



White Paper: Preventing Disasters in Bulk Storage Silos through Comprehensive Servicing

Preventing Disasters in Bulk Storage Silos through Comprehensive Servicing

*Best practice for preventing over-pressurisation of storage silos dictates that there should be a written maintenance programme and detailed records should be kept. However, ineffective service providers using untrained or unskilled engineers often short-circuit the servicing process, leaving companies and site personnel unaware and vulnerable to potentially damaging consequences. **Hycontrol's** UK Sales Manager **David Wadsworth** discusses how structured and comprehensive servicing is essential for all bulk storage silos.*

Introduction

It is commonly accepted across a wide spectrum of industries that silos used for storing bulk powdered products (such as cement) should be fitted with an effective silo protection system (SPS). Such a system should, at the very least, monitor the pressure and product level in the silo during the pneumatic filling process. There are a range of SPS products on the market, of varying degrees of complexity.

Whilst silo safety technology has advanced considerably over recent years, ensuring that systems remain in peak operating condition is still an involved task – and in a complex, interdependent system, overlooking or neglecting



the care of critical components will have far-reaching ramifications. As engineers from UK-based silo instrument manufacturer Hycontrol have observed, this can have major implications for site Health & Safety and can cause serious operational problems.

Effective silo servicing routines published in UK guidance notes from the **Health & Safety Executive**, **DEFRA** and the **MPA (Mineral Products Association)** state the necessity of checking and testing all critical protection components on a regular basis. These checks should include the pressure relief valve (PRV), pressure sensor, the dust filter and the ultimate High Level sensor – all essential components of a silo safety system. The best practice guidelines state that the checks should be conducted in a routine, scheduled manner in order to optimise the functionality of the equipment and pre-empt any impending faults.

Unfortunately the reality is that in most cases these procedures are often overlooked or worse misunderstood.

Common Faults

Poor silo servicing is relatively easy to spot for the experienced eye; however due to the 'out of sight, out of mind' nature of safety equipment tucked away on the top of silos, site personnel may not realise their scheduled servicing has been lacking in any way until a fault reveals itself. Hycontrol engineers have evidence of 'serviced' silos which have, in reality, only been subjected to a cursory visual inspection and a quick dust-down. This completely fails to assess the true condition of the vital components of the protection system. It is similar to booking a car in for a service but only receiving a valet!

Common faults encountered on a daily basis include:



Filter cartridges in a damaged and neglected state, often completely blinded by powdered product. These pose the risk of emission issues if they burst, or if they are completely blocked they have the potential to cause serious damage to the silo. There have been several recorded incidents of blocked filter housings being blown clean off silo roofs by pressure build-up – and the dangers of heavy metal objects being thrown from height into busy work-yards or quarries do not need explaining.



Pressure relief valves that, while dusted off on top, have not been pressure-tested or even had the lid removed to clean the valve. Frequently these valves have become blocked with product blown out of the silo (typically due to blockages in the filter or uncontrolled filling procedures). In one recent case, Hycontrol engineers found large deposits of moss growing underneath the lid of a PRV that had just been 'serviced' the previous week.



Powdered product on top of the silo: beside the obvious pollution issues, this is a clear sign that there is a fault somewhere in the protection system. Steps should be taken to establish the root cause of this, but it is frequently ignored.



Pressure sensors and PRVs that fail to operate at the correct set points. Problems like this are impossible to diagnose visually and require physical testing. Whilst it has not historically been possible to test this equipment in situ, modern service techniques and pressure-testing technology mean that there is no longer a valid reason to neglect this.

Reasons for ineffective servicing can include: lack of experience, insufficient understanding of the importance of silo protection equipment and how the individual components work together, and simple reluctance to climb high silos in poor weather conditions to carry out regular weekly checks.

These issues will almost certainly lead to problems accruing over time. A PRV will not under normal circumstances become caked with product overnight, but a slow build-up of product may eventually encase the valve and render it useless. This risks damage to the silo through over-pressurisation and jeopardises personnel Health & Safety.

