ATTACHMENT 2 OF OPERATION, MONITORING AND MAINTENANCE PLAN

Remediation System Design Documents

90-30 Metropolitan Avenue Site
Rego Park, Queens, New York

NYSDEC VCP Number: V00253-2

Prepared for:

Titan Management LP
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NOVEMBER 2009

EnviroTrac
Environmental Services

AIR SPARGE & SOIL VAPOR EXTRACTION SYSTEM

OPERATION AND MAINTENANCE MANUAL

Project:

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March 2007

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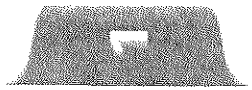


G_200 – An innovative classic

Gas ring vacuum pumps and compressors

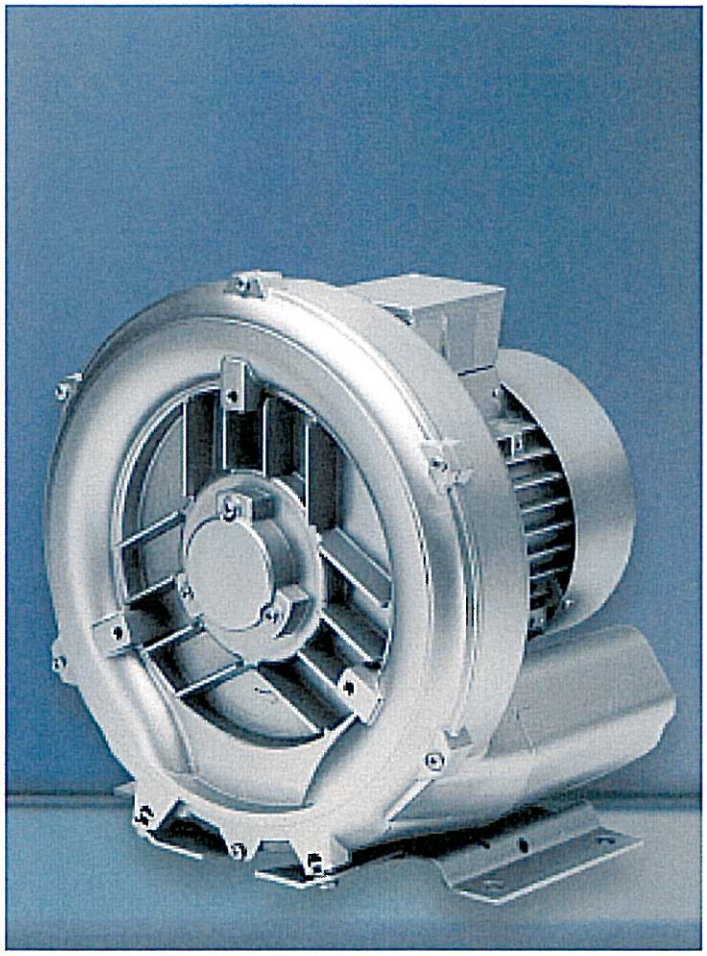
Our G_200 (2BH1) blowers have a long history of success. These quiet all-rounders are known for their extremely high suction capacities of up to 2,500 m^3/h (1,500 cfm) at pressure differences of up to 780 mbar (313 inches of H_2O). Their superior design and precise production engineering ensure a long service life and low operating costs. These extremely dependable, low-maintenance devices are the top choice for a wide range of applications in the mechanical engineering industry – even where conditions are harsh.

Comfortably quiet for better working conditions

Meeting the highest requirements in the most diverse application areas is a nash_elmo obligation. The designers and engineers in our laboratories are constantly striving to perfect performance and technology with particular emphasis on your personnel's subjective experience of noise levels. Consequently, we have significantly reduced the high tonal peaks, typical of turbomachines, making G_200 machines comfortably quiet in operation.

Variable power range

With a frequency converter installed directly on the motor or in a control cabinet, the same size machine can generate a lot more power while saving energy. This is achieved by precise control systems that always provide you with the exact amount of power needed in the process, thereby avoiding excess capacities. The result is a sustained reduction in operating costs for your system.



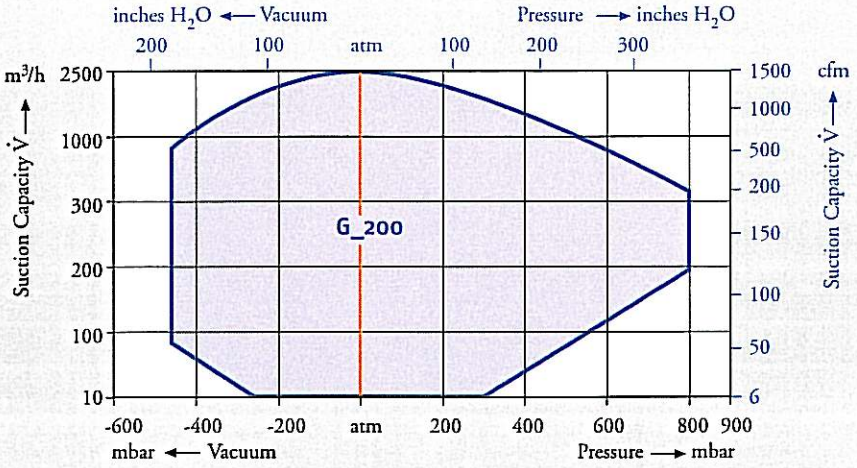
Advantages at a glance

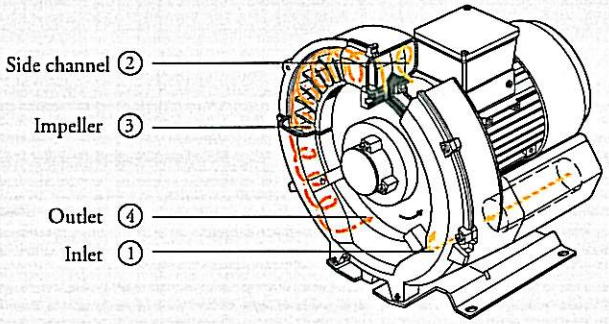
- Significantly reduced low noise level
- Robust and durable
- Usable worldwide, available ex stock, UL/CSA-certified c UL us
- ATEX 94/9 EC
- Variable performance range
- Light-weight construction with compact design (aluminium cast)
- Installable in any axial orientation
- Environmentally friendly operation
- Comprehensive accessories, e. g. frequency converter and sound enclosure

Main applications

- Printing and paper processing industry
- Plastics industry
- Packaging industry
- Environmental engineering
- Water treatment
- Paper treatment
- General mechanical engineering

... and many more





Functional diagram

The gas is taken in through the inlet silencer ①. As it enters the side channel ②, the rotating impeller ③ imparts velocity to the gas in a spiral motion in the direction of rotation. Centrifugal force in the impeller blades accelerate the gas radially outward, pressure increases and the gas is returned to the impeller via the inner wall of the side channel. Every time the gas re-enters the impeller, kinetic energy is added, along the side channel, in the radial direction. The side channel narrows at the rotor where the gas is swept off the impeller blades and discharged through the outlet silencer ④ where it exits the pump.

.vailable ex stock for use anywhere in the world

G_200 machines are equipped with range voltage motors for 50 and 60 Hz in protection class IP55 (temperature class F) and are certified to UL 507 and CSA 22.2 No. 113. This means they can be used anywhere in the world, whether in Europe, Asia or America. Best of all, G_200 pumps and compressors are available at very short notice, including ATEX-certified models.

Comprehensive range of accessories

nash_elmo offers you a comprehensive range of accessories tailored to your machinery and requirements. For example sound enclosures for areas where operation noise levels are of great importance have been developed. These enclosures are also suitable for outdoor installation, are maintenance-free and easy to transport. For G_200 devices with open nozzles, newly designed auxiliary silencers with a rigid construction are now available to reduce noise even further.

Robust and durable in any environment

Whether at high or low temperatures, in the tropics or on the high seas, at higher rotational speeds or in mobile applications – our G_200 powerhouses demonstrate their reliability and durability, even in continuous duty. G_200 gas ring compressors can be operated in any axial orientation and are easy and economical to install and connect.

Environmentally friendly – and inexpensive to operate

Our production process is certified to DIN EN ISO 14001. To save resources throughout their service life, G_200 pumps and compressors operate without auxiliary materials and are extremely efficient, not only protecting the environment but also reducing your costs.

Global quality management

Certified to DIN EN ISO 9001:2000, nash_elmo always puts quality and customer satisfaction first. From the initial design phase through development, production, order processing, logistics and customer support, we always give you the best.

We also design and develop solutions tailored to your individual needs. Let us know.

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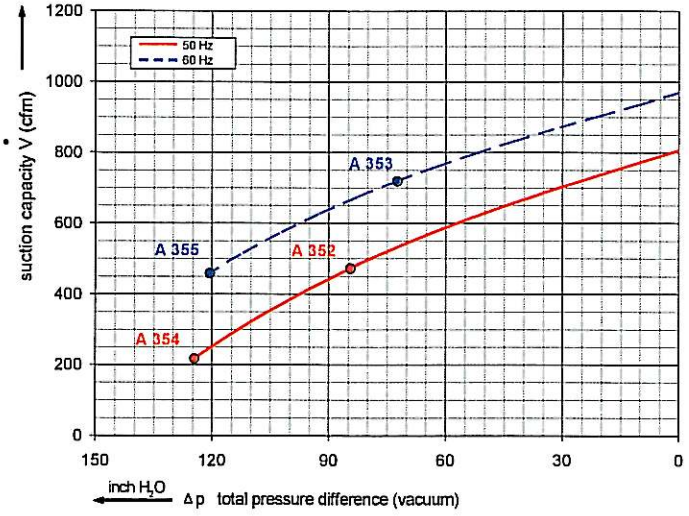
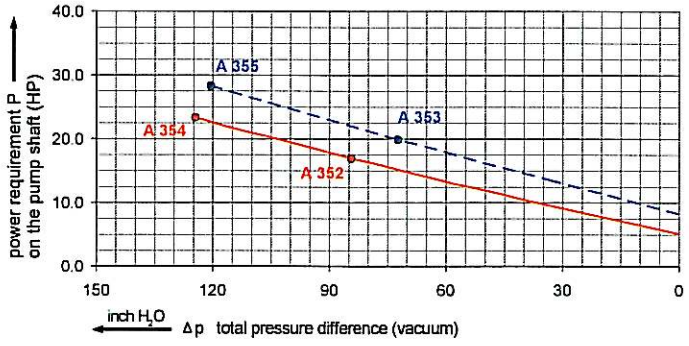
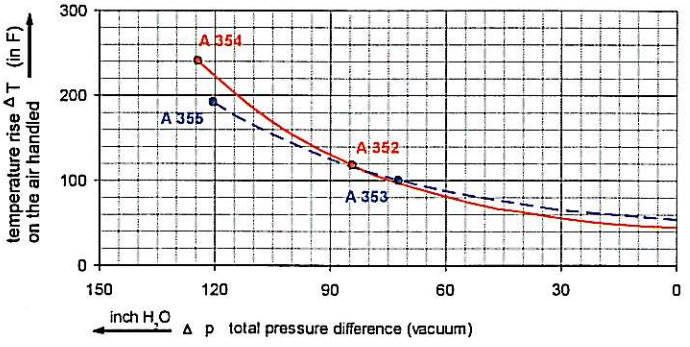
HENNIG - Nbg.

2BH1 930

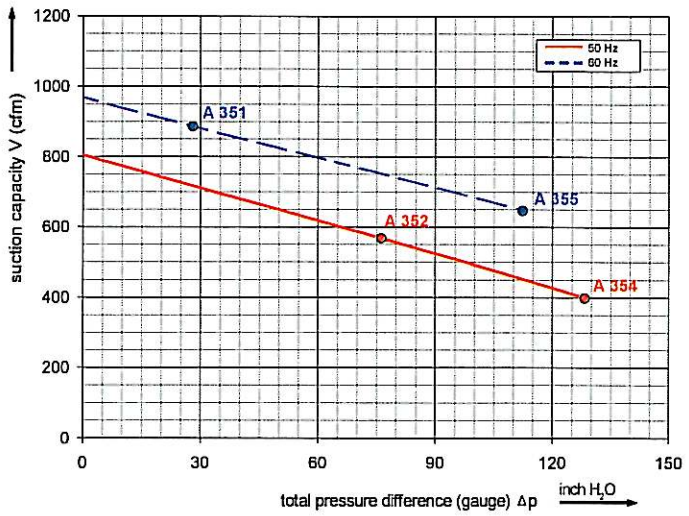
Performance curve for Vacuum pump

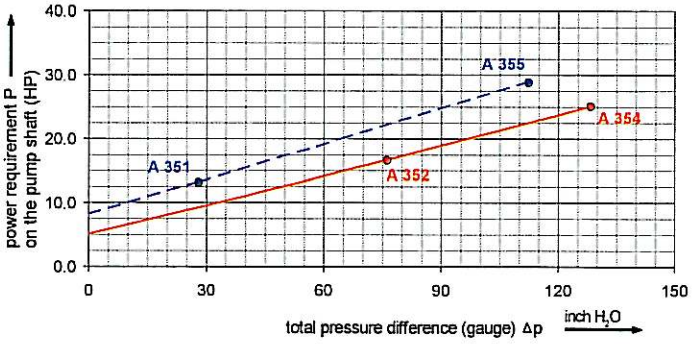


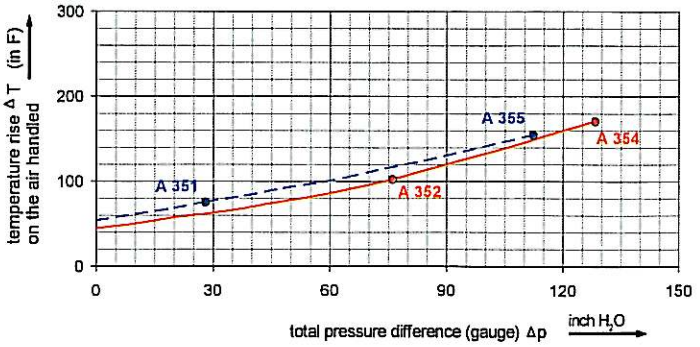




Performance curve for Compressor







The performance curves are based on air at a temperature of 59 F and an atmospheric pressure of 401.53 inch H2O with a tolerance of +/- 10 %.
The total pressure differences are valid for suction and ambient temperatures up to 77 F.
For other conditions please confer with us.

Each G_200 type can be applied both as vacuum pump and compressor in continuous operation over the total stated performance curve range. The motors are available as standard for the input voltage range of 50 and 60 Hz and for protection category IP 55 as well as approbated for UL and CSA. Blowers with ATEX 94/9 EG are available, too.

Type 2BH1 930

Curve No.	Order No.	Frequency Hz	Rated power HP	Input voltage V		Input current A		Permissible total differential pressure [2] Vacuum inch H2O	Permissible total differential pressure [2] Compressor inch H2O	Sound pressure level [3] dB(A)	Weight ca. lbs
~ 50/60 Hz IP55 isulation material class F 1)											
A 350	2BH1930-7AH06	50	11.39	200D ... 240D	345Y ... 415Y	33.0D	19.1Y	-48	44	75	383
A 351	2BH1930-7AH06	60	13.14	220D ... 275D	380Y ... 480Y	33.0D	19.1Y	-32	28	80	383
A 352	2BH1930-7AH16	50	16.76	200D ... 240D	345Y ... 415Y	48.5D	28.0Y	-84	76	75	425
A 353	2BH1930-7AH16	60	19.44	220D ... 275D	380Y ... 480Y	50.0D	29.0Y	-72	64	80	425
A 354	2BH1930-7AH36	50	24.80	200D ... 240D	345Y ... 415Y	64.5D	37.0Y	-124	128	75	454
A 355	2BH1930-7AH36	60	28.55	220D ... 275D	380Y ... 480Y	68.0D	39.0Y	-120	112	80	454

Other voltage ranges

		2BH1930-7A ☐. ☐
50Hz	60Hz	↑ ↑
3~		
185...225 V D / 320...390 V Y	200...240 V D / 345...415 V Y	H 1
200...240 V D / 345...415 V Y	220...275 V D / 380...480 V Y	H 6
345...415 V D	380...480 V D	H 7
500 V D	575 V D	C 5

Machines according to the ATEX norm 94/4 EG are available for the whole performance range.
Following types available: Category 3 G, 3/2 G, 3 D and 3/2 D.

Further voltage range on request; please quote in plain text.

All G_200 achieve the standards and norms of the low voltage directive 72/23/EWG, rotating electrotechnical motor EN 60034-1-34, electromagnetic compatibility (EMC) DIN EN 61000-3/-6/-4.

1) For standard UL for ELECTRIC FANS UL 507 and CSA 22.2 No. 13 for Fans and Ventilators (Certificate Number E225239).
2) Relief-valve are available for limiting differential pressure.
3) Measuring-surface sound-pressure level acc. to DIN EN 21680, measured at a distance of 3.28 ft. The pump is throttled to an average suction pressure, a hose is connected to the discharge side (vacuum pump) / suction side (compressor), but is not fitted with relief valves.

The motors are designed according to the DIN EN 60 034 / DIN IEC 34-1 and temperature class F.
For the three phase machines the tolerances are +/- 10 % for fixed voltage and +/- 5 % for voltage range.
For all three phase machines which designed according to the UL and CSA norm (UL 507 and CSA 22.2 No. 100) the maximum allowed voltage tolerances are - 10 % resp. + 6 %.
The frequency tolerance is maximum +/- 2 %.

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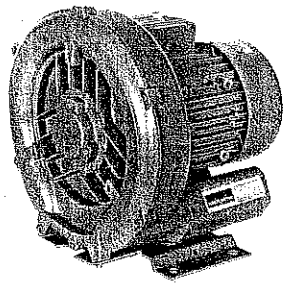
Gas-Ring Vacuum Pumps/Compressors

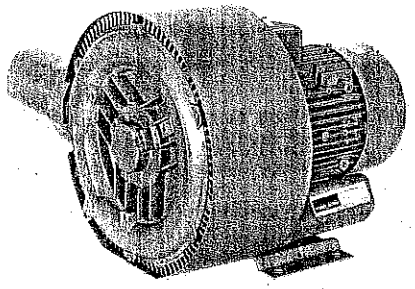
Operating Instructions

Series G_200

Types	2BH1 1	2BH1 3	2BH1 5	2BH1 8
	2BH1 2	2BH1 4	2BH1 6	2BH1 9



Single-impeller model
(single-stage)



Two-impeller model
(two-stage and double-flow)

CE

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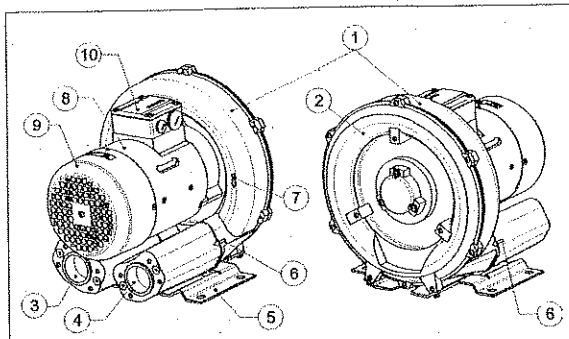


Fig. 1: Design of gas-ring vacuum pump/compressor

1 Vacuum pump/compressor housing
2 Vacuum pump/compressor cover
3 Inlet connection with muffler
4 Discharge connection with muffler
5 Base
6 Arrow indicating delivery direction
7 Arrow indicating direction of rotation
8 Drive motor
9 Fan guard (over external fan)
10 Terminal box

1 Safety

1.1 Definitions

To point out dangers and important information, the following signal words and symbols are used in these operating instructions:

1.1.1 Safety alert symbol

The **safety alert symbol** ⚠ is located in the safety precautions in the highlighted heading field on the left next to the signal word (DANGER, WARNING, CAUTION).
Safety precautions **with** a safety alert symbol indicate a danger of **injuries**.
Be sure to follow these safety precautions to protect against **injuries or death!**
Safety precautions **without** a safety alert symbol indicate a danger of **damage**.

1.1.2 Signal words

DANGER
WARNING
CAUTION
NOTICE
NOTE

The **signal words** are located in the safety precautions in the highlighted heading field. They follow a certain hierarchy and indicate (in conjunction with the safety alert symbol, see Chapter 1.1.1) the **seriousness of the danger** and the **type of warning.**
See the following explanations:

⚠ DANGER

Danger of injuries.
Indicates an imminently hazardous situation, that **will** result in **death or serious injury** if the corresponding measures are not taken.

⚠ WARNING

Danger of injuries.
Indicates a potentially hazardous situation, that **could** result in **death or serious injury** if the corresponding measures are not taken.

⚠ CAUTION

Danger of injuries.
Indicates a potentially hazardous situation, that may result in **minor or moderate injury** if the corresponding measures are not taken.

CAUTION

Danger of damage.
Indicates a potentially hazardous situation that may result in **property damage** if the corresponding measures are not taken.

NOTICE

Indicates a possible **disadvantage**, i.e. undesirable conditions or consequences can occur if the corresponding measures are not taken.

NOTE

Indicates a possible **advantage** if the corresponding measures are taken; tip.

1.2 General safety precautions

⚠ WARNING

Improper use of the unit can result in serious or even fatal injuries!
These operating instructions

- must have been read completely and understood before beginning any work with or at the pump-motor unit,
- must be strictly observed,
- must be available at the operating location of the pump-motor unit.

⚠ WARNING

Improper use of the unit can result in serious or even fatal injuries!
Only operate the pump-motor unit

- for the purposes indicated under "Intended Use"!
- with the fluids indicated under 'Intended Use'!
- with the values indicated under 'Technical Data'!

⚠ WARNING

Improper use of the unit can result in serious or even fatal injuries!
All work on and with the pump-motor unit (transport, installation, operation, shut-down, maintenance, disposal) may only be carried out by **trained, reliable expert personnel!**

⚠ WARNING

When working on the unit, there is a danger of injury, e.g. in the form of cuts/cutting off, crushing and burns!
During all work on and with the pump-motor unit (transport, installation, operation, shut-down, maintenance, disposal) wear **personal safety equipment (safety helmet, protective gloves, safety shoes)!**

⚠ WARNING

Hair and clothing can be pulled into the unit or caught and wound up moving parts!
Do not wear long, loose hair or wide, loose clothes! Use a hair net!

⚠ DANGER

Electrical danger!
Work on electrical installations may be carried out by trained and authorized electricians only!

⚠ DANGER

Electrical danger!
Before beginning work on the unit or system, the following measures must be carried out:

- Deenergize.
- Secure against being switched on again.
- Determine whether deenergized.
- Ground and short-circuit.
- Cover or block off adjacent energized parts.

⚠ DANGER

Electrical danger!
Do not open the motor terminal box until absence of electricity has been ensured!

⚠ WARNING

Danger due to vacuum and gauge pressure: sudden escape of fluids (skin and eye injuries), sudden drawing in of hair and clothing!

Danger due to escaping fluid: Burns!
Use mounting elements, connections, lines, fittings and containers with sufficient freedom from leaks and strength for the pressures which occur.

Check the mounting elements, connections, lines, fittings and containers for strength, leaks and firm seating at regular intervals!

⚠ WARNING

Danger from rotating parts (external fan, impeller, shaft):
Cutting/cutting off of extremities, Grasping/winding up of hair and clothing!

Danger due to vacuum and gauge pressure: sudden escape of fluids (skin and eye injuries), sudden drawing in of hair and clothing!

Danger due to escaping fluid: Burns!
Start-up and operation only under the following conditions:

- The pump-motor unit must be completely assembled. When doing so, pay particular attention to the following components:
  - the vacuum pump/compressor cover,
  - the muffler on inlet and discharge connections,
  - the fan guard.
- The pipes/hoses must be connected to inlet and discharge connections.
- Inlet and discharge connections and the connected pipes/hoses may not be closed, clogged or soiled.
- Check the mounting elements, connections of the pipe/hose connections, lines, fittings and containers for strength, leaks and firm seating at regular intervals.

⚠ WARNING

Danger from rotating parts (external fan, impeller, shaft):
Cutting/cutting off of extremities, Grasping/winding up of hair and clothing!

Danger due to vacuum and gauge pressure: sudden escape of fluids (skin and eye injuries), sudden drawing in of hair and clothing!

Danger due to escaping fluid: Burns!
Before beginning work on the pump-motor unit, take the following measures:

- Shut down pump-motor unit and secure against being switched on again.
- Attach a sign on the system controller and on the control elements for the pump-motor unit: "DANGER! Maintenance work on vacuum pump/compressor! Do not switch on!"
- Wait for pump-motor unit to come to a complete stop. Observe run-on time!
- Allow pump-motor unit to cool!
- Shut-off lines. Release pressure.
- Make sure that no vacuum or gauge pressure is present in the lines/tanks to be opened.
- Make sure that no fluids can escape.

⚠ WARNING

Danger from rotating impeller:
Cutting/cutting of off extremities!
The rotating impeller is accessible with the inlet and discharge connections open!

Do not reach into the unit through open connections!

Do not insert objects into the unit through the openings!

⚠ WARNING

Danger from rotating impeller:
Cutting/cutting of off extremities!
The rotating impeller is accessible with the inlet and discharge connections open!

With free entry and exit of gases, i.e. with direct intake out of or direct feeding into the atmosphere without piping, the following therefore applies:

Provide the inlet and discharge connections of the pump-motor unit either with additional mufflers or with additional piping of a sufficient length to prevent access to the impeller!

⚠ WARNING

Danger of burns from hot surfaces of the pump-motor unit and from hot fluids!
High temperatures of up to approx. 160°C [320 °F] can occur on the surface of the pump-motor unit.

Cover the pump-motor unit with a suitable touch protection (e.g. perforated plate cover or wire cover). Do not touch during operation! Allow to cool after shut-down!

1.3 Residual risks

⚠ WARNING

Danger zone:
Hot surface up to approx. 160°C [320 °F].

Hazard:
Possible burns.

Protective measures:
Cover the pump-motor unit with a suitable touch protection (e.g. perforated plate cover or wire cover).

⚠ WARNING

Danger zone:
Fan guard

Hazard:
Long, loose hair can be drawn into external fan through fan guard grate, even with fan guard mounted!

Protective measures:
Wear hair net!

⚠ WARNING

Danger zone:
Missing or defective muffler inlet or discharge connection.

Hazard:
Possible serious hearing damage due to emitted noise.

Protective measures:
Have missing or defective mufflers replaced. Conduct a noise measurement in the system after installing the pump-motor unit. The following measures can be taken from 85 dB(A) and must be taken from 90 dB(A):

- Mark noise area with a warning sign.
- Wear hearing protection.

⚠ WARNING

Danger zone:
Environment of pump-motor unit.

Hazard:
Possible serious hearing damage due to emitted noise.

Protective measures:
Conduct a noise measurement in the system during operation after installing the pump-motor unit.

The following measures can be taken from 85 dB(A) and must be taken from 90 dB(A):

- Mark noise area with a warning sign.
- Wear hearing protection.
- With free entry and exit of gases, i.e. with direct intake out of or direct feeding into the atmosphere without piping, attach an additional muffler.

2 Intended Use

These operating instructions

- apply to gas-ring vacuum pumps/compressors of the G_200 series, types 2BH1 1, 2BH1 2, 2BH1 3, 2BH1 4, 2BH1 5, 2BH1 6, 2BH1 8 and 2BH1 9,
- contains instructions bearing on transport and handling, installation, commissioning, operation, shut-down, storage, servicing and disposal of the G_200,
- must be completely read and understood by all operating and servicing personnel before beginning to work with or on the G_200,
- must be strictly observed,
- must be available at the site of operation of the G_200.

About the operating and servicing personnel of the G_200:

- These persons must be trained and authorized for the work to be carried out.
- Work on electrical installations may be carried out by trained and authorized electricians only.

The G_200s

- are pump-motor units for generating vacuum or gauge pressure;
- are used to **extract, pump** and **compress the following gases**:
  - Air,
  - Non-flammable, non-aggressive, non-toxic and non-explosive gases or gas-air mixtures.
  - With differing gases/gas-air mixtures, inquire with the Service Department.
- are equipped with one of the following kind of drive motors:
  - 3-phase AC drive motor with a standard or explosion-protected design
  - Single-phase AC drive motor

  These operating instructions apply **only to** pump-motor units with a **standard design.** For an explosion-protected design (EEx e II), see the separate operating instructions.
- exist in the following designs:
  - single-impeller
  - two-impeller

  The two-impeller pump-motor units in turn differ in the following designs:
  - two-stage design (for increased pressure difference)
  - double-flow design (for increased feed volume)
- are intended for industrial applications,
- are designed for continuous operation. With an increased switch-on frequency or an increased gas entry and ambient temperature, the limit overtemperature of the winding and the bearing can be exceeded. Consultation with the Service Department is required for operating conditions of this kind.

When operating the G_200, the limits listed in Chapter 3, "Technical Data", Pg. 7 ff. must always be complied with.

Foreseeable Misuse

It is prohibited

- to use the G_200 in applications other than industrial applications unless the necessary protection is provided on the system, e.g. guards suitable for children's fingers;
- to use the device in rooms in which explosive gases can occur if the G_200 is not expressly intended for this purpose;
- to extract, to deliver and to compress explosive, flammable, corrosive or toxic fluids, unless the G_200 is specifically designed for this purpose;
- to operate the G_200 with values other than those specified in Chapter 3, "Technical Data", Pg. 7 ff.

Any unauthorized modifications of the G_200 are prohibited for safety reasons.
The operator is only permitted to perform the maintenance and service work described in these operating instructions.
Any maintenance and service work which goes beyond this many only be performed by companies authorized by the manufacturer (inquire with the Service Department).

3 Technical L

3.1 Mechanical data

Weight

Single-impeller design

Type	Weight [kg]	Weight [lbs]
2BH1100-7..0.	approx. 9	approx. 20
2BH1200-7..0.	approx. 9	approx. 20
2BH1300-7..0.	approx. 9	approx. 20
2BH1300-7..1.	approx. 10	approx. 22
2BH1300-7..2.	approx. 11	approx. 24
2BH1330-7..0.	approx. 10	approx. 22
2BH1330-7..1.	approx. 11	approx. 24
2BH1330-7..2.	approx. 12	approx. 26
2BH1400-7..0.	approx. 13	approx. 29
2BH1400-7..1.	approx. 16	approx. 35
2BH1400-7..2.	approx. 17	approx. 37
2BH1430-7..0.	approx. 14	approx. 31
2BH1430-7..1.	approx. 17	approx. 37
2BH1430-7..2.	approx. 18	approx. 40
2BH1500-7..0.	approx. 20	approx. 44
2BH1500-7..1.	approx. 22	approx. 49
2BH1500-7..2.	approx. 23	approx. 51
2BH1500-7..3.	approx. 25	approx. 55
2BH1500-7..6.	approx. 28	approx. 62
2BH1530-7..0.	approx. 21	approx. 46
2BH1530-7..1.	approx. 23	approx. 51
2BH1530-7..2.	approx. 24	approx. 53
2BH1530-7..3.	approx. 26	approx. 57
2BH1530-7..6.	approx. 29	approx. 64
2BH1600-7..0.	approx. 27	approx. 60
2BH1600-7..1.	approx. 30	approx. 66
2BH1600-7..2.	approx. 36	approx. 79
2BH1600-7..3.	approx. 40	approx. 88
2BH1600-7..6.	approx. 32	approx. 71
2BH1600-7..7.	approx. 39	approx. 86
2BH1630-7..0.	approx. 29	approx. 64
2BH1630-7..1.	approx. 32	approx. 71
2BH1630-7..2.	approx. 37	approx. 82
2BH1630-7..3.	approx. 43	approx. 95
2BH1630-7..6.	approx. 34	approx. 75
2BH1630-7..7.	approx. 40	approx. 88
2BH180.-7..0.	approx. 117	approx. 258
2BH180.-7..1.	approx. 126	approx. 278
2BH180.-7..2.	approx. 132	approx. 291
2BH183.-7..0.	approx. 120	approx. 265
2BH183.-7..1.	approx. 129	approx. 284
2BH183.-7..2.	approx. 135	approx. 298
2BH190.-7..0.	approx. 179	approx. 395
2BH190.-7..1.	approx. 198	approx. 437
2BH190.-7..3.	approx. 210	approx. 463
2BH193.-7..0.	approx. 179	approx. 395
2BH193.-7..1.	approx. 198	approx. 437
2BH193.-7..3.	approx. 209	approx. 463

Two-impeller design

Type	Weight [kg]	Weight [lbs]
2BH1310-7..2.	approx. 15	approx. 33
2BH1410-7..3.	approx. 25	approx. 55
2BH1410-7..4.	approx. 27	approx. 60
2BH1510-7..4.	approx. 40	approx. 88
2BH1510-7..5.	approx. 44	approx. 97
2BH1610-7..1.	approx. 43	approx. 95
2BH1610-7..2.	approx. 48	approx. 106
2BH1610-7..3.	approx. 54	approx. 119
2BH1610-7..4.	approx. 66	approx. 146
2BH1610-7..5.	approx. 73	approx. 161
2BH1610-7).7.	approx. 50	approx. 110
2BH1610-7..8.	approx. 62	approx. 137
2BH1640-7..3.	approx. 54	approx. 119
2BH1640-7..4.	approx. 69	approx. 152
2BH1640-7..5.	approx. 75	approx. 165
2BH1640-7..8.	approx. 62	approx. 137
2BH181.-7..1.	approx. 171	approx. 377
2BH181.-7..2.	approx. 177	approx. 390
2BH181.-7..3.	approx. 203	approx. 448
2BH181.-7..4.	approx. 215	approx. 474
2BH184.-7..2.	approx. 177	approx. 390
2BH184.-7..3.	approx. 203	approx. 448
2BH191.-7..1.	approx. 281	approx. 619
2BH191.-7..2.	approx. 295	approx. 650
2BH191.-7..3.	approx. 306	approx. 675
2BH1940-7B.2.	approx. 275	approx. 606
2BH1940-7B.3.	approx. 314	approx. 692
2BH1940-7B.4.	approx. 324	approx. 714
2BH1943-7..2.	approx. 330	approx. 728
2BH1943-7..3.	approx. 339	approx. 747
2BH1943-7..4.	approx. 349	approx. 769

Minimum distances

Minimum distance to fan guard (for sucking in cooling air):

Type	Minimum distance to fan guard [mm]	Minimum distance to fan guard [inches]
2BH1 1..	34	1.34
2BH1 2..	34	1.34
2BH1 3..	34	1.34
2BH1 4..	34	1.34
2BH1 5..	53	2.09
2BH1 6..	53	2.09
2BH1 8..	53	2.09
2BH1 9..	53	2.09

Minimum distances to vacuum pump/compressor cover:

Type	Minimum distance to face of vacuum pump/compressor cover [mm]	Minimum distance to face of vacuum pump/compressor cover [inches]
2BH1 1..	20	0.79
2BH1 2..	20	0.79
2BH1 3..	20	0.79
2BH1 4..	20	0.79

Type	Minimum distance to face of vacuum pump/compressor cover [mm]	Minimum distance to face of vacuum pump/compressor cover [inches]
2BH1 5..	20	0.79
2BH1 6..	30	1.18
2BH1 8..	40	1.57
2BH1 9..	40	1.57

Noise level

Measuring-surface sound-pressure level as per DIN 45635, T13, measured at a distance of 1 m [3.28 ft] at an operating point of approximately 2/3 of the permissible total pressure difference with the lines connected without a vacuum or pressure relief valve.

Single-impeller design

Type	1-m measuring-surface sound pressure level L [dB (A)] at 50 Hz:	1-m measuring-surface sound pressure level L [dB (A)] at 60 Hz:
2BH1100-7..0.	approx. 52	approx. 55
2BH1200-7..0.	approx. 57	approx. 61
2BH1300-7..0.	approx. 53	approx. 56
2BH1300-7..1.	approx. 53	approx. 56
2BH1300-7..2.	approx. 53	approx. 56
2BH1330-7..0.	approx. 53	approx. 56
2BH1330-7..1.	approx. 53	approx. 56
2BH1330-7..2.	approx. 53	approx. 56
2BH1400-7..0.	approx. 63	approx. 64
2BH1400-7..1.	approx. 63	approx. 64
2BH1400-7..2.	approx. 63	approx. 64
2BH1430-7..0.	approx. 63	approx. 64
2BH1430-7..1.	approx. 63	approx. 64
2BH1430-7..2.	approx. 63	approx. 64
2BH1500-7..0.	approx. 64	approx. 70
2BH1500-7..1.	approx. 64	approx. 70
2BH1500-7..2.	approx. 64	approx. 70
2BH1500-7..3.	approx. 64	approx. 70
2BH1500-7..6.	approx. 64	approx. 70
2BH1530-7..0.	approx. 64	approx. 70
2BH1530-7..1.	approx. 64	approx. 70
2BH1530-7..2.	approx. 64	approx. 70
2BH1530-7..3.	approx. 64	approx. 70
2BH1530-7..6.	approx. 64	approx. 70
2BH1600-7..0.	approx. 69	approx. 72
2BH1600-7..1.	approx. 69	approx. 72
2BH1600-7..2.	approx. 69	approx. 72
2BH1600-7..3.	approx. 69	approx. 72
2BH1600-7..6.	approx. 69	approx. 72
2BH1600-7..7.	approx. 69	approx. 72
2BH1630-7..0.	approx. 69	approx. 72
2BH1630-7..1.	approx. 69	approx. 72
2BH1630-7..2.	approx. 69	approx. 72
2BH1630-7..3.	approx. 69	approx. 72
2BH1630-7..6.	approx. 69	approx. 72
2BH1630-7..7.	approx. 69	approx. 72
2BH180.-7..0.	approx. 70	approx. 74
2BH180.-7..1.	approx. 70	approx. 74
2BH180.-7..2.	approx. 70	approx. 74

Single-impeller design

Type	1-m measuring-surface sound pressure level L [dB (A)] at 50 Hz:	1-m measuring-surface sound pressure level L [dB (A)] at 60 Hz:
2BH183.-7....	approx. 76	approx. 79
2BH190.-7..0.	approx. 74	approx. 79
2BH190.-7..1.	approx. 74	approx. 79
2BH190.-7..3.	approx. 74	approx. 79
2BH193.-7....	approx. 71	approx. 75

Two-impeller design

Type	1-m measuring-surface sound pressure level L [dB (A)] at 50 Hz:	1-m measuring-surface sound pressure level L [dB (A)] at 60 Hz:
2BH1310-7..2.	approx. 55	approx. 61
2BH1410-7..3.	approx. 66	approx. 69
2BH1410-7..4.	approx. 66	approx. 69
2BH1510-7..4.	approx. 72	approx. 74
2BH1510-7..5.	approx. 72	approx. 74
2BH1610-7..1.	approx. 73	approx. 76
2BH1610-7..2.	approx. 73	approx. 76
2BH1610-7..3.	approx. 73	approx. 76
2BH1610-7..4.	approx. 73	approx. 76
2BH1610-7..5.	approx. 73	approx. 76
2BH1610-7..7.	approx. 73	approx. 76
2BH1610-7..8.	approx. 73	approx. 76
2BH1640-7..3.	approx. 74	approx. 78
2BH1640-7..4.	approx. 74	approx. 78
2BH1640-7..5.	approx. 74	approx. 78
2BH1640-7..8.	approx. 74	---
2BH181.-7..1.	approx. 74	---
2BH181.-7..2.	approx. 74	approx. 78
2BH181.-7..3.	approx. 74	approx. 78
2BH181.-7..4.	approx. 74	approx. 78
2BH184.-7..2.	approx. 74	approx. 78
2BH184.-7..3.	approx. 74	approx. 78
2BH191.-7..1.	approx. 74	approx. 84
2BH191.-7..2.	approx. 74	approx. 84
2BH191.-7..3.	approx. 74	approx. 84
2BH1943-7..2.	approx. 75	approx. 84
2BH1943-7..3.	approx. 75	approx. 84
2BH1943-7..4.	approx. 75	approx. 84

Temperature increase

The information listed in the following tables corresponds to the heating of vacuum pump/compressor housings and the air exiting compared to the ambient temperature during operation with a permissible total pressure difference and an air pressure of 1,013 mbar [14.7 psi]. At lower air pressures these values increase.

Single-impeller design (at a frequency of 50 Hz)

Type	Temperature increase	
	ΔT [K]	Δϑ [F]
2BH1100-7..0.	ca. 46	ca. 115
2BH1200-7..0.	ca. 18	ca. 65
2BH1300-7..0.	ca. 32	ca. 90
2BH1300-7..1.	ca. 32	ca. 90
2BH1300-7..2.	ca. 32	ca. 90
2BH1330-7..0.	ca. 27	ca. 81
2BH1330-7..1.	ca. 44	ca. 111
2BH1330-7..2.	ca. 44	ca. 111
2BH1400-7..0.	ca. 37	ca. 99
2BH1400-7..1.	ca. 54	ca. 129
2BH1400-7..2.	ca. 65	ca. 149
2BH1430-7..0.	ca. 30	ca. 86
2BH1430-7..1.	ca. 57	ca. 135
2BH1430-7..2.	ca. 80	ca. 176
2BH1500-7..0.	ca. 30	ca. 86
2BH1500-7..1.	ca. 46	ca. 115
2BH1500-7..2.	ca. 59	ca. 138
2BH1500-7..3.	ca. 95	ca. 203
2BH1500-7..6.	ca. 120	ca. 248
2BH1530-7..0.	ca. 25	ca. 77
2BH1530-7..1.	ca. 46	ca. 115
2BH1530-7..2.	ca. 66	ca. 151
2BH1530-7..3.	ca. 95	ca. 203
2BH1530-7..6.	ca. 95	ca. 203
2BH1600-7..0.	ca. 27	ca. 81
2BH1600-7..1.	ca. 63	ca. 145
2BH1600-7..2.	ca. 77	ca. 171
2BH1600-7..3.	ca. 107	ca. 225
2BH1600-7..6.	ca. 120	ca. 248
2BH1600-7..7.	ca. 120	ca. 248
2BH1630-7..0.	ca. 35	ca. 95
2BH1630-7..1.	ca. 65	ca. 149
2BH1630-7..2.	ca. 120	ca. 248
2BH1630-7..3.	ca. 120	ca. 248
2BH1630-7..6.	ca. 120	ca. 248
2BH1630-7..7.	ca. 120	ca. 248
2BH180.-7..0.	ca. 40	ca. 104
2BH180.-7..1.	ca. 67	ca. 153
2BH180.-7..2.	ca. 120	ca. 248
2BH183.-7....	ca. 60	ca. 140
2BH190.-7..0.	ca. 36	ca. 97
2BH190.-7..1.	ca. 83	ca. 182
2BH190.-7..3.	ca. 110	ca. 230
2BH193.-7....	ca. 116	ca. 241

Single-impeller design (at a frequency of 60 Hz)

Type	Temperature increase	
	ΔT [K]	Δϑ [F]
2BH1100-7..0.	ca. 58	ca. 136
2BH1200-7..0.	ca. 38	ca. 101
2BH1300-7..0.	ca. 25	ca. 77
2BH1300-7..1.	ca. 60	ca. 140
2BH1300-7..2.	ca. 70	ca. 158
2BH1330-7..0.	ca. 25	ca. 77
2BH1330-7..1.	ca. 56	ca. 133
2BH1330-7..2.	ca. 56	ca. 133
2BH1400-7..0.	ca. 30	ca. 86
2BH1400-7..1.	ca. 50	ca. 122
2BH1400-7..2.	ca. 75	ca. 167
2BH1430-7..0.	ca. 27	ca. 81
2BH1430-7..1.	ca. 51	ca. 124
2BH1430-7..2.	ca. 77	ca. 171
2BH1500-7..0.	ca. 22	ca. 72
2BH1500-7..1.	ca. 36	ca. 97
2BH1500-7..2.	ca. 50	ca. 122
2BH1500-7..3.	ca. 82	ca. 180
2BH1500-7..6.	ca. 120	ca. 248
2BH1530-7..0.	ca. 23	ca. 73
2BH1530-7..1.	ca. 33	ca. 91
2BH1530-7..2.	ca. 65	ca. 149
2BH1530-7..3.	ca. 100	ca. 212
2BH1530-7..6.	ca. 100	ca. 212
2BH1600-7..0.	ca. 20	ca. 68
2BH1600-7..1.	ca. 40	ca. 104
2BH1600-7..2.	ca. 80	ca. 176
2BH1600-7..3.	ca. 85	ca. 185
2BH1600-7..6.	ca. 90	ca. 194
2BH1600-7..7.	ca. 120	ca. 248
2BH1630-7..0.	ca. 30	ca. 86
2BH1630-7..1.	ca. 55	ca. 131
2BH1630-7..2.	ca. 70	ca. 158
2BH1630-7..3.	ca. 107	ca. 225
2BH1630-7..6.	ca. 107	ca. 225
2BH1630-7..7.	ca. 107	ca. 225
2BH180.-7..0.	ca. 40	ca. 104
2BH180.-7..1.	ca. 85	ca. 185
2BH180.-7..2.	ca. 105	ca. 221
2BH1830-7..2.	ca. 70	ca. 158
2BH190.-7..0.	ca. 35	ca. 95
2BH190.-7..1.	ca. 68	ca. 155
2BH190.-7..3.	ca. 100	ca. 212
2BH1930-7..3.	ca. 89	ca. 192

Two-impeller design (at a frequency of 50 Hz)

Type	Temperature increase	
	ΔT [K]	Δϑ [F]
2BH1310-7..2.	approx. 53	approx. 127
2BH1410-7..3.	approx. 68	approx. 154
2BH1410-7..4.	approx. 83	approx. 181
2BH1510-7..4.	approx. 88	approx. 190
2BH1510-7..5.	approx. 90	approx. 194
2BH1610-7..1.	approx. 33	approx. 92
2BH1610-7..2.	approx. 54	approx. 129

Two-impeller design (at a frequency of 50 Hz)

Type	Temperature increase	
	ΔT [K]	Δϑ [F]
2BH1610-7..3.	approx. 80	approx. 176
2BH1610-7..4.	approx. 105	approx. 221
2BH1610-7..5.	approx. 120	approx. 248
2BH1610-7..7.	approx. 80	approx. 176
2BH1610-7..8.	approx. 80	approx. 176
2BH1640-7..3.	approx. 20	approx. 68
2BH1640-7..4.	approx. 35	approx. 95
2BH1640-7..5.	approx. 44	approx. 111
2BH1640-7..8.	approx. 20	approx. 68
2BH181.-7..1.	approx. 45	approx. 113
2BH181.-7..2.	approx. 85	approx. 185
2BH181.-7..3.	approx. 120	approx. 248
2BH181.-7..4.	approx. 135	approx. 275
2BH184.-7..2.	approx. 45	approx. 113
2BH184.-7..3.	approx. 80	approx. 176
2BH191.-7..1.	approx. 48	approx. 119
2BH191.-7..2.	approx. 95	approx. 203
2BH191.-7..3.	approx. 120	approx. 248
2BH1943-7..2.	approx. 32	approx. 90
2BH1943-7..3.	approx. 60	approx. 140
2BH1943-7..4.	approx. 100	approx. 212

Two-impeller design (at a frequency of 60 Hz)

Type	Temperature increase	
	ΔT [K]	Δϑ [F]
2BH1310-7..2.	approx. 74	approx. 165
2BH1410-7..3.	approx. 65	approx. 149
2BH1410-7..4.	approx. 82	approx. 180
2BH1510-7..4.	approx. 80	approx. 176
2BH1510-7..5.	approx. 94	approx. 201
2BH1610-7..1.	approx. 30	approx. 86
2BH1610-7..2.	approx. 48	approx. 118
2BH1610-7..3.	approx. 75	approx. 167
2BH1610-7..4.	approx. 88	approx. 190
2BH1610-7..5.	approx. 130	approx. 266
2BH1610-7..7.	approx. 75	approx. 167
2BH1610-7..8.	approx. 120	approx. 248
2BH1640-7..3.	approx. 25	approx. 77
2BH1640-7..4.	approx. 30	approx. 86
2BH1640-7..5.	approx. 42	approx. 108
2BH181.-7..2.	approx. 60	approx. 140
2BH181.-7..3.	approx. 120	approx. 248
2BH181.-7..4.	approx. 130	approx. 266
2BH184.-7..2.	approx. 30	approx. 86
2BH184.-7..3.	approx. 70	approx. 158
2BH191.-7..1.	approx. 46	approx. 115
2BH191.-7..2.	approx. 76	approx. 169
2BH191.-7..3.	approx. 134	approx. 274
2BH1943-7..2.	approx. 30	approx. 86
2BH1943-7..3.	approx. 45	approx. 113
2BH1943-7..4.	approx. 65	approx. 149

Tightening torques for screw connections

The following values apply if no other information is available.

With non-electriapproxl connections, property classes of 8.8 and 8 or higher as per DIN ISO 898 (DIN EN 20898 / DIN ISO 898) are assumed.

Thread	Tightening torques for non-electrical connections [Nm]	[ft lbs]
M4	3 ± 0.3	2.21 ± 0.22
M5	4 ± 0.4	2.95 ± 0.3
M6	8 ± 0.8	5.9 ± 0.59
M8	24 ± 2.4	17.7 ± 1.77
M10	42 ± 4.2	31 ± 3.1
M12	70 ± 7.0	51.6 ± 5.16

The following information for electrical connection applies to all terminal board connections with the exception of terminal strips.

Thread	Tightening torques for electrical connections [Nm]	[ft lbs]
M4	0.8 - 1.2	0.59 - 0.89
M5	1.8 - 2.5	1.33 - 1.84

Especially for metal and plastic threaded cable glands and pipe unions, the following values apply:

Thread	Tightening torques for metal threaded glands/unions [Nm]		[ft lbs]	
	min	max	min	max
M12x1.5	4	6	2.95	4.43
M16x1.5	5	7.5	3.69	5.53
M20x1.5	6	9	4.43	6.64
M32x1.5 M40x1.5	8	12	5.9	8.85

Thread	Tightening torques for plastic threaded glands/unions [Nm]		[ft lbs]	
	min	max	min	max
M12x1.5	2	3.5	1.48	2.58
M16x1.5	3	4	2.21	2.95
M20x1.5	4	5	2.95	3.69
M32x1.5 M40x1.5	5	7	3.69	5.16

3.2 Electrical data

See rating plate.

3.3 Operating conditions

Temperatures

Temperature of pumped gases:	max. permissible temperature: +40 °C [+104 °F] Nominal value: +15 °C [+59 °F] Pump-motor units for higher fluid temperatures on request.
Ambient temperature:	max. permissible temperature: +40 °C [+104 °F] min. permissible temperature: -30 °C [-22 °F] Nominal value: +25 °C [+77 °F] Ambient temperatures between 25 °C [+77 °F] and 40 °C [+104 °F] affect the permissible total pressure difference (see Section "Permissible total pressure difference"). At higher temperatures the winding may be damaged and the grease change interval may be shortened.

Pressures

Min. inlet pressure:	See rating plate.
Max. discharge pressure during compressor operation:	See rating plate.
Max. permissible pressure in pump-motor unit:	2 bar abs. [29 psia] At this pressure the operation of the pump-motor unit may be considerably impaired. Provide a corresponding protective device (e.g. pressure relief valve) if necessary.
Permissible total pressure difference:	The total pressure difference specified on the rating plate only applies under the following conditions: • Ambient temperature: 25°C [77 °F]. • Inlet temperature (temperature of pumped gases at inlet connection): 15°C [59 °F]. • Pressure: during vacuum-pump operation: 1,013 mbar [14.7 psia] at discharge connection; during compressor operation: 1,013 mbar [14.7 psia] at inlet connection; At an ambient temperature of 40 °C [104 °F] the total pressure difference specified on the rating plate must be reduced by 10%. If the ambient temperature is between 25 °C [77 °F] and 40 °C [104 °F], then the total pressure difference specified on the rating plate must be reduced.

Installation altitude

Max. of 1,000 m [3,280 ft] above sea level.
When installing the pump-motor unit at an altitude of more than 1,000 m [3,280 ft] above sea level, first inquire with the Service department.

4 Transport and Handling

⚠ WARNING

Tipping or falling can lead to crushing, broken bones etc.! Sharp edges can cause cuts!
Wear personal safety equipment (gloves, safety shoes and protective helmet) during transport!

⚠ WARNING

Danger from tipping or falling loads!
Prior to transport and handling make sure that all components are securely assembled and secure or remove all components the fasteners of which have been loosened!

Manual handling:

⚠ WARNING

Danger from lifting heavy loads!
Manual handling of the unit is only permitted within the following limits:

- max. 30 kg [max. 66 lbs] for men
- max. 10 kg [max. 22 lbs] for women
- max. 5 kg [max. 11 lbs] for pregnant women

For the weight of the pump-motor unit, see Chapter 3.1, "Mechanical data", Section "Weight", Pg. 7. For weights above the given values use suitable lifting appliances and handling equipment!

Handling by means of lifting equipment:

⚠ WARNING

Danger from tipping or falling loads!
When transporting with lifting equipment, observe the following basic rules:

- The lifting capacity of lifting equipment and lifting gear must be at least equal to the unit's weight. For the weight of the pump-motor unit, see Chapter 3.1, "Mechanical data", Section "Weight", Pg. 7.
- The pump-motor unit must be secured so that it cannot tip or fall.
- Do not stand or walk under suspended loads!

The transport must be carried out in different ways depending on the type:

- 2BH11., 2BH12., 2BH13., 2BH14., 2BH15. (single-impeller): Manual handling
- 2BH15. (two-impeller), 2BH16., 2BH18., 2BH19.:
  Transport with crane, hooked onto eye bolt (1 attachment point)
- 2BH1943:
  Transport with crane, hooked with lifting belts onto eye bolt and onto the holes in the two feet of the vacuum pump/compressor housing (3 attachment points).

For **transport with a crane**, the pump-motor unit can be hooked into the crane hook as follows:

- directly on the eye bolt
  (With 2BH194 the eye bolt and the two foot holes should be used)

or possibly

- with lifting belts.

Eye bolt:

Types with a weight of up to 30 kg [66 lbs] are **not** equipped with an eye bolt (2BH11., 2BH12., 2BH13., 2BH14., 2BH15 [single-impeller]).

Types with a weight of more than 30 kg [66 lbs] are equipped with an eye bolt as **standard** (2BH15. [two-impeller], 2BH16., 2BH18., 2BH19.).

The eye bolt is mounted on the vacuum pump/compressor housing.

In case of possible removal and remounting of the eye bolt, it must be ensured that the eye level is positioned exactly in the axis direction of the pump-motor unit. Lay shims under the eye bolt if necessary.

The eye bolt must be firmly tightened.

Loads laterally to the ring level are not permissible. Heavy impact loads during transport must be avoided.

5 Installation

⚠ WARNING

Improper use of the unit can result in serious or even fatal injuries!
Have you read the safety precautions in Chapter 1, "Safety", Pg. 3 f.?
Otherwise you many not carry out any work with or on the pump-motor unit!

⚠ DANGER

Danger from missing view into area of pump-motor unit!
When operating the control elements without a view into the area of the pump-motor unit, there is a danger that the pump-motor unit will be switched on while other persons are still performing work on it. Extreme injuries are possible!
Provide control elements at a location with a view of the pump-motor unit.

⚠ DANGER

Electrical danger!
The pump-motor unit must be installed so that the electrical device cannot be damaged by external influences!
In particular, the feed pipes must be securely routed, e.g. in cable ducts, in the floor etc.

⚠ WARNING

Danger from balance damage caused by vibration!
Vibrating environments can cause balance damage!

Install the pump-motor unit on a solid foundation or on a solid mounting surface.

Check screw glands/unions for mounting the pump-motor unit on the mounting surface regularly for strength and firm seating.

⚠ WARNING

Danger from crushing due to pump-motor unit tipping over!
Wear personal safety equipment (protective gloves and safety shoes). Handle the unit with the appropriate care. Install the pump-motor unit on a solid foundation or on a solid mounting surface! Check screw glands/unions for mounting the pump-motor unit on the mounting surface regularly for strength.

⚠ WARNING

Danger of fire from flammable substances!
The pump-motor unit must never come into contact with flammable substances.

For exact information on the temperature increase, see Chapter 3.1, "Mechanical data", Section "Temperature increase", Pg. 9.

⚠ WARNING

Danger of burns from hot surfaces of the pump-motor unit and from hot fluids!
High temperatures of up to approx. 160°C [320 °F] can occur on the surface of the pump-motor unit.

The pump-motor unit must be installed so that accidental touch of its surface is not possible. Cover the pump-motor unit with a suitable touch protection (e.g. perforated plate cover or wire cover).

⚠ WARNING

Danger of injuries from flying parts!
Select installation so that parts that are thrown out through the grate if the external fan breaks cannot hit persons!

⚠ CAUTION

Danger of tripping and falling!
Make sure the unit does not present a danger of tripping. Lay cables and pipes so that they cannot be reached during operation(recessed in floor, in ducts on the wall etc.).

CAUTION

Danger of overheating due to hot surface of pump-motor unit!
High temperatures can occur on the surface of the pump-motor unit.

Temperature sensitive parts, such as lines or electronic components, may not come into contact with the surface of the pump-motor unit.

The pump-motor unit is ready to connect on delivery. However, if the time from delivery to commissioning of the pump-motor unit exceeds a certain period, the lubrication of the rolling bearings must be renewed.
See Chapter 8.2, "Storage conditions", Section "Lubrication of rolling bearings after longer storage", Pg. 22 for information on this topic.

Carry out the following work to install the pump-motor unit:

- Installation and securing,
- Attachment of the included loose muffler if necessary,
- Attachment of threaded flange or hose flange (available as accessories) for the connection of inlet or discharge pipe to the muffler,
- Electrical connection,
- Connection of inlet and discharge connection to the system.

5.1 Installation

⚠ WARNING

For an installation that differs from the following specifications, it is necessary to inquire with the Service Department!

Ambient conditions:

The pump-motor unit is suitable for installation in the following environments:

- In a dusty or damp environment,
- in buildings,
- in the open.
  When properly installed in the open, the pump-motor unit must be protected from exposure to intensive sunlight, e.g. by attaching a protective roof. Otherwise, no special protective devices against the effects of weathering are required.

The drive motors of the pump-motor units have the following design:

- with degree of protection IP55 (see rating plate),
- with tropicalized insulation.

Installation conditions:

The pump-motor unit must be installed as follows:

- on level surfaces,
- at a maximum height of 1000 m [3280 ft] above sea level.
  When installing at an altitude of more than 1,000 m [3,280 ft] above sea level, first inquire with the Service Department.

Minimum distances:

To ensure sufficient cooling of the pump-motor unit, it is absolutely necessary that the required minimum distances to the **fan guard** and to the **face of the vacuum pump/compressor cover** be maintained. see Chapter 3.1, "Mechanical data", Section "Minimum distances", Pg. 7.

The minimum distances to the face of the vacuum pump/compressor cover are especially important when installing on the vacuum pump/compressor cover or near a wall.

CAUTION

To ensure sufficient cooling of the pump-motor unit, also observe the following:

- Ventilation screens and openings must remain clear.
- Discharge air of other units may not be directly sucked in again!

Noise radiation:

To reduce the noise radiation, the following must be observed:

- Do not mount pump-motor unit on noise-conducting or noise-radiating parts (e.g. thin walls or sheet-metal plates).
- Provide pump-motor unit with sound-insulating intermediate layers (e.g. rubber buffers under the base of the pump-motor unit) if necessary.
- Install the pump-motor unit on a stable foundation or on a rigid mounting surface. This provides for smooth, low-vibration running of the pump-motor unit.

Components for reducing noise on the pump-motor unit:

- **Mufflers** (included as standard equipment):
  On delivery the pump-motor units are equipped with attached mufflers as standard. The noise radiation is considerably reduced by the mufflers. See Fig. 2 to Fig. 9, Pg. 17 ff.
- **Additional mufflers** (available as an option):
  The additional mufflers enable a further noise reduction. They may only be used with free entry and exit of gases, i.e. with direct intake out of or direct feeding into the atmosphere **without piping**.
- **Noise protection hoods** (available as an option):
  Noise protection hoods are suitable for installation in rooms and in the open. They reduce both the total sound pressure level and tonal components that are perceived as particularly annoying.

Installation variants/axis position:

Basically, when installing the pump-motor unit, the following variants are possible with a different axis position (horizontal or vertical):

- Horizontal installation
- Vertical installation on the vacuum pump/compressor cover ("cover installation")
- Vertical mounting on the wall

Basically, all variants are possible with all type.

Exception:
With type 2BH1943 vertical installation on the vacuum pump/compressor cover ("cover installation") is mandatory.

In addition, a distinction must be made between a design with and a design without a **condensed water opening** for the axis position:

- The pump-motor units without a condensed water opening can be installed and secured in any axis position.
- The pump-motor unit with a condensed water opening may only be installed and secured horizontally with the base at the bottom.

Horizontal installation

Screw the base of the pump-motor unit to the surface with suitable mounting elements. Proceed as follows:

- Provide the base of the pump-motor unit with mounting holes.

- Select the suitable screw type.
- Screw the base of the pump-motor unit to the surface with the screws. When doing so, be sure to provide **all** mounting holes with screws!

Vertical installation on the vacuum pump/compressor cover ("cover installation")

With vertical installation of the pump-motor unit with the vacuum pump/compressor cover facing downward, rubber feet must be used.

Proceed as follows:

- The rubber feet are available as accessories. They are delivered in a set of 3. On the upper section they are provided with stud bolts and on the lower section with a threaded hole.
- Mount the rubber feet on the pump-motor unit:
  Screw the stud bolts of the rubber feed into the holes on the face of the vacuum pump/compressor cover and tighten them.
- Mount the pump-motor unit together with the rubber feet on the installation surface:
  Select suitable mounting elements for the threaded hole. Screw the rubber feet to the surface or foundation via the threaded hole.

Vertical mounting on the wall

With vertical mounting of the pump-motor unit on the wall, the pump-motor unit is mounted via the holes in the base.
Proceed as follows:

- Position the pump-motor unit as close to the wall as possible on a stable supporting plate with sufficient load-bearing capacity. The pump-motor unit must be positioned with the base toward the wall.
- Provide the base of the pump-motor unit with mounting holes.
- Select the suitable screw type.
- Screw the base of the pump-motor unit to the wall with the screws.
  When doing so, be sure to provide **all** mounting holes with screws!
- Remove the supporting plate.

Eye bolt:

Following installation the eye bolt can be removed.

5.2 Electrical connection (motor)

⚠ DANGER

Electrical danger!
Malpractice can result in severe injuries and material damage!

⚠ DANGER

Electrical danger!
The electrical connection may be carried out by trained and authorized electricians only!

⚠ DANGER

Electrical danger!
Before beginning work on the unit or system, the following measures must be carried out:

- Deenergize.
- Secure against being switched on again.
- Determine whether deenergized.
- Ground and short-circuit.
- Cover or block off adjacent energized parts.

CAUTION

Incorrect connection of the motor can lead to serious damage to the unit!

Regulations:

The electrical connection must be carried out as follows:

- according to the applicable national and local laws and regulations,
- according to the applicable system-dependent prescriptions and requirements,
- according to the applicable regulations of the utility company.

Electrical power supply:

Observe the **rating plate**.
It is imperative that the operating conditions correspond to the data given on the rating plate!

Deviations permissible without reduction in performance:

- ±5 % voltage deviation
- ±2 % frequency deviation

Connection to drive-motor terminal box:

Open the required cable entry openings on the terminal box. Here the following two cases are differentiated:

- The cable entry opening is prefabricated and provided with a sealing plug.
- Screw out sealing plug.

OR

- The cable entry opening is closed off with a casting skin (only on pump-motor units with drive-motor axis heights of 100 to 160 in standard design).
- Break out casting skin using a suitable tool. For example, use a metal pin with a corresponding diameter or a chisel and hammer.

CAUTION

When pounding out the casting skin on the cable entry openings in the terminal box, the terminal box or its parts can be damaged (e.g. terminal board, cable connections).
Proceed with suitable caution and precision when doing so! Prevent flash formation!

Mount cable glands on the terminal box.
Proceed as follows:

- Select one cable gland in each case which is suitable for the cable diameter.
- Insert this cable gland in the opening of the terminal box.
  Use a reducer if necessary.
- Screw on the cable gland so that no moisture, dirt etc. can penetrate into the terminal box.

Carry out the connection and the arrangement of the jumpers in accordance with the **circuit diagram in the terminal box**.

Connect the protective conductor to the terminal with the following symbol:
⏚.

The electrical connection must be carried out as follows:

- The electrical connection must be permanently safe.
- There may be no protruding wire ends.
- Clearance between bare live parts and between bare live parts and ground:
  ≥ 5.5 mm [0.217"] (at a nominal voltage of $U_N \leq 690V$).
- For the tightening torques for terminal board connections (except terminal strips), see Chapter 3.1, "Mechanical data", Section "Tightening torques for screw connections", Pg. 10.
- For terminals with clamping straps (e.g. as per DIN 46282), the conductors must be inserted so that approximately the same clamping height results on both sides of the bar. Individual conductors must therefore be bent into a U-shape or connected with a cable lug (DIN 46234).

This also applies to:

- the protective conductor,
- the outer ground conductor.

Both conductors can be recognized from their color (green/yellow).

⚠ DANGER

Electrical danger!
The terminal box must be free from

- foreign bodies,
- dirt,
- humidity.

Terminal box cover and cable entries must be tightly closed so as to make them dustproof and waterproof. Check for tightness at regular intervals.

⚠ DANGER

Electrical danger!
Clearance between bare live parts and between bare live parts and ground:
at least **5.5 mm [0.217"]** (at a nominal voltage of $U_N \leq 690V$).
There may be no protruding wire ends!

For **motor overload protection**:

- Use motor circuit breakers.
- This must be adjusted to the specified nominal current (see rating plate).

⚠ DANGER

Electrical danger!
There is danger of an electrical shock when a defective pump-motor unit is touched!
Mount motor circuit breaker.
Have electrical equipment checked regularly by an electrician.

Interference immunity of drive motor:

For drive motors with integrated sensors, the operator must provide for a sufficient

interference immunity its ... select a suitable sensor signal cable (e.g. with screening, connection as for a motor power-supply cable) and analyzing unit.

Operation with frequency converter:

With a power supply by a frequency converter, the following must be observed:

- High-frequency current and voltage harmonics in the motor supply cables can lead to emitted electromagnetic interference. This is dependent on the converter design (type, manufacturer, interference suppression measures).
- Be sure to observe the EMC notes of the converter manufacturer!
- Use screened power supply cables if necessary. For optimal screening, the screen must be conductively connected over a large area to the metal terminal box of the drive motor with a screwed metal gland.
- In the case of drive motors with integrated sensors (e.g. PTC thermistors) interference voltage can occur on the sensor cable depending on the converter type.
- Limit speed:
  see specifications on the rating plate.

⚠ WARNING

Pump-motor units with a UL approbation may not be operated on frequency converters in the US without testing by a suitable test agency!

5.3 Connecting pipes/hoses (vacuum pump/compressor)

Mufflers:

The pump-motor units are delivered with mufflers (indicated with arrows in the following illustrations) for the inlet and discharge connections as standard equipment.

On delivery the mufflers are already mounted on the following pump-motor units.

