



## **OPERATING and MAINTENANCE INSTRUCTIONS**

***SAFE Systems, Inc.***

**Model PD2100D Vacuum Recovery Unit  
w/ VDC-4, Vacuum Dust Collector**

**SAFE SYSTEMS, INC.**

**MODEL PD2100D VACUUM RECOVERY UNIT**  
**w/ VDC-4 Vacuum Dust Collector**

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**I. DAILY OPERATOR CONSIDERATIONS & LOG**

- A.** DO NOT OVERLOAD the system. Do not exceed a 40% abrasive to 60% air mixture during recovery operations
- B.** DO NOT introduce wet air to the system.
- C.** Drain condensate from the air reservoir (manifold) and regulator/filter throughout the day.
- D.** DO NOT operate without an abrasive collection tank or hopper.
- E.** Replace any burned out bulbs in the engine control panel.
- F.** Check the safety filter Magnehelic (differential pressure) gauge. If the readings indicate 12" or less of pressure, the equipment should be inspected for problems.
- G.** Check the Magnehelic gauge (located at the end of the safety filter near the Main Control panel) during operation to verify consistent readings. If inconsistent readings exist, check for vacuum leaks in the system. Tighten the flanges, if required.
- H.** Empty the dust collector hopper at least every four hours, or more frequently if required.
- I.** When storing the unit, ensure the hopper has been emptied and the unit is protected from the elements.
- J.** When transporting the unit, ensure that the hopper has been emptied and the unit is attached to a stable transport device.
- K.** Follow all instructions in this manual and component manufacturers' literature, in individual sections.

## DAILY OPERATOR LOG SHEET

\*\*\* Make copies of this sheet to use daily and retain in file.\*\*\*

DATE _____		TIME _____		NAME _____		AIR TEMP _____ °F	
<b>BEFORE STARTING</b>				<b>AFTER STARTING</b>			
1. ENGINE				1. ENGINE			
Oil Level				Oil Pressure			
Coolant Level				Coolant Temperature (after 10 minutes of run time)			
2. VACUUM PUMP				Fuel Level			
Oil Level (drive end)				Amperage/Voltage			
Oil Level (non drive end)				2. VDC-4			
3. VDC-4				Magnehelic Reading			
Empty dust				3. SAFETY FILTER			
				Magnehelic Reading			
<b>EMERGENCY SHUT-DOWNS</b>							
TYPE				TYPE			
TIME				TIME			
<b>COMMENTS:</b>							

## **II. INTRODUCTION AND SYSTEM DESCRIPTION**

Spent abrasive is recovered into the customer-supplied collection tank or hopper with the vacuum provided by the Model PD2100D vacuum system. See the illustration on Page 6 for system configuration.

A Roots Vacuum Model 616DVJ positive displacement vacuum pump, serial # ?????????? with inlet and exhaust silencer package is provided for recovery of the abrasive from the blast chamber (provided by others).

