Section 1 ROUTINE MAINTENANCE SCHEDULE

It is recommended that a Maintenance / Inspection Log is maintained to record the results of all maintenance carried out on the Plant which will facilitate fault diagnosis when required.

This section covers the requirements of the CBMH pneumatic conveying systems only. Always check the specific O&M Manual sections for routine maintenance requirements of the ancillary equipment listed at the end of this section.

1.1 Weekly Maintenance Schedule

All Site Safety Rules should be complied with when carrying out these inspections however there should be no need to specifically isolate any areas of the Plant unless any disassembly work is being carried out.

1.1.1 The CBMH pneumatic conveying systems are designed to be operated automatically from the central control station and as such will generally be unattended out in the field however it is recommended that on a weekly basis:

- a general visual walk-through inspection of the whole Plant is carried out from the CBMH conveying vessels through to the storage silo/hopper top and any discrepancies, signs of leakage or wear noted
- a functional check is carried out on the various operating conditions from the central control station and any discrepancies noted

Any discrepancies or signs of wear should be recorded and suitable corrective or preventative maintenance carried out as soon as practical.

1.1.2 Visually check the silo dust filter(s) for evidence of dust leakage and maintain as necessary.

1.2 6-Monthly Maintenance Schedule

In order to carry out this maintenance it is expected that the CBMH System being maintained will be safely shutdown and isolated. All Site Safety Rules should be complied with when carrying out such work.

> ⚠ ***Warning!***
>
> Before carrying out maintenance on any system, the system must be fully shut-down and safely isolated from compressed air, electrical, cooling water and material supplies and any residual air pressure safely vented using the recommended **Maintenance Shutdown Procedure**.
>
> Where practical all isolating valves should be locked into the 'closed' position using chain & padlock or other suitable devices.
>
> Ensure equipment surface temperatures have sufficiently cooled to allow safe manual handling of components.

In addition to the weekly routine maintenance:

1.2.1 CBMH recommend that all Dome Valve shafts and bearings are greased on a 6-monthly basis using MobilTemp SHC460 Special grease or equivalent. The grease nipples are located on the Dome Valve body.

1.2.2 Visually inspect the condition of all Pneumatic Panel filters and note any cleaning required, including those fitted to Route Selection Valves, Dome switch Valves and Dump Valves.

1.2.3 Visually inspect all conveying vessel Inlet Expansion Bellows (thermal expansion joint above the inlet Dome Valve on the conveying vessel) and note any signs of wear, stress or leakage.

1.2.4 Any discrepancies or signs of wear should be recorded and suitable corrective or preventative maintenance carried out as soon as practical.

1.3 12-Monthly Maintenance Schedule

In order to carry out this maintenance it is expected that the CBMH System being maintained will be safely shutdown and isolated. All Site Safety Rules should be complied with when carrying out such work.

> ⚠ ***Warning!***
>
> Before carrying out maintenance on any system, the system must be fully shut-down and safely isolated from compressed air, electrical, cooling water and material supplies and any residual air pressure safely vented using the recommended **Maintenance Shutdown Procedure**.
>
> Where practical all isolating valves should be locked into the 'closed' position using chain & padlock or other suitable devices.
>
> Ensure equipment surface temperatures have sufficiently cooled to allow safe manual handling of components.

In addition to the 6-monthly routine maintenance:

1.3.1 Inspect all Dome Valve air limit switch and any positional limit or proximity switch settings for correctness and reset as necessary.

1.3.2 Inspect the condition of the exhaust silencers on the Pneumatic Panel (located on the panel underside) and replace as necessary.

1.3.3 Inspect and clean the Pneumatic Panel air filter. Replace filter element if necessary.

1.3.4 Remove and clean the screen from the conveying air manifold strainer. Replace as necessary.

1.3.5 Visually inspect all valves fitted to the conveying vessel and air manifolds and check that they are functioning correctly. Replace any faulty valves.

1.3.6 Visually inspect all field-mounted level switches, pressure and temperature instruments fitted to the conveying system and check that they are functioning correctly. Replace any faulty components.

1.3.7 Visually inspect the condition of all instrument pneumatic piping fitted to the conveying vessel(s), Route Selection Valves, Dome Switch Valves and Dump Valves for signs of damage or deterioration and replace as necessary.

1.3.8 Inspect the condition of the electrical connections to all field-mounted level switches, pressure and temperature instruments fitted to the conveying system for signs of deterioration and replace / repair as necessary.

1.3.9 Inspect the manual isolating valve(s) between the process collection hopper/silo outlet and conveying vessel inlet, clean off any build-up of dirt on the spindle, grease the spindle and check that the valve can be closed.

1.3.10 Visually inspect the condition of all conveying pipeline air injection points and any Density Stabilisers fitted to the system, and replace any damaged components.

1.3.11 Visually inspect the condition of the conveying pipeline, all pipeline components and joints for signs of leakage, wear or deterioration and repair / replace as necessary.

1.3.12 Inspect the clean-side internals of the silo dust filter(s) for signs of leakage, replace bags and clean as necessary.

1.3.13 Inspect and clean all Storage Silo pressure and vacuum relief valves, removing any foreign matter and ensuring that all seals are intact. If these have not been supplied by CBMH, refer to the documentation provided by their supplier.

1.3.14 Inspect and clean all **pressure relief safety valves** fitted to the Plant following the manufacturer's instructions and check that they are set correctly to the values shown on the Plant P&ID's. These are generally fitted to the air compressor discharge header(s) and all air receivers. All safety valves should be identifiable from the Plant P&ID's.

1.4 24-Monthly Maintenance Schedule

In order to carry out this maintenance it is expected that the CBMH System being maintained will be safely shutdown and isolated. All Site Safety Rules should be complied with when carrying out such work.

> ⚠ ***Warning!***
>
> Before carrying out maintenance on any system, the system must be fully shut-down and safely isolated from compressed air, electrical, cooling water and material supplies and any residual air pressure safely vented using the recommended **Maintenance Shutdown Procedure**.
>
> Where practical all isolating valves should be locked into the 'closed' position using chain & padlock or other suitable devices.
>
> Ensure equipment surface temperatures have sufficiently cooled to allow safe manual handling of components.