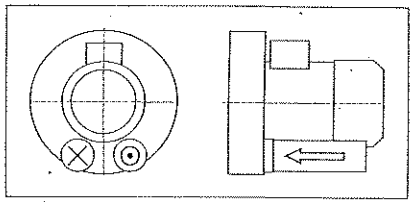


Fig. 2: 2BH1100 ... 2BH1930 (single-impeller pump-motor units)

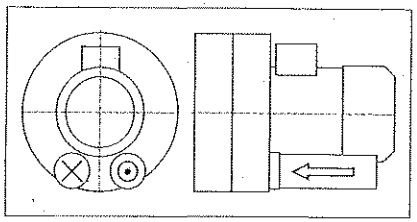


Fig. 3: 2BH1640 (two-impeller pump-motor unit with double-flow design)

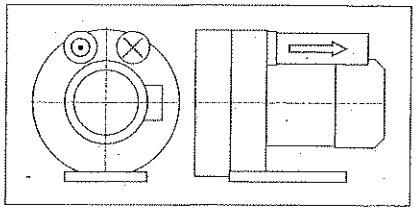


Fig. 4: 2BH1840-7G... (two-impeller pump-motor unit with double-flow design)

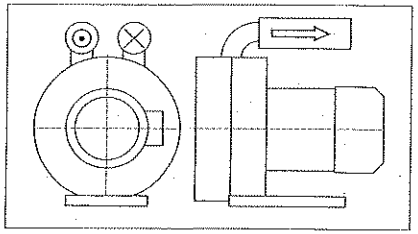


Fig. 5: 2BH1840-7J... (two-impeller pump-motor unit with double-flow design)

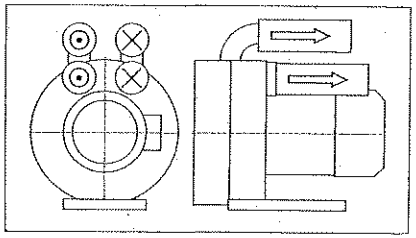


Fig. 6: 2BH1840-7L... (two-impeller pump-motor unit with double-flow design)

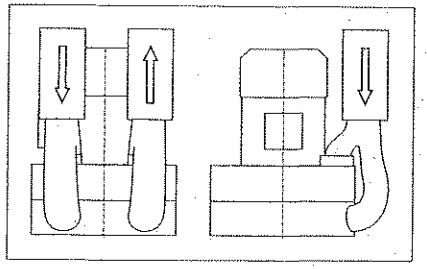


Fig. 7: 2BH1943 (two-impeller pump-motor unit with double-flow design)

On **two-impeller pump-motor units with a two-stage design of the types 2BH1310 to 2BH1910** the discharge-side muffler is included loose for packing-related reasons and must be mounted by the customer.

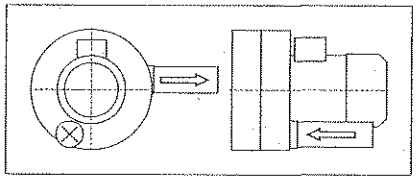


Fig. 8: 2BH1310 ... 2BH1610, 2BH1910 (two-impeller pump-motor units with a two-stage design)

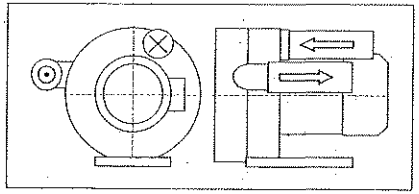


Fig. 9: 2BH1810 (two-impeller pump-motor unit with a two-stage design)

⚠ WARNING

Danger from rotating impeller: Cutting/cutting of off extremities!

The rotating impeller is accessible with the inlet and discharge connections open!

With free entry and exit of gases, i.e. with direct intake out of or direct feeding into the atmosphere without piping, the following therefore applies:

Provide the inlet and discharge connections of the pump-motor unit either with additional mufflers or with additional piping of a sufficient length to prevent access to the impeller!

Connections:

To prevent foreign bodies from entering the unit, all connections are sealed off when delivered. Do not remove the sealing plugs until immediately before connecting the pipes/hoses.

The following applies for the arrangement of the pipe/hose connections:

The **pumped gases** are sucked in via the inlet connection (see Chapter 5.3.1, Pg. 19) and discharged via the discharge connection (see Chapter 5.3.2, Pg. 19).

The **shaft rotating direction** is marked with an arrow on the back of the vacuum pump/compressor housing (Fig. 1, Pg. 2, Item 7).

The **delivery direction of the gases** is marked with arrows on both connections (Fig. 1, Pg. 2, Item 6).

⚠ WARNING

Danger from interchanging inlet and pressure line!

Interchanged inlet and pressure lines can lead to damage to the pump-motor unit and the system, and as a result of this to serious injuries!

Make sure that the inlet and pressure line cannot be confused when connecting.

Look for the clear marking with the arrow indicating the delivery direction on the inlet and discharge connections.

⚠ WA[illegible]G

Danger due to vacuum and gauge pressure!

Danger due to escaping fluid!

During operation, connected pipes and vessels are vacuumized or pressurized!

Use only mounting elements, connections, lines, fittings and containers with sufficient freedom from leaks and strength for the pressures which occur.

Make sure that the mounting elements and connections are mounted sufficiently firmly and leak-free!

CAUTION

If the pumped gases are passed on on the discharge side in a closed pipe system, then it must be ensured that the pipe system is adapted to the maximum discharge pressure. See Chapter 3.3: "Operating conditions", Section "Pressures", Pg. 11. Connect a pressure relief valve upstream if necessary.

NOTICE

Attach pipes/hoses free of mechanical tensions. Support the weight of the pipes/hoses.

5.3.1 Inlet connection

The inlet connection with the related muffler (Fig. 1, Pg. 2, Item 3) is marked with an arrow pointing into the vacuum pump/compressor. Connect the inlet pipe here. The pumped gases are sucked in via this. Procedure: see Chapter 5.3.3.

⚠ WARNING

Danger from solid bodies and impurities in the pump-motor unit!

If solid bodies penetrate into the pump-motor unit, blades of the impellers can break and broken pieces can be thrown out.

Install a filter in the inlet pipe.
Replace filter regularly!

5.3.2 Discharge connection

The discharge connection with the related muffler (Fig. 1, Pg. 2, Item 4) is marked with an arrow pointing out of the vacuum pump/compressor. Connect the discharge pipe here. The pumped gases are discharged via this. Procedure: see Chapter 5.3.3.

5.3.3 Procedure when connecting pipes/hoses

Attach the pipes/hoses to the unit as described in the following. The pipes/hoses are connected differently to inlet and discharge connections depending on the muffler design and the type of line (pipe or hose):

- Muffler with inside threads:
  The pipe is screwed directly into the muffler.
- Muffler without inside thread:
  - Screw threaded flange (available as an accessory) onto the muffler.
  - Screw the pipe into the threaded flange.
- Hose connection:
  - Screw hose flange (available as an accessory) onto the muffler.
  - Push the hose onto the hose flange and secure it with a hose clamp. See Chapter 3.1, "Mechanical data", Section "Tightening torques for screw connections", Pg. 10 for information on this topic.

6 Commissioning

⚠ WARNING

Improper use of the unit can result in serious or even fatal injuries!

Have you read the safety precautions in Chapter 1, "Safety", Pg. 3 f.? Otherwise you many not carry out any work with or on the pump-motor unit!

⚠ WARNING

Danger from rotating parts (external fan, impeller, shaft): Cutting/cutting off of extremities, Grasping/winding up of hair and clothing!

Danger due to vacuum and gauge pressure: sudden escape of fluids (skin and eye injuries), sudden drawing in of hair and clothing!

Danger due to escaping fluid: Burns!

Start-up and operation only under the following conditions:

- The pump-motor unit must be completely assembled. When doing so, pay particular attention to the following components:
  - the vacuum pump/compressor cover,
  - the muffler on inlet and discharge connections,
  - the fan guard.
- The pipes/hoses must be connected to inlet and discharge connections.
- Inlet and discharge connections and the connected pipes/hoses may not be closed, clogged or soiled.
- Check the mounting elements, connections of the pipe/hose connections, lines, fittings and containers for strength, leaks and firm seating at regular intervals.

6.1 Preparation

⚠ WARNING

Danger from closed connections!

With closed/soiled intake or discharge connections vacuum or gauge pressure results in the pump-motor unit.

This can overheat and damage the drive motor winding.

Before start-up, make sure that the inlet and discharge connections are not closed, clogged or soiled!

CAUTION

Before starting up again after a longer standstill:
Measure the insulation resistance of the motor. With values ≤ 1 kΩ per volt of nominal voltage, the winding is too dry.

Measures before start-up:

- If a shut-off device is installed in the discharge pipe:
  Make sure that the unit is NOT operated with the shut-off device closed.
- Before starting up the pump-motor unit, observe the values specified on the rating plate. Specifications on the drive-motor nominal current apply at a gas entry and ambient temperature of +40° C [104 °F].
- Adjust the motor circuit breaker to the drive-motor nominal current.

Check direction of rotation:

- The intended rotating direction of the shaft is marked with arrows on the vacuum pump/compressor housing (Fig. 1, Pg. 2, Item. 7).
- The gas delivery direction is marked with arrows on the inlet and discharge connections (Fig. 1, Pg. 2, Item 6).
- Make sure the pipes/hoses on the inlet and discharge connections are properly connected.
- Switch the pump-motor unit on briefly and then off again.
- Compare the actual rotating direction of the external fan with the intended shaft rotating direction indicated with the arrows shortly before the pump-motor unit comes to a standstill.
- If necessary, reverse the direction of rotation of the motor.

⚠ WARNI[illegible]

Danger due to rotating parts! Danger due to vacuum and gauge pressure! Danger due to escaping fluid!

Test runs may also only be conducted with the pump-motor unit completely mounted.

⚠ DANGER

Electrical danger!

The electrical connection may be carried out by trained and authorized electricians only!

⚠ DANGER

Electrical danger!

Before beginning work on the unit or system, the following measures must be carried out:

- Deenergize.
- Secure against being switched on again.
- Determine whether deenergized.
- Ground and short-circuit.
- Cover or block off adjacent energized parts.

Check operating speeds:

Observe the operating speed specified on the rating plate. This may not be exceeded, as otherwise the noise radiation, vibration behavior, grease consumption duration and bearing change interval worsen. To prevent damage as a result of higher speeds, it may be necessary to inquire with the Service Department as to the maximum speed.

⚠ WARNING

Danger of hearing damage due to noise radiation!

For the noise emission of the pump-motor unit measured by the manufacturer, see Chapter 3.1, "Mechanical data", Section "Noise level", Pg. 8. However, the actual noise emission during operation is highly dependent on the installation and system conditions. Conduct a noise measurement in the system during operation after installing the pump-motor unit. The following measures can be taken from 85 dB(A) and must be taken from 90 dB(A):

- Mark noise area with a warning sign.
- Wear hearing protection.
- With free entry and exit of gases, i.e. with direct intake out of or direct feeding into the atmosphere without piping, attach an additional muffler.

6.2 Start-up and shut-down

Start-up

- Open shut-off device in intake/discharge pipe.

- Switch on power supply for drive motor.

Shut-down:

- Switch off power supply for drive motor.
- Close shut-off device in intake/discharge pipe.

7 Operation

⚠ WARNING

Improper use of the unit can result in serious or even fatal injuries!
Have you read the safety precautions in Chapter 1, "Safety", Pg. 3 f.?
Otherwise you many not carry out any work with or on the pump-motor unit!

Also **be sure** to read the safety precautions in Chapter 6, "Commissioning", Pg. 19!

Starting up and shutting down

See Chapter 6, "Commissioning", Sub-Chapter 6.2, "Start-up and shut-down", Pg. 20. Also be sure to observe the following important notes especially for operation:

⚠ WARNING

Danger of burns from hot surfaces of the pump-motor unit and from hot fluids!
High temperatures of up to approx. 160°C [320 °F] can occur on the surface of the pump-motor unit.

Do not touch during operation!
Allow to cool after shut-down!

CAUTION

Danger of overheating due to hot surface of pump-motor unit!
High temperatures of up to approx. 160°C [320 °F] can occur on the surface of the pump-motor unit.

Temperature sensitive parts, such as lines or electronic components, may not come into contact with the surface of the pump-motor unit.

CAUTION

Danger of overheating!
During operation the standstill heating may, if installed, **not** be switched on!

CAUTION

Danger of rusting due to collection of condensed water in drive motor area!
On drive motors with closed condensed water openings:
Remove closures occasionally to allow any water which has collected to drain off.

CAUTION

Danger of bearing damage!
Heavy mechanical impacts must be avoided during operating and while at a standstill.

8 Shut-Down and Longer Standstills

8.1 Preparing for shut-down or longer standstill

⚠ WARNING

Improper use of the unit can result in serious or even fatal injuries!
Have you read the safety precautions in Chapter 1, "Safety", Pg. 3 f.?
Otherwise you many not carry out any work with or on the pump-motor unit!

CAUTION

Danger of rusting due to collection of condensed water in drive motor area!
On drive motors with closed condensed water openings:
Remove closures occasionally to allow any water which has collected to drain off.

CAUTION

Danger of bearing damage!
Heavy mechanical impacts must be avoided during operating and while at a standstill.

Prior to shut-down or longer standstill, proceed as follows:

- Switch off the pump-motor unit.
- Close shut-off device in inlet and pressure line if installed.
- Disconnect pump-motor unit from power supply.
- Release pressure.
  When doing so, open pipes/hoses slowly and carefully so that the vacuum or gauge pressure in the pump-motor unit can be released.
- Remove pipes/hoses.

- Provide mufflers on inlet and discharge side with sealing plugs.

8.2 Storage conditions

To prevent standstill damage during storage, the environment must provide the following conditions:

- dry,
- dust-free,
- low-vibration ($V_{eff} \leq 2{,}8$ mm/s [0,11"/sec]).
- Ambient temperature: max. 40 °C [+104 °F].

CAUTION

Danger of overheating due to high temperature!
When storing in an environment with a temperature of over 40 °C [104 °F], the winding may be damaged and the grease change interval may be shortened.

Lubrication of rolling bearings after longer storage:

The new pump-motor unit may at first be stored following delivery. If the time from deliver to commissioning exceeds the following periods, the lubrication of the rolling bearings must be renewed:

- Under advantageous storage conditions (as specified above): 4 years.
- Under disadvantageous storage conditions (e.g. high humidity, salty air, sandy or dusty air): 2 years.

In these cases open rolling bearings must be relubricated and closed rolling bearings must be completely replaced. In this case be sure to inquire with the Service Department. In particular, exact information with regard to the procedure and grease type are required.

⚠ WARNING

Improper use of the unit can result in serious or even fatal injuries!
All maintenance work on the pump-motor unit must always be performed by the Service Department!

Maintenance work on the pump-motor unit may only be conducted by the operator itself when the related **maintenance manual** on hand!

Inquire with the Service Department!

Commissioning after longer standstill:

Before recommissioning after a longer standstill, measure the insulation resistance of the drive motor. With values ≤ 1 kΩ per volt of nominal voltage, the winding is too dry.

9 Servicing

⚠ WARNING

Improper use of the unit can result in serious or even fatal injuries!
Have you read the safety precautions in Chapter 1, "Safety", Pg. 3 f.?
Otherwise you many not carry out any work with or on the pump-motor unit!

⚠ WARNING

Improper use of the unit can result in serious or even fatal injuries!
All maintenance work on the pump-motor unit must always be performed by the Service Department!

Maintenance work on the pump-motor unit may only be conducted by the operator itself when the related **maintenance manual** on hand!

Inquire with the Service Department!

9.1 Repairs/troubleshooting

Fault	Cause	Remedy	Carried out by
Motor does not start; no motor noise.	At least two power supply leads interrupted.	Eliminate interruption by fuses, terminals or power supply cables.	Electrician
Motor does not start; humming noise..	One power supply lead interrupted.	Eliminate interruption by fuses, terminals or power supply cables.	Electrician
	Impeller is jammed.	Open vacuum pump/compressor cover, remove foreign body, clean.	Service*)
		Check or correct impeller gap setting if necessary.	Service

Fault	Cause	Remedy	Carried out by
	Impeller defective.	Replace impeller.	Service*)
	Rolling bearing on drive motor side or vacuum pump/compressor side defective.	Replace motor bearing or vacuum pump/compressor bearing.	Service*)
Protective motor switch trips when motor is switched on. Power consumption too high.	Winding short-circuit.	Have winding checked.	Electrician
	Motor overloaded. Throttling does not match specification on rating plate.	Reduce throttling.	Service*)
		Clean filters, mufflers and connection pipes if necessary.	Service*)
	Compressor is jammed.	See fault: "Motor does not start; humming noise." with cause: "Impeller is jammed.".	Service*)
Pump-motor unit does not generate any or generates insufficient pressure difference.	Leak in system.	Seal leak in the system.	Operator
	Wrong direction of rotation.	Reverse direction of rotation by interchanging two connecting leads.	Electrician
	Incorrect frequency (on pump-motor units with frequency converter).	Correct frequency.	Electrician
	Shaft seal defective.	Replace shaft seal.	Service*)
	Different density of pumped gas.	Take conversion of pressure values into account. Inquire with Service Department.	Service
	Change in blade profile due to soiling.	Clean impeller, check for wear and replace if necessary.	Service*)
Abnormal flow noises.	Flow speed too high.	Clean pipes. Use pipe with larger cross-section if necessary.	Operator
	Muffler soiled.	Clean muffler inserts, check condition and replace if necessary.	Service*)
Abnormal running noise.	Ball bearing lacking grease or defective.	Regrease or replace ball bearing.	Service*)
Compressor leaky.	Seals on muffler defective.	Check muffler seals and replace if necessary.	Service*)
	Seals in motor area defective.	Check motor seals and replace if necessary.	Service.

*) Only when the maintenance manual is at hand: rectification by the operator.

9.2 Service/After-sales service

Our Service is available for work (in particular the installation of spare parts, as well as maintenance and repair work), not described in these operating instruction.

A list of spare parts with an exploded drawing is available on the Internet at www.nash-elmo.com.

Observe the following when **returning** pump-motor unit:

- The pump-motor unit must be delivered complete, i.e. not dismantled.
- The pump-motor unit may not present a danger to the workshop personnel. If the pump-motor unit has come into contact with dangerous substances, then the procedure described in Chapter 9.3, "Decontamination and Declaration of Clearance", Pg. 24, must be used.
- The original rating plate of the pump-motor unit must be properly mounted, intact and legible. All warranty claims are voided for pump-motor units delivered for a damage expertise without the original rating plate or with a destroyed original rating plate.
- In case of warranty claims, the manufacturer must be informed of the operating conditions, operating duration etc. and additional detailed information provided on request if necessary.

9.3 Decontamination and Declaration of Clearance

⚠ WARNING

Danger from flammable, caustic or toxic substances!

To protect the environment and persons, the following applies:

Pump-motor unit which have come into contact with **dangerous substances** must always be decontaminated before being passed on to a workshop!

To provide proof that the decontamination was carried out, a so-called **declaration of clearance** must be included with the pump-motor unit on delivery to the workshop. The form required for this purpose is available from the Service Department.

10 Disposal

Have the entire pump-motor unit scrapped by a suitable disposal company. No special measures are required when doing so. For additional information on disposing of the unit, ask the Service Department.

11 Explosion-Protected Design

An additional set of operating instructions with supplementary or specific information is provided with these pump-motor units.

12 Declaration of Conformity

nash_elmo

EC Declaration of Conformity

Manufacturer: nash_elmo Industries GmbH
Postfach 1510
D-97605 Bad Neustadt / Saale

Product designation: Gas-Ring Vacuum Pumps/Compressors of the G_200 Series,
Types 2BH1 1.., 2BH1 2.., 2BH1 3.., 2BH1 4.., 2BH1 5.., 2BH1 6.., 2BH1 8..,
2BH1 9..

The designated product complies with the provisions of the following European Directives:

98/37/EC	Machinery Directive
73/23/EEC	Low Voltage Directive
89/336/EEC*)	EMC Directive

The conformity with these Directives is proven by complete adherence to the following standards:

Harmonized standards:

DIN EN 292-1	Safety of machinery: Basic concepts, general principles for design; Part 1: Basic terminology, methodology
DIN EN 292-2	Safety of machinery; Basic concepts, general principles for design; Part 2: Technical principles and specifications
DIN EN 294	Safety of machinery; Safety distances to prevent danger zones from being reached by the upper limbs
DIN EN 563	Safety of machinery; Temperatures of touchable surfaces; Ergonomics data to establish temperature limit values for hot surfaces
DIN EN 626-1	Safety of machinery; Reduction of risk to health from hazardous substances emitted by machinery; Part 1: Principles and specifications for machinery manufacturers
DIN EN 1012-1	Compressors and vacuum pumps; Safety requirements; Part 1: Compressors
DIN EN 1012-2	Compressors and vacuum pumps; Safety requirements; Part 2: Vacuum pumps
EN ISO 11688-1	Acoustics; Recommended practice for the design of low-noise machinery and equipment ; Part 1: Planning (ISO/TR 11688-1:1995)
DIN EN 60034	Rotating electrical machines
DIN EN 60146-1-1*)	Semiconductor converters; General requirements and line commutated converters
DIN EN 60204-1	Safety of machinery; Electrical equipment of machines; Part 1: General requirements (IEC 204-1:1992, modified)
DIN EN 61000-6-2*)	Electromagnetic compatibility (EMC); Part 6-2: Generic emission standard: Interference immunity for industrial applications (IEC 61000-6-2:1999, modified); German version EN 61000-6-2:2001
DIN EN 61000-6-4*)	Electromagnetic compatibility (EMC); Part 6-4: Generic emission standards: Basic specification on emitted interference for industrial applications (IEC 61000-6-4:1997, modified); German version EN 61000-6-4:2001

The machine's operating instructions are available in German (original version) and in English. The technical construction file is available in German (original version). Any modifications of the machine that have not beforehand been agreed upon and permitted by us in writing invalidate this Declaration of Conformity.

nash_elmo Industries GmbH
Bad Neustadt / Saale, 09/10/2002

(Erich Michael Wenzel, Management)

(Dr. Uwe Seidel, Director of Development)

*) Only applicable for design with (mounted or unmounted) frequency converter.

J. E. GASHO & ASSOCIATES, INC.

Authorized Manufacturer's Representative
Air / Gas Moving Equipment
460 W. GAYSTREET
WEST CHESTER, PA 19380
PHONE: 610-692-5650 FAX: 610-692-5837

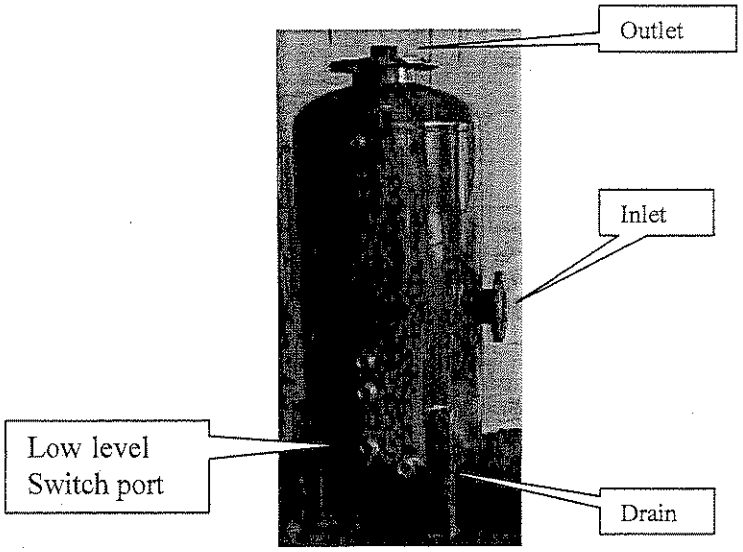
Moisture Separators

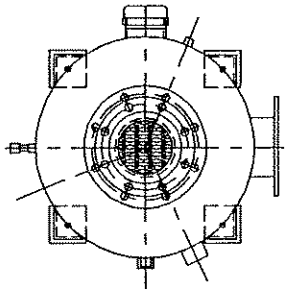
Moisture separators are used to remove water and other liquids from air streams. They are typically used on the inlet of vacuum systems to remove water and other contaminants before they enter the vacuum pump. The air volume of the moisture separator reduces the velocity of the air stream to allow liquids to precipitate. Up to 95% water removal is possible. The models GX-30 & GX-60 are rated for 29.9 in. Hg. vacuum. Other moisture separators are rated to 18 in. Hg. higher vacuum ratings available.

Standard accessories include a sight gauge, drain valve, and a hand operated sludge pump. Inside the top of the separator is a basket with "tri-packs®" demister material to promote condensation of vapors.

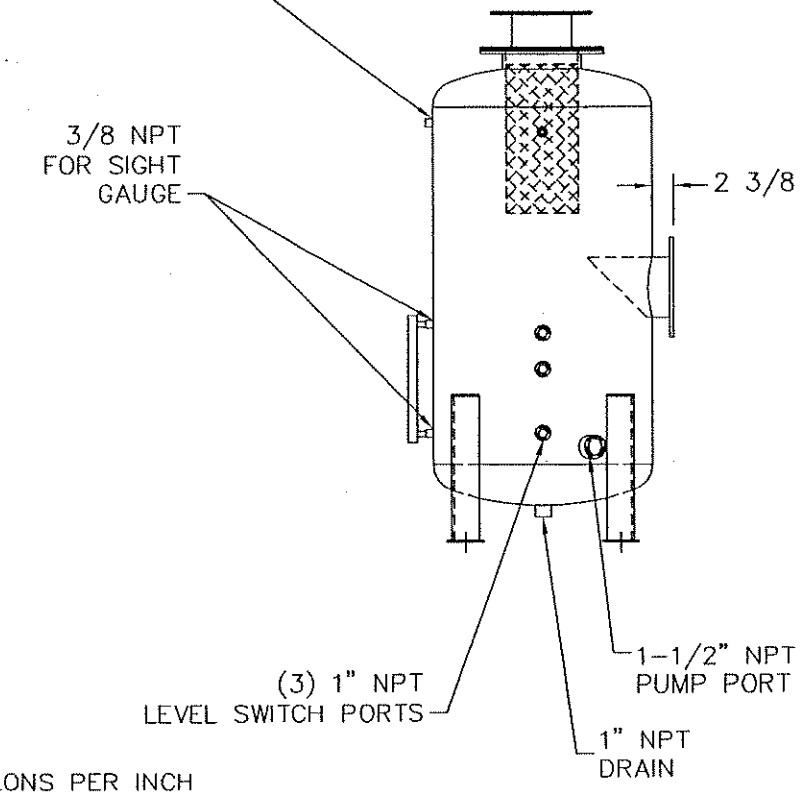
Options include: 1 to 3 level switches, automatic pump down systems, heat tracing, vacuum gauges, and thermometers.

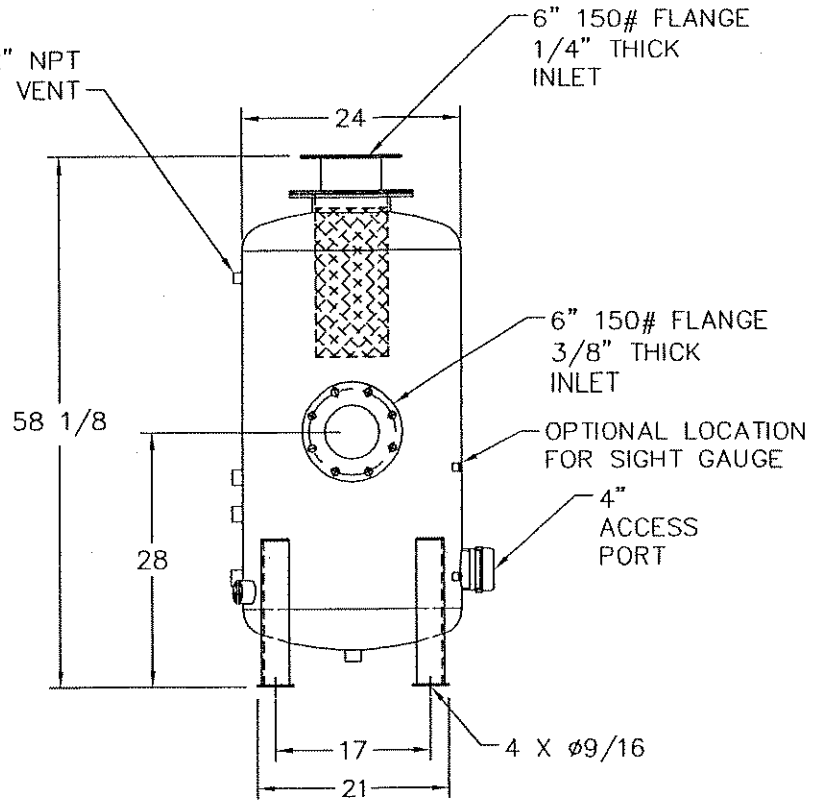
Model Number	Nominal Flow Rate	Liquid Capacity	Diameter (inches)	Height (inches)	Inlet Size	Discharge Size	Cleanout Size
GX-30	250	8	16	47	3"	3"	4"
GX-60	500	22	20	57	4"	4"	4"
GX-90	1200	30	24	57	6" Flange	6" Flange	4"
GX-120	2000	40	24	70	8" Flange	8" Flange	4"
GX-200	2000	95	30	85	8" Flange	8" Flange	4"





NOTES:
1. FINISH: GRAY ENAMEL
2. ALL PORTS ARE FEMALE EXCEPT 4"





1.93 GALLONS PER INCH
APPROX. 13.5 GALLONS LOW TO HIGH
APPROX. 7.7 GALLONS HIGH TO HIGH-HIGH

REV.	DATE	DESCRIPTION

DRAWN BY: M. WITTE — DATE: 12-14-01
APPROVED BY: — DATE:
DIMENSIONS IN INCHES
SCALE:
TOLERANCE: — ANGULAR TOLERANCE:
MATERIAL: — WEIGHT: 240
SHEET 1 OF 1

J.E.GASHO & Assoc., Inc.
460 W. GAY ST.
WEST CHESTER, PENNSYLVANIA 19380

GX-90 SEPARATOR
90 GALLON VESSEL
30 GAL. LIQ. CAPACITY

1500-C-0513 | D

GX-90.dwg 09/02/03 12:57

"L" STYLE INLET VACUUM AIR FILTERS
"CSL" Series 4"-6" Flange 125/150# Class Pattern

APPLICATIONS

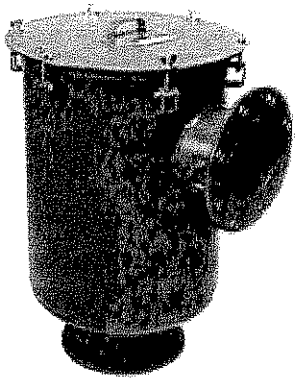
- Ash Handling
- Bag House Systems
- Blowers Fan
- Blowers-PD Type
- Chemical Processing
- Envelope Manufacturing
- Factory Automation
- Food Processing-Vacuum
- Glass, Ceramic-Vacuum
- Intake Suction Filters
- Medical
- Paper Processing
- Pneumatic Conveying Systems
- Vacuum Furnaces
- Vacuum Packaging
- Vacuum Pump-Positive Displacement
- Vacuum Pump-Rotary Piston
- Vacuum Pump-Rotary Vane
- Vacuum Pumps & Systems
- Vacuum Pump-Screw Technology
- Vacuum Pump-Side Channel
- Vacuum Systems-Central
- Waste Water Aeration
- Woodworking

FEATURES & SPECIFICATIONS

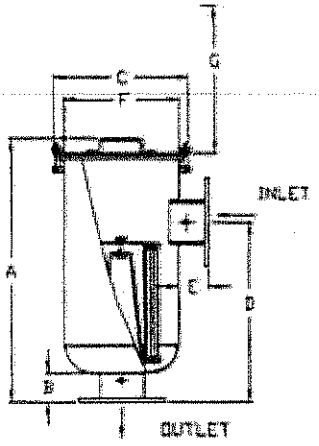
- ;99%+ removal efficiency std: Paper=2 micron, Polyester=5 micron
- Filter change out differential: 10"-15" in. H_2O above initial Delta P
- Heavy duty T bolts for easy maintenance
- Hydrostically tested 0.5 bar pressure for vacuum tightness
- Inlet air enters canister above element
- Inlet/Outlet 1/4" Gauge Taps standard
- Large dirt holding capacity and easy field cleaning, especially when mounted horizontally or inverted
- Low pressure drop
- Positive sealing O-ring seal system
- Powder coat paint finish
- Rugged construction
- Temp (continuous): min -15° F (-26° C) max 220° F (104° C)
- Vacuum level: Typically $1x10^{-3}$ mmHg ($1.3x10^{-3}$ mbar)

OPTIONS

- Activated carbon prefilter to reduce odor
- Available in *Stainless Steel*
- Epoxy coated housings
- Larger sizes available
- Special connections, BSPT/Metric
- Support brackets
- ious elements available



Line Drawing



***All measurements are shown in standards.**

Typical Lead Times:	
Normally in stock	
1 - 2 weeks	5 - 7 weeks
3 - 4 weeks	8 + weeks

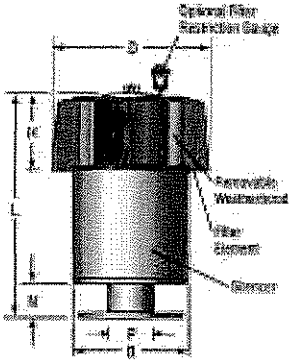
Add To Order	Model Number	Element Type	Inlet in. NPT or FLG	Outlet in. NPT or FLG	Connection Style	Dim A in.	Dim B in.	Dim C in.	Dim D in.	Dim E in.	Dim F in.	Dim G in.	Parent Flow SCFM	Element Parent Flow SCFM	Approx. Weight lbs.	CAD
	CSL-275P-600F	Polyester	6	6	Call	29.12	4	18.5	20.5	4	16	15	1100	1100	110	CAD

Solberg Mfg.

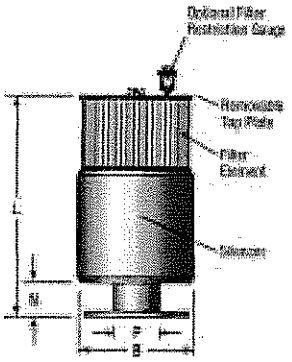
CCS/CS Series
Filter-Silencers

CCF/CF Series
Filters

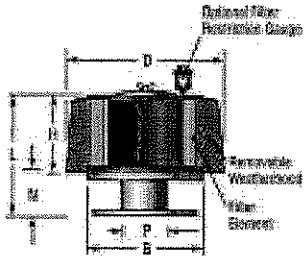
CCS Series (with weatherhood)



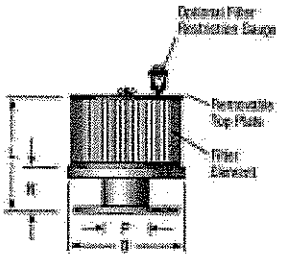
CS Series (with top plate)



CCF Series (with weatherhood)



CF Series (with top plate)



Part Numbers

Pipe Size	CCS	CS	CCF	CF
½	34-K50-TT*	34-M50-TT*		
¾	34-K70-TT*	34-M70-TT*	*Sizes ½"–1" Use CCS or CS Series*	
1	34-K01-TT*	34-M01-TT*		
1¼	34-K21-TT*	34-M21-TT*	34-L21-TT*	34-N21-TT*
1½	34-K15-TT*	34-M15-TT*	34-L15-TT*	34-N15-TT*
2	34-K02-TT*	34-M02-TT*	34-L02-TT*	34-N02-TT*
2½	34-K25-TT*	34-M25-TT*	34-L25-TT*	34-N25-TT*
3	34-K03-TT*	34-M03-TT*	34-L03-TT*	34-N03-TT*
3½	34-K35-TT*	34-M35-TT*	34-L35-TT*	34-N35-TT*
4	34-K04-TT*	34-M04-TT*	34-L04-TT*	34-N04-TT*
4	34-K04-AA*	34-M04-AA*	34-L04-AA*	34-N04-AA*
5	34-K05-TT*	34-M05-TT*	34-L05-TT*	34-N05-TT*
5	34-K05-AA*	34-M05-AA*	34-L05-AA*	34-N05-AA*
6	34-K06-AA*	34-M06-AA*	34-L06-AA*	34-N06-AA*
8	34-K08-AA*	34-M08-AA*	34-L08-AA*	34-N08-AA*
10	34-K10-AA*	34-M10-AA*	34-L10-AA*	34-N10-AA*
12	34-K12-AA*	34-M12-AA*	34-L12-AA*	34-N12-AA*
14	34-K14-AA*	34-M14-AA*	34-L14-AA*	34-N14-AA*
16	34-K16-AA*	34-M16-AA*	34-L16-AA*	34-N16-AA*

*Specify "P" at end of part number for unit with pleated paper elements, "F" for pleated felt or "W" for wire mesh.

Universal Silencer's cartridge filters and filter-silencers offer high-performance filtration and silencing in a convenient, economical cartridge configuration. Choose from four standard models for pipe sizes ranging from ½" to 16" and for flow capacities ranging from 15 to 7,700 CFM. Three types of filter element media—pleated paper, pleated felt, or wire mesh—are available to suit your application.

The CCF and CF series filters are high-quality air filters without a silencing section. The CCF has a removable weatherhood, and the CF has a removable top plate. Our CCS and CS intake filter-silencers have a built-in silencing section. The CCS features a removable weatherhood, and the CS has a removable top plate for easy access to the filter element.

Performance Benefits

- **Durability**
  Weatherhoods for CCF and CCS sizes 2½" through 5" are rugged blue ABS composite material that may be painted. All other components are carbon steel construction with a high-quality semi-gloss enamel finish.
- **High Performance**
  Unique design options, combined with the latest manufacturing techniques, ensure optimum performance and long life even under demanding conditions.
- **Functional**
  Choice of filter only or filter-silencer.
- **Easy to Maintain**
  Removable lightweight weatherhood (CCS and CCF) or removable top plate (CS and CF) for easy access to the filter element.
- **Versatile**
  Interchangeable element options for desired filtration characteristics in the same housing.

See pages 1.1–1.3 for ordering information | www.universalsilencer.com

CCS/CS Series

Filter-Silencers

CCF/CF Series

Filters

Noise Attenuation, CCS/CS

Attenuation, dB	Octave Band Center Frequency, Hz
5	63
8	125
10	250
12	500
14	1,000
14	2,000
14	4,000
14	8,000

Pressure Drop, All Models

Pressure Drop (in. of H_2O)	Percentage of Rated Flow
0.7	50%
1.6	75%
2.8	100%
4.4	125%
6.3	150%

P (size)	Rated Flow Cap. (CFM)	D	H	B	N				L				Approx. Weight with Paper Elements			
					CCF	CCS	CF	CS	CCF	CCS	CF	CS	CCF	CCS	CF	CS
½	15	8.00	3.13	6.00	Use	—	Use	—	Use	6.50	Use	6.50	Use	7	Use	7
¾	22	8.00	3.13	6.00	CCS	—	CS	—	CCS	6.50	CS	6.50	CCS	7	CS	7
1	35	8.00	3.13	6.00	Series	—	Series	—	Series	6.50	Series	6.50	Series	7	Series	7
1¼	60	9.00	3.50	6.50	—	—	—	—	3.50	7.88	3.50	7.88	9	10	5	9
1½	75	9.00	3.50	6.50	—	—	—	—	3.50	7.88	3.50	7.88	9	10	5	9
2	120	9.00	3.50	6.50	—	—	—	—	3.50	7.88	3.50	7.88	8	10	5	8
2½	190	13.44	6.75	10.00	1.00	1.00	1.00	1.00	7.50	17.69	7.13	17.31	11	19	10	18
3	275	13.44	6.75	10.00	1.00	1.00	1.00	1.00	7.50	17.69	7.13	17.31	10	18	9	17
3½	375	13.44	6.75	10.00	1.13	1.13	1.13	1.13	7.63	17.69	7.25	17.31	13	20	12	19
4 (NPT)	500	13.44	6.75	10.00	1.13	1.13	1.13	1.13	7.63	17.69	7.25	17.31	12	19	11	18
4 (flanged)	500	13.44	6.75	10.00	4.00	3.00	4.00	3.00	10.50	19.63	10.13	19.25	14	21	13	20
5 (NPT)	750	13.44	6.75	10.00	1.81	1.81	1.81	1.81	8.38	18.25	8.00	17.88	12	19	11	18
5 (flanged)	750	13.44	6.75	10.00	4.00	3.00	4.00	3.00	10.50	19.56	10.13	19.13	16	23	15	22
6	1,100	18.00	9.50	14.00	4.00	3.00	4.00	3.00	13.31	25.25	12.75	24.75	31	43	23	35
8	2,200	20.00	18.00	14.00	4.00	3.00	4.00	3.00	21.88	33.88	21.38	33.38	43	56	30	43
10	3,000	24.00	11.50	18.00	4.00	3.00	4.00	3.00	15.38	29.25	14.19	28.13	52	83	41	67
12	4,300	24.00	11.50	18.00	4.00	3.00	4.00	3.00	15.38	29.25	14.19	28.13	64	91	48	75
14	5,900	30.00	15.44	24.00	4.00	3.00	4.00	3.00	19.38	36.25	18.25	35.06	97	143	75	121
16	7,700	30.00	15.44	24.00	4.00	3.00	4.00	3.00	19.38	36.25	18.25	35.06	101	145	79	123

All models have a ⅛" FNPT tap for installation of a gauge or manometer to monitor pressure drop. Sizes **½" through 3½"** are standard with female pipe thread connection (FNPT). Sizes **4" and 5"** are available with female threads or flanges. Please specify "threaded" or "flanged" when you order 4" and 5" sizes. Sizes **6" through 16"** are standard with 150# ANSI drilled plate flanges. Rated capacity is based upon exit velocity of approximately 5,500 ft/min. If pressure drop allowance permits, capacity may be increased by as much as 50%.

∴ See pages 1.1–1.3 for ordering information | www.universalsilencer.com

J. E. GASHO & ASSOCIATES, INC.

Authorized Manufacturer's Representative
Air / Gas Moving Equipment
460 W. GAY STREET
WEST CHESTER, PA 19380
PHONE: 610-692-5650 FAX: 610-692-5837
email: cs@gashoinc.com

Replacement Paper Filter Elements

High quality replacement elements are available for the filters of various manufactures used on packages built by J.E. Gasho & Assoc., Inc.

Paper elements are normally used in inlet filters and replaced when they are dirty.

Filter Size, In.	Universal Filter #	EM Prod. Filter #	Full-On Filters #	Gasho Filter #	Box Quantity	O.D.	I.D.	Ht.
1	81-0470		FOF810470	GA-0470	6	5-13/16	4	2
2	81-0471	P-642	FOF810471	GA-0471	6	5-13/16	4	2-1/2
2.5-3	81-0472	P-974	FOF810472	GA-0472	2	9-3/4	7-1/4	4
4	81-1063	P-976	FOF811063	GA-1063	2	9-3/4	7-1/4	6
5	81-0474	P-1197	FOF810474	GA-0474	1	11-1/2	9-7/8	7
6	81-0475	P-13118	FOF810475	GA-0475	1	13-5/8	11-5/8	8-5/8
8-12	81-1163	P-171310	FOF811163	GA-1163	1	17	13	10

Gasho Filter #	Box Quantity	List Price
GA-0470	6	$17.00
GA-0471	6	$17.00
GA-0472	2	$23.00
GA-1063	2	$27.00
GA-0474	1	$35.00
GA-0475	1	$53.00
GA-1163	1	$185.00

GA-0471 Elements are frequently used to replace GA-0470

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www.jegasho.net

CARBTROL®

AIR PURIFICATION CANISTERS 140-200 LB. ACTIVATED CARBON

G-1
G-2
G-3

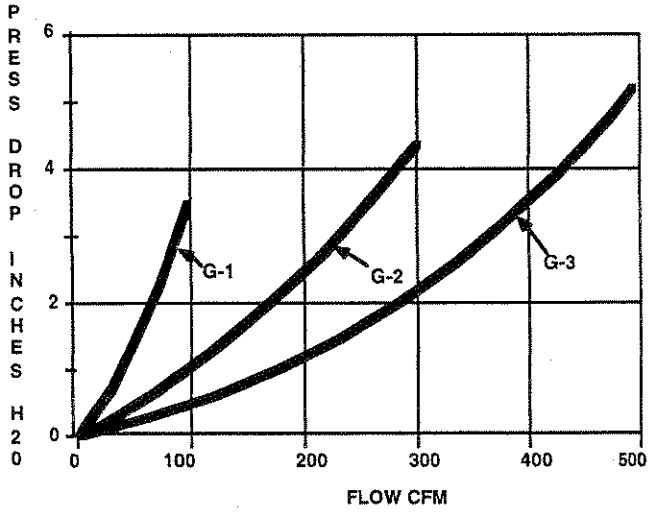
The CARBTROL "G" Canisters handles flows up to 500 CFM.

FEATURES

- High activity carbon.
- Epoxy lined steel or polyethylene construction.
- DOT rated. Acceptable for shipment of hazardous spent carbon.
- Side drain for removal of accumulated condensate.
- Low pressure drop.
- PVC internal piping.
- High temperature (180°F) steel units available.

APPLICATIONS

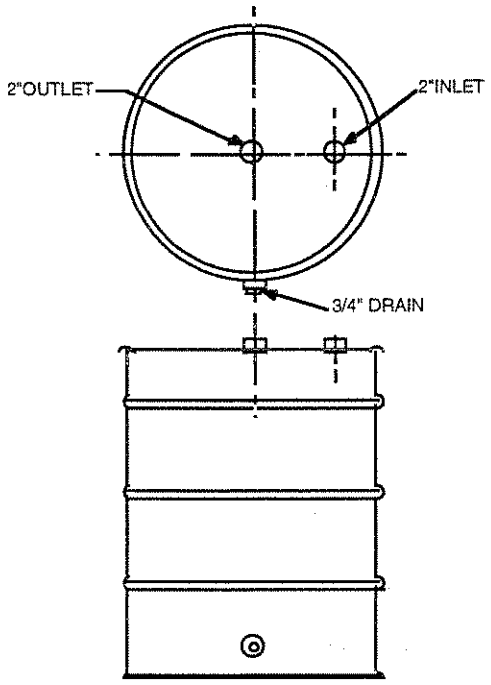
- Soil vapor remediation
- Air stripper exhausts
- Tank vents
- Exhaust hoods
- Work area purification
- Sewage plant odor control



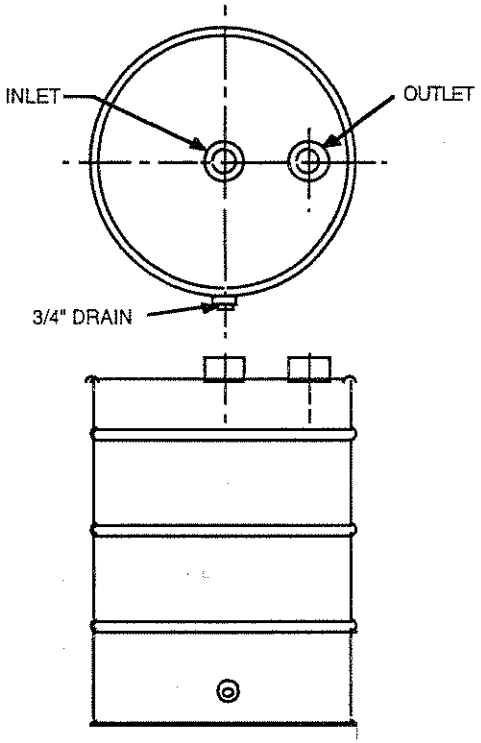
CARBTROL® CORPORATION
51 Riverside Avenue, Westport, CT 06880 • 1-800-242-1150 • (203) 226-5642

AIR PURIFICATION CANISTERS
140-200 LB. ACTIVATED CARBON

G-1
G-2
G-3 ←



MODEL G-1



MODEL G-2,G-3

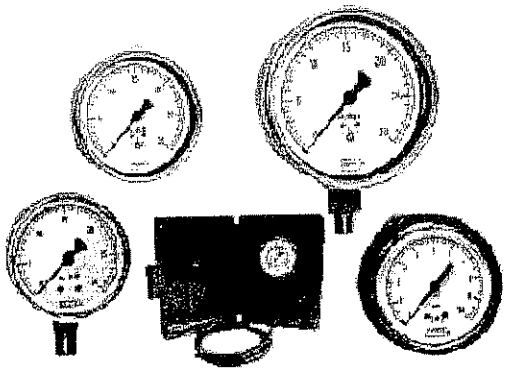
SPECIFICATIONS

MODEL	DIAMETER/HEIGHT	CARBON WEIGHT	INLET/OUTLET	MAX. RATED FLOW	APPROX. SHIP WT.
G-1*	24"/36"	200 lbs.	2"/2"	100 CFM	240 lbs.
G-2*	24"/36"	170 lbs.	4"/4"	300 CFM	210 lbs.
G-3P	24"/36"	140 lbs.	6"/6"	500 CFM	180 lbs.
→ G-3S	24"/34"	140 lbs.	4"/4"	500 CFM	180 lbs.

* Specify: Polyethylene (P) or Epoxy Lined Steel (S)

Select A 200 Series Model Number

ALL 200 210 224 234



GENERAL INFORMATION

NOSHOK 200 Series Diaphragm Gauges are designed for extremely low pressure or vacuum measurement. The ultra sensitive diaphragm capsules are rated for pressure (or vacuum) as low as 0-10 **inches of water** and as high as 0-10 **psi**.

The cases are constructed of black painted steel on the 2 ½" size and 304 Stainless Steel on the 4" size. The lenses are molded plexiglass on the 2½" size and instrument glass on the 4" size for strength and clarity. The diaphragm capsules are phosphor bronze and when coupled to the precision all-brass movements, provide extremely accurate indication over the service life of the gauge.

Available options include a recalibrator on the 2½" size (accessible through the front of the dial) and overpressure protection of up to 200% of the dial range. Mounting options include 304 stainless steel or black steel triangular bezels and U-Clamps in addition to chrome or black steel front flanges.

Applications for **NOSHOK 200 Series Gauges** include medical, biomedical, heating-ventilating and air conditioning, gas distribution, filtration, burner and gas combustion service, waste water treatment and everywhere low pressure and vacuum measurement is required.

NOSHOK Selection, Installation & Maintenance Guide

Pressure Gauge Series 100, 200, 300, 400, 500, 600, 700, 800 and 900

Installation

Prior to pressure gauge installation, the following conditions should be considered: temperature, humidity, vibration, pulsation, shock, and other climatic and environmental conditions of the application, as well as the potential need for protective accessories and/or special installation requirements.

Always use a wrench on the gauge socket when installing a NOSHOK pressure gauge into position; never use force on the gauge case to tighten into position. This may result in a loss of accuracy, excessive friction and/or mechanical damage to the measuring element and case of the NOSHOK pressure gauge. When surface or panel mounting a gauge, be sure the surface is flat and the panel cutout and/or the mounting hole configuration is correct (please refer to the NOSHOK Pressure Gauge catalog NK95G for these specifications). If the surface is uneven or the panel cutout is larger than the gauges diameter, use an adapter ring to remove mounting strain and/or adapt the gauge to the larger diameter panel cutout. When connecting a gauge to a rigid pipe service, use flexible tubing where possible as a connector to eliminate plumbing strain. Rapid pressure pulsation and extreme mechanical vibration may be damaging to some NOSHOK pressure gauge movement gearing, bushings, and linkage. In extreme cases, steps should be taken to dampen these forces. In pressure ranges over 600 psi, a NOSHOK orifice is recommended for pulsation dampening, but in extreme pulsation applications a NOSHOK Piston Type Pressure Snubber may be required.

When installing a gauge into a corrosive situation be sure to select a pressure gauge or pressure gauge and diaphragm seal combination suitable for your application. Gauges to be used on high temperature service should have a five foot or longer leg of pipe or tubing connecting the gauge to dissipate heat and protect the gauge measuring element from damage.

A gauge to be used on steam pressure service should be installed with a water filled NOSHOK pigtail steam syphon between the gauge and the steam line.

Maintenance

Apart from occasional calibration, NOSHOK pressure gauges require little or no maintenance. Some applications may be more aggressive than others, resulting in an increased frequency in the need for calibration. The environmental limitations for the specific NOSHOK pressure gauge series should be observed in all cases, and gauges applied in situations outside these requirements may result in premature wear and/or failure of the gauge.

Warranty

All NOSHOK pressure gauges carry a one or three year warranty. NOSHOK warrants for three years our 300, 500, 600, 700 and 900 series liquid filled pressure gauges to be free from defects in materials and workmanship, to remain within the cataloged accuracy and performance specifications, and to maintain the integrity of the hermetically sealed case preventing leakage. NOSHOK warrants for one year our 100, 200, 400, 600, 700, and 800 series non-liquid filled pressure gauge. Certain limitations do apply; for more information please consult page three of the NOSHOK Pressure Gauges catalog (NK95G).

Please do not hesitate to contact us with any additional questions.

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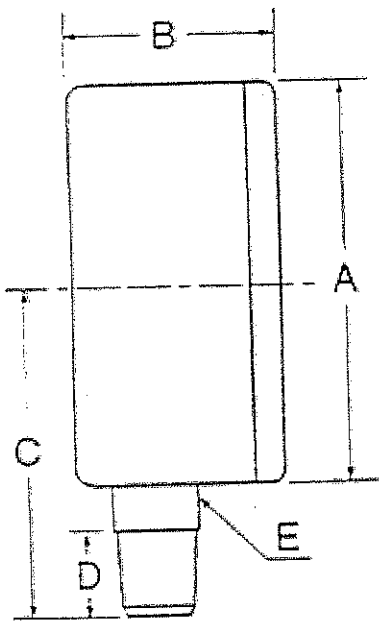
Operating conditions including, but not limited to, system pressure, media compatibility and ambient conditions must be considered when selecting gauges and accessories. Improper selections and use of gauges could possibly cause gauge failure and lead to possible property damage or person injury. Refer to American National Standard ASME B40 for the correct selection and use of gauges. A copy of this standard may be obtained from the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, NY 10017.

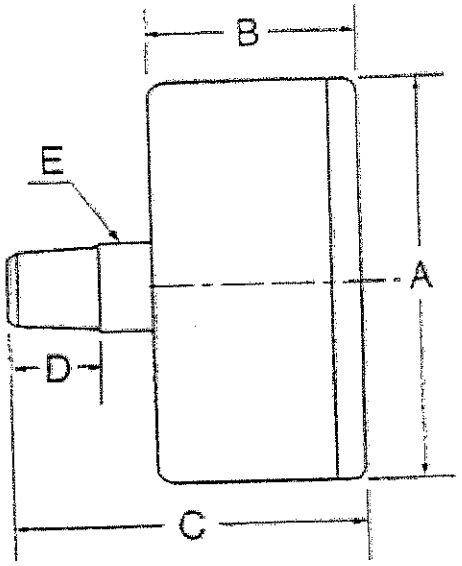
Glycerine or silicone could result in a spontaneous chemical reaction or explosion when combined with strong oxidizing agents including (but not limited to) chlorine, hydrochloric or nitric acid and hydrogen peroxide. Do not use glycerine or silicone filled gauges or accessories in these types of service. Consult factory for application assistance.

In keeping with and for the purposes of product and/or manufacturing improvements, NOSHOK reserves the right to make design changes without prior notice.

200 Series Pressure Gauges Diagrams



25.200, 40.200

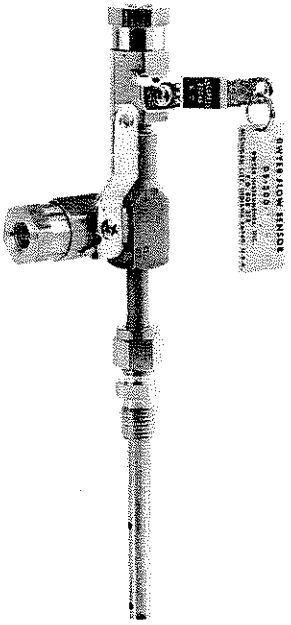


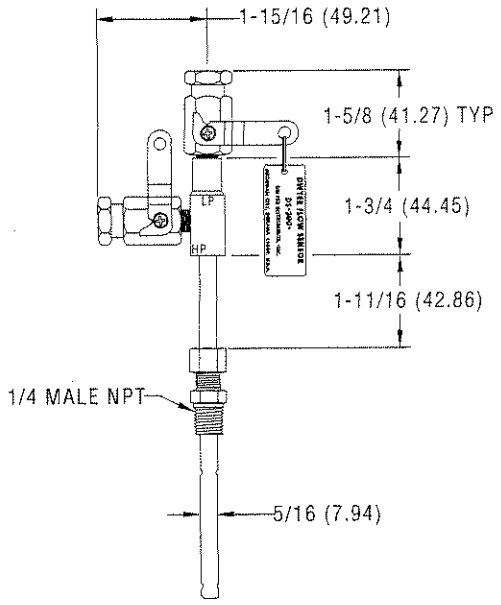
25.210

Model		A	B	C	D	E	F	G	H
25-200	IN	2.48	1.58	2.09	0.55	0.55	---	---	---
	MM	63	40	53	14	14	---	---	---
25-210	IN	2.48	1.58	2.17	0.55	0.55	3.35	2.96	0.14
	MM	63	40	55	14	14	85	75	3.6
25-234	IN	7.50	2.06	5.75	2.11	---	---	---	---
	MM	190.5	52.3	146.1	53.5	---	---	---	---
40-200	IN	3.98	1.94	3.43	0.55	0.87	---	---	---
	MM	101	49.5	87	14	22	---	---	---

Series DS-300 Flow Sensors

Installation and Operating Instructions Flow Calculations





Series DS-300 Flow Sensors are averaging pitot tubes that provide accurate, convenient flow rate sensing. When purchased with a Dwyer Capsuhelic® for liquid flow or Magnehelic® for air flow, differential pressure gage of appropriate range, the result is a flow-indicating system delivered off the shelf at an economical price. Series DS-300 Flow Sensors are designed to be inserted in the pipeline through a compression fitting and are furnished with instrument shut-off valves on both pressure connections. Valves are fitted with 1/8″ female NPT connections. Accessories include adapters with 1/4″ SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic® kit. Standard valves are rated at 200°F (93.3°C). Where valves are not required, they can be omitted at reduced cost. Series DS-300 Flow Sensors are available for pipe sizes from 1″ to 10″.

INSPECTION

Inspect sensor upon receipt of shipment to be certain it is as ordered and not damaged. If damaged, contact carrier.

INSTALLATION

General - The sensing ports of the flow sensor must be correctly positioned for measurement accuracy. The instrument connections on the sensor indicate correct positioning. The side connection is for total or high pressure and should be pointed upstream. The top connection is for static or low pressure.

Location - The sensor should be installed in the flowing line with as much straight run of pipe upstream as possible. A rule of thumb is to allow 10 - 15 pipe diameters upstream and 5 downstream. The table below lists recommended up and down piping.

PRESSURE AND TEMPERATURE

Maximum: 200 psig (13.78 bar) at 200°F (93.3°C).

Upstream and Downstream Dimensions in Terms of Internal Diameter of Pipe*

Upstream Condition	Minimum Diameter of Straight Pipe		
	Upstream		Downstream
	In-Plane	Out of Plane	
One Elbow or Tee	7	9	5
Two 90° Bends in Same Plane	8	12	5
Two 90° Bends in Different Plane	18	24	5
Reducers or Expanders	8	8	5
All Valves**	24	24	5

* Values shown are recommended spacing, in terms of internal diameter for normal industrial metering requirements. For laboratory or high accuracy work, add 25% to values.

** Includes gate, globe, plug and other throttling valves that are only partially opened. If valve is to be fully open, use values for pipe size change. **CONTROL VALVES SHOULD BE LOCATED AFTER THE FLOW SENSOR.**

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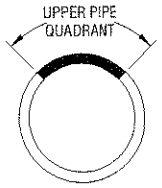
POSITION

Be certain there is sufficient clearance between the mounting position and other pipes, walls, structures, etc, so that the sensor can be inserted through the mounting unit once the mounting unit has been installed onto the pipe.

Flow sensors should be positioned to keep air out of the instrument connecting lines on liquid flows and condensate out of the lines on gas flows. The easiest way to assure this is to install the sensor into the pipe so that air will bleed into, or condensate will drain back to, the pipe.

For Air or Gas Flow

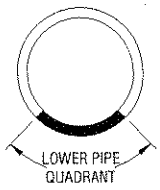
Install in upper quadrant of pipe



Condensate drains back to pipe

For Liquid or Steam Flow

Install in lower quadrant of pipe



Air bleeds back to pipe

INSTALLATION

1. When using an A-160 thred-o-let, weld it to the pipe wall. If replacing a DS-200 unit, an A-161 bushing (1/4" x 3/8") will be needed.

2. Drill through center of the thred-o-let into the pipe with a drill that is slightly larger than the flow sensor diameter.

3. Install the packing gland using proper pipe sealant. If the packing gland is disassembled, note that the tapered end of the ferrule goes into the fitting body.

4. Insert sensor until it bottoms against opposite wall of the pipe, then withdraw 1/16" to allow for thermal expansion.

5. Tighten packing gland nut finger tight. Then tighten nut with a wrench an additional 1-1/4 turns. Be sure to hold the sensor body with a second wrench to prevent the sensor from turning.

INSTRUMENT CONNECTION

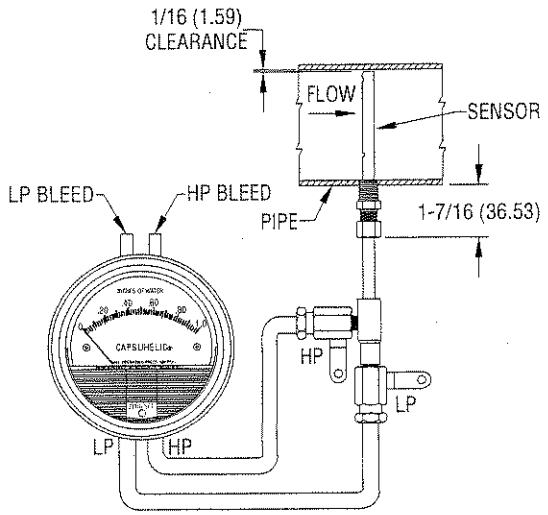
Connect the slide pressure tap to the high pressure port of the Magnehelic® (air only) or Capsuhelic® gage or transmitting instrument and the top connection to the low pressure port.

See the connection schematics below.

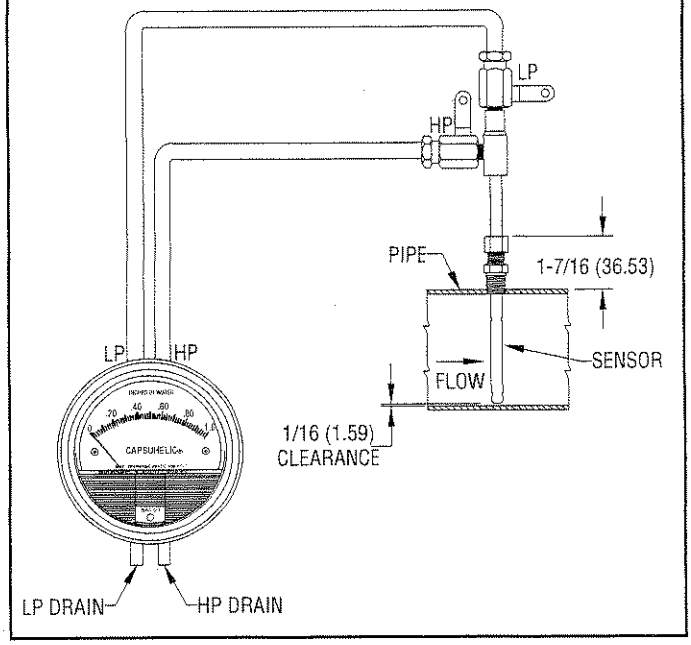
Bleed air from instrument piping on liquid flows. Drain any condensate from the instrument piping on air and gas flows.

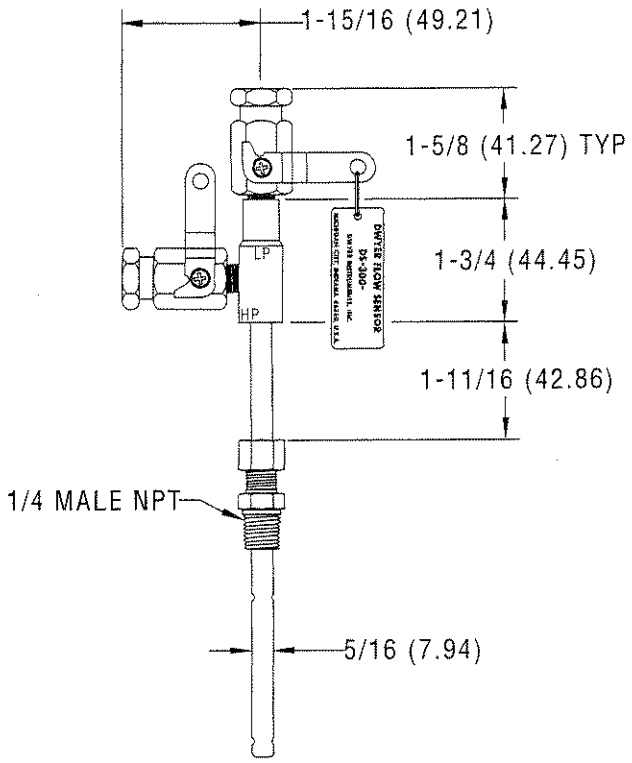
Open valves to instrument to place flow meter into service. For permanent installations, a 3-valve manifold is recommended to allow the gage to be zero checked without interrupting the flow. The Dwyer A-471 Portable Test Kit includes such a device.

Water Flow



Air or Gas Flow





Flow Calculations and Charts

The following information contains tables and equations for determining the differential pressure developed by the DS-300 Flow Sensor for various flow rates of water, steam, air or other gases in different pipe sizes.

This information can be used to prepare conversion charts to translate the differential pressure readings being sensed into the equivalent flow rate. When direct readout of flow is required, use this information to calculate the full flow differential pressure in order to specify the exact range of Dwyer Magnehelic® or Capsuhelic® gage required. Special ranges and calculations are available for these gages at minimal extra cost. See bulletins A-30 and F-41 for additional information on Magnehelic® and Capsuhelic® gages and DS-300 flow sensors.

For additional useful information on making flow calculations, the following service is recommended: Crane Valve Co. Technical Paper No. 410 "Flow of Fluids Through Valves, Fittings and Pipe." It is available from Crane Valve Company, www.cranevalve.com.

Using the appropriate differential pressure equation from Page 4 of this bulletin,calculate the differential pressure generated by the sensor under normal operating conditions of the system. Check the chart below to determine if this value is within the recommended operating range for the sensor. Note that the data in this chart is limited to standard conditions of air at 60°F (15.6°C) and 14.7 psia static line pressure or water at 70°F (21.1°C). To determine recommended operating ranges of other gases, liquids an/or operating conditions, consult factory.

Note: the column on the right side of the chart which defines velocity ranges to avoid. Continuous operation within these ranges can result in damage to the flow sensor caused by excess vibration.

Pipe Size (Schedule 40)	Flow Coefficient "K"	Operating Ranges Air @ 60°F & 14.7 psia (D/P in. W.C.)	Operating Ranges Water @ 70°F (D/P in. W.C.)	Velocity Ranges Not Recommended (Feet per Second)
1	0.52	1.10 to 186	4.00 to 675	146 to 220
1-1/4	0.58	1.15 to 157	4.18 to 568	113 to 170
1-1/2	0.58	0.38 to 115	1.36 to 417	96 to 144
2	0.64	0.75 to 75	2.72 to 271	71 to 108
2-1/2	0.62	1.72 to 53	6.22 to 193	56 to 85
3	0.67	0.39 to 35	1.43 to 127	42 to 64
4	0.67	0.28 to 34	1.02 to 123	28 to 43
6	0.71	0.64 to 11	2.31 to 40	15 to 23
8	0.67	0.10 to 10	0.37 to 37	9.5 to 15
10	0.70	0.17 to 22	0.60 to 79	6.4 to 10

FLOW EQUATIONS

1. Any Liquid

$$Q\ (GPM) = 5.668 \times K \times D^2 \times \sqrt{\Delta P / S_f}$$

2. Steam or Any Gas

$$Q\ (lb/Hr) = 359.1 \times K \times D^2 \times \sqrt{p \times \Delta P}$$

3. Any Gas

$$Q\ (SCFM) = 128.8 \times K \times D^2 \times \sqrt{\frac{P \times \Delta P}{(T + 460) \times S_s}}$$

DIFFERENTIAL PRESSURE EQUATIONS

1. Any Liquid

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_f}{K^2 \times D^4 \times 32.14}$$

2. Steam or Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2}{K^2 \times D^4 \times p \times 128{,}900}$$

3. Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_s \times (T + 460)}{K^2 \times D^4 \times P \times 16{,}590}$$

Technical Notations

The following notations apply:

ΔP = Differential pressure expressed in inches of water column
Q = Flow expressed in GPM, SCFM, or PPH as shown in equation
K = Flow coefficient— See values tabulated on Pg. 3.
D = Inside diameter of line size expressed in inches.

