

SHIELD LITE

Preventing Silo Over-Pressurization



Remove the **RISK** from tanker deliveries



Many industries handle and transport **millions of tons of powdered or particulate products every year**, including cement, lime, sugar, flour and many others. These products are mainly transported by road tanker and are then deposited in storage silos by fluidizing the powders and blowing them in at pressure.

This pneumatic conveying operation uses highly pressurized air to carry the product into the silo. **This creates an extremely serious over-pressurization risk if the airflow is not controlled or if air is not vented efficiently through a suitable filter.** Most silos are not tested as pressure vessels, and it may take only a small increase in internal pressure (as little as 1 psi) to either rupture the silo or blow the filter unit off the silo roof. Over-pressurization can also cause buckling and structural weakening of a vessel.

RISK OF SILO FAILURE & DANGER TO PERSONNEL

The worst-case risks of over-pressurization are either a silo rupture or the filter unit being physically blown off the roof. Either of these outcomes is nothing short of catastrophic; both will cause **extensive disruption and loss of production**, requiring costly repairs and equipment replacement.

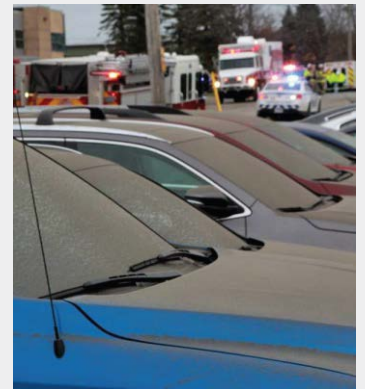
Even more critical is the risk of **severe injury or even death** if a heavy filter **weighing over 200 lbs** falls from the silo-top onto an area where site personnel are working. **Lack of effective silo protection is a serious health and safety concern and a very real threat to life and limb.**



RISK OF EMISSIONS INTO THE ENVIRONMENT

Over-pressurization during the filling process leads to powdered product being ejected into the atmosphere through the silo emergency PRV vent system. **Clouds of product blowing out during fills are an alarmingly common sight and are indicative of silo protection failure.**

Emissions damage the environment, particularly corrosive or hazardous products. Companies and sites are then at risk of large fines, expensive clean-ups and negative publicity. **Leaking product will block pressure relief valves, accelerating the risk of a full-blown over-pressurisation event.**



RISK FROM WORKING AT HEIGHT

All silos fed from a road tanker should have safety systems installed on the silo top and working at height becomes a serious concern. Equipment in these systems can only be tested *in situ*, effectively meaning that silos must be climbed before every delivery to perform a functionality test.

Even with correct safety gear, working at height is very dangerous. Falls from height are the largest single cause of workplace fatalities in the USA according to the OSHA, accounting for nearly 40% of workplace deaths in 2017 alone. **Therefore, it is clear that all practicable steps should be taken to reduce working at height.**



SIGNS OF SILO PROTECTION SYSTEM FAILURE

BLOCKED, LEAKING OR DAMAGED PRV



One of the most common problems associated with silo protection, and one of the biggest misconceptions, is that when pressure relief valves emit product they are doing their job. **In fact, the opposite is true - this is a clear sign of silo protection failure.** Why is product escaping from the pressure relief valve? The answer is simple - because it is being put under pressure! This is happening because of a failure of the monitoring and control system.

DAMAGED OR FAULTY PRESSURE SENSOR



Pressure sensors are essential for preventing silo over-pressurization. They have to detect pressures as low as 40 millibar (0.5 psi) so must be accurate and capable of operating in a low range. Unfortunately these sensors are often ignored and are rarely tested. Alternately, they are tested by applying hand pressure to a sensitive rubber diaphragm, a force 50 times higher than the required set point. Beside being incorrectly set, many sensors fitted to silos are **not failsafe** or suitable for a safety application at all.

