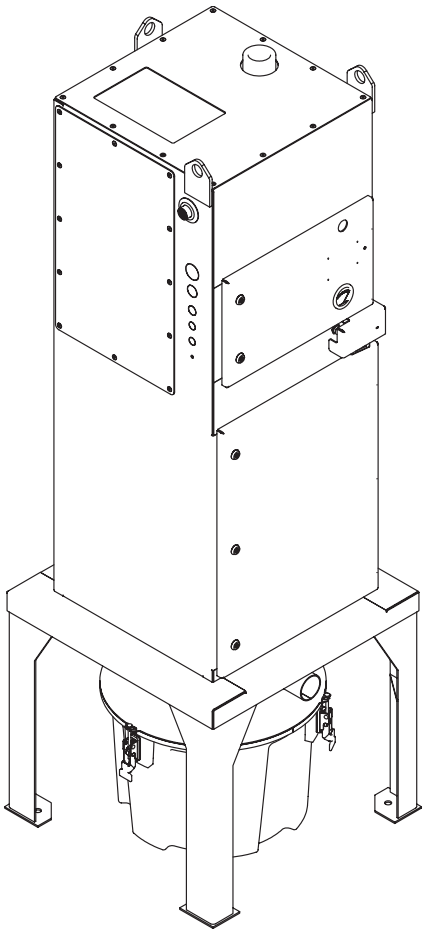
OWNER'S MANUAL & OPERATING INSTRUCTIONS

Original Instructions



FlexPro Hi-Vacuum Series Cartridge Collector

Model Number: HVE-175-80-1
for Serial No. 27310 and higher

Manufactured by: RoboVent Product Group, Inc., 37900 Mound Rd., Sterling Heights, MI 48310, USA | (888) ROBOVENT | www. robovent.com

Table of Contents

Introduction

Thank you for choosing the RoboVent HVE Hi-Vac filtration machine. This high-vacuum unit is designed for industrial environments, collecting both fumes and dust at the source in welding and related processes. The energy-efficient motor is directly coupled to the regenerative blower and operated by onboard controls, combining what might otherwise be a very complex operation into a simple, user-friendly package. It ships in two pieces, the motor/filter cabinet and the dust containment (hopper) and is pre-tested, making it easy to set up and use.

The HVE Hi-Vac machine has been designed for production use and has a few standout characteristics:

Regenerative blower: The backbone of the machine, it requires little maintenance, and the advanced design provides the powerful suction required.

Vertical cartridge filters: Vertical cartridge filters have superior loading and cleaning performance; RoboVent Endurex filters improve on these inherent characteristics with proprietary design features that optimize performance and promote effective pulse cleaning.

Pulsing system: Automatic and efficient, the pulse system ensures filter life is maximized. Online and offline modes work together as needed to ensure filter is consistently cleaned: a quick pulse sheds dust from the filter, causing it to fall into the hopper area and collect in the drum. Effective pulsing is combined with a filter chamber designed to prevent re-entrainment of dust, resulting in maximum filter life.

Intuitive controls: Simple, intuitive controls are equipped with auto and manual blower modes. Optional sensors integrate filtration with welding processes. Additional electronics monitor airflow and motor speeds to indicate operating condition with green, yellow and red lights.

With user-friendly electronics and only requiring connections to electricity and compressed air, the HVE Hi-Vac machine is simple to set up. Additional details can be found in the section titled “Prerequisites for Use”.

Persons involved with installing, operating, maintaining, and servicing this RoboVent HVE Hi-Vac machine must read these instructions prior to use. Keep this manual in a safe and convenient place for reference. In the case of loss or damage, please contact RoboVent for replacement.

RECEIVING & INSPECTION

The equipment will arrive on a pallet or in a crate. Perform a visual inspection before removing from the truck. If there is any damage, it should be noted on the shipping documents and photographed. It is the receiver's responsibility to file shortage reports and damage claims with the carrier. The carrier is responsible for any damage to the equipment while it is in transit. Notify RoboVent if any damage has occurred so repair can be arranged.

The filter cartridge(s) will be shipped inside the machine.

Before discarding packing material, make sure no small parts are concealed within wrapping.

SAFETY SIGNS AND SYMBOLS

Below are the safety symbols and meanings as used throughout this manual and on the machine itself. Specific hazards and labels are shown in the "Specifications" section.

Warning Sign: Yellow Triangle with black edging. Specific icon shown on the face for specific concerns, or exclamation mark (as shown) for generic safety alerts to hazardous conditions.

Prohibition Sign: White circle with red edging and crossbar. Specific icon shown on the face for specific concerns, or STOP (as shown) for generic alerts to conditions that may lead to damage to the job, machine or other factor.

Mandatory Sign: Blue circle with white icon. Specific icon shown on the face for specific concerns, for example as shown, it is mandatory to consult the manual before operating.

Reference Sign: This symbol indicates that the reader should refer to the specific section and read about this identified component, task or location and learn more before continuing. Where this sign is shown, DO NOT attempt to continue before reading the section as indicated.

PURPOSE & LIMITATIONS

The HVE Hi-Vac filtration machine is designed for use with fume extraction welding guns in production applications. Its powerful suction, simple controls, and small footprint are suited for use in many facilities, including fabrication shops, production facilities, shipbuilding, and large structures.

This machine is intended for filtration of airborne fumes and non-explosive dry dust captured at the source. The design and controls are optimized for welding processes, especially when used with fume extraction welding guns, but it can be used intermittently for related processes such as grinding or sanding.

Introduction

Whilst it can perform in 'high-loading' applications, such as robotic welding, plasma cutting, and grinding applications, these processes generate more fume and particles than what is practical for the collection capacity of the HVE Hi-Vac machine. Therefore, it is not recommended for use in such applications.

Some welding conditions or atmospheres can generate oily or sticky particulate that 'blinds' the filter media. Blinding occurs when the pores in the fiber of the media become blocked so that pulse cleaning does not remove the blockage, leading to diminished cleaning results, finally resulting in reduced filter life. If you notice decreased filter life, or if differential pressure of the filter does not drop after an offline cleaning cycle, it may indicate blinding. You can improve filter condition by welding clean material, reducing the amount of oil on parts, and/or limiting use of anti-spatter spray. Nozzle gel must not be used with fume extraction welding guns. Metal particulate collected from welding or related processes can be combustible when built-up in the collector, on the filter, or in hoses.

Combined with the presence of sparks in the incoming air stream, this presents a potential fire risk. Typically, turbulence in the hose extinguishes sparks; for additional protection, the machine is equipped with a Delta3 Spark Arrestor. Despite these features, it may be possible for a spark to get through. Observe the process periodically to ensure intake of sparks is not excessive. Often, the position of inlets can be adjusted to prevent a consistent intake of sparks or settings on the process can be adjusted to reduce sparks.

Follow all regulations applicable to your workplace and usage conditions. RoboVent or a consultant in your area can assist with compliance. If the intake becomes obstructed, shut the machine down and fix the issue to prevent overheating of the motor and blower. Overpressure is indicated by the red band on the airflow gauge.

The blower motor is designed for continuous duty. Starting the motor more than six times per hour, however, can decrease its life. When using the AutoSaver function, it is possible for the number of starts to exceed this count. The program delays shut-off for one minute after welding stops to evacuate fumes from the hose and to allow for pauses between welds.

Pay attention to a typical production cycle: if there are breaks in welding longer than one minute, keep track to make sure motor will not be required to start more than six times per hour. If this frequency will be exceeded, either switch the unit on before each period of welding, or leave the unit on throughout the day.

Personal Protective Equipment (PPE) is required when servicing the machine. Specific requirements are to be determined by applicable regulations, dust toxicity testing and your workplace policies. As a general rule, gloves, dust mask and safety goggles are recommended to prevent exposure to or inhalation of dust.

Some dusts collected from welding and related processes can be hazardous. The factory is responsible to test for toxicity and determining precautions for emptying and disposing hazardous waste.

The HVE Hi-Vac is not designed to filter gases, odors or noxious fumes.

This filtration machine is not approved for filtration of Carcinogenic, Mutagenic, or Reproductively-harmful (CMR) substances.

The HVE Hi-Vac unit is not designed for use in explosive atmospheres, potentially explosive atmospheres, or for extracting substances from such atmospheres. Neither is it intended to process substance which could create an explosive or potentially explosive atmosphere inside the machine. If the dust to be extracted may create aforementioned conditions, it must be sampled and tested for explosivity. Responsibility lies with the factory to perform testing and ensure compliance with NFPA guidelines.

PREREQUISITES FOR USE

All users and maintenance personnel must read this manual before installing, operating, or servicing the RoboVent HVE Hi-Vac. Maintenance personnel must thoroughly understand the troubleshooting and servicing sections of this manual.

The machine requires compressed air and electrical connections:

- Compressed air must be regulated to 5.86 bar (85 PSI) and must be clean and dry according to ISO 8573-1 Class 7. It is recommended to connect to the machine with a ¾" hard pipe compressed air line.
- Electrical supply is dependent on collector, see rating tag for more info.
- Power cord and air connection are on right side of machine (if facing control panel door).

The machine will require adjustment of airflow to ensure effective capture; refer to the operating instructions. It is recommended to check airflow at the beginning of each shift to ensure fumes are being captured and settings are maintained.

The machine is limited by the amount of vacuum it can safely create. Too much resistance by such conditions as unsuitable hose, excessive hose length or constricted intake can overload the blower and prevent it from successfully capturing fumes. Changes can be made to setup if machine does not perform as expected. Review "Testing & Commissioning" section If you need assistance with adjustment or setup, please contact RoboVent Customer Service & Tech Support at 888-ROBOVENT.

Specifications

SPECIFICATIONS CHART

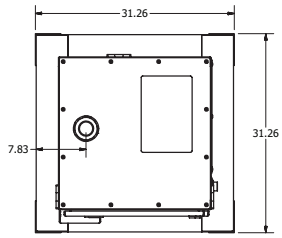
Weight Full	565 lbs (257 kg)
Equivalent Filter Area	256 ft^2 (23.8 m^2)
Maximum Airflow	140 CFM @ 80 in. w.c. (238 m^3/hr @ 20 kPa)
Operating Temperature	10 – 50° C (50 – 120° F)
Cabinet Construction	11-gauge Steel, Polyester Powdercoat
Compressed Air Requirements	Offline Pulse: 12.24 SCFM Online (Dynamic Pulse): 6.35 SCFM 11 m^3/hr (6.34 SCFM) @ 5.9 bar (85 psi)
Compressed Air Connection	3/4" (19.05mm) NPT Hard Pipe
Voltage Supply	480 Volts, 60 Hertz, 14 Full Load Amps 230 Volts, 60 Hertz, 28 Full Load Amps 575 Volts, 60 Hertz, 11 Full Load Amps
Control Voltage	24 VDC

DATA PLATE INFO

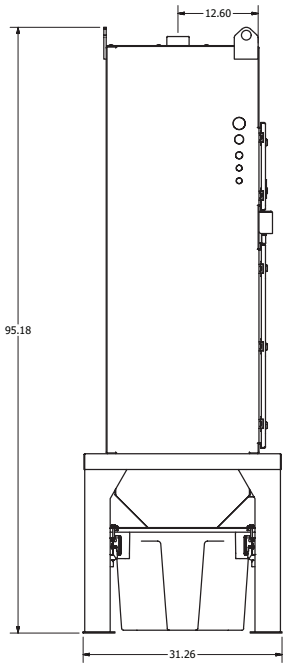
Locate the data plate and record model number, serial number and manufacture date here for quick reference.

