Kondinin Group
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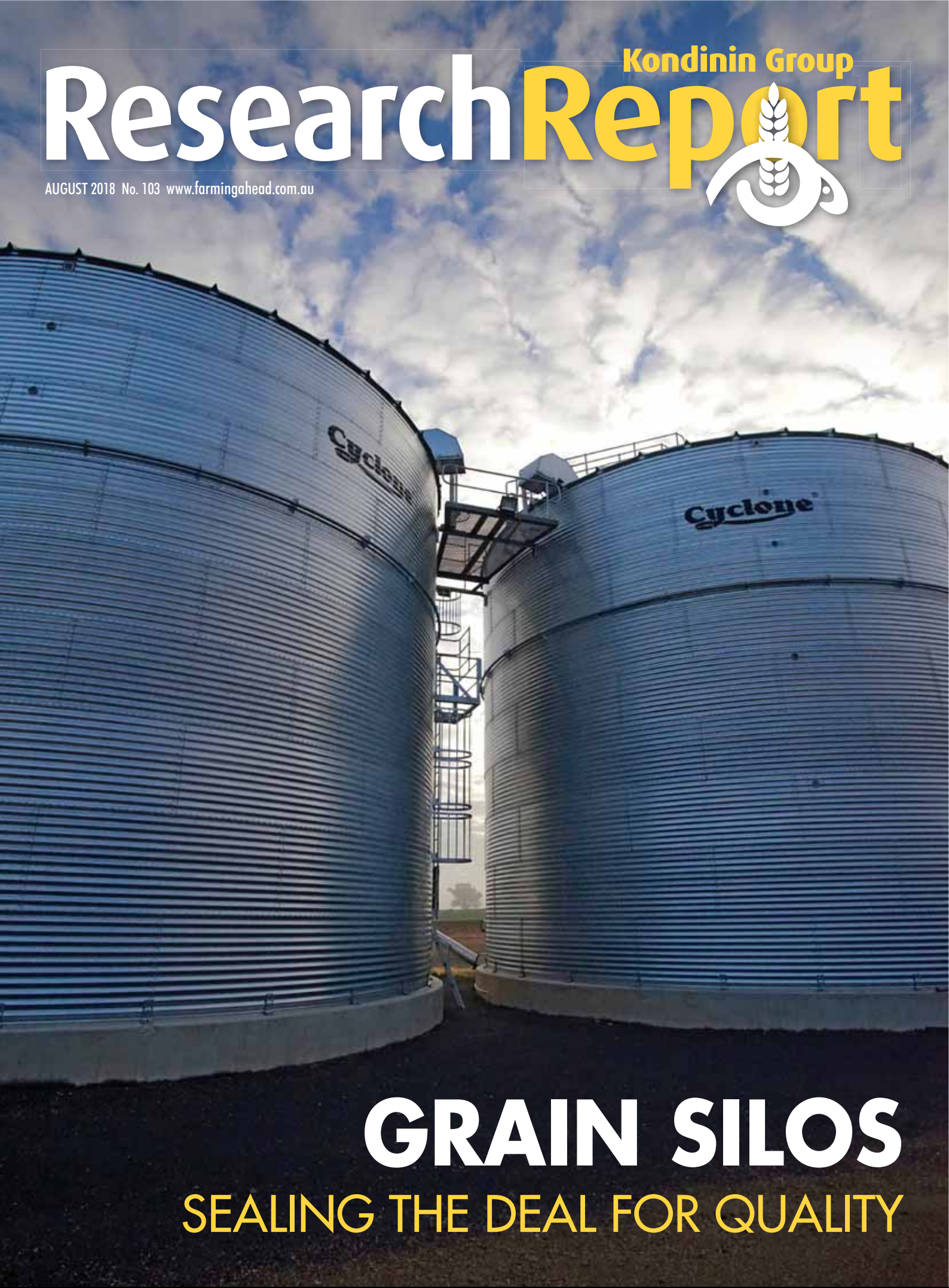


GRAIN SILOS
SEALING THE DEAL FOR QUALITY

Independent information for agriculture

Silos: Informed selection before sealing the deal

Kondinin Group engineer and GRDC grain storage expert, **Ben White**, travelled the country, driving 9000km through every mainland state to visit silo installations on farm from 24 brands.

In all cases the silo installations were less than 18-months old and most had been filled and emptied at least once in that time.

SPEND THE MONEY ONCE

An investment in grain storage can be significant and unlike machinery is typically not liquid, meaning trading up later is not usually an option.

So cutting corners with lower quality products, or products that don't quite meet current or future requirements should be avoided.

In the case of sealed silos, the additional cost of buying a better quality product may be around 10-20%, but will usually mean the silo will not compromise the value of the products it will hold. Better quality silos should see the useable life extended well beyond the additional premium paid.

WHY SEAL SILOS?

Silos do not seal to physically prevent insects from entering the grain in a silo.

Sealing a silo stops fumigants like phosphine from escaping and maintains fumigant levels at adequate concentrations for the time required to disinfect grain and kill insects at all life stages. Fumigants, for example, phosphine, need to be held at a minimum concentration of 200 parts per million for ten days to control all life stages including adults, pupae and larvae.

Even a small leak can see the fumigant concentration drop under this level, meaning insects at all life stages are not controlled. This will inevitably lead to reinfestation and increases the potential risk for the development strong insect resistance.

If a silo does not seal to be gas-tight and meet the Australian Standard, it cannot be used with fumigants to provide an effective disinfestation option. This includes phosphine, or licenced-fumigator applied chemistry including sulfuryl fluoride or ethyl formate.

Flat-bottom silos are larger with additional components requiring sealing, by nature making them more difficult to seal than elevated cone base silos.

When asked to provide a recent example of an installed large flat-bottom silo, three manufacturers were able to provide an example for testing. This is an increase of one with Cyclone joining Kotzur and Allied MFS in the list of verified gas-tight sealable silos.

There are a number of brands claiming to meet the standard for sealing, but efforts to test these ultimately failed with numerous examples for each of these brands tested and found not to meet the mark.

The majority of the flat-bottom site constructed brands of silos are imported

Testing times: All makes and models featured in this report were inspected for design and construction and where claimed to be gas-tight sealable, silos were pressure tested according to Australian Standards. Wherever possible, a number of silos of each make were tested to verify AS2628 sealing status.

Import: North America enjoys a cold storage period and does not experience the insect issues we do in Australia, so without skilled modification, they do not seal for fumigation.

from North America where sealing is not required thanks to their freezing winter conditions which eliminates most insect infestation issues.

But the transition from chilly North America to an Australian operational context, requiring sealing to meet the Australian standard if it is to be used for fumigation, can mean substantial modifications need to be made.

On North American silo brands brought to Australia, the top inlet and access doors, out-loaders, roof vents and aeration fan couplings are common places for air leaks and all need to be addressed with non-temporary, easy to fit and remove sealing solutions.

NO AS2628? WHAT ARE THE OPTIONS?

If silos do not seal to meet AS2628, options include aeration or grain protectants like Conserve Plus or K-Obiol. These protectants are not registered for use in Western Australia where the export market is dominant.

Protectants need to be applied early to provide protection and are not disinfestants that will kill an infestation of insects in stored grain.

But caution should be applied, as use of these protectants can limit marketing opportunities.

Growers outside WA considering using these products should check with buyers to ensure potential markets are not limited.

Always read and carefully follow chemical label information, and apply uniformly.

Gauged: We use a sensitive differential pressure gauge, but farmers can use the oil valve on their silo or a piece of clear hose in a u-shape filled with some water to make a manometer. Don't forget a stopwatch.

Blown: Silos that do not seal to AS 2628 can use aeration to cool grain and excellent hygiene including a structural treatment like diatomaceous earth in their silo to prevent insect infestations occurring.

WHAT IS AUSTRALIAN STANDARD 2628?

AS2628-2010 was established to provide a minimum standard of sealing required to maintain fumigant gas concentrations for the required time to kill all lifecycles and disinfest grain.

Terms like "semi-sealed" are confusing and meaningless.

If purchasing a gas-tight sealable silo for fumigation, insist the manufacturer commits to seal it to AS2628 in writing, preferably in the purchase contract.

Manufacturers confident in their product will be happy to receive final payment once this has been proven. Note that a brand new silo should meet a five minute AS2628 half-life pressure test.

HALF-LIFE TIMES

While the Australian standard specifically notes silos must pass a five minute half-life pressure test to be deemed "sealed", this is typically in reference to new silos.

Researchers have found that in-practice, older used silos on-farm meeting a three-minute half-life pressure test will generally hold the required concentration of gas for seven to 10 days, making them suitable for fumigation.

But the aim should be for a five-minute half-life result, particularly when they are new.

TESTING PROCEDURE

To pass the Australian standard, silos must hold at least half (125 or more) of 250 pascals of induced pressure for five minutes when new. The 250 pascals ▶

equates to one inch, or 25mm water gauge, so silos with clear or semi-opaque pressure relief valves can be used to monitor in-silo pressure levels for testing.

Testing should only be done when the ambient air temperature is stable, not early morning or late afternoon when air temperatures can rise or fall rapidly or when sun is shining in on the side of a silo. Scattered cloudy days can see sunshine and shadow cast over the silo, raising and lowering the temperature, and resulting pressure inside a silo fluctuating, these conditions should also be avoided.

A still overcast day is ideal. Monitor ambient temperature levels and select a time when these do not vary significantly.

Gas-tight sealable silos should seal and pass the standard when they are full, part full or empty.

Pushing air into the silo can be done with a small handheld blower, or for smaller silos, an air compressor will suffice. In a perfectly sealed silo, only a few hundred litres of air is required for every 100-tonnes of capacity (wheat) to get it to 25mm water gauge of pressure.

INCORPORATING AERATION

Where the silo construction site is close to power, or a generator option is feasible, growers are encouraged to consider the installation of an aeration fan and controller when purchasing a new silo.

