PAB05

LYSAGHT PRODUCT ADVISORY BULLETIN

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OIL CANNING

WHAT IS OIL CANNING?

Oil Canning can be defined as a perceived waviness in the flat areas of metal roofing and metal cladding panels. Generally the period and amplitude of the wave depend on the continuous width of the flat section of the profile. Oil canning is an inherent part of light gauge cold formed metal products, particularly those with broad flat areas.

Profiles having wide flat surfaces are often referred to as "architectural" roofing and cladding panels. Such panels are distinguished from corrugated shapes as the latter are more fluted in design, have much narrower flats, and are less like to exhibit oil canning.

Oil canning can be more apparent during certain times of day and in certain seasons based upon the angle at which sunlight hits the roof or wall, and based upon the temperature differential.

WHAT CAUSES OIL CANNING?

There are numerous causes of oil canning.

1. METAL COIL PRODUCTION

Residual stresses induced during coil production can contribute to oil canning. Examples of these types of features are:

- **Full centre:** the coil is longer in the middle of the strip which creates ripples or buckles near the mid-coil area. This is the most common example.
- **Wavy edge:** the coil is longer along the edge of the strip.
- **Camber:** the deviation of a side edge from a straight line.

These conditions exist to some extent in all light flat rolled metal and tend to become more exaggerated as the strength level of the sheet product increases and also for thinner and wider sheet products. When excessive, each circumstance can cause oil canning after roll forming.

2. PANEL FABRICATION

- **Slitting:** The slitting of a master coil can release and redistribute residual forces. The coil's response can create or increase oil canning. The economics of producing wider coils makes slitting almost mandatory.
- **Forming:** New residual stresses can be created during some forming operations. Architectural panel profiles typically require more forming along the edges than in the middle of the sheet. They often require more forming along one side than the other. This requires that forming begins along the sides. The sequential "working" of the sheet will have a tendency to "trap" uneven metal contained within the central areas. For example, corrugated ribbed profiles are most often roll-formed from the centre and moving outward, thereby "pushing" the uneven metal to the edges.

3. PANEL INSTALLATION

- **Misalignment of the Support System:** Structural supports that are produced, fabricated, and installed within allowable tolerances can create a "non-planar" or contoured bearing surface. Stresses induced while panels conform to this surface can contribute to oil canning.
- **Over Engagement of Panels:** Most panels accommodate transverse thermal expansion by flexing of webs and by "take up" at side joints. When panels are over engaged, these relief features are hindered or eliminated. In the extreme case, the over engagement process itself can generate waviness. Either cause can contribute to oil canning.
- **Over Driving of Fasteners:** This operation creates stresses in the panel and provides a "reading line" along the fastener alignment.
- **Longitudinal Expansion:** The surface temperature of exposed panels cycles throughout the year and even fluctuates daily. The temperature and the cycle depend on many variables (e.g., project location and building orientation, cloud cover, panel configuration, surface finish or colour, system thermal insulation characteristics). Under temperature fluctuation, the panels expand or contract. If panels are restrained by fasteners, clips or perimeter details, they accommodate thermal forces through several mechanisms. These include "slotting" around fasteners, out-of-plane "bowing", and local distortion of flat areas. The magnitude of thermal force depends on the restraint provided, on the base materials' physical properties and on the temperature differential between the support structure and external skin. Waviness can be amplified when there is uneven fastener restraint along the panel. Such restraint is common on "concealed fastener" systems having fasteners along one edge and an interlock along the other. Waviness caused by thermal forces differs from the other forms of oil canning in that waves can appear and disappear daily as the sun moves across the sky.
- **Movement of the Primary Structure:** Excessive differential deflection, racking, drift, or settlement within the primary structure can cause noticeable waviness within panel flats. This distortion can be temporary or sustained.
- **Handling:** Carrying panels in the flat orientation or twisting panels can induce a wavy appearance to a previously flat panel. Twisting can occur if one corner of a panel is used to lift a panel or to remove the panel from a bundle.
- **Orientation:** The orientation of the surface to direct sunlight can potentially cause oil canning.

HOW CAN OIL CANNING BE CONTROLLED?

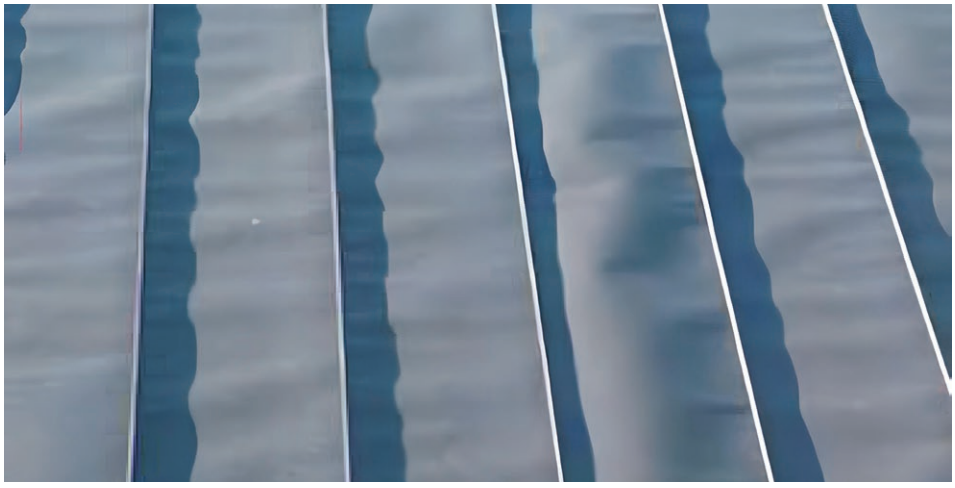
Coil producers and panel manufacturers attempt to minimise these conditions and produce quality products. Research continues on improved production methods. Regardless, all of the above factors contribute to oil canning in architectural roofing or walling products. While a number of factors are a function of the panel design, there are steps that the designer, panel manufacturer, and erector can take to reduce the chances of oil canning.

1. **Design:** The use of fasteners and clips that allow panels to float without causing thermal stresses is a means of controlling oil canning on roof panels. The addition of stiffening ribs in the panel profile "break-up" the flat surface and make oil canning less apparent. An embossed surface or a surface painted with a low gloss paint system will also help reduce visible surface waviness in the metal. Due to the different thermal properties of each section, wider flat pans with large ribs will oil can more than other profiles.
2. **Installation:** Particular attention must be paid to installation practices to avoid any misalignment or over-engagement of panels, overtightening of fasteners and ensure adequate allowance is made for thermal or structural movement. Additionally installation of a 10mm thermal break tape between the cladding and the supporting structure can provide a buffer against both thermal movement and potential thermally induced oil canning as well as over tightening of fasteners.
3. **Handling:** Proper handling is one of the most critical considerations and should be addressed in production, transportation and installation activities.

CONCLUSION

Oil canning is an aesthetic issue. Normally, structural integrity is not affected; however, it must be reviewed if the distortion is extreme. Such distortion might indicate movement within the primary structure or distressed connections within the panel system. Since many uncontrollable factors are involved, no manufacturer can realistically assure the total elimination of oil canning. With careful attention to the production and selection of material, to the panel design, and to installation practice, oil canning can be effectively minimised.

Unless specific tolerances have been incorporated into the contract documents and accepted by the panel provider and panel manufacturer, and if reasonable precautions have been taken, oil canning is not grounds for panel rejection.



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2. US Steel Sheet & Strip Handbook. July 1983.

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