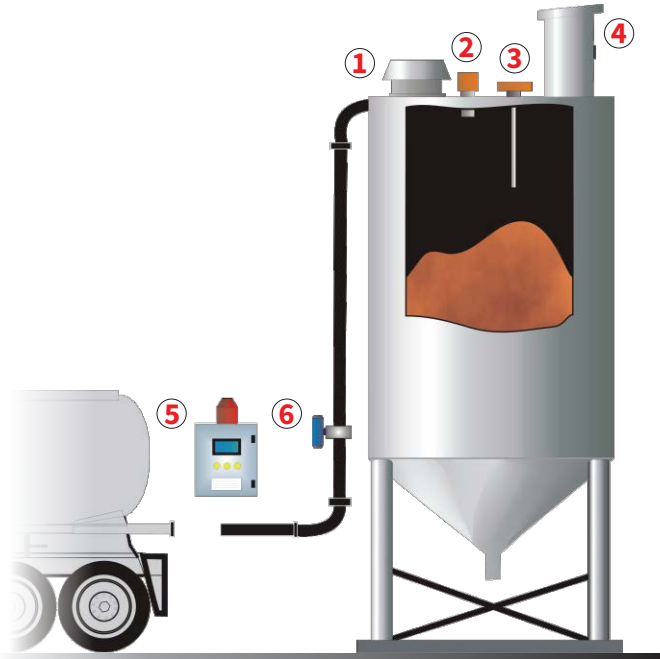
BLOCKED AIR FILTER



A comprehensive silo protection system should indicate when filter cartridges are degrading and/or air is not being vented quickly enough. **Poor filtration, where particles of product cause congestion, traps pressure inside the vessel and increases risk.** A high number of over-pressurization events would typically indicate blocked filters or poor driver delivery behavior. This illustrates why a pressure sensor and a system that records pressure events are both essential.



WHAT IS ESSENTIAL FOR SILO PROTECTION?



A silo protection system (SPS) is the name given to an interlinked collection of safety devices on a silo. In its most basic form, it should monitor pressure in the silo during a fill and take action to protect the vessel if anything goes wrong.

The essential components of a standard SPS are as follows:

- 1 Pressure relief valve (PRV)
- 2 Pressure sensor
- 3 High-level alarm probe
- 4 Air filter (AKA a binvent or venting unit)
- 5 Control and alarm panel at the fill point
- 6 Shut-off valve on the fill pipe

If a tanker-fed silo does not at the very least have all of these components fitted then it is in serious danger. **But, as we will see, fitting these key components alone is not enough to guarantee safety.**

WHY ARE YOU STILL **NOT SAFE** WITH THIS?

These images show where many sites go wrong. A selection of components have been installed in accordance with general industry guidelines, including an air filter, pressure sensor, PRV, level sensor, shut-off valve and control panel. **However, product continues to be emitted, and has to be regularly bagged up and cleared away on top of the silo.**

This is the most common mistake by companies trying to implement silo protection. They install a system designed by unqualified personnel and assembled using a checklist of off-the-shelf general-purpose sensors, which are then inadequately maintained and left untested. **Crucially, they are also unlikely to be failsafe. It is not surprising that these systems stop working after a short period of time and that silos are regularly over-pressurized, compromising safety.**

Silo safety cannot be treated as a box-ticking exercise; it requires a **comprehensive, failsafe and testable** solution to be put in place. Attempting to circumvent this is not only a waste of time; it actually increases the problems and risks!



Level probe PRV Pressure sensor Air filter Bags of leaked product



Failed silo protection



Failed silo protection



TESTING IS ESSENTIAL TO ELIMINATE RISKS

As we have seen, testing silo-top equipment is essential for safety. Many systems have a test button, but in most instances all this actually does is test that the beacon and alarm on the panel are working. It is important to know the difference, and that this does not confirm functionality. Therefore, working at height is still required in order to check essential safety equipment is operating correctly, meaning a potential risk for site staff.

Hycontrol's Ground Level Testing (GLT) innovation allows the complete functional testing of the silo protection equipment *in situ*, with both feet firmly on the ground - in just six seconds.

Equipment with GLT capability provides the following:

- ✓ Reduces spills, filter and silo damage, product loss, maintenance costs
- ✓ Eliminates unnecessary working at height risks
- ✓ Avoids injuries, repair and clean-up costs, and dangerous situations
- ✓ Provides a safer working environment on site

The GLT function is integral to Hycontrol's **SHIELD Lite silo protection system**, enabling site operators to fully check vital safety equipment before each and every delivery takes place, **guaranteeing all the system components are working**. It is activated with a single key-turn on the control panel, usually located at the fill point. **The system won't permit a fill to take place until a test has been performed**.

