Modulating Burner with Input Less Than 2,500 MBH (732.7 kW)

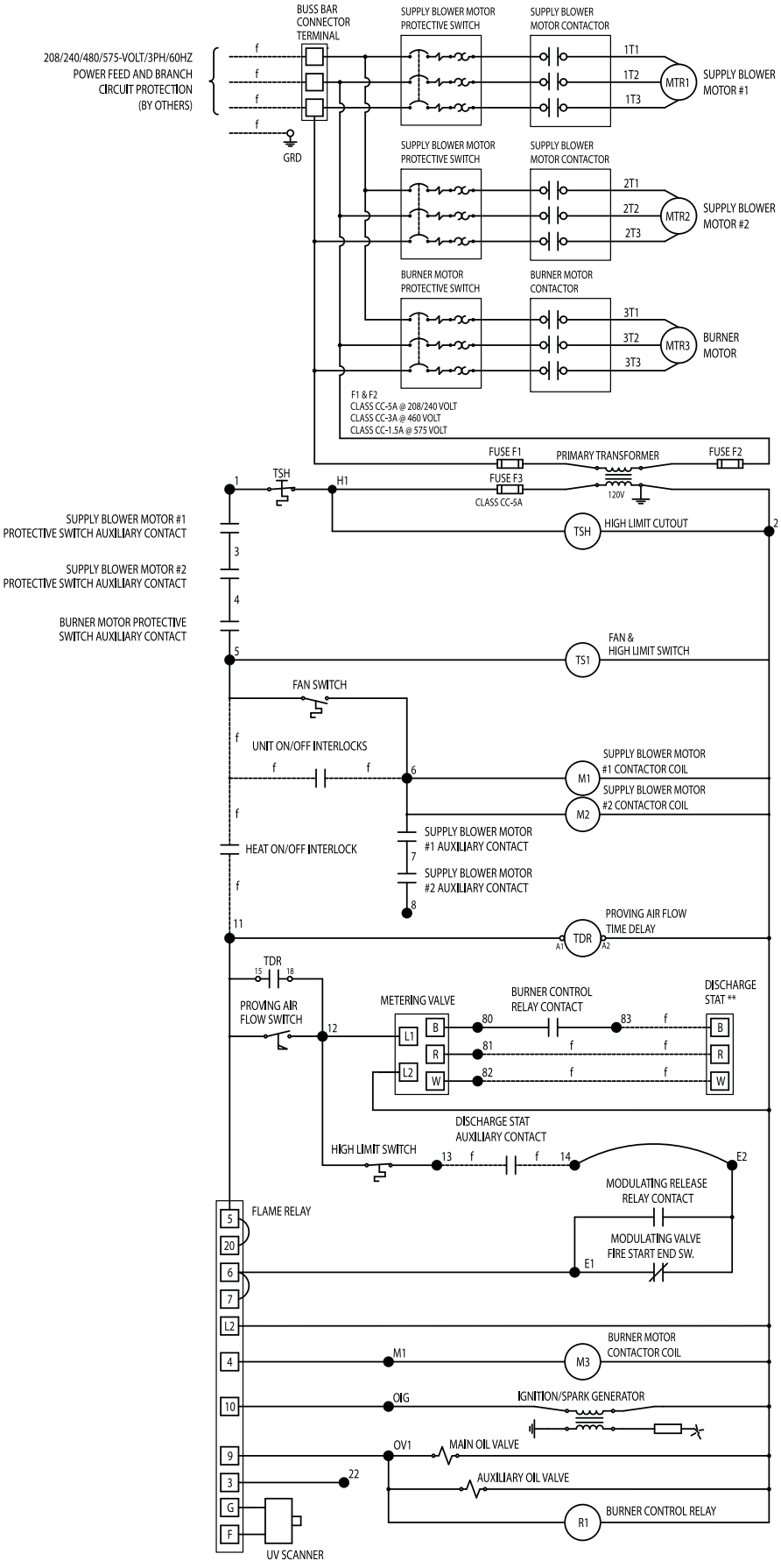


FIGURE 76: Wiring Diagram for Oil-Fired, Dual Propeller Fans Air Turnover Unit with FM-Compliant Manifold and Fully-Modulating Burner with Input More Than 2,500 MBH (732.7 kW)

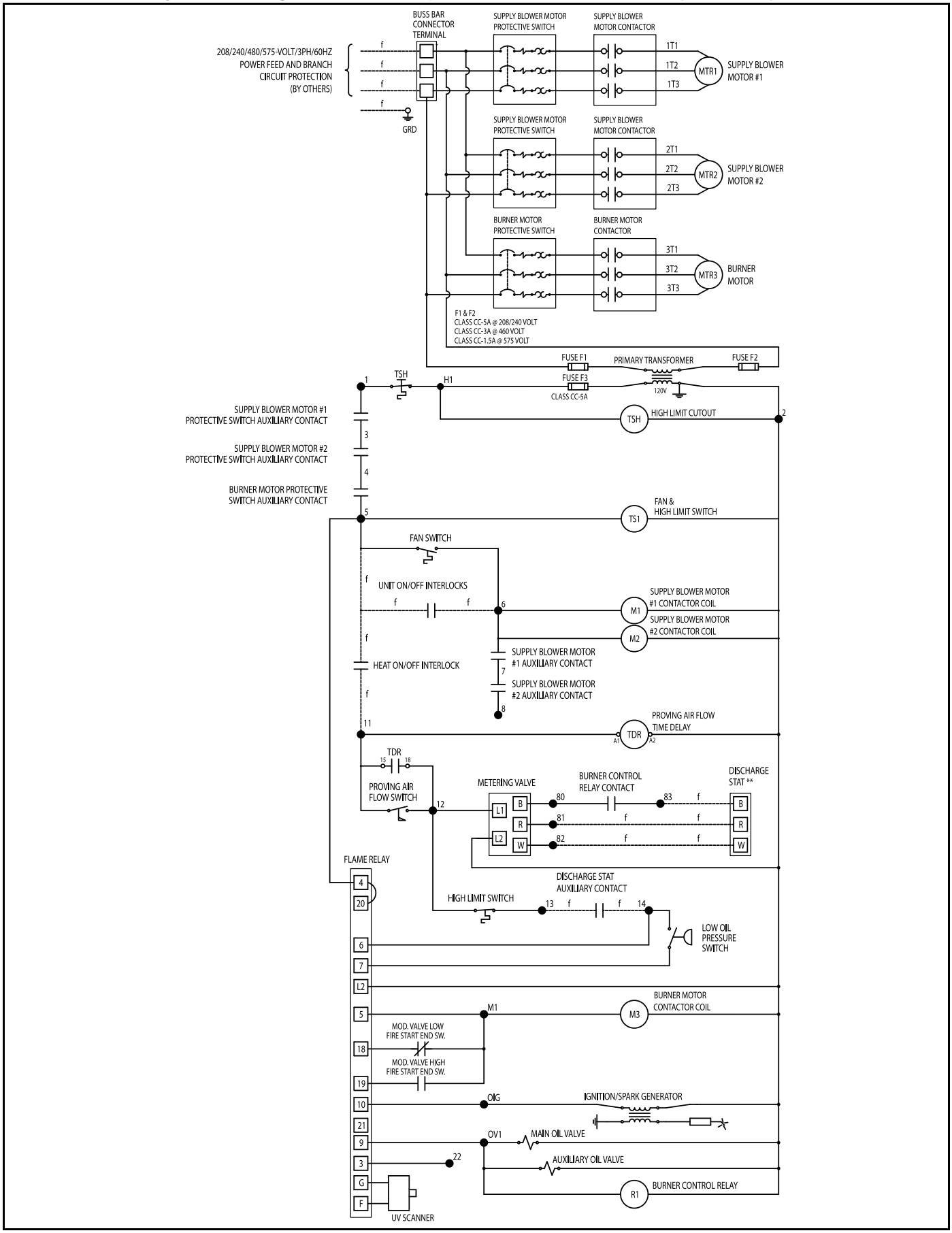


FIGURE 77: Wiring Diagram for Oil-Fired, Dual Propeller Fans Air Turnover Unit with XL-Compliant Manifold and On/Off Burner with Input Less Than 1,000 MBH (293.1 kW)

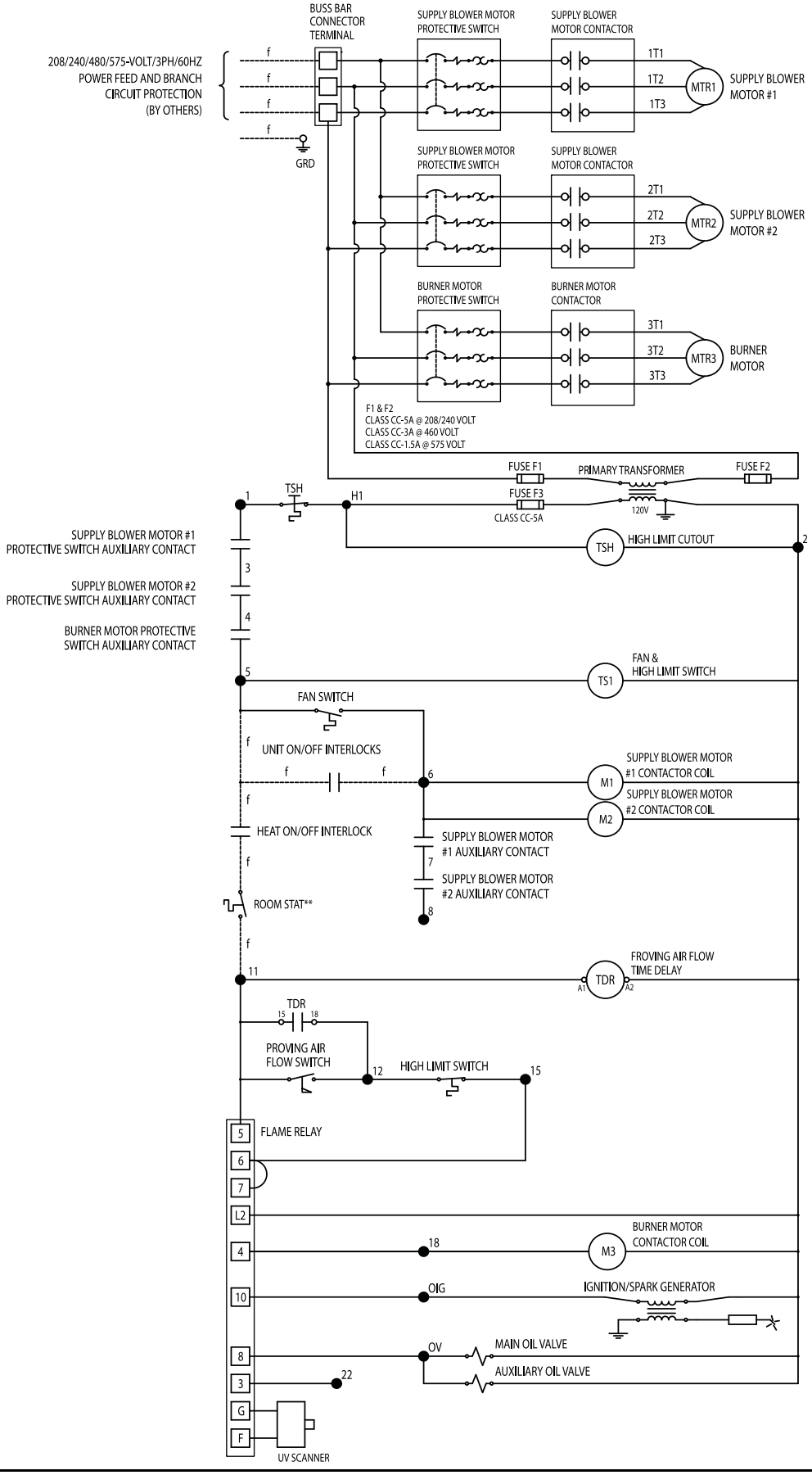


FIGURE 78: Wiring Diagram for Oil-Fired, Dual Propeller Fans Air Turnover Unit with XL-Compliant Manifold and On/Off Burner with Input 1,000 to 2,500 MBH (293.1-732.7 kW)

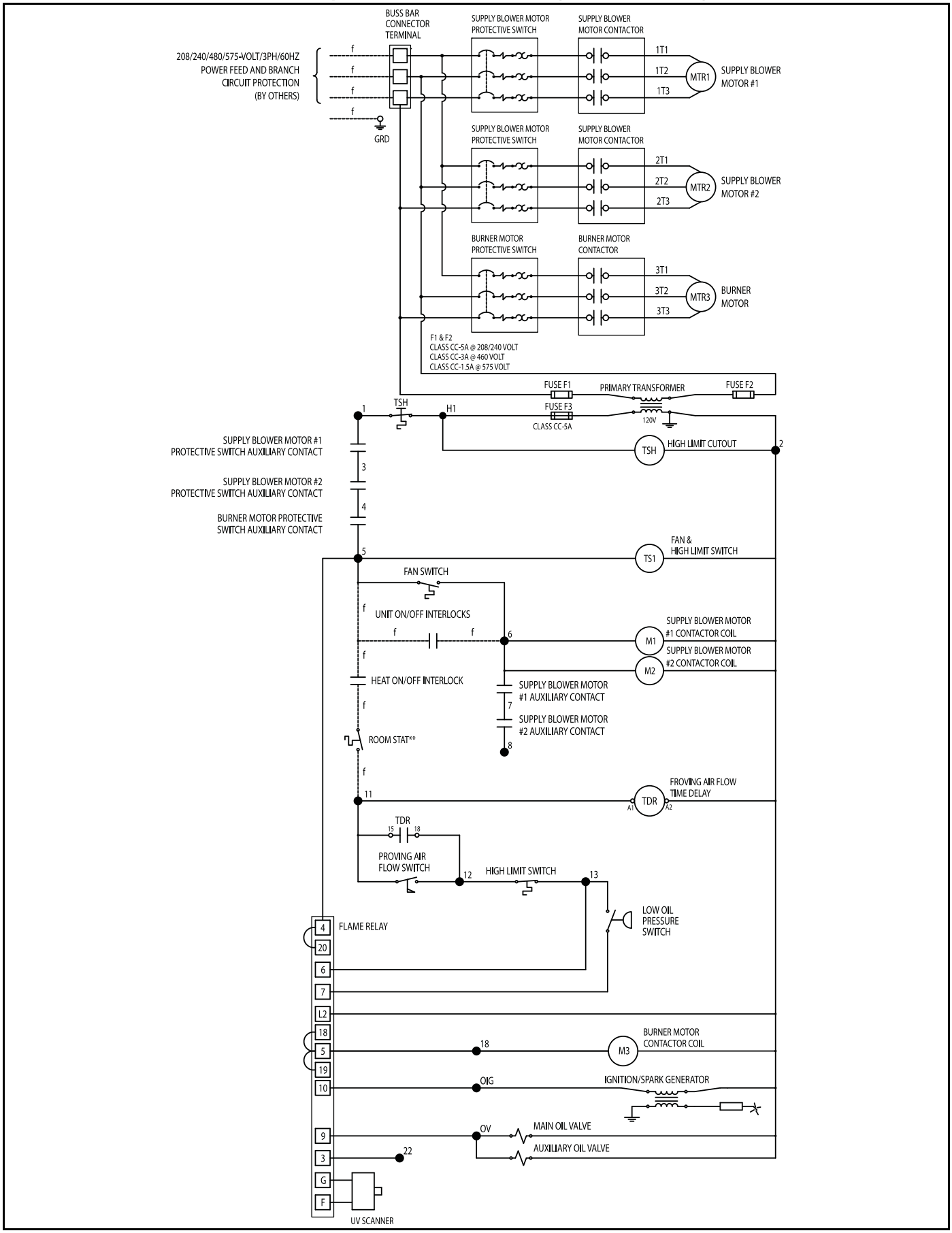


FIGURE 79: Wiring Diagram for Oil-Fired, Dual Propeller Fans Air Turnover Unit with XL-Compliant Manifold and High/Low/Off Burner with Input Less Than 1,000 MBH (293.1 kW)

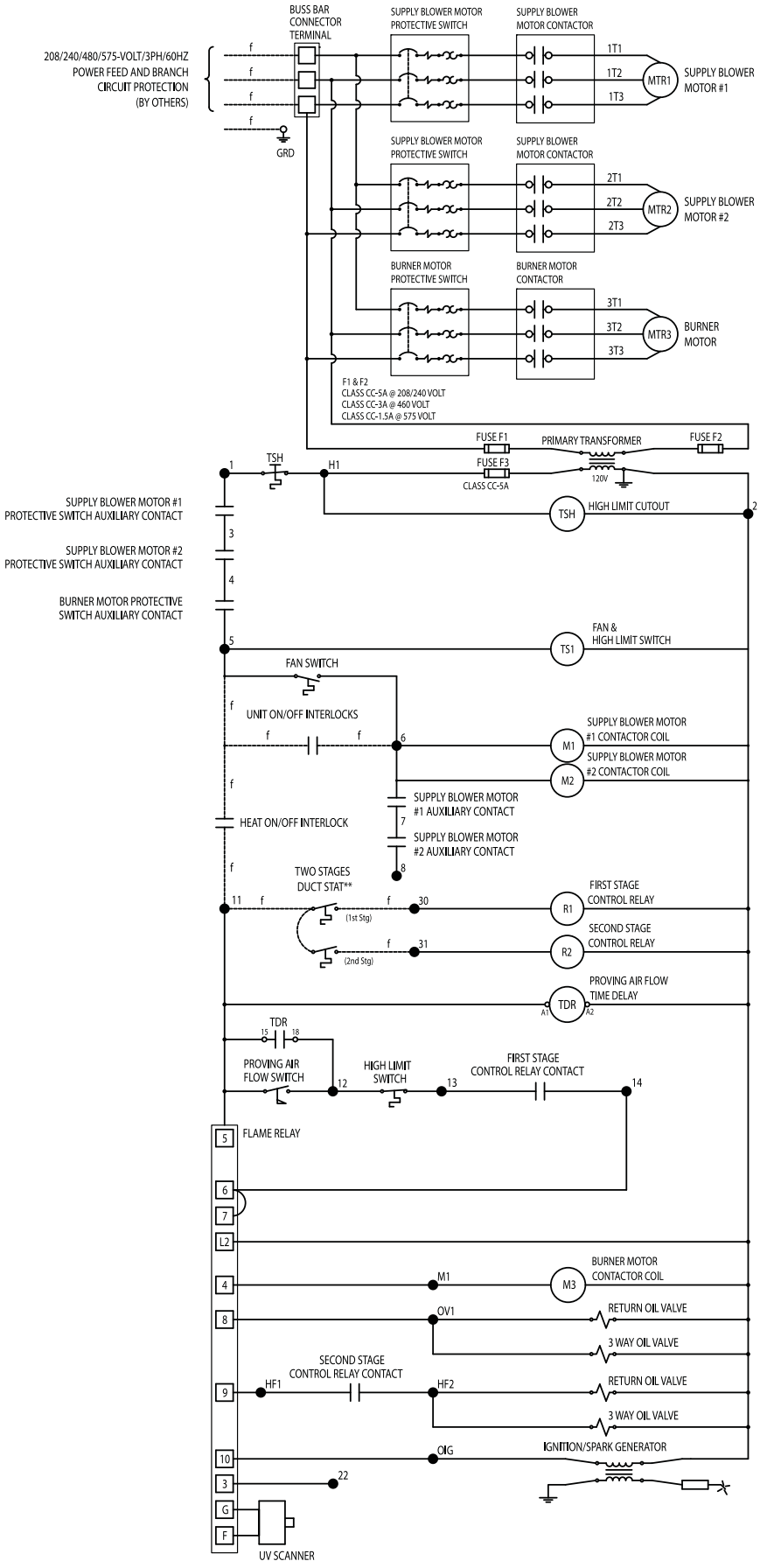


FIGURE 80: Wiring Diagram for Oil-Fired, Dual Propeller Fans Air Turnover Unit with XL-Compliant Manifold and High/Low/Off Burner with Input 1,000 to 5,000 MBH (293.1-1465.4 kW)

