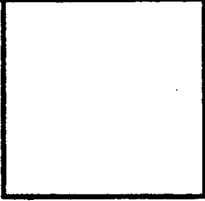


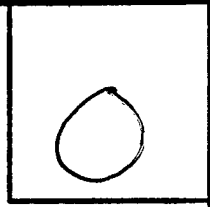
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OPERATIONS AND MAINTENANCE...

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**Operations and Maintenance Manual for  
Full-Scale Bioventing System at  
FSA-1**



**Air Force Plant 4  
Fort Worth, Texas**

Prepared For

**Air Force Center for Environmental Excellence  
Technology Transfer Division  
Brooks Air Force Base  
San Antonio, Texas**

**ASC/EMR  
Wright-Patterson Air Force Base  
Dayton, Ohio**

and

**Lockheed Martin  
Fort Worth, Texas**

April 1996



**PARSONS  
ENGINEERING SCIENCE, INC.**

1700 Broadway, Suite 900 • Denver, Colorado 80290

AQ M01-03-0484

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## SECTION 1

### INTRODUCTION

This Operations and Maintenance (O&M) Manual has been created as a guide for monitoring and maintaining the performance of the full-scale bioventing blower system and vent well plumbing at FSA-1 at Air Force Plant 4 (AFP4), Texas. This site is located south of Building 14 and is the location of an abandoned JP-4 jet fuel pipeline and two former underground storage tanks. Record drawings of the full-scale bioventing system installed at FSA-1 are provided in Appendix A.

Bioventing is the forced injection of fresh air, or withdrawal of soil gas, to enhance the supply of oxygen in subsurface soils for *in situ* bioremediation. A blower system is used to inject air into the soil, thereby supplying fresh atmospheric air (with approximately 20.8 percent oxygen) to contaminated soils. Once oxygen is provided to the subsurface, existing bacteria aerobically break down fuel residuals. Aerobic biodegradation is much more efficient than anaerobic biodegradation which occurs in oxygen depleted soils.

Parsons Engineering Science, Inc. (Parsons ES) has installed an air injection bioventing system consisting of an air injection blower, three vent wells (VWs), three soil gas monitoring points (MPs), and associated piping at the site. The blower at FSA-1 was started in March 1996 and the injection rates were optimized at each vent well to assure adequate aeration of contaminated soils to promote aerobic biodegradation.

AFP4 personnel are responsible for routine monitoring of the bioventing system. Parsons ES has trained AFP4 personnel on the maintenance requirements of this plan. If significant problems are encountered with the operation of the system, Parsons ES should be notified so repairs can be made. Under the Extended Bioventing Project Option 1, Parsons ES is responsible for system repair for a 1-year period after system startup (i.e., until March 1997). Should the bioventing system cease to operate or develop a significant problem, please call the Parsons ES Site Manager, Mr. John Hall, at (970) 244-8829. If the system ceases to operate, please have a base electrician verify that adequate power is being supplied to the bioventing system blower motor prior to notifying Parsons ES.

## SECTION 2

### SYSTEM DESCRIPTION

#### 2.1 BLOWER SYSTEM

A Gast® R5 blower powered by a 2-horsepower direct-drive motor was installed at FSA-1. This blower is rated as having a flow rate of 110 standard cubic feet per minute (scfm) at a pressure of 40 inches of water; however, the actual performance of the blower will vary with changing site conditions. As installed, the blower at FSA-1 was producing an estimated flow rate of 12 actual cubic feet per minute (acfm) into each of three injection VWs (VW1, VW2, and VW3) at a pressure of 19 inches of water. The blower system includes an inlet air filter to remove any particulates which are entrained in the inlet air stream and several valves and monitoring gauges which are described in Section 2.2. A schematic of the full-scale blower system installed at FSA-1 is shown in Appendix A. Corresponding blower performance curves and relevant service information are provided in Appendix B.

#### 2.2 MONITORING AND FLOW CONTROL EQUIPMENT

##### 2.2.1 Monitoring Gauges

The bioventing system is equipped with vacuum, pressure, and temperature gauges, and air velocity measurement ports. Gauges have been installed on the air injection system at the following locations: a vacuum gauge in the inlet piping and pressure and temperature gauges in the outlet piping.

##### 2.2.2 Flow Control Equipment

Manual and automatic flow control valves (FCVs) have been installed on the bioventing blower system. Manual FCVs have been installed in the piping leading to each VW to enable the flow rate to each VW to be adjusted individually. An automatic FCV, or pressure relief valve (PRV), is used to protect the blower systems from burning out if pressures rise due to pipe blockage. The PRV is set to bleed off flow at a preset pressure and thus prevent blower outlet pressure from ever exceeding the rated pressure.

An additional FCV (bleed valve) has been installed to control the total air flow out of the blower by releasing excess air flow to the atmosphere. The FCVs have been set by Parsons ES personnel to deliver a calculated amount of air to each VW and should not be adjusted unless directed to do so by Parsons ES personnel.

The blower system has also been equipped with flow measurement ports. These ports consist of brass bushings installed in the outlet piping leading to each VW. These bushings, which should be plugged during system operation, allow the insertion of a thermal anemometer for

the measurement of air velocity. These ports are used by Parsons ES personnel to measure and control the flow of air into each individual vent well.

## SECTION 3

### SYSTEM MAINTENANCE

Although the blower system installed at FSA-1 is relatively maintenance free, periodic system maintenance is required for proper operation and long life. Recommended maintenance procedures and schedule are described in detail in the instruction manuals included in Appendix B and briefly summarized in this section.

Filter inspection must be performed with the system turned off. Do not change the flow control valve settings (valves have been pre-set for a specific flow rate) before re-starting the blower.

#### 3.1 BLOWER/MOTOR

The blower and motor are relatively maintenance free and should not require any maintenance during the operational period. Both the blower and motor have sealed bearings and do not require lubrication.

#### 3.2 AIR FILTER

To avoid damage caused by passing solids through the blower, an air filter has been installed in-line before the blower. The paper filter element is accompanied by a polyurethane foam prefilter. The filter should be checked weekly for the first 2 months of operation. A facility employee should determine the best schedule for filter replacement based on the first 2 months of system monitoring. The polyurethane prefilters can be washed with lukewarm water and a mild detergent. Paper filter elements should never be washed, and should be disposed of and replaced as necessary. When the pressure or vacuum drop across the filter is 15 inches of water or greater, a dirty filter element should be suspected, and cleaning or replacement should be performed. Typical filter element replacement intervals range from 3 to 6 months.

To remove the filter, turn the system off by pushing the stop button on the starter, loosen the three clamps or the wing nut on the filter top, lift the metal top off the air filter, and lift the air filter element from the metal housing. Remove the polyurethane prefilter (if applicable) and wash before replacing.

The filter element is manufactured by Solberg Manufacturing, Inc. in Itasca, Illinois. Their telephone number is (708) 773-1363. Additional filters can also be obtained through Parsons ES. The Parsons ES contacts are Mr. John Hall (970) 244-8829 and Mr. Craig Snyder (303) 831-8100. The part number for the replacement filter element is 30P. Spare air filter elements have been placed inside the blower enclosure.

### 3.3 MAINTENANCE SCHEDULE

The following maintenance schedule is recommended for the blower system. During the initial few months of operation more frequent monitoring is recommended to ensure that any startup problems are quickly corrected. A daily drive-by inspection is recommended during the initial 2 weeks of operation to ensure that the blower system is still operating with no unusual sounds. Thereafter monitoring inspections every 2 weeks are recommended (see Section 4). Preprinted data collection sheets have been provided to the facility. Extra data collection sheets for recording maintenance activities are provided in Appendix C.

<u>Maintenance Item</u>	<u>Maintenance Frequency</u>
Filter	Check once every 2 weeks, wash or replace as necessary (see Section 3.3). Inlet vacuum exceeding 15 inches of water indicates that the filter requires cleaning or replacement.

### 3.4 MAJOR REPAIRS

Blowers systems are very reliable when properly maintained. Occasionally, however, a motor or blower will develop a serious problem. If a blower system fails to start, and a qualified electrician verifies that power is available at the blower or starter, Parsons ES should be contacted to arrange for repairs. The Parsons ES contacts are Mr. John Hall (970) 244-8829 and Mr. Craig Snyder (303) 831-8100. Parsons ES is responsible for major repairs during the first year of operation.

## SECTION 4

### SYSTEM MONITORING

#### 4.1 BLOWER PERFORMANCE MONITORING

To monitor the blower performance, the vacuum, pressure, and temperature will be measured. These data should be recorded every 2 weeks on a data collection sheet (provided in Appendix C). All measurements should be taken at the same time while the system is running. Because the systems are noisy, hearing protection should be worn at all times.

##### 4.1.1 Vacuum/Pressure

With hearing protection in place, unlock and open the blower enclosure and record all vacuum and pressure readings directly from the gauges (in inches of water). Record the measurements on the data collection sheet.

##### 4.1.2 Temperature

With hearing protection in place, open the blower enclosure and record the temperature readings directly from the gauges in degrees Fahrenheit (°F). Record the measurements on a data collection sheet (provided in Appendix C). The temperature change can be converted to degrees Celsius (°C) using the formula  $^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times 5/9$ .

#### 4.2 MONITORING SCHEDULE

The following monitoring schedule is recommended for these systems. During the initial month of operation, more frequent monitoring is recommended to ensure that any start up problems are quickly corrected. Data collection sheets have been provided to assist your data collection and are included in Appendix C.