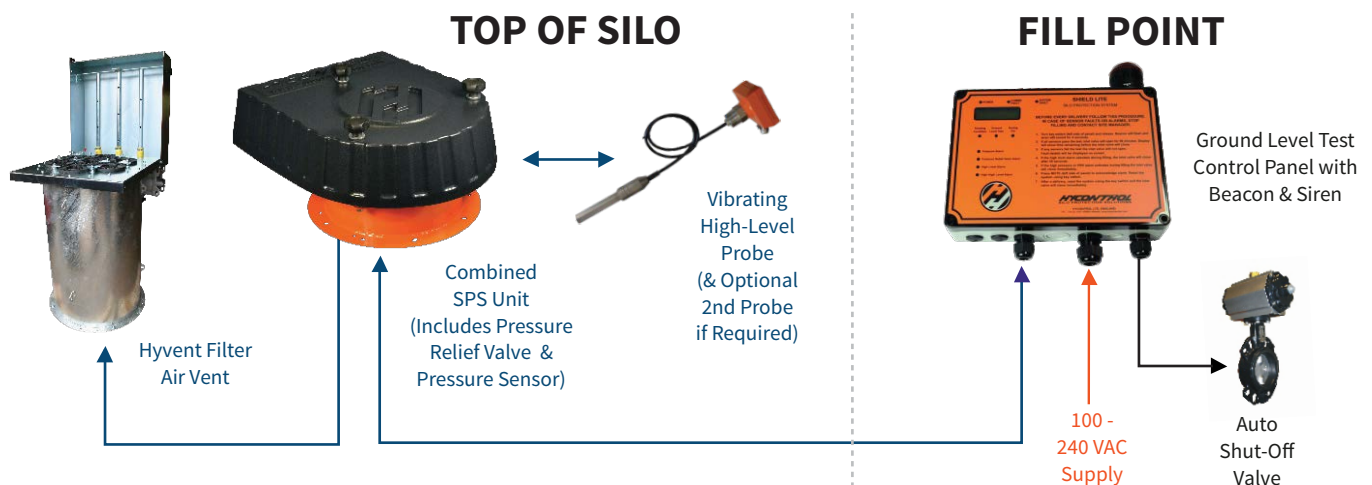
Hycontrol GLT is unique: it fully tests the pressure sensor, level sensor and pressure relief valve, as well as the air supply to the filter self-cleaning mechanism. When a **SHIELD Lite SPS** passes these tests, site staff can be confident that the filters are not at risk from blinding and pressure build-up, and the silo is safe from overflowing wastage and pollution risks. **All the components are failsafe, ensuring safety in all circumstances.**

Testing is essential. Failsafe is essential.

Your safety system must be regularly tested to ensure it is fully operational!



SHIELD LITE SPS - FAILSAFE AND TESTABLE



Hycontrol's new **SHIELD Lite silo protection system** is the most advanced SPS on the market today and is the result of decades of silo pressure technology expertise. This new model is compact and simple to install, without compromising any of its outstanding features. Utilising state-of-the-art pressure monitoring/control equipment, advanced silo diagnostics systems and Hycontrol's pioneering **Ground Level Test (GLT)** facility, the **SHIELD Lite SPS** provides users with total failsafe silo pressure safety.



SHIELD LITE SILO PROTECTION SYSTEM



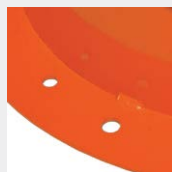
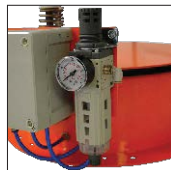
(1) PRV inspection facility - single button lifting mechanism to open valve for cleaning and inspection on silo-top, instead of trying to lift a 110 lb calibrated load!

(2) Durable polypropylene weather shield to protect PRV and electronics. **(3)** Corrosion-resistant, powder-coated steel for use in all weather conditions.



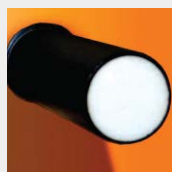
(4) VIPER seals - twin seal air spring pocket eliminates air leakage and water ingress. Easy to remove and replace, saving time and money and simplifying maintenance.

(5) High-specification pneumatic filter regulator with auto-drain feature to reduce moisture in the air-flow. Provides accurate compressed air control.



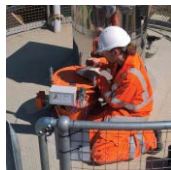
(6) Multi-point mounting holes for easy retrofitting to fit most popular silo process connections or (for a new install) to mount on the optional upstand unit.

(7) Integrated pressure relief valve (PRV) with full GLT cycling. Valve calibrated to vent pressure at 50 millibars (0.75 psi). Records PRV lifts during filling.

