THE
# WHITMAN
COMPANIES, INC.

*Setting the Standard in*
*Environmental Engineering & Management*

## OM & M MANUAL

FOR

DEXTER CHEMICAL LLC
845 EDGEWATER ROAD
BRONX, NEW YORK

VOLUME II
EQUIPMENT MANUALS

COMPILED BY

THE WHITMAN COMPANIES, INC.

DECEMBER 2005

DRAFT

# OM & M MANUAL
# VOLUME II

## DEXTER CHEMICAL LLC
## 845 EDGEWATER ROAD
## BRONX, NEW YORK

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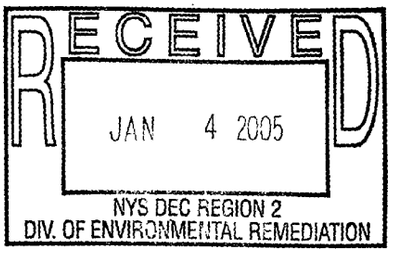
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RAE SYSTEMS

MiniRAE 2000

# Using the MiniRAE 2000 & ppbRAE PID

Firmware v. 1.20 (rev C)

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RAE SYSTEMS

# Training Agenda:

- MiniRAE 2000 & ppbRAE features
- Turning on the MiniRAE 2000 & ppbRAE
- Recommended Daily Start-up Procedure
- User modes & displays
- Alarm modes
- Programming displays
- Calibration

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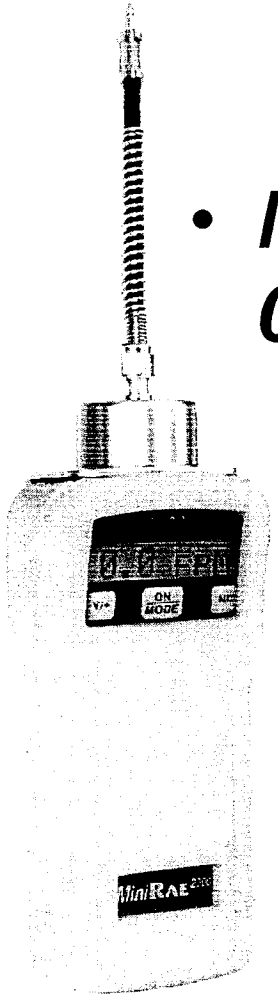
# MiniRAE 2000/ppbRAE



- ***MiniRAE 2000: 0.1-10,000 ppm***

- ***pppRAE: 1-9999 ppb/ 0.1-2000 ppm***

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RAE SYSTEMS

# RAE 2000: Internal Pump

- 500 cc/min makes remote sampling easy
- Sample draw over 100 feet!
- Use external white liquid water trap for added protection
- Pump stall feature: when moisture is detected or when pump is blocked the pump will shut off, protecting the MiniRAE 2000 from potential damage
- Runs 10 hours with pump
- Only use Teflon tubing

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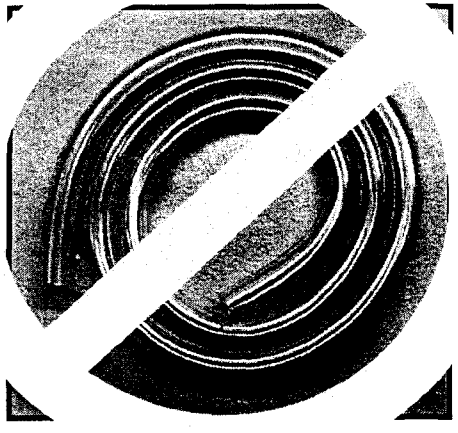
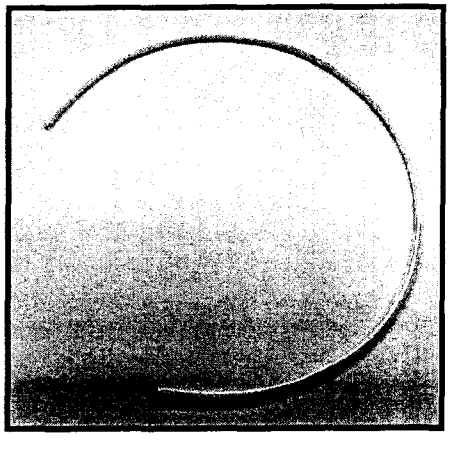
# MiniRAE 2000: Tubing





- Never Use Tygon tubing!
  - Absorbs chemicals like a "sponge"
  - Reduces ppm readout when chemicals exist
  - Causes "false positives" when chemicals don't exist
- Always use Teflon or similar non-reactive tubing
  - Will not absorb chemicals but might get coated
  - Clean with anhydrous methanol if it gets dirty

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# RAE 2000: External Prefilter

- Use the white external prefilter in high moisture environments like rain and saturated headspace sampling.
- Replace filter when it looks very dirty or when it introduces PID drift.
- Replace filter when in pump alarm with the filter on and you can clear the pump alarm with the filter off.
- Consider eliminating external prefilter & internal C-filter when measuring high-boiling/flashpoint chemicals (phenols, CWA)

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# MiniRAE 2000: Reliability

- Extremely rugged for extensive field use
- Weather Proof Case with gasketed case breaks
- Temperature range of 14°F to 113°F (-10°C to 40°C)
- 4-Way power: NiMH, Alkaline or run continuously on 110 VAC and 12 VDC
- RFI protection against radio interference
- Intrinsically safe: Class I, Division I, Groups A, B, C, D

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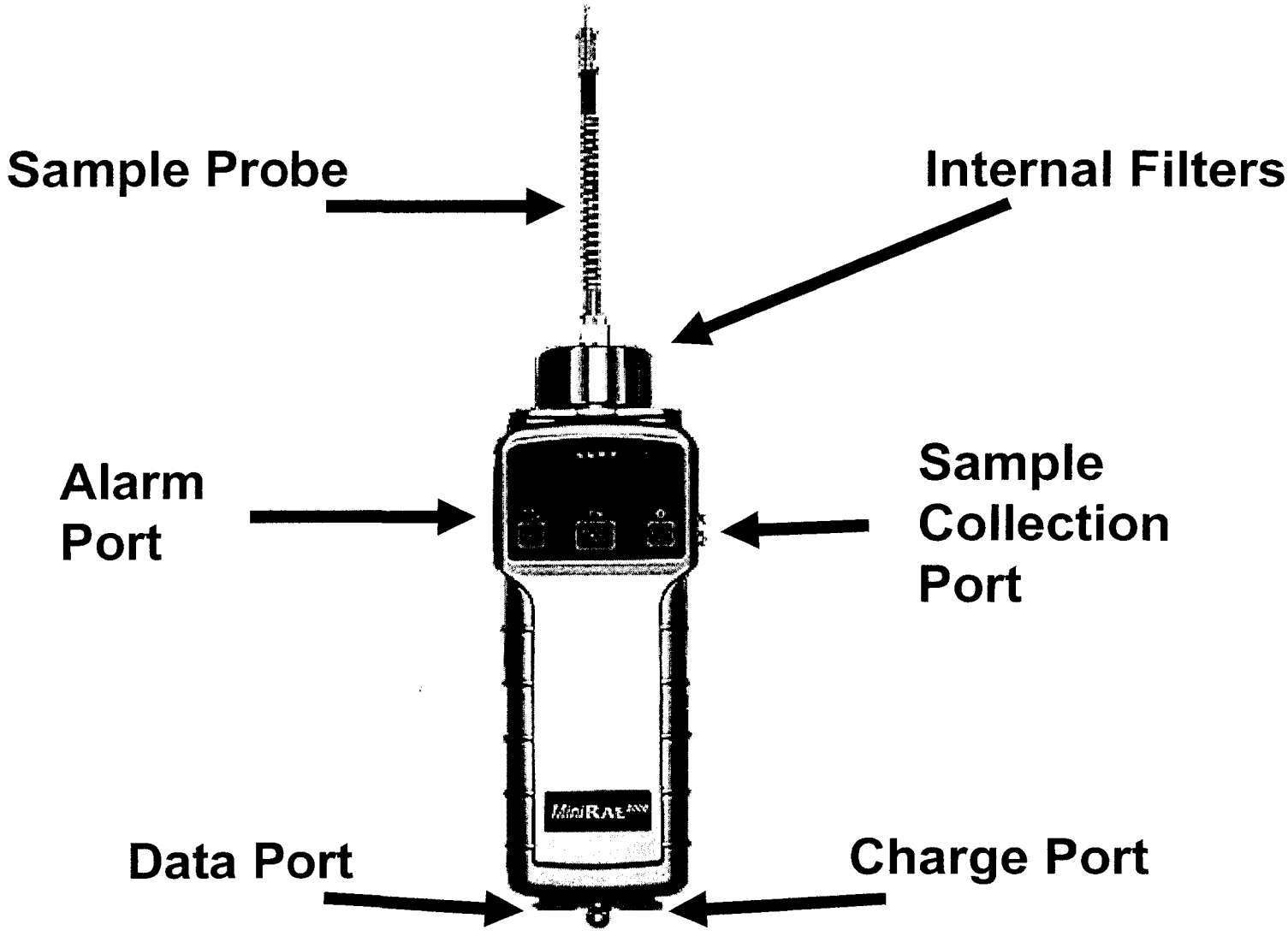
RAE SYSTEMS

# RAE 2000: Physical Description



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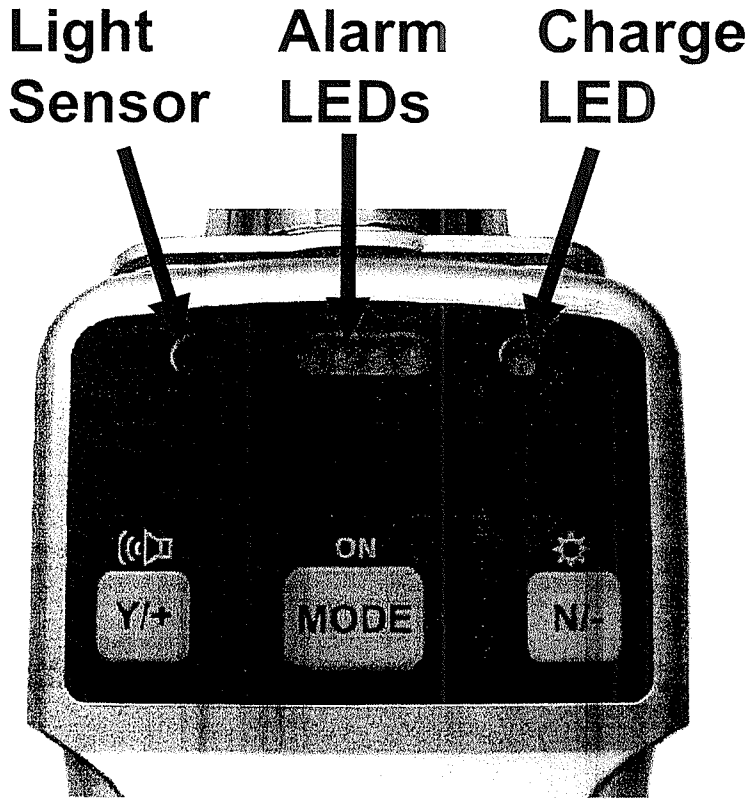
RAE SYSTEMS

# MiniRAE 2000: Faceplate

- Three buttons on a sealed membrane faceplate:
  - Y/+ (horn): clears & tests alarms
  - N/- (light): turns on manual backlight for 60 seconds
  - MODE (on)



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RAE SYSTEMS

# Start-up: Turning On

- Unplug MiniRAE 2000/ppbRAE from charger
- Hold “MODE” Key to turn on
- Alarm will beep once
- Watch display screen for configuration messages.
- Warm-up will take approximately 30 seconds

RAE SYSTEMS

## E 2000: Survey/Hygiene Mode

# *The MiniRAE 2000 and ppbRAE have two main operating modes:*

- **Survey Mode:** the factory default mode. After warm-up the pump shuts off and "Ready" is displayed.
- **Hygiene Mode:** for health and safety applications. After warm-up the meter samples continuously (similar to MultiRAE & AreaRAE).

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RAE SYSTEMS

# miRAE 2000: Survey Mode

- A discrete sampling mode can easily start/stop datalogging for many points
- Perfect for drum or headspace sampling

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RAE SYSTEMS

# Survey Displays

**Ready/Instantaneous reading**

**Stop?**

**Avg:** shows average reading

**Peak:** holds highest reading

**Run Time:**

**Battery Voltage & Shut-Off**

**Date/Time/Temperature:** (MiniRAE 2000 Only)

**Log On/Off?** Starts Manual Datalog

**Cancel/Show Background:** ppbRAE only

**PC comm?**

**Advance to next screen with "Mode" key**

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RAE SYSTEMS

## rvey Mode: Ready Screen

Ready...

- After warm-up the pump will stop and display will read "Ready..." The MiniRAE is in stand-by mode ready for sampling.
- To start sampling push the "Y" key

Site ID = Drum 043

- The Site ID screen will increase by one digit every time that the MiniRAE is started and stopped in Survey Mode.

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RAE SYSTEMS

# Survey Mode: Ready Screen

Gas = Isobutylene

- The "Gas =" screen shows the Correction Factor (CF) Gas currently in use.
- Stop sampling in survey mode by pressing the mode key. The display will show "Stop ?"

Stop ?

- Pressing "Y" will stop sampling and return to the "Ready" screen.

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RAE SYSTEMS

# Start-up: Lamp Alarm

## 0.0 Lamp

"Lamp" display along with audible alarm indicates that PID lamp has failed to light

If after a few minutes the "Lamp" message remains, turn off MiniRAE 2000 and restart

If after restart "Lamp" message disappears, MiniRAE 2000 is ready for use

If after restart "Lamp" message remains, the PID needs service

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RAE SYSTEMS

# Start-up: Pump Check

## 0.0 Pump

Every time the MiniRAE 2000 is used it is important to check pump flow

Block the probe inlet, the MiniRAE 2000 will go into alarm and display “Pump”

Reset pump alarm by pressing the “Y” key

If pump does not go into alarm, check for leaks in the probe or service pump

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# Survey Mode: Alarms

50.0 ppm

The MiniRAE 2000 will beep twice per second when the low alarm has been exceeded.

The MiniRAE 2000 will beep three times per second when the low alarm has been exceeded.

Press “Y/+” key to clear if latching alarm.

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RAE SYSTEMS

# rvey Mode: Peak Clearing

Peak 78.0 ppm

Press the "Y" key once during the "Peak" display

Reset Peak?

Pressing the "Y" key once during the "Reset Peak?" screen will clear the Peak Hold feature

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RAE SYSTEMS

## giene Mode: Datalog Indicator

0.0 L ppm

- The small "L" indicates that the MiniRAE 2000 is datalogging.

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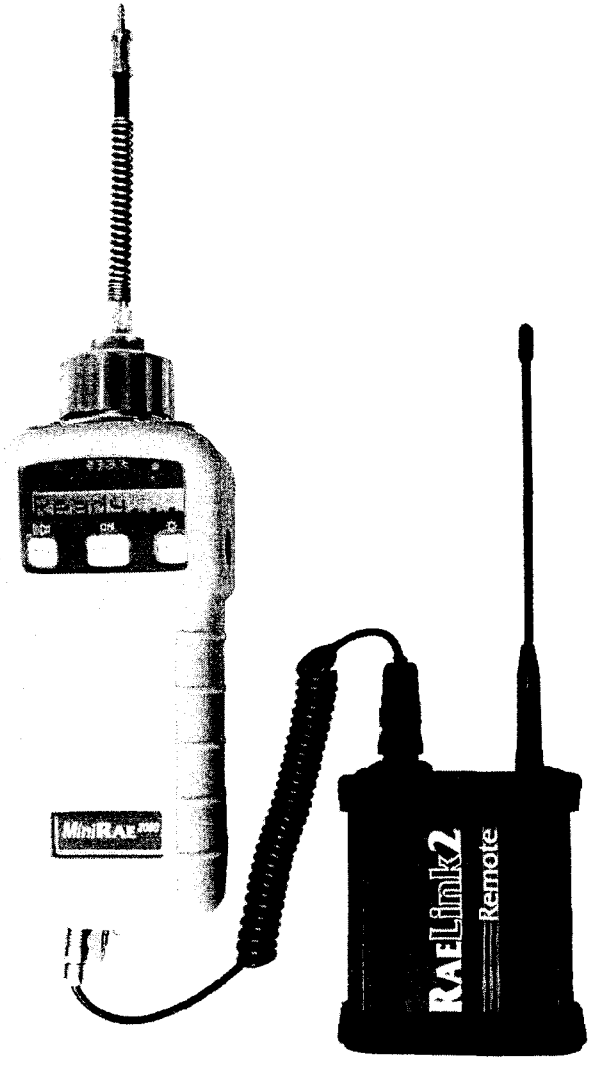
RAE SYSTEMS

## Hygiene Mode: Wireless Indicator




0.0 $^{T}$ ppm

- The small "T" indicates that the MiniRAE 2000 or ppbRAE is communicating to a host computer running ProRAE Remote software via the optional wireless RAELink modem.

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RAE SYSTEMS

# RAE: Canceled Background

0.0 + ppm

- The ppbRAE has the ability to cancel the background without recalibration.
- When background is canceled, alarms are still based upon actual levels. Datalogging records actual levels.
- The small "+" indicates that the background has been canceled.

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RAE SYSTEMS

# RAE 2000: Hygiene Mode

- A continuous sampling mode for health & safety applications like confined space entry.
- Alarms are just like those on the MultiRAE, QRAE and ToxiRAE

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RAE SYSTEMS

# Hygiene Displays

***Instantaneous reading***

***TWA:*** *Time Weighted Average*

***STEL:*** *Short Term Exposure Limit (displays "****" unit 15 minutes of run time have elapsed)*

***Peak:*** *holds highest reading*

***Run Time***

***Battery Voltage***

**Advance to next screen with "Mode" key**

***Date/Time/Temperature:*** *(MiniRAE 2000 only)*

***Log On/Off?*** *Starts Manual Datalog*

***Cancel/Show Background:*** *(ppbRAE only)*

***Gas=*** *Correction Factor Gas (MiniRAE 2000 only)*

***PC comm?***

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RAE SYSTEMS

# Hygiene Mode: High Alarm

| 9999 High |
|---|

"High" display along with 3 beep audible alarm, flashing alarm LEDs and flashing display backlight indicates that the High alarm setpoint has been exceeded.

Press "Y/+" key to clear if latching alarm.

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RAE SYSTEMS

# Hygiene Mode: Low Alarm

50.0 Low

"Low" display along with 2 beep audible alarm, flashing alarm LEDs and flashing display backlight indicates that the Low alarm setpoint has been exceeded.

Press "Y/+" key to clear if latching alarm.

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RAE SYSTEMS

# Hygiene Mode: STEL Alarm

50.0 STEL

"STEL" display along with 1 beep per second audible alarm, flashing alarm LEDs and flashing display backlight indicates that the Short Term Exposure alarm setpoint has been exceeded.

This alarm will only clear if the average concentration dips below the STEL alarm setpoint or the PID is turned off.

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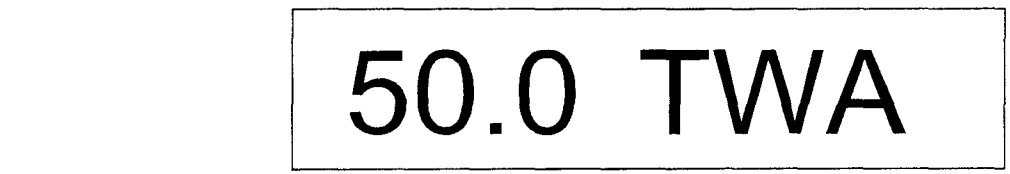
RAE SYSTEMS

# Hygiene Mode: TWA Alarm




"TWA" display along with 1 beep per second audible alarm, flashing alarm LEDs and flashing display backlight indicates that the Time Weighted Average alarm setpoint has been exceeded.

This alarm will only clear if the average concentration dips below the TWA alarm setpoint or the PID is turned off.

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RAE SYSTEMS

## y/Hygiene Mode: Pump Alarm

# 0.0 Pump

"Pump" display along with 3 beep audible alarm indicates that pump has stopped due to line clog or a clogged sample port.

Pump alarm is a latching alarm

Press "Y/+" key to clear alarm and restart pump

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RAE SYSTEMS

# Hygiene Mode: Battery Alarm

0.0 Bat

A flashing "Bat" display along with a 1 beep alarm every 10 seconds indicates that the battery voltage is low and MiniRAE 2000 or ppbRAE will shut down in 20-30 minutes

Full battery is over 4.8 volts

Low Bat alarm at 4.4 volts

Shut down at 4.2 volts

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RAE SYSTEMS

# Getting Into Programming

- *Hold "MODE" and "N/-" keys for 5 sec. to get in Programming Mode*
- If MiniRAE 2000 asks a question "?"
  - Answer "Y" or "N"
- To Accept or Escape
  - Use "MODE" Key
  - repeatedly pushing the "MODE" key will always eventually return user to main display

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RAE SYSTEMS

# Programming Menus

- Calibrate/select Gas? *(alarms are silenced when in this menu)*
- Change alarm limits?
- View/change datalog?
- Change monitor setup?
- *Choose (Y) to accept or (N) to move on*

*If you get lost, refer to Appendix A-1 in MiniRAE 2000 Manual*

# Calibrate Monitor?

- Fresh air/Zero cal?
  - *Make sure air is clean or use Charcoal filter*

  - *From v1.20 on, ppbRAEs do not use an electronic zero, so make sure to use a VOC Zeroing tube or Ultra-zero air*
  - *Refer to TN-150 for ppbRAE zeroing*
- Span cal?

*Choose (Y) to accept or (N) to move on, MODE to escape*

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# Basic Span Calibration

Cal gas = Isobutylene

Span value = 0100.0

These two screens MUST match the type and concentration of cal gas used (MiniRAE is ppm, ppbRAE in ppb)

If they do not, reset the MiniRAE to "Cal Memory 0" under the "Select Cal Memory" menu.

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# Basic Span Calibration

## Apply gas now!

Attach calibration hose to MiniRAE 2000 and make sure it is tight

Turn on calibration gas and it will be automatically detected by the MiniRAE

Follow instructions on screen

Disconnect regulator when finished calibration

RAE SYSTEMS

# Basic Span Calibration

## NO Gas!

If you get this screen check for gas flow

Try span calibration again after you have verified that the gas is correct and is flowing properly through the regulator

Press [Y/+] if gas is OK to override the message and start the calibration

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RAE SYSTEMS

# Matched Flow Calibration

***For best accuracy a matched flow calibration is required!***

- Use matched flow regulator
- Fill Tedlar bag with calibration gas and then draw down with MiniRAE 2000
- Use "T" or open tube connection with excess flow

***ppbRAE always requires matched flow calibration!***

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RAE SYSTEMS

# Calibrate Monitor?

- Select cal memory?
  - *For most uses, leave on "Cal Memory 0", which is for Isobutylene calibration and optional correction factors*
  - *Changing the cal memory lets you calibrate using a gas other than Isobutylene*
  - *Lets you load 7 frequently used gases*
  - ***For advanced users only***

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# Calibrate Monitor?

- Change span value? (*NOTE: the value in the ppbRAE is in parts per billion not ppm! 10000 ppb = 10 ppm)*
- Modify cal memory?
  - *Changes Measurement Gas name, Correction Factor* ***AND ALARM POINT***
- Change correction factor?

*Choose (Y) to accept or (N) to move on, MODE to escape*

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RAE SYSTEMS

# Change Alarm Limits?

- High limit?
- Low limit?
- STEL limit?
- TWA limit?
  - *These values are set to the default values for each gas selected under "Modify Cal Memory" but can be modified in these menus.*

*Choose (Y) to accept or (N) to move on, MODE to escape*

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RAE SYSTEMS

# View/Change Datalog?

- Reset Peak? (not in ppbRAE)
- View data?
- Clear data?
- Change data period?
- Change average type?

*Choose (Y) to accept or (N) to move on, MODE to escape*

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RAE SYSTEMS

# Change Monitor Setup?

- Change Op Mode? *Survey or Hygiene*
- Change Site ID?
- Change User ID?
- Change Alarm Mode? *Reset or Latched*
- Change User Mode? *Program/Display*
- Change Date?
- Change Time?

*Choose (Y) to accept or (N) to move on, MODE to escape*

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RAE SYSTEMS

# Change Monitor Setup?

- Change Lamp? *(9.8, 10.6, 11.7 eV)*
  - *ppbRAE 10.6 eV only*
- Change Lamp Duty Cycle?
  - For self-cleaning during continuous operation
  - Pump runs then turns off, the lamp remains on to clean the sensor and lamp surface
  - When concentration exceeds 2 ppm the pump runs continuously until the concentration drops
  - Set to 30-100%. Time on in a 10 second interval. If set to 30% then on 3 seconds off 7 seconds. If set to 50% then on 5 off 5 seconds.
  - Will reduce loss of span sensitivity to <5% running 24/7 for over 90 days in backgrounds of <10 ppm (Refer to TN-165)

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RAE SYSTEMS

# Change Monitor Setup?

- Change Unit? *(ppm or mg/m3)*
- Change Pump Speed? (ppbRAE only)
- Change Dilution Ratio? (M2K only)
- Change Output? *(DAC or Alarm)*
- Change DAC range? *(20, 200, 2000, 10k ppm)*
- Set Temperature Unit? (°C or °F)

*Choose (Y) to accept or (N) to move on, MODE to escape*

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RAE SYSTEMS

# Power Off

- Hold Mode Key for full 5 seconds
- Audible alarm will beep and display will read “Power-down in ...5 seconds”
- Leave MiniRAE 2000 on charger when not in use

# Deep Discharge?

- Plug 12 VDC charger into charge port
- The screen will display "Deep Discharge?" for 10 sec.
  - ***Pushing "N/-" will initiate charging***
  - ***Don't push anything and the unit will switch to charge in 10 sec.***
  - ***Full charge can take up to 8 hours***
  - ***Deep Discharge is not necessary for Nickel Metal Hydride batteries in MiniRAE 2000 or ppbRAE***

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RAE SYSTEMS



# *Patented RAE Systems Breakthrough!*

- Lamp runs for 4 hours during charging
- Generates small amounts of ozone which helps to scrub sensor and lamp clean
- With probe removed user will see the sensor glow purple during charging
- Does not decrease lamp life
- Drastically increases PID stability and reduces requirement for cleaning (Refer to TN-165)

RAE SYSTEMS

# Maintenance

- Clean PID Lamp & Sensor
  - When display creeps upwards after good zero
  - When PID responds to moisture
  - When movement of PID results in response on display

***Clean Sensor***


*No dirt build-up to foster a decrease in airspace resistance*

***Dirty Sensor***


*Dirt build-up absorbs water and breaks down airspace resistance leading to sensor "leakage" or moisture response*

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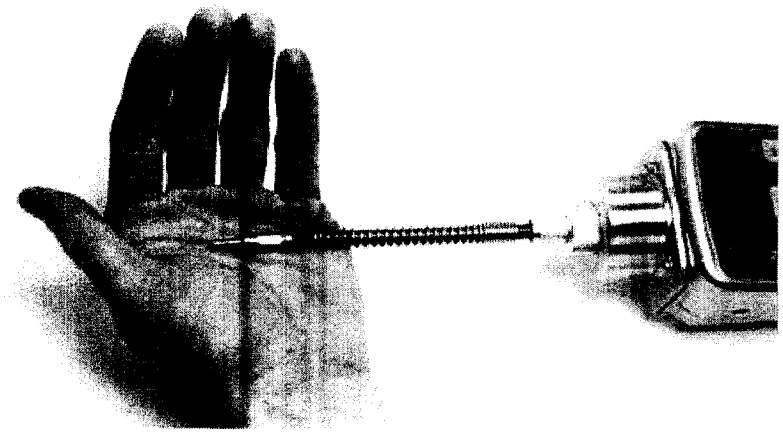
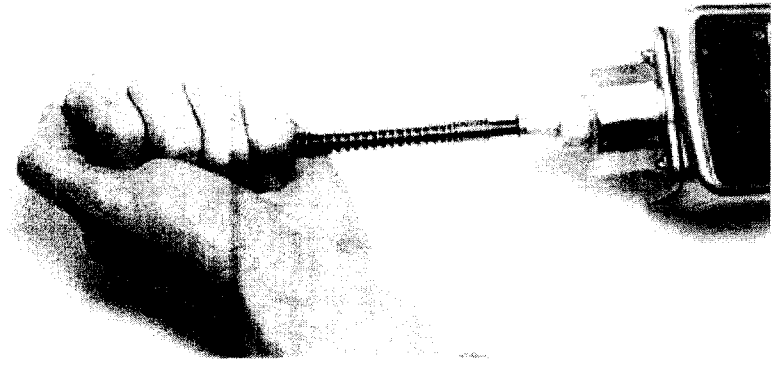
RAE SYSTEMS

# Maintenance

- Humidity Check
  - Cup hand over inlet or breathe into inlet for 10-20 seconds
  - Do not block flow
  - If M2K reads >2 ppm or ppbRAE reads >500 ppb, then the sensor needs cleaning





RAE SYSTEMS

# Maintenance

- How to Clean PID Sensor
  - Always clean sample probe and replace or clean filters FIRST! If PID holds a stable zero after this step then further cleaning may not be necessary
  - Use anhydrous methanol (Lamp cleaning solution)
  - Clean lamp face with lens tissue
  - Clean sensor by immersion in cleaning solution
  - Ultrasonic Cleaner (Jewelry cleaner) for 15 min. cleans much better than just dipping in
- Drying the PID Sensor
  - Let air dry overnight
  - Warm air (not hot) will speed drying

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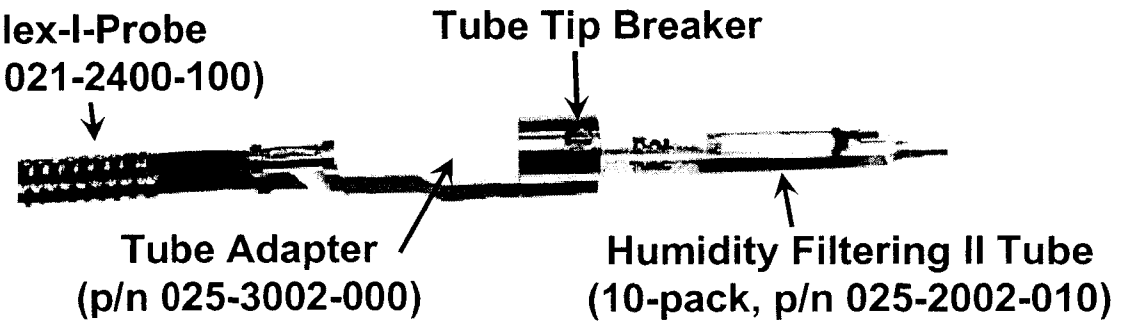
RAE SYSTEMS

# Humidity Filtering II Tubes




- Temporary relief for a dirty sensor
- Dries sample gas for about ½ hour
- Measure VOCs; multiple sample use OK
- Useful for gasoline and chlorinated solvents
- **CAUTION:** May cause low response for some compounds or at low temperature or concentration

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RAE SYSTEMS

# Configuration from Computer Datalogging

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RAE SYSTEMS

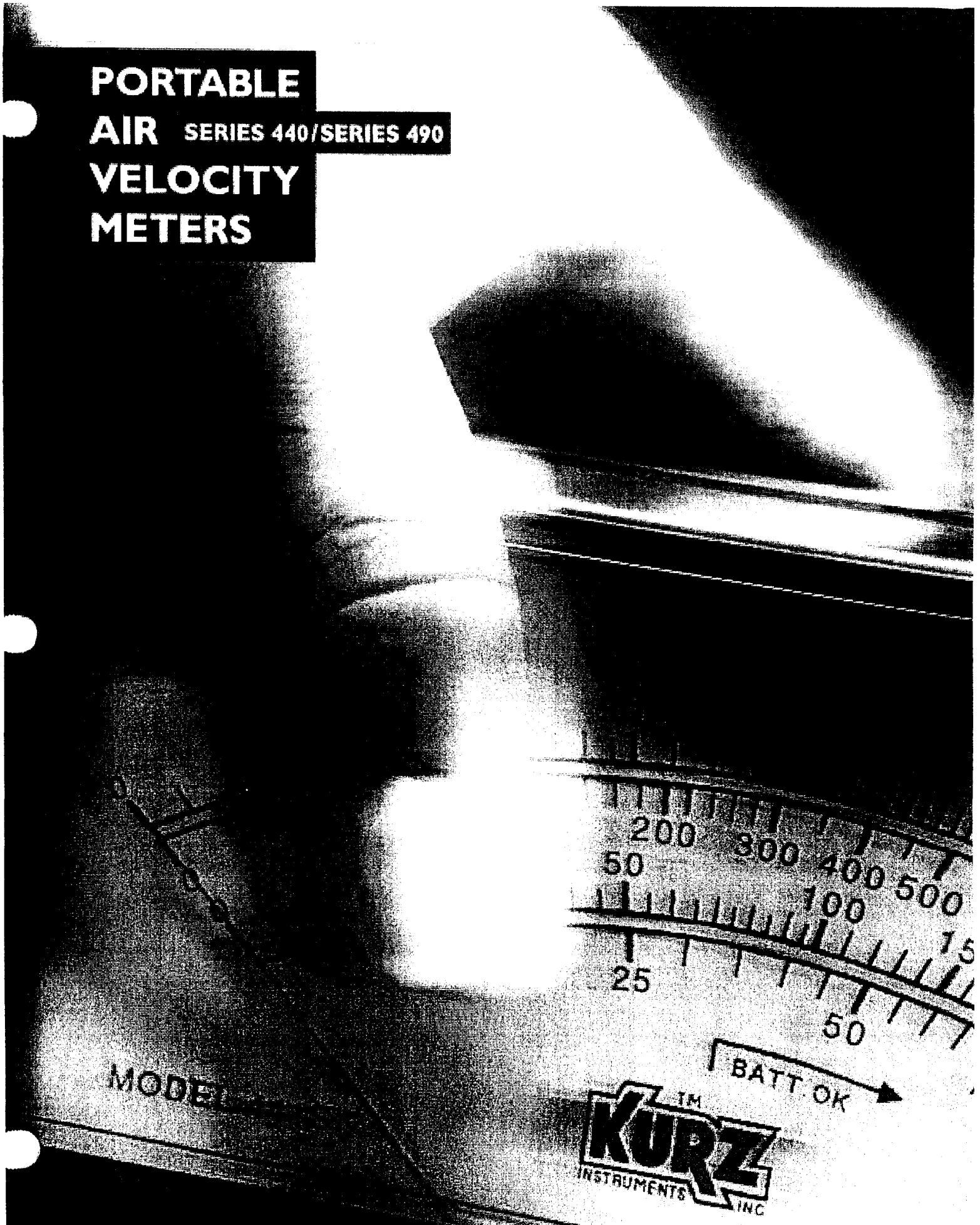
# Questions?

Service: 888-723-4800

Sales: 877-723-2878

# PORTABLE AIR VELOCITY METERS

SERIES 440/SERIES 490




KURZ INSTRUMENTS, INC.

The technology leader in portable air velocity meters.

**For over 17 years** Kurz Portable Air Velocity Meters have been used by thousands of customers world wide. Kurz anemometers have earned a reputation for accurate and fast flow measurements in a variety of industrial applications.

**Industries That Use Kurz Air Velocity Meters**

- Aerospace
- Cogeneration
- Chemical Processing
- Food Processing
- Hospitals & Laboratories
- Manufacturing
- Metals & Mining & Glass
- Petro-Chemical
- Pharmaceutical/Biotechnology
- Safety & Industrial Hygiene
- Semiconductor
- Transportation
- Utilities—Fossil & Nuclear
- Wastewater

**Typical Applications**

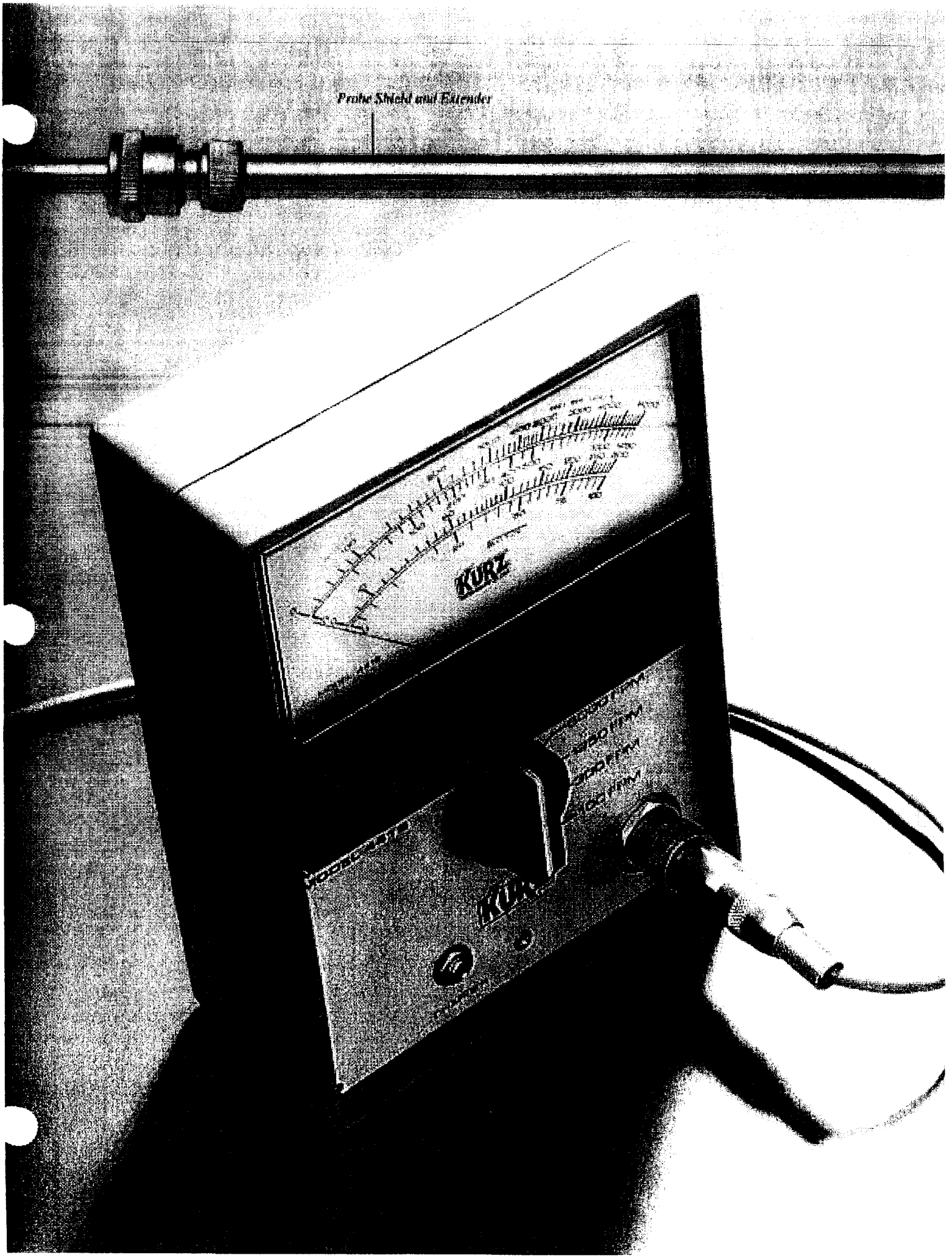
- Environmental Monitoring
- HVAC Duct Balancing
- Fume Hood Monitor/Profiling
- Scrubber Performance Monitoring
- Extruder Quench Air Monitoring
- Clean Room Air Monitor/Profiling
- Leak Detection
- Cooling Air Flow Monitor

**Sensor Technology.** Kurz portables utilize a "constant temperature" thermal flow technology principle. An analogy would be the human body. If you stand in the wind and bare your arms, you will feel a chill on your arms. This chill is caused by the temperature of the wind and by the mass of wind molecules taking heat energy away as the air crosses your skin surface. Your brain controls your body temperature at a constant 98°F. When the air passes over your arms, your skin temperature is reduced by the thermal transfer of your body heat to the air molecules. Your brain tells your body to burn calories to maintain a constant temperature. If your brain included a calorie meter, it could provide an indication of the air flow rate.

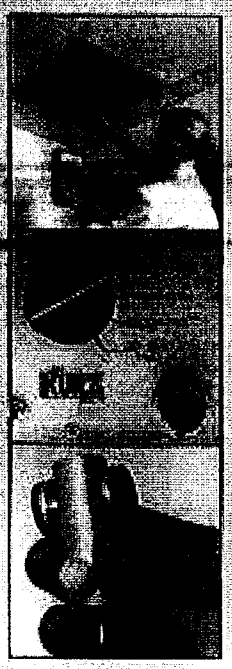
Kurz sensors incorporate two temperature sensing elements. One element is passive and is used as a reference for tracking the air stream temperature. The second element is heated by an electrical current to maintain a constant temperature above the air stream temperature. As the air stream molecules take heat energy away from the heated element, more current is required to maintain the temperature differential. The required electrical current is proportional to air mass velocity and is displayed on the Air Velocity Meter enclosure.

Kurz thermal flow technology offers the following advantages over competitive alternatives:

- Low Pressure Drop
- Simple Insertion Measurement
- Extremely Fast Response
- Wide Flow Rangeability
- Low Flow Measurement Capability
- No Corrections Required for Temperature or Pressure
- Direct Flow Rate Reading
- No Moving Parts to Wear or Fail
- Resistance to Dirt Fouling


Probe Shield and Extender
KURZ

# The Series 440, tough portables with proven technology.



A. *Easy to handle with compact case and lightweight probe.*
B. *Easy to change settings for wide rangeability.*
C. *Measure differential pressure with static pressure adaptor.*

**The workhorse of our line** of anemometers, the Series 440 has proven its utility with thousands of users in hundreds of applications since 1977.

The rugged Series 440 has demonstrated its reliability and sensitivity in air balancing, fan testing and circuit board cooling; and for air flow and ventilation profiling in offices, factories, hospitals, clean rooms, restaurants–the Series 440 finds applications everywhere. By owning a Series 440 you can join the thousands of satisfied users who'll be using their Series 440's well into the next century.

**Kurz sensor technology.** The Series 440 uses the rugged Dura-Flo™ sensor originally developed by Dr. Kurz. The two sensor elements are constructed of reference grade platinum wire wound over a ceramic mandrel, coated with a thin layer of glass and mounted in the sensor supported with high temperature epoxy. This construction provides a highly repeatable, rugged and dirt resistant thermal mass velocity sensor.

**Rugged enclosure.** With a tough, strong, Cycolac™ ABS enclosure, the Series 440 readily stands up to the knocks of field use. Equally at home in the boiler room, on the factory floor, or up on the catwalk, the Series 440 has an internal one amp/hour rechargeable NiCad battery. These provide continuous power for a full days operation in the field, but in practice usually last for several weeks of occasional measurements.

**Wide rangeability.** All models in the 440 Series have multiple ranges. This broad selection of air velocity ranges offers unmatched accuracy for velocities to 12,000 standard-feet-per-minute (SFPM), but without losing the ability to measure low flows [illegible] with the added feature of optional temperature and [illegible] measurement ranges.

**Measure differential pressure too!** Selected models of the Series 440 include a static pressure adaptor that fits over the end of the air velocity probe. The adaptor has opposing ports and identical nozzles just inside those ports. Alignment scribe lines on the probe provide for correctly positioning the adaptor. By pressing one of the rubber gasketed ports against a 1/4" hole drilled in duct or pipe, the Series 440 can measure up to 5" water column differential pressure. This additional feature makes the Series 440 especially attractive to users with HVAC and air balancing applications.

When you need an air velocity meter everyone can use, choose the Series 440. Its utility, simple operation and many practical features make it a pleasure to own.

# Service Information

**Kurz Field Service Includes**:

- Field Start-Up and Training
- Review of customer's electrical connections of Kurz systems
- Duct or pipe velocity profile and flow rate measurements. (Kurz technicians can use either a Kurz velocity meter, Pitot tube, or Tracer Gas, whichever customer prefers)
- Calibration "dial-in" of Kurz systems for maximum application accuracy
- Repair of Kurz System technical problems
- Training of customer's personnel on the operation, care and maintenance of Kurz products
- Trace Gas Dilution Flow Calibration of different flow geometries

**Recalibrations**:
We have NIST Traceable Wind Tunnels and In-Line Flow Standards for air. Laboratory and Gas Correlation Calibrations for specialty gases are available.

**Repair and Warranty**:
Please contact our Service Department to obtain a RMA Number (Return Material Authorization) before sending your units to Kurz. Call for prices and scheduling. Service Fax: 831-646-1033

**Other Services**:

- Factory and Field Training Programs
- Special Factory Testing and Customer Technical Assistance
- Application Assistance

**Click a button below:**

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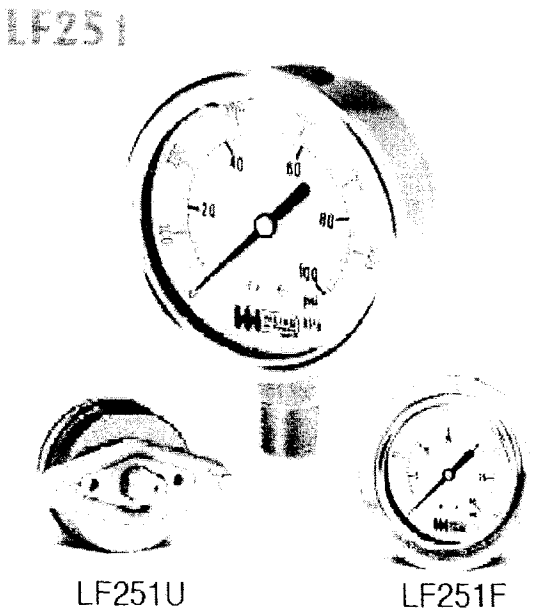
**The Leader in Mass Flow Technology for Process and Environmental Measurements**
**Kurz Instruments, Inc., 2411 Garden Road, Monterey, CA 93940**
**800-424-7356 /831-646-5911 /Fax: 831-646-8901**
**http://www.kurzinstruments.com / email:sales@kurzinstruments.com**

Meter to be sent to Kurz annually for Calibration

WEISS INSTRUMENTS, INC.



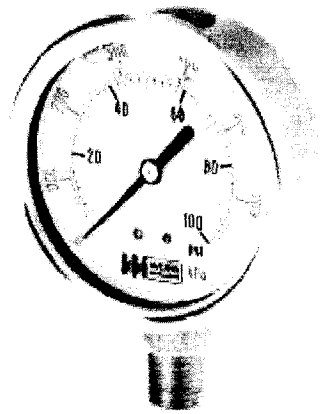
# Liquid Filled Gauges-Crimped Ring Stainless Steel Cases 2 1/2" and 4"




**CASE & RING:** 2 1/2" type 304 stainless steel case with polished stainless steel crimped ring.
**DIAL:** ABS, white with black and red markings.(psi & kpa )
**WINDOW:** Clear acrylic
**TUBE:** Phosphor Bronze to 6000 psi, 316SS to 10,000 psi.
**SOCKET:** Brass with push-in restrictor.
**POINTER:** Black anodized aluminum.
**MOVEMENT:** Brass.
**ACCURACY:** ± 1.6% of span.
**CONNECTION:** 1/4" NPT bottom or center back.
**RANGES:** Vacuum, Compound, Pressure to 10,000 psi.
**PANEL MOUNTING VARIATIONS**
**U-CLAMP:** Series LF251U
**FRONT FLANGE:** Series LF251F

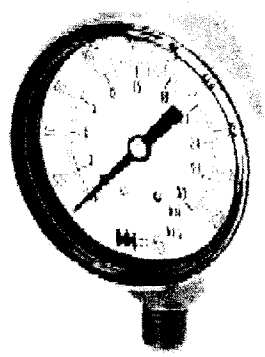
**CASE & RING:** 2 1/2" type 304 stainless steel case with polished stainless steel crimped ring.
**DIAL:** ABS, white with black and red markings.(psi & kpa )
**WINDOW:** Clear acrylic.
**TUBE:** Type 316 Stainless Steel .
**SOCKET:**Type 316 Stainless Steel with threaded restrictor.
**POINTER:** Black anodized aluminum.
**MOVEMENT:** Stainless Steel.
**ACCURACY:** ± 1.6% of span.
**CONNECTION:** 1/4" NPT bottom or center back.
**RANGES:** Vacuum, Compound, Pressure to 10,000 psi.
**PANEL MOUNTING VARIATIO**

LF252



**N S**
**U-CLAMP:** Series LF252U
**FRONT FLANGE:** Series LF252F

LF201



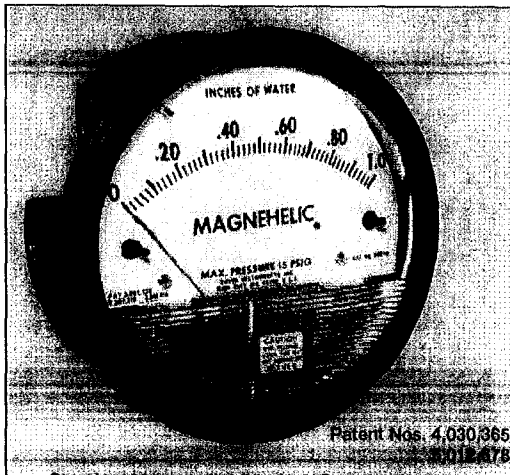
**CASE & RING:** 2" type 304 stainless steel case with polished stainless steel crimped ring.
**DIAL:** ABS, white with black and red markings.(psi & kpa )
**WINDOW:** Clear acrylic.
**TUBE:** Phosphor Bronze.
**SOCKET:** Brass with push-in restrictor.
**POINTER:** Black anodized aluminum.
**MOVEMENT:** Brass.
**ACCURACY:** ± 1.6% of span.
**CONNECTION:** 1/8" NPT bottom or center back.
**RANGES:** 0-30, 60, 100, 200, 300, 600, 1,000, 3,000, 6,000 psi.
**PANEL MOUNTING VA R I A T I O N S**
**U-CLAMP:** Series LF201U

**Page 4**

Go to Page: 3 4 5 6 7 8 9 10 11

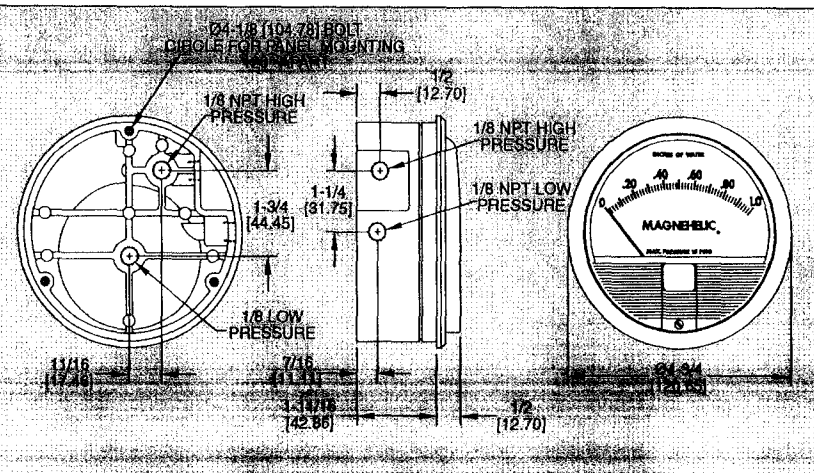
# Series 2000 Magnehelic® Differential Pressure Gages

## Indicate Positive, Negative or Differential, Accurate within 2%




Patent Nos. 4,030,365
3,901,078

Standard Magnehelic® Pressure Gage has a large, easy-to-read 4" dial.




Dimensions, Standard Series 2000 Magnehelic® Pressure Gages. (Slightly different on medium and high pressure models)

**Select the Dwyer Magnehelic® gage** for high accuracy – guaranteed within 2% of full scale – and for the wide choice of 81 models available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® movement, it quickly indicates low air or non-corrosive gas pressures – either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.

The Magnehelic® is the industry standard to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.

**Note:** May be used with Hydrogen where pressures are less than 35 psi.

**MOUNTING.** A single case size is used for most models of Magnehelic® gages. They can be flush or surface mounted with standard hardware supplied. With the optional A-610 Pipe Mounting Kit they may be conveniently installed on horizontal or vertical 1¼" - 2" pipe. Although calibrated for vertical position, many ranges above 1" may be used at any angle by simply re-zeroing. However, for maximum accuracy, they must be calibrated in the same position in which they are used. These characteristics make Magnehelic® gages ideal for both stationary and portable applications. A 4⁹⁄₁₆" hole is required for flush panel mounting. Complete mounting and connection fittings plus instructions are furnished with each instrument.

Flush ...Surface...or Pipe Mounted

### VENT VALVES

In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.

### HIGH AND MEDIUM PRESSURE MODELS

Installation is similar to standard gages except that a 4¹³⁄₁₆" hole is needed for flush mounting. The medium pressure construction is rated for internal pressures up to 35 psig and the high pressure up to 80 psig. Available for all models. Because of larger case, the medium pressure and high pressure models will not fit in a portable case size. Installation of the A-321 safety relief valve on standard Magnehelic® gages often provides adequate protection against infrequent overpressure.