Model No:	
Serial No:	
Manufacture Date:	

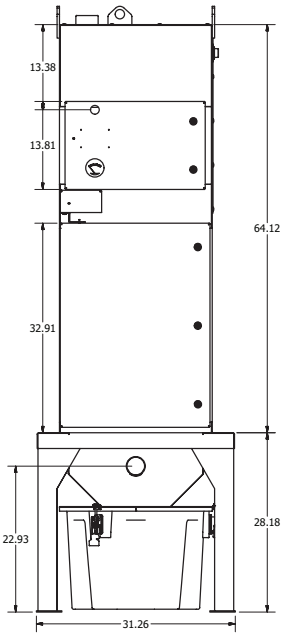
DIMENSIONS



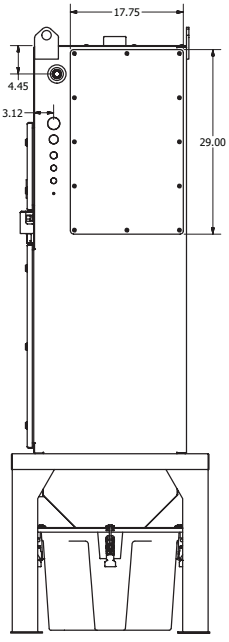
TOP



LEFT SIDE

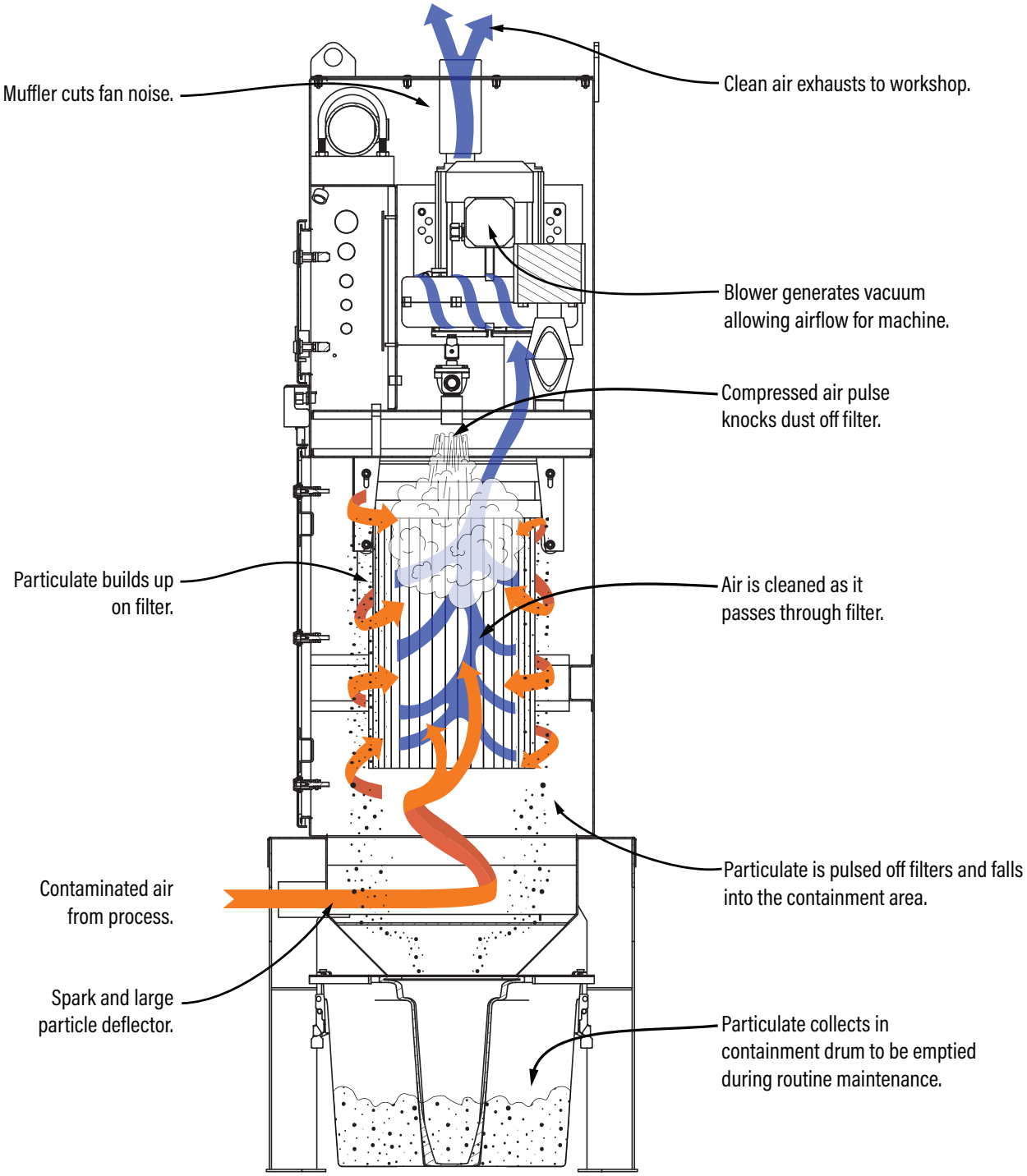


FRONT

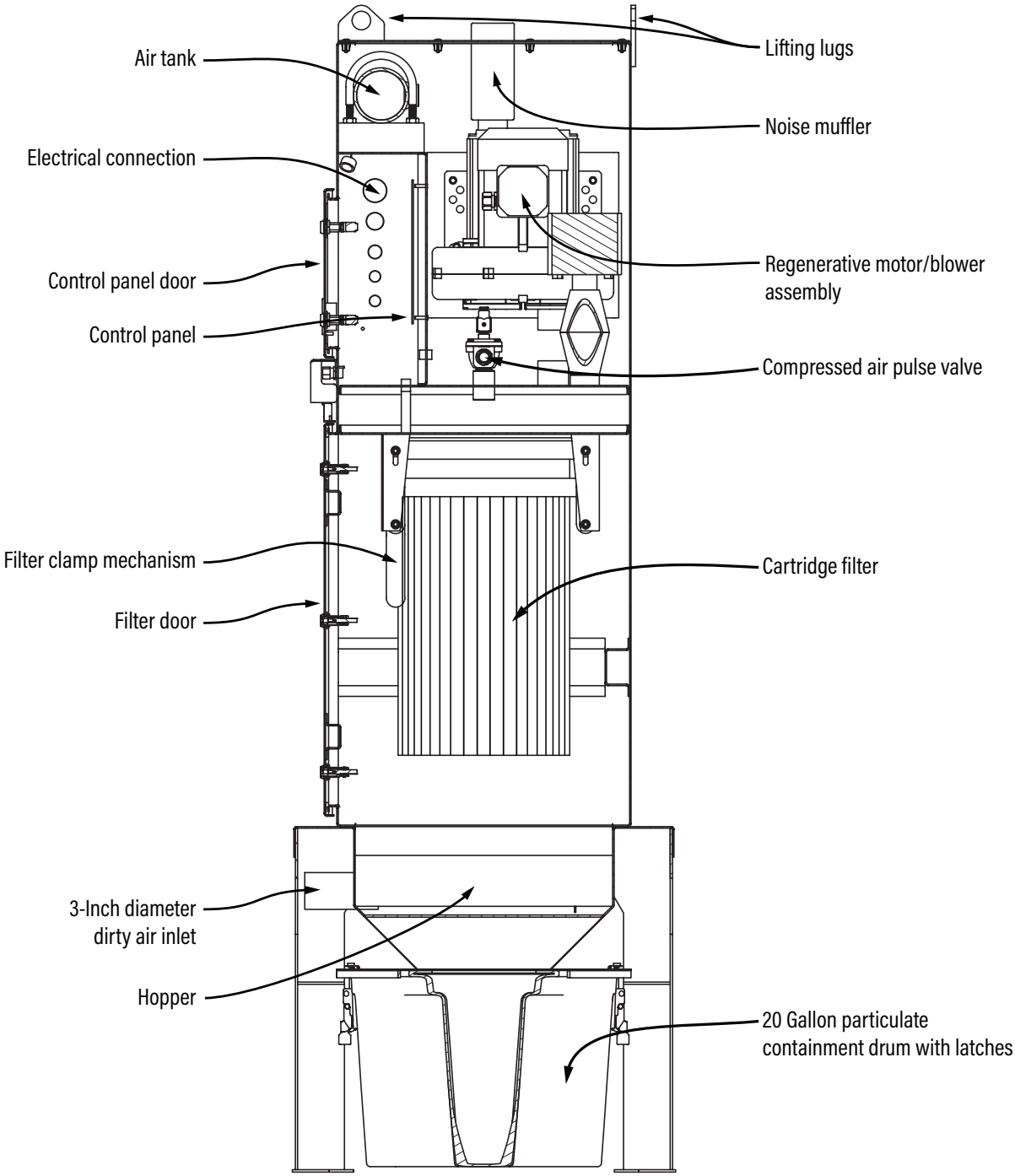


RIGHT SIDE

AIRFLOW SCHEMATIC



COMPONENTS



Unpacking & Locating

Follow workplace safety guidelines when handling and unpacking this machine. Gloves, safety glasses and safety footwear are recommended.

Set aside a 3 m (9 ft) work area to allow adequate space for shipping material and lifting from pallet. Consider cordoning off to prevent traffic from entering the area.

ENVIRONMENTAL REQUIREMENTS & CONSTRAINTS

This machine is designed to operate in an environment with temperature 10 – 50° C (50 – 120° F) and relative humidity 40-70% (non-condensing).

The Spire machine is designed for use indoors. Floor surface must be hard, flat, level, and capable of supporting 1.2 kg/cm^2 (17.6 psi) in order for the unit to remain safely stable. Atmosphere must be mostly free from contaminants such as dust, oil mist, water and airborne chemical solvents.

If outdoor use is required, the machine must be sheltered from wind, blown dust and precipitation. Storage must be indoors to prevent condensation in control panel and motor areas.

Explosive Atmospheres

The machine is neither certified nor designed for use in explosive atmospheres, potentially explosive atmospheres or for collecting explosive dusts. The user is therefore strictly prohibited from using it in such applications and conditions. Do not attempt to modify this machine for the purposes of use in any explosive environment.

Lighting

The machine's work area must be illuminated so that the control panel, power cord connection and gauges are clearly visible without the need for additional local lighting.

When servicing, additional temporary lighting may be needed by maintenance personnel.

Vibration

This machine has been assessed and determined, that in normal design use parameters, this machine offers no appreciable vibration hazards and as such, does not require any remedial or secondary action to reduce vibration.

Noise

The machine is designed in such a way as to offer reduced acoustic sound pressure levels. The machine noise level will vary based on the surrounding environment.

PROCESS FOR LOCATING

Inspect packaging and machine for missing parts or shipping damage as described in the "Receiving & Inspection" section.

Use the following steps to unpack and locate:

1. Remove packing material and crating from sides.
2. Use a crane attached to lifting points to remove from pallet.
3. Set machine in place with forklift or crane. Connect to process(es) with high-vacuum ducting.
4. Adjust airflow to ensure effective fume capture. Refer to operating instructions.

Testing & Commissioning

Once unit has been connected to power and compressed air, it is important to verify the machine is operating correctly and adjust airflow to ensure effective capture.

Record details of setup and settings through pictures and notes. Keep these on file with a logbook for daily checks.

Verify Machine Operation

Perform these quick checks to verify machine is running correctly:

1. Turn unit on. Listen for blower to ramp up and level off at running speed. Watch that KPI and Total Static Pressure changes on HMI.
2. Once the function has been confirmed, testing and adjustment can be performed as required on VFD (if installed).

Installation

Setting the Unit in Place

The first step is to set the hopper in the designated area. Floor will need to be concrete (at least 4" thick) and fairly level. Bolt hopper to the concrete using concrete anchors (provided in install hardware kit). Make sure hopper is level and use shims as necessary.

Set unit onto top of hopper using crane or forklift (diagram 1A). Open the filter door and remove filter to provide access to all bolt areas. Using provided bolts, wasters and sealing washers bolt cabinet to hopper (see and 1C) through the filter door. Hook-up compressed air and electrical and mount HMI and your HVE H-Vac machine is ready to go!

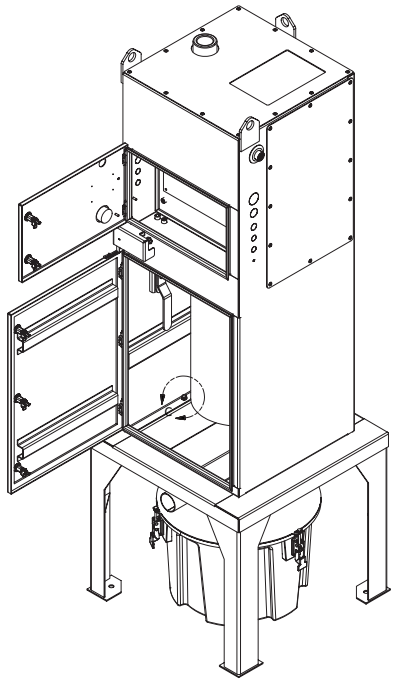


Diagram 1A

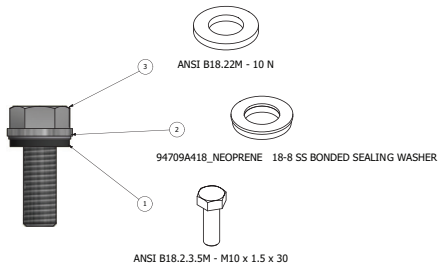


Diagram 1B

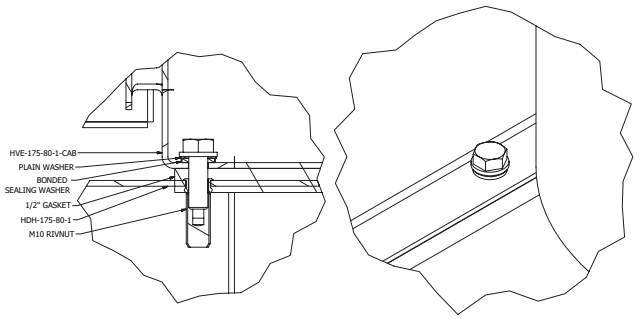


Diagram 1C

Refer to diagram below for callouts of the control interface located on control panel door. Below are descriptions of the simple control modes.

More than six starts of the motor in one hour can be harmful. Refer to the "Purpose & Limitations" section for a detailed description.