In addition to the 12-monthly routine maintenance:

1.4.1 Remove and inspect all conveying vessel Dome Valves using suitable lifting equipment.

- check the top surface of the dome for signs of wear and replace if necessary
- replace the Dome Valve inflatable seal
- replace the Dome Valve shaft bearings and shaft seals
- inspect the air cylinder barrel for score marks, scratches, pitting or rust etc. and if found replace the air cylinder as necessary.
- inspect the vane actuator for signs of wear or damage, and if found replace the actuator as necessary.

1.4.2 Remove and inspect all Route Selection Valve and Dome Switch Valve Dome Valves using suitable lifting equipment.

- check the top surface of the dome for signs of wear and replace if necessary
- replace the Dome Valve inflatable seal
- replace the Dome Valve shaft bearings and shaft seals
- inspect the vane actuator for signs of wear or damage, and if found replace the actuator as necessary.

1.4.3 Remove and inspect all Dump Valve internal parts using suitable lifting equipment.

- inspect the sealing surface inside the Dump Valve body for signs of wear or corrosion and clean as necessary
- inspect the inflatable seal for signs of wear and replace the seal as necessary
- inspect the deflector plate for signs of wear and replace as necessary
- inspect the air cylinder barrel for score marks, scratches, pitting or rust etc. and if found replace the air cylinder as necessary.

1.4.4 Remove and inspect all Terminal Box internal parts using suitable lifting equipment.

- inspect the deflector plate for signs of wear and replace as necessary

1.4.5 Remove and inspect a sample of each type of Expansion Joint used in the conveying pipeline for signs of internal wear and repair / replace as necessary. If it is necessary to repair / replace the Expansion Joint then it is likely that similar work may be required on all downstream Expansion Joints.

1.4.6 Remove a Bend from the start and towards the end of the conveying pipeline and inspect for build-up of material and signs of wear. Clean, repair or replace as necessary.

1.4.7 Remove a suitable straight pipework section near the start, and near to the end of the conveying pipeline and inspect for build-up of material and signs of wear. Clean, repair or replace as necessary.

1.5 Conveying Pipework Maintenance

1.5.1 Items within the conveying pipeline requiring regular maintenance are covered above, and their maintenance procedures are included in Section 9.

1.5.2 It is possible to extend the life of straight conveying pipe sections, providing that there are no additional sockets or components attached, by rotating the section on the flanges through 45°.

1.5.3 Pipe sections and bends or wear straights which have worn through may be temporarily repaired by welding a patch over the affected area, providing that this can be accessed safely, and once all conveying systems connected to that pipeline have been shutdown. The worn pipe section or component should be replaced with a new identical part as soon as practical.

Section 2 MAINTENANCE PROCEDURES

2.1 Maintenance Shutdown Procedure

> ⚠ ***Warning!***
> Before carrying out maintenance on any system, the system must be fully shut-down and safely isolated from compressed air, electrical, cooling water and material supplies and any residual air pressure safely vented using this recommended **Maintenance Shutdown Procedure**.
>
> Where practical all isolating valves should be locked into the 'closed' position using chain & padlock or other suitable devices.
>
> Ensure equipment surface temperatures have sufficiently cooled to allow safe manual handling of components.

2.1.1 if 'local / remote' control facilities are available, switch to 'local' to ensure that you have control of the system and cannot be overridden by the control room, otherwise take appropriate steps to ensure that the system cannot be inadvertently "started" or operated except at your command

2.1.2 switch the Logic Control for the System to 'stop' and wait until the system reaches the end of its cycle and actually stops

2.1.3 isolate the electrical supplies to the system using either the main isolator on the PLC panel, or individual terminal isolation within the PLC for the required panels and components on the system being maintained ~ **this should be carried out by a competent qualified electrician**

2.1.4 lock the PLC panel and attach a warning notice of maintenance work being carried out so that the electrical supply should not be inadvertently reconnected

2.1.5 close the manual or pneumatic isolating valve above the conveying vessel to stop the material flow

2.1.6 ensure the vessel is empty of material by selecting the 'purge' command at the system HMI screen

2.1.7 ensure that the temperature of the conveying vessel and all valves is sufficiently cool to allow safe contact when dismantling

2.1.8 close the conveying air supply isolating valve and ensure that the vessel / pipeline pressure is fully vented to atmospheric pressure through the vessel drain valve

2.1.9 close the control air supply isolating valve to the pneumatic panel and vent to atmospheric pressure through the panel filter set

2.1.10 close any cooling-water supply isolating valves (if fitted)

2.1.11 use warning notices around the plant to inform other personnel of work being carried out

2.1.12 ⚠ ***Caution!*** when replacing components, pipework or fittings within the equipment pneumatic circuits on any CBMH products, always use thread sealant for any screwed joints, such as Loctite 577, Impact Adhesive Pipe Seal 203 or equivalent ~ **do not use PTFE tape**

2.1.13 when dismantling equipment in order to clear any alarm condition always be aware that depending on circumstances the vessel and/or pipeline may be full of material which could be hot and may be in a pressurised condition which will need to be vented through the vessel drain valve, or by carefully cracking open a pipeline flange if the vessel outlet Dome Valve is closed

2.1.14 ⚠ ***Caution!*** before starting any maintenance activity, **always refer** to the **General Safety information** contained in Section 1 of this Manual, and in particular, familiarise yourself with any Health & Safety Hazards associated with the material(s) being conveyed, and use suitable protective clothing and equipment to avoid excessive contact with the material

2.2 Maintaining the CBMH Dump Valve™

2.2.1 The CBMH Dump Valve™

The Dump Valve is used as a silo / hopper feeding valve within the conveying pipeline and is located directly on the silo top to either direct the flow of material into a reception silo/hopper or allow it to by-pass the silo/hopper to the next reception point. The Dump Valve is used in conjunction with the CBMH Terminal Box to allow multiple reception points to be fed from a single pipeline.

