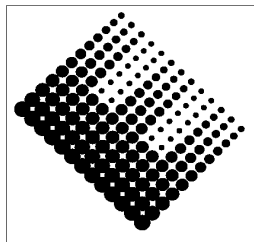


# INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

DUPONT  
E10020  
SPCL36104-S SUCTION SYSTEM



# EMPIRE

ABRASIVE EQUIPMENT COMPANY

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**INSTALLATION, OPERATION, AND MAINTENANCE MANUAL**  
**for an**  
**SPCL36104-S SUCTION BLAST SYSTEM**

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## 1.0 INTRODUCTION

This manual describes the installation, operation and maintenance of an Empire Suction Blast System. Packaged separately is literature describing the commercial components integrated into your system. Please read these instructions carefully before installing and operating your system.

If you have any questions or need further information, contact your local Empire distributor.

For technical information please call the Empire TECHNICAL SERVICE GROUP at (215) 752-8800.

**IMPORTANT - READ THIS BEFORE GOING ANY FURTHER:**

Your blast system may not include all of the components and options described in this manual. See the Table of Contents for the appropriate sections of this manual that describe components included with your system. Please consult the drawings and Bill of Material if you are unsure which components and options are included with your system. Passages in this manual that describe design features and/or options which are **NOT** included on your machine are typically marked “(N/A)” to indicate that they don’t apply.

2.0 INSTALLATION INSTRUCTIONS

Reference drawings are listed in Section 12.0.

- 2.1 Remove the system components from the skids and check for any damage which may have occurred during shipment. **IF DAMAGE IS FOUND, IT IS THE RESPONSIBILITY OF THE CUSTOMER TO FILE AN INSURANCE CLAIM WITH THE SHIPPING COMPANY.** The system will be arranged as shown on the System Assembly Drawing. Refer to the drawings listed in Section 12.0.

2.2 DUST COLLECTOR AND BLOWER ASSEMBLY

- 2.2.1 A Cartridge Dust Collector will require a Storage Hopper, legs, and in most cases, a Blower Assembly. Instructions may be found packed with the hardware and drum cover.
- 2.3 Position the Dust Collector. It may be placed anywhere within the reach of the connecting dust hose. Keep in mind that dust must be removed from the Dust Collector. Filter access doors of the Dust Collector must be positioned to allow maintenance, filter replacement and access to the Reverse Pulse components.
- 2.4 The Reclaimer may have been removed from the Storage Hopper for shipment. Install it on the Storage Hopper as shown on the Assembly Drawing. Be sure that the gasket between the Reclaimer and hopper makes an airtight seal. This seal is critical for proper operation.
- 2.5 Position the Blast Cabinet and make sure it is level. Clear space must be available on both sides of the Blast Cabinet for doors and access to the Main Electrical Enclosure, and at the back of the Cabinet for maintenance and adjustments.
- 2.6 Assemble the dust hose from the Reclaimer outlet to the Dust Collector inlet. Secure the dust hose at each end with the worm gear clamps provided. Connections must be airtight.
- 2.7 Assemble the heavy-duty conveying hose from the Blast Cabinet cone pickup tube to the Reclaimer inlet.
- 2.7.1 Heavy-duty conveying hose is assembled to the Blast Cabinet cone pickup tube and Reclaimer inlet. Secure the hose with the clamps provided. Connections must be airtight.
- 2.7.2 (Optional) Urethane Duct is connected to the Blast Cabinet cone pickup tube and Reclaimer adapters. Steel couplings are provided for connecting the urethane joints. Sheet metal screws are provided for each adapter and coupling. All adapters and couplings must be caulked (with RTV silicone) to insure an airtight seal.
- 2.7.2 (Optional) The Makeup Hopper is installed connecting the two (2) inch discharge or six (6) inch steel tube to the conveying duct. The connection must be airtight. Apply RTV silicone caulk around the hole in the Urethane Duct and two (2) inch discharge of the hopper.

2.8 A main air shutoff valve with lockout has been provided. It is designed to be locked in the “OFF” position and bleed the air when closed. Close the main air shutoff valve. Make the compressed air connection to the Blast Cabinet pipe string on the back wall of the Cabinet. The supply line must be at least as large as the pipe string inlet. If the supply line must be run more than 25 feet, increase the line to one size larger.

2.9 DUST COLLECTOR COMPRESSED AIR SUPPLY

2.9.1 Cartridge Dust Collectors with Reverse Pulse

Connect a 1” airline to the Dust Collector manifold. Plug the opposite end of the manifold. A 90-100 PSI air supply is required for proper operation of the cleaning pulse. If line pressure exceeds 100 PSI, a regulator must be installed in the Dust Collector air supply.

**NOTE: IF AIR PRESSURE EXCEEDS 100 PSI, THE DUST COLLECTOR CARTRIDGES WILL BE SEVERELY DAMAGED.**

2.10 A qualified electrician may now make the necessary electrical connections in accordance with applicable codes. Refer to the Electrical Drawings. If not provided with your system, an Electrical Disconnect shall be provided to open all ungrounded supply conductors. This disconnect shall be located within sight of the Main Electrical Enclosure.

2.10.1 Complete the wiring from the Dust Collector and other electrical components to the Main Electrical Enclosure. Once these connections are complete, the Blower Motor should be jogged and the rotation checked. Fan blades must rotate toward the fan outlet. If the rotation is incorrect, open the Main Electrical Disconnect and switch two of the three-phase Motor power connections to reverse the motor direction.

2.10.2 The Blast Cabinet and Reclaimer stand must have a good earth ground. The Urethane Duct static ground wire must be connected to the earth ground.

2.11 Shut off all manual air valves on the system.

2.12 Open the main air supply valve. Check each manual air valve, all control lines and the entire system for leaks.

2.13 Before proceeding, check that all gearboxes are filled with oil to the correct level. Refer to the gearbox manufacturer’s instructions. Generally, the oil level should be just above the centerline of the input shaft.

2.14 Prior to adding media, review the function and operation of system components as described in Sections 3.0, 4.0 and 5.0. Also check for and remove from the interior of the Blast Cabinet cone and Storage Hopper debris (metal shavings, nuts, bolts, etc.) that may plug media orifices and Blast Guns.

**SUGGESTION:** Use a magnet on a long handle or shop vacuum to clean debris from the bottom of the Blast Cabinet cone and Storage Hopper.

2.15 Run the system “dry” (without media) as described in Section 5.0. This step is important to verify that the system is ready for media.

2.16 ABRASIVE MEDIA LOADING

This system is designed to use aluminum oxide.. The amount of media needed to operate the system is approximately 5 cubic feet. With the optional Makeup Hopper, 10 cubic feet of media is required. Changes may be required before the system is capable of using a different type or size of media.

To fill the system, the following procedure should be followed:

2.16.1 Press the red “SYSTEM OFF” pushbutton.

2.16.2 Open the abrasive loading door located on top of the Storage Hopper. Fill the Storage Hopper until the media is up to the bottom of the screen inside the hopper.

2.16.3 (Optional) Open the Makeup Hopper door. The Makeup Hopper may be filled to the top.