<u>Monitoring Item</u>	<u>Monitoring Frequency</u>
Vacuum/Pressure	Daily during first week, then once every 2 weeks.
Temperature	Daily during first week, then once every 2 weeks.

#### 4.3 REPORTING MONITORING RESULTS

System monitoring data sheets should be faxed to the Parsons ES Site Manager, Mr. John Hall at (970) 244-8829, once every 2 months. However, if a significant change in the system temperature or pressure is noted (such as a significant drop or increase in pressure) please call

Mr. John Hall, at (970) 244-8829 immediately. A significant change in system temperature or pressure may be indicative of a problem with the air delivery system or blower.

**APPENDIX A**  
**RECORD DRAWINGS**

**RECORD DRAWINGS FOR  
FULL-SCALE BIOVENTING SYSTEM  
SITE FSA-1  
AIR FORCE PLANT 4, TEXAS**

**PREPARED FOR  
AFCEE  
APRIL 1996**

**DRAWING INDEX**

DRAWING NO.	DRAWING NAME
G-01	TITLE SHEET AND SITE LAYOUT
G-02	LEGEND AND STANDARD TRENCH DETAILS
G-03	VENT WELL AND MONITORING POINT STANDARD DETAILS
G-04	BLOWER P & ID
G-05	BLOWER PIPING LAYOUT DETAIL
G-06	BLOWER SHED FIELD INSTALLATION DETAIL AND BLOWER SHED CONSTRUCTION DETAIL

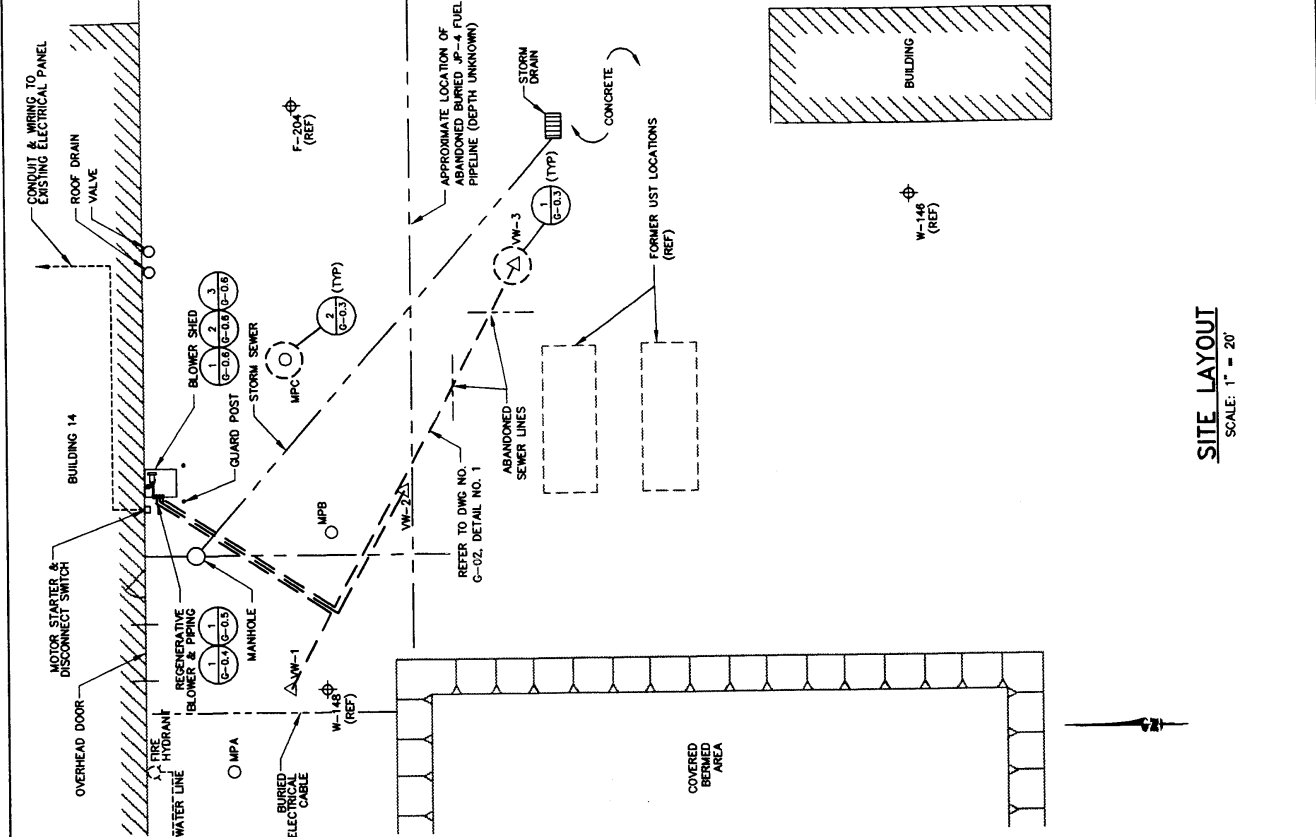
Date	Rev	Date	Description	By
	1	4/12/96	RECORD DRAWING	

PARSONS ENGINEERING SCIENCE, INC.  
Denver, Colorado (303) 631-8100

**AIR FORCE CENTER FOR  
ENVIRONMENTAL EXCELLENCE  
(AFCEE)  
FULL-SCALE BIOVENTING SYSTEM  
SITE FSA-1  
AIR FORCE PLANT 4, TEXAS**

**TITLE SHEET AND  
SITE LAYOUT**

DRAWING NO  
**G-0.1**  
REV  
**A**



**SITE LAYOUT**  
SCALE: 1" = 20'

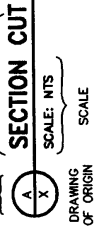
# ABBREVIATIONS

- AJ AIR INJECTION
- APPROX APPROXIMATE
- ASTM AMERICAN SOCIETY OF TESTING AND MATERIALS
- & AND
- AT CENTER BACK MOUNT
- CBM CUBIC METERS
- CLR CLEAR
- DA DIA
- EAB EXPLORATORY BORING
- EC ECCENTRIC
- EC EACH WAY
- FOOT FEET
- FPT FEMALE PIPE THREAD
- FT FOOT
- HDPE HIGH DENSITY POLYETHYLENE
- HP FOR EXAMPLE
- LM LOWER MOUNT
- MAX MAXIMUM
- MIN MINIMUM
- MP MONITORING POINT
- MPT MALE PIPE THREAD
- NO. # NUMBER
- NPT NATIONAL PIPE THREAD
- NTS NOT TO SCALE
- OC ON CENTER
- OD OUTSIDE DIAMETER
- PVC POLYVINYL CHLORIDE
- PW PROPOSED WELL
- RED REDUCER
- REF REFERENCE
- SCH SCHEDULE
- S SOCKET
- SPVC SLOTTED POLYVINYL CHLORIDE
- ST STL
- TYP TYPICAL
- UST UNDERGROUND STORAGE TANK
- VENT WELL
- W/ WITH
- WN WELD NECK
- WWF WELDED WIRE FABRIC

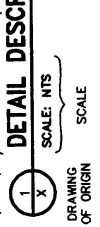
# SYMBOLS

- F-204 MONITORING WELL
- MPC BIOVENTING MONITORING POINT
- VM-1 VENT WELL
- HEADER PIPE TO VENT WELL
- BERM AND SLOPE

# SECTION CUT



# DETAIL DESCRIPTION



# MATERIAL LEGEND

- ASPHALT
- BENTONITE
- BENTONITE/CEMENT GROUT
- BENTONITE PELLETS
- BUILDING (EXISTING)
- COMPACTED BACKFILL
- COMPACTED BASE STONE
- CONCRETE
- PEA GRAVEL
- SAND
- UNDISTURBED SOIL

# PIPE MATERIAL

- CS CARBON STEEL
- GALV GALVANIZED STEEL
- PVC POLYVINYL CHLORIDE
- SPVC SCREENED POLYVINYL CHLORIDE

# PIPE SERVICE

- AJ AIR INJECTION
- BIV BIOVENTING
- DR DRAIN

# SECTION NAME



# DETAIL NAME



Rev	Date	Description
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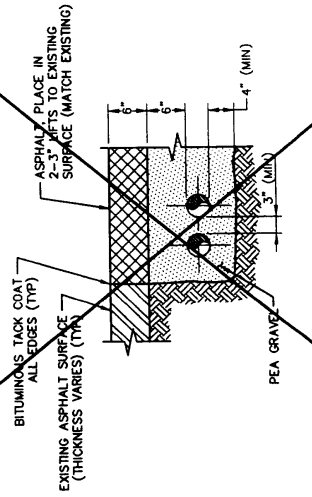
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 Drawn MW  
 Checked  
 Approved  
 Reg No

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 (303) 831-8100

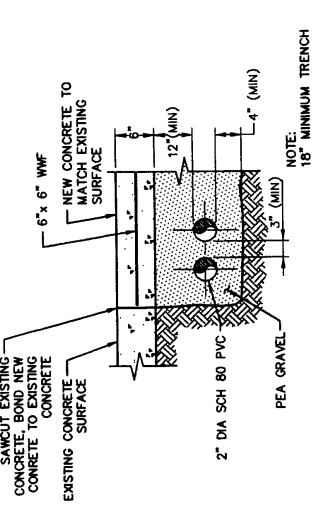
**AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)**  
 FULL-SCALE BIOVENTING SYSTEM  
 AIR FORCE PLANT 4, TEXAS