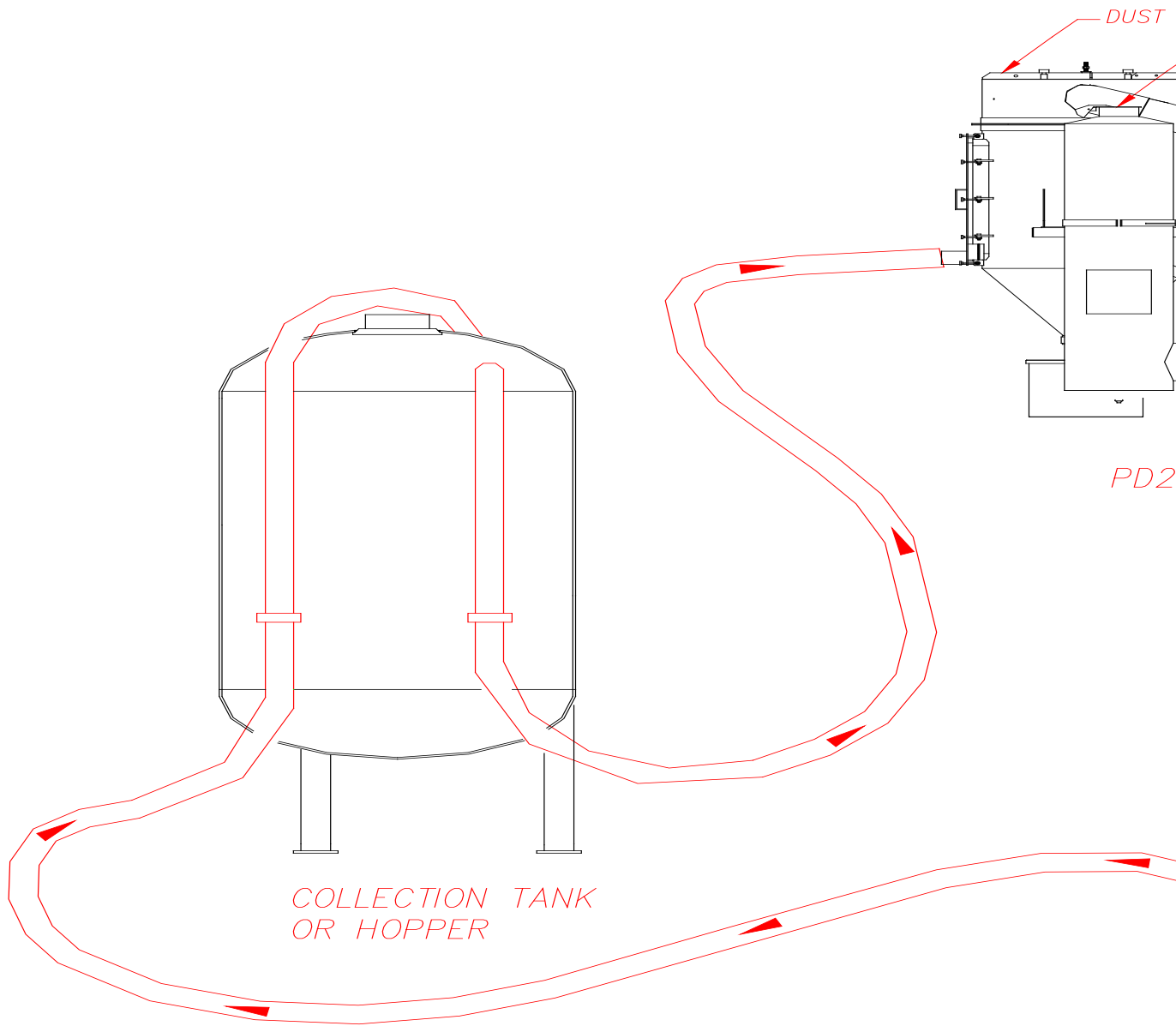
The vacuum pump is a direct drive unit utilizing a flexible coupling connected to a John Deere diesel engine at approximately 2400 rpm. At this rpm, the unit draws approximately 2100 SCFM of air. This vacuum pump consumes approximately 100 HP and provides an efficient and economical means to provide recovery of the spent abrasive. The unit is capable of pulling 27" HG vacuum with a plugged hose (zero airflow).

An exhaust and bleed air silencer package by Stoddard Silencer has been provided to give the best sound reduction at many frequencies. Stoddard is the industry leader in sound reduction of positive displacement vacuum pumps.

A complete Roots Vacuum Operating and Maintenance Manual is provided in the Vacuum Pump section IV. A. and should be referenced for continued proper operation. A record of all lubrication and maintenance performed is required.

A John Deere diesel engine, model ??????, serial # 4?????????, with a Twin Disc PTO, serial #1P2662, is provided to drive the vacuum pump. A complete Cummins operating and maintenance manual is provided in the Diesel Engine section, IV. B. Specific instructions for start-up, operation and service are included and must be followed for proper operation.

The SAFE Systems VDC-4 Cartridge Dust Collector is an aspirated cartridge, self-cleaning design which works in conjunction with the Roots vacuum pump.



### **System configuration using PD2100D with VDC-4**

The vacuum recovery system **MUST** be used in conjunction with a collection tank or hopper.

### **III. INTENDED USE OF EQUIPMENT**

The equipment was developed, designed and engineered based upon various parameters supplied by the customer for their specific needs. The basic design used is premised upon use in conjunction with a blast enclosure (supplied separately by others).