The Dump Valve comprises a fabricated by-pass tube and deflector assembly which is moved into alternate positions within a fabricated mild steel case by a heavy-duty pneumatic cylinder. Inflatable pneumatic seals are used to ensure air-tightness when the by-pass tube is in either position.

The Dump Valve is controlled to move through the conveying system Logic Controls only whilst the conveying system is between transfer cycles, and the position is indicated by open/closed proximity switches.

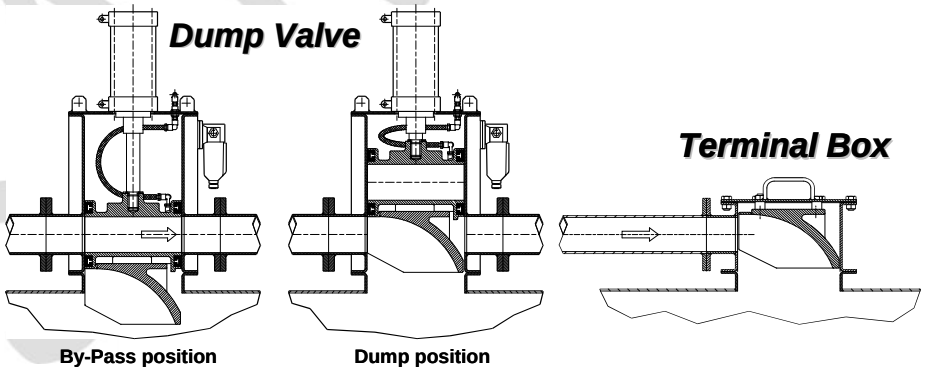
The **Dump Valve** is supported from a rectangular flanged upstand on the silo top and is complete with a pneumatic panel housing the required solenoid valves and pressure switches for safe operation and complete with an isolated, filtered control air supply connection.

Care must be taken that there is no obstruction to the movement of the slide assembly from the silo top mounting flange.

Deflector construction varies depending on application and the correct part no. will be specified in the relevant Dump Valve Parts List.

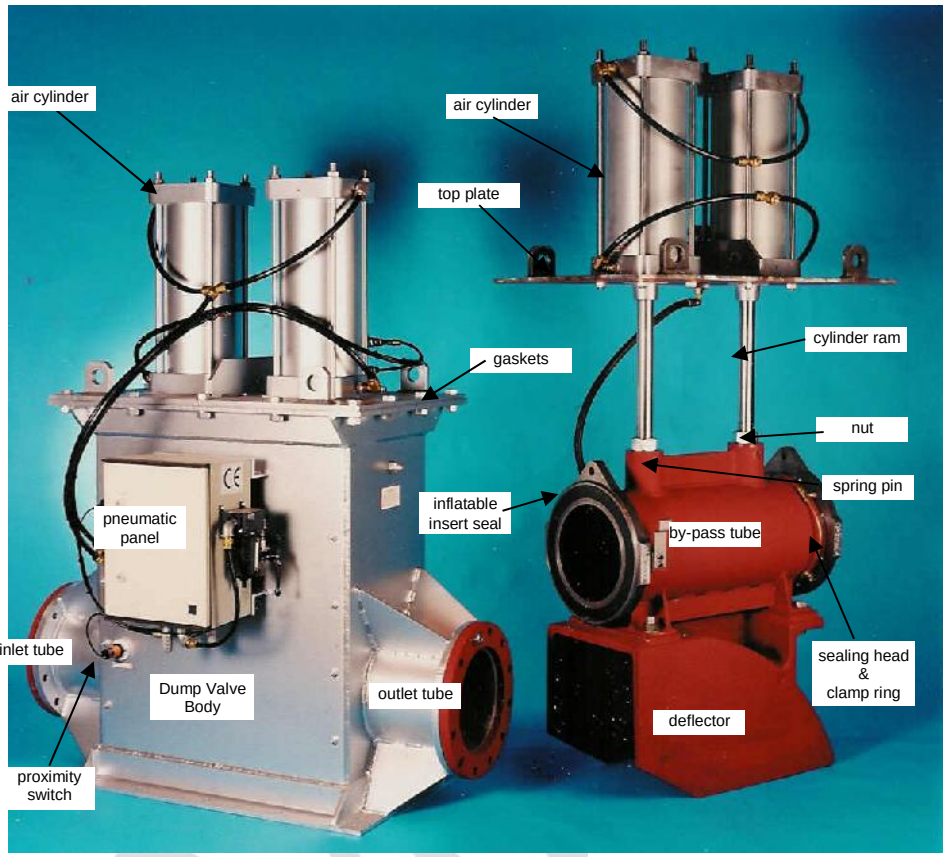
Dump Valve and Terminal Box deflectors are similar and may be interchangeable for equivalent pipe sizes and applications.

Inflatable Seal Material	neoprene or silicone rubber
Pneumatic Panel Rating	IP 55



Dump Valves and Terminal Boxes of equal size are interchangeable with regard to pipeline termination and silo top fixings.

2.2.2 Dump Valve Key Components



The above information showing a 250mm Dump Valve is included only for guidance purposes and may be different for this Plant. Smaller Dump Valve sizes only use 1 air cylinder. Please refer to the Dump Valve General Arrangement drawing(s) and Pneumatic Circuit(s) for the precise arrangement and location of components for the Plant and other components not shown in the above photograph.

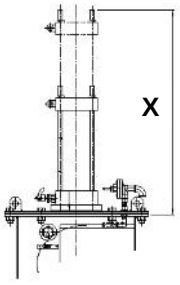
2.2.3 Removal of the Dump Valve Internal Assembly

To carry out maintenance on the Dump Valve it will be necessary to remove the internal assembly which can be carried out with the air cylinder still attached if sufficient height is available above the valve as shown in the following table.

Take care that adequate lifting facilities and safe working access are available to carry out the work.