**LEGEND AND STANDARD TRENCH DETAILS**

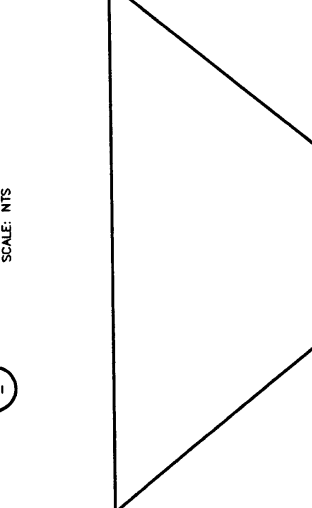
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 REV **A**



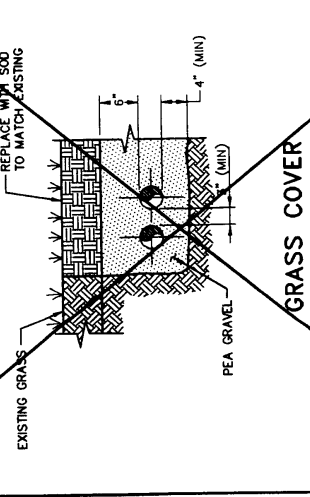
**2 ASPHALT REPLACEMENT DETAIL**  
 SCALE: NTS



**1 CONCRETE REPLACEMENT DETAIL**  
 SCALE: NTS



**3 SOIL COVER REPLACEMENT DETAIL**  
 SCALE: NTS



**7 GRASS COVER REPLACEMENT DETAIL**  
 SCALE: NTS

Rev	Date	Description
1	4/12/96	RECORD DRAWING

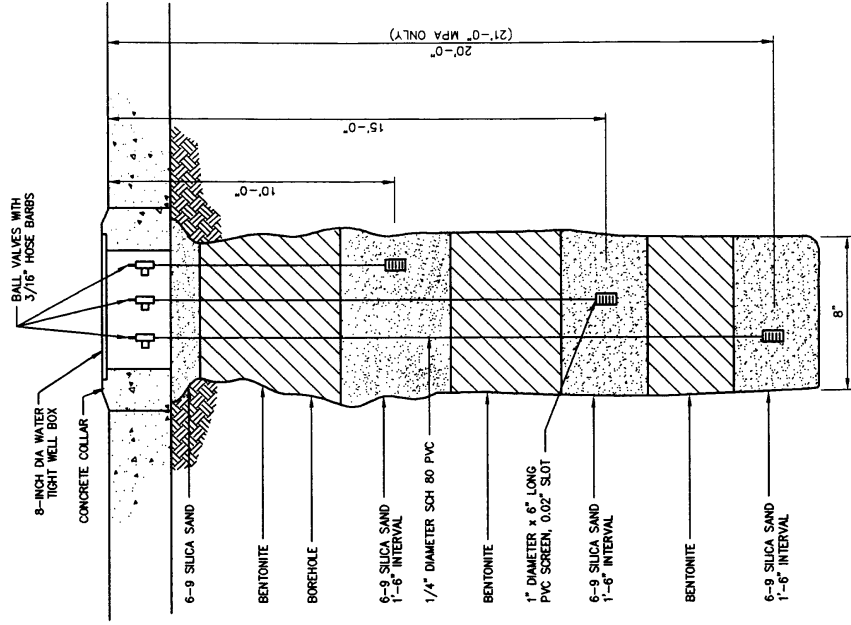
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 Reg No: [ ]  
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**AIR FORCE CENTER FOR  
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 (AFCEE)**  
 FULL-SCALE BOVENTING SYSTEM  
 SITE FSA-1  
 AIR FORCE PLANT 4, TEXAS

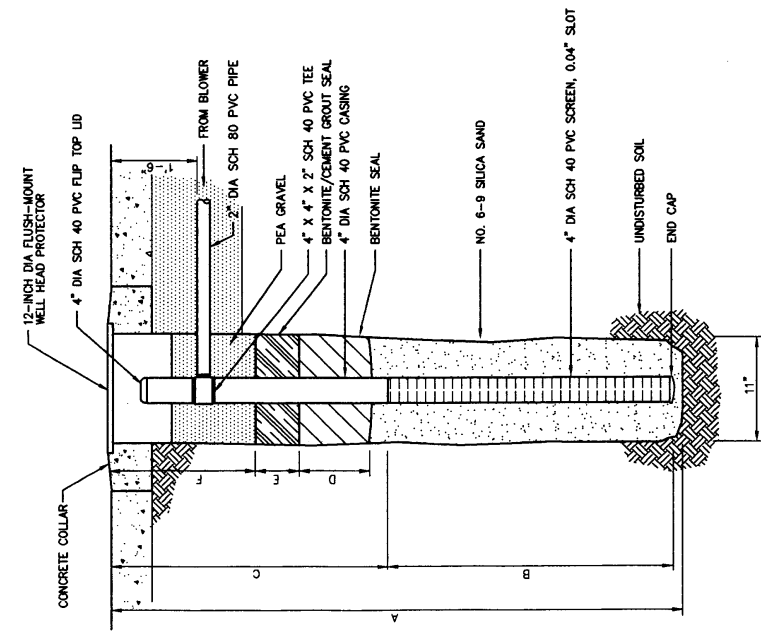
**VENT WELL AND  
 MONITORING POINT  
 STANDARD DETAILS**

DRAWING NO: **G-03**  
 REV: **A**



**MONITORING POINT (MP) DETAIL**  
 SCALE: NTS

2



WELL	WELL DIMENSIONS (FEET)					
	A	B	C	D	E	F
VW-1	28	15	12	2	3	5
VW-2	26	15	10	3	2	4
VW-3	25	15	10	3	2	4

**VENT WELL (VW) DETAIL**  
 SCALE: NTS

1

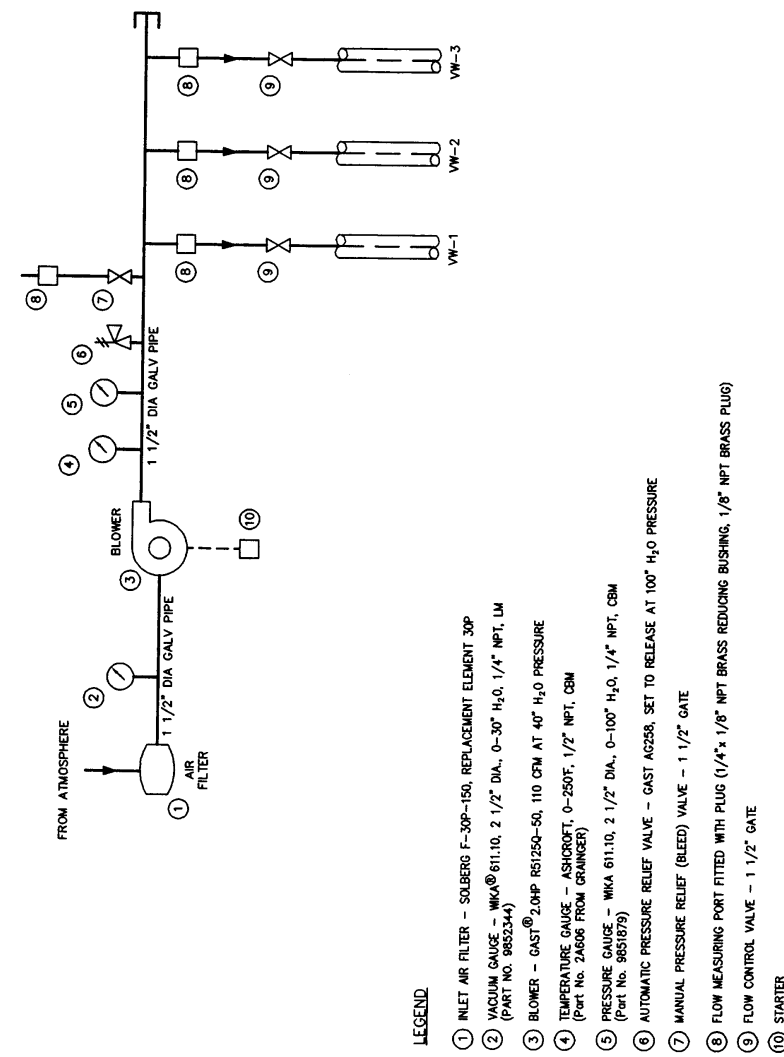
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 Drawn: MFM  
 Checked:  
 Approved:  
 Reg. No.