### SPECIFICATIONS

**Service:** Air and non-combustible, compatible gases. (Natural Gas option available.)
**Wetted Materials:** Consult factory.
**Housing:** Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.
**Accuracy:** ±2% of full scale (±3% on - 0, -100 Pa, -125 Pa, 10MM and ±4% on - 00, -60 Pa, -6MM ranges), throughout range at 70°F (21.1°C).
**Pressure Limits:** -20" Hg. to 15 psig.† (-0.677 bar to 1.034 bar); MP option: 35 psig (2.41 bar), HP option: 80 psig (5.52 bar).
**Overpressure:** Relief plug opens at approximately 25 psig (1.72 bar), standard gages only.
**Temperature Limits:** 20 to 140°F.* (-6.67 to 60°C).
**Size:** 4" (101.6 mm) Diameter dial face.
**Mounting Orientation:** Diaphragm in vertical position. Consult factory for other position orientations.
**Process Connections:** 1/8" female NPT duplicate high and low pressure taps - one pair side and one pair back.
**Weight:** 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g).
**Standard Accessories:** Two 1/8" NPT plugs for duplicate pressure taps, two 1/8" pipe thread to rubber tubing adapter and three flush mounting adapters with screws. (Mounting and snap ring retainer substituted for 3 adapters in MP & HP gage accessories.)
*Low temperature models available as special option.
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options at lower left.

## OPTIONS AND ACCESSORIES

### Transparent Overlays

Furnished in red and green to highlight and emphasize critical pressures.

### Adjustable Signal Flag

Integral with plastic gage cover. Available for most models except those with medium or high pressure construction. Can be ordered with gage or separate.

### LED Setpoint Indicator

Bright red LED on right of scale shows when setpoint is reached. Field adjustable from gage face, unit operates on 12-24 VDC. Requires MP or HP style cover and bezel.

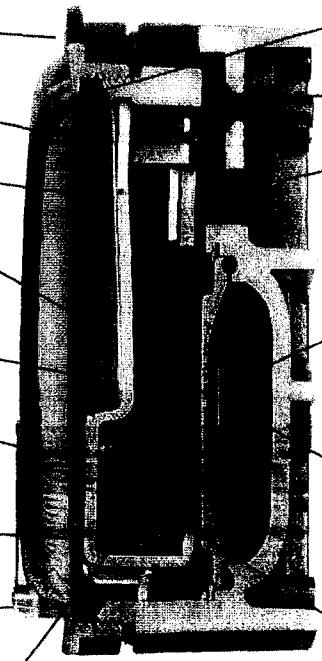
### Portable Units

Combine carrying case with any Magnehelic® gage of standard range, except high pressure connection. Includes 9 ft. (2.7 m) of ⅜" I.D. rubber tubing, standhang bracket and terminal tube with holder.

### Air Filter Gage Accessory Package

Adapts any standard Magnehelic® for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft. (1.5 m) lengths of ¼" aluminum tubing two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves.

# Quality design and construction features



**Bezel** provides flange for flush mounting in panel.

**Clear plastic face** is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

**Precision litho-printed scale** is accurate and easy to read.

**Red tipped pointer** of heat treated aluminum tubing is easy to see. It is rigidly mounted on the helix shaft.

**Pointer stops** of molded rubber prevent pointer over-travel without damage.

***"Wishbone" assembly*** *provides mounting for* helix, helix bearings and pointer shaft.

**Jeweled bearings** are shock-resistant mounted; provide virtually friction-free motion for helix. Motion damped with high viscosity silicone fluid.

**Zero adjustment screw** is conveniently located in the plastic cover, and is accessible without removing cover. O-ring seal provides pressure tightness.

**Helix** is precision made from an alloy of high magnetic permeability. Mounted in jeweled bearings, it turns freely, following the magnetic field to move the pointer across the scale.

***O-ring seal*** *for cover assures pressure* integrity of case.

**Blowout plug** of silicone rubber protects against overpressure on 15 psig rated models. Opens at approximately 25 psig.

**Die cast aluminum case** *is precision made* and iridite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

**Silicone rubber diaphragm** with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

**Calibrated range** spring is flat spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.

**Samarium Cobalt magnet** mounted at one end of range spring rotates helix without mechanical linkages.

## MODELS

| Dual Scale English/Metric Models | | |
|---|---|---|
| Model Number | Range, In. W.C. | Range, Pa or kPa |
| 2000-0D | 0-0.5 | 0-125 Pa |
| 2001D | 0-1.0 | 0-250 Pa |
| 2002D | 0-2.0 | 0-500 Pa |
| 2003D | 0-3.0 | 0-750 Pa |
| 2004D | 0-4.0 | 0-1.0 kPa |
| 2006D | 0-6.0 | 0-1.5 kPa |
| 2008D | 0-8.0 | 0-2.0 kPa |
| 2010D | 0-10 | 0-2.5 kPa |

## SERIES 2000 MAGNEHELIC®— MODELS AND RANGES

The models below will fulfill most requirements. Page 11 also shows examples of special models built for OEM customers. For special scales furnished in ounces per square inch, inches of mercury, metric units, etc., contact the factory.

| Model Number | Range Inches of Water |
|---|---|
| 2000-00†•• | 0-.25 |
| 2000-0†• | 0-.50 |
| 2001 | 0-1.0 |
| 2002 | 0-2.0 |
| 2003 | 0-3.0 |
| 2004 | 0-4.0 |
| 2005 | 0-5.0 |
| 2006 | 0-6.0 |
| 2008 | 0-8.0 |
| 2010 | 0-10 |
| 2015 | 0-15 |
| 2020 | 0-20 |
| 2025 | 0-25 |
| 2030 | 0-30 |
| 2040 | 0-40 |
| 2050 | 0-50 |
| 2060 | 0-60 |
| 2080 | 0-80 |
| 2100 | 0-100 |
| 2150 | 0-150 |

| Model Number | Range Zero Center Inches of Water |
|---|---|
| 2300-0†• | .25-0-.25 |
| 2301 | .5-0-.5 |
| 2302 | 1-0-1 |
| 2304 | 2-0-2 |
| 2310 | 5-0-5 |
| 2320 | 10-0-10 |
| 2330 | 15-0-15 |

| Model Number | Range PSI |
|---|---|
| 2201 | 0-1 |
| 2202 | 0-2 |
| 2203 | 0-3 |
| 2204 | 0-4 |
| 2205 | 0-5 |
| 2210* | 0-10 |
| 2215* | 0-15 |
| 2220* | 0-20 |
| 2230** | 0-30 |

*MP option standard
**HP option standard

| Dual Scale Air Velocity Units | | |
|---|---|---|
| Model Number | Range In W.C. Velocity, F.P.M. | |
| 2000-00AV†•• | 0-.25/300-2000 | |
| 2000-0AV†• | 0-.50/500-2800 | |
| 2001AV | 0-1.0/500-4000 | |
| 2002AV | 0-2.0/1000-5600 | |
| 2010AV | 0-10/2000-12500 | |
| For use with pitot tube. | | |

| Model Number | Range MM of Water |
|---|---|
| 2000-6MM†•• | 0-6 |
| 2000-10MM†• | 0-10 |
| 2000-25MM | 0-25 |
| 2000-50MM | 0-50 |
| 2000-80MM | 0-80 |
| 2000-100MM | 0-100 |
| Zero Center Ranges | |
| 2300-20MM† | 10-0-10 |

| Model Number | Range, CM of Water |
|---|---|
| 2000-15CM | 0-15 |
| 2000-20CM | 0-20 |
| 2000-25CM | 0-25 |
| 2000-50CM | 0-50 |
| 2000-80CM | 0-80 |
| 2000-100CM | 0-100 |
| 2000-150CM | 0-150 |
| 2000-200CM | 0-200 |
| 2000-250CM | 0-250 |
| 2000-300CM | 0-300 |
| Zero Center Ranges | |
| 2300-4CM | 2-0-2 |
| 2300-10CM | 5-0-5 |
| 2300-30CM | 15-0-15 |

| Model Number | Range, Pascals |
|---|---|
| 2000-60PA†•• | 0-60 |
| 2000-100PA†• | 0-100 |
| 2000-125PA†• | 0-125 |
| 2000-250PA | 0-250 |
| 2000-300PA | 0-300 |
| 2000-500PA | 0-500 |
| 2000-750PA | 0-750 |
| Zero Center Ranges | |
| 2300-250PA | 125-0-125 |
| 2300-500PA | 250-0-250 |

| Model Number | Range, Kilopascals |
|---|---|
| 2000-1KPA | 0-1 |
| 2000-1.5KPA | 0-1.5 |
| 2000-2KPA | 0-2 |
| 2000-3KPA | 0-3 |
| 2000-4KPA | 0-4 |
| 2000-5KPA | 0-5 |
| 2000-8KPA | 0-8 |
| 2000-10KPA | 0-10 |
| 2000-15KPA | 0-15 |
| 2000-20KPA | 0-20 |
| 2000-25KPA | 0-25 |
| 2000-30KPA | 0-30 |
| Zero Center Ranges | |
| 2300-1KPA | .5-0-.5 |
| 2300-3KPA | 1.5-0-1.5 |

**Accessories**

**A-299**, Surface Mounting Bracket
**A-300**, Flat Flush Mounting Bracket.....
**A-310A**, 3-Way Vent Valve.....
**A-321**, Safety Relief Valve.....
**A-432**, Portable Kit.....
**A-605**, Air Filter Kit.....
**A-610**, Pipe Mount Kit.....

***Options*** — To order, add suffix: I.E. 2001-ASF
ASF (Adjustable Signal Flag)
HP (High Pressure Option)
LT (Low Temperatures to -20°F)
MP (Med. Pressure Option)
SP (Setpoint Indicator)

Scale Overlays — Red, Green, Mirrored or Combination, Specify Locations

**Special Purpose Ranges**

| Scale No. 2401 | Scale No. 2402 |
|---|---|
| Square Root | Blank Scale |
| Specify Range | Specify Range |

Model 2000-00N. range -.05 to +.20" W.C. For room pressure monitoring

†These ranges calibrated for vertical scale position.
• Accuracy +/-3%. •• Accuracy +/-4%

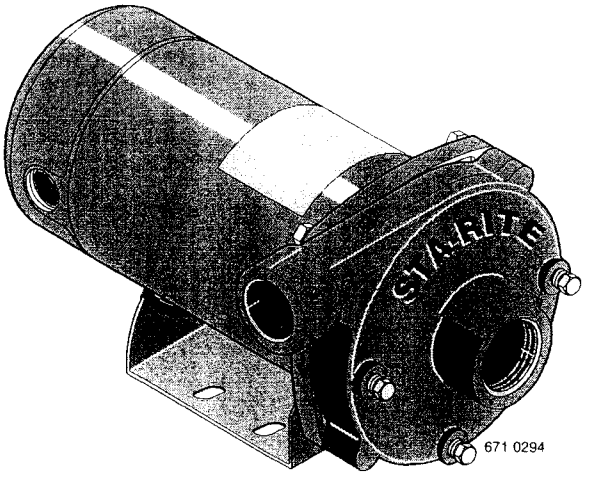
1011R01-0298P

# STA-RITE®

# OWNER'S MANUAL

INSTALLATION AND OPERATING INSTRUCTIONS
REPAIR PARTS LIST

# 60 CYCLE "J" and "JB" SERIES CENTRIFUGAL PUMP




## MODELS

| HP | MEDIUM HEAD MODELS | | | | HIGH HEAD MODELS | | | |
|---|---|---|---|---|---|---|---|---|
| 1/3 | JBMB-56S | – | JMB-56L | – | JBHB-61S | – | JHB-61HL | – |
| 1/2 | JBMC-56S | JBMC3-56S | JMC-56L | JMC3-56 | JBHC-61S | JBHC3-61S | JHC-61HL | JHC3-61H |
| 1/2 | | | JMCV-56L | JMC3V-56 | | | | |
| 3/4 | JBMD-57S | JBMD3-57S | JMD-57L | JMD3-57 | JBHD-62S | JBHD3-62S | JHD-62HL | JHD3-62H |
| 3/4 | | | JMDV-57L | JMD3V-57 | | | | |
| 1 | JBME-58S | JBME3-58S | JME-58L | JME3-58 | JBHE-63S | JBHE3-63S | JHE-63HL | JHE3-63H |
| 1 | | | JMEV-58L | JME3V-58 | | | | |
| 1-1/2 | JBMF-40S | JBMF3-40S | JMF-40L | JMF3-40 | JBHF-51S | JBHF3-51S | JHF-51HL | JHF3-51H |
| 2 | JBMG-41S | JBMG3-41S | JMG-41L | JMG3-41 | JBHG-52S | JBHG3-52S | JHG-52HL | JHG3-52H |
| 2-1/2 | JBMMG-59S | JBMMG3-59S | – | – | JBHHG-53S | JBHHG3-53S | JHHG-53HL | JHHG3-53H |

STA-RITE INDUSTRIES, INC., DELAVAN, WISCONSIN 53115



S683 (10/4/02)

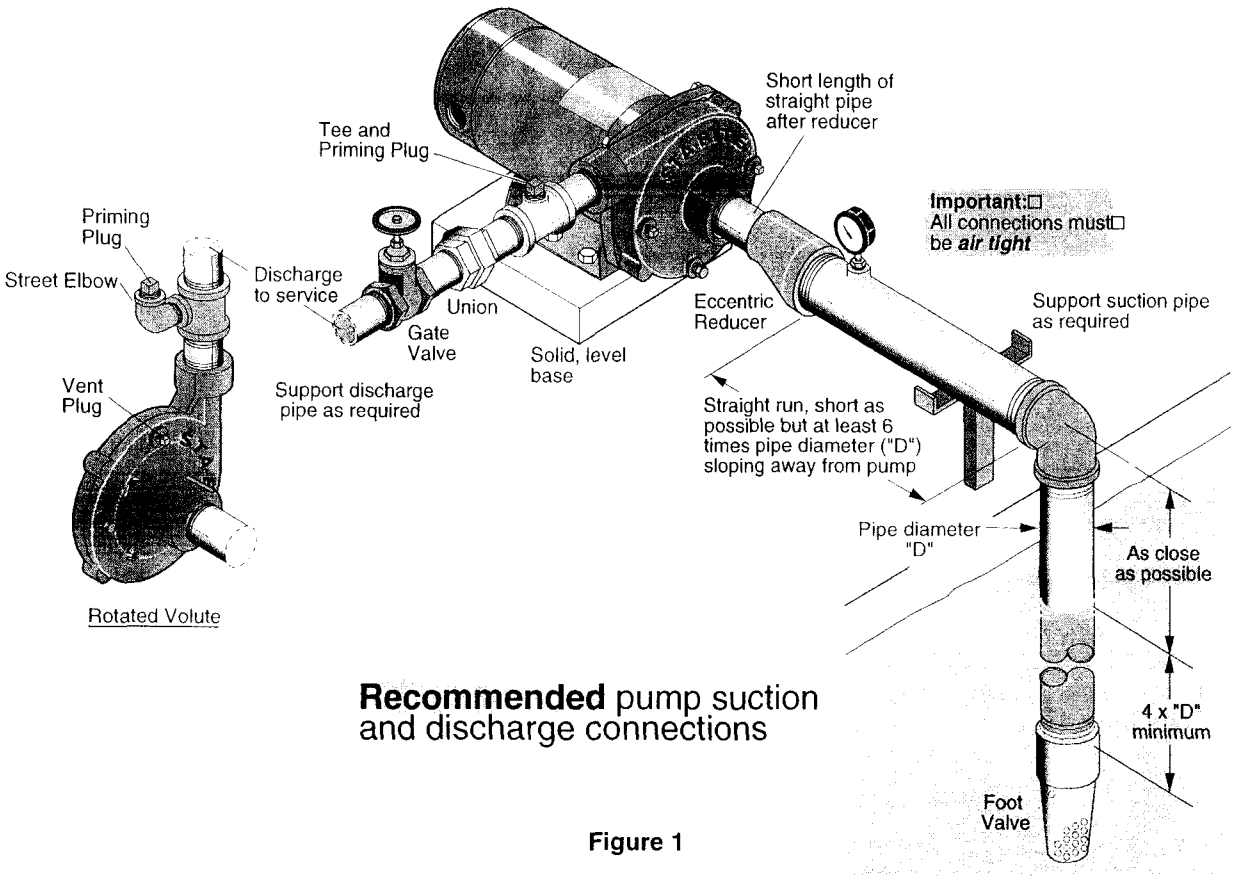



**Figure 1**

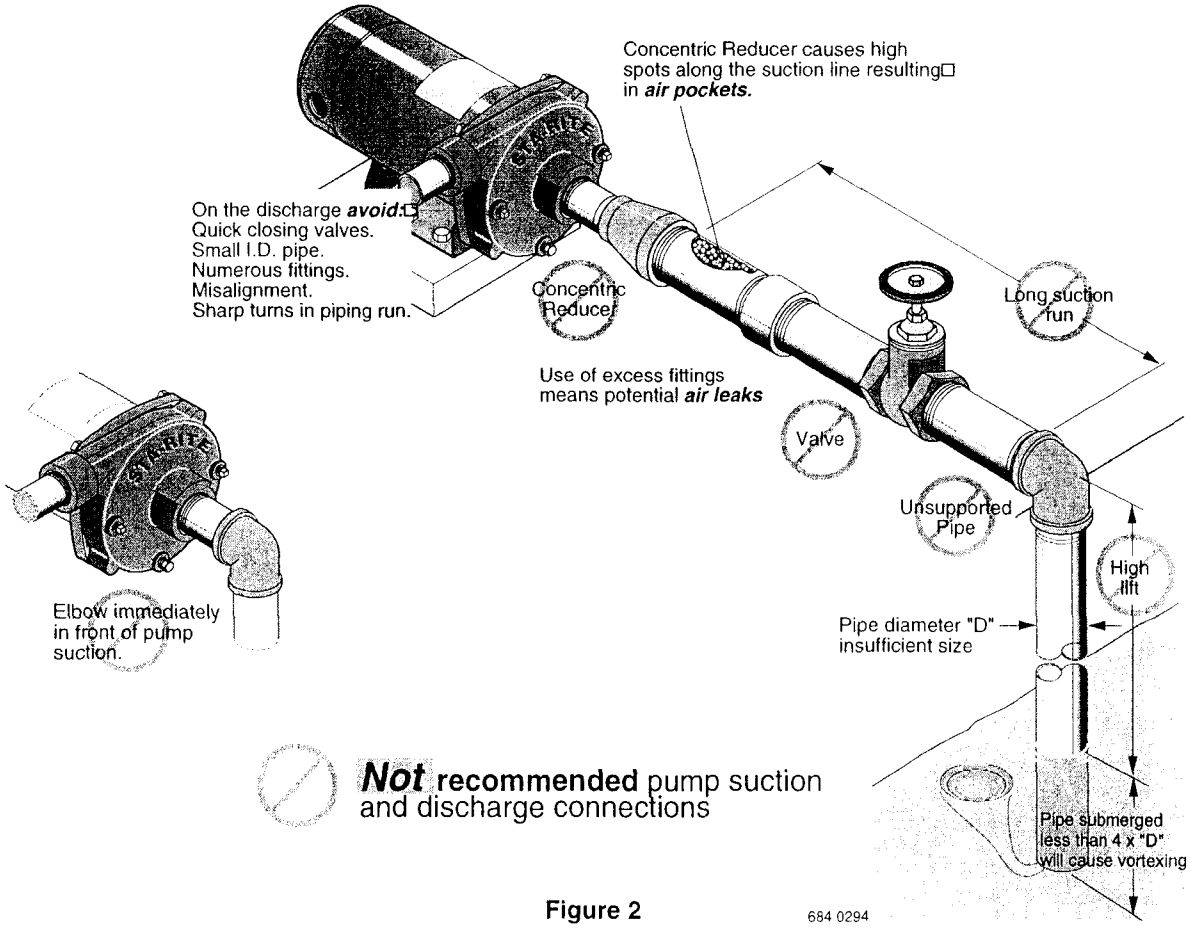



**Figure 2**

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## PIPING - GENERAL

Support both suction and discharge piping independently at a point near the pump to avoid putting a strain on the pump housing. Start all piping **AT THE PUMP.**

Increase pipe diameter at both the suction and discharge by one (1) standard pipe size (minimum) to obtain desired performance and flow rate. Refer to Table I when sizing pipe for your pumping system.

**NOTE:** Do not use pipe with **smaller** diameter on the suction side of pump.

## TABLE I

| Pipe Tapping Size On Pump | | Recommended Pipe Size | |
|---|---|---|---|
| Suction | Discharge | Suction | Discharge |
| 1-1/4 | 1 | 1-1/2 | 1-1/4 |
| 1-1/2 | 1-1/4 | 2 | 1-1/2 |
| 2 | 1-1/2 | 3 | 2 |

## SUCTION PIPE

Increase pipe size from pump tapping as shown in Table I.

Figure 1 (Page 2) depicts a recommended run of pipe and fittings for the suction side of a centrifugal pump. Please refer to this illustration when choosing pipe and fittings for your suction connection.

**IMPORTANT:** All connections must be air tight!

Figure 2 (Page 2) depicts conditions that are **NOT DESIRABLE** on the suction side of a centrifugal pump and may cause problems in flow rate and priming. Please look this illustration over carefully before choosing pipe and fittings for your suction connection.

## DISCHARGE PIPING

Increase pipe size from pump tapping as show in Table I.

Figure 1 (Page 2) depicts a recommended run of pipe and fittings for the discharge. Install tee with priming plug as close to pump as possible. Figure 2 (Page 2) notes conditions that should be avoided. Please read over carefully before making discharge connection.

## PRIMING THE PUMP

A pump is primed when all air in the suction line and pump volute has been evacuated and replaced with water.

**To Prime:**

1. Close valve in discharge line.
2. Remove priming plug from tee and fill pump and suction line with water until water is flowing back out of tee.
3. Replace priming plug.
4. Start pump and slowly open valve until desired water flow is achieved.
   **NOTE:** If water is not being pumped, turn off pump, close valve, and repeat steps 1 thru 4.

If pump volute is rotated as shown in Figure 1 (Page 2), loosen vent plug when priming to evacuate air trapped inside volute and tighten when volute is completely filled with water.

⚠ WARNING **Risk of explosion and scalding.** Never run pump against closed discharge. To do so can boil water inside pump, causing hazardous pressure buildup and possible explosion.

⚠ CAUTION **Risk of flooding.** Do not run the pump dry. This will damage mechanical seal and void warranty. It may cause burns to person handling pump.

⚠ CAUTION **Motor normally operates at high temperature and will be too hot to touch.** It is protected from heat damage during operation by an automatic internal cutoff switch. Before handling pump or motor, stop motor and allow it to cool for 20 minutes.

## TABLE II - RECOMMENDED FUSING AND WIRING DATA - 60 CYCLE MOTORS

| MOTOR HP | MAX. LOAD AMPERES | BRANCH FUSE* RATING AMPS | DIAMETER IN FEET FROM MOTOR TO METER | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 0' TO 50' | 51' TO 100' | 101' TO 200' | 201' TO 300' | 301' TO 400' | 401' TO 500' |
| | | | WIRE SIZE | | | | | |
| SINGLE PHASE - 115/230 VOLT | | | | | | | | |
| 1/3 | 9.4/4.7 | 15/15 | 14/14 | 14/14 | 10/14 | 10/14 | 6/14 | 6/12 |
| 1/2 | 9.4/4.7 | 15/15 | 14/14 | 14/14 | 10/14 | 10/14 | 6/14 | 6/12 |
| 3/4 | 12.2/6.1 | 20/15 | 12/14 | 12/14 | 10/14 | 8/14 | 6/12 | 6/12 |
| 1 | 14.8/7.4 | 20/15 | 12/14 | 12/14 | 8/14 | 6/14 | 6/12 | 4/10 |
| 1-1/2 | 19.2/9.6 | 25/15 | 10/14 | 10/14 | 8/14 | 6/12 | 4/10 | 4/10 |
| SINGLE PHASE - 230 VOLT | | | | | | | | |
| 2 | 12.0 | 15 | 14 | 14 | 14 | 12 | 10 | 10 |
| 2-1/2 | 12.0 | 15 | 14 | 14 | 14 | 12 | 10 | 10 |
| THREE PHASE - 230/460 VOLT | | | | | | | | |
| 1/2 | 2.3/1.15 | 15/15 | 14/14 | 14/14 | 14/14 | 14/14 | 14/14 | 14/14 |
| 3/4 | 3.1/1.55 | 15/15 | 14/14 | 14/14 | 14/14 | 14/14 | 14/14 | 14/14 |
| 1 | 3.6/1.8 | 15/15 | 14/14 | 14/14 | 14/14 | 14/14 | 14/14 | 14/14 |
| 1-1/2 | 4.7/2.35 | 15/15 | 14/14 | 14/14 | 14/14 | 14/14 | 14/14 | 14/14 |
| 2 | 6.8/3.4 | 15/15 | 14/14 | 14/14 | 14/14 | 14/14 | 12/14 | 12/14 |
| 2-1/2 | 8.5/4.25 | 15/15 | 14/14 | 14/14 | 14/14 | 14/14 | 12/14 | 10/14 |

*A Fusetron is recommended instead of a fuse in any motor circuit.

# ELECTRICAL

Connection diagram for dual voltage, single-phase motors. Your dual-voltage motor's terminal board (under the motor end cover) will match one of the diagrams below. Follow that diagram if necessary to convert motor to 115 Volt power.

Connect power supply wires to L1 and L2. For 3-phase motors, or if motor does not match these pictures, follow the connection diagram on the motor nameplate.

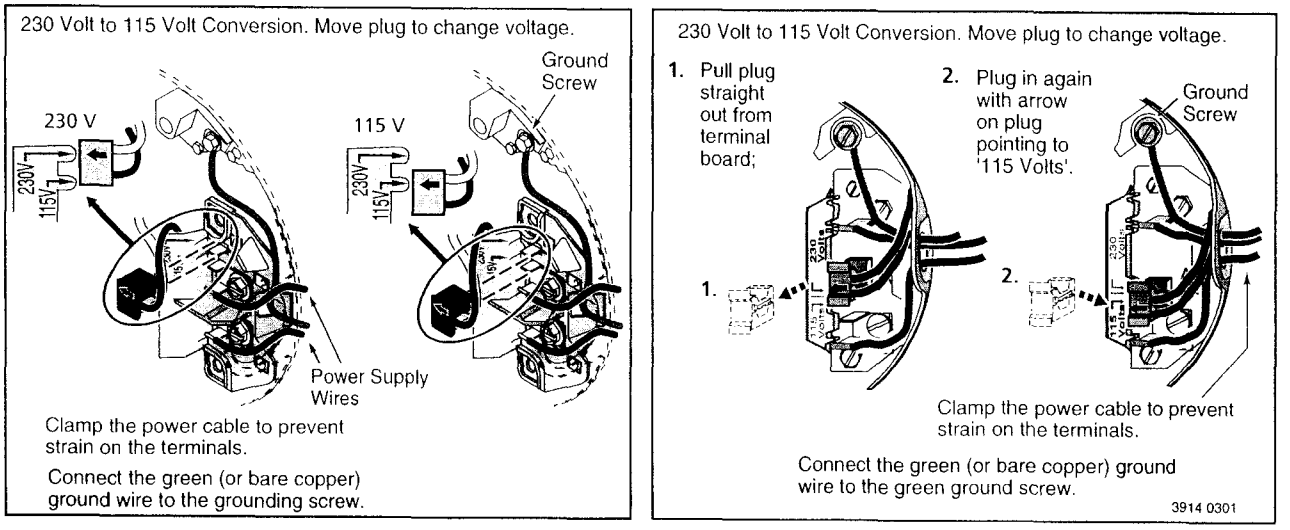



**FIGURE 3 – 115/230V Dual Voltage Single Phase Wiring Diagram**

**⚠WARNING Hazardous voltage.** Can shock, burn, or cause death. Disconnect power to motor before working on pump or motor. Ground motor before connecting to power supply.

## WIRING

**⚠ Ground motor before connecting to electrical power supply. Failure to ground motor can cause severe or fatal electrical shock hazard.**

**⚠ Do not ground to a gas supply line.**

**⚠ To avoid dangerous or fatal electrical shock, turn OFF power to motor before working on electrical connections.**

**⚠ Supply voltage must be within ±10% of nameplate voltage. Incorrect voltage can cause fire or damage motor and voids warranty. If in doubt consult a licensed electrician.**

**⚠ Use wire size specified in Wiring Chart (Page 3). If possible, connect pump to a separate branch circuit with no other appliances on it.**

**⚠ Wire motor according to diagram on motor nameplate. If nameplate diagram differs from diagrams above, follow nameplate diagram.**

1. Install, ground, wire and maintain your pump in compliance with the National Electrical Code (NEC) in the U.S., or the Canadian Electrical Code (CEC), as applicable, and with all local codes and ordinances that apply. Consult your local building inspector for code information.
2. Provide a correctly fused disconnect switch for protection while working on motor. For switch requirements, consult your local building inspector for information about codes.
3. Disconnect power before servicing motor or pump. If the disconnect switch is out of sight of pump, lock it open and tag it to prevent unexpected power application.
4. Ground the pump permanently using a wire of the same size as that specified in wiring chart (Page 3). Make ground connection to green grounding terminal under motor canopy marked GRD. or ⏚.
5. Connect ground wire to a grounded lead in the service panel or to a metal underground water pipe or well casing at least 10 feet long. Do not connect to plastic pipe or insulated fittings.
6. Protect current carrying and grounding conductors from cuts, grease, heat, oil, and chemicals.
7. Connect current carrying conductors to terminals L1 and L2 under motor canopy. When replacing motor, check wiring diagram on motor nameplate against Figure ##. If the motor wiring diagram does not match either diagram in Figure 3, follow the diagram on the motor.

**IMPORTANT:** 115/230 Volt single phase models are shipped from factory with motor wired for 230 volts. If power supply is 115 volts, remove motor canopy and reconnect motor as shown in Figure 3. Do not try to run motor as received on 115 volt current.

8. Motor has automatic internal thermal overload protection. If motor has stopped for unknown reasons, thermal overload may restart it unexpectedly, which could cause injury or property damage. Disconnect power before servicing motor.
9. If this procedure or the wiring diagrams are confusing, consult a licensed electrician.

# SERVICE

## PUMP SERVICE

This centrifugal pump requires little or no service other than reasonable care and periodic cleaning. Occasionally, however, a shaft seal may become damaged and must be replaced. The procedure as outlined below will enable you to replace the seal.

**NOTICE: Pumps use mechanical seals with a rubber seat ring or a sealing O-Ring. THESE SEALS ARE COMPLETELY INTERCHANGEABLE.**

**NOTICE:** The highly polished and lapped faces of this seal are easily damaged. Read instructions and handle the seal with care.

Some models are equipped with an impeller screw, which has a left hand thread. Before unscrewing the impeller, remove the impeller screw.

### REMOVAL OF OLD SEAL

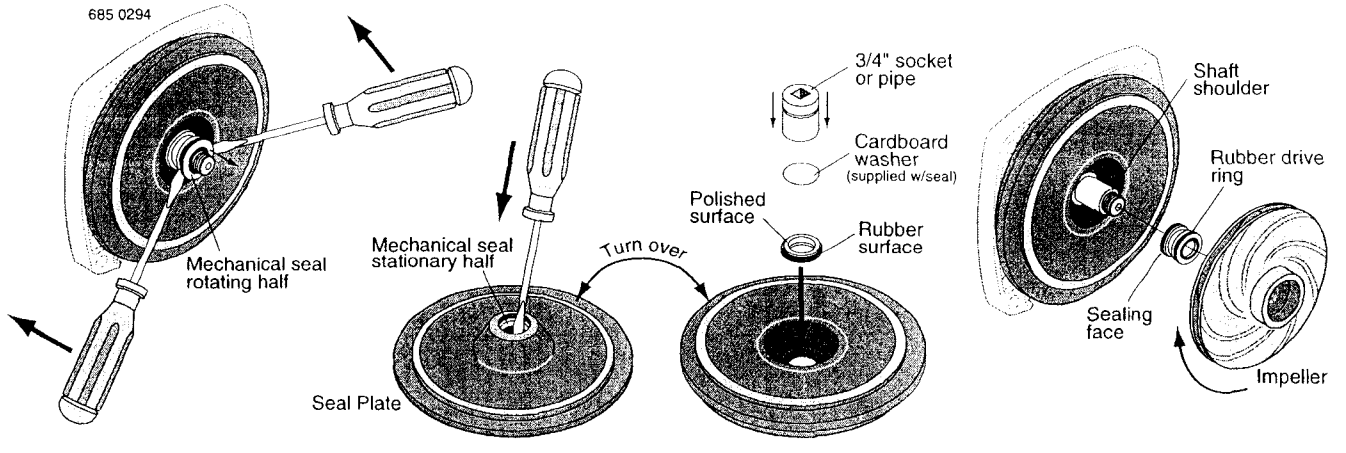
1. After unscrewing impeller, carefully remove rotating part of seal by prying up on sealing washer, using two screwdrivers (see Figure 4A). Use care not to scratch motor shaft.
2. Remove seal plate from motor and place on flat surface, face down. Use a screwdriver to push ceramic seat out from seal cavity (see Figure 4B).

### INSTALLATION OF FLOATING SEAT (Figure 4C)

1. Clean polished surface of floating seat with clean cloth.
2. Turn seal plate over so seal cavity is up, clean cavity thoroughly.
3. Lubricate outside rubber surface of ceramic seat with soapy water and press firmly into seal cavity with finger pressure. If seat will not locate properly in this manner, place cardboard washer over polished face of seat and press into seal cavity using a 3/4" socket or 3/4" piece of standard pipe.
4. **DISPOSE OF CARDBOARD WASHER.** Be sure polished surface of seat is free of dirt and has not been damaged by insertion. Remove excess soapy water.

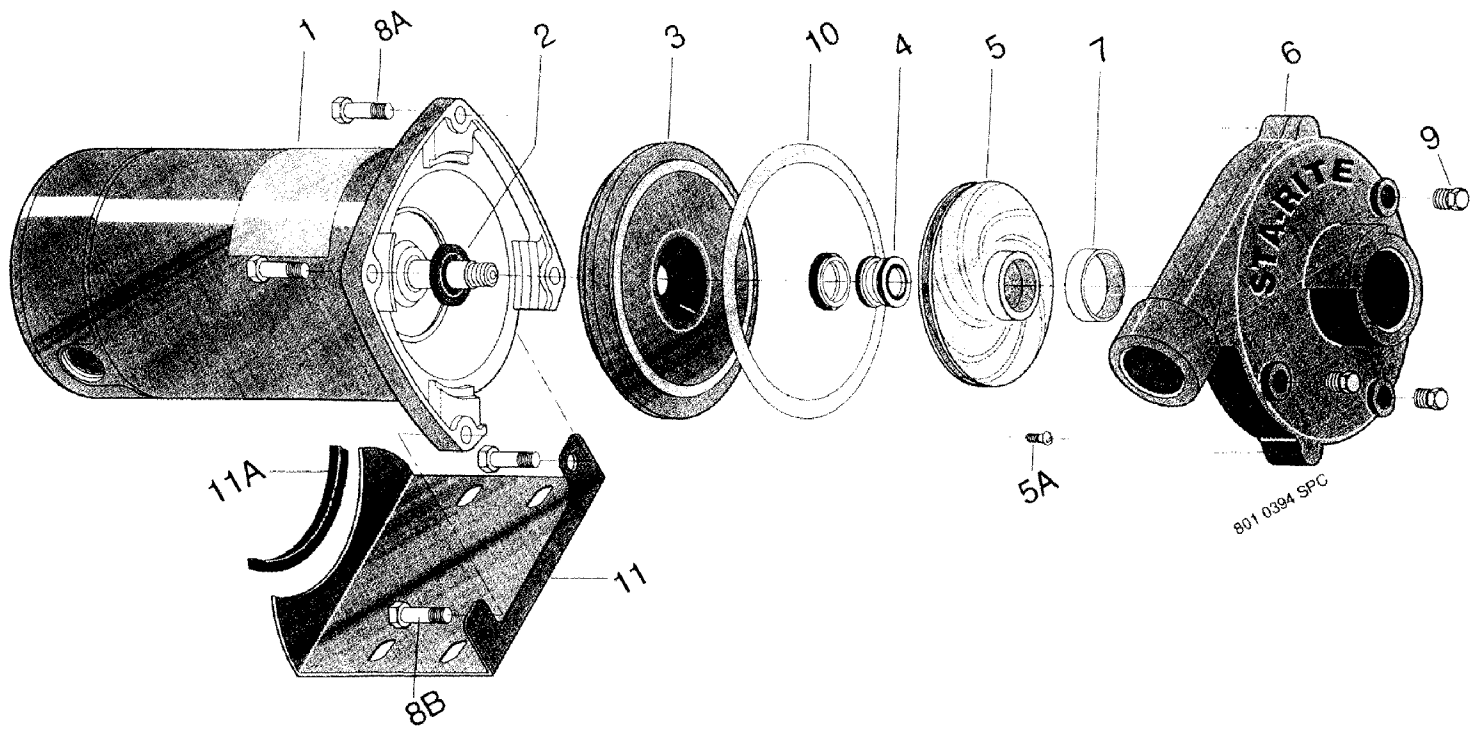
### INSTALLATION OF ROTATING PART OF SEAL UNIT (Figure 4D)

1. Reinstall seal plate using extreme caution not to hit ceramic portion of seal on motor shaft.
2. Inspect shaft to make sure that it is clean.
3. Clean face of sealing washer with clean cloth.
4. Lubricate inside diameter and outer face of rubber drive ring with soapy water and slide assembly on motor shaft (sealing face first) until rubber drive ring hits shaft shoulder.
5. Screw impeller on shaft until impeller hub hits shaft shoulder. This will automatically locate seal in place and move the sealing washer face up against seat facing. Reinstall impeller screw (if used).




**A**-Seal removal-rotating half **B**-Seal removal-stationary half **C**-Stationary half installation **D**-Rotating half installation

**FIGURE 4**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8A
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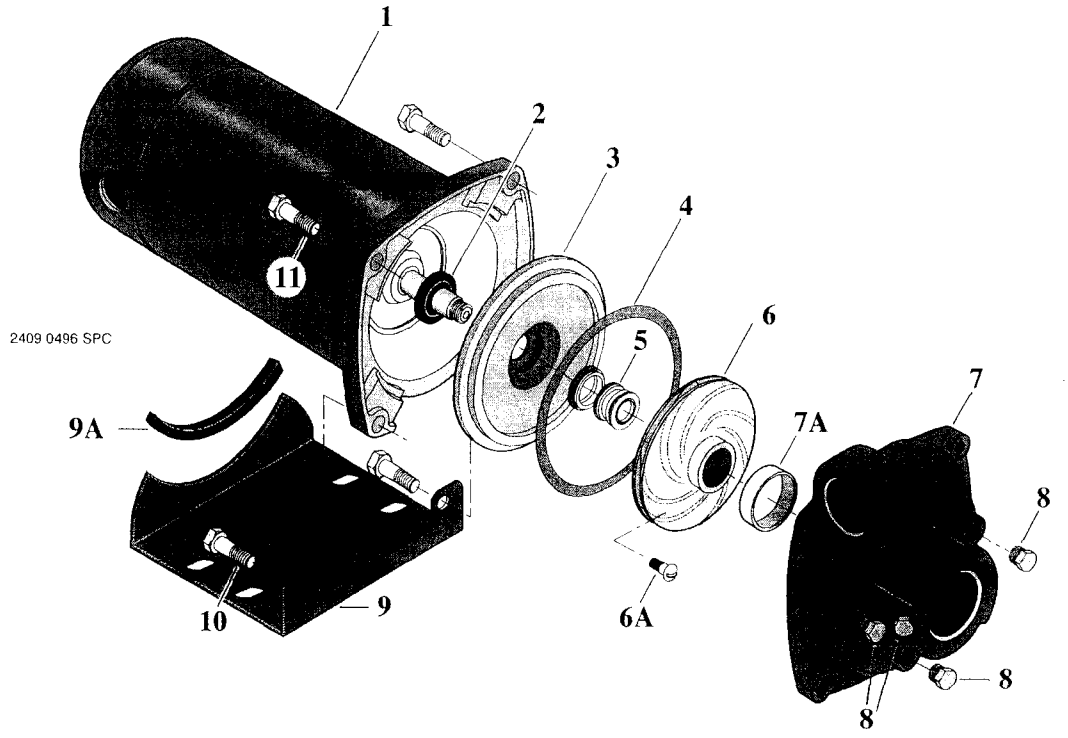
10
4
5
7
6
9
STA-RITE
11A
11
8B
5A
801 0394 SPC

# REPAIR PARTS LIST – "J" SERIES - HIGH HEAD

| Key No. | Part Description | No. Used | MOTOR AND HORSEPOWER | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | JHB-61HL – 1/3 HP | JHC-61HL JHC3-61H 1/2 HP | JHD-62HL JHD3-62H 3/4 HP | JHE-63HL JHE3-63H 1 HP | JHF-51HL JHF3-51H 1-1/2 HP | JHG-52HL JHG3-52H 2 HP | JHHG-53HL JHHG3-53H 2-1/2 HP |
| 1* | Motor, 115V, Single Phase | 1 | A100BHL | – | – | – | – | – | – |
| 1* | Motor, 115/230V, Single Phase | 1 | – | A100CLL | A100DLL | A100ELL | A100FLL | – | – |
| 1* | Motor, 230/460V, Three Phase | 1 | – | AP100CL | AP100DL | AP100EL | AP100FL | A100GSL | AE100G5L |
| 1* | Motor, 230V, Single Phase | 1 | – | – | – | – | – | AP100GL | AP100G5L |
| †2 | Water Slinger | 1 | 17351-0009 | 17351-0009 | 17351-0009 | 17351-0009 | 17351-0009 | 17351-0009 | 17351-0009 |
| 3 | Seal Plate | 1 | C3-178 | C3-178 | C3-178 | C3-178 | C3-178 | C3-181 | C3-181 |
| †4 | Shaft Seal | 1 | U109-6A | U109-6A | U109-6A | U109-6A | U109-6A | U109-6A | U109-6A |
| 5 | Impeller - Single Phase | 1 | C105-92PNX | C105-92PNX | C105-92PMX | C105-92PLX | C105-92PBX | C105-214PCA | C105-214PA |
| 5 | Impeller - Three Phase | 1 | – | C105-92PNXA | C105-92PMXA | C105-92PLXA | C105-92PBXA | C105-214PCA | C105-214PA |
| 5A | Impeller Screw - Three Phase | 1 | – | C30-12 | C30-14SS | C30-14SS | C30-14SS | C30-47SS | C30-47SS |
| 6 | Volute Assembly - Complete | 1 | C101-284A | C101-284A | C101-284A | C101-284A | C101-284A | C101-264 | C101-264B |
| 7 | Wear Ring | (1) | C23-27 | C23-27 | C23-27 | C23-27 | C23-27 | C23-19 | C23-19 |
| 8A | Capscrew - 3/8 - 16 x 1" Lg. | (2) | – | – | – | – | – | U30-74ZP | U30-74ZP |
| 8A | Capscrew - 3/8 - 16 x 1-1/4" Lg. | (2) | U30-75ZP | U30-75ZP | U30-75ZP | U30-75ZP | U30-75ZP | – | – |
| 8B | Capscrew - 3/8 - 16 x 1-1/4" Lg. | (2) | U30-75ZP | U30-75ZP | U30-75ZP | U30-75ZP | U30-75ZP | U30-75ZP | U30-75ZP |
| 9 | Pipe Plug - 1/4" NPT | (3) | U78-941ZPV | U78-941ZPV | U78-941ZPV | U78-941ZPV | U78-941ZPV | U78-941ZPV | U78-941ZPV |
| †10 | Gasket - Volute | 1 | C20-121 | C20-121 | C20-121 | C20-121 | C20-121 | C20-122 | C20-122 |
| 11 | Base | 1 | J104-9 | J104-9 | J104-9 | J104-9 | J104-9 | J104-9 | J104-9 |
| 11A | Motor Pad | 1 | C35-5 | C35-5 | C35-5 | C35-5 | C35-5 | C35-5 | C35-5 |
| | **SERVICE KIT** | | | | | | | | |
| | Seal and Gasket Kit | 1 | PP1700 | PP1700 | PP1700 | PP1700 | PP1700 | PP1700 | PP1700 |
| | NOTE: † Included in Seal and Gasket Kit. | | | | | | | | |

* For repair or service to motors, always give the motor Model Number and any other data found on the Motor Model Plate.

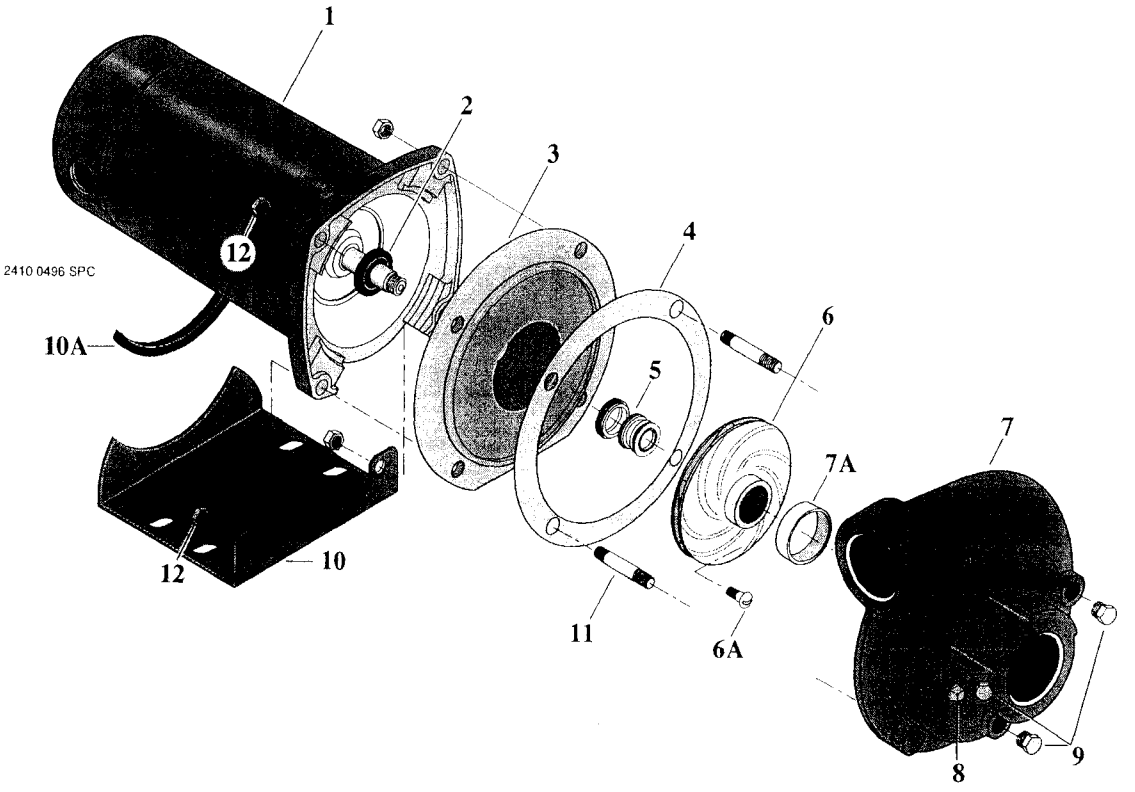



# REPAIR PARTS LIST – "J" SERIES - MEDIUM HEAD

| Key No. | Part Description | No. Used | MOTOR AND HORSEPOWER | | | |
|---|---|---|---|---|---|---|
| | | | JMB-56L 1/3 HP | JMC-56L JMC3-56 JMCV-56L JMC3V-56 1/2 HP | JMD-57L JMD3-57 JMDV-57L JMD3V-57 3/4 HP | JME-58L JME3-58 JMEV-58L JME3V-58 1 HP |
| 1* | Motor, 115V, Single Phase | 1 | AS100BHL | – | – | – |
| 1* | Motor, 115/230V, Single Phase | 1 | – | A100CLL | A100DLL | A100ELL |
| 1* | Motor, 230V, Single Phase | 1 | – | – | – | – |
| 1* | Motor, 230/460V, Three Phase | 1 | – | – | AP100DL | AP100EL |
| †2 | Water Slinger | 1 | 17351-0009 | 17351-0009 | 17351-0009 | 17351-0009 |
| 3 | Seal Plate | 1 | N3-8 | N3-8 | N3-8 | N3-8 |
| 4 | Gasket, Seal Plate | 1 | N29-26 | N29-26 | N29-26 | N29-26 |
| †5 | Shaft Seal | 1 | U109-6A | U109-6A | U109-6A | U109-6A |
| 6 | Impeller - Single Phase | 1 | J105-42PHA | J105-42PHA | J105-42PJA | J105-42P |
| 6 | Impeller - Three Phase | 1 | – | J105-42PHA | J105-42PJA | J105-42PPA |
| 6A | Impeller Screw - Three Phase | 1 | C30-21 | C30-6SS | C30-6SS | C30-6SS |
| 7 | Volute Assembly w/Wear Ring | 1 | C101-122E | C101-122E | C101-122E | C101-122 |
| 7 | Volute Assembly w/Wear Ring (JM_V Models**) | 1 | – | C101-122 | C101-122 | C101-122 |
| 7A | Wear Ring (Only) | (1) | N23-7 | N23-7 | N23-7 | N23-7 |
| 8 | Pipe Plug - 1/4" NPT | (4) | U78-941ZPV | U78-941ZPV | U78-941ZPV | U78-941ZPV |
| 9 | Base | 1 | J104-9 | J104-9 | J104-9 | J104-9 |
| 9A | Motor Pad | 1 | C35-5 | C35-5 | C35-5 | C35-5 |
| 10 | Capscrews - 3/8 - 16 x 1-1/4" | (2) | U30-75ZP | U30-75ZP | U30-75ZP | U30-75ZP |
| 11 | Capscrews - 3/8 - 16 x 1-1/2" | (2) | U30-76ZP | U30-76ZP | U30-76ZP | U30-76ZP |
| | **SERVICE KIT** | | | | | |
| | Seal and Gasket Kit | 1 | PP1700 | PP1700 | PP1700 | PP1700 |
| | NOTE: † Included in Seal and Gasket Kit. | | | | | |

* For repair or service to motors, always give the motor Model Number and any other data found on the Motor Model Plate.

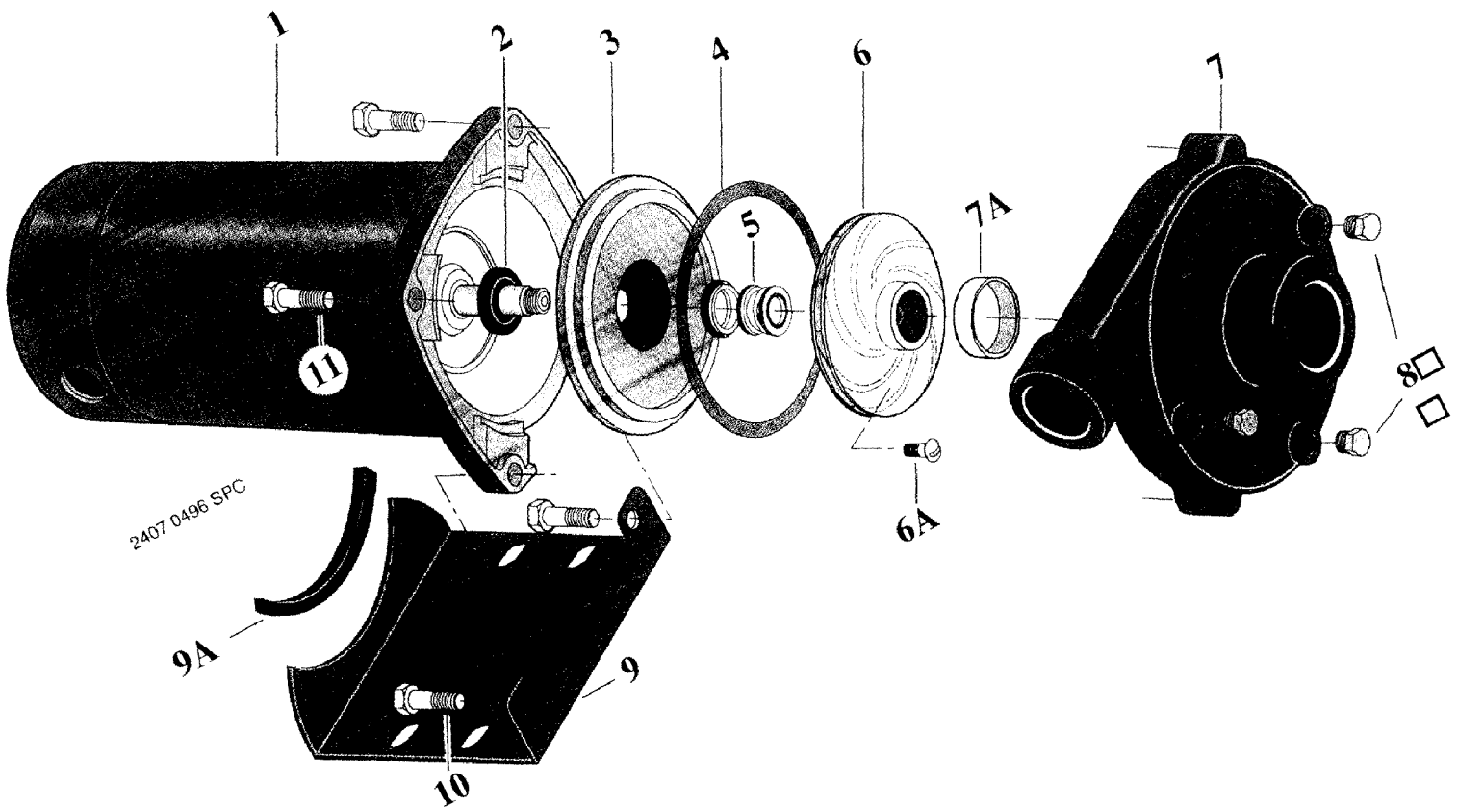
** JM_V models have vertical discharge.