Always refer to the Dump Valve GA Drawing and Pneumatic Circuit for the precise details of each valve, and the Parts List included in Section 10 of this Manual.

Dump Valve Size	**Weight of Internal Assembly** (approx)	**Dimension "X"**	**Dump Valve Size**	**Weight of Internal Assembly** (approx)	**Dimension "X"**
50mm	70 kg	910mm	200mm	275 kg	1680mm
80mm	75 kg	910mm	250mm	300 kg	1995mm
100mm	85 kg	960mm	300mm	350 kg	2250mm
125mm	110 kg	1230mm	350mm	550 kg	2250mm
150mm	150 kg	1390mm	400mm	700 kg	2700mm



2.2.4 Inspection or Replacement of the Dump Valve Seals

> ⚠ ***Warning!***
> Before carrying out maintenance on any system, the system must be fully shut-down and safely isolated from compressed air, electrical, cooling water and material supplies and any residual air pressure safely vented using the recommended **Maintenance Shutdown Procedure**.
>
> Where practical all isolating valves should be locked into the 'closed' position using chain & padlock or other suitable devices.
>
> Ensure equipment surface temperatures have sufficiently cooled to allow safe manual handling of components.

2.2.4.1 isolate the air and electrical supplies and disconnect the pneumatic pipes (two from the cylinder, one from top plate bulkhead)

2.2.4.2 remove the top-plate bolts and lift the by-pass tube/deflector assembly out of the box using suitable lifting equipment so that the deflector is visible

2.2.4.3 check the by-pass tube and deflector for wear or damage and replace if necessary

2.2.4.4 visually inspect the insert seals for signs of wear

2.2.4.5 to pressure test the insert seals, lower the assembly into the box until the whole of the sealing head is below the top of the box

2.2.4.6 inflate the seals to 400 KPa (g) and check the seals, the seal retaining screws and the internal pipework for leaks

2.2.4.7 if there are no leaks and no further work to be done reassemble the Dump Valve as described below

2.2.4.8 to replace a Dump Valve insert seal

- unscrew the set screws, lever the seal from the sealing head and separate it from the clamp ring
- fit the new seal to the clamp ring
- press the insert seal into the sealing head and ensure that the seal inflation holes align
- liberally coat the set screws and washers with an appropriate thread sealant (Chesterton Gold End for example) and tighten
- test the new seal as described above

2.2.4.9 reassemble the Dump Valve as follows (refer to the Parts List Identification Drawing in Section 10 of this Manual for additional information)

- when in the by-pass position, the alignment between the bypass tube and the Dump Valve housing inlet and outlet tubes is very important. Care should be taken to ensure that all gaskets removed from between the air cylinder, top plate and housing should be re-fitted or replaced with ones of the same thickness
- similarly the washer(s) or nut installed between the air cylinder rod and the bypass tube have been fitted to give the correct alignment and must be re-fitted into the same positions on reassembly
- lower the assembly into the box, fit the top plate bolts and reconnect the pneumatic pipes
- where appropriate for Dump Valves > 250 mm size, ensure that the by-pass tube and sealing head alignment is correct to the dimensions indicated on the Parts List Identification Drawing by adjusting the sealing head alignment strip using gaskets
- ensure that the proximity target is in contact with the side of the Dump Valve body as the valve position is changed
- connect the compressed air supply and the electrical supply

2.2.4.10 ⚠ ***Caution!*** **always with the Dump Valve seal deflated**, manually operate the valve into the by-pass and dump positions by moving the solenoid valve spool

2.2.4.11 check the proximity switch LED's to confirm correct operation of the switch at the same instant as the cylinder reaches the full length of its stroke

2.2.4.12 Incorrect proximity switch setting will cause the by-pass tube to stop out of position and damage the seals

2.2.5 Inspection or Replacement of the Dump Valve Deflector

2.2.5.1 remove the by-pass tube/deflector assembly from the Dump Valve box as described in **Inspection or Replacement of the Dump Valve Seals**

2.2.5.2 lift the assembly completely out of the box using suitable lifting equipment and stand it on the floor or preferably a bench

2.2.5.3 undo the bolting to detach the deflector

2.2.5.4 if the seals and by-pass tube are in good condition fit the replacement deflector using Binx nuts

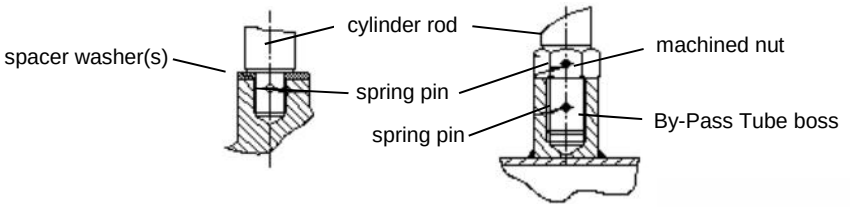
- deflectors are manufactured from different materials, some of which are fitted with wear liners, depending on the application and CBMH technology being used
- refer to the Dump Valve GA drawing for information on the type of deflector fitted to the valve
- it is important that the correct replacement part is fitted to avoid premature wear and the possibility of a more serious failure

2.2.5.5 if there is no further work to be done reassemble the Dump Valve as described in **Inspection or Replacement of the Dump Valve Seals**

2.2.6 Replacement of the Dump Valve By-Pass Tube

2.2.6.1 with the by-pass tube/deflector assembly removed from the Dump Valve, mark and disconnect the internal pneumatic pipework

2.2.6.2 punch out the spring pin(s) which locks the cylinder to the by-pass tube and unscrew the ram



50 – 150mm **200 – 400mm**

2.2.6.3 note the number of washers or shims used where applicable – these will need to be refitted

2.2.6.4 the sealing heads are pressed on to the by-pass tube during assembly and can be removed if they are suitable for further usage on another by-pass tube

2.2.6.5 fit new sealing heads to the by-pass tube and insert the seals as described in **Inspection or Replacement of the Dump Valve Seals** and bolt the deflector to the by-pass tube using Binx nuts

2.2.6.6 grease the cylinder ram thread, place the shims and washer over the thread or locknut and screw into the welded boss on the by-pass tube

2.2.6.7 align the holes in the ram and boss and drive in a new spring pin

2.2.6.8 reconnect the pneumatic pipework

2.2.6.9 lift the by-pass/deflector assembly back into the Dump Valve housing using suitable lifting equipment and test the seals for leaks as described in **Inspection or Replacement of the Dump Valve Seals**

2.2.6.10 reassemble the Dump Valve as described in Inspection or Replacement of the Dump Valve Seals

2.2.7 Replacement of the Dump Valve Air Cylinder

2.2.7.1 with the by-pass tube/deflector assembly removed from the Dump Valve, mark and disconnect the internal pneumatic pipework

2.2.7.2 punch out the spring pin(s) which locks the cylinder the by-pass tube and unscrew the ram as described above noting the number of washers and shims used.