An aeration controller provides optimal fan switching and the controller switches air flow on and off to meet required ambient temperature and humidity limits.

Walls: Wall thickness and galvanising grades can vary between silo manufacturers, makes and models.

Laid: Foundations may need to be built to prescription depending on the silo and the soil type.

CSIRO research indicates improved seed vigour and germination rates in aerated seed silos. The ability to cool grain using aeration can significantly reduce insect pressure.

PLANNING ESSENTIAL

Prior to investing in new grain storage infrastructure, ensure a sound plan for the facility and future expansion has been

Stairway: Safety when climbing ladders required a sound ladder design and build and a safety harness.

considered. The inclusion of weighbridges, lighting, electrical needs and hardstands at the time of construction or in the future should be planned for.

Laying underground cables in preparation for these features can save money and mess in the long run.

GETTING IT THERE

Always compare the cost of the silos delivered and erected on-farm.

Silo transport costs can vary depending on dimensions, pilot requirements, distance and state government transport requirements.

GALVANISING AND WALL THICKNESS

Enquire with suppliers about wall thickness to compare gauges on the specific model under consideration, but also consider the wall design strength. Stiffening ribs and some wall designs can be stronger than others.

CONCRETE PADS

Ask your silo supplier about the requirements for concrete pads and foundations.

Gassed: Fumigating from ground level is much safer and in combination with a headspace plumbed thermosiphon or powered recirculation system in a sealed silo can improve gas distribution.

Most will provide a recommendation for thickness and reinforcing which can vary depending on silo size and soil type. Soil testing is recommended.

Check soil type carefully, issues have arisen for some growers where silos have been inadvertently built over an old dump which has caused the silo foundation to fail.

EASE OF CLEANING

Given the importance of hygiene, make sure the silo is easy to clean. This can include floor grating or even just around the base ring on an elevated cone base silo.

GETTING TO THE TOP

Silos should be fitted with ladders for easy and safe access. Even "no-climb" silos will need to be climbed at some stage to maintain seals, replace springs on closing mechanisms or repair accidental damage caused by the auger. Cages provide additional levels of safety and remember that a climbing harness is a good insurance policy and should be worn when climbing a silo.

There is an Australian standard relevant to silo ladders and access. Ensuring the ladder meets these criteria should be a necessity on any potential buyers list.

GASSING FROM THE GROUND

Ground level fumigation is increasing in popularity and adoption by manufacturers.

Some systems are better than others.

Look for a ground application system with airflow to and from the headspace, preferably running this air over the tablets for optimal results.

Always follow the label rates and allow sufficient time for the full fumigation to be conducted including ventilation and withholding periods.

DURAGAL V HOT-DIPPED

Base construction on silos is typically square hollow section (SHS) or Pipe. While both are usually galvanised, it is worth asking whether the steel is batch hot-dipped or in-line hot dipped (for example, Duragal). The latter has around 100g/m^2 of zinc coating while batch hot-dipped steel, has around 3-5 times as much galvanised zinc coating and offers superior corrosion protection in most cases.

RECIRCULATION SYSTEMS FOR BIG FLATS

Research has clearly shown that recirculation is beneficial for maximising the efficacy of the fumigation process.

Galvanised: Duragal SHS and RHS does not carry as much galvanising as the hot dipped steel in these examples, with the latter also benefiting from internal galvanising protection.

Clean sweep: A good sweep auger will remove almost all of the grain in the silo minimising the volume that has to be swept up.

Capacity ain't capacity: Different grains will consume different volumes by weight and will also compact in the silo to a degree.

Recirculation systems typically use a small aeration fan plumbed to pull air from the top of the silo and blow it through a chamber containing phosphine tablets of blankets.

ELEVATED CONE BASE VERSUS LARGE FLAT BOTTOM

Larger flat bottom silos tend to be lower cost per tonne of stored grain but are more difficult to seal. Only three manufacturers were able to demonstrate a flat bottom silo sealed to AS2628 without intervention. Using non-sealed flat bottom silos with a ▶

quality, high flow aeration system may be an option, but this should be backed up with gas-tight sealed silos for treating insect infestations when they occur.

Elevated cone base silos are often easier than flat bottom silos to clean out and smaller sizes allow for additional levels of segregation but often come at a higher cost per tonne of stored grain.

CLEAN SWEEP

In most cases, flat bottom silos rely on a sweep auger to rotate and push grain into the outload auger trench. Normally these are electrically powered, although hydraulic options are used where power is not available.

With the departure of well-known Victorian manufacturer, Keogh, Kotzur has stepped into the space, but also make a Kotzur-designed high-end sweep which leaves very little grain in the silo.

Optimum engineering, the team who sell and erect Cyclone silos in NSW also make a solidly constructed sweep which, rather than wheels, "walks" the sweep auger around and is driven by an explosion-proof electric motor housed in the centre of the silo in a rocket-shaped housing.

North American imported silos regularly feature Canadian-made Springland branded sweep augers available in budget-conscious standard-build and commercial options.

Kondinin Group will comparatively evaluate sweeps in a future issue.

COMPARING CAPACITY

Silo capacities are quoted in a wide range of units including cubic volumes, tonnages of different grains, bushels and even bags. While cubic volume in meters cubed is strictly more accurate, for ease of comparison in this report we have converted all capacities back to tonnes of wheat stored.

AUGER AND HANDLING REQUIREMENTS

When thinking about investing in grain storage infrastructure, don't forget to include auger or conveyors in the capital outlay equation if a replacement will be required to reach the top of the new facility. A new auger can be a significant additional cost and may influence the selection of the silo size or dimensions.

THE ADVENT OF OVER-CENTRE LATCHES

A noteable inclusion in many silos inspected was the use of over-centre latches. While better than the turnbuckle for locking down sealing components, they are prone to catching top lids and spinning the buckle out of the latch. An R-clip to hold them in position and a nyloc nut or dob of sealant to stop the buckle spinning out is suggested.

Over-centre latches are prominently used. But make sure they won't accidently latch when you don't want them to using an R-clip to secure them in the open position.

Buyers checklist

ENSURE THE SILO:

- ☐ Has a pressure relief valve large enough to suit the silo with clear marking for pressure testing
- ☐ Has a facility to add air, to conduct a half-life pressure test
- ☐ Has high density rubber seals with strong memory and UV resistance
- ☐ Lasting seals between sheet joins, rivets, screws and bolts
- ☐ Maintains seal integrity when filled
- ☐ Has sealing plates to cover aeration fans for fumigation
- ☐ Has latches on sealing plates and manholes for pressure testing the silo when empty
- ☐ Has fans sized appropriately to deliver a minimum of 2-3 litres per second per tonne of capacity for cooling grain (under grain backpressure)
- ☐ Has fans sized appropriately to deliver 15-20 litres per second per tonne of capacity if planning to dry grain (under grain backpressure)
- ☐ Has aeration ducting or distribution plenum to disperse air evenly throughout the grain
- ☐ Has ground opening lids
- ☐ Allows easy ground access for cleaning out the silo
- ☐ Has an easy to clean design including aeration ducting, particularly in flat-bottom silos
- ☐ Has a workplace health and safety compliant ladder
- ☐ Is fabricated with a sturdy steel cone fabrication with quality weldments and a galvanised or quality painted finish
- ☐ Has a powered recirculation system or thermosiphon which is UV stabilised and will not compromise seal integrity in the future
- ☐ Has a sealed fumigation application chamber for phosphine with a sufficiently large tray to spread tablets without excessive stacking and passive or active sealed recirculation to carry released gas out of the chamber.
- ☐ Has wall sight glasses or level sensors to indicate grain level particularly near the top and bottom of the silo to assist filling and emptying.

Source: www.storedgrain.com.au

PETER BOTTA

One of the driving forces behind the establishment of AS2628-2010 was Peter Botta, a former Victorian Department of Agriculture entomologist and grain storage extension expert.

Peter worked with others to push that the AS2628 standard was used as a silo sealing benchmark for the industry to ensure low cost fumigants did not become prone to insect resistance and would continue to work effectively for as long as possible.

Peter assisted with the production of this report until his sudden passing prior to printing which came as a shock to many in the industry including the team here at Kondinin Group.

Peter brought knowledge, expertise and experience to the practice of preserving the quality of grain in storage.

He was a good friend of the Kondinin Group, assisting with the Stalk to Store publication in 2002 and every grain storage report the Group has conducted since. He will be missed for his skilled counsel and genuine friendship. FA

Huge task: Inspecting and testing silos across the country saw the team travel to every mainland state clocking up 9,000km to find silos from every manufacturer listed in this report.

Individual reports

Kondinin Group engineers inspected and tested over 100 silos from 25 manufacturers or importers of both elevated cone-base or flat-bottom silos.

Manufacturers were asked to provide contact details of a number of farmer customers who had made a silo purchase within the last 12-months.

Kondinin Group then contacted farmers and made arrangements to inspect the silos first-hand. In most instances the silos inspected were empty.

Components inspected included the base structure, cone, welding and construction quality, lid and vent opening mechanisms, aeration fixtures and transitions, manholes and access doors, base to wall joins and wall sheet overlaps, thermosiphon tubes, ladders and walkways, sight windows and outlet mechanism.

After checking all lids and access dors were closed, a high volume air-compressor or cordless blower was used to add 25mm of water-gauge (250 Pascals) pressure to the silo in accordance with the Australian Standard AS2628. The half-life time (to 125 pascals) was recorded for each silo.

Some silo manufacturers were reluctant or unable to provide details of silos for inspection, but the Kondinin Group network is wide, and in all cases, a recent example was found and inspected.

In some cases manufacturers were continuing to work on the requirements to meet AS2628 with varying degrees of success.

Remember, if you need your silo to be sealed for fumigation, ensure you have a written guarantee from the manufacturer prior to signing up for the silo and consider witnessing the pressure testing process before signing off on the final payment for the installation.

