



Cabin Pressurization Unit

| | | |
|---------------------|---------------------|---------------------|
| Models: | 15A7610-6000 | 15B7610-6000 |
| 15C7610-6000 | 15D7610-6000 | 15E7610-6000 |
| 15F7610-6000 | 15G7610-6000 | |



11/2022 – Rev. 05

**For Spare Parts, Operations & Service Manuals or Service Needs
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| REVISION | DATE | TEXT AFFECTED |
|----------|---------|--|
| 01 | 11/2019 | Original release |
| 02 | 04/2020 | Modified Parts List |
| 03 | 04/2021 | Modified Parts List |
| 04 | 10/2021 | Modified 5.1.2 Fuel Load Amperage and Parts List |
| 05 | 11/2022 | Modified Parts List |

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This product can not be modified without the written approval of Tronair, Inc. Any modifications done without written approval voids all warranties and releases Tronair, Inc., its suppliers, distributors, employees, or financial institutions from any liability from consequences that may occur. Only Tronair OEM replacement parts shall be used.

Photos in manual may not reflect actual unit.

1.0 PRODUCT INFORMATION

1.1 DESCRIPTION

Cabin Pressurization Unit (CPU)

1.2 MODEL & SERIAL NUMBER

Reference nameplate or software on unit

1.3 MANUFACTURER

TRONAIR, Inc.
1 Air Cargo Pkwy East
Swanton, Ohio 43558 USA

Telephone: (419) 866-6301 or 800-426-6301
Fax: (419) 867-0634
E-mail: sales@tronair.com
Website: www.tronair.com

1.4 FUNCTION

This Cabin Pressurization Unit is designed to provide a controllable air supply for the pressurization of aircraft cabin and cockpit areas for the purpose of cabin leakage testing, and/or outflow valve tests.

Adapter kits (sold separately) must be used to connect the Supply Hose from the CPU to the aircraft

This Cabin Pressurization Unit is to be operated only by qualified trained technicians. This Operation and Service Section is to be used only by qualified trained technicians.

1.5 SPECIFICATIONS

- 350 SCFM (26.3 lbs./min.) flow capability
- 0-13.5 psig at aircraft pressure capability
- 40 hp (30kW) electric motor
- Murphy Digital Controller/Display
- Electronic potentiometer controlled flow
- 50 ft (15.2m) input power cable
- 25ft (7.6 m) 2 inch supply hose with coupler
- 30ft (9.1 m) cabin sense line
- 30 ft (9.1 m) door seal line
- 35-350 SCFM/lbs/min, 2.0% accuracy flow reading
- 15 psi, 1.25% accuracy pressure reading
- 0.12% accuracy air output temperature reading
- Quiet 77.6 dBA t 3ft (1.0m) from operator panel
- Maximum cabin pressure and rate of climb settable warnings (passive)
- Three color indicating stack light (running, warning, fault)
- Heat exchanger for controlled air delivery temperature (100-120 F, 38-49 C)
- Four locking swivel casters and handles for easy maneuvering
- Air inlet filter (replaceable element)
- Hose and electric cable storage hangers

1.6 REGULATED SHOP AIR

The CPU is equipped with a regulator and pressure gauge for the purpose of supplying regulated air to the aircraft door/canopy seals.

These items are located in the Regulated Shop Air area on the instrument panel.

2.0 SAFETY INFORMATION

2.1 USAGE AND SAFETY INFORMATION

To insure safe operations please read the following statements and understand their meaning. Also refer to your equipment manufacturer's manual for other important safety information. This manual contains safety precautions which are explained below. Please read carefully.



WARNING!

Warning is used to indicate the presence of a hazard that can cause **severe personal injury, death, and/or substantial property damage** if the Warning Notice is ignored.



CAUTION!

Caution is used to indicate the presence of a hazard, which will or can cause **minor personal injury or property damage** if the Caution Notice is ignored.

2.2 EXPLANATION OF WARNING & DANGER SIGNS



Accidental Starts! Before servicing the CPU or equipment, always disconnect electrical power supply to prevent accidental starting.



Rotating Parts! Keep hands, feet, hair, and clothing away from all moving parts to prevent injury. Never operate the CPU with covers, shrouds, or guards removed.



Electrical Shock! Never touch electrical wires or components while the CPU is attached to the power source. They can be sources of electrical shock. **DO NOT** operate CPU with cabinet panels removed.



Pressurized Fluid! Before servicing the CPU or equipment, always open the flow control to relieve any residual pressure in the system.

2.3 COMPONENT SAFETY FEATURES

- Overload and short circuit protection
- Pressure relief valve for blower protection set at 15.0 psig (1.03 bar)
- Emergency Stop button located on control panel
- Separate Start and Stop buttons
- Caster brakes and swivel locks on all four corners
- Software adjustable maximum pressure and rate of climb warnings (passive)

2.4 FUNCTIONAL SAFETY FEATURES

The pressure relief valve has been sized to bypass the full output of the blower. This feature provides operator and Cabin Pressurization Unit protection in the case where an operator may inadvertently start the machine with Airflow Control Valve fully open.

2.5 PERSONAL PROTECTIVE EQUIPMENT

- Safety glasses must be worn when operating the CPU, Ear protection if operating in an enclosed space.
- Additional equipment recommended by the airframe manufacturer (gloves, etc.).

2.6 SAFETY GUIDELINES

Any uses other than those identified in this manual are prohibited.

2.7 GENERAL COMMENTS

This Cabin Pressurization Unit is designed to provide a controllable air supply for the pressurization of aircraft cabin and cockpit areas for the purpose of cabin leakage testing, and/or outflow valve tests.



3.0 PREPARATION PRIOR TO FIRST USE

3.1 GENERAL

Reference the nameplate for the required electrical power, **must** match the supplied electrical power

| MODEL NUMBER | VOLTAGE/FREQUENCY | FULL LOAD AMPS |
|--------------|---------------------|----------------|
| 15A7610-6000 | 208VAC/60HZ | 104A |
| 15B7610-6000 | 230VAC/60HZ | 96A |
| 15C7610-6000 | 380VAC/60HZ | 54.5A |
| 15D7610-6000 | 460VAC/60HZ | 48A |
| 15E7610-6000 | 575VAC/60HZ | 42.5A |
| 15F7610-6000 | 380/145/440VAC/50HZ | 54.5A |
| 15G7610-6000 | 200/220VAC/50HZ | 96A |

3.2 SERVICING

Any servicing must be done by a qualified GSE technician familiar with electrical and mechanical safety procedures.

4.0 TRAINING

4.1 TRAINING REQUIREMENTS

The employer of the operator is responsible for providing a training program sufficient for the safe operation of the unit.

4.2 TRAINING PROGRAM

The employer provided operator training program should cover safety procedures concerning use of the unit in and around the intended aircraft at the intended aircraft servicing location.

4.3 OPERATOR TRAINING

The operator training should provide the required training for safe operation of the unit.

NOTE: Maintenance and Trouble Shooting are to be performed by a skilled and trained technician.

5.0 INSTALLATION

5.1 INSTALLATION REQUIREMENTS

5.1.1 Electrical Power Supply

The Cabin Pressurization Unit is supplied with a 100 ft (31 m) power cord of the proper current rating for this length cord, and the motor/voltage of the machine. The end user must select and connect the proper cord termination plug per all local and federal code requirements.

The Cabin Pressurization Unit is supplied with proper overload and short circuit protection.

The facilities connection to be used for the Cabin Pressurization Unit must be equipped with a properly sized disconnect.

5.1.2 Full Load Amperage

| MODEL NUMBER | VOLTAGE/FREQUENCY | FULL LOAD AMPS |
|--------------|---------------------|----------------|
| 15A7610-6000 | 208VAC/60HZ | 117A |
| 15B7610-6000 | 230VAC/60HZ | 106A |
| 15C7610-6000 | 380VAC/60HZ | 57A |
| 15D7610-6000 | 460VAC/60HZ | 53A |
| 15E7610-6000 | 575VAC/60HZ | 42.5A |
| 15F7610-6000 | 380/145/440VAC/50HZ | 62A |
| 15G7610-6000 | 200/220VAC/50HZ | 120A |

5.1.3 Motor Overload Protection

The CPU is equipped with a solid-state overload relay. The trip point of the relay is factory set to the proper current level. Adjustment is not recommended.

5.1.4 Shop Air Connection

Shop air must be supplied to the Cabin Pressurization Unit. The connection is located on the back of the machine

Maximum pressure: 150 psi (10.3 bar)

Connection size: ¼ NPT

5.1.5 Blower

Blower is filled to the correct level with oil, no customer action required. See maintenance section for oil type and viscosity.

5.1.6 Relief Valve

The pressure relief valve is factory set at 15.0 psi (1.03 bar). This is to protect the blower from excessive pressure. **Do not adjust the pressure relief valve.**

5.2 PERSONNEL REQUIREMENTS (TECHNICAL EXPERTISE) FOR INSTALLATION

5.2.1 Electrical Connections

Electrical connections are to be made by a qualified electrician per all applicable codes and regulations.

5.2.2 Shop Air Connections

Shop air connections are to be made by qualified personnel per all applicable codes and regulations.

5.3 INSPECTION AND TESTING PROCEDURE ON INSTALLATION

Check for any loose bolts, panels, or hardware. Correct as necessary.

6.0 OPERATION

6.1 OPERATING PARAMETERS

Due to the complexities, differences, and changes in aircraft pneumatic systems, no attempt has been made to relate to any specific aircraft. The customer must **always** follow the aircraft manufacturer's instructions regarding aircraft cabin pressurization procedures and pressure levels. It is mandatory that the operators read, and understand, this manual and the aircraft maintenance manual prior to using this equipment.



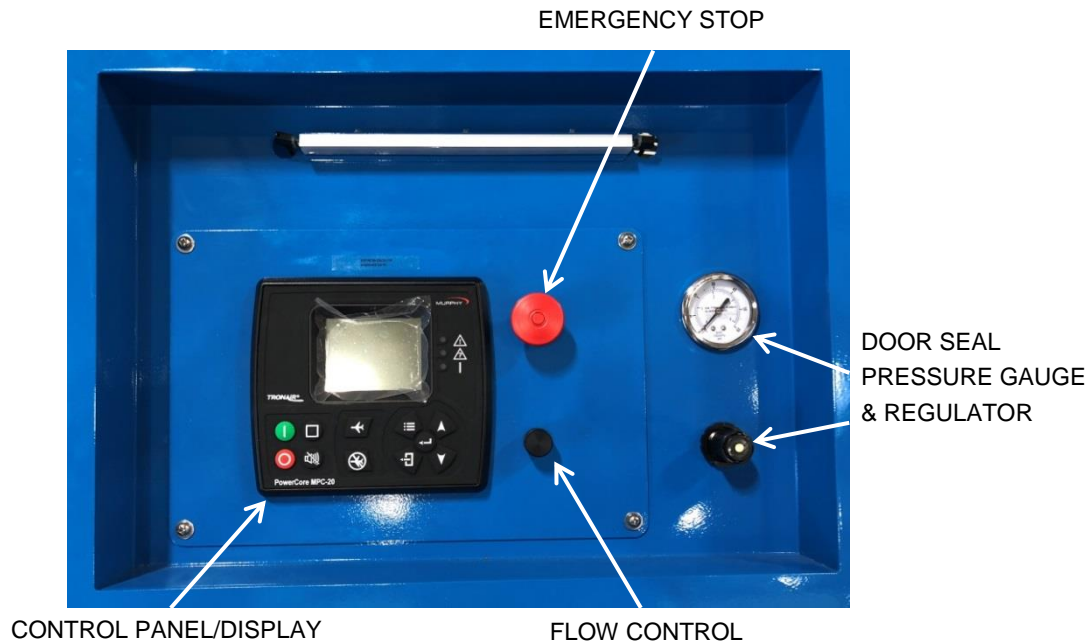
WARNING!

To prevent personal injury and/or damage to aircraft:

1. **ALWAYS** follow aircraft manual procedures for aircraft pressurization.
2. **NEVER** exceed specified aircraft pressure levels.
3. **Never** operate this CPU prior to reading this manual.
4. **Never** open any aircraft cabin door or access panel if there is any pressure in the cabin.
5. **ALWAYS** use applicable safety equipment required for aircraft pressurization tests.

6.2 LOCATION & LAYOUT OF CONTROLS

OPERATOR PANEL

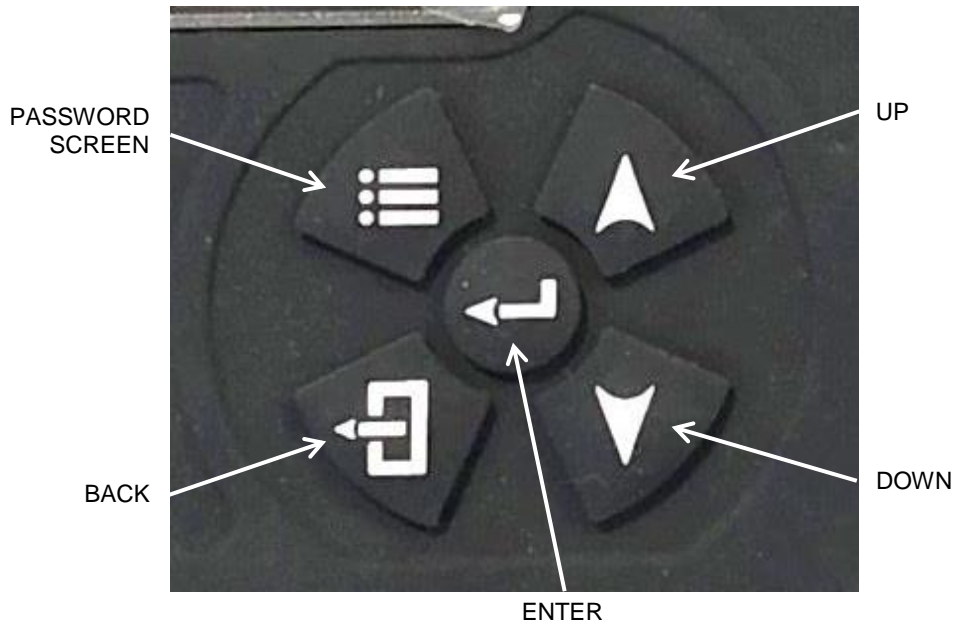


6.2 LOCATION & LAYOUT OF CONTROLS (continued)

CONTROL PANEL/DISPLAY



MULTI-FUNCTION KEYS

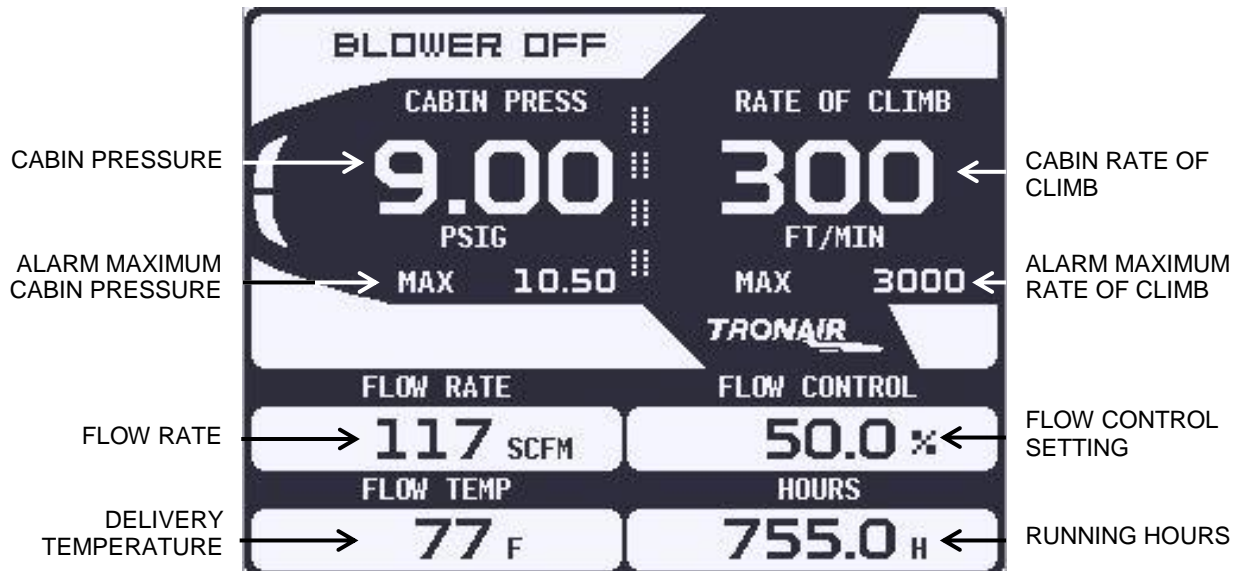


6.2 LOCATION & LAYOUT OF CONTROLS (continued)

MAIN SCREEN (SLEEP MODE)

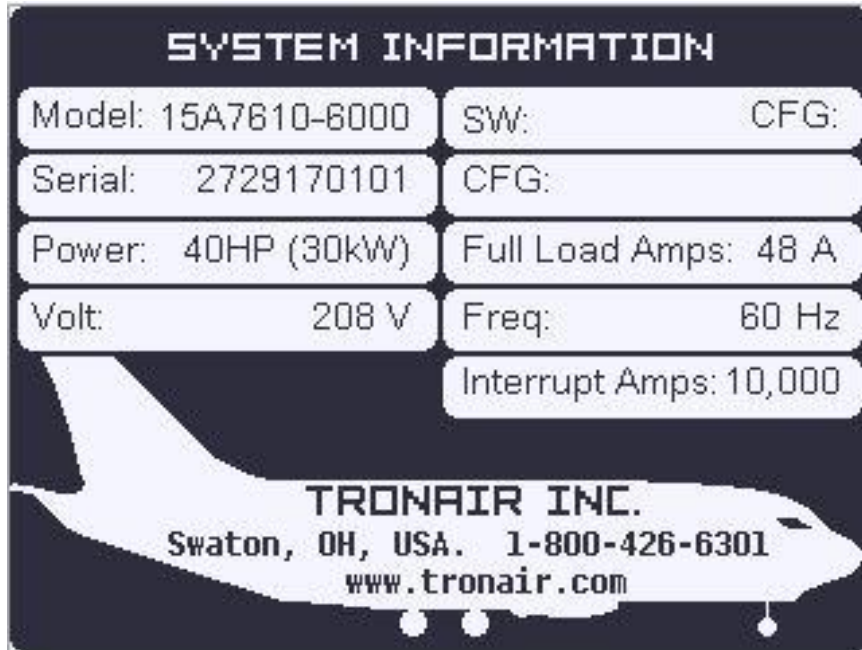


MAIN OPERATING SCREEN



6.2 LOCATION & LAYOUT OF CONTROLS (continued)

SYSTEM INFORMATION



Press the **Password** button; Press the **Enter** button four times (0000);

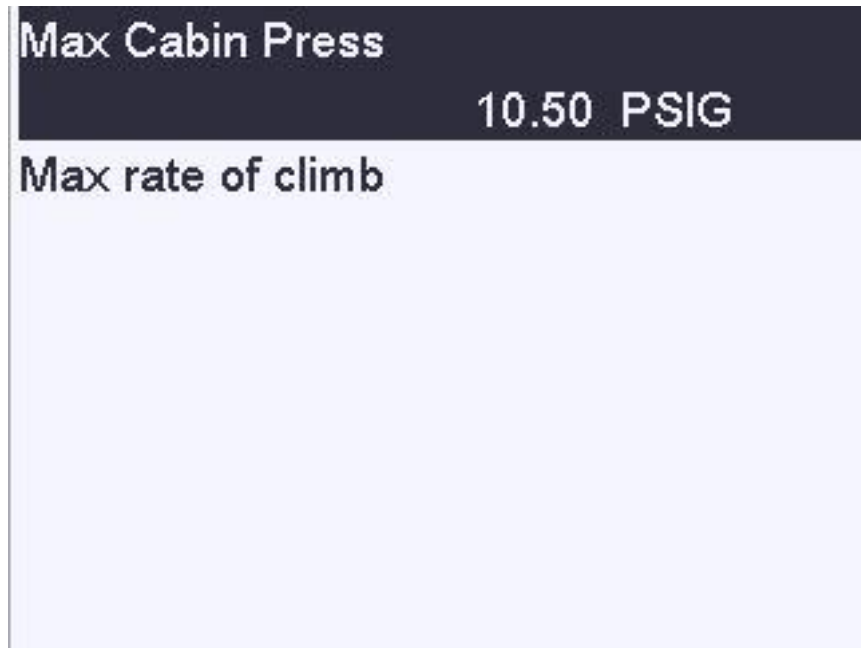


6.2 LOCATION & LAYOUT OF CONTROLS *(continued)*

The Tronair screen allows operators to set the **Maximum Cabin Pressure** and **Rate of Climb warning** values.

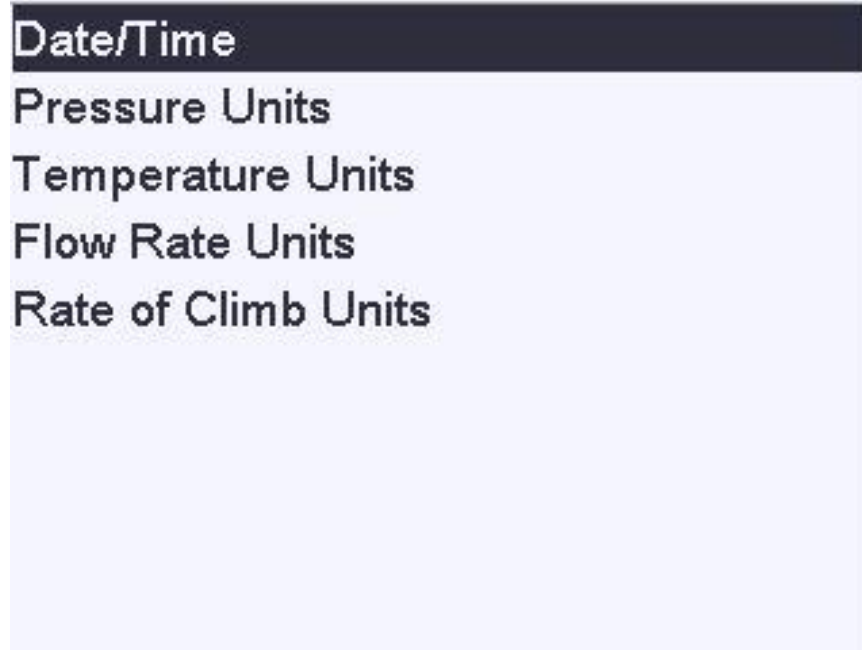


The Tronair screen allows operators to set the **Maximum Cabin Pressure** and **Rate of Climb warning** values.



6.2 LOCATION & LAYOUT OF CONTROLS *(continued)*

The System screen allows the operator to set **units** for the various display values.



Units available in the software:

- Pressure Units – PSIG or PSIA
- Temperature Units - °F or °C
- Flow Rate Units – SCFM or LB/MIN
- Rate of Climb Units – FT/MIN or M/SEC

6.3 START UP PROCEDURES

- Electrical connections are to be made by a qualified **electrician** per all applicable codes and regulations
- Attach the customer supplied electrical plug to the power cord, plug must be properly rated for the application
- After electrical connections to facilities supply is complete, open the ball valve located on the back of the unit, turn the airflow control fully counter clockwise, and turn on the electrical disconnect on the unit
- The unit will go through a check procedure. Press the “Start” button – the blower will start spinning
- **Verify** air is blowing **out** the exhaust vent located on the back bottom of the unit.
- If not, **remove** electrical power from the unit and switch any two supply power supply wires at the fused disconnect **INPUT** side, located inside the electrical box on the machine
- **Verify** air is blowing **out** the exhaust vent located on the back bottom of the unit.

6.4 ADJUSTMENTS FOR OPERATION

- Set the Maximum cabin pressure and maximum rate of climb in the software. This is a warning system, NOT a control system. Constant monitoring of the cabin condition must be done while operating this unit.
- Connect the supply line and cabin sense line to the aircraft.
- Connect the door seal supply and compressed source if required.
- Fully open the supply line ball valve
- Adjust the flow control to minimum value (fully CCW).
- Press the start button
- Observe that the cabin pressure and rate of climb values respond, this is a verification that the cabin sense line is properly connected
- SLOWLY increase the flow control until the desired cabin pressure is achieved
- Constantly monitor the cabin rate of climb to assure the maximum acceptable value is not exceeded
- When the desired cabin pressure is achieved and the cabin rate of climb is at 0.00
- Read the flow rate entering the cabin, this is the aircraft leak rate
- Keep the unit running while the cabin is pressurized
- To decrease the cabin pressure, a similar procedure is used
- SLOWLY decrease the flow control until the desired cabin pressure is achieved
- Constantly monitor the cabin rate of climb to assure the maximum acceptable value is not exceeded
- When the flow control is at the fully CCW position and the cabin rate of climb is 0.00
- Press the stop button
- Disconnect the supply, cabin sense, and door seal hoses from the aircraft

6.5 EMERGENCY SHUT DOWN PROCEDURE

- If The Aircraft Is NOT Pressurized - Press the “EMERGENCY STOP” button.
- If The Aircraft IS Pressurized - Shut the ball valve, Press the “EMERGENCY STOP” button.

6.6 DESCRIPTION OF ALARM SYSTEMS

Set the Maximum cabin pressure and maximum rate of climb in the software. This is a warning system, NOT a control system. Constant monitoring of the cabin condition must be done while operating this unit.

7.0 PACKAGING AND STORAGE

Packaging for shipment should include a suitable pallet with surrounding crating to prevent damage to unit. The machine should be securely strapped to the pallet. Rings for this purpose are located at either end of the machine, on the bottom of the frame.

7.1 HANDLING

The Cabin Pressurization Unit can be rolled freely by hand. If required, the unit may be lifted, by a suitable fork truck, from any side provided that the forks extend thru to the side opposite the fork truck.

7.2 STORAGE ENVIRONMENT

The Cabin Pressurization Unit is suitable for either indoor or outdoor storage. While moisture sensitive components are sealed from falling rain, it is recommended that a soft tarp be used to cover the machine if stored outdoors.

8.0 TRANSPORTATION

- Rings are provided at either end of the machine for tie down points.
- The unit may be lifted by a fork truck from any side, provided the forks extend to the side opposite the fork truck.
- A handle is provided for manually rolling the machine.
- No other handling points are provided.

9.0 TROUBLE SHOOTING

| PROBLEM | PROBABLE CAUSE | REMEDY |
|---|---------------------------------------|---|
| Cannot build required cabin air pressure – Flow high | Excessive cabin leakage | Assure all aircraft inspection panels in place |
| | | Assure door seal inflated |
| | | Assure aircraft cabin air controls are properly set Check outflow and safety valves |
| Cannot build required cabin air pressure – Flow low | Back pressure loss in aircraft system | Assure aircraft cabin air controls are set properly |
| | | Common on aircraft where CPU air enters upstream of aircraft mass air flow valve Re-plumb downstream of aircraft mass air flow valve |
| Low CPU output pressure and/or flow | Loose belts | Tighten belt/Replace belts |
| | Dirty inlet filter | Replace filter |
| | Low power | Check for facility blown fuse, loose wire |
| No CPU output (Motor not running) | No inlet power | Check facility |
| | Overload relay tripped | Power switch in OFF position, allow unit to cool and restart unit |
| | Failed motor | Replace motor |
| No CPU output (Motor running) | Blocked inlet | Inspect inlet silencer/filter for blockage and correct |
| | Leakage between unit and aircraft | Leak check hose connections and over all hose |
| | Drive belts failed | Inspect and tighten or replace |
| | Failed blower | Blower needs Maintenance |

10.0 MAINTENANCE

10.1 BLOWER

Oil level in the blower should be checked every 100 hours of running time. Level is correct when oil is just running out the blower fill port when at room temperature.

10.2 FILTER

Air inlet filter should be replaced every 50 hours of running time in a clean environment. If used in a dirty environment or performance is reduced, replace as needed.

