TECHNICAL BULLETIN

CORROSION RESISTANCE TESTING ON HOG FLOORING: J&L vs. the Competition

There are numerous manufacturers today providing hog flooring for agricultural applications. Each manufacturer offers its own design, making claims to the benefits and advantages of using their product over the competition's. J&L is proud to be a manufacturer of quality designs and products and continually explores new ways to improve upon existing products, and/or create new products for the marketplace. It is for this reason that it was decided to go forward with a test program to compare the corrosion resistance on the competition's offering with J&L's. It was agreed that through controlled environmental testing, J&L would be able to determine their place in the hog flooring market, and if weaknesses were found, make improvements to the existing product.

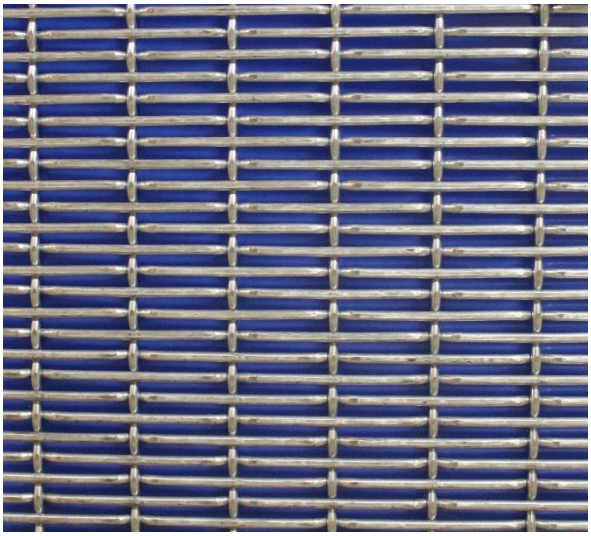
SALT-SPRAY EXPOSURE TEST – ASTM B117 Salt Spray (Fog) Exposure

Testing consisted of exposing three different flooring types to salt-spray. The salt-spray test is an aggressive environmental test that accelerates a corrosive attack to the test samples. Typically, testing is conducted to compare similar products to determine effectiveness of protective coatings against this corrosive environment and to determine suitability for their intended end use. This test method is often used by the military to provide comparative results on various parts and equipment subjected to atmospheric corrosion for evaluation purposes. Visual inspection during and following testing provides the necessary information to help determine the suitability of the material for the given application. Typically, the longer the test piece holds up under test before revealing signs of corrosion (formation of iron oxides, commonly referred to as red rust), the better and longer it will function.

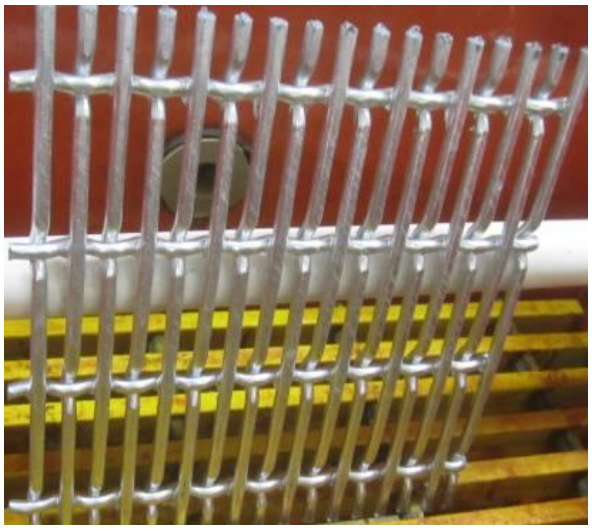
Three common configurations were provided to an independent test lab. From the three basic configurations, four flooring panels were to be evaluated. These panels consisted of the following:

One (1) Zinc-coated woven wire sample - J&L – Boss Hog™ (our original standard floor)
One (1) Zinc-coated woven wire sample - J&L – Boss Hog Extra™ (new and improved version of Boss Hog™)
One (1) Cast Iron floor sample - Competitor #1 - no coating applied to metal surface
One (1) Galvanized triangular bar floor sample - Competitor #2 - (zinc-coated floor panel)

The following photographs were taken prior to samples being subjected to testing.

