

Roof in acid rain environment, USA.

1994



Already 20 years old...



1999

At 25, comfortably outpacing
galvanized accessories...



2004

30 years young, and good
for at least another 10...



North American and European validation

Projected to give
40+YEARS LIFE
without major maintenance

**ROOFS IN BARE
55% Al-Zn
COATED STEEL**

55% Al-Zn
**THE MAGIC FORMULA
FOR ROOFS**

55% Al-Zn **THE MAGIC FORMULA** FOR ROOFS

In North America, it's generally known as Galvalume®. In Europe, it's also Aluzinc®. And across the world it may be marketed under Zinalume®, Zintro-Alum®, Galval® and other brand names. But whatever the name, one thing is certain: 55% Aluminium-Zinc coated steel is the magic formula for roofs. In bare unpainted form, it outperforms all other metallic-coated steels, giving more than twice the life of an ordinary zinc coating of the same thickness and providing superb cut-edge protection against corrosion.

This comprehensive field inspection report shows that even in low-pitch standing seam roofs it has a life expectancy of well over 40 years.

It's no surprise, then, that the technology is now licensed to manufacturers in more than 28 countries on six continents, or that exponential growth has seen more than 40 million tonnes produced in the last ten years. By the end of the decade the cumulative total is predicted to rise to more than 100 million tonnes.

This report covers surveys of established roofs in unpainted 55% Al-Zn in both the USA and Europe. Roofs examined were mainly in urban, industrial, marine and acid rain environments, and ranged in age from 9 to 30 years. Most had a slope of less than 10 degrees (1 degree = 1/4:12).

