Gardner Denver EPC
11611 Tanner Road
Houston, TX 77041-6906

Gardner Denver

INSTRUCTION OPERATION
AND
MAINTENANCE MANUAL
REVISION 3

C. EMERY NELSON, INC.

METROPOLITAN WASTEWATER TREATMENT PLANT
SOLIDS PROCESSING IMPROVEMENT PROJECT

MCES NO. 970300

(5) GARDNER DENVER CYCLOBLOWER®
11CDL31-L BLOWER PACKAGE

TAG NO. 1206 S/N 136962
TAG NO. 1207 S/N 136963
TAG NO. 1208 S/N 138685
TAG NO. 1209 S/N 138687
TAG NO. 1210 S/N 138686

P.O. CENO2-6011

GDEPC S.O. 85131

FOR PARTS AND SERVICE

GARDNER DENVER
ENGINEERED PACKAGING CENTER.
1800 GARDNER EXPRESSWAY
QUINCY IL 62305-4024
PHONE: 217-222-5400 - 800-682-9868
FAX: 217-228-8247

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GARDNER DENVER CYCLOBLOWER® 11CDL31-L BLOWER PACKAGE
P.O. CENO2-6011 - GDEPC S.O. 85131

CONTRACTOR: **KNUTSON CONSTRUCTION SERVICES**
5500 WAYZATA BLVD, SUITE 300
MINNEAPOLIS MN 55416-1264
RESPONSIBLE PARTY: JASON VALCHECK
PHONE: 763-546-1400 FAX: 763-546-2226

TABLE OF CONTENTS

OPERATIONS MANUAL
LONG TERM / OUTDOOR STORAGE
BILL OF MATERIAL / PERFORMANCE DATA
SUPPLIERS

SECTION 1 BLOWER **CYCLOBLOWER 11CDL31-L**
BLOWER OUTLINE DIMENSION DRAWING SC-449
BLOWER PERFORMANCE / BLOWER CURVE
PRESSURE PERFORMANCE CURVE
VIBRATION LIMITS
OPERATING AND SERVICE MANUAL / PARTS LIST
LIFTING BLOWER WITHOUT LIFTING LUGS PROCEDURE

SECTION 2 MOTOR **GE INDUSTRIAL MOTOR MODEL 5K449SSH222**
MOTOR MANUFACTURER
MOTOR PERFORMANCE DATA
OUTLINE DRAWING 225B6575BD
CONNECTION DIAGRAM
SPEED TORQUE CURRENT CURVE
INSTALLATION & MAINTENANCE INSTRUCTIONS

SECTION 3 DRIVE **FALK T10 STEELFLEX COUPLING**
FALK COUPLING DRIVE MANUFACTURER
DIMENSION DRAWING
INSTALLATION AND MAINTENANCE MANUAL

SECTION 4 ACCESSORIES & INSTRUMENTS
EXPANSION JOINT – 14" STAINLESS STEEL
EXPANSION JOINT – 12" STAINLESS STEEL
SPECIAL CCS-14 INTAKE FILTER SILENCER DWG 34-214-AK
INSTALLATION OPERATION & MAINTENANCE INSTRUCTIONS
STANDARD RISH-14 INLET SILENCER DRAWING 54-314-AA
STANDARD RISY/SDY-12 BLOWER SILENCER DRAWING 54-212-AA
INSTALLATION OPERATION & MAINTENANCE INSTRUCTIONS
SUTORBILT WEIGHT LOADED PRESSURE RELIEF VALVE
MURPHY 4.5 IN DIAL TEMP SWITCHGAGE SPL SERIES
ASHCROFT PRESSURE SWITCH MODEL B4
ASHCROFT TEMPERATURE SWITCH MODEL T4
ASHCROFT PRESSURE GAUGE/ VACUUM GAUGE DURAGAUGE TYPE 1377
METREX VIBRATION SWITCH PMC-4400SR-0.2 – 0.3
METREX VIBRATION PROBES PMC 160A-000-1172
THERMOMETRIC RISTANCE TEMPERATURE DETECTOR

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P.O. CENO2-6011 - GDEPC S.O. 85131

TABLE OF CONTENTS

SECTION 5 CONTROL PANEL

TAG NO. 1206	
INTERIOR & EXTERIOR LAYOUT DRAWING	**85131-650**
CONTROL POWER WIRING DIAGRAM	**85131-600**
DISCRETE INPUTS WIRING DIAGRAM	**85131-601**
DISCRETE OUTPUTS WIRING DIAGRAM	**85131-602**
RTD INPUTS WIRING DIAGRAM	**85131-603**
RELAY DRY CONTACT WIRING DIAGRAM	**85131-604**
TAG NO. 1207	
INTERIOR & EXTERIOR LAYOUT DRAWING	**85131-651**
CONTROL POWER WIRING DIAGRAM	85131-610
DISCRETE INPUTS WIRING DIAGRAM	**85131-611**
DISCRETE OUTPUTS WIRING DIAGRAM	**85131-612**
RTD INPUTS WIRING DIAGRAM	**85131-613**
RELAY DRY CONTACT WIRING DIAGRAM	**85131-614**
TAG NO. 1208	
INTERIOR & EXTERIOR LAYOUT DRAWING	**85131-652**
CONTROL POWER WIRING DIAGRAM	**85131-620**
DISCRETE INPUTS WIRING DIAGRAM	**85131-621**
DISCRETE OUTPUTS WIRING DIAGRAM	**85131-622**
RTD INPUTS WIRING DIAGRAM	**85131-623**
RELAY DRY CONTACT WIRING DIAGRAM	**85131-624**
TAG NO. 1209	
INTERIOR & EXTERIOR LAYOUT DRAWING	**85131-653**
CONTROL POWER WIRING DIAGRAM	**85131-630**
DISCRETE INPUTS WIRING DIAGRAM	**85131-631**
DISCRETE OUTPUTS WIRING DIAGRAM	**85131-632**
RTD INPUTS WIRING DIAGRAM	**85131-633**
RELAY DRY CONTACT WIRING DIAGRAM	**85131-634**
TAG NO. 1210	
INTERIOR & EXTERIOR LAYOUT DRAWING	**85131-654**
CONTROL POWER WIRING DIAGRAM	**85131-640**
DISCRETE INPUTS WIRING DIAGRAM	**85131-641**
DISCRETE OUTPUTS WIRING DIAGRAM	**85131-642**
RTD INPUTS WIRING DIAGRAM	**85131-643**
RELAY DRY CONTACT WIRING DIAGRAM	**85131-644**

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11611 Tanner Road
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C. EMERY NELSON, INC.
METROPOLITAN WASTWATER TREATMENT PLANT
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GARDNER DENVER CYCLOBLOWER® 11CDL31-L BLOWER PACKAGE
P.O. CENO2-6011 - GDEPC S.O. 85131

TABLE OF CONTENTS

SECTION 5 CONTROL PANEL

TAG NO. 1206, 1207, 1208, 1209, 1210

BLOWER PACKAGE BASE MOUNTED WIRING DIAGRAM **85131-660** (1 OF 2)
BLOWER PACKAGE BASE MOUNTED WIRING DIAGRAM **85131-660** (2 OF 2)
BLOWER PACKAGE 120 VAC JUNCTION BOX DRAWING **85131-661**
BLOWER PACKAGE ANALOG JUNCTION BOX DRAWING **85131-662**
BLOWER PACKAGE BASE MOUNTED CONDUIT ASSEMBLY DWG **85131-663**
PLC PROGRAM PRINT OUT

SECTION 6 TEST PROCEDURE / TEST DATA

CYCLOBLOWER TEST PROCEDURE
CYCLOBLOWER TEST DATA
STANDARD BLOWER MECHANICAL RUNNING TEST

TAG NO. 1206

CYCLOBLOWER ASSEMBLY & TEST RECORD
MOTOR TEST DATA
COLD ALIGNMENT DIAGRAM
MECHANICAL TEST RUN

TAG NO. 1207

CYCLOBLOWER ASSEMBLY & TEST RECORD
MOTOR TEST DATA
COLD ALIGNMENT DIAGRAM
MECHANICAL TEST RUN

TAG NO. 1208

CYCLOBLOWER ASSEMBLY & TEST RECORD
MOTOR TEST DATA
COLD ALIGNMENT DIAGRAM
MECHANICAL TEST RUN

TAG NO. 1209

CYCLOBLOWER ASSEMBLY & TEST RECORD
MOTOR TEST DATA
COLD ALIGNMENT DIAGRAM
MECHANICAL TEST RUN

TAG NO. 1210

CYCLOBLOWER ASSEMBLY & TEST RECORD
MOTOR TEST DATA
COLD ALIGNMENT DIAGRAM
MECHANICAL TEST RUN

CORPRO SYSTEMS COATING INSPECTION LOG
MATERIAL TEST REPORTS

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GARDNER DENVER CYCLOBLOWER® 11CDL31-L BLOWER PACKAGE
P.O. CENO2-6011 - GDEPC S.O. 85131

TABLE OF CONTENTS

SECTION 7 LUBRICATION
AEON PD LUBRICATION
MATERIAL SAFETY DATA SHEET

SECTION 8 SPARE PARTS
PARTS QUOTATION

SECTION 9 DRAWINGS
CUSTOMER INSTALLATION DRAWING **85131-200**
GENERAL ARRANGEMENT DRAWING **85131-201** (SHEET 1 OF 3)
GENERAL ARRANGEMENT DRAWING **85131-201** (SHEET 2 OF 3)
GENERAL ARRANGEMENT DRAWING **85131-201** (SHEET 3 OF 3)

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Engineered Packaging Center

Blowers • Compressors • Vacuum Pumps
Air & Gas Systems

OPERATIONS MANUAL

Rotary Positive Displacement Blower Packages

Safety Precautions ..... Page 2
Start-up Procedures ..... Page 2
Preventative Maintenance ..... Page 3
Trouble Shooting ..... Page 4

11611 Tanner Road
Houston, Texas 77041-6906
Ph: 1-800-369-9395 / 713-896-6510
Fx: 713-896-1693

www.allen-stuart.com

SAFETY PRECAUTIONS

Safety Valves: Safety valves are pressure relief valves and should be sized and purchased with a pressure setting to protect the weakest link in the system. Never change the pressure setting, only the safety valve manufacturer or an approved representative is qualified to make a change.

The safety valve shall prevent pressure in the weakest component from exceeding 110% of the maximum allowable working pressure during maximum flow conditions but must not be set higher than the maximum working pressure of the weakest link. Failure to properly size, set and install pressure relief valves can be fatal.

Guards: All mechanical action or motion is hazardous in varying degrees and requires guarding. Guarding shall be in compliance with OSHA.

Guards must be fastened in place before starting the machine and never removed before cutting off and locking out the main power supply.

Electrical: Before installation, the electrical supply should be checked for adequate wire size and transformer capacity. During installation a suitably fused or circuit breaker disconnect switch should be provided. Where a 3 phase motor is used to drive the unit any unreasonable voltage unbalance between the legs must be reduced and any low voltage corrected to prevent excessive current draw. The installation, electric motor, wiring and all electrical controls must be in accordance with ANSI National Electrical Code, state and local codes. All electrical work should be performed by a qualified electrician. Failure to abide by the national, state and local codes may result in physical harm, death and/or property damage. See enclosed wiring diagram.

WARNING, be sure the skid is grounded.

Warnings: Warning signs and labels shall be provided with enough light to read, conspicuously located and maintained for legibility. Do not remove any warnings, caution or instructional material attached!

Instructional Manual: Provisions should be made to have the instuction manual readily available to the operator and maintenance personnel. If for any reason the manual is lost or becomes illegible, have it replaced immediately. The instruction manual should be read periodically to refresh one's memory, it may prevent a serious accident.

Preparing for Maintenance or Service:
WARNING - NEVER ASSUME THE UNIT IS READY FOR MAINTENANCE OR SERVICE BECAUSE IT IS STOPPED. THE AUTOMATIC STOP-START CONTROL MAY START THE UNIT AT ANY TIME.

The following procedure should be followed to maximize safety when preparing for maintenance or service:

1. Disconnect and lock-out the main power switch and hang a sign at the switch informing of the unit being serviced.
2. Close shutoff valves ahead of the inlet and after the outlet to prevent any flow through or pressure build up in the unit. Never depend upon a check valve to isolate the system.
3. Lock open the manual vent valves and wait for the pressure in the system to be completely stabilized at atmospheric pressure before starting service. DO NOT close the manual vent valves at any time while servicing.
4. Shut off water and depressurize system if it is water cooled.

Service Safety: Safety procedures while servicing a vacuum pump or blower are important to both the service personnel at the time of servicing and to those who may then or at a later date be around the vacuum pump or blower and the system it serves. Listed below are some procedures, but not all, that should be followed:

1. Wait for the unit to cool before starting service. Temperatures at 125 °F can burn the skin, and some surface temperatures exceed 200 °F when the unit is working.
2. Clean up oil spilled immediately to prevent slipping.
3. Loosen, but do not remove, flange or component bolting then carefully pry apart to be sure there is no residual pressure before removing the bolting.
4. Tighten bolts and screws periodically.
5. Never use a flammable solvent, such as gasoline or kerosene, for cleaning air filters or unit parts. Safety solvents are available and should be used in accordance with their instructions.
6. Never attempt to add or drain oil from a running unit.

START-UP PROCEDURE

Pre-Start Checks

1. Inspect package for any loose wires or capillary tubing to and from the safety shutdown switches. Tighten any loose bolts.
2. Remove drive guard. For V-belt drive, check for proper belt tension and sheave alignment per V-Belt drive instructions. Use V-Belt tension test tool for this procedure. For coupling drive units, check final alignment conformance to coupling manufacturer's recommendations.

   For 2 stage blowers driven by one motor, adjust both motor slide base and idler sheave.
3. If splash lubricated, check the oil level on each end of the blower. If two-stage, check both blowers. Fill to proper level as indicated on sight gauge using oil viscosity as shown in blower manufacturer's instruction manual. DO NOT OVERFILL.

   If pressure lubricated, the oil reservoir has no oil in it. It must be filled to proper level prior to starting.

   NOTE: BLOWER PACKAGES ARE SHIPPED WITHOUT OIL.
4. Be sure that no strain from piping or silencers is exerting force on blower case. Loosen each bolt on blower feet from the base. Make sure all feet sit absolutely flat on the base and no rocking of the blower occurs. Any uneven setting when bolts are tightened down can put a twist in the case and cause failure. Shim as necessary using stainless steel shim material. **RETIGHTEN ALL BOLTS.**
5. Rotate blower by hand and check for any obstruction or unusual noise.
6. Make sure motor is wired properly.
7. "Bump start" control button to check for proper rotation (see drawing).
8. Be sure pressure is off of system downstream and/or upstream of the blower. Make sure all blind flanges are removed from piping and that no restriction is in upstream or downstream side of the blower.
9. Make sure electrical overload devices are installed in the motor control center. Check all shutdown circuitry for proper wiring logic. Check all shutdown and alarm switches for proper set points.
10. Check inlet filter for any dirt or obstructions.
11. Open any drains in silencers, blowers, or coolers. Replace plugs after draining.
12. **REPLACE DRIVE GUARD BEFORE STARTING!**

Start-Up

1. For pressure lubricated units, if supplied with water cooled oil cooler, start cooling water flow. Be sure all valves in water sytem are open and confirm flow through the cooler. For air cooled oil cooler, make sure the louvers are open, then start the fan motor. Check fan rotation. Start the electric oil-driven pump motor. Check pump rotation. Before starting the blower(s), the oil pressure must be maintained as specified on drawings. The adjustment is on the relief valve near the oil filter.
2. If water cooled intercooler or aftercooler are part of the package, start cooling water flow. Be sure all valves in water system are open and confirm flow through the cooler. For air cooled coolers, make sure the louvers are open before starting fan motor. Check fan rotation.
3. Open blow-off line to allow unloaded start-up of the blower.
4. Start blower, let it accelerate to full speed, then shut off. Listen for knocking sounds, both with power on and as it slows down.
5. If no problems have occurred, restart unit, partially close blow-off line and operate for 5 to 10 minutes under minimal load condition. Check motor amperage draw with an ammeter to insure that no overload is occurring. Check the cylinder surfaces all over to locate any hot spots indicating impeller rubs. Continue to listen for noises and watch for changes in vibration.
6. Re-check switches by reducing pressure and/or temperature settings and making sure they trip out the equipment. Then reset to recommended settings.
7. Increase pressure gradually and observe pressures and temperatures for any unusual readings. Continue running the unit for one (1) hour after which time all temperature readings should be stable.
8. Check relief valve for proper system protection by increasing pressure to relief point. Do this with extreme caution so as not to overload the motor or exceed the blower pressure and temperature ratings.
9. For V-belt drive units, check belt tension every eight (8) hours during the first twenty-four (24) hours. Belts have a break-in period during which they may stretch. For coupling drive units, re-check "hot" alignment after running unit at full load design conditions for one hour.
10. After 24 hours:
    - Check inlet and/or discharge filter elements. Replace if necessary.
    - Check oil and replace if deteriorated.
    - If pressure lubricated, change oil filter.
11. Record pressures and temperatures for first week of operation at four hour intervals to isolate any potential malfunctions.

PREVENTATIVE MAINTENANCE

A. Daily

1. Record the following (when applicable):
   - ☐ Lube oil pressure (pressure lube units only)
   - ☐ Lube oil temperature (pressure lube units only)
   - ☐ Blower inlet temperature
   - ☐ Blower inlet pressure/vacuum
   - ☐ Blower discharge temperature
   - ☐ Blower discharge pressure or differential pressure
   - ☐ Motor amperage
   - ☐ Motor voltage, if available
   - ☐ Motor stator temperature, if available
   - ☐ Motor bearing temperature, if available
2. Observe any abnormalities, i.e., burned paint, unusual noises, vibration, strange odors, oil leaks and et cetera.
3. Review log sheets to determine if there are any changes from previous readings. It is very important to look for any changes or trends which might indicate pending problems.
4. Check oil levels.

B. Monthly

1. Check all protective switches, air pressure and relief valves for proper operation and setpoints.
2. Record bearing housing vibration levels at each bearing in the horizontal, vertical and axial planes. Note any changes from previous readings and take a complete vibration signature (amplitude versus frequency) if any trends are noted. (It may be helpful to keep a chart on monthly readings.)
3. Sample lube oil. Change oil if the following values are exceeded:
   a. Water 2-3% Max.
   b. Metals 50 - 75 PPM Max.
   c. Acid 5.0 - 7.5 Mg/KOH/g Max.

   Increase frequency of sampling if any of the above shows approximately 20-25% increase over the last sample.

   When changing oil for pressure lubricated blowers, clean oil pump suction strainer and flush all oil reservoirs before filling with clean oil. Replace oil filter element.
4. Check inlet air filter element(s), clean or replace as required. A differential pressure gauge can be installed to allow for visual check without shutdown.

D. Annually

1. Remove an inlet or discharge expansion joint or spool piece, inspect impellers, and record all impeller clearances.
2. Check coupling alignment, inspect coupling for wear and repack with fresh grease (if required).
3. Inspect V-belts and V-belt sheaves. Check sheave alignment and tension V-belts with a "tension tester."
4. Measure internal clearances for signs of wear.

E. Every Three Years

1. Remove gearbox housing and thrust end bearing covers.
2. Inspect gear tooth wear pattern.
3. Measure gear backlash at four points spaced 90 degrees.
4. Check bearing clearance by indicating shaft vertical movement adjacent to the bearing. (Consult factory for maximum variances on gear and bearing measurements.)

F. A **PREVENTATIVE MAINTENANCE SHEDULE** SHOULD BE ESTABLISHED FOR DRIVER(S) AND ALL ACCESSORIES IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATION.

ASECO TROUBLESHOOTING CHECKLIST

TROUBLE	ITEM	POSSIBLE CAUSE	REMEDY
No Flow	1	Speed too low	Check by tachometer and compare with speed shown on final performance sheet.
	2	Wrong rotation	Compare actual rotation with spec. sheet. Change driver if wrong.
	3	Obstruction in piping	Check piping, screen, valves, silencer, to assure open flow path.
Low Capacity	4	Speed too low	See item 1. If belt drive, check for slippage and readjust tension.
	5	Exessive pressure rise	Check inlet vacuum and discharge pressure, and compare these figures with specified operating conditions on order.
	6	Obstruction in piping	See Item 3.
	7	Excessive slip	Check inside of casing for worn or eroded surfaces causing excessive clearances.
Excessive Power	8	Speed too high	See item 1.
	9	Excessive pressure rise	See item 3.
	10	Impellers rubbing	Inspect outside of cylinder for high temperature areas, then check for impeller contact at these points. Correct blower mounting, drive alignment.
Overheating of Bearings or Gears	11	Inadequate lubrication	Check oil sump levels in gearhouse and drive end covers.
	12	Excessive lubrication	Check oil levels. If incorrect, drain and refill with oil of recommended grade.
	13	Excessive pressure rise	See item 5.
	14	Coupling misalignment	Check carefully. Realign if questionable.
	15	Excessive belt tension	Readjust for correct tension.
Vibration	16	Misalignment	See item 14.
	17	Impellers rubbing	See item 10.
	18	Worn bearing/gears	Check gear backlash and condition of bearings and replace as indicated.
	19	Unbalances or rubbing impellers	Scale or process material may build-up on casing and impellers, or inside impellers. Remove build-up to restore original clearances and impeller balance.
	20	Driver or blower loose	Tighten mounting bolts securely.
	21	Piping Resonances	Determine whether standing wave pressure pulsations are present in the piping. Refer to Sales Office.

DISCLAIMER OF WARRANTY

SELLER DOES NOT WARRANT THE MERCHANTABILITY OF ITS PRODUCTS AND DOES NOT WARRANT THE FITNESS OF THE EQUIPMENT FOR A PARTICULAR PURPOSE. SELLER DOES NOT MAKE ANY WARRANTY, EXPRESS OR IMPLIED, OTHER THAN THE WARRANTY CONTAINED HEREIN. THERE ARE NO WARRANTIES EXPRESS OR IMPLIED BEYOND THAT WHICH IS DESCRIBED BELOW.

WARRANTY OF GOODS MANUFACTURED BY SELLER

Seller warrants parts manufactured by it and sold hereunder to be free from defect in material and workmanship for a period of twelve (12) months from date of startup of eighteen (18) months from date of shipment whichever occurs sooner provided, however, that Seller's sole responsibility under this warranty shall be to either repair or replace at Seller's option, any part which fails during the warranty period because of a defect in workmanship and material, provided Purchaser has promptly reported same to seller in writing. Such replacement parts shall be provided at no cost to Purchaser, at the business establishment or Seller during regular working hours. This warranty shall not apply to component part or accessories not manufactured by Seller or to routine maintenance or routine maintenance parts. Seller's obligation under this warranty shall not include any transportation charges, cost of installation, duty, taxes or any other charges whatsoever.

WARRANTY OF OTHER MANUFACTURER'S PRODUCTS

Seller makes no warranties or representation of any kind whatsoever, either expressed, implied or statutory on any component parts or accessories sold hereunder which are not manufactured by Seller. Seller hereby extends the manufacturer's warranty or guaranties, if any, given to Seller by the manufacturer of said component parts and accessories, but only to the extent Seller is able to enforce such warranty or guaranties. Seller does not guaranty warranties of other manufacturers' products. Claims under any manufacturer's warranty shall be maid in accordance with the manufacturer's requirements regarding the return, repair or replacement of the goods. Seller agrees to use its best efforts and will cooperate with Purchaser in enforcing any claims against manufacturer(s) for defects that may occur.

Seller has not authorized any party to make any representation or warranty other than the above warranty statements.

SPECIAL PROVISIONS

The Equipment or parts sold hereunder are not designed or manufactured for use in or with any atomic installation or activity. If Purchaser or the ultimate user of these products intends to use them in such an installation or activity, Seller's Terms for Nuclear Sales shall be a part of this Contract. Seller will furnish Purchaser with a copy of its Terms for Nuclear Sales upon request.

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IMPORTANT

SPECIFICATIONS FOR LONG TERM STORAGE

1. Blowers should have end bells completely filled with oil on mechanically sealed units (to be done by customer in the field). Units should be completely coated with an oil type preservative, and all seals, shafts, gears and bearings must be thoroughly coated. For greased bearing units regrease drive end bearings.

2. All openings should be plugged and port fittings fitted with plastic, wood, or metal covers.

3. A dessicant bag should be attached to the port fitting cover in such a way that the blower can be turned without contacting it.

4. The blower should be stored in a warm, dry storage area.

5. The blower is to be manually turned by hand at least twice a month.

6. The blower is to be inspected every month.

FOR OUTDOOR STORAGE

***** IN ADDITION TO THE ABOVE *****

1. All openings, flanges and port fittings to be sealed water tight. Screwed openings to be plugged with plugs and sealer. Flanges and port fittings to be greased and gasketed. Covers to be 1/4" metal covers and fully bolted.

2. The blower to be manually turned by hand at least once a week.

3. Electric motors stored outdoors to have space heaters. Space heaters to be hooked up and operating.

4. If possible, cover with tarp. If not, couplings/v-drive sheaves should be protected from rusting. V-belts to be wrapped, or removed, and stored in a dry place until start-up.

BILL OF MATERIAL

GDEPC DOCUMENT NUMBER 85131-201 REV. 2

ITEM	QTY	PART NUMBER	DESCRIPTION	WEIGHT
1	1	11CDL31P79S	BLOWER, HELICAL SCREW, 14"-125# FF FLANGE INLET, 12"-125# FF FLANGE OUTLET, CYCLOBLOWER MODEL 11CDL31 WITH 6 BEARING RTD's	3,530 LB
2	1	302AUX348G	MOTOR, TEFC, 350 HP, 1800 RPM, 3PH/60HZ/460V, 1.15 S.F., 449HO T FRAME, GENERAL ELECTRIC PER OUTLINE DRAWING 225B6575BD	2,970 LB
3	1	8507612	COUPLING, FLEXIBLE, GRID TYPE, HORIZONTAL SPLIT COVER, FALK STEELFLEX TYPE T10, SIZE 1100T, ONE HUB BORED WITH CLEARANCE FIT FOR 3.250" DIA SHAFT & 3/4" SQ KEYWAY, AND ONE HUB BORED WITH CLEARANCE FIT FOR 3.375" DIA SHAFT & 7/8" SQ KEYWAY	90 LB
4	1	315AUX535	EXPANSION JOINT, 14" CORRUGATED BELLOWS HOSE, 321 SS, 14"-125# FF FLANGE BOTH ENDS, A36 CS, 6" OVERALL LENGTH, RATED MAX. 75 PSI	75 LB
5	1	314AUX535	EXPANSION JOINT, 12" CORRUGATED BELLOWS HOSE, 321 SS, 12"-125# FF FLANGE BOTH ENDS, A36 CS, 6" OVERALL LENGTH, RATED MAX. 75 PSI	65 LB
6	1	304RSA059	FILTER-SILENCER, WEATHERHOOD INLET, 14"-125# FF FLANGE OUTLET, PLEATED FELT ELEMENT, UNIVERSAL SILENCER CCS-14 WITH P/N 81-1210 ELEMENT (SHIPPED LOOSE)	175 LB
7	1	316AUX1365	INLET SILENCER, 30" DIA., 14"-125# FF FLANGED END INLET & HIGH SIDE OUTLET, 3-LEG MOUNTING, UNIVERSAL SILENCER RISH-14, "Y" DIM. = 89-1/2", "K" DIM. = 40", LEG MOUNT "X" DIM. = 6" (SHIPPED LOOSE)	895 LB
8	1	317AUX365	DISCHARGE SILENCER, 26" DIA., 12"-125" FF FLANGED SIDE INLET & END OUTLET, 3-LEG MOUNTING, UNIVERSAL SILENCER SDY-12, "Y" DIM. = 15", "K" DIM. = 29-1/2", LEG MOUNT "X" DIM. = 2-1/2" (SHIPPED LOOSE)	535 LB
9	2	909831040423	VALVE, PRESSURE RELIEF, WEIGHT LOADED, 4" NPT MALE INLET, WEIGHT SET AT 14.5 PSI, SUTORBILT P/N 909831040423 (SHIPPED LOOSE)	370 LB
10	1	307AUX322	GAUGE, VACUUM, GRADE 2A (1/2%) ACCURACY, 4-1/2" DIAL, FLUSH MOUNT, 1/2" NPT BACK CONNECTION, 30-0" HG RANGE, ASHCROFT DURAGAUGE 45-1377-AS-04B-30/0"HG	3 LB
11	1	306AUX322	GAUGE, PRESSURE, GRADE 2A (1/2%) ACCURACY, 4-1/2" DIAL, FLUSH MOUNT, 1/2" NPT BACK CONNECTION, 0-15 PSI RANGE, ASHCROFT DURAGAUGE 45-1377-AS-04B-0/15PSI	3 LB
12	1	301AUX1451	GAUGE, TEMPERATURE, 4-1/2" DIAL, PANEL MOUNT, 15-250°F/9-121°C DUAL SCALE RANGE, ±2°F ACCURACY MID SCALE, 15 FT ARMORED CAPILLARY, 1/2" OD x 7" BULB WITH 1/2" NPT COMPRESSION FITTING, MURPHY SPLFC-250-S-15-ES	8 LB
13	1	302AUX1451	GAUGE, TEMPERATURE, 4-1/2" DIAL, PANEL MOUNT, 130-350°F/60-180°C DUAL SCALE RANGE, ±2°F ACCURACY MID SCALE, 5 FT ARMORED CAPILLARY, 1/2" OD x 7" BULB WITH 1/2" NPT COMPRESSION FITTING, MURPHY SPLFC-350-S-15-ES	8 LB
14	1	300AUX352	SWITCH, PRESSURE, NEMA 4X ENCLOSURE, 1/4" NPT PORT, SINGLE SPDT, 15A AT 125VAC, VITON SEAL, 0-30 PSI RANGE, SET AT 13.5 PSI RISING, ASHCROFT B4-24-V-XFS-30PSI SET 13.5 PSI RISING	3 LB
15	1	300AUX1488	SWITCH, TEMPERATURE, NEMA 4X ENCLOSURE, SINGLE SPDT, 15A AT 125VAC, REMOTE MOUNT WITH 10 FT SPRING ARMOR CAPILLARY & 3/8" x 3" BULB WITH 1/2" NPT CONNECTION BUSHING, 235-375°F RANGE, SET AT 300° F RISING, ASHCROFT T4-24-T10-030-XBX-XFS-235/375°F SET 300°F RISING	3 LB
17	1	85131-804	SET OF ANCHOR BOLTS, 316 SS, FOR BLOWER PACKAGE BASE, INLET SILENCER, AND DISCHARGE SILENCER MOUNTING PER GDEPC 85131-804 (SHIPPED LOOSE)	39 LB
18	1	85131-650	BLOWER PACKAGE CONTROL PANEL, NEMA 12 ENCLOSURE, PER GDEPC ASSEMBLY 85131-650 WITH -601, -602, -603, & -604 WIRING DIAGRAMS, MOUNTING PROVIDED BY CUSTOMER (SHIPPED LOOSE)	100 LB
19	1	85131-301	BLOWER PACKAGE BASE PER GDEPC 85131-301	1,874 LB
20	1	85131-302	MOTOR ALIGNMENT BASE WITH JACKSCREWS PER GDEPC 85131-302	125 LB
21	1	85131-303	BLOWER PACKAGE COUPLING GUARD PER GDEPC 85131-303	13 LB
22	1	85131-501	BLOWER PACKAGE INLET PIPE SPOOL PER 85131-501 (SHIPPED LOOSE)	220 LB
23	1	85131-502	BLOWER PACKAGE DISCHARGE PIPE SPOOL PER 85131-502 (SHIPPED LOOSE)	172 LB
24	1	85131-503	BLOWER PACKAGE PIPING & TUBING ASSEMBLY PER GDEPC 85131-503	200 LB
25	1	85131-801	BLOWER PACKAGE INSTRUMENT PANEL ASSEMBY GDEPC 85131-801	9 LB
26	1	85131-802	BLOWER BEARINGS RTD'S INSTALLATION PER GDEPC 85131-802	12 LB
27	1	85131-803	BLOWER VIBRATION TRANSMITTERS INSTALLATION PER GDEPC 85131-803	3 LB
28	1	85131-661	BLOWER PACKAGE 120 VAC JUCTION BOX, NEMA 12, SCREW COVER, 10"Hx8"Wx4"D, WITH TERMINALS FOR PRESSURE & TEMPERATURE SWITCHES PER GDEPC 85131-661	10 LB
29	1	85131-662	BLOWER PACKAGE ANALOG JUCTION BOX, NEMA 12, SCREW COVER, 10"Hx10"Wx4"D, WITH TERMINALS FOR RTD's & VIBRATION TRANSMITTERS PER GDEPC 85131-662	12 LB
30	1	85131-663	BLOWER PACKAGE BASE MOUNTED WIRING & CONDUIT ASSEMBLY PER GDEPC 85131-663	93 LB
31	1	85131-660	BLOWER PACKAGE BASE MOUNTED WIRING DIAGRAM PER GDEPC 85131-660	- LB
32	1	85131-304	INLET PIPE SPOOL SUPPORT PER GDEPC 85131-304 (SHIPPED LOOSE)	98 LB
33	1	85131-504	FILTER & SILENCERS LIFTING EYES PER GDEPC 85131-504	5 LB
			TOTAL APPROXIMATE WEIGHT BASE MOUNTED PACKAGE	9,109 LB
			TOTAL APPROXIMATE WEIGHT ALL ITEMS	11,718 LB

BILL OF MATERIAL QUANTITIES ARE FOR ONE (1) PACKAGE
S.O. NO. 248352/JOB NO. 85131 REQUIRES FIVE (5) PACKAGES

D

PERFORMANCE DATA

SERVICE: AIR AT 100% RELATIVE HUMIDITY
BLOWER: CYCLOBLOWER MODEL 11CDL31
MOTOR: TEFC, 350 HP, 1800 RPM, 3PH/60HZ/460V, 1.15 S.F.
ALTITUDE: 700.0 FT
BAROMETER: 14.32 PSIA
INLET PRESSURE: 0.0 PSIG
INLET TEMPERATURE: 100.0° F
INLET FLOW: 4225.9 SCFM
DISCHARGE PRESSURE: 12.5 PSIG
BLOWER SPEED: 1790 RPM
BLOWER POWER: 311.9 BHP
DIRECT DRIVE COUPLING: FALK TYPE T10 SIZE 1100T
INLET & DISCHARGE SILENECERS RATINGS:
NON-ASME SERVICE
PRESSURE: MAX. 15 PSIG FOR NON-ASME SERVICE
TEMPERATURE: MAX. 325° F

NOTES:

1. SEE GDEPC DRAWING 85131-200 FOR INSTALLATION IN CUSTOMER BUILDING AND REPAIR KIT AND SPARE PARTS ON THE BOM
2. SEE SHEET 2 OF 3 FOR VIEWS A-A, B-B, & C-C WITH SILENCERS
3. SEE SHEET 3 OF 3 FOR VIEWS A-A, C-C, D-D, & E-E WITHOUT SILENCERS AND FOR THE SHAFT COUPLING ALIGNMENT PROCEDURES AND DETAILS
4. SEAL ALL PIPE THREADS WITH LOCTITE SEALANT
5. FLANGE BOLT HOLES STRADDLE CENTERLINES OR MATCH PERVIOUSLY INSTALLED COMPANION FLANGE
5. CUSTOMER TO PROVIDE FLANGE FASTENERS AND GASKETS FOR THE FILTER-SILENCER OUTLET, INLET SILENCER INLET, AND DISCHARGE SILENCER OUTLET
6. CUSTOMER TO PROVIDE HOLES, CONDUIT CONNECTORS, STRAIN RELIEF CONNECTORS, WIRING, CABLE, AND CONDUIT FOR CONNECTIONS BETWEEN THE BASE MOUNTED JUCTIONS BOXES AND THE BLOWER PACKAGE CONTROL PANEL ENCLOSURE
7. PRIME & FINISH COAT EXPOSED METAL SURFACES IN ACCORDANCE WITH CUSTOMER SPECIFICATIONS PER SECTION 09800, SECTION 3.6, SYSTEM NO. 3

"N" CONNECTIONS & PORTS:

- (N1) FILTER-SILENCER AIR INLET, BOTTOM OF WEATHERHOOD
- (N2) FILTER-SILENCER AIR OUTLET, 14"-125# FF FLANGE
- (N3) INLET SILENCER AIR INLET, 14"-125# FF FLANGE
- (N4) INLET SILENCER AIR OUTLET, 14"-125# FF FLANGE
- (N5) BASE MOUNTED PACKAGE AIR INLET, 14"-125# FF FLANGE
- (N6) BASE MOUNTED PACKAGE AIR DISCHARGE, 12"-125# FF FLANGE
- (N7) DISCHARGE SILENCER AIR INLET, 12"-125# FF FLANGE
- (N8) DISCHARGE SILENCER AIR DISCHARGE, 12"-125# FF FLANGE
- (N9) INLET PRESSURE GAUGE SENSOR PORT, 1/4" NPT FEMALE
- (N10) INLET TEMPERATURE GAUGE SENSOR PORT, 1/2" NPT FEMALE
- (N11) DISCHARGE PRESSURE GAUGE & SWITCH SENSOR PORT, 1/4" NPT FEMALE
- (N12) DISCHARGE TEMPERATURE GAUGE SENSOR PORT, 1/2" NPT FEMALE
- (N13) DISCHARGE TEMPERATURE SWITCH SENSOR PORT, 3/4" NPT WITH 1/2" NPT INTERNAL THERMOWELL
- (N14) MOTOR CONDUIT CONNECTIONS, TWO 3" NPT WHICH CAN BE ROTATED TO TOP, BOTTOM, OR EITHER END OF CONDUIT BOX

C. EMERY NELSON, INC.
METROPOLITAN WASTWATER TREATMENT PLANT
SOLIDS PROCESSING IMPROVEMENT PROJECT
TAG NO. 1206, 1207, 1208, 1209, 1210 - MCES NO. 970300 -
GARDNER DENVER CYCLOBLOWER® 11CDL31-L BLOWER PACKAGE
P.O. CENO2-6011 - GDEPC S.O. 85131

CONTRACTOR: **KNUTSON CONSTRUCTION SERVICES**
5500 WAYZATA BLVD, SUITE 300
MINNEAPOLIS MN 55416-1264
RESPONSIBLE PARTY: JASON VALCHECK
PHONE: 763-546-1400 FAX: 763-546-2226

SUPPLIERS

C EMERY NELSON INC.
7631 COMMERCE STREET
HAMEL, MN 55340

PHONE: 763-420-3844
FAX: 763-420-2542

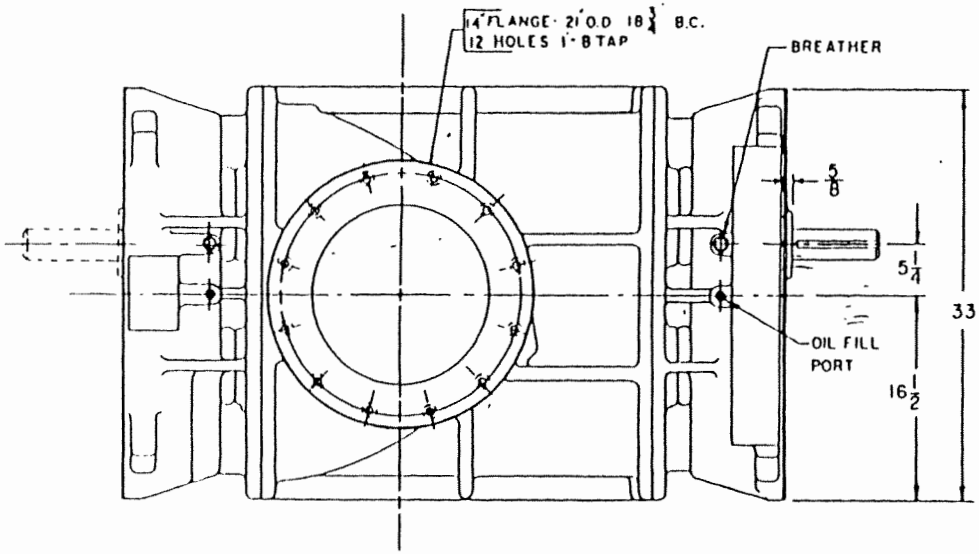
GARDNER DENVER
ENGINEERED PACKAGE CENTER
1800 GARDNER EXPRESSWAY
QUINCY IL 62305

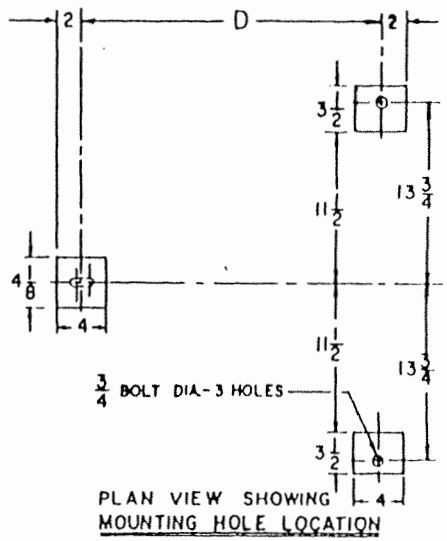
PHONE: 217-222-5400
800-6829868
FAX: 217-228-8247

GARDNER DENVER
BLOWER DIVISION
100 GARDNER PARK
PEACHTREE CITY GA 30269

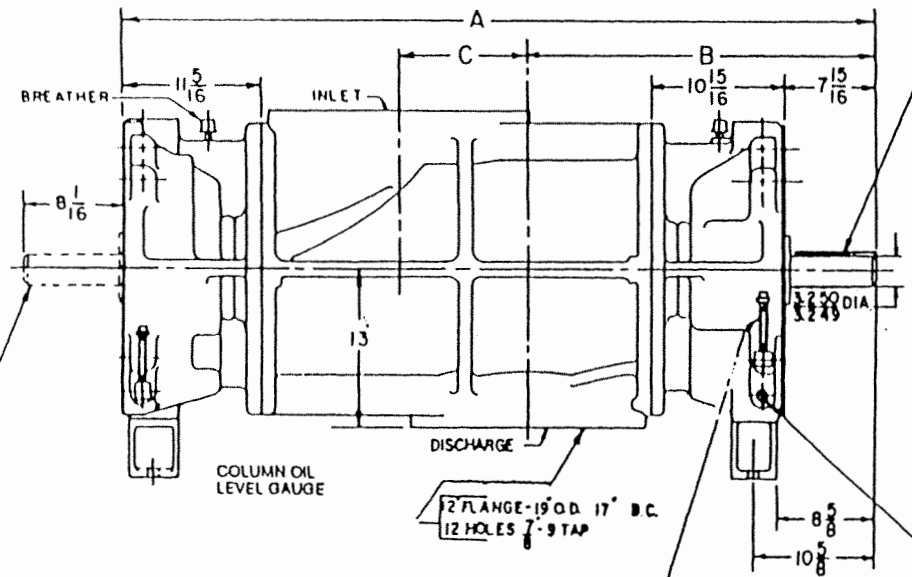
PHONE: 770-486-5655

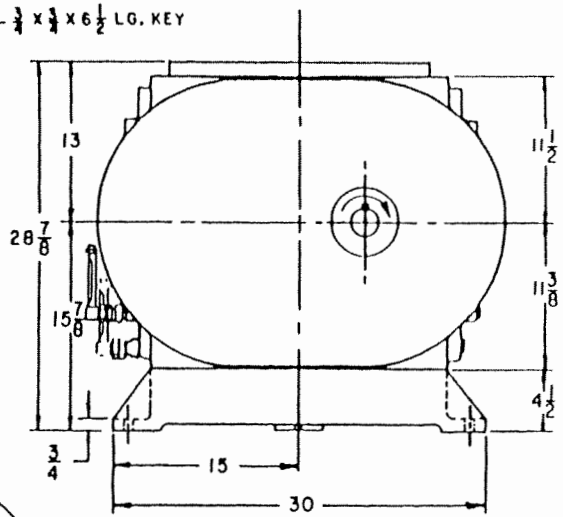
FAX: 770-486-5682





PLAN VIEW SHOWING MOUNTING HOLE LOCATION





SHAFT EXTENSION MAY BE EITHER OR BOTH ENDS PER CUSTOMERS REQUEST

NOTE: OIL LEVEL GAUGE IS LOCATED IN TOP HOLE ON THIS END AND IN BOTTOM HOLE ON GEAR END.

NOTE:
EXPANSION JOINTS MUST BE USED BETWEEN BLOWER AND PIPING

MODEL	DIM. A	DIM. B	DIM. C	DIM. D	WT.
IICDL 23	53¼	28⅞	2 1/16	40	3160
IICDL 27	57¼	30⅞	2 1/16	44	3400
IICDL 31	61¼	28⅞	10 1/16	48	3560

QUINCY, ILLINOIS
ROTARY BLOWER
IICDL-D SERIES BLOWER
OUTLINE DIMENSIONS

DR. C.M	SCALE	DATE 2/1/83	DWG. NO. SC-449

COPYRIGHT© 1984 Gardner Denver Machinery Inc

Gardner Denver

Date: 3/5/02 PROJECT:

GD CycloBlower

Application:
Customer Name:
Comments:

Application Engineer:
Sales Order Number:

GAS MIXTURE: Air(100%)
MACHINE SELECTION: Model 11CDL31
SERVICE: Pressure

CORRECTED VALUES	ORIGINAL UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Altitude	700.000 Alt.(ft)	700.000 ft	213.350 m
Barometer	14.320 PSIA	14.320 PSIA	0.987 Bars(A)
Inlet Pres.	0.000 PSIG	14.320 PSIA	0.987 Bars (A)
Inlet Temp.	100.00 F	100.00 F	37.78 C
Blower Speed	1,790 RPM		
% of Max. Speed	81.4 %		
Dis. Pres.	12.500 PSIG	12.500 PSIG	0.862 Bars (G)
Rel. Humid.	100.0 %	100.0 %	100.0 %
Delta Pressure	12.500 PSIG	12.500 PSIG	0.862 Bars (G)

MEASURED VALUES	PLOT UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Inlet Flow	4225.88 SCFM	4885.29 ICFM	8299.85 m^3/hr(A)
Blower Power **	311.9 HP	311.9 HP	232.6 KW
Efficiency	67.2 %		
Discharge Temp.	247.8 F	247.8 F	119.9 C
Estimated Noise	92.1 dBA		
Actual Disch. Flow	3313.4 CFM	3313.41 CFM	5629.31 m^3/hr(A)

** Drive losses not included

GAS PARAMETERS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1		
Molecular Weight	28.58 lbm/lbmol	28.58 kg/kgmol
R Value	54.07 ft.lbf/lbm.R	0.29 kJ/kg.K
Density	0.067 lbm/ft^3	1.078 kg/m^3
Sp. Heat @ Const. P	0.249 BTU/lbm.R	1.040 kJ/kg.K
Ratio of Sp. Heats	1.39	1.39
Saturated Vapor Pres.	28.7174 PSIA	1.9800 Bars(A)
Partial Pres. of Gas	13.3713 PSIA	0.9219 Bars(A)
Partial Pres. of Vapor	0.9487 PSIA	0.0654 Bars(A)

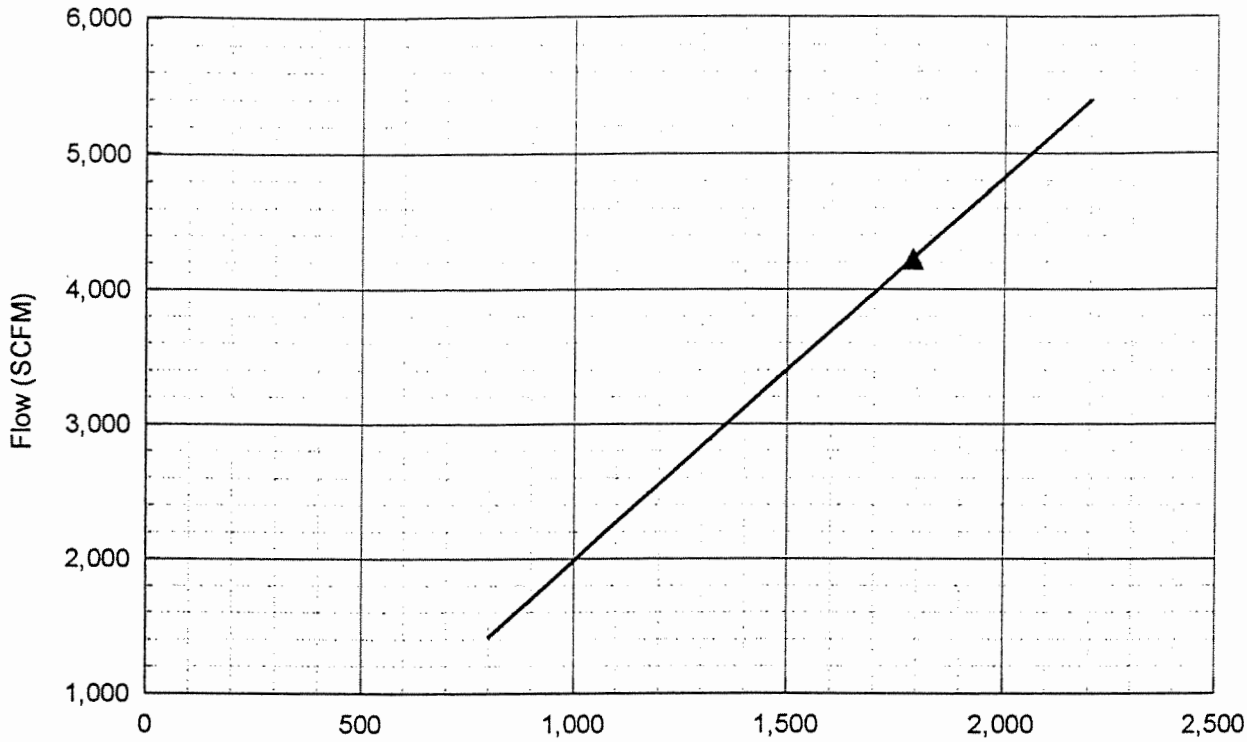
Summer

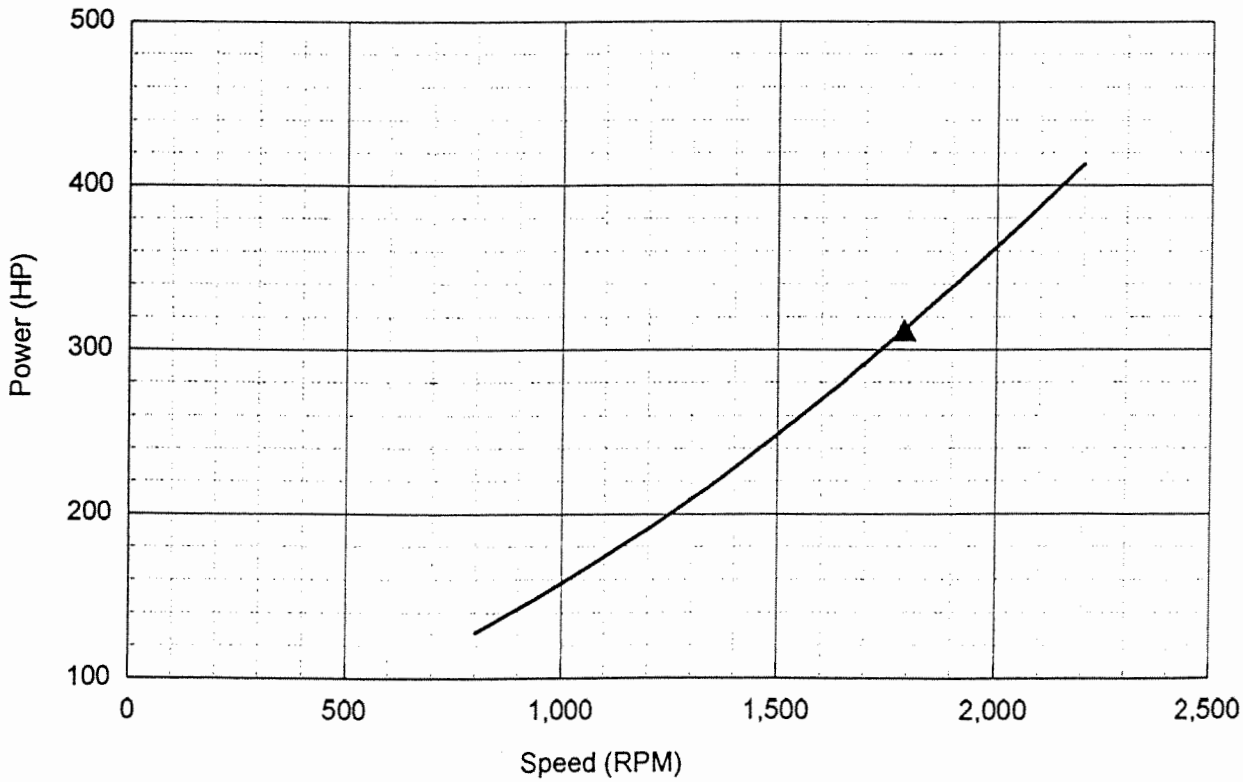
AT OPERATIONAL CONDITIONS

Date: 3/5/02

PROJECT:

GAS MIXTURE: Air(100%)
MACHINE SELECTION: Model 11CDL31





Date: 3/5/02 PROJECT:

GD CycloBlower

Application:
Customer Name:
Comments:

Application Engineer:
Sales Order Number:

GAS MIXTURE: Air(100%)
MACHINE SELECTION: Model 11CDL31
SERVICE: Pressure

CORRECTED VALUES	ORIGINAL UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Altitude	700.000 Alt.(ft)	700.000 ft	213.350 m
Barometer	14.320 PSIA	14.320 PSIA	0.987 Bars(A)
Inlet Pres.	0.000 PSIG	14.320 PSIA	0.987 Bars (A)
Inlet Temp.	100.00 F	100.00 F	37.78 C
Blower Speed	1,790 RPM		
% of Max. Speed	81.4 %		
Dis. Pres.	8.700 PSIG	8.700 PSIG	0.600 Bars (G)
Rel. Humid.	100.0 %	100.0 %	100.0 %
Delta Pressure	8.700 PSIG	8.700 PSIG	0.600 Bars (G)

MEASURED VALUES	PLOT UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Inlet Flow	4377.65 SCFM	5060.75 ICFM	8597.94 m^3/hr(A)
Blower Power **	231.9 HP	231.9 HP	172.9 KW
Efficiency	69.3 %		
Discharge Temp.	206.1 F	206.1 F	96.7 C
Estimated Noise	90.2 dBA		
Actual Disch. Flow	3762.4 CFM	3762.39 CFM	6392.10 m^3/hr(A)

** Drive losses not included

GAS PARAMETERS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1		
Molecular Weight	28.52 lbm/lbmol	28.52 kg/kgmol
R Value	54.19 ft.lbf/lbm.R	0.29 kJ/kg.K
Density	0.067 lbm/ft^3	1.078 kg/m^3
Sp. Heat @ Const. P	0.249 BTU/lbm.R	1.040 kJ/kg.K
Ratio of Sp. Heats	1.39	1.39
Saturated Vapor Pres.	13.0594 PSIA	0.9004 Bars(A)
Partial Pres. of Gas	13.3713 PSIA	0.9219 Bars(A)
Partial Pres. of Vapor	0.9487 PSIA	0.0654 Bars(A)

Summer

AT OPERATIONAL CONDITIONS

Date: 3/5/02 PROJECT:

GD CycloBlower

Application:
Customer Name:
Comments:

Application Engineer:
Sales Order Number:

GAS MIXTURE: Air(100%)
MACHINE SELECTION: Model 11CDL31
SERVICE: Pressure

CORRECTED VALUES	ORIGINAL UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Altitude	700.000 Alt.(ft)	700.000 ft	213.350 m
Barometer	14.320 PSIA	14.320 PSIA	0.987 Bars(A)
Inlet Pres.	0.000 PSIG	14.320 PSIA	0.987 Bars (A)
Inlet Temp.	100.00 F	100.00 F	37.78 C
Blower Speed	1,790 RPM		
% of Max. Speed	81.4 %		
Dis. Pres.	3.500 PSIG	3.500 PSIG	0.241 Bars (G)
Rel. Humid.	100.0 %	100.0 %	100.0 %
Delta Pressure	3.500 PSIG	3.500 PSIG	0.241 Bars (G)

MEASURED VALUES	PLOT UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Inlet Flow	4585.34 SCFM	5300.84 ICFM	9005.85 m^3/hr(A)
Blower Power **	123.3 HP	123.3 HP	92.0 KW
Efficiency	60.6 %		
Discharge Temp.	153.9 F	153.9 F	67.7 C
Estimated Noise	86.1 dBA		
Actual Disch. Flow	4687.2 CFM	4687.23 CFM	7963.35 m^3/hr(A)

** Drive losses not included

GAS PARAMETERS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1		
Molecular Weight	28.39 lbm/lbmol	28.39 kg/kgmol
R Value	54.44 ft.lbf/lbm.R	0.30 kJ/kg.K
Density	0.067 lbm/ft^3	1.078 kg/m^3
Sp. Heat @ Const. P	0.249 BTU/lbm.R	1.040 kJ/kg.K
Ratio of Sp. Heats	1.39	1.39
Saturated Vapor Pres.	4.0871 PSIA	0.2818 Bars(A)
Partial Pres. of Gas	13.3713 PSIA	0.9219 Bars(A)
Partial Pres. of Vapor	0.9487 PSIA	0.0654 Bars(A)

Summer

AT OPERATIONAL CONDITIONS

Date: 3/11/02 PROJECT:

GD CycloBlower

Application:
Customer Name:
Comments:

Application Engineer:
Sales Order Number:

GAS MIXTURE: Air(100%)
MACHINE SELECTION: Model 11CDL31
SERVICE: Pressure

CORRECTED VALUES	ORIGINAL UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Altitude	700.000 Alt.(ft)	700.000 ft	213.350 m
Barometer	14.320 PSIA	14.320 PSIA	0.987 Bars(A)
Inlet Pres.	0.000 PSIG	14.320 PSIA	0.987 Bars (A)
Inlet Temp.	85.00 F	85.00 F	29.44 C
Blower Speed	1,790 RPM		
% of Max. Speed	81.4 %		
Dis. Pres.	12.500 PSIG	12.500 PSIG	0.862 Bars (G)
Rel. Humid.	30.0 %	30.0 %	30.0 %
Delta Pressure	12.500 PSIG	12.500 PSIG	0.862 Bars (G)

MEASURED VALUES	PLOT UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Inlet Flow	4614.02 SCFM	4908.38 ICFM	8339.08 m^3/hr(A)
Blower Power **	313.6 HP	313.6 HP	233.9 KW
Efficiency	67.2 %		
Discharge Temp.	230.2 F	230.2 F	110.1 C
Estimated Noise	92.1 dBA		
Actual Disch. Flow	3320.0 CFM	3319.98 CFM	5640.47 m^3/hr(A)

** Drive losses not included

GAS PARAMETERS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1		
Molecular Weight	28.90 lbm/lbmol	28.90 kg/kgmol
R Value	53.48 ft.lbf/lbm.R	0.29 kJ/kg.K
Density	0.071 lbm/ft^3	1.131 kg/m^3
Sp. Heat @ Const. P	0.241 BTU/lbm.R	1.010 kJ/kg.K
Ratio of Sp. Heats	1.40	1.40
Saturated Vapor Pres.	20.8686 PSIA	1.4388 Bars(A)
Partial Pres. of Gas	14.1414 PSIA	0.9750 Bars(A)
Partial Pres. of Vapor	0.1787 PSIA	0.0123 Bars(A)

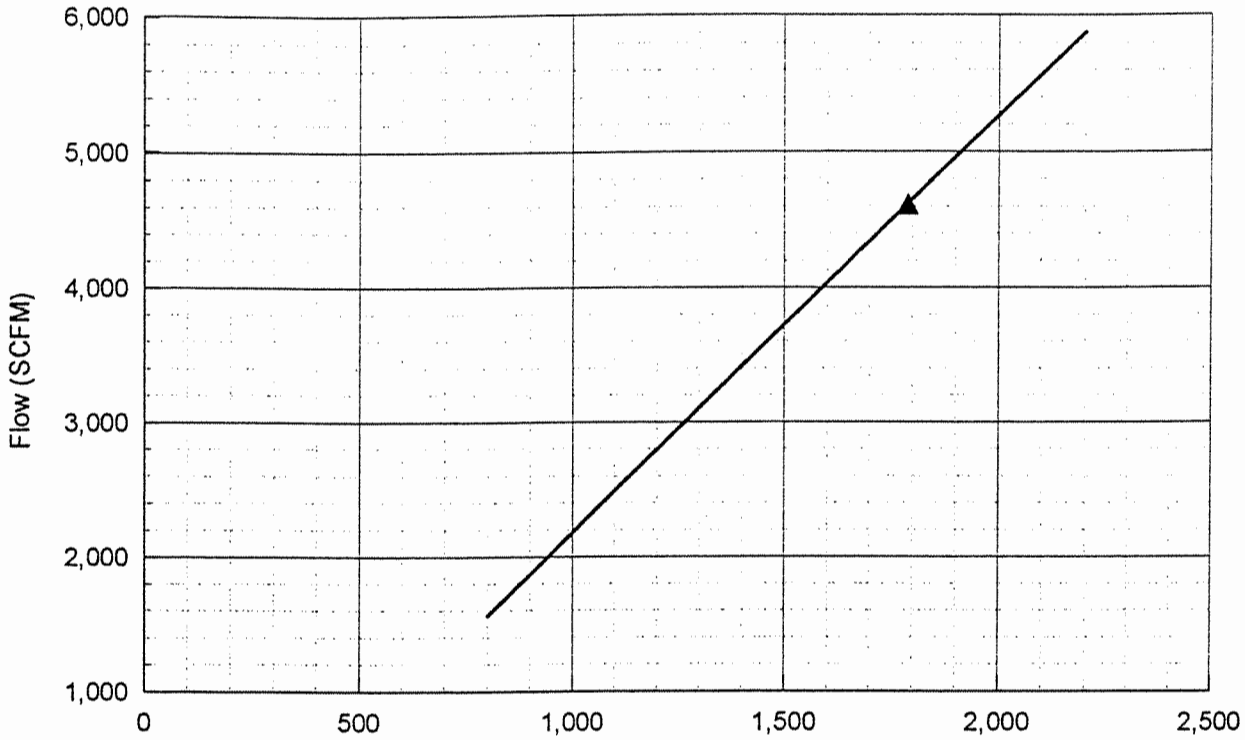
Normal

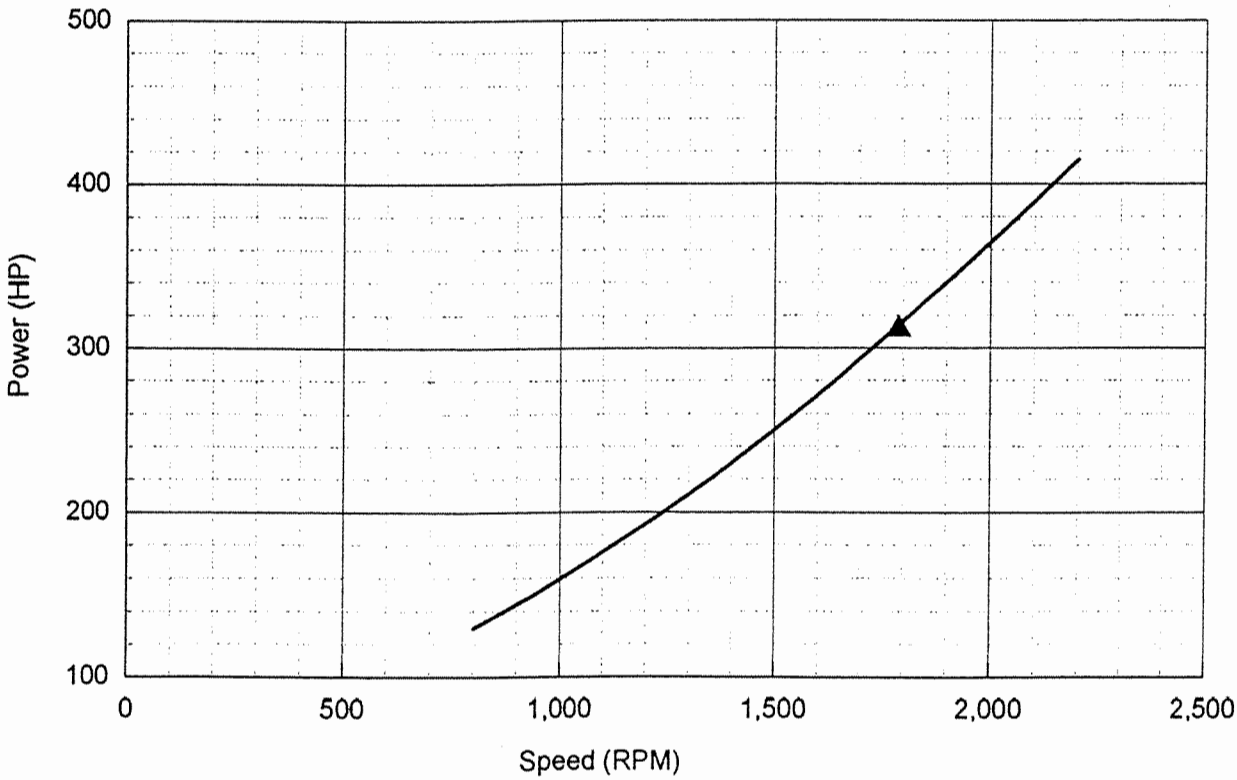
AT OPERATIONAL CONDITIONS

Date: 3/11/02

PROJECT:

GAS MIXTURE: Air(100%)
MACHINE SELECTION: Model 11CDL31





Date: 3/11/02 PROJECT:

GD CycloBlower

Application:
Customer Name:
Comments:

Application Engineer:
Sales Order Number:

GAS MIXTURE: Air(100%)
MACHINE SELECTION: Model 11CDL31
SERVICE: Pressure

CORRECTED VALUES	ORIGINAL UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Altitude	700.000 Alt.(ft)	700.000 ft	213.350 m
Barometer	14.320 PSIA	14.320 PSIA	0.987 Bars(A)
Inlet Pres.	0.000 PSIG	14.320 PSIA	0.987 Bars (A)
Inlet Temp.	85.00 F	85.00 F	29.44 C
Blower Speed	1,790 RPM		
% of Max. Speed	81.4 %		
Dis. Pres.	8.700 PSIG	8.700 PSIG	0.600 Bars (G)
Rel. Humid.	30.0 %	30.0 %	30.0 %
Delta Pressure	8.700 PSIG	8.700 PSIG	0.600 Bars (G)

MEASURED VALUES	PLOT UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Inlet Flow	4775.06 SCFM	5079.70 ICFM	8630.13 m^3/hr(A)
Blower Power **	232.9 HP	232.9 HP	173.7 KW
Efficiency	69.3 %		
Discharge Temp.	189.2 F	189.2 F	87.3 C
Estimated Noise	90.2 dBA		
Actual Disch. Flow	3765.1 CFM	3765.09 CFM	6396.69 m^3/hr(A)

** Drive losses not included

GAS PARAMETERS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1		
Molecular Weight	28.89 lbm/lbmol	28.89 kg/kgmol
R Value	53.50 ft.lbf/lbm.R	0.29 kJ/kg.K
Density	0.071 lbm/ft^3	1.131 kg/m^3
Sp. Heat @ Const. P	0.241 BTU/lbm.R	1.010 kJ/kg.K
Ratio of Sp. Heats	1.40	1.40
Saturated Vapor Pres.	9.1828 PSIA	0.6331 Bars(A)
Partial Pres. of Gas	14.1414 PSIA	0.9750 Bars(A)
Partial Pres. of Vapor	0.1787 PSIA	0.0123 Bars(A)

Normal

AT OPERATIONAL CONDITIONS

Date: 3/11/02 PROJECT:

GD CycloBlower

Application:
Customer Name:
Comments:

Application Engineer:
Sales Order Number:

GAS MIXTURE: Air(100%)
MACHINE SELECTION: Model 11CDL31
SERVICE: Pressure

CORRECTED VALUES	ORIGINAL UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Altitude	700.000 Alt.(ft)	700.000 ft	213.350 m
Barometer	14.320 PSIA	14.320 PSIA	0.987 Bars(A)
Inlet Pres.	0.000 PSIG	14.320 PSIA	0.987 Bars (A)
Inlet Temp.	85.00 F	85.00 F	29.44 C
Blower Speed	1,790 RPM		
% of Max. Speed	81.4 %		
Dis. Pres.	3.500 PSIG	3.500 PSIG	0.241 Bars (G)
Rel. Humid.	30.0 %	30.0 %	30.0 %
Delta Pressure	3.500 PSIG	3.500 PSIG	0.241 Bars (G)

MEASURED VALUES	PLOT UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Inlet Flow	4995.43 SCFM	5314.12 ICFM	9028.41 m^3/hr(A)
Blower Power **	124.0 HP	124.0 HP	92.5 KW
Efficiency	60.4 %		
Discharge Temp.	138.0 F	138.0 F	58.9 C
Estimated Noise	86.1 dBA		
Actual Disch. Flow	4686.7 CFM	4686.69 CFM	7962.43 m^3/hr(A)

** Drive losses not included

GAS PARAMETERS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1		
Molecular Weight	28.86 lbm/lbmol	28.86 kg/kgmol
R Value	53.55 ft.lbf/lbm.R	0.29 kJ/kg.K
Density	0.071 lbm/ft^3	1.131 kg/m^3
Sp. Heat @ Const. P	0.241 BTU/lbm.R	1.010 kJ/kg.K
Ratio of Sp. Heats	1.40	1.40
Saturated Vapor Pres.	2.7448 PSIA	0.1892 Bars(A)
Partial Pres. of Gas	14.1414 PSIA	0.9750 Bars(A)
Partial Pres. of Vapor	0.1787 PSIA	0.0123 Bars(A)

Normal

AT OPERATIONAL CONDITIONS

Date: 3/11/02 PROJECT:

GD CycloBlower

Application:
Customer Name:
Comments:

Application Engineer:
Sales Order Number:

GAS MIXTURE: Air(100%)
MACHINE SELECTION: Model 11CDL31
SERVICE: Pressure

CORRECTED VALUES	ORIGINAL UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Altitude	700.000 Alt.(ft)	700.000 ft	213.350 m
Barometer	14.320 PSIA	14.320 PSIA	0.987 Bars(A)
Inlet Pres.	0.000 PSIG	14.320 PSIA	0.987 Bars (A)
Inlet Temp.	85.00 F	85.00 F	29.44 C
Blower Speed	1,790 RPM		
% of Max. Speed	81.4 %		
Dis. Pres.	12.500 PSIG	12.500 PSIG	0.862 Bars (G)
Rel. Humid.	30.0 %	30.0 %	30.0 %
Delta Pressure	12.500 PSIG	12.500 PSIG	0.862 Bars (G)

MEASURED VALUES	PLOT UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Inlet Flow	4614.02 SCFM	4908.38 ICFM	8339.08 m^3/hr(A)
Blower Power **	313.6 HP	313.6 HP	233.9 KW
Efficiency	67.2 %		
Discharge Temp.	230.2 F	230.2 F	110.1 C
Estimated Noise	92.1 dBA		
Actual Disch. Flow	3320.0 CFM	3319.98 CFM	5640.47 m^3/hr(A)

** Drive losses not included

GAS PARAMETERS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1		
Molecular Weight	28.90 lbm/lbmol	28.90 kg/kgmol
R Value	53.48 ft.lbf/lbm.R	0.29 kJ/kg.K
Density	0.071 lbm/ft^3	1.131 kg/m^3
Sp. Heat @ Const. P	0.241 BTU/lbm.R	1.010 kJ/kg.K
Ratio of Sp. Heats	1.40	1.40
Saturated Vapor Pres.	20.8686 PSIA	1.4388 Bars(A)
Partial Pres. of Gas	14.1414 PSIA	0.9750 Bars(A)
Partial Pres. of Vapor	0.1787 PSIA	0.0123 Bars(A)

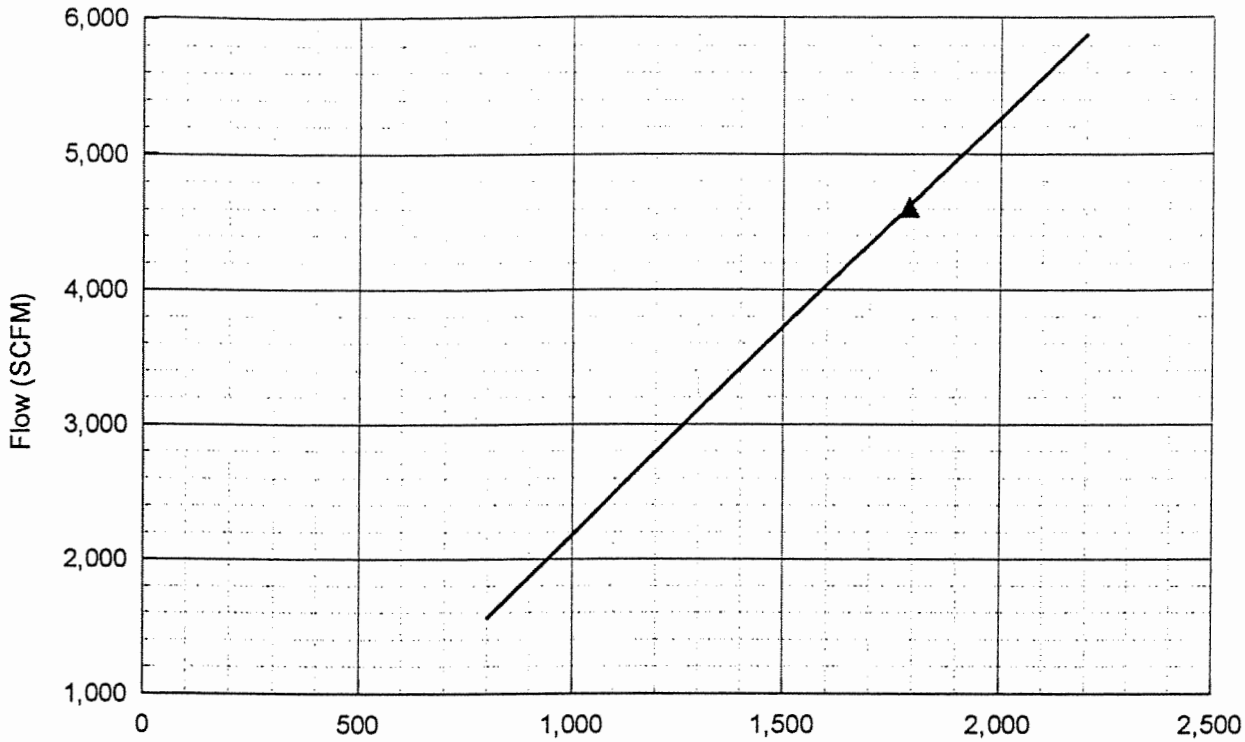
WINTER

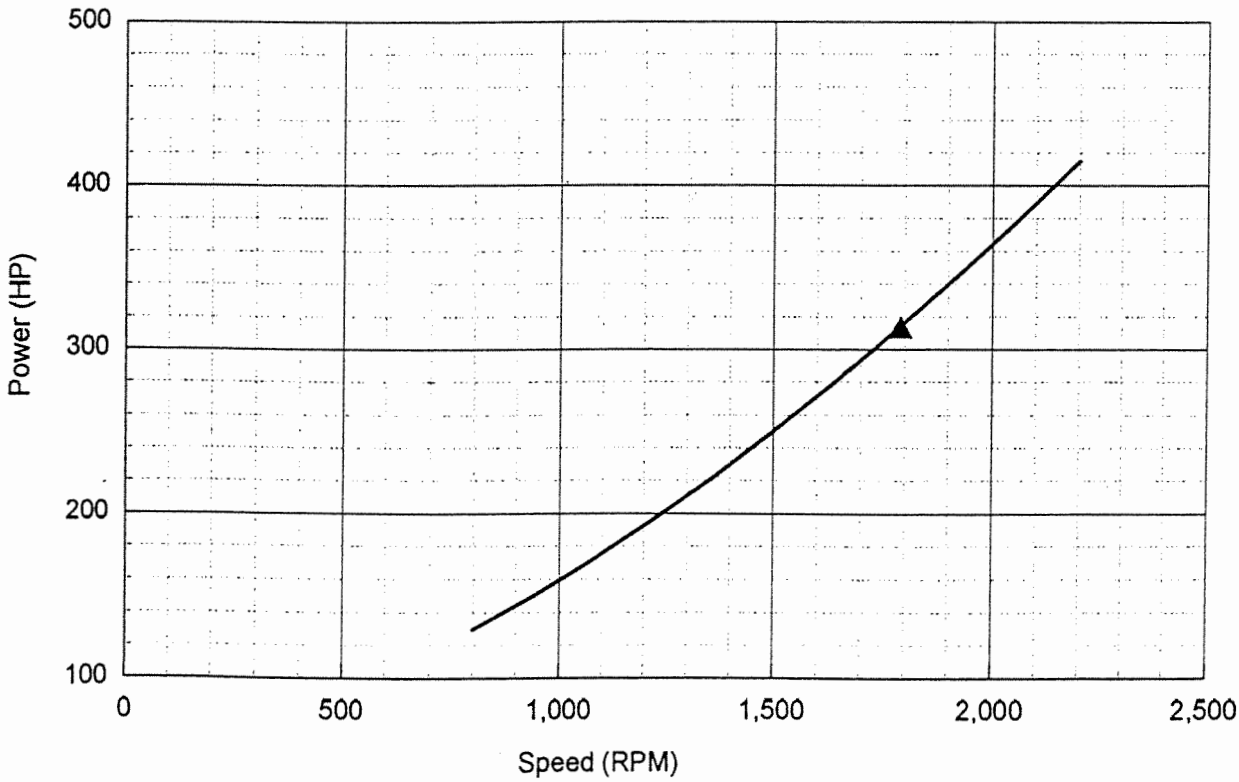
AT OPERATIONAL CONDITIONS

Date: 3/11/02

PROJECT:

GAS MIXTURE: Air(100%)
MACHINE SELECTION: Model 11CDL31





Date: 3/11/02 PROJECT:

GD CycloBlower

Application:
Customer Name:
Comments:

Application Engineer:
Sales Order Number:

GAS MIXTURE: Air(100%)
MACHINE SELECTION: Model 11CDL31
SERVICE: Pressure

CORRECTED VALUES	ORIGINAL UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Altitude	700.000 Alt.(ft)	700.000 ft	213.350 m
Barometer	14.320 PSIA	14.320 PSIA	0.987 Bars(A)
Inlet Pres.	0.000 PSIG	14.320 PSIA	0.987 Bars (A)
Inlet Temp.	60.00 F	60.00 F	15.56 C
Blower Speed	1,790 RPM		
% of Max. Speed	81.4 %		
Dis. Pres.	3.500 PSIG	3.500 PSIG	0.241 Bars (G)
Rel. Humid.	30.0 %	30.0 %	30.0 %
Delta Pressure	3.500 PSIG	3.500 PSIG	0.241 Bars (G)

MEASURED VALUES	PLOT UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Inlet Flow	5286.82 SCFM	5327.59 ICFM	9051.29 m^3/hr(A)
Blower Power **	124.4 HP	124.4 HP	92.8 KW
Efficiency	60.4 %		
Discharge Temp.	110.7 F	110.7 F	43.7 C
Estimated Noise	86.1 dBA		
Actual Disch. Flow	4699.0 CFM	4699.05 CFM	7983.43 m^3/hr(A)

** Drive losses not included

GAS PARAMETERS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1		
Molecular Weight	28.92 lbm/lbmol	28.92 kg/kgmol
R Value	53.43 ft.lbf/lbm.R	0.29 kJ/kg.K
Density	0.074 lbm/ft^3	1.189 kg/m^3
Sp. Heat @ Const. P	0.240 BTU/lbm.R	1.006 kJ/kg.K
Ratio of Sp. Heats	1.40	1.40
Saturated Vapor Pres.	1.3007 PSIA	0.0897 Bars(A)
Partial Pres. of Gas	14.2432 PSIA	0.9820 Bars(A)
Partial Pres. of Vapor	0.0768 PSIA	0.0053 Bars(A)

WinTek

AT OPERATIONAL CONDITIONS

Date: 3/11/02 PROJECT:

GD CycloBlower

Application:
Customer Name:
Comments:

Application Engineer:
Sales Order Number:

GAS MIXTURE: Air(100%)
MACHINE SELECTION: Model 11CDL31
SERVICE: Pressure

CORRECTED VALUES	ORIGINAL UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Altitude	700.000 Alt.(ft)	700.000 ft	213.350 m
Barometer	14.320 PSIA	14.320 PSIA	0.987 Bars(A)
Inlet Pres.	0.000 PSIG	14.320 PSIA	0.987 Bars (A)
Inlet Temp.	85.00 F	85.00 F	29.44 C
Blower Speed	1,790 RPM		
% of Max. Speed	81.4 %		
Dis. Pres.	8.700 PSIG	8.700 PSIG	0.600 Bars (G)
Rel. Humid.	30.0 %	30.0 %	30.0 %
Delta Pressure	8.700 PSIG	8.700 PSIG	0.600 Bars (G)

MEASURED VALUES	PLOT UNITS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1			
Inlet Flow	4775.06 SCFM	5079.70 ICFM	8630.13 m^3/hr(A)
Blower Power **	232.9 HP	232.9 HP	173.7 KW
Efficiency	69.3 %		
Discharge Temp.	189.2 F	189.2 F	87.3 C
Estimated Noise	90.2 dBA		
Actual Disch. Flow	3765.1 CFM	3765.09 CFM	6396.69 m^3/hr(A)

** Drive losses not included

GAS PARAMETERS	ENGLISH UNITS	METRIC UNITS
Inlet Set #1		
Molecular Weight	28.89 lbm/lbmol	28.89 kg/kgmol
R Value	53.50 ft.lbf/lbm.R	0.29 kJ/kg.K
Density	0.071 lbm/ft^3	1.131 kg/m^3
Sp. Heat @ Const. P	0.241 BTU/lbm.R	1.010 kJ/kg.K
Ratio of Sp. Heats	1.40	1.40
Saturated Vapor Pres.	9.1828 PSIA	0.6331 Bars(A)
Partial Pres. of Gas	14.1414 PSIA	0.9750 Bars(A)
Partial Pres. of Vapor	0.1787 PSIA	0.0123 Bars(A)

WINTER

AT OPERATIONAL CONDITIONS

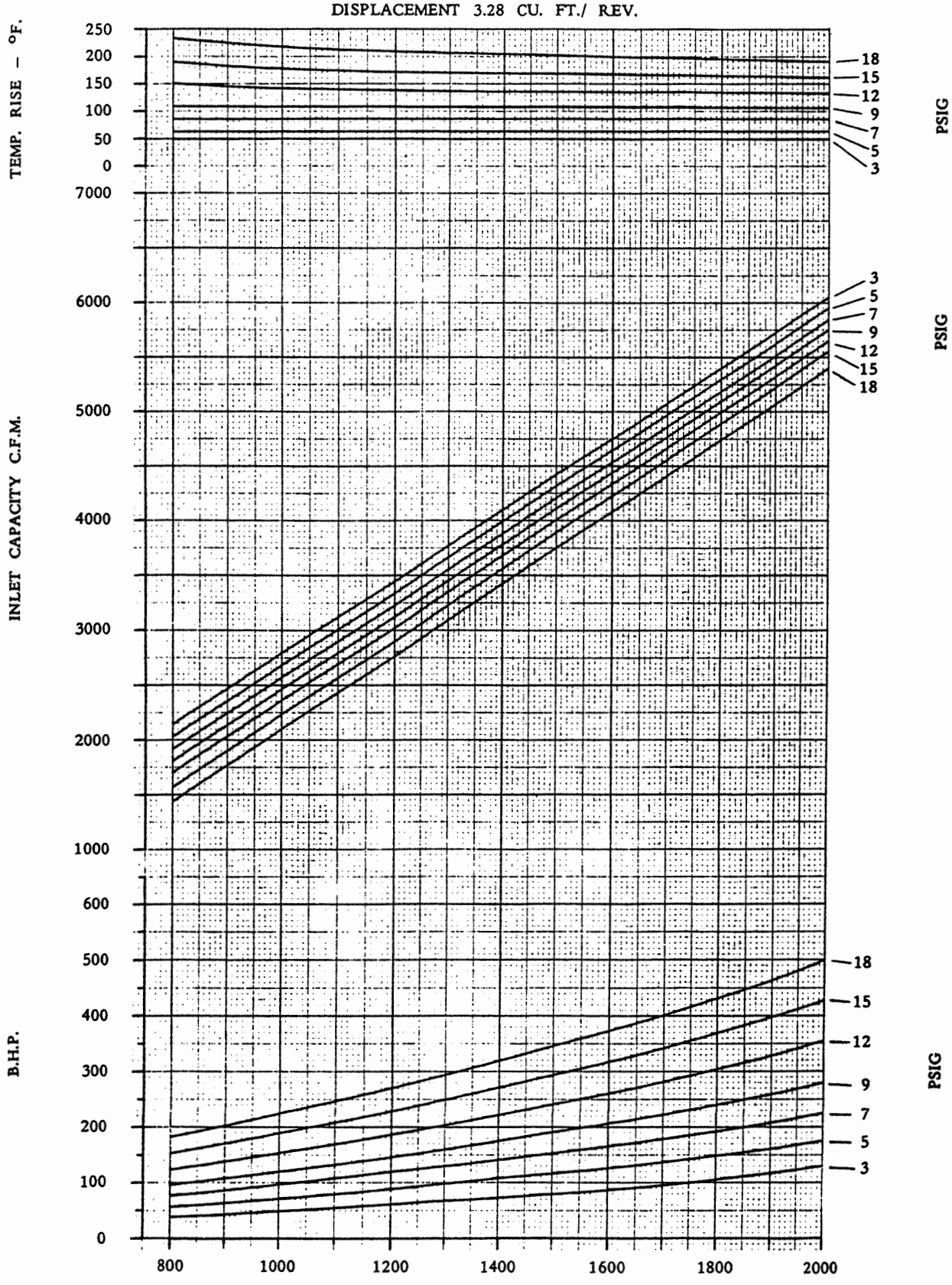
Gardner Denver

Curve 37-1-343
1st Edition
Replaces SC-1058 of 7-8-65

CYCLOBLOWER®

PRESSURE PERFORMANCE CURVE FOR 11CDL31 (MAIN ROTOR DRIVE)

CURVE DATA BASED ON INLET AIR AT:
14.7 PSIA – 68° F. TEMPERATURE – 36% RELATIVE HUMIDITY
DISPLACEMENT 3.28 CU. FT./ REV.



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Form No. AA-55		EDS-22
Supersedes	GARDNER DENVER CYCLOBLOWER® & ROTARY BLOWER VIBRATION LIMITS	
Dated		Date: 5-2-83

CYCLOBLOWER® & ROTARY BLOWER VIBRATION LIMITS

Occasionally, Gardner Denver is asked to comment on the severity of vibration of a blower in field service. Some manufacturers of vibration testing equipment issue general guidelines which define excessive overall (filter out) vibration levels for a particular type of machine. Although issued as guidelines only, often they are erroneously applied to any and all machines, including our blowers.

Excess vibration is defined as the level of vibration which experience has shown to be harmful to a particular piece of equipment. Our experience has proven that overall (unfiltered) vibration levels can be very misleading. In order to clarify the confusion in this area, Gardner-Denver has established the following guidelines for helical lobe and straight lobe blowers.

(1) New Start-ups:

An acceptable overall (filter out) velocity level is 0.45 inches/second peak.

(2) Above 0.45 inches/second, a frequency analysis should be taken and reviewed.

(3) When filter out levels are 0.60 inches/second or greater, a frequency analysis is required. Units operating at or above this filter out level require immediate attention.

To assure reliable vibration data for preventive maintenance or other purposes, the blower must be isolated from inlet and/or discharge piping strain and the shaft alignment must be within 0.003 inch TIR. Confirmation that this has been done must be submitted with all vibration data sent to us for analysis.

Refer to EDS-22.1 & EDS-22.2 for vibration limits at discrete frequencies.

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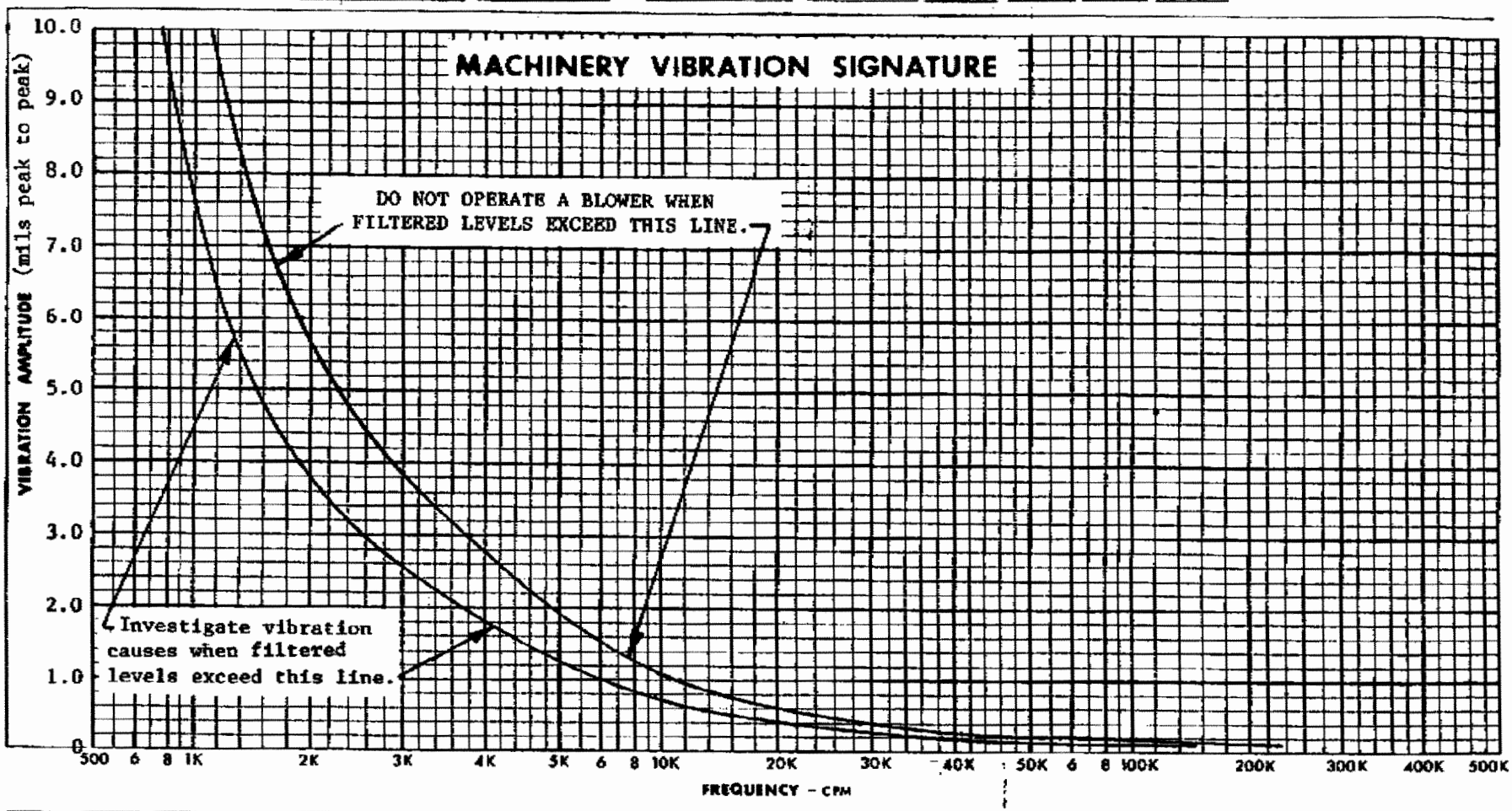
GARDNER DENVER CycloBlower & RotaryBlower Vibration Limits Guide Sheet (mils)



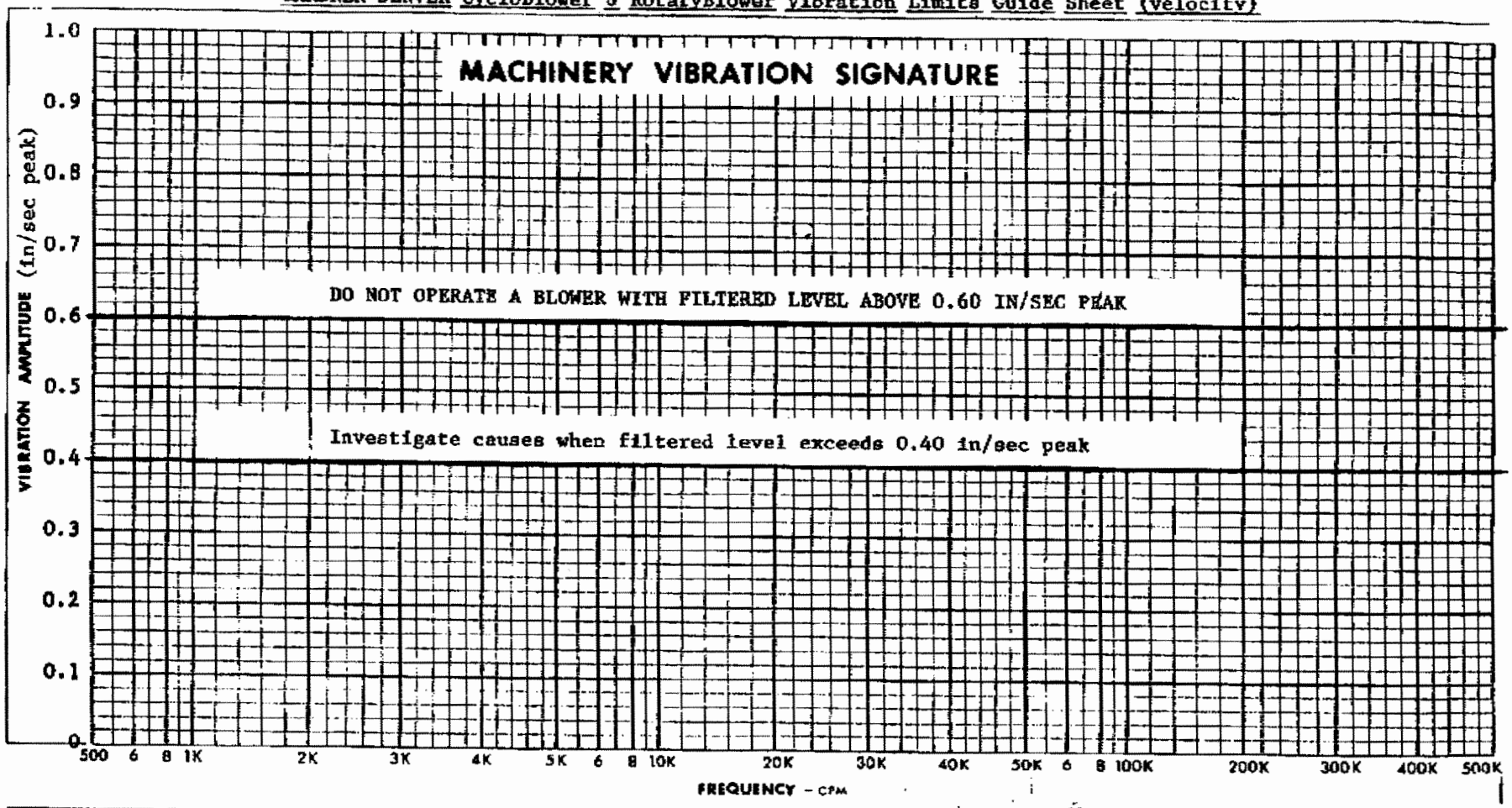
MACHINE: CycloBlower & RotaryBlower	AMPLITUDE FILTER OUT
MACHINE LOCATION: Jobsite	AMPLITUDE RANGE (FULL SCALE) 10.0 MILS PK-PK _____ IN/SEC PK _____ g PK
OPERATING CONDITIONS (RPM, LOAD, TEMP, ETC.)	_____ MICRONS PK-PK _____ MM/SEC PK
	FILTER IN: ☒ SHARP ☐ BROAD
	TYPE PICKUP: ☒ VEL ☐ ACCEL ☐ N/C
	MEASURE POSITION: _____ ☐ H ☐ V ☐ A
DATA SHEET NO. EDS - 22.1	DATE 5 / 2 / 85 BY TPM

Filter Out Vibration Limits

4.0 mils - vibration signature advised
(vibration switch alarm point)

6.0 mils - vibration signature <u>required</u>
and refer to limits for
filtered levels.
(vibration switch shutdown point)

GARDNER-DENVER CycloBlower & RotaryBlower Vibration Limits Guide Sheet (velocity)



MACHINE: CycloBlower & RotaryBlower	AMPLITUDE FILTER OUT
MACHINE LOCATION: Jobsite	AMPLITUDE RANGE (FULL SCALE)
OPERATING CONDITIONS (RPM, LOAD, TEMP, ETC.)	_____ MILS PK-PK 1.0 IN/SEC PK _____ g PK
	_____ MICRONS PK-PK _____ MM/SEC PK
	FILTER IN ☒ SHARP ☐ BROAD
	TYPE PICKUP ☒ VEL ☐ ACCEL ☐ N/C
	MEASURE POSITION _____ ☐ H ☐ V ☐ A
DATA SHEET NO: EDS - 22.2	DATE: 5 / 2 / 85 BY: TPM

Filter Out Vibration Limits

0.45 in/sec pk - vibration signature advised (vibration switch alarm point)

0.60 in/sec pk - vibration signature required and refer to limits for filtered levels (vibration switch shutdown point)

June 7, 1994

Supplement to Engineering Data Sheet EDS-22

Recently there has been some confusion in the interpretation of the vibration limits used by Gardner Denver for all of the blower product lines. Enclosed are EDS 22, 22-1 and 22-2 as well as LSF-2894, 2895 & 2896 which show the locations for the vibration pickup and the numbering scheme used to identify those points and the orientation of the pickup. On a vertical blower, the data should be collected on the discharge side, if possible (see LSF-2895). Data taken at any other locations on the blower cannot be considered in a vibration analysis since it is not supported by past history.

As stated in EDS-22, there have been general guidelines published by other sources which define excessive vibration limits in "overall" or filter out terms. Overall is essentially a total or addition of the individual peaks that would be found in an amplitude versus frequency spectra such as the example included here.

Our experience, up to 1985 when the original EDS-22 was released, and since then has shown that the "overall" level can be misleading and is not a good measure of the vibration severity of any positive displacement blower. Low " overall " levels are usually the result of low individual peaks but high " overall " levels are not always the result of high individual peaks but could just be the summation of numerous low amplitude peaks. See the spectra dated 2/23/82.

The reference to the "overall" level in EDS-22 was only for those people who chose to use it for a quick indicator of the machinery condition and for those people who use a mechanical vibration trip switch (see the lower right hand corner of EDS-22.2). Since the "overall" is a summation of the individual peaks, the individual peaks cannot be over 0.45 in/sec peak if the overall is not over 0.45 in/sec peak.

The pass/fail criterion that we have successfully applied over the years is that all of the individual peaks must be under 0.4 in/sec peak for the blower to be acceptable. When the individual peaks exceed 0.4 in/sec peak, causes should be determined and remedial action scheduled so that the individual peaks do not reach 0.6 in/sec peak.

Above 0.6 in/sec peak, we were once told that there is a high likelihood of metal to metal contact in the bearings due to lubricant suspension. Therefore we recommend not to operate any blower with individual peaks (filtered levels) above 0.6 in/sec peak.

June 7, 1994

There are typically many variables from site to site which can affect the recorded vibration amplitudes. Some of these would be alignment, drive means i.e. gearbox, direct, or v-belt, base and foundation construction, piping loads and even the instrumentation that is used to make the measurements. For these reasons, it is extremely difficult to predict the expected vibration amplitudes at any site. Therefore we think the most effective vibration predictive maintenance programs are those that take baseline amplitude versus frequency spectra at startup and then look for significant increases as they trend the data over an extended period of time.

The most consistent vibration data is that which is recorded while the blower is unloaded. If the load is cyclical and varies from day to day or throughout the day, data should be collected under the same loading conditions. The preferred units of measure are velocity in inches per second peak since velocity is frequency independent.

One of the outside loads that can seriously affect the collection of consistent vibration data is piping loads on the inlet and discharge ports of the blower. These loads should be isolated from the blower by the use of properly mounted expansion joints at each blower port. A rubber expansion joint that is either compressed or stretched beyond its maximum limits will transfer loads and piping vibration similar to hard pipe. It is not necessary to remove the inlet and discharge piping, just to isolate the blower from these outside loads for effective and reliable vibration trending.

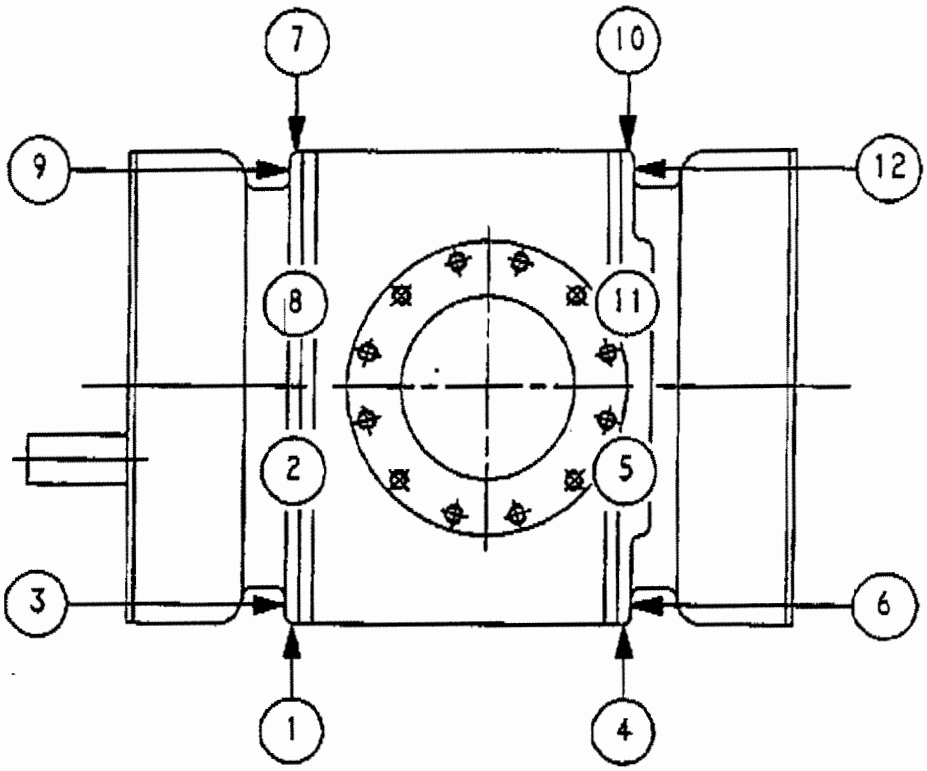
The machines should be visually surveyed, then tested for (a) soft foot, and (b) for piping strain.

a). To check for soft foot, the machine must be firmly bolted to the baseplate. Each support foot is checked with a dial indicator, loosening the hold-down bolts one at a time. If movement exceeds two mils (0.002 inches), soft foot is indicated. The shimmed feet must be firm and uniformly torqued. A maximum of four shims is recommended under any foot to avoid a spongy connection.

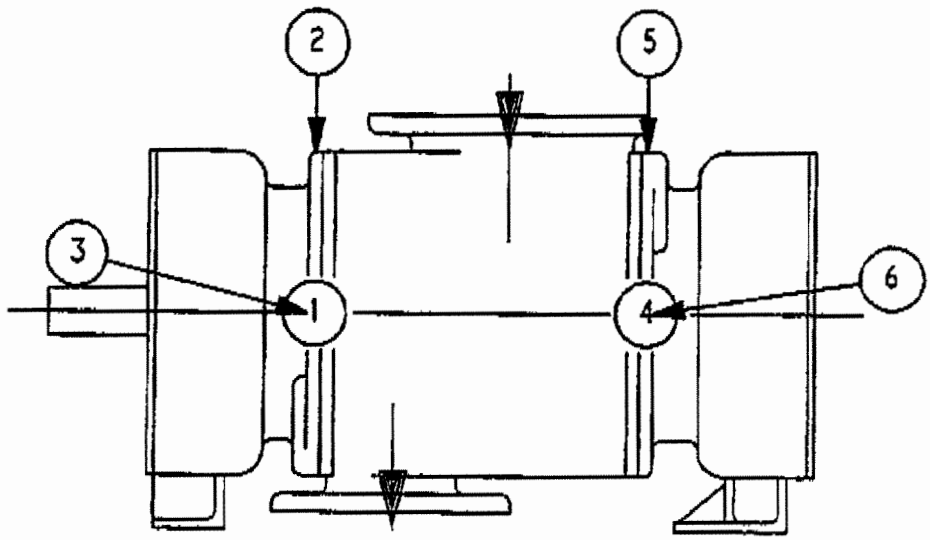
b). To check for piping strain, place dial indicators to measure both vertical and horizontal shaft movements simultaneously. Piping flanges should be made up separately, with indicator readings observed continuously. Should shaft movement exceed one mil (0.001 inch), piping strain is considered excessive and should be corrected. Loosen pipe until alignment is complete, then tighten and retest for strain.

Since two of the three vibration instruments used by Gardner Denver for vibration analysis are not capable of measuring " overall ", we would be hard pressed to predict "overall" levels on blowers simply because we have not been taking this type data either during our production tests or in any jobsite vibration analysis.

VIBRATION PICK-UP LOCATIONS



1	MAIN D.E.	H
2		V
3		A
4	MAIN I.E.	H
5		V
6		A
7	GATE D.E.	H
8		V
9		A
10	GATE I.E.	H
11		V
12		A

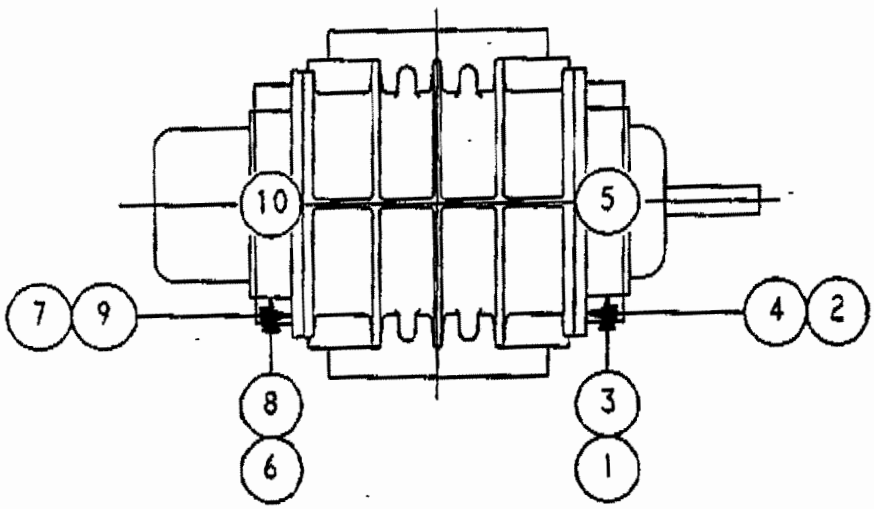


LEGEND:
D.E. - DISCHARGE END
I.E. - INLET END
H - HORIZONTAL
V - VERTICAL
A - AXIAL

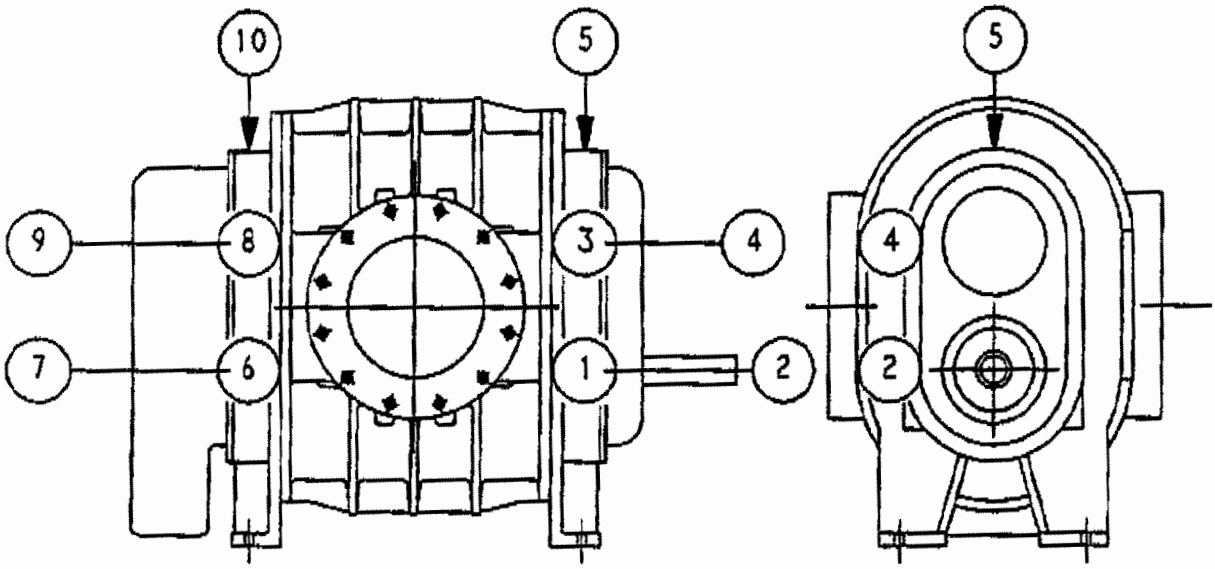
LSF-2894
J.A.M. 5-4-94

VIBRATION PICK-UP LOCATIONS FOR A VERTICAL BLOWER

1	DRIVE END	LWR BRG	H
2			A
3		UPR BRG	H
4			A
5		TOP	V
6	GEAR END	LWR BRG	H
7			A
8		UPR BRG	H
9			A
10		TOP	V



LEGEND:
- LWR - LOWER
- UPR - UPPER
- BRG - BEARING
- H - HORIZONTAL
- V - VERTICAL
- A - AXIAL

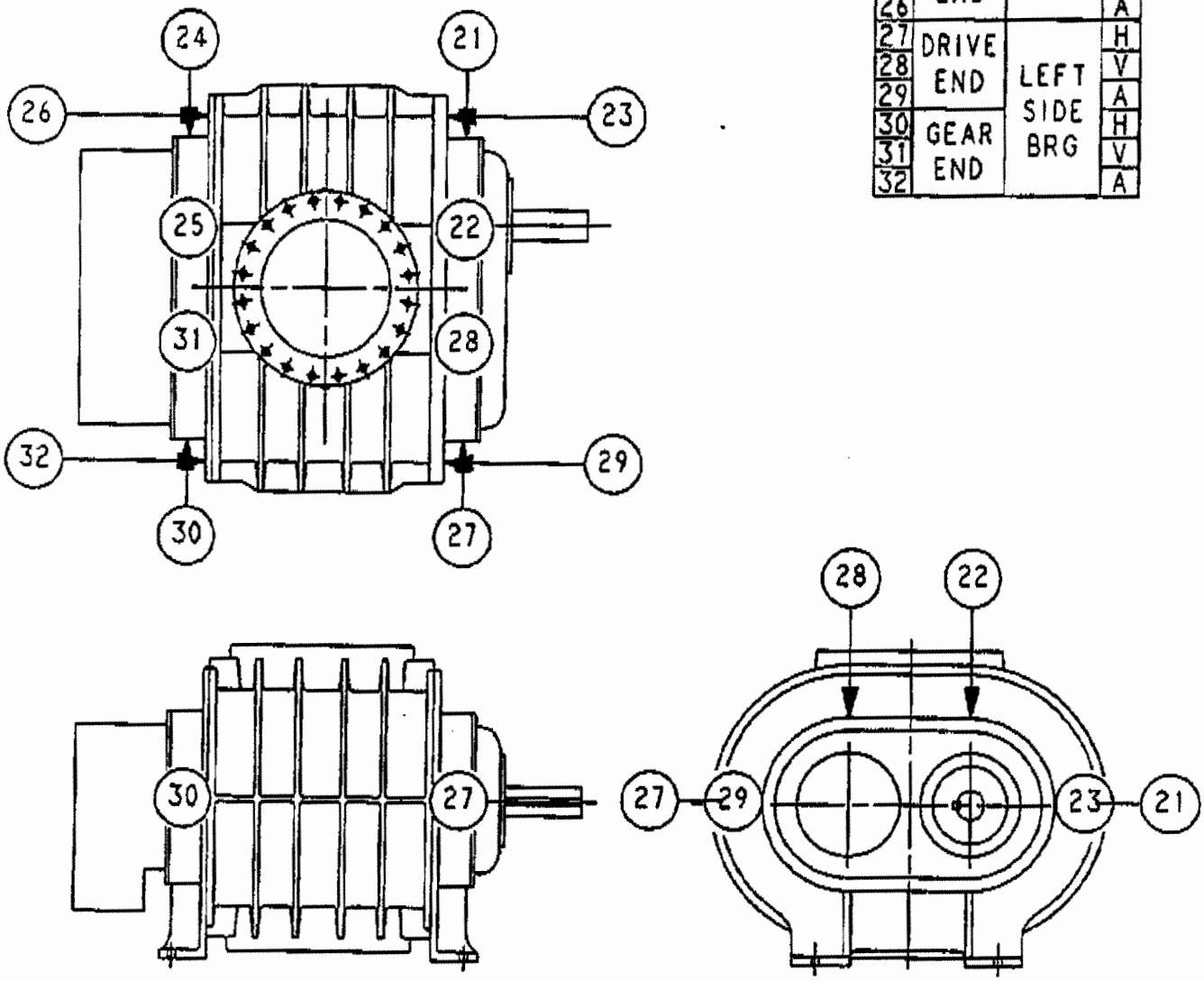


NOTE:
THE PREFERRED SIDE FOR THE PICKUPS IS THE DISCHARGE SIDE, BUT DATA CAN BE TAKEN ON THE INLET. ALL DATA SHOULD BE TAKEN ON THE SAME SIDE.

LSF-2895
J.A.M. 5-4-94

VIBRATION PICK-UP LOCATIONS FOR A HORIZONTAL BLOWER

21	DRIVE END	RIGHT SIDE BRG	H
22			V
23			A
24	GEAR END		H
25			V
26			A
27	DRIVE END	LEFT SIDE BRG	H
28			V
29			A
30	GEAR END		H
31			V
32			A



LEGEND:
BRG - BEARING
H - HORIZONTAL
V - VERTICAL
A - AXIAL

LSF-2896
J.A.M. 5-4-94

GARDNER DENVER®

37–1–608
1st Edition
January, 1999

CYCLOBLOWER®

11CDL–L SERIES BLOWERS

MODELS
11CDL23L
11CDL27L
11CDL31L

PARTS LIST
OPERATING AND
SERVICE MANUAL

Gardner Denver

MAINTAIN BLOWER RELIABILITY AND PERFORMANCE WITH GENUINE GARDNER DENVER PARTS AND SUPPORT SERVICES

Factory genuine parts, manufactured to design tolerances, are developed for optimum dependability — specifically for your blower. Design and material innovations are born from years of experience with hundreds of different blower applications. When you specify factory genuine parts you are assured of receiving parts that incorporate the most current design advancements . . . manufactured in our state–of–the–art blower factory under exacting quality standards.

Your AUTHORIZED DISTRIBUTOR offers all the backup you require. A worldwide network of authorized distributors provides the finest product support in the blower industry.

Your local AUTHORIZED DISTRIBUTOR maintains a large inventory of genuine parts and is also backed by direct access to our Master Distribution Center (MDC) in Memphis, Tennessee, for immediate emergency response.

1. Trained parts technical representatives to assist you in selecting the correct replacement parts.
2. Complete inventory of new machines and new, genuine factory parts.
3. A full line of factory tested AEON™ PD blower lubricants specifically formulated for optimum performance in all blowers.
4. Authorized distributor service technicians are factory–trained and skilled in blower maintenance and repair. They are ready to respond and assist you by providing fast, expert maintenance and repair services.

For the location of your local authorized Gardner Denver blower distributor refer to the yellow pages of your phone directory or contact:

Gardner Denver Blower Division
100 Gardner Park
Peachtree City, GA 30269
Phone: (770) 486–5655
Fax: (770) 486–5628

INSTRUCTIONS FOR ORDERING REPAIR PARTS

For pricing and ordering information, contact your nearest AUTHORIZED FACTORY DISTRIBUTOR. When ordering parts, specify Blower MODEL and SERIAL NUMBER (see nameplate on unit).

Use this Parts List to select the parts you require. Where NOT specified, quantity of parts required per blower is one (1); where more than one is required per unit, quantity is indicated.

Specify EXACTLY the number of parts required.

Rely upon the knowledge and experience of your AUTHORIZED DISTRIBUTOR and let them assist you in making the proper parts selection for your blower.

Gardner Denver® blowers are the result of advanced engineering and skilled manufacturing. To be assured of receiving maximum service from this machine the owner must exercise care in its operation and maintenance. This book is written to give the operator and maintenance department essential information for day-to-day operation, maintenance and adjustment. Careful adherence to these instructions will result in economical operation and minimum downtime.

⚠ DANGER

Danger is used to indicate the presence of a hazard which will cause severe personal injury, death, or substantial property damage if the warning is ignored.

⚠ WARNING

Warning is used to indicate the presence of a hazard which can cause severe personal injury, death, or substantial property damage if the warning is ignored.

⚠ CAUTION

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

NOTICE

Notice is used to notify people of installation, operation or maintenance information which is important but not hazard-related.

TABLE OF CONTENTS

Page

Instructions For Ordering Repair Parts i

Foreword ii

Index ..... iv, v

Safety Precautions vi

Introduction, Your Key To Trouble Free Service 1

Section 1, Equipment Check 1

Section 2, Installation 2

Section 3, Lubrication 9

Section 4, Operation 13

Section 5, Parts List 18

Section 6, Disassembly Instructions 23

Section 7, Assembly Instructions 27

INDEX

Accessories 3
  Couplings 4
  Inlet Filter or Filter Silencer 3
Air Filters and Filter–Silencers, Maintenance 10
Altitude 14
ASSEMBLY INSTRUCTIONS, SECTION 7 27

Bearing Oil Seals 11
Blower Failure, Common Causes 12
Blower Overhaul 12
Blower Startup Checklist 17
Bypass Valve 5

Check
  Daily 13
  Prestart 13
Check Valve 6
Checklist, Blower Startup 17
Clearance Chart, Rotor End 29
Construction 2
Couplings 4

Daily Check 13
DIMENSIONAL OUTLINE 7
Dimensions – Adaptor Plates 23, 24
DISASSEMBLY INSTRUCTIONS, SECTION 6 ... 23
Discharge Piping 6
Discharge Silencer 11
Drawings, Outline 6, 7
Drive, V–Belt 4
Drive Installation 4
  V–Belt Drive 4
Dry Type Filter and Filter–Silencer, Maintenance . 11

Emergencies 15
EQUIPMENT CHECK, SECTION 1 1
Exchanger, Heat 5

FIlter, Inlet, or Filter Silencer 3
Filter–Silencer and Dry Type Filter, Maintenance . 11
Filter–Silencers and Air Filters, Maintenance 10
Foreword ii
Foundations 3

Heat Exchanger 5
High Temperature and High Pressure Shutdown .. 6

Inlet FIlter or Filter Silencer 3
Inlet Piping 6
Inspections, Periodic 11

INSTALLATION, SECTION 2 2
Installation
  Drive 4
  General 2

Kit, Overhaul 22

Location 3
Lubricant, Recommended 9
LUBRICATION, SECTION 3 9
Lubrication 9
  General 9

Maintenance 10
  Air Filters and Filter–Silencers 10
  Dry Type Filter and Filter–Silencer 11
  Oil Bath Filter 10
  Oil Wetted Filter–Silencer 10

Oil Bath Filter 10
  Maintenance 10
Oil Wetted Filter–Silencer 10
Operating Principle 2
Operating Temperature 15
OPERATION, SECTION 4 13
Operation, General 13
Outline Dimensions, Opposite Gear End Drive 8
Outline Drawings 6, 7
Overhaul, Blower 12
Overhaul Kit 22

PARTS LIST, SECTION 5 18
  Overhaul Kit 22
  Sectional Views 18, 19
Periodic Inspections 11
Piping
  Discharge 6
  Inlet 6
Prestart Check 13

Recommended Lubricant 9
Relief Valve 6
Repair Parts 12
Repair Parts, Ordering Instructions i
Rotation 13
Rotor End Clearance Chart 29
Rotor Shaft Seals 11

Safety Devices 5
  Check Valve 6
  Relief Valve 6

INDEX

Safety Precautions vi
Seals
  Bearing Oil 11
  Rotor Shaft 11
Shutdown, High Temperature and High Pressure .. 6
Silencer, Discharge 11
Speed 14
Starting Blower 13
Startup Checklist, Blower 17
Stopping Blower 15
Storage 1

Temperature, Operating 15
Timing of Rotors 35
Type of Service 13
  Pressure 13
  Vacuum 14

V–Belt Drive 4
V–Belt Drive Limitation Chart 5
Valve
  Bypass 5
  Check 6
  Relief 6
Ventilation 6
Viscosity Requirements 9

YOUR KEY TO TROUBLE FREE SERVICE,
  INTRODUCTION 1

SAFETY PRECAUTIONS

Safety is everybody's business and is based on your use of good common sense. All situations or circumstances cannot always be predicted and covered by established rules. Therefore, use your past experience, watch out for safety hazards and be cautious. Some general safety precautions are given below:

⚠ DANGER

Failure to observe these notices could result in injury to or death of personnel.

- **Keep fingers and clothing away from revolving sheave, drive coupling, etc.**
- **Do not use the air discharge from this unit for breathing – not suitable for human consumption.**
- **Do not loosen or remove the oil filler plug, drain plugs, covers, or break any connections, etc., in the blower air or oil system until the unit is shut down and the air pressure has been relieved.**
- **Electrical shock can and may be fatal.**
- **Blower unit must be grounded in accordance with the National Electrical Code. A ground jumper equal to the size of the equipment ground conductor must be used to connect the blower motor base to the unit base.**
- **Open main disconnect switch, tag and lockout before working on the blower.**
- **Disconnect the blower unit from its power source, tag and lockout before working on the unit – the machine may be automatically controlled and may start at any time.**

⚠ WARNING

Failure to observe these notices could result in damage to equipment.

- **Stop the unit if any repairs or adjustments on or around the blower are required.**
- **Disconnect the blower unit from its power source, tag and lockout before working on the unit – the machine may be automatically controlled and may start at any time.**
- **Do not exceed the rated maximum speed shown on the nameplate.**
- **Do not operate unit if safety devices are not operating properly. Check periodically. Never bypass safety devices.**

INTRODUCTION
YOUR KEY TO TROUBLE FREE SERVICE

Although Gardner Denver blowers are sturdy, precision–engineered machines, there are several relatively simple but basic installation and maintenance procedures that must be observed to assure optimum performance. As there is no guesswork in the manufacture of these highly advanced units, there must be none in preparing them to get the job done in the field.

It is the purpose of this manual to help you properly install, maintain and service your Gardner Denver blower. It is important that no section be overlooked when preparing to install your blower.

Follow the instructions carefully and you will be rewarded with years of trouble–free operation.

SECTION 1
EQUIPMENT CHECK

Before uncrating, check the packing slip carefully to be sure all the parts have been received. All accessories are listed as separate items on the packing slip, and small important accessories such as relief valves can be overlooked or lost. After every item on the packing slip has been checked off, uncrate carefully. Register a claim with the carrier for lost or damaged equipment.

⚠ WARNING

Customers are cautioned to provide adequate protection, warning and safety equipment necessary to protect personnel against hazards involved in installation and operation of this equipment in the system or facility.

STORAGE

Your Gardner Denver Blower was packaged at the factory with adequate protection to permit normal storage for up to six (6) months.

If the unit is to be stored under adverse conditions or for extended periods of time, the following additional measures should be taken to prevent damage.

1. Store the blower in a clean, dry, heated (if possible) area.
2. Make certain inlet and discharge air ports are tightly covered to prevent foreign material from entering the air box.
3. All exposed, non–painted surfaces should be protected against rust and corrosion.
4. Provide adequate protection to avoid accidental mechanical damage.
5. In high humidity or corrosive environments, additional measures may be required to prevent rusting of the blower internal surfaces.
6. To prevent rusting of gears, bearings, etc., the oil reservoirs may be filled with normal operating oil.

⚠ CAUTION

Before running the blower, drain the oil and replace to the proper operating level with clean, fresh lubricant.

7. Rotate the blower shaft (10 to 25 turns) monthly during storage. Inspect the blower shaft (near the shaft seal area) monthly and spray with rust inhibitor if needed.
8. For long term storage (over six (6) months), contact Gardner Denver Blower Division Customer Service for recommendations.

SECTION 2
INSTALLATION

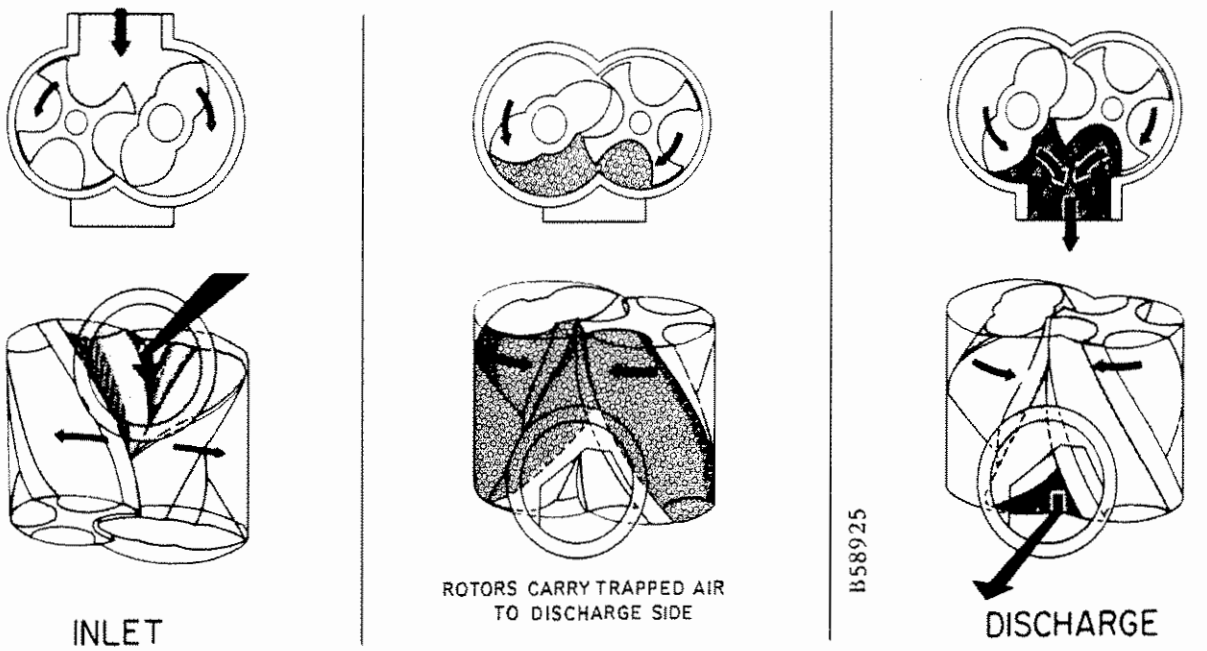


FIGURE 1 – OPERATING PRINCIPLE

GENERAL – The CycloBlower® is a compact, rotary lobe type axial flow blower. The meshing of two screw type rotors synchronized by timing gears provides controlled compression of the air for maximum efficiency and pulsation–free discharge.

OPERATING PRINCIPLE – Compression is effected by the main (2 lobe) and gate (4 flute) rotors meshing enclosed in the housing. The timing gears maintain close rotor clearances. The rotors do not touch each other, the housing, or the bearing carriers. Although clearances are small, lubrication in the compression chamber is not required, insuring oil–free air delivery.

The compression cycle (Figure 1) begins as the rotors unmesh at the inlet port. Air is drawn into the rotor cavities, trapped, and compressed by the reducing cavities as rotation continues. When proper compression is made, the cavities cross the discharge port, completing the cycle. The cycle occurs twice each revolution and is continuous.

CONSTRUCTION – All models of the 11CDL–L Series CycloBlower® are of similar design and construction except for rotor length. The housing is a one–piece casting with flanged inlet and discharge openings.

Main rotors and the 11CDL23L Gate Rotor are ductile iron with an integral cast shaft.

Model 11CDL27L and 11CDL31L Gate Rotors are ductile iron with pressed in steel shaft.

Rotors are dynamically balanced to minimize vibration.

Helical timing gears are of alloy steel, hobbed and shaved for quiet operation.

Two heavy–duty duplex mounted angular contact ball bearings are used on each rotor shaft, at the discharge end, as fixed bearings to maintain rotor end clearance.

A radial bearing is used on each rotor shaft at the gear end as a floating bearing.

All gears and bearings are oil splash lubricated.

Standard construction is top inlet, bottom discharge with drive shaft extension from the main rotor at the discharge end. Rotation is clockwise facing the drive shaft. Blowers may be mounted for either V–belt or direct–coupled drive. The gate rotor speed is half (1/2) the main rotor or drive speed.

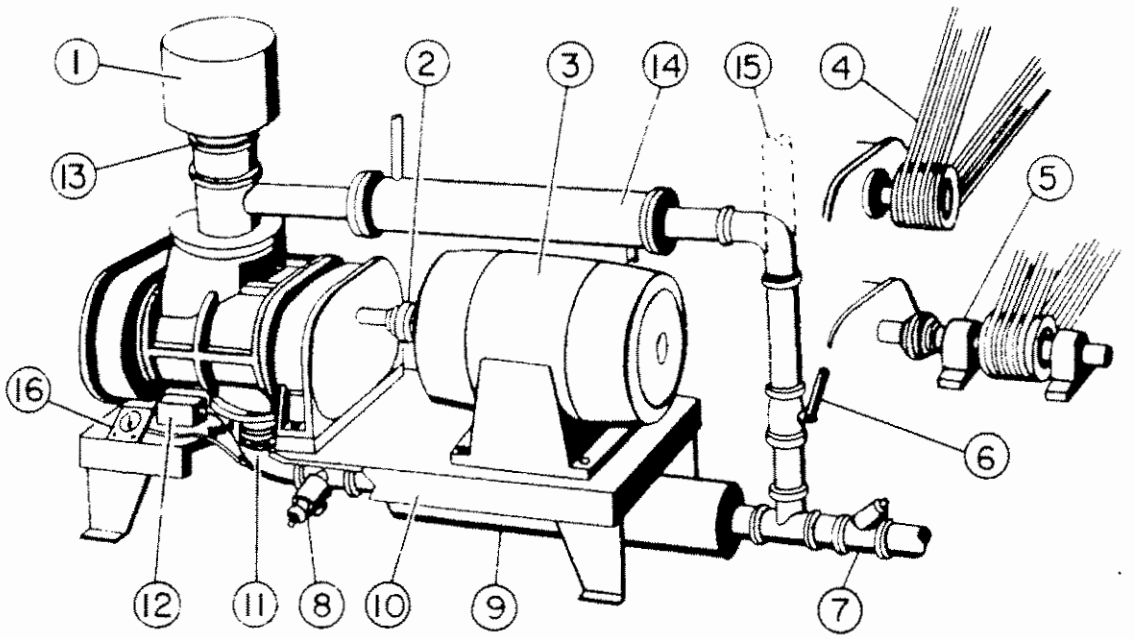


FIGURE 2 – ACCESSORIES AND SAFETY DEVICES

LOCATION – Select a clean, dry, well–ventilated area for installing blower and allow ample room for normal maintenance. Proper ventilation is necessary for blower cooling and cool air intake.

> **⚠ WARNING**
>
> **Do not electric weld on the blower or base; bearings can be damaged by the passage of current.**

FOUNDATIONS – Correct supporting is important. Distortion by incorrect supporting will affect internal operating clearances. The foundation or base must provide a level, rigid, nonworking support for the blower. It must be on uniform and solid footing. Complete foundation design cannot be given because of varying conditions. If necessary, use shims under feet for leveling to prevent distortion when foundation bolts are tightened. After installation on the foundation is complete, check alignment of the coupling or drive before starting blower.

ACCESSORIES (FIGURE 2) – The type of service determines the accessory group required. The typical items are listed as follows:

1. Inlet Filter or Filter–silencer.
2. Flexible Coupling.
3. Driver.
4. Simple V–Belt Drive.
5. Jackshaft V–Belt Drive.
6. Bypass Valve.
7. Check Valve.
8. Relief Valve, Vacuum or Pressure.
9. Discharge Silencer.
10. Base plate.
11. Expansion Joint(s) – Inlet and/or Discharge.
12. Temperature or Pressure Shutdown Switch.
13. Check Valve (Inlet Bypass).
14. Heat Exchanger.
15. Bypass to atmosphere (alternate).
16. Pressure Gauge or Vacuum Gauge.

Inlet Filter or Filter–Silencer – For pressure service handling air, the blower inlet must be protected by a fil-

ter of suitable size to allow full flow of air to the blower inlet. The filter must be of adequate efficiency to trap any foreign materials which may be in the general area of the air inlet. If noise is a factor, filter–silencers are available.

⚠ WARNING

Rotating components will cause severe injury in case of personal contact. Keep hands away from the blower inlet and discharge ports.

In choosing a location for the filter, consideration should be given to a source of cool, clean air, and most important, access for maintenance.

Filters generally used for blower service fall under three types:

Oil–wetted Screen Type

Oil Bath

Dry Type

Filter–silencers are also available in the above types.

For vacuum service, the type of system used and materials being handled will determine the necessity for an in–line filter.

Couplings – For direct–coupled units, a flexible type coupling, accurately aligned, should be used between the blower and power unit. Misaligned couplings may cause vibration, additional bearing loads and stresses which will affect life of parts involved. DO NOT drive the couplings on the shaft. Check shaft and coupling bore for burrs. Polish the shaft and bore if necessary for proper fit. Fit keys to keyways. Check coupling alignment. Exact alignment will vary with the type of couplings; however, it is not uncommon to hold alignment within .003" in all directions. With lubricated or special couplings, follow the manufacturer's instructions for installation and maintenance.

DRIVE INSTALLATION

V–Belt Drive – Follow normal specifications recommended by the belt manufacturers for installation of belt drives on blowers. To provide the most compact drive, it is suggested the high capacity V–belt drives be used. Blower shaft and power unit shaft should be parallel, with sheaves aligned on shafts so belts run true. Use only matched belt sets and replace belts in complete sets only. Belt tension should be according to manufacturer's recommendations. Slippage can be detected by belt squeal, overheating or loss of speed. A few hours after initial starting with new belts, it is advisable to recheck belt tension and provide tension adjustment as necessary.

⚠ WARNING

Overtightening belts leads to heavy bearing loads and premature failure.

When selecting a V–belt drive, check to be sure the shaft overhung load limitation is not exceeded. Refer to FIGURE 3, page 5, for minimum blower sheave diameter limitations.

Belt drives must be carefully aligned. Motor and blower pulleys must be parallel to each other and in the same plane within 1/16 inch. Belt tension should be carefully adjusted and belts tightened only enough to prevent slippage.

NOTICE

The sheave should be positioned as close as possible to the drive cover. This will reduce the overhung load and extend the bearing life.

On direct connected units, alignment and lubrication of the couplings to specifications of the coupling manufacturer are very important. When mounted drives are supplied from the factory, proper alignment has been established before shipment. However, during shipping, handling and installation, it is likely that the alignment has been disturbed and final adjustment must be made before startup.

MINIMUM ALLOWABLE BLOWER SHEAVE DIAMETER (INCHES)
AT VARIOUS SPEEDS AND MOTOR HORSEPOWER.
WHERE NO SHEAVE DIAMETER IS SHOWN, JACKSHAFT V–BELT DRIVE IS REQUIRED.

NOTE: Chart Covers Two Items of Primary Interest:

1. Simple V–Belt Drive Motor HP Limitations; or at what motor HP it becomes necessary to use a Jackshaft Drive on the blower, and
2. The minimum allowable Blower Sheave Diameter for Simple V–Belt Drive, for a given blower speed and motor horsepower.

The chart applies to standard blowers only (driveshaft on discharge end of main rotor). Contact Gardner Denver Blower Division Sales for belt drive recommendations on blowers with nonstandard driveshaft locations. Motor or engine suppliers should be consulted for driver limitations.

11CDL SERIES

Motor Nameplate HP To:	Blower Speed – RPM				
	800	1100	1400	1700	2000
60	9.00	9.00	9.00	9.00	9.00
75	10.90	9.00	9.00	9.00	9.00
100	15.00	10.30	9.00	9.00	9.00
125	18.50	13.20	10.30	9.00	9.00
150	22.90	16.00	12.50	10.30	9.00
200 & up	——	——	——	——	——
	Maximum Blower Sheave Diameter For Above Blower Speeds				
	31.00	22.50	17.70	14.50	12.40

FIGURE 3 – SIMPLE V–BELT DRIVE LIMITATION CHART

Bypass Valve – Installation of a bypass valve at the blower discharge (FIGURE 2, page 3) will allow the blower to be started under no–load. The bypass line may be discharged to atmosphere or to the blower inlet depending on local requirements or material being handled.

Heat Exchanger – When the bypass line discharges to blower inlet, a heat exchanger must be included in the line between blower discharge and blower inlet, to remove the heat of compression before the gas is reintroduced into the blower inlet. A check valve (FIGURE 2, page 3) should also be placed in the inlet line between the bypass line and the inlet filter or silencer, to prevent discharging backwards through the filter or silencer.

SAFETY DEVICES – For all installations the following safety devices are a requirement for safe blower operation. Numbers shown are reference numbers used in FIGURE 2, page 3.

7. Check Valve, Blower Discharge Line
8. Relief Valve, Vacuum or Pressure

Check Valve (FIGURE 2, page 3) – When the blower is used in a pneumatic conveying system, a check valve must be used to prevent backflow of materials into the blower. In any system it is a safety device preventing the down stream pressure from motoring the blower through shutdown periods. A check valve must be provided for each blower when several blowers are manifolded into a common system.

Relief Valve (FIGURE 2, page 3) – The relief valve must be installed as close to the blower ports as possible. There should be no accessories such as valves, check valves, silencers, etc. between the relief valve and the blower ports. It should be set 2 to 3 PSI above the blower operating pressure (1/2" to 1" Hg. in vacuum service).

NOTICE

Relief valves should be placed as close as possible to the blower inlet port (vacuum operation) or discharge port (pressure operation).

High Temperature and High Pressure Shutdown – All blower installations should be protected with a high temperature shutdown switch. The controls should be set to stop the blower when the discharge temperature reaches 355° F. In some installations a high pressure shutdown switch may also be advisable. The sensing element of these controls should be installed as close to the blower discharge as possible. See FIGURE 2, page 3. On remote or unattended installations these controls are normally mandatory.

INLET PIPING – During the installation of piping make sure dirt and other foreign materials do not enter blower openings. When inlet piping is used IT MUST BE CLEAN, AND FREE OF SCALE AND OTHER FOREIGN MATERIALS WHICH COULD ENTER THE BLOWER. It is suggested that an expansion joint be installed near blower openings to prevent stressing of the blower housing. Support the pipe to relieve weight on the expansion joint and the blower. Make sure the pipe size is adequate and as straight as possible to prevent pressure drop at the blower inlet. Where bends are necessary use long radius fittings. All connections must be air tight.

For vacuum service, an accurate vacuum gauge must be used near the blower inlet to indicate operating vacuum, and a suitable vacuum relief valve must be used. A vacuum blower in pneumatic conveying service requires pre–inlet separation and filtering to prevent material carry-over into the blower.

Inlet pipe size is determined as follows:

0 to 10 feet long, use pipe size equal to blower inlet flange size

10 to 17 feet, one pipe size larger than blower inlet

17 to 33 feet, two pipe sizes larger than blower inlet.

DISCHARGE PIPING – In general, the type system used will govern the piping arrangement. However, the following suggestions should be followed for blower protection and efficiency.

An expansion joint should be installed as close to the blower opening as possible to protect the blower housing from stresses. All pipe connections should be square and even to prevent distortion from misalignment.

An accurate pressure gauge must be provided near the blower discharge to indicate operating pressure. If noise level is a factor, a discharge silencer should be used. The discharge line should be as straight as possible. Where bends are necessary, use long radius fittings. Provision for condensate drainage at the lowest point in the piping may be required.

VENTILATION – If the blower is to operate in a housing or enclosure, proper ventilation must be provided for adequate blower cooling. Cooling air should be taken from outside the enclosure.

OUTLINE DRAWINGS – Certified outline drawings are available upon request. All important dimensions are shown in FIGURE 4, pages 7 and 8.

TOP INLET, MAIN ROTOR DRIVE

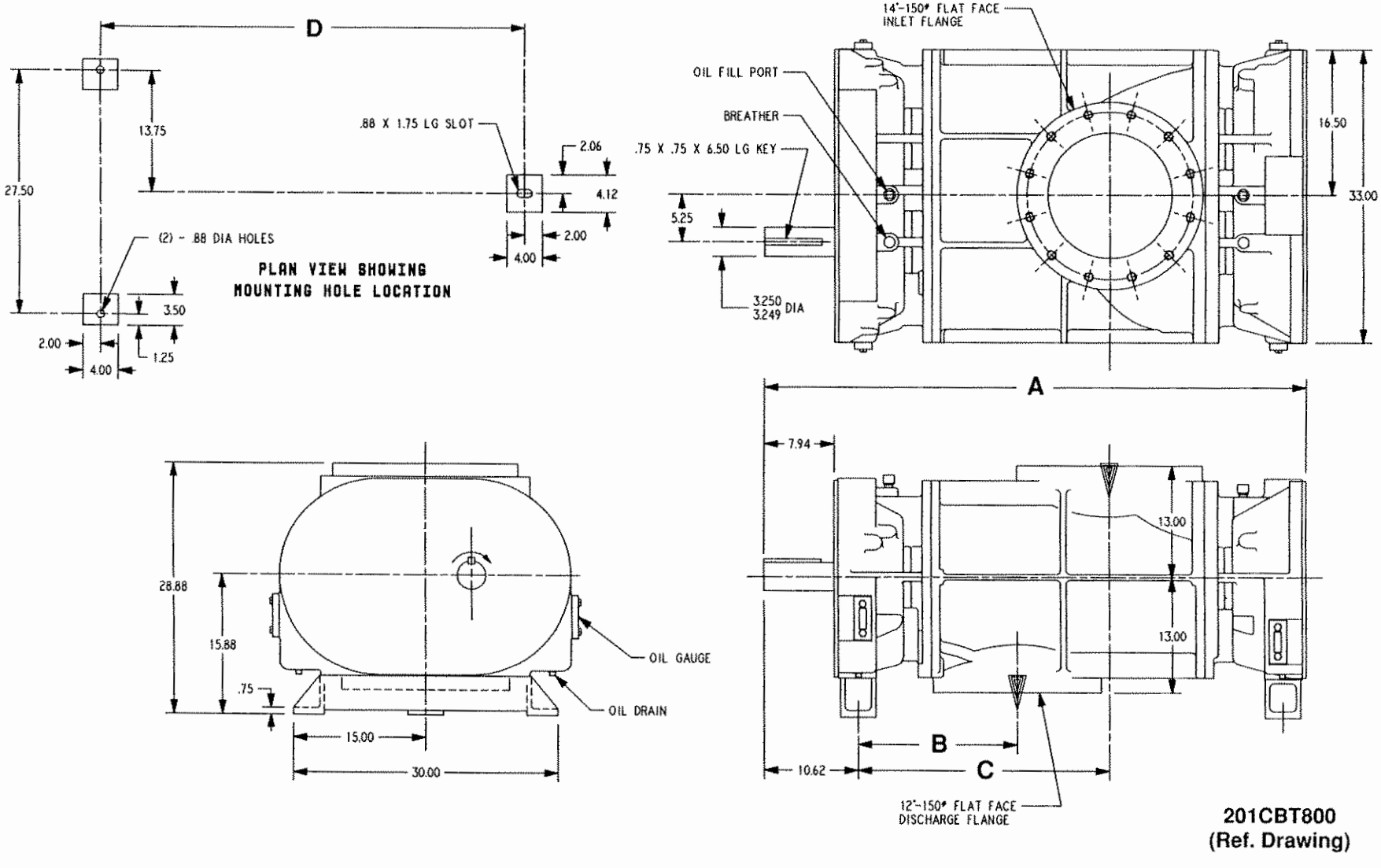


FIGURE 4 – OUTLINE DIMENSIONS – TOP INLET, MAIN ROTOR DRIVE

OUTLINE DIMENSIONS – TOP INLET, MAIN ROTOR DRIVE

MODEL	WT.	A	B	C	D	OUTLINE DIMENSIONS DRAWING NO.
11CDL23L	3160	53.38	19.56	22.00	40	203CBT800
11CDL27L	3400	57.25	20.00	22.44	44	202CBT800
11CDL31L	3560	61.25	18.00	28.44	48	201CBT800

SECTION 3
LUBRICATION

GENERAL – Blower efficiency and life depend on the quality of maintenance the blower receives. Maintenance must be done regularly and with care. Clean work space, tools, solvents and wiping rags are necessary to avoid transferring dirt into the unit. A maintenance chart listing each blower and scheduling regular maintenance of the unit is valuable. A good program, well carried out, will insure long trouble–free service from the blower.

LUBRICATION – Gears and bearings are splash lubricated. The discharge end sump requires 15–3/4 quarts and the gear end sump requires 8–1/2 quarts of oil. Filling with this amount of oil will bring the oil level to about the middle of the sight gauge. Add more oil if necessary to bring the level to the middle. DO NOT OPERATE THE BLOWER UNLESS OIL LEVEL IS AT THE MIDDLE OF THE SIGHT GAUGE. Do not overfill. Oil is added through the oil fill hole at the top of each bearing carrier.

RECOMMENDED LUBRICANT – AEON PD Synthetic Blower Lubricant is recommended. Refer to FIGURE 5 for AEON PD part numbers.

AEON PD is formulated especially for positive displacement blower service to provide maximum blower protection at any temperature. One filling of AEON PD will last a minimum of 4 times longer than a premium mineral oil, depending on actual operating conditions. Order AEON PD from your Gardner Denver distributor or call Gardner Denver Blower Division direct at:

770–486–5655

Blower Discharge Temperature		Factory Tested Recommended and Approved Lubricant
° F	° C	AEON PD
32°	0°	Synthetic Blower Lubricant
100°	38°	One Superior Lubricant
275°	135°	For
350°	177°	All Operating Temperatures

AEON PD	1 Qt. Bottle	Part No. 28G23
AEON PD	12 Qt. Case	Part No. 28G24
AEON PD	5 Gal. Pail	Part No. 28G25
AEON PD	55 Gal. Drum	Part No. 28G28

FIGURE 5 – RECOMMENDED LUBRICANT

	Ref. Viscosity at 104° F	Viscosity Grade
Cold Weather Operation: 10° F. to 32° F. Ambient	417–510 SUS	ISO 100
Warm Weather Operation: 32° F. to 90° F.	625–765 SUS	ISO 150
Warm Weather Operation: 90° F. Ambient	918–1122 SUS	ISO 220

NOTES:

1. Napthenic base lubricants are not recommended.
2. For operation at ambient temperatures below 10° F., the use of oil sump heaters or synthetic lubricants is recommended. The pour point of the lubricant should be at least 5° F. to 10° F. below the minimum expected ambient temperature.
3. For continuous operation where oil sump temperatures exceed 200° F., use AEON PD Synthetic Blower Lubricant.

FIGURE 6 – VISCOSITY REQUIREMENTS

If not using AEON PD synthetic blower lubricant, use turbine quality oils with rust and oxidation inhibitors, anti–foam additives and the viscosities listed in FIGURE 6, page 9.

Check the oil level at both ends of the blower daily. The oil change period is governed by operating conditions, such as load, temperature, dirt, humidity, fumes and the quality of the oil used. Under severe operating conditions the oil should be changed every 100 hours or more often. Under ideal operating conditions oil may be used up to 1000 hours. Use of AEON PD could extend the change interval up to 8000 hours based on a good oil analysis program. Good practice is to change the oil often enough that it appears clean and clear when drained from the sump. Oil sumps should be flushed with a clean solvent every fourth oil change. ALWAYS USE CLEAN CONTAINERS FOR OIL AND CLEANING SOLVENTS.

MAINTENANCE

AIR FILTERS AND FILTER–SILENCERS

⚠ WARNING

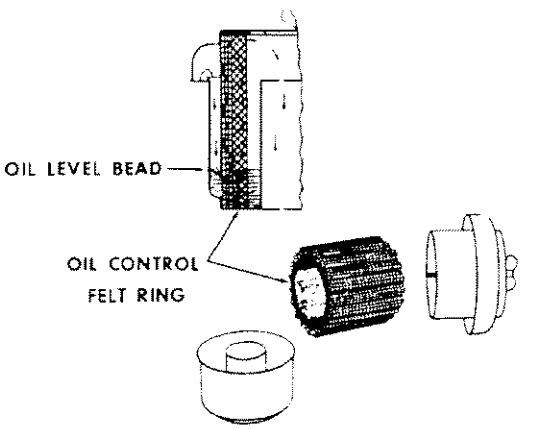
Servicing the air filters is one of the most important maintenance operations to be performed to insure long blower life.

Servicing frequency of filter elements is not time predictable. A differential pressure indicator, with a continuous gauge reading, should be installed across the inlet filter. It will tell how much of the service life of the filter element has been used. It will also eliminate both premature filter servicing and premature blower failure due to a plugged filter when the filter pressure drop is used to establish maintenance points.

In all cases refer to the filter manufacturer's service instructions. Due to the many types of filters, it is not practical to give specific instructions covering all models; however, the following paragraphs describe some of those most commonly used.

NOTICE

No matter what type of filter is used, always make sure all seats, gaskets, clamps and hose connections on the filter and inlet line are absolutely air tight. Each time the filter is serviced, inspect interior of the blower for dirt.



TEMPERATURE	OIL USED
–20° F. to 0° F	Mixture of 2/3 SAE 10W and 1/3 Diesel Fuel
0° F. to 30° F	SAE 10W
30° F. to 50° F	SAE 20
50° F. to 110° F	SAE 30
110° F. to 112° F	SAE 50

FIGURE 7 – OIL BATH FILTER

Oil Bath Filter (FIGURE 7) – The following instructions also apply when the filter is equipped with a silencing chamber:

1. Remove cover, screen and bowl from the base.
2. Wash the screen and bowl.
3. Fill the bowl to oil level bead with oil listed.
4. Place the end of the screen bonded with felt down into the oil. Upside–down installation will result in heavy oil carryover.
5. Replace the cover and tighten wing nut securely.
6. Make sure all connections to the air filter are tight.