2.16.4 Close and secure the Storage Hopper, Reclaimer, and Media Makeup Hopper doors.

2.16.5 Press the green “SYSTEM ON” pushbutton.

**NOTE:** Never let the Storage Hopper media level get below one half full.

### 3.0 FUNCTION OF COMPONENTS

This section gives a brief description and explains the operation of system components.

#### 3.1 OPERATOR ELECTRIC CONTROL PANEL

- 3.1.1 The red illuminated “EMERGENCY STOP” operator disengages the “Emergency Stop Relay” and removes power from all motion devices and their respective controls. When activated, the operator illuminates indicating its active state. Resetting of the operator is performed by twisting and pulling.
- 3.1.2 The green “SYSTEM ON” illuminated pushbutton is used to energize the system and turn on the Dust Collection System. The pushbutton illuminates to indicate its “ON” status.
- 3.1.3 The red extended head “SYSTEM OFF” pushbutton is used to shut off the system and Dust Collection System. Pressing this operator extinguished the lamp in the “SYSTEM ON” illuminated pushbutton.
- 3.1.4 Cabinet “LIGHTS”. This selector switch turns on the cabinet lights when put in the “ON” position.
- 3.1.5 The white “BLAST” “OFF” or “ON” selector switch sets the system to allow blasting with media. This initiates the door locks and activates the blast solenoid when required by the process. This selector switch illuminates when in the “ON” position.
- 3.1.6 The “SYSTEM” “MANUAL” or “AUTO” selector switch allows for manual operation or automatic operation which would be initiated when pressing the cycle start pushbutton. Manual operation is used for setup and maintenance purposes.
- 3.1.7 The green “CYCLE START” pushbutton enables the Blast Cycle. This pushbutton will illuminate when the system is in a Blast Cycle. If the system is placed in a hold status, the indicating lamp will flash.
- 3.1.8 The red extended head “CYCLE STOP” pushbutton pauses the blast and nozzle movement during a Blast Cycle. This allows any modifications to the part position or media flow to be made and the process then resumed.
- 3.1.9 The amber “HOPPER LOW” indicating lamp illuminates when the media level in the storage hopper falls below the capacitive level sensor.
- 3.1.10 The red “SYSTEM FAULT” indicating lamp illuminates in the event of a system fault. Details on the exact fault can be found utilizing the Operator Interface Terminal (OIT).  
The lamp extinguished when the fault is cleared and the system reset.
- 3.1.11 The black “FAULT RESET” pushbutton is used to reset the system fault and return the machine back to normal running conditions.

- 3.1.12 The blue “E-STOP RESET” illuminated pushbutton is used to enable the Emergency Stop Relay (ESR) and apply power to all motion control components. This operator illuminates when the circuit is energized and in a normal operating mode.
- 3.1.13 The “BLAST ELAPSED TIME INDICATOR” records the total time that nozzles are blasting. The “BLAST” selector switch must be in the “ON” position for this hourmeter to run.
- 3.1.14 the white “TRY” illuminated pushbutton is to be used to verify the presence or lack of power when the main disconnect is turned off and locked out for service.
- 3.1.15 (remote) an additional “EMERGENCY STOP” pushbutton station is located near the loading door of the machine. Pressing this will disengage the ESR and remove power from all motion devices and their respective controllers. This operator will illuminate when pressed and remain lit until power is removed or the operator is reset.
- 3.1.16 (remote) A green Tower Light is used to alert the operator to the run condition of the process cycle. A steady green light indicates that the current cycle is in process. A blinking green light indicates that the system is in a hold state. When the light is extinguished, either the cycle is complete or the system is waiting for the next cycle to be run.



### 3.2 OPERATOR LOAD & UNLOAD STATIONS

The operator opens the load door and slides the part over mandrel. When finished, operator removes the part.

### 3.3 BLAST PRESSURE CONTROL

3.3.1 Locate the Pressure Regulator on the pipe string on the media storage hopper. Rotate the Pressure Regulator knob clockwise to increase, or counter clockwise to decrease the Blast Pressure.

#### 3.3.2 Precision Regulator

An optional Precision Pressure Regulator pilot and slave regulator provides more accurate control of Blast Pressure when blasting parameters are critical. Pressure is adjusted manually at the pilot regulator, clockwise to increase and counter clockwise to decrease the Blast Pressure.

#### 3.3.3 (N/A) Optional Front Access Pressure Regulator

This option allows the operator to monitor and/or change the Blast Pressure from the front of the Blast Cabinet. The operator does not have to walk to the back of the machine to adjust the pressure.

### 3.4 BLAST COMPONENTS

The MH-2 Suction Blast Gun and MH-3 Suction Blast Gun mix blast air and media. They exit from the nozzle creating the blast. The air leaving the air jet entering the nozzle cone creates suction, pulling media and air through the media hose from the Media Regulator. See Figures 1 and 2.

#### 3.4.1 Nozzle

The Suction Blast Gun is designed to accept nozzles made of boron carbide, tungsten carbide or ceramic. Boron carbide is the longest wearing nozzle material and is strongly recommended when blasting with aluminum oxide or silicon carbide medias. Standard sizes are 1/4", 5/16", 3/8" and 7/16" ID. A nozzle adapter is threaded onto the Gun Assembly to hold the nozzle in place.

Boron carbide is the hardest and longest wearing nozzle material. It is strongly recommended for use when blasting with aluminum oxide or silicon carbide medias. A 3/8" boron Venturi nozzle is available for the MH-3 suction gun.

#### 3.4.2 Air Jet

The air jet is located inside the Suction Blast Gun and is threaded into the air inlet connector. It discharges the blast air to the rear of the nozzle. The air jet is hardened steel for extended wear.

3.4.3 Air Jet Connector

The MH-3 air connector is fastened to the gun body by two socket head screws. Air jet position is fixed within the gun and is not adjustable.

3.4.4 Media Hose

3.4.4.1 (N/A) The 5/8" media hose enters through the handle of the MH-2 gun. A hose clamp nut and "O" ring seal the hose to the gunbody. Any air leak around the media hose will cause premature wear and failure of air jet and gunbody. See Figure 1.

3.4.4.2 The 5/8" media hose enters the MH-3 Suction Blast Gun at the back and is held in place by four (4) screws. The gun hose entry must be sealed with silicone. Any air leak around the media hose will cause premature wear and gun body failure. See Figure 2.

**NOTE:**

Blast hoses must be routed with a sweeping gradual bend. Tight turns and hard bends cause high wear locations where the hoses will prematurely wear out from the inside. When replacing hoses, avoid sharp bends and turns.

3.4.5 Media Regulator Assembly (See Figure 3)

The SAR-2 Media Regulator is threaded onto a 1 1/4" pipe nipple under the Storage Hopper. The media hose is inserted into the 1 1/8" horizontal bore of the regulator. The thumbscrew is provided to apply slight pressure against the media hose to prevent movement. The media hose will partly cover the secondary air port. A smaller opening will increase media flow and a larger opening will decrease media flow.

3.4.6 Storage Hopper

The Storage Hopper has a four (4) cubic foot capacity and is used as a reservoir for media. It should be one half (1/2) full or more at all times. There is a hinged access door for loading media and trash screen removal.