# REPAIR PARTS LIST – "J" SERIES - MEDIUM HEAD

| Key No. | Part Description | No. Used | MOTOR AND HORSEPOWER | |
|---|---|---|---|---|
| | | | JMF-40L JMF3-40 1-1/2 HP | JMG-41L JMG3-41 2 HP |
| 1 | Motor, 115/230V, 1 Phase | 1 | A100FLL | – |
| 1 | Motor, 230/460V, 3 Phase | 1 | AP100FL | – |
| 1 | Motor, 230V, 1 Phase | 1 | – | A100GSL |
| 1 | Motor, 230/460V, 3 Phase | 1 | – | AP100GL |
| 2 | Water Slinger | 1 | 17351-0009 | 17351-0009 |
| 3 | Seal Plate | 1 | C3-52 | C3-52 |
| 4 | Gasket, Seal Plate | 1 | C20-21 | C20-21 |
| 5 | Shaft Seal | 1 | U109-6A | U109-6A |
| 6 | Impeller, Single Phase | 1 | C105-114PC | C105-114PNA |
| 6 | Impeller, Three Phase | 1 | C105-114PCA | C105-114PNA |
| 6A | Impeller Screw | 1 | C30-14SS | C30-14SS |
| 7 | Volute Assembly with Wear Ring | 1 | C101-123 | C101-123 |
| 7A | Wear Ring | 1 | C23-19 | C23-19 |
| 8 | Pipe Plug, 1/4" NPT Sq. Hd. | 1 | U78-57DT | U78-57DT |
| 9 | Pipe Plug, 1/4" NPT Hex Hd. | 3 | U78-941ZPV | U78-941ZPV |
| 10 | Base with Motor Pad | 1 | J104-9 | J104-9 |
| 10A | Motor Pad | 1 | C35-5 | C35-5 |
| 11 | Stud, 3/8 - 16 x 1-13/16" | 4 | U30-35SS | U30-29 |
| 12 | Hex Nut, 3/8 - 16 | 4 | U36-38ZP | U36-38ZP |
| | **SERVICE KIT** | | | |
| | Seal and Gasket Kit | 1 | PP1700 | PP1700 |
| | NOTE: † Included in Seal and Gasket Kit. | | | |

* For repair or service to motors, always give the motor Model Number and any other data found on the Motor Model Plate.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7A
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9A
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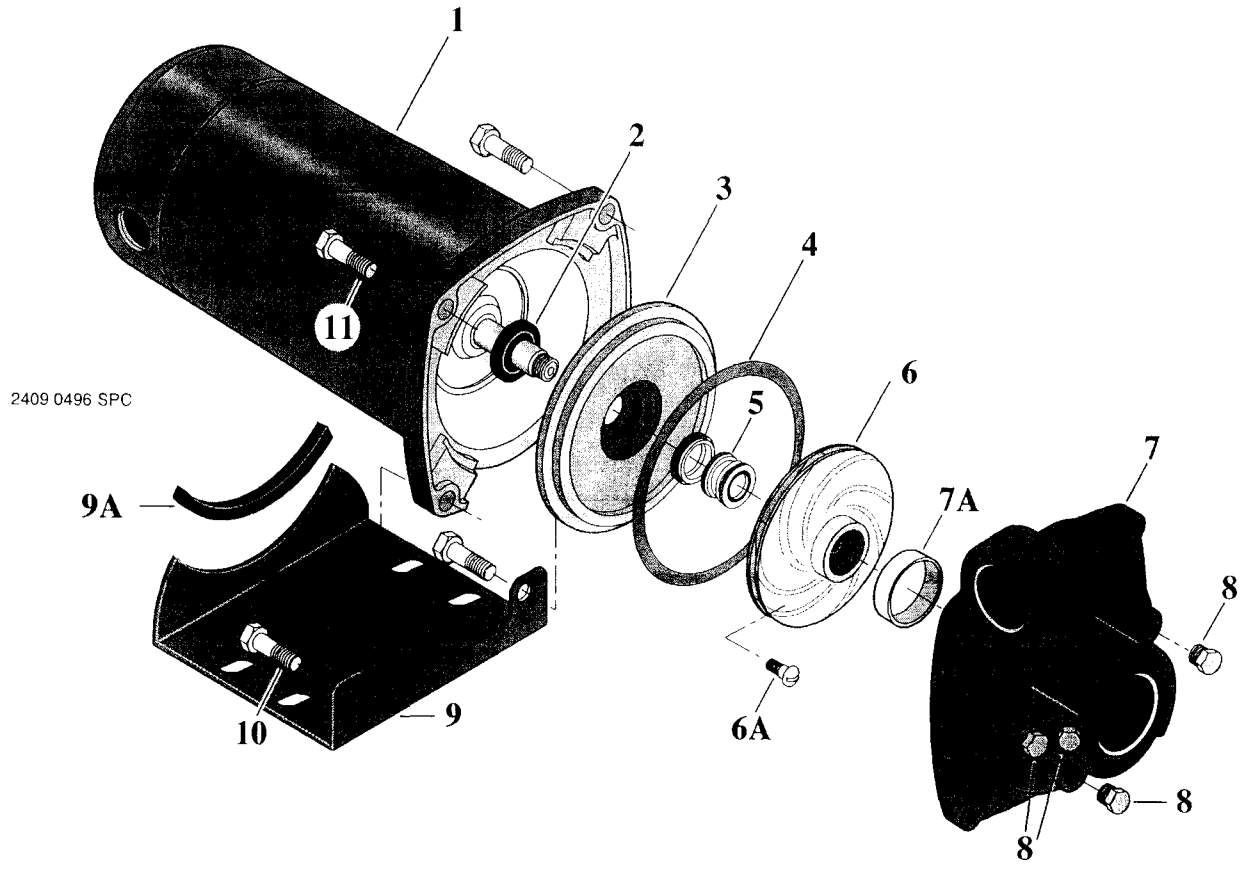
2407 0496 SPC

# REPAIR PARTS LIST – "JB" SERIES - MEDIUM HEAD

| Key No. | Part Description | No. Used | MOTOR AND HORSEPOWER | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | JBHB-61S – 1/3 HP | JBHC-61S JBHC3-61S 1/2 HP | JBHD-62S JBHD3-62S 3/4 HP | JBHE-63S JBHE3-63S 1 HP | JBHF-51S JBHF3-51S 1-1/2 HP | JBHG-52S JBHG3-52S 2HP | JBHHG-53S JBHHG3-53S 2-1/2 HP |
| 1 | Motor, 115V, 1 Phase | 1 | AS100BHL | – | – | – | – | – | – |
| 1 | Motor, 115/230V, 1 Phase | 1 | – | A100CLL | A100DLL | A100ELL | A100FLL | – | – |
| 1 | Motor, ,230V, 1 Phase | | – | – | – | – | – | A100GSL | AE100G5LL |
| 1 | Motor, , 230/460V, 3 Phase | 1 | – | AP100CL | AP100DL | AP100EL | AP100FL | AP100GL | AP100G5L |
| †2 | Water Slinger | 1 | 17351-0009 | 17351-0009 | 17351-0009 | 17351-0009 | 17351-0009 | 17351-0009 | 17351-0009 |
| 3 | Seal Plate | 1 | C3-178 | C3-178 | C3-178 | C3-178 | C3-178 | C3-131 | C3-131 |
| †4 | Gasket, Seal Plate | 1 | C20-121 | C20-121 | C20-121 | C20-121 | C20-121 | C20-122 | C20-122 |
| †5 | Shaft Seal | 1 | U109-6A | U109-6A | U109-6A | U109-6A | U109-6A | U109-6A | U109-6A |
| 6 | Impeller, Single Phase | 1 | C5-256BA | C5-256BA | C5-256BAA | C5-254BA | C5-254BC | C5-257BB | C5-257B |
| 6 | Impeller, Three Phase | 1 | – | C5-256BA | C5-256BAA | C5-254BA | C5-254BC | C5-257BB | C5-257B |
| 6A | Impeller Screw, Three Phase | 1 | C30-14SS | C30-14SS | C30-14SS | C30-14SS | C30-14SS | C30-14SS | C30-14SS |
| 7 | Volute Assembly with Wear Ring | 1 | C101-284A | C101-284A | C101-284A | C101-284A | C101-284A | C101-264 | C101-264B |
| 7A | Wear Ring | 1 | C23-27 | C23-27 | C23-27 | C23-27 | C23-27 | C23-27 | C23-27 |
| 8 | Pipe Plug, 1/4" NPT Hex Hd. | 3 | U78-941ZPV | U78-941ZPV | U78-941ZPV | U78-941ZPV | U78-941ZPV | U78-941ZPV | U78-941ZPV |
| 9 | Base with Motor Pad | 1 | J104-9 | J104-9 | J104-9 | J104-9 | J104-9 | J104-9 | J104-9 |
| 9A | Motor Pad | 1 | C35-5 | C35-5 | C35-5 | C35-5 | C35-5 | C35-5 | C35-5 |
| 10 | Hex Capscrew, 3/8" - 16 x 1" Lg. | 2 | – | – | – | – | – | U30-74ZP | U30-74ZP |
| 10 | Hex Capscrew, 3/8" - 16 x 1-1/4" Lg. | 2 | U30-75ZP | U30-75ZP | U30-75ZP | U30-75ZP | U30-75ZP | – | – |
| 11 | Hex Capscrew, 3/8" - 16 x 1-1/4" Lg. | 2 | U30-75ZP | U30-75ZP | U30-75ZP | U30-75ZP | U30-75ZP | U30-75ZP | U30-75ZP |

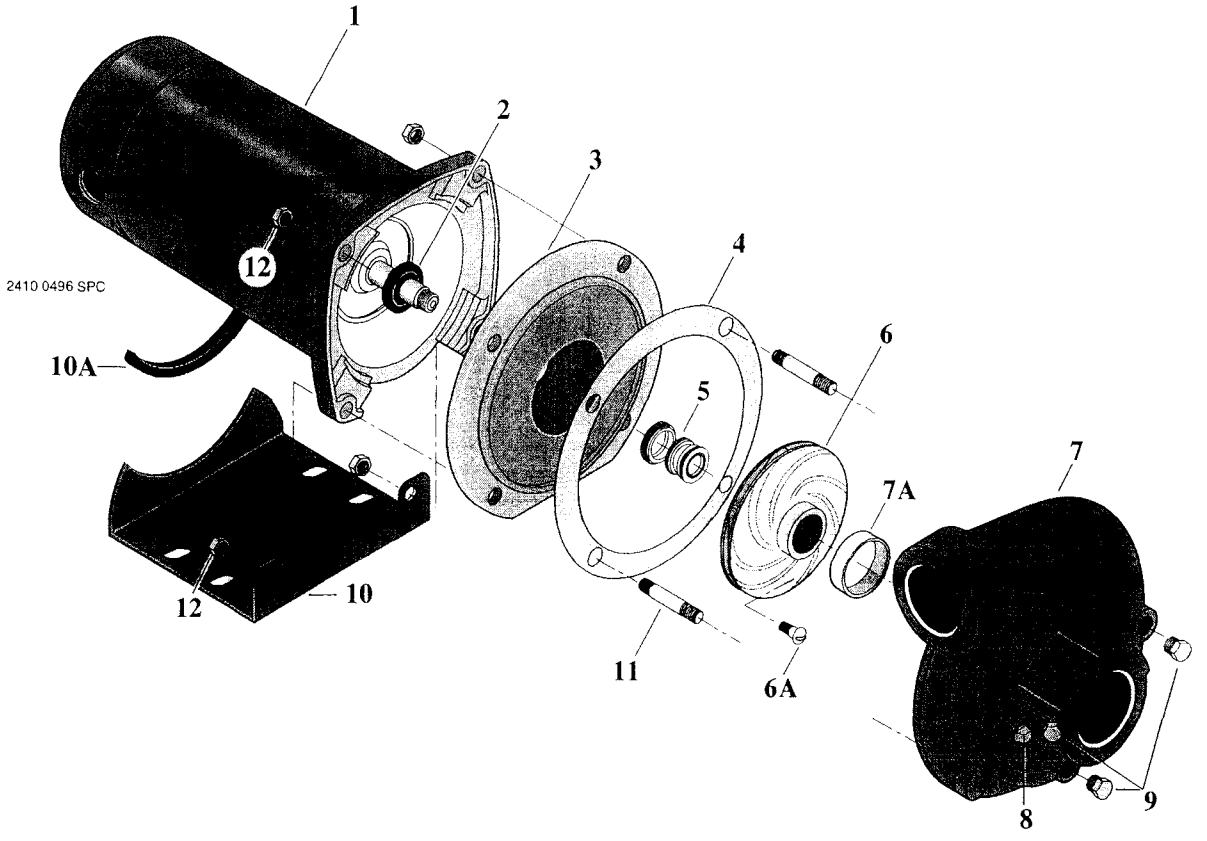
* For repair or service to motors, always give the motor Model Number and any other data found on the Motor Model Plate.




## REPAIR PARTS LIST – "J" SERIES - HIGH HEAD

| Key No. | Part Description | No. Used | MOTOR AND HORSEPOWER | | | |
|---|---|---|---|---|---|---|
| | | | JBMB-56S – 1/3 HP | JBMC-56S JBMC3-56S 1/2 HP | JBMD-57S JBMD3-57S 3/4 HP | JBME-58S JBME3-58S 1 HP |
| 1 | Motor, 115V, 1 Phase | 1 | AS100BHL | – | – | – |
| 1 | Motor, 115/230V, 1 Phase | 1 | – | A100CLL | A100DLL | A100ELL |
| 1 | Motor, 230/460V, 3 Phase | 1 | – | AP100CL | AP100DL | AP100EL |
| 2 | Water Slinger | 1 | 17351-0009 | 17351-0009 | 17351-0009 | 17351-0009 |
| 3 | Seal Plate | 1 | N3-8 | N3-8 | N3-8 | N3-8 |
| 4 | Gasket, Seal Plate | 1 | N20-26 | N20-26 | N20-26 | N20-26 |
| 5 | Shaft Seal | 1 | U109-6A | U109-6A | U109-6A | U109-6A |
| 6 | Impeller, Single Phase | 1 | J105-42MA | J105-42MA | J105-42LA | J105-42NA |
| 6 | Impeller, Three Phase | 1 | – | J105-42MA | J105-42LA | J105-42NA |
| 6A | Impeller Screw | 1 | – | C30-6SS | C30-6SS | C30-6SS |
| 7 | Volute Assembly with Wear Ring | 1 | C101-122E | C101-122E | C101-122E | C101-122 |
| 7A | Wear Ring | 1 | N23-7 | N23-7 | N23-7 | N23-7 |
| 8 | Pipe Plug, 1/4" NPT Hex Hd. | 4 | U78-941ZPV | U78-941ZPV | U78-941ZPV | U78-941ZPV |
| 9 | Base with Motor Pad | 1 | J104-9 | J104-9 | J104-9 | J104-9 |
| 9A | Motor Pad | 1 | C35-5 | C35-5 | C35-5 | C35-5 |
| 10 | Hex Capscrew, 3/8" - 16 x 1-1/2" Lg. | 2 | U30-76ZP | U30-76ZP | U30-76ZP | U30-76ZP |
| 11 | Hex Capscrew, 3/8" - 16 x 1-1/4" Lg. | 2 | U30-75ZP | U30-75ZP | U30-75ZP | U30-75ZP |
| | SERVICE KIT | | | | | |
| | Seal and Gasket Kit | 1 | PP1700 | PP1700 | PP1700 | PP1700 |
| | NOTE: † Included in Seal and Gasket Kit. | | | | | |

* For repair or service to motors, always give the motor Model Number and any other data found on the Motor Model Plate.




# REPAIR PARTS LIST – "J" SERIES - HIGH HEAD

| Key No. | Part Description | No. Used | MOTOR AND HORSEPOWER | | |
|---|---|---|---|---|---|
| | | | JBMF-40S JBMF3-40S 1-1/2 HP | JBMG-41S JBMG3-41S 2 HP | JBMMG-59S JBMMG3-59S 2-1/2 HP |
| 1 | Motor, 115/230V, 1 Phase | 1 | A100FLL | – | – |
| 1 | Motor, 30/460V, 3 Phase | 1 | AP100FL | AP100GL | AP100G5L |
| 1 | Motor, 230V, 1 Phase | 1 | – | A100GSL | AE100G5LL |
| 2 | Water Slinger | 1 | 17351-0009 | 17351-0009 | 17351-0009 |
| 3 | Seal Plate | 1 | C3-52 | C3-52 | C3-52 |
| 4 | Gasket, Seal Plate | 1 | C20-21 | C20-21 | C20-21 |
| 5 | Shaft Seal | 1 | U109-6A | U109-6A | U109-6A |
| 6 | Impeller, Single Phase | 1 | C105-79B | C105-73BA | C105-80DA |
| 6 | Impeller, Three Phase | 1 | C105-79BA | C105-73BA | C105-80DA |
| 6A | Impeller Screw | 1 | C30-14SS | C30-14SS | C30-14SS |
| 7 | Volute Assembly with Wear Ring | 1 | C101-123 | C101-123 | C101-123B |
| 7A | Wear Ring | 1 | C23-19 | C23-19 | C23-19 |
| 8 | Pipe Plug, 1/4" NPT Sq. Hd. | 1 | U78-57DT | U78-57DT | U78-57DT |
| 9 | Pipe Plug, 1/4" NPT Hex Hd. | 3 | U78-941ZPV | U78-941ZPV | U78-941ZPV |
| 10 | Base with Motor Pad | 1 | J104-9 | J104-9 | J104-9 |
| 10A | Motor Pad | 1 | C35-5 | C35-5 | C35-5 |
| 11 | Stud, 3/8 - 16 x 1-13/16" | 4 | U30-35SS | U30-35SS | U30-35SS |
| 12 | Hex Nut, 3/8 - 16 | 4 | U36-38ZP | U36-38ZP | U36-38ZP |
| | **SERVICE KIT** | | | | |
| | Seal and Gasket Kit | 1 | PP1700 | PP1700 | PP1700 |
| | NOTE: † Included in Seal and Gasket Kit. | | | | |

* For repair or service to motors, always give the motor Model Number and any other data found on the Motor Model Plate.

# TROUBLE - CAUSES AND REMEDY

| TROUBLE AND CAUSE | REMEDY |
|---|---|
| **FAILURE TO PUMP** | |
| 1. Pump not properly primed. | 1. Make sure pump casing and suction line are full of water. See priming instructions. |
| **REDUCED CAPACITY AND/OR HEAD** | |
| 1. Air pockets or leaks in suction line. | 1. Check suction piping. |
| 2. Clogged impeller. | 2. Remove and clean. |
| **PUMP LOSES PRIME** | |
| 1. Air leaks in suction line. | 1. Check suction piping |
| 2. Excessive suction lift and operating too near shut-off point. | 2. Move pump nearer to water level. |
| 3. Water level drops while pumping, uncovering suction piping. | 3. Check water supply. Add length of pipe to suction to keep submerged end under water. |
| **MECHANICAL TROUBLES AND NOISE** | |
| 1. Bent shaft and/or damaged bearings. | 1. Take motor to authorized motor repair shop. |
| 2. Suction and/or discharge piping not properly supported and anchored. | 2. See that all piping is supported to relieve strain on pump assembly. |

# LIMITED WARRANTY

Sta-Rite Industries, Inc., warrants to the original consumer of the products listed below, that they will be free from defects in material and workmanship for the Warranty Period from the date of original installation or manufacture as noted.

| Product | Warranty Period |
|---|---|
| Water Systems Products – jet pumps, small centrifugal pumps, submersible pumps and related accessories | *whichever occurs first:* 1 year from date of original installation, or 2 years from date of manufacture |
| Hydro-Flow Filters | 1 year from date of purchase |
| Signature 2000® Fibrewound Tanks | 5 years from date of original installation |
| Pro-Source™ Steel Pressure Tanks | 5 years from date of original installation |
| Pro-Source™ Epoxy-Lined Tanks | 3 years from date of original installation |
| Sump/Sewage/Effluent Products | 1 year from date of original installation, or 2 years from date of manufacture |

Our warranty will not apply to any product that has been subject to negligence, misapplication, improper installation or maintenance. In the event a three phase submersible motor is operated with single phase power through a phase converter, or if three-leg ambient compensated, extra-quick trip overload relays of recommended size are not used, our warranty is void.

Buyer's only remedy and Sta-Rite Industries, Inc.'s only duty is to repair or replace defective products (at Sta-Rite Industries, Inc.'s choice). Buyer agrees to pay all labor and shipping charges associated with this warranty and to request warranty service through the installing dealer as soon as a problem is discovered. If warranty service is requested more than 30 days after the Warranty Period has ended, it will not be honored.

STA-RITE INDUSTRIES, INC. SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL, OR CONTINGENT DAMAGES WHATSOEVER.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESS WARRANTIES. IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, SHALL NOT EXTEND BEYOND THE WARRANTY PERIOD PROVIDED HEREIN.

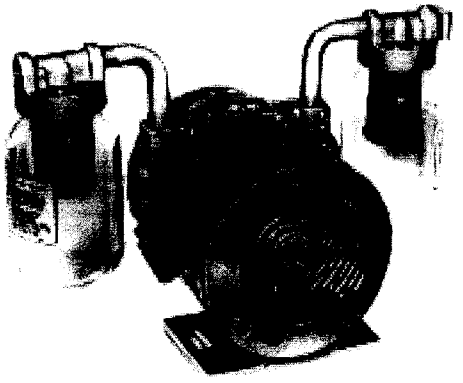
Certain states do not permit the exclusion or limitation of incidental or consequential damages or the placing of limitations on the duration of an implied warranty, therefore, the limitations or exclusions herein may not apply. This warranty sets forth specific legal rights and obligations, however, additional rights may exist, which may vary from state to state.

Supersedes all previous publications.

**Sta-Rite Industries, Inc. 293 Wright St., Delavan, WI 53115**

# 67 SERIES OIL-LESS ROTARY VANE VACUUM PUMPS & COMPRESSORS

## OPERATION & MAINTENANCE MANUAL



Model 2067-V103 Shown

Thank you for purchasing this Gast product. It is manufactured to the highest standards using quality materials. Please follow all recommended maintenance, operational and safety instructions and you will receive years of trouble free service.

**IMPORTANT: PLEASE READ THIS MANUAL AND SAVE FOR FUTURE REFERENCE.**

### General information

- **Clearances in inches:**

| MODEL | 1067 | 1567 | 2067/2567 |
|---|---|---|---|
| TOP | .0015 | .003 | .003 |
| DRIVE END | .001 | .002 | .002 |
| DEAD END | .0025 | .0029 | .005 |
| | .003 | .0035 | .0055 |

- **Vane Life:** 8,000 – 23,000 hours depending upon application

**Product Use Criteria:**

- Pump only clean, dry air.
- Operate at 32°F - 104°F (0°C - 40°C).
- Protect unit from dirt & moisture.
- Do not pump flammable or explosive gases or use in an atmosphere that contains such gases.
- Protect all surrounding items from exhaust air. This exhaust air can become very hot.
- Corrosive gases and particulate material will damage unit. Water vapor, oil-based contaminants or other liquids must be filtered out.
- Consult your Gast Distributor/Representative before using at high altitudes.
- Oil-Less rotary-vanes require NO lubrication.
- Sealed bearings are grease packed.
- Use of petroleum or hydrocarbon products will reduce carbon vane service life.

GAST
A Unit of IDEX Corporation

ISO 9001 & 14001 CERTIFIED

www.gastmfg.com

**Your safety and the safety of others is extremely important.**

**We have provided many important safety messages in this manual and on your product. Always read and obey all safety messages.**

**This is the safety alert symbol. This symbol alerts you to hazards that can kill or hurt you and others. The safety alert symbol and the words "DANGER" and "WARNING" will precede all safety messages. These words mean:**

**DANGER**

**You will be killed or seriously injured if you don't follow instructions.**

**WARNING**

**You can be killed or seriously injured if you don't follow instructions.**

**All safety messages will identify the hazard, tell you how to reduce the chance of injury, and tell you what can happen if the safety instructions are not followed.**

## INSTALLATION

**WARNING**

**Electrical Shock Hazard**

**Disconnect electrical power at the circuit breaker or fuse box before installing this product.**

**Install this product where it will not come into contact with water or other liquids.**

**Install this product where it will be weather protected.**

**Electrically ground this product.**

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

**Correct installation is your responsibility.** Make sure you have the proper installation conditions and that installation clearances do not block air flow. Proper guards should be installed to prevent contact with moveable parts of this pump. Do Not lift the unit by the fan shroud.

**Blocking air flow over the product in any way can cause the product to overheat.**

**Mounting**
This product can be installed in any orientation. Mounting the product to a stable, rigid operating surface and using shock mounts will reduce noise and vibration.

**Plumbing**
Remove plugs from the IN and OUT ports. Connect with pipe and fittings that are the same size or larger than the product's threaded ports.

**Accessories**
The product's internal intake and exhaust filters will provide adequate filtration in most applications. Check filters periodically and replace when necessary. All units should have an intake and exhaust filter to prevent contaminants from entering the pump or the pneumatic system. Please consult your Gast Distributor/Representative for additional filter recommendations.

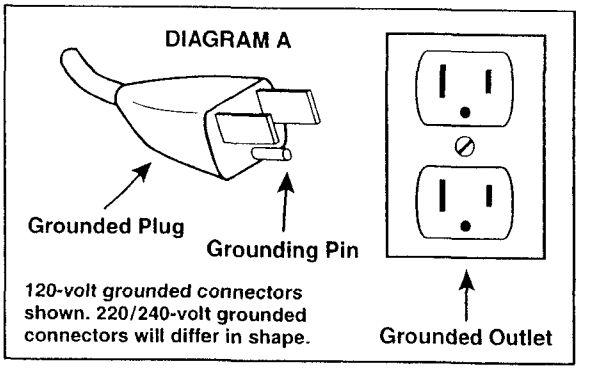
Install relief valves and gauges at inlet or outlet, or both, to monitor performance. Check valves may be required to prevent back streaming through the pump.

**Motor Control**
It is your responsibility to contact a qualified electrician to assure that the electrical installation is adequate and in conformance with all national and local codes and ordinances.

Determine the correct overload setting required to protect the motor (see motor starter manufacturer's recommendations). Select fuses, motor protective switches or thermal protective switches to provide protection. Fuses act as short circuit protection for the motor, not as protection against overload. Incoming line fuses help to withstand the motor's starting current. Motor starters with thermal magnetic overload or circuit breakers protect motor from overload or reduced voltage conditions.

The wiring diagram supplied with the product provides required electrical information. Check that power source is correct to properly operate the dual-voltage motors.

**Electrical Connection**




***120-volt grounded connectors shown. 220/240-volt grounded connectors will differ in shape.***

**Model with a power supply cord:**
This product must be grounded. For either 120-volt or 220/240-volt circuits connect power supply cord grounding plug to a matching grounded outlet. Do not use an adapter. (See DIAGRAM A)

In the event of an electrical short circuit, grounding reduces the risk of electric shock by providing an escape wire for the electric current. This product may be equipped with a power supply cord having a grounding wire with an appropriate grounding plug. The plug must be plugged into an outlet that is properly installed and grounded in accordance with all local codes and ordinances.

**Check with a qualified electrician or serviceman if the grounding instructions are not completely understood, or if you are not sure whether the product is properly grounded. Do not modify the plug provided. If it will not fit the outlet, have the proper outlet installed by a qualified electrician.**

**Model that is permanently wired:**
This product must be connected to a grounded, metallic, permanent wiring system, or an equipment grounding terminal or lead on the product.

Power supply wiring must conform to all required safety codes and be installed by a qualified person. Check that supply voltage agrees with that listed on product nameplate.

**Extension cords:**
Use only a 3-wire extension cord that has a 3-blade grounding plug. Connect extension cord plug to a matching 3-slot receptacle. Do not use an adapter. Make sure your extension cord is in good condition. Check that the gage wire of the extension cord is the correct size wire to carry the current this product will draw.

**Minimum gage for extension cords**

| Amps | Volts | Length of cord in feet | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 120v | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 400 | 500 |
| | 240v | 50 | 100 | 200 | 300 | 400 | 500 | 600 | 800 | 1000 |
| 0-2 | | 18 | 18 | 18 | 16 | 16 | 14 | 14 | 12 | 12 |
| 2-3 | | 18 | 18 | 16 | 14 | 14 | 12 | 12 | 10 | 10 |
| 3-4 | | 18 | 18 | 16 | 14 | 12 | 12 | 10 | 10 | 8 |
| 4-5 | | 18 | 18 | 14 | 12 | 12 | 10 | 10 | 8 | 8 |
| 5-6 | | 18 | 16 | 14 | 12 | 10 | 10 | 8 | 8 | 8 |
| 6-8 | | 18 | 16 | 12 | 10 | 10 | 8 | 6 | 6 | 6 |
| 8-10 | | 18 | 14 | 12 | 10 | 8 | 8 | 6 | 6 | 4 |
| 10-12 | | 16 | 14 | 10 | 8 | 8 | 6 | 6 | 4 | 4 |
| 12-14 | | 16 | 12 | 10 | 8 | 6 | 6 | 6 | 4 | 2 |
| 14-16 | | 16 | 12 | 10 | 8 | 6 | 6 | 4 | 4 | 2 |
| 16-18 | | 14 | 12 | 8 | 8 | 6 | 4 | 4 | 2 | 2 |
| 18-20 | | 14 | 12 | 8 | 6 | 6 | 4 | 4 | 2 | 2 |

## OPERATION

**⚠ WARNING**

Injury Hazard

**Install proper safety guards as needed. Pumps with glass jars need safety guards to protect against breaking glass.**

**Use only recommended air handling parts acceptable for pressure not less than 70 psi.**

**Keep fingers and objects away from openings and rotating parts.**

**When provided, motor terminal covers must be in place for safe operation.**

**Check that coupling guard and shroud are in place before operating.**

**Product surfaces may become hot during operation, allow product surfaces to cool before handling.**

**Do Not direct air stream at body. Air stream from product may contain solid or liquid material that can result in eye or skin damage, wear proper eye protection.**

**Do Not spray flammable or combustible liquid.**

**Wear hearing protection. Sound level from motor may exceed 85 dBA.**

**Failure to follow these instructions can result in burns, eye injury or other serious injury.**

**It is your responsibility to operate this product at recommended pressures or vacuum duties and room ambient temperatures. Do Not start against a vacuum or pressure load.**

### Start Up

If motor fails to start or slows down significantly under load, shut off and disconnect from power supply. Check that the voltage is correct for motor and that motor is turning in the proper direction. Vane life will be drastically reduced if motor is not operating properly. Vanes can break or be damaged if motor/pump runs in the wrong direction.

## MAINTENANCE

**⚠ WARNING**

Electrical Shock Hazard

**Disconnect electrical power supply cord before performing maintenance on this product.**

**If product is hard wired into system, disconnect electrical power at the circuit breaker or fuse box before performing maintenance on this product.**

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

## ⚠ WARNING

**Injury Hazard**

**Product surfaces may become hot during operation, allow product surfaces to cool before handling.**

**Do Not direct air stream at body. Air stream from product may contain solid or liquid material that can result in eye or skin damage, wear proper eye protection.**

**Clean this product in a well ventilated area.**

**Failure to follow these instructions can result in burns, eye injury or other serious injury.**

**It is your responsibility to:**

- **Regularly inspect and make necessary repairs to product in order to maintain proper operation.**
- **Make sure that pressure and vacuum is released from product before starting maintenance.**

Check intake and exhaust filters after first 500 hours of operation. Clean filters and determine how frequently filters should be checked during future operation. **This one procedure will help to assure the product's performance and service life.**

Clean filters when necessary by removing and washing in a solvent or soap and water. After cleaning, dry with compressed air to make sure all moisture is removed before replacing filters.

### Flushing

Flushing this product to remove excessive dirt, foreign particles, moisture or oil that occurs in the operating environment will help to maintain proper vane performance. If your pump is not getting the vacuum or pressure level expected, flushing is required. Vanes will stick when dirty and may cause pump to be noisy or inefficient.

**Use only Gast AH255B Flushing Solvent or other non-petroleum based flushing solvent. Do Not use kerosene or ANY other combustible solvent to flush product.**

1. Disconnect electrical power supply.
2. Release all pressure and vacuum from pump.
3. Remove all accessories at the inlet and exhaust ports.
4. Remove filter.
5. Start product. Place towel over exhaust port to clean up solvent. If using liquid solvent, pour several tablespoons directly into inlet port. If using Gast AH255B Flushing Solvent, spray solvent for 5-10 seconds into inlet port.
6. Block the inlet port and draw a deep vacuum for 15-20 seconds. Release the vacuum.
7. Listen for changes in the sound of the motor. If motor sounds smooth, go to next step. If motor does not sound like it is running smoothly, repeat steps 5 and 6 until you can hear a difference in the operating sound of the pump.
8. Start the pump and let it run for 1 minute, then turn pump off.
9. Replace all accessories at the inlet and exhaust ports.
10. Replace filter before resuming operation.

**Check that all external accessories such as relief valves and gauges are attached to cover and are not damaged before re-operating product.**

## SHUTDOWN PROCEDURES

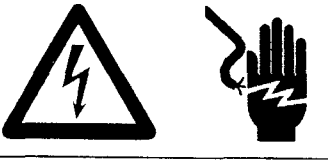
**It is your responsibility to follow proper shutdown procedures to prevent product damage.**
**NEVER ADD OIL TO THIS OIL-LESS PUMP.**

Proper shutdown procedures must be followed to prevent pump damage. Failure to do so may result in premature pump failure. The Gast Manufacturing Rotary Vane Oil-Less Vacuum Pumps and Compressors are constructed of ferrous metals or aluminum which are subject to rust and corrosion when pumping condensable vapors such as water. Follow the steps below to assure correct storage and shutdown between operating periods

1. Disconnect plumbing.
2. Operate product for at least 5 minutes without plumbing.
3. Run at maximum vacuum for 10-15 minutes.
4. Repeat step 2.
5. Disconnect power supply.
6. Plug open ports to prevent dirt or other contaminants from entering product.

## SERVICE KIT INSTALLATION

## ⚠ WARNING



**Electrical Shock Hazard**

**Disconnect electrical power supply cord before installing Service Kit.**

**If product is hard wired into system, disconnect electrical power at the circuit breaker or fuse box before installing Service Kit.**

**Disconnect air supply and vent all air lines to release pressure or vacuum.**

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

**Gast will NOT guarantee field-rebuilt product performance. For performance guarantee, the product must be returned to a Gast Authorized Service Facility.**

Service Kit contents vary. Most contain vanes, gaskets and filter parts.

**Do Not attempt to remove the rotor.** It is held in place by Loctite and can only be serviced by a Gast Authorized Service Facility.

**Do Not loosen or adjust motor thru-bolts** to prevent misalignment and damage to the pump.

**Disassembly**

1. Remove two fan/coupling guard screws. Remove guard.
2. Remove four motor bolts. Remove motor.
3. Loosen two set screws in coupling flange. Remove coupling flange from drive end shaft.
4. Remove four screws from the dead end fan guard. Remove guard. Use a pulley puller to remove fan.
5. Remove eight dead end plate bolts with the special adapter tool.
6. Use a small hammer to carefully tap on dead end plate to remove. Do Not use a screwdriver.
7. Remove the dowel pins from the body and dead end plate.
8. Remove vanes. If vanes are stuck, use needle nose pliers to help loosen and remove vanes.
9. Use snap ring pliers to remove snap ring.
10. Remove Belleville springs, flat washer, bearing and deflector. Not how items are placed for reassembly.
11. Place unit with the drive end shaft in an upright position on a protected surface. Remove rotor.
12. Use an adjustable spanner wrench or a special adapter tool to remove drive end cap, bearing and deflector from drive end plate.

**Do Not disassemble any further parts. The factory has determined the exact top and overall end clearances. Further disassembly will change these settings.**

**Cleaning**

1. Clean all parts with solvent and remove all solvent from parts.
2. Use a 12" smooth file on the faces of end plates and body to remove burrs.
3. Use file to carefully clean out vane slots in rotor.
4. Use emery cloth to clean and remove burrs from body bore and rotor outside diameter.
5. Clean filed parts again with solvent then remove all solvent from parts.

**Reassembly**

1. Place drive end plate on shim aligning bolt holes.
2. Install eight drive end bolts by hand. Do Not tighten at this time.
3. Drive two dowel pins into body through drive end plate.
4. Torque bolts to 75-125 in. lbs.
5. Place rotor with drive end up in a fixture on an arbor press.
6. Place body and drive end plate assembly over shaft so that drive end plate is on the face of rotor.
7. Place deflector and bearing on shaft and slide both down to bearing journal.
8. Use bearing pusher and arbor press to press bearing down all the way. Bearing pusher must make contact with both inner and outer race of bearing.
9. Flip unit over so the dead end is up.
10. Install vanes into rotor.
11. Replace dead end plate over shaft and body aligning bolt holes.
12. Place deflector and bearing on shaft and slide both down to bearing journal.
13. Drive two dowel pins into body through drive end plate.
14. Torque bolts to 75-125 in. lbs.
15. Place large cupped end of one Belleville spring down against the outer bearing race. Place a flat washer on top of Belleville spring.
16. Use snap ring pliers to place snap ring over Belleville spring and press into groove in dead end plate.
17. Secure a dial indicator onto dead end shaft to check axial movement. Push in indicator to allow for a free travel of .01" to the rear.
18. Install drive end cap onto drive end plate. Hand tighten until end cap bottoms out on bearing.
19. Tighten drive end cap with a spanner wrench or a special adapter tool until drive end cap is tight. Dial indicator should move back to .007" or .0075" for the 2067/2567 Series models, .0049" to .0055" for the 1567 Series model and .0035" to .004" for the 1067 Series model to assure proper clearance. If reading does not fall into range for the model in question, disassemble and add or remove shims until proper clearance range is achieved.
20. Remove drive end cap and apply several drops of Loctite 222 to threads. Replace drive end cap and tighten until clearance dial indicator moves to .002" back for 1567 and 2067/2567 Series models and .001" back for the 1067 Series model. Clearances should be:

| End | 2067/2567 Series | 1567 Series | 1067 Series |
|---|---|---|---|
| Drive | .002" | .002" | .001" |
| Dead | .005"-.0055" | .0029"-.0035" | .0035" |

21. Press dead end cooling fan on and center it so it will not hit dead end plate or fan guard.
22. Replace dead end fan guard and attach with four bolts.
23. Replace drive end coupling on drive end shaft. Tighten set screws.
24. Place motor on motor bracket and attach with four motor bolts.
25. If motor is 3-phase, check that motor rotates properly.
26. Push motor coupling flange against coupling sleeve until tight. Tighten set screws in motor coupling flange.
27. Replace coupling fan guard and attach with two guard bolts.

**Replacing New Body or Rotor**

1. Use a micrometer to read the rotor length and body thickness. Subtract rotor length from body thickness. This overall clearance should be .007" to .0075" for the 2067/2567 Series models, .0049" to .0055" for the 1567 Series model and .0035" to .004" for the 1067 Series model. If clearance is less, add shims to drive end to get the required clearance.
2. For desired rotation, the inlet port needs to be to the left of the body for counter-clockwise rotation or to the right for clockwise rotation.
3. If gasket is needed, place one or more gaskets on body face.
4. Place rotor through body bore.
5. Place drive end plate on body gasket.
6. Install all screws and hand tighten.
7. Place motor with drive down in fixture and apply pressure to hold against drive end plate.
8. Place a .003" shim between rotor and body bore. Tap body toward or away from rotor until shim is snug and resists being moved.
9. Tighten bolts at the 9:00 and 3:00 o'clock positions.

10. Release shaft and rotate rotor to next position. Check rotor lobe. Set each clearance to the tightest setting. Repeat until all lobes have been checked.
11. Remove from fixture and tighten remaining screws.
12. Either leave dowel pins out or drill new dowel pin holes and use new dowel pins. **Do Not re-use old dowel pins.**

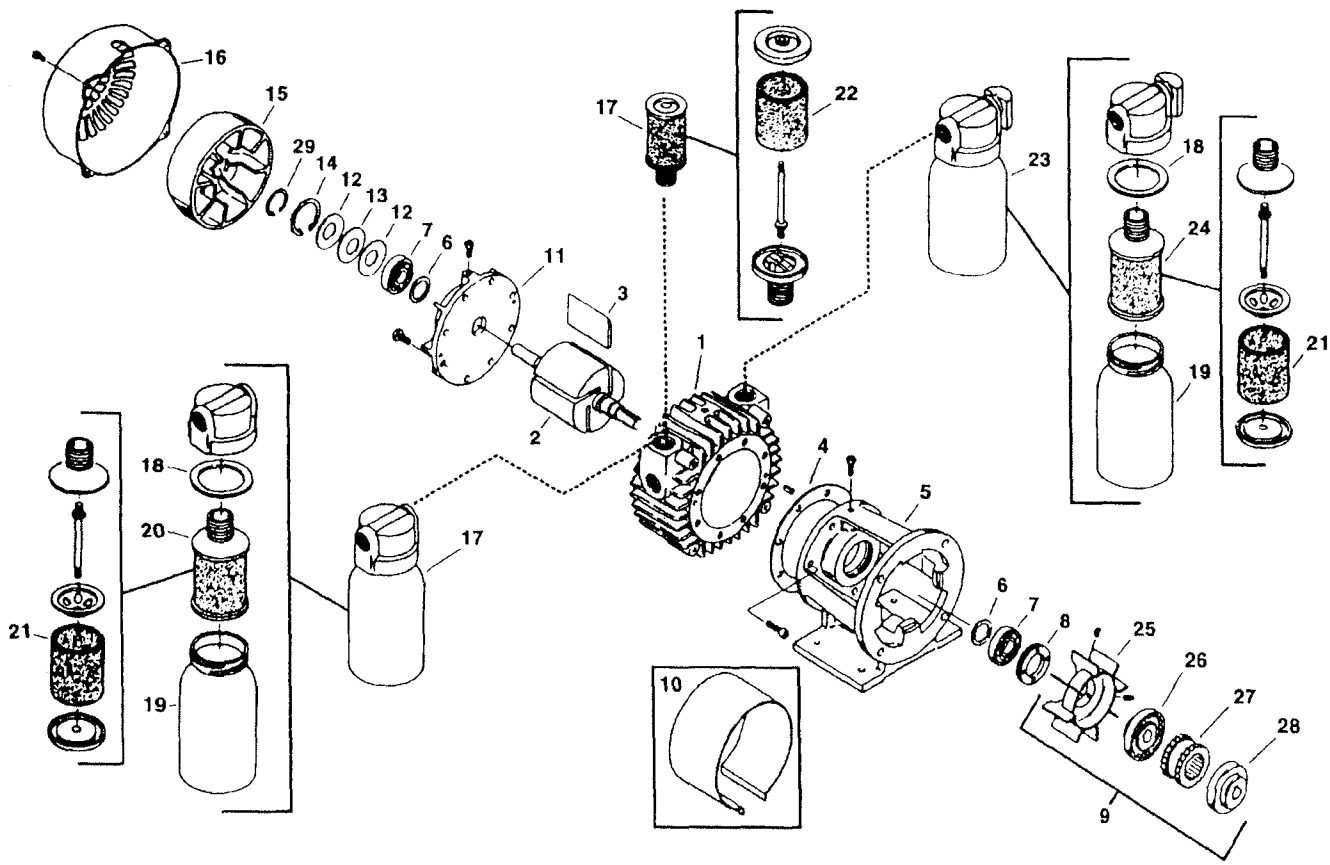
**Check that all external accessories such as relief valves and gauges are attached to cover and are not damaged before re-operating product.**

**If pump still does not produce proper vacuum or pressure, send unit to a Gast Authorized Service Facility for repair.**

**Disposal** (Please note current regulations)
Parts of the rotary vane pumps and compressors, shafts, iron or aluminum castings, plastic or glass parts or bearings, may be recycled as scrap materials.

## EXPLODED PRODUCT VIEW, PARTS & ORDERING INFORMATION

**For the following exploded view, please reference Series and Model parts chart on facing page.**



| | PRODUCT SERIES Pump or Compressor Model # | | SERIES 1067 Vacuum Pump 1067-V103 | SERIES 1067 Compressor 1067-P102 | SERIES 1567 1567-101 | SERIES 2067 Vacuum Pump 2067-V103 | SERIES 2067 Compressor 2067-P102 | SERIES 2567 Vacuum Pump 2567-V103 | SERIES 2567 Compressor 2567-P102 |
|---|---|---|---|---|---|---|---|---|---|
| REF | DESCRIPTION | QTY | | | | | | | |
| 1 | BODY | 1 | AH345 | AH345 | AH291 | AH191 | AH191 | AH355 | AH355 |
| 2 | ROTOR ASSEMBLY | 1 | AH428 | AH428 | AH292 | AH192 | AH192 | AH192 | AH192 |
| 3 Δ | VANE | 4 | AH430 | AH430 | AB125B | AH195 | AH195 | AH195 | AH195 |
| 4 Δ | BODY GASKET | 1 | AH567 | AH567 | AH567 | AH567 | AH567 | AH567 | AH567 |
| 5 | FOOT BRACKET | 1 | AH208 | AH208 | AH208A | AH208 | AH208 | AH208 | AH208 |
| 6 Δ | DEFLECTOR | 2 | AH193 | AH193 | AH193A | AH193 | AH193 | AH193 | AH193 |
| 7 Δ | BALL BEARING (Drive & Dead) | 2 | AC894 | AC894 | AC894 | AC894 | AC894 | AC894 | AC894 |
| 8 | END CAP, DRIVE | 1 | AB339 | AB339 | AB339 | AB339 | AB339 | AB339 | AB339 |
| 9 | FAN COUPLING ASSEMBLY | 1 | – | – | AH198-1 | AH198-1 | AH198-1 | AH198-1 | AH198-1 |
| 10 | FAN GUARD | 1 | AH194 | AH194 | AH194 | AH194 | AH194 | AH194 | AH194 |
| 11 | END PLATE, DEAD | 1 | AH205 | AH205 | AH205B | AH205 | AH205 | AH205 | AH205 |
| 12 | BELLEVILLE SPRINGS | 2 | AB337 | AB337 | AB337 | AB337 | AB337 | AB337 | AB337 |
| 13 | WASHER | 1 | AB338 | AB338 | AB338 | AB338 | AB338 | AB338 | AB338 |
| 14 | SNAP RING | 1 | AB335 | AB335 | AB335 | AB335 | AB335 | AB335 | AB335 |
| 15 | FAN | 1 | AC326B | AC326B | AC326B | AC326B | AC326B | AC326B | AC326B |
| 16 | FAN GUARD | 1 | AC102C | AC102C | AC102C | AC102C | AC102C | AC102C | AC102C |
| 17 | INTAKE FILTER ASSEMBLY | 1 | AA800C | AA905F | – | AA900D | AA905G | AA900D | AA905G |
| 18 | GASKET | 2 | AA405 | – | – | AA405 | – | AA405 | – |
| 19 | JAR | 2 | AA401 | – | – | AA401 | – | AA401 | – |
| 20 | FILTER ASSEMBLY | 1 | AC434-1 | – | – | AC435-1 | – | AC435-1 | – |
| 21 Δ | CARTRIDGE | 2 | AC393 | – | – | AC393 | – | AC393 | – |
| 22 Δ | FILTER FELT | 1 | – | D344B | – | – | D344B | – | D344B |
| 23 | MUFFLER | 1 | AA800F | – | – | AA900F | – | AA900F | – |
| 24 | MUFFLER ASSEMBLY | 1 | AC434-1 | – | – | AC436-1 | – | AC436-1 | – |
| 25 | FAN | 1 | AH197 | AH197 | AH197 | AH197 | AH197 | AH197 | AH197 |
| 26 | FLANGE | 1 | AH196 | AH196 | AH196 | AH196 | AH196 | AH196 | AH196 |
| 27 | SLEEVE | 1 | AE546 | AE546 | AE546 | AE546 | AE546 | AE546 | AE546 |
| 28 | FLANGE | 1 | AE545B | AE545B | AE546B | AE545B | AE545B | AE545B | AE545B |
| 29 | RETAINER RING | 1 | AC447 | AC447 | AC447 | AC447 | AC447 | AC447 | AC447 |
| | SERVICE KIT | 1 | K356 | K356 | K897 | K350 | K357 | K350 | K357 |

Δ Denotes parts included in the Service Kit.
Parts listed are for stock models. For specific OEM models, please consult the factory.
When corresponding or ordering parts, please give complete model and serial numbers.

## WARRANTY

Gast finished products, when properly installed and operated under normal conditions of use, are warranted by Gast to be free from defects in material and workmanship for a period of twelve (12) months from the date of purchase from Gast or an authorized Gast Representative or Distributor. In order to obtain performance under this warranty, the buyer must promptly (in no event later than thirty (30) days after discovery of the defect) give written notice of the defect to Gast Manufacturing Incorporated, PO Box 97, Benton Harbor Michigan USA 49023-0097 or an authorized Service Center (unless specifically agreed upon in writing signed by both parties or specified in writing as part of a Gast OEM Quotation). Buyer is responsible for freight charges both to and from Gast in all cases.

This warranty does not apply to electric motors, electrical controls, and gasoline engines not supplied by Gast. Gast's warranties also do not extend to any goods or parts which have been subjected to misuse, lack of maintenance, neglect, damage by accident or transit damage.

THIS EXPRESS WARRANTY EXCLUDES ALL OTHER WARRANTIES OR REPRESENTATIONS EXPRESSED OR IMPLIED BY ANY LITERATURE, DATA, OR PERSON. GAST'S MAXIMUM LIABILITY UNDER THIS EXCLUSIVE REMEDY SHALL NEVER EXCEED THE COST OF THE SUBJECT PRODUCT AND GAST RESERVES THE RIGHT, AT ITS SOLE DISCRETION, TO REFUND THE PURCHASE PRICE IN LIEU OF REPAIR OR REPLACEMENT.

GAST WILL NOT BE RESPONSIBLE OR LIABLE FOR INDIRECT OR CONSEQUENTIAL DAMAGES OF ANY KIND, however arising, including but not limited to those for use of any products, loss of time, inconvenience, lost profit, labor charges, or other incidental or consequential damages with respect to persons, business, or property, whether as a result of breach of warranty, negligence or otherwise. Notwithstanding any other provision of this warranty, BUYER'S REMEDY AGAINST GAST FOR GOODS SUPPLIED OR FOR NON-DELIVERED GOODS OR FAILURE TO FURNISH GOODS, WHETHER OR NOT BASED ON NEGLIGENCE, STRICT LIABILITY OR BREACH OF EXPRESS OR IMPLIED WARRANTY IS LIMITED SOLELY, AT GAST'S OPTION, TO REPLACEMENT OF OR CURE OF SUCH NONCONFORMING OR NON-DELIVERED GOODS OR RETURN OF THE PURCHASE PRICE FOR SUCH GOODS AND IN NO EVENT SHALL EXCEED THE PRICE OR CHARGE FOR SUCH GOODS. GAST EXPRESSLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE WITH RESPECT TO THE GOODS SOLD. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTIONS SET FORTH IN THIS WARRANTY, notwithstanding any knowledge of Gast regarding the use or uses intended to be made of goods, proposed changes or additions to goods, or any assistance or suggestions that may have been made by Gast personnel.

Unauthorized extensions of warranties by the customer shall remain the customer's responsibility.

CUSTOMER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF GAST PRODUCTS FOR CUSTOMER'S USE OR RESALE, OR FOR INCORPORATING THEM INTO OBJECTS OR APPLICATIONS WHICH CUSTOMER DESIGNS, ASSEMBLES, CONSTRUCTS OR MANUFACTURES.

This warranty can be modified only by authorized Gast personnel by signing a specific, written description of any modifications.