Oil Wetted Filter–Silencer (FIGURE 8, page 11) – Cleaning of the filtering media is accomplished by thoroughly washing in a commercial solvent and blowing dry with air. Blow from inside to outside to dislodge dirt particles from the finer screen sections. After the media is cleaned, recharge by dipping in oil. The filter–silencer can be supplied with an all–weather hood. If an oil wetted filter without silencer is used, the service instructions on the previous page will also apply.

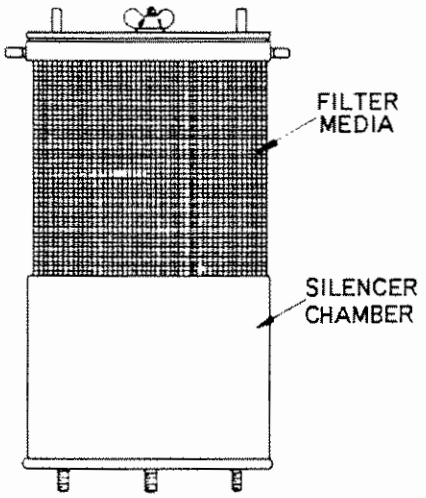


FIGURE 8 – OIL WETTED FILTER–SILENCER

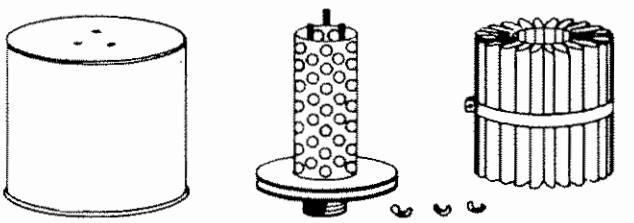


FIGURE 9 – DRY TYPE FILTER AND FILTER–SILENCER

Dry Type Filter and Filter–Silencer (FIGURE 9) – When the outside surface of the element appears to be evenly coated with dirt, it should be cleaned as follows:

1. Remove wing nuts and lift off the hood.
2. Loosen the outside retaining strap to remove the media.
3. Vibrate or blow off heavy dirt accumulation.
4. If required, wash the media in any carbon base commercial solvent and blow off the excess solvent.
5. Allow to dry and examine for damage or conditions requiring replacement.

Because the media in the dry type filter is of wool felt, it may become impregnated with oil or water, if present in any large degree. Corrosive gases may also attack the media. While such conditions are not common, they should be kept in mind.

DISCHARGE SILENCER – A drain may be provided in the silencer at the lowest point for draining condensate. Draining intervals will depend upon humidity conditions and must be established by the user.

ROTOR SHAFT SEALS – Rotors have a labyrinth type shaft air seal to minimize air leakage along the shaft from the compression chamber. More air will leak through the seals at the discharge end since they are under higher air pressure. Excessive air leakage indicates shaft seal failure.

The air seal consists of two parts, a hardened steel bearing spacer with grooves cut into the outside diameter, and a steel–backed babbitt ring (shaft seal) pressed into the bearing carrier. The grooved end of the spacer and the shaft seal bore have a close fit when cold. When the blower reaches operating temperature for the first time, the babbitt embeds slightly into the grooves, forming a close running fit to control air leakage along the shaft. No maintenance is required, except that bearing carrier removal usually will destroy the babbitt grooving and the shaft seal must be replaced. Shaft seals that have been in operation should not be reused as excessive leakage may result. The bearing spacer can be reused unless damaged. After installation of new seals, rotation of the blower may be tight for a few turns until bearing spacer grooves cut running ways into the babbitt. For seal replacement refer to Disassembly Section, page 23, and Assembly Section, page 27.

BEARING OIL SEALS – Oil leakage along each shaft from the oil sumps is prevented by a lip type seal pressed into the bearing carrier. Usual causes of seal failure are: high temperature, rough surface on bearing spacer, damage during installation, and improper seal used. The radius at the end of the bearing spacer and O.D. should be highly polished to prevent seal lip damage during installation. Use only seals shown in parts list as they have been selected for blower service.

PERIODIC INSPECTIONS – A well–organized maintenance program will provide for periodic inspection of the blower, drive and components. These inspections may prevent major repair and downtime.

1. Observe the blower for vibration, heating, noise, oil seal leaks and excessive shaft air leaks.

2. Check for proper operation of the filters, coupling, drive, power unit, relief and check valves, gauges and other controls.

3. Disconnect the drive and turn the blower by hand to check for drag, tight spots, bearing wear (radial and axial) and gear backlash. Rotation should be free with no indication of drag or metallic interference.

4. Inspect the interior through the inlet or discharge port for cleanliness, corrosion or parts contact.

⚠ WARNING

Rotating components will cause severe injury in case of personal contact. Keep hands away from the blower inlet and discharge ports.

5. Check tightness of all screws and bolts.

SOME COMMON CAUSES OF BLOWER FAILURE

1. Poor air filter maintenance or incorrect selection.
2. Inadequate lubrication (wrong, dirty or low oil).
3. Backflow of materials into the blower.
4. Discharge pressure or inlet vacuum above blower rating.
5. Blower speed below minimum rating.
6. Blower speed too low for discharge pressure or inlet vacuum.

BLOWER OVERHAUL – Refer to Disassembly Section, page 23, and Assembly Section, page 27.

REPAIR PARTS – When ordering parts, specify Blower Model, Size and Serial Number. All parts orders should be placed with MDC.

Reference numbers shown in the left hand column of the parts list are used to help locate the parts shown on the drawing and sectional view. DO NOT ORDER BY REFERENCE NUMBERS.

After locating the reference number, the part number may be found for your particular blower under the correct Model Number Column.

Specify exactly the number of parts required (see column "Qty. "). DO NOT ORDER BY SETS.

SECTION 4
OPERATION

Future operating problems can be avoided if proper precautions are observed when the equipment is first put into service.

Before starting under power, the blower should be turned over by hand to make certain there is no binding, or internal contact.

Each size blower has limits on pressure differential, running speed, and discharge temperature which must not be exceeded. These limits are shown in the following tabulation.

GENERAL – A new blower from the factory must be checked and serviced before operation. The blower must be lubricated and operated according to the following instructions. Blower failure can be caused by operation at above rated pressure or below rated minimum speed. Both cause excessive discharge temperature and seizure of rotating parts.

STARTING BLOWER – Start at reduced speed and no–load if possible. If speed is fixed, start without load by bleeding discharge to atmosphere. Starting should be smooth and free of vibrations. After initial no–load start, and operation is satisfactory, apply load gradually until maximum operating conditions are attained. BE SURE OPERATING CONDITIONS ARE WITHIN BLOWER RATINGS. Maintain a close check for severe vibrations, unusual noise, leaks and undue heating. The blower will gradually heat up due to compression, but after a reasonable length of time, temperature will stabilize. With very cold ambient conditions, warm up blower at no–load before going into full load service.

If the blower is used as part of a specific system, check the system's manual for any procedures that may be necessary when starting the blower.

PRESTART CHECK (For New or Overhauled Blower) – see "Blower Startup Checklist," page 17.

ROTATION – Facing the main rotor drive shaft, rotation is clockwise when the shaft extension is at discharge end, and counterclockwise when the shaft extension is at the inlet end. An arrow indicating rotation is attached to the blower end cover near the drive shaft.

DAILY CHECK

1. Air filter tight, clean and serviced.
2. Proper oil level in oil sumps.
3. Observe pressure.
4. Relief valve functions.
5. Blower turns freely.

⚠ WARNING

Operating beyond the specified operating limitations will result in damage to the unit.

TYPE OF SERVICE – The blower can be operated in either pressure or vacuum service.

Pressure – Never operate the blower above the maximum pressure shown in FIGURE 10. Excessive pressure may cause overheating and blower failure; it is therefore most important to have an accurate pressure gauge in the discharge line as close to the blower dis-

Models	Drive Shaft RPM	Discharge Pressure* Sea Level	Dry Vacuum* Inches Hg.	Wet Vacuum* Inches Hg.
11CDL23	2000	18 PSIG	16	24
11CDL27	2000	18 PSIG	16	24
11CDL31	2000	18 PSIG	16	24

* Pressures or vacuums are gauged at immediate blower discharge or inlet. For suggested maximum ratings at reduced speeds, see FIGURE 14, page 16.

FIGURE 10 – MAXIMUM RATING

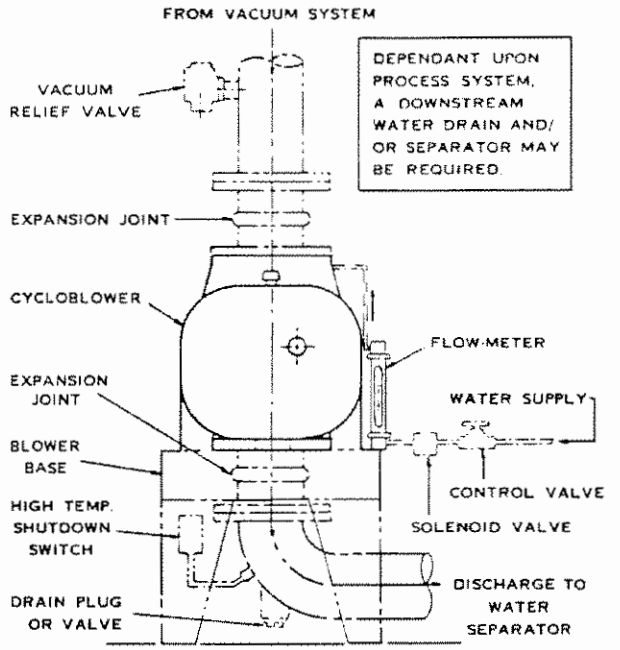


FIGURE 11 – INLET WATER INJECTION DIAGRAM

charge as possible. Reduced speeds have a direct bearing on allowable pressure (FIGURE 14, page 16). A bypass valve to bleed air from the discharge to atmosphere (FIGURE 2, page 3) may be used to control the pressure. NEVER reduce the blower speed to maintain a certain pressure before it is determined if the reduced speed is adequate for that pressure. An accurate pressure gauge must be maintained.

Vacuum – The blower may be operated either in dry vacuum or wet vacuum service. Do not operate the blower above the maximum vacuums shown in FIGURE 10, page 13, or below the minimum speeds shown in FIGURE 14, page 16. All vacuum ratings are based on standard atmospheric discharge. An accurate vacuum gauge and vacuum relief valve must be used as close to the blower inlet as possible.

Wet vacuum service employs a suitable liquid, normally water, injected into the system near the blower inlet to control temperature rise and increase the degree of vacuum developed. The liquid used MUST BE clean and free of foreign matter, chemical contaminants and hardness, which may cause corrosion, deposits, or damage in the rotor chamber. See FIGURE 11, for typical installation.

If the injection water supply is allowed to run after blower shutdown, both the blower and adjacent discharge piping may fill with water and present a serious overload problem at the next attempted start. To prevent this, it is strongly recommended that an electric solenoid valve (normally open) be installed at the lowest point in the discharge elbow and/or connecting piping. The valve will open on blower shutdown and drain any water which might accumulate in the discharge piping. It is also recommended that a time delay be used between injection water shutoff and blower/motor shutdown to allow the interior of the blower to dry out prior to shutdown. Up to five minutes time delay may be required for larger blowers running under no load.

On wet vacuum service, temperature control and a minimum amount of rotor sealing is obtained with small quantities (1 gallon per minute) of injected liquid. Best performance is attained by using the larger amounts of liquid shown in FIGURE 12.

Liquid Rate (GPM) – For Optimum Performance	11CDL23	11CDL27	11CDL31
	4	4	4

FIGURE 12 – LIQUID RATE

In applications where liquid carry–over from the upstream system may exceed these quantities, even for momentary periods, separation prior to blower inlet must be employed to reduce water flow to this figure or less.

Where inlet injection of water is used, it may be introduced in any convenient manner. No particular water pressure is required, only that sufficient to deliver the water to the injection point. A reliable metering device, such as a rotameter, to indicate water injection rate is supplied.

Since water injection is used primarily for discharge temperature reduction and control, overheating will occur with water shutoff or supply failure. Provisions against inadvertent water shutoff should be incorporated in every water–injected blower system.

A high discharge temperature safety shutdown switch should be used to protect the blower.

Individual system requirements will determine whether downstream (discharge side) separation of injection water may be required. Combination discharge silencers and separators are available.

See Engineering Data Sheet 37–1–432, for complete wet vacuum details.

ALTITUDE – Maximum allowable discharge pressure and/or inlet vacuum will be decreased with operation at altitudes. See FIGURE 13, page 15.

SPEED – Refer to FIGURE 10, page 13, for maximum and FIGURE 14, page 16 for minimum speeds. Never

operate the blower below the minimum or above the maximum speed shown. There is a definite relationship between blower speed, discharge pressure and/or inlet vacuum, and the resulting discharge air temperature. Reduced speed at high pressure or vacuum can cause excessive heating which may result in rapid blower failure. For engine–driven units provide an accurate speed indicator.

Altitude (Feet above Sea Level)	Maximum Discharge Pressure*	Maximum Inlet Vacuum*
1000	17.0 PSIG	15.5 Inches Hg.
2000	16.5 PSIG	15.0 Inches Hg.
3000	16.0 PSIG	14.5 Inches Hg.
4000	15.5 PSIG	14.0 Inches Hg.
5000	15.0 PSIG	13.5 Inches Hg.

* Gauge readings are taken as close as possible to blower openings. Above 5000 feet, consult the nearest Gardner Denver Office.

FIGURE 13 – ALTITUDE – PRESSURE/VACUUM

Examples of minimum allowable speed at given pressures or vacuums are listed in FIGURE 14, page 16; as speed is reduced, pressure or vacuum must also be reduced.

EXAMPLE: Using a 11CDL27 blower, operating against 18 PSIG, minimum allowable speed is 900 RPM.

NOTICE

Blower speed, line losses, elevation, and increased inlet temperatures will affect the maximum operating limitations.

OPERATING TEMPERATURE – Blower air discharge temperature will increase with higher operating pressures or vacuums. Maximum allowable discharge temperature is 355° F.

If the discharge temperature continues to exceed 355° F., stop the blower at once and correct the trouble.

⚠ WARNING

Do not continue to run a blower that is overheating. Check the blower for damage before restarting.

Lubricating oil temperature will increase with increasing discharge air temperature. Oil temperature in the discharge end sump will exceed that in the inlet end sump. Oil sump temperatures at the discharge end in the 200–250° F. range are not uncommon.

STOPPING BLOWER – Where possible, reduce the system pressure to zero gauge before stopping the blower. To prevent backflow of foreign material into the blower on shutdown, provide a check valve in the discharge line.

On engine–driven units, idle the engine for a few minutes prior to shutdown.

EMERGENCIES – In event of system failures, shut down the blower immediately. Inspect the blower for foreign material backflow. If materials are found inside the blower housing, a thorough cleaning is necessary before restarting.

⚠ WARNING

Do not operate a blower which is noisy, vibrating, or heating excessively.

Models	Minimum Speed (RPM) – Dry Pressure		
	Up To 12 PSIG	15 PSIG	18 PSIG
11CDL23	800	800	800
11CDL27	800	800	900
11CDL31	800	800	800

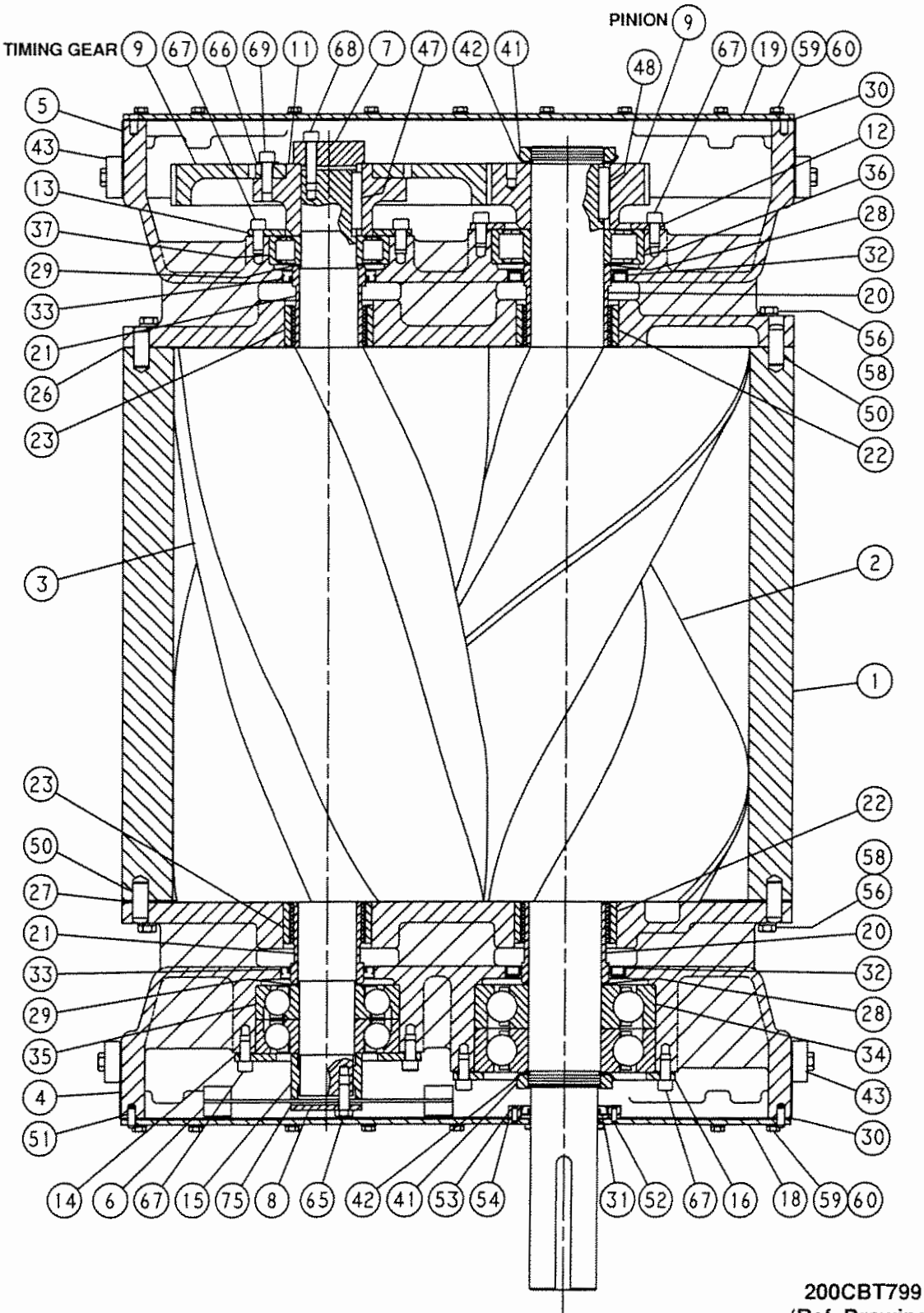
Models	Minimum Speed (RPM)		
	Dry Vacuum	Wet Vacuum	
	Up To 16" Hg.	Up To 22" Hg.	24" Hg.
11CDL23	800	800	800
11CDL27	800	800	800
11CDL31	800	800	800

FIGURE 14 – MINIMUM SPEED, MAXIMUM PRESSURE OR VACUUM

BLOWER STARTUP CHECKLIST

This startup procedure should be followed during the initial installation and after any shutdown periods or after the blower has been worked on or moved to a new location. It is suggested that the steps be followed in sequence and checked off (✓) in the boxes provided.

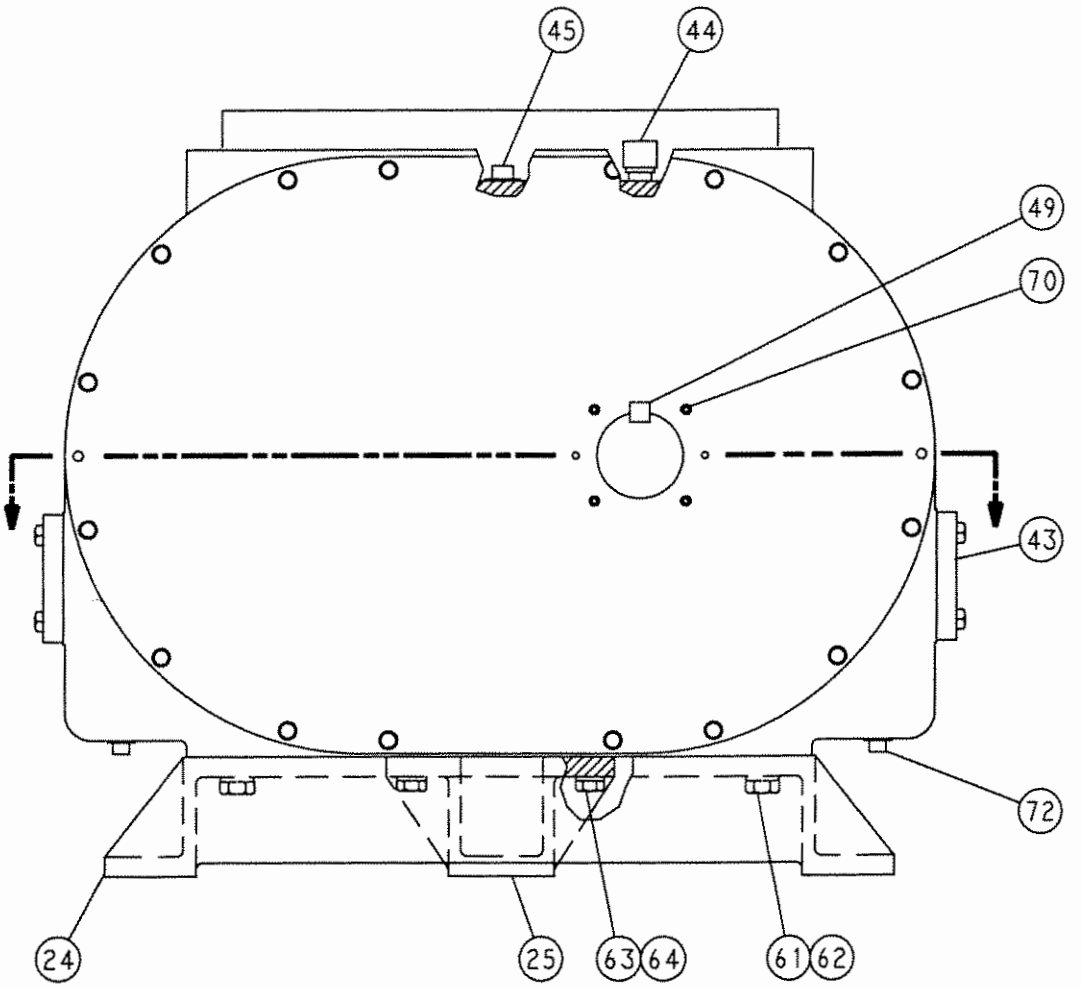
- ☐ 1. Check the unit and all piping for foreign material and clean if required.
- ☐ 2. Check the flatness of the feet and the alignment of the drive. Feet that are bolted down in a bind can cause housing distortion and internal rubbing. Misaligned V–drives can cause the rotors to rub against the headplates and cause a reduction in the volumetric efficiency of the unit. Misaligned couplings can ruin bearings.
- ☐ 3. If the blower is V–belt driven, check the belt tension and alignment. Over–tensioned belts create heavy bearing/shaft loads which lead to premature failure.
- ☐ 4. Be sure adequate drive guards are in place to protect the operator from severe personal injury from incidental contact.
- ☐ 5. Check the unit for proper lubrication. Proper oil level cannot be over–emphasized. Too little oil will ruin bearings and gears. Too much oil will cause overheating and can ruin gears and cause other damage. Insure that grease lubricated bearings are properly lubricated.
- ☐ 6. Turn the driveshaft by hand to be certain the rotors do not bind.
- ☐ 7. "Jog" the unit with the motor a few times to check that rotation is in the proper direction, and to be certain it turns freely and smoothly.
- ☐ 8. Start the unit and operate 15 minutes at no load. During this time, check for hot spots and other indications of interference.
- ☐ 9. Apply the load and observe the operation of the unit for one hour. Check frequently during the first day of operation.
- ☐ 10. If malfunctions occur, do not continue to operate. Problems such as knocking rotors can cause serious damage if the unit is operated without correction.



200CBT799
(Ref. Drawing)

SECTIONAL VIEW

11CDL_ _L – TOP INLET



200CBT799
(Ref. Drawing)

Order by Part Number and Description. Reference Numbers for your convenience only. *

Ref. No	Name of Part	Qty.	Model 11CDL23L Part No.	Model 11CDL27L Part No.	Model 11CDL31L Part No.
1	HOUSING	1	8500850	8500851	8500735
	GROUP–ROTOR (Includes Ref. Nos. 2 & 3)	1	200CBT010A	203CBT010C	205CBT010A
2 **	ROTOR	1			
3	ROTOR–GATE ASM	1			
4	CARRIER–BEARING	1	211CBT006	213CBT006	215CBT006
5	CARRIER–BEARING	1	210CBT006	212CBT006	214CBT006
6	SLINGER–OIL	1	8508482	8508482	8508482
7	PLATE–SHAFT CLAMP	1	8500739	8500739	8500739
8	PLATE–SHAFT CLAMP	1	8508476	8508476	8508476
9	GEAR KIT	1	300CBT6008	300CBT6008	300CBT6008
	GEAR–TIMING				
	GEAR–PINION				
11	HUB–GEAR	1	8500742	8500742	8500742
12	PLATE–BEARING CLAMP	1	8508479	8508479	8508479
13	PLATE–BEARING CLAMP	1	8508478	8508478	8508478
14	PLATE–BEARING CLAMP	1	8508477	8508477	8508477
15	SPACER	1	8508480	8508480	8508480
16	RETAINER	1	200CBT205	200CBT205	200CBT205
18	COVER–END	1	8500746	8500746	8500746
19	COVER–END	1	8500747	8500747	8500747
20	SPACER–BEARING	2	8500749	8500749	8500749
21	SPACER–BEARING	2	8504514	8504514	8504514
22	SEAL–ROTOR SHAFT	2	8500750	8500750	8500750
23	SEAL–ROTOR–SHAFT	2	8500390	8500390	8500390
24	FOOT–SUPPORT	1	8500752	8500752	8500752
25	FOOT–SUPPORT	1	8500751	8500751	8500751
26	SHIM–HOUSING	1	8500753	8500753	8500753
27	SHIM–HOUSING SET	1	8500760	8500760	8500760
28	SHIM–SHAFT SET	2	8500269	8500269	8500269
29	SHIM–SHAFT SET	2	8501514	8501514	8501514
30	GASKET	2	8500761	8500761	8500761
31	SEAL–OIL	1	8500068	8500068	8500068
32	SEAL–OIL	2	60DD708	60DD708	60DD708
33	SEAL–OIL	2	8500065	8500065	8500065
34	BEARING–ANGULAR CONTACT	2	8500411	8500411	8500411
35	BEARING–BALL	2	8508458	8508458	8508458
36	BEARING–ROLLER	1	8500045	8500045	8500045
37	BEARING–ROLLER	1	8500044	8500044	8500044
41	LOCKNUT–BEARING	2	50Z18	50Z18	50Z18
42	WASHER	2	95N18	95N18	95N18
43	SIGHT GLASS OIL LEVEL	4	918811100101	918811100101	918811100101
44	BREATHER–CRANKCASE	2	5L223	5L223	5L223

Order by Part Number and Description. Reference Numbers for your convenience only. *

Ref. No	Name of Part	Qty.	Model 11CDL23L Part No.	Model 11CDL27L Part No.	Model 11CDL31L Part No.
45	PLUG–SQHD PIPE	2	64AA1	64AA1	64AA1
47	KEY–SQUARE	1	8500117	8500117	8500117
48	KEY–SQUARE	1	8500082	8500082	8500082
49	KEY–SQUARE	1	8508545	8508545	8508545
50	PIN–DOWEL	4	62M112	62M112	62M112
51	PIN–DOWEL	2	62M50	62M50	62M50
52	PIN–DOWEL	2	62M22	62M22	62M22
53	ADAPTOR–SEAL	1	8500762	8500762	8500762
54	GASKET–SEAL ADAPTOR	1	8500763	8500763	8500763
56	SCREW–HEX HD	36	655EE090	655EE090	655EE090
58	WASHER–LOCK	36	95B5	95B5	95B5
59	SCREW–HEX HD	36	655ED04N	655ED04N	655ED04N
60	LOCKWASHER	36	95B3	95B3	95B3
61	SCREW–HEX HD	4	655EF070	655EF070	655EF070
62	WASHER–LOCK	4	95B8	95B8	95B8
63	SCREW–HEX HD	2	655EF070	655EF070	655EF070
64	WASHER–LOCK	2	95B7	95B7	95B7
65	SCREW–HEX HD	3	655EE05N	655EE05N	655EE05N
66	WASHER–PLAIN	5	95W49	95W49	95W49
67	SCREW SOHD CAP	16	75P75N	75P75N	75P75N
68	SCREW	3	75P77N	75P77N	75P77N
69	SCREW SOHD CAP	5	75P2N	75P2N	75P2N
70	SCREW SOHD CAP	4	75P4N	75P4N	75P4N
72	PLUG–MAGNETIC	4	64BJ4	64BJ4	64BJ4
75	SHIM	1	77H68	77H68	77H68

* Refer to Drawings on pages 18 and 19.

** Rotors must be ordered and used in matched pairs.

OVERHAUL KIT – 203CBT6010

Description	Qty.	Part Number
SPACER–BEARING	2	8500749
SPACER–BEARING	2	8504514
SEAL–ROTOR SHAFT	2	8500750
SEAL–ROTOR–SHAFT	2	8500390
SHIM–HOUSING	1	8500753
SHIM–HOUSING SET	1	8500760
SHIM–SHAFT SET	2	8500269
SHIM	2	8501514
GASKET–COVER	2	8500761
GASKET–SEAL ADAPTOR	1	8500763
SEAL–OIL	1	8500068
SEAL–OIL	2	60DD708
SEAL–OIL	2	8500065
BEARING–ANGULAR CONTACT	2	8500411
BEARING–BALL	2	8508458
BEARING–ROLLER	1	8500045
BEARING–ROLLER	1	8500044
LOCKNUT–BEARING	2	50Z18
LOCKNUT–BEARING	1	8508483
LOCKNUT–BEARING	1	95N18
LOCKWASHER–BEARING	2	95N18
SCREW SOHD CAP	16	75P75N
SCREW	3	75P77N
SCREW SOHD CAP	5	75P2N
SCREW SOHD CAP	4	75P4N
SCREW–HEX HD	3	655EE05N
WASHER–PLAIN	5	95W49

IMPORTANT: For spare parts requirement in remote areas, export or where more than one unit is operating, a spare gear set is recommended.

For 11CDL Series, order Gear Kit part number 300CBT6008.

NOTE: Overhaul kit is recommended for spare parts and/or scheduled maintenance or overhaul requirements.

SECTION 6
DISASSEMBLY INSTRUCTIONS

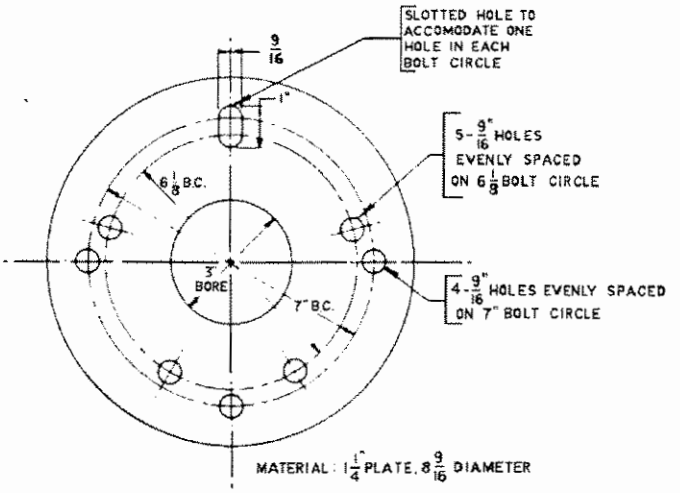


FIGURE 1 – ADAPTOR PLATE

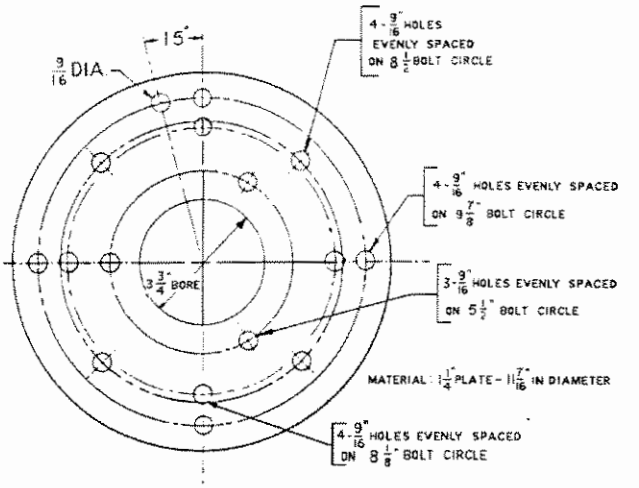


FIGURE 2 – ADAPTOR PLATE

NOTICE

Numbers in parentheses ( ) refer to key numbers in assembly drawings on pages 18, 19, 20 and 21.

⚠ WARNING

Pulling directly on the gear hub flange will distort the flange causing gear run–out.

1. Provide adaptor plate, FIGURE 1, for pulling the gear hub (11) and for installation of the inlet end gate rotor bearings (37) on the shaft.

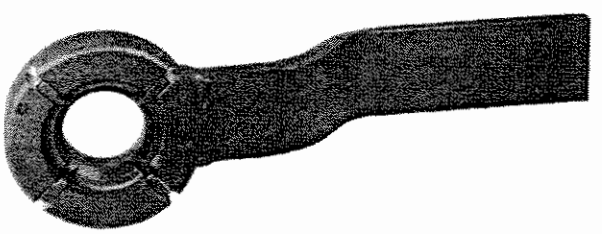


FIGURE 3

2. Provide adaptor plate, FIGURE 2, for pulling the pinion (9) and for installation of the bearings at the other three positions.

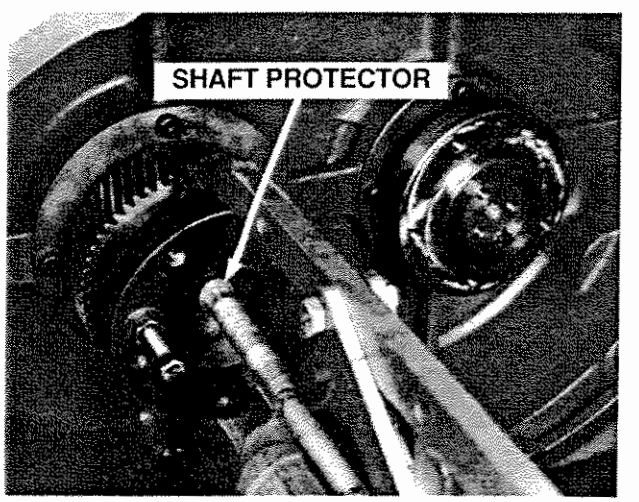


FIGURE 4

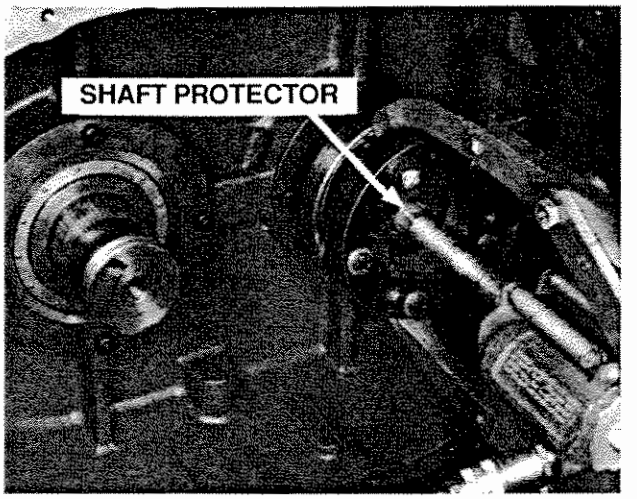


FIGURE 5

⚠ WARNING

Pulling directly on pinion teeth will damage teeth making timing difficult and will cause gear wear and failure.

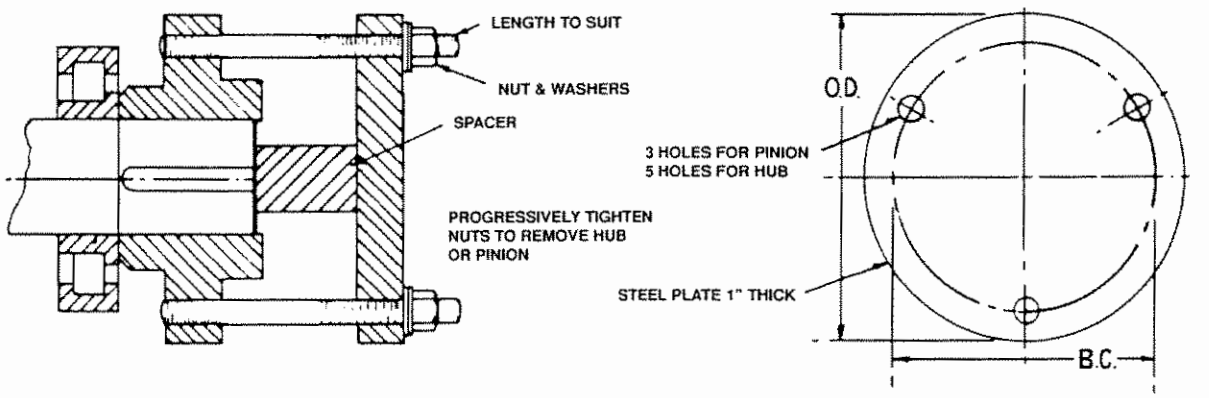
The adaptor plates shown are designed for a jaw type hydraulic puller, FIGURE 4, page 23, and FIGURE 5. Other type pullers are available, and if used, suitable adaptor plates should be provided. This method is highly recommended as it saves assembly time and eliminates chances for bearing damage. The plates are also used in Step 5 at disassembly removing the rotors from the discharge end bearings.

3. Place the unit in a horizontal position on a solid blocking so the gear end bearing carrier (5) hangs free. Remove the breathers (44) and drain oil from both carriers. At the gear end, remove the cover (19), hub retainer plate (7), gear (10) (slip fit on the hub) and pinion lock nut (41). It is suggested that a spanner wrench similar to that shown in FIGURE 3, page 23 be made to prevent damage to the lock nut. The wrench is especially useful at assembly in saving time and, more important, assures proper tightening of the nuts.

4. Mount the adaptor plate and puller (FIGURE 4, page 23), and pull the pinion. Be sure to use a shaft protector to prevent damage to the end of the shaft. Remove the key from the shaft.

5. Mount the adaptor plate and puller (FIGURE 5), and pull the gear hub. Use a shaft protector. Remove the key from the shaft.

6. If a hydraulic puller is not available, the hub and pinion may be pulled as shown in FIGURE 6.



PINION				GEAR HUB			
O.D.	B.C.	Holes	Stud	O.D.	B.C.	Holes	Stud
7–3/4"	6–1/8"	3–9/16"	1/2" – 13 UNC	7–1/4"	5–1/2"	5–9/16"	1/2" – 13 UNC

FIGURE 6 – ALTERNATE ADAPTOR PLATES

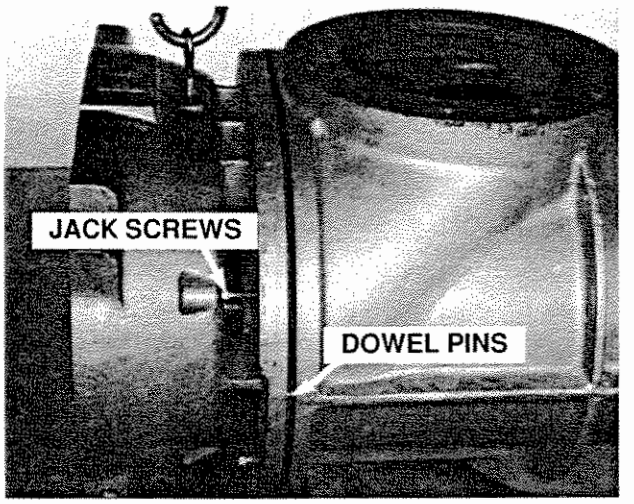


FIGURE 7

7. Support the bearing carrier (5) with a hoist in the eye bolt (FIGURE 7). The tapped opening in the carrier is 1" P.T. An alternate method is to use a nut and washer on the end of the eye bolt with the long shank extended through the oil fill opening. Remove all carrier to housing screws. With four jack screws in the tapped holes in the carrier flange, FIGURE 7, pull the carrier. This also pulls the bearings from the rotor shaft. Tighten the jack screws evenly to prevent binding the carrier on the dowel pins and bearings. When the carrier is free, remove the bearing retainers (12, 13), bearings (36, 37), lip oil seal (32, 33) and shaft seals (22, 23). If the bearings are to be reused, handle with care.

NOTICE

Never reuse shaft seals that have been in operation. Refer to "Rotor Shaft Seal," page 11.

After the carrier is removed, place .018" shim stock or sheet metal under the rotors in the machined area of the housing (1) to **support rotors level in the housing**. THIS IS IMPORTANT to prevent binding of the rotor shaft in the discharge end bearings when performing Step 9. Without shim stock under the rotors, damage to the discharge end bearings will result at Step 9.

8. Remove the discharge end carrier cover (19), shaft clamp plate (8), oil slinger (6), bearing lock-

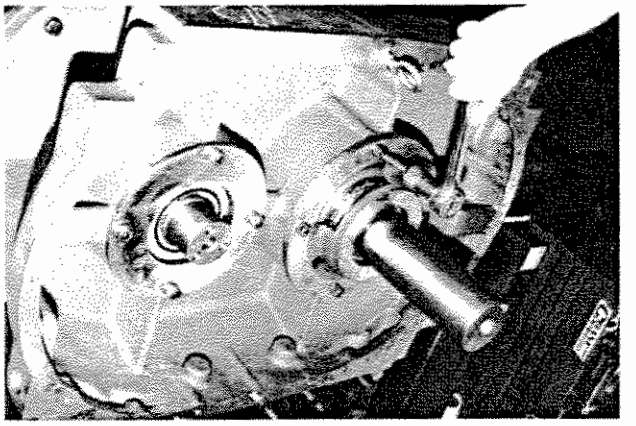


FIGURE 8

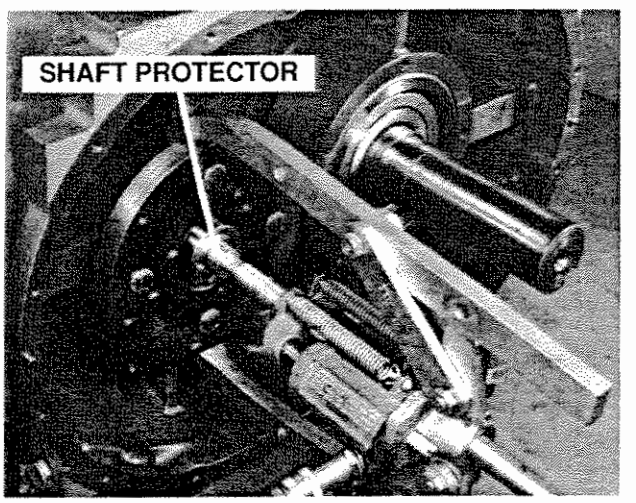


FIGURE 9

nut (41), lockwasher (42), spacer (15) and bearing retainer plates (14, 16). See FIGURE 8.

9. Rig the plates (shown in FIGURE 1 and FIGURE 2, page 23) and the puller as shown in FIGURE 9 and press the rotor shaft through the bearings. Use a shaft protector. Be sure the bolts holding the plate are threaded into the tapped holes of the bearing housing far enough to prevent stripping of the threads, and evenly adjusted so the plate is square with the shaft. Press one rotor through the bearing at a time, then proceed to Step 10. Repeat Step 9 and 10 on the second rotor.

   As the rotor moves through the housing, be sure it does not slide off the supporting shim stock placed under rotors in Step 7.

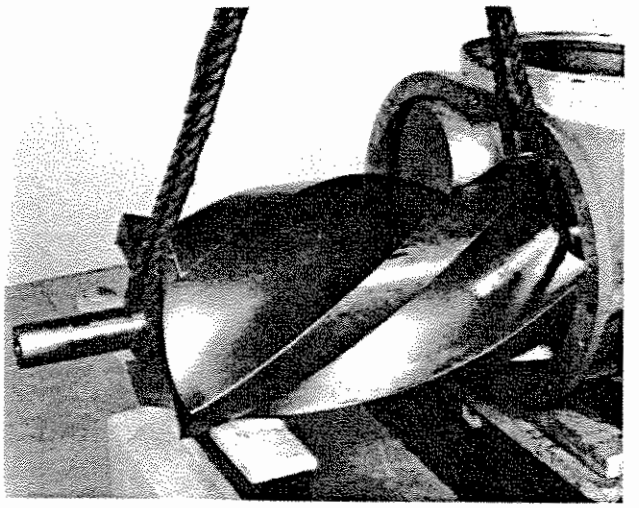


FIGURE 10

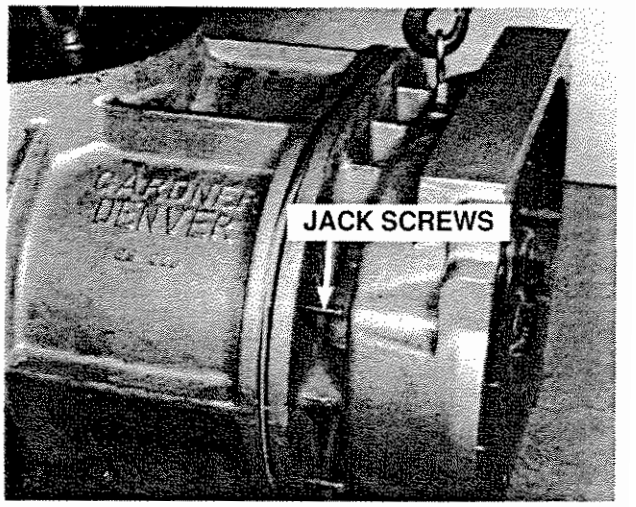


FIGURE 11

10. When the rotor shaft is free of bearings, work the rotor through the housing with the aid of a hoist until extended as shown in FIGURE 10. Block the rotor end as shown and rig a sling to complete removal of the rotor from the housing. Due to the weight of the rotors, handle with care to prevent burrs on rotors and housing.

11. After removal of the rotors, rearrange blocking so the carrier hangs free. Support the carrier with a hoist, remove all screws, and jack the carrier evenly from the dowel pins. See FIGURE 11.

    Remove the parts from the carrier as described in Step 7, page 25.

SECTION 7
ASSEMBLY INSTRUCTIONS

NOTICE

Numbers in parentheses ( ) refer to key numbers in assembly drawings on pages 18, 19, 20 and 21.

The CycloBlower® is manufactured with close tolerances for efficient operation. All parts must be handled carefully to prevent burrs which will give false clearance readings and/or cause rapid wear. All parts and oil passages must be thoroughly cleaned of dirt which will cause galling of close running parts. Clean work area, washing tank, tools, and wiping rags must be provided. Refer to Parts List, Section 5, pages 18, 19, 20 and 21, for sectional views showing complete assembly of parts.

NOTICE

The following illustrations are of a standard blower with top suction bottom discharge, main rotor discharge end drive. Some variations will be noticed in the following illustrations for blowers of other arrangements.

There may be cases where foreign materials have entered the blower, or other causes have resulted in galling of the rotor ends, carrier faces, rotor lobes, or housing walls. Since the blower is designed with no contact of parts within the rotor chambers, these parts may be cleaned and polished for reuse unless galling is severe. Reuse of parts severely galled may result in loss of blower efficiency. All damaged parts which have been reworked should be checked for run–out or warpage before reuse.

1. Place the gear end bearing carrier (5) on blocking, to protect the machined surface, with the open end up (FIGURE 1). Coat the O.D. of the bearing oil seal and I.D. of the seal bore with a sealing compound. With suitable plate, drive the seals (32, 33) in the bore with the lip of the seal up (toward the bearing bore). Make sure the driving plate rests on the outer diameter of the seal, otherwise damage to the seal case and lip will result. Drive the seal flush with the bottom of the bearing housing.

   NOTE: The gear end bearing carrier has the shallow bearing bore – the discharge end bearing carrier has the deepest bearing bore.

2. Turn the bearing carrier over on the blocking. Oil the O.D. of the rotor shaft seals (22, 23) to prevent seizure and press into each bore of the carrier (FIGURE 2). NEVER REUSE SHAFT SEALS. Refer to "Maintenance," page 10, for an explanation. A simple press utilizing a bolt and two bars,

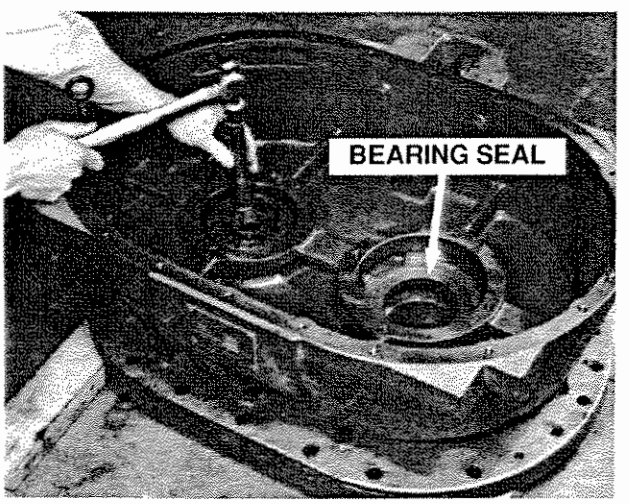


FIGURE 1

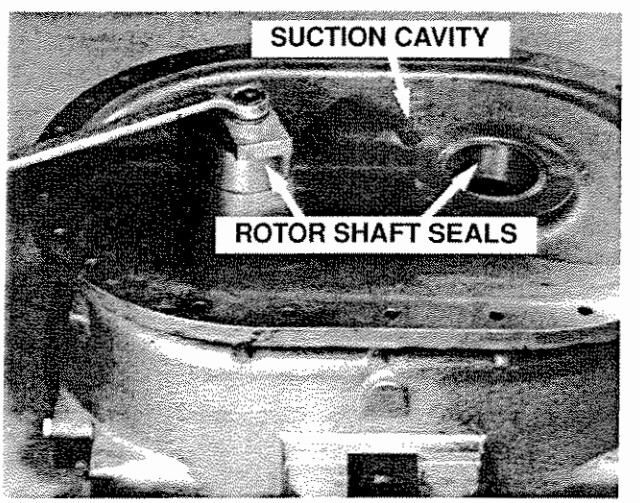


FIGURE 2

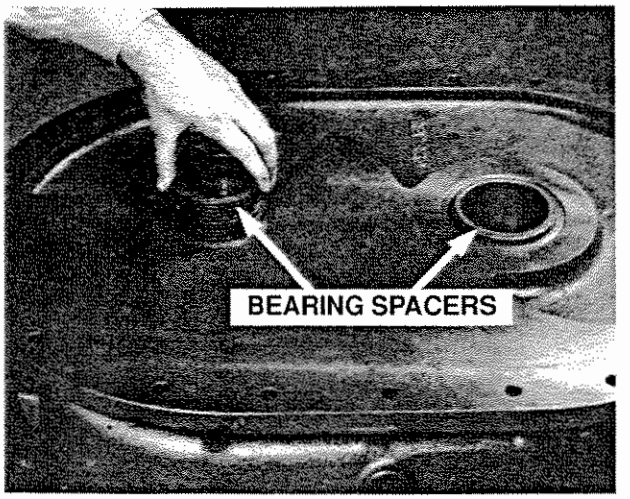


FIGURE 3

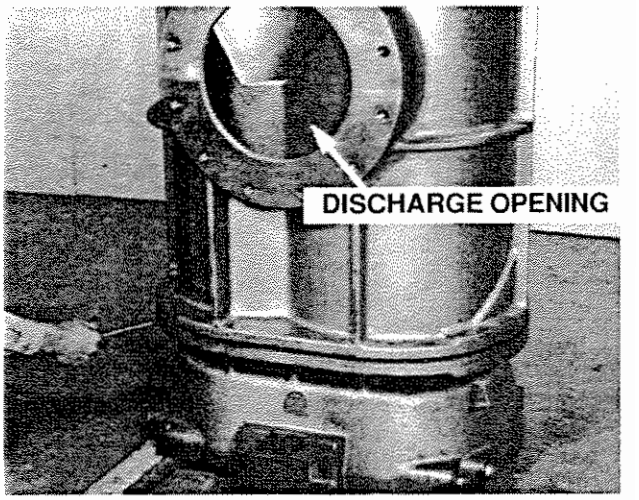


FIGURE 4

one across the seal and one underneath across the bearing bore, is an effective method for installing the seal. Tightening the nut on the bolt presses the seal into place. Press the seal .010 to .015 below the face of the carrier to prevent the end of the rotor from rubbing the end of the seal. A simple method is to place a .010 to .015 shim on the end of the seal under the press bar which will allow the seal to be pressed the correct distance below the face of the carrier. Handle the seal with care to prevent damage to the babbitt lining.

3. To ease assembly in later steps, fit the bearing spacers (20, 21) to the seals (22, 23) (FIGURE 3). Be sure there are no burrs on the spacer O.D. and seal I.D. Spacer should be SLIP FIT in the seal. A sloppy fit will cause excess air leakage and lower blower efficiency. Do not drive the space through the seal as damage to the babbitt will result. It may be necessary to polish high spots from seal I.D. to allow slip fit of spacer. USE CROCUS CLOTH, not emery cloth.

   Never push the grooved end of the spacer through the bearing oil seal as the lip of the seal may be damaged. Inspect polished area of the spacer. Any imperfections may result in oil seal leakage. When the spacers are fitted, apply Loctite to the gear end shaft extension of the rotor in the area where the spacer will be located. Slide the spacer on the shaft extension with grooved end toward the rotor.

   With the spacer seated against the face of the rotor, spin spacer on shaft several times to evenly spread the Loctite. Make sure there are no burrs on either end of the spacer or end of the rotor. Place tape around the shaft to prevent the spacer from sliding off as shown in Figure 5, page 23.

4. Place .030 thick aluminum shim (26) on the bearing carrier (5). The pointed section of the gasket is positioned on the machined surface of the carrier to match the figuration of the housing. Lower the housing, as level as possible, onto the carrier with the discharge opening up (FIGURE 4), and the suction opening matching the cavity side (FIGURE 2, page 27), of the carrier. Engage the dowel pins (50) with matching holes in the carrier with care. Tighten the carrier to housing screws (56) evenly so the dowel pins will not be damaged.

5. Coat the inside of both shaft seals and the grooved end of the bearing spacer with "Moly" type grease for seal break–in purposes. Be sure the ends of the rotors and machined face of the carrier are free of burrs and dirt. The easiest method of assembly is to lower the gate rotor into the housing first (FIGURE 5, page 29). The gear end shaft extension of the rotors, with the bearing spacer installed in Step 3, go down. Rotors must be suspended plumb when lowering so the shaft extension and bearing spacer can be carefully guided through the close fit of the shaft seal and bearing oil seal without damage to the babbitt lining and lip of the seal.

   NOTE: The CycloBlower® is designed for no metal–to–metal contact of parts within the housing. To achieve this, some preliminary measurements are necessary before completing the assembly. The first set of measurements are used to determine the shaft shim set (28, 29) thickness necessary for positioning the rotors in the housing to give the required clearance between the end of

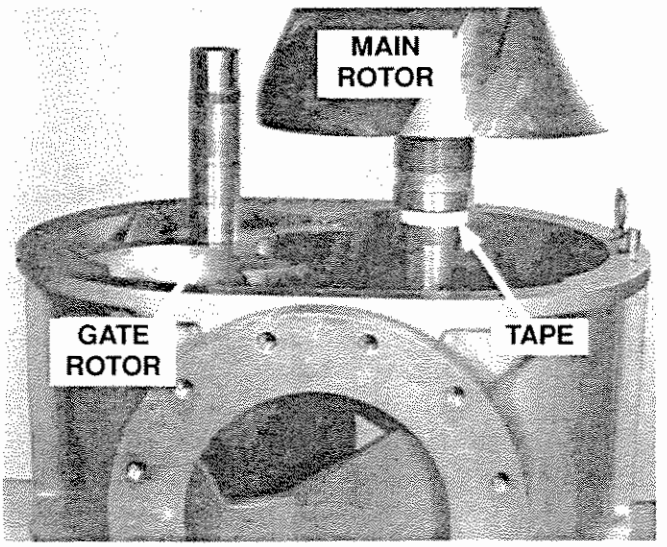
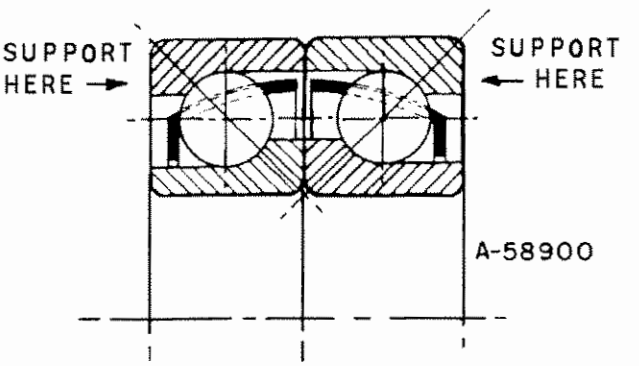


FIGURE 5



MAIN AND GATE ROTOR

FIGURE 6

the rotors and the carrier face at the discharge end. End clearance is maintained at the discharge end by two angular contact bearings (34, 35), bearing spacer (20, 21) and shim set. The shaft shim set is determined as outlined in Steps 14, 15 and 16, page 31.

6. The angular contact bearings must be assembled as shown in FIGURE 6. Assemble the angular contact bearings face to face as shown in FIGURE 6 to assure a fixed bearing. Marked face of inner bearing is placed down in the bearing bore; the marked face of the outer bearing is placed up.

7. Install the bearing oil seal (32, 33), shaft seal (22, 23), and fit the bearing spacers (20, 21) in the discharge end bearing carrier (4) using the same method as outlined in Steps 1, 2 and 3, page 27.

   The set of measurements listed in FIGURE 7, below, is used to determine total end clearance. To give proper rotor end clearance at both suction and discharge ends (referred to as total end clearance) the distance between the face of the bearing carriers must be equal to the rotor length plus both end clearances. Total end clearance is obtained by adding shims (27) as required between the flange of the housing (1) and the discharge end bearing carrier (4). The thickness of the shim set is determined as outlined in Steps 8 and 9.

8. With a depth micrometer (FIGURE 8, page 30), measure the distance from the end of the rotor lobes to the end of the housing. Rotate rotors to check each lobe and record the largest micrometer reading. If the measurement varies more than .005, remove the rotors and check for burrs on the gear end carrier face and the end of the rotors. To the largest micrometer reading add the total end clearance shown in the clearance chart, FIGURE 7, plus .002 for crush fit, to determine the thickness of the shim set.

   EXAMPLE – FOR 11CDL31 BLOWER: Micrometer reading of .090 plus .051 total end clearance

Models	Total End Clearance (Suction & Discharge)	Suction End	Discharge End
11CDL23	.041	.029	.012
11CDL27	.046	.034	.012
11CDL31	.051	.039	.012

Dimensions are for Ideal Clearances. Allow +/– .001 for Tolerance

FIGURE 7 – ROTOR END CLEARANCE CHART (UNIT COLD)

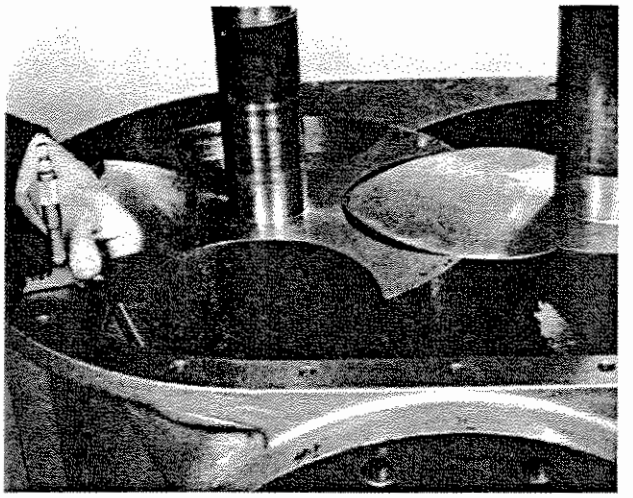


FIGURE 8

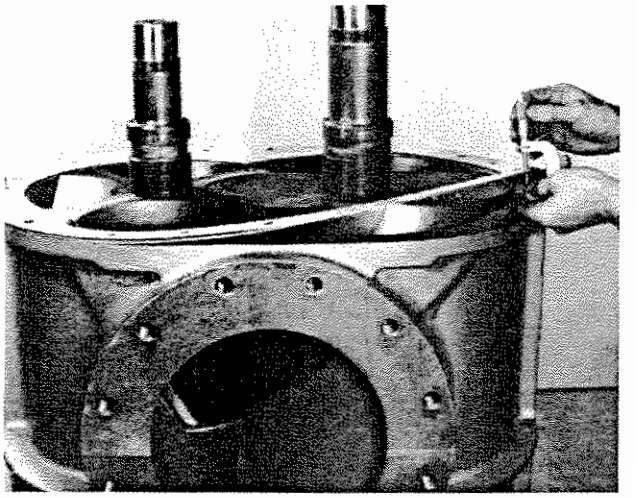


FIGURE 9

plus .002 for crush gives a shim set thickness of .143.

9. Select the correct thickness of aluminum shims (27) to give the shim set established in Step 8. Check the thickness of the shims with an outside micrometer (FIGURE 9). Place the shims on the end of the housing, matching the pointed section of the shims with the contour of the housing. Apply Loctite to the shaft extension of the rotor in the area where the spacer will be located; slide the spacer on the shaft extension with the grooved end toward the rotor, with the spacer seated against the face of the rotor. Spin the spacer several times to evenly spread the Loctite. Coat the grooved end of the spacer with "Moly" type grease for seal break–in purposes.

10. Coat the I.D. of the shaft seals (22, 23) in the discharge end bearing carrier (4) with "Moly" type grease. Match the cavity of the carrier (FIGURE 10), with the discharge opening of the housing (FIGURE 11), and lower the carrier, suspended plumb, in place on the housing.

11. Take care that the babbitt lining of the shaft seal and the lip of the oil seal are not damaged by the shaft extension. Be sure there are no shaft shims in place during this operation as sharp edges of shims will damage the seals. Tighten the carrier to the housing screws evenly to prevent damage to the dowel pins.

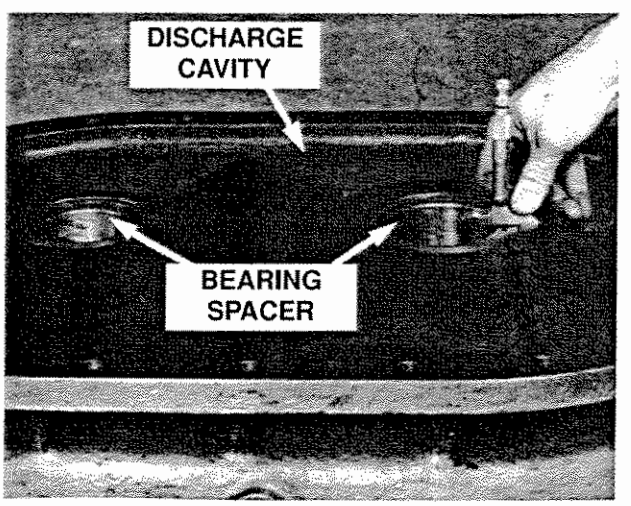


FIGURE 10

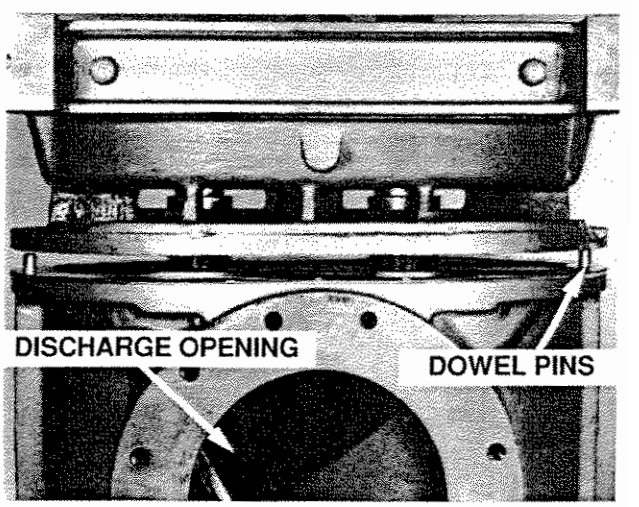


FIGURE 11

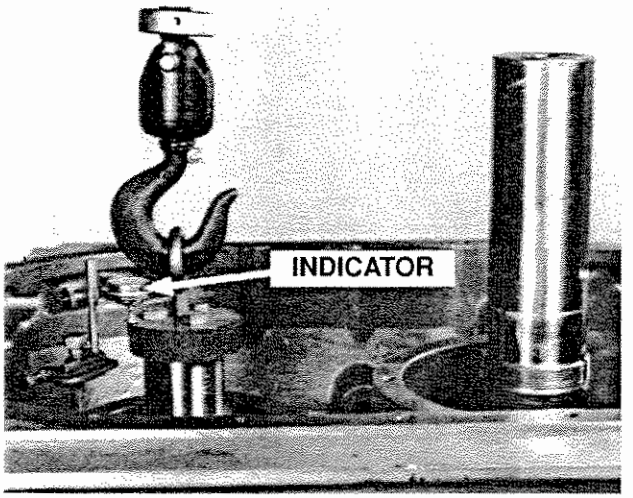


FIGURE 12

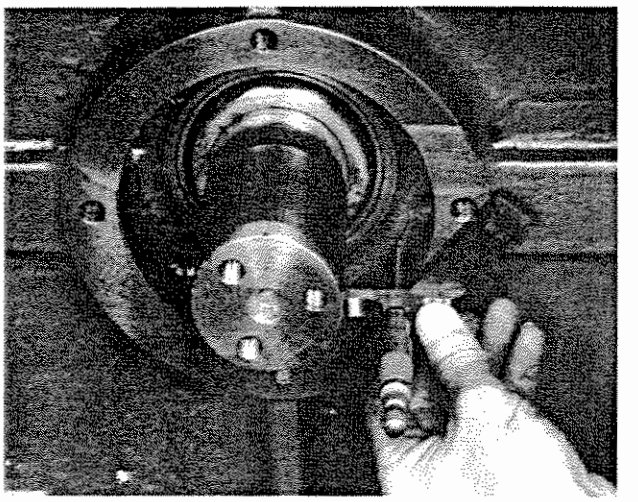


FIGURE 13

12. With the dial indicator attached as shown in FIGURE 12, check the total end clearance. Set the indicator on zero and lift the rotor with a hoist until the end of the rotor strikes the face of the discharge end bearing carrier. The reading of the indicator will be the total end clearance and should match dimensions listed in the clearance chart, FIGURE 7, page 29. If the indicator reading differs from the chart and allowable tolerance, repeat Steps 8 and 9 as well as check for burrs giving false readings.

NOTICE

Due to allowable machining tolerance of the rotor lengths, there may be cases where one rotor will be within limits and the other slightly over or under.

13. With a depth micrometer on a perfectly flat parallel bar across the bearing bore, measure the distance to the shoulder in the bearing bore, FIGURE 13.

14. Tap the spacer to be sure it is solidly against the end of the rotor. This is important for the next measurement. With the depth micrometer on the same parallel bar used in Step 13, measure the distance to the end of the bearing spacer, FIGURE 14.

15. Add the discharge end clearance (FIGURE 7, page 29) plus .002" shim for crush fit to the difference between the measurements taken in Steps 13 and 14. This is the amount of shaft shim required. Measure the thickness of the shim set with the micrometer (FIGURE 15, page 32). Be sure shims are clean of dirt and oil for true measurement.

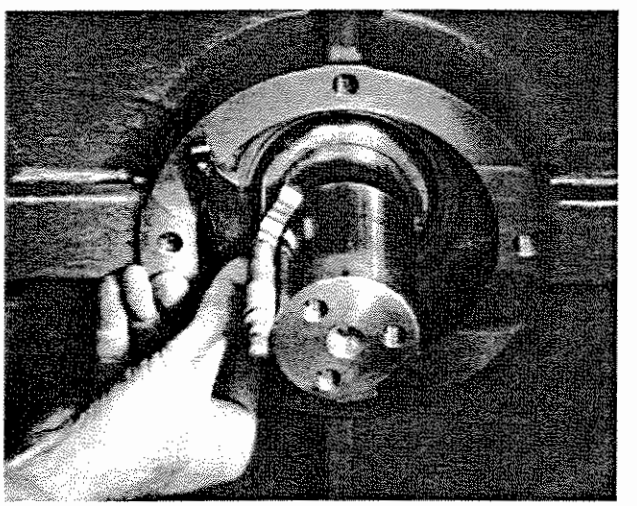


FIGURE 14

16. Slide the shims determined in Steps 14 and 15 over the shafts (FIGURE 16, page 32), up against the end of the bearing spacer.

17. Lightly coat the shaft extension and bearing bore with oil. Assemble bearings, as shown in FIGURE 6, page 29, on the shaft. Assemble the press plates (refer to FIGURE 1 and FIGURE 2 in Disassembly Section, page 23), on the bearing

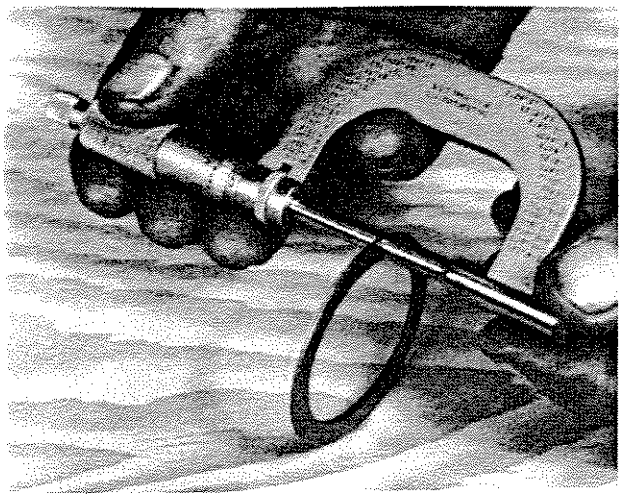


FIGURE 15

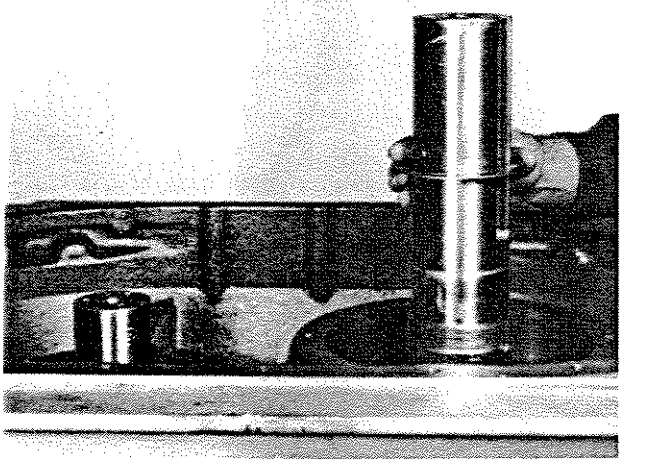


FIGURE 16

and install the jack screws (FIGURE 17). To prevent possible damage to threads on the shaft, press one bearing over the shaft into the bore at a time, rather than with both bearings stacked together. When the first bearing is flush with the top face of the bore, the second bearing may be started. Tighten nuts on the jack screws evenly to prevent cocking of the bearing on the shaft and in the bore.

NOTICE

It is not recommended to hammer bearings of this size in place.

18. Install the bearing clamp plate (14) and four "nylok" type screws (67) on the gate rotor bearing (FIGURE 18).

19. Install the shaft spacer (15), oil slinger (6) and shaft clamp plate (18) on the gate rotor shaft using three hex head "nylok" type screws (65). (FIGURE 19, page 33).

    Be sure the reinforcing plate on the oil slinger is placed up and is located between the oil slinger and shaft clamp plate. Insert enough shim (75) behind the slinger so that the slinger is not distorted when the hex head nylok screws are drawn up tight. This operation pulls the gate rotor shaft through the bearings until the shims and bearing spacer are clamped solidly between the rotor end and bearings, assuring a fixed position of the rotor.

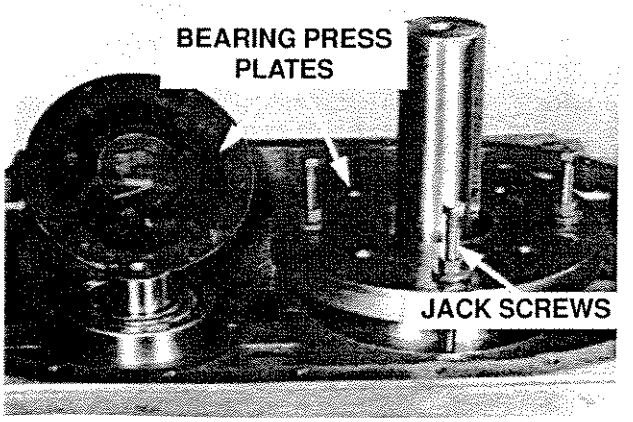


FIGURE 17

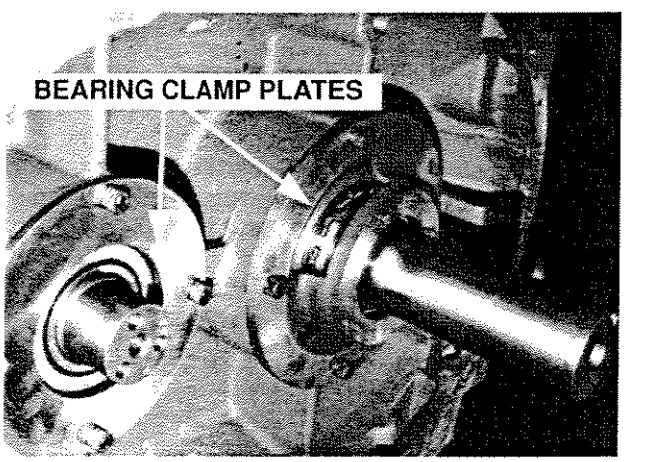


FIGURE 18

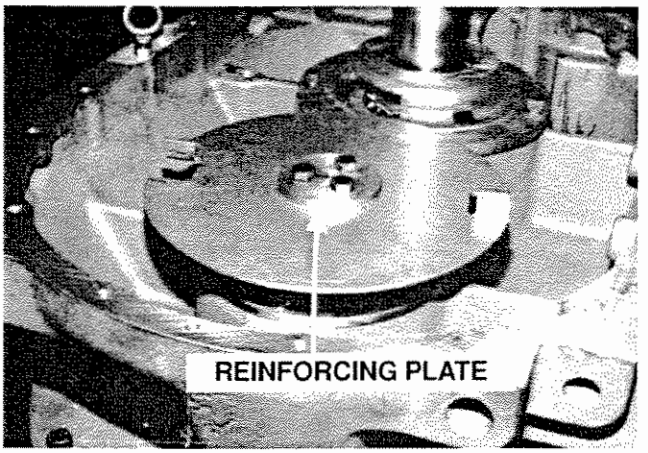


FIGURE 19

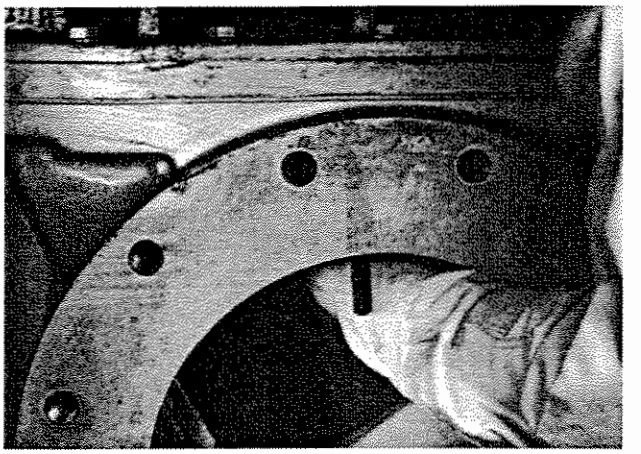


FIGURE 20

Install lockwasher (42) and locknut (41) on the main rotor shaft. Drive the nut tight so that the shims and bearing spacer are clamped solidly between the rotor end and bearings. This is an important step in the assembly to assume a fixed position of the rotors. The best method for tightening the locknut on the main rotor shaft is with a wrench of the type shown in FIGURE 3 in "Disassembly", page 23.

Bend the ear of the lockwasher into the slot of the locknut on the main rotor shaft extension.

20. Check the discharge end clearance of the rotor with a feeler gauge through the discharge opening (FIGURE 20). Also check rotor end clearance at the suction end through the suction opening. Clearance should match those listed in the chart, FIGURE 7, page 29, keeping in mind the allowable tolerance and possible .005 variation in rotor lengths. Never allow rotors to run closer than allowable tolerance. Wider clearance will not result in blower failure but may affect efficiency. If the discharge end clearance is too great, make sure the bearing retainer plates are tight, holding the bearing solidly in the bore, and the bearing retainer nuts are tight, which clamp the shims and bearing spacer solid against the end of the rotor. If clearance is too close, remove the discharge end carrier (4) and repeat the steps to establish shaft shim sets and total end clearance.

21. Oil the bearing generously. Check the shaft extension and keyway for burrs. Cover the keyway with tape to prevent damage to the lip of the oil seal. Install the cover gasket (30) and cover (18) with the seal adaptor (53) and seal (3) on the inside of the cover.

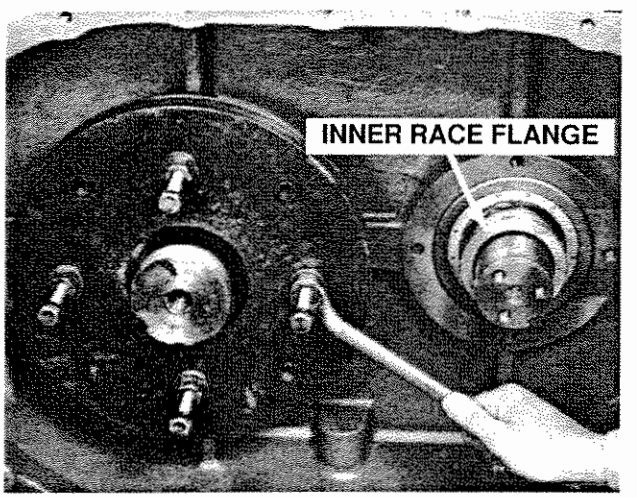


FIGURE 21

NOTE: The third important measurement for clearance is to provide for floating bearing at the gear end. The bearing inner race is flanged at one end. The flanged end is assembled "out" (towards gears) (FIGURE 21). Therefore, the opposite end of the inner race must bear against the bearing spacer before the outer race (and roller assembly) touches the shoulder in the bearing bore to prevent the inner race flange from jamming the bearing rollers. This is accomplished with shims determined in the following steps.

Turn the unit in a horizontal position on the mounting feet. With a depth micrometer on a perfectly flat parallel bar across the bearing bore, measure the distance to the shoulder in the bearing bore, FIGURE 13, page 31.

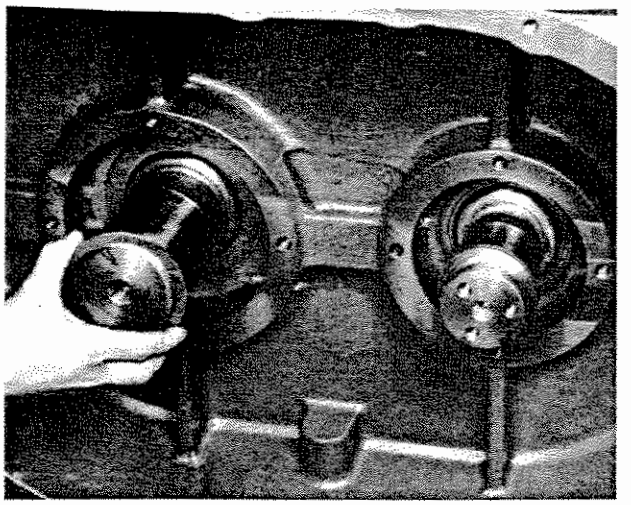


FIGURE 22

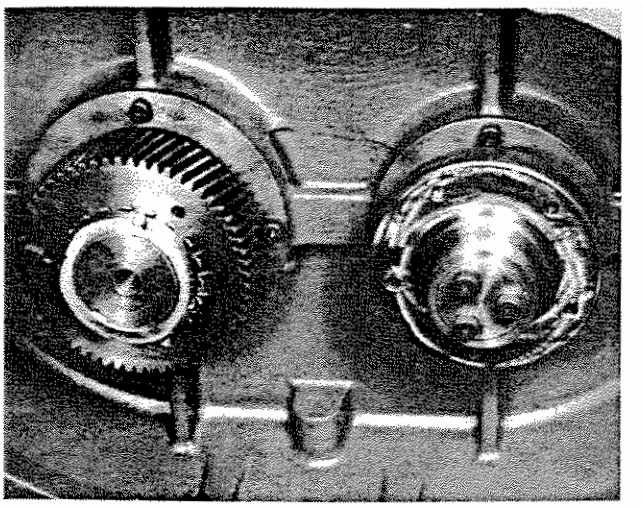


FIGURE 23

Remove tape from the shaft holding the bearing spacers in place. Tap the spacer to be sure it is solidly against the end of the rotor. This is important for the next measurement. With a depth micrometer on the same parallel bar, measure the distance to the end of each bearing spacer (FIGURE 14, page 31). Subtract the depth to the bearing bore from the depth to the spacer. Add approximately .010". Make up shim sets of this thickness for each shaft.

22. Slide enough shims (28) over the shafts (FIGURE 22, page 34) up against the end of the bearing spacer until the depth to the shims is .008 to .013 LESS than the depth to the bearing bore. This will give .008 to .013 running clearance between the inner race flange and the end of the bearing rollers. Check the thickness of the shim set with an outside micrometer.

23. Install the roller assembly of the bearings (36, 37) in each bore of the carrier (5) with the numbered side out. The roller assembly is a slip fit in the bore. Slide the inner race of the bearing on the shaft with the flanged end out (FIGURE 21, page 33). Assemble the press plate and jack screws as shown and press the inner race over the shaft solidly against the shims and bearing spacer. Tighten the nuts on the jack screws evenly to prevent cocking of the race.

24. Install the bearing clamp plates (12, 13) with "Nylok" type screws (67) (FIGURE 21, page 33). Check the fit of the key in the gear hub (11) and pinion (9). Check the pinion, hub and shaft extensions for burrs. Install the keys (47, 48) in the shafts, making sure of a snug fit. Heat the pinion and hub in oil or dry heat, such as an oven (NEVER USE TORCH) to 350° F for thirty minutes minimum to allow for complete heat penetration. If heating with oil in a confined area, use of cooking oils will prevent undesirable odors.

    Lock the rotors from turning with a piece of hard wood or belting. Install the hub and pinion and pull tight with a locking device (FIGURE 23). Use the hub retainer (7) and screws to pull the hub up tight against the bearing.

    As the hub and pinion cool, check for tightness. The bearing, shims and bearing spacer must be clamped tight against the rotor. Bend the ear of the lockwasher (42) into the slot of the locknut (41) holding the pinion. Oil the bearings generously.

    NOTE: The final check to be made for running clearances is dividing the interlobe clearance of the rotors to prevent metal–to–metal contact. This is referred to as **"TIMING OF ROTORS"** and is accomplished in the following five steps.

25. Install the gear on the hub (FIGURE 25), which is a slip fit. If gear teeth were marked at disassembly, line up these marks. New gears are not marked and should be positioned so tapped holes in the hub are centered with holes in the gear to allow radial movement of the gear for timing. Tighten the "Nylok" screws (69) against the flat washers (66) (always use new washers) just tight enough to allow the gear to slip radially on the hub. Mount an indicator and button bracket as shown in FIGURE 25, page 35. In order to accurately follow the next four steps in timing, the indicator must be mounted in a clockwise position from the bracket. The gear has a 3/8–16 tapped hole for

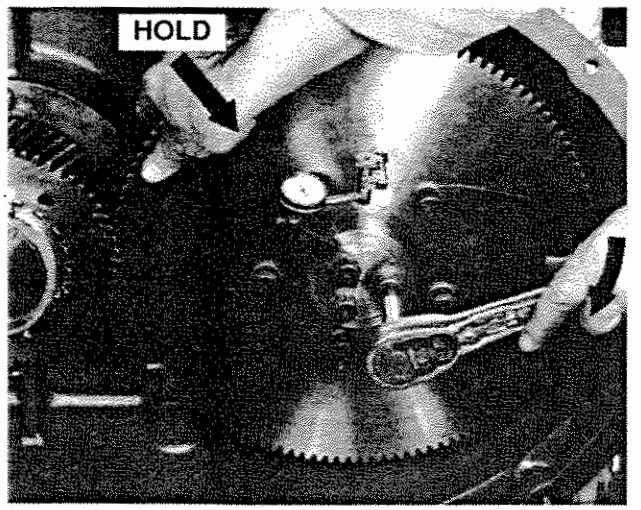


FIGURE 24

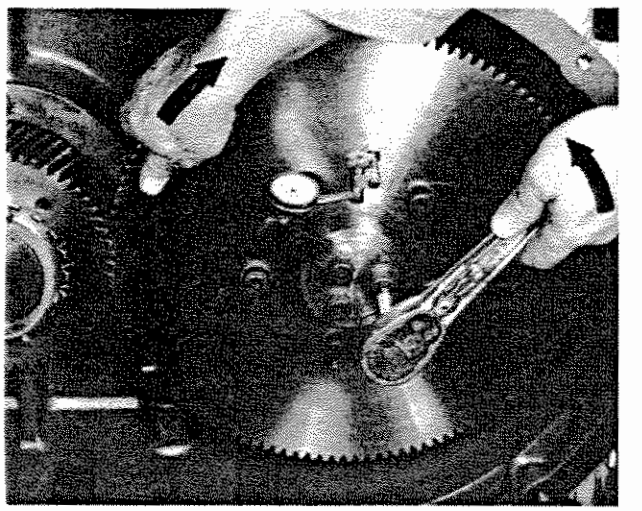


FIGURE 25

indicator support. When the indicator is mounted, hold the gear from rotating and with a wrench in one of the hub retainer screws, move the shaft in a clockwise direction until all slack is taken out of the gears and rotors to give a metal–to–metal contact. To prepare for the first reading, set the indicator at zero.

26. FINDING SMALLEST MINUS READING – FIGURE 26. Hold the gear under clockwise pressure to maintain metal–to–metal contact. Rotate the shaft counterclockwise two complete revolutions with a wrench. (Do not rotate by moving the gear.) If at any time the indicator hand moves to the plus side, reset at zero, and again rotate two complete revolutions. Notice the place of the smallest reading (this is the smallest number of thousandths from zero, not the smallest figure on the indicator dial). Continue rotation until the smallest reading is again reached and reset the indicator at zero. This is the closest clearance of rotors in this direction of rotation. If the indicator pointer flutters at any time during rotation, check for burrs or dirt on the rotors or gear teeth.

27. FINDING SMALLEST PLUS READING – FIGURE 27. Hold the gear under counterclockwise pressure to take up all slack, and rotate the rotor clockwise two complete revolutions with a wrench. Note the place of the smallest plus read-

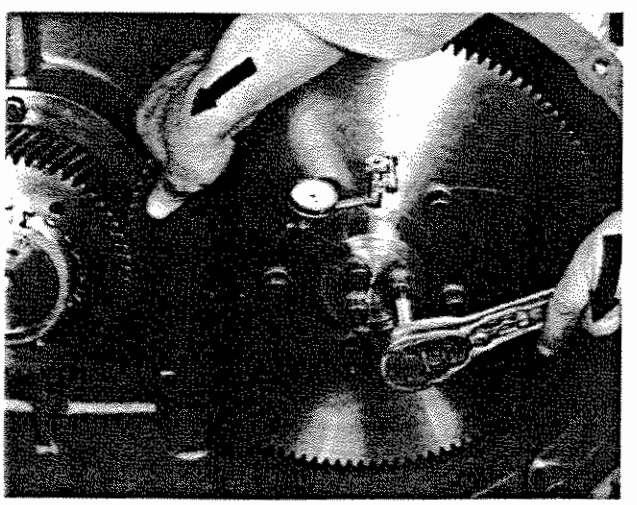


FIGURE 26

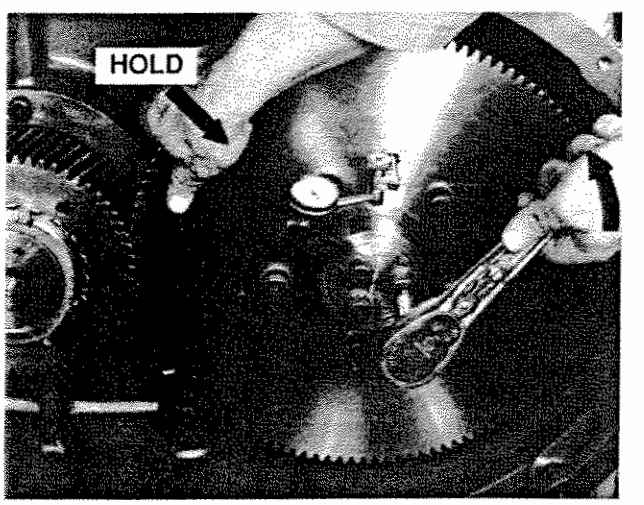


FIGURE 27

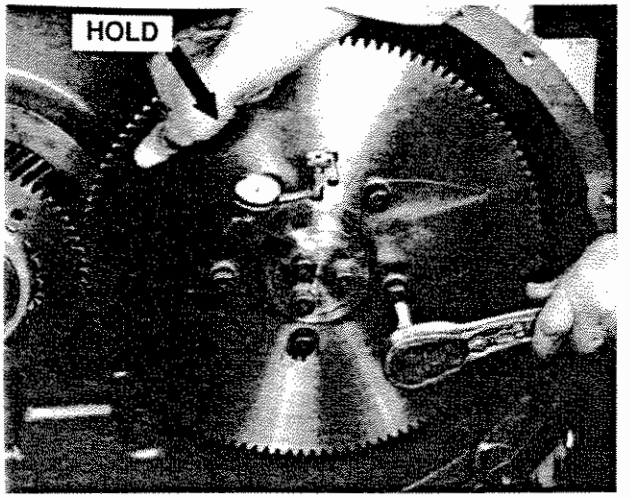


FIGURE 28

ing, and continue rotation until the smallest reading is again reached and stop. This is the point of minimum interlobe clearance.

28. SETTING THE INTERLOBE CLEARANCE – FIGURE 27, page 35. The interlobe clearance is divided with 2/3 on the discharge side and 1/3 on the suction side. Hold the gear from turning. Move the shaft counterclockwise with a wrench just enough to obtain 1/3 of the indicator reading obtained in Step 26.

    EXAMPLE: The minimum plus reading in Step 26 is +.018; move the rotor until the indicator reads +.012. This divides the interlobe clearance with 2/3 on the discharge side and 1/3 on the suction side.

29. Hold the gear and shaft from turning and evenly tighten five gear to hub "Nylok" screws (FIGURE 28, page 36.). Be sure the indicator reading does not change while tightening the screws. The rotors are held in time by the clamping action of the screws and distortion of the flat washers into the gear holes. Tighten screws securely. Check interlobe clearance to make sure the 2/3 indicator reading is on the discharge side.

    Discharge side clearance is checked with a feeler gauge through the discharge opening in the housing. Rotate the blower several times to be sure timing has not slipped. Recheck the discharge side interlobe clearance and discharge end clearance. When timing is completed remove the indicator, button the bracket and gear hub retainer plate. Install the hub retainer plate (7) with pilot in the hub bore with three "Nylok" type screws (18). Install the gasket (30) and carrier cover plate (19). Clean both carrier breathers (44).

    Referring to "Lubrication" , page 9, fill the carriers with proper oil. Cover all openings to prevent dirt entering the blower during transportation and installation.

    If the blower is to be stored, refer to "Storage", page 1.

Gardner Denver

100 GARDNER PARK
PEACHTREE CITY, GA 30269
TEL: (770) 486–5655 • FAX: (770) 486–5628

WARRANTY

GARDNER DENVER® CDL SERIES CYCLOBLOWERS®

GENERAL PROVISIONS AND LIMITATIONS

Gardner Denver (the "Company") warrants to each original retail purchaser ("Purchaser") of its new products from the Company or its authorized distributor that such products are, at the time of delivery to the Purchaser, made with good material and workmanship. No warranty is made with respect to:

1. Any product which has been repaired or altered in such a way, in the Company's judgment, as to affect the product adversely.
2. Any product which has, in the Company's judgment been subject to negligence, accident, improper storage, or improper installation or application.
3. Any product which has not been operated or maintained in accordance with normal practice and with the recommendations of the Company.
4. Components or accessories manufactured, warranted and serviced by others.
5. Any reconditioned or prior owned product.

Claims for items described in (4) above should be submitted directly to the manufacturer.

WARRANTY PERIOD

The Company's obligation under this warranty is limited to repairing or, at its option, replacing, during normal business hours at an authorized service facility of the Company, any part which in its judgment proved not to be as warranted within the applicable Warranty Period as follows.

BARE BLOWERS

Basic bare blowers, consisting of all parts within, are warranted for 12 months from date of initial use or 18 months from date of shipment to the first purchaser, whichever occurs first.

Any disassembly or partial disassembly of the blower, or failure to return the"unopened" blower per Company instructions, will be cause for denial of warranty.

OTHER COMPONENTS

All other components are warranted for 12 months from date of initial use or 18 months from date of shipment to first purchaser, whichever comes first.

LABOR TRANSPORTATION AND INSPECTION

The Company will provide labor, by Company representative or authorized service personnel, for repair or replacement of any product or part thereof which in the Company's judgment is proved not to be as warranted. Labor shall be limited to the amount specified in the Company's labor rate schedule.

Labor costs in excess of the Company rate schedule amounts or labor provided by unauthorized service personnel is not provided for by this warranty.

All costs of transportation of product, labor or parts claimed not to be as warranted and, of repaired or replacement parts to or from such service facilities shall be borne by the Purchaser. The Company may require the return of any part claimed not to be as warranted to one of its facilities as designated by Company, transportation prepaid by Purchaser, to establish a claim under this warranty.

Replacement parts provided under the terms of the warranty are warranted for the remainder of the Warranty Period of the product upon which installed to the same extent as if such parts were original components thereof.

DISCLAIMER

THE FOREGOING WARRANTY IS EXCLUSIVE AND IT IS EXPRESSLY AGREED THAT, EXCEPT AS TO TITLE, THE COMPANY MAKES NO OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY.

THE REMEDY PROVIDED UNDER THIS WARRANTY SHALL BE THE SOLE, EXCLUSIVE AND ONLY REMEDY AVAILABLE TO PURCHASER AND IN NO CASE SHALL THE COMPANY BE SUBJECT TO ANY OTHER OBLIGATIONS OR LIABILITIES. UNDER NO CIRCUMSTANCES SHALL THE COMPANY BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, EXPENSES, LOSSES OR DELAYS HOWSOEVER CAUSED.

No statement, representation, agreement, or understanding, oral or written, made by any agent, distributor, representative, or employee of the Company which is not contained in this Warranty will be binding upon the Company unless made in writing and executed by an officer of the Company.

This warranty shall not be effective as to any claim which is not presented within 30 days after the date upon which the product is claimed not to have been as warranted. Any action for breach of this warranty must be commenced within one year after the date upon which the cause of action occurred.

Any adjustment made pursuant to this warranty shall not be construed as an admission by the Company that any product was not as warranted.

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Gardner Denver

For additional product and parts information contact your local representative or contact:

Gardner Denver Blower Division
Customer Service Department
100 Gardner Park
Peachtree City, GA 30269
Telephone: (770) 486–5655
FAX: (770) 486–5628

Sales and Service in all major cities.

Specifications subject to change without notice.

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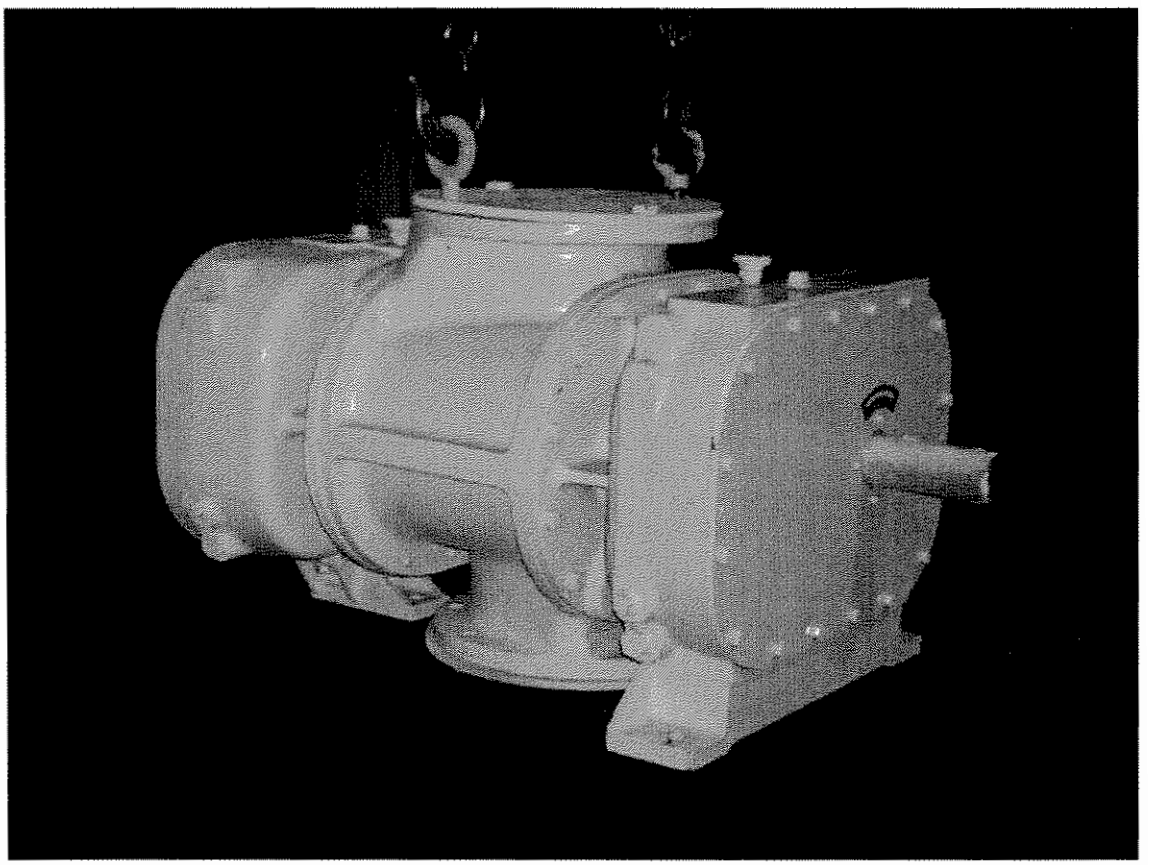
CYCLOBLOWER
RECOMMENDED LIFTING



Assembled Blower:

The assembled blower can be lifted by screwing 1" 8UNC eye bolts into two of the holes on the 14" inlet flange of the blower. This is the case if it is a top inlet blower. For a top discharge blower, the bolts are 7/8" 9UNC on the 12" discharge flange. The hooked end of a high strength chain, with safety catches on the hooks, should go through each of the eyebolts to pick up the blower slightly. If the blower is not in a balanced condition, the eyebolts should be moved to locations that bring the blower as close to level as possible prior to a full lift. Putting eyebolts in the blind holes closest to the middle of the housing (near the rib) would be a good starting point.

Step 7 (page 25) in the disassembly procedure from manual 37-1-608:
A long eye bolt with a washer and nut on the end of the eye bolt can be extended through the 1" NPT oil fill opening as it states in this step to pick up the bearing carrier as it is removed from the assembly.

We do not recommend picking up a blower assembly with straps.

C. EMERY NELSON, INC.
METROPOLITAN WASTWATER TREATMENT PLANT
SOLIDS PROCESSING IMPROVEMENT PROJECT
TAG NO. 1206, 1207, 1208, 1209, 1210 - MCES NO. 970300 -
GARDNER DENVER CYCLOBLOWER® 11CDL31-L BLOWER PACKAGE
P.O. CENO2-6011 - GDEPC S.O. 85131

CONTRACTOR: **KNUTSON CONSTRUCTION SERVICES**
5500 WAYZATA BLVD, SUITE 300
MINNEAPOLIS MN 55416-1264
RESPONSIBLE PARTY: **JASON VALCHECK**
PHONE: 763-546-1400 **FAX: 763-546-2226**

MOTOR MANUFACTURER

G E INDUSTRIAL SYSTEMS
2000 TAYLOW
FORT WAYNE IN 46801

PHONE: 260-439-2000

GE Industrial Systems

Friday, February 07, 2003

Technical Data Center
PO Box 2205
Fort Wayne, IN 46802-2205

Customer: GARDNER DENVER MACHINERY
ENGINEERED PACKAGING CTR
11611 TANNER RD
HOUSTON TX 770416906

DataPack Document, Version: v03022548.01

Contact:	Technical Data Center	**Phone:**	219-439-2000
Model Number:	5K449SSH222	**Customer Order: No:**	12306-85131
GE Requisition\Item:	1230685131\1	**Customer Item No:**	
GE Job Number:	021212334	**Customer Part No:**	350HP
Instruction Manual:	GEI-56128	**Outline Drawing:**	225B6575BD
Connection Diagram:	GEM2034E-FIG20		

Accessory Connection Diagrams

Bearing Thermocouple:	None	**Heater:**	None
RTD:	None	**Thermistor:**	None
Thermostat:	None	**Winding Thermocouple:**	None
Bearing RTD:	None		

Revision History

Version	*Date*	*Comments*
v03022548.01	02/07/2003	Original Version

Distribution Information

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Friday, February 07, 2003

Technical Data Center
PO Box 2205
Fort Wayne, IN 46802-2205

Customer: GARDNER DENVER MACHINERY
ENGINEERED PACKAGING CTR
11611 TANNER RD
HOUSTON TX 770416906

DataPack Document, Version: v03022548.01

Customer Order / Item:	12306-85131	**GE Requisition / Item:**	1230685131/1
Customer Part:	350HP	**GE Job Number:**	021212334

MODEL NUMBER:	**5K449SSH222**	**ESTIMATED WEIGHT:**	**2960 Lbs**
Outline Drawing:	225B6575BD	**Service Factor:**	1.15
Connection Diagram:	GEM2034E-FIG20	**Time Rating:**	CONT
Instruction Book:	GEI-56128	**Enclosure:**	TEFC
Design Code:	49HD1024E	**Encl Construction:**	SD
Type:	K	**Ambient:**	40
Frame:	449T	**Insulation Class:**	F
Phases:	3	**NEMA Design:**	B
Poles:	4	**Nominal Efficiency:**	95.4
Horsepower:	350	**KVA Code:**	F
RPM:	1785	**Max KVAR:**	91.1
Voltage:	480	**Bearing - DE:**	6318ZC3
Hertz:	60	**Bearing - ODE:**	6318ZC3
Amps - FL:	385.0		

Enclosure is Totally Enclosed Fan-Cooled

Additional Notes:
GREASE POLYREX EM
4 POLE - T SHAFT EXTN
SUITABLE FOR 80% VOLTAGE SUITABILITY
CODE F START
OVERSIZED CONDUIT BOX W/(2) 3" NPT
C/B GROUND PLATE

The subject motor is 5K449SSH222 (ORDERED ON REQN 12306-85131)

Max voltage ..... 528 volts at rated frequency (10%)
Min voltage ..... 432 volts at rated frequency (10%)
Special design consideration included, product suitable for acceleration with 80% voltage
based on supplied load curve and specific load inertia.
Max frequency ..... 63 hz at rated voltage (5%)
Min frequency ..... 57 hz at rated voltage (5%)
The combination of Voltage and frequency variation must not exceed the arithmetic sum of 10%
Rated running current ..... 385 amps at 480 volt, 60 hz
Rated horsepower ..... 350 Hp
Max starting current ..... 2293 amps at 480 volt, 60 hz across-the-line
Ramp time/special starting curves ..... Depends on load, inertia and voltage at start
Max RPM ..... 1785 rpm at 60 Hz
Min RPM ..... n/a
Max winding temperature ..... Class F insulation allows up to 105 deg C rise over 40 C ambient
Calculated Winding rise by resistance is 75.4 deg C at full load condition
Calculated Winding rise by resistance is 97.7 deg C at 1.15 Service Factor
Max number of restarts/time period : 2 cold / 1 hot
Time between restarts ..... 1,800 seconds between starts
Wye/Delta starting/running? ..... Winding is delta connected
Max vibration limits ..... 0.0015 inches peak-to-peak unfiltered or 0.15 ips unfiltered

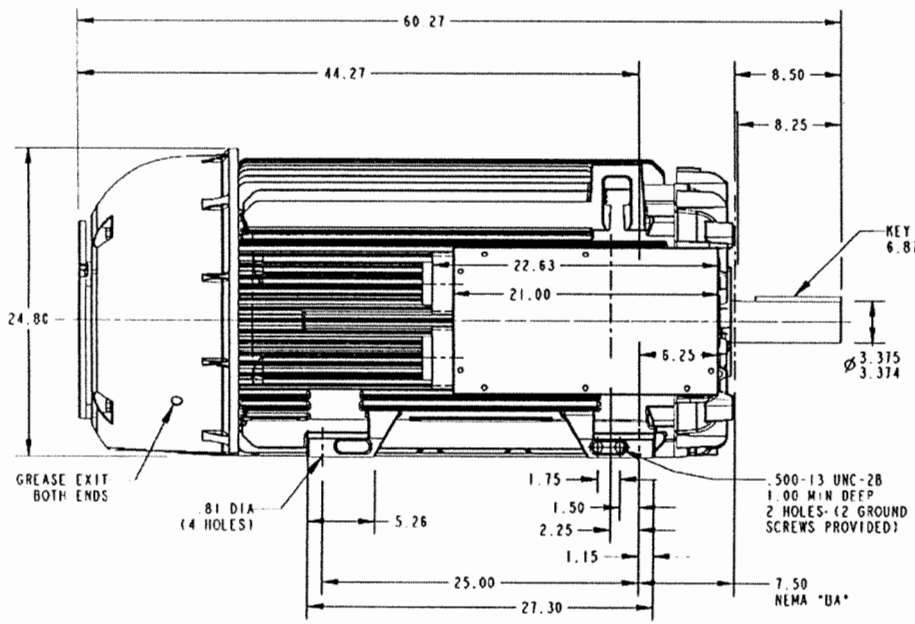
Friday, February 07, 2003

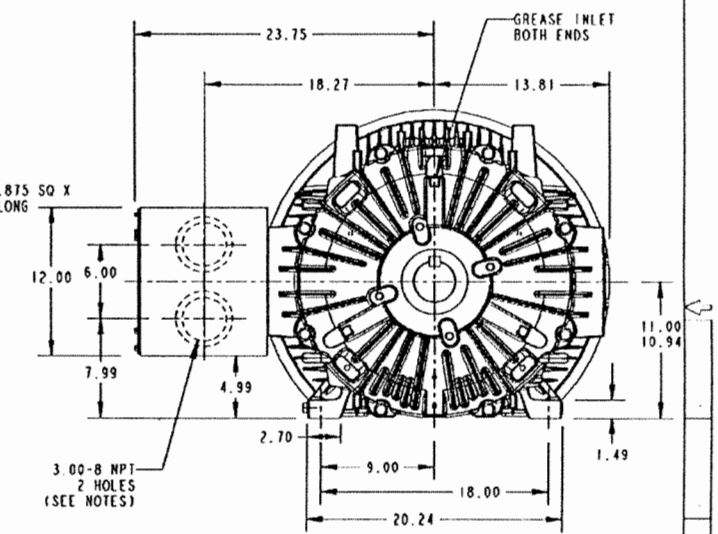
Certified Print

Model Number: 5K449SSH222

SIZE	DRAWING NO.	SH	REV
B	225B6575BD	1	0

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED





NOTES.

1. CONDUIT BOX MAY BE PLACED WITH THE ENTRANCE DOWN, UP OR TOWARD EITHER SIDE
2. F-1 ASSEMBLY SHOWN. F-2 ASSEMBLY HAS CONDUIT BOX ON OPPOSITE SIDE

THIRD ANGLE PROJECTION

SIGNATURES		DATE
DRAWN	MANOHAR	02/07/03
CHECKED	ABHISHEK	02/07/03
ENGR.		
ISSUED	MANOHAR	02/07/03
APPLIED PRACTICES		

GE Industrial Systems — GENERAL ELECTRIC COMPANY, Fort Wayne, Indiana

OUTLINE

449HO T TEFC

2500 CU.IN.CONDUIT BOX, 2 (3") NPT, (1) PR GND HOLES

SIZE	DRAWING	REV.
B	225B6575BD	0

SCALE: 0.120 | REF. NO: | SHEET 1 OF 1

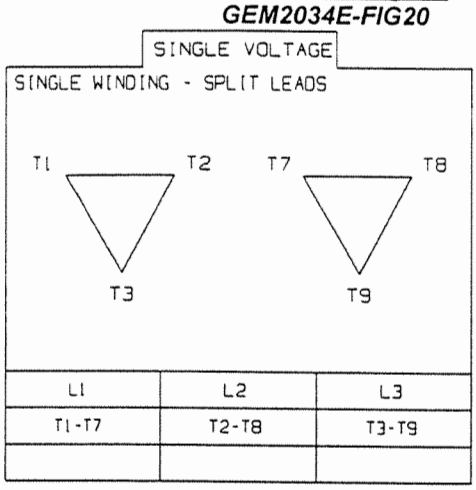
DISTRIBUTION | OWP

NAME P*-296 OBJECT:225B6575BD DATE:07-Feb-03 21:50:18

Diagrams for Model: 5K449SSH222

Connection Diagram

GEM2034E-FIG20



L1	L2	L3
T1-T7	T2-T8	T3-T9

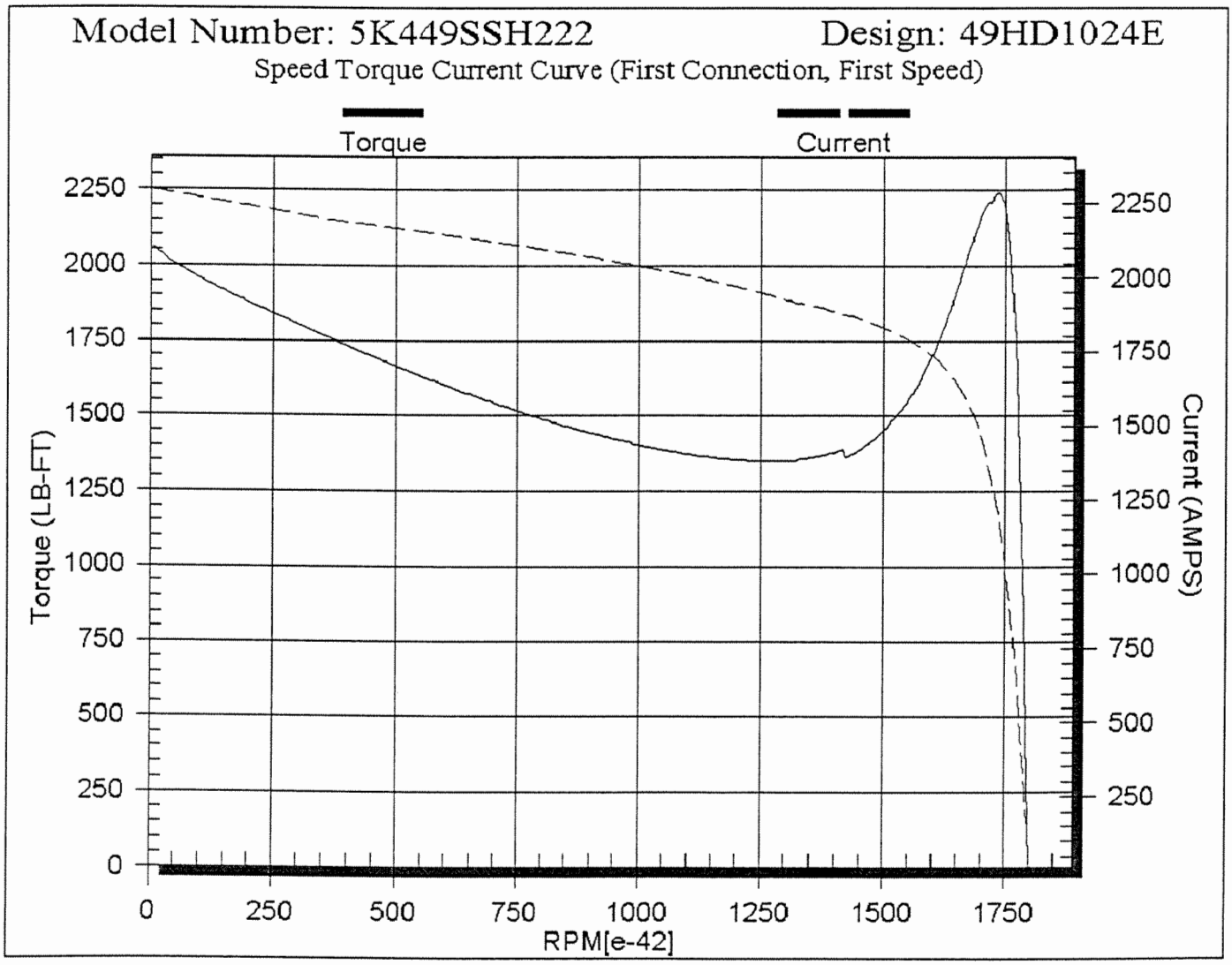
Performance Characteristics 1st Winding 1st Connection Design: 49HD1024E

LOAD %	125.0	115.0	100.0	75.0	50.0	25.0	0.0
% EFF	95.53	95.68	95.40	95.87	95.32	92.66	0.00
% PF	86.05	85.93	85.50	82.40	74.61	53.54	4.51
AMPS	477.34	439.10	385.00	298.05	220.71	158.19	121.78

TORQ(FL)#FT 1029.60 **TORQ(LR)%FL** 202.11 **TORQ(BD)%FL** 214.68
AMPS(LR) 2293.17 **PF AT START** 0.29

This motor is capable of two cold or one hot start with a maximum connected load inertia of 8718.1 Lb-Ft Sq (367.4 Kgs-Meter Sq) at 100% voltage, where the load torque varies with the square of the speed. Acceleration time with maximum inertia and the above load type is 40 seconds. Safe stall time at 100% voltage is 69 seconds cold, 52 hot. Rotor inertia is 129.14 Lb-Ft Sq (5.442 Kgs-Meter Sq).

Open Circuit A-C: 0.948 **Short Circuit D-C:** 0.042
Short Circuit A-C: 0.049 **X/R Ratio:** 15.783



GE Industrial Systems

Motor Installation And Maintenance Instructions

All Enclosures – Frames 143 – 449
Single and Polyphase – Ball Bearing

SAFE MOTOR OPERATION

High voltage and rotating parts of electrical machinery can cause serious or fatal injury. Its installation, operation, and maintenance should be performed by qualified personnel only. Familiarization with NEMA MG2 Safety Standard for Construction and Guide for Selection, Installation, and Use of Fractional and Integral Motors, the National Electrical Code and sound local practices is recommended. For equipment covered by these instructions, it is important to observe safety precautions to protect personnel from possible injury. Personnel should be instructed to:

- *Avoid contact with energized circuits. Disconnect all power sources before attempting maintenance or repair.*
- *Avoid contact with rotating parts and be sure that the shaft key is fully captive before the motor is energized.*
- *Avoid contact with the start or run capacitors in single-phase motors until a safe discharge procedure has been followed.*
- *Act with care and in accordance with prescribed procedures in handling, fitting, installing, operating and maintaining equipment.*
- *Do not lift motor and driven equipment with the motor lifting means. If eyebolts are used for lifting motors, they must be securely tightened and the direction of the lift must not exceed a 15° angle with the shank of the eyebolt.*
- *Do not use motors with automatic thermal protection where unexpected starting of equipment might be hazardous to personnel. Provide proper safeguards for personnel against possible failure of motor mounted brakes, particularly on applications involving overhauling loads.*
- *Safe maintenance practices and qualified personnel are imperative. Before initiating maintenance procedures, be sure that all power sources are disconnected and secured to avoid electrical shock and personal injury from rotating parts. If high potential insulation test is required, procedures and precautions outlined in NEMA Standard MG1 should be followed.*

Failure to properly ground motor may cause serious injury to personnel. Grounding should be in accordance with the National Electrical Code and consistent with sound local practice.

These instructions do not purport to cover all of the details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

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Motor Installation and Maintenance Instructions
All Enclosures – Frames 143-449 Single and Polyphase – Ball Bearing

I. INSTALLATION

A. Location

1. Dripproof motors are used in a well-ventilated place reasonably free of dirt and moisture.

2. Standard enclosed motors are used where they are exposed to dirt, moisture, and most outdoor conditions.

3. Severe-duty enclosed motors are used in highly corrosive or excessively moist areas.

4. Explosion-proof motors bearing the Underwriters' Laboratories label designating the motor UL Class and Group as defined in the National Electrical Code are designed for operation in areas classified by local authorities as hazardous in accordance with standards set forth in that Code.

B. Mounting

1. Mount motors securely on a firm, flabase. Grout-in larger motors, if necessary. Ball bearing motors can be sidewall or ceiling mounted. Ball bearing motors 143-326 frame ratings can be vertically mounted. The standard transition and/or sliding bases are suitable for floor mounting. For other locations, check the factory for base recommendations. For motors having bolt-on bases shipped not assembled, refer to paragraph "C" for assembly instructions before motors are put in service.

Caution	***Remove drain plugs from the frame or endshields of enclosed motors used outdoors or in other high moisture areas.***

2. Align motors accurately. For direct drive, use flexible couplings if possible. For drive recommendations, consult drive or equipment manufacturers or GE.

3. For base assembly and motor mounting, the bolts must be carefully tightened to prevent changes in alignment and possible damage to the equipment. It is recommended that a washer be used under each nut or bolt head to get a secure hold on the motor feet; or as an alternative, flanged nuts or bolts may be used. The recommended tightening torques for medium carbon steel bolts, identified by three radial lines at 120° on the head are:

Bolt Size		Recommended Torque in Ft.-lb (N-M)			
Inch	(Metric)	Minimum		Maximum	
1/4	(M6)	7	(9)	11	(15)
5/16	(M8)	14	(19)	21	(28)
3/8	(M10)	25	(34)	37	(50
1/2	(M12)	60	(81)	90	(122)
5/8	(M16)	120	(163)	180	(244)
3/4	(M20)	210	(285)	320	(433)

Note: For low carbon steel bolts, use 50% of the above recommended tightening torques. There are no ID marks on low carbon steel bolts.

4. When bases are removed on enclosed motors, the enclosure must be maintained by plugging the bolt holes with plastic plugs from Kit No. 1821BPK1.

Warning	***Do not replace the bolts in the frame with the base removed.***

5. Tighten belts only enough to prevent slippage. Belt speed should not exceed 5000 feet per minute.

6. The application of pulleys, sheaves, sprockets, and gears on motor shaft is shown in NEMA Standard MG1-14.07. The application of the V-belts dimensions to alternating current motors is shown in MG1-14.24A. V-belt sheave pitch diameters should not be less than the values shown in Table 1. Sheave rations greater than 5:1 and center-to-center distances less than the diameter of the large sheave should be referred to the Company.

7. On motors with dual mounting holes, use the holes indicated per the drawing on the following page.

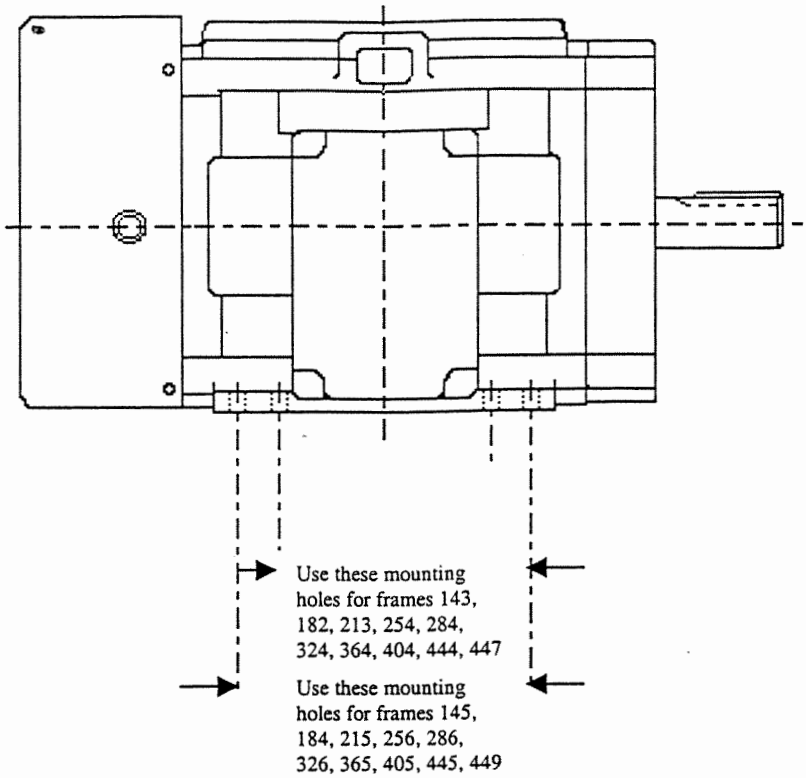


Table 1. V-Belt Sheave Diameters (Minimum in Inches)

Horsepower				Conventional	Narrow
Synchronous Speed (RPM)				A, B, C, D, E*	3V, 5V, 8VΔ
3600	1800	1200	900	Pitch Diameter	Outside Diameter
1.5	1	.75	.50	2.2	2.2
2 – 3	1.5 – 2	1	.75	2.4	2.4
—	3	1.5	1	2.4	2.4
—	—	2	1.5	2.4	2.4
5	—	—	—	2.6	2.4
7.5 – 10.0	5 – 7.5	3 – 5	2 – 3	3.0	3.0
—	10	7.5	5	3.8	3.8
15	15	10	7.5	4.4	4.4
20 – 25	20	15	10	4.6	4.4
—	25		—	5.0	4.4
—	30	20	15	5.4	5.2
—	40	25	20	6.0	6.0
—	50	30 – 40	25 – 30	6.8	6.8
—	60	—	—	7.4	7.4
—	—	50	40	8.2	8.2
—	75	—	—	9.0	8.6
—	—	60	—	9.0	8.0
—	—	—	50	9.0	8.4
—	100	—	—	10.0	8.6
—	—	75	60	10.0	10.0
—	125	—	—	11.5	10.5
—	—	100	—	11.0	10.0
—	—	—	75	10.5	9.5
—	150	—	—	—	9.5
—	—	125	100	12.5	12.0
—	200	—	—	—	13.2

Maximum sheave width = 2(N-W) – ¼" where N-W is the approximate usable shaft length.
Maximum sheave width = N-W.

C. Power Supply and Connections

1. Nameplate voltage and frequency should agree with the power supply. Motors will operate satisfactorily on line voltage within ±10% of the nameplate value or frequency within ±5%, combined variation to exceed ±10%.

2. Dual voltage motors can be connected for the desired voltage using instructions on nameplate or connection diagram.

3. Wiring of motor, control, overload protection and grounding should meet the National Electrical Code and local building codes.

Select wire size from the following table to help avoid voltage drop in the branch circuit of single-phase motors:

Individual Branch Circuits for Single-Phase Motors

Motor HP	Volts	Max* Fuse Amps	Minimum Size Wire Gauge for Branch Circuit Lengths In Feet			
.75	230	25	14	12	10	6
	115	45	12	8	6	2
1	230	25	14	14	12	8
	115	50	12	8	6	—
1.5	230	30	14	12	10	6
	115	60	10	6	4	—
2	230	40	14	12	8	4
	115	80	10	6	—	—
3	230	60	12	10	8	4
	115	110	8	8	—	—
5	230	90	10	8	6	2
7.5	230	125	8	6	—	—

D. Thermal Protectors

1. Thermally-protected motors have those words on the nameplate and have built-in protection against dangerous overheating.

2. Manual-reset protectors are reset (after motor cools) by pressing external reset button.

3. Automatic-reset protectors (no external button) reset automatically after motor cools.

Warning	***Where unexpected starting would be dangerous to personnel, do not use automatic reset protection.***

II. OPERATION

A. Dry out motors thoroughly which have been stored in a damp location before operating. Do not exceed a temperature of 85° C (185°F) in drying.

B. Operate at no load to check rotation and for free running. To reverse rotation:

1. Three phase – interchange leads T1 and T3.

2. One phase – follow the motor connection nameplate or label.

C. Operate under load for an initial period of at least one hour to observe whether any unusual noise or hot spots develop.

D. Check operating current against nameplate current. Do not exceed the value of the nameplate amperes multiplied by the service factor (if any) under continuous load.

E. 208 Volt system. When a 230/460 Volt motor with a nameplate which states "usable at 200V, _Hp, _Amps, 1.0SF" is operated on a 208 Volt system, the motor slip will increase approximately 30% and the motor locked-rotor, pull-up and breakdown torque values will be reduced by approximately 20 to 30%. Therefore, it should be determined by the user that the motor will start and accelerate the connected load without injurious heating and that the breakdown torque is adequate for the application.

III. MAINTENANCE

A. Inspection

1. Inspect motor at regular intervals. Keep motor clean and ventilation openings clear.

B. Lubrication

1. Ball bearing motors are adequately lubricated at the factory. Motors with regreasing facilities should be relubricated at intervals consistent with type of service (see **Table 3, Motor Lubrication Guide**) to provide maximum bearing life. Excessive or too frequent lubrication may damage the motor.

2. Relubricate motors with GE grease D6A2C14 or any Polyurea thickened grease unless a special grease is specified on the nameplate.

Warning	***If lubrication is performed with the motor running, stay clear of rotating parts.***

3. Dripproof Motors. On the drive end and opposite drive end of motors with pipe plugs, insert a lubrication fitting. Remove the other plug for grease relief of all motors. Clean grease relief opening of any hardened grease. Be sure fittings are clean and free of dirt. Insert a pipe cleaner down the relief hole. Using a low-pressure, hand-operated grease gun, pump in clean recommended grease until new grease appears on the pipe cleaner. After lubricating, allow the motor to run for ten minutes before replacing relief plug.

4. Totally Enclosed Fan Cooled Motors. Remove the caps on the fan cover for access to the grease plugs. Follow the greasing instructions described above for dripproof motors.

5. Motors not having pipe plugs or grease fittings in bearing housing can be relubricated by removing endshields from motor, cleaning grease cavity and refilling with recommended grease.

Caution	***Bearings and grease must be kept free of dirt.***

6. Oil Lubricated Bearings. Motors 320 frame sizes and larger generally have an oil lubricated upper bearing. The following instructions apply to that bearing. Grease lubricated instructions for all other bearings are shown above.

Motors covered by these instructions have oil lubricated bearings. Maintain proper lubrication by checking the oil level periodically and adding oil when necessary. Because of the clearing action of the bearing as the motor accelerates up to speed, and the expansion of the oil as it comes up to operating temperature, the oil level will be higher after the motor has been in operation for a while than it is with the motor at standstill. The normal level, with the motor stopped and the oil cold, is marked STANDSTILL LEVEL on the sight gauge.

Overfilling should be avoided not only because of the possibility that expansion may force the oil over the oil sleeve and into the motor, but also because operating with oil level too high prevents the bearing from clearing itself of excess oil. The resultant churning can cause extra loss, high temperatures, and oxidized oil. If, during operation, the oil level goes above the maximum shown on the site gauge, drain enough oil to bring the level back within operating range. A hole is provided inside the drain plug to make it possible to do this without completely removing the plug.

Do not permit the operating oil level to fall below minimum shown on the gauge. Should it ever become necessary to add excessive amounts of makeup oil, investigate immediately for oil leaks.

Change oil at regular intervals. The time between oil changes depends upon the severity of operating conditions and, hence, must be determined by the motor user. One or two changes a year is average, but special conditions, such as high ambient temperature, may require more frequent changes. Avoid operating motor with oxidized oil.

Use only best grade, oxidation, and corrosion inhibited turbine oil produce by reputable oil companies. The viscosity (weight) of the oil to be used depends upon the type and size of the bearing, its load and speed, the ambient temperature, and the amount and temperature of the cooling water (if used). The lubrication nameplate or instruction with each motor specifies the viscosity range of oil suitable for average conditions. The usual recommendations are summarized in Table 2, Oil Viscosity (below). Operation in ambient temperatures that are near or below freezing may require preheating the oil or the use of a special oil.

In some cases, water cooling for the oil is impractical or undesirable, and the normal operating oil temperature will be in the range of 170°F to 210°F. Also in some cases the bearing size, thrust-load and speed are so high that even with water cooling the normal oil temperature may be as high as 210°F. In these cases, it is especially important that proper viscosity, high-grade oil containing an oxidation inhibitor be used. Observe the condition of the oil frequently and change oil when it begins to show signs of deterioration.

Oil-lubricated bearing housings are provided with large settling chambers in which dust, dirt, and sludge collect. Unless oil has been permitted to oxidize, the draining of the old oil during regular changes will usually provide sufficient flushing actions to clean out the reservoir.

Whenever the motor is disassembled for general cleaning and reconditioning, the bearing housing may be washed out with suitable cleaning solvent. 1,1,1 Trichloroethane may be used, following the same instructions and cautions. Avoid using any solvent that will soften the paint used on the interior of the oil reservoir. Be sure that the oil metering hole is clean, and then dry the housing thoroughly before reassembly.

Table 2. Oil Viscosity

For a particular motor, refer to the lubrication nameplate or instructions.

Bearing Function and Location	Bearing Type	Oil Viscosity @100º F	SUS @F	GE Spec.
Thrust Bearing (In Top endshield) 320-405 Frame	Angular Contact Ball	150	45	D6B6A
Guide Bearing (In base endshield) 405 frame, 3600 rpm only – others are grease lubricated.	Ball	150	45	D6B6A

Table 3. Motor Lubrication Guide

Type of Service	Typical Examples	Hp Range	Lubrication Interval (Yrs.) Horizontal	Vertical
Easy	Valves; door openers; portable floor sanders; motor operating infrequently (one hour per day)	1.0 – 7.5 10 – 40 50 – 150 200 – 350 400 – 800	10 7 4 3 1	9 3 1.5 9 mo. –
Standard	Machine tools; air-conditioning apparatus; conveyors, one or two shifts; garage compressors; refrigeration machinery; laundry machinery; oil well pumps; water pumps; wood working machinery	1.0 – 7.5 10 – 40 50 – 150 200 – 350 400 – 800	7 4 1.5 1 6 mo.	3 1 6 mo. 3 mo. –
Severe	Motor for fans, M-G sets, etc., that run 24 hours per day, 365 days per year; coal and mining machinery; motors subject to severe vibration; steel mill machinery	1.0 – 7.5 10 – 40 50 – 150 200 – 350 400 – 800	4 1.5 9 mo. 6 mo. 3 mo.	1.5 6 mo. 3 mo. 1.5 mo. -
Very Severe	Dirty, vibrating applications; where end of shaft is hot (pumps and fans); high ambient temperature	1.0 – 7.5 10 – 40 50 – 150 200 – 350 400 – 800	9 mo. 4 mo. 4 mo. 3 mo. 2 mo.	6 mo. 3 mo. 2 mo. 1 mo. -

C. Explosion Proof Motors

1. Explosion-proof motors have special features and are manufactured in accordance with UL and carry its label. Therefore, it is recommended that repairs be made at a GE Service Shop which has been authorized to make such repairs.

D. Motor Windings

1. To clean motors use a soft brush and, if necessary, a slow acting solvent in a well ventilated room.

IV. SERVICE

Your GE motor should be serviced only by qualified persons who have the proper tools and equipment. Fast, dependable in-warranty service for your motor can be obtained from any of the worldwide network of GE Authorized Electric Motor Servicenters. Consult the Yellow Pages of your telephone directory for the Servicenter nearest you.

C. EMERY NELSON, INC.
METROPOLITAN WASTWATER TREATMENT PLANT
SOLIDS PROCESSING IMPROVEMENT PROJECT
TAG NO. 1206, 1207, 1208, 1209, 1210 - MCES NO. 970300 -
GARDNER DENVER CYCLOBLOWER® 11CDL31-L BLOWER PACKAGE
P.O. CENO2-6011 - GDEPC S.O. 85131

CONTRACTOR: **KNUTSON CONSTRUCTION SERVICES**
5500 WAYZATA BLVD, SUITE 300
MINNEAPOLIS MN 55416-1264
RESPONSIBLE PARTY: **JASON VALCHECK**
PHONE: 763-546-1400 **FAX: 763-546-2226**

DRIVE MANUFACTURER

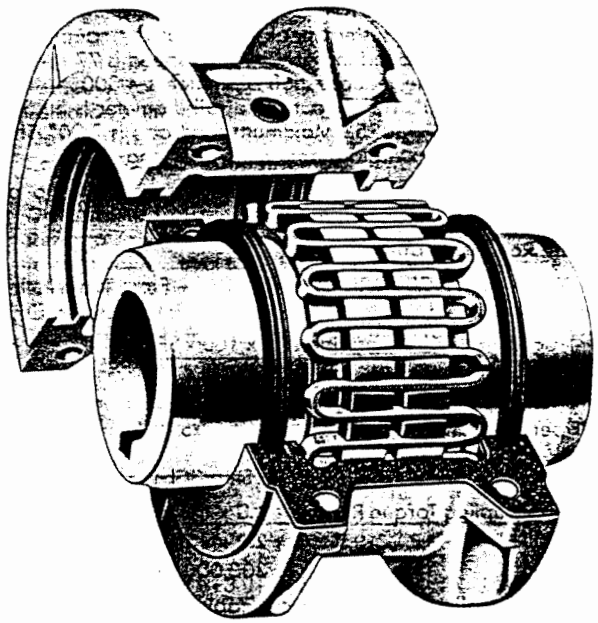
FALK CORPORATION
1600 PUMPHREY AVE
AUBURN AL 36832

PHONE: 770-475-7945
FAX: 414-937-4444

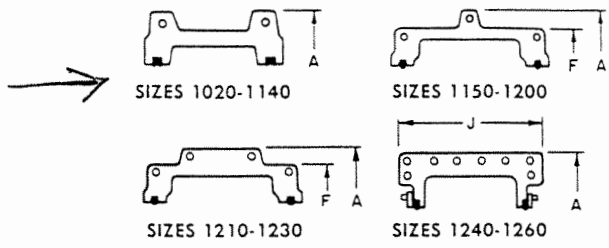
Type T10 Dimensions—Inches

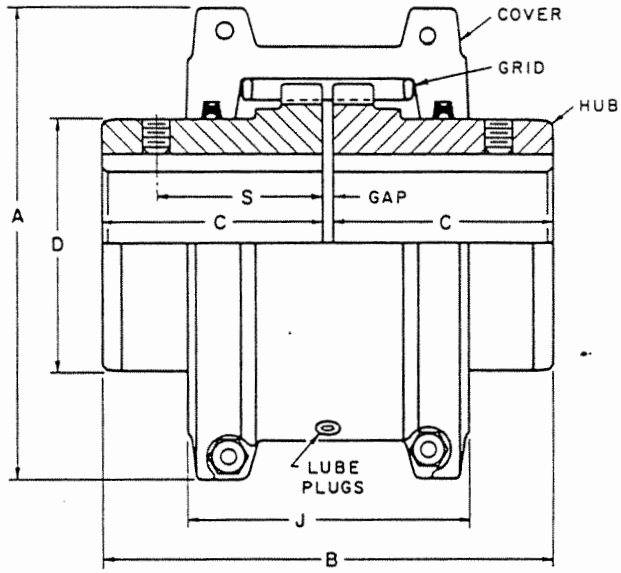
with Horizontal Split Cover

Sizes 1020T10 thru 1260T10



COVER PROFILES





SIZE ★	Torque Rating (lb-in.)■	Allow. Speed rpm†	Max✱ Bore (Sq. Key)	Min‡ Bore	Cplg Wt With No Bore-lb	Lube Wt lb	DIMENSIONS—INCHES A	B	C	D	F	J	S	Gap	SIZE ★
1020T	422	4500	1.125	.500	4.2	.06	4.00	3.88	1.88	1.56	...	2.62	1.54	.125	1020T
1030T	1,200	4500	1.375	.500	5.7	.09	4.38	3.88	1.88	1.94	...	2.69	1.54	.125	1030T
1040T	2,000	4500	1.625	.500	7.4	.12	4.62	4.12	2.00	2.25	...	2.75	1.58	.125	1040T
1050T	3,500	4500	1.875	.500	12	.15	5.44	4.88	2.38	2.62	...	3.12	1.76	.125	1050T
1060T	5,500	4350	2.125	.750	16	.19	5.94	5.12	2.50	3.00	...	3.62	2.06	.125	1060T
1070T	8,000	4125	2.500	.750	23	.25	6.38	6.12	3.00	3.44	...	3.75	2.12	.125	1070T
1080T	16,500	3600	3.000	1.062	39	.38	7.62	7.12	3.50	4.12	...	4.56	2.54	.125	1080T
1090T	30,000	3600	3.500	1.062	56	.56	8.38	7.88	3.88	4.88	...	4.81	2.82	.125	1090T
1100T	50,500	2440	4.000	1.625	93	.94	9.88	9.69	4.75	5.59	...	6.12	...	.188	1100T
1110T	75,000	2250	4.500	1.625	120	1.12	10.62	10.19	5.00	6.31	...	6.36	...	.188	1110T
1120T	110,000	2025	5.000	2.375	179	1.62	12.12	12.00	5.88	7.06	...	7.54	...	.250	1120T
1130T	160,000	1800	6.000	2.625	266	2.0	13.62	13.00	6.38	8.56	...	7.68	...	.250	1130T
1140T	230,000	1650	7.250●	2.625	392	2.5	15.12	14.75	7.25	10.00	...	7.92	...	.250	1140T
1150T	320,000	1500	8.000●	4.250	516	4.3	17.84	14.65	7.20	10.60	15.37	10.68	...	.250	1150T
1160T	450,000	1350	9.000●	4.750	698	6.2	19.74	15.85	7.80	12.00	17.18	10.98	...	.250	1160T
1170T	600,000	1225	10.000●	5.250	987	7.7	22.30	17.25	8.50	14.00	19.18	11.98	...	.250	1170T
1180T	832,000	1100	11.000●	6.000	1365	8.3	24.80	19.05	9.40	15.50	21.84	12.64	...	.250	1180T
1190T	1,100,000	1050	12.000●	6.000	1710	9.7	26.60	20.65	10.20	17.20	23.93	12.80	...	.250	1190T
1200T	1,500,000	900	13.000●	7.000	2331	12.4	29.80	22.25	11.00	19.60	26.00	14.00	...	.250	1200T
1210T	2,000,000	820	14.000●	7.000	3140	23.2	33.25	24.50	12.00	21.00	29.56	17.00	...	.500	1210T
1220T	2,700,000	730	15.000●	8.000	3935	35.4	36.25	26.10	12.80	22.50	32.37	19.30	...	.500	1220T
1230T	3,500,000	680	16.000●	8.000	4997	53.0	39.50	27.70	13.60	24.00	35.62	21.50	...	.500	1230T
1240T	4,500,000	630	17.000●	10.000	6504	74.5	42.80	29.50	14.50	25.50	...	25.50	...	.500	1240T
1250T	6,000,000	580	18.500●	10.000	8450	110.5	46.50	32.10	15.80	28.00	...	27.50	...	.500	1250T
1260T	7,500,000	540	20.000●	10.000	10322	148.1	49.64	34.50	17.00	30.00	...	30.00	...	500	1260T

★ Dimensions are for reference only and are subject to change without notice unless certified. Size 1020 thru 1230T10 covers are cast aluminum alloy; Size 1240 thru 1260T10 covers are fabricated steel.

✱ Maximum bores are LESS than shown above for hubs with an INTERFERENCE FIT and a set screw OVER the keyway; refer to Engineering 427-105 for details. For the above Max Bores, Sizes 1020 thru 1090 will be furnished for CLEARANCE FIT with a set screw OVER the keyway. Sizes 1100 and larger will be furnished for INTERFERENCE FIT without a set screw. Falk standards apply unless otherwise specified. Recommended key sizes for above maximum bores are listed in Table 14 on Page 21. For other maximum bore-key combinations that can be manufactured to order, refer to Table 9 on Page 20.

● Maximum bore is for hub with keyway for rectangular key.

‡ Minimum bore is the smallest bore to which a RSB (rough stock bore) hub can be bored. Depending upon coupling size, rough stock bore hubs have only a blind centering hole or a small through hole that will permit remachining of the hubs to the minimum bores specified. RSB hubs are not drilled and tapped for set screws.

■ Torque rating values for hubs with Taper Lock® bushings differ from those shown above; refer to Table 13 on Page 21.

† Consult Factory for speeds higher than those shown.

How To Use This Manual

This manual provides detailed instructions on maintenance, lubrication, installation, and parts identification. Use the table of contents below to locate required information.

Table of Contents

Introduction . . . . . Page 1
Lube Fittings . . . . . Page 1
Limited End Float . . . . . Page 1
Lubrication . . . . . Pages 1-2
Installation & Alignment Instructions . . . . . Pages 2-4
Annual Maintenance, Relube & Disassembly . . . . . Page 4
Installation & Alignment Data . . . . . Page 5
Parts Identification & Parts Interchangeability . . . . . Page 6

CAREFULLY FOLLOW THE INSTRUCTIONS IN THIS MANUAL FOR OPTIMUM PERFORMANCE AND TROUBLE FREE SERVICE.

INTRODUCTION

This manual applies to Sizes 1020T thru 1140T and 20T thru 140T10 Falk Steelflex Tapered Grid Couplings. Unless otherwise stated, information for Sizes 1020T thru 1140T applies to Sizes 20T thru 140T respectively, e.g. 1020T = 20T, 1100T = 100T, etc. These couplings are designed to operate in either the horizontal or vertical position without modification. Beginning in 1994, these couplings are being supplied with one set of inch series fasteners and one set of metric fasteners. Use either set of fasteners, depending on your preference. Refer to Page 6 for part interchangeability.

The performance and life of the couplings depend largely upon how you install and service them. Carefully follow the instructions in this manual for optimum performance and trouble free service.

CAUTION: Consult applicable local and national safety codes for proper guarding of rotating members. Observe all safety rules when installing or servicing couplings.

WARNING: Lockout starting switch of prime mover and remove all external loads from drive before installing or servicing couplings.

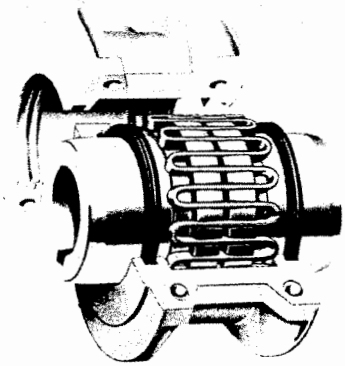
LUBE FITTINGS

Cover halves have 1/8 NPT lube holes. Use a standard grease gun and lube fitting as instructed on Page 4.

LIMITED END FLOAT

When electric motors, generators, engines, compressors and other machines are fitted with sleeve or straight roller bearings, limited axial end float kits are recommended for protecting the bearings. Falk Steelflex couplings are easily modified to limit end float; refer to Manual 428-820 for instructions.

TYPE T10 STEELFLEX COUPLING



LUBRICATION

Adequate lubrication is essential for satisfactory operation. Page 2 provides a list of typical lubricants and specifications for general purpose and long term greases. Because of its superior lubricating characteristics and low centrifuge properties, Falk Long Term Grease (LTG) is highly recommended. Sizes 1020T to 1090T10 are furnished with a pre-measured amount of grease for each coupling. The grease can be ordered for larger size couplings.

The use of general purpose grease requires re-lubrication of the coupling at least annually.

Long Term Grease (LTG)

The high centrifugal forces encountered in couplings separate the base oil and thickener of general purpose greases. Heavy thickener, which has no lubrication qualities, accumulates in the grid-groove area of Steelflex couplings resulting in premature hub or grid failure unless periodic lubrication cycles are maintained.

Falk Long Term Grease (LTG) was developed specifically for couplings. It resists separation of the oil and thickener and is an extreme pressure grease.

Steelflex couplings initially lubricated with LTG will not require re-lubrication until the connected equipment is stopped for servicing. If a coupling leaks grease, is exposed to extreme temperatures, excessive moisture, or experiences frequent reversals, more frequent lubrication may be required.

Although LTG grease is compatible with most other coupling greases, the mixing of greases may dilute the benefits of LTG.

USDA Approval

LTG has the United States Department of Agriculture Food Safety & Inspection Service approval for applications where there is no possibility of contact with edible products. (H-2 ratings).

CAUTION: Do not use LTG in bearings.

Specifications — Falk LTG

The values shown are typical and slight variations are permissible.

AMBIENT TEMPERATURE RANGE — -20°F (-29°C) to 250°F (121°C).

MINIMUM BASE OIL VISCOSITY — 3300SSU (715cST) @ 100°F (38°C)

THICKENER — less than 12% by weight.

CENTRIFUGE SEPARATION CHARACTERISTICS — ASTM #D4425 (Centrifuge Test) — K36 = 2/24 max., very high resistance to centrifuging.

NLGI GRADE (ASTM D-217) — $\frac{1}{2}$

MINIMUM DROPPING POINT — with 60 stroke worked penetration value in the range of 320 to 365 — 350°F (177°C) min.

MINIMUM TIMKEN O.K. LOAD — 40 lbs.

ADDITIVES — Rust and oxidation inhibitors that do not corrode steel or swell or deteriorate synthetic seals.

Packaging

14 OZ. CARTRIDGES — For use in standard grease guns. Sufficient quantity to initially lubricate sizes thru 1090T.

35 LB. PAIL — Ideal for larger size couplings or many smaller sizes.

120 LB. KEG & 400 LB. DRUM — For plants with central storage areas. A pump with a pressurized follower plate is required for dispensing grease.

CASE LOTS OF 24-14 OZ. CARTRIDGES — also available.

General Purpose Grease

Annual Lubrication — The following specifications and lubricants for general purpose grease apply to Falk Steelflex couplings that are lubricated annually and operate within ambient temperatures of 0°F to 150°F (-18°C to 66°C). For temperatures beyond this range (see Table 1), consult the Factory.

If a coupling leaks grease, is exposed to extreme temperatures, excessive moisture or experiences frequent reversals, more frequent lubrication may be required.

Specifications — General Purpose Coupling Lubricants

The values shown are typical and slight variations are permissible.

DROPPING POINT — 300°F (149°C) or higher.

CONSISTENCY — NLGI No. 2 with 60 stroke worked penetration value in the range of 250 to 300.

SEPARATION AND RESISTANCE — Low oil separation rate and high resistance to separation from centrifuging.

LIQUID CONSTITUENT — Possess good lubricating properties ... equivalent to a high quality, well refined petroleum oil.

INACTIVE — Must not corrode steel or cause swelling or deterioration of synthetic seals.

CLEAN — Free from foreign inclusions.

General Purpose Greases Meeting Falk Specifications

Lubricants listed below are typical products only and should not be construed as exclusive recommendations.

TABLE 1 — General Purpose Greases

Ambient Temperature Range	0°F to 150°F (-18°C to +66°C)	-30°F to 100° F [1] (-34°C to +38°C)
NLGI Grade	#2	#2
Manufacturer	Lubricant [2]	Lubricant [2]
Amoco Oil Co.	Amolith Grease #2	Amolith Grease #2
Atlantic Richfield Co.	Litholene HEP 2	Litholene HEP 2
Chevron U.S.A. Inc.	Chevron Dura-Lith EP-2	Chevron Dura-Lith EP 2
Cities Service Co.	Citgo HEP-2	Citgo HEP 2
Conoco Inc.	EP Conolith #2	EP Conolith #2
Exxon Company, USA	Ronex MP	Ronex MP
Gulf Oil Corp.	Gulfcrown Grease #2	Gulfcrown Grease #2
E. F. Houghton & Co.	Cosmolube #2	Cosmolube #1
Imperial Oil Ltd.	Esso MP Grease H	Lotemp EP
Kendall Refining Co.	Kenlube L-421 Grease	Kenlube L-427 Grease
Keystone Div. (Pennwalt)	#81 Light	#84 Light
Mobil Oil Corp.	Mobilux EP 111	Mobilux #1
Phillips Petroleum Co.	IB & RB Grease	Philube IB & RB Grease
Shell Oil Co.	Alvania Grease #2	Alvania Grease #2
Standard Oil Co. (OH)	Factran #2	Factran #2
Sun Oil Company	Prestige 42	Prestige 42
Texaco Lubricants	Starplex HD2	Multifak EP2
Texaco Canada Inc.	Marfak HD 2	Marfak AP
Union Oil Co. (CA)	Union Unoba #2	Union Unoba #2
Valvoline Oil Co.	Val-Lith EP #2	Val-Lith EP #2

[1] For northern climate applications. For continuous operation at constant ambient temperatures less than 0°F (-18°C) — for example, refrigeration systems; consult The Falk Corporation.

[2] Lubricants listed may not be suitable for use in the food processing industry; check with lube manufacturer for approved lubricants.

INSTALLATION OF TYPE T10 STEELFLEX TAPERED GRID COUPLINGS

Installation

Only standard mechanics tools, wrenches, a straight edge and feeler gauges are required to install Falk Steelflex couplings. Coupling Sizes 1020T thru 1090T are generally furnished for CLEARANCE FIT with setscrew over the keyway. Sizes 1100T and larger are furnished for an INTERFERENCE FIT without a setscrew.

CLEARANCE FIT HUBS — Clean all parts using a non-flammable solvent. Check hubs, shafts and keyways for burrs. Do not heat clearance fit hubs. Install keys, mount hubs with flange face flush with shaft ends or as otherwise specified and tighten setscrews.

INTERFERENCE FIT HUBS — Furnished without setscrews. Heat hubs to a maximum of 275°F (135°C) using an oven, torch, induction heater or an oil bath.