For square or rectangular ducts, use: $D = \sqrt{\frac{4 \times \text{Height} \times \text{Width}}{\pi}}$

P = Static Line pressure (psia)
T = Temperature in degrees Fahrenheit (plus 460 = °Rankine)
p = Density of medium in pounds per square foot
S_f = Sp Gr at flowing conditions
S_s = Sp Gr at 60°F (15.6°C)

SCFM TO ACFM EQUATION

$$SCFM = ACFM \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

$$ACFM = SCFM \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520}\right)$$

$$\text{POUNDS PER CUBIC FOOT STD.} = \text{POUNDS PER CUBIC FOOT ACT.} \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520^*}\right)$$

$$\text{POUNDS PER CUBIC FOOT ACT.} = \text{POUNDS PER CUBIC FOOT STD.} \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

1 Cubic foot of air = 0.076 pounds per cubic foot at 60° F (15.6°C) and 14.7 psia.
* (520°= 460 + 60°) Std. Temp. Rankine

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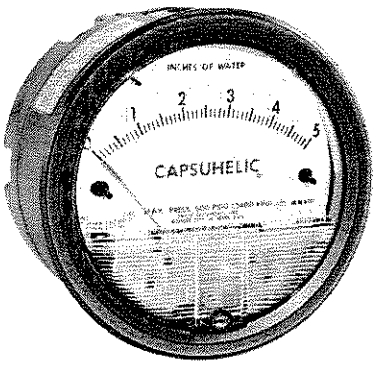
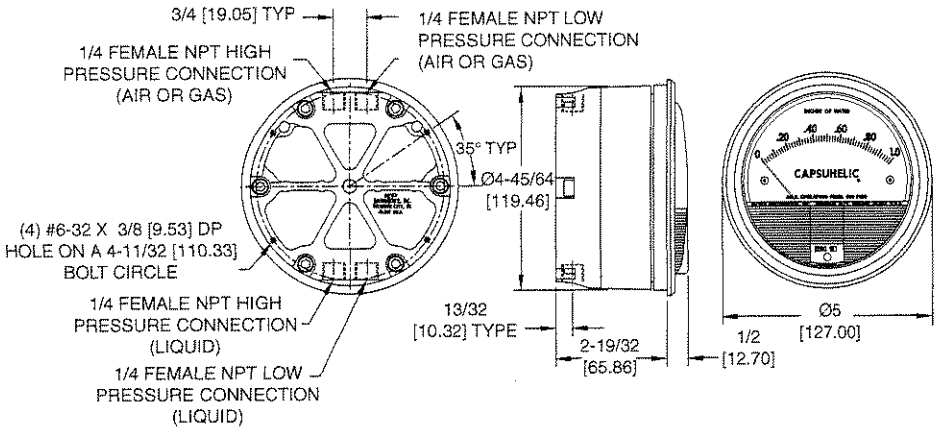
Series 4000 Capsuhelic® Differential Pressure Gage

Specifications - Installation and Operating Instructions





CAUTION: Use of a line filter (Dwyer model A-391 or equivalent) is recommended to prevent entry of liquid borne particles into gage. Dwyer Instruments cannot assume responsibility for failure of gages due to clogging of internal passages.

NOTE: DO NOT use with hydrogen gas. Toxic and/or explosive gas may form due to reaction with rare earth magnet.

CAPSUHELIC® INSTALLATION

1. Select a location free from excessive vibration and where the ambient temperature will not exceed 200°F. Sensing lines may be run any necessary distance. For example, 250 foot lines will not affect accuracy but will damp the reading slightly. Do not restrict lines. If pulsating pressures or vibration cause excessive pointer oscillation, consult factory for means of providing additional damping.

2. All standard models are calibrated for use with the diaphragm and scale in a vertical position. Special factory calibration is necessary for operation in an inclined or horizontal position. The exceptions are ranges under 5 in. w.c., (or metric equivalents) which can only be calibrated for vertical operation.

SPECIFICATIONS

Service: Aluminum Case: Air and compatible gases and oil based liquids. Brass Case: Air and compatible gases and water based liquids.
Wetted Materials: Consult factory.
Housing: Die cast aluminum with impregnated hard coating, standard. Optional forged brass housing is required for water or water based fluids. Special material diaphragms available, contact factory.
Accuracy: ±3% of full scale at 70°F (21.1°C). (±2% on 4000S models, ±4% on 4200, 4210, 4215, 4220, 4300, 4400, and 4500).
Pressure Limits: -20˝ Hg to 500 psig. (-0.677 bar to 34.4 bar).
Temperature Limits: 20 to 200°F. (-6.67 to 93.3°C).
Size: 4˝ (101.6 mm) diameter dial face.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Process Connections: 1/4˝ female NPT high and low pressure taps, duplicated -one pair top for air and gas, and one pair bottom for liquids.
Weight: 3 lb, 3 oz (1.45 kg) aluminum case; 7 lb, 13 oz (3.54 kg) brass case.
Standard Accessories: Two 1/4˝ NPT plugs for duplicate pressure taps, four flush mounting adapters with screws and four surface mounting screws.

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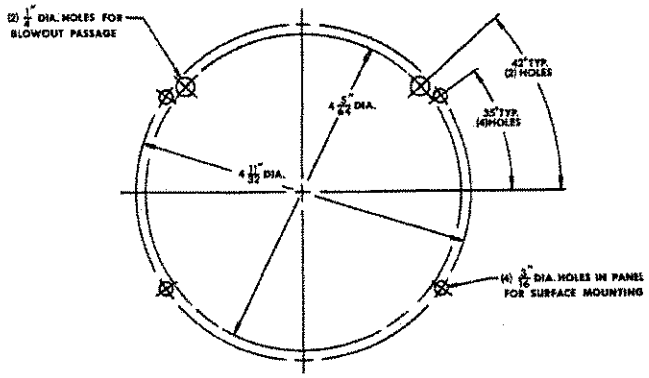
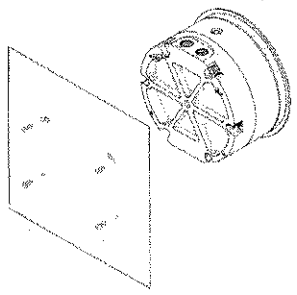
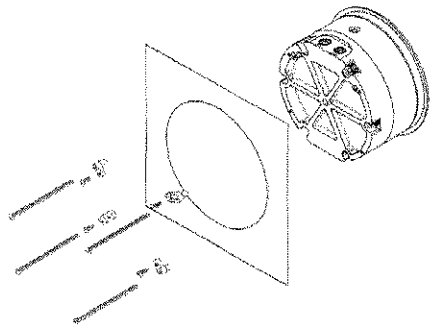
3. Surface Mounting





Locate 4 mounting holes, 35° from horizontal centerline on a 4-11/32" dia. circle. Use No. 6-32 machine screws of appropriate length. Be sure to drill 1/4" holes for blowout protection as shown in the diagram.



4. Flush Mounting

Provide a 4-13/16" dia. opening in panel. Insert gage and secure in place with No. 6-32 machine screws of appropriate length, with mounting lugs firmly secured in place.

5. To zero the gage after installation

Set the indicating pointer exactly on the zero mark, using the external zero adjust screw on the cover at the bottom. Note that the zero check or adjustment can only be made with the high and low pressure taps both open to atmosphere.

CAUTION

Note location of blowout or vent holes in the surface mounting diagram. Do not block these holes as their function is to vent overpressure failure out the back of the gage rather than blowing off the front cover.

Important Notes:

Two pairs of high and low pressure taps are provided, one pair on the top and a duplicate pair on the bottom. These fittings may be utilized according to the type of service for which the gage will be used. For gas or vapor service the gage should be connected from the pressure source to the top pressure fittings so that any accumulation of condensate may be drained or bled out the bottom fittings. For liquid service the pressure source should bee connected to the bottom taps so that any trapped gas may be vented out the top fittings. Optional bleed fittings may be obtained to replace the standard 1/4 NPT plugs for installations requiring frequent draining or venting of the gage. Note that the unused pair of pressure taps must be plugged in order for the gage to operate. For straight pressure or vacuum applications where only one of a pair of high and low pressure taps are being utilized, the other tap must be open to atmosphere.

For portable use or temporary installation use 1/4 male NPT to male flare fitting and connect to pressure source with high pressure hose or tubing will flare nut connectors.
For permanent installation 1/4" OD copper or stainless steel tubing is recommended.

Proper installation of fittings and plugs is important. Sparingly apply pipe thread sealant to threads. Excessive amounts can fall into pressure passages and cause blockage. we recommend Loctite® 69-31 Hydraulic Sealant. Install using torque wrench. Tighten only to 20 ft/lbs. Overtightening can damage case.

CAPSUHELIC® MAINTENANCE

Note: Capsuhelic® differential pressure gages are high precision instruments assembled and calibrated in a modern factory. If trained instrument mechanics are not available, we recommend that any instruments requiring repair be returned to the factory.

1. No lubrication or periodic servicing is required. If the interior is protected from dust, dirt, corrosive gases and fluids, years of trouble free service may be expected.

2. For service requiring a high degree of continued accuracy, periodic calibration checks are recommended. Send back to the factory for re-calibration.

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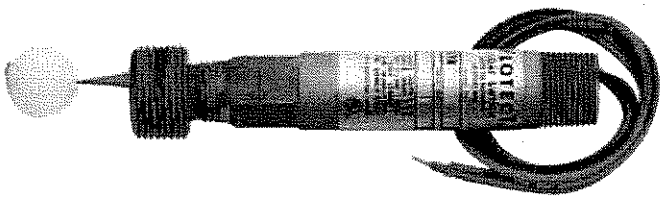
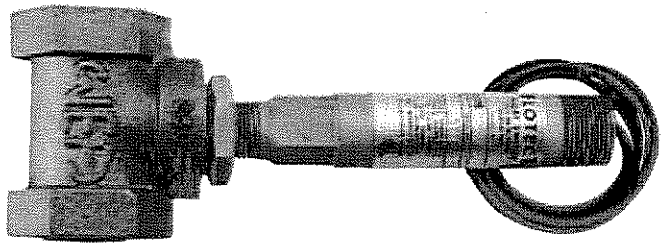
Model L6 FLOTECT® Float Switch

Specifications - Installation and Operating Instructions

Explosion-Proof; UL and CSA Listed -
Class I, Groups *A, B, C, & D
Class II, Groups E, F & G
Directive 94/9/EC (ATEX) Compliant for
II 2 G EEx d IIC T6 Process Temp≤75°C CE Ex
*(Group A, stainless steel body only)





SPECIFICATIONS

Service: Liquids compatible with wetted materials.
Wetted Materials:
Float: Solid polypropylene or 304 SS.
Lower Body: Brass or 303 SS.
Magnet: Ceramic.
External Float Chamber (Tee): Matches lower body choice of brass or 303 SS.
Other: Lever Arm, Spring, Pin, etc.: 301 SS.
Temperature Limit: -4 to 220°F (-20 to 105°C) Standard, MT high temperature option 400°F (205°C)(MT not UL, CSA or ATEX). ATEX compliant AT option ambient temperature -4 to 167°F (-20 to 75°C) process temperature: -4 to 220°F (-20 to 105°C).
Pressure Limits: See next page.
Enclosure Rating: Weatherproof and Explosion-proof. Listed with UL and CSA for Class I, Groups A, B, C and D; Class II, Groups E, F, and G. (Group A on stainless steel body models only). CE 0344 Ex II 2 G EEx d IIC T6 Process Temp≤75°C.
EC-Type Certificate No.: KEMA 04ATEX2128
Switch Type: SPDT snap switch standard, DPDT snap switch optional.
Electrical Rating: UL models: 5A @ 125/250 VAC (V~). CSA and ATEX models: 5A @ 125/250 VAC (V~); 5A res., 3A ind. @ 30 VDC (V=). MV option: .1A @ 125 VAC (V~). MT option: 5A @125/250 VAC (V~). [MT option not UL, CSA or ATEX].
Electrical Connections: UL models: 18 AWG, 18″ (460 mm) long. ATEX/CSA models: terminal block.
Upper Body: Brass or 303 SS.
Conduit Connection: 3/4″ male NPT standard, 3/4″ female NPT on junction box models.
Process Connection: 1″ male NPT on models without external float chamber, 1″ female NPT on models with external float chamber.
Mounting Orientation: Horizontal with index arrow pointing down.
Weight: Approximately 1 lb (.5 kg) without external float chamber, 1.75 lb (.8 kg) with external float chamber.
Specific Gravity: See next page.

Example	L6	EP	B	B	S	3	B	MT		L6EPB-B-S-3-B-MT level switch; brass upper housing, brass lower housing, brass tee with Polypropylene spherical float, SPDT snap switch, and high temperature option
Series	L6									Series L6 level switch
Construction		EP								Explosion proof and weatherproof
Upper Body Material			B S							Brass 303 Stainless Steel
Lower Body Material				B S						Brass 303 Stainless Steel
Circuit (Switch) Type					S D					SPDT DPDT
Line Size						3 4 5 6				1″ NPT 1-1/4″ NPT (No tee models only) 1-1/2″ NPT (No tee models only) 2″ NPT
Tee and Float Options							0 A B C H L S			No Tee, Solid Polypropylene Spherical Float* No Tee, 304 SS Cylindrical Float Brass Tee, Solid Polypropylene Spherical Float* No Tee, 304 SS Spherical Float Brass Tee, 304 SS Spherical Float 303 SS Tee, 304 SS Spherical Float 303 SS Tee, Solid Polypropylene Spherical Float*
Switch Options								MV MT		Gold Contacts on snap switch for dry circuits (see specifications for ratings) High Temperature switch rated 400°F (205°C) (see specifications for ratings)*
Options									AT CSA GL ID JCT TBC TOP	ATEX approved construction (with JCT option standard) CSA approved construction (with JCT option standard)* Ground Lead* Customer Information on standard nameplate Weatherproof and explosion-proof junction box* Terminal Block Connector* Top Mounted (No tee models only)*

*Options that do not have ATEX

Attention: Units without the "AT" suffix are not Directive 94/9/EC (ATEX) compliant. These units are not intended for use in potentially hazardous atmospheres in the EU. These units may be CE marked for other Directives of the EU.

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MAXIMUM PRESSURE CHART

Model Number	Float	Minimum Sp. Gr.	Pressure Rating psig (bar)
.6EPB-B-S-3-A	Cylindrical SS	0.5	200 (13.8)
L6EPB-B-S-3-B	Polypropylene	0.9	250 (17.2)
L6EPB-B-S-3-C	Round SS	0.7	350 (24.1)
L6EPB-B-S-3-H	Round SS	0.7	250 (17.2)
L6EPB-B-S-3-O	Polypropylene	0.9	1000 (69.0)
L6EPB-S-S-3-A	Cylindrical SS	0.5	200 (13.8)
L6EPB-S-S-3-C	Round SS	0.7	350 (24.1)
L6EPB-S-S-3-L	Round SS	0.7	350 (24.1)
L6EPB-S-S-3-O	Polypropylene	0.9	2000 (138)
L6EPB-S-S-3-S	Polypropylene	0.9	2000 (138)

WETTED MATERIALS CHART

Model	Brass	Bronze	Ceramic	Polypropylene	301SS	303SS	304SS
B-S-3-A	X		X		X		X
B-S-3-B	X	X	X	X	X		
B-S-3-C	X		X		X		X
B-S-3-H	X	X	X		X		X
B-S-3-O	X	X	X	X	X		
S-S-3-A			X	X	X		X
S-S-3-C			X		X	X	X
S-S-3-L			X		X	X	X
S-S-3-O			X	X	X	X	
S-S-3-S			X	X	X	X	

INSTALLATION

Unpack switch and remove any packing material found inside lower housing or float chamber.

Switch must be installed with body in a horizontal plane and arrow on side pointing down.

If switch has an external float chamber (tee), connect it to vertical sections of 1″ NPT pipe installed outside vessel walls at appropriate levels. If unit has no external float chamber, it must be mounted in a 1″NPT half coupling welded to the vessel wall. The coupling must extend through the wall.

Inspect and clean wetted parts at regular intervals.

ELECTRICAL CONNECTIONS

Connect wire leads in accordance with local electrical codes and switch action required. N.O. contacts will close and N.C. contacts will open when liquid level causes float to rise. They will return to "normal" condition on decreasing liquid level. Black = common, Blue = N.O. and Red = N.C.

For units supplied with both internal and external grounds the ground screw inside the housing must be used to ground the control. The external ground screw is for supplementary bonding when allowed or required by local code. Some CSA listed models are furnished with a separate green ground wire. Such units must be equipped with a junction box, no supplied but available on special order.

EC-Type Certificate Installation Instructions:

Cable Connection

The cable entry device shall be certified in type of explosion protection flameproof enclosure "d", suitable for conditions of use and correctly installed. For ambient temperatures over 70°C, cable and cable glands suitable for at least 90°C shall be used.

Conduit Connection

An EEx d certified sealing device such as a conduit seal with setting compound shall be provided immediately to the entrance of the valve housing. For ambient temperatures over 70°C, the wiring and setting compound in the conduit seal shall be suitable for at least 90°C.

Note: ATEX units only: The temperature class is determined by the maximum ambient and or process temperature. Units are intended to be used in ambient of -20°C≤ Tamb ≤75°C. Units may be used in process temperatures up to 105°C providing the enclosure and switch body temperatures do not exceed 75°C. The standard Temperature Class is T6 Process Temp ≤75°C.

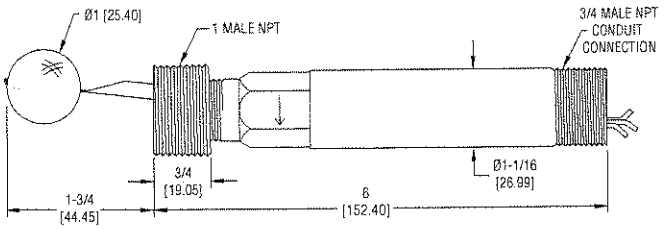
All wiring, conduit and enclosures must meet applicable codes for hazardous areas. Conduits and enclosures must be properly sealed. For outdoor or other locations where temperatures vary widely, precautions should be taken to prevent condensation inside switch or enclosure. Electrical components must be kept dry at all times.

CAUTION: To prevent ignition of hazardous atmospheres, disconnect the device from the supply circuit before opening. Keep assembly tightly closed when in use.

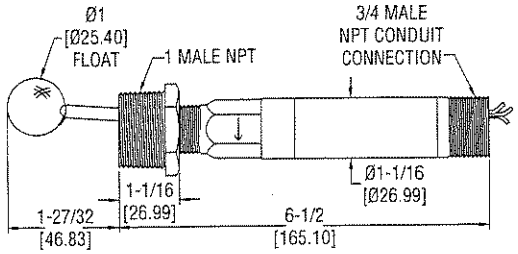
MAINTENANCE

Inspect and clean wetted parts at regular intervals. The cover should be in place at all times to protect, the internal components from dirt, dust and weather and to maintain hazardous location ratings. Disconnect device from the supply circuit before opening to prevent ignition of hazardous atmosphere.

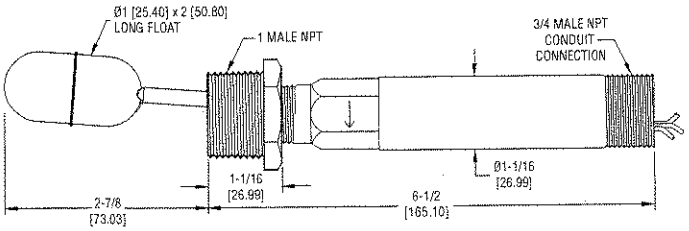
FLOTECT® MODEL L-6 FLOAT SWITCH — DIMENSION DRAWINGS



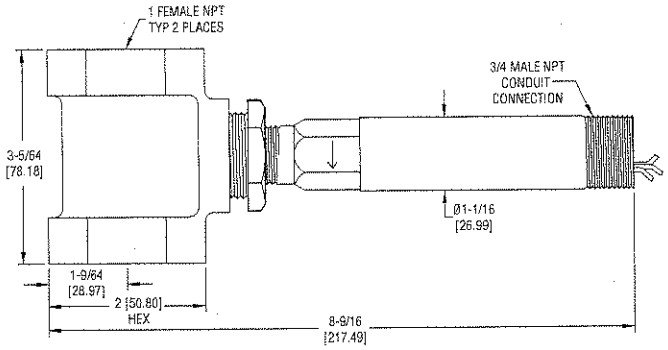
Polypropylene Float



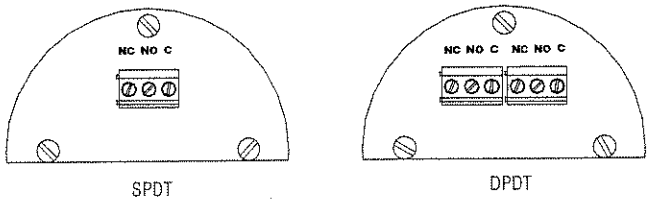
Round Stainless Steel Float



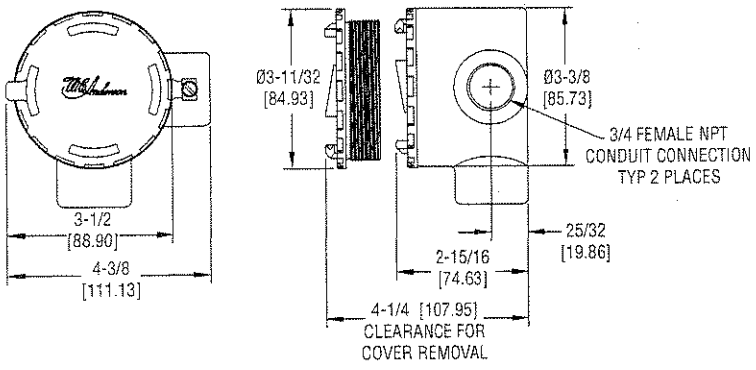
Cylindrical Stainless Steel Float



With External Chamber (Tee)



Terminal Connections CSA, ATEX Enclosures



CSA, ATEX Conduit Enclosure

Limited Warranty: The Seller warrants all Dwyer instruments and equipment to be free from defects in workmanship or material under normal use and service for a period of one year from date of shipment. Liability under this warranty is limited to repair or replacement F.O.B. factory of any parts which prove to be defective within that time or repayment of the purchase price at the Seller's option provided the instruments have been returned, transportation prepaid, within one year from the date of purchase. All technical advice, recommendations and services are based on technical data and information which the Seller believes to be reliable and are intended for use by persons having skill and knowledge of the business, at their own discretion. In no case is Seller liable beyond replacement of equipment F.O.B. factory or the full purchase price. This warranty does not apply if the maximum ratings label is removed or if the instrument or equipment is abused, altered, used at ratings above the maximum specified, or otherwise misused in any way.

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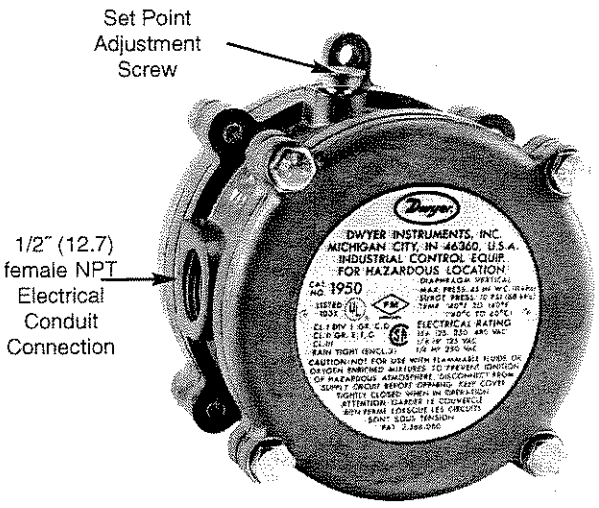
Series 1950 Explosion-Proof Differential Pressure Switches

Specifications - Installation and Operating Instructions



Series 1950 Explosion-Proof Differential Pressure Switches combine the best features of the Dwyer Series 1900 Pressure Switch with an integral explosion-proof and weather-proof housing. Each unit is UL & CSA listed; FM approved for use in Class I, Groups C & D; Class II, Groups E, F, & G; and Class III atmospheres (NEMA 7 & 9). They are totally rain-tight for outdoor installations. Twelve models allow set-points from .03 to 20 inches w.c. and from .5 to 50 psi (3.4 to 345 kPa).

Easy access to the SPDT switch for electrical hook-up is provided by removing the top plate of the three-part aluminum housing. Adjustment to the set point of the switch can be made without disassembling the housing. The unit is very compact, about half the weight and bulk of equivalent conventional explosion-proof switches.

CAUTION

For use only with air or compatible gases. Use of the Model 1950 switch with explosive media connected to the Low pressure port (including differential pressure applications in such media) is not recommended. Switch contact arcing can cause an explosion inside the switch housing which, while contained, may render the switch inoperative. If switch is being used to sense a single positive pressure relative to atmosphere, run a line from the low pressure port to a non-hazardous area free of combustible gases. This may increase response time on -0 and -00 models.

NOTE: The last number-letter combination in the model number identifies the switch's electrical rating (number) and diaphragm material (letter). The 2F combination is standard as described in the physical data above. In case of special models, a number 1 rating is the same as 2; a number 3 or 4 rating is 10A 125, 250, 480 VAC; 1/8 H.P. 125 VAC; 1/4 H.P. 250 VAC; a number 5 or 6 rating is 1A 125 VAC. Letter B indicates a Buna-N diaphragm; N = Neoprene; S = Silicone; and V = Viton®.

UL and CSA Listed, FM Approved For
CL. I GR. C, D - CL. II GR. E, F, G - CL. III

Series 1950 Switches
Operating ranges and deadbands

To order specify Model Number	Operating Range: Inches, W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1950-02-2S	0.03 to 0.10	0.025	0.05
1950-00-2F	0.07 to 0.15	0.04	0.05
1950-0-2F	0.15 to 0.5	0.10	0.15
1950-1-2F	0.4 to 1.6	0.15	0.20
1950-5-2F	1.4 to 5.5	0.3	0.4
1950-10-2F	3.0 to 11.0	0.4	0.5
1950-20-2F	4.0 to 20.0	0.4	0.6
Model Number	**Operating Range: PSI**	**Approximate Dead Band**	
		Min. Set Point	Max. Set Point
1950P-2-2F	0.5 to 2.0	0.3 psi	0.3 psi
1950P-8-2F	1.5 to 8.0	1.0 psi	1.0 psi
1950P-15-2F	3.0 to 15.0	0.9 psi	0.9 psi
1950P-25-2F	4.0 to 25.0	0.7 psi	0.7 psi
1950P-50-2F	15.0 to 50	1.0 psi	1.5 psi

SPECIFICATIONS

Service: Air and non-combustible, compatible gases.
Wetted Materials: Consult factory.
Temperature Limits: -40 to 140°F (-40 to 60°C); 0 to 140°F (-17.8 to 60°C) for 1950P-8, 15, 25, and 50. -30 to 130°F (-34.4 to 54.4°C) for 1950-02.
Pressure Limits:
Continuous: 1950's - 45" w.c. (0.11 bar);
1950P's - 35 psi (2.41 bar); 1950P-50 only - 70 psi (4.83 bar).
Surge: 1950's - 10 psi (0.69 bar), 1950P's - 50 psi (3.45 bar), 1950P-50 only - 90 psi (6.21 bar).
Enclosure Rating: IP64, NEMA 3, 7 and 9.
Switch Type: Single-pole double-throw (SPDT).
Electrical Rating: 15 A @, 125, 250, 480 VAC, 60 Hz. Resistive 1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC, 60 Hz.
Electrical Connections: 3 screw type, common, normally open and normally closed.
Process Connections: 1/8" female NPT.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Set Point Adjustment: Screw type on top of housing.
Weight: 3.25 lb (1.5 kg); 1950-02 model, 4.4 lb (2 kg).
Agency Approvals: CE, UL, CSA, FM.

RESPONSE TIME: Because of restrictive effect of flame arrestors, switch response time may be as much as 10-25 seconds where applied pressures are near set point.

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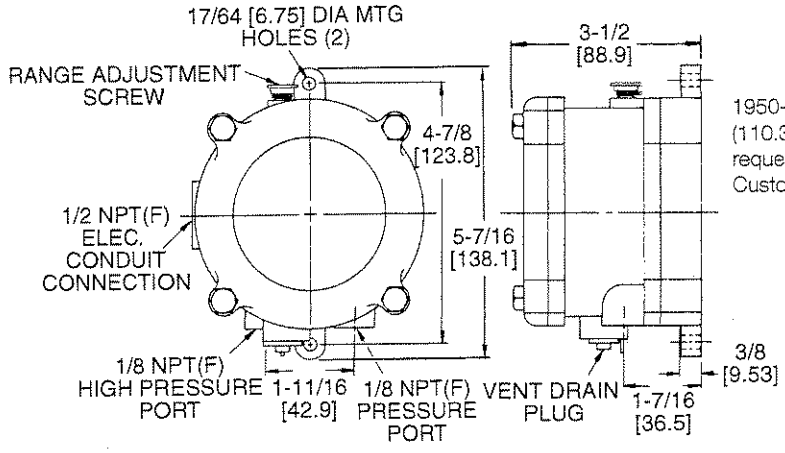

1950-02: 7-3/4" (196.9) dia. x 4-11/32" (110.3) depth. For complete dimensions request drawing 28-700175-00 from our Customer Service Department

1950 Switch Outline Dimensions

INSTALLATION

1. Select a location free from excess vibration and corrosive atmospheres where temperatures will be within the limits noted under Specifications on reverse. Switch may be installed outdoors or in areas where the hazard of explosion exists. See reverse for specific types of hazardous service.

2. Mount standard switches with the diaphragm in a vertical plane and with switch lettering and Dwyer nameplate in an upright position. Some switches are position sensitive and may not reset properly unless they are mounted with the diaphragm vertical.

3. Connect switch to source of pressure, vacuum or differential pressure. Metal tubing with 1/4" O.D. is recommended, but any tubing which will not restrict the air flow can be used. Connect to the two 1/8" female NPT pressure ports as noted below:

A. Differential pressures - connect pipes or tubes from source of greater pressure to high pressure port marked HIGH PRESS, and from source of lower pressure to low pressure port marked LOW PRESS.

B. Pressure only (above atmospheric pressure) - connect tube from source of pressure to high pressure port. The low pressure port is left open to atmosphere.

C. Vacuum only (below atmospheric pressure) - connect tube from source of vacuum to low pressure port. The high pressure port is left open to atmosphere.

4. To make electrical connections, remove the three hex head screws from the cover and after loosening the fourth captive screw, swing the cover aside. Electrical connections to the standard single pole, double throw snap switch are provided by means of terminals marked "COM" (common), "NO" (norm open), "NC" (norm closed). The normally open contacts close and the normally closed contacts open when pressure increases beyond the set point. Switch loads for standard models should not exceed the maximum specified current rating of 15 amps resistive. Switch capabilities decrease with an increase in ambient temperature, load inductance, or cycling rate. Whenever an application involves one or more of these factors, the user may find it desirable to limit the switched current to 10 amps or less in the interest of prolonging switch life.

ADJUSTMENT: To Change the Set point

1. Remove the plastic cap and turn the slotted Adjust-ment Screw at the top of the housing clockwise to raise the set point pressure and counter-clockwise to lower the set point. After calibration, replace the plastic cap and re-check the set point.

2. The recommended procedure for calibrating or checking calibration is to use a "T" assembly with three rubber tubing leads, all as short as possible and the entire assembly offering minimum flow restriction. Run one lead to the pressure switch, another to a manometer of known accuracy and appropriate range, and apply pressure through the third tube. Make final approach to the set point very slowly. Note that manometer and pressure switch will have different response times due to different internal volumes, lengths of tubing, fluid drainage, etc. Be certain the switch is checked in the position it will assume in use, i.e. with diaphragm in a vertical plane and switch lettering and Dwyer nameplate in an upright position.

3. For highly critical applications check the set point adjustment and if necessary, reset it as noted in step A.

MAINTENANCE

The moving parts of these switches need no maintenance or lubrication. The only adjustment is that of the set point. Care should be taken to keep the switch reasonably clean. Periodically the vent drain plug should be rotated, then returned to its original position. This will dislodge deposits which could accumulate in applications where there is excessive condensation within the switch. The Series 1950 Explosion-Proof Differential Pressure Switch is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.

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POWEREX

PURE AIR TECHNOLOGY

OILLESS SCROLL COMPRESSORS

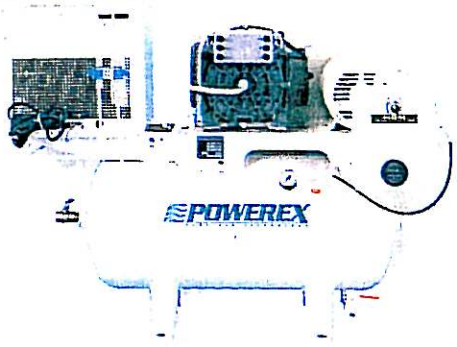
Model SES

Enclosure Scroll Compressor

Features

- Oilless "Scroll" Air End
- Whisper Quiet Enclosure (49 dBa)
- Aftercooler
- UL Listed Controls
- A.S.M.E. Air Receiver
- Compact
- Run Hour Meter
- Service Video
- Light Weight Portability
- Temperature Warning System
- Optional Automatic Tank Drain
- No Exhaust or Intake Valving
- 3 Year Air End Warranty
- 1 Year System Warranty

Model STS

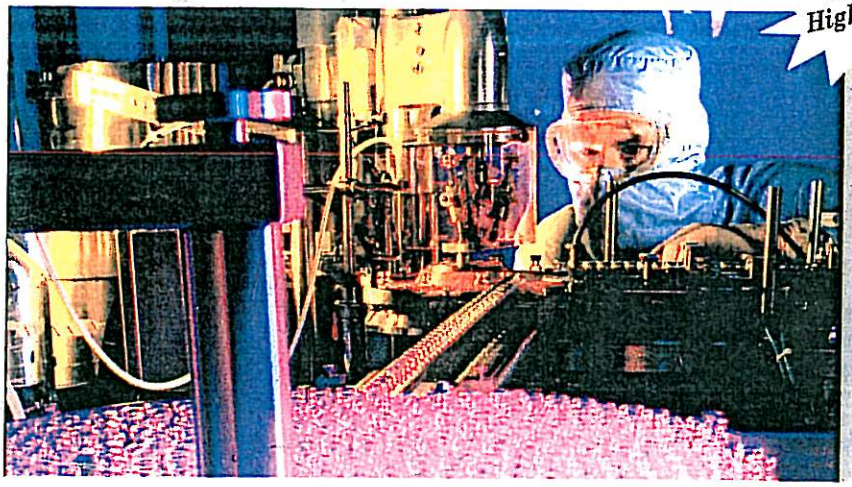


Scroll Tankmount

Features

- Oilless "Scroll" Air End
- Aftercooler
- A.S.M.E. Air Receiver
- ODP High Efficiency Motor
- Optional Refrigerator or Desiccant Dryer
- Optional UL Listed Magnetic Starter

Now Available in High Pressure Models up to 145 PSIG



When your pure air system demands reliability... demand Powerex's oilless compressors.

Aerospace

Automotive

Chemical Processing

Climate Control

Dental

Environmental

Food Processing

Instrumentation

Laboratories

Manufacturing Facilities

Medical

N_2 Generation

O_2 Generation

Petrochemical

Pharmaceutical

Service Vehicles

Soil Remediation

ENGINEERING SPECIFICATIONS

Scroll Enclosure Simplex – Model SES (Starter and Aftercooler Included)

MODEL	HP	PHASE	SCFM @145 PSIG	SCFM @100 PSIG	VOLTAGE	FLA/ Motor	GALLON TANK	DIMENSION LxWxH	SHP. WT (Lbs.)
SES0308	3	3	7.5	8.8	208/230/460	8.7/8/4	10	24 x 19 x 33	256
SES1308	3	1	7.5	8.8	230	17	10	24 x 19 x 33	269
SES0508	5	3	12	15.2	208/230/460	13.7 / 13.2 / 6.6	10	24 x 19 x 33	365
SES1518	5	1	12	15.2	230	25	10	24 x 19 x 33	384

Scroll Basemount Simplex – Model SBS (Aftercooler Included)

MODEL	HP	PHASE	SCFM @145 PSIG	SCFM @100 PSIG	VOLTAGE	FLA/ Motor	GALLON TANK	DIMENSION LxWxH	SHP. WT (Lbs.)
SBS0307	3	3	7.5	8.8	208/230/460	8.7/8/4	Basemount	28 x 16 x 16	120
SBS1307	3	1	7.5	8.8	230	16	Basemount	28 x 16 x 16	135
SBS0507	5	3	12	15.2	208/230/460	13.7 / 13.2 / 6.6	Basemount	28 x 16 x 16	140
SBS1517	5	1	12	15.2	230	25	Basemount	28 x 16 x 16	150

Scroll Tankmount Simplex – Model STS (Aftercooler Included)

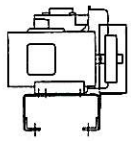
MODEL	HP	PHASE	SCFM @145 PSIG	SCFM @100 PSIG	VOLTAGE	FLA/ Motor	GALLON TANK	DIMENSION LxWxH	SHP. WT (Lbs.)
STS030	3	3	7.5	8.8	208/230/460	8.7/8/4	30 / 60	39x22x35 / 51x23x39	240 / 350
STS130	3	1	7.5	8.8	230	16	30 / 60	39x22x35 / 51x23x39	255 / 365
STS050	5	3	12	15.2	208/230/460	13.7 / 13.2 / 6.6	30 / 60	39x22x35 / 51x23x39	260 / 370
STS151	5	1	12	15.2	230	25	30 / 60	39x22x35 / 51x23x39	276 / 386

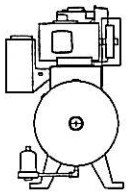
Scroll Tankmount Duplex – Model STD (Aftercoolers Included)

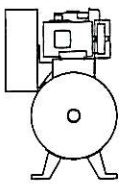
MODEL	HP	PHASE	SCFM @145 PSIG	SCFM @100 PSIG	VOLTAGE	FLA/ Motor	GALLON TANK	DIMENSION LxWxH	SHP. WT (Lbs.)
STD030	3(2)	3	15	17.6	208/230/460	8.7/8/4	80	64 x 26 x 40	570
STD130	3(2)	1	15	17.6	230	16	80	64 x 26 x 40	500
STD050	5(2)	3	24	30.4	208/230/460	13.7 / 13.2 / 6.6	80 / 120	64x26x40 / 71x31x75	610/615
STD151	5(2)	1	24	30.4	230	25	80 / 120	64x26x40 / 71x31x75	642/726

DIMENSIONAL DRAWINGS*

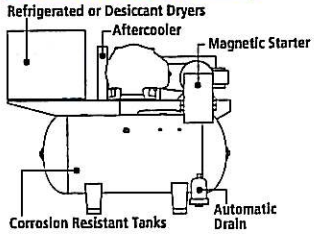
MODEL SES_____ MODEL SBS_____ MODEL STS_____ MODEL STD_____



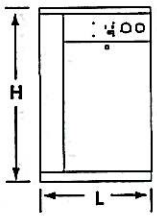


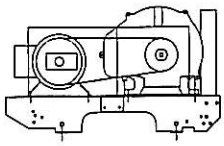


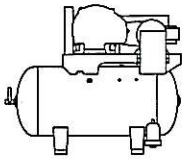
OPTIONAL EQUIPMENT

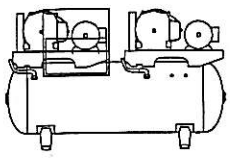


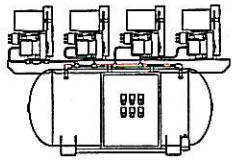
SPECIAL ENGINEERED PRODUCTS_____











*Drawings for reference only.

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POWEREX

PURE AIR TECHNOLOGY

Scroll Tankmount/Basemount Air Compressors

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Descriptions

GENERAL

The Powerex Oilless Rotary Scroll Air Compressor has advanced scroll compressor technology through the development of a completely oilless unit. The Powerex Scroll Compressor offers a dynamically balanced air end which insures vibration-free operation. The rotary design permits a continuous 100% duty cycle. No oil separation, oil filtration, or inlet valves are required on the Powerex Scroll unit.

COMPRESSION CYCLE

The Powerex oilless rotary scroll air compressor is based on the theory of scroll compression. A scroll is a free standing, intricate spiral bounded on one side by a solid, flat plane or base. A scroll set, the basic compression element of a scroll compressor, is made up of two identical spirals which form right and left hand parts. One of these scroll components is indexed or phased 180° with respect to the other so the scrolls can mesh. Crescent-shaped gas pockets are formed and bounded by the spirals and the base plate of both scrolls. As the moving scroll is orbited around the fixed scroll, the pockets formed by the meshed scrolls follow the spiral toward the center and diminish in size. The moving scroll is prevented from rotating during this process so the 180° phase relationship of the scrolls is maintained. The compressor's inlet is at the outer boundary of the scrolls. The compressed gas is discharged through the outlet at the center of the fixed scroll so no valves are needed.

TIP SEAL

The tip seal on the scroll compressor is self-lubricated and allows the unit to operate efficiently without oil and expensive filtration. The tip seal should be replaced every 10,000 hours of operation.

BEARINGS

The bearings on the scroll compressor are regreaseable to allow extended compressor life. Service should be performed every 10,000 hours of operation.

DRY TYPE INLET FILTER (P/N 91348550)

Order P/N 91348550 for both the 3 HP and 5HP units. Change every 2,500 hours or more often in dirty locations.

HOURMETER

The hourmeter on the scroll compressor indicates the actual number of hours the unit has been in operation. The hourmeter is also used to determine maintenance and service timing. **An hourmeter must be installed with every Scroll compressor.**

CONDENSATE DRAIN VALVE

A condensate drain valve must be installed on any tank used to allow removal of the liquid which will collect during compressor operation.

NOTICE ***Drain liquid from tank daily.***

⚠DANGER

Breathable Air Warning

This compressor/pump is NOT equipped and should NOT be used "as is" to supply breathing quality air. For any application of air for human consumption, you must fit the air compressor/pump with suitable in-line safety and alarm equipment. This additional equipment is necessary to properly filter and purify the air to meet minimal specifications for Grade D breathing as described in Compressed Gas Association Commodity Specification G 7.1 - 1966, OSHA 29 CFR 1910. 134, and/or Canadian Standards Associations (CSA).

DISCLAIMER OF WARRANTIES IN THE EVENT THE COMPRESSOR IS USED FOR THE PURPOSE OF BREATHING AIR APPLICATION AND PROPER IN-LINE SAFETY AND ALARM EQUIPMENT IS NOT SIMULTANEOUSLY USED, EXISTING WARRANTIES ARE VOIDED, AND POWEREX DISCLAIMS ANY LIABILITY WHATSOEVER FOR ANY LOSS, PERSONAL INJURY OR DAMAGE.

nstallation

RECEIVING THE UNIT

Immediately upon receipt of the scroll compressor, the unit should be inspected for any damage which may have occurred in shipment. Any shipping damage must be immediately filed with the freight carrier.

The compressor nameplate should be checked to see if the unit is the correct model and voltage as ordered.

APPLICATION

When the scroll compressor is to be used in applications other than the compressing of atmospheric air, please contact a Powerex representative for engineering and warranty information at 1-888-769-7979.

INSTALLATION SITE

1. The scroll compressor must be located in a clean, well lit and well ventilated area.
2. The area should be free of excessive dust, toxic or flammable gases, moisture, water and direct sunlight.
3. Never install the compressor where the ambient temperature is higher than 104° F or where humidity is high.
4. Clearance must allow for safe, effective inspection and maintenance.

Minimum Clearances	
Above	24"
Drive belt side	12"
Other sides	20"

5. If necessary, use metal shims or leveling pads to level the compressor. Never use wood to shim the compressor.

VENTILATION

1. If the scroll compressor is located in a totally enclosed room, an exhaust fan with access to outside air must be installed.
2. Never restrict the cooling fan exhaust air.
3. Never locate the compressor where hot exhaust air from other heat generating units may be pulled into the unit.

WIRING

Refer to the general product manual. All electrical hook-ups must be performed by a qualified electrician. Installations must be in accordance with local and national electrical codes.

Use solderless terminals to connect the electric power source.

PIPING

Refer to the general product manual.

1. Make sure the piping is lined up without being strained or twisted when assembling the piping for the scroll compressor.
2. Appropriate expansion loops or bends should be installed at the compressor to avoid stresses caused by changes in hot and cold conditions.
3. Piping supports should be anchored separately from the compressor to reduce noise and vibration.
4. Never use any piping smaller than the compressor connection.
5. Use flexible hose to connect the outlet of the compressor to the piping so that the vibration of the compressor does not transfer to the piping.

SAFETY VALVES

Tank mounted compressors are shipped from the factory with safety valves installed in the tank. The flow capacity of the safety valve is equal to or greater than the capacity of the compressor.

1. The pressure setting of the safety valve must be no higher than the maximum working pressure of the tank.
2. Safety valves should be placed ahead of any possible blockage point in the system, i.e. shutoff valve.
3. Avoid connecting the safety valve with any tubing or piping.
4. Manually operate the safety valve every six months to avoid sticking or freezing.

Operation

BEFORE START UP

1. Make sure all safety warnings, labels and instructions have been read and understood before continuing.
2. Remove any shipping materials, brackets, etc.
3. Confirm that the electric power source and ground have been firmly connected.
4. Be sure all pressure connections are tight.
5. Check to be certain all safety relief valves, etc., are correctly installed.
6. Check that all fuses, circuit breakers, etc., are the proper size.
7. Make sure the inlet filter is properly installed.
8. Confirm that the drain valve is closed.
9. Visually check the rotation of the compressor pump. If the rotation is incorrect, have a qualified electrician correct the motor wiring.

START-UP AND OPERATION

1. Follow all the procedures under "Before start-up" before attempting operation of the compressor.
2. Switch the electric source breaker on.
3. Open the tank discharge valve completely.
4. Check that the compressor operates without excessive vibration, unusual noises or leaks.
5. Close the discharge valve completely.
6. If the pressure does not rise on a three phase unit, turn the unit off. Have a qualified electrician switch the breaker OFF and exchange the L1 and L2 connections (two out of three phases of electric source) inside the magnetic starter enclosure.
7. Check the discharge pressure. Also make sure the air pressure rises to the designated pressure setting by checking the discharge pressure gauge.
8. Check the operation of the pressure switch by opening the tank outlet valve and confirming the compressor starts as pressure drops.

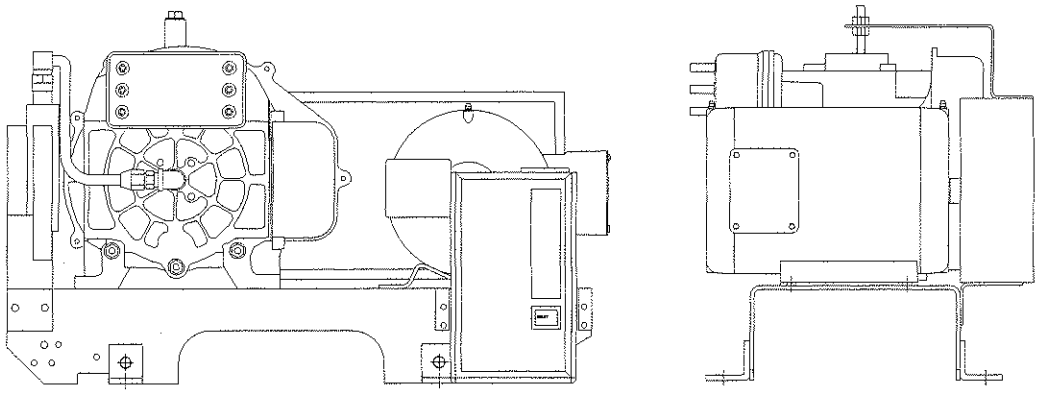


Figure 1 - SBS Scroll Basemount Simplex

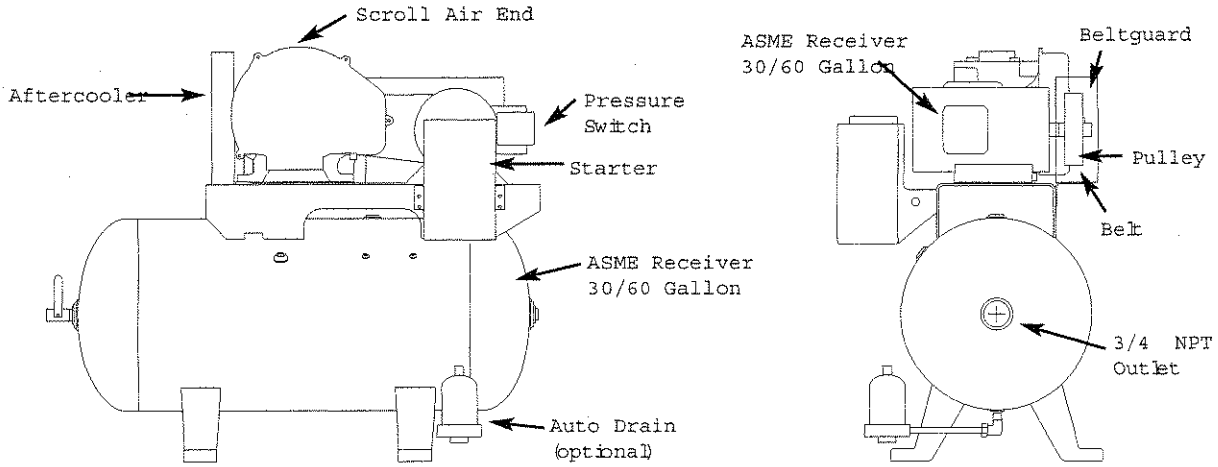


Figure 2 - STS Scroll Tankmount

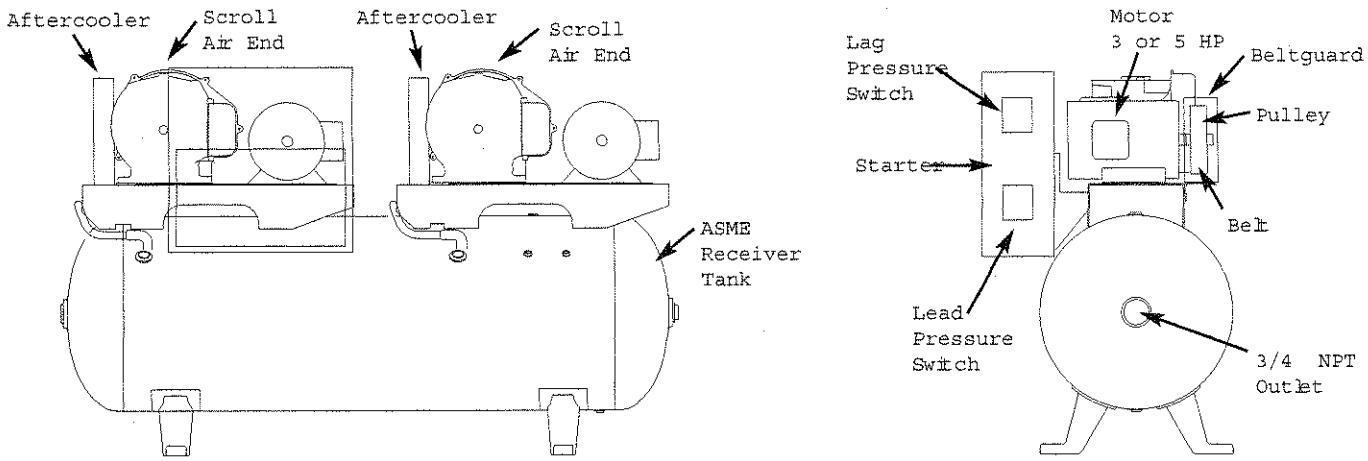


Figure 3 - STD Scroll Tankmount Duplex

Scroll Air Compressors Tankmount/Basemount

Specifications

Scroll Basemount Simplex - Model SBS

Model	HP	Phase	SCFM @100 PSIG	Voltage	Full Load Amperage	Gallon Tank	Dimension LxWxH	Ship Weight (Lbs.)
SBS0307	3	3	8.6	208/230/460	8.7/8.0/4.0	Basemount	29x19x19	160
SBS1307	3	1	8.6	230	17	Basemount	29x19x19	175
SBS0507	5	3	14.7	208/230/460	13.7/13.2/6.6	Basemount	29x19x19	180
SBS1517	5	1	14.7	230	25	Basemount	29x19x19	190

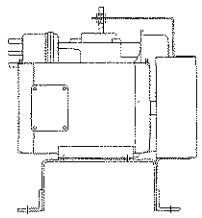
Scroll Tankmount Simplex - Model STS

Model	HP	Phase	SCFM @100 PSIG	Voltage	Full Load Amperage	Gallon Tank	Dimension LxWxH	Ship Weight (Lbs.)
STS030	3	3	8.6	208/230/460	8.7/8.0/4.0	30 /60	39x22x35 /51x23x39	280 /390
STS130	3	1	8.6	230	17	30 /60	39x22x35 /51x23x39	295 /405
STS050	5	3	14.7	208/230/460	13.7/13.2/6.6	30 /60	39x22x35 /51x23x39	300 /410
STS151	5	1	14.7	230	25	30 /60	39x22x35 /51x23x39	310 /420

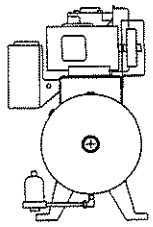
Scroll Tankmount Duplex - Model STD

Model	HP	Phase	SCFM @100 PSIG	Voltage	Full Load Amperage	Gallon Tank	Dimension LxWxH	Ship Weight (Lbs.)
STD030	3 (2)	3	17.2	208/230/460	17.4/16.0/8.0	80	64x26x40	650
STD130	3 (2)	1	17.2	230	34	80	64x26x40	680
STD050	5 (2)	3	29.4	208/230/460	27.4/26.4/13.2	80 /120	64x26x40 /71x35x75	690 /715
STD151	5 (2)	1	29.4	230	50	80 /120	64x26x40 /71x35x75	710 /735

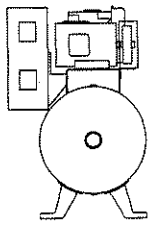
MODEL SBS



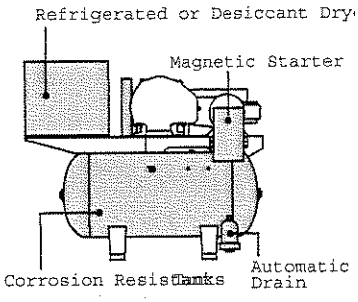
MODEL STS

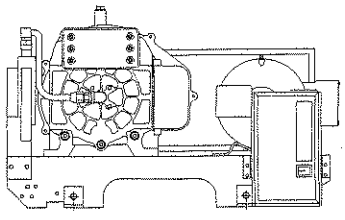


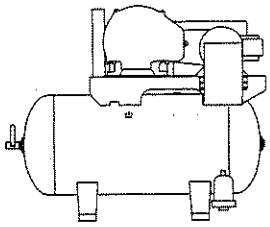
MODEL STD

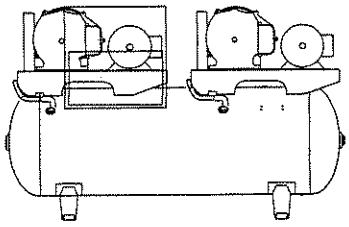


OPTIONAL EQUIPMENT









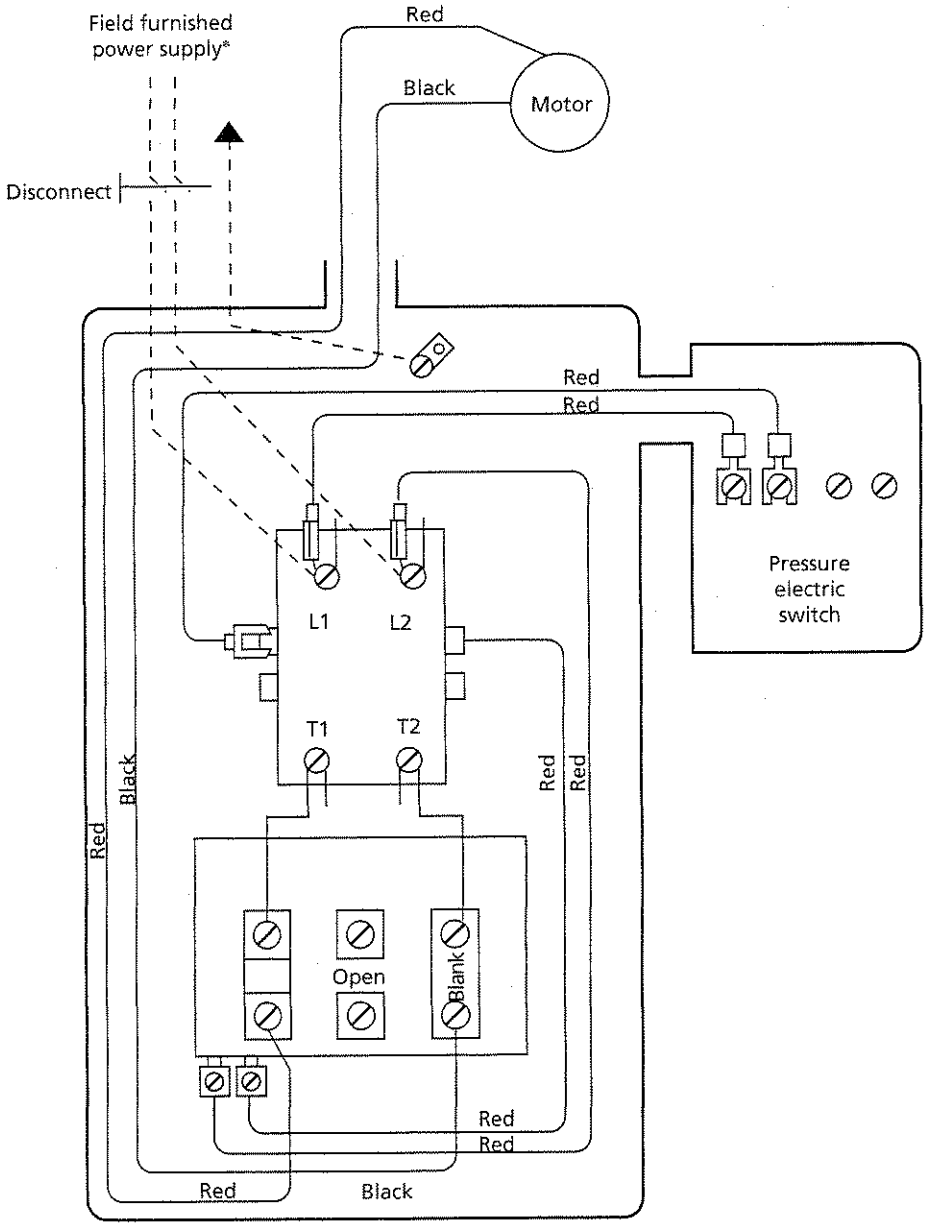
Maintenance Schedule

Item	Action needed	Operating Hours 500	2500	5000	10,000	15,000	20,000	Remarks
Tank	Drain moisture	Daily						
Inlet air filter	Replace	●	▲	*(Every 2,500 hrs or less)*				Part #91348550
Blower fan	Clean			●	●	●	●	
Fan Duct	Clean			●	●	●	●	
Compressor Fins	Clean		●	*(Every 2,500 hrs or less)*				
Bearings	Grease				▲		▲	Service Center Only
Tip seal	Replace				▲		▲	
Dust seal	Replace				▲		▲	
V-belt	Inspect, replace	*Note 3	●	▲	▲	▲	▲	
Pressure Switch	Confirm operation				●		●	
Magnetic starter	Inspect				●		●	Replace if contact points deteriorated
Safety valve	Confirm operation		●	*(Every 2,500 hrs or less)*				
Pressure gauge	Inspect		●	*(Every 2,500 hrs or less)*				
●	Inspect							
▲	Replace							

NOTES:

1. Inspect and perform maintenance periodically according to maintenance schedule.
2. The maintenance schedule relates to the normal operating conditions. If the circumstances and load condition are adverse, shorten the cycle time and do maintenance accordingly.
3. * The tension of the V-belt should be adjusted during the initial stage and inspected every 2,500 hours afterwards. Proper belt tension for 3 HP units is 7 lbs./.16" deflection; for 5 HP units, 7 lbs./.19" deflection.
4. See Compressor Pump Manuals for replacement or service procedures.

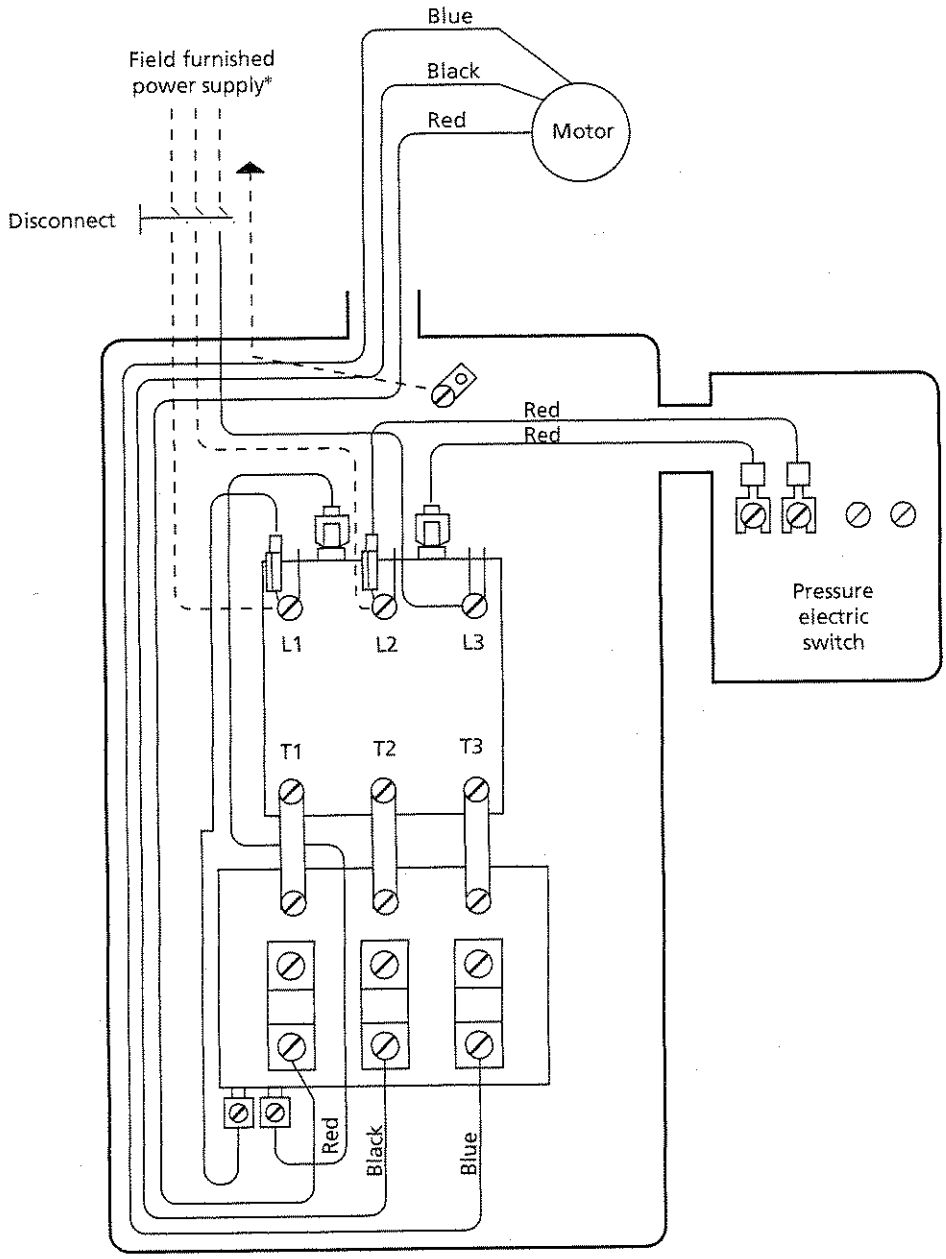
Electrical Wiring Diagram - Simplex



*Main disconnect and branch circuit protection to be installed by a qualified electrician in accordance with national and local codes.

Figure 4 - 3-5 HP Basemount/Simplex Single-Phase 208/230 Volts

Electrical Wiring Diagram - Simplex



*Main disconnect and branch circuit protection to be installed by a qualified electrician in accordance with national and local codes.