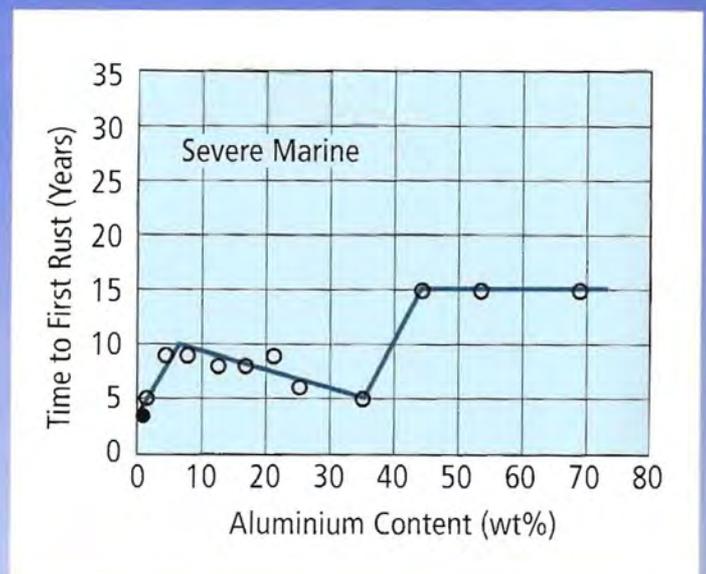
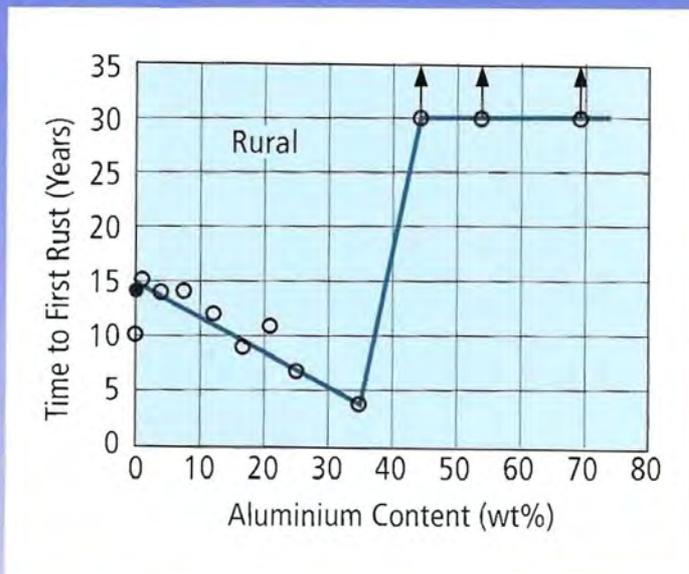
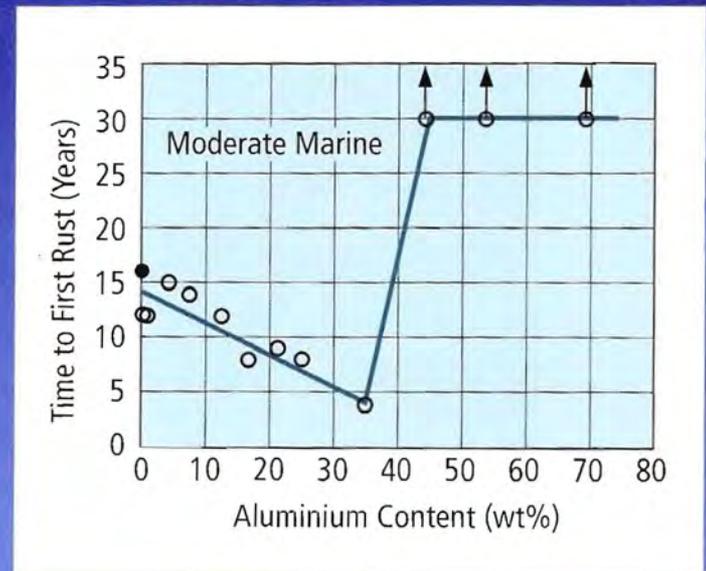
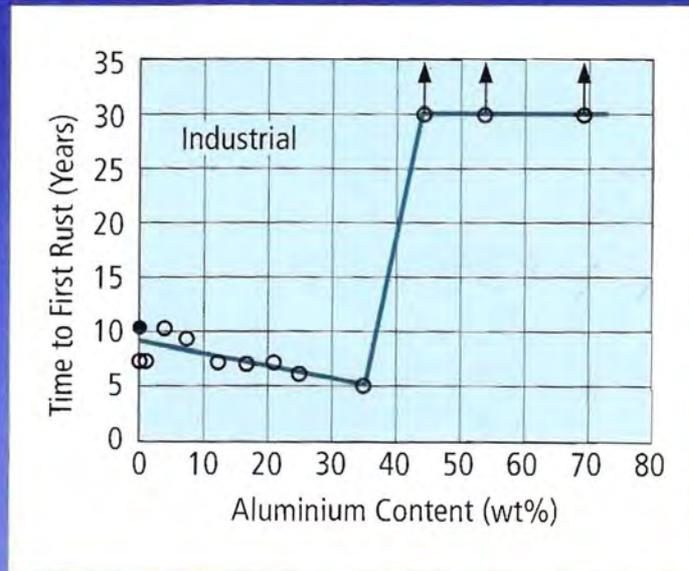
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SUMMARY OF FINDINGS