When an oxy-acetylene or blow torch is used, use an excess acetylene mixture. Mark hubs near the center of their length in several places on hub body with a temperature sensitive crayon, 275°F (135°C) melt temperature. Direct flame towards hub bore using constant motion to avoid overheating an area.

The Falk Corp., subsidiary of Sundstrand Corp.
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-937-4284, Fax: 414-937-4359

WARNING: If an oil bath is used, the oil must have a flash point of 350°F (177°C) or higher. Do not rest hubs on the bottom of the container. Do not use an open flame in a combustible atmosphere or near combustible materials.

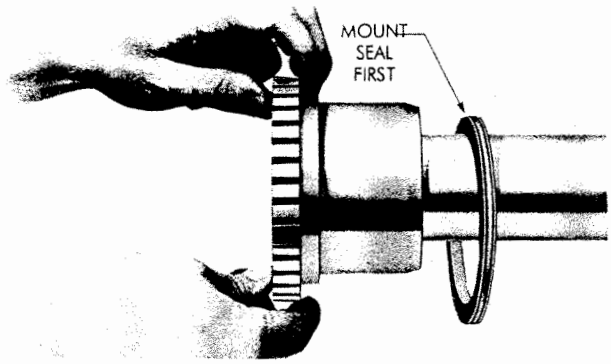
Heat hubs as instructed above. Mount hubs as quickly as possible with hub flange face flush with shaft end. Allow hubs to cool before proceeding. Insert setscrews (if required) and tighten.

Maximize Performance And Life

The performance and life of couplings depend largely upon how you install and maintain them. Before installing couplings, make certain that foundations of equipment to be connected meet manufacturers' requirements. Check for soft foot. The use of stainless steel shims is recommended. Measuring misalignment and positioning equipment within alignment tolerances is simplified with an alignment computer. These calculations can also be done graphically or mathematically.

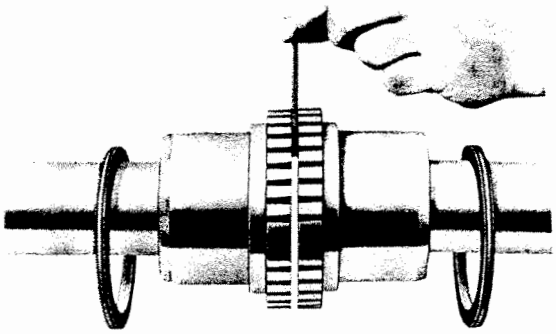
Alignment is shown using spacer bar and straight edge. This practice has proven to be adequate for many industrial applications. However, for superior final alignment, the use of dial indicators (see Manual 458-834 for instructions), lasers, alignment computers or graphical analysis is recommended.

1— Mount Seals And Hubs



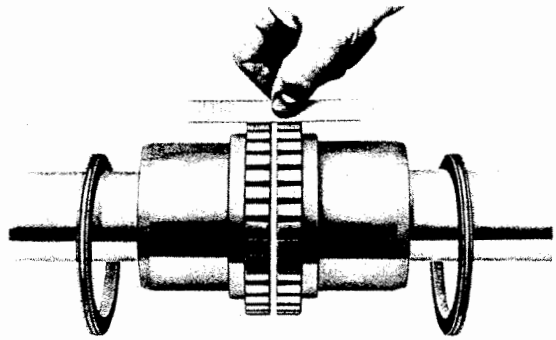
Lock out starting switch of prime mover. Clean all metal parts using a non-flammable solvent. Lightly coat seals with grease and place on shafts BEFORE mounting hubs. Heat interference fit hubs as previously instructed. Seal keyways to prevent leakage. Mount hubs on their respective shafts so the hub face is flush with the end of its shaft unless otherwise indicated. Tighten setscrews when furnished.

2 — Gap and Angular Alignment



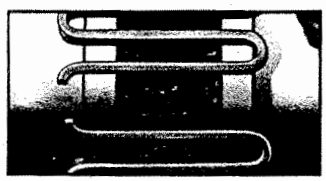
Use a spacer bar equal in thickness to the gap specified in Table 2, Page 5. Insert bar as shown below left, to same depth at 90° intervals and measure clearance between bar and hub face with feelers. The difference in minimum and maximum measurements must not exceed the ANGULAR installation limits specified in Table 2.

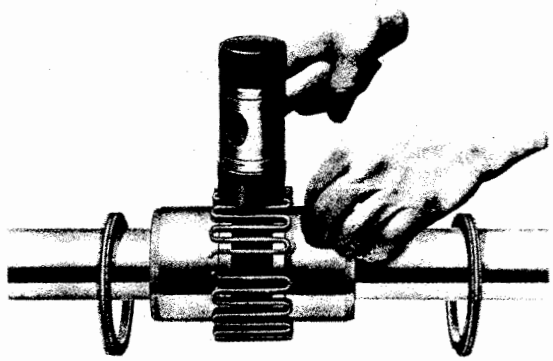
3 — Offset Alignment



Align so that a straight edge rests squarely (or within the limits specified in Table 2) on both hubs as shown above and also at 90° intervals. Check with feelers. The clearance must not exceed the PARALLEL OFFSET installation limits specified in Table 2. Tighten all foundation bolts and repeat Steps 2 and 3. Realign coupling if necessary.

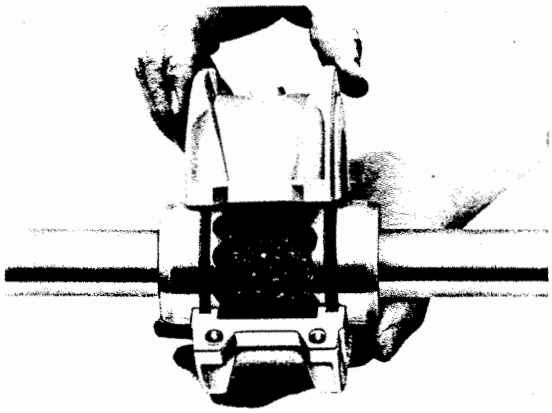
4 — Insert Grid

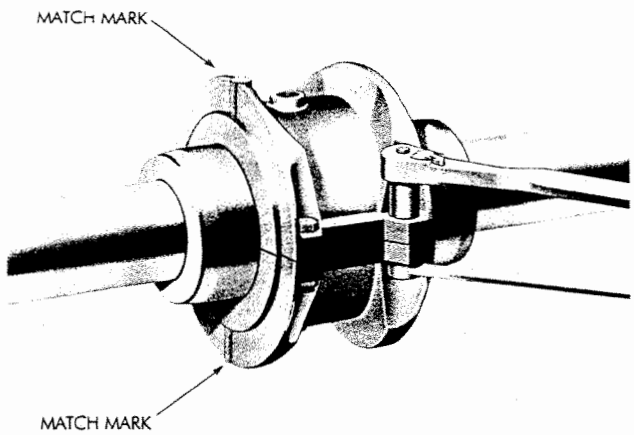




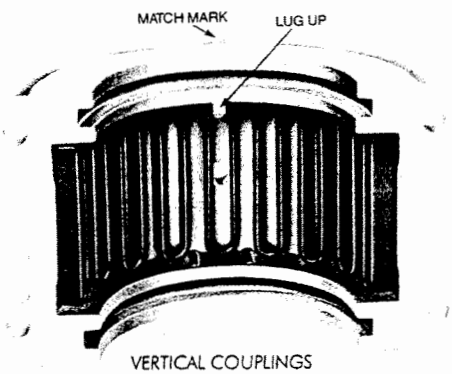
Pack gap and grooves with specified lubricant before inserting grid. When grids are furnished in two or more segments, install them so that all cut ends extend in the same direction (as detailed in the exploded view picture above); this will assure correct grid contact with non-rotating pin in cover halves. Spread the grid slightly to pass over the coupling teeth and seat with a soft mallet.

5 — Pack With Grease And Assemble Covers





Pack the spaces between and around the grid with as much lubricant as possible and wipe off excess flush with top of grid. Position seals on hubs to line up with grooves in cover. Position gaskets on flange of lower cover half and assemble covers so that the match marks are on the same side (see above). If shafts are not level (horizontal) or coupling is to be used vertically, assemble cover halves with the lug and match mark



VERTICAL COUPLINGS

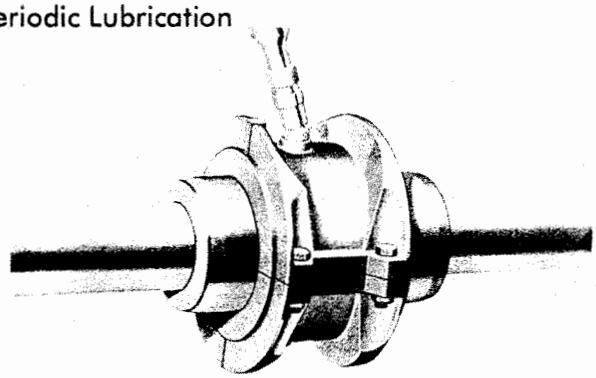
UP or on the high side. Push gaskets in until they stop against the seals and secure cover halves with fasteners, tighten to torque specified in Table 2. Make sure gaskets stay in position during tightening of fasteners. **CAUTION:** *Make certain lube plugs are installed before operating.*

ANNUAL MAINTENANCE

For extreme or unusual operating conditions, check coupling more frequently.

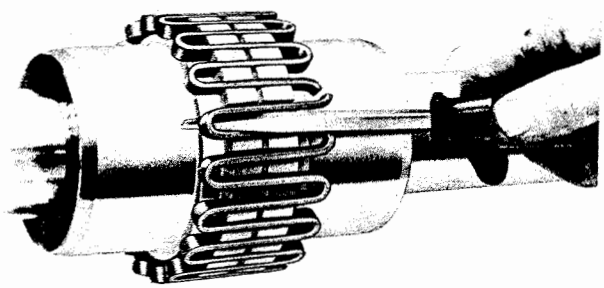
1. Check alignment per steps on Page 3. If the maximum operating misalignment limits are exceeded, realign the coupling to the recommended installation limits. See Table 2 for installation and operating alignment limits.
2. Check tightening torques of all fasteners.
3. Inspect seal ring and gasket to determine if replacement is required. If leaking grease, replace.
4. When connected equipment is serviced, disassemble the coupling and inspect for wear. Replace worn parts. Clean grease from coupling and repack with new grease. Install coupling using new gasket as instructed in this manual.

Periodic Lubrication



The required frequency of lubrication is directly related to the type of lubricant chosen, and the operating conditions. Steelflex couplings lubricated with common industrial lubricants, such as those shown in Table 1, should be relubed annually. The use of Falk Long Term Grease (LTG) will allow relube intervals to be extended to beyond five years. When relubing, remove both lube plugs and insert lube fitting. Fill with recommended lubricant until an excess appears at the opposite hole. **CAUTION:** *Make certain all plugs have been inserted after lubricating.*

Coupling Disassembly And Grid Removal



Whenever it is necessary to disconnect the coupling, remove the cover halves and grid. A round rod or screwdriver that will conveniently fit into the open loop ends of the grid is required. Begin at the open end of the grid section and insert the rod or screwdriver into the loop ends. Use the teeth adjacent to each loop as a fulcrum and pry the grid out radially in even, gradual stages, proceeding alternately from side to side.

The Falk Corp., subsidiary of Sundstrand Corp.
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-937-4284, Fax: 414-937-4359

TYPE T COUPLING INSTALLATION & ALIGNMENT DATA

Maximum life and minimum maintenance for the coupling and connected machinery will result if couplings are accurately aligned. Coupling life expectancy between initial alignment and maximum operating limits is a function of load, speed and lubrication. Maximum operating values listed in Table 2 are based on cataloged allowable rpm.

Values listed are based upon the use of the gaps listed, standard coupling components, standard assemblies and cataloged allowable speeds.

Values may be combined for an installation or operating condition.

Example: 1060T max. operating misalignment is .016" parallel plus .018" angular.

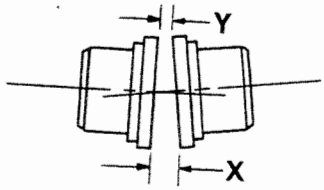
NOTE: For applications requiring greater misalignment, refer application details to the Factory.

Angular misalignment is dimension X minus Y as illustrated below.

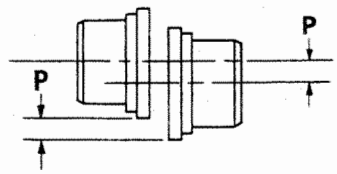
Parallel misalignment is distance P between the hub center lines as illustrated below.

End float (with zero angular and parallel misalignment) is the axial movement of the hubs(s) within the cover(s) measured from "O" gap.

ANGULAR MISALIGNMENT



PARALLEL MISALIGNMENT



END FLOAT

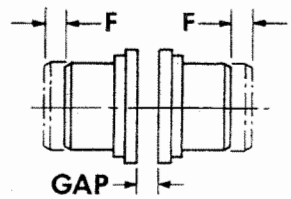


TABLE 2 — Misalignment And End Float

Size	Installation Limits						Operating Limits						Cover Fastener Tightening Torque Values		Allow Speed (rpm)	Lube Wt.	
	Parallel Offset-P		Angular (x-y)		Normal Gap ± 10%		Parallel Offset-P		Angular (x-y)		End Float Physical Limit (Min.) 2 x F						
	Max. In.	Max mm	Max. In.	Max. mm	In.	mm	Max. In.	Max. mm	Max. In.	Max. mm	In	mm	In. Series Fasteners (lb-in.)	Metric Fasteners (Nm)		lb	kg
1020T	.006	.15	.003	.08	.125	3	.012	.30	.010	.25	.210	5.33	100	11.3	4500	.06	.03
1030T	.006	.15	.003	.08	.125	3	.012	.30	.012	.30	.198	5.03	100	11.3	4500	.09	.04
1040T	.006	.15	.003	.08	.125	3	.012	.30	.013	.33	.211	5.36	100	11.3	4500	.12	.05
1050T	.008	.20	.004	.10	.125	3	.016	.41	.016	.41	.212	5.38	200	23.6	4500	.15	.07
1060T	.008	.20	.005	.13	.125	3	.016	.41	.018	.46	.258	6.55	200	23.6	4350	.19	.09
1070T	.008	.20	.005	.13	.125	3	.016	.41	.020	.51	.259	6.58	200	23.6	4125	.25	.11
1080T	.008	.20	.006	.15	.125	3	.016	.41	.024	.61	.288	7.32	200	23.6	3600	.38	.17
1090T	.008	.20	.007	.18	.125	3	.016	.41	.028	.71	.286	7.26	200	23.6	3600	.56	.25
1100T	.010	.25	.008	.20	.188	5	.020	.51	.033	.84	.429	10.90	312	35	2440	.94	.43
1110T	.010	.25	.009	.23	.188	5	.020	.51	.036	.91	.429	10.90	312	35	2250	1.1	.51
1120T	.011	.28	.010	.25	.250	6	.022	.56	.040	1.02	.556	14.12	650	73	2025	1.6	.74
1130T	.011	.28	.012	.30	.250	6	.022	.56	.047	1.19	.551	14.00	650	73	1800	2.0	.91
1140T	.011	.28	.013	.33	.250	6	.022	.56	.053	1.35	.571	14.50	650	73	1650	2.5	1.14

TABLE 3 — Coupling Cover Fastener Identification

SIZE	INCH SERIES FASTENERS		METRIC FASTENERS
	Old Style	New Style	
1020-1070T10	SAE Grade 8 [1]	SAE Grade 8	Property Class 10.9
1080-1090T10	SAE Grade 8	SAE Grade 8	Property Class 10.9
1100-1140T10	SAE Grade 5	SAE Grade 5	Property Class 8.8

[1] Older style covers, Sizes 1020T10 thru 1070T10 must utilize socket head cap screws and locknuts held by the cover.

PARTS IDENTIFICATION

All coupling parts have identifying part numbers as shown below. Parts 3 and 4 (Hubs and Grids), are the same for both Type T10 and T20 couplings. All other coupling parts are unique to Type T10. When ordering parts, always SPECIFY SIZE and TYPE shown on the COVER.

PARTS INTERCHANGEABILITY

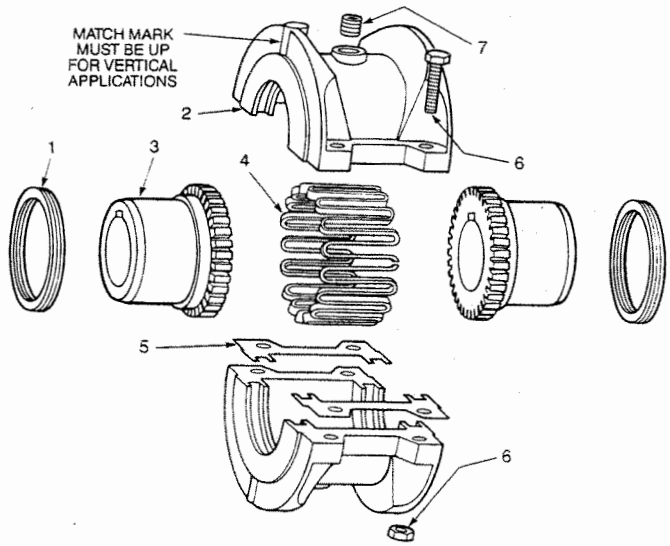
Parts are interchangeable between Sizes 20T and 1020T, 30T and 1030T, etc. except as noted.

GRIDS — Size 1020T thru 1140T Steelflex couplings use blue grids. Older models, 20T thru 140T, use orange grids.

CAUTION: Blue grids may be used in all applications, but DO NOT substitute orange grids for blue.

COVERS — ***CAUTION***: DO NOT mix cover halves of different designs. Sizes 1020T thru 1070T10 covers have been manufactured in several different two-rib designs and 80T thru 140T covers have been manufactured with two and three ribs.

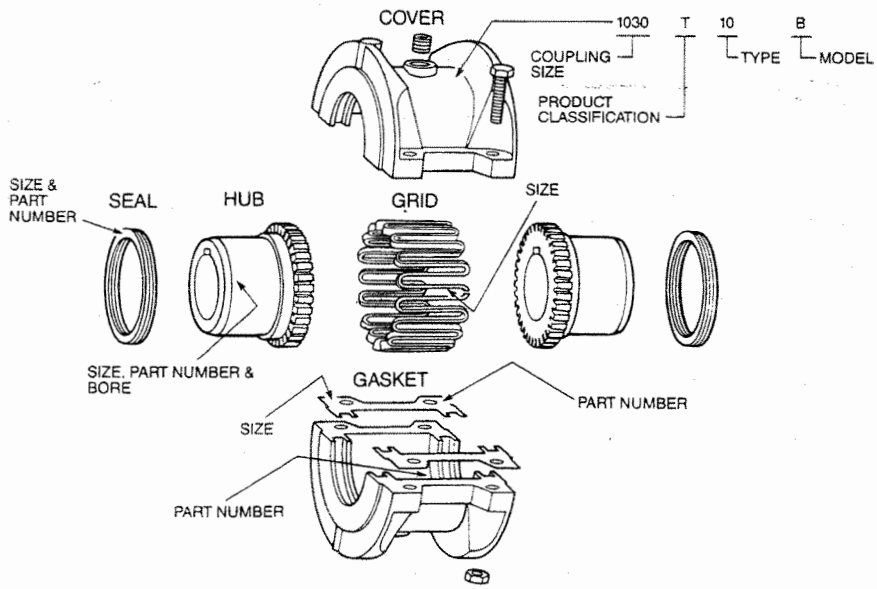
HARDWARE — Older style covers, Sizes 1020T10 thru 1070T10, utilized socket head cap screws with captured locknuts. The new style covers use hex head cap screws (either inch or metric) and unrestrained locknuts. Specify either inch series SOCKET head or inch or metric series HEX head cap screws when ordering replacement parts.



PART NUMBERS

1. Seal (T10)
2. Cover (T10)
3. Hub (Specify bore and keyway)
4. Grid
5. Gasket (T10)
6. Fasteners (T10) — Coupling may be supplied with one set each of inch series fasteners and metric fasteners.
7. Lube Plug

PART NUMBER LOCATION



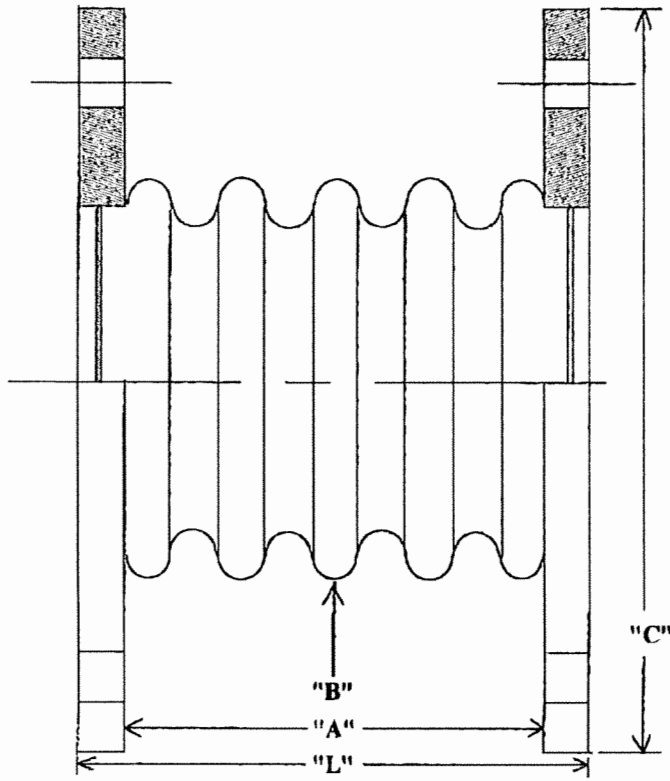
ORDER INFORMATION

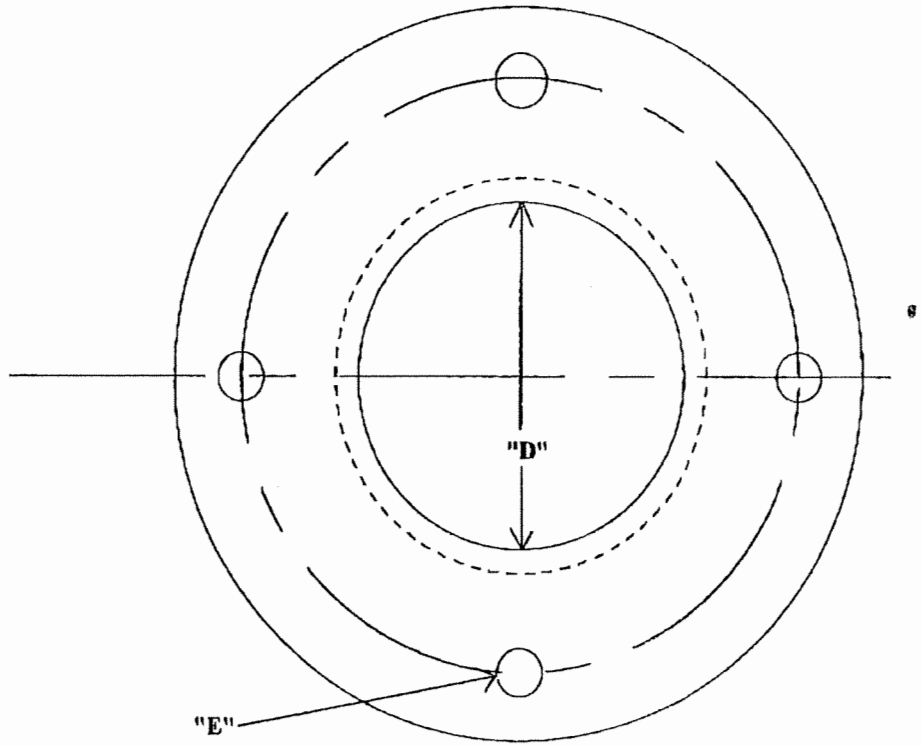
1. Identify part(s) required by name above.
2. Furnish the following information.

   EXAMPLE:
   Coupling Size: 1030
   Coupling Type: T10
   Model: B
   Bore: 1.375
   Keyway: .375 x .187
3. Price parts from Price List 422-110 and appropriate discount sheet.

The Falk Corp., subsidiary of Sundstrand Corp.
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-937-4284, Fax: 414-937-4359

02/07/03 FRI 10:26 FAX 7136761420 INDEPENDENT HOSE 002





QUANTITY - 1

MAX. WORKING PRESSURE - 75 PSI WORKING PRESSURE

"L" 6" OVERALL LENGTH

"E" 12 - 1-1/8" BOLT HOLES

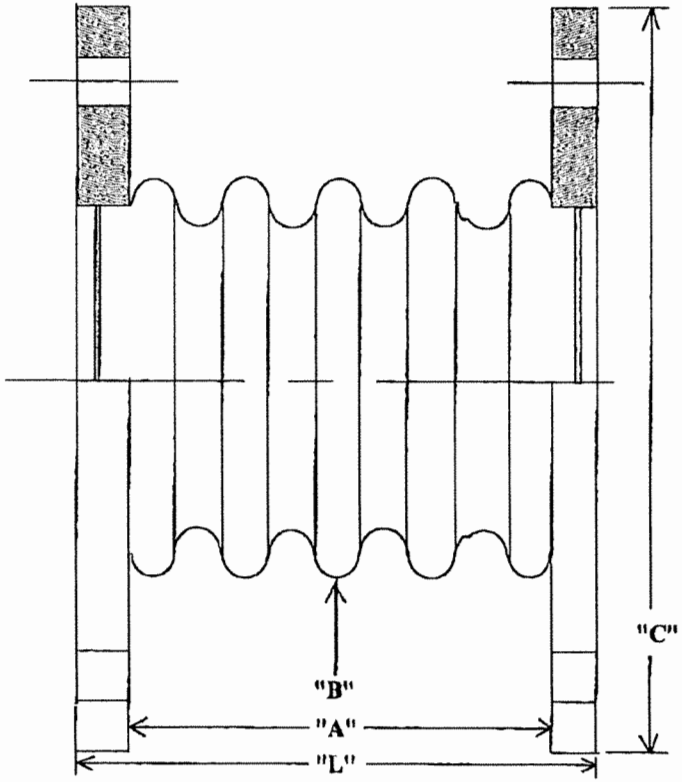
"D" 14" ID

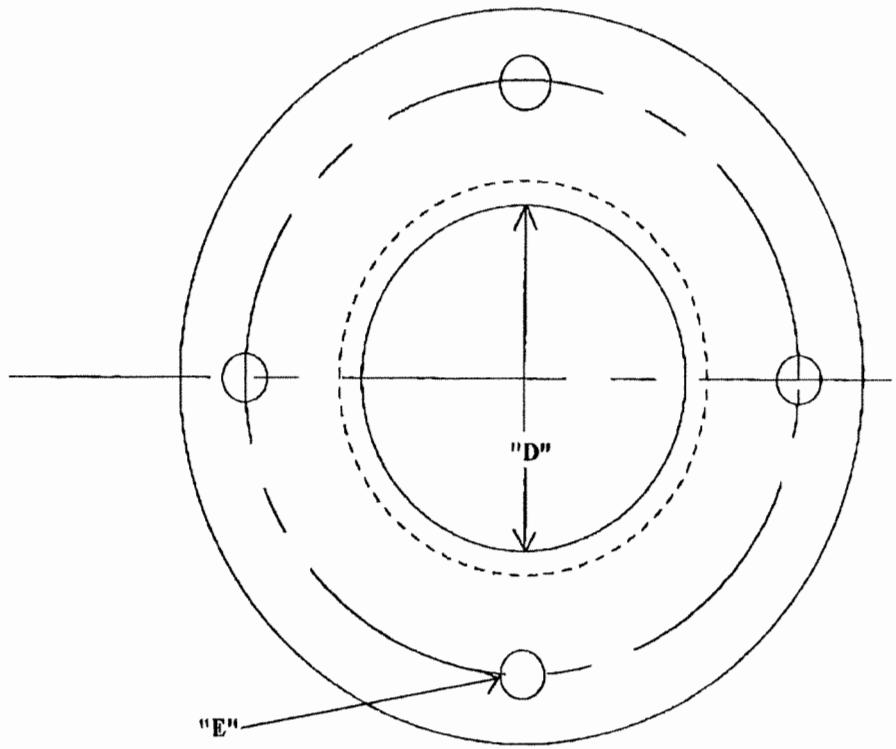
"C" 21"

"B" 14", 321SS, 75# WORKING PRESSURE BELLOWS

"A" 1/2" CARBON STEEL PLATE FLANGE

INDEPENDENT HOSE & EXP., JOINTS, INC.				
14" STAINLESS STEEL "HP" EXPANSION JOINT				
PURCHASE ORDER NO.		SCALE: NONE	DWN. BY: RES	
GARDNER - DENVER EPC				
DATE 2/7/03	CHK.BY:	APPVD. BY:	DRAWING NUMBER: 20703-2	REV. 0





QUANTITY - 1

MAX. WORKING PRESSURE - 75 PSI WORKING PRESSURE

"L" 6" OVERALL LENGTH

"E" 12 - 1" BOLT HOLES

"D" 12-3/4" ID

"C" 19"

"B" 12", 321SS, 75# WORKING PRESSURE BELLOWS

"A" 1/2" CARBON STEEL PLATE FLANGE

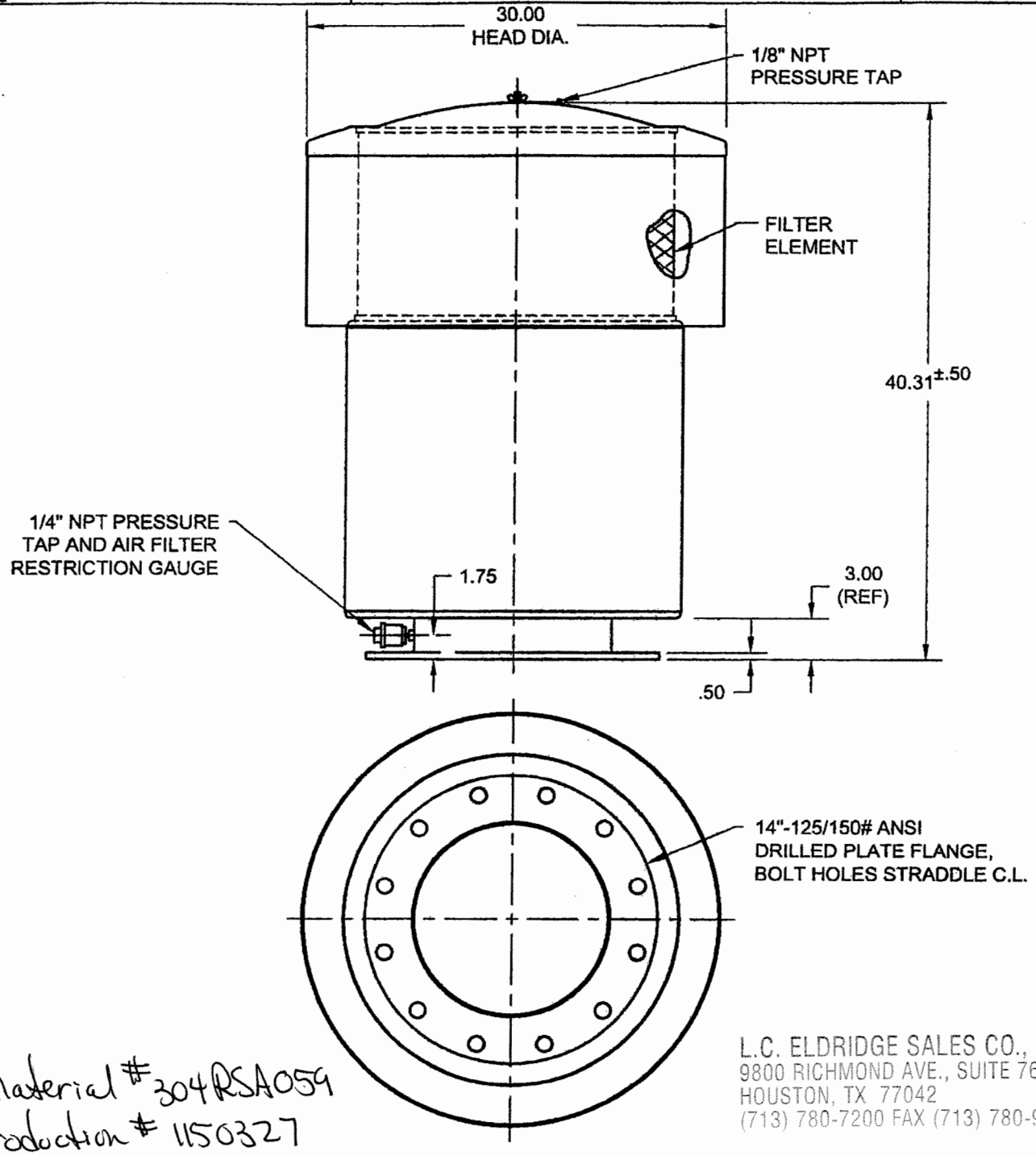
INDEPENDENT HOSE & EXP., JOINTS, INC.				
12" STAINLESS STEEL "HP" EXPANSION JOINT				
PURCHASE ORDER NO.			SCALE: NONE	DWN. BY: RES
GARDNER - DENVER EPC				
DATE 2/7/03	CHK.BY:	APPVD. BY:	DRAWING NUMBER: 20703-1	REV. 0

UNIVERSAL SILENCER
A FLEETGUARD/NELSON COMPANY
P.O. Box 411, Stoughton, Wisconsin 53589
608-873-4272 Fax 608-873-4298

SPECIAL CCS-14
INTAKE FILTER SILENCER

DATE	11-26-02
SHEET	1 OF 1
SCALE	NTS

NO.	REVISION	DRAWN	APP'D
1	REDRAWN ON AUTOCAD	MCM 11-26-02	CB 11-26-02



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Material # 304RSA059
Production # 1150327

L.C. ELDRIDGE SALES CO., INC.
9800 RICHMOND AVE., SUITE 760
HOUSTON, TX 77042
(713) 780-7200 FAX (713) 780-9324

DIMENSIONAL DRAWING NO. 34-214-AK

FILTER ELEMENTS INCLUDED (APPLIED ONLY TO ORDER FOR WHICH DRAWING IS CERTIFIED)			
FILTER TYPE AND PART NUMBER	SINGLE STAGE	DUAL STAGE	
		PRE-FILTER	FINAL FILTER
CC-16P (PAPER) 81-1164	1		

DIMENSIONS CERTIFIED FOR:

GARDNER DENVER
P.O. NO: 315471
U.S. S.O. NO: 140528
BY Linda Rigdon/BO
DATE 12/04/02

REV.	APPROX WT	145	MATERIAL	STEEL	DRAWN	MCM	DIMENSIONAL DRAWING NO.	REV.
1	FINISH	88-1085 BLUE ENAMEL			CHECK	CB 11-27-02	34-214-AK	1

UNIVERSAL SILENCER
A FLEETGUARD/NELSON COMPANY
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608-873-4272 Fax 608-873-4298

Installation, Operation and Maintenance Instructions for CF, CCF, CS & CCS Series Filter Silencers

Description

The CS and CCS series of combination filter silencers is a reactive design that includes a cartridge filter element. The CF and CCF series provide filtration only. They provide effective filtration and, for the CS, CCS versions, moderate noise reduction for a wide range of operating conditions. The standard unit of this series is designed for applications where the temperature does not exceed 225°F, the pressure does not exceed 10 psig and/or vacuum does not exceed 10"Hg. There are no moving parts in the operation of the filter silencer units.

Receiving Inspection

- Upon receipt of the unit, check the nameplate against the packing list to verify the correct part numbers are received.
- Keep the shipping container to protect the unit until installation.
- Prior to unpacking check for shipping damage.
- Advise Universal Silencer of shipping damage within three days.

Storage

- Leave any cardboard boxing, plywood covering, crating, and/or plastic covering intact until ready to install.
- Be sure that all openings are closed so that no debris, vermin, rain, snow and/or ice can get into unit.
- Store unit on blocks, a minimum of 4" high so that air can freely circulate around unit.
- Do not store in contact with the ground or in a wet or flooded area.
- Indoor ambient temperature storage is essential as these units contain filtration media. If this is not possible, keep the unit covered and protected from the weather.
- Clean unit prior to installation. Remove any minor corrosion and refinish per paint manufacturer's recommendations. If major corrosion has occurred such that the integrity of the unit is in question, contact Universal Silencer.

Mounting and alignment

- Insure that the necessary equipment to install the unit, including anchor and/or support bolts, flange bolts, and expansion joints, are available before beginning installation.
- Anchor and/or support bolting and grouting is not included with the unit.
- Place the unit on a level, structurally adequate support. These units are often supported by their outlet flange. Insure that the supporting duct or piping is properly designed and does not induce vibrations into the unit.

+ ***IMPORTANT:*** The unit is not designed to serve as a support for any piping, additional mounting pads or loads on the inlet or outlet other than those stated in the Universal Silencer drawing or product bulletin.

- Use thread lubricant on all bolted joints.
- Use all gaskets provided with the unit.
- If you replace or add bolts or gaskets, use the same size and material as the originals.
- Ensure that the unit is firmly mounted immediately prior to startup of the equipment, and again 24 hours after startup to verify that supports and/or flange bolts have not vibrated loose from the supporting surface.

Inspection and maintenance

- Components are either complete weldments or permanently assembled having no replaceable parts except for filter elements.
- Cartridge filter elements are the only replaceable part.
- Periodically inspect paint finish for damage or deterioration. **NOTE**: Minor localized damage may be touched up using touch-up paint. Areas with extensive damage or deterioration may require spot blasting and recoating. Consult paint manufacturer's recommendations.
- Examine connecting flanges and support/ anchor bolting at least annually. Retighten loose nuts as required.

Safety Issues

- If performing any work internal to the filter silencer or adjacent components, ensure that all confined space requirements are met and that all tools and other materials are removed once work is completed.

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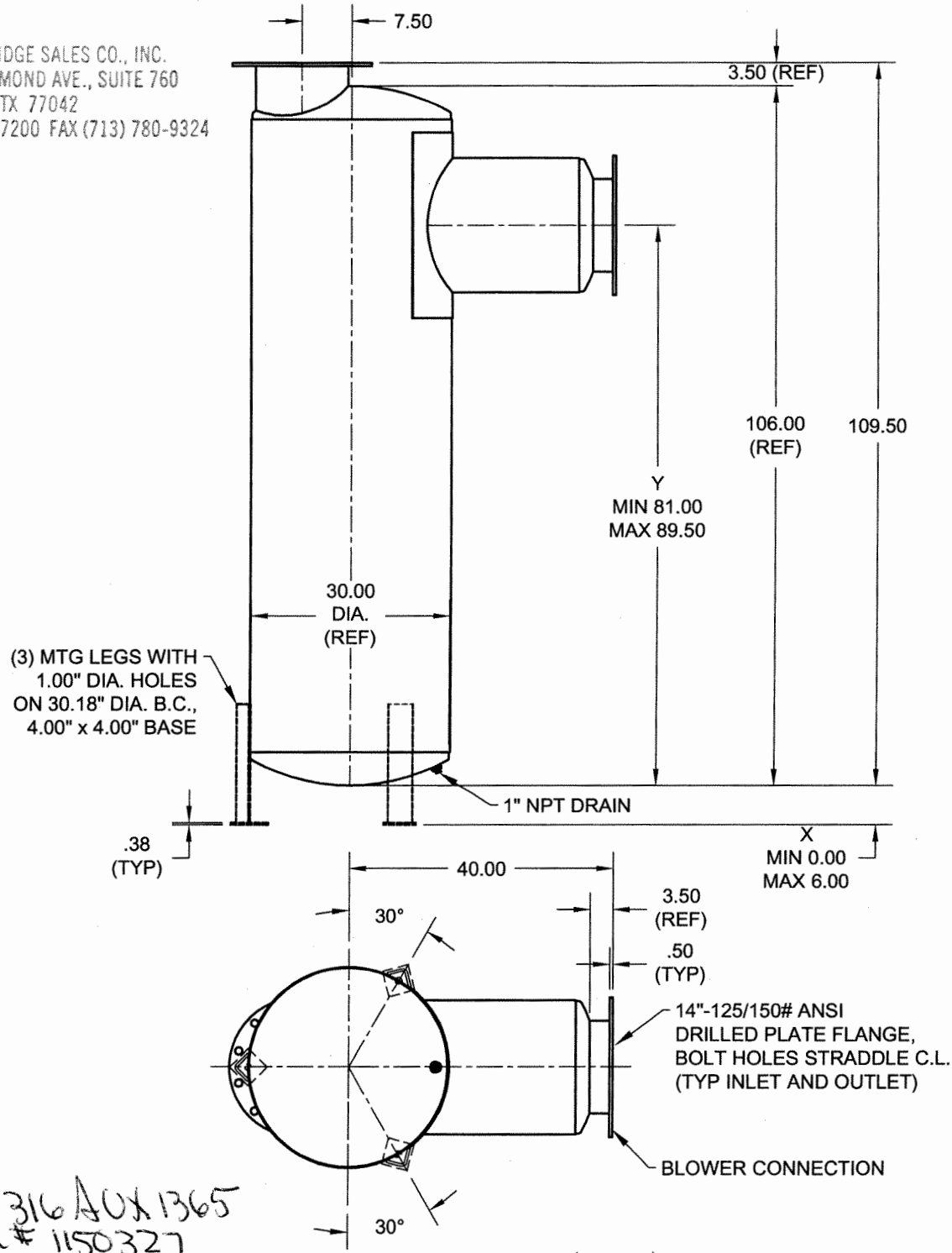
STANDARD RISH-14 INLET SILENCER

DATE 07-12-02
SHEET OF
SCALE NTS

NO.	REVISION	DRAWN	APP'D
4	REDRAWN ON AUTOCAD.	DY 07-12-02	CB 07-15-02

L. C. ELDRIDGE SALES CO., INC.
9800 RICHMOND AVE., SUITE 760
HOUSTON, TX 77042
(713) 780-7200 FAX (713) 780-9324



Material # 316 AUX 1365
Production # 1150327

DIMENSIONAL DRAWING NO. 54-314-AA

MOUNTING LEGS
YES [X]
NO [ ]
X DIM= 6"
Y DIM= 89.5"
X+Y DIM= 95.5"

DIMENSIONS CERTIFIED FOR: Gardner Denver EPC
P.O. NO: 315566
U.S. S.O. NO: 138502
BY Todd Mott 2/13/03

REV.	APPROX WT	MATERIAL	DRAWN	DIMENSIONAL DRAWING NO.	REV.
4	895 LBS.	STEEL	DY	54-314-AA	4
	FINISH 88-0102 SHOP COAT PRIMER		CHECK CB 07-15-02		

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STANDARD RISY/SDY-12 BLOWER SILENCER

DATE 5-7-02
SHEET OF
SCALE NTS

NO.	REVISION	DRAWN	APP'D
1	REDRAWN & UPDATED	BGL 5-7-02	CB 5-9-02

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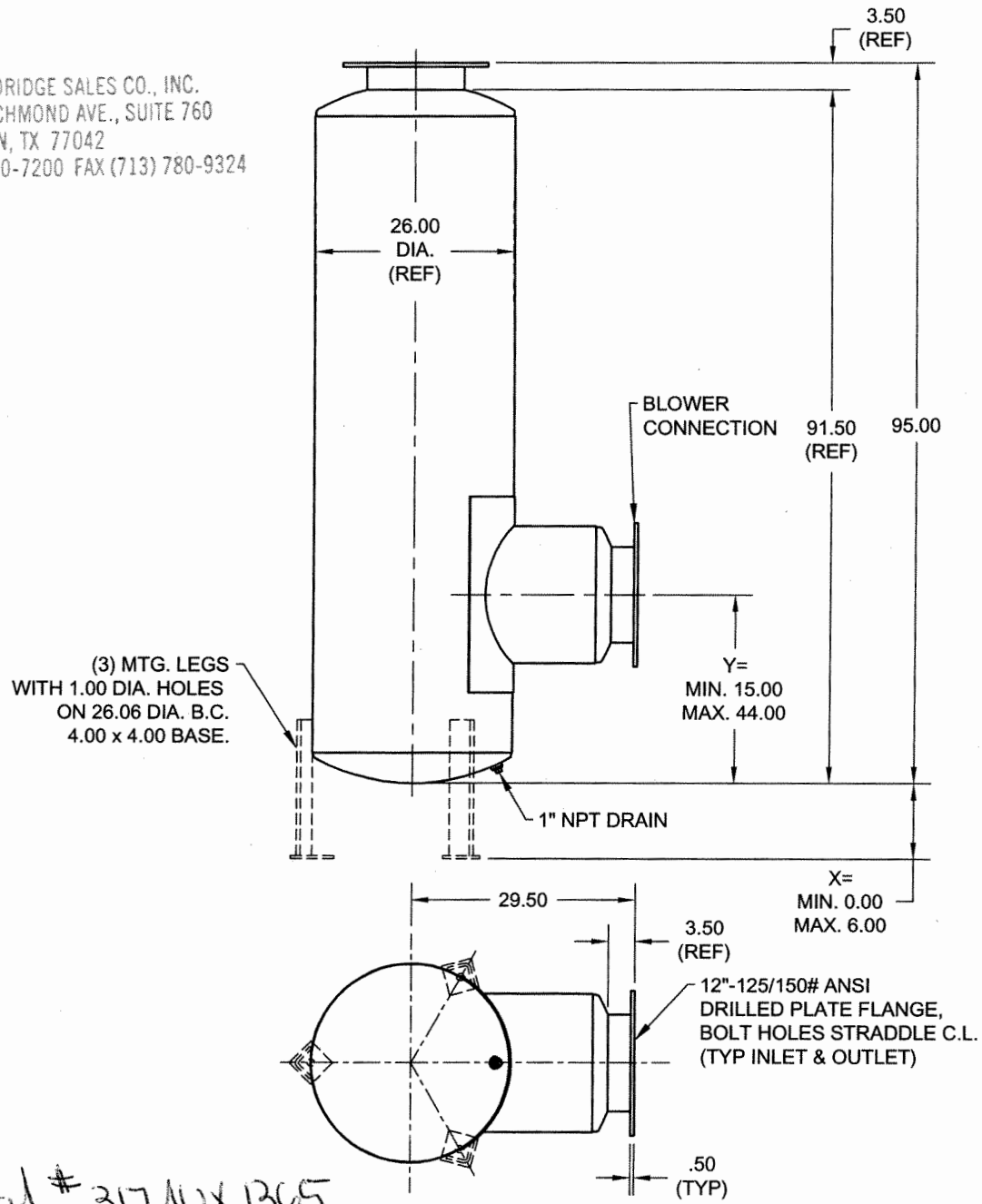

Material # 317AUX1365
Production # 1150327

DIMENSIONAL DRAWING NO. 54-212-AA

MOUNTING LEGS
YES [X]
NO [ ]
X DIM= 2.5"
Y DIM= 15"
X+Y DIM= 17.5"

DIMENSIONS CERTIFIED FOR: Gardner Denver EPC
P.O. NO: 315566
U.S. S.O. NO: 138502
BY Fred Matt 2/13/03

REV.	APPROX WT	MATERIAL	DRAWN	DIMENSIONAL DRAWING NO.	REV.
9	535 LBS.	STEEL	BGL	54-212-AA	9
	FINISH 88-0102 SHOP COAT PRIMER		CHECK CB 5-9-02		

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A FLEETGUARD/NELSON COMPANY
P. O. Box 411, Stoughton, Wisconsin 53589
608-873-4272 Fax 608-873-4298

Installation, Operation and Maintenance Instructions for RIS/SD Series Blower Silencers

Description

The RIS/SD series of blower intake and discharge silencers is a combination reactive and absorptive design that is suitable for most rotary positive displacement blower applications. It provides effective pulsation control and noise reduction for a wide range of operating conditions. The standard unit of this series is designed for applications where the temperature does not exceed 325°F, the pressure does not exceed 15 psig and/or vacuum does not exceed 15"Hg. There are no moving parts in the operation of the blower silencer units.

Receiving Inspection

- Upon receipt of the unit , check the nameplate against the packing list to verify the correct part numbers are received.
- Keep the shipping container to protect the unit until installation.
- Prior to unpacking check for shipping damage.
- Advise Universal Silencer of shipping damage within three days.

Storage

- Leave any cardboard boxing, plywood covering, crating, and/or plastic covering intact until ready to install.
- Be sure that all openings are closed so that no debris, vermin, rain, snow and/or ice can get into unit.
- Store unit on blocks, a minimum of 4" high so that air can freely circulate around unit.
- Do not store in contact with the ground or in a wet or flooded area.
- Indoor ambient temperature storage is preferable, especially for a unit with internal absorptive material. If this is not possible, keep the unit covered and protected from the weather.
- Clean unit prior to installation. Remove any minor corrosion and refinish per paint manufacturer's recommendations. If major corrosion has occurred such that the integrity of the unit is in question, contact Universal Silencer.

Mounting and alignment

- Insure that the necessary equipment to install the unit, including anchor and/or support bolts, flange bolts, and expansion joints, are available before beginning.
- Anchor and/or support bolting and grouting is not included with the unit.
- Place the unit on a level, structurally adequate surface.

+ ***IMPORTANT***: The unit is not designed to serve as a support for any piping, additional mounting pads or additional loads on the inlet or outlet other than those stated in the Universal Silencer drawing or product bulletin.

- Align the unit with the blower and piping connections.
- Mount the unit securely to the foundation.
- To reduce the likelihood of vibration induced damage to the unit we recommend that you install a suitable expansion joint between the unit and the blower.
- Use thread lubricant on all bolted joints.
- Use all gaskets provided with the unit.
- If you replace or add bolts or gaskets, use the same size and material as the originals.
- Ensure that the unit is firmly mounted immediately prior to startup of the equipment, and again 24 hours after startup to verify that the unit has not vibrated loose from the foundation.

Inspection and maintenance

- Components are either complete weldments or permanently assembled having no replaceable parts.
- Spare parts are not required.
- Periodically inspect paint finish for damage or deterioration. **NOTE**: Minor localized damage, such as scratches, may be repaired using touch-up paint. Areas with extensive damage or deterioration may require spot blasting and recoating. Consult paint manufacturer's recommendations.
- Examine connecting flanges and support/ anchor bolting at least annually. Retighten loose nuts as required.

Safety Issues

- ***CAUTION*** - All personnel working near high-temperature blower components during operation and cool down period should use care to prevent injury due to contact with high temperature surfaces.
- If performing any work internal to the silencer or adjacent components, ensure that all confined space requirements are met and that all tools and other materials are removed once work is completed.

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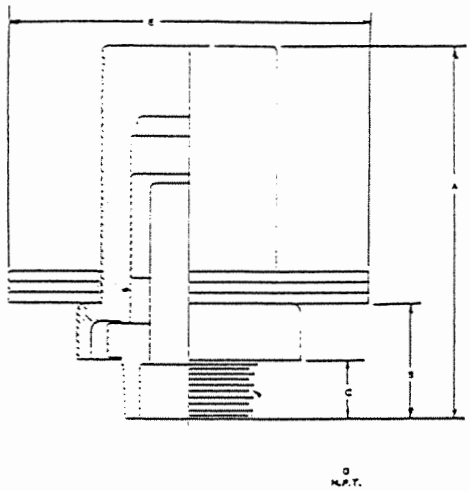
WEIGHT LOADED PRESSURE RELIEF VALVES

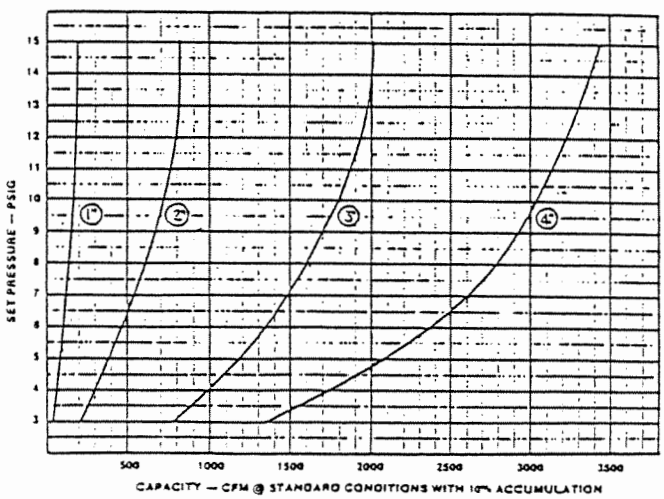
THREADED CONNECTION – 1", 2", 3" AND 4"



DIMENSION CHART

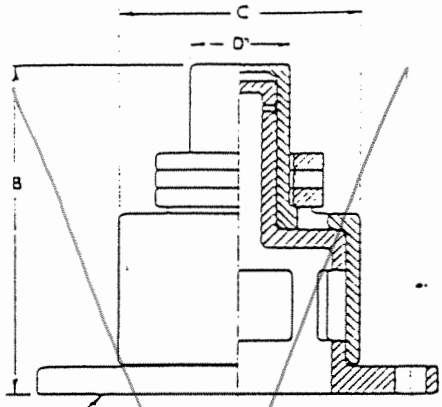
VALVE SIZE	A	B	C	D	E
1 INCH	6-13/16	2-1/16	1-7/16	1" N.P.T.	3-1/2
2 INCH	7-1/8	2-3/8	1-5/16	2" N.P.T.	6-13/16
3 INCH	9-7/8	3-1/16	1-9/16	3" N.P.T.	9-1/4
4 INCH	11-3/8	3-7/16	1-11/16	4" N.P.T.	11-11/16

CAPACITY CHART



NOTE: Valves not recommended to relieve at set pressures under 3 psig.

FLANGED CONNECTION – 6" AND 8"

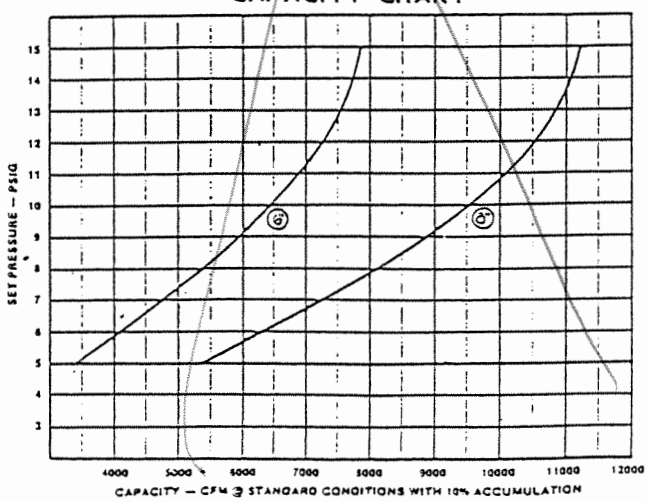


A. MOUNTING FLANGE, ASA 125# DRILLING
USE ONLY FULL FLANGE GASKET.

DIMENSION CHART

VALVE SIZE	DIMENSIONS — INCHES			
	A	B	C	D
6 INCH	6	9-5/8	6-1/2	2-5/8
8 INCH	8	11-1/4	9-1/4	2-3/4

CAPACITY CHART



NOTE: Valves not recommended to relieve at set pressures under 5 psig.

All prices subject to change without notice.
All prices are F.O.B. shipping point.

F	No.	SB-5-330
	Eff.	1-13-89
	Sup.	90910-D

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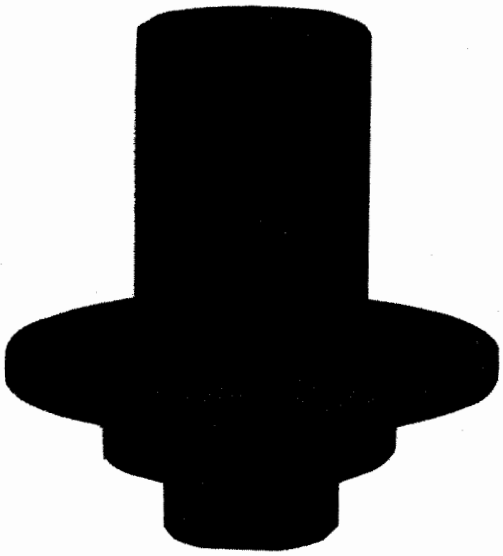
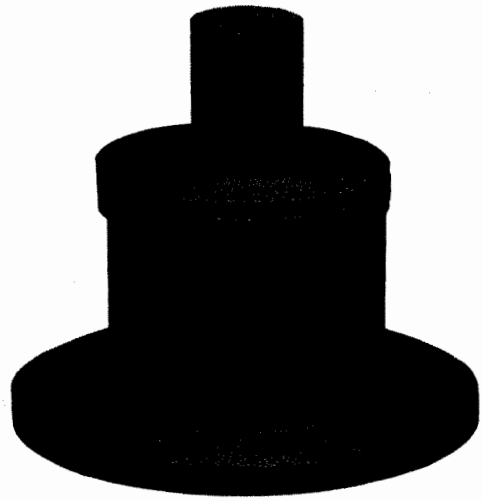
Data Sheet SB-5-415
July 31, 1989
Supersedes 90912-B
Dated 10-25-69

SUTORBILT® WEIGHT LOADED PRESSURE RELIEF VALVES

THREADED – 1" thru 4"



FLANGED 125# ANSI – 6" and 8"



The SUTORBILT® weight loaded pressure relief valve offers inexpensive relief capacity in a sturdy, trouble free design in 1" through 8" sizes.

Sizes 1" through 4" have standard male threaded connections. Sizes 6" and 8" have standard 125# ANSI flange drillings.

Removable weights have been carefully designed to permit accurate pressure settings in 1/2 PSI increments in the 1" through 4" size and 1/2 and 1 PSI increments in 6" and 8" size.

The operation of the relief valve is simple. As the service line air pressure reaches the pressure setting, the weight loaded cap is forced upwards off the valve seat. As pressure increases, the cap rises to expose the discharge ports. The flow-through capacity of the valve is such that no damage can be caused to the blower or related systems.

The valve automatically reseats itself as line pressure is reduced.

Since the opening and closing of the valve is essentially the sliding of a piston in a cylinder, the valve is virtually chatter-free.

The body and cap of the valve are made of cast iron with close tolerance machined surfaces in the operating areas. The weights are cut from uniform steel plate or uniformly cast to give accurate pressure adjustment.

Application of light oil to the mating surfaces of the cap and body periodically is all the maintenance required on this valve.

The SUTORBILT weight loaded relief valve was engineered to provide long life and dependable protection for your SUTORBILT blower and associated systems by its simplicity of design. Weight loaded pressure relief valves are designed to protect the blower against damage caused by operation at greater than design pressure or vacuum. **However, they are not intended as pressure regulators.**

For proper operation, the valve must be mounted in exact upright position.

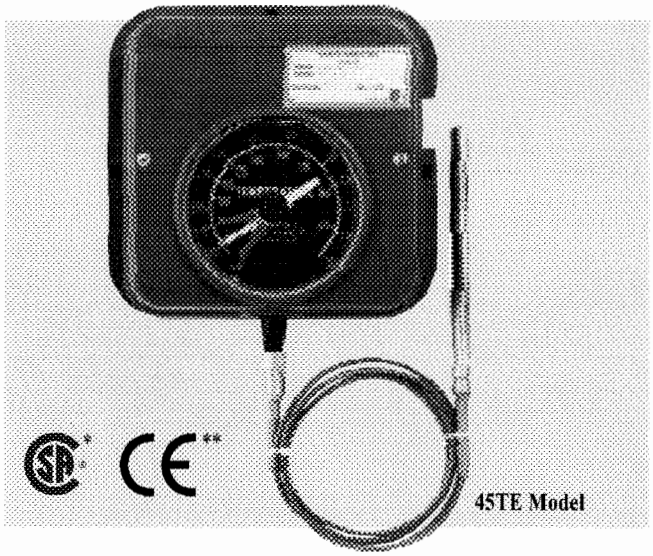
Use only FULL FLANGE gasket.

GD PURCH SPEC # 300AUX1451

4.5 in. (114 mm) Dial Temperature SWICHGAGE®

SPL/45-94117B
Revised 04-02
Catalog Section 10
(00-02-0044)

FW Murphy



SPL and 45TE Series

- Combination Indicating Gage and Critical Temperature Limit Switches
- High and Low Temperature Limit Contacts Are Visible and Adjustable
- SPDT Snap-Acting Models
- Panel and Wall Mount Versions
- Latching Control Relay Versions Available

Description

The 4-1/2 in. (114 mm) dial size SWICHGAGE® is a mechanical gage for temperature indication. It includes adjustable, electrical contacts that can be used for start and stop, to trip alarms and to shut down equipment.

Ranges are available from -60° to 60°F (-51° to 16°C) thru 260° to 450°F (127° to 232°C).

Basic Operation

This vapor actuated gage features a sealed capillary tube and sensing bulb. When subjected to heat, the liquid in the sensing bulb expands to vapor creating pressure against a bourdon tube mechanism. The bourdon tube translates this vapor pressure into a mechanical gage reading.

For models SPLC and SPLFC, the gage pointer acts as a pressure indicator and as one switch pole which completes a circuit when it touches the adjustable limit contacts. Contacts have self-cleaning motion to ensure electrical continuity.

A toggle switch is provided on SPLC models to override the low contact for equipment start-up.

Models 45TE and 45TEF have internal snap-acting SPDT switches.

Applications

Typical applications include:

- Gas Compressors
- Engine Coolant Temperature
- Process Temperature
- Heaters and Coolers
- Water Pump Temperature

Specifications

Dial: White on black, dual scale, °F and °C standard, 4-1/2 in. (114 mm) diameter.

Case: Die cast aluminum, surface or panel mount.

Capillary: PVC armored copper tube, 5 ft. long (1.5 m.) standard–see options next page.

Sensing Bulb: Copper bulb: *1/2 in. (13 mm) OD*; Length: *7 in. (178 mm). Minimum bulb insertion–see corresponding chart, on page 2.* Pressure Rating: *600 psi (4.1 MPa) [41 bar].* Connection: *1/2 NPT compression fitting.*

Overrange: Do not exceed 10% above full range.

Limit Contacts (SPLC and SPLFC): 1-SPDT, Center off; pilot-duty; 2 A @ 30 V; 1 A @ 125 VAC. Contacts are gold plated silver.

Snap-Acting Switches (45TE and 45TEF): 2-SPDT; 2 A @ 250 VAC.

Dry Relay Contact ("BP" Models): 10 A @ 28 VDC or 10 A @ 120 VAC.

Wire Connections:
Surface mount models: *1/2 NPT conduit and terminal block.*
Panel mount models: *Wire leads, 18 AWG (1.0 mm²) x 9 in. (229 mm) long.*
"OS" models: *1/2 NPT conduit and wire leads, 18 AWG (1.0 mm²) x 9 in. (229 mm) long.*

Item Weight: 8 lb. (3.6 kg) approximately. Explosion-proof models: 22 lb. (10 kg) approx.

Item Dimensions: 16 x 11 x 5-1/2 in. (406 x 279 x 140 mm).
Explosion-proof models: *12 x 12 x 9 in. (305 x 305 x 229 mm).*

Basic Models

SPLC Series SWICHGAGE®
Surface mount version of the SWICHGAGE®. For these models the gage pointer makes with two adjustable contacts to complete a pilot duty circuit.

SPLFC Series SWICHGAGE®
Panel-mounting (round case) version of the SPLC.

SPLBP Latching Control Relay SWICHGAGE®
This version of the SPLC Series is designed to start and to stop electric motor driven equipment. The pilot duty contacts of the SPLBP are connected to a latching control relay for automatic ON/ OFF control, either directly or through a motor starter.

45TE Series Snap-Acting SWICHGAGE®
Surface mount version of the SWICHGAGE®. These models offer internal snap-acting SPDT switches, instead of the single pole contacts.

45TEF Series SWICHGAGE®
This is the panel mounting (round case) version of the 45TE series.

45TEBP Snap-Acting and Latching Control Relay SWICHGAGE®
Same as 45TE–includes an internal latching control relay for automatic ON/OFF control either directly or through a motor starter.

Murphy offers square case configurations altered to fit round panel openings, see "Dimensions", next page.

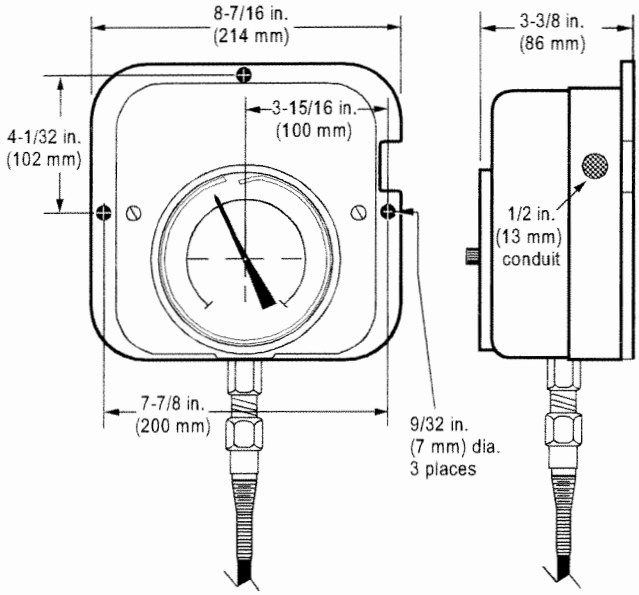
***Selected configurations are third party listed. Call Murphy for details.**

****Products covered by this bulletin comply with EMC Council directive 89/336/EEC regarding electromagnetic compatibility except as noted.**

murphy®

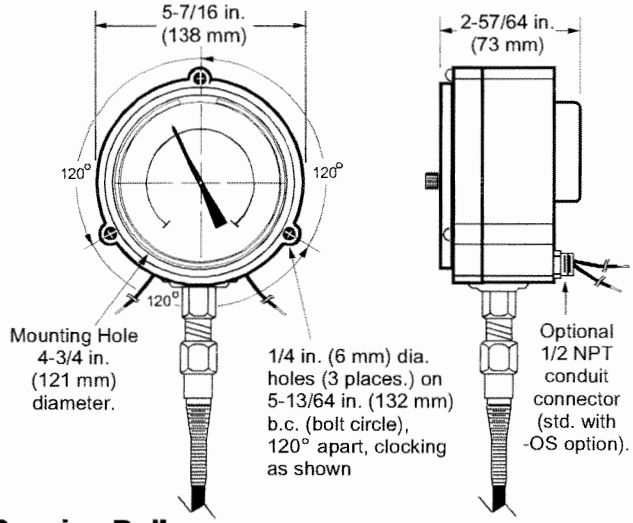
Dimensions

Surface Mount Models*

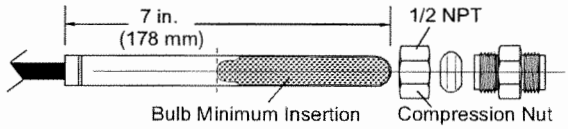


* **SPLCE, SPLBPE, 45TEE and 45TEBPE** versions feature square case, but altered to fit standard round panel mounting–not pictured.

Panel Mount Models



Sensing Bulb



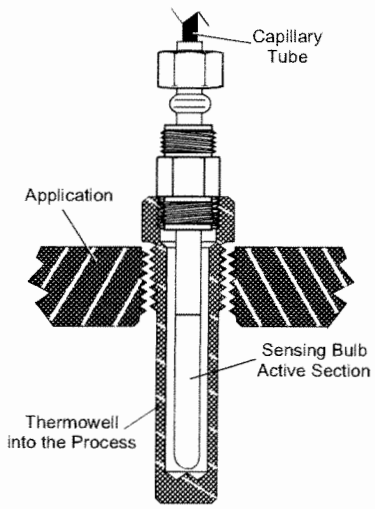
Ranges and Accuracy — Sensing Bulb Insertion

Temperature Ranges Available (dual scale dials)		Accuracy (SPL and 45 Series Models)			Minimum Sensing Bulb
Fahrenheit	Celsius	Lower 1/4	Middle 1/2	Upper 1/4	Insertion into Process
-40° to 136°F	-40° to 58°C	±4°F/±2°C	±2°F/±1°C	±2°F/±1°C	5 in. (127 mm)
15° to 250°F	9° to 121°C	±8°F/±4°C	±2°F/±1°C	±2°F/±1°C	5 in. (127 mm)
130° to 350°F	60° to 180°C	±8°F/±4°C	±2°F/±1°C	±3°F/±1.5°C	2-1/2 in. (64 mm)
260° to 450°F	127° to 232°C	±8°F/±4°C	±2°F/±1°C	±3°F/±1.5°C	2-1/2 in. (64 mm)

Using a Thermowell

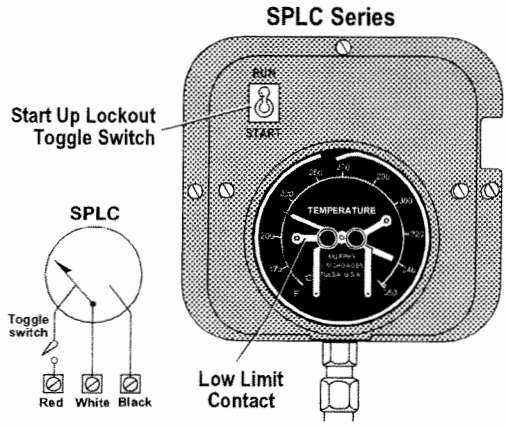
Installing a thermowell is recommended for high pressure applications or corrosive environments. It also allows sensing bulbs to be changed or adjusted without opening the connection to process. Murphy offer thermowells for a variety of applications.

For details see Murphy bulletin T-9003B.



Start-Up Lockout

The SPLC SWICHGAGE® low limit contact can be bypassed for equipment start up. A toggle switch is provided for this purpose. The toggle switch must be manually reset when temperature rises above the low limit.

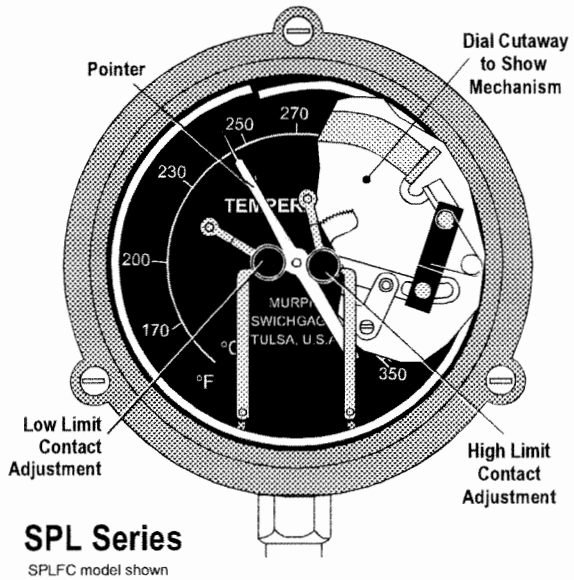


How the SPL Works

SPLC and SPLFC SWICHGAGE® temperature indicator gages include 2 pilot duty, pointer-type limit contacts (one for high and one for low) that can be used for alarm and/or shutdown. The SPLC and SPLFC models will complete a circuit when the gage pointer and either limit contact meet. This provides an electrical signal to alert the operator of critical temperature conditions or, when required, to shut-down the equipment.

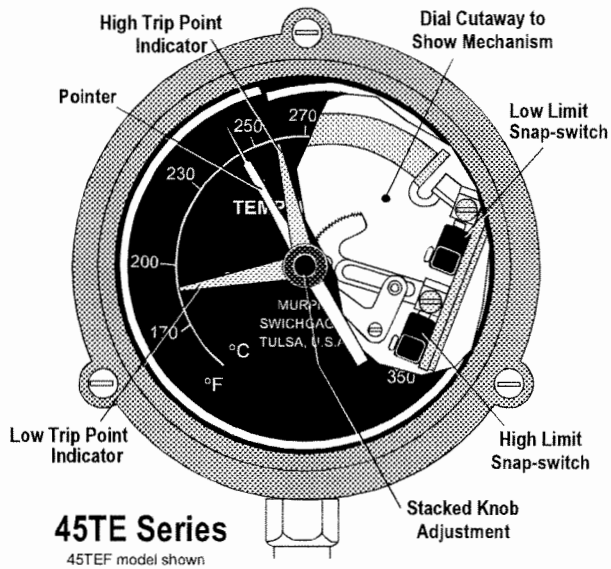
Both limit contacts (high and low) are field adjustable by simply turning the fingertip type knob to the desired point on the scale dial.

The graphic below shows details of a typical SPLFC SWICHGAGE® model.



How the 45TE Works

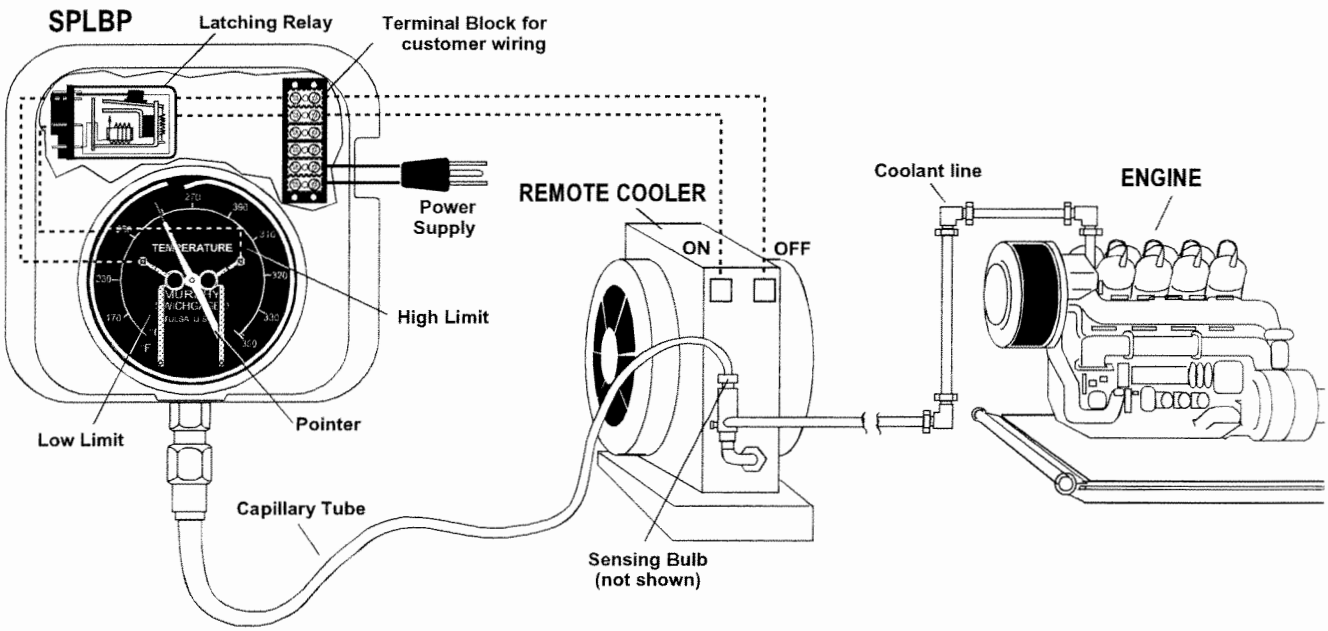
The 45TE series SWICHGAGE® incorporates 2 SPDT snap-switches instead of the pointer-type contacts of the SPL. Unlike the SPL that completes an electrical circuit as soon as the pointer touches the contact, the 45TE trip point indicators will stop the pointer movement slightly before the switches operate. As temperature continues to increase (reaching high set point) or to decrease (reaching low set point), the electrical circuit is then made. It provides the ability to set the trip point exactly with the indicator needle—no guessing or equipment calibration is needed as on blind switches. The 45TE trip points (high and low) can be easily set using its stacked knob adjustment. See the schematic below for details.



(BP) Latch Relay Contact Models

Primarily designed to maintain a specific temperature range by turning ON or OFF heaters or coolers having 125 VAC circuitry, the SPLBP and 45TEBP SWICHGAGE® models are applicable to a variety of situations where temperatures are variable and controlling factors. As the pointer touches a preset high or low limit contact/snap-switch, the magnetic latching relay sets or resets to latch a heater or cooler ON or OFF. The relay unlatches, (resets) when the opposite contact operates. Pictured below is a typical application.

For applications with higher voltages, a Murphy TR assembly can be used in conjunction with any 4-1/2 in. (114 mm) dial SWICHGAGE®.



How to Order

Specify model number. **NOTE:** No designator is required for **Standard** configurations.
Also, list options in alphabetical order (A to Z). Place a dash (–) between each option. See example below.

SPLBP – 4 – 350 G 10 – EX

Base Model

SPLC	45TE
SPLCE	45TEE
SPLFC	45TEF
SPLBP*	45TEBP*
SPLBPE*	45TEBPE*

*This version not covered by CE mark.

Latching Control Relay Voltage (applies to "BP" models only)
Blank = 120 VAC
2 = 12 VDC
3 = 24 VAC
4 = 24 VDC

Range
136 = -40 to 136°F
250 = 15 to 250°F
350 = 130 to 350°F
450 = 260 to 450°F

Armor / Capillary / Bulb
P = PVC / Copper / Copper
G = Galvanized / Copper / Copper
S = Stainless steel / Stainless steel / Stainless Steel

Capillary Length

Specify in feet:	*Specify in metres:*
05 = 5 feet	**1.5M** = 1-1/2 metres
10 = 10 feet	**2M** = 2 metres
Etc.	**Etc.**

5 ft. increments available to 30 ft., thereafter 10 ft. increments only. Some ranges are not available over 50 ft.

15 FT

Options
NOTE: Verify option availability. Not all options can be provided for every model.

- **BC** = Capillary tubing exits from back of case
- **ES** = Environmentally sealed for isolation from the elements
- **EX** = Explosion-proof; SWICHGAGE* enclosed within explosion proof case; Class I, Division 1, Groups C & D
- **EL** = (EXLC) Explosion-proof less case; internal gage mechanism only–without case
- **LC** = Less case; SWICHGAGE* mechanism and hardware connections–without case
- **OS** = Liquid filled case for resistance against corrosion, environment, vibration and electrical arc
- **TA** = (TCA) Tickler contact; includes 1 auxiliary contact (tickler) and 2 limit contacts (all-face-adjustable-SPL series)

Warranty

A two-year limited warranty on materials and workmanship is given with this Murphy product. Details are available on request and are packed with each unit.

Find us on the internet: → http://www.fwmurphy.com

murphy
FW**Murphy**
P.O. Box 470248
Tulsa, Oklahoma 74147 USA
(918) 317-4100
fax (918) 317-4266
e-mail sales@fwmurphy.com
www.fwmurphy.com

CONTROL SYSTEMS & SERVICES DIVISION
P.O. Box 1819; Rosenberg, Texas 77471; USA
(281) 342-0297 **fax** (281) 341-6006
e-mail sales@fwmurphy.com

MURPHY DE MEXICO, S.A. DE C.V.
Blvd. Antonio Rocha Cordero 300, Fracción del Aguaje
San Luis Potosí, S.L.P.; México 78384
+52-444-8206264 **fax** +52-444-8206336
e-mail ventas@murphymex.com.mx
www.murphymex.com.mx

FRANK W. MURPHY, LTD.
Church Rd.; Laverstock, Salisbury SP1 1QZ; U.K.
+44 1722 410055 **fax** +44 1722 410088
e-mail sales@fwmurphy.co.uk
www.fwmurphy.co.uk

MURPHY SWITCH OF CALIFORNIA
41343 12th Street West
Palmdale, California 93551-1442; USA
(661) 272-4700 **fax** (661) 947-7570
e-mail sales@murphyswitch.com
www.murphyswitch.com

MACQUARRIE CORPORATION
1620 Hume Highway
Campbellfield, Vic 3061; Australia
+61 3 9358-5555 **fax** +61 3 9358-5558
e-mail murphy@macquarrie.com.au

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SPL-92106N
Revised 07-95
Section 10

Installation for 4-1/2 in. (114 mm) dial Temperature MURPHYGAGE® and SWICHGAGE®

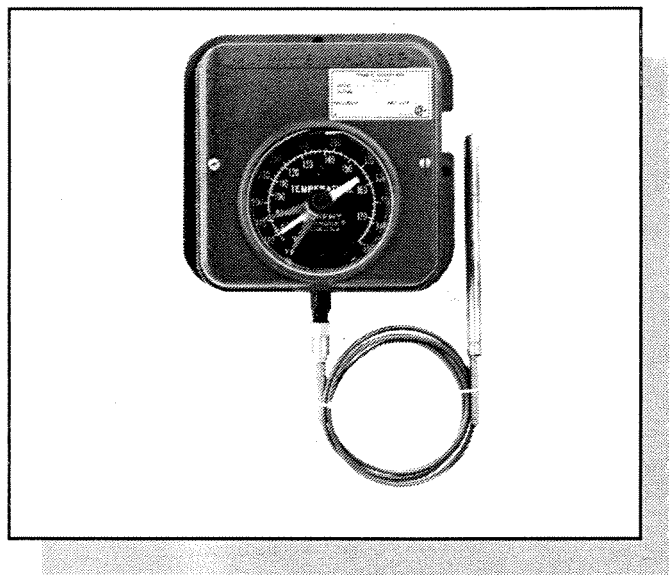
Model Series: SPLG, SPLC, SPLBP, 45TE and 45TEBP
Options: -OS and -ES

Please read the following instructions before installing. A visual inspection is recommended before mounting. General Information and these installation instructions are intended for all 4-1/2 in. (114 mm) dial temperature models.

GENERAL INFORMATION

WARNING

BEFORE BEGINNING INSTALLATION OF THIS MURPHY PRODUCT
- ✔ Disconnect all electrical power to the machine.
- ✔ Make sure the machine cannot operate during installation.
- ✔ Follow all safety warnings of the machine manufacturer.
- ✔ Read and follow all installation instructions.



SPLC and SPLFC SWICHGAGE® instruments have high and low limit contacts to monitor, alarm or shutdown. The SPLC has a flanged case. SPLFC has a flush mount case intended for installation within a panel. A method to override the low limit contact for startup is provided on most models (see Operation Test Instructions on page 3).

SPLG and SPLFG MURPHYGAGE® instruments are indication only temperature gages. Same as SPLC, SPLFC except without switch contacts.

45TE and 45TEF Series are versions of the SPL Series with 2-snap acting SPDT switches instead of the pointer type contacts. The 45TE Series does not include low contact lockout.

SPLBP and 45TEBP models are designed to start and stop electric motor driven equipment. The pilot duty contacts are connected to a latching control relay for automatic ON/OFF control, either directly or through a motor starter.

Options -OS and -ES

The -OS (oil sealed case) and the -ES (environment sealed case) options for corrosive environment feature flush mount case design to be installed within a panel.

Precautions

- Do NOT exceed rated temperature range.
- Use shock mounts as necessary to protect from vibration.
- Cutting or sharp bending the capillary will cause permanent damage to the SWICHGAGE® and will void the warranty.
- Excess capillary should be carefully coiled and secured away from damage.
- Do not route capillary along exhaust manifold.
- Avoid routing capillary at level higher than gage mounting.

Specifications

Case: Die cast aluminum.

Contacts: See page 4 for ratings.

Geared Movement: 302 and 304 stainless steel.

Sensing connections: 1/2 NPT compression fitting.
Capillary: *5 feet (1.5 m) PVC armored copper tube.*
Sensing Bulb: *1/2 in. O.D. copper; 7 in. (178 mm) total length; 5-5/16 in. (135 mm) insertable length; 600 psi (4.14 MPa) [41.37 bar] pressure rating. For higher pressure use of thermowell is recommended, back connection is optional.*

Dial: 4-1/2 in. (114 mm), white on black background.

Conduit: With -OS/-ES options: *1/2 NPT (male).*
Flanged case: *1/2 in. (13 mm), 1/2 in. (13 mm) conduit knock-out.*
Flush case: *Optional 1/2 in. (13 mm) male.*

Overrange: Do not exceed 30% above full range.

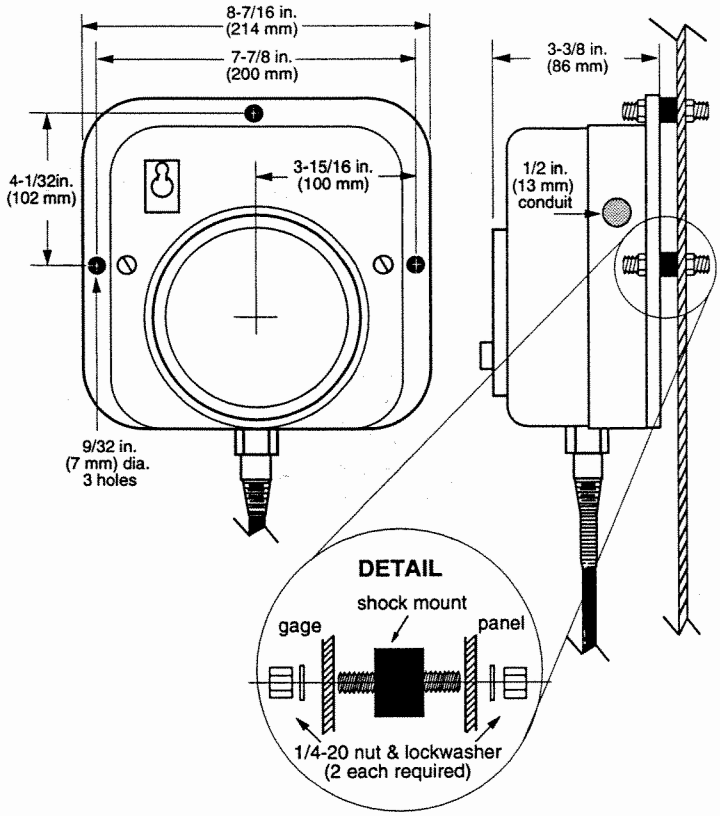
Accuracy

Temperature Range	Lower 1/4	Middle 1/2	Upper 1/4
-60 to 60°F (-51 to 16°C)	± 2°F (± 1°C)	± 2°F (± 1°C)	± 2°F (± 1°C)
-40 to 136°F (-40 to 58°C)	± 4°F (± 2°C)	± 2°F (± 1°C)	± 2°F (± 1°C)
15 to 250°F (9 to 121°C)	± 8°F (± 4°C)	± 2°F (± 1°C)	± 2°F (± 1°C)
130 to 350°F (54 to 177°C)	± 8°F (± 4°C)	± 2°F (± 1°C)	± 3°F (± 1.5°C)
260 to 450°F (127 to 232°C)	± 8°F (± 4°C)	± 2°F (± 1°C)	± 3°F (± 1.5°C)

CASE MOUNTING

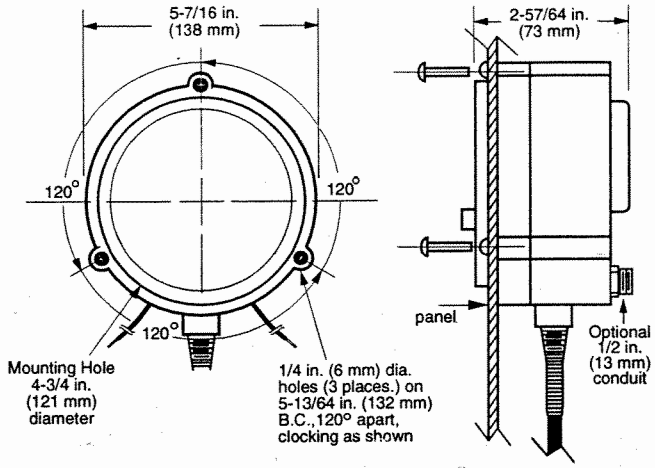
Wall Mount

Flanged case design intended for wall mount. Shown with shock mounts (optional).

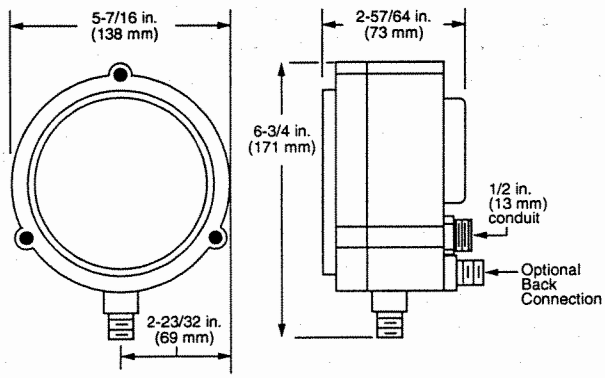


Flush Mount

A round case design to be mounted within a panel from 1/32 in. (1 mm) to 1/8 in. (3 mm) thick.

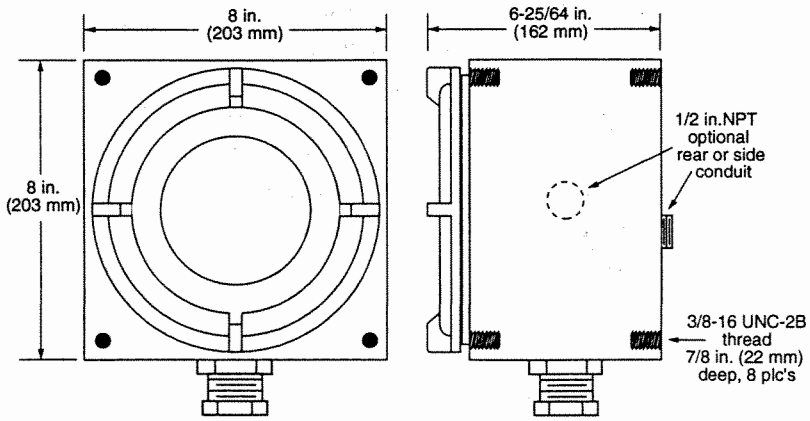


Options -OS, -ES (flush mount case)

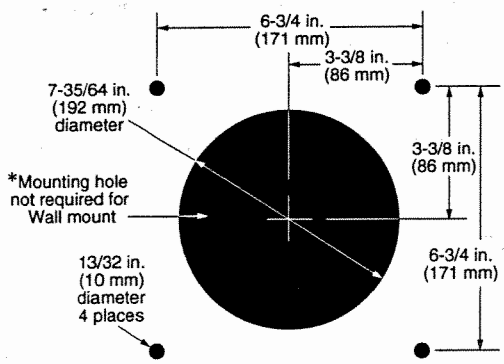


Explosion-proof Case Mount

Explosion-proof case can be mounted from face or rear.



Flush mount/Wall mount*



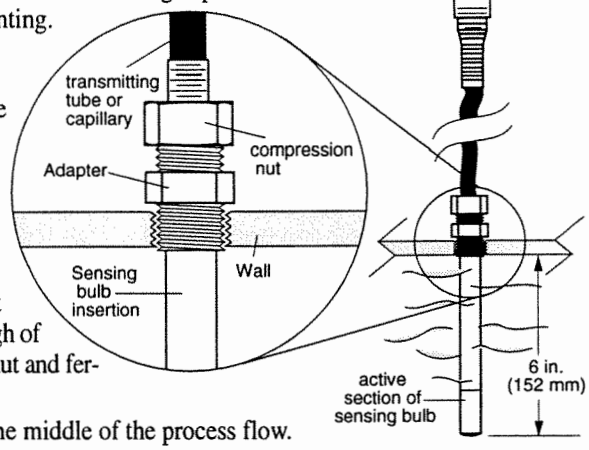
SENSING BULB-THERMOWELL INSTALLATION

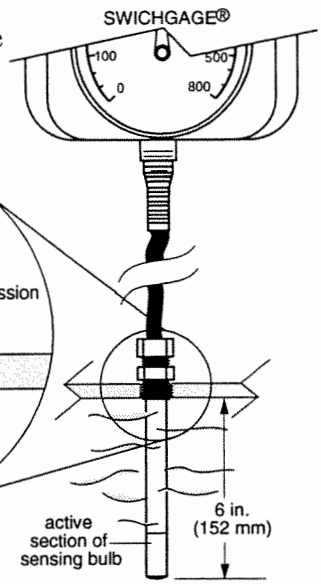
Precautions

Cutting or sharp bending the capillary will cause permanent damage to the SWICHGAGE® and will void the warranty. Excess capillary should be carefully coiled and secured away from damage. Do not route capillary along exhaust manifold. Avoid routing capillary at a level higher than gage mounting.

Installing Sensing Bulb

1. Install the 1/2 NPT adapter into the application.
2. Slip compression nut and ferrule onto bulb.
3. Insert the sensing bulb directly through the adapter and fully immerse it into the process without interference. Be sure to leave enough of the bulb to allow the compression nut and ferrule to be tightened.
4. Keep the bulbs active section in the middle of the process flow.
5. Tighten the compression nut and ferrule. This will keep the bulb in place and obtain a full seal.





Installing Thermowell

Thermowell is recommended for high pressure applications or corrosive environments. It also allows temperature sensor to be changed or adjusted without opening connection to process.

1. First screw the thermowell into the process (pipe line).
2. Pass the sensing bulb through the nut and ferrule.
3. Fully insert the sensing bulb into the thermowell housing and secure it with the compression nut.

NOTE: The use of temperature transmitter grease or silicon grease on the tip of the sensing bulb is recommended to facilitate heat transfer to sensing bulb junction.

LIMIT CONTACTS / INDICATION POINTER ADJUSTMENTS

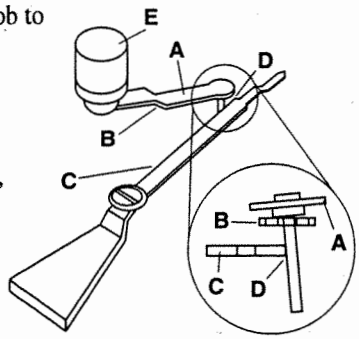
Limit Contact Adjustments

Facing the dial, left side knob is "Low limit" contact. Right side is "High limit" contact.

NOTE: the 45TE Series features a stacked limit indicator knob with both limit adjustments included. The bottom half knob adjusts the "Low" limit indicator, the top half is to adjust the "High" limit indicator.

A. Contact arm-flex
B. Contact arm
C. Pointer Contact
D. Initial point of contact
E. Limit contact knob

To set limit contact, turn the knob to the desired point on the scale.



Limit Contact Wiping Feature (SPL)

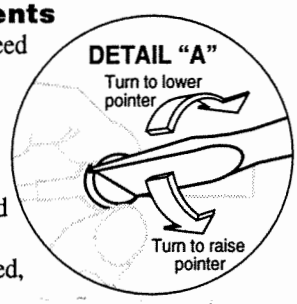
The force of pointer causes the flexible contact arm (A) to "tilt" resulting in a wiping action (D). This clears away film or corrosion formed on the contact surfaces.

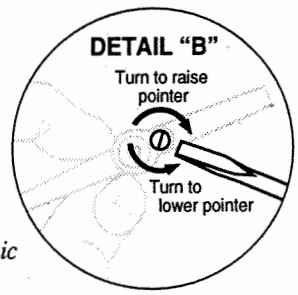
Indication Pointer Adjustments

To reset to zero or to a known value proceed as follows:

1. Turn off power. Remove the snap ring and the lens/contact assembly (or open hinged cover).
2. Hold the pointer hub with thumb and forefinger then turn screw to desired point. Avoid touching the gold flashed, silver contact areas.
   See **DETAIL "A".**
   For the 45TE Series see DETAIL "B".
3. Replace lens contact assembly and snap ring (or close hinged cover), and turn on power.

NOTE: Span adjustments and recalibration must be performed by an authorized mechanic or return the unit to Frank W. Murphy Mfr.





OPERATION TEST INSTRUCTIONS

SPLC and SPLFC Series

1. Perform operation test after the unit is installed and wired appropriately (see Typical Electrical Diagrams on page 4).
2. When temperature is applied to the sensing bulb the pointer will travel in a clockwise direction. (Adjust contacts to desired set points.)
3. Place the toggle switch (SPLC Series only) in the "start" position or otherwise override low contact. After the indication pointer rises past the low limit contact, return the toggle switch to the "run" position.
4. To test the limit contacts, turn the limit contact to be tested until it touches the pointer. That will trip the control circuit.
5. Reset the shutdown or alarm circuit device.

45TE Series

1. Perform steps 1 and 2 in the SPLC Operation Test Instructions.
2. To test the switches, turn the limit indicator until it touches the pointer, then continue to rotate until the snap-switch operates*
3. Reset the shutdown or alarm circuit device.

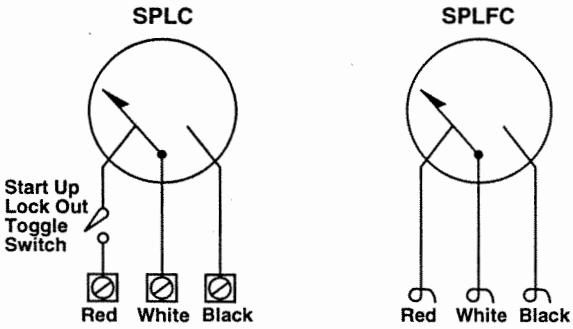
**The trip point indicator will stop the pointer movement slightly before the snap-switch operates. As temperature continues to increase or decrease, the trip point setting is reached.*

TYPICAL ELECTRICAL DIAGRAMS

CAUTION: Perform the wiring operation with the power source "OFF". Make sure the voltage and current requirements are within the SWICHGAGE® ratings. Before wiring determine voltage and polarity for the application. Use the appropriate wire size. All connections should be made using a spade (forked) or ring terminals. For pigtail connections use wire nuts. Conduit is recommended to protect wires from damage.

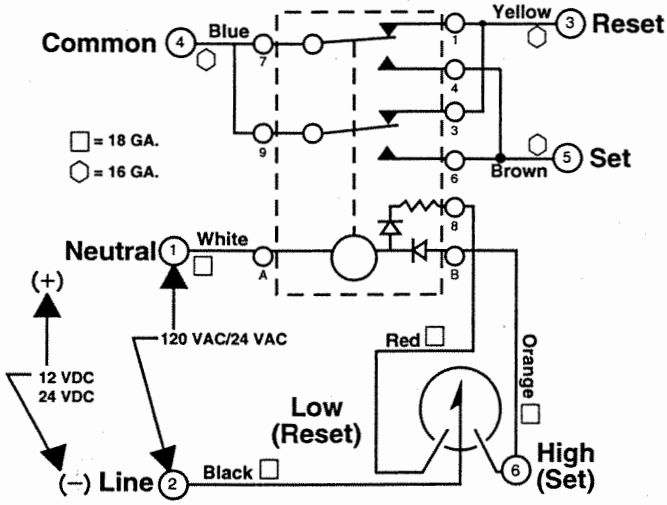
SPLC and SPLFC

Contact Ratings: 2-SPST, pilot duty only; 2 A @ 30 V, 1 A @ 125 VAC.
NOTE: Diagrams below show the pointer in the at rest (shelf) position.



SPLBP

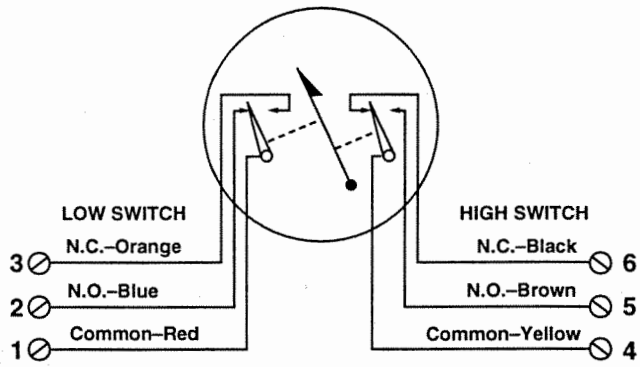
Contact Ratings: SPDT Dry Relay Contacts, 10 A @ 28 VDC and 10 A @ 120 VAC.



Transformer Relay Assemblies
For higher voltages the Murphy TR Assemblies can be used in conjunction with any SWICHGAGE®.

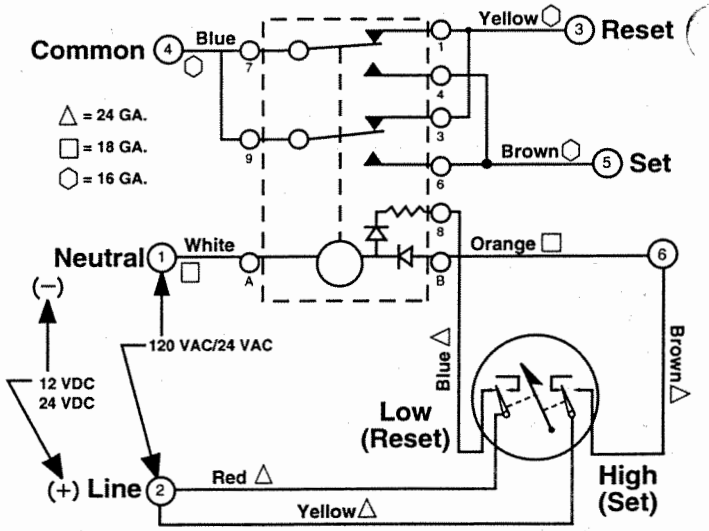
45TE and 45TEF

Contact Ratings: 2-SPDT snap-switches (One for high and low temperature); 4 A @ 250 VAC.



45TEBP

Contact Ratings: SPDT Dry Relay Contacts, 10 A @ 28 VDC and 10 A @ 120 VAC



In order to consistently bring you the highest quality, full featured products, we reserve the right to change our specifications and designs at any time.

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■ **Frank W. Murphy Manufacturer**
P.O. Box 470248; Tulsa, Oklahoma 74147; USA
tel. (918) 627-3550 **fax** (918) 664-6146

■ **Frank W. Murphy Southern Division**
P.O. Box 1819; Rosenberg, Texas 77471; USA
tel. (713) 342-0297 **fax** (713) 341-6006

■ **Frank W. Murphy, Ltd.**
Church Rd.; Laverstock, Salisbury SP1 1QZ; U.K.
tel. +44 1722 410055 **fax** +44 1722 410088 **tlx** 477088

■ **Frank W. Murphy Pte., Ltd.**
26 Siglap Drive; Republic of Singapore 456153
tel. +65 241-3166 **fax** +65 241-8382

■ **Murphek Pty., Ltd.**
1620 Hume Highway; Campbellfield, Vic 3061; Australia
tel. +61 3 9358-5555 **fax** +61 3 9358-5556

■ **Murphy de México, S.A. de C.V.**
Blvd. Antonio Rocha Cordero 300, Fracc. El Aguaje
San Luis Potosí, S.L.P.; México 78384
tel. +52-48-206264 **fax** +52-48-206336

■ **Murphy Switch of California**
P.O. Box 900788; Palmdale, California 93590; USA
tel. (805) 272-4700 **fax** (805) 947-7570

■ **Frank W. Murphy France**
tel. +33 1 30 762626 **fax** +33 1 30 763989

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ASHCROFT
ORDER INFORMATION

PUR SPEC #300AUX352

B-SERIES PRESSURE AND DIFFERENTIAL PRESSURE SWITCH MODEL NUMBER:

To specify the exact switch desired, select entries from appropriate tables as shown in example below.

1		2		3	4			5
B	4	2	0	B	X	P	K	600 PSI

1 – ENCLOSURE

B4	Pressure switch, type 400, watertight enclosure meets NEMA 3, 4, 4X, 13 and IP66 requirements.
B7	Pressure switch, type 700, explosion-proof enclosure meets Div. 1 & 2, NEMA 7, 9 and IP66 requirements.
D4	Differential pressure switch, type 400, watertight enclosure meets NEMA 3, 4, 4X, 13 and IP66 requirements.
D7	Differential pressure switch, type 700, explosion-proof enclosure meets Div. 1 & 2, NEMA 7, 9 and IP66 requirements.

3 – ACTUATOR SEAL

Code and Material	Process Temperature Limits °F[9]	Range			
		Vac. ˝ H_2O	0-600 psi	1000 psi	3000 psi
B – Buna-N	0 to 150	•	•	•	•
V – Viton	20 to 300	•	•	•	
T – Teflon	0 to 150	•	•	•	•
S – 316L[8]	0 to 300		•	•	
P – Monel[8]	0 to 300		•	•	

4 – OPTIONS

Use table from page 3

5 – RANGE

Select from table on page 2

2 – SWITCH ELEMENT SELECTION

Order Code	Switch Elements UL/CSA Listed SPDT	
20[7]	Narrow deadband ac	15A, 125/250 Vac
21	Ammonia service	5A, 125/250 Vac
22[6]	Hermetically sealed switch, narrow deadband	5A, 125/250 Vac
23	Heavy duty ac	22A, 125/250 Vac
24[1]	General purpose	15A, 125/250/480 Vac ½A, 125 Vdc ¼A, 250 Vdc; 6A, 30 Vdc
25[2]	Heavy duty dc	10A, 125 Vac or dc, ⅛ HP, 125 Vac or dc
26[7]	Sealed environment proof	15A, 125/250 Vac
27	High temperature 300°F	15A, 125/250 Vac
28[5]	Manual reset trip on increasing	15A, 125/250 Vac
29[5]	Manual reset trip on decreasing	15A, 125/250 Vac
31	Low level (gold) contacts	1A, 125 Vac
32	Hermetically sealed switch, general purpose	11A, 125/250 Vac 5A, 30 Vdc
42	Hermetically sealed switch, gold contacts	1A, 125 Vac
50	Variable deadband	15A, 125/250 Vac
	UL/CSA Listed Dual (2 SPDT)	
61[7]	Dual narrow deadband	15A, 125/250 Vac
62[7]	Dual sealed environment proof	15A, 125/250 Vac
63	Dual high temp. 300°F	15A, 125/250 Vac
64	Dual general purpose	15A, 125/250/480 Vac ½A, 125 Vdc ¼A, 250 Vdc
65	Dual ammonia service	5A, 125/250 Vac
67[4,6]	Dual hermetically sealed switch, narrow deadband	5A, 125/250 Vac
68[4]	Dual hermetically sealed switch, general purpose	11A, 125/250 Vac 5A, 30 Vdc
71[4]	Dual hermetically sealed switch, gold contacts	1A, 125 Vac

NOTES:

1 Standard switch.
2 Not available with psid ranges.
3 Dual switches are 2 SPDT snap-action switches, not independently adjustable.
4 Not available with type 400 enclosure.
5 Not available with type 700 enclosure.
6 Estimated dc. rating, 2.5A, 28 Vdc (not UL listed).
7 Estimated dc rating, 0.4A, 120 Vdc (not UL listed).
8 Available on pressure only.
9 Ambient operating temperature limits –20 to 150°F, all styles, setpoint shift of ±1% of range per 50°F temperature change is normal.

PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

B-Series pressure, differential pressure and vacuum switches use two different actuators depending on setpoint requirements. For setpoints between 2 and 3000 psi, the simple, rugged diaphragm-sealed piston actuator is used. This design features high reliability and choice of actuator seal materials for virtually every application. An optional welded design is also available for setpoints up to 1000 psi for maximum reliability. This design is available in 316 SS or Monel. Differential pressure models use a unique, dual diaphragm-sealed piston design that features very high static operating pressures and small size.

For setpoints between 4.5 and 150 inches of H_2O, a large diaphragm is used for increased sensitivity in both pressure and differential pressure designs with good choice of materials of construction.

All standard models feature ±1 percent of range setpoint repeatability and a minimum of 400 percent of range proof pressures.

These standard designs perform well in applications where shock and vibration could be a problem and may be used in conjunction with Ashcroft diaphragm seals in extreme services such as slurries or abrasive process fluids.

PRESSURE/VACUUM SWITCHES

Nominal Range[1]			Overpressure Ratings		Approximate Deadband[2] Switch Element				
			Proof psi	Burst psi	20, 26, 27	21, 24, 31	50	22	32
Vacuum									
–30″ Hg	–760mm Hg	-100 kPa	250	400	0.3-0.7	1.5-3.0	0.5-2.2	0.4-1.5	2.1-4.2
Compound									
–15″ H_2O/	–375mm H_2O/	–3.7 kPa/	20	35	0.15-75/	1.5-2.5/	0.45-2.0/	0.5-1.2/	2.1-3.5/
15″ H_2O	375mm H_2O	3.7 kPa			0.15-75	1.5-2.5	0.45-2.0	0.5-1.2	2.1-3.5
–30″ H_2O/	–760mm H_2O/	–7.5 kPa/	20	35	0.30-60/	1.5-2.5/	0.45-2.0/	0.5-1.5/	2.1-3.5/
30″ H_2O	760mm H_2O	7.5 kPa			0.30-60	1.5-2.5	0.45-2.0	0.5-1.5	2.1-3.5
–30″ Hg/	–760mm Hg/	–100 kPa/			0.5-1.0/	2.0-3.0/	0.75-2.5/	0.7-1.8/	2.8-4.2/
15 psi	1.0 kg/cm²	100 kPa	250	400	0.3-0.7	0.5-1.5	0 .5-1.0	0.7-1.4	0.7-2.1
–30″ Hg/	–760mm Hg/	–100 kPa/			1.0-1.5/	3.0-6.0/	1.2-4.5/	1.4-2.4	4.2-8.4/
30 psi	2.0 kg/cm²	200 kPa	250	400	0.3-0.8	1.0-2.0	0.7-1.5	0.4-1.3	1.4-2.8
–30″ Hg/	–760mm Hg/	–100 kPa/			2.0-3.0/	5.0-9.0/	2.5-7.0/	2.8-4.5	7.0-12.0/
60 psi	4.0 kg/cm²	400 kPa	250	400	0.7-1.5	3.0-5.0	1.1-4.0	1.0-2.3	4.2-7.0
Pressure									
10″ H_2O	250mm H_2O	2.5 kPa	20	35	0.2-0.5	1.0-2.0	0.35-1.5	0.4-1.0	1.4-2.8
30″ H_2O	750mm H_2O	7.5 kPa	20	35	0.3-0.6	1.5-2.5	0.45-2.0	0.5-2.0	2.1-3.5
60″ H_2O	1500mm H_2O	15 kPa	20	35	0.5-1.3	1.5-3.5	0.9-2.5	0.7-3.0	2.1-5.0
100″ H_2O	2500mm H_2O	25 kPa	20	35	0.6-1.6	2.5-5.5	1.1-4.0	1.0-4.0	3.5-7.7
150″ H_2O	3750mm H_2O	37 kPa	20	35	1.0-2.5	4.5-8.5	1.7-6.5	2.0-6.0	6.0-12.0
15 psi	1.0 kg/cm²	100 kPa	500	1500	0.1-0.35	0.5-1.5	0.2-1.0	0.4-1.0	0.7-2.1
30 psi	2.0 kg/cm²	200 kPa	500	1500	0.1-0.50	0.5-1.5	0.3-1.0	0.4-1.0	0.7-2.1
60 psi	4.0 kg/cm²	400 kPa	500	1500	0.3-1.0	1.0-3.5	0.7-2.5	0.6-2.0	1.4-5.0
100 psi	7.0 kg/cm²	700 kPa	1000	3000	0.5-1.7	1.5-5.0	1.1-3.5	1.0-4.5	2.1-7.0
200 psi	14 kg/cm²	1400 kPa	1000	3000	1-3	5-13	2-9	3.0-7.5	7.0-18.2
400 psi	28 kg/cm²	2800 kPa	2400	3000	4-7.5	5-24	5.5-15	4.0-11.0	7.0-33.6
600 psi	42 kg/cm²	4200 kPa	2400	3000	4-11	9-30	7-20	5.0-23.0	12.6-42
1000 psi	70 kg/cm²	7000 kPa	12000	18000	7-30	30-110	18-70	15-80	42-154
3000 psi	210 kg/cm²	2100 kPa	12000	18000	15-60	80-235	37-160	30.0-230	112-329

PRESSURE/VACUUM SWITCHES

Nominal Range[1]			Pressure Ratings		Approximate Deadband[2] Switch Element				
			Static Working Pressure	Proof psi	20, 26, 27	21, 24, 31	50	22	32
30″ H_2O	750mm H_2O	7.5 kPa	5.4	21.6	0.3-0.6	1.5-2.5	0.45-2.0	0.5-2.0	2.1-3.5
60″ H_2O	1500mm H_2O	15 kPa	5.4	21.6	0.5-1.3	1.5-3.5	0.9-2.5	0.7-3.0	2.1-5.0
100″ H_2O	2500mm H_2O	25 kPa	5.4	21.6	0.6-1.6	2.5-5.5	1.1-4.0	1.0-4.0	3.5-7.7
150″ H_2O	3750mm H_2O	37 kPa	5.4	21.6	1.0-2.5	4.5-8.5	1.8-6.5	2.0-6.0	6.3-12.0
15 psid	1.0 kg/cm²	100 kPa	500	2000	0.5-1.0	2.0-5.0	0.7-3.5	0.7-1.4	2.8-7.0
30 psid	2.0 kg/cm²	200 kPa	500	2000	1.0-2.0	2.0-5.0	1.5-3.5	1.4-2.8	2.8-7.0
60 psid	4.0 kg/cm²	400 kPa	500	2000	2.0-4.0	3.0-6.0	3.0-4.5	2.8-5.6	4.2-8.5
100 psid	7.0 kg/cm²	700 kPa	1000	4000	4.0-10.0	11.0-20.0	7.0-15.0	6.0-14.0	16.0-28.0
200 psid	14.0 kg/cm²	1400 kPa	1000	4000	5.0-15.0	12.0-40.0	10.0-26.0	7.0-21.0	17.0-56.0
400 psid	28.0 kg/cm²	2800 kPa	1000	8000	10.0-20.0	20.0-60.0	15.0-40.0	14.0-28.0	28.0-84.0
600 psid	42 0 kg/cm²	4200 kPa	2000	8000	20.0-40.0	80.0-150.0	30.0-115.0	30.0-56.0	112.0-210.0

Values shown are for zero static working pressure.

NOTES:

1 Switches may generally be set between 15% and 100% of nominal range on increasing pressure. Consult factory for applications where setpoints must be lower.

2 All deadbands are given in English units as shown in the nominal range column. Deadbands shown are for switches with Buna N diaphragm. Approximate deadbands for optional diaphragms:

Viton: Multiply Buna N value by 1.4
Teflon: Multiply Buna N value by 1.2
Stainless Steel: Multiply Buna N value by 1.7
Monel: Multiply Buna N value by 1.7
Dual Switch Element: Multiply single switch element value by 1.6 for approximate deadband.

OPTIONAL FEATURES AND ACCESSORIES

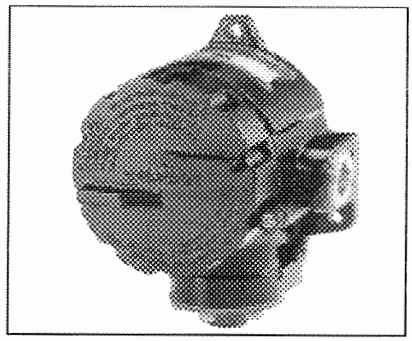
B-SERIES SWITCH OPTIONS

		Appicable Switch Series					
		Pressure		Differential Pressure		Temp-erature	
Code	Description	(psi)	(in. H_2O)	(psi)	(in. H_2O)	All Ranges	Notes
XBP	Wall Mounting Bracket in. H_2O		•		•		
XBX	½" Male NPT Bushing					•	
XCH	Chained Cover	•	•	•	•	•	
XC8	CSA Approval	•	•	•	•	•	11
XCN	Cenelec EEx d IIC T6	•	•	•	•	•	
XFM	FM Approval – Single Element	•	•	•	•		17
	FM Approval – Dual Element	•	•	•	•		17
XFP	Fungus Proofing	•	•	•	•	•	
XFS	Factory Adjusted Setpoint	•	•	•	•	•	2
XG3	Belleville Actuator	•					16,17
XG4	Teflon Actuator and Pressure Conn.	•					8
XG5	UL Limit Control to 150" H_2O				•		1, 17
XG6	UL Limit Control to 600 psi	•					1, 17
XG7	Secondary Chamber with Vent	•					13
XG8	Steam Limit Control to 300 psi	•					7
XG9	Fire Safe Welded Actuator	•					7
XHS	High Static Diflerential Pressure			•			15
XHX	High Pressure, 40 psi, (static) DIP 160 psi (proof) DIP 100 psi proof pressure		•		•		
XJK	Left Conduit Connection	•	•	•	•	•	9
XJL	¾" to ½" Reducing Bushing	•	•	•	•	•	
XK3	Terminal Block (700 Series only)	•	•	•	•	•	6
XL9	Low Hardness SS Press. Conn.	•					12
XNH	Tagging Stainless Steel	•	•	•	•	•	
XPK	Pilot Light(s) Top Mounted	•	•	•	•	•	4
XPM	¾" Sealed Conduit Connection with 16" Lead Wires	•	•	•	•	•	
XTA	316 Stainless Steel Pressure Connection for in. H_2O Range		•		•		
XTM	2" Pipe Mounting Bracket	•	•	•	•	•	
XUD	316 Stainless Steel Pressure Conn.			•			
X06	Pressure Connection: ½ NPT Male, ¼ NPT Female 316 Stainless Steel (Combination)	•	•	•	•		5
X07	½ NPTF Press. Conn., 316 SS	•	•	•	•		10
X2B	Breather Drain	•	•	•	•	•	
X6B	Cleaned for Oxygen Service	•	•	•			3
	Diaphragm Seal	•	•	•	•		

CENELEC APPROVAL FOR HAZARDOUS LOCATIONS

CENELEC is a European designation that deals with standards for equipment and protective systems intended for use in potentially explosive atmospheres. This approval is required for switches intended for use in hazardous locations, especially important to OEMs who export to Europe and contractors specifying or purchasing products for European applications.
XCN option adds special features to Ashcroft 700-Series switch enclosures that meet the requirements for the highest levels of security and danger, such as:

- Special locking device requiring an Allen wrench to remove cover
- Special vents that blow out should the diaphragm rupture, thus preventing pressure build-up in the enclosure
- Special conduit plug requiring an Allen wrench for removal
- Available on pressure, temperature and differential pressure models
- Meets Explosion Class EEx d IIC T6



Order option XCN

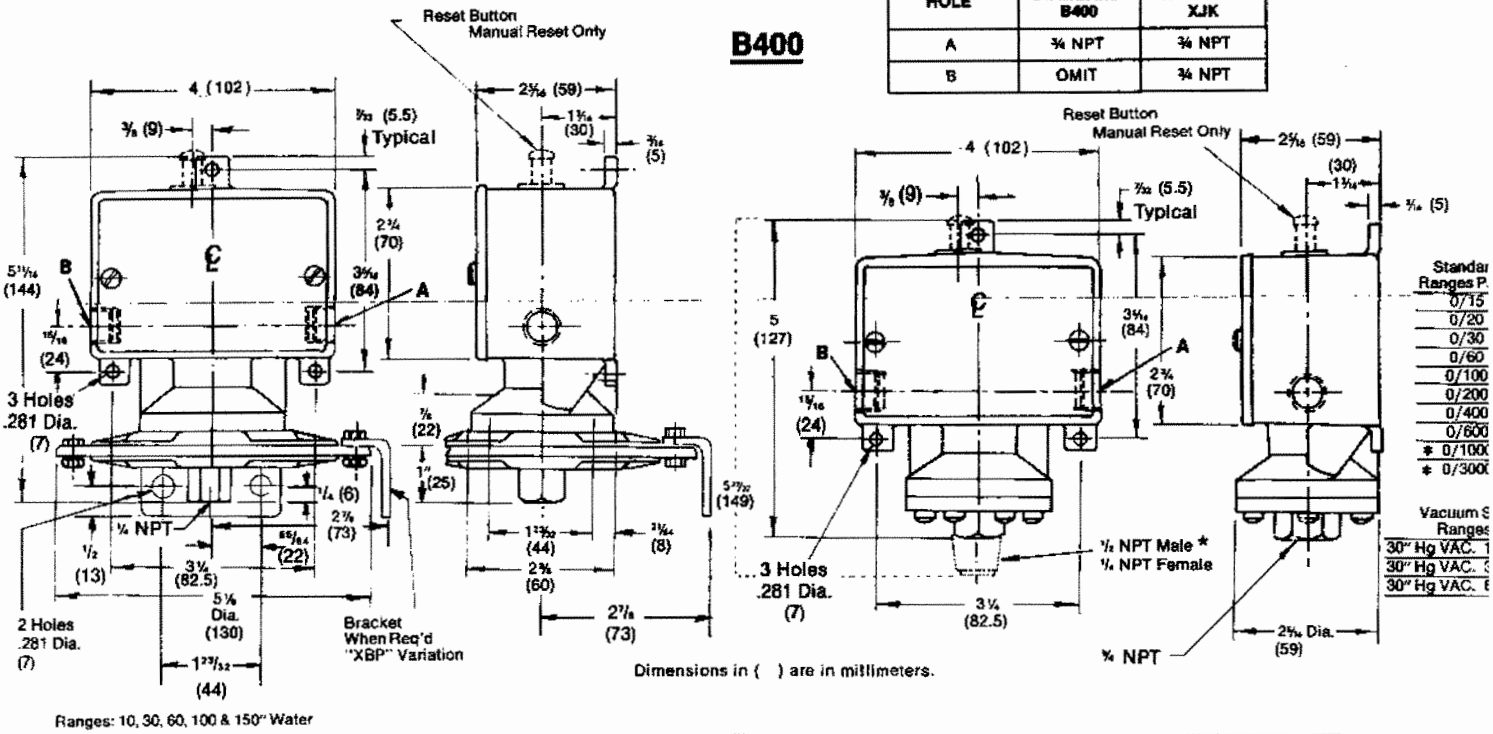
NOTES:

1 Buna N and Viton diaphragm.
2 Advise static or working pressure for differential pressure switches.
3 Buna N cannot be cleaned for oxygen service.
4 N/A on 700 Series.
5 Standard with 1000 and 3000 psi ranges. Bottom connection only on DIP in H_2O ranges.
6 Terminal Blocks standard with 700 dual switches.
7 Stainless steel diaphragm only.
8 Pressure connection ¼ NPTF.
9 Standard on 700 Series. N/A with DPDT element on 400 Series.
10 N/A with Monel diaphragm.
11 Standard on 400 Series.
12 N/A on 3000 psi range. Available with Teflon diaphragm only.
13 SS diaphragm required. Teflon diaphragm is the backup. NEMA 7 only.
14 Available in ranges vacuum to 600 psi. Not available with stainless steel or Monel diaphragm.
15 Buna N and Viton diaphragm – 15#D & 30#D only.
16 24, 32, 64 or 68 element only.
17 N/A on all combinations

INSTALLATION AND MAINTENANCE B400 & B700 SERIES
ASHCROFT® SNAP ACTION SWITCHES FOR PRESSURE CONTROL

HOLE	TYPE	
	STANDARD B400	VARIATION XJK
A	¾ NPT	¾ NPT
B	OMIT	¾ NPT

B400

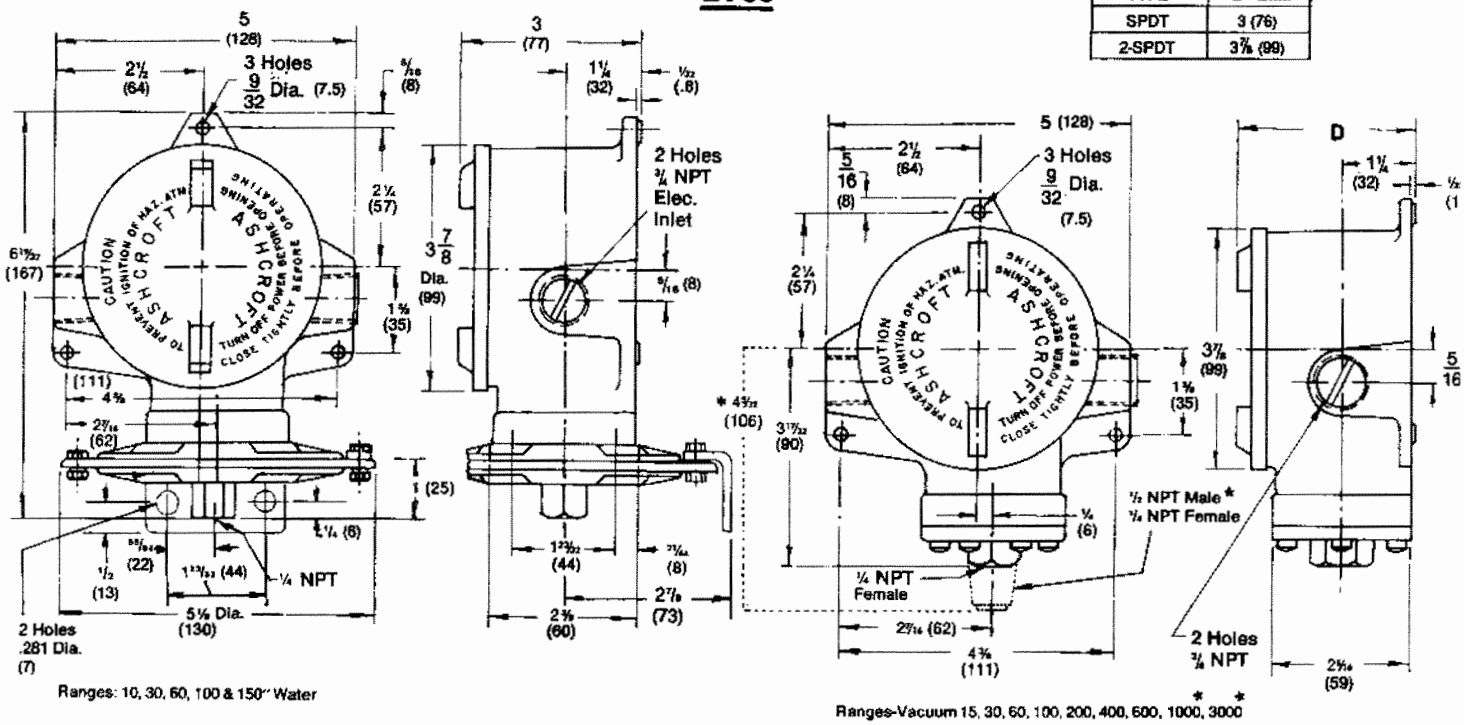


Ranges: 10, 30, 60, 100 & 150" Water

Dimensions in ( ) are in millimeters.

B700

TYPE	"D" DIM.
SPDT	3 (76)
2-SPDT	3 7/8 (99)



Ranges: 10, 30, 60, 100 & 150" Water

Ranges-Vacuum 15, 30, 60, 100, 200, 400, 600, 1000, 3000

Dimensions in ( ) are in millimeters.

INTRODUCTION

The Ashcroft pressure switch is a precision built U.L. and F.M. approved control device which features a mechanical snap action switch. Controllers are available for operation on pressure or vacuum with fixed or variable differential. Also manual reset types for operation on increasing or decreasing pressure. The manual reset types remain tripped until reset by pressing a button on top of the enclosure. Standard electrical switch is SPDT, available with various electrical characteristics. Two SPDT switch elements mounted together are available except on variable Deadband and manual reset types. Various wetted material constructions for compatibility with a range of pressure media may be obtained.

The Ashcroft snap action pressure switch is furnished in the standard NEMA 4 and explosion-proof NEMA 7 & 9 enclosure styles. Both enclosures are epoxy coated aluminum castings.

INSTALLATION

These controls are precision instruments and should never be left with internal components exposed. During installation insure that covers are in place and conduit openings are closed except when actually working on the control.

MOUNTING B400 AND B700 SERIES

Three holes external to the enclosure for surface mounting. Location of these holes is shown on the general dimension drawing. They may also be mounted directly on pressure line using the pressure connection. **When tightening control to pressure line, always use the wrench flats or hex on the lower housing.**

ELECTRICAL CONNECTIONS

Remove cover
B400 Series — two screws hold cover to enclosure
B700 Series — cover unscrews

CONDUIT CONNECTIONS

NOTE — It is recommended that Teflon tape or other sealant be used on conduit, bushing or plug threads to ensure integrity of the enclosure.

B400 series standard — one ¾" NPT conduit hole right side.

B700 series standard — two ¾" NPT conduit holes with one permanent plug. NEMA 7 & 9 enclosures require proper conduit seals and breathers as per the National Electrical Code.

B400 & B700 series — XJL variation — two ¾" NPT conduit holes with two ¾" to ½" NPT reducing bushings.

B400 series — XJK variation — two ¾" NPT conduit holes.

B400 SERIES

SPDT — Wire directly to the switch according to circuit requirements. On controls with pilot lights wire lights according to circuit diagram on inside of cover. See special wiring instruction tag for single switches with two pilot lights and dual switches with one or more lights.

2-SPDT — Dual switching elements consist of two SPDT switches mounted together in a bracket. Switches are calibrated to have simultaneous operation within 1% of range either on increasing or decreasing pressure but not in both directions. Wire directly to the front and rear switch according to circuit requirements. Leads are provided on rear switch color coded as follows:

Common	— White
Normally Closed	— Red
Normally Open	— Blue

See SPDT instructions for pilot light hook-up.

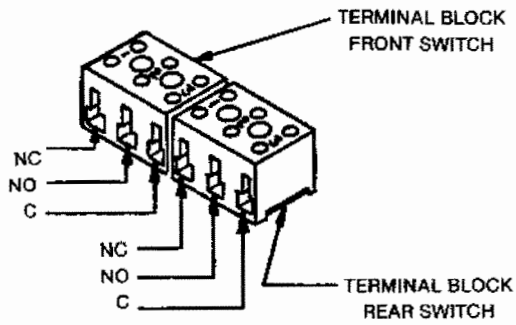
When hermetically sealed switch elements (s) are supplied, the lead color coding is as follows:

Common	— White
Normally Closed	— Red
Normally Open	— Blue

B700 SERIES

SPDT — Wire directly to the switch according to circuit requirements.

2-SPDT — Wire to front switch terminal block (left) and rear switch terminal block (right) as marked. Strip insulation 5/16", insert in proper terminal connector and tighten clamping screw to secure.



ADJUSTMENT OF SET POINT

B400 & B700 Series — A single set point adjustment nut (⅞") is located centrally at the bottom on the inside of the enclosure.

For accurate set point calibration, mount the switch on a calibration stand, a pump or catalog No. 1305 deadweight gauge tester. A suitable reference standard such as an Ashcroft Duragauge or Test Gauge is necessary to observe convenient changes in pressure.

As received, the pressure switch will normally be set to approximately 90% of the indicated range. Pressurize the system to required set point and turn the adjustment nut until switch changes mode. Direction of turning is indicated on a label affixed to the inside of the control enclosure. When set point has been achieved raise and lower pressure to insure that set point is correct.

After installation of the control replace cover to insure electrical safety and to protect internal parts from the environment.

B450 and B750 VARIABLE DEADBAND SWITCHES

Deadband is varied by rotating the wheel on the precision switch. When viewed from the front of the enclosure, rotation to the left increases deadband—rotation to the right decreases deadband. Letters on the wheel may be used as a reference. Deadbands obtainable will vary from 0.5% to 9% of pressure range depending on range segment and type of diaphragm.

ADJUSTMENT OF SET POINT

As received, the pressure switch will normally be set to approximately 90% of range. Rotate the wheel on the MICRO SWITCH all the way to the right; this will provide smallest deadband. Pressurize the system to the required set point and turn the adjustment nut until the switch changes mode. Lower the pressure to reset the switch. Rotate the wheel on the MICRO SWITCH until the desired deadband is obtained. The upper set point will be changing upward with this adjustment. Lower the pressure to reset the switch. Then increase the pressure to the desired set point and turn the adjusting nut until the switch changes mode. Lower the pressure and check reset point and deadband.

NOTE — As indicated above, adjustment of set point is made by use of ⅞" nut. Precision switch element mounting screws and bracket adjusting screw are factory sealed and should not be tampered with.

DRESSER INSTRUMENT

INSTRUMENT DIVISION
DRESSER EQUIPMENT GROUP, INC.
MILFORD, CONNECTICUT 06460

Installation and Maintenance Instructions for CE Mark on ASHCROFT® Switches/Low Voltage Directive 73/23/EEC

ASHCROFT®

INSTALLATION REQUIREMENTS

- To minimize the risk of injury, the switch enclosure must be selected according to the area classification and installed according to the required safety and electrical codes.
- Before operating the switch all conduit entries and/or junction boxes need to be closed according to the required safety and electrical codes.
- To attain the degree of protection listed on the switch it may be necessary to add required conduit fittings.
- The switch must be protected from moisture, shock and/or extreme vibration.
- The ambient temperature limits for switches are –20 to 150°F, (–28 to 65°C).

CAUTIONS

- Always install the cover after wiring the switch and before power is supplied.
- Before removing the cover in hazardous areas be sure there is no explosive atmosphere present and the power supply is turned off.
- For CENELEC approved switches all safety locking devices and electrical earthing must be installed or connected before operating.
- Never carry a temperature switch by holding only the stem, bulb or capillary.
- Do not exceed ranges, current and/or voltage limits.
- The protection degree of the switch is only valid when the switch is installed in accordance with all safety and electrical codes and regulations.

CLEANING

- Never use aggressive solvents.
- Do not use high pressure water to clean the switch.

MAINTENANCE/TROUBLESHOOTING

- All Ashcroft switches require little or no maintenance.
- Be sure that the case is closed at all times.
- When the switch is exposed to process media that may harden and/or build up in the pressure port, the switch should be removed and cleaned as needed.
- If the switch does not function, only trained and skilled personnel should check on the wiring, power supply and/or mounting.
- If the problem can not be solved, please contact one of the Dresser affiliates or distributors.

ELECTRICAL CONNECTIONS

- Only trained and skilled personnel are allowed to install the wires to the electrical terminals of the switch.
- Cable couplers, glands and conduit connectors must have the correct electrical approvals.
- Always follow safety and electrical regulations when connecting these devices.
- The system ground of the device is marked with a green colored screw and/or by the ground symbol.
- CENELEC approved switches have an external ground screw that must be connected.
- Micro switch terminals and wire color codes:

NO	(Normally Open)	Blue
NC	(Normally Closed)	Red
C	(Common)	White
Ground		Green (F-Series only)

TABLE 1: MICRO SWITCH ELECTRICAL RATINGS

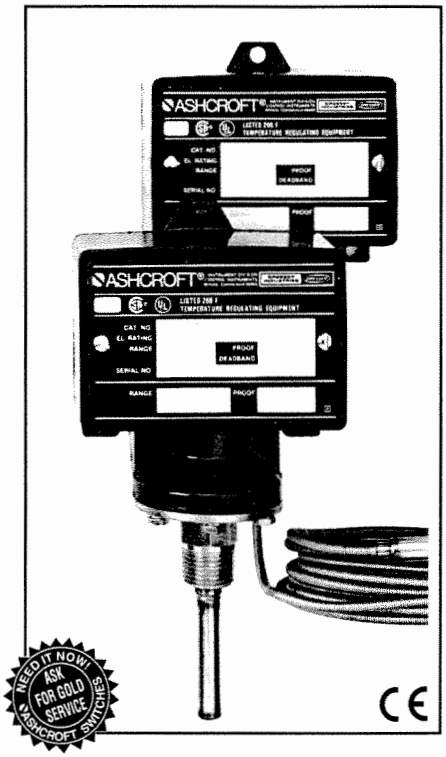
MICRO SWITCH CODE				ELECTRICAL RATING	
Single	Dual	Single	Dual	Vac	Vdc
K	KK	20	61	15A, 250V	0.4A, 120V
W	WW	21	65	5A, 250V	
P	PP	22	67	5A, 250V	2.5A, 28V
C	N/A	23	N/A	22A, 250V	
G	GG	24	64	15A, 480V	0.25A, 250V
S	N/A	25	N/A	10A, 250V	10A, 250V
F	FF	26	62	15A, 250V	0.4V, 120V
Y	YY	27	63	15A, 250V	
U	UU	28	N/A	15A, 250V	
E	EE	29	N/A	15A, 250V	
M	MM	31	70	1A, 250V	50mA, 60V
J	JJ	32	68	11A, 250V	5A, 30V
L	LL	42	71	1A, 125V	
N/A	N/A	50	N/A	15A, 250V	
H	HH	35	N/A	10A, 250V	0.3A, 250V

ASHCROFT®

Temperature Switches Watertight Enclosure, Type 400, B-Series

This broad Ashcroft® switch series is easy to use and readily retrofits to virtually all process, industrial and OEM applications.

- ***Watertight NEMA 4X, IP66 enclosure***
- ***Choice of switch elements for all applications, including hermetically sealed***
- ***UL, CSA listings standard***
- ***Wetted material is all-welded stainless steel***
- ***Fixed or limited adjustable deadband***
- ***Readily available***



1 - ENCLOSURE

T4 - Temperature switch, type 400, watertight enclosure meets NEMA 3, 4, 4X and 13, IP66 requirements

2 - SWITCH ELEMENTS

Order Code	Description/Maximum Electrical Ratings UL/CSA listed SPDT	
20[4]	Narrow deadband	15A, 125/250 Vac
21	Ammonia service	5A, 125/250 Vac
22[3]	Hermetically sealed switch, narrow deadband	5A, 125/250 Vac
23	Heavy duty ac	20A,125/250 Vac
24[1]	General purpose	15A,125/250/480 Vac 1/2A, 125 Vdc 1/4A, 250 Vdc
25	Heavy duty dc	10A,125/ Vac or dc 1/8HP 125/ Vac or dc
26[4]	Sealed environment proof	15A, 125/250 Vac
27	High temp. 300°F	15A, 125/250 Vac
28	Manual reset trip on increasing	15A, 125/250 Vac
29	Manual reset trip on decreasing	15A, 125/250 Vac
31	Low level (gold) contacts	1A,125/250 Vac
32	Hermetically sealed switch, general purpose	11A, 125/250 Vac 5A, 30 Vdc
50	Variable deadband	15A,125/250 Vac
	UL/CSA listed dual SPDT[2]	
61[4]	Dual narrow deadband	15A, 125/250 Vac
62[4]	Dual narrow environment proof	15A, 125/250 Vac
63	Dual high temp. 300°F	15A, 125/250 Vac
64	Dual general purpose	15A,125/250/480 Vac 1/2A, 125 Vdc 1/4A, 250 Vdc
65	Dual ammonia service	5A, 125/250/480

3 - THERMAL SYSTEM SELECTION[5]

DIRECT MOUNT

Order Code	System Material	Style
TS	316 SS	Rigid

REMOTE MOUNT

Order Code	System Material	Line Length	Style
T05	316 SS	5'	Capillary with 302 SS Spring Armor
T10	316 SS	10'	
T15	316 SS	15'	
T20	316 SS	20'	
T25	316 SS	25'	

4 - BULB LENGTH SELECTION[6]

DIRECT MOUNT

Order Code	"S" Dimension	Minimum Thermowell "U" Dimension
027	2¾"	—
040	4"	2½"
060	6"	4½"
090	9"	7½"
120	12"	10½"
	REMOTE MOUNT	
030	3"	2½"

5 - OPTIONS

See page 154

6 - STANDARD TEMPERATURE RANGES

See page 151

NOTES:

1. Standard switch.
2. Dual switches are 2 SPDT snap-action switches not independently adjustable.
3. Estimated dc rating, 2.5A, 28 Vdc (not UL listed).
4. Estimated dc rating, 0.4A, 120 Vdc (not UL listed).
5. Additional line lengths available, call factory.
6. Additional bulb lengths available, call factory.

TO ORDER THIS B-SERIES TEMPERATURE SWITCH:

Select:	T4	20	T05	030	XNH	150° to 260°F
1. Enclosure:						
2. Switch Element:						
3. Thermal System:						
4. Bulb Length:						
5. Options (page 154):						
6. Temperature Range (page 151):						

Reference Bulletin SW-10 *Consult factory for guidance in product selection*
Phone (203) 878-5641 FAX (203) 877-8519

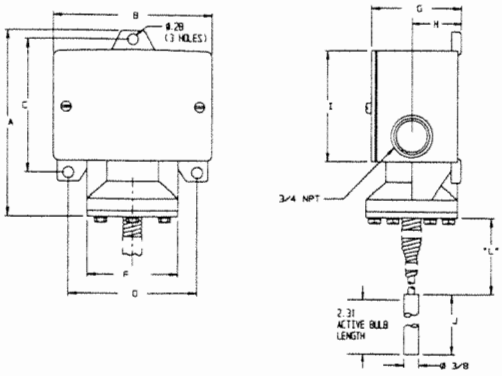
DRESSER INSTRUMENT

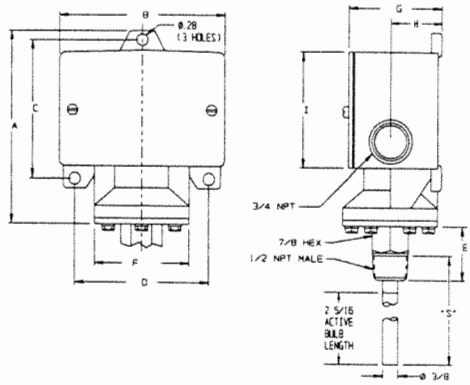
INSTALLATION AND MAINTENANCE T400 AND T700 SERIES ASHCROFT® SNAP ACTION SWITCHES FOR TEMPERATURE CONTROL

TEMPERATURE SWITCH - REMOTE MOUNT

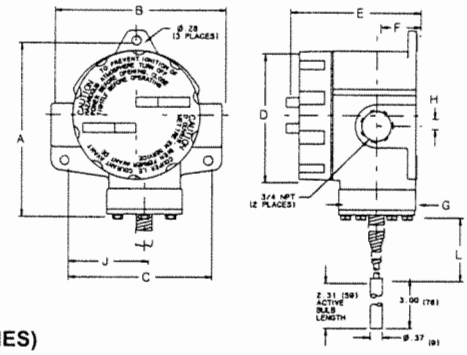
TEMPERATURE SWITCH - DIRECT MOUNT

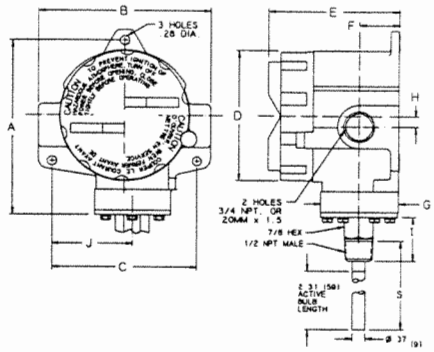
T400





T700





Dimensions (INCHES)

	A	B	C	D	E	F	G	H	I
T400	4.6	4.0	3.31	3.25	1.30	2.31	2.27	1.19	2.75
T700	5.23	5.20	4.38	3.88	3.58	1.22	2.31	.312	1.30

Stem Length - inches

S	2.75	4.0	6.0	9.0	12.0

Line Length - feet

L	5.0	10.0	15.0	20.0	25.0

INTRODUCTION

The Ashcroft® temperature switch is a precision built U.L. and C.S.A. approved control device which features a mechanical snap action switch. Controllers are available for operation on temperature with fixed or variable differential. Also, manual reset types are available for operation on increasing or decreasing temperature. The manual reset types remain tripped until reset by pressing a button on the top of the enclosure. The standard electrical switch is SPDT and is available with various electrical characteristics. Two SPDT switch elements mounted together are available except on variable deadband and manual reset types.

Bulb materials are either stainless steel or copper.

The Ashcroft snap action temperature switch is furnished in the standard NEMA 4/4x and explosion proof NEMA 7 and 9 enclosure styles. Both enclosures are epoxy coated aluminum castings.

INSTALLATION

These controls are precision instruments and should never be left with internal components exposed. During installation insure that covers are in place and conduit openings are closed except when actually working on the control. Good piping practice requires the use of a thermowell for installation where pressure may be applied to the thermal system. The thermowell provides protection against physical damage as well as corrosive effects of media flow. Use of a thermowell also facilitates removal of the bulb from the process line without disturbing the process. Standard thermowell materials include brass, steel and stainless steel; other materials are available upon request. Selection should be based on corrosion resistance requirements and process pressure.

DRESSER INSTRUMENT

INSTRUMENT DIVISION
DRESSER EQUIPMENT GROUP, INC.
MILFORD, CONNECTICUT 06460
PHONE: 203-878-5641 • FAX: 203-877-8519

250-2230-G.DOC
Rev. 01/30/98

PRINTED IN U.S.A.

MOUNTING T400 AND T700 SERIES

There are three holes external to the enclosure for surface mounting. Location of these holes is shown on the general dimension drawing..

A. Direct - Mounted Controls

These controls have a 1/2 NPT threaded adapter and may be attached directly or indirectly by means of a thermowell to equipment to be controlled.

When installing or removing control always use the wrench flats or hex above the threads. Do not twist the housing.

B. Remote Mounted Controls

Two types of union bushings are available to install a remote mounted bulb into a thermowell or other 1/2 NPT threaded hole. A non-pressure tight type consists of a bushing, split grommet and compression nut. To use this, the bulb is inserted through the nut and the split grommet is slipped into the capillary between the compression nut and the bushing. After positioning the bulb as desired tighten the nut to the bushing. This will lock the capillary at the desired location. The pressure tight type is clamped to the bulb after insertion by tightening the compression nut. To use this, the union bushing is screwed into the 1/2 NPT threaded hole. The compression nut and sleeve are slipped onto the bulb which is then inserted into the union bushing. The bulb is then positioned and the compression nut is hand tightened pus 2 1/4 turns. This will lock the capillary at the desired location.

ELECTRICAL CONNECTIONS

Remove cover
T400 Series - two screws hold cover to enclosure
T700 Series - cover unscrews

CONDUIT CONNECTIONS

Note - It is recommended that Teflon® tape or other sealant be used on conduit, bushing or plug threads to ensure integrity of the enclosure.

T400 series standard - one 3/4 NPT conduit hole right side.

T700 series standard - two 3/4 NPT conduit holes with one permanent plug. NEMA 7 & 9 enclosures require proper conduit seals and breathers as per the National Electrical Code.

T400 & WT700 series - XJL variation - 3/4 to 1/2 NPT reducing bushing supplied.

T400 series - XJK variation - two 3/4 NPT conduit holes.

T400 SERIES

SPDT - Wire directly to the switch according to circuit requirements. On controls with pilot lights wire lights according to circuit diagram on inside of cover. See special wiring instruction tag for single switches with two pilot lights and dual switches with one or more lights.

2-SPDT - Dual switching elements consist of two SPDT switches mounted together in a bracket. Switches are calibrated to have simultaneous operation within 1% of range either on increasing or decreasing pressure but not in both directions. Wire directly to the front and rear switch according to circuit requirements. Leads are provided on rear switch color coded as follows:

Common	- White
Normally Closed	- Red
Normally Open	- Blue

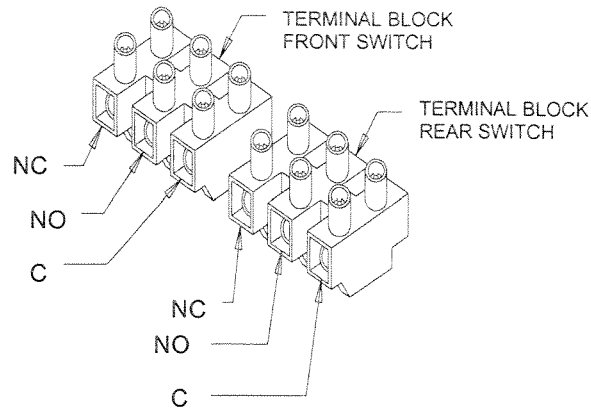
When hermetically sealed switch element (s) are supplied, the lead color coding is as follows:

Common	- White
Normally Closed	- Red
Normally Open	- Blue

T700 SERIES

SPDT - Wire directly to the switch according to circuit requirements.

2-SPDT - Wire to front switch terminal block (left) and rear switch terminal block (right) as marked. Strip insulation 5/16", insert in proper terminal connector and tighten clamping screw to secure.



ADJUSTMENT OF SETPOINT

T400 & T700 Series - A single setpoint adjustment nut (7/8") is located centrally at the bottom on the inside of the enclosure.

The bulb of the control should be immersed in a bath at the desired set point temperature. Optimum performance will be obtained if the bulb is fully immersed. Allow five minutes for initial stabilization.

As received, the temperature switch will normally be set to approximately 90% of the indicated range. After stabilization, turn the adjustment nut until switch changes mode. Direction of turning is indicated on a label affixed to the inside of the control enclosure. When set point has been achieved raise and lower temperature to insure that the set point is correct.

After installation of the control replace cover to insure electrical safety and to protect internal parts from the environment.

T450 and T750 VARIABLE DEADBAND SWITCHES

Deadband is varied by rotating the wheel on the precision switch. When viewed from the front of the enclosure, rotation to the left increases deadband - rotation to the right decreased deadband. Letters on the wheel may be used as a reference. Deadbands obtainable will vary from 0.5% to 9% of pressure range depending on range segment and type of diaphragm.

ADJUSTMENT OF SETPOINT

As received, the temperature switch will normally be set to approximately 90% of range. Rotate the wheel on the MICRO SWITCH all the way to the right; this will provide smallest deadband. Increase bath temperature to the required set point and turn the adjustment nut until the switch changes mode. Lower the bath temperature to reset the switch. Rotate the wheel on the MICRO SWITCH until the desired deadband is obtained. The upper set point will be changing upward with this adjustment. Lower the bath temperature to reset the switch. Raise the bath temperature to the desired set point and turn the adjusting nut until the switch changes mode. Lower the bath temperature and check reset point and deadband.

T428 & T429 MANUAL RESET SWITCHES

Dress wire leads from switch terminals so as not to interfere with or touch reset button.

Note- As indicated above, adjustment of set point is made by use of 7/8" nut. Precision switch element mounting screws and bracket adjusting screw are factory sealed and should not be tampered with.

MOUNTING T400 AND T700 SERIES

There are three holes external to the enclosure for surface mounting. Location of these holes is shown on the general dimension drawing..

A. Direct - Mounted Controls

These controls have a 1/2 NPT threaded adapter and may be attached directly or indirectly by means of a thermowell to equipment to be controlled.

When installing or removing control always use the wrench flats or hex above the threads. Do not twist the housing.

B. Remote Mounted Controls

Two types of union bushings are available to install a remote mounted bulb into a thermowell or other 1/2 NPT threaded hole. A non-pressure tight type consists of a bushing, split grommet and compression nut. To use this, the bulb is inserted through the nut and the split grommet is slipped into the capillary between the compression nut and the bushing. After positioning the bulb as desired tighten the nut to the bushing. This will lock the capillary at the desired location. The pressure tight type is clamped to the bulb after insertion by tightening the compression nut. To use this, the union bushing is screwed into the 1/2 NPT threaded hole. The compression nut and sleeve are slipped onto the bulb which is then inserted into the union bushing. The bulb is then positioned and the compression nut is hand tightened pus 2 1/4 turns. This will lock the capillary at the desired location.

ELECTRICAL CONNECTIONS

Remove cover

T400 Series - two screws hold cover to enclosure

T700 Series - cover unscrews

CONDUIT CONNECTIONS

Note - It is recommended that Teflon® tape or other sealant be used on conduit, bushing or plug threads to ensure integrity of the enclosure.

T400 series standard - one 3/4 NPT conduit hole right side.