2.2.7.3 grease the cylinder ram thread, place the shims and washer, or machined nut over the thread as appropriate and screw into the welded boss on the by-pass tube

2.2.7.4 fit the assembly into the Dump Valve body and align the by-pass tube to within ± 1.0mm of the inlet and outlet pipes adjusting and marking the cylinder rod position to suit

2.2.7.5 remove the assembly and mark the position of the spring pin(s) on the cylinder ram

2.2.7.6 unscrew the ram, and drill a hole(s) for the spring pin(s) as required

2.2.7.7 reassemble the ram, washer, shims, nut as applicable and screw into position in the by-pass tube aligning the holes in the ram, boss and nut (as applicable) and drive in a new spring pin

2.2.7.8 reconnect the pneumatic pipework

2.2.7.9 lift the by-pass/deflector assembly back into the Dump Valve housing using suitable lifting equipment and test the seals for leaks as described in **Inspection or Replacement of the Dump Valve Seals**

2.2.7.10 reassemble the Dump Valve as described in Inspection or Replacement of the Dump Valve Seals

2.2.7.11 check the correct valve position as indicated in **Inspection or Replacement of the Dump Valve Seals**, and carry out further adjustment as necessary as described above

2.2.8 Maintaining the Pneumatic Panel

Pneumatic Panel and Components

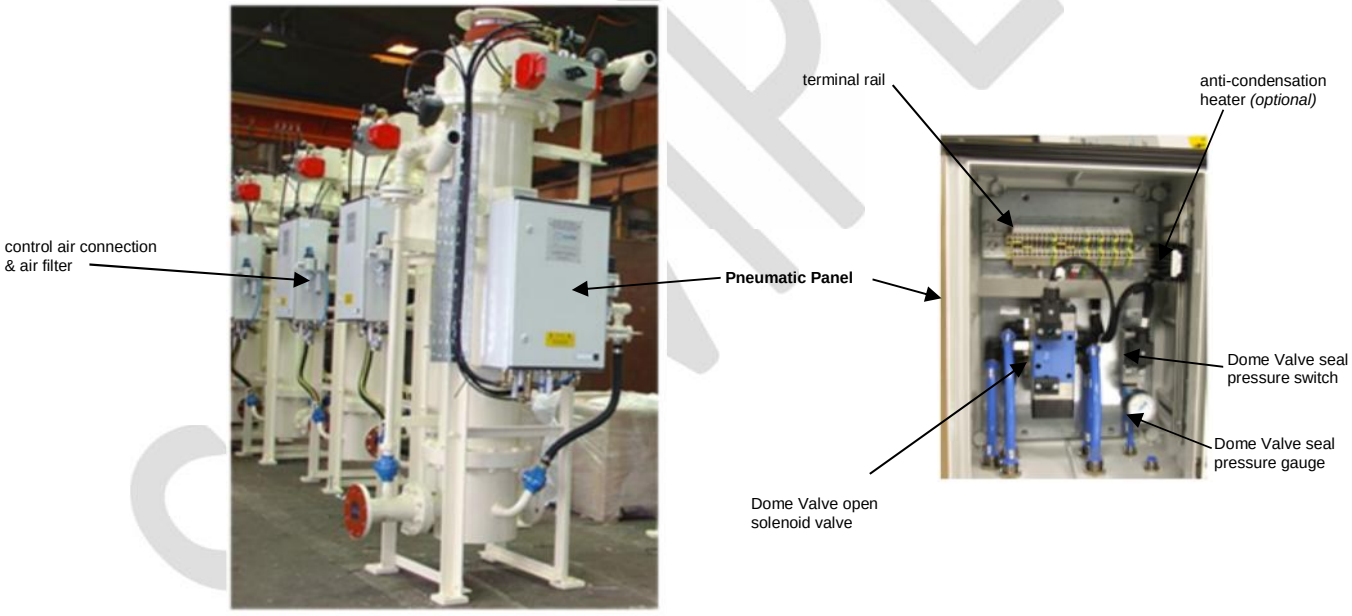
Pneumatic panels are attached to most CBMH products to house the solenoid valves and pressure switches (and sometimes other equipment) necessary to perform control functions, however some solenoid valves or pressure switches may be field-mounted directly to the machine and in this case the air supply to these items will be taken from within the pneumatic panel.

Depending on the CBMH technology and application, the pneumatic panels for the project may vary from the typical examples shown below for guidance purposes.

Caution!
The pneumatic panel is lockable and should be kept locked at all times as it contains live electrical components, and should only be opened by trained personnel when maintenance of the system is required.

Although the pneumatic panel includes important control items, there are no regular or routine maintenance requirements for these other than inspecting and cleaning the **air filter** on an annual basis. If any component within the panel is faulty or damaged the complete item should be replaced with a spare part supplied by CBMH.

Always follow the manufacturer's installation, set-up and fitting instructions supplied with the part, and install the replacement part in the position shown on the GA drawings.



If there is possibility of dust present in any of the pneumatic lines through non-return valve failure etc., clean this out thoroughly by removing the lines in question and blowing through with compressed air.