Manual Mode Operation
Once airflow has been set up according to the "Testing & Commissioning" section, manual mode is simple to operate – just on when you need it, off when you don't. The blower is rated for continuous duty, so it can run for a complete shift if needed.

AutoSaver Mode Operation
The automatic mode is controlled by optional sensors on the weld unit's power cord. The optional cables connect to the rear of the machine.

Simply turn the mode switch to the far right 'auto' position and begin welding. The sensor will detect an increase in power drawn by the welder and signal the Spire unit to start.

Pulse Cleaning

The HVE Series Hi-Vac machine is equipped with electronic pulse cleaning. Two modes are automatically activated, 'online' and 'offline'. Online cleaning pulses the unit after it has been running for 30 minutes continuously. Once the unit has been shut off after a 30-minute or longer work period, an offline pulsing cycle will be initiated.

ePad Operation

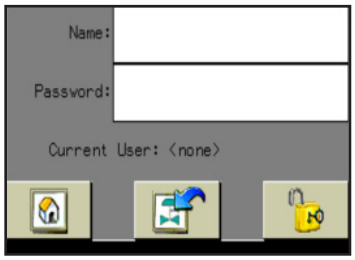
System Control Page

A System Control

Enables/Disables the system for blower control. "Off" is under security. A login is required to turn unit off.

B Login

Allows customers to login with their provided User Name and Password to change parameters.

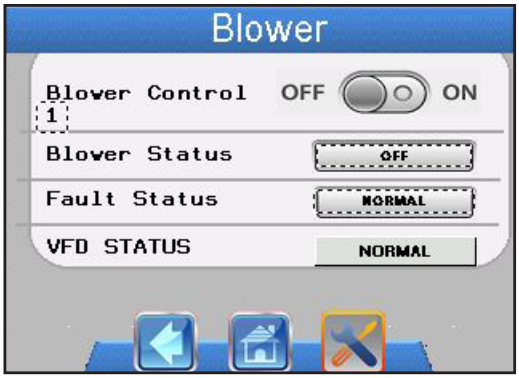


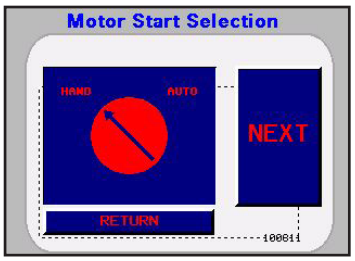
C Auto Control

Enables RoboVent unit to be turned on or off from a connected machine.

D

Blower Control Page





A Blower Control

Enables/Disables the blower to run the collector.

B Blower Status

Message box which shows the current status of the blower.

C Fault Status

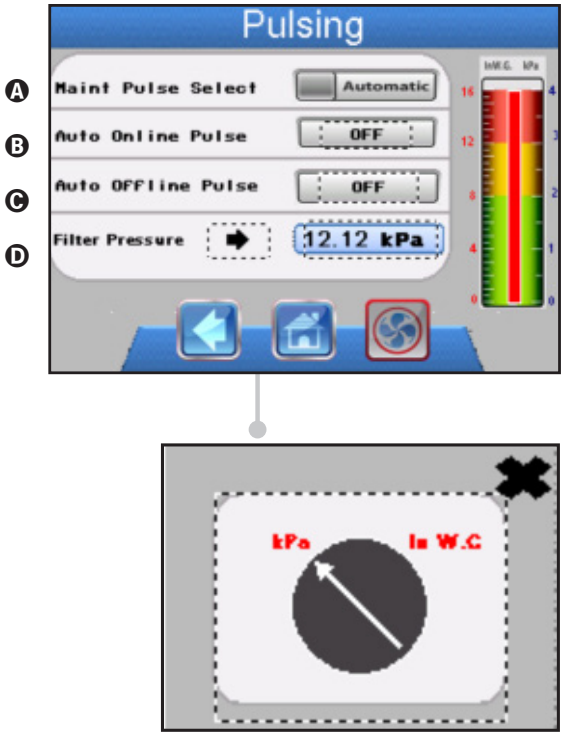
Message box which shows the current condition for the Motor overload.

D VFD Status

Message box which shows the current condition of the Variable Frequency Drive (VFD). Also allows user to reset when there is a fault.

ePad Operation

Pulsing Control Page



Ⓐ Maint. Pulse Select

Allows User to switch from automatic pulsing and maintenance pulse down mode.

Ⓑ Auto Online Pulse

Message box which shows the current status of the Auto Online Pulse Cycle (On/Off).

Ⓒ Auto Offline Pulse

Message box which shows the current status of the Auto Offline Pulse Cycle (On/Off).

Ⓓ Filter Pressure

Message box which shows the current status of Filter Pressure in the collector.

*Use the Arrow button to change readout from kPa in W.C.

Unit Hours Page

Ⓐ Total Machine Hours

Display showing the accumulated machine hours.

Ⓑ Hours Since Service

Display showing the accumulated machine hours since service has been conducted on the collector.

Ⓒ Service Hours Reset

Service Hours reset button. When pushed resets the Service Hours Meter to zero.

Service Messages Page

A Filter Service Message

Informs the operator that the filters need maintenance.

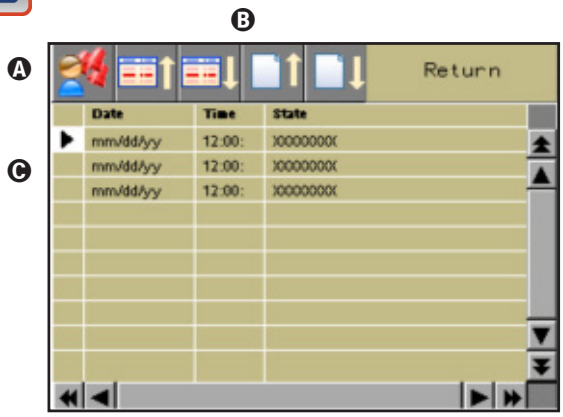
B Suppression Tank Message

Informs the operator that the Suppression Tank needs to be serviced.

C Collection Drum Message

For optional barrel sensor, informs the operator that the collection drum is full and needs to be emptied.

Alarm Log Page



A Acknowledge All Alarms

Acknowledge all current alarms that are active.

B Alarm Scroll Navigation Buttons

Allows for scrolling up and down by alarm and page.

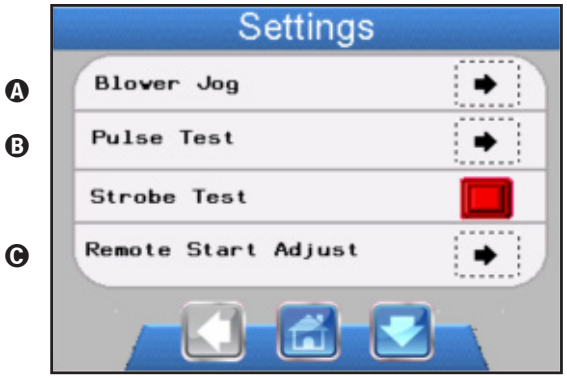
C Alarm Notification Window

Date: Shows current month, day and year.

Time: Shows time when alarm was activated.

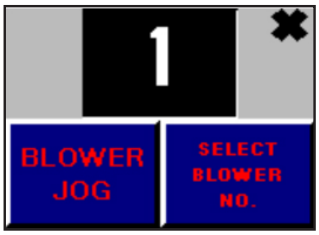
State: Shows the current state of the alarm (active, deactivate and acknowledged).

System Settings Page



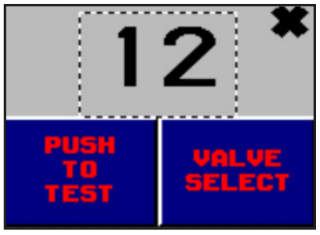
A Blower Jog

Momentary contact to test blower rotation, etc.



B Pulse Test

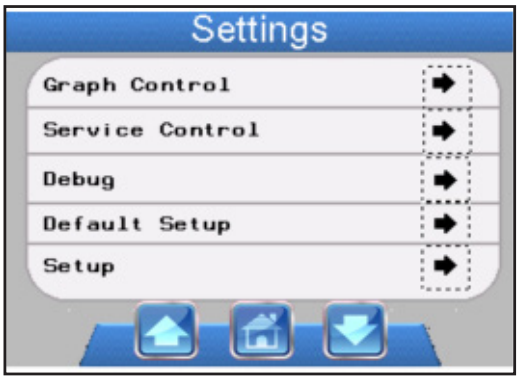
Momentary contact that energizes pulse valve. Helpful for diagnostics.



C Shut Down Delay

Amount of Time (in minutes) equipment continues to run after the remote start signal ends.

System Settings Page

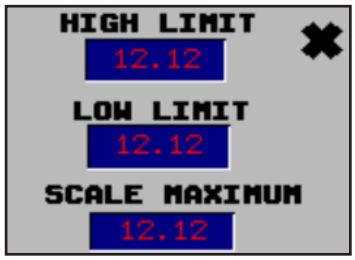


A Bar Graph Control

High Limit: Controls the position of the top pointer.

Low Limit: Controls the position of the lower pointer

Scale Maximum: Sets the overall range of the display. Usually set at 4.00.



System Settings Page

Pulse Control Settings

There are (3) different Pulse Modes. Online (while running), Offline (after shutdown) and maintenance (at select times to maximize filter life).

Online: Filters are pulsed while unit is running.

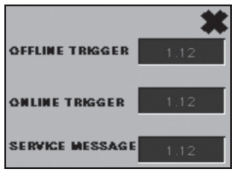
Offline: Filters are pulsing after the blower(s) are shut down

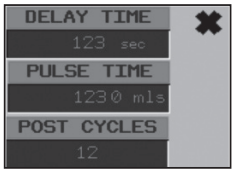
Maintenance: Filters are pulsed for an extended period, for maximum cleaning.

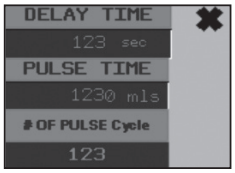
Delay Time: Amount of time (in seconds) between pulses.

Pulsing Time: Amount of time (in milliseconds) that pulse valve is open. Usually set at 200 msec. (Note: The right hand zero is fixed, so enter 200 for 200).

Post Cycles: Number of times each filter bank is pulsed after blower shutdown.

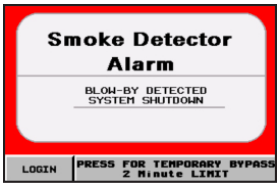






Warning and Alert Messages

Alarm Screen- Blow-By Detected



This feature is very important. It detects both when filters are 'leaking' as well as if there is smoke present.

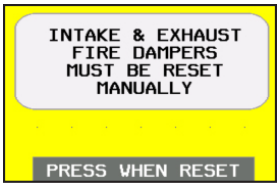
Temporary Bypass: Provides for unit operation, Bypasses detector for two minutes.

Alarm Screen- Optional Equipment

Indicates the fire suppression tank is low or empty. Unit will operate without tank being full but it is not advised.

Proceed Without Servicing: When proceed without servicing button is pressed, screen is switched to screen #2.

Alarm Screen- Optional Equipment



Indicates the fire dampers have been deployed.

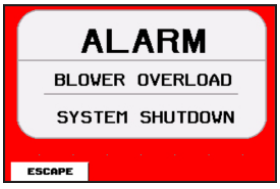
Unit will NOT operate properly until dampers are reset.

Only press **RESET** button when dampers have been reset.

Alarm Screen- Emergency Stop Tripped

Indicates tripping of an E-stop. Unit controls are completely shutdown.

Alarm Screen- Blower Overload



Electrical power overload Escape; transfers to screen #2.

Preventative Maintenance

Safety
Emptying the dust containment area, performing monthly service or changing filters requires PPE to minimize exposure to metal dust. It is recommended to wear disposable coveralls, non-porous gloves, dust mask and safety goggles when performing these procedures. Follow company MSDS and PPE guidelines.

Dust collected by this machine may be hazardous. Toxicity testing must be performed by your local waster service provider and dust disposed of according to local disposal and workplace safety regulations.

The Dust Containment Drum
Empty the dust containment drum as soon as it is full. The time between changes will vary with production schedules, processes or other factors. A good estimate of time required between drum changes can be determined after a few changes; record percentage full and hours each time to help you estimate when the next change is needed.

To empty the dust containment drum, follow these steps:

1. Complete a maintenance pulse to remove excess dust from filters.
2. Brush down the inside of the filter cabinet to knock down any dust to the containment drum (removal of filters is not required).
3. Unlatch the dust containment drum and empty the contents into waste disposal bin (or other means as required by site EHS regulations).
4. Repeat the process for other drum (if applicable).
5. Replace dust containment drum and latch securely in place.
6. Record machine hours and service action.

Monthly Maintenance
On a monthly schedule, perform the following steps and checks:

1. Start machine, allow it to ramp up. Record machine hours and filter differential pressure. Turn machine off once values are recorded.
2. Machine will start offline pulse sequence.
3. Once pulsing has finished, open filter cabinet and brush any piles of dust into containment drum at bottom.
4. Inspect inside of cabinet and vacuum out large build up of dust.
5. Close filter compartment and start machine again.
6. Record post-cleaning filter differential pressure.
7. If filter differential pressure is 3.5 or higher, it is time to replace your filters. Contact RoboVent at 888.ROBOVENT.

