Convair Pneumatic Bulk Tanker Manual.
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THE CONVAIR "POIVENT" SYSTEM (IF FITTED)
(PATENT NO. 674434)
FOR VENTING OF THE VOIDS IN PNEUMATIC BULK TANKERS
HATCH ADJUSTMENT
GENERAL DESCRIPTION OF EQUIPMENT.

The tanker is a Class 3 pressure vessel manufactured in accordance with AS1210. It is made from carbon steel boilerplate and pressure tested to 1.5 times its design pressure. The vessel is fitted with a pressure gauge and a relief valve to prevent over pressurising.

It is constructed with internal "shedder plates" to shed the material towards the outlet where it is fluidised and conveyed out the outlet valve, into the discharge manifold, through the discharge hose and into the silo. These shedder plates are not pressure bearing (eg. are not part of the pressure vessel) in the interests of low tare weight.

The tanker is either fitted with internal filters which allow air to flow freely into and out of the void under the shedders or with the "Posivent" system (Patent No. 674434) which balances the pressure across the shedders without the need for internal filters.

The function of the aeration devices at the base of each discharge cone is to mix air with the product such that it can be pumped through the discharge pipework more or less like a fluid. Fine powders such as cement, flyash and flour retain air quite well and are therefore conveyed well pneumatically. They are fairly difficult to fluidise initially and hence aeration cloth type fluidisers are generally the most efficient although SureFlo rubber disc fluidisers can function almost as well and can be more practical.

Other products require little or no fluidising as they will not retain air. Such products are sugar, dry sand, poultry feed, and plastic pellets. For these products, aerators such as the SureFlo are the most efficient and require little maintenance.
PNEUMATIC TANKER LAYOUT SCHEMATIC.
NOTES ON PNEUMATIC TANKER FUNCTION.

**Item 1. Air Supply.**
The air supply to the tanker can come from a variety of sources. A PTO driven compressor mounted on the primemover, self contained powerpack fitted on the tanker or in some instances air supply is provided by the plant. In most instances the source of the air supply will be a positive displacement compressor or blower. It is therefore most important that the air supply never be started up or shutdown under load. This places a great deal of stress on the compressor or in the case of a blower will almost certainly result in damage to its rotors. It also greatly increases the likelihood of having a reverse flow of product in the airline/ aeration system, resulting in irreparable damage to the compressor/ blower.

Any air supply will have a balance of volumetric capacity and pressure. The manner in which the tanker is operated is dependant on the product that you have to unload, the silo arrangement that you are unloading into & the type of air supply you have to operate the tanker with.

A high pressure low volume air supply, ie Betico piston compressor will be ideal for products that are easily aerated such as cement, flyash, flour, and lime at times. Products that are easily aerated use pressure in the tanker & only limited airflow to be very efficiently conveyed. Products such as Soda Ash, coarser Lime, sugar, pellets etc are not easily aerated and require higher air volume to be conveyed efficiently.

**Item 2. Pressure Relief Valve.**
A pressure relief is required by law to be fitted to a pressure tank. Its function is to ultimately limit the pressure that the tanker is capable of achieving. To do this the pressure valve is fitted in the airline manifold so as to prevent product from entering the valve. The valve is also a protection for the compressor or blower and is often set at a pressure for protection of the compressor or blower. It is vital that the relief valve be tested on a weekly basis and maintained in good order.

**Item 3. Air manifold Check Valve.**
The air manifold check valve is there to provide protection for the air supply against a reverse flow of air & or product. The failure of a check valve can result in very permanent and expensive damage to the compressor/ blower.

**Item 4. Boost Valve.**
The boost valve is used to control the operating pressure of the tanker and also the consistency of product flow during discharge. The setting of this valve constantly
changes during discharge. Generally the setting of this valve should be just enough to maintain a consistent flow and maintain an optimum pressure in the tanker.

**Item 5. Boost Line Check Valve.**
The boost line check valve when playing its role is not noticed. If this valve fails product will travel backwards into the air manifold and block the aeration system and possibly cause damage to the compressor.