INDIVIDUAL PRICING

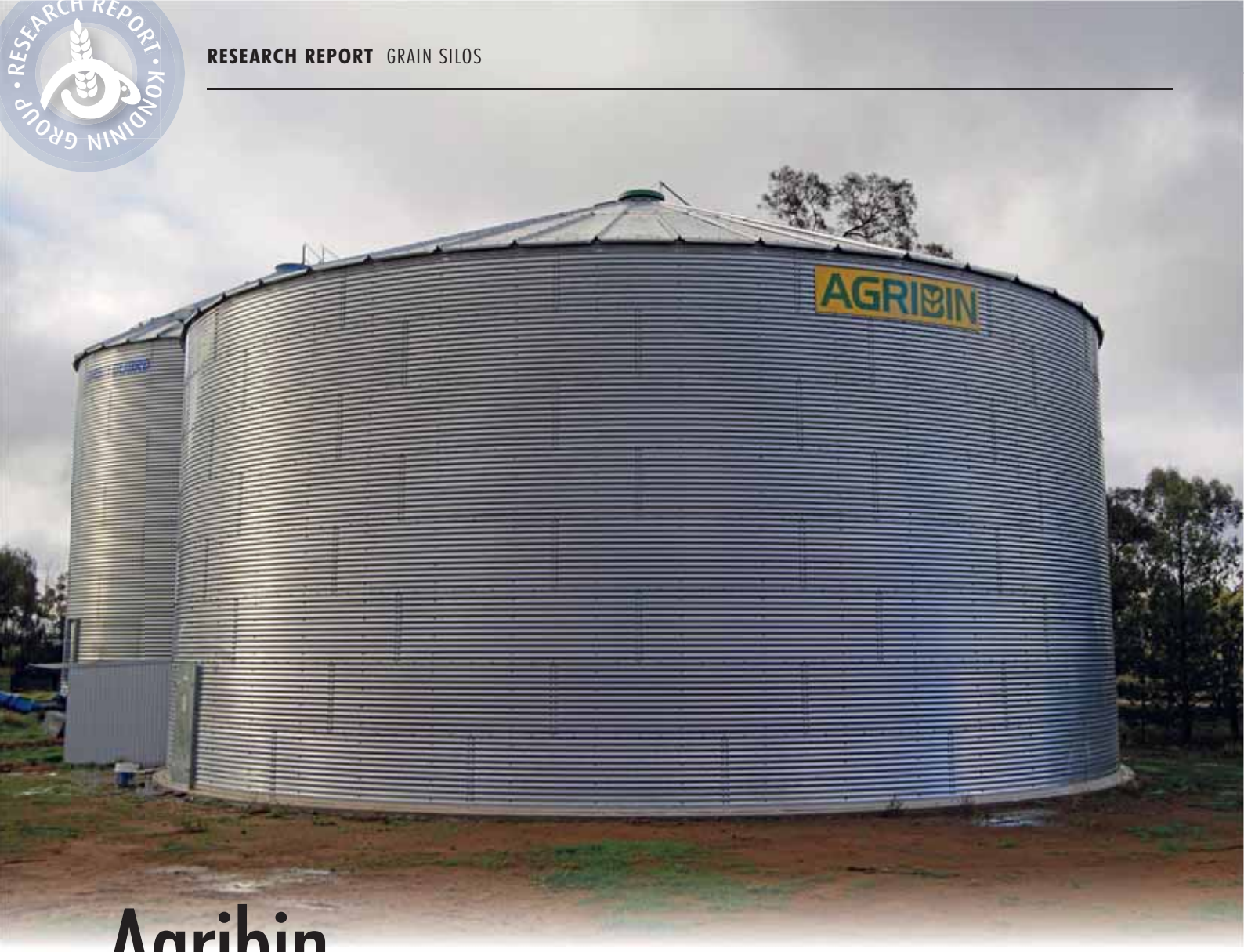
Our 2015 report cited indicative pricing but given fluctuations in steel prices and the influence size, transport pilot requirements, distance from the manufacturer and soil-type can have on foundations, we have excluded pricing in this 2018 report.

Expect to pay between $100 and $150 per tonne of storage (wheat) for large flat-bottom unsealed silos, $130 to $250 per tonne for gas-tight flat bottom silos.

Elevated cone base silos start at around $130 per tonne and go up to $250 per tonne of storage.

In most, (but not all), cases quality and price correlate strongly.

Acknowledgements
Thank you to the GRDC Grain storage extension team and all the farmers who owned the silos we tested in this report.



Agribin

Agribin, a Lake Cargelligo manufacturer of grain and fertiliser storage and handling equipment, is the importer of the Agribin. Hailing from the largest silo manufacturer in new Zealand, Dan Cosgrove, Agribin silos are large flat-bottom silos ranging in size from 600 to 2000 tonne capacity.

Outloading is via a Springland sweep auger.

SEAL STATUS

No sealing option available - cannot be fumigated.

Contact:
www.agribin.com.au
1800 743 583

WHAT WE LIKED

✓ Low-cost and simple silo
✓ Caged ladder

WHAT COULD BE BETTER

✗ No sealing option – cannot be fumigated
✗ Lid opening rod is very basic
✗ No rooftop rails

Lid opening: Ground-operated lid is no frills, simple pin-lock for securing the position but could do with a horizontal handle to improve ease of use.

Caged ladder: Good to see a caged ladder, but getting up to it is a struggle. There was no retractable or removable section on the model inspected.

Sweep auger: Hydraulic Springland sweep augers are used in Agribin silos.

Ahrens

Having acquired Websters, Sherwell and Jaeschke brands and manufacturing plants, there are some design differences between the Ahrens branded elevated cone-base silos.

Manufacturing plants in Gawler South Australia, Gilgandra New South Wales, Nhill/Tarranyurk, Sheoak Log in Victoria and Goombungee in Queensland all see silos with the Ahrens branding turned out.

The Gawler and Goombungee sites both deliver site constructed flat-bottom and cone base silos.

Since our 2015 report, some design consolidations have been made on elevated cone base silos with the winch-opening spring-closing lid common amongst the half-dozen sub-12-month-old silos we inspected. Unfortunately, we suspect this lid sealing mechanism having contributed to the AS2628 failure on six Ahrens silos we tested, three 76m^3 S700 models and three 149m^3 4100SATA models.

Cone base silos have welded cones while wall sections typically feature three convex ribs and are lap-riveted.

SEAL STATUS

S700 and 4100 models we tested failed to meet an AS2628 half-life pressure test.

Contact:
www.ahrens.com.au
1800 810 420

WHAT WE LIKED

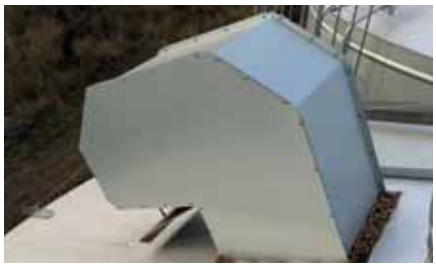
- ✓ Visible oil level in pressure relief valve for transportable elevated cone base models
- ✓ Phosphine ground application system recirculated using aeration fan
- ✓ Quality ladder and cage

WHAT COULD BE BETTER

- ✗ Elevated cone base models tested did not meet AS2628
- ✗ Bottom seal plate on S700 model difficult to seat and seal
- ✗ Common branding with differences in design can be confusing

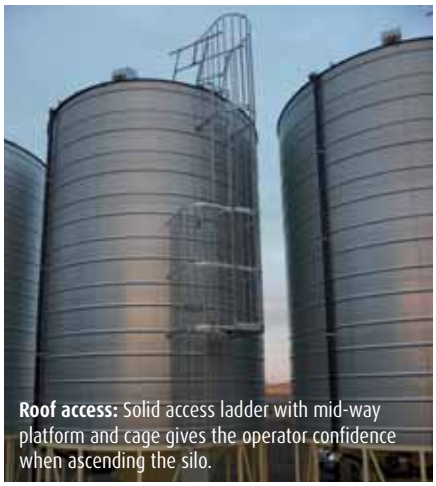
Outlet and seal plates: The S700 outlet seal (left) was inferior to the 4100SATA (right) model, with the S700 requiring the plate clamps to be bent in an attempt to seat the seal onto the uneven sealing face.

Gas application: Recirculation plumbed phosphine ground application system on the 4100SATA model (left) has a much larger gas transfer pipe and powers recirculation using the aeration fan while the S700 (right) relies on a smaller sectional pipe plumbed back into the silo inside the fumigation chamber.



Aeration rooftop vent: A large single roof-top vent for aeration exhaust uses a wire-rope pull with in-line spring for closing from ground-level.

Lid mechanism: The lid relies on trampoline style springs to apply pressure on the sealing faces of the lid with a ground winch for opening the lid. Geometry and design could be improved to provide firmer sealing pressure.



Roof access: Solid access ladder with mid-way platform and cage gives the operator confidence when ascending the silo.

Allied (MFS) Silos

One of only three large flat bottom silo brands to make AS2628. Allied Grain Systems is based in Young NSW and sells both elevated cone base and flat bottom imported MFS silos with modifications to enable sealing to AS2628.

Grain-Guard pressure relief valves are used with the large flat-bottom models using three in parallel with a gate valve for isolation when under aeration.

Cone base models have a bolted sectional base cone and use a slide-plate mechanism on the out-load door with a large plate attachable for sealing.

SEAL STATUS

Elevated cone base and flat bottom silos passed an AS2628 5-minute half-life pressure testing.

Contact:
www.alliedgrainsystems.com.au
1800 689 433

WHAT WE LIKED

- ✓ Both cone base and flat-bottom met AS2628 sealing standard
- ✓ Top access steps, mid-platform and vent access
- ✓ Base structure on cone base versions is of solid construction

WHAT COULD BE BETTER

- ✗ Turnbuckles on vents can foul making them hard to open and close
- ✗ Multiple bolts required to secure access door seal plate
- ✗ Flat step treads would be better than angle section treads to top lid

Access door: Also housing the operator manual, the access door has a sealing plate with eight bolts for uniform seal pressure.