Filter Change
Once the filter differential pressure gauge has reached 3.5 KPA, it is time to replace the filter.

Perform the procedures outlined in monthly maintenance. While filter compartment is open, and once cleaning of dust build-up is complete, replace the existing filters (see part number reference on page 21).

Replacement Parts

Description	Item #	Qty.
Cartridge filters:	PL-14D26-M11-SF	1
	PL-14D26-A15-SF	1
	EX-14D26-B16-SF	1
Motor & Blower Wheel Combo	HVE-BLR-175	1
Andon Light	HS-3C-24	1
HMI Screen	HMI-EPAD	1
Pulse Valve	DV-10-TU	1
Pulse Nozzle	NS-SPR-200	1
Filter Regulator - 3/4"	FR-34	1
Minihelic Gauge	MHG-60	1
Inlet Filter	IL-FLT-2	1
20 Gallon Drum	DR-20	1

RoboVent Customer Service:
For replacement parts, service or to speak to a representative, contact RoboVent at:

Phone: **888.ROBOVENT**

Email: **customer.service@robovent.com**

Troubleshooting

HVE Hi-Vac Machine is making excessive noise.

1. Check for correct motor rotation. The motor should be running in the direction indicated by the arrow on the back of the motor.
2. Check that all HVE Hi-Vac Machine mounting bolts are secure and not loose.
3. Make sure motor bearings are good. (Amperage rating will be higher than normal if bad.)
4. Blower could be out of balance. If this is the case call 1-888-ROBOVENT for assistance.
5. If the noise is an electrical hum in the control panel, it could be a defective VFD.

PowerFlex Pulse Cleaning System not operating. Check the following.

1. Verify that the airline is connected to the air tank and that there are no pinched or clogged airlines.
2. Check air tank pressure. The Power Flex works best when pressurized at 85 PSI.
3. Check setting of ePad Controller Settings (Page 11).
4. Check diaphragm on solenoid valve. If optimum pressure is supplied to the air tank and the controller is operational then this would indicate a problem with the diaphragm.
5. Check for leaks in the air tank or fittings around the solenoids.
6. Check for voltage at the firing solenoid. Note that this will be a very quick firing voltage for less than 300 ms.

Little or no suction across intake. Check the following:

1. Check motor rotation. When the unit is powered down note the rotation of the motor shaft. Motor rotation should be as specified in the HVE Hi-Vac Machine manual for that particular motor. If the rotation direction is incorrect, switch the position of two of the three power supply conductors on the terminals.
2. The cartridge filters may be full or blinded. Perform a Maintenance or Manual Cleaning cycle on the ePad controller as specified on page 10 of this manual (check differential pressure value). This is to be done with the motor in the off position. Restart the system and check your differential pressure value again on the controller. If the pressure did not drop below 3 kPa then replace the filters.
3. Check the frequency feeding into the HVE Hi-Vac Machine from the VFD (frequency reading is displayed on the VFD screen). If there is not enough suction at the inlets the VFD setting may need to be increased. This is done by increasing the B5-19 setting on the VFD. Follow the instructions in the VFD manual.
4. Check the safety valve spring setting to ensure the spring is set at the correct location to ensure that proper static pressure can be reached without the safety valve flap opening.

HVE Hi-Vac Machine shuts down.

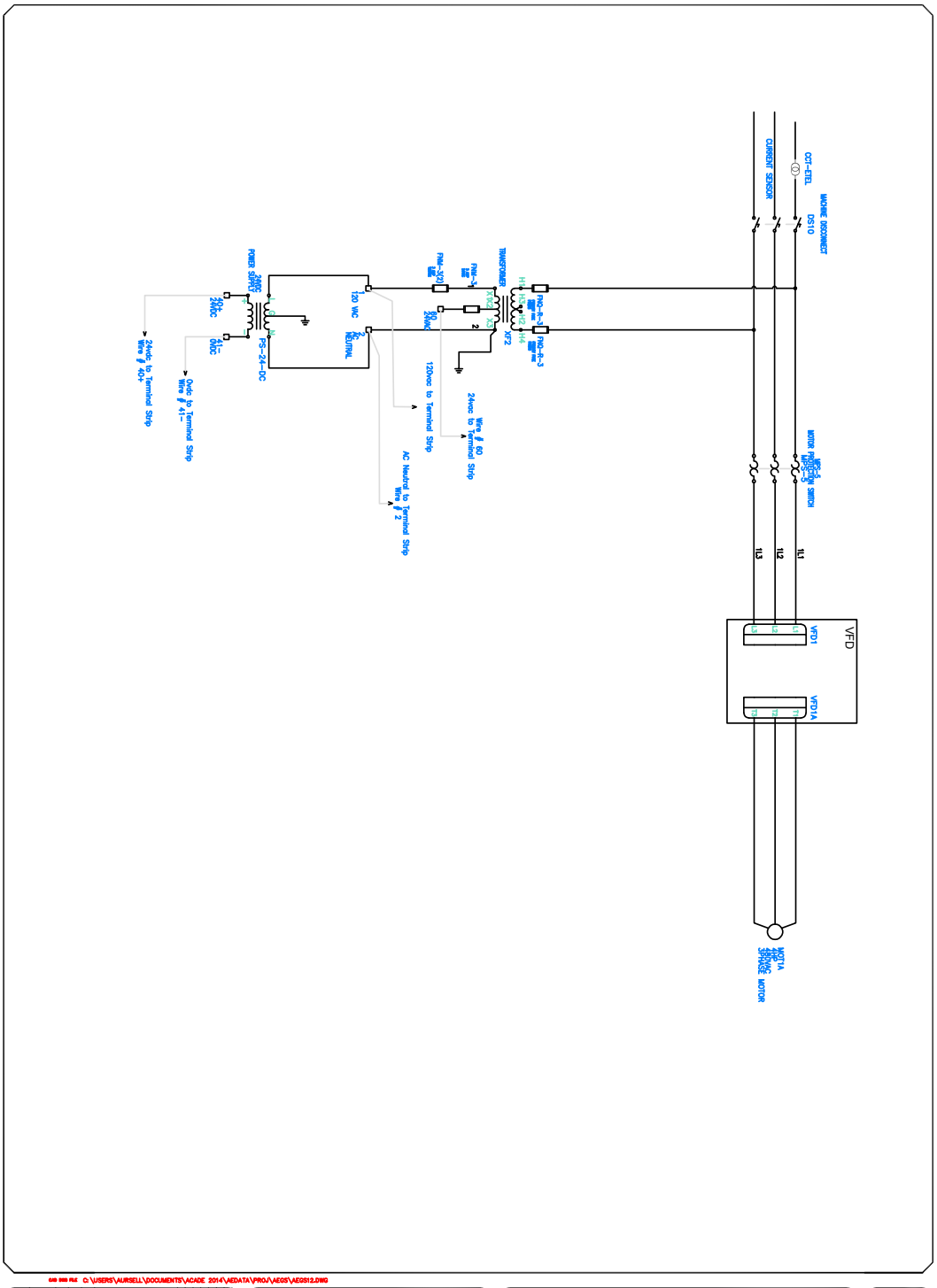
1. If all intakes are closed the HVE Hi-Vac Machine may go into fault mode. In this case the VFD will need to be reset. This is an amperage overload fault to protect the turbine from burning up. Note that your turbine will always need air going into the intake to allow blower cooling. If not, the turbine will shut down the whole system. Make sure the inlet Surge Filter is clean.
2. Check the Safe Sensor. If there is excessive particulate or smoke present in the clean air side of the collector the Safe Sensor will go off and shut down the system. Check for a cartridge filter fire or a hole or gap in the filter. If particulate passes the filter media the Safe Sensor will go off, shutting down the system.

Cartridge Filter loads up but no dust in the dust tray.

1. Check that the PowerFlex is working properly and that the parameters on the ePad Controller are set properly.
2. Check for oil or moisture on the filter media. If oil or moisture exists in the air supply it will transfer to the cartridge.
3. In some cases high oil content is introduced in the welding process causing the oil to vaporize. This will cause the cartridge filters to load up prematurely. In this situation a specialized filter may be needed. Call the RoboVent Service Department at 1-888-ROBOVENT.
4. Check for re-entrainment. Run a Manual Pulse-Down Cycle on the ePad Controller. When finished record how much particulate is in the 5 gallon bucket. Replace the bucket and run the system for one minute. Shut off the HVE Hi-Vac Machine with the Power Disconnect. Remove the 5 gallon bucket and compare the particulate level. If the level has reduced by 30-40% then there could be an air leak in or around the flex hose or bucket cover. Check for leaks and plug with Vulkem. Allow to fully dry before restarting the HVE Hi-Vac Machine.

Differential Pressure Gauge consistently displays a high reading.

1. Check for a pinched line in the blue plastic tubing from the Minihelic Gauge.
2. Make sure the hoses to the Differential Pressure Monitor on the back of the ePad have not been switched or removed. There should be 2 hoses.
3. Check for loaded cartridge filters. Clean or replace if needed.
4. Check for dirty metal baffle filters. Clean or replace if needed.



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1 OF 7

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7/31/2017

STEEL Wiring

Primary Wiring

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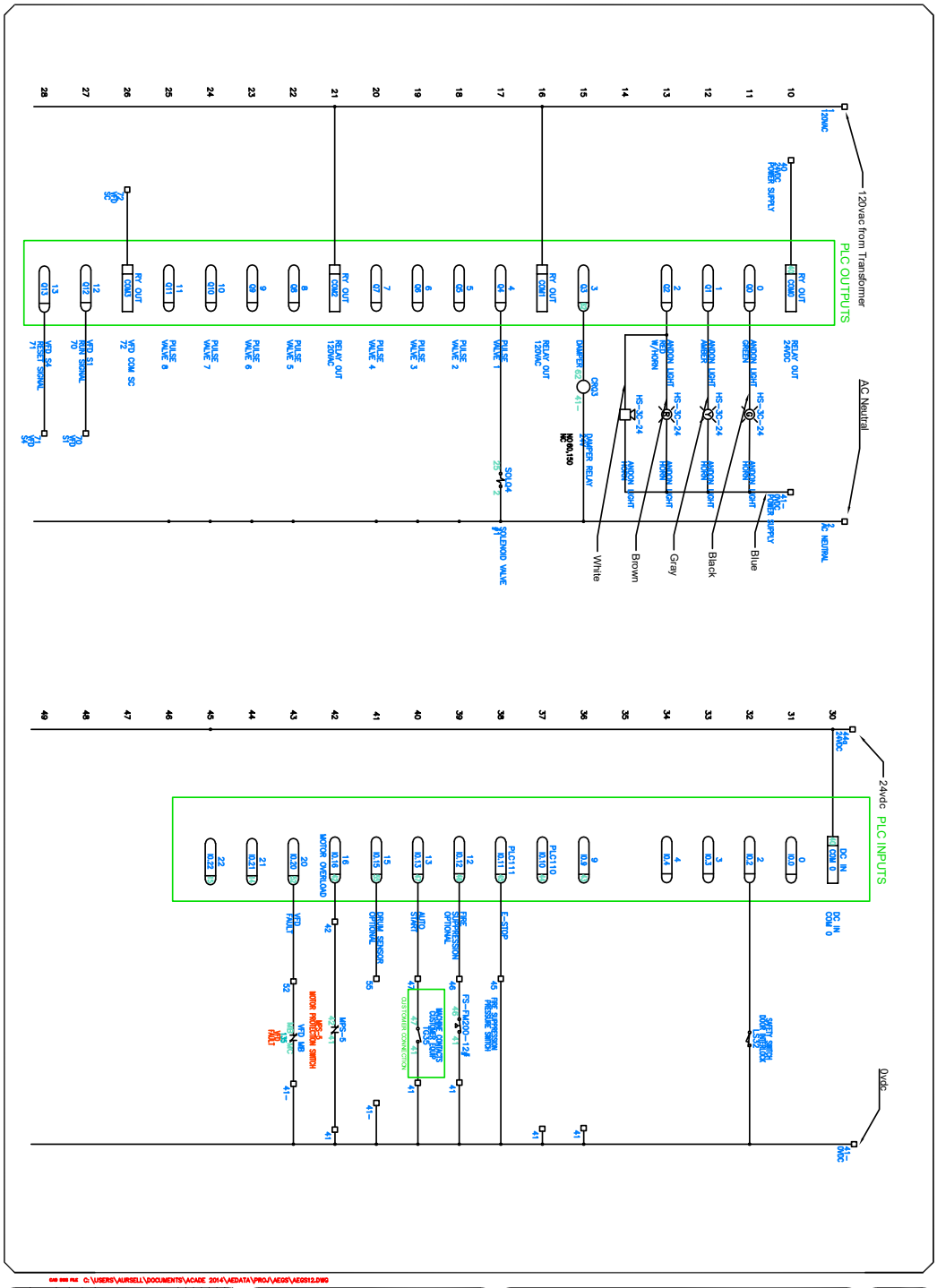