The following is a list of material and operational parameters established to enable the system to function properly:

- |  |  |
|--|--|
| <b>A.</b> Type and size of abrasive  | 270 lbs./ft <sup>3</sup> or less             |
| <b>B.</b> Recovery hose to vacuum  | 4" diameter                                  |
| <b>C.</b> Maximum and minimum ambient temperature  | 100°F, -40°F                                 |
| <b>D.</b> Maximum incline (front to rear)  | +/- 8 degrees                                |
| <b>E.</b> Engine/vacuum pump speed during operation  | 2000 – 2400 rpm                              |
| <b>F.</b> Maximum abrasive flow rate   | 6 to 8 ton/hour w/100'<br>of horizontal hose |
| <b>G.</b> Engine type  | Cummins Diesel, model B3.9                   |
| <b>H.</b> Operating hours per day  | 8 hrs max continuous operation               |
| <b>I.</b> Unit must be used in conjunction with an abrasive collection tank or hopper.   |  |
| <b>J.</b> Only dry air may be introduced to the system.  |  |
| <b>K.</b> Operating manual(s) must be followed precisely.  |  |
| <b>L.</b> Daily Operator Log Sheets (section I.) must be completed and kept on file.   |  |
| <b>M.</b> Complete maintenance records must be available.  |  |
| <b>N.</b> Only properly trained personnel can operate the system. It is the responsibility of the owner to train and assign properly trained personnel to this equipment. The owner will provide documentation showing which personnel have been properly trained. |  |
| <b>O.</b> The blast machine and/or enclosure and abrasive collection tank/hopper may be supplied by others.  |  |

**Please Note:** The parameters outlined above are extremely important and must be followed to validate the warranty on the equipment. Failure to comply with these parameters may result in a system malfunction and inefficient/ineffective operation.

#### **IV. VACUUM RECOVERY SYSTEM SPECIFICATIONS**

The PD2100D vacuum recovery system is provided for recovery of abrasive from a blast chamber.

The components of the vacuum system are as follows:

- A. Positive Displacement Vacuum Pump Unit**
- B. Diesel Engine**
- C. Silencers**
- D. Safety Filter**
- E. VDC-4 Vacuum Dust Collector**
- F. Control Panel**

Each component is covered fully in the following sections.



**A. POSITIVE DISPLACEMENT VACUUM PUMP UNIT**

The Roots Positive Displacement vacuum pump, Model 616DVJ (serial #????????), is a direct drive unit utilizing a flexible coupling connected to a diesel engine at approximately 2300 rpm. At this rpm, the unit draws approximately 2100 SCFM of air (free air capacity). At 21", 85 brake horsepower it draws approximately 1100 CFM.

This vacuum pump consumes approximately 100 HP and provides an efficient and economical means to provide recovery of spent abrasive. The unit is capable of pulling 27" HG vacuum with a plugged hose (zero airflow).

A vacuum instrumentation package is included with the unit.

The PD vacuum unit is capable of recovering six (6) to eight (8) tons of abrasive per hour with one hundred (100) feet of 4" diameter vacuum hose in the horizontal position.

**B. DIESEL ENGINE**

A Cummins diesel engine, Model ????????, (serial # ????????) with Twin Disc PTO, Model SP111-P326 (serial # ????????) is provided to drive the vacuum pump.

See manufacturer's literature following this page for complete information and instructions.

***All manufacturer's instructions and recommendations must be followed. Special care is required during the "break-in" period.***

### **C. SILENCERS**

An inlet, exhaust and bleed air silencer package has been provided by Stoddard Silencer to give the best sound reduction at many frequencies. Stoddard is the industry leader in sound reduction of positive displacement vacuum pumps.

See manufacturer's literature following this page for complete information.

#### **D. SAFETY FILTER**

A vacuum rated safety filter is provided to prevent carry-over of dust from the reclaim system to the vacuum pump. It is a single cartridge type dust filter with 2100 CFM capacity, intended to protect the vacuum pump in the case of a seal or filter failure in the VDC-4 vacuum dust collector. The safety filter housing will operate under a negative pressure condition of 29" HG.

The safety filter has a Magnehelic gauge to indicate when there is a carry-over problem from the VDC-4. With the PD2100-D connected to a vacuum collection tank or hopper and vacuum recovery hose, a reading of 10 – 12 inches WC would indicate a possible problem and the equipment should be inspected. A reading of 0 during operation of the equipment is indication of a definite problem and the equipment should be shut down immediately. The safety filter may well be damaged and need to be replaced.