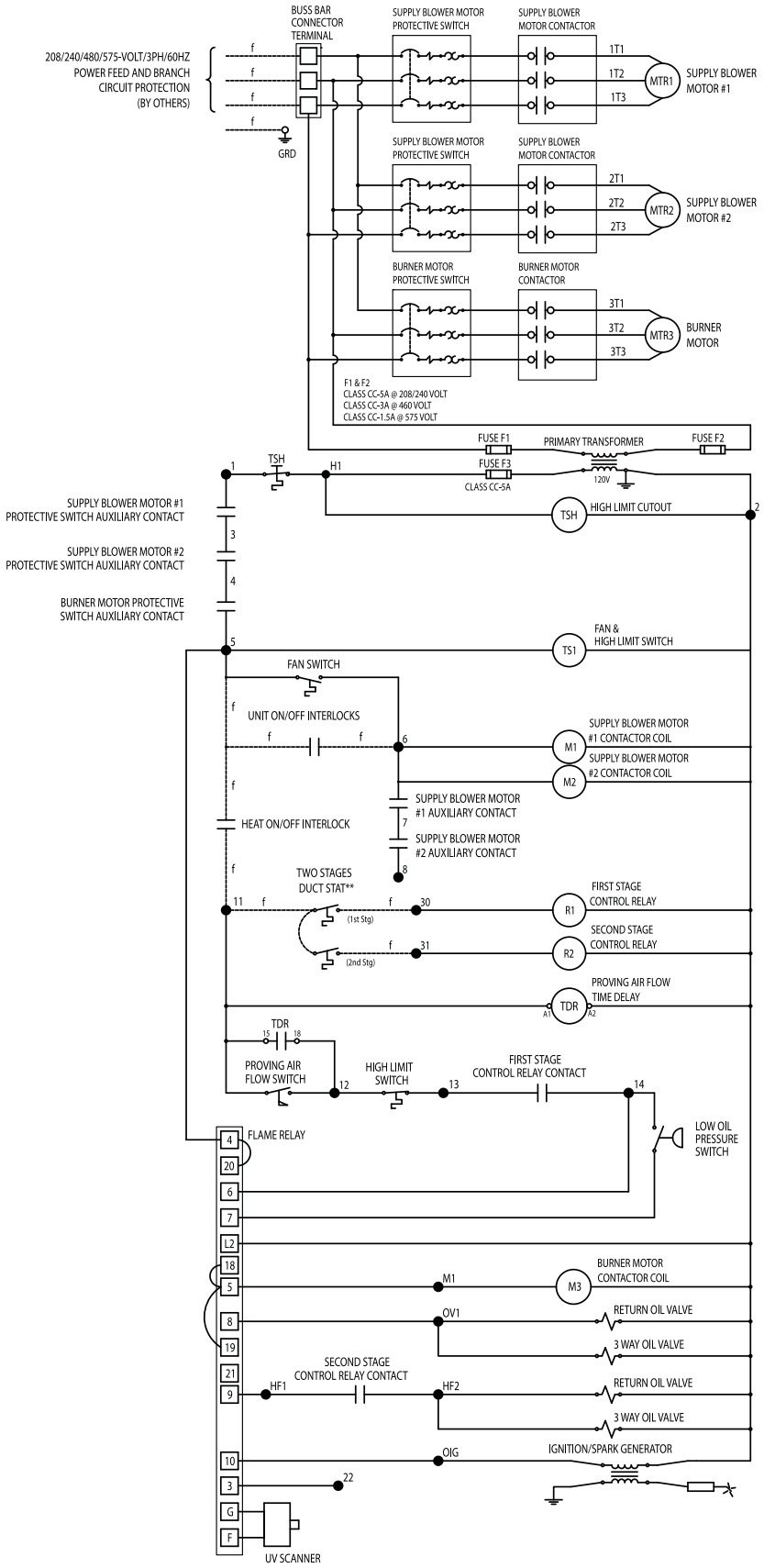


FIGURE 81: Wiring Diagram for Oil-Fired, Dual Propeller Fans Air Turnover Unit with XL-Compliant Manifold and Fully-Modulating Burner with Input Less Than 1,000 MBH (293.1 kW)

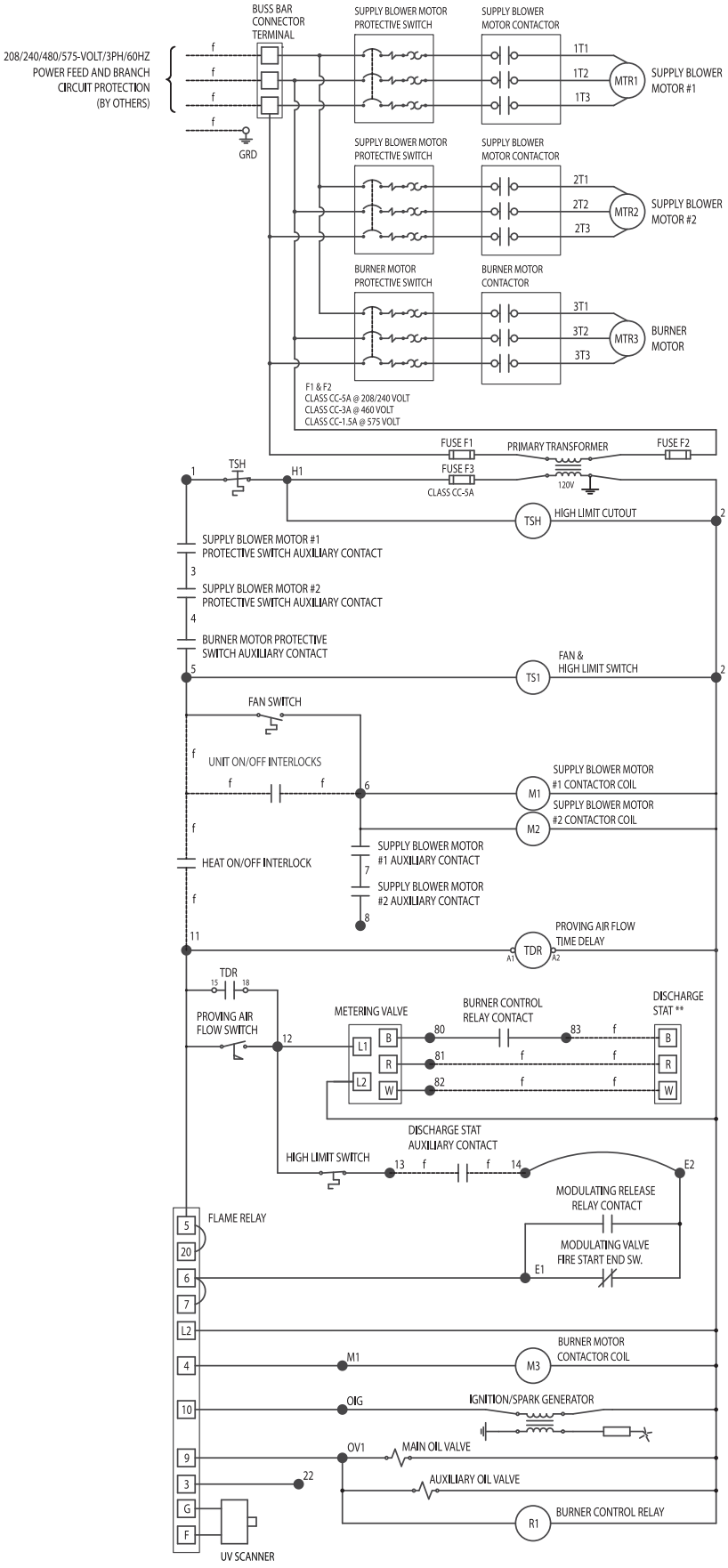
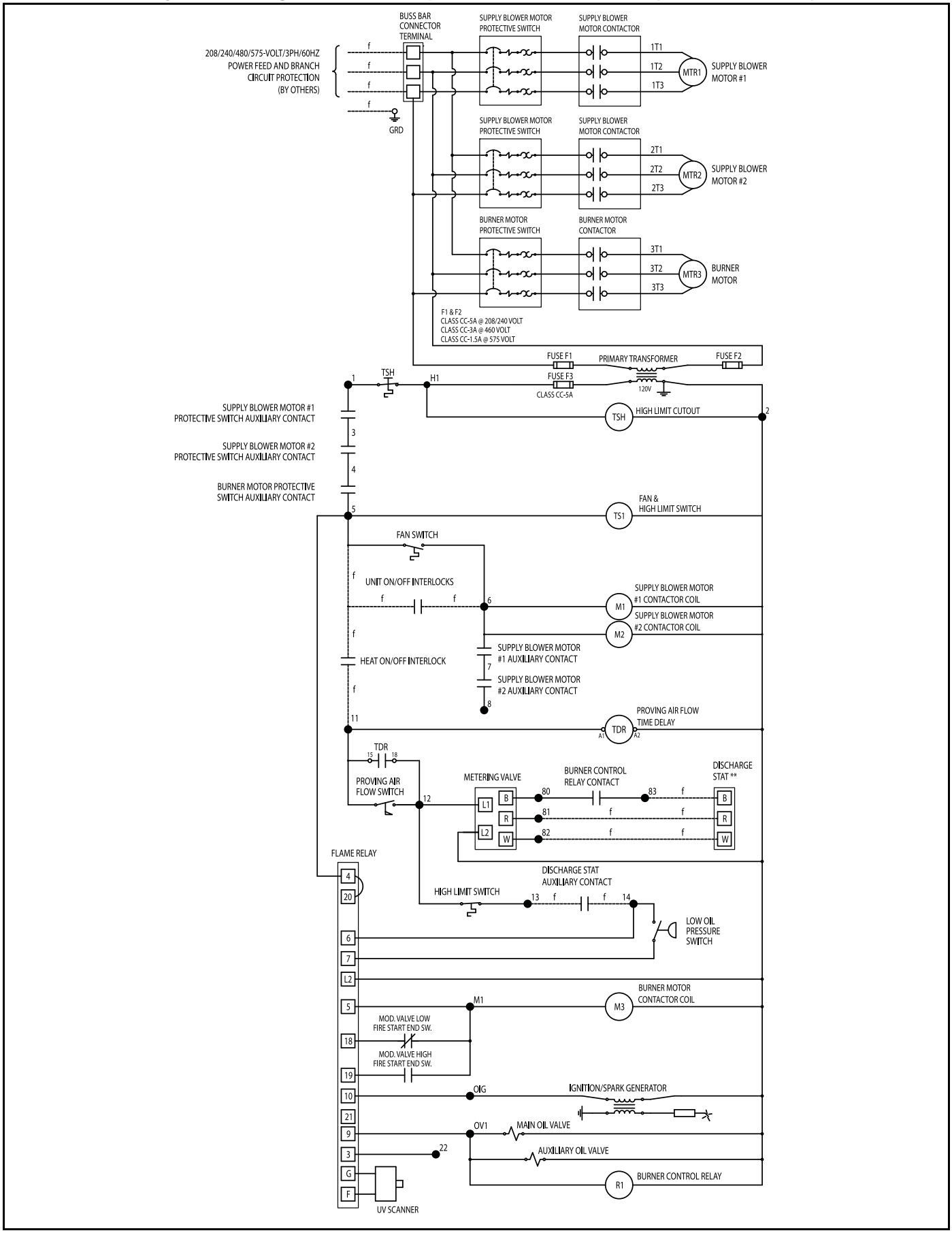
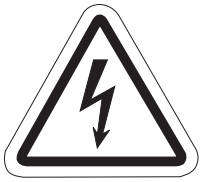


FIGURE 82: Wiring Diagram for Oil-Fired, Dual Propeller Fans Air Turnover Unit with XL-Compliant Manifold and Fully-Modulating Burner with Input 1,000 to 5,000 MBH (293.1-1465.4 kW)



SECTION 15: SEQUENCE OF OPERATION

⚠ DANGER



Electrical Shock Hazard

Disconnect electric before service.

More than one disconnect switch may be required to disconnect electric from equipment.

Equipment must be properly grounded.

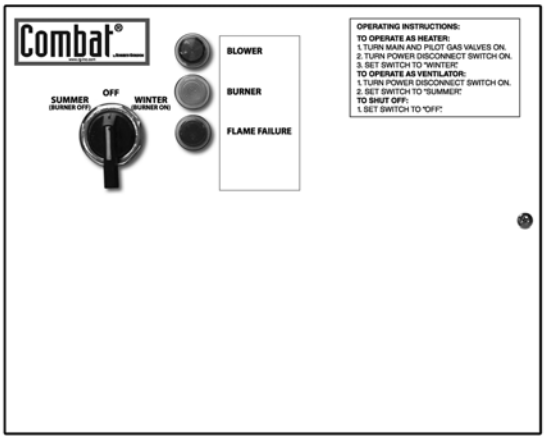
Failure to follow these instructions can result in death or electrical shock.

15.1 Remote Panel Options

The remote panel should be mounted in the conditioned space in a convenient location for controlling the air turnover unit. Care must be taken when locating a remote panel that contains temperature sensing equipment, such that it is not located in an area that is directly affected by this air turnover unit or another heat source as it may interfere with the operation of the air turnover unit.

Mount the remote panel using the four 0.25" (0.6 cm) holes in the back panel of the box with appropriate hardware (supplied by others).

15.1.1 8.1 Remote Panel



The 8.1 Remote Panel includes Summer/Off/Winter switch and blower, burner, and flame failure indicators in a NEMA 1 style enclosure.

Blower Indicator:
Indicates the air turnover unit is supplying power to the main fan motor via the motor controls.

Burner Indicator:
Indicates that the air turnover unit has supplied power to open the main fuel shut off valve.

Flame Failure Indicator:
The burner control module has experienced a fault and will need to be reset. The burner control module must be reset at the air turnover unit. Refer to the Maintenance and Trouble Shooting sections of this manual to determine the cause of the fault.

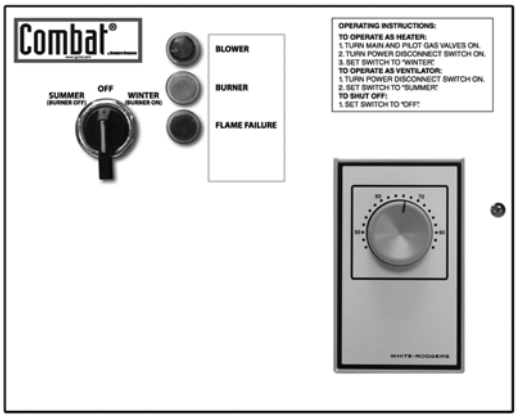
Summer/Off/Winter Switch:

Summer position:
The blower will operate without the burner for summer ventilation.

Winter position:
The blower and burner will operate as needed for the application to maintain airflow and temperature.

15.1.2 8.5 Remote Panels

8.5 Remote Panel for Air Turnover Units with On/Off or High/Low/Off Burners



8.5 Remote Panel for Air Turnover Units with Modulating Burners

The 8.5 Remote Panel includes Summer/Off/Winter switch and blower, burner, and flame failure indicators in a NEMA 1 enclosure and temperature controller.

Blower Indicator:
Indicates the air turnover unit is supplying power to the main fan motor via the motor controls.

Burner Indicator:
Indicates that the air turnover unit has supplied power which opens the main fuel shut off valves.

Flame Failure Indicator:
The burner control module has experienced a fault and will need to be reset. The burner control module must be reset at the air turnover unit. Refer to the Maintenance and Trouble Shooting sections of this manual to determine the cause of the fault.

Summer/Off/Winter Switch:

Summer position:
The blower will operate without the burner for summer ventilation.

Winter position:
The blower and burner will operate as needed for the application to maintain airflow and temperature.

The On-Off / Staged / Modulating temperature controller (whether space / discharge / return air) would be set from here.

15.1.3 DDC - Ready Option

The DDC-ready option provides inputs to receive control signals from a customer determined control system and outputs to provide sequence status to the same. With this option, the customer's control system would supply the blower and call for heat on/off function. For temperature control, this option allows for the customer to supply the following input signals; On/Off, Two-Stage or Modulation (4-20 mA, 0 or 2-10 vdc). The customer may control the temperature either based on discharge, space or return air temperature. A discharge sensor is required whenever space or return air control is used to limit the discharge temperature for proper air turnover unit performance. For optimum efficiency, Roberts-Gordon LLC suggests to limit discharge temperature to 120° F (48.9° C).

15.2 Basic Sequence of Operation

The following is an overview of the sequence of operation. Depending on the application and options supplied with the air turnover unit, this can vary greatly. Thoroughly review all documentation for the air turnover unit, including the electrical print, to familiarize and understand the actual sequence of operation.

Summer (Blower Only)

With power supplied to the air turnover unit and the Summer/Off/Winter switch on the remote panel in the SUMMER position, power is supplied to the blower motor starter coil(s), allowing the blower motor(s) to start. The burner circuit is NOT energized.

Winter (Blower & Burner)

With power supplied to the air turnover unit and the Summer/Off/Winter switch on the remote panel in the Winter position, power is supplied to the heating circuit.

The flame relay is powered up through the air turnover unit's airflow switch warm-up bypass timer circuit, high temperature limit switch, and low gas pressure switch and high gas pressure switch (if provided).

When combustion airflow is proven by the burner airflow switch, the burner ignition system is energized.

After the pilot flame or main flame is proven by the flame detector, the main and blocking valves are opened and the ignition system is de-energized.

The temperature control system is powered separately and controls the flow of the fuel/air mixture to maintain applicable space / discharge / return air set point temperature.

NOTE: Refer to the separate manufacturer's literature included with the documentation shipped with the air turnover unit for proper set-up and operation of the temperature controls supplied.

After the heat exchanger reaches operating temperature, the fan controller closes and power is supplied to the air turnover unit's fan motor starter coil(s), allowing the blower motor(s) to start. The air turnover unit's airflow switch closes and the warm-up bypass timer completes its time out cycle, removing the bypass circuit and allowing the burner to function only as long as airflow is present throughout the air turnover unit.

