

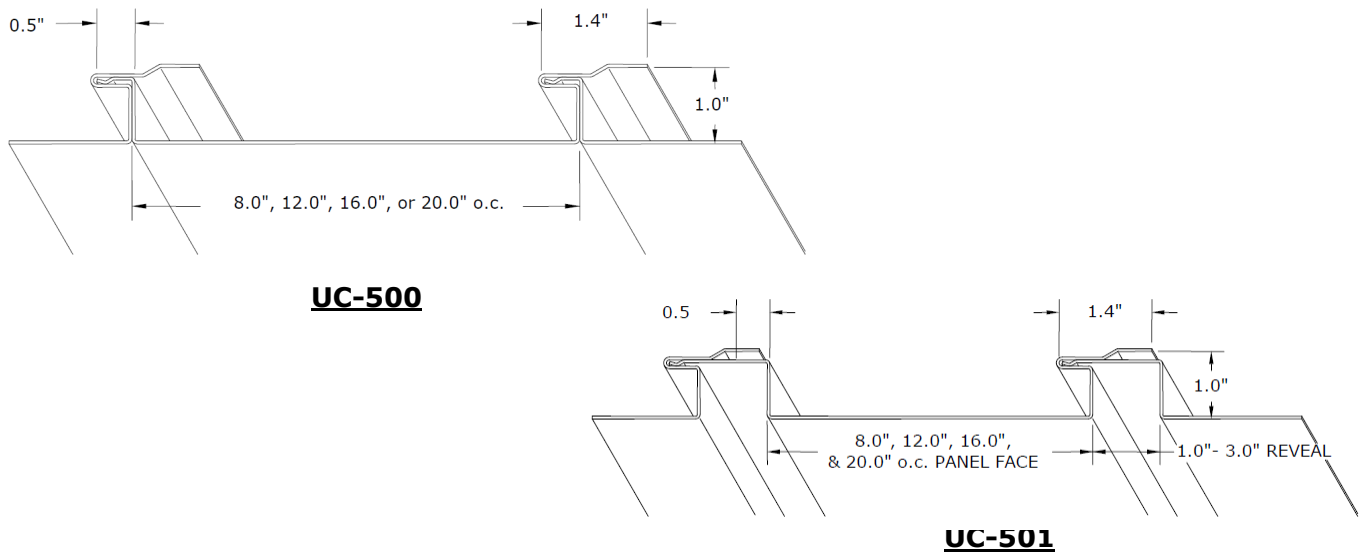


Wall Panel Design Considerations

UC-500 and UC-501 Panel Systems

Design Considerations for Specified Vertical Concealed Fastener Wall Panels

Recent construction trends have shown an increased popularity in the use of concealed fastener wall panel systems. Due to this increased popularity, both the UC-500 and UC-501 have been used more frequently as an option when vertical concealed fastener wall panels are specified. As both the UC-500 and UC-501 panel systems were originally designed for use as linear soffit panel systems; complications can and do arise in the application of these panels on a vertical wall surface. The appropriate time to address the panel characteristics, aesthetic expectations, design considerations, application and installation tolerances is prior to bidding the project.



Panel Characteristics

The UC-500 and UC-501 are single skin flush wall panel systems that attach to a wall in a sequential method via interlocking panel joinery. Panels are fabricated from light gauge materials. Panels are available in a variety of finish and material options. A variety of embossing, stiffening rib and vent pattern options are available. Panel widths available are 8", 12", 16" or 20" and the panel system is 1" in depth.

Generally speaking these single skin panel systems are less expensive than many other wall panel systems available on the market. Performance and aesthetic appeal are sacrificed with a smooth single skin product. Alternative panel systems should be used if this is a concern.

As an example, a panel that is 20" wide and 30 feet long fabricated from 24 gauge material will not perform or look as good as one that is 8" wide and 30 feet long fabricated from 22 gauge material. Please read and understand the design expectations, material considerations and installation tolerances listed below before promoting the use of UC-500 and UC-501 panels on a project.