Figure 5 - 3-5 HP Basemount/Simplex Three-Phase 208-230/460 Volts

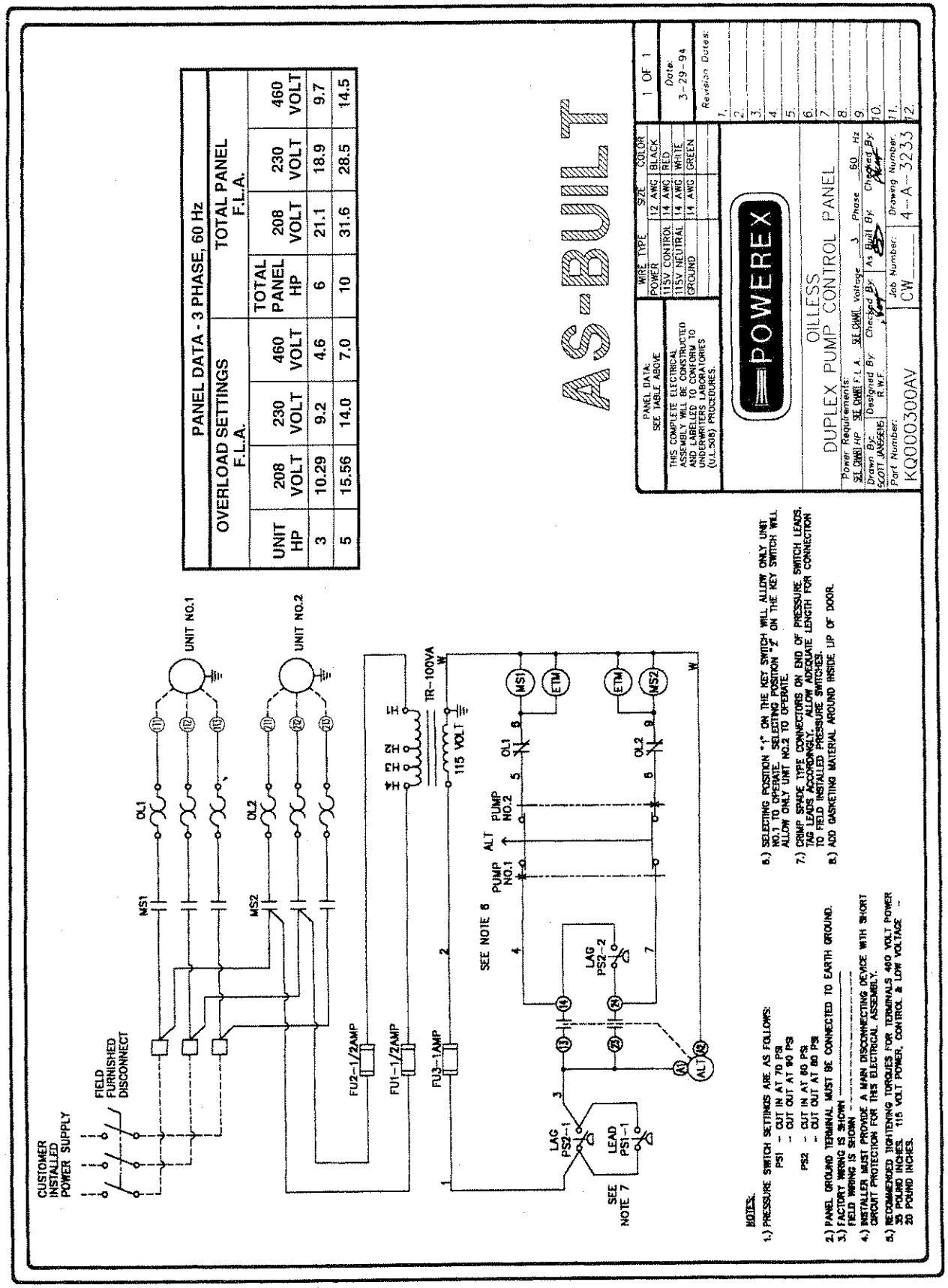
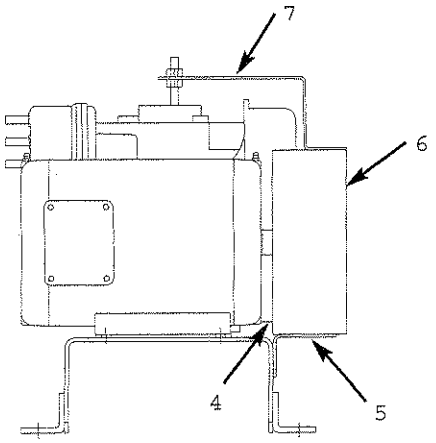


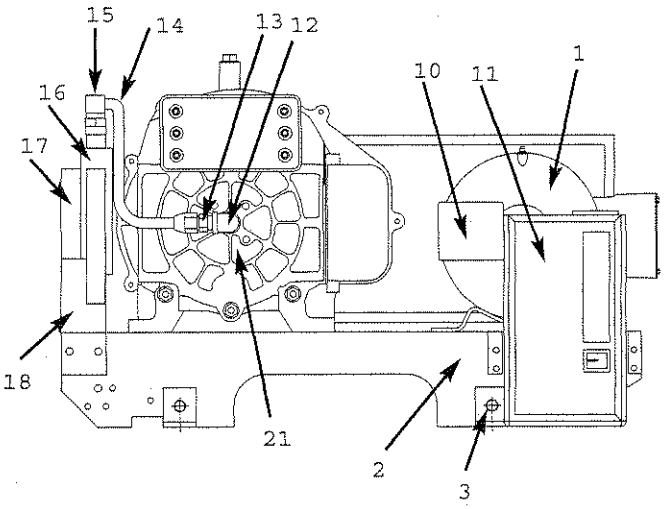
Figure 6 - 3-5 HP Duplex Three-Phase 208-230/460 Volts

Replacement Parts List for SBS Models

Ref. No.		Description	SBS Model Part Number	Qty.
1		Motor 3 HP 3 Phase	MC022374AV	1
		Motor 3 HP 1 Phase	MC301519AV	1
		Motor 5HP 3 Phase	MC022307AV	1
		Motor 5HP 1 Phase	MC301520AV	1
2		Base	BA000301AV	1
3		Angle bracket	ST185500AV	4
4		Beltguard back	BG303800AV	1
5		Bracket	SL050700AV	1
6		Beltguard front	BG303900AV	1
7		3 HP Beltguard bracket	BG304000AV	1
		5 HP Beltguard bracket	BG304100AV	1
8	Δ	Belt:		
		3 HP	BT010700AV	1
		5 HP	BT010700AV	2
9	Δ	Motorpulley:		
		3 HP	PU009753AV	1
		5 HP	PU009754AV	1
10		Pressure switch	CW 207559AV	1
11		Starter:		
		3 HP 230V 1 Phase	JP001045AV	1
		5 HP 230V 1 Phase	JP001046AV	1
		3 HP 230V 3 Phase	JP001047AV	1
		5 HP 230V 3 Phase	JP001049AV	1
		3 HP 460V 3 Phase	JP001048AV	1
		5 HP 460V 3 Phase	JP001050AV	1
12		90¡ Elbow	ST074204AV	1
13		1/2" Flare	ST126207AV	1
14		Discharge tube	SL300900AV	1
15		90¡ Flare elbow	ST126204AV	1
16		Aftercooler	SL300100AV	1
17		Left aftercooler bracket	SL300200AV	1
18		Right aftercooler bracket	SL300300AV	1
19	Δ	Check valve	JP087700AV	1
20	Δ	Safety valve	V-215100AV	1
21		Scroll air end:		
		3 HP	SL014002AJ	1
		5 HP	SL016502AJ	1

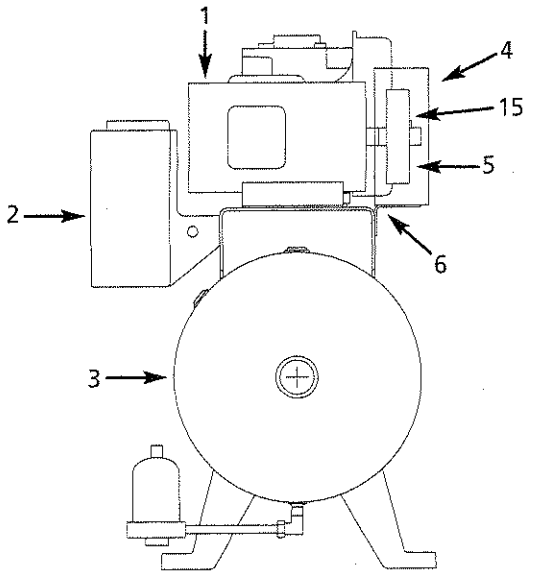
(Δ) Not shown.

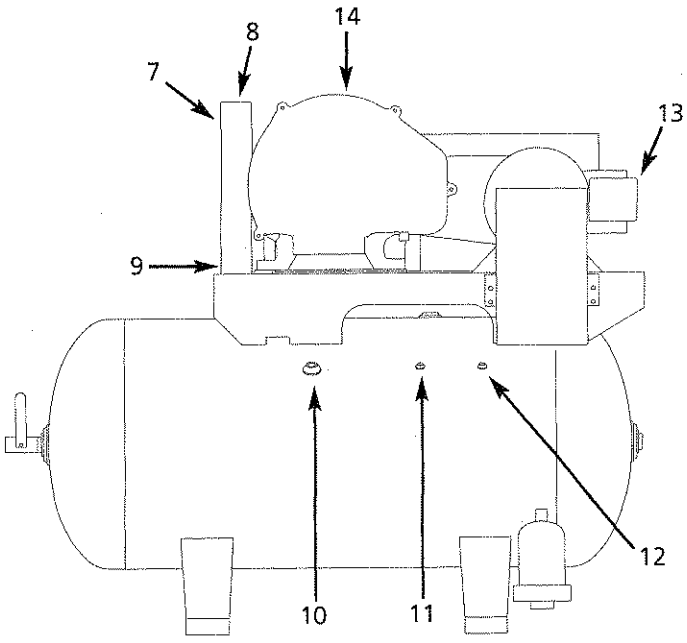




Replacement Parts List for STS Models

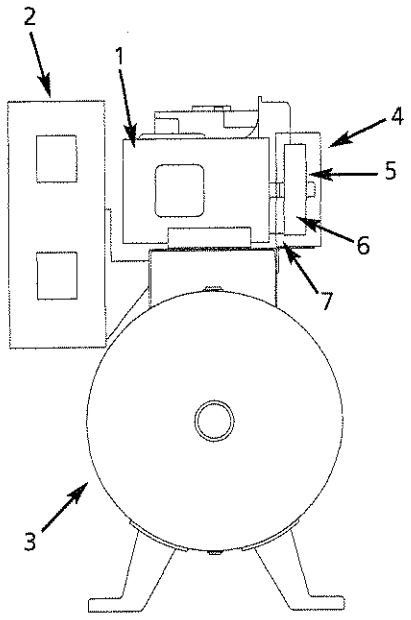
Ref. No.	Description	STS Model Part Number	Quantity
1	Motor:		
	3 HP 3 Phase	MC022374AV	1
	3 HP 1 Phase	MC301519AV	1
	5 HP 3 Phase	MC022307AV	1
	5 HP 1 Phase	MC301520AV	1
2	Starter:		
	3 HP 230V 1 Phase	JP001045AV	1
	5 HP 230V 1 Phase	JP001046AV	1
	3 HP 230V 3 Phase	JP001047AV	1
	5 HP 230V 3 Phase	JP001049AV	1
	3 HP 460V 3 Phase	JP001048AV	1
	5 HP 460V 3 Phase	JP001050AV	1
3	Receiver tank:		
	30 gallon	AR024700AJ	1
	60 gallon	AR022500AJ	1
4	Beltguard	BT303900AV	1
5	Motor pulley:		
	3 HP	PU009753AV	1
	5 HP	PU009754AV	1
6	Guard plate	BG217500AV	1
7	Aftercooler	SL300100AV	1
8	Tube air end/aftercooler	SL301000AP	1
9	Tube aftercooler/tank	SL300900AP	1
10	Check valve	IP087700AV	1
11	Pressure gauge	GA016701AV	1
12	Safety valve	V-215100AV	1
13	Pressure switch	CW207573AV	1
14	Scroll air end:		
	3 HP	SL014002AJ	1
	5 HP	SL016502AJ	1
15	Belt:		
	3 HP	BT010702AV	1
	5 HP	BT010702AV	2

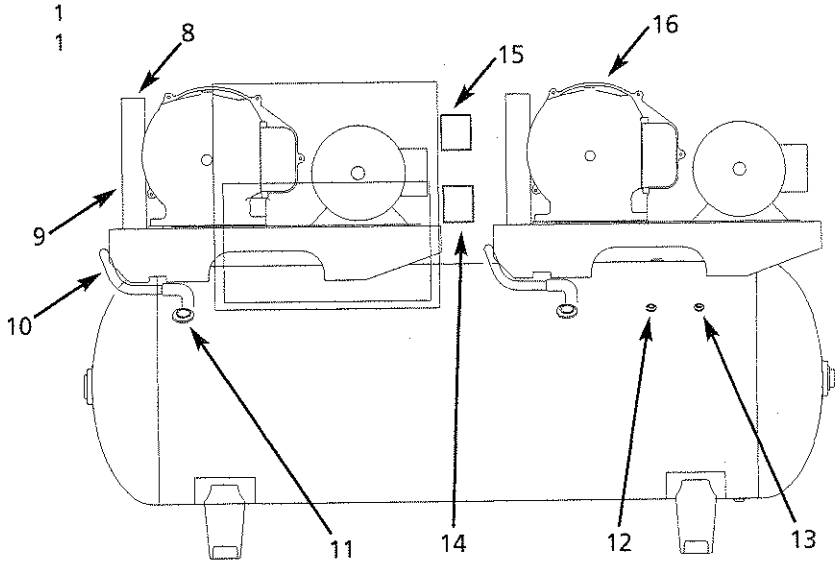




Replacement Parts List for STD Models

Ref. No.	Description	STD Model Part Number	Quantity
1	Motor:		
	3 HP 3 Phase	MC022374AV	1
	3 HP 1 Phase	MC301519AV	1
	5 HP 3 Phase	MC022307AV	1
	5 HP 1 Phase	MC301520AV	1
2	Starter alternator panel:		
	3 HP 230V 1 Phase	ZZ000435AJ	1
	5 HP 230V 1 Phase	ZZ000436AJ	1
	3 HP 230V 3 Phase	ZZ000418AJ	1
	5 HP 230V 3 Phase	ZZ000419AJ	1
	3 HP 460V 3 Phase	ZZ000420AJ	1
	5 HP 460V 3 Phase	ZZ000421AJ	1
3	Receiver tank:		
	80 gallon	AR022900AJ	1
	120 gallon	AR023600AJ	1
4	Beltguard	BT303900AV	1
5	Belt:		
	3 HP	BT010700AV	2
	5 HP	BT010700AV	4
6	Motor pulley:		
	3 HP	PU009753AV	1
	5 HP	PU009754AV	1
7	Guard plate	BG217500AV	1
8	Aftercooler	SL300100AV	1
9	Tube air end/aftercooler	SL301000AP	1
10	Tube aftercooler/tank	SL300900AP	1
11	Check valve	IP087700AV	1
12	Pressure gauge	GA016701AV	1
13	Safety valve	V-215100AV	1
14	Pressure switch (Lead)	CW207558AV	1
15	Pressure switch (Lag)	CW207559AV	1
16	Scroll air end:		
	3 HP	SL014002AJ	1
	5 HP	SL016502AJ	1





Powerex Limited Warranty

Powerex 3 Year / 10,000 Hour Extended Parts Limited Warranty - Powerex warrants each Compressor Pump or Scroll Air-End against defects in material or workmanship from the date of purchase for a period of **Three years or 10,000 hours**, whichever may occur first. This warranty applies to the exchange of part(s) of the compressor pump or air-end found to be defective by an Authorized Powerex Service Center.

Powerex 1 Year / 5,000 Hour Inlet to Outlet Limited Warranty - Powerex warrants each Compressor Unit, System, Pump, or Air-End against defects in material or workmanship from the date of purchase for a period of **One Year or 5,000 Hours,** whichever may occur first. This warranty applies to the exchange of defective component part(s) and labor performed by an Authorized Powerex Service Center.

The above mentioned warranty applies to POWEREX manufactured units or systems only.
Items listed in the operator's manual under routine maintenance are not
covered by this or any other warranty.

THERE IS NO OTHER EXPRESS WARRANTY. IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO ONE YEAR FROM THE DATE OF PURCHASE: AND TO THE EXTENT PERMITTED BY LAW, ANY AND ALL IMPLIED WARRANTIES ARE EXCLUDED. THIS IS THE EXCLUSIVE REMEDY AND LIABILITY FOR CONSEQUENTIAL DAMAGES UNDER ANY AND ALL WARRANTIES IS EXCLUDED TO THE EXTENT EXCLUSION IS PERMITTED BY LAW.

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POWEREX

PURE AIR TECHNOLOGY

Scroll Air Compressor Service and Maintenance

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Description

GENERAL

The Powerex Oilless Rotary Scroll Air Compressor has advanced scroll compressor technology through the development of a completely oilless unit.

The Powerex Scroll Compressor offers a dynamically balanced air end which insures vibration-free operation. The rotary design permits a continuous 100% duty cycle. No oil separation, oil filtration, or inlet valves are required on the Powerex Scroll air compressor.

The Powerex oilless rotary scroll air compressor is based on the theory of scroll compression. A scroll is a free standing, intricate spiral bounded on one side by a solid, flat plane or base. A scroll set, the basic compression element of a scroll compressor, is made up of two identical spirals which form right and left hand parts. One of these scroll components is indexed or phased 180° with respect to the other so the scrolls can mesh.

Crescent-shaped gas pockets are formed and bounded by the spirals and the base plate of both scrolls. As the moving scroll is orbited around the fixed scroll, the pockets formed by the meshed scrolls follow the spiral toward the center and diminish in size. The moving scroll is prevented from rotating during this process so the 180° phase relationship of the scrolls is maintained. The compressor's inlet is at the outer boundary of the scrolls. The compressed gas is discharged through the outlet at the center of the fixed scroll so no valves are needed.

Dry Type Inlet Filter

2500 HOURS - MAINTENANCE

The inlet filter on the scroll compressor assures 99% particulate free air is admitted to the unit. Order P/N IP032901AV for both the 3 HP and 5HP units. Change every 2,500 hours or more often in dirty locations.

1. Remove filter cover by releasing spring clamps (See Figure 1).
2. Remove wing screw.

⚠CAUTION ***Do not attempt to clean filter. This filter requires replacement and is to be replaced when contaminated.***

3. Clean inlet plate, filter cover and six (6) silencer tubes using an air gun or by wiping dry with a cloth.
4. Install new inlet filter (Part Number IP032901AV) and reassemble cover.

See Service and Maintenance Video for Visual and Audio Instructions (Part Number IP633900AV).

⚠DANGER

Breathable Air Warning

This compressor/pump is not equipped and should not be used "as is" to supply breathing quality air. For any application of air for human consumption, the air compressor/pump will need to be fitted with suitable in-line safety and alarm equipment. This additional equipment is necessary to properly filter and purify the air to meet minimal specifications for Grade D breathing as described in Compressed Gas Association Commodity Specification for air, OSHA, ANSI and/or Canadian Standards Associations (CSA).

DISCLAIMER OF WARRANTIES

In the event the compressor is used for the purpose of breathing air application and proper in-line safety and alarm equipment is not simultaneously used, existing warranties shall be voided, and Powerex disclaims any liability whatsoever for any loss, personal injury or damage.

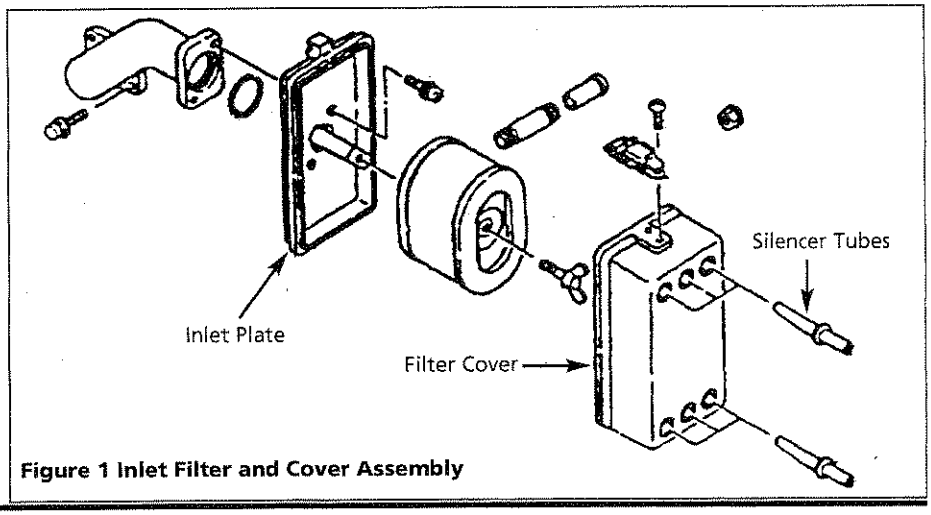


Figure 1 Inlet Filter and Cover Assembly

Grease Compressor Bearings

10,000 HOURS - MAINTENANCE

⚠WARNING ***Per OSHA regulations, ALL power must be locked out before performing any maintenance.***

⚠CAUTION ***This service should be performed by an authorized Powerex Service Center to avoid failure.***

MAIN BEARINGS

1. Remove the plastic dust cap. Use only one of two locations found on the air end (See Figure 2).
2. Rotate the compressor pulley until the grease fitting is visible through the dust cap hole (See Figure 2). This will allow regreasing of the main bearings.
3. Use a grease gun extension adaptor to engage the grease fitting and supply the proper volume of grease as indicated on the grease delivery chart (See Grease Delivery chart below & Figure 2).

⚠CAUTION ***Use only Powerex genuine grease. Pump grease gun before feeding (this eliminates air from the grease passage of the extension adapter. (Complete Grease Kit Part Number IP616200AJ and Grease Tube Part Number IP600000AV).***

4. Replace plastic dust cap.

GREASING PIN CRANK BEARINGS

The bearings on the scroll compressor are regreaseable to allow extended compressor life. Service should be performed every 10,000 hours of operation.

1. Remove the V-Belts and the fan cover.
2. Remove the air end pulley and cooling fan with a gear puller (See Figure 3).

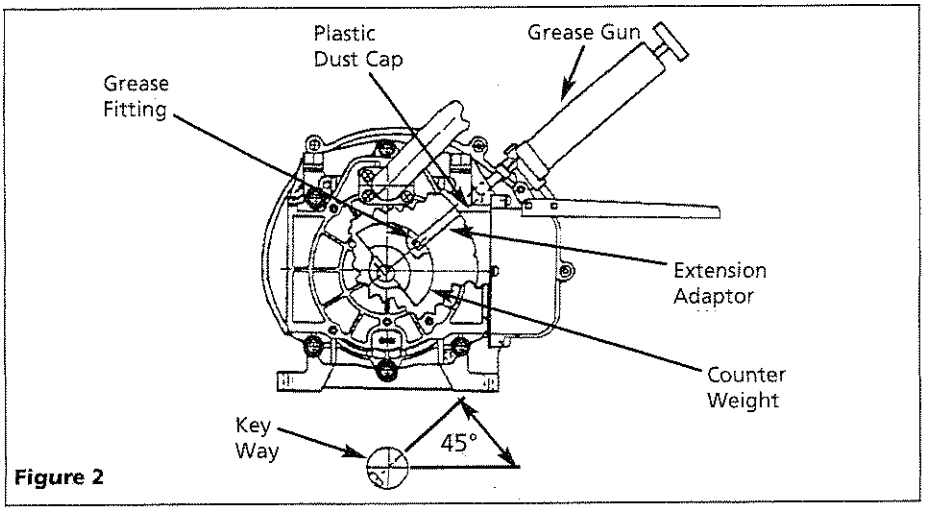


Figure 2

3. Remove the fan duct shroud.
4. Remove the three grease caps. **Do not attempt to loosen or tighten the bolt.**
5. Grease all three pin crank bearings (See Figures 3, 4 & 5 and Grease Delivery Chart below).

⚠CAUTION ***The grease fitting, located in the center of the pin crank bearing, feeds only the orbit scroll side bearing. Use a needle adapter to supply grease to the housing side bearing. PUMP GREASE GUN BEFORE FEEDING TO ELIMINATE AIR FROM GREASE PASSAGE OF THE NEEDLE ADAPTER. Hold grease gun for 5 - 10 seconds after feeding to prevent grease blowback from the grease fitting.***

6. Replace grease caps, fan shroud, pulley, etc.

(See Scroll Service and Maintenance Video for Audio and Visual Instructions.)

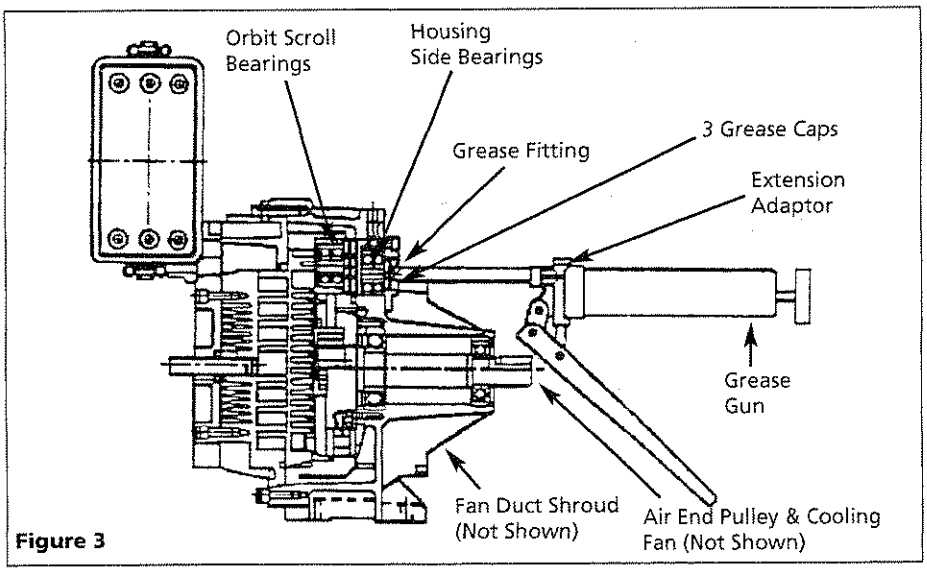


Figure 3

GREASE DELIVERY

Bearing	SLAE03 1st Time	SLAE03 2nd Time	SLAE05 1st Time	SLAE05 2nd Time
Orbit Scroll Bearing	5 Times	3 Times	6 Times	4 Times
Pin Crank Bearing Orbit Scroll Side	5 Times	3 Times	6 Times	4 Times
Pin Crank Bearing Housing Side	5 Times	3 Times	6 Times	4 Times

NOTE: Each pump of the grease gun equals 0.65 grams of grease.

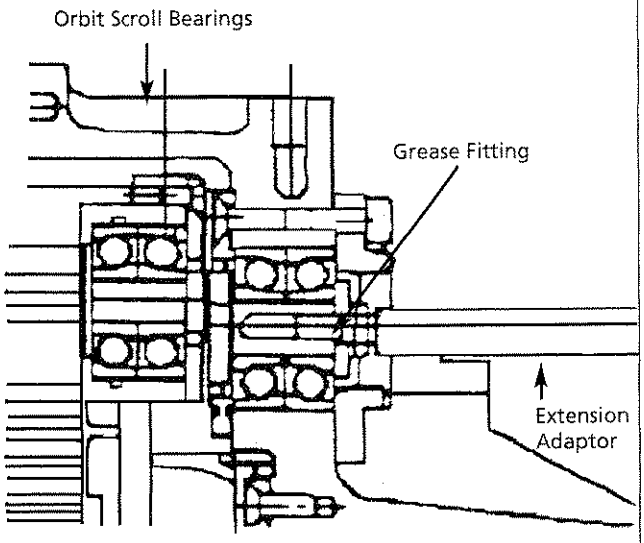


Figure 4

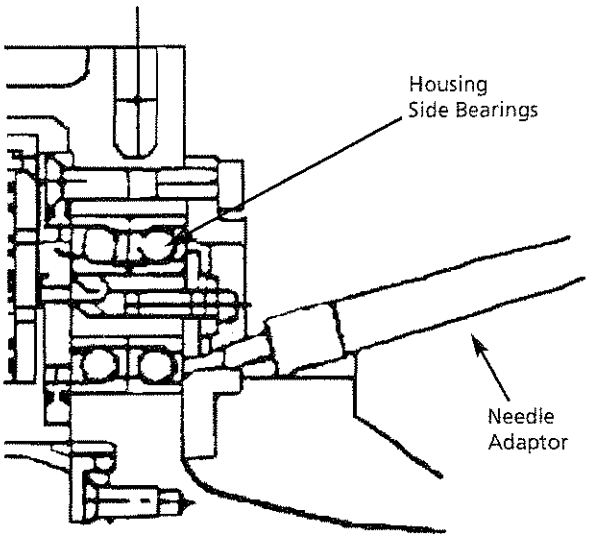


Figure 5

Maintenance Schedule

Item	Action needed	Operating Hours 500	2500	5000	10,000	15,000	20,000	Remarks
Tank	Drain moisture	Daily						
Inlet air filter	Replace	●	▲	*(Every 2,500 hrs or less)*				Part #IP032901AV
Blower fan	Clean			●	●	●	●	
Fan Duct	Clean			●	●	●	●	
Compressor Fins	Clean		●	*(Every 2,500 hrs or less)*				
Bearings	Regrease	*(Every 5,000 hours for 145 psig scroll)*			●		▲	Service Center Only
Tip seal set	Replace	*(Every 5,000 hours for 145 psig scroll)*			▲		▲	
V-belt	Inspect, replace	*Note 3	●	▲	▲	▲	▲	
Pressure Switch	Confirm operation				●		●	
Magnetic starter	Inspect				●		●	Replace if contact points deteriorated
Safety valve	Confirm operation		●	*(Every 2,500 hrs or less)*				
Pressure gauge	Inspect		●	*(Every 2,500 hrs or less)*				
●	Inspect							
▲	Replace							

NOTES:

1. Inspect and perform maintenance periodically according to maintenance schedule.
2. The maintenance schedule relates to the normal operating conditions. If the circumstances and load condition are adverse, shorten the cycle time and do maintenance accordingly.
3. * The tension of the V-belt should be adjusted during the initial stage and inspected every 2,500 hours afterwards. Proper belt tension for 3 HP units is 7 lbs./.16" deflection; for 5 HP units, 7 lbs./.19" deflection.
4. See Compressor Pump Manuals for replacement or service procedures.

Tip Seal Set Replacement

10,000 HOURS - MAINTENANCE

⚠WARNING ***Per OSHA regulations, ALL power must be locked out before performing any maintenance.***

The "Tip Seal Set" is a replacement part for SLAE03 and SLAE05 air ends. Please read these instructions thoroughly and carefully to ensure correct replacement.

NOTE: Replace tip seal on SLAE03HP and SLAE50HP at 5,000 hours when operated at 145 psig.

(See Scroll Service and Maintenance Video for Audio and Visual Instructions.)

The tip seal on the scroll compressor is self-lubricated and allows the unit to operate efficiently without oil and expensive filtration. The tip seal should be replaced every 10,000 hours of operation.

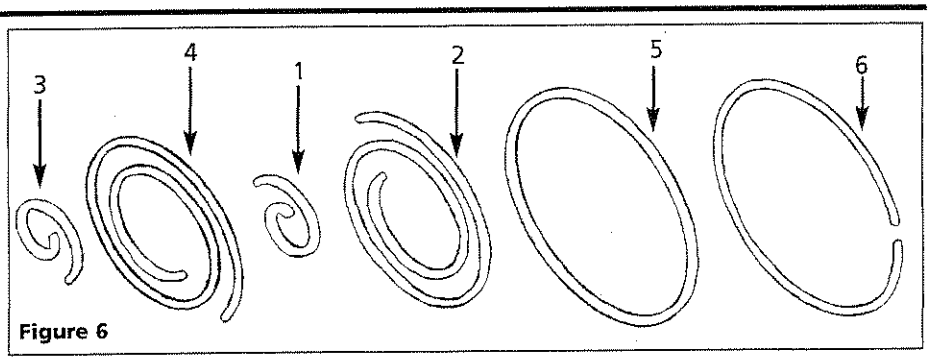


Figure 6

Item No.	Description	Qty.
1	HP tip seal for FS	1
2	LP tip seal for FS	1
3	HP tip seal for OS	1
4	LP tip seal for OS	1
5	Dust Seal	1
6	Backup Tube	1

HP = High Pressure LP = Low Pressure
FS = Fixed Scroll OS = Orbital Scroll

CONFIRMATION OF THE PARTS

1. Confirm if the tip seal you purchased is correct for the air end you are repairing (See Parts Listing below).
2. Confirm if the following parts are included (See Figure 6).

Tip Seal Set	SLAE03	SLAE03HP	SLAE05	SLAE05HP
Air End Model	3 hp	3 hp HP	5 hp	5 hp HP
Part No.	92510050	92510050	IP604600AV	92663060

REPLACEMENT

1. Remove six nuts with T-type wrench and then FS set from air end (See Figure 7).
2. Remove LP and HP tip seals from Fixed Scroll set and Orbit set. Using the tip of a ball-point pen at the start will make it much easier (See Figure 7).
3. Remove dust from Scroll with clean cloth or air.

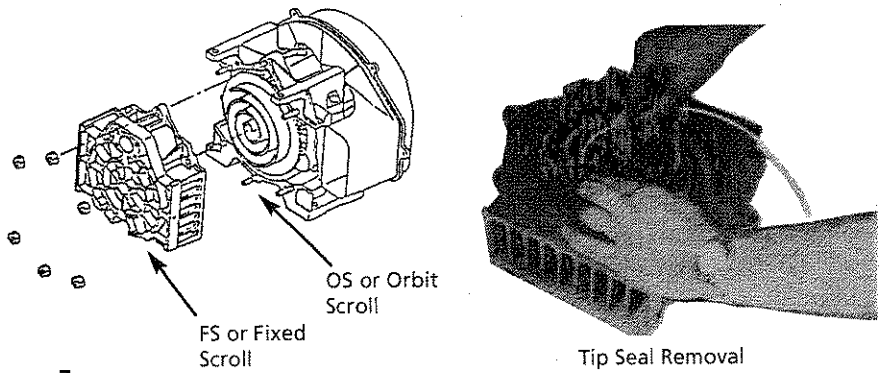
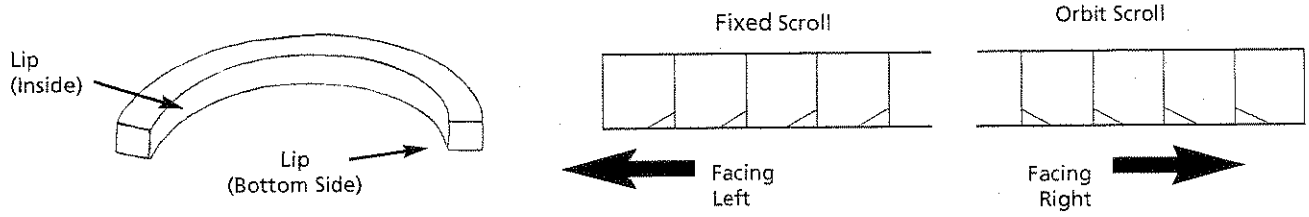


Figure 7

NOTE: In order to distinguish between the tip seal for Fixed Scroll and the tip seal for Orbit Scroll place the tip seal as shown below then view from the arrow direction and refer to the figure on the right.



Tip Seal Set Replacement (Continued)

INSERTING TIP SEALS

NOTE: Tips seals for Fixed Scroll and Orbit Scroll have opposing seal cut angels (See NOTE and explanatory diagram below).

Insert tip seal so that the lip of tip seal is on the bottom of seal groove and inner side of involute and the direction of lip faces the center of involute (curving spiral). See Figure 9. This is to be done for both FS and OS sets.

Use caution not to tear or distort lip.

1. Insert new HP tip seal from the center section for OS or Orbit Scroll so that there will be no clearance at the tip (start) section (See Figure 8 and 9).

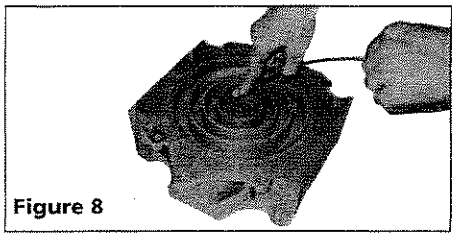


Figure 8

2. Insert so that new LP tip seal will contact closely with HP tip seal inside Scroll Groove (See Figure 7 on page 4).

⚠CAUTION ***Insert approximately half of the LP tip seal and remove the tip seal to confirm that a notch in the tip seal has been achieved. This will prevent movement during installation (See Figure 11).***

3. Repeat the same procedure for FS or Fixed Scroll tip seal set, remove both the dust seal and backup tube located on outermost side FS set.
4. Insert new backup tube in the FS Scroll in the 6 o' clock position (See Figure 10).
5. Insert new dust seal on the backup tube. Face seamed section of the dust seal in the 3 o'clock position (See Figure 10).
8. After replacing tip seal set, reassemble Fixed Scroll set to the Orbit Scroll. Tighten 6 nuts temporarily and confirm if crankshaft rotates smoothly by hand and tighten them firmly. Tightening torques are:

Bolt Torque	First	Second
SLAE03/SLAE03HP	15 in lb.	175 in lb.
SLAE05/SLAE05HP	15 in lb.	175 in lb.

NOTE: Assemble so that dust seal and tip seal will not drop between Orbit Scroll set and Fixed Scroll set.

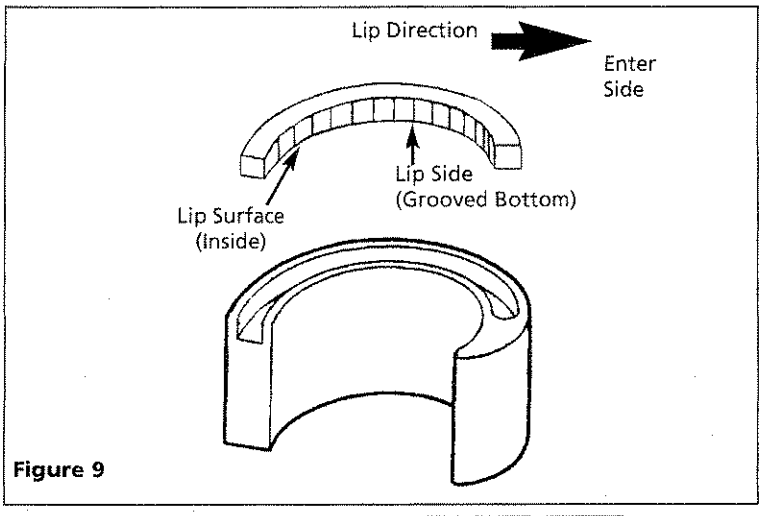


Figure 9

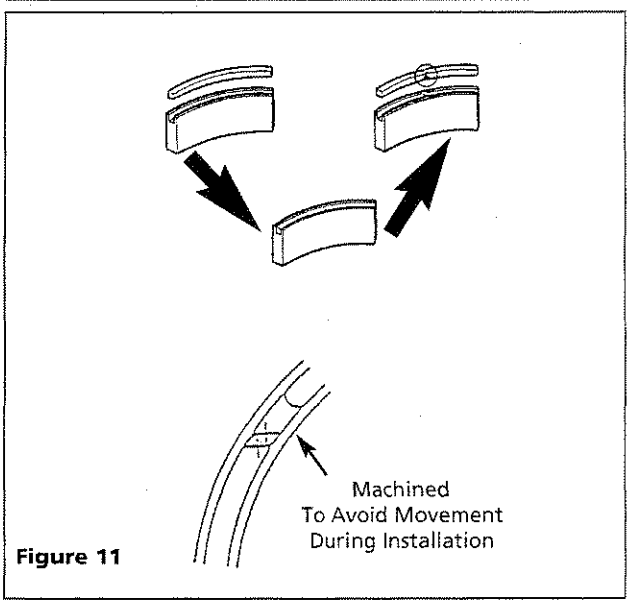


Figure 11

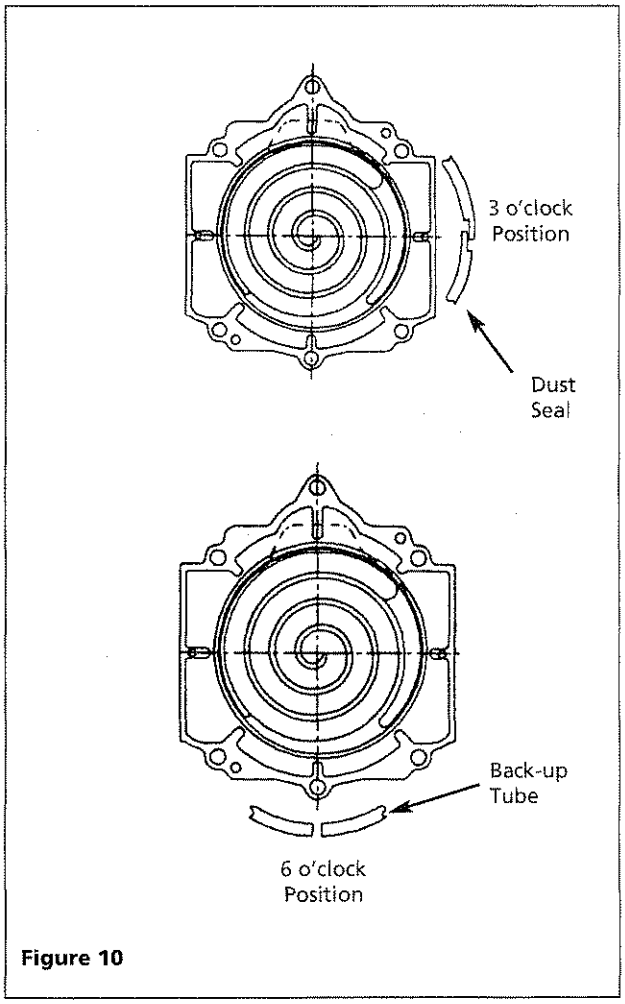


Figure 10

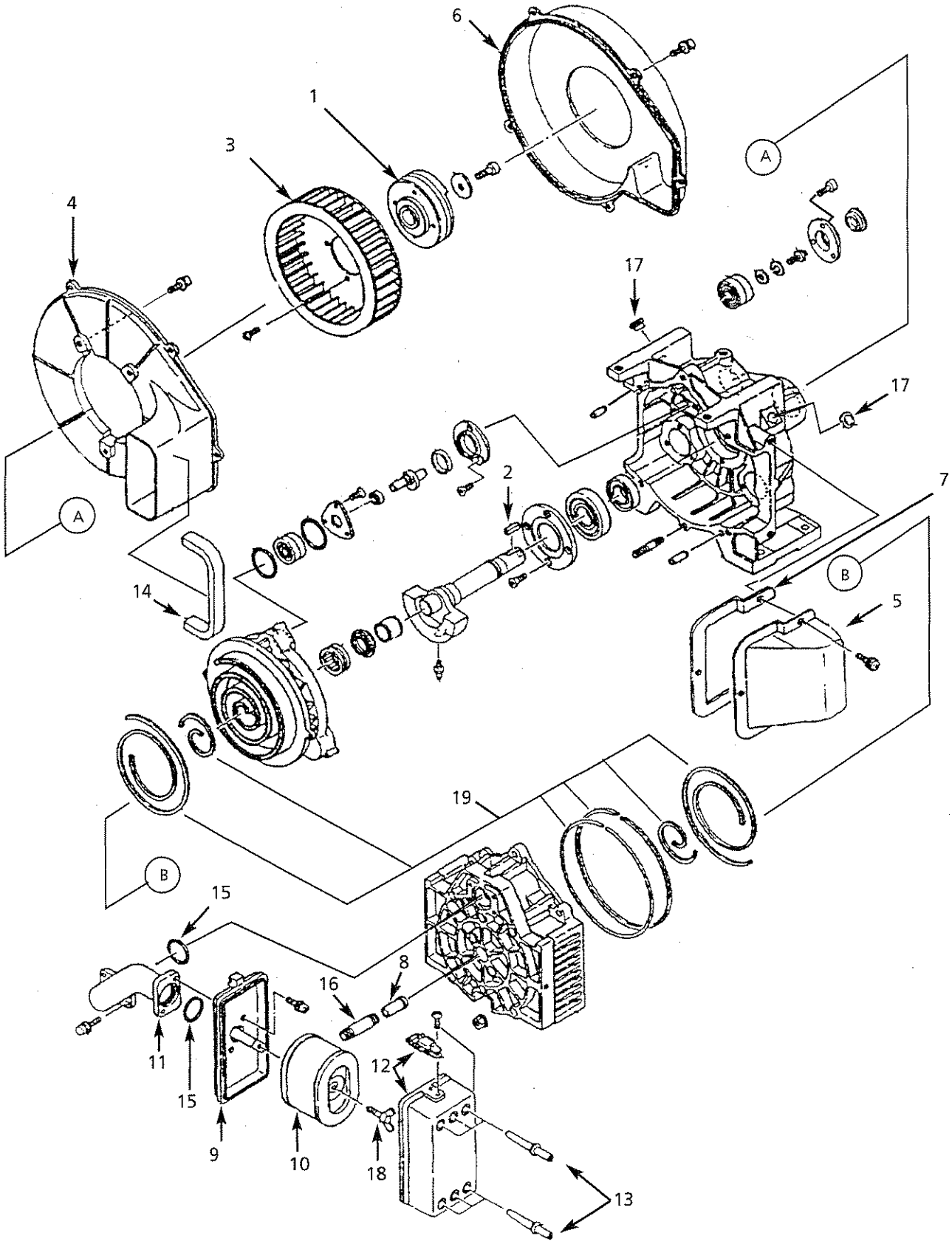


Figure 12 - Compressor Parts

Service Parts List

Ref. No.		Description	Part No. For Models SLAE03	SLAE05	SLAE03HP	SLAE05HP	Quantity
1		Airend Pulley	92805020	IP600400AV	92805020	IP600400AV	1
2		Key	IP600600AV	IP600600AV	IP600600AV	IP600600AV	1
3		Centrifugal Fan	IP601300AV	IP601300AV	IP601300AV	IP601300AV	1
4		Fan Duct (1)	IP601400AV	IP601400AV	IP601400AV	IP601400AV	1
5		Fan Duct (2)	IP601500AV	IP601600AV	IP601500AV	IP601600AV	1
6		Fan Cover	IP601700AV	IP601700AV	IP601700AV	IP601700AV	1
7		Fan Dust Gasket (1)	IP601800AV	IP601900AV	IP601800AV	IP601900AV	1
8		Heat Insulation Pipe	IP602000AV	IP602000AV	IP602000AV	IP602000AV	1
9		Filter Plate	IP602100AV	IP602100AV	IP602100AV	IP602100AV	1
10		Cartridge Filter	IP032901AV	IP032901AV	IP032901AV	IP032901AV	1
11		Intake Pipe	IP602200AV	IP602200AV	IP602200AV	IP602200AV	1
12		Intake Filter Cover	IP016101AV	IP016101AV	IP016101AV	IP016101AV	1
13		Filter Cover Pipe	IP602300AV	IP602300AV	IP602300AV	IP602300AV	6
14		Fan Duct Gasket (2)	IP602400AV	IP602400AV	IP602400AV	IP602400AV	1
15		O-Ring	IP603200AV	IP603200AV	IP603200AV	IP603200AV	2
16		Long Nipple	96647011	96647011	96647011	96647011	1
17		Dust Cap	IP603500AV	IP603500AV	IP603500AV	IP603500AV	2
18		Wing Bolt	IP604200AV	IP604200AV	IP604200AV	IP604200AV	1
19		Tip Seal Set	92510050	IP604600AV	92510050	92663060	1
20	*	Grease Gun Kit	IP616200AJ	IP616200AJ			
21	*	Grease Gun	IP616100AJ	IP616100AJ			
22	*	Grease (80g.)	IP600000AV	IP600000AV			

• Not Shown

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Limitation of Liability. To the extent allowable under applicable law, Powerex's liability for consequential and incidental damages is expressly disclaimed. Powerex's liability in all events is limited to, and shall not exceed, the purchase price paid.

Warranty Disclaimer. Powerex has made a diligent effort to illustrate and describe the products in this literature accurately; however, such illustrations and descriptions are for the sole purpose of identification, and do not express or imply a warranty that the products are merchantable, or fit for a particular purpose, or that the products will necessarily conform to the illustrations or descriptions.

Product Suitability. Many jurisdictions have codes and regulations governing sales, construction, installation, and/or use of products for certain purposes, which may vary from those in neighboring areas. While Powerex attempts to assure that its products comply with such codes, it cannot guarantee compliance, and cannot be responsible for how the product is installed or used. Before purchase and use of a product, please review the product applications,and national and local codes and regulations, and be sure that the product, installation, and use will comply with them.

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POWEREX

PURE AIR TECHNOLOGY

General Safety Guidelines — **Compressed Air / Vacuum Systems**

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Safety Guidelines

This manual contains information that is very important to know and understand. This information is provided for SAFETY and to PREVENT EQUIPMENT PROBLEMS. To help recognize this information, observe the following symbols.

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

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

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

⚠ NOTICE ***Notice indicates important information that, if not followed, may cause damage to equipment.***

Unpacking

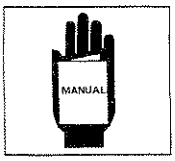
After unpacking the unit, inspect carefully for any damage that may have occurred during transit. Make sure to tighten fittings, bolts, etc., before putting unit into service.

⚠ WARNING ***Do not operate unit if damaged during shipping, handling or use. Damage may result in bursting and cause injury or property damage.***

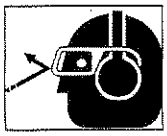
General Safety Information

Since the air compressor, vacuum pump and other components (material pump, spray guns, filters, lubricators, hoses, etc.) used make up a high pressure or vacuum system, the following safety precautions must be observed at all times:

1. Read all manuals included with this product carefully. Be thoroughly familiar with the controls and the proper use of the equipment.



2. Follow all local electrical and safety codes as well as in the United States, the National Electrical Codes (NEC) and Occupational Safety and Health Act (OSHA).
3. Only persons well acquainted with these rules of safe operation should be allowed to use the compressor.
4. Keep visitors away and NEVER allow children in the work area.
5. Wear safety glasses and use hearing protection when operating the unit.



6. Do not stand on or use the unit as a handhold.
7. Before each use, inspect compressed air or vacuum system and electrical components for signs of damage, deterioration, weakness or leakage. Repair or replace defective items before using.
8. Check all fasteners at frequent intervals for proper tightness.

⚠ WARNING

Motors, electrical equipment and controls can cause electrical arcs that will ignite a flammable gas or vapor. Never operate or repair in or near a flammable gas or vapor. Never store flammable liquids or gases in the vicinity of the unit.

⚠ WARNING

Never operate compressor or vacuum pump without a protective guard. This unit can start automatically without warning. Personal injury or property damage could occur from contact with moving parts.

⚠ DANGER

Breathable Air Warning

This unit is NOT equipped and should NOT be used "as is" to supply breathing quality air. For any application of air for human consumption, you must fit the air compressor/pump with suitable in-line safety and alarm equipment. This additional equipment is necessary to properly filter and purify the air to meet minimal specifications for Grade D breathing as described in Compressed Gas Association Commodity Specification for air, OSHA, ANSI and/or Canadian Standards Associations (CSA).

DISCLAIMER OF WARRANTIES

IN THE EVENT THE COMPRESSOR IS USED FOR THE PURPOSE OF BREATHING AIR APPLICATION AND PROPER IN-LINE SAFETY AND ALARM EQUIPMENT IS NOT SIMULTANEOUSLY USED, EXISTING WARRANTIES ARE VOID, AND POWEREX DISCLAIMS ANY LIABILITY WHATSOEVER FOR ANY LOSS, PERSONAL INJURY OR DAMAGE.

9. Do not wear loose clothing or jewelry that will get caught in the moving parts of the unit.

⚠ CAUTION

Surface may be hot even if the unit is stopped.

10. Keep fingers away from a running unit; fast moving and hot parts will cause injury and/or burns.

General Safety Information (Continued)

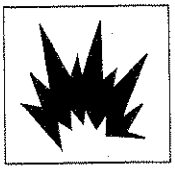
11. If the equipment should start to vibrate abnormally, STOP the unit and check immediately for the cause. Vibration is generally a warning of trouble.
12. To reduce fire hazard, keep unit exterior free of oil, solvent, or excessive grease.

⚠WARNING ***An ASME code safety relief valve with a setting no higher than the tank maximum allowable working pressure MUST be installed in the air lines or in the tank of any compressor. The ASME safety valve must have sufficient flow and pressure ratings to protect the pressurized components from bursting. The flow rating can be found in the parts manual.***

⚠ CAUTION ***Do not operate with pressure switch or pilot valves set higher than the tank maximum allowable working pressure.***

13. Never attempt to adjust ASME safety valve on compressed air units. Keep safety valve free from paint and other accumulations.

⚠ DANGER



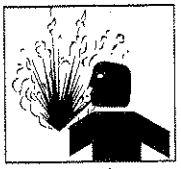
Never attempt to repair or modify a tank! Welding, drilling or any other modification will weaken the tank resulting in damage from rupture or explosion. Always replace worn, cracked or damaged tanks.

⚠ NOTICE ***Drain liquid from tank daily.***

14. Tanks rust from moisture build-up, which weakens the tank. Make sure to drain tank regularly and inspect periodically for unsafe conditions such as rust formation and corrosion.
15. Fast moving air will stir up dust and debris which may be harmful. Release air slowly when draining moisture or depressurizing a compressor system.

Installation

⚠WARNING



Disconnect, tag and lock out power source then release all pressure from the system before attempting to install, service, relocate or perform any maintenance.

⚠ CAUTION ***Do not lift or move unit without appropriately rated equipment. Be sure the unit is securely attached to lifting device used. Do not lift unit by holding onto tubes or coolers. Do not use unit to lift other attached equipment.***

⚠ CAUTION ***Never use the wood shipping skids for mounting the unit.***

Install and operate unit at least 24" from any obstructions in a clean, well ventilated area. The surrounding air temperature should not exceed 104° F. This will ensure an unobstructed flow of air to cool unit and allow adequate space for maintenance.

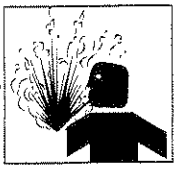
⚠ CAUTION ***Do not locate the air inlet near steam, paint spray, sandblast areas or any other source of contamination.***

NOTE: If compressor system is installed in a hot, moist environment, supply compressor pump with clean, dry outside air. Pipe supply air in from external sources.

TANK MOUNTING

Bolt tank on a flat, even, concrete floor or on a separate concrete foundation. Use vibration isolators between the tank leg and the floor. After placing unit on vibration pads, **do not draw bolts tight**. Allow the pads to absorb vibrations. Install a flexible hose or coupling between the tank and service piping.

⚠WARNING



Failure to properly install the tank can lead to cracks at the welded joints and possible bursting or leakage.

PIPING

⚠WARNING ***Never use plastic (PVC) pipe for compressed air. Serious injury or death could result.***

Any tube, pipe or hose connected to the unit must be able to withstand the temperature generated and retain the pressure. All pressurized components of the air system must have a pressure rating higher than or equal to the ASME safety valve setting. Incorrect selection and installation of any tube, pipe or hose could result in bursting and injury.

INSTALLING A SHUT-OFF VALVE

Install a shut-off valve on the discharge port of the compressor tank to control the air flow out of the tank. Locate the valve between the tank and the piping system.

⚠WARNING ***Never install a shut-off valve between a compressor pump and the tank without an appropriate safety valve. Personal injury and/or equipment damage may occur. Never use reducers in discharge piping.***

When creating a permanently installed system to distribute compressed air, find the total length of the system and select pipe size from the chart. Bury

MINIMUM PIPE SIZE FOR COMPRESSED AIR LINE

	Length Of Piping System			
CFM	25'	50'	100'	250'
10	1/2"	1/2"	1/2"	3/4"
20	3/4	3/4	3/4	1
40	3/4	1	1	1
60	3/4	1	1	1
100	1	1	1	1¼

MINIMUM PIPE SIZE FOR VACUUM SYSTEMS

	Length Of Piping System			
CFM	25'	50'	100'	250'
10	3/4"	3/4"	1"	1"
20	3/4	3/4	1	1
40	1	1¼	1¼	1½
60	1½	1½	1½	2
100	2	2	3	3

underground lines below the frost line ... avoid pockets where condensation ... gather and freeze.

Apply air pressure to the piping installation and make sure all joints are free from leaks BEFORE underground lines are covered. Before putting the unit into service, find and repair all leaks in the piping, fittings and connections.

WIRING

⚠ WARNING ***All wiring and electrical connections must be performed by a qualified electrician. Installations must be in accordance with local and national codes.***

⚠ CAUTION ***Overheating, short circuiting and fire damage will result from inadequate wiring.***

Wiring must be installed in accordance with National Electrical Code and local codes and standards that have been set up covering electrical apparatus and wiring. Consult the codes and standards and observe local ordinances. Be certain that adequate wire sizes are ...d, and that:

1. ...Service is of adequate ampere rating.
2. The supply line has the same electrical characteristics (voltage, cycles and phase) as the motor.
3. Ensure the line wire is the proper size and that no other equipment is operated from the same line. The chart gives minimum recommended wire sizes for horsepower of motor provided.

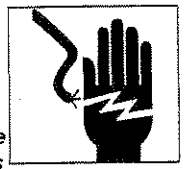
MINIMUM WIRE SIZE
USE 75°C COPPER WIRE

HP	Single Phase 230V	Three Phase 208/230V	Three Phase 460/575V
3	10AWG	14 AWG	14 AWG
5	8 AWG	12 AWG	14 AWG
7.5	8 AWG	10 AWG	12 AWG
10	N/A	8 AWG	12 AWG
15	N/A	6 AWG	10 AWG
25	N/A	3 AWG	8 AWG

...ecommended wire sizes may be larger ...an the minimum set up by local ordi...ances. If so, use the larger size wire to prevent excessive line voltage drop. The additional wire cost is very small compared with the cost of repairing or replacing a motor electrically "starved" by the use of supply wires which are too small.

GROUNDING

⚠ DANGER



Improperly grounded electrical components are shock hazards. Make sure all the components are properly grounded to prevent death or serious injury.

This product **must** be grounded. Grounding reduces the risk of electrical shock by providing an escape wire for the electric current if short circuit occurs.

MOTOR HOOKUP AND STARTER INSTALLATION

Branch circuit protection must be provided as specified in National Electrical Code, Chapter 2, "Wiring Design and Protection." Article 210, using the applicable article "For Motors and Motor Controllers," (Article 430).

DIRECTION OF ROTATION

NOTE: Improper rotation will result in reduced unit life or unit failure. The direction of rotation is indicated near the motor(s).

The proper direction is very important. The direction of rotation of 3 phase motors can be reversed by interchanging any two motor-line leads. For single phase motors, refer to the motor nameplate.

IMPORTANT: Check motor rotation before operating the unit.

GENERAL WIRING DIAGRAMS

⚠ NOTICE ***Consult starter manufacturer's wiring diagram for more specific information.***

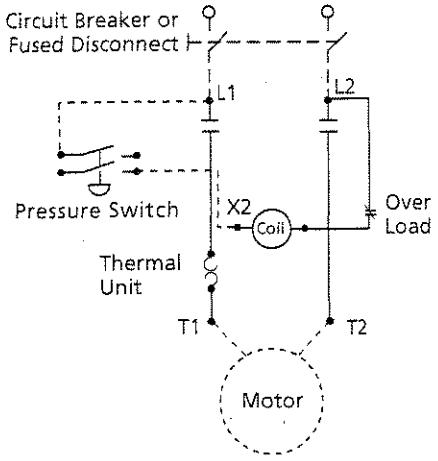


Figure 1 - Single Phase Wiring Diagram

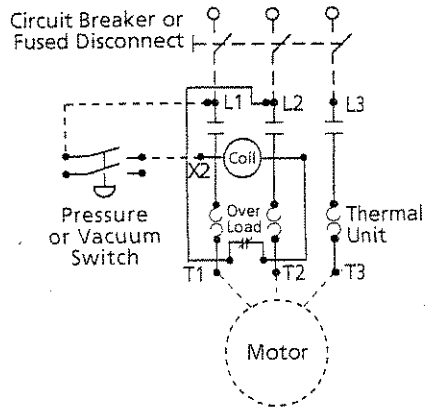
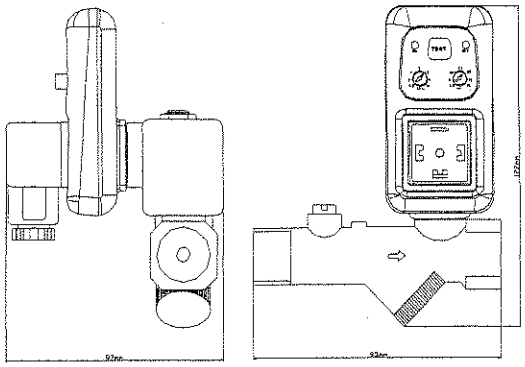
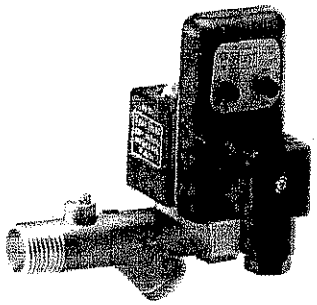


Figure 2 - Three phase wiring diagram

Notes

Automatic Tank Drain Valve





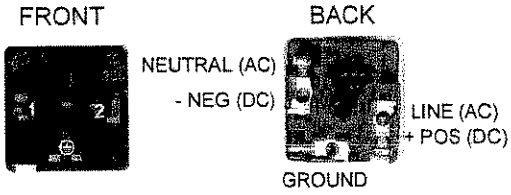
SL300AV
SERIES DRAIN

WHEN INSTALLING THE ELECTRONIC DRAIN VALVE MAKE SURE:
- POWER IS TURNED OFF
- AIR SYSTEM IS DRAINED (ZERO PRESSURE)

CONTACT BLOCK

INSTALLATION

- Verify flow direction. (stamped on valve body)
- Valve can be mounted in any position.
- Install a condensate drain on the outlet side of drain valve for proper collection and drainage of condensate.
- If tubing is used for draining, Beware of "Whipping" when valve is open.
- Remove Contact Block from connector and attach wires as shown at right.



SPECIFICATIONS

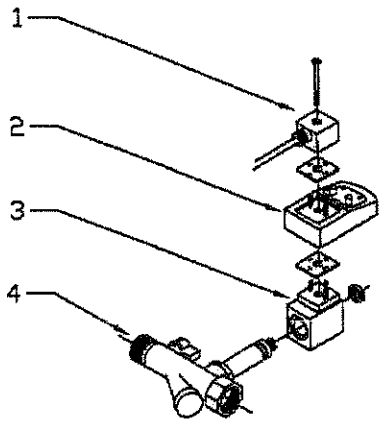
TIMER

Interval time (T2)	.5 - 45 minutes
Discharge time (T1)	.5 - 10 seconds
Supply Voltage	12v-240v 50/60Hz (+/- 10%)
Current Consumtion	4mA Max.
Operating Temperature	-10°C to +50°C
Environmental Protection	NEMA 4
Case Material	ABS Plastic FR Grade
Connection	DIN 43650A ISO 4400/6952

VALVE

Type	2-way direct acting valve
In/Out Ports	3/8"NPT X ½"PT Male inlet
Max. Working Pressure	300 PSI
Operating Temperature	35° F - 130°F Ambient
Media Temperature	190°F Max.
Valve Body	Forged Brass I
Orifice	5/32" - 4.0MM
Insulation	Thermal Group H
Environmental Protection	IP 65/Nema 4
Supply Voltage	12v - 240v (see coil for correct supply)
Voltage Tolerance	+/- 10%
Mounting	Any position

MAINTENANCE



REPLACEMENT PARTS

Description	Part No.
1 – Electric Cord	3021457F0000
(6 foot Length Molded Din)	
1- Din Connector	**C18209N2**
1- Condult Connector	**M550Z-RB**
2 - Timer	8201 **(24v-240v)**
	8070 (10v-30v)
3 - Coil	
Standard	
24v AC	297300
48v AC	295210
115v AC	42320
230v AC	42300
12v DC	297500
24v DC	42360
4- Valve Only	321496
Valve Assy.	(Valve & Coil)
1/2"-115V	321492
½"-230V	321493

TIMER SETTING

Set Interval time (T2) using Right adjusting knob.

Set DISCHARGE time(T1) using LEFT adjusting knob.

Set T1 to 2 seconds and T2 to 20 minutes.

(Adjust as necessary)

The SL300AV **has a built in strainer.**

We recommend periodically checking to ensure strainer has not clogged.

Testing the drain is accomplished by pressing on the test area of the timer.

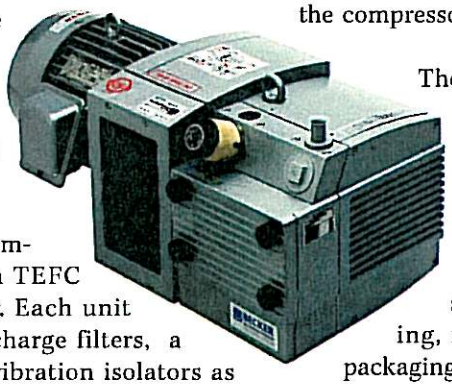
BECKER

ISO 9001 Certified
CE Compliant

KDT Series

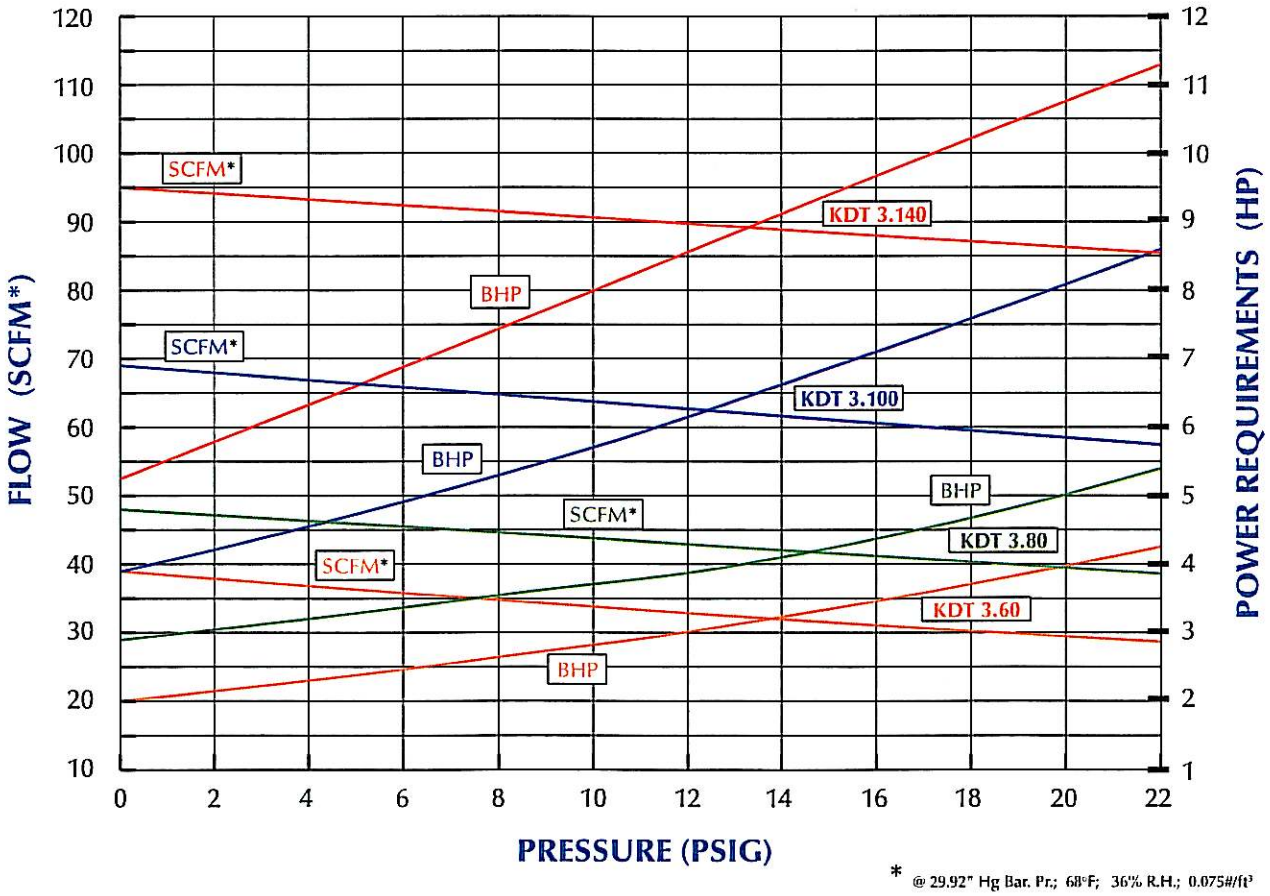
100% OIL-LESS COMPRESSORS

The Becker KDT series is a line of 100% Oil-less, rotary vane, low pressure compressors. They are designed to operate on a continuous basis throughout a pressure range from atmospheric pressure to 22 PSIG.



Each KDT unit is a direct drive compressor and is supplied with a TEFC flange mounted electric motor. Each unit is equipped with inlet and discharge filters, a pressure regulating valve, and vibration isolators as standard equipment, all of which are an integral part of the compressor.

The Becker KDT compressor is ideal for applications where air is the gas and where operation is in the low pressure range where high pressure compressors are less efficient. Applications for the KDT compressor include graphic arts, soil remediation, pneumatic conveying, robotics and material handling, packaging, and paper converting.