11.0 PROVISION OF SPARES

11.1 SOURCE OF SPARE PARTS

Spare parts may be obtained from the manufacturer:

TRONAIR, Inc. Telephone: (419) 866-6301 or 800-426-6301
 1 Air Cargo Pkwy East Fax: (419) 867-0634
 Swanton, Ohio 43558 USA E-mail: sales@tronair.com
 Website: www.tronair.com



For Spare Parts, Operations & Service Manuals or Service Needs:
 Scan the QR code or visit Tronair.com/aftermarket

11.2 BLOWER

| Part Number | Description | Qty |
|-------------|-----------------|-----|
| H-4141 | BLOWER 325 SCFM | 1 |

11.3 FILTER

| Part Number | Description | Qty |
|-------------|-------------------------|-----|
| K-5242 | KIT, REPLACEMENT FILTER | 1 |

11.4 EXTERNAL COMPONENTS

| Part Number | Description | Qty |
|-------------|-----------------------------|-----|
| Z-11194 | ASSEMBLY, HOSE (SUPPLY) | 1 |
| Z-1697-02 | ASSEMBLY, HOSE (SENSE) | 1 |
| Z-1698-02 | ASSEMBLY, HOSE (DOOR SEAL) | 1 |
| U-1100 | CASTER, SWIVEL | 2 |
| U-1099 | CASTER, RIGID | 2 |
| EC-2420 | LIGHT, TOWER | 1 |
| H-2657 | GAGE, PRESSURE 0-60 PSI/BAR | 1 |

11.5 REPLACEMENT LABELS PARTS LIST

| LABEL NO. | DESCRIPTION | QTY. |
|-----------|------------------------|------|
| V-1001 | MADE IN USA | 1 |
| V-1050 | ISO ELECTRICAL SHOCK | 1 |
| V-1340-04 | TRONAIR | 3 |
| V-1814 | WARNING KEEP 5FT | 2 |
| V-1850 | MAX TOW | 1 |
| V-1986 | READ MANUAL | 1 |
| V-2023 | FORKLIFT POINT | 4 |
| V-2083 | 28.5V | 2 |
| V-2096 | DANGER | 3 |
| V-2097 | WARNING | 1 |
| V-2099 | WARNING | 1 |
| V-2108 | BATTERY SWITCH | 1 |
| V-2109 | FILL RATE | 1 |
| V-2113 | MAX TIRE PRESSURE | 3 |
| V-2562 | DIESEL ONLY | 1 |
| V-2625 | 400 HZ | 2 |
| V-2669 | OPERATING INSTRUCTIONS | 1 |
| V-2765 | DEF FLUID | 1 |
| V-2773 | 28.5VDC | 1 |
| V-2774 | 400 HZ | 1 |

11.6 RECOMMENDED SPARE PARTS LISTS

Reference the following page(s) for Replacement Parts and Kits available.

| Part Number | Description | Qty |
|-----------------|-----------------------------|-----|
| H-4178 | DRIVE BELT | 2 |
| K-5242 | KIT, REPLACEMENT FILTER | 2 |
| H-2657 | GAGE, PRESSURE 0-60 PSI/BAR | 1 |
| Z-11194 | ASSEMBLY, HOSE (SUPPLY) | 1 |
| Z-1697-02 | ASSEMBLY, HOSE (SENSE) | 1 |
| Z-1698-02 | ASSEMBLY, HOSE (DOOR SEAL) | 1 |
| TF-1153-064.43 | TUBE, PTFE 1/4" | 1 |
| EC-3059 | POTENTIOMETER | 1 |
| EC-3119 | RTDT, TRANSDUCER | 1 |
| EC-3060 | PRESSURE TRANSDUCER | 1 |
| SEE PARTS LISTS | FUSES, MAIN POWER | 3 |
| SEE PARTS LISTS | FUSES, POWER SUPPLY | 2/3 |
| SEE PARTS LISTS | FUSES, HEAT EXCHANGER MOTOR | 3 |

12.0 CALIBRATION OF INSTRUMENTATION

SYSTEM PRESSURE CALIBRATION

| Applied Pressure (System Pressure Gauge) (psig) | Minimum Acceptable (psig) | Maximum Acceptable (psig) | Gauge Movement (Direction) | Indicated Pressure (Calibration Gauge) (psig) |
|--|---------------------------------|---------------------------------|-------------------------------|---|
| 5.00 | 4.81 | 5.19 | Increasing | |
| 10.00 | 9.81 | 10.19 | Increasing | |
| 15.00 | 14.81 | 15.19 | Increasing | |
| 10.00 | 9.81 | 10.19 | decreasing | |
| 5.00 | 4.81 | 5.19 | decreasing | |
| Allowable operating tolerance: +/- 1.25% of full scale (15 psig) at room temperature (70° F) is +/- 0.188 psig | | | | |

13.0 IN SERVICE SUPPORT

Contact Tronair, Inc. for technical services and information. See Section 1.3 – Manufacturer.

14.0 GUARANTEES/LIMITATION OF LIABILITY

Tronair products are warranted to be free of manufacturing or material defects for a period of one year after shipment to the original customer. This is solely limited to the repair or replacement of defective components. This warranty does not cover the following items:

- a) Parts required for normal maintenance
- b) Parts covered by a component manufacturers warranty
- c) Replacement parts have a 90-day warranty from date of shipment

If you have a problem that may require service, contact Tronair immediately. Do not attempt to repair or disassemble a product without first contacting Tronair, any action may affect warranty coverage. When you contact Tronair be prepared to provide the following information:

- a) Product Model Number
- b) Product Serial Number
- c) Description of the problem

If warranty coverage is approved, either replacement parts will be sent or the product will have to be returned to Tronair for repairs. If the product is to be returned, a Return Material Authorization (RMA) number will be issued for reference purposes on any shipping documents. Failure to obtain a RMA in advance of returning an item will result in a service fee. A decision on the extent of warranty coverage on returned products is reserved pending inspection at Tronair. Any shipments to Tronair must be shipped freight prepaid. Freight costs on shipments to customers will be paid by Tronair on any warranty claims only. Any unauthorized modification of the Tronair products or use of the Tronair products in violation of cautions and warnings in any manual (including updates) or safety bulletins published or delivered by Tronair will immediately void any warranty, express or implied.

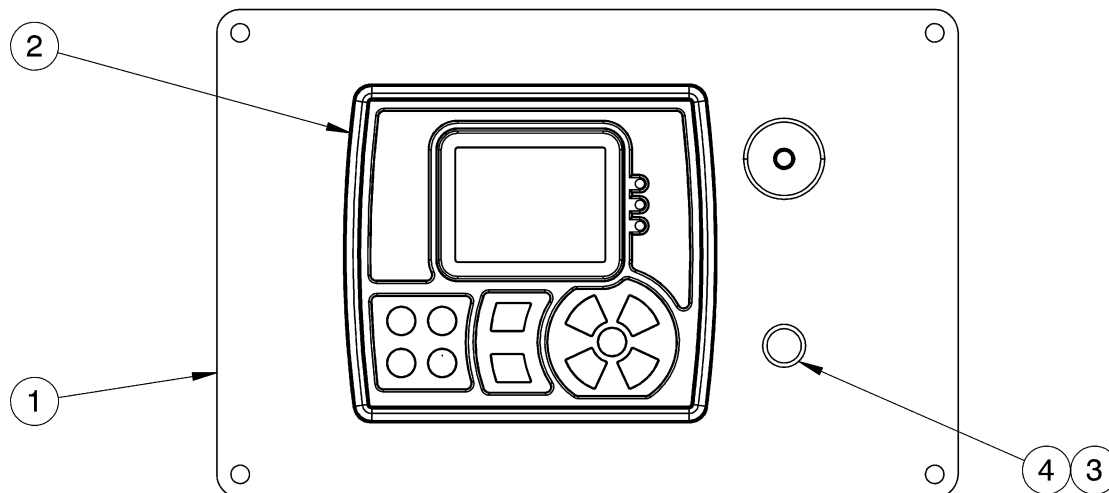
The obligations of Tronair expressly stated herein are in lieu of all other warranties or conditions expressed or implied. **Any unauthorized modification of the Tronair products or use of the Tronair products in violations of cautions and warnings in any manual (including updates) or safety bulletins published or delivered by Tronair will immediately void any warranty, express or implied and Tronair disclaims any and all liability for injury (WITHOUT LIMITATION and including DEATH), loss or damage arising from or relating to such misuse.**

15.0 APPENDICIES

| | |
|--------------|---------------------------------|
| Appendix I | Electric Schematics |
| Appendix II | Pneumatic Schematic |
| Appendix III | Blower Maintenance Data |
| Appendix IV | Motor Maintenance Data |
| Appendix V | Instrument Certification Notice |
| Appendix VI | Declaration of Conformity |

Parts List

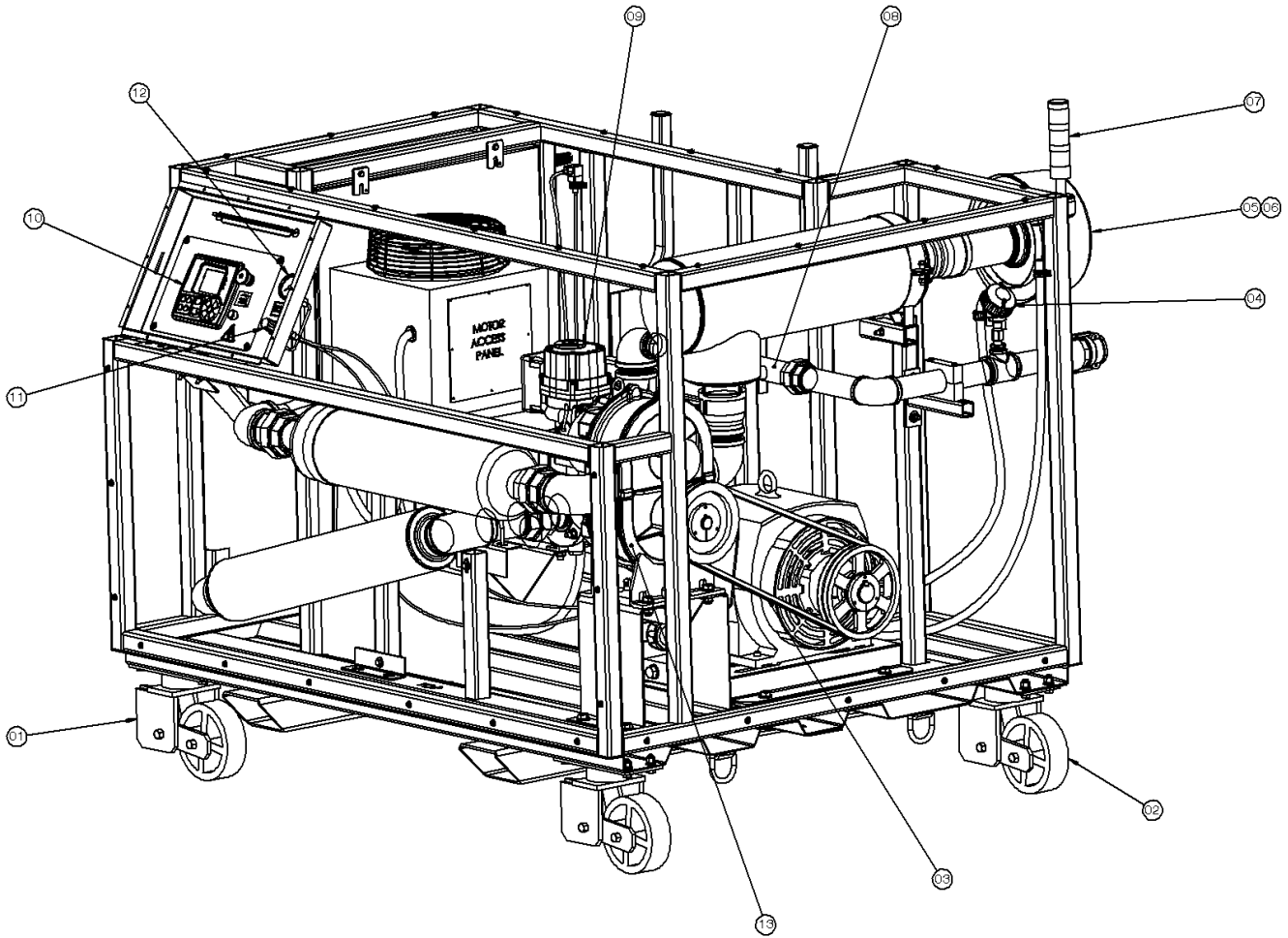
When ordering replacement parts/kits, please specify model, serial number and color of your unit.



| Item | Part Number | Description | Qty |
|------|-------------|----------------|-----|
| 1 | S-3260-01 | PANEL, CONTROL | 1 |
| 2 | EC-3441-CPU | CONTROLLER | 1 |
| 3 | EC-3059 | POTENTIOMETER | 1 |
| 4 | EC-3051 | KNOB | 1 |

Parts List

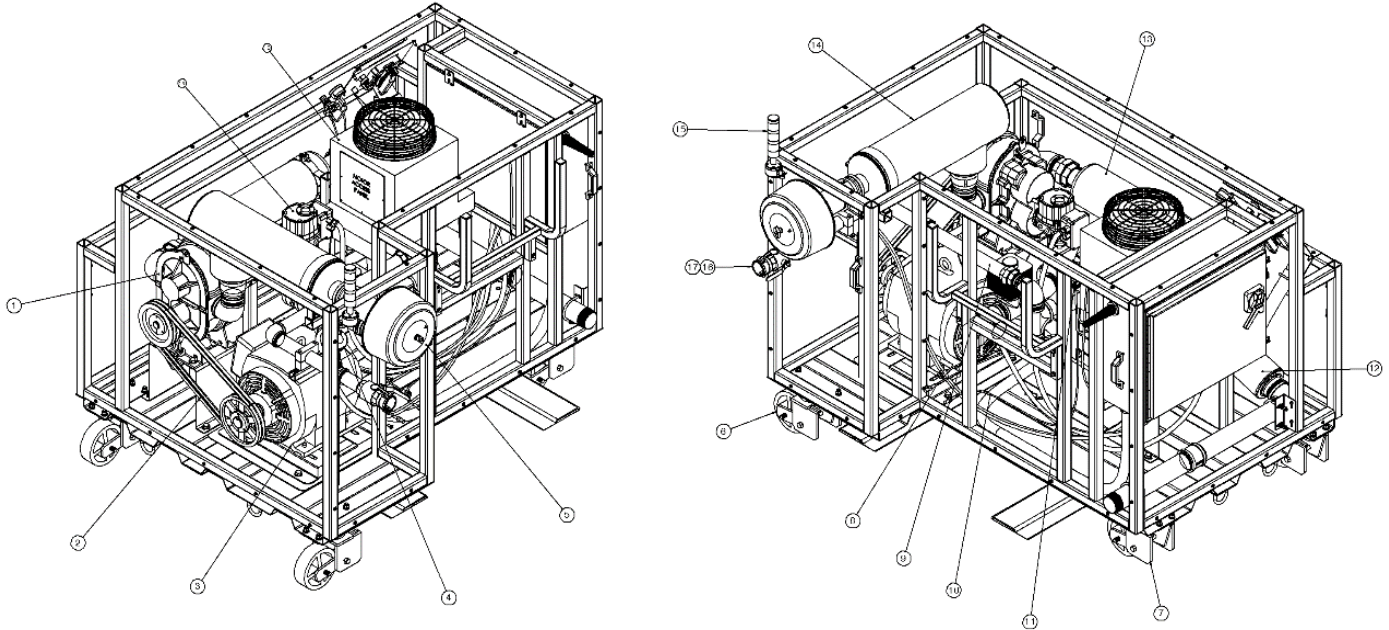
When ordering replacement parts/kits, please specify model, serial number and color of your unit.



| Item | Part Number | Description | Qty |
|------|-------------|------------------------------|-----|
| 1 | U-1100 | CASTER, SWIVEL | 2 |
| 2 | U-1099 | CASTER, RIGID | 2 |
| 3 | H-4178 | DRIVE BELT | 2 |
| 4 | EC-3119 | RTDT, TRANSDUCER | 1 |
| 5 | H-4179 | FITLER, INLET | 1 |
| 6 | K-5242 | KIT, REPLACEMENT FILTER | 1 |
| 7 | EC-2420 | LIGHT, TOWER | 1 |
| 8 | H-4385 | FLOWMETER | 1 |
| 9 | H-4142 | VALVE, BUTTERFLY 3 INCH MOD. | 1 |
| 10 | EC-3441-CPU | MURPHY PANEL & E-STOP | 1 |
| 11 | H-1397 | REGULATOR | 1 |
| 12 | H-2657 | GAGE, PRESSURE 0-60 PSI/BAR | 1 |
| 13 | H-4141 | BLOWER, 325 SCFM | 1 |
| 14 | Z-11194 | ASSEMBLY, HOSE (SUPPLY) | 1 |
| 15 | Z-1697-02 | ASSEMBLY, HOSE (SENSE) | 1 |
| 16 | Z-1698-02 | ASSEMBLY, HOSE (DOOR SEAL) | 1 |

Parts List

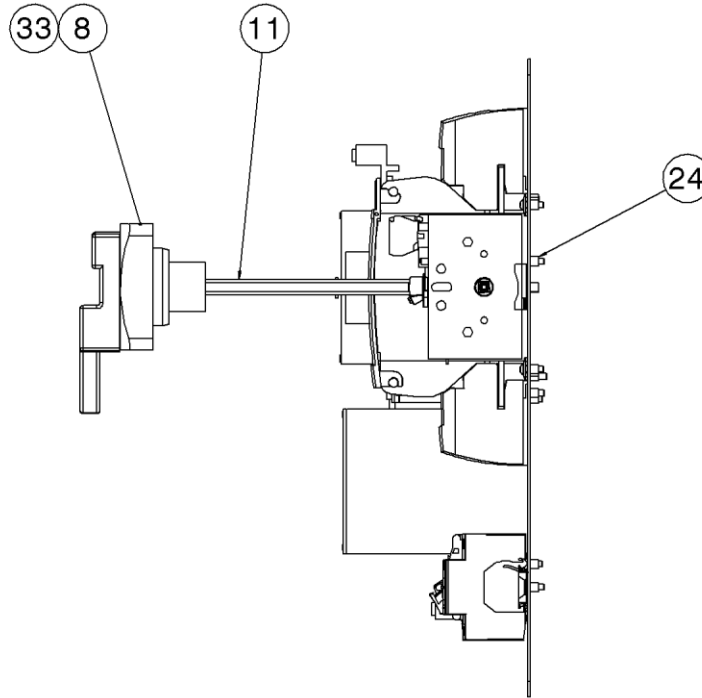
When ordering replacement parts/kits, please specify model, serial number and color of your unit.



| Item | Part Number | Description | Qty |
|------|----------------|-------------------------|-----|
| 1 | H-4141 | BLOWER 325 SCFM | 1 |
| 2 | H-4178 | DRIVE BELT | 1 |
| 3 | SEE ELECTRICAL | MOTOR, C-FACE 40HP | 1 |
| 4 | EC-3119 | RTDT, TRANSDUCER | 1 |
| 5 | H-4179 | FILTER, INLET | 1 |
| 6 | TF-1153-073.00 | TUBE, PTFE 1/4" | 1 |
| 7 | H-4385 | FLOWMETER | 1 |
| 8 | TF-1153-064.43 | TUBE, PTFE 1/4" | 1 |
| 9 | EC-1778 | CABLE, DIN CONNECTOR | 1 |
| 10 | U-1100 | CASTER, SWIVEL | 2 |
| 11 | U-1099 | CASTER, RIGID | 2 |
| 12 | H-4180 | SILENCER, BLOW OFF VENT | 1 |
| 13 | H-4187 | SILENCER, DISCHARGE | 1 |
| 14 | H-4186 | SILENCER, INLET | 1 |
| 15 | EC-2420 | LIGHT, TOWER | 1 |
| 16 | N-3073 | COUPLER, NPT | 1 |
| 17 | HC-1179 | VAVLE, BALL | 1 |
| 18 | PC-1198 | EXCHANGER, HEAT | 1 |
| 19 | H-4142 | VALVE, BUTTERFLY | 1 |

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.



THE FOLLOWING PARTS ARE APPLICATION SPECIFIC

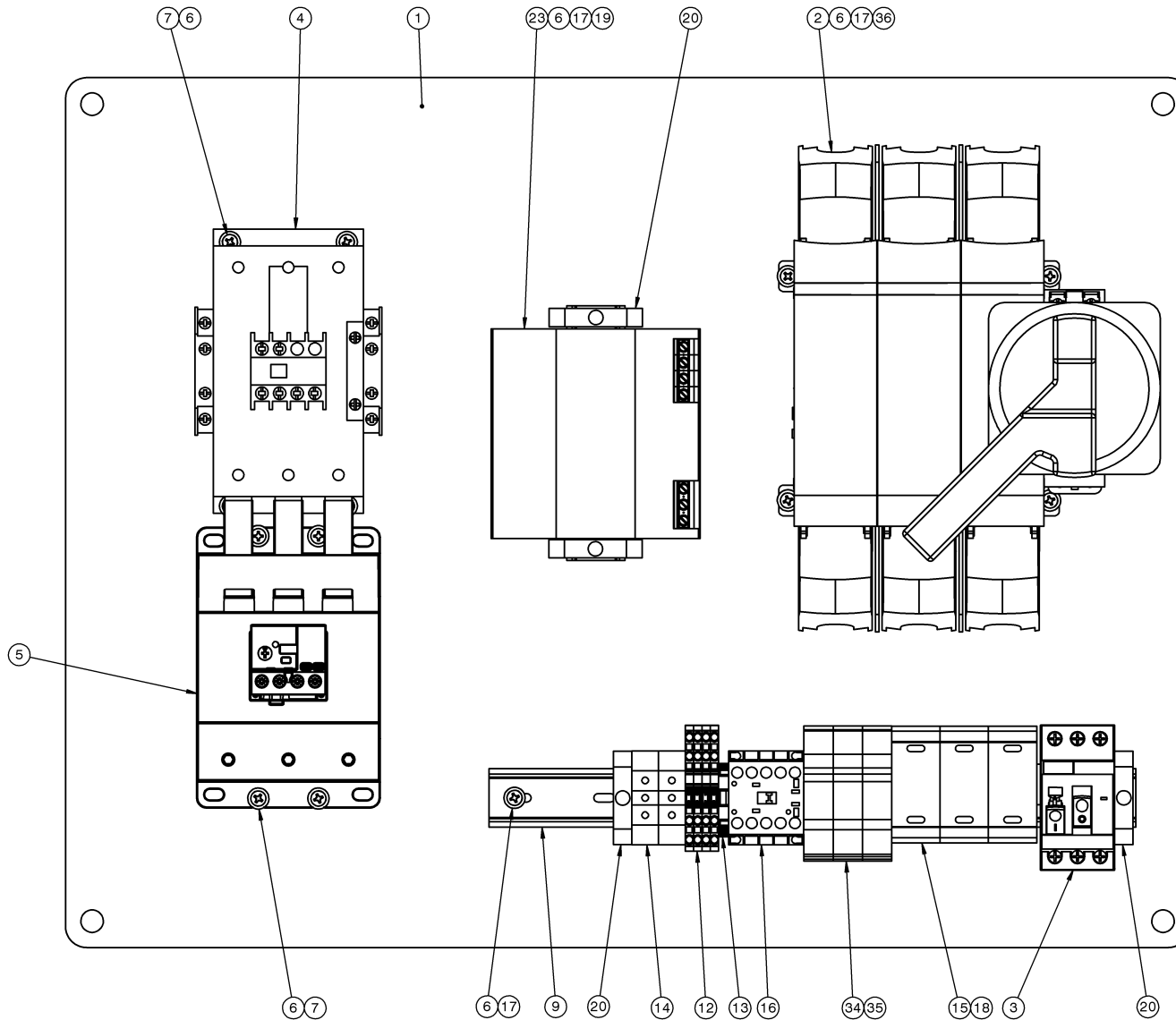
Be sure to locate the correct voltage and hertz of the unit before selecting the part

| Item | 60 Hz Applications | | | | | Description | Qty |
|------|--------------------|---------|-----|-----|---------------|-------------------------|-----|
| | 208 | 230 | 380 | 460 | 575 | | |
| 8 | | EC-2654 | | | N/A | HANDLE, DISCONNECT | 1 |
| 11 | | EC-2655 | | | N/A | SHAFT, EXTENSION | 1 |
| 24 | | | | | G-1440-1035-S | NUTSERT, 10-32 OPEN END | 26 |
| 33 | | N/A | | | S-3448-00 | ADAPTOR PLATE | 1 |

| Item | 50 Hz Applications | | | | | Description | Qty |
|------|--------------------|-----|---------------|-----|-----|-------------------------|-----|
| | 380 | 415 | 440 | 200 | 220 | | |
| 8 | | | EC-2654 | | | HANDLE, DISCONNECT | 1 |
| 11 | | | EC-2655 | | | SHAFT, EXTENSION | 1 |
| 24 | | | G-1440-1035-S | | | NUTSERT, 10-32 OPEN END | 26 |
| 33 | | | N/A | | | ADAPTOR PLATE | 1 |

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.



Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

THE FOLLOWING PARTS ARE APPLICATION SPECIFIC

Be sure to locate the correct voltage and hertz of the unit before selecting the part

| Item | 60 Hz Applications | | | | | Description | Qty |
|------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------------|-----|
| | 208 | 230 | 380 | 460 | 575 | | |
| 2 | EC-2670 | EC-2670 | EC-2653 | EC-2669 | EC-2669 | DISCONNECT, SWITCH | 1 |
| 3 | EC-3097-09 | EC-3097-09 | EC-3097-08 | EC-3097-08 | EC-3097-08 | STARTER, MOTOR | 1 |
| 4 | EC-3366 | EC-3366 | EC-3365 | EC-3365 | EC-3365 | CONTACTOR | 1 |
| 5 | EC-3349 | EC-3349 | EC-3349 | EC-3349 | EC-3349 | OVERLOAD | 1 |
| 10 | EC-1556-07 | EC-1556-06 | EC-1556-01 | EC-1557-31 | EC-1557-31 | FUSE, CLASS J | 3 |
| 18 | EC-1557-15 | EC-1557-15 | EC-1557-06 | EC-1557-06 | EC-1557-06 | FUSE, CLASS J | 3 |
| 23 | EC-3163 | EC-3163 | EC-3164 | EC-3164 | EC-3165 | POWER SUPPLY | 1 |
| 25 | PC-1198 | PC-1198 | PC-1198 | PC-1198 | PC-1207 | EXCHANGER, HEAT | 1 |
| 26 | EC-1227-07-1236 | EC-1227-06-1236 | EC-1227-02-1236 | EC-1227-02-1236 | EC-1227-01-1236 | CABLE, POWER | 1 |
| 27 | EC-1433-43 | EC-1433-42 | EC-1433-31 | EC-1433-31 | EC-1433-30 | CONNECTOR, STRAIN RELIEF | 1 |
| 28 | EC-1176-07 | EC-1176-07 | EC-1176-06 | EC-1176-06 | EC-1176-06 | LOCKNUT, CONDUIT | 1 |
| 29 | N/A | N/A | EC-1306-15 | EC-1306-15 | EC-1306-15 | WASHER, REDUCING | 2 |
| 30 | EC-1480-20 | EC-1480-20 | EC-1480-20 | EC-1480-20 | EC-1480-21 | MOTOR, NON C FACE | 1 |
| 31 | H-4174 | H-4174 | H-4174 | H-4174 | H-4174 | PULLEY, MOTOR | 1 |
| 32 | H-4178 | H-4178 | H-4178 | H-4178 | H-4178 | DRIVE BELT | 2 |
| 34 | EC-1541-03 | EC-1541-03 | EC-1541-05 | EC-1541-05 | EC-1541-05 | FUSEHOLDER | 1 |
| 35 | EC-1675-17 (qty 2) | EC-1675-17 (qty 2) | EC-1675-14 (qty 3) | EC-1675-14 (qty 3) | EC-1675-09 (qty 3) | FUSE | |
| 36 | EC-2727-01 | EC-2727-01 | N/A | N/A | N/A | LUGS, TERMINAL | 2 |
| 37 | EC-2728-02 | EC-2728-02 | N/A | N/A | N/A | SHROUD, TERMINAL | 2 |

Parts List

When ordering replacement parts/kits, please specify model, serial number and color of your unit.