Aesthetic Expectations and Design Considerations

The UC-500 or UC-501 system should not be used if the desired expectation is for a flat and uniform concealed fastener panel application.

- UC-500 or UC-501 panels are prone to an oil canning appearance (refer to the "installation" and "oil canning" section of this document for additional information).
- Inconsistencies in the wall framing can telegraph through to the panel face.
- Due to the inherent design characteristics of single skin concealed fastener flush panels, they should not be used when a high performance application is desired.
- Large panel deflection can be expected.
- Project specific structural calculations are needed to verify fastener application, wind pressure compliance, framing requirements are recommended.
 - The use of stitch fasteners in the lap joint is normally required to meet project specific wind pressures.
 - Panels installed with out engineering verification are likely to unzip (disengage) at low wind pressures.
 - Depending upon project wind loads; UC-501 panels may require an exposed fastener in the reveal joint.
- Panel system should not be deemed water tight; use of properly installed weather resistant membrane is required.

- Firestone Metal Products recommends shorter panel lengths (under 10') applied vertically. The wider and longer the panels are, the more likely there will be oil canning issues.
- *Panels applied to a wall horizontally are not recommended.* Anytime a design calls out for a horizontally applied panel installation pattern, please contact Firestone Metal Products Technical Services for design assistance.

Installation Tolerances

- **Joint Support Spacing:** To provide for uniform alignment of the panel ends and proper fitting of the vertical joint assemblies, the vertical support members at the panel ends (joint supports) must be positioned and plumbed to within +/- 1/8" of the specified spacing.
- **Engineered Connections:** A qualified engineer should determine the span capacity of the desired panel and validate fastener, stitch fastener and support framing requirements.
- **Support Framing Tolerances:** For support spacing of 8' or greater, the suggested support alignment tolerance is 0" to 1/4" outside of the nominal wall plane. For support spacing less than 8' and greater than 4', the suggested support alignment tolerance is 0" to 1/8" outside of the nominal wall plane.
 - To ensure the proper alignment of the panel supports, it is recommended that the supports at the panel ends (joint supports) are first set to the specified positions. Then use a string line between the joint supports to set and check the alignment of the intermediate supports. The alignment of supports is measured at the panel bearing surfaces of the respective support members.
 - The building must be squared, acceptable to standard practices.
 - Verify that any required subgirt framing members are installed as detailed and that they are straight and shimmed plumb.

Panel Installation

- **Handling:** Carrying panels in the flat orientation or twisting panels can induce an oil canning 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. Panels over 7 feet in length should be handled by two or more men (depending on the length of the panel). Panels should always be carried on edge and never over head.
- **Galvanic Reaction:** Dissimilar metal materials have a tendency to react with one another in certain environments; this reaction is a form of electrochemical corrosion. Proper care must be taken in the separation of dissimilar materials to avoid galvanic reaction. Metals such as aluminum and steel should not be in direct contact with one another, a material separator (barrier or isolator) must be used. Common methods for creating a material separation are: heavy bituminous paint barrier, heavy PVC sheeting, electric tapes, butyl tapes and plastic shims. Do not use common duct tape material separator as the fibers in the tape will conduct moisture and void the material separation.
- **Installing Screws:** Always refer to the fastener manufacturer's instructions for specific installation requirements. Before starting a screw, the materials to be joined must be pressed firmly together to ensure that there are no gaps between the materials.