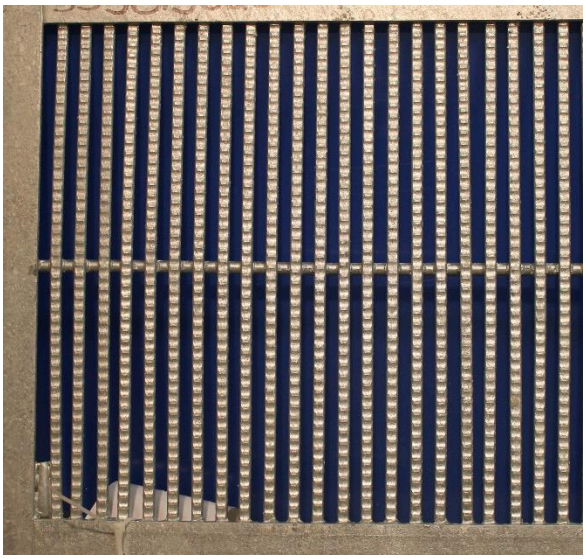


J&L BOSS HOG™
Standard Floor Panel



J&L BOSS HOG EXTRA™
Improved Floor Panel

COMPETITOR #1
Cast Iron Floor Panel



COMPETITOR #2
Triangular Bar Floor Panel

Samples submitted for testing were virgin pieces as either manufactured (from J&L), or as received from a supplier. There were no visible signs of corrosion on any of the pieces prior to placement in the salt-spray chamber. Pictures were taken at scheduled intervals throughout the remaining length of testing to help document the procedure and to provide visual evidence on the effect the environment had on the panels.

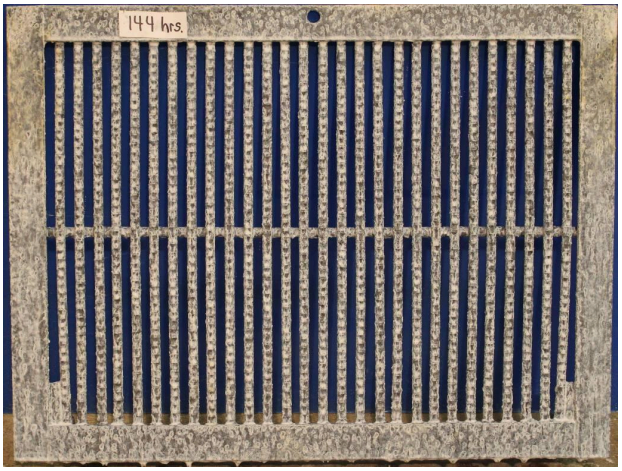
The photographs that follow are presented to show the deterioration of panels by corrosion. It should be noted that the harsh environment of salt spray exposure accelerates the corrosion process, and its purpose is to provide a side by side comparison of the parts under test. Testing is not designed to offer actual product life data. Pictures were periodically taken on each panel throughout testing to show the effect of exposure. It was decided to conclude the test, based on results, after 768 hours of exposure.

For the purpose of this discussion, corrosion begins when red rust begins to form on the surface. Red rust, or iron oxide (Fe_2O_3) occurs when iron or an alloy that contains iron, like steel, is exposed to oxygen and moisture for long periods of time. It is this oxidation that is corrosive to metal causing it to prematurely weaken, break down, and eventually fail. Galvanized coatings help to protect steel from the environment by forming an integral zinc-alloy bond between the base steel and outer zinc layer, but they too in time corrode to form a zinc oxide barrier. The oxide that forms during this process is referred to as white rust. The powdery coating formed creates a protective barrier thereby hindering the corrosive deterioration of the base metal. Naturally, as time progresses and the protective zinc coating continues to break down, the base metal will become exposed and begin the corrosion process. You will see from the pictures, that the galvanized panels will be covered in this white oxide (white rust). Again, white rust acts as a protection to the underlying metal impeding the formation of red rust.

COMPETITOR #1
Cast Iron Floor Panel
After 6 hours

COMPETITOR #1
Cast Iron Floor Panel
After 48 hours

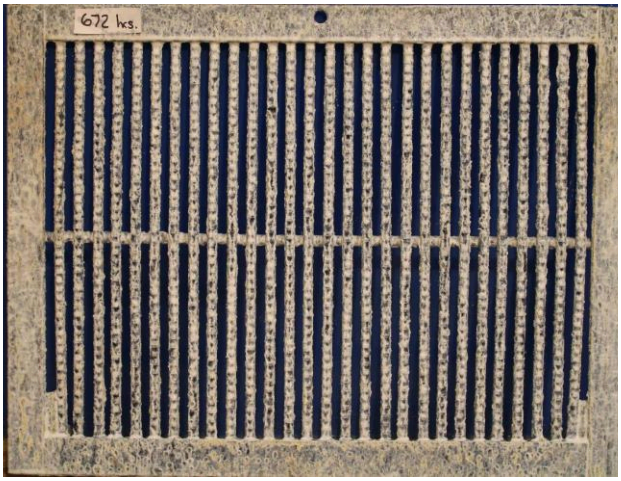
As expected, due to the lack of a protective coating, red rust immediately began to form after exposure to salt-spray. After only 48 hours, extensive deterioration of the steel was evident. It was decided to continue with testing to observe the corrosive effect and for comparison to the other samples.