- The superior corrosion resistance of bare (unpainted) 55% Al-Zn metallic coated steel is established beyond any reasonable doubt. Components and accessories in galvanized steel were in most cases suffering from advanced deterioration, while the 55% Al-Zn sheets remained virtually unaffected.
- All the roofs were in good to excellent condition both technically and aesthetically – regardless of age, location and environment. The 55% Al-Zn roof panels performed outstandingly well in North American regions subject to acid rain and harsh winters.
- **Based on the field inspection results, all roofs surveyed are projected to give a life in excess of 40 years (some will achieve their half century) without needing major maintenance.**
- Environmental conditions play a vital role in the long-term performance of unpainted 55% Al-Zn roofs, because a highly corrosive environment depletes the protective metallic coating. Regulatory changes to reduce emissions of airborne acidifying pollutants (and hence acid rain) mean that the long-term performance of 55% Al-Zn is likely to increase yet further.
- The buildings surveyed benefited from the excellent solar reflection of 55% Al-Zn sheets, which exceeds the requirements of the US Environmental Protection Agency's ENERGY STAR® Cool Roof program.
- In some cases, isolated corrosion incidents were observed. These were generally attributable to design, detailing, installation or maintenance practices – for example, where ponding had been allowed to occur. In some cases, localised highly corrosive environments near chimneys or roof vents had initiated corrosion.
- Quality of design, installation and maintenance is vital to obtain the full benefit of the exceptional corrosion resistance and long life offered by 55% Al-Zn. The survey and the pictures in this report underline the strong recommendation for designers and installers to select ancillary fittings and fasteners in materials compatible with 55% Al-Zn.

LIFE EXPECTANCY OF 55% Al-Zn COATED STEELS IS AT LEAST TWICE THAT OF HOT DIP GALVANIZED

Long-term evaluations show that 55% Al-Zn sheets will have a life of >30 to 40+ years, except in severe marine applications, and at least twice the life of galvanized steels



● Galvanized
○ 55% Al-Zn Coated Steel

ROOFS IN NORTH AMERICA: 1



Location: Indianapolis, Indiana, USA

Environment: Industrial, acid rain

Slope: 1 degree

Age: 30 years

The deterioration of the galvanized accessories is obvious, but the 55% Al-Zn sheets are virtually like new, except for a cosmetic reduction of the surface shine through dirt accumulation and natural oxidation. There has been very little change since the 1994 survey: indeed, very little change since the roof was first built – despite the acid rain environment of Indianapolis.



ROOFS IN NORTH AMERICA: 2

Location:	Medina, Ohio, USA
Environment:	Urban, severe acid rain and dew
Slope:	1 degree
Age:	32 years

It's hard to believe, but this roof is sited in an area with severe acid rain. As can be seen from the 1994 and 2004 pictures, the roof also has to contend with heavy morning dews. Despite these problems, the 55% Al-Zn sheets continue to perform well. In 1999, our inspectors predicted another 10 years life; five years later, the prediction confidently stands at the same figure – giving a life of over 40 years with only routine minor maintenance.



Location:	Appleton, Wisconsin, USA
Environment:	Industrial (Paper Mill)
Slope:	1 degree
Age:	31 years

Nearby paper mills make this an aggressive environment, but despite being more than 30 years old, the 55% Al-Zn coating remains intact and continues to protect the roof sheets from corrosion. This roof looks set to last another 10 years without major maintenance.



Location: Appleton, Wisconsin, USA

Environment: Industrial

Slope: 1 degree

Age: 30 years

The main picture confirms the good condition of this roof, technically and aesthetically. Picture A demonstrates that the roof has to accommodate a number of ancillary structures, some showing advanced deterioration. Picture B shows that there is only minimal damage around fastenings and at the drip edge.



A



B



1999



2004

ROOFS IN NORTH AMERICA:3

Location: Indianapolis, Indiana, USA

Environment: Urban

Slope: 1 degree

Age: 30 years

Correct specification of fasteners is important to ensure maximum roof life.



Location: Appleton, Wisconsin, USA

Environment: Industrial

Slope: 5 degrees

Age: 30 years



Dirt has affected the cosmetic appearance of this roof after 30 years, but there is no damage to the coating which continues to perform well.

Location: Omaha, Nebraska, USA

Environment: Urban

Slope: 1 degree

Age: 29 years

No problems at the drip edge after nearly 30 years.





Location:	Indianapolis, Indiana, USA
Environment:	Urban
Slope:	1 degree
Age:	30 years



Again, the drip edge is clean and corrosion-free after 30 years' service. The 55% Al-Zn roof sheets continue to perform, although accessories in galvanized steel display significant red rust.