Light-Off of On/Off Burners

This firing mode is only available for models having an input of 2,500 MBH (732.7 kW) or less.

The combustion air dampers are adjusted and locked in place for the most efficient firing rate. Smooth light-off on gas is achieved by the use of a slow opening

valve, which, once open, allows gas flow to steadily increase from the initial light-off volume up to required firing rate.

Smooth light-off on oil is achieved by the use of a solenoid valve bypass system which allows a reduced amount of oil to be burned at light-off and then switching to the required firing rate once low fire has been established.

Light-Off of High/Low/Off Burners

For gas, movable combustion air dampers are mechanically linked with a slow opening valve to provide a smooth light-off position. The flow of gas is controlled by this valve which will move to its designated low fire volume and then to its high fire volume through readjusting the combustion air dampers through mechanical linkage. As requirements change, the burner will move between low fire and high fire, as needed.

For oil, the same dampers are operated by a hydraulic cylinder which, through mechanical linkage, provides a smooth light-off in the low fire position and then open to a point where the high fire rate will be achieved if needed. Smooth oil light-off is further achieved by the use of a solenoid valve bypass system, which allows a reduced amount of oil to flow at light-off and then switches to the high fire rate (simultaneously energizing the hydraulic cylinder) as needed once low fire has been established.

Light-Off of Fully-Modulating Burners

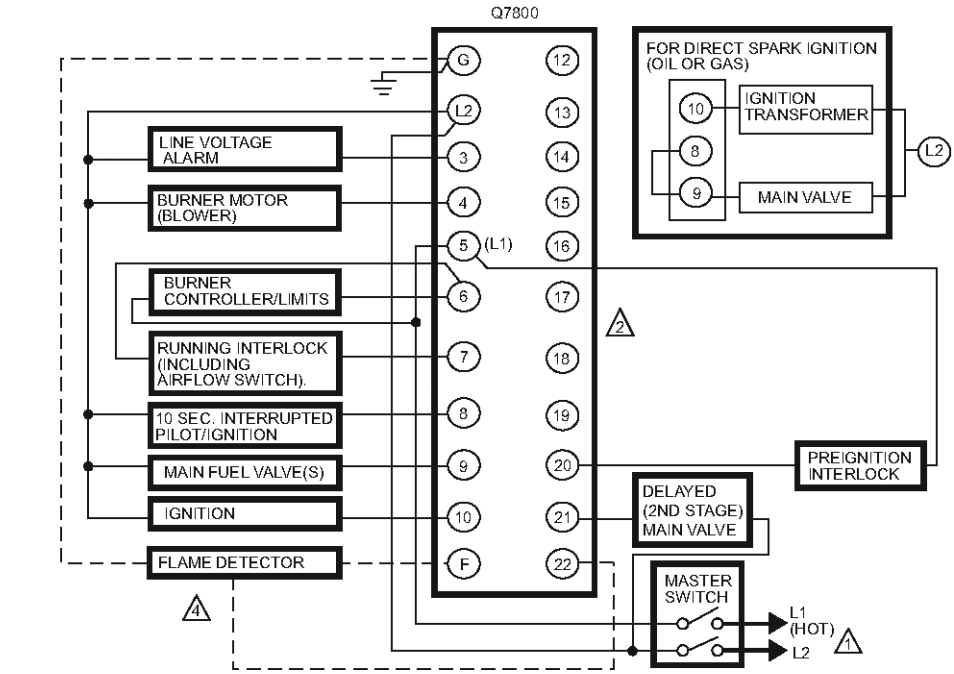
The gas system utilizes an automatic valve to control the on/off flow of the fuel. A modulating motor controls the modulated positioning of a butterfly type proportioning valve. The modulating motor also controls the positioning of the combustion air dampers, through appropriate sequencing - providing low fuel/air input for a smooth low fire start and an infinite number of fuel air positions between low and high fire.

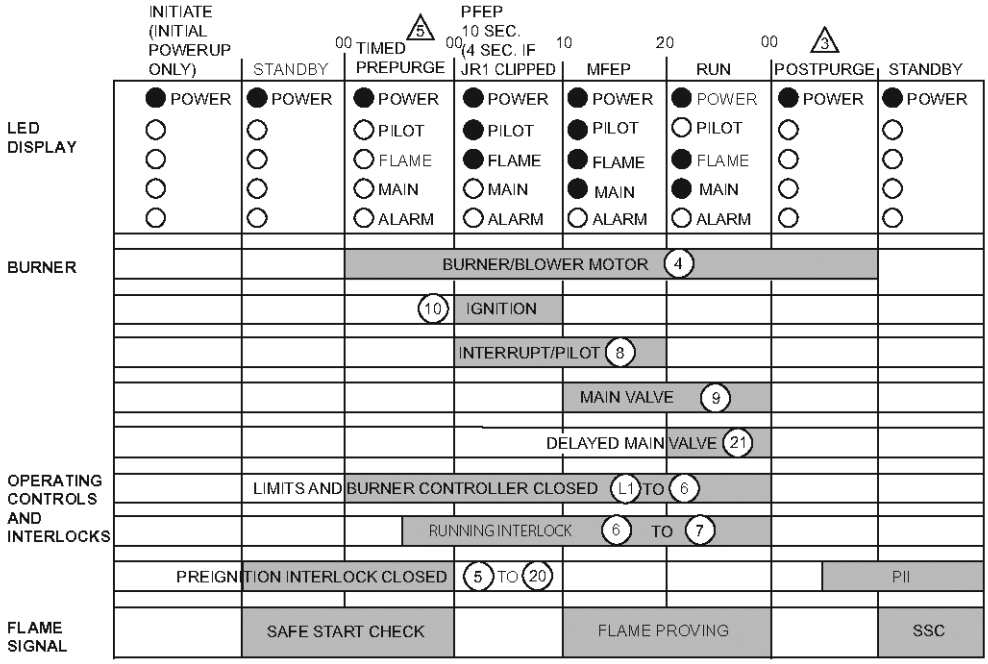
The oil system utilizes a solenoid valve to control the on/off flow of the fuel to the oil nozzle. A modulating motor controls the modulated positioning of a V ported metering oil valve located in the oil nozzle return line. The modulating motor also controls the positioning of the combustion air dampers, through appropriate sequencing - providing low fuel/air input for a smooth low fire start and an infinite number of fuel air positions between full low and high fire.

15.2.1 Burner Control Module

Two types of burner control modules are used as standard. They are the Honeywell RM7897 and the RM7800. The Honeywell model RM7897 is used on air turnover units with a FM compliant manifold and less than 2,500 MBH (732.7 kW) input and XL compliant equipment less than 1,000 MBH (293.1 kW) input. The Honeywell model RM7800 is used on air turnover units with a FM compliant manifold and with 2,500 MBH (732.7 kW) input and greater and on air turnover units with a XL compliant manifold and with 1,000 MBH (293.1 kW) input and greater. The burner control module is a safety device and not serviceable. *See Page 103, Figure 83 and Page 104, Figure 84* for the detailed sequence of operation.

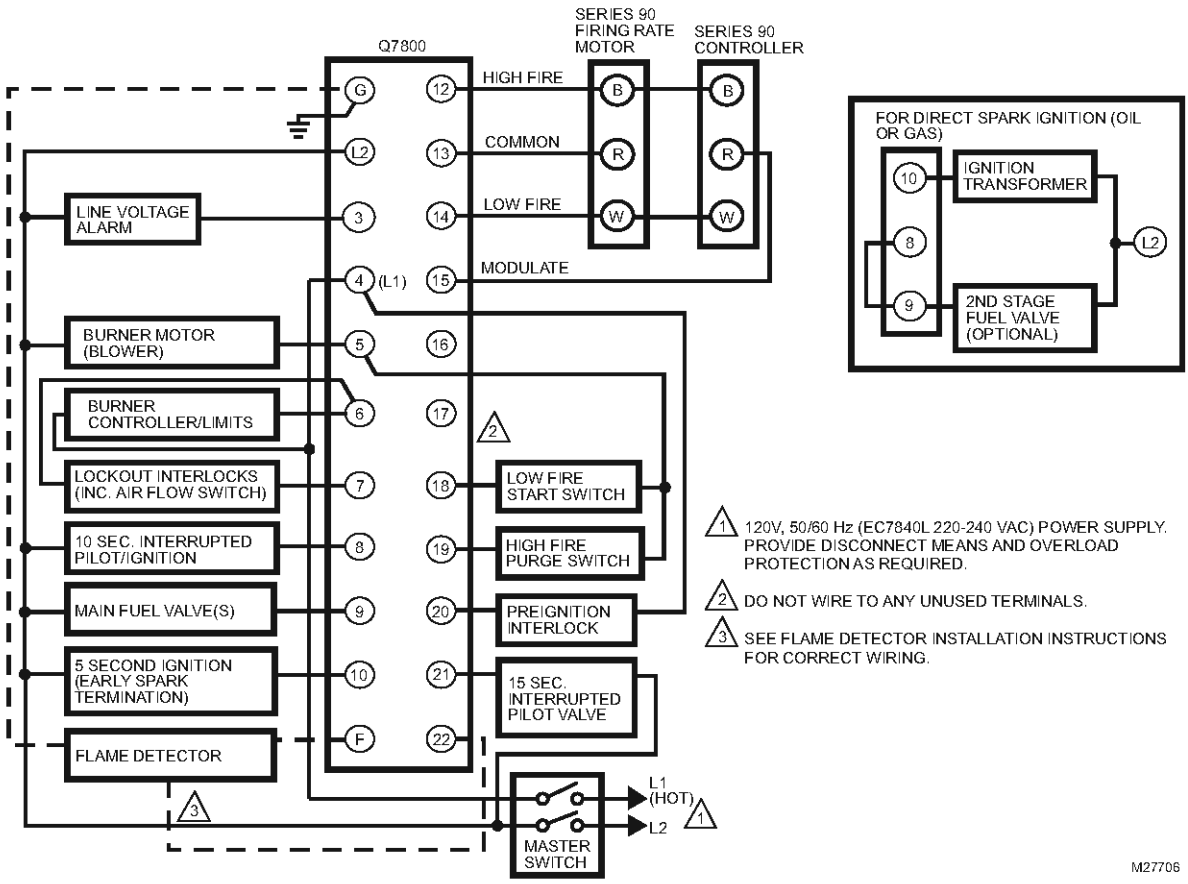
FIGURE 83: Wiring Subbase and Sequence Chart for RM7897 Burner Control Module



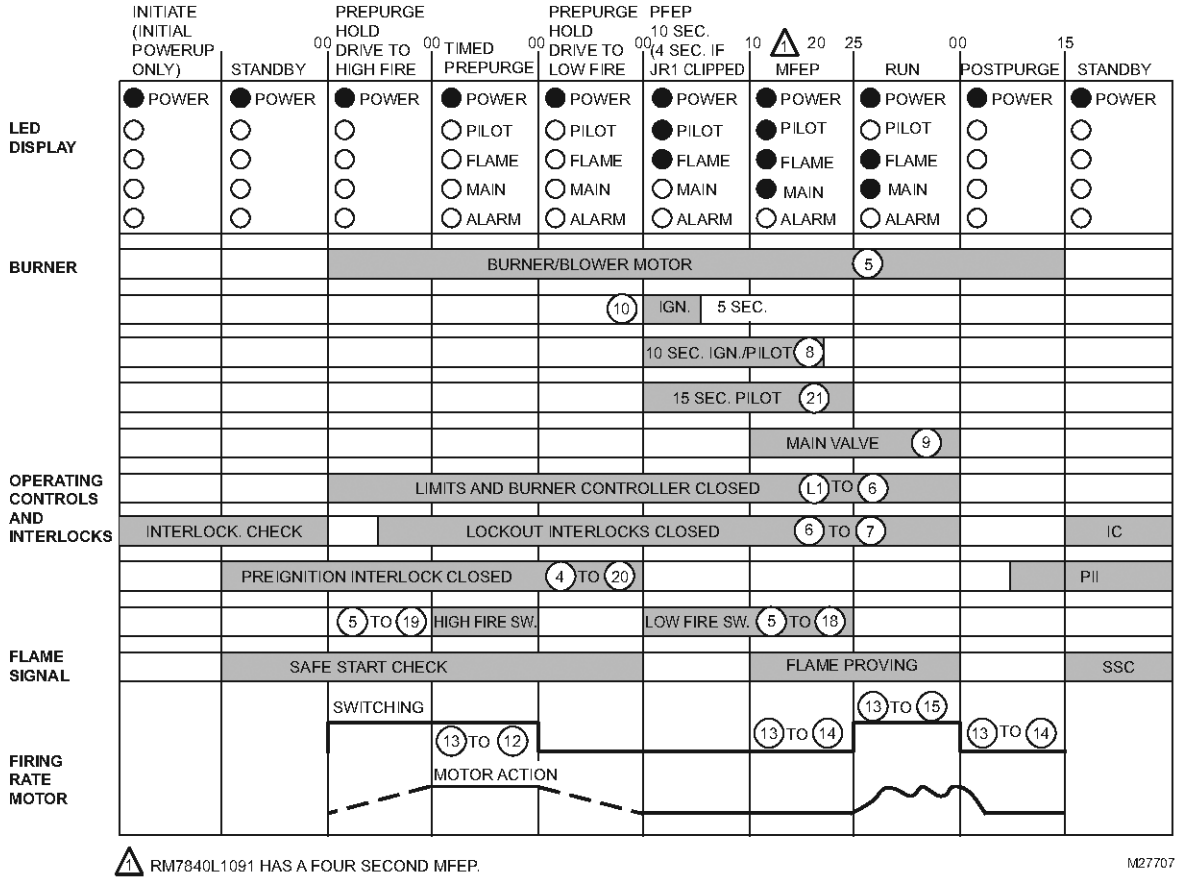


1. 120 VAC, 50/60 HZ POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
2. DO NOT CONNECT ANY WIRES TO UNUSED TERMINALS.
3. PROGRAMMABLE POST PURGE TIMING USING S7800A1142 KDM.
4. SEE FLAME DETECTOR SPECIFICATIONS FOR CORRECT WIRING.
5. PURGE TIME DEPENDS ON WHICH ST7800 IS INSTALLED.

FIGURE 84: Wiring Subbase and Sequence Chart for RM7800 Burner Control Module



RM7800/RM7840L/EC7840L



1 RM7840L1091 HAS A FOUR SECOND MFEP.

M27707

15.3 Night Setback Options

15.3.1 Night Setback with Occupied/Unoccupied Switch

This option provides manual control of occupied and unoccupied cycles, operated by an occupied/unoccupied switch. It includes a line voltage room thermostat (shipped loose) and an occupied/unoccupied switch (mounted on remote panel). During the unoccupied cycle, the air turnover unit remains off until the room thermostat calls for heat. At that time, the air turnover unit goes to a standard daytime sequence until the thermostat is satisfied.

15.3.2 Night Setback with Electro-Mechanical Time Clock

This option provides automatic control of occupied and unoccupied cycles, operated by an electro-mechanical time clock. It includes a seven-day electro-mechanical time clock (shipped loose). The time clock can be set for different on and off times any of the days during the seven-day period. During the unoccupied cycle, the air turnover unit remains off until the room thermostat calls for heat. At that time, the air turnover unit goes to a standard daytime sequence until the thermostat is satisfied.

15.3.3 Night Setback with Electronic Time Clock

This option provides automatic control of occupied and unoccupied cycles, operated by an electronic time clock. It includes a seven-day electronic time clock (mounted on the remote panel). The time clock can be set for different on and off times any of the days during the seven-day period. During the unoccupied cycle, the air turnover unit remains off until the room thermostat calls for heat. At that time, the air turnover unit goes to a standard daytime sequence until the thermostat is satisfied.

15.4 Other Control Options

15.4.1 Exhaust Fan Interlock

This option provides an interlock between an exhaust fan and an air turnover unit. It includes a break in the control circuitry to which wiring from an auxiliary set of contacts on the starter of an exhaust fan can be connected.

15.4.2 Unit Mounted On/Off Switch

This option provides manual operation of the air turnover unit. It includes a double-pole, double-throw (DPDT) toggle switch (mounted in the air turnover unit's control panel).

15.4.3 Post-Purge Timer

This option allows the supply fan on the equipment to run for a timed period (adjustable 1 to 100 minutes) after burner shutdown. It includes timer (mounted on air turnover unit).

15.4.4 Pre-Purge Timer

This option allows the supply fan on the equipment to run for a timed period (adjustable 0.1 to 15 minutes) before allowing the burner to fire and run. It includes timer (mounted on air turnover unit).

15.4.5 Audible Alarm for Flame Failure

This option sounds an alarm upon burner failure. It includes an alarm bell/horn (mounted on the air turnover unit's control panel or remote panel).

15.4.6 Service Receptacle Powered by Others

This option provides a service receptacle. It includes ground-fault interrupter (GFI) receptacle (mounted on the air turnover unit). Power to the receptacle is supplied by the installer.

15.4.7 Service Receptacle with a 7 A Power Source from Air Turnover Unit

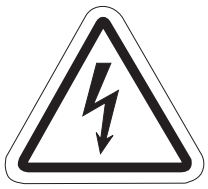
This option provides a service receptacle. It includes ground-fault interrupter (GFI) receptacle (mounted on the air turnover unit). Power to the receptacle is supplied by a 7A power source from the air turnover unit itself.

15.4.8 UL-Listed Flame Control Panel

This option provides for the air turnover unit's control panel to be built to Underwriters Laboratories (UL) standards. It includes an UL label on the control panel.

SECTION 16: START-UP PROCEDURES

⚠ DANGER

	
Electrical Shock Hazard	**Severe Injury Hazard**
Disconnect electric before service. **More than one disconnect switch may be required to disconnect electric from equipment.** **Equipment must be properly grounded.**	**Do not enter equipment while in operation.** **Equipment may start automatically.** **Do not operate with door open.** **Installation, operation and service must be done by a trained technician only.**
Failure to follow these instructions can result in death, electrical shock or injury.	

⚠ WARNING

		
Explosion Hazard	**Falling Hazard**	**Burn Hazard**
Leak test all components of equipment gas/oil piping before operation. **Gas/oil can leak if piping is not installed properly.** **Do not high pressure test gas/oil piping with equipment connected.**	**Use proper safety equipment and practices to avoid falling.** **Do not use any part of equipment as support.**	**Allow equipment to cool before service.** **Internal components of equipment may still be hot after operation.**
Failure to follow these instructions can result in death, injury or property damage.		

Installation Code and Annual Inspections:
All installation and service of ROBERTS GORDON® equipment must be performed by a contractor qualified in the installation and service of equipment sold and supplied by Roberts-Gordon LLC and conform to all requirements set forth in the ROBERTS GORDON® manuals and all applicable governmental authorities pertaining to the installation, service operation and labeling of the equipment.