T700 series standard - two 3/4 NPT conduit holes with one permanent plug. NEMA 7 & 9 enclosures require proper conduit seals and breathers as per the National Electrical Code.

T400 & WT700 series - XJL variation - 3/4 to 1/2 NPT reducing bushing supplied.

T400 series - XJK variation - two 3/4 NPT conduit holes.

T400 SERIES

SPDT - Wire directly to the switch according to circuit requirements. On controls with pilot lights wire lights according to circuit diagram on inside of cover. See special wiring instruction tag for single switches with two pilot lights and dual switches with one or more lights.

2-SPDT - Dual switching elements consist of two SPDT switches mounted together in a bracket. Switches are calibrated to have simultaneous operation within 1% of range either on increasing or decreasing pressure but not in both directions. Wire directly to the front and rear switch according to circuit requirements. Leads are provided on rear switch color coded as follows:

Common	- White
Normally Closed	- Red
Normally Open	- Blue

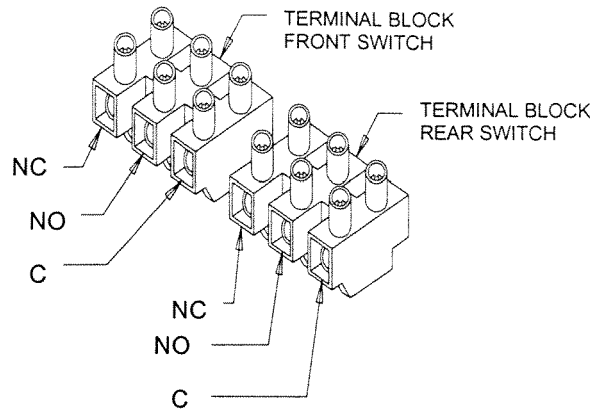
When hermetically sealed switch element (s) are supplied, the lead color coding is as follows:

Common	- White
Normally Closed	- Red
Normally Open	- Blue

T700 SERIES

SPDT - Wire directly to the switch according to circuit requirements.

2-SPDT - Wire to front switch terminal block (left) and rear switch terminal block (right) as marked. Strip insulation 5/16", insert in proper terminal connector and tighten clamping screw to secure.



ADJUSTMENT OF SETPOINT

T400 & T700 Series - A single setpoint adjustment nut (7/8") is located centrally at the bottom on the inside of the enclosure.

The bulb of the control should be immersed in a bath at the desired set point temperature. Optimum performance will be obtained if the bulb is fully immersed. Allow five minutes for initial stabilization.

As received, the temperature switch will normally be set to approximately 90% of the indicated range. After stabilization, turn the adjustment nut until switch changes mode. Direction of turning is indicated on a label affixed to the inside of the control enclosure. When set point has been achieved raise and lower temperature to insure that the set point is correct.

After installation of the control replace cover to insure electrical safety and to protect internal parts from the environment.

T450 and T750 VARIABLE DEADBAND SWITCHES

Deadband is varied by rotating the wheel on the precision switch. When viewed from the front of the enclosure, rotation to the left increases deadband - rotation to the right decreased deadband. Letters on the wheel may be used as a reference. Deadbands obtainable will vary from 0.5% to 9% of pressure range depending on range segment and type of diaphragm.

ADJUSTMENT OF SETPOINT

As received, the temperature switch will normally be set to approximately 90% of range. Rotate the wheel on the MICRO SWITCH all the way to the right; this will provide smallest deadband. Increase bath temperature to the required set point and turn the adjustment nut until the switch changes mode. Lower the bath temperature to reset the switch. Rotate the wheel on the MICRO SWITCH until the desired deadband is obtained. The upper set point will be changing upward with this adjustment. Lower the bath temperature to reset the switch. Raise the bath temperature to the desired set point and turn the adjusting nut until the switch changes mode. Lower the bath temperature and check reset point and deadband.

T428 & T429 MANUAL RESET SWITCHES

Dress wire leads from switch terminals so as not to interfere with or touch reset button.

Note- As indicated above, adjustment of set point is made by use of 7/8" nut. Precision switch element mounting screws and bracket adjusting screw are factory sealed and should not be tampered with.

85731

Installation and Maintenance Instructions for CE Mark on ASHCROFT® Switches/Low Voltage Directive 73/23/EEC

ASHCROFT®

INSTALLATION REQUIREMENTS

- To minimize the risk of injury, the switch enclosure must be selected according to the area classification and installed according to the required safety and electrical codes.
- Before operating the switch all conduit entries and/or junction boxes need to be closed according to the required safety and electrical codes.
- To attain the degree of protection listed on the switch it may be necessary to add required conduit fittings.
- The switch must be protected from moisture, shock and/or extreme vibration.
- The ambient temperature limits for switches are –20 to 150°F, (–28 to 65°C).

CAUTIONS

- Always install the cover after wiring the switch and before power is supplied.
- Before removing the cover in hazardous areas be sure there is no explosive atmosphere present and the power supply is turned off.
- For CENELEC approved switches all safety locking devices and electrical earthing must be installed or connected before operating.
- Never carry a temperature switch by holding only the stem, bulb or capillary.
- Do not exceed ranges, current and/or voltage limits.
- The protection degree of the switch is only valid when the switch is installed in accordance with all safety and electrical codes and regulations.

CLEANING

- Never use aggressive solvents.
- Do not use high pressure water to clean the switch.

MAINTENANCE/TROUBLESHOOTING

- All Ashcroft switches require little or no maintenance.
- Be sure that the case is closed at all times.
- When the switch is exposed to process media that may harden and/or build up in the pressure port, the switch should be removed and cleaned as needed.
- If the switch does not function, only trained and skilled personnel should check on the wiring, power supply and/or mounting.
- If the problem can not be solved, please contact one of the Dresser affiliates or distributors.

ELECTRICAL CONNECTIONS

- Only trained and skilled personnel are allowed to install the wires to the electrical terminals of the switch.
- Cable couplers, glands and conduit connectors must have the correct electrical approvals.
- Always follow safety and electrical regulations when connecting these devices.
- The system ground of the device is marked with a green colored screw and/or by the ground symbol.
- CENELEC approved switches have an external ground screw that must be connected.
- Micro switch terminals and wire color codes:

NO	(Normally Open)	Blue
NC	(Normally Closed)	Red
C	(Common)	White
Ground		Green (F-Series only)

TABLE 1: MICRO SWITCH ELECTRICAL RATINGS

MICRO SWITCH CODE				ELECTRICAL RATING	
Single	Dual	Single	Dual	Vac	Vdc
K	KK	20	61	15A, 250V	0.4A, 120V
W	WW	21	65	5A, 250V	
P	PP	22	67	5A, 250V	2.5A, 28V
C	N/A	23	N/A	22A, 250V	
G	GG	24	64	15A, 480V	0.25A, 250V
S	N/A	25	N/A	10A, 250V	10A, 250V
F	FF	26	62	15A, 250V	0.4V, 120V
Y	YY	27	63	15A, 250V	
U	UU	28	N/A	15A, 250V	
E	EE	29	N/A	15A, 250V	
M	MM	31	70	1A, 250V	50mA, 60V
J	JJ	32	68	11A, 250V	5A, 30V
L	LL	42	71	1A, 125V	
N/A	N/A	50	N/A	15A, 250V	
H	HH	35	N/A	10A, 250V	0.3A, 250V

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All sales subject to standard terms and conditions of sale. I&M009-10030-10/00 (250-3136) GBE

DRESSER Measurement

ASHCROFT®

Duragauge® Pressure Gauge
Type 1377, Grade 2A (±0.5%)

- ***Exclusive Teflon coated 400 series stainless steel rotary movement for longer life***
- ***Patented Duratube™ with "Welded-Tube" construction controls stress for longer life***
- ***Exclusive "Round Cap Tip" construction lowers stresses for longer life***
- ***Easily adjustable, self-locking micrometer pointer***
- ***New PLUS!™ Performance Option:***
  - ***Liquid-filled performance in a dry gauge***
  - ***Fights vibration and pulsations without liquid-filled headaches***
  - ***See page 174 for details***
  - ***Order as option XLL***

Type 1377 Duragauge® pressure gauge is offered in 4½", 6" and 8½" dial sizes.

Designed for flush mounting, this solid-front gauge is ideal for panel board applications. Its black epoxy coating and its tough aluminum weatherproof case easily allow application in a variety of climatic conditions.

BOURDON SYSTEM SELECTION

Ordering Code	Bourdon Tube & Tip Material[1] (all joints TIG welded except "A")	Socket Material	Tube Type	Range Selection Limits (psi)	NPT Conn.[2]
A	Grade A Phosphor Bronze Tube-Brass Tip, Silver Brazed	Brass	C-Tube	12/1000	¼,½
B	4130 alloy steel	1019 steel	C-Tube	15/1500	¼,½
			Helical	2000/5000	¼,½
R[4]	316 stainless steel	1019 steel	C-Tube	12/1500	¼,½
			Helical	2000/20,000	¼,½
S	316 stainless steel	316 stainless steel	C-Tube	12/1500	¼,½
			Helical	2000/20,000	¼,½
P[3]	K Monel	Monel 400	C-Tube	15/1500	¼,½
			Helical	2000/30,000	¼,½[5]

(1) For selection of the correct bourdon system material, see the media application table on page 178.
(2) Other connections available on application.
(3) Use for applications where NACE standard MR-01-75 is specified.
(4) "R" bourdon system not available in 8½" dial size.
(5) 30,000 psi range supplied with ¼ high pressure connection, ½ NPT optional.

STANDARD RANGES

Pressure psi	Compound psi
0/15	30" Hg/15 psi
0/30	30" Hg/30 psi
0/60	30" Hg/60 psi
0/100	30" Hg/100 psi
0/160	30" Hg/150 psi
0/200	30" Hg/300 psi
0/300	
0/400	**Vacuum**
0/600	30/0 in.Hg
0/800	34/0 ftH_2O
0/1000	
0/1500	
0/2000	
0/3000	
0/5000	**NOTE:**
0/10,000	**Equivalent standard**
0/20,000	**kg/cm², and kPa metric**
0/30,000	**ranges are available.**

TO ORDER THIS 1377 DURAGAUGE:

Select: **45** **1377** **AS*** **04B** **XXX** **0/2000 psi**

1. Dial size–4½"
2. Case type–1377
   Ring–steel, black enamel finish
3. Bourdon system selection ordering code
4. Connection–¼ NPT (02), ½ NPT (04), Lower (L), Back (B)
5. Optional features–see page 108
6. Standard pressure range
7. Accessories–see pages 166-173

(*) "S" denotes solid front case design

Reference Bulletin DU-1

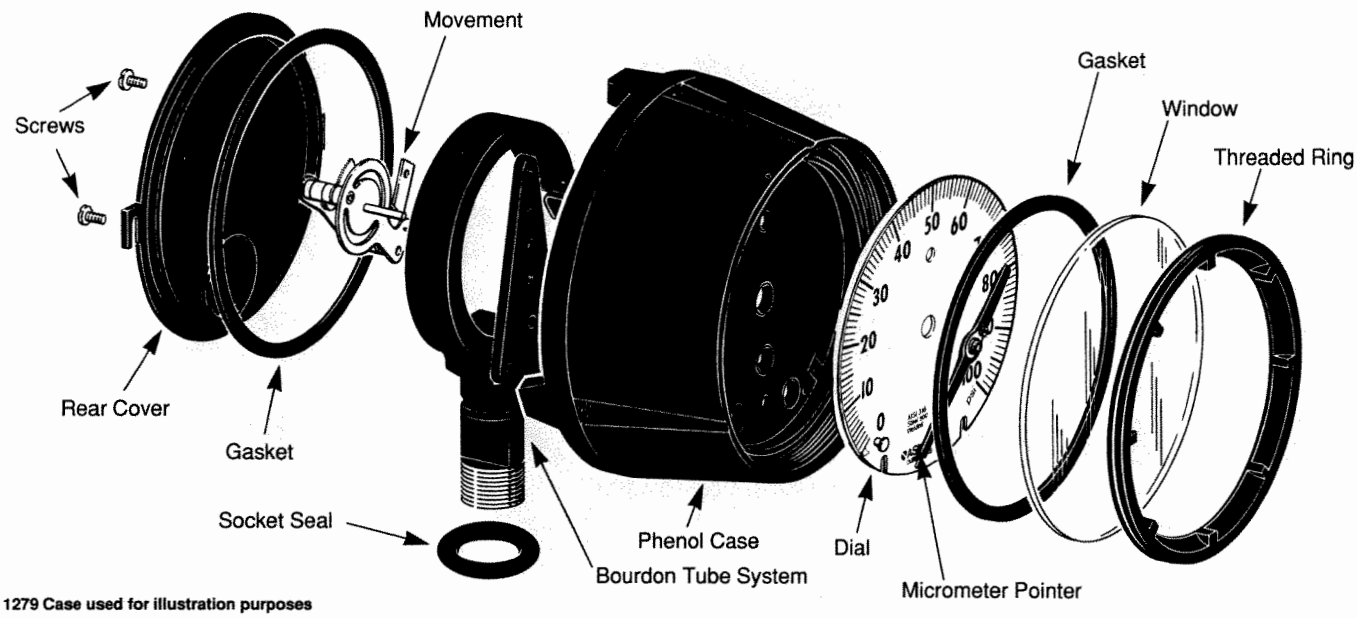
MADE IN U.S.A.

Consult factory for guidance in product selection
Phone (203) 378-8281, FAX (203) 385-0499 or
visit our web site at www.ashcroft.com

INSTRUMENT
a Halliburton company

Product Selection Information

Ashcroft Duragauge® Pressure Gauge



1279 Case used for illustration purposes

Consult ASME B40.1 for guidance in gauge selection

WARNING: To prevent misapplication, pressure gauges should be selected considering media and ambient operating conditions. Improper application can be detrimental to the gauge, causing failure and possible personal injury or property damage. The information contained in this catalog is offered as a guide to assist in making the proper selection of a pressure gauge. Additional information is available from Dresser Instrument Division.

Pressure Ranges:

As recommended by ASME B40.1, select a gauge with a full scale pressure range of approximately twice the normal operating pressure. The maximum operating pressure should not exceed approximately 75% of the full scale range. Failure to select a gauge range within these criteria may ultimately result in fatigue failure of the bourdon tube.

Operating Conditions:

The operating conditions to which a gauge will be subjected must be considered. If the gauge will be subjected to severe vibrations or pressure pulsation, liquid filling the gauge may be necessary to obtain normal product life. Other than discoloration of the dial and hardening of the gasketing that may occur as ambient temperatures exceed 150°F, metal case Duragauges (that are not liquid filled) can withstand continuous ambient temperatures as high as 350°F. All gauges can withstand ambient temperatures up to 250°F. Accuracy will be affected by approximately 1.5% per 100°F. Gauges with welded joints will withstand 750°F (450°F with silver brazed joints) for short times without rupture, although other parts of the gauge will be destroyed and calibration will be lost. Proper selection of the bourdon system material is dependent on the process fluid to which the system will be subjected. If the correct material is not available, the use of a diaphragm seal may be necessary to protect the system from the process fluid. Liquid filled gauges are recommended for the discharge side of positive displacement pumps.

Pressure Elements:

Available in a wide variety of materials, including: phosphor bronze, alloy steel, 316 stainless steel, K Monel and Inconel.

Cases:

Four solid front case types are offered. Solid front cases have a solid wall between the bourdon tube and the window. The 1279 & 1379 Duragauge cases are field convertible by means of a kit. These gauges can be converted to hermetically sealed or liquid filled. Buna-N seals at the front and rear of the case provide resistance to aggressive atmospheres.

Rings:

The ring, which retains the window, is threaded, bayonet (cam), or hinged, depending upon case type.

Movements:

Movements are designed and materials of construction selected to reduce friction and extend wear life. The Duragauge gauge's stainless steel movement is a rotary geared design with Teflon coated wear parts.

Dials:

Dials are uniformly graduated and have highly legible black markings. A pointer dial stop pin at the 7:00 o'clock position is standard.

Windows:

The standard is glass on dry gauges and acrylic on liquid filled gauges. Options are laminated safety glass, non-glare glass or acrylic.

Pointers:

Duragauge pressure gauges have balanced micrometer adjustable pointers which can be repositioned without removal from the pinion shaft.

Viton®, Teflon®, Kalrez®, Kynar® – DuPont Trademark
Carpenter 20® – Carpenter Steel Trademark
Inconel®, Monel® – Huntington Alloys Inc. Trademark
Hastelloy – Cabot Corp. Trademark
Nickel® – International Nickel Co., Inc. Trademark
Halocarbon® – Halocarbon Products Co. Trademark

ASHCROFT®

PRESSURE GAUGE INSTALLATION, OPERATION AND MAINTENANCE

DRESSER Instruments

I&M012-10098-5/02 (250-1353H)

CONTENTS

1.0 Selection and Application *Page*

1.1 Range 1
1.2 Temperature 1
1.3 Media 1
1.4 Oxidizing media 1
1.5 Pulsation/Vibration 1
1.6 Gauge fills 1
1.7 Mounting 2

2.0 Temperature

2.1 Ratings 2
2.2 Accuracy 2
2.3 Steam service 2
2.4 Hot or very cold media 2
2.5 Diaphragm seals 2
2.6 Autoclaving 2

3.0 Installation

3.1 Location 3
3.2 Gauge reuse 3
3.3 Tightening of gauge 3
3.4 Process isolation 3
3.5 Surface mounting 3
3.6 Flush mounting 3

4.0 Operation

4.1 Frequency of inspection 3
4.2 In-service inspection 3
4.3 When to check accuracy 4
4.4 When to recalibrate 4
4.5 Other considerations 4
4.6 Spare parts 4

5.0 Gauge Replacement 4

6.0 Accuracy: Procedures/Definitions 4-5

6.1 Calibration - Rotary movement gauges 7
6.2 Calibration - 1009 Duralife® Pressure Gauge 7
6.3 Positive Pressure Ranges 7-10

CONTENTS

Page

7.0 Diaphragm Seals

7.1 General 12
7.2 Installation 12
7.3 Operation 12
7.4 Maintenance 12
7.5 Failures 12

8.0 Dampening Devices

8.1 General 13
8.2 Throttle Screws & Plugs 13
8.3 Ashcroft Gauge Saver 13
8.4 Ashcroft Pulsation Dampener 13
8.5 Ashcroft Pressure Snubber 13
8.6 Campbell Micro-Bean® 13
8.7 Ashcroft Needle Valves 13
8.8 Chemiquip® Pressure Limiting Valves 13

9.0 Resources

9.1 Training Videos 14
9.2 Pressure Instrument Testing Equipment 14
9.3 Tools & Tool Kits 14
9.4 Sales Bulletins 14

Cover photo courtesy of Johnson/Yokogawa Co.

Campbell Micro-Bean® is a registered trademark of J.A. Campbell Co.

Chemiquip® is a registered trademark of Chemiquip Products Co. Inc.

1.0 SELECTION & APPLICATION

Users should become familiar with ASME B40.1 (Gauges – Pressure Indicating Dial Type – Elastic Element) before specifying pressure measuring instruments. That document – containing valuable information regarding gauge construction, accuracy, safety, selection and testing – may be ordered from:

ASME International
Three Park Avenue
New York, N.Y. 10016-5990
800-843-2763 (US/Canada)
95-800-843-2763 (Mexico)
973-882-1167 outside North America
Email: infocentral@asme.org

WARNING: To prevent misapplication, pressure gauges should be selected considering media and ambient operating conditions. Improper application can be detrimental to the gauge, causing failure and possible personal injury, property damage or death. The information contained in this manual is offered as a guide in making the proper selection of a pressure gauge. Additional information is available from Dresser Instrument Division.

The following is a highlight of some of the more important considerations:

1.1 Range – The range of the instrument should be approximately twice the maximum operating pressure. Too low a range may result in (a) low fatigue life of the elastic element due to high operating stress and (b) susceptibility to overpressure set due to pressure transients that exceed the normal operating pressure. Too high a range may yield insufficient resolution for the application.

1.2 Temperature – Refer to page 2 of this manual for important information concerning temperature related limitations of pressure gauges, both dry and liquid filled.

1.3 Media – The material of the process sensing element must be compatible with the process media. Consult the Corrosion Guide available on the website: **www.dresserinstruments.com** or Dresser Instrument Division. Use of a diaphragm seal with the gauge is recommended for process media that (a) are corrosive to the process sensing element; (b) contain heavy particulates (slurries) or (c) are very viscous including those that harden at room temperature.

1.4 Oxidizing media – Gauges for direct use on oxidizing media should be specially cleaned. Gauges for oxygen service should be ordered to variation X6B and will carry the ASME required dial marking "USE NO OIL" in red letters. Gauges for direct use on other oxidizing media may be ordered to variation X6W. They will be cleaned but carry no dial marking. Plus!® gauges or Halocarbon filled gauge or diaphragm fill is required for use with oxidizing media; order variation XCF. See page 4 of the text of the Ashcroft Corrosion Guide mentioned in paragraph 1.4 above for more information.

1.5 Pulsation/Vibration – Pressure pulsation can be dampened by several mechanisms; the patented *PLUS! Performance* gauge will handle the vast majority of applications. One exception to this is high frequency pulsation which is difficult to detect. The only indication may be an upscale zero shift due to movement wear. These applications should be addressed with a liquid filled gauge, or in extreme cases, a remotely mounted liquid filled gauge connected with a length of capillary line. The small diameter of the capillary provides excellent dampening, but can be plugged. The Ashcroft 1106 pulsation dampener and 112 snubber are auxiliary devices which dampen pulsation with less tendency to plug.

1.6 Gauge fills. – Once it has been determined that a liquid filled gauge is in order, the next step is selecting the type of fill. **Glycerin** satisfies most applications. While being the least expensive fill, its usable temperature range is 20/250°F. **Silicone** filled gauges have a broader service range: –40/250°F. Oxidizing media require the use of **Halocarbon,** with a service range of –50/250°F. Pointer motion will be slowed at the low end of the low end of these temperature ranges.

1.7 Mounting – Users should predetermine how the gauge will be mounted in service: stem (pipe), wall (surface) or panel (flush). Ashcroft wall or panel mounting kits should be ordered with the gauge. See paragraph 3 Installation.

2.0 TEMPERATURE

2.1 Ambient Temperature – To ensure long life and accuracy, pressure gauges should preferably be used at an ambient temperature between –20 and +150F (–30 to +65C). At very low temperatures, standard gauges may exhibit slow pointer response. Above 150F, the accuracy will be affected by approximately 1.5% per 100F. Other than discoloration of the dial and hardening of the gasketing, non-liquid filled type 1279 (phenolic case) and 1379 (aluminum case) Duragauges, with standard glass windows, and Duralife gauges types 1008 and 1009, can withstand continuous operating temperatures up to 250F. Liquid filled gauges can withstand 200F but glycerin fill and the acrylic window of Duragauges will tend to yellow. Silicone fill will have much less tendency to yellow. Low pressure, liquid filled types 1008 and 1009 gauges may have some downscale errors caused by liquid fill expansion. This can be alleviated by "burping" the gauge by gently pushing the top fill plug to one side to admit air to the case.

Although the gauge may be destroyed and calibration lost, gauges can withstand short times at the following temperatures: gauges with all welded pressure boundary joints, 750F (400C); gauges with silver brazed joints, 450F (232C) and gauges with soft soldered joints, 250F (121C). For expected long term service below –20F (–30C) Duragauges and 4½″ 1009 gauges should be hermetically sealed and specially lubricated; add "H" to the product code for hermetic sealing. Add variation XVY for special lubricant. Standard Duralife gauges may be used to –50F (–45C) without modification.

2.2 Accuracy – Heat and cold affect accuracy of indication. A general rule of thumb for **dry gauges** is 0.5% of full scale change for every 40°F change from 75°F. Double that allowance for gauges with hermetically sealed or liquid filled cases, except for Duragauge® gauges where no extra allowance is required due to the elastomeric, compensating back. Above 250°F there may exist very significant errors in indication.

2.3 Steam service – In order to prevent live steam from entering the bourdon tube, a siphon filled with water should be installed between the gauge and the process line. Siphons can be supplied with ratings up to 4,000 psi. If freezing of the condensate in the loop of the siphon is a possibility, a diaphragm seal should be used to isolate the gauge from the process steam. Siphons should also be used whenever condensing, hot vapors (not just steam) are present. Super heated steam should have enough piping or capillary line ahead of the siphon to maintain liquid water in the siphon loop.

2.4 Hot or very cold media – A five foot capillary line assembly will bring most hot or cold process media within the recommended gauge ambient temperature range. For media above 750F (400C) the customer should use his own small diameter piping to avoid possible corrosion of the stainless steel. The five foot capillary will protect the gauges used on the common cryogenic (less than –300F (200C) gases, liquid argon, nitrogen, and oxygen. The capillary and gauge must be cleaned for oxygen service. The media must not be corrosive to stainless steel, and must not plug the small bore of the capillary.

2.5 Diaphragm seals – As mentioned above, a diaphragm seal should be used to protect gauges from corrosive media, or media that will plug the instrument. Diaphragm seals are offered in a wide variety of designs and corrosion resistant materials to accommodate almost any application and most connections. Request bulletin OH-1 for details. Recommended materials for corrosive service may be found in the Corrosion Guide available at **www.dresserinstruments.com**.

2.6 Autoclaving – Sanitary gauges with

clamp type connections are frequently steam sterilized in an autoclave. Gauges equipped with polysulfone windows will withstand more autoclave cycles than those equipped with polycarbonate windows. Gauges equipped with plain glass or laminated safety glass **should not be autoclaved.** Gauge cases should be vented to atmosphere (removing the rubber fill/safety plug if necessary) **before** autoclaving to prevent the plastic window from cracking or excessively distorting. If the gauge is liquid filled, the fill should also be drained from the case and the front ring loosened before autoclaving.

3.0 INSTALLATION

3.1 Location – Whenever possible, gauges should be located to minimize the effects of vibration, extreme ambient temperatures and moisture. Dry locations away from very high thermal sources (ovens, boilers etc.) are preferred. If the mechanical vibration level is extreme, the gauge should be remotely located (usually on a wall) and connected to the pressure source via flexible tubing.

3.2 Gauge reuse – ASME B40.1 recommends that gauges not be moved indiscriminately from one application to another. The cumulative number of pressure cycles on an in-service or previously used gauge is generally unknown, so it is generally safer to install a new gauge whenever and wherever possible. This will also minimize the possibility of a reaction with previous media.

3.3 Tightening of gauge – Torque should never be applied to the gauge case. Instead, an open end or adjustable wrench should always be used on the wrench flats of the gauge socket to tighten the gauge into the fitting or pipe. NPT threads require the use of a suitable thread sealant, such as pipe dope or teflon tape, and must be tightened very securely to ensure a leak tight seal.

CAUTION: Torque applied to a diaphragm seal or its attached gauge, that tends to loosen one relative to the other, can cause loss of fill and subsequent inaccurate readings. Always apply torque **only** to the wrench flats on the lower seal housing when installing filled, diaphragm seal assemblies or removing same from process lines.

3.4 Process isolation – A shut-off valve should be installed between the gauge and the process in order to be able to isolate the gauge for inspection or replacement without shutting down the process.

3.5 Surface mounting – Also known as wall mounting. Gauges should be kept free of piping strains. The gauge case mounting feet, if applicable, will ensure clearance between the pressure relieving back and the mounting surface.

3.6 Flush mounting – Also known as panel mounting. The applicable panel mounting cutout dimensions can be found in Ashcroft sales bulletins – see item 9.4 RESOURCES on page 14 of this manual. These dimensions are also on Ashcroft® gauge general dimension drawings which can be obtained from the Customer Service department in Stratford, Connecticut.

4.0 OPERATION

4.1 Frequency of inspection – This is quite subjective and depends upon the severity of the service and how critical the accuracy of the indicated pressure is. For example, a monthly inspection frequency may be in order for critical, severe service applications. Annual inspections, or even less frequent schedules, are often employed in non-critical applications.

4.2 In-service inspection – If the accuracy of the gauge cannot be checked in place, the user can at least look for (a) erratic or random pointer motion; (b) readings that are suspect – especially indications of pressure when the user believes the true pressure is 0 psig. Any gauge which is obviously not working or indicating erroneously, should be immediately valved-off or removed from service to avoid a possible pressure boundary failure.

4.3 When to check accuracy – Obviously any suspicious behavior of the gauge pointer warrants a full accuracy check be performed. Even if the gauge is not showing any symptoms of abnormal performance, the user may want to establish a frequency of bench type inspection.

4.4 When to recalibrate – This depends on the criticality of the application. If the accuracy of a 3-2-3% commercial type gauge is only 0.5% beyond specification, the user must decide whether it's worth the time and expense to bring the gauge back into specification. Conversely if the accuracy of a 0.25% test gauge is found to be 0.1% out of specification then obviously the gauge should be recalibrated.

4.5 Other considerations – These include (a) bent or unattached pointers due to extreme pressure pulsation; (b) broken windows which should be replaced to keep dirt out of the internals; (c) leakage of gauge fill; (d) case damage – dents and/or cracks; (e) any signs of service media leakage through the gauge including its connection; (f) discoloration of gauge fill that impedes readability.

4.6 Spare parts – As a general rule it is recommended that the user maintain in his parts inventory one complete Ashcroft instrument for every ten (or fraction thereof) of that instrument type in service.

5.0 GAUGE REPLACEMENT

It is recommended that the user stock one complete Ashcroft instrument for every ten (or fraction thereof) of that instrument type in service. With regard to gauges having a service history, consideration should be given to discarding rather than repairing them. Gauges in this category include the following:

a. Gauges that exhibit a span shift greater than 10%. It is possible the bourdon tube has suffered thinning of its walls by corrosion.

b. Gauges that exhibit a zero shift greater than 25%. It is likely the bourdon tube has seen significant overpressure leaving residual stresses that may be detrimental to the application.

c. Gauges which have accumulated over 1,000,000 pressure cycles with significant pointer excursion.

d. Gauges showing any signs of corrosion and/or leakage of the pressure system.

e. Gauges which have been exposed to high temperature or simply exhibit signs of having been exposed to high temperature – specifically 250°F or greater for soft soldered systems; 450°F or greater for brazed systems; and 750°F or greater for welded systems.

f. Gauges showing significant friction error and/or wear of the movement and linkage.

g. Gauges having damaged sockets, especially damaged threads.

h. Liquid filled gauges showing loss of case fill.

NOTE: ASME B40.1 does not recommend moving gauges from one application to another. This policy is prudent in that it encourages the user to procure a new gauge, properly tailored by specification, to each application that arises.

6.0 ACCURACY: PROCEDURES/DEFINITIONS

Accuracy inspection – Readings at approximately five points equally spaced over the dial should be taken, both upscale and downscale, before and after lightly rapping the gauge to remove friction. A pressure standard with accuracy at least 4 times greater than the accuracy of the gauge being tested is recommended.

Equipment – A finely regulated pressure supply will be required. It is critical that the piping system associated with the test setup be leaktight. The gauge under test should be

positioned as it will be in service to eliminate positional errors due to gravity.

Method – ASME B40.1 recommends that **known** pressure (based on the reading from the pressure standard used) be applied to the gauge under test. Readings including any error from the nominal input pressure, are then taken from the gauge under test. The practice of aligning the pointer of the gauge under test with a dial graduation and then reading the error from the master gauge ("reverse reading") can result in inconsistent and misleading data and should NOT be used.

Calibration chart – After recording all of the readings it is necessary to calculate the errors associated with each test point using the following formula: ERROR in percent = 100 times (TRUE VALUE minus READING) ÷ RANGE. Plotting the individual errors (Figure 1 on page 6) makes it possible to visualize the total gauge characteristic. The plot should contain all four curves: upscale – before rap; upscale – after rap; downscale – before rap; downscale – after rap. *Rap* means lightly tapping the gauge **before** reading to remove friction as described in ASME B40.1.

Referring to Figure 1 on page 6, several classes of error may be seen:

Zero – An error which is approximately equal over the entire scale. This error can be manifested when either the gauge is dropped or overpressured and the bourdon tube takes a permanent set. This error may often be corrected by simply repositioning the pointer. Except for test gauges, it is recommended that the pointer be set at midscale pressure to "split" the errors.

Span – A span error exists when the error at full scale pressure is different from the error at zero pressure. This error is often proportional to the applied pressure. Most Ashcroft gauges are equipped with an internal, adjusting mechanism with which the user can correct any span errors which have developed in service.

Linearity – A gauge that has been properly spanned can still be out of specification at intermediate points if the response of the gauge as seen in Figure 1 on page 6 is not linear. The Ashcroft Duragauge® is equipped with a rotary movement feature which permits the user to minimize this class of error. Other Ashcroft gauge designs (e.g., 1009 Duralife®) require that the dial be moved left or right prior to tightening the dial screws.

Hysteresis – Some bourdon tubes have a material property known as hysteresis. This material characteristic results in differences between the upscale and downscale curves. This class of error can **not** be eliminated by adjusting the gauge movement or dial position.

Friction – This error is defined as the difference in readings before and after lightly tapping the gauge case at a check point. Possible causes of friction are burrs or foreign material in the movement gearing, "bound" linkages between the movement and the bourdon tube, or an improperly tensioned hairspring. If correcting these potential causes of friction does not eliminate excessive friction error, the movement should be replaced.

(Continued on page 7)

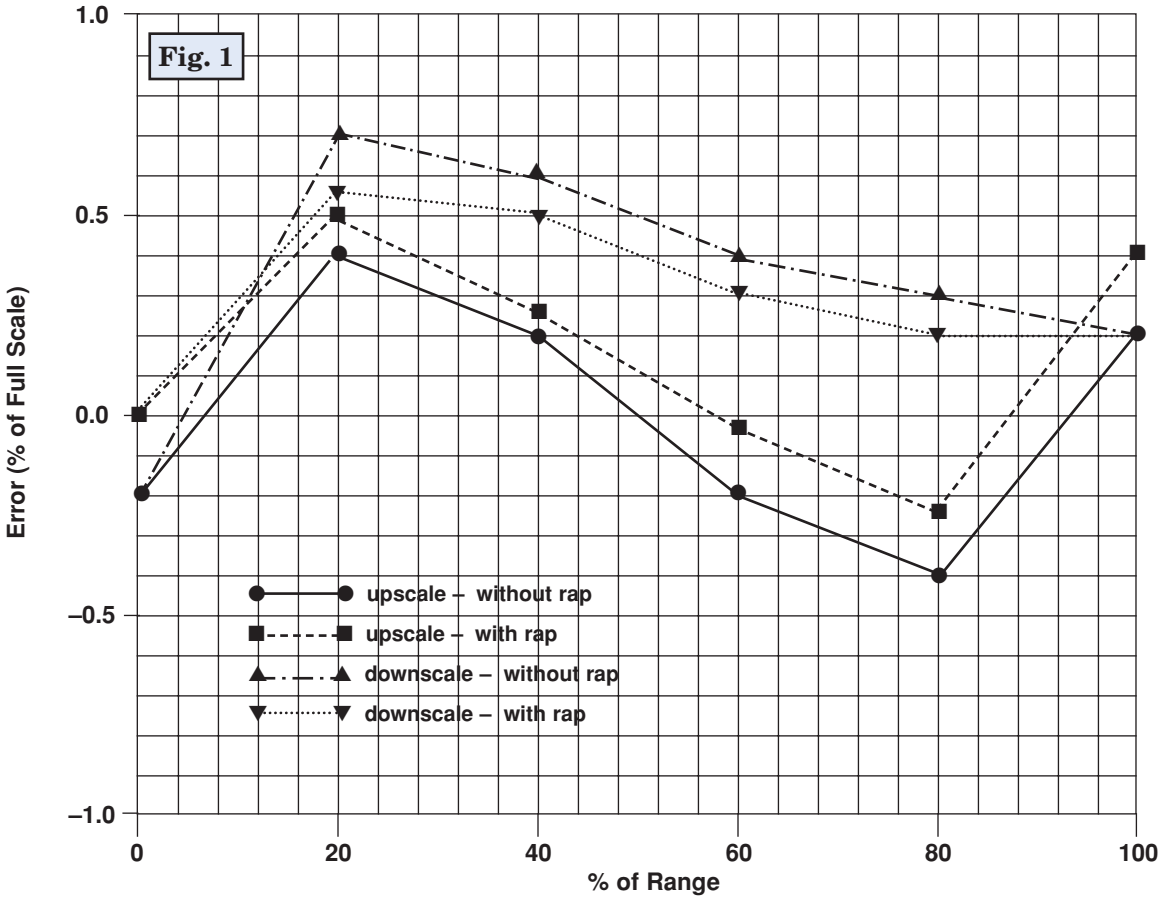
TYPICAL CALIBRATION CHART

INDICATED VALUE (PSI)

True Value – PSI	Increasing – Without RAP	Increasing – With RAP	Decreasing – Without RAP	Decreasing – With RAP
0	–.4	0	–.4	0
40	+.8	+1.0	+1.4	+1.1
80	+.4	+.5	+1.2	+1.0
120	–.4	–1.0	+.8	+.6
160	–.8	–.5	+.6	+.4
200	+.4	+.8	+.4	+.4

ERROR (% OF FULL SCALE)

True Value – % of Range	Increasing – Without RAP	Increasing – With RAP	Decreasing – Without RAP	Decreasing – With RAP
0	–.20	0	–.20	0
20	+.40	+.50	+.70	+.55
40	+.20	+.25	+.60	+.50
60	–.20	–.05	+.40	+.30
80	–.40	–.25	+.30	+.20
100	+.20	+.40	+.20	+.20



6.1 Calibration – Rotary Movement Gauges

– Inspect gauge for accuracy. Many times gauges are simply "off zero" and a simple pointer adjustment using the micrometer pointer is adequate. If inspection shows the gauge warrants recalibration to correct span and/or linearity errors, proceed as follows:

a. Remove ring, window and, if solid front case, the rear closure assembly.

b. Pressurize the gauge **once** to full scale and back to zero.

c. Refer to Figure 2 on page 8 for a view of a typical Ashcroft system assembly with component parts identified.

d. For solid front gauges, adjust the micrometer pointer so that it rests at the true zero position. For open front gauges the pointer and dial must also be disassembled and the pointer should then be lightly pressed onto the pinion at the 9:00 o'clock position.

e. Apply full scale pressure and note the magnitude of the span error. With open front gauges, ideal span (270 degrees) will exist when at full scale pressure the pointer rests exactly at the 6:00 o'clock position.

f. If the span has shifted significantly (span error greater than 10%), the gauge should be replaced because there may be some partial corrosion inside the bourdon tube which could lead to ultimate failure. If the span error exceeds 0.25%, loosen the lower link screw and move the lower end of the link toward the movement to increase span or away to decrease span. An adjustment of 0.004 inch will change the span by approximately 1%. This is a repetitive procedure which often requires more than one adjustment of the link position and the subsequent rechecking of the errors at zero and full scale pressure.

g. Apply midscale pressure and note error in reading. Even though the gauge is accurate at zero and full scale, it may be inaccurate at the midpoint. This is called linearity error and is minimized by rotating the movement. If the error is positive, the movement should be rotated counter clockwise. Rotating the movement one degree will change this error by approximately 0.25%. Rotating the movement often affects span and it should be subsequently rechecked and readjusted if necessary according to step 6.1e and 6.1f.

h. While recalibrating the gauge, the friction error – difference in readings taken with and without rap – should be noted. This error should not exceed the basic accuracy of the gauge. If the friction error is excessive, the movement should be replaced. One possible cause of excessive friction is improper adjustment of the hairspring. The hairspring torque,or tension, must be adequate without being excessive. The hairspring should also be level, unwind evenly (no turns rubbing) and it should never tangle.

NOTES:

1 For operation of test gauge external zero reset, refer to Figure 3 on page 8.

2 For test gauge calibration procedure, refer to Figure 4 on page 9.

6.2 Calibration – 1009 Duralife® Gauge –

Inspect gauge for accuracy. Many times gauges are simply "off zero" and a simple pointer adjustment using the adjustable pointer is adequate. If the inspection shows that the gauge warrants recalibration to correct span and/or linearity errors, proceed as follows:

Remove ring, window, gasket and pointer using Ashcroft tool kits 1205T and 1206T.

6.3 Positive Pressure Ranges –

a. Remove dial and lightly press pointer onto pinion at 9:00 o'clock position.

b. Apply full scale pressure and rotate span block as shown in Figure 5a on page 11 until pointer rests at 6:00 o'clock position.

c. Fully exhaust pressure and check that pointer still is at 9:00 o'clock position. If not repeat steps 1 and 2 until span is correct.

(Continued on page 10)

Fig. 2

ASHCROFT SYSTEM ASSEMBLY

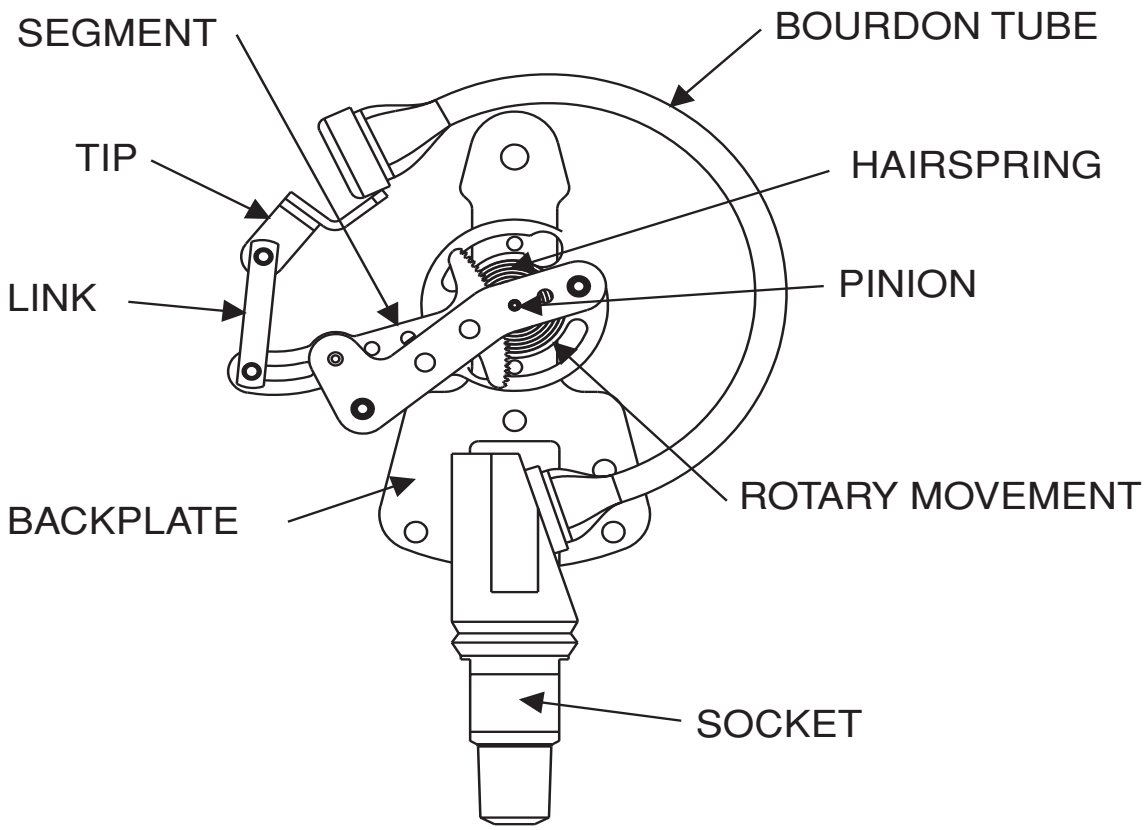
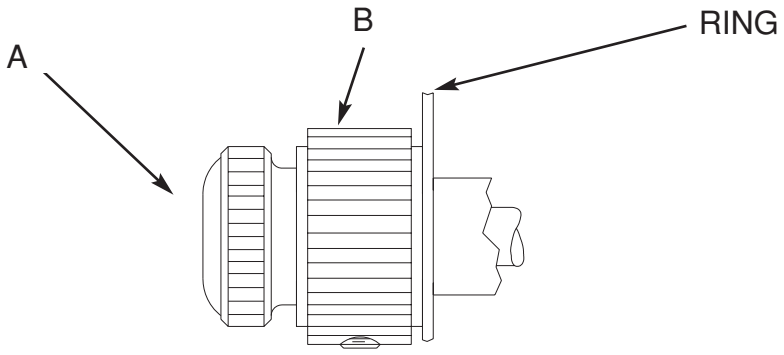


Fig. 3

TYPE 1082 EXTERNAL ZERO ADJUST FEATURE*



INSTRUCTIONS FOR USE:

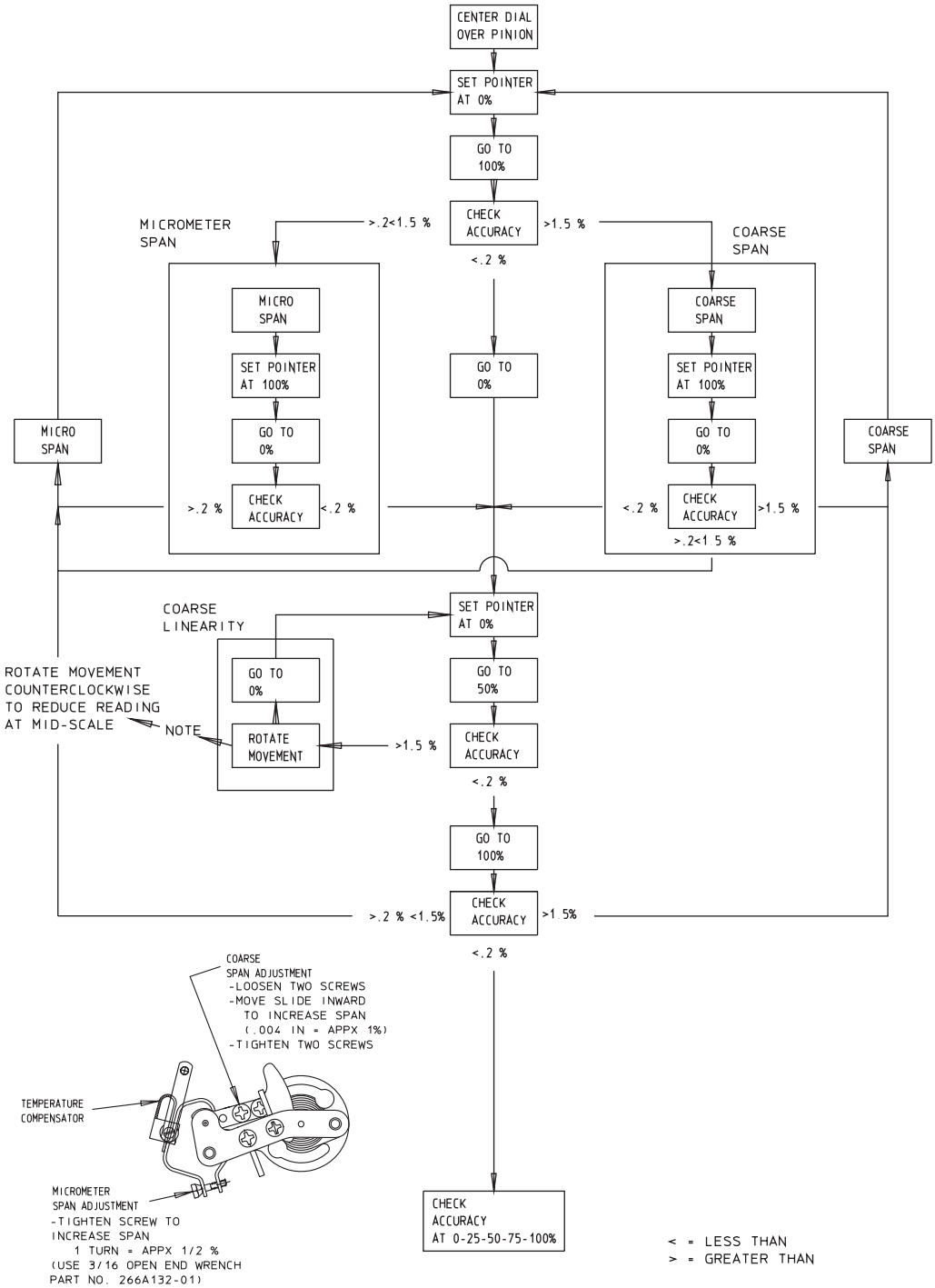
LOOSEN RING LOCKING **SCREW "A"**
OBTAIN REQUIRED ADJUSTMENT BY ROTATING
KNOB "B" CLOCKWISE OR COUNTER-CLOCKWISE.
TIGHTEN **SCREW "A"** DOWN ON **KNOB "B".**

*Applicable only for test gauge with hinged ring design.

Fig. 4

TYPE 1082 TEST GAUGE CALIBRATION PROCEDURE

THIS TEST GAUGE IS PROVIDED WITH A MICROMETER SPAN ADJUSTMENT, TO SIMPLIFY CALIBRATION. THE FLOW CHART BELOW OUTLINES THE RECOMMENDED CALIBRATION PROCEDURE.



d. Remove pointer and reassemble dial and dial screws (finger tight).

e. Lightly press pointer onto pinion.

f. Check accuracy at full scale. If error exceeds 1% return to step 1, otherwise proceed.

g. Check accuracy at midscale. If error exceeds 1% slide dial left or right to compensate.

h. Continue at * below.

Vacuum range –

a. Using a pencil, refer to dial and mark the 0 and 25 inch of Hg positions on the case flange.

b. Remove the dial.

c. Apply 25 inches of Hg vacuum.

d. Lightly press pointer onto pinion carefully aligning it with the 25 inch of Hg vacuum mark on case flange.

e. Release vacuum fully.

f. Note agreement of pointer to zero mark on case flange.

g. If span is high or low, turn span block as shown in Figure 5b on page 11.

h. Repeat steps 4 through 8 until span is correct.

i. Remove the pointer.

j. With 25 inches of Hg vacuum applied, reassemble dial, dial screws (finger tight) and pointer.

k. Apply 15 inches of Hg vacuum and note accuracy of indication. If required, slide dial left or right to reduce error to 1% maximum.

l. Continue at * below.

*Now complete calibration of the gauge as follows:

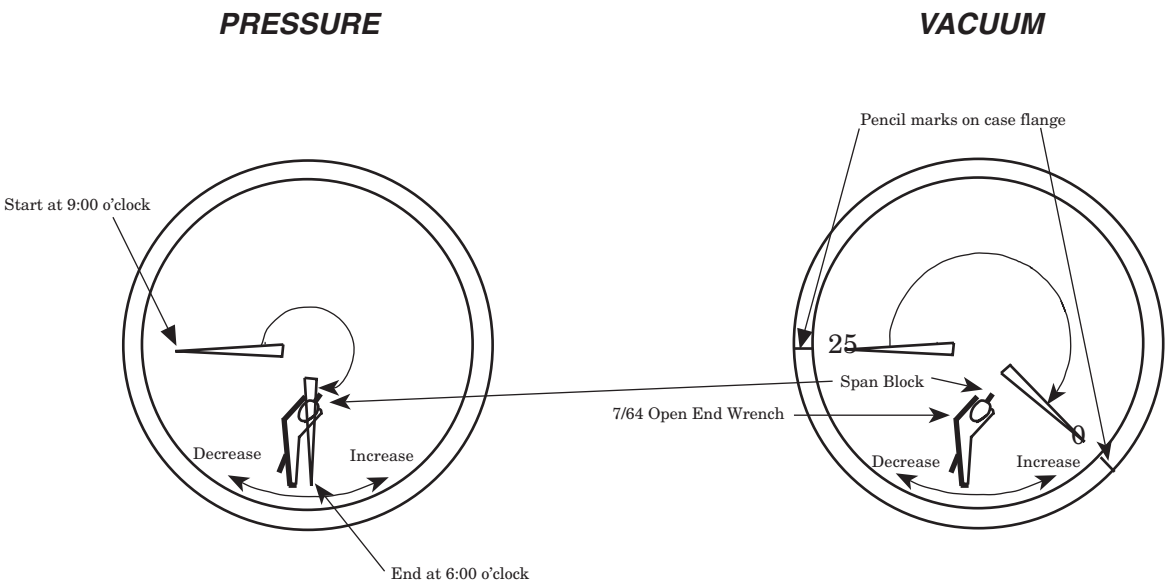
a. Firmly tighten dial screws.

b. Firmly tap pointer onto pinion, using brass back-up tool from Ashcroft kit 1205T if gauge has rear blow-out plug. If gauge has top fill hole no back-up is required.

c. Recheck accuracy at zero, midscale and full scale points (Figures 5a & 5b on page 11).

d. Reassemble window, gasket and ring.

1009 DURALIFE® PRESSURE GAUGE CALIBRATION



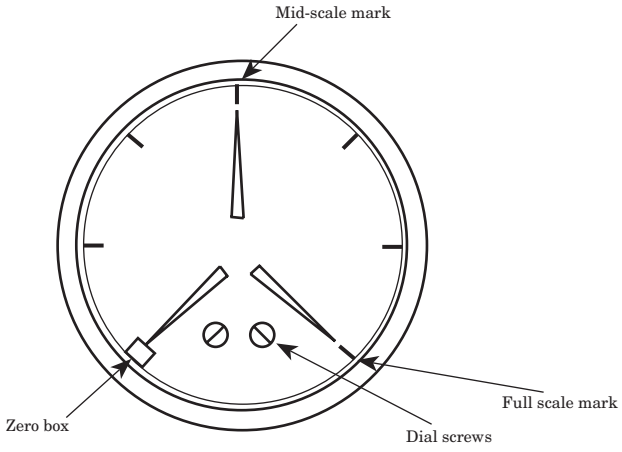


Fig. 5a

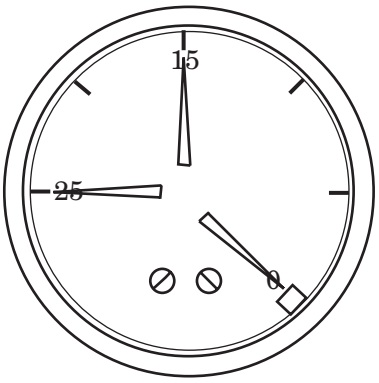


Fig. 5b

7.0 DIAPHRAGM SEALS

7.1 General – A diaphragm seal (isolator) is a device which is attached to the inlet connection of a pressure instrument to isolate its measuring element from the process media. The space between the diaphragm and the instrument's pressure sensing element is solidly filled with a suitable liquid. Displacement of the liquid fill in the pressure element, through movement of the diaphragm, transmits process pressure changes directly to a gauge, switch or any other pressure instrument. When diaphragm seals are used with pressure gauges, an additional 0.5% tolerance must be added to the gauge accuracy because of the diaphragm spring rate.

Used in a variety of process applications where corrosives, slurries or viscous fluids may be encountered, the diaphragm seal affords protection to the instrument where:

- The process fluid being measured would normally clog the pressure element.
- Pressure element materials capable of withstanding corrosive effects of certain fluids are not available.
- The process fluid might freeze due to changes in ambient temperature and damage the element.

7.2 Installation – Refer to sales bulletin OH-1 for information regarding (a) seal configurations; (b) filling fluids; (c) temperature range of filling fluids; (d) diaphragm material pressure and temperature limits; (e) bottom housing material pressure and temperature limits; (f) pressure rating of seal assembly; (g) accuracy/temperature errors of seal assembly; (h) diaphragm seal displacement. The volumetric displacement of the diaphragm must at least equal the volumetric displacement of the measuring element in the pressure instrument to which the seal is to be attached.

It is imperative that the pressure instrument/diaphragm seal assembly be **properly** filled prior to being placed in service. Ashcroft diaphragm seal assemblies should only be filled by a seal assembler certified by Dresser Industries. Refer to section 3.3 for a cautionary note about not applying torque on either the instrument or seal relative to the other.

7.3 Operation – All Ashcroft diaphragm seals, with the exception of Type 310 mini-seals, are continuous duty. Should the pressure instrument fail, or be removed accidentally or deliberately, the diaphragm will seat against a matching surface preventing damage to the diaphragm or leakage of the process fluid.

7.4 Maintenance – Clamp type diaphragm seals – Types 100, 200 and 300 – allow for replacement of the diaphragm or diaphragm capsule, if that ever becomes necessary. The Type 200 top housing must also be replaced with the diaphragm. With all three types the clamping arrangement allows field disassembly to permit cleaning of the seal interior.

7.5 Failures – Diaphragm failures are generally caused by either corrosion, high temperatures or fill leakage. Process media build-up on the process side of the diaphragm can also require seal cleaning or replacement. Consult Customer Service, Stratford CT for advice on seal failures and/or replacement. Refer also to Product Information page ASH/PI-14C containing drawing 96A121 *Corrosion Data Guide.*

WARNING: All seal components should be selected considering process and ambient operating conditions to prevent misapplication. Improper application could result in failure, possible personal injury, property damage or death.

8.0 DAMPENING DEVICES

8.1 General – Some type of dampening device should be used whenever the pressure gauge may be exposed to repetitive pressure fluctuations that are fairly rapid, high in magnitude and especially when transitory pressure spikes exceeding the gauge range are present (as with starting and stopping action of

valves and pumps). A restricted orifice of some kind is employed through which pressure fluctuations must pass before they reach the bourdon tube. The dampener reduces the magnitude of the pressure pulse thus extending the life of the bourdon tube and movement. This reduction of the pressure pulsation as "seen" by the pressure gauge is generally evidenced by a reduction in the pointer travel. If the orifice is very small the pointer may indicate the average service pressure, with little or no indication of the time varying component of the process pressure.

Commonly encountered media (e.g. – water and hydraulic oil) often carry impurities which can plug the orifice over time thus rendering the gauge inoperative until the dampener is cleaned or replaced.

Highly viscous media and media that tend to periodically harden (e.g., asphalt) require a diaphragm seal be fitted to the gauge. The seal contains an internal orifice which dampens the pressure fluctuation within the fill fluid.

8.2 Throttle Screws & Plugs – These accessories provide dampening for the least cost. They have the advantage of fitting completely within the gauge socket and come in three types: (a) a screwed-in type which permits easy removal for cleaning or replacement; (b) a pressed in, non-threaded design and (c) a pressed in, threaded design which provides a highly restrictive, helical flow path. Not all styles are available on all gauge types.

8.3 Ashcroft Gauge Saver – Type 1073 Ashcroft Gauge Saver features an elastomeric bulb that fully isolates the process media from the bourdon tube. In addition to providing dampening of pressure pulses, the bourdon tube is protected from plugging and corrosion. The space between the bulb and bourdon tube is completely filled with glycerin. Felt plugs located between the bulb and bourdon tube are first compressed some amount to restrict the flow of glycerin through an orifice and thus provide a degree of dampening. The greater the compression of the felts the greater the degree of dampening.

8.4 Ashcroft Pulsation Dampener – Type 1106 Ashcroft Pulsation Dampener is a moving pin type in which the restricted orifice is the clearance between the pin and any one of five preselected hole diameters. Unlike a simple throttle screw/plug, this device has a self-cleaning action in that the pin moves up and down under the influence of pressure fluctuations.

8.5 Ashcroft Pressure Snubber – The heart of the Type 1112 pressure snubber is a thick porous metal filter disc. The disc is available in four standard porosity grades.

8.6 Campbell Micro-Bean® – Type 1110 Micro-Bean is a precision, stainless steel, needle valve instantly adjustable to changing conditions of flow and viscosity. A very slight taper on the valve stem fits into tapered hole in the body. The degree of dampening is easily adjusted by turning the valve handle. A filter is built into the Micro-Bean to help prevent plugging.

8.7 Ashcroft Needle Valves – Type 7001 thru 7004 steel needle valves provide varying degrees of dampening similar to the Campbell Micro-Bean but with a less precise and less costly adjustability. Like the Micro-Bean these devices, in the event of plugging, can easily be opened to allow the pressure fluid to clear away the obstruction.

8.8 Chemiquip® Pressure Limiting Valves – Model PLV-255, PLV-2550, PLV-5460, PLV-5500 and PLV-6430, available with and without built-in snubbers, automatically "shut off" at adjustable preset values of pressure to protect the gauge from damage to overpressure. They are especially useful on hydraulic systems wherein hydraulic transients (spikes) are common.

9.0 RESOURCES

9.1 Training Videos

9.1.1 Test gauge calibration
9.1.2 1009 Duralife® calibration
9.1.3 Duragauge® calibration
9.1.4 Diaphragm seal filling

9.2 Pressure Instrument Testing Equipment

9.2.1 Type 1305D Deadweight Tester
9.2.2 Type 1327D Pressure Gauge Comparator
9.2.3 Type 1327CM “Precision” Gauge Comparator

9.3 Tools & Tool Kits

9.3.1 Type 2505 universal carrying case for 1082 test gauge
9.3.2 Type 266A132-01 span wrench for 1082 test gauge
9.3.3 Type 1280 conversion kit for 4½˝ lower connect 1279/1379
9.3.4 Type 1283 conversion kit for 4½˝ back connect 1279/1379
9.3.5 Type 1284 conversion kit for 6˝ lower & back connect
9.3.6 Type 1281 socket O-Ring kit for 1279/1379 lower connect
9.3.7 Type 1285 4½˝ ring wrench for 1279/1379 lower & back connect
9.3.8 Type 1286 6˝ ring wrench for 1379 lower & back connect
9.3.9 Type 1287 cone tool for installing diaphragm & spring on 1279/1379 back connect
9.3.10 Type 1105T calibration tool kit (all gauges except 1009 Duralife®)
9.3.11 Type 3220 pointer puller (all gauges except 1009 Duralife®)
9.3.12 Type. 3530 pinion back-up tool for 1009 Duralife®
9.3.13 Type 1230 throttle plug insertion (¼ NPT) for 1009 Duralife®
9.3.14 Type 1231 throttle plug insertion (½ NPT) for 1009 Duralife® (body only)
9.3.15 Type 1205T calibration hand tools for 1009 Duralife®
9.3.16 Type 1206T ring removal & assembly tools for 1009 Duralife®

9.4 Sales Bulletins

9.4.1 Pressure Instrument Testing Equipment – Bulletin TE-1
9.4.2 Type 1327CM Portable Precision Gauge Comparator – Bulletin TE-2
9.4.3 Test Gauges – Bulletin TG-2
9.4.4 Duragauge® Pressure Gauges – Bulletin DU-1
9.4.5 General Service Gauges – Bulletin IG-1
9.4.6 Type 1009 Duralife® Industrial Gauges – Bulletin SS-1
9.4.7 Type 1008 Metric Case Gauges – Bulletin SS-1
9.4.8 Duralife® Metric Process Gauges – Bulletin SS-1
9.4.9 Type 1032 Sanitary Pressure Gauges – Bulletin SG-2
9.4.10 Special Service Gauges – Bulletin IG-1
9.4.11 Diaphragm Seals – Bulletin OH-1

Instrument Division Sales and Customer Service Locations

U.S. & International Headquarters

Stratford, Connecticut
250 E. Main Street
Stratford, CT 06614-5145
Tel: (203) 378-8281
Fax: (203) 381-9042

U.S. Sales Offices

Midwest Region
Chicago, Illinois
400 W. Lake Street
Suite 318
Roselle, IL 60172-3573
Tel: (630) 980-9030
Fax: (630) 980-9440

Southeast Region
Mobile, Alabama
605 Bel Air Blvd.
Suite 10
Mobile, AL 36606
Tel: (251) 473-1692
Fax: (251) 473-1782

Northeast Region
Stratford, Connecticut
250 E. Main Street
Stratford, CT 06614-5145
Tel: (203) 385-0670
Fax: (203) 385-0756

Pacific Region
Stratford, Connecticut
250 E. Main Street
Stratford, CT 06614-5145
Tel: (203) 385-0399
Fax: (203) 385-0402

International Operations

Brazil
Dresser Industria e
Comercio Ltda.
Rua Senador Vergueiro #433
09521-320 Sao Caetano do Sul
Sao Paulo, Brazil
Tel: 55-11-4224-7400
Fax: 55-11-4224-7477
E-Mail: vendas.instrumentos@
dresser.com

Brazil (Jacarei)
Dresser Industria e Comercio Ltda.
Divisao Masoneilan
Rua Particular– Estrada
Velha Rio De Janeiro –
Sao Paulo, KM 101Jacarei,
Sao Paulo Caixa
Postal 167, CEP 12305-330
Tel: 55-11-3958-2011
Fax: 55-11-3958-2670
E-Mail: dresserjac@uol.com.br

Canada
Dresser Canada, Inc.
2135 Meadowpine Blvd.
Mississauga,
Ontario L5N 6L5 Canada
Tel: 905-335-3529
Fax: 905-826-9106
E-Mail: Lance_Barette@dresser.com

China
Dresser Industries, Inc.
Room #2404, Capital Mansion
No. 6 Xin Yuan Nan Road Beijing,
People's Republic of China 100004
Tel: 86-10-84862440/1/2/3/4
Fax: 86-10-84862445
E-Mail: dresser@public3.bta.net.cn

France
Dresser Europe GmbH
Dresser Instrumentation
206 ZA Le Mandinet
Rue des Campanules
F 77185 Lognes, France
Tel: 33-1-60372530
Fax: 33-1-60372539
E-Mail: europe@wanadoo.fr

Germany
Dresser Europe GmbH
Postfach 11 20 Max-Planck-Str. 1
D-52499 Baesweiler, Germany
Tel: 49-24-01-8080
Fax: 49-24-01-7027
E-Mail: jbiermans@dresserbae.de

Germany
Ebro Electronic GmbH
Peringerstr 10D-85055
Ingolstadt, Germany
Tel: 49-84-1-95478-0
Fax: 49-84-1-95478-80
E-Mail: info@ebro.de

Japan
Dresser Japan Ltd.
Room 818, Shin Tokyo Building
3-1 Marunouchi 3-Chome,
Chiyoda-ku, Tokyo, Japan
Tel: 813-3201-1501
Fax: 813-3213-6567
E-Mail: yuichi.yamamoto@
dresserjapan.co.jp

Korea
Dresser International, S.A
Room 2107
#2015 Kuk Dong Bldg.
60-1, 3-KA, Choongmu-Ro,
Chung-ku, Seoul, Korea 100-705
Tel: 82-2-2274-0792
Fax: 82-2-2274-0794
E-Mail: dkisjlee@chollian.net

Mexico
Dresser Instruments S.A. De C.V.
Mexico Operations
Henry Ford No. 114
Esq. Foulton Fracc.
Industrial San Nicolas
54030 Tlalnepantla,
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Tel: (52)55-53-10-72-17
(52)55-53-10-89-83
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E-Mail: mendiet@avantel.net

Saudi Arabia
Dresser Al Rushaid Valve &
Instrument Co. (DARVICO)
P.O. Box 10145
Jubail Industrial City
Saudi Arabia 31961
Tel: 966-3-341-0278
Fax: 966-3-341-7624
E-Mail: bill_dumasia@darvico.com
E-Mail: sam_dastur@darvico.com

Singapore
Dresser Singapore
Instrument Operations
Block 1004 Toa Payoh North
#07-15/17 Singapore 318995
Tel: 65-6252-6602
Fax: 65-6252-6603
E-Mail: john.wong@dresser.com.sg

United Kingdom
Dresser Europe GmbH
East Gillibrands, Skelmersdale
Lancashire, WN8 9TU
United Kingdom
Tel: 44-16-95-52600
Fax: 44-16-95-52693
E-Mail: sales@dresser-instrument.co.uk

Venezuela
Manufactures Petroleras
Venezolanas (M.P.V.)
KM 7 Carretera A El Mojan Calle 18,
#15B355 ZONA Ind. Norte Sector
Canchancha Maracaibo Edo
Zulia Venezuela
Tel: 58-261-757-9070
Fax: 58-261-757-9561
E-Mail: contactenos@mapvensa.com
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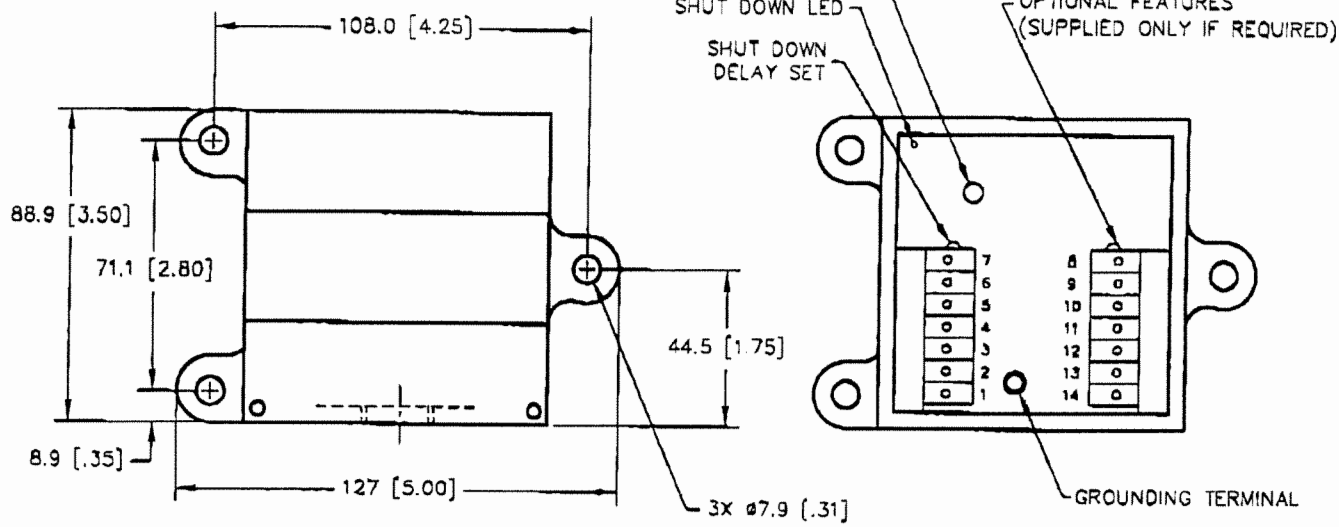

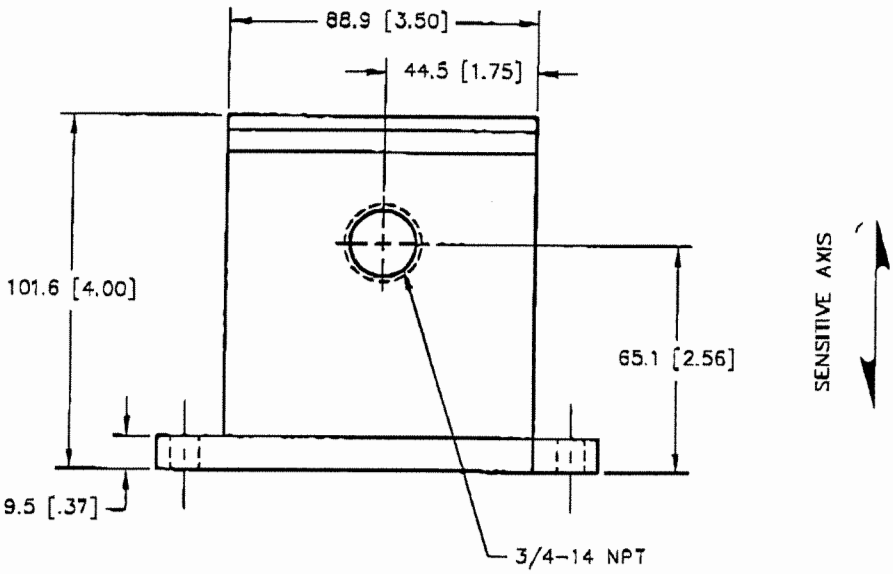

DIMENSIONS IN mm [inches]

UNLESS SPECIFIED TOLERANCES	
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS (IN PARENTHESIS)
DECIMALS XX ±.01 XXX ±.005	DECIMALS XX ±0.3 XXX ±0.13
ANGLES ±1 DEGREE	ANGLES ±2 DEGREES
FILLETS AND RADII .010	FILLETS AND RADII (0.07 – .013)

DRAWN	AO	12/29/89	MFG			
CHK'D			ENGR			
APP'D	RSC					

TITLE: OUTLINE & DIMENSION DRAWING, 440S/440SR

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Tel: 713-461-2131 Fax: 713-461-8223
e-mail: techsvcs@metrix1.com

INSTALLATION AND OPERATING MANUAL
MODEL 440S-R/450S-R VIBRALOG

For units with Mechanical Relays
in Place of Triacs

Drawings included:

A24400
A24402
A24404
A24458
A24462

INDEX

Section 1.0 General Description

1.1 Introduction
1.2 Protection of Rotating and Reciprocating Machinery
1.3 Summary of Capabilities
1.4 Panel Controls
1.5 Specifications

Section 2.0 Mechanical Installation

2.1 Orientation
2.2 Mounting Surface
2.3 Temperature Considerations
2.4 Cable/Wire
2.5 Sealing
Outline Drawings

Section 3.0 Electrical Installation

3.1 Wiring to the Vibration Switch

3.1.1 AC Power
3.1.2 Shut-Down Circuit
3.1.3 Remote Reset
3.1.4 Lockout Option
3.1.5 4-20 mA Output

3.2 Functional Description and Installation Considerations

3.2.1 Alarm or Shutdown
3.2.2 Wiring for N.O. or N.C.
3.2.3 Remote Reset/Latch
3.2.4 Lockout Option
3.2.5 4-20 mA Output

3.3 Special Considerations

3.3.1 Light Loads
3.3.2 D.C. Applications
Wiring Diagrams

Section 4.0 Control Settings

4.1 Setting Trip Points
4.2 Setting of Time Delay
4.3 Test Mode
4.4. Alarm and Shutdown LED's

Section 5.0 System Block Diagram

AN 811 - Mounting PMC/BETA Electronic Switches

INSTRUCTION AND INSTALLATION
VIBRATION SWITCH
MODEL 440S-R/450S-R VIBRATION SWITCH

1.0 General Description

1.1 Introduction

The models 440S-R/450S-R contain one trip limit for alarm or shutdown. The trip is set in inches per second (velocity model) or mils (displacement model). In addition a 4-20 mA output proportional to vibration level is provided.

The 440 and 450 performance, wiring and specifications are identical except for the enclosure. The 440 meets NEMA 3, 4 and 12. The 450 meets these and in addition, certain explosion proof specifications.

1.2 Protection of Rotating and Reciprocating Machinery

a) A system is required which is responsive to faults which:

1) present themselves as low frequency vibrations such as imbalance, misalignments, defective sleeve bearings, broken tie down bolts, etc. and

2) faults which present themselves as higher frequency vibrations such as defective ball or roller bearings, gear mesh, blade pass frequencies, and in the case of reciprocating machinery, detonation and broken parts.

Velocity is the optimum parameter for both high and low frequencies, since it is equally sensitive to both. Acceleration (as with mechanical switches) is over sensitive to the high frequencies and very insensitive to the low frequencies.

On machines operating at very low RPM (100 - 200 RPM), displacement may also be suitable.

b) Time delay is absolutely essential in any usable vibration monitor. Virtually all machines will exhibit high vibration for several seconds during startup. If time delay is not provided, the operator must turn up the trip point to get thru startup. The resultant setting will be too high to provide protection during normal running. This is one reason there are so many cases where machines with mechanical type vibration switches have not tripped. Time delay is included in the Solid State Model 440.

1.3 Summary of Capabilities

A discussion of the 440/450 system and its control is as follows: (please refer to paragraph 1.4)

a) Trip is based on vibration severity (velocity). The sensor is built in (unless the separate sensor option has been purchased) and is a piezoelectric crystal with built-in amplifier to reduce noise sensitivity. The output signal is electronically integrated to measure and trip on velocity. (Electronically converted to displacement on displacement models).

b) Calibrated set point controls permit adjusting set points to known values of vibration level. Shutdown setpoint range is in velocity.

c) 4-20 mA output provides continuous monitoring capability on a milliammeter or a programable controller for data logging or alarm. The 4 mA will be present even when there is no vibration, thus demonstrating the unit is functioning. The 4-20 mA output is normalized to the shutdown set point. Therefore, the output can be directly calibrated as a percent of set point.

d) One switch closure is provided. The mechanical relay option is provided in lieu of the standard triac.

e) Built-in adjustable time delay is standard. This prevents false tripping on high startup vibrations and also from non-repetitive transient events. The standard range of adjustability is 2-15 seconds.

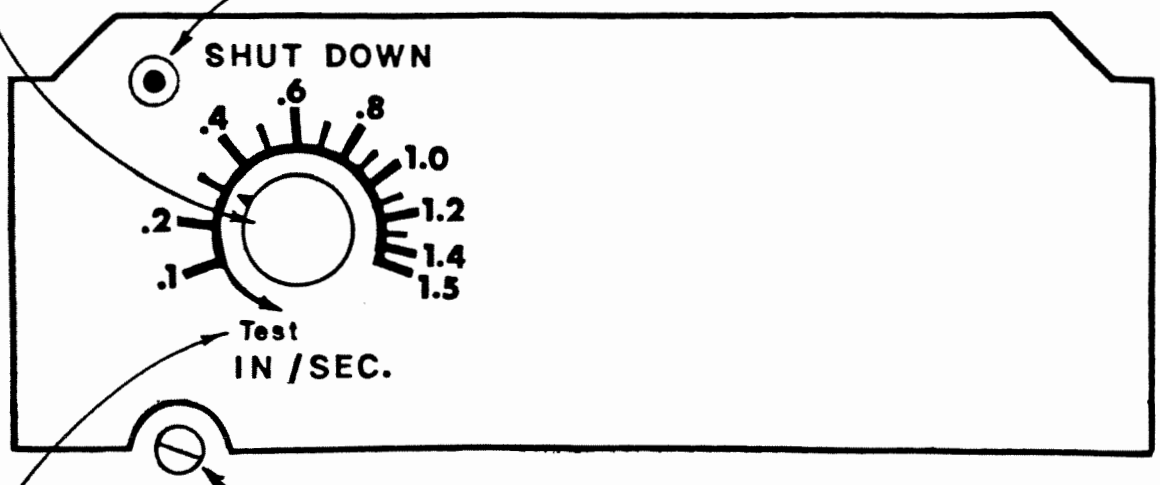
f) Self test and calibrate
A light adjacent to the set point control comes on the instant the measured vibration level exceeds the set point. The unit can be periodically calibrated on line, by turning the set point control down until the light comes on. This setting is then compared with the vibration measured with a portable vibration meter, thus providing a calibration check of the unit. If this setting is maintained, trip will occur after the duration of the time delay.

g) The 440 series is designed with thick film hybrid circuits which are more rugged than the conventional IC and discrete circuitry. The resulting unit is also smaller in size.

1.4 PANEL CONTROLS

Calibrated set point controls enable operator to set specific velocity trip points

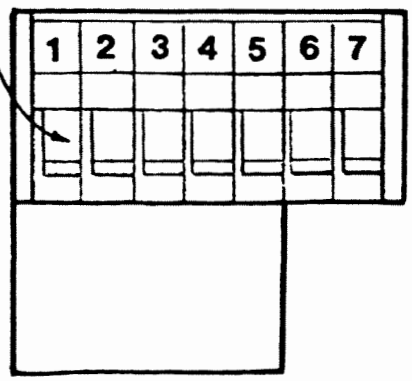
Light comes on immediately when vibration exceeds set point (alarm or shutdown will trip after 3 second time delay).



Adjustable time delay of 2-15 seconds. Factory set at 3 seconds.

Test position sets in minimum set point so that any vibration will cause trip condition. Light will come on immediately, and trip will occur after duration of the time delay, proving that the complete system is operational. If test position is maintained for less than the duration of the time delay, trip will not occur, thus permitting system test without shutdown.

VDE approved terminal strip accepts #12 wire. Screw adjustable clamping yoke rather than screw terminal permits easy, vibration proof connection. All hardware is captive.



1.5 Specifications

Specifications for the appropriate models are given below

Specifications

Model No.	440S	440S-R	440D	440D-R
No of Trips	ONE: for alarm or shutdown. Set in in/sec (velocity model) or mils (displacement model).		TWO: One for alarm and one for shutdown. Shutdown set in in/sec (velocity model) or mils (displacement model). Alarm set as percent of shutdown.	
Analog Output for Remote Indication	N/A	± 10% accuracy over 4-20 mA DC range. 4 mA is 0 vibration; 14 mA is set point; 20 mA is 160% of set point. Termination load resistance, less than 450 ohms	N/A	± 10% accuracy over 4-20 mA DC range. 4 mA is 0 vibration; 14 mA is set point; 20 mA is 160% of set point. Termination load resistance, less than 450 ohms
Velocity Set Point	0.1 to 1.5 in/sec or 0.2 to 3 in/sec peak. Metric ranges: 3 to 40 mm/sec or 6 to 80 mm/sec peak (Select one)			
Displacement Model	1 to 15 mils or 10 to 150 mils peak to peak. Metric ranges: 30μm to 400μm or 300μm to 4 mm peak to peak (Select one)			
Frequency Range	2 to 1000 Hz (120 to 60,000 RPM)			
Time Delay	Field adjustable 2-15 sec. Factory set for 3 sec unless specified otherwise			
*Alarm or Shutdown Output(s)	Solid state relay (triac). One in 440S, 440S-R; Two in 440D, 440D-R. Insulated (dry) contact Each triac field settable for close on alarm (N.O.) or open on alarm (N.C.) 5 A continuous, 100A for 10 msec. Max. off-state leakage current: 1 mA Min holding current: 20 mA typical Max voltage across SS relay: 140VAC (280VAC on 230V input units)			
Remote Reset	Connection between terminals 5 and 6 latches triac output in alarm state after set point is exceeded. Opening the connection will reset the output to non-alarm state.			
Set Point Accuracy	± 10% of setting with repeatability of ± 2%. Circuitry utilizes RMS detector			
Vibration Sensitive Axis	Perpendicular to base. Unit can be mounted in any orientation without affecting setting			
Temp. Limits	–20°F to +140°F (–30°C to +60°C) including internal transducer. –65°F to +190°F (–55°C to +88°C) for optional external transducer			
Humidity	1% to 100% (non-condensing)			
Input Power	100-130 VAC 50/60 Hz standard. 200-260 VAC 50/60 Hz optional. DC input power optional. 440S, 3 Watt, 440D, 4 Watt			
Enclosure	Rugged, water-tight, dust-tight, cast aluminum. Meets NEMA 3, 4, and 12 standards. Optional explosion-proof Model 450 available.			
Weight	3.5 lbs (1.6 Kg)			
Mounting	¼" hardware, 3 mounting bosses			
Terminals	All terminals will accept #12 AWG wire in clamping type yoke without need for termination hardware. ALL hardware is captive.			
Self Test	Test position on set point control and light emitting diode provide functional test of trip circuitry, time delay and triac closure. Also permits on-line calibration of switch.			
Circuitry	Proprietary hybrid circuitry throughout for minimum size and maximum reliability in vibration environment			
Remote Transducer Option	The standard 440 includes a built-in transducer. When packaged in an optional separate housing, the transducer is designated Model 160A. The 160A is 1.6 inch diameter by 3 inches high. If the remote transducer option is desired, it should be ordered at the time the 440 is ordered. To add a 160 transducer option at a later time, consult factory. Explosion-proof Model designated 160E.			

*Mechanical Relay Option: SPDT version: 8 amps at 250 VAC or 24 VDC.

DPDT version: 8 amps each half at 250 VAC or 24 VDC.

2.0 Mechanical Installation

Please see outline drawings provided at the end of Section 2.

2.1 Orientation

The sensitive vibration "measuring" axis is perpendcular to the base of the unit (vibration switch or transducer). Always mount the unit such that the desired vibration of the equipment being monitored will occur along this axis.

2.2 Mounting Surface

Choose or fabricate a solid (rigid) surface (on the equipment being monitored) to mount the vibration switch or transducer to. This will ensure transferral of the vibration to the vibration transducer, while not introducing spurious vibrations.

In addition, the surface presented to the base of the unit should be flat. Fasten using sturdy hardware at all places provided.

2.3 Temperature considerations

The switch is designed to dissipate internal heat by conduction through its base. Hence it is quite important to keep the mounting surface below the switch max temperature limit of 140° (60°C). If the equipment being monitored is going to exceed this limit, consideration should be given to either using one of the remote transducers, or thermally isolating the switch.

To insure accurate switch performance, a warm-up time of 5 minutes is recommended.

2.4 Cable/Wiring

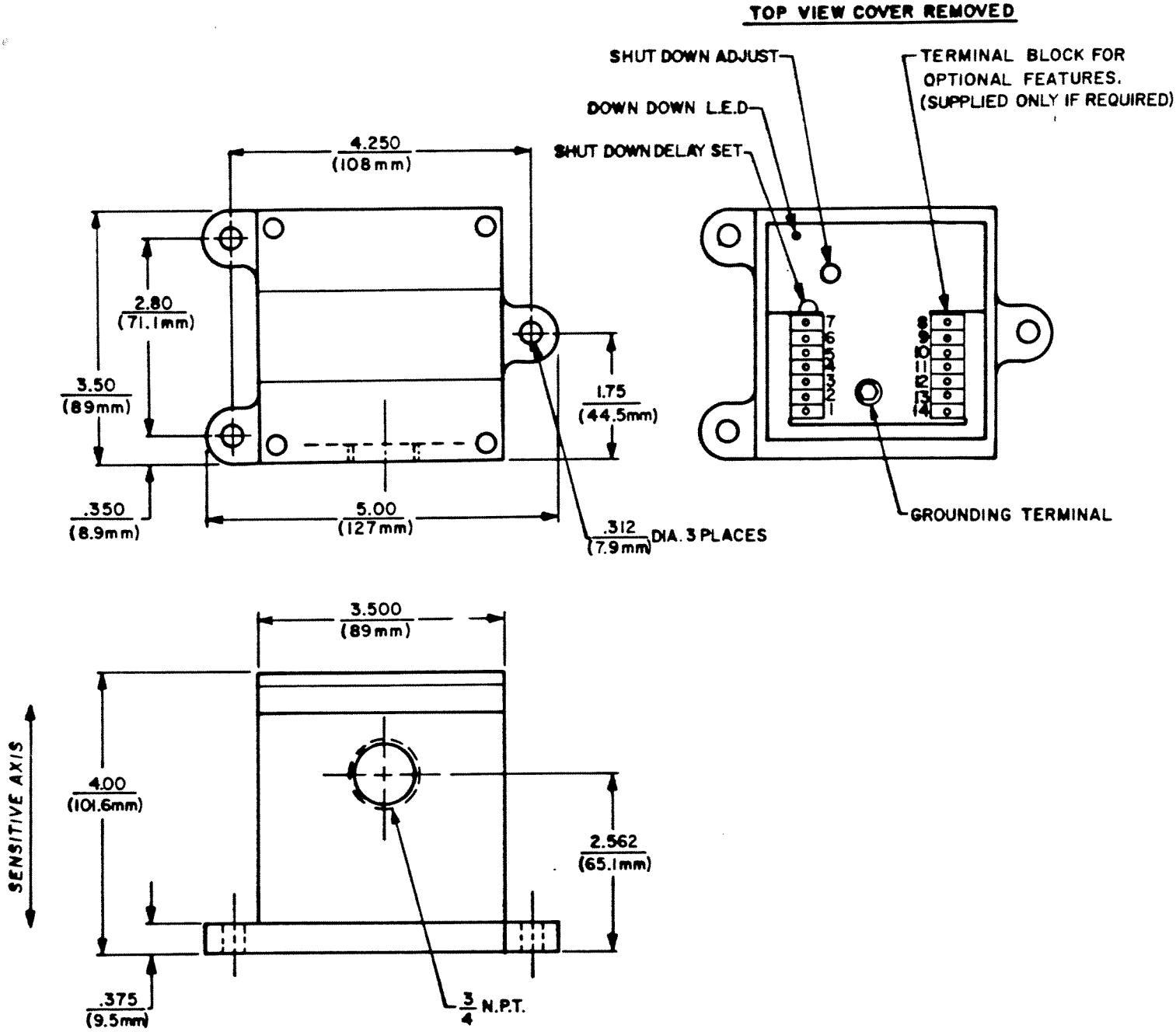
The method chosen to electrically connect to the switch or transducer should be mechanically flexible, to eliminate the measurement of vibration of material not of interest (piping, etc.), and provide a moisture barrier as well.

Although sealtight and other flexible conduit have been used successfully, in areas of extreme humidity or moisture it is recommended that an "SO" type cable together with a suitable raintight CGB fitting be used.

2.5 Sealing

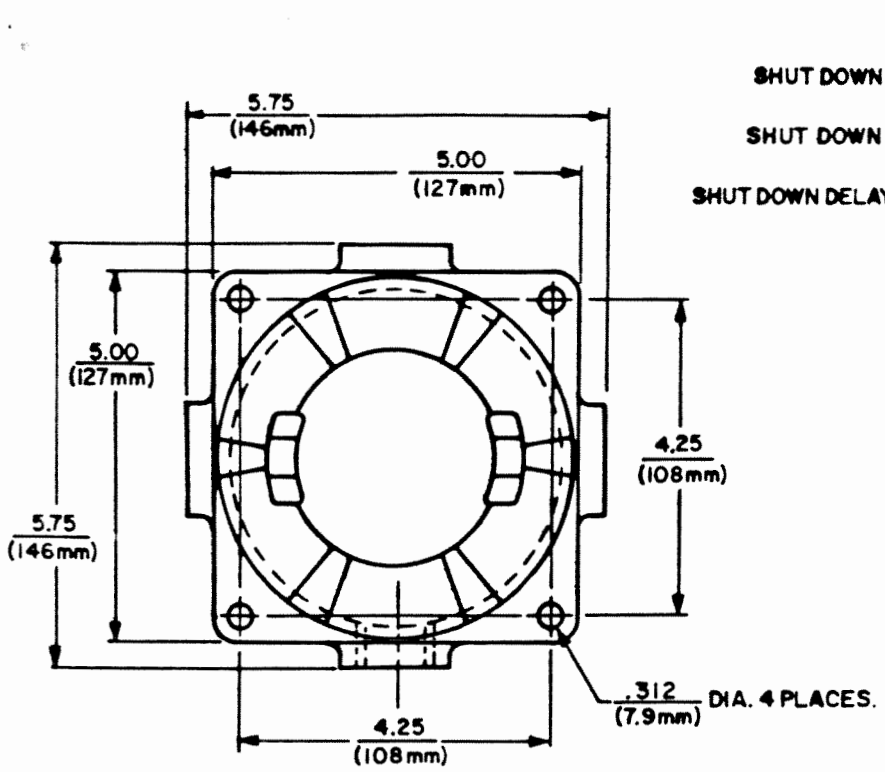
In 440 installations where temperature and humidity conditions vary around the dew point, it is important that the cover plate be evenly and firmly fastened down with the four screws provided.

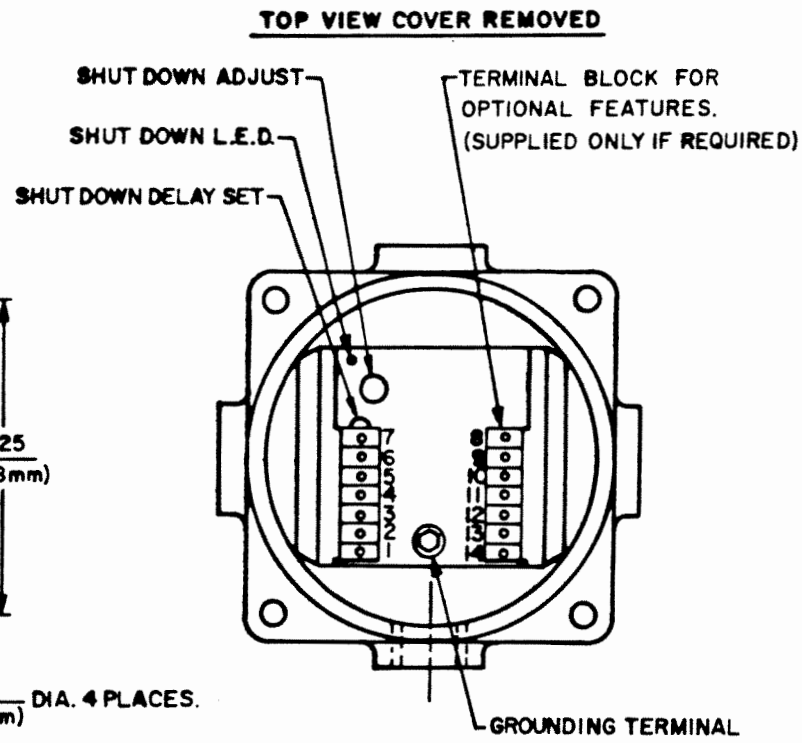
Although the switch enclosures meet NEMA standards for water tightness, it will do no good if proper sealing of both the cover and wiring entrances are not followed. Please remember that a hollow pipe through which wires may enter a switch may conduct moisture as well.

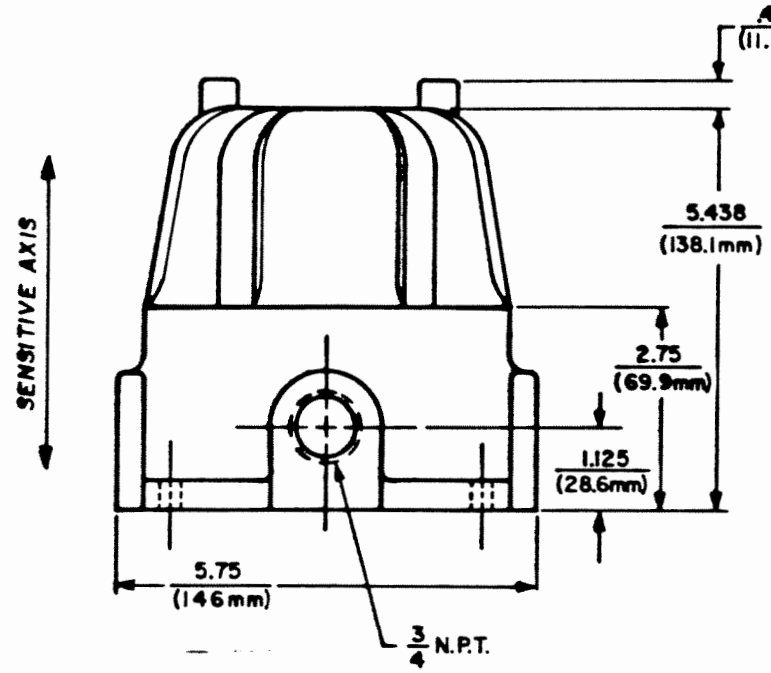


PMC/BETA 4 Tech Circle, Natick, Mass. 01760 U.S.A.		DIMENSIONAL TOLERANCES UNLESS OTHERWISE NOTED .X = ± .1 ∠'s = ± 1° .XX = ± .01 X/XX = ± .XXX = ±
MATERIAL	DRAWN BY A. ORDWAY	
NEXT ASSEMBLY	DATE 12-29-89	
USED ON	CHECKED BY	SHEET 1 OF 1
FOR ALL MODEL 440S VERSIONS	APPROVED BY	DRAWING NUMBER A24400
TITLE OUTLINE DRAWING MODEL 440S/R	SCALE	

A24400







NOTES:

1. HOUSING MATERIAL–COPPER FREE ALUMINUM.
2. ENCLOSURE MEETS REQUIRMENTS OF
   NEC: CLASS I GROUP D, DIV. 1&2.
   CLASS II GROUPS E,F,G.
   CLASS III.
   U.L. STANDARD 886.

ECO 9003/

PMC/BETA

4 Tech Circle, Natick, Mass. 01760 U.S.A.

DIMENSIONAL TOLERANCES UNLESS OTHERWISE NOTED

.X = ± .1 ∠'s = ± 1°

.XX = ± .01 $\frac{X}{XX}$ = ±

.XXX = ±

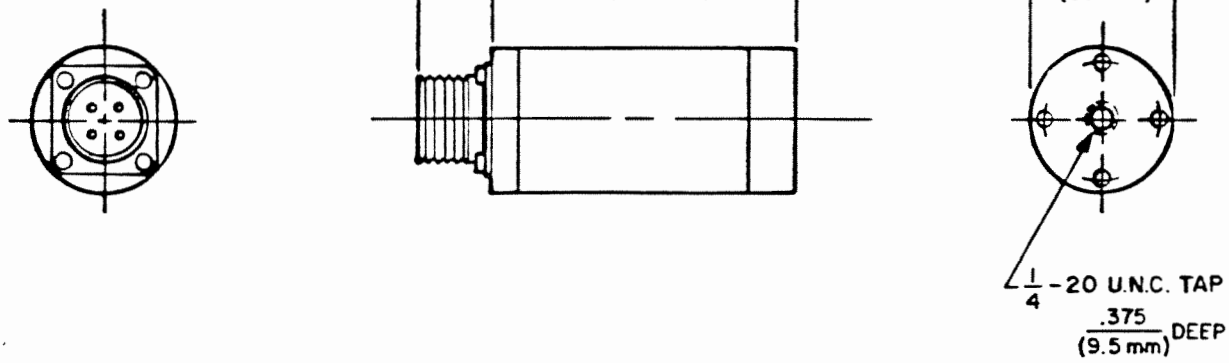
MATERIAL	DRAWN BY A. ORDWAY
NEXT ASSEMBLY	DATE 12-29-89
USED ON	CHECKED BY
FOR	APPROVED BY
TITLE OUTLINE DRAWING, MODEL 450S / 450SR	SCALE

SHEET 1 OF 1

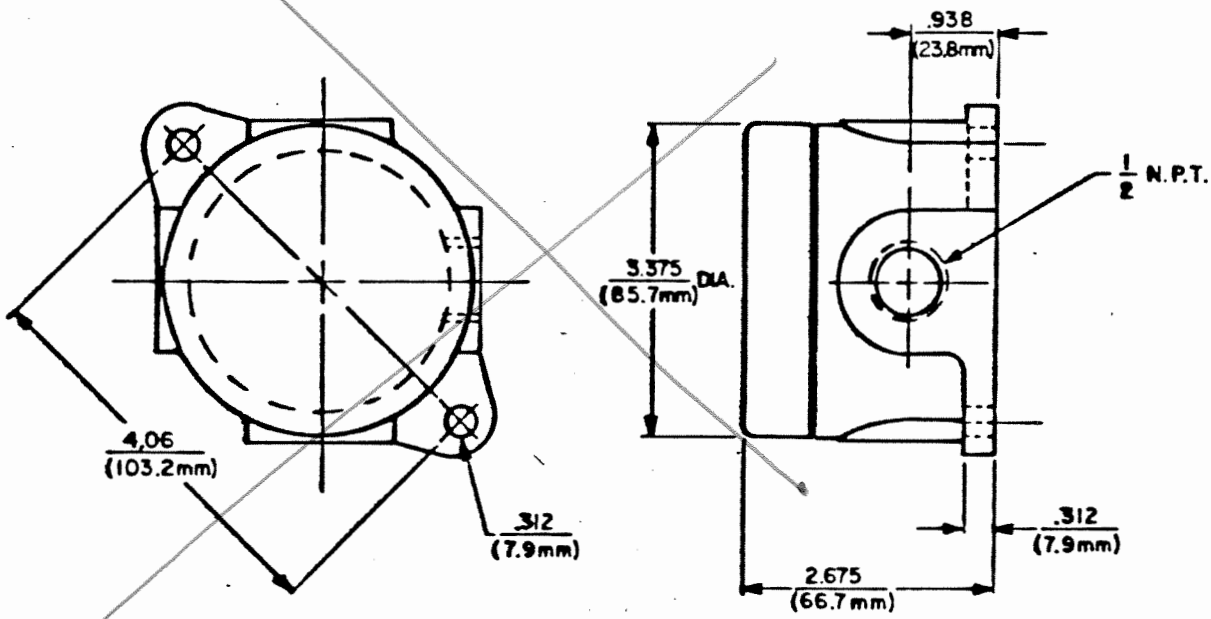
DRAWING NUMBER A24402 A

A24402A

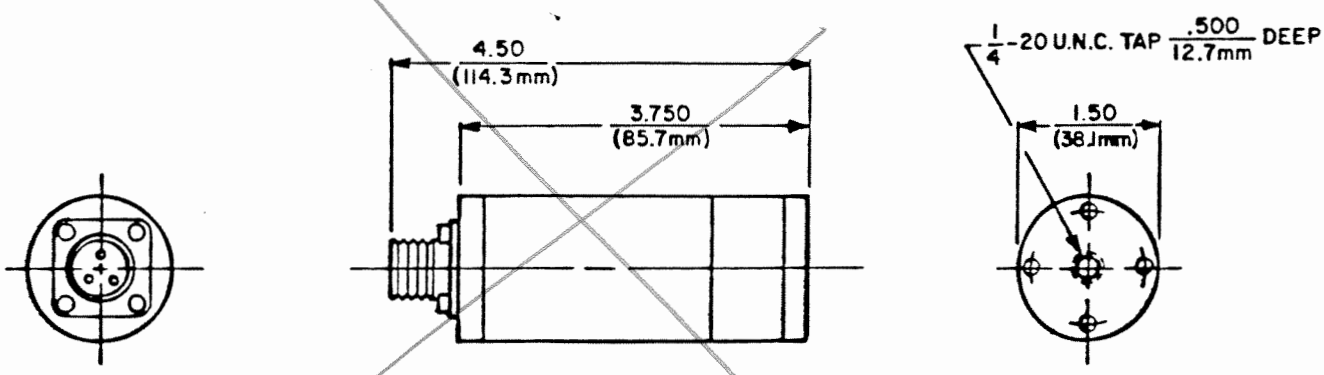
MODEL 160A



MODEL 160E VIBRATION TRANSDUCER



MODEL 258 VIBRATION TRANSDUCER



3.0 Electrical Installation

3.1 Wiring to the Vibration Switch

The following paragraphs refer to the wiring diagrams at the end of section 3

3.1.1 AC Power (Terminals 1 & 2)

Connect a grounding wire to the grounding lug provided in the switch. This is important for safety as well as noise.

Power only with the AC voltage level indicated on the inner cover label. Orientation of AC power to terminals 1 and 2 is not important.

3.1.2 Shutdown Circuit

On SPDT versions - terminals 3, 4 and 5 (R1)

On DPDT versions - terminals 3, 4 and 5 (R1) and 12, 13, and 14 (R2)

3.1.3 Remote Reset (Terminals 6 & 7)

Shielded wiring is required. To avoid creating ground loops, the N.C. remote switch contacts should be isolated i.e.: not electrically connected to other circuits or grounds. See section 3.2.3 for further information.

3.1.4 Lockout (Optional)

Not applicable to relay versions.

3.1.5 4-20 mA Analog Output (Terminal 6 & 8)

To avoid the possibility of ground loops, the 4-20 mA remote meter terminals should be electrically isolated from external grounds. Shielded wire is recommended to protect against damage due to long wire runs and the possibility of high induced voltage spikes from storms, etc. See section 3.2.5.

3.2 Functional Description and Installation Considerations

3.2.1 Alarm or Shutdown

Maximum ratings for the mechanical relay used for alarm or shutdown are as follows:

SPDT version: 8 AMPS at 250 VAC or 24 VDC

DPDT version: 8 AMPS each half at 250 VAC or 24 VDC

3.2.2 Open/Close on Alarm

The N.O. (close on alarm) or N.C. (open on alarm) slide switch is not operative on mechanical relay versions.

3.2.3 Remote Reset/Latch

The following paragraphs refer to the wiring diagrams and also paragraph 3.1.3.

3.2.3.1 Auto Reset Mode

In this mode, alarm and shutdown switches are automatically reset to the non-alarm condition when the vibration level falls below the set point.

(As shipped, no connection between terminals 6 and 7).

3.2.3.2 Latch Mode

In this mode, alarm or shutdown switch remains "latched" in alarm (shutdown) condition when the vibration level exceeds the set point for the duration of the time delay. The unit is in this condition when terminal 6 is connected to terminal 7.

3.2.3.3 Remote Reset Mode

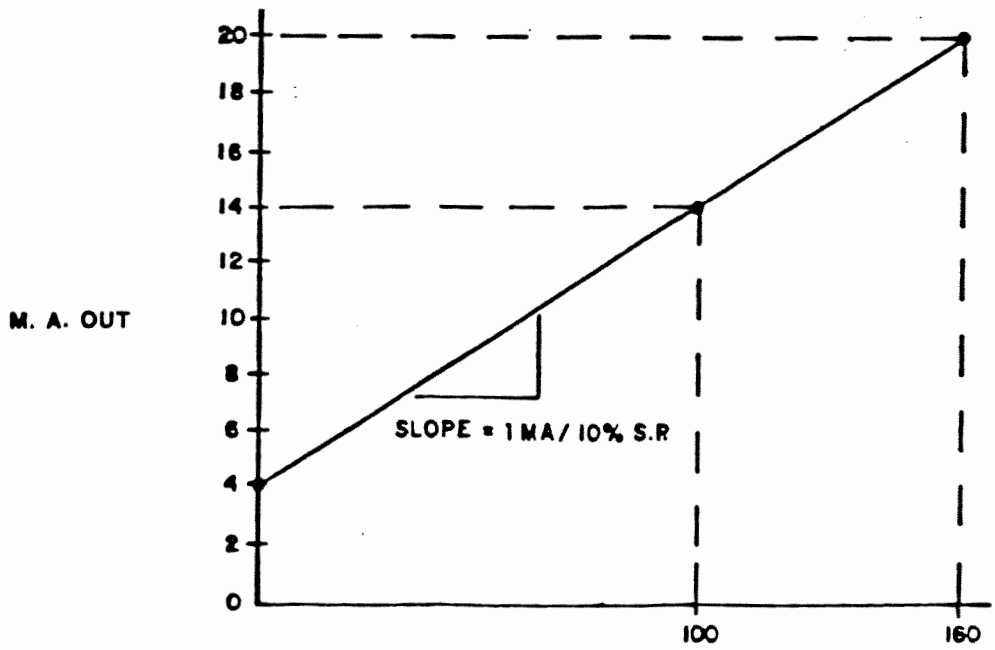
When wired in this mode the alarm and shutdown switches latch in "trip" but can be reset to "non-alarm" mode by momentarily interrupting the connection from terminal 6 and 7. This can be accomplished with a normally closed momentary switch. The switch contacts should be isolated from other circuits, potentials, or grounds.

3.2.4 Lockout (Optional)

Not applicable to mechanical relay versions.

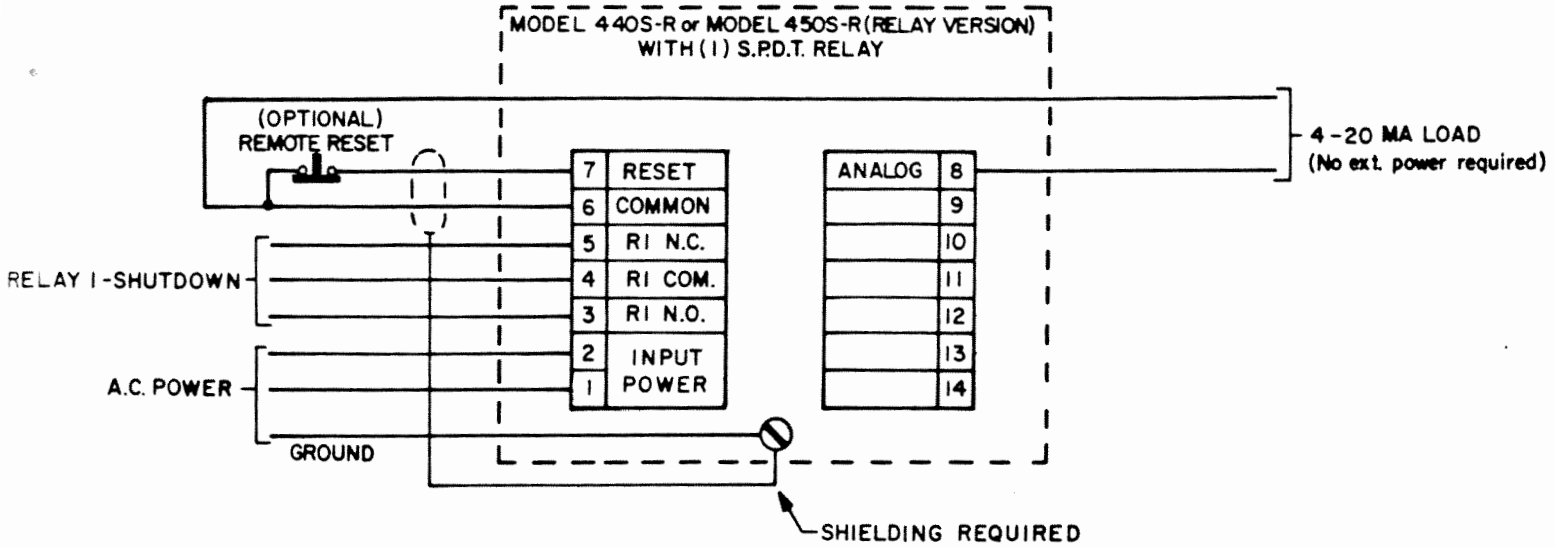
3.2.5 4-20 mA Output

Terminal 8 is labelled "analog" with return (loop) to terminal 6. This loop provides a 4-20 mA output current proportional to vibration. 4 mA = 0 vibration, 14 mA occurs at whatever shutdown setpoint has been set, 20 mA at 160% of shutdown setpoint. This is shown in the following graph.

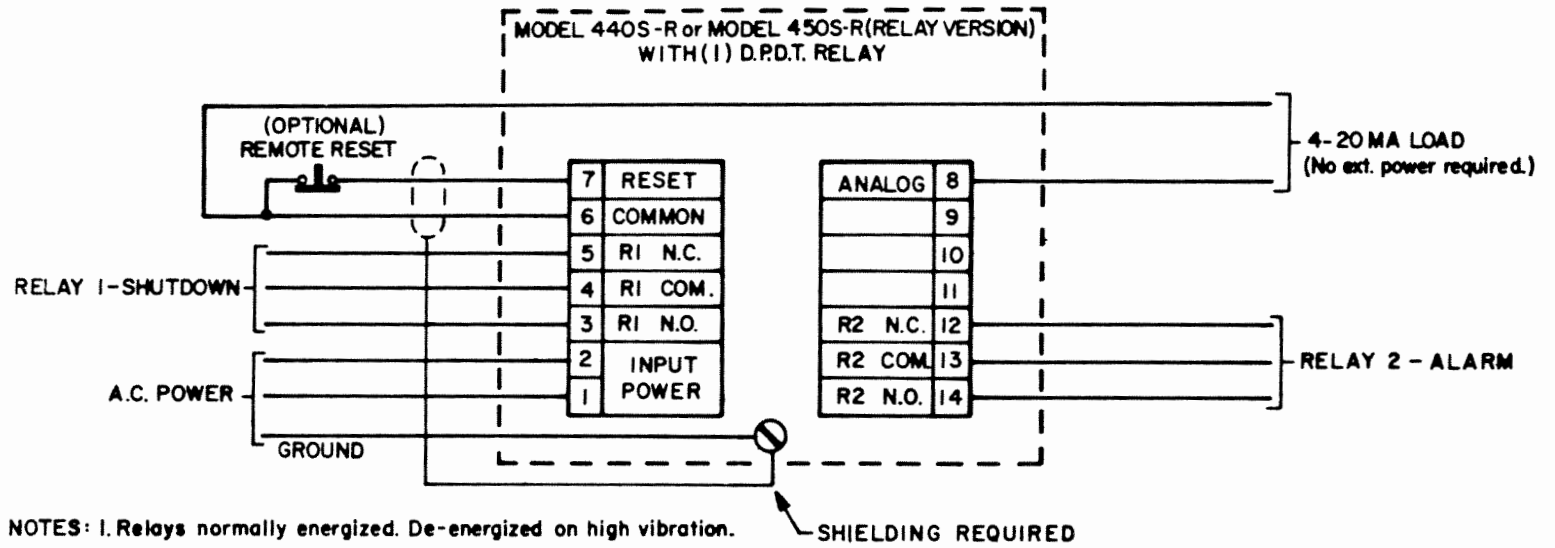


3.3 Special Considerations

Not applicable to mechanical relay versions.



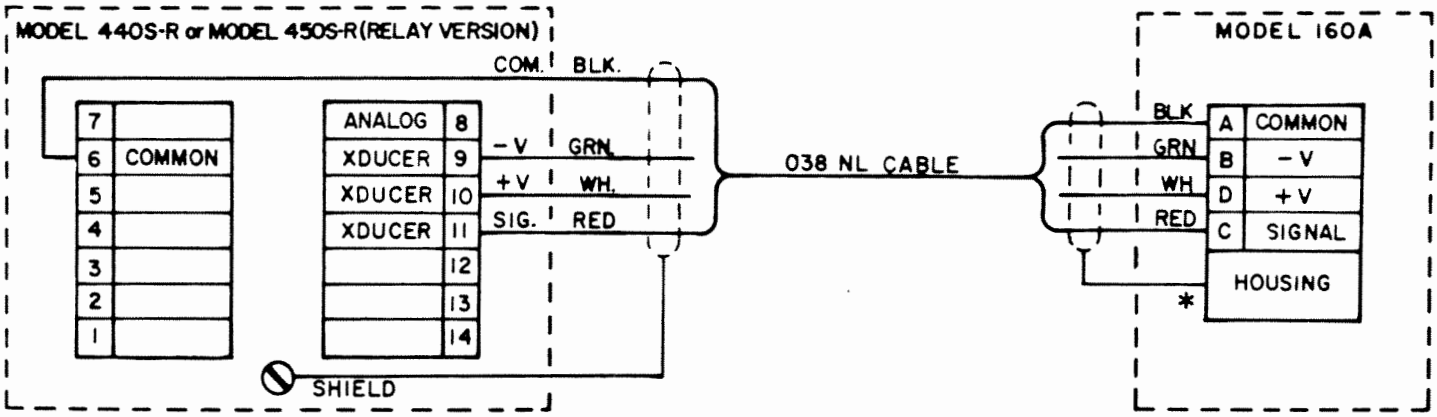
NOTE: Relays normally energized. De-energized on high vibration.



NOTES: 1. Relays normally energized. De-energized on high vibration.

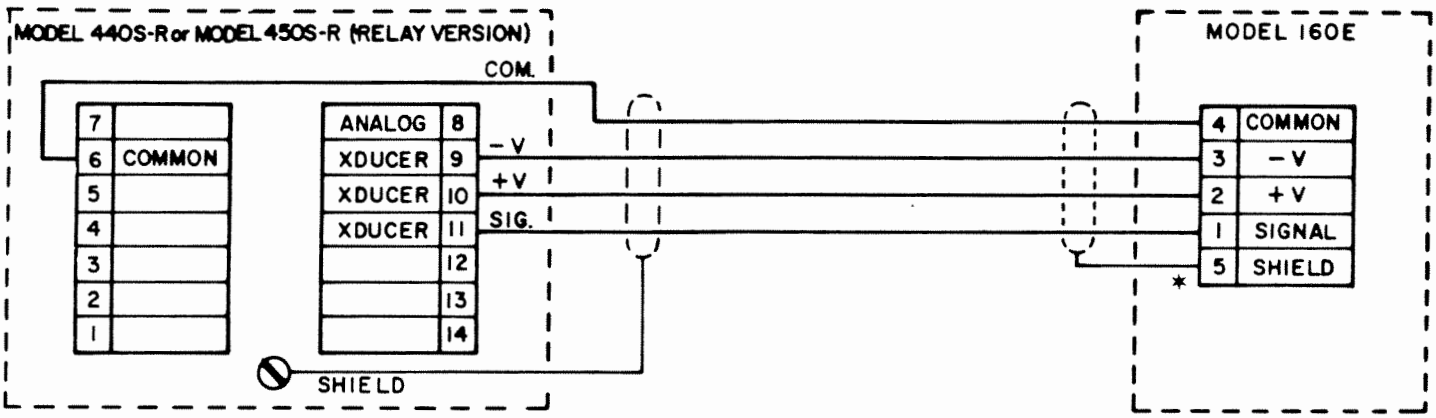
A24458

NOTE: Applies only if remote 160A transducer option is purchased.



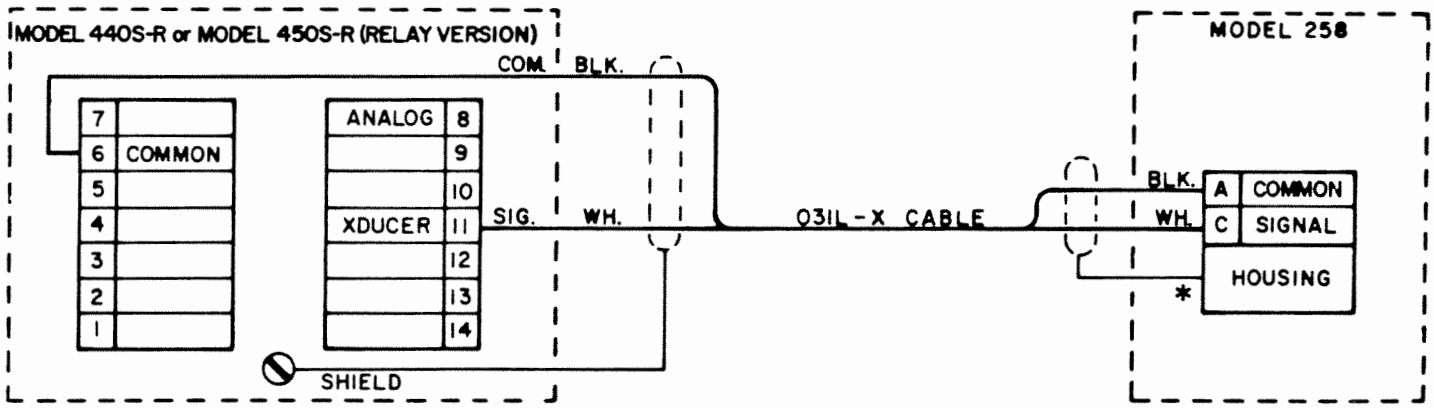
* This connection should not be made in typical motor driven machinery applications where magnetic fields and circulating currents are typical sources of noise pickup. Where large static charges such as from ignition systems are likely, completing this connection is recommended.

NOTE: Applies only if remote 160E transducer option is purchased.



* This connection should be made in all cases.

NOTE: Applies only if remote 258 transducer option is purchased.



* This connection should not be made in typical motor driven machinery applications where magnetic fields and circulating currents are typical sources of noise pickup. Where large static charges such as from ignition systems are likely, completing this connection is recommended.

A24462

A24462

4.0 Control Setting

4.1 Setting Trip Points

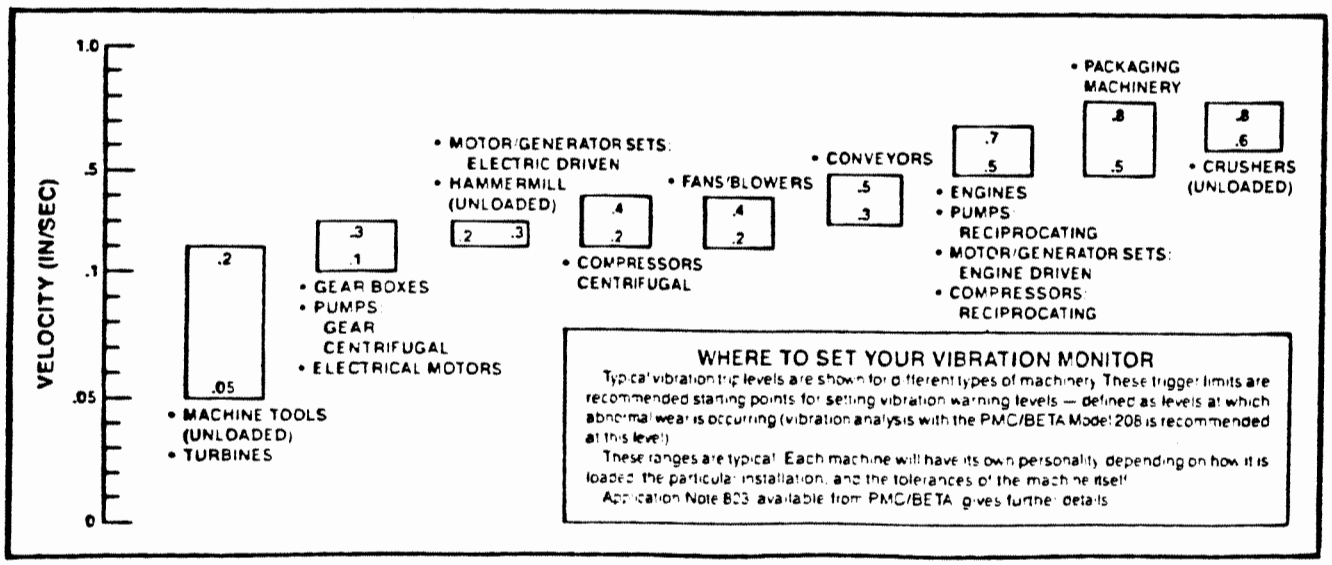
The models 440S-R and 450S-R provides one trip: one for alarm or for shutdown.

The alarm or shutdown trip is set directly in inches/seconds (velocity models) or mils (displacement models).

Since the set point control has a calibrated scale (unlike mechanical switches where you cannot tell what the trip point is), known trip points can be set in. The proper set point varies with the type machine. The following will assist you in determining the proper set point.

1. The Warning Level Guide shown below indicates recommended starting points for vibration warning levels - defined as levels at which abnormal wear is occuring. Vibration analysis is recommended at this level. Different warning levels are given for different types of machinery.
2. These ranges are typical. Each machine will have its own personality, depending on how it is loaded, the particular installation, and the tolerances of the machine itself. Thus, you must make the final judgment for your equipment.
3. Trend information is frequently as meaningful as absolute levels. Thus, an alternate method is to determine the existing vibration level (this is easily accomplished using a vibration meter such as the PMC 101 or 201) and setting the trigger between 25% and 50% above this. The 440 itself can be used to determine the existing vibration level. (See paragraph 4.4).
4. If the existing level is near or above the upper end of the range noted in the Warning Guide, vibration analysis with an instrument such as the PMC 208 should be performed as soon as possible and corrective action taken. (Write for Vibration Identification Guide contained in AN 803).

Determine Vibration Warning Levels



4.2 Setting of Time Delay

An important feature of PMC/BETA switches is the built-in time delay. This prevents triggering of the alarm or shutdown functions from transient increases in vibration levels. It also avoids shutdown due to transitory vibrations occuring during start-up.

Almost all machines experience a few seconds of high vibration during start-up before reaching operating speed. When no time delay function is included (as with mechanical switches), this start-up vibration causes a trip. Frequently, the operator turns the trip setting up until he can get through start-up. The resultant trip level is too high to afford protection at the machine's operating speed.

The time delay is adjustable. It will have been set at the factory for three (3) seconds unless your order specified otherwise.

The time a vibration must be above setpoint before trip occurs is individually adjustable for shutdown and alarm from 2 to 15 seconds.

To readjust the time delay, turn the shutdown set point (or alarm set point for alarm time delay) knob CCW until the LED illuminates. The time from this point to relay actuation is the time delay. Change the time delay via screw-driver adj., clockwise to increase time delay (one complete turn is approximately 0.5 seconds). Then recheck and readjust until the desired time delay is achieved.

4.3 Test Mode

The test position on the setpoint control is used to test the switch functions without the need for vibration. When the shutdown knob is turned to test, the shutdown LED should immediately illuminate, the 4-20 mA should exceed 20 mA, followed after the delay time by actuation of the shutdown triac.

If the setpoint knob is returned to a normal setting before the duration of the time delay has been exceeded, the LED will come on but the actuation of the triac can be avoided.

4.4 Alarm and Shutdown Light Emitting Diodes

Since the LED activate instantaneously (before time delay), it can be used to check the machine's actual vibration level, i.e.: slowly decrease shutdown setpoint by turning the setpoint counter-clockwise until the shutdown LED illuminates. Note this setting and return the knob to a higher setting (before time delay runs out). This is the actual vibration level present.

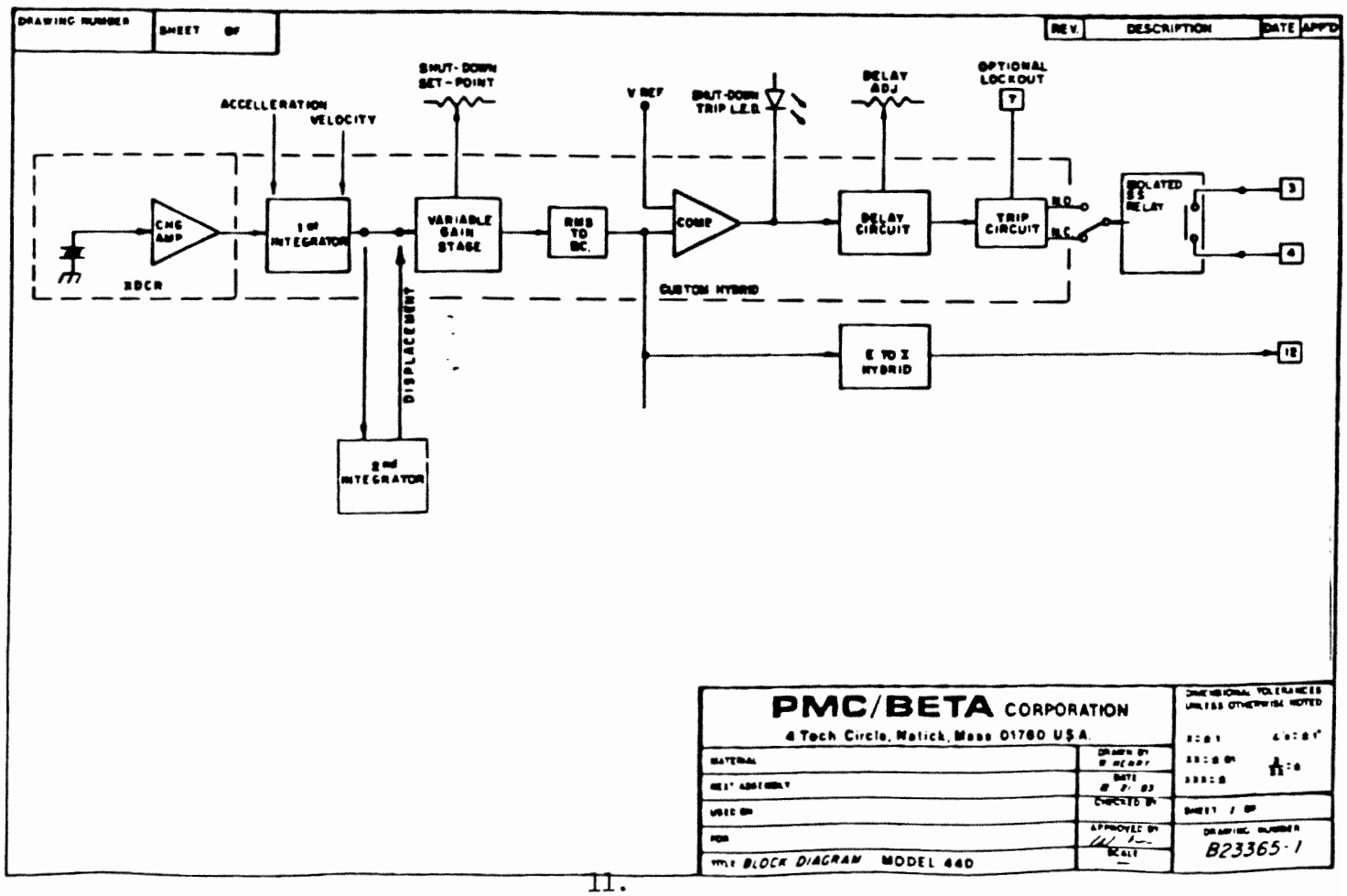
5.0 SYSTEM BLOCK DIAGRAM

Vibration is sensed by an internal transducer module consisting of a crystal assembly and integral charge amplifier. Thus, the electrical output of the transducer is a well buffered (low impedance) signal directly proportional to acceleration (G) of the switch.

The signal goes to a custom hybrid circuit, where, depending on the model, it may pass through one or more stages of signal conditioning to yield an A.C. signal now proportional to velocity (or displacement, in displacement models). This signal in turn is routed through an amplifier, the gain of which is controlled by the "shutdown setpoint".

Next, the signal is processed through a true RMS to DC stage and compared against a preset internal voltage reference. If the signal level is higher than reference, the shutdown LED is illuminated.

If the voltage level stays above the reference for the duration of the time delay an output trip occurs and the shutdown solid state relay will trip. (Change state).



PMC/BETA

Application Note 811

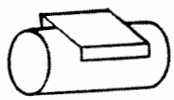
MOUNTING PMC/BETA ELECTRONIC VIBRATION SWITCHES

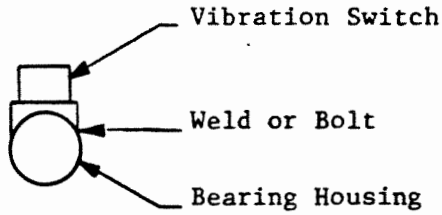
WHERE TO MOUNT THE SWITCH

It is desirable to mount the PMC electronic switch (or transducers for remote monitoring systems) on the bearing housing, since the forces on the rotating member (unbalance, misalignments, bearing wear, aerodynamics, etc.) reach the outside world through the bearings.

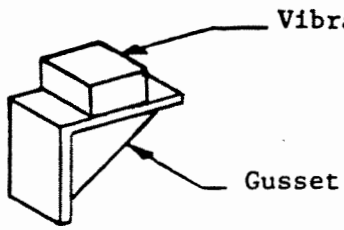
Most bearing housings are curved so it is necessary to attach a bracket with a flat surface for mounting the switch. If the machine has bolted end plates on the bearings or horizontally split bearing housings, these bolts can be used to attach the bracket.

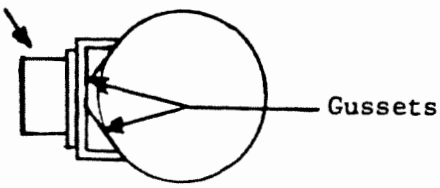
When bolt holes are not available or are not suitable, an alternative way is to weld an angle iron bracket similar to that in the sketch, but oriented so as to straddle the bearing housing similar to:





The best approach is to mount a gusseted bracket:

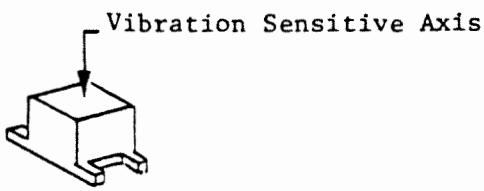


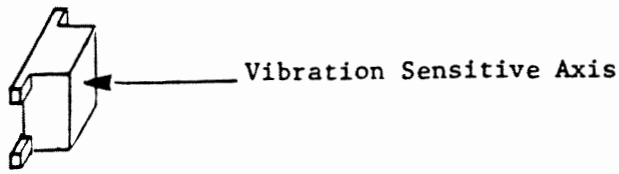


For most applications 3/8 inch material (preferably steel) will be suitable.

SENSITIVE AXIS

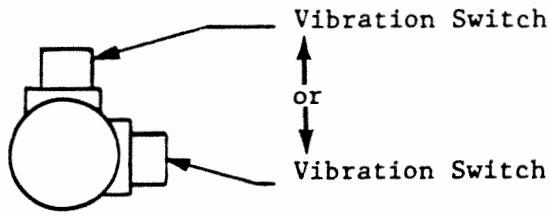
Please note that the electronic vibration switch can be mounted in any orientation without a change in sensitivity. It senses vibration in a direction perpendicular to its mounting surface.





CHOOSING MOUNTING DIRECTION

The vibration switch can be mounted in the vertical or horizontal direction (or anything in between).



The best way to choose the mounting direction is to measure the vibration level in both directions with a vibration meter (such as the PMC Model 101 or 201A) and choose the direction with the highest level. This will usually be horizontal, since the machine structure is usually less rigid horizontally than vertically.

HOW MANY MONITOR POINTS PER MACHINE

Anywhere from one to four switches are used per machine (depending on how critical the machine is to the process or how expensive it is), one on each end of the motor and one on each end of the compressor, fan, pump or whatever is being driven. If there is a gear box in between, one may be used here also.

It is quite common to use only one switch. In this case, it is best to mount on or near the driven bearing. For example, if you have a motor and large fan with a bearing on each end of the fan, the fan bearing on the motor side would be the driven bearing. It will usually see the highest forces and have the highest vibration level.

MOUNTING AT OTHER LOCATION

It is not always possible to mount on the bearing. The unit can then be mounted on the bearing pedestal or on a structural member nearby. Again, it is desirable to survey the machine with a vibration meter. If the level at the intended location is about the same (within 25 or 50%) it probably will be satisfactory. Of course, the trip setting would be reduced if the vibration level at the mounting location is smaller than at the bearing. (See Application Note 803 for information on recommended trigger levels).

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RESISTANCE THERMOMETRY: Principles and applications of resistance thermometers and thermistors

Resistance thermometers and thermistors are temperature sensors which change electrical resistance with temperature. The superior sensitivity and stability of these devices, in comparison to thermocouples, give them important advantages in low and intermediate temperature ranges. In addition, resistive devices often simplify control and readout electronics.

Resistance thermometers are specified primarily for accuracy and stability from cryogenic levels to the melting points of metals. They are accurate over a wide temperature range, may be used to sense temperature over a large area, and are highly standardized. The standard platinum resistance thermometer is specified by the ITS–90 (International Temperature Scale of 1990) to interpolate between fixed points in the range 13.80K (–259.35°C) to 1234.93K (961.78°C).

While normally less stable than resistance thermometers, thermistors offer lower cost and higher sensitivity over more limited ranges. Thermistor sensors can be relatively small and are well suited to product or equipment applications where quantities of use justify the design of special readout circuits.

Resistance Thermometers

Resistance thermometers may be called RTD's (resistance temperature detectors), PRT's (platinum resistance thermometers), or SPRT's (standard platinum resistance thermometers). These thermometers operate on the principle that electrical resistance changes in pure metal elements, relative to temperature.

The traditional sensing element of a resistance thermometer consists of a coil of small diameter wire wound to a precise resistance value. The most common material is platinum, although nickel, copper, and nickel-iron alloys compete with platinum in many applications.

A relatively recent alternative to the wire-wound RTD substitutes a thin film of platinum or nickel-iron, which is deposited on a ceramic substrate and laser-trimmed to the desired resistance. Thin film elements attain high resistances with less metal, thereby lowering cost.

Resistance/temperature characteristics

Resistance thermometers exhibit the most linear signal with respect to temperature of any sensing device. Small deviations from straight line response, however, dictate the use of interpolating polynomials to calculate resistance values between fixed temperature points.

Platinum

The resistance/temperature characteristic for standard platinum resistance thermometers, as defined by the ITS–90, is a complex set of equations beyond the scope of this document. A good reference for understanding the ITS–90 is *NIST Technical Note 1265: Guidelines for Realizing the ITS–90*, B. W. Mangum and G. T. Furukawa, U. S. Department of Commerce, 1990.

Platinum generally follows the modified Callendar-Van Dusen equation over the range –200 to 850°C (–328 to 1562°F):

t(°C)	Equation
–200 to 0	$R_t = R_0 [1 + At + Bt^2 + Ct^3 (t - 100)]$
0 to 850	$R_t = R_0 [1 + At + Bt^2]$

R_t = Resistance at temperature t (in °C),
R_0 = Base resistance at 0°C, and
A, B, and C are constants that describe a given thermometer.

The A, B, and C coefficients, which can be individually determined for high precision laboratory thermometers, are entered into the Callendar-Van Dusen equation to generate resistance vs temperature tables.

Nominal values are:

TCR* = 0.003926 Ω/Ω°C (Minco element code **PA** et al.)
A: 3.9848×10^{-3} B: -5.870×10^{-7} C: -4.0000×10^{-12}

TCR = 0.003911 Ω/Ω/°C (Minco element code **PB** et al.)
A: 3.9692×10^{-3} B: -5.8495×10^{-7} C: -4.2325×10^{-12}

TCR = 0.003850 Ω/Ω/°C (Minco element code **PD** et al.)
A: 3.9083×10^{-3} B: -5.775×10^{-7} C: -4.183×10^{-12}

To determine temperature from a measured resistance for t above 0°C:

$$t = \frac{-A + \sqrt{A^2 - 4B\left(1 - R_t / R_0\right)}}{2B}$$

*Temperature Coefficient of Resistance

Effects of leadwire resistance and bridge design

This sensitivity is desirable, however, only in laboratory systems where the bridge is constantly rebalanced. Typical industrial circuits will have unequal resistors.

The value of R_t at the temperature point of most interest will influence the selection of the bridge arm resistors. Values should also be chosen to limit bridge currents and consequent self-heating in the thermometer. Bridge resistors must be stable and insensitive to ambient temperature variations for best accuracy.

In a 2-lead bridge, the leadwire resistance $L_1 + L_2$ adds directly to readings. If leads are short enough or sensitivity high enough, the offset may be acceptable. When long extension runs are required between the sensor and instrument, or sensitivity is low, the specifier should consider a 3-lead system. All resistance thermometers with copper elements must have three leads to offset their low sensitivity.

Figure 3 shows a 3-lead compensating bridge circuit. L_1 and L_2 are now in two separate arms of the bridge, so the measuring currents and voltage drops across them are identical. The third lead L_3 forms part of the output circuit and does not affect the bridge ratios or balance. In fact, no current flows through L_3 when the bridge is in balance.

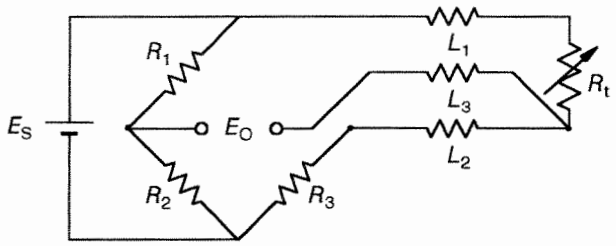


Figure 3: 3-lead compensating bridge circuit

Proper compensation with the 3-lead system depends on these conditions:

1. Lead resistances L_1 and L_2 should be equal. Most manufacturers match leads within ±5%. In most cases, therefore, error with a 3-lead system is less than 5% of the error with a similar 2-wire system.
2. Leadwires should stay bundled together to ensure that ambient temperature changes act equally on all leads.
3. Electronic circuitry connected to E_O should have sufficient input impedance to prevent appreciable current drain through L_3. L_3 normally acts only as a potential-carrying lead. Any current through it will cause errors when the bridge is out of balance.

3-lead systems represent a practical compromise between accuracy over distance and the cost of extra leads. Although well suited to most industrial areas, they may be affected by electrical noise and contact resistance at the junction points.

4-lead circuits provide the same resistance compensation as 3-lead systems, but also relieve problems with unmatched leads, contact resistances, and thermal EMF's. Thermal EMF's are spurious voltages introduced by the thermocouple effect where two dissimilar metals make contact. Laboratory systems, used for the highest precision measurements, are often variants of the Mueller bridge. The Mueller bridge is basically a switched three-wire system requiring two readings which are averaged to yield a true reading.

The need to throw switches and calculate the mean of readings excludes Mueller bridges from use in automated readout or control. An alternative, still using 4-lead RTD's, is the constant current circuit of Figure 4. Here a constant current source drives I_s through L_1 and L_4, and the potential produced by R_t appears across L_2 and L_3. Circuitry connected to E_O must have an impedance high enough to prevent appreciable current flow through L_2 and L_3. In this circuit, the measured potential is unaffected by lead and contact resistance. Use of an AC current source nullifies EMF's.

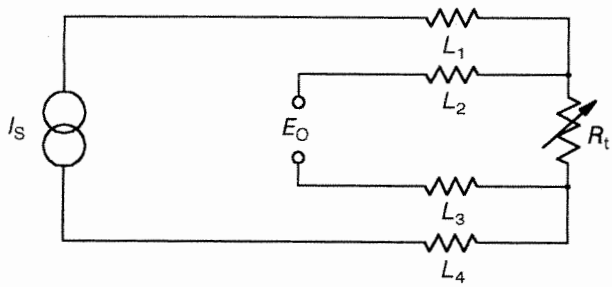


Figure 4: 4-lead system with constant current source

Industrial RTD Probes

The encased probe is the standard resistance thermometer configuration for industrial process control and machinery protection. Most probe cases are stainless steel or Inconel to withstand high temperatures, although other materials offer advantages at intermediate ranges. For example, the tip-sensitive probe of Figure 11 has a copper-alloy tip which conducts heat 20 times better than stainless steel. This design improves thermal contact with sensed surfaces and reduces errors from conduction along the sheath.

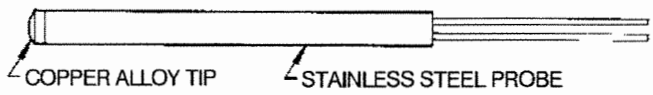


Figure 11: Tip-sensitive probe

Standard probe diameters range from 0.125" to 0.250". Smaller probes respond faster when directly immersed, but larger probes may fit more snugly in standard thermowells. Probe lengths range from a few inches to ten feet or more.

Figure 12 shows the construction of a high temperature probe. The element fits in the tip, surrounded by high temperature powder or cement. Extension leads, normally uninsulated, extend back from the element and are encapsulated by powder, cement, or bored ceramic spacers. External leads, often insulated with Teflon or glass braid, are potted with cement at the entry point to seal against moisture.

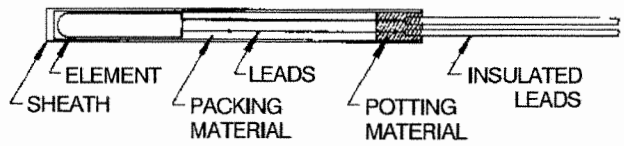


Figure 12: High temperature probe

The alternative construction of Figure 13 places the element, potting, and lead transitions within a module at the tip of the probe. This design allows the user to cut the probe to required lengths. Temperature is limited to the rating of the external leadwire insulation: 260°C (500°F) for Teflon, up to 550°C (1022°F) for insulations such as woven mica/glass.

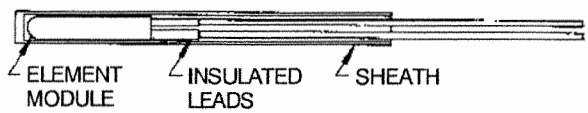


Figure 13: Cut-to-length probe

Probe Assemblies

A wide variety of mounting fittings and accessories aid probe installation. Selection depends on the nature of the medium being sensed and cost requirements.

Direct immersion of a probe into a liquid requires a fitting with a pipe thread, which may be adjustable or welded on the probe. Figure 14 shows a typical assembly, with one thread for mounting the probe and another for a connection head. Connection heads provide a transition between probe leads and external signal wires.

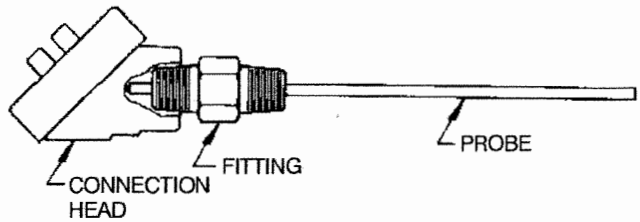


Figure 14: Typical probe assembly

Mounting in a solid material is best accomplished with a spring-loaded holder, which may be fixed or adjustable. Spring loading provides good contact of the probe tip against the bottom of the hole and dampens potentially damaging vibration.

When liquids are particularly corrosive, under high pressure, or fast-flowing, a thermowell may be necessary. A thermowell is a tube, closed at one end, which protects the probe and allows its removal without breaking the liquid seal. Many materials and styles are available to match application requirements. Thermowells drilled from solid bar stock provide the highest pressure ratings, but welded models cost much less. Figure 15 shows a typical thermowell assembly, including a spring-loaded holder for enhanced thermal response and reliability.

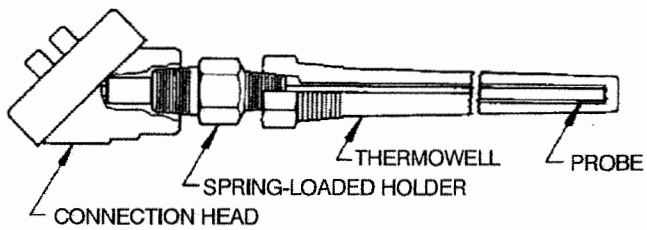
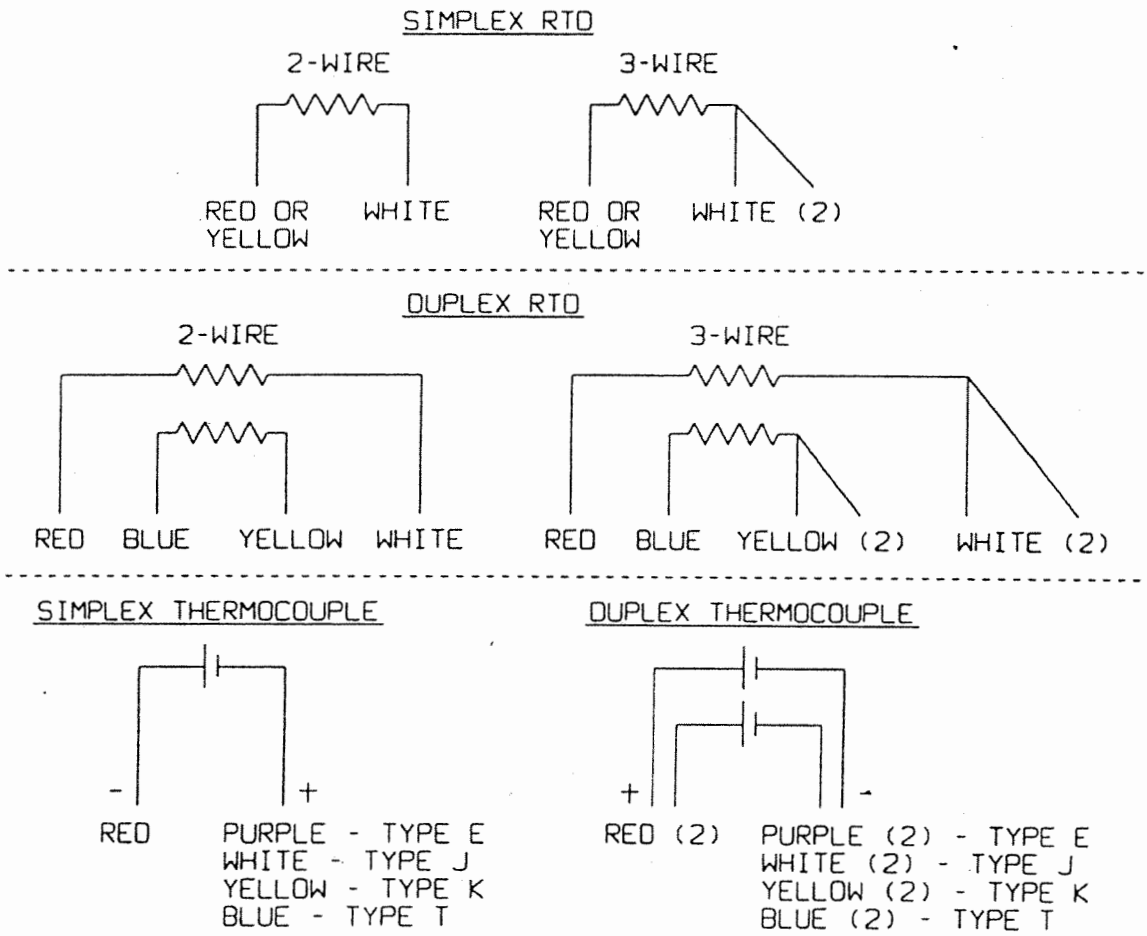


Figure 15: Thermowell assembly

Electrical Connections:

Note: If assembly contains a transmitter, skip this step and see special instructions (Form #880216).

Make connection to external wiring using connectors provided (terminals or wire nuts). See the schematic diagrams below for probe leadwire color code. External wiring and conduit must be in accordance with the National Electrical Code for the specific hazardous atmosphere. No conduit seal is required at the connection head.

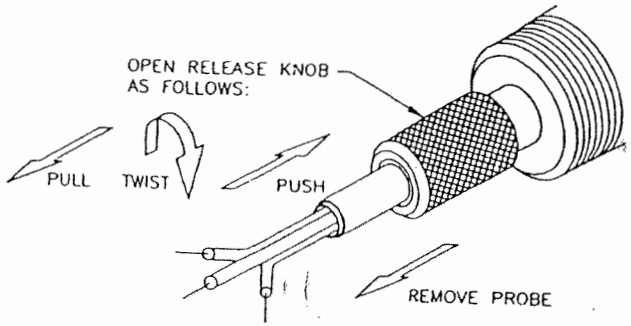


WESSCO MODEL
FG210, FG213
SPRING LOADED HOLDER

STEP 1 "OPEN RELEASE KNOB"

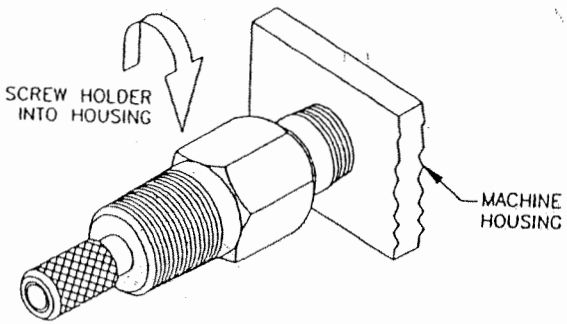
Grasp release knob, pull it out, and twist approximately 1/2 turn clockwise against the stop. Push in to lock open. Remove probe from holder by pulling on case.

CAUTION: Do not pull on probe leadwires.



STEP 2 "THREAD HOLDER INTO HOUSING"

Install the spring-loaded holder into a female thread in the machine housing, bearing block, thermowell, or fitting. Tighten using an open end or adjustable wrench.

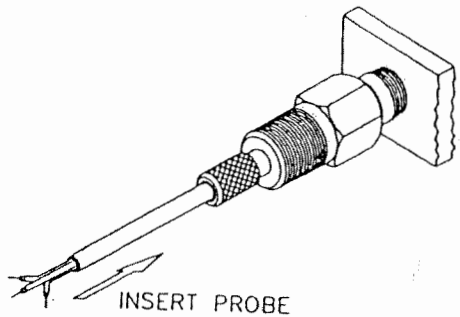


STEP 3 "INSERT PROBE"

Insert the probe, tip end first, through the hole in release knob of spring-loaded holder. Push the probe slowly through o-ring seal until it contacts the surface to be sensed.

CAUTION: Do not push in probe when knob is in the closed position.

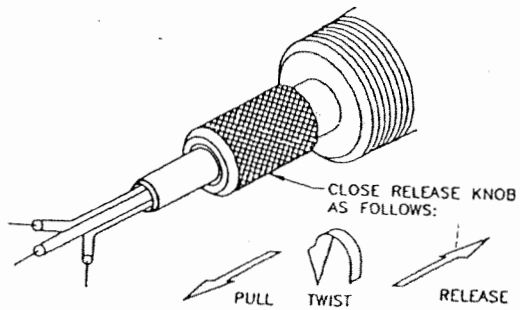
NOTE: If spring loading is not required, as in the case where liquid or gas temperature is to be monitored rather than surface or bearing temperature, insert probe 1/4" short of the desired depth.



