Wet Stack Corrosion

A Technical Explanation of the Phenomenon

Wet Stack Corrosion

- ***What is wet stack corrosion?***
- ***What causes wet stack corrosion?***
- ***What are the remedies for wet stack corrosion?***

Wet Stack Corrosion

What is wet stack corrosion?

Under-film corrosion of prepainted products characterized by:

- ***bottom side and top side panel corrosion initiated beneath the paint film at the substrate surface***

- ***more severe corrosion on panel ribs and embossments as compared with flat-panel sections***

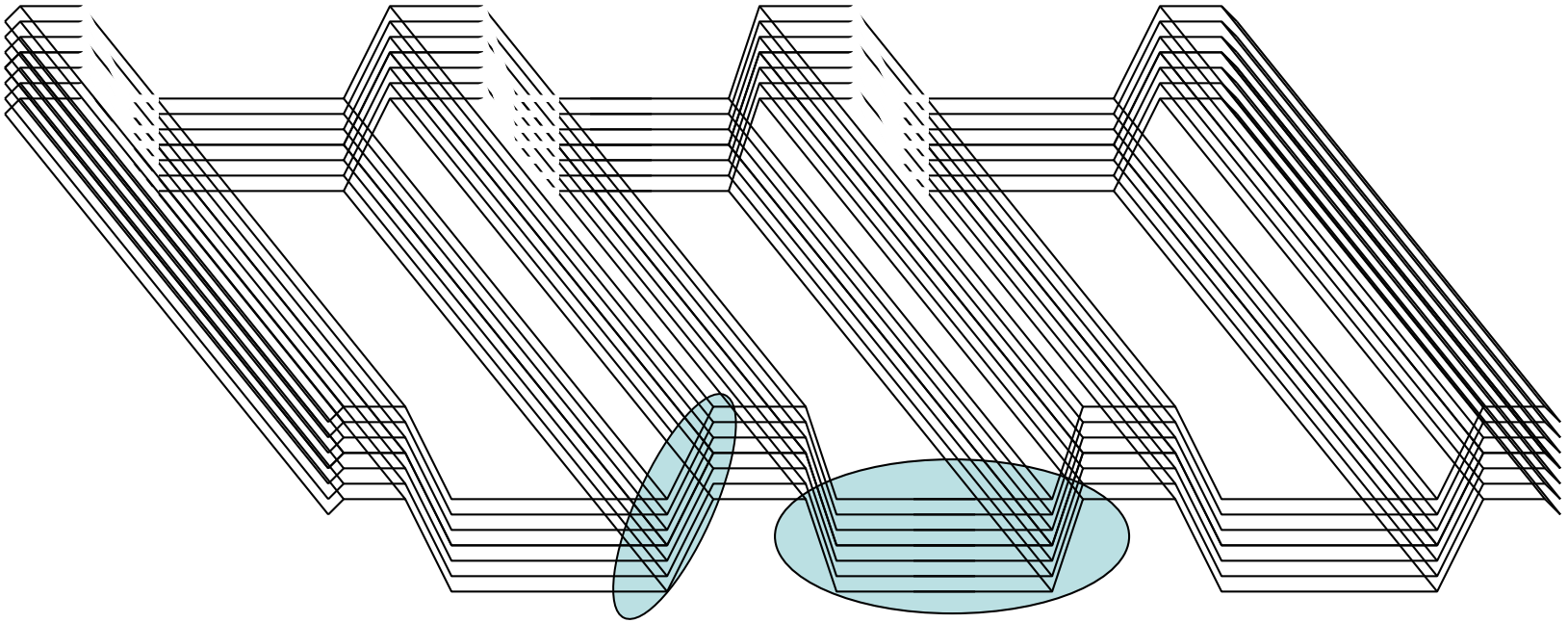
- ***no specific pattern of corrosion as related to the panel orientation to the flat stock***

What causes wet stack corrosion?

Consider a typical bundle of panels stored at a job site

General Observations

- **Panel ends and sides open to the atmosphere**
- **Stacking is not perfect leading to offset panel ends**
- **Panel to Panel contact is greater in rib areas as compared with flat areas**
- **Panel to Panel gap is smaller in rib areas than in flat areas**



Rib slopes and radii have more intimate contact than flat portions of panel

What causes wet stack corrosion?