* @ 29.92" Hg Bar. Pr.; 68°F; 36% R.H.; 0.075#/ft³

Becker Pumps Corp. • 100 East Ascot Lane • Cuyahoga Falls, Ohio 44223-3768
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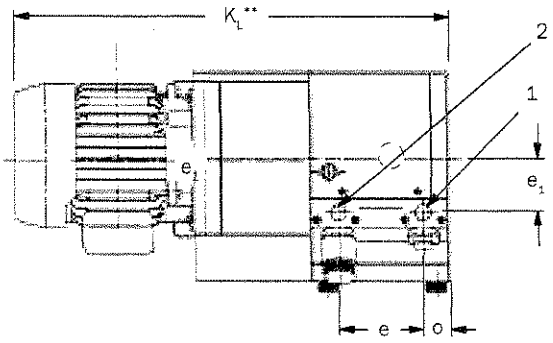
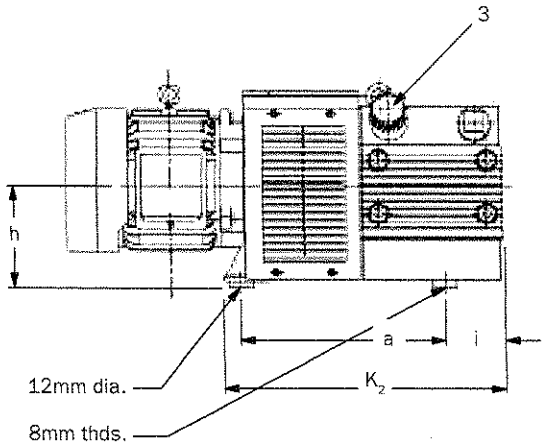
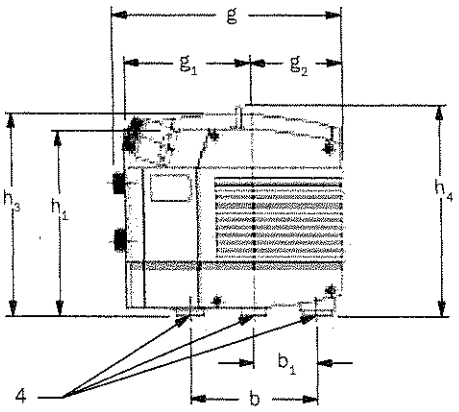
TECHNICAL DATA



Top View



Side View



End View (Opposite Motor End)

All data based on 60 Hz operation	KDT 3.60	KDT 3.80	KDT 3.100	KDT 3.140
Flow (SCFM @ 0 PSIG)	39	48	69	95
Horsepower	5*	7 1/2*	10*	12*
Speed (RPM)	1740	1740	1740	1740
Maximum Pressure (PSIG)	22	22	22	22
Weight (lbs.)—w/o motor	104	108	156	172
Weight (lbs.)—w/ motor**	191*	265*	323*	368*
Noise Level (Max. dBA)	74	76	78	84
Outlet size (BSP, inches)	1	1	1 1/2	1 1/2
Dimensional Data	(Inches)			
a	12.83	12.83	15.67	15.67
b	7.5	7.5	9.65	9.65
b_1	3.75	3.75	4.82	4.82
e	5.43	5.43	7.5	7.5
e_1	2.56	2.56	3.75	3.75
g	13.9	13.9	18.5	18.5
g_1	7.68	7.68	8.78	8.78
g_2	5.55	5.55	9.06	9.06
h	6.38	6.38	6.38	6.38
h_1	11.38	11.38	11.7	11.7
h_3	12.28	12.28	13.0	13.0
h_4	12.9	12.9	13.25	13.25
i	3.78	3.78	5.5	5.5
k_2	17.64	17.64	22.17	22.17
k_L	28.2	30	34.15	36.6
o	1.81	1.81	2.36	2.36

Manufacturer reserves right to alter data without notice.
* Operation at lower pressure may use smaller motor.
** May vary with motor type and manufacturer

1 - Inlet Port
2 - Discharge Port
3 - Pressure Relief Valve
4 - Vibration Isolators

3LIT0006 • 2/00

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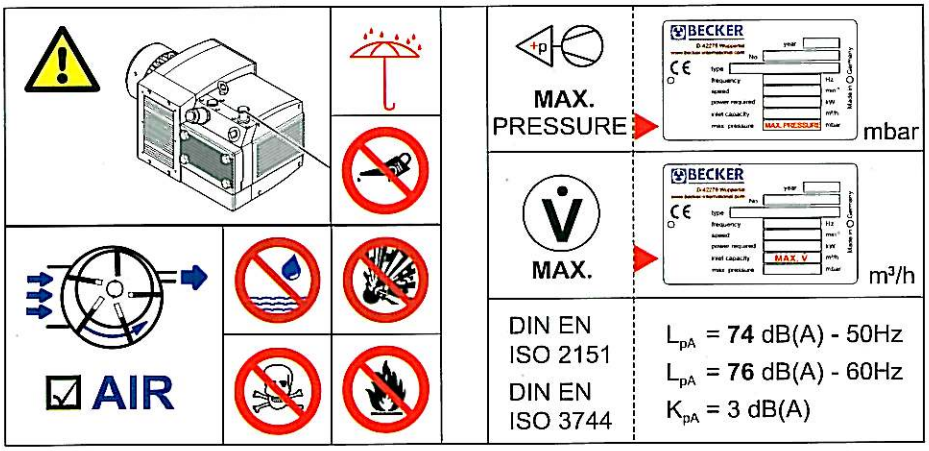
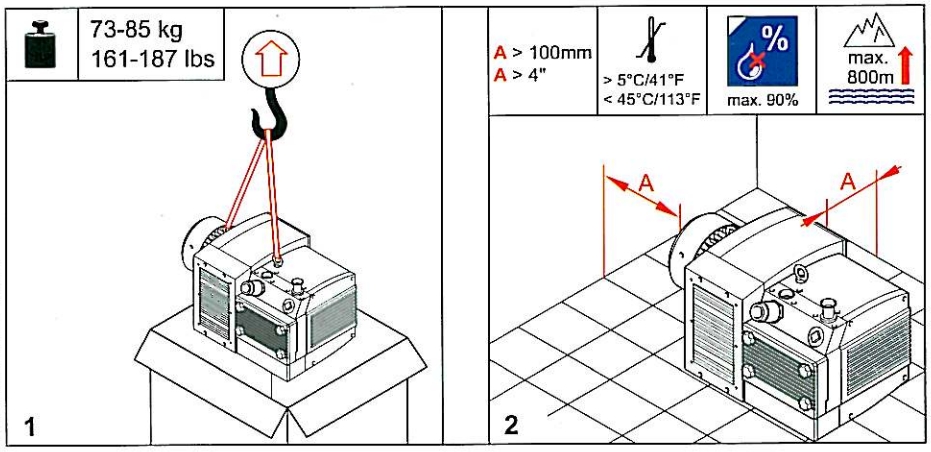
Betriebsanleitung
Operating Instructions
Instructions de service
Istruzioni d'uso
Handleiding
Instrucciones para el manejo
Manual de instruções
Naudojimosi instrukcija
Kasutusjuhend
Lietošanas instrukcija
Οδηγίες χρήσης
取扱説明書
사용설명서

Driftsinstruks
Driftsinstruktioner
Käyttöohje
Driftsvejledning
Instrukcja obsługi
Kezelési útmutató
Návod k obsluze
Navodilo za uporabo
Návod na obsluhu
El Kitabi
Инструкция по эксплуатации
使用说明书

KDT 3.80

98/37 EG
73/23 EWG





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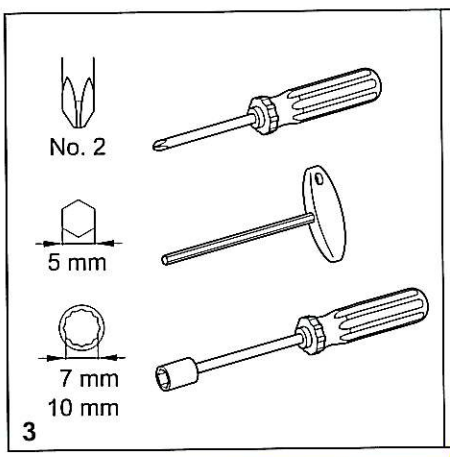
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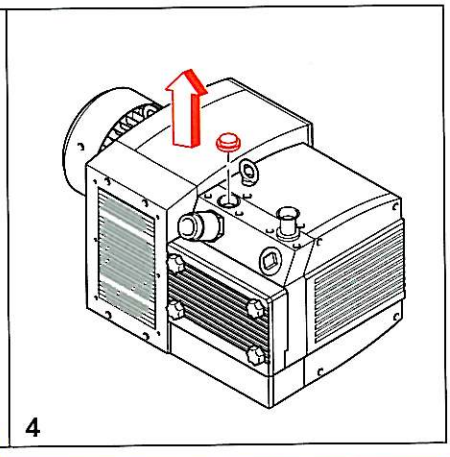
10 mm
3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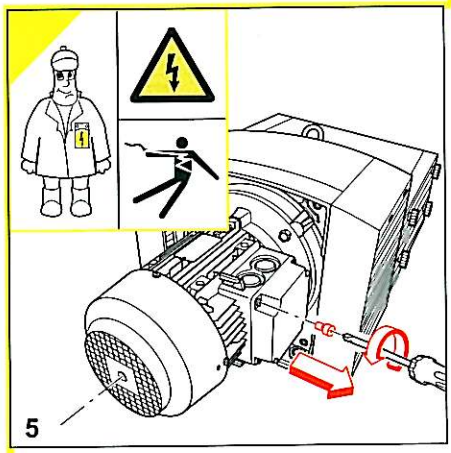
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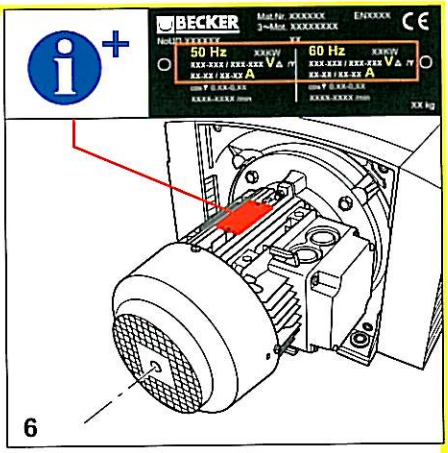
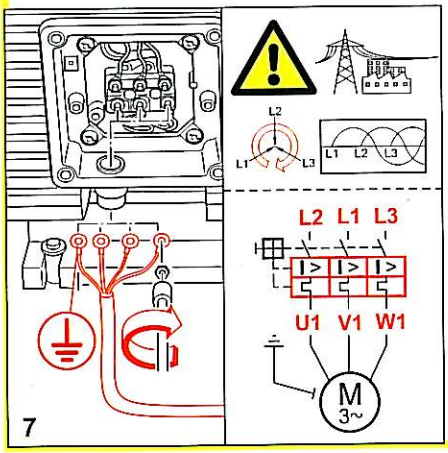

BECKER
50 Hz
60 Hz
6


L2 L1 L3
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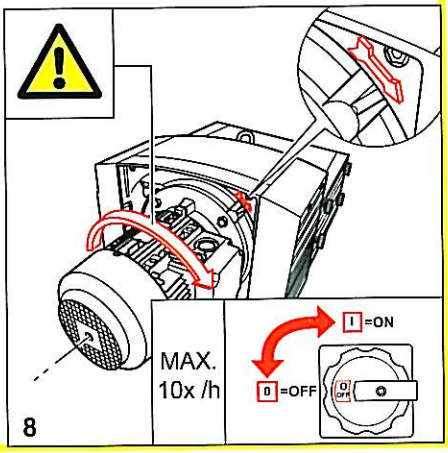
7


MAX.
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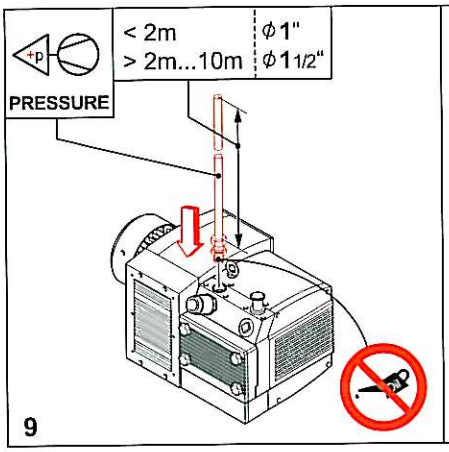
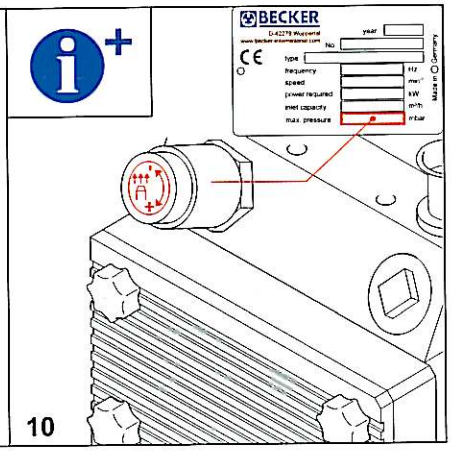
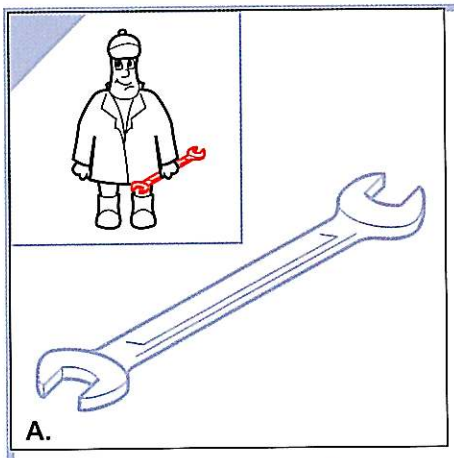
O =OFF
8


PRESSURE
< 2m
> 2m...10m
ϕ1"
ϕ1 1/2"
9


BECKER
10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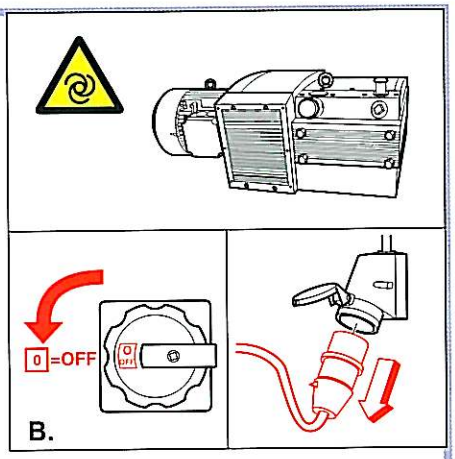
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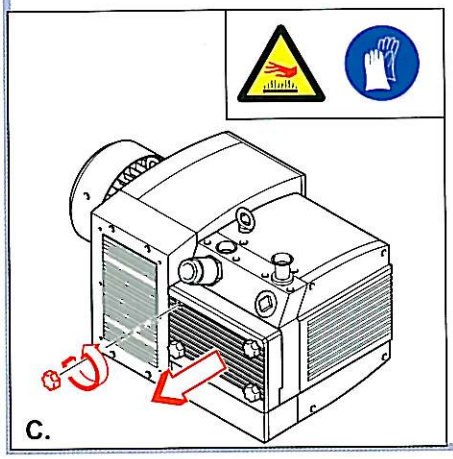
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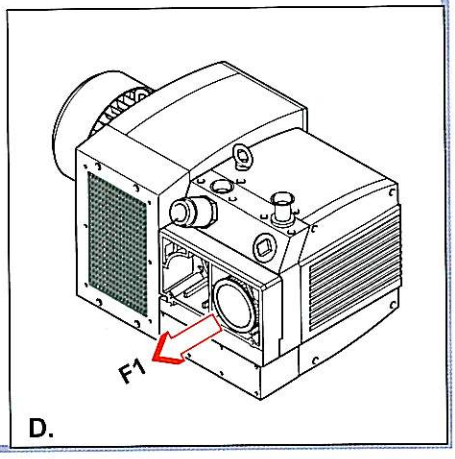
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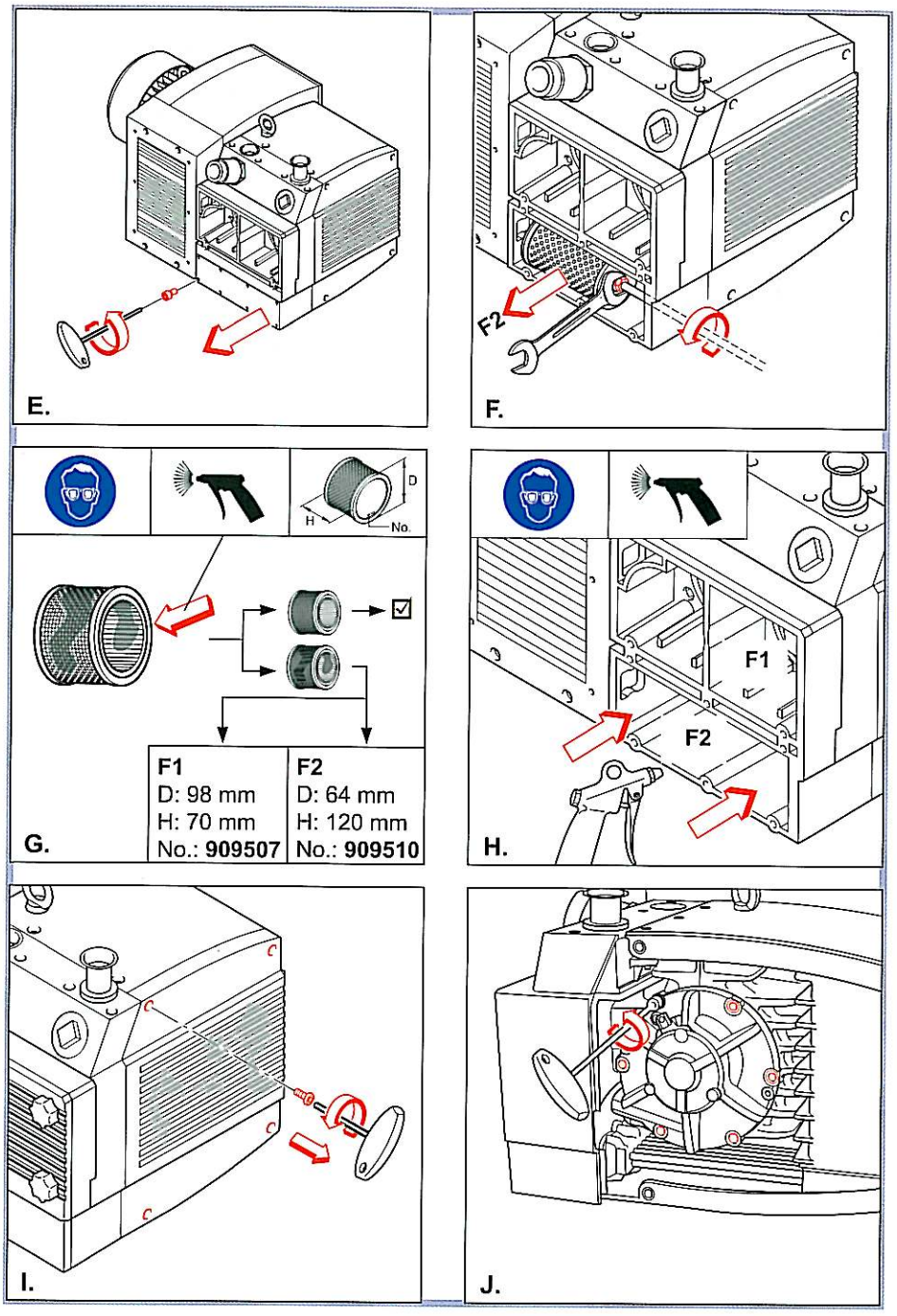
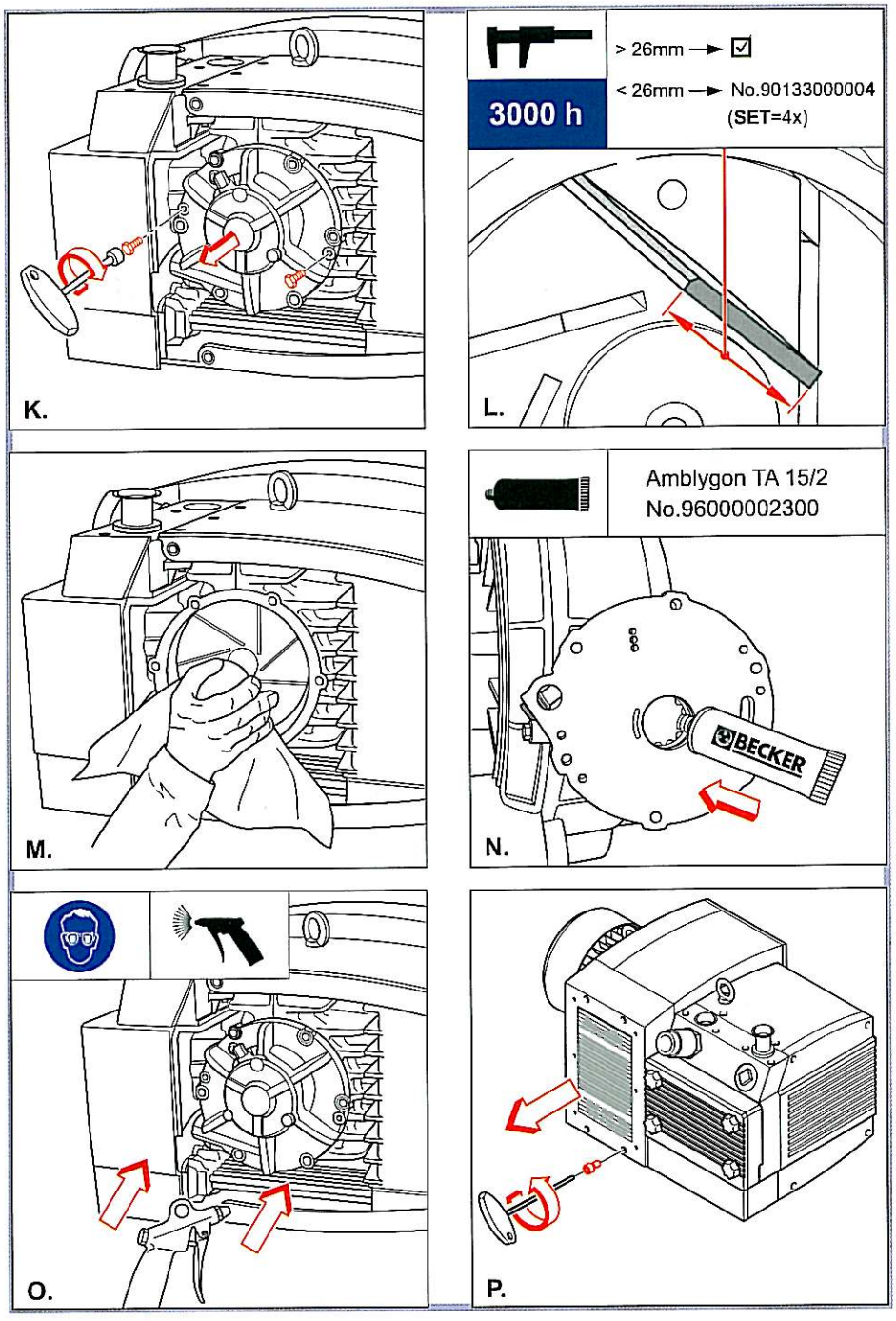
D.


E.
F2
F.
D
H
No.
F1
D: 98 mm
H: 70 mm
No.: 909507
F2
D: 64 mm
H: 120 mm
No.: 909510
G.
F1
F2
H.
I.
J.


K.
> 26mm → ☑
3000 h
< 26mm → No.90133000004
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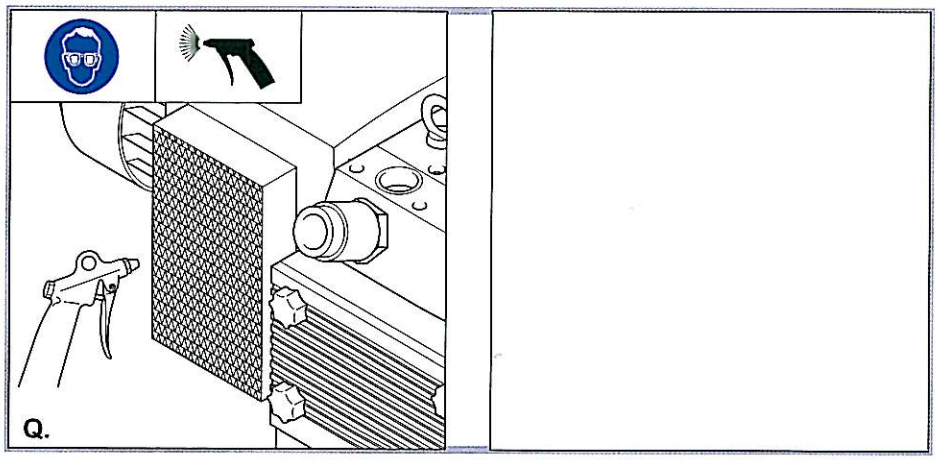
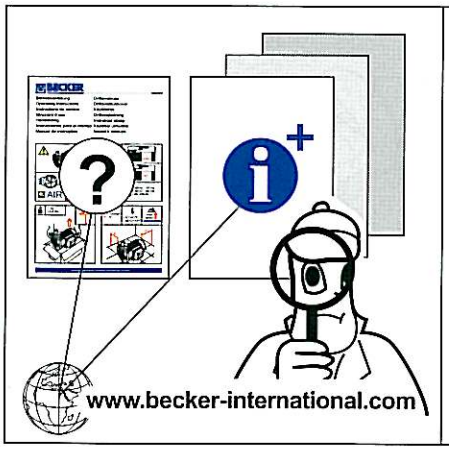
L.
M.
Amblygon TA 15/2
No.96000002300
BECKER
N.
O.
P.





BECKER

Gebr. Becker GmbH
Hölker Feld 29-31
D-42279 Wuppertal

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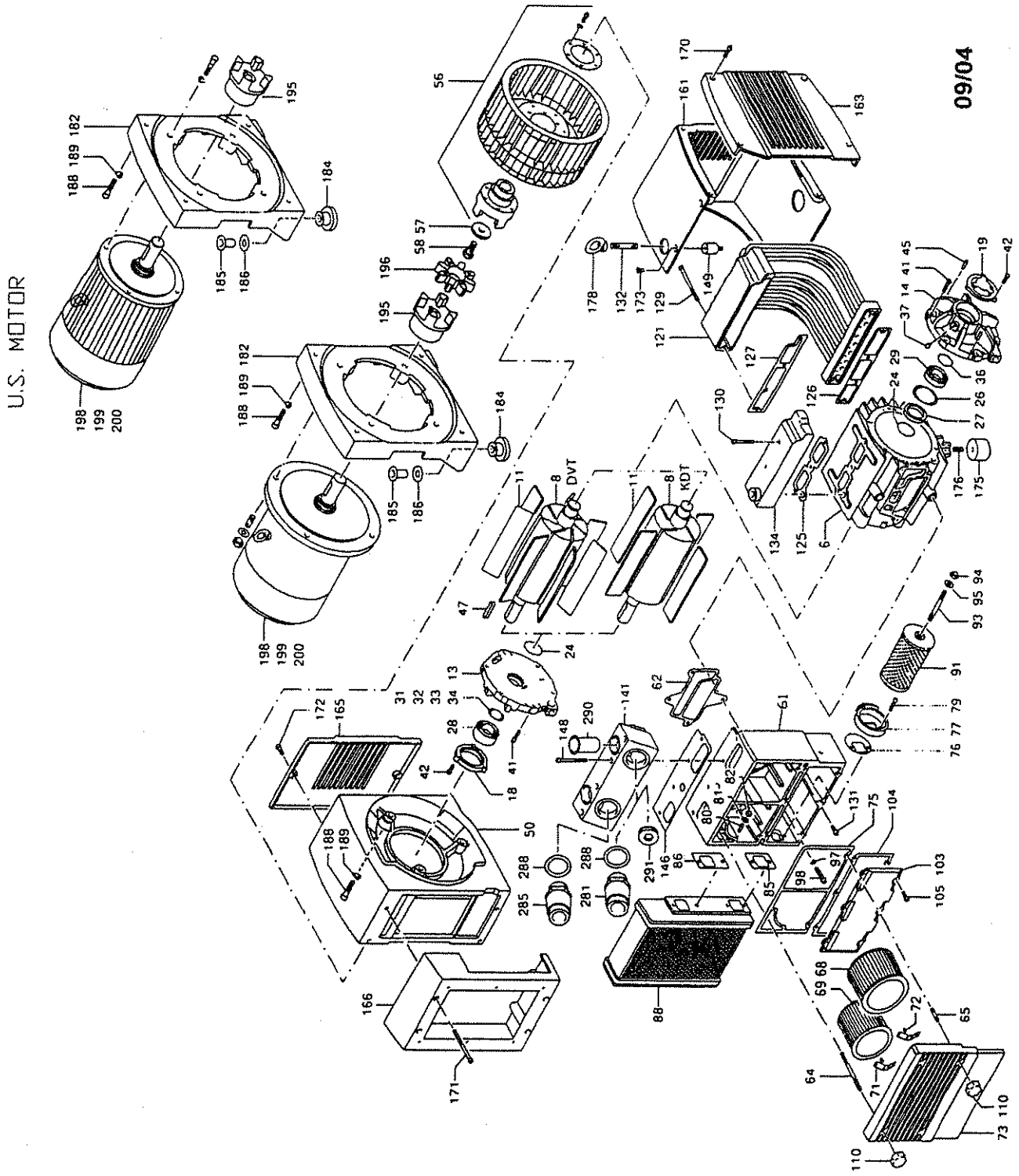
(D) **Service:**
Tel: +49 (0)202 697-171
Fax: +49 (0)202 64 44 74

BECKER

SPARE PARTS LIST

DVT 3.60–3.80
KDT 3.60–3.80



Becker Pumps Corp. • 100 East Ascot Lane • Cuyahoga Falls, Ohio 44223
Ph. (330) 928-9966 • (888) 633-1083 • FAX: (330) 928-7065 • e-mail: info@beckerpumps.com • www.beckerpumps.com

DVT/ KDT 3.60-3.80

Pos	Beschreibung	Description	Designation	Designazione
-	DICHTUNGSSATZ	GASKET SET	JEU DE JOINTS	SERIE DI GUARNIZIONE
6	GEHAEUSE	PUMP BODY	CARCASSE	CARCASSA
8	KOLBEN	ROTOR	ROTOR	ROTORE
11	SCHIEBER KOHLE	CARBON VANES	PALETTE DE CHARBON KDT/KVT/DVT2.80	PALETTE DI CHARBONE
13	SEITENDECKEL	LEFT SIDE SHIELD	COUVERCLE	COPERCHIO
14	SEITENDECKEL	RIGHT SIDE SHIELD	COUVERCLE	COPERCHIO
18	LAGERDECKEL	BEARING COVER	COUVERCLE DE ROULEMENTE	COPERCHIO CUSCINETTO
19	LAGERDECKEL	BEARING COVER	COUVERCLE DE ROULEMENTE	COPERCHIO CUSCINETTO
24	DICHTUNGSSCHLAUCH 35 X 2	SEAL 35X2	JOINT 35X2	GUARNIZIONE 35X2
26	AUSGLEICHSCHEIBE	COMPENSATING DISC	DISQUE DE COMPENSATION	DISCO COMPENSATORE
27	WELLENDICHTRING DF 35X45X7	SHAFT SEAL DF 35X45X7	BAGUE D'ETANCHEITE P.L'AXE 35X45X7	GUARNIZIONE PER L'ALBERO 35X45X7
28	WAELZLAGER 3205 2RS C3 TA	BEARING 3205 2RS C3 TA	ROULEMENT 3205 2RS C3 TA	CUSCINETTO 3205 2RS C3 TA
29	WAELZLAGER NU 205 ZS	BEARING NU 205 Z2	ROULEMENT NU 205 ZS	CUSCINETTO NU 205 ZS
31	DISTANZSCHEIBEN 25X33X0,025	DISTANCE DISC 25X33X0,025	DISQUE DE TOLERANCE25X33X0,025	DISCO GIUOCO 25X33X0,025
32	DISTANZSCHEIBE 25X33X0,05	DISTANCE DISC 25X33X0,05	DISQUE DE TOLERANCE25X33X0,05	DISCO GIUOCO 25X33X0,05
33	DISTANZSCHEIBEN 25X33X0,1	DISTANCE DISC 25X33X0,1	DISQUE DE TOLERANCE25X33X0,1	DISCO GIUOCO 25X33X0,1
34	ZWISCHENLEGRING WN175 25X33X0,2	DISTANCE DISC 25X33X0,2	DISQUE DE TOLERANCE25X33X0,2	DISCO GIUOCO 25X33X0,2
36	SPRENGRING	RING	BAQUE	ANELLO
37	SECHSKANTSCHRAUBE	HEX HEAD SCREW	VIS HEXAGONALE VITE ESAGONALE	
41	SECHSKANTSCHRAUBE M 6X25 DIN 933	HEX-HEAD SCREW M 6X25 DIN 933	VIS HEXAGONALE M 6X25 DIN 933	VITE ESAGONALE M 6X25 DIN 933
42	SECHSKANTSCHRAUBE M 6X15 DIN 933	HEX-HEAD SCREW M 6X15 DIN 933	VIS HEXAGONALE M 6X15 DIN 933	VITE ESAGONALE M 6X15 DIN 933
45	PASSKERBSTIFT 5X20 DIN 1472	STRAIGHT PIN	GOUPILLE CYLINDRIQUE	PERNO
47	PASSFEDER A 8X7X40	KEY A 8X7X40	CLAVETTE A 8X7X40	CHIAVETTA A 8X7X40
50	LATERNE	CONNECTION FLANGE	BRIDGE DE RACCORDEMENT	FLANGIA DI RACCORDE
52	FEDERSCHEIBEA8DIN137	DISC	DISQUE	DISCO
53	INNENSECHSKANTSCHRAUBE M8X25 DIN912	SOCKET HEAD SCREW M8X25 DIN 912	VIS HEXAGONALE INTERNE M 8X25 D 912	VITE ESAGONALE INTERNE M 8X25 D 912
56	GEBLAESEKUPPLUNGSHAELFTE	COUPLING PUMP SIDE	ACCOUPLEMENT POMPE	GUINTO POMPA
57	UNTERLEGSCHEIBE A 1 3X40X5 DIN 9021	WASHER	RONDELLE	RONDELLA
58	WELLENENDSCHRAUBE	SHAFT END BOLT	VIS SITUEE EN BOUT D'ARBRE	VITE DI CHIUSURA DELL'ALBERO
61	FILTERGEHAEUSE	FILTER HOUSING	BOITE POUR FILTRE	CONTENITORE FILTRO A CARTUCCIA
62	DICHTUNG	GASKET	JOINT	GUARNIZIONI
64	STIFTSCHRAUBE	STUD	TOURILLON	L'ASTA A VITE
65	STIFTSCHRAUBE	STUD	TOURILLON	L'ASTA A VITE
68	FILTERPATRONEC11122	FILTER CARTRIDGE C1112/2	CARTOUCHEFILTREC1112/2	CARTUCCIAFILTROC1112/2
69	FILTERPATRONE C 912	FILTER CARTRIDGE C 912	CARTOUCHE FILTRE C 912	CARTUCCIA FILTRO C 912
71	ANPRESSFEDER	LEAF SPRING	RESSORT-JAME	MOLLA
72	BLINDNIET 4 X 6,8	SLOTTED PIN 4 X 8,8	GOUPILLE A ENCOCHE 4 X 6,8	PERNO 4 X 6,8
73	FILTERDECKEL	FILTER COVER	COUVERCLE DU FILTRE	COPERCHIO FILTRO
75	DICHTUNG	GASKET	JOINT	GUARNIZIONI
76	DICHTUNG	GASKET	JOINT	GUARNIZIONI
77	FILTERTRAEGER	FILTER HOLDER	SUPPORT FILTRE	SUPPORTO FILTRO
79	INNENSECHSKANTSCHRAUBE M6X25 DIN912	HEX HEAD SCREW M 6X25 DIN 912	VIS HEXAGONALE M 6X25 D 912	VITE ESAGONALE M 6X25 D 912
80	STIFTSCHRAUBE	STUD	PRISONNIER	PRIGIONIERO
81	UNTERLEGSCHEIBE 8,4 DIN 125	WASHER	RONDELLE	RONDELLA
82	SECHSKANTMUTTER M6 DIN 934	HEX. NUT M6 DIN 934	ECROU A 6 PANS M6 DIN 934	DADO ESCAGONALE M6 DIN 934
85	DICHTUNG	GASKET	JOINT	GUARNIZIONI
86	DICHTUNG	GASKET	JOINT	GUARNIZIONI
88	KUEHLER	COOLER	REFROIDISSEUR	RAFFREDDATORE

DVT/ KDT 3.60-3.80

Pos	Beschreibung	Description	Designation	Designazione
91	FILTERPATRONE C 713	FILTER CARTRIDGE C 713	CARTOUCHE FILTRE C 713	CARTUCCIA FILTRO C 713
93	STIFTSCHRAUBE	STUD	TOURILLON	L'ASTA A VITE
94	SKT.MUTTER M 8 DIN 934	HEX NUT M 8 DIN 934	ECROU A 6 PANS M 8 DIN 934	DADO ESAGONALE M 8 DIN 934
95	UNTERLEGSCHEIBE	WASHER	RONDELLE	RONDELLA
97	FEDERSCHEIBE	LOCK WASHER	RONDELLE GROVER	RONDELLA
98	INNENSECHSKANTSCHRAUBE M6X30 DIN912	SOCKET HEAD SCREW M 6X30 DIN 912	VIS HEXAGONALE INTERNE M 6X30 D 912	VITE ESAGONALE INTERNA M 6X30 D 912
103	STAUBABSCHEIDERDECKEL	DUST SEPARATOR COVER	COUVERCLE DE SEPARATOR POUSSIERE	COPERCHIO DEPOLVERATORE
104	DICHTUNG	GASKET	JOINT	GUARNIZIONI
105	INNENSECHSKANTSCHRAUBE M6X15 DIN912	HEX HEAD SCREW M6X15 DIN 912	VIS HEXAGONALE	M6X15 D 912/VITE ESAGONALE M6X15 D 912
110	HANDGRIFF	HANDLE	POIGNEE	MANETTA
121	KUEHLER	COOLER	REFROIDISSEUR	RAFFREDDATORE
125	DICHTUNG	GASKET	JOINT	GUARNIZIONI
126	DICHTUNG	GASKET	JOINT	GUARNIZIONI
127	DICHTUNG	GASKET	JOINT	GUARNIZIONI
129	INNENSECHSKANTSCHRAUBE M6X80 DIN912	HEX HEAD SCREW M6X80 DIN 912	VIS HEXAGONALE	M6X80 DIN912/VITE ESAGONALE M6X80 DIN912
130	INNENSECHSKANTSCHRAUBE M6X45 DIN912	SOCKET HEAD SCREW M 6X45 DIN 912	VIS HEXAGONALE INTERNE M 6X45 D 912	VITE ESAGONALE INTERNA M 6X45 D 912
131	INNENSECHSKANTSCHRAUBE M6X15 DIN912	HEX HEAD SCREW M6X15 DIN 912	VIS HEXAGONALE M6X15 D 912	VITE ESAGONALE M6X15 D 912
132	STIFTSCHRAUBE M 1 0X60 DIN939	STUD M 10X60 DIN 939	TOURILLON M 1 0X80 DIN 939	L'ASTA A VITE M 1 0X60 DIN 939
134	DECKEL	COVER	COUVERCLE	COPERCHIO
141	ANSCHLUSS-STUECK	CONNECTING PIECE	PIECE RACCORD	PEZI RACCORDI
146	DICHTUNG	GASKET	JOINT	GUARNIZIONI
148	INNENSECHSKANTSCHRAUBE M6X65 D 912	SOCKET HEAD SCREW M6X65 D 912	VIS HEXAGONALE INTERNE M6X65 D 912	VITE ESAGONALE INTERNA M6X65 D 912
149	GUMMI-PUFFER	RUBBER BUFFER	AMORTISSEUR EN CAOUTCHOUC	AMMORTIZZATORE IN GOMMA
161	ABDECKHAUBE	CANOPY	CAPOT DE FERMETURE	LAMIERA DI COPERTURA
163	LUFTLEITRING	AIR GUIDE COVER RING	CAPOT DE CANALISATION DE L'AIR	CONDOTTA ARIA
165	LUEFTERHAUBE	PROTECTING HOOD	CARTER PROTECTEUR	CAPOTO DI PROTECIONE
166	LUEFTERHAUBE	PROTECTING HOOD	CARTER PROTECTEUR	CAPOTO DI PROTECIONE
170	INNENSECHSKANTSCHRAUBE M6X20 DIN912	HEX HEAD SCREW M6X20 DIN 912	VIS HEXAGONALE M6X20 D 912	VITE ESAGONALE M6X20 D 912
171	INNENSECHSKANTSCHRAUBE M6X75 DIN912	SOCKET HEAD SCREW	VIS HEXAGONALE INTERNE	VITE ESAGONALE INTERNA
172	INNENSECHSKANTSCHRAUBE M6X15 DIN912	HEX HEAD SCREW M6X15 DIN 912	VIS HEXAGONALE M6X15 D 912	VITE ESAGONALE M6X15 D 912
173	SENKSCHRAUBE	HEX HEAD SCREW	VIS HEXAGONALE	VITE ESAGONALE
175	GUMMIPUFFER 781084	RUBBER BUFFER 781084	AMORTISSEUR EN CAOUTCHOUC 781084	AMMORTIZZATORE IN GOMMA 781084
176	GEWINDESTIFTE 8X20	THREADED PIN M 8 X 20 DIN 551	GOUPILLE FILETEE M 8 X 20 DIN 551	SPINA FILETTOTA M 8 X 20 DIN 551
178	RINGMUTTER M 10 DIN 582	RING	PITON	GANCIO
182	ZWISCHENFLANSCH	FLANGES	BRIDES	FLANGE
184	KABELTUELLE WN386.13	RUBBER BUSHING WN386.13	PROTECTION EN CAOUTCHOUC	PROTEZIONE IN GOMMA
185	ROHRNIETE	TUBE	TUYAU	TUBO
186	UNTERLEGSCHEIBE A15 DIN 125	WASHER	RONDELLE	RONDELLA
188	INNENSECHSKANTSCHRAUBE M8X35 DIN912	HEX HEAD SCREW M 8X35 DIN 912	VIS HEXAGONALE M 8X35 D 912	VITE ESAGONALE M 8X35 D 912
189	FEDERSCHEIBEA8DIN137	DISC	DISQUE	DISCO
190	STIFTSCHRAUBE M 10X25 DIN 835	STUD	PRISONNIER	PRIGIONIERO
191	UNTERLEGSCHEIBE 10,5 DIN 125	WASHER	RONDELLE	RONDELLA
192	SECHSKANTMUTTER M 10 DIN 934	HEX NUT M 10 DIN 934	ECROU A 6 PANS M 10 DIN 934	DADO ESCAGONALE M 10 DIN 934
195	KUPPLUNGSHAELFTE	COUPLING	ACCOUPLEMENT	GIUNTO
196	KUPPLUNGSSCHEIBE	COUPLING DISC	DISQUE D'ACCOUPLEMENT	DISCO GUINTO
281	REGULIERVENTIL	REGULATING VALVE	SOUPAPE REGLAGE	VALVOLA REGULAZIONE
285	REGULIERVENTIL	REGULATING VALVE	SOUPAPE REGLAGE	VALVOLA REGULAZIONE
288	DICHTRING	SEALING RING	JOINT	ANELLO
290	SCHALLDAEMPFERDUESE	NOZZLE	BUSE	UGGELLO
291	VERSCHLUSS-SCHRAUBE	LOCKING SCREW	BOUCHON	VITE DI CHIUSURA

Bestell Nr.
Ident No.

No.Identification
Pos. Serie No. Identificazione

KDT 3.80

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14	00070021100	79 B...	94531900000
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18	00110021100	81	94750400000
19	00100021100	82	94710400000
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26	91715200000	86 **	02550921100
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		88 B...	56020321100
28	90661250000	91	90951000000
29	90665700000	93	94696500000
31	51140010100	94	94710500000
32	91142900000	95	94751200000
33	91143100000	97	95170300000
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36	94961400000	103	06880021100
37	94521700000	104 **	02550221100
38 C...	01680121100		
39 C...	94980700000		
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61	04010021100	134	00560021100
		141	01660021100
62 **	02550121100	141 R VER	01660321100
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67	96440700000		
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72	94875000000	163	92080021100

Bestell Nr.
Ident No.

No.Identification
Pos. Serie No. Identificazione

DVT 3.80

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**Gasket set

Bestell Nr.
Ident No.

No.Identification
Pos. Serie No. Identificazione

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88 A...	56020321100	184	95191600000
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126 **	02550521100	288	94806600000
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141 R VER	01660321100		
146 **	02550721100		
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**Gasket set

KDT 3.60

Pos.	Serie	Bestell Nr. Ident No. No.Identification No. Identificazione
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24***		91131200000
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31		51140010100
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37		94521700000
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146***		02550721100
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165		96070021100

DVT 3.60

Pos.	Serie	Bestell Nr. Ident No. No. Identificazione
166		96070121100
170		94532100000
171		94537100000
172		94531900000
173		94980600000
175		74130200000
176		94563400000
178		95160200000
182	US	01490121100
182	B5/250	01490021100
182	B5/200	01490021600
184		95191600000
185		94877200000
186		94750800000
188		94533300000
189		95170700000
190		95101800000
191		94750600000
192		94710600000
195	D=28	90210800000
195	US	90210021100
195	D=24	90210021600
196		90220900000
285	+2.0	72800299622
285	+1.0	72800199622
285	+0.6	72800099622
288		94806600000
290		96430700000
291		91280500000

***Gasket set

*025517211 s/n C...

Pos.	Serie	Bestell Nr. Ident No. No. Identificazione
-		54900021100
6		00010021600
8		02000021100
11		90133000000
13		00080021100
13 A - D		00080121100
14		00070021100
14 A - D		00070121100
18		00110021100
19		00100021100
20 ***		02551121100
24 ***		91131200000
26		91715200000
27		90654000000
28		90661250000
29		90665700000
31	0.025	91142800000
32	0.050	91142900000
33	0.1	91143100000
34	0.2	91143200000
36		94961400000
37		94521700000
41		94522400000
42		94522000000
45		94874200000
47		94773600000
50		05320021100
52		95170700000
53		94533100000
56		54450121100
57		94940900000
58		94527000000
61		04010021100
62 ***		02550121100
64		94695700000
65		95100300000
68		90950700000
69		90950600000
71		00900027000

Pos.	Serie	Bestell Nr. Ident No. No. Identification No. Identificazione
72		94875000000
73		04020021100
75 ***		02550021100
76 ***		02550321100
77		02280021100
79		94532100000
80		94694400000
81		94750400000
82		94710400000
85 ***		02550821100
86 ***		02550921100
88		56020321100
88 A...		56020221100
91		90951000000
93		94695000000
94		94710500000
95		94945000000
97		95170300000
98		94532200000
103		06880121100
104 ***		02550221100
105		94531900000
110		92150050000
121		56020421100
125 ***		02550421100
126 ***		02550521100
127* ***		02550621100
129		94537200000
130		94532700000
131		94531900000
132		94693000000
134		00560021100
141		01660021100
141 R VER		01660321100
146		02550721100
148		94536800000
149		74131030000
161		91830021100
163		92080021100
165		96070021100
166		96070121100
170		94532100000
171		94537100000
172		94531900000
173		94980600000
175		74130200000
176		94563400000
178		95160200000
182	US	01490121100
182		01490021100
184		95191600000
185		94877200000
186		94750800000
188		94533300000
189		95170700000
190		95101800000
191		94750600000
192		94710600000
195		9021080000
195	US	90210021100
196		90220900000
281	-0,6	73600099624
281	-0,3	73600099613
285	+0,6	72800099622
288		94806600000

*025517211 s/n C...

LIMITED WARRANTY
FOR
NEW PRODUCTS

The Seller (Becker Pumps Corp.) warrants to Buyer (Original Consumer, Purchaser or End User) that its products will be free from defects in materials and workmanship for one (1) year after date of purchase **(See: Exception)**. This date of purchase shall be the actual date the product(s) was shipped from an authorized Distributor of the Seller or the Seller's own facilities to the Buyer. Formal proof of receipt may be required. It is the responsibility of the Buyer to inform the Seller's "Customer Service Department" of any problems with the operation of the products within this one (1) year warranty period and to obtain authorization prior to returning such product for warranty consideration should it be deemed necessary.

WARRANTY SERVICE CAN ONLY BE PROVIDED BY SERVICE PERSONNEL AUTHORIZED BY BECKER PUMPS CORPORATION.

All products authorized for return shall be sent with shipping charges "PREPAID" to the Seller at 100 East Ascot Lane, Cuyahoga Falls, Ohio 44223 or an approved Warranty Service Center. A Return Authorization Number shall be provided to Buyer to be placed on the outside of the package as well as on any enclosed packing list. All shipments received "Freight Collect" by Seller will be refused.

After the product is received, a detailed analysis will be made as to the nature of the problem. Should it be found that there is a defect of materials or workmanship, corrective steps will be immediately taken either to repair or replace in whole or in part the defective item(s) at no charge to the Buyer. Should the Seller determine it best to replace the whole product with a new identical product, the warranty on the new product shall be in force only to the extent of completing the warranty period of the original purchased product. The repaired or replaced product will then be returned to the Buyer freight prepaid via standard motor freight, and a credit in the same amount of the return standard motor freight charges will be issued to the Buyer as reimbursement for the incoming freight.

IF IT IS DETERMINED THAT THE PROBLEM WAS THE RESULT OF ONE OF THE FOLLOWING CAUSES:

1. Damage resulting from improper installation or operation in excess of nameplate specifications.
2. Damage from improper maintenance.
3. Damage from misuse, abuse, accident or alteration.
4. Damage from improper electrical supply and/or wiring.
5. Damage from excessive foreign materials (dirt, dust, metal, plastic, water, etc.) ingested by the unit.

WARRANTY WILL NOT BE HONORED and the usual charges for repair or replacement will be made, FOB the factory. NOTE: Normally wearing parts are not covered by this Becker Limited Warranty (examples would be coupling discs, vanes, oil and air filter elements, etc.).

This is the sole expressed Warranty of the Seller. No affirmations or promises of the Seller shall be deemed to create an expressed Warranty regarding a sale of Seller's products.

Exception: All new Becker U Series, Dekatorr, Pumps that have been operated from initial purchase throughout the full warranty period with Becker Vacuum Pump Oil shall be warranted for a period of two (2) years after the date of initial purchase. Proof of oil purchase may be required.

BECKER PUMPS CORP.
100 East Ascot Lane • Cuyahoga Falls • Ohio • 44223 • (330) 928-9966

05.11.05

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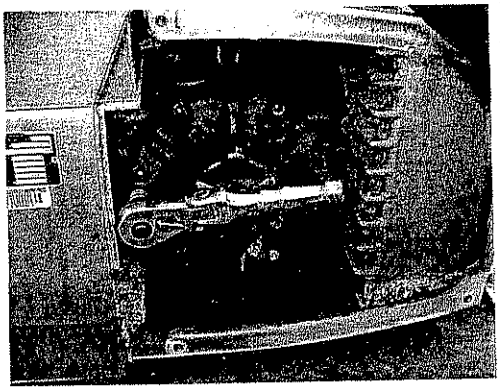
Checking Vane Wear in Becker Compressors

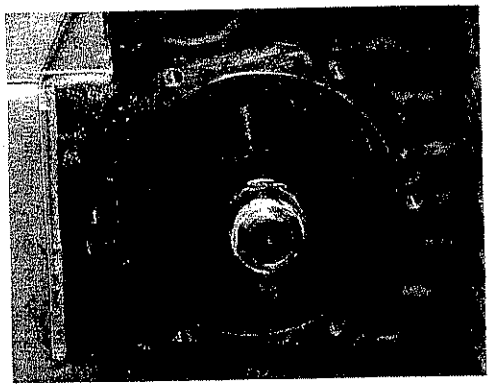
Becker® Pumps Corporation recommends checking the vane wear at 3,000-hour intervals based on "normal" installations. "Normal" basically means that the compressor is protected from rain, high humidity, temperature extremes, dust, etc. Typically, however, remediation systems have Becker compressors located outside in the weather and subject to all types of adverse operating conditions. Therefore, Becker recommends that a weather shield be installed above the compressor and that the vanes be checked on monthly (or 1000-hour) intervals. Moisture entering the compressor (even though an air intake filter is used) carries particulates into the vane/rotor chamber. Since the vanes are made of carbon, and are very brittle, even small amounts of particulates will cause rapid vane wear. Checking vane wear will allow the consultant to determine wear rate and estimate when vane replacement will be required. Each Becker model has a minimum vane thickness specification. If the vane is allowed to wear below minimum, then vane breakage will occur and entails a time consuming and costly repair. Checking the vanes is only a 15- to 30-minute procedure and requires simple hand tools.

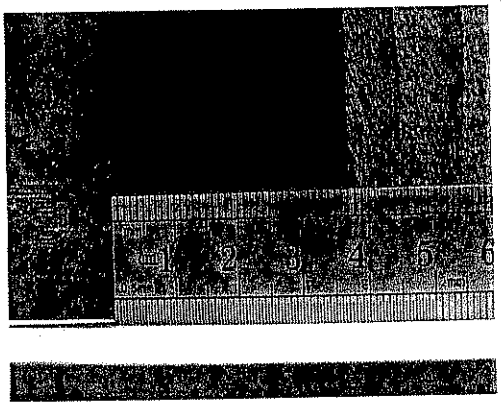
Vane Inspection Procedure

First, shut off power to the compressor and close all process piping valves at the air sparge manifold. Release any pressure from the compressor. Pressurized air in the sparge points will try to return through the compressor. Lock out/Tag out the electrical power to the compressor motor. Allow the compressor to cool for a few minutes. Using a 5mm or 6mm hex key (depends on the compressor model), remove the plastic end housing of the compressor to expose the compressor endplate.

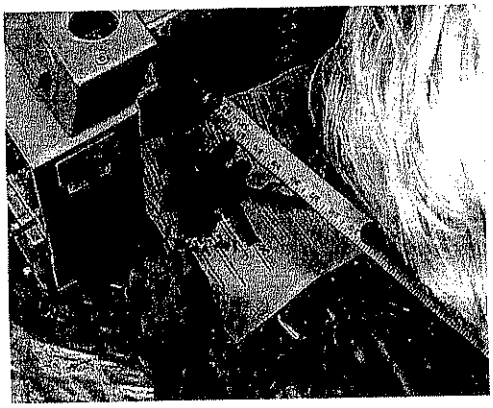


Using a 10mm socket, remove the bolts holding the endplate to the rotor chamber body (See picture, left). Now thread two of the 10mm bolts into the 2 threaded holes in the endplate. Alternately tighten the two bolts to "pull" the endplate free from the rotor chamber (See picture, right). Now the vanes (4 or 5 depending on model) are accessible.





Make note of the vane's beveled edge orientation. Remove each vane and visually inspect for cracks and chips. Use a metric ruler to measure the width of each vane and compare with factory specifications (See picture, left). If the vanes are below the manufactures minimum specs replace them with new ones. Reusing worn out or damaged vanes could result in vane breakage (See picture, right).

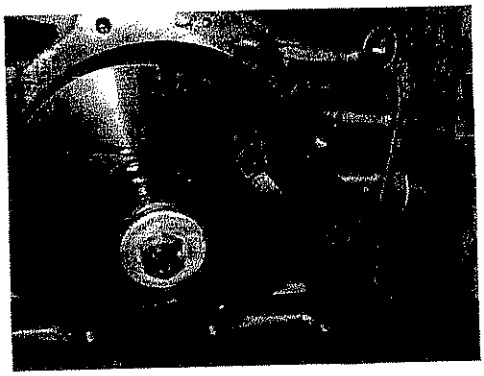


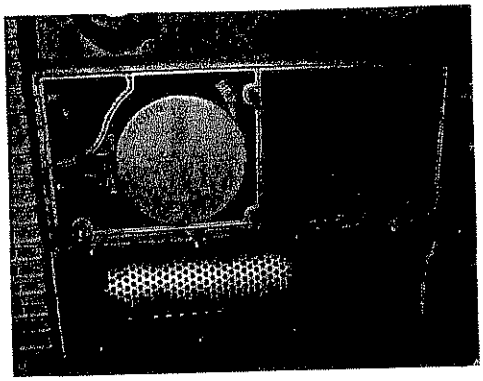
See *Checking Compressor Vanes, Continued*, on Page 3

Checking Compressor Vanes, Continued

Before reassembling the compressor, inspect the rotor shaft bearing located in the end housing. Make sure that it isn't scored, pitted, or contaminated with dirt. Also inspect the machined surfaces of the rotor chamber and end housing for debris and rust. Minor rust can be removed with fine grit sandpaper (don't forget to clean out any residue). Reassemble the compressor in the reverse order of disassembly.

Check that the vanes move freely in the slots in the rotor (See picture, below left). Any binding will prevent proper operation. Here's a hint: a wooden yard stick is the perfect size to "rod out" the vane slots. Another good idea is to put anti-seize lubricant on all bolt threads; that will make future disassembly much easier. Lubricate the front and rear bearings using the Becker grease gun and lubricant. Inspect and clean all the air intake filters. It is also a good idea to visually check the electric motor to compressor coupling (the "lovejoy" coupling) for abnormal wear (See picture, below right). Now the Becker can be put back into service.

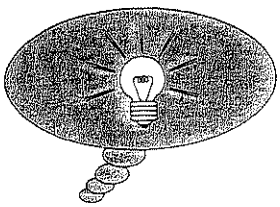




Helpful Links:
Becker Pumps Corporation: http://www.beckerpumps.com/

This article is part of a series written by Broward County's Remediation System Inspector, Mr. Stirling Gosa. If you have any questions, please feel free to email Mr. Gosa at sgosa@broward.org.

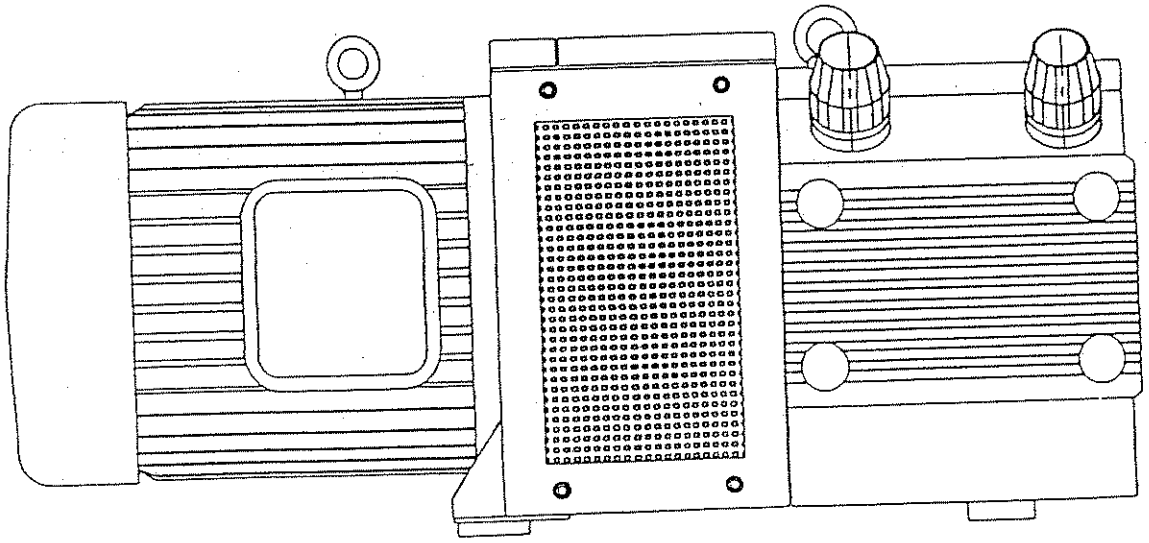
Feedback Forum



In order to improve the services which the EAR Section provides and better understand your needs, we need your feedback! Do you have a suggestion for the *Times*? Are there areas in which the Section can serve you better? Any comments may be sent via US Mail or fax to:

Broward County DPEP/PPRD
ATTN: Lorenzo Fernandez, P.E.
218 S.W. 1st Avenue
Fort Lauderdale, FL 33301
Fax: (954) 765-4804
You may also contact Mr. Fernandez via email at **lfernandez@broward.org** or by telephone at **(954) 519-1249.**

DVT/KVT/KDT 3.000
REPAIR & SERVICE MANUAL



BECKER
Vacuum Pumps • Compressors

100 East Ascot Lane • Cuyahoga Falls, OH 44223
Tel: 330-928-9966 • Fax: 330-928-7065

2/00 ST

DVT, KVT, KDT 3.000

REPAIR & SERVICE MANUAL

This manual is intended to be used in conjunction with the current parts list for the appropriate model. Reference numbers used in this manual are position numbers shown on the parts list. The sealing compounds and greases referred to in this manual are the sealants and greases recommended by the pump manufacture. These are available through your Becker Pump Distributor.

Disassembly

1. Remove the 4 bolts (#188) from the motor flange (#182) and remove the motor and flange.
2. Remove the coupling disc. (#196)
3. Remove the shaft end screw from the rotor shaft. (#58)
4. Remove the coupling with fan (#56) and shaft key. (#47)
5. Remove the 4 socket head cap screws (#171) and protective hood (#161).
6. Loosen and remove the 3 socket head cap screws (#188) with spring washers from the connection flange (#50) and remove flange.
7. Remove the filter cover and remove the filter cartridges. (#68 and #69)
8. Remove the ring bolt. (#178)
9. Remove the 4 SHCS (#170) and remove air guide cover (#163)
10. Remove valves (#285 and 281 or 341 and 345)
11. Roll pump housing onto filter cover gasket surface.
12. Remove SHCS (#173) and rubber foot. (#175)
13. Remove canopy. (protective hood #161)
14. Remove 6 SHCS (#105) and cover (#103).
15. Remove dust separator (#91).
16. **DVT/KVT/KDT 3.80:**
    - Remove 2 SHCS (#79) and filter holder (#77).
    - Remove 4 SHCS (#131) and 4 SHCS (#129) to separate cooler (#121) from cover (#134) and filter housing (#61).
    - Separate after cooler (#88) from filter housing. (DVT/KDT only)
    - Remove 3 SHCS (#130) and cover (#134).
    - Remove 4 SHCS (#198) and filter housing (#61).

    DVT/KVT/KDT 3.100 & 3.140:
    - Remove 6 SHCS (#138) and 4 SHCS holding filter housing (#161) to pump body(#5)
    - Separate after cooler (#88) from filter housing. (DVT/KDT only)
    - Roll unit on to inlet port and remove 4 SHCS (#132) and remove cooler assembly (#123&121).
17. Remove 6 bolts (#41) from B-side endshield (#14/16). Screw 2 bolts in to threaded holes in endshield and tighten to pull endshield off locating pins.
18. Remove vanes (#11).
19. Remove 6 bolts (#41) from A-side endshield (#13/15). Screw 2 bolts in to threaded holes in endshield and tighten to pull endshield off locating pins. Remove A-side endshield and rotor assembly from housing.
20. Press rotor out of A-side endshield.

The unit is now completely disassembled. Thoroughly clean the unit in a suitable solvent, discarding gaskets, filters, and dust separator. After cleaning in solvent, degrease rotor, end shields, and cylinder with contact cleaner and blow dry with compressed air to remove all traces of solvent and grease.

Inspection

1. Inspect cylinder for chatter marks or scoring.
2. Inspect side shields. If heavily scored, replace.
   Note: Anytime a major component (end shield, rotor, or cylinder housing) is replaced, the rotor to cylinder clearance must be reset.
3. Inspect rotor for damage.

Reassembly

1. Replacement of A side bearing

- Remove the 3 internal hex head screws from bearing cap and remove cap. (# 42&18)
- Remove bearing, shaft seal (if unit is equipped with seal on A-side) and teflon tube seals. (#28,26&24)
- If unit does not have sealed bearings, fill new bearing with Amblygon TA15/2 grease.
- Install new shaft seal and teflon tube seals.
- Place bearing in seat in end shield and replace bearing cap, be sure to evenly tighten screws.

2. Replacement of B side bearing

- Remove the 3 internal hex head screws from bearing cap and remove cap. (#42&19)
- Remove bearing outer race with rollers and cage, shaft seal, and teflon tube seals. (#28,26, &24)
- Install new shaft seal and teflon tube seals.
- Fill new roller bearing half full with Amblygon grease and place in bearing seat in end shield.
- Replace bearing cap and be sure to evenly tighten internal hex head screws.
- Remove bearing retaining clip (#36).
- Remove bearing inner race from rotor end and replace with new race .
- Replace bearing retaining clip (#36).

Setting rotor to A side endshield clearance

1. With new bearings and shaft seals in A side endshield, place shim stack of 0.15mm to 0.20mm on A side of rotor shaft. Press endshield onto shaft and measure clearance between endshield and rotor. See table 2 for proper clearances. Add or subtract shims to obtain proper clearance.

Setting rotor to cylinder clearance

The following steps 1- 18 are only required if a major component of the pump has been replaced. (endshield, rotor, or pump housing.)

1. Place housing on work bench so that the minimum clearance area (the area of minimum rotor to cylinder clearance when the pump is fully assembled) is positioned at the bottom.
2. Remove locating pegs (#17) from both endshields. Mark endshields for suitable location of new holes for locating pegs.
3. Set rotor to endshield clearance using new bearings and shaft seals.
4. Insert gauge tape (feeler gauge, shim stock, paper, or non reinforced tape) of proper thickness, and approximately the same width as a rotor segment between two vane slots), into the cylinder. Make sure the rotor is supported by a single thickness of gauge tape above the cylinder.
5. Place rotor and A side endshield into housing making sure that rotor segment, not a vane slot, is resting on the gauge tape.
6. Install A side endshield bolts but do not fully tighten.
7. Install B side endshield bolts but do not fully tighten
8. Using moderate pressure, press down on endshield and center endshield bolts in holes, tighten bolts.
9. On 4.5mm drill bit mark drilling depth using peg as guide.
10. Drill holes in endshield to proper depth, taking care to keep drill perpendicular to endshield.
11. Repeat on opposite end.
12. Remove endshields and redrill holes in body with 4.9mm drill bit.
13. Using 5mm H7 reamer ream holes in endshields.
14. Ream holes in body using 5mm carbide reamer.
15. Install locating pegs in endshields and remove gauge tape from rotor and cylinder.
16. Reinstall A side endshield and rotor.
17. Install vanes and B side endshield.
18. Rotor to cylinder clearance is now reset, continue reassembling unit in normal manner.

Reassembly

1. Reinstall filter housing (#61) and after cooler (DVTs & KDTs only) with new gaskets.
2. Stand assembly on B-side endshield and install cooler (#121 on 3.80s or 123&121 on 3.100 and 3.140) with new gaskets.
3. On 3.80 replace cover (#134) and filter holder (#77) for dust separator.
4. With assembly still standing on B-side endshield reinstall connection flange (#50)

Reassembly continued

5. Reinstall shaft key (#47) and fan with coupling (#56)
6. Replace shaft end bolt and washer and fully tighten.
7. Replace cooler cover (#166 protective hood).
8. Replace protective hood (#161), foot (#175) and ring screw (#178&#132).
9. Install motor mounting flange (#182)
10. Check motor coupling distance and install new coupling disc.
11. Mount motor to pump; wire for correct voltage and rotation.
12. Test unit for 1 hour before installation.

Setting motor coupling distance

1. Place straight edge across the machined surface of the motor connection flange (# 50) and measure to the outer ring of the pump coupling. (#56)
2. Subtract 2mm (.080") from measurement obtained in step 1.
3. Place straight edge across motor coupling (#195) and push coupling on to motor shaft far enough to obtain the distance calculated in step 2 from outer ring of coupling to mating surface of motor adaptor ring. (#182)
4. Apply blue lock tite (Lock Tite # 242) to motor coupling set screw and tighten.
5. Attach motor to pump.

Unit testing

1. Check that motor is wired for correct voltage and frequency. Check motor for correct direction of rotation.

2. Operate pump under no load for approximately 20 minutes.

3. Place vacuum gauge and ball or gate valve on inlet port (on combined units also install pressure gauge and valve on discharge port). Adjust pump relief valves so that pump can not exceed rated vacuum and pressure. Check motor amperage. As unit warms up, amps will go down and vacuum and pressure may go up, so it may be necessary to reset valves.

