KEEP THIS MANUAL WITH THE PERSONS RESPONSIBLE FOR THE OPERATION AND MAINTENANCE OF THIS MACHINE, AND FOR THE ORDERING OF REPAIR PARTS.

OPERATION, MAINTENANCE AND REPAIR PARTS MANUAL

MACHINE SERIAL NO.: ES1923/S890714 ROTOBLAST CABINET

PANGBORN S.O. NO.: 301-9200

CUSTOMER ORDER NO.: 53035-LW

CUSTOMER: A.C.F. INDUSTRIES
MILTON, PA. 17847

REPAIR PARTS ORDERING

WHEN ORDERING REPAIR PARTS, SPECIFY MACHINE SERIAL NO.

SEND ORDERS TO:

ORDER ENTRY DEPARTMENT
PANGBORN CORPORATION
P.O. BOX 380
HAGERSTOWN, MD 21741-0380

PARTS ORDERING: 1-800-638-3046
OTHER ASSISTANCE: 1-301-739-3500

DO NOT ORDER BY ITEM NUMBER

ORDER BY PART NUMBER ONLY

LUBRICATION

BLAST CLEANING MACHINES

PROPER LUBRICATION IS NECESSARY TO INSURE SATISFACTORY SERVICE. WHERE THERE IS NO AUTOMATIC LUBRICATION SYSTEM, A REGULAR SCHEDULE MUST BE SET UP FOR MANUAL LUBRICATION USING THE RECOMMENDATIONS BELOW. LUBRICANTS SHOWN ARE MOBILE, EXXON, TEXACO, AND SHELL PRODUCTS. LUBRICANTS BY SUPPLIERS OTHER THAN THOSE SHOWN MAY BE SUBSTITUTED IF THEIR PRODUCTS MEET OR EXCEED THE SPECIFICATIONS OF THOSE SHOWN. DO NOT MIX DIFFERENT TYPE GREASES WITHOUT FIRST CHECKING THEIR COMPATIBILITY.

UNIT	LUB. METHOD	SERVICE PERIOD	SUPPLIER	LUBRICANT
ROTOBLAST SPINDLE (WITH FEEDER BLOCK)	FEEDER BLOCK	LUBRICATE PER INSTRUCTIONS ON ROTO-BLAST SPINDLE HOUSING	MOBIL EXXON TEXACO SHELL	MOBILUX NO. EP-2 FOR OPERATING LIDOK EP-2 TEMP. -20°F MULTIFAX NO. EP-2 TO 200°F ALVANIA NO. EP-2
ROTOBLAST SPINDLE (WITH LUBE FITTINGS)	FITTINGS (NO FEEDER BLOCK)	LUBRICATE WEEKLY OR SEMI-WEEKLY AS SPECIFIED IN OPERATING INSTRUCTIONS	MOBIL	MOBILTEMP # 2 FOR OPERATING TEMP. 200°F TO 225°F (DO NOT ADD TO OTHER TYPE GREASES)
ROTOBLAST SPINDLE	OIL MIST	DAILY	MOBIL	MOBIL MIST LUBE 27
SPROCKET & CHAINS -OPEN IN BLAST AREAS	SPRAY MIST PREFERABLY	WEEKLY	MOBIL	MIXTURE OF 25% D.T.E. 24 AND 75% PENETRATING OIL
MISC. BEARINGS	FITTINGS	MONTHLY	XXX	SAME AS ROTOBLAST SPINDLE SEE ABOVE
MOTOR BEARINGS	LUBRICATE ACCORDING TO MANUFACTURERS' SERVICE MANUAL INCLUDED IN THE PANGBORN OPERATING AND MAINTENANCE INSTRUCTIONS MANUAL.			
GEAR HEAD MOTORS				
WORM GEARS				
EXHAUSTER BEARINGS				

IMPORTANT NOTICE
REGARDING HAZARDOUS MATERIALS

The following is the minimum safety precautions to be taken when cleaning aluminum, magnesium, titanium and similar metal parts.

Blast cleaning of the above metals may produce a potentially hazardous condition due to the presence of fine metallic dust. It is the user's responsibility to determine the degree of hazard involved and whether or not the environment in which the machine will be used requires the application of Article 500 of the National Electric Code.

USER MUST INSURE THAT:

A. Before adding abrasive to the machine, all pockets and dead spaces in the cabinet and abrasive system are filled with a noncombustible inert material.

B. No open flame, smoking, electric or gas cutting or welding is permitted in the area where such fine hazardous dusts are produced or exist.

C. Good housekeeping is practiced in the entire work area. The floors, exposed structural members, piping, conduit and duct work shall be kept free of dust.

D. The blast machine is equipped with safety devices, such as pressure relief panels or work opening seals which act as pressure relief, and vacuum sensing switch. (DO NOT OBSTRUCT OR ALTER PANEL OR SEALS.)

E. Duct work is inspected on the inside for accumulations of metallic dust as frequently as exploratory experience dictates and cleaned thoroughly as necessary. Extreme care should be exercised in dust removal to avoid the creation of a dust cloud.

F. The dust collector is equipped with safety devices such as pressure relief panels, spark resistant fan, grounded bags, rotary valve, fire extinguisher system, etc. per the insurance underwriter recommendations, or any applicable codes.

G. The equipment, its location, and operation complies with any applicable state or local codes and/or ordinances.

H. Blast machine DOES NOT become contaminated with combustibles such as paper, wood, oil, etc.

WRITTEN	GGS.	REVISED	DGC 5/22/87
CHECKED	T.H.M.	REVISED	DGC 5/22/87
APPROVED	J.E.B.		
DATE	5/24/78		

EXHAUST SYSTEM

Precautions must be taken in the design and operation of fume collection and exhaust systems to protect against the occurrence in them of fires, explosions, or generation of toxic chemicals. The first step needed is to analyze the entire process to determine whether a hazardous condition can be expected. The precautions to be taken depend on the nature of the hazard and on the design of the exhaust system, particularly the dust collector.

Make sure all exhaust duct work volumes from blast machine are properly set. For correct volumes, refer to the general arrangement drawing.

Make sure that the vacuum sensing device in the exhaust duct work, at the machine, is always working and will stop the machine if the static pressure is below a pre-set point.

Balance the exhaust system to the stipulated exhaust volumes for the blast machine. Set the vacuum sensing switch for 80% of the static pressure measured at the point of monitoring. Insure the tubing is connected to the low pressure port on the sensing switch. (High pressure port should be open to atmosphere.)

System components must be electrically grounded.