THE FOLLOWING PARTS ARE APPLICATION SPECIFIC

Be sure to locate the correct voltage and hertz of the unit before selecting the part

| Item | 50 Hz Applications | | | | | Description | Qty |
|------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------------|-----|
| | 380 | 415 | 440 | 200 | 220 | | |
| 2 | EC-2653 | EC-2653 | EC-2653 | EC-2670 | EC-2670 | DISCONNECT, SWITCH | 1 |
| 3 | EC-3097-08 | EC-3097-08 | EC-3097-08 | EC-3097-09 | EC-3097-09 | STARTER, MOTOR | 1 |
| 4 | EC-3365 | EC-3365 | EC-3365 | EC-3366 | EC-3366 | CONTACTOR | 1 |
| 5 | EC-3349 | EC-3349 | EC-3349 | EC-3349 | EC-3349 | OVERLOAD | 1 |
| 10 | EC-1556-01 | EC-1556-01 | EC-1556-01 | EC-1556-06 | EC-1556-06 | FUSE, CLASS J | 3 |
| 18 | EC-1557-06 | EC-1557-06 | EC-1557-06 | EC-1557-15 | EC-1557-15 | FUSE, CLASS J | 3 |
| 23 | EC-3164 | EC-3164 | EC-3164 | EC-3163 | EC-3163 | POWER SUPPLY | 1 |
| 25 | PC-1198 | PC-1198 | PC-1198 | PC-1198 | PC-1198 | EXCHANGER, HEAT | 1 |
| 26 | EC-1227-02-1236 | EC-1227-02-1236 | EC-1227-02-1236 | EC-1227-07-1236 | EC-1227-07-1236 | CABLE, POWER | 1 |
| 27 | EC-1433-31 | EC-1433-31 | EC-1433-31 | EC-1433-43 | EC-1433-43 | CONNECTOR, STRAIN RELIEF | 1 |
| 28 | EC-1176-06 | EC-1176-06 | EC-1176-06 | EC-1176-07 | EC-1176-07 | LOCKNUT, CONDUIT | 1 |
| 29 | EC-1306-15 | EC-1306-15 | EC-1306-15 | - | - | WASHER, REDUCING | 2 |
| 30 | EC-1480-20 | EC-1480-20 | EC-1480-20 | EC-1480-20 | EC-1480-20 | MOTOR, NON C FACE | 1 |
| 31 | H-4200 | H-4200 | H-4200 | H-4200 | H-4200 | PULLEY, MOTOR | 1 |
| 32 | H-4201 | H-4201 | H-4201 | H-4201 | H-4201 | DRIVE BELT | 2 |
| 34 | EC-1541-05 | EC-1541-05 | EC-1541-05 | EC-1541-03 | EC-1541-03 | FUSEHOLDER | 1 |
| 35 | EC-1675-14 (qty 3) | EC-1675-14 (qty 3) | EC-1675-14 (qty 3) | EC-1675-17 (qty 2) | EC-1675-17 (qty 2) | FUSE | |
| 36 | N/A | N/A | N/A | EC-2727-01 | EC-2727-01 | LUGS, TERMINAL | 2 |
| 37 | N/A | N/A | N/A | EC-2728-02 | EC-2728-02 | SHROUD, TERMINAL | 2 |

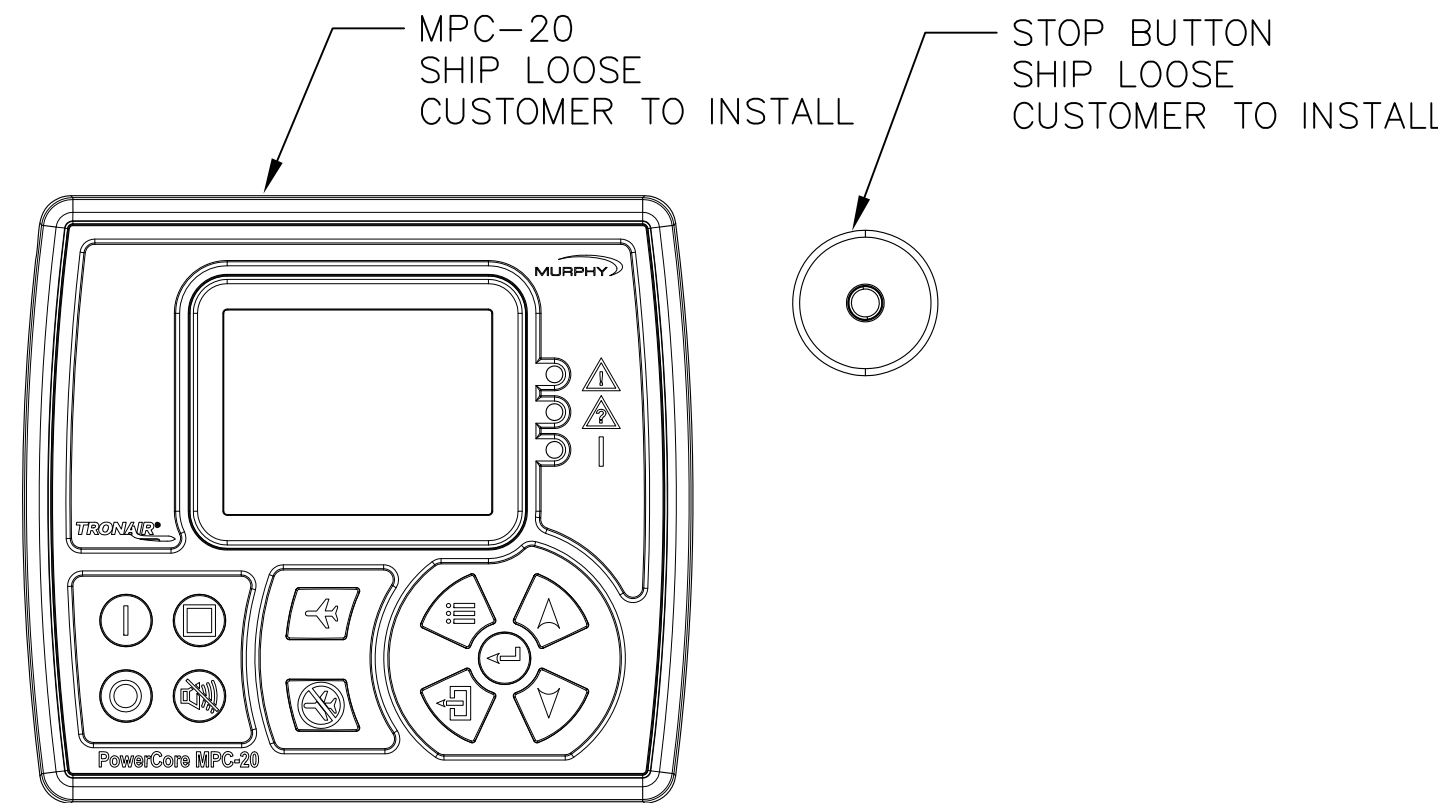
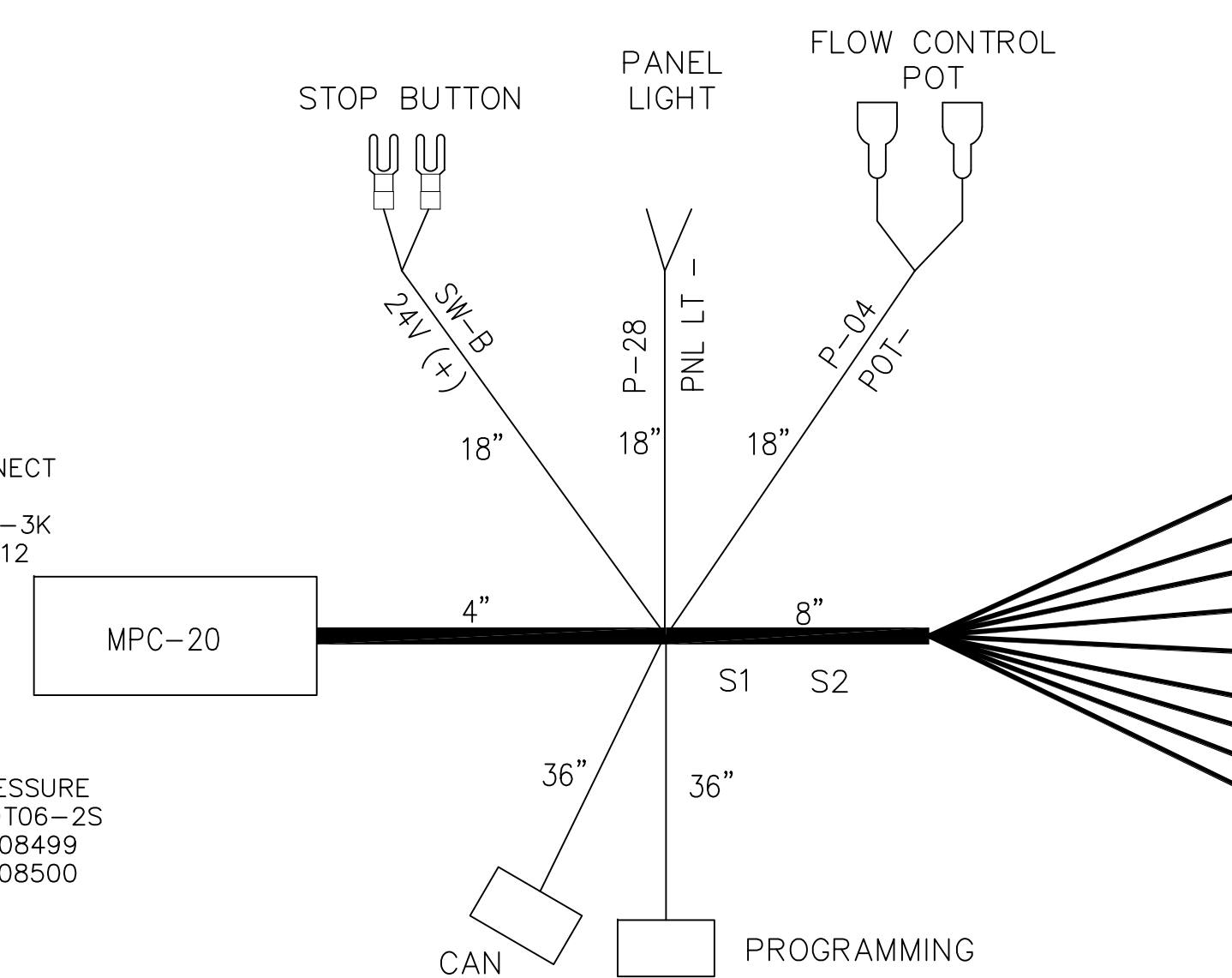
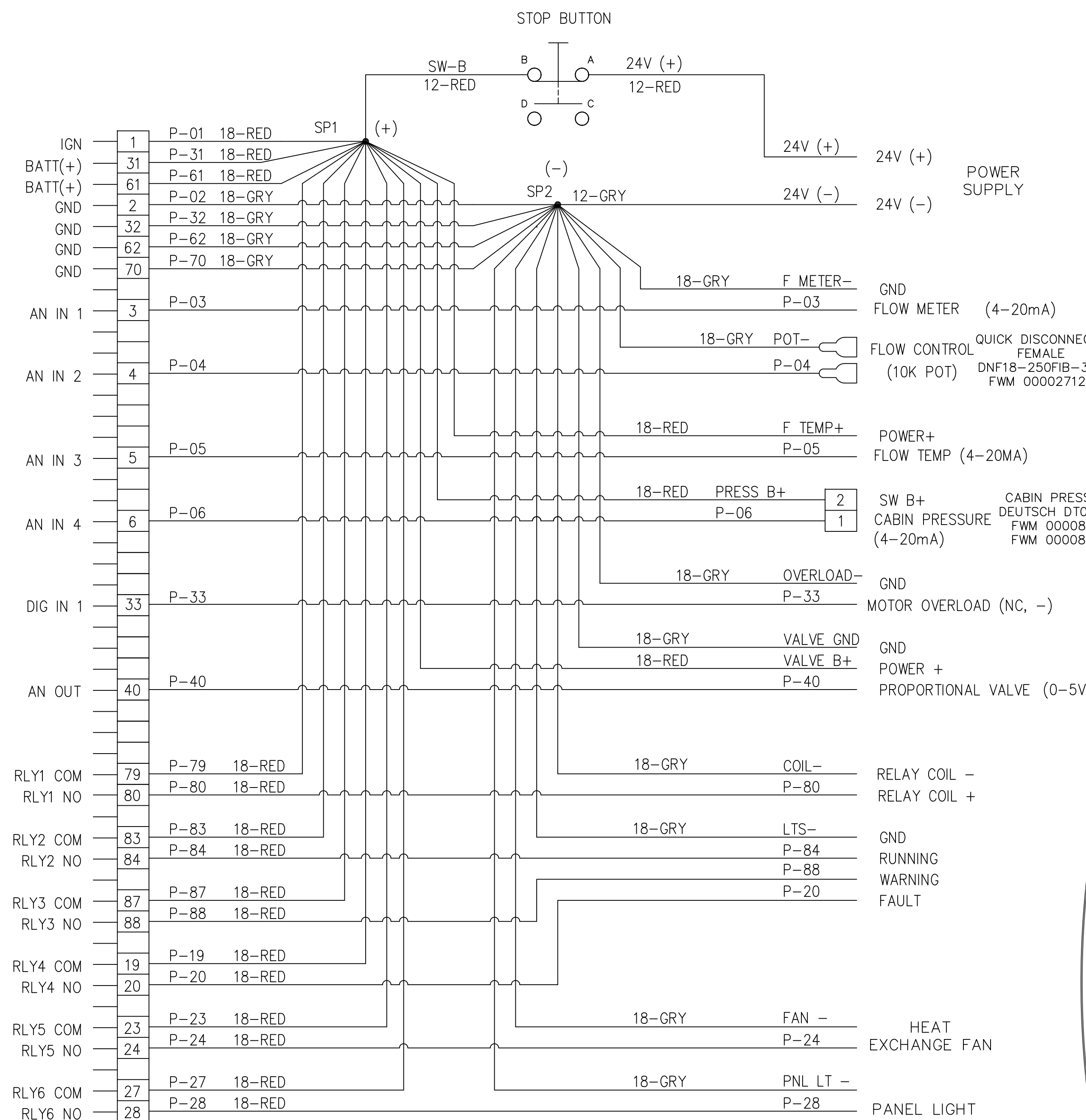
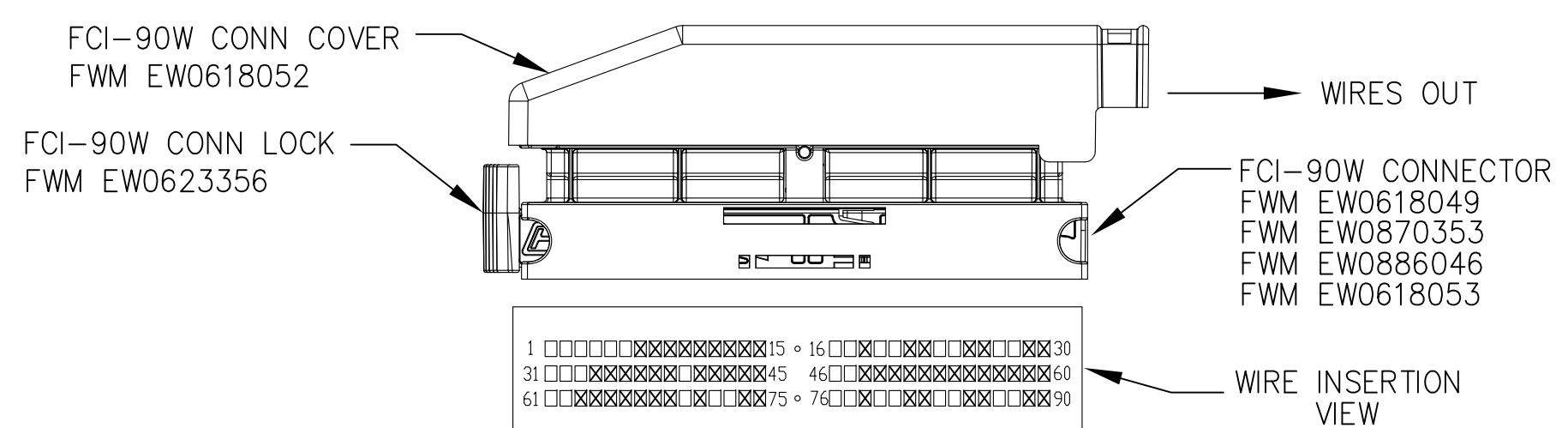


APPENDIX I

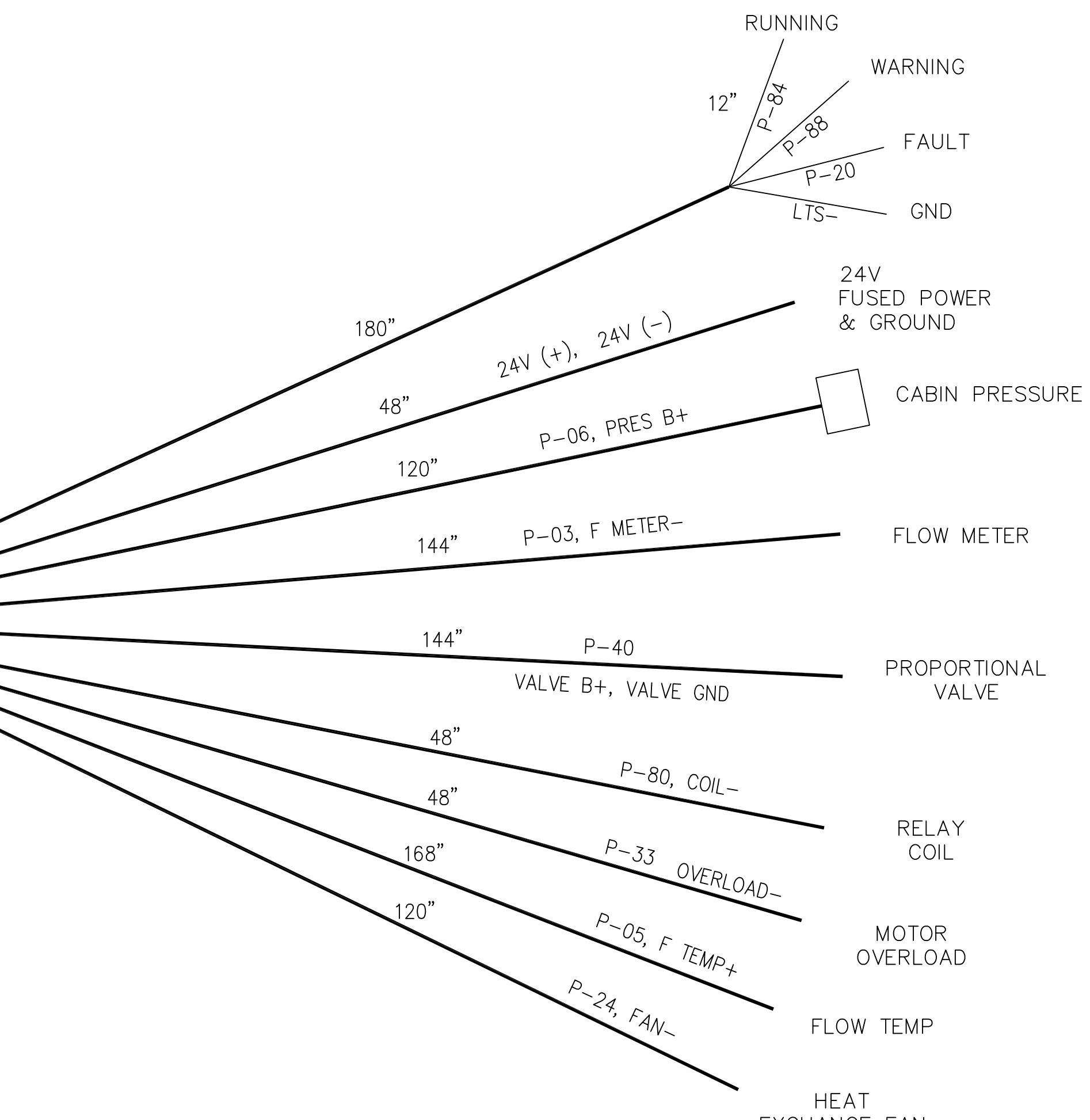
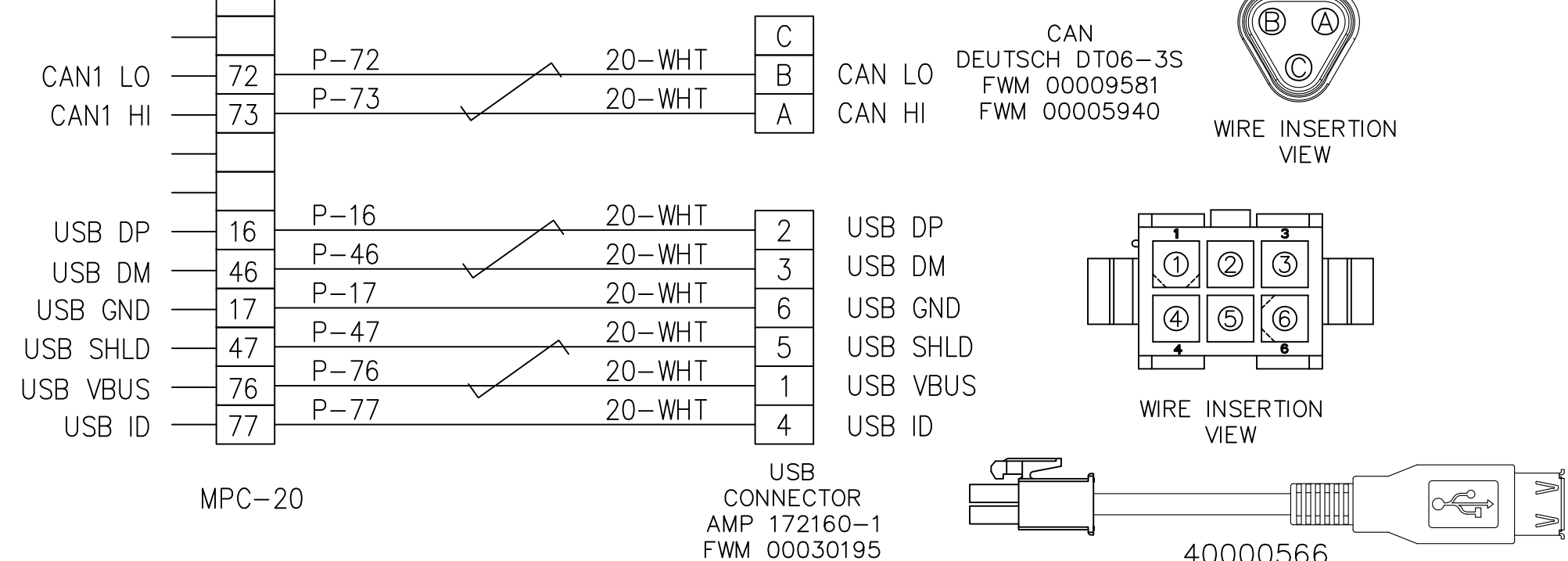
**Electrical Schematics
INS-2420 and INS-2678**

NOTES:

1. ALL WIRE TO BE 18 GAUGE, WHITE, TXL OR UL UNLESS SPECIFIED OTHERWISE.
2. = TWISTED WIRES, ABOUT ONE TWIST PER INCH.
3. MAXIMUM CURRENT 10AMP FOR EACH RELAY 1-6.
4. NO LOOM ON WIRES.



- 40350431 KIT INCLUDE:
1. HARNESS (PROGRAMMING HARNESS 40000566 INCLUDED)
 2. TRONAIR MPC-20 CONTROLLER.
 3. STOP BUTTON.
 4. PXT-K-15 W/2POS CONNECTOR KIT
 5. 10704220 (RTDT-225-400-100)



| MPC-20 CONTROLLER I/O FUNCTIONS | |
|---------------------------------|-----------------------------------|
| I/O | FUNCTION |
| RELAY OUTPUT 1 | MOTOR ON/OFF RELAY (B+, 24V) |
| RELAY OUTPUT 2 | RUNNING |
| RELAY OUTPUT 3 | WARNING |
| RELAY OUTPUT 4 | FAULT |
| RELAY OUTPUT 5 | HEAT EXCHANGER FAN |
| RELAY OUTPUT 6 | PANEL LIGHT LED |
| OUTPUT 1 [B-] | - |
| OUTPUT 2 [B-] | - |
| OUTPUT 3 [B+] | - |
| OUTPUT 4 [B+] | - |
| OUTPUT 5 [5V] | - |
| OUTPUT 6 [5V] | - |
| ANALOG INPUT 1 | FLOW RATE METER (4-20mA) |
| ANALOG INPUT 2 | FLOW RATE SETTING (10k POT) |
| ANALOG INPUT 3 | FLOW TEMPERATURE (4-20mA) |
| ANALOG INPUT 4 | CABIN PRESSURE (0-15PSI) (4-20mA) |
| ANALOG INPUT 5 | - |
| ANALOG INPUT 6 | - |
| ANALOG INPUT 7 | - |
| ANALOG INPUT 8 | - |
| DIGITAL INPUT 1 | MOTOR OVERLOAD |
| DIGITAL INPUT 2 | - |
| DIGITAL INPUT 3 | - |
| DIGITAL INPUT 4 | - |
| DIGITAL INPUT 5 | - |
| DIGITAL INPUT 6 | - |
| FREQUENCY INPUT | - |
| ANALOG OUTPUT (0-5V) | PROPORTIONAL VALVE |

| | | |
|--|---|--------------|
| REV. | CHANGES MADE | |
| MURPHY by INFLATION CONTROLS | | |
| DRAWN BY: WW | E.R.NO. IPD | |
| DATE: 06/27/2018 | CHKD. BY: AU | APPD. BY: AU |
| MODEL: | KIT, HARNESS, MPC-20 PRESSURIZATION UNIT, TRONAIR | |
| DRAWING NO. 40-35-0431 | SHEET 1 OF 1 | SIZE D |
| | | REV. A |

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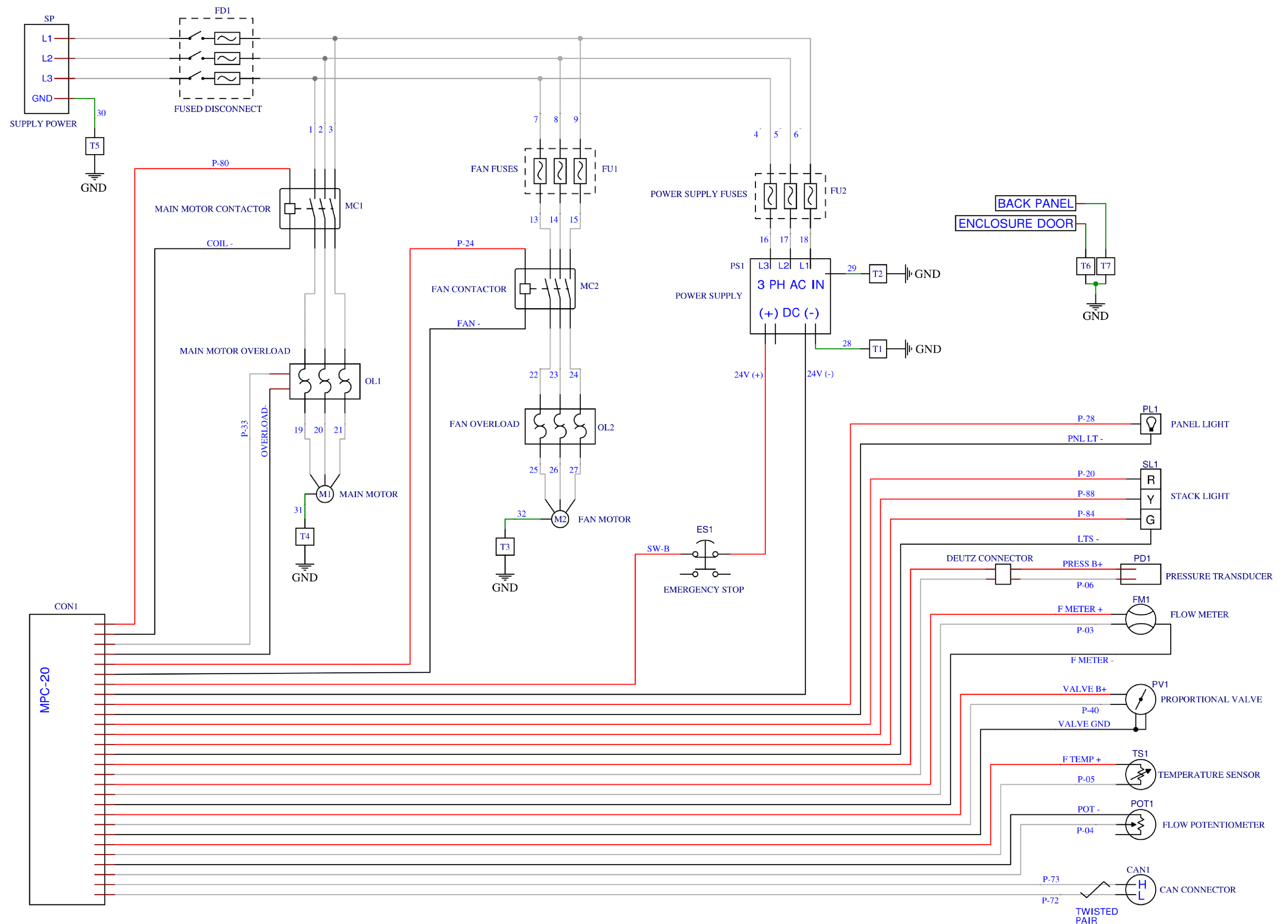
| REVISIONS | | | | | |
|-----------|------------------|-------|-----|-----|----------|
| REV | DESCRIPTION | EC# | DWN | CHK | DATE |
| A | ORIGINAL RELEASE | 21624 | NCS | PEH | 09-20-21 |

COMPONENT ABBREVIATIONS:

- FD - FUSED DISCONNECT
- MC - MOTOR CONTACTOR
- OL - OVERLOAD
- M - MOTOR
- ES - EMERGENCY STOP
- CON - MPC-20 CONTROLLER
- FU - FUSES
- PS - POWER SUPPLY
- PL - PANEL LIGHT
- SL - STACK LIGHT
- PD - PRESSURE TRANSDUCER
- FM - FLOW METER
- PV - PROPORTIONAL VALVE
- TS - TEMPERATURE SENSOR
- POT - FLOW POTENTIOMETER
- CAN - CAN BUS CONNECTOR
- T - TERMINAL BLOCK

WIRE COLORS:

- DC (+) RED
- DC (-) BLACK
- GND GREEN / YELLOW
- AC WHITE (LARGE WIRE - BLACK)



| | | |
|------------------------|---|---|
| MADE FROM N/A | BREAK ALL SHARP EDGES AND CORNERS INTERPRET PER ASME Y14.5-2009 | TRONAIR AIRCRAFT GROUND SUPPORT EQUIPMENT |
| MATERIAL N/A | DIMENSIONS IN INCHES AND TOLERANCES PER BELOW UNLESS OTHERWISE SPECIFIED: DIMENSION INCH [mm]: .X [X] ± .1 [3] .XX [X] ± .03 [0.8] .XXX [XX] ± .010 [0.25] .XXXX [XXX] ± .0030 [0.076] | |
| FINISH N/A | FRACTION INCH [mm]: 1/XX [1/X] ± 1/16 [1.6] | DWN BY NCS |
| THIRD ANGLE PROJECTION | ANGULAR DEGREE [RADIAN]: X [XXX] ± .5 [0.01] | CKD BY PEH |
| SCALE: 1:4 | SIZE C | DATE 08/12/2021 |
| DO NOT SCALE DRAWING | | SHEET 1 OF 1 |