4. When everything is operating properly continue test for 60 minutes.

Trouble Shooting

Problem	Possible Cause	Solution
Unit lacks sufficient vacuum or compressed air.	Clogged filters	Clean or change filters; add a higher capacity external filter in series with the existing internal filters.
	Stuck rotor vanes.	Disassemble unit and clean all oil traces from internal parts. Replace carbon vanes, since they become hygroscopic when exposed to oil. Chect for oil contamination in the suction line.
	Pressure or vacuum relief valves need adjusting.	Recalibrate valves.
	Leaks or restrictions in piping.	Open pipe connections and examine for internal contamination or buildup. Tighten all piping connections. Replace rubber hoses.
	Insufficient pump speed (RPM).	Check voltage and amperage to motor. Inspect motor and coupling halves. Check that the pump shaft turns freely.
	Clogged Ports.	Clean and open all ports.
	Defective gaskets.	Inspect gaskets for breakage or disintegration. Replace if necessary.

Problem	Possible Cause	Solution
Unit lacks sufficient vacuum or compressed air (cont.).	Line losses too high.	Piping diameter too small—replace with larger diameter. Check for clogged filter elements—replace if necessary.
	Carbon dust separator clogged.	Inspect, clean, or replace.
	Unit is operating at an elevated altitude.	Contact the factory for assistance. Performance may be reduced when operating above sea level.
Motor breakers trip constantly.	Defective motor.	Test motor and replace if necessary.
	Undersized circuit breaker.	Replace with correctly sized breaker.
	Heaters too small.	Replace with correctly sized heaters.
	Low motor voltage.	Check at motor terminals. Contact electric service provider.
	Ambient temperature too high.	Reduce ambient temperature to below 104°F.
	Stuck rotor.	Disassemble pump to determine reason. Replace all necessary parts.
	Clogged carbon dust separator—back pressure too high.	Clean or replace dust separator.
Unit runs rough and cannot be rotated manually.	Broken rotor vane.	Disassemble unit and replace vane. Check cylinder for wear.
	Worn coupling disc.	Remove motor and inspect rubber coupling disc and pins. Replace, if necessary, and realign.
	Siezed bearings.	Remove end shields and inspect bearings. Replace if necessary. Reshim bearings to maintain proper clearance.

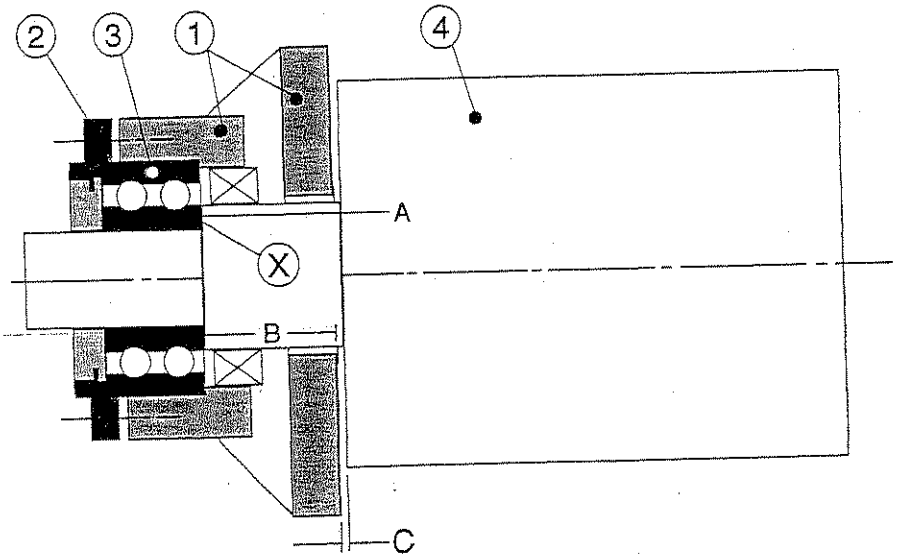
Problem	Possible Cause	Solution
Unit runs rough and cannot be rotated manually (cont.).	Oil in the cylinder.	Remove end shields and inspect cylinder. Clean oil and replace vanes. Clean unit thoroughly. Inspect piping; determine source of oil and eliminate.
	Locked rotor.	Remove end shields and inspect cylinder. Remove contamination.
Pump overheats.	Cooling ducts blocked.	Clean cooling ducts.
	Cooling fan broken.	Replace fan.

Repair Tolerances

Pump Type	Rotor Length	Cylinder Length	Cylinder Inside Dia.
DVT 3.80	169.685 - 169.710	169.975 - 170.000	118.000 - 118.035
DVT 3.100	249.571 - 249.600	249.971 - 250.000	118.000 - 118.035
DVT 3.140	239.571 - 239.600	239.971 - 240.000	142.000 - 142.040
KVT/KDT 3.80	169.655 - 169.680	169.975 - 170.000	118.000 - 118.035
KVT/KDT 3.100	249.541 - 249.570	249.971 - 250.000	118.000 - 118.035
KVT/KDT 3.140	239.541 - 239.570	239.971 - 240.000	142.000 - 142.040

Pump Type	Vane Length (D)	Vane Width, (E) Min. New	Rotor to End Shield (C)	Rotor to Cylinder
DVT 3.80	169.75 - 169.78	27.0 - 39.0	0.04 - 0.07	0.09 - 0.11
DVT 3.100	249.61 - 249.65	27.0 - 39.0	0.04 - 0.07	0.09 - 0.11
DVT 3.140	239.66 - 239.70	32.0 - 49.0	0.05 - 0.08	0.09 - 0.11
KVT/KDT 3.80	169.75 - 169.78	27.0 - 39.0	0.04 - 0.07	0.09 - 0.11
KVT/KDT 3.100	249.61 - 249.65	27.0 - 39.0	0.04 - 0.07	0.09 - 0.11
KVT/KDT 3.140	239.66 - 239.70	32.0 - 49.0	0.05 - 0.08	0.09 - 0.11

Note: All dimensions are in Millimeters



Legend

X = Location of bearing shims

A = Shaft collar length

B = Depth to bearing in side shield

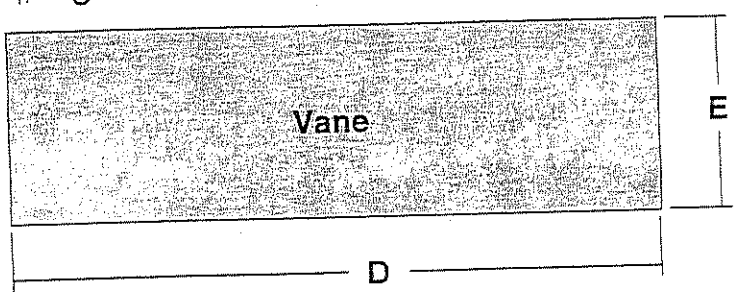
C = Tolerance required

1 = Side shield

2 = Bearing cap

3 = Bearing

4 = Rotor

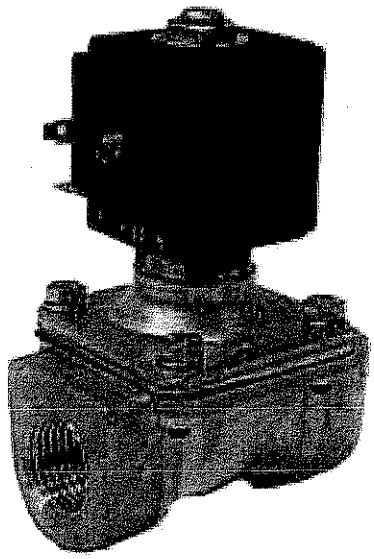


100 East Ascot Lane • Cuyahoga Falls, OH 44223
Tel: 330-928-9966 • Fax: 330-928-7065

Solenoid Valve 21HN

DESCRIPTION:

2-way, internally piloted, normally closed, solenoid valve with assisted lift



PIPE SIZE: 1/4" – 1"

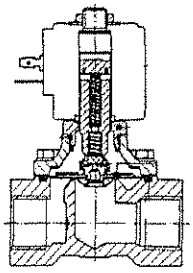
COILS:

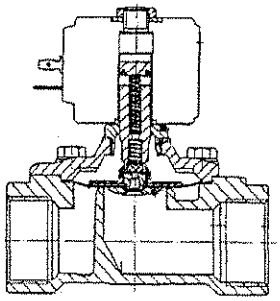
BDU - 8W 310°F (Class F)
DA - 8W 310°F (Class F)
ADF - 8W 360°F (Class H)
UDA -12W 310°F (Class F)
DH -12W 360°F (Class H)
GH -14W 360°F (Class H)

Sealing Material	Temperature		Medium
Y = NBR + PA (polyamide)	14°F	195°F	Air, Inert gas, Water

Pipe Size	Model	Orifice Size	Cv Flow Factor	Power (watt)	Operating Pressure		
					Min	M.O.P.D.	
					psi	AC psi	DC psi
1/4"	21HN2KY110	7/16"	1.4	8	0	200	75
				12			200
				14			
3/8"	21HN3KY110	7/16"	1.4	8			75
				12			200
				14			
1/2"	21HN4KY160	5/8"	2.8	8			35
				12			160
				14			200
3/4"	21HN5KY160	5/8"	2.8	8			35
				12			160
				14			200
1"	21HN6KY250	1"	8.3	8		116	-
				12		200	22
				14			85

Solenoid Valve 21HN

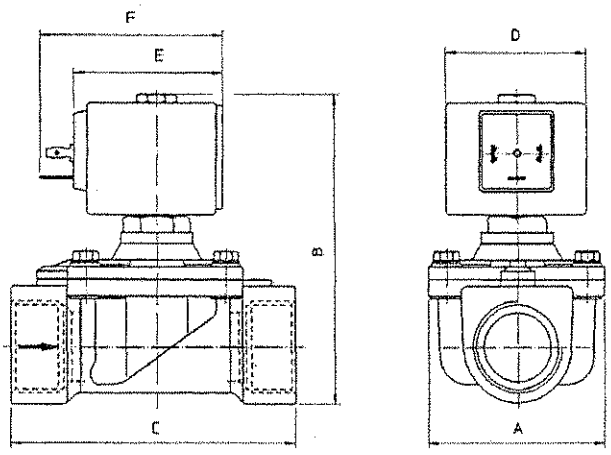




MATERIALS OF CONSTRUCTION:	
Body	Brass
Armature Tube	Stainless Steel 300
Fixed Core	Stainless Steel 400
Plunger	Stainless Steel 400
Spring	Stainless Steel 300
Shading Ring	Copper
Orifice	Brass

ELECTRICAL CONNECTION:	
Rating:	NEMA 4
Strain relief connector:	Model 009
1/2" conduit connector:	Model 010
6 ft. power cord:	Model GRN100

SPARE PARTS:		
Coils:	see other side	
Kit:	1/4" – 3/8"	KTGHT3KOY11
	1/2" – 3/4"	KTGHT4KOY16
	1"	KTGHT6KOY25



COIL SPECIFICATIONS:		
Watt	**Inrush VA**	**Holding VA**
8	25	14.5
12	36	23
14	43	27

VALVE DIMENSIONS			
MODEL	**A**	**B**	**C**
21HN2KY110	1-31/32	3-1/2	2-7/32
21HN3KY110			
21HN4KY160		3-15/16	2-3/4
21HN5KY160			
21HN6KY250	2-9/16	4-13/32	4-3/32

COIL DIMENSIONS			
WATT	**D**	**E**	**F**
8	1-3/16	1-21/32	2-1/8
12	1-7/16	1-29/32	2-3/8
14	2-1/16	2-7/32	2-21/32

Dimensions in inches

GRANZOW INC.

2300 CrownPoint Executive Drive
Charlotte, NC 28227
Phone 704-845-2300 FAX 704-845-2301

www.granzow.com

INSTALLATION, OPERATING & MAINTENANCE INSTRUCTIONS SOLENOID VALVES

The manufacturer warrants the equipment manufactured by it to be free from defects in materials or workmanship for a period of ninety (90) days from the date of shipment to buyer. If the equipment or any part thereof becomes defective within ninety (90) days from such date, the defective equipment will be replaced or credit allowed therefore at the sole option of manufacturer, but without credit or payment for any labor.

The foregoing is the exclusive remedy of any buyer of manufacturer's equipment. The maximum damages liability of the manufacturer is the cost of replacement of the equipment or part.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES WHETHER WRITTEN, ORAL OR STATUTORY, AND IS EXPRESSLY IN LIEU OF THE IMPLIED WARRANTY OF MERCHANTABILITY AND THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. THE MANUFACTURER SHALL NOT BE LIABLE FOR LOSS OR DAMAGE BY REASON OF STRICT LIABILITY IN TORT OF ITS NEGLIGENCE IN WHATEVER MANNER INCLUDING DESIGN, MANUFACTURE OR INSPECTION OF THE EQUIPMENT OR ITS FAILURE TO DISCOVER, REPORT, REPAIR OR MODIFY LATENT DEFECTS INHERENT THEREIN.

THE MANUFACTURER, HIS REPRESENTATIVE OR DISTRIBUTOR SHALL NOT BE LIABLE FOR LOSS OR USE OF THE EQUIPMENT OR OTHER INCIDENTAL OR CONSEQUENTIAL COSTS, EXPENSES OR DAMAGES INCURRED BY THE BUYER, WHETHER ARISING FROM BREACH OF WARRANTY, NEGLIGENCE OR STRICT LIABILITY IN TORT.

The manufacturer does not warrant any equipment, part, material component, or accessory manufactured by others and sold or supplied in connection with the sale of manufacturers products.

CAUTION

1. PRESSURIZED DEVICES

This equipment is a pressure containing device

-Do not exceed maximum operating pressure.

-Make sure equipment is depressurized before working on or disassembling it for service.

2. ELECTRICAL

This equipment requires electricity to operate.

–Install equipment in compliance with national and local electrical codes.

–Standard equipment is supplied with NEMA 4 electrical enclosures and is not intended for installation in hazardous environments.

–DISCONNECT POWER SUPPLY TO EQUIPMENT WIHEN PERFORMING ANY ELECTRICAL SERVICE WORK.

A. INSTALLATION

a.1 Before mounting the valve it is essential to check that the solenoid valve model, the voltage (Volt) and the frequency (Hz) correspond to the characteristics required.

B. MECHANICAL PART

b.1 Assembly of the solenoid valve must correspond with the flow directions indicated with an arrow on the valve body.

b.2 If the valves are provided with caps for protecting the connections, make sure they are removed before assembly.

b.3 Care should be taken to prevent foreign bodies from entering the valve during the assembly phase, e.g. material chips, dirt or particles of insulating material such as the PTFE tape from the "external thread" connections.

b.4 Although the valve can be used in any position, the inverted position is not advised since possible impurities could become blocked inside the core tube causing malfunctioning.

b.5 When installing the valve make sure that the position and surrounding space are sufficient to allow for possible future maintenance or replacement of the coil.

b.6 Never use a part of the core tube or the coil itself as a lever during the tightening phase: this could cause irreparable damage to the valve.

b.7 In those installations where impurities, slag or deposits of various types may infiltrate the fluid, it is advisable to mount a filter upstream the valve.

b.8 In case of solenoid valves with holes drilled for supports, use must be made exclusively of these without modifying the holes or anything else on the valve body.

b.9 For solenoid valves with connections to be welded, please refer to paragraph d.4.

C. ELECTRICAL CONNECTIONS

c.1 Before connecting the coil to the supply system, make sure that the characteristics conform to the supply voltage.

c.2 Each coil features two terminals located opposite each other and a ground terminal. The terminals opposite each other are used for energizing the coil and are not polarized. If a plug-in connector is provided the terminals on the connector are marked 1 and 2.

c.3 Where applicable the ground terminal must be connected.

c.4 The coil should not be energized before being installed on the valve since this could cause it to burn out.

c.5 Rotate the coil to the most suitable position, loosening and subsequently tightening the upper nut.

c.6 If the valve body should be subject to condensation or defrosting it is advisable to add a moistureproof O Ring as illustrated in our catalogue.

D. WORKING TEMPERATURE

d.1 It is normal for the coil temperature to increase during operation; irregular overheating will cause smoke and a smell of burning. In this case the supply must be immediately isolated.

d.2 Care should be taken not to install the valve near to sources of heat or in environments where there could be a dissipation of the heat produced by the coil.

d.3 For special conditions, e.g. high temperatures or particular safety regulations, please consult our catalogue or our Technical Office.

d.4 Particular attention should be paid to the temperatures when installing valves with connections welded.

d.5 When carrying out welding between the valve connection and the pipe of the system, it is necessary to dismantle the coil and check that the temperature of the valve body does not exceed values of 100 -150°C (200-300° F). The flame should be regulated so that it does not come into contact with the valve. The body of the latter should be cooled by wrapping it in wet cloth. Should it be impossible to carry out these precautions, we suggest dismantling the parts inside the valve.

E. MAINTENANCE

e.1 After disconnecting the supply voltage and discharging the pressure carry out inspection of the valve.

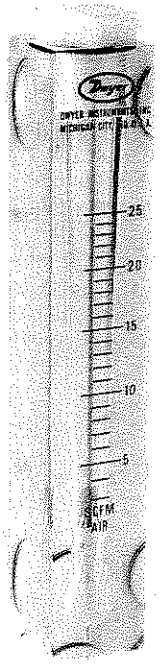
e.2 Clean and inspect all the internal parts and replace them if necessary.

e.3 Remount all the parts making up the solenoid valve with care, paying great attention to the correct position of each part and protecting the sealing surfaces.

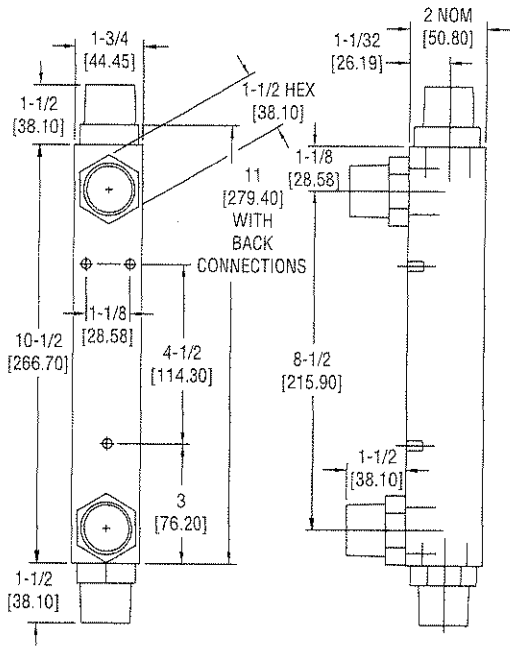
e.4 Check for tightness and correct operation.

VFC Series Visi-Float® Flowmeter

Specifications - Installation and Operating Instructions



Back Connections



Dwyer Series VFC Visi-Float® flowmeters are available in two basic styles, either back or end connected with direct reading scales for air or water. Installation, operation, and maintenance are simple and require only a few common sense precautions to assure long, accurate, trouble-free service.

CALIBRATION

All Dwyer flowmeters are calibrated at the factory and normally will remain within their accuracy tolerance for the life of the device. If at any time you wish to re-check its calibration, do so only with instruments or equipment of certified accuracy. Do not attempt to check the Dwyer Visi-Float® flowmeter with a similar flowmeter as even minor variations in piping and back pressure can cause significant differences between the indicated and actual readings. If in doubt, your Dwyer flowmeter may be returned to the factory and checked for conformance at no charge.

LOCATION

Select a location where the flowmeter can be easily read and where the temperature will not exceed 120°F (49°C). The mounting surface and piping to the flowmeter should be free from vibration which could cause fatigue of fittings or mounting inserts. Piping must be carefully arranged and installed to avoid placing stress on fittings and/or flowmeter body. Avoid locations or applications with strong chlorine atmospheres or solvents such as benzene, acetone, carbon tetrachloride,etc. Damage due to contact with incompatible gases or liquids is not covered by warranty. Compatibility should be carefully determined before placing in service.

SPECIFICATIONS

Service: Compatible gases & liquids.

Wetted Materials:

Body: Acrylic plastic.

O-Ring: Buna-N (Viton® available).

Metal Parts: Stainless steel.

Float: Stainless steel.

Temperature & Pressure Limits: 100 psig (6.9 bar) @ 120°F (48°C).

Accuracy: 2% of full scale.

Process Connection: VFC: 1″ female NPT back connections. End connections optional. VFCII: 1″ male NPT back connections. End Connections optional.

Scale Length: 5″ typical length.

Mounting Orientation: Mount in vertical position.

Weight: 24-25 oz (.68-.71 kg).

PIPING

Inlet Piping:

It is good practice to approach the flowmeter inlet with as few elbows, restrictions and size changes as possible. Inlet piping should be as close to the flowmeter connection size as practical to avoid turbulence which can occur with drastic size changes. The length of inlet piping has little effect on normal pressure fed flowmeters.

For vacuum service, the inlet piping should be as short and open as possible to allow operation at or near atmospheric pressure and maintain the accuracy of the device. Note that for vacuum service, any flow control valve used must be installed on the discharge side of the flowmeter.

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e-mail: info@dwyer-inst.com

Discharge Piping
Piping on the discharge side should be at least as large as the flowmeter connection. For pressure fed flowmeters on air or gas service, the piping should be as short and open as possible. This allows operation at or near atmospheric pressure and assures the accuracy of the device. This is less important on water or liquid flowmeters since the flowing medium is generally incompressible and back pressure will not affect the calibration of the instrument.

POSITION AND MOUNTING
All Visi-Float® flowmeters must be installed in a vertical position with the inlet connection at the bottom and outlet at the top.

Surface Mounting
Drill three holes in panel using dimensions shown in drawing. Holes should be large enough to accommodate #10 - 32 machine screws. If back connected model, drill two additional holes for clearance of fittings. Install mounting screws of appropriate length from rear. Mounting screws must not be longer than the panel thickness plus 3/16" (9.66 mm), or the screw will hit the plastic and may damage the meter. The screws will require additional force during the initial installation, since the insert boots are of a collapsed thread type and must be expanded into the plastic for the knurled surface to take hold. Insert boots will not have the proper 10-32 threads until the first screw has been inserted to expand the boot. Attach piping using RTV silicone sealant or Teflon® tape on threads to prevent leakage.

CAUTION: Do not overtighten fittings or piping into fittings. Maximum recommended torque is 10 ft. (lbs) (13.56 newton (meter)). Hand tighten only.

In Line Mounting
Both end connected and back connected models may be installed in-line supported only by the piping. Be sure that flowmeter is in a vertical position and that piping does not create excess stress or loading on the flowmeter fittings.

OPERATION
Once all connections are complete, introduce flow as slowly as possible to avoid possible damage. With liquids, make sure all air has been purged before taking readings. Once the float has stabilized, read flow rate by sighting across the largest diameter of the float to the scale graduations on the face of the device.

The standard technique for reading a Variable Area Flowmeter is to locate the highest point of greatest diameter on the float, and then align that with the theoretical center of the scale graduation. In the event that the float is not aligned with a grad, an extrapolation of the float location must be made by the operator as to its location between the two closest grads. The following are some sample floats shown with reference to the proper location to read the float.

Variable Area Flowmeters used for gases are typically labeled with the prefix "S" or "N", which represents "Standard" for English units or "Normal" for metric units. Use of this prefix designates that the flowmeter is calibrated to operate at a specific set of conditions, and deviation from those standard conditions will require correction for the calibration to be valid. In practice, the reading taken from the flowmeter scale must be corrected back to standard conditions to be used with the scale units. The correct location to measure the actual pressure and temperature is at the exit of the flowmeter, except under vacuum applications where they should be measured at the flowmeter inlet. The equation to correct for nonstandard operating conditions is as follows:

$$Q_2 = Q_1 \times \sqrt{\frac{P_1 \times T_2}{P_2 \times T_1}}$$

Where: Q_1 = Actual or Observed Flowmeter Reading
Q_2 = Standard Flow Corrected for Pressure and Temperature
P_1 = Actual Pressure (14.7 psia + Gage Pressure)
P_2 = Standard Pressure (14.7 psia, which is 0 psig)
T_1 = Actual Temperature (460 R + Temp °F)
T_2 = Standard Temperature (530 R, which is 70°F)

Example: A flowmeter with a scale of 10-100 SCFH Air. The float is sitting at the 60 grad on the flowmeter scale. Actual Pressure is measured at the exit of the meter as 5 psig. Actual Temperature is measured at the exit of the meter as 85°F.

$$Q_2 = 60.0 \times \sqrt{\frac{(14.7 + 5) \times 530}{14.7 \times (460 + 85)}}$$

Q_2 = 68.5 SCFH Air

MAINTENANCE
The only maintenance normally required is occasional cleaning to assure proper operation and good float visibility.

Disassembly
The flowmeter can be completely disassembled by removing the connection fittings and top plug. When lifting out the float guide assembly, be careful not to lose the short pieces of plastic tubing on each end of the guide rod which serve as float stops.

Cleaning
The flowmeter body and all other parts can be cleaned by washing in a mild soap and water solution. A soft bristle bottle brush will simplify cleaning of the flow tube. Avoid benzene, acetone, carbon tetrachloride, gasoline, alkaline detergents, caustic soda, liquid soaps, (which may contain chlorinated solvents), etc., and avoid prolonged immersion.

Re-assembly
Install the lower fitting and then the float and float guide. Finally install the upper fitting and plug being certain that both ends of the float guide are properly engaged and the float is correctly oriented. A light coating of silicone stop cock grease or petroleum jelly on the "O" rings will help maintain a good seal as well as ease assembly.

ADDITIONAL INFORMATION
For additional flowmeter application information, conversion curves, correction factors and other data covering the entire line of Dwyer flowmeters, please request a dwyer full-line catalog.

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DWYER INSTRUMENTS, INC.
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e-mail: info@dwyer-inst.com

3989K

Bimetal Thermometers
All Stainless Steel Construction
Back Connection Without External Reset
Type TI.20

Thermometers

Application
Industrial type design for fluid medium which does not corrode 304 stainless steel.

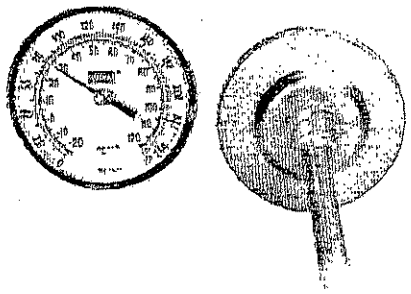
Size
2" (50.8 mm) - Type TI.20

Accuracy
±1.0% full scale value (ASME B40.3)

Min. / Max. Ranges
-100°F to 1000°F (and equivalent Celsius)

Working Range
Steady: full scale value
Short time: 110% of full scale value

Under / Over Range Protection
Temporary over or under range tolerance of 50% of scale up to 500°F (260°C). For ranges above 500°F, maximum over range is 800°F; continous, 1000°F intermittent.



STANDARD RANGES

Fahrenheit	Dual Scale F & C	Celsius
Single Scale	F Outer, C Inner	Single Scale
-100/150 F	-100/150 F & -70/70 C	-50/50 C
-40/120 F	-40/120 F & -40/50 C	-20/120 C
0/140 F	0/140 F & -20/60 C	0/50 C
0/200 F	0/200 F & -15/90 C	0/100 C
0/250 F	0/250 F & -20/120 C	0/150 C
20/240 F	20/240 F & -5/115 C	0/200 C
25/125 F	25/125 F & -5/50 C[1]	0/250 C
50/300 F	50/300 F & 10/150 C	0/300 C
50/400 F	50/400 F & 10/200 C	0/450 C[1]
50/550 F	50/500 F & 10/260 C	100/550 C[1]
150/750 F	150/750 F & 65/400 C	
200/1000 F[1]	200/1000 F & 100/540 C[1]	

[1]Not recommended for continous service over 800°F (425°C)

Standard Features

Connection
Material: 304 stainless steel
Center back mount (CBM)
¼" NPT

Stem
Material: 304 stainless steel
Diameter: ¼" (6.35 mm)
Length: 2 ½" to 24" (63.5 mm to 609.6 mm)

Measuring Element
Bi-metal helix

Case
Material: 304 stainless steel
Hermetically sealed per ASME B40.3 standard

Dial
White aluminum, dished, with black markings

Pointer
Black aluminum

Standard Scales
Single: Fahrenheit or Celsius
Dual: Fahrenheit (outer) and Celsius (inner)

Window
Flat instrument glass

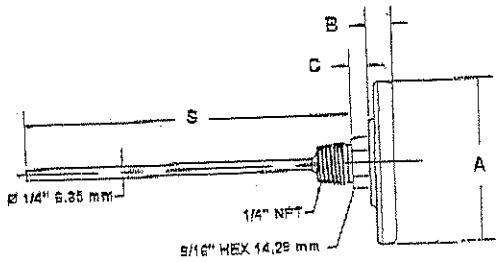
Weight
2" - 5 oz.
Add 1 oz. for every 2" of stem length

Dampening
Viscous silicone to minimize pointer oscillation (ranges below 400°F)

Order Options (min. order may apply)
Special scales and dial markings
Acrylic windows
Calibration certification traceable to NIST

Dimensions:

Type TI.20



WIKA TYPE	DIAL SIZE	A	B	C	S (Stem Length)
20	2" (50.8 mm)	2- 1/16" (52.4 mm)	7/16" (11.1 mm)	1/4" (6.4 mm)	As specified

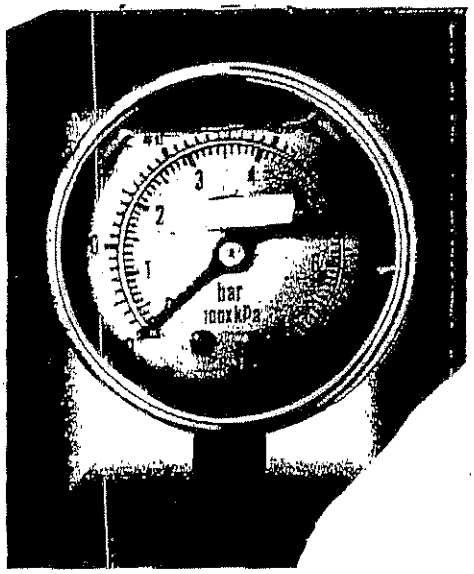
Note: Thermowells for temperature instruments are recommended for all process systems where pressure, velocity, or viscous, abrasive and corrosive materials are present individually or in combination. A properly selected thermowell protects the temperature instrument from possible damage resulting from these process variables. Furthermore, a thermowell permits removal of the temperature instrument for replacement, repair or testing without effecting the process media or the system.

STEM LENGTH
2½" (63.5 mm)
4" (101.6 mm)
6" (152.4 mm)
9" (228.6 mm)
12" (304.8 mm)
15" (381.0 mm)
18" (457.2 mm)
24" (609.6 mm)

LIQUID FILLED GAUGES

LIQUID FILLED SERIES #400
STAINLESS STEEL CASE
1½", 2", 2½" and 4" Gauges

This series is designed for use with air, gas, oil and water or any medium not corrosive to brass or bronze. Liquid filled gauges are recommended for reducing shock waves caused by pressure or vibration fluctuations.



1½", 2", 2½" and 4" SIZES

STANDARD FEATURES:

MOVEMENT: Brass.

BOURDON TUBE: C Shaped in phosphor bronze up to 600 psi and Helical above 600 psi.

POINTER: Black enamelled aluminum.

DIAL: White aluminum.

WINDOW: Polycarbonate. (Temperature compensating)

LIQUID FILL: Glycerin.

CONNECTION: 1/8 NPT male standard on 1½" size. 1/4 NPT male connection at bottom, or back of case on 2", 2½" and 4" sizes.

ACCURACY: ASME/ANSI B40.1 Grade A (2-1-2%)

** Additional options available as noted on next page.*

➪ ***Standard gauge scales, outer scale is PSI, inner scale is metric (kPa & Bar).***

➪ ***FD - Available Dry***

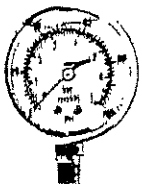
STANDARD RANGES:

STANDARD DIAL RANGES AND CORRESPONDING RANGE IN BAR		AVAILABLE RANGES FOR SIZES: 1½"	2"	2½" and 4"	MAJOR (psi)	MINOR (psi)	ORDER CODE	STANDARD DIAL RANGES AND CORRESPONDING RANGE IN BAR		AVAILABLE RANGES FOR SIZES: 1½"	2"	2½" and 4"	MAJOR (psi)	MINOR (psi)	ORDER CODE
0-30" VAC.	-1 bar	✔	✔	✔	5	.5	VAC	0-200 psi	0-14 bar	✔	✔	✔	50	5	200
30"-0-15 psi	-1-0-1 bar	✔	✔	✔	5	.5	3015	0-300 psi	0-20 bar	✔	✔	✔	50	5	300
30"-0-30 psi	-1-0-2 bar	✔	✔	✔	10	1	3030	0-400 psi	0-25 bar	✔	✔	✔	100	10	400
30"-0-60 psi	-1-0-4 bar	✔	✔	✔	10	1	3060	0-600 psi	0-40 bar	✔	✔	✔	100	10	600
30"-0-100 psi	-1-0-7 bar	✔	✔	✔	20	2	30100	0-1000 psi	0-70 bar	✔	✔	✔	200	20	1000
30"-0-150 psi	-1-0-10 bar	✔	✔	✔	20	2	30150	0-1500 psi	0-100 bar	✔	✔	✔	200	20	1500
30"-0-200 psi	-1-0-14 bar	✔	✔	✔	40	4	30200	0-2000 psi	0-140 bar	✔	✔	✔	500	50	2000
30"-0-300 psi	-1-0-20 bar	✔	✔	✔	50	5	30300	0-3000 psi	0-200 bar	✔	✔	✔	500	50	3000
0-15 psi	0-1 bar	✔	✔	✔	2	.2	15	0-5000 psi	0-315 bar	✔	✔	✔	1000	100	5000
0-30 psi	0-2 bar	✔	✔	✔	5	.5	30	0-6000 psi	0-400 bar			✔	1000	100	6000
0-60 psi	0-4 bar	✔	✔	✔	10	1	60	0-10000 psi	0-700 bar			✔	2000	200	10000
0-100 psi	0-7 bar	✔	✔	✔	20	2	100	0-15000 psi	0-1000 bar			✔	2000	200	15000
0-160 psi	0-11 bar	✔	✔	✔	20	2	160								

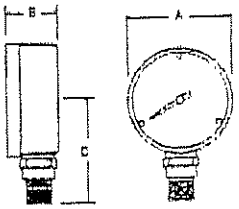
❒ AVAILABLE CASE STYLES AND DIMENSIONS:

STYLE L

304 Stainless Steel Case, Bottom Connection

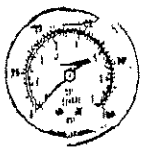


DIMENSIONS



STYLE B

304 Stainless Steel Case Back Connection



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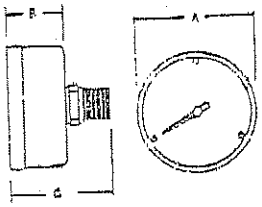
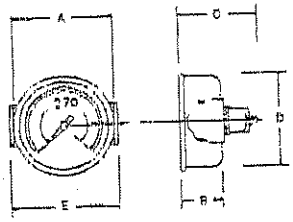


STYLE U

304 Stainless Steel Case, Back Connection with U-Clamp

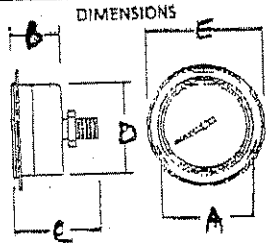
DIMENSIONS



STYLE F

304 Stainless Steel Case, Back Connection, Front Flange with Three Mounting Holes

DIMENSIONS



SIZE	STYLE:	A	B	C	D	E	SIZE	STYLE:	A	B	C	D	E
1½"	L	1-47/64"	1-1/32"	1-1/2"	N/A	N/A	2½"	L	2-41/64"	1-7/64"	2-3/32"	N/A	N/A
1½"	B	1-47/64"	1-1/32"	1-47/64"	N/A	N/A	2½"	B	2-41/64"	1-7/64"	1-57/64"	N/A	N/A
1½"	U	1-47/64"	1-1/32"	1-47/64"	1-37/64"	1-55/64"	2½"	U	2-41/64"	1-7/64"	1-57/64"	2-1/2"	1-7/64"
1½"	F	1-47/64"	1-1/32"	1-47/64"	1-37/64"	2-13/32"	2½"	F	2-41/64"	1-7/64"	1-57/64"	2-1/2"	2-9/32"
2"	L	2-1/8"	1-1/16"	1-47/64"	N/A	N/A	4"	L	4-3/32"	1-17/64"	2-7/8"	N/A	N/A
2"	B	2-1/8"	1-1/16"	1-57/64"	N/A	N/A	4"	B	4-3/32"	1-17/64"	2-1/8"	N/A	N/A
2"	U	2-1/8"	1-1/16"	1-57/64"	1-31/32"	2-9/32"	4"	U	4-3/32"	1-17/64"	2-1/8"	4"	4-13/64"
2"	F	2-1/8"	1-1/16"	1-57/64"	1-31/32"	2-3/4"	4"	F	4-3/32"	1-17/64"	2-1/8"	4"	5-19/64"

❒ TO ORDER:

Additional options – To order please specify option.

Description:	Option:
Covers	Rubber Case Cover
Connection	Reduce connection from 1/4 NPT to 1/8 NPT
Dial	Special Art Work or Logo
Pointer	Maximum Pointer (Dry Only)
Window	Glass (Dry Only)
Accuracy	Certification

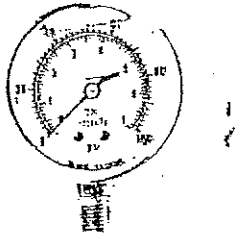
Ordering Number - Construct by selecting one item from each of the columns below:

1	Dial Size:	2	Series Number:	3	Fill Option:	4	Connection Size:	5	Type Connection:	6	Range Code:
	15 = 1½" 20 = 2" 25 = 2½" 40 = 4" Example: 25400FG02L100		= 400		FG = GLYCERIN FS = SILICONE FD = DRY		01=1/8 NPT 02=1/4 NPT		L=BOTTOM B=BACK U=U-CLAMP F=FRONT FLANGE		See standard range chart for code.
	25		400		FG		02		L		100

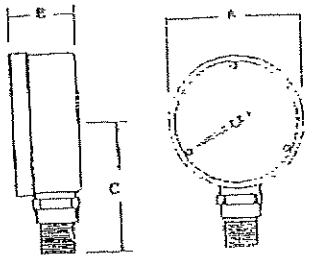
❒ AVAILABLE CASE STYLES AND DIMENSIONS:

STYLE L

304 Stainless Steel Case, Bottom Connection

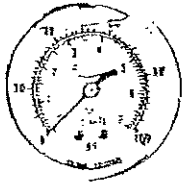


DIMENSIONS

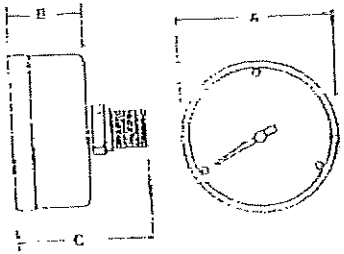


STYLE B

304 Stainless Steel Case, Back Connection

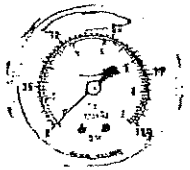


DIMENSIONS

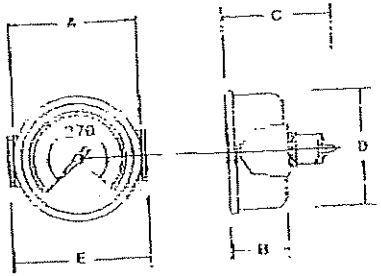


STYLE U

304 Stainless Steel Case, Back Connection with U-Clamp

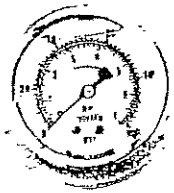


DIMENSIONS

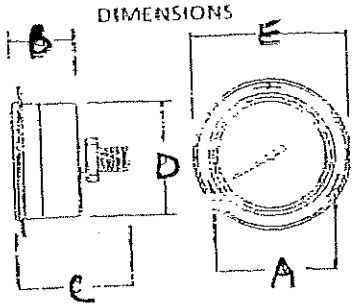


STYLE F

304 Stainless Steel Case, Back Connection, Front Flange with Three Mounting Holes



DIMENSIONS



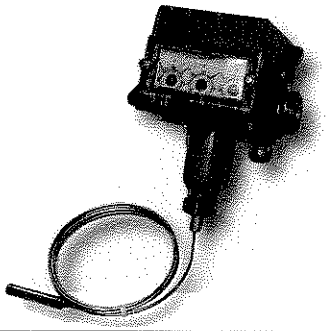
SIZE	STYLE:	A	B	C	D	E
1½"	L	1-47/64"	1-1/32"	1-1/2"	N/A	N/A
1½"	B	1-47/64"	1-1/32"	1-47/64"	N/A	N/A
1½"	U	1-47/64"	1-1/32"	1-47/64"	1-37/64"	1-55/64"
1½"	F	1-47/64"	1-1/32"	1-47/64"	1-37/64"	2-13/32"
2"	L	2-1/8"	1-1/16"	1-47/64"	N/A	N/A
2"	B	2-1/8"	1-1/16"	1-57/64"	N/A	N/A
2"	U	2-1/8"	1-1/16"	1-57/64"	1-31/32"	2-9/32"
2"	F	2-1/8"	1-1/16"	1-57/64"	1-31/32"	2-3/4"

SIZE	STYLE:	A	B	C	D	E
2½"	L	2-41/64"	1-7/64"	2-3/32"	N/A	N/A
2½"	B	2-41/64"	1-7/64"	1-57/64"	N/A	N/A
2½"	U	2-41/64"	1-7/64"	1-57/64"	2-1/2"	1-7/64"
2½"	F	2-41/64"	1-7/64"	1-57/64"	2-1/2"	2-9/32"
4"	L	4-3/32"	1-17/64"	2-7/8"	N/A	N/A
4"	B	4-3/32"	1-17/64"	2-1/8"	N/A	N/A
4"	U	4-3/32"	1-17/64"	2-1/8"	4"	4-13/64"
4"	F	4-3/32"	1-17/64"	2-1/8"	4"	5-19/64"

❒ TO ORDER:

Additional options – To order please specify option

Description: Option:



400 Series Temperature Controls

Types: B400, B402, B403, C400, C402,C403, E400, E402, E403, F400, F402, F403

UNITED ELECTRIC CONTROLS

Installation and Maintenance Instructions

Please read all instructional literature carefully and thoroughly before starting. Refer to the final page for the listing of Recommended Practices, Liabilities and Warranties.

GENERAL

Types B & C (Immersion Stem)
Temperature variations are sensed by a liquid filled sensor which expands or contracts against a bellow which in turn actuates or deactuates one, two or three snap-action switches at a predetermined set point(s). Set points are adjusted by turning an internal calibrated pointer and dial (B type) or internal adjustment screw (C type).

Type E & F (Bulb & Capillary)
Temperature variations of a liquid filled sensing bulb are hydraulically transmitted to a bellow which either actuates or deactuates one, two, or three snap-acting switches at a pre-determined set point(s). Set points are adjusted by turning an internal calibrated pointer and dial (E type) or internal adjustment screw (F type).

PART I - Installation

Tools Needed
Screwdriver
Hammer
Adjustable wrench

MOUNTING

INSTALL UNIT WHERE SHOCK, VIBRATION AND TEMPERATURE FLUCTUATIONS ARE MINIMAL. ORIENT UNIT SO THAT MOISTURE IS PREVENTED FROM ENTERING THE ENCLOSURE. DO NOT MOUNT UNIT IN AMBIENT TEMPERATURES EXCEEDING PUBLISHED LIMITS.

400 Series temperature controls can be mounted in any position, provided the electrical conduit is not facing up. The preferred mounting position is vertical (temperature connection down).

A 3/4" NPT E/C is provided on the right of the enclosure in addition to the two (2) cast-in knockouts for 1/2" electrical conduit that are located on the left side and rear of the enclosure. These can easily be knocked out by placing the blade of a screwdriver in the groove and tapping sharply with a hammer.

Mount the unit via the (2) 1/4" screw clearance holes on the enclosure (see dimensions). Units may also be mounted via the NPT on the immersion stem.

ALWAYS HOLD A WRENCH ON THE IMMERSION STEM HEX WHEN MOUNTING UNIT. DO NOT TIGHTEN BY TURNING ENCLOSURE. THIS WILL DAMAGE SENSOR AND WEAKEN SOLDERED OR WELDED JOINTS.

For remote mounting, fully immerse the bulb and 6" of capillary in the control zone. For best control, it is generally desirable to place the bulb close to the heating or cooling source in order to sense temperature fluctuations quickly. Be sure to locate the bulb so that it will not be exposed to temperatures beyond the instruments range limits.

WIRING

DISCONNECT ALL SUPPLY CIRCUITS BEFORE WIRING UNIT. WIRE UNITS ACCORDING TO NATIONAL AND LOCAL ELECTRICAL CODES. MAXIMUM RECOMMENDED WIRE SIZE IS 14 AWG. THE RECOMMENDED TIGHTENING TORQUE FOR FIELD WIRING TERMINALS IS 7 TO 17 IN-LBS.

ELECTRICAL RATINGS STATED IN LITERATURE AND ON NAMEPLATE SHOULD NEVER BE EXCEEDED. OVER-LOAD ON A SWITCH CAN CAUSE FAILURE ON THE FIRST CYCLE.

Connect conduit to the case and wire directly to the switch terminals according to local and national electrical codes. Bring the wires up to terminals from the rear of the case. (See Figure 1.) If manual reset switch or DPDT options are used, lead wires are supplied, color coded as follows:

	Switch 1	Switch 2
Common	Violet	Yellow
Normally Open	Blue	Orange
Normally Closed	Black	Red

ALLOW ENOUGH SLACK SO AS NOT TO AFFECT SWITCH MOVEMENT WHEN MAKING SETTING ADJUSTMENTS AND ENSURE THAT THE WIRES ARE NOT TOUCHING THE COVER WHEN INSTALLED.

NOTE: For larger wire gauges, a one time shift may be experienced or expected due to space limitations within the enclosure. Verify setpoint after installation.

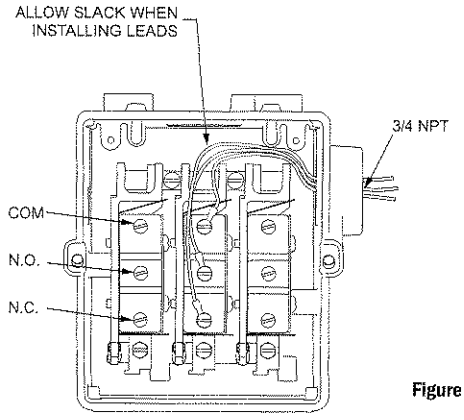


Figure 1

NOTE: The middle switch assembly is omitted for dual switch controllers. The outer two switch assemblies are omitted for single switch controllers. Type "C" and "F" controls have internal hex screw adjustments and type "B" and "E" have cam assemblies for internal calibrated adjustments, via a reference dial.

Types with Terminal Block (Option M100)

Types with Terminal Block option M100, only available with single and dual switches. Not available with all options.

PART II - Adjustments

Tools Needed
Screwdriver

NOTE: For set point adjustments and re-calibration, insert bulb or immersion stem into a calibrated temperature bath. Allow temperature to stabilize for 10 minutes.

Type C400 & F400

Remove cover. Switch has screw adjustments inside enclosure. If switch transfer point differs from actual temperature, adjust setting. To RAISE the temperature setting turn the screw IN (clockwise) and to LOWER the setting turn the screw OUT (counter clockwise). When making adjustments, do not exceed the maximum temperature rating on nameplate (see Figure 2).

Types C402, C403, F402 & F403

Remove cover. Follow same procedure as paragraph above. Switches may be set together or apart, up to 100% of range scales. On dual switch models, either switch may be set high. On triple switch models, the third (middle) switch has no over-travel mechanism and must always be set to the highest temperature when switches are set apart. Altering the setting of one switch will usually have little effect on the other(s), however re-adjustment may be desired at a critical temperature setting (see Figure 2).

Types B400, B402, B403, E400, E402 & E403

Controls are factory calibrated for maximum accuracy at the dial midpoint. Switches may be set together or apart up to 100% of the range scale. On dual switch models either switch may be set high. On triple switch models, the third (middle) switch has no over-travel mechanism and must always be set to the highest temperature when the switches are set apart. Altering the setting of one switch will usually have little effect on the other(s), however re-calibration may be desired at a critical setting.

To re-calibrate, turn pointer to desired set point. If the actual temperature and set point temperature do not agree, turn zero adjustment screw clockwise to raise and counter clockwise to lower set temperature setting (See Figure 2)

Types With Manual Reset (Option 1530)

These optional models incorporate a snap switch that, when actuated, remains tripped until temperature decreases and the reset button is manually depressed to the reset position. On multi-switch units, this switch must be set to the highest setting.

Re-Calibration Adjustment

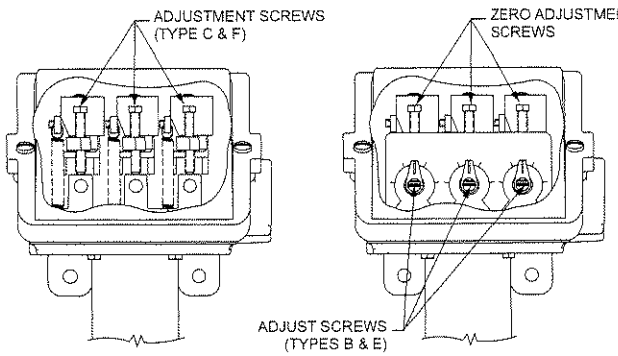
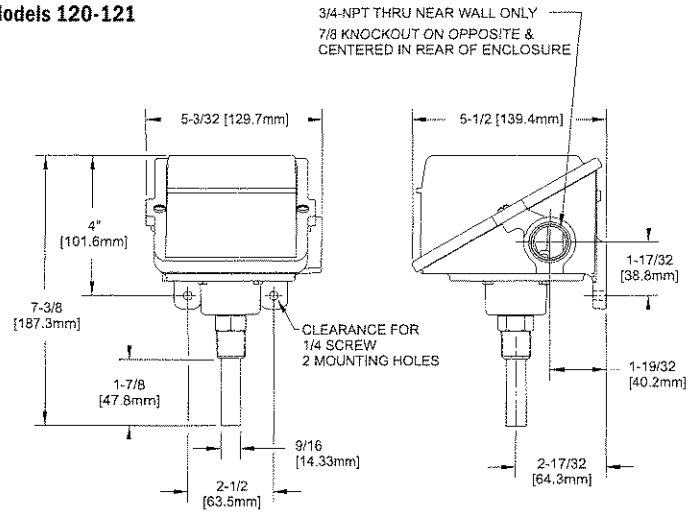


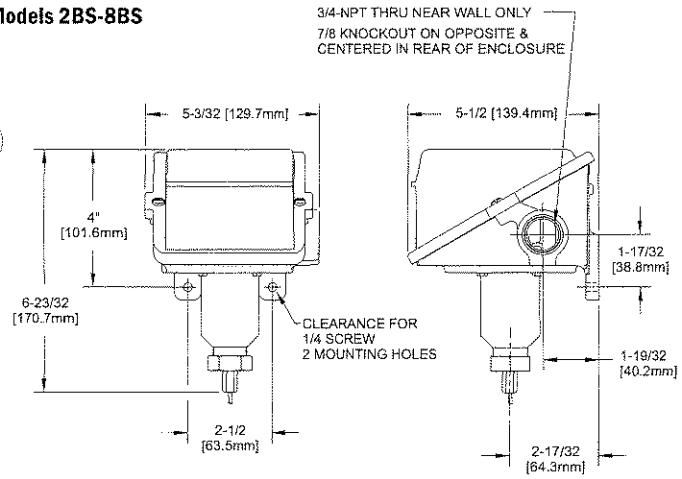
Figure 2

Dimensional Drawings

Models 120-121



Models 2BS-8BS



RECOMMENDED PRACTICES AND WARNINGS

United Electric Controls Company recommends careful consideration of the following factors when specifying and installing UE pressure and temperature units. Before installing a unit, the Installation and Maintenance instructions provided with unit must be read and understood.

- To avoid damaging unit, proof pressure and maximum temperature limits stated in literature and on nameplates must never be exceeded, even by surges in the system. Operation of the unit up to maximum pressure or temperature is acceptable on a limited basis (e.g., start-up, testing) but continuous operation must be restricted to the designated adjustable range. Excessive cycling at maximum pressure or temperature limits could reduce sensor life.
- A back-up unit is necessary for applications where damage to a primary unit could endanger life, limb or property. A high or low limit switch is necessary for applications where a dangerous runaway condition could result.
- The adjustable range must be selected so that incorrect, inadvertent or malicious setting at any range point cannot result in an unsafe system condition.
- Install unit where shock, vibration and ambient temperature fluctuations will not damage unit or affect operation. When applicable, orient unit so that moisture does not enter the enclosure via the electrical connection. When appropriate, this entry point should be sealed to prevent moisture entry.
- Unit must not be altered or modified after shipment. Consult UE if modification is necessary.
- Monitor operation to observe warning signs of possible damage to unit, such as drift in set point or faulty display. Check unit immediately.
- Preventative maintenance and periodic testing is necessary for critical applications where damage could endanger property or personnel.
- Electrical ratings stated in literature and on nameplate must not be exceeded. Overload on a switch can cause damage, even on the first cycle. Wire unit according to local and national electrical codes, using wire size recommended in installation sheet.
- Do not mount unit in ambient temp. exceeding published limits.

LIMITED WARRANTY

Seller warrants that the product hereby purchased is, upon delivery, free from defects in material and workmanship and that any such product which is found to be defective in such workmanship or material will be repaired or replaced by Seller (Ex-works, Factory, Watertown, Massachusetts. INCOTERMS); provided, however, that this warranty applies only to equipment found to be so defective within a period of 24 months from the date of manufacture by the Seller. Seller shall not be obligated under this warranty for alleged defects which examination discloses are due to tampering, misuse, neglect, improper storage, and in any case where products are disassembled by anyone other than authorized Seller's representatives. EXCEPT FOR THE LIMITED WARRANTY OF REPAIR AND REPLACEMENT STATED ABOVE, SELLER DISCLAIMS ALL WARRANTIES WHATSOEVER WITH RESPECT TO THE PRODUCT, INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

LIMITATION OF SELLER'S LIABILITY

Seller's liability to Buyer for any loss or claim, including liability incurred in connection with (i) breach of any warranty whatsoever, expressed or implied, (ii) a breach of contract, (iii) a negligent act or acts (or negligent failure to act) committed by Seller, or (iv) an act for which strict liability will be inputted to seller, is limited to the "limited warranty" of repair and/or replacement as so stated in our warranty of product. In no event shall the Seller be liable for any special, indirect, consequential or other damages of a like general nature, including, without limitation, loss of profits or production, or loss or expenses of any nature incurred by the buyer or any third party.

UE specifications subject to change without notice.

UNITED ELECTRIC CONTROLS

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Watertown, MA 02471-9143 USA
Telephone: 617 926-1000 Fax: 617 926-2568
http://www.ueonline.com

Orbit® WaterMaster®

Installation Manual / User's Manual
Sprinkler Controllers by Orbit®

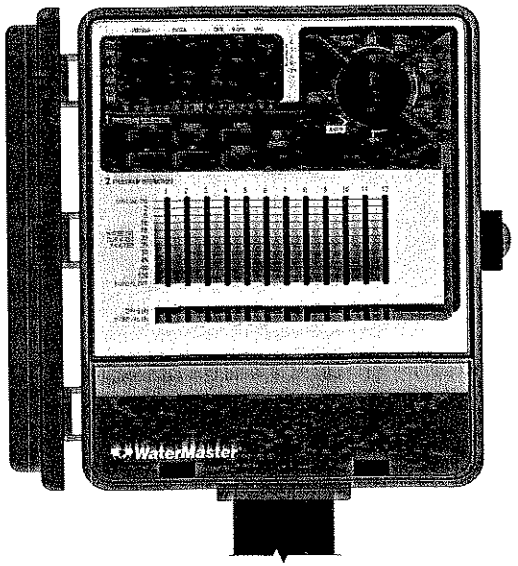
Manuel d'installation / Manuel d'utilisation
Programmateurs d'arrosage par Orbit®

Manual de Instalación / Manual del usuario
Controladores para sistemas de aspersión Orbit®

Manuale d'installazione / Manuale d'uso
Programmatore per irrigazione Orbit®

Installationshandbuch / Benutzerhandbuch
Orbit® Controller für Bewässerungssysteme

Manuel d'installation / Manuel d'utilisation
Programmateurs d'arrosage par Orbit®



MODELS

57004, 57006, 57008, 57122, 57254, 57256, 57258, 57252, 57606, 57012, 57344, 57346, 57348, 57342, 94028, 94002, 94004, 94006, 94008, 91024, 91026, 91028, 91016, 91012, 94022, 94024, 94026,

WT 7/8 versions

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section 1

Introduction

Thank you for selecting an Orbit® sprinkler controller. Orbit® designers have combined the simplicity of mechanical switches with the accuracy of digital electronics to give you a controller that is both easy to program and extremely versatile. The Orbit® controller provides convenience and flexibility, letting you run a fully automatic, semi-automatic, or a manual watering program for all your watering needs.

Please read this manual completely before you begin to program and use the controller. A few of the most notable design features include:

At-a-Glance Simplicity
By turning the rotary dial to one of seven settings you can review programming or easily make changes.

Arm Chair Programmable
By inserting two AA alkaline batteries you can program the controller prior to installing it in its permanent location.

Automatic Electronic Circuit Breaker w/Fail Safe
An electronic circuit breaker protects the controller's power supply. If the circuit breaker trips, it will reset automatically. In most cases, there is no loss of data or watering cycles.

Smart-Scan® Diagnostic Fault Sensing
A diagnostic fault sensor skips over any station that has a short in the solenoid or wiring. If the controller senses a short in a station, it skips the faulty station and moves on to the next programmed station. The controller displays FAULTY and identifies the faulty station number.

Pump Start or Master Valve Connection
If a pump will be included in the sprinkler system, a terminal is provided to send a signal to the relay to activate the pump (note section on pump connection in the *Installation Manual*). This terminal will also activate a master valve.

Language Overlays
Available in Spanish, French, Italian, German and English.

1. Digital Display
An extra large LCD (Liquid Crystal Display) shows the time of day and indicates many of the programming settings. The display is completely interactive with all other controls.

2. Programming Buttons
The controller has seven push buttons for setup and program entry. Working in conjunction with the rotary dial, the buttons are used to set the time of day, watering time, watering days, start times, and other functions.

3. Duration Slide Switches
The vertical slide switches set the number of minutes a station is on when the controller is operated in automatic mode. The slide switches also set any individual station to always on, always off, or on with duration when the controller is operated in manual mode.

4. Program Slide Switches
The program slide switches assign each station to one of three programs: Program A (14 day cycle), Program B (interval cycle), or Programs A and B combined.

5. Rotary Selector Dial
The heart of the controller is the rotary selector dial. This dial makes it easy to see which function is currently selected and/or in which mode the controller is set to operate.

6. Reset Button
The reset button clears all your programming but does not remove the factory installed fail-safe program. To prevent an accidental reset, the button is recessed into the panel and must be pressed with a small pointed object such as a pen or pencil tip.

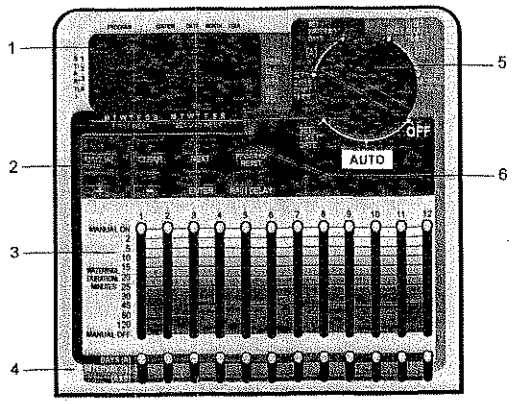


FIGURE 1: Features of the Controller

Notable Programming Features

Two Watering Programs—Summary

The controller gives you the option of using any or all of these independent programs. Note that each station can independently be set to either A or B or both A and B programs.

Program A—Days

Any or all days in a two week schedule can be set to water. This program lets you schedule selected stations to water on specific days of the first and second weeks. At the end of the two weeks, Program A repeats continuously.

Program B—Interval, Odd, Even

Provides two options: One for odd or even day watering and another for an interval ranging from every day to every 28th day. This feature is designed to meet the growing needs and restrictions imposed by local governments and to conserve water.

The controller automatically calculates odd and even days (by date) for each month and makes adjustments for leap years to provide true odd and even watering. An interval of "1" will water every day, an interval of "2" will water every other day, and so on.

Program A+B—Combined

This setting allows the stations to water under a combination of the A and B programs. This feature is especially useful for new grass (for watering up to 8 times per day) and allows greater flexibility in scheduling watering. If both the A and B programs are scheduled to water on a specific day, the station will water multiple times per day.

Start-Time Stacking

The controller has the intelligence to "stack" start times that might overlap. If you enter two or more start times that overlap (in the same or in different programs), the controller will not activate two stations at the same time. Instead, the controller activates the first program cycle and then activates the next program cycle(s) in sequence after the first program finishes its preset watering duration.

The controller will not stack to the next calendar day. This prevents the controller from violating an odd or even day watering schedule.

Manual and Semi-Automatic Modes

The controller gives you a number of manual and semi-automatic modes for flexibility in watering. You can override the controller's automatic programming in a variety of ways.

User-Selectable Rain Delay

Unique watering delay button cancels program for 24, 48, or 72 hours (user-selectable), then resumes automatically.

Getting Started

Programming the controller can be accomplished in just a few basic steps. Before you begin programming, it is important to install the batteries, set the time of day and date, and determine a watering plan.

Install the Batteries

The controller requires two AA alkaline batteries to keep the program in memory in case of AC power loss. In a typical installation, fully charged batteries should provide sufficient power for approximately one year of protection. Therefore, we recommend changing the batteries annually.

- Remove the battery cover by sliding it to the left.
- Insert two AA alkaline batteries into the battery compartment.
- Return the battery cover to its closed position.

Weak or missing batteries can cause the time, date, and program to be erased after a power failure. If this happens, you will need to install fully charged batteries and reprogram the controller.

Note: *Batteries alone will not operate the valves in your sprinkling system. The 24-volt transformer must be plugged in and have power to operate your system normally.*

Set the Time of Day and Date

If this is the first time the controller has been programmed, you should press the small recessed button labeled **RESET.** Pressing **RESET** does not affect the factory installed fail-safe program **[See Figure 2].**

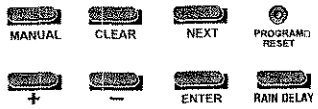


FIGURE 2: Programming Keys

Do not press the **RESET** button again unless you want to completely remove all your programming.

- Turn the rotary dial to the **SET TIME/DATE** position.
- **12:00 AM** will appear in the display with three arrows pointing to the year, month, and day.
- Press and hold the **+** button to advance the clock to the correct time of day. Use the **–** button to go in reverse **[See Figure 3].** When the correct time of day is reached, press the **ENTER** button to lock in the time.

To increase or decrease more rapidly, hold down either the + or – buttons until the display goes into rapid advance mode.

- A cursor will appear below the arrow for the year, month, and date when programming [**See Figure 4**].
- Use the + and – buttons to set the correct year, then press **ENTER.**
- Use the + and – buttons to set the correct month, then press **ENTER.**
- Use the + and – buttons to set the correct day of the week, then press **ENTER.**

The display will show the correct time and day of the week.

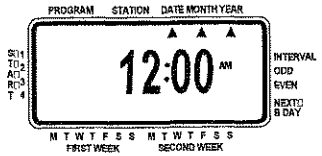


FIGURE 3: LCD Display with Surrounding Information

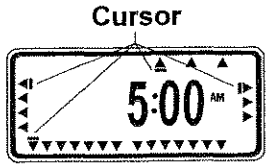


FIGURE 4: LCD Display with Cursors Showing

After the time of day, date, and year are set, this procedure does not need to be entered again for any other programming.

Caution: *If a watering schedule is not entered into the controller, the factory installed fail-safe program will turn on each station every day for 10 minutes. To avoid accidental station activation, either turn the rotary switch to* **OFF** *or enter a watering schedule.*

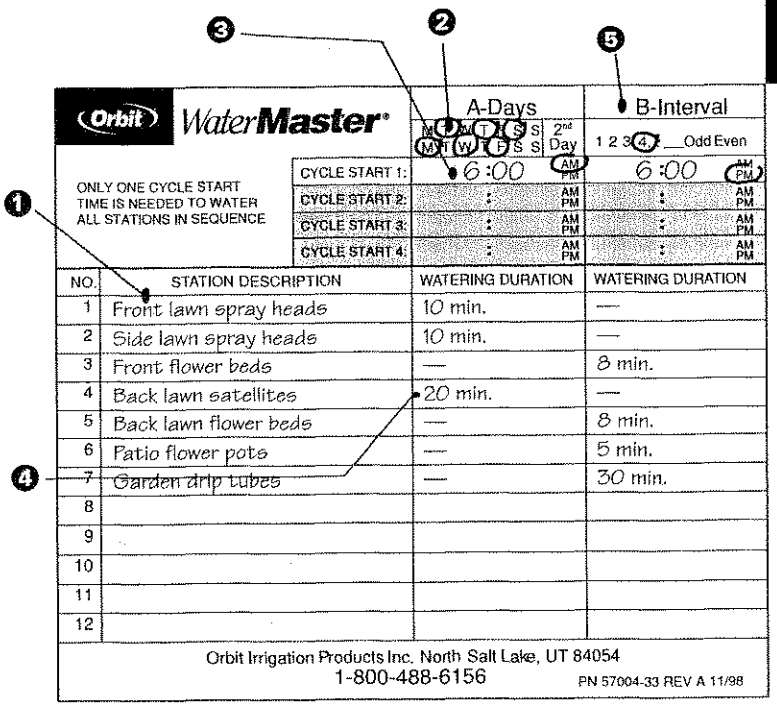
Determine a Watering Plan

To help you visualize how best to program the controller, it might be helpful to make a watering plan on paper. This will help you establish which days and times you want to water.

Use the sticker inside the controller door to help determine and record your watering plan.

Sample Watering Plan

Before programming the controller, we suggest that you fill out the watering plan sticker inside the door. Below is a sample watering plan for your reference.



Orbit WaterMaster®

ONLY ONE CYCLE START TIME IS NEEDED TO WATER ALL STATIONS IN SEQUENCE

	A-Days (M T W T F S S, 2nd Day)	B-Interval (1 2 3 4 __ Odd Even)
CYCLE START 1:	6:00 AM PM	6:00 AM PM
CYCLE START 2:	: AM PM	: AM PM
CYCLE START 3:	: AM PM	: AM PM
CYCLE START 4:	: AM PM	: AM PM

NO.	STATION DESCRIPTION	WATERING DURATION	WATERING DURATION
1	Front lawn spray heads	10 min.	—
2	Side lawn spray heads	10 min.	—
3	Front flower beds	—	8 min.
4	Back lawn satellites	20 min.	—
5	Back lawn flower beds	—	8 min.
6	Patio flower pots	—	5 min.
7	Garden drip tubes	—	30 min.
8			
9			
10			
11			
12			

Orbit Irrigation Products Inc. North Salt Lake, UT 84054
1-800-488-6156 PN 57004-33 REV A 11/98

❶ Briefly describe each station and its location.

❷ In the A-Days Program column, circle the desired watering days.

❸ Enter the cycle start time for Program A. Generally, only one cycle start time is required for Program A.

❹ Enter the watering duration for each station assigned to Program A.

❺ In the B-Interval Program column, fill in the desired interval (1 to 28) or circle odd or even. Repeat steps 3-4 for the B-Interval Program.

section 3 **Programming**

The controller has three programs that control a variety of watering plans. Depending on your needs, you can use one or all programs.