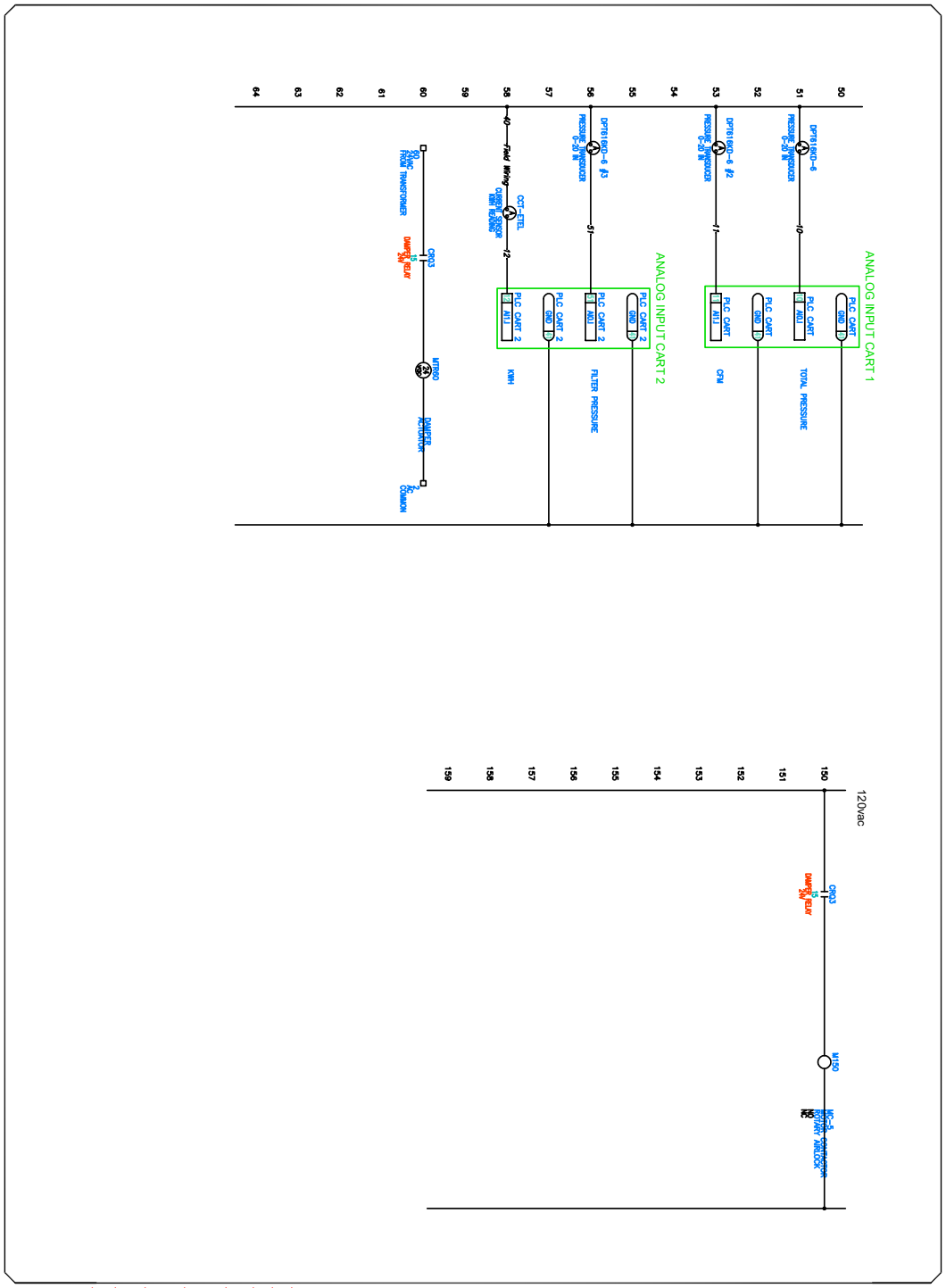

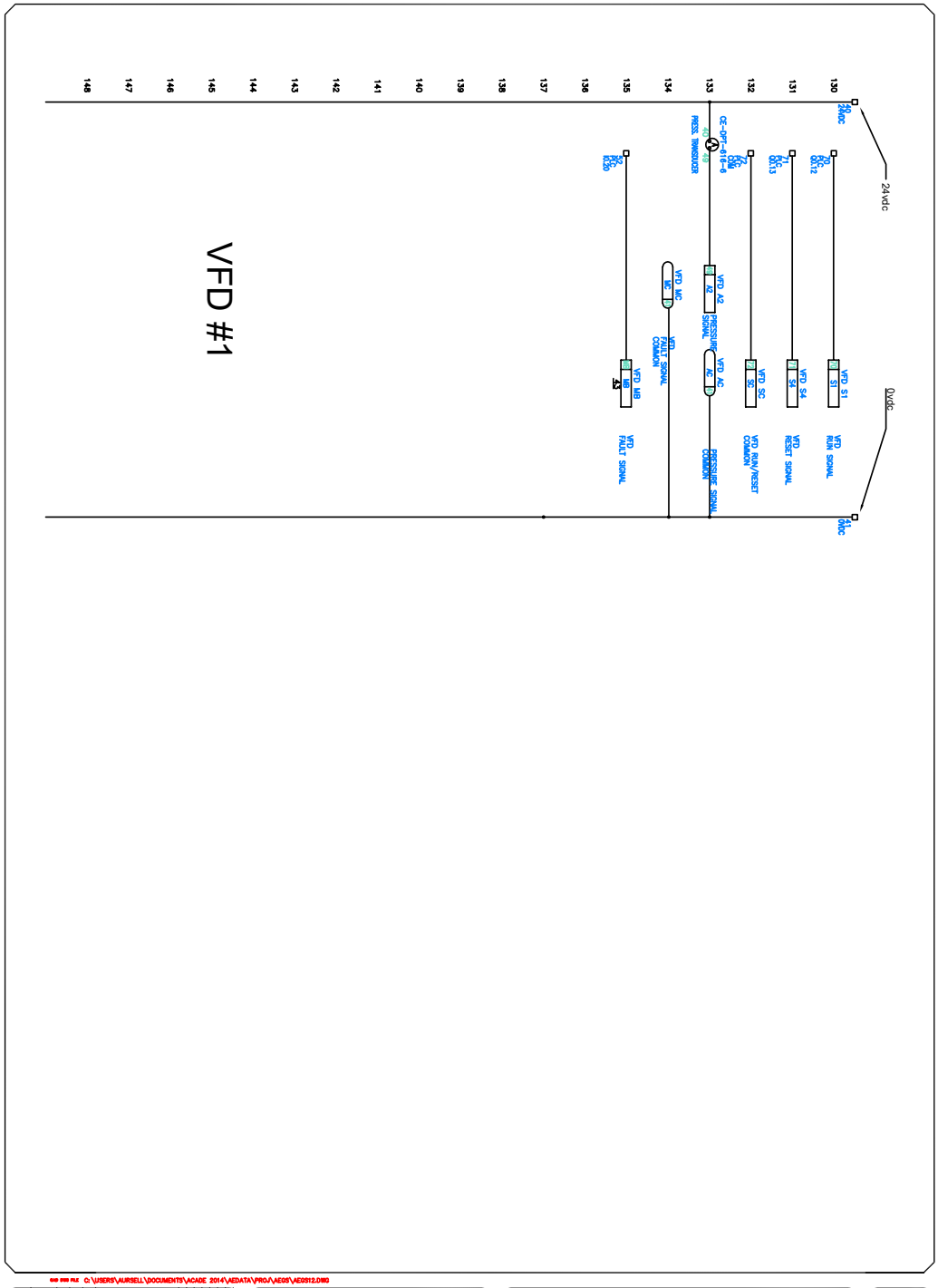

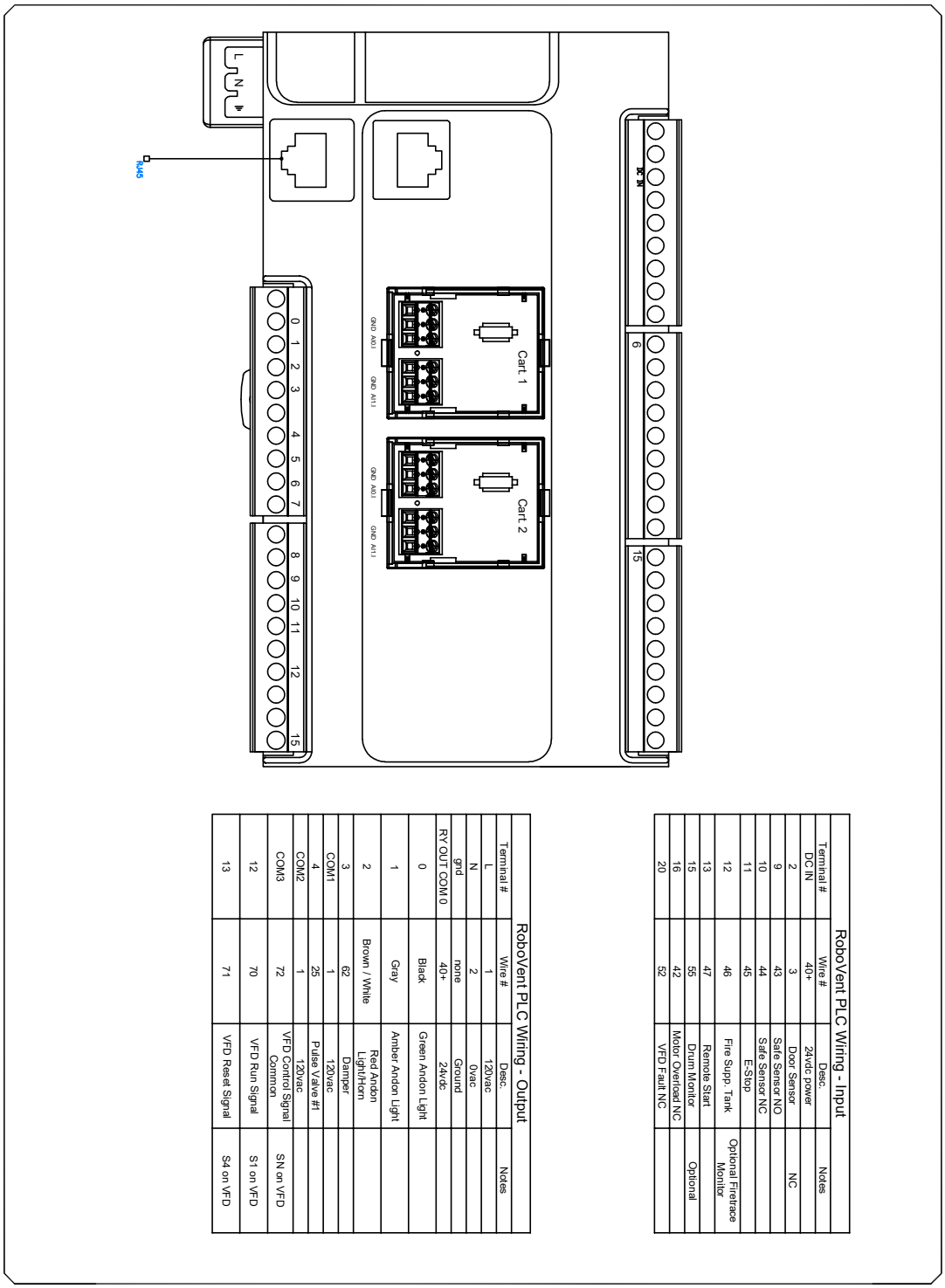

RoboVent PLC Wiring - Input

Terminal #	Wire #	Desc.	Notes
DC IN	40+	24vdc power	
2	3	Door Sensor	NC
9	43	Safe Sensor NO	
10	44	Safe Sensor NC	
11	45	E-Stop	
12	46	Fire Supp. Tank	Optional Firetrace Monitor
13	47	Remote Start	
15	55	Drum Monitor	Optional
16	42	Motor Overload NC	
20	52	VFD Fault NC	

RoboVent PLC Wiring - Output

Terminal #	Wire #	Desc.	Notes
L	1	120vac	
N	2	0vac	
gnd	none	Ground	
RY OUT COM 0	40+	24vdc	
0	Black	Green Andon Light	
1	Gray	Amber Andon Light	
2	Brown / White	Red Andon Light/Horn	
3	62	Damper	
COM1	1	120vac	
4	25	Pulse Valve #1	
COM2	1	120vac	
COM3	72	VFD Control Signal Common	SN on VFD
12	70	VFD Run Signal	S1 on VFD
13	71	VFD Reset Signal	S4 on VFD