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**AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)**  
 FULL-SCALE BLOWING SYSTEM  
 AIR FORCE PLANT 4, TEXAS  
 SITE 75A-1

**BLOWER P & ID**  
 DRAWING NO. **G-0.4**  
 REV. **A**



**1** BLOWER PIPING AND INSTRUMENTATION DIAGRAM  
 SCALE: NTS

- LEGEND.**
- ① INLET AIR FILTER - SOLBERG F-30P-150, REPLACEMENT ELEMENT 30P
  - ② VACUUM GAUGE - WKA® 611.10, 2 1/2" DIA., 0-30" H<sub>2</sub>O, 1/4" NPT, LM (PART NO. 9852344)
  - ③ BLOWER - GAST® 2.0HP R81250-50, 110 CFM AT 40" H<sub>2</sub>O PRESSURE
  - ④ TEMPERATURE GAUGE - ASHROFT, 0-250°F, 1/2" NPT, CBM (PART NO. 24608 FROM GRANGER)
  - ⑤ PRESSURE GAUGE - WKA 611.10, 2 1/2" DIA., 0-100" H<sub>2</sub>O, 1/4" NPT, CBM (PART NO. 9851979)
  - ⑥ AUTOMATIC PRESSURE RELIEF VALVE - GAST AG258, SET TO RELEASE AT 100" H<sub>2</sub>O PRESSURE
  - ⑦ MANUAL PRESSURE RELIEF (BLEED) VALVE - 1 1/2" GATE
  - ⑧ FLOW MEASURING PORT FITTED WITH PLUG (1/4" x 1/8" NPT BRASS REDUCING BUSHING, 1/8" NPT BRASS PLUG)
  - ⑨ FLOW CONTROL VALVE - 1 1/2" GATE
  - ⑩ STARTER

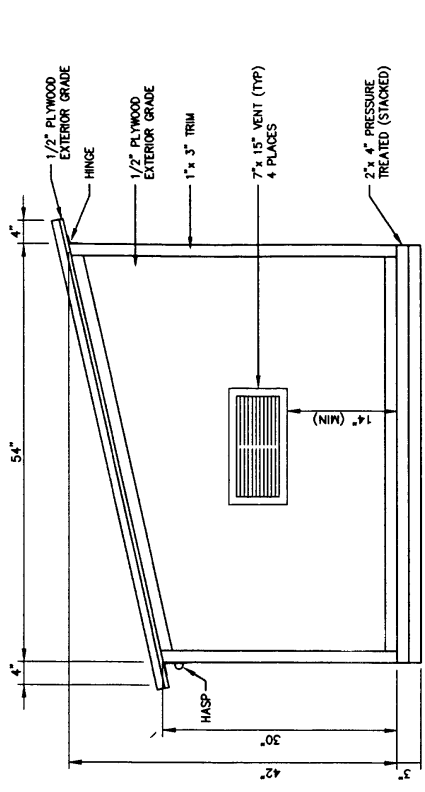


Job No. 226876.171A3	Designed R.A.F.	Drawn M.H.	Checked	Reviewed	Approved	Rev	Date
						1	4/17/96
							RECORD DRAWING
							By

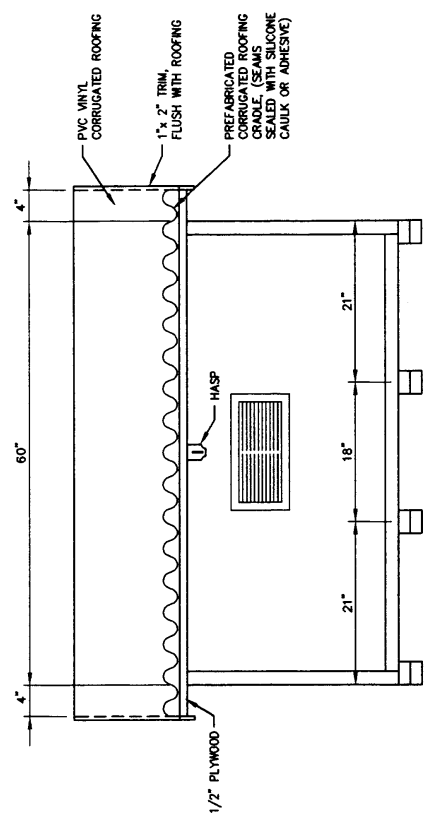
**PARSONS**  
 ENVIRONMENTAL SCIENCE, INC.  
 Denver, Colorado  
 (303) 851-8100

**AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE (AFCEE)**  
 FULL-SCALE BLOWING SYSTEM  
 SITE 15A-1  
 AIR FORCE PLANT 4, TEXAS

**BLOWER SHED FIELD INSTALLATION DETAIL AND BLOWER DETAIL**  
 CONSTRUCTION DETAILS  
 DRAWING NO. **G-0-6**  
 REV. **A**



**SIDE ELEVATION**

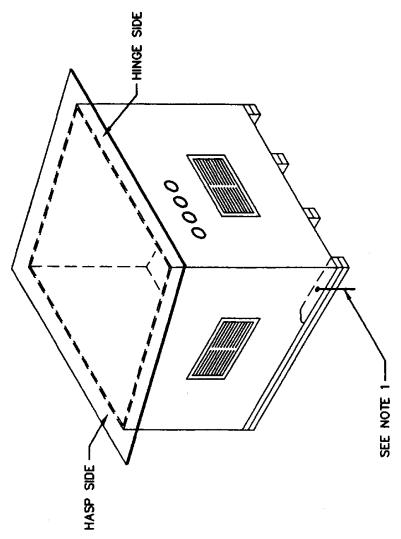


**FRONT ELEVATION**

- NOTES:
- 2"x 2" FRAME CONSTRUCTION
  - FLOOR CONSTRUCTED OF 3/4" EXTERIOR GRADE PLYWOOD
  - ROOF CONSTRUCTED OF 1/2" EXTERIOR GRADE PLYWOOD COVERED WITH PVC VINYL CORRUGATED ROOFING

**BLOWER SHED CONSTRUCTION DETAIL**  
 3/4" = 1'-0"

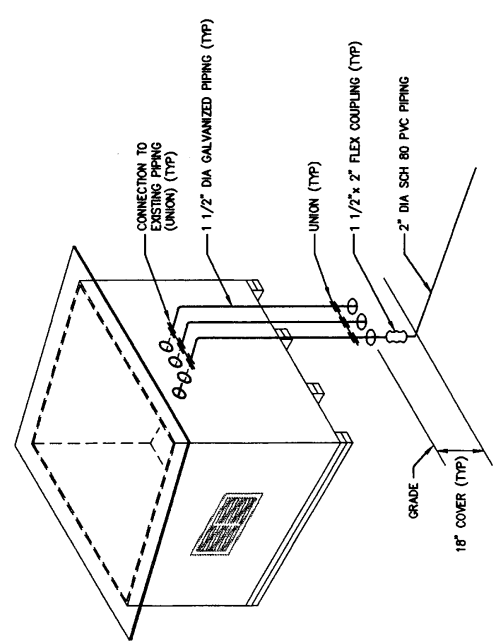
3  
-



- NOTES:
- FIELD SECURE BLOWER SHED TO CONCRETE PAVEMENT AT 4 LOCATIONS BY THRU BOLTING. USE 3/8" x 6" LONG ST STL WEDGE ANCHOR BOLTS

**BLOWER SHED FIELD INSTALLATION DETAIL**  
 NOT TO SCALE

1  
-



**TYPICAL MANIFOLD DISCHARGE PIPING LAYOUT**  
 NOT TO SCALE

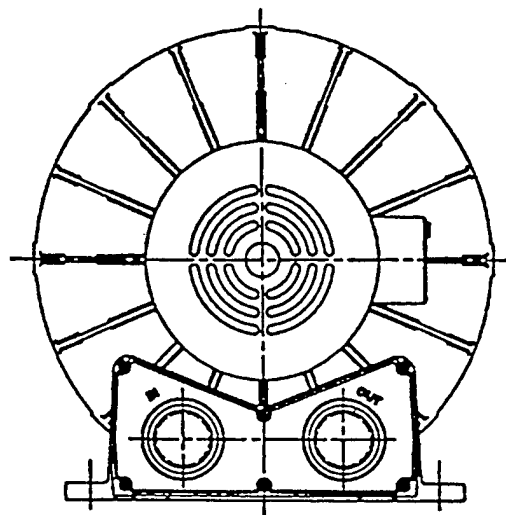
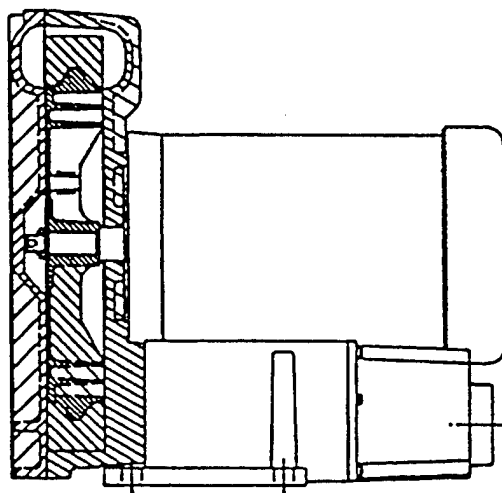
2  
-

**APPENDIX B**  
**REGENERATIVE BLOWER INFORMATION**



Post Office Box 97  
Benton Harbor, Michigan 49023-0097  
Ph: 616/926-6171  
Fax: 616/925-8288

## Maintenance Instructions for Gast Standard Regenerative Blowers



For original equipment manufacturers  
special models, consult your local distributor

### Gast Rebuilding Centers

Gast Mfg. Corp.  
2550 Meadowbrook Rd.  
Benton Harbor MI. 49022  
Ph: 616/926-6171  
Fax: 616/925-8288

Gast Mfg Corp.  
505 Washington Avenue  
Carlstadt, N. J. 07072  
Ph: 201/933-8484  
Fax: 201/933-5545