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PANGBORN

PANGBORN CORPORATION

P. O. Box 380
301-739-3500

FAX #301-739-2279

Hagerstown, Maryland 21741-0380
Telex: 198190

INSTALLATION, OPERATING, AND MAINTENANCE INSTRUCTIONS

FOR

ES-1923 ROTOBLAST - DESCALING MACHINE

CUSTOMER ORDER NO. 5035LW

PANGBORN ORDER NO. 301-9200

ACF INDUSTRIES

2ND AND ARCH STREETS

MILTON, PA 17847

WRITTEN MJS REVISED _____
CHECKED ✓
APPROVED _____
DATE _____

1.0 REFERENCE DRAWINGS

See Equipment Summary Sheet S-890714

2.0 GENERAL SPECIFICATIONS

Material to be handled: Steel Plate

SIZE	MINIMUM	MAXIMUM
Thickness	1/4"	1-1/4"
Width	4'-4"	12'-10"
Length	10'-0"	36'-6"
Weight		15,600 lbs.

Three most common sizes:
4'-4" wide x 10'-0" long x 1-1/4" thick -- 2,200 lbs.
12'-5" wide x 12'-5" long x 1-1/4" thick -- 7,900 lbs.
12'-10" wide x 36'-6" long x 13/16" thick -- 15,600 lbs.

Operation performed -- to descale top and bottom surfaces of plates. The cleaning shall be to a white metal finish as defined by the Steel Structures Painting Council specification SSPC-5.

Total HP for all drives (blast machine) -- 175

Ventilation requirements -- 6,700 CFM at 3500 FPM

Total machine electrical power requirements -- approximately 310 AMPS at full load, 460 volt, 3 Phase, 60 Hertz

Recommended abrasive -- S-280 or S-330

Abrasive amount required to charge system -- 25,000 lb.

Compressed air requirements --
Blast Cabinet (gates and blow-off) -- 245 SCFM at 75 PSIG
Dust Collector (cartridge blow-down) -- 7.2 SCFM at 90 PSIG

3.0 GENERAL MACHINE INTRODUCTION

The Pangborn ES-1923 type Rotoblast machine is designed to descale individual steel plates as specified in Section 2.0.

The basic machine consists of a cabinet containing an entrance vestibule, a blast compartment with six Rotoblast units and a brush-off/blow-off compartment with a lateral brush and blow-off manifold, an abrasive handling system, a complete conveyor system, and load/unload vacuum lifts.

3.0 GENERAL MACHINE INTRODUCTION -- continued

CAUTION REGARDING HAZARDOUS MATERIALS:

ABRASIVE BLASTING OF ALUMINUM, MAGNESIUM, TITANIUM AND SIMILAR PARTS CAN PRODUCE DUSTS WHICH ARE FLAMMABLE OR EXPLOSIVE. PANGBORN CAN FURNISH CERTAIN FEATURES IN THIS MACHINE WHICH WILL MITIGATE THE POTENTIAL RESULTS OF HANDLING THESE DUSTS.

IN THE EVENT THAT YOUR PLANT CONDITIONS SURROUNDING THESE MACHINES ARE SUCH THAT CONDUCTIVE METALLIC DUST MIGHT BE PRESENT IN QUANTITIES GREAT ENOUGH TO REQUIRE THE APPLICATION OF ARTICLE 500 OF THE NATIONAL ELECTRIC CODE, WHICH IS ADOPTED BY OSHA, UPON NOTIFICATION, PANGBORN WILL BE GLAD TO QUOTE THE ELECTRICAL CONTROLS, COMPONENTS, MOTORS, AND ENCLOSURES WHICH COMPLY WITH NEC GROUP II, CLASS E.

IF YOU DETERMINE THAT THE ENVIRONMENTAL ENVELOPE SURROUNDING THIS MACHINE DOES NOT REQUIRE THE APPLICATION OF ARTICLE 500, THEN, SINCE THESE MACHINES ARE CONSIDERED BY PANGBORN TO BE ADEQUATELY ENCLOSED AND PROPERLY VENTILATED AND INTERLOCKED TO A DUST COLLECTION SYSTEM, WE FEEL THAT NEMA 12 DUST TIGHT ENCLOSURES, COMPONENTS AND CONTROLS AS WELL AS TOTALLY ENCLOSED MOTORS ARE ADEQUATE FOR THIS APPLICATION.

4.0 SPECIFIC SYSTEM DESCRIPTION

4.1 FOUNDATION

The foundation as shown on dwg. L-890464 is provided in its entirety by the contractor. This includes all anchor bolts for mounting machine and conveyor supports and for machine loads as noted on drawing.

4.2 CABINET AND WEAR PLATING

The cabinet serves as the supporting structure for the Rotoblast units, as well as an enclosure to confine the abrasive blast action. The cabinet consists of an entrance vestibule, a blast compartment and a brush-off/blow-off compartment. The blast compartment is fabricated of manganese steel plate. The brush-off/blow-off and the entrance vestibule are fabricated of mild steel.

The work openings located in the entrance vestibule, the entrance and exit to the blast compartment and the exit end of the brush-off/blow-off are 6" high and 162" long. All openings are provided with two sets each of slit rubber seals to minimize the escape of rebounding abrasive.

Access to the interior of the blast compartment is accomplished through three hinged doors. The brush-off/blow-off compartment is also provided with two hinged access doors. A limit switch is provided for each hinged access door and is electrically interlocked to prevent starting of the Rotoblast units if any door is open.

WARNING: THE MACHINE MUST NEVER BE ENTERED AND NO DOOR OPENED UNTIL THE NECESSARY Z.M.S. PROCEDURE (REF. SECTION 5.3) HAS BEEN FOLLOWED. SERVICE ACCESS DOORS MUST NOT BE USED FOR ANY PURPOSE EXCEPT INSPECTION AND MAINTENANCE OF THE BLAST MACHINE.

4.2 CABINET AND WEAR PLATING -- continued

The blast compartment is constructed with 3/8" thick manganese steel. An extra layer of 1/2" thick manganese steel is provided on the sides and ceiling in line with the Rotoblast streams.

Located integral with the cabinet is a ventilation take-off opening complete with removable manganese angles. Air being drawn from the blast compartment passes through these grid angles into the vent hood. The air then decreases in velocity to enable heavy abrasive particles to drop and dust particles to continue through the vent hood. All duct work from vent connection to dust collector is provided by the contractor.

The cabinet flooring consists of removable steel bar grating sections, completely covering the hopper area.

4.3 ROTOBLAST UNITS

Six 240DD-4RI Rotoblast units are mounted on the cabinet to provide the blasting action. Each Rotoblast unit is directly driven from a 25 HP, 1800 RPM, frame 284TSC motor.

For instructions for checking Rotoblast amperage and additional information on the Rotoblast units, see the Rotoblast section of this manual.