This panel includes general electronic equipment and instruments which may present an ecological hazard and should be disposed of in accordance with local regulations regarding Waste Electrical & Electronic Equipment.

2.2.9 Cleaning or Replacing the Air Filter

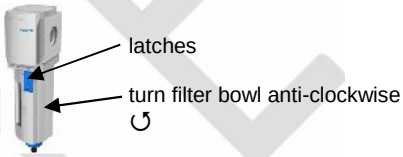
(courtesy of Festo)

The air filter is fitted to the control air inlet supply to remove particulate matter and any condensate from the air supply before it can enter the various pneumatic control circuits and components.

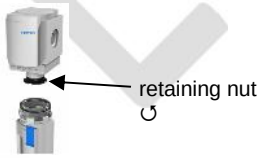
The filter includes an automatic condensate drain which operates when a specific condensate level is reached within the cartridge, discharging from the bottom of the filter bowl. If necessary a suitable plastic tube can be attached to divert any discharge into a collection device however, as most CBM conveying systems recommend the use of control air dried to -20°C pressure dew point, it is unlikely that condensate discharge will warrant any such measures.

Inspect and clean the filter element during the annual inspection of the CBMH product, and replace the element with a new part if necessary.

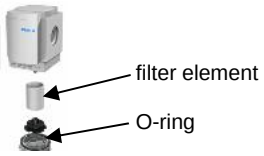
- close the control air supply isolating valve
- slide the latches on the filter bowl to allow release and release by turning the bowl anti-clockwise



- turn the retaining nut anti-clockwise and remove to release the filter element



- withdraw the filter element, inspect, clean or replace



- reassemble the filter by reversing the procedure replacing the sealing O-ring if damaged

2.3 Obstruction Clearing Procedure

Obstruction and blockages can occur in various sections of the Plant due to a number of reasons:

- a foreign object creating an obstruction in an inlet, outlet Dome Valve or pipeline routing equipment
- a foreign object creating an obstruction in the vessel discharge or conveying pipeline
- out-of-specification material being conveyed and causing a blockage in the system feed hopper, conveying vessel or conveying pipeline
- failure of a process valve, instrument or component causing material to settle in the pipeline
- failure of the logic control system
- failure of the compressed air system

CBMH pneumatic conveying systems have a degree of anti-blockage protection built-in to the logic controls which varies depending on the CBMH technology being used, which will always attempt to automatically clear any pipeline blockages which are thought to be occurring, however none of these systems can accommodate all foreseeable circumstances and at some point operator intervention may be required to try to clear the blockage.

In extreme circumstances, especially where foreign bodies or out-of-specification material is the cause, then the obstruction will have to be removed manually before the system can be put back into normal operation.

The system HMI screens will advise on all alarm conditions which should then be investigated according to the Alarm Condition & Fault Diagnosis charts before embarking on any manual clearing activity.

> ⚠ ***Warning!***
>
> Before carrying out any site activities for investigating or clearing obstructions or blockages which involve entering system pneumatic panels, or dismantling any components, then ensure that the system is set to ‘stop’ in the Logic Controls and that the plant operators are aware of the work being carried out so that they do not attempt to ‘start’ or ‘purge’ the system until it is safe to do so.
>
> Before carrying out maintenance on any system, the system must be fully shut-down and safely isolated from compressed air, electrical, cooling water and material supplies and any residual air pressure safely vented using the recommended **Maintenance Shutdown Procedure**.
>
> Where practical all isolating valves should be locked into the ‘closed’ position using chain & padlock or other suitable devices.
>
> Ensure equipment surface temperatures have sufficiently cooled to allow safe manual handling of components.

2.3.1 Obstruction in the System Feed Hopper

If an obstruction is suspected within the conveying system feed hopper or chutes then this will have to be manually removed using appropriate and safe maintenance procedures.

Depending on the arrangement of the feed hopper / chutes it may be possible to gain access through inspection ports or rodding points without having to remove any major equipment.

If this equipment is within the CBM scope of supply, refer to the system GA Drawings for appropriate access points.

Be aware that if the blockage is caused by out-of-specification material or a foreign body then any such material or foreign body entering the CBMH conveying system may result in obstructions and blockages within that part of the process in which case it may be advisable to manually remove all such material from the hopper.

Be aware that the hopper will be full of material which may be hot and take appropriate precautions to prevent skin contact.

Warning!
Never enter a hopper or silo, or work beneath a hopper or silo with an open outlet, which is full of material without taking suitable safety precautions and ensuring that you are completely secure against falling into, or becoming covered with material, especially when dealing with fine dusts such as fly ash, and hot materials.

2.3.2 Obstruction of Conveying Vessel inlet Dome Valve

If an obstruction is suspected within the inlet Dome Valve then it may be possible to clear this manually by cycling the valve open / closed repeatedly without having to dismantle any equipment.

> ***Warning!***
>
> Ensure that the system is set to ‘stop’ in the Logic Controls and that the plant operators are aware of the work being carried out so that they do not attempt to ‘start’ or ‘purge’ the system until it is safe to do so.
>
> Be careful when entering the pneumatic panel which will still have a ‘live’ electrical supply

2.3.2.1 isolate the conveying air supply to the conveying vessel

2.3.2.2 open the pneumatic control panel and use the override button on the Dome Valve ‘open’ solenoid to cause the valve to open and close for 2 cycles

2.3.2.3 if the Dome Valve closes and seals correctly, turn on the conveying air supply and at the HMI screen select the ‘purge’ command to convey the material within the conveying vessel to the silo

more than one ‘purge’ cycle may be required to ensure that the obstruction actually clears the pipeline

be aware that an obstruction cleared in this way may cause problems in the system further down stream, or in the storage silo or its discharge equipment

2.3.2.4 if the Dome Valve has not closed and sealed after the 2nd cycle then the obstruction will have to be manually removed by dismantling the vessel inlet Flexible Adaptor above the Dome Valve or removing the Dome Valve itself using appropriate and safe maintenance procedures

be aware that the vessel, and any chutes between the inlet Dome Valve and the manual isolation valve will be full of material which may be hot and take appropriate precautions to prevent skin contact

2.3.2.5 always restart the system following such maintenance with a ‘purge’ cycle to ensure that the system is clear of material before setting it to the normal ‘start’ condition

2.3.3 Obstruction of other Dome Valves

If an obstruction is suspected in

- the Conveying Vessel outlet Dome Valve, or
- a Dome Valve on any Route Selection Valve, or
- a Dome Valve on any Dome Switch Valve

this will have to be cleared manually by dismantling adjacent equipment in order to gain access to the Dome Valve, or removing the Dome Valve itself using appropriate and safe maintenance procedures.

