25 important considerations for building a profitable blast facility

SPECIAL REPORT

Contents

Introduction

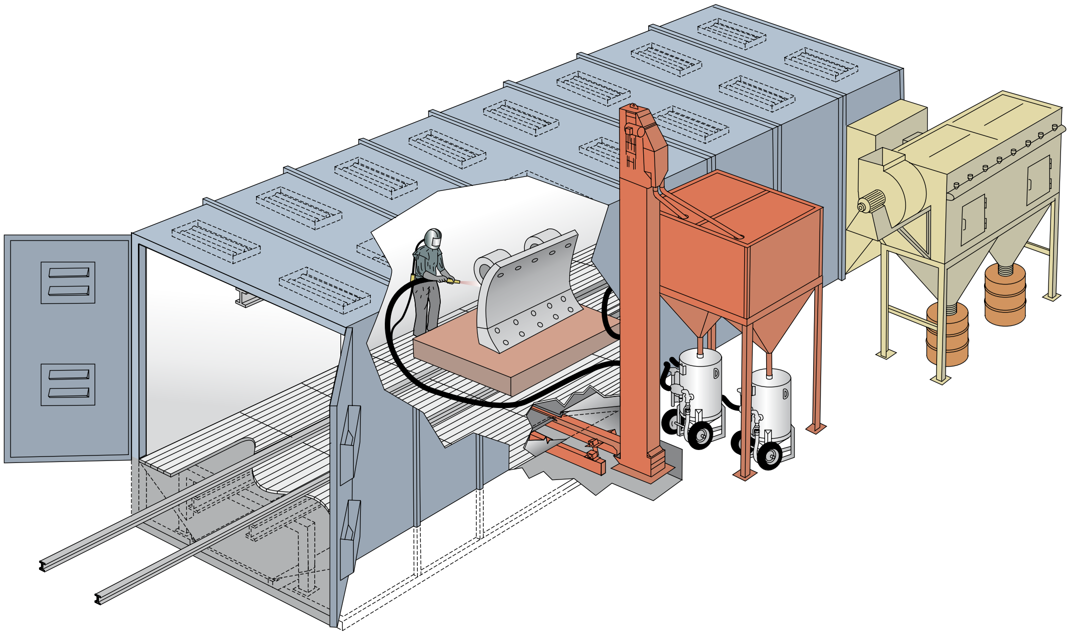
The '25 important considerations' when building a blast room

Let us now go over the various systems that are used in a blast room. The functions of each are discussed and then various types of equipment available for the function listed. It will be noted that for most systems the most cost efficient system is highlighted. This is because generally the cost difference between systems initially is not nearly as great as the cost difference of running those systems.

Main features of a performance blast room

There are five main components in a performance blasting chamber.

1. The chamber itself which includes lights, rugged doors and is normally lined with heavy duty steel plate on all surfaces to resist abrasion from ricochet. The room must also have correctly sized air entry and exit plenums for efficient ventilation without allowing abrasive to escape.
2. The dust collection and ventilation system provides sufficient airflow in the blast room to keep dust levels low, increase operator visibility and to quickly clear the room of dust when blasting ceases.
3. An abrasive recovery system – normally under-floor – conveys the spent abrasive to a central point for recycling and cleaning. An efficient system will recover automatically from all or just from part of the floor, depending on the design.
4. The abrasive recycling and cleaning unit will clean the used abrasive by separating dust, fines, paint flakes and trash from the good reusable abrasive. The abrasive is then stored ready to be used again.
5. Blasting pots, hoses and nozzles are selected to suit the blast room function. Typically multiple outlets are installed to allow more than one operator to blast continuously.



Why install a blast room?

There are several advantages gained by installing a blast room, both economical and environmental. Weather constraints are no longer a problem. You can blast 24 hours per day, 365 days a year allowing you to achieve higher productivity and meet customer's deadlines. The controlled environment assists your blaster to achieve a consistent quality of work.

Typically blast rooms will incorporate an automatic abrasive recycling system which allows the use of recyclable abrasives, reducing your costs drastically. Not only do you reduce the purchase costs of abrasive, you also reduce handling and disposal costs. By containing all your dust from your blasting operation, your general site environment is cleaner and tidier and your neighbours are happier too!

Recovery systems

Recovery systems range from 100% area under-floor systems to simple sweeping hopper systems. A recovery system that has 100% floor recovery allows maximum productivity as operators never need be involved in handling spent abrasive. (An alternative to this is a 25% or 50% floor area recovery system that requires daily operator sweeping to recycle all abrasives).

When the spent abrasive falls through the floor grating, it is collected by a conveyor, typically an oscillating tray conveyor which transports the abrasive across to a bucket elevator and abrasive cleaning station. Oscillating tray conveyors are a reliable, self cleaning, low maintenance and a low profile solution to efficient under floor recovery requirements.

Design and construction of blast rooms

A blast room is a vital part of the industrial coatings industry. It is necessary to bring raw-off-the-mill and fabricated steel to a suitably clean finish and ready to receive a protective coating. In most instances, a “profile” is imparted to the surface to provide a “key” so that the paint film will adhere well.

The idea of directing a blast of high velocity abrasive at any object grew from the days when anyone who had a compressor and some form of pressure vessel could direct some form of abrasive at the work, however the abrasive was not recoverable. The concept of a blast room, introduced an area where the abrasive could be recycled, allowing the reuse of abrasive that would otherwise be wasted. This stops the process from becoming too expensive and wasteful. In a blast room, dust can be controlled by proper ventilation, proper lighting allows the operator to see clearly, producing a constant work quality and where blasting can be done 365 days a year without being interrupted by weather conditions, dew etc. This can be done with an absolute minimum of manual labour.

To ensure high production and low maintenance from blast rooms, it is essential they are carefully designed. Walls should be constructed from 5mm steel plate suitably stiffened to prevent buckling. All interior surfaces should be free form any protrusion inside the chamber to avoid collecting dust and abrasive.

Lighting is of paramount importance to provide sufficient visibility levels for the operator to easily see inside angles, corners, cleats or around complex fabricated items. Lights should never be mounted inside a blast room.

Doors should be open to allow full access to the room to utilise the entire size of the chamber. Floor grating and the associated support structure should be engineered to handle the loading levels necessary. Typically 50 tonne loadings are easily accommodated.

Blastroom dust collectors

A dust collector is a vital part of any blast chamber. It provides ventilation inside the chamber and it removes contaminants from the exhaust air. It is essential that the dust collector is carefully selected to suit the size of the blast chamber, to maintain visibility and the required air velocity in the room. In general, the larger the cross section of the blast chamber, the larger the dust collector. Blast-One can assist in all design and engineering calculations. Both wet and dry type dust collectors can be provided.

Wet type Dust Collectors
Wet type Collectors use water to scrub the dusty air and collects the dust as a sludge.

Dry Cartridge Dust Collectors
Dry Cartridge Collectors offer high efficiency dust filtration. Dust is trapped on specially designed cartridges which are automatically cleaned by a Smart PulseTM cleaning system. Dust is collected in bins for easy disposal.

Don’t build a rig, plan a system

These words, by American blast equipment consultant A.B. Williams are so true:- “blast rooms, more than any other piece of equipment, tend to be built as a rig with little or no design input other than perhaps having seen someone else’s “rig” or from some vague photograph in a sales brochure. Often with just a little fore-knowledge a room can change from an inefficient rig to an effective asset”.