4.4 BRUSH-OFF/BLOW-OFF ASSEMBLY

The brush-off/blow-off assembly consists of a lateral brush and blow-off manifold mounted in a frame and attached to a counterweight lift mechanism. The lateral brush is made of segments of stainless steel wire bristles mounted on a steel clip and attached to a belt which travels on rollers in the structural frame. The brush mechanism is driven by a 5 HP, 1200 RPM 215TC frame motor.

The abrasive blow-off consists of a manifold with ten air nozzles controlled by a normally closed, two-way, solenoid valve. Customer to supply clean, dry air to the 1.500 NPT solenoid valve located on the blow-off compartment wall. See section 2.0 for compressed air requirements.

The lift mechanism is controlled by a counterweight system located on top of the blow-off compartment. Customer to fill counterweight containers with used abrasive or equivalent to balance the system. The brush-off/blow-off frame assembly must raise and lower freely with very little force.

4.5 LOWER ABRASIVE SYSTEM

4.5.1 REPLENISHER

An 8 cu. ft. replenisher is provided to allow abrasive to be fed into the system as needed. A low level indicator mounted on the storage bin is actuated when abrasive in that bin becomes too low. At this time, the abrasive gate under the replenisher opens and allows abrasive to be fed directly to the elevator where it enters the abrasive system. When abrasive in the storage bin has built back up to a normal level again, the indicator signals the gate under the replenisher to close.

4.5.2 HOPPERS

As the work is cleaned, the abrasive and debris fall by gravity through the flooring into the hopper where the abrasive is conveyed by a 14" "JG" screw conveyor and discharged into the elevator boot.

4.6 UPPER ABRASIVE SYSTEM

4.6.1 ELEVATOR

A #6 "IF" elevator is provided for conveying abrasive and refuse to the separating system. The elevator is a belt and bucket type, completely enclosed in a dust and abrasive tight casing, with a reinforced rubber belt and metal buckets.

A lift-off inspection door is provided on the side of the elevator casing, accessible from the floor. All elevator doors must be closed during operation.

The elevator drive is located at the elevator head casing and consists of a 7.5 HP, 1800 RPM motor, shaft-mounted reducer and belt drive.

A screw take-up is provided in the elevator head section to maintain proper belt tension.

The abrasive and refuse from the elevator are discharged from the elevator head into the elevator discharge spout. Located at the wear lip area of the discharge spout is a removable steel wear plate. For additional information on the elevator, see elevator section of this manual.

4.6.2 SEPARATOR

The #4 "BEH" separator assembly consists of a distributing screw driven by a 5 HP, 1800 RPM frame 184T motor.

The distributing conveyor receives the used abrasive and refuse from the elevator discharge spout. The material received from the distributing conveyor is deposited behind the air-operated metering gate. The air-operated, probe controlled metering gate is set and locked in pre-determined positions for operating four or six Rotoblast units, to provide a uniform curtain of material across the full width of the airwash section.

The abrasive mixture curtain falling from the separator lip passes through the airwash zone. Air being drawn to the dust collector passes through the curtain, carrying dust and airborne fines into a collection hopper for discharge. Two adjustable skimmer plates are located in the separator below the lip. The primary (top) skimmer plate is adjusted to divert to the dust collector only the portion of fines not containing good abrasive. The secondary skimmer plate is adjusted to divert a small portion of the abrasive containing any unremoved contaminants. The abrasive/contaminant mixture collected by the second skimmer plate is then recirculated through the abrasive handling system.

4.6.2 SEPARATOR -- continued

The usable abrasive from the airwash sections falls through screen trays which retain any coarse refuse that may still be mixed with the good abrasive. These trays must be inspected periodically and cleaned if necessary.

The fine refuse spout from the airwash casing is a flexible metal tube. This spout terminates at the customer's refuse receptacle. For additional information on the airwash separator, see separator section of this manual.

4.6.3 STORAGE BIN, SPOUTS, AND ABRASIVE GATE ASSEMBLY

The good, clean, usable abrasive from the separators flows into the storage bin. The storage bin has a 100 cubic feet capacity and is fabricated from 1/4" steel plate. The abrasive is then stored in the bin for distribution through the abrasive gates and into the gravity feed spouts to each Rotoblast unit.

The abrasive gates are equipped with an individually manual cut-off gate and an air-operated slide plate which is opened and closed by a solenoid controlled air cylinder. Compressed air at approximately 80 PSI must be maintained at the solenoid valve for proper operation.

4.6.4 SUPERSTRUCTURE AND ACCESS PLATFORM

The superstructure is provided to support and provide access to the upper abrasive system, for separator service, and elevator head and drive service. Safety railing is provided around the service platform with a ladder for access from the floor.

4.7 WORK CONVEYOR SYSTEM

4.7.1 LOAD CONVEYOR

The load conveyor is 40 feet long and the total effective width is 14'-0" consisting of two lanes with a 6'-6" effective width per lane. Each lane consists of 28 rollers with 3 1/2" diameter rollers spaced on 18" centers. Adjustments to the vacuum lift limit switches will insure proper placement of plates onto conveyor bed. Located near the entrance vestibule are two work present switches provided to sense the width of work and start the proper number of Rotoblast units depending on the width of work. For additional information, see "NORMAL START-UP" section of this manual.

4.7.2 CABINET CONVEYOR

Located in the cabinet are six work conveyor rollers. One 6 5/8" diameter roll is located in the entrance vestibule. Three 6 5/8" diameter rolls, made of abrasive resistant steel, are location in the blast compartment. And two 6 5/8" diameter rolls are located in the brush-off/blow-off compartment.

4.7.3 UNLOAD CONVEYOR

The unload conveyor is 40 feet long and the total effective width is 14'-0" consisting of two lanes with a 6'-6" effective width per lane. Each lane consists of 28 rollers with 3 1/2" diameter rollers spaced on 18" centers. The unload conveyor will stop when the plate has reached the proper position to be removed by the unload vacuum lift. This process will be controlled by the sensor switch assembly (conveyor clock) located at the work conveyor roller in the entrance vestibule.

4.7.4 WORK CONVEYOR DRIVES

There are three variable speed conveyor drives. Each driven by a 1 HP, 1800 RPM frame 184C D.C. motor. All drives have a variable control speed range of 2 to 10 FPM. The one drive unit drives the load conveyor and one drives the cabinet conveyor. The other unit drives the unload conveyor.

4.8 WORK LOAD AND UNLOAD SYSTEM

Two vacuum lift transfers are used to load and unload the infeed and exit conveyors. The feed stack is to be positioned along side the load conveyor by transfer cars, supplied by customer. The length of material is to be centered between the 37'-9" span runways regardless of length of material variation in stack. The leading edge of the material's width is always to be located at a constant position regardless of width of material variation in stack.

The operator will infeed the stacked material data into the controls and energize the automatic cycle, whereas the following automatic sequence shall occur.