**Item 6. Aeration Valve.**
Is an on/off valve that is used to control airflow to the aerators in individual discharge cones.

**Item 7. Posivent Valve. (Where fitted.)**
This valve is characterised by the big brass nut on the top of the valve. The function of this valve is to provide air supply to the voids under the shedder plates. During discharge it will produce a distinctive soft rattle sound. Its function should be checked regularly. Don’t worry if this line does not get hot, it will only pass enough air to balance the pressure under the shedders as the pressure increases.

**Item 8. Discharge Valve.**
A golden rule when operating a pneumatic tanker. This valve is always the last valve you open and the first you close. Always.

**Item 9. Air Manifold Butterfly Valve.**
Used to control or direct airflow in the airline. Before operating these valves the path for the airflow should be checked, ie camlocks secure, valves set accordingly.

**Item 10. Discharge Outlet.**
Can be an extremely dangerous place. Make sure camlocks have seals & are in good condition, camlocks are in good condition and the discharge hose is in good order. Importantly ensure that the hose is attached to the camlock with at least two ‘Mikalor’ type clamps each end. Camlock caps should have a hole drilled to ensure there is no residual pressure build up behind the cap when removing.

**Item 11. Aerator.**
Very important to the efficient unloading of a tanker. Wear will cause them to leak air backwards. When this happens generally product will follow and cause the air manifold to block. Leaking aerators should be replaced immediately.
**Item 12. Internal Posivent Valve (where fitted).**
The function of this valve is to allow the high pressure air under the shedder plates to escape into the tanker as the pressure rises and falls during operation of the tanker.

**Item 13. Internal Filter (where fitted).**
Internal filters are used to prevent product from inside the tanker from entering vent lines which enable air to be vented from inside the tanker to either under the shedder plates or to the atmosphere. In either instance it is always important that these filters be kept in good order.

**Item 14. Loading Hatch.**
Must be kept in good order. Accidents involving hatches are by far the most common cause of injury and death with pneumatic tankers. Great care must be taken when opening hatches, even residual pressure built up during travel will be enough for the hatch to fly open when opened carelessly.

**Item 15. Vent Valve.**
This valve when opened will vent the tanker to atmospheric pressure. It is a good habit to always leave this valve open at the completion of discharge. This ensures that the tanker is always at atmospheric except when the tanker is being pressurised to unload.

**Item 16. Pressure Gauge.**
The pressure gauge is provides an indication of the internal pressure of the tanker. They should always be kept in good order and be accurate. They should be redlined with the working pressure of the tanker or compressor. Often a second pressure gauge is fitted in the airline. This is of assistance during discharge of difficult products when line pressure can vary from tank pressure.

**Item 17. Top Air Valve.**
This valve when opened will pass air into the tanker, above the product. It is used in conjunction with the aeration valves to both pressurise the tanker and assist with discharge. This means the operator can pressurise the tanker with the top air valve and one aeration valve, which reduces noise from the aerators and prolongs their life.

We recommend this valve is left open to prevent product building up in this line.
OPERATING INSTRUCTIONS.

Connect the discharge hose to the silo fill line.

Ensure that the boost/bypass valve is fully open so that the compressor can be started with no back-pressure.

Ensure all discharge valves are closed.

Ensure that at least, the top air valve and one aeration valve are open (the one on the discharge cone that will be unloaded first).

Start the compressor.

Close the boost valve.

Build up pressure to close to the maximum operating pressure.

Open the boost valve about half way.

Immediately open the discharge valve closest to the silo.

Check the pressure gauge to see if the pressure is rising or falling.

If the pressure is rising, gradually open up the boost valve in small increments until the pressure stabilises at or close to the maximum operating pressure of the tanker.

If the pressure is falling, reverse the above.

When the first discharge cone is close to empty, the pressure will start to fall. Quickly close the discharge valve and open the next gradually. It should be possible to change from one cone to the next with virtually no drop in pressure. This will minimise the discharge time for the tanker.