3.4.7 Individual Suction Blast Gun Shutoff Valves

A ball valve is provided to shut off each Blast Gun. Rotate the valve handle 90 degrees to shut off the air supply and stop the blast.

### 3.5 PNEUMATIC RECLAIM SYSTEM

The Reclaim System consists of a pickup tube at the bottom of the Blast Cabinet cone, a media recovery duct, and a Reclaimer Assembly. The Blast Cabinet ventilation air is used to pneumatically convey spent media to the Reclaimer. Good media is centrifugally separated from dust and broken down media (fines). Good media falls to the Storage Hopper while dust and fines are conveyed to the Dust Collector. The Reclaimer has a secondary air metering band and exterior wear plate. Optional wear resistant linings are available for the Reclaimer.

#### 3.5.1 Secondary Air Metering Band (See Figure 4)

The metering band allows secondary air to enter the Reclaimer. The more secondary air induced, the larger the particles removed from the system and sent to the Dust Collector. If good media is carried to the Dust Collector, close the metering band. If too much dust is being recycled along with the good blast media, open the metering band. Changes should be made in 1/16" increments until the final setting is determined. A system must normally be operated for (8) hours to "season" the filters before it reaches equilibrium and the tuning band setting may be finalized. See the appropriate section in Chapter 9.

### 3.6 DUST COLLECTION COMPONENTS

The Dust Collection System components consist of the Dust Collector with filters, the filter cleaning controls, and the Blower. Dust and fines are drawn from the Reclaimer to the Dust Collector. Clean air is discharged from the Blower. One of two types of Dust Collector may be supplied and are described below. With any Dust Collector, filters require a coating of dust to achieve maximum filter efficiency. The system may require several hours of operation before filters are fully coated ("seasoned").

#### 3.6.1 (N/A) Bag Type Dust Collector

The Dust Collector must be shut down periodically to allow bags to be cleaned. Tubular bags are mounted with the sealed end up and hooked onto a hanger rod on the dust bag rack. The open end of the bag has a ring which seals into holes in the bag plate in the hopper of the Dust Collector.

#### 3.6.2 Filter Cleaning

Filter bags are suspended from the bag rack at the top of the Dust Collector housing. The bag rack is lifted and lowered by a cylinder at a moderate rate, flexing the bags and dislodging dust and fines. Filters should be cleaned every two (2) hours. This may vary depending on dust loading. Manual cleaning is accomplished after the Blower is shut down and the button on the side of the Dust Collector housing is pressed and released.

#### 3.6.3 (N/A) Optional Auto Bag Shake Control

The Auto Bag Shake Control Box, mounted on the Dust Collector, energizes and de-energizes a solenoid valve to raise and lower the bag rack. A normally closed vacuum switch enables the Bag Shake control only when the Blower is shut down. Auto Bag Shake controls may be located in the Main Electrical Enclosure and not use a pressure

switch. A timer controls the duration of the shake cycle and a flasher controls the cylinder movement by powering the solenoid valve.

3.6.4 Cartridge Dust Collector

These Dust Collectors can operate continuously without Blower shutdown. Electronically timed pulses of compressed air clean the dust from the cartridges without interfering with normal airflow. Refer to the manufacturer's manual for complete information.

3.6.5 Dust Collector Efficiency

Dust Collector efficiency may not be stated as an absolute value since it will vary depending on:

- a. Dust loading of inlet air
- b. Micron size distribution of dust carried by inlet air
- c. Amount of dust cake on filters (frequency of filter cleaning)

Emissions from Empire Dust Collectors in good condition will normally be within the OSHA limit for "nuisance dust". The OSHA limit is 5 milligrams of dust per cubic meter of air (.002185 grains per cubic foot). This emission rate is equal to .0042 pounds of dust per 1000 pounds of air at standard temperature and pressure. To determine the actual emission rate, an air sample from the blast operation must be analyzed.

Dust Collector efficiencies are stated to show the normal range which might be expected and are not a guarantee of performance.

If dust contains any toxic substances, secondary filtration of discharge air from the Blower may be required. Consult Empire if dust to be filtered is classified as other than "nuisance dust".

#### 4.0 OPTIONAL COMPONENT FUNCTIONS

Additional options may be supplied with the system. The following are available at time of manufacture.

#### 4.1 POWERED PART HOLD DOWN ROLLERS

Pneumatic powered rollers hold the part down against the mandrel. The rollers come down on each end of the part to secure it during a blast cycle. One set of these rollers moves horizontally to accommodate the length of the part to be blasted This is accomplished thru the PLC .

#### 4.2 NOZZLE OSCILLATOR

The Nozzle Oscillator drive is mounted on the back wall of the Blast Cabinet. An oscillating bar extends into the Blast Cabinet to support the Blast Guns. The Oscillator moves horizontally over the surface of the part. Home (park) position may be extended or retracted and is determined at time of manufacture.

##### 4.2.1 (N/A) Pneumatic Cylinder Driven Oscillator

This Oscillator provides an inexpensive means of increasing blast coverage. Oscillation speed is adjustable with flow control valves at each of the cylinder's two (2) ports. Limit switches control the cylinder stroke length. The duration of the blast is controlled by a Blast Timer or a Blast Counter.

##### 4.2.2 D.C. Motor Driven Timing Belt Oscillator

The D.C. driven Oscillator permits improved control of oscillation speed and distance. This is required when precise blast specifications must be met. A DC Motor Control Board controls the Oscillator Speed. Stroke length is controlled with the PLC.

##### 4.2.3 D.C. Motor Oscillator with PLC Control

When incorporated with a PLC, the processor may be programmed to control the Oscillator movement including Park Position, Blast Length and Blast Strokes/Time. A DC Motor Control Board controls Oscillator Speed.

#### 4.3 (N/A) AUTOMATIC MEDIA REPLENISHING SYSTEM

This system includes a 4 cubic foot capacity Makeup Hopper, an automatic Sure-Flo® Grit Valve and a Makeup Hopper Low Level Sensor. The Sure-Flo® Grit Valve at the bottom of the Makeup Hopper will open and add media to the system if the media level in the Storage Hopper is not at the proper level. The Makeup Hopper Low Level Sensor and a panel mounted indicating light which will illuminate when the Makeup Hopper must have media added.

This option is particularly useful when media must remain consistent. As media breaks down and is drawn to the Dust Collector, fresh media of the proper size will mix with the reclaimed media ensuring a consistent mix and repeatable finish.

4.4 (N/A) VIBRATORY CLASSIFIER (SCREENER)

The purpose of a Vibratory Classifier is to have more control over the media that is reclaimed from the blast process and put back into the Storage Hopper. When media “breaks down” as a result of hitting the part being blasted, it may change shape (deform), and it may fracture, resulting in smaller particles of media. Consequently, what is often found in the Storage Hopper consists of a combination of properly sized media particles, undersized media particles, virgin media from the Makeup Hopper, material that has been removed (e.g. cleaning or surface-etching processes) from the part being blasted and possibly dust.