Enter the Watering Schedule in Any Order

You have the option of entering your watering schedule in whatever order you like. This feature makes it very easy to review and change your watering schedule. Your settings can be changed at any time—while you're setting up the initial schedule or even after years of operation.

Start Times for Program A or B

Note: *A cycle start time is the time of day that the program begins watering the first station, and all other programmed stations will then follow in sequence. There are not separate start times for each station. Cycle start times do not correspond to specific stations. If you enter more than one cycle start time, all stations programmed to operate will water again (in sequence).*

The way you set the cycle start time is the same for all programs. To set the cycle start times for each program you will be using, do the following:

- Turn the rotary selector to set the **CYCLE START TIMES** position in the program that you want to set up. The display will show an **A** or **B** depending on which program you have selected. The display will show —— : —— and a blinking cursor will appear in **START 1** location **[See Figure 5]**.
- Set the time you want to begin watering for cycle start time 1 using the **+** or **–** buttons, then press the **ENTER** button. For additional cycle start times, simply press **NEXT** to advance to the next cycle start time and repeat this procedure by using the **+** and **–** buttons to enter the time and then press **ENTER.** Generally, only one cycle start time is required for each program (A, B).

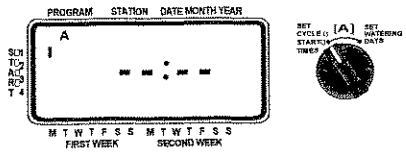


FIGURE 5: LCD Display with Start Time

Note: *You cannot set a cycle start time for each station. Stations can be assigned to either Program A or B or both A and B. Each program can have up to four cycle start times. Stations assigned to either program will turn on sequentially according to the cycle start times assigned. Generally only one cycle start time is required for each program (A, B).*

Program A Setup

Program A is a two-week daily schedule. Watering may be scheduled for each of the 14 days. After 14 days, the A program continues to repeat itself—there is no need to reselect the watering days. To set the watering days, **[Note Figure 6]**

- Set start times as outlined in the previous column (Start Times for Program A or B).
- Turn the rotary selector to **SET WATERING DAYS.** The cursor (—) will blink above the current day in the first week. Any or all days in the two-week schedule can be programmed to water.
- To program a day to water, press **ENTER.** An arrow will be displayed above programmed days and the cursor will move to the next day. To advance to a specific day, press **NEXT.** To clear a day, press **NEXT** until the cursor is above that day, then press **CLEAR.**

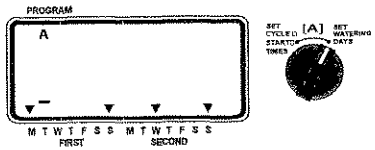


FIGURE 6: Program A Setup for Two-Week Schedule

Program B Setup

Program B is used to water an interval from 1 to 28 or on odd or even days. An interval of 1 will water every day; an interval of 2 will water today and then every other day, etc. The odd or even schedule is based on the date. If the time of day and the date are set correctly, the controller will only water on even or odd days. If selected, the controller has leap-year compensation to ensure conformance to the odd or even schedule.

To set the watering interval,

- Set start times as outlined in the previous column (Start Times for Program A or B).
- Turn the rotary selector to **SET WATERING INTERVAL.** The cursor will blink to the right of the word **INTERVAL. [Note Figure 7.]**

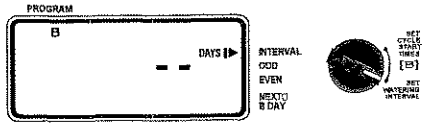


FIGURE 7: Program B Setup for Fixed Schedule

- When selecting an interval of days, press the + or – buttons to the desired interval. (Example: If you want to water once every ten days, the interval will be set for 10.) To program the interval, press **ENTER.**
- To select either odd or even day watering, press **NEXT.** This moves the cursor to the odd or even setting. Then press **ENTER.**

- To clear a schedule, press the **NEXT** button to move the cursor to the schedule and then press **CLEAR.** To enter a new schedule, press the **NEXT** button to move to the desired schedule and then press **ENTER.**

Note: *If an interval of "3" is entered today, the controller will water for the first time today and then again every third day.*

Note: *The controller will NOT water on the first day the program is entered or modified if the start time(s) have already passed.*

Program B Interval Countdown

If the interval watering selection is used for Program B, the controller displays the number of days until the next interval watering day. The controller will display a number in the lower right corner labeled **NEXT B DAY.** For example, if the display shows "1" as the next B day, the interval watering program will water tomorrow **[See Figure 8]**. A "0" indicates that the B program will water today.

FIGURE 8: Program B Interval Countdown

Set Watering Durations and Program Assignments for A or B

The way you set the watering duration is the same for all programs. To set the duration for each program you will be using, do the following—

- Select the watering duration for the stations by sliding each switch to its desired time from 2 to 120 minutes.
- To skip a station, move the station's slide switch to the **MANUAL OFF** position at the bottom of the slide.
- Set the program slide switch for each station that you want to assign to Program A or B or A and B **[See Figure 9]**.

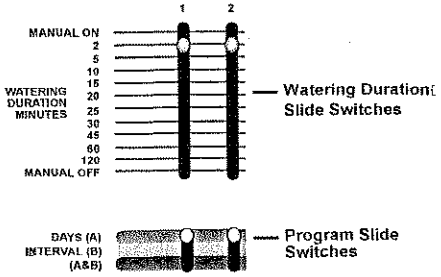


FIGURE 9: Slide Switches

Reviewing and Changing Your Program

The Orbit® controller lets you easily review a complete watering plan. For example, to review Program A watering cycle start times, simply turn the rotary selector to the **CYCLE START TIMES** position in Program A and check the times that have been entered. Using the **NEXT** button, you can advance through the schedule without fear of disturbing any programming.

If you want to change the cycle start times, watering days, or watering intervals, simply follow the directions for that program modification.

After reviewing or changing a watering schedule, remember to turn the rotary selector back to **AUTO** if you want the controller to automatically follow your plan.

Ready for Automatic Operation

After programming is complete, turn the rotary selector to **AUTO [See Figure 10]**. The controller is now fully programmed and ready to use in the automatic mode. In automatic mode, each station will operate sequentially, starting with Program A.

FIGURE 10: Ready for Automatic Operation

section 4

Semi-Automatic & Manual Operation

The Orbit® controller has the ability to override the automatic program without disturbing the preset program.

1. Manual Operation—Using Slide Switches

You can override the automatic program and operate the controller manually by using the watering duration slide switches [See Figure 11]. If a manual operation is started during an automatic program cycle, the automatic program cycle will be cancelled.

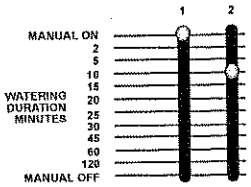


FIGURE 11: Manual Watering

A. Manual On—One Station

- Turn the rotary selector to the **AUTO** position.

- Turn on any individual station by moving that station's watering duration slide switch to the **MANUAL ON** position (fully up). The display blinks back and forth between the water drop and the time of day.

The rotary selector must stay in **AUTO** for this operation to take effect.

Only one station can be active at a time. The last station set to the **MANUAL ON** position will be active (watering).

When a station is turned on manually, the display will show **ON** inside a water drop. The display also shows the number of the station that is activated [See Figure 12].

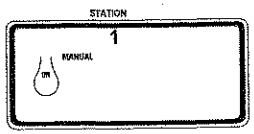


FIGURE 12: Manual Operation Display

B. Manual Off—One Station or Multiple Stations

- Turn off any individual station or stations by moving the watering duration slide switch to the **MANUAL OFF** position (fully down). [See Figure 13.]

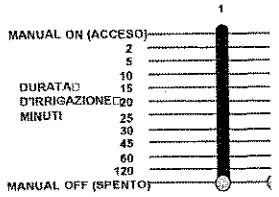


FIGURE 13: Duration Slide Switch Set to Manual Off

Leave the rotary selector in the **AUTO** position for the **MANUAL OFF** to affect individual stations.

Turning the rotary selector to the **OFF** position will turn all stations and all programming off. This turns all watering off and is essentially used as a system shut down.

To resume automatic watering—

- Turn the rotary selector to the **AUTO** position and make sure the duration slide switch or switches are set for the specific watering durations.

C. Manual Timed Watering for One Station

You can set any single station to go on manually for a specific amount of time from 2 to 120 minutes. This is a two-step process using the watering duration slide switch.

- First move the watering duration slide switch to the **MANUAL ON** (fully up) position, then back to any duration position. For example, if you want to water a specific station for 15 minutes, push the slide switch to the **MANUAL ON** position then back to the 15 minute position [See Figure 14.]

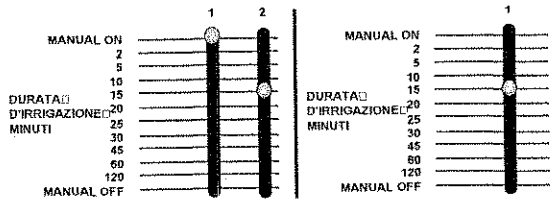


FIGURE 14: Manual Watering Station 1 Using the Slide Switch

If more than one station is set for manual duration, the controller will activate only the last station you set.

For example: You set station 2 to **MANUAL ON** for 30 minutes. Then you immediately set station 6 to **MANUAL ON** for 20 minutes. The controller will only activate station 6 for 20 minutes—your last input. **[See Figure 15.]**.

FIGURE 15: Manual Timed Watering

At the completion of the manual watering duration set on the slide switch, the controller reverts to the automatic mode.

Watering can be turned off at any time by pushing the slide switch to **MANUAL OFF.** (Remember to push the slide switch back from **MANUAL OFF** to a duration if you are using this station in the automatic watering schedule.)

Note: *If a manual operation is started during an automatic program cycle, the automatic program cycle will be cancelled.*

Semi-Automatic Mode

In addition to the manual modes previously discussed, the controller also lets you override the programmed watering schedule temporarily without adjusting the water duration slide switches.

By using the semi-automatic mode, you won't need to remember to return the duration slide switches to their normal positions.

A. All Stations Cycle Once

This can be especially helpful if you happen to experience unusually warm weather and you want to have all stations activate one time for their normal duration as set on the slide switches.

To turn on all stations once in sequence (rotary selector in **AUTO**) press the **MANUAL** button once (a blinking **ALL** is displayed), and then press **ENTER.** **[See Figure 16.]**

FIGURE 16: Watering All Stations Once

The display will show the first station number that is activated and will count down the minutes assigned to the watering duration slide switch. All stations will activate once in sequence (except those that are set to the **MANUAL OFF** position) for the durations set on the watering duration slide switches. Any station set to the **MANUAL OFF** position will not water.

Note: *After* **MANUAL** *has been pushed, if* **ENTER** *is not pushed within 60 seconds, the display will return to the time of day.*

- To interrupt or discontinue this cycle, press the **CLEAR** button once.
- At the completion of this function, the controller reverts back to your normal automatic watering plan.

Note: *If a manual operation is started during an automatic program cycle, the automatic program will be cancelled.*

(All stations cycle once, A program only.)

- To activate each station assigned watering durations for the A program only, press the **MANUAL** button, followed by the **NEXT** button. This will select stations with assigned watering durations in the A program only. To initiate this semi-automatic watering, press **ENTER.**

(All stations cycle once, B program only.)

- To activate each station assigned watering durations for the B program only, press the **MANUAL** button followed by pressing the **NEXT** button two distinct times. This will select only those stations with assigned watering durations in the B program only. To initiate this semi-automatic watering, press **ENTER.**

(All stations cycle once, AB program only.)

- To activate each station assigned watering durations for the AB program only, press the **MANUAL** button followed by pressing the **NEXT** button three distinct times. This will select only those stations with assigned watering durations in the AB program only. To initiate this semi-automatic watering, press **ENTER.**

Note: *After the* **MANUAL** *button has been pushed, if a selection is not made within 60 seconds the display returns to the time of day.*

- To halt or discontinue semi-automatic or manual watering, press the **CLEAR** button once. The controller will revert to your original automatic watering program.

Using the User-Selectable Rain Delay Mode

To stop automatic watering for 24, 48, or 72 hours, use the **RAIN DELAY** mode button.

- With the rotary dial set to **AUTO,** press the **RAIN DELAY** button once. The controller will force a 24-hour interruption of all scheduled watering. After 24 hours, the controller will automatically return to its initial watering schedule.
- To increase the rain delay to 48 or 72 hours, simply press the **RAIN DELAY** button again until the desired delay time is displayed. Press **ENTER.**
- To cancel the rain delay mode, press **CLEAR** [See Figure 17].

Note: *While in rain delay mode, the controller will display the remaining hours (counting down) to the end of the accepted delay alternating with the current time and date. No other button besides* **CLEAR** *will be accepted while the controller is in the rain delay mode.*

FIGURE 17: Display Showing Rain Delay

Complete System Shut Down

To shut the system down, turn the rotary dial to the **OFF** position. The controller remains programmed but will not water.

Smart-Scan® Diagnostic Fault Sensing

A diagnostic fault sensor is built into the electronics of the controller. This feature will automatically scan for the presence of a faulty solenoid or wiring short in each station as part of each watering sequence. If the controller senses a short in a station, it will skip the faulty station and move to the next working station. The controller displays faulty and the faulty station number **[See Figure 18].** If a short is detected in the pump/master control valve terminal, a "P" is displayed under the station number and the watering cycle is discontinued. Only the last station detected as having a wiring short will be displayed to the controller.

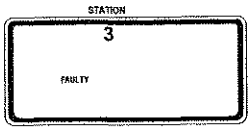


FIGURE 18: Display Showing Station Fault

At the next scheduled watering sequence, the controller will attempt to water the faulty station once more. If a short is not detected, the controller will continue to water the station and the faulty message will be eliminated from the display.

In order to cancel the faulty message from the display:

1. First repair the short in the wiring or replace the faulty solenoid.
2. Test the station by operating a manual watering sequence.
3. If the short is not detected after a few seconds, the FAULTY message will be terminated.
4. If the message continues, a short in the wiring still exists.

The **FAULTY** message can also be eliminated from the display by turning the rotary dial.

Internal Auto-Resetting Electronic Circuit Breaker

The controller is equipped with an internal electronic circuit breaker. Unlike a mechanical circuit breaker, the internal circuit breaker has the advantages of being more temperature stable, having a higher degree of sensitivity, and resets automatically. In combination with the diagnostic fault sensing, the internal electronic circuit breaker adds real value to your controller. The batteries will maintain program data in the event of a circuit breaker trip. We recommend that you replace the batteries annually.

The internal circuit breaker will "trip" whenever the controller receives a high current spike. This might occur in the following situations:

1. If lightning strikes nearby.
2. When the power supply has an electric spike.
3. If a station has a wiring short.

Whenever one of these conditions occurs, the electronic circuit breaker may "trip" causing the station output from the controller to be halted momentarily. The batteries will continue to store the program information and activates the LCD. After a few moments, the controller will automatically retest the circuit to see if the condition has stopped. In most cases, the problem causing the current spike has stopped (lightning strike stopped, power supply spike over, or the diagnostic fault sensor has switched to a non-faulty station). If so, the electronic circuit breaker will reset itself. It is **NOT** necessary to reset the controller manually.

section 5

Installation of Indoor Mount Controller

Install the controller in 5 easy steps—

1. Choosing a Controller Location
2. Mounting the Controller
3. Installing the Batteries
4. Connecting the Transformer
5. Connecting Valve Wires to Controller

1. Choosing a Controller Location

- Select a location near a standard electrical outlet. Avoid using an outlet controlled by an On/Off switch.
- The controller should not be exposed to the weather or operate at temperatures below 14 degrees or above 113 degrees Fahrenheit (-10 degrees or above 45 degrees Celsius). Avoid direct sunlight.
- Installation works best in a garage or protected area. The controller should not be mounted outdoors.

2. Mounting the Controller

- A mounting template is provided to assist you in mounting the controller.
- Screw a No. 8 screw at eye level leaving the screw head extended out from the wall about 1/8" (3 mm). Use expanding anchors in plaster or masonry if necessary.
- Slip the keyhole slot in the back of the controller over the extended screw.
- Screw a No. 8 screw through each of the two holes at the bottom of the box into the wall **[See Figure 19]**.

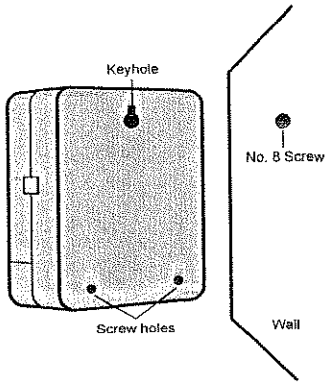


FIGURE 19: Mounting the Controller

3. Install the Batteries

The controller requires two AA alkaline batteries to keep the program in memory in case of AC power loss. In a typical installation, fully charged batteries should provide sufficient power for approximately one year of protection. Therefore, we recommend changing the batteries annually.

- Remove the battery cover by sliding it to the left.
- Insert two AA alkaline batteries into the battery compartment.
- Return the battery cover to its closed position.

Weak or missing batteries can cause the time, date, and program to be erased after a power failure. If this happens, you will need to install fully charged batteries and reprogram the controller.

Note: *Batteries alone will not operate the valves in your sprinkling system. The 24-volt transformer must be plugged in and have power to operate your system normally.*

4. Connecting the Transformer

- With the cover off, find the two terminal holes labeled "24 VAC." Make sure the transformer is not plugged in. Insert one of the two power leads from the transformer into each terminal. It doesn't matter which lead goes into which terminal.
- It may be necessary to open the terminal to allow for wire insertion or removal. To do this, simply press upward on the tab located on top of the terminal **[See Figure 8, Page 4]**.
- Plug in the transformer **[See Figure 20]**.
  Warning: *Do not link two or more controllers together with one transformer.*
- Slide the cover back on until it snaps.

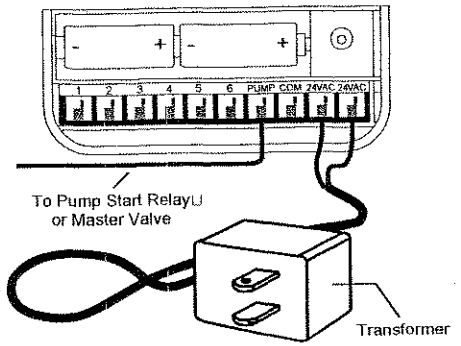


FIGURE 20: Connecting Pump Start, Master Valve and Transformer

section 6 Installation of Weather-resistant indoor-outdoor Controller

All our Weather-resistant Indoor/Outdoor controllers can run at temperatures between 35 and 140 degrees Fahrenheit (0 to 60degrees Celsius). Storage temperature is -4 to 149F (-20 to 65C).

Direct sunlight can easily increase temperatures inside the Controllers so chose a shaded location.

The controllers are weather-resistant to UL-50 and ETL® Listed, but should not be placed in areas where continuous water could cause damage.

Caution: Do not open the Controller when it is raining.

To make installation easier the Controller has a removable door. Remember to leave at least 7ins (18cm) to the left of the controller box for the door to swing open after installation.

Check the model number of your timer: various models are configured differently to meet national requirements, look for the section covering the model number on your controller. The model number can be found on the back of the housing, together with other useful information.

Models 57396, 57392, 57384, 57386, 57388, 57382

are for installation in Australia, New Zealand, and South Africa using the fitted line cord.

Models 57606, 57012

are for 110/117VAC operation and are suitable for either wall-hanging installation using the line cord fitted or permanent installation. You need to decide which type of installation you are going to use. Ensure that you have the appropriate electrical

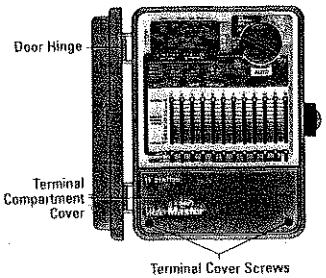


FIGURE 21: Outdoor Timer, Showing Terminal Cover

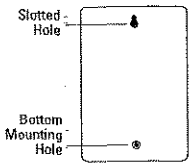


FIGURE 22: Back of Timer Box

power available at the location you intend to use. If used outdoors with the line cord, a suitable weatherproof power outlet must be available.

Installation using the fitted line cord

- Use the mounting template provided to assist you in preparing the mounting location: choose a flat, clean surface.
- Using the upper mark on the template, insert a No. 8 screw (included) at eye level leaving the screw head about 1/8th inch (3mm) out from the wall. (Use expanding anchors in plaster or masonry if necessary).
- Using the lower mark on the template, affix a No. 8 screw (included), again leaving the head protruding.
- Slip the slotted keyhole in the back of the Controller over the extended upper screw and allow the lower screw to recess into the lower hole in order to prevent the Controller from swinging. [See Fig. 22].
- The line cord may now be inserted into the power outlet.
- Proceed to section 7.

Installation using permanent wiring

Preparing the Controller for Permanent Installation

- Before commencing to install the controller you must remove the fitted line cord and replace with the pigtail wires provided.
- Take off the terminal compartment cover by unscrewing the two screws and pulling the plastic cover forward. [See figure 21], this reveals the AC Power Cover [Figure 23].
- Remove the rubber weather plug from the hole in the center and unscrew the one fixing screw, pull the plastic cover forward to reveal the AC wiring.
- Use a punch to create a hole in the blind Bottom Mounting Hole on the back of the controller box [Figure 22: Bottom Mounting Hole].
- Loosen the screw on the cord restraint and the three screws on the terminal block and remove the line cord completely.
- Feed the three wires of the pigtail through the exit nipple, under the strain relief, and cross to the terminal block. Fasten the wires to the terminal block ensuring that the black wire is connected to the Live terminal marked L, the white wire is connected to the Neutral terminal marked N, and the green wire is connected to the Earth terminal marked E. Ensure that the terminal screws and the strain relief screw are all firmly tightened. Check that the wires are clear of any obstruction and will not be trapped by the AC Power Cover when it is replaced.
- Replace the AC Power Cover and screw tight, do not force into place, if resistance is met check that no wires are trapped.

The Controller is now ready for permanent installation; follow all the instructions for the following models to complete the installation.

Models 57344, 57346, 57348, 57342

International Models 94024, 94026, 94028, 94022

All the above listed models are designed for permanent installation only. Local building and electrical codes usually require that an approved electrical conduit and electrical fittings be used to connect exterior wall-mounted equipment to AC power. Please check local codes. Any permanent connection should be made by a licensed electrical contractor in accordance with the requirements of the National Electrical Code and other state and local codes.

- Take off the terminal compartment cover of the controller by unscrewing the two screws and pulling the plastic cover forward. [Figure 21].
- Remove the rubber weather plug from the screw hole.
- Use the mounting template provided to assist you in preparing the mounting location: choose a flat, clean surface.
- Using the upper mark on the template, insert a No. 8 screw (included) at eye level leaving the screw head about 1/8th inch (3mm) out from the wall.

(Use expanding anchors in plaster or masonry if necessary).

- Slip the slotted keyhole in the back of the controller box over the extended screw [Figure 22].
- Push a No. 8 screw (included) through the Bottom Mounting Hole [Figure 22] in the controller box and tighten until the box is held firmly to the wall, but do not over-tighten.

The Controller has separate compartments for the AC line power input and the low voltage outputs. You must keep the input power and the low voltage in their separate places when wiring the controller box.

The controller has a built in transformer that must be connected to an AC line voltage source. Check the back of the controller box for power requirements. This connection should be made by a licensed electrical contractor in accordance with the requirements of the National Electrical Code and other state and local codes.

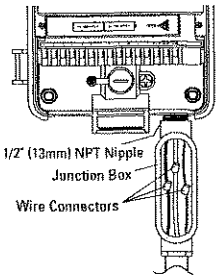


FIGURE 23: AC Wiring Using Junction Box

Wiring the AC input:

Caution: *do not connect the controller to one phase of a there-phase power system used by a pump or other electrical equipment.*

The controller has a nipple-mounted external power connection [Figure 23]. Use this 1/2 inch (13mm) NPT nipple to connect the controller to a standard electrical junction box that should be UL Listed (or equivalent) or comply with IEC or EN standards (or equivalent).

- Turn off the AC power at the AC circuit breaker and apply an appropriate safety lockout. Verify that the power has been turned off to the installation site using an AC voltmeter set for the correct measurement range.
- Use power feed wire of 14 gauge (AWG) minimum with a temperature rating of 155 degrees Fahrenheit (68 degrees Celsius) or higher.
- Install the conduit and associated fittings. Connect the AC electrical power wiring to the source by following all the right codes and local standards.
- Connect the junction box (not included) to the NPT nipple [Figure 23].
- Connect the source power conduit to the entrance of the junction box, following all the appropriate codes.
- Connect the source wires to the wires extending from the controller.
- Take care to follow the correct color code. For USA: connect the Green for Ground, Black for Live, and White for Neutral. Often the source ground may be bare copper conductor rather than green wire. For Europe: Live is Brown and Neutral is Blue, there is no ground connection required. Be sure that all wires are connected to the proper source wire.
- Make sure all connections are made with code-approved insulated connectors.
- Be sure to place a weatherproof gasket and lid on the junction box.

Installing Valves, Pump Starts & Master Valves

1. Wiring the Electric Valves

- If the distance between the controller and valves is under 700' (210 m), use WaterMaster® sprinkler wire or 20 gauge (AWG) plastic jacketed thermostat wire to connect the controller to the valves. If the distance is over 700' (210 m), use 16 gauge (AWG) wire. The wire can be buried in the ground; however, for more protection wires can be pulled through PVC pipe and buried underground. Be careful to avoid burying the wires in locations where they could be damaged by digging or trenching in the future.

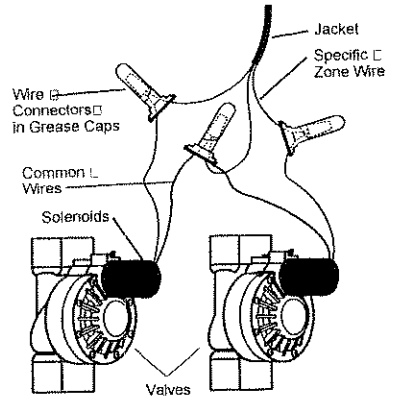


FIGURE 23: Connecting Controller Wires to Valves

- Each valve has two wires. One wire is to be connected as the common. The common wires for all the valves can be connected together to one common wire going to the controller. The other valve wire is to be connected to the specific station wire that will control that valve **[See Figure 23].**
- All wires should be joined together using wire nuts, solder, and/or vinyl tape. For additional protection to waterproof connections, a WaterMaster® grease cap can be used.
- To avoid electrical hazards, only one valve should be connected to each station.

2. Connecting Valve Wires to the Controller

- Remove the terminal compartment cover.
- Strip 1/4" (6 mm) of the plastic insulation off the end of each wire.
- Determine which valve you want to connect to which station. Connect each valve wire to its station terminal (labeled 1-12) by inserting the bare wire fully into the terminal.
- It may be necessary to open the terminal to allow for wire insertion or removal. To do this, simply press upward on the tab located on top of the terminal **[See Figure 24]**.
- Connect the common wire to the terminal labeled **COM** **[See Figure 24]**.

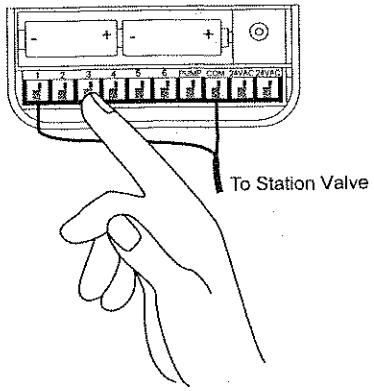


FIGURE 24: Connecting Valve Wires

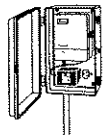
Note: *Only one wire can be installed into each terminal. If more than two common wires are used in your system, splice several together so only one wire runs into each of the* **COM** *terminals. Protect the splice connection with a wire nut.*

OTHER QUALITY PRODUCTS AND ACCESSORIES

Automatic Rain Shut-Off

For automatic rain shut-off, contact your Orbit® dealer to purchase an Orbit® Model 57091 (94060) automatic rain shut-off switch. The rain shut-off easily connects to the controller and prevents overwatering during rainy periods.

Weather Resistant Controller Box



Allows outdoor installation of most brands of indoor mount controllers.
UL® listed.

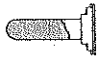
Automatic Valves

Durable, non-corrosive plastic construction. Automatic valves are available in anti-siphon or straight valves with safe, low voltage.

Automatic Converters

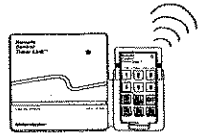
Durable non-corrosive plastic construction. Converts most brands of plastic or brass valves to automatic.

Grease Caps



Protects low voltage wires from corrosion or shorts.

Remote Control Transmitter and Receiver



Control your sprinklers with the touch of a button up to 200' (60 m) from your sprinkler controller.

TROUBLESHOOTING

Possible Causes of Problems

One or more stations do not turn on:
1. Faulty solenoid.
2. Wire broken or not connected.
3. Flow control stem screwed down, shutting valve off.
4. Programming is incorrect.

Stations turn on when they are not supposed to:
1. Water pressure is too high.
2. More than one start time is programmed.

One station is stuck on and will not shut off:
1. Faulty valve.
2. Particles of dirt or debris stuck in valve.
3. Valve diaphragm faulty.

All stations do not turn on:
1. Transformer defective or not connected.
2. Programming is incorrect.
3. Circuit breaker has been tripped.

Controller will not power up:
1. Circuit breaker has been tripped.
2. Transformer not plugged into an operational AC outlet.

Stations continue to turn on and off when they are not programmed to:
1. More than one start time is programmed with overlapping schedules.
2. Excessive pressure.

Circuit breaker trips repeatedly:
1. Short in wiring or solenoids.

Help

Before returning this controller to the store, contact Orbit® Technical Service at: **1-800-488-6156, 1-801-299-5555**

Listings

The controller is tested to UL-1951 (Models 57004, 57006, 57008, 57122) and UL-50 (Models 57606, 57012) standard and is ETL® listed. Appropriate international models are CSA® and CE® approved.

Trademark Notice

Control Star®, WaterMaster®, and Smart-Scan® are registered trademarks of Orbit® Irrigation Products, Inc.

The information in this manual is primarily intended for the user who will establish a watering schedule and enter that schedule into the controller. This product is intended to be used as an automatic timer controller for activating 24 VAC irrigation valves, as described in this manual.

WaterMaster® by Orbit® Limited Two Year Warranty

Orbit® Irrigation Products, Inc. warrants to its customers that its WaterMaster® products will be free from defects in materials and workmanship for a period of two years from the date of purchase. We will replace, free of charge, the defective part or parts found to be defective under normal use and service for a period of up to two years after purchase (proof of purchase required). We reserve the right to inspect the defective part prior to replacement. Orbit® Irrigation Products, Inc. will not be responsible for consequential or incidental cost or damage caused by the product failure. Orbit® liability under this warranty is limited solely to the replacement or repair of defective parts.

To exercise your warranty, return the unit to your dealer with a copy of the sales receipt.

1-800-488-6156
1-801-299-5555
www.orbitonline.com

Orbit® Irrigation Products Inc.
845 North Overland Rd.
North Salt Lake, Utah 84054

57004-24 Rev D

Please read and save these instructions. Read through this owner's manual carefully before using product. Protect yourself and others by observing all safety information, warnings, and cautions. Failure to comply with instructions could result in personal injury and/or damage to product or property. Please retain instructions for future reference.

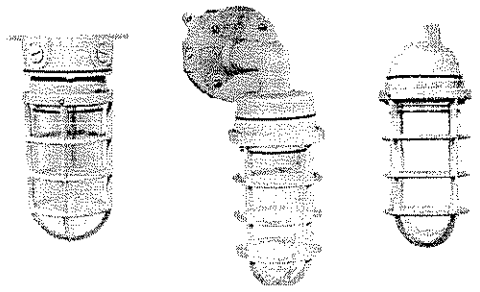
LumaPro®

VAPOR TIGHT FIXTURE

Description

The LumaPro Vapor Tight fixture is designed for heavy-duty non-explosive environments. Vapor resistant for use in weather, exposed high traffic areas whenever dust or moisture are present. Applications include processing plants, cold storage, foundries, factories, loading docks. railways, tunnels, bridges, and walkways. UL listed for wet locations if installation has a weatherproof outlet box.

3RB17 3RB18 3RB24



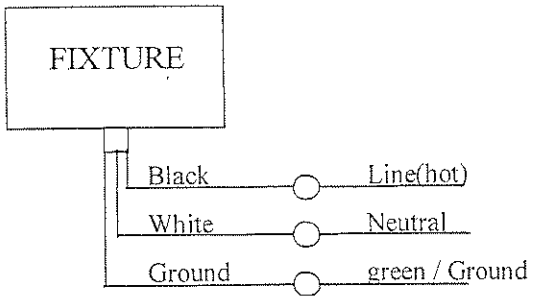
Unpacking

After unpacking unit, inspect carefully for any damage that may have occurred during transit. Check for loose, missing, or damaged parts. Shipping damage claim must be filed with carrier.

Specifications and Dimensions

Model	Volts	Watts	Housing Dimensions (in) H	W
3RB17	120	200	9 ¾	5 ⅝
3RB18	120	200	12 ½	7
3RB24	120	200	10 ¼	4 ¼

Wiring Diagrams



General Safety Information

1. Failure to comply with the instructions and safety information could result in malfunction of unit, fire hazard of unit, fire hazard or electrical shock.

⚠ CAUTION *Make sure power supply line is 120 volts.*

LumaPro

Vapor Tight Fixture

General Safety Information (continued)

⚠WARNING *Potential fatal shock hazard! Do not handle an energized fixture or energize any fixture with wet hands or when standing on a wet or damp surface, or in water.*

⚠WARNING *Use only with grounded cover plates or boxes.*

⚠ CAUTION *This fixture is not suitable for Hazardous or Classified locations.*

2. This fixture must be installed in accordance with all electrical and safety codes and ordinances and the most recent National electrical Code (NEC) and the Occupational Safety and Health Act (OSHA) . (Refer to Volume 1 on General Industry Standards and Interpretations (OSHA).)
3. All commercial installations should be performed by a qualified electrician.
4. Make certain the power conforms to the requirements of this fixture.
5. Disconnect power before installing or servicing. If the power disconnect switch is out of sight, lock it in the open position and tag it to prevent unexpected application of power.

Installation

⚠WARNING ***Model 3RB24 must be installed with a weatherproof outlet box if used in wet location. Models 3RB17 and 3RB18 are furnished with UL approved weatherproof outlet boxes.***

1. Remove guard and globe for ease of installation.
2. When using model 3RB17 or 3RB18 for wet locations use an approved caulking compound between mounting surface and back of fixture.
3. Secure fixture to mounting surface, fixture 3RB24 requires ¾" conduit or adapt to ½" conduit using reducer (supplied).
4. Use UL approved connectors (not furnished) to connect wires to power supply. Connect black fixture wire to black supply wire. Connect white fixture wire to white supply wire. Connect ground wire.
5. Screw 200 watt max incandescent lamp into lamp socket. Rough service or industrial lamps are recommended.
   ⚠ CAUTION *DO NOT OVERTIGHTEN.*
6. Replace globe and guard, securing guard with set screw provided.

Maintenance

⚠WARNING ***Be sure all power to the fixture is disconnected before attempting any service or repair!***

Troubleshooting Chart

Symptom	Possible Causes	Corrective Action
Lamp will not operate	1. Loose bulb	1. Check bulb installation
	2. ON/OFF switch in OFF position	2. Put ON/OFF switch in ON position
	3. Loose wire	3. Check connections.

LumaPro

Vapor Tight Fixture

Repair Parts List 3RB17, 3RB18, 3RB24

Reference Number	Description	Part No. 3RB17	Part No. 3RB18	Part No. 3RB24	QTY
1	GUARD	3VGRD2	3VGRD2	3VGRD2	1
2	GLOBE	VG20	VG20	VG20	1
3	GASKET FOR GLOBE/GUARD	3VGKGL2	3VGKGL2	3VGKGL2	1
4	ELECTRICAL BOX	CPRB3	CPRB3	--	1
5	WALL ADAPTER	--	3VWAD	--	1
6	PENDANT ADAPTER	--	--	3VPEN3	1

Warranty

LIMITED ONE-YEAR WARRANTY

Should this product fail to perform satisfactorily due to a defect or poor workmanship within ONE YEAR from the date of purchase, return it to the place of purchase and it will be replaced, free of charge. Incidental or consequential damages are excluded from this warranty.

QSS004
Printed in China
06/09/04

Manufactured for Grainger International, Inc.
100 Grainger Pkwy., Lake Forest IL 60045 U.S.A.

LumaPro

LumaPro

Vapor Tight Fixture

For Repair Parts, call 1-800-323-0620

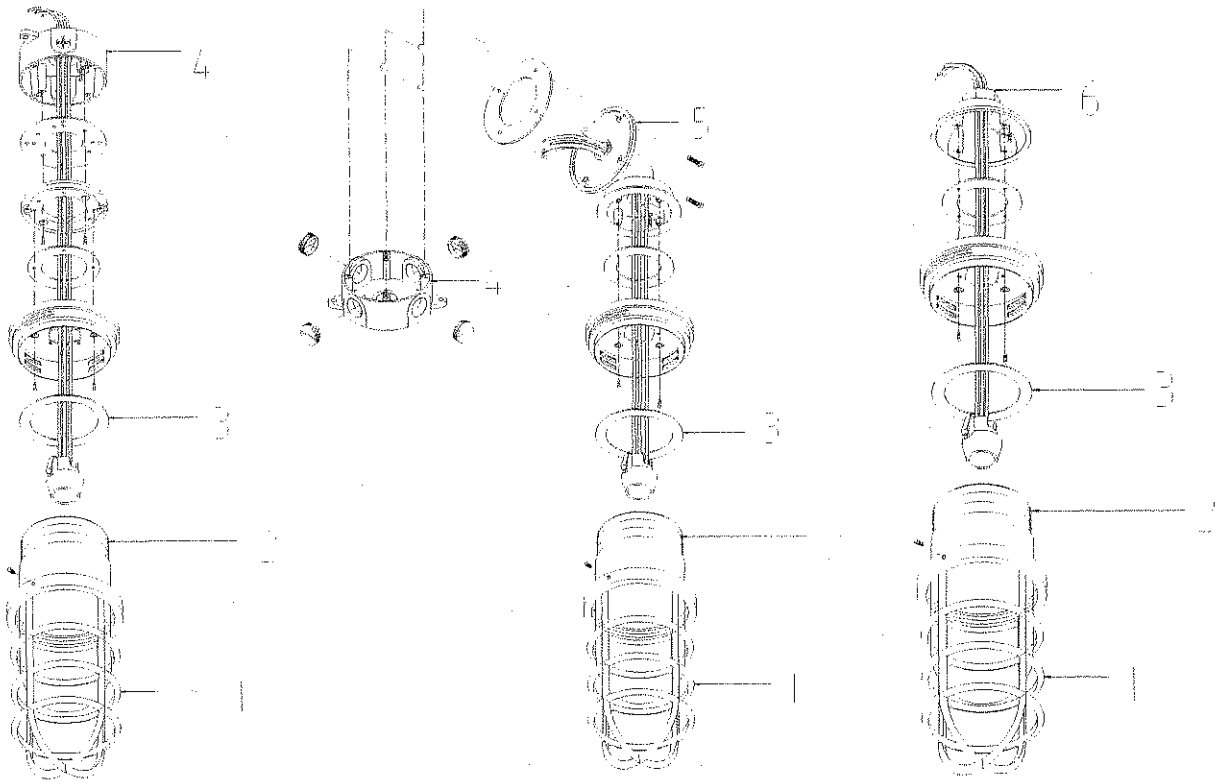
24 hours a day – 365 days a year

Please provide the following:
- . Model Number
- Serial Number (if any)
- Part description and number as shown on parts list

Address parts correspondence to:
Grainger Parts
P.O. Box 3074
1657 Shermer Road
Northbrook, IL 60065-3074 U.S.A.

Figure1– Repair Parts Illustration for Model 3RB17, 3RB18, 3RB24

3RB17 **3RB18** **3RB24**



Operating Instructions & Parts Manual

1HKL9, 1HLA1, 1HLA2, 1HLA3, 1HLA4, 1HLA5, 1HLA6, 1HLA7, 1HLA8, 1HLA9, 1HLB1, 1HLB2, 1HLB3, 1HLB4, 1HLB5, 1HLB6

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Dayton® Utility Shutter-Mounted Exhaust Fans

ENGLISH

ESPAÑOL

FRANÇAIS

Description

Dayton utility exhaust fans are designed for general purpose exhaust applications and may be used in stores, offices, factories, shops, farm buildings, greenhouses, etc. Efficient, easy-to-install exhaust fans with automatic shutters. Model 1HKL9, 7" Shutter fan fits in half of an 8 x 16" concrete block. Shutter flanges have eight pre-punched 1/4 x 1/2" slotted mounting holes for ease of installation. 7 to 36" diameter deep pitched propeller. Fan guards have charcoal grey metallic polyester finish to resist corrosion. Wire guards comply with OSHA Federal 1/2" max. opening requirement. Totally enclosed, sleeve bearing 115V, 60 Hz motors. Shipped completely assembled.
Optional Speed controllers available, see table below.

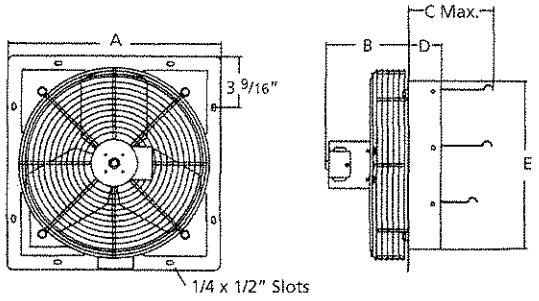


Figure 1 - Dimensions

Unpacking

1. Inspect for any damage that may have occurred during shipment.
2. Shipping damage claim must be filed with carrier.
3. Check all bolts, screws, setscrews, etc. for looseness that may have occurred during transit. Retighten as required.
4. Before installing, rotate the propeller to be sure there are no obstructions which would interfere with proper operation. Adjust as required.

E307468

Dimensions

Model	Prop. Dia.	A Square	B	C	D	E
1HKL9	7"	11 1/8"	4 15/16"	6"	2 3/8"	8"
1HLA1	10	13 1/8	5 9/16	5 1/8	2 3/8	10
1HLA2	12	15 1/8	6	6 1/8	2 3/8	12
1HLA3	16	19 1/8	6 1/2	6 1/8	2 3/8	16
1HLA4	18	21 1/8	8 3/4	6 1/8	2 3/8	18
1HLA5	18	21 1/8	12 1/2	5 3/4	3	18
1HLA6	20	23 1/8	12 1/8	5 3/4	3	20
1HLA7	20	23 1/8	12 1/8	5 3/4	3	20
1HLA8	20	23 1/8	11 9/16	5 3/4	3	20
1HLA9	20	23 1/8	12 1/8	5 3/4	3	20
1HLB1	24	27 1/8	12 5/16	5 3/4	3	24
1HLB2	24	27 1/8	12 5/16	5 3/4	3	24
1HLB3	24	27 1/8	13 5/8	5 3/4	3	24
1HLB4	24	27 1/8	11 13/16	5 3/4	3	24
1HLB5	30	33 1/8	13 1/8	5 3/4	3	30
1HLB6	36	39 1/8	13 1/8	5 3/4	3	36

Performance

Model	Prop. Dia.	CFM @ 0.0" SP	CFM @ 0.125" SP	CFM @ 0.250" SP	Sones@ 0.0" SP @ 5'	Nom. HP	Amps	Nom. RPM	Recommended Speed Control
1HKL9	7"	140	N/A	N/A	4.8	1/30	1.4	1550	4YC44
1HLA1	10	585	285	N/A	6.6	1/30	1.4	1550	4YC44
1HLA2	12	800	470	N/A	7.6	1/30	1.4	1550	4YC44
1HLA3	16	1095	720	N/A	8.0	1/20	1.8	1550	4YC44
1HLA4	18	1860	850	N/A	8.4	1/15	1.3	1075	4YC44
1HLA5	18	2590	2190	1705	14.3	1/4	4.5	1725	
1HLA9	20	3830	2255	1235	11.3	1/4	5.0	1725	4YC46
1HLA8	20	2955	2450	1960	14.4	1/4	4.5	1725	
1HLA7	20	2635	3115	2760	16.9	1/3	4.8	1075	
1HLA6	20	2985	2445	1965	14.3	1/4	4.3	1725	
1HLB3	24	3240	2485	1110	11.7	1/4	4.0	1075	4YC46
1HLB2	24	3270	2515	1205	10.7	1/4	4.1	1075	
1HLB4	24	3970	3240	1900	12.1	1/3	5.3	1075	
1HLB1	24	3985/3760	3255/2995	1950/1563	11.8/11.3	1/3	5.3	1075	
1HLB5	30	6075	4195	2150	13.5	1/3	4.5	825	
1HLB6	36	8225	6480	2935	14.7	1/2	6.4	825	

Form 5S5617

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Dayton®

Dayton® Utility Shutter-Mounted Exhaust Fans

General Safety Information

⚠WARNING ***Do not depend on any switch as sole means of disconnecting power when installing or servicing the fan. If the power disconnect is out-of-sight, lock it in the open position and tag to prevent application of power. Failure to do so may result in fatal electrical shock. Employ proper lock-out procedures during maintenance and installation.***

⚠CAUTION ***All electrical connections should be made by a qualified electrician.***

1. Follow all local electrical and safety codes in the United States and Canada, as well as the National Electrical Code (NEC) and the Occupational Safety and Health Act (OSHA) in the United States, and the Canadian Electric Code (CEC) in Canada.
2. Always disconnect power source before working on or near a motor or its connected load.

⚠WARNING ***Motor will restart without warning after protector trips.***

⚠CAUTION ***In United States to reduce the risk of injury to persons, OSHA complying guards are required when fan is installed within 7 feet of floor or working level.***

⚠CAUTION ***In Canada to reduce the risk of injury to persons, CSA complying guards are required when fan is installed below 2.5 meters (8.2 feet) above floor or grade level.***

3. Protect the power cable from coming in contact with sharp objects.
4. Do not kink power cable and never allow the cable to come in contact with oil, grease, hot surfaces, or chemicals.

⚠CAUTION ***Do not use in explosive atmospheres.***

5. Make certain that the power source conforms to the requirements of your equipment.
6. The fan frame and motor must be electrically grounded to a suitable electrical ground, such as a grounded water pipe or ground wire system.

Installation

1. The unit should be securely mounted in a rigid framework.

NOTE: Allowing the fan frame to flex or move will result in undue vibrations and possible premature motor, propeller, or shutter failure.

2. Install any auxiliary components.
3. Connect power to the motor, using an approved wiring method.

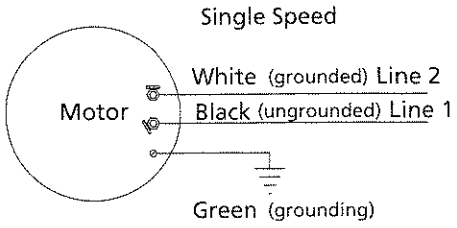

Figure 2 - Wiring Diagram: 115 Volt Connection

⚠CAUTION ***Fan frame and motor must be securely and adequately grounded to a suitable electrical ground, such as a ground water pipe or ground wiring system.***

4. Before activating the fan, check to ensure that there are no obstructions (framing, stud, shutter, etc.) which would interfere with proper fan operation by turning the propeller by hand. Also verify that there are no obstructions interfering with the full opening and closing of the shutter.

Operation

1. Keep the area free of objects that could impede air flow on both the intake and exhaust side of fan.
2. For proper exhaust operation, a window, door, or louver should be opened on the opposite side of the area to be ventilated.
3. Turn the fan on, the shutter will open automatically. When the unit is turned OFF, the shutter will close.
4. Speed controllable units are designed to operate at a minimum of fifty percent line voltage.

Maintenance

⚠WARNING ***Do not depend on any switch as sole means of disconnecting power when installing or servicing the fan. If the power disconnect is out-of-sight, lock it in the open position and tag to prevent application of power. Failure to do so may result in fatal electrical shock. Employ proper lock-out procedures when performing maintenance.***

MINOR AND ROUTINE

1. Disconnect power source before servicing.
2. Lubricate the motor sleeve bearings every six months using S.A.E. 20 non-detergent oil as per instructions (see motor label).
3. Periodically clean the propeller, guard, motor, and shutter of any accumulated dirt.

PARTS REPAIR

1. Refer to illustration of parts placement (Figure 3).
2. Disconnect power before servicing.
3. Remove the four screws holding the guard to the venturi panel. Remove the guard/motor/propeller assembly.
4. Loosen the setscrew on propeller hub and remove the propeller.

⚠CAUTION ***Do not repair damaged propeller. Replace with a properly balanced unit (see Figure 3 Reference No. 3).***

5. Loosen the nuts holding motor on guard and remove motor.
6. Reassemble the unit in reverse order of disassembly.

⚠CAUTION ***Propeller is installed hub first on motor shaft, flush with end, and setscrew located over the flat area.***

For Repair Parts, call 1-800-323-0620

24 hours a day - 365 days a year

Please provide following information:
-Model number
-Serial number (if any)
-Part description and number as shown in par

Address parts correspondence to:
Grainger Parts
P.O. Box 3074
1657 Shermer Road
Northbrook, IL 60065-3074 U.S.A.

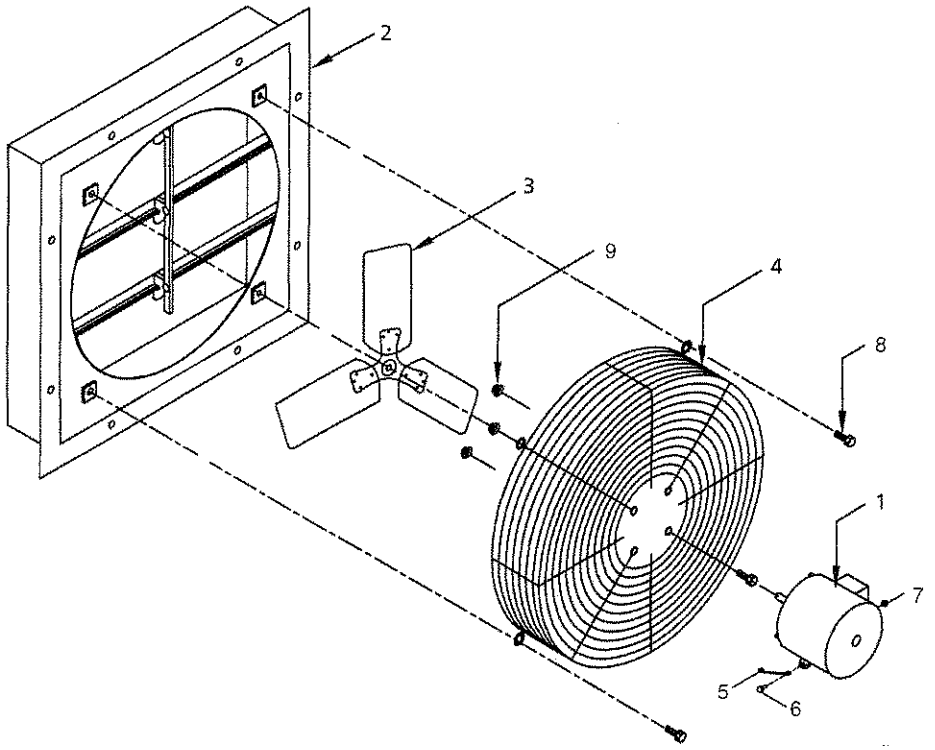

Figure 3 — Repair Parts Illustration

Repair Parts List

Ref. No.	Description	Part Number for Models: 1HKL9	1HLA1	1HLA2	1HLA3	1HLA4	1HLA5	Qty.
1.	Motor	XXMT71731715	XXMT71731715	XXMT71731715	XXMTHX2185	XXMTHX3835	XXMTKZ6804	1
2	Shutter assembly	502G-08	502G-10	502G-12	502G-16	502G-18	502G-18	1
3	Propeller	XXPR07A	XXPR10A	XXPR12A	XXPR16A	XXPR18B	XXPR18A	1
4	Intake guard	XXWG07A	XXWG10A	XXWG12A	XXWG16A	XXWG18B	XXWG18A	1
5	Yolk Brace	NA	NA	NA	NA	NA	XXSS494PC	1
6	3/8-24 X 1" Screw	*	*	*	*	*	*	1
7	3/8-24 Locknut	*	*	*	*	*	*	1
8	#10-16 x 5/8" SM Screw	*	*	*	*	*	*	4
9	#8-32 Spinlock Nut	*	*	*	*	*	*	4

Ref. No.	Description	Part Number for Models: 1HLA6	1HLA7	1HLA8	1HLA9	1HLB1	Qty.
1	Motor	XXMTKZ6805	XXMTKZ6805	XXMTKZ6804	XXMT71265117	XXMTHX6065	1
2	Shutter assembly	502G-20	502G-20	502G-20	502G-20	502G-24	1
3	Propeller	XXPR20A	XXPR20B	XXPR20A	XXPR20C	XXPR24B	1
4	Intake guard	XXWG20A	XXWG20A	XXWG20A	XXWG20A	XXWG24A	1
5	Yolk Brace	XXSS680PC	XXSS680PC	XXSS680PC	XXSS4680PC	XXSS930PC	1
6	3/8-24 X 1" Screw	*	*	*	*	*	1
7	3/8-24 Locknut	*	*	*	*	*	1
8	#10-16 x 5/8" SM Screw	*	*	*	*	*	4
9	#8-32 Spinlock Nut	*	*	*	*	*	4

Ref. No.	Description	Part Number for Models: 1HLB2	1HLB3	1HLB4	1HLB5	1HLB6	Qty.
1	Motor	XXMTHX6082	XXMTHX6804	XXMTHX6083	XXMTHX7341	XXMTHX7278	1
2	Shutter assembly	502G-24	502G-24	502G-24	556G-30	556G-36	1
3	Propeller	XXPR24A	XXPR24A	XXPR24B	XXPR30A	XXPR36A	1
4	Intake guard	XXWG24A	XXWG24A	XXWG24A	XXWG30A	XXWG36A	1
5	Yolk Brace	XXSS930PC	XXSS930PC	XXSS930PC	XXSS930PC	XXSS1350PC	1
6	3/8-24 X 1" Screw	*	*	*	*	*	1
7	3/8-24 Locknut	*	*	*	*	*	1
8	#10-16 x 5/8" SM Screw	*	*	*	*	*	4
9	#8-32 Spinlock Nut	*	*	*	*	*	4

(*) Standard hardware items, available locally.

Dayton® Utility Shutter-Mounted Exhaust Fans

Troubleshooting Chart

Symptom	Possible Cause(s)	Corrective Action
Excessive noise	1. Dry motor bearings	1. Relubricate motor bearings as per instructions or replace motor.
	2. Loose propeller	2. Tighten setscrews in hub
	3. Crooked or damaged propeller	3. Replace propeller
Fan inoperative	1. Blown fuse or open circuit breaker	1. Replace fuse or reset circuit breaker
	2. Defective motor	2. Repair or replace motor (see Figure 3)
	3. Speed control off or too low	3. Turn controller on
Insufficient air flow	1. Blocked intake or exhaust opening	1. Clear opening of obstruction or increase size of opening, clean guard/shutter
	2. Low voltage	2. Determine cause and correct
	3. Speed control set too low	3. Increase speed with controller

LIMITED WARRANTY

DAYTON ONE-YEAR LIMITED WARRANTY. *Dayton® Utility Shutter-Mounted Exhaust Fans, Models covered in this manual, are warranted by Dayton Electric Mfg. Co. (Dayton) to the original user against defects in workmanship or materials under normal use for one year after date of purchase. Any part which is determined to be defective in material or workmanship and returned to an authorized service location, as Dayton designates, shipping costs prepaid, will be, as the exclusive remedy, repaired or replaced at Dayton's option. For limited warranty claim procedures, see PROMPT DISPOSITION below. This limited warranty gives purchasers specific legal rights which vary from jurisdiction to jurisdiction.*

LIMITATION OF LIABILITY. *To the extent allowable under applicable law, Dayton's liability for consequential and incidental damages is expressly disclaimed. Dayton's liability in all events is limited to and shall not exceed the purchase price paid.*

WARRANTY DISCLAIMER. *Dayton has made a diligent effort to illustrate and describe the products in this literature accurately; however, such illustrations and descriptions are for the sole purpose of identification, and do not express or imply a warranty that the products are MERCHANTABLE, or FIT FOR A PARTICULAR PURPOSE, or that the products will necessarily conform to the illustrations or descriptions. Except as provided below, no warranty or affirmation of fact, expressed or implied, other than as stated in the "LIMITED WARRANTY" above is made or authorized by Dayton.*

PRODUCT SUITABILITY. *Many jurisdictions have codes and regulations governing sales, construction, installation, and/or use of products for certain purposes, which may vary from those in neighboring areas. While Dayton attempts to assure that its products comply with such codes, it cannot guarantee compliance, and cannot be responsible for how the product is installed or used. Before purchase and use of a product, review the product applications, and all applicable national and local codes and regulations, and be sure that the product, installation, and use will comply with them.*

Certain aspects of disclaimers are not applicable to consumer products; e.g., (a) some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you; (b) also, some jurisdictions do not allow a limitation on how long an implied warranty lasts, consequentially the above limitation may not apply to you; and (c) by law, during the period of this limited warranty, any implied warranties of implied merchantability or fitness for a particular purpose applicable to consumer products purchased by consumers, may not be excluded or otherwise disclaimed.

PROMPT DISPOSITION. *Dayton will make a good faith effort for prompt correction or other adjustment with respect to any product which proves to be defective within Limited Warranty. For any product believed to be defective within Limited Warranty, first write or call dealer from whom the product was purchased. Dealer will give additional directions. If unable to resolve satisfactorily, write to Dayton at address below, giving dealer's name, address, date, and number of dealer's invoice, and describing the nature of the defect. Title and risk of loss pass to buyer on delivery to common carrier. If product was damaged in transit to you, file claim with carrier.*

Manufactured for Dayton Electric Mfg. Co., 5959 W. Howard St., Niles, Illinois 60714 U.S.A.

Manual de instrucciones de funcionamiento y piezas

1HKL9, 1HLA1, 1HLA2, 1HLA3, 1HLA4, 1HLA5, 1HLA6, 1HLA7, 1HLA8, 1HLA9, 1HLB1, 1HLB2, 1HLB3, 1HLB4, 1HLB5, 1HLB6

Por favor, lea y guarde las siguientes instrucciones. Lea detenidamente las instrucciones antes de armar, instalar, hacer funcionar o dar mantenimiento al producto descrito. Para su protección personal y la de otros, le recomendamos observar toda la información de seguridad. ¡El incumplimiento de las instrucciones podría causar lesiones personales y/ o daños a la propiedad! Conserve las instrucciones para futuras consultas.

Ventiladores de extracción Dayton® con registro de aire integrado para uso general

Descripción

Los ventiladores de extracción Dayton han sido diseñados para trabajos de ventilación general y pueden utilizarse en recintos como tiendas, oficinas, fábricas, talleres, instalaciones agrícolas, viveros, etc. Los ventiladores de extracción con registros de aire automáticos son eficaces y fáciles de instalar. El ventilador de extracción de 7", modelo 1HKL9, cabe en la mitad de un bloque de concreto de 8 X 16". Las faldillas del registro tienen ocho agujeros ranurados de montaje preperforados de 1/4 x 1/2" para facilitar la instalación. Una hélice articulada de 7 a 36" de diámetro. El dispositivo protector tiene un acabado gris de poliéster secado al horno resistente a la corrosión. Los protectores metálicos están conformes con las regulaciones de la Ley de Seguridad Ocupacional e Higiene (OSHA, por sus siglas en inglés), que e
máxima de 1/2". Tienen motores blindados de 115V, 60 Hz., con cojinetes de manguito. Se entregan totalmente armados. Controles de velocidad opcionales disponibles, ver cuadro de más abajo.

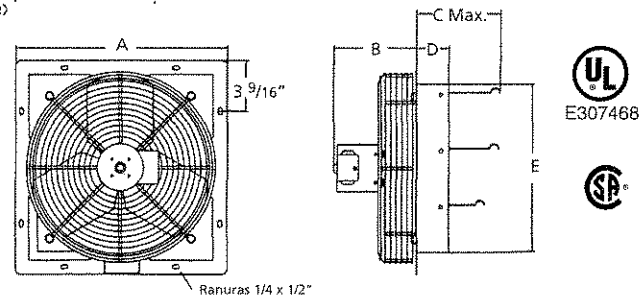

Ilustración 1- Dimensiones

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Al desempaquetar

1. Inspeccione detenidamente la unidad al recibirla, para asegurarse de que no haya sufrido daños durante el traslado.
2. Los reclamos por daños ocasionados durante el traslado deben remitirse al agente transportista.
3. Inspeccione los pernos, tornillos, tornillos de fijación, etc. puesto que pudieran haberse aflojado durante el traslado. Haga los ajustes necesarios.
4. Antes de instalar, haga rotar la hélice para asegurarse de que no haya obstrucciones que impidiesen el funcionamiento satisfactorio de la unidad. Haga los ajustes necesarios.

ESPAÑOL

Dimensions

Modelo	Diám. Helicoidal	Diám A	B	C	D	E
1HKL9	7"	11 1/8"	4 15/16"	6"	2 3/8"	8"
1HLA1	10	13 1/8	5 9/16	5 1/8	2 3/8	10
1HLA2	12	15 1/8	6	6 1/8	2 3/8	12
1HLA3	16	19 1/8	6 1/2	6 1/8	2 3/8	16
1HLA4	18	21 1/8	8 3/4	6 1/8	2 3/8	18
1HLA5	18	21 1/8	12 1/2	5 3/4	3	18
1HLA6	20	23 1/8	12 1/8	5 3/4	3	20
1HLA7	20	23 1/8	12 1/8	5 3/4	3	20
1HLA8	20	23 1/8	11 9/16	5 3/4	3	20
1HLA9	20	23 1/8	12 1/8	5 3/4	3	20
1HLB1	24	27 1/8	12 5/16	5 3/4	3	24
1HLB2	24	27 1/8	12 5/16	5 3/4	3	24
1HLB3	24	27 1/8	13 5/8	5 3/4	3	24
1HLB4	24	27 1/8	11 13/16	5 3/4	3	24
1HLB5	30	33 1/8	13 1/8	5 3/4	3	30
1HLB6	36	39 1/8	13 1/8	5 3/4	3	36

Funcionamiento

Modelo	Diám. Helicoidal	CFM @ 0.0" SP	CFM @ 0.125" SP	CFM @ 0.250" SP	Sones @ 0.0" SP @ 5'	HP nominal	Amps	RPM Nominal	Control de velocidad recomendado
1HKL9	7"	140	N/A	N/A	4.8	1/30	1.4	1550	4YC44
1HLA1	10	585	285	N/A	6.6	1/30	1.4	1550	4YC44
1HLA2	12	800	470	N/A	7.6	1/30	1.4	1550	4YC44
1HLA3	16	1095	720	N/A	8.0	1/20	1.8	1550	4YC44
1HLA4	18	1860	850	N/A	8.4	1/15	1.3	1075	4YC44
1HLA5	18	2590	2190	1705	14.3	1/4	4.5	1725	
1HLA9	20	3830	2255	1235	11.3	1/4	5.0	1725	4YC46
1HLA8	20	2955	2450	1960	14.4	1/4	4.5	1725	
1HLA7	20	2635	3115	2760	16.9	1/3	4.8	1075	
1HLA6	20	2985	2445	1965	14.3	1/4	4.3	1725	
1HLB3	24	3240	2485	1110	11.7	1/4	4.0	1075	4YC46
1HLB2	24	3270	2515	1205	10.7	1/4	4.1	1075	
1HLB4	24	3970	3240	1900	12.1	1/3	5.3	1075	
1HLB1	24	3985/3760	3255/2995	1950/1563	11.8/11.3	1/3	5.3	1075	
1HLB5	30	6075	4195	2150	13.5	1/3	4.5	825	
1HLB6	36	8225	6480	2935	14.7	1/2	6.4	825	

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Dayton®

Ventiladores de extracción Dayton® con registro de aire integrado para uso general

Información general sobre seguridad

⚠ ADVERTENCIA ***No dependa de ningún interruptor como el único medio para desconectar la energía cuando está instalando o reparando el ventilador. Si el dispositivo de desconexión no estuviera a la vista, enganchelo en posición abierta y márquelo para prevenir que se alimente corriente eléctrica. De lo contrario, podría recibir una carga eléctrica mortal. Aplique los procedimientos de bloqueo adecuados durante la instalación y el mantenimiento.***

⚠ PRECAUCIÓN ***Todas las conexiones eléctricas deben realizarse por un electricista calificado.***

1. Observe todos los códigos de electricidad y seguridad aplicables en los Estados Unidos y Canadá, al igual que el Código Eléctrico Nacional (NEC) y la Ley de Seguridad Ocupacional e Higiene (OSHA) en los Estados Unidos y el Código Eléctrico Canadiense (CEC) cuando en Canadá.
2. Siempre desconecte la fuente de corriente eléctrica cuando trabaja en un motor o cerca a éste o su carga conectada.

⚠ ADVERTENCIA ***El motor entrará en marcha sin aviso al desengancharse el protector.***

⚠ PRECAUCIÓN ***A fin de minimizar el riesgo de lesiones personales, en los Estados Unidos, OSHA exige la instalación de protectores si el ventilador será instalado a siete pies del piso o de la superficie de trabajo.***

⚠ PRECAUCIÓN ***A fin de minimizar el riesgo de lesiones personales, en Canadá, la CSA exige la instalación de protectores si el ventilador será instalado a menos de 2.5 metros (8.2 pies) sobre el piso o del rasante del suelo.***

3. Evite que el cable de alimentación entre en contacto con objetos punzantes.
4. No doble el cable de alimentación ni permita que entre en contacto con aceite, grasa, superficies calientes o agentes químicos.

⚠ PRECAUCIÓN ***No usar en atmósferas explosivas.***

5. Asegúrese de que la fuente de energía cumpla los requisitos del equipo.
6. El marco y el motor del ventilador deben conectarse a una toma de tierra eléctrica adecuada tal como un tubería de agua puesta a tierra o un sistema de conductor de tierra.

Instalación

1. La unidad debe montarse de manera segura en un marco rígido.

NOTA: Si el marco del ventilador es flexible o se mueve, podrían producirse vibraciones excesivas, lo que podría causar la avería prematura del motor, la hélice o el registro de aire.

2. Instale todos los componentes auxiliares.
3. Conecte el motor a una fuente de energía, usando un método de cableado autorizado.

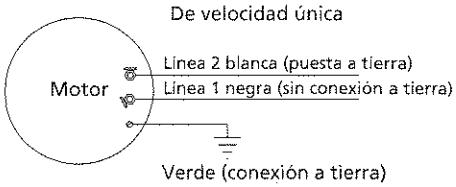

Ilustración 2- Diagrama de cableado: Conexión de 115 voltios

⚠ PRECAUCIÓN ***El marco y el motor del ventilador deben conectarse debidamente a una toma de tierra eléctrica adecuada tal como una tubería de agua puesta a tierra o un sistema de conductor de tierra.***

4. Antes de activar el ventilador, gire manualmente la hélice para asegurarse de que no haya ningún tipo de obstrucción (marco, pernos, registro, etc.) que pudiera interferir con el funcionamiento satisfactorio del ventilador. Verifique también que no haya obstrucciones que impidan que el registro se abra y cierre completamente.

Funcionamiento

1. Mantenga el área libre de objetos que pudieran impedir la circulación de aire tanto en la entrada como el lado de extracción del ventilador.
2. Para que el extractor funcione debidamente, deberá mantenerse abierta una ventana, puerta o rejilla en el lado opuesto al área a ser ventilada.
3. Al encender el ventilador, el registro de aire se abrirá automáticamente. Al apagar la unidad, el registro se cerrará.
4. Las unidades con velocidad controlable han sido diseñadas para funcionar con una tensión de línea mínima de cincuenta por ciento.