Be aware that the vessel and pipeline may be full of material which may be hot and take appropriate precautions to prevent skin contact.

With a vessel outlet Dome Valve, depending on the vessel size, there may be a significant volume of material to be removed from the vessel and will need to be cleared up safely.

Depending on the extent and type of the obstruction, it is advisable to remove the Dome Valve top plate to check for any damage to the dome or seal.

Always restart the system following such maintenance with a 'purge' cycle to ensure that the system is clear of material before setting it to the normal 'start' condition.

2.3.4 Conveying Vessel Obstruction

If an obstruction or blockage is suspected within the conveying vessel then this will have to be manually removed by dismantling sections of the vessel assembly using appropriate and safe maintenance procedures.

This is generally most easily accomplished by removing the vessel outlet components below the outlet flange of the vessel shell, or a conveying pipe section adjacent to the vessel so that the material or obstruction can be removed.

Be aware that the vessel and local pipeline may be full of material which may be hot and take appropriate precautions to prevent skin contact.

Depending on the vessel size, there may be a significant volume of material to be removed from the vessel and will need to be handled and cleared up safely.

Caution!
Never look directly up into a conveying vessel with material inside which could release and fall from the vessel at any time.

It is advisable to check that any vessel integral level switches are not damaged and are working correctly before reassembling the vessel.

Always restart the system following such maintenance with a 'purge' cycle to ensure that the system is clear of material before setting it to the normal 'start' condition.

2.3.5 Dump Valve Obstruction

If an obstruction or blockage is suspected within a Dump Valve then this will have to be manually removed by dismantling the adjacent conveying pipework sections to gain access to the Dump Valve by-pass tube using appropriate and safe maintenance procedures.

Be aware that the local pipeline may be full of material which may be hot and take appropriate precautions to prevent skin contact.

Depending on the extent and type of the obstruction, it is advisable to also remove the Dump Valve internal assembly to check for any damage.

Always restart the system following such maintenance with a 'purge' cycle to ensure that the system is clear of material before setting it to the normal 'start' condition.

2.3.6 Conveying Pipeline Obstruction

If an obstruction or blockage is suspected within the conveying pipeline then the section of pipe which is blocked will have to be first identified.

For MD-Pump systems, where and additional pressure transmitter is monitoring conveying pressure downstream of the conveying vessels, the pressure trace at the HMI screen may help to determine if the blockage is within the inter-vessel pipework, or the main conveying pipe.

Before dismantling any equipment it may be possible to clear the obstruction by some simple measures which involve work both on the plant, and at the HMI screen.

> ⚠ ***Warning!***
>
> Ensure that the system is set to 'stop' in the Logic Controls and that the plant operators are aware of the work being carried out so that they do not attempt to 'start' or 'purge' the system until it is safe to do so.

2.3.6.1 on the plant, open the conveying vessel(s) manual drain valve(s) to vent any residual pressure and close the drain valve(s) when complete

2.3.6.2 at the HMI screen, select the 'purge' command which will carry out a conveying cycle without introducing any further material into the system

2.3.6.3 if the system is still has residual pressure then repeat the vent and 'purge' procedure again

2.3.6.4 if there is no residual pressure select a further 'purge' cycle at the HMI screen and check the length of the conveying period against a normal cycle and repeat until the cycle time appears normal or better

2.3.6.5 if the obstruction has not been cleared, then on the plant, and where safely accessible, try to identify the location of the obstruction within the pipework by tapping the pipe with a hammer starting at the silo end and working backwards

2.3.6.6 for a one-off attempt, with the system in 'purge' and during the cycle when air pressure is present, heavily hit the blockage area of the pipe with a hammer to see if the obstruction will release starting at the point nearest to the silo and working backwards

2.3.6.7 if the obstruction has still not been cleared it will have to removed manually by dismantling the pipework local to the blockage using appropriate and safe maintenance procedures and ensuring that any residual pressure in the system is first vented

2.3.6.8 always restart the system following such maintenance with a 'purge' cycle to ensure that the system is clear of material before setting it to the normal 'start' condition

Section 3 PARTS LISTS

3.1 Index to Parts Included and Where Used

This section contains the Parts Lists and Parts Identification Drawings for the following CBMH products used on the Plant in the areas described. No other items on the Plant should require routine maintenance and all other CBMH Part No's should be identifiable from the GA Drawings, Pneumatic Circuits and Valve & Instrument Lists.