With this in mind, this guide has been written. It is just that – a guide. There are many important aspects which are too difficult to cover, for instance, the type and capability of dust collector fans; you may get someone who will supply a fan capable of 10,000 cfm, but won’t suit a dust collector which must continue to put out 10,000 cfm even when the filter medium is partially clogged. Unfortunately, some manufacturers cut corners with equipment which does not perform as expected, or fail to tell you about how much the equipment will cost to run. This guide is a brief outline on the basic design concepts.

It is essential to understand that each component within a blast facility has its effect on the economics of running a blast room. For instance: poor lighting, poor dust collection or airflow design, will increase blast time on each job. If you take 20% longer to do each job, wear and tear increases 20%, consumption increases 20%, power consumption increases 20%, labour increases 20%, but you don’t get any more for the job.

A The blast pot package

1 The blast machine

At the heart of a Blast Room Facility is the blast machine itself. This is a pressure vessel with a means of loading abrasive through an opening in the top. An Abrasive Metering Valve on the bottom allows the abrasive to fall by ***gravity*** into the airstream from the compressor in the “pusher line”. This in turn travels at great speed along the blast hose to the blast nozzle where, because so much air is forced through a comparatively small orifice, the velocity of the air and abrasive increases dramatically and abrasive is expelled at a very high velocity at the work surface.

2 The remote control system

The other element of the blast pot is the remote control system. This allows the operator to start the blast by means of a valve (known as the deadman handle) strapped to the blast hose near the nozzle. This valve must by law automatically shut the blast machine down if the valve is released, and lock in the 'off' position. The deadman handle actuates a valve on the blast pot which controls the flow of compressed air to the nozzle and the release of abrasive from the hopper.

3 Moisture removal

A moisture trap is commonly fitted to the incoming pipework. This, besides removing moisture, will remove a certain amount of oil (if present), and will remove particles from the air. This is important, as particles in the deadman control valves can cause malfunctions. After the moisture trap a pressure regulator is sometimes fitted to control the blast intensity.

Important note: The temperature of air passing through the moisture trap has a direct relationship to the amount of moisture removed; moisture traps cannot take moisture out of hot air; air coolers are available to increase the efficiency of moisture removal. Most abrasive flow problems are caused by moisture condensing on the internal wall of the blast pot.

4 The blast machine cone

The cone at the bottom of the hopper should have sloping sides at approx 40°- 45° to ensure that all of the abrasive will flow out.

5 The abrasive metering valve

The type and design of the abrasive metering valve is important. Many valves are just not suited to use with all abrasives. The best valves have a short abrasive flow path and can be easily adjusted to very fine settings. Too much abrasive can slow the blast operation just as much as too little abrasive can.

6 Pressure loss

Pipework size is highly critical. A guide is that a pot with 1” pipework will satisfactorily handle up to a ¼” (No 4) nozzle; although a 5⁄16” (No 5) could be used but with increased pressure loss. It is recommended that all nozzle sizes from 5⁄16” (No 5) and larger use blast pots with 1¼” pipework. For high production blasting, 1½” is recommended for No 7 and No 8 nozzles.

The design of fixed pipework between the compressor and blast pot is very important as all tee-offs, elbows, bends, etc, will cause small, but not insignificant, pressure loss. Refer to Blast-One's Catalogue for details on pipe line designs.

Moisture Traps & Remote Control Valves must be capable of passing air with minimal pressure loss. ¼" (No 4) nozzles should use at least 1" moisture traps and valves. ⁵⁄₁₆" (No 5) and ⅜" (No 6) nozzles should use 1½" moisture traps with large element size and 1¼" deadman valves. (Do not use 1½" or 2" moisture traps with small elements in this industry). ⁷⁄₁₆" and ½" nozzles require full flow 2" ported moisture traps. We recommend a non-element type, e.g. high volume 2" moisture separator – stand mount.

Care in selection of remote control valves is warranted, as many with 1¼" connections are restricted by small 1" internal passages resulting 5-10 psi pressure loss across the valve itself. We recommend 1½" valving where ⁷⁄₁₆" and ½" nozzles are to be used.

Air control valves and metering valves are available with up to 2" air passages where very high air volumes are needed.

7 Hose couplings

Air and Blast Hoses for the incoming air must be large enough. Jack Hammer style ('A' type) couplings and hoses to 1" are suitable for up to ¼" nozzles.

Do not use these types of couplings for ⁵⁄₁₆" nozzle or larger! Surelock (or similar) 1½" couplings and hose are suitable for ⁵⁄₁₆" (No 5) and ⅜" (No 6) nozzles. Surelock couplings are about three times the size of 'A' type couplings and provide very little flow restriction. 2" Surelock or BOSS Nut & Tail Couplings and hose are ideal for ⁷⁄₁₆" and ½" nozzles (Nos 7 & 8).

The air supply hose should never be PVC type hose, as this hose cannot handle the heat and oil and is dangerous. Only premium "synthetic" rubber bull hose should be used. A larger diameter should be used for any hose over 15m.

Only proper static conductive blast hose should be used as a blast hose. It is recommended that 1¼" standard blast hose be used over long lengths and a 25' or 50', 1¼" Super Whip (lightweight) hose be used for the last length. Being lighter and more flexible will make for easier blast conditions. Note: always use as short as possible blast hose (i.e. don't use 100' of hose if 50' will reach). Not only will you be wearing out blast hose unnecessarily, you'll be getting a greater pressure drop!

In general, a blast hose should be 3 times the nozzle size and a bull hose (the air supply hose) 4 times.

8 Blast hose fittings

When selecting the **Blast Hose, Couplings & Nozzle Holders** consider the following points. **ALWAYS** use proper blast couplings, as any normal hose fitting which is not designed for blasting will become unsafe before long. Check couplings and nozzle holder gaskets regularly. Nozzle gaskets should be 1¼" bore for 1¼" hose and nozzle entry size. Deadman control hose lines should be strapped to blast hose every three feet'. As a guide, ¾" hose may be used with up to ¼" nozzles. 1" hose may be used with up to ⁵⁄₁₆" nozzles, always use 1¼" or even 1½" hose with larger nozzles.

9 Blast nozzles

Blast Nozzles should be "supersonic" venturi type nozzles made with either tungsten carbide or silicon carbide. **VERY IMPORTANT**: never fit or use 1" entry size blast nozzles on to 1¼" bore blast hose as blast speed will drop dramatically. 1¼" blast hose must have 1¼" entry size nozzle fitted. Hint: nozzle wear is easily checked by using an equivalent size drill bit, even 1⁄16" is a lot of wear. **NEVER** bash a blast nozzle against the job as the sleeve can crack rendering the nozzle uselsss. Blast pressure should always be measured with a needle pressure gauge behind the nozzle. **NEVER just assume** that because you have 100psi at the compressor or at the blast pot that you have sufficient nozzle pressure. Pressure drops of 35 psi or more are regularly found on systems being used by unsuspecting operators.

10 The blast helmet

Blast Helmets & Filters must be approved by all relevant statutory authorities. As well, the helmet should be comfortable and quiet. Regulations require a thick INNER LENS. An outer disposable lens which can be readily replaced should be provided. If an inner lens of glass is used, a thick plastic lens must be used inside that; so that if the glass shatters, glass cannot injure the operator. Helmet air conditioners are effective in providing cool air to the helmet. Air conditioners that heat and cool are also available.

