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## Advisory Note

### Wet Storage Stain White Rust

GEN/5/1

June 2001

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The rapid corrosion of zinc surfaces under certain adverse conditions, generally referred to as wet storage stain and sometimes as "white rust", is a problem familiar to all galvanizers and many users.

Wet storage stain is the voluminous white or grey deposit formed by accelerated corrosion of the zinc coating when closely-packed, newly-galvanized articles are stored or shipped under damp and/or poorly ventilated conditions.

It is most often found on stacked and bundled items such as galvanized sheets, plates, angles, bars and pipe. Weathered zinc surfaces which already have formed their normal protective layer of corrosion products are seldom attacked.

In some instances climatic conditions can also cause wet storage staining to occur on freshly galvanized surfaces which have not been quenched in water ie. in autumn with condensation forming on cold nights followed by hot days.

Wet storage results from the exposure conditions and is not indicative of inferior galvanizing quality.

The bulky white grey corrosion product associated with wet storage stain should not be confused with the protective layer of zinc corrosion products which can have a similar colour which form under normal atmospheric exposure.

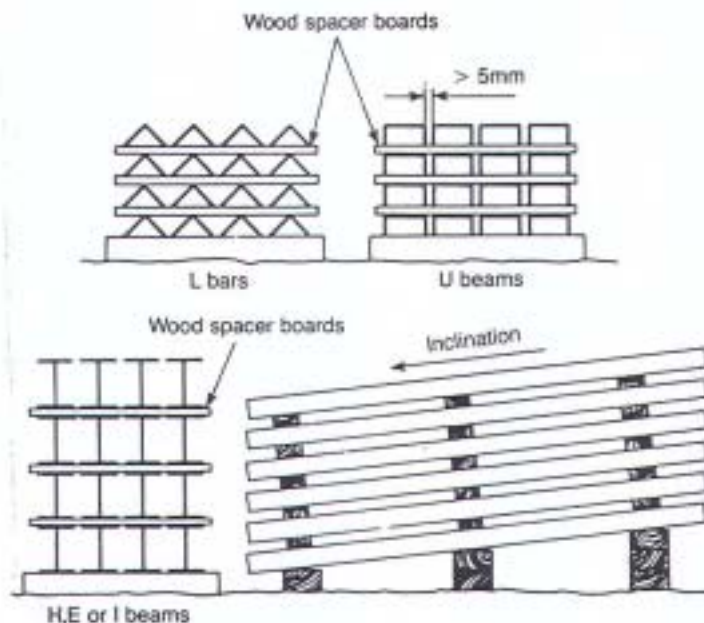
When wet storage staining is found on galvanized materials, it is not usually sufficient to be detrimental to coating protection. Normally it disappears with weathering. However, with inadequate transportation, poor handling, and storage methods, it can become serious.

When wet storage staining has occurred, the objects should be arranged to permit their surfaces to dry rapidly. The attack will then cease and, with a free supply of air to the surfaces, the normal protective layer of corrosion products will form. The white corrosion products are generally washed off and the surface of the coating takes on the normal appearance of a hot dip galvanized exposed object. However, attention must be given to the dark grey to black spots or areas if corrosion attack has already gone too far and the local thickness in these areas may no longer meet the minimum coating mass requirements of AS/NZ 4680. 1999.

As the corrosion products are very voluminous, occupying a space about a hundred times or more greater than the zinc that has corroded, even slight attack will be prominent and may appear to be serious. Usually, however, such wet-storage stain attack is of little or no importance to the durability of the galvanized coating.

Wet-storage stain is best avoided by preventing new zinc surfaces from coming into contact with rain or condensate water during storage and transportation. Materials stored outdoors should be arranged in such a manner that water can easily run off the surfaces and that all surfaces are well ventilated as shown below.

Non-staining timber should be used for wooden spacers.



Short-term protection against wet-storage staining is obtained by chromating or phosphating.

Heavy build-ups of white corrosion products can be partially removed by brushing with a stiff-bristle brush. They can be removed completely by washing with 10% acetic acid, which must be followed by very thorough rinsing with water. The original bright, metallic lustrous surface cannot be restored by these treatments.

#### References

- Wet Storage Stain - American Hot Dip Galvanizers Association.
- Zinc, Handbook - ILZRO
- Corrosion Resistance of Zinc and Zinc Alloys - ILZRO

#### Assessment of White Rust Removal Methods

Test Solution	Comments on Coating Appearance
50g/L Sodium Dichromate + 0.1% Sulphuric Acid	Not very effective - the white rust remaining was stained yellow.
420g/L Chromium Trioxide + 0.5% Nitric Acid	Effective - white rust removed leaving bright, shiny coating with black spots.
262g/L Sodium Hydroxide + Talc	Effective - white rust removed leaving a dark but shiny coating with black spots. Some etching which revealed spangles in the coating.
200g/L Chromic Acid	Very effective - white rust removed leaving a bright, shiny coating.

#### Assessment of Passivation Performance Following Outdoor Exposure

Test Solution	Comments on Coating Appearance
50g/L Sodium Dichromate + 0.1% Sulphuric Acid	Virtually unchanged - white rust still remains, yellow staining gone.
420g/L Chromium Trioxide + 0.5% Nitric Acid	Excellent white rust resistance - no white rust, coating slightly dull.
262g/L Sodium Hydroxide + Talc	Poor white rust resistance - white rust evident, coating slightly dull.
200g/L Chromic Acid	Good white rust resistance - isolated spots of white rust present, coating dull.