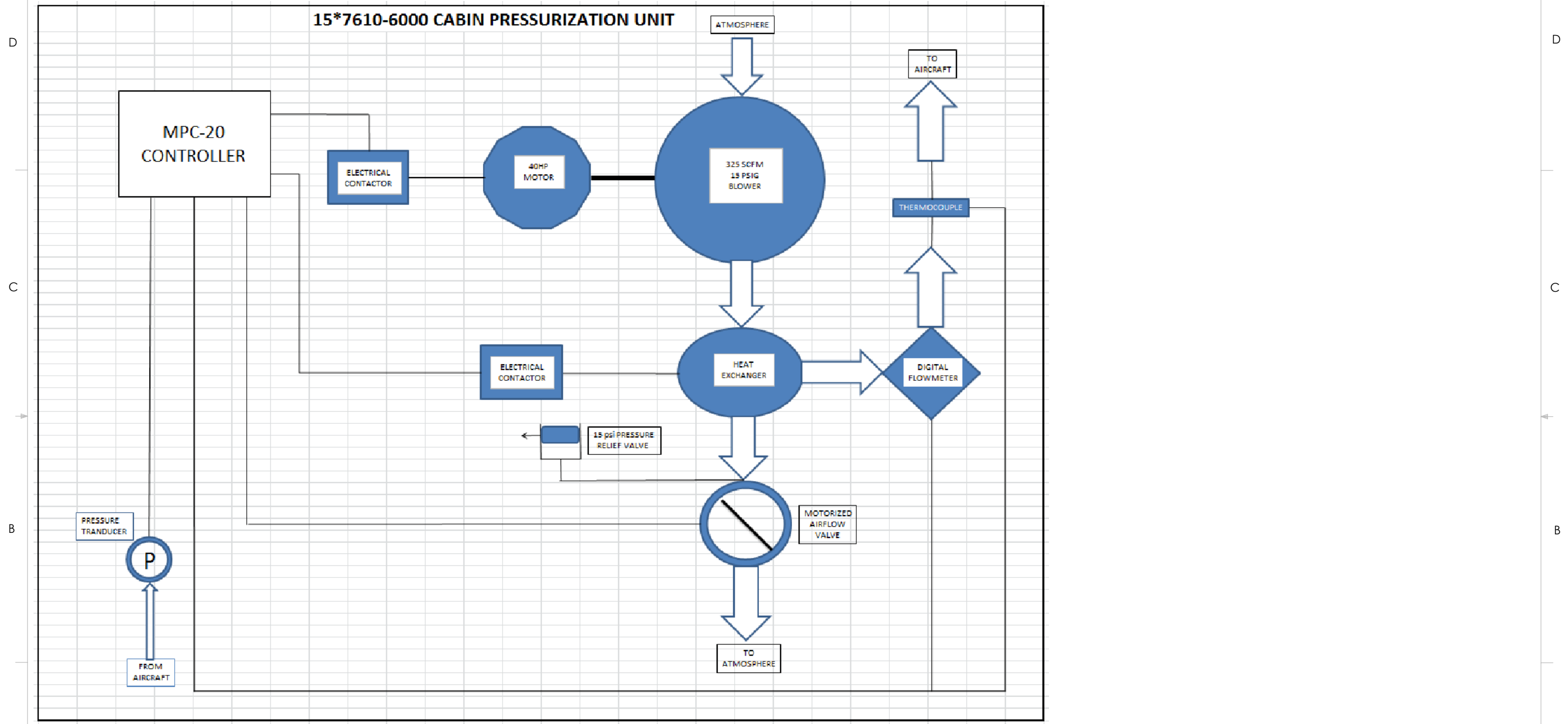


APPENDIX II

Pneumatic Schematic INS-2421

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| REVISIONS | | | | | |
|-----------|------------------|-------|-----|-----|------------|
| REV | DESCRIPTION | EC# | DWN | CHK | DATE |
| A | ORIGINAL RELEASE | 20856 | - | - | 02-13-2020 |



GEOMETRIC TOLERANCE SYMBOLS

| | |
|------------------------------|---------------------|
| ⊙ CONCENTRICITY | ⊥ PERPENDICULARITY |
| ≡ SYMMETRICAL | — STRAIGHTNESS |
| // PARALLELISM | ∠ ANGULARITY |
| ▭ FLATNESS | ↗ CIRCULAR RUNOUT |
| ⊗ MOST MATERIAL CONDITION | ⌒ PROFILE OF A LINE |
| △ PROFILE OF A SURFACE | ⊘ CYLINDRICITY |
| ⓪ LEAST MATERIAL CONDITION | ↗ TOTAL RUNOUT |
| Ⓢ REGARDLESS OF FEATURE SIZE | *** BASIC DIMENSION |
| ⊕ POSITION | □ DATUM |
| ○ CIRCULARITY | |

MODEL NUMBER:

MADE FROM

MATERIAL

FINISH

THIRD ANGLE PROJECTION

SCALE: 1:1

DO NOT SCALE DRAWING

SIZE **B**

BREAK ALL SHARP EDGES AND CORNERS
 () INDICATES REFERENCE DIMENSIONS
 ⊖ ITEM NUMBER ABOVE, QUANTITY BELOW

UNLESS OTHERWISE SPECIFIED:

.X[X] ± .100[3]
 .XX[X] ± .030[0.8]
 .XXX[.XX] ± .010[0.25]
 .XXXX[.XXX] ± .003[0.076]

FRACTION INCH[mm]:
 1/XX[1/X] ± 1/16[1.6]

ANGULAR: DEGREE [RADIANS]
 X[XXX] ± .5[0.01]

TRONAIR AIRCRAFT GROUND SUPPORT EQUIPMENT

DWN BY PEH CKD BY PEH DATE 04/08/2020

SCHEMATIC, PNEUMATIC

INS-2421 REV **A**



APPENDIX III

Blower Maintenance Data



Universal RAI[®], URAI-DSL, URAI-G and Metric Series

Contents

| | | | |
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| Information Summary | 1 | Inspection & Maintenance. | 11 |
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| Installation. | 4 | Assembly Drawings. | 17-22 |
| Lubrication. | 8 | Parts List. | 23-24 |
| Operation. | 9 | Basic Connection & Drive Shaft Information. | 25-27 |
| Troubleshooting. | 10 | | |

Do These Things To Get The Most From Your ROOTS[®] blower

- Check shipment for damage. If found, file claim with carrier and notify ROOTS.
- Unpack shipment carefully, and check contents against Packing List. Notify ROOTS if a shortage appears.
- Store in a clean, dry location until ready for installation. Lift by methods discussed under INSTALLATION to avoid straining or distorting the equipment. Keep covers on all openings. Protect against weather and corrosion if outdoor storage is necessary.
- Read OPERATING LIMITATIONS and INSTALLATION sections in this manual and plan the complete installation.
- Provide for adequate safeguards against accidents to persons working on or near the equipment during both installation and operation. See SAFETY PRECAUTIONS.
- Install all equipment correctly. Foundation design must be adequate and piping carefully done. Use recommended accessories for operating protection.
- Make sure both driving and driven equipment is correctly lubricated before start-up. See LUBRICATION.**
- Read starting check points under OPERATION. Run equipment briefly to check for installation errors and make corrections. Follow with a trial run under normal operating conditions.
- In event of trouble during installation or operation, do not attempt repairs of ROOTS furnished equipment. Notify ROOTS, giving all nameplate information plus an outline of operating conditions and a description of the trouble. Unauthorized attempts at equipment repair may void ROOTS warranty.
- Units out of warranty may be repaired or adjusted by the owner. Good inspection and maintenance practices should reduce the need for repairs.

NOTE: Information in this manual is correct as of the date of publication. ROOTS reserves the right to make design or material changes without notice, and without obligation to make similar changes on equipment of prior manufacture.

For your nearest ROOTS Office, dial our Customer Service Hot Line toll free; 1 877 363 ROOT(S) (7668) or direct 281-966-4700.



**ROOTS® products are sold subject to the
current General Terms of Sale, GTS-5001
and Warranty Policy WP-5020. Copies are
available upon request.**

**Contact your local ROOTS Office
or ROOTS Customer Service**

**Hot Line 1-877-363-ROOT(S) (7668) or
direct 281-966-4700.**

Safety Precautions

It is important that all personnel observe safety precautions to minimize the chances of injury. Among many considerations, the following should be particularly noted:

- Blower casing and associated piping or accessories may become hot enough to cause major skin burns on contact.
- Internal and external rotating parts of the blower and driving equipment can produce serious physical injuries. Do not reach into any opening in the blower while it is operating, or while subject to accidental starting. Protect external moving parts with adequate guards.
- Disconnect power before doing any work, and avoid bypassing or rendering inoperative any safety or protective devices.
- If blower is operated with piping disconnected, place a strong coarse screen over the inlet and avoid standing in the discharge air stream. **CAUTION: Never cover the blower inlet with your hand or other part of body.**
- Stay clear of the blast from pressure relief valves and the suction area of vacuum relief valves.
- Use proper care and good procedures in handling, lifting, installing, operating and maintaining the equipment.
- Casing pressure must not exceed 25 PSI (1725 mbar) gauge. Do not pressurize vented cavities from an external source, nor restrict the vents without first consulting ROOTS.
- Do not use air blowers on explosive or hazardous gases.
- Other potential hazards to safety may also be associated with operation of this equipment. All personnel working in or passing through the area should be trained to exercise adequate general safety precautions.

Operating Limitations

A ROOTS blower or exhauster must be operated within certain approved limiting conditions to enable continued satisfactory performance. Warranty is contingent on such operation.

Maximum limits for pressure, temperature and speed are specified in TABLE 1 for various models & sizes of blowers & exhausters. These limits apply to all units of normal construction, when operated under standard atmospheric conditions. Be sure to arrange connections or taps for instruments, thermometers and pressure or vacuum gauges at or near the inlet and discharge connections of the unit. These, along with a tachometer, will enable periodic checks of operating conditions.

PRESSURE – The pressure rise, between inlet and discharge, must not exceed the figure listed for the specific unit frame size concerned. Also, in any system where the unit inlet is at a positive pressure above atmosphere a maximum case rating of 25 PSI gauge (1725 mbar) should not be exceeded without first consulting the ROOTS. Never should the maximum allowable differential pressure be exceeded.

On vacuum service, with the discharge to atmospheric pressure, the inlet suction or vacuum must not be greater than values listed for the specific frame size.

TEMPERATURE – Blower & exhauster frame sizes are approved only for installations where the following temperature limitations can be maintained in service:

- Measured temperature rise must not exceed listed values when the inlet is at ambient temperature. Ambient is considered as the general temperature of the space around the unit. This is not outdoor temperature unless the unit is installed outdoors.
- If inlet temperature is higher than ambient, the listed allowable temperature rise values must be reduced by 2/3 of the difference between the actual measured inlet temperature and the ambient temperature.
- The average of the inlet and discharge temperature must not exceed 250°F. (121°C).
- The ambient temperature of the space the blower/motor is installed in should not be higher than 120°F (48.8°C).

SPEED – These blowers & exhausters may be operated at speeds up to the maximum listed for the various frame sizes. They may be direct coupled to suitable constant speed drivers if pressure/temperature conditions are also within limits. At low speeds, excessive temperature rise may be a limiting factor.

Special Note: The listed maximum allowable temperature rise for any particular blower & exhauster may occur well before its maximum pressure or vacuum rating is reached. This may occur at high altitude, low vacuum or at very low speed. The units' operating limit is always determined by the maximum rating reached first. It can be any one of the three: Pressure, Temperature or Speed.

Installation

ROOTS blowers & exhausters are treated after factory assembly to protect against normal atmospheric corrosion. The maximum period of internal protection is considered to be one year under average conditions, if shipping plugs & seals are not removed. Protection against chemical or salt water atmosphere is not provided. Avoid opening the unit until ready to start installation, as corrosion protection will be quickly lost due to evaporation.

If there is to be an extended period between installation and start up, the following steps should be taken to ensure corrosion protection.

- ❑ Coat internals of cylinder, gearbox and drive end bearing reservoir with Nox-Rust VCI-10 or equivalent. Repeat once a year or as conditions may require. Nox-Rust VCI-10 is petroleum soluble and does not have to be removed before lubricating. It may be obtained from Daubert Chemical Co., 2000 Spring Rd., Oak Brook, Ill. 60521.
- ❑ Paint shaft extension, inlet and discharge flanges, and all other exposed surfaces with Nox-Rust X-110 or equivalent.
- ❑ Seal inlet, discharge, and vent openings. It is not recommended that the unit be set in place, piped to the system, and allowed to remain idle for extended periods. If any part is left open to the atmosphere, the Nox-Rust VCI-10 vapor will escape and lose its effectiveness.
- ❑ Protect units from excessive vibration during storage.
- ❑ Rotate shaft three or four revolutions every two weeks.
- ❑ Prior to start up, remove flange covers on both inlet and discharge and inspect internals to insure absence of rust. Check all internal clearances. Also, at this time, remove gearbox and drive end bearing cover and inspect gear teeth and bearings for rust.

Because of the completely enclosed unit design, location of the installation is generally not a critical matter. A clean, dry and protected indoor location is preferred. However, an outdoor location will normally give satisfactory service. Important requirements are that the correct grade of lubricating oil be provided for expected operating temperatures, and that the unit be located so that routine checking and servicing can be performed conveniently. Proper care in locating driver and accessory equipment must also be considered.

Supervision of the installation by a ROOTS Service Engineer is not usually required for these units. Workmen with experience in installing light to medium weight machinery should be able to produce satisfactory results. Handling of the equipment needs to be accomplished with care, and in compliance with safe practices. Unit mounting must be solid, without strain or twist, and air piping must be clean, accurately aligned and properly connected.

Bare-shaft Units: Two methods are used to handle a unit without base. One is to use lifting lugs bolted into the top of the unit headplates. Test them first for tightness and frac-

tures by tapping with a hammer. In lifting, keep the direction of cable pull on these bolts as nearly vertical as possible. If lifting lugs are not available, lifting slings may be passed under the cylinder adjacent to the headplates. Either method prevents strain on the extended drive shaft.

Packaged Units: When the unit is furnished mounted on a baseplate, with or without a driver, use of lifting slings passing under the base flanges is required. Arrange these slings so that no strains are placed on the unit casing or mounting feet, or on any mounted accessory equipment. **DO NOT** use the lifting lugs in the top of the unit headplates.

Before starting the installation, remove plugs, covers or seals from unit inlet and discharge connections and inspect the interior completely for foreign material. If cleaning is required, finish by washing the cylinder, headplates and impeller thoroughly with an appropriate solvent. Turn the drive shaft by hand to make sure that the impellers turn freely at all points. Anti-rust compound on the connection flanges and drive shaft extension may also be removed at this time with the same solvent. Cover the flanges until ready to connect piping.

Mounting

Care will pay dividends when arranging the unit mounting. This is especially true when the unit is a "bare-shaft" unit furnished without a baseplate. The convenient procedure may be to mount such a unit directly on a floor or small concrete pad, but this generally produces the least satisfactory results. It definitely causes the most problems in leveling and alignment and may result in a "Soft Foot" condition. Correct soft foot before operation to avoid unnecessary loading on the casing and bearings. Direct use of building structural framing members is not recommended.

For blowers without a base, it is recommended that a well anchored and carefully leveled steel or cast iron mounting plate be provided. The plate should be at least 1 inch (25 mm) thick, with its top surface machined flat, and large enough to provide leveling areas at one side and one end after the unit is mounted. It should have properly sized studs or tapped holes located to match the unit foot drilling. Proper use of a high quality machinist's level is necessary for adequate installation.

With the mounting plate in place and leveled, set the unit on it without bolting and check for rocking. If it is not solid, determine the total thickness of shims required under one foot to stop rocking. Place half of this under each of the diagonally-opposite short feet, and tighten the mounting studs or screws. Rotate the drive shaft to make sure the impellers turn freely. If the unit is to be direct coupled to a driving motor, consider the height of the motor shaft and the necessity for it to be aligned very accurately with the unit shaft. Best unit arrangement is directly bolted to the mounting plate while the driver is on shims of at least 1/8 inch (3mm) thickness. This allows adjustment of motor position in final shaft alignment by varying the shim thickness.

Aligning

When unit and driver are factory mounted on a common baseplate, the assembly will have been properly aligned and is to be treated as a unit for leveling purposes. Satisfactory

installation can be obtained by setting the baseplate on a concrete slab that is rigid and free of vibration, and leveling the top of the base carefully in two directions so that it is free of twist. The slab must be provided with suitable anchor bolts. The use of grouting under and partly inside the leveled and shimmed base is recommended.

It is possible for a base-mounted assembly to become twisted during shipment, thus disturbing the original alignment. For this reason, make the following checks after the base has been leveled and bolted down. Disconnect the drive and rotate the unit shaft by hand. It should turn freely at all points. Loosen the unit foot hold-down screws and determine whether all feet are evenly in contact with the base. If not, insert shims as required and again check for free impeller rotation. Finally, if unit is direct coupled to the driver, check shaft and coupling alignment carefully and make any necessary corrections.

In planning the installation, and before setting the unit, consider how piping arrangements are dictated by the unit design and assembly. Drive shaft rotation must be established accordingly and is indicated by an arrow near the shaft.

Typical arrangement on vertical units has the drive shaft at the top with counterclockwise rotation and discharge to the left. Horizontal units are typically arranged with the drive shaft at the left with counterclockwise rotation and discharge down. See Figure 4 for other various unit arrangements and possible conversions.

When a unit is DIRECT COUPLED to its driver, the driver RPM must be selected or governed so as not to exceed the maximum speed rating of the unit. Refer to Table 1 for allowable speeds of various unit sizes.

A flexible type coupling should always be used to connect the driver and unit shafts.

When direct coupling a motor or engine to a blower you must insure there is sufficient gap between the coupling halves and the element to prevent thrust loading the blower bearings. When a motor, engine or blower is operated the shafts may expand axially. If the coupling is installed in such a manner that there is not enough room for expansion the blower shaft can be forced back into the blower and cause the impeller to contact the gear end headplate resulting in damage to the blower. The two shafts must be in as near perfect alignment in all directions as possible, and the gap must be established with the motor armature on its electrical center if end-play exists. Coupling manufacturer's recommendations for maximum misalignment, although acceptable for the coupling, are normally too large to achieve smooth operation and maximum life of the blower.

The following requirements of a good installation are recommended. When selecting a coupling to be fitted to the blower shaft ROOTS recommends a taper lock style coupling to insure proper contact with the blower shaft. If the coupling must have a straight bore the coupling halves must be fitted to the two shafts with a line to line thru .001" interference fit. Coupling halves must be warmed up per coupling manufacturer's recommendations. Maximum deviation in offset alignment of the shafts should not exceed .005" (.13 mm) total indicator reading, taken on the two coupling hubs. Maximum deviation from parallel of the inside coupling faces should not exceed .001" (.03 mm) when checked at six points around

the coupling.

When a unit is BELT DRIVEN, the proper selection of sheave diameters will result in the required unit speed. When selecting a sheave to be fitted to the blower shaft ROOTS recommends a taper lock style sheave to insure proper contact with the blower shaft. This flexibility can lead to operating temperature problems caused by unit speed being too low. Make sure the drive speed selected is within the allowable range for the specific unit size, as specified under Table 1.

Belt drive arrangements usually employ two or more V-belts running in grooved sheaves. Installation of the driver is less critical than for direct coupling, but its shaft must be level and parallel with the unit shaft. **The driver should be mounted on the inlet side of a vertical unit (horizontal piping) and on the side nearest to the shaft on a horizontal unit. SEE PAGE 6 - Acceptable Blower Drive Arrangement Options.** The driver must also be mounted on an adjustable base to permit installing, adjusting and removing the V-belts. To position the driver correctly, both sheaves need to be mounted on their shafts and the nominal shaft center distance known for the belt lengths to be used.

CAUTION: Drive couplings and sheaves (pulleys) should have an interference fit to the shaft of the blower (set screw types of attachment generally do not provide reliable service.) It is recommended that the drive coupling or sheave used have a taper lock style bushing which is properly sized to provide the correct interference fit required. Drive couplings, that require heating to fit on the blower shaft, should be installed per coupling manufacturer recommendations. A drive coupling or sheave should not be forced on to the shaft of the blower as this could affect internal clearances resulting in damage to the blower.

Engine drive applications often require special consideration to drive coupling selection to avoid harmful torsional vibrations. These vibrations may lead to blower damage if not dampened adequately. It is often necessary to install a flywheel and/or a torsionally soft elastic element coupling based on the engine manufacturer recommendations.

The driver sheave should also be mounted as close to its bearing as possible, and again should fit the shaft correctly. Position the driver on its adjustable base so that 2/3 of the total movement is available in the direction away from the unit, and mount the assembly so that the face of the sheave is accurately in line with the unit sheave. This position minimizes belt wear, and allows sufficient adjustment for both installing and tightening the belts. After belts are installed, adjust their tension in accordance with the manufacturer's instructions. However, only enough tension should be applied to prevent slippage when the unit is operating under load. Excessive tightening can lead to early bearing concerns or shaft breakage.

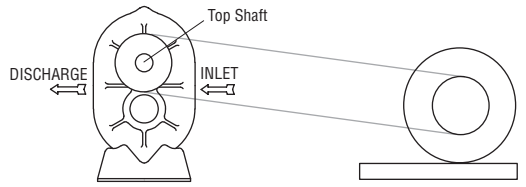
Before operating the drive under power to check initial belt tension, first remove covers from the unit connections. Make sure the interior is still clean, then rotate the shaft by hand. Place a coarse screen over the inlet connection to prevent anything being drawn into the unit while it is operating, and avoid standing in line with the discharge opening. Put oil in the sumps per instructions under **LUBRICATION**.

Piping

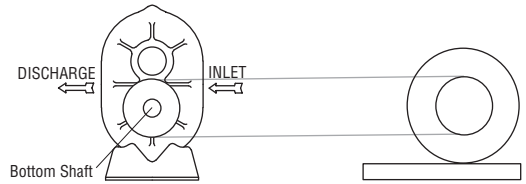
Before connecting piping, remove any remaining anti-rust compound from unit connections. Clean pipe should be no

Acceptable Blower Drive Arrangement Options

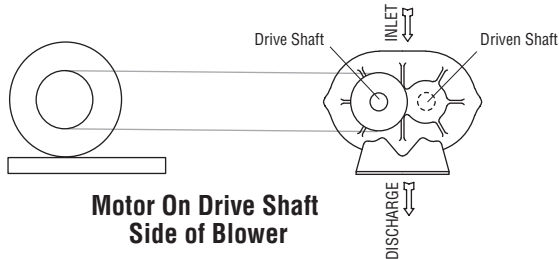
ACCEPTABLE



Motor On Inlet Side of Blower (Top Shaft)

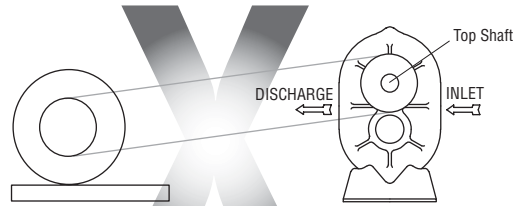


Motor On Inlet Side of Blower (Bottom Shaft)

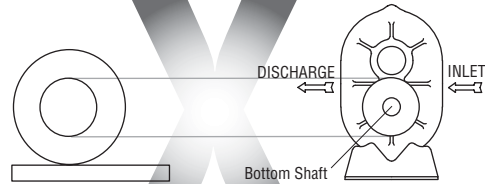


Motor On Drive Shaft Side of Blower

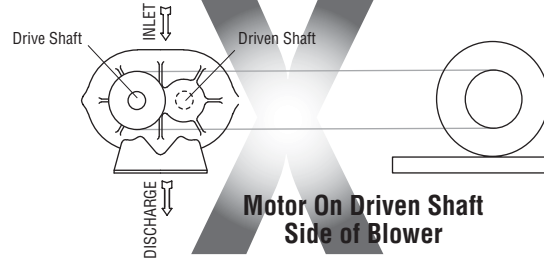
UNACCEPTABLE



Motor On Discharge Side of Blower (Top Shaft)



Motor On Discharge Side of Blower (Bottom Shaft)



Motor On Driven Shaft Side of Blower

smaller than unit connections. In addition, make sure it is free of scale, cuttings, weld beads, or foreign material of any kind. To further guard against damage to the unit, especially when an inlet filter is not used, install a substantial screen of 16 mesh backed with hardware cloth at or near the inlet connections. Make provisions to clean this screen of collected debris after a few hours of operation. It should be removed when its usefulness has ended, as the wire will eventually deteriorate and small pieces going into the unit may cause serious damage.

Pipe flanges or male threads must meet the unit connections accurately and squarely. DO NOT attempt to correct misalignment by springing or cramping the pipe. In most cases this will distort the unit casing and cause impeller rubbing. In severe cases it can prevent operation or result in a broken drive shaft. For similar reasons, piping should be supported near the unit to eliminate dead weight strains. Also, if pipe expansion is likely to occur from temperature change, installation of flexible connectors or expansion joints is advisable.

Figure 3 represents an installation with all accessory items that might be required under various operating conditions. Inlet piping should be completely free of valves or other restrictions. When a shut-off valve can not be avoided, make sure a full size vacuum relief is installed nearest the unit inlet. This will protect against unit overload caused by accidental closing of the shut-off valve.

Need for an inlet silencer will depend on unit speed and pressure, as well as sound-level requirements in the general surroundings. An inlet filter is recommended, especially in dusty

or sandy locations. A discharge silencer is also normally suggested, even though Whispair units operate at generally lower noise levels than conventional rotary blowers. Specific recommendations on silencing can be obtained from your local ROOTS distributor.

Discharge piping requires a pressure relief valve, and should include a manual unloading valve to permit starting the unit under no-load conditions. Reliable pressure/vacuum gauges and good thermometers at both inlet and discharge are recommended to allow making the important checks on unit operating conditions. The back-pressure regulator shown in Figure 3 is useful mainly when volume demands vary while the unit operates at constant output. If demand is constant, but somewhat lower than the unit output, excess may be blown off through the manual unloading valve.

In multiple unit installations where two or more units operate with a common header, use of check valves is mandatory. These should be of a direct acting or free swinging type, with one valve located in each line between the unit and header. Properly installed, they will protect against damage from reverse rotation caused by air and material back-flow through an idle unit.

After piping is completed, and before applying power, rotate the drive shaft by hand again. If it does not move with uniform freedom, look for uneven mounting, piping strain, excessive belt tension or coupling misalignment.

DO NOT operate the unit at this time unless it has been lubricated per instructions.

Technical Supplement for URAI® Gas Blowers

Technical Supplement for 32, 33, 36, 42, 45, 47, 53, 56, 59, 65, 68, 615 Universal RAI-G blowers

ROOTS Universal RAI-G rotary positive gas blowers are a design extension of the basic Universal RAI blower model. URAI-G blower uses (4) mechanical seals in place of the standard inboard lip seals to minimize gas leakage into the atmosphere. The seal vent chambers are plugged. These units are intended for gases which are compatible with cast iron case material, steel shafts, 300/400 series stainless steel and carbon seal components, viton o-rings and the oil/grease lubricants. If there are any questions regarding application or operation of this gas blower, please contact factory.

Precaution: URAI-G blowers: Care must be used when opening the head plate seal vent chamber plugs (43) as some gas will escape—if it is a pressure system, or the atmospheric air will leak in-if the system is under vacuum. There is a possibility of some gas leakage through the mechanical seals. This leakage on the gear end will escape through the gear box vent, and on the drive end, through the grease release fittings. If the gas leakage is undesirable, each seal chamber must be purged with an inert gas through one purge gas hole (43) per seal . There are two plugged purge gas holes(1/8 NPT) provided per seal. The

purge gas pressure must be maintained one psi above the discharge gas pressure. Also, there exists a possibility of gear end oil and drive end grease leakage into the gas stream.

The lubricants selected must be compatible with the gas.

URAI GAS Blower Oil and Grease Specifications

The specified oil should be ROOTS synthetic P/N 813-106- of the proper viscosity.

When servicing drive end bearings of a Gas blower, use the specified NLGI #2 premium grade aluminum complex* grease, ROOTS P/N T20019001, with 300°F (149°C) service temperature and moisture resistance and good mechanical stability.

*ROOTS Synthetic Oil & Grease is superior in performance to petroleum based products. It has high oxidation stability, excellent corrosion protection, extremely high film strength and low coefficient of friction. Typical oil change intervals are increased 2-3 times over petroleum based lubricants. Also, ROOTS Synthetic Oil is 100% compatible with petroleum based oils. Simply drain the oil in the blower and refill the reservoirs with ROOTS Synthetic Oil to maintain optimum performance of your ROOTS blower.