Outload ager: Modified to ensure sealing, Kansas, USA built Hutchinson sweep augers are used.

Fan and valve arrangement: Neco axial fans are used with a customised transition which is simple to seal for pressure testing and fumigation.

Roof access: Sturdy steps on flat-bottom models with a mid-way landing and a crows nest platform make locking the top lid sown securely for sealing easy and gives the operator confidence which could be marginally improved with flat roof-top treads.

Top lid: Ground operated using a steel-rope pull-cord, the lid springs closed but latches for sealing.

Bird's Silos

Bird's silos are located at Popanyinning in Western Australia with transportable models featuring two ribs per wall section and flat-face sealing between sections. Every ring section has a window at the top of the section to observe grain level in the silo.

A thermosiphon is connected from the headspace to a semi-opaque pressure relief valve to monitor oil levels and undertake pressure testing.

The outlet has a removable bowl which can be used for fumigation with plumbing to the headspace via the thermosiphon.

Lid actuation provides a positive and evenly distributed downforce and is one of the best designs we inspected with a ground operated winch for opening and closing. ▶

Inlet: Easy to operate, Bird's ground operated lid has a unique action and is one of the better designed lids inspected.

Base construction is solid in hot-dipped galvanised pipe section with vertical struts and cross-member bracing.

SEAL STATUS

Silos passed AS2628 5-minute half-life pressure testing.

Contact:
birdssilos.com.au
(08) 9887 5055

WHAT WE LIKED

- ✓ Ground-based lid actuation is one of the best we saw
- ✓ Oil levels in pressure relief valve can be clearly seen
- ✓ Ground application of phosphine is simple

WHAT COULD BE BETTER

- ✗ Roof-top rails fabricated in light aluminium feel flimsy
- ✗ 80-tonne maximum
- ✗ Elevating shims on base could assist cleaning around silo frame

Ground application: The application of phosphine is made simple with a bowl to hold phosphine clipping onto the outlet at ground level with plumbing to the thermosiphon in the outlet manifold.

Pressure relief valve: A semi opaque pressure relief valve connected to the thermosiphon allows oil levels to be monitored and used to check sealing status.

Ladder access: The caged ladder on the Bird's silos was sturdy and supportive but the aluminium rooftop frame felt flimsy.

Brock Silos

Protector Grains distributes Brock silos and has office locations on both the east and west coast. Supplying and installing the north American imports, Protector Grains offers both cone base elevated and flat-bottom silos.

Construction of most components is from folded sheet-metal of varying gauge while wall sections are corrugated galvanised sheet. Side-wall spiral ladders provide roof access on large flat bottom silos while vertical ladders are fitted to cone base silos.

To date, moves toward an Australian standard seal have been made but ultimately not achieved. So it is disappointing to see fumigation recirculation fans installed in-line, inferring fumigation is possible.

Potential buyers of Brock silos should instead carefully select appropriately sized aeration fans and an aeration controller. Protector Grains supplies axial and centrifugal fans from Pacific HVAC including Chicago Blower branded models.

SEAL STATUS

Manufacturer was unable to provide Kondinin Group with an example meeting AS2628.

Contact:
www.protectorgrain.com.au
(02) 9437 6505

WHAT WE LIKED

- ✓ Side steps, hand-rail and lid access platform
- ✓ Large inlet lid
- ✓ High volume aeration fans available

WHAT COULD BE BETTER

- ✗ Unable to provide an example of a silo meeting AS2628
- ✗ Inclusion of in-line recirculation fan and thermosiphon infers sealing status
- ✗ Improved rooftop walkway to lid access platform

Top lid access: Ladder access can be shared between two silos which then branches to walkways up to the top lid with a healthy platform for access. We would like to see a landing every 18 treads and flat treads on the rooftop rungs.

Headspace vents: Roof-top aeration exhaust vents are simple to operate from ground level using over-centre latches.

Inclusion of a recirculation fan erroneously infers the silos are suitable for fumigation.

Outlet: The outload auger fed by an internal Brock sweep auger.

Base: Fabricated using SHS with vertical and angled uprights to accommodate larger auger hoppers.

Campbell Silos

We aren't sure why Campbell silos refused to assist us in finding some recent example of their work for this report. We were told in no uncertain terms by the receptionist that they wouldn't be participating, unfortunately, we think members deserve better than that and tapped into our membership network to track some down.

Campbell silos are built in Nhill in Western Victoria. The elevated-cone base silos are constructed in zincalume with v-shaped ribs and lapped ring sheets. The base is fabricated using Duragal SHS with a combination of vertical and angled supports with cross-bracing.

The top lid is actuated using a length of SHS and formed pipe to flip the lid open, using tek-screws in the SHS and tethered chain to hold the lid in position.

Since our last report, the phosphine application system looks to have been changed to a horizontal chamber teed into the thermosiphon at ground level. Industry experts agree that airflow across the tablets would be a better option. The oil-filled pressure relief valve is a piece of semi opaque flexible plastic pipe of small cross-sectional area for the silo volume and may be prone to spitting oil out.

SEAL STATUS

Silos passed AS2628 5-minute half-life pressure test.

Contact:
www.campbellsilos.com.au
(03) 5391 1102

WHAT WE LIKED

✓ Bottom seal door is easy to fit
✓ Ground operated lid provides a uniform seal

WHAT COULD BE BETTER

✗ Access and roof-top ladders do not have a cage
✗ Pressure relief valve may spit oil out
✗ Needs a tyre tube valve as standard for pressure testing

Outlet: A slide gate operable standing outside the base is simple to use.

Top lid: The flip-over lid is ground operated and pressure applied with a spring to the centre to provide a uniform seal.

Cyclone Silos

Cyclone silos are distributed nationally through a number of constructors including Optimum Engineering Solutions (OES) who, since our last report have been working on meeting AS2628 standards.

Kondinin Group tested a number of Cyclone silos in southern NSW and is pleased to report they met AS2628. Sealed status units reportedly comes at a premium of around $8,000.

Access ladders are caged with rest platforms and a large shared central platform for silo pairs works well.

Some of the changes made since we last looked at them included a new oil-filled pressure relief valve, sealing access door and a new top lid. Both the top lid and access door feature solid frames as sealing faces meaning ample pressure can be applied to get an adequate seal. While it does have a couple of drainage holes, the top lid design may be prone to becoming a bird waste collection tray. ▶

WHAT WE LIKED

- ✓ Another flat-bottom option meeting AS2628
- ✓ Ladder and shared platform on silo pairs
- ✓ OES outload auger was well-designed and built

WHAT COULD BE BETTER

- ✗ Top lid design likely to trap dust and bird manure which could block drainage holes
- ✗ No crows-nest means operators need to lean over from roof-top walkway to get to top-lid threaded latches
- ✗ Flat step-treads to top lid would improve operator confidence getting to the top

The Cyclone models constructed by OES included their own designed and built outload augers and internal sweep augers. Both are solidly constructed.

SEAL STATUS

Silos passed AS2628 5-minute half-life pressure testing.

Contact:
www.cycloneproducts.com.au/silos
1800 199 450

Pressure relief valve: A novel pressure relief valve works well. The only downside is that a climb is required to fill it.

Roof-top walkway: Solidly built access ladders and platforms make ascending easy, but could be marginally improved with flat roof-top treads.

Outload auger: Well-built and finished, the OES outload augers were fitted to all Cyclone silos insoected.

Inlet lid: Ground operated roof-top lid seals well with threaded latches but the opposite side requires a stretch and the lid design may trap dust and bird manure.

Chief

Chief silos are distributed nationally through Geronimo Farm Equipment in Cowra NSW, while Ahrens also sells the North American imported brand.

Construction is solid with heavy-duty vertical ribs and roof panel sections with vertical ribs adding strength. Two GrainGuard pressure relief valves were fitted to the unit inspected which also had plumbing for a fumigation recirculation system.

Both Ahrens and Geronimo quote Chief silos as meeting AS2628-2010 on their respective websites but Kondinin Group tested two sub-12-month-old Chief silos on-farm and found they did not pass five minute half-life pressure tests.

Chief silo roof sections join in a vertical rib shaped like and inverted J, as opposed to an A-shaped rib meaning meeting at the eve of the roof and wall sections has a reduced gap to be filled.

The Geronimo supplied unit tested required the air intake fan grille to be removed and blanking plate screwed on while the entire fan motor was sealed off in a box and cover plate with 11-bolts.

Given Phosphine is a highly corrosive gas on copper, we have concerns for the longevity of the copper components in fan motors using this method of sealing.

SEAL STATUS

Two Chief silos were tested and did not pass AS2628.

Contact:
www.geronimo.com.au/silos
02 6341 3369
http://www.ahrensagri.com.au/products/silos/flat-bottom-silos/
1800 810 420

WHAT WE LIKED

- ✓ Well-constructed with solid vertical W-shaped ribs
- ✓ Sturdy rooftop ladder and walkway
- ✓ Strength of J-rib roof

WHAT COULD BE BETTER

- ✗ Silos not passing AS2628, so cannot be fumigated successfully
- ✗ Fiddly seal plates with multiple bolts and screws
- ✗ Enclosure of aeration fan motor with fumigant could see reduced longevity

Roof-top: Lid access is sturdy via a sturdy ladder to a half-crows-nest around the top lid.

Outload auger: Supplied by recently closed manufacturer Keogh, a new supplier is expected to be used for outloading augers on future Chief silos.

Top lid: Ground operated with rubber pull-up latches. Turnbuckles may provide improved longevity and not be affected by UV light.

Aeration fan sealing: Fiddly seal plates and enclosure of the fan motor in the fumigated zone

DE Engineers

WA based DE Engineers builds a range of transportable silos from three to 87 tonnes as well as a range of spiral-built silos from 109-152 tonne capacity.