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ePak Control
I/O Wiring

5 OF 7

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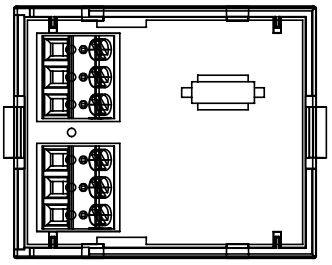
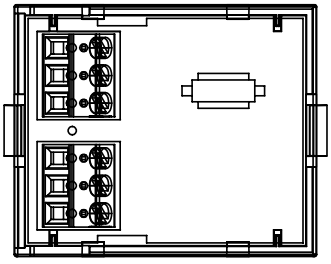
Analog Input Cartridge 1



RoboVent PLC Wiring - Input Analog Cart 1

Terminal #	Wire #	Desc.	Notes
AI0.V	NA	No Wire	Not Used
GND	41-	0vdc	
AI0.I	10	4-20ma	Total Pressure
GND	41-	0vdc	
AI1.I	11	4-20ma	CFM Reading

Analog Input Cartridge 2



RoboVent PLC Wiring - Input Analog Cart 1

Terminal #	Wire #	Desc.	Notes
AI0.V	NA	No Wire	Not Used
GND	41-	0vdc	
AI0.I	51	4-20ma	Filter Pressure
GND	41-	0vdc	
AI1.I	12	4-20ma	KWH

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RoboVent BOM

Part Number	Reference Number	Location	Description	Qty
BMD20	DS10	1	20amp Disconnect	1
T-350-120/24			Transformer/Power	1
DPT-616KD-04			Differential Pressure Transmitter	4
HMI-DTS			ePad Touch Screen Assembly 3.5	1
HMI-ENC-XE			ePad HMI Enclosure	1
ESB-1			Stop Button	1
ESLP-1			Stop Legend Plate	1
PS-24-DC			Power Supply	1
W-CBL-8			Cable for EPAD	1
CPC-002			Control Panel Z Bracket	1
BP-16x21			Sub Plate; 16x21	5
ELEC-079			Secondary Fuse - 3amp FNM3	2
ELEC-078			Primary Fuse - FNMQ-3	2
ELEC-169			Secondary Fuse Holder	2

RoboVent Electrical Ratings

Serial Number		
Motor Size	4hp	
Amperage	6.1 FLA	
Voltage	480vac	3 phase

eTell Control
Control Panel
Wiring Notes

7/13/2017

7

7 OF 7

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OSHA's HexChrome Standards

Contents

Introduction

This document is intended to supplement OSHA's Small Entity Compliance Guide for the Hexavalent Chromium Standards published in 2006 (see Additional Information section for web link to this document) and to give readers an overview of the provisions and requirements of the Hexavalent Chromium standards for general industry (29 CFR 1910.1026), shipyards (29 CFR 1915.1026), and construction (29 CFR 1926.1126).

Hexavalent chromium (Cr(VI)) is a toxic form of the element chromium. Hexavalent chromium is rarely found in nature and is generally man-made. Cr(VI) is widely used in pigments, metal finishing (electroplating), wood preservatives and fungicides, and in chemical synthesis as an ingredient and catalyst. Table 1 on the next page lists some selected Cr(VI) compounds with their synonyms and common uses.

Hexavalent chromium may also be present in fumes generated during the production or welding of chrome alloys. Chromium metal is often alloyed with other metals or plated on metal and plastic substrates to improve corrosion resistance and provide protective coatings. The steel industry is a major consumer of chromium metal in the production of stainless steel.

This booklet is intended to provide information about the Hexavalent Chromium standards for general industry (29 CFR 1910.1026), shipyards (29 CFR 1915.1026), and construction (29 CFR 1926.1126). The *Occupational Safety and Health Act* requires employers to comply with safety and health standards promulgated by OSHA or by a state with an OSHA-approved state plan. However, this booklet is not itself a standard or regulation, and it creates no new legal obligations.

Since 2000, there has been a decline in the use of chromates in pigments for paints and coatings; printing inks; ceramic, glass and construction materials; roofing and plastics. Employers are substituting less toxic inorganic and organic pigments where possible (SRI Consulting, 2008).

Table 1. Selected Cr(VI) Compounds and Their Uses

Chemical Name	*Synonyms*	*Uses*
Chromium Trioxide	Chromic acid, chromia, chromic (VI) acid, chromic trioxide, chromium oxide, chromium (VI) oxide	Most common uses: chromium plating, aluminum anodizing, and chemical intermediate for chromated copper arsenate wood preservatives. Other uses: ceramic glazes, colored glass, metal cleaning, inks, and paints (inorganic pigments).
Lead Chromate	C.I. pigment Yellow 34, crocoite, lead chromium oxide, plumbous chromate	Decorating china, pigment in industrial paints, rubber and plastics, pigment in oil paints and watercolors, and printing fabrics.
Sodium Dichromate	Disodium salt, chromium sodium oxide, dichromic acid, disodium dichromate, sodium bichromate, sodium dichromate	Inks, oxidizing agent in the manufacture of dyes and many other synthetic organic chemicals, electric batteries, manufacture of chromic acid, other chromates and chrome pigments, corrosion inhibiting paints, component of wood preservatives, and colorant for glass.
Zinc Chromate	Zinc salt, chromium zinc oxide, zinc chromium oxide, zinc tetraoxychromate	Priming paints for metals, varnishes and pigments in aerospace paints.

Adapted from: Meridian Research, 1994.

Worker Exposure and Health Consequences

Workplace exposure to Cr(VI) may cause the following health effects:

- lung cancer in workers who breathe airborne Cr(VI);
- irritation or damage to the nose, throat and lungs (respiratory tract) if Cr(VI) is inhaled; and
- irritation or damage to the eyes and skin if Cr(VI) contacts these organs.

Workers can inhale airborne Cr(VI) as a dust, fume or mist while, among other things, producing chromate pigments, dyes and powders (such as chromic acid and chromium catalysts); working near chrome electroplating; performing hot work and welding on stainless steel, high chrome alloys and chrome-coated metal; and applying and removing chromate-containing paints and other surface coatings. Skin exposure can occur while handling solutions, coatings and cements containing Cr(VI).

OSHA'S Hexavalent Chromium Standards

OSHA has separate standards for Cr(VI) exposures in general industry, shipyards and construction. Most of the requirements are the same for all sectors, with the exception of provisions for regulated areas, hygiene areas and practices, and housekeeping. Where there are differences, they will be explained in this booklet. The standards generally apply to occupational exposures to Cr(VI) in all forms and compounds in general industry, shipyards and construction, with specific exceptions outlined in the box below. States that administer their own OSHA-approved occupational safety and health plans may have different requirements. See the Additional Information section for a list of State plans and their contact information.

Exceptions

The Cr(VI) standards do not apply in three situations:

- exposures that occur in the application of pesticides;
- exposures to Portland cement; and
- where the employer has objective data demonstrating that a material containing Cr(VI) or a specific process, operation, or activity involving Cr(VI) cannot release dusts, fumes or mists of Cr(VI) in concentrations at or above 0.5 micrograms per cubic meter (µg/m³) of air as an 8-hour time-weighted average (TWA) under any expected conditions of use.

Exposure Limits

The final Cr(VI) rule establishes an 8-hour TWA permissible exposure limit (PEL) of 5 µg/m³ measured as Cr(VI). This means that over the course of any 8-hour work shift, the average exposure to Cr(VI) cannot exceed 5 µg/m³.

The Action Level is set at 2.5 µg/m³ of Cr(VI) calculated as an 8-hour TWA.

Exposures above the Action Level trigger specific requirements, and exposures above the PEL trigger additional requirements. The substantive provisions of the Cr(VI) standard are described below.

Exposure Monitoring and Determinations

Each employer who has a workplace or work operation covered by the Cr(VI) standards must determine the 8-hour TWA exposure for each worker exposed to Cr(VI). To comply with this provision, employers can choose between two options for performing exposure determinations:

- a scheduled monitoring option; or
- a performance-oriented option.

When monitoring for Cr(VI), employers must use a method of monitoring and analysis that provides values within plus or minus 25 percent of the true value at least 95 percent of the time for airborne concentrations at or above the Action Level. Examples of methods that meet these criteria are OSHA method ID215 (version 2) and NIOSH methods 7600, 7604, 7605 and 7703.

Scheduled Monitoring Option

The Initial Monitoring

Employers who select the scheduled monitoring option must conduct initial exposure monitoring to determine exposure to Cr(VI) for each worker. This involves taking a sufficient number of personal breathing zone air samples to accurately characterize full shift exposure on each shift, for each job classification, in each work area. Monitoring results must indicate the worker's time-weighted average exposure to airborne Cr(VI) over a typical 8-hour workday.

In some cases the employer will need to monitor all exposed workers, while in other cases it will be sufficient to monitor "representative" personnel. Representative exposure sampling is permitted when a number of workers perform essentially the same job under the same conditions. For example, an employer may choose one welder to sample as a representative of several welders who work in a welding shop for determining exposure as long as all of the welders represented by the monitoring perform the same job under the same conditions. Representative personal sampling for workers engaged in similar work involving similar Cr(VI) exposures is achieved by monitoring the worker(s) reasonably expected to have the highest Cr(VI) exposures. For example, this may involve monitoring the Cr(VI) exposure of the worker closest to an exposure source. This exposure result may then be used to represent the exposure of other workers in the group. The employer must take at least one sample characteristic of the entire work shift or consecutive representative samples taken over the length of the shift.

Periodic Monitoring

Periodic monitoring is required if the initial monitoring shows that the worker's exposure is at or above the Action Level (See

Table 2, below, for monitoring frequency.)

Table 2. Monitoring Frequency

Exposure Scenario	*Required Monitoring Activity*
Below the Action Level (< 2.5 µg/m³)	No periodic monitoring required for workers represented by the initial monitoring.
At or above the Action Level but at or below the PEL (2.5 µg/m³ to 5 µg/m³)	Monitor every six months.
Above the PEL (> 5 µg/m³)	Monitor every three months.

If initial monitoring shows exposures above the PEL, but subsequent periodic measurements indicate that exposures have fallen to levels at or below the PEL, but still above the Action Level, the employer may reduce the frequency of periodic monitoring to every six months. In addition, an employer may discontinue periodic monitoring for workers represented by monitoring results indicating that exposures have fallen below the Action Level if those results are confirmed by a second measurement taken at least seven days later.

Additional Monitoring

Additional monitoring is necessary when a workplace change may result in new or additional exposures to Cr(VI) or the employer has any reason to believe that new or additional exposures have occurred. These changes may include alterations in the production process, raw materials, equipment, personnel, work practices, or control methods used in the workplace.

Examples of Situations Requiring Additional Monitoring

Example 1: If an employer has conducted monitoring for an electroplating operation while using fume suppressants, and the use of fume suppressants is discontinued, then additional monitoring would be necessary to determine worker exposures under the modified conditions.

Example 2: A welder may move from an open, outdoor location to an enclosed or confined space. Even though the task performed and materials used may remain constant, the changed environment could reasonably be expected to result in higher exposures to Cr(VI).

Performance-Oriented Option

The performance-oriented option allows the employer to determine the 8-hour TWA exposure for each worker on the basis of any combination of air monitoring data, historical monitoring data, or objective data sufficient to accurately determine current worker exposure to Cr(VI). This option is intended to allow employers flexibility in assessing the Cr(VI) exposures of their personnel. Where the employer elects to use this option, the exposure determination must be performed prior to the time that the work operation commences and must provide the same degree of assurance that worker exposures have been correctly characterized as is provided for under the scheduled monitoring option. Like under the scheduled monitoring option, the employer is expected to reevaluate worker exposures when there is any change in the production process, raw materials, equipment, personnel, work practices, or control methods that may result in new or additional exposures to Cr(VI). However, the employer using the performance-oriented option does not have to follow any particular fixed schedule for performing reevaluations.

Objective Data

The Objective data means information that demonstrates the expected worker exposure to Cr(VI) associated with a particular product or material or a specific process, operation, or activity. Information that can serve as objective data includes, but is not

limited to, air monitoring data from an industry-wide survey; data collected by a trade association from its members; or calculations based on the composition or chemical and physical properties of a material. The data must reflect workplace conditions closely resembling the processes, types of material, control methods, work practices and environmental conditions in the employer's current operations.

Regulated Areas

The Cr(VI) standard for general industry includes requirements for regulated areas wherever a worker's exposure to airborne concentrations of Cr(VI) is or is reasonably expected to be above the PEL. However, OSHA has not included this requirement in the construction and shipyard standards due to the expected practical difficulties of establishing regulated areas for operations in these sectors.

Employers are required to distinguish the regulated area from the rest of the workplace in a manner that adequately establishes and alerts workers to the boundaries of the regulated area. The standard does not specify how employers are to indicate the regulated areas. Warning signs, gates, ropes, barricades, lines, textured flooring, or other methods may be appropriate. Whatever methods are chosen must effectively warn workers not to enter the area unless they are authorized. Authorized personnel are those persons required by their job duties to be present in the area and may include maintenance/repair personnel, managers and quality control engineers. Also, designated worker representatives may enter the regulated area to observe exposure monitoring. All persons who enter the regulated area must use proper protective equipment, including respirators when appropriate.