STEP 4 "CLOSE RELEASE KNOB"

Grasp release knob, pull it out, twist approximately 1/2 turn counter-clockwise against the stop, and release. The knob will move inward approximately 1/8", locking and applying spring loading force to hold the probe against the surface to be sensed.

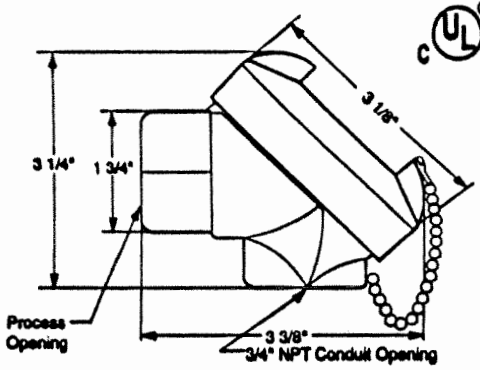
NOTE: If the probe is not bearing against a surface, the knob will move fully inward, approximately 1/4" when released, and will lock probe in position.



ACCESSORIES

HAZARDOUS LOCATION (UL)® LISTED CONNECTION HEADS

The series 800 thermocouple and RTD connection heads listed below are UL listed and they meet the requirements listed under UL886 and CSA C22.2 for Class I Groups C, D; Class II Groups E, F, G; Class III for use in hazardous locations as described by the National Electrical Code. Series 804 and 805 heads are supplied with a bright finish 316L stainless steel body and cap, and they provide excellent chemical and corrosion resistance. Series 807 and 808 heads are provided with a zinc plated cast iron body and polished aluminum cap, and they provide some degree of corrosion resistance. An available white epoxy coating option will further enhance their chemical and corrosion resistance. All heads are supplied with an internal ground screw, a 825°F temperature rated gasket, and they will accept any of the series 340 terminal blocks listed below.



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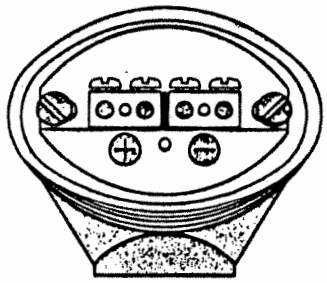
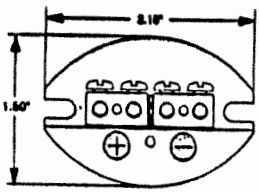


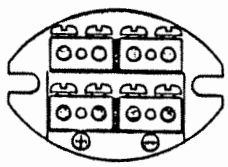
316L STAINLESS STEEL							
PROCESS OPENING SIZE	ORDER CODE HEAD & CAP WITHOUT BLOCK	Order Code for Complete Head and Block Assemblies: SINGLE	DUPLEX	TRIPLEX 2 - Term	3 - Term	4 - Term	6 - Term
1/2" NPT	804	814	824	834-2	834-3	834-4	834-6
3/4" NPT	805	815	825	835-2	835-3	835-4	835-6
CAST IRON / ALUMINUM							
1/2" NPT	807	817	827	837-2	837-3	837-4	837-6
3/4" NPT	808	818	828	838-2	838-3	838-4	838-6

HEAD OPTIONS	
ORDER CODE	DESCRIPTION
W	Protective epoxy coating (2 mil. thickness - white only)
R	Ethylene propylene rubber gasket w/adhesive
SPECIFY	Private logo nameplate (consult factory for details)
Add suffix above to part number Example: #834 - 4W	

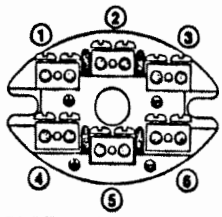
CERAMIC TERMINAL BLOCKS



5/8" Thick Single Block
#341

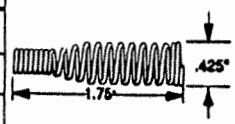


15/16" Thick Duplex Block
#342



7/8" Thick Triplex Block
#343

Terminal Block Order Code	Terminal Positions As Supplied
343-2	1 3
343-3	2 4 6
343-4	1 3 4 6
343-6	ALL



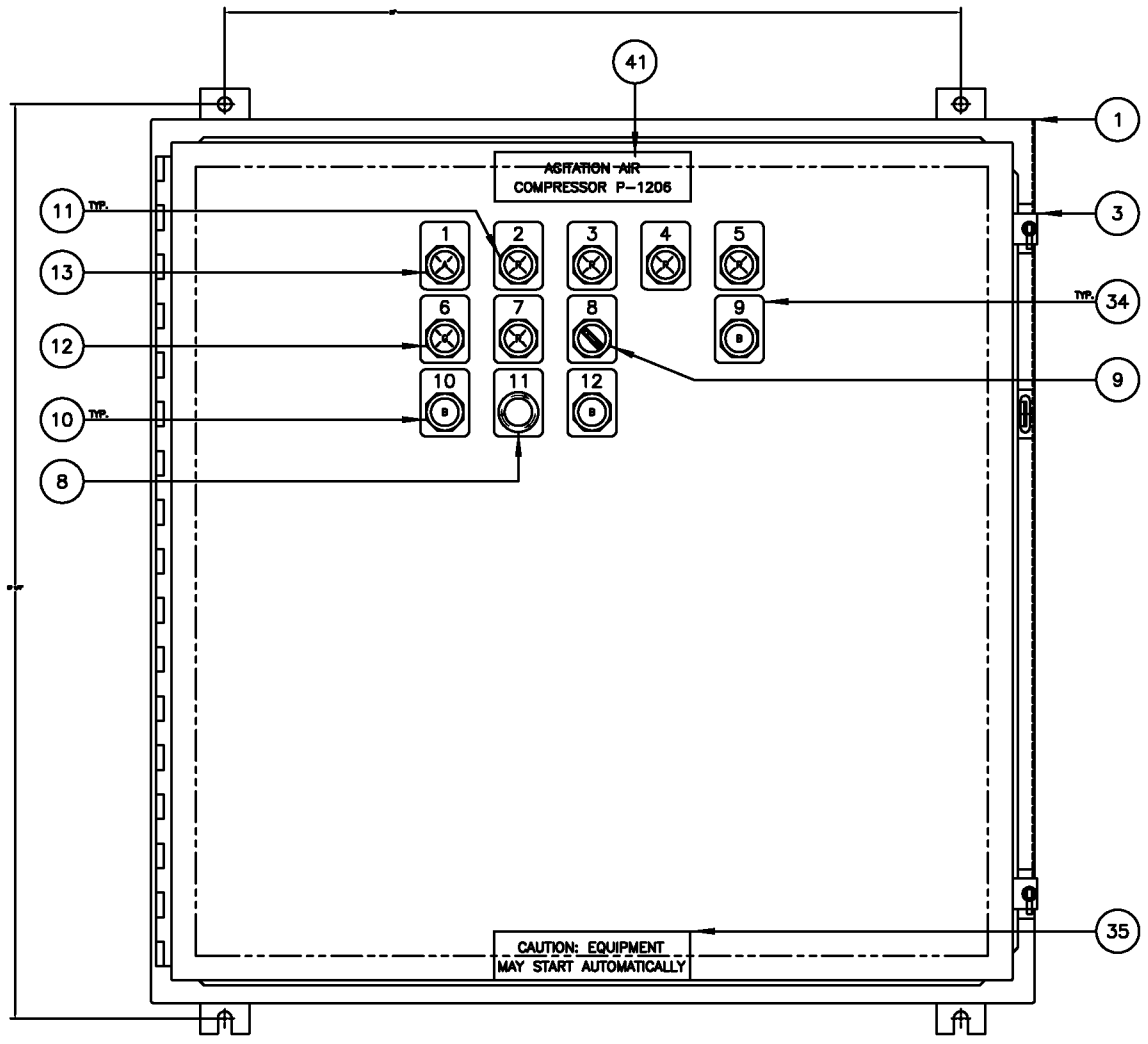
Spring Loading Sheath Spring

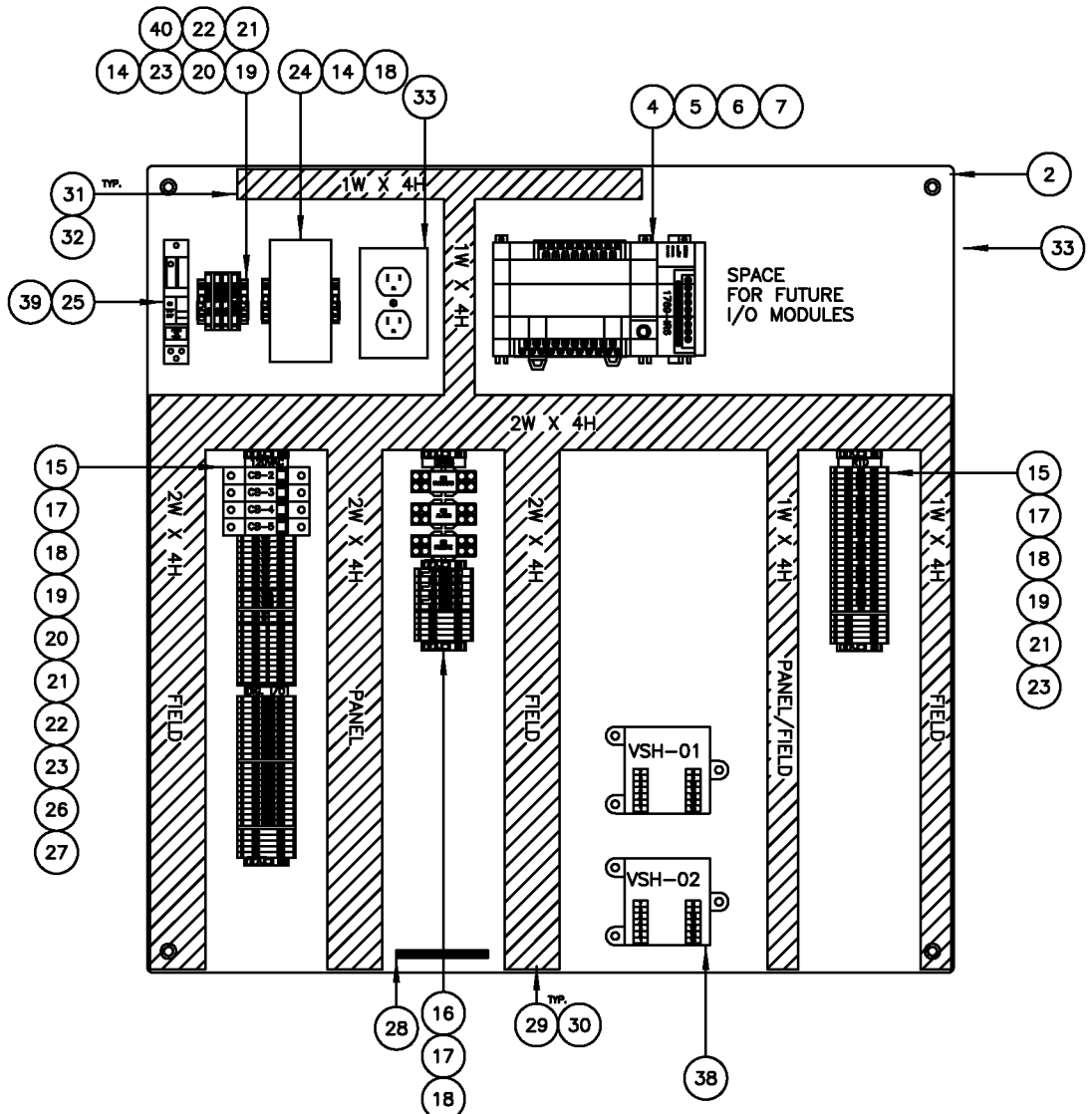
REPLACEMENT COMPONENT PARTS			
ORDER CODE	DESCRIPTION	ORDER CODE	DESCRIPTION
341	Single terminal block	349-1	Head gasket (gasket material is Phelps 7075 (trade name)
342	Duplex terminal block	349-2	Ethylene propylene rubber gasket with adhesive
343-2	Triplex terminal block with 2 brass terminals	382	1/8" OD spring loading sheath spring
343-3	Triplex terminal block with 3 brass terminals	383	3/16" OD spring loading sheath spring
343-4	Triplex terminal block with 4 brass terminals	384	1/4" OD spring loading sheath spring
343-6	Triplex terminal block with 6 brass terminals	386	3/8" OD spring loading sheath spring

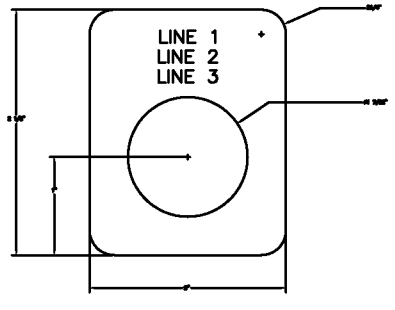
GARDNER DENVER CYCLOBLOWER
11CDL31-L BLOWER PACKAGE
CONTROL PANEL
PLC PROGRAM PRINTOUT

TAG NO. 1206, 1207, 1208, 1209, 1210

GARDNER DENVER CYCLOBLOWER
11CDL31-L BLOWER PACKAGE
CONTROL PANEL
TAG NO. 1206







WHITE W/ BLACK 1/8" TEXT

TAG #	LINE 1	LINE 2	LINE 3
1	STEADY-READY/	FLASH-FAIL	.
2	HIGH DISCHARGE	AIR PRESSURE	SHUTDOWN
3	HIGH DISCHARGE	AIR TEMPERATURE	SHUTDOWN
4	HIGH VIBRATION	SHUTDOWN	.
5	HIGH BEARING	TEMPERATURE	.
6	RUNNING	.	.
7	OFF	.	.
8	OPERATION	.	LOCAL REMOTE
9	RESET	.	.
10	START	.	.
11	STOP	.	.
12	JOG	.	.

MATERIAL LIST

ITEM	PART NUMBER	DESCRIPTION	QTY.
1	A-363612LP	HOFFMAN OR EQUAL ENCLOSURE, 36"H X 36"W X 12"D, N12, CARBON STEEL	1 EA.
2	A-36P36	HOFFMAN OR EQUAL SUBPANEL, 33" X 33"	1 EA.
3	A-FC412SS	HOFFMAN OR EQUAL QUICK-RELEASE LATCH, N12, STEEL	2 EA.
4	1764-24AWA	ALLEN-BRADLEY, MIRCOLOGIX 1500, BASE UNIT, 120VAC, 12 INPUTS, 12 OUTPUTS	1 EA.
5	1764-LSP	ALLEN-BRADLEY, MICROLOGIX 1500, PROCESSOR	1 EA.
6	1769-IR6	ALLEN-BRADLEY, MICROLOGIX 1500, COMPACT I/O RTD MODULE, 6 CHANNEL	1 EA.
7	1769-ECR	ALLEN-BRADLEY, MICROLOGIX 1500, END CAP	1 EA.
8	800T-FRXT6D4	ALLEN BRADLEY PUSHBUTTON, MAINT., MUSH. HD, RED, 1-NCLB	1 EA.
9	800T-HR2D1	ALLEN BRADLEY SELECTOR SWITCH, 2-POS., MAINT., 1-NO	1 EA.
10	800T-A2D1	ALLEN BRADLEY PUSHBUTTON, MAINT., BLACK, 1-NO	3 EA.
11	800T-QTH10R	ALLEN BRADLEY PILOT LIGHT, RED, 120VAC, LED PILOT LIGHT	5 EA.
12	800T-QTH10G	ALLEN BRADLEY PILOT LIGHT, GREEN, 120VAC, LED PILOT LIGHT	1 EA.
13	800T-QTH10A	ALLEN BRADLEY PILOT LIGHT, AMBER, 120VAC, LED PILOT LIGHT	1 EA.
14	199-DR1	LOW RISE DIN RAIL	1 FT.
15	1492-DR6	ALLEN BRADLEY HI RISE DIN RAIL	4 FT.
16	RH2B-ULC	IDEC RELAY, DPDT, 120VAC, W/INDICATOR LIGHT AND PUSH TO TEST BUTTON	3 EA.
17	163193	WEIDMULLER TERMINAL GROUP MARKER, SchT 5 s	4 EA.
18	38356	WEIDMULLER TERMINAL CLAMP	11 EA.
19	102010	WEIDMULLER TERMINAL BLOCK, BEIGE, FEED-THRU, SINGLE TIER	75 EA.
20	102018	WEIDMULLER TERMINAL BLOCK, BLUE, FEED-THRU, SINGLE TIER	11 EA.
21	105000	WEIDMULLER TERMINAL BLOCK END, BEIGE, FEED-THRU, SINGLE TIER	11 EA.
22	105008	WEIDMULLER TERMINAL BLOCK END, BLUE, FEED-THRU, SINGLE TIER	1 EA.
23	102016	WEIDMULLER TERMINAL BLOCK, GREEN, FEED-THRU, SINGLE TIER	9 EA.
24	51010 -WM/-DIN	LEVITON, TRANSIENT SURGE SUPPRESSOR, 10 AMP, 120VAC	1 EA.
25	THQC1115WL	GE, GFCI 15 AMP BREAKER	1 EA.
26	MG 24430	SQUARE D, 6 AMP BREAKER	1 EA.
27	MG 24426	SQUARE D, 2 AMP BREAKER	3 EA.
28	P-K9GTA	SQUARE D GROUND BAR	1 EA.
29	F-2X4WH6	PANDUIT WIREWAY, 2"WIDE X 4"HIGH, WHITE	5 FT.
30	C-2WH6	PANDUIT COVER, 2" WIDE, WHITE	5 FT.
31	F-1X4WH6	PANDUIT WIREWAY, 1"WIDE X 4"HIGH, WHITE	3 FT.
32	C-1WH6	PANDUIT COVER, 1" WIDE, WHITE	3 FT.
33		DUPLEX RECEPTACLE FOR PC USE ONLY	1 EA.
34		NAMEPLATES, 2-3/4" X 2", WHITE W/ BLACK 1/8" TEXT	12 EA.
35		NAMEPLATE, 2" X 8", YELLOW W/ BLACK 3/8" TEXT	1 EA.
36	47456	WEIDMULLER FUSED TERMINAL BLOCK END, SINGLE TIER	3 EA.
37	38036	WEIDMULLER FUSED TERMINAL BLOCK END, SINGLE TIER	3 EA.
38	.	METRIX, VIBRATION SWITCH	2 EA.
39	TQCBMPA1	GE, GFCI BREAKER MOUNTING PLATE	1 EA.
40	107220	WEIDMULLER TERMINAL BLOCK END, GREEN, FEED-THRU, SINGLE TIER	1 EA.
35		NAMEPLATE, 2" X 8", WHITE W/ BLACK 3/8" TEXT	1 EA.

NOTES:
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED – 120VAC HOT & PLC I/O
   WHITE – 120VAC NEUTRAL
   GREEN – GROUND
   BLUE – +24VDC
   BLACK – 0VDC
   YELLOW – FOREIGN VOLTAGE
4. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
5. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
6. LABEL WIRES THE SAME ON BOTH ENDS WITH WIRE NUMBERS SHOWN ON SCHEMATIC. USE BRADY SLEEVE TYPE WIRE LABELS.
7. PANEL TO BE LOCATED IN A NON-HAZARDOUS AREA.

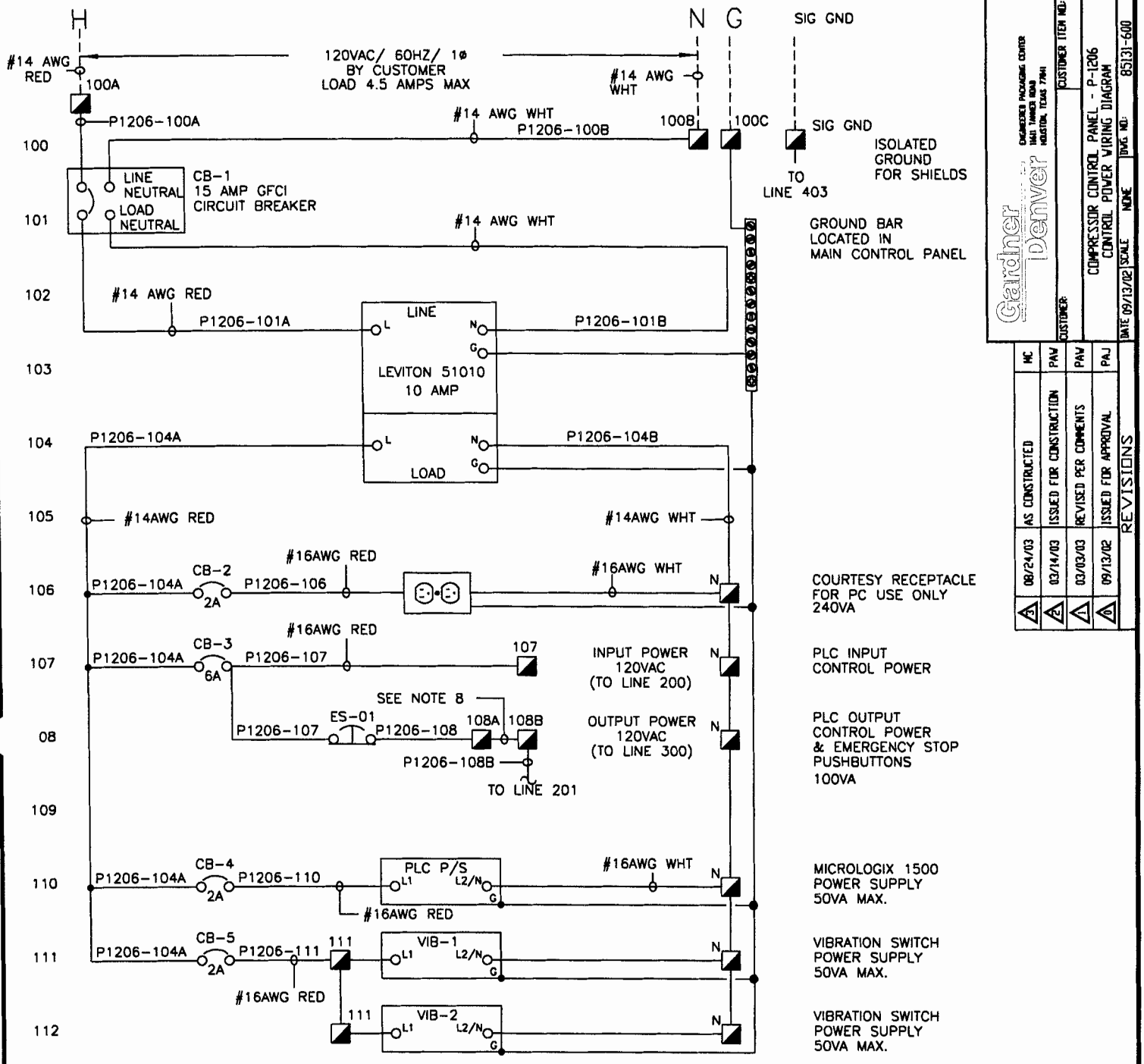
REVISIONS			
5	08/24/03	AS CONSTRUCTED	MC
4	03/14/03	ISSUED FOR CONSTRUCTION	PW
3	03/03/03	REVISED PER COMMENTS	PAW
2	09/13/02	ISSUED FOR APPROVAL	RE

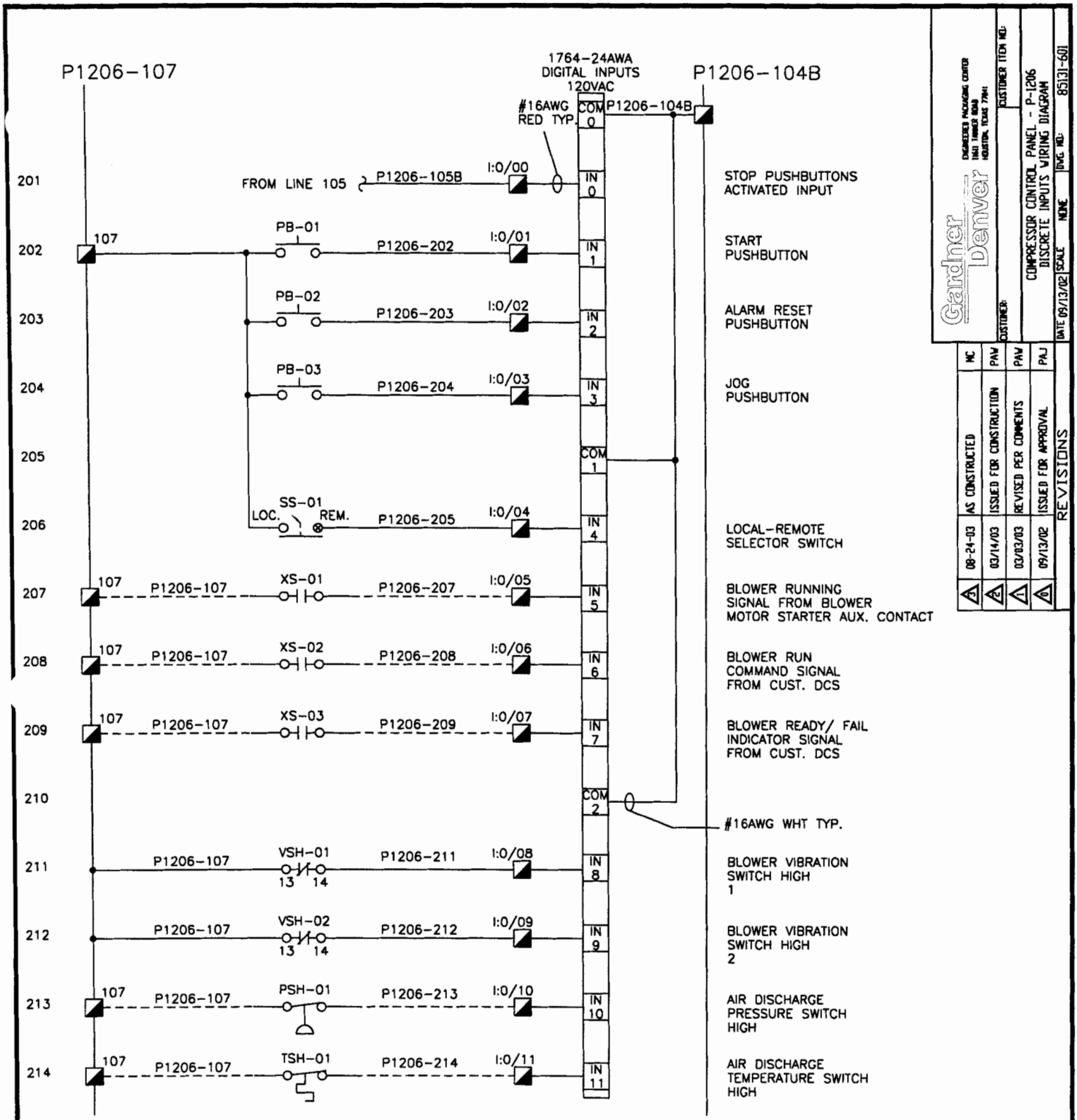
Gardner Denver
ENGINEERED PACKAGING CENTER
11911 TANNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER: | CUSTOMER ITEM NO.:

P-1206 – POSITIVE DISPLACEMENT BLOWER CONTROL PANEL INTERIOR & EXTERIOR LAYOUT

DATE 09/13/02 | SCALE 3"=1'-0" | DWG. NO.: 85131-650


H
N
G
SIG GND
#14 AWG RED
100A
120VAC/ 60HZ/ 1ø
BY CUSTOMER
LOAD 4.5 AMPS MAX
#14 AWG WHT
P1206-100A
#14 AWG WHT
P1206-100B
100B
100C
SIG GND
ISOLATED GROUND FOR SHIELDS
TO LINE 403
100
LINE
NEUTRAL
LOAD
NEUTRAL
CB-1
15 AMP GFCI
CIRCUIT BREAKER
101
#14 AWG WHT
GROUND BAR
LOCATED IN
MAIN CONTROL PANEL
102
#14 AWG RED
P1206-101A
LINE
L
N
G
P1206-101B
103
LEVITON 51010
10 AMP
104
P1206-104A
L
N
G
LOAD
P1206-104B
105
#14AWG RED
#14AWG WHT
#16AWG RED
CB-2
2A
P1206-104A
P1206-106
#16AWG WHT
106
COURTESY RECEPTACLE
FOR PC USE ONLY
240VA
#16AWG RED
CB-3
6A
P1206-104A
P1206-107
107
INPUT POWER
120VAC
(TO LINE 200)
107
PLC INPUT
CONTROL POWER
SEE NOTE 8
ES-01
P1206-107
P1206-108
108A
108B
OUTPUT POWER
120VAC
(TO LINE 300)
08
PLC OUTPUT
CONTROL POWER
& EMERGENCY STOP
PUSHBUTTONS
100VA
P1206-108B
TO LINE 201
109
CB-4
2A
P1206-104A
P1206-110
PLC P/S
L1
L2/N
G
#16AWG WHT
110
MICROLOGIX 1500
POWER SUPPLY
50VA MAX.
#16AWG RED
CB-5
2A
P1206-104A
P1206-111
111
VIB-1
L1
L2/N
G
111
#16AWG RED
VIBRATION SWITCH
POWER SUPPLY
50VA MAX.
VIB-2
L1
L2/N
G
112
VIBRATION SWITCH
POWER SUPPLY
50VA MAX.
113
114
LEGEND
– WIRES NOT CONNECTED
– WIRES CONNECTED
115
– PANEL WIRING
– FIELD WIRING
– TERMINAL IN MAIN CONTROL PANEL
116
117
NOTES:
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
RED – 120VAC HOT & PLC I/O
WHITE – 120VAC NEUTRAL
GREEN – GROUND
YELLOW – FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
GREY – HOT & PLC I/O
BLUE – NEUTRAL
GREEN – GROUND
YELLOW – FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.
8. REMOVE JUMPER IF REMOTE E-STOP IS TO BE USED.
Gardner Denver
ENGINEERED PACKAGING CENTER
1666 TURNER ROAD
HOUSTON, TEXAS 77041
CUSTOMER:
CUSTOMER ITEM NO:
COMPRESSOR CONTROL PANEL - P-1206
CONTROL POWER WIRING DIAGRAM
DATE 09/13/02
SCALE NONE
DWG NO: 85131-600
REVISIONS
A | 08/24/03 | AS CONSTRUCTED | MC
B | 03/14/03 | ISSUED FOR CONSTRUCTION | PAV
C | 03/03/03 | REVISED PER COMMENTS | PAV
D | 09/13/02 | ISSUED FOR APPROVAL | PAJ



NOTES:
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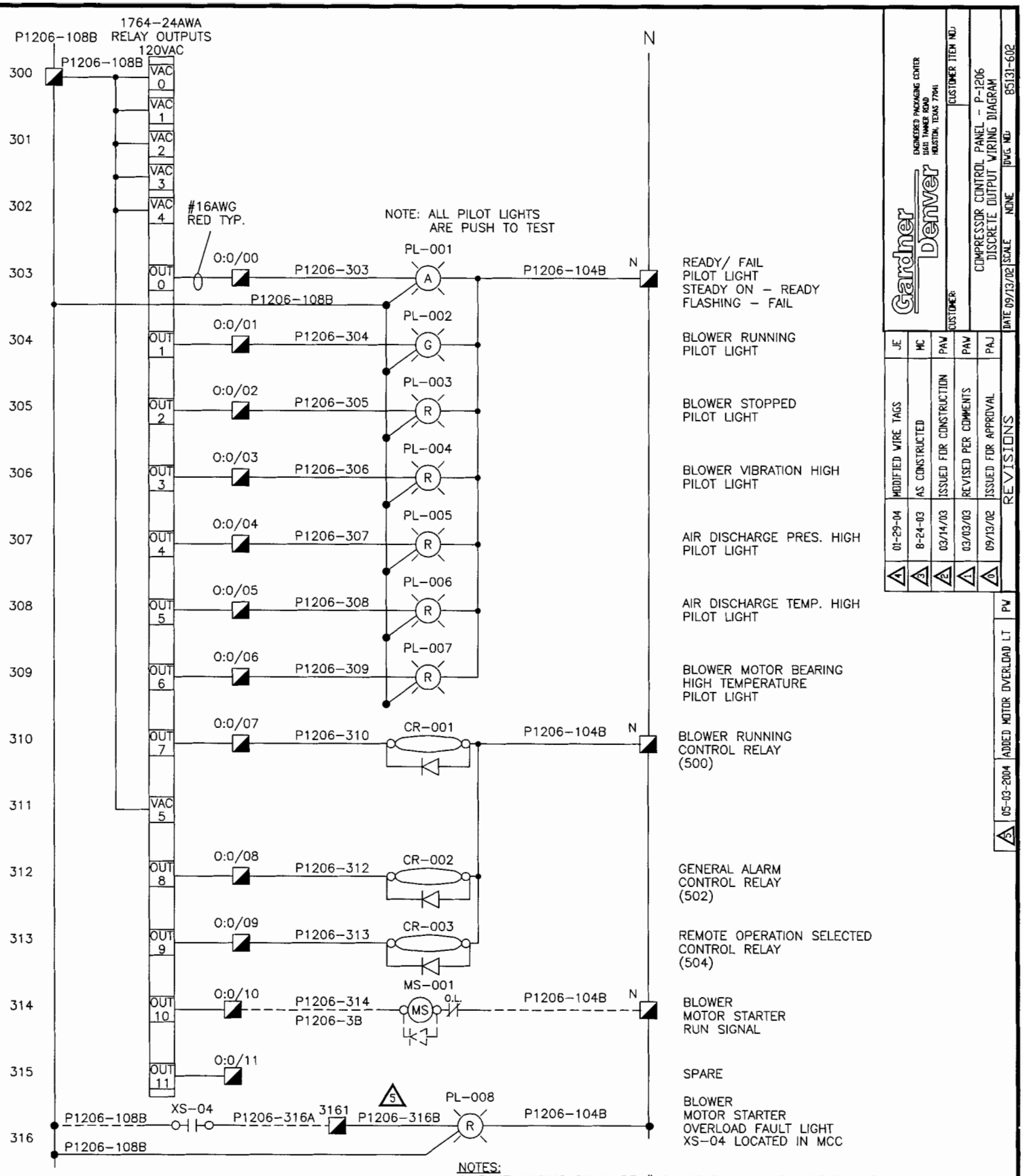
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED - 120VAC HOT & PLC I/O
   WHITE - 120VAC NEUTRAL
   GREEN - GROUND
   YELLOW - FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
   GREY - HOT & PLC I/O
   BLUE - NEUTRAL
   GREEN - GROUND
   YELLOW - FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.

A



NOTES:
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED - 120VAC HOT & PLC I/O
   WHITE - 120VAC NEUTRAL
   GREEN - GROUND
   YELLOW - FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
   GREY - HOT & PLC I/O
   BLUE - NEUTRAL
   GREEN - GROUND
   YELLOW - FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.

Gardner Denver
ENGINEERED PACKAGING CENTER
1565 TANNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER:
CUSTOMER ITEM NO.:

COMPRESSOR CONTROL PANEL - P-1206
DISCRETE OUTPUT WIRING DIAGRAM

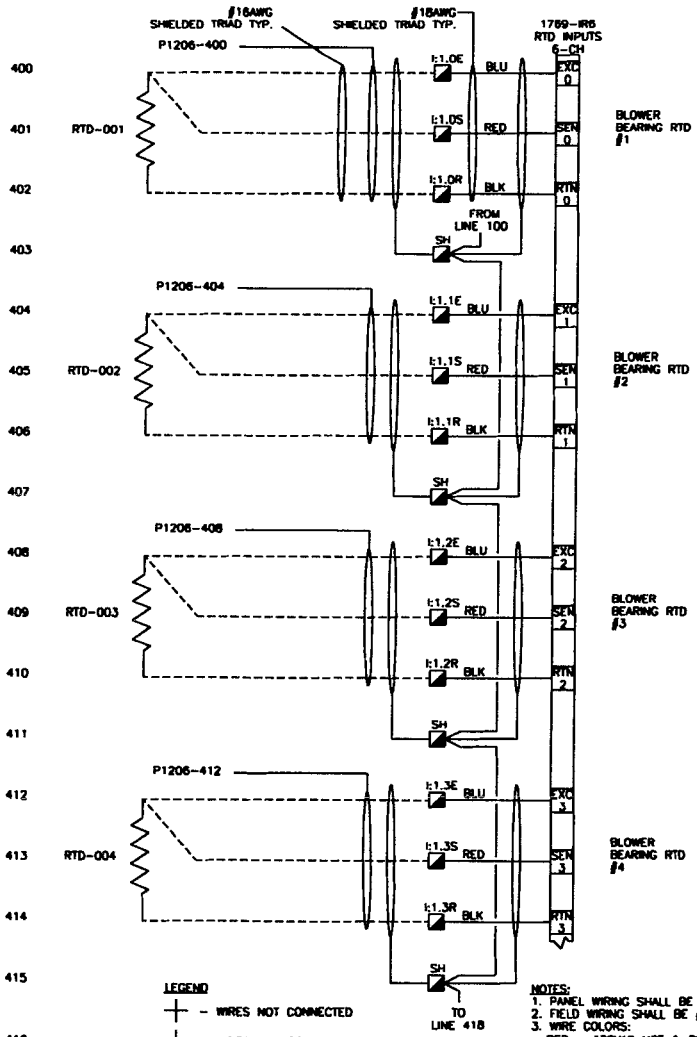
DATE 09/13/02 | SCALE NONE | DWG. NO. 85131-602

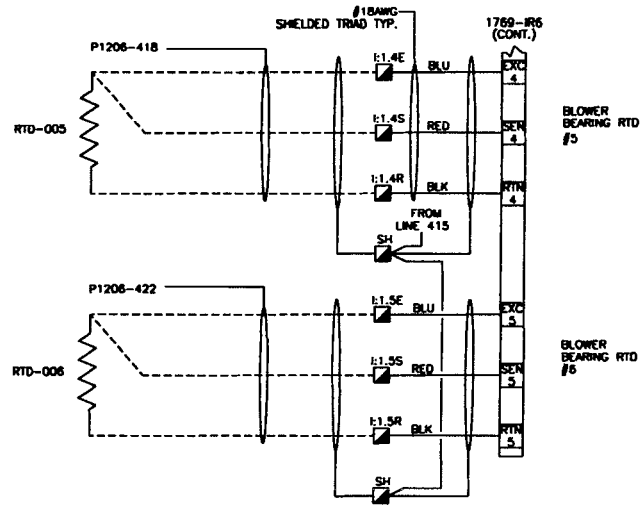
REVISIONS

4	01-29-04	MODIFIED WIRE TAGS	JE	
3	8-24-03	AS CONSTRUCTED	MC	
2	03/14/03	ISSUED FOR CONSTRUCTION	PAW	
1	03/03/03	REVISED PER COMMENTS	PAW	
0	09/13/02	ISSUED FOR APPROVAL	PAJ	

5 05-03-2004 ADDED MOTOR OVERLOAD LT PW

A





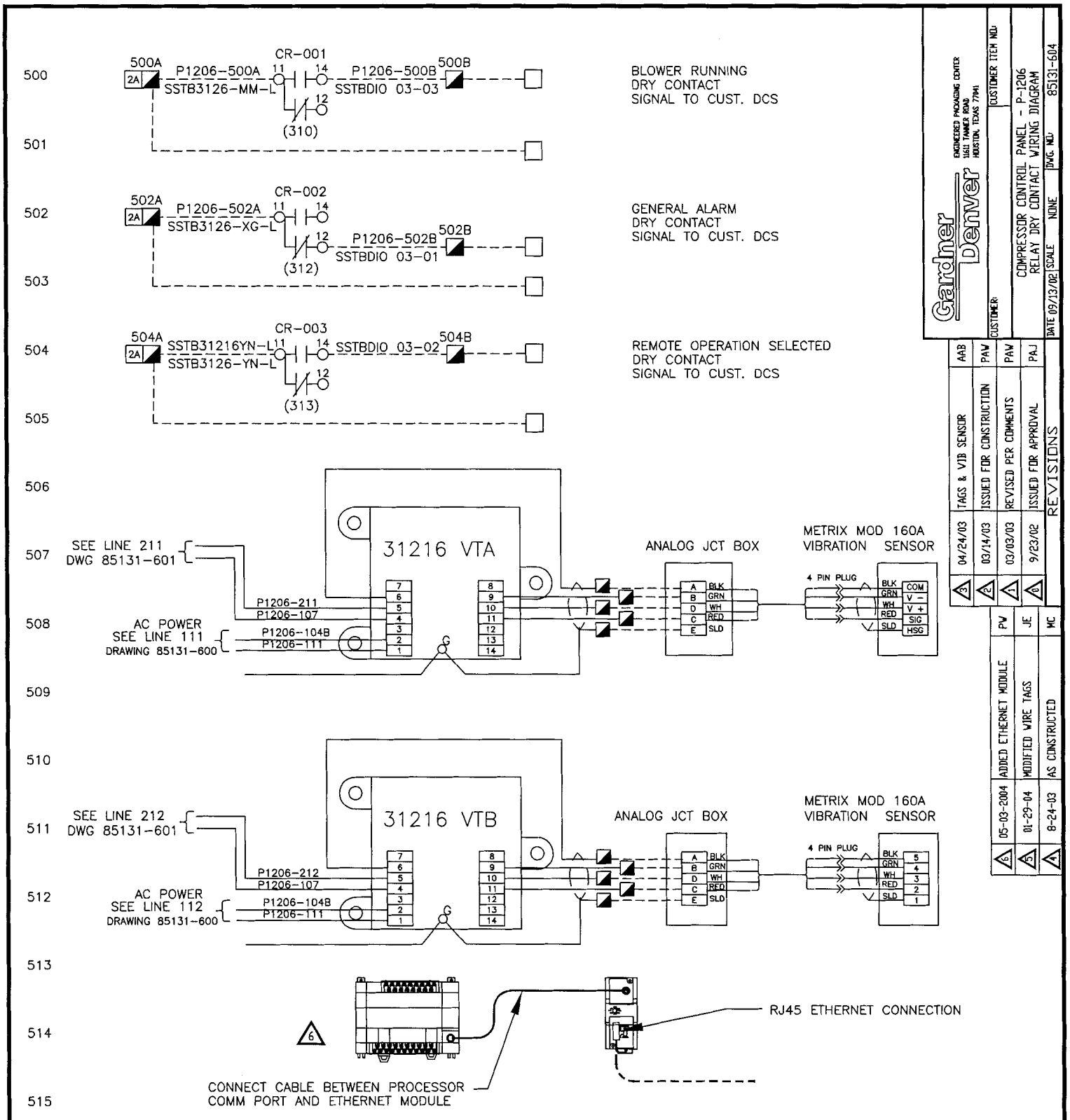
NOTES:
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED - 120VAC HOT & PLC I/O
   WHITE - 120VAC NEUTRAL
   GREEN - GROUND
   YELLOW - FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
   GREY - HOT & PLC I/O
   BLUE - NEUTRAL
   GREEN - GROUND
   YELLOW - FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.

REVISIONS			
3	8-24-03	AS CONSTRUCTED	MC
2	03/14/03	ISSUED FOR CONSTRUCTION	PMV
1	03/03/03	REVISED PER COMMENTS	PMV
0	09/13/02	ISSUED FOR APPROVAL	MC

Gardner Denver

COMPRESSOR CONTROL PANEL - P-1206
RTD INPUTS WIRING DIAGRAM

DATE 09/13/02 SCALE NONE DWG NO. 85131-603



LEGEND

- WIRES NOT CONNECTED
- WIRES CONNECTED
- PANEL WIRING
- FIELD WIRING
- TERMINAL IN MAIN CONTROL PANEL

NOTES:

1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED – 120VAC HOT & PLC I/O
   WHITE – 120VAC NEUTRAL
   GREEN – GROUND
   YELLOW – FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
   GREY – HOT & PLC I/O
   BLUE – NEUTRAL
   GREEN – GROUND
   YELLOW – FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.

Gardner Denver
ENGINEERED PACKAGING CENTER
11611 TANNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER:
CUSTOMER ITEM NO.:

COMPRESSOR CONTROL PANEL - P-1206
RELAY DRY CONTACT WIRING DIAGRAM

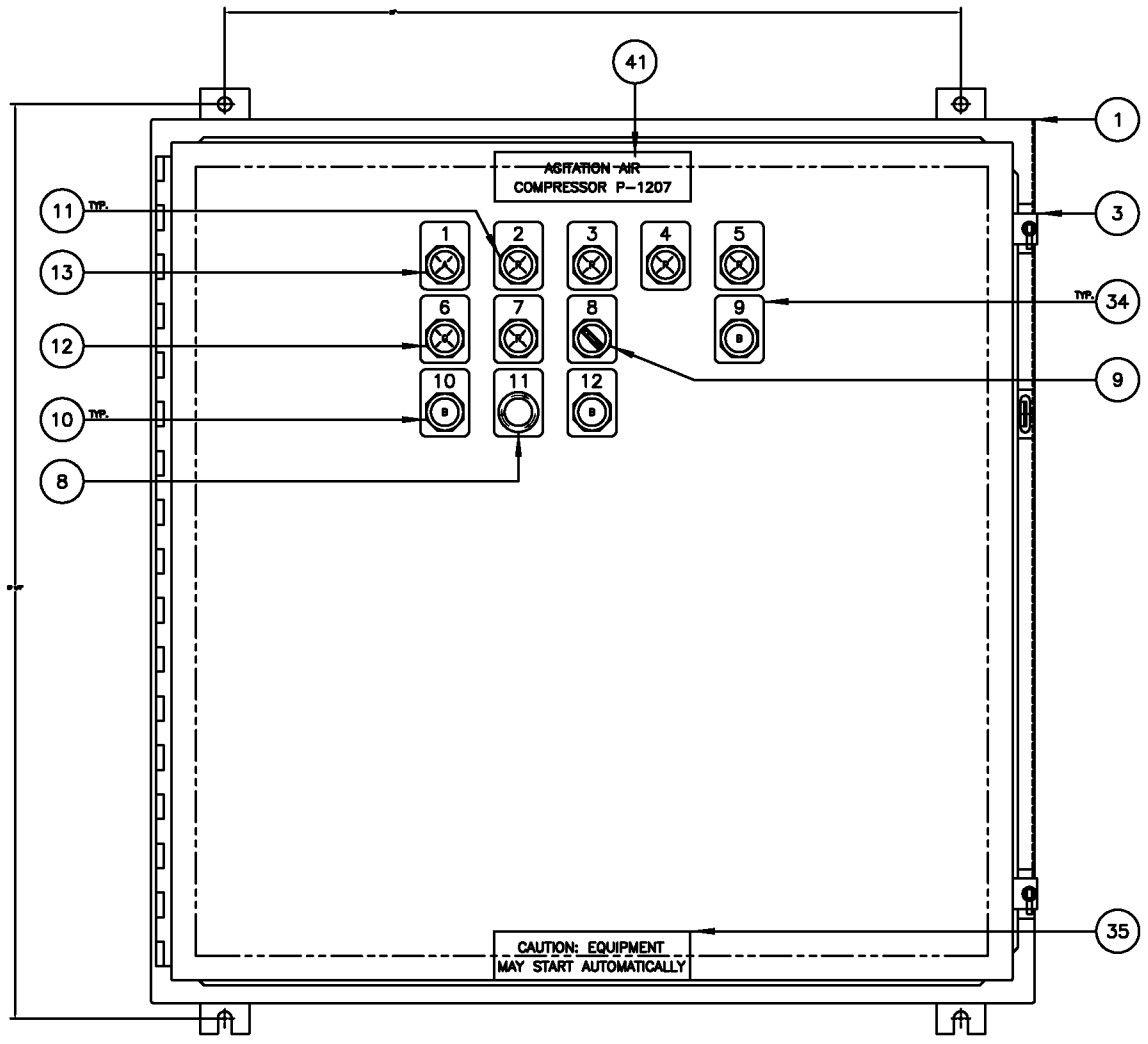
DATE 09/13/02 | SCALE NONE | DWG. NO. 85131-604

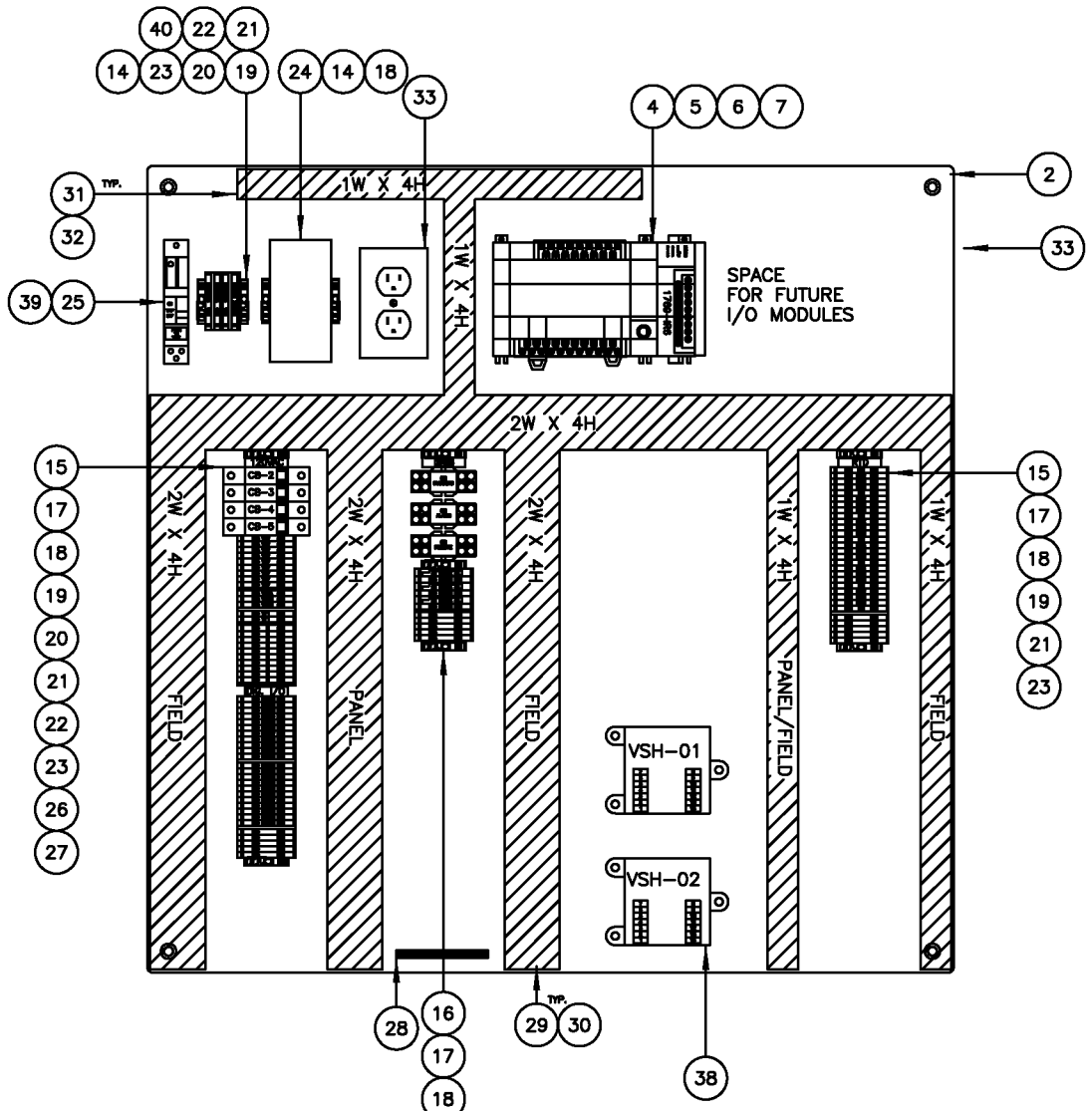
REVISIONS

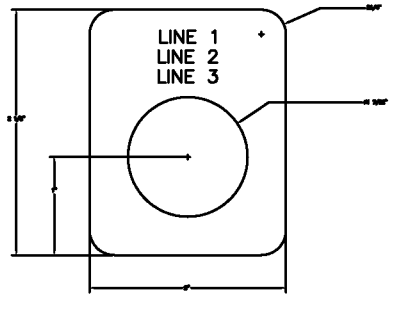
5	04/24/03	TAGS & VIB SENSOR	AAB
4	03/14/03	ISSUED FOR CONSTRUCTION	PAW
3	03/03/03	REVISED PER COMMENTS	PAW
2	9/23/02	ISSUED FOR APPROVAL	PAJ
6	05-03-2004	ADDED ETHERNET MODULE	PV
5	01-29-04	MODIFIED WIRE TAGS	JE
4	8-24-03	AS CONSTRUCTED	MC

A

GARDNER DENVER CYCLOBLOWER
11CDL31-L BLOWER PACKAGE
CONTROL PANEL
TAG NO. 1207







WHITE W/ BLACK 1/8" TEXT

TAG #	LINE 1	LINE 2	LINE 3
1	STEADY-READY/	FLASH-FAIL	.
2	HIGH DISCHARGE	AIR PRESSURE	SHUTDOWN
3	HIGH DISCHARGE	AIR TEMPERATURE	SHUTDOWN
4	HIGH VIBRATION	SHUTDOWN	.
5	HIGH BEARING	TEMPERATURE	.
6	RUNNING	.	.
7	OFF	.	.
8	OPERATION	.	LOCAL REMOTE
9	RESET	.	.
10	START	.	.
11	STOP	.	.
12	JOG	.	.

MATERIAL LIST

ITEM	PART NUMBER	DESCRIPTION	QTY.
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2	A-36P36	HOFFMAN OR EQUAL SUBPANEL, 33" X 33"	1 EA.
3	A-FC412SS	HOFFMAN OR EQUAL QUICK-RELEASE LATCH, N12, STEEL	2 EA.
4	1764-24AWA	ALLEN-BRADLEY, MIRCOLOGIX 1500, BASE UNIT, 120VAC, 12 INPUTS, 12 OUTPUTS	1 EA.
5	1764-LSP	ALLEN-BRADLEY, MICROLOGIX 1500, PROCESSOR	1 EA.
6	1769-IR6	ALLEN-BRADLEY, MICROLOGIX 1500, COMPACT I/O RTD MODULE, 6 CHANNEL	1 EA.
7	1769-ECR	ALLEN-BRADLEY, MICROLOGIX 1500, END CAP	1 EA.
8	800T-FRXT6D4	ALLEN BRADLEY PUSHBUTTON, MAINT., MUSH. HD, RED, 1-NCLB	1 EA.
9	800T-HR2D1	ALLEN BRADLEY SELECTOR SWITCH, 2-POS., MAINT., 1-NO	1 EA.
10	800T-A2D1	ALLEN BRADLEY PUSHBUTTON, MAINT., BLACK, 1-NO	3 EA.
11	800T-QTH10R	ALLEN BRADLEY PILOT LIGHT, RED, 120VAC, LED PILOT LIGHT	5 EA.
12	800T-QTH10G	ALLEN BRADLEY PILOT LIGHT, GREEN, 120VAC, LED PILOT LIGHT	1 EA.
13	800T-QTH10A	ALLEN BRADLEY PILOT LIGHT, AMBER, 120VAC, LED PILOT LIGHT	1 EA.
14	199-DR1	LOW RISE DIN RAIL	1 FT.
15	1492-DR6	ALLEN BRADLEY HI RISE DIN RAIL	4 FT.
16	RH2B-ULC	IDEC RELAY, DPDT, 120VAC, W/INDICATOR LIGHT AND PUSH TO TEST BUTTON	3 EA.
17	163193	WEIDMULLER TERMINAL GROUP MARKER, SchT 5 s	4 EA.
18	38356	WEIDMULLER TERMINAL CLAMP	11 EA.
19	102010	WEIDMULLER TERMINAL BLOCK, BEIGE, FEED-THRU, SINGLE TIER	75 EA.
20	102018	WEIDMULLER TERMINAL BLOCK, BLUE, FEED-THRU, SINGLE TIER	11 EA.
21	105000	WEIDMULLER TERMINAL BLOCK END, BEIGE, FEED-THRU, SINGLE TIER	11 EA.
22	105008	WEIDMULLER TERMINAL BLOCK END, BLUE, FEED-THRU, SINGLE TIER	1 EA.
23	102016	WEIDMULLER TERMINAL BLOCK, GREEN, FEED-THRU, SINGLE TIER	9 EA.
24	51010 -WM/-DIN	LEVITON, TRANSIENT SURGE SUPPRESSOR, 10 AMP, 120VAC	1 EA.
25	THQC1115WL	GE, GFCI 15 AMP BREAKER	1 EA.
26	MG 24430	SQUARE D, 6 AMP BREAKER	1 EA.
27	MG 24426	SQUARE D, 2 AMP BREAKER	3 EA.
28	P-K9GTA	SQUARE D GROUND BAR	1 EA.
29	F-2X4WH6	PANDUIT WIREWAY, 2"WIDE X 4"HIGH, WHITE	5 FT.
30	C-2WH6	PANDUIT COVER, 2" WIDE, WHITE	5 FT.
31	F-1X4WH6	PANDUIT WIREWAY, 1"WIDE X 4"HIGH, WHITE	3 FT.
32	C-1WH6	PANDUIT COVER, 1" WIDE, WHITE	3 FT.
33		DUPLEX RECEPTACLE FOR PC USE ONLY	1 EA.
34		NAMEPLATES, 2-3/4" X 2", WHITE W/ BLACK 1/8" TEXT	12 EA.
35		NAMEPLATE, 2" X 8", YELLOW W/ BLACK 3/8" TEXT	1 EA.
36	47456	WEIDMULLER FUSED TERMINAL BLOCK END, SINGLE TIER	3 EA.
37	38036	WEIDMULLER FUSED TERMINAL BLOCK END, SINGLE TIER	3 EA.
38	.	METRIX, VIBRATION SWITCH	2 EA.
39	TQCBMPA1	GE, GFCI BREAKER MOUNTING PLATE	1 EA.
40	107220	WEIDMULLER TERMINAL BLOCK END, GREEN, FEED-THRU, SINGLE TIER	1 EA.
35		NAMEPLATE, 2" X 8", WHITE W/ BLACK 3/8" TEXT	1 EA.

NOTES:
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED – 120VAC HOT & PLC I/O
   WHITE – 120VAC NEUTRAL
   GREEN – GROUND
   BLUE – +24VDC
   BLACK – 0VDC
   YELLOW – FOREIGN VOLTAGE
4. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
5. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
6. LABEL WIRES THE SAME ON BOTH ENDS WITH WIRE NUMBERS SHOWN ON SCHEMATIC. USE BRADY SLEEVE TYPE WIRE LABELS.
7. PANEL TO BE LOCATED IN A NON-HAZARDOUS AREA.

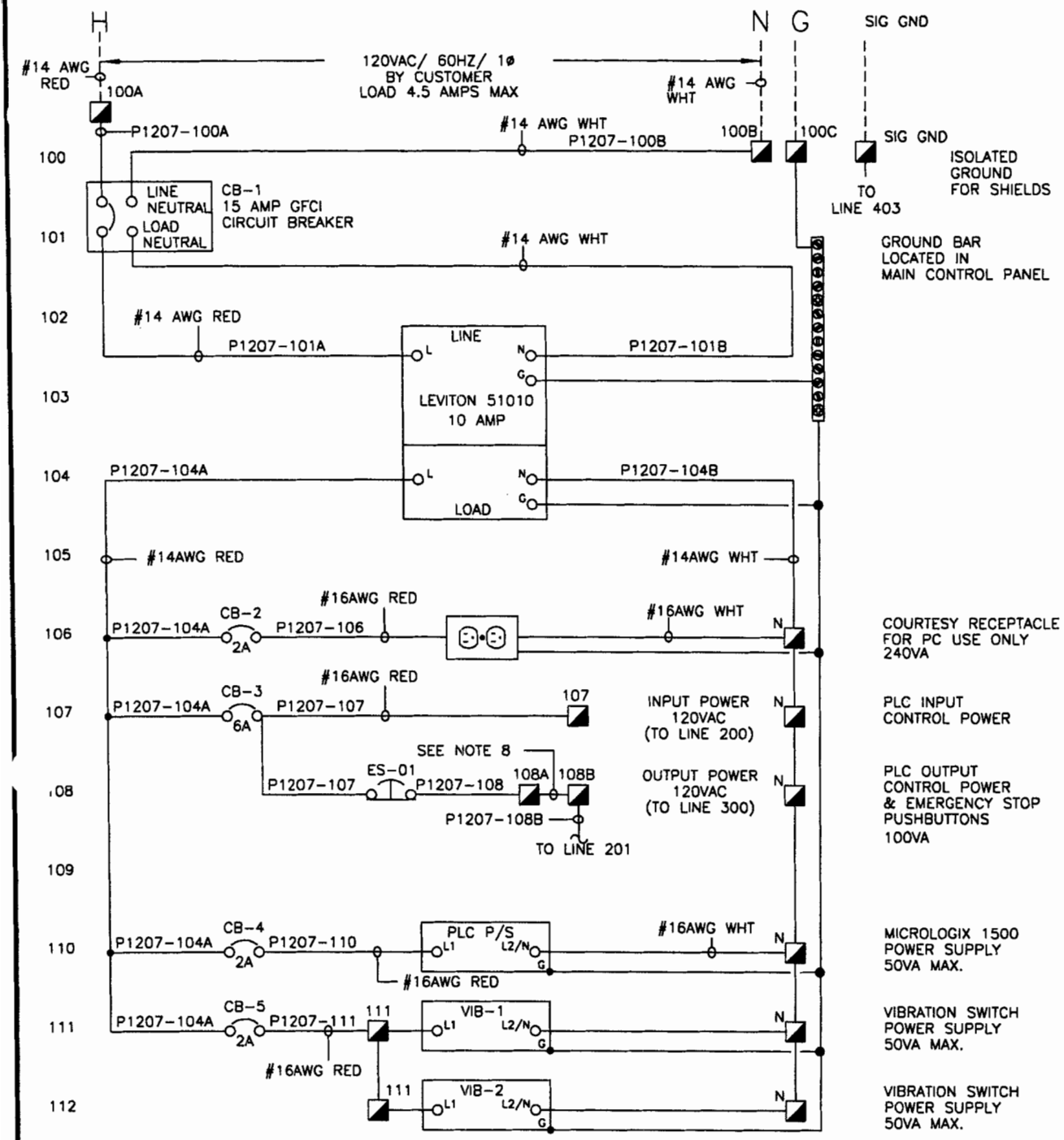
Gardner Denver
ENGINEERED PACKAGING CENTER
11911 TANNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER: | CUSTOMER ITEM NO.:

1	8-24-03	AS CONSTRUCTED	MC
0	03/14/03	ISSUED FOR CONSTRUCTION	PW
		REVISIONS	

P-1207 – POSITIVE DISPLACEMENT BLOWER CONTROL PANEL INTERIOR & EXTERIOR LAYOUT

DATE 03/14/03 | SCALE 3"=1'-0" | DWG. NO.: 85131-651



LEGEND

- WIRES NOT CONNECTED
- WIRES CONNECTED
- PANEL WIRING
- FIELD WIRING
- TERMINAL IN MAIN CONTROL PANEL

NOTES:

1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED – 120VAC HOT & PLC I/O
   WHITE – 120VAC NEUTRAL
   GREEN – GROUND
   YELLOW – FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
   GREY – HOT & PLC I/O
   BLUE – NEUTRAL
   GREEN – GROUND
   YELLOW – FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.
8. REMOVE JUMPER IF REMOTE E-STOP IS TO BE USED.

Gardner Denver

ENGINEERED PACKAGING CENTER
1800 TURNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER:
CUSTOMER ITEM NO:

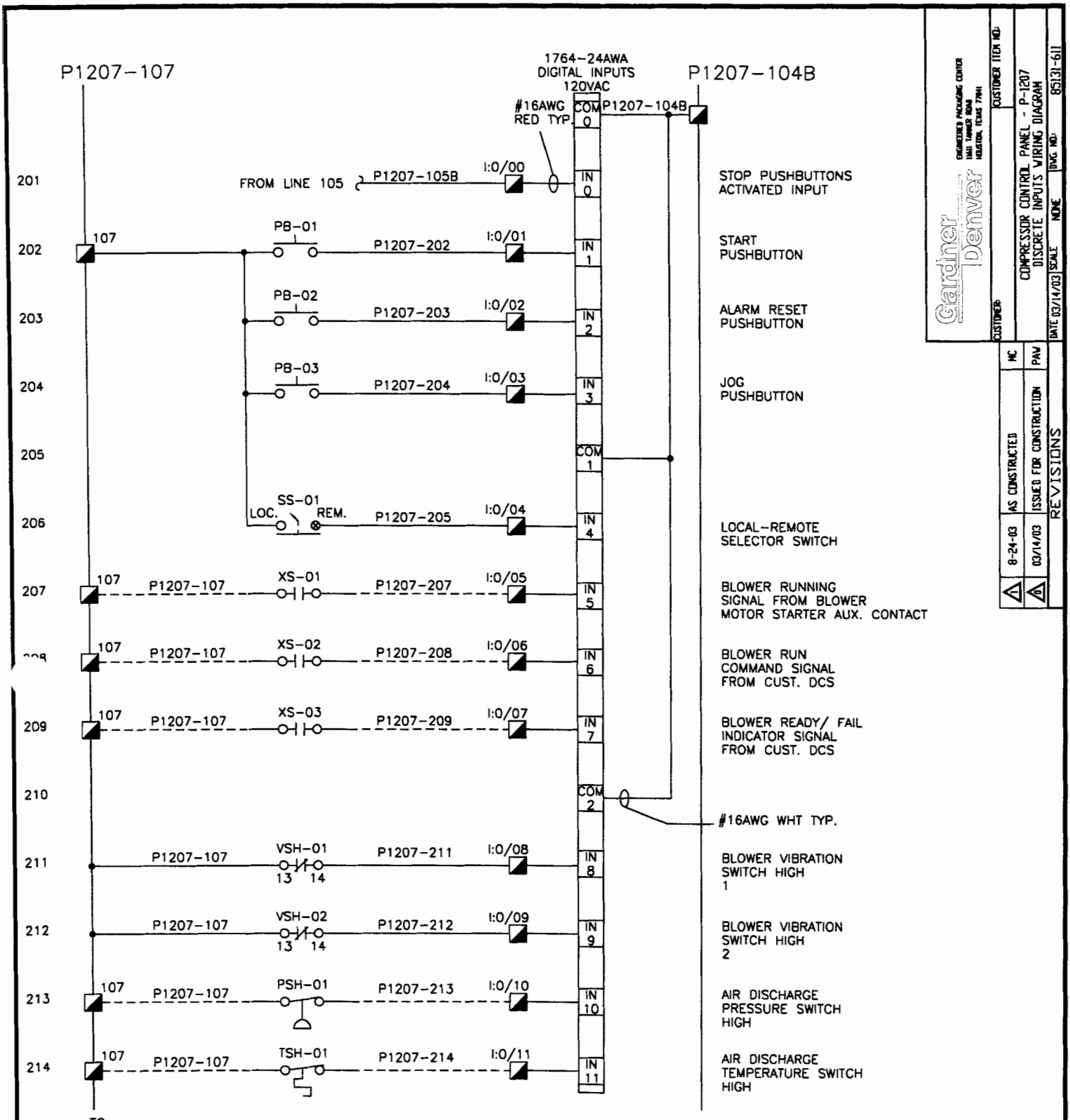
COMPRESSOR CONTROL PANEL - P-1207
CONTROL POWER WIRING DIAGRAM

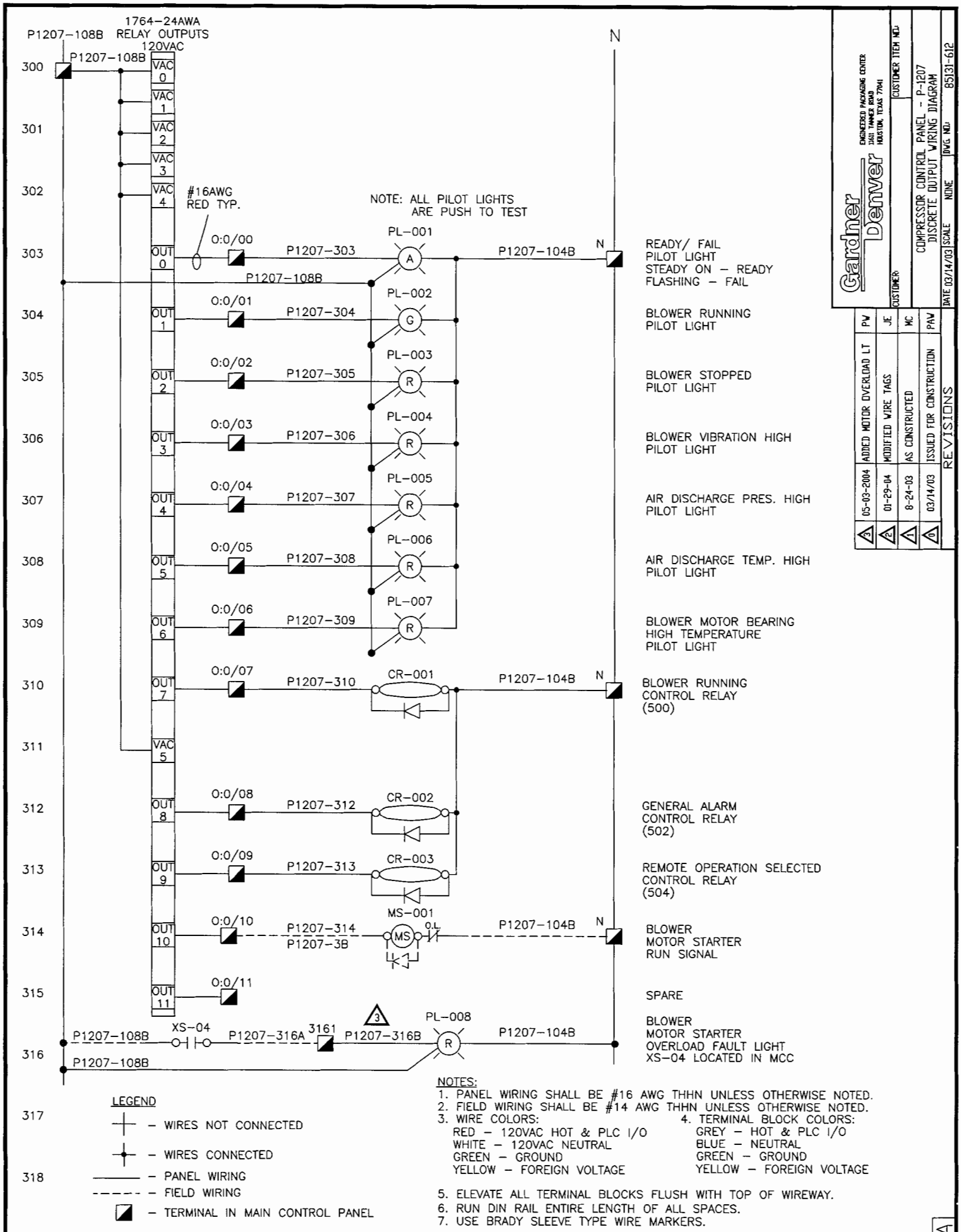
DATE 03/14/03 | SCALE NONE | DWG. NO. 8513-610

REVISIONS

A	8-24-03	AS CONSTRUCTED	MC
B	03/14/03	ISSUED FOR CONSTRUCTION	PAV

A


P1207-107
1764-24AWA
DIGITAL INPUTS
120VAC
P1207-104B
#16AWG
RED TYP.
COM
0
P1207-104B
201
FROM LINE 105
P1207-105B
I:0/00
IN
0
STOP PUSHBUTTONS
ACTIVATED INPUT
202
107
PB-01
P1207-202
I:0/01
IN
1
START
PUSHBUTTON
203
PB-02
P1207-203
I:0/02
IN
2
ALARM RESET
PUSHBUTTON
204
PB-03
P1207-204
I:0/03
IN
3
JOG
PUSHBUTTON
205
COM
1
206
SS-01
LOC.
REM.
P1207-205
I:0/04
IN
4
LOCAL-REMOTE
SELECTOR SWITCH
207
107
P1207-107
XS-01
P1207-207
I:0/05
IN
5
BLOWER RUNNING
SIGNAL FROM BLOWER
MOTOR STARTER AUX. CONTACT
208
107
P1207-107
XS-02
P1207-208
I:0/06
IN
6
BLOWER RUN
COMMAND SIGNAL
FROM CUST. DCS
209
107
P1207-107
XS-03
P1207-209
I:0/07
IN
7
BLOWER READY/ FAIL
INDICATOR SIGNAL
FROM CUST. DCS
210
COM
2
#16AWG WHT TYP.
211
P1207-107
VSH-01
13
14
P1207-211
I:0/08
IN
8
BLOWER VIBRATION
SWITCH HIGH
1
212
P1207-107
VSH-02
13
14
P1207-212
I:0/09
IN
9
BLOWER VIBRATION
SWITCH HIGH
2
213
107
P1207-107
PSH-01
P1207-213
I:0/10
IN
10
AIR DISCHARGE
PRESSURE SWITCH
HIGH
214
107
P1207-107
TSH-01
P1207-214
I:0/11
IN
11
AIR DISCHARGE
TEMPERATURE SWITCH
HIGH
215
TO
LINE 600
LEGEND
- WIRES NOT CONNECTED
- WIRES CONNECTED
216
- PANEL WIRING
- FIELD WIRING
- TERMINAL IN MAIN CONTROL PANEL
217
NOTES:
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
RED - 120VAC HOT & PLC I/O
WHITE - 120VAC NEUTRAL
GREEN - GROUND
YELLOW - FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
GREY - HOT & PLC I/O
BLUE - NEUTRAL
GREEN - GROUND
YELLOW - FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.
Gardner Denver
ENGINEERED PACKAGING CENTER
1681 TAMBOR ROAD
HOUSTON, TEXAS 77041
CUSTOMER:
CUSTOMER ITEM NO:
COMPRESSOR CONTROL PANEL - P-1207
DISCRETE INPUTS WIRING DIAGRAM
DATE 03/14/03
SCALE NONE
DWG. NO: 85131-611
REVISIONS
8-24-03 AS CONSTRUCTED MC
03/14/03 ISSUED FOR CONSTRUCTION PAW
A


1764-24AWA
RELAY OUTPUTS
120VAC
P1207-108B
N
#16AWG
RED TYP.
NOTE: ALL PILOT LIGHTS
ARE PUSH TO TEST
VAC 0
VAC 1
VAC 2
VAC 3
VAC 4
VAC 5
OUT 0
OUT 1
OUT 2
OUT 3
OUT 4
OUT 5
OUT 6
OUT 7
OUT 8
OUT 9
OUT 10
OUT 11
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
O:0/00
O:0/01
O:0/02
O:0/03
O:0/04
O:0/05
O:0/06
O:0/07
O:0/08
O:0/09
O:0/10
O:0/11
P1207-303
P1207-304
P1207-305
P1207-306
P1207-307
P1207-308
P1207-309
P1207-310
P1207-312
P1207-313
P1207-314
P1207-3B
P1207-104B
P1207-316A
P1207-316B
PL-001
PL-002
PL-003
PL-004
PL-005
PL-006
PL-007
CR-001
CR-002
CR-003
MS-001
PL-008
XS-04
3161
O.L.
READY/ FAIL
PILOT LIGHT
STEADY ON - READY
FLASHING - FAIL
BLOWER RUNNING
PILOT LIGHT
BLOWER STOPPED
PILOT LIGHT
BLOWER VIBRATION HIGH
PILOT LIGHT
AIR DISCHARGE PRES. HIGH
PILOT LIGHT
AIR DISCHARGE TEMP. HIGH
PILOT LIGHT
BLOWER MOTOR BEARING
HIGH TEMPERATURE
PILOT LIGHT
BLOWER RUNNING
CONTROL RELAY
(500)
GENERAL ALARM
CONTROL RELAY
(502)
REMOTE OPERATION SELECTED
CONTROL RELAY
(504)
BLOWER
MOTOR STARTER
RUN SIGNAL
SPARE
BLOWER
MOTOR STARTER
OVERLOAD FAULT LIGHT
XS-04 LOCATED IN MCC
LEGEND
- WIRES NOT CONNECTED
- WIRES CONNECTED
- PANEL WIRING
- FIELD WIRING
- TERMINAL IN MAIN CONTROL PANEL
NOTES:
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
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3. WIRE COLORS:
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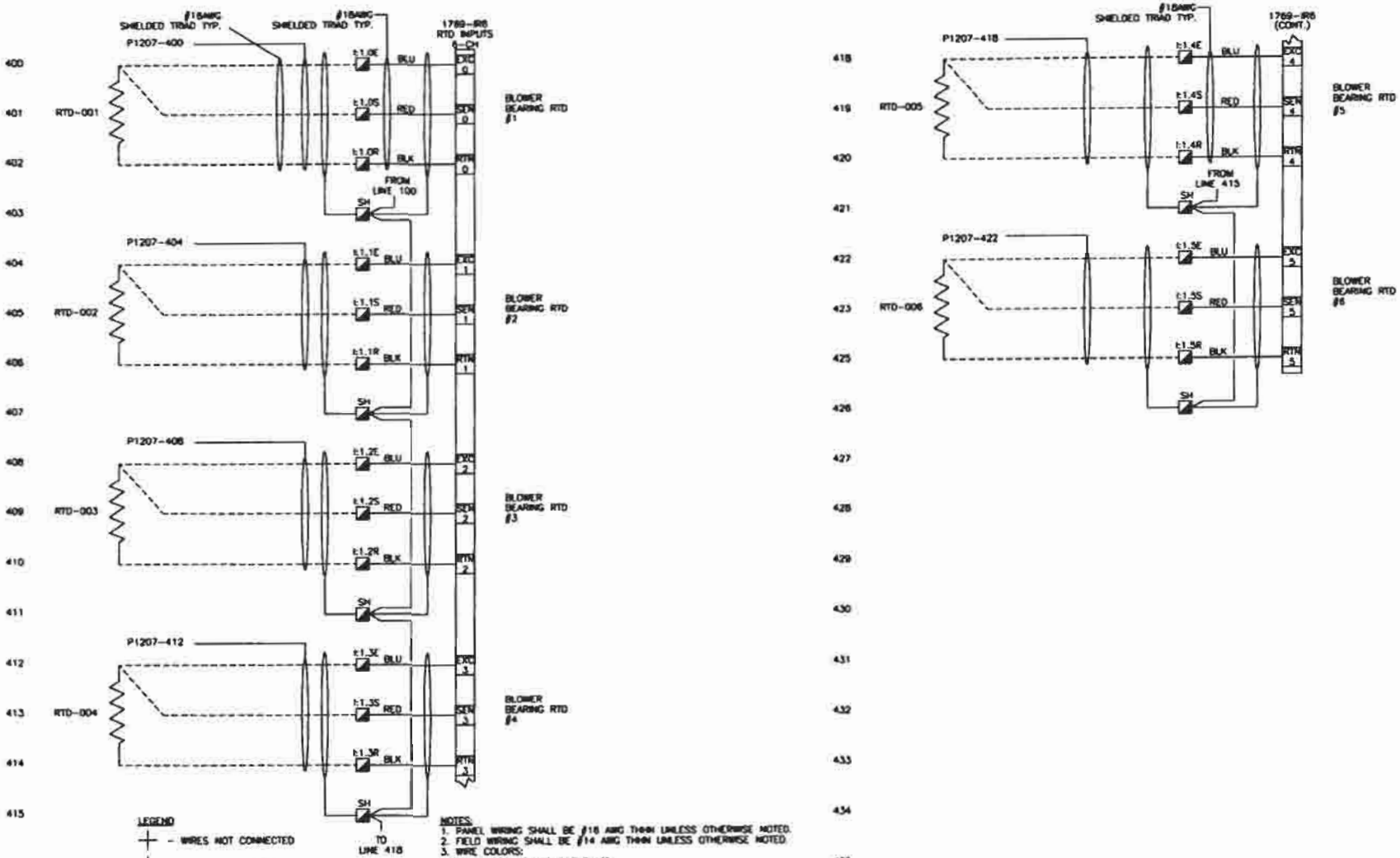
GREEN - GROUND
YELLOW - FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
GREY - HOT & PLC I/O
BLUE - NEUTRAL
GREEN - GROUND
YELLOW - FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.
Gardner Denver
ENGINEERED PACKAGING CENTER
1565 TANNER ROAD
HOUSTON, TEXAS 77041
CUSTOMER
CUSTOMER ITEM NO.:
COMPRESSOR CONTROL PANEL - P-1207
DISCRETE OUTPUT WIRING DIAGRAM
DATE 03/14/03
SCALE NONE
DWG NO. 85131-612
REVISIONS
05-03-2004 ADDED MOTOR OVERLOAD LT PW
01-29-04 MODIFIED WIRE TAGS JE
8-24-03 AS CONSTRUCTED MC
03/14/03 ISSUED FOR CONSTRUCTION PAW
A



NOTES:
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2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
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   WHITE - 120VAC NEUTRAL
   GREEN - GROUND
   YELLOW - FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
   GREY - HOT & PLC I/O
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   GREEN - GROUND
   YELLOW - FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.

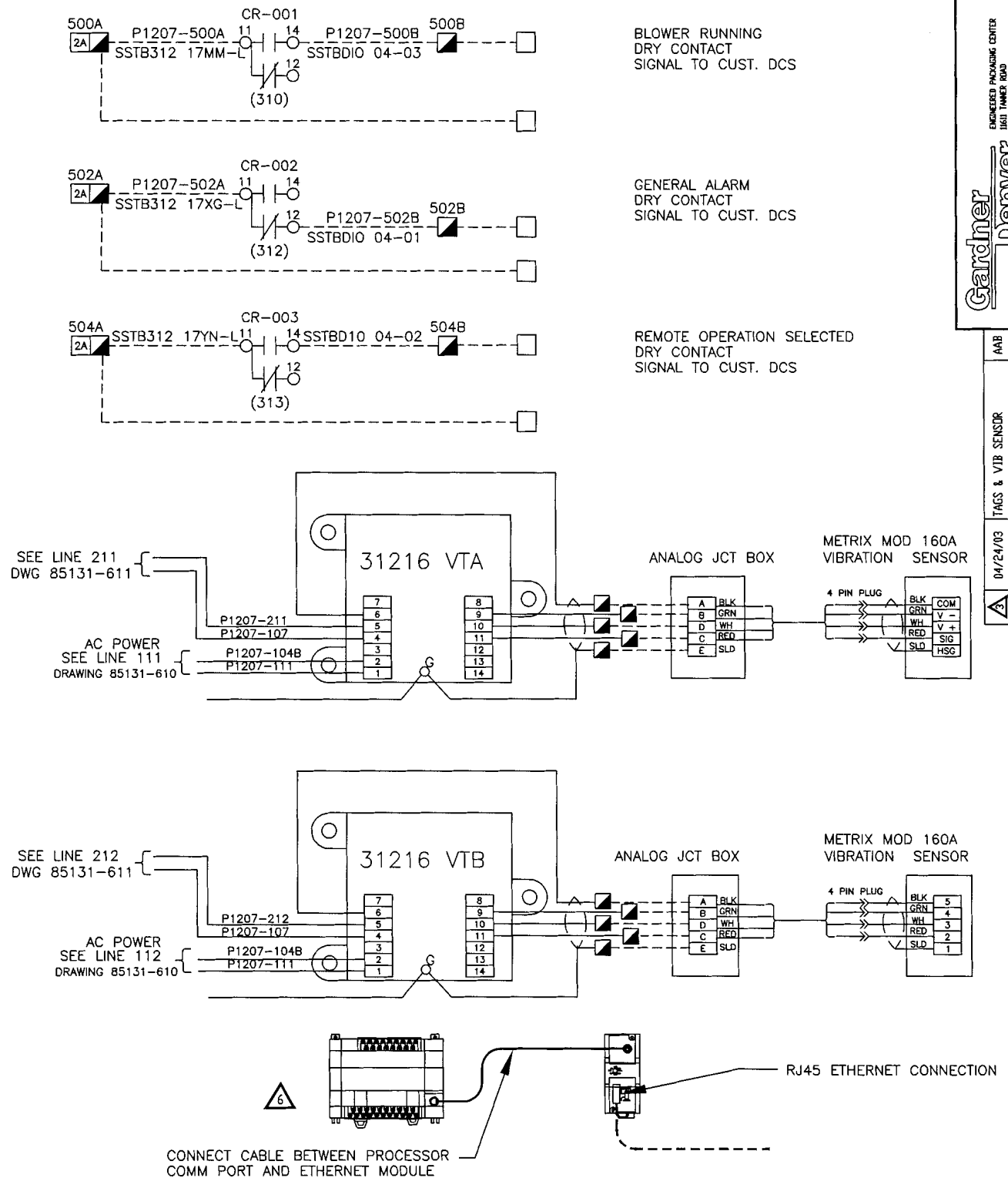
Gardner Denver

1	8-24-23	AS CONSTRUCTED	MC
0	03/14/23	ISSUED FOR CONSTRUCTION	Peter

REVISIONS

COMPRESSOR CONTROL PANEL - P-1207
RTD INPUTS WIRING DIAGRAM

DATE 03/14/23 SCALE NONE DWG NO. 05C31-613



LEGEND

- ┼ – WIRES NOT CONNECTED
- ┼ – WIRES CONNECTED
- ——— – PANEL WIRING
- - - - - – FIELD WIRING
- ◪ – TERMINAL IN MAIN CONTROL PANEL

NOTES:

1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED – 120VAC HOT & PLC I/O
   WHITE – 120VAC NEUTRAL
   GREEN – GROUND
   YELLOW – FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
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   BLUE – NEUTRAL
   GREEN – GROUND
   YELLOW – FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.

Gardner Denver
ENGINEERED PACKAGING CENTER
11611 TANNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER:
CUSTOMER ITEM NO.:

COMPRESSOR CONTROL PANEL - P-1207
RELAY DRY CONTACT WIRING DIAGRAM

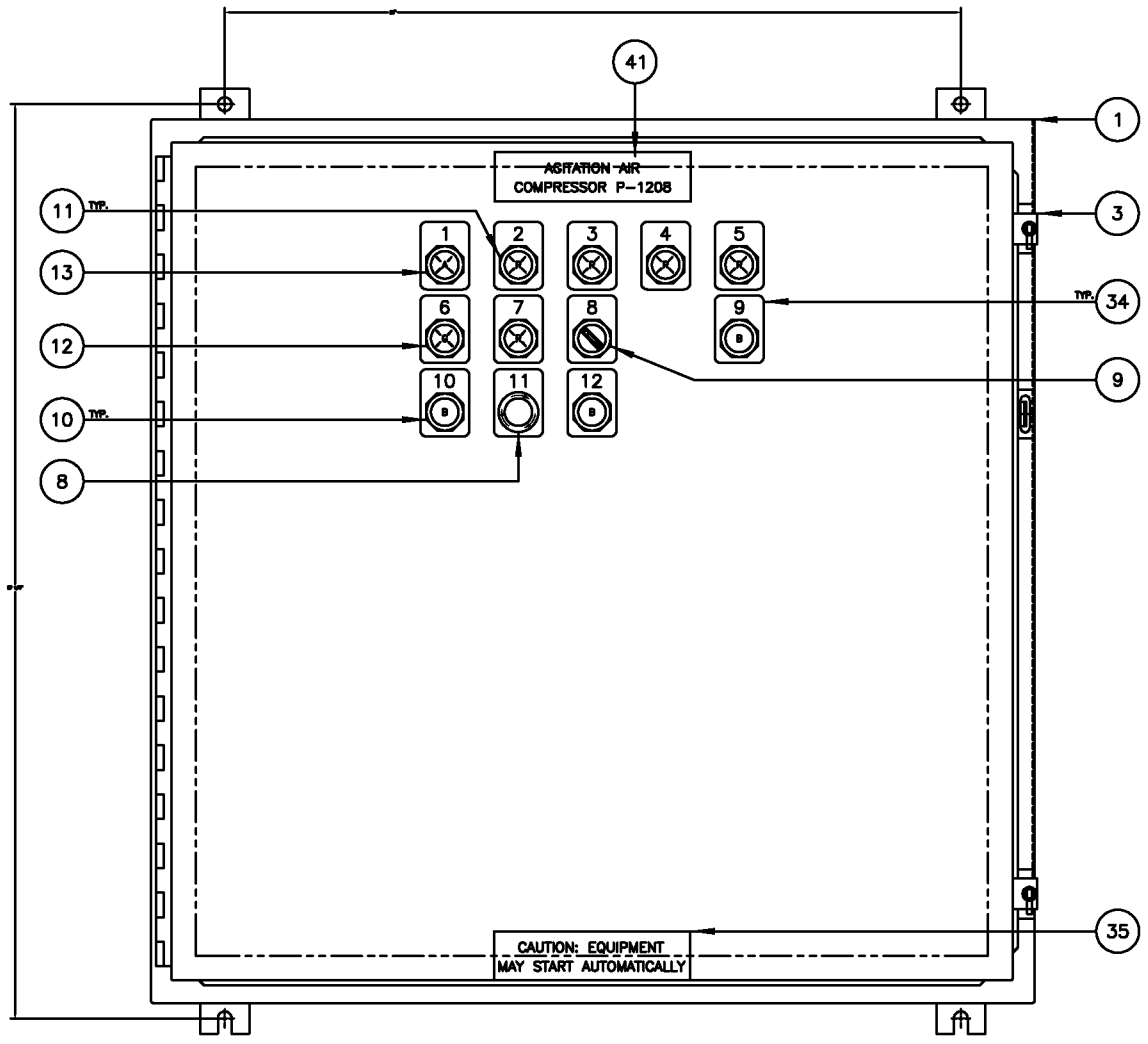
DATE 09/13/02 | SCALE NONE | DWG. NO. 85131-614

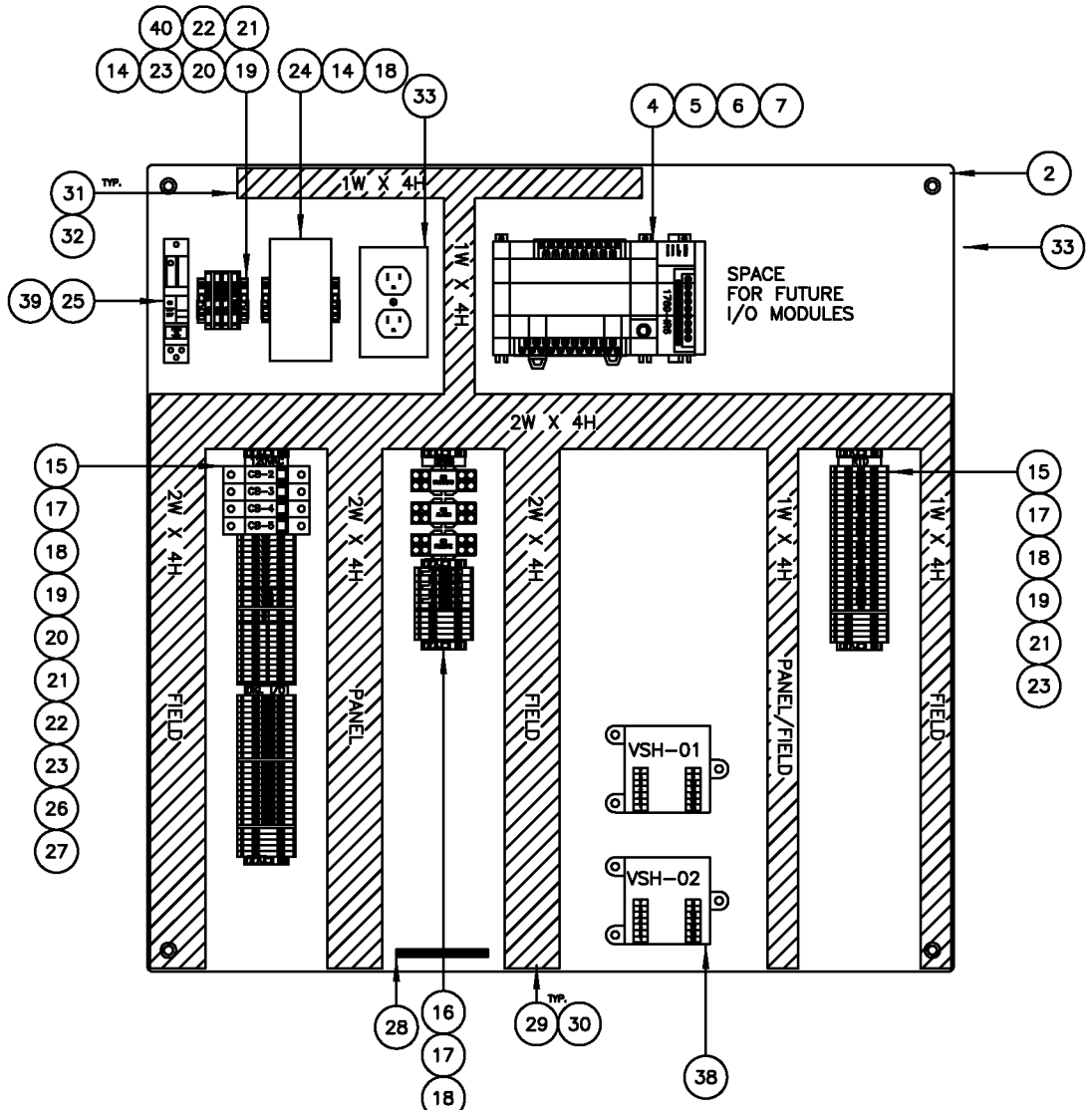
REVISIONS

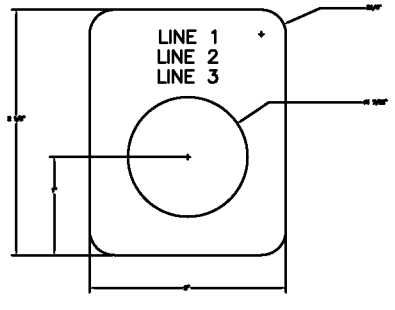
4	04/24/03	TAGS & VIB SENSOR	AAB
3	03/14/03	ISSUED FOR CONSTRUCTION	PAW
2	03/03/03	REVISED PER COMMENTS	PAW
1	9/23/02	ISSUED FOR APPROVAL	PAJ
6	05-03-2004	ADDED ETHERNET MODULE	PW / JE / MC
5	01-29-04	MODIFIED WIRE TAGS	
4	8-24-03	AS CONSTRUCTED	

A

GARDNER DENVER CYCLOBLOWER
11CDL31-L BLOWER PACKAGE
CONTROL PANEL
TAG NO. 1208







WHITE W/ BLACK 1/8" TEXT

TAG #	LINE 1	LINE 2	LINE 3
1	STEADY-READY/	FLASH-FAIL	.
2	HIGH DISCHARGE	AIR PRESSURE	SHUTDOWN
3	HIGH DISCHARGE	AIR TEMPERATURE	SHUTDOWN
4	HIGH VIBRATION	SHUTDOWN	.
5	HIGH BEARING	TEMPERATURE	.
6	RUNNING	.	.
7	OFF	.	.
8	OPERATION	.	LOCAL REMOTE
9	RESET	.	.
10	START	.	.
11	STOP	.	.
12	JOG	.	.

MATERIAL LIST

ITEM	PART NUMBER	DESCRIPTION	QTY.
1	A-363612LP	HOFFMAN OR EQUAL ENCLOSURE, 36"H X 36"W X 12"D, N12, CARBON STEEL	1 EA.
2	A-36P36	HOFFMAN OR EQUAL SUBPANEL, 33" X 33"	1 EA.
3	A-FC412SS	HOFFMAN OR EQUAL QUICK-RELEASE LATCH, N12, STEEL	2 EA.
4	1764-24AWA	ALLEN-BRADLEY, MIRCOLOGIX 1500, BASE UNIT, 120VAC, 12 INPUTS, 12 OUTPUTS	1 EA.
5	1764-LSP	ALLEN-BRADLEY, MICROLOGIX 1500, PROCESSOR	1 EA.
6	1769-IR6	ALLEN-BRADLEY, MICROLOGIX 1500, COMPACT I/O RTD MODULE, 6 CHANNEL	1 EA.
7	1769-ECR	ALLEN-BRADLEY, MICROLOGIX 1500, END CAP	1 EA.
8	800T-FRXT6D4	ALLEN BRADLEY PUSHBUTTON, MAINT., MUSH. HD, RED, 1-NCLB	1 EA.
9	800T-HR2D1	ALLEN BRADLEY SELECTOR SWITCH, 2-POS., MAINT., 1-NO	1 EA.
10	800T-A2D1	ALLEN BRADLEY PUSHBUTTON, MAINT., BLACK, 1-NO	3 EA.
11	800T-QTH10R	ALLEN BRADLEY PILOT LIGHT, RED, 120VAC, LED PILOT LIGHT	5 EA.
12	800T-QTH10G	ALLEN BRADLEY PILOT LIGHT, GREEN, 120VAC, LED PILOT LIGHT	1 EA.
13	800T-QTH10A	ALLEN BRADLEY PILOT LIGHT, AMBER, 120VAC, LED PILOT LIGHT	1 EA.
14	199-DR1	LOW RISE DIN RAIL	1 FT.
15	1492-DR6	ALLEN BRADLEY HI RISE DIN RAIL	4 FT.
16	RH2B-ULC	IDEC RELAY, DPDT, 120VAC, W/INDICATOR LIGHT AND PUSH TO TEST BUTTON	3 EA.
17	163193	WEIDMULLER TERMINAL GROUP MARKER, SchT 5 s	4 EA.
18	38356	WEIDMULLER TERMINAL CLAMP	11 EA.
19	102010	WEIDMULLER TERMINAL BLOCK, BEIGE, FEED-THRU, SINGLE TIER	75 EA.
20	102018	WEIDMULLER TERMINAL BLOCK, BLUE, FEED-THRU, SINGLE TIER	11 EA.
21	105000	WEIDMULLER TERMINAL BLOCK END, BEIGE, FEED-THRU, SINGLE TIER	11 EA.
22	105008	WEIDMULLER TERMINAL BLOCK END, BLUE, FEED-THRU, SINGLE TIER	1 EA.
23	102016	WEIDMULLER TERMINAL BLOCK, GREEN, FEED-THRU, SINGLE TIER	9 EA.
24	51010 -WM/-DIN	LEVITON, TRANSIENT SURGE SUPPRESSOR, 10 AMP, 120VAC	1 EA.
25	THQC1115WL	GE, GFCI 15 AMP BREAKER	1 EA.
26	MG 24430	SQUARE D, 6 AMP BREAKER	1 EA.
27	MG 24426	SQUARE D, 2 AMP BREAKER	3 EA.
28	P-K9GTA	SQUARE D GROUND BAR	1 EA.
29	F-2X4WH6	PANDUIT WIREWAY, 2"WIDE X 4"HIGH, WHITE	5 FT.
30	C-2WH6	PANDUIT COVER, 2" WIDE, WHITE	5 FT.
31	F-1X4WH6	PANDUIT WIREWAY, 1"WIDE X 4"HIGH, WHITE	3 FT.
32	C-1WH6	PANDUIT COVER, 1" WIDE, WHITE	3 FT.
33		DUPLEX RECEPTACLE FOR PC USE ONLY	1 EA.
34		NAMEPLATES, 2-3/4" X 2", WHITE W/ BLACK 1/8" TEXT	12 EA.
35		NAMEPLATE, 2" X 8", YELLOW W/ BLACK 3/8" TEXT	1 EA.
36	47456	WEIDMULLER FUSED TERMINAL BLOCK END, SINGLE TIER	3 EA.
37	38036	WEIDMULLER FUSED TERMINAL BLOCK END, SINGLE TIER	3 EA.
38	.	METRIX, VIBRATION SWITCH	2 EA.
39	TQCBMPA1	GE, GFCI BREAKER MOUNTING PLATE	1 EA.
40	107220	WEIDMULLER TERMINAL BLOCK END, GREEN, FEED-THRU, SINGLE TIER	1 EA.
35		NAMEPLATE, 2" X 8", WHITE W/ BLACK 3/8" TEXT	1 EA.

NOTES:
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED – 120VAC HOT & PLC I/O
   WHITE – 120VAC NEUTRAL
   GREEN – GROUND
   BLUE – +24VDC
   BLACK – 0VDC
   YELLOW – FOREIGN VOLTAGE
4. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
5. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
6. LABEL WIRES THE SAME ON BOTH ENDS WITH WIRE NUMBERS SHOWN ON SCHEMATIC. USE BRADY SLEEVE TYPE WIRE LABELS.
7. PANEL TO BE LOCATED IN A NON-HAZARDOUS AREA.

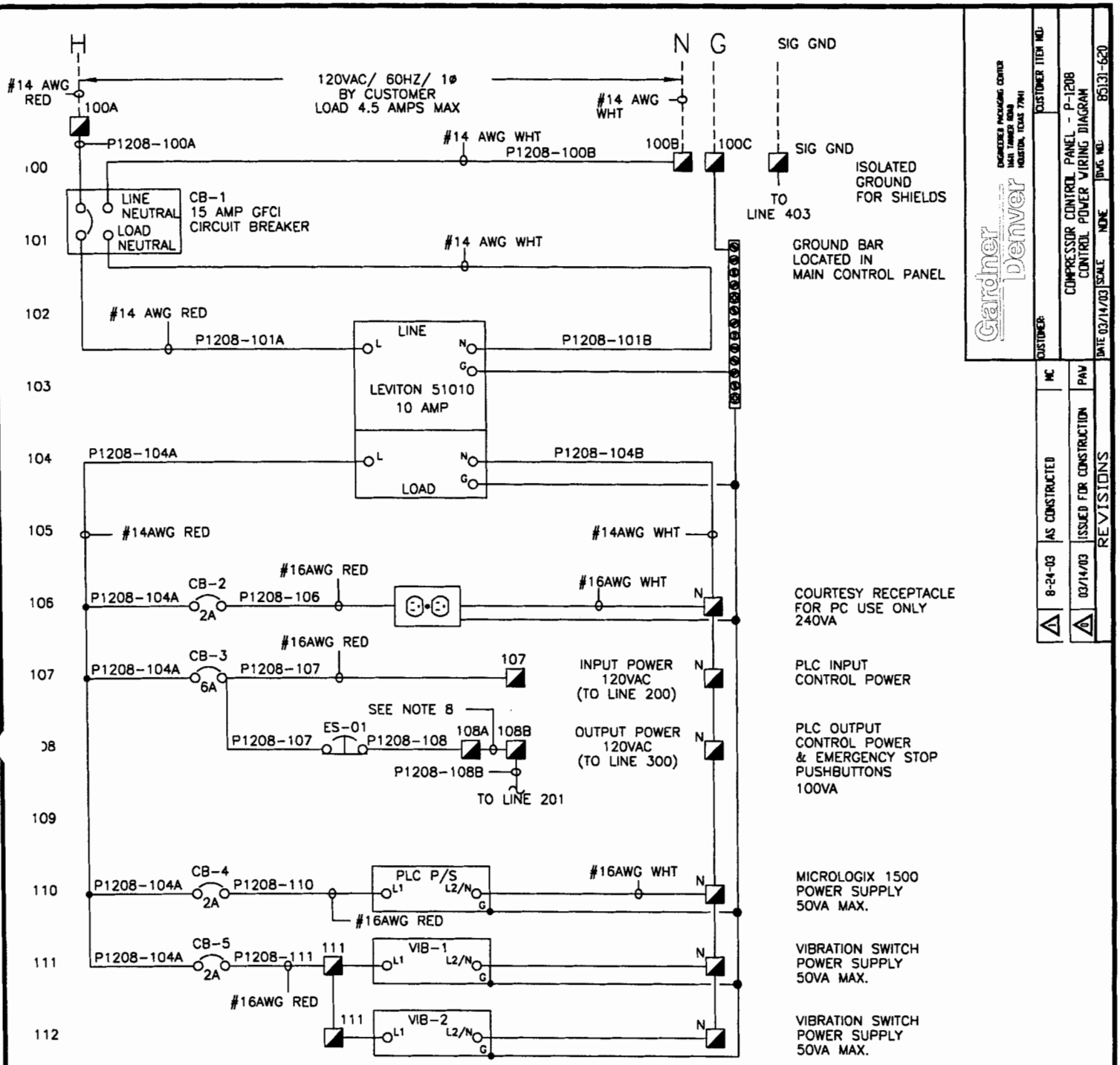
Gardner Denver
ENGINEERED PACKAGING CENTER
11911 TANNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER: | CUSTOMER ITEM NO.:

1	8-24-03	AS CONSTRUCTED	MC
0	03/14/03	ISSUED FOR CONSTRUCTION	PW
		REVISIONS	

P-1208 – POSITIVE DISPLACEMENT BLOWER CONTROL PANEL INTERIOR & EXTERIOR LAYOUT

DATE 03/14/03 | SCALE 3"=1'-0" | DWG. NO.: 85131-652



LEGEND

- WIRES NOT CONNECTED
- WIRES CONNECTED
- PANEL WIRING
- FIELD WIRING
- TERMINAL IN MAIN CONTROL PANEL

NOTES:

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   GREEN - GROUND
   YELLOW - FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.
8. REMOVE JUMPER IF REMOTE E-STOP IS TO BE USED.

Gardner Denver
ENGINEERED PACKAGING CENTER
1666 TANNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER:
CUSTOMER ITEM NO.:
COMPRESSOR CONTROL PANEL - P-1208
CONTROL POWER WIRING DIAGRAM
DATE 02/14/03
SCALE NONE
DWG NO. 85131-620

REVISIONS

8-24-03	AS CONSTRUCTED	MC	
03/14/03	ISSUED FOR CONSTRUCTION	PAV	

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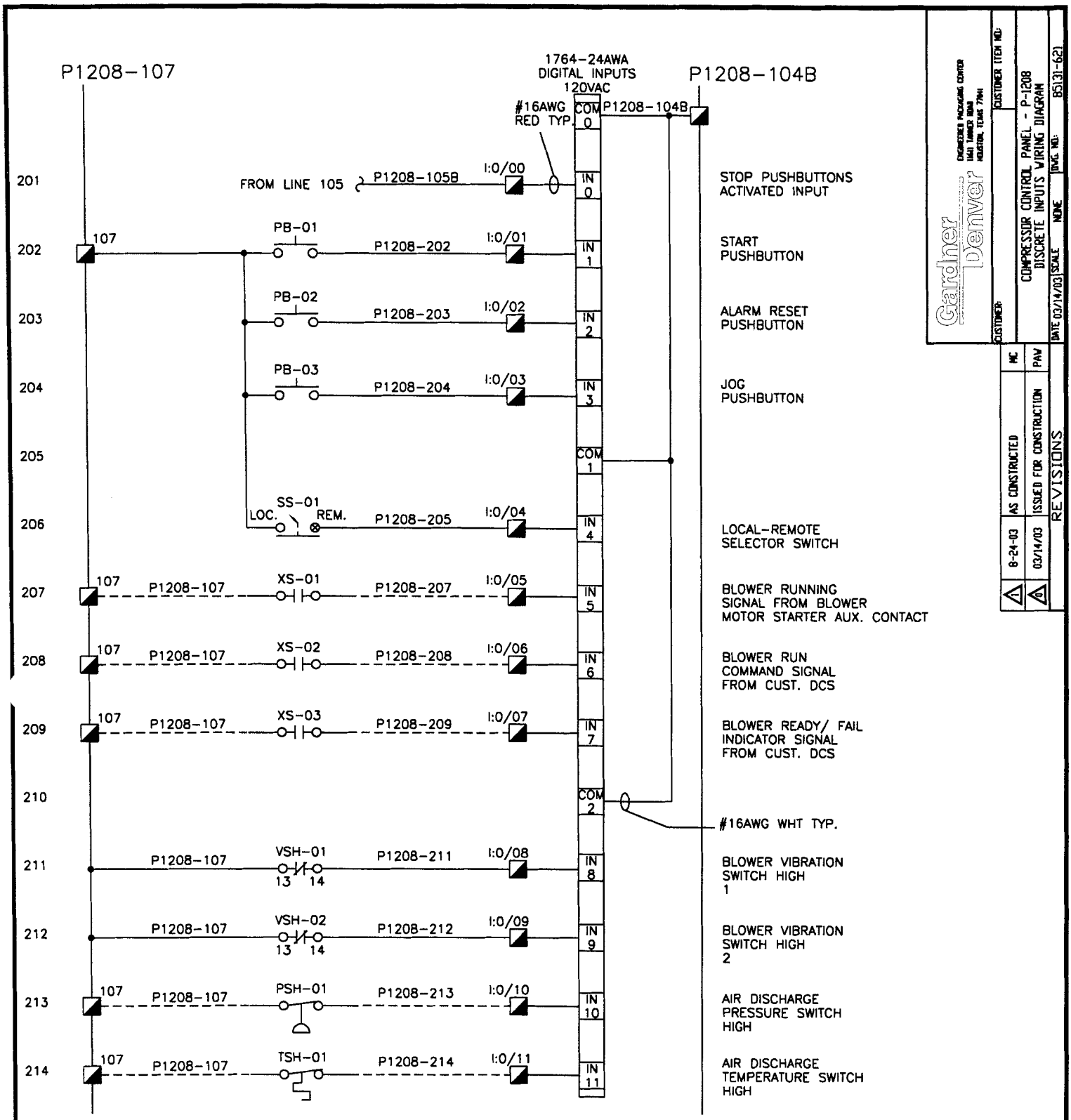

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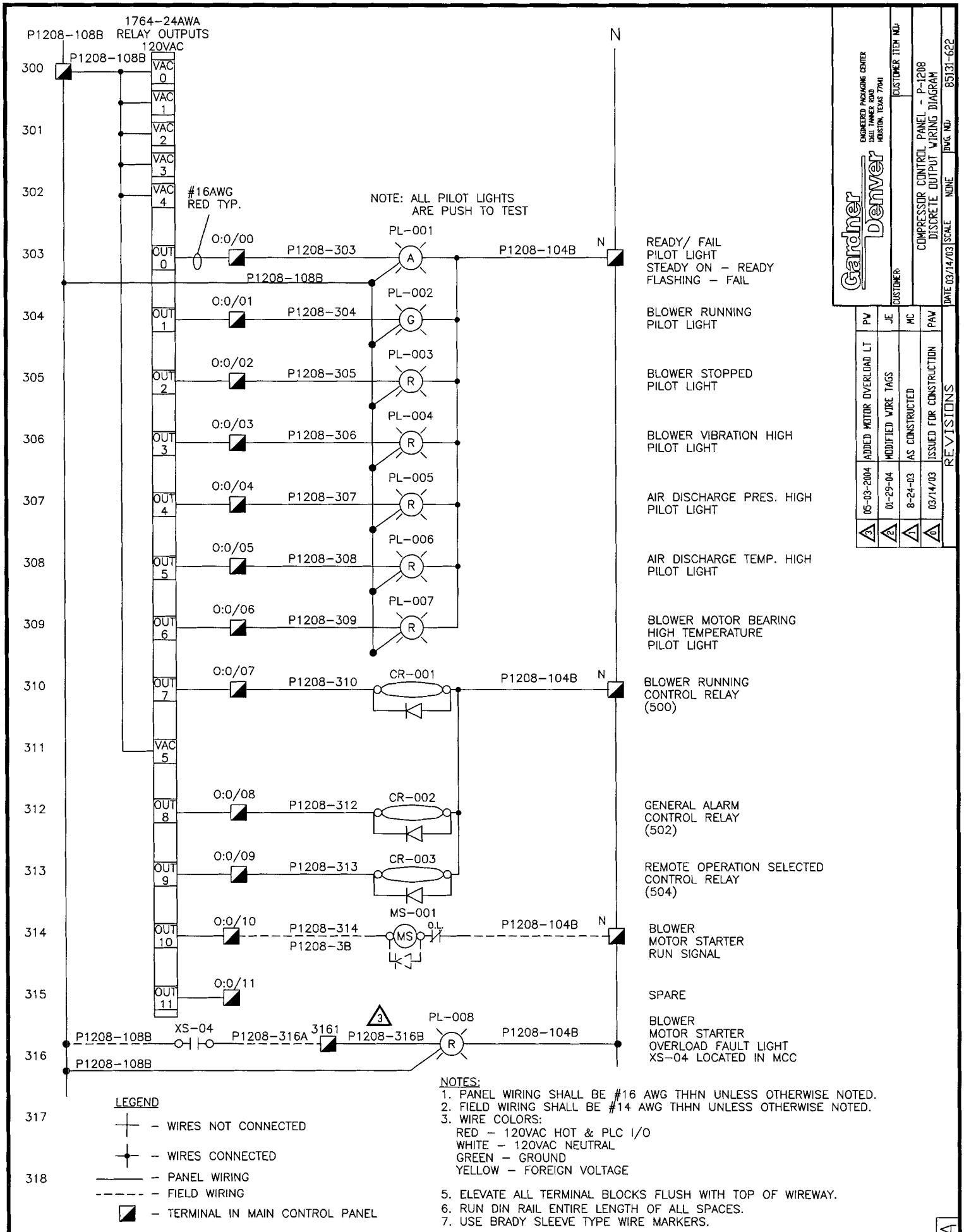
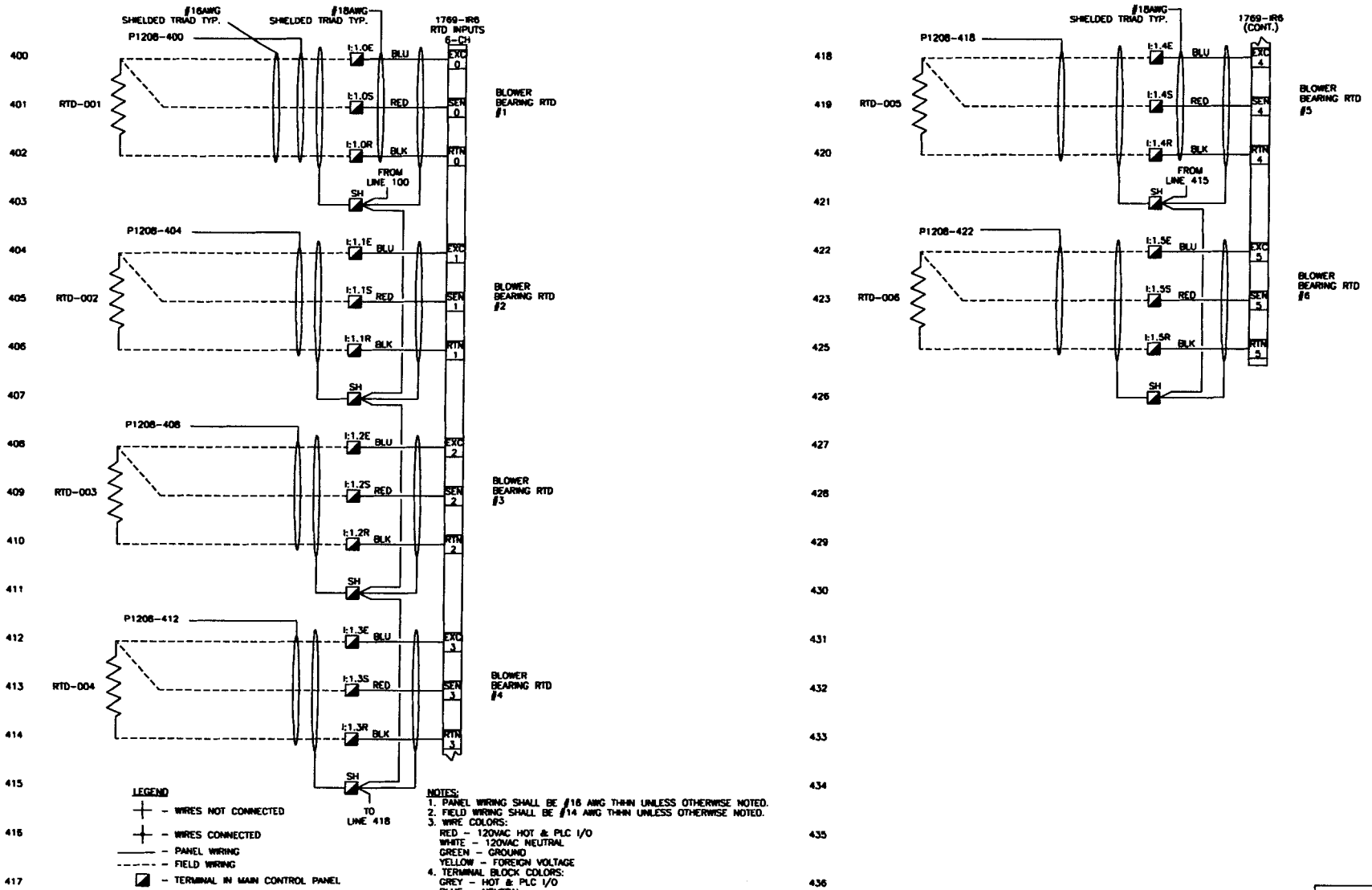

1764-24AWA
RELAY OUTPUTS
120VAC
P1208-108B
P1208-108B
N
#16AWG
RED TYP.
NOTE: ALL PILOT LIGHTS
ARE PUSH TO TEST
VAC 0
VAC 1
VAC 2
VAC 3
VAC 4
VAC 5
OUT 0
OUT 1
OUT 2
OUT 3
OUT 4
OUT 5
OUT 6
OUT 7
OUT 8
OUT 9
OUT 10
OUT 11
0:0/00
0:0/01
0:0/02
0:0/03
0:0/04
0:0/05
0:0/06
0:0/07
0:0/08
0:0/09
0:0/10
0:0/11
P1208-303
P1208-304
P1208-305
P1208-306
P1208-307
P1208-308
P1208-309
P1208-310
P1208-312
P1208-313
P1208-314
P1208-3B
P1208-104B
PL-001
PL-002
PL-003
PL-004
PL-005
PL-006
PL-007
CR-001
CR-002
CR-003
MS-001
O.L.
READY/ FAIL
PILOT LIGHT
STEADY ON - READY
FLASHING - FAIL
BLOWER RUNNING
PILOT LIGHT
BLOWER STOPPED
PILOT LIGHT
BLOWER VIBRATION HIGH
PILOT LIGHT
AIR DISCHARGE PRES. HIGH
PILOT LIGHT
AIR DISCHARGE TEMP. HIGH
PILOT LIGHT
BLOWER MOTOR BEARING
HIGH TEMPERATURE
PILOT LIGHT
BLOWER RUNNING
CONTROL RELAY
(500)
GENERAL ALARM
CONTROL RELAY
(502)
REMOTE OPERATION SELECTED
CONTROL RELAY
(504)
BLOWER
MOTOR STARTER
RUN SIGNAL
SPARE
BLOWER
MOTOR STARTER
OVERLOAD FAULT LIGHT
XS-04 LOCATED IN MCC
XS-04
P1208-316A
3161
P1208-316B
PL-008
LEGEND
- WIRES NOT CONNECTED
- WIRES CONNECTED
- PANEL WIRING
- FIELD WIRING
- TERMINAL IN MAIN CONTROL PANEL
NOTES:
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
RED - 120VAC HOT & PLC I/O
WHITE - 120VAC NEUTRAL
GREEN - GROUND
YELLOW - FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.
Gardner Denver
ENGINEERED PACKAGING CENTER
13681 TANNER ROAD
HOUSTON, TEXAS 77041
CUSTOMER:
CUSTOMER ITEM NO:
COMPRESSOR CONTROL PANEL - P-1208
DISCRETE OUTPUT WIRING DIAGRAM
DATE 03/14/03
SCALE NONE
DWG. NO. 85131-622
REVISIONS
A 05-03-2004 ADDED MOTOR OVERLOAD LT PW
B 01-29-04 MODIFIED WIRE TAGS JE
C 8-24-03 AS CONSTRUCTED MC
D 03/14/03 ISSUED FOR CONSTRUCTION PAW



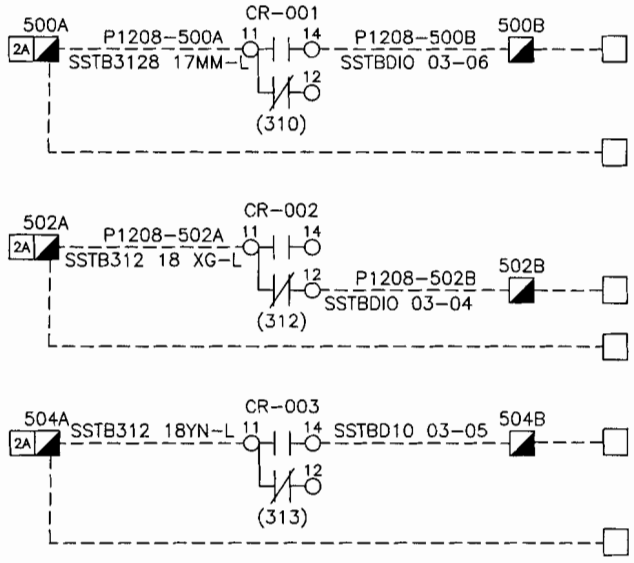
1	8-24-03	AS CONSTRUCTED	MC
0	03/14/03	ISSUED FOR CONSTRUCTION	PMV

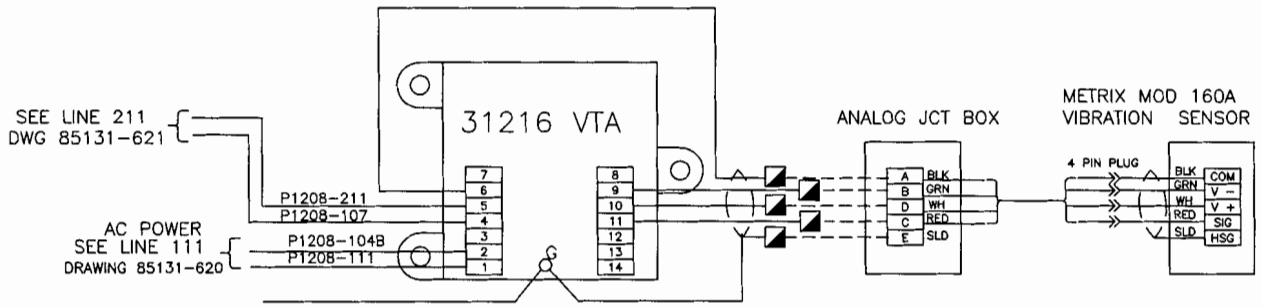
REVISIONS

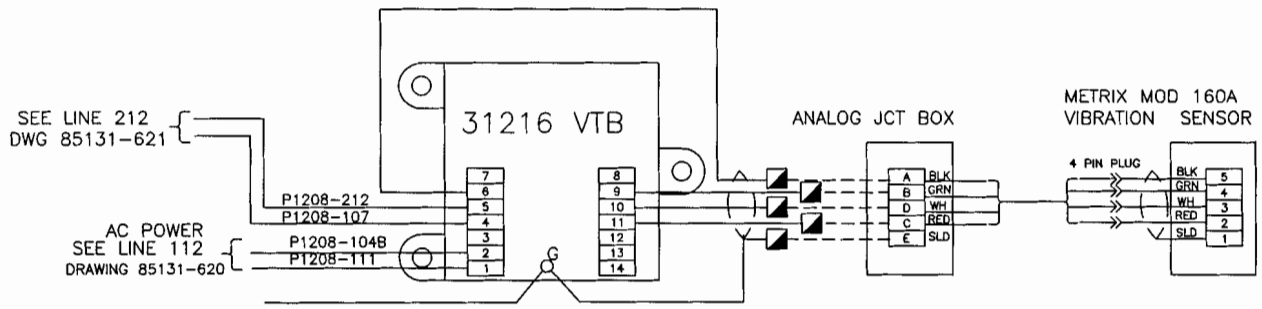
Gardner Denver

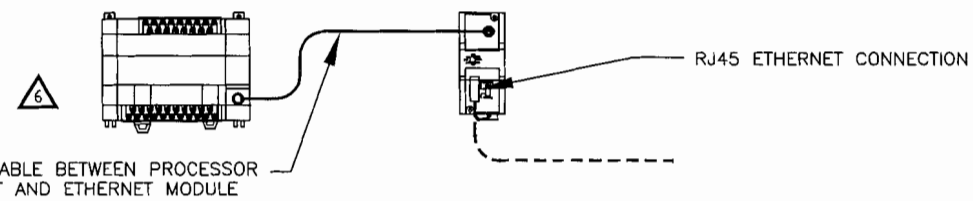
COMPRESSOR CONTROL PANEL - P-1208
RTD INPUTS WIRING DIAGRAM

DATE 03/14/03 SCALE NONE DWG NO. 85131-623









LEGEND

516 — WIRES NOT CONNECTED

— WIRES CONNECTED

— PANEL WIRING

517 - - - - - - FIELD WIRING

— TERMINAL IN MAIN CONTROL PANEL

518

NOTES:
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED – 120VAC HOT & PLC I/O
   WHITE – 120VAC NEUTRAL
   GREEN – GROUND
   YELLOW – FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
   GREY – HOT & PLC I/O
   BLUE – NEUTRAL
   GREEN – GROUND
   YELLOW – FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.

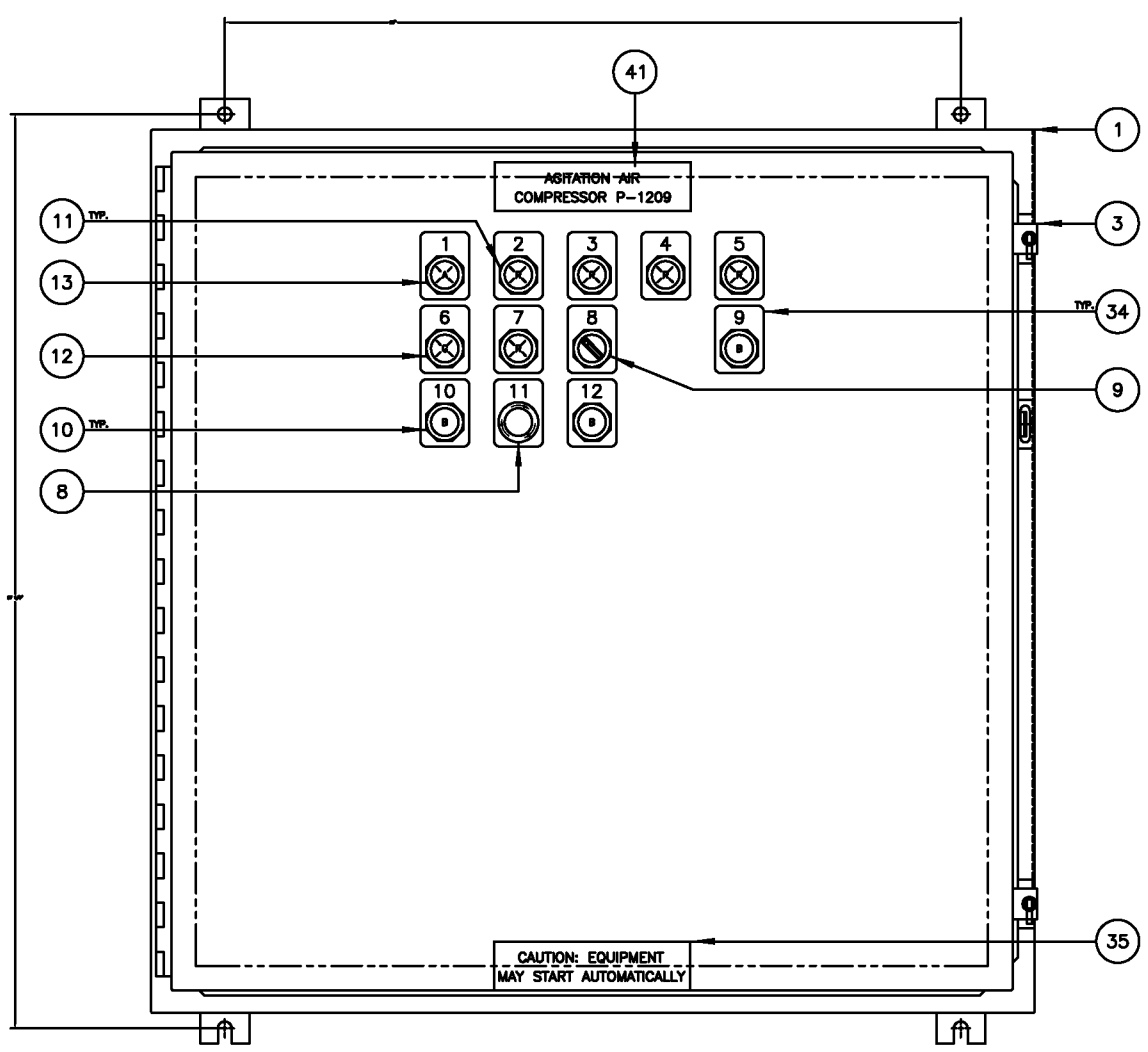
REVISIONS			
6	05-03-2004	ADDED ETHERNET MODULE	PW
5	01-29-04	MODIFIED WIRE TAGS	JE
4	8-24-03	AS CONSTRUCTED	MC
3	04/24/03	TAGS & VIB SENSOR	AAB
2	03/14/03	ISSUED FOR CONSTRUCTION	PAW
1	03/03/03	REVISED PER COMMENTS	PAW
0	9/23/02	ISSUED FOR APPROVAL	PAJ

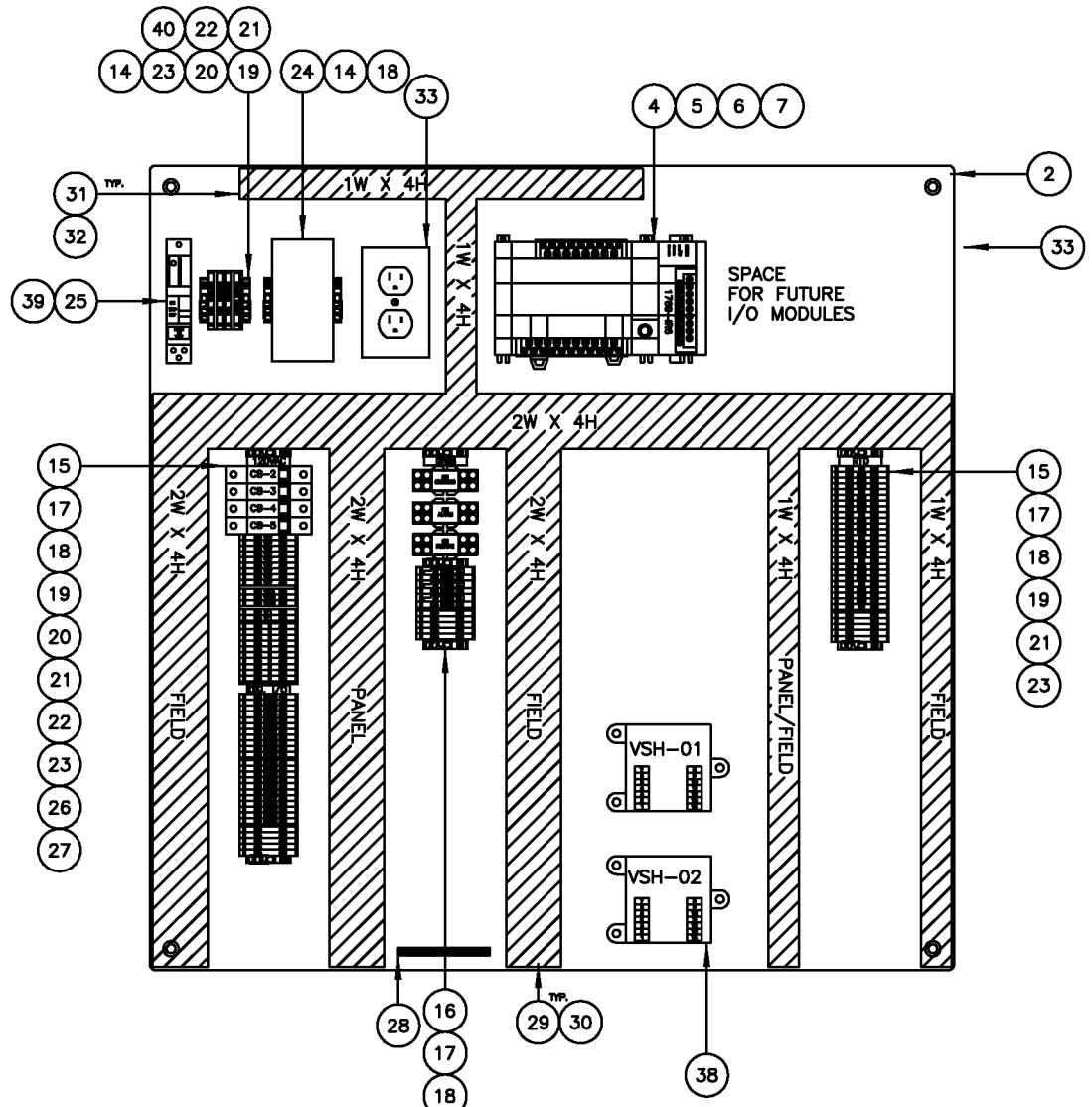
Gardner Denver
ENGINEERED PACKAGING CENTER
1501 TANNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER:
CUSTOMER ITEM NO:
COMPRESSOR CONTROL PANEL - P-1208
RELAY DRY CONTACT WIRING DIAGRAM
DATE 09/13/02 | SCALE NONE | DWG NO: 85131-624

A

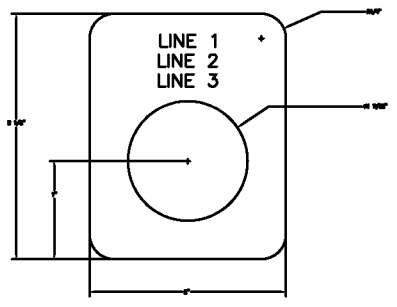
GARDNER DENVER CYCLOBLOWER
11CDL31-L BLOWER PACKAGE
CONTROL PANEL
TAG NO. 1209





MATERIAL LIST

ITEM	PART NUMBER	DESCRIPTION	QTY.
1	A-363612LP	HOFFMAN OR EQUAL ENCLOSURE, 36"H X 36"W X 12"D, N12, CARBON STEEL	1 EA.
2	A-36P36	HOFFMAN OR EQUAL SUBPANEL, 33" X 33"	1 EA.
3	A-FC412SS	HOFFMAN OR EQUAL QUICK-RELEASE LATCH, N12, STEEL	2 EA.
4	1764-24AWA	ALLEN-BRADLEY, MIRCOLOGIX 1500, BASE UNIT, 120VAC, 12 INPUTS, 12 OUTPUTS	1 EA.
5	1764-LSP	ALLEN-BRADLEY, MICROLOGIX 1500, PROCESSOR	1 EA.
6	1769-IR6	ALLEN-BRADLEY, MICROLOGIX 1500, COMPACT I/O RTD MODULE, 6 CHANNEL	1 EA.
7	1769-ECR	ALLEN-BRADLEY, MICROLOGIX 1500, END CAP	1 EA.
8	800T-FRXT6D4	ALLEN BRADLEY PUSHBUTTON, MAINT., MUSH. HD, RED, 1-NCLB	1 EA.
9	800T-HR2D1	ALLEN BRADLEY SELECTOR SWITCH, 2-POS., MAINT., 1-NO	1 EA.
10	800T-A2D1	ALLEN BRADLEY PUSHBUTTON, MAINT., BLACK, 1-NO	3 EA.
11	800T-QTH10R	ALLEN BRADLEY PILOT LIGHT, RED, 120VAC, LED PILOT LIGHT	5 EA.
12	800T-QTH10G	ALLEN BRADLEY PILOT LIGHT, GREEN, 120VAC, LED PILOT LIGHT	1 EA.
13	800T-QTH10A	ALLEN BRADLEY PILOT LIGHT, AMBER, 120VAC, LED PILOT LIGHT	1 EA.
14	199-DR1	LOW RISE DIN RAIL	1 FT.
15	1492-DR6	ALLEN BRADLEY HI RISE DIN RAIL	4 FT.
16	RH2B-ULC	IDEC RELAY, DPDT, 120VAC, W/INDICATOR LIGHT AND PUSH TO TEST BUTTON	3 EA.
17	163193	WEIDMULLER TERMINAL GROUP MARKER, SchT 5 a	4 EA.
18	38356	WEIDMULLER TERMINAL CLAMP	11 EA.
19	102010	WEIDMULLER TERMINAL BLOCK, BEIGE, FEED-THRU, SINGLE TIER	75 EA.
20	102018	WEIDMULLER TERMINAL BLOCK, BLUE, FEED-THRU, SINGLE TIER	11 EA.
21	105000	WEIDMULLER TERMINAL BLOCK END, BEIGE, FEED-THRU, SINGLE TIER	11 EA.
22	105008	WEIDMULLER TERMINAL BLOCK END, BLUE, FEED-THRU, SINGLE TIER	1 EA.
23	102016	WEIDMULLER TERMINAL BLOCK, GREEN, FEED-THRU, SINGLE TIER	9 EA.
24	51010 -WM/-DIN	LEVITON, TRANSIENT SURGE SUPPRESSOR, 10 AMP, 120VAC	1 EA.
25	THQC1115WL	GE, GFCI 15 AMP BREAKER	1 EA.
26	MG 24430	SQUARE D, 6 AMP BREAKER	1 EA.
27	MG 24426	SQUARE D, 2 AMP BREAKER	3 EA.
28	P-K9GTA	SQUARE D GROUND BAR	1 EA.
29	F-2X4WH6	PANDUIT WIREWAY, 2"WIDE X 4"HIGH, WHITE	5 FT.
30	C-2WH6	PANDUIT COVER, 2" WIDE, WHITE	5 FT.
31	F-1X4WH6	PANDUIT WIREWAY, 1"WIDE X 4"HIGH, WHITE	3 FT.
32	C-1WH6	PANDUIT COVER, 1" WIDE, WHITE	3 FT.
33		DUPLEX RECEPTACLE FOR PC USE ONLY	1 EA.
34		NAMEPLATES, 2-3/4" X 2", WHITE W/ BLACK 1/8" TEXT	12 EA.
35		NAMEPLATE, 2" X 8", YELLOW W/ BLACK 3/8" TEXT	1 EA.
36	47456	WEIDMULLER FUSED TERMINAL BLOCK END, SINGLE TIER	3 EA.
37	38036	WEIDMULLER FUSED TERMINAL BLOCK END, SINGLE TIER	3 EA.
38	.	METRIX, VIBRATION SWITCH	2 EA.
39	TQCBMPA1	GE, GFCI BREAKER MOUNTING PLATE	1 EA.
40	107220	WEIDMULLER TERMINAL BLOCK END, GREEN, FEED-THRU, SINGLE TIER	1 EA.
35		NAMEPLATE, 2" X 8", WHITE W/ BLACK 3/8" TEXT	1 EA.



WHITE W/ BLACK 1/8" TEXT

TAG #	LINE 1	LINE 2	LINE 3
1	STEADY-READY/	FLASH-FAIL	.
2	HIGH DISCHARGE	AIR PRESSURE	SHUTDOWN
3	HIGH DISCHARGE	AIR TEMPERATURE	SHUTDOWN
4	HIGH VIBRATION	SHUTDOWN	.
5	HIGH BEARING	TEMPERATURE	.
6	RUNNING	.	.
7	OFF	.	.
8	OPERATION	.	LOCAL REMOTE
9	RESET	.	.
10	START	.	.
11	STOP	.	.
12	JOG	.	.

NOTES:
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED – 120VAC HOT & PLC I/O
   WHITE – 120VAC NEUTRAL
   GREEN – GROUND
   BLUE – +24VDC
   BLACK – 0VDC
   YELLOW – FOREIGN VOLTAGE
4. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
5. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
6. LABEL WIRES THE SAME ON BOTH ENDS WITH WIRE NUMBERS SHOWN ON SCHEMATIC. USE BRADY SLEEVE TYPE WIRE LABELS.
7. PANEL TO BE LOCATED IN A NON-HAZARDOUS AREA.

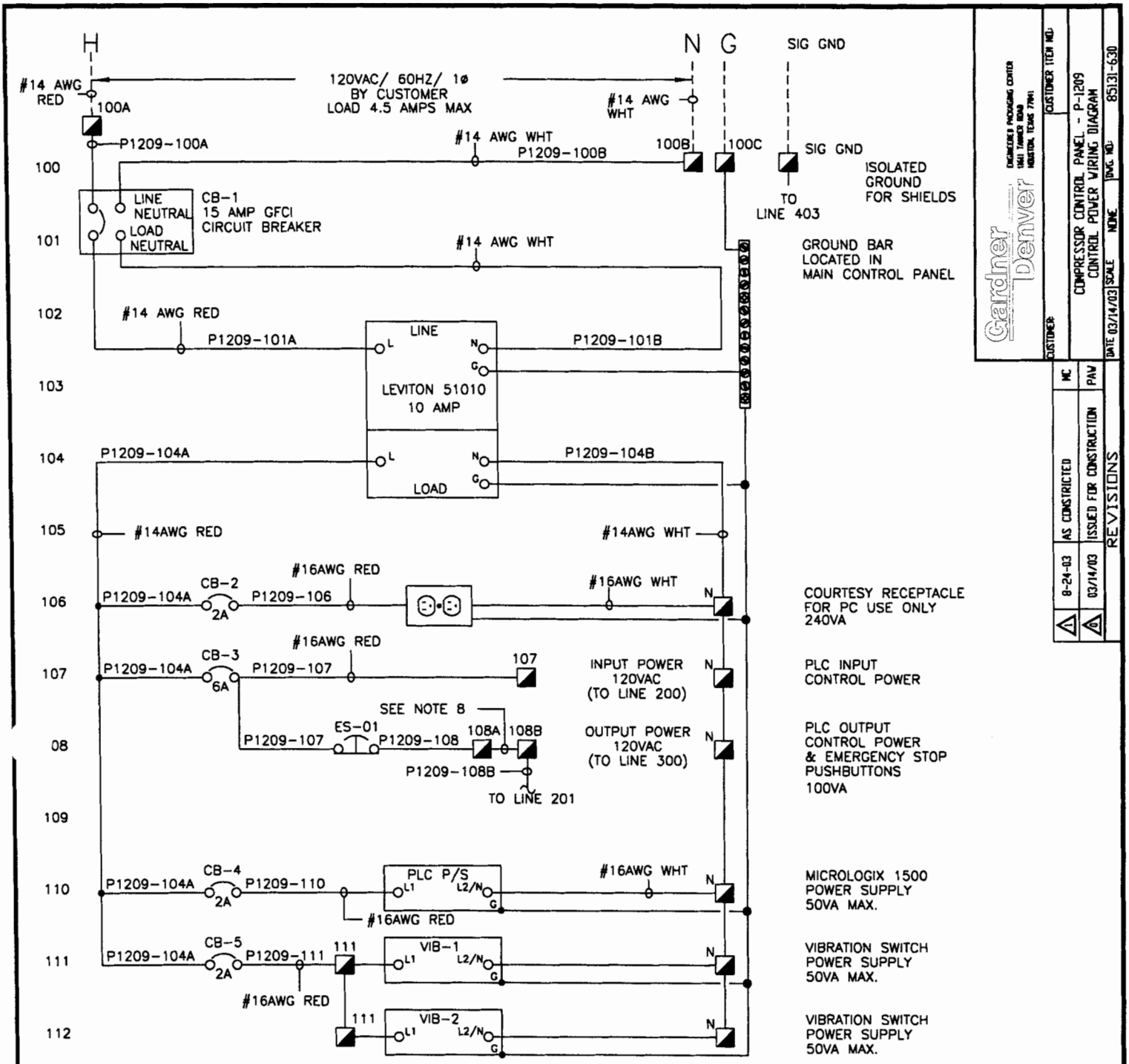
Gardner Denver
ENGINEERED PACKAGING CENTER
11811 TANNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER: | CUSTOMER ITEM NO.:

1	8-24-03	AS CONSTRUCTED	MC
0	03/14/03	ISSUED FOR CONSTRUCTION	PW
		REVISIONS	

P-1209 – POSITIVE DISPLACEMENT BLOWER CONTROL PANEL INTERIOR & EXTERIOR LAYOUT

DATE 03/14/03 | SCALE 3"=1'-0" | DWG. NO.: 85131-653



LEGEND

- WIRES NOT CONNECTED
- WIRES CONNECTED
- PANEL WIRING
- FIELD WIRING
- TERMINAL IN MAIN CONTROL PANEL

NOTES:

1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED – 120VAC HOT & PLC I/O
   WHITE – 120VAC NEUTRAL
   GREEN – GROUND
   YELLOW – FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
   GREY – HOT & PLC I/O
   BLUE – NEUTRAL
   GREEN – GROUND
   YELLOW – FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.
8. REMOVE JUMPER IF REMOTE E-STOP IS TO BE USED.