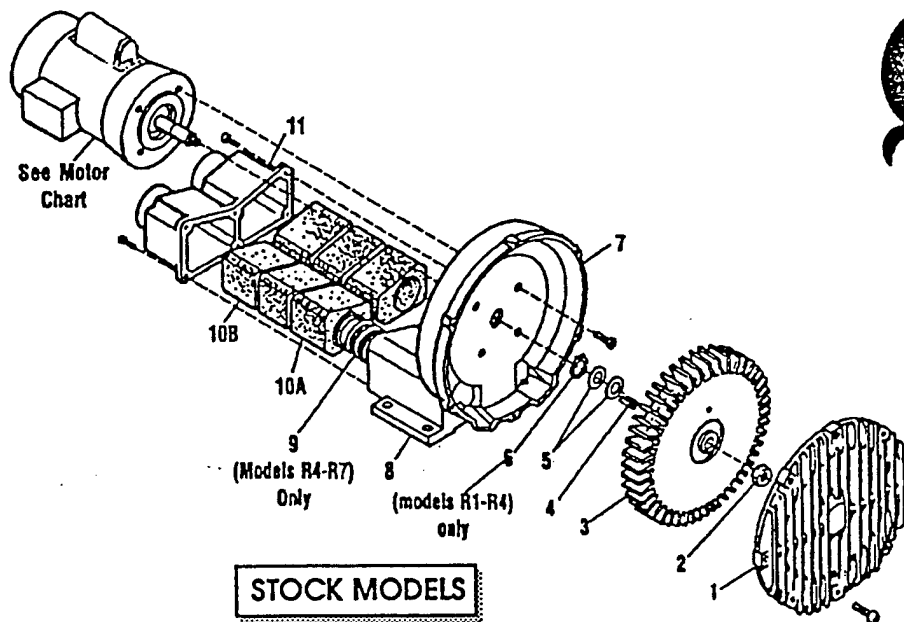
Brenner Fiedler & Assoc.  
13824 Bentley Place  
Cerritos, CA. 90701  
Ph: 213/404-2721  
Fax: 213/404-7975

Wainbee, Limited  
121 City View Drive  
Toronto, Ont. Canada M9W 5A9  
Ph: 416/243-1900  
Fax: 416/243-2336

Wainbee, Limited  
215 Brunswick Drive  
Pointe Claire, P.Q. Canada H9R 4R7  
Ph: 514/697-8810  
Fax: 514/697-3070

Gast Mfg. Co. Limited.  
Halifax Rd, Cressex Estate  
High Wycombe, Bucks HP12 3SN  
Ph. 44 494 523571  
Fax: 44 494 436588

Japan Machinery Co. Ltd.  
Central PO Box 1451  
Tokyo 100-91 Japan  
Ph: 813/3573-5421  
Fax: 813/3571-7865



**STOCK MODELS**

Part Name	R1	R2	R3	R4	R5	R6	R6P	R6PP/R6PS	R7
#1 Cover	AJ101A	AJ101B	AJ101C	AJ101D	AJ101EQ	AJ101F	AJ101K	(2)AJ101KA	AJ101G
#2 Stopnut	BC187	BC187	BC181	BC181	BC181	BC181	BC181	(2)BC182	BC183
#3 Impeller	AJ102A	AJ102BQ	AJ102C	AJ102D	AJ102E	AJ102FR	AJ102K	(2)AJ102KA	AJ102GA
#4 Square Key	AH212C	AH212	AB136A	AB136D	AB136	AB136	AB136	(2)AB136	AC628
#5 Shim Spacer (s)	AJ132	AE686-3	AJ109	AJ109	AJ109	AJ116A	AJ116A	AJ116A	AJ110
#6 Retaining Ring	AJ145	AJ145	AJ149	AJ149					
#7 Housing	AJ103A	AJ103BQ	AJ103C	AJ103DR	AJ103E	AJ103F	AJ103K	AJ103KD	AJ103GA
#8 Muffler Box					AJ104E	AJ104F			
#9 Spring				AJ113DR	AJ113DQ	AJ113FQ	AJ113FQ		AJ113G
#10A Foam	(4)AJ112A	(4)AJ112B	(4)AJ112C	(4)AJ112DS	(4)AJ112ER	(6)AJ112F	(8)AJ112K		(8)AJ112GA
#10B Foam		(2)AJ112BQ	(2)AJ112CQ	(2)AJ112DR	(2)AJ112EQ				
#11 Muffler Extension/ Adapter Plate	AJ106H	AJ106BQ	AJ106CQ	AJ106DQ	AJ106EQ	AJ106FQ	AJ104K		AJ104GA
Shim Kit	K396	K396							K395

**MOTOR CHART**

REGENAIR MODEL NUMBER	MOTOR NUMBER	MOTOR SPECIFICATIONS		PHASE
		60 HZ VOLTS	50 HZ VOLTS	
R1102	J111X	115/208-230	110/220-240	1
R1102C	J112X	115		1
R2103	J311X	115/208-230	110/220	1
R2105	J411X	115/208-230	110/220	1
R2303A	J310	208-230/460	220/380-415	3
R2303F	J313	208-230	220	3
R3105-1/R3105-12	J411X	115/208-230	110/220-240	1
R3305A-1/R3305A-13	J410	208-230/460	220/380-415	3
R4110-2	J611AX	115/208-230	110/220-240	1
R4310A-2	J610	208-230/460	220/380-415	3
R5125-2	J811X	115/208-230		1
R5325A-2	J810X	208-230/460	220/380-415	3
R6125-2	J811X	115/208-230		1
R6325A-2	J810X	208-230/460	220/380-415	3
R6335A-2	J910X	208-230/460	220/380-415	3
R6150J-2	J1013	230		1
R6350A-2	J1010	208-230/460	220/380-415	3
R6P335A	J910X	208-230/460	220/380-415	3
R6P350A	J1010	208-230/460	220/380-415	3
R6P355A	J1110A	208-230/460	220/380-415	3
R7100A-2*	J1210B	208-230/460	220/380-415	3
R6PP/R6PS3110M	JD1100	208-230/460	220/380-415	3

\* No lubrication needed at start up. Bearings lubricated at factory.

\* Motor is equipped with alemite fitting. Clean tip of fitting and apply grease gun. Use 1 to 2 strokes of high quality ball bearing grease.

Consistency	Type	Typical Grease
Medium	Lithium	Shell Dolum R

Hours of service per year	Suggested Relube Interval
5,000	3 years

Continual Normal Application 1 year

Seasonal service motor idle for 6 months or more 1 year beginning of season  
6 months

Continuous-high ambient, dirty or moist applications.

All performance figures relate to stock models. A few high pressure units may be available. Consult your local distributor.

Regenair Model Number	PRESSURE						Maximum Pressure "H <sub>2</sub> O"
	0"H <sub>2</sub> O	20"H <sub>2</sub> O	40"H <sub>2</sub> O	60"H <sub>2</sub> O	80"H <sub>2</sub> O	100"H <sub>2</sub> O	
R1	26	14					28
R2	42	26					38
R3105-1	52	38	14				42
R3105-12	52	36	23				55
R3305A-13	52	36	23				55
R4	90	70	50				52
R5	145	130	100				65
R6125-2	200	180					35
R6325A-2	200	180	152				40
R6335A-2	205	175	155	135			70
R6350A-2	200	180	150	130	110	80	105
R6P335A	290	250					30
R6P350A	300	260	230	200			60
R6P355A	300	260	230	200	160		90
R7100A-2	420	380	340	310	280	230	115
R6PP311OM	485	452	420	380	330		95
R6PS311OM	265	258	252	244	236	226	170

Regenair Model Number	VACUUM					Maximum Vacuum "H <sub>2</sub> O"
	0"H <sub>2</sub> O	20"H <sub>2</sub> O	40"H <sub>2</sub> O	60"H <sub>2</sub> O	80"H <sub>2</sub> O	
R1	25	14				26
R2	40	22				34
R3105-1	50	34	9			40
R3105-12	51	34	20			50
R3305A-13	51	34	20			50
R4	82	62	39			48
R5	140	115	90	50		60
R6125-2	190	155	125			45
R6325A-2	190	155	125			45
R6335A-2	190	150	125	100		75
R6350A-2	190	180	150	100	70	90
R6P335A	270	230				37
R6P350A	280	240	210	170		70
R6P355A	280	240	210	170	100	86
R7100A-2	410	350	300	250	170	90
R6PP311OM	470	425	375	320	220	80
R6PS311OM	240	225	210	195	175	130

\*This number indicates the maximum static pressure differential recommended (with cooling air still flowing through unit). In general, units 1hp or less can be dead headed. Check with local representative or distributor to verify which models apply.

Operation of the blower above the recommended maximum duty will cause premature failure due to the build up of heat damaging the components.

Performance data was determined under the following conditions:

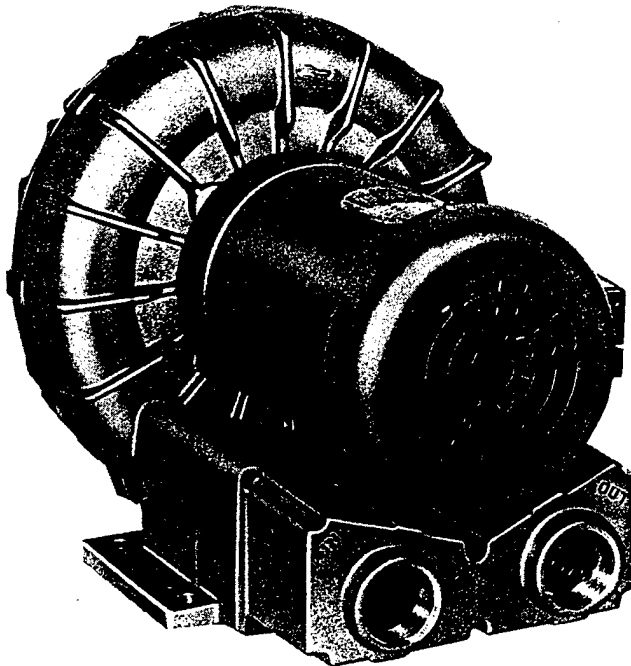
- 1) Unit in a temperature stable condition.
- 2) Test conditions: Inlet air density at 0.075lbs. per cubic foot. (20°C(68°F), 29.92 in. Hg(14.7PSIA)).
- 3) Normal performance variations on the resistance curve within +/- 10% of supplied data can be expected.
- 4) Specifications subject to change without notice.
- 5) All performance at 60Hz operation.