The safety filter is the LAST line of defense for the vacuum pump. Replacement cost of a vacuum pump constitutes 50% of the total price of the equipment. Protect your investment by watching the Magnehelic gauge and changing the safety filter when necessary.

## **E. VDC-4 VACUUM DUST COLLECTOR**

The Cartridge Dust Collector is an aspirated cartridge, self-cleaning unit designed to remove airborne dust coming from the customer-supplied collection tank or hopper. It is not intended to collect abrasive. The abrasive should be vacuumed up into a collection tank. See *the system configuration illustration on Page 6 of this manual*.

**NOTE:** It is VERY IMPORTANT that the hopper not be allowed to overfill as that may result in carryover damaging the filters, the dust collector housing or even destruction of the vacuum pump.

The VDC-4 is designed for operation under vacuum up to a maximum of 29" Hg. The incoming air passes from the outside to the inside of the cartridges; enters the upper or clean air plenum; and exits through the clean air outlet. Cartridges are cleaned in sequence by back flushing with air from the clean air plenum. A short burst of compressed air creates this momentary airflow reversal which is limited to only one (1) cartridge at a time. Therefore, the unit continues to collect dust while its cartridges are being cleaned.

A solid-state Sequential Controller located in the control box determines the order in which the solenoid valves will be operated; the length of time that each valve will be opened; and the time interval between such valve openings. The solid state controller operates continuously whenever electrical power is supplied to it.

The dust collector is equipped with a regulator/filter and a pressure gauge. This filter/regulator is intended to remove only minor amounts of water and dirt. Periodic draining of condensate from the air reservoir (manifold) and regulator/filter is recommended.

**NOTE:** It is very important that only clean, dry air be supplied to the dust collector. Wet air will drastically shorten the life of the filters.

### UTILITIES SUPPLY AND CONNECTION

Recommended operating pressure is 90 to 105 PSIG.

The total usage of compressed air is a variable that is dependent upon the amount and type of dust being collected; the size of the dust collector; the condition of the filter cartridges; the set points of the RATE and DURATION timers in the Sequential Controller and the pressure in the air reservoir (manifold). When the DURATION timer is set at its normally recommended time of 0.1 second, the approximate amount of air usage will be as follows:

Number of Cartridges	Air Usage per Pulse Cubic Feet Free air (when RATE timer is set at 60 seconds)
4	0.9

The air usage rate in CFM of free air depends upon the setting of the RATE timer. If the timer is set at twenty (20) seconds, the rate will be three (3) times the values above, etc.

## OPERATION AND MAINTENANCE

The dust collector requires only a weekly visual check to make sure that nothing has gone wrong and replacement of the cartridges when necessary.

NOTE: DO NOT use the hopper as a receptacle for the temporary storage of the collected dust. It is merely a large funnel from which the dust must be removed on a continual basis. If dust is allowed to collect in the hopper, it will tend to re-entrain in the air stream, re-depositing on the cartridges and shortening their life. If the dust being collected is sticky or has long fibers in it, check the hopper every two (2) hours, or as required, to make sure that the dust has not bridged across and plugged the outlet.

After each dumping of dust from the dust collector, make sure the butterfly valve is completely closed to the last notch on the handle indicator.

## FILTER REPLACEMENT

When the pressure drop across the cartridges is between six (6) to eight (8) inches on the Magnehelic gauge, cartridges should be replaced as described in the following instructions. Prior to installing new filters, verify that the cartridges have not been damaged during shipment, storage or transporting of the unit.

Shut off electrical power to the dust collector.

Refer to the VDC drawing in this section for a graphic depiction.

The cartridges are removed and installed through the main access door of the Dust Collector. Remove the bolts securing the door and open the door. Remove the top nut and loosen the second, locking nut, on the top of the dust collector. This will allow the threaded rod (adjustment rod) to lower to a position where the top of the threaded rod is flush with the top of the bottom nut. This will allow the four (4) legged filter platform to turn like a "Lazy Susan".

NOTE: Do not remove the second nut completely or the rod will drop out.

Remove and reinstall the filters on this turn-table platform. Once all filters are in place, line the filters up with the capture rings located in the top of the dirty air chamber of the dust collector. Slowly tighten the nut on the top of the dust collector, which will raise the filters until they are sealed against the top of the dirty air chamber.