Kondinin Group engineers inspected two transportable cone base silo with a sturdy hot-dipped galvanised pipe steel constructed base with smaller section cross-bracing.

Wall sections are zincalume with two rolled concave ribs and two mid-section convex ribs. Wall sections join using a horizontally rolled profile between wall rings.

Spiral-built silos have a continuous join along a rolled rib and therefore no metal fixings. Testing of a new spiral silo found it sealed to AS2628, but given the novel design, we are keen to re-test the silo after a number of seasons of use.

The fumigation chamber on all models is vertical using a metal rod to hold a number of 60-tonne phosphine bag-chains in the thermosiphon tube. While bag-chains are a more costly option and the dosage in 60-tonne increments may see over-application, there is no residual dust to deal with.

SEAL STATUS

Brand new spiral and ring-construction silos passed AS2628 5-minute half-life pressure testing.

Contact:
www.deengineers.com.au
08 9274 2632

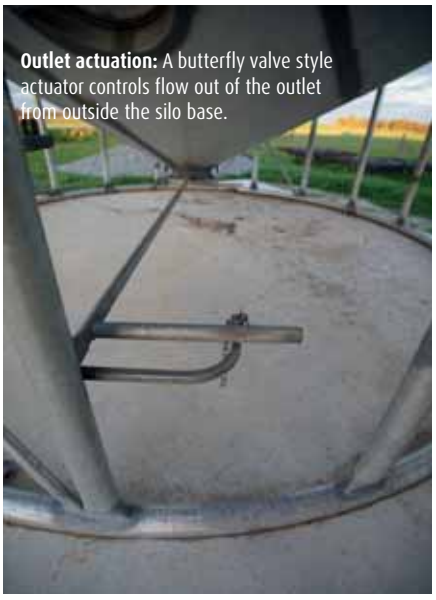
WHAT WE LIKED

- ✓ Offers WA growers 80t+ capacity transportable silos
- ✓ Solid base construction
- ✓ Visible oil level in pressure relief valve

WHAT COULD BE BETTER

- ✗ Needs fitment of tyre valve for pressure testing
- ✗ Uses more expensive bag-chains for ground-application fumigation
- ✗ Longer-term seal-status of spiral build yet to be tested

The thermosiphon and pressure relief valve with integrated vertical fumigation chamber allow for bag-chain ground application.



Outlet actuation: A butterfly valve style actuator controls flow out of the outlet from outside the silo base.

Top lid: Pulled back out of the way for loading, the top lid mechanism is easy to operate from ground level.

Dennys Silos

Allora based Dennys Engineering owned by Japanese company Satake offers a range of site-built elevated cone base and flat-bottom silos. Elevated cone base models have a fabricated sectional base comprising six sections which are bolted together.

Base and wall construction is solid with three or five prominent convex rib sections in the walls sections and bolted fixings of wall sections.

Top inlet lids are ground operated and sealed using adjustable over-centre latches. Unfortunately these latches had missing buckles thanks to the wind spinning them off. While Kondinin Group replaced the missing components for the purposes of testing, the issue could be easily resolved by retaining the buckle with an R-clip and or nyloc nut.

Ladder access is solid with caging and mid-way platforms. Roof aeration exhaust vents can be sealed from ground level using a larger over centre laser-cut and folded metal latch. Integrated silo fumigation recirculation from the headspace is ▶

achieved by plumbing the thermosiphon into one of the aeration fans.

Previous testing of 227t silos found they passed the 5-minute Australian Standard for sealing, but more recent testing of three, larger 450t Dennys elevated cone base silos and a large flat-bottom model found they did not pass the AS2628 half-life pressure test. Given some of these were new installs that had never been filled, the result is disappointing.

Dennys continues to install GrainGuard pressure relief valves in an awkward position for servicing, a design fault that could be easily rectified by plumbing the valve into the ground-level thermosiphon piping.

SEAL STATUS

Smaller (circa 200t) silos met AS2628 5-minute half-life pressure testing, but larger 450t and large flat-bottom models installed on-farm did not pass.

Contact:
www.dennys.com.au
07 4666 3266

WHAT WE LIKED

- ✓ Heavily engineered base structure
- ✓ Design easily adapts to aeration system fumigation recirculation
- ✓ Most access ports and outlets are easily sealed and seal force adjusted

WHAT COULD BE BETTER

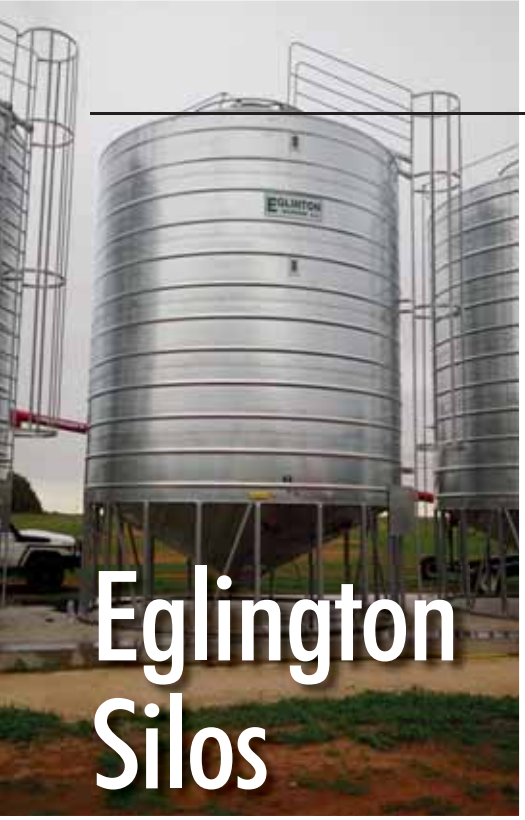
- ✗ Inconsistent seal status – larger silos not meeting AS2628
- ✗ Inconvenient pressure relief valve location for servicing
- ✗ Lost buckles on roof-top latches

High valve: At over three metres off the ground, the valve is too high to service or read for pressure testing without a step-ladder.

Slider: The outlet slide gate uses a wheel and geared axle to open and close the outlet gate. This gate becomes the sealing plate with two eccentric pins rotate to push the plate up to seal the outlet.

Recirculation: One of the two aeration fans on this 450t elevated cone base is plumbed into the thermosiphon from the headspace.

Access: The access door like the rest of the Dennys silo elevated cone base, is solid , but requires tools to pull tight for seal testing when empty.



Eglington Silos

Built in Waikerie South Australia, Eglinton silos are built using Duragal SHS for base construction. Wall sections are galvanised and have two large convex ribs per wall section and overlap riveted joins on both vertical and horizontal transitions. Cone base is fabricated using 2mm welded sheet.

An improved top inlet door clamping method has been incorporated since we looked at the Eglington silos in 2015 but the manhole door still had to be pulled to apply sealing force for testing.

Ladder access is also improved with sturdy flat roof steps and a wide ladder for ascending the silo.

An oil pressure relief valve in the form of an oil-filled pipe is fitted but a GrainGuard pressure relief valve is available. The silos inspected were all 90T capacity.

SEAL STATUS

Used silos on farm passed AS2628 5-minute half-life pressure testing with pressure applied to manhole door.

Contact:
www.eglintonsilos.com.au
(08) 8541 2411

WHAT WE LIKED

- ✓ Solid base structure design
- ✓ 3-minute pressure test met
- ✓ Sturdy roof-top steps, ladder and cage