Contaminants such as dust and particles dislodged from the part being blasted are usually carried over to the Dust Collector by the cyclonic Reclaimer, which is better than 90% efficient. However, small amounts may wind up in the Storage Hopper. These contaminants plus undersized media particles may reduce the efficiency of the blasting process. Blast processes that require very precise control of the media often include a Vibratory Screener, which is practically 100% efficient. A series of mesh “screens” located on successive “decks” sequentially filter the material that is removed from the Blast Cabinet. Dust and undersized media particles are removed and dumped into a waste drum and good reusable media is sent to the Storage Hopper.

4.5 (N/A) FRONT ACCESS PRESSURE REGULATOR

This option allows the operator to monitor and/or change the Blast Pressure from the front of the Blast Cabinet.

5.0 SYSTEM START-UP PROCEDURE

Follow this procedure to insure safe and continuous operation.

5.1 Open the main air valve.

5.2 Close the Main Electrical Disconnect switch and turn on the Blast Cabinet lights. Listen for the Automatic Bag Shake control to operate if your system has a Bag Type Dust Collector.

**NOTE:** Reverse Pulse Cartridge Dust Collectors only clean while the Blower is in operation.

5.3 Perform Daily Maintenance and Operation Check. See Section 6.0.

5.4 The system is now ready for production.

5.5 Follow the Sequence of System Operation. See Section 7.0.

6.0 SYSTEM MAINTENANCE AND OPERATION CHECK

Follow all the steps in this section to insure the system is ready for production.

6.1 DAILY CHECKS

- 6.2 Dump the Dust Collector waste. Inspect the waste for good media. If large quantities of usable media are present, refer to Section 9.7.
- 6.3 Inspect the contents of the Storage Hopper. It must be one half (1/2) full or more at all times. Clean the trash screen. Check the size and condition of the media and look for large quantities of dust and fines. If poor media quality and/or large quantities of dust and fines are found, empty the Storage Hopper and install new media into the hopper. Refer to Section 9.7.
- 6.4 Inspect all supply and control airlines and hoses for wear or leaks. Repair or replace as needed before operating the system.
- 6.5 Inspect the media hoses for leaks and wear. Interior wear of the media hose may be checked by pinching the hose to detect soft spots. Bends in the media hose will wear before straight sections. If a hose is worn, replace it before operating the system.
- 6.6 CABINET INTERIOR WEAR DUE TO BLAST

Special precautions have been taken to protect the interior of the Blast Cabinet from premature wear. Due to the high volume of abrasive media being delivered by the Blast Nozzles at a high pressure, wear is unavoidable. Careful daily maintenance and inspection are mandatory to the longevity of this system.

- 6.6.1 Operators and maintenance personnel should familiarize themselves with the expected high wear areas within the Blast Cabinet.
- 6.6.2 There will be a high wear area opposite each Blast Nozzle. If the system is blasting without parts, the blast stream will impact upon the surface in front of the nozzles.
- 6.6.3 Inspect the Blast Cabinet interior for wear to the rubber curtains and metal surfaces. Replace worn curtains promptly. They prevent wear to the sound absorbing material (when supplied), Blast Cabinet walls and cone.
- 6.7 Clean debris from the Blast Cabinet screens and cone. Replace light bulbs and globes as needed.
- 6.8 Inspect the rolling mandrel components for wear. Check the drive for loose and worn components, and oil leaks.
- 6.9 Inspect the nozzles and couplings for external wear and holes in the sides of the assembly. If holes are found, replace the worn components before operating the system.
- 6.10 (N/A) Inspect the top of the Blast Cabinet for loose components and gearbox oil leakage. Repair the oil leaks and check oil levels before operating the system.



- 6.11 Inspect all Oscillator limit switch arms for free movement and all split collar limit switch trippers for tightness and proper orientation. Repair and/or adjust before operating the system.
- 6.12 Replace all cracked or frosted windows, worn window curtains, and damaged door gaskets.
- 6.13 Turn the “BLAST” selector switch to “OFF”. Press the “SYSTEM ON” pushbutton.
- 6.14 Observe the operation of the rotating mandrel. Check that hoses do not rub on the interior of the Blast Cabinet.
- 6.15 Turn the “BLAST” selector switch to “ON”. Observe blast from each nozzle. Pay special attention to media flow, direction, and consistency of flow. Correct any problem before operating the system. Refer to Section 9.0.
- 6.16 Press the red “SYSTEM OFF” pushbutton to shut the system down. On Bag Type Collectors, listen for the Dust Collector Automatic Bag Shake to operate. If the Bag Shake does not function, repair it before operating the system. Cartridge Dust Collectors Reverse Pulse clean only when the system is “ON”.
- 6.17 PERIODIC CHECKS - (N/A)
- 6.18 MANDREL REPLACEMENT  
If the Mandrel needs replacement due to different part diameters, locate the coupling that secures the mandrel to the main drive shaft. Before loosening this coupling properly support the mandrel through out its length then disassemble it. When installing a new mandrel be sure to add the rubber washer that is located in between the end of the drive shaft and the matching end of the mandrel. This washer creates the necessary seal required when applying air for the I.D. blowoff.

7.0 SEQUENCE OF SYSTEM OPERATION

7.1 Close all manual Blast Cabinet doors.

7.2 Press the green “SYSTEM ON” pushbutton.

**NOTE:** The system may be shut down at any time by pressing the red “SYSTEM OFF” pushbutton.

7.3 Set “Blast” selector switch to “ON”. The “LIGHTS” selector switch may be “OFF”.

7.4 Set “System” selector switch to “AUTO”.

7.5 Set the Blast Pressure as required for the parts to be processed.

7.6 Set proper parameters for the part to be blasted using the OIT.  
(See section 7.11 for operation of the Operator Interface Terminal OIT)

7.7 Open load door and install part over mandrel. Use the collar at the load end as a “home” edge to properly position the part. Closing the door will engage the tail spindle into the opened end of the mandrel to help support it. Be sure the load door is secured before continuing. Press “CYCLE START “ button.

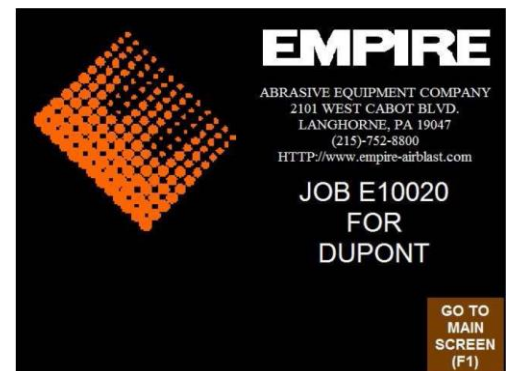
7.8 At end of cycle, remove the part and inspect it for an acceptable finish. If the finish is unacceptable, make system adjustments as outlined in Section 9.0. Run new parts for inspection after adjustments have been made.

7.9 Continue processing parts inspecting the finish of the blast treated parts.

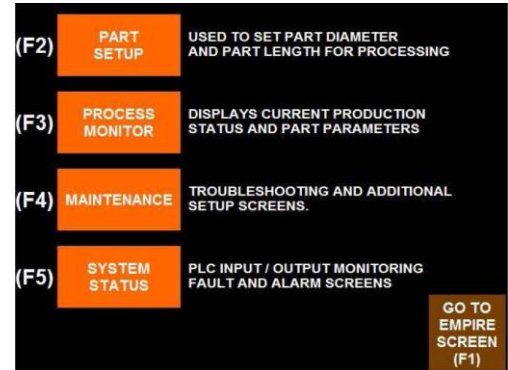
7.10 Shut the system down. See Section 8.0.