IMPORTANT: While tightening the nut, make sure the filters are rising straight and that they are all lined up correctly in their appropriate capture ring. Tighten the nut until the filters are tight and will not slide or move. Be careful not to over tighten the filters as this may cause the filters to collapse.

Once the desired tightness (approximately forty-five (45) ft. lbs. of torque) is achieved, install the second nut and tighten it down against the first nut to act as a jam nut so the adjustment rod can not loosen.

Close and fasten the access door and pre-coat the filters as described below. Pre-coating the cartridges with a suitable filter aid material will both increase efficiency and increase cartridge life. Filters are expensive. The cost of pre-coat material could save many dollars in filter costs. A simple feeder and qualified pre-coat material are available from SAFE Systems.

With the controls set to pulse continuously at five (5) second intervals, feed five (5) to ten (10) pounds of filter pre-coat material per cartridge through an open hopper discharge device or into the inlet duct. Repeat as frequently as desired.

Reset the RATE (OFF) timer to sixty (60) seconds. Check the DURATION (ON) timer. It should be set for 0.1 second. Close the door of the Control Box. Tighten all door clamps.

**SAFETY NOTES:**

The manufacturer relies on the skills and expertise of its customer, and any consulting engineers and/or installing contractor hired by that customer, to properly design and operate the dust collection system of which the dust collector is a part. Please take precautions as required to minimize the inherent risk of dust combustion, fires and explosions. Be sure to read this manual thoroughly and comply with all precautionary statements relative to worker safety.

Take special care whenever the door of the control box is open. The full line voltage can appear from any electrical point on the circuit board to the metal enclosure or to ground.

Do not collect combustible materials along with dust from ferrous grinding or other spark generating operations. Sparks caused by such operations may start a fire in the combustible dust.

Under no circumstances should anyone be allowed to discard a lighted cigarette or other burning material into an inlet hood or ducting of the dust collection system.

It is the responsibility of the user to comply with all applicable national or local fire and safety codes.

The dust collector does not contain explosion vents except on special order. Refer to NFPA 68 "Guide for Explosion Venting" or your insurance underwriter for recommendations regarding the sizing and installation of explosion vents.

## **F. CONTROL PANEL**

An electrical control panel is provided to operate the diesel engine and vacuum dust collector. Specifications are as follows:

1. Engine start.
2. Emergency shutdowns for high water temperature and low oil pressure.

See manufacturer's literature in the Diesel Engine section (Section IV. B.) for more complete information.

**Utilities:** #2 diesel fuel.  
12V DC battery



## **V. LUBRICATION SCHEDULE**

Item #	Item Description	Interval	
1	Vaccum Pump	500 hrs	Oil change, UNAX AW220 or equivalent
2	Diesel Engine	250 hrs	Oil change, see Cummins Engine manual
3	PTO Throwout Collar	100 hrs	Refer to PTO manual, High temp lithium
4	Main Shaft Bearing	100 hrs	Refer to PTO manual, High temp lithium
5	Shift Lever	100 hrs	Refer to PTO manual, High temp lithium

See drawing # 064M02 following this page for graphical location of lubrication points. Also, reference all manufacturers' literature and information provided.

## **VI. RECOMMENDED SPARE PARTS**

The following is a list of spare parts we recommend you keep on hand to avoid costly down time.

<b>Description</b>	<b>Qty</b>	<b>Part #</b>
Magnehelic Gauge	1	SAFE #32002010
Engine fuel filter	1	Fleetguard FS1251
Engine air filter	1	Nelson #70301N
Engine oil filter element	1	Fleetguard LF3345
HEPA safety filter element	1	HE384P
Direct drive flex coupling	1	Dodge #011109 Px90HH Flange style TL
Vacuum Dust Collector filters	4	SAFE #10001245
Pamic filter	1	SAFE #10001500
6" Butterfly valve	1	SAFE #31003706

**VII. DRAWING INDEX**

<b>Drawing #</b>	<b>Description</b>	<b>Located at the back of Section#</b>
064M01	PD2100D w/ VDC-4 Layout	II.
064M02	PD2100D w/ VDC-4 Lubrication Schedule	V.
064M04	VDC-4 Layout	IV. E.