11 Remote control system speed

The **Deadman system** should react reasonably quickly with the operation of the deadman handle. If a quick start/stop is required, a Thompson Valve system should be installed. This system can include an extra control which allows the operator to stop the flow of abrasive and "blow down" the job with just compressed air, also known as a 'remote abrasive cut-off' system. The release of the deadman will depressurise the blast pot and allow it to reload. If, due to a long length of control hose, the reaction time is too slow, then a low voltage electric over air system may be installed.

12 Communication system

Excellent **Communication Systems** are available. The traditional cable type units have been more reliable as they are not affected by static electricity, however advancements have been made with wireless communication system, such as the NovaTalk system which suits the Nova2000 and the Nova3 Blast Helmet.

Significant production increases can be realised if the operators can communicate freely with the supervisor without having to put down the blast nozzle and stop work.

13 The blast room

This section covers some points regarding the layout of the room, including air inlet position and air exhaust. For more details on air inlet and exhaust refer to section on *Dust Collection*.

The first consideration that generally arises when discussing a blast room is the size. Don't make it too big! The suggestion is that four feet clearance each side and above the largest item you need to get into a blast room is generally considered about right.

The critical thing here to understand is that the width and height particularly has a direct impact on the cost to establish initially, and ***cost to run***. Here's why. If a room of 18' wide x 16' high was built, you will have a cross sectional area of 288 square feet, which means an 18,000 cfm dust collector would suffice. A 20' wide x 20' high room however requires at least 24,000 cfm. Not only is there a difference in original price between a 18,000 cfm unit compared to a 24,000 cfm unit, there is also a difference in the cost per hour to run. We suggest that 98% of all your work (including semi-trailers) will fit into a 18' x 16' room. This is probably the best size option and doing the other 2% can be outside.

The same rule applies to the length. While the length will not change the size of dust collector required, you will have a larger floor area to recover abrasive from, so there will be added costs in the building of the room. The oscillating tray floor type of grit recovery will not make a big difference to the running cost, but if you opted for a pneumatic recovery (waffle) Floor, you will be paying quite a lot more to run the room in electricity charges (refer to underfloor recovery floor section). Of course, if your decision is to have a steel plate floor and manually recover abrasive, you may not want too large a room to sweep.

Many blast rooms are built with doors at each end. If you have enough area on your site for this, it is an option worth considering. It allows you to load the item to be blasted next onto a work trolley while blasting is in progress, then once completed the blasted item can be moved out through the far doors into the paint section and the next item can be moved into the room, saving considerable time for the blaster. This option, of course, will have an effect on the location of the abrasive reclaim system and dust collector etc. Generally doors at each end are built on the larger blast rooms.

14 Material handling

Careful planning is also required regarding the means of handling of items to be blasted in and out of the room. The following comments may help.

A **Track Mounted Work Trolley System** is the most common method used. Several trolleys are often provided; rails extend from within the blast room to outside, and the work loaded by forklift or overhead crane and the whole item wheeled into the room. While blasting is in progress, the previous item blasted can be painted while on its trolley, and the next item to be blasted can be loaded onto its trolley. The trolleys often have 20+ tonne capacity.

Forklift. Except for rooms with a steel plate floor, it appears from observation over the years that it is better to keep forklifts out of blast rooms. The high concentration of weight buckles the grid mesh quite quickly and the ability for the back wheels to "screw" the grid panels out of position has seen many a forklift wheeled through the floor.

An **Overhead Gantry Crane** is sometimes used where the operators feel that they can satisfactorily crane the items to be blasted in. Usually a wire rope passes along a long slot in the ceiling of the blast room, the gantry passing over the top of the room. Rubber flats along each side of the slot prevents the loss of abrasive. In most cases, operators end up using trolleys on rails to wheel the items into the room and the gantry is only used to load the trolleys while blasting is in progress, as it seems to be a slow process.

15 Blast room construction

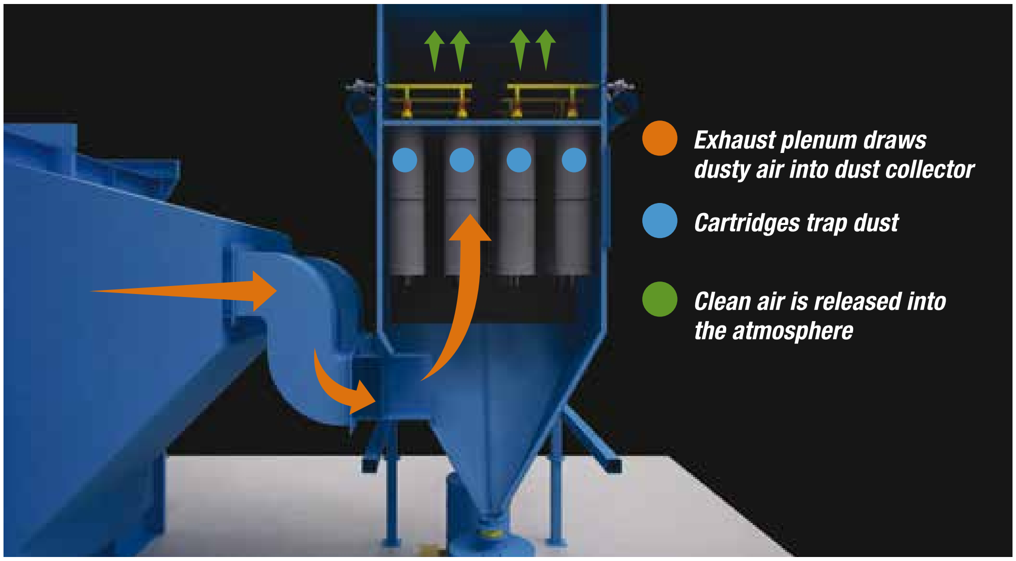
Construction Materials regulations in most states prevent the use of certain materials including masonry, rubber, and sheet roof and walling steels such as corrugated iron, trimdeck etc. Blast rooms are best made of mild steel plate walls, ceilings, and in the case of non-recovery floor rooms, the floor. Lighter plate is suitable for the ceiling, 3⁄16" for the walls and 3⁄8" is ideal for floors. Generally, it is good to erect the room inside a shed or workshop as it makes weatherproofing easier, it also means the blast pot and abrasive separator can be out of the weather.

Generally, the dust collector is sited outside the building particularly in the case of larger units, although it is quite satisfactory inside. **Important:** weatherproofing of the blast room, including the door areas, the blast pot and abrasive handling equipment is essential as a very small amount of moisture will clog the abrasive and steel grit as it will rust into hard lumps. Bear in mind also that once blasted it will be an advantage if you don't need to take the item out into the weather as the smallest amount of rain, dew etc. will cause a rust "bloom".

Floor grating is for the standard duty blast room is typically made of 1" high steel grate panels – heavy industrial rooms will use 1¼" high section grating. It is important that the underfloor support structure be carefully designed to cope with the maximum anticipated weight.

16 Dust collection

This important item, required by statutory authorities, is an essential component towards making your blast room efficient.



If you find it difficult to see inside a blast room because of dust, the lighting may be very good, but to be practical each item can and does take longer to do, because you will be going back over areas that have been missed. It is not uncommon for increased times of 25%. Usually of course, an operator does not realise just how much time he is losing until the problem is rectified.

The two main questions that will need to be addressed as to the dust collector are:

– What size (capacity) will I need?

– What type of dust collector will suit best?