NOTE: THE AUTOMATIC CYCLE WILL ONLY PROCESS THE THREE COMMON SIZES AS SPECIFIED BY CUSTOMER TO BE THE FOLLOWING:
4'-4" wide x 10'-0" long x 1 1/4" thick -- 2,220 lbs.
12'-5" wide x 12'-5" long x 1 1/4" thick -- 7,900 lbs.
12'-10" wide x 36'-6" long x 13/16" thick -- 15,600 lbs.

Customer to be aware that plate sizes other than those listed above may require manual adjustments.

Depending on material width and length of plate to be transferred, the vacuum pad selection valves will turn off unnecessary pads to the vacuum source. The vacuum load beam will lower (5'-0" maximum) and attach to top plate, raise to travel height and travel 16'-11 1/2", lower load until the load conveyor is contacted, release load, raise to travel height, travel 16'-11 1/2" to home position and repeat cycle until stack is depleted.

The unload vacuum lift transfer will automatically retrieve and stack plates after they exit the blast cabinet. The plate pick-up location on the unload conveyor will be controlled by the sensor switch assembly (conveyor clock) located at the work conveyor roller in the entrance vestibule.

The bridge drive is a direct, dual axle which consists of a reducer, 1.6 HP brakemotor, shafts, bearings and couplings. The drive speed is approximately 20 FPM. The bridge has an end truck mounted crane bumpers for extreme travel protection. Crane rails are 40 lbs./yd. ASCE rails.

4.8 WORK LOAD AND UNLOAD SYSTEM -- continued

The vertical lift consists of a 11.5 HP driven cone drive reducer and dual wire rope drums to allow four point suspension of the vacuum load beam. The reeving is such to minimize "sway" and insure level raise and lower operation in spite of off-center loading requirements. The lift/lower speed will be approximately 15 FPM single speed.

The vacuum pump is driven by a 3 HP motor. The vacuum load beam is a welded and bolted structure approximately 12'-0" wide x 32'-0" long and incorporates 18, three point chain suspended vacuum pads. The pads have fixed positions with control valves to automatically control pad selection for the three specified plate sizes. Customer to be aware that plate sizes other than the three specified plate sizes (section 2.0) may require manual adjustments.

4.9 VENTILATION

A 20CP5RP dust collector is provided to handle machine ventilation with a minimum requirement of 6,700 cubic feet per minute and a duct velocity of 3,500 nominal feet per minute. All ventilation duct work is provided by the contractor. Blast gates mounted to the vent hood to be provided the contractor. Separator blast gates are provided and mounted by Pangborn. Reference - ductwork arrangement drawing number L-890556 for vent sizes and locations.

5.0 ERECTION, SAFETY AND OPERATING INSTRUCTIONS

5.1 ERECTION INSTRUCTIONS

The following is offered as a suggested general procedure for erecting the ES-1923 Rotoblast machine. It is general in nature due to variable conditions in the customer's plant that are beyond our control.

The erector(s) should always refer to the general arrangement drawing and appropriate assembly drawings for specific details and information.

When installing any components requiring abrasive tight fit, always use sealing tape or mastic.

5.1.1 Buyer must prepare a level foundation with necessary reinforcing, waterproofing, etc. as required by local conditions in accordance with foundation drawing number, L-890464.

5.1.2 When the machine arrives, assign it to a weather protected area. A minimum of protection would be to cover all machine operating parts with a tarpaulin. All parts should be stored in one general area, if possible, near the site the machine will occupy. Electrical components should be sealed in air-tight bags such as polyethylene.

5.1.3 It is intended that the cabinet be pre-assembled with rolls, seals, wear plates, lower Rotoblast units, cabinet flooring and all access doors installed. Set the cabinet on its anchor bolts and assemble any of the above mentioned items that may not have been pre-assembled. Insure that all components are securely assembled and aligned, and not adversely affected by shipment and/or handling.

5.1.4 It is also intended that the brush-off/blow-off compartment be pre-assembled with rolls, seals, lift frame with brush and blow-off manifold, and access doors installed. Set compartment on anchor bolts and bolt to blast compartment and field weld.

5.1.5 Assemble collecting hoppers to bottom of brush-off/blow-off compartment.

5.1.6 Lower elevator boot section into pit and onto anchor bolts, using shims if necessary.

5.1.7 Install screw conveyor trough between cabinet and elevator and connect screw. Use mastic to seal joints.

5.1.8 Install all Rotoblast units with motor.

5.1.9 Erect lower elevator casing with vent connect. Plumb and bolt to elevator boot and cabinet.

5.1.10 Install platform section with storage bin. Bolt in place and field weld.

5.1.11 Install elevator intermediate elevator casing.

5.1.12 Install upper platform with elevator casing.

5.1.13 Install complete separator using mastic between bottom surface of airwash casing, storage bin, and other joints.

5.1.14 Install elevator head, drive and discharge spout, using mastic between joints. Align and bolt discharge spout to the feed screw trough and plumb entire elevator casing.

5.1.15 Plumb the center of the elevator head pulley to the center of the elevator boot pulley. Adjust as required. Install the elevator belt with buckets, keeping the boot take-up in full up position.

5.1.16 Install railing and ladder for platform.

5.1.17 Install replenisher.

5.1.18 Set all conveyor support beams on anchor bolts, level and grout. See drawing L-890567 for pass line height.

5.1.19 In load conveyor area install work present switch assembly per L-890567.

5.1.20 Install crane runway supports, runways and crane rails. Crane rails are to be level within ± 1/4" in 60'-0". Crane rails are to be parallel to each other within ± 1/8". Do not weld crane rails to runways until entire rail is aligned and level.

5.1.21 Install load and unload vacuum lift transfers being sure to keep the festooning systems toward the blast cabinet as shown on drawing L-890557.

5.1.22 Install chains, sprocket, conveyor drives, and guards.

5.1.23 Install blow-off assembly.

5.1.24 Install all abrasive gates and spouts, hoses, etc.

5.1.25 Check and align all drive systems, then install all drive guards.

5.1.26 Install ventilation duct work and pneumatic piping.

5.1.27 Install electrical conduit. Run wiring according to wiring diagram.

5.1.28 Grout or weld shims to machine as installed.

5.1.29 Check all reducers for proper oil level.

5.1.30 Check lubrication points for proper lubricant.

5.1.31 Insure that all safety signs, cover plates, and access panels are in place.

5.1.32 Install all other contractor supplied items - refuse bin, guardrail (if required), etc.

5.1.33 Some important points which should be reiterated are:

5.1.33.1 All joints which required sealing (such as elevator, separator, etc.) should be sealed dust-tight with sealing tape, roofing cement, mastic, or other suitable material.