7.11 Operator Interface Terminal (OIT)

7.11.1 When the system is powered up the “EMPIRE” screen will appear. Press the button on the touch screen or the “F1” soft-touch button below the screen to switch to the “MAIN MENU” screen.



7.11.2 The “MAIN” screen is now displayed, from here you can either adjust the “PART SETUP” parameters, go to the “PROCESS MONITOR” screen to see where in the cycle the system is currently at, switch to the “MAINTENANCE” screens to perform additional setup configurations or manual operate the machine, or check the overall “SYSTEM STATUS” of the inputs, outputs, and faults.



7.11.3 PART SETUP

Pressing the “PART SETUP” button on the “MAIN” screen, brings up the basic setup screen where the operator enters the “PART DIAMETER” and the “PART LENGTH” for the next cycle. Pressing in the orange field or the corresponding soft-touch function key will bring up a numeric entry panel. Here the desired value is entered.



If the length of the part to be run is shorter than the previously run part, the “PINCH OSCILLATOR” will have automatically repositioned itself. In the event that the new part to be run is Longer than the previous part, the oscillator will need to be reset by either pressing the “F7” button or the “reset” button on the screen.

Once the parameters are correct and the oscillator is in the correct position, the operator then needs to acknowledge that the Part Setup is Complete by pressing the “YES” button or “F8”. Movement from this screen to other screens is done by pressing the desired button on the screen or their corresponding function key.

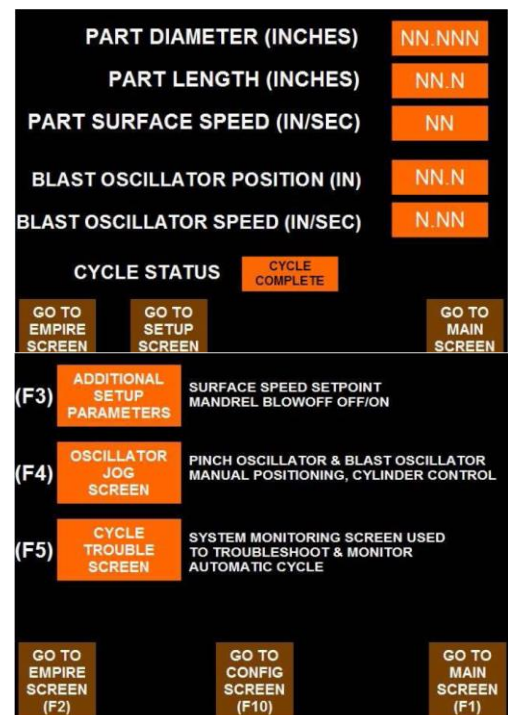
The current Cycle Status is also displayed on this SETUP SCREEN.

7.11.4 PROCESS MONITOR

This screen displays the current setup parameters and the process variables at the current point in the operation cycle.

The current “CYCLE STATUS” is also shown on this display.

Movement between screens is again performed by touching the desired button or pressing the desired function key.



7.11.5 MAINTENANCE SCREEN

Pressing the “MAINTENANCE” button or “F4” on the main screen brings up the “MAINTENANCE” menu screen. From here a choice of “ADDITIONAL SETUP PARAMETERS”, “OSCILLATOR JOG SCREEN”, or “CYCLE TROUBLE SCREEN” can be made.

In the event that communication problems arise or the operator interface program acts irrationally, the “GO TO CONFIG SCREEN” button can be pressed.

This switches to the panelview operations setup screen where the program can be restarted and/or setup changes made.

Again, movement between screens is performed with the touch screen or the function keys.

### 7.11.6 ADDITIONAL SETUP PARAMETERS

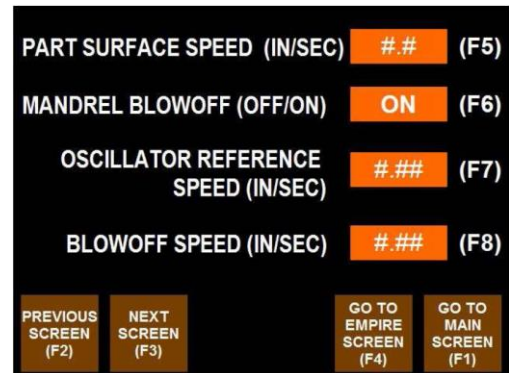
This screen allows the setting of four additional process control variables. These variables are to be used for fine tuning of the process and are not meant to be continually adjusted.

“PART SURFACE SPEED” is used to set the speed at which the part will rotate. Adjusting this setting will speed up or slow down the mandrel rotation and thus the surface speed the part is processed at.

“MANDREL BLOWOFF” turns ON or OFF the flow of air thru the mandrel and into the ID of the part.

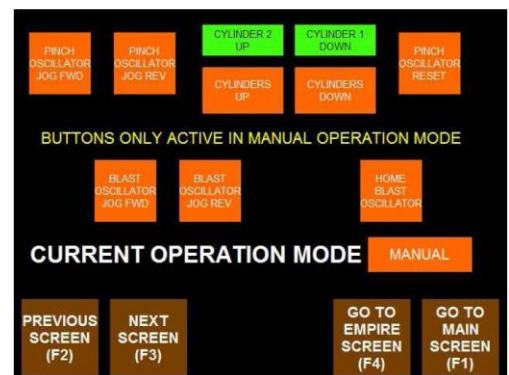
“OSCILLATOR REFERENCE SPEED” sets the reference value used to calculate the horizontal travel speed of the BLAST OSCILLATOR during a cycle. This is also the speed that the largest diameter part would be run at. The actual Oscillator speed is the ratio of the largest part diameter / the current part diameter multiplied by this reference value.

“BLOWOFF SPEED” is the travel speed of the BLAST OSCILLATOR during its BLOWOFF stroke , return to home.



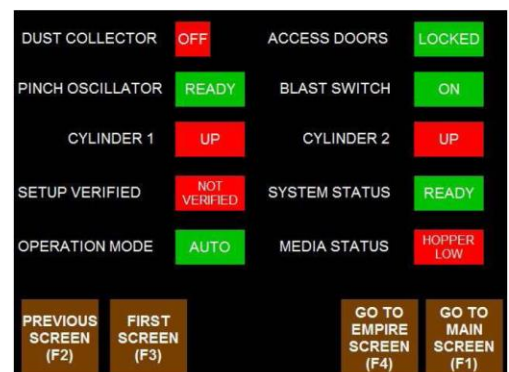
### 7.11.7 OSCILLATOR JOG SCREEN

This screen is used to manually position the oscillators for assisting in setup of the guns and or Maintenance of components. The mode of operation must be in the MANUAL mode in order to activate any of these motions. The Pinch Oscillator will not move unless the cylinders are in the UP position. Homing of the Blast Oscillator will move the gun assembly automatically back to their HOME position and should be performed any time the BLAST OSCILLATOR is jogged or the cycle is aborted during running. This resets all required counters to allow proper operation in future cycles.