The **size of a Dust Collector** is discussed on page 11 and it was noted that the cross-sectional area was a deciding factor relating to the needed capacity. For instance we said an 18' wide x 16' high room had a cross-sectional area of 288 square feet (18 x 16 = 288). We also noted that a 18,000 cfm unit was sufficient. This was arrived at because if we were using garnet or steel grit, which by itself produces almost little dust, 60 feet per minute airflow is adequate. Thus 288 sq ft cross-sectional area x 60 feet / minute flow – 18,000 cfm.

If we were to use a dusty abrasive in a blast room like copper slag, (this is more common in rooms with no underfloor conveying systems), 80 feet per minute would be quite adequate if you had a good quality abrasive separator, but 100 feet/min or greater would be recommended. This means a 24,000 cfm dust collector would perform well in a 16' x 18' room.

Of course if an abrasive such as slag were to be used in an enclosed blast room you would probably require somewhere between 120-150 feet/min. This means you would require 40,000 cfm at least to operate. This sized unit will consume more than double the original calculation of electrical power.

17 Types of dust collectors

Broadly speaking there are two types of dust collectors that meet EPA Guidelines. These are: wet scrub type units and dry reverse pulse element or cloth filter bag. Each type has its merits and its downsides. Some of the features that relate to each type are:

The **Wet Scrub Type Dust Collector** can be used with any situation or abrasive. Not to be confused with water spray type units, the wet scrub actually passes the dusty air below water level, literally scrubbing the air. The dust is entrained in the water and after passing a series of baffles etc. nearly all moisture is removed before being exhausted to atmosphere. It is not uncommon for a very small amount of mist to get through, so generally it is exhausted outside the building. This also keeps noise levels down.

Wet type units can cope with large volumes of dust. Because there are no elements to clog, air flow remains fairly constant which is always important. In other words, the water can become extremely dirty before any appreciable difference occurs. A small amount of detergent added to the water helps prevent solidifying of steel dust in the water. Clean out is easiest if done regularly, and a truck with heavy duty suction facilities used on water tanks or septic tanks makes a clean-out easier. Manual cleaning may be necessary to get the last portion out.

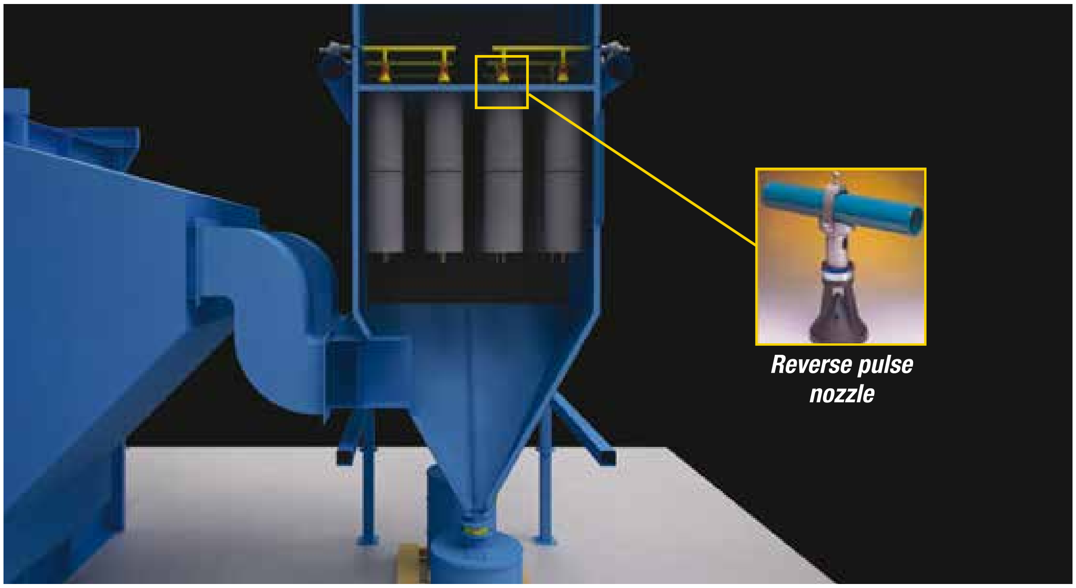
A wet type dust collector fitted with an under water cooling coil will reduce compressed air temperatures, thus reducing troubles with moisture clogging abrasive in the blast pot.

The other point about wet type units is that the initial purchase price is usually much less than dry type units. Running (power) costs are usually close to being the same as dry type units.

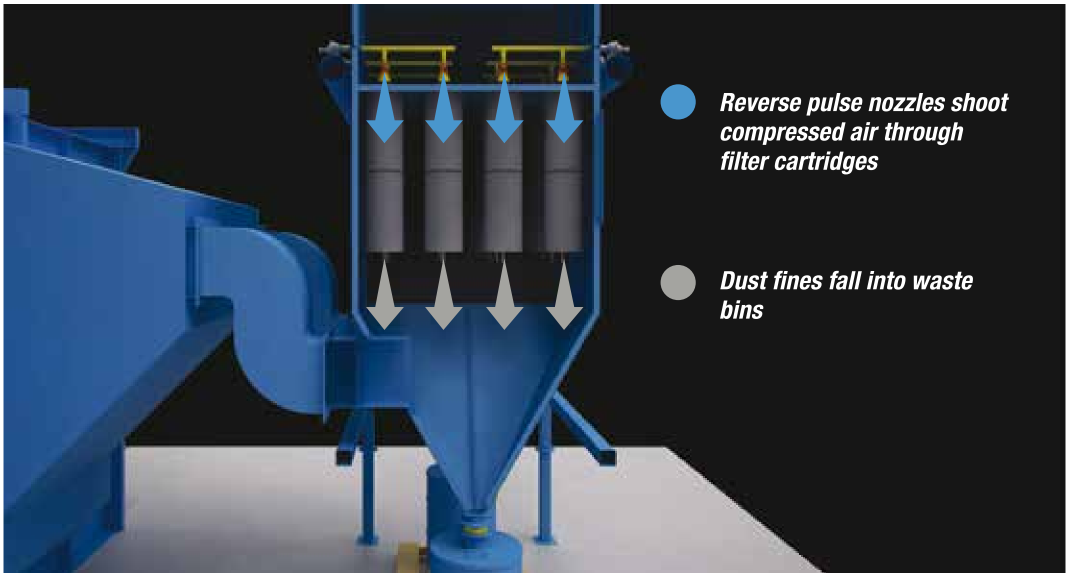
Dry Type Dust Collectors have been used for many years. It is in more recent years that reverse pulse units have made these much more efficient.

Mechanical shakers have been employed to shake and loosen dust from filter bags when the dust collector is turned off. This is necessary as the fine dust clogs the bag, reducing airflow dramatically.

Reverse pulse is used in the case of bag type and element type collectors.



A sequential timer activates an air solenoid valve which sends a “shock” of compressed air through the element or bag in the opposite direction to air flow. If the shock is sufficient, dust which has accumulated on the outside will be released and most should fall away, even while the dust collector is operating. It is an especially good idea to continue the pulse for several cycles after the dust collector fan is turned off.



Today most dry type units use elements not at all unlike large truck type air filter elements. (Automotive elements are not used as they do not provide the life or level of dust emission standards required). Whichever filter medium is used, the cost of replacement does need to be weighed up as the life of the elements/bag is a significant cost factor. Fines and dust will need to be disposed of regularly and this can be a hazardous job.

Dry type units are better suited to situations where dust concentrations are lower, hence they are used in blast rooms using steel or chilled iron and not where high levels of dust are common from the items being blasted, ie. from heavily rusted steel etc. Increasing the pulse frequency will help if dust generation is increased.