Mantenimiento

⚠ ADVERTENCIA ***No dependa de ningún interruptor como el único medio para desconectar la energía cuando está instalando o reparando el ventilador. Si el dispositivo de desconexión no estuviera a la vista, enganchelo en posición abierta y márquelo para prevenir que se alimente corriente eléctrica. De lo contrario, podría recibir una carga eléctrica mortal. Aplique los procedimientos de bloqueo adecuados durante todo trabajo de mantenimiento.***

MANTENIMIENTO MENOR Y RUTINARIO

1. Desconecte la fuente de corriente antes de empezar su labor de servicio.
2. Lubrique los cojinetes de manguito del motor cada seis meses con aceite sin detergente S.A.E. 20, siguiendo las instrucciones provistas (ver etiqueta del motor).
3. Limpie periódicamente la hélice, el protector y el motor para eliminar cualquier acumulación excesiva de suciedad.

PIEZAS DE RECAMBIO

1. Remítase a la ilustración de las piezas de repuesto (Ilustración 3).
2. Desconecte la fuente de corriente antes de empezar su labor de servicio.
3. Retire los cuatro tornillos que sostienen el dispositivo protector en el panel de venturi. Retire el conjunto del protector/ motor/ hélice.
4. Afloje los tornillos de fijación en el cubo de la hélice y retire la hélice.

⚠ PRECAUCIÓN ***Si se daña la hélice, no intente repararla. Reemplácela con una pieza debidamente equilibrada (ver Ilustración 3 Referencia No. 3).***

5. Afloje las tuercas que sostienen el motor en el protector y retírelo.
6. Arme nuevamente la unidad invirtiendo el orden del desmontaje.

⚠ PRECAUCIÓN ***Instale primero el cubo de la hélice en el eje del motor, nivelándolo con el extremo y los tornillos de fijación ubicados sobre el área plana.***

Para solicitar repuestos, llame al 1-800-323-0620

24 horas al día, 365 días al año

Sírvase proporcionar la siguiente información:
-Número del modelo
-Número de serie (si corresponde)
-Descripción y número de la pieza según figur

Toda correspondencia sobre piezas o repuestc
Grainger Parts
P.O. Box 3074
1657 Shermer Road
Northbrook, IL 60065-3074 U.S.A.

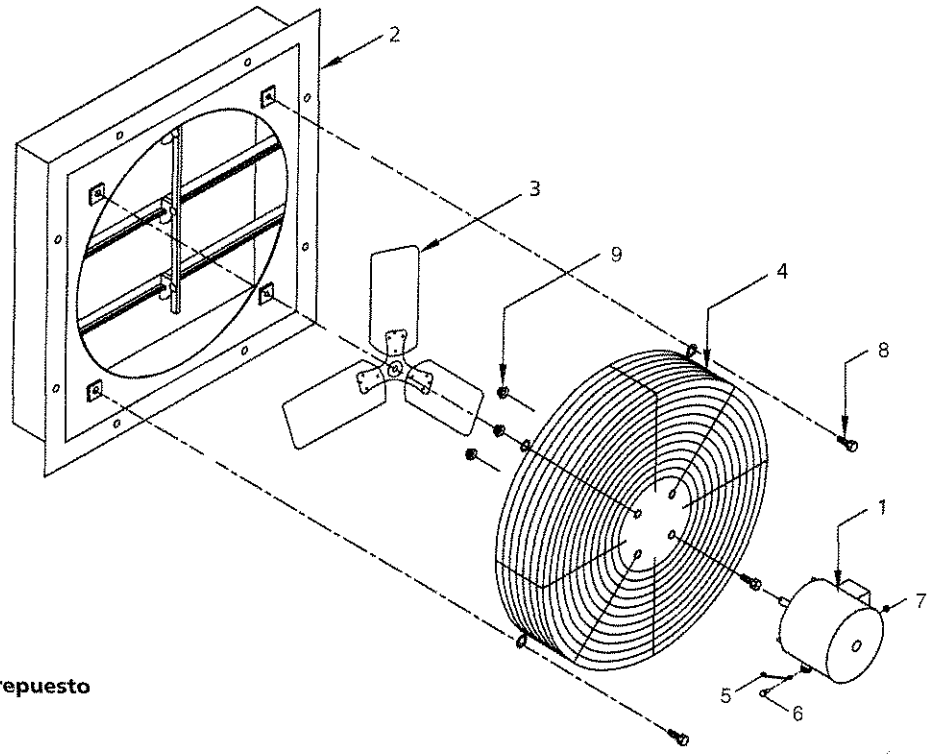

Ilustración 3 - Diagrama de las piezas de repuesto

Lista de las piezas de repuesto

No. de referencia	Descripción	Número de pieza para modelos: 1HKL9	1HLA1	1HLA2	1HLA3	1HLA4	1HLA5	Cant.
1	Motor	XXMT71731715	XXMT71731715	XXMT71731715	XXMTHX2185	XXMTHX3835	XXMTKZ6804	1
2	Conjunto del registro	502G-08	502G-10	502G-12	502G-16	502G-18	502G-18	1
3	Hélice	XXPR07A	XXPR10A	XXPR12A	XXPR16A	XXPR18B	XXPR18A	1
4	Protector de entrada	XXWG07A	XXWG10A	XXWG12A	XXWG16A	XXWG18B	XXWG18A	1
5	Abrazadera de brida	NC	NC	NC	NC	NC	XXSS494PC	1
6	Tornillo de 3/8-24 X 1"	*	*	*	*	*	*	1
7	Contratuerca de 3/8-24	*	*	*	*	*	*	1
8	Tornillo SM #10/-16 X 5/8"	*	*	*	*	*	*	4
9	Tuerca de fijación #8-32	*	*	*	*	*	*	4

No. de referencia	Descripción	Número de pieza para modelos: 1HLA6	1HLA7	1HLA8	1HLA9	1HLB1	Cant.
1	Motor	XXMTKZ6805	XXMTKZ6805	XXMTKZ6804	XXMT71265117	XXMTHX6065	1
2	Conjunto del registro	502G-20	502G-20	502G-20	502G-20	502G-24	1
3	Hélice	XXPR20A	XXPR20B	XXPR20A	XXPR20C	XXPR24B	1
4	Protector de entrada	XXWG20A	XXWG20A	XXWG20A	XXWG20A	XXWG24A	1
5	Abrazadera de brida	XXSS680PC	XXSS680PC	XXSS680PC	XXSS4680PC	XXSS930PC	1
6	Tornillo de 3/8-24 X 1"	*	*	*	*	*	1
7	Contratuerca de 3/8-24	*	*	*	*	*	1
8	Tornillo SM #10/-16 X 5/8"	*	*	*	*	*	4
9	Tuerca de fijación #8-32	*	*	*	*	*	4

No. de referencia	Descripción	Número de pieza para modelos: 1HLB2	1HLB3	1HLB4	1HLB5	1HLB6	Cant.
1	Motor	XXMTHX6082	XXMTHX6804	XXMTHX6083	XXMTHX7341	XXMTHX7278	1
2	Conjunto del registro	502G-24	502G-24	502G-24	556G-30	556G-36	1
3	Hélice	XXPR24A	XXPR24A	XXPR24B	XXPR30A	XXPR36A	1
4	Protector de entrada	XXWG24A	XXWG24A	XXWG24A	XXWG30A	XXWG36A	1
5	Abrazadera de brida	XXSS930PC	XXSS930PC	XXSS930PC	XXSS930PC	XXSS1350PC	1
6	Tornillo de 3/8-24 X 1"	*	*	*	*	*	1
7	Contratuerca de 3/8-24	*	*	*	*	*	1
8	Tornillo SM #10/-16 X 5/8"	*	*	*	*	*	4
9	Tuerca de fijación #8-32	*	*	*	*	*	4

(*) Artículos regulares de quincallería disponibles en su localidad.

ESPAÑOL

Dayton®

Ventiladores de extracción Dayton® con registro de aire integrado para uso general

Tabla para la detección de averías

Síntoma	Causa(s) posible(s)	Medida correctiva
Ruido excesivo	1. Cojinetes del motor resecos	1. Lubricar los cojinetes del motor siguiendo las instrucciones provistas o reemplazar el motor.
	2. Hélice floja	2. Ajustar los tornillos de fijación del cubo.
	3. Hélice torcida o dañada	3. Reemplazar la hélice
El ventilador no funciona.	1. Fusible quemado o disyuntor abierto	1. Reemplazar fusible quemado o reposicionar el disyuntor
	2. Motor defectuoso	2. Reparar o cambiar el motor (ver ilustración)
	3. Control de velocidad apagado o muy bajo	3. Prender el controlador

ESPAÑOL

GARANTIA LIMITADA

GARANTIA LIMITADA DE DAYTON POR UN AÑO. *Dayton Electric Mfg. Co. (Dayton) le garantiza al usuario original que losmodelos tratados en este manual del Ventiladores de extracción Dayton® con registro de aire integrado para uso generalDayton® están libres de defectos en la mano de obra o elmaterial, cuando se les somete a uso normal, por un año a partir de la fecha de compra. Cualquier parte que se encuentredefectuosa, tanto en el material como en la mano de obra, y sea devuelta a un lugar de servicio autorizado designado porDayton, con los costos de envío pagados por adelantado, será reparada o reemplazada a la discreción de Dayton comoremedio exclusivo. Para obtener la información sobre los procedimientos de reclamo cubiertos en la garantía limitada veaATENCION OPORTUNA a continuación. Esta garantía limitada confiere a los compradores derechos legales específicos quevarían de jurisdicción a jurisdicción.*

LIMITES DE RESPONSABILIDAD. *Hasta el punto que las leyes aplicables lo permitan, la responsabilidad de Dayton por losdaños emergentes o incidentales está expresamente excluida. La responsabilidad de Dayton expresamente está limitada y nopuede exceder el precio de compra pagado por el artículo.*

EXCLUSION DE RESPONSABILIDAD DE LA GARANTIA. *Dayton se ha esforzado diligentemente para proporcionarinformación sobre el producto en esta literatura en forma apropiada; sin embargo, tal información y las ilustraciones ydescripciones tienen como único propósito la identificación del producto y no expresan ni implican garantía de que losproductos son VENDIBLES o ADECUADOS PARA UN PROPOSITO EN PARTICULAR o que se ajustan necesariamente a lasilustraciones o descripciones. Con excepción de lo que se establece a continuación, Dayton no hace ni autoriza ningunagarantía o afirmación de hecho, expresa o implícita, que no sea estipulada en la "GARANTIA LIMITADA" anterior.*

ADAPTACION DEL PRODUCTO. *Muchas jurisdicciones tienen códigos o reglamentos que rigen las ventas, la construcción, lainstalación y/o el uso del producto para ciertos propósitos que pueden variar con respecto a los aplicables a las zonas vecinas. Sibien Dayton trata de que sus productos cumplan con dichos códigos, no puede garantizar su conformidad y no puede hacerseresponsable por la forma en que su producto se instala o usa. Antes de comprar y usar el producto, revise su aplicación y todoslos códigos y regulaciones nacionales y locales aplicables, y asegúrese que el producto, la instalación y el uso los cumplan.*

Ciertos aspectos de limitación de responsabilidad no se aplican a los productos del consumidor; es decir (a) algunasjurisdicciones no permiten la exclusión o la limitación de daños incidentales o emergentes, de modo que las limitaciones oexclusiones anteriores puede que no se apliquen en su caso; (b) también, algunas jurisdicciones no permiten limitar el tiempoque una garantía implícita dura, por lo tanto, la limitación anterior puede que no se aplique en su caso; y (c) por ley, duranteel período que dura esta Garantía Limitada, las garantías implícitas de comercialización o de adecuación para un propósito enparticular aplicables a los productos del consumidor comprados por consumidores no pueden ser excluidas o no puedenexcluirse de la responsabilidad en alguna otra forma.

ATENCION OPORTUNA. *Dayton hará un esfuerzo de buena fe para corregir puntualmente, o hacer otros ajustes, con respectoa cualquier producto que resulte defectuoso dentro de los términos de esta garantía limitada. En el caso de que encuentre unproducto defectuoso y que esté cubierto dentro de los límites de esta garantía haga el favor de escribir primero, o llame, aldistribuidor de quien compró el producto. El distribuidor le dará las instrucciones adicionales. Si no puede resolver el problemaen forma satisfactoria, escriba a Dayton a la dirección a continuación, dando el nombre del distribuidor, su dirección, la fecha yel número de la factura del distribuidor y describa la naturaleza del defecto. La propiedad del artículo y el riesgo de pérdidapasan al comprador en el momento de la entrega del artículo a la compañía de transporte. Si el producto se daña durante eltransporte debe presentar su reclamo a la compañía de transporte.*

Fabricado por Dayton Electric Mfg. Co., 5959 W. Howard St., Niles, Illinois 60714 U.S.A.

Fabricado por Dayton Electric Mfg. Co.
Niles, Illinois 60714 U.S.A.

Dayton®

Manuel d'utilisation et de pièces **1HKL9, 1HLA1, 1HLA2, 1HLA3, 1HLA4, 1HLA5, 1HLA6, 1HLA7, 1HLA8, 1HLA9, 1HLB1, 1HLB2, 1HLB3, 1HLB4, 1HLB5, 1HLB6**

Prière de lire et conserver ces instructions. Lire attentivement avant de commencer à monter, installer, utiliser ou entretenir l'appareil décrit. Protégez-vous et les autres en respectant toutes les instructions de sécurité. Le non-respect de ces instructions peut causer des blessures corporelles et/ou des dommages matériels. Veuillez conserver ces instructions pour référence ultérieure.

Ventilateurs d'extraction utilitaires à claire-voie Dayton®

Description

Les ventilateurs utilitaires Dayton sont conçus pour des applications d'extraction générale efficace et peuvent être utilisés dans les magasins, bureaux, usines, ateliers, batiments de ferme, serres, etc... Ces ventilateurs ont des volets automatiques et sont efficaces et faciles à installer. Le ventilateur à claire-voie de 7", modèle 1HKL9, s'intègre dans la moitié d'un bloc de béton de 8 X 16". Les brides de volet ont huit trous de montage rainurés pré-perforés de 1/4 à 1/2" pour faciliter l'installation. L'hélice à forte inclinaison va de 7" à 36" de diamètre. Les grilles de ventilateur ont une finition polyester anti-corrosion gris anthracite métallisé. Les grilles sont conformes aux exigences d'ouverture max. de 1/2 po de la Loi sur la Santé et la Sécurité au Travail (OSHA). Les moteurs de 115 V, 60 Hz, sont entièrement enclos, avec palier à douilles. Ils sont expédiés complètement assemblés. Des contrôleurs de vitesse sont disponibles en option, voir tableau ci-dessous.

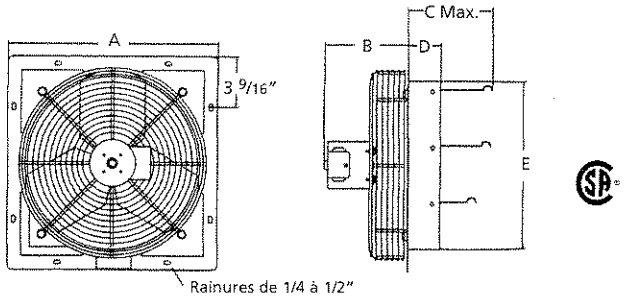

Figure 1 - Dimensions

Déballage

1. Vérifiez si l'appareil n'a pas été endommagé pendant le transport.
2. Toute réclamation pour dég,ts dus au transport doit être adressée au transporteur.
3. Vérifiez si les écrous, vis, vis de pression, etc... ne se sont pas desserrées pendant le transport. Resserrez si nécessaire.
4. Avant le montage, faites tourner l'hélice pour vous assurer qu'il n'y a pas d'obstacle. Réglez si nécessaire.

E307468

Dimensions

Modèle	Dia. Hél.	A Carré	B	C	D	E
1HKL9	7"	11 1/8"	4 15/16"	6"	2 3/8"	8"
1HLA1	10	13 1/8	5 9/16	5 1/8	2 3/8	10
1HLA2	12	15 1/8	6	6 1/8	2 3/8	12
1HLA3	16	19 1/8	6 1/2	6 1/8	2 3/8	16
1HLA4	18	21 1/8	8 3/4	6 1/8	2 3/8	18
1HLA5	18	21 1/8	12 1/2	5 3/4	3	18
1HLA6	20	23 1/8	12 1/8	5 3/4	3	20
1HLA7	20	23 1/8	12 1/8	5 3/4	3	20
1HLA8	20	23 1/8	11 9/16	5 3/4	3	20
1HLA9	20	23 1/8	12 1/8	5 3/4	3	20
1HLB1	24	27 1/8	12 5/16	5 3/4	3	24
1HLB2	24	27 1/8	12 5/16	5 3/4	3	24
1HLB3	24	27 1/8	13 5/8	5 3/4	3	24
1HLB4	24	27 1/8	11 13/16	5 3/4	3	24
1HLB5	30	33 1/8	13 1/8	5 3/4	3	30
1HLB6	36	39 1/8	13 1/8	5 3/4	3	36

Funcionamiento

Modèle	Dia. Hél.	Débit d'air pi3/min PS 0,0 po	Débit d'air pi3/min 0,125 po	Débit d'air pi3/min 0,250 po	Sones à pi3/min PS 0,0 po à 5'	CV nom.	Intensité pleine charge	TR/min nom.	Controle vitesse recom.
1HKL9	7"	140	N/A	N/A	4.8	1/30	1.4	1550	4YC44
1HLA1	10	585	285	N/A	6.6	1/30	1.4	1550	4YC44
1HLA2	12	800	470	N/A	7.6	1/30	1.4	1550	4YC44
1HLA3	16	1095	720	N/A	8.0	1/20	1.8	1550	4YC44
1HLA4	18	1860	850	N/A	8.4	1/15	1.3	1075	4YC44
1HLA5	18	2590	2190	1705	14.3	1/4	4.5	1725	
1HLA9	20	3830	2255	1235	11.3	1/4	5.0	1725	4YC46
1HLA8	20	2955	2450	1960	14.4	1/4	4.5	1725	
1HLA7	20	2635	3115	2760	16.9	1/3	4.8	1075	
1HLA6	20	2985	2445	1965	14.3	1/4	4.3	1725	
1HLB3	24	3240	2485	1110	11.7	1/4	4.0	1075	4YC46
1HLB2	24	3270	2515	1205	10.7	1/4	4.1	1075	
1HLB4	24	3970	3240	1900	12.1	1/3	5.3	1075	
1HLB1	24	3985/3760	3255/2995	1950/1563	11.8/11.3	1/3	5.3	1075	
1HLB5	30	6075	4195	2150	13.5	1/3	4.5	825	
1HLB6	36	8225	6480	2935	14.7	1/2	6.4	825	

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Formulaire 5S5617

Imprimé aux Etats-Unis
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0906/249/VCPCP

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Ventilateurs d'extraction utilitaires à claire-voie Dayton®

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Consignes générales de sécurité

⚠ AVERTISSEMENT ***Il ne faut pas seulement se contenter d'éteindre l'interrupteur pendant l'installation ou l'entretien du ventilateur. Si le dispositif de débranchement n'est pas visible, il faut le bloquer en position ouverte et le signaler pour éviter le rétablissement du courant. Le non-respect de cette consigne risque d'entraîner une décharge électrique fatale. Il faut suivre les procédures adéquates de bloquage pendant l'entretien et l'installation.***

⚠ ATTENTION ***Tous les branchements électriques doivent être effectués par un électricien qualifié.***

1. Respecter tous les codes locaux d'électricité et de sécurité aux Etats-Unis et au Canada, ainsi que le Code Electrique National (CEN) et la Loi sur la Santé et la Sécurité au Travail (OSHA) aux Etats-Unis, et le Code Electrique Canadien (CEC) au Canada.
2. Toujours débrancher la source d'alimentation de courant avant de travailler sur ou près d'un moteur ou de sa charge connectée.

⚠ AVERTISSEMENT ***Le moteur redémarre sans prévenir quand la protection se déclenche.***

⚠ ATTENTION ***Aux Etats-Unis, pour réduire les risques d'accidents personnels, des protections conformes à OSHA doivent être installées quand un ventilateur est monté à 2,10m (7 pi.) du sol ou au niveau de la surface de travail.***

⚠ ATTENTION ***Au Canada, pour réduire les risques d'accidents personnels, des protections conformes au CSA doivent être installées quand un ventilateur est monté à moins de 2,50m (8,2 pi.) du sol ou de la surface.***

3. Protéger le cordon d'alimentation des objets tranchants.
4. Il faut éviter de tordre le cordon d'alimentation et l'empêcher d'entrer en contact avec l'huile, la graisse, les surfaces chaudes ou les produits chimiques.

⚠ ATTENTION ***Ne pas utiliser dans des atmosphères explosives.***

5. Vérifier si la source d'alimentation électrique correspond aux exigences de votre matériel.
6. Le cadre et le moteur du ventilateur doivent être reliés à une masse adéquate, comme un tuyau d'eau ou un système de cables mis à la terre.

Installation

1. L'appareil doit être solidement monté dans un cadre rigide.

NOTE : tout mouvement ou flexion du cadre du ventilateur peut causer des vibrations indésirables et une panne du moteur, de l'hélice ou du registre.

2. Installer les éléments auxiliaires.
3. Brancher le moteur sur le courant suivant une méthode de cablage approuvée.

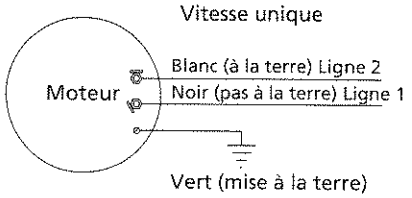

Figure 2 - Diagramme de connexions : 115 V

⚠ ATTENTION ***Le cadre et le moteur du ventilateur doivent être reliés de façon sûre et adéquate à une masse électrique appropriée, comme un tuyau d'eau ou un système de cables mis à la terre.***

4. Avant de mettre en marche le ventilateur, faire tourner l'hélice à la main pour s'assurer qu'il n'y a pas d'obstacle (cadrage, planche, volet, etc...) qui pourrait empêcher le bon fonctionnement du ventilateur. Vérifier aussi s'il n'y a pas d'obstruction à l'ouverture et la fermeture totales des volets.

Fonctionnement

1. Débarrasser tout objet qui pourrait gêner la circulation d'air des cÙtés entrée et sortie d'air du ventilateur.
2. Pour une bonne extraction, une porte, fenêtre ou lucarne devrait être ouverte du cÙté opposé de la zone à ventiler.
3. En allumant le ventilateur, les volets s'ouvrent automatiquement. En l'éteignant, les volets se ferment.
4. Les appareils à vitesse variable sont conçus pour fonctionner à un minimum de 50 % de tension de la ligne.

Entretien

⚠ AVERTISSEMENT ***Il ne faut pas seulement se contenter d'éteindre l'interrupteur pendant l'installation ou l'entretien du ventilateur. Si le dispositif de débranchement n'est pas visible, il faut le bloquer en position ouverte et le signaler pour éviter le rétablissement du courant. Le non-respect de cette consigne peut causer une décharge électrique fatale. Suivre les procédures adéquates de bloquage pendant l'entretien et l'installation.***

ENTRETIEN REGULIER ET MINEUR

1. Débrancher la source de courant avant l'entretien.
2. Lubrifier les coussinets de douille du moteur tous les six mois avec une huile non-détergente SAE 20 suivant les instructions (voir étiquette du moteur).
3. Nettoyer périodiquement l'hélice, la grille, le moteur et les volets de toute poussière excessive.

REPARATION DES PIECES

1. Consulter l'illustration du placement des pièces (Figure 3).
2. Débrancher la source d'alimentation avant l'entretien.
3. Retirer les 4 vis qui relient la grille au panneau Venturi. Retirer l'assemblage grille/moteur/hélice.
4. Dévisser la vis de pression au centre de l'hélice et retirer l'hélice.

⚠ ATTENTION ***Eviter de réparer une hélice endommagée. Remplacer par une hélice bien équilibrée (voir Figure 3, référence no. 3).***

5. Dévisser les boulons qui maintiennent le moteur sur la grille et retirer le moteur.
6. Remonter l'appareil dans l'ordre inverse du démontage.

⚠ ATTENTION ***Le centre de l'hélice est installé en premier sur l'axe du moteur, à niveau avec l'extrémité, et la vis de pression est placée sur la surface plate.***

Pour les pièces de rechange, appeler le 1-800-323-0620

24 heures sur 24, 365 jours par an

Prière de fournir les informations suivantes:
-Numéro du modèle
-Numéro de série (s'il y en a un)
-Numéro et description de la pièce tels qu'ind

Adresser la correspondance des pièces à:
Grainger Parts
P.O. Box 3074
1657 Shermer Road
Northbrook, IL 60065-3074 U.S.A.

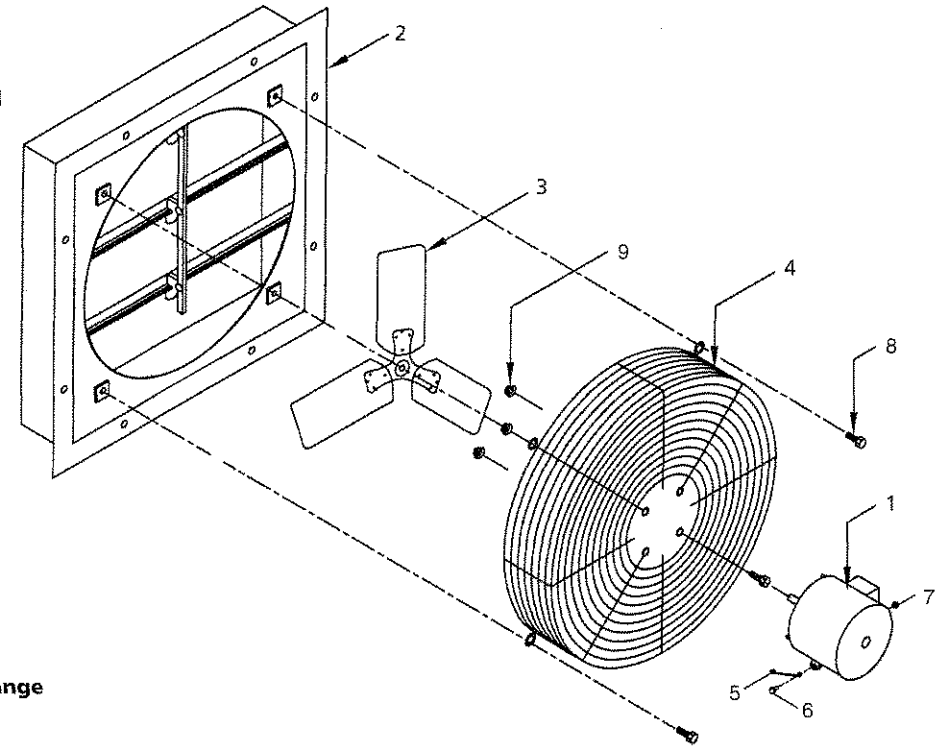

Figure 3 : Illustration des pièces de rechange

Liste des pièces de rechange

No. de ref.	Description	Numéro de pièce pour les modèles 1HKL9	1HLA1	1HLA2	1HLA3	1HLA4	1HLA5	Qté
1	Moteur	XXMT71731715	XXMT71731715	XXMT71731715	XXMTHX2185	XXMTHX3835	XXMTKZ6804	1
2	Assemblage claire-voie	502G-08	502G-10	502G-12	502G-16	502G-18	502G-18	1
3	Hélice	XXPR07A	XXPR10A	XXPR12A	XXPR16A	XXPR18B	XXPR18A	1
4	Grille d'entrée	XXWG07A	XXWG10A	XXWG12A	XXWG16A	XXWG18B	XXWG18A	1
5	Bride de fixation	NC	NC	NC	NC	NC	XXSS494PC	1
6	Vis 3/8-24 X 1"	*	*	*	*	*	*	1
7	Ecrou bloquant 3/8-24	*	*	*	*	*	*	1
8	Vis SM no. 10-16 x 5/8"	*	*	*	*	*	*	4
9	Ecrou verrouillage cranté no. 8-32	*	*	*	*	*	*	4

No. de ref.	Description	Numéro de pièce pour les modèles 1HLA6	1HLA7	1HLA8	1HLA9	1HLB1	Qté.
1	Moteur	XXMTKZ6805	XXMTKZ6805	XXMTKZ6804	XXMT71265117	XXMTHX6065	1
2	Assemblage claire-voie	502G-20	502G-20	502G-20	502G-20	502G-24	1
3	Hélice	XXPR20A	XXPR20B	XXPR20A	XXPR20C	XXPR24B	1
4	Grille d'entrée	XXWG20A	XXWG20A	XXWG20A	XXWG20A	XXWG24A	1
5	Bride de fixation	XXSS680PC	XXSS680PC	XXSS680PC	XXSS4680PC	XXSS930PC	1
6	Vis 3/8-24 X 1"	*	*	*	*	*	1
7	Ecrou bloquant 3/8-24	*	*	*	*	*	1
8	Vis SM no. 10-16 x 5/8"	*	*	*	*	*	4
9	Ecrou verrouillage cranté no. 8-32	*	*	*	*	*	4

No. de ref.	Description	Numéro de pièce pour les modèles 1HLB2	1HLB3	1HLB4	1HLB5	1HLB6	Qté.
1	Moteur	XXMTHX6082	XXMTHX6804	XXMTHX6083	XXMTHX7341	XXMTHX7278	1
2	Assemblage claire-voie	502G-24	502G-24	502G-24	556G-30	556G-36	1
3	Hélice	XXPR24A	XXPR24A	XXPR24B	XXPR30A	XXPR36A	1
4	Grille d'entrée	XXWG24A	XXWG24A	XXWG24A	XXWG30A	XXWG36A	1
5	Bride de fixation	XXSS930PC	XXSS930PC	XXSS930PC	XXSS930PC	XXSS1350PC	1
6	Vis 3/8-24 X 1"	*	*	*	*	*	1
7	Ecrou bloquant 3/8-24	*	*	*	*	*	1
8	Vis SM no. 10-16 x 5/8"	*	*	*	*	*	4
9	Ecrou verrouillage cranté no. 8-32	*	*	*	*	*	4

(*) Quincaillerie standard, disponible sur place

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Ventilateurs d'extraction utilitaires à claire-voie Dayton®

Tableau de dépannage

Symptôme	Cause(s) possible(s)	Mesure corrective
Fonctionnement trop bruyant	1. Coussinets de moteur secs	1. Relubrifier coussinets moteur suivant instructions ou remplacer moteur.
	2. Hélice desserrée	2. Serrer la vis de pression au centre
	3. Hélice tordue ou endommagée	3. Remplacer hélice
Ventilateur ne fonctionne pas	1. Fusible grillé ou disjoncteur ouvert	1. Remplacer fusible ou rétablir disjoncteur
	2. Moteur défectueux	2. Réparer ou remplacer moteur (voir Figure 3)
	3. Contrôleur de vitesse éteint ou trop bas	3. Augmenter la vitesse à l'aide du contrôleur

GARANTIE LIMITÉE

GARANTIE DAYTON LIMITÉE À UN AN. *Les modèles couverts dans ce manuel Ventilateurs d'extraction utilitaires à claire-voie Dayton® sont garantis àl'utilisateur d'origine par Dayton Electric Mfg. Co. (Dayton), contre tout défaut de fabrication ou de matériaux, lors d'uneutilisation normale, et cela pendant un an après la date d'achat. Toute pièce, dont les matériaux ou la main d'oeuvre serontjugés défectueux par Dayton, et qui sera renvoyée, port payé, à un centre de réparation autorisé par Dayton, sera, à titre desolution exclusive, soit réparée, soit remplacée, par Dayton. Pour le procédé de réclamation sous garantie limitée, reportez-vous à la clause de DISPOSITION PROMTE ci-dessous. Cette garantie limitée donne aux acheteurs des droits légaux spécifiquesqui varient de juridiction à juridiction.*

LIMITES DE RESPONSABILITÉ. *La responsabilité de Dayton, dans les limites permises par la loi, pour les dommages indirectsou fortuits est expressement déniée. Dans tous les cas la responsabilité de Dayton est limitée et ne dépassera pas la valeur duprix d'achat payé.*

DÉSISTEMENT DE GARANTIE. *Dayton a fait de dilligents efforts pour fournir avec précision les informations et illustrationsdes produits décrits dans cette brochure ; cependant, de telles informations et illustrations sont pour la seule raisond'identification, et n'expriment ni n'impliquent que les produits sont COMMERCIALISABLES, ou ADAPTABLES À UN BESOINPARTICULIER, ni que ces produits sont nécessairement conformes aux illustrations ou descriptions. Sauf pour ce qui suit,aucune garantie ou affirmation de fait, énoncée ou impliquée, autre que ce qui est énoncé dans la « GARANTIE LIMITÉE »ci-dessus n'est faite ou autorisée par Dayton.*

CONFORMITÉ DU PRODUIT. *De nombreuses juridictions ont des codes et réglements qui gouvernent les ventes,constructions, installation et/ou usage de produits pour certains usages qui peuvent varier par rapport à une zone voisine.Bien que Dayton essaie de s'assurer que ses produits s'accordent avec ces codes, il ne peut pas garantir cet accord, et ne peutpas être responsable de la façon dont le produit et installé ou utilisé. Avant l'achat et l'usage d'un produit, revoir lesapplications de ce produit, ainsi que tous les codes et réglements nationaux et locaux applicables, et s'assurer que le produit,son installation et son usage sont en accord avec eux.*

Certains aspects de désistement ne sont pas applicables aux produits pour consommateur ; ex : (a) certaines juridictions nepermettent pas l'exclusion ou la limitation des dommages indirects ou fortuits et donc la limitation ou exclusion ci-dessuspeut ne pas s'appliquer dans le cas présent ; (b) également, certaines juridictions n'autorisent pas de limitations de durée dela garantie implicite, en conséquence, la limitation ci-dessus peut ne pas s'appliquer dans le cas présent ; et (c) par force deloi, pendant la période de cette Garantie Limitée, toutes garanties impliquées de commerciabilité ou d'adaptabilité à unbesoin particulier applicables aux produits de consommateurs achetés par des consommateurs, peuvent ne pas être exclues ni autrement désistées.

DISPOSITION PROMPTE. *Dayton fera un effort de bonne foi pour corriger ou ajuster rapidement tout produit prouvé défec-tueux pendant la période de la garantie limitée. Pour tout produit considéré défectueux pendant la période de garantielimitée, contacter tout d'abord le concessionnaire où l'appareil a été acheté. Le concessionnaire doit donner des instructionssupplémentaires. S'il est impossible de résoudre le problème de façon satisfaisante, écrire à Dayton à l'adresse ci-dessous, en indiquant le nom et l'adresse du concessionnaire, la date et le numéro de la facture du concessionnaire, et en décrivant la nature du défaut. Le titre et le risque de perte passent à l'acheteur au moment de la livraison par letransporteur. Si le produit a été endommagé pendant le transport, une réclamation doit être faite auprès du transporteur.*

Fabriqué pour Dayton Electric Mfg. Co., 5959 W. Howard St., Niles, Illinois 60714 États-Unis

FRANÇAIS

sunne controls

DIVISION PECO, INC.

NEMA 4X RAINTIGHT THERMOSTAT INSTALLATION AND OPERATING INSTRUCTIONS

INSTRUCCIONES DE INSTALACION Y OPERACION DEL THERMOSTATO A PRUEBA DE LLUVIA NEMA 4X

THERMOSTAT NEMA 4X ÉTANCHE AUX INTEMPÉRIES INSTRUCTION D'INSTALLATION ET D'UTILISATION

⚠ WARNING

To prevent overheating or fire, use this control as an operating or regulating thermostat. ALWAYS USE A BACKUP CONTROL OR ALARM if a control failure could cause the controlled appliance to overheat or could cause a fire

Where thermostat is capable of cycling directly between heating and cooling loads, failure to provide a load transfer switch will result in thermostat failure.

Do not install, use or operate if product appears damaged, the enclosure is cracked or broken or if the sensor has been bent, crimped or is dirty.

APPROPRIATE APPLICATION

This thermostat has been tested by CSA and Underwriters Laboratories Inc. (UL), meets the requirements for NEMA 4X equipment and is suitable for use under the National Electrical Code (NEC), Article 547-7, when used with appropriate watertight connectors (not included).

INSTALLATION

⚠ WARNING

To avoid electrical shock or damage to equipment, disconnect all power before installing or servicing.

To avoid potential fire and/or explosion, do not use in potentially flammable or explosive atmospheres.

Installation must be made by a trained, qualified service person in accordance with the National Electrical Code (NEC) and all applicable local codes and ordinances. Installation should meet all applicable national, state and local codes. Refer to the appropriate wiring diagram included. Locate the thermostat (local sensing models) or sensing bulb (remote sensing models) for optimum temperature sensing of the controlled space. Thermostat operation will be affected by unusual heat or cold, such as direct sunlight, near windows or doors or on outside walls.

All fittings and materials used for the installation should be approved, suitable and installed properly for the intended application. For water tightness, the cord seal or conduit hub should be UL listed and marked 4X. The conduit hub is to be tightened onto the conduit before installing in the enclosure.

Where applicable, remove knockout(s) by impacting near the inside edge of the knockout to be removed. **IMPORTANT: Do not impact, dent or use the sensor for support. This will cause calibration and/or thermostat failure.**

⚠ WARNING

READ INSTRUCTION CAREFULLY BEFORE ATTEMPTING TO INSTALL, OPERATE OR SERVICE THIS THERMOSTAT. Failure to observe safety information and comply with instructions could result in PERSONAL INJURY, DEATH AND/OR PROPERTY DAMAGE.
Retain these instructions for future reference. This product, when installed, will be part of an engineered system whose specifications and performance characteristics are not designed or controlled by Sunne Controls. You must review your application and national and local codes to assure that your installation will be functional and safe.

Even though this thermostat is sealed, water or dust could enter through improperly sealed wiring. A drip loop should be provided to prevent water and other liquids from entering the thermostat housing. The cord or conduit connections to the enclosure must be water and dust tight. The cover must be tightened securely to compress the gasket and provide a watertight seal. Use only screws provided. Do not over-tighten.

Maximum sensing element withstand temperature is 35°F (20°C) above the highest temperature setting. Maximum temperature for the plastic enclosure is 140°F 60°C.

⚠ CAUTION

For use in wet or humid environments or where water tightness is required, failure to use suitable watertight connections and suitable drip loop could allow water to enter the enclosure resulting in thermostat failure.

Use copper wire only. Insulate or wire-nut all unused leads.

Use the grounding provisions provided for connection to the line ground and equipment ground wire.

OPERATION AND CHECK-OUT

Allow one hour or necessary amount of time for the thermostat and system to stabilize for normal operation. This thermostat is factory calibrated and requires no correction on site.

TO CHECK OPERATION OF HEATING SYSTEMS:

1. Disconnect power.
2. Place the heat/cool selector switch, if applicable, in the heat position.
3. Adjust the thermostat set point to at least 10°F (5°C) below the temperature of the controlled space.
4. Restore power.
5. Slowly adjust the thermostat knob to raise the set point. When the set point reaches the approximate temperature of the controlled space, the heating equipment should start.

TO CHECK OPERATION OF COOLING SYSTEMS:

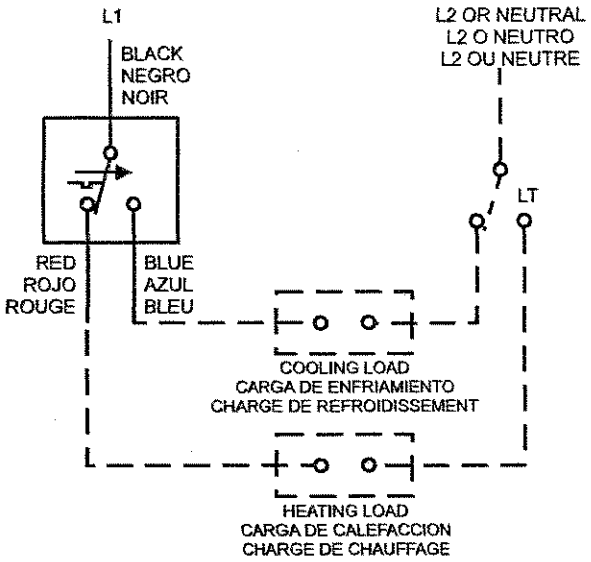
1. Disconnect power.
2. Place the heat/cool selector switch, if applicable, in the cool position.
3. Adjust the thermostat set point to at least 10°F (5°C) above the temperature of the controlled space.
4. Restore power.
5. Slowly adjust the thermostat knob to lower the set point. When the set point reaches the approximate temperature of the controlled space, the cooling equipment should start.

LIMITED WARRANTY

1. WARRANTY COVERAGE. Sunne Controls warrants to the original user of its products that the products will, at the date of initial purchase, meet the applicable specification for such products and will be free from any defects in materials or manufacture under normal use for 18 months after date of manufacture.
2. DISCLAIMER OF WARRANTY OF PRODUCT SUITABILITY. Sunne Controls makes no warranty to the purchaser or any third party that its products are suitable for a particular application or design. Many states and localities have differing codes or regulations governing the installation and/or use of Sunne Controls' products. Sunne Controls cannot guarantee compliance with such regulations; purchaser is solely responsible for safe and correct installation and use of the product and for compliance with applicable codes and regulations.
3. EXCLUSION OF IMPLIED WARRANTIES. This warranty is the only warranty applicable to this product and excludes all other warranties, including any WARRANTY OF MERCHANTABILITY, any warranty of fitness for a particular purpose, and any implied warranties otherwise arising from course of dealing or usage of trade, except where the product purchased is subject to consumer product warranty laws, in which case ANY APPLICABLE IMPLIED WARRANTIES ARE LIMITED TO 18 MONTHS, or such shorter period as permitted or required under applicable law.
Some States do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.
4. REMEDIES FOR NONCONFORMITY. If the product purchased does not conform to the applicable warranty, Sunne Controls will provide, at its option and in accordance with the procedures in the following section, one of the following remedies: (1) repair of the nonconforming product, (2) replacement with a conforming product, (3) refund of the original purchase price. THESE REMEDIES SHALL BE THE EXCLUSIVE AND SOLE REMEDY for any breach of warranty.
5. TO OBTAIN WARRANTY SERVICE. For any product believed to be defective within the limited warranty period, first write or call dealer from whom product was purchased. Dealer will give additional directions. If unable to resolve satisfactorily, write to Sunne Controls at the address below, giving dealer's name, address, date and number of dealer's invoice, and describe the nature of the defect.
6. LIMITATION OF LIABILITY. SUNNE CONTROLS WILL NOT BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES resulting from any defect in the product purchased. Some States do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from State to State.

Manufactured by Sunne Controls, a division of PECO Mfg. Co., Inc.
4709 SE 18th Avenue - Portland, OR 97202 - USA
P.O. Box 82189 - Portland, OR 97282 - USA



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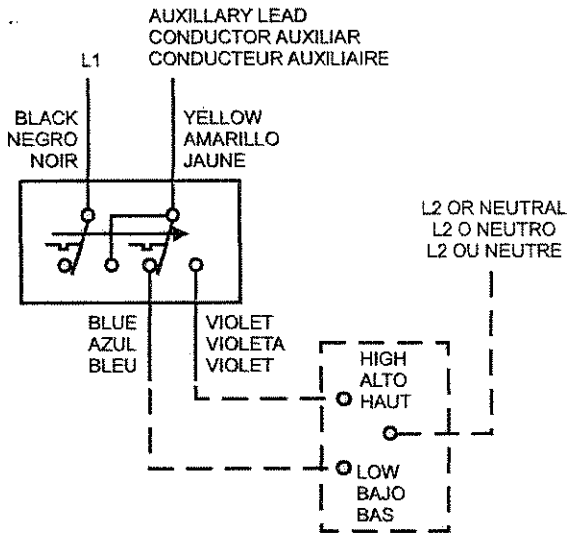
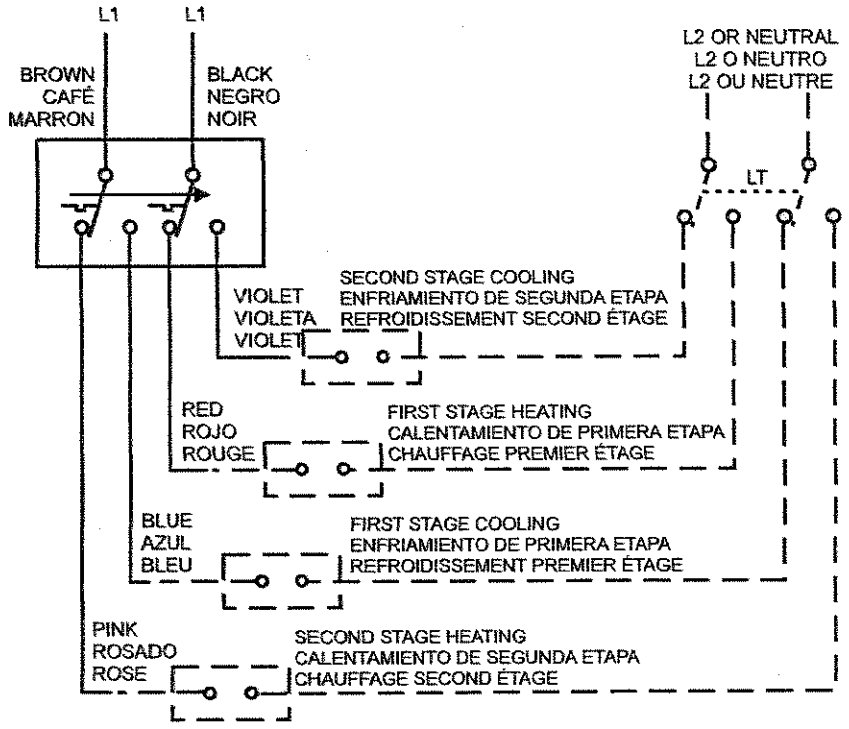


TJ109 MODELS



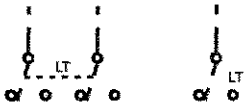
TH109

LEGEND
LEYENDA
LÉGENDE

THERMOSTAT WIRING
CABLEADO DEL TERMOSTATO
CABLAGE DU THERMOSTAT

FIELD WIRING
CABLEADO EN EL TERRENO
CABLAGE SUR PLACE

INDICATES SEQUENCE ON TEMPERATURE RISE
INDICA LA SECUENCIA CUANDO LA TEMPERATURA SE
INDIQUE LA SE SÈQUENCE DE LA MONTÉE DE TEMPÉRATURE



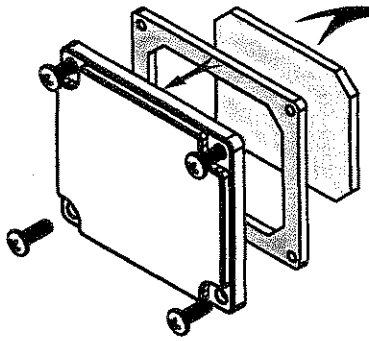
LOAD TRANSFER SWITCH
INTERRUPTOR DE TRANSFERENCIA DE CARGA
INTERRUPTEUR DE TRANDFERT DE CHARGE

WARNING
ADVERTENCIA
AVERTISSEMENT

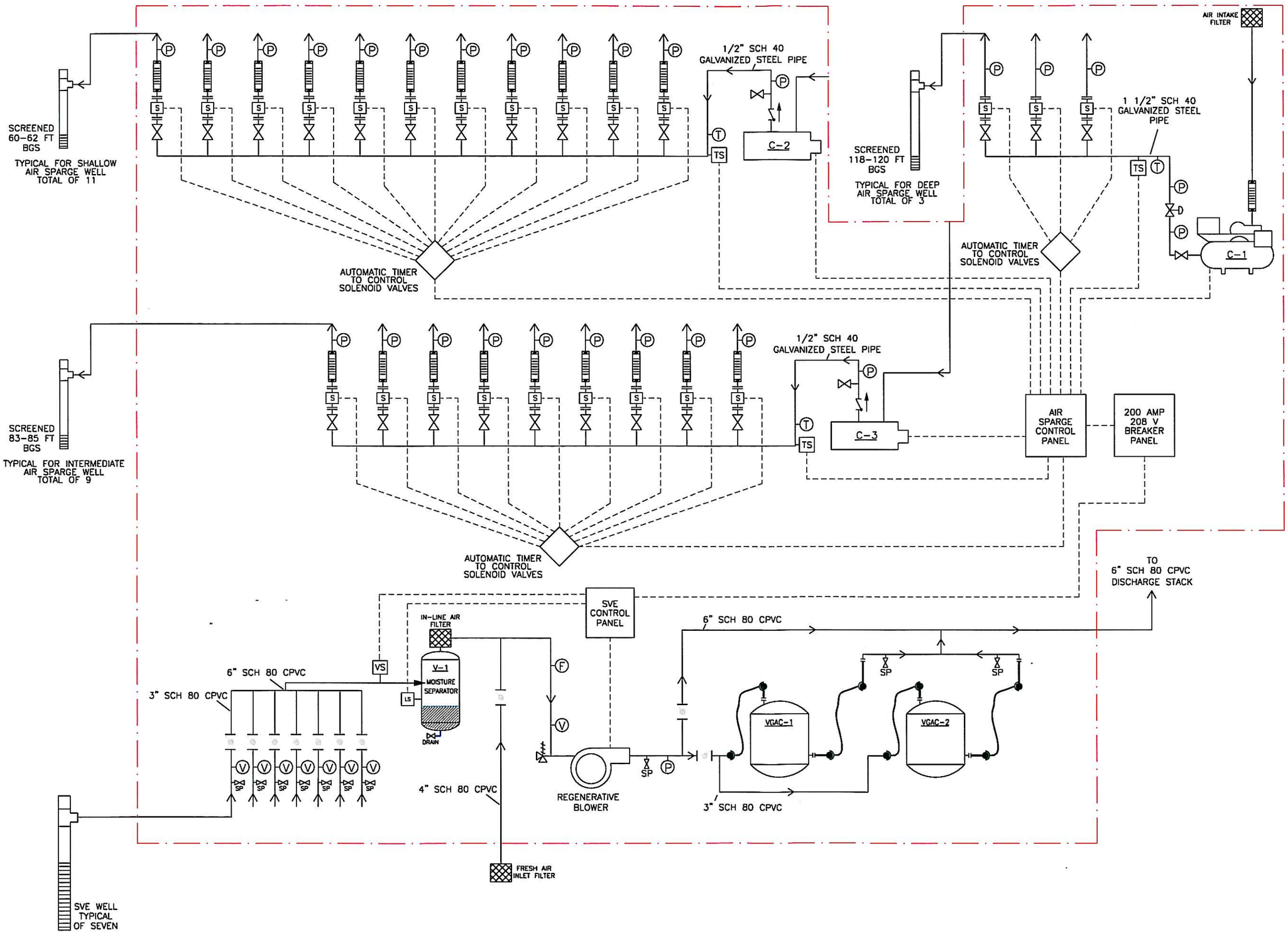
-TO INSURE WATER TIGHTNESS, THE ENCLOSED GASKET MUST BE INSTALLED UNDER THE WIRING CAP.

-PARA ASEGURAR LA ESTANQUIDAD AL AGUA, LA JUNTA SUMINISTRADA DEBERÁ INSTALARSE DEBAJO DEL CASQUETE DEL ALAMBRADO.

-POUR ASSURER L'ÉTANCHÉITÉ À L'EAU, LE JOINT STATIQUE (FOURNI) DOIT ÊTRE INSTALLÉ SOUS LE CULOT POUR CÂBLAGE.



-REMOVE AND DISCARD THE CENTER OF THE GASKET
-EXTRAIGA Y DESCARTE LA PARTE CENTRAL DE LA JUNTA
-ENLEVER LE CENTRE DU JOINT ET LE METTRE AU REBUT



SYSTEM LEGEND:

- VACUUM GAUGE
- TEMPERATURE GAUGE
- PRESSURE GAUGE
- FLOW INDICATOR
- ROTAMETER FLOW METER
- BALL VALVE
- SAMPLE PORT
- BUTTERFLY VALVE
- SOLENOID VALVE
- PRESSURE REGULATOR VALVE
- RELIEF VALVE
- CHECK VALVE
- LEVEL SWITCH
- VACUUM SWITCH
- TEMPERATURE SWITCH
- AIR FLOW DIRECTION
- ENCLOSURE LIMITS
- ELECTRIC LINE

DRAWN/REVISED BY: JW
REVISION DATE: JANUARY 8, 2007

FIGURE: 2

DRAWING TITLE

AIR SPARGE/SOIL VAPOR EXTRACTION SYSTEM PROCESS AND INSTRUMENTATION DIAGRAM

PROJECT NAME

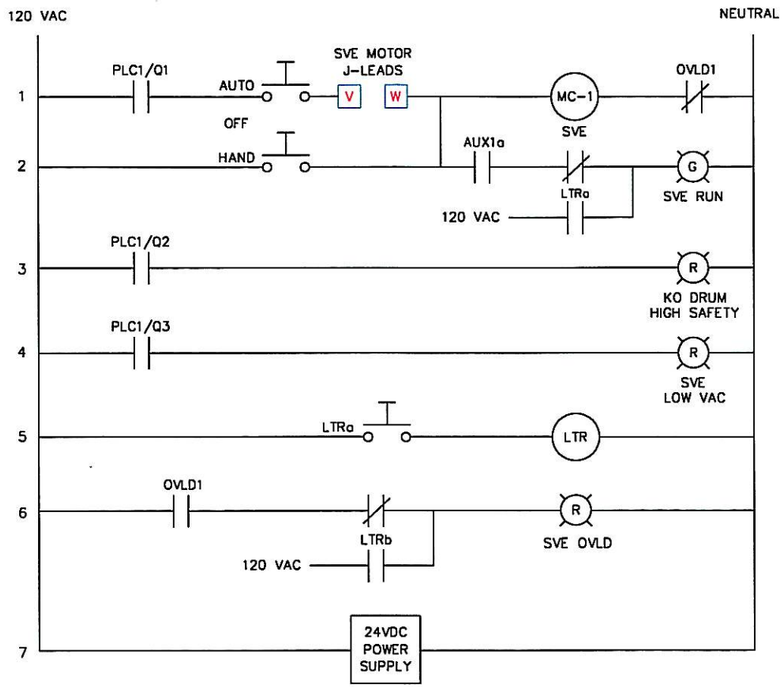
MARK HOLDINGS
90–30 METROPOLITAN AVENUE
REGO PARK, NEW YORK

PREPARED FOR

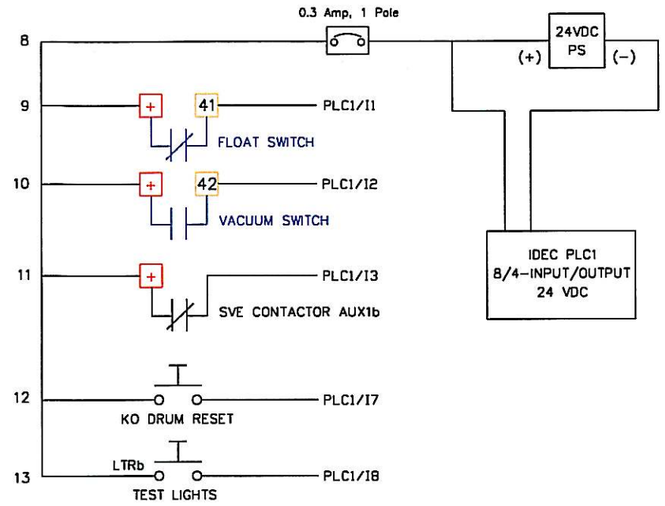
FPM GROUP
909 MARCONI AVENUE
RONKONKOMA, NY 11779

EnviroTrac
ENVIRONMENTAL SERVICES
5 OLD DOCK ROAD, YAPHANK, NEW YORK 11980
PHONE: (631)924–3001 FAX: (631)924–5001

CONTROL CIRCUIT LADDER SCHEMATIC



LOW VOLTAGE (24DC) LADDER SCHEMATIC

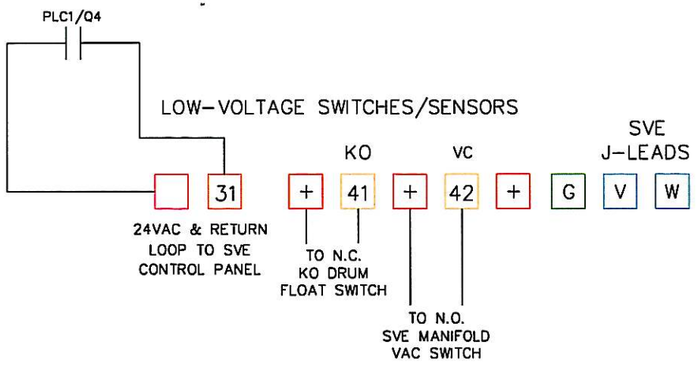


LEGEND:

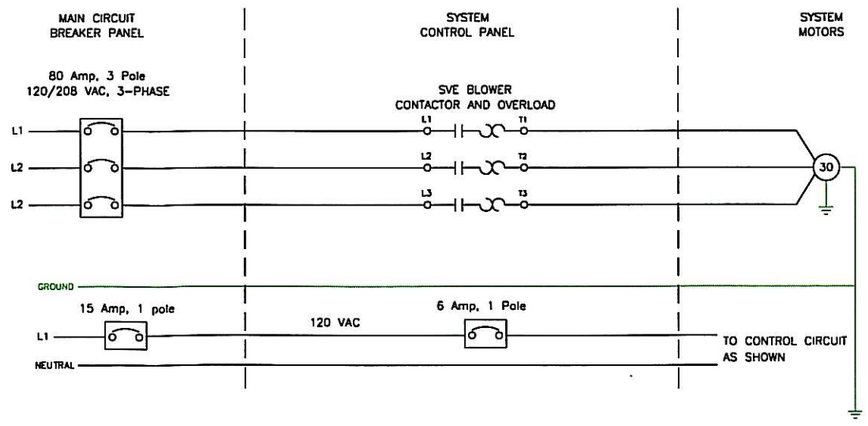
- NORMALLY OPEN SWITCH
- MC-X — COIL OF MOTOR CONTACTOR "X"
- G — GREEN LIGHT
- R — RED LIGHT
- NORMALLY CLOSED CIRCUIT
- NORMALLY OPEN CIRCUIT
- OVLD — THERMAL OVERLOAD
- TERMINAL BLOCK

PLC1/Qx PLC1 DISCRETE OUTPUT x
PLC1/Ix PLC1 DISCRETE INPUT x

TERMINAL BLOCK LAYOUT & DESIGNATIONS



TERMINAL BLOCK LAYOUT & DESIGNATIONS



DRAWN/REVISED BY: OL
REVISION DATE: FEB. 20, 2007

FIGURE: E1

DRAWING TITLE

AIR SPARGE/SOIL VAPOR EXTRACTION
SVE CONTROL PANEL SCHEMATIC
ETNY S/N: REGOPK-CP1-022007

PROJECT NAME

MARK HOLDINGS
90-30 METROPOLITAN AVENUE
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PREPARED FOR

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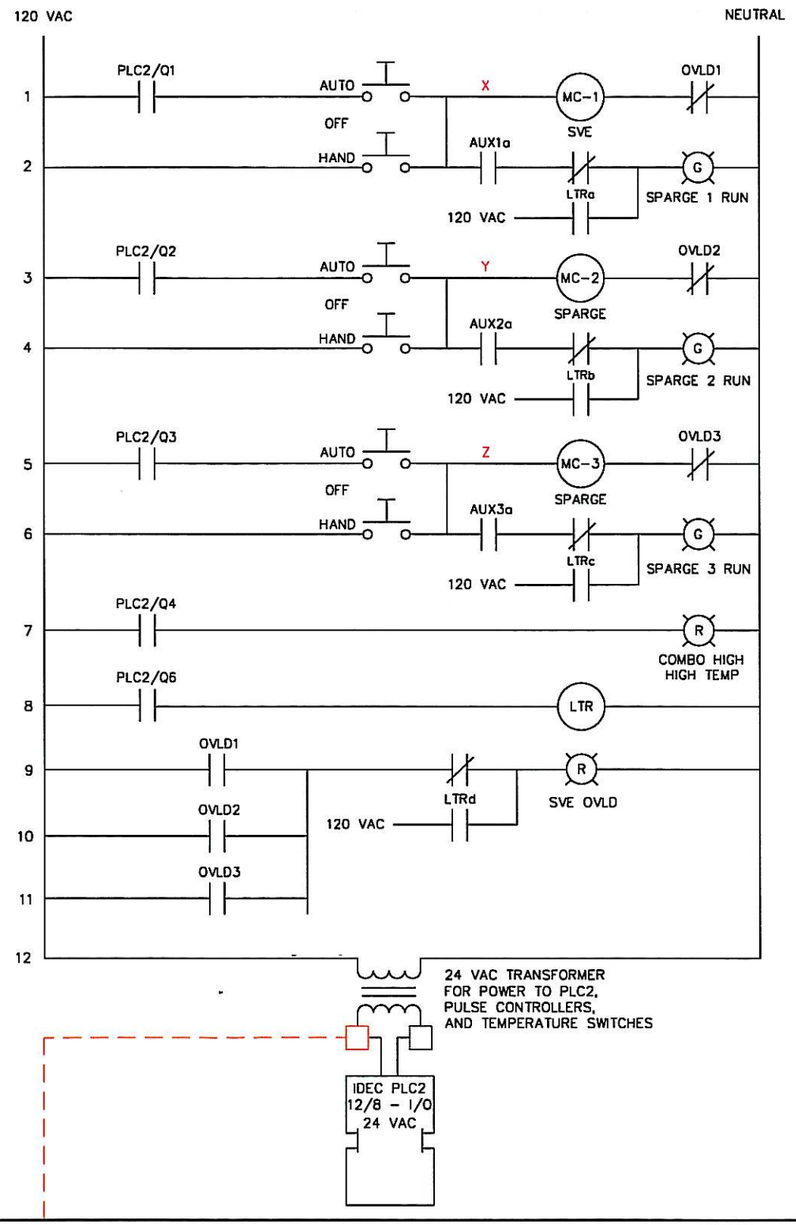
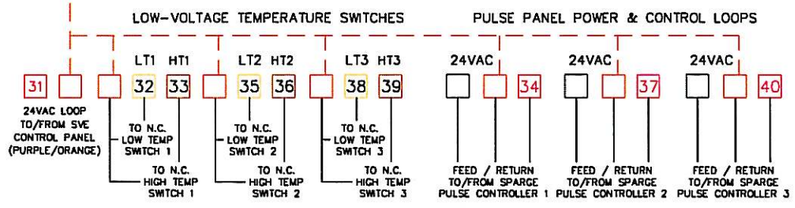
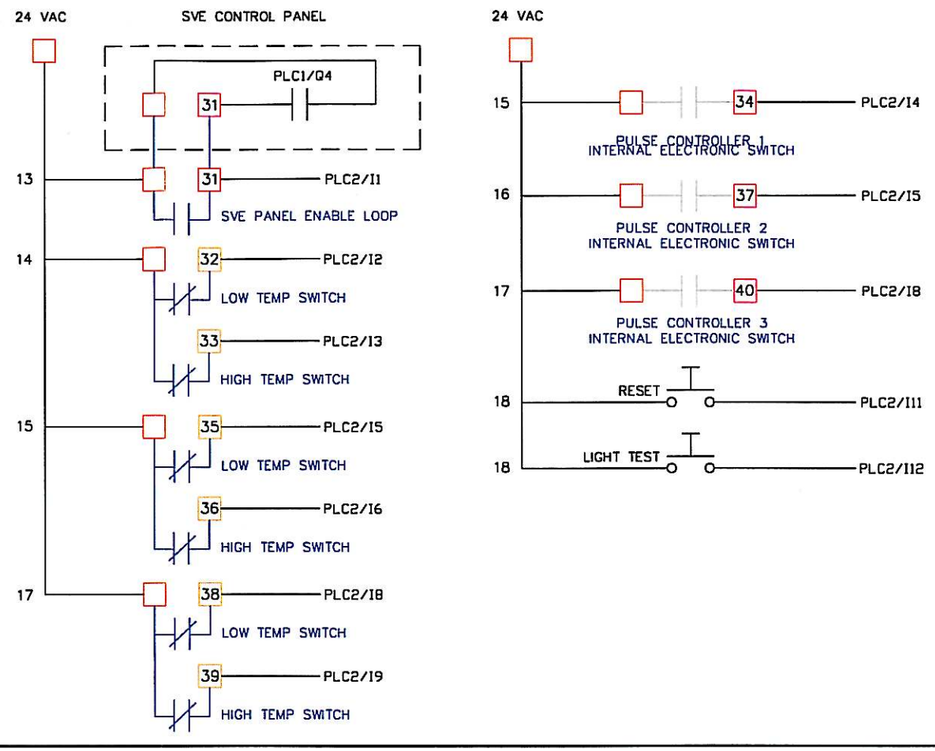
CONTROL CIRCUIT LADDER SCHEMATIC



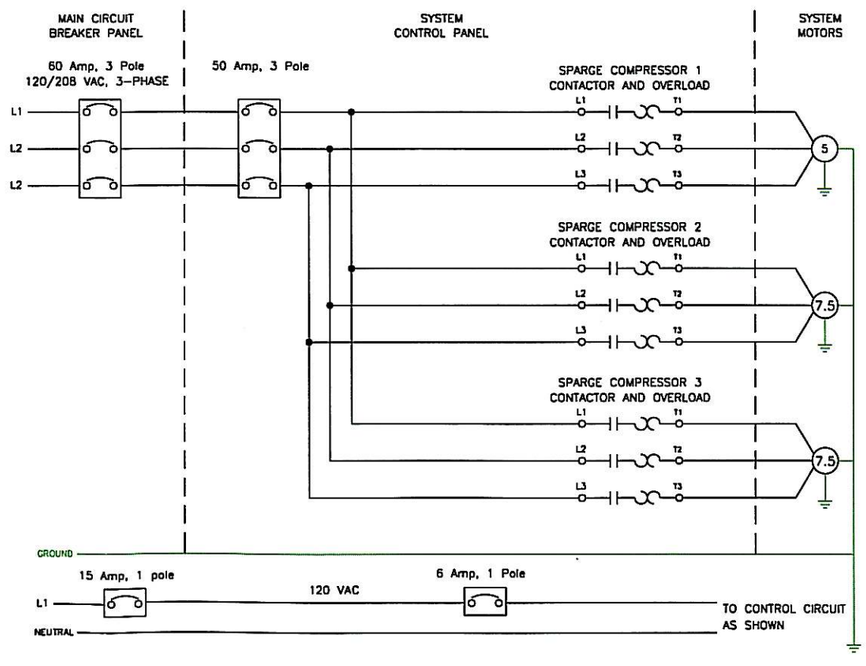
TERMINAL BLOCK LAYOUT & DESIGNATIONS



LOW VOLTAGE (24VAC) LADDER SCHEMATIC



HIGH VOLTAGE POWER DISTRIBUTION



LEGEND:

- NORMALLY OPEN SWITCH
- (MC-X) COIL OF MOTOR CONTACTOR "X"
- (G) GREEN LIGHT
- (R) RED LIGHT
- NORMALLY CLOSED CIRCUIT
- NORMALLY OPEN CIRCUIT
- OVLD THERMAL OVERLOAD
- TERMINAL BLOCK
- PLC/Qx PLC DISCRETE OUTPUT x
- PLC/Ix PLC DISCRETE INPUT x

NOTE: ALL PLC2 OUTPUTS ARE INTERNALLY SHORTED.

DRAWN/REVISED BY: OL
REVISION DATE: FEB. 22, 2007

FIGURE: E2

DRAWING TITLE

AIR SPARGE/SOIL VAPOR EXTRACTION
SPARGE CONTROL PANEL SCHEMATIC
ETNY S/N: REGOPK-CP2-B2007

PROJECT NAME

MARK HOLDINGS
90-30 METROPOLITAN AVENUE
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