5.1.33.2 Be certain that all components are level and to the proper height as specified on the drawings.

5.1.33.3 Take care to insure that the elevator is plumb.

5.1.33.4 Prior to start-up, be certain that all maintenance, safety, and initial start-up procedures in the machine operator's manual have been adhered to.

5.2 SAFETY CHECKLIST

(Use safety checklist on initial start-up and after each periodic maintenance.)

WARNING: WEAR APPROVED SAFETY GLASSES WITH SIDE SHIELDS. MAKE SURE THAT Z.M.S. PROCEDURE (REF. SECTION 5.3) HAS BEEN FOLLOWED BEFORE PERFORMING ANY SERVICE OR MAINTENANCE WORK ON ANY PART OF THE MACHINE.

5.2 SAFETY CHECKLIST -- continued

Before operating the machine, careful inspection of the following items must be made:

5.2.1 Insure that limit switches are in operating condition.

5.2.2 Access door in elevator boot, elevator section, and discharge spout cover must be in place.

5.2.3 Access covers on Rotoblast units must be closed and secured.

5.2.4 All drives must have guards in place and securely fastened.

5.3 Z.M.S. (ZERO MECHANICAL STATE) PROCEDURE

5.3.1 Follow "Normal Shutdown" sequence insuring abrasive system has run sufficiently long enough to clear elevator of abrasive (three minute minimum).

5.3.2 Turn main electrical disconnect switch to "OFF" position and lock out with a padlock. Perform the following test to insure power is off.

5.3.3 Push "EXHAUSTER START" pushbutton and insure collector components are not energized.

5.3.4 Push "ABRASIVE SYSTEM START" pushbutton and insure abrasive system components are not energized.

5.3.5 Close main compressed air line valve and lock out with a padlock (customer is to provide one three-way lock-out valve to block pressure from the power source and eliminate pressure on the machine side part of the valve by venting to atmosphere).

5.3.6 To insure compressed air is locked off, manually override abrasive gate solenoid valve and insure the air cylinder is disabled.

5.3.7 Remove work from conveyor.

5.4 INITIAL START-UP

WARNING: BEFORE ATTEMPTING ANY PHASE OF THIS SECTION, ALL PERSONNEL INVOLVED IN THE INITIAL START-UP SHOULD HAVE READ AND/OR BEEN COMPLETELY AND CLEARLY INFORMED OF THE ENTIRE OPERATING INSTRUCTIONS AND MACHINE FUNCTIONS. DUE TO THE FACT THAT THIS MAY BE A DE-BUGGING OPERATION, CARE MUST BE TAKEN TO PROTECT THE EQUIPMENT AND PERSONNEL.

5.4.1 Lubricate all components per lubrication instructions for commercial components supplied by manufacturers.

5.4.2 Clear all debris from inside all components and from the general area (especially welding rods, bolts, and nuts, packing materials, etc.). Remove each auxiliary feed spout from the Rotoblast unit and locate a bucket under the abrasive gate. Reassemble the auxiliary feed spout to the Rotoblast unit.

5.4.3 Check all drives and "bump" motors to check rotation as shown on assembly drawings. Make sure all guards and covers are in place.

5.4.4 Make sure elevator belt is tight.

NOTE: ELEVATOR BELTS SHOULD BE INSTALLED WITH GRAVITY TAKE-UP ADJUSTMENTS (LOCATED IN BOOT) FULLY RAISED SO THAT A MINIMUM AMOUNT OF BELT WILL HAVE TO BE CUT OFF AFTER RUN IN AND STRETCHING. FILL (COUNTER WEIGHT) BELT TAKE-UP TROUGH WITH ABRASIVE AS REQUIRED.

5.4.5 Initially adjust all ventilation blast gates 3/4 open. After abrasive is added to the system, the blast gates will have to be finely adjusted for proper air flows.

5.4.6 Make sure all limit switches operate according to the limit switch tabulations listed on the Schematic Wiring Diagrams included in the electrical section of this manual.

5.4.7 Make sure all utilities are properly installed (duct work, compressed air, etc.) and are operational.

5.5 FILLING THE SYSTEM WITH ABRASIVE

5.5.1 Insure all covers are in place and initial start-up instructions have been strictly enforced. Observe all safety signs and wear approved safety glasses with side shields.

5.5.2 Start exhauster.

5.5.3 Start abrasive system.

5.5.4 Add clean, dry abrasive to the abrasive replenisher. Check operation of the distributing screw and elevator. Continue to pour abrasive until it fills up the primary and secondary storage bins and the replenisher abrasive gate closes. Continue to add abrasive until replenisher is full.

5.6 TARGETING THE ROTOBLAST ABRASIVE STREAM

One of the most important procedures that affects blast cleaning is the aiming or targeting of the Rotoblast units. All Rotoblast machines, regardless of design, require that each Rotoblast unit be targeted properly in order to hit the parts being cleaned.

The factors affecting targeting are:

5.6 TARGETING THE ROTOBLAST ABRASIVE STREAM -- continued

The Abrasive

The abrasive must be clean and bright, free of contaminants that can cause wheel stream distortion. Size and types of abrasive have different flow characteristics and must be considered. An abrasive operating mix of large and small particles is required for best results -- the large to break up the surface contaminants and the small particles for coverage. To maintain a desirable operating mix, additions of new abrasive of one size should not exceed 10 percent by volume of the abrasive storage bin (approximately 3400 pounds).

The Condition of the Feed Parts

If the feed parts (vanes, impeller, impeller case and feed spout) are worn, they should be replaced before targeting. Worn vanes, especially, will hold abrasive longer, affecting the concentration of abrasive in the blast stream.

The Unit Rotation

Rotoblast units provided are designed for clockwise or counterclockwise rotation. Careful attention must be given to this aspect. DO NOT arbitrarily change or mix parts. It will result in an ineffective blast pattern.

The Rotoblast Unit Speed

The speed of the Rotoblast unit greatly affects the targeting and velocity of the abrasive. Check the "Rotoblast" section in this manual for the correct unit speed for your machine.

Work Parts Orientation

The location of the parts in relation to the Rotoblast unit or units is very important; areas of the part not in line with the units will not clean properly. On multi-Rotoblast unit machines, each unit has been positioned to hit certain areas of the work. Check the Blast Stream Diagram in this manual.

Impeller Case Setting

Any change in the impeller case setting or opening will change the aim or targeting of the abrasive stream. The abrasive is fed through the opening in the impeller case onto the vanes, carried out the vanes and onto the workpiece approximately 160 degrees (depending on unit speed and other variables) from where it enters on the vanes.

There are two methods for targeting the Rotoblast unit. First, Pangborn engineering developed a drawing called the Blast Stream Diagram, using a template that simulates an actual blast stream. Each Rotoblast unit is located on the scaled drawing representing the machine and relating to the work. From this, a tentative impeller case indicator setting is determined and noted on the drawing. This drawing is provided in this manual.