Close the aeration valve on the cone that has just been emptied and open another.

Always monitor the pressure gauge and adjust the boost valve accordingly.

When the majority of product is emptied from each discharge cone, move progressively back over each cone and allow the pressure to drop slightly as each cone cleans out completely. Total clean-out will be evident when the aerators vibrate freely.

If the tanker is fitted with a shallow angle SureFlo aeration pad in the front of the tanker all other aeration valves must be shut and the boost valve must be gradually closed as the pressure drops during the clean-out process. Eg. all air must be directed to the one pad in order to achieve total clean-out. The front cones should be cleaned out after the rear cones.

When all cones are empty, allow the tank pressure to drop back to atmospheric through one or two discharge valves and fully open the boost valve. If the dust collector on the silo is suspect, it may be necessary to throttle the discharge valves to reduce the airflow to the silo.
When the pressure has dropped to atmospheric, stop the compressor, close the discharge valves and disconnect the discharge hose from the silo.

DO NOT start the compressor under load.

DO NOT stop the compressor under load.

DO NOT leave the tanker while it is unloading.

ALWAYS have at least one aeration line and the top air valve open at all times.

CHECK the operation of the relief valve every week to ensure that it does function and prevents the tanker pressure exceeding the max. operating pressure by 10%.

ALWAYS operate the tanker at or close to maximum operating pressure for maximum efficiency of discharge.
PROCEDURE TO UNBLOCK TANKERS

If a tanker discharge line becomes blocked during unloading it may be possible to unblock the discharge line without the need to disconnect any hoses.

All equipment (valves, hoses and camlocks) need to be in good condition for this to procedure to work.

This procedure should only be carried out by confident competent operator otherwise the blockage could be made worse or equipment could be damaged.

Once a blockage has occurred, close all discharge valves, open tanker dump valve and then shut down the compressor.

With the dump valve open, the tanker pressure will drain down to atmospheric. Determine if the blockage is due to silo being full or lack of pressure during unloading.

The blockage will be easiest to clear back into the tanker cone that is most empty and closest to the blockage.

Close all aeration valves, fully open the boost line and leave tanker dump valve open.

Start up the compressor and set to operating rpm.

The relief valve will most likely go off.

Fully open discharge valve (closest to silo or of most empty cone), and close quickly. Repeat this procedure until the relief valve does not blow off.

Product should run back into the tanker and clear the blockage.

This procedure works by using the blockage to trap pressure between the product blockage and the tanker discharge valve. When this pressure is drained quickly back into the tanker, it creates a vacuum that draws product back with it.
AERATION PADS (WHEN FITTED).
Aeration cloths usually last 1-2 years on cement, depending on the tanker usage. They usually fail due to abrasion and should be replaced when a hole appears or failure of the stitching. The discharging performance will deteriorate markedly if there are holes in the cloths.

It is very important to fit new cloths in accordance with the detailed instructions for maximum life and performance.

SUREFLO AERATORS.
SureFlo aerators should give a period in excess of 1000hours of service with no maintenance. They are quick and simple to replace when the need arises. Ensure that there is no wear of the vessel wall where it is contacted by the disc. A sacrificial stainless steel disc is usually fitted between the vessel and the disc. Wear rates of the disc and wear plate vary depending on how the tanker is operated with what product. It is imperative that the wear rate is monitored and from this periodical preventative maintenance can be scheduled.

INTERNAL FILTERS (WHEN FITTED)
The function of these filters is to vent the void area under the shedder plates and to prevent product entering the void. It is therefore important that they are keep in good condition. Check them at least monthly. The usual life is 2-3 years.

POSIVENT SHEDDER PLATE VENTING SYSTEM (WHEN FITTED).
The key component in this system is the spring loaded check valve that feeds the air into the void section from the main airline. If the spring fails, the fluidising system will not work effectively. If the non return function fails, it is possible to overload the shedder plates causing structural damage. It is therefore important to check this valve on a monthly basis.