Control Measures

To protect workers from Cr(VI) hazards, whenever exposures exceed the PEL employers must use engineering and work practice controls to reduce and maintain Cr(VI) exposures to or below the PEL. These are the most effective controls. Whenever feasible engineering and work practice controls are not sufficient to reduce exposures to or below the PEL, the employer must use such controls to reduce exposures to the lowest levels achievable and supplement them by the use of respiratory protection.

Engineering controls include substitution (using a less toxic material or process that results in lower exposures), isolation (such as enclosing the source of exposure), and ventilation (such as using a local exhaust system that captures airborne Cr(VI) near its source).

Work practice controls involve adjustments in the way a task is performed. Workers must know the proper way to perform a task in order to minimize their exposure and to maximize the effectiveness of the control. For example, a welder should be properly trained to correctly position himself and the local exhaust ventilation to minimize exposure to the welding fume. In many cases, work practice controls complement engineering controls in providing worker protection.

Employers are not permitted to rotate workers to different jobs as a means of achieving compliance with the PEL.

Exceptions to the general requirement for primary use of feasible engineering and work practice controls to reduce worker exposures to within permissible limits:

- In the aerospace industry, when workers are painting aircraft or large aircraft parts (e.g., the interior or exterior of whole aircraft, aircraft wings or tail sections, or comparably sized aircraft parts), the employer must use feasible engineering and work practice controls to reduce worker Cr(VI) exposures to levels at or below 25 µg/m^3. The employer must supplement its engineering and work practice controls with respiratory protection to achieve the PEL.
- If the employer can demonstrate that a particular process or task does not result in worker exposures to Cr(VI) exceeding the PEL for 30 or more days during any 12 consecutive months, the employer is allowed to use any combination of

controls, including respirators alone, to achieve the PEL. Historical data, objective data, or exposure monitoring data may be used for this purpose.

Respiratory Protection

Employers are required to provide workers with respirators when feasible engineering and work practice controls are unable to reduce worker exposure to Cr(VI) to levels at or below the PEL. Respirators are required during:

- Work operations such as maintenance and repair activities for which engineering and work practice controls are not feasible;
- Emergencies (i.e., any occurrence that results or is likely to result in an uncontrolled release of Cr(VI) that is not an incidental release that can be controlled by workers in the immediate area or by maintenance personnel);
- Where workers are exposed above the PEL for fewer than 30 days per year and the employer has opted not to implement engineering/work practice controls to achieve the PEL;
- Periods necessary to install or implement feasible engineering and work practice controls; or
- Operations where all feasible engineering and work practice controls have been implemented but are not sufficient to reduce exposures to or below the PEL.

Where respirator use is required, the employer must establish a respiratory protection program in accordance with OSHA's Respiratory Protection standard (29 CFR 1910.134). The respiratory protection program addresses procedures for properly selecting, using and maintaining respirators in the workplace. OSHA has prepared the document, a *Small Entity Compliance Guide for the Revised Respiratory Protection Standard* (see the Additional Information section at page 22).

Requirements for Protective Work Clothing and Equipment

Employers are required to provide and ensure the proper use of appropriate protective clothing and equipment whenever a hazard evaluation of the workplace has identified that skin or eye contact with Cr(VI) presents or is likely to present a hazard to workers. Where such a hazard is identified, the employer must select the clothing and equipment needed to protect workers from Cr(VI) hazards. Some examples of protective clothing and equipment that may be necessary include, but are not limited to, gloves, aprons, coveralls, foot coverings and goggles. Normal street clothing and uniforms or other accessories that do not protect workers from Cr(VI) hazards are not considered protective clothing or equipment under the standard. Employers must provide and maintain the clothing and equipment at no cost to the worker.

The following precautions must be taken to protect workers and others who handle protective clothing and equipment:

- The employer must ensure that workers remove protective clothing and equipment that has become contaminated with Cr(VI) either at the end of their work shift or when they complete their tasks involving Cr(VI) exposure, whichever comes first.
- The employer must not allow any worker to remove contaminated protective clothing or equipment from the workplace, except for those workers whose job it is to launder, clean, maintain, or dispose of the clothing or equipment.
- When contaminated protective clothing or equipment is removed for laundering, cleaning, maintenance or disposal, the employer must ensure that it is stored and transported in sealed, impermeable bags or other closed, impermeable containers.
- Bags or containers of contaminated protective clothing or equipment that are removed from change rooms for laundering, cleaning, maintenance or disposal must be labeled in accordance with OSHA's Hazard Communication standard at 29 CFR 1910.1200.
- The employer must clean, launder, repair and replace protective clothing and equipment as necessary to ensure that the effectiveness of the clothing and equipment is maintained.
- The employer must inform any person who launders or cleans protective clothing or equipment contaminated with Cr(VI) of the potentially harmful effects of Cr(VI) exposure, and that the

clothing and equipment should be laundered or cleaned in a manner that minimizes skin or eye contact with Cr(VI) and prevents exposure to Cr(VI) in excess of the PEL. Removal of Cr(VI) from protective clothing and equipment by blowing, shaking, or any other means that disperses Cr(VI) into the air or onto a worker's body is prohibited.

Hygiene Areas and Practices

The Cr(VI) standards include requirements for change rooms, washing facilities, and eating and drinking areas to minimize exposure to Cr(VI). They are:

Change rooms are only required when workers must change out of their street clothes to use protective clothing and equipment. The change rooms must conform to 29 CFR 1910.141 (for general industry and shipyards) and 29 CFR 1926.51 (for construction), prevent Cr(VI) contamination of street clothes, and be equipped with separate storage facilities for protective clothing and equipment and for street clothes. This provision is intended to limit exposures after the work shift ends and avoid the contamination of workers' cars and homes.

Washing facilities must be provided and must be readily accessible and capable of removing Cr(VI) from the skin. Washing facilities must comply with OSHA's sanitation requirements at 29 CFR 1910.141 (for general industry), 29 CFR 1926.51 (for construction), and 29 CFR 1915.97 (for shipyards). The employer must ensure that affected workers use these facilities when necessary. This includes making sure that workers who have skin contact with Cr(VI) wash their hands and faces at the end of the work shift and prior to eating, drinking, smoking, chewing tobacco or gum, applying cosmetics, or using the toilet.

Eating and drinking areas and surfaces must conform with 29 CFR 1910.141 (for general industry), 29 CFR 1926.51 (for construction), and 29 CFR 1915.97 (for shipyards) and be maintained as free as practicable of Cr(VI) whenever employers allow workers to consume food or beverages at a worksite where Cr(VI) is present. Employers are also required to ensure that workers do not enter eating and drinking areas wearing protective clothing or equipment, unless the protective clothing or equipment is properly cleaned beforehand. Employers may use any method for removing surface Cr(VI) from clothing and equipment that does not disperse the dust into the air or onto the worker's body. For example, if a worker is wearing coveralls for protection against Cr(VI), thorough HEPA vacuuming of the coveralls could be performed prior to entry into a lunchroom. **Do NOT blow dust off protective clothing and equipment**.

The employer must ensure that workers do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics – or carry or store products associated with these activities – in regulated areas or in areas where skin or eye contact with Cr(VI) occurs.

Housekeeping

The Cr(VI) standard for general industry includes housekeeping measures. OSHA did not include these requirements in the construction and shipyard standards due to the expected practical difficulties of complying with such requirements in those sectors. Proper housekeeping requirements are important because they target sources of exposure to Cr(VI) that engineering controls are generally not designed to address (such as skin exposures). Employers must ensure that all surfaces are maintained as free as practicable of accumulations of Cr(VI). Spills and releases of Cr(VI)-containing material must be cleaned up promptly. The requirement to maintain surfaces "as free as practicable" is performance-oriented. The standard does not specify what an allowable surface loading of Cr(VI) contamination in work areas would be. Instead, the requirement for "as free as practicable" is met when the employer is vigilant in efforts to ensure that surfaces are kept free of accumulation of Cr(VI) dust. OSHA will consider the employer's housekeeping schedule, the possibility of exposure from the surfaces in question, and the characteristics of the workplace. (OSHA, Jan. 13, 2003, Letter of Interpretation.)

Cleaning Methods

Surfaces contaminated with Cr(VI) must be cleaned by HEPA-filtered vacuuming or other methods that minimize exposure to

Cr(VI), including wet methods such as wet sweeping or wet scrubbing. Dry methods (e.g., dry shoveling, dry sweeping and dry brushing) are only allowed in cases where HEPA-filtered vacuuming or other methods that minimize the likelihood of exposure to Cr(VI) have been tried and found not to be effective. The use of compressed air for cleaning surfaces is only allowed when used in conjunction with a ventilation system designed to capture the dust cloud or when no alternative method is feasible. Employers should use caution whenever compressed air is used as a cleaning method, since the air will spread the contamination further unless the dust is appropriately collected. Compressed air should never be directed at workers and should not be used to clean protective clothing or equipment.

Employers must ensure that waste, scrap, debris and any other materials contaminated with Cr(VI) are collected and disposed of in sealed, impermeable bags or other closed, impermeable containers. Additionally, bags or containers of waste, scrap, debris and any other materials contaminated with Cr(VI) must be labeled in accordance with the requirements of the Hazard Communication standard, 29 CFR 1910.1200.

Medical Surveillance

The purpose of medical surveillance is to determine if an individual can be exposed to Cr(VI) at his or her workplace without experiencing adverse health effects; to identify Cr(VI)-related adverse health effects when they do occur so that appropriate intervention measures can be taken; and to determine a worker's fitness to use personal protective equipment such as respirators.

All medical examinations and procedures required by the standards must be performed by or under the supervision of a physician or other licensed healthcare professional (PLHCP). When medical surveillance is required it must be provided at no cost to workers and at a reasonable time and place. If participation requires travel away from the worksite, the employer must bear the cost. Workers must be paid for time spent taking medical examinations, including travel time.

Employers must provide medical surveillance to workers who are:

- Exposed or may be exposed to Cr(VI) at concentrations at or above the Action Level (as an 8-hour TWA) for 30 or more days per year;
- Experiencing signs and symptoms of adverse health effects associated with Cr(VI) exposures (e.g., blistering lesions, redness or itchiness of exposed skin, shortness of breath or wheezing that worsens at work, nosebleeds, a whistling sound while inhaling or exhaling); or
- Exposed in an emergency situation (i.e., any occurrence that results or is likely to result in an uncontrolled release of Cr(VI) that is not an incidental release that can be controlled by workers in the immediate area or by maintenance personnel).

Frequency of Medical Examination

Medical examinations must be given:

- Within 30 days after initial assignment to a job involving Cr(VI) exposure, unless the worker has received an examination that meets the requirements of the standard within the last 12 months;
- Annually;
- Within 30 days after a PLHCP's written medical opinion recommends an additional examination;
- Whenever a worker shows signs or symptoms of the adverse health effects associated with Cr(VI) exposure;
- Within 30 days after exposure during an emergency which results in an uncontrolled release of Cr(VI); or
- At the termination of employment, unless the last examination provided was less than six months prior to the date of termination.

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Contents of the Medical Exams

- A medical and work history which focuses on: the worker's past, present and anticipated future exposure to Cr(VI); any history of respiratory system dysfunction; any history of asthma, dermatitis, skin ulceration or nasal septum perforation; and smoking status and history.
- A physical examination of the skin and respiratory tract.
- Any additional tests that the examining PLHCP considers appropriate for that worker.

Note: The standards do not specify tests or procedures that must be provided to all workers. Rather, the information obtained from the medical and work history along with the physical examination of the skin and respiratory tract (the main targets of Cr(VI) toxicity) allow the PLHCPs to use their medical judgment to determine what tests, if any, are warranted.

Information Provided to the PLHCP

The employer must ensure that the PLHCP has a copy of the Cr(VI) standard, and must provide the PLHCP with:

- A description of the affected worker's former, current and anticipated duties as they relate to Cr(VI) exposure;
- Information on the worker's former, current and anticipated Cr(VI) exposure levels;
- A description of any personal protective equipment used or to be used by the worker, including when and for how long the worker has used that equipment; and
- Information from records of employment-related medical examinations previously provided to the affected worker, currently within the control of the employer.

The Written Medical Opinion

The employer must obtain a written medical opinion from the PLHCP for each medical examination performed. The written medical opinion must be obtained within 30 days of the examination, and must contain:

- The PLHCP's opinion as to whether the worker has any detected medical condition(s) that would place the worker at increased risk of material impairment to health from further exposure to Cr(VI);
- Any recommended limitations on the worker's exposure to Cr(VI) or on the use of personal protective equipment such as respirators; and
- A statement that the PLHCP has explained to the worker the results of the medical examination, including any medical conditions related to Cr(VI) exposure that require further evaluation or treatment, and any special provisions for the use of protective clothing or equipment.

The PLHCP must not reveal to the employer any specific findings or diagnoses that are not related to workplace Cr(VI) exposure. The employer is required to provide a copy of the written medical opinion to the examined worker within two weeks after receiving it.