- Most self-drilling screws require 20 pounds of pressure to maintain the drilling action and to start the thread cutting action. Applying such pressure before starting the screw gun will usually prevent tip walking or wandering. If too little pressure is applied, the drill point may not cut into the metal and the spinning will cause the point to heat up and become dull. If the pressure is too heavy, the far side material may be deflected away causing a stand-off condition or the drill tip may break or split.
- Before starting the wall installation, preset and test the screw gun's clutch for the proper torque setting for each specific combination of fastener size and material thickness (and hole size for self-tapping screws).
- Do not over drive fasteners as this creates panel stresses resulting in a "reading line" that is telegraphed to the face of the panel.
- Screws must always be installed perpendicular to the surface of the material being secured. A tilted screw causes eccentric bearing under the screw's head, which may result in break off of the screw heads. Tilted screws can also cause lateral drifting between the materials being secured.
- Maintain screw installation pattern as panels are mounted to the wall. Changes in the screw installation pattern can create tension and oil canning issues in panels.
- **Joint Sealant:** Shop or field applied sealant on the inside flange of the panel is required to ensure that the documented test results can be achieved.
- **UC-500 Panel Loads and Stitch Fasteners:** UC-500 panels do not perform well at higher wind loads. The use of stitch fasteners during installation to attach the panels to each other maybe required. Project specific engineering should be completed.
- **UC-501 Panel Loads and Exposed Fasteners:** UC-501 panels do not perform well at higher wind loads. The use of an exposed fastener with a EPDM washer may be required in the reveal joint during installation. Project specific engineering should be completed.
- **Reverse Panel Install:** When installed on a vertical wall in a horizontal application the correct method for attachment of the panels is to start at the top and install down to the bottom of the wall. The reason for what seems like a reverse panel installation so that the panel engagement flange does not become a water collection point. The panel engagement flange is not be used as "gutter" as any water that gets inside the flange is either trapped or evacuates toward the inside of the wall.
 - Moisture trapped inside a flange will undergo thermal cycling and create panel distortion.
 - Moisture that ends up inside the wall will travel down the weather resistant membrane looking for a point to escape.
- **Stiffing Ribs:** The addition of stiffening ribs in the panel profile "break-up" the flat surface and make oil canning less apparent.
- **Embossing:** A non-directional embossed surface will help to make oil canning less apparent.

Oil Canning

Oil Canning can be defined as a perceived waviness in the flat areas of metal siding panels. Generally the period and amplitude of the wave depend on the continuous width of the flat. Oil canning is an inherent part of light gauge cold formed metal products, particularly those with broad flat areas. Profiles like the UC-500 and UC-501 having wide flat surfaces are more likely to exhibit oil canning than corrugated profile panels. Oil canning can be more

apparent during certain times of day (and in certain seasons) based upon the angle at which sunlight hits the wall, panel installation tolerances and based upon the temperature differential. *Oil canning is not cause for rejection of a UC-500 or UC-501 panel.*

Following are several items which contribute to the oil canning appearance of a UC-500 or UC-501 panel.

- **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. Warped, twisted or uneven surfaces will transfer stress back to the face of the panel causing an oil canned appearance.
- **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 by forcing them into locations, 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 color, 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.

All of the factors above contribute to oil canning in UC-500 and UC-501 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.

- **Design:** The use of fasteners that allow panels to float without causing thermal stresses is a means of controlling oil canning. 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.
- **Panel Width:** Narrower panel widths will help to minimize oil canning. Wider panels (12", 16" or 20") will exhibit more oil canning than a narrower 8" panel.

- **Installation:** More stringent specifications regarding the alignment of the supporting structure will focus attention on this critical aspect.
- **Handling:** Proper handling is one of the most critical considerations and should be addressed in production, transportation and installation activities.
- **Gauge:** Increased gauge thickness will also help to reduce oil canning.

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 minimized. Oil canning is not grounds for panel rejection.



This guide is to be used as a reference to understand Firestone Metal Products panel systems. The reader should refer to Firestone Metal Products installation shop drawings for all details and notes specific to a project. Firestone Metal Products is not responsible for the misuse of the information in this document or the improper installation of panels.

References

1. American Iron & Steel Institute. "Sheet Steel Coils & Cut Lengths" Steel Products Manual, October 1979.
2. US Steel Sheet & Strip Handbook. July 1983.
3. Metal Construction Association Technical Bulletin #95-1060 Revised 1/03
4. Firestone Building Product Technical Information Sheet 3/10