Do not fit a dump valve to the void if the Posivent system is fitted. Air must be vented direct from the vessel. One of the internal channel rings is set up for dumping air through a 1½” ball valve and silencer.

DISCHARGE VALVES.
The life of these valves can vary between 3 months (on abrasive products) to 1 or 2 years on non-abrasive products such as flour. Leakage can lead to line blockages, slow pressurising and erratic discharge.
**AIRLINE VALVES.**
Aeration valves generally last many years. Boost valves have a lot shorter life due to being exposed to the product being handled and operated in a throttled position. It is important to maintain these valves in easy to operate, leak free condition for maximum efficiency of operation.

**CHECK VALVES.**
The function of the check valves is to prevent backflow of product into the compressor. They suffer a fairly high wear rate due to the pulsing flow of the air and should therefore be checked for wear on a regular basis - every 3 months.

**RELIEF VALVES.**
The relief valve performs the very important function of preventing the tanker over-pressurising if the tanker is not operated in such a way as to limit the maximum pressure. It therefore should not leak or relieve in normal operation. It is possible for the valve to become frozen shut with potentially dangerous results. Tankers are designed with a significant safety factor but there have been several failures of older tankers due to over-pressurising. We therefore recommend that the relief valve be checked for correct function on a weekly basis.

**PRESSURE GAUGES.**
The pressure gauge is extremely important to the safe, efficient operation of any tanker. The standard oil filled gauge should last 6-18 months and be replaced with a similar quality gauge as soon as its accuracy is suspected.

**HATCHES.**
Routine maintenance in accordance with manufacturers recommendations. Hatches are an extremely critical component of the tanker. When any component is worn or suspect in any way it should be replaced. Do not attempt to open a hatch when there is pressure in the tanker. It is extremely important that hatches are kept in as new working condition.

**SUSPENSION.**
Maintain in accordance with manufacturers recommendations.

**BRAKING SYSTEM.**
The braking system is designed to comply with ADR38. It should therefore not be modified in any way and should be maintained in accordance with the manufacturers recommendations.


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# This maintenance schedule should be treated as a guide only, as service demands on equipment may vary. Ensure the tanker and its’ components are well maintained for optimum operation and performance.
TANK CLEANING INFORMATION

The following procedure has been outlined for tanker washout. This procedure should be used as a base and should be cleared with your customers. Their cleanliness and QA procedures would need to be met and some areas may be able to be relaxed others may be more attention.

Dry and wet wash is described and a combination of these will give the best cleanout. If a dry wash only is needed several steps could be omitted.

Additional care should be taken on flushing out as much product at the silo as possible prior to conducting a clean out. This minimises product to be collected at clean out.

Before entering a tanker Confined space entry guidelines must be followed.

The Prime Mover and Tanker are not to be moved while work is being carried out inside the tanker. The unit must be clearly identified/restricted so that it can’t be moved.

A cursory internal inspection should be made from the hatches to check product level prior to opening any washout valves.

Washout valve outlets and or caps for clean out should be opened/removed and a suitable container placed to collect product.

Residual product in the tanker on the walls should be dry swept where possible with the use of a stiff broom and or a plastic flexible type scrapper. Work from top down and care should be taken not to use the Aerators as steps, this can easily damage them. Care must be taken not to damage/scratch the paint surface.

It is possible that a dry sweep with the operator outside the vessel is all that is needed.

Particular attention should be given cleaning the inside top of the tanker and build up in the tide line area. Moisture will tend to enable more product build up in those areas.

Attention should also be given to cleaning the inside of the hatches.

When as much product as is practicable has been removed the operator should determine if the tanker is suitable for reloading, or if further steps are needed.

If the tanker is ready for another load the washout valves and plugs should be replaced. The tanker should then be run up to clear any product from around the aerators and to blow the discharge line clean. Use two to three aerators at a time to clear product. Give the discharge valves short bursts to clear product. Tanker only needs to be at approx 20kPa. Product and dust blown out line will depend on cleanliness of tank and depending on the location of cleanout a container/bag may be needed.