Location:	Fond du Lac, Wisconsin, USA
Environment:	Urban
Slope:	2 degrees
Age:	30 years

Cleaning has affected the appearance of the 55% Al-Zn sheets, but the drip edge and around the fastenings show no material damage after a life of 30 years.

Location:	New Orleans, Louisiana, USA
Environment:	Industrial
Slope:	1 degree
Age:	26 years

This roof has to cope with rainwater run-off from the extension on the right. Although the design is not ideal, the 55% Al-Zn coating is performing well.



55% Al-Zn COMPARED WITH HOT DIP GALV

Outperforms and outlasts ordinary g

Location: Vecoux, France

Environment: Rural

Slope: 20 degrees

Age: 17 years

The post-painted (field-painted) hot dip galvanized roof section is in poor condition, and even perforated at a few points. The 55% Al-Zn section, though dirty, is in good condition – apart from localized corrosion due to pollution from the roof stack.



Location: Appleton, Wisconsin, USA

Environment: Industrial

Slope: 1 degree

Age: 30 years

The galvanized hanger is at an advanced stage of rusting, but the 55% Al-Zn sheets are in excellent condition.

Location: Bremen, Germany

Environment: Urban

Slope: <5 degrees

Age: 23 years

The performance of 55% Al-Zn on this 23-year-old roof is in stark contrast with the deterioration of the hot dip galvanized steel roof vent.



ALVANIZED IN THE ROOF ENVIRONMENT

Galvanized steels, painted or unpainted.



Location: Cambridgeshire, UK (left) and Indiana, USA (right)

Environment: Industrial (UK) and industrial acid rain (USA)

Slope: <5 degrees (UK) and 2 degrees (USA)

Age: 22 years (UK) and 25 years (USA)

Terminal rusting is clear on the galvanized roof vents in both these applications, but the roofing sheets in 55% Al-Zn remain in excellent condition, despite harsh environments.



Location: Cumbria, UK

Environment: Rural

Slope: 22 degrees

Age: 18 years

The 18-year-old 55% Al-Zn roof contrasts with galvanized panels on the right, which had begun to show rust after only 6 years.



Location: Appleton, Wisconsin, USA

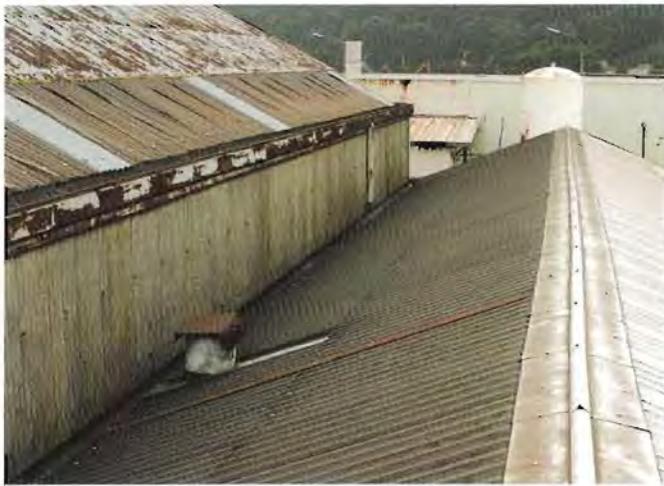
Environment: Industrial

Slope: 5 degrees

Age: 30 years

The picture clearly shows how the 55% Al-Zn coating sacrifices itself to protect the fasteners.

ROOFS IN EUROPE



Location: Flemalle, Belgium

Environment: Heavy industrial

Slope: 10 degrees

Age: 26 years

Installed in 1977, the 55% Al-Zn steel roof in the centre of the main picture is very dirty, but despite 26 years in a highly aggressive environment it is still in good condition. A section of the 55% Al-Zn roof abuts on to another profiled section in pre-painted hot dip galvanized steel, and is also bordered by unpainted hot-dip galvanized. If ever a picture were worth a thousand words, this is it: the superior performance of 55% Al-Zn is obvious. The drip edge of this roof shows how the 55% Al-Zn coating continues to restrict the spread of red rust.