## PART NO. 70-235 G365PL (Rev. E)

## TROUBLESHOOTING CHART

| Low | | High | | Pump | Motor | Reason and remedy |
|---|---|---|---|---|---|---|
| Vacuum | Pressure | Vacuum | Pressure | Overheat | Overload | for problem. |
| • | • | At pump | | • | • | Filter dirty.<br>Clean or replace. |
| | • | | At pump | • | • | Muffler dirty.<br>Clean or replace. |
| • | | At pump | | • | • | Vacuum line collapsed.<br>Repair or replace. |
| • | | | • | • | • | Relief valve set too high.<br>Inspect and adjust. |
| • | • | | | | | Relief valve set too low.<br>Inspect and adjust. |
| • | • | At pump | At pump | • | • | Plugged vacuum/pressure line.<br>Inspect and repair. |
| • | • | | | | | Vanes sticking.<br>Clean or replace. |
| • | • | | | | | Vanes worn.<br>Replace. |
| • | • | | | | | Shaft seal worn.<br>Replace. |
| • | • | | | • | • | Dust or offset powder in pump.<br>Inspect and clean. |
| • | • | | | • | | Motor not wired correctly.<br>Check wiring diagram and line voltage. |
| | | • | • | • | • | Running at too high an RPM.<br>Check wiring diagram and line voltage. |

## AUTHORIZED SERVICE FACILITIES

Gast Manufacturing Inc.
2550 Meadowbrook Road
Benton Harbor, MI 49022
TEL: 269-926-6171
FAX: 269-925-8288
www.gastmfg.com

Gast Manufacturing Inc.
505 Washington Avenue
Carlstadt, NJ 07072
TEL: 201-933-8484
FAX: 201-933-5545
www.gastmfg.com

Kinequip, Inc.
365 Old Niagara Falls Blvd.
Buffalo, NY 14228-1636
TEL: 716-694-5000
TEL: 800-982-8894
www.kinequip.com

John Henry Foster Co.
4700 Lebourget Drive
St. Louis, MO 63134-0820
TEL: 314-427-0600
TEL: 800-444-0522
FAX: 314-427-3502
www.jhf.com

Air-Oil Products Corp.
301 30th Street NE 31,#112
Auburn, WA 98002
TEL: 800-282-2672
FAX: 877-808-4601
www.air-oil.com

Gast Manufacturing Co., Ltd.
Beech House
Knaves Beech Business Centre
Loudwater, High Wycombe
Bucks, England HP10 9SD
TEL: 011-44-1628-532600
FAX: 011-44-1628-532470
www.gastltd.com

D & F Distributors
1144 Indy Court
Evansville, IN 47725
TEL: 812-867-2441
FAX: 812-867-6822
www.dfdistrib.com

Brenner Fiedler & Assoc
13824 Bentley Place
Cerritos, CA 90701
TEL: 800-843-5558
TEL: 310-404-2721
FAX: 310-404-7975
www.brenner-fiedler.com

Hydraulic & Pneumatic Sales
11100 Park Charlotte Blvd.
Charlotte NC 28273
TEL: 704-588-3234
FAX: 704-588-1569
www.hpsalesinc.com

Wainbee Limited
215 boul Brunswick
Pointe Claire, Quebec
Canada H9R 4R7
TEL: 514-697-8810
FAX: 514-697-3070
www.wainbee.ca

Japan Machinery Co., Ltd
Central PO Box 1451
Tokyo, 100-91 Japan
TEL: 81-3-3573-5421
FAX: 81-3-3571-7865
or: 81-3-3571-7896
www.japanmachinery.com

James E. Watson & Co.
29 Doran Ave.
Marietta, GA 30060
TEL. 770-422-1154
www.jwatsonco.com

Wainbee Limited
5789 Coopers Avenue
Mississauga, Ontario
Canada L4Z 3S6
TEL: 905-568-1700
FAX: 905-568-0083
www.wainbee.ca

TUTHILL CORPORATION | M-D Pneumatics Division

4840 West Kearney Street, P.O. Box 2877
Springfield, Missouri USA 65801-0877
Tel 417 865-8715 Fax 417 865-2950

# MAINTENANCE MANUAL

## MODELS 4000 AND 5500

| SERIES | |
|---|---|
| 16/47 | HORIZONTAL FLOW / VERTICAL FLOW |
| 17/46 | HORIZONTAL FLOW / VERTICAL FLOW |
| 57/81 | HORIZONTAL FLOW (GAS SERVICE) / VERTICAL FLOW (GAS SERVICE) |
| 64/67 | HORIZONTAL FLOW (GAS SERVICE) / VERTICAL FLOW (GAS SERVICE) |

WARNING:
Do Not Operate
Before Reading The
Enclosed Instruction Manual

**Best In The Blower Business**

TUTHILL CORPORATION | M-D Pneumatics Division

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Tel 417 865-8715 Fax 417 865-2950

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**WARNING:**
Do Not Operate
Before Reading The
Enclosed Instruction Manual

**Best In The Blower Business**

## WARRANTY AND LIMITATION OF LIABILITY

Subject to the terms and conditions hereinafter set forth and set forth in General Terms of Sale, Tuthill Corporation, M-D Pneumatics Division (the Seller) warrants products and parts of its manufacture, when shipped, and its work (including installation and start-up) when performed, will be of good quality and will be free from defects in material and workmanship. This warranty applies only to Seller's equipment, under use and service in accordance with seller's written instructions, recommendations and ratings for installation, operating, maintenance and service of products, for a period within one (1) year after date of shipment for all new products and six (6) months for all rebuilt or remanufactured products which are not supplied for warranty situations. On warranty repairs, the warranty period will be either whatever time was left on the original warranty at time of removal or three (3) months, which ever is greater. Because of varying conditions of installation and operation, all guarantees of performance are subject to plus or minus 5% variation.

THIS WARRANTY EXTENDS ONLY TO BUYER AND/OR ORIGINAL END USER, AND IN NO EVENT SHALL THE SELLER BE LIABLE FOR PROPERTY DAMAGE SUSTAINED BY A PERSON DESIGNATED BY THE LAW OF ANY JURISDICTION AS A THIRD PARTY BENEFICIARY OF THIS WARRANTY OR ANY OTHER WARRANTY HELD TO SURVIVE SELLER'S DISCLAIMER.

All accessories furnished by Seller but manufactured by others bear only that manufacturer's standard warranty.

All claims for defective products, parts, or work under this warranty must be made in writing immediately upon discovery and, in any event within one (1) year from date of shipment of the applicable item and all claims for defective work must be made in writing immediately upon discovery and in any event within one (1) year from date of completion thereof by Seller. Unless done with prior written consent of Seller, any repairs, alterations or disassembly of Seller's equipment shall void warranty. Installation and transportation costs are not included and defective items must be held for Seller's inspection and returned to Seller's F.O.B. point upon request.

THERE ARE NO WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS.

After Buyer's submission of a claim as provided above and its approval, Seller shall at its option either repair or replace its product, part, or work at the original F.O.B. point of shipment, or refund an equitable portion of the purchase price.

The products and parts sold hereunder are not warranted for operation with erosive or corrosive material or those which may lead to build up material within the product quoted. The Buyer shall have no claim whatsoever and no product or part shall be deemed to be defective by reason of failure to resist erosive or corrosive action nor for problems resulting from build-up of material within the unit.

Any improper use, operation beyond capacity, substitution of parts not approved by Seller, or any alteration or repair by others in such manner as in Seller's judgment affects the product materially and adversely shall void this warranty.

No employee or representative of Seller other than an officer of the Company is authorized to change this warranty in any way or grant any other warranty.

The foregoing is Seller's only obligation and Buyer's only remedy for breach of warranty, and except for gross negligence, willful misconduct and remedies permitted under the General Terms of Sale in the sections on CONTRACT PERFORMANCE, INSPECTION AND ACCEPTANCE and the PATENTS Clause hereof, the foregoing is BUYER'S ONLY REMEDY HEREUNDER BY WAY OF BREACH OF CONTRACT, TORT OR OTHERWISE, WITHOUT REGARD TO WHETHER ANY DEFECT WAS DISCOVERED OR LATENT AT THE TIME OF DELIVERY OF THE PRODUCT OR WORK. In no event shall Buyer be entitled to incidental or consequential damages. Any action for breach of this agreement must commence within one (1) year after the cause of action has occured.

January, 1989

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## SAFETY PRECAUTIONS

For equipment covered specifically or indirectly in this instruction book, it is important that all personnel observe safety precautions to minimize the chances of injury. Among many considerations, the following should particularly be 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. Cover 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 discharge air stream.
- Stay clear of the blast from pressure relief valves and the suction area of the vacuum relief valves.
- Avoid extended exposure in close proximity to machinery with high intensity noise levels.
- Use proper care and good procedures in handling, lifting, installing, operating, and maintaining the equipment.
- 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 warned by signs and trained to exercise adequate general safety precautions.
- Hearing protection may be required depending on silencing capabilities.

*See back page of manual for important information on safety tags.*

# Operating Characteristics

The M D Pneumatics rotary lobe blower is a positive displacement type unit, whose pumping capacity is determined by size, operating speed, and pressure conditions. It employs tri-lobe or dual-lobe rotors rotating in opposite directions within a housing closed at the ends by end plates.

Effective sealing of the blower inlet area to the discharge area is accomplished by use of very small operating clearances. Resulting absence of moving contacts eliminates the need for any internal lubrication. Clearances between the rotors during rotation are maintained by a pair of accurately machined helical timing gears, mounted on the two shafts extended outside the air chamber. The two intermeshing rotary lobes are designed to rotate and trap air or gas between each rotor and the housing. As the rotor lobes rotate past the edge of the suction port, the trapped air or gas is essentially at suction pressure and temperature, since the blower is a constant volume device, the trapped air remains at suction pressure until the leading rotor lobe opens into the discharge port. Immediately, the high pressure air in the discharge line compresses the low pressure air to discharge pressure. The rotors continue to rotate and force the air from the blower into the discharge line.

It can be seen by the illustration that the air moves not between the rotors but between the rotors and the side of the housings. Also, the rotation of the blower can make either side the inlet or discharge.

No attempt should ever be made to control capacity by means of a throttle valve in the intake or discharge piping. This will increase the power load on the drive system, increase operating temperatures, and can overload and/or seriously damage the blower. Likewise, if a possibility exists that flow to the blower inlet may be cut off during normal operation of a process, then an adequate vacuum relief valve must be installed near the blower. A pressure type relief valve in the discharge line near the blower is also strongly recommended for protection against cut-off or blocking in this line. Check valves should also be used on every blower when more than one blower is connected to a discharge line. This is for both safety and operating conditions.

When a belt drive is employed, blower speed, if necessary, can usually be adjusted to obtain desired capacity by changing the diameter of one or both sheaves, or by using a vari-speed motor pulley. In a direct coupled arrangement, a variable speed motor or transmission is required, or excess air or gas may be blown off through a manually controlled unloading valve and silencer. Gas units can use bypasses, but some application may require additional cooling. If there is a large volume of high pressure air or gas downstream of the blower, a check valve in the piping downstream of the blower will protect the blower from overspeeding backwards on shutdown.

Consult your M D Pneumatics sales representative if questions arise.

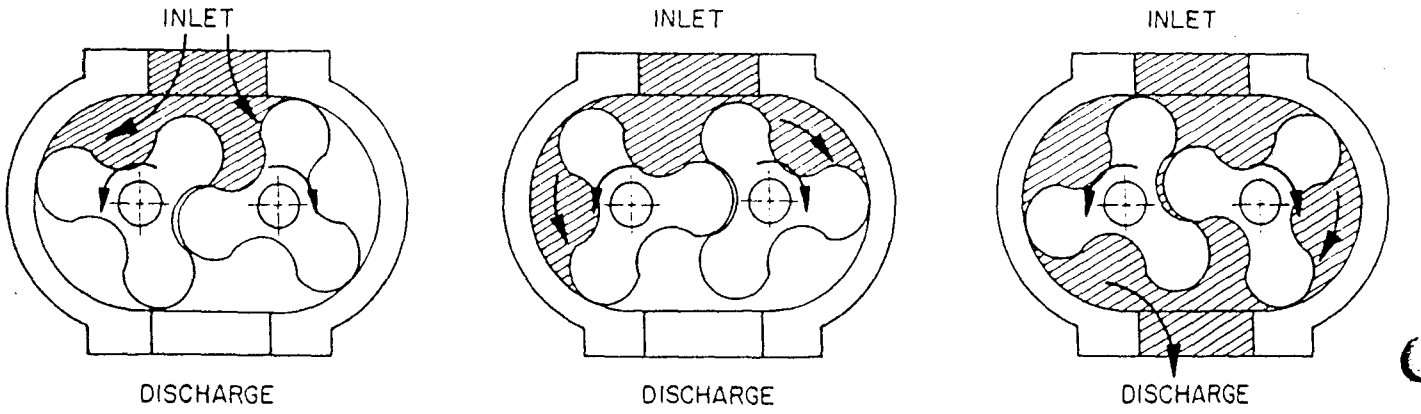



FIGURE 1

# Operating Limitations

To permit continued satisfactory performance, a blower must be operated within certain approved limiting conditions. The manufacturer's warranty is, of course, also contingent on such operation. Maximum limits for pressure, temperature and speed are specified here for various blower sizes when operated under the standard atmospheric conditions. Do not exceed any one of these limits.

Example: The listed maximum allowable temperature limit (the limit is a function of the temperature rise as well as the inlet temperature) for any particular blower may occur well before the maximum speed or maximum pressure rating is reached. Temperature rise then becomes the limiting condition. In other words, the operating limit is always to be determined by the maximum rating reached first, and it can be any one of the four: pressure, temperature, speed, or horsepower.

Note: Special attention must be paid when a blower has a higher than standard ambient suction temperature. Special recommendations for operating parameters and/or additional cooling may be recommended. Consult the factory or local representative for appropriate information.

Be sure to arrange connections or taps for thermometers and mercury type pressure or vacuum gauges near the inlet and discharge connections of the blower. These, along with a good tachometer will enable periodic checks of operating conditions to be made easily.

Note: Specially ordered blowers with nonstandard construction, or with rotor end clearances greater than shown on page 11, will not have the operating limits specified here. Contact your M D Pneumatics sales representative for specific information.

PRESSURE: On pressure service with an inlet of 14.7 PSIA, the pressure differential in pounds per square inch (between blower inlet and discharge) must not exceed the figure listed in Table 1 for the specific blower model concerned. Individual blowers may have further restrictions on operating limits (ref. performance curves). Consult the factory in any system where the blower inlet is a positive pressure above atmosphere.

On vacuum service, with the discharge going to 14.7 PSIA, the inlet suction or vacuum in inches of mercury (In. Hg.) must not be greater than the values listed in Table 1.

**TABLE 1 — 4000 & 5500 MODELS**

| Series | Max. PSIG or "HG" Vac. | Max. RPM* |
|---|---|---|
| 16/47 | 10 | 3600 |
| 17/46 | 15 | 3600 |
| 57/81 | 15 | 3600 |
| 64/67 | 15 | 3600 |

*Maximum RPM may vary depending upon unit size, pressure and CFM.

TEMPERATURE: Best life for continuous service will be obtained where the maximum discharge temperature on splash lubrication blowers does not exceed 250°F.

Cooling coils installed in oil chamber reservoirs or an external lube system with cooler are generally recommended for air discharge temperatures from 250-300°F. Discharge temperatures above 300°F normally require an external lube system with cooler. Consult your MD Pneumatics sales representative if temperature questions arise.

# Flow Direction by Rotation

Refer to the illustrations below before installing inlet and discharge piping.

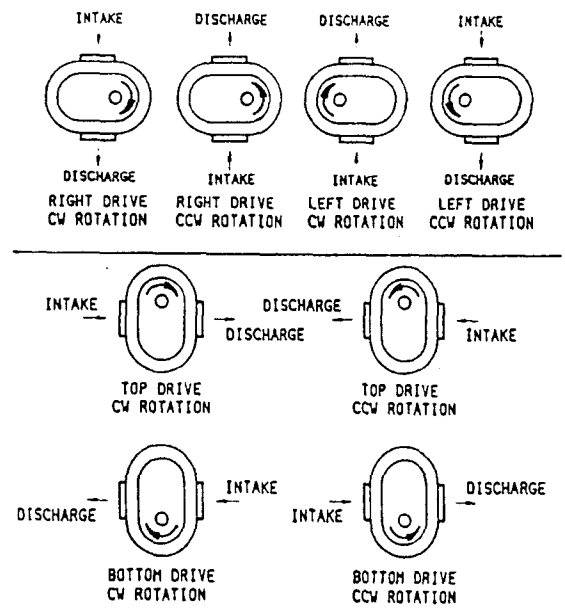



FIGURE 2

# Installation

Install blower in a protected indoor location, if possible. However, an unprotected outdoor installation will be satisfactory if correct lubrication for expected temperatures is provided (see recommended lubrication section). Just before starting the installation, remove plugs or covers from inlet and discharge connections. Inspect for dirt or foreign objects inside blower, then turn drive shaft by hand to make sure it rotates freely.

Mount blower in a level position. Use of a rigid, solidly supported, structurally sound baseplate is recommended. Make sure blower feet rest evenly on the plate before fastening down. Twisting or cramping the blower in mounting will cause rotor contact and binding during operation.

A blower, factory-mounted on a base, should not require the above adjustments. The assembly can become twisted in shipping or installation, however, this needs to be done after base installation. Shims may be needed for alignment. Loosen the foot hold-down screws to check foot contact with the mounting surface. The base should be mounted on a solid foundation or heavy flooring, using shims as necessary at bolting points to prevent warping the assembly.

Transmission of small operating vibrations to a support structure in some cases may be objectionable. Use of vibration isolators or vibration absorbing materials can be effective in overcoming this problem. To avoid blower casing distortion, the treatment used should be applied under the motor-blower common mounting plate or base, rather than directly under the blower feet alone.

Piping should be accurately squared with the blower and supported independently. Use only clean new pipe and make certain it is free of scale, cuttings, weld beads, dirt, or any other foreign material. To guard against damage to the blower, insure that an inlet filter is used. Make provisions to clean the filter of collected debris after a few hours of operation and periodically thereafter.

Figure 3 shows a typical complete installation of blower and accessories. Note the absence of throttle or shut-off valves in either

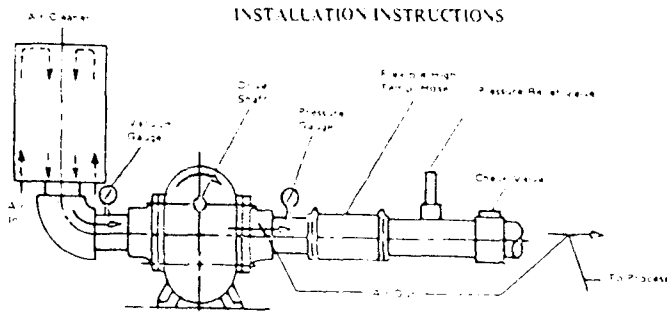



FIGURE 3

discharge or intake piping. If it is possible for air flow to be cut off in either of these lines, make provisions to add a pressure and/or vacuum relief valve as discussed under Operating Characteristics.

In some installations, it may be desirable to use only an inlet silencer-cleaner supported directly from the blower connection. Weight of accessories and piping must be kept to a minimum to prevent blower casing distortion. Weights in excess of 10% of blower weight should be supported independently of blower and connected with a flexible hose or connectors.

A blower may be driven by direct coupling to the driver or by v-belt drive to obtain other speeds within the approved range.

Coupling halves must correctly fit the blower and drive shafts so that only light tapping is required to install each half. The two shafts must be accurately aligned, per the coupling manufacturer's requirements, both horizontally and vertically, to limit operating strain on either shaft. Proper gap between coupling halves must be established according to coupling manufacturers instructions with the motor armature. This will minimize the change for end thrust on the blower shaft. All direct coupled base mounted units must be re-aligned and greased after field installation.

In a v-belt drive, the blower sheave must fit its shaft accurately, run true, and be mounted as close to the bearing housing as possible to minimize bearing loads.

A tight or driving fit will force the drive shaft out of its normal position and cause internal damage. A loose fit will probably result in shaft damage or breaking. The motor sheave must also fit correctly and be properly aligned with the blower sheave.

Adjust motor position on its sliding base so that belt tension is in accordance with drive manufacturer's instructions. Avoid excessive belt tension at all times. Recheck tension after the first ten hours of operation and periodically thereafter to avoid slippage and loss of blower speed.

Check blower after installation and before applying power by rotating the drive shaft by hand. If it does not rotate freely, look for uneven mounting, piping strain, excessive belt tension, or coupling misalignment. Check blower at this time to insure oil was added to reservoirs.

# Lubrication

Every M D Pneumatic Blower is factory tested, oil drained, and shipped dry to its installation point. Both independent oil reservoirs must be filled to proper level before operation.

Shaft bearings at the gear end of the blower are splash lubricated by one or both gears dipping into an oil reservoir formed in the end plate and cover. Shaft bearings at the free end of the blower are lubricated by a slinger assembly dipping into an oil reservoir. Before starting the blower, fill sumps as instructed below:

1. Remove fill plugs or breathers from gear end and free end covers.
2. Pour oil through fill hole slowly until oil appears in oil sight glass. Slowly bring oil up to proper level. See figure 4.
3. Replace plugs or breathers in end covers (64/67 series does not have breathers.)

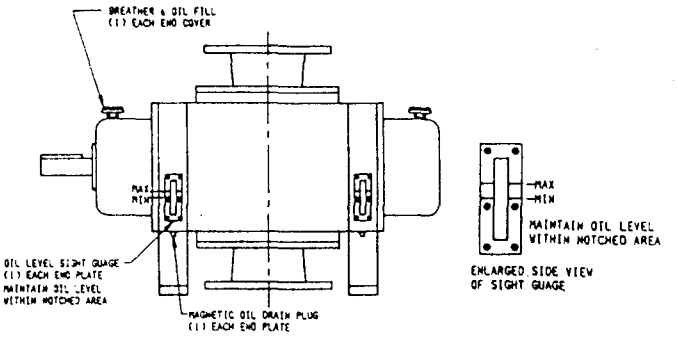
M D Pneumatics recommends a good grade industrial type non-detergent oil (heavy duty type). Recommended oil viscosity as follows:

| Ambient Temperature | |
|---|---|
| A. 30°F and under | SAE 20 |
| B. 30-90°F | SAE 30 |
| C. above 90°F | SAE 40 |

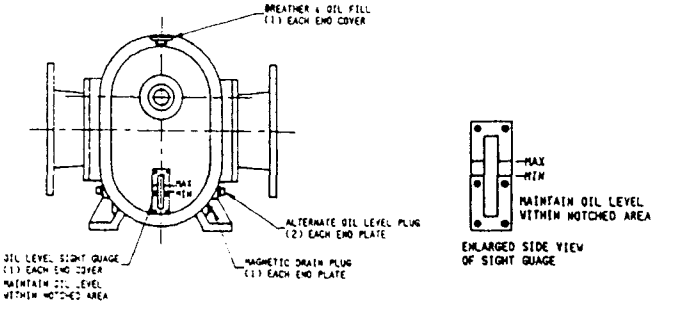
Lubrication should be checked every 24 hours of operation. Time lapse between oil changes will have to be determined for each individual installation and normally will be between 250-1000 operating hours.

**WARNING:** Never attempt to change or add oil while blower is running. Failure to heed this warning could result in damage to the equipment or personal injury.

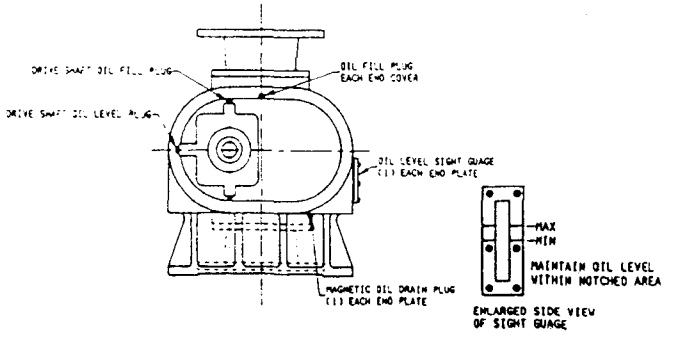
Note: For blowers using the external lube system, the oil sump capacity is 7½ gallons and oil change interval can be 4-6 months.



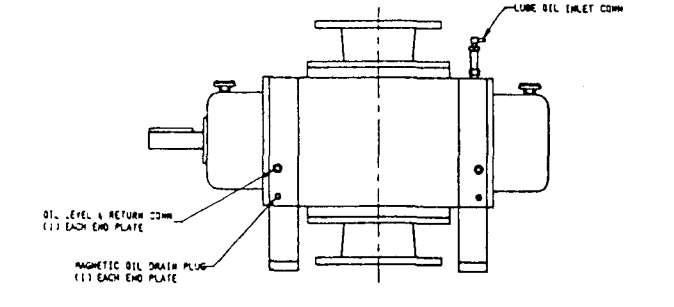

VERTICAL AIR FLOW




HORIZONTAL AIR FLOW




GAS SERVICE



BLOWER W/ EXTERNAL LUBE CONNECTIONS

FIGURE 4

Current horizontal flow models are now provided with "bulls eye" type oil level sight glasses. Maintain oil levels at center of glass. They can be disassembled for cleaning by removing the notched collar on the front of the glass.

## Approximate Oil Capacities

**4000 Models**

| Series | Total Per Unit |
|---|---|
| 16/17/57/64/18/54 | 1 Quart |
| 47/46/81/67/85/84 | 1 3/4 Quarts |

**5500 Models**

| Series | Total Per Unit |
|---|---|
| 16/17/57/64/18/54 | 2 Quarts |
| 47/46/81/67/85/84 | 4 Quarts |

## Water Cooled End Plate Option

Units having water cooled end plates (available in vertical flow configuration only) are normally identified by the letter "E" in the model number.

Example: 5507-46L2E. They can also be identified by the connecting hose which runs from the top of the drive end plate to the bottom of the rear end plate. See figure 4A.

Units that will operate with continuous discharge gas temperatures of 250°F or more must be connected to a water (liquid) supply in order to maintain reasonable oil temperatures. Generally a water flow of 1/2 to 1 GPM is sufficient to maintain oil temperatures below 150°F.

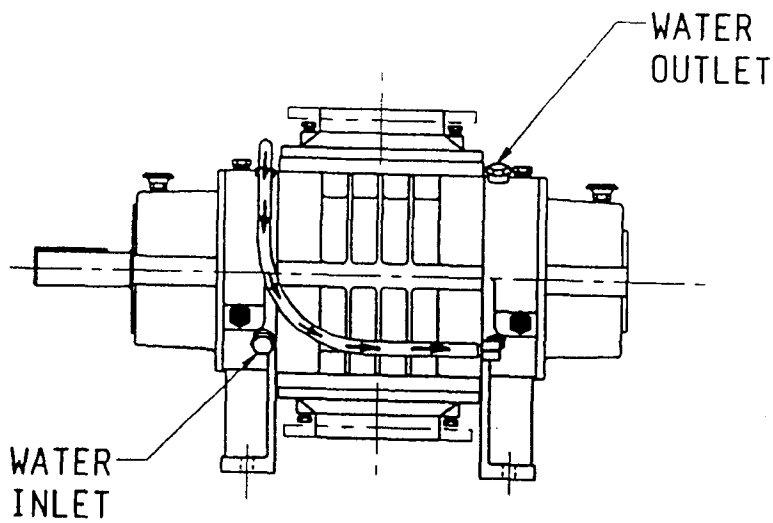
WARNING: If unit is to be located outside or in a building where ambient temperatures can fall below freezing then care must be taken to ensure the water or liquid used for cooling does not freeze and damage the blower end plates. End plates must be drained of liquid during downtime unless a recirculating unit using a glycol mixture has been installed.

NOTE: Units are never shipped from the manufacturer with liquid in the end plates.

## COOLING WATER SPECIFICATIONS

Flow rate: Less than 2 GPM total both end plates.

Maximum Pressure: 100 PSIG




TYPICAL WATER FLOW DIRECTION

**FIGURE 4A**

# Operation

Before starting the blower for the first time ıder power, recheck the installation thoroughly .ɔ reduce the likelihood of troubles. Use the following check list as a guide, but also consider any othe special conditions in your installation.

1. Be certain no bolts, rags, or dirt have been left in blower.
2. Be certain that inlet piping is free of debris. If an open outdoor air intake is used, be sure the opening is clean and protected by an inlet filter. This also applies to indoor use.
3. If installation is not recent, check blower leveling, drive alignment, belt tension, and tightness of all mounting bolts.
4. Be certain the proper volume of oil is in the oil reservoir chambers.
5. Be certain the driving motor is properly lubricated, and that it is connected through suitable electrical overload devices.
6. Rotate blower shaft several times by hand to make sure blower is rotating freely. Unevenness or tight spots is an indication of a problem.
7. Check motor rotation by momentarily pushing the start button and check flow direction of the blower. Reverse the motor connections if flow is in the wrong direction.

Initial operation should be carried out under "no load" conditions by opening all valves and venting the discharge to atmosphere, if possible. Then start motor briefly, listen for unusual noises, and check that the blower coasts freely to a stop. If no problem appears, repeat this check, and let the motor run a little longer. If any questions exist, investigate before proceeding further.

Assuming all tests are satisfactory, the blower will now be ready for continuous full load operation. During the first several days, make periodic checks to determine that all conditions remain acceptable and steady. These checks may be particularly important if the blower is part of a process system where conditions may vary. At the first opportunity, stop the blower and clean or remove inlet filter. Also, recheck leveling, coupl- g alignment or belt tension, and mounting bolts ror tightness.

# Special Instructions For External Lube Systems

Blowers furnished with external lube tanks are designated with a suffix number after the model number, for example, 4009-84. On older units, it will appear before the model number. There are four variations manufactured:

85 Lip Seal/Vertical Flow *(46)
18 Lip Seal/Horizontal Flow *(17)
84 Mechanical Seal/Vertical Flow *(81)
54 Mechanical Seal/Horizontal Flow *(57)

*Use this corresponding number when following the repair procedure. The blowers are the same except for the end plates which have different drillings for lubrication purposes.

WARNING: Field conversions cannot be made on 46 and 81 series without replacing end plates. Consult factory before making any conversions.

1. The M D external lube tank is equipped with an oil filter which has a replaceable element. The part number for the element is 91999-1.
2. Each tank has an oil pressure relief valve which is set at the factory between 12 and 15 PSIG and normally requires no adjustment. If an adjustment becomes necessary, remove the cap and adjust the screw. Clockwise will increase pressure, and counterclockwise will reduce pressure.
3. Oil tank should be on a level surface with return connections of tank below the blower return connections (2 inch drop per foot approximately). Each end of blower shall have separate return hose lines (¾" I.D. minimum) not over six feet from farthest blower.
4. The oil supply hose and connections must be kept free of dirt and foreign material during installation to prevent clogging of blower oil supply restrictors (.055 diameter).
5. Make sure motor pump wiring connection is for correct rotation as indicated by arrow on motor.
6. Tanks equipped with heat exchangers should have water flow direction counter to oil flow. Water flow rate approx. .25 to 1.0 GPM dependent upon blower operating condition (sump temperature should not exceed 250°F maximum).

7. WARNING: Fill both ends of blower with oil to the proper level, then operate oil supply system, and be sure oil is returning from both blower return hoses prior to starting blower.

## Methane Gas

Instructions for injecting fuel oil, kerosene, and lube oil into blowers sludged by sewage gas.

Some sewage gases will adhere to the rotors in a gas blower. If enough sludge from the gas being pumped builds up on the rotors, it destroys the clearances between the rotors. The build-up can cause the blower to clatter and eventually freeze up when the rotors no longer have clearance to turn.

This can be easily prevented by periodically flushing the blower with a mixture of 75% kerosene or fuel oil and 25% lubricating oil. The kerosene or fuel oil disolves the sludge buildup and the lubricating oil coats the rotors to slow the build-up.

The mixture should be injected on the inlet side through a valve set to feed a gallon of mixture in 15-20 minutes. On units regularly flushed, once a week is sufficient. If the unit is dirty, it should be flushed daily until the hard build-up is removed then put on a weekly cycle. In very dirty gas installations. the cycle must be varied to meet the demand.

## Water Injected Vacuum or Pressure Blowers

Water injected into the inlet of a blower operating on vacuum service will cool the blower. The water absorbs the heat of compression as it passes through the unit along with the air/gas being compressed. A blower cooled in this manner can operate safely at higher vacuums or higher inlet temperatures than a normally uncooled unit.

The amount of water required depends on the inlet air/gas temperature, inlet vacuum, water temperature, and the maximum discharge temperature desired. Check with the factory or sales representative for additional guidance.

OPERATION:

1. Check oil level in sight glass of blower and assure all fittings are tight.
2. Check the water injection system to assure water is available.
3. Operate the blower dry for a few minutes at no load to check correct rotation and smooth operation.
4. Turn water on and adjust flow as recommended for the individual blower. Assure water discharges freely from the outlet piping.
5. Apply vacuum and observe operation at the desired inlet condition.

SHUTDOWN:

1. The blower can be shut down for brief periods by relieving the inlet vacuum, shutting the water off, and then stopping the unit.
2. Rusting during a slightly longer shutdown period can be avoided by operating the blower under a partial vacuum without the water injection, allowing the blower to heat to within safe limits. The heat will tend to drive off residual moisture.
3. For extended shutdown, oil may be injected into the inlet of the heated blower just prior to shutting the unit down. The oil will provide a protective coating on the internals. Insure that the water is completely shut off after shutdown.
4. Special coatings or platings are available to minimize rusting or corrosion in applications where units can remain wet.

CAUTION: Water injection can cause lime buildup on rotors. Check water supply for hardness. The use of water softeners, other chemicals, or distilled water may be necessary to prevent or remove this build-up. M D Pneumatics will not be responsible for damage which may result should this build-up occur. Units should be inspected regularly to determine any problems.

Vertical flow units with two-lobed, plugged rotors should always be used. Suction at top and discharge at bottom.

NOTE: For liquid injection other than water, consult the factory.

## Long Term Storage

1. Spray the interior (lobes, housing and end plates) with a rust preventative.
2. Fill both end bells completely full of oil.
3. Firmly attach a very prominent tag stating that the end bells are full of oil and must be drained and refilled to proper levels prior to startup.
4. Apply a rust preventative grease to the drive shaft.
5. Attached a desiccant bag to either of the port fitting caps to prevent condensation from occuring inside the blower. Make sure any desiccant bag (or bags) is so attached to the covers that they will be removed when dust cover is removed. It is imperative that these be removed before startup of the blower.
6. Store the blower in an air conditioned and heated building if at all possible. At least insure as dry conditions as possible.
7. If possible, rotate the drive shaft by hand at least monthly in order to prevent the seals from setting in one position.

## Service

MD Pneumatics, Inc. offers 2 to 3 day service (working days) on all repair parts shipments. If any trouble occurs to a unit within the warranty period, we suggest you immediately contact the factory for assistance. When returning units under warranty, transportation charges must be prepaid to MD Pneumatics, Inc., Springfield, Missouri.

## Repair Parts

When ordering repair parts or replacement units, please give the following information:

1. Model Number and Serial Number of unit.
2. Description of part — use item number shown on parts list.

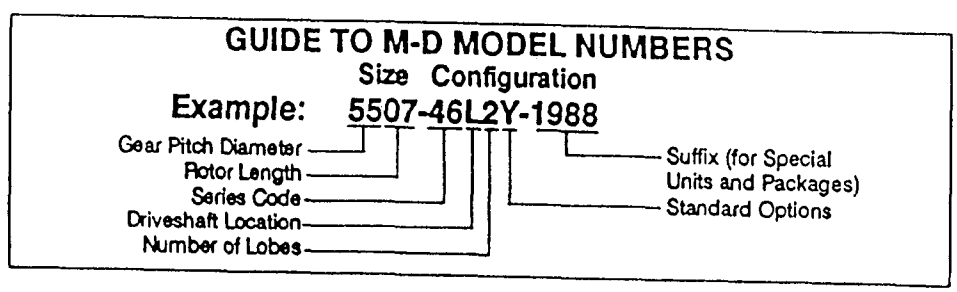
## Maintenance & Replacements

Regular inspection of the blower and its installation, along with complete checks on operating conditions will pay dividends in added life and usefulness. Particular attention should be paid to lubrication of timing gears and bearings in accordance with comments under LUBRICATION. Also, service the driver per manufacturer's instructions and lubricate the coupling or check belt drive tension. By use of thermometers and gauges, make sure that blower operating temperature and pressure remain within allowed limits.

When a blower is taken out of service, it may require internal protection against rusting or corrosion. The need for such protection must be a matter of judgement based on existing conditions as well as length of down time. Under atmospheric conditions producing rapid corrosion, the blower should be protected immediately.

Should adjustments or replacements eventually be needed, these can often be performed locally as described in this book after obtaining required parts. Personnel should have a good background of mechanical experience and be thoroughly familiar with these instructions. Major repairs not covered in this book should be referred to the nearest M D Pneumatics service representative.

When ordering parts, give all blower nameplate information, plus the item numbers and names as taken from the appropriate assembly drawing in this book. Numbers shown in brackets () in the following repair procedures correspond to item numbers in the drawings.



APPROXIMATE DRY WEIGHTS

4000 AND 5500 BLOWERS

(THREE LOBE ROTOR DESIGN ONLY)

| SERIES | 4000 MODELS | | | |
|---|---|---|---|---|
| | 4006 | 4009 | 4012 | 4014 |
| 16 | 135 | 155 | 180 | 205 |
| 47 | 150 | 170 | 195 | 220 |
| 17/57/64 | 155 | 175 | 200 | --- |
| 46/81/67 | 165 | 185 | 210 | --- |

| SERIES | 5500 MODELS | | | | | | |
|---|---|---|---|---|---|---|---|
| | 5507 | 5509 | 5511 | 5514 | 5516 | 5518 | 5520 |
| 16 | 300 | 310 | 350 | 425 | 445 | 490 | 530 |
| 47 | 330 | 335 | 380 | 450 | 470 | 515 | 555 |
| 17/57/64 | 340 | 345 | 390 | 460 | 480 | 530 | 565 |
| 46/81/67 | 380 | 390 | 430 | 505 | 525 | 575 | 610 |

*These weights do not apply to special units made of cast steel, stainless steel, bronze and two lobe rotor design. They will weigh substantially different.

# Trouble Shooting Blowers

## How to spot blower trouble

| Trouble | Cause | Reasons |
|---|---|---|
| Lack of performance. | Loss of RPM.<br>Restricted inlet.<br>Excessive slip.<br>Leaking pressure or vacuum relief valve | V-belts worn or loose.<br>Clogged or undersized filter.<br>Rotor tips worn.<br>Worn seats or incorrect setting. |
| Unusual noises. | Rotors making contact with case, end plates or each other. | Excessive pressure ratio.<br>Failing bearings or gears. |
| Leaking oil. | Seals failing.<br>Oil Foaming. | Excessive pressure ratio and temperatures.<br>Improper oil spec. or overfilling.<br>Seal vent holes plugged (17/46 Series only). |
| Over heating. | Loss of RPM.<br>Restricted inlet.<br>Excessive slip.<br>Over pressure.<br>High vacuum. | Worn or loose V-belts.<br>Clogged or undersized filter.<br>Rotor tips worn.<br>Pressure relief valve setting incorrect.<br>Vacuum relief valve setting incorrect or restricted discharge. |
| Failing bearings and/or gears. | Using incorrect oil.<br><br>Low or high oil levels.<br>Oil temperatures too high.<br>Infrequent oil changes. | Instructions on page 5 or contact factory.<br>Check levels as required.<br>Excessive pressure ratio and RPM.<br>Instructions on page 5. |

# Trouble Shooting V-Belts

## How to spot V-belt trouble

| Trouble | Cause | To Correct |
|---|---|---|
| Belt slip (sidewalls glazed) | Not enough tension. | Replace belts; apply proper tension. |
| Drive squeals | Shock load.<br>Not enough arc of contact.<br>Heavy starting load. | Apply proper tension.<br>Increase center distance.<br>Increase tension. |
| Belt turned over. | Broken cord caused by prying on sheave.<br>Overloaded drive.<br>Impulse loads.<br>Misalignment of sheave and shaft.<br>Worn sheave grooves.<br>Excessive belt vibration. | Replace set of belts correctly.<br>Redesign drive.<br>Apply proper tension.<br>Realign drive.<br>Replace sheaves.<br>Check drive design. Check equipment for solid mounting. Consider use of banded belts. |
| Mismatched belts. | New belts installed with old belts.<br>Sheave grooves worn unevenly: Improper groove angle. Give appearance of mismatched belts.<br>Sheave shafts not parallel. Give appearance of mismatched belts. | Replace belts in matched set only.<br>Replace sheaves.<br>Align drives. |
| Belt breaks. | Shock loads.<br>Heavy starting loads.<br>Belt pried over sheaves.<br>Foreign objects in drives. | Apply proper tension; Recheck drive.<br>Apply proper tension; Recheck drive. Use compensator starting.<br>Replace set of belts correctly.<br>Provide drive shroud. |
| Belt wears rapidly. | Sheave grooves worn.<br>Sheave diameter too small.<br>Mismatched belts.<br>Drive overloaded.<br>Belt slips.<br>Sheaves misaligned.<br>Oil or heat condition. | Replace sheaves.<br>Redesign drive.<br>Replace with matched belts.<br>Redesign drive.<br>Increase tension.<br>Align sheaves.<br>Eliminate oil. Ventilate drive. |

# Clearances

## 16/47/17/46/57/81/64/67-4000 Series

| | Model | Minimum | Maximum |
|---|---|---|---|
| Rotor to End Plate | | | |
| Gear End | All | .004 | .007 |
| Free End | 4006 | .006 | .011 |
| " " | 4009 | .008 | .012 |
| " " | 4012 | .010 | .014 |
| " " | 4014 | .012 | .016 |
| Rotor Tip to Housing | All | .008 | .011 |
| Interlobe | | | |
| Center Time | | | |
| Gear Backlash | All | .0005 | .0025 |

## 16/47/17/46/57/81/64/67-5500 Series

| | Model | Minimum | Maximum |
|---|---|---|---|
| Rotor to End Plate | | | |
| Gear End | All | .005 | .007 |
| Free End | 5507 | .009 | .013 |
| " " | 5509 | .010 | .014 |
| " " | 5511 | .012 | .016 |
| " " | 5514 | .014 | .018 |
| " " | 5516 | .016 | .020 |
| " " | 5518 | .018 | .023 |
| " " | 5520 | .020 | .025 |
| Rotor Tip to Housing | All | .012 | .014 |
| Interlobe | | | |
| Center Time | | | |
| Gear Backlash | All | .0005 | .0025 |

Interlobe clearance: Leading and trailing edges should be equal or within .002.

# Disassembly of Blower

1. Insure that all oil is drained from unit and remove port fittings (38).
2. Remove cap screws (26) from gear end cover.
3. Remove gear end cover (6) using beveled chisel and hammer; unless jack screw holes have been provided.
4. Remove snap ring (47) from drive shaft.
5. Using gear pullers, remove drive shaft bearing (50).
6. Remove drive shaft (45).
7. Remove gear locknuts (35) and locks (36).
8. Align timing marks, see Fig. 5A on timing gears (8).

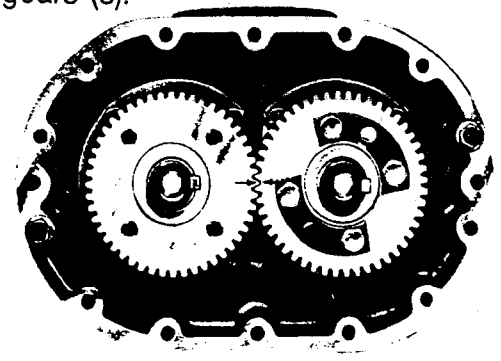


FIGURE 5A
Keyways in line and timing marks matched.

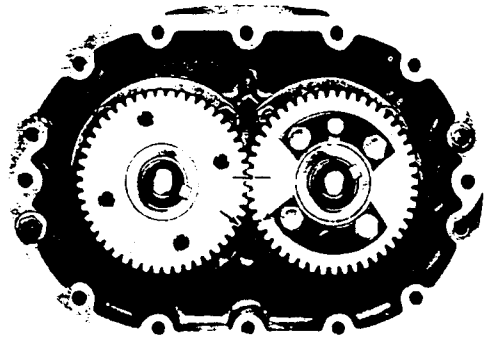


FIGURE 5B
Timing marks advanced 5 teeth.
(Reference marks aligned.)

9. Rotate drive gear in a clockwise rotation approximately 4 or 5 teeth and mark this location, see Fig. 5B. This gear position is necessary so rotors will clear and not jam. Do not allow the reference marks to change location while the driven gear is being removed.
10. Using gear pullers, pull driven gear first.
11. After removal of the driven gear, continue with pulling the drive gear.
12. Remove gear end bearing retainer rings (14) exposing bearings.
13. Remove cap screws (26) and free end cover (7) exposing oil slinger assembly.
14. Remove flat head socket screw (69) from oil slinger and gently pry oil slinger (21) from shaft. (On some models.)
15. Remove flat head socket screw (29) and washer (25) from opposite rotor.
16. Use bar pullers (see Fig. 6) and attach to free end plate bores. Using bar pullers, pull free end plate (4) from rotor shafts. (Note: two bar pullers are suggested.)

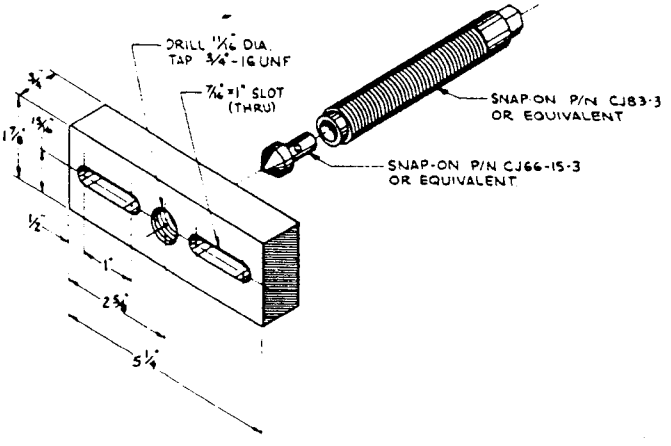


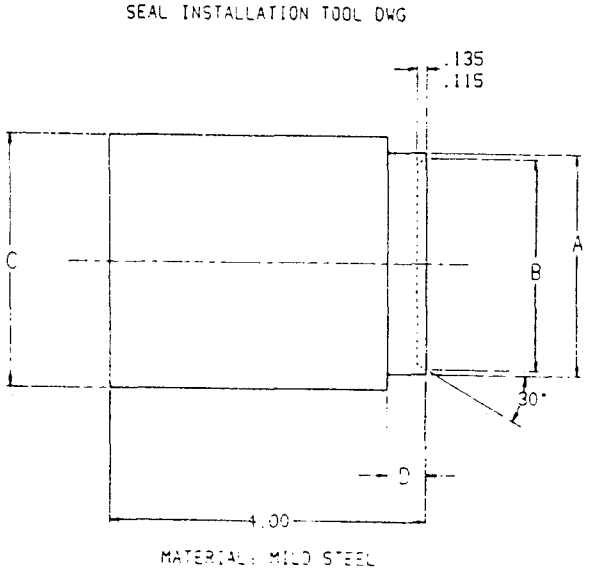

FIGURE 6

17. Attach bar puller to gear end plate bore and push out rotors (1) one at a time.
18. Using rubber mallot, tap end plate from housing (3).
19. Using soft metal punch and a mallet, tap out bearings from end plate bores.
20. Using bevel chisel, remove seals (#12 on lip seal units and #54 on mechanical seal units) from end plate bores.
21 Series 17/46, 57/81, 64/67 units have lab seals (51) installed. If necessary, remove lab seals (51) with bevel chisel and hammer.
22. Inspect all parts for wear and serviceability.

# Assembly of Blower (4000 & 5500)

Preparation of End Plates for Assembly

1. Make sure all parts are clean and free of any debris, remove all nicks or burrs caused by disassembly.
   (See Figure 7 for dimensions of seal pressing tool for your particular blower, 4000 or 5500.)




| Seal & Tool No. | A DIA. | B DIA. | C DIA. | D |
|---|---|---|---|---|
| 5500 | 2.746 / 2.745 | 2.625 / 2.645 | 3.147 / 3.146 | .500 |
| 4000 | 2.244 / 2.243 | 2.093 / 2.113 | 2.437 / 2.436 | .250 |

Figure 7

2. 17/46, 57/81, 64/67 series blowers require labyrinth seal. Press lab seals (51) into end plate bores with slots pointing up.
3. 16/47, 17/46 series blowers utilize lip seals (12). As means of sealing, apply a smooth coating of Permatex #2 or silicone sealer to the O.D. edge of the seal shell. Press lip seal (12) into each end plate bore making sure the seal "lip" is facing up, or towards the oil. Grease lip seals only.
4. 57/81, 64/67 series blowers require mechanical seals (54). Apply smooth coating of silicone to the O.D. of the seal shell as above. Press mechanical seal (carbon face up) (54) into each end plate bore. Wipe carbon with soft tissue and acetone or similar cleaner. make sure seal is fully seated and shell is not deformed. Insure carbon is not scarred or cracked. Mating rings will be seated later in the assembly procedure.

B. Gear End Assembly

1. Stand rotors (1) on free end in arbor press. (Keyways must be in line and point to the right.)
2. Place gear end plate (4) with seals installed on rotor shafts. Make sure threads on rotor shafts do not damage seals.
3. 57/81, 64/67 series blowers must have mating rings (54) installed. Make sure surface is clean, and gently place a few drops of clean oil on seal face, for lubrication. Install mating ring (lapped surface) against carbon face.
4. Lightly coat rotor shaft with antiseize or equivalent.
5. Using flush ground bearings on gear end only, press bearings (9) onto rotor shafts and into end plate bores.

   CAUTION: These bearings have flush ground faces and should be installed with manufacturers bearing number towards the gear side. Do not use standard bearings which have not been flush ground within .001" tolerance.
6. Install oil retainer (15) (4000 series only).
7. Install bearing retainer ring (14) and lock plates (61) on all series blowers. Bolts are item (62).
8. Check clearance between gear end plate and rotor lobe ends. Correct clearances are shown on page 11 for all blower models.

C. Installation of Timing Gears

1. Insert gear keys (24) into shafts.
2. Apply light coat of antiseize or similar, for ease of pressing on gear.
3. Install drive gear first, press on drive rotor.
4. Install driven gear on shaft, insuring that special marks are aligned (See Figure 5B).

5. Install item (36) gear lock washer and (35) gear lock nut.

D. Free End Plate Assembly

1. Remove thus far assembled blower from arbor press and place on work bench. Support blower using wooden support blocks with gears facing downward toward bench.
2. Insure that drive gear is on your left side facing blower.
3. Insure that housing (3) is clean and free of burrs, and dowel pins (22) are still in place.
4. Place housing over rotors and secure with two bolts (26) opposite each other (washer may be required). Firmly tighten bolts to secure housing to end plate. (Note: on 57/81 and 64/67 series blowers, a small bead of silicone should be placed on end plate to insure seal against housing.)
5. Secure housing and check free end clearances. See chart on page 11.
6. Install free end plate (4).
   . On 57/81 and 64/67 series install mating rings using same procedure as on gear end.
   (On 57/81 and 64/67 series, put a light coat of silicone on housing to provide seal for end plate.)
8. Install free end spacer (123). (This may not appear on 16/47, 17/46 5500 series blowers.)
9. Lubricate free end of rotor shafts with light coat of antiseize.
10. Install free end bearings (10) on free end rotor shafts, insuring that bearings are secured in end plate bores.
11. Install oil retainer rings (14). Secure with screws (30).
12. (4000 series only.) Oil slinger (21) is installed as follows:

    **Vertical Flow** Units — slingers can be mounted on either shaft.
    **Horizontal Flow** Units — slingers must be mounted on lower rotor shaft to provide proper lubrication.

    Install dowel pin (68), then oil slinger (21) and secure with flat head screw (69). On opposite shaft of oil slinger, install washer (25) and secure with flat head screw (29).
    (5500 series only.) Oil slingers are installed as follows:

    **Vertical Flow** Units — slingers can be mounted on either shaft.
    **Horizontal Flow** Units — slingers must be mounted on lower rotor shaft to provide proper lubrication. On opposite shaft of oil slinger, install spacer (57), washer (25), and secure with screw (29).

13. **Adjusting Rotor Interlobe Clearance**
    The driven gear is made of two pieces. The outer gear shell is fastened to the inner hub with four cap screws and located with two dowel pins. Adding or removing shims between the gear shell and the inner hub moves the gear shell axially. The helix causes the gear to rotate which changes the clearances between rotor lobes. Adding .006 shim thickness will change the rotor lobe clearances by approximately .003.

    The timing shim is formed from a number of .003 shims which have been laminated together. They are easily peeled off as necessary.

    Use a feeler gage to check the clearance at AA (left hand reading) and BB (right hand reading). See Figure 8. The clearances should be adjusted so they are as equal between all lobes as possible. Usually within .002.

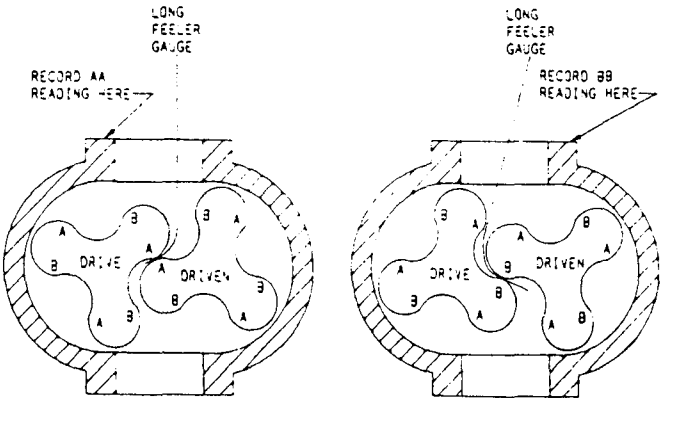



FIGURE 8

Example: If AA reading is .013 and BB reading is .007, by adding .006 shims the readings will change .003. AA should then read .010 and BB should read .010.

14. Install free end cover gasket (28) and secure free end cover (7) with cap screw (26). Note: Gaskets are not used on 57/81, 64/67 series. Use silicone sealer; bead the end plate not the cover.
15. Install drive shaft (45) and secure by lock plates and cap screws (66) and bend over tab. Insure dowel pins (22) are in gear end plate. Note: Drive shaft runout should be within .003 T.I.R.
16. Install drive shaft bearing (50).
17. Secure bearing on drive shaft with snap ring (47). (This item not required on 64/67 series.)
18. Install gear end cover gasket (28). Not required on 57/81, 64/67 series. Use silicone seal instead (on end plate).