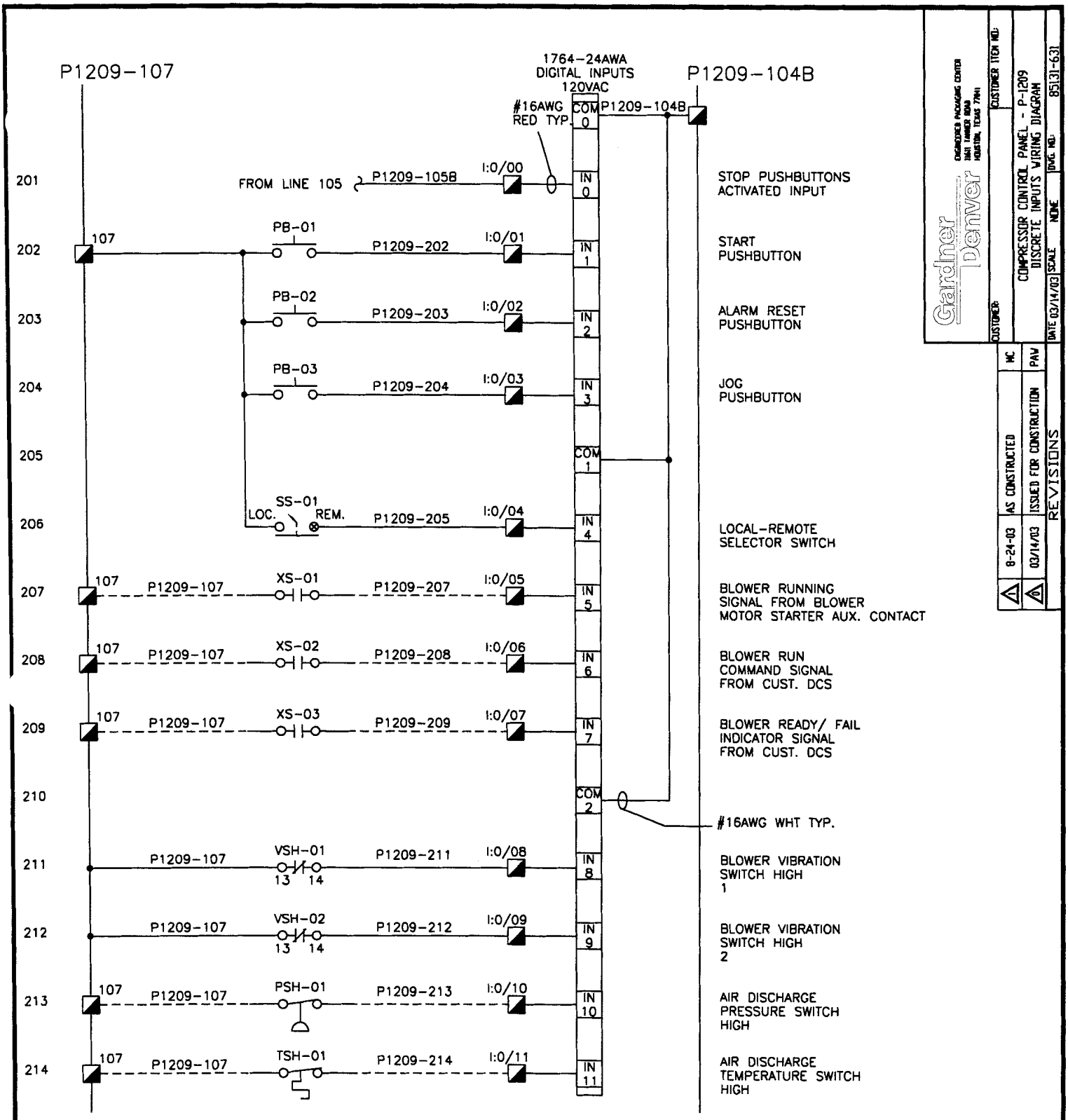
Gardner Denver
ENGINEERED HOUSING CENTER
10441 Telge Road
Houston, Texas 77041

CUSTOMER:
CUSTOMER ITEM NO:
COMPRESSOR CONTROL PANEL - P-1209
CONTROL POWER WIRING DIAGRAM
DATE 03/14/03 | SCALE NONE | DWG NO: 85131-630

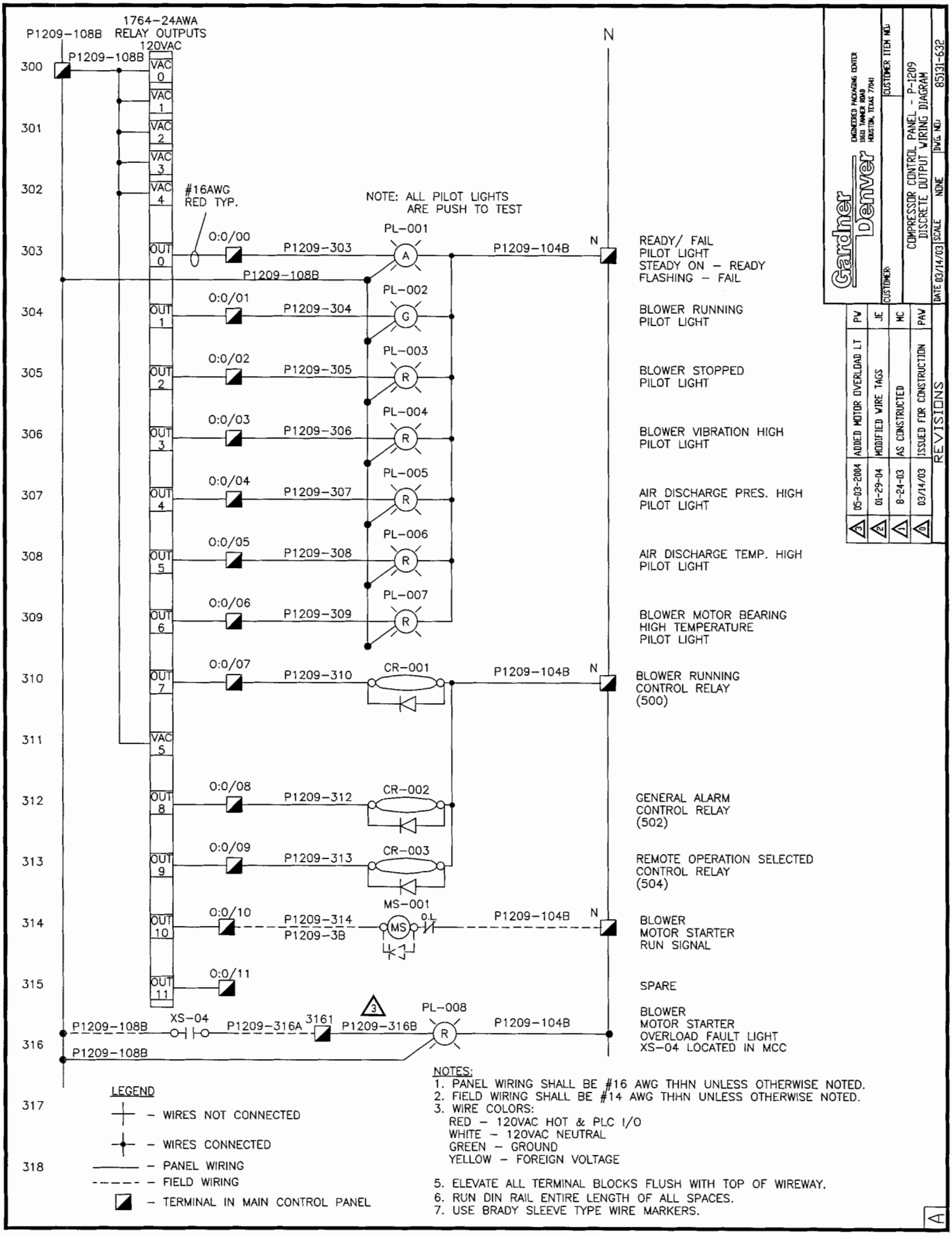
REVISIONS

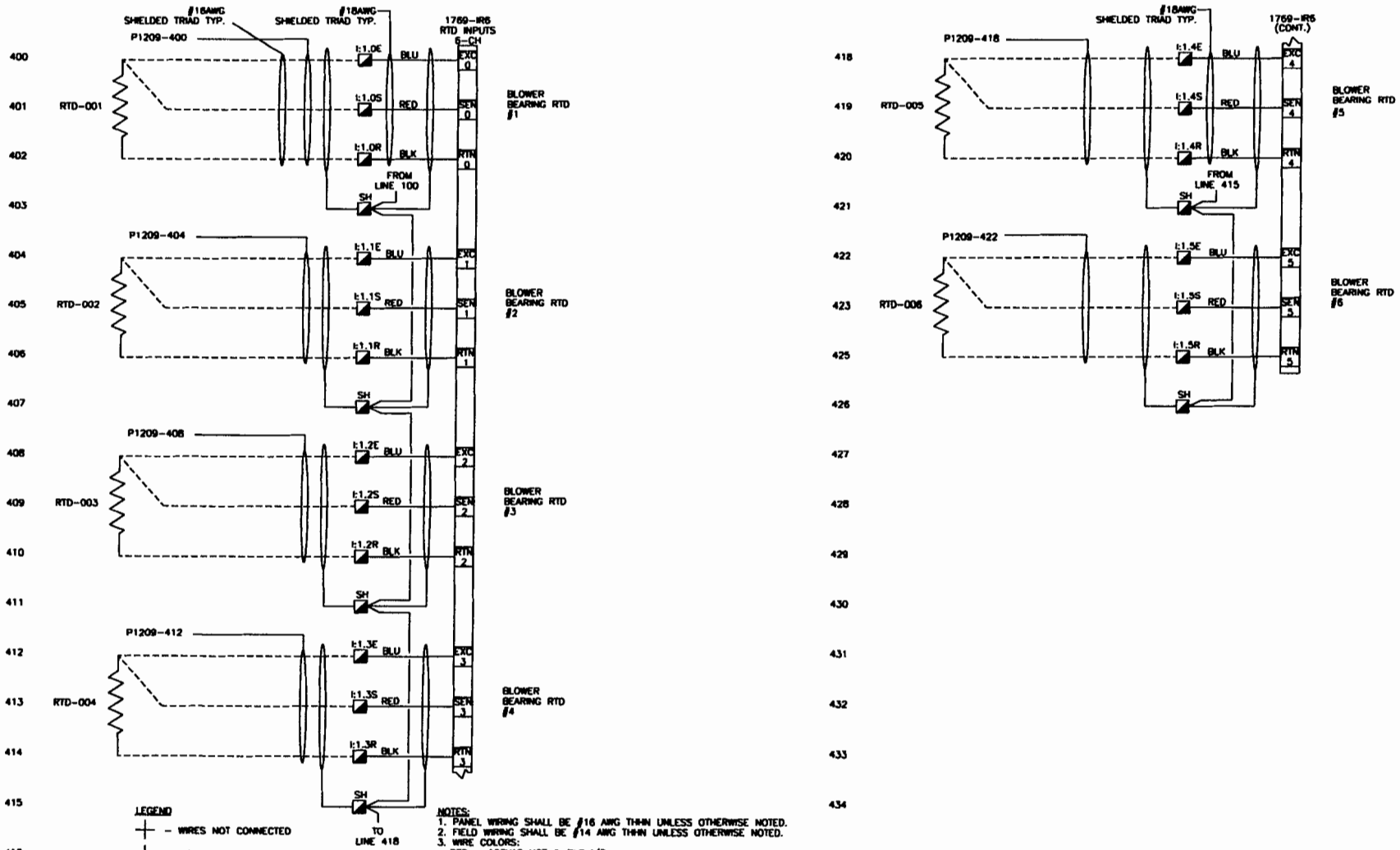
8-24-03	AS CONSTRICTED	MC	
03/14/03	ISSUED FOR CONSTRUCTION	PAW	

A



NOTES:
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED - 120VAC HOT & PLC I/O
   WHITE - 120VAC NEUTRAL
   GREEN - GROUND
   YELLOW - FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
   GREY - HOT & PLC I/O
   BLUE - NEUTRAL
   GREEN - GROUND
   YELLOW - FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.


1764-24AWA
RELAY OUTPUTS
120VAC
P1209-108B
P1209-108B
VAC 0
VAC 1
VAC 2
VAC 3
VAC 4
VAC 5
OUT 0
OUT 1
OUT 2
OUT 3
OUT 4
OUT 5
OUT 6
OUT 7
OUT 8
OUT 9
OUT 10
OUT 11
#16AWG
RED TYP.
NOTE: ALL PILOT LIGHTS
ARE PUSH TO TEST
N
0:0/00
P1209-303
PL-001
A
P1209-104B
READY/ FAIL
PILOT LIGHT
STEADY ON - READY
FLASHING - FAIL
P1209-108B
0:0/01
P1209-304
PL-002
G
BLOWER RUNNING
PILOT LIGHT
0:0/02
P1209-305
PL-003
R
BLOWER STOPPED
PILOT LIGHT
0:0/03
P1209-306
PL-004
R
BLOWER VIBRATION HIGH
PILOT LIGHT
0:0/04
P1209-307
PL-005
R
AIR DISCHARGE PRES. HIGH
PILOT LIGHT
0:0/05
P1209-308
PL-006
R
AIR DISCHARGE TEMP. HIGH
PILOT LIGHT
0:0/06
P1209-309
PL-007
R
BLOWER MOTOR BEARING
HIGH TEMPERATURE
PILOT LIGHT
0:0/07
P1209-310
CR-001
P1209-104B
BLOWER RUNNING
CONTROL RELAY
(500)
0:0/08
P1209-312
CR-002
GENERAL ALARM
CONTROL RELAY
(502)
0:0/09
P1209-313
CR-003
REMOTE OPERATION SELECTED
CONTROL RELAY
(504)
0:0/10
P1209-314
P1209-3B
MS-001
MS
O.L.
P1209-104B
BLOWER
MOTOR STARTER
RUN SIGNAL
0:0/11
SPARE
3
PL-008
P1209-108B
XS-04
P1209-316A
3161
P1209-316B
R
P1209-104B
BLOWER
MOTOR STARTER
OVERLOAD FAULT LIGHT
XS-04 LOCATED IN MCC
P1209-108B
LEGEND
- WIRES NOT CONNECTED
- WIRES CONNECTED
- PANEL WIRING
- FIELD WIRING
- TERMINAL IN MAIN CONTROL PANEL
NOTES:
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
RED - 120VAC HOT & PLC I/O
WHITE - 120VAC NEUTRAL
GREEN - GROUND
YELLOW - FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.
Gardner Denver
ENGINEERED PACKAGING CENTER
16651 TANNER ROAD
HOUSTON, TEXAS 77041
CUSTOMER:
CUSTOMER ITEM NO.:
COMPRESSOR CONTROL PANEL - P-1209
DISCRETE OUTPUT WIRING DIAGRAM
DATE 03/14/03
SCALE NONE
DWG. NO. 85131-632
REVISIONS
A 05-03-2004 ADDED MOTOR OVERLOAD LT PV
A 01-29-04 MODIFIED WIRE TAGS JE
A 8-24-03 AS CONSTRUCTED MC
A 03/14/03 ISSUED FOR CONSTRUCTION PAV
A

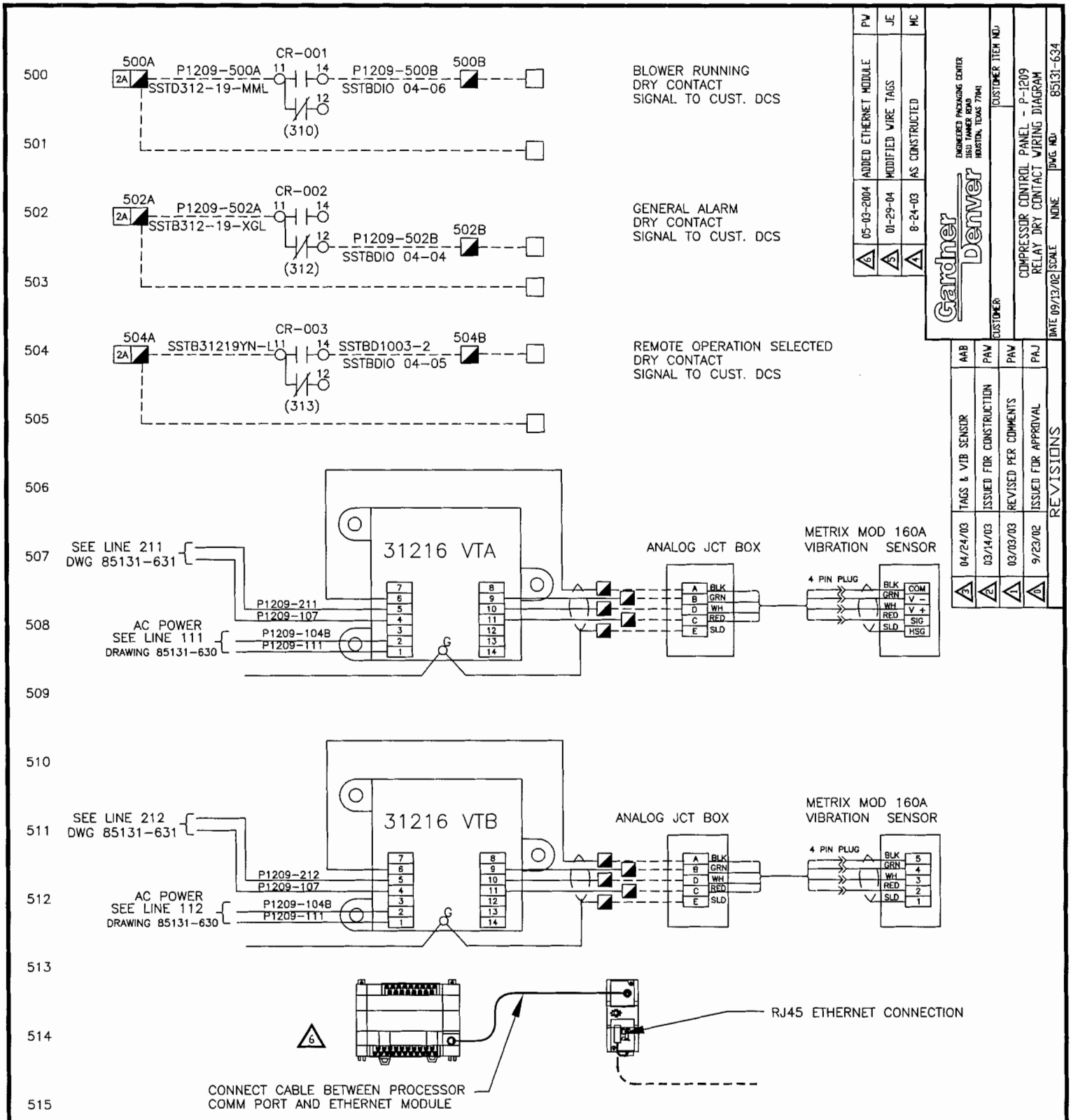


REVISIONS			
1	8-24-03	AS CONSTRUCTED	MC
0	03/14/03	ISSUED FOR CONSTRUCTION	PMM

Gardner Denver

COMPRESSOR CONTROL PANEL - P-1209
RTD INPUTS WIRING DIAGRAM

DATE 03/14/03 SCALE NONE SHEET NO. 05131-633



6	05-03-2004	ADDED ETHERNET MODULE
5	01-29-04	MODIFIED WIRE TAGS
4	8-24-03	AS CONSTRUCTED

PV JE MC

Gardner Denver
ENGINEERED PACKAGING CENTER
1151 TANNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER

CUSTOMER ITEM NO.

COMPRESSOR CONTROL PANEL - P-1209
RELAY DRY CONTACT WIRING DIAGRAM

DATE 09/13/02 | SCALE NONE | DWG NO. 85131-634

REVISIONS

4	04/24/03	TAGS & VIB SENSOR
3	03/14/03	ISSUED FOR CONSTRUCTION
2	03/03/03	REVISED PER COMMENTS
1	9/23/02	ISSUED FOR APPROVAL

AAB PAW PAW PAJ

LEGEND

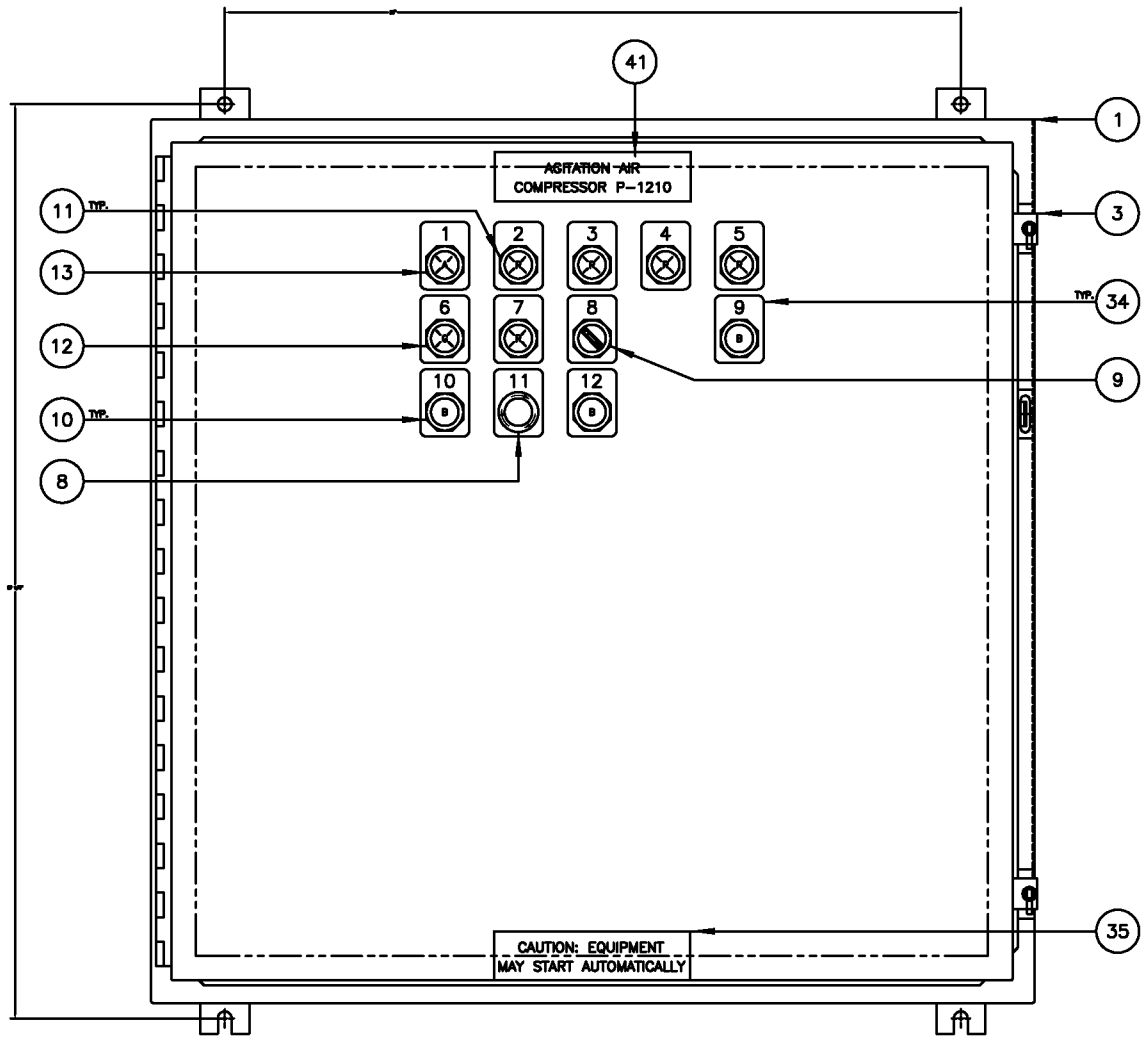
- WIRES NOT CONNECTED
- WIRES CONNECTED
- PANEL WIRING
- FIELD WIRING
- TERMINAL IN MAIN CONTROL PANEL

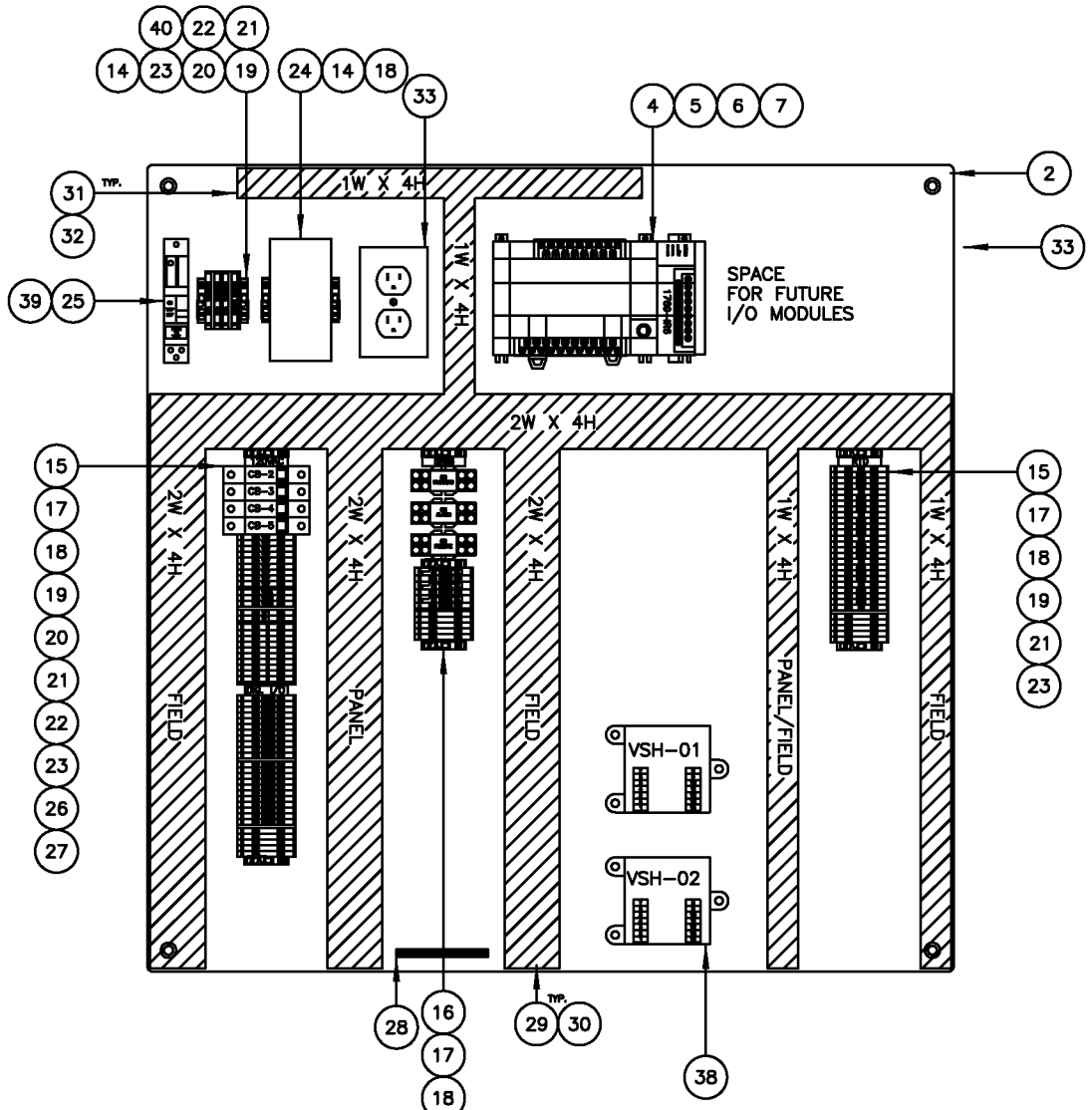
NOTES:

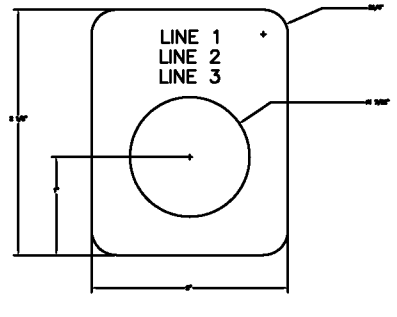
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED – 120VAC HOT & PLC I/O
   WHITE – 120VAC NEUTRAL
   GREEN – GROUND
   YELLOW – FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
   GREY – HOT & PLC I/O
   BLUE – NEUTRAL
   GREEN – GROUND
   YELLOW – FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.

A

GARDNER DENVER CYCLOBLOWER
11CDL31-L BLOWER PACKAGE
CONTROL PANEL
TAG NO. 1210







WHITE W/ BLACK 1/8" TEXT

TAG #	LINE 1	LINE 2	LINE 3
1	STEADY-READY/	FLASH-FAIL	.
2	HIGH DISCHARGE	AIR PRESSURE	SHUTDOWN
3	HIGH DISCHARGE	AIR TEMPERATURE	SHUTDOWN
4	HIGH VIBRATION	SHUTDOWN	.
5	HIGH BEARING	TEMPERATURE	.
6	RUNNING	.	.
7	OFF	.	.
8	OPERATION	.	LOCAL REMOTE
9	RESET	.	.
10	START	.	.
11	STOP	.	.
12	JOG	.	.

MATERIAL LIST

ITEM	PART NUMBER	DESCRIPTION	QTY.
1	A-363612LP	HOFFMAN OR EQUAL ENCLOSURE, 36"H X 36"W X 12"D, N12, CARBON STEEL	1 EA.
2	A-36P36	HOFFMAN OR EQUAL SUBPANEL, 33" X 33"	1 EA.
3	A-FC412SS	HOFFMAN OR EQUAL QUICK-RELEASE LATCH, N12, STEEL	2 EA.
4	1764-24AWA	ALLEN-BRADLEY, MIRCOLOGIX 1500, BASE UNIT, 120VAC, 12 INPUTS, 12 OUTPUTS	1 EA.
5	1764-LSP	ALLEN-BRADLEY, MICROLOGIX 1500, PROCESSOR	1 EA.
6	1769-IR6	ALLEN-BRADLEY, MICROLOGIX 1500, COMPACT I/O RTD MODULE, 6 CHANNEL	1 EA.
7	1769-ECR	ALLEN-BRADLEY, MICROLOGIX 1500, END CAP	1 EA.
8	800T-FRXT6D4	ALLEN BRADLEY PUSHBUTTON, MAINT., MUSH. HD, RED, 1-NCLB	1 EA.
9	800T-HR2D1	ALLEN BRADLEY SELECTOR SWITCH, 2-POS., MAINT., 1-NO	1 EA.
10	800T-A2D1	ALLEN BRADLEY PUSHBUTTON, MAINT., BLACK, 1-NO	3 EA.
11	800T-QTH10R	ALLEN BRADLEY PILOT LIGHT, RED, 120VAC, LED PILOT LIGHT	5 EA.
12	800T-QTH10G	ALLEN BRADLEY PILOT LIGHT, GREEN, 120VAC, LED PILOT LIGHT	1 EA.
13	800T-QTH10A	ALLEN BRADLEY PILOT LIGHT, AMBER, 120VAC, LED PILOT LIGHT	1 EA.
14	199-DR1	LOW RISE DIN RAIL	1 FT.
15	1492-DR6	ALLEN BRADLEY HI RISE DIN RAIL	4 FT.
16	RH2B-ULC	IDEC RELAY, DPDT, 120VAC, W/INDICATOR LIGHT AND PUSH TO TEST BUTTON	3 EA.
17	163193	WEIDMULLER TERMINAL GROUP MARKER, SchT 5 s	4 EA.
18	38356	WEIDMULLER TERMINAL CLAMP	11 EA.
19	102010	WEIDMULLER TERMINAL BLOCK, BEIGE, FEED-THRU, SINGLE TIER	75 EA.
20	102018	WEIDMULLER TERMINAL BLOCK, BLUE, FEED-THRU, SINGLE TIER	11 EA.
21	105000	WEIDMULLER TERMINAL BLOCK END, BEIGE, FEED-THRU, SINGLE TIER	11 EA.
22	105008	WEIDMULLER TERMINAL BLOCK END, BLUE, FEED-THRU, SINGLE TIER	1 EA.
23	102016	WEIDMULLER TERMINAL BLOCK, GREEN, FEED-THRU, SINGLE TIER	9 EA.
24	51010 -WM/-DIN	LEVITON, TRANSIENT SURGE SUPPRESSOR, 10 AMP, 120VAC	1 EA.
25	THQC1115WL	GE, GFCI 15 AMP BREAKER	1 EA.
26	MG 24430	SQUARE D, 6 AMP BREAKER	1 EA.
27	MG 24426	SQUARE D, 2 AMP BREAKER	3 EA.
28	P-K9GTA	SQUARE D GROUND BAR	1 EA.
29	F-2X4WH6	PANDUIT WIREWAY, 2"WIDE X 4"HIGH, WHITE	5 FT.
30	C-2WH6	PANDUIT COVER, 2" WIDE, WHITE	5 FT.
31	F-1X4WH6	PANDUIT WIREWAY, 1"WIDE X 4"HIGH, WHITE	3 FT.
32	C-1WH6	PANDUIT COVER, 1" WIDE, WHITE	3 FT.
33		DUPLEX RECEPTACLE FOR PC USE ONLY	1 EA.
34		NAMEPLATES, 2-3/4" X 2", WHITE W/ BLACK 1/8" TEXT	12 EA.
35		NAMEPLATE, 2" X 8", YELLOW W/ BLACK 3/8" TEXT	1 EA.
36	47456	WEIDMULLER FUSED TERMINAL BLOCK END, SINGLE TIER	3 EA.
37	38036	WEIDMULLER FUSED TERMINAL BLOCK END, SINGLE TIER	3 EA.
38	.	METRIX, VIBRATION SWITCH	2 EA.
39	TQCBMPA1	GE, GFCI BREAKER MOUNTING PLATE	1 EA.
40	107220	WEIDMULLER TERMINAL BLOCK END, GREEN, FEED-THRU, SINGLE TIER	1 EA.
35		NAMEPLATE, 2" X 8", WHITE W/ BLACK 3/8" TEXT	1 EA.

NOTES:
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED – 120VAC HOT & PLC I/O
   WHITE – 120VAC NEUTRAL
   GREEN – GROUND
   BLUE – +24VDC
   BLACK – 0VDC
   YELLOW – FOREIGN VOLTAGE
4. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
5. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
6. LABEL WIRES THE SAME ON BOTH ENDS WITH WIRE NUMBERS SHOWN ON SCHEMATIC. USE BRADY SLEEVE TYPE WIRE LABELS.
7. PANEL TO BE LOCATED IN A NON-HAZARDOUS AREA.

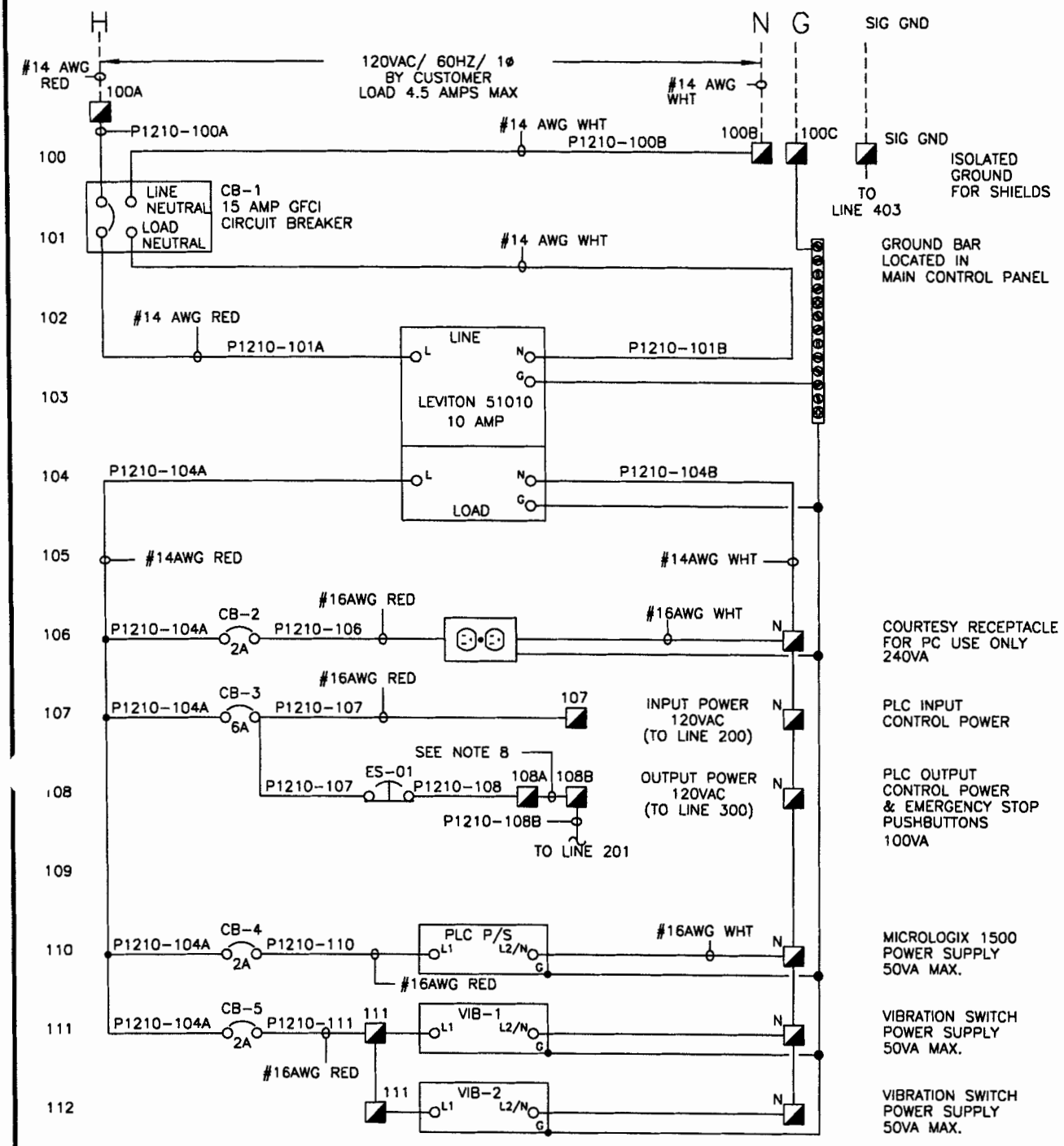
Gardner Denver
ENGINEERED PACKAGING CENTER
11911 TANNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER: | CUSTOMER ITEM NO.:

1	8-24-03	AS CONSTRUCTED	MC
0	03/14/03	ISSUED FOR CONSTRUCTION	PW
		REVISIONS	

P-1210 – POSITIVE DISPLACEMENT BLOWER CONTROL PANEL
INTERIOR & EXTERIOR LAYOUT

DATE 03/14/03 | SCALE 3"=1'-0" | DWG. NO.: 85131-654



LEGEND

- WIRES NOT CONNECTED
- WIRES CONNECTED
- PANEL WIRING
- FIELD WIRING
- TERMINAL IN MAIN CONTROL PANEL

NOTES:

1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED – 120VAC HOT & PLC I/O
   WHITE – 120VAC NEUTRAL
   GREEN – GROUND
   YELLOW – FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
   GREY – HOT & PLC I/O
   BLUE – NEUTRAL
   GREEN – GROUND
   YELLOW – FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.
8. REMOVE JUMPER IF REMOTE E-STOP IS TO BE USED.

Gardner Denver

ENGINEERED PACKAGING CENTER
1800 TURNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER:
CUSTOMER ITEM NO:

COMPRESSOR CONTROL PANEL - P-1210
CONTROL POWER WIRING DIAGRAM

DATE 03/14/03 | SCALE NONE | DWG. NO. 85131-640

REVISIONS

8-24-03	AS CONSTRUCTED	MC	
03/14/03	ISSUED FOR CONSTRUCTION	PAV	

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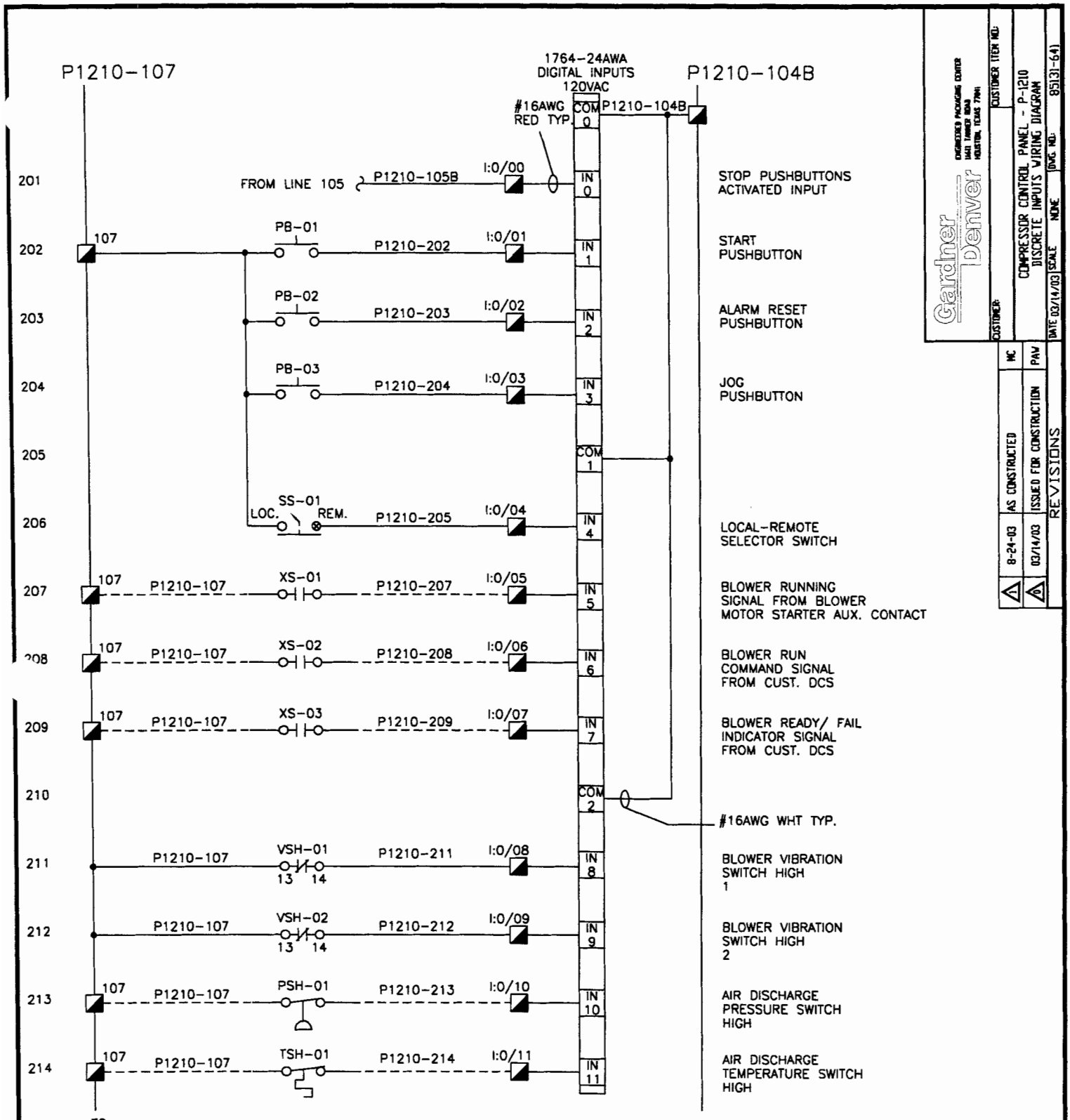
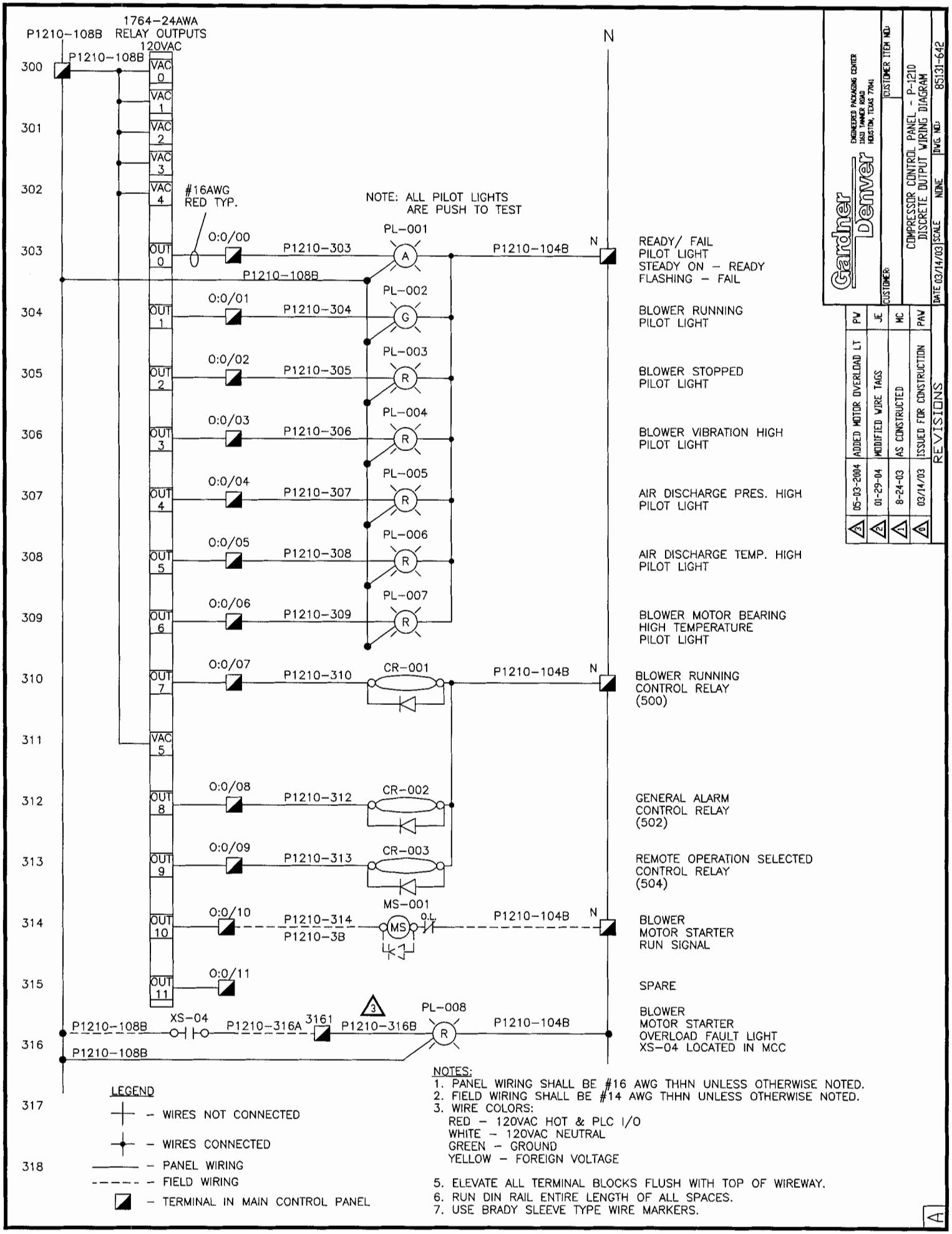
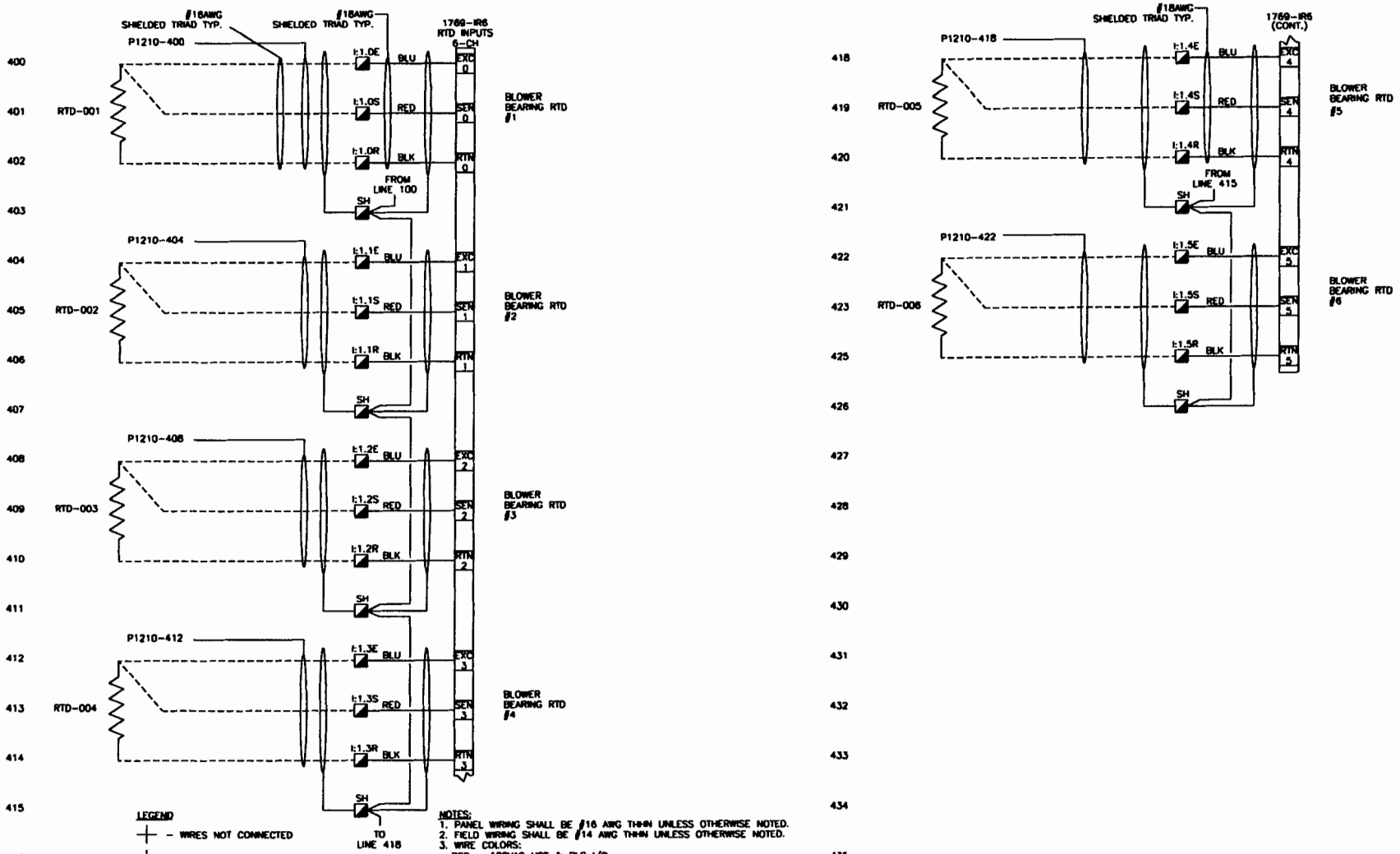

P1210-107
1764-24AWA
DIGITAL INPUTS
120VAC
P1210-104B
#16AWG
RED TYP.
COM
0
P1210-104B
201
FROM LINE 105
P1210-105B
I:0/00
IN
0
STOP PUSHBUTTONS
ACTIVATED INPUT
202
107
PB-01
P1210-202
I:0/01
IN
1
START
PUSHBUTTON
203
PB-02
P1210-203
I:0/02
IN
2
ALARM RESET
PUSHBUTTON
204
PB-03
P1210-204
I:0/03
IN
3
JOG
PUSHBUTTON
205
COM
1
206
SS-01
LOC.
REM.
P1210-205
I:0/04
IN
4
LOCAL-REMOTE
SELECTOR SWITCH
207
107
P1210-107
XS-01
P1210-207
I:0/05
IN
5
BLOWER RUNNING
SIGNAL FROM BLOWER
MOTOR STARTER AUX. CONTACT
208
107
P1210-107
XS-02
P1210-208
I:0/06
IN
6
BLOWER RUN
COMMAND SIGNAL
FROM CUST. DCS
209
107
P1210-107
XS-03
P1210-209
I:0/07
IN
7
BLOWER READY/ FAIL
INDICATOR SIGNAL
FROM CUST. DCS
210
COM
2
#16AWG WHT TYP.
211
P1210-107
VSH-01
13 14
P1210-211
I:0/08
IN
8
BLOWER VIBRATION
SWITCH HIGH
1
212
P1210-107
VSH-02
13 14
P1210-212
I:0/09
IN
9
BLOWER VIBRATION
SWITCH HIGH
2
213
107
P1210-107
PSH-01
P1210-213
I:0/10
IN
10
AIR DISCHARGE
PRESSURE SWITCH
HIGH
214
107
P1210-107
TSH-01
P1210-214
I:0/11
IN
11
AIR DISCHARGE
TEMPERATURE SWITCH
HIGH
215
TO
LINE 600
LEGEND
– WIRES NOT CONNECTED
– WIRES CONNECTED
216
– PANEL WIRING
– FIELD WIRING
– TERMINAL IN MAIN CONTROL PANEL
217
NOTES:
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
RED – 120VAC HOT & PLC I/O
WHITE – 120VAC NEUTRAL
GREEN – GROUND
YELLOW – FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
GREY – HOT & PLC I/O
BLUE – NEUTRAL
GREEN – GROUND
YELLOW – FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.
Gardner Denver
ENGINEERED PACKAGING CENTER
1441 TANNER ROAD
HOUSTON, TEXAS 77041
CUSTOMER:
CUSTOMER ITEM NO:
COMPRESSOR CONTROL PANEL - P-1210
DISCRETE INPUTS WIRING DIAGRAM
DATE 03/14/03
SCALE NONE
DWG. NO. 85131-641
REVISIONS
8-24-03 AS CONSTRUCTED MC
03/14/03 ISSUED FOR CONSTRUCTION PAW
A


1764-24AWA
P1210-108B RELAY OUTPUTS
120VAC
P1210-108B
N
#16AWG
RED TYP.
NOTE: ALL PILOT LIGHTS
ARE PUSH TO TEST
VAC 0
VAC 1
VAC 2
VAC 3
VAC 4
VAC 5
OUT 0
OUT 1
OUT 2
OUT 3
OUT 4
OUT 5
OUT 6
OUT 7
OUT 8
OUT 9
OUT 10
OUT 11
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
0:0/00
P1210-303
PL-001
A
P1210-104B
P1210-108B
READY/ FAIL
PILOT LIGHT
STEADY ON - READY
FLASHING - FAIL
0:0/01
P1210-304
PL-002
G
BLOWER RUNNING
PILOT LIGHT
0:0/02
P1210-305
PL-003
R
BLOWER STOPPED
PILOT LIGHT
0:0/03
P1210-306
PL-004
R
BLOWER VIBRATION HIGH
PILOT LIGHT
0:0/04
P1210-307
PL-005
R
AIR DISCHARGE PRES. HIGH
PILOT LIGHT
0:0/05
P1210-308
PL-006
R
AIR DISCHARGE TEMP. HIGH
PILOT LIGHT
0:0/06
P1210-309
PL-007
R
BLOWER MOTOR BEARING
HIGH TEMPERATURE
PILOT LIGHT
0:0/07
P1210-310
CR-001
P1210-104B
BLOWER RUNNING
CONTROL RELAY
(500)
0:0/08
P1210-312
CR-002
GENERAL ALARM
CONTROL RELAY
(502)
0:0/09
P1210-313
CR-003
REMOTE OPERATION SELECTED
CONTROL RELAY
(504)
0:0/10
P1210-314
P1210-3B
MS-001
MS
O.L.
P1210-104B
BLOWER
MOTOR STARTER
RUN SIGNAL
0:0/11
SPARE
3
PL-008
P1210-108B
XS-04
P1210-316A
3161
P1210-316B
R
P1210-104B
P1210-108B
BLOWER
MOTOR STARTER
OVERLOAD FAULT LIGHT
XS-04 LOCATED IN MCC
LEGEND
- WIRES NOT CONNECTED
- WIRES CONNECTED
- PANEL WIRING
- FIELD WIRING
- TERMINAL IN MAIN CONTROL PANEL
NOTES:
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
RED - 120VAC HOT & PLC I/O
WHITE - 120VAC NEUTRAL
GREEN - GROUND
YELLOW - FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.
Gardner Denver
ENGINEERED PACKAGING CENTER
1860 TANNER ROAD
HOUSTON, TEXAS 77041
CUSTOMER:
CUSTOMER ITEM NO:
COMPRESSOR CONTROL PANEL - P-1210
DISCRETE OUTPUT WIRING DIAGRAM
DATE 03/14/03
SCALE NONE
DWG. NO: 85131-642
REVISIONS
A 05-03-2004 ADDED MOTOR OVERLOAD LT PW
1 01-29-04 MODIFIED WIRE TAGS JE
2 8-24-03 AS CONSTRUCTED MC
3 03/14/03 ISSUED FOR CONSTRUCTION PAW
A



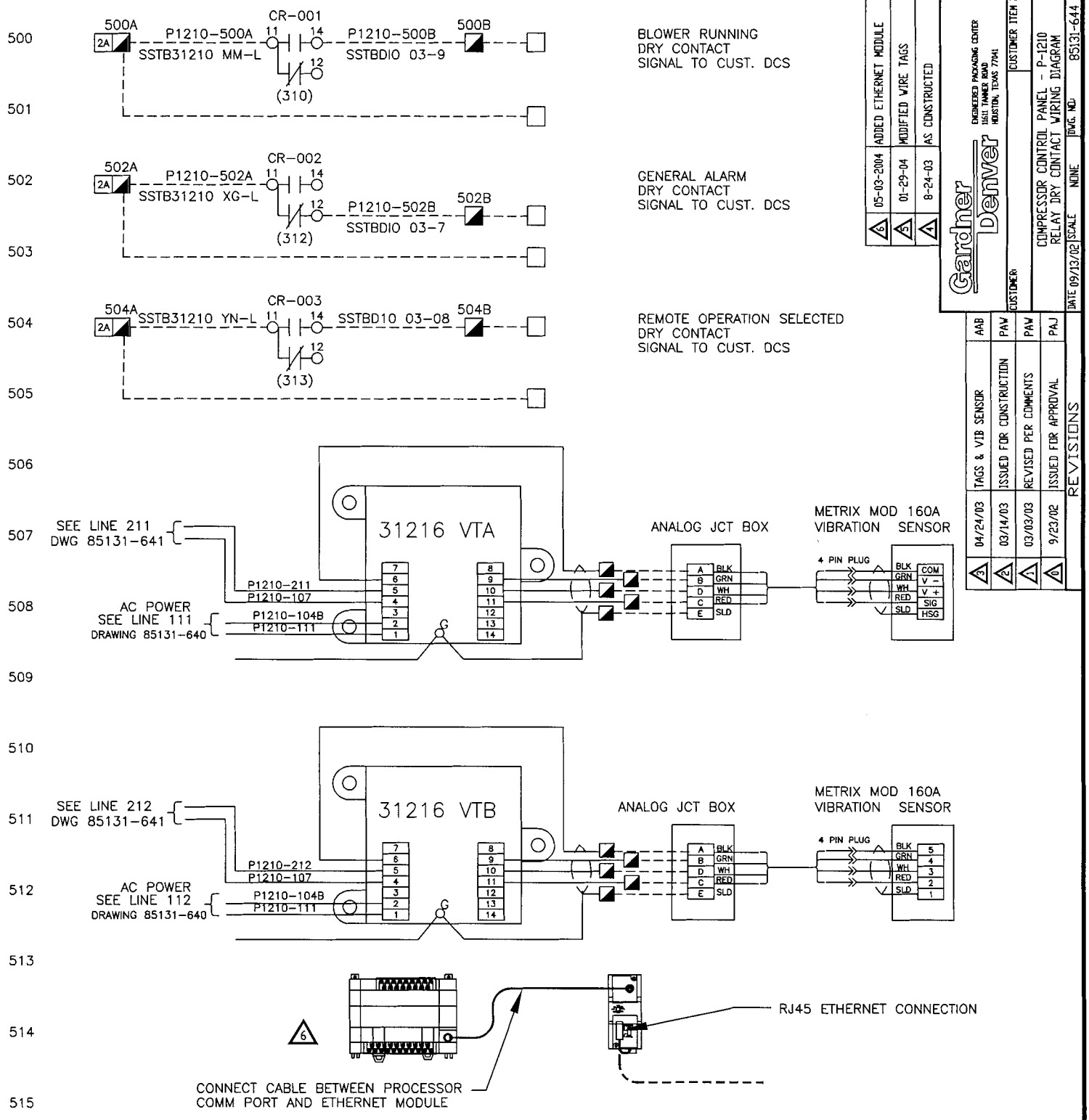
NOTES:
1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED - 120VAC HOT & PLC I/O
   WHITE - 120VAC NEUTRAL
   GREEN - GROUND
   YELLOW - FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
   GREY - HOT & PLC I/O
   BLUE - NEUTRAL
   GREEN - GROUND
   YELLOW - FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.

REVISIONS			
1	9-24-03	AS CONSTRUCTED	HC
A	03/14/03	ISSUED FOR CONSTRUCTION	PAW

Gardner Denver

COMPRESSOR CONTROL PANEL - P-1210
RTD INPUTS WIRING DIAGRAM

DWG. NO. 85131-643



5	05-03-2004	ADDED ETHERNET MODULE
4	01-29-04	MODIFIED WIRE TAGS
3	8-24-03	AS CONSTRUCTED

PW JE MC

Gardner Denver
ENGINEERED PACKAGING CENTER
1565 HAMMER ROAD
HOUSTON, TEXAS 77041

CUSTOMER:
CUSTOMER ITEM NO:

COMPRESSOR CONTROL PANEL - P-1210
RELAY DRY CONTACT WIRING DIAGRAM

DATE 09/13/02 | SCALE NONE | DWG. NO. 85131-644

REVISIONS

6	04/24/03	TAGS & VIB SENSOR	AAB
5	03/14/03	ISSUED FOR CONSTRUCTION	PAW
4	03/03/03	REVISED PER COMMENTS	PAW
3	9/23/02	ISSUED FOR APPROVAL	PAJ

LEGEND

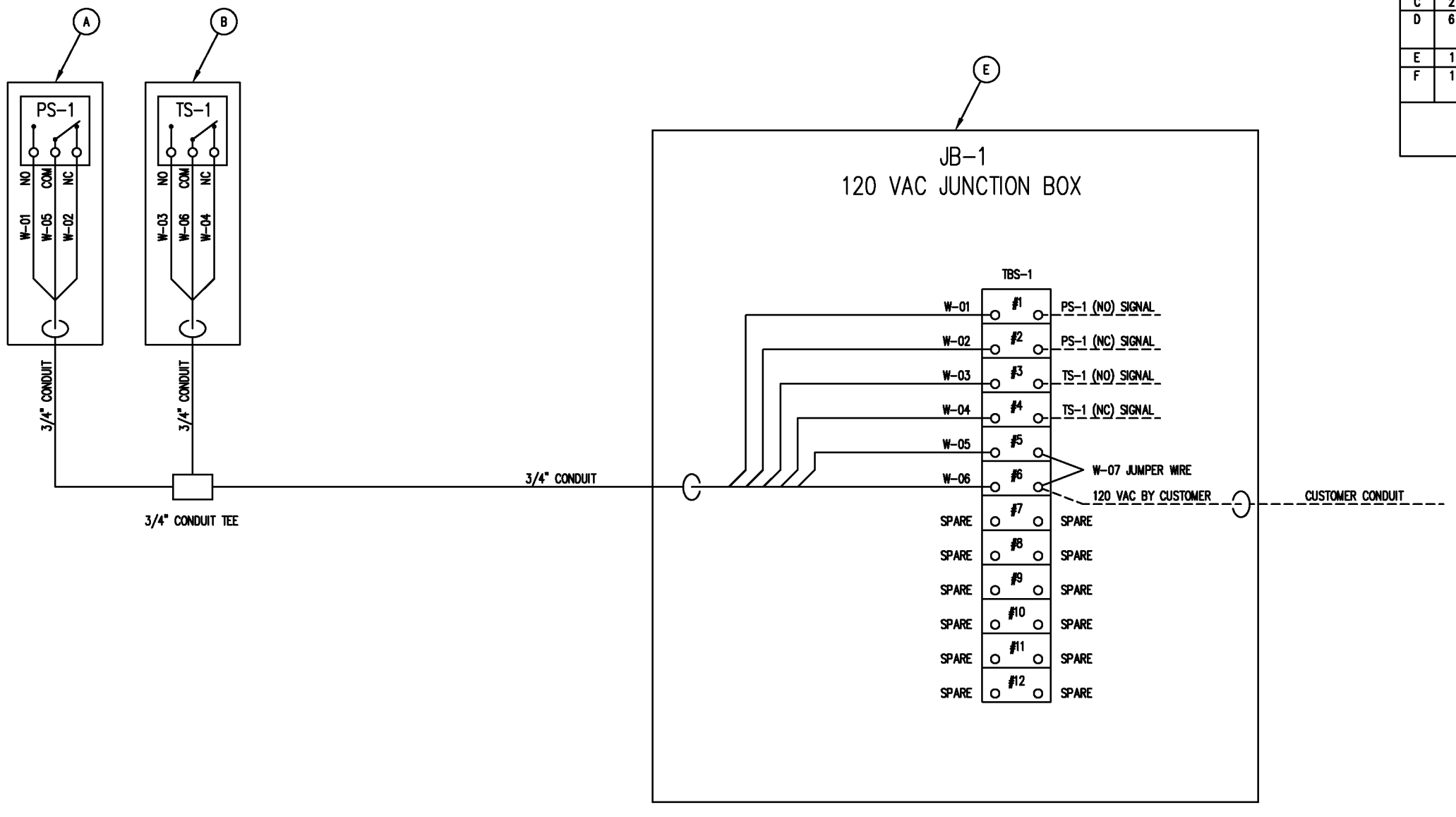
- WIRES NOT CONNECTED
- WIRES CONNECTED
- PANEL WIRING
- FIELD WIRING
- TERMINAL IN MAIN CONTROL PANEL

NOTES:

1. PANEL WIRING SHALL BE #16 AWG THHN UNLESS OTHERWISE NOTED.
2. FIELD WIRING SHALL BE #14 AWG THHN UNLESS OTHERWISE NOTED.
3. WIRE COLORS:
   RED – 120VAC HOT & PLC I/O
   WHITE – 120VAC NEUTRAL
   GREEN – GROUND
   YELLOW – FOREIGN VOLTAGE
4. TERMINAL BLOCK COLORS:
   GREY – HOT & PLC I/O
   BLUE – NEUTRAL
   GREEN – GROUND
   YELLOW – FOREIGN VOLTAGE
5. ELEVATE ALL TERMINAL BLOCKS FLUSH WITH TOP OF WIREWAY.
6. RUN DIN RAIL ENTIRE LENGTH OF ALL SPACES.
7. USE BRADY SLEEVE TYPE WIRE MARKERS.

A

GARDNER DENVER CYCLOBLOWER
11CDL31-L BLOWER PACKAGE
CONTROL PANEL
TAG NO. 1206, 1207, 1208, 1209, 1210



120 VAC WIRING DIAGRAM
NOT TO SCALE

CABLE & WIRE LIST

GDEPC DOCUMENT NUMBER 85131-660 REV. 0

ITEM	QTY	PART NUMBER	DESCRIPTION	CABLE TAG	WIRE TAG
1	1		WIRE, THHN, WHITE, 14 AWG, APPROX. 40'-0" TOTAL	-	W-01, W-02, W-03, W-04,
2	1		WIRE, THHN, RED, 14 AWG, APPROX. 20'-0" TOTAL	-	W-05, W-06, W-07
3	1		CABLE, SHIELDED WITH DRAIN WIRE, PVC JACKET, 105° C, 1 TWISTED TRIAD, 16 AWG, APPROX. 60'-0" TOTAL	SC-10 SC-20 SC-30 SC-40 SC-50 SC-60	W-11, W-12, W-13 W-21, W-22, W-23 W-31, W-32, W-33 W-41, W-42, W-43 W-51, W-52, W-53 W-61, W-62, W-63
4	1		CABLE, SHIELDED WITH DRAIN WIRE, PVC JACKET, 105° C, 1 TWISTED PAIR, 16 AWG, APPROX. 20'-0" TOTAL	SC-70 SC-80	W-71, W-72 W-81, W-82
5	2		CONNECTOR, TYPE MIL-C5015, 5/8"-24UNF FEMALE, 2-PIN RECEPTACLE, 2 WIRE TERMINALS	SC-70 SC-80	

CABLE & WIRE LIST QUANTITIES ARE FOR ONE (1) PACKAGE
S.O. NO. 248352/JOB NO. 85131 REQUIRES FIVE (5) PACKAGES

INSTRUMENT & JUNCTION BOX REFERENCE

ITEM	QTY	PART NUMBER	DESCRIPTION	INSTRUMENT TAG
A	1	REFERENCE ONLY	PRESSURE SWITCH PER BOM 85131-201, ITEM 14	PS-1
B	1	REFERENCE ONLY	TEMPERATURE SWITCH PER BOM 85131-201, ITEM 15	TS-1
C	2	REFERENCE ONLY	VIBRATION TRANSMITTER PER BOM 85131-803, ITEM 1	VT-1, VT-2
D	6	REFERENCE ONLY	BLOWER BEARING RTD PER BOM 85131-802, ITEM 1	RTD-1, RTD-3, RTD-6 RTD-2, RTD-4, RTD-5
E	1	REFERENCE ONLY	120 VAC JUNCTION BOX PER 85131-661	JB-1 WITH TBS-1
F	1	REFERENCE ONLY	ANALOG JUNCTION BOX PER 85131-662	JB-2 WITH TBS-2, TBS-3 TBS-4

INSTRUMENT REFERENCE & JUNCTION BOX QUANTITIES ARE FOR ONE (1) PACKAGE
S.O. NO. 248352/JOB NO. 85131 REQUIRES FIVE (5) PACKAGES

NOTES:

1. SEE 85131-663 FOR THE ASSOCIATED BLOWER PACKAGE CONDUIT ASSEMBLY
2. SEE 85131-201 FOR THE LOCATON OF THE PRESSURE SWITCH AND TEMPERATURE SWITCH ON THE INSTRUMENT PANEL AND THE LOCATION OF THE 120 VAC JUNCTION BOX AND ANALOG JUNCTION BOX ON THE PACKAGE BASE
3. SEE 85131-802 FOR THE LOCATON OF THE BEARING RTD's ON THE BLOWER
4. SEE 85131-803 FOR THE LOCATON OF THE VIBRATION TRANSMITTERS ON THE BLOWER
5. CUT CABLE AND WIRE LENGTH TO FIT AND INSTALL SUITABLE FORK TYPE TERMINAL CONNECTORS ON WIRE ENDS

REVISION 1 SHEET 1 OF 2 FILENAME: 85131-660R0S1.dwg

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11611 TANNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER: C. EMERY NELSON/METROPOLITAN COUNCIL
CUSTOMER ITEM NO.: P.O. No. CEN02-6011

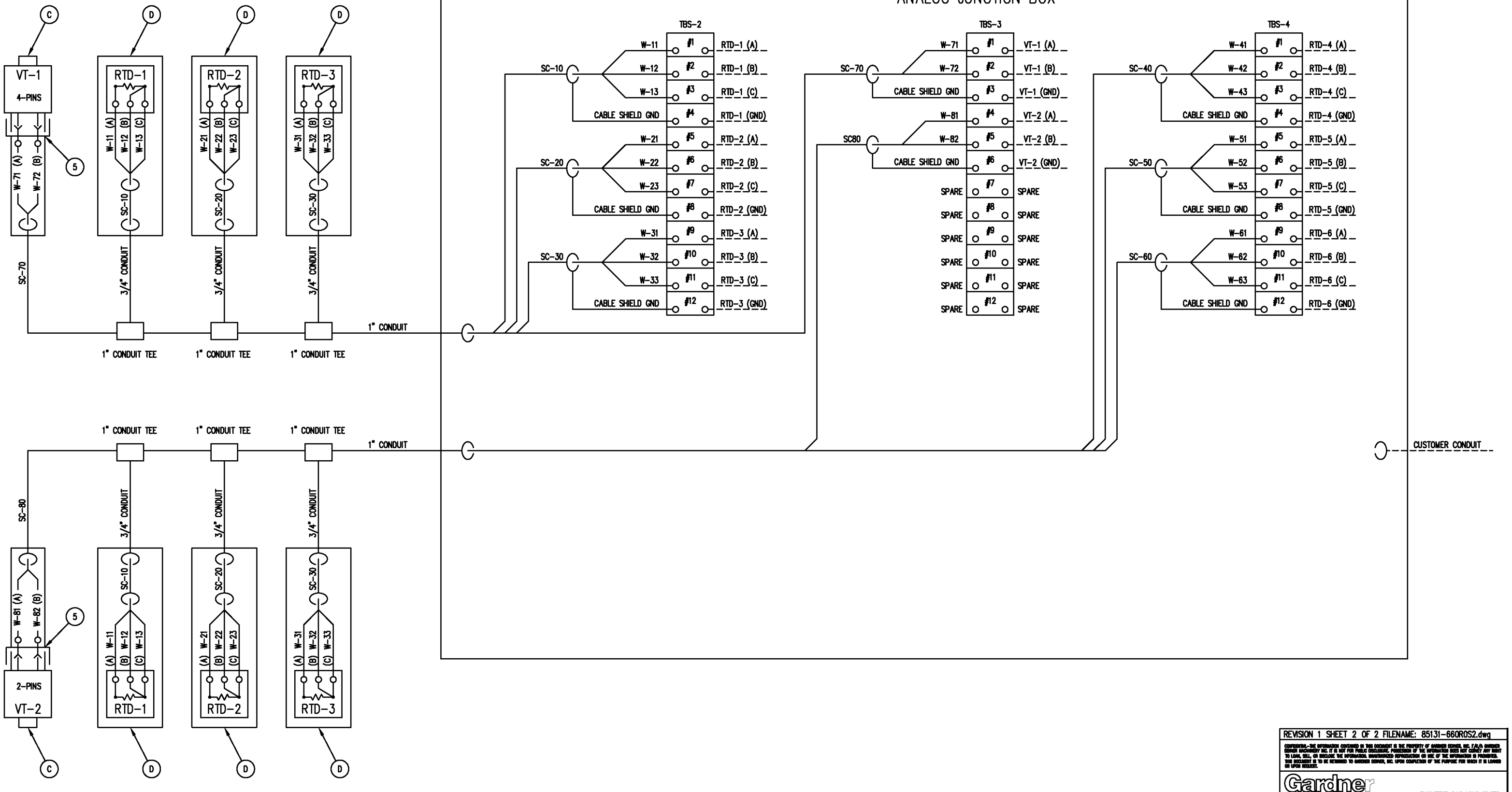
350 HP CYCLOBLOWER 11CDL31 BLOWER PACKAGE
BLOWER PACKAGE BASE MOUNTED WIRING DIAGRAM

DATE 03/10/03 SCALE 1/1 DWG. NO.: 85131-660 (1 of 2)

REVISIONS					
1	8-24-03	AS CONSTRUCTED	MC		
0	03/10/03	RELEASED FOR FABRICATION	KE	MH	RH

SALES ORDER NO.: 248352
PRODUCTION ORDER NO.: 1150327

NOTE FOR SHEET 2:
SEE SHEET 1 FOR CABLE & WIRE LIST, INSTRUMENT REFERENCE, AND NOTES



ANALOG WIRING DIAGRAM
NOT TO SCALE

SALES ORDER NO.:	248352	1 - SEE SHEET 1 OF 2	-	-	-
PRODUCTION ORDER NO.:	1150327	2 - SEE SHEET 1 OF 2	-	-	-
		REVISIONS			

REVISION 1 SHEET 2 OF 2 FILENAME: 85131-660R0S2.dwg

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Gardner Denver
ENGINEERED PACKAGING CENTER
11911 TANNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER: C. EMERY NELSON/METROPOLITAN COUNCIL
CUSTOMER ITEM NO.: P.O. No. CEN02-6011

350 HP CYCLOBLOWER 11CDL31 BLOWER PACKAGE
BLOWER PACKAGE BASE MOUNTED WIRING DIAGRAM

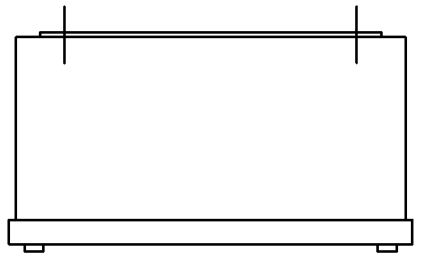
DATE 03/10/03 SCALE 1/1 DWG. NO.: 85131-660 (2 of 2)

ITEM	BILL OF MATERIAL			GDEPC DOCUMENT NUMBER 85131-661 REV. 0
ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL	WEIGHT
1	1	302AUX1463	JUNCTION BOX, NEMA 12/13, SCREW COVER, 10" x 8" x 4" SIZE, HOFFMAN A-1008SC	-	8 LB
2	1	304AUX1463	TERMINAL BRACKET ASSEMBLY, 8" WIDE JUNCTION BOX, HOFFMAN A-8JTMA	-	1 LB
3	1	306AUX1463	TERMINAL BLOCK STRIP, 10" HIGH JUNCTION BOX, 12 BUCHANAN 600V TERMINAL BLOCKS, #22 TO #10 WIRE SIZE, HOFFMAN A-10JBNS	-	1 LB
TOTAL APPROXIMATE WEIGHT					10 LB

BILL OF MATERIAL QUANTITIES ARE FOR ONE (1) PACKAGE
S.O. NO. 248352/JOB NO. 85131 REQUIRES FIVE (5) PACKAGES

NOTES:

1. INSTALL ITEM 2 & ITEM 3 IN ITEM 1 AS SHOWN
2. PROVIDE THE FOLLOWING TAGS LOCATED AS SHOWN
   "JB-1, 120 VAC" FOR THE JUCNTION BOX EXTERIOR
   "TBS-1" FOR THE TERMINAL BLOCK STRIP
   "01" THRU "12" FOR THE INDIVIDUAL TERMINAL BLOCKS
3. CUT ONE HOLE IN BOTTOM FOR 3/4" CONDUIT CONNECTION



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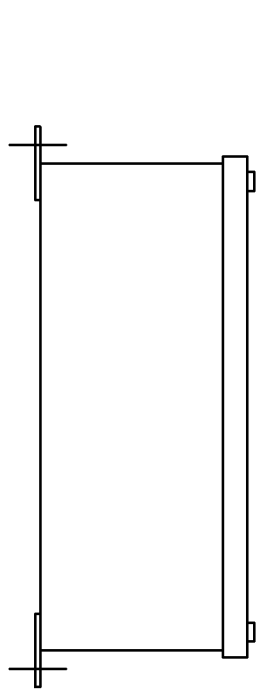

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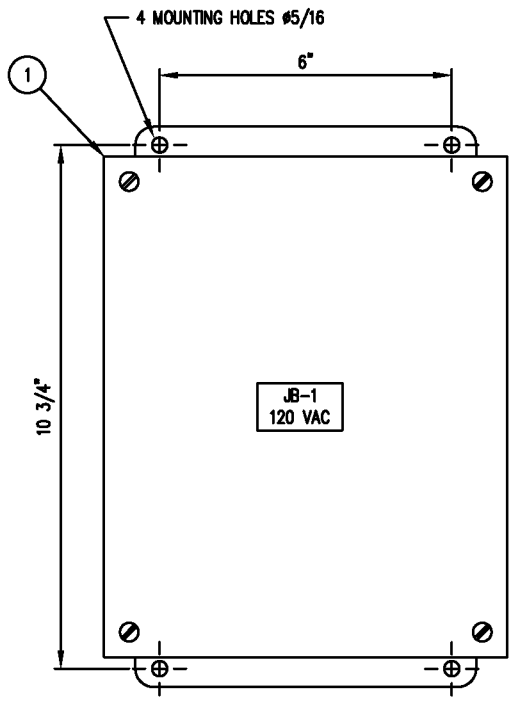

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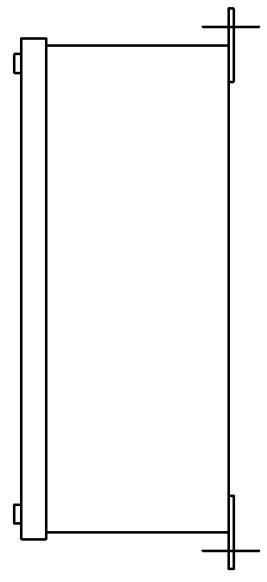
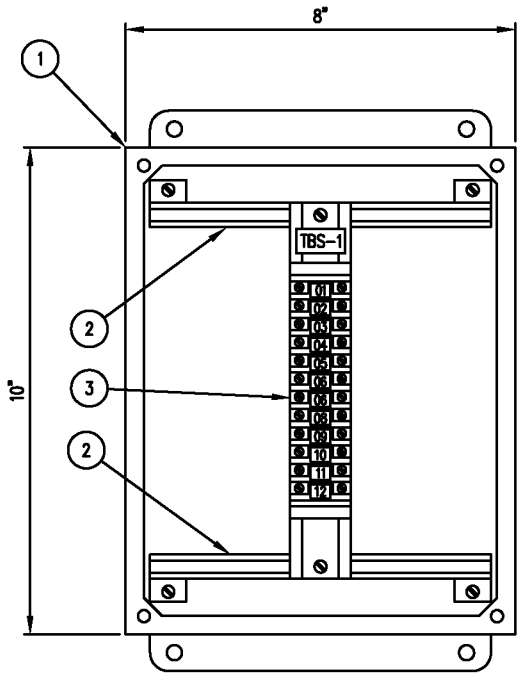
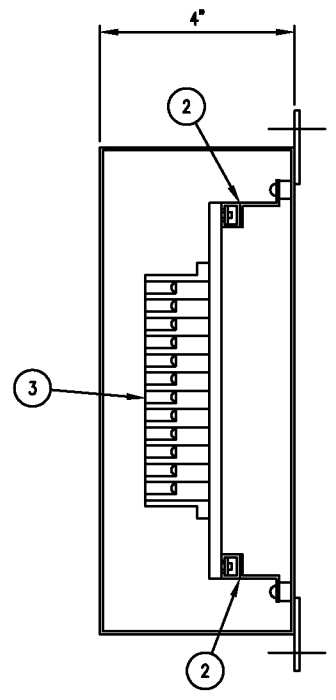


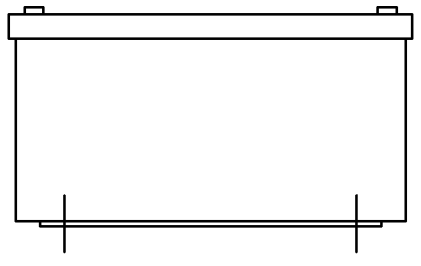
RIGHT SIDE



FRONT INTERIOR



SIDE INTERIOR



BOTTOM

REVISION 1 SHEET 1 OF 1 FILENAME: 85131-661R0S1.dwg

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Gardner Denver

ENGINEERED PACKAGING CENTER
11611 TANNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER: C. EMERY NELSON/METROPOLITAN COUNCIL
CUSTOMER ITEM NO.: P.O. No. CEN02-6011

350 HP CYCLOBLOWER 11CDL31 BLOWER PACKAGE
BLOWER PACKAGE 120 VAC JUNCTION BOX

DATE 03/11/03 SCALE 1/2 DWG. NO.: 85131-661 (1 of 1)

REVISIONS					
1	8-24-03	AS CONSTRUCTED	MC		
0	03/11/03	RELEASED FOR FABRICATION	KE	RH	RH

SALES ORDER NO.: 248352
PRODUCTION ORDER NO.: 1150327

ITEM	BILL OF MATERIAL			GDEPC DOCUMENT NUMBER 85131-662 REV. 0
ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL	WEIGHT
1	1	303AUX1463	JUNCTION BOX, NEMA 12/13, SCREW COVER, 10" x 10" x 4" SIZE, HOFFMAN A-1010SC	-	9 LB
2	1	305AUX1463	TERMINAL BRACKET ASSEMBLY, 10" WIDE JUNCTION BOX, HOFFMAN A-10JTMA	-	1 LB
3	3	306AUX1463	TERMINAL BLOCK STRIP, 10" HIGH JUNCTION BOX, 12 BUCHANAN 600V TERMINAL BLOCKS, #22 TO #10 WIRE SIZE, HOFFMAN A-10JBNS	-	2 LB
TOTAL APPROXIMATE WEIGHT					12 LB

BILL OF MATERIAL QUANTITIES ARE FOR ONE (1) PACKAGE
S.O. NO. 248352/JOB NO. 85131 REQUIRES FIVE (5) PACKAGES

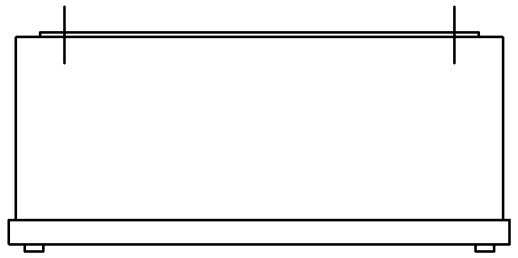
NOTES:

1. INSTALL ITEM 2 & ITEM 3 IN ITEM 1 AS SHOWN
2. PROVIDE THE FOLLOWING TAGS LOCATED AS SHOWN

   "JB-2, ANALOG" FOR THE JUCNTION BOX EXTERIOR

   "TBS-2", "TBS-3", & "TBS-4" FOR THE TERMINAL BLOCK STRIPS

   "01" THRU "12" FOR THE INDIVIDUAL TERMINAL BLOCKS ON EACH TERMINAL BLOCK STRIP
3. CUT TWO HOLES IN BOTTOM FOR 1" CONDUIT CONNECTIONS



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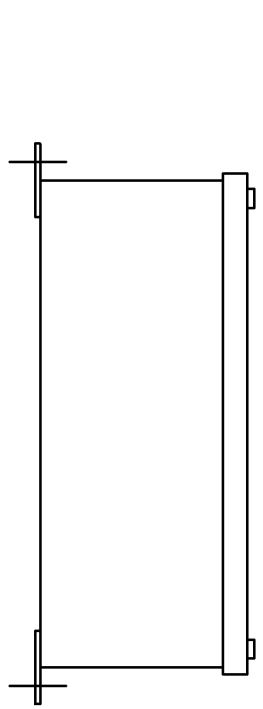
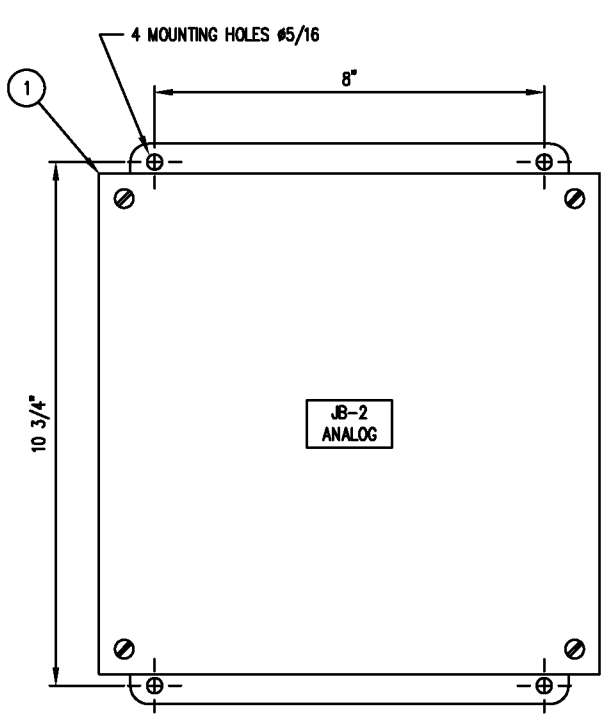


LEFT SIDE



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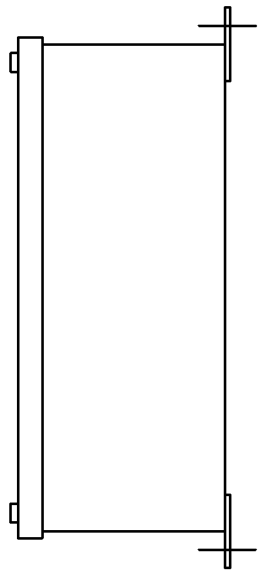
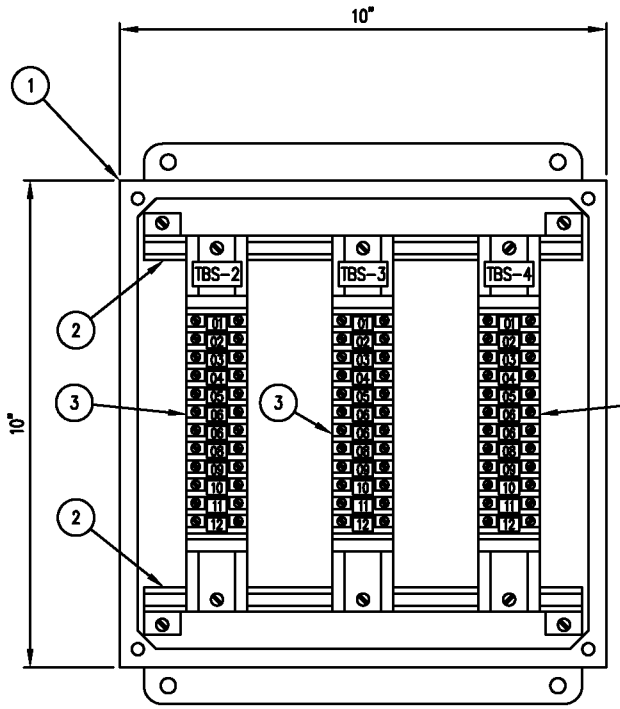
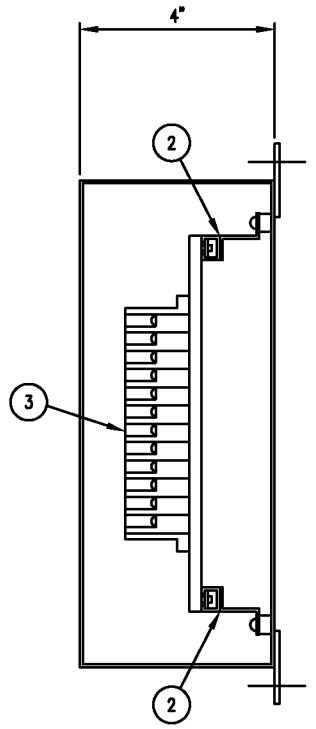


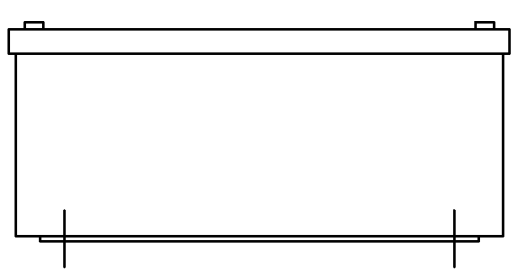
RIGHT SIDE



FRONT INTERIOR



SIDE INTERIOR



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REVISION 1 SHEET 1 OF 1 FILENAME: 85131-662R0S1.dwg

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Gardner Denver
ENGINEERED PACKAGING CENTER
11611 TANNER ROAD
HOUSTON, TEXAS 77041

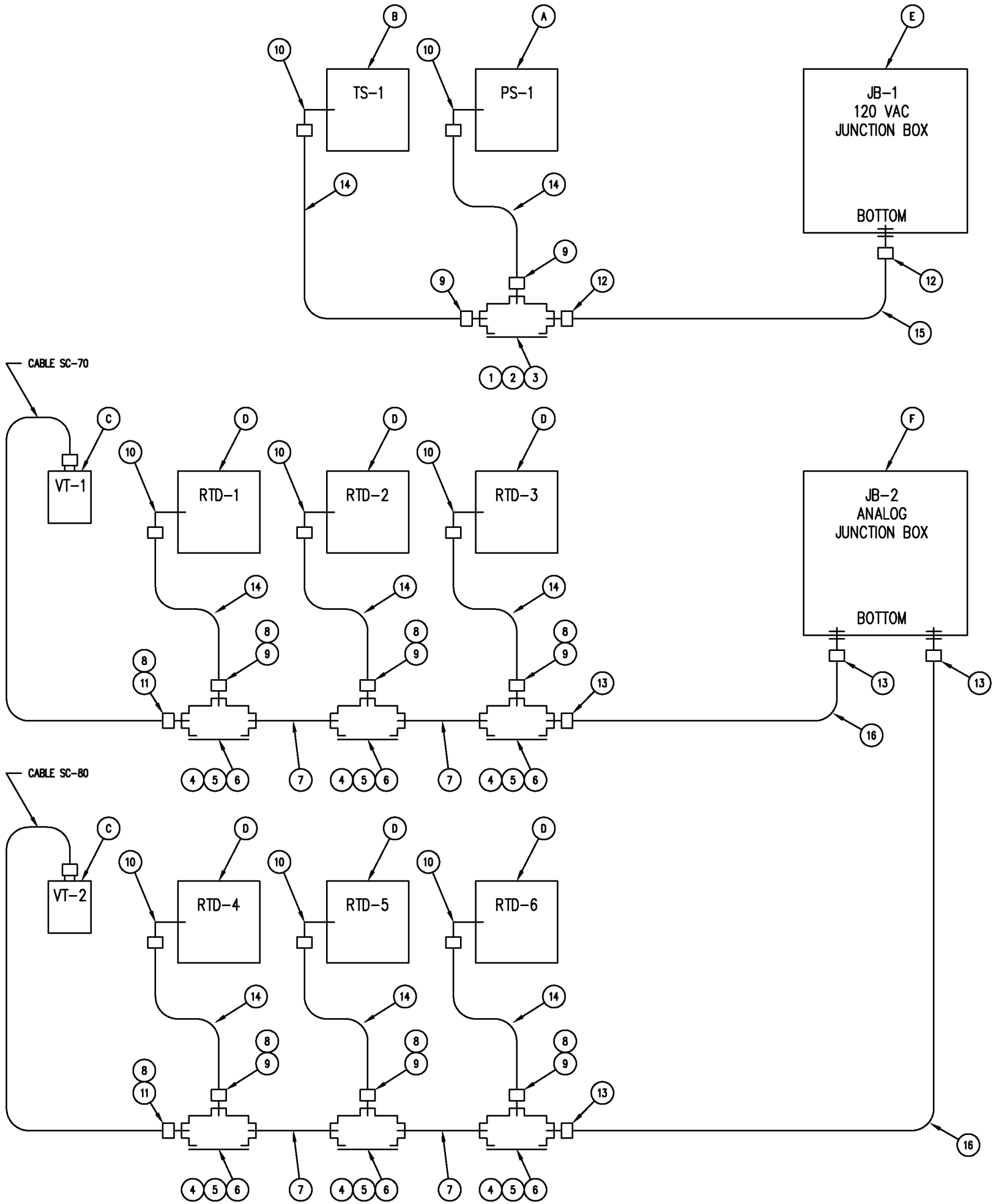
CUSTOMER: C. EMERY NELSON/METROPOLITAN COUNCIL
CUSTOMER ITEM NO.: P.O. No. CEN02-6011

350 HP CYCLOBLOWER 11CDL31 BLOWER PACKAGE
BLOWER PACKAGE ANALOG JUNCTION BOX

SALES ORDER NO.: 248352
PRODUCTION ORDER NO.: 1150327

REVISIONS					
1	8-24-03	AS CONSTRUCTED	MC		
0	03/11/03	RELEASED FOR FABRICATION	KE	RH	RH

DATE 03/11/03 | SCALE 1/2 | DWG. NO.: 85131-662 (1 of 1)



BILL OF MATERIAL

GDEPC DOCUMENT NUMBER 85131-663 REV. 0

ITEM	QTY	PART NUMBER	DESCRIPTION	MATERIAL	WEIGHT
1	1		CONDULET, TEE, FORM 7, TB STYLE, 3/4" SIZE, CROUSE-HINDS T27 OR EQUAL	GALVANIZED STEEL	1 LB
2	1		BLANK COVER, FORM 7, 3/4" SIZE, CROUSE-HINDS 270 OR EQUAL	GALVANIZED STEEL	– LB
3	1		SOLID GASKET, FORM 7, 3/4" SIZE, CROUSE-HINDS GASK572 OR EQUAL	NEOPRENE	– LB
4	6		CONDULET, TEE, FORM 7, TB STYLE, 1" SIZE, CROUSE-HINDS T37 OR EQUAL	GALVANIZED STEEL	6 LB
5	6		BLANK COVER, FORM 7, 1" SIZE, CROUSE-HINDS 370 OR EQUAL	GALVANIZED STEEL	– LB
6	6		SOLID GASKET, FORM 7, 1" SIZE, CROUSE-HINDS GASK573 OR EQUAL	NEOPRENE	– LB
7	4		PIPE NIPPLE, SCH 40, 1" NPT x 12" LONG	GALVANIZED STEEL	7 LB
8	8		REDUCING BUSHING, 1" x 3/4" NPT	GALVANIZED STEEL	1 LB
9	8		FITTING, LIQUIDTIGHT FLEXIBLE CONDUIT, STRAIGHT, 3/4" HUB SIZE, 3/4" CONDUIT SIZE	GALVANIZED STEEL	2 LB
10	8		FITTING, LIQUIDTIGHT FLEXIBLE CONDUIT, 90° ANGLE, 3/4" HUB SIZE, 3/4" CONDUIT SIZE	GALVANIZED STEEL	2 LB
11	2		FITTING, CABLE, STRAIGHT, 3/4" NPT MALE, .250 TO .375 CABLE OD SIZE, NEOPRENE BUSHING, CROUSE-HINDS CGB293 OR EQUAL	GALVANIZED STEEL	1 LB
12	2		CONNECTOR, RIGID CONDUIT, STRAIGHT, 3/4" SIZE	GALVANIZED STEEL	1 LB
13	4		CONNECTOR, RIGID CONDUIT, STRAIGHT, 1" SIZE	GALVANIZED STEEL	2 LB
14	1		CONDUIT, FLEXIBLE, LIQUIDTIGHT, GALVANIZED STEEL, PVC COVER, 3/4" SIZE, APPROX. 40'-0" TOTAL LENGTH	–	40 LB
15	1		CONDUIT, RIGID, 3/4" SIZE, APPROX. 10'-0" TOTAL LENGTH	GALVANIZED STEEL	10 LB
16	1		CONDUIT, RIGID, 1" SIZE, APPROX. 20'-0" TOTAL LENGTH	GALVANIZED STEEL	20 LB
TOTAL APPROXIMATE WEIGHT					93 LB

BILL OF MATERIAL QUANTITIES ARE FOR ONE (1) PACKAGE
S.O. NO. 248352/JOB NO. 85131 REQUIRES FIVE (5) PACKAGES

INSTRUMENT & JUNCTION BOX REFERENCE

ITEM	QTY	PART NUMBER	DESCRIPTION	INSTRUMENT/BOX TAG
A	1	REFERENCE ONLY	PRESSURE SWITCH PER BOM 85131-201, ITEM 14	PS-1
B	1	REFERENCE ONLY	TEMPERATURE SWITCH PER BOM 85131-201, ITEM 15	TS-1
C	2	REFERENCE ONLY	VIBRATION TRANSMITTER PER BOM 85131-803, ITEM 1	VT-1, VT-2
D	6	REFERENCE ONLY	BLOWER BEARING RTD PER BOM 85131-802, ITEM 1	RTD-1, RTD-3, RTD-6 RTD-2, RTD-4, RTD-5
E	1	REFERENCE ONLY	120 VAC JUNCTION BOX PER 85131-661	JB-1
F	1	REFERENCE ONLY	ANALOG JUNCTION BOX PER 85131-662	JB-2

INSTRUMENT & JUNCTION BOX REFERENCE QUANTITIES ARE FOR ONE (1) PACKAGE
S.O. NO. 248352/JOB NO. 85131 REQUIRES FIVE (5) PACKAGES

NOTES:

1. SEE 85131-660 FOR THE ASSOCIATED BLOWER PACKAGE WIRING DIAGRAM
2. SEE 85131-201 FOR THE LOCATON OF THE PRESSURE SWITCH AND TEMPERATURE SWITCH ON THE INSTRUMENT PANEL AND THE LOCATION OF THE 120 VAC JUNCTION BOX AND ANALOG JUNCTION BOX ON THE PACKAGE BASE
3. SEE 85131-802 FOR THE LOCATON OF THE BEARING RTD's ON THE BLOWER
4. SEE 85131-803 FOR THE LOCATON OF THE VIBRATION TRANSMITTERS ON THE BLOWER
5. CUT AND BEND THE CONDUIT TO FIT
6. SUPPORT THE CONDUIT FROM THE BOTTOM OF THE PACKAGE BASE STRUCTURE CROSS MEMBERS

SALES ORDER NO.: 248352
PRODUCTION ORDER NO.: 1150327

1	8-24-03	AS CONSTRUCTED	MC		
0	03/11/03	RELEASED FOR FABRICATION	KE	MH	RH

REVISIONS

REVISION 1 SHEET 1 OF 1 FILENAME: 85131-663R0S1.dwg

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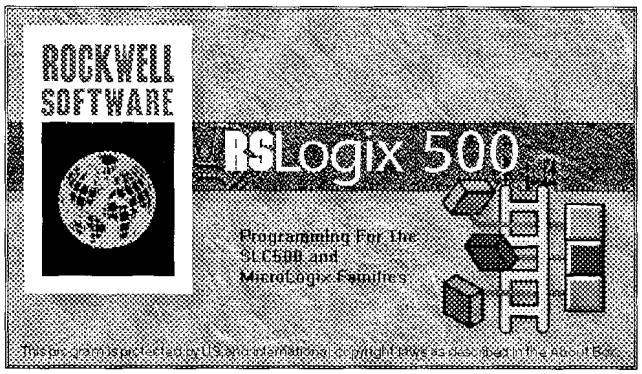
11611 TANNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER: C. EMERY NELSON/METROPOLITAN COUNCIL
CUSTOMER ITEM NO.: P.O. No. CEN02-6011

350 HP CYCLOBLOWER 11CDL31 BLOWER PACKAGE
BLOWER PACKAGE BASE MOUNTED CONDUIT ASSEMBLY

DATE 03/11/03 SCALE 1/1 DWG. NO.: 85131-663 (1 of 1)

RSLogix500 Project Report



Processor Information

Processor Type: Bul.1764 Micrologix 1500 LSP Series C

Processor Name: GD_85131

Total Memory Used: 283 Instruction Words Used - 137 Data Table Words Used

Total Memory Left: 5413 Instruction Words Left

Program Files: 4

Data Files: 13

Program ID: 19bf

I/O Configuration

0	Bul.1764	Micrologix 1500 LSP Series C
1	1769-IR6	6 Channel RTD Module
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		

Channel Configuration

CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Edit Resource/Owner Timeout: 60
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Passthru Link ID: 1
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Write Protected: No
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Comms Servicing Selection: No
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex Message Servicing Selection: No
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex 1st AWA Append Character: \d
CHANNEL 0 (SYSTEM) - Driver: DF1 Full Duplex 2nd AWA Append Character: \a

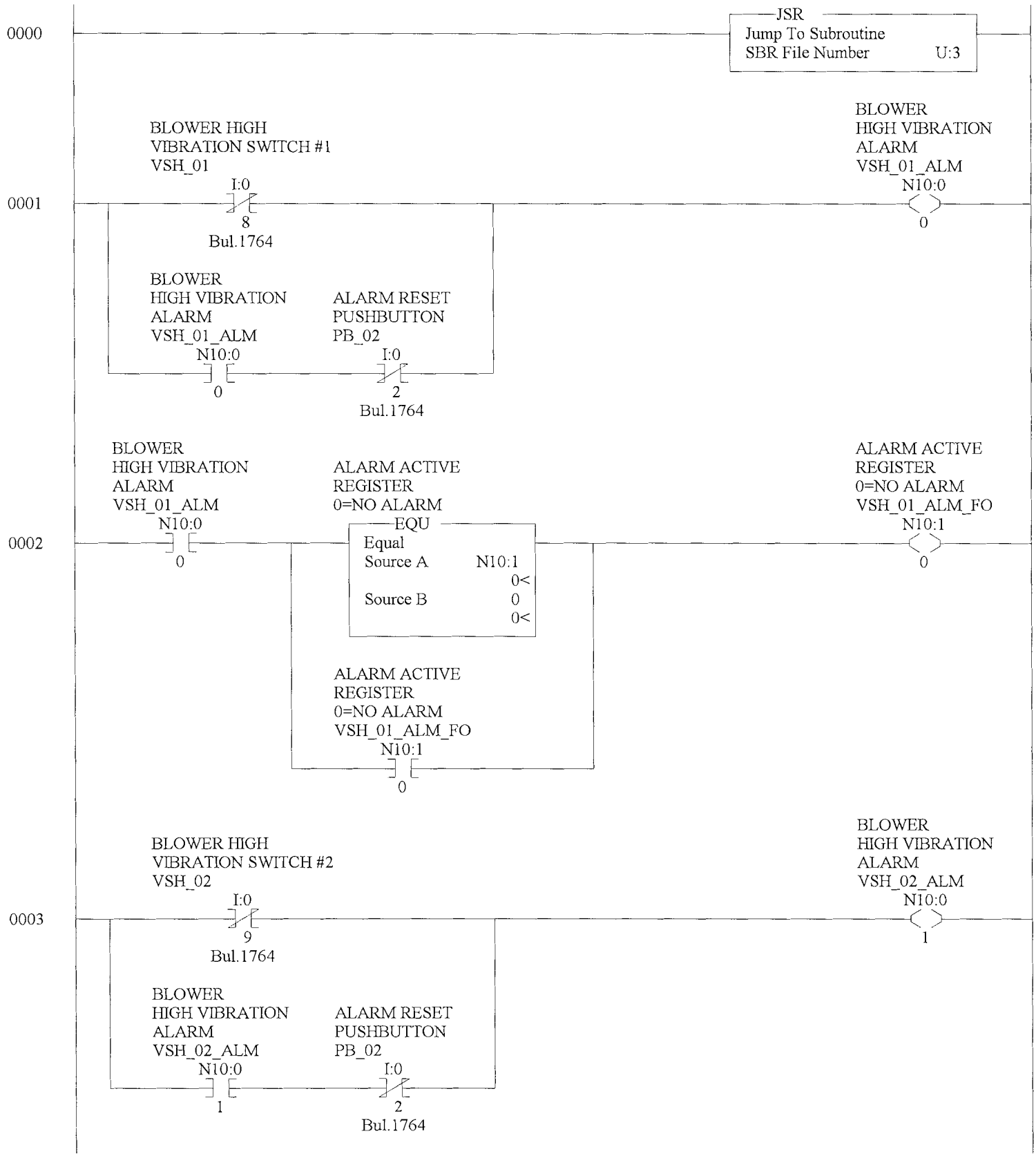
Source ID: 1 (decimal)
Baud: 19200
Parity: NONE
Control Line : No Handshaking
Error Detection: CRC
Embedded Responses: Auto Detect
Duplicate Packet Detect: Yes
ACK Timeout: 50
NAK Retries: 3
ENQ Retries: 3

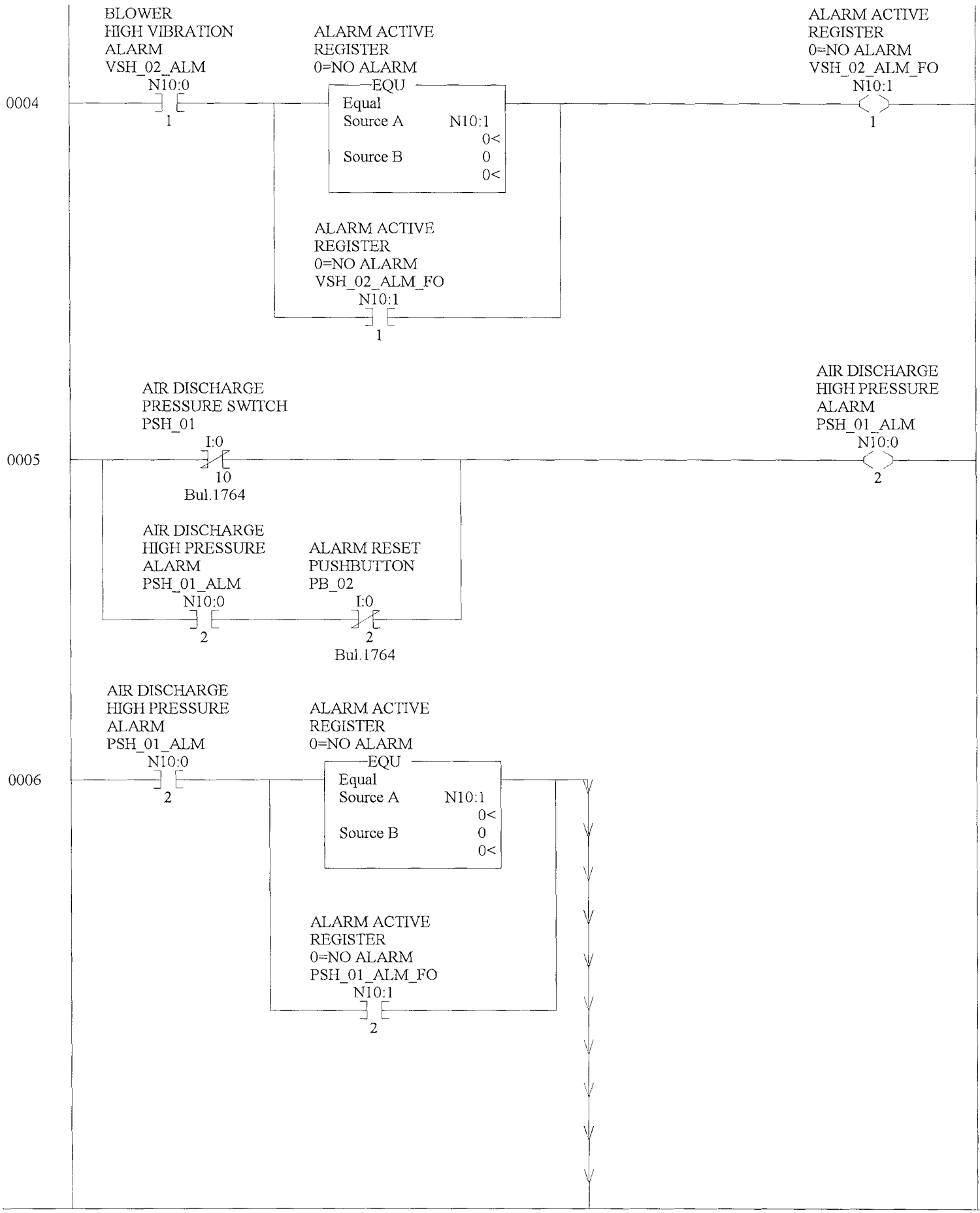
Program File List

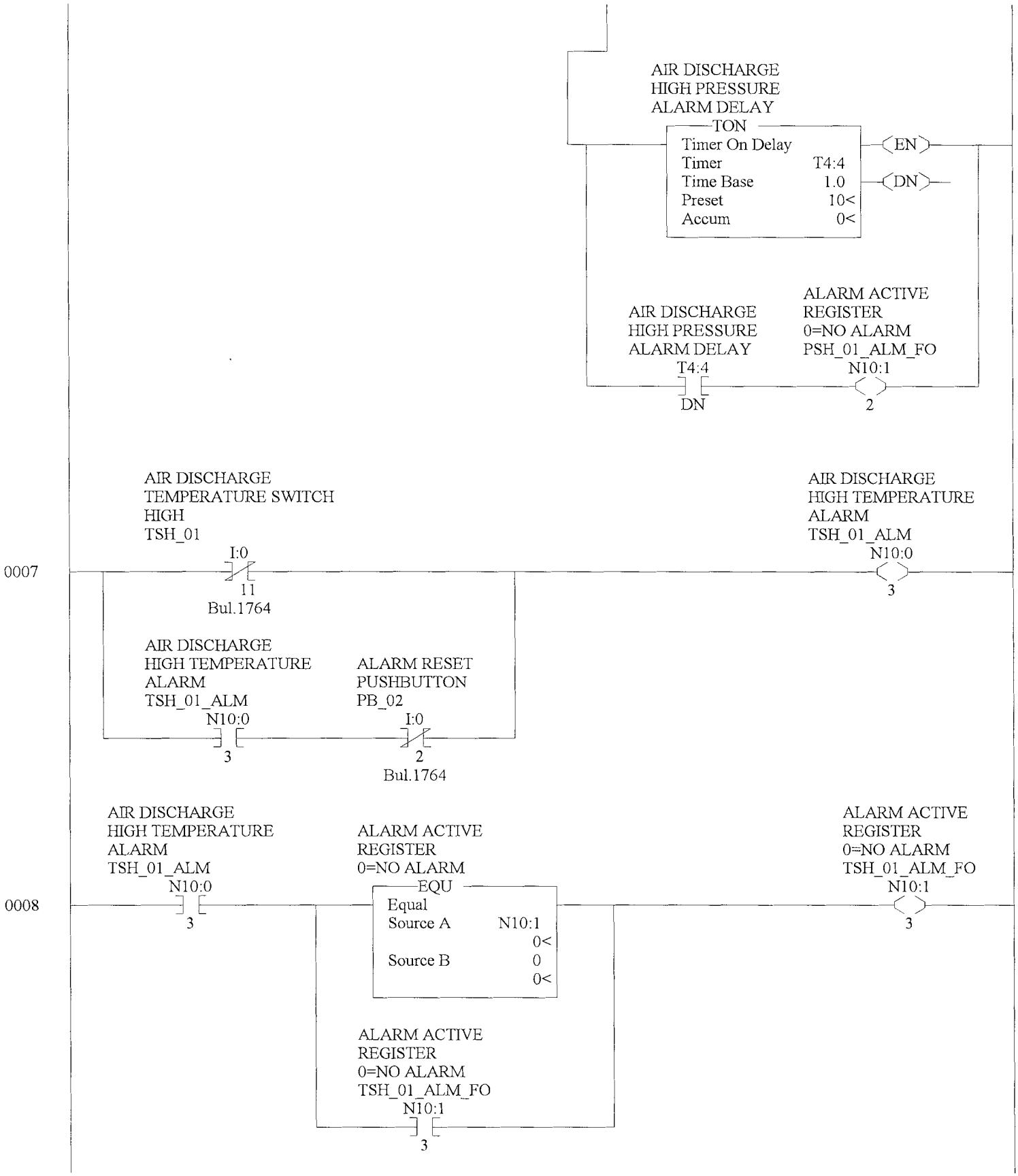
Name	Number	Type	Rungs	Debug	Bytes
[SYSTEM]	0	SYS	0	No	0
	1	SYS	0	No	0
MAIN	2	LADDER	29	No	937
RTD_SCALE	3	LADDER	7	No	129

Data File List

Name	Number	Type	Scope	Debug	Words	Elements	Last
OUTPUT	0	O	Global	No	4	4	O:3
INPUT	1	I	Global	No	12	12	I:11
STATUS	2	S	Global	No	66	66	S:65
BINARY	3	B	Global	No	1	1	B3:0
TIMER	4	T	Global	No	15	5	T4:4
COUNTER	5	C	Global	No	3	1	C5:0
CONTROL	6	R	Global	No	3	1	R6:0
INTEGER	7	N	Global	No	1	1	N7:0
FLOAT	8	F	Global	No	2	1	F8:0
	10	N	Global	No	10	10	N10:9
	11	N	Global	No	10	10	N11:9
	12	N	Global	No	10	10	N12:9


0000
JSR
Jump To Subroutine
SBR File Number U:3
0001
BLOWER HIGH VIBRATION SWITCH #1
VSH_01
I:0
8
Bul.1764
BLOWER HIGH VIBRATION ALARM
VSH_01_ALM
N10:0
0
BLOWER HIGH VIBRATION ALARM
VSH_01_ALM
N10:0
0
ALARM RESET PUSHBUTTON
PB_02
I:0
2
Bul.1764
0002
BLOWER HIGH VIBRATION ALARM
VSH_01_ALM
N10:0
0
ALARM ACTIVE REGISTER
0=NO ALARM
EQU
Equal
Source A N10:1
0<
Source B 0
0<
ALARM ACTIVE REGISTER
0=NO ALARM
VSH_01_ALM_FO
N10:1
0
ALARM ACTIVE REGISTER
0=NO ALARM
VSH_01_ALM_FO
N10:1
0
0003
BLOWER HIGH VIBRATION SWITCH #2
VSH_02
I:0
9
Bul.1764
BLOWER HIGH VIBRATION ALARM
VSH_02_ALM
N10:0
1
BLOWER HIGH VIBRATION ALARM
VSH_02_ALM
N10:0
1
ALARM RESET PUSHBUTTON
PB_02
I:0
2
Bul.1764


0004
BLOWER
HIGH VIBRATION
ALARM
VSH_02_ALM
N10:0
1
ALARM ACTIVE
REGISTER
0=NO ALARM
EQU
Equal
Source A
N10:1
0<
Source B
0
0<
ALARM ACTIVE
REGISTER
0=NO ALARM
VSH_02_ALM_FO
N10:1
1
ALARM ACTIVE
REGISTER
0=NO ALARM
VSH_02_ALM_FO
N10:1
1
0005
AIR DISCHARGE
PRESSURE SWITCH
PSH_01
I:0
10
Bul.1764
AIR DISCHARGE
HIGH PRESSURE
ALARM
PSH_01_ALM
N10:0
2
AIR DISCHARGE
HIGH PRESSURE
ALARM
PSH_01_ALM
N10:0
2
ALARM RESET
PUSHBUTTON
PB_02
I:0
2
Bul.1764
0006
AIR DISCHARGE
HIGH PRESSURE
ALARM
PSH_01_ALM
N10:0
2
ALARM ACTIVE
REGISTER
0=NO ALARM
EQU
Equal
Source A
N10:1
0<
Source B
0
0<
ALARM ACTIVE
REGISTER
0=NO ALARM
PSH_01_ALM_FO
N10:1
2


AIR DISCHARGE
HIGH PRESSURE
ALARM DELAY
TON
Timer On Delay
Timer T4:4
Time Base 1.0
Preset 10<
Accum 0<
EN
DN
AIR DISCHARGE
HIGH PRESSURE
ALARM DELAY
T4:4
DN
ALARM ACTIVE
REGISTER
0=NO ALARM
PSH_01_ALM_FO
N10:1
2
0007
AIR DISCHARGE
TEMPERATURE SWITCH
HIGH
TSH_01
I:0
11
Bul.1764
AIR DISCHARGE
HIGH TEMPERATURE
ALARM
TSH_01_ALM
N10:0
3
AIR DISCHARGE
HIGH TEMPERATURE
ALARM
TSH_01_ALM
N10:0
3
ALARM RESET
PUSHBUTTON
PB_02
I:0
2
Bul.1764
0008
AIR DISCHARGE
HIGH TEMPERATURE
ALARM
TSH_01_ALM
N10:0
3
ALARM ACTIVE
REGISTER
0=NO ALARM
EQU
Equal
Source A N10:1
0<
Source B 0
0<
ALARM ACTIVE
REGISTER
0=NO ALARM
TSH_01_ALM_FO
N10:1
3
ALARM ACTIVE
REGISTER
0=NO ALARM
TSH_01_ALM_FO
N10:1
3

0009

RTD-001
TEMPERATURE
INDICATOR

GEQ
Grtr Than or Eql (A>=B)
Source A N11:0
32<
Source B N12:0
230<

RTD-002
TEMPERATURE
INDICATOR

GEQ
Grtr Than or Eql (A>=B)
Source A N11:1
1562<
Source B N12:1
230<

RTD-003
TEMPERATURE
INDICATOR

GEQ
Grtr Than or Eql (A>=B)
Source A N11:2
1562<
Source B N12:2
230<

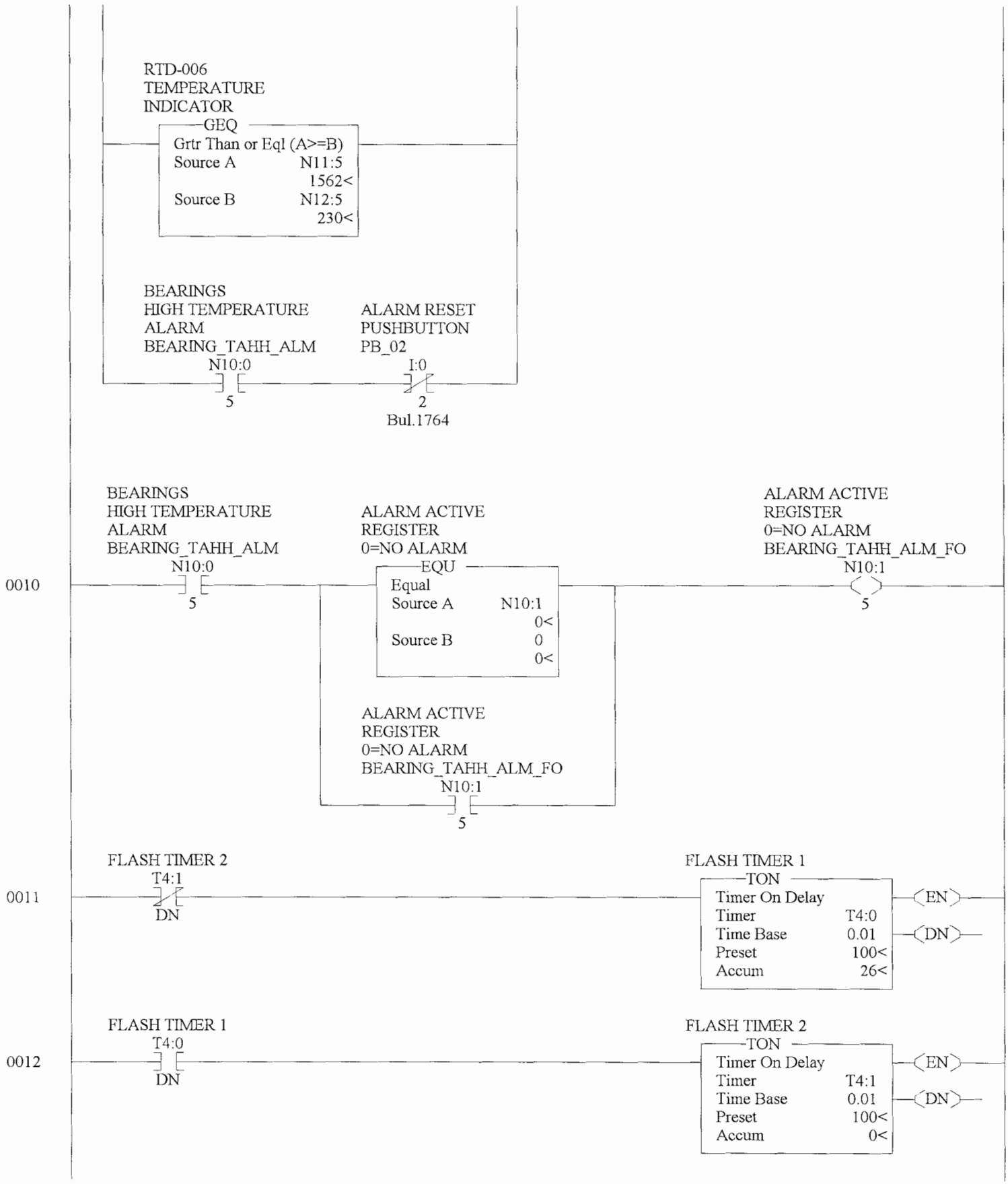
RTD-004
TEMPERATURE
INDICATOR

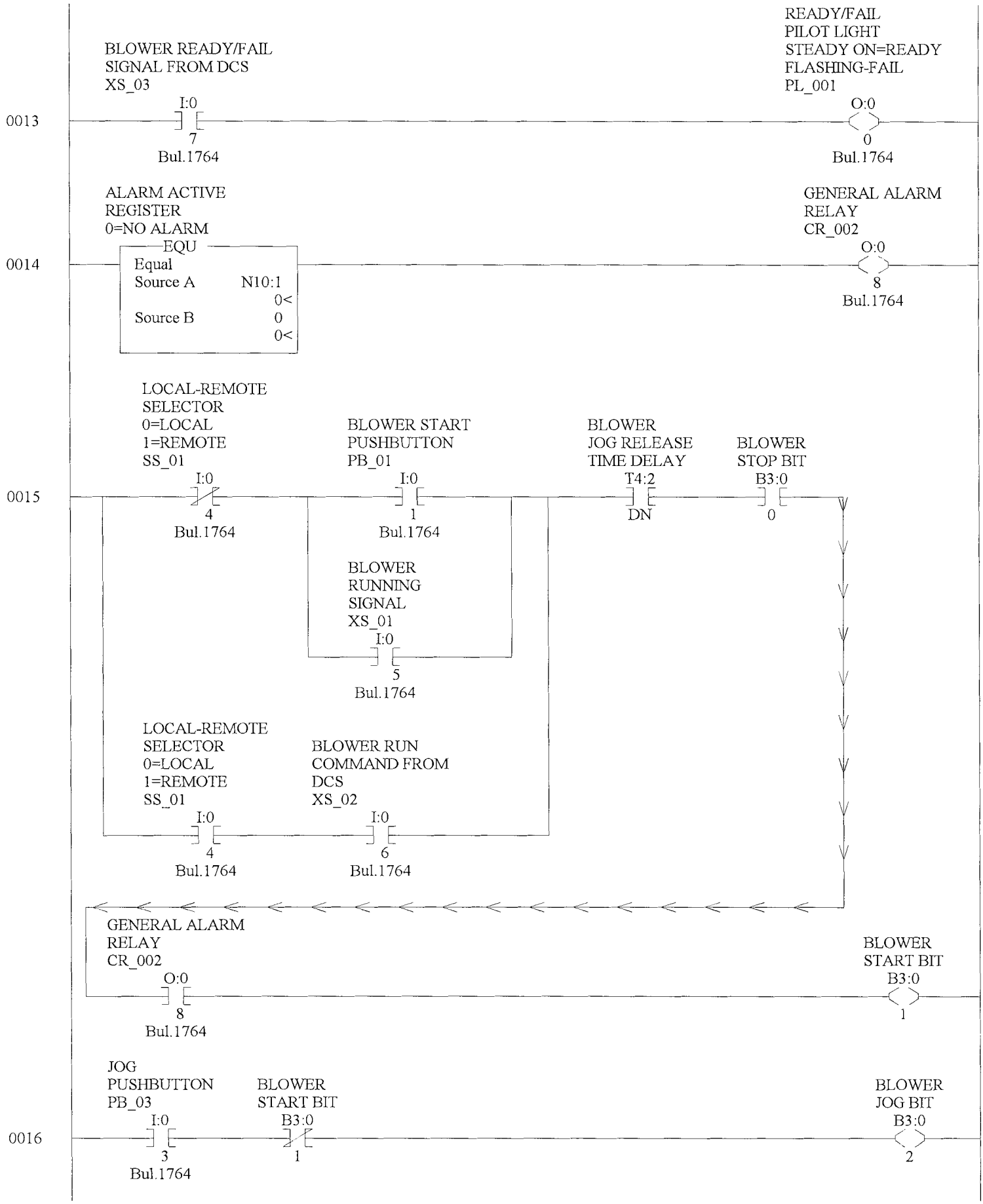
GEQ
Grtr Than or Eql (A>=B)
Source A N11:3
1562<
Source B N12:3
230<

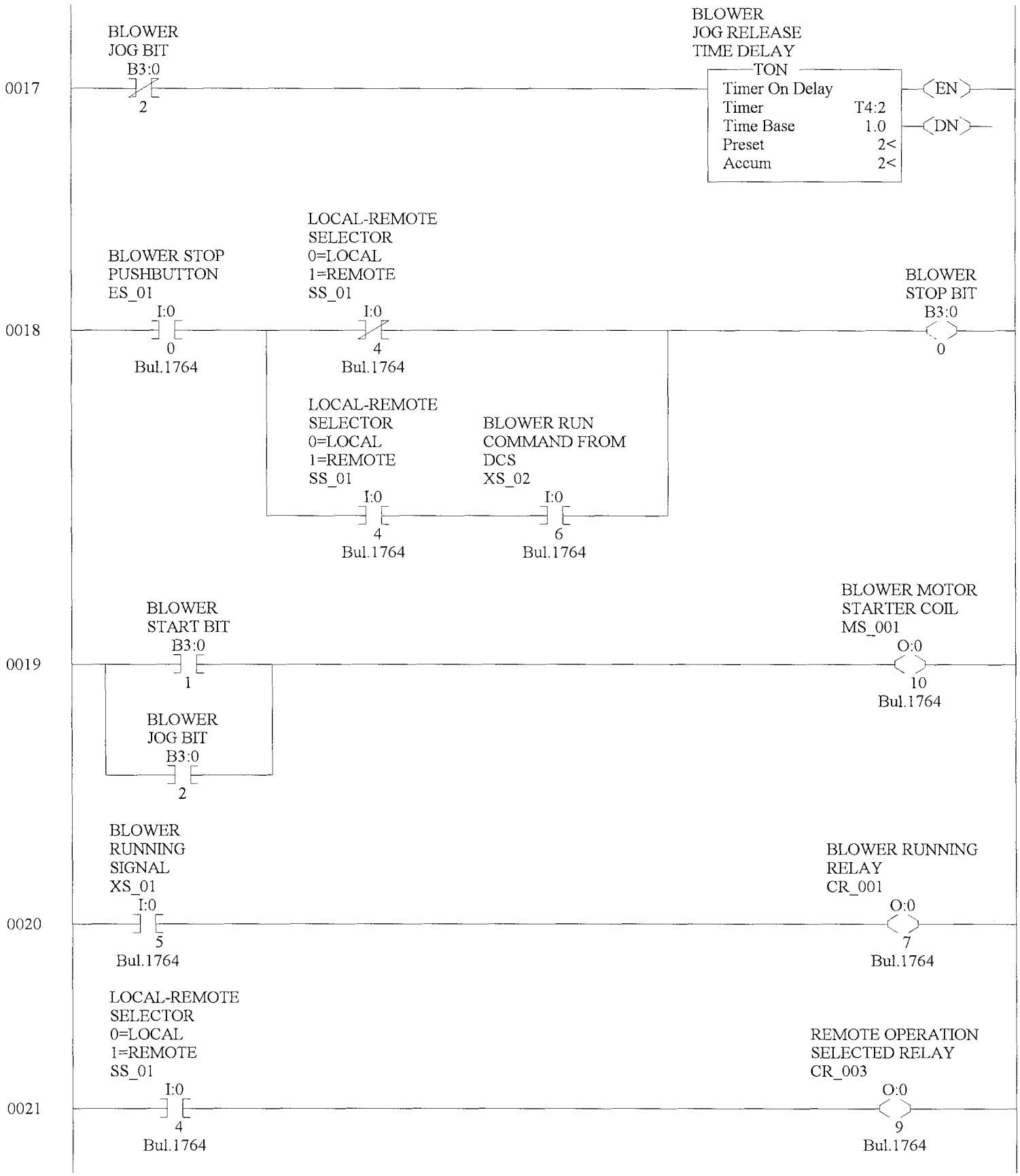
RTD-005
TEMPERATURE
INDICATOR

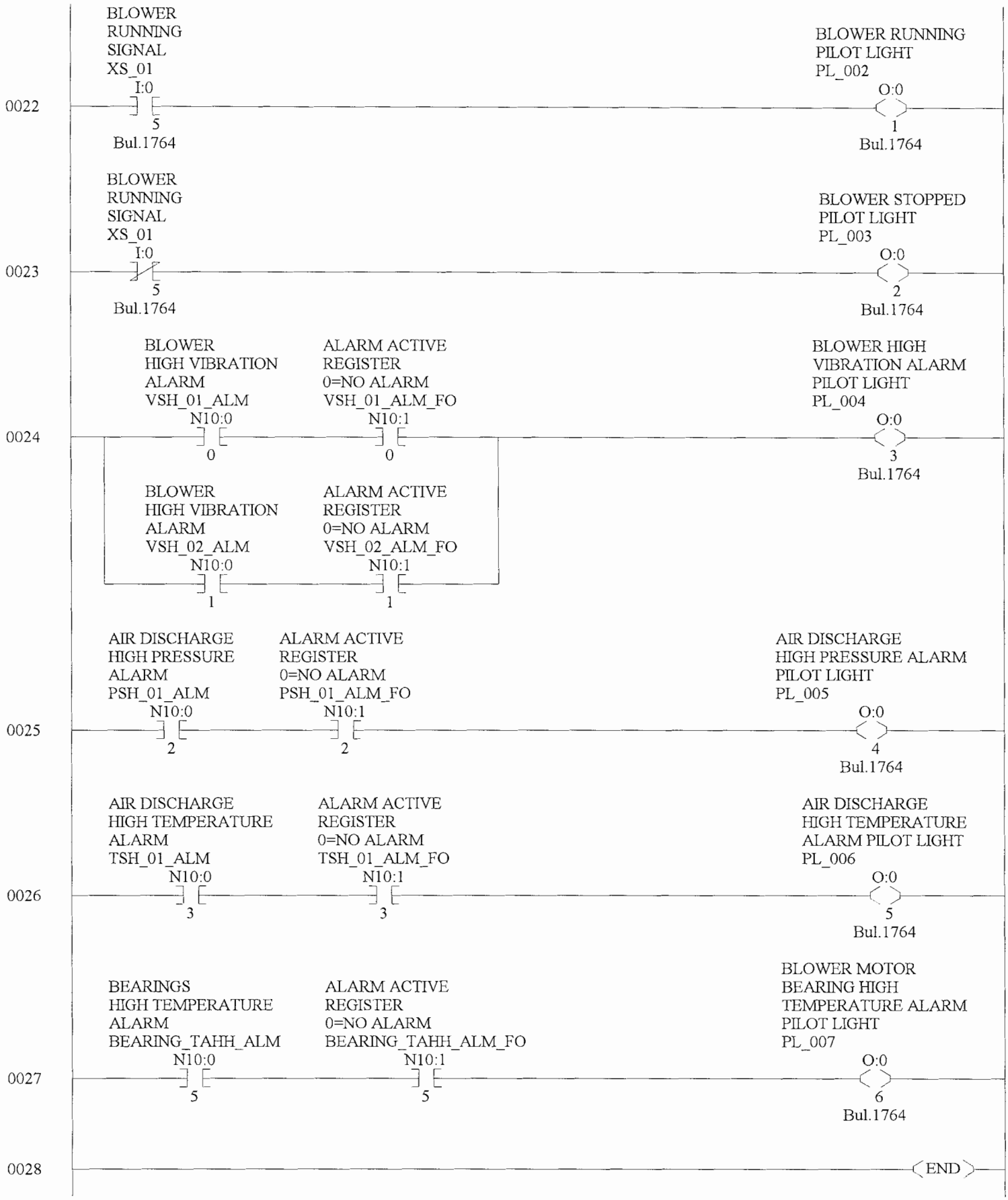
GEQ
Grtr Than or Eql (A>=B)
Source A N11:4
1562<
Source B N12:4
230<

BEARINGS
HIGH TEMPERATURE
ALARM
BEARING_TAHH_ALM
N10:0
5

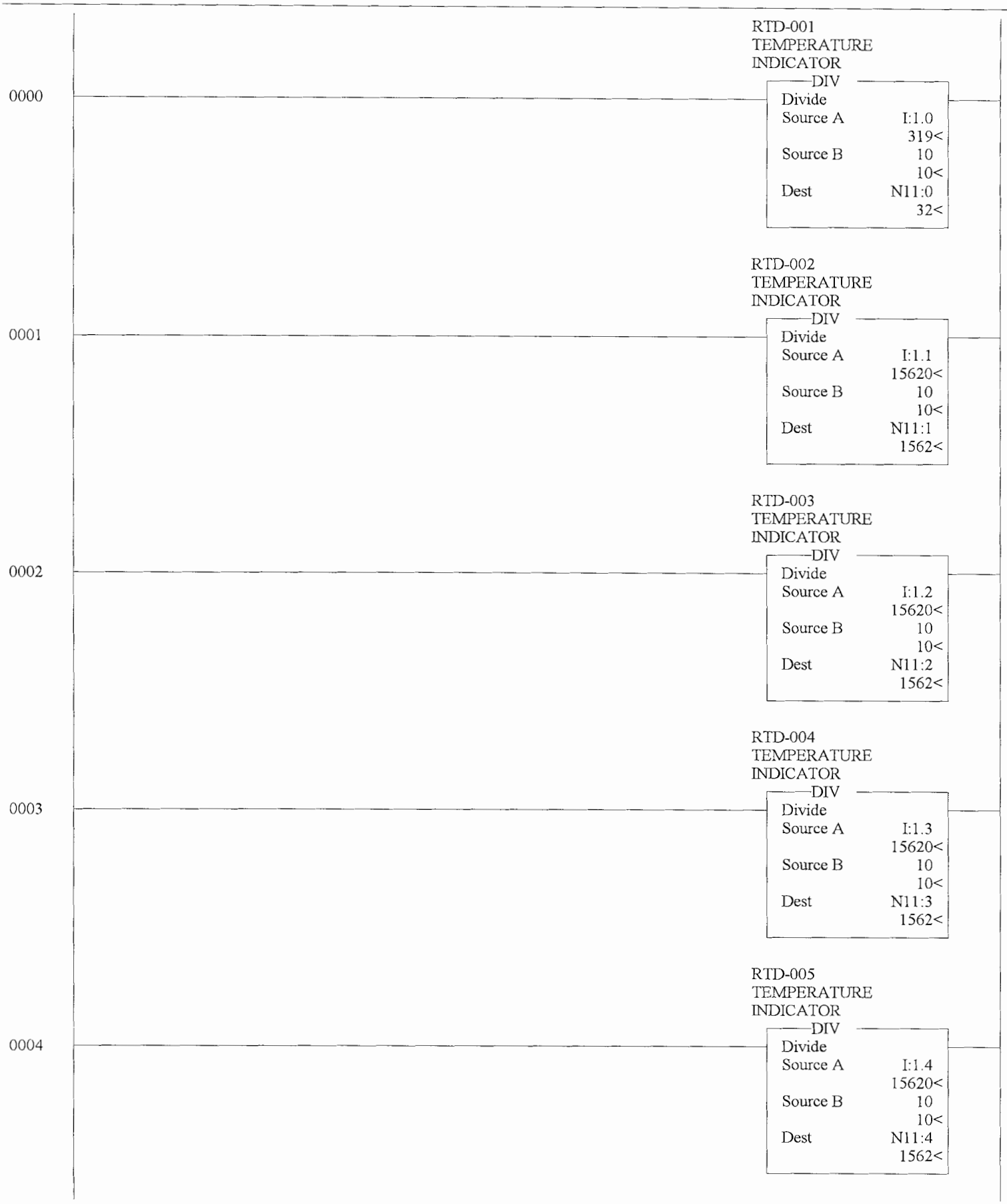

RTD-006
TEMPERATURE
INDICATOR
GEQ
Grtr Than or Eql (A>=B)
Source A N11:5
1562<
Source B N12:5
230<
BEARINGS
HIGH TEMPERATURE
ALARM
BEARING_TAHH_ALM
N10:0
5
ALARM RESET
PUSHBUTTON
PB_02
I:0
2
Bul.1764
0010
BEARINGS
HIGH TEMPERATURE
ALARM
BEARING_TAHH_ALM
N10:0
5
ALARM ACTIVE
REGISTER
0=NO ALARM
EQU
Equal
Source A N10:1
0<
Source B 0
0<
ALARM ACTIVE
REGISTER
0=NO ALARM
BEARING_TAHH_ALM_FO
N10:1
5
ALARM ACTIVE
REGISTER
0=NO ALARM
BEARING_TAHH_ALM_FO
N10:1
5
0011
FLASH TIMER 2
T4:1
DN
FLASH TIMER 1
TON
Timer On Delay
Timer T4:0
Time Base 0.01
Preset 100<
Accum 26<
EN
DN
0012
FLASH TIMER 1
T4:0
DN
FLASH TIMER 2
TON
Timer On Delay
Timer T4:1
Time Base 0.01
Preset 100<
Accum 0<
EN
DN


0013
BLOWER READY/FAIL
SIGNAL FROM DCS
XS_03
I:0
7
Bul.1764
READY/FAIL
PILOT LIGHT
STEADY ON=READY
FLASHING-FAIL
PL_001
O:0
0
Bul.1764
0014
ALARM ACTIVE
REGISTER
0=NO ALARM
EQU
Equal
Source A N10:1
0<
Source B 0
0<
GENERAL ALARM
RELAY
CR_002
O:0
8
Bul.1764
0015
LOCAL-REMOTE
SELECTOR
0=LOCAL
1=REMOTE
SS_01
I:0
4
Bul.1764
BLOWER START
PUSHBUTTON
PB_01
I:0
1
Bul.1764
BLOWER
JOG RELEASE
TIME DELAY
T4:2
DN
BLOWER
STOP BIT
B3:0
0
BLOWER
RUNNING
SIGNAL
XS_01
I:0
5
Bul.1764
LOCAL-REMOTE
SELECTOR
0=LOCAL
1=REMOTE
SS_01
I:0
4
Bul.1764
BLOWER RUN
COMMAND FROM
DCS
XS_02
I:0
6
Bul.1764
GENERAL ALARM
RELAY
CR_002
O:0
8
Bul.1764
BLOWER
START BIT
B3:0
1
0016
JOG
PUSHBUTTON
PB_03
I:0
3
Bul.1764
BLOWER
START BIT
B3:0
1
BLOWER
JOG BIT
B3:0
2

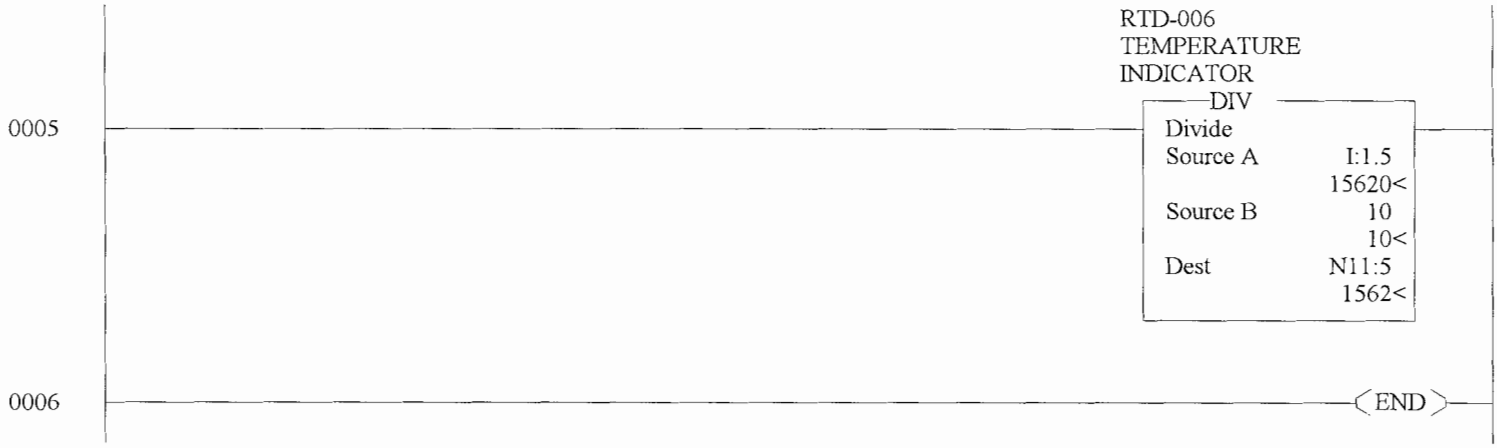

0017
BLOWER
JOG BIT
B3:0
2
BLOWER
JOG RELEASE
TIME DELAY
TON
Timer On Delay
Timer T4:2
Time Base 1.0
Preset 2<
Accum 2<
EN
DN
0018
BLOWER STOP
PUSHBUTTON
ES_01
I:0
0
Bul.1764
LOCAL-REMOTE
SELECTOR
0=LOCAL
1=REMOTE
SS_01
I:0
4
Bul.1764
BLOWER
STOP BIT
B3:0
0
LOCAL-REMOTE
SELECTOR
0=LOCAL
1=REMOTE
SS_01
I:0
4
Bul.1764
BLOWER RUN
COMMAND FROM
DCS
XS_02
I:0
6
Bul.1764
0019
BLOWER
START BIT
B3:0
1
BLOWER
JOG BIT
B3:0
2
BLOWER MOTOR
STARTER COIL
MS_001
O:0
10
Bul.1764
0020
BLOWER
RUNNING
SIGNAL
XS_01
I:0
5
Bul.1764
BLOWER RUNNING
RELAY
CR_001
O:0
7
Bul.1764
0021
LOCAL-REMOTE
SELECTOR
0=LOCAL
1=REMOTE
SS_01
I:0
4
Bul.1764
REMOTE OPERATION
SELECTED RELAY
CR_003
O:0
9
Bul.1764


0022
BLOWER RUNNING SIGNAL XS_01 I:0 5 Bul.1764
BLOWER RUNNING PILOT LIGHT PL_002 O:0 1 Bul.1764
0023
BLOWER RUNNING SIGNAL XS_01 I:0 5 Bul.1764
BLOWER STOPPED PILOT LIGHT PL_003 O:0 2 Bul.1764
0024
BLOWER HIGH VIBRATION ALARM VSH_01_ALM N10:0 0
ALARM ACTIVE REGISTER 0=NO ALARM VSH_01_ALM_FO N10:1 0
BLOWER HIGH VIBRATION ALARM VSH_02_ALM N10:0 1
ALARM ACTIVE REGISTER 0=NO ALARM VSH_02_ALM_FO N10:1 1
BLOWER HIGH VIBRATION ALARM PILOT LIGHT PL_004 O:0 3 Bul.1764
0025
AIR DISCHARGE HIGH PRESSURE ALARM PSH_01_ALM N10:0 2
ALARM ACTIVE REGISTER 0=NO ALARM PSH_01_ALM_FO N10:1 2
AIR DISCHARGE HIGH PRESSURE ALARM PILOT LIGHT PL_005 O:0 4 Bul.1764
0026
AIR DISCHARGE HIGH TEMPERATURE ALARM TSH_01_ALM N10:0 3
ALARM ACTIVE REGISTER 0=NO ALARM TSH_01_ALM_FO N10:1 3
AIR DISCHARGE HIGH TEMPERATURE ALARM PILOT LIGHT PL_006 O:0 5 Bul.1764
0027
BEARINGS HIGH TEMPERATURE ALARM BEARING_TAHH_ALM N10:0 5
ALARM ACTIVE REGISTER 0=NO ALARM BEARING_TAHH_ALM_FO N10:1 5
BLOWER MOTOR BEARING HIGH TEMPERATURE ALARM PILOT LIGHT PL_007 O:0 6 Bul.1764
0028
END

LAD 3 - RTD_SCALE --- Total Rungs in File = 7



LAD 3 - RTD_SCALE --- Total Rungs in File = 7



Data File O0 (bin) -- OUTPUT

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
O:0.0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	Bul.1764	Micrologix 1500 LSP Series C
O:0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1764	Micrologix 1500 LSP Series C
O:0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1764	Micrologix 1500 LSP Series C
O:0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1764	Micrologix 1500 LSP Series C

Data File I1 (bin) -- INPUT

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
I:0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1764 Micrologix 1500 LSP Series C
I:0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1764 Micrologix 1500 LSP Series C
I:0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1764 Micrologix 1500 LSP Series C
I:0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Bul.1764 Micrologix 1500 LSP Series C
I:1.0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1	1769-IR6 - 6 Channel RTD Module
I:1.1	0	0	1	1	1	1	0	1	0	0	0	0	0	1	0	0	1769-IR6 - 6 Channel RTD Module
I:1.2	0	0	1	1	1	1	0	1	0	0	0	0	0	1	0	0	1769-IR6 - 6 Channel RTD Module
I:1.3	0	0	1	1	1	1	0	1	0	0	0	0	0	1	0	0	1769-IR6 - 6 Channel RTD Module
I:1.4	0	0	1	1	1	1	0	1	0	0	0	0	0	1	0	0	1769-IR6 - 6 Channel RTD Module
I:1.5	0	0	1	1	1	1	0	1	0	0	0	0	0	1	0	0	1769-IR6 - 6 Channel RTD Module
I:1.6	0	0	1	1	1	1	1	0	0	0	1	1	1	1	1	0	1769-IR6 - 6 Channel RTD Module
I:1.7	0	0	0	1	0	1	0	1	0	1	0	1	0	0	0	0	1769-IR6 - 6 Channel RTD Module

Main

Processor Mode S:1/0 - S:1/4 = Remote Run
On Power up Go To Run (Mode Behavior) S:1/12 = 0
First Pass S:1/15 = No
Free Running Clock S:4 = 1010-0000-0101-0111

Proc

OS Catalog Number S:57 = 1500
OS Series S:58 = C
OS FRS S:59 = 6
Processor Catalog Number S:60 = 20563
Processor Series S:61 = A
Processor FRN S:62 = 4
User Program Type S:63 = 280
Compiler Revision Number S:64 = 1066

Scan Times

Maximum (x10 ms) S:22 = 15
Watchdog (x10 ms) S:3 (high byte) = 10
Last 100 uSec Scan Time S:35 = 7
Scan Toggle Bit S:33/9 = 0

Math

Math Overflow Selected S:2/14 = 0
Overflow Trap S:5/0 = 0
Carry S:0/0 = 0
Overflow S:0/1 = 0
Zero Bit S:0/2 = 0
Sign Bit S:0/3 = 0
Math Register (lo word) S:13 = 0
Math Register (high word) S:14-S:13 = 0
Math Register (32 Bit) S:14-S:13 = 0

Chan 0

Processor Mode S:1/0- S:1/4 = Remote Run
Node Address S:15 (low byte) = 0
Baud Rate S:15 (high byte) = ?
Channel Mode S:33/3 = 0
Comms Active S:33/4 = 0
Incoming Cmd Pending S:33/0 = 0
Msg Reply Pending S:33/1 = 0
Outgoing Msg Cmd Pending S:33/2 = 0

Debug

Suspend Code S:7 = 0
Suspend File S:8 = 0

Errors

Fault Override At Power Up S:1/8 = 0
Startup Protection Fault S:1/9 = 0
Major Error Halt S:1/13 = 0
Overflow Trap S:5/0 = 0
Control Register Error S:5/2 = 0
Major Error Executing User
Fault Rtn. S:5/3 = 0
Battery Low S:5/11 = 0
Input Filter Selection Modified S:5/13 = 0
ASCII String Manipulation error S:5/15 = 0
Fault Routine S:29 = 0
Major Error S:6 = 0h
Error Description:

Protection

Deny Future Access S:1/14 = No
Data File Overwrite Protection Lost S:36/10 = False

Mem Module

Memory Module Loaded On Boot S:5/8 = 0
Password Mismatch S:5/9 = 0
Load Memory Module On Memory Error S:1/10 = 0
Load Memory Module Always S:1/11 = 0
On Power up Go To Run (Mode Behavior) S:1/12 = 0
Program Compare S:2/9 = 0
Data File Overwrite Protection Lost S:36/10 = 0

Forces

Forces Enabled S:1/5 = Yes
Forces Installed S:1/6 = No

Data File B3 (bin) -- BINARY

Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	(Symbol) Description
B3:0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	

Data File T4 -- TIMER

Offset	EN	TT	DN	BASE	PRE	ACC	(Symbol) Description
T4:0	1	1	0	.01 sec	100	26	FLASH TIMER 1
T4:1	0	0	0	.01 sec	100	0	FLASH TIMER 2
T4:2	1	0	1	1.0 sec	2	2	BLOWER JOG RELEASE TIME DELAY
T4:3	0	0	0	1.0 sec	5	0	READY/FAIL SIGNAL FROM DCS IS A STEADY SIGNAL AND NOT FLASHING
T4:4	0	0	0	1.0 sec	10	0	AIR DISCHARGE HIGH PRESSURE ALARM DELAY

Data File C5 -- COUNTER

Offset	CU	CD	DN	OV	UN	UA	PRE	ACC	(Symbol)	Description
C5:0	0	0	0	0	0	0	0	0		

Data File R6 -- CONTROL

Offset	EN	EU	DN	EM	ER	UL	IN	FD	LEN	POS	(Symbol)	Description
R6:0	0	0	0	0	0	0	0	0	0	0		

Data File N7 (dec) -- INTEGER

Offset	0	1	2	3	4	5	6	7	8	9
N7:0	0									

Data File F8 -- FLOAT

Offset	0	1	2	3	4
F8:0	0				

Data File N10 (dec)

Offset	0	1	2	3	4	5	6	7	8	9
N10:0	63	0	0	0	0	0	0	0	0	0

Data File N11 (dec)

Offset	0	1	2	3	4	5	6	7	8	9
N11:0	32	1562	1562	1562	1562	1562	0	0	0	0

Data File N12 (dec)

Offset	0	1	2	3	4	5	6	7	8	9
N12:0	230	230	230	230	230	230	0	0	0	0

Address (Symbol) = Value

Address (Symbol) = Value, File Description, Description

```
O:0/0       - {PL_001} READY/FAIL PILOT LIGHT STEADY ON=READY FLASHING-FAIL
              OTE - File #2 MAIN - 13
O:0/1       - {PL_002} BLOWER RUNNING PILOT LIGHT
              OTE - File #2 MAIN - 22
O:0/2       - {PL_003} BLOWER STOPPED PILOT LIGHT
              OTE - File #2 MAIN - 23
O:0/3       - {PL_004} BLOWER HIGH VIBRATION ALARM PILOT LIGHT
              OTE - File #2 MAIN - 24
O:0/4       - {PL_005} AIR DISCHARGE HIGH PRESSURE ALARM PILOT LIGHT
              OTE - File #2 MAIN - 25
O:0/5       - {PL_006} AIR DISCHARGE HIGH TEMPERATURE ALARM PILOT LIGHT
              OTE - File #2 MAIN - 26
O:0/6       - {PL_007} BLOWER MOTOR BEARING HIGH TEMPERATURE ALARM PILOT LIGHT
              OTE - File #2 MAIN - 27
O:0/7       - {CR_001} BLOWER RUNNING RELAY
              OTE - File #2 MAIN - 20
O:0/8       - {CR_002} GENERAL ALARM RELAY
              OTE - File #2 MAIN - 14
              XIC - File #2 MAIN - 15
O:0/9       - {CR_003} REMOTE OPERATION SELECTED RELAY
              OTE - File #2 MAIN - 21
O:0/10      - {MS_001} BLOWER MOTOR STARTER COIL
              OTE - File #2 MAIN - 19
I:0/0       - {ES_01} BLOWER STOP PUSHBUTTON
              XIC - File #2 MAIN - 18
I:0/1       - {PB_01} BLOWER START PUSHBUTTON
              XIC - File #2 MAIN - 15
I:0/2       - {PB_02} ALARM RESET PUSHBUTTON
              XIO - File #2 MAIN - 1, 3, 5, 7, 9
I:0/3       - {PB_03} JOG PUSHBUTTON
              XIC - File #2 MAIN - 16
I:0/4       - {SS_01} LOCAL-REMOTE SELECTOR 0=LOCAL 1=REMOTE
              XIC - File #2 MAIN - 15, 18, 21
              XIO - File #2 MAIN - 15, 18
I:0/5       - {XS_01} BLOWER RUNNING SIGNAL
              XIC - File #2 MAIN - 15, 20, 22
              XIO - File #2 MAIN - 23
I:0/6       - {XS_02} BLOWER RUN COMMAND FROM DCS
              XIC - File #2 MAIN - 15, 18
I:0/7       - {XS_03} BLOWER READY/FAIL SIGNAL FROM DCS
              XIC - File #2 MAIN - 13
I:0/8       - {VSH_01} BLOWER HIGH VIBRATION SWITCH #1
              XIO - File #2 MAIN - 1
I:0/9       - {VSH_02} BLOWER HIGH VIBRATION SWITCH #2
              XIO - File #2 MAIN - 3
I:0/10      - {PSH_01} AIR DISCHARGE PRESSURE SWITCH
              XIO - File #2 MAIN - 5
I:0/11      - {TSH_01} AIR DISCHARGE TEMPERATURE SWITCH HIGH
              XIO - File #2 MAIN - 7
I:1.0       - DIV - File #3 RTD_SCALE - 0
I:1.1       - DIV - File #3 RTD_SCALE - 1
I:1.2       - DIV - File #3 RTD_SCALE - 2
I:1.3       - DIV - File #3 RTD_SCALE - 3
I:1.4       - DIV - File #3 RTD_SCALE - 4
I:1.5       - DIV - File #3 RTD_SCALE - 5
B3:0/0      - BLOWER STOP BIT
              OTE - File #2 MAIN - 18
              XIC - File #2 MAIN - 15
B3:0/1      - BLOWER START BIT
              OTE - File #2 MAIN - 15
              XIC - File #2 MAIN - 19
              XIO - File #2 MAIN - 16
B3:0/2      - BLOWER JOG BIT
              OTE - File #2 MAIN - 16
              XIC - File #2 MAIN - 19
              XIO - File #2 MAIN - 17
T4:0        - FLASH TIMER 1
              TON - File #2 MAIN - 11
T4:0/DN     - XIC - File #2 MAIN - 12
T4:1        - FLASH TIMER 2
              TON - File #2 MAIN - 12
T4:1/DN     - XIO - File #2 MAIN - 11
```

```
T4:2          - BLOWER JOG RELEASE TIME DELAY
                TON - File #2 MAIN - 17
T4:2/DN       - XIC - File #2 MAIN - 15
T4:4          - AIR DISCHARGE HIGH PRESSURE ALARM DELAY
                TON - File #2 MAIN - 6
T4:4/DN       - XIC - File #2 MAIN - 6
N10:0/0       - {VSH_01_ALM} BLOWER HIGH VIBRATION ALARM
                OTE - File #2 MAIN - 1
                XIC - File #2 MAIN - 1, 2, 24
N10:0/1       - {VSH_02_ALM} BLOWER HIGH VIBRATION ALARM
                OTE - File #2 MAIN - 3
                XIC - File #2 MAIN - 3, 4, 24
N10:0/2       - {PSH_01_ALM} AIR DISCHARGE HIGH PRESSURE ALARM
                OTE - File #2 MAIN - 5
                XIC - File #2 MAIN - 5, 6, 25
N10:0/3       - {TSH_01_ALM} AIR DISCHARGE HIGH TEMPERATURE ALARM
                OTE - File #2 MAIN - 7
                XIC - File #2 MAIN - 7, 8, 26
N10:0/5       - {BEARING_TAHH_ALM} BEARINGS HIGH TEMPERATURE ALARM
                OTE - File #2 MAIN - 9
                XIC - File #2 MAIN - 9, 10, 27
N10:1         - ALARM ACTIVE REGISTER 0=NO ALARM
                EQU - File #2 MAIN - 2, 4, 6, 8, 10, 14
N10:1/0       - {VSH_01_ALM_FO}
                OTE - File #2 MAIN - 2
                XIC - File #2 MAIN - 2, 24
N10:1/1       - {VSH_02_ALM_FO}
                OTE - File #2 MAIN - 4
                XIC - File #2 MAIN - 4, 24
N10:1/2       - {PSH_01_ALM_FO}
                OTE - File #2 MAIN - 6
                XIC - File #2 MAIN - 6, 25
N10:1/3       - {TSH_01_ALM_FO}
                OTE - File #2 MAIN - 8
                XIC - File #2 MAIN - 8, 26
N10:1/5       - {BEARING_TAHH_ALM_FO}
                OTE - File #2 MAIN - 10
                XIC - File #2 MAIN - 10, 27
N11:0         - RTD-001 TEMPERATURE INDICATOR
                DIV - File #3 RTD_SCALE - 0
                GEQ - File #2 MAIN - 9
N11:1         - RTD-002 TEMPERATURE INDICATOR
                DIV - File #3 RTD_SCALE - 1
                GEQ - File #2 MAIN - 9
N11:2         - RTD-003 TEMPERATURE INDICATOR
                DIV - File #3 RTD_SCALE - 2
                GEQ - File #2 MAIN - 9
N11:3         - RTD-004 TEMPERATURE INDICATOR
                DIV - File #3 RTD_SCALE - 3
                GEQ - File #2 MAIN - 9
N11:4         - RTD-005 TEMPERATURE INDICATOR
                DIV - File #3 RTD_SCALE - 4
                GEQ - File #2 MAIN - 9
N11:5         - RTD-006 TEMPERATURE INDICATOR
                DIV - File #3 RTD_SCALE - 5
                GEQ - File #2 MAIN - 9
N12:0         - RTD-001 HIGH TEMPERATURE ALARM SETPOINT
                GEQ - File #2 MAIN - 9
N12:1         - RTD-002 HIGH TEMPERATURE ALARM SETPOINT
                GEQ - File #2 MAIN - 9
N12:2         - RTD-002 HIGH TEMPERATURE ALARM SETPOINT
                GEQ - File #2 MAIN - 9
N12:3         - RTD-004 HIGH TEMPERATURE ALARM SETPOINT
                GEQ - File #2 MAIN - 9
N12:4         - RTD-005 HIGH TEMPERATURE ALARM SETPOINT
                GEQ - File #2 MAIN - 9
N12:5         - RTD-006 HIGH TEMPERATURE ALARM SETPOINT
                GEQ - File #2 MAIN - 9
U:3           - JSR - File #2 MAIN - 0
```

Data File O0 -- OUTPUT Usage

Offset	FW	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
O:0.0		.	.	.	.	.	X	X	X	X	X	X	X	X	X	X	X	Bul.1764	Micrologix 1500 LSP Series C
O:0.1		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Bul.1764	Micrologix 1500 LSP Series C
O:0.2		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Bul.1764	Micrologix 1500 LSP Series C
O:0.3		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Bul.1764	Micrologix 1500 LSP Series C

Data File I1 -- INPUT Usage

Offset	FW	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
I:0.0		.	.	.	.	X	X	X	X	X	X	X	X	X	X	X	X	Bul.1764	Micrologix 1500 LSP Series C
I:0.1		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Bul.1764	Micrologix 1500 LSP Series C
I:0.2		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Bul.1764	Micrologix 1500 LSP Series C
I:0.3		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	Bul.1764	Micrologix 1500 LSP Series C
I:1.0	W	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1769-IR6 - 6 Channel RTD Module	
I:1.1	W	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1769-IR6 - 6 Channel RTD Module	
I:1.2	W	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1769-IR6 - 6 Channel RTD Module	
I:1.3	W	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1769-IR6 - 6 Channel RTD Module	
I:1.4	W	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1769-IR6 - 6 Channel RTD Module	
I:1.5	W	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1769-IR6 - 6 Channel RTD Module	
I:1.6		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1769-IR6 - 6 Channel RTD Module	
I:1.7		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1769-IR6 - 6 Channel RTD Module	

Main

Processor Mode S:1/0 - S:1/4 = Remote Run
On Power up Go To Run (Mode Behavior) S:1/12 = 0
First Pass S:1/15 = No
Free Running Clock S:4 = 1010-0000-0101-0111

Proc

OS Catalog Number S:57 = 1500
OS Series S:58 = C
OS FRS S:59 = 6
Processor Catalog Number S:60 = 20563
Processor Series S:61 = A
Processor FRN S:62 = 4
User Program Type S:63 = 280
Compiler Revision Number S:64 = 1066

Scan Times

Maximum (x10 ms) S:22 = 15
Watchdog (x10 ms) S:3 (high byte) = 10
Last 100 uSec Scan Time S:35 = 7
Scan Toggle Bit S:33/9 = 0

Math

Math Overflow Selected S:2/14 = 0
Overflow Trap S:5/0 = 0
Carry S:0/0 = 0
Overflow S:0/1 = 0
Zero Bit S:0/2 = 0
Sign Bit S:0/3 = 0
Math Register (lo word) S:13 = 0
Math Register (high word) S:14-S:13 = 0
Math Register (32 Bit) S:14-S:13 = 0

Chan 0

Processor Mode S:1/0- S:1/4 = Remote Run
Node Address S:15 (low byte) = 0
Baud Rate S:15 (high byte) = ?
Channel Mode S:33/3 = 0
Comms Active S:33/4 = 0
Incoming Cmd Pending S:33/0 = 0
Msg Reply Pending S:33/1 = 0
Outgoing Msg Cmd Pending S:33/2 = 0

Debug

Suspend Code S:7 = 0
Suspend File S:8 = 0

Errors

Fault Override At Power Up S:1/8 = 0
Startup Protection Fault S:1/9 = 0
Major Error Halt S:1/13 = 0
Overflow Trap S:5/0 = 0
Control Register Error S:5/2 = 0
Major Error Executing User
Fault Rtn. S:5/3 = 0
Battery Low S:5/11 = 0
Input Filter Selection Modified S:5/13 = 0
ASCII String Manipulation error S:5/15 = 0
Fault Routine S:29 = 0
Major Error S:6 = 0h
Error Description:

Protection

Deny Future Access S:1/14 = No
Data File Overwrite Protection Lost S:36/10 = False

Mem Module

Memory Module Loaded On Boot S:5/8 = 0
Password Mismatch S:5/9 = 0
Load Memory Module On Memory Error S:1/10 = 0
Load Memory Module Always S:1/11 = 0
On Power up Go To Run (Mode Behavior) S:1/12 = 0
Program Compare S:2/9 = 0
Data File Overwrite Protection Lost S:36/10 = 0

Forces

Forces Enabled S:1/5 = Yes
Forces Installed S:1/6 = No

Data File B3 -- BINARY Usage

Offset	FW	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	(Symbol) Description
B3:0		.	.	.	.	.	.	.	.	.	.	.	.	.	X	X	X	

Data File T4 -- TIMER Usage

Offset	FW	EN	TT	DN	BASE	PRE	ACC	(Symbol) Description
T4:0	W	.	.	X	.	.	.	FLASH TIMER 1
T4:1	W	.	.	X	.	.	.	FLASH TIMER 2
T4:2	W	.	.	X	.	.	.	BLOWER JOG RELEASE TIME DELAY
T4:3		.	.	.	.	.	.	READY/FAIL SIGNAL FROM DCS IS A STEADY SIGNAL AND NOT FLAS
T4:4	W	.	.	X	.	.	.	AIR DISCHARGE HIGH PRESSURE ALARM DELAY

Data File C5 -- COUNTER Usage

Offset	FW	CU	CD	DN	OV	UN	UA	PRE	ACC	(Symbol)	Description
C5:0		.	.	.	.	.	.	.	.		