### 7.11.8 CYCLE TROUBLE SCREEN

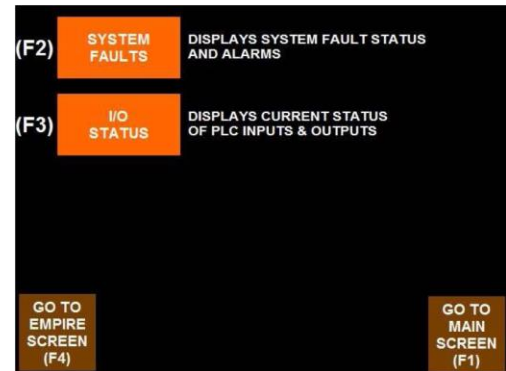
In the event that a cycle will not start, this screen will give a possible indication as to the reason why. All indicators should be in their “GREEN” satisfied state in order to perform a cycle. The Media Status



will not prevent a cycle from running but there is a possibility that the system will run out of media during the cycle and improper finish will be attained.

### 7.11.9 SYSTEM STATUS

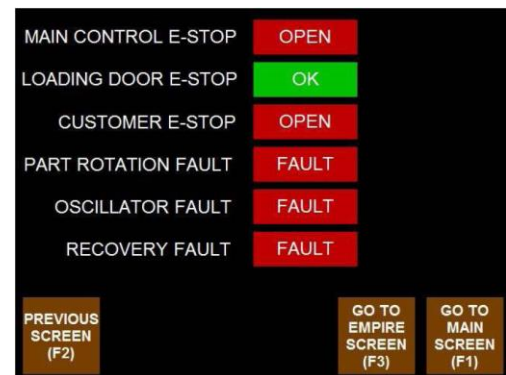
This screen allows a choice between looking at System faults or monitoring the status of the inputs and outputs of the PLC.



### 7.11.10 SYSTEM FAULTS

In the event that the SYSTEM FAULT light is illuminated on the control panel, this screen will give an indication to what was the cause of the fault and what area needs to be checked.

The E-Stops are monitored for individual input and in the event that one is depressed, the ESR will drop out causing the machine to stop, and it will be shown on this display as to which one was activated.



The operational speeds of the Part Rotation, and Blast Oscillator are monitored during the cycle. In the event that they fall outside of their tolerance range for more than 5 seconds, a fault will be generated and the cycle will be put on hold.

This allows maintenance to check the system and resume operation when a fix is made.

In the event that the Dust Collection System falls out of its desired operating range, a Photohelic guage will signal the PLC of the alarm and will stop the process cycle. This is indicated as a RECOVERY FAULT. Once normal operation of the dust collector is resumed, the process can be continued.

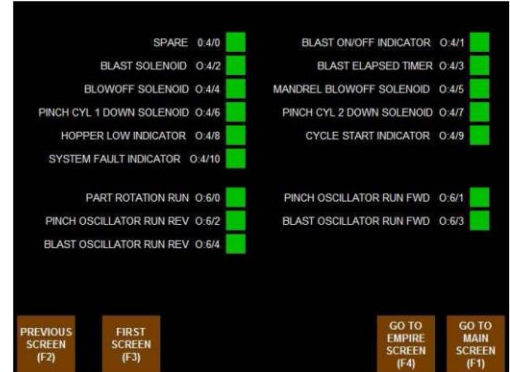
### 7.11.11 SYSTEM INPUTS

This screen shows the current condition of all the inputs to the PLC. Green indicates a positive or made input, red indicates the lack or presence of a input.



### 7.11.12 SYSTEM OUTPUTS

This screen shows the current condition of all the outputs from the PLC. Green indicates that the output is on or active, red indicates that the output is off or inactive.



8.0 SEQUENCE OF SYSTEM SHUTDOWN

Follow this procedure when blasting is complete, at the end of the day, or during extended idle time.

- 8.1 Turn all selector switches to “OFF”. Press the red “SYSTEM OFF” pushbutton.
- 8.2 Open the Main Electric Disconnect and close the main air supply valve. The main air supply valve will bleed off air from the system when closed.
- 8.3 Empty the Dust Collector cone, close the dump door, and dispose of the waste material as required.

9.0 OPTIMUM PERFORMANCE ADJUSTMENTS

This section will explain how to adjust components for optimum performance.

9.1 MEDIA FLOW

The Media Regulator is threaded onto a 1 1/4" pipe nipple under the Storage Hopper. The media hose is inserted into the 1 1/8" horizontal bore of the regulator. The thumbscrew is provided to apply slight pressure against the media hose to prevent movement. The media hose will partly cover the secondary air port. A smaller opening will increase media flow and a larger opening will decrease media flow.

9.2 (N/A)

9.3 NOZZLE DIRECTION AND DISTANCE

Supporting each Suction Blast Gun are extension arms and knuckle assemblies. The assembly permits the nozzles to be directed in any direction. The Suction Blast Gun should be supported when loosening, aiming, and tightening the assemblies. A distance of six (6) inches is recommended between nozzle and part. See Figure 5.

9.4 BLAST INTENSITY

The blast intensity on a part may be increased by one or more operating parameters: number of nozzles blasting; raising Blast Pressure; reducing media flow; increasing blast time; moving nozzles closer to part; and slower oscillation. To lower intensity, the reverse may be used. It is recommended that only one parameter be changed at a time.

9.5 MANDREL SPEED

Mandrel speed is controlled by an adjustable potentiometer on the Operator Electric Control Panel. A scale is provided to reference settings. Slower speed increases blast intensity and faster speed reduces intensity.

9.6 BLAST PRESSURE

Blast Pressure is the most common adjustment for intensity. The Pressure Regulator may be turned clockwise to increase and counter clockwise to decrease Blast Pressure.

9.7 RECLAIMER (SEE FIGURE 4)

The Reclaimer is supplied with a tunable secondary air adjustment. When the band is properly adjusted, reusable media will be returned to the Storage Hopper while unwanted dust and broken down media (fines) are removed from the system and conveyed to the Dust Collector. Adjust the band as described below:

9.7.1 The band is joined at both ends by a bolt that must be loosened before adjusting the secondary air. A slot pattern in the Reclaimer body has one (1) slot omitted. The joined ends of the band must be located over the area of the omitted slot. Also no Reclaimer slots should be visible through the band slots.



9.7.2 Band Adjustment

9.7.2.1 Horizontal Slot Pattern Reclaimer and Band (refer to Figure 4)

Rotate the band by sliding in one (1) direction until 1/16" of the opening is created between the band and Reclaimer slots. Place a pencil mark on the band and a corresponding reference mark on the Reclaimer body.

9.7.2.2 Vertical Slot Pattern in Reclaimer/Solid Band (See Figure 4)

Slide the band up on the Reclaimer body exposing approximately 1/16" of opening between the band and each Reclaimer slot. Place several reference pencil marks around the Reclaimer at the bottom edge of the band.

9.7.3 Operate the blast system for one (1) hour to create dust to coat the filter bags. See Section 3.6.

9.7.4 Press the red "SYSTEM OFF" pushbutton. Check the Dust Collector Waste Drum for good reusable media.

9.7.5 If no media is found in the waste, adjust the Reclaimer metering band 1/16" exposing more Reclaimer body slot area. Make a new corresponding reference mark on the Reclaimer body.