    Note: 5500 series only (except 64/67 series) — See figure 9 for tool to hold bearing square while installing gear end cover.
19. Install gear end cover. See special instructions below for 64/67 series cover installation.
20. 4000 Series - 16/47, 17/46, 57/81 — Lightly coat seal area on drive shaft with grease. Carefully slide lip seal (13) over drive shaft and secure seal in end cover. Note: Take care as not to damage seal on drive shaft.

    5500 Series - 16/47, 17/46, 57/81 — Press lip seal (13) into seal adapter ring (46) and carefully slide this arrangement over drive shaft and secure adapter ring in end cover. Seal and adapter ring should be flush with cover. Note: Take care as not to damage seal on drive shaft.

# Special Instructions 64/67 Series

A. Assemble on drive shaft, O-ring spacer (74) and O-ring (75). Install mating ring (54B) with lapped surface facing outward. Install face seal sleeve (77), O-ring spacer (74), and O-ring (75).
B. Assemble the following items into the drive end cover: Install seal retaining ring (78) coat O.D. of seal (54A) with sealant and press into bore until carbon side of seal comes to rest on snap ring. Lay mating ring (54B) with lapped surface facing outward on top of seal. Install second seal retaining ring (78) and seal (54A) into cover.
C. Coat end plate with sealant and install drive end cover, being careful to align the loose mating ring onto the shaft. Carefully tap cover until seated and secure with cap screws (26).
D. Assemble face seal sleeve (77), seal dust washer (82), and seal lock nut (83), onto shaft.

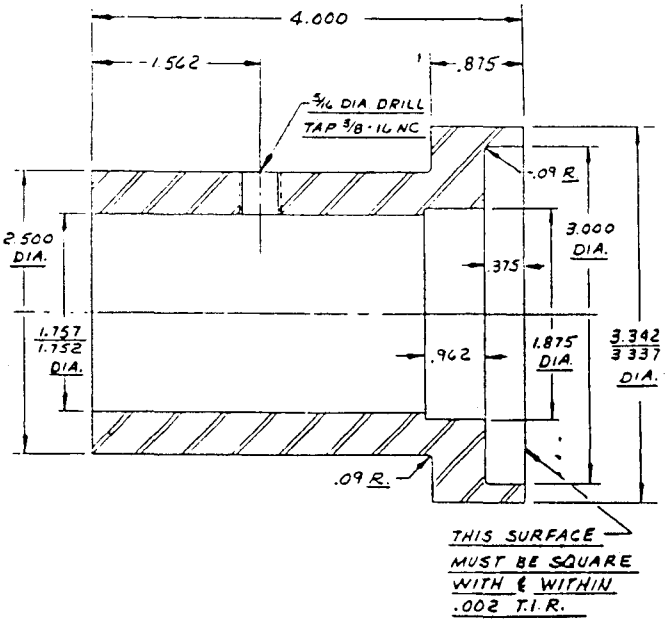
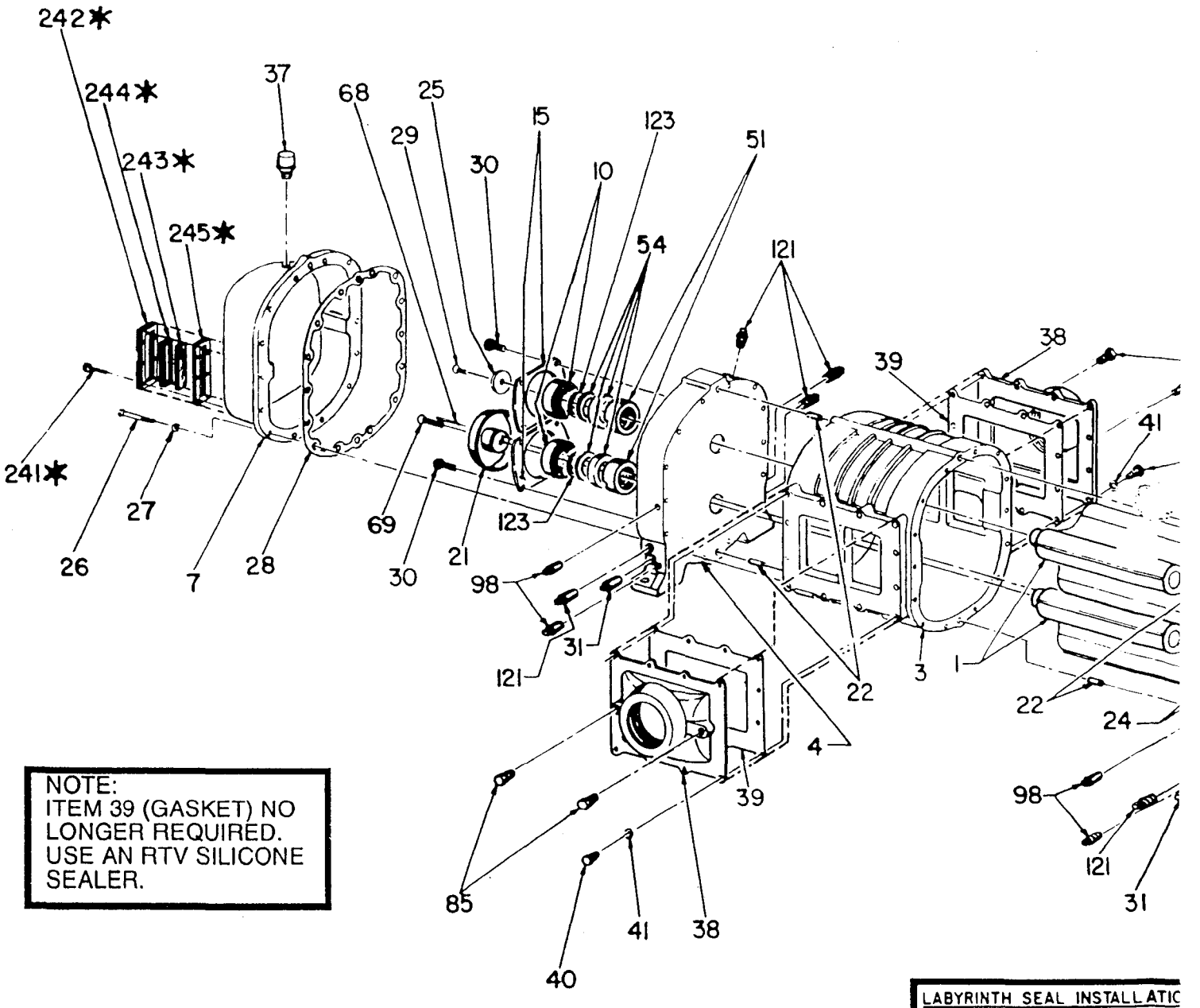



FIGURE 9

| ITEM NO. | DESCRIPTION | 4000 SERIES | | | | 5500 SERIES | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 16/47 | 17/16 | 57/81 | 64/67 | 16/47 | 17/46 | 57/81 | 64/67 |
| 1 | Rotor | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | Housing | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 4 | End Plate | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 6 | Drive End Cover | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 7 | Free End Cover | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 8 | Timing Gear Assy | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 9 | Bearing | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 10 | Bearing | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 12 | Rotor Shaft Lip Seal | 4 | 4 | — | — | 4 | 4 | — | — |
| 13 | Drive Shaft Lip Seal | 1 | 1 | 1 | — | 1 | 1 | 1 | — |
| 14 | Bearing Retainer Ring | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 4 |
| 15 | Oil Retainer Ring | 4 | 4 | 4 | 4 | — | — | — | — |
| 21 | Oil Slinger | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 22 | Dowel Pin | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 23 | Drive Shaft Key | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 24 | Timing Gear Key | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 25 | Rotor Shaft Washer | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 26 | Hexhead Cap Screw | 28 | 28 | 28 | 28 | 28 | 28 | 28 | 28 |
| 27 | Lockwasher | AR | AR | AR | — | AR | AR | AR | — |
| 28 | Gasket | 2 | 2 | 2 | — | 2 | 2 | 2 | — |
| 29 | Flathead Socket Screw | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 30 | Sockethead Cap Screw | 4 | 4 | 4 | 4 | 6 | 6 | 6 | 6 |
| 31 | Magnetic Pipe Plug | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 34 | Dowel Pin Spacer | 2 | — | — | — | — | — | — | — |
| 35 | Gear Locknut | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 36 | Gear Lockwasher | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 37 | Breather | 2 | 2 | 2 | — | 2 | 2 | 2 | — |
| 38 | Port Fitting | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 39 | Port Fitting Gasket | 2 | 2 | – | — | 2 | 2 | – | — |
| 40 | Hexhead Cap Screw | AR | AR | AR | AR | AR | AR | AR | AR |
| 41 | Lockwasher | AR | AR | AR | — | AR | AR | AR | — |
| 45 | Driveshaft | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 46 | Adapter Ring | — | — | — | — | 1 | 1 | 1 | — |
| 47 | Retaining Ring | 1 | 1 | 1 | — | 1 | 1 | 1 | — |
| 50 | Bearing | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 51 | Lab Seal | — | 4 | 4 | 4 | — | 4 | 4 | 4 |
| 54 | Face Seal | — | — | 4 | 6 | — | — | 4 | 6 |
| 57 | Spacer | — | — | — | — | — | 1 | 1 | 1 |
| 61 | Cap Screw Lock | 4 | 4 | 4 | 4 | 6 | 6 | 6 | 6 |
| 62 | Hexhead Cap Screw | 8 | 8 | 8 | 8 | 12 | 12 | 12 | 12 |
| 65 | Cap Screw Lock | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 67 | Spacer | 4 | — | — | — | — | — | — | — |
| 68 | Dowel Pin | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 69 | Flathead Socket Cap Screw | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 74 | Spacer | — | — | — | 2 | — | — | — | 2 |
| 75 | O-Ring | — | — | — | 2 | — | — | — | 2 |
| 77 | Spacer | — | — | — | 2 | — | — | — | 2 |
| 78 | Retaining Ring | — | — | — | 2 | — | — | — | 2 |
| 82 | Washer | — | — | — | 1 | — | — | — | 1 |
| 83 | Locknut | — | — | — | 1 | — | — | — | 1 |
| 85 | Pipe Plug | AR | AR | AR | AR | AR | AR | AR | AR |
| 98 | Plug | AR | AR | AR | AR | AR | AR | AR | AR |
| 108 | Magnetic Pipe Plug | — | — | — | 1 | — | — | — | 1 |
| 121 | Plug | AR | AR | AR | AR | AR | AR | AR | AR |
| 123 | Spacer | 2 | 2 | 2 | 2 | — | — | 2 | 2 |
| 174 | Pipe Plug | — | — | — | — | AR | AR | AR | AR |
| 234 | Oil Level Tag | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 241 | Sockethead Cap Screw | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 242 | Frame, Sightglass | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 243 | Window | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 244 | Gasket, Window | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 245 | Gasket, Frame | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

# ROTARY F .C
## SERIES 400(




NOTE:
ITEM 39 (GASKET) NO LONGER REQUIRED. USE AN RTV SILICONE SEALER.

NOTE:
*PARTS NOT USED FOR LOWER DRIVE UNITS.

LABYRINTH SEAL INSTALLATIC

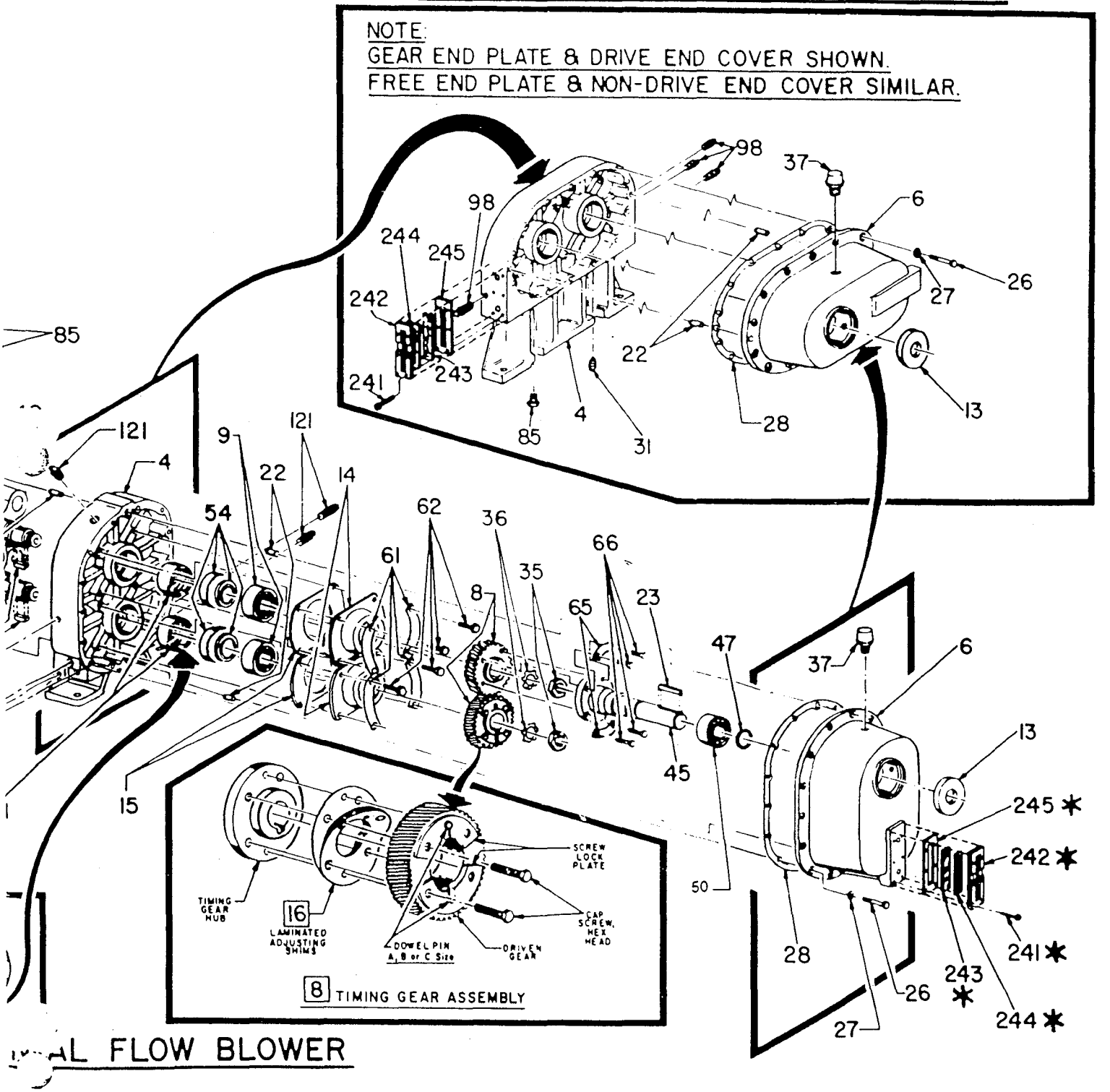
Install Labyrinth Seal Case with the middle slot pointing toward the bottom of the end plate.

Typical installation for both end plates:

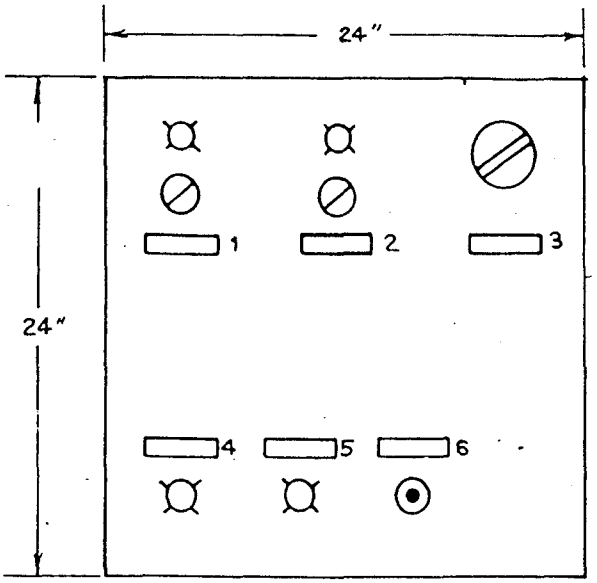
(MODEL 57) HORI

# WER ASSEMBLY
## -MODELS 57/81

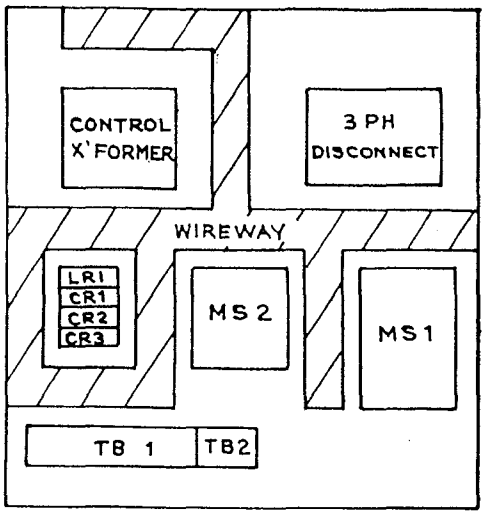
## (MODEL 81) VERTICAL FLOW BLOWER



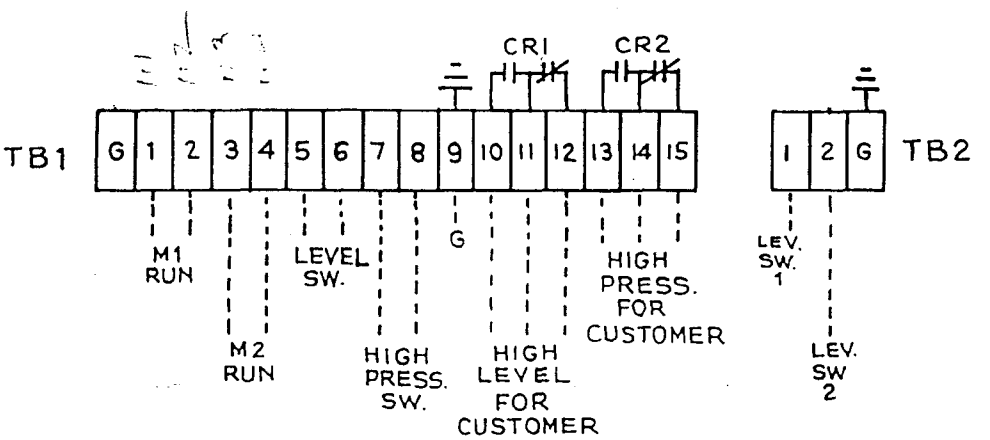

## AL FLOW BLOWER




FRONT PANEL
NEMA 12



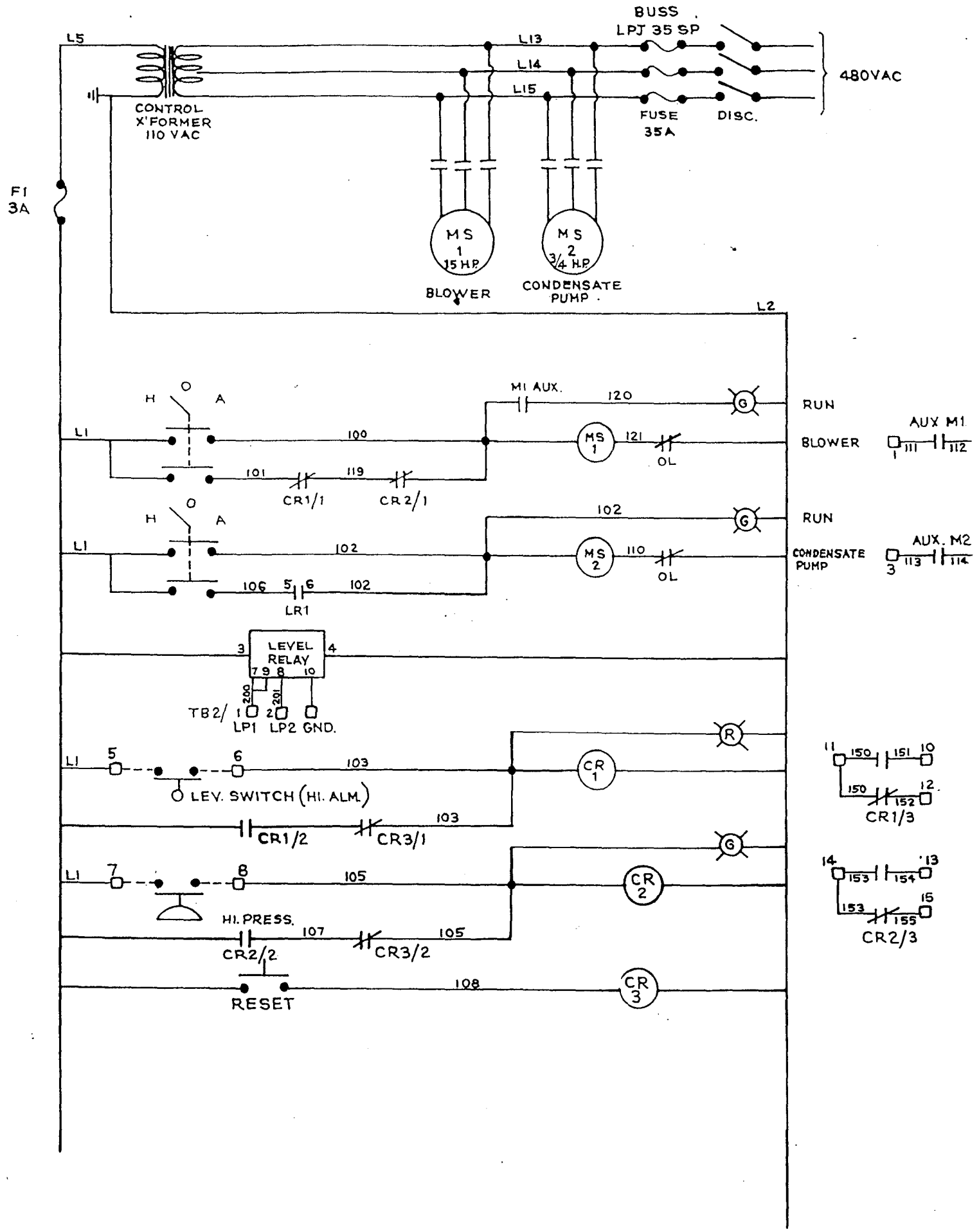

INTERNAL LAYOUT

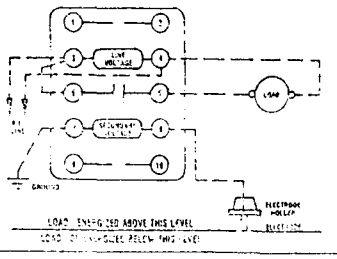
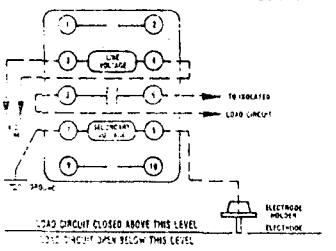
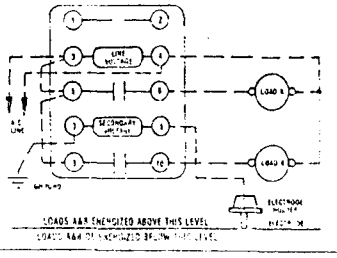
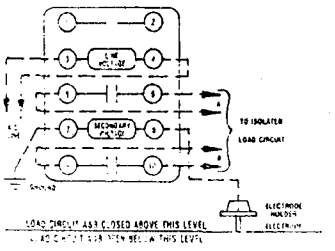
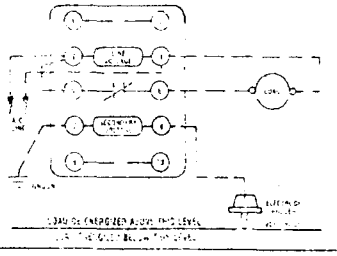
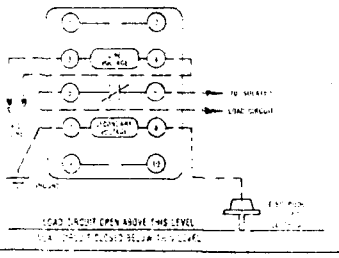
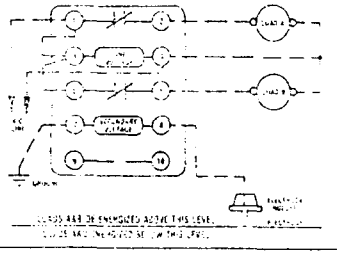
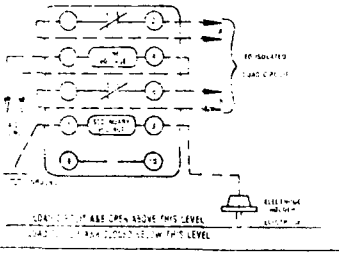
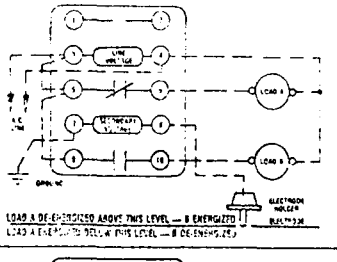
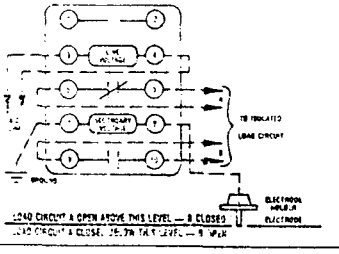
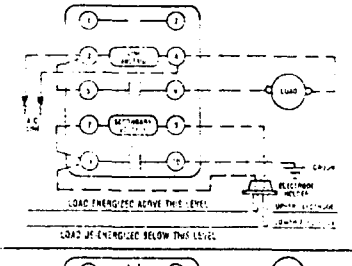
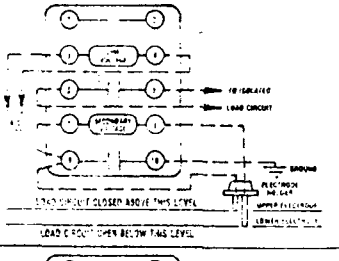
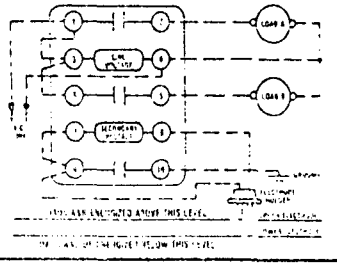
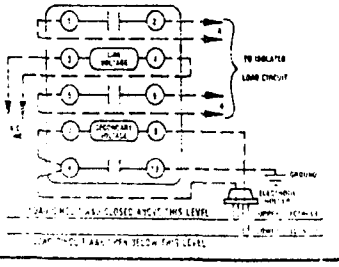



LEGEND

1.) BLOWER H.O.A/RUN
2.) CONDENSATE PUMP H.O.A/RUN.
3.) DISCONNECT
4.) HIGH LEVEL ALARM.
5.) HIGH PRESSURE ALARM.
6.) RESET BUTTON.

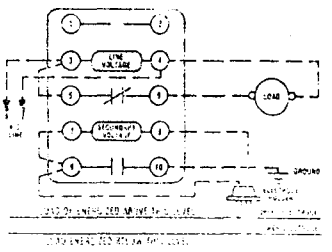
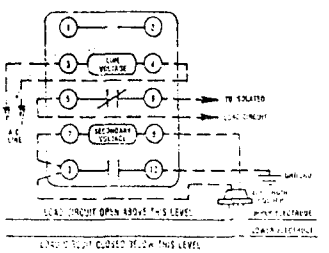
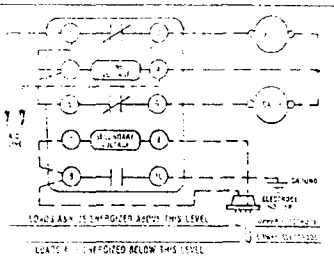
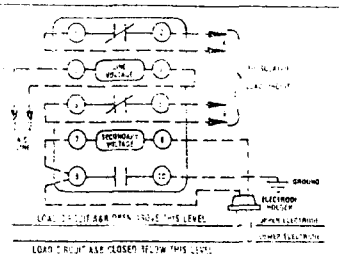
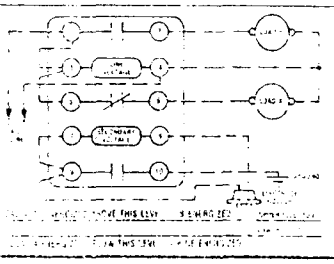
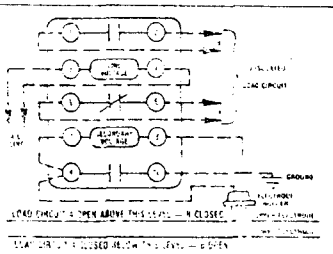
| | | |
|---|---|---|
| **SCOTT INSTRUMENTS, INC.**<br>514 West Walnut St., Perkasie, PA 18944 (215) 257-3200 | | |
| G. S. & G., INC. | | |
| MOTOR CONTROL PANEL | | |
| **Scale:** N.T.S. | **Drawn by:** P.S. | **Dwg. No.** 95-507 |
| **Date:** 3-24-95 | **Revised:** 5-8-95 (AS BUILT) | |


BUSS
LPJ 35 SP
L5
L13
L14
L15
480VAC
CONTROL
X'FORMER
110 VAC
FUSE
35A
DISC.
F1
3A
MS
1
15 H.P.
BLOWER
MS
2
3/4 H.P.
CONDENSATE
PUMP
L2
H
O
A
L1
100
101
CR1/1
119
CR2/1
M1 AUX.
120
MS
1
121
OL
RUN
BLOWER
AUX M1
111
112
102
MS
2
110
OL
RUN
CONDENSATE
PUMP
AUX. M2
113
114
106
5
6
LR1
LEVEL
RELAY
7 9 8 10
200
201
TB2/ 1 2
LP1 LP2 GND.
LEV. SWITCH (HI. ALM.)
103
CR1/2
CR3/1
CR
1
R
150
151
152
CR1/3
105
CR
2
HI. PRESS.
107
CR2/2
CR3/2
CR2/3
RESET
108
CR
3

| INDUCTION RELAY CONTACT ARRANGEMENT | WIRING DIAGRAM AND OPERATION | | TYPICAL APPLICATIONS |
|---|---|---|---|
| | DIRECT OPERATION | PILOT OPERATION | |
| **1500-A RELAY**<br>Contact Arrangement<br>Normally Open: 1 — Normally Closed: 0 — Holding Circuit: 0 |  |  | High Level Signal Control. Low Level Cutoff when wired in series with Stop button in 3-wire pushbutton stations. Remote long distance and low voltage manual control applications etc.<br>(Similar to 1100-L) |
| **1500-C RELAY**<br>Contact Arrangement<br>Normally Open: 2 — Normally Closed: 0 — Holding Circuit: 0 |  |  | Same as 1500-A Relay above except that an additional Normally Open contact is provided to permit simultaneous operation of different types of secondary signal devices in remote locations.<br>(Similar to 1100-2L) |
| **1500-B RELAY**<br>Contact Arrangement<br>Normally Open: 0 — Normally Closed: 1 — Holding Circuit: 0 |  |  | Low Level Signal Control. High Level Cutoff when wired in series with Stop button in 3-wire pushbutton stations. Remote long distance and low voltage manual control applications etc.<br>(Similar to 1100-R) |
| **1500-E RELAY**<br>Contact Arrangement<br>Normally Open: 0 — Normally Closed: 2 — Holding Circuit: 0 |  |  | Same as 1500-B Relay above except that an additional Normally Closed contact is provided to permit simultaneous operation of different types of secondary signal devices in remote locations.<br>(Similar to 1100-2R) |
| **1500-D RELAY**<br>Contact Arrangement<br>Normally Open: 1 — Normally Closed: 1 — Holding Circuit: 0 |  |  | High or Low Level Signal Control. High or Low Level Cutoff when wired in series with Stop button in 3-wire pushbutton stations. Can also be used to interlock various types of signal devices.<br>(Similar to 1100-D) |
| **1500-C RELAY**<br>Contact Arrangement<br>Normally Open: 1 — Normally Closed: 0 — Holding Circuit: 1 |  |  | Pump Down Control for sewage and sump pumps, condensate return system, etc. Low Level Cutoff for submersible pumps. Normally closed Solenoid Valve Control for discharging liquids from tanks, etc. (Similar to 1100-LH) |
| **1500-F RELAY**<br>Contact Arrangement<br>Normally Open: 2 — Normally Closed: 0 — Holding Circuit: 1 |  |  | Same as 1500-C Relay above except that additional Normally Open contact is provided to permit simultaneous operation of second pump. Extra contact can also be used for signal purposes if desired.<br>(Similar to 1100-2LH) |

CAUTION: Electrodes are terminals of live electrical circuits and must be insulated to prevent accidental contact by personnel. Control power must be disconnected before servicing.

A good dependable ground return connection to the liquid is required.

| INDUCTION RELAY CONTACT ARRANGEMENT | WIRING DIAGRAM AND OPERATION | | TYPICAL APPLICATIONS |
|---|---|---|---|
| | DIRECT OPERATION | PILOT OPERATION | |
| **1500-D RELAY**<br>Contact Arrangement<br>ially Open / Normally Closed / Holding Circuit<br>0 / 1 / 1 |  |  | Pump Up Control for supply pumps on elevated tanks and towers, carbonators, etc. High Level Cutoff for pumps and valves. Normally closed Solenoid Valve Control for plating tank and boiler make-up, etc.<br>(Similar to 1100-RH) |
| **1500-D RELAY**<br>Contact Arrangement<br>Normally Open / Normally Closed / Holding Circuit<br>0 / 2 / 1 |  |  | Same as 1500-D Relay above except that additional Normally Closed contact is provided to permit simultaneous operation of second pump. Extra contact can also be used for signal purposes if desired.<br>(Similar to 1100-2RH) |
| **1500-G RELAY**<br>Contact Arrangement<br>Normally Open / Normally Closed / Holding Circuit<br>1 / 1 / 1 |  |  | Pump Up or Pump Down Control for same applications listed above for B\W 1500-C and 1500-D Relays. It is also suitable for use in controlling hydropneumatic tanks and motorized valve installations.<br>(Similar to 1100-DH) |

CAUTION: Electrodes are terminals of live electrical circuits and must be installed to prevent accidental contact by personnel. Control power must be disconnected before servicing.

A good dependable ground return connection to the liquid is required.

# CATALOG NUMBERING SYSTEM

1500 — A — L1 — S7

Catalog Section

| | CONTACT ARRANGEMENTS | |
|---|---|---|
| | NORMALLY OPEN | CLOSED |
| A | 1 | 0 |
| B | 0 | 1 |
| C | 2 | 0 |
| D | 1 | 1 |
| E | 0 | 2 |
| F | 3 | 0 |
| G | 2 | 1 |
| H | 1 | 2 |
| J | 0 | 3 |

| | LINE VOLTAGE |
|---|---|
| L1 | 110-120 Volts 50/60 HZ |
| L2 | 208-240 Volts 50/60 HZ |
| L3 | 440-480 Volts 50/60 HZ |
| L4 | 550-600 Volts 50/60 HZ |

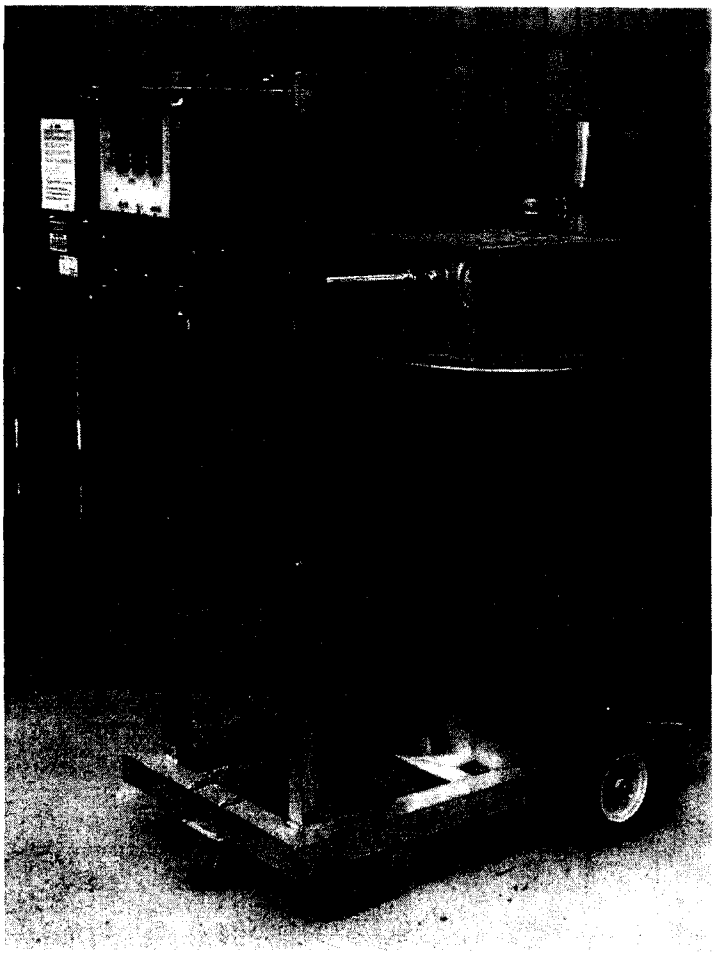
Consult Factory For Special Line Voltages Not Listed.

All contacts rated at:
25 Amp Resistive at 120, 240, or 480 VAC
1 HP Single Phase at 120 or 240 VAC
Heavy Duty Pilot 120 to 600 VAC
2 Amp Resistive at 120 VDC
10 Amp Resistive at 48 VDC

| | SECONDARY COIL VOLTAGE | TYPICAL LIQUIDS |
|---|---|---|
| S1 | 12 Volts A.C. | Metallic circuits |
| S2 | 24 Volts A.C. | Metallic circuits |
| S3 | 40 Volts A.C. | Acid or caustic solutions; Milk; Brine and salt solutions; Plating solutions; Buttermilk; Soups. |
| S4 | 90 Volts A.C. | Weak acid or caustic solutions; Beer; Baby foods; Fruit juices. |
| S7 | 220 Volts A.C. | Sewage; Most water-except very soft; Pottery slip; Water soluble oil solutions; Starch solutions. |
| S8 | 350 Volts A.C. | Very soft water; Sugar syrup. |
| S9 | 480 Volts A.C. | Steam condensate; Strong alcohol solutions. |
| S11 | 800 Volts A.C. | Demineralized or distilled water. |
| S1Z | 12 Volts A.C. | 17 Volt D.C. Sensing Circuit |
| S2Z | 24 Volts A.C. | 34 Volt D.C. Sensing Circuit |
| S3Z | 40 Volts A.C. | 56 Volt D.C. Sensing Circuit |

# Falmouth Products Catalytic Oxidizer
# FALCO 300
## *With Vapor Control Valve (VCV)*

Installation and Operations Manual



**Manual 2003.300.01**
**Technical Assistance: 800-340-8125**

$15

*FALMOUTH PRODUCTS P.O. BOX 541 FALMOUTH, MA 02541 PHONE 508 548 6686 FAX 508 548 8144*

## CONTENTS

# *FALMOUTH PRODUCTS FALCO 300 CATALYTIC OXIDIZER INSTALLATION AND OPERATIONS MANUAL*

FALMOUTH PRODUCTS CATALYTIC OXIDIZER (FALCO) converts hydrocarbon contaminates in an air stream to carbon dioxide and water vapor. Combustion occurs in the temperature range 300°C-620°C. Heat is transferred from the hot exhaust stream to the incoming contaminated air, heating it to the catalytic oxidation temperature. This manual covers models delivered after 7-30-03.

FALCO is equipped with three programmable controllers. One controller (T1) monitors and responds to a thermocouple sensing the temperature at the upstream end of the catalyst. The second controller (T2) monitors and responds to a thermocouple sensing temperature downstream from the catalyst. The third controller (T3) senses the temperature at an intermediate position inside the catalyst. The T3 controller provides a rapid response to increasing vapor concentration by increasing dilution air and shutting the system down if necessary. (See figure 3)

The three controllers regulate the temperature of vapor entering the catalyst. The T1 controller regulates an electric heater, which adds heat to the incoming flow when required. The three controllers cooperate in the regulation of a vapor control valve (VCV) that controls the input vapor concentrations to the unit.
The controllers are programmed to shut down the system if selected temperature limits are exceeded.

Auxiliary relays in the T1, T2, and T3 controllers shut down the system if the thermocouple temperatures move above or below the setpoints by selected amounts. If the Vapor Control Valve (VCV) does not respond rapidly enough to an increase in vapor line concentration, T2 and T3 will increase to their alarm settings and turn off the system. FALCO is also equipped with a pressure switch, which interrupts the heater circuit if flow is interrupted.

## TRANSPORTATION & STORAGE

The FALCO 300 weighs approximately 850 pounds with flame arrestor removed. FALCO is weatherproof while in operation. When FALCO is in storage it should be kept dry. The unit should be transported and moved around on site carefully. FALCO 300 is supplied with tires mounted on steel axles. These steel axles may be inserted into holes in the frame to ease in **manual** transportation around the site. (See figure 10)
Before transporting the FALCO VCV close the valve so its indicator pin is flush with the guard. Turning the FALCO power switch off and on does this. On startup the VCV closes and retracts the pin.

**CAUTION! WHEN FALCO IS NOT OPERATING, ALL OPENINGS MUST BE COVERED.**

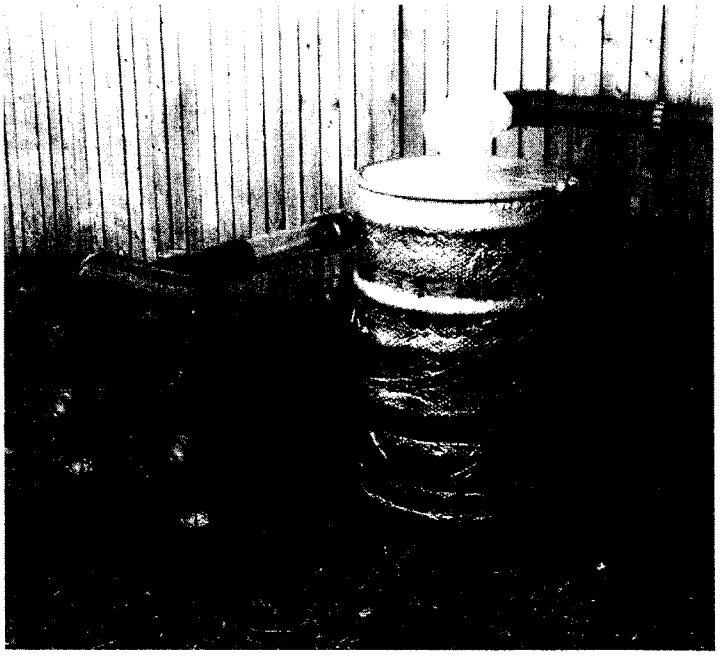
## INSTALLATION

The FALCO 300 should be installed in a well ventilated area.
Place FALCO on a level surface in a **secure** area. Figure 4 illustrates a plan view of a typical installation.
In cold climates all vapor lines should be protected from freezing by heating cable and insulation.

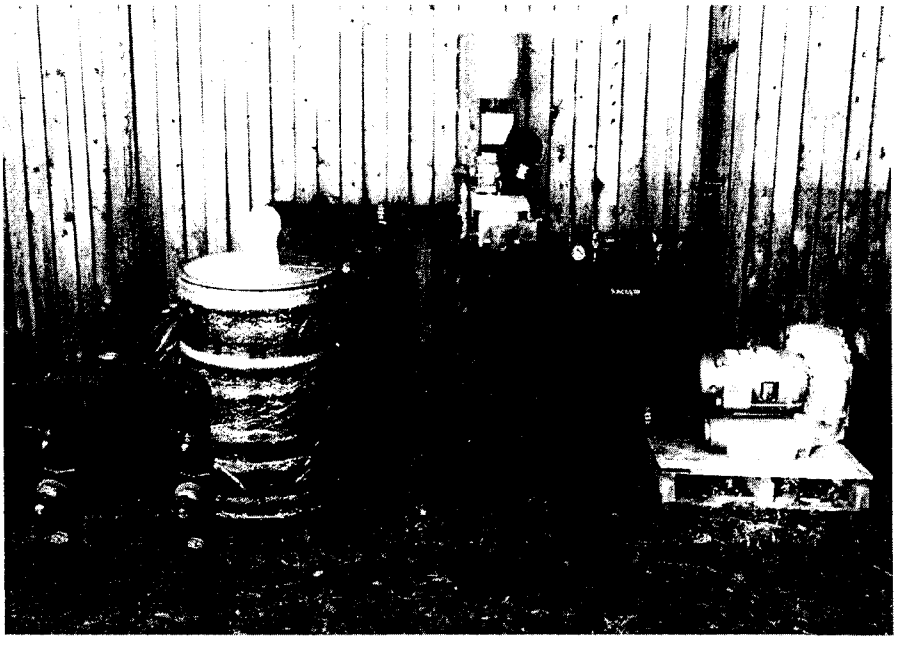
**PVC piping to vacuum side of blower**
Beginning at the vapor lines, the **PVC** piping should be installed as follows:

1. Install valves on each separate vapor line. These lines should each be equipped with sample and vacuum ports.

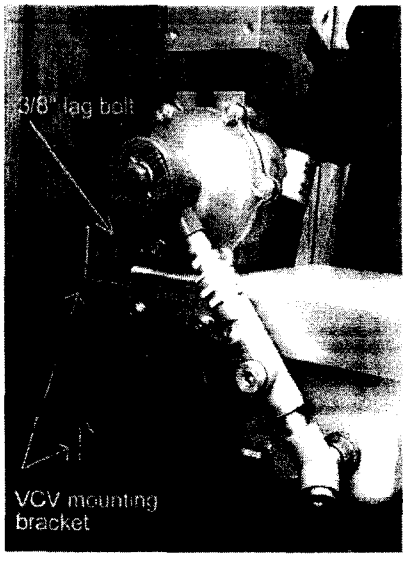
2. Combine the vapor lines together into a single line and install a piece of clear PVC so water may be seen entering the knockout.



3. Run this main vapor line through a large capacity water knockout (30 gallons minimum).



4. Install the FALCO Vapor Control Valve (VCV) into the vapor line **after** the water knockout. The VCV should be mounted so it is accessible and will not be damaged. Install the VCV with its filter vertical, vapor inlet horizontal, and the vapor discharge on the bottom of the valve.




5. Install a vacuum gauge between the VCV and the blower. Install a filter on the vacuum side of the blower. For operation in cold climates, all piping on the vacuum side of the blower, including the water knockout, must be insulated and heating cable installed.

**Steel piping on pressure side of blower**
Note: Minimize the use of galvanized pipe and Teflon based pipe thread sealant, they may damage the catalyst. Use Rectorseal™ #5 pipe thread sealant.

When the oxidizer is mounted close to the blower use 3" steel **non-galvanized** piping.

If the oxidizer is mounted more then 10' (total pipe length) away from the blower, use at least 5' of steel pipe for blower heat dissipation. Next install a steel coupling and a 3" schedule 80 PVC male adapter into this coupling. The piping may be finished with schedule 80 PVC pipe to the oxidizer.

The Steel piping is installed as follows:

1. Adapt the discharge piping from the blower up to 3-inch pipe. For ease of installation and reduced time it is advantageous to locate the blower parallel to and next to the catalytic unit. (See figure 4).

2. Install a 3" pipe nipple on the discharge side of the blower.
   Install a 3" union so that the blower may be removed for service.
   Install a 3" nipple into this union and a 3" 90° elbow onto the nipple.

3. Screw the flame arrestor onto the 4" inlet pipe on the oxidizer.
   Screw a 4" x 3" reducer bushing into the flame arrestor inlet.
   Install a 3" nipple into the 4" X 3" reducer bushing. Screw a 3" 45° elbow onto the 3" nipple.

4. Install a short 3" nipple onto the 45° elbow, and then install a 90° elbow onto the other end of the 3" nipple.

5. Install 3" steel pipe between the elbow on the flame arrestor inlet to the elbow on the blower.
   Include in this steel piping (schedule 80 PVC piping in some cases as mentioned earlier) an influent sample port, a pressure gauge and another union if needed.

**Water (Soil vapor extraction applications)**
Most vapor recovery operations produce some water. While water vapor is not a problem, **liquid water will damage the catalyst.** The following strategies minimize the transportation of water to the FALCO 300.

1. Slant vapor lines downhill toward the vapor wells.

2. Avoid low points that might accumulate slugs of water. If low points can not be avoided, provide a means for draining accumulations.

3. In cold climates, install heating cable and insulate pipe that is not buried.

4. Install a water knockout upstream from the blower. Install a vacuum gauge. A bouncing vacuum gauge often means there is a slug of water in a vapor line. Install a high level switch in the knockout drum.

5. Site check intervals should not exceed the time for water to fill the knockout.

## ELECTRICAL POWER CONNECTIONS

**WARNING: Hazardous voltage can cause severe or fatal injury. This equipment must be installed and grounded by qualified personnel per the National Electric Code and local codes.**

**Control box to breaker box.**
FALCO control box is connected by rigid metal conduit to the breaker box (not supplied).
Two 1" holes are supplied with hubs on the bottom of the control box. Explosion proof seal fittings must be installed in line with the conduit just below the control box and the breaker box.

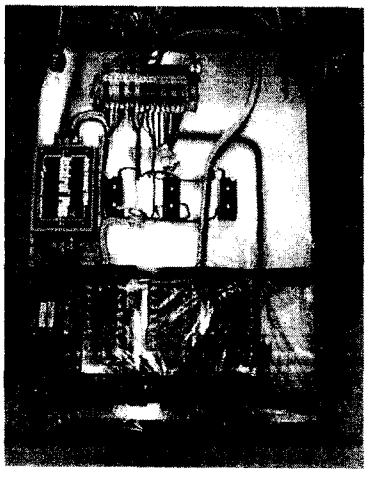
**Three circuits feed power to FALCO 300 through the rigid conduit.**
All wires used should be stranded copper wire. **Do not attach feed wires to yellow thermocouple wires.**

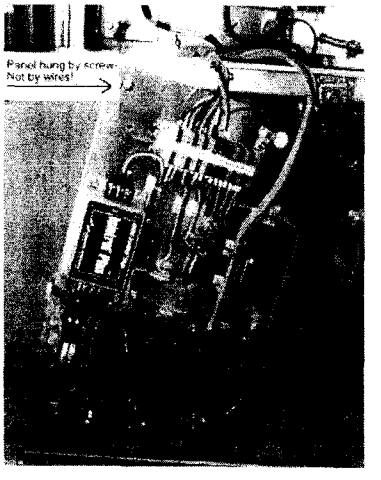
1. A 70-amp. three pole (208 volts three phase) breaker supplies power to the electric heaters (20,300 watts) through three #6 wires. (Optionally the heater can be wired for operation at lower power levels).

2. A second three-pole breaker (size depends on blower horsepower) supplies power to the blower.

3. A third 15-amp single pole 120-volt breaker supplies power to the controllers and relays through two #12 wires. A # 6 grounding wire is run from the FALCO control box grounding bar through the conduit and attached to a ground in the breaker box.

**Feed Conduit**
Remove the control panel retaining nuts and lower the top of the control panel out of the box until it is horizontal. Do not pull on the panel wires. While wiring the FALCO, wrap the front control panel with a plastic bag. Slide the panel four inches inward so it is bearing on the bottom two studs and is face down on the foam pad. Alternatively, carefully hang the front panel on the lower enclosure door clamp.



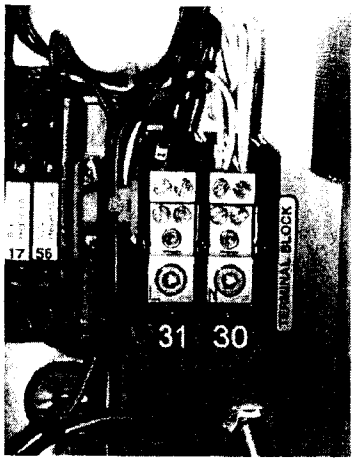


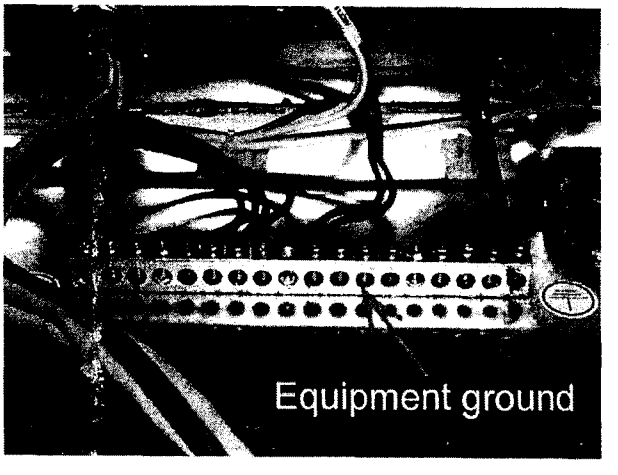

The temperature controllers are expensive and fragile! Do not get them wet or allow metal chips to enter their cases or they will be damaged.

1. Install rigid conduit with seals between the breaker box and the control box.

   Pull the following nine wires through the conduit:
   Three #6 wires for the heaters.
   Three wires appropriately sized for the blower (usually three #8's).
   One pair of #12 wires for the controls.
   One #6 ground wire.