# Oilless Regenerative Blowers, Motor Mounted to 145 cfm



## REGENAIR® R5 Series

VACUUM



**MODEL R5325A-2**  
60" H<sub>2</sub>O MAX. VAC., 145 CFM OPEN FLOW

### PRODUCT FEATURES

- Oilless operation
- TEFC motor mounted
- Can be mounted in any plane
- Rugged construction/low maintenance
- Class B insulation on motors
- Automatic restart thermal protection on motors

### COMMON MOTOR OPTIONS

- 115/208-230V, 60 Hz; 110/220-240V, 50 Hz, single phase
- 208-230/460V, 60 Hz; 190-220/380-415V, 50 Hz, three phase
- 575V, 60 Hz, three phase

### RECOMMENDED ACCESSORIES

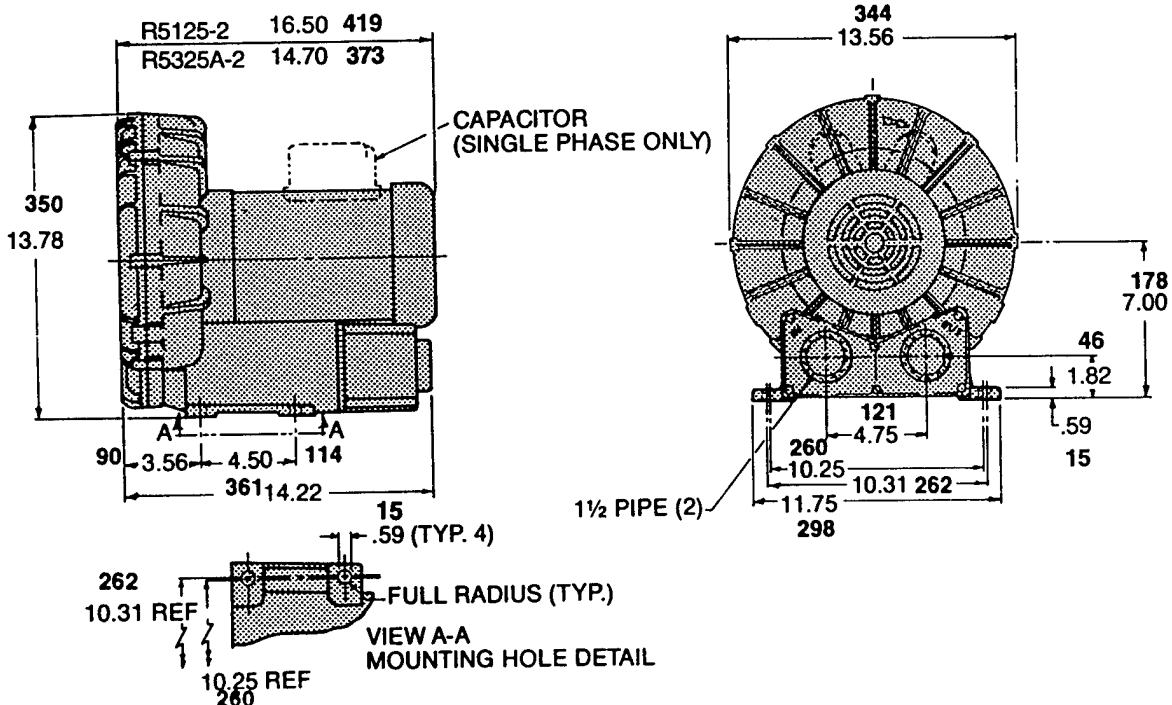
- Vacuum gauge AJ497
- In-line filter AJ151E
- Muffler AJ121D
- Relief valve AG258
- Nema motor starter (reference Blower Catalog accessory section or consult your Gast representative)

Various brand name motors are used on any model at the discretion of Gast Mfg. Corp.

### Important Notice:

Pictorial and dimensional data is subject to change without notice.

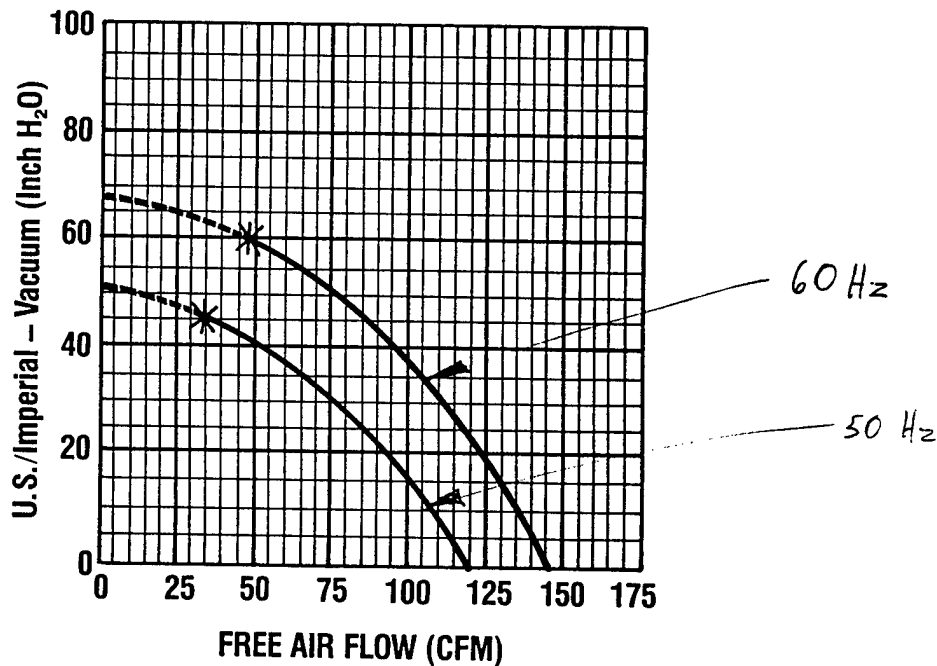
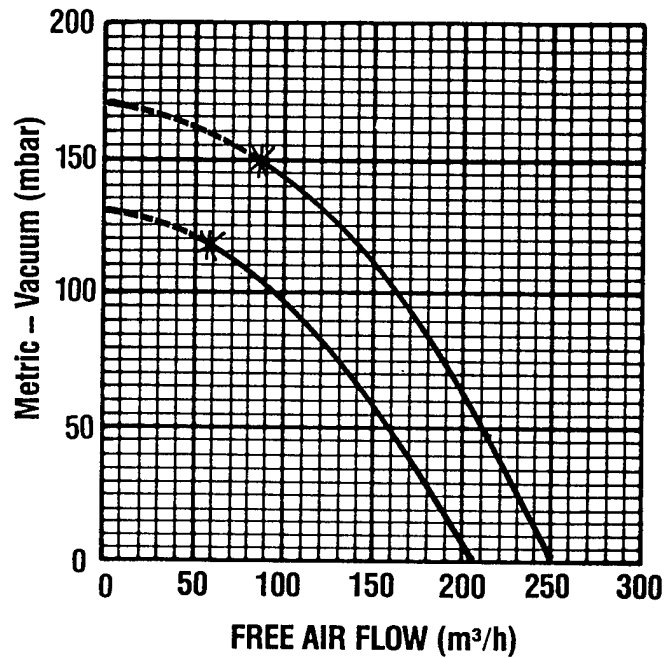
### Product Dimensions Metric (mm) U.S. Imperial (Inches)



## Product Specifications

Model Number	Motor Specs	Full Load Amps	HP	RPM	Max Vac		Max Flow		Net Wt.	
					"H <sub>2</sub> O	mbar	cfm	m <sup>3</sup> /h	lbs.	kg
R5325A-2	190-220/380-415-50-3	6.6-6.7/3.3-3.5	1.85	2850	47	117	120	204	65	29,5
	208-230/460-60-3	6.9/3.45	2.5	3450	60	149	145	246		
R5125-2	110/220-240-50-1	17.6/8.8-9.5	1.5	2850	47	117	120	204	76	34,5
	115/208-230-60-1	23.6/12.9-11.8	2.5	3450	60	149	145	246		

**Product Performance (Metric U.S. Imperial)**      Black line on curve is for 60 cycle performance.  
 Blue line on curve is for 50 cycle performance.



\*Recommended maximum duty.  
 - - - - Intermittent duty only.



70-6100  
F2-205/8/92  
Rev. E

Post Office Box 97  
Benton Harbor, MI. 49023-0097  
Ph: 616/926-6171  
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# INSTALLATION AND OPERATING INSTRUCTIONS FOR GAST HAZARDOUS DUTY REGENAIR BLOWERS

This instruction applies to the following models ONLY: R3105N-50, R4110N-50, R4310P-50, R4P115N-50, R5125Q-50, R5325R-50, R6130Q-50, R6P155Q-50, R6350R-50, R6P355R-50 and R7100R-50.

*Gast Authorized Service Facilities are Located in the locations listed below*

Gast Manufacturing Corporation  
505 Washington Avenue  
Carlstadt, N. J. 07072  
Ph: 201/933-8484  
Fax: 201/933-5545

Gast Manufacturing Corporation  
2550 Meadowbrook Road  
Benton Harbor, MI. 49022  
Ph: 616/926-6171  
Fax: 616/925-8288

Brenner Fiedler & Associates  
13824 Bentley Place  
Cerritos, CA. 90701  
Ph: 310/404-2721  
Ph: 800/843-5558  
Fax: 310/404-7975

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

Wainbee Limited  
5789 Coopers Ave.  
Mississauga, Ontario  
Canada L4Z 3S6  
Ph: 416/243-1900  
Fax: 416/243-2336

Japan Machinery  
Central PO Box 1451  
Toyko 100-91, Japan  
Ph: 813 3573-5421  
Fax: 813 3571-7896

Gast Manufacturing Co. Ltd.  
Halifax Road, Cressex Estate  
High Wycombe, Bucks HP12 3SN  
England  
Ph: 44 494 523571  
Fax: 44 494 436588.