**NOTE:** Repeat 9.7.2 through 9.7.5 until media is present in the Dust Collector waste.

9.7.6 When only small amounts of media have been found in the Dust Collector waste, the band is adjusted correctly. If large quantities of media are found in the Dust Collector waste, move the Reclaimer metering band back to the last reference mark on the Reclaimer body.

9.7.7 As a new system is used, the filters become coated (seasoned) and air in the media recovery system will decrease to normal operational flow. If media again becomes present in the Dust Collector waste, repeat 9.7.4 through 9.7.6.

9.7.8 Some dust may be present in the Storage Hopper after normal operation. The Reclaimer slot openings may have to be opened in several more fine adjustments to remove this dust. This is a final fine adjustment to tune the Reclaimer. Press the red "SYSTEM OFF" pushbutton, increase the slot opening the metering band 1/16". Operate the system for one (1) hour and repeat this step until only small amounts of dust are present in the Storage Hopper.

## 9.8 FINE TUNING OF AIRFLOW THROUGH CARTRIDGE DUST COLLECTORS

9.8.1 If your system includes a Cartridge Dust Collector, you may refer to the manufacturer's manual for adjustment procedures and general principles of operation. The following paragraphs describe how Dust Collectors with filter cartridges and "reverse pulse cleaning" interact with Empire's air blast systems.

### 9.8.2 General Principals of Operation

#### Background:

Dust Collectors generally are used to convey dust, which is not usually very abrasive. When coupled to an abrasive blast system however, these Dust Collectors may experience greater wear (especially to the filter cartridges) if not adjusted properly. Ideally, to ensure the most efficient blast finishing, ALL of the broken-down media and material that is blasted off the parts should be carried away immediately. Otherwise you will be blasting parts with a combination of good media and dust, which is not as efficient. This collection of waste products consists of very fine particles that are somewhat abrasive. **THEY MAY BE VERY DAMAGING TO THE FILTER CARTRIDGES IF THE SYSTEM IS NOT PROPERLY ADJUSTED.** The following required adjustments are important:

### 9.8.3 Adjusting Airflow using the Slide Gate

A new Dust Collector with new filter cartridges has the ability to pass TOO MUCH air initially. The slide gate on the outlet of the Dust Collector should be set AT LEAST 50% closed.

This setting may be adjusted if Blast Cabinet visibility is poor, or if the blasted media is not adequately conveying up to the Reclaimer. The slide gate may need to be opened slightly as the filter cartridges get seasoned.

### 9.8.4 "Seasoning" the Cartridges

Although "seasoning" is not a Dust Collector adjustment, it is an important concept to understand since the other adjustments presented here all may affect successful seasoning of the cartridges.

Many Cartridge Dust Collectors are shipped directly to the customer since they are not required to performance test the blast system at Empire. We have dedicated in-house Dust Collectors for use when testing new machines. Since they are shipped direct, the cartridges are totally CLEAN when first put into service. **THEY MUST BE "SEASONED"**, which means they must pick up a natural coating of dust. This is achieved during the first few days of operation. This natural coating is necessary to the proper performance of the filter cartridges.

9.8.5 “Delta-P” (Pressure Drop) Across the Cartridges

A sufficiently thick coating of dust must build up on the cartridges to cause a pressure drop of 2” to 3” as read on the magnehelic or photohelic gages on the Dust Collector. Cartridges that are too clean do not filter well and may be damaged.

9.8.6 Reverse Pulse Cleaning

The Dust Collectors clean the filter cartridges by sending large pulses of air in the opposite direction (back down through the cartridge) to “puff out” and blow the dust off.

**TOO MUCH PULSING IS UNNECESSARY. IT WASTES COMPRESSED AIR AND MONEY, AND PREVENTS THE FILTER CARTRIDGES FROM GETTING PROPERLY SEASONED.**

Dust Collector with Magnehelic Gage

The Reverse Pulse feature is always on. The only control over the frequency of pulsing is a timer which usually sets the Dust Collectors to pulse every 10 seconds. The maximum duration between pulses possible is 30 seconds. **SET THE PULSE INTERVAL TO 30 SECONDS.** You may have to adjust back to more-frequent pulses if the pressure drop across the cartridges starts to exceed 3 inches.

Dust Collector with Photohelic Gage

This control gives the operator the ability to adjust the pulsing of the Dust Collector. Instead of the pulsing timer being on all the time, the photohelic gage senses the pressure drop across the filters and only energizes the timer when the pressure drop gets too high indicating that the cartridges are dirty. **THE RECOMMENDED SETTING IS 2 INCHES TO 4 INCHES.** When adjusted this way, the pulsing won’t happen until the cartridges experience more than 4 inches of pressure drop. They will keep cleaning until the pressure drop comes down to 2 inches. With this control system, the factory setting of 10 seconds between pulses is acceptable. **This type of control system is the most cost-effective, and results in the longest-possible filter life.** If your Dust Collector wasn’t purchased with a Photohelic Gage, they may be added at a later date.

**NOTE:** Proper operation of the pulse sequencing on photohelic systems depends upon maintaining constant power to the Pulse Timer Package. This guarantees that the cartridges are pulse-cleaned in the proper order. Without constant power, the control package has no memory to tell it which cartridge was cleaned last. It will always start over by cleaning Cartridge #1 when the Pulse Timer is energized. As such, the other cartridges may never get cleaned.

9.9 NOZZLE DIAMETER AND AIR JET SIZE

9.9.1 The nozzle orifice size is normally twice the size of the air jet orifice size.

**EXAMPLE:** A 5/32" air jet will be used with a 5/16" nozzle.

A drill bit may be used to measure the orifice sizes. If the nozzle diameter increases by 1/16" or more, replace it.

9.9.2 The air jet must be checked for wear every 80 hours of blast time. Erosion of the air jet tip will disrupt airflow inside of the suction gun body. Change the air jet when uneven erosion is present.

10.0 OPERATIONAL PROBLEMS AND SOLUTIONS

The following recommendations may help locate and solve system problems.

10.1 SYSTEM WILL NOT START

1. Main Electric Disconnect open.
2. Blown supply fuse.
3. Blown control fuse.
4. Tripped Blower Motor Starter and/or Blower Motor bad.

10.2 NO BLAST

1. Main air supply valve off.
2. Individual nozzle air valve off.
3. Blast Pressure Regulator set to zero.
4. Air jet plugged.
5. "BLAST" selector switch "OFF".
6. Faulty solenoid.
7. Door open or limit switch not made.

10.3 BLAST AIR WITHOUT MEDIA

1. Storage Hopper is empty. Must be ½ full minimum.
2. Damp media.
3. Media hose is out of Media Regulator, hole in hose, or hole in suction gun.
4. Media hose not inserted to proper air gap in Media Regulator.
5. Media hose not installed or sealed in Suction Blast Gun.
6. Worn nozzle air jet.
7. Hole in air jet.
8. Media hose clogged.