If more cleaning is needed the tanker could be manually vacuumed out. The tankers are not designed to cope with a vacuum pressure and can only be cleaned out by local manual vacuuming it is common to use small industrial type cleaners to do this.

**Warning: Under no circumstances should a Pressure tanker be closed up and subject to a Vacuum pressure.**

If the tanker has aeration type cloths it should only ever be dry cleaned out by sweeping and vacuuming. Otherwise the cloths can become blanked or blinded off and will not aerate product. If a cloth aeration type tanker needs to be wet washed it may be necessary to replace the cloths afterwards.

If the tanker is an aerator type they can be wet washed out.
For a wet wash care should be taken in a few particular areas inside the vessel. Determine whether the tanker is a “Posivent System” or not and if the tanker has any internal filters. Pancake or tube type in the vessel roof.

Posivent tankers have a check valve in the roof area. This valve needs to be kept clean and should not be flooded with water. There is an elbow on the outlet and generally it is safe to spray in the area around the valve.

If the tanker has any filters in the roof that area should not be wet washed. Wet washing could be with cold or hot water and detergents can be used. You would need to check with your end customer as to the suitability compatibility of detergents with the product and to make sure that the detergent isn’t a contaminant for your given product.

Care must be given if a Truck wash solution was to be used on the inside of a food grade tanker.

When the tanker is wet washed the care must be taken that there is not too much product residue in the tanker to begin with otherwise this may be washed into the discharge line. If it is not fully cleaned out may latter form a dry plug of product in the line.

Make sure that the water level during wet cleaning doesn’t submerge the aerators or the entire discharge pipe at the bottom of the cone.

It may be necessary to scrub product off the walls while washing depending on the level of build up and time interval between cleanouts.

Once the vessel is cleaned the excess water should be drained and could also be blown out of the vessel.

The tanker should then be dried. It is best to dry the tanker out straight away. This ensures that wet product is able to cleared from the tanker and minimises the potential risk of loading onto excess water.

For stockfeed and flour tankers it is also recommended to dry the tanker out to reduce the chance of mould/bacteria growth.

To dry the tanker out the blower should be run up and air should be run into the tanker through all the aerators with the rear discharge valve open and the boost valve closed. After 3-4 minutes and some initial warm up all but the front aerators should be closed off. Air will then be able to flow through from front to rear through the tanker. Initially some moisture will come through then warm dry air should be easily felt at the tanker outlet. When warm air is felt each discharge valve should be opened and closed in turn to drive any moisture from the lower section of each cone. The tanker should be dry after approx 15 minutes of running.

It is important after a wet wash to ensure that all aerators are functioning properly. This is generally done by feeling and hearing the noise from each cone as the aerators are switched on and off. If any cone is suspect (No noise or hoses not warm) it should be more thoroughly checked out prior to loading.

The blower should be shut down and the discharge valve of the tanker closed. The air drain dump should be open so as the tank can breathe while it cools back to ambient temp.
The period between washouts will be quite varied depending on the products being carted and the customers' expectation on cleanliness.

Cement and mineral tankers would generally require a minimum of clean out and may only require cleaning to reduce build up on the walls. Possibly a clean out is only needed every six months this would probably be in combination with some other servicing.

Cleaning may be needed to enable a product change. (Lime to cement or for special strength cements)

For flour and food grade tankers the time between cleanouts would again vary. With flour we would recommend tank be cleaned out once a week and more frequently if a product change requires it. For pelletised stock feed clean out should be approx monthly with main emphasis on the inside top of the vessel, hatches and tide mark. For sugar approx two to three weeks dependant on product change and build up on the walls.

Cleanout intervals could be varied and with the establishment of a cleaning history. The large variety of products and conditions means that this is best established with your customers, and to suit your operational conditions. (Metro vs Long haul. Dry vs humid)

Once the inside of the tanker has been cleaned and the lids are securely closed. The top of the tanker should also be cleaned. Special attention should be given to the hatch ring areas, any product build up on nonskid surfaces as well as debris in mesh walkways. Truck exhaust soot may also need to be cleaned off.