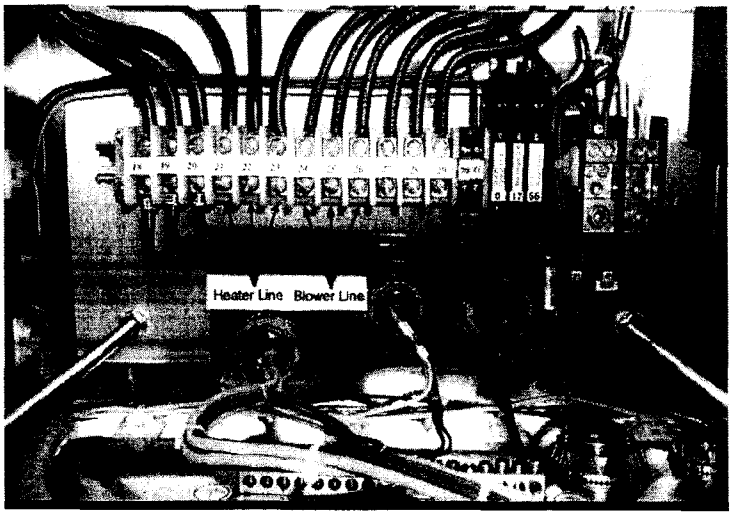
**Control circuit**
The (120-volt) control circuit is wired as follows: Locate the power distribution block on the rear control panel (terminals 30 and 31). The Neutral lead (white) is attached to terminal #30 and the Hot lead (colored) is attached to terminal #31.




**Ground**
FALCO is grounded as follows: Locate the grounding bar on the bottom of the FALCO control box. Install a grounding wire (Green # 6) from the bar, through the conduit to a ground inside the breaker box.

**Heater**
Wire the heater feed wires as follows: Attach three #6 wires (240 volt) to terminals 21, 22, 23 located on the rear panel of the FALCO control box.




**Blower**
Two methods for installing the extraction blower are as follows: In the first case, the line voltage for the blower is switched by the contactor in the FALCO control panel. In the second case, the contactor in the FALCO panel controls the coil of a remotely mounted motor starter, which controls the line voltage to the blower. Wire the blower as follows:

**Case #1** Locate terminals 24, 25, and 26 on the rear control panel in the FALCO control box. For three phase power, three of these terminals should be supplied with power from the breaker box (240 volts blower line). The blower load is attached to the corresponding load terminals 27, 28, and 29.

Note: The FALCO 300 is supplied with a motor starter with a **three-phase** overload relay.
If a single-phase blower is used, and the line and load are run through the motor starter,
a single-phase overload relay must be installed (A-B 193-ES4DC).

**Case #2** If a separate, remotely mounted, blower motor starter is used, it must be interlocked with the FALCO starter. The FALCO starter is wired in series with the coil wire on the remote starter. Choose a pair of line and load terminals (for example 24 and 27) in the FALCO control box.

**Caution: The T1 temperature controller enables the starter in the FALCO control box, and MUST control the blower through the starter.**

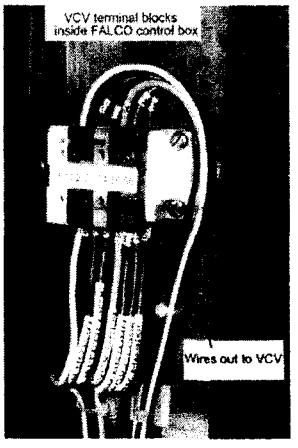
**Blower**
Install conduit with seals between the blower and the control box. Install an explosion proof union at the blower so it may be removed for service.

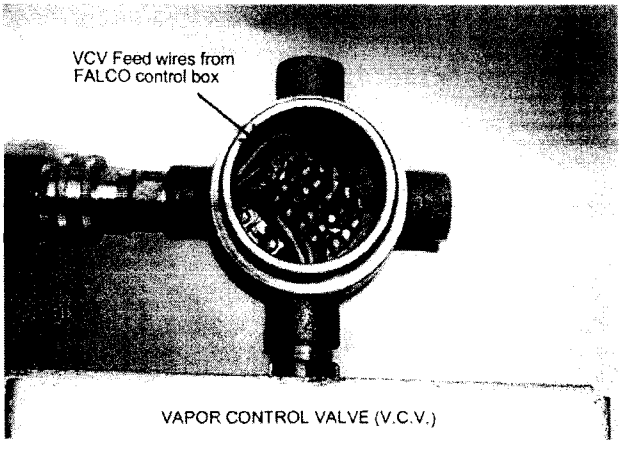
**Blower ground**
Ground the blower as follows: Install a grounding wire (green) from the case of the blower through the conduit and attach it to the grounding bar inside the control box.

**Vapor control valve (VCV)**

1. Install 1/2" rigid conduit with a seal fitting between the FALCO control box and the VCV conduit body.

2. Pull seven # 14 wires (two red, one white, one yellow, one brown, one blue, and one green) through the 1/2" rigid conduit. In the FALCO control box make the following terminations: Connect the six colored wires (two red, white, yellow, brown, and blue) to the corresponding terminal blocks # 51, 52, 53, 54, 55, and 56). Connect the green wire to the grounding bar inside the oxidizer control box.




VAPOR CONTROL VALVE (V.C.V.)

3. Unscrew the round VCV conduit body cover and locate the white, reds, yellow, brown, blue and green wires that were previously pulled into the box through the 1/2" conduit. Connect these wires to the corresponding terminal blocks inside the VCV conduit body. Do not open the pvc VCV enclosure.

4. Verify correct VCV operation as outlined in the cold start procedure.

**Water knockout high-level switch**

The FALCO control panel has a pair of terminal blocks (70 and 71) that may be used to wire a water knockout high-level switch. These terminals are factory wired in series with the motor starter coil wire in the control panel. To integrate a high level switch (or other remote shutdown device) a conduit should be run between the switch and FALCO control panel. Feed a pair of wires through the conduit and connect them to terminal blocks 70 and 71 (remove the jumper).

**CONTROLLER OPERATION** (Figure 9)

The control parameters have been set by FALMOUTH PRODUCTS before delivery. With the exception of the temperature setpoints, control settings will normally not be changed by the operator. If circumstances indicate a need to change controller programming, consult with Falmouth Products.

The setpoints are adjusted on the controllers by pressing the up or down buttons. Holding in the button effects a continuous, accelerating change. Pressing a button momentarily produces a 1° change. Alarms on the temperature controllers turn off the system (blower and heater) if the temperature limits are exceeded.

**Alarm limits and setpoints**
If the process temperatures exceed the following limits the system shuts down.

On the T1 controller the alarm settings are **+175°** and **-60° C**, relative to the T1 setpoint (deviation alarms). T1 controller shutdown occurs (L2 light) if the T1 process temperature exceeds the T1 setpoint by 175°C, or drops below by 60°C.
**T1 setpoint 330°C** **High alarm +175 shutdown 505°** **Low alarm -60 shutdown 270°**

On the T2 controller the alarm settings is **+20°** relative to the T2 setpoint (deviation alarms).
T2 controller shutdown occurs (L2 light) if the T2 process temperature exceeds the T2 setpoint by 20°C.

**T2 setpoint 600°C** **High alarm + 20 shutdown 620°**

T3 controller shutdown occurs (L2 light) if the process temperature exceeds 600°C (process alarm).
**T3 setpoint 580°C** **High alarm 600°** **shutdown 600°**

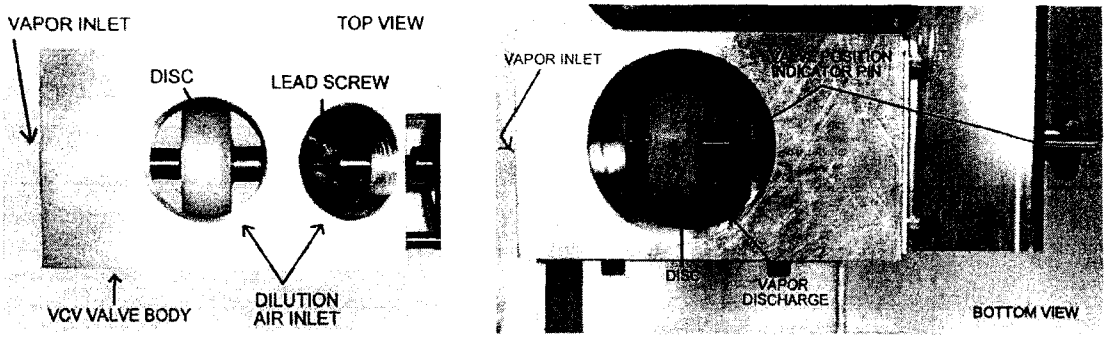
If temperatures deviate from the setpoint enough to cause an alarm condition, the lower display will alternately flash the nature of the alarm HI (high) or LO (low), and back to the setpoint. For example, if the T1 setpoint is 330° and the temperature drops to 265°, the system will shut down and the alarm will flash 330°/LO.

To clear alarms, change the setpoint to be within the alarm limit and press the AUTO/MAN button. If a high alarm is tripped, and the T2 or T3 temperatures exceed their setpoints, restart the system by cycling the power switch. On power up, the VCV will return to its closed position before the blower will operate.

## DISCUSSION OF UNIT OPERATION

**Vapor control valve (VCV)**
The Vapor Control Valve (VCV) regulates inlet vapor concentrations to the oxidizer. It is an essential part of the control system and must be operational for safe operation of the oxidizer. A sprocket on the VCV motor drives a chain, which adjusts the valve toward open or close.

The VCV (figure 5) consists of a valve body which includes a valve disc, two valve seats and a motor. The motor opens and closes the valve in response to input from the three temperature controllers. The valve can simultaneously regulate dilution air and source vapors by moving the valve disc. A solenoid valve is supplied for rapid introduction of dilution air, regardless of valve position.




**Note:** An indicator pin on the side of the valve shows valve position. When the pin is fully extended, the vapor line is conductive and dilution air is closed off. When the pin is flush with the guard, the vapor line is closed and full dilution flow is available.

Operation of the VCV is automatic. The VCV is integrated with the temperature control system to automatically control system warm up, introduction of vapors, and temperature modulation.

The T1 controller regulates the electric heater and increases vapor concentrations by opening the VCV (HEAT). The T2 and T3 controllers decrease vapor concentrations by closing the VCV (COOL). A rate alarm (L4 light) on the T2 and T3 controllers is a control feature that limits the rate of temperature increase. If the T1 controller calls for heat (L1 light is lit), the VCV will open and increase vapor concentrations (HEAT). If the T2 or T3 process temperatures approach their setpoint, the VCV will close to reduce concentrations (COOL). When the T2 or T3 controllers close the VCV, the solenoid on the VCV will simultaneously open.

**Vapor introduction**

Prior to the introduction of vapors, the catalyst is heated to a reactive temperature. Once the catalyst is hot, concentrations are gradually increased by the VCV. Vapor oxidation results in a temperature rise across the catalyst. Catalyst temperature takes several minutes to reach equilibrium after a change in concentration. The higher the concentration of vapor, the greater the temperature rise ($\Delta T$) or T2-T1. During start up, the control system and the VCV regulate this temperature rise. Alarms on the controllers turn off the blower and heaters if set temperature limits are exceeded. Temperatures exceeding 650°C damage the catalyst. Vapors must be fed in gradually.

**Use caution on initial startup when concentrations are unknown.** Restrict individual vapor line valves before starting FALCO. Valves can be opened more (after shutdown), once control stability is confirmed.

## COLD STARTUP

1. Configure supply vapor lines as desired. (Supply valves should not be adjusted while system is in operation). Note: If this is the **first** time the system has been started, the VCV must be tested (see below). Close the vapor supply lines (or disconnect piping to the inlet of the VCV) before turning on the power switch.

2. Close the heat exchanger bypass valve (see figure 7).

3. Turn the Power switch on (Cycle switch if controller(s) flash alarms).
   A4LO will flash on the T1 controller until T1 reaches 241°C (this is normal).

4. Adjust the setpoints to: T1=330°C, T2=600°C, and T3=580°C

5. Turn the VCV and Heater switches on.

6. Verify the VCV is closing (knob turning clockwise and indicator pin moves in). If the VCV is fully open, automatic closure will take 8 minutes. If the VCV is already closed, the pin is flush with the guard and the blower will start without delay.

   **Caution:** When the VCV valve reaches its closed position, the blower starts automatically.

   Confirm blower direction and airflow through the oxidizer. Verify flow by opening the influent sample port. A pressure gauge prior to the flame arrestor is useful for estimating flow rate (When the FALCO 300 is cold 23" $H_20$ inlet pressure equals approximately 300 scfm).

7. FALCO enters a ramp mode on initial start up and the T1 low alarm is bypassed.

8. Once the blower is running, warm-up is automatic. A4HI (L4) may flash on T3 and T2 intermittently.

9. When T1 temperature reaches 241°C, the VCV starts opening (introducing vapors).

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## VCV OPERATION TEST

**Close supply vapor lines or temporarily disconnect piping to inlet of VCV.**

Test 1: Verify the VCV begins opening (knob turns counterclockwise and pin moves out) when the T1 process temperature reaches 241°C.

Test 2: Temporarily lower the T1 setpoint to 220°C using the down arrow. Temporarily lower the T3 setpoint 20° below the T3 process temperature using the down arrow. After 10 seconds the VCV will close (knob turns clockwise and pin moves in). The VCV solenoid should also open (a snap will be heard). After verifying this, adjust the T3 setpoint back to 580°C using the up arrow. Adjust the T1 setpoint back to 330°C (this may trip a low alarm on T1).

Test 3: Turn the power switch on the FALCO control panel to the off position and open supply vapor lines. Turn power back on. Verify that the VCV is returning to its closed position. Blower should start when VCV is closed.

If VCV operation is incorrect, check the wiring between the FALCO control box and the VCV.

**Caution:** Correct VCV operation is essential! Do not operate with an incorrectly installed VCV. If you have a problem call Falmouth Products 800-340-8125.

9. Observe temperature rise on the T3 controller. Assent is limited by rate alarms on the T2 and T3 controllers. Temperatures may oscillate slightly before steady state operation is achieved. Time is required to reach new equilibrium temperatures after the VCV valve changes position. About one minute is required after an adjustment in concentrations to see an effect on T2. T3 provides early indication of increased concentrations and responds quickly by preventing the VCV from opening, and if necessary closing it.

10. When T1 temperature reaches or exceeds its setpoint, startup is complete.

System operation is automatic. The vapor extraction blower is prevented from starting until the VCV fully closes. Each time power is interrupted, or an alarm is tripped, the VCV valve will automatically return to its closed position and the startup sequence will repeat.

After the VCV reaches the closed position, a proximity switch enables the motor starter and the blower starts. When the blower starts, the unit heats up to the minimum temperature for the introduction of hydrocarbons. When the electric heater is on, the L1 light is lit on the T1 controller. During warm up, the L4 light is lit on the T1 controller and A4LO (AL4) will flash on the display. This indicates the unit has not yet reached the temperature required for the introduction of vapors.

When the T1 process temperature reaches 241°C the L4 light goes out, and the VCV begins to introduce vapors. The rate at which vapors are introduced is controlled by rate alarms on the T2 and T3 controllers. Temperature assent greater than 15 degrees/minute interrupts the VCV opening adjustments. Once the assent rate declines to below 15 degrees/minute, the rate alarm self clears and vapor introduction resumes.

Once up to operating temperature, the unit regulates input concentrations based on heater demand. Each time the T1 controller demands heat to maintain the T1 setpoint (330°C) the L1 light will come on and the VCV valve will open to increase concentrations. As source concentrations decline over time, the VCV will eventually open completely (dilution air closed and vapor line open). A proximity switch disables the open circuit once the VCV is fully open.

**Caution:** Manual adjustment of the VCV is not recommended. If a vapor line is opened too quickly the automatic controls may not respond fast enough to prevent overheating and damage to the catalyst. Do not adjust vapor line valves, or open wells while system is running.

As the T3 or T2 temperatures approach their setpoints the VCV may close slightly. When this occurs, L1 will light up on the T2 or T3 controllers. The VCV solenoid activates each time the VCV closes.

The T1 setpoint should still be at 330°, but the T1 temperature may be above the setpoint. After temperature equilibrium is established, observe the value of $\Delta T$ (temperature difference between T1 and T2). If for example, T1 = 340°C and T2 = 540°C then $\Delta T$ is 540-340 or 200°C. Input concentration may be estimated by multiplying $\Delta T$ by 8. Therefore, the input concentration is approximately 200 * 8 or 1,600 PPMV.

When vapor line concentration is high, (at the start of a vapor recovery operation, concentrations over 30,000 ppmv are common) the vapor stream must be diluted to below 2,200 ppmv. The oxidizer may reach full operating temperature, and maximum loading, without fully opening the VCV at sites with high vapor line concentration and low flow resistance. High dilution ratios (VCV toward close) will result in low vapor line vacuum.

As the vapor line concentrations decrease, the VCV reduces dilution airflow and vapor line vacuum increases. This may effect water production at soil vapor extraction sites. A vacuum relief valve or manual dilution valve may be required on the vacuum side of the blower to limit vacuum applied to the vapor extraction piping. A vacuum gauge is recommended.

## CONTROLLING INPUT CONCENTRATIONS

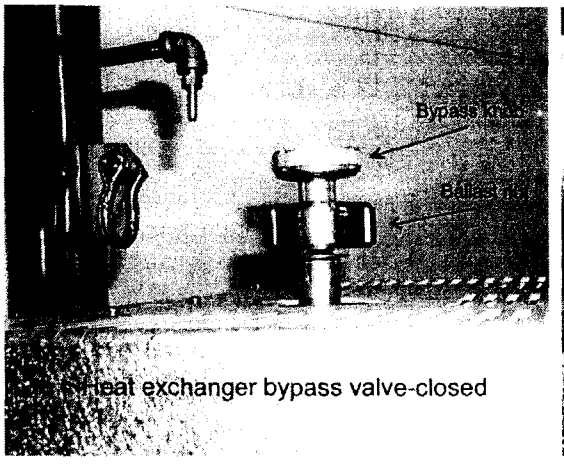
**High concentrations**
When the vapor line concentration is relatively high, the VCV controls the vapor concentration fed to the oxidizer. The input concentration maintained by the VCV is a function of heat recovery efficiency.
When heat recovery efficiency is decreased, the input concentration maintained by the VCV increases.

**Heat exchanger bypass valve**
On the FALCO 300 heat recovery may be adjusted with the heat exchanger bypass valve.

The heat exchanger bypass is an adjustable valve in the passage connecting the discharge side of the catalyst to the exhaust stack. Flow of hot exhaust gas through the bypass provides a corresponding reduction in flow through the heat exchanger. In this way, the heat exchanger bypass regulates heating of the inlet vapor stream.

As the heat exchanger bypass is adjusted toward open, the flow of hot exhaust gas through the heat exchanger is reduced, thus reducing heat recovery. During operation with low vapor line concentration, when electric heat is needed to help preheat the vapor being treated, the heat exchanger bypass should be closed to minimize energy use. The heat exchanger bypass is also closed during warm-up. In order to **maximize** vapor input during operation at high concentrations, the valve must be manually opened.

**Valve adjustment (See figures 6, 7, and 8)**
The top portion of the bypass valve assembly projects through the top of the heat shield.
In figure 6 the bypass valve is in the **closed** position. The ballast nut has been screwed upward so threads are visible below it.



Heat exchanger bypass valve-closed


Heat exchanger bypass valve-open

In figure 7 the bypass valve is adjusted to an **open** position. The ballast nut supports the valve off its seat. The bypass knob is now approximately 1.5" higher than the top of the ballast nut (the maximum adjustment). The distance between the bypass knob and the ballast nut represents the amount of heat exchanger bypass.

**CAUTION:** If the oxidizer has been running with the bypass open, it will be hot; wear gloves to make adjustments.

After an adjustment to the heat exchanger bypass valve toward open observe the T1 controller and the VCV. The heater may begin to cycle after a short time, and the VCV will commence making small adjustments of the valve toward open. Allow 15 minutes for a new equilibrium to be established, and observe T1 and T2. A larger $\Delta T$ (T2-T1) indicates an increase in input concentration.

The closing force on the bypass valve is the weight of the valve assembly. Therefore, the bypass valve also serves as a pressure relief valve, limiting pressure in the catalyst chamber.

**Examples of control response to bypass adjustments.**
**Case 1.**
Initial conditions: VCV partially open, and vapor concentration is relatively high. The objective is to increase input concentrations.

Heat recovery is **reduced** by adjusting the bypass valve toward **open.**
Control system responds by **increasing** inlet vapor concentration.
The control mechanism is as follows:

1. Reduction in heat recovery results in a drop in the temperature of vapors entering the catalyst. The T1 thermocouple senses the new temperature, at or below the T1 set point.

2. The T1 controller responds to the drop in temperature by signaling the VCV to make adjustments toward open. As a result, the inlet vapor concentration is increased.

3. The increased inlet vapor concentration makes more heat available. In this way, the temperature of the inlet vapor is raised to or above the T1 set point, despite the lower heat recovery efficiency.

Further adjustments of the bypass valve toward open result in a repetition of the above control cycle, with further increases in concentration.

Increases in inlet vapor concentration result in temperature increases at T3 and T2. The maximum allowable inlet vapor concentration is reached when the temperature rise through the catalyst results in T2 approaching its setpoint temperature of 600°C.

**Case 2.**
Initial conditions: Concentrations have dropped over time and the heater has started to cycle. Objective is to increase heat recovey to reduce heater load.

Heat recovery is **increased** by adjusting the bypass valve toward **close.**
The control mechanism is as follows:

1. The increase in heat recovery results in an increase in the temperature of vapors entering the catalyst. This temperature increase propagates through the catalyst as a temperature wave, increasing the temperatures at T2 and T3.

2. After approximately five minutes the T1 temperature will increase and the heater load will be reduced. The T1 temperature may drift above its setpoint.

3. If the effect of the adjustment is great enough, all three temperatures will drift upward after about ten minutes. The T2 or T3 controller may respond by signaling the VCV to start making small adjustments toward close.

**Low concentrations**

Declining input concentrations are accompanied by decreasing temperatures. After the end of the dilution phase, if input concentrations have continued to decline, the heater light will be on for gradually increasing portions of its 15-second cycle. After the heater is on for more than 5 seconds, the heat exchanger bypass valve should be closed. If these adjustments are not made, power consumption will be significantly increased during operation at low concentrations. Closing the bypass valve will be accompanied by an increase in T1, T2 and T3. Temperatures may increase until the VCV closes slightly.

As the input concentration declines below 1,400 ppm, the T1 setpoint may need to be increased in order to maintain high conversion efficiency. At 1,400 ppm a T1 setpoint of 330°C is a good choice. At 400 ppm and lower, a setpoint of 340°C may be required to maintain conversion efficiency. If the catalyst is damaged, a higher T1 setpoint may be required. To maximize heater life, when operating at low vapor concentrations, operate at the lowest temperature that will yield satisfactory destruction efficiency, but not below 330 °C or above 380°. This limitation refers to the T1 setpoint, not the actual temperature, which can substantially exceed the T1 setpoint under certain conditions.

## TROUBLESHOOTING

**WARNING: Hazardous voltage can cause severe or fatal injury.**
**This equipment must be installed and grounded by qualified personnel per the National Electric Code and local codes.**
**Hazardous voltage can cause severe or fatal injury.**
**Electrical work should be performed by qualified personnel only.**
***This equipment has multiple sources of electric supply.***
**Follow lock out / tag out safety procedures.**

**Blower Problems**

1. Problem: FALCO controls turn on and flash LO or HI, but blower will not start.

   Possible cause: An alarm limit has been exceeded, interrupting the blower relay. The controllers flash the alarm condition and the setpoint alternately. Bring setpoint to within alarm limits and clear alarms. Wait 10 seconds after clearing alarms and cycle power. When blower starts a *thump* will be heard. This is the blower relay being activated.

2. Problem: FALCO controls turn on, no alarms present, blower will not start.

   Possible cause: VCV is not closed. The VCV is equipped with a proximity switch, which prevents blower operation until VCV is closed. Blower should start when the VCV position-indicating pin is flush with the belt guard. If VCV is not closed (or closing on power up) check VCV input wiring.

   Possible cause: Inlet piping and VCV are heavily iced or obstructed, preventing VCV closure.

   Possible cause: Circuit breaker for blower has tripped.

   Possible cause: Thermal protection on the blower or on a motor starter has interrupted the blower relay and stopped blower. Investigate blower motor starter overload relay adjustment inside FALCO control box.

   Possible cause: A float switch on the water knockout, if present, may have interrupted the motor relay. High-level switch should be interlocked at terminals 70 and 71 in control panel. Thermal cutout on a blower may trip due to a high vacuum. If the blower trips its thermal overload, flow is stopped to FALCO and the heater turns off. Temperatures then drop until a low alarm is displayed on the controllers. Verify the blower is not exceeding its maximum vacuum and pressure ratings. Cooling air must circulate freely across the blower motor.

Check amperage draw on the blower motor. If a motor starter has been used, check the adjustment of the overload relay on the starter and adjust appropriately for motor horsepower.

3. Problem: FALCO controls turn on, no alarms present, blower will not start and blower circuit breaker has tripped.

   Possible cause: Does blower spin over freely? Blowers that have been outside for long periods without operating, may freeze up. Ice or corrosion may have accumulated preventing a restart and tripping the circuit breaker.

4. Problem: Blower starts but no flow gets to FALCO.

   Possible causes:
   Flame arrestor on FALCO is clogged with debris.
   VCV valve plugged with debris.
   Restricted vapor lines.
   Improper blower rotation.
   Piping from blower discharge to FALCO is broken or plugged.
   Broken drive belt or couplings on blower.

**Heater problems**

1. Problem: FALCO starts but will not warm up at all.
   Possible causes:
   VCV has not returned to closed position and blower is not running.
   Heater switch in off position.
   Breaker for heater in off position.
   Improperly adjusted controller setpoints. If controller setpoints are not adjusted properly, FALCO will not warm up. Make sure the T2 setpoint is set at 600°C.

   Little or no air flow to unit. Check for airflow at sample port or needle valve at base of intake manifold. FALCO is equipped with a pressure switch that disables the heater circuit, protecting the heater from low flow conditions. This switch disables the heater circuit at approximately 30 CFM or less. A pressure gauge before the flame arrestor will allow the operator to estimate flow rate.

   Clogged flame arrestor is reducing flow to the oxidizer to below 30 CFM so the pressure switch is interrupting the heater circuit.

   Remove the steel tube that runs from the intake manifold to the pressure switch. Clear obstructions. Confirm that the high and low-pressure ports on the pressure switch are unobstructed.

2. Problem: FALCO warms up but not all the way to 241° C on T1 (System needs to be up to this temperature before VCV feeds in vapors).

   Possible causes:
   *Improper adjustment of controller setpoints (See cold startup).*
   Heat exchanger bypass must be closed prior to cold start (See figure 6).
   Low voltage to the heater circuit. Voltage should be between 208-240 Volts.

   High flow rate entering FALCO. Flows exceeding 350 CFM will make warm up difficult.
   It may be necessary to **partially** restrict the source vapor lines to achieve temperatures beyond 241°C.
   Inlet pressure to FALCO 300 is 23" H20 @ 300 CFM (cold).

   A blower flow control (recirculation valve) may need to be installed.

   Damaged or incorrectly wired heaters or heater relays. Call Falmouth Products.

**Controller problems**
The temperature controllers may exhibit unusual behavior if they are too cold, or get wet. The control box has a thermostatically controlled heater inside that keeps the controllers at the appropriate temperatures for proper operation (above 30° F). In very cold conditions (outside temperatures of less then 25° F) the outside of the control box must be insulated.

1. Problem: Alarm cannot be cleared with the Auto/Man key.
   Possible cause: Process temperatures are not within alarm limits.

2. Problem: Controllers will not turn on.
   Possible cause: Circuit breakers are not turned on at the breaker box. If the controllers still will not turn on, turn **off** the main circuit breaker and check the two fuses on the front control panel
   (tip - out fuse holders # 1and # 2.).

3. Problem: Controller is reading in °F rather than °C
   Possible cause: Controller has deprogrammed. This can be verified by pushing the display key.
   This key will show the following in succession:
   - Setpoint
   - Deviation from setpoint
   - Percent of relay load
   - Units used (this should read °C)

   If units used reads in °F the controller has deprogrammed and FALCO should not be run until the controller has been reprogrammed. Contact Falmouth Products for technical assistance.

**Problems with conversion efficiency**
FALCO does not destroy methane completely at its normal operating temperatures. When using a Flame Ionization Detector, methane may show up in the output emissions. By taking two output samples (one with an activated carbon tip, and one without) the non-methane emissions may be determined.

At low input concentrations, destruction efficiency is generally lower then the destruction at high input concentrations. This is due to the lower average treatment temperature. However, the absolute emission while operating at low input concentration is normally lower than while operating at high input concentrations. For example: assume the input concentrations are 2,000 PPM and emissions are 10 PPM. Then conversion is 10/2000=. 005 or 99.5% conversion. However, if the input concentration is 100 PPM and the emissions are 10 PPM, then the conversion is 10/100= .1 or 90% conversion. The conversion efficiency is lower but the overall emissions are the same.

Problem: High output emissions
Possible causes:

1. High methane concentrations in the influent stream.
   Check for methane with a carbon tip if using a flame ionization detector.
   Improperly calibrated test instrument.

   Organic material may have entered the top of the unit and is being burned.
   For example, if leaves fall down the stack they may cause high emissions.
   Clean the effluent sample port.

2. Low influent temperature.
   Check T1 setpoint if you are operating at low concentrations with the heater on. Normal setpoint is 330°. This setpoint may be increased in increments of 5°C to a maximum of 370°C. Check emissions after FALCO has reached equilibrium after each increase in setpoint. Increasing input temperatures generally increase conversion efficiency.

3. High influent flow rate
Check flow rate in CFM going into FALCO. The FALCO 300 is designed for flow rates up to 320 CFM. Higher flow rates decrease residence time in the catalyst reducing destruction efficiency. At high input concentrations, slightly higher flow rates may yield acceptable conversion because of higher operating temperatures. At low input concentrations and high flow rate, the electric heater may have trouble maintaining adequate input temperatures for good conversion.

4. Catalyst settling.
The packed bed catalyst in the FALCO 300 is comprised of 1/8" ceramic spheres with a platinum deposited on them. The catalyst is contained in a chamber that is screened on two sides to allow the vapors to flow through horizontally. Excessive catalyst bed settling may reduce conversion efficiency. The fill level may be checked and topped off through the fill plugs (see figures 1 and 2 for component locations).

**Caution: Before opening fill plugs verify that all flow through FALCO has stopped. Use lockout on breaker box. The catalyst will be hot. Wear gloves, dust mask, protective clothing, and safety glasses.**

Remove the rectangular heat guard on the top of the unit.
Remove the brass fill plugs on the top of the catalyst chamber.The plugs are under the pressure switch and thermocouple conduit body. Pour new catalyst into the catalyst chamber. A **clean** flathead screwdriver may be used to gently distribute catalyst toward the ends of the chamber.

5. Catalyst poisoning, masking, and overheating.
Certain poisons and contaminants can deactivate the catalyst. Vapor streams should be analyzed before operation. If poisoning is suspected, a catalyst sample may be removed from the fill tubes discussed in section 4 for analysis. Avoid running water into the oxidizer. Water can transport solids and mineral salts that may mask or poison the catalyst. Always install a filter on the vapor line prior to the blower to capture particulate. Certain compounds can poison the platinum catalyst used on the FALCO 300. Poisons such as phosphorus and silicone coat the catalyst. Halogens such as chlorine will attack the platinum deposited on the catalyst converting it to an inactive form. Sulfur may mask the catalyst. Operation of the unit at temperatures lower than 300°C may cause incomplete combustion. Deposits of carbon on the catalyst may reduce its efficiency. Overheating must be prevented. Temperatures exceeding 650°C will reduce catalyst activity by reducing active surface area. If necessary, the catalyst may be changed by vacuuming the old catalyst out through the fill tubes, and pouring in new catalyst.

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**7-5 EASTERN STANDARD TIME PHONE 800-340-8125**

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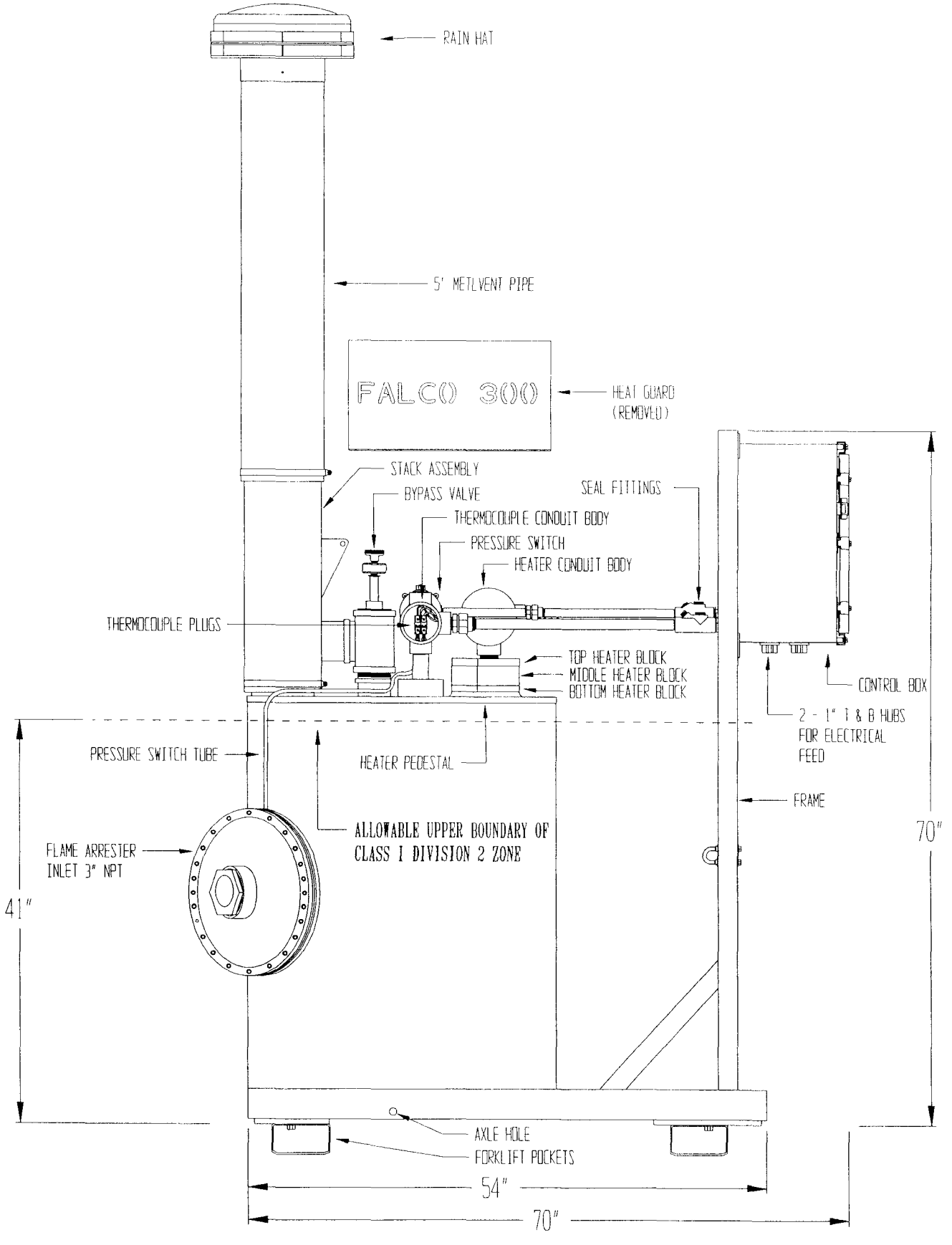


FIGURE 1
FALCO 300 MAJOR COMPONENTS - SIDE VIEW

LAST REVISON 10-13-97

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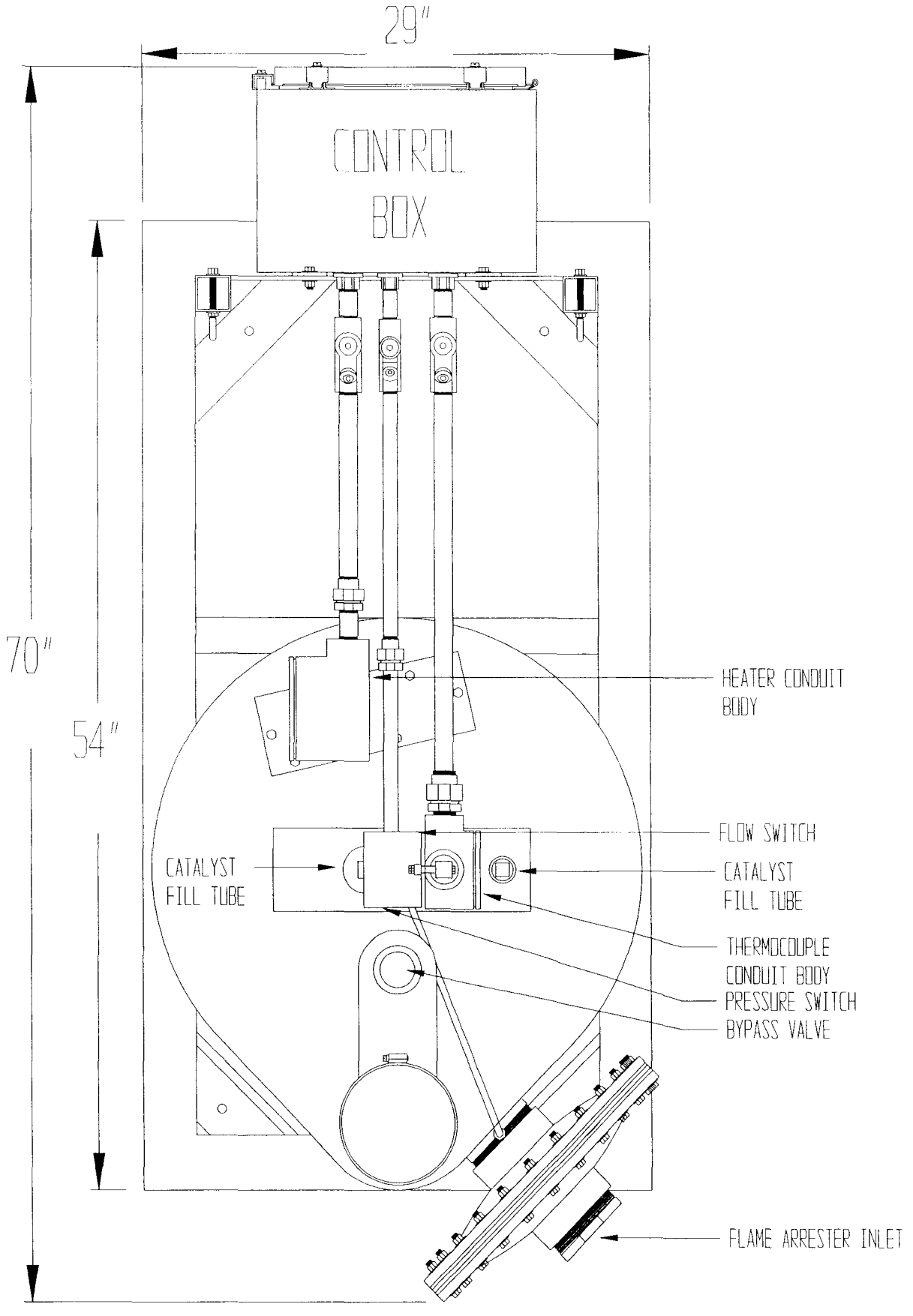


FIGURE 2
FALCO 300 MAJOR COMPONENTS - TOP VIEW

LAST REVISON 10-06-97

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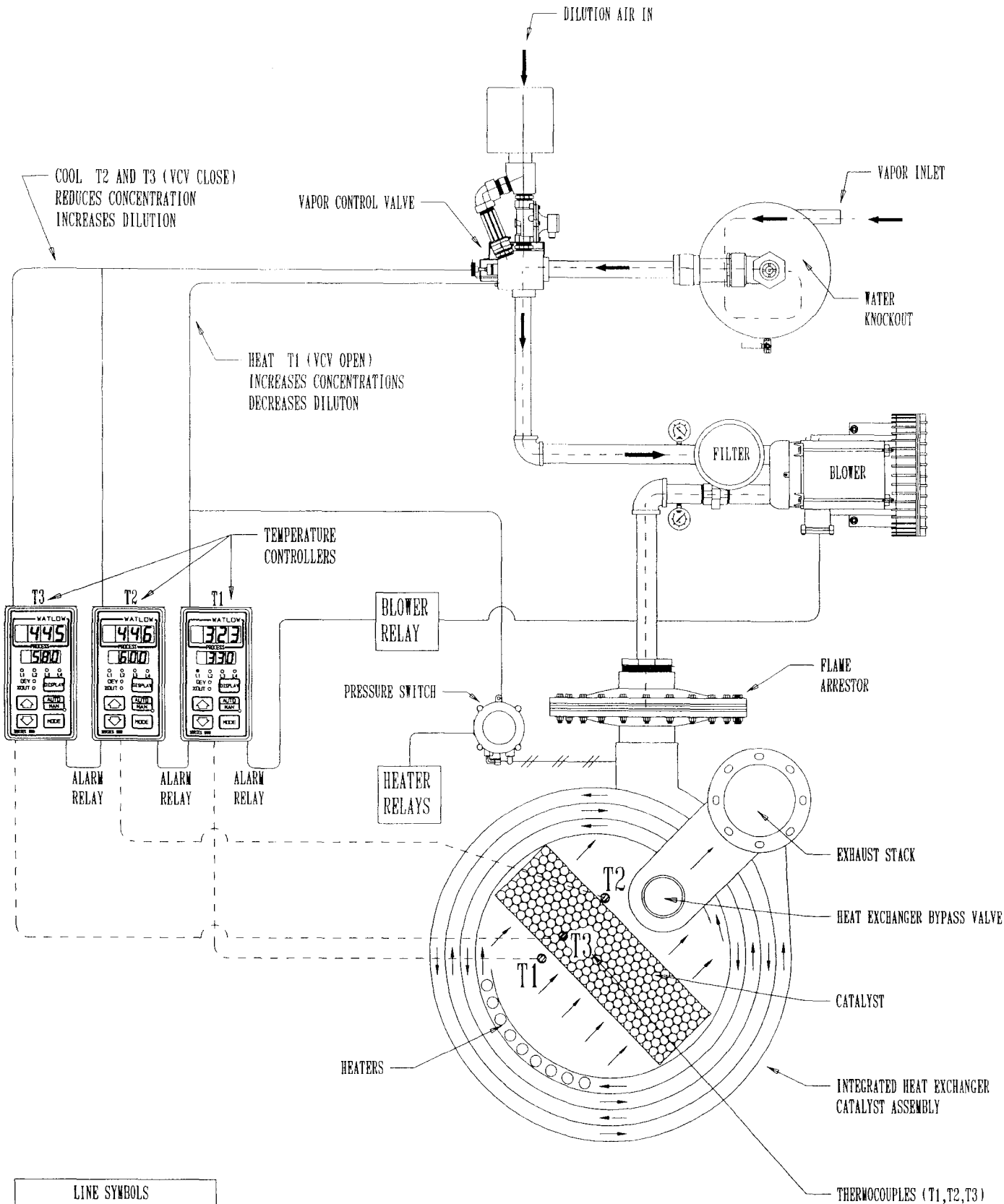


| LINE SYMBOLS |
|---|
| —— DILUTION AIR |
| - - PROCESS PIPING |
| —— CONTROL OUTPUTS |
| - - THERMOCOUPLE CIRCUITS |
| //// PNEUMATIC SIGNAL |

FIGURE 3 FALCO 300 FLOW AND CONTROL

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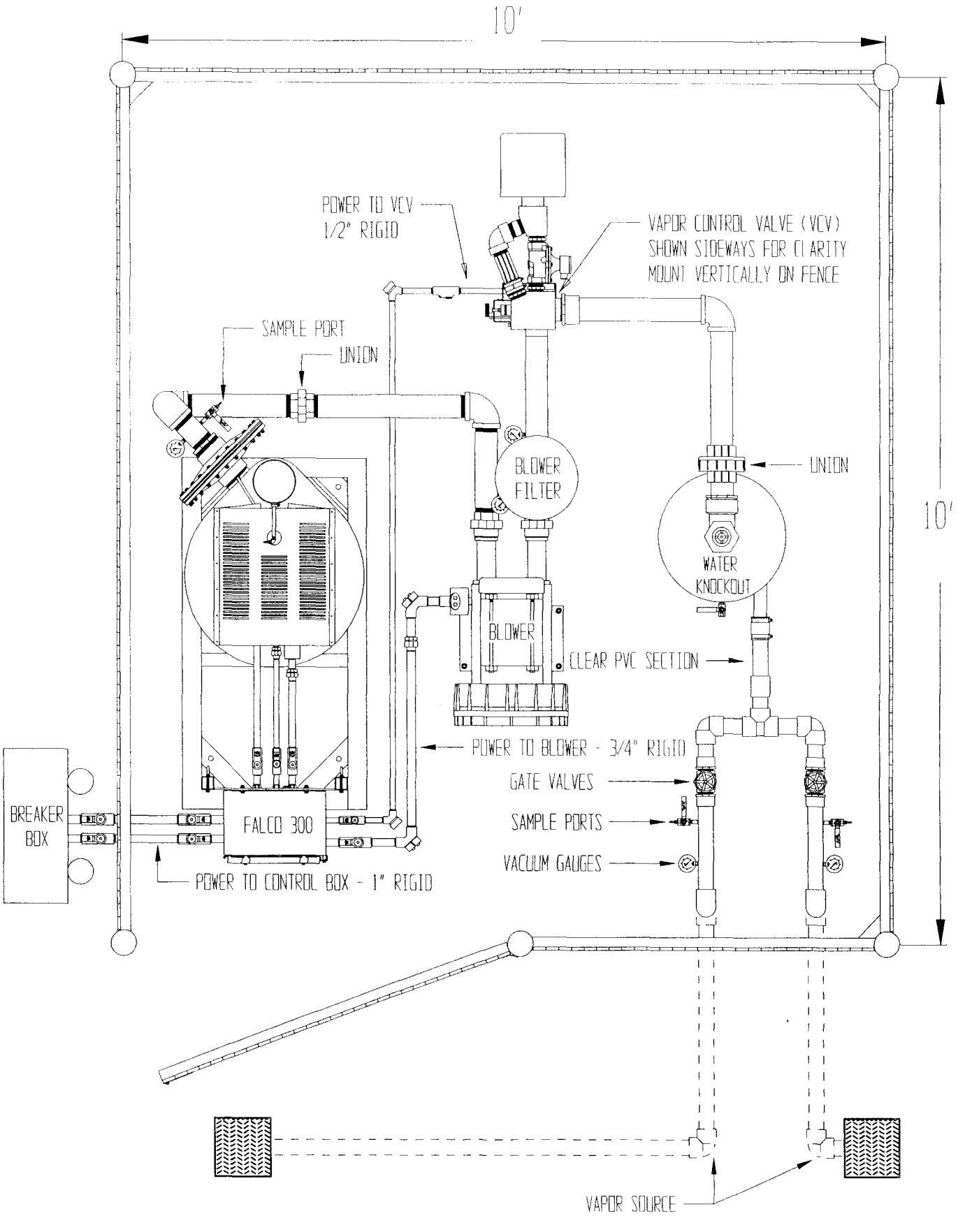



FIGURE 4
PLAN VIEW OF INSTALLATION

300 REV 8-27-02

FALMOUTH PRODUCT PO BOX 541 FALMOUTH MA 02541 PHONE 508 548 6686 FAX 508 548 8144

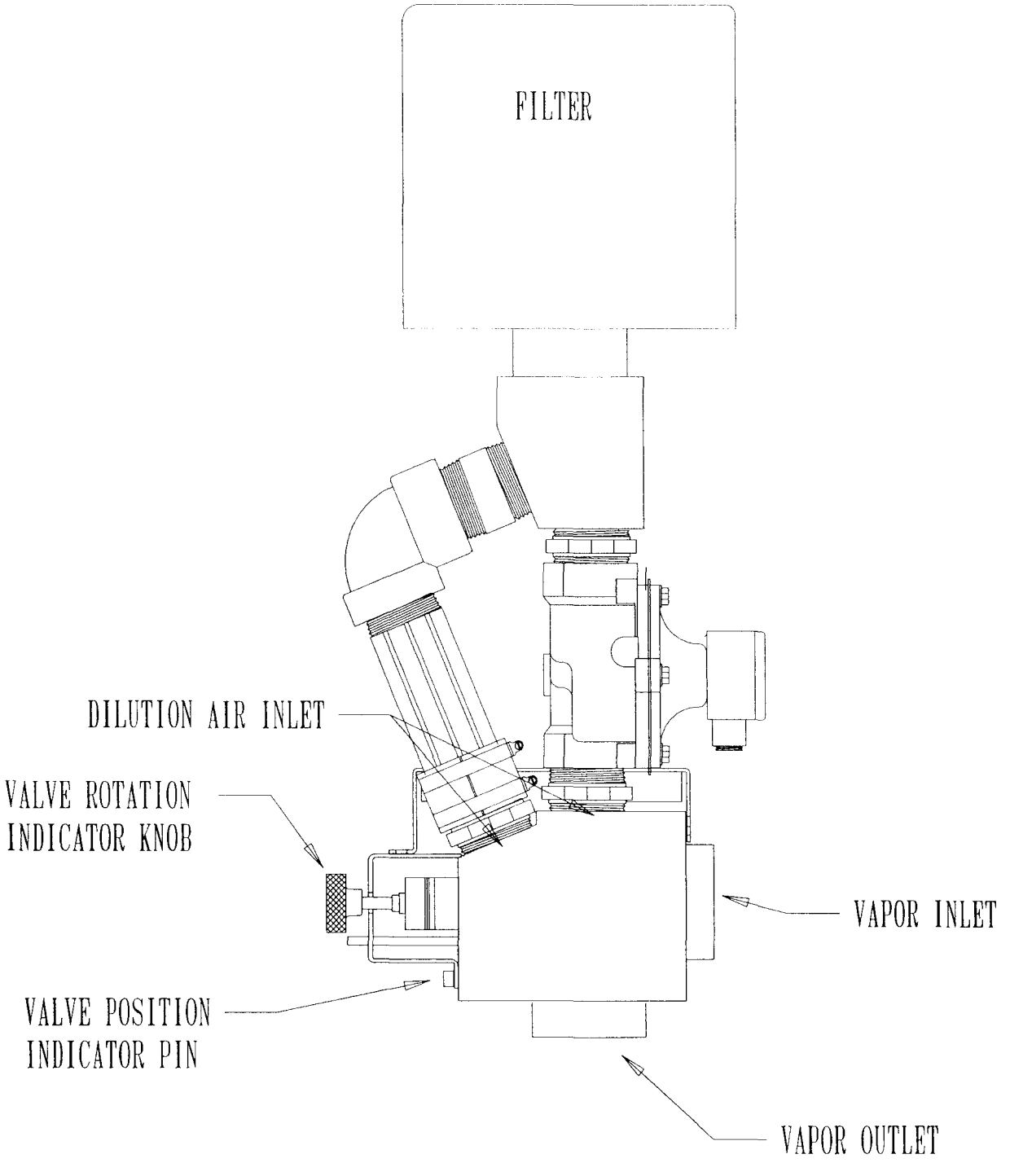
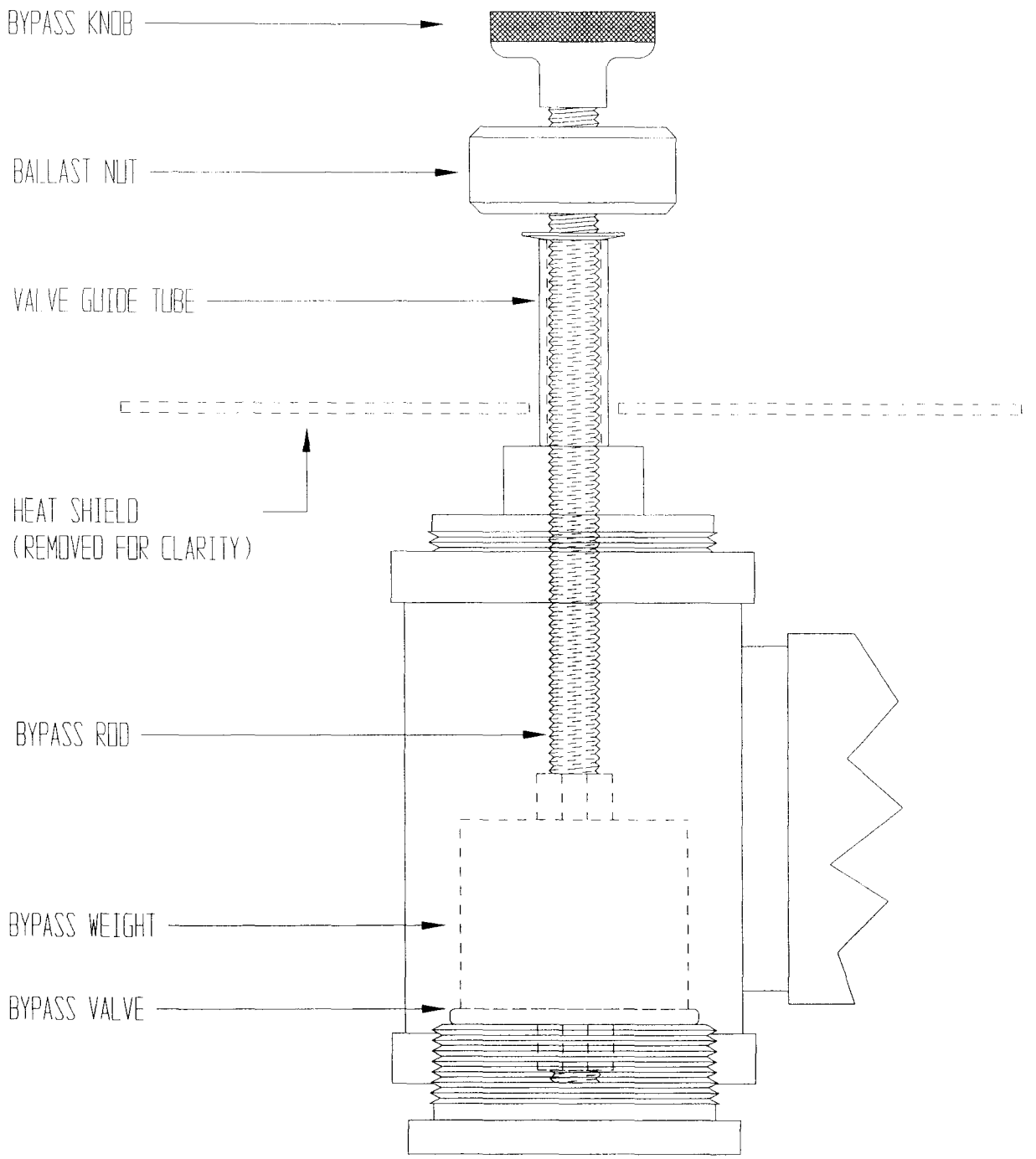



FIGURE 5
VAPOR CONTROL VALVE (VCV) SIDE VIEW

REV 8-27-02

*FALMOUTH PRODUCTS P.O. BOX 541 FALMOUTH, MA. 02541 PHONE 508 548 6686 FAX 508 548 8144*




# FIGURE 6
# BYPASS VALVE - CLOSED POSITION

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# ADJUSTMENT:

1. PUT ON GLOVES, COMPONENTS SHOULD BE ADJUSTED BY HAND AND MAY BE HOT.
2. GRASP BYPASS KNOB AND LIFT ASSEMBLY UPWARD
3. TURN BALLAST NUT CLOCKWISE BY HAND TO INCREASE BYPASS, COUNTERCLOCKWISE BY HAND TO DECREASE BYPASS. (MUST HOLD BYPASS KNOB BY HAND WHILE TURNING BALLAST NUT)
4. LOWER VALVE ASSEMBLY AND OBSERVE EFFECT OF ADJUSTMENT ON CATALYST TEMPERATURES.