10.4 BLAST WITH PARTIAL COVERAGE

1. Low level in Storage Hopper.
2. Damp media.
3. Loose media hose in Media Regulator or Suction Blast Gun.
4. Mandrel speed set incorrectly.
5. Partially clogged nozzle.
6. Low Blast Pressure.
7. Nozzle direction adjustment.
8. Media flow too rich.

10.5 MANDREL WILL NOT RUN

1. Mandrel speed potentiometer set too slow.
2. Door open or limit switch not made.
3. Drive tension too light or chain has jumped off pulleys.
4. Bearing failure.
5. Internal adjustments on DC Motor Control Board (MIN, MAX, IR, CL, ACCEL, DECEL). See Manufacturer's literature.
6. Blown control fuse.
7. DC Motor Control Board failure.

10.6 (N/A)

10.7 (N/A)

10.8 OSCILLATOR WILL NOT RUN

1. Oscillator speed potentiometer set too slow.
2. Door open or limit switch not made.
3. Timer or Counter set to zero.
4. Oscillator movement restricted.
5. Internal adjustments on DC Motor Control Board (MIN, MAX, IR, CL, ACCEL, DECEL). See Manufacturer's literature.
6. Blown control fuse.
7. DC Motor Control Board failure.
8. Check for the red brake light on the DC Motor Control Board. If it is illuminated, there is no run signal. See Electrical Drawings and Manufacturer's literature.

10.9 BLAST CABINET CONE FULL OF MEDIA - MUST BE REMOVED FROM CABINET

1. Hole in recovery duct, dust hose, Reclaimer door open, Storage Hopper door open or Dust Collector door open.
2. Dust filters clogged or filter cleaning system not functional.
3. Too much media flow.
4. Media too large for conveying system.
5. Media level in Storage Hopper Low.
6. Debris blocking opening(s) to pickup tube.

11.0 SUGGESTED SPARE PARTS

This list is recommended for "ON HAND" stock parts. Maintaining these parts in your stock will reduce down time for replacement of normal wear items.

11.1 EXPECTED WEAR ITEMS (for 1000 Hours of Blasting)

<u>Quantity</u>	<u>Description</u>	<u>Stock Number</u>
1	Window	510401
1	Window Gasket	524451
4	Light Globes	532621
100 Ft.	5/8" Blast Hose	520802
50 Ft.	1/2" Air Hose	520861

**NOTE:** Your system has 6 MH-3 Blast Guns with 3/8" diameter di-carb nozzles which use 3/16" air jets. Refer to Figure 2 for additional component information.

2	Gun body, MH-3	752353
4	Gasket	523983
6	Air Jet	505733
18	Nozzle	503573

**IMPORTANT:** Always state the serial number of your system with your order for spare parts. Your serial number for this system is E10020.

11.2 SUGGESTED MAINTENANCE PARTS

If continuous operation is critical, we recommend that these items be stocked. They may not be available for immediate delivery from Empire.

<u>Quantity</u>	<u>Description</u>	<u>Stock Number</u>
1	25 Ft. Heavy-Duty Recovery Hose	515921
1	15 Ft. Dust Hose (10")	516999
2	Light Fixture	532601
1	Door Limit Switch	534418
1	Proximity Switch, Osc	534993
1	Proximity Sensor, Hopper	600883
1	2" Air Regulator	340085
1	2" Filter/Separator	504662
1	* Replacement Element	508022
1	* "O" Ring and Gasket Kit	508122
1	2" Aquamatic Valve	518423
1	Repair Kit	518911
1	Solenoid Valve	340200-1
3	Blowoff Nozzle	503503
2	Limit Switch, Roller Assembly	534323
1	60 to 1 Reducer, Roller Assembly	571472
1	Reducer, Part Rotation	10020-88
2	Rotary Air Union	10017-142
2	V-Groove Wheel, Oscillator	01560-R30
1	5 to 1 Ratio Multiplier	549614
1	DC Motor, 1/4 HP	549923-10020



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2	Compression Spring, 2 ½"lg	10020-58
2	Flange Bearing	H571095
4	Crown Roller	97557-N22
2	Air Cylinder, Osc.	10020-54
4	Stilson Hold Down Roller	10020-55
2	DC Motor Controller	535003
3	Disconnect Fuse	532944
3	Motor Branch Fuse	532938
2	Transformer Primary Fuse	532231
3	DC Power Supply Fuse	532405
1	Control Fuse 10A	532376
1	Control Fuse 6A	532378
3	DC Controller Fuse 4Amp	532413

12.0 REFERENCE DRAWINGS

12.1 STANDARD ASSEMBLIES

<u>Description</u>	<u>Drawing No.</u>
System Bill of Materials	B/M #10020
System Assembly	D10020-A
Cabinet Assembly	D10020-C
Roller Assembly	D10020-R
Oscillation Assembly	D10020-N
Blow Off Assembly	B10020-B
Suction Blast Gun Assembly	B803378X
Storage Hopper Assembly	D806997X
1200 CFM Reclaimer with Ultrawear	D806942X
Pipe String Assembly	D966057X
Electrical Assembly	D10020-E

12.2 OPTIONAL COMPONENTS AS SUPPLIED

<u>Description</u>	<u>Drawing No.</u>
Wiring for Timer Option with Photohelic Gauge	B992012X

**IMPORTANT:** Always state the serial number of your system with your order for spare parts. Your serial number for this system is E10020

### 13.0 WARRANTY

Empire Abrasive Equipment Company (Empire) warrants all parts and equipment in “Normal Use and Service” against defects in material and workmanship, to the original purchaser, for fourteen (14) months after shipment, or for twelve (12) months after installation, whichever comes first.

“Normal Use and Service” is defined as an average of 8 hours of operation per day, 5 days per week. Be advised that for equipment operated more hours than that, it is incumbent upon the operators to perform more frequent inspections and maintenance to guard against premature wear. All components located within the blast chamber are especially vulnerable to wear and should be inspected daily.

Components that are determined by Empire to be defective within the warranty period will be replaced or repaired at the factory at NO CHARGE.

### 13.1 LIMITATIONS OF WARRANTY

13.1.1. Warranty does not apply to the normal wear of nozzles, blast hose, Reclaimer, or other components exposed to or in contact with the blast media.

13.1.2. Recommended maintenance schedules must be followed in order to validate the warranty. For equipment operated in excess of the “Normal Use and Service” as defined above, maintenance schedules must be adjusted to perform more frequent inspections and preventative maintenance.

13.1.3. Warranty is void if unauthorized service, repair or alteration has been made.

13.1.4. Warranty does not cover misapplication of products.

13.1.5. Empire neither assumes nor authorizes anyone else to assume additional liability in connection with the sale of this product.

13.1.6. Transportation costs from the factory, as well as installation costs, are excluded from the Warranty and are to be paid by the purchaser.

13.1.7. A Returned Materials Authorization (RMA) form must be obtained from Empire, **FILLED OUT COMPLETELY** and must accompany the returned goods. Returned goods will not be accepted unless agreed to in advance by Empire.

13.1.8 Empire makes no warranty whatsoever in respect to parts not supplied by Empire. USE ONLY GENUINE EMPIRE REPLACEMENT PARTS or warranty may be voided.

13.1.9 Commercial parts not manufactured by Empire will be warranted to the extent warranted by the original manufacturer.