COMPETITOR #2
Triangular Floor Panel
After 144 hours

COMPETITOR #2
Triangular Floor Panel
After 144 hours
(Enlarged to show beginning yellowing)

The photographs above reveal the surface condition of the triangular bar floor panel after 144 hours of exposure. As can be seen, the panels are holding up well to the corrosive environment revealing only slight signs of deterioration. The photograph to the right was enlarged to point out the slight yellowing in the upper left corner of the panel, and to show the deterioration of the coating along the outer portions of the ridges found along the surface, but no visible signs of red rust are evident.



COMPETITOR #2
Triangular Floor Panel
After 672 hours

COMPETITOR #2
Triangular Floor Panel
After 672 hours
(Enlarged to show formation of red rust)

As seen from the photographs taken after 672 hours of salt-spray exposure, the triangular bar panels reveal the beginning of red rust. As with the other panels tested, in time the deterioration process would continue causing metal fatigue and eventual failure. Worth noting, our primary point of focus was on the outer-flat portions of the panel, which held up well during testing as seen in the photographs. Of interest, was the apparent loss of protection on the edges of the ridges found on the cross bars during the early part of testing. On these edges, the protective coating does not appear to be as effective.

J&L
Standard Floor Panel
After 48 hours

J&L
Standard Floor Panel
After 48 hours
(Enlarged to Show Deterioration of Coating)

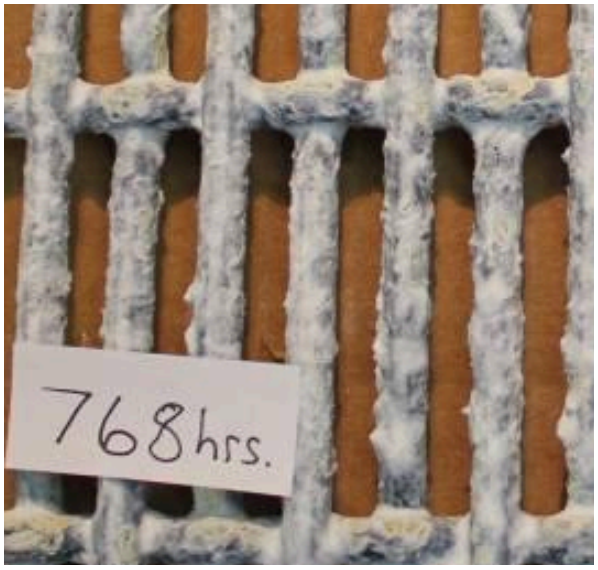
Testing after 48 hours on the J&L panel revealed the beginning of red rust due to the deterioration of the zinc coating. The oxidation of the zinc coating is still protecting portions of the panels, but not to the extent to prevent rest rust from forming. Although better than the cast pieces from Competitor #1 (covered with a fine coating of red rust), it was falling short with Competitor's #2 panel. Early testing confirmed that our standard floor needed to be better. Coupled with past history and comments from our customers, J&L had invested resources to research alternative methods that would improve our coating process. The result was an improved (upgraded) version of our standard floor that was added for testing.

J&L BOSS HOG EXTRA™
Improved Floor Panel
After 552 hours

J&L BOSS HOG EXTRA™
Improved Floor Panel
After 552 hours
(Enlarged to show protective coating)

The photograph taken on J&L's Boss Hog Extra™ improved floor panel after 552 hours was to show how the protective zinc coats the metal to protect the base metal from oxidation. In the enlarged photograph, you can see the powdery coating formed from the oxidation of the zinc. This powdery coating that forms over the steel wire is protecting it from the deteriorating effect of red rust corrosion (iron oxide – Fe_2O_3). After 552 hours of salt-spray exposure, the panel is holding up well with only minimal signs of the corrosion process.