Lubrication

For Units with a Grease Lubricated Drive End

A simple but very effective lubrication system is employed on the drive shaft end bearings. Hydraulic pressure relief fittings are provided to vent any excess grease, preventing pressure build-up on the seals. A restriction plug and metering orifice prevent loss of lubricant from initial surges in lubricant pressure but permit venting excess lubricant under steadily rising pressures.

When servicing drive end bearings of Non Gas blower, use the specified NLGI #2 premium grade microgel grease with 250°F (121°C) service temperature and moisture resistance and good mechanical stability. ROOTS specifies Shell Darina EP NLGI Grade 2. Product Code 71522.

URAI GAS Blower Oil and Grease Specifications

The specified oil should be ROOTS synthetic P/N 813-106- of the proper viscosity.

When servicing drive end bearings of a Gas blower, use the specified NLGI #2 premium grade aluminum complex* grease, ROOTS P/N T20019001, with 300°F (149°C) service temperature and moisture resistance and good mechanical stability.

NOTE: Lithium based greases are not compatible with the ROOTS Synthetic grease used when assembling a Gas blower or the non-soap base grease used when assembling a standard URAI blower. Lithium based grease is not approved for any ROOTS blowers.

Using a pressure gun, slowly force new lubricant into each drive end bearing housing until traces of clean grease comes out of the relief fitting. The use of an electric or pneumatic grease gun could force the grease in too rapidly and thus invert the seals and should not be used.

After a long shutdown, it is recommended that the grease fittings be removed, the old grease flushed out with kerosene or #10 lubricating oil, drained thoroughly, and bearings refilled with new grease. Be sure grease relief fittings are reinstalled. Grease should be added using a hand operated grease gun to the drive end bearings at varying time intervals depending on duty cycle and RPM. Table 4 has been prepared as a general greasing schedule guide based on average operating conditions. More frequent intervals may be necessary depending on the grease operating temperature and unusual circumstances.

For Units with Splash Lubrication on Both Ends

Bearings and oil seals are lubricated by the action of the timing gears or oil slingers which dip into the main oil sumps causing oil to splash directly on gears and into bearings and seals. A drain port is provided below each bearing to prevent an excessive amount of oil in the bearings. Seals located inboard of the bearings in each headplate effectively retain oil within the sumps. Any small leakage that may occur should the seals wear passes into a cavity in each vented headplate

and is drained downward.

Oil sumps on each end of the blower are filled by removing top vent plugs, Item (25), and filling until oil reaches the middle of the oil level sight gauge, Item (45 or 53), or the overflow plug (see pages 14 and 15).

Initial filling of the sumps should be accomplished with the blower not operating, in order to obtain the correct oil level. Approximate oil quantities required for blowers of the various models and configurations are listed in Table 3. Use a good grade of industrial type non-detergent, rust inhibiting, anti-foaming oil and of correct viscosity per Table 2. *ROOTS synthetic oil (ROOTS P/N 813-106-) is highly recommended. ROOTS does not recommend automotive type lubricants, as they are not formulated with the properties mentioned above.

The oil level should not fall below the middle of the site gauge or overflow plug on URAI (ref. pages 14 & 15) when the blower is idle. It may rise or fall on the gauge during operation, to an extent depending somewhat on oil temperature and blower speed.

Proper lubrication is usually the most important single consideration in obtaining maximum service life and satisfactory operation from the unit. Unless operating conditions are quite severe, a weekly check of oil level and necessary addition of lubricant should be sufficient. During the first week of operation, check the oil levels in the oil sumps about once a day, and watch for leaks. Replenish as necessary. Thereafter, an occasional check should be sufficient. It is recommended that the oil be changed after initial 100 hours of operation. Frequent oil changing is not necessary unless the blower is operated in a very dusty location.

Normal life expectancy of petroleum based oils is about 2000 hours with an oil temperature of about 180°F (82°C). As the oil temperature increases by increments of 15-18°F (8°C - 10°C), the life is reduced by half. Example: Oil temperatures of 210-216°F (99°C - 102°C) will produce life expectancy of 1/4 or 500 hours. Therefore, it is considered normal to have oil change periods of 500 hours with petroleum based oils.

Normal life expectancy of ROOTS™ Synthetic Oil is about 4000 to 8000 hours with an oil temperature of about 180°F (82°C). As the oil temperature increases by increments of 15-18°F (8°C - 10°C), the life is reduced by half. Example: Oil temperatures of 210-216°F (99°C - 102°C) will produce life expectancy of 1/4 or 1000 to 2000 hours.

NOTE: To estimate oil temperature, multiply the discharge temperature of the blower by 0.80. Example: if the discharge air temperature of the blower is 200° F, it is estimated that the oil temperature is 160° F.

*ROOTS™ Synthetic Oil & Grease is superior in performance to petroleum based products. It has high oxidation stability, excellent corrosion protection, extremely high film strength and low coefficient of friction. Typical oil change intervals are increased 2-3 times over petroleum based lubricants. Also, ROOTS™ Synthetic Oil is 100% compatible with petroleum based oils. Simply drain the oil in the blower and refill the reservoirs with ROOTS™ Synthetic Oil to maintain optimum performance of your ROOTS™ blower.

Operation

Before operating a blower under power for the first time, recheck the unit and the installation thoroughly to reduce the likelihood of avoidable troubles. Use the following procedure check list as a guide, but consider any other special conditions in the installation.

- Be certain that no bolts, tools, rags, or debris have been left in the blower air chamber or piping.
- If an outdoor intake without filter is used, be sure the opening is located so it cannot pick up dirt and is protected by a strong screen or grille. Use of the temporary protective screen as described under INSTALLATION is strongly recommended.
- Recheck blower leveling, drive alignment and tightness of all mounting bolts if installation is not recent. If belt drive is used, adjust belt tension correctly.
- Turn drive shaft by hand to make sure impellers still rotate without bumping or rubbing at any point.
- Ensure oil levels in the main oil sumps are correct.
- Check lubrication of driver. If it is an electric motor, be sure that power is available and that electrical overload devices are installed and workable.
- Open the manual unloading valve in the discharge air line. If a valve is in the inlet piping, be sure it is open.
- Bump blower a few revolutions with driver to check that direction of rotation agrees with arrow near blower shaft, and that both coast freely to a stop.

After the preceding points are cleared, blower is ready for trial operation under “no-load” conditions. The following procedure is suggested to cover this initial operation test period.

- a. Start blower, let it accelerate to full speed, then shut off. Listen for knocking sounds, both with power on and as speed slows down.
- b. After blower comes to a complete stop, repeat above, but let blower run 2 or 3 minutes. Check for noises, such as knocking sounds.
- c. After blower comes to a complete stop, operate blower for about 10 minutes unloaded. Check oil levels. Observe cylinder and headplate surfaces for development of hot spots such as burned paint, indicating impeller rubs. Be aware of any noticeable increase in vibration.

Assuming that all trials have been satisfactory, or that necessary corrections have been made, the blower should now have a final check run of at least one hour under normal operating conditions. After blower is restarted, gradually

close the discharge unloading valve to apply working pressure. At this point it is recommended that a pressure gauge or manometer be connected into the discharge line if not already provided, and that thermometers be in both inlet and discharge lines. Readings from these instruments will show whether pressure or temperature ratings of the blower are being exceeded.

During the final run, check operating conditions frequently and observe the oil levels at reasonable intervals. If excessive noise or local heating develops, shut down immediately and determine the cause. If either pressure rise or temperature rise across the blower exceeds the limit specified in this manual, shut down and investigate conditions in the piping system. Refer to the TROUBLESHOOTING CHECKLIST for suggestions on various problems that may appear.

The blower should now be ready for continuous duty operation at full load. During the first few days make periodic checks to determine whether all conditions remain steady, or at least acceptable. This may be particularly important if the blower is supplying air to a process system where conditions can vary. At the first opportunity, stop the blower and clean the temporary inlet protective screen. If no appreciable amount of debris has collected, the screen may be removed. See comments under INSTALLATION. At this same time, verify leveling, coupling alignment or belt tension, and mounting bolt tightness.

Should operating experience prove that blower capacity is a little too high for the actual air requirements, a small excess may be blown off continuously through the manual unloading or vent valve. Never rely on the pressure relief valve as an automatic vent. Such use may cause the discharge pressure to become excessive, and can also result in failure of the valve itself. If blower capacity appears to be too low, refer to the TROUBLESHOOTING CHECKLIST.

Vibration Assessment Criteria

With measurements taken at the bearing locations on the housings, see chart below for an appropriate assessment guide for rotary lobe blowers rigidly mounted on stiff foundations.

In general, blower vibration levels should be monitored on a regular basis and the vibration trend observed for progressive or sudden change in level. If such a change occurs, the cause should be determined through spectral analysis.

As shown on the chart below, the level of all pass vibration will determine the need to measure discrete frequency vibration levels and the action required.

| All Pass Vibration (in/sec) | Discrete Frequency Vibration (in/sec) | Action |
|-----------------------------------|---------------------------------------|-------------|
| 0.45 or less | N/R | Acceptable |
| Greater than 0.45 but 1.0 or less | 0.45 or less @ any frequency | Acceptable |
| | Greater than 0.45 @ any frequency | Investigate |
| Greater than 1.0 | Less than 1.0 | Investigate |
| | Greater than 1.0 | Investigate |

Troubleshooting Checklist

| Trouble | Item | Possible Cause | Remedy |
|---|------|---|--|
| No flow | 1 | Speed too low | Check by tachometer and compare with published performance |
| | 2 | Wrong rotation | Compare actual rotation with Figure 1 Change driver if wrong |
| | 3 | Obstruction in piping | Check piping, valves, silencer to assure open flow path |
| Low capacity | 4 | Speed too low | See item 1, If belt drive, check for slippage and readjust tension |
| | 5 | Excessive pressure rise | Check inlet vacuum and discharge pressure and compare with Published performance |
| | 6 | Obstruction in piping | See item 3 |
| | 7 | Excessive slip | Check inside of casing for worn or eroded surfaces causing excessive clearances |
| Excessive power | 8 | Speed too high | Check speed and compare with published performance |
| | 9 | Excessive pressure rise | See Item 5 |
| | 10 | Impeller rubbing | Inspect outside of cylinder for high temperature areas, then check for impeller contact at these points. Correct blower mounting, drive alignment |
| | 11 | Scale, sludge, rust or product build up | Clean blower appropriately |
| Damage to bearings or gears | 12 | Inadequate lubrication | Check oil sump levels in gear and drive end headplates |
| | 13 | Excessive lubrication | Check oil levels. If correct, drain and refill with clean oil of recommended grade |
| | 14 | Excessive pressure rise | See Item 5 |
| | 15 | Coupling misalignment | Check carefully. Realign if questionable |
| Vibration | 16 | Excessive belt tension | Readjust for correct tension |
| | 17 | Misalignment | See Item 15 |
| | 18 | Impellers rubbing | See Item 10 |
| | 19 | Worn bearings/gears | Check gear backlash and condition of bearings, and replace as indicated |
| | 20 | Unbalanced or rubbing impeller | Scale or process material may build up on casing and impellers, or inside impellers. Remove build-up to restore original clearances and impeller balance |
| | 21 | Driver or blower loose | Tighten mounting bolts securely |
| | 22 | Piping resonances | Determine whether standing wave pressure pulsations are present in the piping |
| | 23 | Scale/sludge build-ups | Clean out interior of impeller lobes to restore dynamic balance |
| Driver stops, or will not start | 24 | Casing strain | Re-work piping alignment to remove excess strain |
| | 25 | Impeller stuck | Check for excessive hot spot on headplate or cylinder. See item 10. Look for defective shaft bearing and/or gear teeth |
| | 26 | Scale, sludge, rust or product build-up | Clean blower appropriately |
| Excessive breather | 27 | Broken seal | Replace seals |
| Blow-by or excessive oil leakage to vent area | 28 | Defective O-ring | Replace seals and O-ring |
| Excessive oil leakage in vent area | 29 | Defective/plugged breather | Replace breather and monitor oil leakage |
| | 30 | Oil level too high | Check sump levels in gear and drive headplates. |
| | 31 | Oil type or viscosity incorrect | Check oil to insure it meets recommendations. Drain then fill with clean oil of recommended grade. |
| | 32 | Blower running hot | Recommended oil temperature can be found on page 6 of this manual. The blower must be operated within the conditions of this manual |

Inspection & Maintenance: Universal RAI® series blowers

A good program of consistent inspection and maintenance is the most reliable method of minimizing repairs to a blower. A simple record of services and dates will help keep this work on a regular schedule. Basic service needs are:

- Lubrication
- Checking for hot spots
- Checking for increases or changes in vibration and noise
- Recording of operating pressures and temperatures

Above all, a blower must be operated within its specified rating limits, to obtain satisfactory service life.

A newly installed blower should be checked often during the first month of full-time operation. Attention there after may be less frequent assuming satisfactory performance. Lubrication is normally the most important consideration and weekly checks of lubricant levels in the gearbox and bearing reservoirs should be customary. Complete oil change schedules are discussed under **LUBRICATION**.

Driver lubrication practices should be in accordance with the manufacturer's instructions. If direct connected to the blower through a lubricated type coupling, the coupling should be checked and greased each time blower oil is changed. This will help reduce wear and prevent unnecessary vibration. In a belted drive system, check belt tension periodically and inspect for frayed or cracked belts.

In a new, and properly installed, unit there is no contact between the two impellers, or between the impellers and cylinder or headplates. Wear is confined to the bearings (which support and locate the shafts) the oil seals, and the timing gears. All are lubricated and wear should be minimal if clean oil of the correct grade is always used. Seals are subject to deterioration as well as wear, and may require replacement at varying periods.

Shaft bearings are designed for optimum life under average conditions with proper lubrication and are critical to the service life of the blower. Gradual bearing wear may allow a shaft position to change slightly, until rubbing develops between impeller and casing. This will cause spot heating, which can be detected by observing these surfaces. Sudden bearing failure is usually more serious. Since the shaft and impeller are no longer supported and properly located, extensive general damage to the blower casing and gears is likely to occur.

Oil seals should be considered expendable items, to be replaced whenever drainage from the headplate vent cavity becomes excessive or when the blower is disassembled for

any reason. Some oil seal leakage may occur since an oil film under the lip is required for proper operation. Periodically leaked oil should be wiped off from surfaces. Minor seal leakage should not be considered as indicating seal replacement.

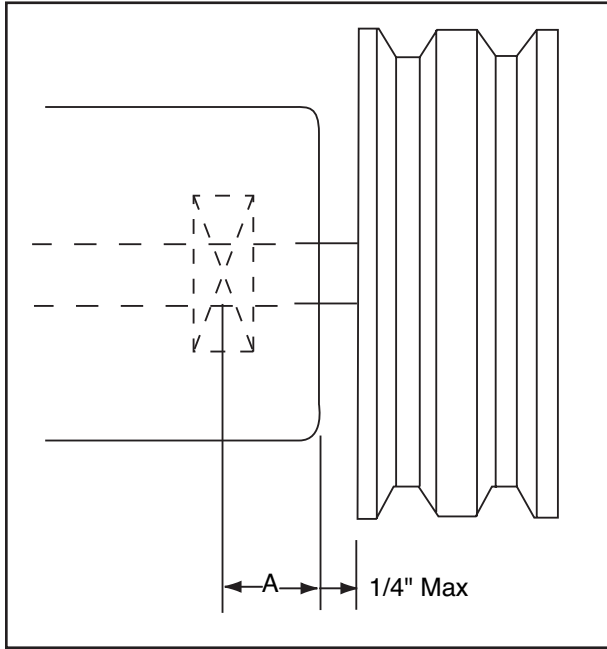
Timing gear wear, when correct lubrication is maintained, should be negligible. Gear teeth are cut to provide the correct amount of backlash, and gears correctly mounted on the shafts will accommodate a normal amount of tooth wear without permitting contact between lobes of the two impellers. However, too high an oil level will cause churning and excessive heating. This is indicated by unusually high temperature at the bottom of the gear housing. Consequent heating of the gears will result in loss of tooth-clearance, backlash and rapid wear of the gear teeth usually will develop. Continuation of this tooth wear will eventually produce impeller contacts (knocking), and from this point serious damage will be unavoidable if blower operation is continued. A similar situation can be produced suddenly by gear tooth fracture, which is usually brought on by sustained overloading or momentary shock loads.

Problems may also develop from causes other than internal parts failure. Operating clearances within a blower are only a few thousandths of an inch. This makes it possible for impeller interference or casing rubs to result from shifts in the blower mounting, or from changes in piping support. If this type of trouble is experienced, and the blower is found to be clean, try removing mounting strains. Loosen blower mounting bolts and reset the leveling and drive alignment. Then tighten mounting again, and make sure that all piping meets blower connections accurately and squarely. Foreign materials in the blower will also cause trouble, which can only be cured by disconnecting the piping and thoroughly cleaning the blower interior.

A wide range of causes & solutions for operating troubles are covered in the **TROUBLE SHOOTING CHECKLIST**. The remedies suggested should be performed by qualified mechanics with a good background. Major repairs generally are to be considered beyond the scope of maintenance, and should be referred to an authorized ROOTS distributor.

Warranty failures should not be repaired at all, unless specific approval has been obtained through ROOTS before starting work. Unauthorized disassembly within the warranty period may void the warranty.

Figure 2 - Allowable Overhung Loads for V-Belt Drives Universal RAI®/URAI®-J Units



$$\text{Belt Pull lbs} = \frac{252100 \cdot \text{Motor HP}}{\text{Blower RPM} \cdot \text{Sheave Diameter}}$$

$$\text{Shaft Load (lb.in)} = \text{Belt Pull} \cdot \left(A + \frac{1}{4} + \frac{\text{Sheave Width}}{2} \right)$$

| Frame Size | Dimension "A" | Max Allowable Shaft Load (lb-in.) | Min Sheave Diameter |
|--------------|---------------|-----------------------------------|---------------------|
| 22, 24 | 0.61 | 150 | 4.00 |
| 32, 33, 36 | 0.80 | 400 | 5.00 |
| 42, 45, 47 | 1.02 | 650 | 5.00 |
| 53, 56, 59 | 1.13 | 1,325 | 6.00 |
| 65, 68, 615 | 1.36 | 2,250 | 8.00 |
| 76, 711, 718 | 1.16 | 2,300 | 9.50 |

NOTE:

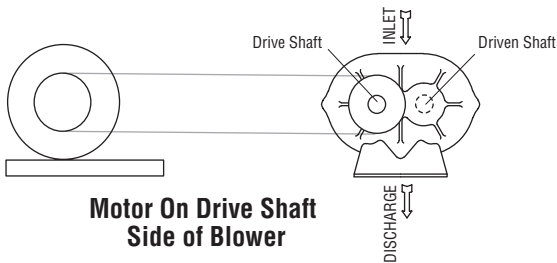
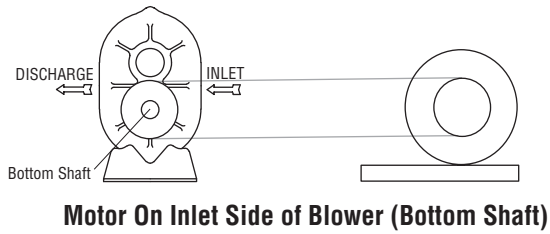
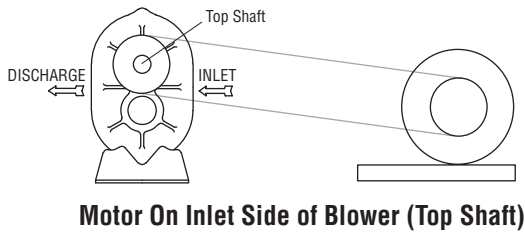
Arc of sheave belt contact on the smaller sheave not to be less than 170°

Driver to be installed on the inlet side for vertical units, and on the drive shaft side for horizontal units.

ROOTS recommends the use of two or more 3V, 5V or 8V belts and sheaves.

Acceptable Blower Drive Arrangement Options

ACCEPTABLE



UNACCEPTABLE

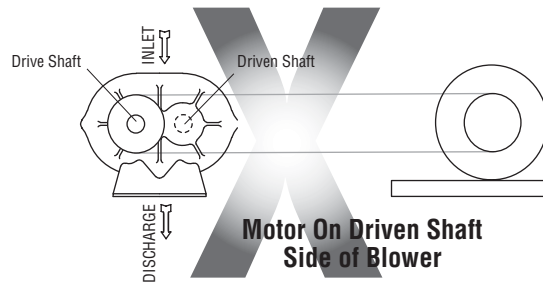
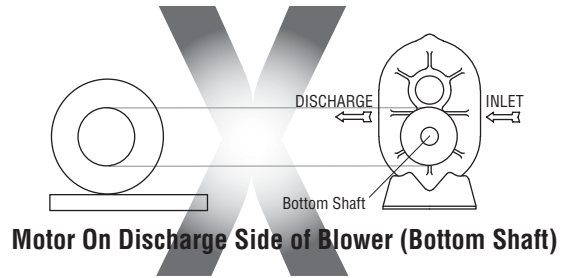
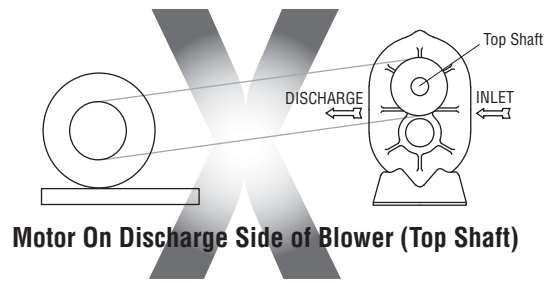
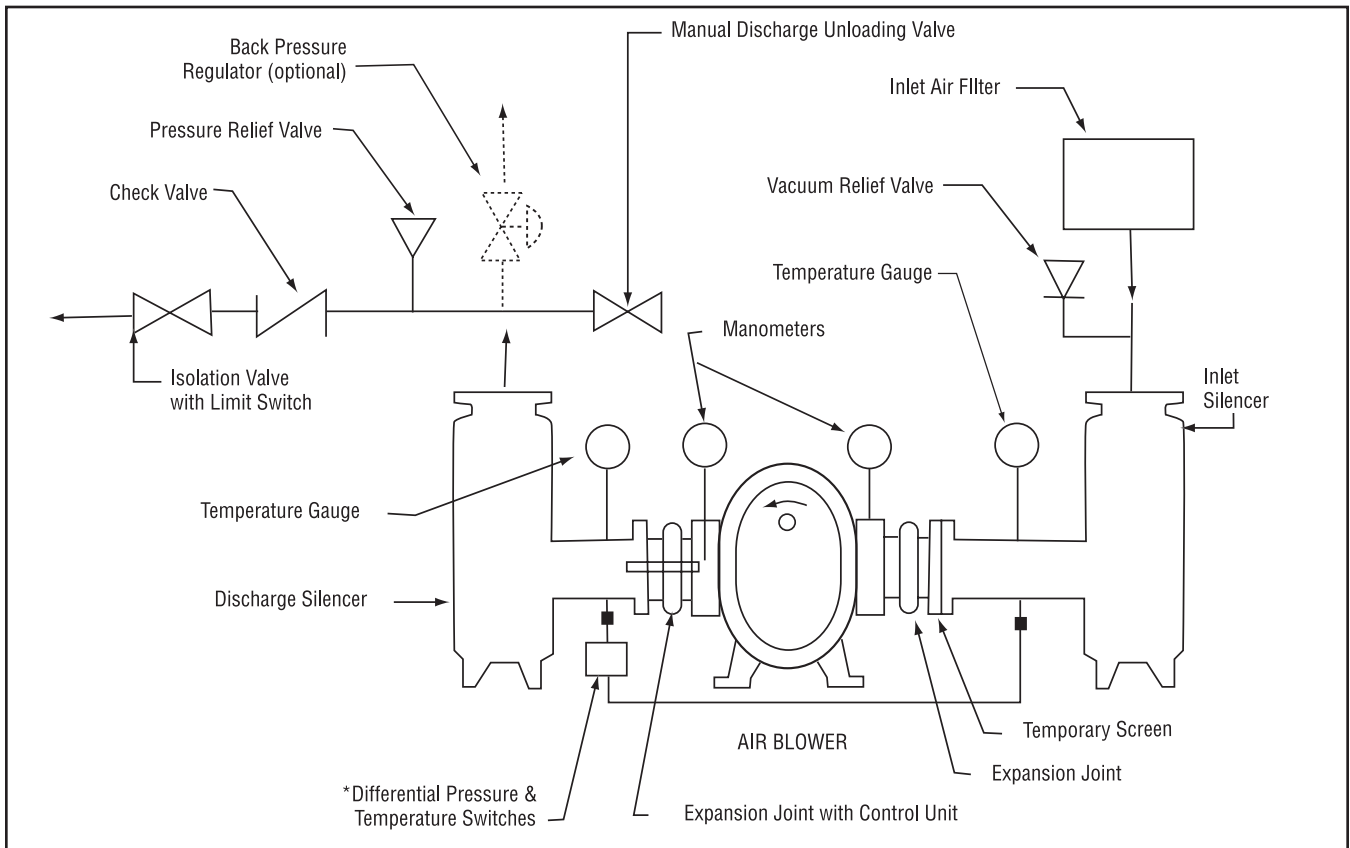
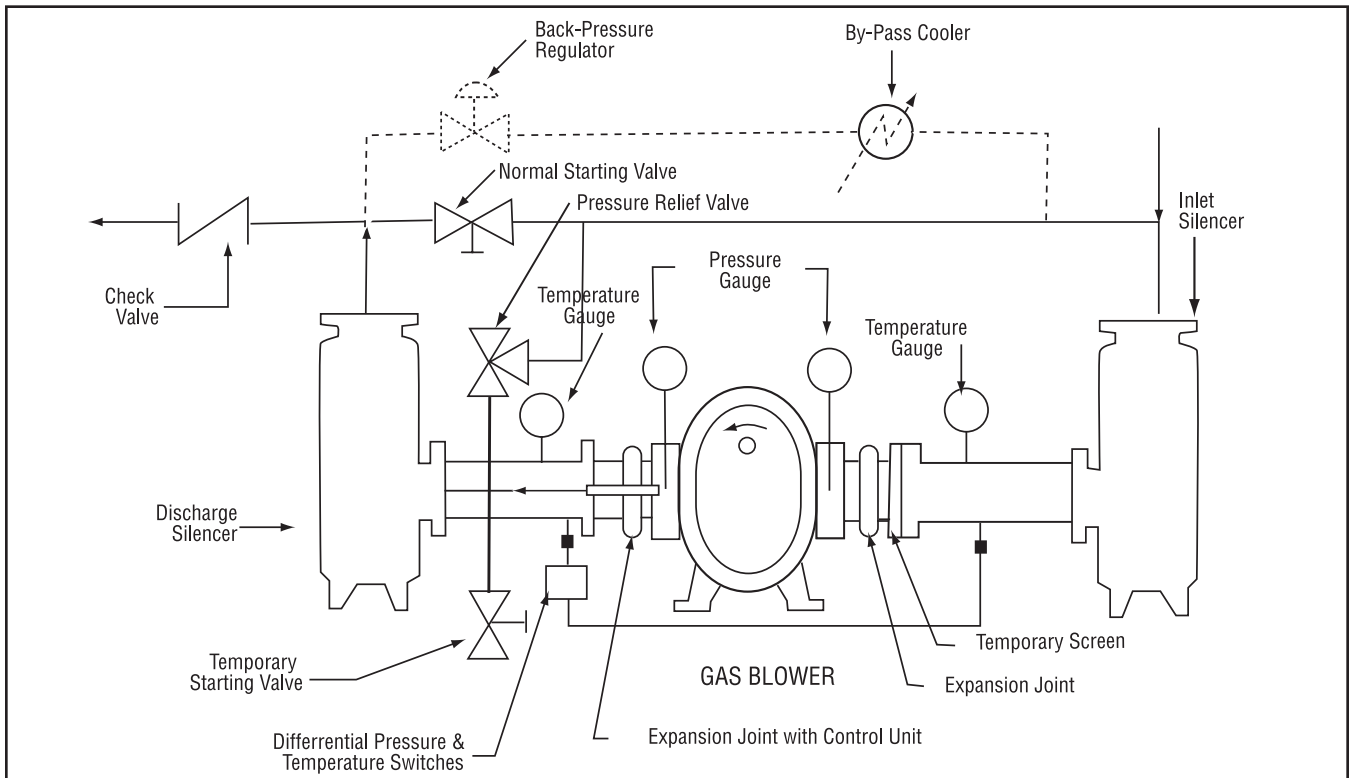


Figure 3a - Air Blower Installation with Accessories



Above are suggested locations for available accessories.

Figure 3b - Gas Blower Installation with Accessories



Above are suggested locations for available accessories.