18 Airflow within the room

This subject is one of the most important and least understood aspects of blast rooms. Planning the airflow within a room should be the next step after determining first the size; the position on the site; then where the dust collector is. Here are some tips:

a) The air should enter the room at one end and exit at the other. If air enters on one long side and exits on the other long side, the speed of airflow will be low, unless you had huge or multiple dust collectors. If air speed is low, dust will settle on the floor. Next time the blast is pointing in the dusty area you will pick it up again, and again, and you will create your own dust storm. ***This point cannot be stressed enough.***

b) The air inlet vents therefore will be at opposite ends to the dust collector. As it is common for the dust collector to be at the opposite end to the doors, the vents frequently are placed in the doors. This has the advantage of not forming dead spots where airflow is low and dust will settle on the floor. If vents were in the roof just inside the doors you would have a 'dead' spot where dust would settle just inside the doors. It is usual for vents to be positioned not far above floor level (up to 3'). Additional vents of course may be necessary and can be either higher up or on each side of doors on side walls. The inlet air vents are best made so that air can pass in without undue restriction, (approx 1000 feet/min but so that baffles precludes abrasives from passing through.

19 Exhaust plenum

The **Exhaust Plenum** is located at the opposite end of the room to the inlet air vents. If this unit is located on the end wall 'dead' spots will be minimised, however, it is sometimes necessary for the exhaust plenum to be on the side wall. If this happens, the corner opposite may form a low airflow 'dead' area. To overcome this a small additional inlet air vent not far up from the floor will overcome this problem.

To lose even a small amount of good abrasive out through the exhaust into the dust collector will rapidly make the blast operation costly. Design of the exhaust plenum is critical. Abrasive blasted at the exhaust exit and passing into the exhaust plenum must be deflected and speed reduced so that gravity can allow the particle to drop out and back into the room without the airflow carrying it out and into the dust collector. Hence the exhaust plenum is also a critical element in the whole process of making the blast facility as efficient as possible.

It should be noted that some rooms utilise the power of the dust collector to convey abrasive from "waffles" under the mesh floor to abrasive separator. The dust collector in this case obviously needs to be massive to provide enough air speed to carry steel abrasive along (3600 feet/min minimum) the under floor channels. Power consumption and (therefore cost) to run this type needs to be evaluated carefully (see: Underfloor Recovery

Systems page 18). Rooms with waffle floors typically have downdraft airflow; the air entering inlet vents in the ceiling of the blast chamber.

D The abrasive elevating & separation units

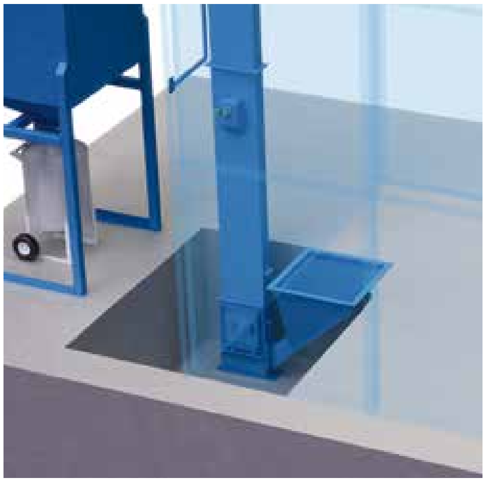
20 Design and type considerations

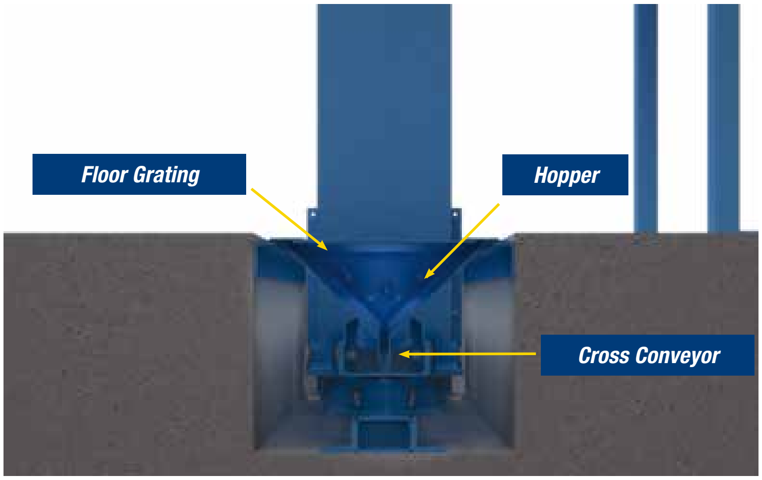
Whether or not your blast facility is going to have a full floor area recovery or just a partial floor recovery, the problem remains that you will need to elevate the grit either before or after it is cleaned (separated) and drop it back into the storage hopper on top of the blast pot. Two methods are common in the industry: bucket elevators or pneumatic (airflow).

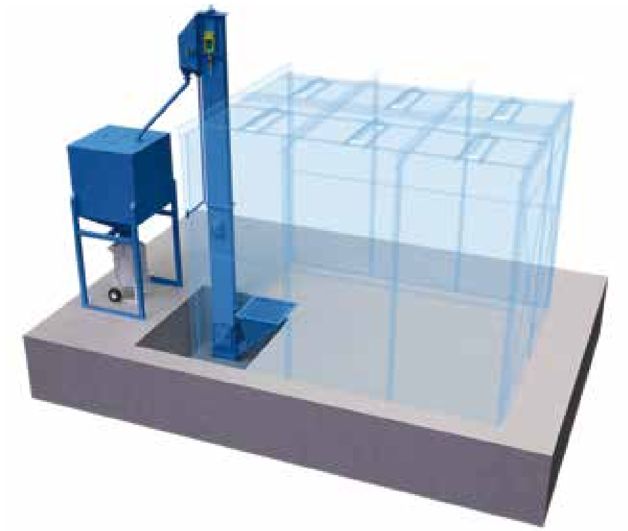
Of the two, pneumatic is, as far as cost is concerned, a little cheaper. As you have already got a dust collector sucking lots of air, why not utilise the airflow? Its advantage is that it is cheaper to supply and install initially. However, its disadvantages are:

- **velocities** must be high to carry abrasive, ie. > 3600 feet/min hence wear particularly on bends tends to be high even with wear plates installed.
- **power** consumption is high. Usually this type of elevator is used in conjunction with a full or partial recovery waffle floor.
- such systems are prone to clogging. If airflow drops or if too much abrasive is fed at one time, the weight of abrasive becomes greater than what the velocity of air can lift, and it will bog down. Care needs to be taken not to allow this to happen.

Bucket elevators have the disadvantage of costing a little more initially, but a bucket elevator cannot bog down once the flow control gate is set. You will need to replace the buckets every few years depending on usage.







Their features include:

- low power consumption, usually about 1kW
- high transfer rate of abrasive (6-9 tonne / hour)
- they cannot bog
- they are quiet
- low wear and low maintenance
- they match in with the 'airwash' separator

Augers are not used or recommended with abrasives. They are occasionally used by persons who build their own room. Experience would dictate that high wear and being subject to failure due to high mass materials, would make them hard to recommend. Steel grit also does not easily 'flow'.

21 Abrasive separation

Abrasive Separators are necessary at some stage to separate the dust, fines and trash from the good abrasive. In the case of pneumatic recovery this can be done in two ways.