Data File R6 -- CONTROL Usage

Offset	FW	EN	EU	DN	EM	ER	UL	IN	FD	LEN	POS	(Symbol)	Description
R6:0		.	.	.	.	.	.	.	.	.	.		

Data File N7 -- INTEGER Usage

Offset	0	1	2	3	4	5	6	7	8	9
N7:0	.									

Data File F8 -- FLOAT Usage

Offset	0	1	2	3	4
F8:0	.				

Data File N10 Usage

Offset	0	1	2	3	4	5	6	7	8	9
N10:0	X	X	.	.	.	.	.	.	.	.

Data File N11 Usage

Offset	0	1	2	3	4	5	6	7	8	9
N11:0	X	X	X	X	X	X	.	.	.	.

Address/Symbol Database

Address	Symbol	Scope	Description
B3:0/0			BLOWER STOP BIT
B3:0/1			BLOWER START BIT
B3:0/2			BLOWER JOG BIT
I:0/0	ES_01	Global	BLOWER STOP PUSHBUTTON
I:0/1	PB_01	Global	BLOWER START PUSHBUTTON
I:0/2	PB_02	Global	ALARM RESET PUSHBUTTON
I:0/3	PB_03	Global	JOG PUSHBUTTON
I:0/4	SS_01	Global	LOCAL-REMOTE SELECTOR 0=LOCAL 1=REMOTE
I:0/5	XS_01	Global	BLOWER RUNNING SIGNAL
I:0/6	XS_02	Global	BLOWER RUN COMMAND FROM DCS
I:0/7	XS_03	Global	BLOWER READY/FAIL SIGNAL FROM DCS
I:0/8	VSH_01	Global	BLOWER HIGH VIBRATION SWITCH #1
I:0/9	VSH_02	Global	BLOWER HIGH VIBRATION SWITCH #2
I:0/10	PSH_01	Global	AIR DISCHARGE PRESSURE SWITCH
I:0/11	TSH_01	Global	AIR DISCHARGE TEMPERATURE SWITCH HIGH
N10:0/0	VSH_01_ALM	Global	BLOWER HIGH VIBRATION ALARM
N10:0/1	VSH_02_ALM	Global	BLOWER HIGH VIBRATION ALARM
N10:0/2	PSH_01_ALM	Global	AIR DISCHARGE HIGH PRESSURE ALARM
N10:0/3	TSH_01_ALM	Global	AIR DISCHARGE HIGH TEMPERATURE ALARM
N10:0/4	DCS_SIGNAL	Global	DCS SIGNAL 0=READY 1=FAIL
N10:0/5	BEARING_TAHH_ALM	Global	BEARINGS HIGH TEMPERATURE ALARM
N10:1			ALARM ACTIVE REGISTER 0=NO ALARM
N10:1/0	VSH_01_ALM_FO	Global	
N10:1/1	VSH_02_ALM_FO	Global	
N10:1/2	PSH_01_ALM_FO	Global	
N10:1/3	TSH_01_ALM_FO	Global	
N10:1/4	DCS_SD_FO	Global	
N10:1/5	BEARING_TAHH_ALM_FO	Global	
N11:0			RTD-001 TEMPERATURE INDICATOR
N11:1			RTD-002 TEMPERATURE INDICATOR
N11:2			RTD-003 TEMPERATURE INDICATOR
N11:3			RTD-004 TEMPERATURE INDICATOR
N11:4			RTD-005 TEMPERATURE INDICATOR
N11:5			RTD-006 TEMPERATURE INDICATOR
N12:0			RTD-001 HIGH TEMPERATURE ALARM SETPOINT
N12:1			RTD-002 HIGH TEMPERATURE ALARM SETPOINT
N12:2			RTD-002 HIGH TEMPERATURE ALARM SETPOINT
N12:3			RTD-004 HIGH TEMPERATURE ALARM SETPOINT
N12:4			RTD-005 HIGH TEMPERATURE ALARM SETPOINT
N12:5			RTD-006 HIGH TEMPERATURE ALARM SETPOINT
O:0/0	PL_001	Global	READY/FAIL PILOT LIGHT STEADY ON=READY FLASHING-FAIL
O:0/1	PL_002	Global	BLOWER RUNNING PILOT LIGHT
O:0/2	PL_003	Global	BLOWER STOPPED PILOT LIGHT
O:0/3	PL_004	Global	BLOWER HIGH VIBRATION ALARM PILOT LIGHT
O:0/4	PL_005	Global	AIR DISCHARGE HIGH PRESSURE ALARM PILOT LIGHT
O:0/5	PL_006	Global	AIR DISCHARGE HIGH TEMPERATURE ALARM PILOT LIGHT
O:0/6	PL_007	Global	BLOWER MOTOR BEARING HIGH TEMPERATURE ALARM PILOT LIGHT
O:0/7	CR_001	Global	BLOWER RUNNING RELAY
O:0/8	CR_002	Global	GENERAL ALARM RELAY
O:0/9	CR_003	Global	REMOTE OPERATION SELECTED RELAY
O:0/10	MS_001	Global	BLOWER MOTOR STARTER COIL
S:0			Arithmetic Flags
S:0/0			Processor Arithmetic Carry Flag
S:0/1			Processor Arithmetic Underflow/ Overflow Flag
S:0/2			Processor Arithmetic Zero Flag
S:0/3			Processor Arithmetic Sign Flag
S:1			Processor Mode Status/ Control
S:1/0			Processor Mode Bit 0
S:1/1			Processor Mode Bit 1
S:1/2			Processor Mode Bit 2
S:1/3			Processor Mode Bit 3
S:1/4			Processor Mode Bit 4
S:1/5			Forces Enabled
S:1/6			Forces Present
S:1/7			Comms Active
S:1/8			Fault Override at Powerup
S:1/9			Startup Protection Fault
S:1/10			Load Memory Module on Memory Error
S:1/11			Load Memory Module Always
S:1/12			Load Memory Module and RUN
S:1/13			Major Error Halted
S:1/14			Access Denied
S:1/15			First Pass
S:2/0			STI Pending
S:2/1			STI Enabled
S:2/2			STI Executing
S:2/3			Index Addressing File Range
S:2/4			Saved with Debug Single Step
S:2/5			DH-485 Incoming Command Pending
S:2/6			DH-485 Message Reply Pending
S:2/7			DH-485 Outgoing Message Command Pending
S:2/15			Comms Servicing Selection
S:3			Current Scan Time/ Watchdog Scan Time

Address/Symbol Database

Address	Symbol	Scope	Description
S:4			Time Base
S:5/0			Overflow Trap
S:5/2			Control Register Error
S:5/3			Major Err Detected Executing UserFault Routine
S:5/4			M0-M1 Referenced on Disabled Slot
S:5/8			Memory Module Boot
S:5/9			Memory Module Password Mismatch
S:5/10			STI Overflow
S:5/11			Battery Low
S:6			Major Error Fault Code
S:7			Suspend Code
S:8			Suspend File
S:9			Active Nodes
S:10			Active Nodes
S:11			I/O Slot Enables
S:12			I/O Slot Enables
S:13			Math Register
S:14			Math Register
S:15			Node Address/ Baud Rate
S:16			Debug Single Step Rung
S:17			Debug Single Step File
S:18			Debug Single Step Breakpoint Rung
S:19			Debug Single Step Breakpoint File
S:20			Debug Fault/ Powerdown Rung
S:21			Debug Fault/ Powerdown File
S:22			Maximum Observed Scan Time
S:23			Average Scan Time
S:24			Index Register
S:25			I/O Interrupt Pending
S:26			I/O Interrupt Pending
S:27			I/O Interrupt Enabled
S:28			I/O Interrupt Enabled
S:29			User Fault Routine File Number
S:30			STI Setpoint
S:31			STI File Number
S:32			I/O Interrupt Executing
S:33			Extended Proc Status Control Word
S:33/0			Incoming Command Pending
S:33/1			Message Reply Pending
S:33/2			Outgoing Message Command Pending
S:33/3			Selection Status User/DF1
S:33/4			Communicat Active
S:33/5			Communicat Servicing Selection
S:33/6			Message Servicing Selection Channel 0
S:33/7			Message Servicing Selection Channel 1
S:33/8			Interrupt Latency Control Flag
S:33/9			Scan Toggle Flag
S:33/10			Discrete Input Interrupt Reconfigur Flag
S:33/11			Online Edit Status
S:33/12			Online Edit Status
S:33/13			Scan Time Timebase Selection
S:33/14			DTR Control Bit
S:33/15			DTR Force Bit
S:34			Pass-thru Disabled
S:34/0			Pass-Thru Disabled Flag
S:34/1			DH+ Active Node Table Enable Flag
S:34/2			Floating Point Math Flag Disable,Fl
S:35			Last 1 ms Scan Time
S:36			Extended Minor Error Bits
S:36/8			DII Lost
S:36/9			STI Lost
S:36/10			Memory Module Data File Overwrite Protection
S:37			Clock Calendar Year
S:38			Clock Calendar Month
S:39			Clock Calendar Day
S:40			Clock Calendar Hours
S:41			Clock Calendar Minutes
S:42			Clock Calendar Seconds
S:43			STI Interrupt Time
S:44			I/O Event Interrupt Time
S:45			DII Interrupt Time
S:46			Discrete Input Interrupt- File Number
S:47			Discrete Input Interrupt- Slot Number
S:48			Discrete Input Interrupt- Bit Mask
S:49			Discrete Input Interrupt- Compare Value
S:50			Processor Catalog Number
S:51			Discrete Input Interrupt- Return Number
S:52			Discrete Input Interrupt- Accumulat
S:53			Reserved/ Clock Calendar Day of the Week
S:55			Last DII Scan Time
S:56			Maximum Observed DII Scan Time
S:57			Operating System Catalog Number
S:58			Operating System Series

Address/Symbol Database

Address	Symbol	Scope	Description
S:59			Operating System FRN
S:61			Processor Series
S:62			Processor Revision
S:63			User Program Type
S:64			User Program Functional Index
S:65			User RAM Size
S:66			Flash EEPROM Size
S:67			Channel 0 Active Nodes
S:68			Channel 0 Active Nodes
S:69			Channel 0 Active Nodes
S:70			Channel 0 Active Nodes
S:71			Channel 0 Active Nodes
S:72			Channel 0 Active Nodes
S:73			Channel 0 Active Nodes
S:74			Channel 0 Active Nodes
S:75			Channel 0 Active Nodes
S:76			Channel 0 Active Nodes
S:77			Channel 0 Active Nodes
S:78			Channel 0 Active Nodes
S:79			Channel 0 Active Nodes
S:80			Channel 0 Active Nodes
S:81			Channel 0 Active Nodes
S:82			Channel 0 Active Nodes
S:83			DH+ Active Nodes
S:84			DH+ Active Nodes
S:85			DH+ Active Nodes
S:86			DH+ Active Nodes
T4:0			FLASH TIMER 1
T4:1			FLASH TIMER 2
T4:2			BLOWER JOG RELEASE TIME DELAY
T4:3			READY/FAIL SIGNAL FROM DCS IS A STEADY SIGNAL AND NOT FLASHING THE READY/ FAIL
T4:4			AIR DISCHARGE HIGH PRESSURE ALARM DELAY

Wired-in Surge Protection Modules

APPLICATION

These modules are designed for use by equipment manufacturers who wish to incorporate integral transient voltage surge suppression with exceptional EMI filtering into their product. These devices provide a clamping profile that fully tracks the AC sine wave, providing low clamping voltage levels. They are also suitable for providing surge protection to branch circuits.

Cat. No. 51005-DIN Front View

Cat. No. 51005-DIN Back View

STANDARD SPECIFICATION

The wired-module is designated Transient Voltage Surge Suppressor and is designed for use on AC power lines or for integral SPD protection built into equipment. The Cat. Nos. 51005-WM, 51010-WM, 51015-WM, 51020-WM, and 51240-WM are backed by Leviton's 10-Year Limited Warranty. These devices have been tested to ANSI/IEEE C62.41 standards for categories A and B environments. All models are available with integral DIN-rail mounting clip designated by –DIN suffix.

Cat. No. 51020-DIN

FUNCTIONAL AND PERFORMANCE REQUIREMENTS

Branch Circuit Attachment—Wired modules are series (in-line) installed and available in models with circuit current capacity of 5, 10, 15, or 20 amps.

Diagnostics—Real-time diagnostics are provided with a visual and audible alarm sounding if surge protection is lost. These series-operated devices will continue to provide power to the load in the event that surge protection is lost. LED indicators identify an open ground line as well as reverse polarity.

Performance—Staged multi-component circuitry provides a clamping envelope that follows the AC sine-wave contour.

PERFORMANCE SPECIFICATIONS:

	51005-WM/-DIN	51010-WM/-DIN	51015-WM/-DIN	51020-WM/-DIN	51240-WM/-DIN
Rated Line Voltage	120V AC	120V AC	120V AC	120V AC	240V AC
Maximum Continuous Current Capability	5 Amps	10 Amps	15 Amps	20 Amps	20 Amps
Max. Continuous Operating Voltage	150V AC	150V AC	150V AC	150V AC	270V AC
Max. Single-Pulse Transient Current (8 x 20µs Amps peak)	L-N 26kA L-G 13kA N-G 13kA	L-N 26kA L-G 13kA N-G 13kA	L-N 26kA L-G 13kA N-G 13kA	L-N 26kA L-G 13kA N-G 13kA	L-L 26kA L-G 13kA
Rated single-pole transient energy (10 x 1000µs Joules	L-N 336 Joules L-G 168 Joules N-G 168 Joules	L-N 336 Joules L-G 168 Joules N-G 168 Joules	L-N 336 Joules L-G 168 Joules N-G 168 Joules	L-N 336 Joules L-G 168 Joules N-G 168 Joules	L-L 540 Joules L-G 270 Joules
Noise Rejection @ 50 Ohms 5kHz to 100Mhz	-20 to -40 dB	-20 to -40 dB	-40dB to -50 dB	-40dB to -50 dB	-40dB to -50 dB
Operating Frequency Range	50/60 Hz	50/60 Hz	50/60 Hz	50/60Hz	50/60Hz

Note: Load current draw must not exceed amp rating of device

Product Specifications

PHYSICAL SPECIFICATIONS:

	51005-WM/-DIN	51010-WM/-DIN	51015-WM/-DIN	51020-WM/-DIN	51240-WM/-DIN
Operating Temperature Range:	-10°C to 60°C	-10°C to 60°C	-10°C to 60°C	-10°C to 60°C	-10°C to 60°C
Storage Temperature Range:	-20°C to 85°C	-20°C to 85°C	-20°C to 85°C	-20°C to 85°C	-20°C to 85°C
Dimension (L x W x D)	5.0" (127.0mm) x 2.5" (63.5mm) x 1.6" (40.1 mm)		7.5" (190.5 mm) x 4.25" (108.0 mm) x 2.34" (59.4 mm)		

CLAMPING PERFORMANCE:

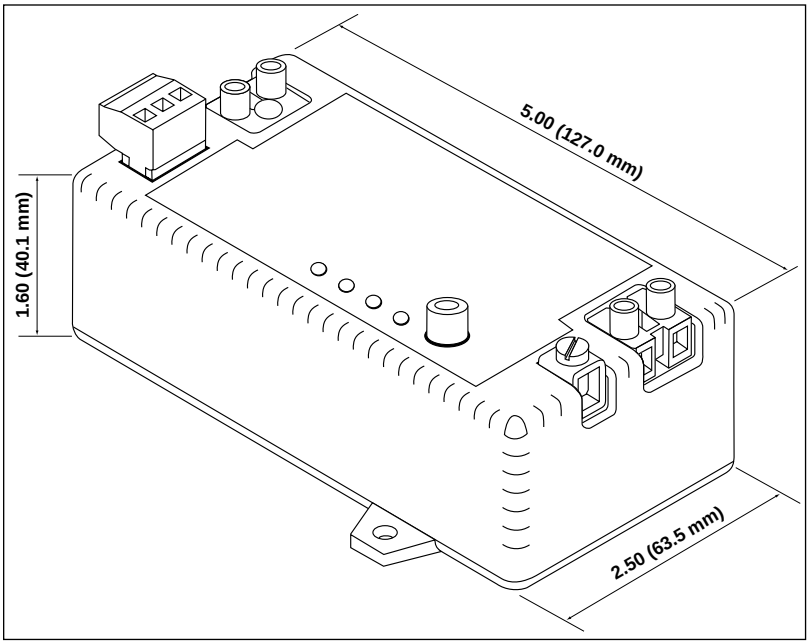
	51005-WM/-DIN	51010-WM/-DIN	51015-WM/-DIN	51020-WM/-DIN	51240-WM/-DIN
UL 1449 SVR Rating Cat B1 combination wave (8 x 20 µs, 3000A)	L-N 400V L-G 400V N-G 400V	L-N 400V L-G 400V N-G 400V	L-N 330V L-G 330V N-G 400V	L-N 330V L-G 330V N-G 400V	L-L 600V L-G 600V N-G 700V

ORDERING INFORMATION:

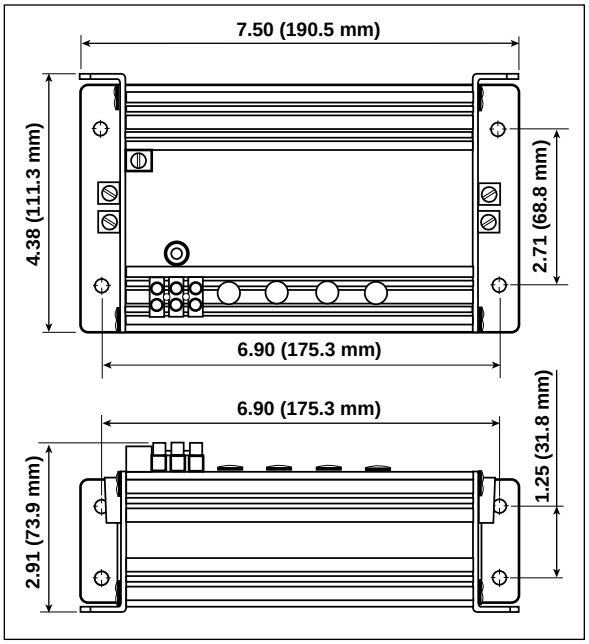
Description	Cat. No.
Wired Module Surge Protection Devices 120V AC, 5 Amps	51005-WM/-DIN
Wired Module Surge Protection Devices 120V AC, 10 Amps	51010-WM/-DIN
Wired Module Surge Protection Devices 120V AC, 15 Amps	51015-WM/-DIN
Wired Module Surge Protection Devices 120V AC, 20 Amps	51020-WM/-DIN
Wired Module Surge Protection Devices 240V AC, 20 Amps	51240-WM/-DIN

Note: All units come in black only.

DIMENSIONAL DRAWINGS



51005 & 51010 Series



51015, 51020 & 51240 Series

LEVITON
POWER QUALITY DIVISION
Building a Connected World

Leviton Manufacturing Co., Inc.—Power Quality Division
860 Harold Place, Chula Vista, CA 91914
Tech Line: 1-800-648-3332 • Fax: 1-877-711-8135

Leviton Manufacturing of Canada, Ltd.
165 Hymus Boulevard, Pointe Claire, Quebec H9R 1E9
Telephone: 1-800-469-7890 • Fax: 1-800-563-1853

Visit our Website at: www.leviton.com

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GARDNER DENVER
PRODUCT TEST SPECIFICATION

DOCUMENT NO: PT 9002 **DOCUMENT VERSION: 01**

Title: CYCLOBLOWER TEST PROCEDURE

I SCOPE:

To provide a method to assess the performance of helical lobe blowers. This procedure applies to all Gardner Denver Cycloblowers.

II TEST REPORT:

All test data shall be recorded on TR9002. (Cycloblower Assembly Test Report). Refer to QWI #16-004 for instructions for completion of the test record.

III ACCEPTANCE:

The test technician is authorized to accept or reject the unit based on condemning limits and criteria set forth in this procedure. If the unit fails to satisfy this criterion the tester is to reject the unit following Nonconforming Material Procedure. (QWI #13-001)

IV PROCEDURE:

1.0 Test Setup:

1.1 The blower is anchored to the test stand and direct connected to the drive motor. Motor shaft to blower shaft coupling is sight aligned.

1.2 The blower is connected to inlet and discharge piping as required.

1.3 Temperature probes are inserted into the piping and blower as required.

1.4 Oil sumps are filled with oil to the upper half of the level gauge.

1.5 A pressure indicating device is connected to the discharge piping of the blower.

1.6 The discharge line control valve is fully opened for initial startup with no pressure loaded on the blower.

1.7 Ambient temperature (°F) and barometric pressure (in-Hg) are recorded on the blower assembly and test report.

GARDNER DENVER
PRODUCT TEST SPECIFICATION

DOCUMENT NO: PT 9002 **DOCUMENT VERSION: 01**

Title: CYCLOBLOWER TEST PROCEDURE

2.0 Operational Test:

2.1 With the blower under a no-load condition, the drive motor is started and allowed to coast to a full stop. Meanwhile the tester checks for any signs of unusual noise or vibration.

2.2 The drive motor is again engaged and the blower is loaded to the conditions outlined in PT 9002.1. Test pressures are adjusted for barometric pressure at the time of the test per PT 9002.1.

2.3 During operation the tester records required test data at the times specified on PT 9002.1.

2.3.1 The blower is visually inspected for leaks at the gaskets and seals and for hot spots on the housing.

2.3.2 On 11CDL models only, take a vibration trace on each bearing housing in the horizontal direction at minimum discharge pressure. If any peak exceeds 0.2 in/sec, neglecting 3560 cpm, reject the blower per the NCM.

2.4 After the test is completed the tester disconnects all piping and inspects the interior of the blower for any contact which may have occurred.

3.0 Rejection Criterion:

3.1 All blowers which exhibit seal or gasket leakage or do not meet the temperature rise or KW limits on PT 9002.1 are moved to the material review board (MRB) area.

3.2 All blowers with end contact or rotor to cylinder contact are rejected, tagged and moved to the MRB area.

3.3 Incidental interlobe contact is acceptable. Polishing or burnishing of the rotor surface without significant discoloration of the metal is considered incidental contact. Heavy interlobe contact is defined by obvious discoloration (blue or black) of the metal surface as well as wiping or smearing of the machining marks. To be unacceptable, heavy contact must cover a continuous area.

3CDL	1.0 sq. in.
5CDL	2.5"
A5CDL	2.5"
T5CDL	2.5"
7CDL	4.5"
9CDL	7.4"
11CDL	12.0"

GARDNER DENVER
PRODUCT TEST SPECIFICATION

DOCUMENT NO: PT 9002 **DOCUMENT VERSION: 01**

Title: CYCLOBLOWER TEST PROCEDURE

3.4 If the unit does not meet all specifications it should be tagged and processed per Non Conforming Material (NCM) procedure.

3.5 All units must be re verified following the rework process.

4.0 Post Test Operations:

4.1 Remove the unit from the test stand.

4.1.1 Drain oil and install plug.

4.2 Complete all remaining applicable fields on the test report.

4.3 Install (2) anti-rust capsules inside the blower. Treat all internal surfaces of blower inside rotor housing and drive shaft with rust preventative.

4.4 Install wooden shipping covers on flanges, or install plastic plugs in threaded inlet and discharge ports as required per PT 9002.1 table 4.

4.5 Attach the test report to the blower.

GARDNER DENVER
PRODUCT TEST SPECIFICATION

DOCUMENT NO: PT9002.1 **DOCUMENT VERSION: 02**

Title: CYCLOBLOWER TEST DATA

I PURPOSE:

This document will provide the necessary test data required for testing per Product Test Specification PT9002.

II CYCLOBLOWER TEST SPECIFICATIONS:

Table 1

MODEL	RPM	TEST ROTATION	FINAL TEST PRESS	MAXIMUM KW	MAXIMUM TEMP RISE
3CDL5	3600	CW	20 PSIG	26	301
3CDL8	3600	CW	20 PSIG	37	290
A5CDL5	3600	CCW	20 PSIG	28	302
A5CDL9	3600	CCW	20 PSIG	46	291
A5CDL13	3600	CCW	20 PSIG	63	280
5CDL5	3600	CW	20 PSIG	28	302
5CDL9	3600	CW	20 PSIG	46	291
5CDL13	3600	CW	20 PSIG	63	280
7CDL11	3600	CW	19 PSIG	121	256
7CDL14	3600	CW	19 PSIG	135	240
7CDL17	3600	CW	19 PSIG	158	225
9CDL13	1800	CW	19 PSIG	107	260
9CDL18	1800	CW	19 PSIG	134	250
9CDL23	1800	CW	19 PSIG	165	240
11CDL23	1800	CW	19 PSIG	279	246
11CDL27	1800	CW	19 PSIG	322	238
11CDL31	1800	CW	19 PSIG	362	230
T5CDL9	1800	CCW	20 PSIG	46	302
T5CDL12-PTO	1800	CCW	20 PSIG	58	295
T5CDL12-ENG	3600	CW	20 PSIG	58	295
T5CDL13-PTO	1800	CCW	20 PSIG	63	293
T5CDL13-ENG	3600	CW	20 PSIG	63	293

NOTE: Test Pressures must be adjusted for Barometric Pressure at time of test. Refer to Table 2.

GARDNER DENVER

PRODUCT TEST SPECIFICATION

DOCUMENT NO: PT9002.1 **DOCUMENT VERSION: 02**

Title: CYCLOBLOWER TEST DATA

III BLOWER TEST PRESSURES ADJUSTED FOR VARIOUS BAROMETRIC PRESSURES:

Table 2

NOMINAL TEST PRESS (FROM Table 1)	20 PSI		19 PSI	
BAROMETRIC PRESS(in-Hg)	Adjusted Test Pressure			
	(in-Hg)	(PSI)	(in-Hg)	(PSI)
30.2	39.7	19.5	37.8	18.6
30.1	39.6	19.4	37.7	18.5
30.0	39.4	19.4	37.6	18.4
29.9	39.3	19.3	37.4	18.4
29.8	39.2	19.2	37.3	18.3
29.7	39.0	19.2	37.2	18.3
29.6	38.9	19.1	37.0	18.2
29.5	38.8	19.0	36.9	18.1
29.4	38.6	19.0	36.8	18.1
29.3	38.5	18.9	36.7	18.0
29.2	38.4	18.8	36.5	17.9
29.1	38.2	18.8	36.4	17.9
29.0	38.1	18.7	36.3	17.8
28.9	38.0	18.6	36.1	17.8
28.8	37.8	18.6	36.0	17.7
28.7	37.7	18.5	35.9	17.6
28.6	37.5	18.4	35.8	17.6
28.5	37.4	18.4	35.6	17.5
28.4	37.3	18.3	35.5	17.4

GARDNER DENVER
PRODUCT TEST SPECIFICATION

DOCUMENT NO: PT9002.1 **DOCUMENT VERSION: 02**

Title: CYCLOBLOWER TEST DATA

IV CYCLOBLOWER TEST SPECIFICATIONS:

Table 3

NOTE:
1.** SPECIFIC MODELS WILL CONTAIN SUFFICES.
2.TEMPERATURE, PRESSURE AND KW DATA IS NOT RECORDED FOR TEST POINTS NUMBER ONE AND THREE.
3.THE FOLLOWING MODELS TO BE TESTED AS SHOWN AFTER A START UP RUN OF FIVE MINUTES WITH ZERO PSTG.
4.TEST POINT NUMBER ONE WILL BE RUN FOR FIVE MIN. AT PRESSURE SHOWN.
5.TEST POINT NUMBER TWO WILL HAVE A RUN TIME OF THIRTY MIN. AT PRESSURE SHOWN.
6.TEST POINT NUMBER THREE WILL RUN FOR FIVE MIN. AT O PSTG.
7. PSIG = 8.1 in-Hg, 5 PSIG = 10.2 in-Hg

**BASIC MODEL FAMILY	TEST RPM	ROTATION	TEST POINT #1	TEST POINT #2
3CDL5	3600	CW	5 PSIG	20 PSIG
3CDL8	3600	CW	5 PSIG	20 PSIG
A5CDL5	3600	CCW	5 PSIG	20 PSIG
A5CDL9	3600	CCW	5 PSIG	20 PSIG
A5CDL13	3600	CCW	5 PSIG	20 PSIG
T5CDL9	1800	CCW	4 PSIG	20 PSIG
T5CDL12-PTO	1800	CCW	4 PSIG	20 PSIG
T5CDL12-ENG	3600	CW	4 PSIG	20 PSIG
T5CDL13-PTO	1800	CCW	4 PSIG	20 PSIG
T5CDL13-ENG	3600	CW	4 PSIG	20 PSIG
5CDL5	3600	CW	5 PSIG	20 PSIG
5CDL9	3600	CW	5 PSIG	20 PSIG
5CDL13	3600	CW	5 PSIG	20 PSIG
7CDL11	3600	CW	5 PSIG	19 PSIG
7CDL14	3600	CW	5 PSIG	19 PSIG
7CDL17	3600	CW	5 PSIG	19 PSIG
9CDL13	1800	CW	5 PSIG	19 PSIG
9CDL18	1800	CW	5 PSIG	19 PSIG
9CDL23	1800	CW	5 PSIG	19 PSIG
11CDL23	1800	CW	5 PSIG	19 PSIG
11CDL27	1800	CW	5 PSIG	19 PSIG
11CDL31	1800	CW	5 PSIG	19 PSIG

GARDNER DENVER
PRODUCT TEST SPECIFICATION

DOCUMENT NO: PT9002.1 **DOCUMENT VERSION: 02**

Title: CYCLOBLOWER TEST DATA

V CYCLOBLOWER PACKAGING REQUIREMENTS:

Table 4

UNIT		VAPOR CAP	PLASTIC PLUG	WOODEN COVER	BOLT NO.
3CDL5	INLET	28H14	64EB535		
	DISC	28H14	64EB535		
3CDL8	INLET	28H14	8503064		
	DISC	28H14	8503064		
A5CDL5	INLET	28H14	8503064		
	DISC	28H14	8503064		
A5CDL5K34T	INLET	28H14		64EB676	655EF040
	DISC	28H14		64EB676	655EF040
A5CDL9	INLET	28H14		64EB678	655EG040
	DISC	28H14		64EB678	655EG040
A5CDL13	INLET	28H14		64EB678	655EG040
	DISC	28H14		64EB678	655EG040
5CDL5	INLET	28H14		64EB676	655EF040
	DISC	28H14		64EB676	655EF040
5CDL9	INLET	28H14		64EB678	655EG040
	DISC	28H14		64EB678	655EG040
5CDL13	INLET	28H14		64EB678	655EG040
	DISC	28H14		64EB678	655EG040
7CDL11	INLET	28H14		64EB680	655EG040
	DISC	28H14		64EB680	655EG040
7CDL14	INLET	28H14		64EB680	655EG040
	DISC	28H14		64EB680	655EG040
7CDL17	INLET	28H14		64EB680	655EG040
	DISC	28H14		64EB680	655EG040
9CDL13	INLET	28H15 (1)		64EB681	655EG040
	DISC	28H14 (2)		64EB680	655EG040
9CDL18	INLET	28H15 (2)		64EB681	8502587
	DISC	28H14 (2)		64EB680	655EG040
9CDL23	INLET	28H15 (2)		64EB681	8502587
	DISC	28H14 (2)		64EB680	655EG040
11CDL23	INLET	28H15 (1)		64EB683	655EH060
	DISC	28H14 (2)		64EB682	8502587
11CDL27	INLET	28H15 (1)		64EB683	655EH060
	DISC	28H14 (2)		64EB682	8502587
11CDL31	INLET	28H15 (1)		64EB683	655EH060
	DISC	28H14 (2)		64EB682	8502587
T5CDL9L	INLET	28H14	8503064		
	DISC	28H14	8503064		
T5CDL12L	INLET	28H14	8503065		
	DISC	28H14	8503064		
T5CDL12L9	INLET	28H14	8503065		
	DISC	28H14	8503064		
T5CDL13L	INLET	28H14	8503065		
	DISC	28H14	8503065		
3 inch metal plug - 64B16 (T5CDL9L)					
4 inch meral plug - 64B10 (T5CDL12L, T5CDL13L)					
4 bolt gasket - 25C802 (A5CDL5K34T discharge)					
Cap screws for shaft protectors on T5CDLs - 75G17					
Cap screws for shaft protectors on A5CDL5K34T, 75LM171, etc					

Gardner Denver

Gardner Denver Engineered Packaging Center
11611 TANNER ROAD HOUSTON, TX 77041-6906

STANDARD BLOWER MECHANICAL RUNNING TEST

1. Set up blower package with contract gauges for temperature and / or pressure. Use calibrated shop gauges if there are no contract gauges available. Attached throttling waive to discharge for pressure, or inlet for vacuum. Make sure valve is open. Make any provisions for noise attenuation at this time.

2. Check that oil levels are ok.

3. Connect all utilities.

4. Turn power on and check for proper rotation.

5. Run blower for 2-3 minutes.
   A. Observe for any abnormal noise.
   B. If abnormal noise is discovered, stop test and return unit to assembly for correction.
   C. If unit has an oil pump, check oil pressure. (10-20 PSI typical).
   D. Check for oil leaks at all connections. Any leaks must be repaired.

6. Using the throttling valve on discharge for pressure, or inlet for vacuum, close until contract pressure / vacuum is reached. Blower will operate for one (1) hour. Check vibration after first ten (10) minutes and record vibration level. Every fifteen (15) minutes, check pressure, temperature, and record readings.

7. Shut unit off.

8. Complete test report.

9. Drain oil and disassemble test set-up.

CYCLOBLOWER ASSEMBLY & TEST RECORD
G E INDUSTRIAL MOTOR TEST DATA
COLD ALIGNENT DIAGRAM
MECHANICAL TEST RUN

TAG NO. 1206

TAG 1206

Gardner Denver

CYCLOBLOWER ASSEMBLY AND TEST RECORD

Model No.	11CDL31P79S
Order No.	1147106
Serial/ID No.	S136962

ROTOR RUNNING CLEARANCES

Discharge End	Main/Drive	0.0012
	Gate/Idler	0.0013
Suction End	Main/Drive	0.0038
	Gate/Idler	0.0041
Interlobe Clearance	Total	0.0028
	Split	0.0090 / 0.0019
Gear Backlash Range		0.0020 / 0.0030

Required Inspection Completed By	
Assembler	Employee Number
1	15001
2	
3	
Date	12/9/2002

BLOWER TEST DATA

Test Stand No. 6

Test No. 1

Orfice Test (in Hg, T5CDL9 Only)

Time Start/Time of Reading	5:30 / 6:10	This Column Teflon Coated Only
Barometer (in Hg)	29.3	
Ambient Temperature (°F)	69	
Suction Air Temperature (°F)	78	
Discharge Air Temperature (°F)	357	
Air Temperature Differential (°F)	279	
Discharge Air Pressure (In Hg)	41.9	
Suction Oil Temperature (°F, Not Applicable on A5CDL or T5CDL)	120	
Discharge Oil Temperature (°F)	178	
Kilowatts	408	
RPM	1781	

TEST CHECKLIST

- Unit is free of oil leaks around bolt holes, flanges, and seals.
- Unit operated without end or cylinder contact.
- Unit operated within specified Kilowatts and Temperature Rise.
- Unit is free of excessive noise and vibration.
- Unit is free of cosmetic defects.
- All test report information is complete and accurate.

TEST RESULTS

☑ ACCEPT ☐ REJECT

Performance Comments: 40 OVR TEMP 10 OVR KW DEV PER JKG

Test Completed By: 10085 Date: 12/11/2002

☑ The test data recorded is certified as true and correct by Gardner Denver Quality Assurance.

TR 09002 (R 12/99)

ROUTINE TEST RESULTS — GENERAL ELECTRIC MOTORS — DATE 05/06/03
MOTOR TECHNOLOGY DEPARTMENT

CUSTOMER: GARDNER DENVER MACHINERY MARKS: PART#:350HP

ENGINEERED PACKAGING CTR
11611 TANNER RD
HOUSTON TX
77041

****

CUSTOMER ORDER NO. 331062 G.E. REQUISITION NO. 1230685131
G.E. ORDER NUMBER. 0083998B

****

ITEM NUMBER	1001	MODEL NUMBER	5K449SSH222
DESIGN NUMBER	49HD1024E	OUTLINE NUMBER	225B6575BD
TYPE	K	FRAME	449T
HP	350	RPM-FL	1785
PHASE	3	VOLTS	480
HZ	60	SERVICE FACTOR	1.15
TIME RATING	CONT	AMB-MAX	40
INSUL CLASS	F	NEMA DESIGN	B
CODE	F	AMPS-FL	385.0
NEMA EFF NOM	95.4	MAX KVAR	91.1
ENCLOSURE	TEFC	CATALOG NUMBER	XX
BEARING-DE	6318ZC3	BEARING-ODE	6318ZC3

****

TEST CHARACTERISTICS
SERIAL NUMBER : 0083998B DATE OF TEST : 04/04/03

NO LOAD 0480 VOLTS 3 PHASE 60 HZ
AMPS 117.067
RPM 1800

IMPEDENCE TEST 120 VOLTS 1 PHASE 60 HZ
AMPS 430.40

WINDING RESISTANCE OHMS (AMBIENT TEMP 30.0 C)
STATOR .0104

VIBRATION (MILS)
AXIAL 0.090
RADIAL (DE) 0.240
RADIAL (ODE) 0.340

DIELECTRIC TEST
STATOR WINDING WITHSTOOD 2640 VOLTS AC FOR 1 SECOND (YES)

NOTES: DATA ON TEST FROM THIS MOTOR
THE AIR GAP, END PLAY, CONDITION OF BEARINGS
(INCLUDING LUBRICATION), ROTOR BALANCE AND
AIR NOISE HAVE BEEN INSPECTED AND ARE SATISFACTORY.

TESTED BY OWENSBORO MOTOR PLANT

GE INDUSTRIAL SYSTEMS

REQN #	**12306-85131**
TYPE OF TEST	**COMPLETE TEST (On returned motor, correcting serial number)**
DATE	5-20-03
COPIES MAILED TO:	CHRIS.VYVIAL@GARDNERDENVER.COM LEE.MOORE@INDSYS.GE.COM JULIE.MAGSAMEN@INDSYS.GE.COM

GE Industrial Systems
INDUSTRIAL MOTORS ENGINEERING
2000 TAYLOR STREET
FORT WAYNE, IN 46801-2205

COMPLETE TEST REPORT

INDUCTION MOTOR

CUSTOMER: GARDNER DENVER MACHINERY
ENGINEERED PACKAGING CTR
11611 TANNER RD
HOUSTON TX 77041

PURCHASE ORDER: 331062

TEST REQUEST:	03-145
REQUISITION:	12306-85131
JOB NUMBER / ITEM:	021212334 / 1
MODEL NUMBER:	5K449SSH222
DESIGN NUMBER:	49HD1024E
SERIAL NUMBER:	83998B
DATE OF TEST:	5/15/2003

NAMEPLATE DATA

POWER OUTPUT:	350 HP	**FRAME:**	449T
SPEED:	1785 RPM	**ENCLOSURE:**	TEFC
VOLTAGE:	480 VOLTS	**NEMA DESIGN:**	B
CURRENT:	385.0 AMPS	**SERVICE FACTOR:**	1.15
FREQUENCY:	60 HZ	**NOMINAL FULL-LOAD EFFICIENCY:**	95.4 %
MAX AMBIENT:	40 °C	**MINIMUM GUARANTEED EFFICIENCY:**	- %

HEAT RUN TEST

VOLTAGE	480 VOLTS	**POWER OUTPUT:**	350.9 HP	(261.7 kW)
FREQUENCY:	59.9 HZ	**TORQUE OUTPUT:**	1030.7 LB-FT	(1,397.4 N-m)
SPEED:	1788 RPM	**WINDING TEMP RISE:**	76.3 °C	
CURRENT:	387.4 AMPS	**AMBIENT:**	27.7 °C	

EFFICIENCIES & POWER FACTOR

LOAD, PERCENT OF RATED	125	115	100	75	50	25
EFFICIENCY (%)	95.2	95.9	96.0	95.9	95.2	92.2
POWER FACTOR (%)	84.9	85.0	84.5	82.1	75.4	56.0
SPEED (RPM)	1774	1785	1788	1791	1794	1797
LINE CURRENT (AMPS)	483.3	443.7	387.3	298.9	219.5	153.2
INPUT POWER (kW)	341.4	313.6	272.4	204.3	137.6	71.3

NOTE: EFFICIENCIES AND LOSSES ARE DETERMINED IN ACCORDANCE WITH IEEE STD 112 METHOD B AND CSA C-390

HIGH POTENTIAL TEST CONDITIONS: 2640 VOLTS FOR 1 SECOND
LINE-TO-LINE RESISTANCE: 0.0105 OHMS @ 29.4 °C
NO LOAD CURRENT AT RATED VOLTAGE: 115.4 AMPS

LOCKED ROTOR AMPS:	2445 AMPS	
LOCKED ROTOR TORQUE:	2928 LB-FT	(3,969.3 N-m)
BREAKDOWN TORQUE:	2297 LB-FT	(3,115.0 N-m)

DATA FROM TEST ON THIS MOTOR
APPROVED & CERTIFIED BY Stephen M. Long DATE 5/16/2003

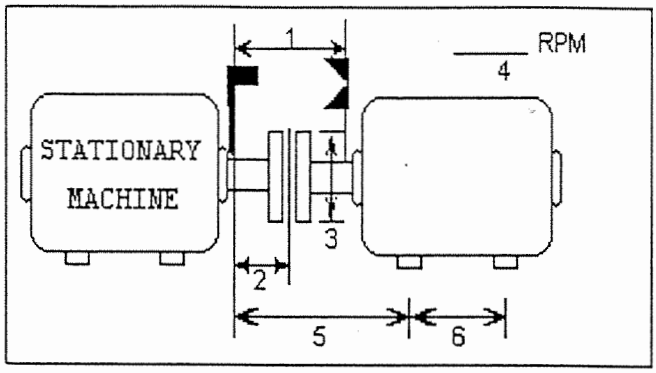
Gardner Denver

Gardner Denver Engineered Packaging Center
11611 TANNER ROAD HOUSTON, TX 77041-6906

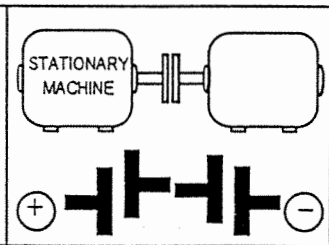
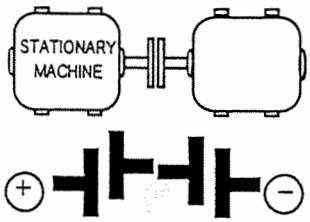
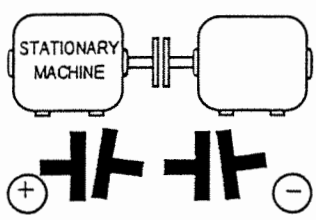
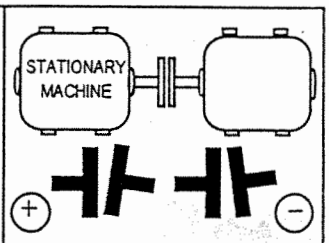
COLD ALIGNMENT DIAGRAM

DRIVER MODEL: 5K449 55/58 1+222
DRIVER SN: OV6839980
GDEPC JOB NO. Pkg#
ALIGNMENT BY Dan Brown
CPLG.MFG.
Customer:

DRIVEN MODEL: 11CDL310798
DRIVEN SN: 513952
DATE
CHECKED BY DB
CPLG.MODEL



1. Laser to prism	7.25"
2. Laser to center of coupling	3.675"
3. Working diameter	10"
4. RPM	1800
5. Laser to front foot	19"
6. Front foot to back foot	25"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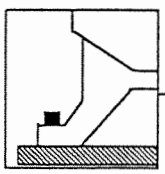

	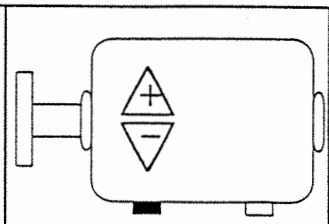	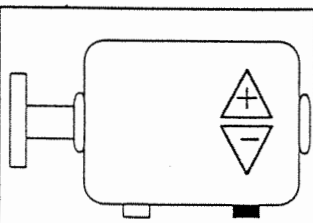	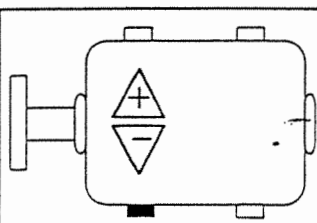	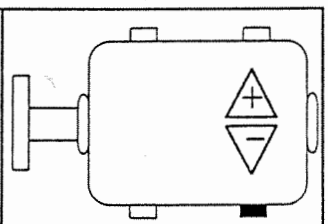
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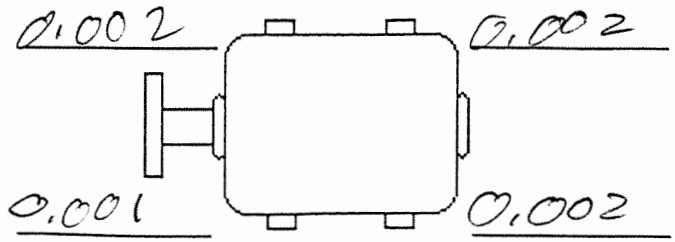
SOFT FOOT



1206

Gardner Denver

Gardner Denver Engineered Packaging Center
11611 TANNER ROAD HOUSTON, TX 77041-6906

COLD ALIGNMENT DIAGRAM

DRIVER MODEL:

DRIVER SN: OV68 3998B

GDEPC JOB NO. Pkg# 1206

ALIGNMENT BY

CPLG.MFG.

DRIVEN MODEL:

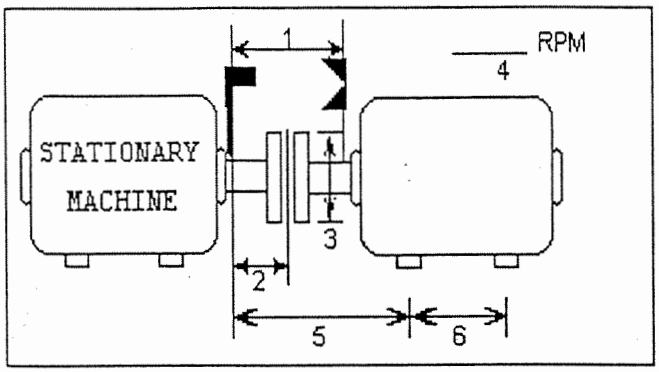
DRIVEN SN: 5136962

DATE

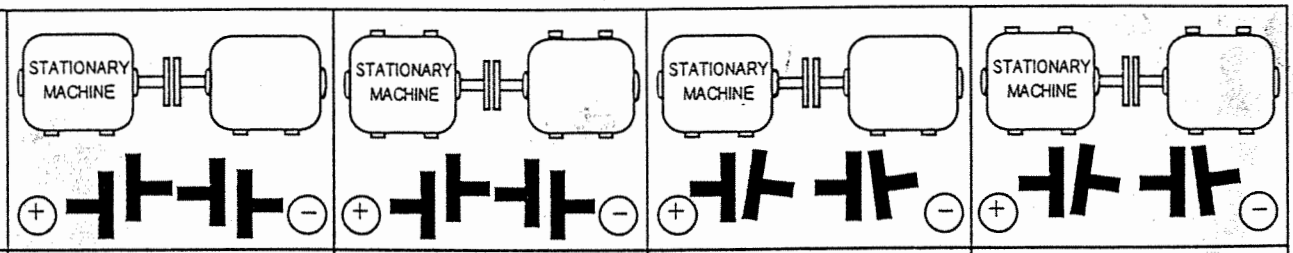
CHECKED BY

CPLG.MODEL

Customer:



1. Laser to prism	7
2. Laser to center of coupling	3.5
3. Working diameter	10
4. RPM	1800
5. Laser to front foot	18"
6. Front foot to back foot	25"



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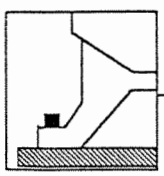
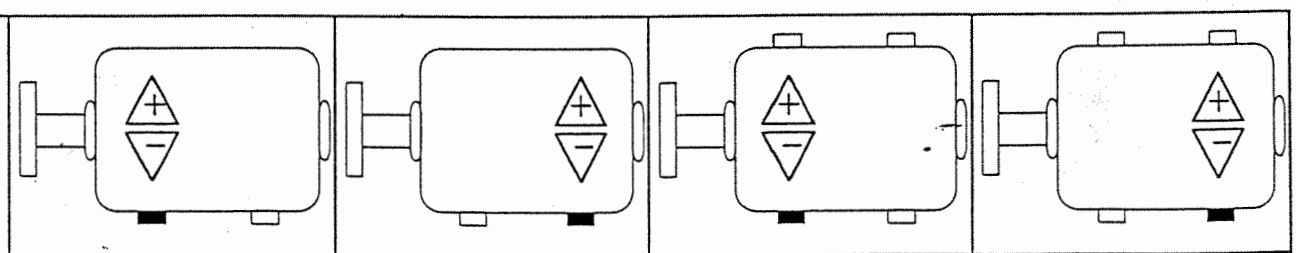
2	.0020	.0004	+.0009	-.0000

1/1000"





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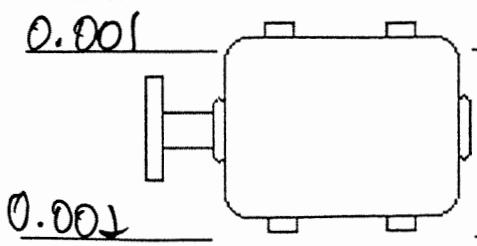
SOFT FOOT



Gardner Denver

Gardner Denver Engineered Packaging Center
11611 TANNER ROAD HOUSTON, TX 77041-6906

CUSTOMER C. EMERY NELSON, INC. **PO#** CEN02-6011

GDEPC# 248352 **ITEM** (5) 11CDL31 CYCLOBLOWER 1206 S/N S136962

MECHANICAL TEST RUN

DATE 04/23/03

DESCRIP \ TIME	10:05	10:10	10:15	10:20	10:25	10:30							
Inlet Air Temperature	76	77	77	77	77	77							
Inlet Air Pressure psia	14.7	14.7	14.7	14.7	14.7	14.7							
Relative Humidity	79	78	78	77	77	76							
-Discharge Air Temperature	190	205	210	215	220	220							
Discharge Pressure psig	12.5	12.5	12.5	12.5	12.5	12.5							
Discharge Air Flow scfm	4569	4569	4569	4569	4569	4569							
Blower Motor Voltage	480	480	480	480	480	480							
Blower Motor Amps	360	361	364	364	364	363							
Drive End Vibration (in/sec)	.015	.015	.016	.016	017	.017							
Free End Vibration (in/sec)	.028	.028	.029	.029	.029	.029							
Blower Speed rpm	1800	1800	1800	1800	1800	1800							

GDEPC Project Manager

Client Representative

GDEPC Inspector

GDEPC QA/QC Manager

CYCLOBLOWER ASSEMBLY & TEST RECORD
G E INDUSTRIAL MOTOR TEST DATA
COLD ALIGNENT DIAGRAM
MECHANICAL TEST RUN

TAG NO. 1207

TAG 1207

Gardner Denver

CYCLOBLOWER ASSEMBLY AND TEST RECORD

Model No.	11CDL31P79S
Order No.	1147106
Serial/ID No.	S136963

ROTOR RUNNING CLEARANCES

Discharge End	Main/Drive	0.0012
	Gate/Idler	0.0013
Suction End	Main/Drive	0.0037
	Gate/Idler	0.0040
Interlobe Clearance	Total	0.0025
	Split	0.0080 / 0.0017
Gear Backlash Range		0.0030 /

Required Inspection Completed By	
Assembler	Employee Number
1	10305
2	
3	
Date	12/9/2002

BLOWER TEST DATA

Test Stand No. 6

Test No. 1

Orifice Test (In Hg, T5CDL9 Only) ____

		This Column Teflon Coated Only
Time Start/Time of Reading	12:00 / 12:40	
Barometer (in Hg)	29.3	
Ambient Temperature (°F)	76	
Suction Air Temperature (°F)	86	
Discharge Air Temperature (°F)	369	
Air Temperature Differential (°F)	283	
Discharge Air Pressure (in Hg)	41.9	
Suction Oil Temperature (°F, Not Applicable on A5CDL or T5CDL)	138	
Discharge Oil Temperature (°F)	185	
Kilowatts	402	
RPM	1783	

TEST CHECKLIST

- Unit is free of oil leaks around bolt holes, flanges, and seals.
- Unit operated within specified Kilowatts and Temperature Rise.
- Unit is free of cosmetic defects.
- Unit operated without end or cylinder contact.
- Unit is free of excessive noise and vibration.
- All test report information is complete and accurate.

TEST RESULTS

☑ ACCEPT ☐ REJECT

Performance Comments: 44 OVR TEMP 4 OVR KW DEV PER JKG

Test Completed By: 10085 Date: 12/11/2002

☑ The test data recorded is certified as true and correct by Gardner Denver Quality Assurance.

ROUTINE TEST RESULTS — GENERAL ELECTRIC MOTORS — DATE 05/06/03
MOTOR TECHNOLOGY DEPARTMENT

CUSTOMER: GARDNER DENVER MACHINERY MARKS: PART#:350HP

ENGINEERED PACKAGING CTR
11611 TANNER RD
HOUSTON TX
77041

****

CUSTOMER ORDER NO. 331062 G.E. REQUISITION NO. 1230685131
G.E. ORDER NUMBER. 0083998E

****

ITEM NUMBER	1001	MODEL NUMBER	5K449SSH222
DESIGN NUMBER	49HD1024E	OUTLINE NUMBER	225B6575BD
TYPE	K	FRAME	449T
HP	350	RPM-FL	1785
PHASE	3	VOLTS	480
HZ	60	SERVICE FACTOR	1.15
TIME RATING	CONT	AMB-MAX	40
INSUL CLASS	F	NEMA DESIGN	B
CODE	F	AMPS-FL	385.0
NEMA EFF NOM	95.4	MAX KVAR	91.1
ENCLOSURE	TEFC	CATALOG NUMBER	XX
BEARING-DE	6318ZC3	BEARING-ODE	6318ZC3

****

TEST CHARACTERISTICS
SERIAL NUMBER : 0083998E DATE OF TEST : 04/03/03

NO LOAD 0480 VOLTS 3 PHASE 60 HZ
AMPS 113.467
RPM 1800

IMPEDENCE TEST 120 VOLTS 1 PHASE 60 HZ
AMPS 424.40

WINDING RESISTANCE OHMS (AMBIENT TEMP 29.7 C)
STATOR .0104

VIBRATION (MILS)
AXIAL 0.060
RADIAL (DE) 0.170
RADIAL (ODE) 0.130

DIELECTRIC TEST
STATOR WINDING WITHSTOOD 2640 VOLTS AC FOR 1 SECOND (YES)

NOTES: DATA ON TEST FROM THIS MOTOR
THE AIR GAP, END PLAY, CONDITION OF BEARINGS
(INCLUDING LUBRICATION), ROTOR BALANCE AND
AIR NOISE HAVE BEEN INSPECTED AND ARE SATISFACTORY.

TESTED BY OWENSBORO MOTOR PLANT

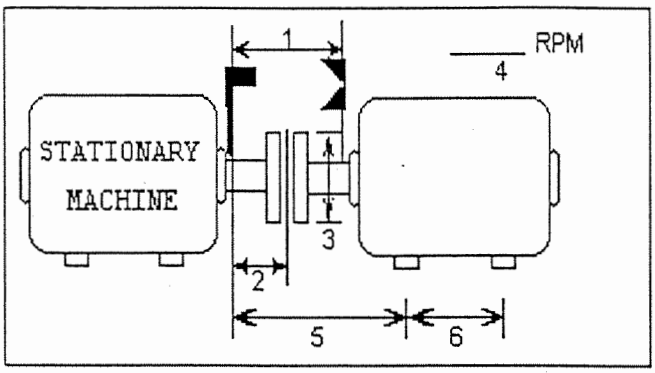
Gardner Denver

Gardner Denver Engineered Packaging Center
11611 TANNER ROAD HOUSTON, TX 77041-6906

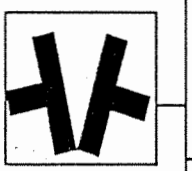
COLD ALIGNMENT DIAGRAM

DRIVER MODEL: GE 350 HP
DRIVER SN: 0Y683598E
GDEPC JOB NO. 160327 Pkg# 1207
ALIGNMENT BY
CPLG.MFG.
Customer:

DRIVEN MODEL: 11CDL31P795
DRIVEN SN: 5136963
DATE
CHECKED BY
CPLG.MODEL Falk 1100T10C



1. Laser to prism	7.00
2. Laser to center of coupling	3.50
3. Working diameter	10
4. RPM	1800
5. Laser to front foot	18.00
6. Front foot to back foot	25.00



	STATIONARY MACHINE	STATIONARY MACHINE	STATIONARY MACHINE	STATIONARY MACHINE
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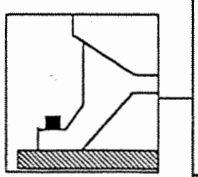
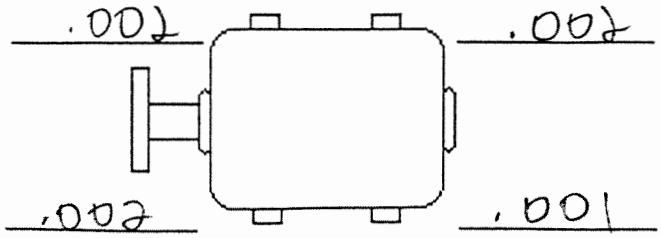
2				

1/1000"



1	-0.000	0.002	-0.001	-0.002
2				

SOFT FOOT



Gardner Denver

Gardner Denver Engineered Packaging Center
11611 TANNER ROAD HOUSTON, TX 77041-6906

CUSTOMER C. EMERY NELSON, INC. **PO#** CEN02-6011

GDEPC# 248352 **ITEM** (5) 11CDL31 CYCLOBLOWER 1207 S/N S136963

MECHANICAL TEST RUN

DATE 04/22/03

DESCRIP / TIME	3:00	3:05	3:10	3:15	3:20	3:25	3:30						
Inlet Air Temperature	74	74	75	75	75	75	75						
Inlet Air Pressure psia	14.7	14.7	14.7	14.7	14.7	14.7	14.7						
Relative Humidity	54	54	53	52	52	53	53						
-Discharge Air Temperature	200	205	210	210	215	215	215						
Discharge Pressure psig	12.5	12.5	12.5	12.5	12.5	12.5	12.5						
Discharge Air Flow scfm	4569	4569	4569	4569	4569	4569	4569						
Blower Motor Voltage	480	480	480	480	480	480	480						
Blower Motor Amps	356	354	354	356	355	355	356						
Drive End Vibration (in/sec)	.015	.016	.019	.019	.019	.019	.019						
Free End Vibration (in/sec)	.029	.029	.030	030	.031	.031	.031						
Blower Speed rpm	1800	1800	1800	1800	1800	1800	1800						

GDEPC Project Manager

Client Representative

GDEPC Inspector

GDEPC QA/QC Manager

CYCLOBLOWER ASSEMBLY & TEST RECORD
G E INDUSTRIAL MOTOR TEST DATA
COLD ALIGNENT DIAGRAM
MECHANICAL TEST RUN

TAG NO. 1208

TAG 1208

Gardner Denver

CYCLOBLOWER ASSEMBLY AND TEST RECORD

Model No.	11CDL31P79S
Order No.	1147107
Serial/ID No.	S138685

ROTOR RUNNING CLEARANCES

Discharge End	Main/Drive	0.0013
	Gate/Idler	0.0013
Suction End	Main/Drive	0.0037
	Gate/Idler	0.0041
Interlobe Clearance	Total	0.0025
	Split	0.0080 / 0.0017
Gear Backlash Range		0.0030 /

Required Inspection Completed By	
Assembler	Employee Number
1	12634
2	
3	
Date	12/9/2002

BLOWER TEST DATA

Test Stand No. 6

Test No. 1

Orifice Test (In Hg, T5CDL9 Only)

		This Column Teflon Coated Only
Time Start/Time of Reading	8:20 / 9:00	
Barometer (in Hg)	29.3	
Ambient Temperature (°F)	72	
Suction Air Temperature (°F)	81	
Discharge Air Temperature (°F)	363	
Air Temperature Differential (°F)	282	
Discharge Air Pressure (in Hg)	41.9	
Suction Oil Temperature (°F, Not Applicable on A5CDL or T5CDL)	125	
Discharge Oil Temperature (°F)	184	
Kilowatts	409.8	
RPM	1782	

TEST CHECKLIST

- Unit is free of oil leaks around bolt holes, flanges, and seals.
- Unit operated without end or cylinder contact.
- Unit operated within specified Kilowatts and Temperature Rise.
- Unit is free of excessive noise and vibration.
- Unit is free of cosmetic defects.
- All test report information is complete and accurate.

TEST RESULTS

☑ ACCEPT ☐ REJECT

Performance Comments: 43 OVR TEMP 11.8 OVR KW DEV PER J K G

Test Completed By: 10085 Date: 12/11/2002

☑ The test data recorded is certified as true and correct by Gardner Denver Quality Assurance.

TR 09002 (R 12/99)

ROUTINE TEST RESULTS — GENERAL ELECTRIC MOTORS — DATE 05/06/03
MOTOR TECHNOLOGY DEPARTMENT

CUSTOMER: GARDNER DENVER MACHINERY MARKS: PART#:350HP

ENGINEERED PACKAGING CTR
11611 TANNER RD
HOUSTON TX
77041

****

CUSTOMER ORDER NO. 331062 G.E. REQUISITION NO. 1230685131
G.E. ORDER NUMBER. 0083998C

****

ITEM NUMBER	1001	MODEL NUMBER	5K449SSH222
DESIGN NUMBER	49HD1024E	OUTLINE NUMBER	225B6575BD
TYPE	K	FRAME	449T
HP	350	RPM-FL	1785
PHASE	3	VOLTS	480
HZ	60	SERVICE FACTOR	1.15
TIME RATING	CONT	AMB-MAX	40
INSUL CLASS	F	NEMA DESIGN	B
CODE	F	AMPS-FL	385.0
NEMA EFF NOM	95.4	MAX KVAR	91.1
ENCLOSURE	TEFC	CATALOG NUMBER	XX
BEARING-DE	6318ZC3	BEARING-ODE	6318ZC3

****

TEST CHARACTERISTICS
SERIAL NUMBER : 0083998C DATE OF TEST : 04/03/03

NO LOAD 0480 VOLTS 3 PHASE 60 HZ
AMPS 125.200
RPM 1800

IMPEDENCE TEST 120 VOLTS 1 PHASE 60 HZ
AMPS 443.20

WINDING RESISTANCE OHMS (AMBIENT TEMP 29.7 C)
STATOR .0103

VIBRATION (MILS)
AXIAL 0.110
RADIAL (DE) 0.170
RADIAL (ODE) 0.180

DIELECTRIC TEST
STATOR WINDING WITHSTOOD 2640 VOLTS AC FOR 1 SECOND (YES)

NOTES: DATA ON TEST FROM THIS MOTOR
THE AIR GAP, END PLAY, CONDITION OF BEARINGS
(INCLUDING LUBRICATION), ROTOR BALANCE AND
AIR NOISE HAVE BEEN INSPECTED AND ARE SATISFACTORY.

TESTED BY OWENSBORO MOTOR PLANT

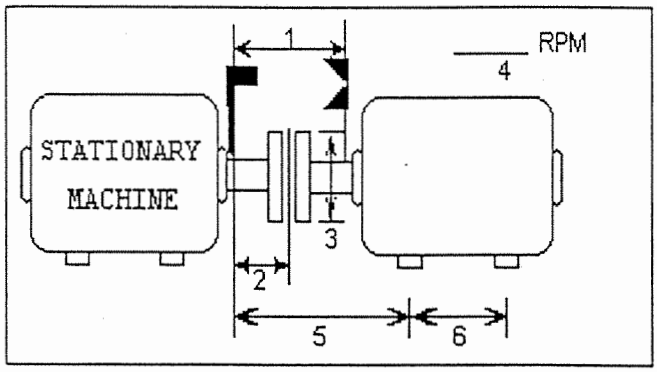
Gardner Denver

Gardner Denver Engineered Packaging Center
11611 TANNER ROAD HOUSTON, TX 77041-6906

COLD ALIGNMENT DIAGRAM

DRIVER MODEL: GE 350 HP
DRIVER SN: 0V6839981C
GDEPC JOB NO. 160327 Pkg# 1208
ALIGNMENT BY
CPLG.MFG.
Customer:

DRIVEN MODEL: 11CDL31P795
DRIVEN SN: 5138685
DATE
CHECKED BY 4-22-03
CPLG.MODEL Falk 1100 T10C



1. Laser to prism	7.00
2. Laser to center of coupling	3.50
3. Working diameter	10
4. RPM	1800
5. Laser to front foot	18.00
6. Front foot to back foot	25.00

	STATIONARY MACHINE	STATIONARY MACHINE	STATIONARY MACHINE	STATIONARY MACHINE
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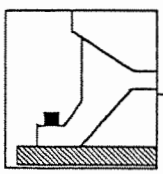
2				

1/1000"



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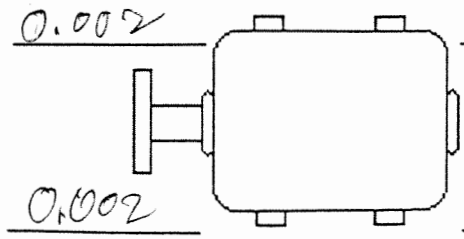
SOFT FOOT



Gardner Denver

Gardner Denver Engineered Packaging Center
11611 TANNER ROAD HOUSTON, TX 77041-6906

CUSTOMER C. EMERY NELSON, INC. **PO#** CEN02-6011

GDEPC# 248352 **ITEM** (5) 11CDL31 CYCLOBLOWER 1208 S/N S138685

MECHANICAL FLOW TEST RUN

DATE 04/22/03

DESCRIP / TIME	9:00	9:05	9:10	9:15	9:20	9:25	9:30	9:35	9:40	9:45			
Inlet Air Temperature	71	71	71	71	71	72	72	72	72	72			
Inlet Air Pressure psia	14.7	14.7	14.5	14.3	14.3	14.3	14.3	14.3	14.3	14.3			
Relative Humidity	58	58	56	54	53	53	52	52	52	52			
-Discharge Air Temperature	130	130	170	180	196	208	215	215	215	215			
Discharge Pressure psig	3	3	6	10	12.5	12.5	12.5	12.5	12.5	12.5			
Discharge Air Flow scfm	5141	5012	5012	4735	4569	4569	4569	4569	4569	4569			
Blower Motor Voltage	480	480	480	480	480	480	480	480	480	480			
Blower Motor Amps	172	218	233	269	351	353	354	354	354	355			
Drive End Vibration (in/sec)	.010	.010	.014	.015	.016	.016	.017	.017	.017	.017			
Free End Vibration (in/sec)	.021	.021	.025	.029	.030	.030	.031	.031	.031	.031			
Blower Speed rpm	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800			

GDEPC Project Manager

Client Representative

GDEPC Inspector

GDEPC QA/QC Manager

CYCLOBLOWER ASSEMBLY & TEST RECORD
G E INDUSTRIAL MOTOR TEST DATA
COLD ALIGNENT DIAGRAM
MECHANICAL TEST RUN

TAG NO. 1209

TAG 1209

Gardner Denver

CYCLOBLOWER ASSEMBLY AND TEST RECORD

Model No.	11CDL31P79S
Order No.	1147107
Serial/ID No.	S138687

ROTOR RUNNING CLEARANCES

Discharge End	Main/Drive	0.0013
	Gate/Idler	0.0014
Suction End	Main/Drive	0.0038
	Gate/Idler	0.0039
Interlobe Clearance	Total	0.0028
	Split	0.0090 / 0.0019
Gear Backlash Range		0.0030 /

Required Inspection Completed By	
Assembler	Employee Number
1	12634
2	
3	
Date	12/12/2002

BLOWER TEST DATA

Test Stand No. 6

Test No. 1

Orfice Test (In Hg, T5CDL9 Only) _____

Time Start/Time of Reading	9:35 / 10:15	This Column Teflon Coated Only
Barometer (In Hg)	29.2	
Ambient Temperature (°F)	74	
Suction Air Temperature (°F)	82	
Discharge Air Temperature (°F)	360	
Air Temperature Differential (°F)	278	
Discharge Air Pressure (in Hg)	41.7	
Suction Oil Temperature (°F, Not Applicable on A5CDL or T5CDL)	126	
Discharge Oil Temperature (°F)	175	
Kilowatts	392	
RPM	1782	

TEST CHECKLIST

- Unit is free of oil leaks around bolt holes,flanges, and seals.
- Unit operated within specified Kilowatts and Temperature Rise.
- Unit is free of cosmetic defects.
- Unit operated without end or cylinder contact.
- Unit is free of excessive noise and vibration.
- All test report information is complete and accurate.

TEST RESULTS

☑ ACCEPT ☐ REJECT

Performance Comments: 39 OVR TEMP DEV PER JKG

Test Completed By: 10085 Date: 12/12/2002

☑ The test data recorded is certified as true and correct by Gardner Denver Quality Assurance.

ROUTINE TEST RESULTS — GENERAL ELECTRIC MOTORS — DATE 05/06/03
MOTOR TECHNOLOGY DEPARTMENT

CUSTOMER: GARDNER DENVER MACHINERY MARKS: PART#:350HP

ENGINEERED PACKAGING CTR
11611 TANNER RD
HOUSTON TX
77041

****

CUSTOMER ORDER NO. 331062 G.E. REQUISITION NO. 1230685131
G.E. ORDER NUMBER. 0083998A

****

ITEM NUMBER	1001	MODEL NUMBER	5K449SSH222
DESIGN NUMBER	49HD1024E	OUTLINE NUMBER	225B6575BD
TYPE	K	FRAME	449T
HP	350	RPM-FL	1785
PHASE	3	VOLTS	480
HZ	60	SERVICE FACTOR	1.15
TIME RATING	CONT	AMB-MAX	40
INSUL CLASS	F	NEMA DESIGN	B
CODE	F	AMPS-FL	385.0
NEMA EFF NOM	95.4	MAX KVAR	91.1
ENCLOSURE	TEFC	CATALOG NUMBER	XX
BEARING-DE	6318ZC3	BEARING-ODE	6318ZC3

****

TEST CHARACTERISTICS
SERIAL NUMBER : 0083998A DATE OF TEST : 04/17/03

NO LOAD 0480 VOLTS 3 PHASE 60 HZ
AMPS 116.533
RPM 1800

IMPEDENCE TEST 120 VOLTS 1 PHASE 60 HZ
AMPS 428.00

WINDING RESISTANCE OHMS (AMBIENT TEMP 28.5 C)
STATOR .0105

VIBRATION (MILS)
AXIAL 0.060
RADIAL (DE) 0.120
RADIAL (ODE) 0.100

DIELECTRIC TEST
STATOR WINDING WITHSTOOD 2640 VOLTS AC FOR 1 SECOND (YES)

NOTES: DATA ON TEST FROM THIS MOTOR
THE AIR GAP, END PLAY, CONDITION OF BEARINGS
(INCLUDING LUBRICATION), ROTOR BALANCE AND
AIR NOISE HAVE BEEN INSPECTED AND ARE SATISFACTORY.

TESTED BY OWENSBORO MOTOR PLANT

Gardner Denver

Gardner Denver Engineered Packaging Center
11611 TANNER ROAD HOUSTON, TX 77041-6906

COLD ALIGNMENT DIAGRAM

DRIVER MODEL: _____ DRIVEN MODEL: _____

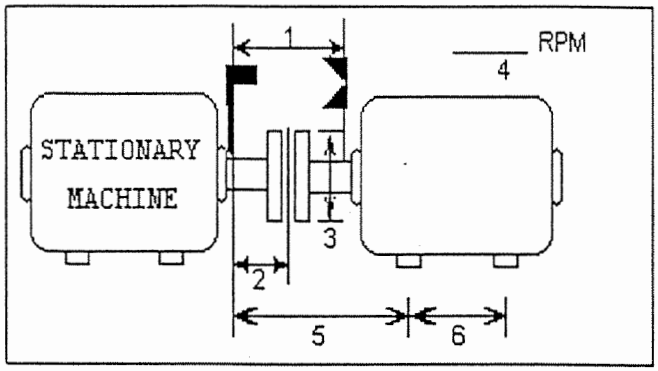
DRIVER SN: 0V683998A DRIVEN SN: 5138687

GDEPC JOB NO. _____ Pkg# 1209 DATE _____

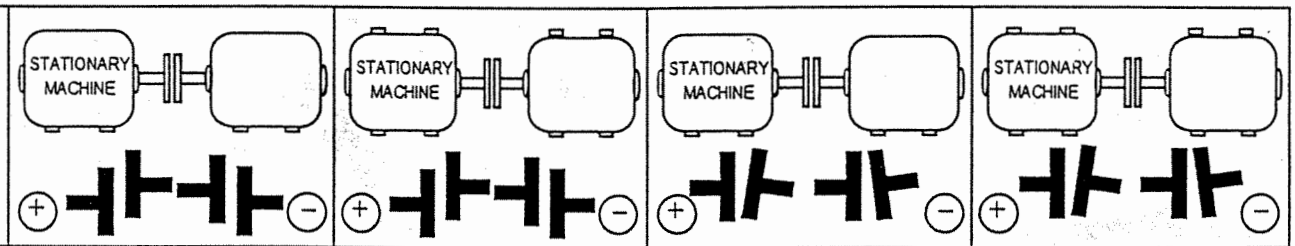
ALIGNMENT BY _____ CHECKED BY _____

CPLG.MFG. _____ CPLG.MODEL _____

Customer:



1. Laser to prism _____
2. Laser to center of coupling _____
3. Working diameter _____
4. RPM _____
5. Laser to front foot _____
6. Front foot to back foot _____



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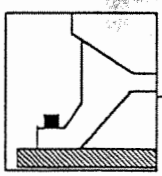
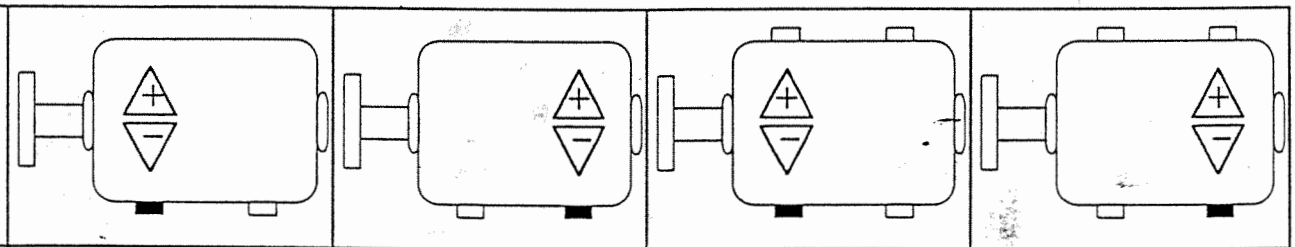
1/1000"





1	.0002	.0002	-0.001	0.000
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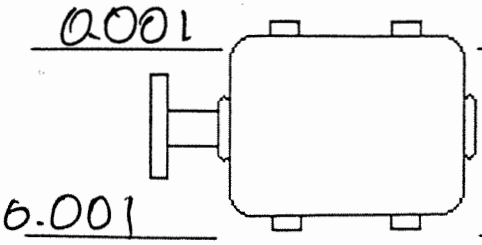
SOFT FOOT



Gardner Denver

Gardner Denver Engineered Packaging Center
11611 TANNER ROAD HOUSTON, TX 77041-6906

CUSTOMER C. EMERY NELSON, INC. **PO#** CEN02-6011

GDEPC# 248352 **ITEM** (5) 11CDL31 CYCLOBLOWER 1209 S/N S138687

MECHANICAL TEST RUN

DATE 04/23/03

DESCRIP \ TIME	11:25	11:30	11:35	11:40	11:45	11:50							
Inlet Air Temperature	77	77	77	78	79	79							
Inlet Air Pressure psia	14.7	14.7	14.7	14.7	14.7	14.7							
Relative Humidity	73	72	71	69	67	66							
-Discharge Air Temperature	190	205	210	215	218	218							
Discharge Pressure psig	12.5	12.5	12.5	12.5	12.5	12.5							
Discharge Air Flow scfm	4569	4569	4569	4569	4569	4569							
Blower Motor Voltage	480	480	480	480	480	480							
Blower Motor Amps	351	353	351	350	348	347							
Drive End Vibration (in/sec)	.015	.016	.016	.018	.018	.018							
Free End Vibration (in/sec)	.027	.027	.027	.028	.028	.028							
Blower Speed rpm	1800	1800	1800	1800	1800	1800							

GDEPC Project Manager

GDEPC Inspector

Client Representative

GDEPC QA/QC Manager

CYCLOBLOWER ASSEMBLY & TEST RECORD
G E INDUSTRIAL MOTOR TEST DATA
COLD ALIGNENT DIAGRAM
MECHANICAL TEST RUN

TAG NO. 1210

TAG 1210

Gardner Denver

CYCLOBLOWER ASSEMBLY AND TEST RECORD

Model No.	11CDL31979S
Order No.	1147107
Serial/ID No.	S138686

ROTOR RUNNING CLEARANCES

Discharge End	Main/Drive	0.0012
	Gate/Idler	0.0011
Suction End	Main/Drive	0.0038
	Gate/Idler	0.0042
Interlobe Clearance	Total	0.0025
	Split	0.0080 / 0.0017
Gear Backlash Range		0.0030

Required Inspection Completed By	
Assembler	Employee Number
1	12634
2	
3	
Date	12/9/2002

BLOWER TEST DATA

Test Stand No. 6

Test No. 1

Orifice Test (In Hg, T5CDL9 Only) _____

Time Start/Time of Reading	2:25 / 3:05	This Column Teflon Coated Only
Barometer (in Hg)	29.2	
Ambient Temperature (°F)	77	
Suction Air Temperature (°F)	85	
Discharge Air Temperature (°F)	367	
Air Temperature Differential (°F)	282	
Discharge Air Pressure (in Hg)	41.7	
Suction Oil Temperature (°F. Not Applicable on A5CDL or T5CDL)	129	
Discharge Oil Temperature (°F.	187	
Kilowatts	404	
RPM	1783	

TEST CHECKLIST

- Unit is free of oil leaks around bolt holes,flanges, and seals.
- Unit operated within specified Kilowatts and Temperature Rise.
- Unit is free of cosmetic defects.
- Unit operated without end or cylinder contact.
- Unit is free of excessive noise and vibration.
- All test report information is complete and accurate.

TEST RESULTS

☑ ACCEPT ☐ REJECT

Performance Comments: 43 OVR TEMP 6 OVR KW DEV PER JKG

Test Completed By: 10085 Date: 12/11/2002

☑ The test data recorded is certified as true and correct by Gardner Denver Quality Assurance.

ROUTINE TEST RESULTS

GENERAL ELECTRIC MOTORS
MOTOR TECHNOLOGY DEPARTMENT

DATE 05/06/03

CUSTOMER: GARDNER DENVER MACHINERY

MARKS: PART#:350HP

ENGINEERED PACKAGING CTR
11611 TANNER RD
HOUSTON TX
77041

****

CUSTOMER ORDER NO. 331062

G.E. REQUISITION NO. 1230685131
G.E. ORDER NUMBER. 0083998D

****

ITEM NUMBER	1001	MODEL NUMBER	5K449SSH222
DESIGN NUMBER	49HD1024E	OUTLINE NUMBER	225B6575BD
TYPE	K	FRAME	449T
HP	350	RPM-FL	1785
PHASE	3	VOLTS	480
HZ	60	SERVICE FACTOR	1.15
TIME RATING	CONT	AMB-MAX	40
INSUL CLASS	F	NEMA DESIGN	B
CODE	F	AMPS-FL	385.0
NEMA EFF NOM	95.4	MAX KVAR	91.1
ENCLOSURE	TEFC	CATALOG NUMBER	XX
BEARING-DE	6318ZC3	BEARING-ODE	6318ZC3

****

TEST CHARACTERISTICS

SERIAL NUMBER : 0083998D

DATE OF TEST : 04/17/03

NO LOAD 0480 VOLTS 3 PHASE 60 HZ
AMPS 114.533
RPM 1800

IMPEDENCE TEST 120 VOLTS 1 PHASE 60 HZ
AMPS 421.67

WINDING RESISTANCE OHMS (AMBIENT TEMP 25.7 C)
STATOR .0105

VIBRATION (MILS)
AXIAL 0.007
RADIAL (DE) 0.029
RADIAL (ODE) 0.006

DIELECTRIC TEST
STATOR WINDING WITHSTOOD 2640 VOLTS AC FOR 1 SECOND (YES)

NOTES: DATA ON TEST FROM THIS MOTOR
THE AIR GAP, END PLAY, CONDITION OF BEARINGS
(INCLUDING LUBRICATION), ROTOR BALANCE AND
AIR NOISE HAVE BEEN INSPECTED AND ARE SATISFACTORY.

TESTED BY OWENSBORO MOTOR PLANT

Gardner Denver

Gardner Denver Engineered Packaging Center
11611 TANNER ROAD HOUSTON, TX 77041-6906

COLD ALIGNMENT DIAGRAM

DRIVER MODEL: _____ DRIVEN MODEL: _____

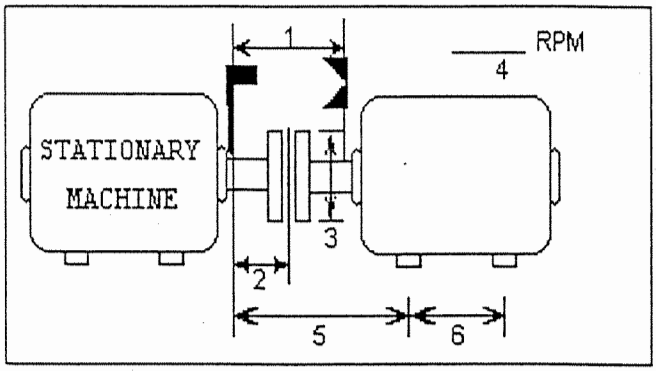
DRIVER SN: OV6839980 DRIVEN SN: 5138686

GDEPC JOB NO. _____ Pkg# 12108 DATE _____

ALIGNMENT BY _____ CHECKED BY _____

CPLG.MFG. _____ CPLG.MODEL _____

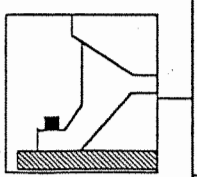
Customer:



1. Laser to prism 7
2. Laser to center of coupling 3.5
3. Working diameter 10
4. RPM 1800
5. Laser to front foot 18"
6. Front foot to back foot 25"

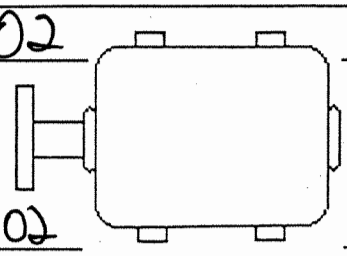
	STATIONARY MACHINE	STATIONARY MACHINE	STATIONARY MACHINE	STATIONARY MACHINE
1	-.0012	-.0002	-.0001	-.0005
2	-.002	-.0003	-.0004	-.0006

1/1000"



1	0.001	0.000	-0.001	-0.002
2	0.001	0.000	-0.000	-0.000

SOFT FOOT



Gardner Denver

Gardner Denver Engineered Packaging Center
11611 TANNER ROAD HOUSTON, TX 77041-6906

CUSTOMER C. EMERY NELSON, INC. **PO#** CEN02-6011

GDEPC# 248352 **ITEM** (5) 11CDL31 CYCLOBLOWER 1210 S/N S138686

MECHANICAL TEST RUN

DATE 04/23/03

DESCRIP \ TIME	1:20	1:25	1:30	1:35	1:40	1:45							
Inlet Air Temperature	79	79	80	80	80	80							
Inlet Air Pressure psia	14.7	14.7	14.7	14.7	14.7	14.7							
Relative Humidity	60	60	59	57	58	59							
-Discharge Air Temperature	185	205	212	218	218	218							
Discharge Pressure psig	12.5	12.5	12.5	12.5	12.5	12.5							
Discharge Air Flow scfm	4569	4569	4569	4569	4569	4569							
Blower Motor Voltage	480	480	480	480	480	480							
Blower Motor Amps	354	358	362	364	352	352							
Drive End Vibration (in/sec)	.015	.016	.016	.017	.017	.017							
Free End Vibration (in/sec)	.028	.028	.028	.029	.029	.029							
Blower Speed rpm	1800	1800	1800	1800	1800	1800							

GDEPC Project Manager

Client Representative

GDEPC Inspector

GDEPC QA/QC Manager

Cor-Pro Systems, Inc. Inspection Log

10545 Fisher Road Houston, Texas 77041 phone(713) 896-1091 fax(713) 896-0878

Work Order Number: 0299491617 Purchase Order Number: 336530
Coating Specification Number: Section 09800
Description: (5) Skid Assemblies
Serial Number: _____ Reference Number: _____
Customer: Gardner Denver

Receipt
Damage: yes____ no✓ initials KD Explain _____
Quantity Correct: yes✓ no____ initials KD Explain _____

Preparation
Typical: yes✓ no____ Explain _____
Acceptable: yes✓ no____ initials KD Customer initials _____

Surface Preparation
Air Quality Acceptable: yes✓ no____ initials KD
Media Used #4 Sand Surface Cleanliness (requirement/result) SP-10 / SP-10
Profile (requirement/result) 3.0-3.0 / 3.5 Contaminate Free: yes✓ no____
Acceptable: yes✓ no____ initials KD Customer initials _____

Coating
Note: Elapsed time between blasting and primer coat: 3 Hours

	Primer Coat	1st Intermediate	2nd Intermediate	Finish Coat
Product	C-b 893	C-b 134HG		C-b 134HG
Date	03-25-03	03-26-03		03-28-03
DFT (mils)	3.0-5.0	3.0-4.0		3.0-4.0
Air Temp	68°	81°		60°
Surf Temp	68°	81°		60°
Humidity	70%	49%	N/A	58%
Dew Point	58°	53°		44°
Adhesion				
Holiday Test	N/A	N/A		N/A
Acceptable	yes✓ no____	yes✓ no____	yes____ no____	yes✓ no____
QA Initials	KD	KD		KD
Customer				

Shipping Preparation
Special Instructions: _____
Acceptable: yes✓ no____ initials KD Explain _____

Final Acceptance
CPS QA Inspector: Keith Byrne COR-PRO SYSTEMS print Keith Byrne
Customer Inspector: _____ print _____
Release for shipment (QA Stamp) Q.A. APPROVED **Date:** 03-31-03

115327

SO# 255621-1
PO# 329900

NUCOR-YAMATO STEEL CO.
P O BOX 1228
BLYTHEVILLE AR 72316

DATE
10/09/02

CERTIFIED MILL TEST REPORT

100% MELTED AND MANUFACTURED IN U.S.A

All shapes produced by Nucor-Yamato Steel are cast and rolled to a fully killed and fine grain practice.

SOLD TO

SHIP TO

INVOICE	CUSTOMER NO.
749881	7643
BILL OF LADING	**CUSTOMER P.O.**
598090	PE-DMQ-801190

*3 SPECIFICATIONS GRADE: ASTM A36-01 ASME SA36-01 ASTM A6/A6M-01b
GRADE: ASTM A709-01a GR36

ITEM	ITEM DESCRIPTION	QTY	HEAT #	MECHANICAL PROPERTIES						CHEMICAL PROPERTIES											
				YIELD TO TENSILE RATIO	YIELD STRENGTH PSI MPa	TENSILE STRENGTH PSI MPa	ELONG % %	CHARPY IMPACT TEMP F C	CHARPY IMPACT ENERGY FT-LBS JOULES	C	Mn	P	S	Si	Cu	Ni	Cr	Mo	V	Cb	CE
																		Sn	Pcm		CI
1	MC012- 31.0	1	205282	.79	57000	72000	23			.05	1.13	.014	.032	.26	.59	.12	.07	.03	.01	.022	.31
	40'			.79	57000	72000	26											.01	.15		
	MC310x 46.0				393	496	23														
	12.192 M				393	496	26														
2	MC012- 31.0	2	205296	.79	56000	71000	25			.05	1.14	.016	.032	.32	.35	.14	.17	.03	.01	.017	.31
	40'			.79	56000	71000	26											.01	.15		
	MC310x 46.0				386	490	25														
	12.192 M				386	490	26														
3	MC012- 31.0	2	205298	.74	52000	70000	24			.06	1.13	.011	.029	.34	.36	.13	.11	.02	.01	.013	.31
	40'			.76	54000	71000	25											.01	.16		
	MC310x 46.0				359	483	24														
	12.192 M				372	490	25														
4	MC012- 31.0	2	205300	.69	50000	72000	26			.07	1.12	.015	.032	.34	.36	.12	.11	.02	.01	.017	.32
	40'			.72	51000	71000	27											.01	.17		
	MC310x 46.0				345	496	26														
	12.192 M				352	490	27														
5	MC012- 31.0	1	205305	.79	59000	75000	25			.08	1.10	.012	.029	.34	.31	.12	.11	.03	.01	.020	.32
	40'			.77	58000	75000	24											.01	.18		
	MC310x 46.0				407	517	25														
	12.192 M				400	517	24														
6	MC012- 31.0	4	205316	.76	55000	72000	25			.08	1.16	.013	.025	.29	.37	.12	.10	.02	.01	.016	.33
	40'			.78	54000	69000	26											.01	.18		
	MC310x 46.0				379	496	25														
	12.192 M				372	476	26														
7	MC012- 35.0	12	205177	.72	52000	72000	28			.07	1.12	.015	.040	.31	.35	.12	.11	.02	.00	.016	.32
	40'			.76	54000	71000	25											.01	.17		
	MC310x 52.0				359	496	28														
	12.192 M				372	490	25														
8	MC012- 35.0	4	205183	.72	52000	72000	26			.07	1.12	.013	.030	.30	.32	.11	.09	.02	.01	.014	.31
	40'			.75	53000	71000	27											.01	.16		
	MC310x 52.0				359	496	26														
	12.192 M				365	490	27														

ELONGATION BASED ON 8.00 INCH GAUGE LENGTH

CARBON EQUIVALENT CE = C+ Mn/6 + (Cr+Mo+V) / 5 + (Ni+Cu) / 15

Pcm=C+Si / 30+Mn / 20+Cu / 20+Ni / 60+Cr / 20+Mo / 15+V / 10+5B B-Approx .0003

Corrosion Index: CI=26.01(%CU)+3.88(%Ni)+1.2(%Cr)+1.49(%Si)+17.28(%P)-7.29(%Cu)(%Ni)-9.10(%Ni)(%P)-33.39(%Cu)^2

I hereby certify that the contents of this report are accurate and correct. All test results and operations performed by this material manufacturer are in results and operations performed by this material manufacturer are in compliance with the requirements of the material specifications, and when designated by the purchaser, meet the applicable specifications.

GARY PENNELL
QUALITY ASSURANCE

STATE OF ARKANSAS
COUNTY OF MISSISSIPPI
SWORN TO AND SUBSCRIBED BEFORE ME THIS
_____ Day of _____
NOTARY PUBLIC

NORTHWESTERN STEEL AND WIRE COMPANY SINCE 1879

CERTIFIED MILL TEST REPORT

100% MELTED AND MANUFACTURED IN U.S.A.

NSW NUMBER	SHIP DATE	B/L NO.	CUSTOMER P.O. NO.	SHIP METHOD	CAR OR TRUCK NUMBERS	SHIP LOT	NO. OF PIECES	GRS.	NET	CODE	PAGE
18804	07-25-01	59706	JNW16 7/24	WILL CALL	WILL CALL 580	14	1			60	1

SHIP TO

TRIPLE S STEEL & SUPPLY
EMDE WAREHOUSE
1 NORTH BRIDGE ST
GARY IN 46401

SOLD TO

TRIPLE S STEEL & SUPPLY

P O BOX 21119
HOUSTON TX 77226

STERLING, IL

LINE NO.	SECTION	SPEC./ LENGTH	PIECES/ WEIGHT	HEAT #	YIELD POINT KSI	TENSILE STRENGTH KSI	ELONG% 8"	CHEMICAL COMPOSITION (%) C X100	Mn X100	Si X100	P X1000	S X1000	Cu X100	Ni X100	Cr X100	Mo X1000	V X1000	Nb X1000
				Y/T	MPa	MPa		CE			TI							Sn
1	L3-1/2X3X3/8	ASTM A36-97A	30	72212	50.8	69.6	20.3	14	76	22	16	35	26	08	13	24	3	3
		40'	9480		48.1	68.0	20.3	32			1							
	L 89 X 76 X 9.5	12.19 METERS		.73	350	480												
				.71	332	469												
4	L3-1/2X3-1/2X1/4	ASTM A36-97A	9	81938	52.5	72.3	22.7	15	70	20	26	21	29	14	08	34	3	2
		20'	1044		52.0	72.2	24.2	32										
	L 89 X 89 X 6.4	6.10 METERS		.73	362	498												
				.72	359	498												

SO# 235691-2
PO# 329900

I, Notary Public in County,
State of hereby certify this affidavit was sworn to by
an agent of Northwestern Steel and Wire Company
under my Notarial Seal this day of

Notary Public My Commission Expires

WE HEREBY CERTIFY THAT THE STEELS HAVE BEEN TESTED IN ACCORDANCE WITH SPECIFICATIONS

MANAGER, QUALITY

	HEAT	VALUE	Q	HEAT	VALUE	Q	HEAT	VALUE	Q
IMPACT TEST									

REMARKS:

11/02/01 12:36 3 of 3
(815)825 0440

SO# 235691-3
PO# 329900

SMI Steel - Alabama
P.O. Box 321188
Birmingham, AL 35232-1188
(205) 592-8981

CERTIFIED MILL TEST REPORT

For additional copies call
(800) 621-0262

We hereby certify that the test results presented here are accurate and conform to the reported grade specification.

Christine Sehn Colburn
Quality Assurance Manager

HEAT NO.: J27377 SECTION: L 6X6X3/8 x20'0" L 152x152x9.5x6.096 GRADE: ASTM A36-01 ASTM A36M-01	SOLD TO	TRIPLE S STEEL SUPPLY PO BOX 21119 HOUSTON, TX 77226-	SHIP TO	TRIPLE S STEEL SUPPLY 6000 JENSEN DRIVE HOUSTON, TX 77026-	SHIP#: 100928/13 BOL #: 175350 INV #: CUST PO #: HOU79198 CUST P/N:

CHEMICAL ANALYSIS	
	%
C	0.18
Mn	0.67
P	0.006
S	0.025
Si	0.23
Cu	0.23
Cr	0.10
Ni	0.07
Mo	0.013
Cb	0.002
V	0.002
Sn	0.008
B	0.0002
Ti	0.001
C.Eq.	0.33
N	0.0094

PROPERTIES						
MECHANICAL	TEST 1		TEST 2		TEST 3	
	IMPERIAL	METRIC	IMPERIAL	METRIC	IMPERIAL	METRIC
Yield Strength	46.8 KSI	322.7 MPA	47.1 KSI	324.8 MPA		
Tensile Strength	69.7 KSI	480.6 MPA	70.8 KSI	488.2 MPA		
Elongation	26 %	26 %	29 %	29 %		
Gauge Length	8 INS	203 MM	8 INS	203 MM		
Reduction of Area						
Bend Test						
Diameter						
Charpy Impact						
Test Temp						
Sample Size						
Orientation						
Hardness						

JOMINY RESULTS - Rockwell C hardness at 1/16th inch increments

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	18	20	22	24	26	28	30	32

GRAIN SIZE	
METHOD	
RESULT	

INCLUSION RATING								
METHOD								
TYPE								
	T	H	T	H	T	H	T	H
SIZE								

100% MELTED AND MANUFACTURED IN THE USA AND FREE OF MERCURY CONTAMINATION IN THE PROCESS

REMARKS:

JAN-24-2003 04:56
Page 1 OF 1

PO/Rel

Certificate of Mill Test Results

WLY-000000-000

PART NO.

Attn:

B/L# 208876

NUCOR BAR MILL - JEWETT
8812 HIGHWAY 79 WEST
JEWETT, TEXAS 75846 PH (903) 626-4461

Date 1/07/02

43045

CERTIFIED MILL TEST REPORT

43045

SO# 264796-1
PO# 334251

SIZE / GRADE	HEAT NUMBER	CUSTOMER PO NUMBER
3/8 X 8 A36-00A/A709-00A/SA36-98	314-4247	WLY-110190
1/2 X 1 1/2 A36-00A/A709-00A/SA36-98	313-4728	WLY-110190
5/8 X 10 A36-00A/A709-00A/SA36-98	315-3810	WLY-110190

		C	Mn	Si	S	P	V	Nb	Cu	Cr	Ni	Mo	Sn	Bend Test
Tensile	70700	.198	.720	.220	.042	.014	.005	.023	.419	.262	.152	.047	.012	
Yield	46900													
Elong%	21													
Tensile	75200	.148	.759	.240	.027	.009	.003	.012	.465	.176	.143	.049	.016	
Yield	49500													
Elong%	23													
Tensile	61800	.115	.728	.230	.047	.014	.005	.015	.384	.171	.115	.050	.015	
Yield	43200													
Elong%	28													

ELONGATION IN 8 INCH SCALE
MELTED AND MANUFACTURED IN U.S.A.

ALL MATERIAL STRAND CAST

CHIEF METALLURGIST
By Traffic

SO# 264796-2

job# 334251

SMI-TEXAS

P. O. Box 911
Seguin, Texas 78156-0911
(830) 372-8200

CERTIFIED MILL TEST REPORT

For additional copies call
(830) 372-8485

We hereby certify that the test results presented here are accurate and conform to the reported grade

Daniel J. Schacht

Quality Assurance Manager

HEAT NO.: 225083 SECTION: L 3x3x3/8x20'0" L 76x76x9.5x6.096 GRADE: ASTM A36/A529Gr50	SOLD TO	TRIPLE-S STEEL SUPPLY CO PO BOX 21119 HOUSTON, TX 77226-	SHIP TO	TRIPLE S STEEL CUSTOMER DROP TRAILER SEGUIN, TX 78155-	SHIP#: 100939/54 BOL #: 309027 INV #: CUST PO #: HOU-80205 CUST P/N:

CHEMICAL ANALYSIS		PROPERTIES							
	%	MECHANICAL	TEST I		TEST		TEST		
			IMPERIAL	METRIC	IMPERIAL	METRIC	IMPERIAL	METRIC	
C	0.17								
Mn	0.64	Yield Strength	55.8 KSI	384.7 MPA					
P	0.009	Tensile Strength	77.9 KSI	537.1 MPA					
S	0.028	Elongation	30 %	30 %					
Si	0.24	Gauge Length	8 INS	203 MM					
Cu	0.43	Reduction of Area							
Cr	0.16	Bend Test							
Ni	0.20	Diameter							
Mo	0.050	Charpy Impact							
Cb	0.000	Test Temp							
V	0.017	Sample Size							
Sn	0.015	Orientation							
B	0.0000	Hardness							
Ti	0.002								
C.Eq.									

JOMINY RESULTS - Rockwell C hardness at 1/16th inch increments												GRAIN SIZE
1	2	3	4	5	6	7	8	9	10	11	12	METHOD
13	14	15	16	18	20	22	24	26	28	30	32	RESULT

INCLUSION RATING							
METHOD							
TYPE							
	T	H	T	H	T	H	T	H
SIZE							

100% MELTED AND MANUFACTURED IN THE USA AND FREE OF MERCURY CONTAMINATION IN THE PROCESS

REMARKS:

FEB-25-2003 19:01

PAC STAINLESS LTD.

5250 Brittmore
Houston, Texas 77041
Phone (713) 466-6160
Fax (713) 466-6334
WATS 800-535-0386

PAC 4 QC

TEST CERTIFICATE

03/10/2003

SOLD TO:	SHIP TO:
GARDNER DENVER, INC. ENGINEERED PACKAGING CTR. 11611 TANNER ROAD HOUSTON, TX 77041 Fax: 713-896-1693	,

P.O. 335260 DATE: 03/10/2003 SHIPPING ORDER: 77629

1

Stock Number	Heat No.	Description and Specification.
760375028	203254	3/8 X.028 X 20' 316L SMLS A&P

CHEMICAL ANALYSIS

C	Si	Mn	P	S	Ni	Cr	Mo			
.027	.45	.82	.031	.003	12.81	16.55	2.18			

MECHANICAL TESTS

Flattening	Flaring	Hydrostatic	Surface	Corrosion	Eddy Current	Flange
GOOD	GOOD	GOOD	GOOD			

TENSILE PROPERTIES

Yield	Tensile	Unit	Elong.	Hardness	Comments
40670	89820	PSI	62%	79 HRB	ASTM A269/A213/SA213

2

Stock Number	Heat No.	Description and Specification.

CHEMICAL ANALYSIS

C	Si	Mn	P	S	Ni	Cr	Mo			

MECHANICAL TESTS

Flattening	Flaring	Hydrostatic	Surface	Corrosion	Eddy Current	Flange

TENSILE PROPERTIES

Yield	Tensile	Unit	Elong.	Hardness	Comments

3

Stock Number	Heat No.	Description and Specification.

CHEMICAL ANALYSIS

C	Si	Mn	P	S	Ni	Cr	Mo			

MECHANICAL TESTS

Flattening	Flaring	Hydrostatic	Surface	Corrosion	Eddy Current	Flange

TENSILE PROPERTIES

Yield	Tensile	Unit	Elong.	Hardness	Comments

We certify that the above data is as furnished by the producing mill or supplier

K. Smith

PAC STAINLESS LTD.

SO# 270126-1

PO# 335262

SMI-TEXAS

P. O. Box 911
Seguin, Texas 78156-0911
(830) 372-8200

CERTIFIED MILL TEST REPORT

For additional copies call
(830) 372-8485

We hereby certify that the test results presented here are accurate and conform to the reported grade

Daniel J. Schacht

Quality Assurance Manager

HEAT NO.: 225085 SECTION: L 3x3x3/8x20'0" L 76x76x9.5x6.096 GRADE: ASTM A36/A52950	SOLD TO	TRIPLE-S STEEL SUPPLY CO PO BOX 21119 HOUSTON, TX 77226-	SHIP TO: TRIPLE S STEEL 2707 CASTROVILLE RD. SAN ANTONIO, TX 78237-

SHIP#: 100931/121
BOL #: 308116
INV #:
CUST PO #: SAN-34234
CUST P/N:

CHEMICAL ANALYSIS		PROPERTIES						
	%	MECHANICAL	TEST I		TEST		TEST	
			IMPERIAL	METRIC	IMPERIAL	METRIC	IMPERIAL	METRIC
C	0.16							
Mn	0.68	Yield Strength	55.3 KSI	381.3 MPA				
P	0.016	Tensile Strength	75.8 KSI	522.6 MPA				
S	0.038	Elongation	34 %	34 %				
Si	0.17	Gauge Length	8 INS	203 MM				
Cu	0.41	Reduction of Area						
Cr	0.28	Bend Test						
Ni	0.19	Diameter						
Mo	0.045	Charpy Impact						
Cb	0.000	Test Temp						
V	0.018	Sample Size						
Sn	0.022	Orientation						
B	0.0000	Hardness						
Ti	0.002							
C.Eq.								

JOMINY RESULTS - Rockwell C hardness at 1/16th inch increments											
1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	18	20	22	24	26	28	30	32

GRAIN SIZE	
METHOD	
RESULT	

INCLUSION RATING							
METHOD							
TYPE							
	T	H	T	H	T	H	T	H
SIZE							

100% MELTED AND MANUFACTURED IN THE USA AND FREE OF MERCURY CONTAMINATION IN THE PROCESS

REMARKS:

FEB-15-2003 05:14

EMS
Electrical Mechanical Services
998 E. Berwood Avenue
St. Paul, MN 55110-5107

February 20, 2004

Mr. Andrew J. Oare
C. Emery Nelson Inc.
P.O. Box 238
7631 Commerce St.
Hamel, MN 55340

Subject: Blowers (Met Council)

Dear Andy,

On the following pages are the alignment results as well as the vibration readings for all the blowers. There are alignment results for the direct-coupled units where an alignment laser was used. The belts were aligned with a laser on Bl-19 and BL-20 as well, but this type of machine does not give a numeric value for alignment.

Complete spectral data for each machine is included in the report as well as the overall values in ips. and mills. All of the values collected appear to be within the operating specifications for this type of equipment.

If you have any questions or comments please feel free to give us a call. Thank you for choosing Electrical Mechanical Services for your alignment and vibration acceptance needs. We look forward to working with you in the future.

Sincerely,

Jason Haugen
Consulting Services
jhaugen@electmech.com

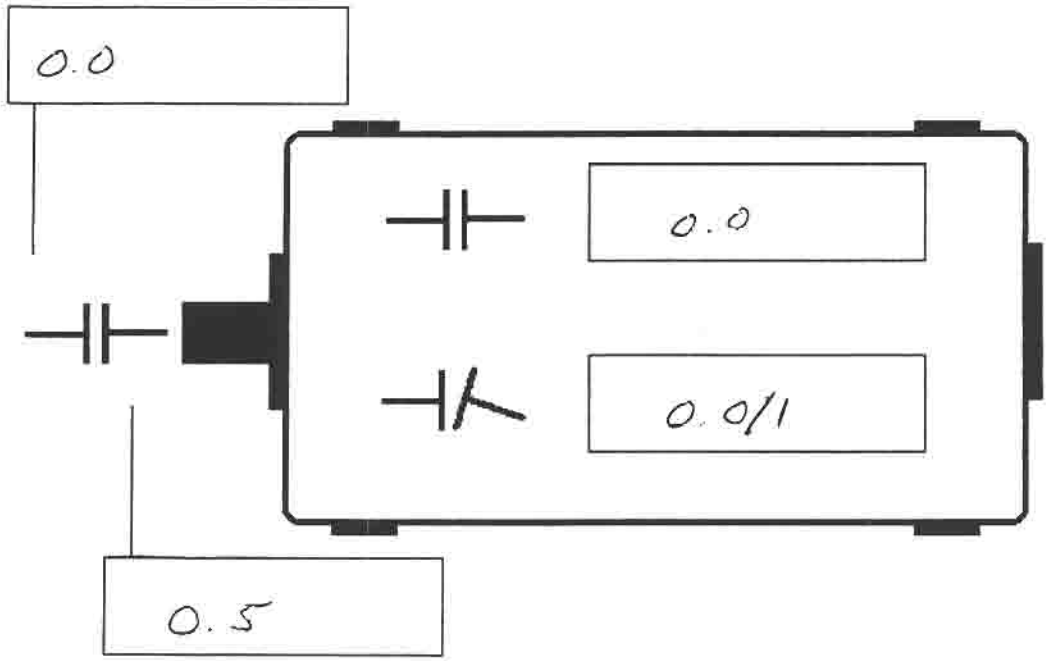
CC: Greg Vokovan-Consulting Services Manager

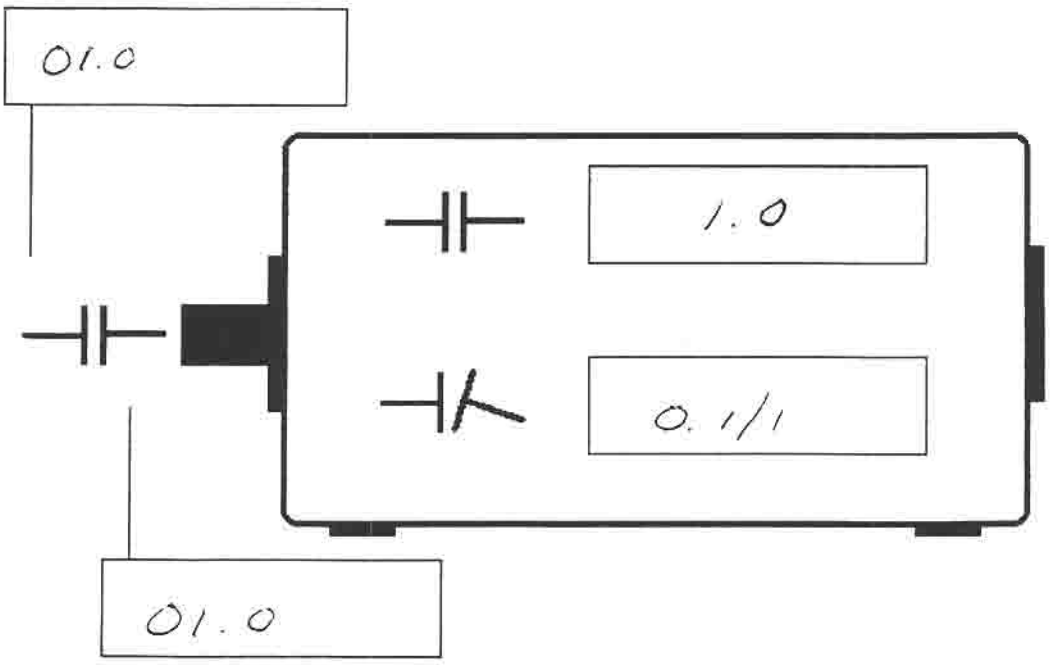
P-1206

GARDNER DENVER
CYCLO BLOWER

Customer: C. Emery Nelson Inc **RO#:** 29099

Machine Speed: 1785 **Machine Info:** GE 350 Hp / Gardner Denver Blower P1206

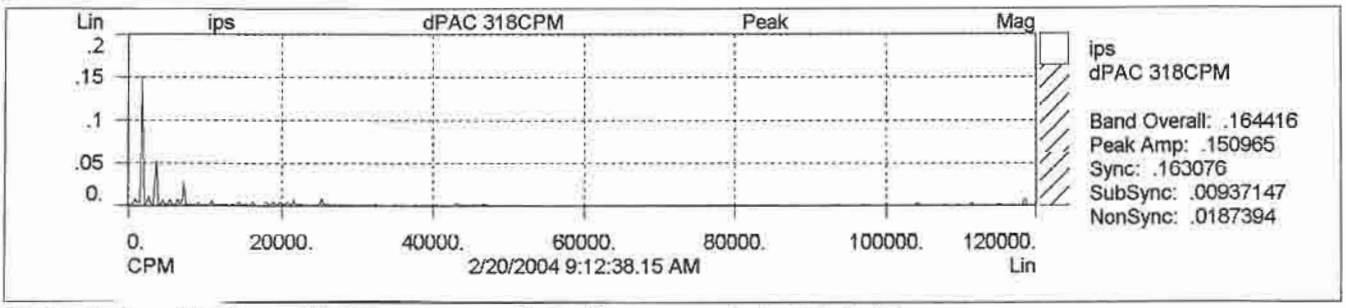




Service Technician: _____ **Date:** 1-20-04

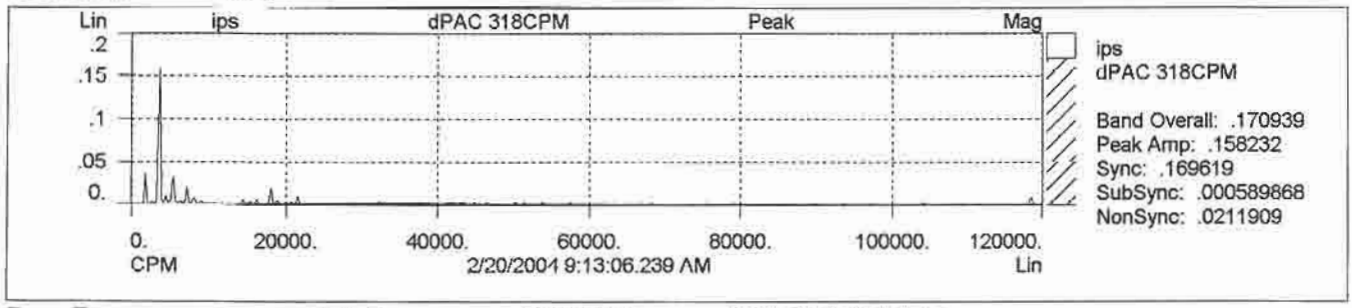
MET COUNCIL (C. EMERY NELSON)

Blowers
1206
POSITION : 1
LOCATION: MTR1H



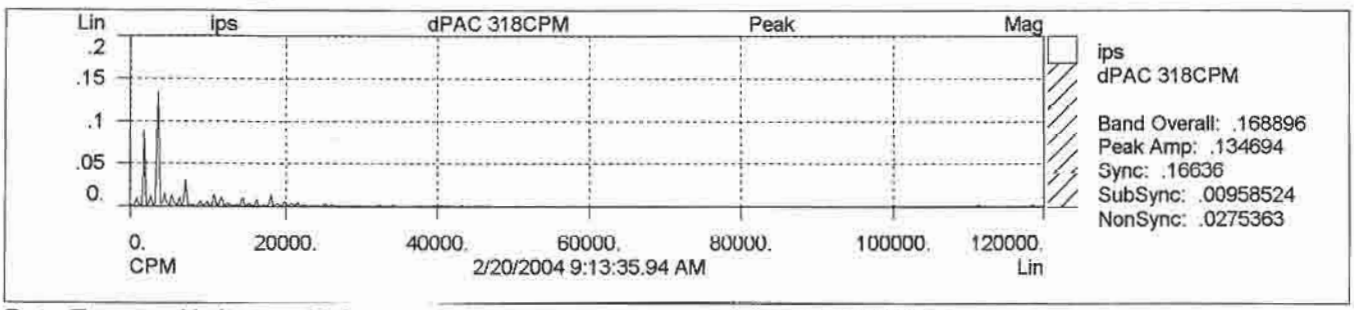
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.166	Peak	2/20/2004 9:12 AM
Magnitude	mils	1.63	Peak-Peak	2/20/2004 9:12 AM

Blowers
1206
POSITION : 2
LOCATION: MTR1V



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.179	Peak	2/20/2004 9:13 AM
Magnitude	mils	.907	Peak-Peak	2/20/2004 9:13 AM

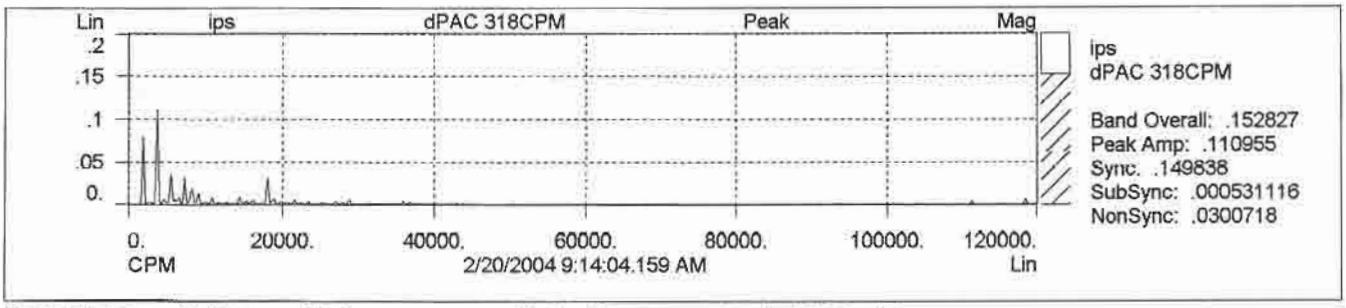
Blowers
1206
POSITION : 3
LOCATION: MTR2H



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.172	Peak	2/20/2004 9:13 AM
Magnitude	mils	1.2	Peak-Peak	2/20/2004 9:13 AM

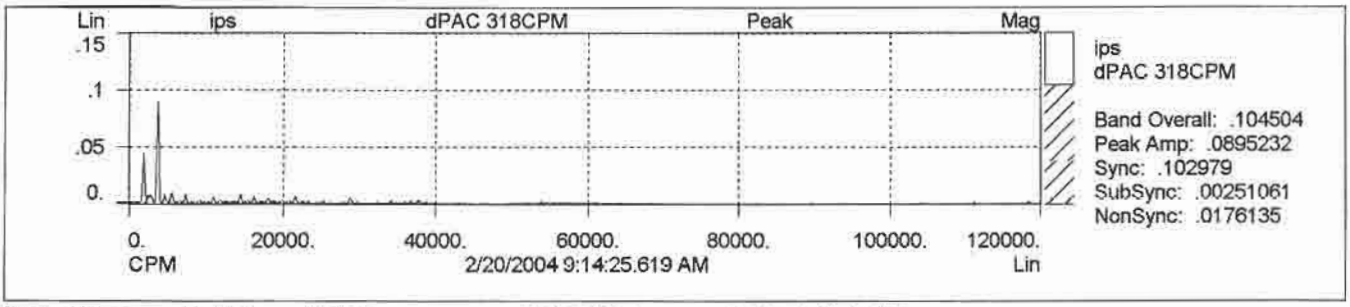
MET COUNCIL (C. EMERY NELSON)

Blowers
1206
POSITION : **4**
LOCATION: **MTR2V**



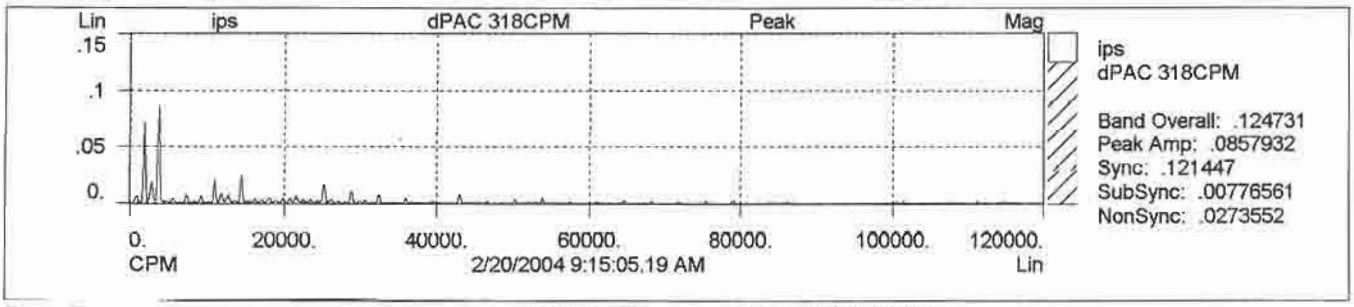
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.153	Peak	2/20/2004 9:14 AM
Magnitude	mils	1.03	Peak-Peak	2/20/2004 9:14 AM

Blowers
1206
POSITION : **5**
LOCATION: **MTR2A**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.106	Peak	2/20/2004 9:14 AM
Magnitude	mils	.698	Peak-Peak	2/20/2004 9:14 AM

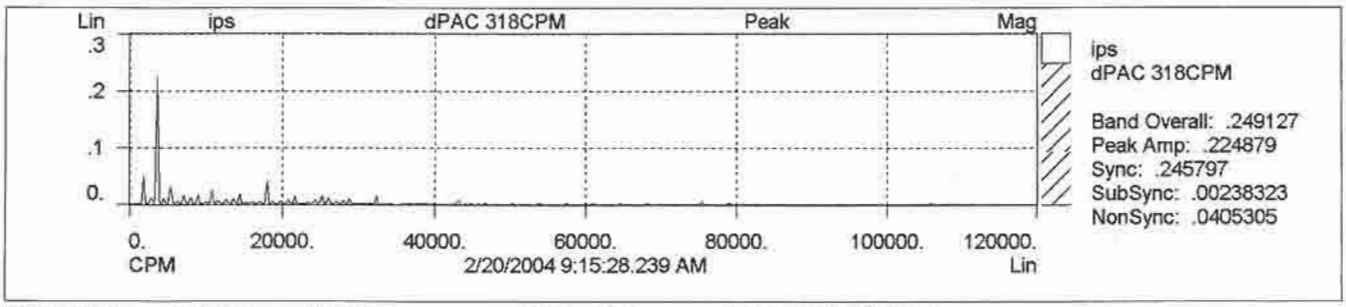
Blowers
1206
POSITION : **6**
LOCATION: **MTR3H**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.127	Peak	2/20/2004 9:15 AM
Magnitude	mils	.907	Peak-Peak	2/20/2004 9:15 AM

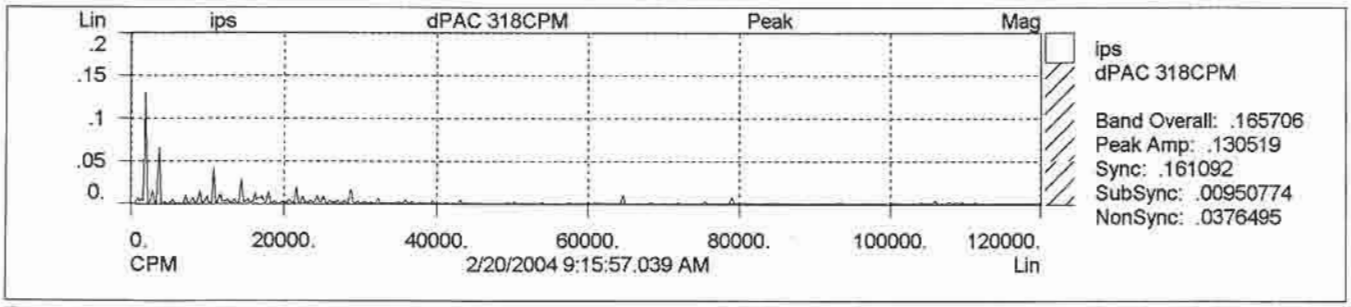
MET COUNCIL (C. EMERY NELSON)

Blowers
1206
POSITION : **7**
LOCATION: **BLW3V**



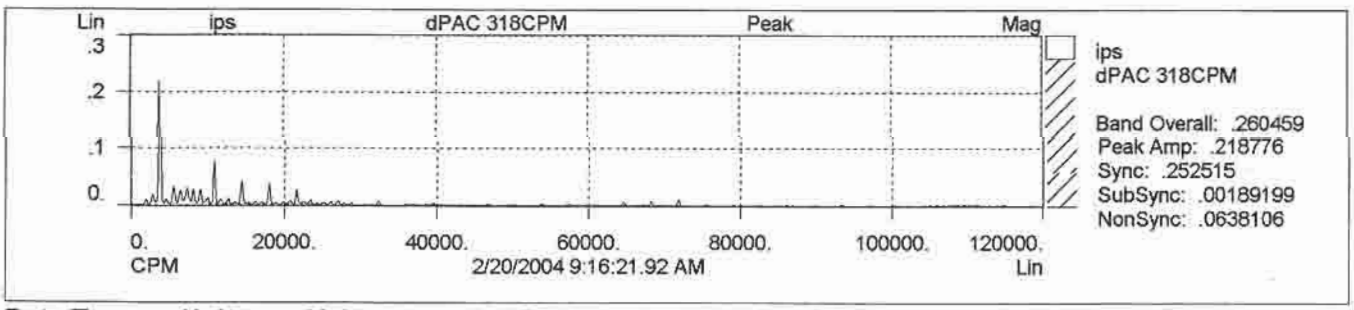
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.251	Peak	2/20/2004 9:15 AM
Magnitude	mils	1.26	Peak-Peak	2/20/2004 9:15 AM

Blowers
1206
POSITION : **8**
LOCATION: **BLW4H**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.168	Peak	2/20/2004 9:15 AM
Magnitude	mils	1.45	Peak-Peak	2/20/2004 9:16 AM

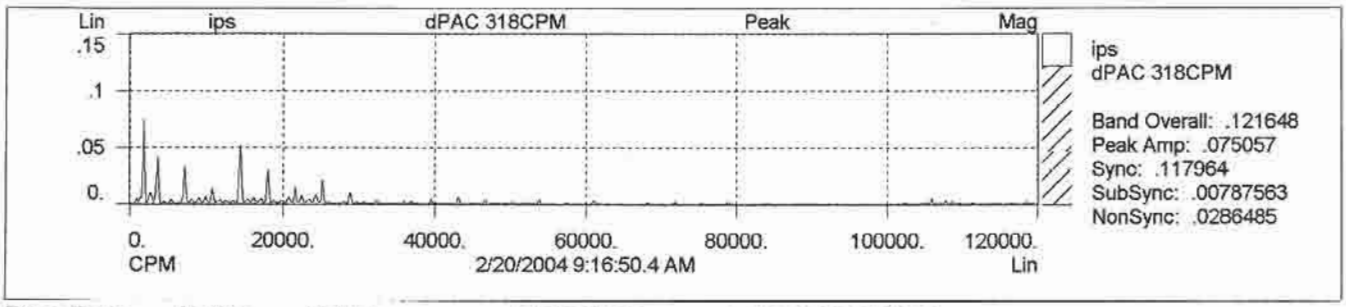
Blowers
1206
POSITION : **9**
LOCATION: **BLW4V**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.269	Peak	2/20/2004 9:16 AM
Magnitude	mils	1.15	Peak-Peak	2/20/2004 9:16 AM

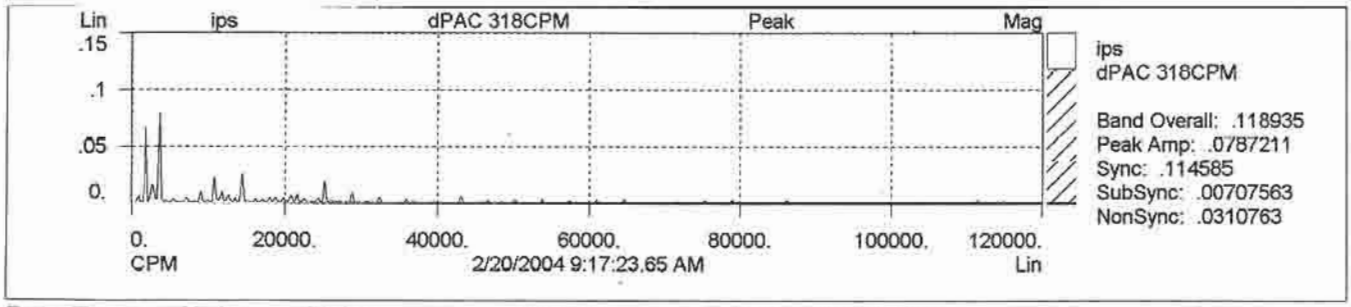
MET COUNCIL (C. EMERY NELSON)

Blowers
1206
POSITION : **10**
LOCATION: **BLW4A**



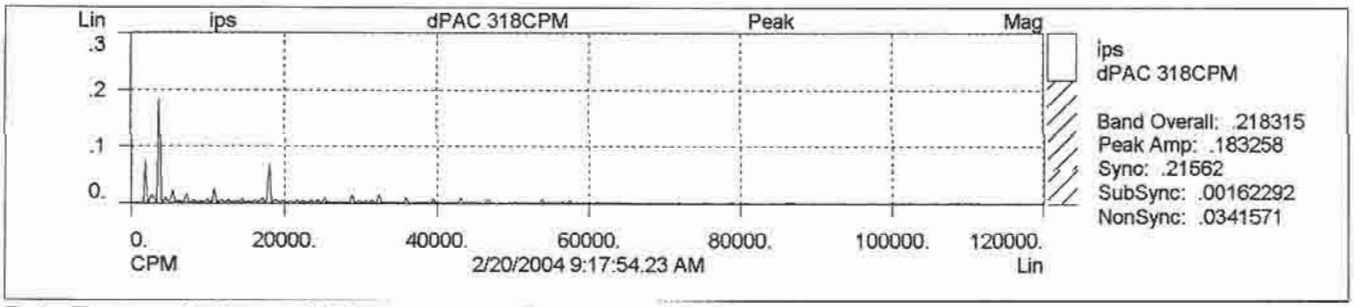
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.122	Peak	2/20/2004 9:16 AM
Magnitude	mils	.854	Peak-Peak	2/20/2004 9:17 AM

Blowers
1206
POSITION : **11**
LOCATION: **BLW5H**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.119	Peak	2/20/2004 9:17 AM
Magnitude	mils	.852	Peak-Peak	2/20/2004 9:17 AM

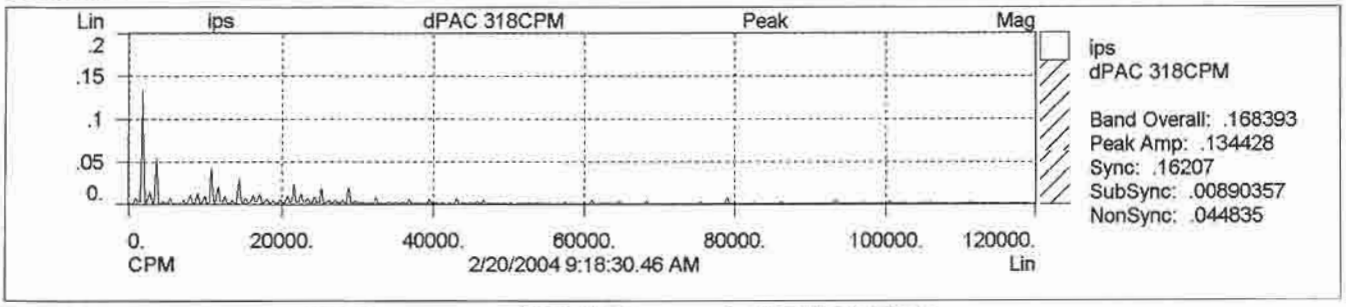
Blowers
1206
POSITION : **12**
LOCATION: **BLW5V**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.223	Peak	2/20/2004 9:17 AM
Magnitude	mils	1.27	Peak-Peak	2/20/2004 9:18 AM

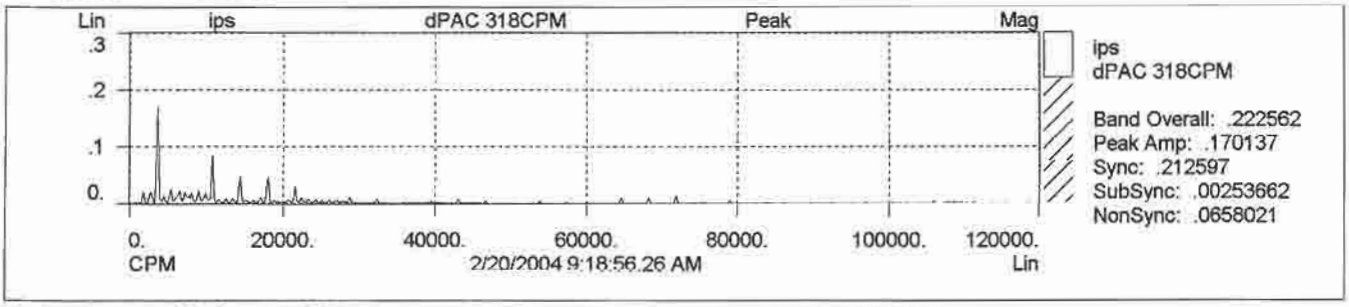
MET COUNCIL (C. EMERY NELSON)

Blowers
1206
POSITION : **13**
LOCATION: **BLW6H**



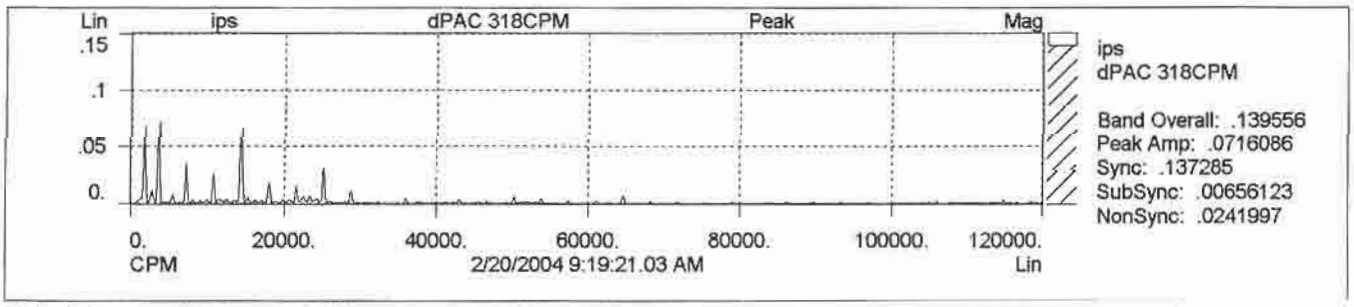
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.169	Peak	2/20/2004 9:18 AM
Magnitude	mils	1.47	Peak-Peak	2/20/2004 9:18 AM

Blowers
1206
POSITION : **14**
LOCATION: **BLW6V**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.234	Peak	2/20/2004 9:18 AM
Magnitude	mils	1.03	Peak-Peak	2/20/2004 9:19 AM

Blowers
1206
POSITION : **15**
LOCATION: **BLW6A**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.139	Peak	2/20/2004 9:19 AM
Magnitude	mils	.820	Peak-Peak	2/20/2004 9:19 AM

P-1207

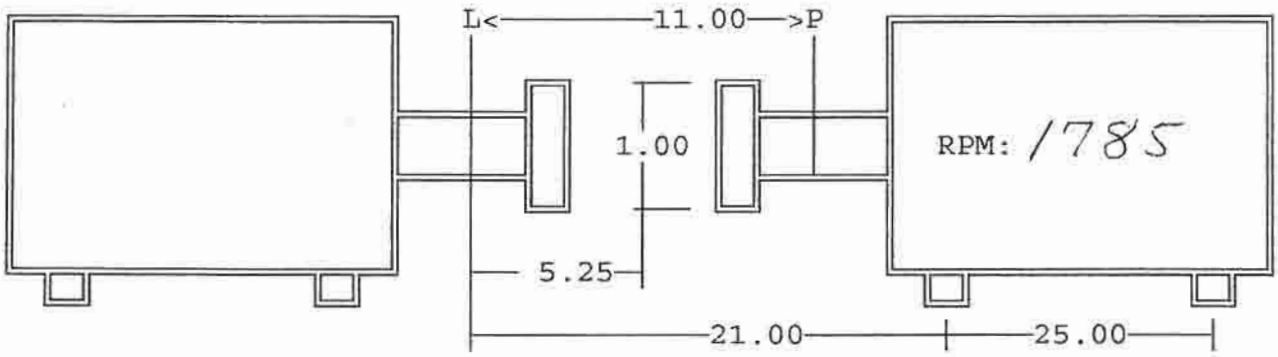
GARDNER DENVER
CYCLO BLOWER

PRUFTECHNIK AG 85737 ISMANING GERMANY
MASTERLIGN V: 1.18 SN: 12981940 File #04 2004 01.20 10:24A

Company: Met Council #1207

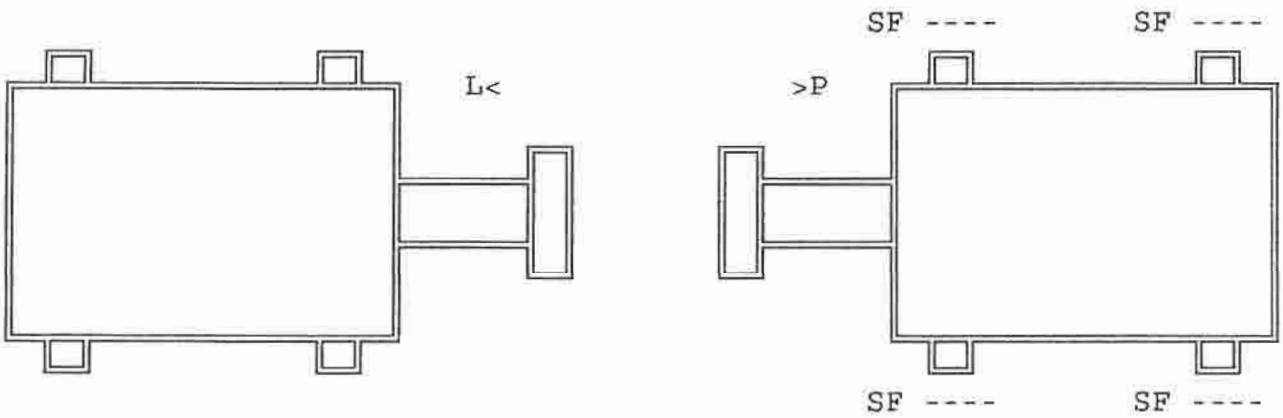
Left Machine | Coupling | Right Machine

VERTICAL RESULTS - Inch



	Gap	Offset	Corrections	
Target			+0.001	+0.001
Actual	/+.0000	-.0005	--	

HORIZONTAL RESULTS - Inch

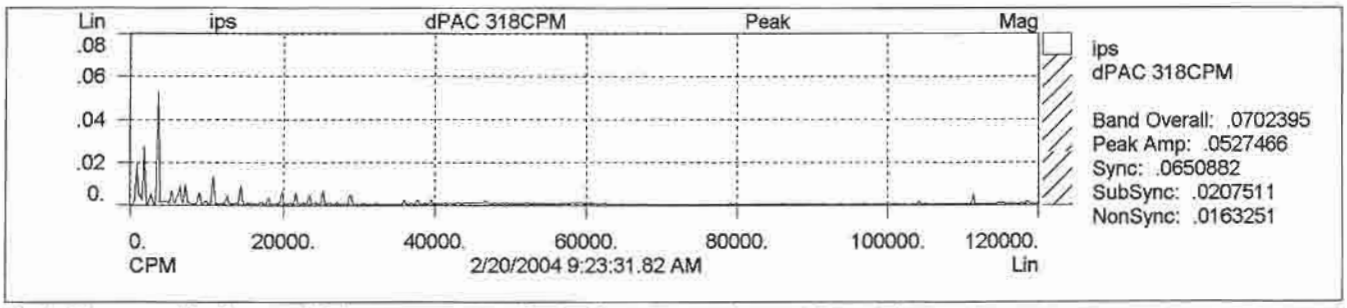


	Gap	Offset	Corrections	
Target			+0.001	+0.002
Actual	/+.0000	-.0006	--	

Operator: 2004 01.23 11:48A Page:1

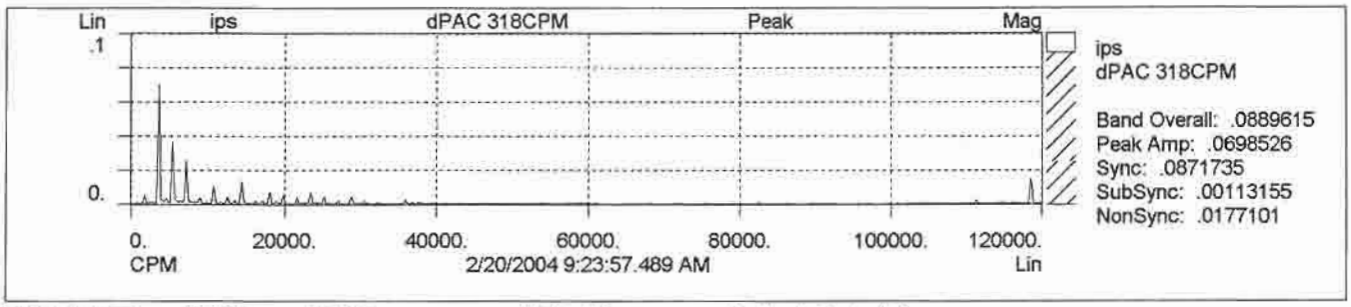
MET COUNCIL (C. EMERY NELSON)

Blowers
1207
POSITION : **1**
LOCATION: **MTR1H**



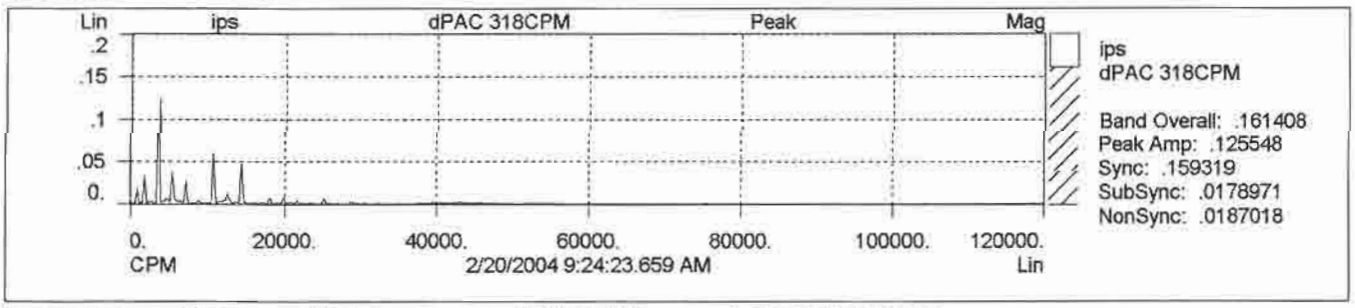
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.0691	Peak	2/20/2004 9:23 AM
Magnitude	mils	.594	Peak-Peak	2/20/2004 9:23 AM

Blowers
1207
POSITION : **2**
LOCATION: **MTR1V**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.0843	Peak	2/20/2004 9:23 AM
Magnitude	mils	.415	Peak-Peak	2/20/2004 9:24 AM

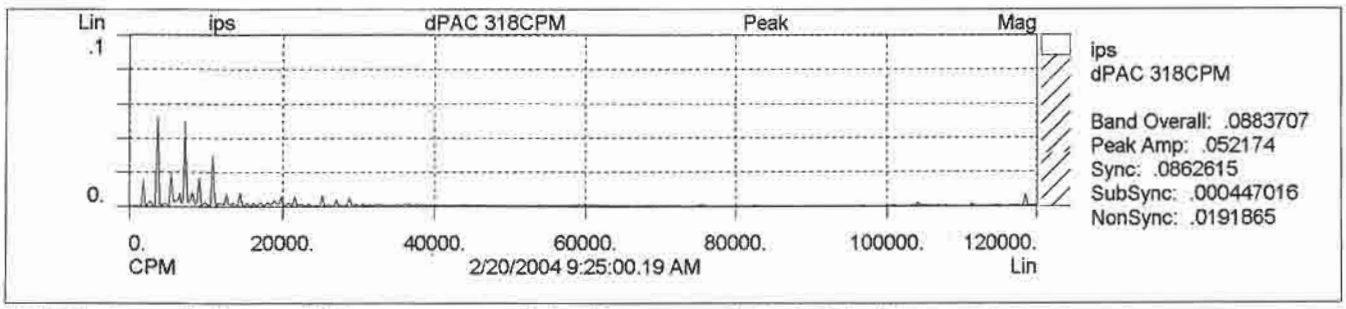
Blowers
1207
POSITION : **3**
LOCATION: **MTR2H**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.169	Peak	2/20/2004 9:24 AM
Magnitude	mils	.871	Peak-Peak	2/20/2004 9:24 AM

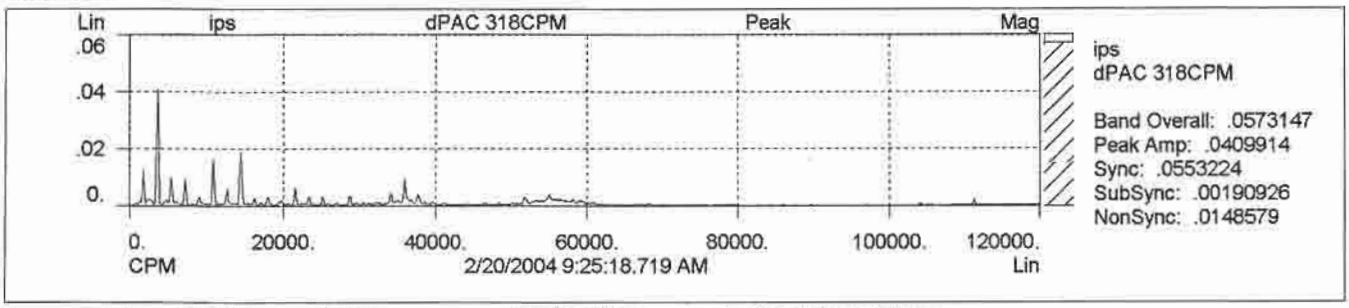
MET COUNCIL (C. EMERY NELSON)

Blowers
1207
POSITION : 4
LOCATION: MTR2V



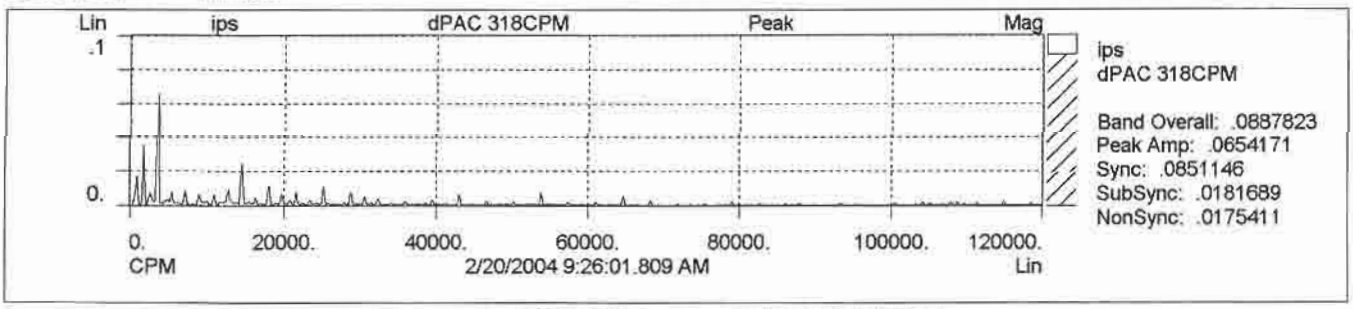
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.0899	Peak	2/20/2004 9:25 AM
Magnitude	mils	.36	Peak-Peak	2/20/2004 9:25 AM

Blowers
1207
POSITION : 5
LOCATION: MTR2A



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.0583	Peak	2/20/2004 9:25 AM
Magnitude	mils	.266	Peak-Peak	2/20/2004 9:25 AM

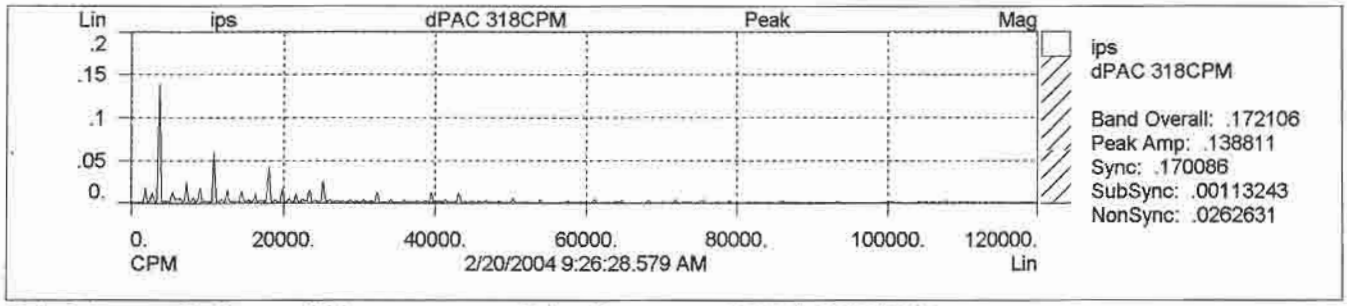
Blowers
1207
POSITION : 6
LOCATION: MTR3H



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.0906	Peak	2/20/2004 9:26 AM
Magnitude	mils	.654	Peak-Peak	2/20/2004 9:26 AM

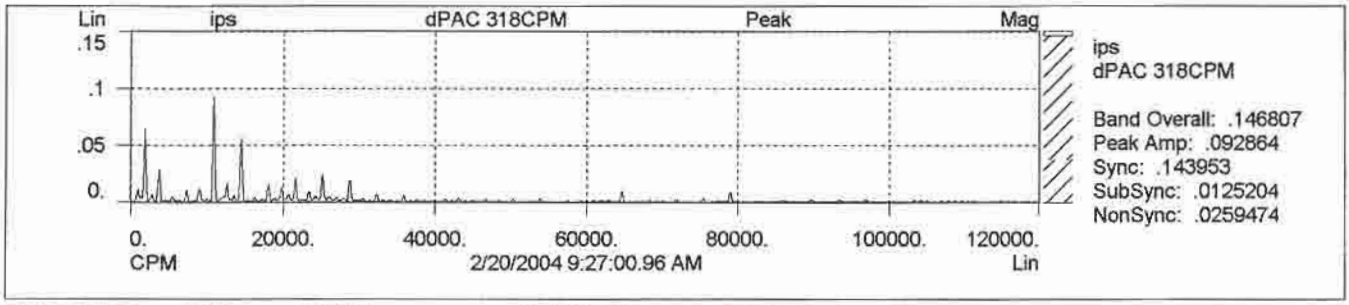
MET COUNCIL (C. EMERY NELSON)

Blowers
1207
POSITION : **7**
LOCATION: **BLW3V**



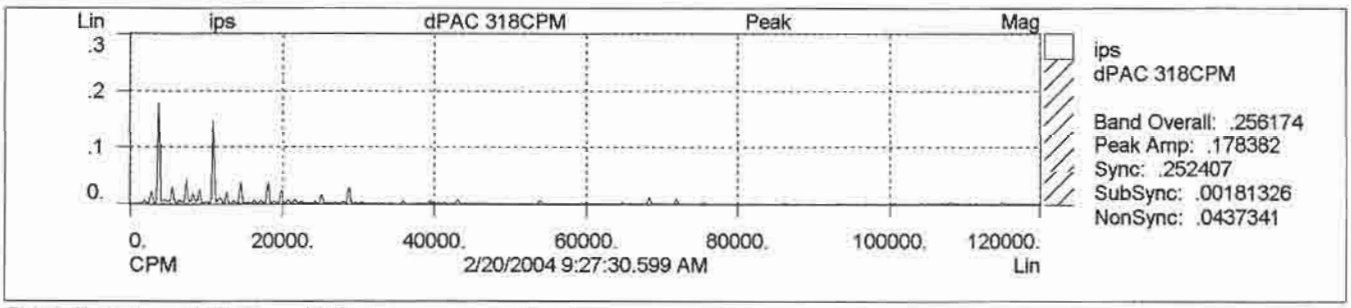
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.175	Peak	2/20/2004 9:26 AM
Magnitude	mils	.779	Peak-Peak	2/20/2004 9:26 AM

Blowers
1207
POSITION : **8**
LOCATION: **BLW4H**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.147	Peak	2/20/2004 9:27 AM
Magnitude	mils	.764	Peak-Peak	2/20/2004 9:27 AM

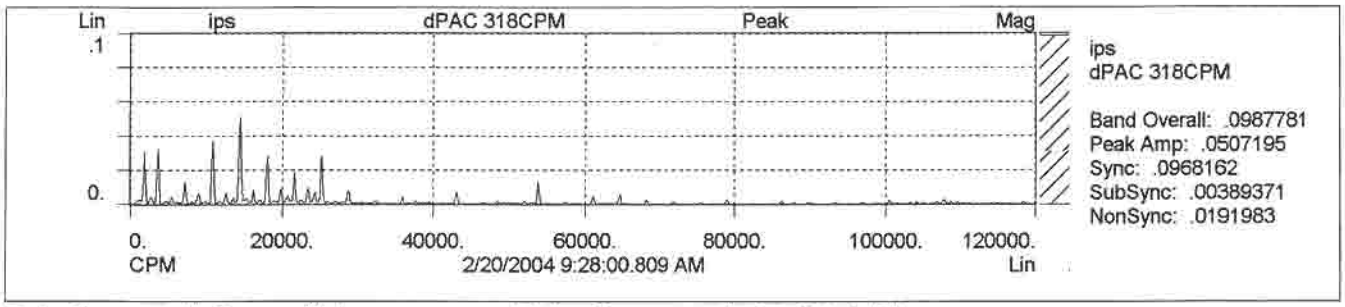
Blowers
1207
POSITION : **9**
LOCATION: **BLW4V**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.257	Peak	2/20/2004 9:27 AM
Magnitude	mils	1.04	Peak-Peak	2/20/2004 9:27 AM

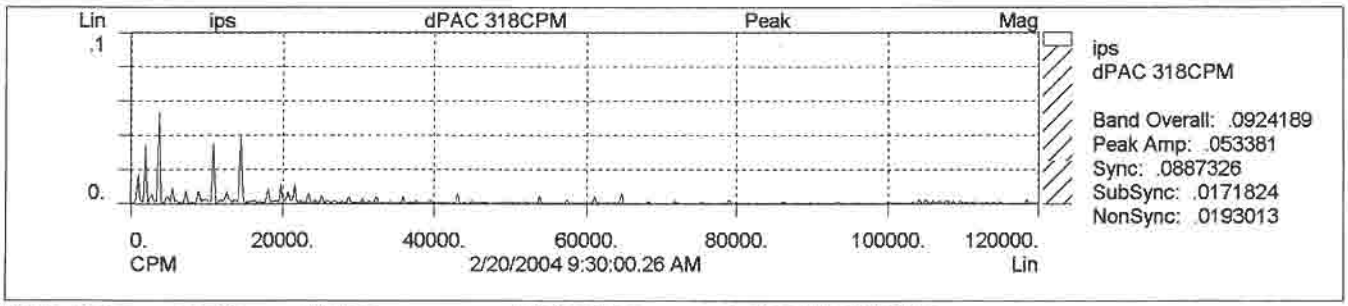
MET COUNCIL (C. EMERY NELSON)

Blowers
1207
POSITION : **10**
LOCATION: **BLW4A**



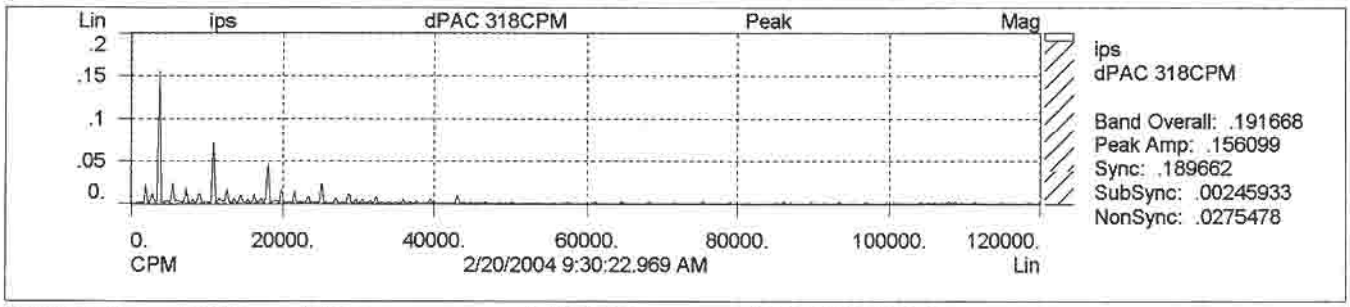
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.098	Peak	2/20/2004 9:28 AM
Magnitude	mils	.395	Peak-Peak	2/20/2004 9:28 AM

Blowers
1207
POSITION : **11**
LOCATION: **BLW5H**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.0928	Peak	2/20/2004 9:30 AM
Magnitude	mils	.616	Peak-Peak	2/20/2004 9:30 AM

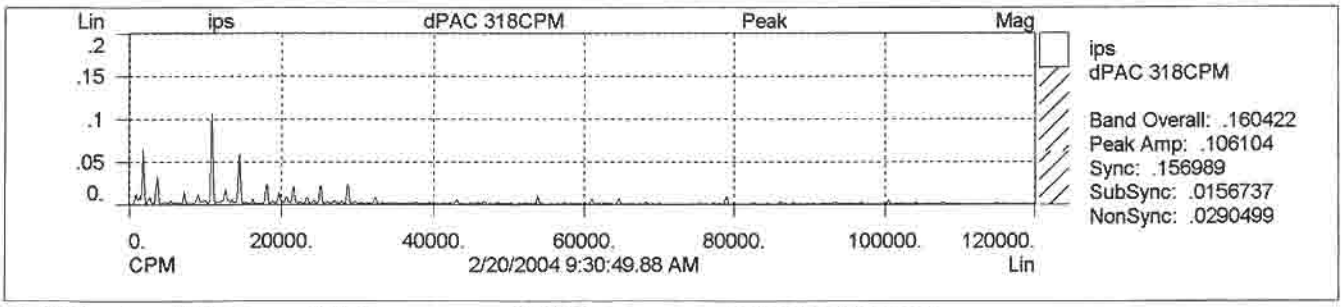
Blowers
1207
POSITION : **12**
LOCATION: **BLW5V**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.194	Peak	2/20/2004 9:30 AM
Magnitude	mils	.905	Peak-Peak	2/20/2004 9:30 AM

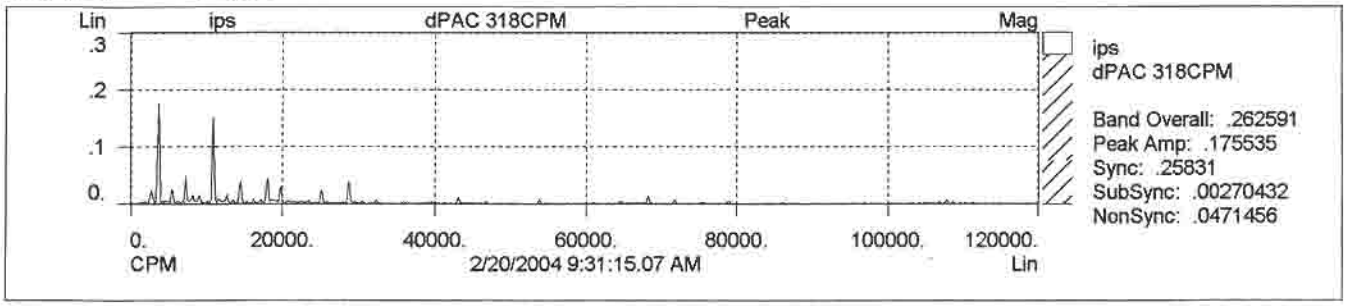
MET COUNCIL (C. EMERY NELSON)

Blowers
1207
POSITION : **13**
LOCATION: **BLW6H**



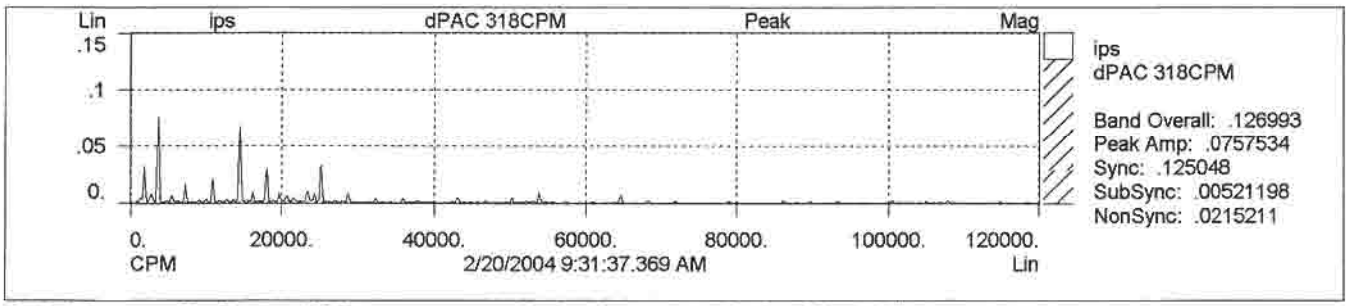
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.163	Peak	2/20/2004 9:30 AM
Magnitude	mils	.801	Peak-Peak	2/20/2004 9:31 AM

Blowers
1207
POSITION : **14**
LOCATION: **BLW6V**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.258	Peak	2/20/2004 9:31 AM
Magnitude	mils	.999	Peak-Peak	2/20/2004 9:31 AM

Blowers
1207
POSITION : **15**
LOCATION: **BLW6A**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.129	Peak	2/20/2004 9:31 AM
Magnitude	mils	.554	Peak-Peak	2/20/2004 9:31 AM

P-1208

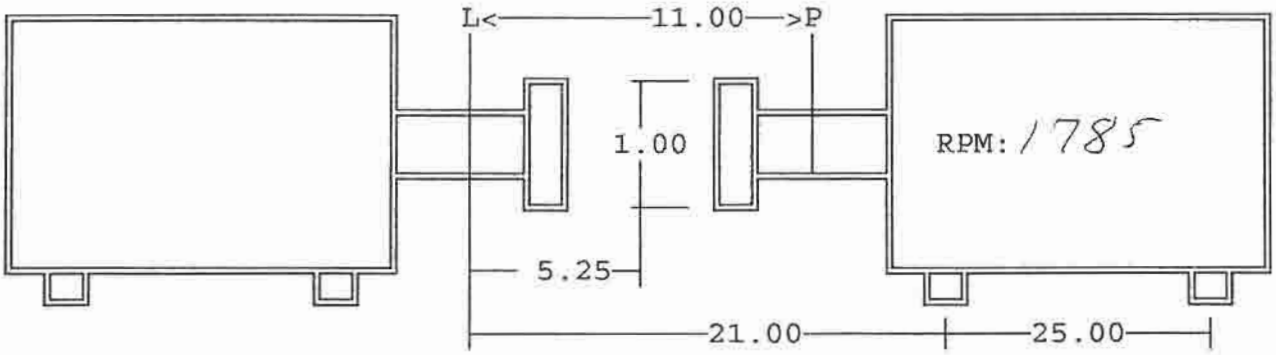
GARDNER DENVER
CYCLO BLOWER

PRUFTECHNIK AG 85737 ISMANING GERMANY
MASTERLIGN V: 1.18 SN: 12981940 File #03 2004 01.20 10:01A

Company: Met...Cover.....#.1208.....