Depending on the products being transported the demand on the cleanliness for the top of the tanker will vary. Food and plastics industry are usually quite involved and tankers used in mining and mineral products areas are less demanding.
THE CONVAIR "POSIVENT" SYSTEM (IF FITTED).
(PATENT NO. 674434)
FOR VENTING OF THE VOIDS IN PNEUMATIC BULK TANKERS.

Many pneumatic bulk tanker vessels have multiple outlets and therefore have void sections in between the discharge cones - refer Diagram 1. These void sections are created by shedder plates whose function it is to shed material down towards the discharge cones where it can be conveyed away.

These shedder plates are designed to be non pressure bearing.

This system relates to a method of equalising the pressure across shedder plates without the necessity to utilise internal filters.

CONVENTIONAL TECHNOLOGY.
Air is delivered to the vessel via a manifold. The vessel is pressurised by passing air through aeration devices and/or top air. As the shedder plates are non pressure bearing, air must be allowed to flow through to the space underneath the shedder plates as the vessel is being pressurised so that the pressure is balanced across the shedder plates. A filter is fitted onto the venting duct to minimise the dust and overflow of product into the void area.

When the vessel is empty, the pressure drops in the vessel and therefore air flows from under the shedder plates through the filter into the vessel in order to maintain equal pressure on both sides of the shedder plates.

THE "POSIVENT" SYSTEM.
This system relates to a configuration of valves and pipework that balance the pressure across the shedder plates without the use of internal filters.

An extra airline is connected into the void and is fitted with a spring loaded check valve. This valve is set to provide a back-pressure such that air will flow through the aeration devices on the discharge cones as well as into the void. The spring loading of this check valve is the key element in this design. With no spring loading all the air from the compressor would flow through the airline to the void and virtually none would be available for aeration. This is due to the fact that all aeration devices have an inherent restriction that is necessary for them to operate efficiently.

A swing check valve is fitted to the top of the venting duct inside the vessel to allow the free escape of air taking that path directly into the vessel thus ensuring that the pressure in the void and in the vessel remain the same.

The function of the internal check valve is to prevent product from inside the vessel flowing down through the venting duct into the void.
If the control valve to one of the aeration devices is restricted in order to achieve more fluidisation in the others, the flow rate through the spring loaded check valve will increase causing an increased restriction. The pressure available to the operating aerators will therefore increase.

When the pressure in the vessel drops at the end of the discharge air flows freely through the internal check valve into the vessel thus maintaining the pressure equalisation.
HATCH ADJUSTMENT
TECHNICAL BULLETIN 08-03

CAM LEVER ADJUSTMENT PROCEDURE
LM 20” MANHOLE ASSEMBLY
WITH ADJUSTABLE CAMS

STEP 1: After cover (1) is installed on weld ring (2) with hinge pin (3), position cam levers (4) on cover and close cam at each hold-down position. Minimal friction resistance between bottom of cam & top of wear plate (5) should be evident. See (FIGURE 1).

STEP 2: Insure upper pivot pin is centered between cam lever “ears.” Use socket wrench to tighten hex bolt (6) on top until gasket and weld ring’s top surface make contact at each of the six cam locations.

STEP 3: To insure a good peripheral seal tighten the hex bolt one additional turn at each of the six positions (Each turn of hex bolt = .050”). Care should be taken so that stud adjustment does not compress gasket more than .075”. Over compressing could result in premature gasket indentation and permanent grooving.

STEP 4: Repeat for each cam position.

NOTE (1): Gaskets should be checked periodically for cuts or accumulation of product that could result in sealing problems. Replace all damaged gaskets.

NOTE (2): Cam levers and wear plate need to be inspected for excessive wear in the area where they make contact. If the cam lever opens easily with minimal resistance, replace the worn component.