The abrasive is sucked up by the pneumatic pipe to a cyclone type separator, enters at high velocity and spins around the cyclone losing speed and dropping down out of the generally high velocity air area and settles at the bottom where it is stored until the pop-up valve drops. This allows the abrasive to run into the blast pot ready to be reused. Fines and dust, however, are carried by the flow of air away from the circumference of the cyclone into an adjustable (usually) opening in the centre onto the dust collector.

Once again high velocities are required hence wear is often a problem. Care needs to be taken to make regular inspections of wear plates. Cyclonic separation is used quite a bit as they are your only option if you have

The abrasive elevating & separation units
continued

pneumatic recovery and it works moderately well if care is taken in the adjustment of them. However, a perfect separation is not usually possible; if you attempt to get rid of all unwanted fines you will discover that you also lose an unacceptably high proportion of good abrasive. Another disadvantage with this system is that all dust and fines go to the dust collector, which means that you will load it up quicker and decrease your efficiency.

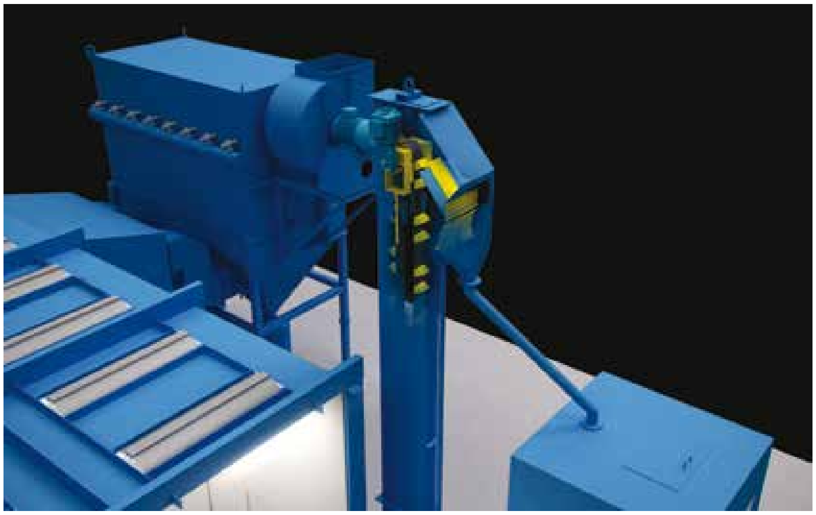
Another way is to suck the abrasive from the floor into a large plenum chamber where the abrasive is slowed down and falls into a tube running along the bottom. Most of the dust has separated at this point, being carried up high in the plenum chamber and into the dust collector.

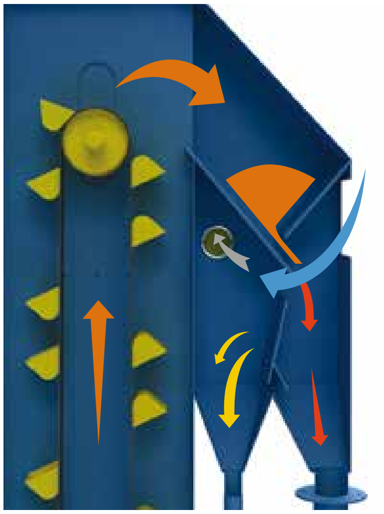
Another type of suction unit draws the abrasive along the tube running along the bottom and up to a cyclonic separator on top of the blast pot.

The added advantage of this system is that you can achieve a little better level of dust separation. The disadvantage apart from the high wear problems associated with high velocities is that there is a further suction unit consuming more horsepower to operate. Once again, it is recommended to stop and calculate just how much it will cost to run that few extra horsepower each year. Electricity costs can make or break a blast operator.

The **Air Wash** Abrasive Separator/Classifier unit is often used in conjunction with a bucket elevator. It utilises the 'winnowing' principle; a comparatively gentle flow of air passes through a curtain or 'waterfall' of abrasive, this carries the dust out to the dust collector, the fines drop into another drum/skip, and the good abrasive falls into a chute which carries it to the storage hopper on top of the blast pot. It is hard to think of any disadvantages with this system; wear is low because of low air velocities, fines are not loading up the dust collector, they are falling into a separate skip; but the best thing is that you can achieve a high class of separation. Very little dust will find its way back into the blast pot reducing dust levels within the blast room, and you will not be disposing good abrasive. You can adjust it simply so that you can keep abrasive which has broken up but is still useful, or increase the airflow a little and it will return only larger particles to the blast pot.

This unit also is particularly good if you change the type of abrasives in your blast room, as it can be easily adjusted to suit any different abrasive.





22 System types

This system is important for the efficient operation of a blast room. The first thing to comment on is that if you are considering a room with no underfloor recovery now, if you wish to upgrade later on you will save extra costs by some forethought as to the type, position of various items.

Underfloor recovery systems are installed to recover spent abrasive, convey it to the abrasive separation system and onto storage ready for reuse without any manual labour being required in the case of full recovery, or minimum labour in the case of partial recovery floors.
There are three main types of Recovery Systems used.
These are:

1. Pneumatic ‘Waffle” type floors
2. Oscillating tray conveyor floors
3. Sweeper floors, augers and conveyor belts

Perhaps the first question that needs to be asked is what criteria will help me to decide which is best for my application? What disadvantages and advantages does each have?

Pneumatic “Waffle” Floors are recommended for use only with the finer grades of steel grit. Chilled Iron grit up to G17 or steel grit up to GL40 should be the largest grade used. Garnet will carry satisfactorily with pneumatic recovery. Waffle type floors have several characteristics which are important. They do not require a deep pit, not that there is a big difference between an 20” pit compared to a 40” pit in cost, but in some areas high ground water can be a problem. Pneumatic floors are a little cheaper than some other types generally. Some disadvantages however are that because it is common for quite large quantities of abrasive to collect in the channels it means that it is not practical to change form one abrasive to another. For example, if you commonly used chilled iron grit and won a contract to blast with steel shot you would be disappointed at the amount of cross-contamination. Or if you had a job which required the use of garnet say on aluminium, you cannot change over without a major problem. For general blast work to get maximum blast speed you will probably use G12 or GL50, but if you had a contract which required a larger profile and you needed to use G24, you would be surprised how much mixture you will get. In a large blast room with waffle floor it is common to eventually have several (costly) tonnes trapped in there.

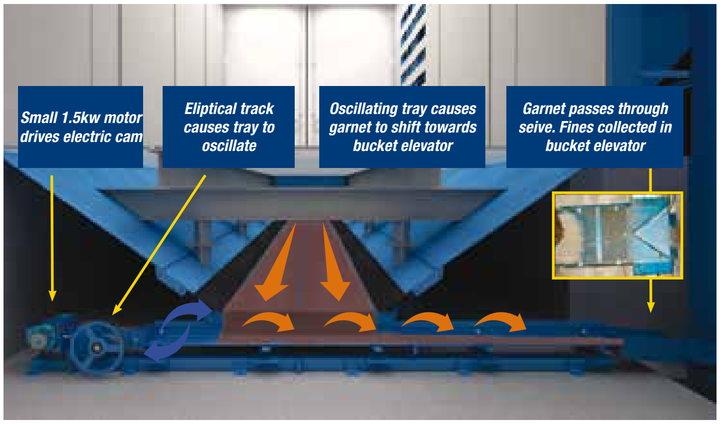
It is wise to consider how much energy costs are going to be. A medium blast room will require a dust collector with at least 10 kW; an extra 8-10 kW more power is needed to provide enough airflow to carry the abrasive, roughly that’s about $4,000 worth of electricity per year, or $20,000 in 5 years!