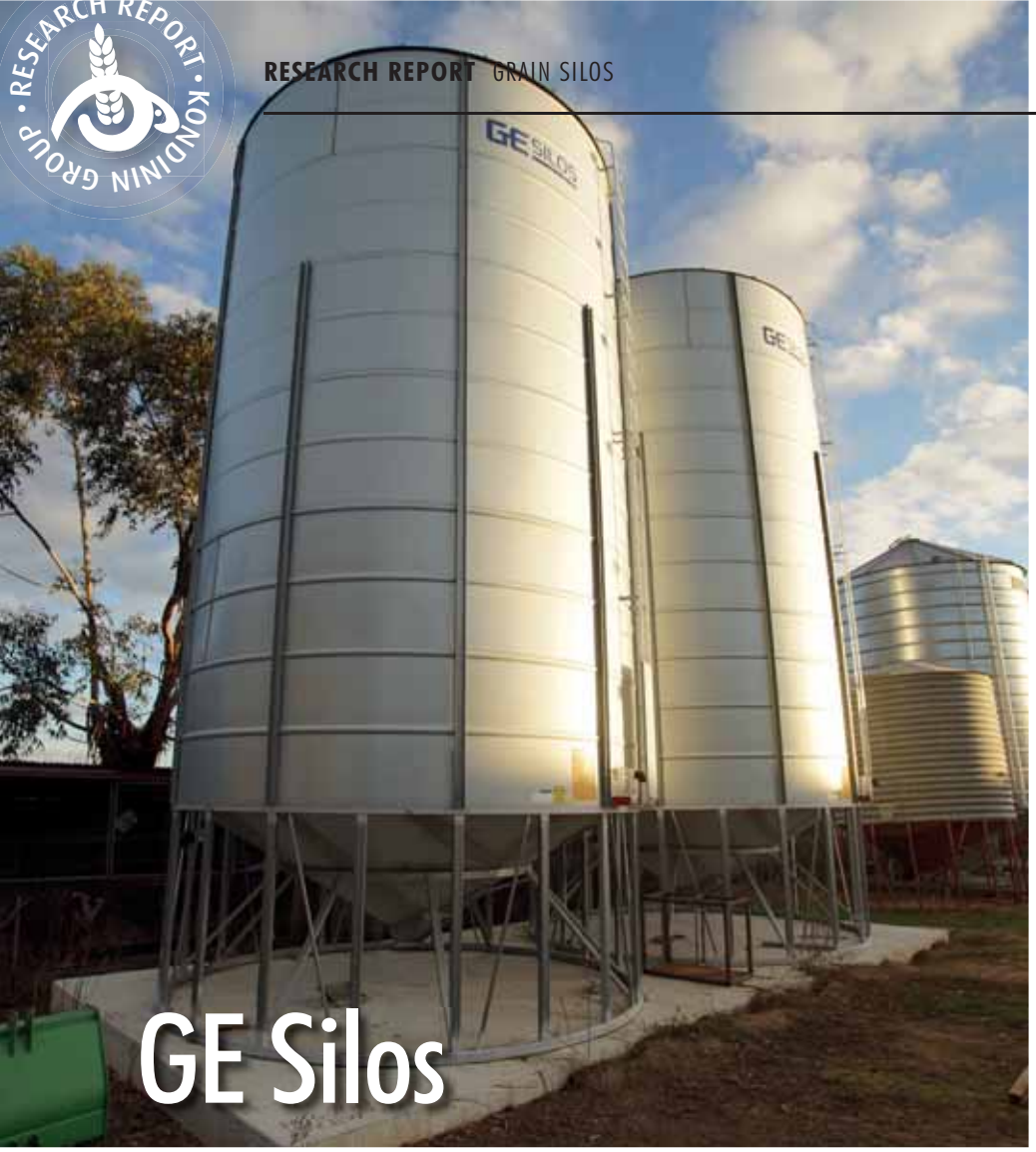
WHAT COULD BE BETTER

- ✗ Pressure relief valve may spit oil out
- ✗ Needs empty silo manhole locking mechanism
- ✗ Ground operated lid opening rod could do with handle and options for adjustment.

Pressure relief valve: A small cross sectional area and minimal oil capacity of pipe-style pressure relief valves can see them lose oil with diurnal variation.

Top lid: An improved locking mechanism ensures seal on top lid.

Roof access: Flat step treads and sturdy hand rails make upstairs access easier.



GE Silos

Goornong Victoria based, GE Silos builds transportable silos up to 111tonne capacity.

Base fabrication on the 97 tonne units inspected is from vertical galvanised RHS section uprights with smaller section SHS diagonal bracing. The spacing of the uprights may restrict some auger hoppers. The unit inspected had been raised at the request of the buyer who correctly pointed out that the standard height was also restrictive to auger and conveyor access.

A secondary mid-cone support frame is built into silos over 50-tonne capacity.

The cone is fabricated from 1.6mm galvanised steel welded from nine sections. Walls feature a single convex mid-rib and another rib on the sheet joins.

External c-channel stiffening struts run from the base to the top and three-quarters the silo height on every second stiffener. Stiffeners are riveted to the wall rib profiles.

A clear GrainGuard pressure relief valve is easily accessed at ground level and two phosphine application tubes are mounted in the cone but have no circulation plumbing.

SEAL STATUS

Silos passed AS2628 5-minute half-life pressure testing.

Contact:
www.gesilos.com.au
(03) 5432 2384

WHAT WE LIKED

- ✓ Solid build quality
- ✓ Sight glasses on every wall ring
- ✓ Ground operated lid mechanism works well for opening, closing and sealing

WHAT COULD BE BETTER

- ✗ No roof-top handrail or cage is a safety issue
- ✗ Ground application fumigation port would be improved with connectivity to the headspace
- ✗ Base design may restrict some auger and conveyor access

Fumigation: Phosphine ground application systems are mounted to the cone but would benefit with connection to the headspace.

Outlet: Clever geometry and laser-cut profile components actuate the outlet slide but the operator has to crawl into the silo base frame to operate it.

Cageless: A relatively narrow ladder and lack of cage or roof-top rails needs to be rectified.

Pressure relief: A GrainGuard valve at ground level with test valve and instructions is easy to get to.

GrainGuard Silos

Not to be confused with the pressure relief valve manufacturer, Victorian company Harberger Farm Supplies distributes the imported GrainGuard silos.

Kondinin Group engineers inspected a pair of newly-built GrainGuard silos which hail from Alberta in Canada.

Fitted with Springland outload augers and full-floor aeration, the GrainGuard silos are not gas tight sealable meaning they cannot be fumigated and aeration is the only option for curtailing insects.

While they may not be sold as gas-tight fumigatable silos, the inclusion of a thermosiphon and aeration fan sealing plate incorrectly infers that they can.

A sturdy set of spiral wall steps with an intermediate platform lead to flat-tread roof-top stairs to the inlet lid surrounded by a crows-nest platform.

SEAL STATUS

The inspected unit did not pass an AS2628 test.

Contact:
harberger.com.au
(03) 54971 420

WHAT WE LIKED

- ✓ Sturdy steps and roof-top platform
- ✓ Ground-operated inlet lid
- ✓ Solid construction

WHAT COULD BE BETTER

- ✗ Does not meet AS2628
- ✗ Aeration fan seal plates and thermosiphon errantly suggests fumigation is an option
- ✗ Full-floor aeration needs to be removed for full clean-out

Outload: Internal sweep and outload come from Springland.

Access: Sturdy steps lead up to a shared platform on this pair of silos. Covers on the aeration fan can be seen, but are not necessary as these silos do not seal for fumigation.

Top lid: Sturdy access steps and railing surround the inlet lid

Entry: A larger square entry door provides adequate access for getting in and out of the silo to sweep up the last of the grain.

Grainmaster Silos

Toowoomba Queensland based Davey Group builds the range of Grainmaster cone base silos from five tonne to 1200 tonne. The units inspected featured 75mm pipe uprights on the base frame and 40mm cross-bracing.

The cone base is solidly fabricated with bolt-together sections while wall construction features three convex ribs per ring section, overlapped and is hex-head screwed.

Aeration system incorporates the fumigation recirculation system and is well designed and simple to operate. Ladder and roof-top access is sturdy with a mid-way platform.

Top-lid sealing requires an ascent and manual latching using over centre buckles. These buckles can errantly catch and could easily be improved by inverting their orientation. Kondinin Group engineers did observe a prototype ground-operated inlet lid-seal system indicating the Davey group is working to address this issue.

SEAL STATUS

Silos passed AS2628 5-minute half-life pressure testing.

Contact:
thedaveygroup.com.au
(07) 4634 7767

WHAT WE LIKED

- ✓ Ground fumigation system
- ✓ Base designed for easy cleanout (no ground ring)
- ✓ outlet seal plate stowage on silo

WHAT COULD BE BETTER

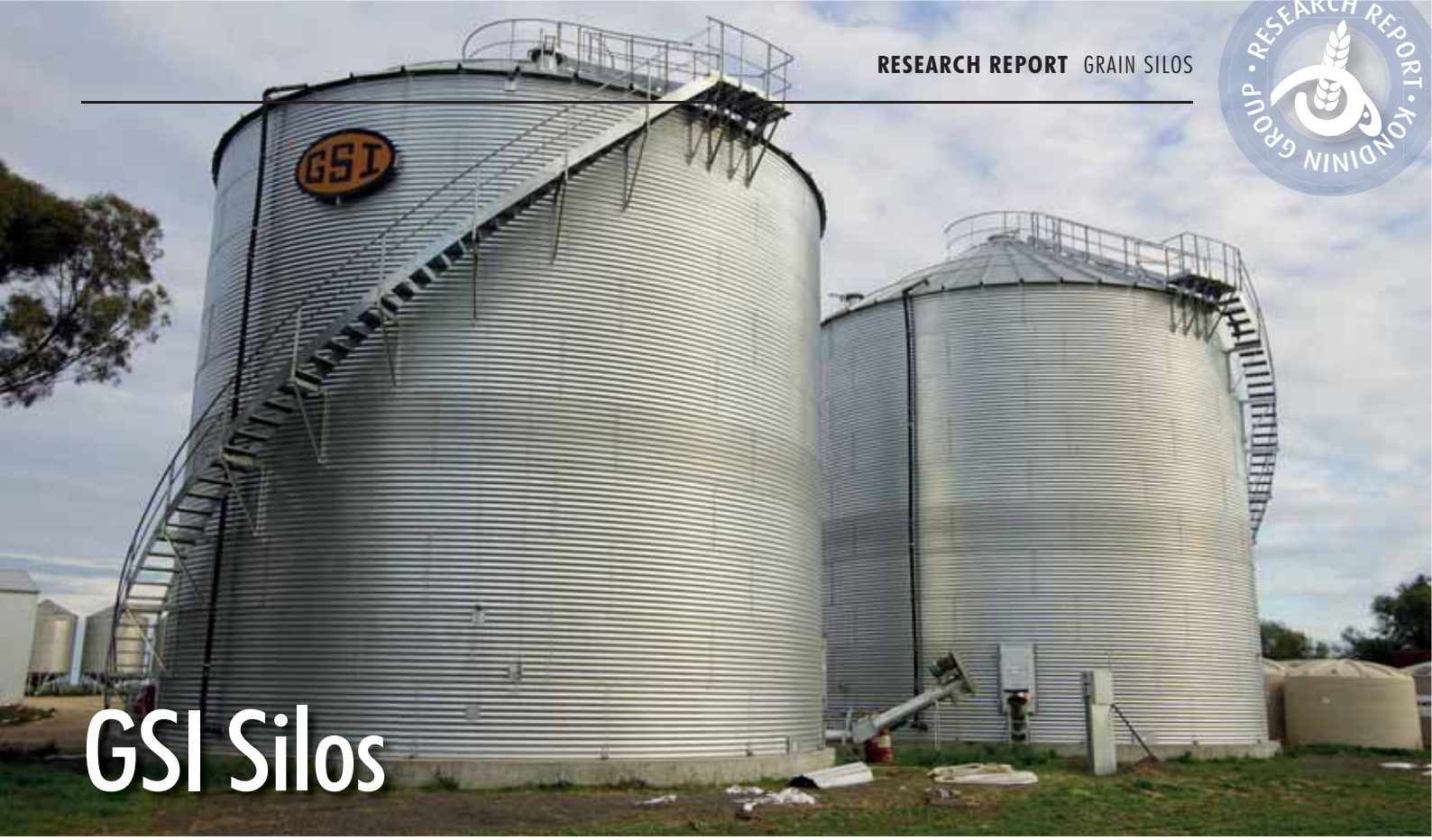
- ✗ Top lid sealing latches could be improved or ground actuated
- ✗ Ground-level over-centre rooftop aeration vent latches a little light

Drainage: A self-emptying water trap fitting built into the thermosiphon.

