# DUST COLLECTOR CARTRIDGES

## LIFE EXPECTANCY AND CAUSES OF FAILURE

BLASTONE
SUPERIOR PERFORMANCE

## DUST COLLECTOR CARTRIDGE LIFE

This technical reference relates to cartridge type dust collectors with reverse pulse cleaning used in the abrasive blasting and associated industries.

The question is often asked as to how long a set of dust collector cartridges will last. The analogy of how long will a set of car tyres last can be used although tyres are much more predictable than dust collector cartridges!

"Normal" dust collector cartridge life is 12 to 24 months (in some cases they last much longer, even 10 years or more) but as a tire that would normally last for 2 years may be worn out in a short time with a poorly adjusted wheel alignment or excessive load/kilometres travelled, so a dust collector cartridge may only last for a few weeks or months if there is something out of adjustment in the settings of the dust collector or the type of dust/quantity of dust/ hours of use are outside the original design parameters .

The cartridges in a dust collector will need to be replaced if they are blocked or perforated. We will look into both of those problems below.


## BLOCKED CARTRIDGES

In simple terms the filter media that the cartridge is made from becomes blocked and no longer passes the correct amount of air through it (also known as plugging or blinding). This problem shows itself in the following problems.

### INDICATORS OF BLOCKED CARTRIDGES

1. Increased dust loading and hence lowered visibility in the room caused by reduced air flow in the room.
2. Most dust collectors have a gauge to measure the differential pressure across the cartridges often referred to as a "Magnahelic". (The gauge has 2 ports; one goes to the clean air side and the other goes to the dirty air side of the cartridges, measuring the different in static pressure between them). Every cartridge will have a specified pressure drop when new and when it has become blocked. This will depend on many factors such as the air flow per cartridge, fan power, dust type etc. Typical examples are:
    - **Standard cartridge -** 0.4 kpa new - 1.6 kpa blocked
    - **Ultratech cartridge -** 0.3 kpa new - 1.6 kpa blocked
    - **Ultra poly cartridge -** 1.0 kpa new - 2.0 kpa blocked

3. Unusual or oscillating noise when the fan pressure becomes unstable due to excessive restriction.

## CAUSES OF BLOCKED CARTRIDGES

1. Old age. No cartridge will last forever.
2. Collection of agglomerative or sticky dusts such as glue.
3. Collection of fibrous dusts such as wood.
4. Blasting objects that are contaminated with grease or other liquid substances.
5. High humidity combined with collection of a dust that is affected by moisture (e.g. cement dust or dust from steel grit)
6. Damp or oily pulse air which causes the dust to stick to the cartridge. This can also weaken the fabric of the cartridge and cause it to split (see below).
7. Reverse pulse system pressure too low, less than 80 psi.
8. Reverse pulse controller not set correctly. Typical problems include:
    - Not pulsing frequently enough
    - Not pulsing at all when fan is shut down
    - Pulse time set too long or too short - the ideal pulse time depends on a number of factors, but it should deliver a short, sharp, shock to remove the dust.
    - Pulse time too close together or air supply restricted. The pulse header tank must come up to full pressure between pulses.
9. Faulty or malfunctioning reverse pulse valves - a quick indicator is simply to listen to the reverse pulse noise and note any inconsistencies.
10. Missing or damaged maxi pulse cones on the blow tubes
11. Excessive dust loading in the air.
12. Excessive face velocity {caused by trying to filter too much air through too few cartridges) causing penetration of dust into cartridges and permanent blockage.

## SOLUTIONS TO BLOCKED CARTRIDGES

1. Remove the cause of the dust that is causing the problem. Examples:
    - Rather than using timber dunnage, replace with a block of plastic.
    - Grind off any glue before blasting.
2. Perform an aggressive clean on the cartridges as follows:
    - Turn off the fan.
    - Ensure the reverse pulse is running between 90 & 100 psi.
    - Turn on the reverse pulse - this may require you to run an alternative power supply to the reverse pulse control board, if it is only powered when the fan is running.
    - Reduce the time between pulses to +/- 1 minute. It can be reduced to less than this as long as the reverse pulse tank comes up to full pressure between pulses.
    - Pulse the cartridges for 30 minutes and then empty the dust.
    - Continue work as normal and repeat this process at the end of each day as long as necessary.