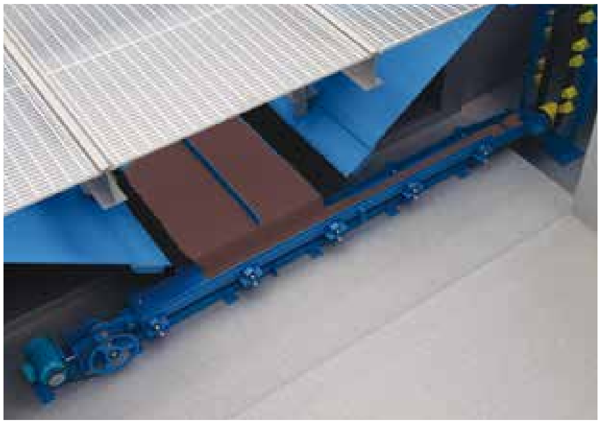
Pneumatic recovery is quite commonly used in partial recovery rooms. Consideration needs to be given to cost to upgrade to full recovery if needed at a later date. This would necessitate replacing the dust collector. Care needs to be taken to prevent small items blocking the abrasive holes at the bottom of each waffle as a blockage means the removal of a grid section and digging out abrasive until the piece can be removed.

Waffle floors do not require daily or weekly maintenance apart from clearing blockages. With time the holes can become worn at the bottom of waffle. A piece of steel with correct hole size, tack welded over enlarged holes will restore airflow to normal.

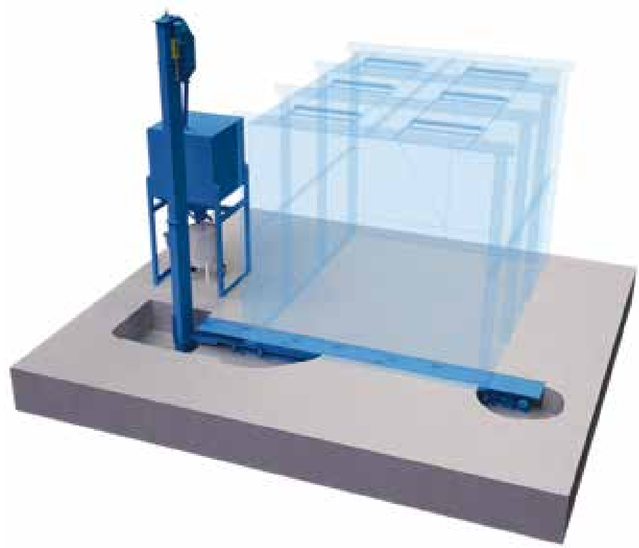
The underfloor recovery systems
continued

Oscillating Tray Conveyors: These conveyors will perform well with all types and sizes of abrasives. They consist of a "tray" underneath the grid mesh floor which runs along the length of the room. They can be anything from 1' to 6' wide and they are suspended at regular intervals along each side on special suspension blocks which have a base firmly fixed to the floor of the pit. The horizontal tray oscillates causing the grit to 'hop' along the tray to the abrasive elevator. Rubber mounting blocks have been used for many years; they have the advantage that there are no bearings to wear out. The rubber mounting blocks should be checked annually and may need to be replaced every few years.





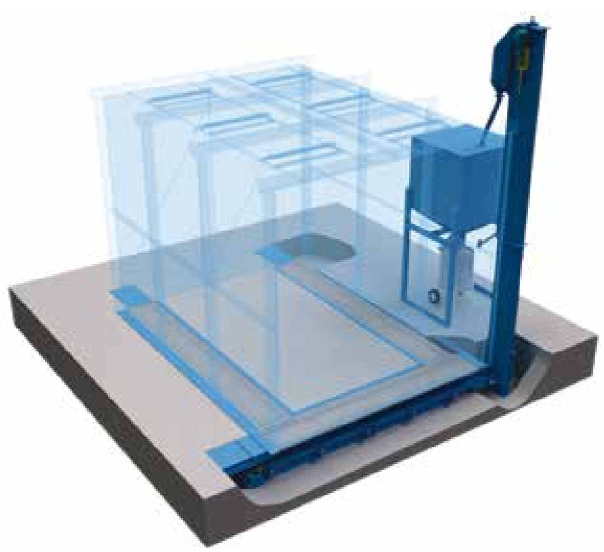
The main bearings on the eccentric are very reliable and have a prolonged life. The tray is usually made to a maximum length of about 60’ which is adequate for most rooms. The pit can be anything from 18” - 72” deep. The deeper the pit, the wider the room can be with a single tray. If a pit is 150” deep with a 72” wide tray, the room can be about 18’ wide. Sloping hopper plates at about 35-40° direct the grit from each side onto the conveyor in the centre.



Generally, the cost to dig and concrete a 60” deep pit is not a lot more than an 20-30” deep pit. For this reason a decision on whether to use this system is not usually based on any cost difference between this system and others, as the advantages outweigh any savings that could be made with a shallow pit. In high groundwater areas where the pit cannot be too deep, or if a very wide room is needed, it is customary to use two oscillating conveyors side by side.

If the blast room only requires one tray and the doors are at one end only, then the oscillating tray simply can convey the abrasive directly into the bucket elevator. A ‘live’ sieve at the end removes trash before entering the elevator.

The oscillating tray cannot be overloaded; even if someone were to dump a whole tonne of steel grit on the tray it will simply carry to the elevator without any problem. Within a few minutes all of the grit will go through. This means that if you had to change abrasives, the abrasive is simply allowed to drain out of the hopper, clean the half shovel full out of the bottom of elevator, clean the top of the blast pot of abrasive and you are ready to drop the different abrasive on the tray with no cross-contamination. This usually takes about half an hour.



In the case of a blast room with two conveyors side by side, the conveyors would carry the abrasive and drop onto a small cross-oscillating conveyor which carries the abrasive across the room to the elevator on one side.

Where a room is too long for one conveyor, it is customary for two conveyors to feed from either end to a cross conveyor running across the middle of the room to an elevator halfway along one side of the room.

Sweeper Floors, Augers, Conveyor Belts have been grouped together in this publication as they are a form of conveying which is being used less frequently. Although they use considerably less power than the pneumatic recovery systems, they have not achieved a reasonable standard of reliability, with broken cables, sweepers and augers when jams occur. High wear due to the scraping action and dust in bearings are common. Tales of successful floors are the exception rather than the rule. Bear in mind that to be successful, a floor should not require undue labour to upkeep, the aim with recovery floors is to reduce the labour required to recover abrasive to almost nothing if possible.

It should always be remembered that abrasives are just that, abrasive. As well, abrasives generally don't 'flow' with sweepers or augers alike. These floors do not lend themselves to change from one type or grade of abrasive to another, as considerable quantities are left behind.

23 Compressors

This section is not intended to deal with the various forms and types of compressors, more what the air requirements are for abrasive blasting and how we can get the maximum compressed air to the nozzle.

The first point to note here is that generally a blast room operator will find an electric powered compressor more practical and cheaper, as the refuelling and maintaining of a diesel motor is quite a consideration. Where power supplies are limited however, using a diesel unit can sometimes be necessary.