To help facilitate optimum performance and safety, Roberts-Gordon LLC recommends that a qualified contractor conduct, at a minimum, annual inspections of your ROBERTS GORDON® equipment and perform service where necessary, using only replacement parts sold and supplied by Roberts-Gordon LLC.

Check installation site to ensure all codes and engineering specifications are correct. This section of the manual is intended to be used as an instructional guide to the commissioning of the indirect fired air turnover unit. Fill out the attached start up sheet (located at the back of the manual) as each step of the procedure is performed. This procedure should be completed by the commissioning contractor and returned to Roberts-Gordon LLC.

16.1 Mechanical

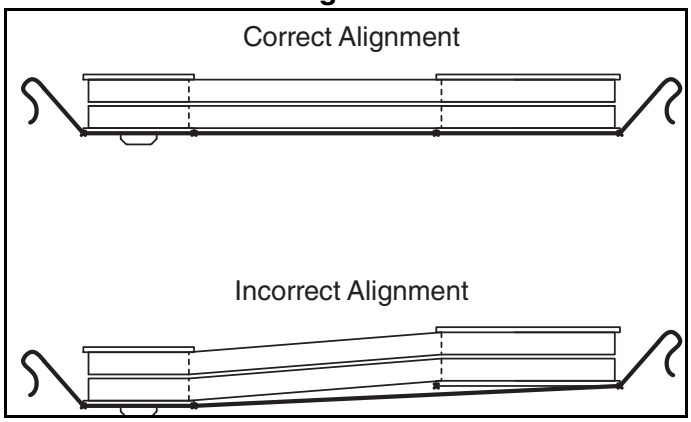
16.1.1 Sheave Alignment

Sheaves are factory aligned. On all air turnover units, check sheave alignment as follows.

1. Attach a string to the vertical surface next to the blower shaft bearing. (*See Page 107, Figure 85*)
2. Wrap the string around the fan sheave and across both sheave surfaces as shown.
3. Adjust until all four contact points (triangle) touch the sheave surfaces. "IN" or "OUT" adjustment of the motor sheave and/or motor adjustment may be required.
4. Pull the string away from the motor sheave and then move it slowly back towards the sheave, making sure the string remains straight while touching all contact points.
5. Remove string before turning air turnover unit on.

NOTE: Allowances must be made for motor sheaves which are wider than the blower sheaves.

FIGURE 85: Sheave Alignment



16.1.2 Belt Tension

- Belt tension should be checked with a belt-tension gauge when one is available. Follow the belt tension gauge instructions.
- When a tension gauge is not available, measure the belt span of the belts.
- Allow for 1/64" (.04 cm) of deflection for each inch of center distance length for the charted pounds of force. Check the table below for proper deflection force.
    - EXAMPLE: A 40" (101.6 cm) shaft center distance would dictate 40"/64" or 5/8" (1.59 cm) of deflection. With a standard B-type V-belt and a motor sheave measuring between 5.8" (1.59 cm) and 8.6" (21.84 cm), the belt will have proper tension if a 5/8" deflection can be achieved with a minimum of 6-3/8 inch lbs. and a maximum of 8-3/4 inch lbs. of pressure as measured with a belt tensioning gauge.

FIGURE 86: Belt Tension

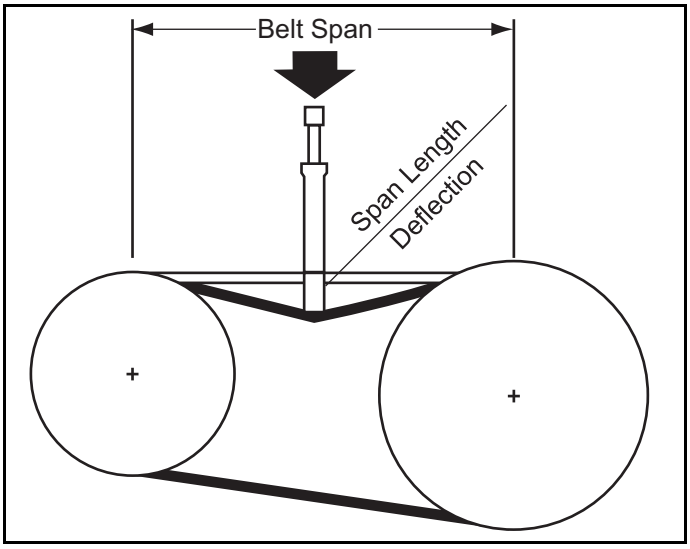


Table 17: Deflection Force of V-Belts

Belt Cross-Section	Motor Sheave Dimension Range (inches) - (cm)	TYPE B		TYPE B-X (High H.P.)	
		Min.	Max.	Min.	Max.
B	3.4 - 4.2	4	5 1/2	5 3/4	8
	4.4 - 5.6	5 1/8	7 1/8	6 1/2	9 1/8
	5.8 - 8.6	6 3/8	8 3/4	7 3/8	10 1/8

NOTE: If drive belts squeal during start-up, increase belt tension to the highest allowed value. Re-check tension during each inspection.

16.2 Electrical

1. Check motor starter for proper overload settings. The overload setting must equal the full load amps (FLA) of motor.
2. Measure the supply voltage with the air turnover unit off and then on. For a system that is powered with three phase power, measure the voltage of each phase.
3. Verify correct fan rotation.
4. While the fan(s) is running and the burner is off, measure the total system current draw with an ammeter. Measure the system current draw again after the burner adjustments are made and with the burner and blower both on.

16.3 Airflow

Factory calibrated, the air flow switches are safety devices for burner air flow. If an air flow switch does not close, the problem may not be the air flow switch. It could be an indication of an air flow problem (incorrect fan rotation, etc.)

16.4 General Start-up Procedures (All Fuels)

A thoroughly qualified burner technician should be employed to provide the initial burner start up. Before beginning start up, the technician should thoroughly study and become familiar with the exact sequence of operation and all other details of the specific flame safeguard control system being used. Because of the various flame safeguard controls being utilized, a separate manufacturer's bulletin is supplied with the air turnover unit.

Complete and/or review all precautions and inspection procedures in previous sections and burner manufacturers' literature.

Close main and manual burner shut-off valves. Open oil suction line manual valves and others as appropriate.

Tighten all screws on terminal blocks in control cabinet in case some may have loosened during transit.

Check vent stack to ensure it is open and unobstructed.

Check rotation of main supply motor(s) and burner blower by momentarily making contact of the motor contractors/starters. Proper rotation is imprinted on the air turnover unit for the supply fan(s) and on the fan(s) housing for the burner.

Check operating controls, limit controls, flame safeguard control reset, high and low gas and/or oil pressure switches (if used) and low fire interlocks (if used) and all other applicable interlocks. All contacts should be closed (an exception would be the low gas and/or oil pressure switch.

16.5 Fan Start-Up

Place main disconnect switch in the on position and the fan selector switch in the manual position and the Summer/Off/Winter switch in the summer position.

With the main supply fan motor running take and record its amp draw, return the selector to the off position.

16.6 Burner Start-Up

The standard burners are manufactured by Power Flame Incorporated®. The following start up information pertains to these burners. If a different manufacturer's burner is utilized, refer to the separate manufacturer's literature included with the documentation shipped with the air turnover unit.

To help prevent unburned fuel in the heat exchanger,

do not repeatedly cycle the burner. Specific instructions relative to component sequencing are provided in the flame safeguard manufacturer's bulletin which is included with the documentation shipped with the burner.

Proper test equipment must be used in order to achieve maximum system operational reliability and fuel efficiencies.

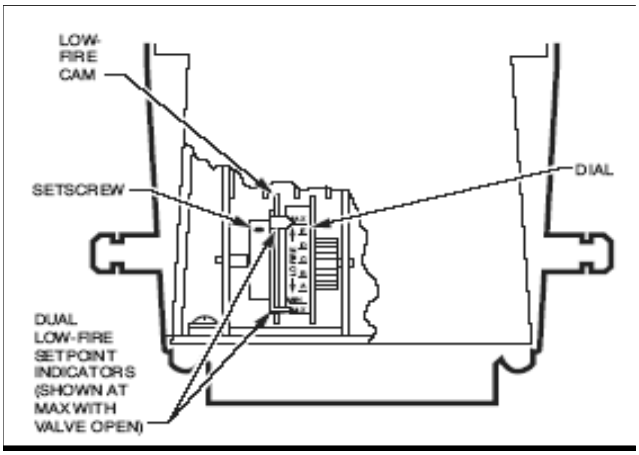
All fuel/air adjustments should be made to achieve required input rate, satisfactory combustion test values, flame stability and appearance.

16.7 Gas Pressure Adjustments

All high fire adjustments, for whatever burner type - on/off, high/low/off and full modulation are accomplished by adjusting the main gas regulator located in the gas manifold. Refer to the equipment's serial tag for proper burner manifold pressure at high fire. *See Page 39, Figure 22 through Page 42, Figure 25*.

To adjust low fire on a high/low/off burner, the control actuator contains the adjustment means. *See Page 109, Figure 87*.

FIGURE 87: Low Fire Adjustment for High/Low/ Off Burner



A dial on the low-fire cam indicates the low-fire setting. Because the cam rotates as the valve opens, scales are marked on the dial so the low-fire setting can be observed with the valve in any position. One scale is visible when the actuator is closed, and the other is visible when it is open. These scales are not independent; the same setting applies to both. The actuator is shipped from the factory with the low-fire setting at a valve gas flow of approximately 40 percent, which is adequate for safe light-off until the final setting can be determined.

16.7.1 Recommended Procedure

To adjust the low-fire setting without energizing the actuator, proceed as follows:

1. Remove the wiring compartment cover.
2. Manually rotate the cam and dial assembly downward so that the setscrew is accessible from the front of the actuator.
3. Loosen the setscrew on the low-fire cam using the special wrench (supplied-taped to the inside of the actuator cover).
4. Set the cam to the predetermined low-fire setting for the burner being used.
5. Tighten the setscrew in the cam.
6. Replace the wiring compartment cover.

16.7.2 Alternate Procedure

To adjust the low-fire setting after the burner is in operation, use the following instructions:

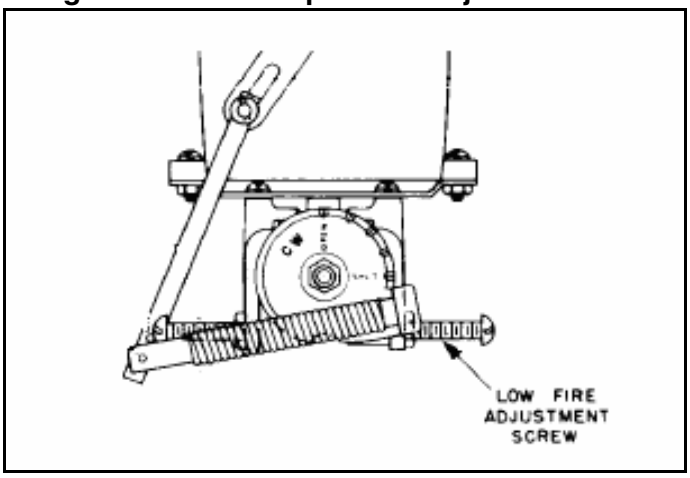
1. Remove the wiring compartment cover.
2. Check to be sure the low-fire adjustment is set at 40% to assure a safe light-off. (Low-fire adjustment is preset at the factory.)
3. Disconnect the firing rate controller lead wire from terminal 4 on the actuator to keep the valve in the low-fire position.
4. Start the system and establish the main burner flame.
5. Loosen the setscrew in the cam with the special wrench. Keep the wrench seated in the setscrew. Rotate the cam slightly downward (by moving the wrench toward the actuator base) to open the bleed valve. The actuator will start to close.
6. When the valve reaches the desired low-fire position, quickly tighten the setscrew and remove the wrench. If the desired low-fire setting is missed, loosen the setscrew and rotate the cam in the opposite direction to the desired set point.
7. Shut down the burner, and then restart. Repeat several times to be sure the low-fire setting is suitable for correct burner light off. Readjust, if necessary.
8. Disconnect power and reconnect the controller lead wire removed in step 3.

9. Replace the wiring compartment cover.

To adjust low fire on a fully-modulating burner, the butterfly metering valve controls the adjustment means. *See Page 110, Figure 88 and Figure 89*. There are two types of butterfly metering valves used on these air turnover units; the first determines the low fire position by linkage adjustment only, the second has an actual stop screw which controls the flow of gas for low fire. In each case, the low fire flow is adjusted to the smallest flow possible while still achieving the best combustion results. *See Page 112, Section 16.9*, *Step 10* for adjustment information.

FIGURE 88: Low Fire Adjustment for Fully-Modulating Burner with Linkage Adjustment

FIGURE 89: Low Fire Adjustment for Fully-Modulating Burner with Stop Screw Adjustment



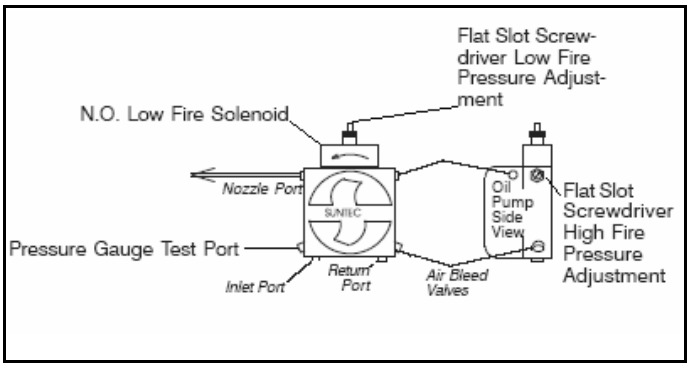
16.8 Oil Pressure Adjustments

All adjustments, for all burner types - on/off, high/low/off and fully-modulating are accomplished by adjusting the oil pump pressure settings. Refer to the pump manufacturer's bulletin packed with the burner.

16.8.1 Oil Pressure Adjustments for On/Off Burner

The on-off system uses a single stage, high suction lift oil pump with a simplex oil nozzle. The nozzle oil flow rate is set by adjusting the oil pump pressure regulating valve. Turn clockwise to increase the pressure and counter-clockwise to decrease the pressure to the nozzle. Normal nozzle pressure will be 100 to 300 PSI (6894 - 20684 mbar). Refer to the burner's manufacturer's manual packed with the burner to determine specific nozzle pressures and firing rates. Nozzle pressures are taken at the nozzle pressure gauge port. The oil on-off flow to the nozzle is controlled by the oil solenoid valve. The combustion air dampers are adjusted and locked in place with the air damper arms. The burner operates at one fixed firing rate.

FIGURE 90: Oil Pressure Adjustments for On/Off Burner



16.8.2 Oil Pressure Adjustments for High/Low Off Burner with Suntec Pump

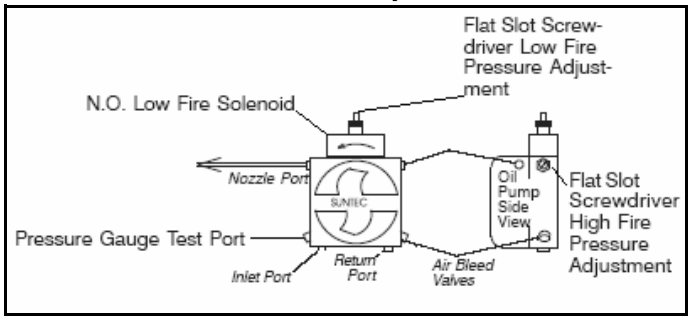
This low-high-off system uses a two-step oil pump with a simplex oil nozzle in conjunction with movable combustion air dampers to provide a low fire start and a high fire run sequence. Nozzle flow rate pressure is taken at the 1/8" plugged pump pressure gauge port. The low fire oil rate is set by adjusting the oil pump low pressure regulator. The high fire oil flow rate is set by adjusting the oil pump high pressure regulator. For both high and low fires, turn the adjustment screws clockwise to increase the pressure and counterclockwise to decrease the pressure to the nozzle. Approximate low fire oil pressures are 100 to 125 psig (6894 - 8618 mbar) and high fire, 200 to 300 psig (13789 - 20684 mbar).

Both settings will vary depending upon the specific nozzle size selected and job conditions. Refer to the burner's manufacturer's manual packed with the

burner to determine specific nozzle pressures and firing rates.

At light off, the main oil solenoid valves are energized, allowing fuel to the nozzle. A normally open pump mounted oil solenoid valve allows a controlled flow of oil to the nozzle in accordance with the pressure setting of the pump low fire adjustment. When the low fire flame is proven by the flame detector, the pump-mounted, normally open solenoid valve is energized (closes), putting full high fire pump pressure on the nozzle. Simultaneously, the three-way solenoid valve is energized, allowing oil into the hydraulic oil cylinder which mechanically drives the air damper arm to the high fire open position. The burner operates at full high fire until the system demand is satisfied.

FIGURE 91: Oil Pressure Adjustment High/Low/Off Burner with Suntec Pump



16.8.3 Oil Pressure Adjustments for High/Low/Off Burner with Webster Pump

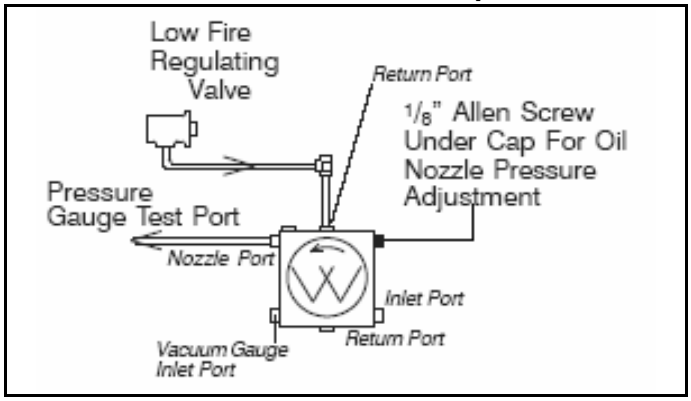
This high/low/off system uses a two-stage oil pump with a simplex oil nozzle or an internal bypass nozzle in conjunction with movable combustion air dampers to provide a low fire start and a high fire run sequence. Nozzle supply pressure is set by adjusting the oil pump pressure regulator. Turn clockwise to increase the pressure and counter-clockwise to decrease the pressure to the nozzle.

Nozzle supply pressure is taken at the plugged pump nozzle pressure gauge port. Nozzle supply pressure will normally be approximately 300 PSI (20684 mbar) at both high and low firing rates. Flow rate pressure for both high and low fire is taken at bypass pressure gauge tee. Low fire pressures are set by adjusting the low fire regulating valve. Turning the low fire regulating valve adjustment nut clockwise will increase the pressure at the bypass pressure test tee gauge (increasing the low fire input) and counter clockwise will reduce the pressure at the gauge (decreasing the low fire input). Low fire return pressure will normally be in 60 to 100 PSI (4135 - 6894 mbar) range and at high fire in the 180 to 225 PSI (12410 - 15513 mbar) range, but both pressures will vary according to the specific nozzle being used, as well as job conditions.