3. If the above 2 solutions fail to correct the problem, replace the cartridges.
4. Consider changing to a different cartridge type more suitable to the dust or operating conditions.
5. Consider using a larger dust collector with more cartridges to lower face velocity and/or dust loading per cartridge.

## PERFORATED CARTRIDGES

In simple terms the filter media that the cartridge is made from has holes worn in it or splits and no longer filters the required sized dust particles which then exit through the fan.

### INDICATORS OF PERFORATED CARTRIDGES

1. Dust exiting from the dust collector stack while the dust collector is operating. The dust emitted may be much more obvious when the cartridge that has failed is pulsed, and by working out the order in which the cartridges are pulsed and then observing the dust exiting the stack you can often work out which cartridges are worn out.
2. Climb into the clean air chamber {while the dust collector is switched off and locked out) and look down inside each stack of cartridges. The presence of abrasive in the bottom of the stack indicates that the cartridge is worn out and due to the weight of the abrasive the dust has been sucked out and any residual abrasive in it has been left behind.
3. Where a substantial amount of dust has passed through the worn out cartridges there will be obvious signs of wear on the fan. Where dust collector cartridges have been worn out by unbalanced airflows you can often see wear patterns either on the exterior of the cartridges or the inside surfaces of the dirty air chamber.
4. When a dust collector cartridge is removed it can be very hard to find the split or worn area as it is covered in dust and a small hole can represent a major leak. Options to check include:
    - Shine a light down the inside of the cartridge in a reasonably dark environment and check the exterior for light escape.
    - Apply low pressure compressed air to the interior of the cartridge through a large bore hose (make up a plywood blanking plate with an A type coupling in the centre which can then have a 1" hose attached.) The pressure must be kept to the minimum as you need high flow not high pressure. This will open up any holes or splits allow you to see them easily. This should be done with the relevant PPE and ideally inside the blast room with the dust collector running to prevent exposure to the dust.
    - Vacuum the outside of the cartridge and observe for signs of sandblasting or physical abrasion (if the cartridge has a metal expanded mesh scrim it is easy to see). If this is present it indicates that the failure is caused by abrasion rather than other causes.

### CAUSES OF PERFORATED CARTRIDGES

1. Old age, all cartridges will eventually wear out.
2. Cartridges can be easily damaged during installation as they are normally made of paper; they are fragile and should be handled with care.
3. Excessive pulse air pressure will cause splits in the cartridge media, air pressure should not exceed 100 psi and a regulator may need to be installed to stop this happening.
4. Water ingress weakens the cartridges; they will either block up or split when next used. As the dust collector operates under negative pressure any water that runs down the outside of the unit will be drawn into any hole that it comes into contact with (this is hard to see as air will be drawn in rather than blown out.) Water can get into the dust collector in the following ways:

- Damaged or missing door seals.
- A cracked weld or other mechanical failure of the dust collector body- this can normally be observed from inside the dust collector as light shining through the damaged area.
- Any other area where there can be the smallest gap (valves, fittings, etc.) will suck in water.
- In heavy rainfall, water can come down the exhaust stack (unless there is a rain cowl or rain flaps fitted) and through the fan while the dust collector is not operating (this could never occur while the fan is running). The fan casing has a hole in the bottom to allow any water that gets in while it is not operating to drain out, however if that hole is plugged, (e.g. by a leaf) or the dust collector is subject to back flow (i.e. the fan is spun backwards) by high winds, water can enter the clean air chamber and run down into the cartridges