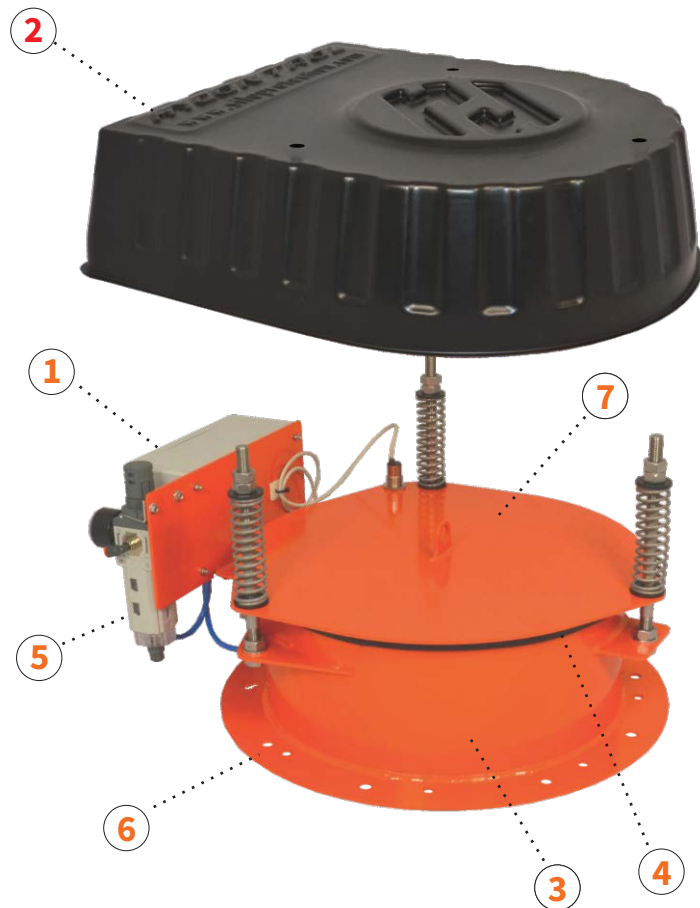


Integrated, purpose-designed silo pressure sensor with Ground Level Test capability and self-cleaning function - the patented, failsafe heart of the protection system!

Simple installation - cabling has been reduced from seventeen wires to five, cutting installation time and costs. Modular system uses a single process connection.



SHIELD LITE SPS UNIT



- ✓ **REMOVE HUMAN ERRORS AND REDUCE RISK** with Ground Level Testing and automatic safety
- ✓ **REDUCE WORKING AT HEIGHT DANGERS** arising from routine inspections and tests
- ✓ **IMPROVE SITE SAFETY** with Ground Level Testing and advanced pressure control
- ✓ **REMOVE RISK OF SILO PRESSURE DAMAGE** - vessels can rupture at pressures above 1 psi without proper controls in place
- ✓ **COMPREHENSIVE EVENT LOGGING** helps prevent override attempts and bad practice
- ✓ **FAILSAFE DESIGN AND SYSTEM OPERATION** - you will always know if there is a problem before or during a fill, without creating risk!



SHIELD LITE - FEATURES AND BENEFITS

SHIELD LITE CONTROL PANEL

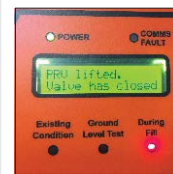


- ✓ **REDUCE ENVIRONMENTAL EMISSIONS** through properly controlled deliveries
- ✓ **GLT CHECKS THE WHOLE SYSTEM IN SIX SECONDS** - reduces maintenance time and service costs
- ✓ **EASY-TO-USE one-key Ground Level Testing system** guarantees complete silo protection and will not allow filling unless all safety components are proven fully functional
- ✓ **PRESSURE AND VACUUM CONTROL** - unique pressure sensor detects not only pressure but also vacuum. If this condition is detected it will fully open both the inlet and pressure relief valves to remove the vacuum before silo damage occurs
- ✓ **THE ONLY SILO PROTECTION SYSTEM THAT MEETS AND EXCEEDS PRESSURE SAFETY GUIDANCE!**



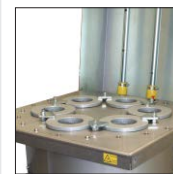
New, compact IP65-rated panel with integrated beacon and siren, bright and clear LED screen, easily visible operating instructions and individual failure alert lights.