J&L BOSS HOG EXTRA™
Improved Floor Panel
After 768 hours



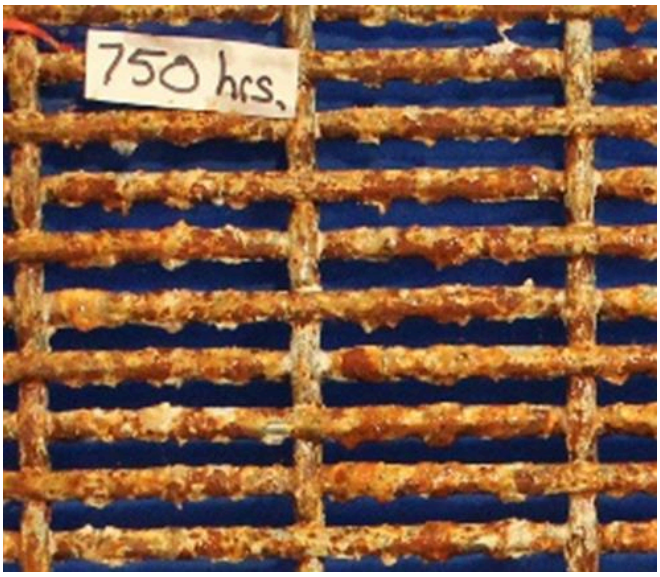
J&L BOSS HOG EXTRA™
Improved Floor Panel
After 768 hours
(Enlarged to show protective coating)

The photograph taken at 768 hours was at the completion of testing. As can be seen from the photograph, the panel is intact with minimal signs of corrosion. Viewing the enlarged photograph, again you can see the protection afforded to the steel wire from the zinc oxide that has formed. Again, only minimal signs of the corrosion process are present.

End of Test Photographs:

COMPETITOR #1
750 Hours Exposure
Extreme Corrosion of Base Metal

COMPETITOR #2
750 Hours Exposure
Some Corrosion (red rust)
Powdery Oxide Seen from Protective Coating



J&L STANDARD FLOOR
750 Hours Exposure
Extensive Corrosion (red rust)

J&L IMPROVED FLOOR PANEL
(BOSS HOG EXTRA™)
768 Hours Exposure
Signs of Yellowing
Powdery Oxide Seen from Protective Coating

Test Results:

Competitor #1

- Corrosion to base metal began as soon as exposure to salt-spray commenced
- After 6 hours, showing signs of corrosion
- After 48 hours, entire surface was coated with red rust
- After 750 hours, metal floor exhibited extreme corrosion

Competitor #2

- Observed early in testing that protective coating on the ridges found along the bars was deteriorating
- Corrosion to base metal (flat portions of panel) was not evident until late in testing
- After 144 hours, only slight corrosion evident by beginning signs of yellowing
- After 672 hours, some red rust was observed on the panel
- After 750 hours, panel is similar to earlier photograph taken at 672 hours with some signs of corrosion

J&L Wire

Standard Flooring

- After 48 hours, panel began showing signs of red rust.
- After 750 hours, panel revealed extensive red rust with little protection remaining

Boss Hog Extra™ Improved Flooring

- After 552 hours, the improved (Boss Hog Extra™) panel revealed only slight signs of yellowing
- After 768 hours, the improved floor panel remained intact with signs of yellowing, but no rest rust
- Boss Hog Extra™ withstood the aggressive effects of the test environment over 15 times longer than the original J&L floor

SUMMARY

As noted earlier, it was the intent of J&L to evaluate our competitor's product with our own, and to make any necessary changes if required to improve product life. Testing confirmed that our standard product was better than competitor #1, lacking any red rust in the early stages of testing, but did not hold up as well when compared with Competitor #2. An improved version of Boss Hog™ was then added to the testing. This new and improved version, Boss Hog Extra™, was our opportunity to provide the market with a longer-lasting floor, and to demonstrate J&L's commitment to quality and their customers.

Testing confirmed that our new and improved version of Boss Hog™ was successful against the corrosive effects of salt spray exposure. When compared with the other samples, Boss Hog Extra™ outperformed Competitor #1, and our "older" standard Boss Hog™ floor, providing the necessary corrosion protection to promote extended service life. Comparable with Competitor #2 in corrosion resistance, our new coating technique provides for a more uniform and controlled coating thickness, something that appears to be lacking along the ridges on Competitor's #2 product as can be seen from the photographs.

The testing discussed above was performed by an independent lab and is just one of many environmental tests used today to help determine a products resistance to corrosion. Salt Spray Exposure testing creates an aggressive and harsh environment that has been widely used by the military and other manufacturers. It is considered one of the best test methods for determining a products resistance to environmental conditions.

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