At light-off, the main oil solenoid valve is energized, allowing fuel to flow to the nozzle. At the same instant a portion of the oil bypasses the nozzle through the adjustable low fire regulating valve, reducing the pressure at the nozzle as required for low fire rates. When the low fire flame is proven by the flame detector, the return oil solenoid valve is de-energized, putting full high fire pump pressure on the nozzle. Simultaneously, the three-way solenoid valve is energized, allowing oil into the hydraulic cylinder which mechanically drives the air damper arm to the high fire position. The burner operates at full high fire until the system demand is satisfied. Refer to the burner's manufacturer's manual packed with the burner to determine specific nozzle pressures and firing rates.

NOTE: Some high/low/off will be supplied with simplex, rather than internal bypass type, oil nozzles. The mechanical operation of the simplex nozzle system is essentially the same as the internal bypass system - except that low fire oil pressures should be set at 100 to 125 psig (6894 - 8618 mbar) (adjust to suit job conditions) and high fire oil pressures at 280 to 300 psig (19305 - 20684 mbar) at the oil pump nozzle pressure gauge test port. Refer to the burner's manufacturer's manual packed with the burner to determine specific nozzle pressures and firing rates.

FIGURE 92: Oil Pressure Adjustments for High/Low/Off Burner with Webster Pump



16.8.4 Oil Pressure Adjustments for Fully-Modulating Burner with Webster Pump

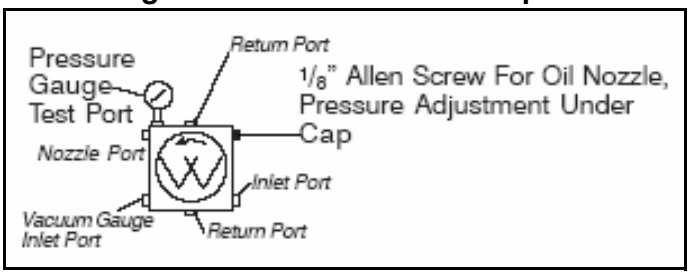
The full modulating system uses a two-stage oil pump with an internal bypass type oil nozzle. A modulating actuator controls the positioning of the

combustion air dampers and the modulating oil valve in the nozzle return line through mechanical linkage. At main flame light-off, the normally-closed oil valve is energized, allowing oil to flow to the nozzle. The modulating oil valve is adjusted to allow a controlled amount of oil to bypass the nozzle, which keeps the pressure reduced to the nozzle for low fire light off. Nozzle oil supply pressure is set by adjusting the oil pump pressure regulator. Turn clock-wise to increase the pressure and counter-clockwise to decrease the pressure to the nozzle.

The low fire nozzle pressures should be taken at the oil pump gauge port and should be approximately 300 PSI (20684 mbar) with pressure at the nozzle bypass gauge port from 60 to 100 PSI (4136 - 6894 mbar), these pressures vary with nozzle size and job conditions. A typical low fire oil flow setting on the modulating oil valve would be number 7, but will vary with job conditions. After a brief period of time for the low fire flame to stabilize, the modulating actuator will drive the fuel/air linkage to the high fire position.

At this point, the combustion air dampers will be fully-open (or as required for good combustion) and the modulating oil valve will be at the closed position and the nozzle bypass line will be fully closed, putting full oil pressure to the nozzle. The oil pump pressure gauge port pressure reading will show approximately 300 PSI (20684 mbar) and pressures at the bypass pressure gauge port will be 180 to 225 PSI (12410 - 15513 mbar), although this will vary with the specific nozzle size being used. Refer to the burner's manufacturer's manual packed with the burner to determine specific nozzle pressures and firing rates.

FIGURE 93: Oil Pressure Adjustments for Fully-Modulating Burner with Webster Pump



16.9 Gas Fired Equipment Start-Up Procedures

1. Review the procedures in this section before proceeding.
2. Verify the burner air dampers are approximately 1/4" (.64 cm) open, and with the pilot cock closed, open the main gas cock (to allow the low gas pressure switch, if supplied, to make its circuit).
3. Start the burner. With the pilot gas cock closed, the burner will go through a blower pre-purge period, after which the pilot ignition transformer will be energized, although no pilot will be established. At the end of the pilot trial for ignition and blower purge period, the flame safeguard control should shut the system down in a safety lock-out mode, requiring manual reset of the flame safeguard control to restart the burner.
4. Reset the flame safeguard control safety switch and open the pilot gas cock. If the flame safeguard control has a timer "Stop/Run" switch, stop the timer while the pilot is on and make adjustments as required once the blower pre-purge period ends and the burner is energized. Refer to the burner manufacturers' bulletin for pilot ignition adjustments. If the flame safeguard control does not have a timer "stop/run" switch, it will be necessary to keep the burner in the pilot light-off position by electrically disconnecting the motorized gas valve or modulating valve to complete pilot adjustments.
5. With pilot adjustments completed, reset the timer switch to the "run" position, which will allow the sequence to proceed to the automatic gas valve energizing position. If the motorized gas valve or modulating valve has been disconnected, shut the burner off and reconnect to allow normal operation.
6. When the main automatic gas valve begins to open, slowly open the firing gas cock to light off the main flame. The main flame should light immediately. If not, it may be necessary to eliminate air from the main gas line and/or adjust main gas pressure regulator flow rates.
7. Adjust the burner as necessary to provide smooth ignition of the main flame. If the flame signal drops significantly when the main automatic gas valve opens, slightly increase the pilot gas pressure to attain a stable flame signal value.
8. For on/off burners - adjust the main gas pressure regulator to achieve the proper main flame gas input. Set and lock the air dampers to provide 8.5 to 10% carbon dioxide (CO_2) and 0% carbon monoxide (CO). Make certain the pilot operates reliably at the final fuel/air settings.
9. For high/low/off burners - adjust the main gas pressure regulator in combination with the air

damper linkage operation to achieve 8.5 to 10% CO_2 and 0% CO at the full high fire input rate position. Make certain the linkage operates smoothly and with-out binding or over travel of the air damper stops. Run burner to the low fire position and lock motorized gas valve internal low fire adjustment to a setting that will attain 7 to 9% CO_2 and 0% CO at the desired low fire input rate.

10. For full modulation burners, adjust the main gas pressure regulator in combination with the air damper and metering valve linkage operation to achieve 8.5 to 10% CO_2 and 0% CO at the full high fire input rate position. Run burner to the low fire position and lock the metering valve external adjustment to a setting that will attain 7 to 9% CO_2 and 0% CO at the desired low fire input rate. Check for proper combustion at the midpoint rate (7 to 9% CO_2 and 0% CO) and make sure the linkage operates smoothly and without binding or over travel of the air damper and metering valve stops.
11. Re-check all reset switches - burner relay, limits, pressure cut-off switches, and, if necessary, main fan & burner motor overload reset button(s). Set the room thermostat and/or duct thermostat to the desired temperatures.

NOTE: When firing natural gas and LPG, it is possible to attain CO_2 readings that appear to be acceptable (i.e., 8%, 9%, 10%, etc.) while actually producing an unsafe condition. At such CO_2 readings, a deficiency of air will create the formation of CO (Carbon Monoxide) in the flue gases. Therefore, when firing gas, test for CO to make certain that the burner is adjusted so that it has an excess, rather than a deficiency, of air, CO is a dangerous product of incomplete combustion and is associated with combustion inefficiency and increased fuel cost. O% CO (Carbon Monoxide) may not be achievable. Readings between 0 and 100 PPM are desirable with the maximum level determined by local codes.

16.10 Oil Fired Equipment Start-Up Procedures

1. Review the procedures in this section before proceeding.
2. Verify the burner air dampers are approximately 1/4" (.64 cm) open and start the burner. The ignition circuit will be energized after the blower pre-purge period has been completed and all limit and other interlock circuits have been closed.
3. The burner is direct spark ignited. Either remove the flame sensor from its sight pipe or electrically disconnect the main oil solenoid valve and start the burner. Regardless of how the burner is started, the flame safeguard control will not detect flame and should go into a safety lockout mode requiring manual reset of the flame safeguard control. There must be no indication of oil pressure at the oil nozzle until the main oil valve is energized through the flame relay.
4. Restart the burner and allow normal sequencing to bring on ignition. Once the main solenoid oil valve is energized, the oil flame should be established immediately. If not, shut the system down and make corrections as required. DO NOT repeatedly recycle the burner, allowing accumulation of unburned fuel in the combustion chamber. **This could result in fire or explosion.**
5. For small "on/off" burners with a simplex nozzle, adjustments consist primarily of attaining correct fuel/air ratios. Adjustments should be set to obtain 11-12% CO_2 and no more than #2 smoke.
6. Fixed air low fire start burners with simplex nozzles require correct fuel/air ratios for high fire and should be set no more than #2 smoke at high fire with 11-12% CO_2. Low fire nozzle pressures are set to achieve smooth light-off with the air dampers fixed in the high fire position.
7. High/low/off burners should have initial adjustments made at the light-off position. After the light-off fuel/air adjustments are made, run the burner to the high fire position and make adjustments as required for good operation. Adjustments should provide 11-12% CO_2 with no more than #2 smoke at high fire and 8-10% CO_2 with no more than a #2 smoke on low fire.
8. For full modulation burners, start adjustments in the low fire position. Adjust the air and fuel linkage to obtain a fuel/air ratio of 8-10% CO_2 and no more than #2 smoke. Mark the linkage for this setting. Increase the firing rate to the mid-fire position. Set the fuel/air ratios to achieve 9-11% CO_2 and no more than #2 smoke. Mark the linkage as a reference point for this mid-fire position. Increase the rate to the high fire position. Results should be 12.5% CO_2 and no more than #2 smoke. Mark this position on the linkage. Operate the modulating arm through the three previously determined reference points. Minor setting changes may be required to ensure that the proper CO_2 and smoke requirements are achieved. Run

the modulating motor through its full travel to ensure that the linkage moves freely and that the travel limits on the metering device and air dampers are not exceeded. Refer to the burner manufacturer's bulletin for oil pump pressure settings.

9. Re-check all reset switches - burner relay, limits, pressure cut-off switches, and, if necessary, main fan & burner motor overload reset button(s). Set the room thermostat and/or duct thermostat to the desired temperatures.

16.11 Accessories and Controls Start-Up

Refer to the separate manufacturer’s literature included in the documentation shipped with the air turnover unit for proper set-up and operation of other included accessories and controls.

SECTION 17: MAINTENANCE

⚠ DANGER

Electrical Shock Hazard

Disconnect electric before service.

More than one disconnect switch may be required to disconnect electric from equipment.

Equipment must be properly grounded.

Severe Injury Hazard

Do not enter equipment while in operation.

Equipment may start automatically.

Do not operate with door open.

Installation, operation and service must be done by a trained technician only.

Failure to follow these instructions can result in death, injury or property damage.

⚠ WARNING

Explosion Hazard

Leak test all components of equipment gas/oil piping before operation.

Gas/oil can leak if piping is not installed properly.

Do not high pressure test gas/oil piping with equipment connected.

Falling Hazard

Use proper safety equipment and practices to avoid falling.

Do not use any part of equipment as support.

Burn Hazard

Allow equipment to cool before service.

Internal components of equipment may still be hot after operation.

Failure to follow these instructions can result in death, injury or property damage.

Prior to any maintenance or service to the air turnover unit, shut off, lockout and tagout, the electrical disconnect and fuel valve that supplies the unit in accordance with OSHA regulations and allow ample time for the air turnover unit to cool. After maintenance is performed or unit is serviced, the unit shall be re-commissioned to the start-up procedure as outlined on *Page 106, Section 16*.

Installation Code and Annual Inspections:
All installation and service of ROBERTS GORDON® equipment must be performed by a contractor qualified in the installation and service of equipment sold and supplied by Roberts-Gordon LLC and conform to all requirements set forth in the ROBERTS GORDON® manuals and all applicable governmental authorities pertaining to the installation, service, operation and labeling of the equipment.

To help facilitate optimum performance and safety, Roberts-Gordon LLC recommends that a qualified contractor conduct, at a minimum, annual inspections of your ROBERTS GORDON® equipment and perform service where necessary, using only replacement parts sold and supplied by Roberts-Gordon LLC.

17.1 General

First 8 Hours of Operation	Check belts and adjust as required (*See Page 107, Section 16.1.2*). Though belts were properly adjusted at the factory, they will stretch after the first few hours of operation.
First 100 Hours of Operation	Re-check belt tension and adjust if necessary.
Annual Fall Start-Up	Follow the entire start-up procedure at this time and check control settings and operation.

17.2 Unit Exterior

Cabinet Exterior	After installation, touch up scratches. Periodic painting should be done thereafter as required.
Unit Location	Verify that no flammable objects, liquids or vapors are present near the air turnover unit. Minimum clearances to combustibles around the vent pipe are significantly higher than for the air turnover unit. *See Page 8, Section 3.1*. Do not hang anything from or place anything on the air turnover unit. Keep the area under and around the air turnover unit free of all objects.
Heat Exchanger Inspection/Relief Cap	This cap must remain closed at all times. It is opened when the heat exchanger experiences extreme internal pressure. Every six months check for tightness of retaining collar, freeness of hinge movement and hinge spring strength/condition. Replace if cap is not securely held closed.
Vent Pipe and Terminals	Look for dirt, obstructions, cracks on the pipe, gaps in the sealed areas and corrosion. Clean or replace as required. Do not use the air turnover unit if there is dirt, sagging, cracking or distortion. Remove any carbon deposits or scale using a wire brush. If applicable, check insulation of vent pipe. Repair as required. Insulation must have a minimum temperature rating of 1000° F (537.8° C).

17.3 Fan Section

Propeller	Inspect propeller and clean as necessary. A small build up of dust can cause a significant decrease in fan performance. Check for excessive vibration, repair as required.
Drive Belts and Sheaves	Check for belt ride in the groove. In multiple groove drives, belt ride should be uniform. Check groove wear area for wear. Side wall of groove should be straight, not dished out. Bottom of groove should show no signs of belt contact. Sheave alignment, set screw torque and belt tension should be checked after 8, 24, and 100 hours of initial start-up. Visually inspect belts and sheaves for excessive wear. If belts have a slick, glazed look, the belts are slipping. Check drive capacity and belt tension. Never replace only one belt in a used set, as used belts will elongate. Replace the entire set if replacement is necessary.
Fan Bearing Lubrication	The fan bearings should be re-lubricated every 3,000 hours of operation or 6 months, whichever occurs first. The recommended lubricant is Shell Alvania #2 or S3 grease. To re-lubricate the blower pillow block/flange bearings, be sure that the grease fittings on the bearing housing (or air turnover unit cabinet wall in the case of extended grease lines) are clean. Apply the recommended amount of grease (per the bearing manufacturer) to the fitting with a low-pressure grease gun and add slowly while the shaft is spun by hand. Do not over-grease. Over-greasing will reduce the service life of the bearings.

Motors

Inspection:

1. Inspect motor every 3 months or 500 hours of operation, which ever occurs first. Keep the motor clean and vent openings clear.

Lubrication:

1. Motors with grease fittings must be lubricated based on the table below.

Table 18: Motor Lubrication Intervals

NEMA Frame Size (Motor HP)	Rated at 1800 RPM (Hrs)
Up to 210 (3 - 5)	6,000
Over 210 to 280 (7.5 - 20)	4,750
Over 280 to 360 (25 - 50)	3,700

Note: These intervals are based on severe duty. Over lubricating bearings could result in reduced motor life.

2. A high grade ball or roller bearing grease must be used. Recommended grease for standard service is Polyrex EM (Exxon Mobil). Other compatible greases include; Texaco Polystar, Rykon Premium #2, Pennzoil Pen 2 Lube and Chevron SRI.
3. Motors without grease fittings are sealed for life and do not require relubrication.

Instructions for Lubricating

Before greasing, be sure fittings are clean and free from dirt. Remove grease relief plug or plate and, using a low-pressure grease gun, pump in the required grease. Do not over-grease. Relubrication intervals are specified in the table above. After relubricating, allow motor to run for 10 minutes before replacing relief hardware.

NOTE: In general it is not recommended to mix greases of different brands. The mixing of different types of thickeners may destroy the composition and physical properties of the grease. In the event that a different grease is required by the end user, the following steps can be taken. Using the instructions for lubrication, open grease outlet and purge the system as much as possible of the old or unwanted grease. Repeat this same operation after 1 week of service. Consult Roberts-Gordon LLC or the motor manufacturer for further recommendations on grease compatibility.

17.4 Manifold and Controls

Manifold	Periodically check fuel control assembly, and internal and external piping for leaks. Relief vent lines to outdoors on fuel controls should be checked to ensure against blockage caused by insects or any other substance. Clean as required.
Air Flow Switch	An annual check of the tubes attached to the air flow switch should be made to ensure against blockage caused by insects or any other substance. Clean as required.
Electric Components	Check to see there is no physical damage on any of the electric components and verify all electrical connections are secure. Ensure equipment is properly grounded.
Temperature Sensors	Calibrate room, outdoor air, and discharge air sensors as required.

17.5 Burner

An annual inspection of the burner and components must be made to insure proper and safe operation. For the most part, the burner is self cleaning. However, if the application is extremely dirty or dusty, it may become necessary to periodically clean the burner. Refer to the burner manufacturer's literature for guidance.

17.6 Filters

Filters should be checked for dirt restriction on a monthly basis (or as required). Replace filters with filters of equal specification when they appear dirty.

17.7 Motor and Drive Components

Gain access to the fan(s) and motor(s) by removing the inlet plenum access panel. First, release tension on the belts by adjusting the motor base closer to the blower pulley. Remove the belts.

To remove the motor pulley, first loosen the adjustment set screws and count the number of turns to fully close the pulley (this number will be required to re-install the pulleys to the previous adjustment). Open the adjustable sheaves to gain access to the shaft set screws. Loosen the set screw(s) that hold it to the motor shaft and pull away from the motor.

To remove the blower pulley, remove the bolts from the bushing and insert into the previously unused threaded holes of the bushing. Carefully press the blower pulley off the bushing, tightening the bolts evenly. Loosen the Allen Head setscrew (located on top of the keyway) and slide the pulley bushing off the shaft.

To remove the motor, first remove the motor pulley as described above. Disconnect the motor power wiring and conduit at the junction box in the side of the motor. Support the motor so that it will be secure when disconnected from the adjustable base. Remove the bolts that hold the motor to the adjustable base. The motor may now be removed.