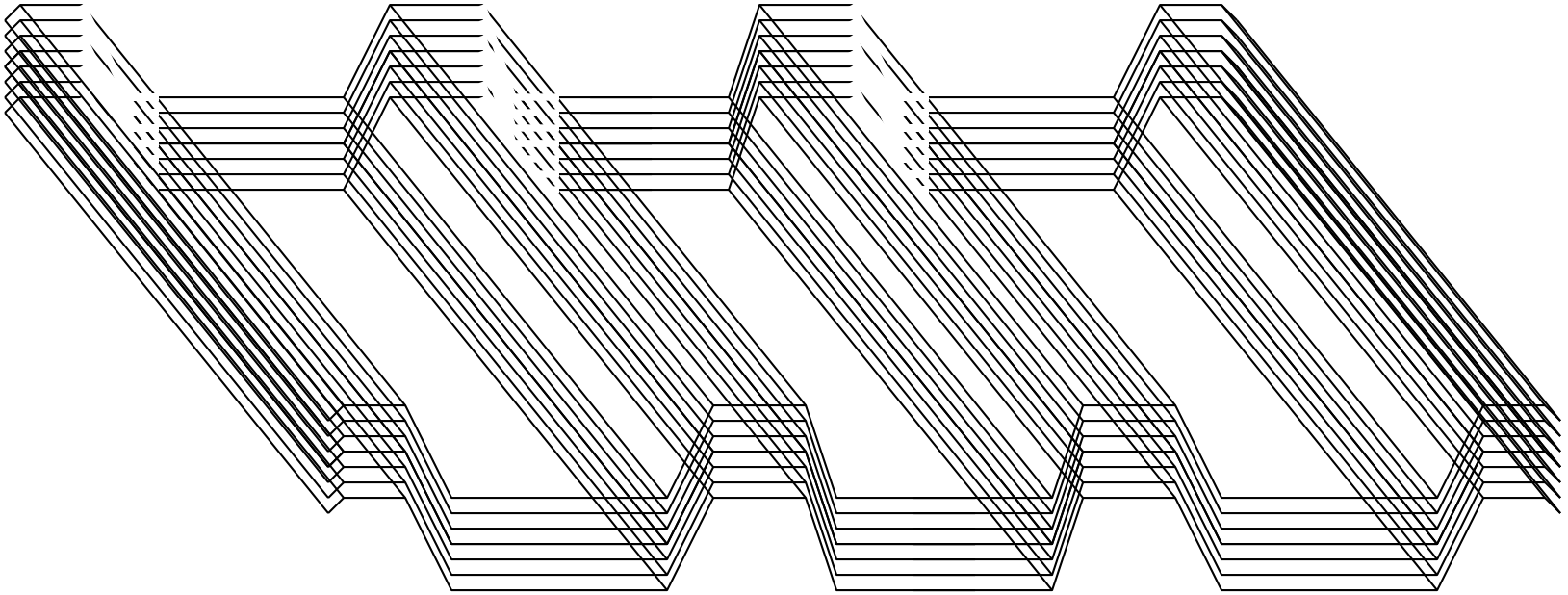
Two sources of water

- Condensation from inter-panel atmosphere
- 'Wicking' of water from wet panel ends

What causes wet stack corrosion?

Condensation of Water from Inter-Panel Atmosphere

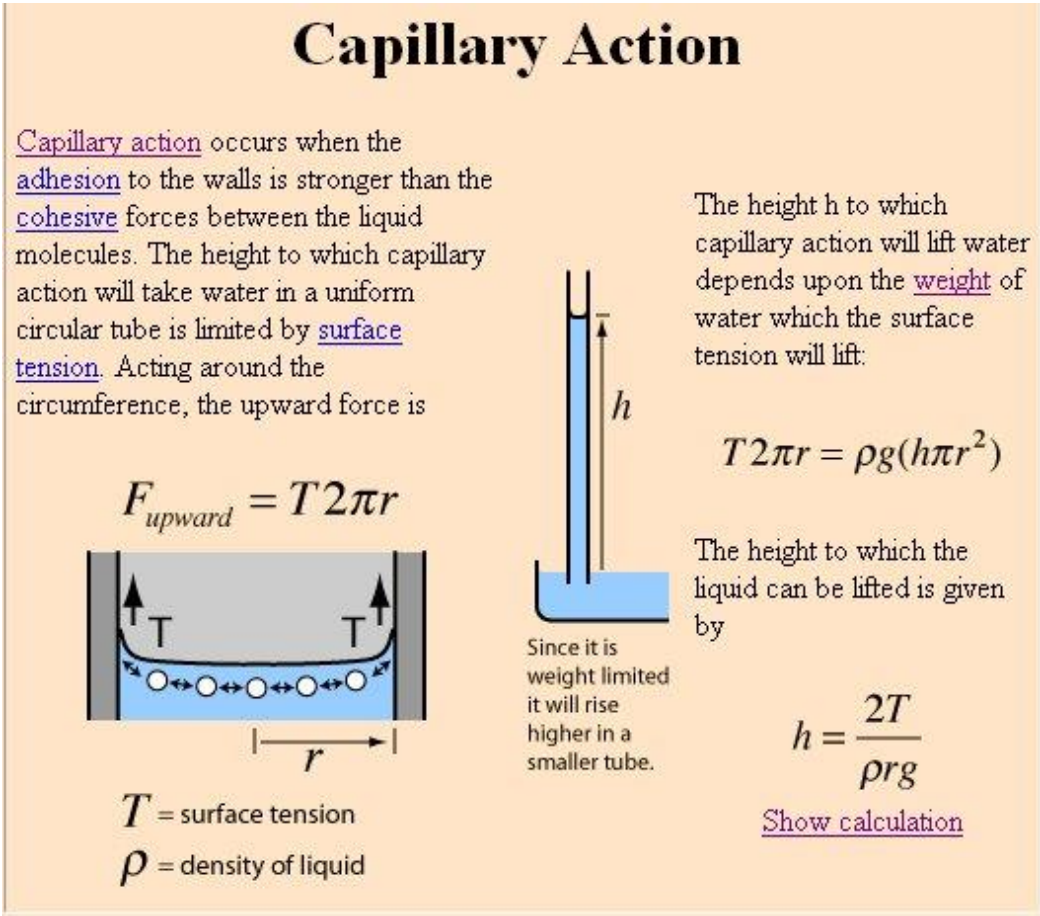
- **During the normal heating – cooling cycle of a day, if the temperature of the inter-panel atmosphere drops below the dew point, water will condense on to the inter-panel surfaces**



