

Insulating Metal Buildings

Automated insulation installation yields higher R-values easier

By Dan Harkins

Metal buildings, with 8- to 12-inch purlins and girts, have the perfect opportunity to install inexpensive insulation material within the wide and deep cavities the structure naturally provides. Current national energy codes and standards have addressed the insulation compression in metal buildings and now prescriptively require higher R-value roof systems that feature uncompressed insulation to fill the purlin cavities without gaps, which is supported by a steel strap platform beneath the purlins.

In older versions of the codes and standards, low R-value insulation methods that compressed the insulation above the purlins did not require the added step of bottom side banding. This is because the insulation was held in place with tension on the laminated facing to the fiberglass insulation and the typical installed thickness came nowhere close to filling the cavity depth, and still left the exposed roof purlins and wall girts which act like fins on a radiator.

PROBLEM

Four primary obstacles to effectively and optimally insulate metal building roofs and walls:

- Isolating the highly conductive steel purlins and girts from the interior conditioned air.
- Minimizing the air infiltration of the insulation assembly from pressure differences.
- Minimize through thermal bridges between the conductive structure and exterior sheeting.
- Avoid insulation compression and gaps over and around bracing.

SOLUTION

Stoughton, Wis.-based Thermal Design Inc. implemented AutoCeil Ceiling and Wall Insulation System, a new automated process used for this project whereby a tension-supported, architectural fabric sheet was quickly installed across the building bay widths in minutes. The custom-fabricated sheets isolated conductive purlins and wall girts from the interior conditioned space, which then supported the lightweight insulation.

This new process eliminates any need for bottom-side strapping with underside fastening to the purlins to support the system. Instead, the sheet is



Automated installation with a winch operator standing on the floor steering AutoCeil sheet throughout the ceiling and down to the floor using AutoCeil Winch push button controls.

supported by adding steel struts—best provided by the metal building manufacturer—spaced approximately every 10 feet and located slightly under the purlin ceiling plane. The rafter bracing that typically tied to the purlins was engineered to attach to the struts, which eliminated compromising the vapor retarder and any excuse to leave the highly conductive purlins and girts exposed.

This new design and automated method removed the need to measure, cut and install thousands of linear feet of steel support strapping and hundreds of fasteners to the bottom side of purlins throughout the entire roof. This eliminated all through thermal bridges except the purlin/girt attachment clips, which can be easily thermally broken with a non-conductive sheet material.

This new automated installation method allowed the operator to install the ceiling and wall sheet from the floor and removed the need to manually pull the sheet continuously from lifts or from the top of rafters during installation. Instead, the operator used a specialized winch system that lifted the sheet up one side wall, across the entire building bay ceiling and down the opposite side wall in one continuous piece.

The sheet is pulled, free of any obstructions, over the support struts and below the roof purlins. In 25 minutes the operator pulled over 5,500 square feet of seamless vapor retarder across the building bay, using push button winch controllers to align the sheet as it moves. The new method was ideal considering a tight time schedule, muddy site conditions and for the size of the new manufacturing facility addition, which measured 200 feet by 100 feet by 20 feet.

Once the durable architectural ceiling fabric was pulled and tensioned, installers mechanically

fastened the ceiling sheet to the top of the two side wall ceiling struts and the ridge strut from the top side of the structure, locking it permanently in tension. The sheet was only required to be sealed along the top of both rafters, as typical with Liner System (LS) technologies. The continuous sheet eliminated any need for taping or rolling and stapling thousands of linear feet of insulation facing tabs. The roof was then ready for the uncompressed, unfaced insulation to be installed between the purlins and resting upon the tensioned sheet.

After the insulation was installed in the bay, the roof panels were immediately installed. The wall insulation and finishing were later completed from the interior of the building, after the concrete floor was poured, out of the cold winter temperatures and windy conditions. The sidewall architectural fabric sheet covering the walls is temporarily lifted up, wall cavities insulated and the sheet repositioned back in place and sealed in tension along the base channel and up the column flanges.

The new process reduced insulation system labor by approximately 50 percent with proven results and allowed the designer to easily specify pre-installed, uncompressed R-values ranging from R-30 single-layer insulation blankets to over R-70 with multiple-layer insulation blankets. 

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