17.8 Cooling Coil(s)

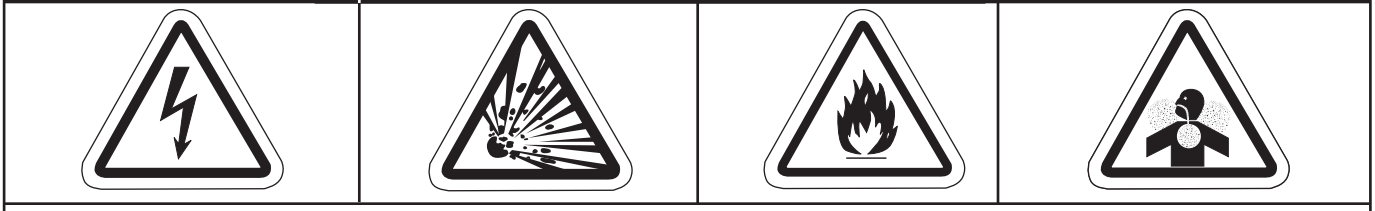
An annual inspection of the coil(s) must be made to insure proper operation. For the most part coils require very little maintenance, however if the application is extremely dirty or dusty, it may become necessary to periodically clean the coil(s). High pressure water (700 psi or less) can be used to clean coils with fins at least 0.0095 inches thick.

IMPORTANT: Test the spray pressure on a small area of the coil(s) to see how well the fins withstand the high pressure.

Spray in the direction opposite of airflow to push dirt out the front of the coil. Foaming chemical sprays and washes are available and should be used instead of high pressure on the more fragile fins or when high fin density does not facilitate high pressure water cleaning.

SECTION 18: REPLACEMENT PARTS

⚠ DANGER **⚠ WARNING**



Electrical Shock Hazard **Explosion Hazard** **Fire Hazard** **Carbon Monoxide Hazard**

Use only genuine ROBERTS GORDON® replacement parts per this installation, operation and service manual.

Failure to follow these instructions can result in death, electric shock, injury or property damage.

Replacement parts list is for general indirect fired applications and MAY NOT BE APPLICABLE FOR your specific unit configuration. Before ordering replacement parts, please contact factory to make sure that the replacement parts are the direct replacement for your specific unit.

18.1 Replacement Blower Components

Description	Part Number
BUSHING, FIXED PULLEY, 0.875"	82200580
BUSHING, FIXED PULLEY, 1.1875"	14153100
BUSHING, FIXED PULLEY, 1.4375"	82200590
BUSHING, FIXED PULLEY, 1.25"	82200470
BUSHING, FIXED PULLEY, 13/16"	82200480
BUSHING, FIXED PULLEY, 1.375"	82200490
BUSHING, FIXED PULLEY, 1.4375"	82200500
BUSHING, FIXED PULLEY, 1.4375"	14130500
BUSHING, FIXED PULLEY, 0.75"	14220000
BUSHING, FIXED PULLEY, 1.1875"	82200420
BUSHING, FIXED PULLEY, 1.375"	82200430
BUSHING, FIXED PULLEY, 1.4375"	82200440
BUSHING, FIXED PULLEY, 1.375"	82200670
BUSHING, FIXED PULLEY, 1.125"	82201020
BUSHING, FIXED PULLEY, 1.1875"	82200660
BUSHING, FIXED PULLEY, 1.4375"	82200680
PULLEY, FIXED-1B X 11.0 1-3/16	82105120
PULLEY, FIXED-1B X 11.0 PD SDS	14093210
PULLEY, FIXED-1B X 12.4 1-3/16	82105140
PULLEY, FIXED-1B X 12.4 PD SDS	14189300
PULLEY, FIXED-1B X 13.6 1-3/16	82105150
PULLEY, FIXED-1B X 13.6 PD SDS	82105160
PULLEY, FIXED-1B X 16.0 PD SDS	82100270
PULLEY, FIXED-1B X 18.4 PD SK	82100280
PULLEY, FIXED-1B X 5.0 PD 5/8	14087100
PULLEY, FIXED-1B X 5.2 PD SDS	14110800
PULLEY, FIXED-1B X 5.8 1-3/16	82100110
PULLEY, FIXED-1B X 6.0 SDS	14120410
PULLEY, FIXED-1B X 6.2 PD SDS	14228904
PULLEY, FIXED-1B X 6.8 1-3/16	82105060
PULLEY, FIXED-1B X 7.4 1-3/16	82105070
PULLEY, FIXED-1B X 7.4 PD SDS	82100180
PULLEY, FIXED-1B X 8.6 1-3/16	82105080
PULLEY, FIXED-1B X 9.4 PD SDS	82100220
PULLEY, FIXED-2B X 11.0 PD SK	82100560
PULLEY, FIXED-2B X 12.4 PD SK	82100570

Description	Part Number
PULLEY, FIXED-2B X 13.6 PD SK	82100580
PULLEY, FIXED-2B X 15.4 PD SK	82100590
PULLEY, FIXED-2B X 16.0 PD SK	82100600
PULLEY, FIXED-2B X 18.4 PD SK	82100610
PULLEY, FIXED-2B X 5.2 PD SDS	82100410
PULLEY, FIXED-2B X 5.4 PD SDS	82100420
PULLEY, FIXED-2B X 5.6 PD SDS	82100430
PULLEY, FIXED-2B X 5.8 PD SDS	82100440
PULLEY, FIXED-2B X 6.0 PD SDS	82100450
PULLEY, FIXED-2B X 6.2 PD SDS	82100460
PULLEY, FIXED-2B X 6.4 PD SDS	82100470
PULLEY, FIXED-2B X 6.6 PD SDS	82100480
PULLEY, FIXED-2B X 6.8 PD SDS	82100490
PULLEY, FIXED-2B X 7.0 PD SK	82100500
PULLEY, FIXED-2B X 7.4 PD SK	82100510
PULLEY, FIXED-2B X 8.0 PD SK	82100520
PULLEY, FIXED-2B X 8.6 PD SK	82100530
PULLEY, FIXED-2B X 9.4 PD SK	82100550
PULLEY, VARIABLE- 1B X 3.1 -4.1 1-1/8"	82105560
PULLEY, VARIABLE- 1B X 3.1-4. 1 7/8"	82105550
PULLEY, VARIABLE- 1B x 3.7-4.7 1-1/8"	82105580
PULLEY, VARIABLE- 1B x 4.3-5.3 1-7/8"	82101560
PULLEY, VARIABLE- 1B x 4.3-5.3 5/8"	82101540
PULLEY, VARIABLE- 1B x 4.3-5.3 7/8"	82101550
PULLEY, VARIABLE- 1B x 4.6-5.6 7/8"	82101650
PULLEY, VARIABLE- 1B x 4.9-5.9 1-1/8"	82101620
PULLEY, VARIABLE- 1B x 4.9-5.9 1-1/8"	82105610
PULLEY, VARIABLE- 1B x 4.9-5.9 1-3/8"	82105610
PULLEY, VARIABLE- 1B x 4.9-5.9 5/8"	82107620
PULLEY, VARIABLE- 1B x 4.9-5.9 7/8"	82101610
PULLEY, VARIABLE- 1B x 5.0-6.5 1-3/8"	82105930
PULLEY, VARIABLE- 1B x 6.0-7.4 1-1/8"	82101630
PULLEY, VARIABLE- 1B X 6.3-7.3 1-1/8"	14128900
PULLEY, VARIABLE- 2B X 3.5-4.9 1-3/8"	82101810
PULLEY, VARIABLE- 2B X 3.5-4.9 7/8"	82101790
PULLEY, VARIABLE- 2B X 4.3-5.3 1-3/8"	82101890
PULLEY, VARIABLE- 2B X 4.3-5.4 1-3/8	14228905
PULLEY, VARIABLE- 2B X 4.5-5.9 1- 1/8	82101910
PULLEY, VARIABLE- 2B X 4.5-5.9 1-3/8"	82101920
PULLEY, VARIABLE- 2B X 4.5-5.9 1-5/8"	82101930
PULLEY, VARIABLE- 2B X 4.5-6.3 1-1/8"	82101950
PULLEY, VARIABLE- 2B X 4.9-5.9 1-3/8"	82101960
PULLEY, VARIABLE- 2B X 4.9-5.9 1-5/8"	82101970
PULLEY, VARIABLE- 2B X 4.9-5.9 7/8"	82101940
PULLEY, VARIABLE- 2B X 4.9-6.3 1"	14105900
PULLEY, VARIABLE- 2B X 5.0-6.4 1-1/8"	82102170
PULLEY, VARIABLE- 2B X 5.0-6.4 1-3/8	82102180
PULLEY, VARIABLE- 2B X 5.5-6.6 1-3/8	82102120
PULLEY, VARIABLE- 2B X 5.5-6.6 1-5/8	82102130
PULLEY, VARIABLE- 2B X 5.5-6.9 1-5/8	82102670
PULLEY, VARIABLE- 2B X 5.6-6.6 1-3/8	82105850
PULLEY, VARIABLE- 2B X 5.8-6.9 1-1/8	82102210
PULLEY, VARIABLE- 2B X 6.0-7.4 1-1/8	82102010
PULLEY, VARIABLE- 2B X 6.0-7.4 1-3/8	82102190
PULLEY, VARIABLE- 2B X 6.0-7.4 1-5/8	82102200
PULLEY, VARIABLE- 2B X 7.0-8.4 1-3/8	14154300
PULLEY, VARIABLE- 2B X 8.0-9.4 1-3/8	82102230
PULLEY, VARIABLE- 2B X 8.0-9.4 1-5/8	82102240
PULLEY, VARIABLE- 2B X5.0-6.4 1-5/8	82102030

18.2 Replacement V-Belts

Description	Part Number
V-BELT B-036	33689436
V-BELT B-040	33689440
V-BELT B-041	33689441
V-BELT B-042	33689402
V-BELT B-043	33689443
V-BELT B-044	33689444
V-BELT B-045	33689445
V-BELT B-046	33689446
V-BELT B-047	33689447
V-BELT B-048	33689448
V-BELT B-050	33689450
V-BELT B-052	33689452
V-BELT B-053	33689453
V-BELT B-054	33689454
V-BELT B-057	33689457
V-BELT B-058	33689458
V-BELT B-060	33689460
V-BELT B-062	33689462
V-BELT B-063	33689463
V-BELT B-064	33689464
V-BELT B-065	33689465
V-BELT B-066	33689466
V-BELT B-067	33689467
V-BELT B-068	33689468
V-BELT B-069	33689469
V-BELT B-070	33689470
V-BELT B-071	33689471
V-BELT B-072	33689472
V-BELT B-073	33689473
V-BELT B-074	33689474
V-BELT B-075	33689475
V-BELT B-076	33689476

18.3 Replacement Burner Components

Description	Part Number
ADIABATIC CHAMBER FOR JR15/30	143132-16
ADIABATIC CHAMBER FOR JR50	143132-17
AIRFLOW SWITCH	83100003
ELECTRODE, FLAME ROD	14117000
ELECTRODE, SPARK (JACOB LADDER) (OIL - 2 REQ'D)	14117101
ELECTRODE, SPARK ROD (GAS)	14117100
GASKET KIT, HTD REPLACEMENT - J15	33694011
GASKET KIT, HTD REPLACEMENT - J30	33694012
GASKET KIT, HTD REPLACEMENT - J50	33694013
MOTOR 1/3HP - 115-230/1/60 - JR30/50	143132-22
MOTOR 1/3HP - 200-208/3/60 - JR15/30/50	143132-25
MOTOR 1/3HP - 208-230-460/3/60 - JR15/30/50	143132-28
MOTOR 1/4HP - 115/1/60 - JR15	143132-21
MOTOR 3/4HP - 115/230/1/60 - CR2	143132-23
ORFICE, PILOT, NATURAL GAS - C1 AND 2	14281201
ORIFICE, PILOT, LPG GAS - C1 AND 2	14281203
ORIFICE, PILOT, LPG GAS - C3,4,5	14281204
ORIFICE, PILOT, NATURAL GAS - C3,4,5	14281202
PILOT ASSEMBLY/FLAME ROD W/NAT ORFICE- JR15/30	143132-01
PILOT ASSEMBLY/FLAME ROD W/NAT ORFICE- JR50	143132-02
PILOT ASSEMBLY/UV MOUNT W/NAT-LP ORFICE- JR15/30	143132-03
PILOT ASSEMBLY/UV MOUNT W/NAT-LP ORFICE- JR50	143132-04
SEALED COMBUSTION AIR INTAKE COLLAR JR15/30	143132-11
SEALED COMBUSTION AIR INTAKE COLLAR JR50	143132-13

18.4 Replacement Manifold Components

Description	Part Number
BUTTERFLY VALVE - 1" (ECLIPSE FULL PORT)	13591019
BUTTERFLY VALVE - 1" (ECLIPSE REDUCED PORT)	13591011
BUTTERFLY VALVE - 1.25" (ECLIPSE REDUCED PORT)	N/A
BUTTERFLY VALVE - 1.25" (ECLIPSE FULL PORT)	N/A
BUTTERFLY VALVE - 1.5" (ECLIPSE FULL PORT)	13591018
BUTTERFLY VALVE - 1.5" (ECLIPSE REDUCED PORT)	13591013
BUTTERFLY VALVE - 2" (ECLIPSE FULL PORT)	13591015
BUTTERFLY VALVE - 2" (ECLIPSE REDUCED PORT)	N/A
BUTTERFLY VALVE - 2.5" (ECLIPSE FULL PORT)	N/A
BUTTERFLY VALVE - 2.5" (ECLIPSE REDUCED PORT)	13591006
BUTTERFLY VALVE- 1" (MIDCO)	14042301
BUTTERFLY VALVE- 1.25" (MIDCO)	14042302
BUTTERFLY VALVE- 1.5" (MIDCO)	14042303
BUTTERFLY VALVE- 2" (MIDCO)	14042304
BUTTERFLY VALVE- 2.5" (MIDCO)	14174100
HIGH/LOW MOTORIZED ACTUATOR	10978600
MANUAL SHUT OFF VALVE- 1"	82580010
MANUAL SHUT OFF VALVE- 1.25"	82580020
MANUAL SHUT OFF VALVE- 1.5"	82580030
MANUAL SHUT OFF VALVE- 2"	82580040
MANUAL SHUT OFF VALVE- 2.5"	82580050
MANUAL SHUT OFF VALVE- 3/8"	82580260
MOTORIZED HIGH/LOW VALVE BODY-1"	11002500
MOTORIZED HIGH/LOW VALVE BODY-1.25"	14047900
MOTORIZED HIGH/LOW VALVE BODY-1.5"	14043901
MOTORIZED HIGH/LOW VALVE BODY-2"	10978600
MOTORIZED PROOF OF CLOSURE ACTUATOR	83400301
MOTORIZED PROOF OF CLOSURE VALVE BODY-1"	82585171
MOTORIZED PROOF OF CLOSURE VALVE BODY-1.25"	82585301
MOTORIZED PROOF OF CLOSURE VALVE BODY-1.5"	82585291
MOTORIZED PROOF OF CLOSURE VALVE BODY-2"	82585261
MOTORIZED PROOF OF CLOSURE VALVE BODY-2.5"	82585361
MOTORIZED VALVE BODY-1"	82580171
MOTORIZED VALVE BODY-1.25"	82580181
MOTORIZED VALVE BODY-1.5"	82580191
MOTORIZED VALVE BODY-2"	82580201
MOTORIZED VALVE BODY-2.5"	82580211
MOTORIZED VALVE BODY-3"	82580221
ON/OFF MOTORIZED ACTUATOR	83400001
ON/OFF MOTORIZED ACTUATOR (SHAFT)	11005800
REGULATOR 3/8	14036300
REGULATOR 1"	82600030
REGULATOR 1.25"	82600040
REGULATOR 1.5"	82600060
REGULATOR 2"	82600070
REGULATOR 2.5"	82600080
SOLENOID VALVE, POSITION INDICATION-1"	82500032
SOLENOID VALVE, POSITION INDICATION-1.25"	82500041
SOLENOID VALVE, POSITION INDICATION-1.5"	82500051
SOLENOID VALVE, POSITION INDICATION-2"	82500061
SOLENOID VALVE-1"	82500031
SOLENOID VALVE-1.25"	82500040
SOLENOID VALVE-1.5"	10762900
SOLENOID VALVE-2"	82500060
SOLENOID VALVE-3/8" (PILOT)	14036400
SOLENOID VENT VALVE-1"	82500110
SOLENOID VENT VALVE-1.25"	82500120
SOLENOID VENT VALVE-1.5"	11056500
SOLENOID VENT VALVE-3/4"	82500280

18.5 Replacement Electrical Components

Description	Part Number
AMPLIFIER-FLAME ROD	15159802
AMPLIFIER-ULTRAVIOLET	15159805
DISPLAY MODULE	15160006
FLAME RELAY SUB-BASE- CHASSIS & KNOCKOUT BASE	15160000
FLAME RELAY SUB-BASE- CHASSIS ONLY	15160001
FLAME SAFEGUARD RELAY MODULE	15159600
FLAME SAFEGUARD RELAY MODULE	15159603
PURGE TIMER-60 SEC	15159702
PURGE TIMER-90 SEC	15159703
ULTRAVIOLET SENSOR-MINUS 40 TO 215 DEG	15180900
CONTROLLER (ELECTRONIC)	14265160
CONTROLLER (ELECTRONIC) DISCHARGE AIR SENSOR	14302802
CONTROLLER (ELECTRONIC) OUTSIDE AIR SENSOR	14303001
DUCTSTAT - 2 STAGE	11113200
DUCTSTAT - MODULATION	83200100
DUCTSTAT - ON/OFF	83200002
MODULATION CONTROLLER (ELECTRONIC)	14302815
MODULATION DUCT STAT SENSOR	14302827
MODULATION ROOM STAT SENSOR	14302831
ROOM THERMOSTAT - 2 STAGE	83200192
ROOM THERMOSTAT - ON/OFF	83200050
CONTACTOR- 115 AMPS	14320710
CONTACTOR- 150 AMPS	14320711
CONTACTOR- 18 AMPS	14320703
CONTACTOR- 25 AMPS	14320704
CONTACTOR- 32 AMPS	14320705
CONTACTOR- 40 AMPS	14320706
CONTACTOR- 50 AMPS	14320707
MOTOR PROTECTOR, ROTARY-.63-1 AMPS	14320505
MOTOR PROTECTOR, ROTARY- 1.6-2.5 AMPS	14320507
MOTOR PROTECTOR, ROTARY- 1-1.6 AMPS	14320506
MOTOR PROTECTOR, ROTARY- 13-18 AMPS	14320520
MOTOR PROTECTOR, ROTARY- 17-23 AMPS	14320521
MOTOR PROTECTOR, ROTARY- 2.5-4 AMPS	14320508
MOTOR PROTECTOR, ROTARY- 20-25 AMPS	14320522
MOTOR PROTECTOR, ROTARY- 24-32 AMPS	14320532
MOTOR PROTECTOR, ROTARY- 4-6.3 AMPS	14320510
MOTOR PROTECTOR, ROTARY- 6-10 AMPS	14320514
MOTOR PROTECTOR, ROTARY- 9-14 AMPS	14320516
MOTOR PROTECTOR, TOGGLE-.63-1 AMPS	14320205
MOTOR PROTECTOR, TOGGLE- 1.6-2.5 AMPS	14320207
MOTOR PROTECTOR, TOGGLE- 1-1.6 AMPS	14320206
MOTOR PROTECTOR, TOGGLE- 13-18 AMPS	14320220
MOTOR PROTECTOR, TOGGLE- 17-23 AMPS	14320221
MOTOR PROTECTOR, TOGGLE- 2.5-4 AMPS	14320208
MOTOR PROTECTOR, TOGGLE- 20-25 AMPS	14320222
MOTOR PROTECTOR, TOGGLE- 24-32 AMPS	14320232
MOTOR PROTECTOR, TOGGLE- 25-40 AMPS	14320340
MOTOR PROTECTOR, TOGGLE- 45-63 AMPS	14320363
MOTOR PROTECTOR, TOGGLE- 4-6.3 AMPS	14320210
MOTOR PROTECTOR, TOGGLE- 6-10 AMPS	14320214
MOTOR PROTECTOR, TOGGLE- 9-14 AMPS	14320216
OVERLOAD-.4-.63 AMPS	14320801
OVERLOAD-.63-1 AMPS	14320802
OVERLOAD- 1.6-2.5 AMPS	14320804
OVERLOAD- 1-1.6 AMPS	14320803
OVERLOAD- 12-18 AMPS	14320810
OVERLOAD- 16-24 AMPS	14320811
OVERLOAD- 2.5-4 AMPS	14320805
OVERLOAD- 23-32 AMPS	14320812
OVERLOAD- 30-40 AMPS	14320813