New ratio alarms help identify filter blockage or driver behavior problems. Excessive high-pressure/GLT events lock the system, forcing corrective action.



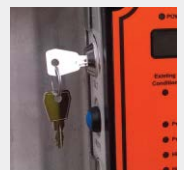
Records and provides totalised counts for pressure, level, and PRV opening events (with timed stamps) to aid and direct preventative maintenance.

Failsafe butterfly valve at fill point will not open until all safety tests are passed. Automatic shut-off of fill pipe should pressure spike, PRV open or high-level alarm activate.



Monitors and controls air to the filter/vent unit. Eliminates compressed air waste. Identifies blocked or faulty filters and hours run cycle to change cartridges.

Ground Level Test (GLT) of the full system activated by a single key turn (with unique key) - eliminates the necessity of climbing the silo to test vital safety equipment!



DP Series vibrating level sensor for high-level alarm. Ground Level Test and self-cleaning function - the most reliable point switch type for solid and powdered products.

Safe, low-voltage power requirements - the whole SHIELD silo protection system operates on a 24 VDC power supply, allowing for a safer working environment.



SYSTEM OVERVIEW

The **SHIELD Lite silo protection system** is designed to provide control and test functions to prevent silo over-pressurization and filter blinding during a tanker delivery. The system can work with one or two level probes of different lengths; these can be Hycontrol level probes which have a built-in GLT, or from an alternative manufacturer providing it is compatible with the **SHIELD Lite** system.

- ✓ **A successful test opens the failsafe fill point valve to allow filling for 90 minutes after which it will close.** At this same time a siren and beacon will also sound to test their operation.
- ✓ **During a fill:**
 - If a **high-pressure alert** is detected, alarm and beacon activate and instantly closes the inlet valve.
 - If a **high-level alert** is detected, alarm and beacon activate and inlet valve closes after 30 seconds.
- ✓ **Logs totalized counts for the number of events on incidents of pressure, level, PRV, override and vacuum detection.** Provides early warning of blocked filters or poor driver behavior using ratio alarms. Silo filter is switched on and off using the control panel.
- ✓ **Simple key/button operation with information displayed on backlit LCD screen.**

SPS-SHIELDLITE ASSEMBLY SPECIFICATION

| | |
|--------------------------|--------------------------|
| PRV weather cover: | Pinseal Polypropylene |
| Main GLT module: | Powder coated mild steel |
| Valve seal: | EPDM rubber |
| 6mm tubing: | Polyurethane |
| 6mm fittings: | Nickel plated brass |
| External regulator body: | Polyamide |
| Air cylinder: | Aluminium, anodised |
| Proximity sensor: | Nickel plated brass |
| Pressure transmitter: | Stainless steel |

PRV components specification

| | |
|------------------|--|
| Inlet regulator: | 6mm male pipe (1/4" male pipe if inlet convertor pipe fitted) |
| Spring: | 50 to 60 millibar (0.73 to 0.87 psi) 302STST |

Pneumatic specification

| | |
|--|--|
| Air supply quality: | Clean dry filtered air 25 micron |
| Air supply required for GLT: (6mm tubing) | 6.0 bar (87 psi) typically 5.5 bar (80 psi) minimum |

Control box specification

| | |
|------------------------------|--|
| Enclosure: | ABS |
| IP rating: | IP66/IP67 |
| Connectors electrical entry: | M20 cable gland (Ø 7-12.5mm) (Ø 9/32 - 1/2") M16 cable gland (Ø 3-6.5mm) (Ø 1/8 - 1/4") |
| Pressure sensor: | -100 to +100mB (-1.45 to 1.45 psi) |
| Electrical supply: | 24 VDC (provided by SHIELDLITEDB panel) |
| AUX outputs: | 0.5A FET output |
| Temperature range (ambient): | -20°C to +50°C (-4°F to +122°F) |
| Weight: | 20 kg with mounting flange |

Control panel

| | |
|------------------------------|--|
| Enclosure: | ABS |
| IP rating: | IP65 |
| Connectors electrical entry: | 3 x M20 cable gland (Ø 7-12.5mm) (Ø 9/32 - 1/2") 1 x M16 cable gland (Ø 3-6.5mm) (Ø 1/8 - 1/4") |
| Electrical supply: | 100-240 VAC (50-60 Hz) |



Control panel weather shield
Material: UV resistant Polypropylene