5. Dirty or oily pulse air will damage the cartridges and cause them to split. This can normally be detected if there is more than trace amounts of water or oil in the reverse pulse header tank. The compressed air supply must have a functioning moisture trap (or an upstream refrigerated dryer) and both it and the tank must be drained at least daily.
6. Over fanning (more air passing through the dust collector than it is designed for) will cause excessive turbulence and abrasion to the cartridges, this is caused by:
    - Failure to precondition new cartridges
    - Running the dust collector at much lower pressure than it was designed for (e.g. using a high pressure dust collector that was designed to be used with a long run of duct on a blast room without any ducting).
    - Pulsing too frequently and having the cartridges too clean, this will cause the dust collector to run at a pressure drop that is less than it was designed for, and hence a higher flow than it was designed for. Pulse frequency should be set to maintain optimum cartridge cleanliness relating to the design parameters.
7. An air leak in the area where the dust exits the bottom of the dust collector hoppers. This could be a leaking seal on a waste bin or a dust bag that is not sealed off correctly. This allows air to flow up against the dust that has been pulsed off the cartridges and is coming down for disposal, as a result the dust cannot easily get out of the hoppers and it stays in the airstream and can dramatically increase the rate of wear on the cartridges.
8. Closing the valve on the bottom of the dust collectors while you are blasting. This valve is installed to stop dust coming out while you are changing the waste bin or bag. It must never be closed from more than 10 minutes at a time while the dust collector is running. The dust collector hoppers are “funnels” to fill the waste containers they are not for storing the waste prior to disposal. If the valve(s) are left closed dust will build up quickly until it begins to be re-entrained into the airstream which will cause rapidly escalating wear on the cartridges.
9. Failure to frequently empty the waste containers leading to overfilling. This will cause the same problems as point 8 above.
10. If a new dust bag is allowed to suck up against the waste dust outlet it can hold the dust up in the hopper and have the same effect as if the valve was shut - see point 8 above.
11. Excessive inlet turbulence caused by incorrect use of dampers. Where it is necessary to reduce the airflow through the dust collector use the following:
    - An inlet damper - ideally this should be ten duct diameters from the dust collector inlet to allow the flow to normalise before it enters the dust collector. If it is closer to the dust collector that this, use with care.

- An outlet damper between the fan outlet and the exhaust stack. This can be difficult to access and to set, as it changes the differential pressure readings.
- Use a variable speed drive on the fan motor to regulate the speed of the fan; this is the best solution as it will also save electricity.
- An intelligent pulse controller can be set to maintain the dust collector cartridges at an optimum differential pressure, giving the required air flow.

12. Excessive quantities of abrasive in the dust. All dust will contain some abrasive but if the amount of larger particles (these have greater kinetic energy and will do much more damage to the cartridges than the dust) is too great it will wear out the cartridges. Causes include:
    - Blasting directly at or in front of the exhaust box. This is designed to drop out the abrasive from the air stream but it cannot cope with a high velocity stream of abrasive directed at it. If it is necessary to blast in this position build a false wall in front of the exhaust box to prevent this problem occurring.
    - Incorrectly adjusted or worn air wash. The abrasive cleaning air wash splits the collected abrasive into three streams as follows:
        i. Good abrasive which goes back to the grit storage.
        ii. Fines which are discharged to the fines waste bin.
        iii. Dust which goes to the dust collector

    If these are out of balance the dust collector can be subjected to a high loading of large particles of abrasive causing accelerated cartridge wear.
13. If the rubber seals between the cartridges leak you will get large amounts of dust escaping. This can be caused by the following:
    - Incorrect installation - correct torque on the cartridge retention nuts (or other system) is vital, the seals must be fully compressed without applying excessive pressure that could collapse the cartridge.
    - Transport damage - a stationary dust collector must never be shipped with the cartridges installed. A mobile dust collector may need its cartridges re-tightened after a long trip.

Dust collector fan motors are very powerful and have the energy to smash abrasive particles into the cartridges causing severe damage if operating parameters are not managed correctly.