Description	Part Number
OVERLOAD- 3-13 AMPS	14320809
OVERLOAD- 37-50 AMPS	14320814
OVERLOAD- 4-6 AMPS	14320806
OVERLOAD- 48-65 AMPS	14320815
OVERLOAD- 5.5-8 AMPS	14320807
OVERLOAD- 7-10 AMPS	14320808

18.6 Replacement Filters

Description	Part Number
FILTER, 30% POLYESTER 16 x 25	14074200
FILTER, 30% POLYESTER 20 x 20	14074201
FILTER, 30% POLYESTER 20 x 25	14074202
FILTER, DISPOSABLE 2 x 16 x 20	82400050
FILTER, DISPOSABLE 2 x 16 x 25	82400060
FILTER, DISPOSABLE 2 x 20 x 20	82400070
FILTER, DISPOSABLE 2 x 20 x 25	82400080
FILTER, PERMANENT 2 x 16 x 20	82400140
FILTER, PERMANENT 2 x 16 x 25	82400150
FILTER, PERMANENT 2 x 20 x 20	82400160
FILTER, PERMANENT 2 x 20 x 25	82400170
FILTER, 30% PLEATED 2 x 16 x 25	82402830
FILTER, 30% PLEATED 2 x 16 x 20	82402850
FILTER, 30% PLEATED 2 x 20 x 25	82402860
FILTER, 30% PLEATED 2 x 20 x 20	82402870

18.7 Miscellaneous Replacement Parts

Description	Part Number
BLOWER AIRFLOW PROVING SWITCH - 0.17>12"	83100006
BLOWER AIRFLOW PROVING BYPASS TIMER	804-001-02
BULB HOLDER	81100310
CLOGGED FILTER SWITCH 0.17>12"	83100006
DOOR GASKET- 1/2 X 3/4	10949903
DOOR HANDLE- LATCH, COMPRESSION, SLOTTED	14303506
DOOR HANDLE- VENTLOC (CHROME COLORED)	10500401
FAN/LIMIT REAR COVER	14279410
FAN/LIMIT WITH 10' SENSOR	14279401
FAN/LIMIT WITH 20' SENSOR	14279402
FUSE	10361700
FUSE	10461500
GAS PRESSURE SWITCH-COMBO GAS PRESSURE SW MTG BRACKET	14297002
GAS PRESSURE SWITCH-COMBO HIGH/LOW PRESSURE	14297001
LIGHT-TOP HAT/AMBER/120V/NEON (NEDCO)	14297311
LIGHT-TOP HAT/GREEN/120V/NEON (NEDCO)	14297313
LIGHT-TOP HAT/RED/120V/NEON (NEDCO)	14297310
LIGHT-TOP HAT/WHITE/120V/NEON (NEDCO)	14297312
RELAY-4PDT 120V IDEC	14132300
RELAY-DPDT 120V IDEC	14163900
RESISTOR 124 OHM	14072706
RESISTOR 140 OHM	14072701
RESISTOR 150 OHM	14072705
RESISTOR 237 OHM	14072702
RESISTOR 35.7 OHM	14072708
RESISTOR 47.5 OHM	14072707
RESISTOR 66.5 OHM	14072703
RESISTOR 71.4 OHM	14072704
SWITCH-N/O CONTACT BLOCK SINGLE-POSITION	14132601
SWITCH-N/O-N/C CONTACT BLOCK SINGLE-POSITION	14142900
SWITCH-SUMMER/OFF/WINTER OPERATOR	14135703
TOGGLE SWITCH-DPDT-ON/OFF	14217304
TOGGLE SWITCH-DPDT-ON/OFF	14217301

TOGGLE SWITCH-SPDT-ON/OFF	14217300
TRANSFORMER- ISOLATION 40 VA 120-24V	83000020
TRANSFORMER- MICRON CONTROL W/FUSE BLOCK 200 THRU 480 V	10115301

SECTION 19: TROUBLESHOOTING

⚠ DANGER

	
Electrical Shock Hazard	**Severe Injury Hazard**
Disconnect electric before service. **More than one disconnect switch may be required to disconnect electric from equipment.** **Equipment must be properly grounded.**	**Do not enter equipment while in operation.** **Equipment may start automatically.** **Do not operate with door open.** **Installation, operation and service must be done by a trained technician only.**
Failure to follow these instructions can result in death, electrical shock or injury.	

⚠ WARNING

				
Explosion Hazard	**Fire Hazard**	**Falling Hazard**	**Burn Hazard**	**Cut/Pinch Hazard**
Turn off gas/oil supply to equipment before service.	**Keep all flammable objects, liquids and vapors the minimum required clearances to combustibles away from equipment.** **Some objects will catch fire or explode when placed close to equipment.**	**Use proper safety equipment and practices to avoid falling.** **Do not use any part of equipment as support.**	**Allow equipment to cool before service.** **Internal components of equipment may still be hot after operation.**	**Wear protective gear during installation, operation and service.** **Edges are sharp.**
Failure to follow these instructions can result in death, injury or property damage.				

The following is divided into two basic categories - fan problems and burner problems. In some cases, they interrelate. In order to use this effectively, you should familiarize yourself with both categories.

19.1 Initial Checks

When encountering any abnormal operation or fault conditions of the equipment, all troubleshooting should start with the following initial checks. If a problem is discovered in these initial checks, it must be corrected before moving on in the trouble shooting.

1. Compare voltage and phase of supply power on site with rating plate information.
2. Review wiring between remote panel and control panel. Do the electrical connections match the supplied wiring diagram?
3. Compare gas type and supply pressure on site with rating plate information.
4. Check for proper fan rotation on air turnover unit.
   - Fans powered with a three phase motor can be reversed by swapping any two incoming power legs to the motor starter.
     For fans powered by a single phase motor, refer to the motor rating plate for reversing instructions.

19.2 Supply Fan

PROBLEM	POSSIBLE CAUSE	SOLUTION
Fan motor does not run	Damper limit switch not closed or inoperative.	Repair or replace switch.
	Motor thermal over-loads tripped.	For tripped condition-reset.
	Fuses blown or missing.	Replace.
	External power source lacking.	Have incoming power lines checked.
	Motor inoperative.	Repair or replace.
Fan motor runs, but fans do not supply enough air	Belts broken or loose.	Readjust or replace.
	Intake filters dirty.	Replace or clean.
	Obstruction in intake.	Check dampers for proper operation. Clear all intake passages of obstructions.
	Fan wheel loose on shaft.	Reposition and tighten.
	Access doors and panels not closed.	Close.
Excessive fan noise	Fan bearing	Replace.
	Fan sheave loose on shaft.	Tighten.
	Belts not adjusted.	Readjust.
	Fan propeller loose on shaft.	Reposition and retighten.
	Fan propeller rubbing.	Loosen setscrews. Reposition wheel and tighten.
	Fan propeller dirty.	Clean.
	Foreign article in fan.	Remove.

19.3 Burner

PROBLEM	POSSIBLE CAUSE	SOLUTION
Burner Fails to Start	Defective On/Off or fuel transfer switch.	Replace.
	Control circuit has an open control contact.	Check limits, proof of closure switch and others as applicable.
	Bad fuse or switch open on in-coming power source.	Correct as required.
	Motor overloads tripped.	Reset and correct cause for trip out.
	Flame safeguard control safety switch tripped out.	Reset and determine cause for apparent flame failure.
	Loose connections or faulty wiring.	Tighten all terminal screws and consult wiring diagram furnished with the air turnover unit.
	Frozen oil pump shaft preventing blower motor operation.	Replace oil pump.
	Flame safeguard control starting circuit blocked due to flame relay being energized.	Possible defective scanner - replace. Possible defective amplifier -replace. Scanner actually sighting flame due to leaking fuel valve-correct unwanted flame cause. Defective flame safeguard control - replace.
	Defective blower motor.	Repair or replace.
Occasional Lockouts for No Apparent Reason	Gas pilot ignition failure.	Refer to pilot adjustment section and readjust to make certain that ignition is instant and that flame signal readings are stable and above minimum values. Use a manometer or 0 to 10 wc (24.9 mbar) gas pressure gauge on pilot test tee to make certain that pressure is as recommended.
	Check for proper settings on direct spark oil ignition electrodes.	Make certain that gap is not too wide and that light-off oil pressure is as recommended.
	Gas pilot ignition and direct spark oil ignition.	Verify that there are no cracks in the porcelain and that transformer end and electrode end plug in connections are tight.
	Loose or broken wires.	Check all wire nut connections and tighten all terminal screw connections in panel and elsewhere as appropriate.
	With flame safeguard controls that incorporate the air flow switch in the non-recycling circuit, ensure that when main flame lights, the air flow switch is not so critically set as to allow occasional momentary opening of the air switch contacts.	

Burner (continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
Occasional Lockouts for No Apparent Reason	Occasional low voltage supply.	Have local utility correct.
	Occasional low gas supply pressure.	Have local utility correct.
	Air leak in oil suction line or check valve not holding.	Correct as required.

19.4 Gas Operation

PROBLEM	POSSIBLE CAUSE	SOLUTION
Burner Motor Runs, but Pilot Does Not Light	Gas supply to burner shut off.	Make sure all manual gas supply valves are open. Automatic high pressure.
	Pilot solenoid valve not opening.	Listen and feel for valve actuation. Solenoid valve not being powered--check electrical circuitry. Replace coil or entire valve if coil is burned out.
	Defective gas pilot regulator.	Replace.
	Gas pressure too high or too low at pilot orifice.	Refer to gas pilot adjustments for correct settings. Readjust as required.
	Defective ignition transformer.	Replace.
	Incorrect ignition electrode settings.	Refer to gas pilot adjustments for correct settings.
	Defective flame safeguard control or plug in purge timing card.	Replace as required.
	Air flow switch not making circuit.	Check out electrically and correct pressure adjustment on switch If required.
	Defective air flow switch.	Replace.
	Air switch negative pressure sensing tube out of position.	Reposition as necessary.
Burner Motor Runs and Pilot Lights, but Main Gas Flame is Not Established.	Main shut off or test cock closed.	Check to make certain fully open.
	Pilot flame signal reading too low to pull in flame safeguard relay.	Refer to gas pilot settings section and readjust as required.
	Defective automatic main or auxiliary gas shut off valves.	Check electrical circuitry to valves. Replace valves or correct circuitry as required.
	Defective flame safeguard control or plug in amplifier.	Check and replace as required.
	Butterfly valve set incorrectly on modulating burner.	Readjust as required.
	Main gas pressure regulator atmospheric vent line obstructed.	Correct.
	Defective main gas pressure regulator	Replace.
	Misadjusted main gas pressure regulator	Readjust to meet required operational values.

Gas Operation (continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
Carbon Monoxide Readings on Gas Firing	Flame impingement on cold start-up of heat exchanger caused by excessive firing rate.	Reduce firing rate to correct input volume.
	Incorrect gas/air ratios.	Readjust burner to correct CO_2/O_2 levels, reducing CO formation to appropriate level.
Gas High Fire Input Cannot Be Achieved	Gas company pressure regulator or meter operating incorrectly, not allowing required gas pressure at gas train inlet.	Have gas company correct.
	Gas cock upstream of train inlet not fully open.	Check and correct.
	Gas line obstructed.	Check and correct.
	Gas train main and/or leak test cocks not fully open.	Check and correct.
	Automatic gas valve not opening fully due to defective operation.	Replace gas valve.
	On modulating burner, butterfly valve not fully opened.	Readjust.
	Defective main gas pressure regulator.	Replace.
	Main gas pressure regulator vent line obstructed.	Check and correct.
	Normally open vent valve (if supplied) not closing when automatic gas valves open.	Check to see if valve is fully closed when automatic valves are open. Replace vent valve, if not closing fully.

19.5 Oil Operation

PROBLEM	POSSIBLE CAUSE	SOLUTION
Burner Motor Runs, but Direct Spark Ignited Oil Flame is Not Established	Defective oil nozzle.	Remove and clean or replace.
	Low oil pressure.	Check with gauge for correct light-off pressure.
	Defective oil pump.	Replace.
	Defective oil solenoid valve.	Replace.
	Oil pump coupling loose or defective.	Replace or tighten as required.
	Low oil pressure switch (if supplied) defective.	Adjust or replace switch.
	Ignition transformer defective.	Replace.
	Ignition electrode set incorrectly.	Remove electrodes and reset.
	Ignition electrodes cracked and grounding out spark.	Replace electrodes.
	Ignition lead wire defective and grounding spark out.	Replace.
	Ignition plug-in connections at transformer or electrodes loose.	Tighten.
	Air flow switch (if provided) not making.	Reset pressure or replace.
	Defective flame safeguard control or plug in purge timer card.	Replace.
	Air dampers held in high fire position due to mechanical binding of linkage.	Readjust linkage.
	Loose wiring connections.	Check and tighten all connections.

Oil Operation (continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
Oil Flame Ignites, but then Flame Safeguard Control Locks Out on Safety.	Flame scanner lens dirty.	Remove and clean.
	Scanner sight tube blocked or dirty.	Check and clean.
	Flame scanner defective.	Replace.
	Defective oil nozzle causing unstable flame and scanning problems.	Replace oil nozzle.
	Fuel/air ratios incorrect, resulting in unstable or smoky flame causing scanner flame sighting problem.	Readjust ratios for clean stable flame.
	Defective flame safeguard amplifier or control.	Replace as appropriate.
Oil Flame Extremely Smoky at Light Off or in Low Fire Position.	Defective or incorrect size oil nozzle.	Replace.
	Fuel/air ratio incorrect.	Readjust.
	Normally closed oil solenoid valve in oil nozzle return line not opening.	Check electrical circuitry and replace valve if defective.
	On two-step pump - Normally open pump mounted solenoid valve malfunctioning.	Replace valve or pump.
Light off Oil Flame Is Established and Proven, but Burner Will Not Attempt to go to the High Fire Position	Low/High/Low or Modulating burner high fire temperature or pressure control could be defective or not set to call for high fire.	Readjust or replace control.
	Loose wires.	Verify wiring and tighten all connections.
	Flame safeguard control or high fire panel switching relay (if supplied) defective.	Verify and correct as required.
	High fire 3 way solenoid valve defective.	Replace.
	Hydraulic oil cylinder defective.	Replace.
	On two-step pump - Normally open solenoid valve defective (not closing).	Replace pump or valve.
	Linkage mechanically binding.	Readjust linkage.
	On modulating system defective modulating motor.	Replace.
Low Oil Flame Is Established and Proven, but Flame Out Occurs in Transition from Low Fire to High Fire	On Low/High/Off or Low/High/Low system - Normally closed oil solenoid valve in nozzle return line not closing (or leaking).	Check valve operation and replace if necessary.
	On two-step oil pump - Normally open solenoid valve defective (not closing).	Replace valve or pump.
	Defective oil nozzle.	Replace.
	High fire oil pressure too low.	Readjust.
	Air dampers set too far open at low fire, which causes flame to blow out in starting to high fire.	Readjust dampers.
	Oil pump coupling loose or defective.	Tighten or replace.
	Defective oil pump.	Replace.
	Linkage mechanically binding.	Readjust.
	Make certain the #72 orifice into the normally closed side of the 3 way valve has not been removed.	
	On modulating systems - fuel/air ratios set incorrectly, causing flame to blow out when going to high fire.	Readjust linkage.

Oil Operation (continued)

PROBLEM	POSSIBLE CAUSE	SOLUTION
White Smoke Formation on Oil Firing	Oil/Air ratios incorrect due to excess air, or oil flow is too low.	Readjust for proper fuel input, CO2 and smoke reading.
Gray or Black Smoke Formation on Oil Firing	Defective or dirty oil nozzle.	Replace or clean nozzle.
	Incorrect oil/air ratios.	Readjust burner to correct CO2 and smoke levels.
	Oil pressure too low resulting in poor atomization.	Readjust.
	Impingement of raw oil spray on the blast tube choke ring or oil nozzle air diffuser.	Make certain that the diffuser is seated firmly against the oil nozzle adapter shoulder. Position the oil gun assembly fore or aft in the blast tube to assist in elimination of oil spray on the blast tube choke ring.
Oil High Fire Input Rate Cannot Be Achieved	Nozzle defective or mesh filter dirty.	Replace or clean mesh.
	Oil supply pressure to nozzle too low.	Readjust.
	Oil pump defective.	Replace.
	On Low/High/Off and Low/High/Low systems - Normally closed oil solenoid valve in nozzle return line not closing (or leaking).	Check valve operation and replace if necessary.
	On two-step pump - Normally open pump mounted oil solenoid valve defective (not closing).	Replace valve or pump.
	Oil pump coupling loose (slipping) or defective.	Replace.
	Linkage mechanically binding.	Readjust.
	On modulating burner, oil nozzle return line metering valve set incorrectly.	Readjust to attain required nozzle bypass pressure.
	Oil suction line is partially blocked.	Clean.
	Blocked or dirty suction line oil filter.	Replace or clean.
	Manual valves in suction line not fully open.	Check and correct.
	Suction line check valve or foot valve operating incorrectly.	Check and correct.
	Vent system on oil tank blocked creating vacuum on tank, with high vacuum and lowered oil flow to burner.	Check and correct.