Location: Rotterdam,
The Netherlands

Environment: Heavy industrial/
light marine

Slope: 7 degrees

Age: 18 years

Chemical operations immediately adjacent to a cement factory, and the sea a couple of miles away... a particularly punishing environment. Yet after 18 years the roof in 55% Al-Zn looks as good as new.





1990



2002

Location:	Cumbria, UK
Environment:	Rural
Slope:	Curved section
Age:	18 years

Not surprisingly, the rural environment of this UK factory has helped the 55% Al-Zn roof sheets to achieve outstanding performance. Even on a potentially troublesome curved section, 55% Al-Zn is still performing well – only a slight black staining has occurred since the picture on the left was taken in 1990. The picture on the right was taken 12 years later.

Location:	Chambéry, France
Environment:	Urban
Slope:	7 degrees
Age:	22 years

The mountains form a suitably rugged backdrop for this roof, still in excellent condition after 18 years – although a few seams showed some rusting caused by installation damage.



Location:	Falun, Sweden
Environment:	Urban
Slope:	<5 degrees
Age:	15 years

Despite ponding problems where the panels sagged between purlins, this low-slope roof is still in good condition, and predicted to give at least another 15 years' service.

KEY DESIGN AND INSTALLATION FACTORS

A superior long-life roof system requires not only the right sheet material, but also good design, installation and maintenance practices. Both the North American and the European roof surveys confirm the strong performance of bare, unpainted 55% Al-Zn sheets – but at the same time, they emphasise that maximising life depends upon “best practice” throughout the project.

For example, areas around various types of roof-mounted equipment and stacks are often dirty and rust-stained. Good maintenance and the use of corrosion-resistant materials to support roof-mounted equipment would minimise this.

Some of the installations surveyed revealed combinations of galvanized steel, 55% Al-Zn, aluminium, painted galvanized and lead being used for curbs, flashings and roof accessories. Designers and installers should be careful to select only those materials that are most compatible with the 55% Al-Zn coating, and should be discouraged from using shorter-life galvanized steel parts on a long-life 55% Al-Zn roof system. If corrosive vapour is being discharged from a roof stack, it may be necessary to post-apply protective coatings to the roof panels in the adjacent affected area.

Location: Omaha, Nebraska, USA

Environment: Urban

Slope: 1 degree

Age: 29 years

Ponding problem. Sagging of the panels has resulted in ponding, and the consequent rust stain is not only unsightly but can lead to premature corrosion if the ponding issue is not addressed.



Location: Falun, Sweden

Environment: Urban

Slope: 14 degrees

Age: 18 years

Careless routine maintenance. Here a storm filter was plugged by debris, due to lack of regular maintenance. Ponding resulted, and corrosive agents released by the bitumen used to seal roof laps had caused red rust. A neutral cure sealant should have been used.



Location: Falun, Sweden

Environment: Urban

Slope: 6 degrees

Age: 15 years

Poor installation practice. Iron debris left on the roof has rusted and stained the roof, although both fastener and sheet are in good condition. Good installation practice and post-installation clean-up would have avoided this. Although there is no accelerated corrosion in this case, the rust stain creates an undesirable cosmetic appearance.



Location: Münster, Germany

Environment: Urban

Slope: <5 degrees

Age: 21 years



Poor installation and maintenance practice. How not to do it. The left hand picture shows how the careless use of asphalt as a patch has accelerated corrosion near the drip edge. In the right hand picture, a spare piece of metal flashing was left lying on the surface of the roof, trapping moisture and debris and leading to accelerated corrosion.