Worker Training and Communication

It is critically important that workers recognize the hazards associated with exposure to Cr(VI) and understand the measures they can take to protect themselves. OSHA's Hazard Communication standard (29 CFR 1910.1200) establishes requirements for employers to provide workers with information on hazardous chemicals such as Cr(VI) through comprehensive chemical hazard communication programs that include material safety data sheets (MSDSs), labels and worker training. Employers must follow the requirements of the Hazard Communication standard with regard to workers exposed to Cr(VI). These requirements include, but are not limited to, informing workers of any operations in their work area where Cr(VI) is present and training workers on the hazards of Cr(VI) and measures theys can take to protect themselves from these hazards (e.g., appropriate work practices, emergency procedures and protective equipment to be used).

In addition, the Cr(VI) standards require the employer to provide information and training sufficient to ensure that workers can demonstrate knowledge of:

- The requirements of the Cr(VI) standard; and
- The medical surveillance program required by the standard, including recognition of the signs and symptoms of adverse health effects that may result from Cr(VI) exposure.

The employer must also make a copy of the Cr(VI) standard available without cost to affected workers.

Recordkeeping

Accurate records can demonstrate employer compliance with the standard and can assist in diagnosing and identifying workplace-related illnesses. Therefore, employers are required to maintain records of worker Cr(VI) exposures (including air monitoring data, historical monitoring data and objective data) and medical surveillance records.

Air Monitoring Data

Employers must keep an accurate record of all air monitoring performed to comply with the standard. The record must indicate:

- The date of the measurement for each sample taken;
- The operation involving exposure to Cr(VI) that was monitored;
- Sampling and analytical methods used and evidence of their accuracy;
- The number, duration and results of samples taken;
- The type of personal protective equipment used (e.g., type of respirators worn); and
- The name, social security number and job classification of all workers represented by the monitoring, specifying which workers were actually monitored.

Historical Monitoring Data

When an employer relies on historical monitoring data to determine worker exposures to Cr(VI), an accurate record of the historical monitoring data must be maintained. The record must show:

- That the data was collected using methods that meet the accuracy requirements of the standard;
- That the processes and work practices, characteristics of the Cr(VI)-containing material, and environmental conditions at the time the data was obtained are essentially the same as those of the job for which current exposure is being determined; and
- Any other relevant data regarding operations, materials, processes, or worker exposures.

Objective Data

When an employer relies on objective data to comply with the Cr(VI) standard, an accurate record of the objective data must be maintained. The record must indicate:

- The Cr(VI)-containing material in question;
- The source of the objective data;
- The testing protocol and results of testing, or analysis of the material for the release of Cr(VI);
- A description of the process, operation, or activity and how the data support the determination; and
- Any other relevant data regarding the processes, operations, activities, materials, or worker exposures.

Medical Surveillance

The employer must maintain an accurate record for each worker provided medical surveillance under the standard. The record must include the following information about the worker:

- Name and social security number;
- A copy of the PLHCP's written opinions; and
- A copy of the information that the employer was required to provide to the PLHCP (i.e., a description of the worker's duties as they relate to occupational Cr(VI) exposure; the worker's Cr(VI) exposure levels; a description of the personal protective equipment used by the worker; and information from previous employment-related medical examinations).

Exposure and medical records must be maintained and made available to workers and their representatives in accordance with 29 CFR 1910.1020, Access to Employee Exposure and Medical Records. In general, exposure records must be kept for at least 30 years, and medical records must be kept for the duration of employment plus 30 years. It is necessary to keep these records for extended periods because cancer often cannot be detected until 20 or more years after exposure, and exposure and medical records can assist in diagnosing and identifying the cause of disease.

Effective Dates

All provisions of the standard are currently in effect, except that employers have until May 31, 2010 to implement required engineering controls.

Additional Information

Small Entity Compliance Guide for the Hexavalent Chromium Standards:
www.osha.gov/Publications/OSHA_small_entity_comp.pdf

Small Entity Compliance Guide for the Revised Respiratory Protection Standard:
www.osha.gov/Publications/3384small-entity-for-respiratory-protection-standard-rev.pdf

OSHA Fact Sheet: Health Effects of Hexavalent Chromium:
www.osha.gov/OshDoc/data_General_Facts/hexavalent_chromium.pdf

Hexavalent Chromium General Industry standard:
www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=13096

Hexavalent Chromium Shipyard standard:
www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=13116

Hexavalent Chromium Construction standard:
www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=13117

For a list of State plans and contact information:
www.osha.gov/dcsp/osp/index.html.

References

Meridian Research, Inc. 1994. Final Report: Selected Chapters of an Economic Impact Analysis for a Revised OSHA Standard for Chromium VI: Introduction, Industry Profiles, Exposure Profiles, Technological Feasibility (for 6 industries) and Environmental Impacts. Prepared for: Office of Regulatory Analysis, OSHA, Prepared by: Meridian Research, Inc., Prepared under Contract Number: J-9-F-4-0012, Task Order No. 1, Base Year, December 18, 1994, pages I-2 through I-7, Document ID Number OSHA-H054A-2006-0064-0720 (formerly Exhibit Number 26).

OSHA. 2003. Clarification of "as free as practicable" and lead contamination under 29 CFR 1926.62. OSHA's Letter of Interpretation response to Mr. Frank White of Organization Resources Counselors, Inc. January 13, 2003.

OSHA. 2006. Occupational Exposure to Hexavalent Chromium. Final Rule. 71 FR 10099-10385. 2/28/2006.

OSHA Instruction. 2008. Inspection Procedures for the Chromium (VI) Standards. Directive Number: CPL 02-02-074. Effective Date: January 24, 2008.

SRI Consulting. 2008. Chemical Economics Handbook. Inorganic Color Pigments. CEH Marketing Research Report. January 2008, pages 575.3002A through 575.3002J.

OSHA Assistance

OSHA can provide extensive help through a variety of programs, including technical assistance about effective safety and health programs, state plans, workplace consultations, and training and education.

Safety and Health Management System Guidelines

Effective management of worker safety and health protection is a decisive factor in reducing the extent and severity of work-related injuries and illnesses and their related costs. In fact, an effective safety and health management system forms the basis of good worker protection, can save time and money, increase productivity and reduce employee injuries, illnesses and related workers' compensation costs.

To assist employers and workers in developing effective safety and health management systems, OSHA published recommended Safety and Health Program Management Guidelines (54 *Federal Register* (16): 3904-3916, January 26, 1989). These voluntary guidelines can be applied to all places of employment covered by OSHA.

The guidelines identify four general elements critical to the development of a successful safety and health management system:

- Management leadership and worker involvement,
- Worksite analysis,
- Hazard prevention and control, and
- Safety and health training.

The guidelines recommend specific actions, under each of these general elements, to achieve an effective safety and health management system. The *Federal Register* notice is available online at www.osha.gov.

State Programs

The Occupational Safety and Health Act of 1970 (OSH Act) encourages states to develop and operate their own job safety and health plans. Twenty-four states, Puerto Rico and the Virgin Islands currently operate approved state plans: 22 cover both private and public (state and local government) employment; Connecticut, New Jersey, New York and the Virgin Islands cover the public sector only. States and territories with their own OSHA-approved occupational safety and health plans must adopt standards identical to, or at least as effective as, the Federal OSHA standards.

Consultation Services

Consultation assistance is available on request to employers who want help in establishing and maintaining a safe and healthful workplace. Largely funded by OSHA, the service is provided at no cost to the employer. Primarily developed for smaller employers with more hazardous operations, the consultation service is delivered by state governments employing professional safety and health consultants. Comprehensive assistance includes an appraisal of all mechanical systems, work practices and occupational safety and health hazards of the workplace and all aspects of the employer's present job safety and health program. In addition, the service offers assistance to employers in developing and implementing an effective safety and health program. No penalties are proposed or citations issued for hazards identified by the consultant. OSHA provides consultation assistance to the employer with the assurance that his or her name and firm and any information about the workplace will not be routinely reported to OSHA enforcement staff. For more information concerning consultation assistance, see OSHA's website at www.osha.gov.

Strategic Partnership Program

OSHA's Strategic Partnership Program helps encourage, assist and recognize the efforts of partners to eliminate serious workplace hazards and achieve a high level of worker safety and health. Most strategic partnerships seek to have a broad impact by building cooperative relationships with groups of employers and workers. These partnerships are voluntary relationships between OSHA, employers, worker representatives, and others (e.g., trade unions, trade and professional associations, universities, and other government agencies).

For more information on this and other agency programs, contact your nearest OSHA office, or visit OSHA's website at www.osha.gov.

OSHA Training and Education

OSHA area offices offer a variety of information services, such as technical advice, publications, audiovisual aids and speakers for special engagements. OSHA's Training Institute in Arlington Heights, IL, provides basic and advanced courses in safety and health for Federal and state compliance officers, state consultants, Federal agency personnel, and private sector employers, workers and their representatives.

The OSHA Training Institute also has established OSHA Training Institute Education Centers to address the increased demand for its courses from the private sector and from other federal agencies. These centers are colleges, universities and nonprofit organizations that have been selected after a competition for participation in the program.

OSHA also provides funds to nonprofit organizations, through grants, to conduct workplace training and education in subjects where OSHA believes there is a lack of workplace training. Grants are awarded annually.

For more information on grants, training and education, contact the OSHA Training Institute, Directorate of Training and Education, 2020 South Arlington Heights Road, Arlington Heights, IL 60005, (847) 297-4810, or see Training on OSHA's website at www.osha.gov. For further information on any OSHA program, contact your nearest OSHA regional office listed at the end of this publication.

Information Available Electronically

OSHA has a variety of materials and tools available on its website at www.osha.gov. These include electronic tools, such as *Safety and Health Topics*, *eTools*, *Expert Advisors*; regulations, directives and publications; videos and other information for employers and workers. OSHA's software programs and eTools walk you through challenging safety and health issues and common problems to find the best solutions for your workplace.

OSHA Publications

OSHA has an extensive publications program. For a listing of free items, visit OSHA's website at www.osha.gov or contact the OSHA Publications Office, U.S. Department of Labor, 200 Constitution Avenue, NW, N-3101, Washington, DC 20210; telephone (202) 693-1888 or fax to (202) 693-2498.

Contacting OSHA

To report an emergency, file a complaint, or seek OSHA advice, assistance, or products, call (800) 321-OSHA or contact your nearest OSHA Regional or Area office listed at the end of this publication. The teletypewriter (TTY) number is (877) 889-5627.

Written correspondence can be mailed to the nearest OSHA Regional or Area Office listed at the end of this publication or to OSHA's national office at: U.S. Department of Labor, Occupational Safety and Health Administration, 200 Constitution Avenue, N.W., Washington, DC 20210.

By visiting OSHA's website at www.osha.gov, you can also:

- File a complaint online,
- Submit general inquiries about workplace safety and health electronically, and
- Find more information about OSHA and occupational safety and health.

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OSHA Regional Offices

Region I
(CT*, ME, MA, NH, RI, VT*)
JFK Federal Building, Room E340
Boston, MA 02203
(617) 565-9860

Region II
(NJ*, NY*, PR*, VI*)
201 Varick Street, Room 670
New York, NY 10014
(212) 337-2378

Region III
(DE, DC, MD*, PA, VA*, WV)
The Curtis Center
170 S. Independence Mall West
Suite 740 West
Philadelphia, PA 19106-3309
(215) 861-4900

Region IV
(AL, FL, GA, KY*, MS, NC*, SC*, TN*)
61 Forsyth Street, SW, Room 6T50
Atlanta, GA 30303
(404) 562-2300

Region V
(IL*, IN*, MI*, MN*, OH, WI)
230 South Dearborn Street
Room 3244
Chicago, IL 60604
(312) 353-2220

Region VI
(AR, LA, NM*, OK, TX)
525 Griffin Street, Room 602
Dallas, TX 75202
(972) 850-4145

Region VII
(IA*, KS, MO, NE)
Two Pershing Square
2300 Main Street, Suite 1010
Kansas City, MO 64108-2416
(816) 283-8745

Region VIII
(CO, MT, NO, SO, UT*, WY*)
1999 Broadway, Suite 1690
PO Box 46550
Denver, CO 80202-5716
(720) 264-6550

Region IX
(AZ*, CA*, HI*, NV,* and American Samoa, Guam and the Northern Mariana Islands)
90 7th Street, Suite 18-100
San Francisco, CA 94103
(415) 625-2547

Region X
(AK*, ID, OR*, WA*)
1111 Third Avenue, Suite 715
Seattle, WA 98101-3212
(206) 553-5930

* These states and territories operate their own OSHA-approved job safety and health programs and cover state and local government employees as well as private sector employees. The Connecticut, Illinois, New Jersey, New York and Virgin Islands plans cover public employees only. States with approved programs must have standards that are identical to, or at least as effective as, the Federal OSHA standards.

Note: To get contact information for OSHA Area Offices, OSHA-approved State Plans and OSHA Consultation Projects, please visit us online at www.osha.gov or call us at 1-800-321-0SHA.