19.6 Burner Control Module

BLINK CODE	SYSTEM FAILURE	RECOMMENDED TROUBLESHOOTING
Code 1-1 *Low AC Line Voltage*	Low AC Line detected.	1. Check the relay module and display module connections. 2. Reset and sequence the relay module. 3. Check the 7800 power supply and make sure that frequency and voltage meet specifications. 4. Check the backup power supply, as appropriate.
Code 1-2*AC Quality Problem*	Excessive noise or device running on slow, fast, or AC line dropout detected.	
Code 2-1*Unexpected Flame Signal*	Flame sensed when no flame is expected during STANDBY or PURGE.	1. Check that flame is not present in the combustion chamber; correct any errors. 2. Make sure that the flame amplifier and flame detector are compatible. 3. Check the wiring and correct any errors. 4. Remove the flame amplifier and inspect its connections. Reseat the amplifier. 5. Reset and sequence the relay module. 6. If the code reappears, replace the flame amplifier and/or the flame detector. 7. If the fault persists, replace the relay module.
Code 2-2*Flame Signal Absent*	No-flame time present at the end of the PIlot Flame Establishing Period; lost during the Main Flame Establishing Period or during RUN.	1. Measure the flame signal. If one exists, verify that it meets specifications. 2. Make sure that the flame amplifier and flame detector are compatible. 3. Inspect the main fuel valve(s) and valve connection(s). 4. Verify that the fuel pressure is sufficient to supply fuel to the combustion chamber. Inspect the connections to the fuel pressure switches. Make sure they are functioning properly. 5. Inspect the airflow switch and make sure that it is functioning properly. 6. Check the flame detector sighting position; reset and recycle. Measure the flame signal strength. Verify that it meets specifications. If not, refer to the flame detector and/or flame amplifier checkout procedures in the installation instructions. 7. Replace the flame amplifier and/or the flame detector, if necessary. 8. If the fault persists, replace the relay module.
Code 2-3*Flame Signal Over range*	Flame signal value is too high to be valid.	1. Make sure the flame detector and flame amplifier are compatible. 2. Remove the flame amplifier and inspect its connections. Reset the flame amplifier. 3. Reset and sequence the relay module. 4. Check the flame detector sighting position; reset and recycle. Measure flame strength. Verify that it meets specifications. If not, refer to the flame detector and/or flame amplifier checkout procedures in the installation instructions. 5. If the code reappears, replace the flame amplifier and/or the flame detector. 6. If the fault persists, replace the relay module.

Burner Control Module (continued)

BLINK CODE	SYSTEM FAILURE	RECOMMENDED TROUBLESHOOTING
Code 3-1*Running/Interlock Switch Problem*	Running or Lockout Interlock fault during Pre-Purge.	1. Check wiring; correct any errors. 2. Inspect the fan; make sure there is no air intake blockage and that it is supply-ing air. 3. Make sure the lockout interlock switches are functioning properly and the contacts are free from contaminants. 4. Reset and sequence the relay module to Pre-Purge (place the TEST/RUN Switch in the TEST position, if available). Measure the voltage between terminal 7 and G (ground); line voltage should be present. Switch TEST/RUN back to RUN. 5. If steps 1 through 4 are correct and the fault persists, replace the relay module.
Code 3-2*Running/Interlock On During Standby*	Lockout Interlock powered at improper point in sequence or On in Standby.	1. Check wiring to make sure that the lockout interlock are connected properly between terminals 6 and 7. Correct any errors. 2. Reset and sequence the relay module. 3. If the fault persists, measure the voltage between terminal 6 and G (ground), then between terminal 7 and G. If there is line voltage at terminal 6 when the controller is off, the controller switch may be bad or is jumpered. 4. If steps 1 through 3 are correct and there is line voltage at terminal 7 when the controller is closed and the fault persists, check for a welded or jumpered running interlock or airflow switch. Correct any errors. 5. If steps 1 through 4 are correct and the fault persists, replace the relay module.
Code 3-3*VPS in Improper State*	VPS (Valve Proving Switch) in wrong state during VPS Test.	1. Check wiring, making sure upstream valve is connected to terminal 9 and downstream valve is connected to terminal 17. 2. Conduct valve seat leakage test using a manometer. 3. Reset and sequence the relay module; if fault repeats, test VPS (connected to terminal 16) is functioning properly; replace if necessary. 4. Reset and sequence the relay module. 5. If fault persists, replace the relay module.
Code 4-1*Purge Card Problem*	No purge card or the purge card timing has changed from the original configuration.	1. Make sure the purge card is seated properly. 2. Inspect the purge card and the connector on the relay module for any damage or contaminants. 3. Reset and sequence the relay module. 4. If the fault code reappears, replace the purge card. 5. Reset and sequence the relay module.6.If the fault code persists, replace the relay module.
Code 4-2*Wiring Problem/ Internal Fault*	Pilot (ignition) valve terminal, main valve, ignition or Main Valve 2 was on when it should be off.	1. Remove system power and turn off fuel supply. 2. Check wiring; correct any errors. 3. Inspect pilot fuel valve(s), both places, and connections. 4. Reset and sequence the relay module. 5. If the fault persists, replace the relay module.

Burner Control Module (continued)

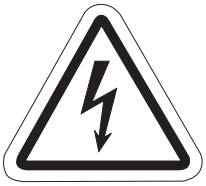
BLINK CODE	SYSTEM FAILURE	RECOMMENDED TROUBLESHOOTING
Code 4-3*Flame Amplifier Problem*	Flame not sensed, or sensed when it should be on or off.	1. Check wiring; correct any errors. 2. Make sure the flame amplifier and flame detector are compatible. 3. Remove the flame amplifier and inspect the connections. Reseat the amplifier. 4. Reset and sequence the relay module. 5. If the code reappears, replace the flame amplifier and/or the flame detector. 6. If the fault persists, replace the relay module.
Code 4-4*Configuration Jumper Problem*	The configuration jumpers differ from the sample taken at startup.	1. Inspect the jumper connections. Make sure the clipped jumpers were completely removed. 2. Reset and sequence the relay module. 3. If the fault persists, replace the relay module.
Code 5-1*Pre-Ignition Interlock*	Pre-Ignition Interlock fault.	1. Check wiring and correct any errors. 2. Check pre-ignition interlock switches to assure proper functioning. 3. Check fuel valve operation. 4. Reset and sequence the relay module; monitor the Pre-Ignition Interlock status. 5. If the fault persists, replace the relay module.
Code 5-2*High Fire Sw. or Low Fire Sw.*	Either High Fire Switch or Low Fire Switch failure.	1. Check wiring and correct any errors. 2. Reset and sequence the relay module. 3. Use manual motor potentiometer to drive the motor open and closed. Verify at motor switch that the end switches are operating properly. Use RUN/TEST switch if manual potentiometer is not available. 4. Reset and sequence the relay module. 5. If the fault persists, replace the relay module.
Code 5-3*Man-Open Sw.; Start Sw. or Control On*	Man-Open Switch, Start Switch or Control On in the wrong operational state.	1. Check wiring and correct any errors. 2. Make sure that the manual open valve switch, start switch and control are operating properly. 3. Stat Switch held “On” too long. 4. Reset and sequence the relay module. 5. Reset and sequence the relay module. If the fault persists, replace the relay module (RM7838A1014; RM7838B1013 or RM7838C1004 only).
Code 6-1*Internal Faults*	Relay Module self-test failure.	1. Reset and sequence the relay module. 2. If fault reappears, remove power from the device, reapply power, then reset and sequence the relay module. 3. If the fault persists, replace the relay module.
Code 6-2*Internal Faults*	Relay Module Self-Test failure.	1. Reset and sequence the relay module. 2. If fault reappears, remove power from the device, reapply power, then reset and sequence the relay module. 3. If fault does not repeat on the next cycle, check for electrical noise being copied into the relay module through the external loads or possibly an electrical grounding issue. 4. If the fault persists, replace the relay module.

Burner Control Module (continued)

BLINK CODE	SYSTEM FAILURE	RECOMMENDED TROUBLESHOOTING
Code 6-3*Device Specific*	Fault with special OEM input circuits.	1. Check wiring and operation of special OEM inputs. 2. Reset and sequence the relay module. 3. If fault reappears, remove power from the device, reapply power, then reset and sequence the relay module. 4. If the fault does not repeat on the next cycle, check for electrical noise being copied into the relay module through the external loads or possibly an electrical grounding issue. 5. If the fault persists, replace the relay module.
Code 6-4*Accessory Fault*	VPS setup.	1. Make sure Relay Module VP is programmed. 2. T6 and T17 powered at the same time—correct wiring. 3. Reset control if fault persists. Replace relay module.
Code 7-7*Unused*	Unused at this time.	-

Additional trouble shooting information can be found in the Flame Safeguard Control bulletin supplied with the air turnover unit.

19.7 ROBERTS GORDON® AT Start-Up Procedures

⚠ DANGER	
	
Electrical Shock Hazard	**Severe Injury Hazard**
Disconnect electric before service. **More than one disconnect switch may be required to disconnect electric from equipment.** **Equipment must be properly grounded.**	**Do not enter equipment while in operation.** **Equipment may start automatically.** **Do not operate with door open.** **Installation, operation and service must be done by a trained technician only.**
Failure to follow these instructions can result in death, electrical shock or injury.	

⚠ WARNING		
		
Explosion Hazard	**Falling Hazard**	**Burn Hazard**
Leak test all components of equipment gas piping before operation. **Gas can leak if piping is not installed properly.** **Do not high pressure test gas piping with equipment connected.**	**Use proper safety equipment and practices to avoid falling.** **Do not use any part of equipment as support.**	**Allow equipment to cool before service.** **Internal components of equipment may still be hot after operation.**
Failure to follow these instructions can result in death, injury or property damage.		

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Model: Invoice No. of Burner: Serial No.:

Installation Name: Start Up Date:

Start Up Contractors Name: Phone No.:

Name of Technician Doing Start Up: Fan Rotation Correct?

Type of Gas: Natural: L.P.: Fuel Grade No.:

Gas Fired

Gas Pressure at Train Inlet
Burner in off position in WC

Gas Pressure at Train Inlet
Low Fire
High Fire

Gas Pressure at Firing Head
Low Fire
High Fire

Gas Pressure at Pilot Test Tee
Low Fire

Flame Signal Readings
Volts:
Ph:
Hz.:
Control Circuit Volts
Blower Motor Amps at High Fire

Flame Signal Readings
Pilot
Low Fire
High Fire

CO2 or O2 (Specify)
Low Fire
High Fire

CO
Low Fire
High Fire

Input Rate BTU/HR
Low Fire
High Fire

Tank Pressure
High Fire

Net Stack Temperature
Low Fire
High Fire

Combustion Efficiency
Low Fire %
High Fire %

Oil Fired

High Fire Vacuum Reading
at Oil Pump Inlet in HG

Gas Pressure at Pilot Train Inlet
(If Applicable)

Gas Pressure at Pilot Train Tee
(If Applicable)

Oil Nozzle Supply Pressure
Low Fire
High Fire

Oil Nozzle Bypass Pressure
Low Fire
High Fire

CO2 or O2 (Specify)
Low Fire
High Fire

Bachrach Scale Smoke Number
Low Fire
High Fire

Power Supply
Volts:
Ph:
Hz.:
Control Circuit Volts
Blower Motor Amps at High Fire
Remote Oil Pump Amps at High Fire

Flame Signal Readings
Pilot (if Applicable)
Low Fire
High Fire

GPH Firing Rate
Low Fire
High Fire

Net Stack Temperature
Low Fire
High Fire

Combustion Efficiency
Low Fire %
High Fire %

Control Settings

General

Fan Limit (Fan switch set to 110, Limit set at 200, HYS Pot set at 20)	
Burner Air Flow Operating	
Full Mod. High Fire Purge	
Full Mod. Low Fire Start	
Full Mod Cycling On/Low Fire Start	
Freeze Stat: 3 Min.-35	
Outdoor Stat: 65	

Gas

Low Gas Pressure Switch	
High Gas Pressure Switch	

Oil

Low Oil Pressure Switch	
High Oil Pressure Switch	

☐ Check all door seals and latches. Confirm the latch is adjusted for proper tension

☐ Check control lights for proper operation (if applicable)

☐ Check temperature control location

☐ Check temperature sensor mounting

☐ Check incoming power supply (line voltage) before turning on unit disconnect.
(NOTE: for 3 phase, voltage should be measured from line to line)

Leg1-2 ☐ Leg1-3 ☐ Leg2-3 ☐ /60/Phase ☐

☐ Record nameplate voltage from serial tag.
Voltage ☐ Phase ☐ 60Hz
(NOTE: This must match incoming power supply. If not, contact the ROBERTS GORDON® Representative of Roberts-Gordon LLC directly)

☐ Record serial and electrical drawing number from the serial tag on the door of the air make-up unit

Serial No. ☐ Electrical Drawing No. ☐
(NOTE: Refer to this number when contacting Weather-Rite on all service questions relating to the air make-up unit)

☐ Record full load amps (f.l.a.) for the voltage matching the service voltage on all motors and set overloads. Set overloads at nameplate

Supply Motor ☐ f.l.a. Overloads set at ☐ amp
Exhaust Motor ☐ f.l.a. Overloads set at ☐ amp

☐ Check the belt tension on supply blower. Adjust if necessary
(NOTE: Belt should not move more than 1/2 inch)

☐ Locate pilot gas line and open pipe plug to bleed off main gas line.

☐ After bleeding, connect pressure gauge to the gas line where the plug was removed and measure incoming gas pressure.
Record Pressure ☐ " W.C.

(NOTE: If pressure is more than 28" of water column (1 LB), a pressure regulator is required. Consult service manual for maximum

☐ Insure pilot and main gas valves are off

START-UP "NO HEAT"

☐ Place all disconnects in "ON" position and test for 120 V on transformer secondary to ground before turning the selector switch to "SUMMER" mode. The unit will start up in the "no heat" mode.

☐ Check for the correct rotation of supply fan. (Reverse if necessary.)

☐ Measure and record amp draws

SUPPLY BLOWER MOTOR

Leg 1 ☐ Leg 2 ☐ Leg 3 ☐

Measure and record RPM of blower: ☐

☐ Note ambient air temperature, with the unit running in the "no heat" mode. Ambient air temperature: _____ deg. F

☐ Check to see that only the pilot shut off valve is open an burner valve is off. Reset the optional low gas pressure switch if the unit is equipped with it and jumper out the optional high gas pressure switch if the unit is equipped with it.

☐ Start the burner. Move the selector switch to "Winter" or "Heat".

☐ After pilot lights, check the flame signal. Read and record the D.C. voltage. Do a visual inspection of the pilot flame and make any adjustments if needed

☐ D.C. Volts

☐ Open main shut off valve; visually inspect the burner to make sure it is not over firing

☐ Adjust the temperature rise to match the serial tag temperature rise

☐ Record the inlet gas pressure while the unit is on high fire ☐ wc

NOTE: The minimum gas pressure must be at least the value listed on the unit serial tag.
If this requirement is not met, the unit will not

The following items should be completed during the final walk through with the customer

Personnel Training Review

It is important that everyone concerned with the operation and maintenance of the equipment be trained in the safety procedures contained in the operation.

☐ Operation of the temperature control? (Including "heat" minimum temp. rise?)
If no, explain: ☐

☐ Location and operation of safety disconnect switch? (use lockout/tag out procedures)
If no, explain: ☐

☐ Proper maintenance and replacement of filters?
If no, explain: ☐

☐ Location and operation of safety devices and location of reset buttons?
If no, explain: ☐

SECTION 20: THE ROBERTS GORDON® AT-SERIES WARRANTY

ROBERTS-GORDON LLC WILL PAY FOR:

Within 24 months from date of purchase by buyer or 27 months from date of shipment by Roberts-Gordon LLC (whichever occurs first), replacement parts will be provided free of charge for any part of the product which fails due to a manufacturing or material defect.

Roberts-Gordon LLC will require the part in question to be returned to the factory. Roberts-Gordon LLC will, at its sole discretion, repair or replace after determining the nature of the defect and disposition of part in question.

ROBERTS GORDON® Replacement Parts are warranted for the later of 12 months from date of shipment from Roberts-Gordon LLC or the remaining ROBERTS GORDON® AT-Series warranty.

ROBERTS-GORDON LLC WILL NOT PAY FOR:

Service trips, service calls and labor charges.

Shipment of replacement parts.

Claims where the total price of the goods have not been paid.

Damage due to:

- Improper installation, operation or maintenance.
- Misuse, abuse, neglect, or modification of the ROBERTS GORDON® AT-Series in any way.
- Use of the ROBERTS GORDON® AT-Series for other than its intended purpose.
- Incorrect gas or electrical supply, accident, fire, floods, acts of God, war, terrorism, or other casualty.
- Improper service, use of replacement parts or accessories not specified by Roberts-Gordon LLC.
- Failure to install or maintain the ROBERTS GORDON® AT-Series as directed in the Installation, Operation and Service Manual.
- Relocation of the ROBERTS GORDON® AT-Series after initial installation.
- Use of the ROBERTS GORDON® AT-Series in a corrosive atmosphere containing contaminants.
- Use of the ROBERTS GORDON® AT-Series in the vicinity of a combustible or explosive material.
- Any defect in the ROBERTS GORDON® AT-Series arising from a drawing, design, or specification supplied by or on behalf of the consumer.
- Damage incurred during shipment. Claim must be filed with carrier.

WARRANTY IS VOID IF:

The ROBERTS GORDON® AT-Series is not installed by an contractor qualified in the installation and service of gas fired heating equipment.

You cannot prove original purchase date and required annual maintenance history.

The data plate and/or serial number are removed, defaced, modified or altered in any way.

The ownership of the ROBERTS GORDON® AT-Series is moved or transferred. This warranty is non-transferable.

Roberts-Gordon LLC is not permitted to inspect the damaged equipment and/or component parts.

READ YOUR INSTALLATION, OPERATION AND SERVICE MANUAL.

If you have questions about your equipment, contact your installing professional. Should you need Replacement Parts or have additional questions, call or write:

Roberts-Gordon LLC
1250 William Street
P.O. Box 44
Buffalo, New York 14240-0044
Telephone: +1.716.852.4400
Fax: +1.716.852.0854
Toll Free: 800.828.7450
www.robertsgordon.com
www.rg-inc.com

Roberts-Gordon LLC's liability, and your exclusive remedy, under this warranty or any implied warranty (including the implied warranties of merchantability and fitness for a particular purpose) is limited to providing replacement parts during the term of this warranty. Some jurisdictions do not allow limitations on how long an implied warranty lasts, so this limitation may not apply to you. There are no rights, warranties or conditions, expressed or implied, statutory or otherwise, other than those contained in this warranty.

Roberts-Gordon LLC shall in no event be responsible for incidental or consequential damages or incur liability for damages in excess of the amount paid by you for the ROBERTS GORDON® AT-Series. Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so this limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from jurisdiction to jurisdiction.

Roberts-Gordon LLC shall not be responsible for failure to perform under the terms of this warranty if caused by circumstances out of its control, including but not limited to war, fire, flood, strike, government or court orders, acts of God, terrorism, unavailability of supplies, parts or power. No person is authorized to assume for Roberts-Gordon LLC any other warranty, obligation or liability.

LIMITATIONS ON AUTHORITY OF REPRESENTATIVES:

No representative of Roberts-Gordon LLC, other than an Executive Officer, has authority to change or extend these provisions. Changes or extensions shall be binding only if confirmed in writing by Roberts-Gordon LLC's duly authorized Executive Officer.