What causes wet stack corrosion?

'Wicking' of Water into Panel Bundles

- Occurs when panel edges become wet by dew or rain
- The mechanism for water ingress is 'Capillary Action'



Capillary Movement Calculations

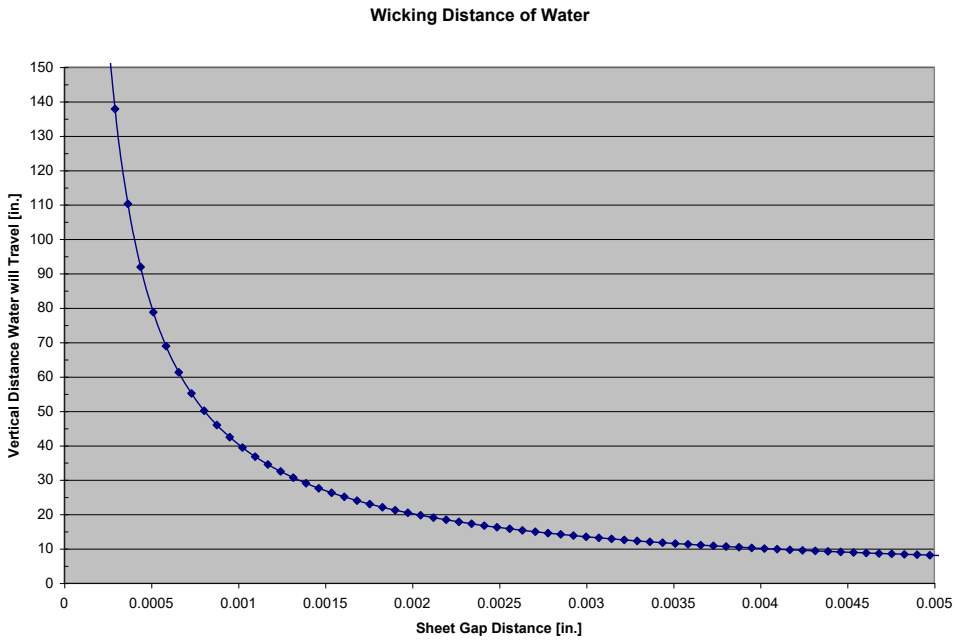
$h = 2T^*\cos(\theta)/(\rho g r)$

Where: T = surface tension, θ = contact angle of the liquid
ρ = liquid density, g = acceleration of gravity
r = ½ the gap distance

Substituting terms for water at sea level we see:

$h = (1.4 \times 10^{-5})/r$

As r decreases water will migrate longer distances.



Capillary Movement of Water

- **The distance that water will ingress is directly proportional to (1/inter-panel distance)**

- **The tighter the stacking, at places where panel contact is not flush, the greater the length of water travel**

- **Not only will water which ingresses from outside the bundle migrate to areas of tight panel stacking, but also water present in the bundle inter-laps from condensation will also migrate to the areas where the inter-lap distance is less because of the identical capillary effect.**

Why does corrosion occur if the material is properly painted?

- No paint system is totally impervious to water penetration
- Paint systems are water resistant but, on a microscopic scale, water moves into and out of the paint film
- In normal atmospheres where water can drain and evaporate the amount of water ingress into the paint system is very small
- In a panel stack, there is less opportunity for water evaporation and wetness time increases significantly as compared with panels normally exposed to the atmosphere
- In a panel stack, the panel edges experience more atmospheric interaction allowing latent water to evaporate to a greater degree thereby decreasing the tendency for wet stack corrosion on panel edges.

Prevention of Wet Stack Corrosion

- **Proper job site storage**
  - **Bundles should be covered with a water proof tarpaulin or canvas and the bundle bottom should be open to allow for air movement**
  - **Bundles should be stored off of the ground and sloped to allow the runoff of any water that penetrates the tarpaulin**
  - **Bundles should be inspected frequently to ensure that moisture has not penetrated the bundles.**
  - **Bundles should also be protected from any chemical exposure.**
  - **If possible the best storage would be covered storage.**