

Herman Miller Furniture

Membrane pressing of heavy-gauge thermoplastic sheet produces contoured furniture shapes

ZEELAND, MI – Herman Miller's Kiva line of office furniture features, what the company terms, "elegant curves, slender planes of seamless tops and rounded or waterfall edges of work surfaces." Called "quick deployment" furniture, a single-surface wing table doubles as a conference table or workstation. A moveable dividing screen and mobile storage shells facilitate instant offices.

The contoured surfaces depart from the rectilinear, boxy shapes produced by two-dimensional surfacing materials – primarily high pressure laminates – with which such furniture is traditionally surfaced.

Herman Miller produces the sweeping curves, ellipses and radii, absent of edge lines and edge banding, by membrane pressing of KYDEX® sheet heavy gauge, proprietary thermoplastic sheet onto a routed MDF core. The material also provides HPL-like surface toughness, outperforming alternative vinyls in physical property tests for heat aging, humidity shock, staining, edge denting and impact resistance, among others.

Paul Dame, Herman Miller senior product development engineer, was aware that membrane pressing would yield the desired slender, contoured surfaces, but found that thin, 6mm - 10mm (0.240" - 0.390"), conventional vinyl sheet lacked the desired toughness. "We compared many vinyls and vinyl alloys to the performance of HPL. KYDEX® sheet came the closest to our desired performance characteristics for impact, sharp object, and heat resistance. The material outperformed other thinner vinyls by ten to one," he says. Even in the edge dent test, which impacts the edge of the work surface with a swinging pendulum, "We knew there would be some damage, but it turned out to be minimal."

Herman Miller applies KYDEX® T high impact sheet in Pewter Gray and KYDEX® 130 sheet in custom Folkstone colour, both in 0.70mm (0.028") thickness. Both possess similar properties, with KYDEX® T exhibiting Notched Izod impact resistance of 801 J/m (15 ft-lb/in) (ASTM D-256), tensile strength of 42 MPa (6100 psi) (ASTM D-638), Rockwell Hardness 94 (ASTM D-785), and heat deflection temperature of 76°C at 1.82 MPa(168°F at 264 psi) (ASTM D-785).



Surface toughness and chemical resistance of KYDEX® sheet protects Herman Miller for Healthcare's nurses stations and wall panels from damage caused by wheelchairs, gurneys and mobile instruments, as well as harsh cleansers.

KYDEX, LLC

ISO 9001 and 14001 Certified

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Routed Under-Cuts Present Membrane Pressing Challenge

For fabrication, Herman Miller selected H&R Wood Specialties, Gobles, MI, due to its membrane pressing expertise; the under-cuts of the Kiva design present special membrane pressing challenges. "It's difficult to pull the complicated Kiva edge profile under the MDF core and attain a good edge bond," says Jim Hurst, H&R co-founder. To attain this bond, H&R has established specific heating temperatures, dwell times, cooling times and other membrane pressing parameters according to individual part shapes and sheet thicknesses.

The process physically presses heated plastic sheet onto the MDF substrate with an inflated bladder, or "membrane," while a vacuum draws the sheet onto the part. The technique eliminates the need for molds, as the flexible membrane presses the plastic into recesses and onto all sides, encapsulating all but the bottom surface of the core, which is typically pre-laminated.



Kiva table top of KYDEX® sheet laminated to MDF core exits Thermolaminator membrane press at H & R Wood Specialties.

Membrane Pressing for Nurses Stations and Hospital Wall Panels

H&R alters its processing parameters when membrane-pressing KYDEX® 150, P1 sheet for Herman Miller for Healthcare's nurses stations and "Wrap Coat" tiles (corridor wall panels). Here, H&R membrane-presses the KYDEX® sheet to a flat steel pan as large as 406mm x 1,219mm (16" x 48") that fastens to a partition. "It's difficult to get a good lamination of the sheet to the thin steel," Hurst says. "The sheet tends to twist on the steel after it cools. Proper cool-down time becomes critical so the part doesn't warp."

Wall panels and nurses stations require the same durability as Kiva furniture surfaces to resist gouging and scratching caused by gurneys, wheelchairs, stretchers and other conveyances. The sheet must also resist staining and fading after repeated contact with harsh cleansers.



Compound curves and seamless tops of Herman Miller's line of Kiva office furniture are produced by membrane pressing of heavy gauge KYDEX® thermoplastic sheet.

Mark Roberts, of Herman Miller's marketing department, says the company wanted durability to exceed that of vinyl tiles or laminates previously utilized for its nurses stations. "We needed something to withstand the aggressive hospital environment where many materials fare poorly. Fabrics and vinyls tear, and paint scratches," he says. The wall panels and nurses stations also present continuity in aesthetics by being clad in the same material.

As for the future of membrane-pressed KYDEX® sheet for Herman Miller products, Roberts says the company contemplates non-hospital applications that would also benefit from increased durability and/or formability of component surfaces.

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