5.6 TARGETING THE ROTOBLAST ABRASIVE STREAM -- continued

The final blast setting is determined by the second method of targeting that is referred to as actual or on-machine targeting.

The blast stream develops into a tear drop shape consisting of a head stream, the hot spot, and the tail stream. The hot spot contains about 35 to 40 percent of the abrasive thrown. The heavy particles of abrasive leave the unit first, and finer particles hang on the unit longer. Changes in the operating mix will change the pattern and may slow or retard the cleaning.

The Rotoblast drive motor amperage should usually be set at the nameplate maximum rating for maximum efficiency. The amperage indicates the amount of abrasive flowing through the unit.

The standard Rotoblast unit flows approximately 1500 pounds of steel abrasive per hour per horsepower, regardless of size of abrasive. If the ammeter indicates five AMPS low, then over three tons of abrasive per hour are not being used for cleaning. See Rotoblast Operating and Maintenance Data.

PROCEDURE FOR TARGETING THE ROTOBLAST ABRASIVE STREAM

To obtain the most accurate blast coverage of the work, it is necessary to run a test pattern during initial start-up of the equipment, whenever you have installed vital replacement parts, whenever a change is made in the size and type of abrasive, or whenever a decrease in productivity is apparent.

5.6.1 Each Rotoblast unit must be targeted individually. Follow the procedure as listed for each of the Rotoblast units.

WARNING: THE MACHINE MUST NOT BE ENTERED AND NO COVERS OPENED UNTIL THE MACHINE IS STOPPED AT THE ELECTRICAL PANEL AND Z.M.S. PROCEDURES (REF. SECTION 5.3) HAVE BEEN FOLLOWED. TIME MUST BE ALLOWED FOR THE ROTOBLAST UNITS TO STOP DUE TO THE FACT THAT THEY CONTINUE ROTATING FOR A PROLONGED PERIOD OF TIME AFTER POWER IS SHUT OFF.

5.6.2 To accurately target the blast pattern, place a piece of scrap metal approximately 1" thick x 60" wide x 12'-10" long in a position in the machine where a piece of work would normally pass in line with the Rotoblast stream. If necessary, block up the test piece to represent the top surface of the work and secure it in position so it will not be dislodged by the blast stream. Do not operate the work conveying mechanism, only the Rotoblast unit and the abrasive handling system.

5.6.3 Start the machine components according to "Starting Sequence" listed in Section 5.7, steps 1, 2, 3, 4, 5, and 8 only. Start only the Rotoblast unit to be targeted.

5.6.4 With blast selector switch in "OFF" position, depress "ROTOBLAST START" pushbutton.

5.6.5 With Rotoblast running, actuate the abrasive gate of the Rotoblast unit to be targeted by manually operating the solenoid valve for 10 to 20 seconds.

5.6.6 Depress "ROTOBLAST STOP" pushbutton.

5.6.7 Assure the Rotoblast unit has stopped spinning.

5.6.8 Stop abrasive system.

5.6.9 Stop exhauster.

5.6.10 Turn main disconnect switch to "OFF" and place machine in Z.M.S. (ref. section 5.3).

5.6.11 Enter cabinet and inspect target.

ADDITIONAL TARGETING:

5.6.12 Adjust impeller case as required, refer to "Operating and Maintenance Instructions for type Rotoblast and Blast Stream Diagram".

5.6.13 Repeat procedure as necessary to recheck targeting.

5.6.14 If the machine is not to be used within a reasonable time, the abrasive should be removed from the machine and stored in steel drums or bags in a dry area to prevent rusting.

After a desirable blast pattern is obtained, paint the indicator number on the Rotoblast housing and also unit direction - CW and CCW. Check the setting daily to make sure no movement of the impeller case has occurred.

5.7 NORMAL START UP, NORMAL SHUTDOWN, AND EMERGENCY SHUTDOWN

5.7.1 Insure all guards and covers are in place. Observe all safety warning signs. Wear approved safety glasses with side shields.

5.7.2 With all access doors closed, observe the "ACCESS DOOR OPEN" pilot light is extinguished.

5.7.3 Press the "CONTROL ON" pushbutton and observe the pilot light is now illuminated.

5.7.4 Press the "EXHAUSTER ON" pushbutton to start the exhauster. Observe the pilot light is now illuminated.

5.7.5 With the exhauster running, the abrasive system may be started. Pressing the "ABRASIVE SYSTEM START" pushbutton will cause the pilot light to begin flashing. The wheel feed screw, distributing screw, elevator, and lower screw are all started in sequence with a few seconds separating each. When all abrasive system drives are running, the pilot light will be illuminated continuously.

5.7.6 In order to start the Rotoblast units, the abrasive system must be running. Press the "ROTOBLASTS START" pushbutton and observe it is flashing. Each Rotoblast unit will start in order with a few seconds separating each. The pilot light will continue to flash until all units are running, then will be on continuously.

5.7.7 Place the "BLAST, OFF-ON" selector in the "ON" position.

5.7.8 Place the "MAN-AUTO" selector switch in the "MAN" position.

5.7.9 At the operator's station, information on the parts to be cleaned needs to be entered. The "STACK DATA" will inform the system the type of parts and quantity of parts to be processed. On the thumbwheels dial "01" to indicate the top position. The digital indicator will also show "01." Select the type of plate on the selector, 1, 2, or 3 indicating the size of the plate. Press the "ENTER" pushbutton. The first position of the "STACK" is now filled. Continue loading each position of the stack until all workpieces have been entered. The control system will recognize the first "0" in the stack as the end of the workpieces. Use the "CLEAR" selector to clear an entry of a specific "POSITION" or "ALL" for all information in the stack.

5.7.10 When the stack information has been entered, place the "MAN-AUTO" selector to the automatic position.

5.7.11 The load area lift controls will now move to the stack area and begin processing parts. Based on the stack data, the correct number of lifting pads will be used to move the first workpiece to the load conveyor. The conveyors will now start and move the workpiece towards the blast cabinet. Trippers on the conveyors record the width of each plate while another switch records the length. Once entering the blast cabinet, the recorded width will determine which blast gates are utilized; however, the recorded leading edge and trailing edge will actually turn the abrasive gates on and off. The brush-off and blow-off manifold will be turned on and off automatically as the part traverses thru the cabinet. Upon exiting the blast, the length of part will be used again to place the center of the part on the center of the unload conveyor. When the unload conveyor stops, the unload area lift controls will remove the part and place it on a stack in the unload area. Again, the number of pads used will be determined by the stack information.

5.7.12 Manual controls are provided to jog each conveyor section individually. Also, manual controls are provided for each lift mechanism including a "PAD SELECT" switch for operating the vacuum pads. Place the "AUTO-MAN" switch in the "MAN" position to activate all manual controls.