Dangers of Over-Pressurisation

Problems with the silo protection system or the air filtration system will become apparent during the filling process. Delivery tankers are pressure-tested vessels typically capable of withstanding up to 2 bar (29 psi) pressure. By comparison, storage silos are only designed to withstand the weight of material stored in them and can rupture at pressures as low as 1-2 psi above atmospheric pressure. Over-pressurisation during the filling process can lead to serious or fatal injury to workers and the public, catastrophic silo damage, loss of material and production, harmful environmental pollution, and negative publicity.

Filter housings at the top of the silos are designed to vent the silo during filling, whilst preventing dust escaping into the atmosphere. Normally these are fitted with some form of self-cleaning system to keep filters clear, typically mechanical shakers or reverse jet systems. Like other vital components they require regular checks and should have scheduled filter replacement, but in practice it would appear this is rarely the case. Faulty operation can be caused by a range of issues, including blockages (as mentioned previously) and the fitting of unsuitable or wrongly-sized filters. Most powders form hard compounds when mixed with water from the atmosphere, further exacerbating the problems at the top of the silo.

Comprehensive Servicing

Considering the risks of neglecting silo safety equipment outlined above – not to mention the financial and legal costs that would be incurred – employing a professional and experienced service provider to

maintain silos and their safety equipment is not only necessary to comply with key safety guidance, but also essential for optimising output and profitability.

Filter Units and Level Probes

Filter units should be assessed on their ability to vent sufficient volumes of air as laid out in current guidance. They should be checked for cartridge integrity and cleanliness, and the cleaning reverse air jets should be tested. Manufacturer's recommendations on filter changing schedules should be observed, although consideration should also be given to the frequency of silo filling and drawing-off as this will affect the cartridge life-span. Level probes should also be inspected for damage, cleaned and tested.



Pressure Relief Valves and Pressure Sensors

Besides ensuring the PRV is clean inside and out, it should be checked to ensure the seal is not leaking and that the open/shut mechanism is in good working order. However, the most important factor of PRV maintenance is also the trickiest to ascertain; namely, if the valve will lift at the correct pressure as per its design specification. If it lifts at too low a pressure the valve will vent product onto the silo top during fills, risking blockage. If the valve does not lift at the recommended pressure then the build-up of compressed air may damage the silo, even to the point of rupturing it. As outlined above, historically it has not been possible to pressure-test PRVs in situ.



There is certainly no way of checking the pressure set point for either the PRV or pressure sensor visually and historically they always would go untested. Hycontrol have now engineered a solution to this in the form of specially-designed pressure and load-test rigs that ensure this vital safety equipment responds at the correct set points and meets the specification required to protect the silo. It should be noted the set point of these devices is as low as 40 mbar or 0.7 psi – so testing without the correct

equipment is almost impossible. However the latest Silo Protection Systems include a self-testing facility for both devices.

Comprehensive Testing

It is self-evident that an effective and comprehensive service should inspect every key safety element of the silo from top to bottom. Hycontrol engineers follow a rigorous 60-point service checklist when conducting inspections, allowing them to detail any issues that are uncovered and make recommendations for resolving any issues. This provides site operators with written proof of the extent to which a silo has been safety-checked, should such documentation be called upon at any time in the future. Indeed, best practice guidance from the UK's MPA states explicitly that: 'In all cases, there should be a written maintenance programme and detailed records should be kept of such maintenance as it is carried out.'

Certain silo protection systems currently available have the added benefit of automatically logging events such as over-pressurisation or PRV lifts. This information enables competent servicing engineers to target any issues affecting the system and resolve them before they become acute problems.

Conclusion

Correctly-serviced safety equipment is an obvious necessity, but evidence shows that in many cases corners are being cut, leading to escalating risk for both site staff and equipment. This may simply arise from a misunderstanding of requirements and the particular functionality of components within a silo protection system. Informative websites such as www.siloprotection.com can help site staff and managers to better understand best practice and how to spot any danger signs on their silo.

However it is clear that relying on visual-only checks and superficial cleaning is woefully inadequate and that issues are not being identified early, allowing them to develop into dangerous problems.

Placing the servicing of silos into the hands of experts is the simple and logical solution. Thorough inspections and physical tests carried out regularly by trained engineers with experience of all presently-available silo safety equipment will not only keep site staff safe and prevent entanglements with the HSE or other legislative bodies. In parallel it will also greatly increase the lifespan of essential safety equipment, leading to a reduced overall cost of ownership.

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