Fumigation: Ground-application of phosphine unitises one of the aeration fans plumbed via the phosphine box.

Laser cut and folded over-centre latches as used by a number of other manufacturers including Dennys silos, seem a little lightly constructed.

Seal plate: Outlet seal plates use over-centre turnbuckles to be secured in position.



GSI Silos

Owned by agricultural machinery manufacturer AGCO, GSI silos are imported from North America where in addition to silos, GSI manufactures a large range of ancillary grain handling equipment.

A bolt-together corrugated wall section silo, the GSI silo inspected featured external stiffening ribs and a spiral wall staircase with an intermediate platform.

Lid access was very sturdy with good handrails and steps to the inlet lid from the staircase platform. ▶

Aeration exhaust vents appear to be well designed and built.

But despite having an aeration fan cowling seal plate, thermosiphon and light door seal, implying suitability for fumigation, the silo inspected did not have a pressure-relief valve and AGCO was unable to provide an example of a silo meeting AS2628.

SEAL STATUS

An example sealing to AS2628 could not be found.

Contact:
www.gsiag.com.au 0408 550 431

WHAT WE LIKED

✓ Access staircase and roof-top walkway
✓ Ground-operated top lid and aeration vents

WHAT COULD BE BETTER

✗ No AS2628 compliant examples
✗ Features speciously imply AS2628 compliance

Remote control: Ground operated lid and aeration exhaust vents are operated by wire rope.

Full-floor aeration provides uniform air flow but must be pulled up to fully clean out.

Aeration: GSI badged aeration fans curiously feature a seal plate, but the silos do not meet AS2628 for fumigation.

Aeration exhaust: Rooftop aeration vents are well made.

HE Silos

HE silos are made in Gunnedah and Forbes under a brand and design licensing arrangement.

Elevated cone base models feature a SHS and pipe constructed base frame. Wall sections feature an interlocking top and bottom convex rib while the ladder has a cage and transition platform.

The cone base is welded while the outlet uses a slide gate with actuation from outside the silo base. Cone base silos range in size from four tonnes to 120 tonnes while on-site cone base silos extend to 500 tonnes capacity.

Pressure relief valve is an older design, small capacity which notoriously crack and drop their oil.

UV-resistant black HDPE pipe constitutes the thermosiphon complete with an expansion sleeve to prevent joint damage due to thermal expansion. Fittings and transitions are neatly butt-welded. A teed-in phosphine fumigation is plumbed into the thermosiphon but air dies not flow across the tablet tray.

Flat-bottom models range in size from 225 to 1000 tonnes and are not made to meet a sealing standard and feature two convex ribs. The flat-bottom models feature a ground operated lid and HE-built sweep and outload auger.

SEAL STATUS

100t Forbes-built elevated cone base silo passed an AS2628 5-minute half-life pressure test. Flat-bottom units are unsealed.

Contact:
hesilos.com.au
1300 764 700 (Gunnedah)
1800 046 046 (Forbes)

WHAT WE LIKED

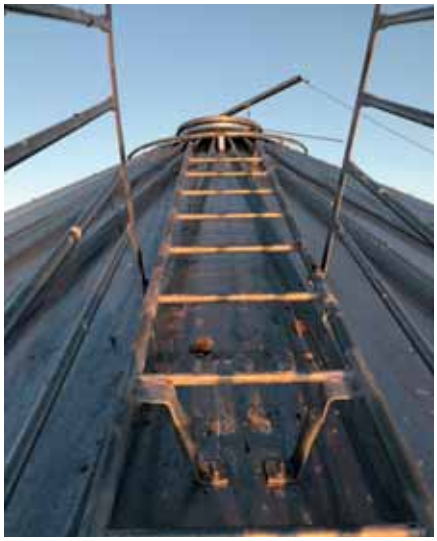
- ✓ Sturdy access ladder with transition
- ✓ Ground-actuated lid is simple to use
- ✓ Well-constructed thermosiphon

WHAT COULD BE BETTER

- ✗ Airflow over fumigation chamber instead of teed plumbing
- ✗ Higher capacity pressure relief valves

Neatly butt-welded HDPE plumbing on the HE elevated cone base gas-tight sealable silos.

Outlet: A Slide-gate outlet and sealing face lock bracket on a HE silo.



Roof-top: Access on a large flat-bottom silo built by the HE team in Gunnedah.

Windows: Each wall section has a top and bottom convex rib and a window at the base to monitor grain level.

Kotzur Silos

Kotzur silos are headquartered in Walla Walla New South Wales offering a wide range of silos in capacity and dimension.

Kondinin Group engineers have inspected and tested numerous elevated cone base silos and flat bottom silos from Kotzur and found all to meet AS2628.

Elevated cone base silos feature wall section profiles with a top and bottom interlocking rib which is solid riveted. Bases are galvanised 75mm SHS with diagonal cross-bracing. Internal stiffeners were installed on the models inspected.

Each wall section on flat-bottom silos has a signature convex bulge to provide structural rigidity, with a rolled top and bottom horizontal lip which are sealed and bolted.

The flat bottom access door is easy to operate without any tools and provides an effective seal.

SEAL STATUS

Silos passed AS2628 5-minute half-life pressure testing.

Contact:
kotzur.com
02 6029 4700

WHAT WE LIKED

- ✓ All models easily met AS2628
- ✓ Ladder, handrails and walkway on flat-bottom silo very sturdy
- ✓ Door closing mechanism on flat bottom silo easy to operate and effective
- ✓ Thermosiphon fumigation design simple and effective on cone base models

WHAT COULD BE BETTER

- ✗ In-floor venting screens heavy to lift for cleanout in flat-bottom silos
- ✗ Quality comes at a price and the waiting list can be long
- ✗ Pressure relief valve on elevated cone base too high for servicing

Lid and vent actuation: Lid and vent actuation is simple with R-clip locking positions depending on the operation.

Access: The silo access door on flat-bottom models is simple to use and seals effectively.

Thermosiphon and pressure relief valves: Easy to access and service on flat bottom models, pressure relief valves are mounted in a high, hard to service position on elevated cone base silos.

Upstairs: Top lid access is very good with sturdy handrails and crows-nest platform.

Moylan Silos

Moylan silos are manufactured in the WA wheat-belt town of Kellerberrin.
With sizes ranging from 10 tonne to 74 tonne, Moylan bases are Duragal 75mm SHS with smaller SHS cross-bracing.
Wall profiles feature two convex flat-bottom 'V' profiled ribs and two concave ribs with horizontally rolled top and bottom ribs connecting wall rings.
A simple to use ground application fumigation chamber is connected to the thermosiphon which has an opaque pressure relief valve. Recent revisions to the pressure relief valve have made observing and topping up the oil level more difficult and prone to neglect.
An angled, caged ladder and sturdy handrails make climbing the silo easier when required although the lid is ground operated and sealed and locked into place from ground level.

SEAL STATUS

Silos passed AS2628 5-minute half-life pressure testing.

Contact:
moylans.com.au
1800 454 305

WHAT WE LIKED

- ✓ Ground operated lid and fumigation application system is easy to use
- ✓ Sturdy access angled ladder with cage and handrails
- ✓ Consistently meet AS2628 when maintained

WHAT COULD BE BETTER

- ✗ Opaque pressure relief valve makes filling and checking oil difficult
- ✗ Outlet seal plate can be difficult to align and clamp
- ✗ 74 tonne maximum capacity

Access: Ladder and roof-top railing on the Moylan is sturdy.

Great fumigation box, poor valve: An opaque valve makes checking and filling oil levels more difficult than it needs to be but the Fumipot ground fumigation system is simple.

Outlet: The outlet can be operated from outside the silo base but aligning and sealing up with a three-piece plate and clamp can be tricky.

Inlet lid: The ground operated inlet let is simple and can be locked in position.

Mighty Bulk Silos

Distributed through Scoresby, Victoria based LGPM, Mighty Bulk silos are a bolt-together, kit-form, site-build option ranging in capacity up to 85 cubic metres for "farm silos", 2,600 cubic metres for "hopper-bottom silos" and 25,000 cubic metres for flat-bottom silos.

A large 1000t elevated cone base silo was inspected in southern Victoria. Components featured heavy galvanising and solid construction utilising hundreds of sections in the cone, walls and roof.

As an imported silo, the Mighty Bulk are not sealed to AS2628 and despite claims of offering a "sealable" unit, none could be located or tested.

SEAL STATUS

An example sealing to AS2628 could not be found.

Contact:
www.lgpm.com.au
(03) 9702 4855

WHAT WE LIKED

✓ Heavy build and galvanised finish
✓ Sturdy ladder and crows-nest platform

WHAT COULD BE BETTER

✗ No AS2628 seal compliance for fumigation

Platform: Crows-nest has a solid platform and railing.

Access: The access ladder, mid-platform and railing are sturdy.

Walls: Corrugated bolted wall sections with stiffening ribs run the height of the silo.

Nelson Silos

Nelson silos have manufacturing plants in Rochester, St Arnaud, Victoria and Parkes, NSW and build sealed silos up to 250 tonne capacity.

The silos inspected in northern Victoria sat on SHS and C-channel fabricated bases and pipe bracing with a mid-cone support ring.

The wall section profile features two convex ribs with the top and bottom of each sheet interlocking and fixed with solid rivets while vertical crimping is spaced at about every 250mm around each ring. Three sight windows were fitted to the silo to monitor grain levels.