5.7.13 For normal shutdown, allow the machine to complete any work in process. Place the "BLAST" selector switch in the "OFF" position.

5.7.14 Press the "ROTOBLAST STOP" pushbutton and observe the Rotoblast on pilot light is extinguished.

5.7.15 Press the "ABRASIVE SYSTEM STOP" pushbutton and observe the "ON" pilot light is extinguished.

5.7.16 Press the "MASTER STOP" pushbutton and observe the "CONTROL ON" pilot light is extinguished. Use the "MASTER STOP" for all emergency stop conditions. Locate and correct the cause of the emergency stop before proceeding. Restart the system using the normal start-up procedure.

6.0 TROUBLESHOOTING, INSPECTION AND MAINTENANCE PROCEDURES

6.1 GENERAL INSTRUCTIONS

6.1.1 Before performing any inspection or maintenance on ANY PART of the machine, make sure that normal shutdown procedure, 5.8, has been executed, and Z.M.S. procedure (ref. section 5.3) has been followed.

6.1.2 Be sure to read all Pangborn and component manufacturers' instructions before performing any maintenance work.

6.1.3 A good inspection and maintenance program is the best assurance of a productive machine.

6.1.4 For safety and performance, always use genuine Pangborn replacement parts.

6.2 TROUBLESHOOTING

6.2.1 If a stalled elevator condition occurs, turn off the electrical power by using the electrical disconnect switch of the "MASTER STOP" pushbutton. With machine in Z.M.S. (ref. section 5.3), open elevator boot access cover. Use a scoop or scraper for removing the abrasive from the boot.

WARNING: DO NOT MANUALLY REMOVE ABRASIVE. DUE TO THE ELEVATOR BELT BEING STRETCHED, PERSONAL INJURY COULD OCCUR WHEN THE TENSION CAUSED BY THE JAM IS RELEASED.

6.2.2 TROUBLESHOOTING

TROUBLE	PROBABLE CAUSE	POSSIBLE REMEDY
1. Excessive vibration of Rotoblast.	Chipped or broken vane.	Replace entire set of vanes.
2. Too much dust and fines in abrasive.	Improper adjustment of separator skimmer plate or not enough air flowing thru separator.	Move skimmer plate further toward abrasive curtain or open blast gate to increase air flow thru separator. Also make sure spouts are clean.
3. Good abrasive removed with fine refuse.	Improper adjustment of separator skimmer plate, or too much air flowing thru separator.	Move plate away from abrasive curtain, or close blast gate to decrease air flow thru separator.
4. Insufficient volume of abrasive passing thru airwash separation.	Improper adjustment of separator metering gate. (Excess abrasive passing thru overflow.)	Adjust metering gates for additional flow.
5. Abrasive curtain not present in all airwash casings.	Improper adjustment of separator metering gate.	Adjust metering gate to utilize full curtain when open.
6. Elevator jamming.	Foreign object in boot casing.	Open boot door and clean out elevator. Inspect before re-starting.
7. Elevator belt slipping.	Insufficient belt tension.	A. Increase belt tension. B. Remove short section of belt.
8. Work not being cleaned sufficiently.	Insufficient time in each blast position.	Increase blast time.
9. Drop in Rotoblast amperage.	Not enough abrasive getting to Rotoblast.	Check level of abrasive in storage bin. If level is low, add abrasive to system. If abrasive level seems adequate, check abrasive gate and Rotoblast spout for restriction.
	Too much abrasive getting to Rotoblast.	If abrasive flooding conditions exist, reduce flow of abrasive to Rotoblast until full flow amperage is obtained.

6.3 INSPECTION INSTRUCTIONS

CAUTION: PLACE MACHINE IN ZERO MECHANICAL STATE (REF. SECTION 5.3) BEFORE PERFORMING INSPECTION OR MAINTENANCE.

6.3.1 Operator or maintenance engineer should inspect daily, or each eight hour shift, the following items:

LIMIT SWITCHES -- Arm must be free to operate when tripped. Limit switch and tripper must be in position to be tripped at the proper time. Report any problems and have corrected before operation.

CABINET -- Inspect for abnormal wear. Report any worn liners for future replacement.

CAUTION: DO NOT OPERATE MACHINE IF ANY LINERS ARE COMPLETELY WORN THROUGH. OPERATION UNDER THESE CONDITIONS MAY RESULT IN SEVERE DAMAGE TO THE MACHINE.

CABINET HOPPER -- Keep floor grating in bottom of cabinet clear of any debris that will impede free flow of abrasive to the screw conveyor.

SCREEN TRAY IN SEPARATOR -- Keep screen tray clear of any debris that will impede free flow of abrasive into storage bin. Replace screens when worn.

ABRASIVE STORAGE BIN -- Maintain proper abrasive level. (When abrasive gate is closed, abrasive level should be just below overflow condition.)

ROTOBLAST -- Inspect vanes; replace if worn halfway through. Check runnerhead for wear and excessive vibration. Check wear plates for abnormal wear.

AMMETER -- Check ammeter reading for proper abrasive flow. DO NOT EXCEED FULL LOAD RATING OF MOTOR. Adjust abrasive gate if necessary.

6.3.2 Operator or maintenance engineer should inspect weekly, or once each 40 hours of operation, the following items:

All items listed under 6.3.1 (eight hour inspection).

ELEVATOR -- Check belt for alignment and tension. Check belt splice and bolts. (Replace when worn.) Replace any missing buckets or worn bolts. Check elevator drive for belt wear and tension. Ref. drawings S-661220, S-661221, and S-661222.

NOTE: WORN HUCK BOLTS SHOULD BE REPLACED BY ELEVATOR BOLTS. THESE CAN BE OBTAINED FROM PANGBORN.

ROTOBLAST -- Inspect impeller; replace if worn over 1/8" on leading face. Inspect impeller case; replace before opening increases. Check Rotoblast housing liners for wear and alignment. Check drive belts for tension.

SEPARATOR -- Inspect per drawing S-662019 and S-662020.

6.3 INSPECTION INSTRUCTIONS -- continued

WEAR PLATES -- Replace if worn excessively.

WORK CONVEYOR -- Check rollers for wear and that rollers turn freely.

6.3.3 Operator or maintenance engineering should check monthly, or once each 160 hours of operation, the following items:

All items listed under 6.3.1 (eight hour inspection).

All items listed under 6.3.2 (40 hour inspection).

ALL SPEED REDUCERS AND BEARINGS -- Check shaft seals for wear and lubrication leakage. Remove any abrasive or dirt from shaft adjacent to seals.