Figure 4

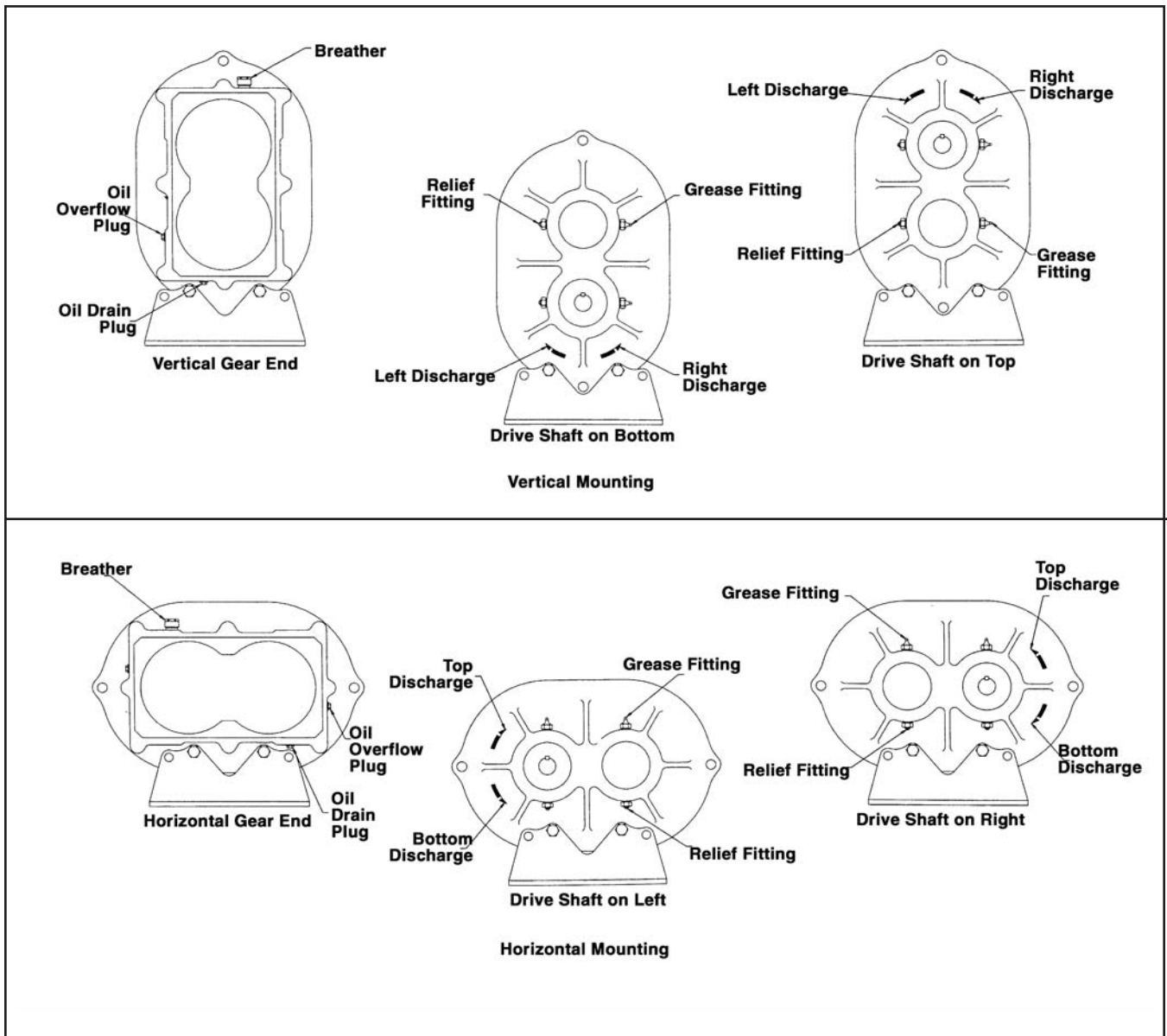
Blower Orientation Conversion

| Model | Reversible Rotation | Whispair™ Design |
|------------------|---------------------|------------------|
| Universal RAI | yes | no |
| URAI-J Whispair™ | no | yes |
| URAI-G | yes | no |

Special Note: WHISPAIR™ models are designed to operate with only one shaft rotation direction to take full advantage of the Whispair feature. Therefore, a WHISPAIR™ blower may be operated in the following combinations.

- CCW Rotation: Bottom Shaft; Right side discharge or a Left Shaft; Bottom discharge
 - CCW Rotation: Top Shaft; Left side discharge or a Right Shaft; Top discharge
- or
- CW Rotation: Bottom Shaft; Left side discharge or a Right Shaft Bottom discharge
 - CW Rotation: Top Shaft; Right side discharge or a Left Shaft Top discharge

Blower Orientation and Lubrication Points: Grease Lubricated Drive End
Universal RAI series & URAI-G gas blowers



Drive End Breather Orientation for U-RAI series - DSL with Oil Lube

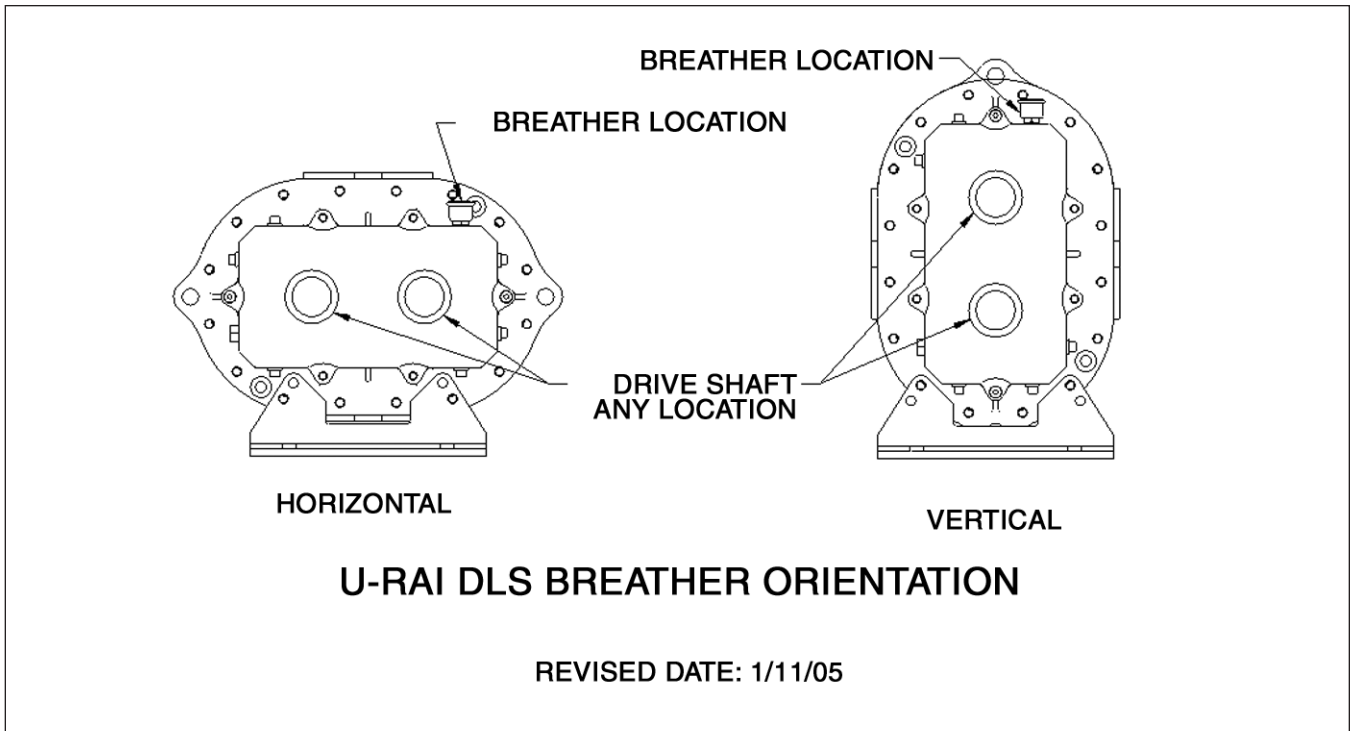


Table 1 - Universal RAI series, Universal URAI-DSI & URAI-G gas blower, Maximum Allowable Operating Conditions

| Frame Size | Gear Diameter (Inch) | Speed RPM | Temp. Rise F° (C°) | Delta Pressure PSI (mbar) | Inlet Vacuum INHG (mbar) |
|------------|----------------------|-----------|--------------------|---------------------------|--------------------------|
| 22 | 2.5 | 5275 | 225 (125) | 12 (827) | 15 (500) |
| 24 | 2.5 | 5275 | 210 (117) | 7 (483) | 15 (500) |
| 32 | 3.5 | 3600 | 240 (133) | 15 (1034) | 16 (539) |
| 33 | 3.5 | 3600 | 225 (125) | 12 (827) | 15 (500) |
| 36 | 3.5 | 3600 | 225 (125) | 7 (483) | 15 (500) |
| 42 | 4.0 | 3600 | 240 (133) | 15 (1034) | 16 (539) |
| 45 | 4.0 | 3600 | 225 (125) | 10 (690) | 16 (539) |
| 47 | 4.0 | 3600 | 225 (125) | 7 (483) | 15 (500) |
| 53 | 5.0 | 2850 | 225 (125) | 15 (1034) | 16 (539) |
| 56 | 5.0 | 2850 | 225 (125) | 13 (896) | 16 (539) |
| 59 | 5.0 | 2850 | 225 (125) | 7 (483) | 15 (500) |
| 65 | 6.0 | 2350 | 250 (130) | 15 (1034) | 16 (539) |
| 68 | 6.0 | 2350 | 240 (133) | 14 (965) | 16 (539) |
| 615 | 6.0 | 2350 | 130 (72) | 7 (483) | 14 (472) |
| 76 | 7.0 | 2050 | 250 (139) | 15 (1034) | 16 (539) |
| 711 | 7.0 | 2050 | 225 (125) | 10 (690) | 16 (539) |
| 718 | 7.0 | 2050 | 130 (72) | 6 (414) | 12 (405) |

Table 2 - Recommended Oil Grades

| Ambient Temperature °F (°C) | ISO Viscosity No. |
|-----------------------------|-------------------|
| Above 90° (32°) | 320 |
| 32° to 90° (0° to 32°) | 220 |
| 0° to 32° (-18° to 0°) | 150 |
| Below 0° (-18°) | 100 |

URAI GAS Blower Oil and Grease Specifications

The specified oil should be ROOTS synthetic P/N 813-106- of the proper viscosity.

Table 3 - Approximate Oil Sump Capacities

These capacities are provided to assist in stocking the correct amount of oil. Exact sump capacities may differ slightly. See "Lubrication" section for proper filling instructions.

UNIVERSAL RAI, URAI-J, URAI-G

| Frame Size | Gear End Capacity Fl. Oz. (Liters) | |
|------------|------------------------------------|-------------|
| | Vertical | Horizontal |
| 22 | 3.4 (.1) | 6.1 (.18) |
| 24 | 3.4 (.1) | 6.1 (.18) |
| 32 | 8.5 (.25) | 16.0 (.47) |
| 33 | 8.5 (.25) | 16.0 (.47) |
| 36 | 8.5 (.25) | 16.0 (.47) |
| 42 | 12.7 (.37) | 22.8 (.67) |
| 45 | 12.7 (.37) | 22.8 (.67) |
| 47 | 12.7 (.37) | 22.8 (.67) |
| 53 | 16.0 (.47) | 27.6 (.82) |
| 56 | 16.0 (.47) | 27.6 (.82) |
| 59 | 16.0 (.47) | 27.6 (.82) |
| 65 | 28.3 (.84) | 52.1 (1.54) |
| 68 | 28.3 (.84) | 52.1 (1.54) |
| 615 | 28.3 (.84) | 52.1 (1.54) |
| 76 | 32.3 (.96) | 59.5 (1.76) |
| 711 | 32.3 (.96) | 59.5 (1.76) |
| 718 | 32.3 (.96) | 59.5 (1.76) |

UNIVERSAL URAI series-DSL Splash Lubricated Drive End

Note that the gear end sump capacity is provided on the adjacent table.

| Frame Size | Drive End Capacity Fl. Oz. (Liters) | |
|------------|-------------------------------------|------------|
| | Vertical | Horizontal |
| 32 | 4.0 (.12) | 6.5 (.19) |
| 33 | 4.0 (.12) | 6.5 (.19) |
| 36 | 4.0 (.12) | 6.5 (.19) |
| 42 | 5.5 (.16) | 10.8 (.32) |
| 45 | 5.5 (.16) | 10.8 (.32) |
| 47 | 5.5 (.16) | 10.8 (.32) |
| 53 | 7.5 (.22) | 14.8 (.44) |
| 56 | 7.5 (.22) | 14.8 (.44) |
| 59 | 7.5 (.22) | 14.8 (.44) |
| 65 | 16 (0.47) | 31 (0.91) |
| 68 | 16 (0.47) | 31 (0.91) |
| 615 | 16 (0.47) | 31 (0.91) |

See page 14 and 15 for illustration of vertical and horizontal configurations.

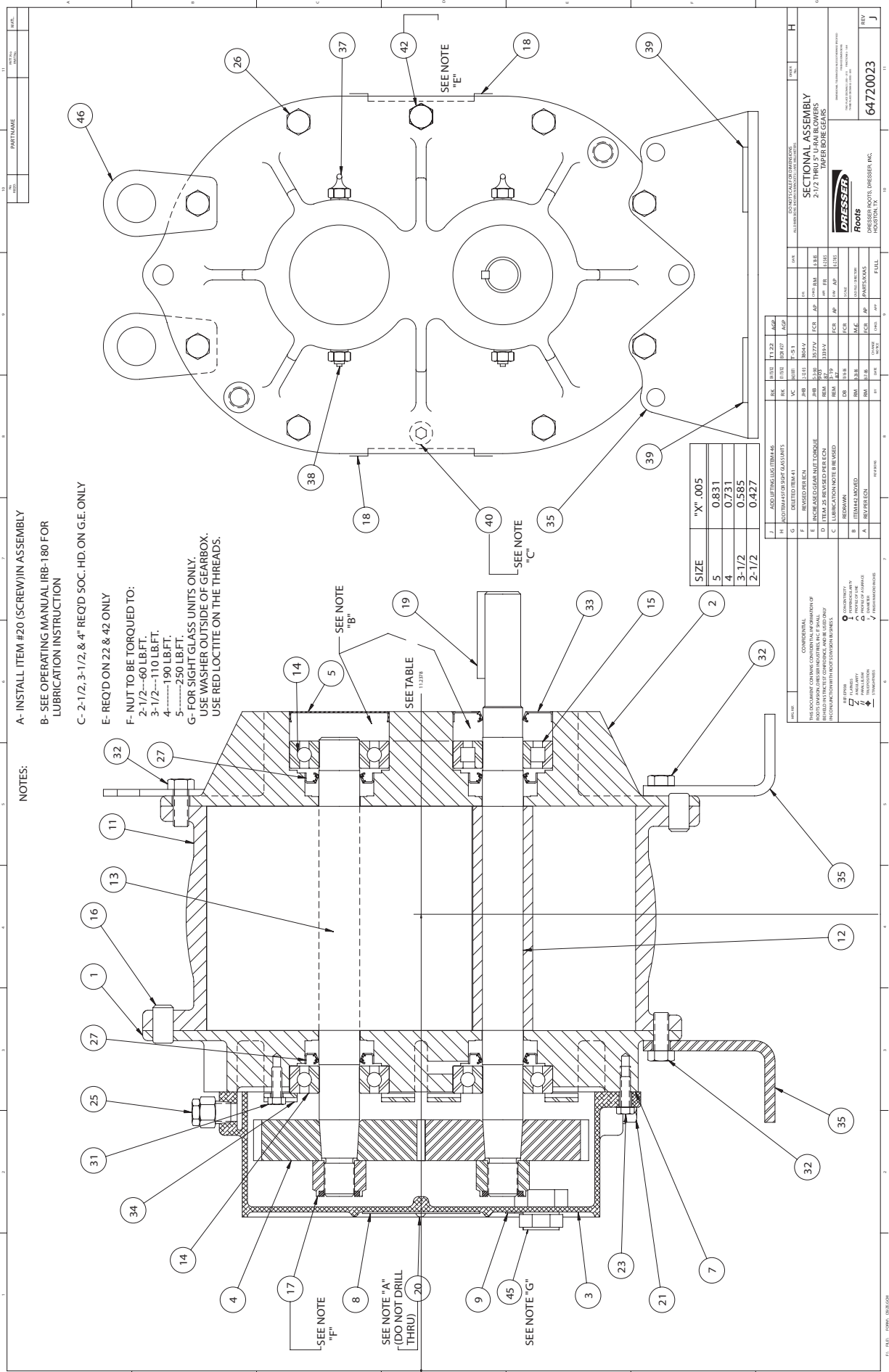
Table 4 - Universal URAI series with Grease Lubricated Drive End: Specified Bearing Greasing Intervals

| Speed In RPM | Operating Hours Per Day | | |
|--------------|-----------------------------|----|----|
| | 8 | 16 | 24 |
| | Greasing Intervals in Weeks | | |
| 750-1000 | 7 | 4 | 2 |
| 1000-1500 | 5 | 2 | 1 |
| 1500-2000 | 4 | 2 | 1 |
| 2000-2500 | 3 | 1 | 1 |
| 2500-3000 | 2 | 1 | 1 |
| 3000 and up | 1 | 1 | 1 |

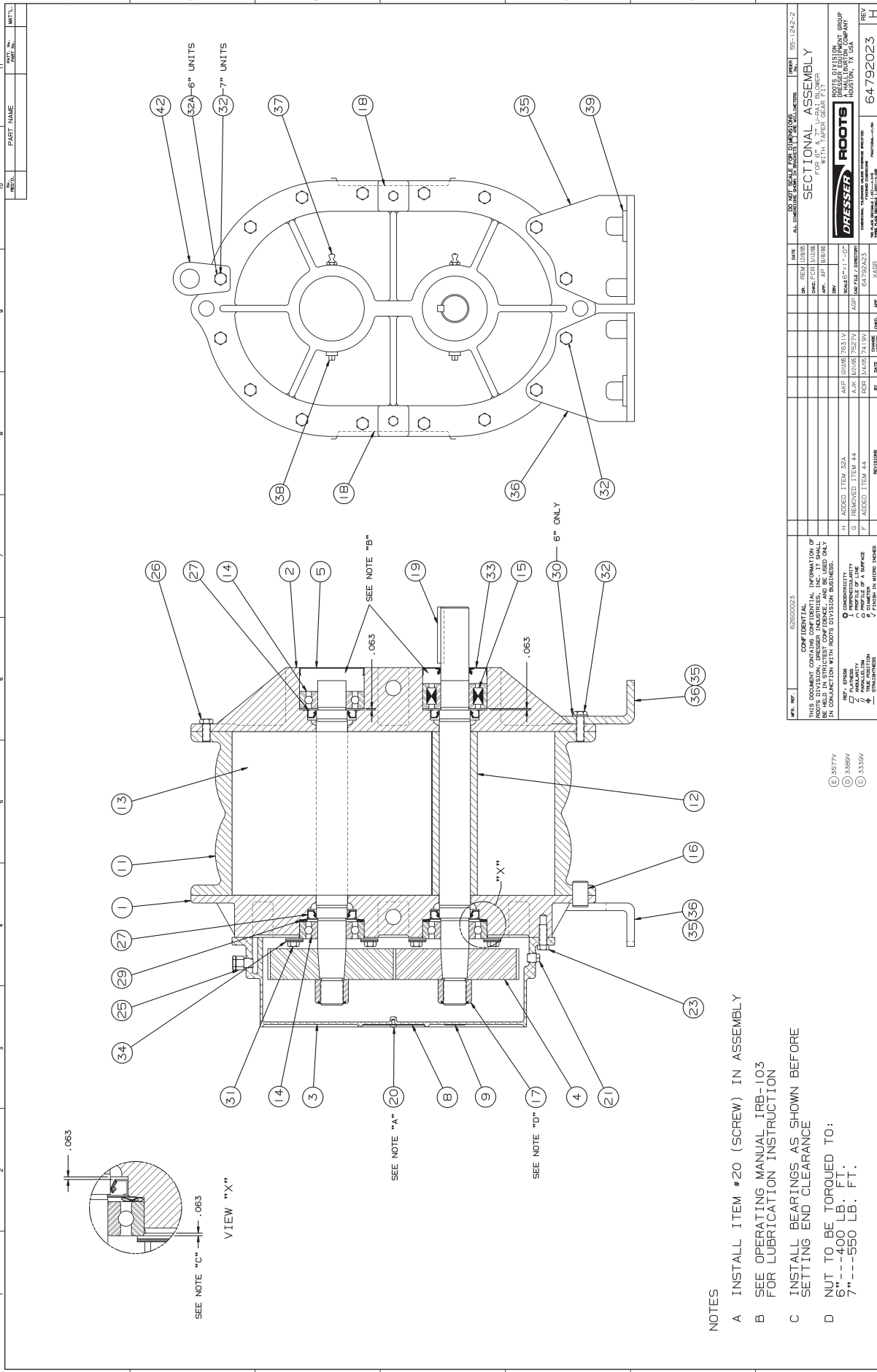
The specified grease for servicing drive end bearings of a Gas blower, use a NLGI #2 premium grade aluminum complex* grease, ROOTS P/N T20019001 with 300°F (149°C) service temperature and moisture resistance and good mechanical stability.

When servicing drive end bearings of Non Gas blower, use a NLGI #2 premium grade microgel grease with 250°F (121°C) service temperature and moisture resistance and good mechanical stability. ROOTS specifies Shell Darina EP NLGI Grade 2. Product Code 71522.

NOTE: Lithium based greases are not compatible with the ROOTS Synthetic grease used when assembling a Gas blower or the non-soap base grease used when assembling a standard URAI blower. Lithium based grease is not approved for any ROOTS blowers.



Assembly of UNIVERSAL RAI Series, Air Blowers, 2-1/2" Through 5" Gear Diameter



- NOTES**
- A INSTALL ITEM #20 (SCREW) IN ASSEMBLY
 - B SEE OPERATING MANUAL IRB-103 FOR LUBRICATION INSTRUCTION
 - C INSTALL BEARINGS AS SHOWN BEFORE SETTING END CLEARANCE
 - D NUT TO BE TORQUED TO:
 6" ---400 LB. FT.
 7" ---550 LB. FT.

Assembly of UNIVERSAL RAI Blowers, 6" and 7" Diameter

P:\FILE\VP\MAN\SIZE.SOH

| DATE | BY | CHKD. | APP. | REV. |
|----------|-----|-------|------|------|
| 06/05/98 | ALP | JAV | WAS | 1 |
| 06/05/98 | ALP | JAV | WAS | 2 |
| 06/05/98 | ALP | JAV | WAS | 3 |
| 06/05/98 | ALP | JAV | WAS | 4 |
| 06/05/98 | ALP | JAV | WAS | 5 |
| 06/05/98 | ALP | JAV | WAS | 6 |
| 06/05/98 | ALP | JAV | WAS | 7 |
| 06/05/98 | ALP | JAV | WAS | 8 |
| 06/05/98 | ALP | JAV | WAS | 9 |
| 06/05/98 | ALP | JAV | WAS | 10 |
| 06/05/98 | ALP | JAV | WAS | 11 |

62500023
 CONFIDENTIAL INFORMATION OF
 ROOTS DIVISION, DRESSER INDUSTRIES, INC. IT SHALL
 REMAIN THE PROPERTY OF DRESSER INDUSTRIES, INC.
 IN CONNECTION WITH ROOTS DIVISION BUSINESS.

REF. FROM
 7 PARTS
 8 MANUFACTURE
 9 MATERIALS
 10 SUPPLIERS

Q CONNECTIVITY
 A PREVIOUSITY
 B PROFILE OF A SURFACE
 C MANUFACTURE
 D FINISH IN OTHER INCHES

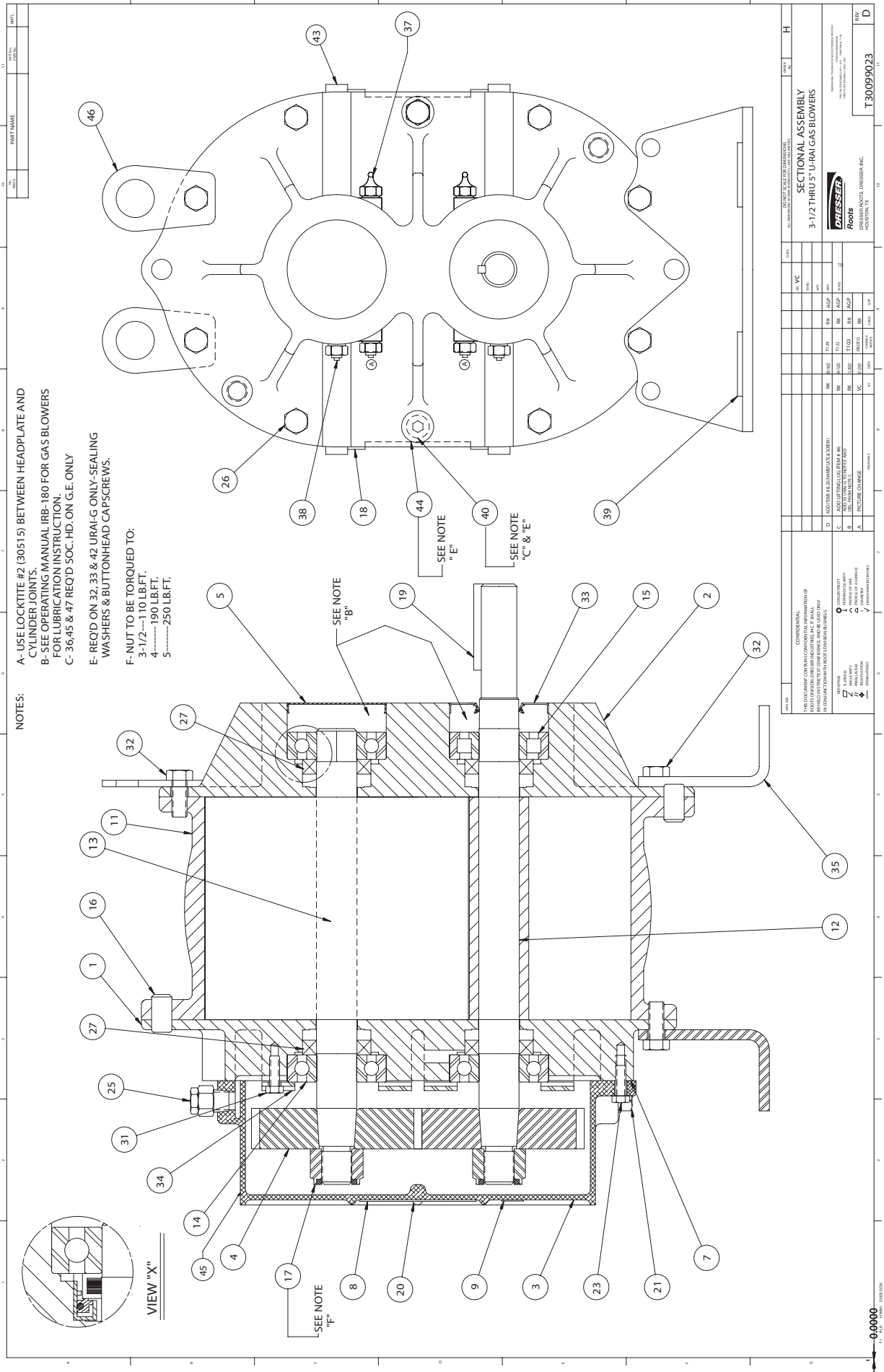
H. ADDED ITEM 33A
 I. REMOVED ITEM 44
 J. ADDED ITEM 44