# OPERATING AND MAINTENANCE INSTRUCTIONS

## SAFETY

This is the safety alert symbol. When you see this symbol personal injury is possible. The degree of injury is shown by the following signal words:

- ⚠ DANGER** Severe injury or death will occur if hazard is ignored.
- ⚠ WARNING** Severe injury or death can occur if hazard is ignored.
- ⚠ CAUTION** Minor injury or property damage can occur if hazard is ignored.

Review the following information carefully before operating.

## GENERAL INFORMATION

*This instruction applies to the following models ONLY: R3105N-50, R4110N-50, R4310P-50, R4P115N-50, R5125Q-50, R5325R-50, R6130Q-50, R6P155Q-50, R6350R-50, R6P355R-50 and R7100R-50.* These blowers are intended for use in Soil Vapor Extraction Systems. The blowers are sealed at the factory for very low leakage. They are powered with a U.L. listed electric motor Class 1 Div. 1 Group D motors for Hazardous Duty locations. Ambient temperature for normal full load operation should not exceed 40° C (105° F). For higher ambient operation, contact the factory.

Gast Manufacturing Corporation may offer general application guidance: however, suitability of the particular blower and/or accessories is ultimately the responsibility of the user, not the manufacturer of the blower.

## INSTALLATION

- ⚠ DANGER** Models R5325R-50, R6130Q-50, R6350R-50, R5125Q-50, R6P155Q-50, R6P355R-50 AND R7100R-50 use Pilot Duty Thermal Overload Protection. Connecting this protection to the proper control circuitry is mandated by UL674 and NEC501. Failure to do so could/may result in a EXPLOSION. See pages 3 and 4 for recommended wiring schematic for these models.

- ⚠ WARNING** Electric shock can result from bad wiring. A qualified person must install all wiring, conforming to all required safety codes. Grounding is necessary.

- ⚠ WARNING** This blower is intended for use on soil vapor extraction equipment. Any other use must be approved in writing by Gast Manufacturing Corp. Install this blower in any mounting position. Do not block the flow of cooling air over the blower and motor.

**PLUMBING** - Use the threaded pipe ports for connection only. They will not support the plumbing. Be sure to use the same or larger size pipe to prevent air flow restriction and overheating of the blower. When installing fittings, be sure to use pipe thread sealant. This protects the threads in the blower housing and prevents leakage. Dirt and chips are often found in new plumbing. Do not allow them to enter the blower.

**NOISE** - Mount the unit on a solid surface that will not increase the sound. This will reduce noise and vibration. We suggest the use of shock mounts or vibration isolation material for mounting.

**ROTATION** - The Gast Regenair Blower should only rotate clockwise as viewed from the electric motor side. The casting has an arrow showing the correct direction. Confirm the proper rotation by checking air flow at the IN and OUT ports. If needed reverse rotation of three phase motors by changing the position of any two of the power line wires.

## OPERATION

- ⚠ WARNING** Solid or liquid material exiting the blower or piping can cause eye damage or skin cuts. Keep away from air stream.

- ⚠ WARNING** - Gast Manufacturing Corporation will not knowingly specify, design or build any blower for installation in a hazardous, combustible or explosive location without a motor conforming to the proper NEMA or U. L. standards. Blowers with standard TEFC motors should never be utilized for soil vapor extraction applications or where local state and/or Federal codes specify the use of explosion-proof motors (as defined by the National Electric Code, Articles 100,500 c1990).

- ⚠ CAUTION** Attach blower to solid surface before starting to prevent injury or damage from unit movement. Air containing solid particles or liquid must pass through a filter before entering the blower. Blowers must have filters, other accessories and all piping attached before starting. Any foreign material passing through the blower may cause internal damage to the blower.

- ⚠ CAUTION** Outlet piping can burn skin. Guard or limit access. Mark "CAUTION Hot Surface. Can Cause Burns". Air temperature increases when passing through the blower. When run at duties above 50 in. H<sub>2</sub>O, metal pipe may be required for hot exhaust air. The blower must not be operated above the limits for continuous duty. Only models R3105N-50, R4110N-50 and R4310P-50 can be operated continuously with no air flowing through the blower. Other units can only be run at the rating shown on the model number label. Do not Close off inlet (for vacuum) to reduce extra air flow. This will cause added heat and motor load. Blower exhaust air in excess of 230°F indicates operation in excess of rating which can cause the blower to fail.

**ACCESSORIES** ...Gast pressure gauge AJ496 and vacuum gauges AJ497 or AE134 show blower duty. The Gas pressure/vacuum relief valve, AG258, will limit the operating duty by admitting or relieving air. It also allows full flow through the blower when the relief valve closes.

### SERVICING

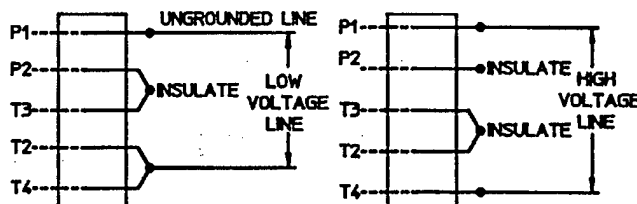
**⚠ WARNING** To retain their sealed construction they should be serviced by Gast authorized service centers ONLY. These models are sealed at the factory for very low leakage.

**⚠ WARNING** Turn off electric power before removing blower from service. Be sure rotating parts have stopped. Electric shock or severe cuts can result. Inlet and exhaust filters attached to the blower may need cleaning or replacement of the elements. Failure to do so will result in more pressure drop, reduced air flow and hotter operation of the blower.

The outside of the unit requires cleaning of dust and dirt. The inside of the blower also may need cleaning to remove foreign material coating the impeller and housing. This should be done at a Gast Authorized Service Center. This buildup can cause vibration, failure of the motor to operate or reduced flow.

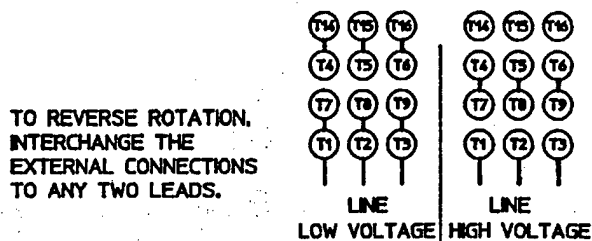
**KEEP THIS INFORMATION WITH THIS BLOWER. REFER TO IT FOR SAFE INSTALLATION, OPERATION OR SERVICE.**

### MOTOR WIRING DIAGRAM FOR R4110N-50 & R3105N-50



**>> \* WARNING**  
THIS MOTOR IS THERMALLY PROTECTED AND WILL AUTOMATICALLY RESTART WHEN PROTECTOR RESETS. ALWAYS DISCONNECT POWER SUPPLY BEFORE SERVICING.

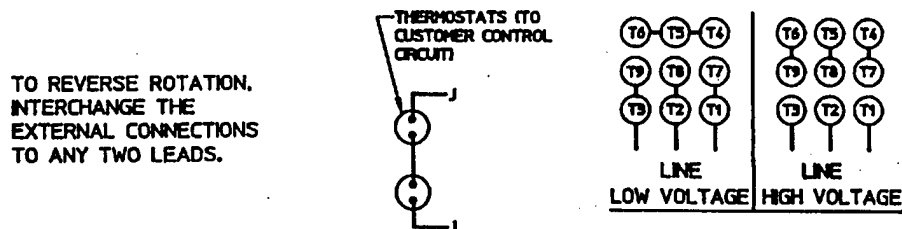
### MOTORS WIRING DIAGRAM FOR R4310P-50



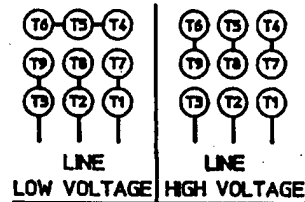
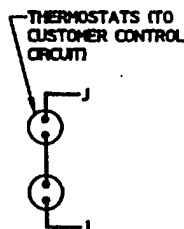
TO REVERSE ROTATION, INTERCHANGE THE EXTERNAL CONNECTIONS TO ANY TWO LEADS.

**>> \* WARNING**  
THIS MOTOR IS THERMALLY PROTECTED AND WILL AUTOMATICALLY RESTART WHEN PROTECTOR RESETS. ALWAYS DISCONNECT POWER SUPPLY BEFORE SERVICING.

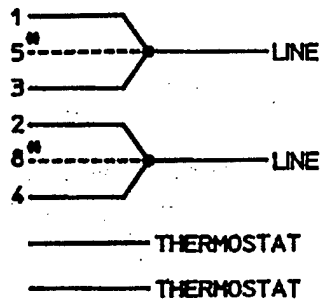
### MOTORS WIRING DIAGRAM FOR R5325R-50, R6350R-50, R6P355R-50, & R7100R-50



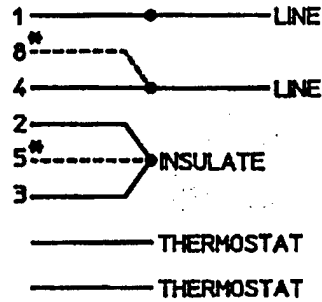
TO REVERSE ROTATION, INTERCHANGE THE EXTERNAL CONNECTIONS TO ANY TWO LEADS.