# IMPORTANT:

ADJUSTMENTS, EITHER OPEN OR CLOSED, SHOULD NOT EXCEED 1/2" VALVE MOVEMENT AT A TIME. WAIT AT LEAST 15 MINUTES BETWEEN ADJUSTMENTS.

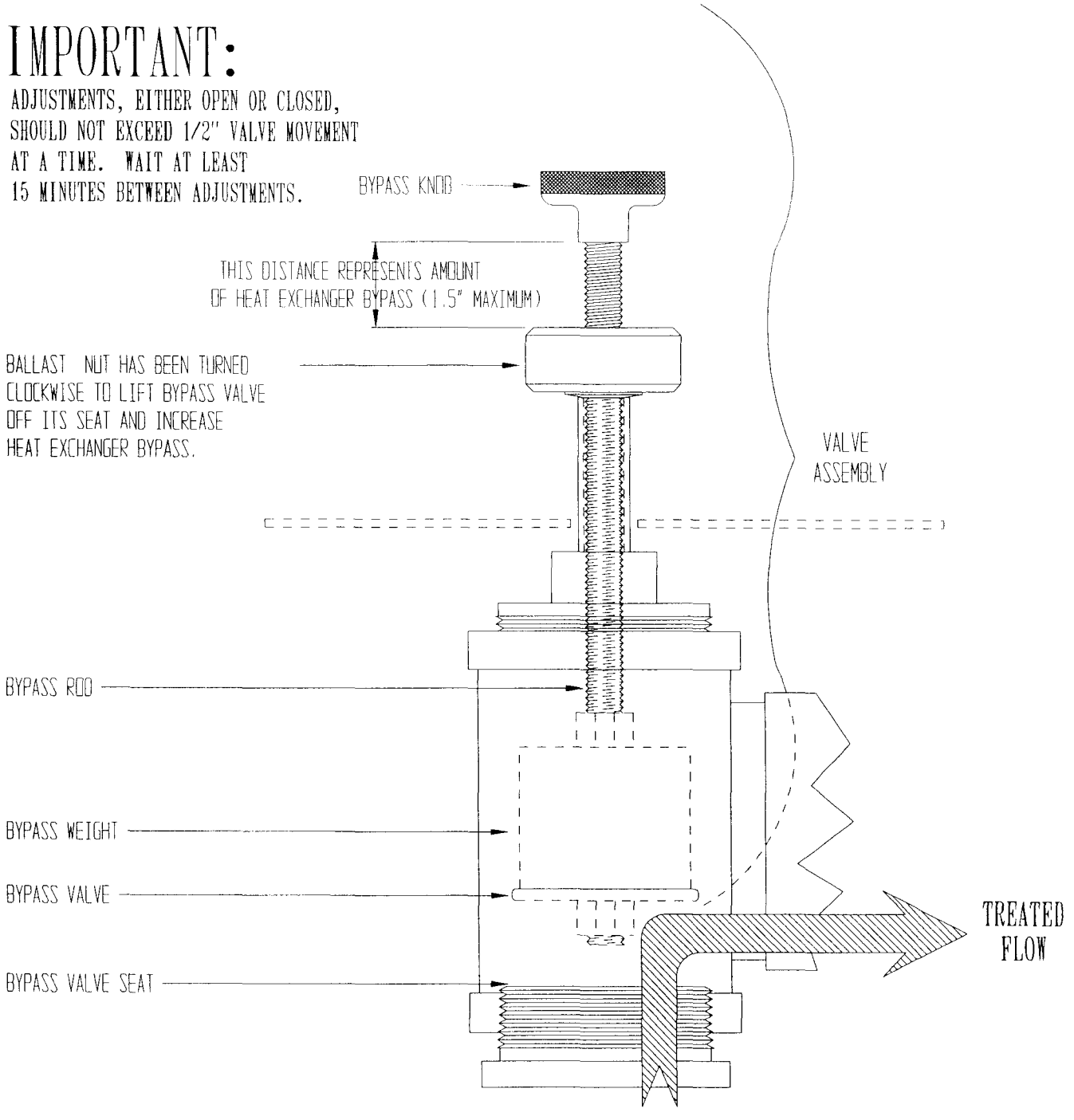


FIGURE 7
BYPASS VALVE - PARTIALLY OPEN POSITION

LAST REVISION 8-20-02

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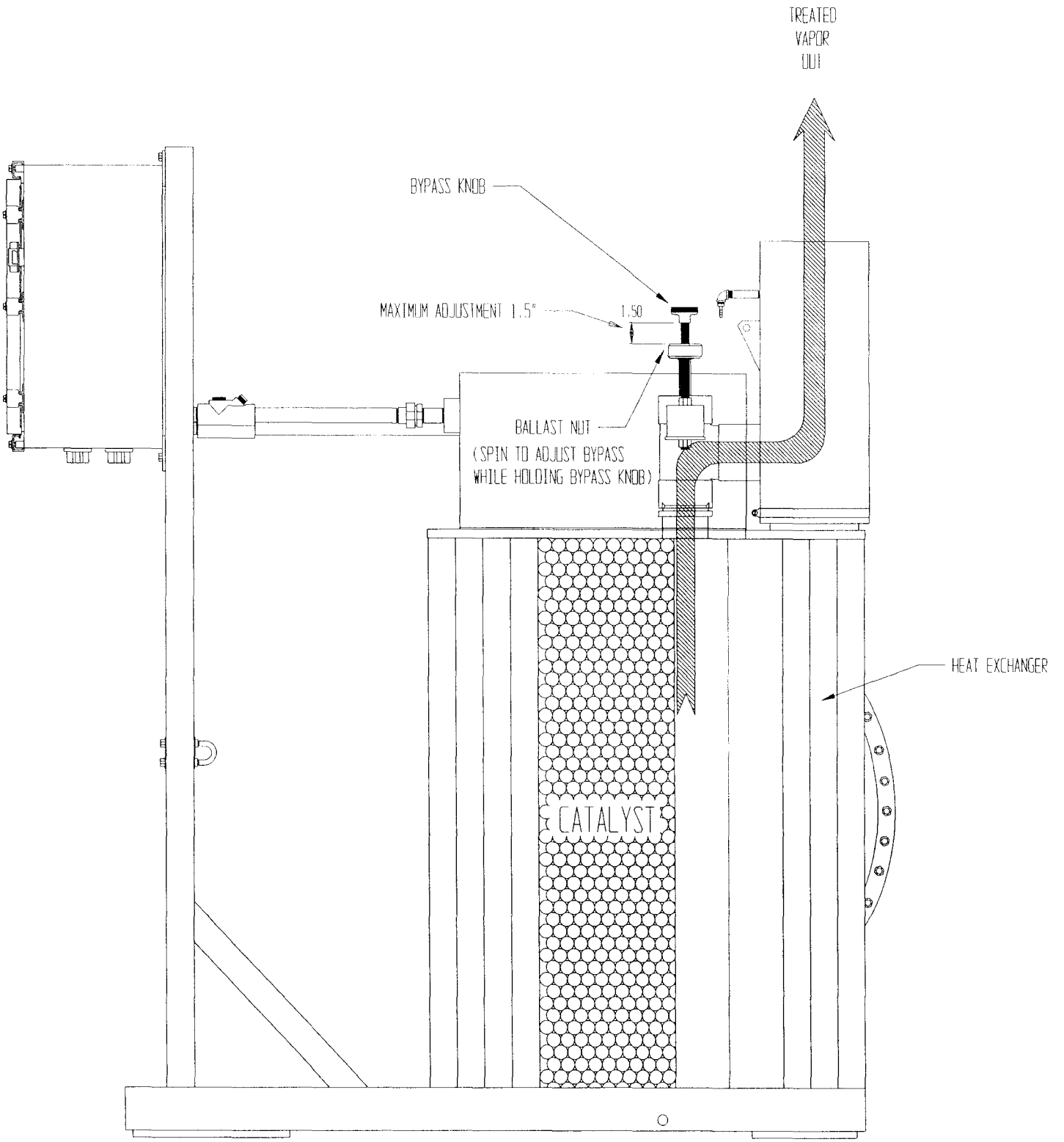


FIGURE 8
MANUAL BYPASS VALVE - OPEN POSITION

LAST REVISION 8-20-02

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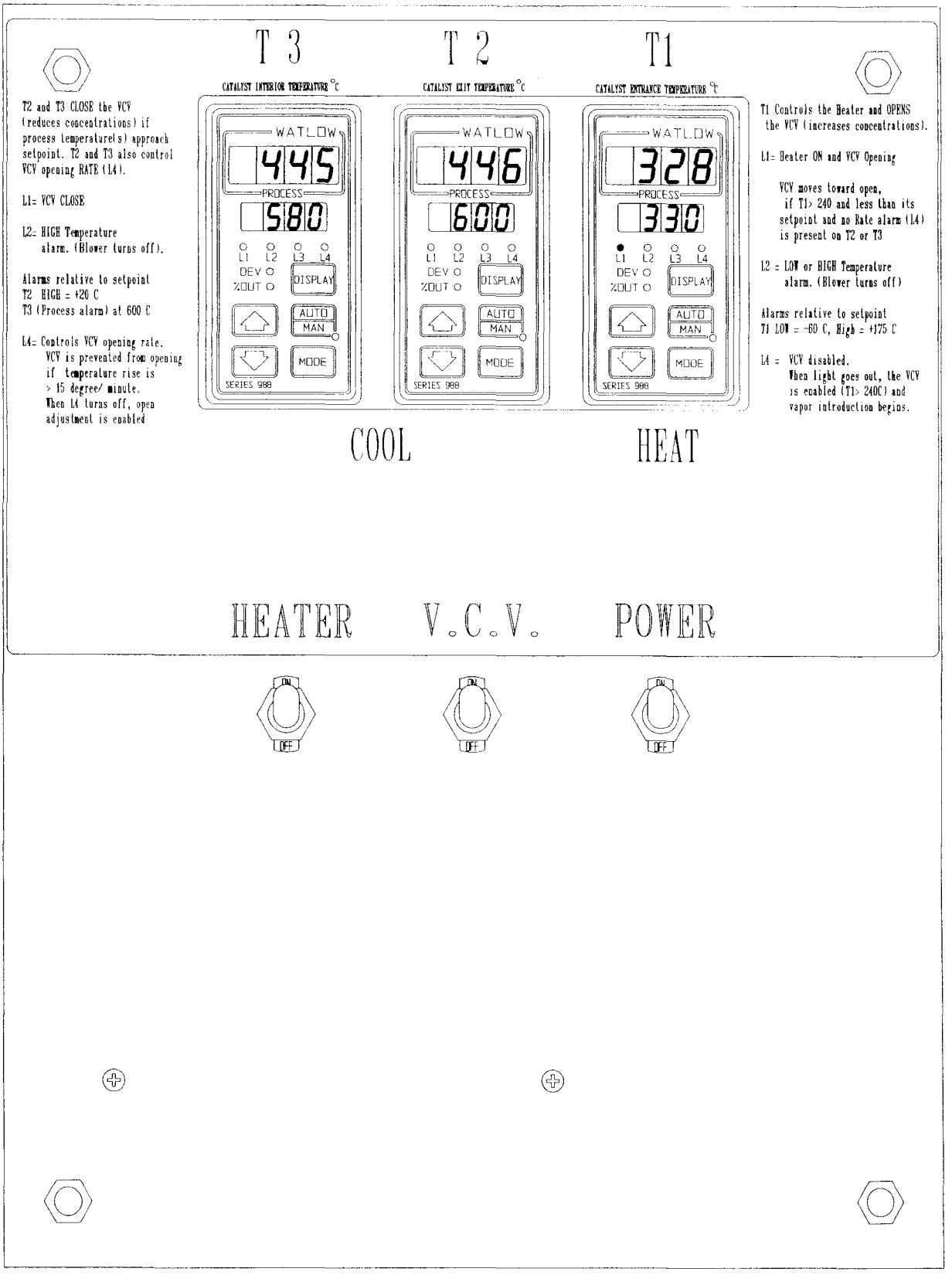


# FIGURE 9
# CONTROL PANEL

LAST REVISION 9-12-03

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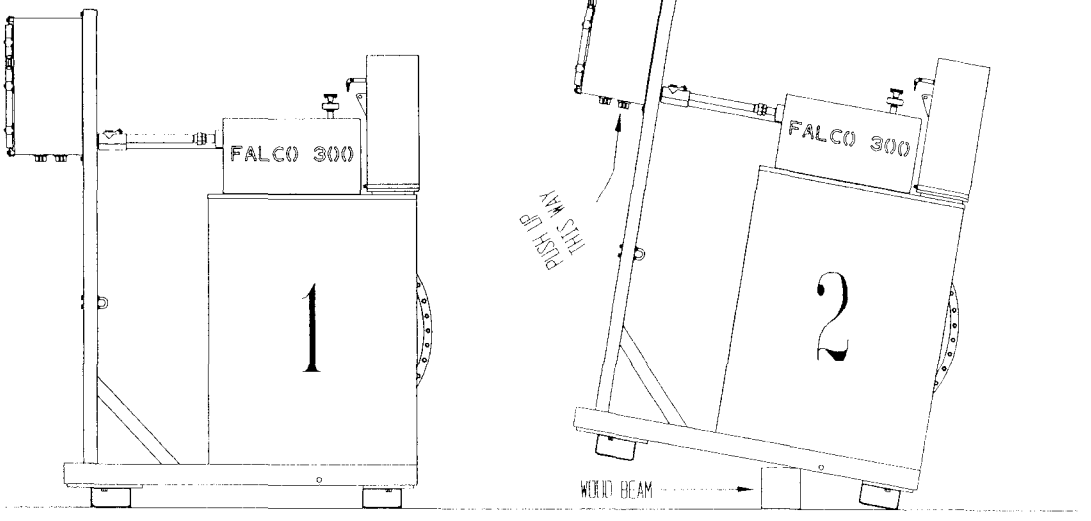
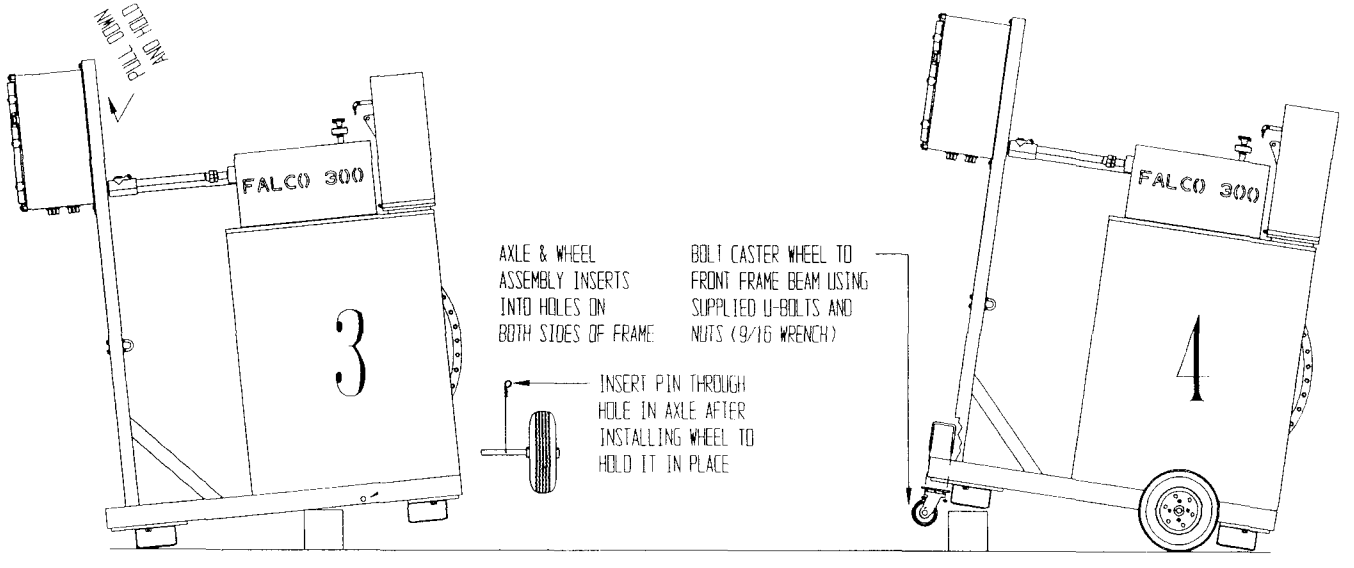
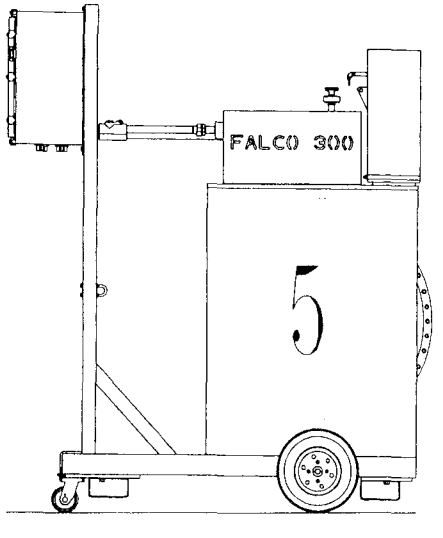


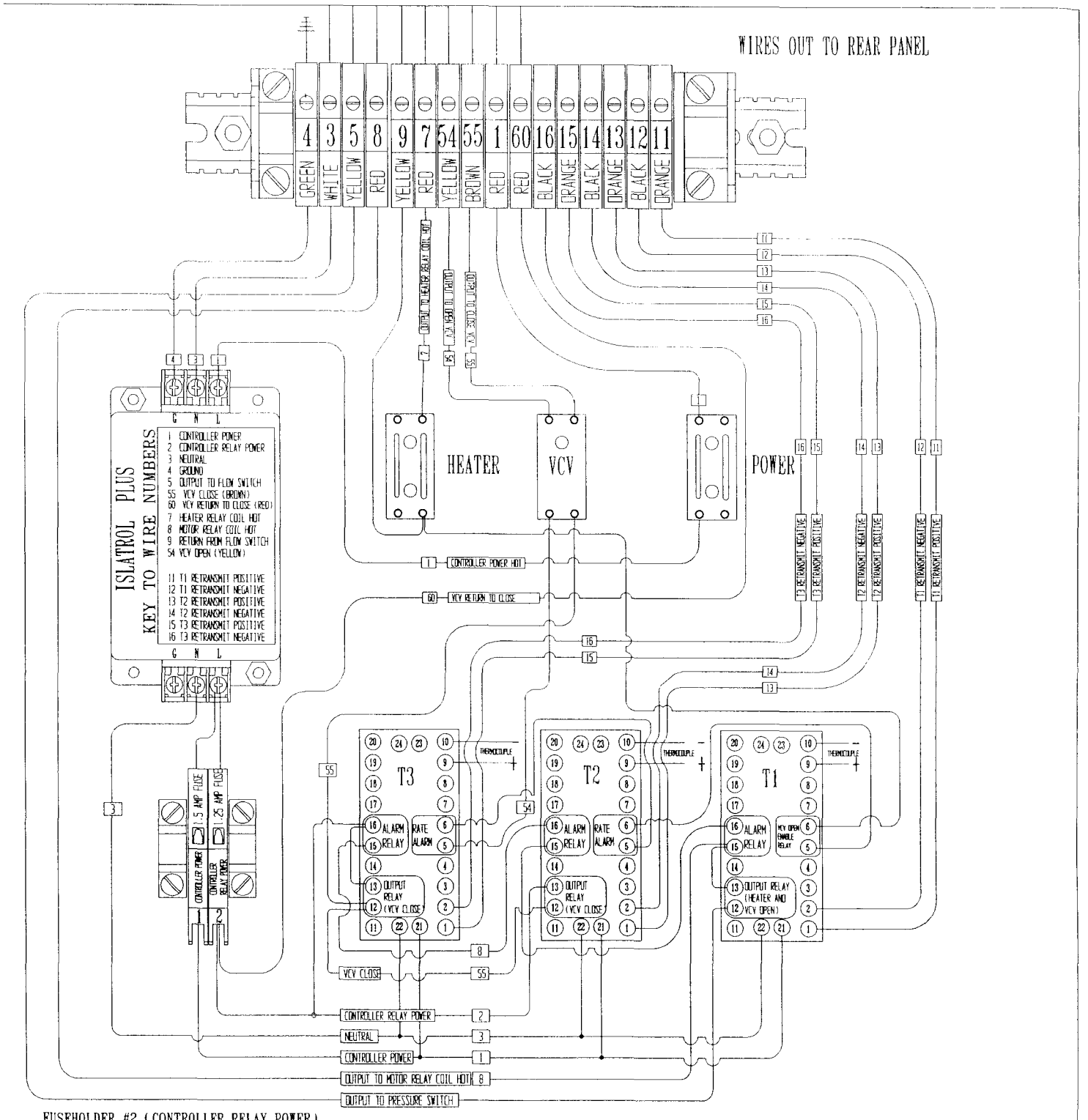




1. FALCO ON GROUND
2. PICK UP FRONT OF FALCO, AND HAVE HELPER PLACE WOODEN BEAM AS FAR BACK AS POSSIBLE UNDER FRAME.
3. PULL FRONT OF FALCO DOWN, AND HOLD. HAVE HELPER INSERT AXLES INTO HOLES IN FRAME, AND PIN IN PLACE.
4. REMOVE WOODEN BEAM, AND PLACE UNDER FRONT FORKLIFT POCKET. FASTEN CASTER WHEEL ON FRONT BEAM OF FRAME.
5. FALCO READY FOR MOVING.

FIGURE 10

FALCO 300 WHEELS FOR MOVING SHORT DISTANCES BY HAND

LAST REVISION 2-13-03




FUSEHOLDER #2 (CONTROLLER RELAY POWER)
"VERY FAST ACTING" 1.25 AMP FUSE ONLY!
(LITTELFUSE PART # 322 1.25)

# FIGURE 11 WIRING FRONT PANEL

rev 5-5-05

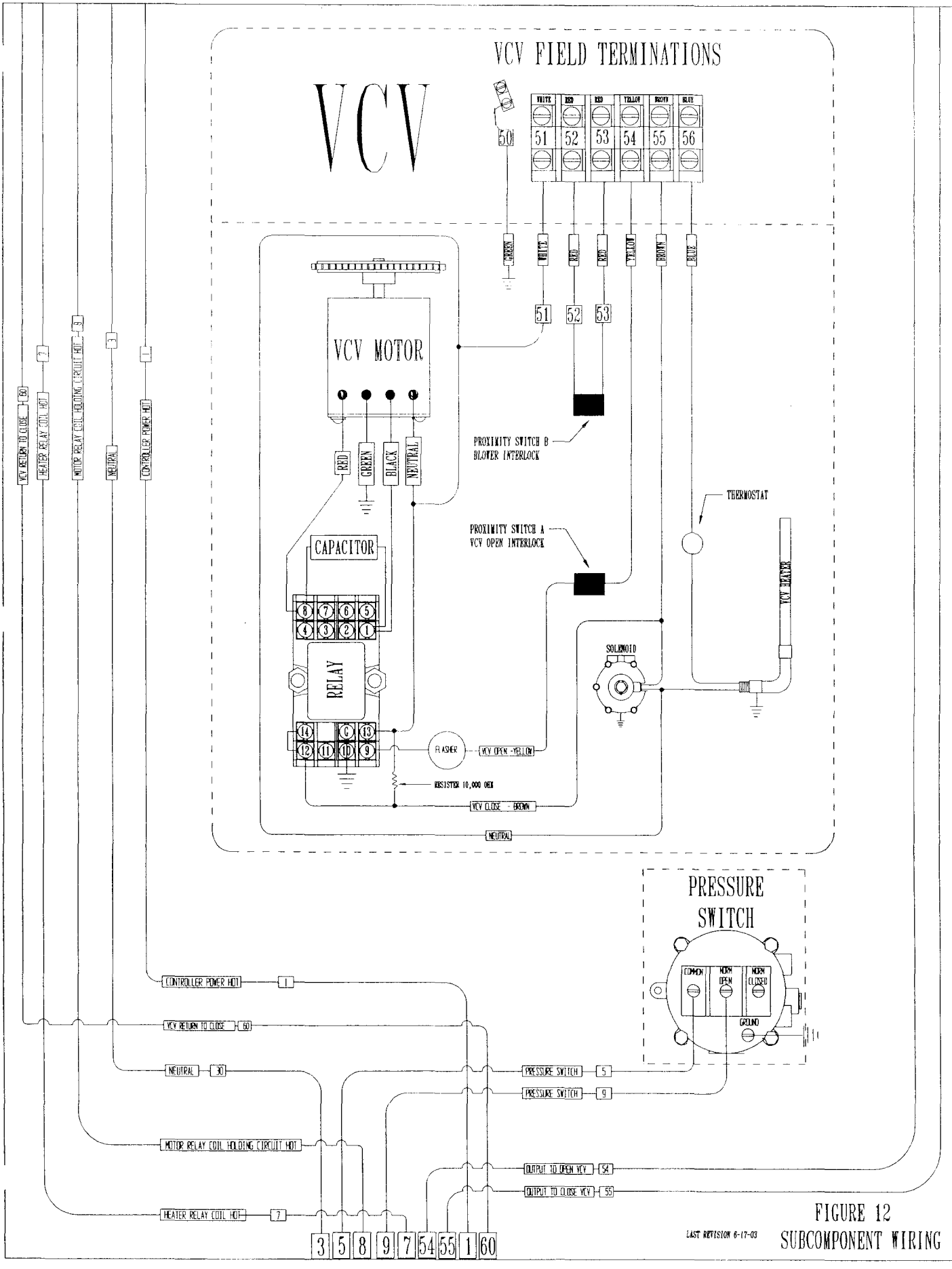
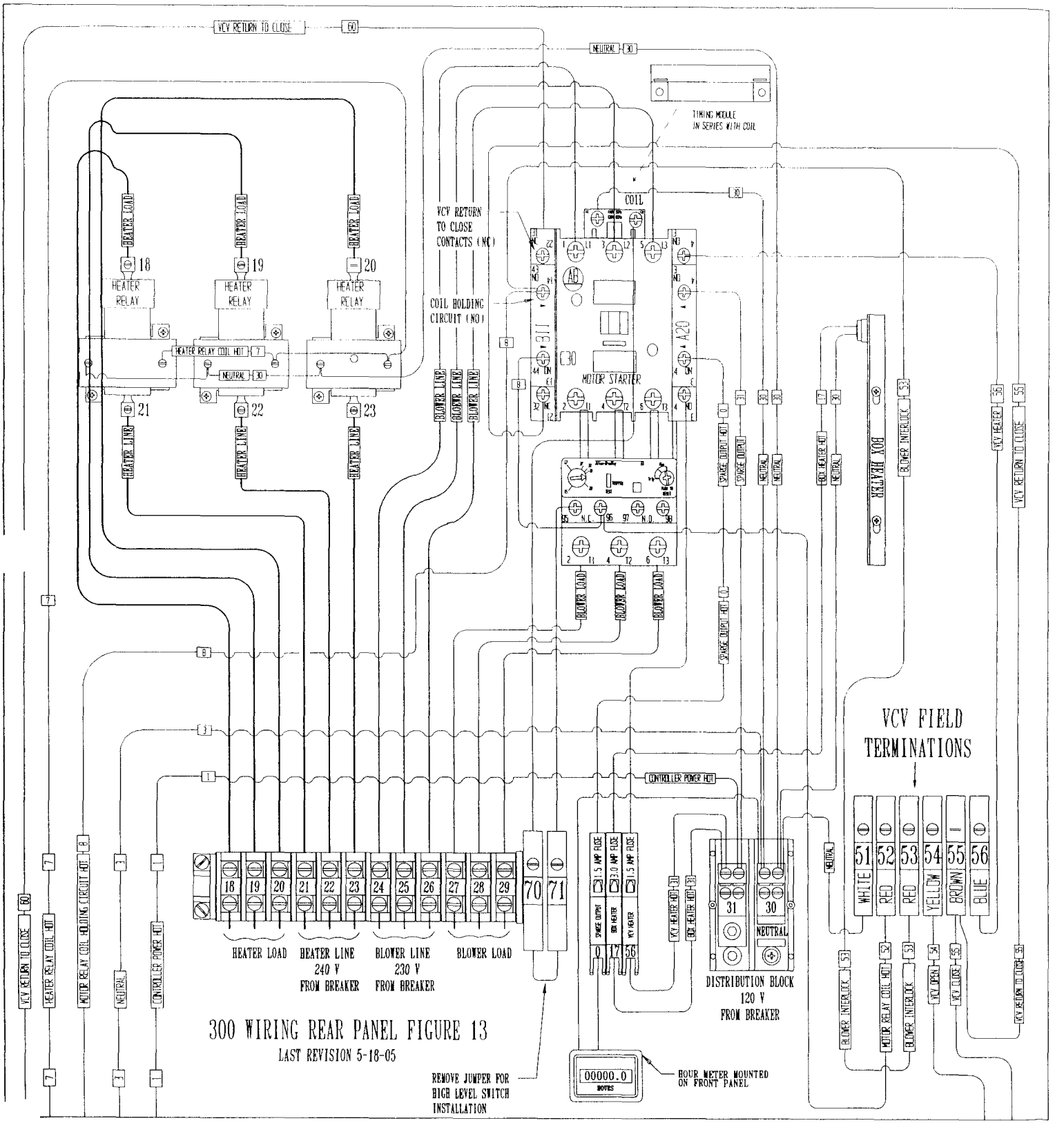



FIGURE 12
SUBCOMPONENT WIRING

LAST REVISION 6-17-03




# 300 WIRING REAR PANEL FIGURE 13

LAST REVISION 5-18-05

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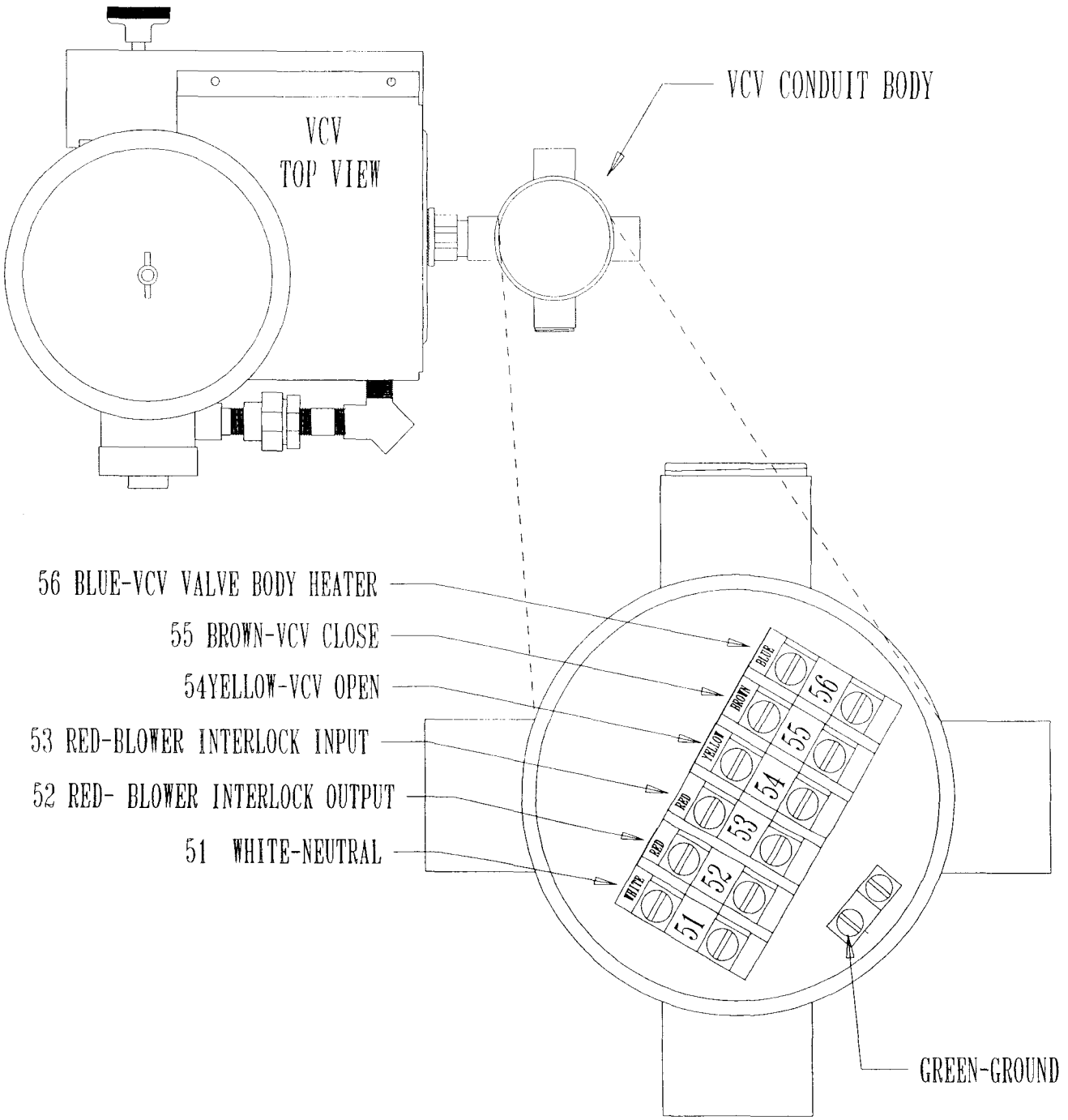
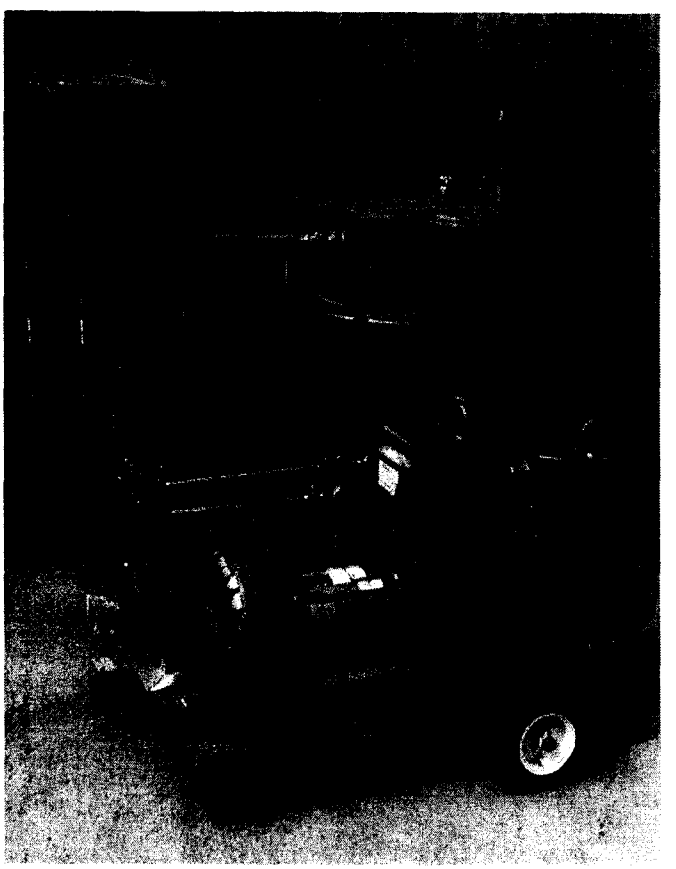



FIGURE 14 VAPOR CONTROL VALVE (VCV)
TERMINAL BLOCK-INPUT WIRING FROM FALCO CONTROL PANEL

# Falmouth Products Catalytic Oxidizer
# FALCO 300 and Optional Blower Package
## *With Vapor Control Valve (VCV)*

Installation and Operations Manual



**Technical Assistance: 800-340-8125**

FALMOUTH PRODUCTS PO BOX 541 FALMOUTH, MA PHONE 508 548 6686 FAX 508 548 8144

## TABLE OF CONTENTS

## DESCRIPTION

The blower package is factory assembled with the FALCO 300 to form an extraction and treatment system. The packaged system simplifies on site installation. (Figure 4)

The blower package includes the following components:

Aluminum mounting frame
Stainless steel forklift pockets
Mounting for Vapor Control Valve (VCV)
Vacuum relief valve
Solberg Inline filter CT-235P-3002
3" manifolding and influent sample port
Stainless steel vacuum and pressure gauges
Factory wired conduit
10 H.P. Regenerative blower (GAST model # R7100R-50)

**IMPORTANT**: For information on wiring and operation of the FALCO 300 refer to the FALCO 300 installation and operations manual.

**CAUTION: Do not start up or operate the equipment without first reading the FALCO 300 installation and operations manual.**

## TRANSPORTATION & STORAGE

The blower package weighs approximately 500 lb. When stored, it should be kept dry. When not in operation all openings should be capped to prevent moisture, and dirt from entering. The blower package and FALCO 300 weighs approximately 1,400 lb. Forklift pockets are provided for lifting. Lifting eye connections are also provided for slinging. Tires and axles may be inserted into holes on the frame for manual movement around the site.

## MOTOR STARTER AND OVERLOAD RELAY

**WARNING: Hazardous voltage can cause severe or fatal injury. This equipment must be installed and grounded by qualified personnel per the National Electric Code and local codes. Only qualified personnel should service this equipment.**

The FALCO 300 has a motor starter and overload relay inside its control box used to control the blower on the blower package. The FALCO 300 must control the blower through this starter.

The 10 hp blower package uses an Allen Bradley motor starter model # 100-C30-00
The 10 hp blower package uses an Allen Bradley overload relay model # 193-EA 1HC

If the blower motor draws too much amperage, the overload relay on the motor starter will trip and shut down power to the blower. The overload relay requires a manual reset. Turn off all power to the oxidizer. Remove the control panel retaining nuts and carefully lower the top of the control panel out of the box until it is horizontal. Do not pull on the wires. Slide the panel four inches inward so it is bearing on the bottom two studs and is face down on the foam pad. The motor starter and overload relay are located on the rear panel on the right hand side (see figure 2). The reset button is on the overload relay. Efforts should be made to discover why the overload has tripped out before resetting. (see troubleshooting section in FALCO 300 manual).

The Gast 10 hp three phase blower model # R7100R-50 can operate on 208-230 volts and has full load amperage of 26.5 amps at 208 volts and 24 amps at 230 volts. The factory overload relay setting is 27 amps. Low voltage will damage the blower.

## MAXIMUM VACUUM AND PRESSURE READINGS

The 10 H.P. Regenerative blower (GAST model # R7100R-50) has a maximum vacuum rating of 110" of $H_20$ and a maximum pressure rating of 100" of $H_20$.

**Important !** When the blower package is operating, load is determined by adding the pressure drop through the oxidizer to the vacuum reading at the blower inlet.

For example, on the 10 hp blower if there is 30" of $H_20$ pressure through the oxidizer and the vacuum reading is 80" of $H_20$, the blower has reached its maximum rating.
The FALCO 300 has approximately 23" of $H_20$ pressure drop when cold at 300 CFM.

## VACUUM RELIEF VALVE

Blower packages are equipped with a vacuum relief valve that protects the blower from exceeding maximum vacuum ratings. The vacuum relief valve is located under the VCV.
The relief valve is factory set to begin opening at approximately 60" of $H_20$, and will not ordinarily require adjustment. However, the valve may be adjusted with a 7/16" socket or nutdriver. The plastic bob at the inlet end is depressed and restrained from turning with a forefinger. The locked nut at the end of the valve stem is then rotated with the nut driver to make the adjustment. Turning the nut clockwise decreases the vacuum setting. (See figure 1)

## WATER KNOCKOUT HIGH LEVEL SWITCH INSTALLATION

Terminal blocks 70 and 71 inside the FALCO 300 control panel may be used for high-level switch installation. For installation of a high level switch (or other remote shutdown device) remove the jumper connecting block 70 to block 71 and connect the normally closed lead from the high level switch to terminal block 70 and the common lead to 71. This will shut down the blower if the hi level switch opens. (See figure 2)

## OPERATION

The FALCO 10 hp blower package is controlled by the FALCO 300 control panel and operation is covered in the FALCO 300 manual. There are, however, various items that should be checked on the blower package. (See figure 3)

**Gauges**- Monitor vacuum and pressure gauges frequently. Excess vacuum or pressure may indicate an obstruction. Inlet pressure to the oxidizer allows the operator to estimate inlet flow.
The Gast 10 H.P regenerative blower should not be operated at more than 80" of $H_20$ vacuum.

**Influent sample port**
Influent concentrations being fed into the oxidizer may be checked at the influent sample port.

**Air velocity port**
Supplied for measuring flow into the oxidizer.

**Vacuum relief valve**
The vacuum relief valve is located under the VCV. It has been factory set at 60" of $H_20$ to protect the blower. Maximum limits for the blower are calculated by adding the vacuum and pressure readings. The FALCO 300 has approximately 23" H20 pressure drop through it when cold at 300 CFM.

## MAINTENANCE

**Water knockout** WEEKLY

The blower package does not include a water knockout. Water knockouts can be purchased separately from Falmouth Products. The system should be shut down and water accumulations drained during each site visit. Do not run water into the oxidizer. Site check intervals should not exceed the time it takes to fill the water knockout, unless some provision is made to shut down the system automatically.

**Blower** WEEKLY

Remove any debris that may have accumulated on the blower cooling fan housing.

**Blower filter** MONTHLY

The filter assembly is located on the vacuum side of the blower. The blower filter has a replacement element (Solberg part # 235P). The filter is washable with mild detergent. Rinse well.

**VCV filter** EVERY 6 MONTHS

Turn the unit off before inspecting the filter. Element should be checked if the unit is operated in dusty conditions more frequently. The filter has a replacement element (Solberg part #231P). The filter is washable with mild detergent. Rinse well.

**Guages** WEEKLY

Check vacuum and pressure gauges frequently for unusual readings.
Obstructions on the vacuum or pressure sides of the blower result in high vacuum and/or pressure readings. For example: a clogged blower filter will result in high vacuum readings.
A high-pressure reading may be a result of an obstruction in the FALCO flame arrestor.

**Cold weather** WINTER

In cold climates heat tape and insulate all exposed inlet vapor lines, water knockout tank, and insulate the control box on the catalytic oxidizer. The VCV has its own heater, and it is not necessary to insulate it.

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**800-340-8125 MON-FRI, 7:00 AM-5:00 PM EST**

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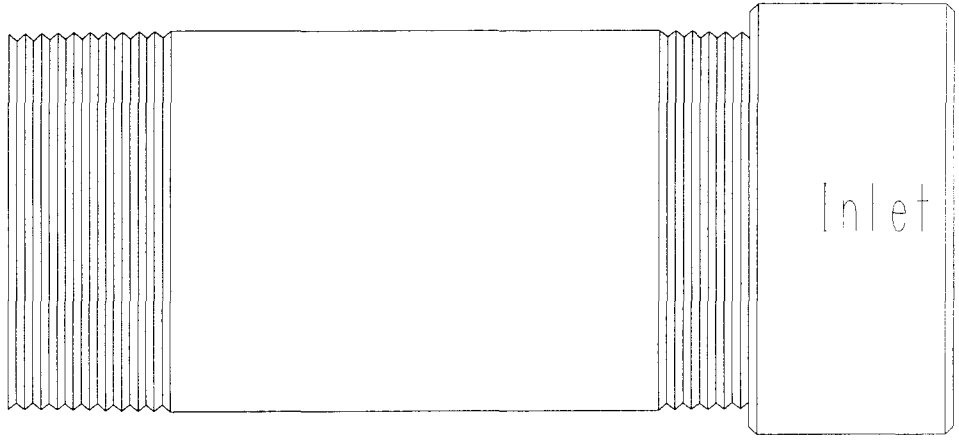


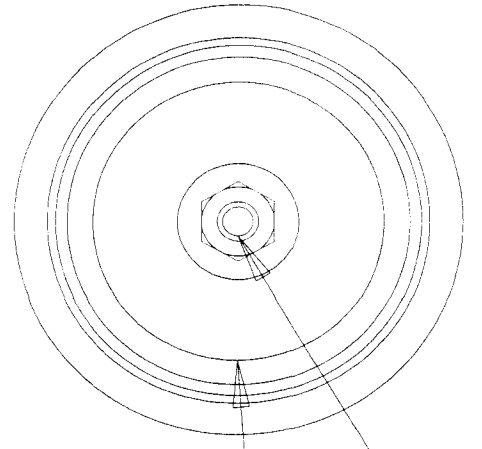


# VACUUM RELIEF VALVE ADJUSTMENT

From the inlet end--

1. Engage nut with 7/16" nut driver.
2. Hold plastic bob so it does not turn.
3. Turn nut counter-clockwise to increase vacuum setting, or turn nut clockwise to decrease setting.