DATE 06/05/98
 BY ALP
 CHKD. JAV
 APP. WAS

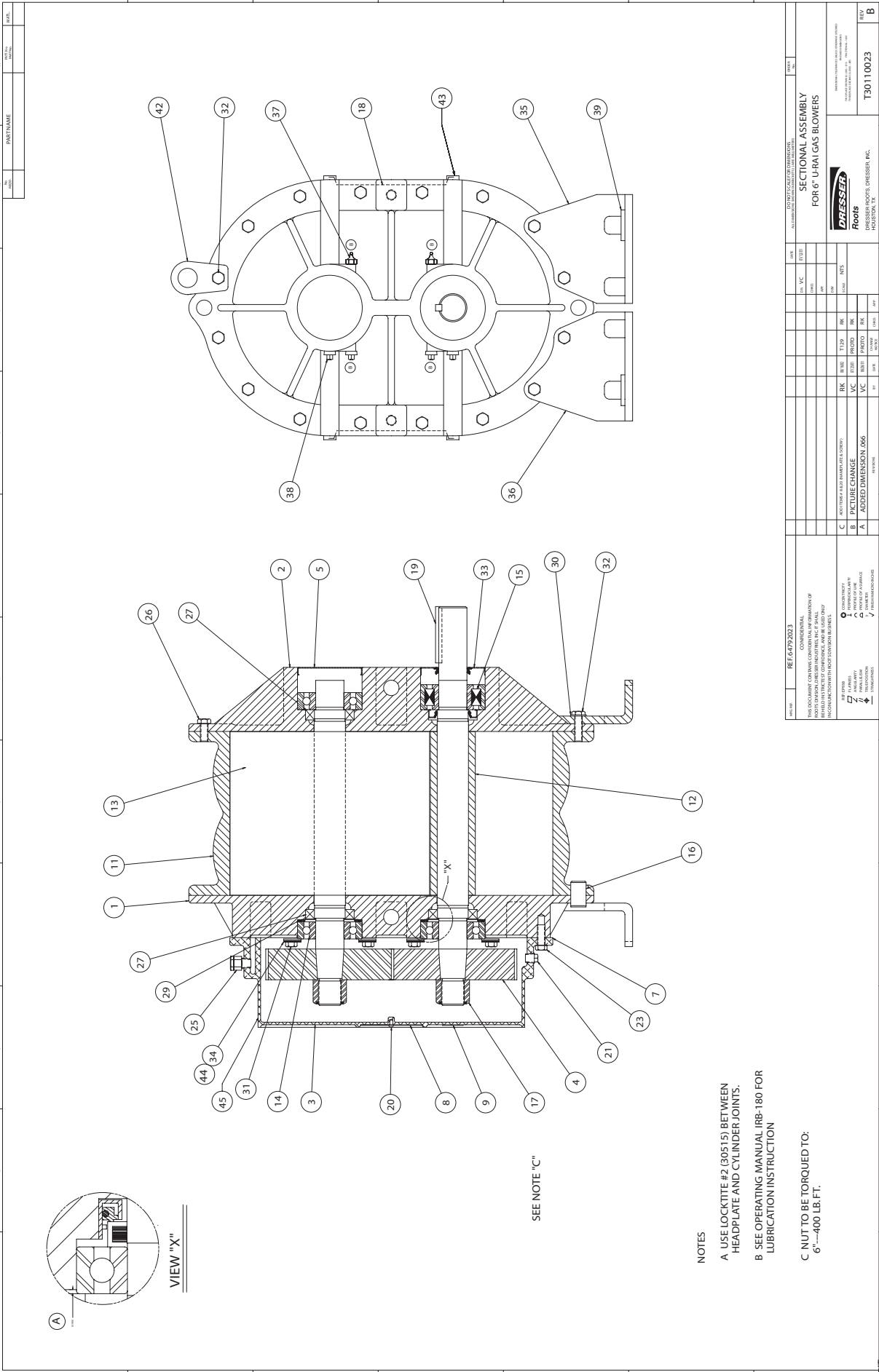
64792023

SECTIONAL ASSEMBLY
 FOR 6" & 7" DIAM. BLOWER
 WITH UPPER BEARING

ROOTS
 DRESSER EQUIPMENT GROUP
 HOUSTON, TX USA



Assembly of UNIVERSAL RAI-G Series Gas Blowers, 3-1/2" Through 5" Gear Diameter

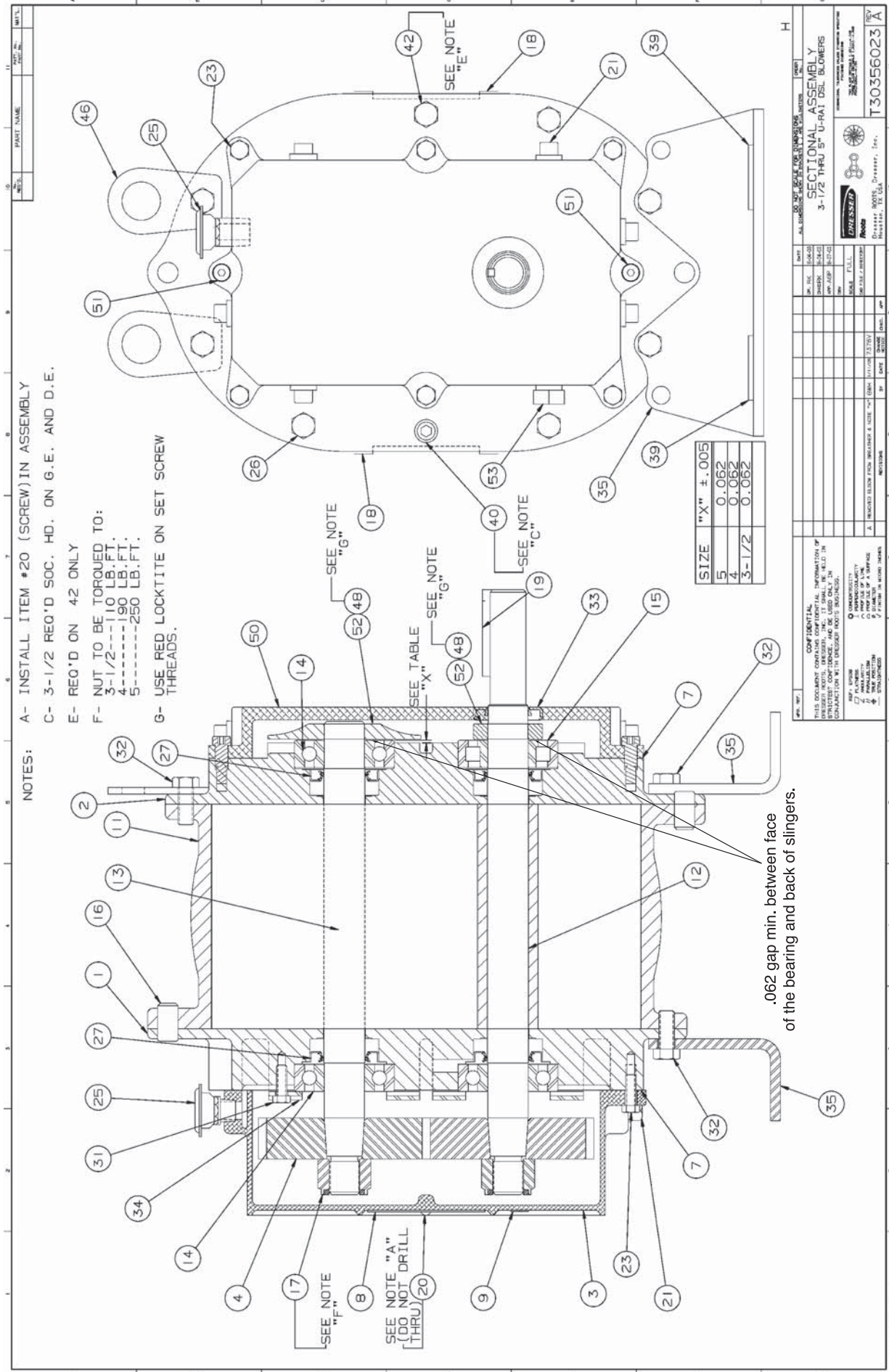


Assembly of UNIVERSAL RAI Series Gas Blowers, 6" Gear Diameter

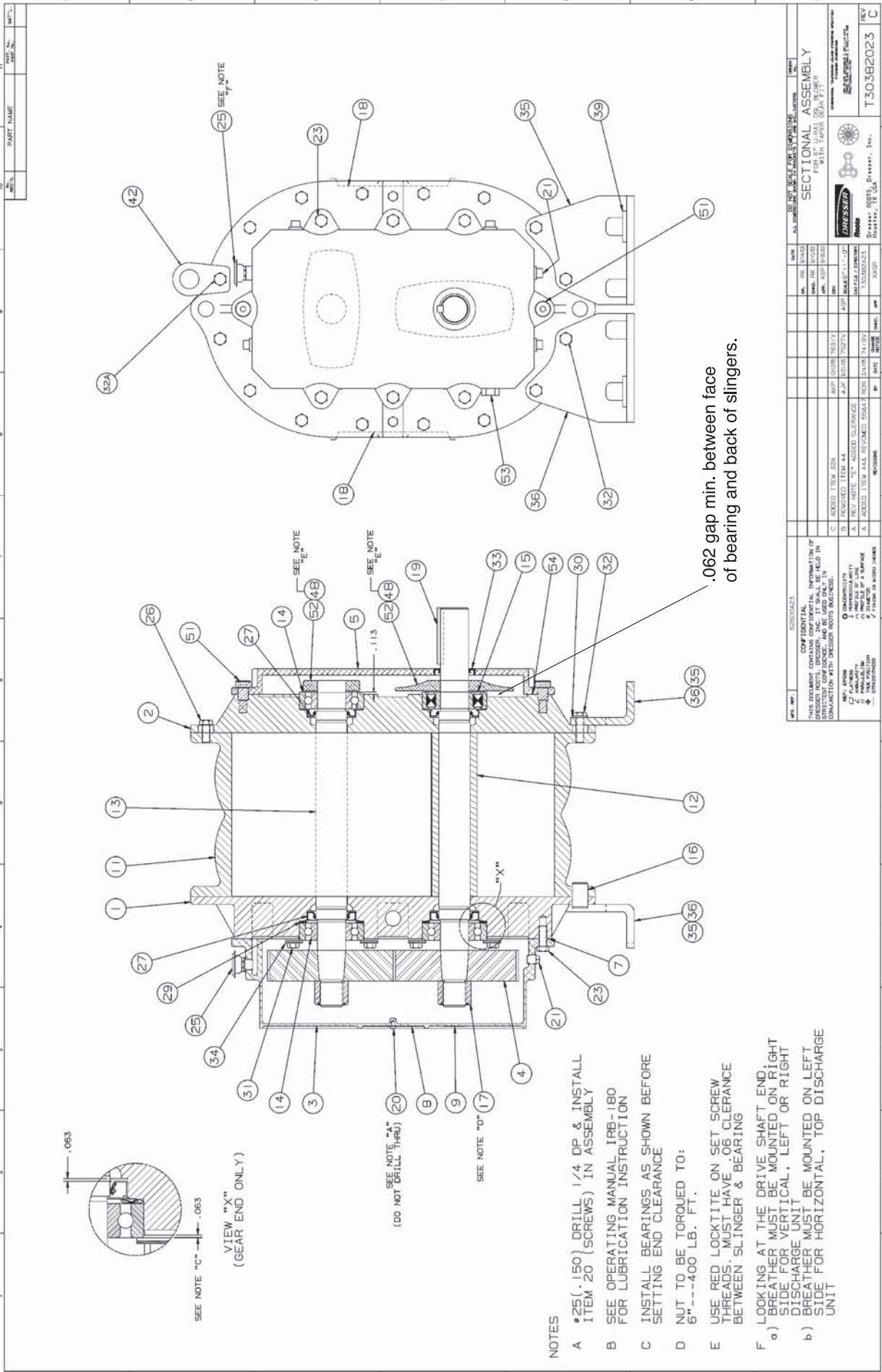
DRESSER
Roots
 DRESSER ROOTS DRIVERS, INC.
 HOUSTON, TX

SECTIONAL ASSEMBLY
FOR 6" U-RAI GAS BLOWERS

| | | | | |
|-----|----------|----|-----|---------------------------------|
| REV | DATE | BY | CHK | DESCRIPTION |
| 1 | 06/24/11 | AK | AK | INITIAL RELEASE FOR MANUFACTURE |
| 2 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 3 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 4 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 5 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 6 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 7 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 8 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 9 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 10 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 11 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 12 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 13 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 14 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 15 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 16 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 17 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 18 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 19 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 20 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 21 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 22 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 23 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 24 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 25 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
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| 27 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 28 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 29 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 30 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 31 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 32 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 33 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 34 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 35 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 36 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 37 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 38 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 39 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 40 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 41 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 42 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 43 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 44 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |
| 45 | 08/12/11 | AK | AK | REWORK (DIMENSION CHANGE) |



Assembly of UNIVERSAL RAI Series - DSL with Splash Lubricated Drive End 3-5" Gear Diameter



- NOTES**
- A #25(.150) DRILL 1/4 DP & INSTALL ITEM 20 (SCREWS) IN ASSEMBLY
 - B SEE OPERATING MANUAL IRB-180 FOR LUBRICATION INSTRUCTION
 - C INSTALL BEARINGS AS SHOWN BEFORE SETTING END CLEARANCE
 - D NUT TO BE TORQUED TO: 6"---400 LB. FT.
 - E USE RED LOCKTITE ON SET SCREW THREADS. MUST HAVE .06 CLEARANCE BETWEEN SLINGER & BEARING
 - F LOOKING AT THE DRIVE SHAFT END:
 - a) BREATHER MUST BE MOUNTED ON RIGHT SIDE FOR VERTICAL, LEFT OR RIGHT DISCHARGE UNIT
 - b) BREATHER MUST BE MOUNTED ON LEFT SIDE FOR HORIZONTAL, TOP DISCHARGE UNIT

.062 gap min. between face of bearing and back of slingers.

| REV | DATE | BY | CHK | APP | DESCRIPTION |
|-----|------|----|-----|-----|------------------------|
| 1 | | | | | ISSUED FOR PRODUCTION |
| 2 | | | | | REVISED TO ADD ITEM 20 |
| 3 | | | | | REVISED TO ADD ITEM 44 |
| 4 | | | | | REVISED TO ADD ITEM 44 |
| 5 | | | | | REVISED TO ADD ITEM 44 |
| 6 | | | | | REVISED TO ADD ITEM 44 |
| 7 | | | | | REVISED TO ADD ITEM 44 |
| 8 | | | | | REVISED TO ADD ITEM 44 |
| 9 | | | | | REVISED TO ADD ITEM 44 |
| 10 | | | | | REVISED TO ADD ITEM 44 |
| 11 | | | | | REVISED TO ADD ITEM 44 |

| REV | DATE | BY | CHK | APP | DESCRIPTION |
|-----|------|----|-----|-----|------------------------|
| 1 | | | | | ISSUED FOR PRODUCTION |
| 2 | | | | | REVISED TO ADD ITEM 20 |
| 3 | | | | | REVISED TO ADD ITEM 44 |
| 4 | | | | | REVISED TO ADD ITEM 44 |
| 5 | | | | | REVISED TO ADD ITEM 44 |
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| 7 | | | | | REVISED TO ADD ITEM 44 |
| 8 | | | | | REVISED TO ADD ITEM 44 |
| 9 | | | | | REVISED TO ADD ITEM 44 |
| 10 | | | | | REVISED TO ADD ITEM 44 |
| 11 | | | | | REVISED TO ADD ITEM 44 |

| REV | DATE | BY | CHK | APP | DESCRIPTION |
|-----|------|----|-----|-----|------------------------|
| 1 | | | | | ISSUED FOR PRODUCTION |
| 2 | | | | | REVISED TO ADD ITEM 20 |
| 3 | | | | | REVISED TO ADD ITEM 44 |
| 4 | | | | | REVISED TO ADD ITEM 44 |
| 5 | | | | | REVISED TO ADD ITEM 44 |
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| 8 | | | | | REVISED TO ADD ITEM 44 |
| 9 | | | | | REVISED TO ADD ITEM 44 |
| 10 | | | | | REVISED TO ADD ITEM 44 |
| 11 | | | | | REVISED TO ADD ITEM 44 |

| REV | DATE | BY | CHK | APP | DESCRIPTION |
|-----|------|----|-----|-----|------------------------|
| 1 | | | | | ISSUED FOR PRODUCTION |
| 2 | | | | | REVISED TO ADD ITEM 20 |
| 3 | | | | | REVISED TO ADD ITEM 44 |
| 4 | | | | | REVISED TO ADD ITEM 44 |
| 5 | | | | | REVISED TO ADD ITEM 44 |
| 6 | | | | | REVISED TO ADD ITEM 44 |
| 7 | | | | | REVISED TO ADD ITEM 44 |
| 8 | | | | | REVISED TO ADD ITEM 44 |
| 9 | | | | | REVISED TO ADD ITEM 44 |
| 10 | | | | | REVISED TO ADD ITEM 44 |
| 11 | | | | | REVISED TO ADD ITEM 44 |

Assembly of UNIVERSAL RAI Series - DSL with Splash Lubricated Drive End 6" Gear Diameter

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Universal RAI Series Blowers Parts List
2-1/2" – 5" Gear Diameter

(Refer to drawing #64720023)

| Item # | Part Name | Qty. |
|--------|----------------------------|------|
| 1 | Headplate Gear End | 1 |
| 2 | Headplate Drive End | 1 |
| 3 | Gearbox | 1 |
| 4 | Timing Gears | 2 |
| 5 | Cover-Blind (Plug Opening) | 1 |
| 7 | Gasket, Gear Box | 1 |
| 11 | Cylinder | 1 |
| 12 | Impeller & Shaft Drive | 1 |
| 13 | Impeller & Shaft Driven | 1 |
| 14 | Bearing, Ball | 3 |
| 15 | Bearing, Roller | 1 |
| 16 | Pin, Dowel | 4 |
| 17 | Gear Nut | 2 |
| 19 | Key | 1 |
| 21 | Plug, Pipe | 3 |
| 23 | Screw Hex | 6 |
| 25 | Breather (Plug Vent) | 1 |
| 26 | Screw, Hex | * |
| 27 | Seal, Lip Bearing | 4 |
| 31 | Screw, Hex, Nylock | 4 |
| 32 | Screw, Hex | 6 |
| 33 | Seal Lip-Drive | 1 |
| 34 | Clamp Plate | 2 |
| 35 | Foot | 2 |
| 37 | Fitting, Grease | 2 |
| 38 | Fitting, Relief | 2 |
| 39 | Washer Mounting | 4 |
| 40 | Screw Socket | 2 |
| 42 | Screw Hex | 2 |

*Quantities vary by blower.

Universal RAI Series Blowers Parts List
6" & 7" Gear Diameter

(Refer to drawing #64792023)

| Item # | Part Name | Qty. |
|--------|----------------------------|------|
| 1 | Headplate Gear End | 1 |
| 2 | Headplate Drive End | 1 |
| 3 | Gearbox | 1 |
| 4 | Timing Gears | 2 |
| 5 | Cover-Blind (Plug Opening) | 1 |
| 7 | Gasket, Gear Box | 1 |
| 11 | Cylinder | 1 |
| 12 | Impeller & Shaft Drive | 1 |
| 13 | Impeller & Shaft Driven | 1 |
| 14 | Bearing, Ball | 3 |
| 15 | Bearing, Roller | 1 |
| 16 | Pin, Dowel | 4 |
| 17 | Gear Nut | 2 |
| 19 | Key | 1 |
| 21 | Plug, Pipe | 3 |
| 23 | Screw Hex Nylock | 8 |
| 25 | Breather (Plug Vent) | 1 |
| 26 | Screw, Hex | * |
| 27 | Seal, Lip Bearing | 4 |
| 29 | Washer, Spring Wavy | 2 |
| 31 | Screw, Hex, Nylock | 4 |
| 32 | Screw, Hex | 10 |
| 33 | Seal Lip-Drive | 1 |
| 34 | Clamp Plate | 2 |
| 35 | Foot | 2 |
| 37 | Fitting, Grease | 2 |
| 38 | Fitting, Relief | 2 |
| 39 | Washer Mounting | 4 |

*Quantities vary by blower.

Universal RAI-DSL Series Blowers Parts List
3-1/2" – 5" Gear Diameter

(Refer to drawing #T30356023)

| Item # | Part Name | Qty. |
|--------|----------------------------|------|
| 1 | Headplate Gear End | 1 |
| 2 | Headplate Drive End | 1 |
| 3 | Gearbox | 1 |
| 4 | Timing Gears | 2 |
| 7 | Gasket, Gear Box, DE Cover | 1 |
| 11 | Cylinder | 1 |
| 12 | Impeller & Shaft Drive | 1 |
| 13 | Impeller & Shaft Driven | 1 |
| 14 | Bearing, Ball | 3 |
| 15 | Bearing, Roller | 1 |
| 16 | Pin, Dowel | 4 |
| 17 | Gear Nut | 2 |
| 19 | Key | 1 |
| 21 | Plug, Pipe | 3 |
| 23 | Screw Hex | 6 |
| 25 | Breather (Plug Vent) | 1 |
| 26 | Screw, Hex | * |
| 27 | Seal, Lip Bearing | 4 |
| 31 | Screw, Hex, Nylock | 4 |
| 32 | Screw, Hex | 6 |
| 33 | Seal Lip-Drive | 1 |
| 34 | Clamp Plate | 2 |
| 35 | Foot | 2 |
| 39 | Washer Mounting | 4 |
| 40 | Screw Socket | 2 |
| 42 | Screw Hex | 2 |
| 48 | DE Oil Slinger Set Screw | 4 |
| 50 | Drive End Cover | 1 |
| 52 | Drive End Oil Slinger | 2 |
| 53 | Oil Sight Glass | 2 |

*Quantities vary by blower.

Universal RAI®-DSL Series Blowers Parts List 6" Gear Diameter

(Refer to drawing #T30382023)

| Item # | Part Name | Qty. | Item # | Part Name | Qty. |
|--------|-------------------------|------|--------|--------------------------|------|
| 1 | Headplate Gear End | 1 | 21 | Plug, Pipe | 3 |
| 2 | Headplate Drive End | 1 | 23 | Screw Hex Nylock | 8 |
| 3 | Gearbox | 1 | 25 | Breather (Plug Vent) | 1 |
| 4 | Timing Gears | 2 | 26 | Screw, Hex | * |
| 7 | Gasket, Gear Box | 1 | 27 | Seal, Lip Bearing | 4 |
| 11 | Cylinder | 1 | 31 | Screw, Hex, Nylock | 4 |
| 12 | Impeller & Shaft Drive | 1 | 32 | Screw, Hex | 10 |
| 13 | Impeller & Shaft Driven | 1 | 33 | Seal Lip-Drive | 1 |
| 14 | Bearing, Ball | 3 | 34 | Clamp Plate | 2 |
| 15 | Bearing, Roller | 1 | 35 | Foot | 2 |
| 16 | Pin, Dowel | 4 | 39 | Washer Mounting | 4 |
| 17 | Gear Nut | 2 | 48 | DE Oil Slinger Set Screw | 4 |
| 19 | Key | 1 | 50 | Drive End Cover | 1 |
| | | | 52 | Drive End Oil Slinger | 2 |

*Quantities vary by blower.

**Universal RAI Series Gas Blowers Parts List
3-1/2" & 5" Gear Diameter**

(Refer to drawing #T30099023)

| Item # | Part Name | Qty. |
|--------|----------------------------|------|
| 1 | Headplate Gear End | 1 |
| 2 | Headplate Drive End | 1 |
| 3 | Gearbox | 1 |
| 4 | Timing Gears | 2 |
| 5 | Cover-Blind (Plug Opening) | 1 |
| 7 | Gasket, Gear Box | 1 |
| 11 | Cylinder | 1 |
| 12 | Impeller & Shaft Drive | 1 |
| 13 | Impeller & Shaft Driven | 1 |
| 14 | Bearing, Ball | 3 |
| 15 | Bearing, Roller | 1 |
| 16 | Pin, Dowel | 4 |
| 17 | Gear Nut | 2 |
| 19 | Key | 1 |
| 21 | Plug, Pipe | 3 |
| 23 | Screw Hex | 8 |
| 25 | Breather (Plug Vent) | 1 |
| 26 | Screw, Hex | 14* |
| 27 | Seal, Bearing | 4 |
| 31 | Screw, Hex | 4 |
| 32 | Screw, Hex | 4 |
| 33 | Seal Lip-Drive | 1 |
| 34 | Clamp Plate | 2 |
| 35 | Foot | 2 |
| 37 | Fitting, Grease | 2 |
| 38 | Fitting, Relief | 2 |
| 39 | Washer Mounting | 4 |
| 40 | Screw Socket | 2 |
| 42 | Screw Hex | 2 |

*Quantities vary by blower.

**Universal RAI Series Gas Blowers Parts List
6" Gear Diameter**

(Refer to drawing #T3011023)

| Item # | Part Name | Qty. |
|--------|----------------------------|------|
| 1 | Headplate Gear End | 1 |
| 2 | Headplate Drive End | 1 |
| 3 | Gearbox | 1 |
| 4 | Timing Gears | 2 |
| 5 | Cover-Blind (Plug Opening) | 1 |
| 7 | Gasket, Gear Box | 1 |
| 7* | Gasket DE Cover | 1 |
| 11 | Cylinder | 1 |
| 12 | Impeller & Shaft Drive | 1 |
| 13 | Impeller & Shaft Driven | 1 |
| 14 | Bearing, Ball | 3 |
| 15 | Bearing, Roller | 1 |
| 16 | Pin, Dowel | 4 |
| 17 | Gear Nut | 2 |
| 19 | Key | 1 |
| 21 | Plug, Pipe | 3 |
| 23 | Screw Hex Nylock | 8 |
| 25 | Breather (Plug Vent) | 1 |
| 26 | Screw, Hex | 14** |
| 27 | Seal, Bearing | 4 |
| 31 | Screw, Hex | 4 |
| 32 | Screw, Hex | 10 |
| 33 | Seal Lip-Drive | 1 |
| 34 | Clamp Plate | 2 |
| 35 | Foot | 2 |
| 37 | Fitting, Grease | 2 |
| 38 | Fitting, Relief | 2 |
| 39 | Washer Mounting | 4 |
| 40 | Screw Socket | 2 |
| 42 | Screw Hex | 2 |
| 43 | Plug | 8 |
| 53 | Oil Sight Glass | 2 |

*DE cover gasket is not the same as the gasket used on the GE. You must specify the gasket required when ordering.

**Quantities vary by blower.

Specified Lubricants

ROOTS Synthetic Oil: ISO-VG-220 Grade

| | Part Number |
|---------------|-------------|
| Quart | 813-106-001 |
| Gallon | 813-106-002 |
| Case (12 qts) | 813-106-008 |

ROOTS Synthetic Oil: ISO-VG-320 Grade

| | Part Number |
|---------------|-------------|
| Quart | 813-106-004 |
| Gallon | 813-106-005 |
| Case (12 qts) | 813-106-007 |

ROOTS Synthetic Grease: NLGI #2

| | Part Number |
|-----------------|-------------|
| 14.5 oz. Tube | T200019-001 |
| 5 Gallon Pail | T200019-003 |
| Case (30 tubes) | T200019-002 |

Basic Connection & Drive Shaft Information

UNIVERSAL RAI (URAI) AIR BLOWERS

URAI AIR BLOWERS (with Grease Lubricated Drive End)

| BOM # * | FRAME SIZE | INLET/DISCH CONN. | SHAFT DIAMETER | BARE WEIGHT |
|----------|------------|-------------------|----------------|-------------|
| 65102020 | 22 | 1" NPT | 0.625" | 32 |
| 65103020 | 24 | 2" NPT | 0.625" | 43 |
| 71048020 | 32 | 1.25" NPT | 0.750" | 69 |
| 65105020 | 33 | 2" NPT | 0.750" | 74 |
| 65106020 | 36 | 2.5" NPT | 0.750" | 102 |
| 65108020 | 42 | 1.5" NPT | 0.875" | 88 |
| 65109020 | 45 | 2.5" NPT | 0.875" | 109 |
| 65110020 | 47 | 3" NPT | 0.875" | 128 |
| 65112020 | 53 | 2.5" NPT | 1.125" | 143 |
| 65113020 | 56 | 4" NPT | 1.125" | 170 |
| 65114020 | 59 | 4" NPT | 1.125" | 204 |
| 65116020 | 65 | 3" NPT | 1.375" | 245 |
| 65117020 | 68 | 5" NPT | 1.375" | 285 |
| 65118020 | 615 | 6" Flange | 1.375" | 425 |
| 65120020 | 76 | 4" NPT | 1.562" | 400 |
| 65121020 | 711 | 6" Flange | 1.562" | 530 |
| 65122020 | 718 | 8" Flange | 1.562" | 650 |

Refer to Specification Sheet S-12K84

URAI-DSL AIR BLOWERS (with Dual Splash Lubrication DSL)

| BOM # * | FRAME SIZE | INLET/DISCH CONN. | SHAFT DIAMETER | BARE WEIGHT |
|-----------|------------|-------------------|----------------|-------------|
| T30378020 | 32 | 1.25" NPT | 0.750" | 72 |
| T30379020 | 33 | 2" NPT | 0.750" | 77 |
| T30380020 | 36 | 2.5" NPT | 0.750" | 105 |
| T30352020 | 42 | 1.5" NPT | 0.875" | 92 |
| T30353020 | 45 | 2.5" NPT | 0.875" | 113 |
| T30354020 | 47 | 3" NPT | 0.875" | 132 |
| T30359020 | 53 | 2.5" NPT | 1.125" | 148 |
| T30360020 | 56 | 4" NPT | 1.125" | 175 |
| T30361020 | 59 | 4" NPT | 1.125" | 209 |
| T30384020 | 65 | 3" NPT | 1.375" | 250 |
| T30385020 | 68 | 5" NPT | 1.375" | 290 |
| T30386020 | 615 | 6" Flange | 1.375" | 430 |

Refer to Specification Sheet S-27S03

Universal RAI air blowers include detachable mounting feet which permit vertical or horizontal installation. The units are center timed for rotation in either direction. The bearings on the URAI are grease lubricated on the drive end and splash lubricated on the gear end. The URAI-DSL is splash lubricated on BOTH ends.