## MOTOR WIRING DIAGRAM FOR R5125Q-50 & R4P115N-50



LOW VOLTAGE

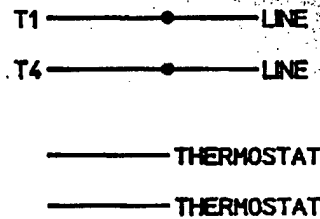


HIGH VOLTAGE

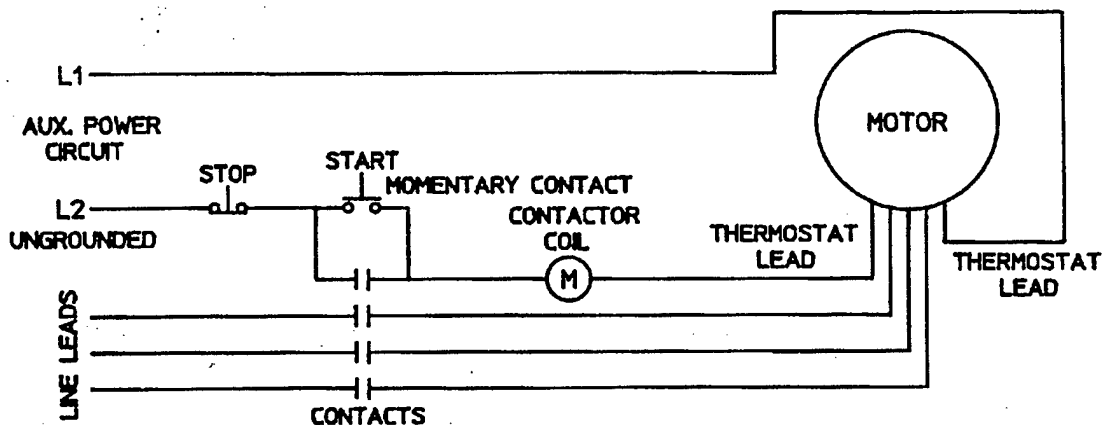
• R5125Q-50 BLOWERS PRODUCED AFTER SEPTEMBER 1992 (SER. NO. 0992)  
DO NOT HAVE MOTOR LEADS 5 & 8.

## MOTOR WIRING DIAGRAM FOR R6130Q-50 & R6P155Q-50

CONNECT THERMOSTAT  
TO MOTOR PROTECTION  
CIRCUIT



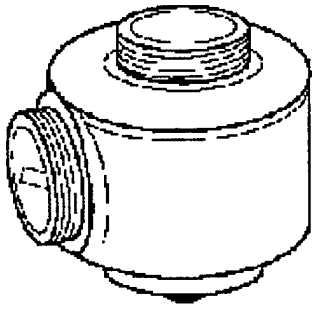
## CONNECTION FOR THERMOSTAT MOTOR PROTECTION



TERMOSTATS TO BE CONNECTED IN SERIES WITH  
CONTROL AS SHOWN. MOTOR FURNISHED WITH  
AUTOMATIC THERMOSTATS RATED A.C. 115-600V. 720VA

AK811 rev. E

## Relief Valve



By setting a relief valve at a given pressure/vacuum, you can ensure excessive duties will not harm the blower or products in your application.

AG258	Relief valve	1½-inch NPT adjustable 30-200 inches H2O, vacuum or pressure, 200 CFM max
AG258F	Relief valve	2½-inch NPT adjustable 30-200 inches H2O, vacuum or pressure, 550 CFM max

[Print Form](#)

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**Gast Manufacturing Corp.**  
**P.O. Box 97**  
**Benton Harbor, MI 49023-0097**  
**(616) 926-6171**

### **Warranty**

REGARDLESS OF CAUSE, if a product you buy from this brochure does not work right, Gast will repair or replace it once, at no charge, for up to one year from the date of shipment from the factory. In the course of repair or replacement, Gast may send you written recommendations on how to prevent a problem from happening again. Gast reserves the right to withdraw this warranty if you do not follow these recommendations. Customer 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, which Gast obtains from other manufacturers. A motor or engine carries only the warranty of the company that makes it.

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL, OR IMPLIED, INCLUDING THE WARRANTY OF MERCHANTABILITY AND OF FITNESS FOR ANY PARTICULAR PURPOSE. GAST'S LIABILITY IS IN ALL CASES LIMITED TO THE REPLACEMENT PRICE OF ITS PRODUCT. GAST SHALL NOT BE LIABLE FOR ANY OTHER DAMAGES, WHETHER CONSEQUENTIAL, INDIRECT, OR INCIDENTAL, ARISING FROM THE SALE OR USE OF ITS PRODUCTS.

Gast's sales personnel may modify this warranty, but only by signing a specific, written description of any modifications.

### **Disclaimer**

The information presented in this electronic catalog is based on technical data and test results of nominal units. It is believed to be accurate and is offered as an aid in the selection of Gast products. It is the user's responsibility to determine suitability of the product for his intended use and the user assumes all risk and liability whatsoever in connection therewith.



# LOW PRESSURE GAUGES

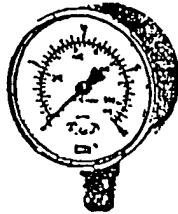
Types 611.10 & 612.20

WIKI INSTRUMENT CORPORATION  
 1000 Wiegand Boulevard  
 Lawrenceville, Georgia 30243-5868  
 (404) 513-8200 1-800-645-0608  
 FAX: (404) 513-8203

## PRICE LIST

Type 611.10 2 1/2" (63mm)

Type 612.20 4" (100mm)



### Standard Features

Case: Black painted steel (611.10)  
 Stainless steel (612.20)

Bayonet Ring: None (2 1/2")  
 Stainless steel (4")

Wetted Parts: Copper alloy

Window: Acrylic (2 1/2")  
 Instrument glass (4")

Dial: White aluminum

Pointer: Black aluminum

Accuracy: ± 1.5% of span

Brass movement with highly polished  
 bearing surfaces

Recalibration screw on dial

### Special Order Options

50 pcs. minimum order quantity per line item required (611.10)  
 25 pcs. minimum order quantity per line item required (612.20)

Custom Dials - Special scales and dial markings are available. Standard list prices apply. Add any applicable artwork/set-up charges. Refer to "Custom Dial Artwork Charges" (price page PL95-32).

Special Connections - No additional charge for standard NPT or metric threads. Contact factory for other special threads.

Gauge Accessories - Additional accessories may be available. Refer to "Pressure Gauge Accessories" (price page PL95-30).

### Additional Options Available -

- Nickel or chrome plated connection
- Lower back mount (Type 612.20 only)
- Rear flange
- U-clamp
- Safety glass window
- Stainless steel wetted parts 2 1/2" (631.10)
- Stainless steel wetted parts 4" (632.50)
- (refer to price page PL95-21 for prices)
- Cleaned for oxygen service
- Stainless steel case and ring
- Red drag pointer

- \* Items with part numbers are available from stock (subject to prior sale).
- \* Please use applicable part numbers when ordering.
- \* Items shown without part numbers are available on special order at no additional charge. Above listed minimum order quantities per line item required. Contact factory for current lead times.

Prices subject to change without notice.  
 This price list supersedes price list dated 01/01/95.

Effective 03/01/95 or  
 Price Page PL95-20

Type	611.10		612.20	
Size	2 1/2"		4"	
Connection	LM	CBM	LM	
Conn. Size	1/4" NPT			
Data Sheet	APM 06.01		APM 06.02	
List Price	\$43.25	\$47.55	\$139.15	
Vacuum Range (dual scale)				
	inch water	mm water		
	0-30	0-760	9852344	9851352 9747724
	0-60	0-1500	9748321	9748339
	0-100	0-2500	9747473	9747465
Pressure Ranges (dual scale)				
	inch water	mm water		
	0-15	0-380	9851682	9851860 9747732
	0-30	0-760	9851690	9855785 9747740
	0-60	0-1500	9851704	9803432 9747758
	0-100	0-2500	9851810	9851879 9747766
	0-200	0-5000	9851828	9851887 9747775
	oz/ sq. in.	mm water		
	0-10	0-440	9851771	
	0-15	0-660	9851780	
	0-20	0-880	9851798	
	0-30	0-1320	9851747	9851917
	0-35	0-1540	9851801	9857273
	0-60	0-2640	9851755	9803548
	oz/ sq. in.	in. water		
	0-20	0-34	9851720	9857281
	0-32	0-55	9851739	9855793
Pressure Ranges (single scale)				
	psi			
	3	9851925	9851836	9747783
	5	9851933	9851844	9747791
Accessories (installed)				
<small>Accessory prices do not apply to orders of 50 pcs or more per line item (25 pcs. for type 612.20). Contact factory for quote.</small>				
FF, chrome plated brass	\$27.55	\$21.55		N/A
	1327085	1327087		
FF, black painted steel	\$21.30	\$24.55		N/A
	1327089	1327091		
FF, stainless steel	--	--		\$23.65
				1327081
Restrictor, brass		\$ .90		
		1326943		

ABBREVIATIONS  
 LM - Lower Mount  
 CBM - Center Back Mount  
 FF - Front Flange  
 N/A - Not Available

In keeping with and for purposes of product improvement, Wika reserves the right to make design changes without prior notice.

Prices: FOB Lawrenceville, GA  
 Terms: 30 days net  
 (subject to credit approval)

**APPENDIX C**  
**DATA COLLECTION SHEETS**