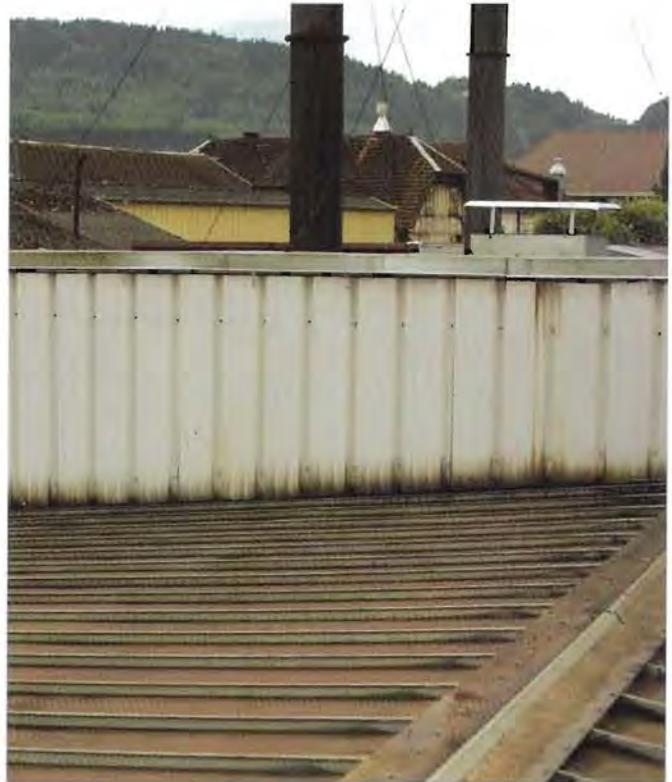
Location: Tyresö, Sweden

Environment: Urban/light marine

Slope: 5 degrees

Age: 20 years

Poor material choice for adjacent chimneys. In the left hand picture, the use of weathering steel for the chimney in the background has caused minor pitting corrosion to the 55% Al-Zn roof after 20 years; copper ions from the chimney material, swept down by rain, will continue to attack and damage the roof. On the right, the weathering steel chimneys have caused some corrosion, but there is so far no perforation of the coating. These problems could have been avoided if the recommended design parameters had been observed.



Location: Le Thillot, France

Environment: Urban

Slope: 10 degrees

Age: 10 years

55% Al-Zn THE MAGIC FORMULA FOR ROOFS

The field inspection surveys covered in this paper were carried out in 2002 and 2003 (Europe) and 2004 (North America). Both surveys predict a life expectancy of 40+ years for roofs in 55% Al-Zn metallic coated steel. This steel is marketed in North America and Europe mainly under the brand names Galvalume®, Aluzinc®, Zinalume®, Zintro-Alum®, and Galval®.

- The inspections were made by experienced engineers from BIEC International Inc, the worldwide licensor of the 55% Al-Zn coated steel technology, and from manufacturing licensees in North America and Europe.
- The roofs inspected used 55% Al-Zn steel with a nominal coating thickness of 20-25 μm and a nominal coating weight of 150 g/m².
- The inspectors noted age, location, slope and overall appearance of each roof, along with a general assessment of the environmental conditions. The assistance and support of the Butler Manufacturing Co. is acknowledged.
- The relative performance of other materials used in such rooftop equipment and fittings as roof stacks, fasteners and gutter hangers was also recorded.
- Where necessary, mild abrasive pads were used to remove dirt and stains, so that the extent of corrosion could be accurately assessed. Different levels of surface contamination and oxidation meant that some of the roofs inspected were dirtier and not as bright as others.
- The results and predictions described in this paper are the educated opinions of professionals with extensive experience in evaluating material performance. The results and predictions are neither guaranteed nor warranted.



55% Al-Zn Coated Sheet Producers of North America and Europe

For more information and details of manufacturers and sales agencies, visit www.steelroofing.com or www.roofsteel.com

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