WHAT WE LIKED

- ✓ Solidly constructed base with secondary cone support ring
- ✓ Ground operated lid actuation is simple
- ✓ Large, easy to see sight windows

WHAT COULD BE BETTER

- ✗ Ladder has no cage and no top handrail
- ✗ Phosphine application system is not linked to the headspace
- ✗ Pressure relief valve is located at the top of the silo making it difficult to service

The phosphine application chamber is at ground level, but is not linked to the headspace for optimal gas transfer and fumigation.

A phosphine delivery port is mounted into the cone base but has no connection to the headspace of the silo.

Cone fabrication is in welded sections while the outlet can be outlet can be actuated from outside the silo base.

SEAL STATUS

Silos passed AS2628 5-minute half-life pressure testing.

Contact:
nelsonsilos.com.au
1800 801 966

Valve: A pressure relief valve mounted to the top of the silo makes servicing and monitoring oil levels difficult.

Outlet: A slide-gate outlet operable from outside the silo base can be sealed using a supplied clamp.

Top lid: Inlet door actuation is simple from ground level and is adjusted using tools.

Pederick Silos

Made in Darkan WA, Pederick manufactures silos to 90 tonnes capacity. Wall sections feature two prominent convex ribs per ring with a simple overlap and solid rivet join.

Base frame is Duragal SHS construction with diagonal bracing.

Windows are spaced in every ring with the top and bottom positioned closer to the roof and the cone respectively.

Lid opening is via a winch release with the release wire rope remaining on front of the inlet, potentially hindering auger manoeuvring.

We raised the issue with the phosphine ground application system in 2015 and reiterate that it should be urgently revised. The design provides insufficient surface area for tablets to liberate and will contribute to potential phosphine resistance.

Since our last appraisal, a ladder cage and rooftop railing has been added making ascending safer.

Older style pressure relief valves are still used and are prone to UV damage.

WHAT WE LIKED

- ✓ Access ladder and cage additions
- ✓ Solidly constructed SHS base with cleanout gaps under the base ring
- ✓ Ample and well positioned sight-windows

WHAT COULD BE BETTER

- ✗ Phosphine application canister poorly designed
- ✗ Release rope used to open lid remains in the centre of the inlet after opening
- ✗ Outlet actuation requires the operator to enter the silo base to actuate

SEAL STATUS

Silos passed AS2628 5-minute half-life pressure testing.

Contact:
pederickengineering.com.au
(08) 9736 1360

Inlet lid: The release cable remains in the centre of the lid in the fully open position providing an obstruction when filling.

Phosphine application: Poorly designed, the canister does not allow phosphine tablets to liberate, potentially under-dosing insects and creating resistance.

Outlet: The slide gate outlet works well with the ¼ turn sealing mechanism doing the job to assist in maintaining AS2628.

Wall: Wall joins are overlapped and solid riveted with two convex ribs per wall section ring.

Sharman Silos

Sharman silos are made in Long Plains about an hour north of Adelaide in South Australia. Sharman silos builds silos in 58 tonne and 70 tonne configurations.

Galvanised sheet metal and pipe is used in the construction with tri-support-pole legs making cleanout under the silo very easy.

The top lid opening is very large at 1.2 metres diameter although this means applying adequate pressure on such a large sealing surface may require some adjustment. Latching would potentially assist in achieving a consistent seal. Clamping the lid is via an over-centre ground-operated latch arrangement which can be adjusted.

Butterfly valve outlet operation is via a lever on the mounted to the uprights on the base.

SEAL STATUS

Silos passed AS2628 5-minute half-life pressure testing.

Contact:
www.sharmans.com.au
(08) 8527 0000

WHAT WE LIKED

- ✓ Semi-opaque valve for monitoring oil level and conducting AS2628 pressure test
- ✓ Bottom seal bowl can be used for phosphine application and is connected to the headspace
- ✓ Ease of cleaning underneath silo without on-ground base ring

WHAT COULD BE BETTER

- ✗ Top lid has a large sealing face and could do with latches to assist with sealing
- ✗ Top lid compression adjustment requires tools, trial and error to get right.

Ground operated lid: Lid opening and seal pressure is applied by an over centre handle. This sealing force may require adjustment using tools.

Ladder access: A caged ladder would improve operator confidence if required to climb the silo for maintenance and insect monitoring.

Legs: The ease of cleaning under the Sharman silos is significantly aided by the lack of a ground ring.

Seal bowl: The sealing bowl doubles as a phosphine tray and is connected to the headspace.

Superior Silos

Superior silos are an imported North American silo distributed through Ag Hub Industries. Silo installations were inspected on three farms in Victoria, the third providing a seal to AS2628 with some intervention and persistence from the manufacturer.

Full floor aeration is standard on Superior silos and while this would need to be removed for full cleanout, one owner noted it was a relatively simple task having done it once before.

From an access perspective, steps to the roof have an intermediate and top platform. The optional roof-top step set and crows-nest inlet platform is recommended for top lid access.

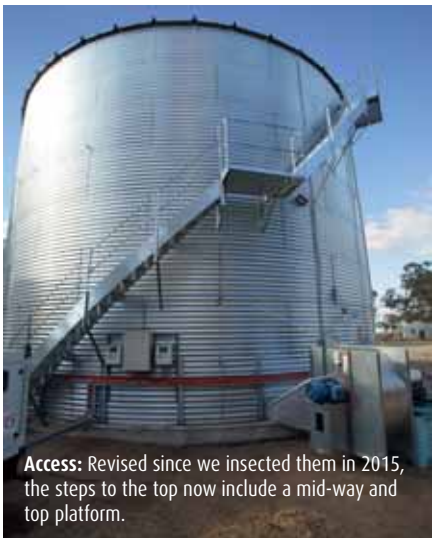
Two of the three silos were fitted with two high capacity aeration fans for drying maize.

To their credit, Superior silo installers worked hard to provide an example of a used silo on-farm meeting a 4.5 minute half-life with intervention. But more permanent measures to ensure sealing with longevity would improve the product. These include rigid access door seal face frames and aeration fan intake sealing plates without the requirement for messy sealant.

SEAL STATUS

Ag Hub were able to provide an example of a used Superior silo on-farm meeting a 4.5 minute half-life pressure test with intervention.

Contact:
www.aghub.com.au
0418 695 933



Access: Revised since we insected them in 2015, the steps to the top now include a mid-way and top platform.

WHAT WE LIKED

- ✓ Access was sturdy with roof-top step set and crows-nest inlet platform
- ✓ Pressure valves simple to service
- ✓ Full floor aeration and high capacity fans available for drying grain

WHAT COULD BE BETTER

- ✗ 4.5 minute half-life pressure test result required some intervention
- ✗ Permanent measures on doors and aeration fans required to ensure a seal with longevity
- ✗ Full-floor aeration needs to be removed for full clean-out

Rooftop: Walkways and handrails on the roof were sturdy on models optioned with roof-top step set and crows-nest inlet platform.

Outload: Springland sweep and outload augers are used.

Seal plate: Large capacity fans pump air through a full floor for drying but sealing these requires a more permanent solution than removal of the grille and attachment of a sealing plate with bolts and polyurethane sealant.

Inside: Twister silos have full floor aeration and a sweep auger.

Twister Silos

Twister are a North American built silo distributed by Cowra NSW based Geronimo Farm Equipment. Wall construction is a corrugated galvanised sheet of varying gauge depending on wall height and the total silo capacity. Stiffening ribs run the height of the silo.

Twister silos offer optional full-floor aeration, and are fitted with sweep and out-load augers which appear to be easy to operate.

Geronimo claims Twister silos can be sealed for fumigation, but was unable to provide Kondinin Group with an example meeting AS2628 and their construction would make sealing them very difficult.

Thanks to the easy to use ground operated inlet lid, rooftop access would rarely be required with some basic foot rails leading to the top lid.

SEAL STATUS

Manufacturer was unable to provide Kondinin Group with an example meeting AS2628.

Contact:
www.geronimo.com.au
02 6341 3369

WHAT WE LIKED

- ✓ Simple outload auger and gate actuation
- ✓ Low cost per tonne of stored grain
- ✓ Simple ground-operated lid

WHAT COULD BE BETTER

- ✗ Basic rooftop access
- ✗ No demonstrated sealing to meet AS2628 meaning these silos cannot be fumigated
- ✗ Full floor removal required for a complete cleanout

Outlet: The outloading auger door actuators were simple to operate.

Rooftop: A ground operated lid means that these basic rooftop rungs should rarely be required.

Westeel

Burando Hill is headquartered in Kattaning, Western Australia, but has dealers and branches nationally.

Amongst the grain handling lines imported are the Canadian-made Westeel silos. Being North American, they are not designed to seal and while Burando Hill builds by the silos to be watertight, they are not constructed to a sealing standard for fumigation.

This means aeration is the primary option for insect control and the silo inspected was fitted with a three-phase CustomVac supplied Downfields Engineering B4000 fan.

Wall sections are corrugated and a single flight of steps leads to a rooftop transition platform up to the lid via a set of angle profile widely spaced steps.

Aeration exhaust vents and inlet lid are all actuated from ground level with roughly finished handles and equally rough handle stowage.

Springland-supplied sweep and outload augers are fitted.

Aeration: In the absence of AS2628 sealing, aeration is the best option for insect minimisation in Westeel silos. The inspected unit was fitted with a Downfields Engineering B4000 three-phase fan for cooling.

SEAL STATUS

Manufacturer was unable to provide Kondinin Group with an example meeting AS2628. FA

Contact:
www.burandohill.com.au
08 9821 4422

WHAT WE LIKED

✓ Ground operated lid and aeration vents
✓ Spiral stairs feel solid and sturdy

WHAT COULD BE BETTER

✗ Inlet lid pull is rough to operate and stow
✗ No demonstrated sealing to meet AS2628 meaning these silos cannot be fumigated

Going up: Single flight spiral stairs are sturdy but could be improved with a mid-way landing

Access and outload: Outload is via a Springland outload auger with a generously sized silo entry for final cleanout.