FIGURE 1
VACUUM RELIEF VALVE

Rev. 3-10-03

| FALMOUTH PRODUCTS, INC. | | |
|---|---|---|
| SHEET 1 OF 1 | 530 THOMAS LANDERS ROAD<br>FALMOUTH, MA 02541 U.S.A.<br>PHONE: (508) 548-6686<br>FAX: (508) 548-8144 | |
| SIZE: A | | |
| SCALE: | | |
| DRAWING # | DRAWN BY: CC | CHECKED BY: JC |
| DESCRIPTION: FALCO 300, 10 HP BLOWER AND WATER K/O | | |
| DATE: 3-17-03 | REVISIONS: | |

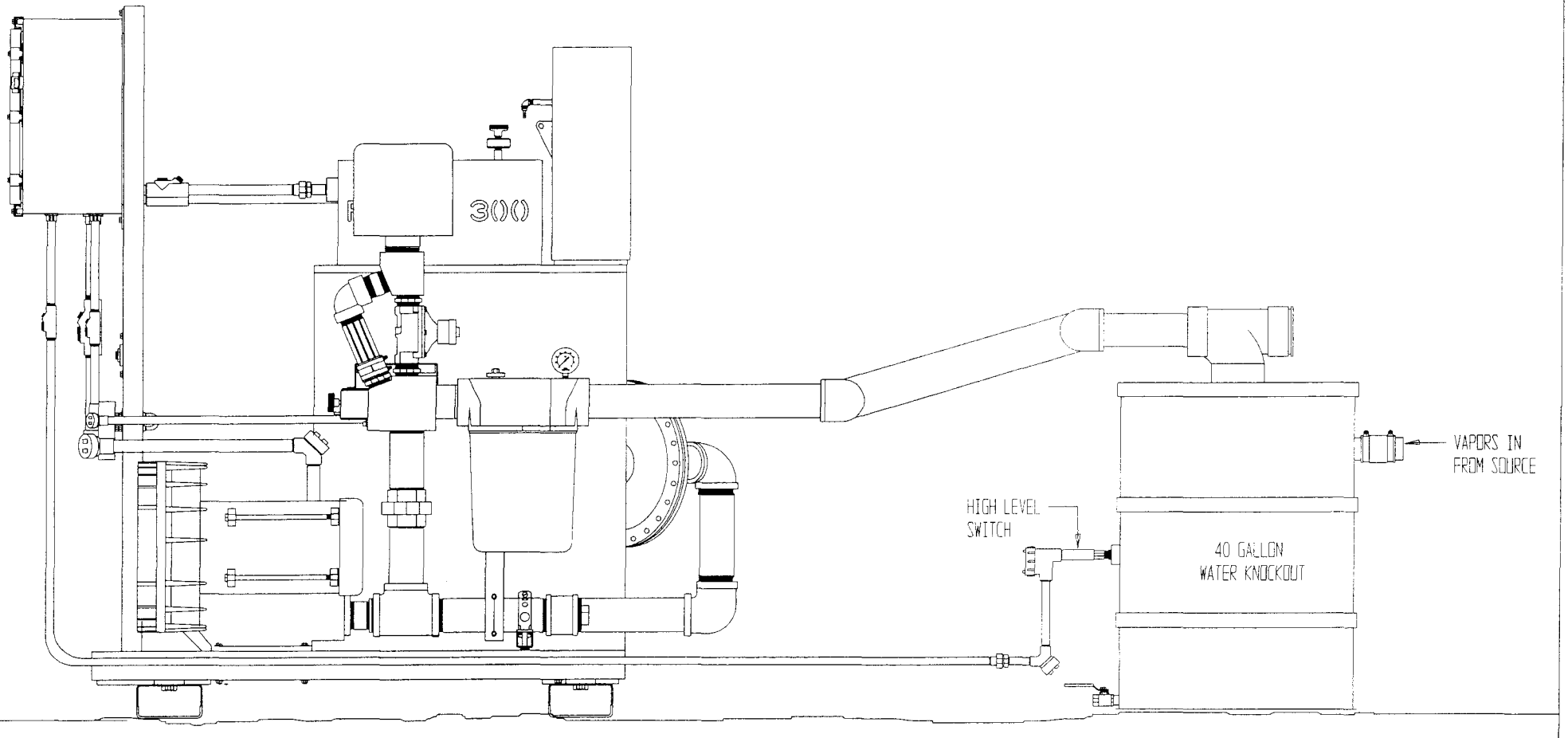


FIGURE 2 KNOCKOUT WITH HIGH LEVEL SWITCH

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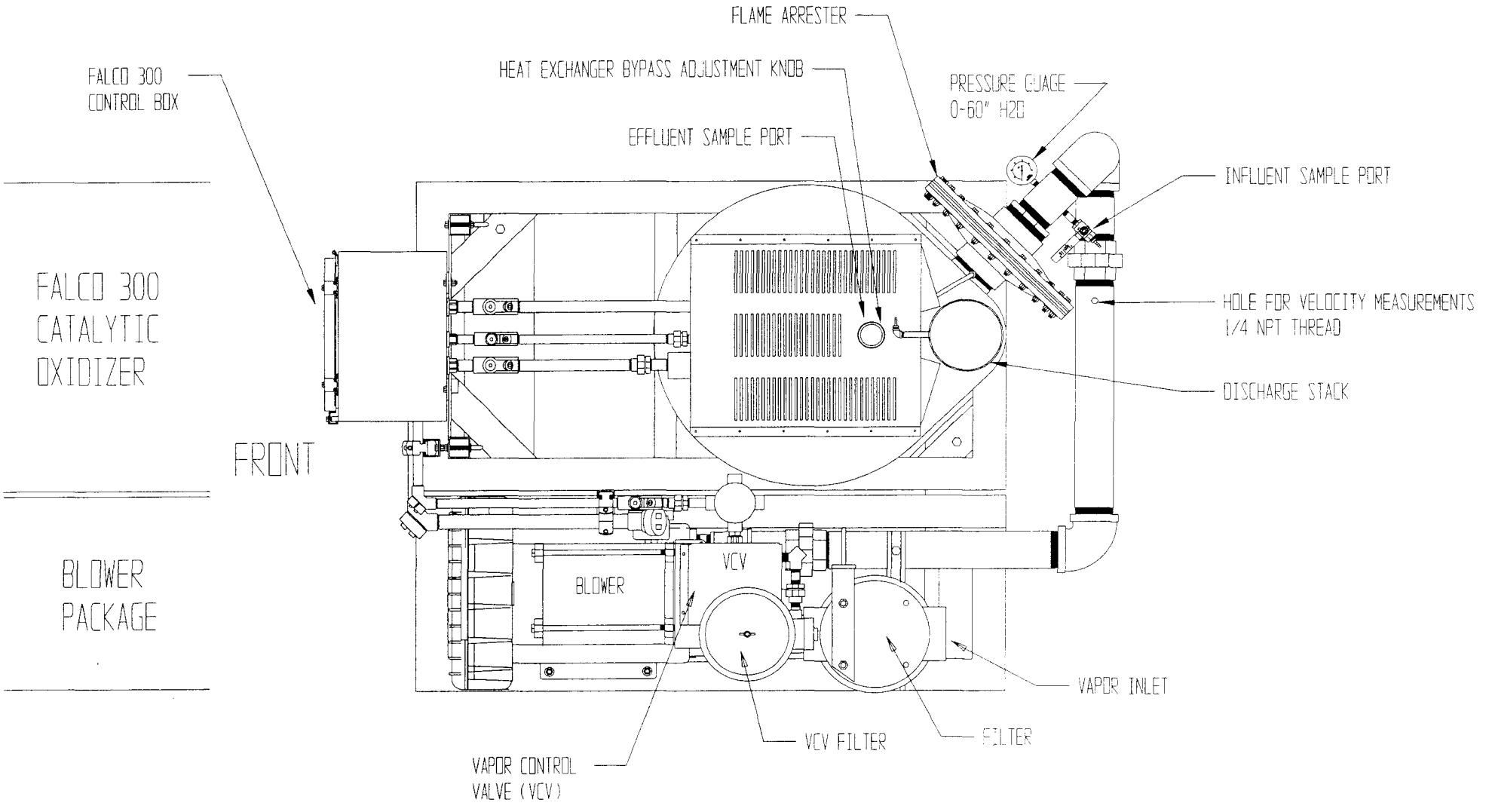


FIGURE 3
FALCO 300
WITH 10 H.P. BLOWER PACKAGE
CONTROLS FOR OPERATION

REV.3-3-03

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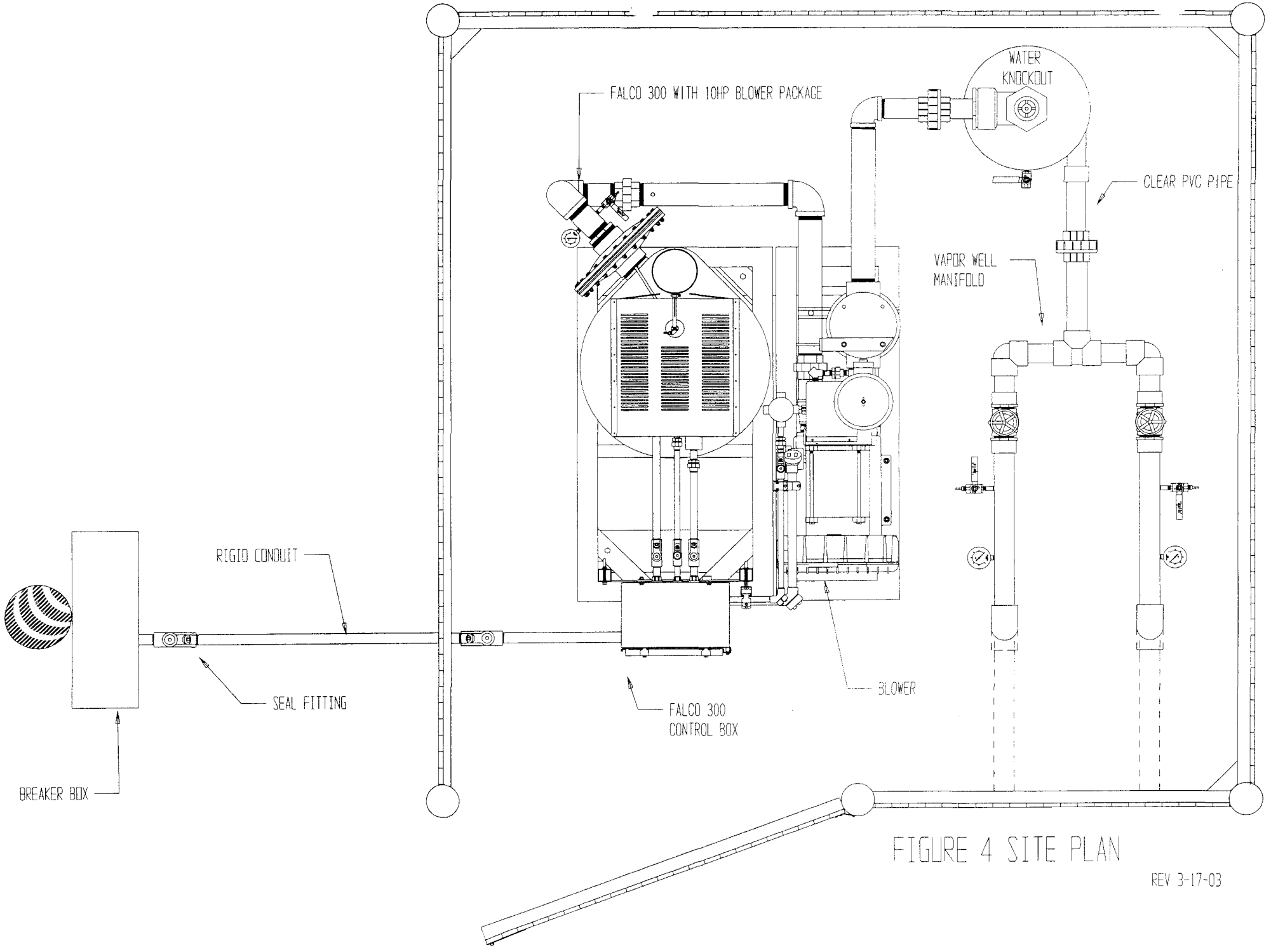


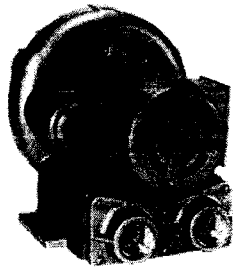

FIGURE 4 SITE PLAN

REV 3-17-03

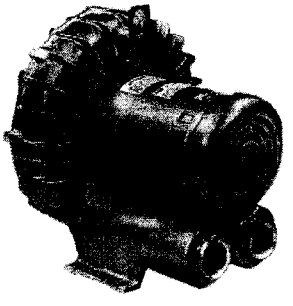
PART NO. 70 - 6000 F2-200 (REV-G)

# STANDARD REGENAIR BLOWER

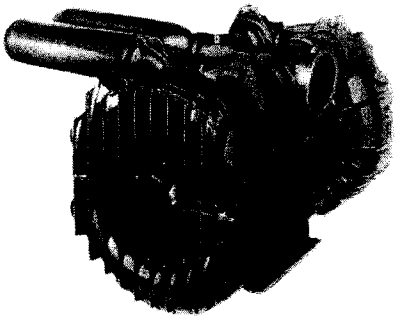
## OPERATION & MAINTENANCE MANUAL



Model R1 Shown



Model R6P350A Shown



Model R7P Shown

Thank you for purchasing this Gast product. It is manufactured to the highest standards using quality materials. Please follow all recommended maintenance, operational and safety instructions and you will receive years of trouble free service.

**IMPORTANT: PLEASE READ THIS MANUAL AND SAVE FOR FUTURE REFERENCE.**

### General information

**This manual does not apply to:**

- SDR Series blowers without motors
- Blowers powered with Explosion Proof Motors

**Product Use Criteria:**

- Pump only clean, dry air.
- Operate at 32°F - 104°F (0°C - 40°C).
- Protect unit from dirt & moisture.
- Do not pump flammable or explosive gases or use in an atmosphere that contains such gases.
- Protect all surrounding items from exhaust air. This exhaust air can become very hot.
- Corrosive gases and particulate material will damage unit. Water vapor, oil-based contaminants or other liquids must be filtered out.
- The blower must be installed with the properly sized inlet and inline filters, gauges and relief valves to protect the product from dirt and over-heating.
- Consult your Gast Distributor/Representative before using at high altitudes.

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ISO 9001 & 14001 CERTIFIED

www.gastmfg.com

**Your safety and the safety of others is extremely important.**

**We have provided many important safety messages in this manual and on your product. Always read and obey all safety messages.**

**This is the safety alert symbol. This symbol alerts you to hazards that can kill or hurt you and others. The safety alert symbol and the words "DANGER" and "WARNING" will precede all safety messages. These words mean:**

**⚠ DANGER**

**You will be killed or seriously injured if you don't follow instructions.**

**⚠ WARNING**

**You can be killed or seriously injured if you don't follow instructions.**

**All safety messages will identify the hazard, tell you how to reduce the chance of injury, and tell you what can happen if the safety instructions are not followed.**

## INSTALLATION

**⚠ WARNING**

**Electrical Shock Hazard**

**Disconnect electrical power at the circuit breaker or fuse box before installing this product.**

**Install this product where it will not come into contact with water or other liquids.**

**Install this product where it will be weather protected.**

**Electrically ground this product.**

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

**Correct installation is your responsibility.** Make sure you have the proper installation conditions and that installation clearances do not block air flow.

**Blocking air flow over the product in any way can cause the product to overheat.**

**The blower must be installed with the properly sized inlet filter, gauge and relief valve to protect the product from dirt and over-heating.**

### Mounting

The single impeller blower should be oriented with the shaft in a horizontal position, unless the model's product features state otherwise. The dual impeller models must be mounted with the shaft in a horizontal position. Mounting the product to a stable, rigid operating surface and using shock mounts will reduce noise and vibration.

### Rotation

From the motor side of the blower, check that the blower is rotating clockwise. (The motor side is marked with an arrow on most models.) Proper rotation can also be checked by the air flow at the IN and OUT ports. On blowers powered by a 3-phase motor, incorrectly connecting any two power lines can reverse direction.

### Plumbing

**Remove any foreign material (burrs, chips, welding drops, slag, pipe cuttings, excess sealant, sand or lime) from plumbing.**

Check motor mounting and rotation before connecting to plumbing. Inlet and outlet ports are not designed to support plumbing.

Remove plugs from the IN and OUT ports. Use a small amount of pipe thread lubricant when connecting plumbing to protect the aluminum blower threads. Connect with pipe and fittings that are the same size or larger than the product's threaded ports. When installing two blowers in parallel, use plumbing that is two whole pipe sizes larger in diameter than that of the blower. Be sure to connect the intake and exhaust plumbing to the correct inlet and outlet ports.

Plumbing to remove the hot discharge air of larger blowers may be required to help maintain proper room ambient temperature. Use a relief valve to discharge excess air into the atmosphere. If the blower will be operated at 125mbar (50" $H_2O$) or higher, metal pipe is required for hot exhaust air.

### Accessories

Install two vacuum gauges, one before and one after filter, to monitor restriction through filters. As filters become clogged, performance efficiency will be reduced. Filters should be checked periodically and replaced when necessary. See page 7 for installation.

Install a relief valve to avoid changes in pressure or vacuum that can cause overloading of large blowers. Install an intake filter with a relief valve to prevent foreign material from entering blower if blower is used in a vacuum application in a dirty environment. In applications where there is high humidity or liquids being used in the process, install a moisture separator.

See Recommended Accessories on pages 7-9 or consult your Gast Distributor/Representative for additional filter and accessories recommendations. Do Not install check valves that close with a strong spring. The recommended check valves (page 7) provide minimal pressure drop, positive sealing and are resistant to the high discharge temperatures of large blowers.

### Motor Control

**It is your responsibility to contact a qualified electrician and assure that the electrical installation is adequate and in conformance with all national and local codes and ordinances.**

Select fuses, motor protective switches or thermal protective switches to provide protection. Fuses act as short circuit protection for the motor, not as protection against overload. Incoming line fuses must be able to withstand the motor's starting current. Motor starters with thermal magnetic overload or circuit breakers protect motor from overload or reduced voltage conditions. Motors without automatic restart require thermal protection or magnetic over-current cutout to prevent motor overloading from one phase in a 3-phase circuit, high starting frequency or jammed blower.

The power required will rise as differential pressure increases. The wiring diagram attached to the product or on page 6 of this manual provides required electrical information. Large motors have two diagrams, one for 50Hz wiring specifications and the other for 60Hz wiring specifications. Check that the power source is correct to properly operate the dual-voltage motor. If additional information is required, please consult your Gast Distributor/Representative.

## Electrical Connection

**⚠ WARNING**

**Electrical Shock Hazard**

**This product must be properly grounded.**

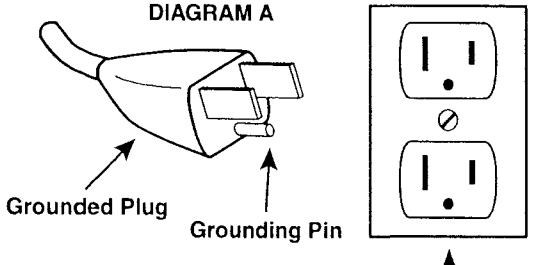
**Do not modify the plug provided. If it will not fit the outlet, have the proper outlet installed by a qualified electrician.**

**If repair or replacement of the cord or plug is necessary, do not connect the grounding wire to either flat blade terminal. The wire with insulation that is green or green with yellow stripes is the grounding wire.**

**Check the condition of the power supply wiring. Do not permanently connect this product to wiring that is not in good condition or is inadequate for the requirements of this product.**

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

DIAGRAM A




120-volt grounded connectors shown. 220/240-volt grounded connectors will differ in shape.

**Model with a power supply cord:**
This product must be grounded. For either 120-volt or 220/240-volt circuits connect power supply cord grounding plug to a matching grounded outlet. **Do not use an adapter.** (See DIAGRAM A)

In the event of an electrical short circuit, grounding reduces the risk of electric shock by providing an escape wire for the electric current. This product may be equipped with a power supply cord having a grounding wire with an appropriate grounding plug. The plug must be plugged into an outlet that is properly installed and grounded in accordance with all local codes and ordinances.

**Check with a qualified electrician or serviceman if the grounding instructions are not completely understood, or if you are not sure whether the product is properly grounded. Do not modify the plug provided. If it will not fit the outlet, have the proper outlet installed by a qualified electrician.**

**Model that is permanently wired:**
This product must be connected to a grounded, metallic, permanent wiring system, or an equipment grounding terminal or lead on the product.

Power supply wiring must conform to all required safety codes and be installed by a qualified person. Check that supply voltage agrees with that listed on product nameplate.

**Extension cords:**
Use only a 3-wire extension cord that has a 3-blade grounding plug. Connect extension cord plug to a matching 3-slot receptacle. **Do not use an adapter.** Make sure your extension cord is in good condition. Check that the gage wire of the extension cord is the correct size wire to carry the current this product will draw.

An undersized cord is a potential fire hazard, and will cause a drop in line voltage resulting in loss of power causing the product to overheat. The following table indicates the correct size cord for length required and the ampere rating listed on the product nameplate. **If in doubt, use the next heavier gage cord. The smaller the gage number, the heavier the wire gage.**

**Minimum gage for extension cords**

| Amps | Volts | Length of cord in feet | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 120v | 25 | 50 | 100 | 150 | 200 | 250 | 300 | 400 | 500 |
| | 240v | 50 | 100 | 200 | 300 | 400 | 500 | 600 | 800 | 1000 |
| 0-2 | | 18 | 18 | 18 | 16 | 16 | 14 | 14 | 12 | 12 |
| 2-3 | | 18 | 18 | 16 | 14 | 14 | 12 | 12 | 10 | 10 |
| 3-4 | | 18 | 18 | 16 | 14 | 12 | 12 | 10 | 10 | 8 |
| 4-5 | | 18 | 18 | 14 | 12 | 12 | 10 | 10 | 8 | 8 |
| 5-6 | | 18 | 16 | 14 | 12 | 10 | 10 | 8 | 8 | 8 |
| 6-8 | | 18 | 16 | 12 | 10 | 10 | 8 | 6 | 6 | 6 |
| 8-10 | | 18 | 14 | 12 | 10 | 8 | 8 | 6 | 6 | 4 |
| 10-12 | | 16 | 14 | 10 | 8 | 8 | 6 | 6 | 4 | 4 |
| 12-14 | | 16 | 12 | 10 | 8 | 6 | 6 | 6 | 4 | 2 |
| 14-16 | | 16 | 12 | 10 | 8 | 6 | 6 | 4 | 4 | 2 |
| 16-18 | | 14 | 12 | 8 | 8 | 6 | 4 | 4 | 2 | 2 |
| 18-20 | | 14 | 12 | 8 | 6 | 6 | 4 | 4 | 2 | 2 |

## OPERATION

### ⚠ WARNING

**Injury Hazard**

**Install proper safety guards as needed to prevent any close contact with blower suction area.**

**Keep fingers and objects away from openings and rotating parts.**

**Product surfaces become very hot during operation, allow product surfaces to cool before handling.**

**Air stream from product may contain solid or liquid material that can result in eye or skin damage, wear proper eye protection.**

**Wear hearing protection. Sound level from some models may exceed 85 dBA.**

**Failure to follow these instructions can result in burns, eye injury or other serious injury.**

**It is your responsibility to operate this product at recommended pressures or vacuum duties and room ambient temperatures. Do not operate R4P or larger size blowers without air flowing through the blower. Do not throttle discharge or suction pipe to reducer capacity. Throttle will increase differential pressure causing increasing power absorption and working temperatures.**

### Start Up

Operate blower for an hour and then check:

1. **Ambient temperature** – Check room and discharge air temperatures. Increased room temperatures may require stronger ventilation especially for larger blowers. Exhaust air should not exceed 215°F (102°C) for all blowers less than 3.5 Hp. Exhaust air should not exceed 275°F (135°C) for all blowers above 3.5 Hp.
2. **Working pressure and vacuum values** – Adjust relief valve pressure or vacuum setting, if needed.
3. **Motor current** – Check that supply current matches recommended current rating on product nameplate.
4. **Electrical overload cutout** – Check that current matches rating on product nameplate.

If motor fails to start or slows down significantly under load, shut off and disconnect from power supply. Check that the voltage is correct for motor and that motor is turning in the proper direction.

## MAINTENANCE

### ⚠ WARNING

**Electrical Shock Hazard**

**Disconnect electrical power supply cord before performing maintenance on this product.**

**If product is hard wired into system, disconnect electrical power at the circuit breaker or fuse box before performing maintenance on this product.**

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

### ⚠ WARNING

**Injury Hazard**

**Product surfaces become very hot during operation, allow product surfaces to cool before handling.**

**Air stream from product may contain solid or liquid material that can result in eye or skin damage, wear proper eye protection.**

**Failure to follow these instructions can result in burns, eye injury or other serious injury.**

**It is your responsibility to regularly inspect and make necessary repairs to this product in order to maintain proper operation. Make sure that pressure and vacuum is released from product before starting maintenance.**

Check filter elements and noise absorbing foam used in mufflers and clean motor and blower after first 500 hours of operation. Replace filter elements and determine how frequently mufflers should be checked during future operation. This one procedure will help assure the product's performance and service life.

When there is an increase in the differential pressure across the inlet filter it is beginning to clog with dirt. Replace the cartridge when the filter will not come clean.

Small motor bearings (less than 5.5 Hp) never need to be greased. Larger motor bearings (greater than 5.5 Hp) have alemite grease fittings. Use a grease gun and apply one or two strokes of Exxon POLYREX® grease to the fittings to lubricate larger motor bearings.

| Hours of Service Per Year | Relubrication Intervals |
|---|---|
| 5,000 | 3 years |
| Continual Normal Service | 1 year |
| Seasonal Service (motor idle for 6 months or more) | 1 year at beginning of season |
| Continuous-high ambients, dirty or moist applications | 6 months |

**Check that all external accessories such as relief valves and gauges are not damaged before re-operating product.**

## WARRANTY

Gast finished products, when properly installed and operated under normal conditions of use, are warranted by Gast to be free from defects in material and workmanship for a period of twelve (12) months from the date of purchase from Gast or an authorized Gast Representative or Distributor. In order to obtain performance under this warranty, the buyer must promptly (in no event later than thirty (30) days after discovery of the defect) give written notice of the defect to Gast Manufacturing Incorporated, PO Box 97, Benton Harbor Michigan USA 49023-0097 or an authorized Service Center (unless specifically agreed upon in writing signed by both parties or specified in writing as part of a Gast OEM Quotation). Buyer is responsible for freight charges both to and from Gast in all cases.

This warranty does not apply to electric motors, electrical controls, and gasoline engines not supplied by Gast. Gast's warranties also do not extend to any goods or parts which have been subjected to misuse, lack of maintenance, neglect, damage by accident or transit damage.

THIS EXPRESS WARRANTY EXCLUDES ALL OTHER WARRANTIES OR REPRESENTATIONS EXPRESSED OR IMPLIED BY ANY LITERATURE, DATA, OR PERSON. GAST'S MAXIMUM LIABILITY UNDER THIS EXCLUSIVE REMEDY SHALL NEVER EXCEED THE COST OF THE SUBJECT PRODUCT AND GAST RESERVES THE RIGHT, AT ITS SOLE DISCRETION, TO REFUND THE PURCHASE PRICE IN LIEU OF REPAIR OR REPLACEMENT.

GAST WILL NOT BE RESPONSIBLE OR LIABLE FOR INDIRECT OR CONSEQUENTIAL DAMAGES OF ANY KIND, however arising, including but not limited to those for use of any products, loss of time, inconvenience, lost profit, labor charges, or other incidental or consequential damages with respect to persons, business, or property, whether as a result of breach of warranty, negligence or otherwise. Notwithstanding any other provision of this warranty, BUYER'S REMEDY AGAINST GAST FOR GOODS SUPPLIED OR FOR NON-DELIVERED GOODS OR FAILURE TO FURNISH GOODS, WHETHER OR NOT BASED ON NEGLIGENCE, STRICT LIABILITY OR BREACH OF EXPRESS OR IMPLIED WARRANTY IS LIMITED SOLELY, AT GAST'S OPTION, TO REPLACEMENT OF OR CURE OF SUCH NONCONFORMING OR NON-DELIVERED GOODS OR RETURN OF THE PURCHASE PRICE FOR SUCH GOODS AND IN NO EVENT SHALL EXCEED THE PRICE OR CHARGE FOR SUCH GOODS. GAST EXPRESSLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE WITH RESPECT TO THE GOODS SOLD. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTIONS SET FORTH IN THIS WARRANTY, notwithstanding any knowledge of Gast regarding the use or uses intended to be made of goods, proposed changes or additions to goods, or any assistance or suggestions that may have been made by Gast personnel.

Unauthorized extensions of warranties by the customer shall remain the customer's responsibility.

CUSTOMER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF GAST PRODUCTS FOR CUSTOMER'S USE OR RESALE, OR FOR INCORPORATING THEM INTO OBJECTS OR APPLICATIONS WHICH CUSTOMER DESIGNS, ASSEMBLES, CONSTRUCTS OR MANUFACTURES.

This warranty can be modified only by authorized Gast personnel by signing a specific, written description of any modifications.

## ELECTRICAL WIRING DIAGRAMS

**Models**
R1102, R2103, R2105, R3105-1, R3105-12, R4110-2, R4P115, R5125-2, R6125-2

| Low Voltage Single Phase | | | High Voltage Single Phase | |
|---|---|---|---|---|
| **Blue** | P1 | Line | P1 | Line |
| **Brown** | P2 | | P2 | Insulate |
| **Black** | 5 | Tie together & Insulate | 5 | |
| **Orange** | 3 | | 3 | Tie together & Insulate |
| **White** | 2 | | 2 | |
| **Yellow** | 4 | Tie together Line | 4 | Line |

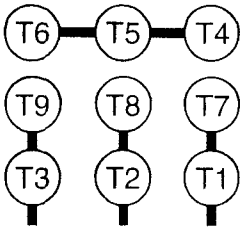
**Model**
R1S103

| | Volt High | Volt Low |
|---|---|---|
| Line A | 1 | 1, 3, 5 |
| Line B | 4 | 4 |
| Join | 2, 3, 5 | – |
| Join | J, 8 | 2, J, 8 |

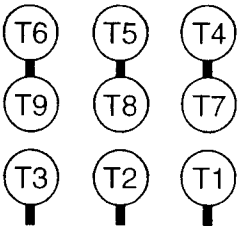
**Models**
R2303A, R3305A-1, R3305A-13, R4310A-2, R4P315A, R6350A-2, R6P350A, R6PP3110M, R6PS3110M, R7100A-3, R7P3180M, R7S3180M, R93150A

**Note:** Model R6P355A has two additional leads labeled "J" for an external thermal motor protection circuit.

### Connections for 3-Phase, 9 Leads

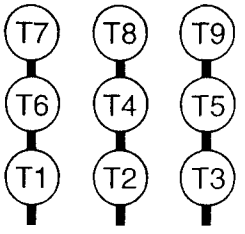



Line
Low Voltage

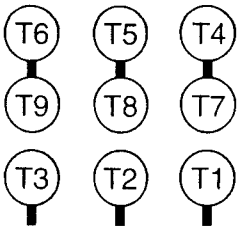



Line
High Voltage

**Model R9P3300M Only**



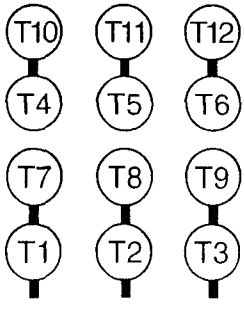

Line
Low Voltage



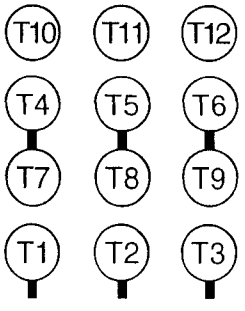

Line
High Voltage

### Connections for 3-Phase, 12 Leads

**Models R6335A-2, R6P335A**

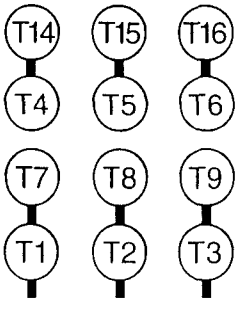



Line
Low Voltage

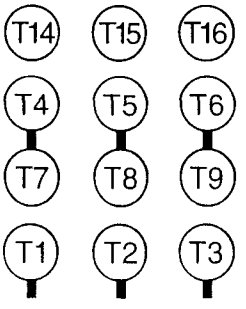



Line
High Voltage

**Models R5325A-2, R6325A-2**




Line
Low Voltage



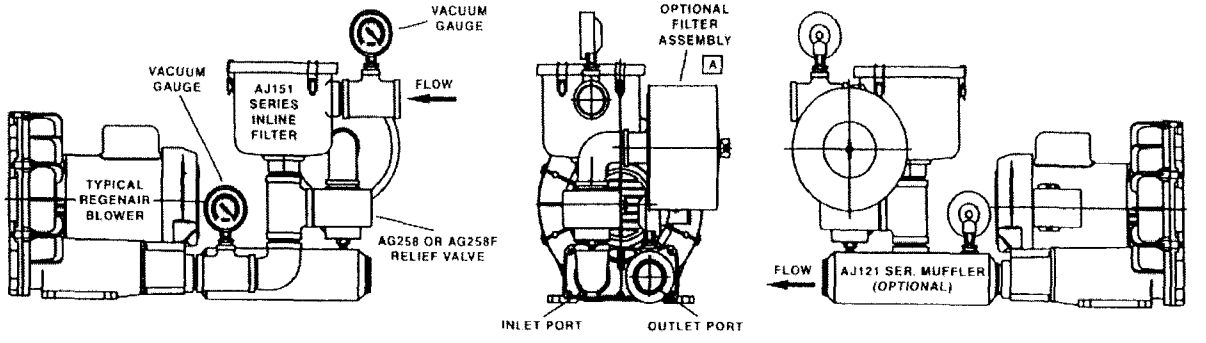

Line
High Voltage

**To reverse rotation on any 3-Phase motor, interchange any two external motor line connections to any two line leads.**

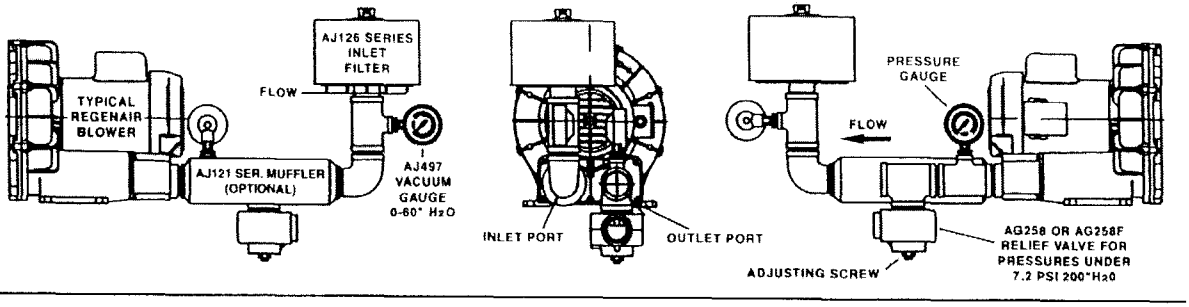
## RECOMMENDED ACCESSORIES

The following diagrams are only suggested configurations for these accessories. These accessory configurations may vary depending upon a particular unit's application.

### VACUUM ACCESSORIES




### PRESSURE ACCESSORIES

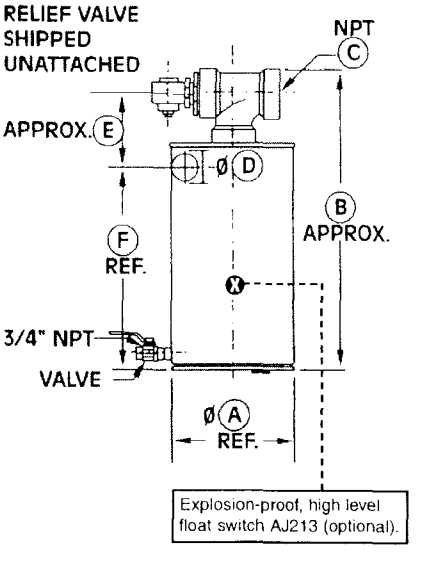



**MOISTURE SEPARATOR (FOR VACUUM)**

This moisture separator removes liquids from the gas stream in a vacuum process. This helps protect the blower from corrosion and the build up of mineral deposits.

| For Model Number | R3, R4, R5 | R4, R4H, R4P, R5 | R4H, R4M, R5, R6, R6P, R6PS, R7H | R4M, R6, R6P, R6PP, R7, R7H, R7P, R7S, R9, R9S |
|---|---|---|---|---|
| **Part Number** | **RMS160** | **RMS200** | **RMS300** | **RMS400** |
| CFM capacity | 160 | 200 | 300 | 400 |
| Liquid capacity (gal.) | 10 | 19 | 19 | 40 |
| Diameter (A) | 14.8" | 19.7" | 19.7" | 24" |
| Dimension (B) | 37.5" | 35" | 35" | 44" |
| NPT outlet (C) | 2" | 2" | 2.5" | 3" |
| Inlet diameter (D) | 2" | 2" | 2.5" | 3" |
| Dimension (E) | 7.5" | 7.5" | 7.5" | 9.7" |
| Dimension (F) | 26.6" | 26.6" | 26.6" | 29" |

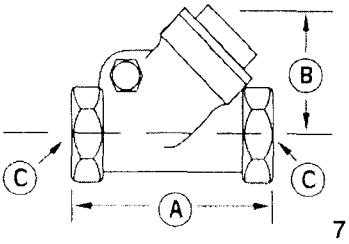
**Maximum vacuum allowed: 22" Hg.**



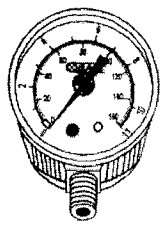

**HORIZONTAL SWING TYPE CHECK VALVE**

This check valve prevents backwash of fluids from entering the blower and air back-streaming. The check valve can be mounted to discharge or inlet either vertically or horizontally. The check valve will open with 3" of water pressure or vacuum.

| Model Number | R1, R2 | R3 | R4, R5, SDR4, SDR4, R4P | R6, R6P, SDR6P, SDR6, R6PS | R7, R7S |
|---|---|---|---|---|---|
| **Part Number** | **AH326B** | **AH326C** | **AH326D** | **AH326F** | **AH326G** |
| Dimension (A) | 3.57" | 4.19" | 4.50" | 5.25" | 8.00" |
| Dimension (B) | 2.32" | 2.69" | 2.94" | 3.82" | 5.07" |
| Dimension (C) | 1.00" NPT | 1.25" NPT | 1.50" NPT | 2.00" NPT | 2.50" NPT |

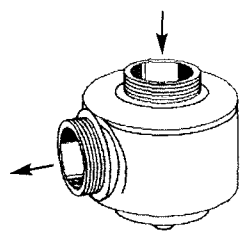


## RECOMMENDED ACCESSORIES



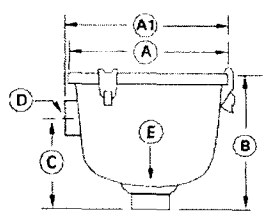
### PRESSURE – VACUUM GAUGE

| Pressure/Vacuum Gauges | | | | |
|---|---|---|---|---|
| **AJ496** | 2.50" Dia. | Pressure | 1/4" NPT | 0-60 in. $H_2O$ and 0-150 mbar |
| **AE133** | 2.50" Dia. | Pressure | 1/4" NPT | 0-160 in. $H_2O$ and 0-400 mbar |
| **AE133A** | 2.50" Dia. | Pressure | 1/4" NPT | 0-200 in. $H_2O$ |
| **AE133F** | 3.50" Dia. | Pressure | 1/4" NPT | 0-15 PSI |
| **AJ497** | 2.50" Dia. | Vacuum | 1/4" NPT | 0-60 in. $H_2O$ and 0-150 mbar |
| **AE134** | 2.50" Dia. | Vacuum | 1/4" NPT | 0-160 in. $H_2O$ and 0-400 mbar |
| **AE134F** | 3.50" Dia. | Vacuum | 1/4" NPT | 0-15 in. HG |



### PRESSURE – VACUUM RELIEF VALVE

| Pressure/Vacuum Relief Valves | | |
|---|---|---|
| **AG258** | 1.50" NPT | Adjustable 30-200 in. $H_2O$; 200 cfm max |
| **AJ121D** | | Silencer for AG258 Relief Valve |
| **AG258F** | 2.50" NPT | Adjustable 25-200 in. $H_2O$; 560 cfm max |
| **AJ121G** | | Silencer for AG258F Relief Valve |



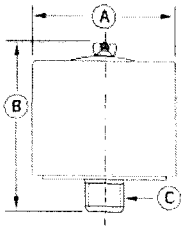

### INLINE FILTERS (FOR VACUUM)

The impeller of a blower passes very closely to the housing. It is recommended to have an inlet or in-line filter to ensure a trouble-free service life.

MPT = Male Pipe Thread
FPT = Female Pipe Thread

| Model Number | R1 | R2 | R3 | R4 | SDR4, R4P, R4H, R5 | SDR5, SDR6, R6, R6P, R7H, R7M | R6PP, SDR6P, R6PS, R7, R7S | R7S, R9, R9P, R9S |
|---|---|---|---|---|---|---|---|---|
| **Part Number** | **AJ151A** | **AJ151B** | **AJ151C** | **AJ151D** | **AJ151E** | **AJ151G** | **AJ151H** | **AJ151M** |
| Dimension (A) | 5.88" | 7.38" | 7.38" | 7.38 | 8.75 | 8.75" | 14.00" | 18.50" |
| Dimension (A1) | – | – | – | – | – | – | 16.25" | 20.75" |
| Dimension (B) | 4.50" | 6.81" | 6.81" | 6.81" | 10.25" | 10.50" | 27.13" | 28.13" |
| Dimension (C) | 2.75" | 4.62" | 4.62" | 4.62" | 5.00" | 5.50" | 18.50" | 19.50" |
| Dimension (D) | 1.00" FPT | 1.00" FPT | 1.25" FPT | 1.50" FPT | 2.00" FPT | 2.50" FPT | 3"MPT | 5" MPT |
| Dimension (E) | 1.00" FPT | 1.00" FPT | 1.25" FPT | 1.50" FPT | 2.00" FPT | 2.50" FPT | 3"MPT | 5" MPT |
| Replacement Element | AJ135D | AJ135E | AJ135E | AJ135E | AJ135F | AJ135G | AJ135C | AJ135H |
| Micron | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

## RECOMMENDED ACCESSORIES

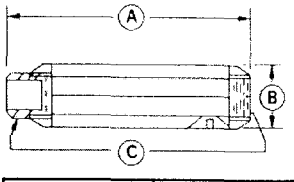



### INLET FILTERS (FOR PRESSURE)

*All filters are heavy duty for high-particulate service. Inlet filters for Regenair blowers are drip-proof when mounted as shown..*

MPT = Male Pipe Thread
FPT = Female Pipe Thread

| Model Number | R1, R2 | R3 | R4, R4H, R4P SDR4, R5 | SDR5, R6, SDR6, R5P, R6PP, R6PS | SDR6P, R7, R7H, R7P, R7S | R9, R9P, R9S |
|---|---|---|---|---|---|---|
| **Part Number** | **AJ126B** | **AJ126C** | **AJ126D** | **AJ126F** | **AJ126G** | **AJ126M** |
| Dimension (A) | 6.00" | 6.00" | 7.70" | 10.62" | 10.00" | 16.00" |
| Dimension (B) | 4.62" | 7.12" | 7.12" | 4.81" | 13.12" | 14.62" |
| Dimension (C) | 1.00" MPT | 1.25" MPT | 1.50" MPT | 2.00" FPT | 2.50" MPT | 5" MPT |
| Replacement Element | AJ134B | AJ134C | AJ134E | AG340 | AJ135A | AJ135H |
| Micron | 10 | 10 | 10 | 10 | 10 | 10 |




### MUFFLERS

Designed to reduce noise by up to 5 dbA and remove high-frequency sound associated with all blowers.

| Model Number | R1, R2 | R3 | R4, SDR4, R4P, R5 | R4H, R6, R6P, R6PS SDR6P, SDR6 | R7, R7S R7H | R6PP, R9 Exhaust | R7P Exhaust | R9P Exhaust | R7 Exhaust |
|---|---|---|---|---|---|---|---|---|---|
| **Part Number** | **AJ121B** | **AJ121C** | **AJ121D** | **AJ121F** | **AJ121G** | **AJ121H** | **AJ121M** | **AJ121N** | **AJ121GE** |
| Dimension (A) | 7.46" | 7.94" | 12.75" | 17.05" | 17.44" | 20.30" | 33.60" | 39.00" | 17.63" |
| Dimension (B) | 2.38" | 2.62" | 3.25" | 3.63" | 4.25" | 4.75" | 6.00" | 7.00" | 4.28 |
| Dimension (C) | 1.00" NPT | 1.25" NPT | 1.50" NPT | 2.00" NPT | 2.50" NPT | 3" NPT | 4"NPT | 5"NPT | 2.50" NPT |

## PARTS & ORDERING INFORMATION

**Please reference the exploded view on Page 11 for the following model and parts table.**

| REF# | ITEM | QTY | R1102 R1102C R1102K | R1S103 | R2103 R2303A | R2105 | R2305B | R3105-1 R3305A-1 R3305B-1 |
|---|---|---|---|---|---|---|---|---|
| 1 | COVER | 1 | AJ101A | AJ101AS | AJ101B | AJ101B | AJ101B | AJ101C |
| 2 | LOCK NUT | 1 | BC187 | BC187 | BC187 | BC181 | BC181 | BC181 |
| 3 | IMPELLER | 1 | AJ102A | AJ102A | AJ102BQ | AJ102B | AJ102B | AJ102C |
| 4 | SQUARE KEY | 1 | AH212C | AH212C | AH212 | AB136A | AB136A | AB136A |
| 5 | SHIM SPACER | Δ | AE686-5 | – | AE686-3 | AJ109 | AE686-3 | AJ109 |
| 6 | RETAINING RING | 1 | AJ145 | – | AJ145 | AJ149 | AJ145 | AJ149 |
| 7 | HOUSING | 1 | AJ103A | AJ103AS | AJ103BQ | AJ103B | AJ103B | AJ103C |
| 8 | – | – | – | – | – | – | – | – |
| 9 | – | – | – | – | – | – | – | – |
| 10A | FOAM | Δ | AJ112A(4) | – | AJ112BQ(6) | AJ112BQ(6) | AJ112BQ(6) | AJ112C(4) |
| 10B | FOAM | 2 | – | – | – | – | – | AJ112CQ |
| 11 | MUFFLER EXTENSION | 1 | AJ106A | – | AJ106BQ | AJ106BQ | AJ106BQ | AJ106CQ |

Δ As required.
Parts listed are for stock models. For specific OEM models, please consult the factory.
When corresponding or ordering parts, please give complete model and serial numbers.

## PARTS & ORDERING INFORMATION

**Please reference the exploded view on the next page for the following model and parts tables.**

| REF# | ITEM | QTY | R3105-12<br>R3305A-13 | R4110-2<br>R4310A-2<br>R4310B-1 | R4P115<br>R4P315A† | R5125-2<br>R5325A-2<br>R5325B-1 | R6125-2<br>R6150J-2<br>R6325A-2<br>R6335A-2<br>R6335B<br>R6350A-2<br>R6350B-2 | R6P335A<br>R6P350A<br>R6P350B | R6135J-10 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | COVER | 1 | AJ101C | AJ101D | AJ101L | AJ101EQ | AJ101FB | AJ101K | AJ101FB |
| 2 | LOCK NUT | 1 | BC181 | BC181 | BC181 | AJ259 | AJ259 | AJ259 | AJ259 |
| 3 | IMPELLER | 1 | AJ102CA | AJ102D | AJ102L | AJ102E | AJ102FR | AJ102K | AJ102FR |
| 4 | SQUARE KEY | 1 | AB136A | AB136D | AB136D | AB136 | AB136 | AB136 | AB136 |
| 5 | SHIM SPACER | Δ | AJ109 | AJ109 | AJ109 | AJ109 | AJ109 | AJ109 | AJ260A |
| 5† | SHIM SPACER† | 1 | – | – | AJ109A† | – | – | – | – |
| 6 | RETAINING RING | 1 | AJ149 | AJ149 | AJ149 | – | – | – | – |
| 7 | HOUSING | 1 | AJ103C | AJ103DR | AJ103L | AJ103EQ | AJ103FQ | AJ103K | AJ103FQ |
| 8 | MUFFLER BOX | 1 | – | – | – | – | – | AJ104K | – |
| 9 | SPRING | 2 | – | AJ113DR | AJ113DQ | AJ113DQ | AJ113FQ | AJ113FQ | AJ113FQ |
| 9A | SCREEN | 2 | – | – | AJ123EQ | AJ123EQ | AJ123FB | – | AJ123FB |
| 10A | FOAM | Δ | AJ112C(4) | AJ112DS(4) | AJ112ER(6) | AJ112ER(6) | AJ112FC(6) | AJ112K(8) | AJ112FC(6) |
| 10B | FOAM | 2 | AJ112CQ | AJ112DR | – | – | – | – | – |
| 11 | MUFFLER EXTENSION | 1 | AJ106CQ | AJ106DQ | AJ106EQ | AJ106EQ | AJ106FR | – | AJ106FR |

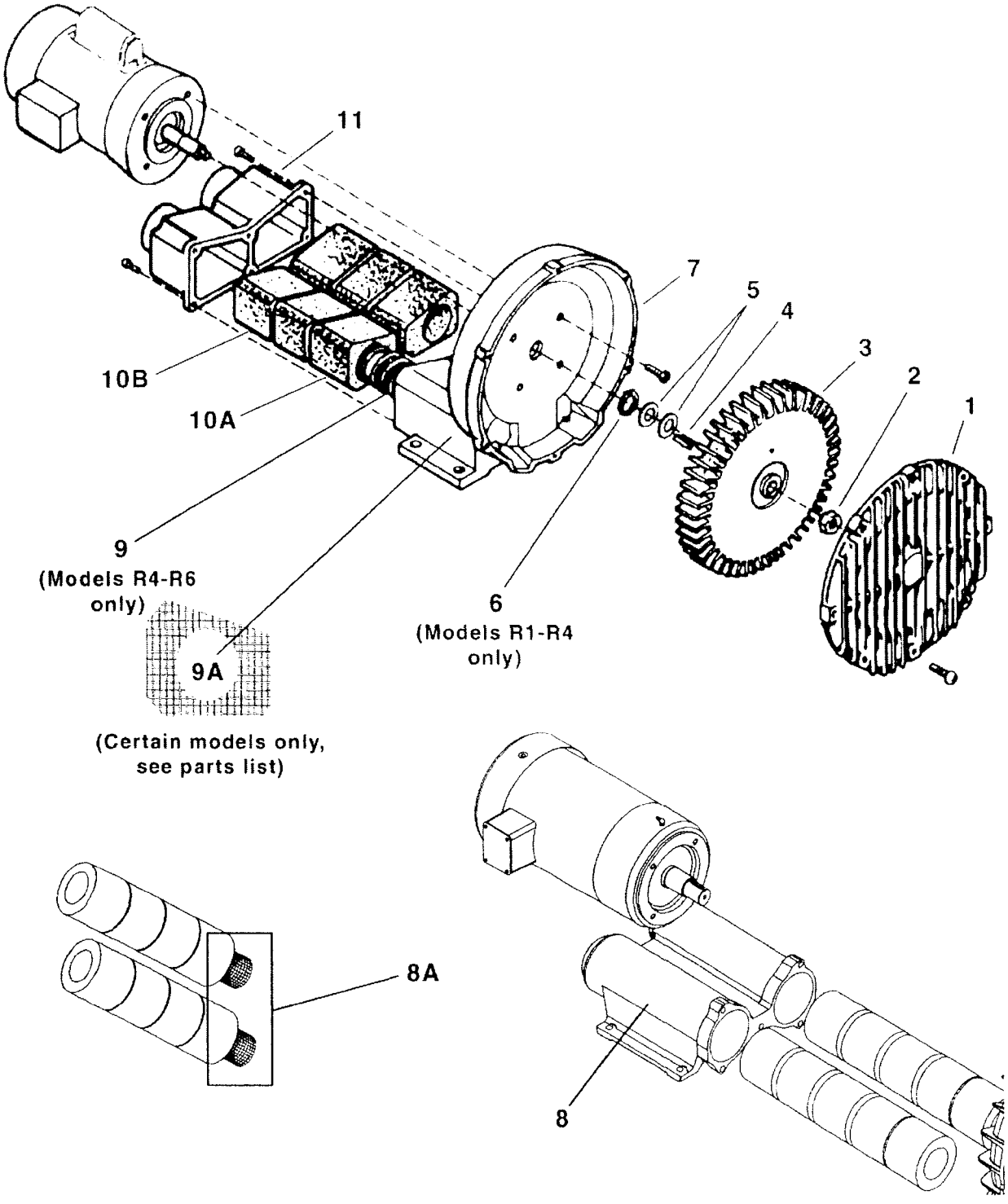
| REF# | ITEM | QTY | R6P355A<br>R6P350A<br>R6P350B | R6PP3110M* | R6PS3110M* | R7100A-3 | R7100B-1 |
|---|---|---|---|---|---|---|---|
| 1 | COVER | 1 | AJ101K | AJ101KA(2) | AJ101KA(2) | AJ101G | AJ101G |
| 2 | LOCK NUT/BOLT | 1 | AJ259 | BB750(2) | BB750(2) | BB750 | BB750 |
| 3 | IMPELLER | 1 | AJ102K | AJ102KA(2) | AJ102KA(2) | AJ102GZ | AJ102GA |
| 4 | SQUARE KEY | 1 | AB136 | AB136(2) | AB136(2) | AC628 | AC628 |
| 5 | SHIM SPACER | Δ | AJ109 | AJ169F | AJ169F | AJ110 | AJ110 |
| 6 | RETAINING RING | 1 | – | – | – | – | – |
| 7 | HOUSING | 1 | AJ103K | AJ103KD(2) | AJ103KD(2) | AJ103GA | AJ103GA |
| 8 | MUFFLER BOX | 1 | AJ104K | – | – | AJ104GA | AJ104GA |
| 8A | SCREEN | 2 | – | – | – | AJ998G | AJ998G |
| 9 | SPRING | 2 | AJ113FQ | – | – | – | – |
| 10A | FOAM | Δ | AJ112K(8) | – | – | AJ112GA(8) | AJ112GA(8) |
| 10B | FOAM | 2 | – | – | – | – | – |
| 11 | MUFFLER EXTENSION | 1 | – | – | – | – | – |
| 12 ** | O-RING | 2 | – | AJ175 | – | – | – |
| 13 | GASKET | 4 | – | AJ107F | AJ107F | – | – |

| REF# | ITEM | QTY | R7P3180M* | R7S3180M* | R9P3300M* | R9S3300M* | R93150A |
|---|---|---|---|---|---|---|---|
| 1 | COVER | 1 | AJ101G(2) | AJ101G(2) | AJ100M(2) | AJ100M(2) | AJ101M |
| 2 | LOCK NUT/BOLT | 1 | BB750(2) | BB750(2) | BB707(2) | BB707(2) | BB707 |
| 3 | IMPELLER | 1 | AJ102GZ(2) | AJ102GZ(2) | AJ102M(2) | AJ102M(2) | AJ102M |
| 4 | SQUARE KEY | 1 | AC628(2) | AC628(2) | AE130A(2) | AE130A(2) | AE130A |
| 5 | SHIM SPACER | Δ | AJ110 | AJ110 | BJ110 | BJ110 | BJ110A |
| 6 | RETAINING RING | 1 | – | – | – | – | – |
| 7 | HOUSING | 1 | AJ103GA(2) | AJ103GA(2) | AJ103M(2) | AJ103M(2) | AJ103M |
| 8 | MUFFLER BOX | 1 | – | – | – | – | AJ104MP |
| 8A | SCREEN | 2 | – | – | – | – | AJ998M |
| 9 | SPRING | 2 | – | – | – | – | – |
| 10A | FOAM | Δ | – | – | – | – | AJ112M(10) |
| 10B | FOAM | 2 | – | – | – | – | – |
| 11 | MUFFLER EXTENSION | 1 | – | – | – | – | – |
| 12 ** | O-RING | 2 | AJ175G | – | AJ175G | – | – |

† R4P315A only.
* Dual models.
** Not shown.
Δ As required.

Parts listed are for stock models. For specific OEM models, please consult the factory.
When corresponding or ordering parts, please give complete model and serial numbers.

## EXPLODED PRODUCT VIEW



## PART NO. 70 - 6000 F2-200 (REV-G)

## TROUBLESHOOTING CHART

| Problem | Reason | Remedy |
|---|---|---|
| Increased sound. | Noise absorbing foam is damaged.<br>Impeller rubbing inside. | Replace foam.<br>Send unit to a Gast Authorized Service Facility. |
| Excessive vibration. | Damaged impeller.<br>Motor and/or impeller are dirty. | Replace impeller.<br>Clean motor and impeller periodically. |
| Ambient and exhaust temperature increases. | Motor and/or blower are dirty.<br>Filters dirty. | Clean motor and blower periodically.<br>Replace filters. |
| Decreased inlet air pressure | Inlet air filter is clogged. | Clean inlet filter. Replace cartridge. |
| Unit is very hot. | Wrong wiring.<br>Low voltage.<br>Inlet air filter is clogged.<br>Motor and/or blower are dirty.<br>Operating at too high a pressure or vacuum. | Check wiring.<br>Supply proper voltage.<br>Clean inlet filter. Replace cartridge.<br>Clean motor and blower periodically.<br>Install a relief valve and pressure or vacuum gauge. |
| Unusual sound. | Impeller is damaged or dirty.<br>Bearing going bad. | Clean or replace impeller.<br>Send unit to a Gast Authorized Service Facility. |
| Motor overload | Low voltage. | Check power source.<br>Check wire size and wire connections. |
| Unit does not start. | Incorrect electrical connection or power source.<br>Impeller is damaged. | Check wiring diagram, circuit fusing and circuit capacity.<br>Clean or replace impeller. Install proper filtration. |

## AUTHORIZED SERVICE FACILITIES

Gast Manufacturing Inc.
2550 Meadowbrook Road
Benton Harbor, MI 49022
TEL: 269-926-6171
FAX: 269-927-0808
www.gastmfg.com

Gast Manufacturing Inc.
505 Washington Ave
Carlstadt, NJ 07072
TEL: 201-933-8484
FAX: 201-933-5545

Brenner Fiedler & Assoc.
13824 Bentley Place
Cerritos, CA 90701
TEL: 800-843-5558
TEL: 310-404-2721
FAX: 310-404-7975

Gast Manufacturing Co., Ltd
Beech House, Knaves Beech
Business Centre, Loudwater
High Wycombe, Bucks HP 10 9SD
England
TEL: 44 628 532600
FAX: 44 628 532470

Wainbee Limited
215 Brunswick Blvd.
Pointe Claire, Quebec
Canada H9R 4R7
TEL: 514-697-8810
FAX: 514-697-3070

Wainbee Limited
5789 Coopers Avenue
Mississauga, Ontario
Canada L4Z 3S6
TEL: 905-568-1700
FAX: 905-568-0083

Japan Machinery Co., Ltd.
Central PO Box 1451
Tokyo, 100-91 Japan
TEL: 81-3-3573-5421
FAX: 81-3-3571-7865
or: 81-3-3571-7896

General Correspondence
should be sent to:
Gast Mfg. Inc./A Unit of IDEX Corporation
P O Box 97
Benton Harbor, MI 49023-0097

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A Unit of IDEX Corporation

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**www.gastmfg.com**