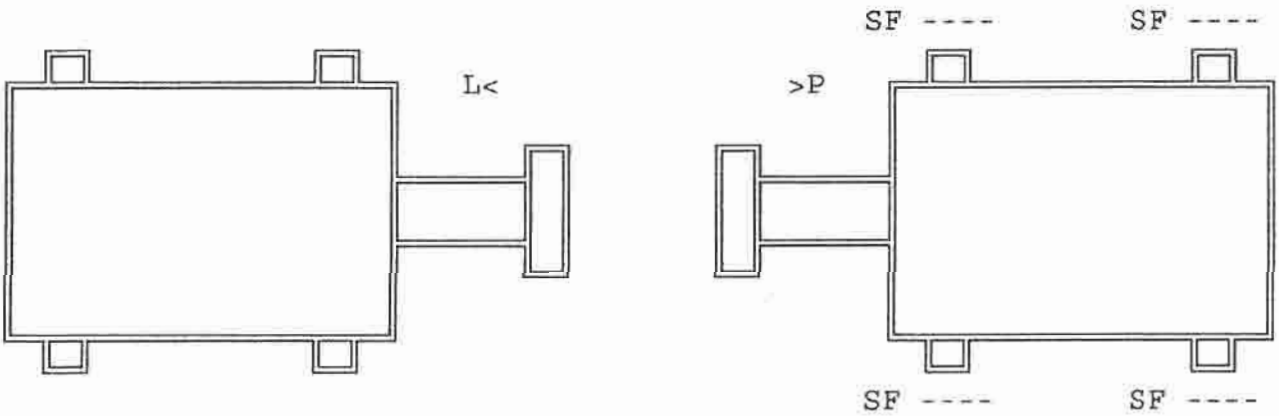
Left Machine | Coupling | Right Machine

VERTICAL RESULTS - Inch



	Gap	Offset		Corrections	
Target				-0.000	-0.002
Actual	\-.0001	-.0010	--		

HORIZONTAL RESULTS - Inch

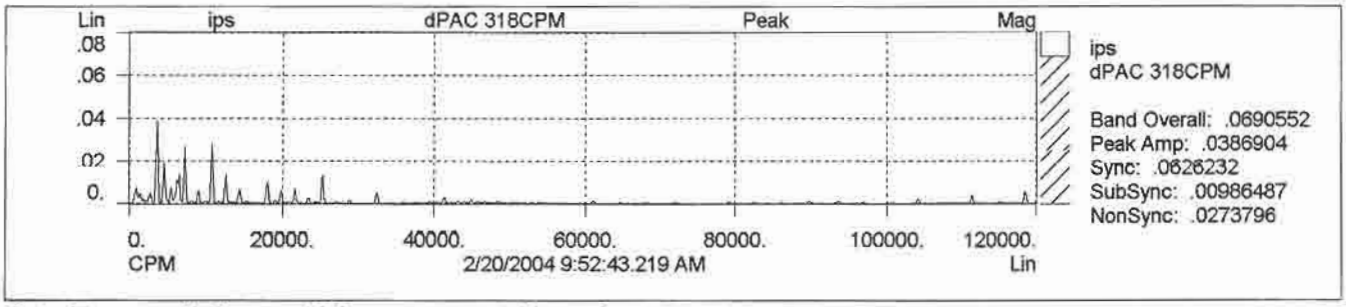


	Gap	Offset		Corrections	
Target				+0.001	+0.001
Actual	\-.0000	-.0011	--		

Operator: 2004 01.23 11:44A Page:1

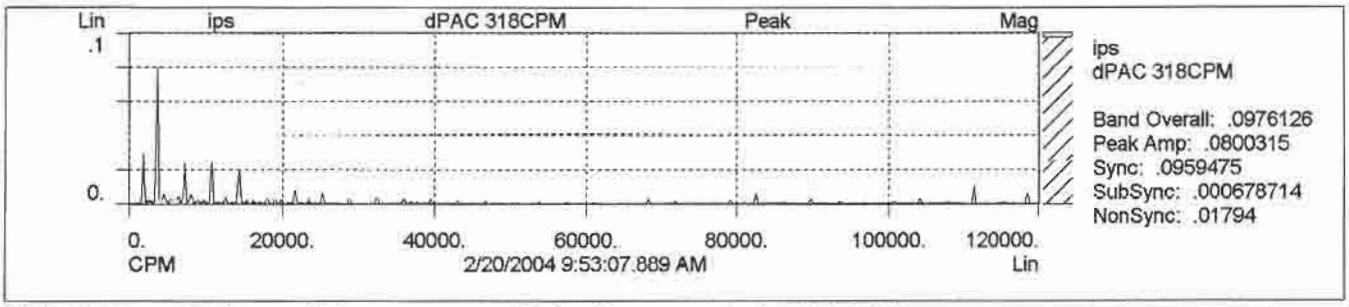
MET COUNCIL (C. EMERY NELSON)

Blowers
1208
POSITION : 1
LOCATION: MTR1H



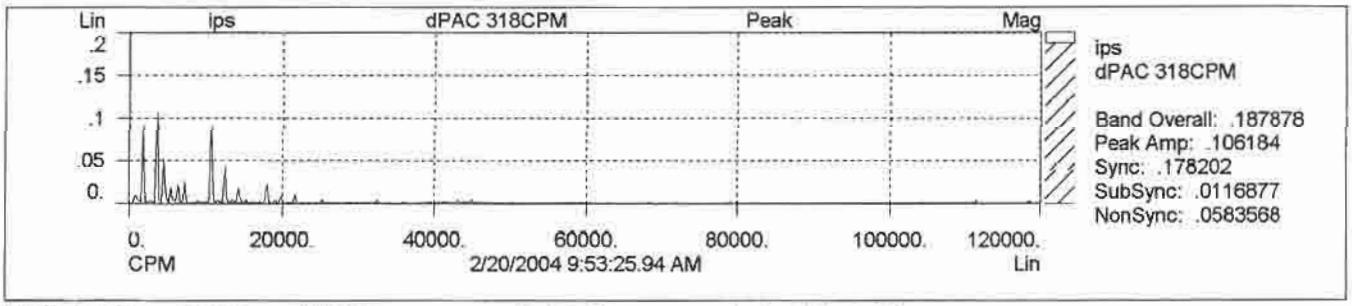
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.0684	Peak	2/20/2004 9:52 AM
Magnitude	mils	.34	Peak-Peak	2/20/2004 9:52 AM

Blowers
1208
POSITION : 2
LOCATION: MTR1V



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.0969	Peak	2/20/2004 9:53 AM
Magnitude	mils	.529	Peak-Peak	2/20/2004 9:53 AM

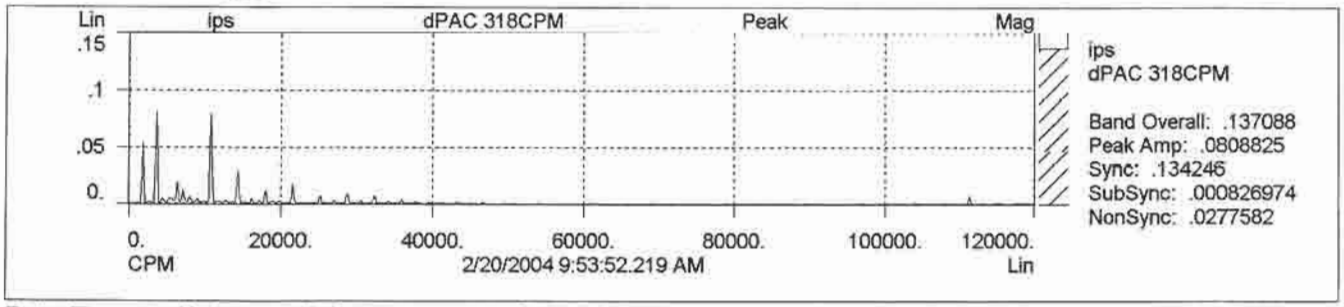
Blowers
1208
POSITION : 3
LOCATION: MTR2H



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.192	Peak	2/20/2004 9:53 AM
Magnitude	mils	1.16	Peak-Peak	2/20/2004 9:53 AM

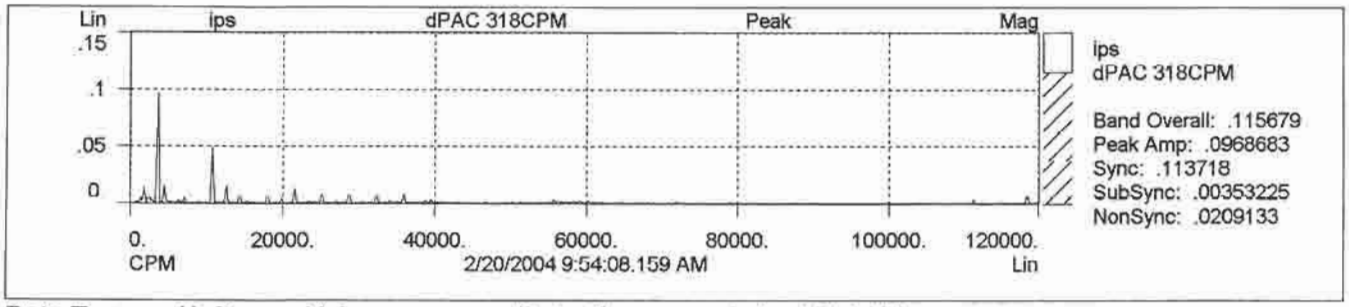
MET COUNCIL (C. EMERY NELSON)

Blowers
1208
POSITION : **4**
LOCATION: **MTR2V**



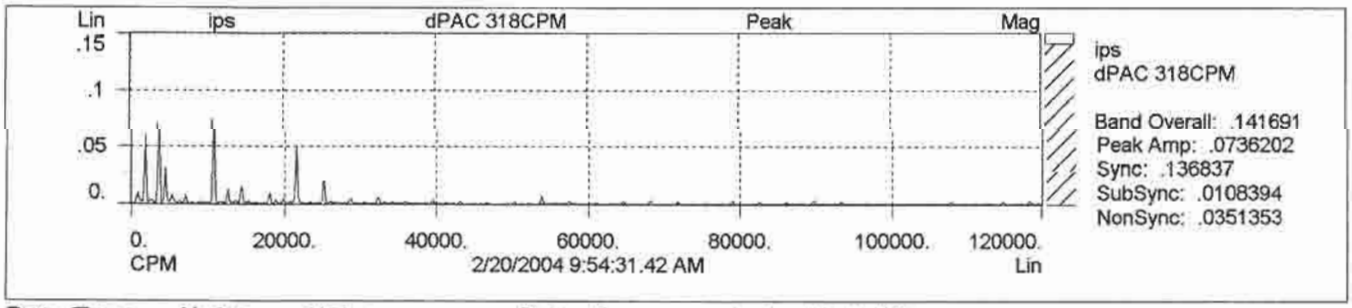
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.138	Peak	2/20/2004 9:53 AM
Magnitude	mils	.724	Peak-Peak	2/20/2004 9:53 AM

Blowers
1208
POSITION : **5**
LOCATION: **MTR2A**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.117	Peak	2/20/2004 9:54 AM
Magnitude	mils	.542	Peak-Peak	2/20/2004 9:54 AM

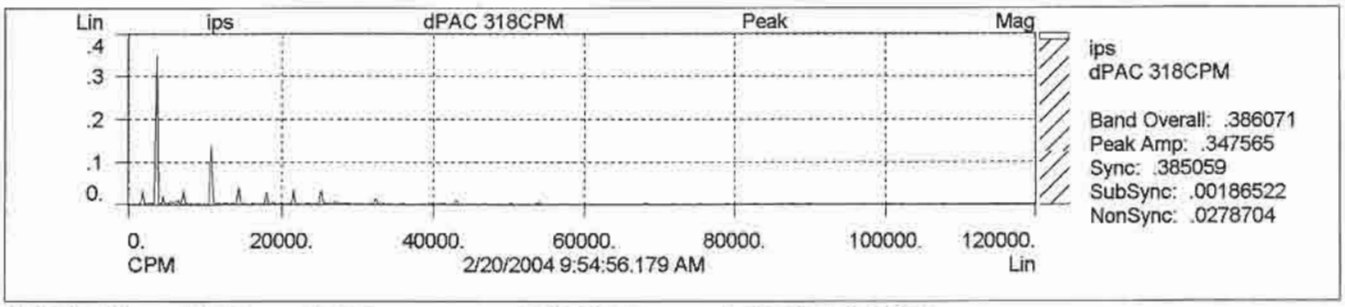
Blowers
1208
POSITION : **6**
LOCATION: **MTR3H**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.144	Peak	2/20/2004 9:54 AM
Magnitude	mils	.878	Peak-Peak	2/20/2004 9:54 AM

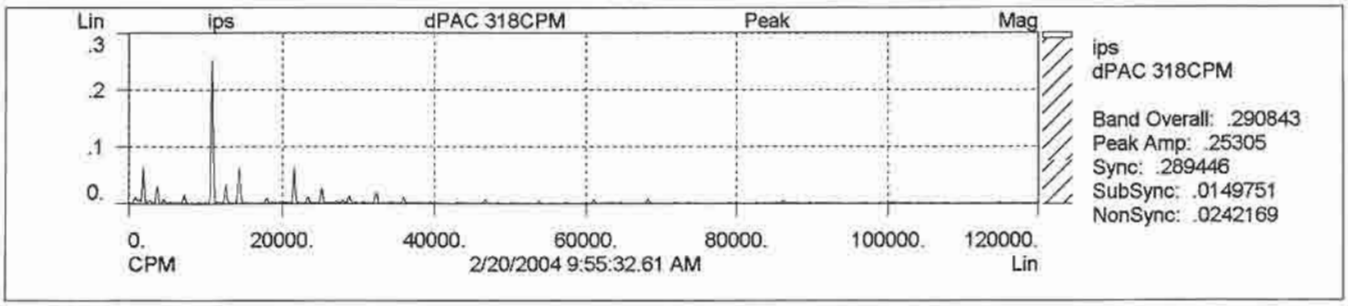
MET COUNCIL (C. EMERY NELSON)

Blowers
1208
POSITION : **7**
LOCATION: **BLW3V**



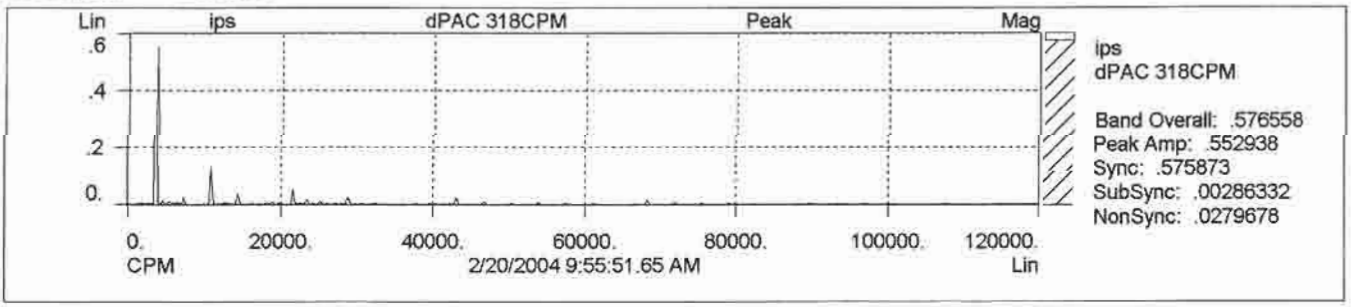
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.389	Peak	2/20/2004 9:54 AM
Magnitude	mils	1.96	Peak-Peak	2/20/2004 9:55 AM

Blowers
1208
POSITION : **8**
LOCATION: **BLW4H**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.292	Peak	2/20/2004 9:55 AM
Magnitude	mils	.873	Peak-Peak	2/20/2004 9:55 AM

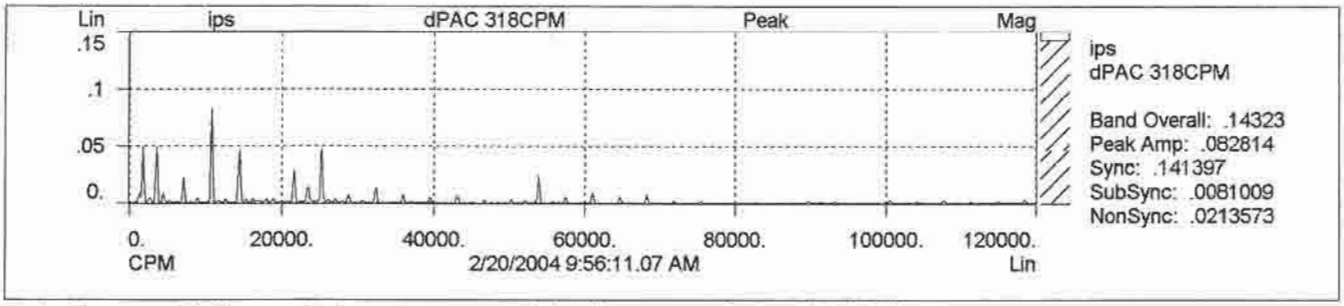
Blowers
1208
POSITION : **9**
LOCATION: **BLW4V**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.573	Peak	2/20/2004 9:55 AM
Magnitude	mils	2.92	Peak-Peak	2/20/2004 9:56 AM

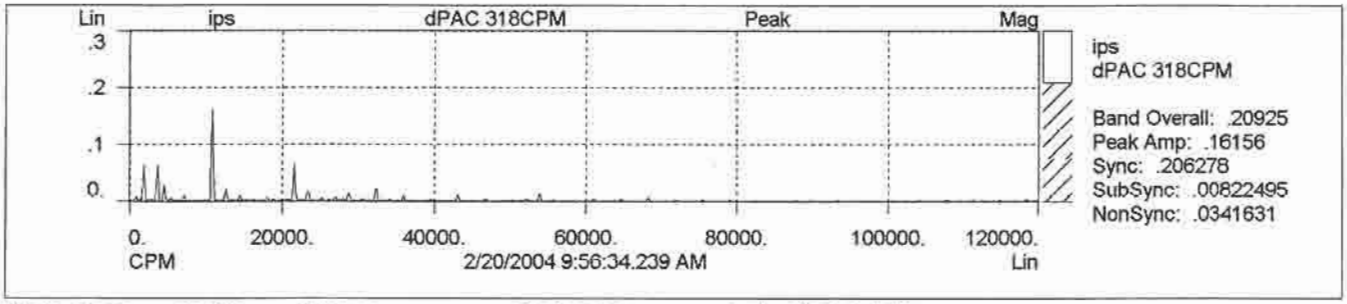
MET COUNCIL (C. EMERY NELSON)

Blowers
1208
POSITION : **10**
LOCATION: **BLW4A**



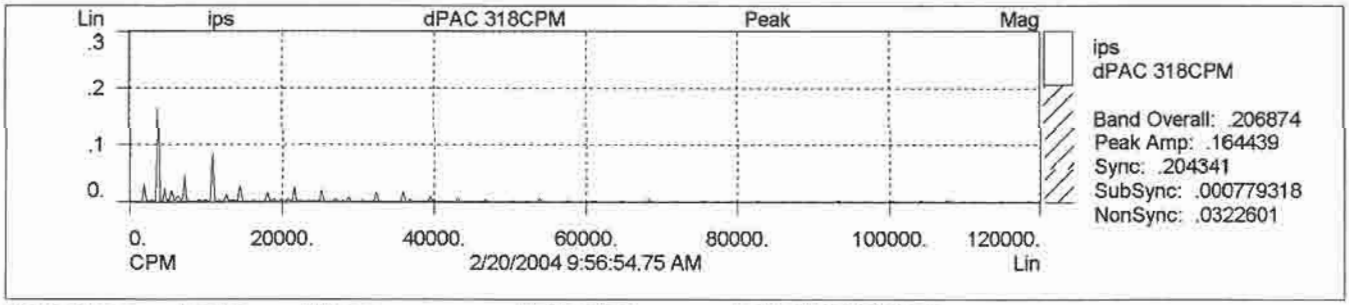
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.148	Peak	2/20/2004 9:56 AM
Magnitude	mils	.631	Peak-Peak	2/20/2004 9:56 AM

Blowers
1208
POSITION : **11**
LOCATION: **BLW5H**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.209	Peak	2/20/2004 9:56 AM
Magnitude	mils	.863	Peak-Peak	2/20/2004 9:56 AM

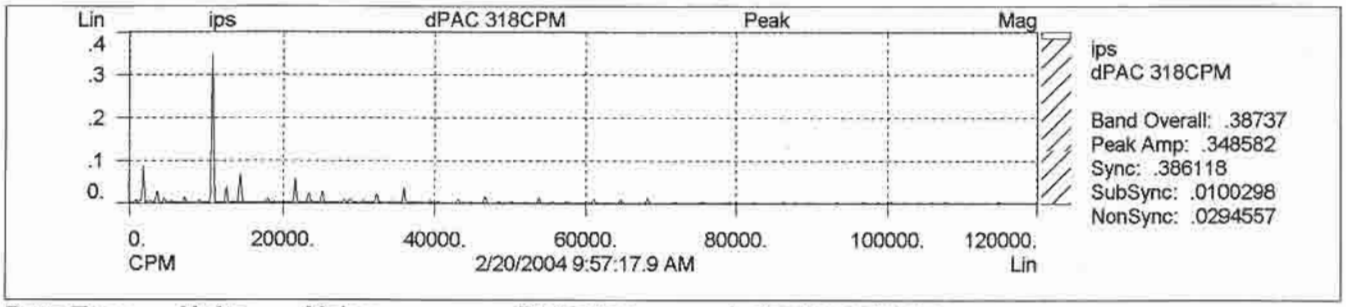
Blowers
1208
POSITION : **12**
LOCATION: **BLW5V**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.206	Peak	2/20/2004 9:56 AM
Magnitude	mils	.949	Peak-Peak	2/20/2004 9:57 AM

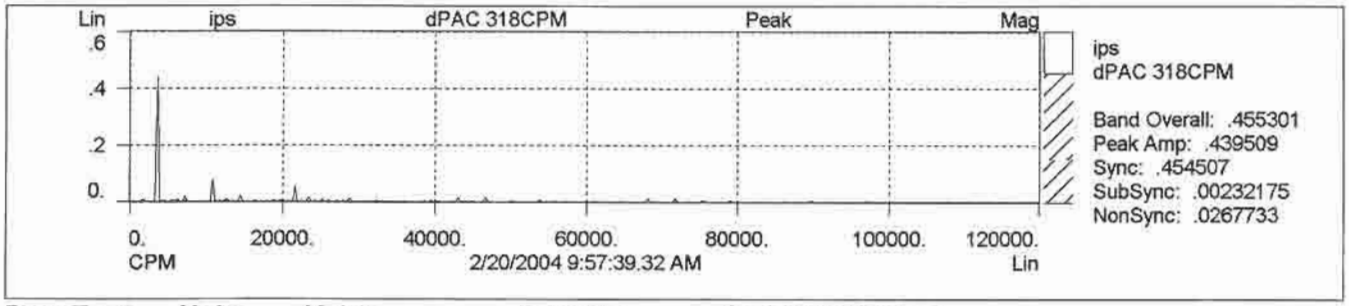
MET COUNCIL (C. EMERY NELSON)

Blowers
1208
POSITION : **13**
LOCATION: **BLW6H**



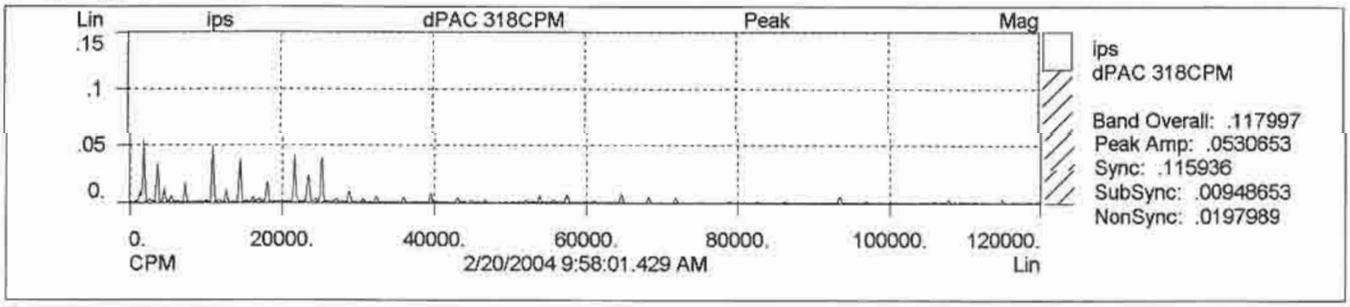
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.391	Peak	2/20/2004 9:57 AM
Magnitude	mils	1.14	Peak-Peak	2/20/2004 9:57 AM

Blowers
1208
POSITION : **14**
LOCATION: **BLW6V**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.454	Peak	2/20/2004 9:57 AM
Magnitude	mils	2.36	Peak-Peak	2/20/2004 9:57 AM

Blowers
1208
POSITION : **15**
LOCATION: **BLW6A**



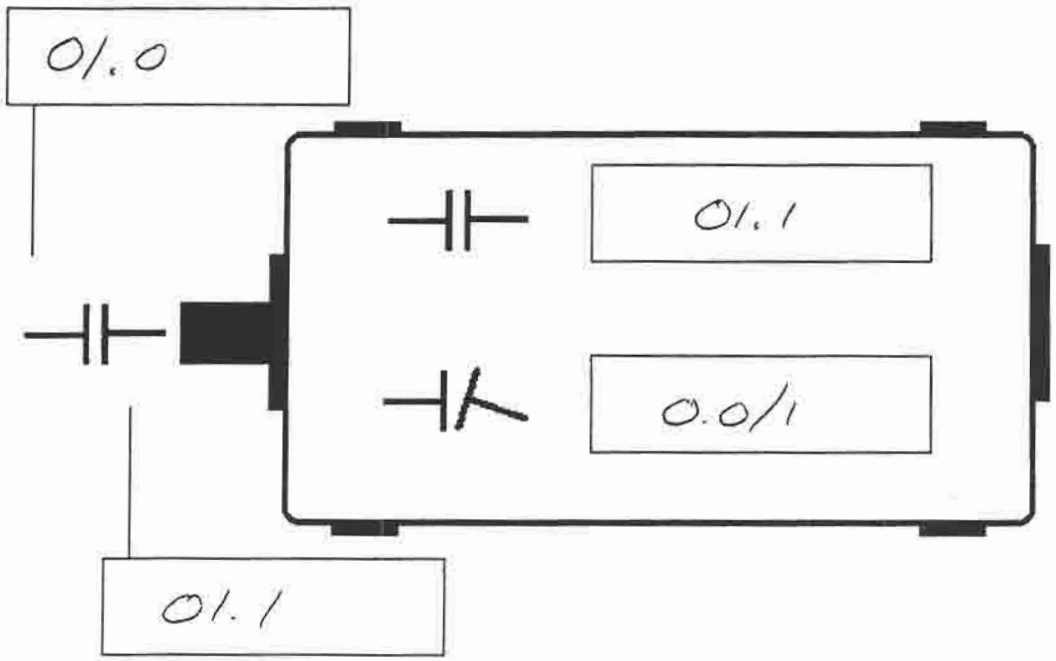
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.118	Peak	2/20/2004 9:58 AM
Magnitude	mils	.613	Peak-Peak	2/20/2004 9:58 AM

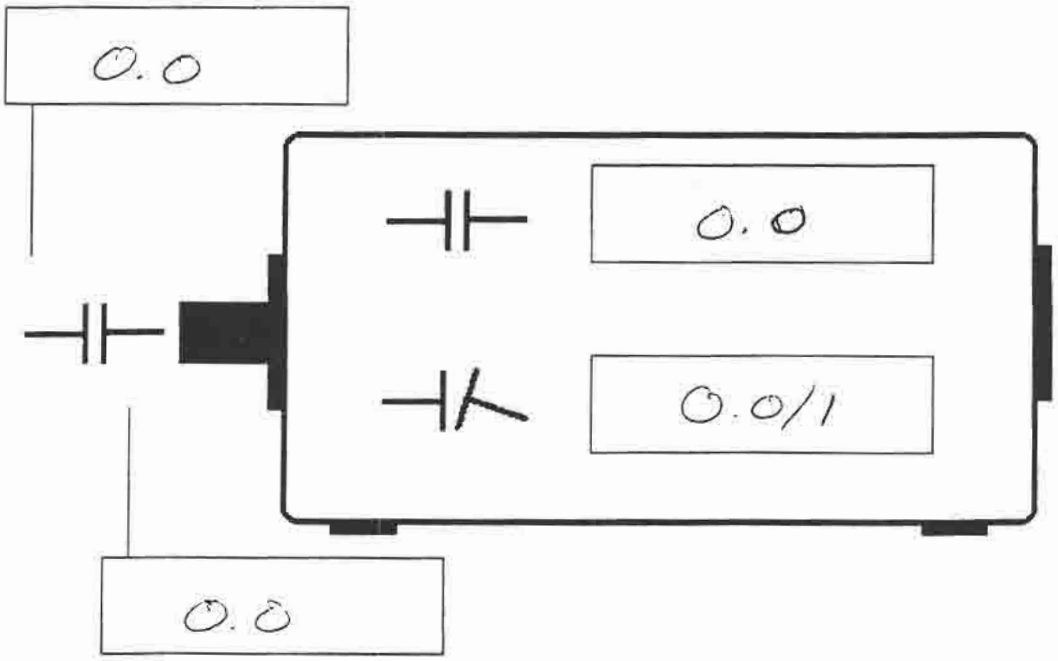
P-1209

GARDNER DENVER
CYCLO BLOWER

Customer: C. Emery Nelson Inc. **RO#:** 29099

Machine Speed: 1785 **Machine Info:** GE 350 Hp / Gardner Denver P-1209 Blower

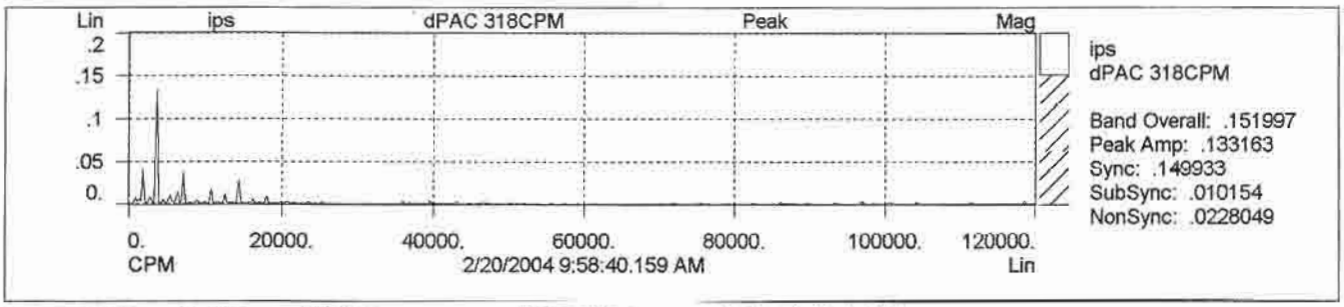




Service Technician: _____ **Date:** 1-20-04

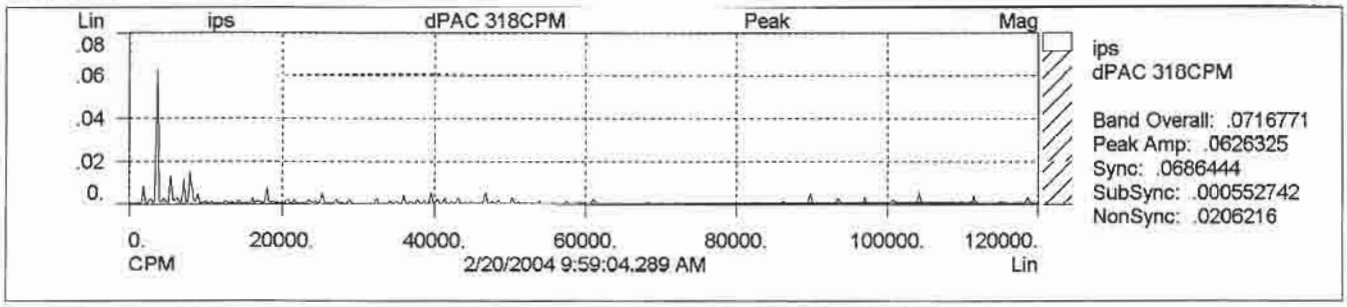
MET COUNCIL (C. EMERY NELSON)

Blowers
1209
POSITION : 1
LOCATION: MTR1H



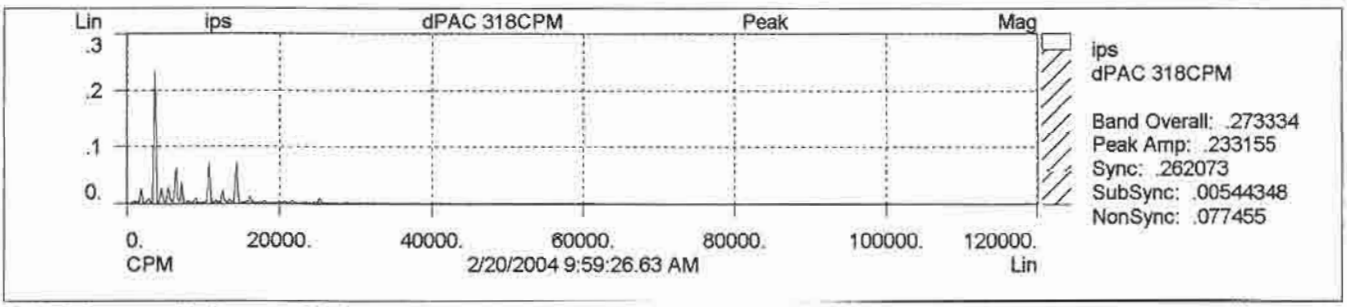
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.145	Peak	2/20/2004 9:58 AM
Magnitude	mils	.899	Peak-Peak	2/20/2004 9:58 AM

Blowers
1209
POSITION : 2
LOCATION: MTR1V



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.0713	Peak	2/20/2004 9:59 AM
Magnitude	mils	.379	Peak-Peak	2/20/2004 9:59 AM

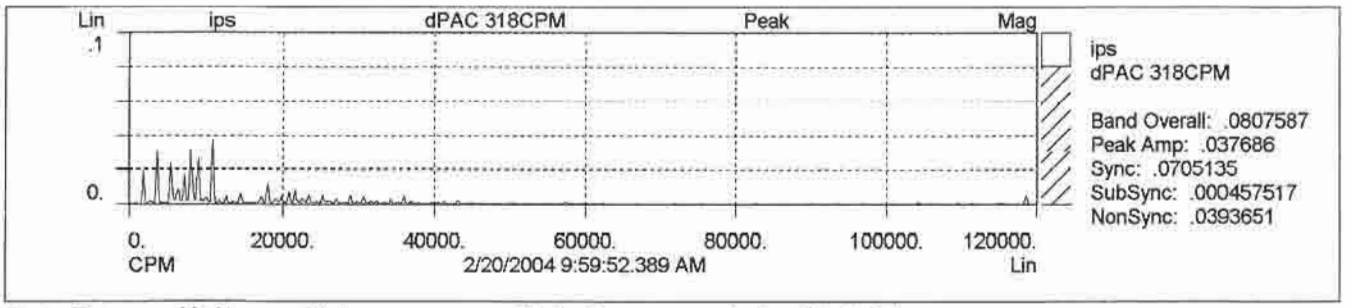
Blowers
1209
POSITION : 3
LOCATION: MTR2H



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.27	Peak	2/20/2004 9:59 AM
Magnitude	mils	1.29	Peak-Peak	2/20/2004 9:59 AM

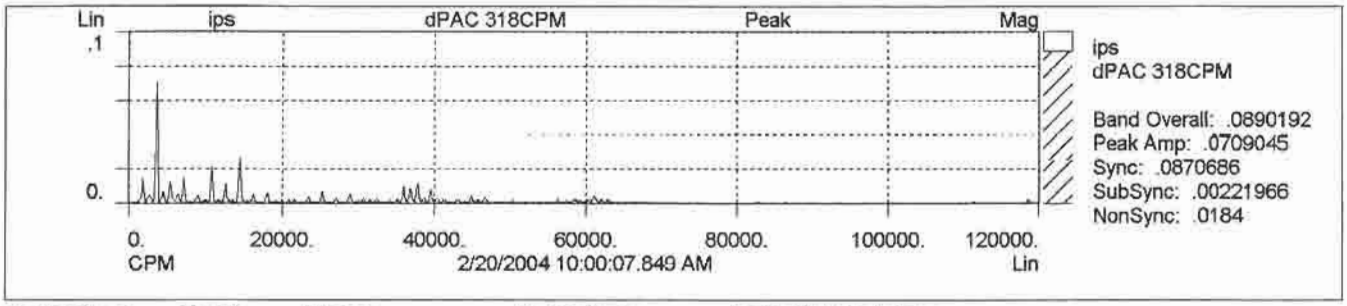
MET COUNCIL (C. EMERY NELSON)

Blowers
1209
POSITION : **4**
LOCATION: **MTR2V**



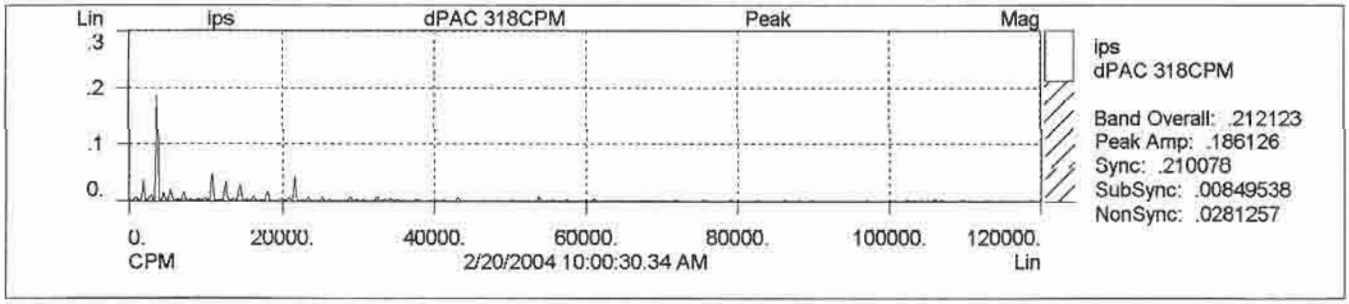
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.0842	Peak	2/20/2004 9:59 AM
Magnitude	mils	.307	Peak-Peak	2/20/2004 9:59 AM

Blowers
1209
POSITION : **5**
LOCATION: **MTR2A**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.0888	Peak	2/20/2004 10:00 AM
Magnitude	mils	.423	Peak-Peak	2/20/2004 10:00 AM

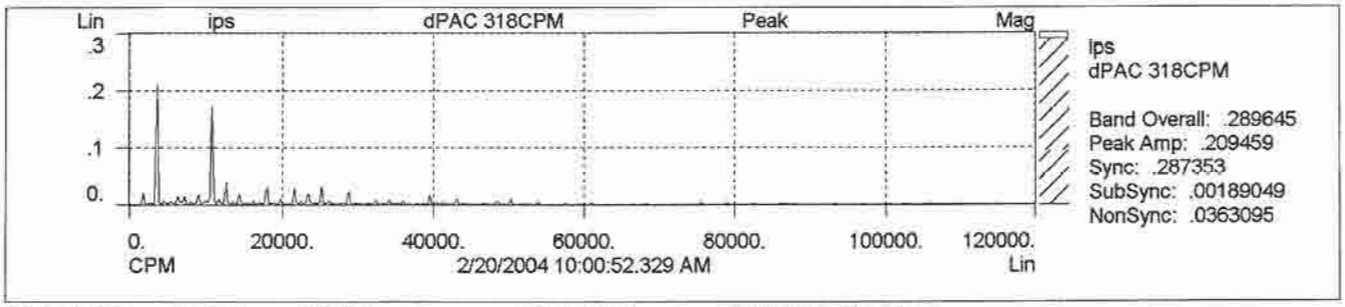
Blowers
1209
POSITION : **6**
LOCATION: **MTR3H**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.213	Peak	2/20/2004 10:00 AM
Magnitude	mils	1.06	Peak-Peak	2/20/2004 10:00 AM

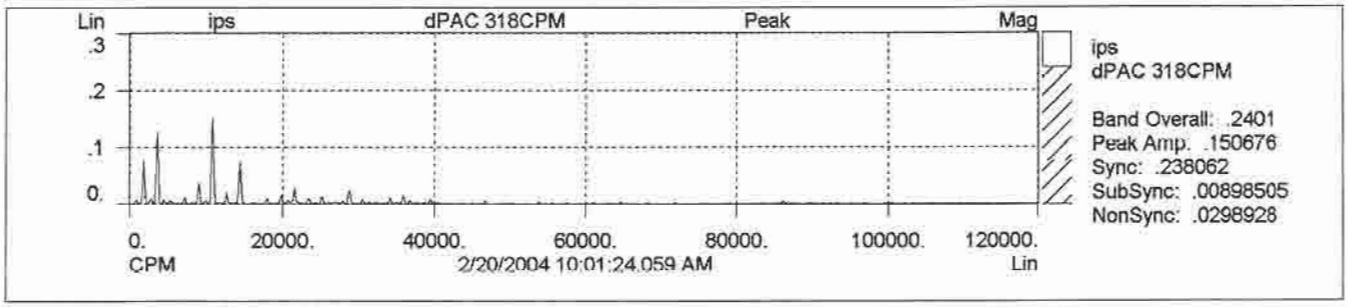
MET COUNCIL (C. EMERY NELSON)

Blowers
1209
POSITION : 7
LOCATION: BLW3V



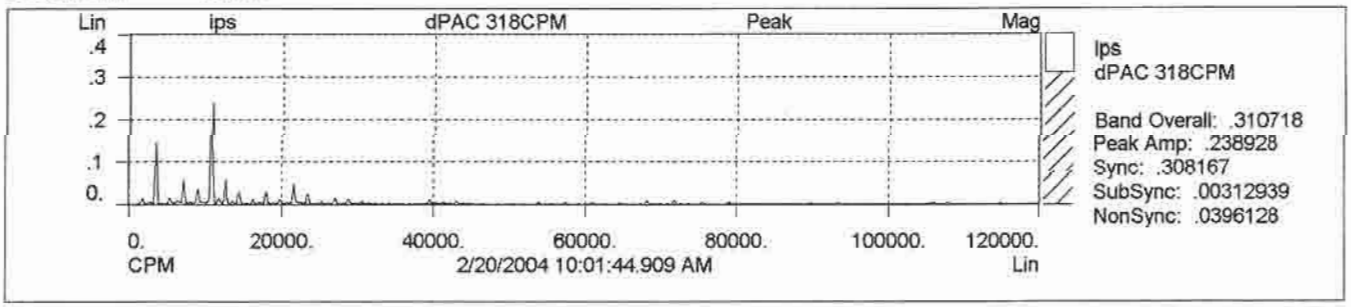
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.291	Peak	2/20/2004 10:00 AM
Magnitude	mils	1.19	Peak-Peak	2/20/2004 10:01 AM

Blowers
1209
POSITION : 8
LOCATION: BLW4H



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.24	Peak	2/20/2004 10:01 AM
Magnitude	mils	1.12	Peak-Peak	2/20/2004 10:01 AM

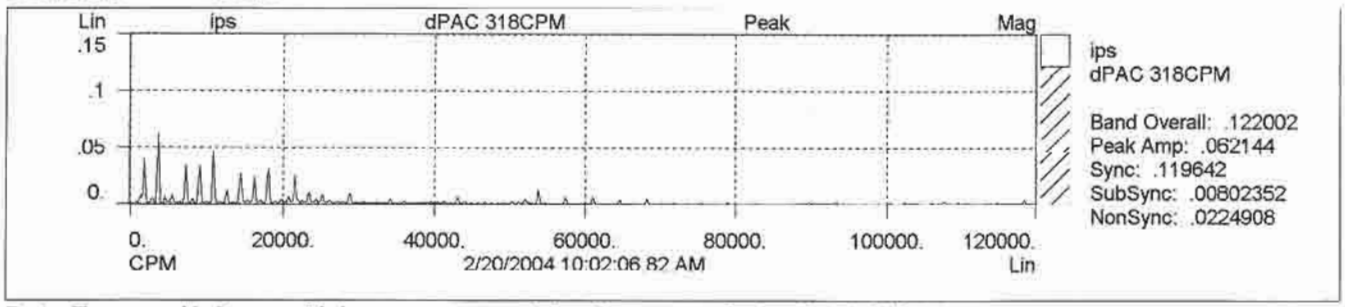
Blowers
1209
POSITION : 9
LOCATION: BLW4V



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.315	Peak	2/20/2004 10:01 AM
Magnitude	mils	.917	Peak-Peak	2/20/2004 10:01 AM

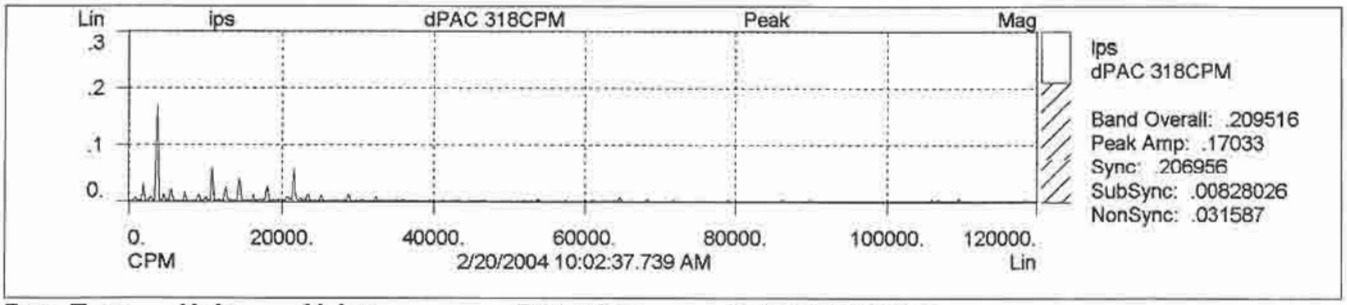
MET COUNCIL (C. EMERY NELSON)

Blowers
1209
POSITION : **10**
LOCATION: **BLW4A**



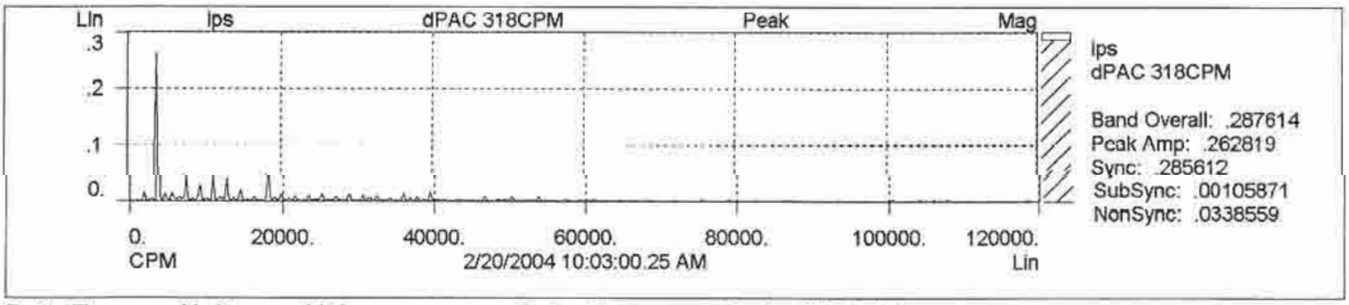
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.123	Peak	2/20/2004 10:02 AM
Magnitude	mils	.569	Peak-Peak	2/20/2004 10:02 AM

Blowers
1209
POSITION : **11**
LOCATION: **BLW5H**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.213	Peak	2/20/2004 10:02 AM
Magnitude	mils	.993	Peak-Peak	2/20/2004 10:02 AM

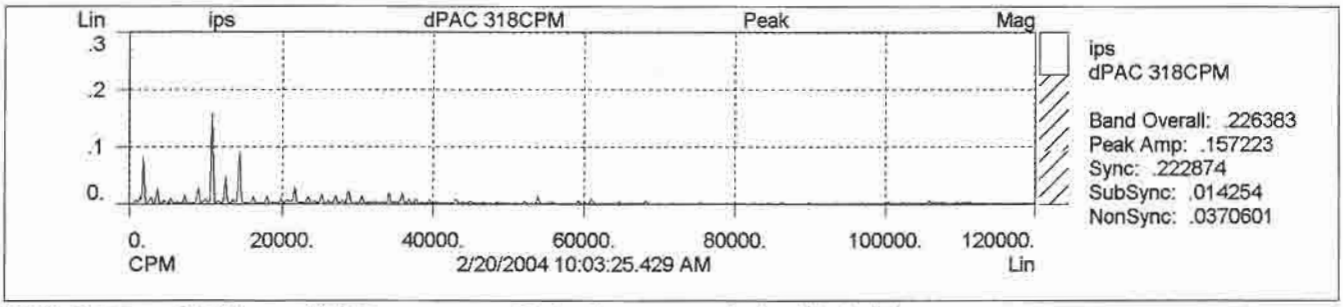
Blowers
1209
POSITION : **12**
LOCATION: **BLW5V**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.286	Peak	2/20/2004 10:03 AM
Magnitude	mils	1.44	Peak-Peak	2/20/2004 10:03 AM

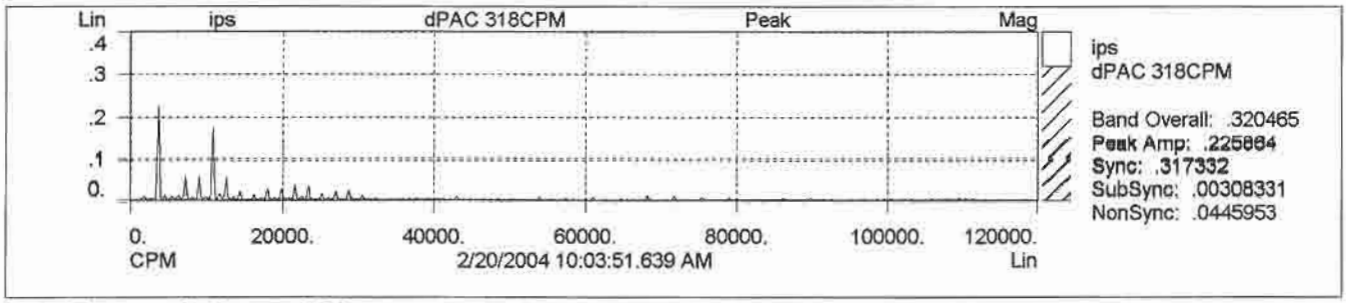
MET COUNCIL (C. EMERY NELSON)

Blowers
1209
POSITION : **13**
LOCATION: **BLW6H**



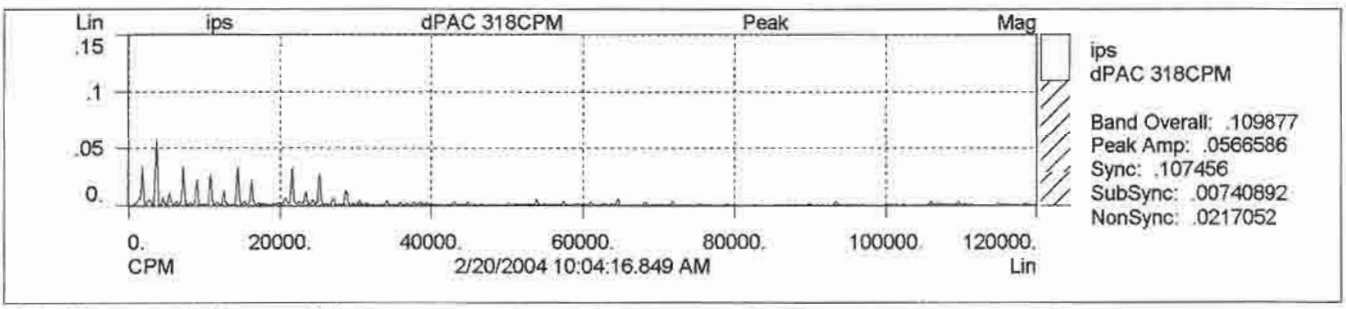
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.226	Peak	2/20/2004 10:03 AM
Magnitude	mils	.953	Peak-Peak	2/20/2004 10:03 AM

Blowers
1209
POSITION : **14**
LOCATION: **BLW6V**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.317	Peak	2/20/2004 10:03 AM
Magnitude	mils	1.24	Peak-Peak	2/20/2004 10:04 AM

Blowers
1209
POSITION : **15**
LOCATION: **BLW6A**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.113	Peak	2/20/2004 10:04 AM
Magnitude	mils	.503	Peak-Peak	2/20/2004 10:04 AM

P-1210

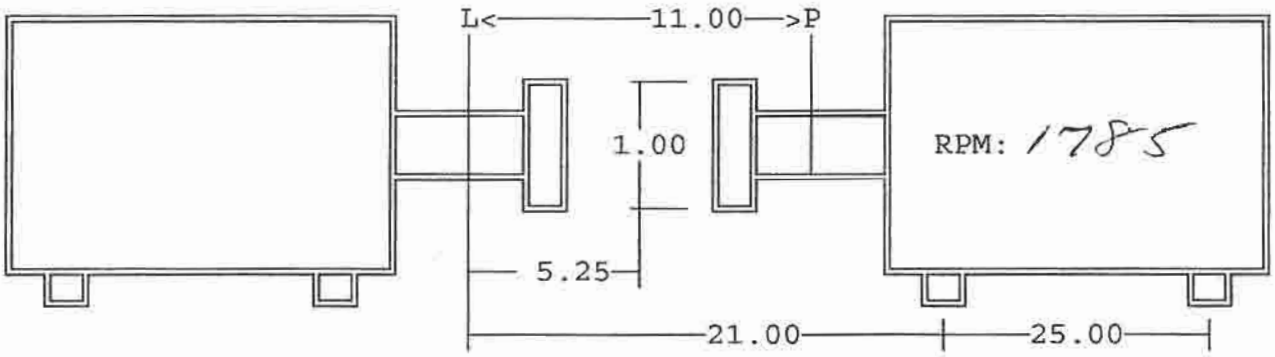
GARDNER DENVER
CYCLO BLOWER

PRUFTECHNIK AG 85737 ISMANING GERMANY
MASTERLIGN V: 1.18 SN: 12981940 File #01 2004 01.20 09:33A

Company: Met. Council #1210

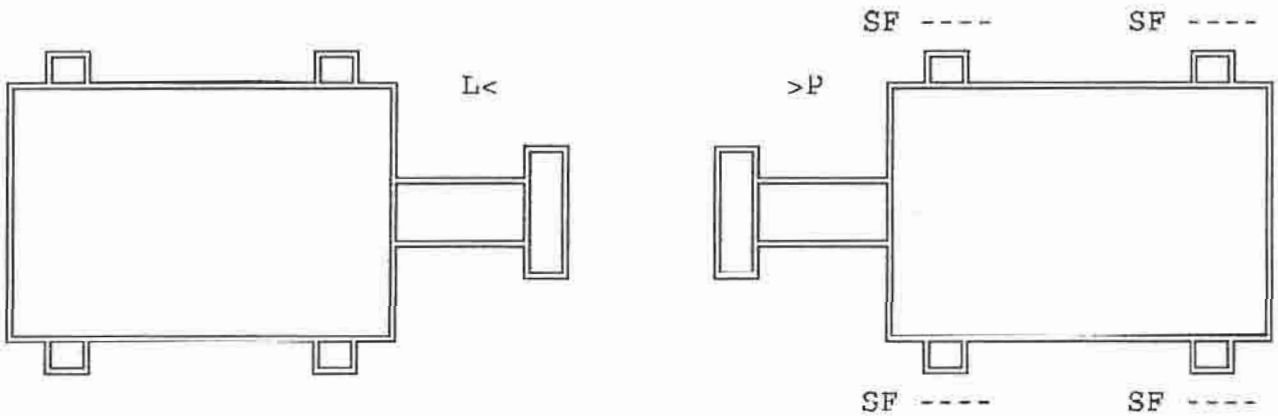
Left Machine | Coupling | Right Machine

VERTICAL RESULTS - Inch



	Gap	Offset	Corrections	
Target			+0.001	-0.000
Actual	┤\ -.0000	┤┌ -.0010	--	

HORIZONTAL RESULTS - Inch

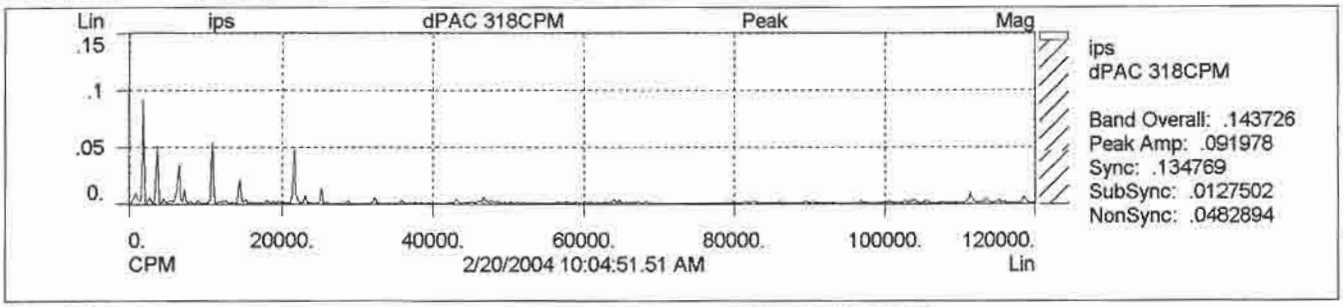


	Gap	Offset	Corrections	
Target			+0.000	-0.001
Actual	┤\ -.0001	┤┌ -.0015	--	

Operator: 2004 01.23 11:41A Page:1

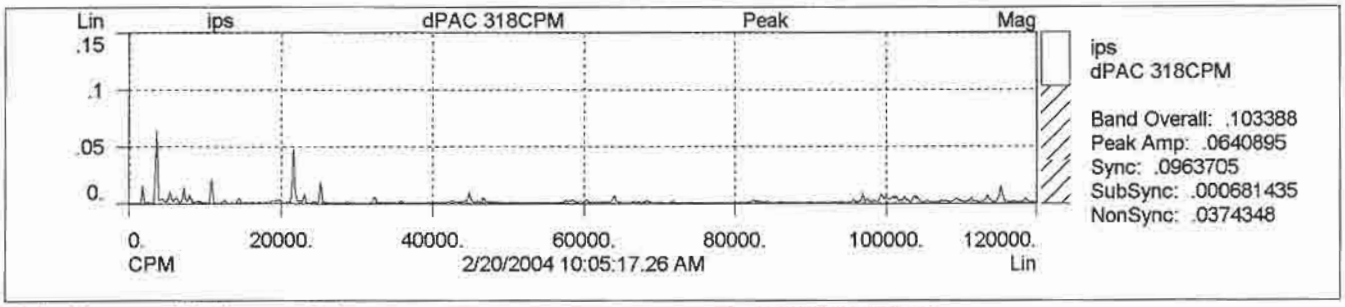
MET COUNCIL (C. EMERY NELSON)

Blowers
1210
POSITION : 1
LOCATION: MTR1H



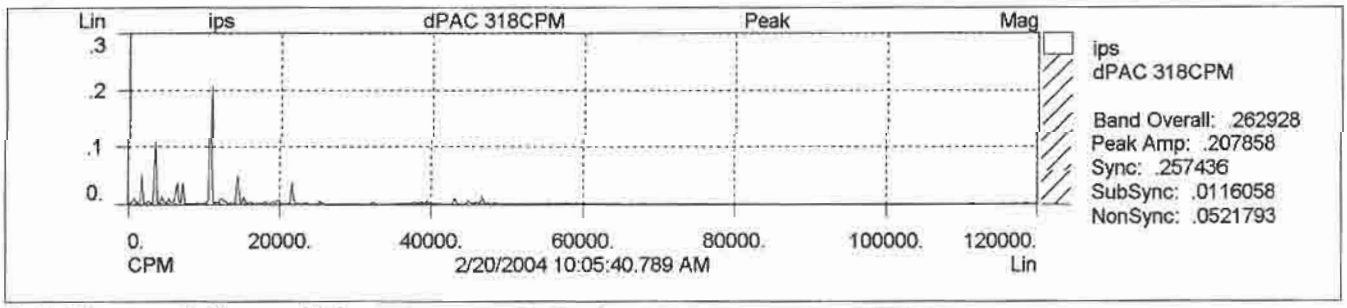
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.143	Peak	2/20/2004 10:04 AM
Magnitude	mils	1.17	Peak-Peak	2/20/2004 10:05 AM

Blowers
1210
POSITION : 2
LOCATION: MTR1V



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.104	Peak	2/20/2004 10:05 AM
Magnitude	mils	.37	Peak-Peak	2/20/2004 10:05 AM

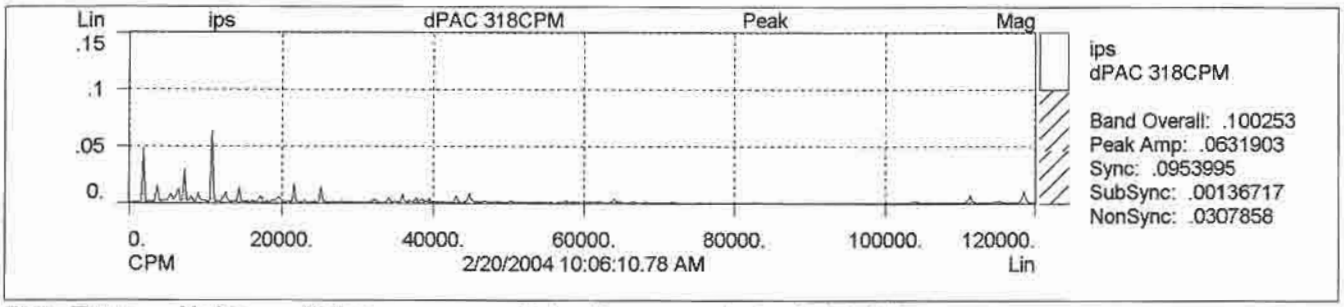
Blowers
1210
POSITION : 3
LOCATION: MTR2H



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.266	Peak	2/20/2004 10:05 AM
Magnitude	mils	1.12	Peak-Peak	2/20/2004 10:05 AM

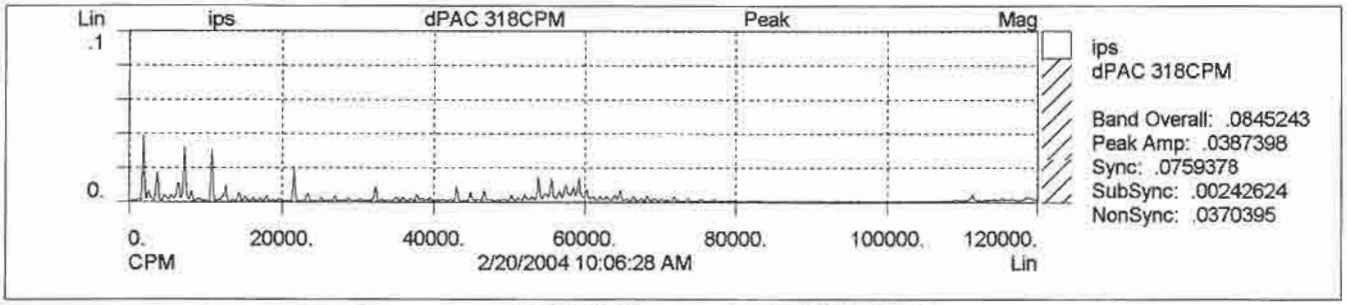
MET COUNCIL (C. EMERY NELSON)

Blowers
1210
POSITION : 4
LOCATION: MTR2V



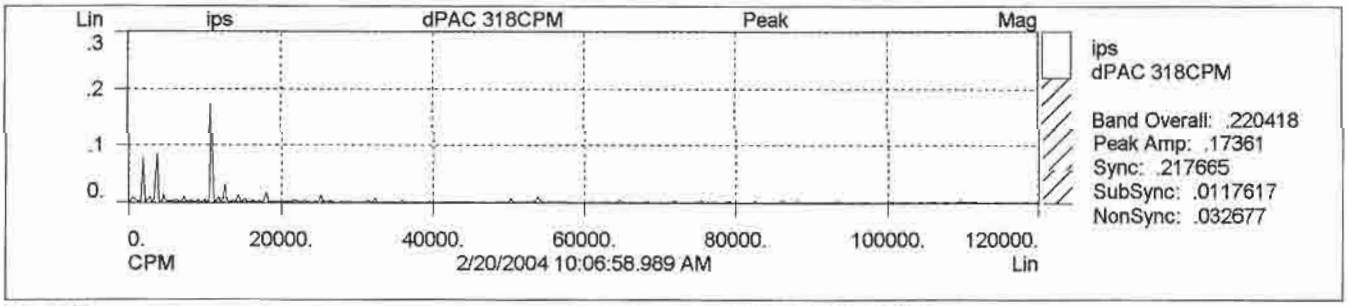
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.1	Peak	2/20/2004 10:06 AM
Magnitude	mils	.533	Peak-Peak	2/20/2004 10:06 AM

Blowers
1210
POSITION : 5
LOCATION: MTR2A



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.0916	Peak	2/20/2004 10:06 AM
Magnitude	mils	.461	Peak-Peak	2/20/2004 10:06 AM

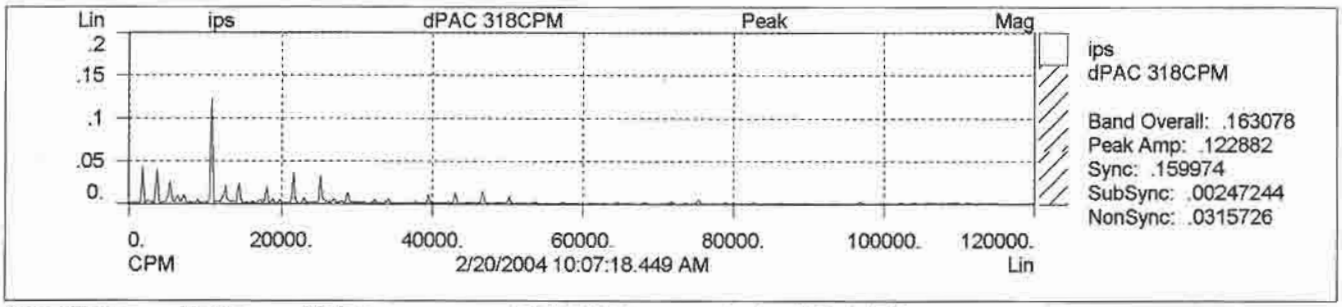
Blowers
1210
POSITION : 6
LOCATION: MTR3H



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.223	Peak	2/20/2004 10:07 AM
Magnitude	mils	1.18	Peak-Peak	2/20/2004 10:07 AM

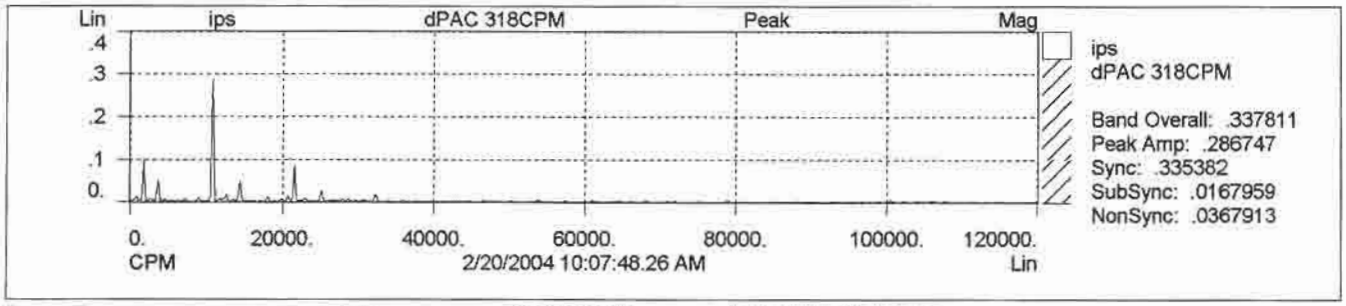
MET COUNCIL (C. EMERY NELSON)

Blowers
1210
POSITION : 7
LOCATION: BLW3V



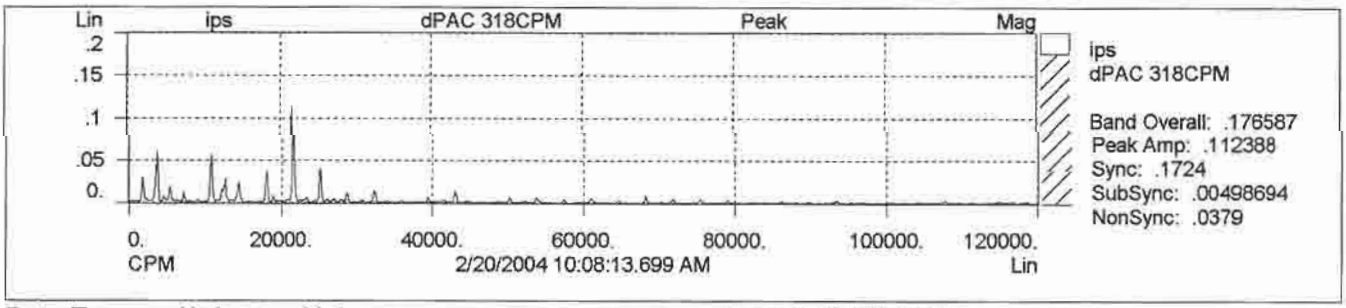
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.163	Peak	2/20/2004 10:07 AM
Magnitude	mils	.586	Peak-Peak	2/20/2004 10:07 AM

Blowers
1210
POSITION : 8
LOCATION: BLW4H



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.339	Peak	2/20/2004 10:07 AM
Magnitude	mils	1.39	Peak-Peak	2/20/2004 10:08 AM

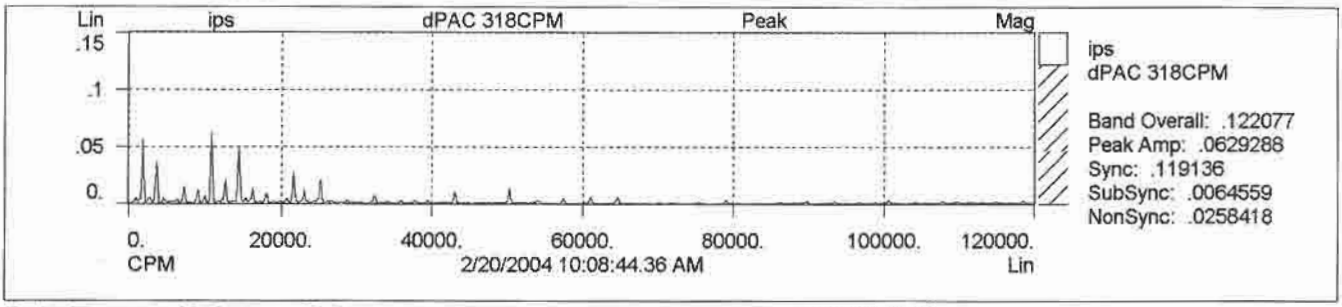
Blowers
1210
POSITION : 9
LOCATION: BLW4V



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.177	Peak	2/20/2004 10:08 AM
Magnitude	mils	.646	Peak-Peak	2/20/2004 10:08 AM

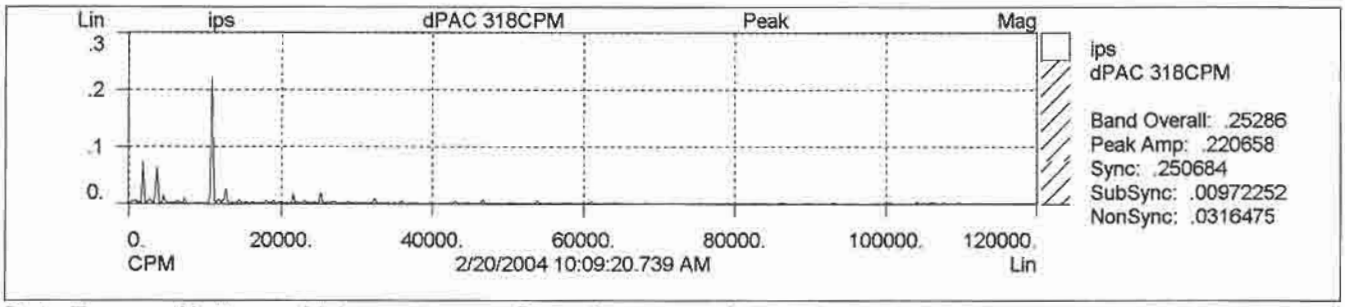
MET COUNCIL (C. EMERY NELSON)

Blowers
1210
POSITION : **10**
LOCATION: **BLW4A**



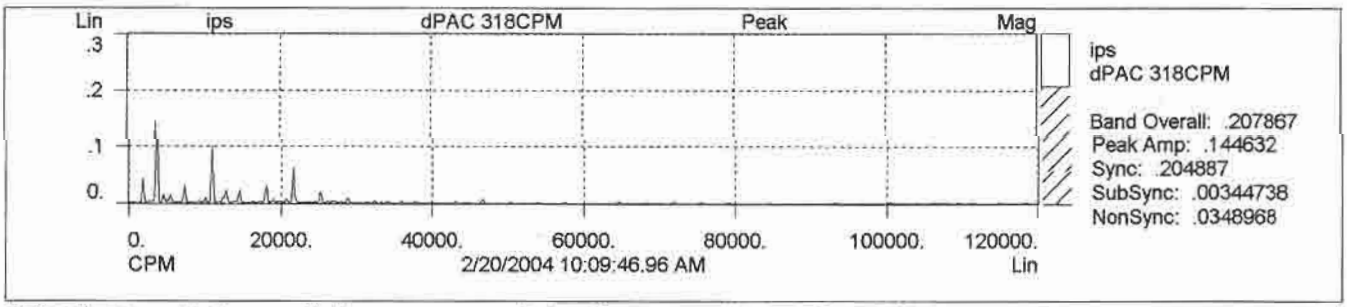
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.125	Peak	2/20/2004 10:08 AM
Magnitude	mils	.655	Peak-Peak	2/20/2004 10:08 AM

Blowers
1210
POSITION : **11**
LOCATION: **BLW5H**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.253	Peak	2/20/2004 10:09 AM
Magnitude	mils	1.18	Peak-Peak	2/20/2004 10:09 AM

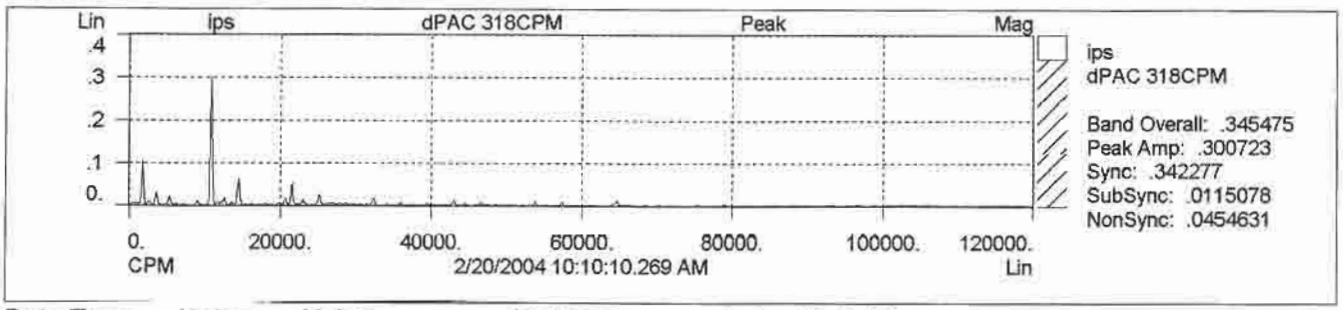
Blowers
1210
POSITION : **12**
LOCATION: **BLW5V**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.211	Peak	2/20/2004 10:09 AM
Magnitude	mils	.949	Peak-Peak	2/20/2004 10:09 AM

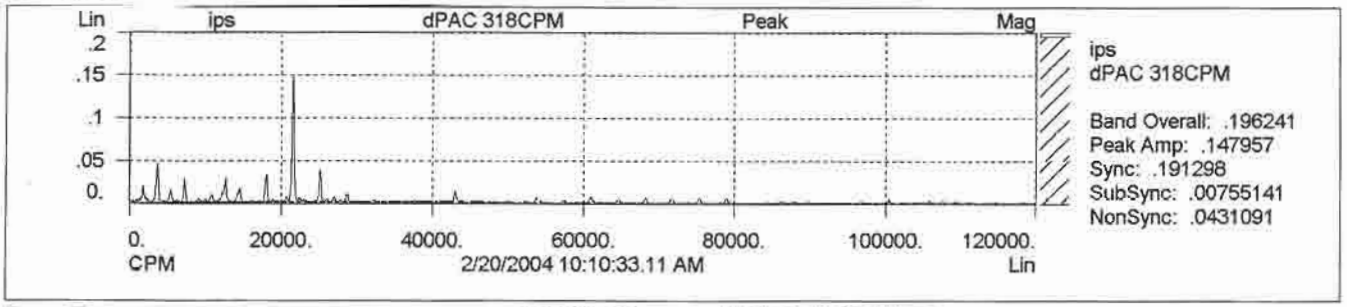
MET COUNCIL (C. EMERY NELSON)

Blowers
1210
POSITION : **13**
LOCATION: **BLW6H**



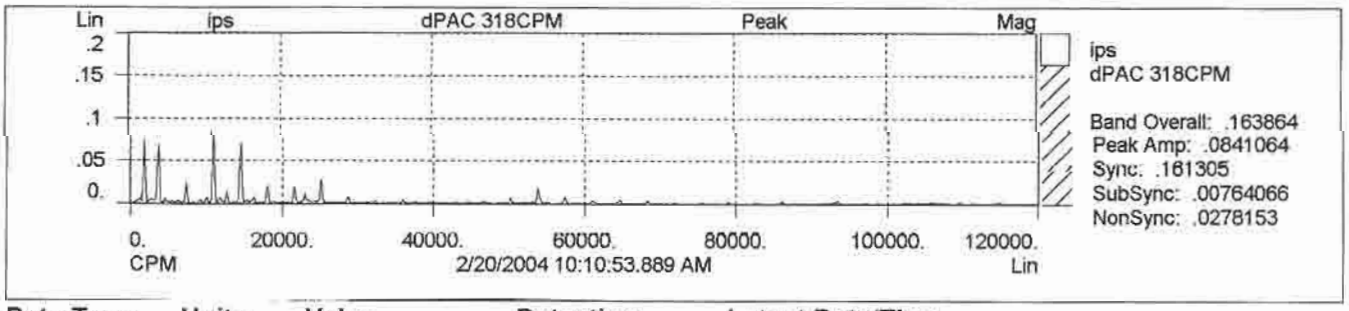
Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.345	Peak	2/20/2004 10:10 AM
Magnitude	mils	1.4	Peak-Peak	2/20/2004 10:10 AM

Blowers
1210
POSITION : **14**
LOCATION: **BLW6V**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.196	Peak	2/20/2004 10:10 AM
Magnitude	mils	.535	Peak-Peak	2/20/2004 10:10 AM

Blowers
1210
POSITION : **15**
LOCATION: **BLW6A**



Data Type	Units	Value	Detection	Latest Date/Time
Magnitude	ips	.163	Peak	2/20/2004 10:10 AM
Magnitude	mils	.889	Peak-Peak	2/20/2004 10:11 AM

AEON™ PD and AEON PD-FG Food Grade Synthetic Lubricants

APPLICATION

The only lubricants specially formulated for Positive Displacement blowers, AEON™ PD and AEON PD-FG Food Grade Synthetic Lubricants provide maximum protection for the demanding operating conditions of PD blowers in any environment or application. The viscosity has been optimized to provide superior lubrication in both severe hot and cold temperatures with minimal energy consumption.

GD
GARDNER DENVER
BLOWERS

DESCRIPTION

AEON PD and AEON PD-FG Food Grade Lubricants are custom-blended, synthetic hydrocarbon oils. AEON PD-FG Food Grade complies with FDA 21 CFR 178.3570 requirements for lubricants with the possibility of incidental food contact.

USAGE

AEON PD and AEON PD-FG provide maximum protection for Gardner Denver Sutorbilt®, DuroFlow® and CycloBlower® blowers, as well as other positive displacement blowers.

NEW & IMPROVED AEON PD FORMULA:

- Better low temperature properties
- Less foaming tendencies
- Less sludge-forming tendencies for cleaner machines

NEW! IMPROVED FORMULA

AEON PD
AEON PD-FG

The only lubricants specially formulated for positive displacement blowers

Factory recommended

Performance proven in a wide variety of applications and temperature ranges

Formulated with the most advanced additive technology to minimize blower wear and maximize equipment life

Longer service life means fewer oil changes

Less down time means higher productivity

Reduced maintenance and oil disposal costs

Gardner Denver AEON PD and AEON PD-FG Food Grade Synthetic Lubricants

FACTORY APPROVED SYNTHETIC LUBRICANTS

- Synthetic hydrocarbon (polyalphaolefin) based lubricants
- Provide superior performance as compared with "multi-purpose" lubricants
- Exceed blower manufacturers' recommendations for viscosity, flash and pour points
- Compatible with most seal materials including: teflon, viton, nitrile buna N, fluorocarbon, polysulfide, polyacrylic and fluorosilicone.
- AEON PD and AEON PD-FG Food Grade do not contain toxic materials or heavy metals per OSHA and EPA guidelines
- Reduced operating temperatures of up to 5% extend blower life
- Lubricant is demulsible and completely separates from water. This minimizes corrosion which can reduce bearing life and lead to serious machine damage. Superior oil/water separation coupled with precisely-blended corrosion inhibitors protect bearings against damage and extend blower life.

BENEFITS OF SYNTHETIC LUBRICANT VS MINERAL OIL

- **Superior protection in a wide range of blower operating temperatures (-30˚F ambient to 400˚F discharge). No need for seasonal oil changes.**
  Please refer to blower Operating and Maintenance Manual for more specific information.
- **Special additive package designed for greater rust and corrosion protection**
- **6000-hour service life far exceeds the normal 1500-hour life of most mineral-based lubricants***
- **Fewer oil drain and service intervals reduce maintenance and oil disposal costs**
- **Reduces power consumption and improves blower efficiency**

COST SAVINGS OF SYNTHETIC LUBRICANT VS MINERAL OIL

Following is a cost comparison of AEON PD Synthetic Lubricant vs. mineral oil for a Sutorbilt 1024-8000 blower with an oil capacity of 13 quarts. Example is based on an operating time of 6000 hours for one blower.

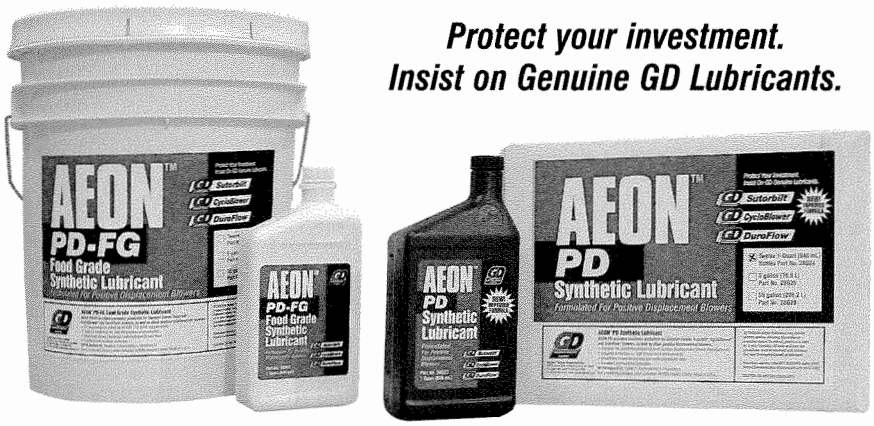
Savings may vary based on your specific conditions.

	AEON PD	MINERAL OIL
Cost of initial fill (13 quarts)	$158.73	$32.50
Lube change interval	6000 hours	1500 hours
Cost of replacement lubricant	$0	$97.50
Labor ($45/change)	$0	$135.00
TOTAL COST	$158.73	$265.00

40% SAVINGS OVER 6000-HOUR PERIOD PER BLOWER

Properties	AEON PD	AEON PD-FG
Viscosity		
at 40˚C cSt	214	217
at 100˚C cSt	22.2	24
at 100˚F SUS	1115	1130
at 210˚F SUS	110.7	120
Pour Point ˚F/˚C	-38/-39	-46/-43
Flash Point ˚F/˚C	450/232	535/279

*Recommended service interval for clean, ambient conditions and normal blower temperatures. Note: Laboratory analysis of AEON PD and AEON PD-FG should be used to help determine the service life.



Protect your investment.
Insist on Genuine GD Lubricants.

ORDER INFORMATION

Convenient Package Sizes	AEON PD Part No.	AEON PD-FG Part No.
1 quart	28G23	28H97
Case/12 quarts	28G24	28H98
5 gallon pail	28G25	28H99
55 gallon drum	28G28	28H100

Contact Your Gardner Denver Representative

Other Gardner Denver Products Available

Sutorbilt · CycloBlower · DuroFlow

For additional information, contact your local representative or

Gardner Denver Blower Division
100 Gardner Park, Peachtree City, GA 30269
Toll Free 800-543-7736 ext. 457
Phone 770-632-5000 • Fax 770-486-5629
E-mail: blowersmktg@gardnerdenver.com
Visit our web site: www.gardnerdenver.com
For Parts Information, Contact:
Gardner Denver Blower Division Customer Service
Toll Free 800-982-3009
Phone 770-632-5000 • Fax 770-486-5629

Gardner Denver

Bulletin GD-300 09022.5M Specifications subject to change without notice. Copyright 2002 Gardner Denver, Inc. Litho in U.S.A.

Gardner Denver

H.M.I.S.
Health: 0
Flammability: 1
Reactivity: 0
These ratings should used only as part of a fu implemented H.M.I. program.

Material Safety Data Sheet

Section I - Product Identification

Trade Name and Synonyms **AEON PD**	Part Numbers: 28G23, 28G24, 28G25 and 28G28	Health Emergency Phone Number **(217) 222-5400** **Safety Department**
Manufacturer's Name Gardner Denver Machinery Inc.		
Address 1800 Gardner Expressway - Quincy, IL 62301		Transport Emergency Phone Number **(800) 424-9300 (CHEMTREC)**
Product Identification Positive Displacement Blower Lubricant		
Chemical Names and Synonyms Syn. Hydrocarbons and additives	Use or Description: Gear Oil	

Section II - Typical Chemical and Physical Properties

Appearance: Lt. Amber Liquid	Viscosity: At 100°F, SUS 1078.0	At 40°C, CS 209.0
Odor: Mild	Viscosity: At 210°F, SUS 128.0	At 100°C, CS 26.0
Relative Density 15/4 C: 0.86	Solubility in Water Negligible	PH: NA
Melting Point F(C): NA	Pour Point F(C): -50(-46)	
Boiling Point F(C): > 600(316)	Flash Point F(C): > 480(249) (ASTM D-92)	
Vapor Pressure-mm Hg 20C: < .1		

NA=Not Applicable NE=Not Established D=Decomposes

Section III - Potentially Hazardous Ingredients

Hazardous Ingredients: None
SEE SECTIONS XII AND XIII FOR REGULATORY AND FURTHER COMPOSITIONAL DATA. Sources: A=ACGIH-TLV, A*=Suggested-TLV, O=OSHA, S=Supplier **NOTE:** Limits shown for guidance only. Follow applicable regulations.

Section IV - Health Hazard Data

— INCLUDES AGGRAVATED MEDICAL CONDITIONS, IF ESTABLISHED —

EFFECTS OF OVEREXPOSURE: Not expected to be a problem.

ection V - Emergency and First Aid Procedures

Eye Contact: Flush thoroughly with water. If irritation persists, call a physician.
Skin Contact: Wash contact areas with soap and water.
Inhalation: Remove from further exposure. If respiratory irration, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance and call a physician. If breathing has stopped, use mouth to mouth resuscitation.
Ingestion: Not expected to be a problem when ingested. If uncomfortable seek medical assistance.

ection VI - Fire and Explosion Hazard Data

Flash Point F(C): > 480(249) (ASTM D-92)	Flammable Limits: LEL: .6% UEL: 7.0%
Extinguishing Media: Carbon dioxide, foam, dry chemical and water fog.	
cial Fire Fighting Procedures: Water or foam may cause frothing. Use water to keep fire exposed containers cool. Water spray may abe used to flush spills away from exposure. For fires in enclosed areas, firefighters must use self-contained breathing apparatus. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply.	
Unusual Fire and Explosion Hazards: None	
NFPA Hazard ID: Health: 0 Flammability: 1 Reactivity: 0	

ection VII - Reactivity Data

Stability (Thermal, Light, etc.): Stable	Conditions to Avoid: Extreme heat
Incompatibility (Materials to Avoid): Strong oxidizers	
Hazardous Decomposition Products: Carbon monoxide	
Hazardous Polymerization: Will not occur	

Section VIII - Spill or Leak Procedure

Environmental Impact:
Report spills as required to appropriate authorities. U.S. Coast Guard regulations require immediate reporting of spills that could reach any waterway including intermittent dry creeks. Report spill to Coast Guard toll free number (800) 424-8802. In case of accident or road spill notify CHEMTREC (800) 424-9300.

Procedures if Material is Released or Spilled:
Absorb on fire retardant treated sawdust, diatomaceous earth, etc. Shovel up and dispose of at an appropriate waste disposal facility in accordance with current applicable laws and regulations, and product characteristics at time of disposal.

Waste Management:
Product is suitable for burning in an enclosed, controlled burner for fuel value or disposal by supervised incineration. Such burning may be limited pursuant to the Resource Conservation and Recovery Act. In addition, the product is suitable for processing by an approved recycling facility or can be disposed of at any government approved waste disposal facility. Use of these methods is subject to user compliance with applicable laws and regulations and consideration of product characteristics at time of disposal.

Section IX - Special Protection Information

Eye Protection:
Normal industrial eye protection practices should be employed.

Skin Protection:
No special equipment required. However, good personal hygiene practices should always be followed.

Respiratory Protection:
No special requirements under ordinary conditions of use and with adequate ventilation.

Ventilation:
Use in well ventilated area.

Section X - Special Precautions

Handling:
No special precautions required.

Section XI - Toxicological Data Acute Toxicological

Oral Toxicity: (RATS):
Nontoxic — Based on testing of similar products and/or the components.

Dermal Toxicity (RABBITS):
Nontoxic — Based on testing of similar products and/or the components.

Inhalation Toxicity (RATS):
Not established

Eye Irritation (RABBITS):
Expected to be non-irritating. — Based on testing of similar products and/or the components.

Skin Irritation (RABBITS):
Expected to be non-irritating. — Based on testing of similar products and/or the components.

Gardner Denver Engineered Packaging Center
11611 Tanner Road • Houston, Texas 77041-6906
Ph: 713-896-6510 • Fax: 713-896-1154

Gardner Denver

PARTS QUOTATION

TO: C. Emery Nelson

ATTN:

FAX:

PH:

CUSTOMER REF: Spare Parts

PROPOSAL DATE: **AUGUST,14 , 2003**

PROPOSAL NO:**DB1087**

REV #:

PAGE: **1** OF **1**

ITEM	QTY	PART NO.	DESCRIPTION	UNIT PRICE	TOTAL
1.	1	302CBT6010	Overhaul Kit 11CDL 31P	$6368.50	$6368.50
2.	1	B4-24-v-XFS-30	Pressure Switch Set 13.5 PSI RISING	$205.54	$205.54
3.	1	T4-24-T10-030-XBX-XFS-235/375	Temp Switch Set 300 RISING	$448.85	$448.85
4.	1	300AUX486	Metrix Vibration Switch	$350.00	$350.00
5.	5	81-1210	Air Filters	$455.00	$2275.00
6.	1	28G25	5gal. Aeon PD Synthetic Oil	$302.66	$302.66
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					

$9950.55

TOTAL COST $ _____

- TERMS OF PAYMENT ARE NET THIRTY (30) DAYS UPON APPROVAL
- PRICES QUOTED ARE FOB HOUSTON, TEXAS (EX-WORKS)
- PLEASE CONFIRM THESE ARE THE PARTS YOU REQUIRE
- IF ANY PARTS ARE RETURNED, THERE WILL BE A 25% RESTOCKING CHARGE

PLEASE CONTACT: DON BROWN AT **713-896-6510**, EXT **139**,

BILL OF MATERIAL

GDEPC DOCUMENT NUMBER 85131-200 REV. 5

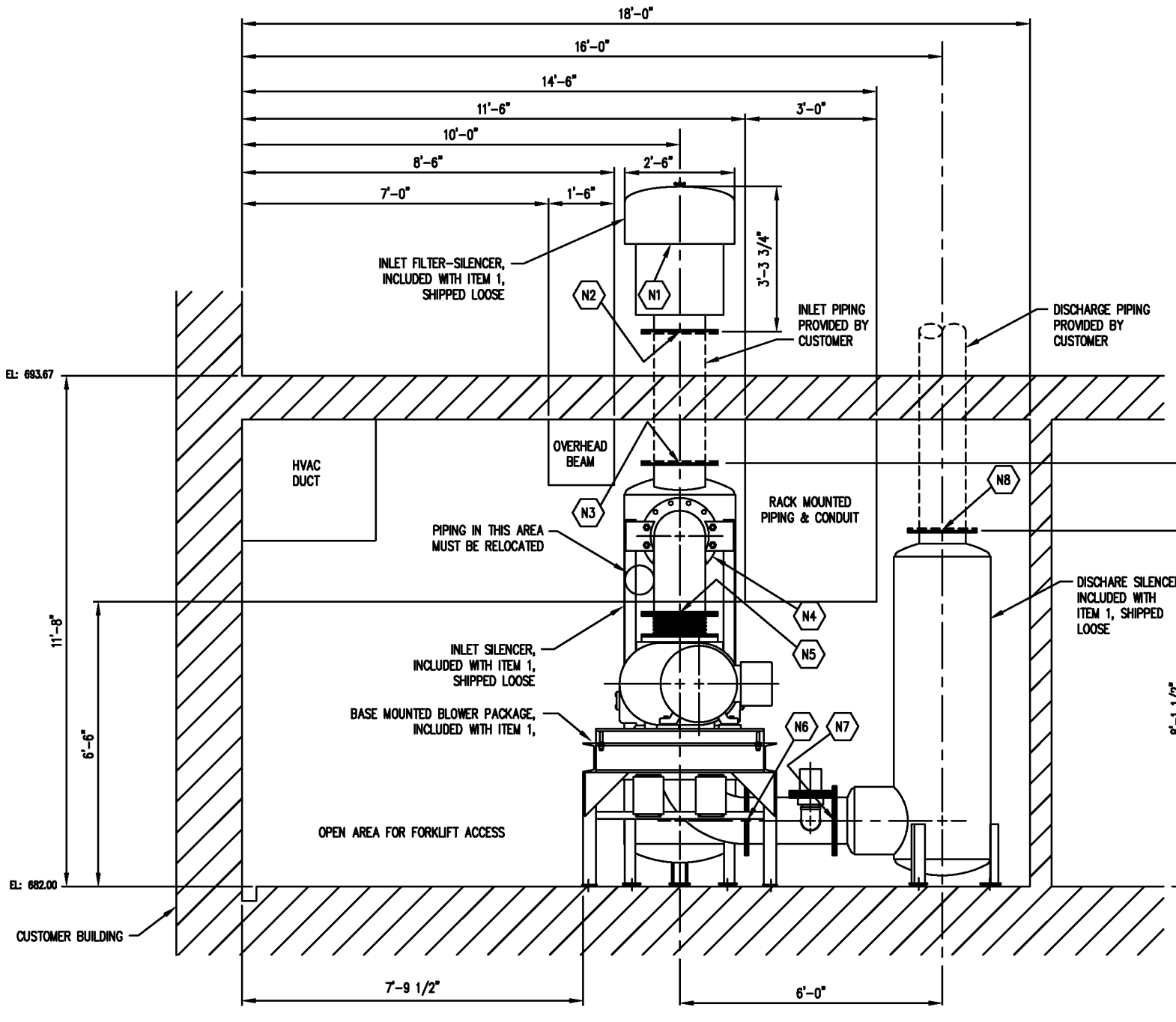
ITEM	QTY	PART NUMBER	DESCRIPTION
1	5	85131-201	BLOWER PACKAGE, SLUDGE STORAGE TANK AGITATOR, 350 HP, 11CDL31 CYCLOBLOWER, PER GDEPC 85131-201 (INCLUDES BASE MOUNTED & SHIPPED LOOSE COMPONENTS FOR BLOWER PACKAGES 1206, 1207, 1208, 1209, & 1210 AND ASSOCIATED CONTROL PANELS)
2	1	?	11CDL31 CYCLOBLOWER REPAIR KIT (SHIPPED LOOSE)
3	1	8507612	COUPLING, FLEXIBLE, GRID TYPE, HORIZONTAL SPLIT COVER, FALK STEELFLEX TYPE T10, SIZE 1100T, ONE HUB BORED WITH CLEARANCE FIT FOR 3.250" DIA SHAFT & 3/4" SQ KEYWAY, AND ONE HUB BORED WITH CLEARANCE FIT FOR 3.375" DIA SHAFT & 7/8" SQ KEYWAY (SHIPPED LOOSE SPARE)
4	1	300AUX1488	TEMPERATURE SWITCH, NEMA 4X ENCLOSURE, SINGLE SPDT, 15A AT 125VAC, REMOTE MOUNT WITH 10 FT SPRING ARMOR CAPILLARY & 3/8" x 3" BULB WITH 1/2" NPT CONNECTION BUSHING, 235-375F RANGE, SET AT 300° F RISING, ASHCROFT T4-24-T10-030-XBX-XFS-235/375F SET 300F RISING (SHIPPED LOOSE SPARE)

"N" CONNECTIONS & PORTS:

- (N1) FILTER-SILENCER AIR INLET, BOTTOM OF WEATHERHOOD
- (N2) FILTER-SILENCER AIR OUTLET, 14"-125# FF FLANGE
- (N3) INLET SILENCER AIR INLET, 14"-125# FF FLANGE
- (N4) INLET SILENCER AIR OUTLET, 14"-125# FF FLANGE
- (N5) BASE MOUNTED PACKAGE AIR INLET, 14"-125# FF FLANGE
- (N6) BASE MOUNTED PACKAGE AIR DISCHARGE, 12"-125# FF FLANGE
- (N7) DISCHARGE SILENCER AIR INLET, 12"-125# FF FLANGE
- (N8) DISCHARGE SILENCER AIR DISCHARGE, 12"-125# FF FLANGE

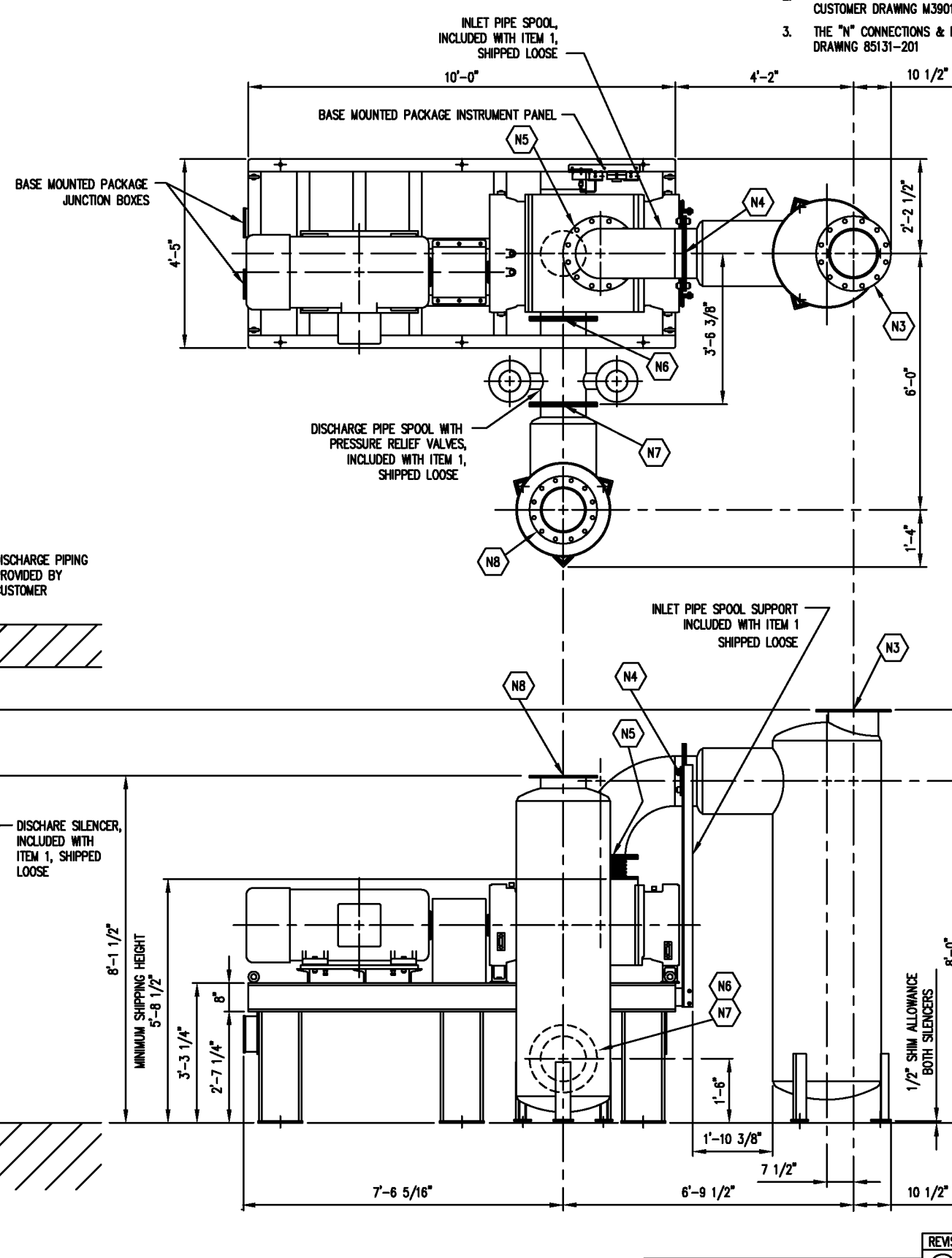
NOTES:

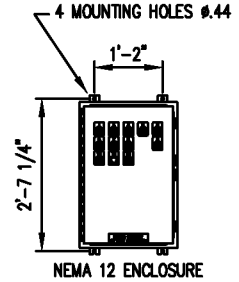
1. SEE GDEPC GENERAL ARRANGEMENT BOM & DRAWING 85131-201 FOR THE BASE MOUNTED & SHIPPED LOOSE COMPONENTS FOR EACH PACKAGE, PLAN & ELEVATION VIEWS, AND ANCHOR BOLT HOLES PLAN
2. INSTALLATION DIMENSIONS FOR THE CUSTOMER BUILDING BASED ON THE CUSTOMER DRAWING M3901R
3. THE "N" CONNECTIONS & PORTS LISTED BELOW ARE THE SAME AS GDEPC DRAWING 85131-201



TYPICAL INSTALLATION ELEVATION

SCALE: 0.60" = 1'-0" (1/20)





NEMA 12 ENCLOSURE
30"H x 20"W x 10"D

BLOWER PACKAGE CONTROL PANEL
INCLUDED WITH ITEM 1
SHIPPED LOOSE
LOCATION & MOUNTING
PROVIDED BY CUSTOMER

7	08/21/03	AS CONSTRUCTED	KE	AB	-
6	03/15/03	RELEASED FOR FABRICATION	KE	CV	AB
5	11/19/02	REVISED FOR APPROVAL	KE	CV	AB
4	10/21/02	REVISED FOR APPROVAL	KE	CV	AB
3	10/16/02	REVISED FOR APPROVAL	KE	CV	AB
2	09/17/02	RELEASED FOR APPROVAL	KE	CV	AB
		REVISIONS			

SALES ORDER NO.: 340362
PRODUCTION ORDER NO.: 1150327

REVISION 5 SHEET 1 of 1 FILENAME: 85131-200R5S1.dwg

Gardner Denver — ENGINEERED PACKAGING CENTER, 11811 TANNER ROAD, HOUSTON, TEXAS 77041

CUSTOMER: C. EMERY NELSON/METROPOLITAN COUNCIL
CUSTOMER ITEM NO.: P.O. CEN02-6011

350 HP CYCLOBLOWER 11CDL31 BLOWER PACKAGE
CUSTOMER INSTALLATION

DATE 08/21/03 SCALE 1/20 DWG. NO.: 85131-200 (1 of 1)

BILL OF MATERIAL

GDEPC DOCUMENT NUMBER 85131-201 REV. 3

ITEM	QTY	PART NUMBER	DESCRIPTION	WEIGHT
1	1	11CDL31P79S	BLOWER, HELICAL SCREW, 14"-125# FF FLANGE INLET, 12"-125# FF FLANGE OUTLET, CYCLOBLOWER MODEL 11CDL31 WITH 6 BEARING RTD's	3,530 LB
2	1	302AUX348G	MOTOR, TEFC, 350 HP, 1800 RPM, 3PH/60HZ/460V, 1.15 S.F., 449HO T FRAME, GENERAL ELECTRIC PER OUTLINE DRAWING 225B6575BD	2,970 LB
3	1	8507612	COUPLING, FLEXIBLE, GRID TYPE, HORIZONTAL SPLIT COVER, FALK STEELFLEX TYPE T10, SIZE 1100T, ONE HUB BORED WITH CLEARANCE FIT FOR 3.250" DIA SHAFT & 3/4" SQ KEYWAY, AND ONE HUB BORED WITH CLEARANCE FIT FOR 3.375" DIA SHAFT & 7/8" SQ KEYWAY	90 LB
4	1	315AUX535	EXPANSION JOINT, 14" CORRUGATED BELLOWS HOSE, 321 SS, 14"-125# FF FLANGE BOTH ENDS, A36 CS, 6" OVERALL LENGTH, RATED MAX. 75 PSI	75 LB
5	1	314AUX535	EXPANSION JOINT, 12" CORRUGATED BELLOWS HOSE, 321 SS, 12"-125# FF FLANGE BOTH ENDS, A36 CS, 6" OVERALL LENGTH, RATED MAX. 75 PSI	65 LB
6	1	304RSA059	FILTER-SILENCER, WEATHERHOOD INLET, 14"-125# FF FLANGE OUTLET, PLEATED FELT ELEMENT, UNIVERSAL SILENCER CCS-14 WITH P/N 81-1210 ELEMENT (SHIPPED LOOSE)	175 LB
7	1	316AUX1365	INLET SILENCER, 30" DIA., 14"-125# FF FLANGED END INLET & HIGH SIDE OUTLET, 3-LEG MOUNTING, UNIVERSAL SILENCER RISH-14, "Y" DIM. = 89-1/2", "K" DIM. = 40", LEG MOUNT "X" DIM. = 6" (SHIPPED LOOSE)	895 LB
8	1	317AUX365	DISCHARGE SILENCER, 26" DIA., 12"-125" FF FLANGED SIDE INLET & END OUTLET, 3-LEG MOUNTING, UNIVERSAL SILENCER SDY-12, "Y" DIM. = 15", "K" DIM. = 29-1/2", LEG MOUNT "X" DIM. = 2-1/2" (SHIPPED LOOSE)	535 LB
9	2	909831040423	VALVE, PRESSURE RELIEF, WEIGHT LOADED, 4" NPT MALE INLET, WEIGHT SET AT 14.5 PSI, SUTORBILT P/N 909831040423 (SHIPPED LOOSE)	370 LB
10	1	307AUX322	GAUGE, VACUUM, GRADE 2A (1/2%) ACCURACY, 4-1/2" DIAL, FLUSH MOUNT, 1/2" NPT BACK CONNECTION, 30-0" HG RANGE, ASHCROFT DURAGAUGE 45-1377-AS-04B-30/0"HG	3 LB
11	1	306AUX322	GAUGE, PRESSURE, GRADE 2A (1/2%) ACCURACY, 4-1/2" DIAL, FLUSH MOUNT, 1/2" NPT BACK CONNECTION, 0-15 PSI RANGE, ASHCROFT DURAGAUGE 45-1377-AS-04B-0/15PSI	3 LB
12	1	301AUX1451	GAUGE, TEMPERATURE, 4-1/2" DIAL, PANEL MOUNT, 15-250°F/9-121°C DUAL SCALE RANGE, ±2°F ACCURACY MID SCALE, 15 FT ARMORED CAPILLARY, 1/2" OD x 7" BULB WITH 1/2" NPT COMPRESSION FITTING, MURPHY SPLFC-250-S-15-ES	8 LB
13	1	302AUX1451	GAUGE, TEMPERATURE, 4-1/2" DIAL, PANEL MOUNT, 130-350°F/60-180°C DUAL SCALE RANGE, ±2°F ACCURACY MID SCALE, 5 FT ARMORED CAPILLARY, 1/2" OD x 7" BULB WITH 1/2" NPT COMPRESSION FITTING, MURPHY SPLFC-350-S-15-ES	8 LB
14	1	300AUX352	SWITCH, PRESSURE, NEMA 4X ENCLOSURE, 1/4" NPT PORT, SINGLE SPDT, 15A AT 125VAC, VITON SEAL, 0-30 PSI RANGE, SET AT 13.5 PSI RISING, ASHCROFT B4-24-V-XFS-30PSI SET 13.5 PSI RISING	3 LB
15	1	300AUX1488	SWITCH, TEMPERATURE, NEMA 4X ENCLOSURE, SINGLE SPDT, 15A AT 125VAC, REMOTE MOUNT WITH 10 FT SPRING ARMOR CAPILLARY & 3/8" x 3" BULB WITH 1/2" NPT CONNECTION BUSHING, 235-375°F RANGE, SET AT 300° F RISING, ASHCROFT T4-24-T10-030-XBX-XFS-235/375°F SET 300°F RISING	3 LB
17	1	85131-804	SET OF ANCHOR BOLTS, 316 SS, FOR BLOWER PACKAGE BASE, INLET SILENCER, AND DISCHARGE SILENCER MOUNTING PER GDEPC 85131-804 (SHIPPED LOOSE)	39 LB
18	1	85131-650	BLOWER PACKAGE CONTROL PANEL, NEMA 12 ENCLOSURE, PER GDEPC ASSEMBLY 85131-650 WITH -601, -602, -603, & -604 WIRING DIAGRAMS, MOUNTING PROVIDED BY CUSTOMER (SHIPPED LOOSE)	100 LB
19	1	85131-301	BLOWER PACKAGE BASE PER GDEPC 85131-301	1,874 LB
20	1	85131-302	MOTOR ALIGNMENT BASE WITH JACKSCREWS PER GDEPC 85131-302	125 LB
21	1	85131-303	BLOWER PACKAGE COUPLING GUARD PER GDEPC 85131-303	13 LB
22	1	85131-501	BLOWER PACKAGE INLET PIPE SPOOL PER 85131-501 (SHIPPED LOOSE)	220 LB
23	1	85131-502	BLOWER PACKAGE DISCHARGE PIPE SPOOL PER 85131-502 (SHIPPED LOOSE)	172 LB
24	1	85131-503	BLOWER PACKAGE PIPING & TUBING ASSEMBLY PER GDEPC 85131-503	200 LB
25	1	85131-801	BLOWER PACKAGE INSTRUMENT PANEL ASSEMBY GDEPC 85131-801	9 LB
26	1	85131-802	BLOWER BEARINGS RTD'S INSTALLATION PER GDEPC 85131-802	12 LB
27	1	85131-803	BLOWER VIBRATION TRANSMITTERS INSTALLATION PER GDEPC 85131-803	3 LB
28	1	85131-661	BLOWER PACKAGE 120 VAC JUCTION BOX, NEMA 12, SCREW COVER, 10"Hx8"Wx4"D, WITH TERMINALS FOR PRESSURE & TEMPERATURE SWITCHES PER GDEPC 85131-661	10 LB
29	1	85131-662	BLOWER PACKAGE ANALOG JUCTION BOX, NEMA 12, SCREW COVER, 10"Hx10"Wx4"D, WITH TERMINALS FOR RTD's & VIBRATION TRANSMITTERS PER GDEPC 85131-662	12 LB
30	1	85131-663	BLOWER PACKAGE BASE MOUNTED WIRING & CONDUIT ASSEMBLY PER GDEPC 85131-663	93 LB
31	1	85131-660	BLOWER PACKAGE BASE MOUNTED WIRING DIAGRAM PER GDEPC 85131-660	– LB
32	1	85131-304	INLET PIPE SPOOL SUPPORT PER GDEPC 85131-304 (SHIPPED LOOSE)	98 LB
33	1	85131-504	FILTER & SILENCERS LIFTING EYES PER GDEPC 85131-504	5 LB
			TOTAL APPROXIMATE WEIGHT BASE MOUNTED PACKAGE	9,109 LB
			TOTAL APPROXIMATE WEIGHT ALL ITEMS	11,718 LB

BILL OF MATERIAL QUANTITIES ARE FOR ONE (1) PACKAGE
S.O. NO. 248352/JOB NO. 85131 REQUIRES FIVE (5) PACKAGES

D

PERFORMANCE DATA

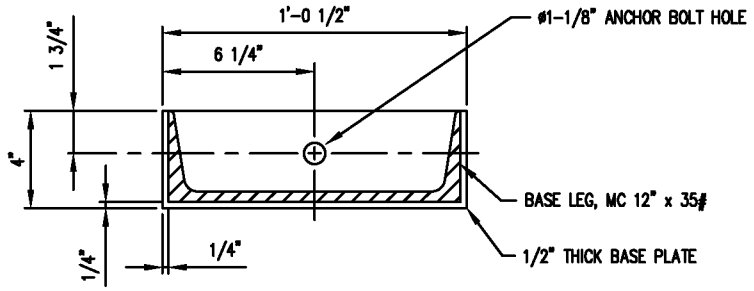
SERVICE: AIR AT 100% RELATIVE HUMIDITY
BLOWER: CYCLOBLOWER MODEL 11CDL31
MOTOR: TEFC, 350 HP, 1800 RPM, 3PH/60HZ/460V, 1.15 S.F.
ALTITUDE: 700.0 FT
BAROMETER: 14.32 PSIA
INLET PRESSURE: 0.0 PSIG
INLET TEMPERATURE: 100.0° F
INLET FLOW: 4225.9 SCFM
DISCHARGE PRESSURE: 12.5 PSIG
BLOWER SPEED: 1790 RPM
BLOWER POWER: 311.9 BHP
DIRECT DRIVE COUPLING: FALK TYPE T10 SIZE 1100T
INLET & DISCHARGE SILENECERS RATINGS:
NON-ASME SERVICE
PRESSURE: MAX. 15 PSIG FOR NON-ASME SERVICE
TEMPERATURE: MAX. 325° F

NOTES:

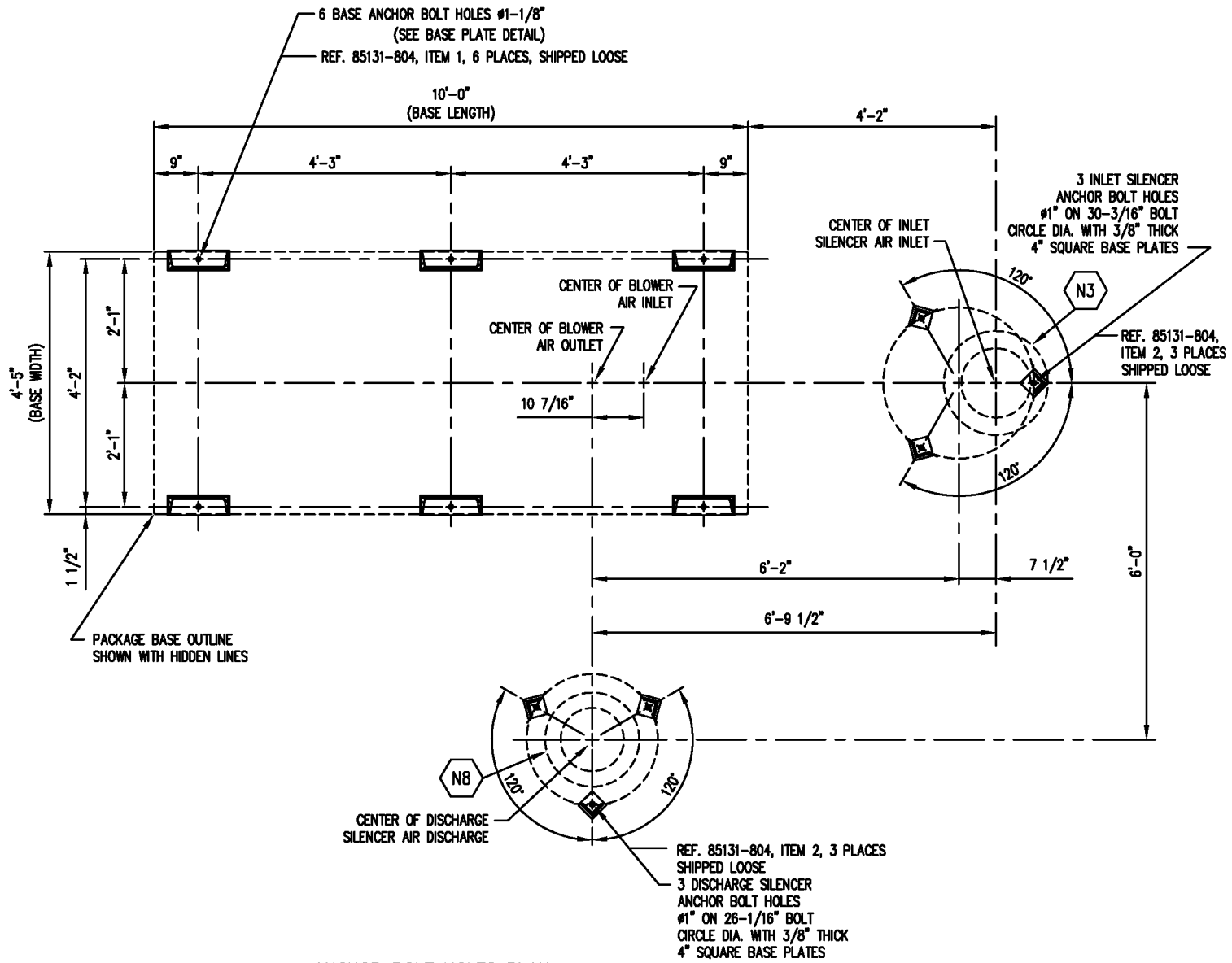
1. SEE GDEPC DRAWING 85131-200 FOR INSTALLATION IN CUSTOMER BUILDING AND REPAIR KIT AND SPARE PARTS ON THE BOM
2. SEE SHEET 2 OF 3 FOR VIEWS A-A, B-B, & C-C WITH SILENCERS
3. SEE SHEET 3 OF 3 FOR VIEWS A-A, C-C, D-D, & E-E WITHOUT SILENCERS AND FOR THE SHAFT COUPLING ALIGNMENT PROCEDURES AND DETAILS
4. SEAL ALL PIPE THREADS WITH LOCTITE SEALANT
5. FLANGE BOLT HOLES STRADDLE CENTERLINES OR MATCH PERVIOUSLY INSTALLED COMPANION FLANGE
5. CUSTOMER TO PROVIDE FLANGE FASTENERS AND GASKETS FOR THE FILTER-SILENCER OUTLET, INLET SILENCER INLET, AND DISCHARGE SILENCER OUTLET
6. CUSTOMER TO PROVIDE HOLES, CONDUIT CONNECTORS, STRAIN RELIEF CONNECTORS, WIRING, CABLE, AND CONDUIT FOR CONNECTIONS BETWEEN THE BASE MOUNTED JUCTIONS BOXES AND THE BLOWER PACKAGE CONTROL PANEL ENCLOSURE
7. PRIME & FINISH COAT EXPOSED METAL SURFACES IN ACCORDANCE WITH CUSTOMER SPECIFICATIONS PER SECTION 09800, SECTION 3.6, SYSTEM NO. 3

"N" CONNECTIONS & PORTS:

- N1 FILTER-SILENCER AIR INLET, BOTTOM OF WEATHERHOOD
- N2 FILTER-SILENCER AIR OUTLET, 14"-125# FF FLANGE
- N3 INLET SILENCER AIR INLET, 14"-125# FF FLANGE
- N4 INLET SILENCER AIR OUTLET, 14"-125# FF FLANGE
- N5 BASE MOUNTED PACKAGE AIR INLET, 14"-125# FF FLANGE
- N6 BASE MOUNTED PACKAGE AIR DISCHARGE, 12"-125# FF FLANGE
- N7 DISCHARGE SILENCER AIR INLET, 12"-125# FF FLANGE
- N8 DISCHARGE SILENCER AIR DISCHARGE, 12"-125# FF FLANGE
- N9 INLET PRESSURE GAUGE SENSOR PORT, 1/4" NPT FEMALE
- N10 INLET TEMPERATURE GAUGE SENSOR PORT, 1/2" NPT FEMALE
- N11 DISCHARGE PRESSURE GAUGE & SWITCH SENSOR PORT, 1/4" NPT FEMALE
- N12 DISCHARGE TEMPERATURE GAUGE SENSOR PORT, 1/2" NPT FEMALE
- N13 DISCHARGE TEMPERATURE SWITCH SENSOR PORT, 3/4" NPT WITH 1/2" NPT INTERNAL THERMOWELL
- N14 MOTOR CONDUIT CONNECTIONS, TWO 3" NPT WHICH CAN BE ROTATED TO TOP, BOTTOM, OR EITHER END OF CONDUIT BOX



BASE MOUNTING PLATE DETAIL
(TYPICAL 6 PLACES)
SCALE: 3"=1'-0" (1/4)



ANCHOR BOLT HOLES PLAN
SCALE: 3/4"=1'-0" (1/16)

REVISION 3 SHEET 1 of 3 FILENAME: 85131-201R3S1.dwg

Gardner Denver
ENGINEERED PACKAGING CENTER
11611 TANNER ROAD
HOUSTON, TEXAS 77041

3	08/21/03	AS CONSTRUCTED	KE	AB	–
2	03/11/03	RELEASED FOR FABRICATION	KE	CV	AB
1	11/19/02	REVISED FOR APPROVAL	KE	CV	AB
0	09/20/02	RELEASED FOR APPROVAL	KE	CV	AB

REVISIONS

CUSTOMER: C. EMORY NELSON/METROPOLITAN COUNCIL
CUSTOMER ITEM NO.: P.O. CEN02-6011

350 HP CYCLOBLOWER 11CDL31 BLOWER PACKAGE
GENERAL ARRANGEMENT

SALES ORDER NO.: 248352
PRODUCTION ORDER NO.: 1150327

DATE 08/21/03 SCALE 1/16 DWG. NO.: 85131-201 (1 of 3)

REVISIONS						
4	-	SEE SHEET 1 OF 3	-	-	-	-
3	-	SEE SHEET 1 OF 3	-	-	-	-
2	-	SEE SHEET 1 OF 3	-	-	-	-
1	-	SEE SHEET 1 OF 3	-	-	-	-

SALES ORDER NO.: 248362
PRODUCTION ORDER NO.: 1150327

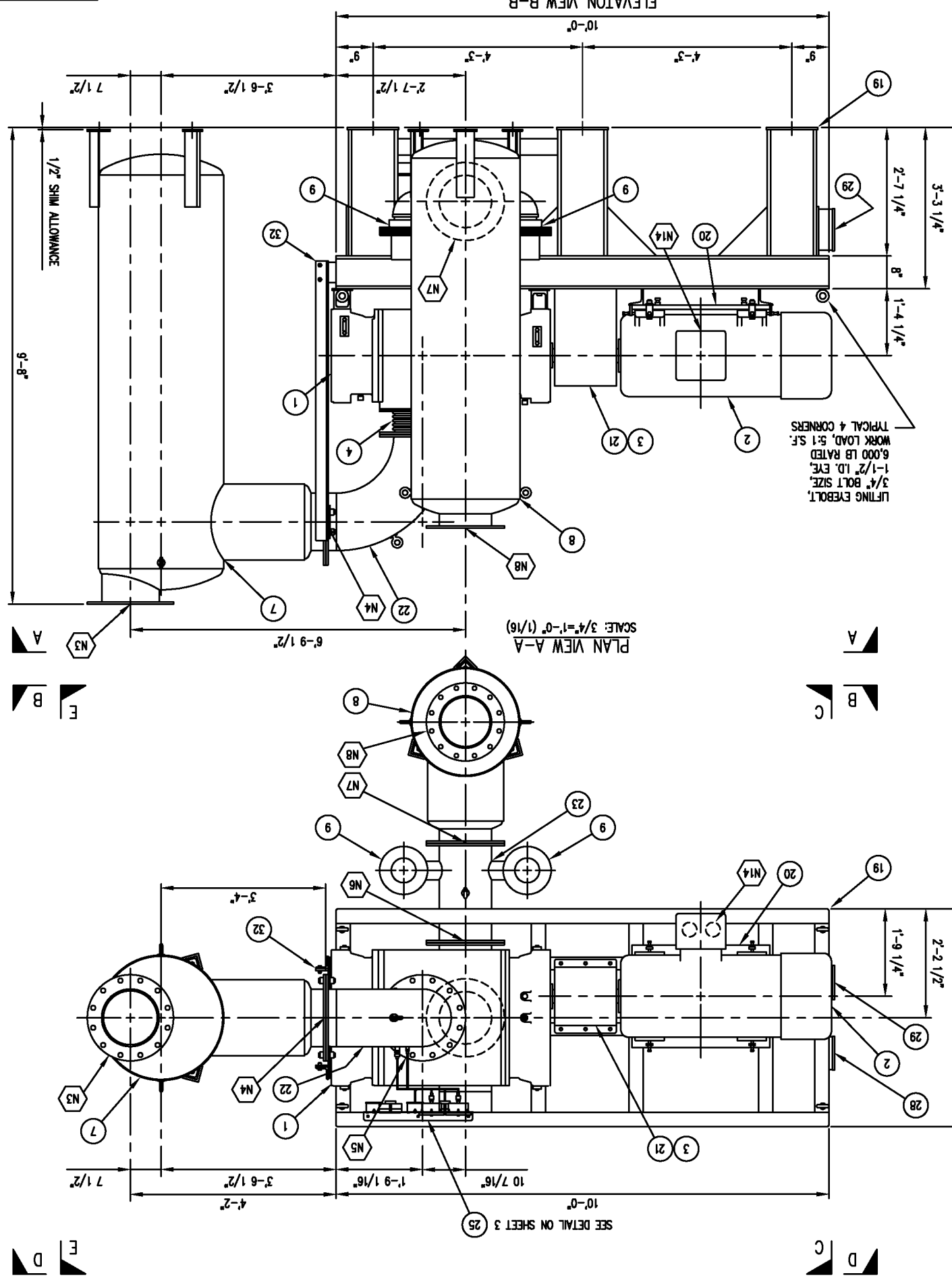
REVISION 3 SHEET 2 of 3 FILENAME: 8513I-20IR352.dwg

Gardner Denver
ENGINEERED PACKAGING CENTER
11611 TANNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER: C. EMORY NELSON/METROPOLITAN COUNCIL
CUSTOMER ITEM NO.: P.O. C8NO2-6011

350 HP CYCLOBLOWER 11CDL31 BLOWER PACKAGE
GENERAL ARRANGEMENT

DATE 08/21/03 SCALE 1/12 DWG. NO.: 8513I-20I (2 of 3)



NOTES FOR SHEET 2 OF 3:

1. SEE SHEET 1 OF 3 FOR BILL OF MATERIAL, PERFORMANCE DATA, NOTES, "N" CONNECTIONS & PORTS LISTING, AND ANCHOR BOLT HOLES PLAN
2. SEE SHEET 3 OF 3 FOR VIEWS A-A, C-C, D-D, & E-E (SHOWN WITHOUT SILENCERS)

REVISION 3 SHEET 3 of 3 FILENAME: 8513I-201R3S3.dwg

Gardner Denver
ENGINEERED PACKAGING CENTER
1101 TANNER ROAD
HOUSTON, TEXAS 77041

CUSTOMER: C. EMORY NELSON/METROPOLITAN COUNCIL
CUSTOMER ITEM NO.: P.O. 0ENO2-6011

350 HP CYCLOBLOWER 11CDL31 BLOWER PACKAGE
GENERAL ARRANGEMENT

DATE 08/21/03 SCALE 1/12 DWG. NO.: 8513I-201 (3 of 3)

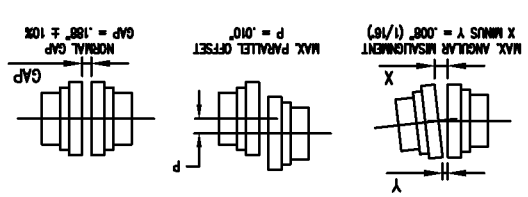
REVISIONS						
4	-	SEE SHEET 1 OF 3	-	-	-	-
3	-	SEE SHEET 1 OF 3	-	-	-	-
2	-	SEE SHEET 1 OF 3	-	-	-	-
1	-	SEE SHEET 1 OF 3	-	-	-	-

SALES ORDER NO.: 248362
PRODUCTION ORDER NO.: 1150327

SHAFT COUPLING ALIGNMENT PROCEDURES:

1. INSTALL THE ASSOCIATED COUPLING HUBS ON THE BLOWER SHAFT AND MOTOR SHAFT
2. ALIGN THE COUPLING HUBS PER THE FALK RECOMMENDED MAXIMUM ANGULAR AND OFFSET MISALIGNMENT AND NORMAL SHAFT GAP SHOWN IN THE DIAGRAM BELOW
3. THE VERTICAL AND 2-AXIS HORIZONTAL JACKSCREWS ON THE MOTOR ALIGNMENT BASE PER SECTION VIEWS F-F & G-G MAY BE USED TO ALIGN THE HUBS. A 1/4" SHIM ALLOWANCE IS PROVIDED FOR VERTICAL ALIGNEMENT.

FALK COUPLING ALIGNEMENT FOR TYPE T10 SIZE 1100T:



NOTES FOR SHEET 2 OF 3:

1. SEE SHEET 1 OF 3 FOR BILL OF MATERIAL, PERFORMANCE DATA, NOTES, "N" CONNECTIONS & PORTS LISTING, AND ANCHOR BOLT HOLES PLAN
2 SEE SHEET 2 OF 3 FOR VIEWS A-A, B-B, & C-C (WITH SILENCERS)