3.1.1 CBMH Dump Valves

CBMH Part No	Description	Where used
XXXXXXXXX		

3.3 P22686B-00 ~ 80mm PH0 Dump Valve - Example

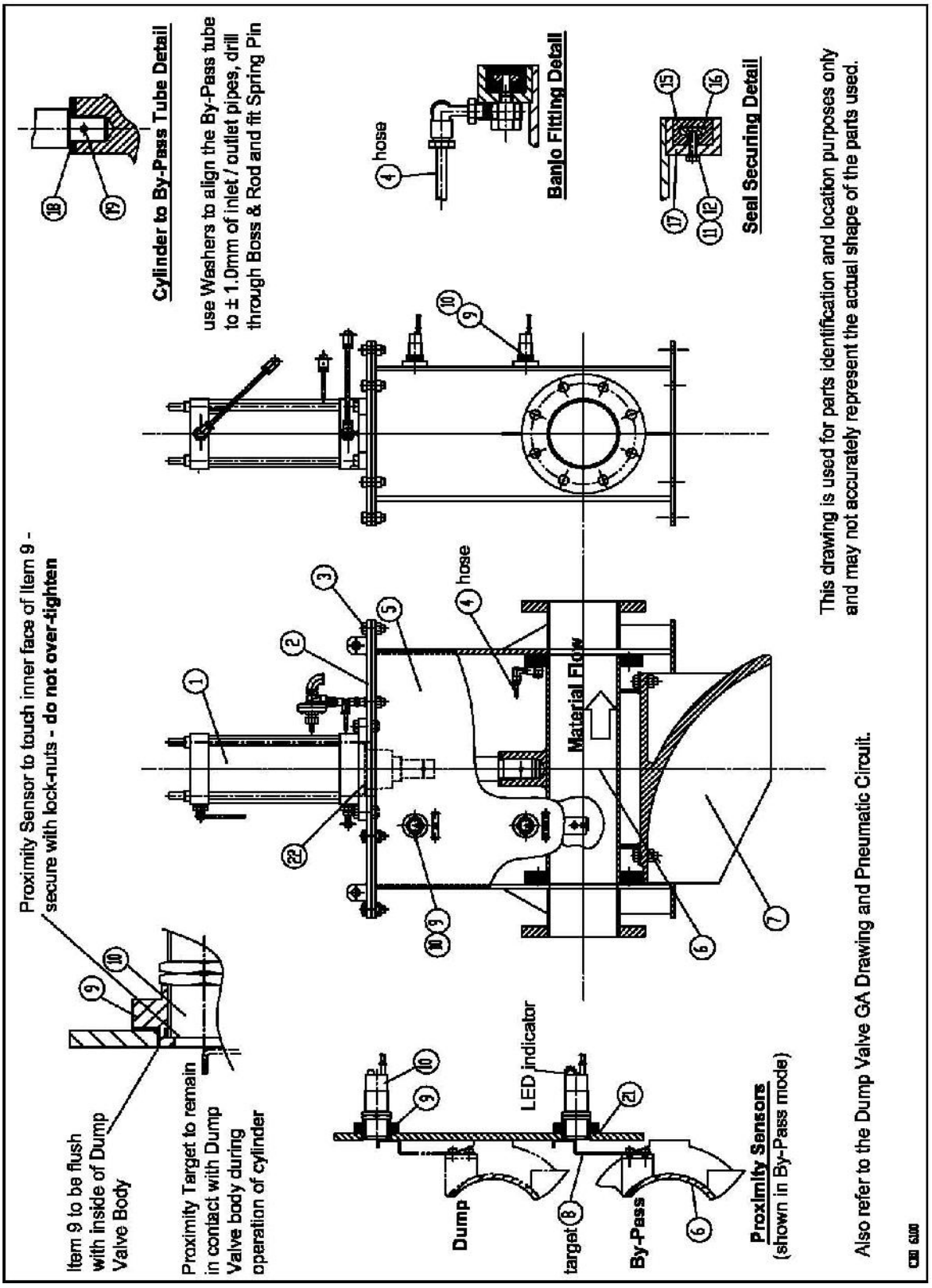
3.3.1 Parts List for P22686B-00 ~ 80mm PH0 Dump Valve

Item	Part No.	Description	Quantity	Recommended Spare Part
1	A1017	Air Cylinder	1	strategic part
2	P18242D-01	Top Plate	1	
3	P2121A-03	Top Plate Gasket	1	wear part
4	A2396	Hose (Flexshield)	0.8 m	
5	P22215A-01	Dump Valve Body	1	
6	P19110B-00-BO	Bypass Tube	1	
7	P2183A-00	Deflector	1	strategic part
8	P18016D-00	Proximity Target	1	
9	P16048D-00	Proximity Housing	2	
10	E1943	Proximity Sensor	2	strategic part
11	M1117	Setscrew M5 x 20	16	
12	A1728	Dowty Washer M5	12	
13		-	-	
14		-	-	
15	P1587C-02	Insert Seal	2	wear part
16	P1761D-00	Clamp Ring	2	
17	P1458C-00	Sealing Head	2	
18	P18371E-00	Spacer Washer	1	
19	M1023	Spring Pin 6D x 45	1	
20		-	-	
21	P16414E-00	Proximity Housing Gasket	2	
22	P2122A-16	Air Cylinder Mounting Gasket	1	

see next page for identification drawing

also refer to the Dump Valve GA Drawing & Pneumatic Circuit

3.3.1 Parts List for P22686B-00 ~ 80mm PH0 Dump Valve



3.4 P22689B-00 ~ 100mm PH0 Dump Valve

Parts List for P22689B-00 ~ 100mm PH0 Dump Valve Example

Item	Part No.	Description	Quantity	Recommended Spare Part
1	A1014	Air Cylinder	1	strategic part
2	P15366D-01	Top Plate	1	
3	P2121A-03	Top Plate Gasket	1	strategic part
4	A2396	Hose (Flexshield)	0.8 m	
5	P22187A-01	Dump Valve Body	1	
6	P13045A-02	Bypass Tube	1	
7	P2183A-00	Deflector	1	strategic part
8	P16410D-00	Proximity Target	1	
9	P16048D-00	Proximity Housing	2	
10	E1943	Proximity Sensor	2	strategic part
11	M1117	Setscrew M5 x 20	16	
12	A1728	Dowty Washer M5	12	
13	-	-	-	
14	-	-	-	
15	P1587C-03	Insert Seal	2	wear part
16	P15815D-00	Clamp Ring	2	
17	P1587C-03	Sealing Head	2	
18	P17691E-00	Spacer Washer	1	
19	M1581	Spring Pin 6D x 60	1	
20		-	-	
21	P16414E-00	Proximity Housing Gasket	2	
22	P2122A-03	Air Cylinder Mounting O-Ring	0.5 m	

see next page for identification drawing

also refer to the Dump Valve GA Drawing & Pneumatic Circuit

Parts List for P22689B-00 ~ 100mm PH0 Dump Valve Example