The next point is probably more important. Except where abrasives are being used which must not be used at high pressure (ie. plastic media, glass beads, stone fruit kernel or shells) pressure plays an important part in the efficiency of a blast operation. Generally, blast pressures should be around the 100psi (689kpa) mark, MEASURED AT THE NOZZLE. The pressure reading at the compressor or even at the blast pot may give little idea as to what is happening at the nozzle.

Why is nozzle pressure important? And why measure at the nozzle? Isn't what the pressure gauge on the blast pot reads near enough? If my compressor is showing 120 psi what more could you ask for?

These and many similar questions are asked every day. The first rule of thumb here is to understand that for every 1 psi increase in air pressure over 80psi you will gain 1.5% more production. Doesn't sound a real lot, but if you increase 10psi and do get a 15% rise in production, you will get about eight hours blasting done in seven hours. That is 1 hour less labour for one (or maybe two) workers, one hour less running for the compressor (that is quite a saving!), 1 hour less running time on the Blast Room and ¾ hour less abrasive consumption (you will break the abrasive up a bit quicker). That sure adds up, doesn't it!

Referring back to nozzle pressure then, we understand that it is the pressure at the nozzle that provides the air, and therefore the abrasive particles, the velocity we need. Refer to Section 1 where we covered essential items such as blast hose, blast pot pipework, moisture trap sizes, and also we spoke about the "bull hose", the hose from the compressor to the blast pot, etc.

A well set up blast room compressed air supply will have full size fittings on the compressor if the compressor is greater than 250 cfm 2" (50mm) minimum size threads full bore ball or stop valves, 2" hosetails. For 175 cfm to 250 cfm; 1½" (40mm) is suitable size thread and hosetails. The hose from the compressor should lead to an air cooler unit, or in the case of a wet type dust collector, air cooling may be achieved by means of a steel coil below the water level. An air receiver tank is not essential and plays little part in a successful blast operation, except that it usually will help a little if you do not have adequate air cooling. Bear in mind that all this should be in correct sized pipe and fittings.

24 Air coolers/dryers

Air coolers take two main forms; Refrigerated units and heat exchange units. Refrigerated units work well, but they cost quite a bit to buy and run. The other type is essentially a heat exchanger which looks similar to a large radiator with air blown through by a fan. These are successful enough, but the best types have a double heat exchange system; after it has cooled the air, removed the moisture in a moisture trap, the air is reheated; this type is very efficient. The relative humidity drops dramatically when reheated and moisture is not a problem.

The compressor & air supply equipment
continued

Important note: any moisture trap will not perform as it should if the air passing through is too warm. Nearly all abrasive flow problems can be traced to moisture.

After the air has passed through the cooler/dryer it may be piped to the blast pot. If the air is cooled in a wet type dust collector, a moisture trap should be installed either on the blast pot nearby. It should not be necessary to have a further moisture trap if you have an air cooler/dryer system; it only will increase the pressure drop unnecessarily.

Getting back to our questions then, we ask, why measure at the nozzle? The reason is because often the fittings, automatic valves and even blast hose that is too long/too small in the bore size will account for significant pressure drops. Always measure the pressure of the air as it comes out of the compressor (always push needle through hose at about 45° and in direction of airflow), **then** measure pressure behind the nozzle. Total pressure drop should be 5-8 psi maximum. This usually means the optimum pressure is obtained when the compressor is delivering 105psi plus, measured when, and only when, the blast is in operation.

25 Different abrasive types explained

Many types and grades of abrasives are used and are required to be used in blast rooms. While the following guide is not exhaustive, it may help to put different abrasives in perspective.

Steel Grit and Chilled Iron Grit abrasive is by far the most commonly found blast medium in blast rooms, and for good reasons. These abrasives can be recovered and re-used many times over and they produce almost no dust.

Steel being more malleable will tend to round over and break up less and produce approx 25-50 cycles (these figures can vary greatly depending on pressure and what type of substrate the abrasive is hitting). Usually the blast speed is slower however, as the abrasive rounds off.

Chilled Iron grit is cheaper (about 10%), is more common and the blast speed is achieved with **finer, not coarser**, grades. The exception to this is when very tough high build coatings etc. have to be removed.

Coarse grades are produced not to go faster, generally they won't, but because the specification calls for a higher blast profile. Generally then, for normal structural steel work, the best and most economical grade is G-12 or G-17, and may be used if a greater profile is required. If you use larger grades than these to get the profile required, it is most likely that you have an equipment (possibly a nozzle pressure) problem.

Steel and chilled iron are specially suitable for blast rooms with full recovery floors and most partial recovery floors. If you have a steel plate floor it can be a problem to sweep and shovel if your recovery system is a long way down the room. Generally, steel and chilled iron grit is not to be used on aluminium etc., as it can leave impregnations in the soft surfaces.

Garnet is fast becoming the preference for most blast room applications, this versatile abrasive can be used on nearly any surface. Very fine grades produce excellent results on lighter alloys (care always needs to be taken to ensure buckling does not occur) while premium grades produce excellent profile and cleaning standards on virtually all surfaces. Blast speeds are generally higher than with steel abrasives. It is used quite extensively in blast rooms where there is no full floor recovery system because it is easier to collect than steel grit. It can be recycled up to between 6-10 times (depending on blast pressure) and while it will produce more dust than steel it is still considered a relatively "low" dust abrasive, which doesn't cause undue dust problems. With an efficient abrasive separator, dust levels should remain low even after many cycles.

Aluminium Oxide is also a relatively "low" dust abrasive, it will recycle several times more than garnet and will produce a good blast profile and cleaning standard. It is much more expensive however and it is not commonly used in blast rooms.

Glass Beads are mostly used in cabinets, this product is generally not used in blast rooms. Used at lower pressures (50 psi approx.) it can be recycled 10-20 times. It is used for low aggression applications requiring no profile and will produce a kind of polished effect. Can be used on cars, aluminium, etc. Larger grade sizes are used for peening and deburring.

Copper Slag is not used in blast rooms, as it has limited recyclability. It is very high dusting requiring a large dust collector, and results in poor blast finish. This abrasive has specific uses in outdoor blasting (where permitted requiring an expendable abrasive.

Plastic Media is excellent on sensitive surfaces but slow – mainly used for surfaces such as aircraft wings etc. where low aggression is required without stressing metal substrates. Can be used on cars with excellent results but because of high cost and low blast speeds is not common. Special equipment required.

Walnut Shell, Stone Fruit Kernel etc are blast mediums being used successfully more and more on items such as cars where low aggression media is required. Cheaper than plastic media, it produces quite good results but special equipment required.

Steel & Chilled Iron Shot is used in a small number of cases of blast rooms where large castings are to be blasted. It is far more common in 'airless' blast operations. Shot, which is spherical steel, or chilled iron is commonly used to clean up castings, removing the casting flash, foundry sand and peening the surface in one operation. Because it doesn't produce a sharp profile it is not so common for use on structural steel, although if the kind of profile is not important, it can be used with low sized grades. Larger grades are typically used in peening operations.

Granulated Perspex etc have evolved as the popularity of low aggression blasting has increased. In some cases quite good results are achievable, care being needed to evaluate each product.

Most abrasives function favourably, but not all are economical. It is better to pay three times more for a product that produces more than three times the result. For instance, if you get four times the life and at the same blast speed it will be to your advantage. Also, you may be better off paying three times as much for a product that only gives you 1.5 times the life, but 1.5 times the blast speed; remember ***your running costs per hour is most likely to be greater than abrasive consumption (cost) per hour***. This is true of all abrasives, and probably ranks as the least understood aspect of the abrasive blast industry. It's all about efficiency.

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