6.4 MAINTENANCE

6.4.1 Before performing any maintenance work on machine, make sure that proper "Shutdown Sequence" has been executed, compressed air line valve has been closed and locked out with a padlock, and Z.M.S. procedure (ref. section 5.3) has been followed.

6.4.2 Replace all worn or damaged parts reported under "Inspection", 6.3.1 and 6.3.2.

6.4.3 Pangborn instructions, Manufacturers' instructions, and part numbers for each component of the machine can be found in the appropriate sections of this manual.

6.4.4 Be sure to read and comply with all Pangborn and manufacturers' instructions before performing any maintenance work.

6.5 LUBRICATION

This section lists lubrication points throughout the machine. For recommended brands of lubricant and their suppliers, see Pangborn's "Lubrication Chart". Lube schedules for manufacturers' components other than Pangborn's may be found in commercial literature located in separate sections throughout this manual and/or tags or labels mounted on the equipment itself.

6.5.1 Elevator drive motors -- follow manufacturer's recommendations.

6.5.2 Elevator drive reducers -- follow manufacturer's recommendations.

6.5.3 Rotoblast drive motors -- follow manufacturer's recommendations.

6.5 LUBRICATION -- continued

6.5.4 Distributing screw drive motor -- follow manufacturer's recommendations

6.5.5 Distributing screw drive reducer -- follow manufacturer's recommendations.

All equipment should be inspected regularly and lubricated when required.

7.0 DO'S AND DON'T'S

7.1 DO

7.1.1 Read and follow procedures as presented in Pangborn and manufacturers' instructions found in this manual.

7.1.2 Execute the proper shutdown and Z.M.S. procedures (ref. section 5.3) whenever the machine is to be shut down and left unattended for an extended period of time and before performing any maintenance or internal inspection work.

7.1.3 Maintain a constant visual check of the machine and report all signs of excessive wear.

7.1.4 Execute "EMERGENCY SHUTDOWN PROCEDURE" whenever a malfunction occurs during operation.

7.1.5 Always replace Rotoblast vanes by the set. Each set of vanes are factory weighed and matched into a set by weight. Mixing matched sets of vanes will create an unbalanced condition in your Rotoblast unit which will cause premature bearing failure.

7.1.6 Wear approved safety glasses with side shields when working around the machine.

7.1.7 Keep areas around the machine clear of trash, debris, abrasive, etc.

7.2 DO NOT

7.2.1 Operate machine until thoroughly familiar with all operating instructions.

7.2.2 Operate machine with worn Rotoblast feed parts (vanes, impeller, and impeller case).

7.2.3 Replace one vane at a time.

7.2.4 Mix vane sets.

RECOMMENDED VENTILATION SYSTEMS FOR PANGBORN EQUIPMENT

GENERAL

Properly designed duct work and hood ventilation systems are necessary to provide suitable system operation. The design sizing and testing of ventilation systems shall follow accepted practices defined in the latest edition of the following publications:

(1) Industrial Ventilation
by Committee on Industrial Ventilation
P.O. Box 16153
Lansing, Michigan 48901

(2) Air Pollution Engineering Manual
Public Health Service Publication No. 999-AP-40
Obtained from:
Documents, U.S. Government Printing Office
Washington, D.C. 20402

(3) Procedure for Determination of Velocity and Gas Flow Rate
Publication E-P-2 by:
Industrial Gas Cleaning Institute, Inc.
Suite 570
1707 L St. N.W.
Washington, D.C. 20036
Phone 202-457-0911

(4) Round-Industrial Duct Construction Standards
SMACNA (Sheet Metal and Air Conditioning Contractors' National Association, Inc.)
8224 Old Courthouse Road
Tysons Corner
Vienna, VA 22180
Phone 703-790-9890

Where federal, state and local codes conflict with these specifications, the more stringent regulation shall be followed.

Normal Pangborn abrasive blasting operations require 3500 FPM duct velocity. Sand systems and blast cleaning operations having heavy dust loads require 4000 FPM duct velocity. Blast operations producing potentially hazardous dust such as aluminum, titanium, berylium, etc., require 4500 FPM duct velocity.

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Collector clean air outlets and clean air ducts to the exhauster inlet are sized for velocities not exceeding 2500 FPM.

The most common method for sizing ventilation ducts for Pangborn equipment is velocity pressure (using blast gates for balancing system).

The interior of all ducting shall be smooth and free from obstruction. Any exposed welds at seams, flanges, etc. shall be smooth.

Ducting shall be fabricated of black iron (mild steel) or galvanized welded sheet. Ducting receiving normal wear, straight sections, and transformers shall be fabricated as follows:

Diameter of Pipe	Gauge No.
up to 18"	16
over 18" to 30"	14
over 30"	12

Elbows are to be a minimum of two gauges heavier than straight runs of equal diameter. Elbows with diameter less than or equal to 6" must be made of five sections; diameters greater than 6" must be made of seven sections.

The elbow center line radius is two times the pipe diameter. Space permitting use 2 1/2 times pipe diameters.

With duct work in systems where high wear is suspected, such as sand reclamation systems, at least 12 ga. material should be used in lieu of above list. In addition, flat back elbows shall be used in high wear systems.

Branches enter the main at the large end of the transition at less than 45° with 30° preferred. Branches should be connected at top or side of main no branches entering opposite each other.

Transitions in the mains should be tapered which should be at least five units long for each one unit change in diameter.

Clean-out doors are to be provided at 10'-0" (maximum) intervals and near each elbow, angle or duct junction in horizontal or main runs. Clean-out doors are recommended in vertical sections.

Slide type blast gates shall be provided in all branches as close to the main duct as possible. The gate shall be used with a clamp or hold-down bolt to hold gate in position. Gates are to be adjustable from fully open to fully closed.

Exhaust stacks shall extend 12 feet above the highest roof elevation within a 20 foot radius. Refer to "Vertical Discharge" design in Industrial Ventilation Manual.

A vibration isolation connection is recommended at the fan inlet using a non-collapsible type such as flexible coil and pipe. A typical connection would be constructed of neoprene rubber and hose clamps.

Duct support work must be capable of supporting a plugged system, eliminate loads on connected equipment, and preventing vibration, noise, and cracking of welds under operating conditions. Vertical ducts must be self-supporting so fans or parts of ducts may be removed without disturbing the connecting duct work.

Details for the construction of ventilation systems are contained in the Industrial Ventilation Manual and Round Industrial Duct Construction Standards.

At the initial system start-up for balancing the system, the tests are conducted with only the collector running and blast machine doors closed (blast machine not running). Check the branch ducts and main ducts for proper velocities and proper volumes. The system balancing is accomplished by adjusting system blast gates and dampers.

Use the procedures set forth in Publication E-P-2 of the Industrial Gas Cleaning Institute, Inc. to determine velocities and gas flow rates.