UNIVERSAL RAI (URAI) GAS BLOWERS

URAI-G™ GAS BLOWERS (with Grease Lubricated Drive End)

| BOM # * | FRAME SIZE | INLET/DISCH CONN. | SHAFT DIAMETER | BARE WEIGHT |
|----------|------------|-------------------|----------------|-------------|
| 710480G0 | 32 | 1.25" NPT | 0.750" | 69 |
| 651050G0 | 33 | 2" NPT | 0.750" | 74 |
| 651060G0 | 36 | 2.5" NPT | 0.750" | 102 |
| 651080G0 | 42 | 1.5" NPT | 0.875" | 88 |
| 651090G0 | 45 | 2.5" NPT | 0.875" | 109 |
| 651100G0 | 47 | 3" NPT | 0.875" | 128 |
| 651120G0 | 53 | 2.5" NPT | 1.125" | 143 |
| 651130G0 | 56 | 4" NPT | 1.125" | 170 |
| 651140G0 | 59 | 4" NPT | 1.125" | 204 |
| 651160G0 | 65 | 3" NPT | 1.375" | 245 |
| 651170G0 | 68 | 5" NPT | 1.375" | 285 |
| 651180G0 | 615 | 6" NPT | 1.375" | 425 |

Refer to Specification Sheet S-60A01

Universal RAI-G™ gas blowers include detachable mounting feet which permit vertical or horizontal installation. **Feet are different for vertical and horizontal mounting.**

The units are center timed for rotation in either direction. The bearings on the Universal RAI-GTM are grease lubricated on the drive end and splash lubricated on the gear end. ROOTS Synthetic lubricant is recommended.

Basic Connection & Drive Shaft Information

UNIVERSAL RAI (URAI-J) WHISPAIR AIR BLOWERS

URAI-J WHISPAIR AIR BLOWERS (with Grease Lubed Drive End)

| BOM # * | FRAME SIZE | INLET/DISCH CONN. | SHAFT DIAMETER | BARE WEIGHT |
|----------------|-------------------|--------------------------|-----------------------|--------------------|
| 74065020 | 33J | 2" NPT | 0.750" | 84 |
| 74086020 | 36J | 2.5" NPT | 0.750 | 112 |
| 74066020 | 45J | 2.5" NPT | 0.875" | 119 |
| 74087020 | 47J | 3" NPT | 0.875 | 138 |
| 74067020 | 56J | 4" NPT | 1.125" | 180 |

Refer to Specification Sheet S-33A93

URAI-J-DSL WHISPAIR AIR BLOWERS (with Dual Splash Lubrication DSL)

| BOM # * | FRAME SIZE | INLET/DISCH CONN. | SHAFT DIAMETER | BARE WEIGHT |
|----------------|-------------------|--------------------------|-----------------------|--------------------|
| T30417020 | 33J | 2" NPT | 0.750" | 87 |
| T30418020 | 36J | 2.5" NPT | 0.750 | 115 |
| T30410020 | 45J | 2.5" NPT | 0.875" | 122 |
| T30412020 | 47J | 3" NPT | 0.875 | 141 |
| T30415020 | 56J | 4" NPT | 1.125" | 185 |

Refer to Specification Sheet S-30S03

URAI-J METRIC WHISPAIR AIR BLOWERS (with Grease Lubed Drive End)

| BOM # * | FRAME SIZE | INLET/DISCH CONN. | SHAFT DIAMETER | BARE WEIGHT |
|----------------|-------------------|--------------------------|-----------------------|--------------------|
| TBD | 33J | 2" BSP | 19 mm | 84 |
| 740860M0 | 36J | 2.5" BSP | 19 mm | 112 |
| TBD | 45J | 2.5" BSP | 24 mm | 119 |
| TBD | 47J | 3" BSP | 24 mm | 138 |
| TBD | 56J | 4" BSP | 28 mm | 180 |

URAI-J-DSL METRIC WHISPAIR AIR BLOWERS (with Dual Splash Lubrication DSL)

| BOM # * | FRAME SIZE | INLET/DISCH CONN. | SHAFT DIAMETER | BARE WEIGHT |
|----------------|-------------------|--------------------------|-----------------------|--------------------|
| TBD | 33J | 2" BSP | 19 mm | 87 |
| T304660M0 | 36J | 2.5" BSP | 19 mm | 115 |
| TBD | 45J | 2.5" BSP | 24 mm | 122 |
| T304550M0 | 47J | 3" BSP | 24 mm | 141 |
| TBD | 56J | 4" BSP | 28 mm | 185 |

Universal RAI-J air blowers incorporate the patented Whispair™ design in addition to the same features as the original URAI blowers. The URAI-J's are center timed, however the Whispair™ benefits can only be realized when the jet is located in the discharge position.

Basic Connection & Drive Shaft Information

UNIVERSAL RAI METRIC (URAI-M) AIR BLOWERS

NOTE: METRIC URAI product has metric shaft diameter and connection sizes

URAI-METRIC AIR BLOWERS (with Grease Lubricated Drive End)

| BOM # * | FRAME SIZE | INLET/DISCH CONN. | SHAFT DIAMETER | BARE WEIGHT |
|-----------|------------|-------------------|----------------|-------------|
| 651020M0 | 22 | 1" BSP | 16 mm | 32 |
| 651030M0 | 24 | 2" BSP | 16 mm | 43 |
| 710480M0 | 32 | 1 1/4" BSP | 19 mm | 69 |
| 651050M0 | 33 | 2" BSP | 19 mm | 74 |
| 651060M0 | 36 | 2 1/2" BSP | 19 mm | 102 |
| 651080M0 | 42 | 1 1/2" BSP | 24 mm | 88 |
| 651090M0 | 45 | 2 1/2" BSP | 24 mm | 109 |
| 651100M0 | 47 | 3" BSP | 24 mm | 128 |
| 651120M0 | 53 | 2 1/2" BSP | 28 mm | 143 |
| 651130M0 | 56 | 4" BSP | 28 mm | 170 |
| 651140M0 | 59 | 4" BSP | 28 mm | 204 |
| T30392060 | 65 | 3" BSP | 32 mm | 245 |
| T30394060 | 68 | 5" BSP | 32 mm | 285 |
| T30390060 | 615 | 150 NP10 | 32 mm | 425 |
| T30396060 | 76 | 4" BSP | 38 mm | 400 |
| T30398060 | 711 | 150 NP10 | 38 mm | 530 |
| T30400060 | 718 | 200 NP10 | 38 mm | 650 |

URAI-DSL-METRIC AIR BLOWERS (with Dual Splash Lubrication DSL)

| BOM # * | FRAME SIZE | INLET/DISCH CONN. | SHAFT DIAMETER | BARE WEIGHT |
|-----------|------------|-------------------|----------------|-------------|
| T30463060 | 32 | 1 1/4" BSP | 19 mm | 72 |
| T30464060 | 33 | 2" BSP | 19 mm | 77 |
| T30465060 | 36 | 2 1/2" BSP | 19 mm | 105 |
| T30451060 | 42 | 1 1/2" BSP | 24 mm | 92 |
| T30452060 | 45 | 2 1/2" BSP | 24 mm | 113 |
| T30453060 | 47 | 3" BSP | 24 mm | 132 |
| T30459060 | 53 | 2 1/2" BSP | 28 mm | 148 |
| T30460060 | 56 | 4" BSP | 28 mm | 175 |
| T30461060 | 59 | 4" BSP | 28 mm | 209 |
| T30472060 | 65 | 3" BSP | 32 mm | 250 |
| T30473060 | 68 | 5" BSP | 32 mm | 290 |
| T30474060 | 615 | 150 NP 10 | 32 mm | 430 |

Universal RAI air blowers include detachable mounting feet which permit vertical or horizontal installation. The units are center timed for rotation in either direction. The bearings on the URAI are grease lubricated on the drive end and splash lubricated on the gear end. The URAI-DSL is splash lubricated on BOTH ends.

CUSTOMER SERVICE

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Direct Line: 832-590-2600
Toll Free Fax: 1-877-357-7238
Direct Fax: 832-590-2325

Roots Factory Service & Repair Centers

Dresser Roots – Houston Service Center Dresser Roots Factory Service & Repair Center

11611B Tanner Rd.
Houston, TX 77041
Ph: 713-896-4810
Fax: 713-896-4927

Dresser Roots – Connersville Service Center Dresser Roots Factory Service & Repair Center

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Dresser Roots – United Kingdom Service Center Dresser Roots Factory Service & Repair Center

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ISRB-2002 rev.0106
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APPENDIX IV

Motor Maintenance Data

Carefully read and fully understand this Owner's Manual prior to installation, operation and maintenance of your motor.

1. SAFETY DEPENDS ON YOU

Lincoln Electric motors are designed and manufactured with safety in mind. However, your overall safety can be increased by properly installing, operating and maintaining the motor. Read and observe all instructions, warnings and specific safety precautions included in this manual and **THINK BEFORE YOU ACT!**

2. RECEIVING AND INSPECTION

Check packing list and inspect motor to make certain no damage has occurred in shipment. Claims for any damage done in shipment must be made by the purchaser against the transportation company.

Turn the motor shaft by hand to be certain that it rotates freely. Be careful not to cut yourself on the shaft keyway; it is razor sharp!

Check the nameplate for conformance with power supply and control equipment requirements.

3. HANDLING

⚠ WARNING



FALLING EQUIPMENT can injure.

- Lift only with equipment of adequate lifting capacity.
- If so equipped, use lift ring(s) on the motor to lift **ONLY** the motor and accessories mounted by Lincoln Electric.

In case of assemblies on a common base, the motor lift ring(s) CANNOT be used to lift the assembly and base but, rather, the assembly should be lifted by a sling around the base or by other lifting means provided on the base. In all cases, care should be taken to assure lifting in the direction intended in the design of the lifting means. Likewise, precautions should be taken to prevent hazardous overloads due to deceleration, acceleration or shock forces.

4. STORAGE

Motor stock areas should be clean, dry, vibration free and have a relatively constant ambient temperature. For added bearing protection while the motor is in storage, turn the motor shaft every six months.

A motor stored on equipment and component equipment prior to installation should be kept dry and protected from the weather. If the equipment is exposed to the atmosphere, cover the motor with a waterproof cover. Motors should be stored in the horizontal position with drains operable and positioned in the lowest point. CAUTION: Do not completely surround the motor with the protective covering. The bottom area should be open at all times.

Windings should be checked with a megohm-meter (Megger) at the time equipment is put in storage. Upon removal from storage, the resistance reading must not have dropped more than 50% from the initial reading. Any drop below this point necessitates electrical or mechanical drying. Note the sensitivity of properly connected megohm-meters can deliver erroneous values. Be sure to carefully follow the megohm-meter's operating instructions when making measurements.

All external motor parts subject to corrosion, such as the shaft and other machined surfaces, must be protected by applying a corrosion-resistant coating.

5. INSTALLATION

For maximum motor life, locate the motor in a clean, dry, well ventilated place easily accessible for inspecting, cleaning and lubricating. The temperature of the surrounding air should not exceed 104°F (40°C) except for motors with nameplates indicating a higher allowable maximum ambient temperature.

⚠ WARNING



MOVING PARTS can injure.

- **BEFORE** starting motor, be sure shaft key is captive.
- Consider application and provide guarding to protect personnel.

5.1 INSTALLATION – MECHANICAL

Base

Mount the motor on a firm foundation or base sufficiently rigid to prevent excessive vibration. On foot-mounted motors, use appropriately sized bolts through all four mounting holes. For frames which have six or eight mounting holes, use the two closest the drive shaft and two on the end opposite the drive shaft (one on each side of the frame). If necessary, properly shim the motor to prevent undue stress on the motor frame and to precision align the unit.

Position

Standard motors may be mounted in any position. The radial and thrust load capacity of the motor's bearing system provides for this feature.

Drains

All motors have drain holes located in the end brackets. As standard, drains are in place for the horizontal with feet down mounting position. Other positions may require either rotation of the end brackets or drilling additional holes to attain proper drainage. Be sure existing drain or vent holes do not permit contaminant entry when motor is mounted in the other positions.

Additional drain holes exist near the bearing cartridge in both end brackets of 284T thru 449T steel frame motors. The drain holes are closed with a plastic plug. When the motor is vertically mounted, the plug located in the lower end bracket must be removed. To access the plug on blower end, simply remove the shroud; on some models, it is also necessary to take off the blower.

Drive – Power Transmission

The pulley, sprocket, or gear used in the drive should be located on the shaft as close to the shaft shoulder as possible. Do not drive the unit on the shaft as this will damage the bearings. Coat the shaft lightly with heavy oil before installing pulley.

Belt Drive: Align the pulleys so that the belt(s) will run true. Consult the belt manufacturer's catalog for recommended tension. Properly tension the belt; excessive tension will cause premature bearing failure. If possible, the lower side of the belt should be the driving side. On multiple belt installations be sure all belts are matched for length.

Chain Drive: Mount the sprocket on the shaft as close to the shaft shoulder as possible. Align the sprockets so that the chain will run true. Avoid excessive chain tension.

Gear Drive and Direct Connection: Accurate alignment is essential. Secure the motor and driven unit rigidly to the base. Shims may be needed to achieve proper alignment.

Excessive motor vibration may result if the full length of the motor shaft key is not completely engaged by the coupling or sheave. For these situations, adjustment of the key length is required.

5.2 INSTALLATION – ELECTRICAL

⚠ **WARNING**

ELECTRIC SHOCK can kill.

- Disconnect input power supply before installing or servicing motor.
- Motor lead connections can short and cause damage or injury if not well secured and insulated.

- Use washers, lock washers and the largest bolt size which will pass through the motor lead terminals in making connections.
- Insulate the connection, equal to or better than the insulation on the supply conductors.
- Properly ground the motor — see **GROUNDING**.

Check power supply to make certain that voltage, frequency and current carrying capacity are in accordance with the motor nameplate.

Proper branch circuit supply to a motor should include a disconnect switch, short circuit fuse or breaker protection, motor starter (controller) and correctly sized thermal elements or overload relay protection.

Short circuit current fuses or breakers are for the protection of the branch circuit. Starter or motor controller overload relays are for the protection of the motor.

Each of these should be properly sized and installed per the National Electrical Code and local codes.

Properly ground the motor – See **GROUNDING**.

Terminal Box

Remove the appropriate knockout. For terminal boxes without a knockout, either a threaded power-conduit entry hole is provided or the installer is responsible for supplying a correctly sized hole.

The majority of terminal boxes can be rotated in place to allow power lead entry from the 3, 6, 9 or 12 o'clock direction.

Motor Connection

All single speed and two-speed Lincoln motors are capable of across-the-line or autotransformer starting. Reference the lead connection diagram located on the nameplate or inside of the terminal box cover.

Single speed motors have reduced voltage start capability per the following chart.

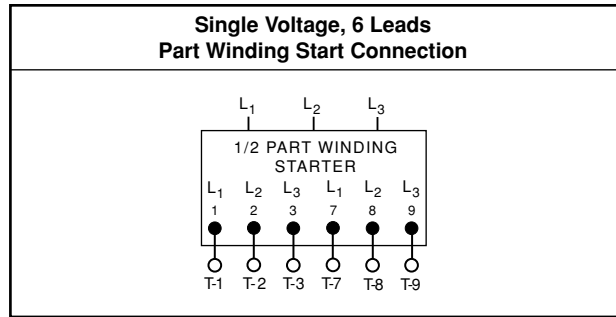
| Number of Motor Leads | Number of Rated Voltages | Lead Numbers | YDS | PWS |
|-----------------------|--------------------------|--------------|--------------------|-------------------|
| 3 | Single | 1-3 | No | No |
| 6 | Single | 1-3, 7-9 | No | Yes |
| | Single | 1-6 | Yes | No |
| 9 | Dual | 1-6 | Yes ⁽¹⁾ | No |
| | Dual | 1-9 | No | No |
| 12 | Single | 1-12 | Yes | Yes |
| | Dual | 1-12 | Yes | No ⁽²⁾ |

(1) YDS capability on lower voltage only.

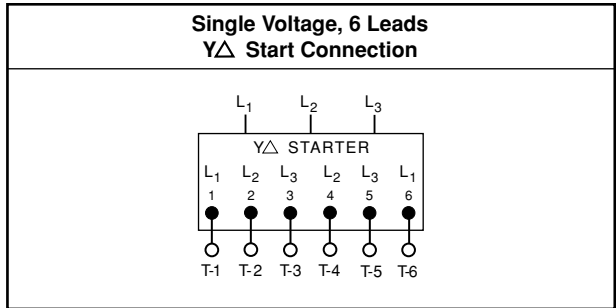
(2) PWS capability on lower voltage only, 1200 RPM, 324T-365T steel frame motors with Model Number efficiency letter of "S" or "H".

Contact Motor Customer Service at 1-800-668-6748 (phone), 1-888-536-6867 (fax) or motors@lincolnelectric.com (e-mail) for a copy of across-the-line and other reduced voltage start connection diagrams.

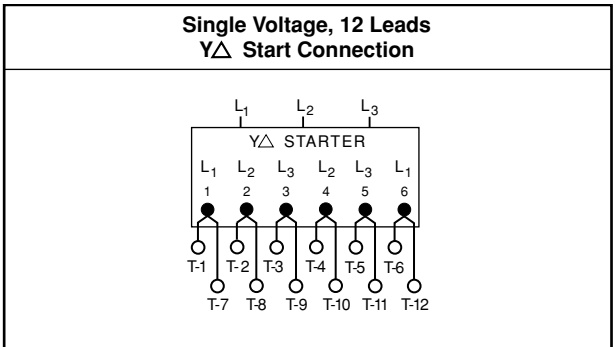
Connection Diagram 1



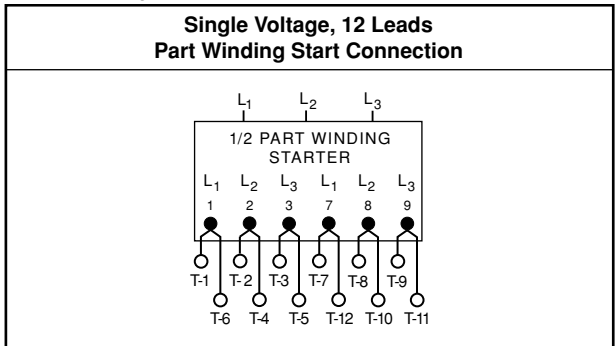
Connection Diagram 2



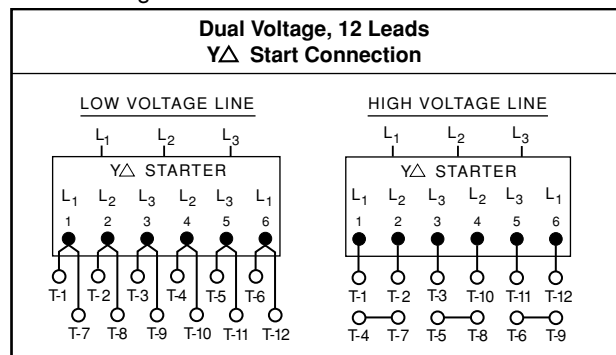
Connection Diagram 3



Connection Diagram 4



Connection Diagram 5



Space Heater (option)

Leads for space heaters are identified as H1 and H2. Heater voltage and watts are marked on the motor nameplate and should be checked prior to connection to power source.

Thermostat (option)

Leads for thermostats (normally closed, automatic reset contacts) are identified as P1 and P2. Connect these to a relay or signaling device. Motor line current cannot be handled by the thermostat.

Table 1 — Thermostat Contact Ratings

| Voltage (60 Hz) | 110V | 220V |
|---------------------------|------|------|
| Max. Cont. Current (amps) | 3.0 | 1.5 |
| Min. Cont. Current (amps) | 0.2 | 0.1 |

Thermistor (option)

Leads for thermistors are identified as P3 and P4. Thermistors require connection to Texas Instruments® Control Module Model 32AA or its equivalent for proper operation. This item may be purchased from Lincoln Electric.

Brake (option)

Carefully read and fully understand the instructions supplied by the brake manufacturer (see inside of brake housing or separately enclosed sheet). Contact the brake manufacturer for additional information.

GROUNDING

WARNING

ELECTRIC SHOCK can kill.

- **Connect the motor frame to a good earth ground per the National Electrical Code and local codes to limit the potential to ground in the event of contact between live electrical parts and the metal exterior.**

Lincoln motors may be electrically connected to earth ground using a terminal box mounting screw or a separate grounding screw when provided. Both are accessible inside the mounted terminal box. When a bronze mounting screw is supplied, always use it as the grounding point. In making the ground connection, the installer should make certain that there is a good electrical connection between the grounding lead and the motor.

6. OPERATION

Three phase squirrel cage induction motors will operate successfully, but not necessarily in accordance with nameplate ratings, at voltages 10 percent above or below nameplated value at the design frequency.

WARNING

MOVING PARTS can injure.

- **Before starting the motor, remove all unused shaft keys and loose rotating parts to prevent them from flying off and causing bodily injury.**
- **Keep away from moving parts.**

ELECTRIC SHOCK can kill.

- **Do not operate with covers removed.**
- **Do not touch electrically live parts.**

After checking that the shaft key is secure, operate the motor free of load and check the direction of rotation. If the motor rotates in the wrong direction, interchange any two supply leads.

Couple the motor to its load and operate it for a minimum of one hour. During this period, check for any unusual noise or thermal conditions. Check the actual operating current to be sure that the nameplate current times service factor is not exceeded for steady continuous loads.

7. MAINTENANCE

WARNING

ELECTRIC SHOCK can kill.

- **Internal parts of the motor may be at line potential even when it is not rotating.**
- **Disconnect all input power to the drive and motor before performing any maintenance.**

Lincoln Electric motors have been designed and manufactured with long motor life expectancy and trouble-free operation in mind.

Periodically inspect the motor for excessive dirt, friction or vibration. Dust may be blown from an inaccessible location using compressed air. Keep the ventilation openings clear to allow free passage of air. Make sure the drain holes in the motors are kept open and the shaft slinger is positioned against the end bracket. Grease or oil can be wiped by using a petroleum solvent.

Overheating of the bearings caused by excessive friction is usually caused by one of the following factors:

1. Bent shaft.
2. Excessive belt tension.
3. Excessive end or side thrust from the gearing, flexible coupling, etc.
4. Poor alignment.

Damaging vibrations can be caused by loose motor mountings, motor misalignment resulting from the settling or distortion of the foundation, or it may be transmitted from the driven machine. Vibration may also be caused by excessive belt or chain tension.

BEARING SYSTEM

Lincoln motors have a high quality, premium design bearing system. Bearing sizes and enclosures are identified on most motor nameplates. The majority are double-shielded, deep-groove ball bearings. Double-sealed ball bearings are used on some motors in frames 56 and 143T thru 145T. A drive-end cylindrical roller bearing is standard on Crusher Duty motors, frames 405T and larger.

Lubrication instructions and/or grease specifications provided on the motor supersede the following information.

In general, the motor's bearing system has sufficient grease to last indefinitely under normal service conditions. For severe or extreme service conditions, it is advisable to add one-quarter ounce of grease to each bearing per the schedule listed in Table 2. Use a good quality, moisture-resistant, polyurea-based grease such as Chevron SRI #2. Lithium based greases are not compatible with polyurea-based greases; mixing the two types may result in the loss of lubrication.

Motors designed for low ambient applications have bearings with special low temperature grease. Use Beacon 325 lithium based grease or equivalent per the appropriate interval in Table 2.

Motors designed for high ambient applications have bearings with special high temperature grease. Use Dow Corning DC44 silicone grease or equivalent per the interval in Table 2 under "Extreme".

Severe Service: Operating horizontally, 24 hours per day, vibration, dirty, dusty, high humidity, weather exposure, or ambient temperatures from 104-130°F (40-55°C).

Extreme Service: Operating vertically, heavy vibration or shock, heavy duty cycle, very dirty or ambient temperatures from 130-150°F (55-65°C).

Table 2 : Bearing Lubrication Intervals

| Motor Syn Speed | Motor Horsepower | Service Conditions | |
|------------------------|------------------|--------------------|----------|
| | | Severe | Extreme |
| BALL BEARINGS | | | |
| 1800 RPM and slower | 1/4 to 7-1/2 HP | 2 years | 6 months |
| | 10 to 40 HP | 1 year | 3 months |
| | 50 HP and up | 6 months | 3 months |
| above 1800 RPM | all sizes | 3 months | 3 months |
| ROLLER BEARINGS | | | |
| all speeds | all sizes | 3 months | 3 months |

When adding lubricant, keep all dirt out of the area. Wipe the fitting completely clean and use clean grease dispensing equipment. More bearing failures are caused by dirt introduced during greasing than from insufficient grease.

If the motor is equipped with a relief port or tube, make certain it is open and free of caked or hardened grease. Before replacing relief plugs, allow excess grease or pressure to vent by running the motor for several minutes after lubrication.

⚠ CAUTION

- LUBRICANT SHOULD BE ADDED AT A STEADY MODERATE PRESSURE. IF ADDED UNDER HEAVY PRESSURE BEARING SHIELD(S) MAY COLLAPSE.
- DO NOT OVER GREASE.

PARTS

All parts should be ordered from Authorized Motor Warranty Stations. Call your Lincoln Electric Sales Office for location and phone number. A "Service Directory" listing all Authorized Motor Warranty Stations geographically is available; request Bulletin SD-6. These shops stock GENUINE Lincoln Electric replacement parts and have factory trained personnel to service your motor.

8. WHO TO CALL

For the location and phone number of the Lincoln Electric District Sales and Technical Support Office nearest you, check your local Yellow Pages or call 1-800-MOTOR-4-U (1-800-668-6748) or visit our web site at www.lincolnelectric.com/motors.

9. WARRANTY

The Lincoln Electric Company, the Seller, warrants all new *standard* motors and accessories thereof against defects in workmanship and material provided the equipment has been properly cared for and operated under normal conditions. All warranty periods begin on the date of shipment to the original purchaser. Warranty periods for **low voltage (< 600 V)** motors are defined in the following chart. The warranty period for **medium voltage (> 600 V)** motors is one year on sine-wave power. Contact Lincoln for warranty period on PWM power.

| Model Number Prefix | Efficiency Code(s) | Frame Sizes | Warranty Period | |
|----------------------------|--------------------|-------------|-----------------|-----------------|
| | | | Sine-Wave Power | PWM Power |
| AA, AF, AN | S, P, B | 143T-286T | 5 Yrs | 2 Yrs* |
| CF, SD | M | 143T-215T | 2 Yrs | 1 Yr |
| CF, CN, CS, CP | E, H, P, B | 143T-449T | 5 Yrs | 2 Yrs* |
| | | 182U-449U | 5 Yrs | 2 Yrs* |
| C5, C6 | H, P | M504-689 | 1 Yr | Contact Lincoln |
| MD, SE | S | 284T-445T | 5 Yrs | 1 Yr |
| RC, RJ, SC | H | 56-145T | 5 Yrs | 2 Yrs* |
| RD, RF | S | 56-56H | 5 Yrs | 2 Yrs* |
| REW, SEW | S | 56-256T | 1 Yr | 1 Yr |
| SD, SF | S, H, P, B | 143T-449T | 5 Yrs | 2 Yrs* |
| Field Kits and Accessories | | | 5 Yrs | |

* Applies to motors with a service factor of 1.15 or higher. Motors with a 1.0 service factor have a 1 year warranty on PWM power.

If the Buyer gives the Seller written notice of any defects in equipment within any period of the warranty and the Seller's inspection confirms the existence of such defects, then the Seller shall correct the defect or defects at its option, either by repair or replacement F.O.B. its own factory or other place as designated by the Seller. The remedy provided the Buyer herein for breach of Seller's warranty shall be exclusive.

No expense, liability or responsibility will be assumed by the Seller for repairs made outside of the Seller's factory without written authority from the Seller.

The Seller shall not be liable for any consequential damages in case of any failure to meet the conditions of any warranty. The liability of the Seller arising out of the supplying of said equipment or its use by the Buyer, whether on warranties or otherwise, shall not in any case exceed the cost of correcting defects in the equipment in accordance with the above guarantee. Upon the expiration of any period of warranty, all such liability shall terminate.

The foregoing guarantees and remedies are exclusive and except as above set forth there are no guarantees or warranties with respect to accessories or equipment, either expressed or arising by option of law or trade usage or otherwise implied, including with limitation the warranty of merchantability, all such warranties being waived by the Buyer.



THE LINCOLN ELECTRIC COMPANY

CLEVELAND, OHIO 44117-2525 U.S.A.

For more information call: 1-800-MOTOR-4-U



APPENDIX V

Instrument Certification Notice



Instrument Certification Notice

The gauge Certificates of Calibration supplied for the gauge(s) on this unit contain the calibration data for the actual instrument calibrated, along with the calibration date of the **STANDARD** used to perform the calibration check.

The due date for re-calibration of the instrument should be based upon the date the instrument was placed in service in your facility. Re-calibration should be done on a periodic basis as dictated by the end user's quality system or other overriding requirements.

Note that Tronair, Inc. does not supply certificates of calibration on flow meters or pyrometers unless requested at the time of placed order. These instruments are considered reference indicators only and are not critical to the test(s) being performed on the aircraft.



APPENDIX VI

Declaration of Conformity



DECLARATION of CONFORMITY

The design, development and manufacture is in accordance with European Community guidelines

CABIN PRESSURIZATION UNIT
Models: 15A7610-6000 15B7610-6000 15C7610-6000 15D7610-6000
15E7610-6000 15F7610-6000 1576G10-6000

Relevant provisions complied with by the machinery:
2006/42/EC
2004/108/EC

Relevant standards complied with by the machinery:
EN ISO 12100:2010
BS ISO 13850:2008
BS ISO 13849-1:2006
BS ISO 4414:2010
BS EN ISO 14121-1:2007
BS EN 60204-1:2018
CEN - EN 1915-1:2013

Identification of person empowered to sign on behalf of the manufacturer:

A handwritten signature in black ink that reads "Patrick Finch". The signature is written in a cursive style and is positioned above a horizontal line.

Quality Assurance Representative