Kawneer Trifab™ framing systems and storefront framing systems are designed to add increased thermal performance and value. The systems offer flexibility, various thermal options, and aesthetic design choices and are comprised mainly of extrusions made from one of the earth’s most plentiful recyclables — aluminum. These durable and lasting extruded products can help contribute to energy efficiency and long term sustainability.

Kawneer Company, Inc., part of Alcoa’s global Building and Construction Systems (BCS) business, has provided the commercial construction industry with best-in-class architectural aluminum products and service for more than 100 years. Its extensive range of solutions — from curtain walls and windows, to entrances and framing systems — help build infinite possibilities for thermal performance, hurricane resistance, blast mitigation and sun control.

Kawneer’s commitment to social and environmental responsibility is rooted in high performing, sustainable solutions that extend beyond energy efficiency to elements like daylighting, acoustical efficiency, recyclability, occupant security and occupant comfort. In fact, sustainability is at the heart of Kawneer’s product line, which is comprised of one of the earth’s most plentiful recyclables — aluminum.

Kawneer offers architects a new way to look at the building façade, placing endless design and sustainability options at their fingertips.

For more information visit www.kawneer.com
This declaration is an environmental product declaration (EPD) in accordance with ISO 14025. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. **Exclusions**: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc. **Accuracy of Results**: EPDs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. **Comparability**: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.

<table>
<thead>
<tr>
<th>PROGRAM OPERATOR</th>
<th>UL Environment</th>
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<tbody>
<tr>
<td>DECLARATION HOLDER</td>
<td>Kawneer North America</td>
</tr>
<tr>
<td>DECLARATION NUMBER</td>
<td>47868332121.104.1</td>
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<tr>
<td>DECLARED PRODUCT</td>
<td>TRIFAB™ FRAMING SYSTEMS AND STOREFRONT FRAMING SYSTEMS</td>
</tr>
<tr>
<td>DATE OF ISSUE</td>
<td>November 16, 2015</td>
</tr>
<tr>
<td>PERIOD OF VALIDITY</td>
<td>5 Years</td>
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**CONTENTS OF THE DECLARATION**

- Product definition and information about building physics
- Information about basic material and the material’s origin
- Description of the product’s manufacture
- Indication of product processing
- Information about the in-use conditions
- Life cycle assessment results
- Testing results and verifications

The PCR review was conducted by:

<table>
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<tr>
<th>PCR Review Panel</th>
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<tbody>
<tr>
<td>Chair: Thomas P. Gloria</td>
</tr>
<tr>
<td>Industrial Ecology Consultants</td>
</tr>
</tbody>
</table>

This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories

- INTERNAL
- EXTERNAL

Wade Stout, UL Environment

This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:

Thomas Gloria, Industrial Ecology Consultants

This EPD conforms with ISO 21930:2007

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TRIFAB™ FRAMING SYSTEMS AND STOREFRONT FRAMING SYSTEMS
Aluminum Storefront Framing Systems

According to ISO 14025

Product Information

Product Description

The Kawneer Trifab™ Framing System platform and Storefront Framing Systems are designed to add increased thermal performance and value. The Trifab™ Framing System platform and Storefront Framing Systems give you more flexibility, more thermal options, and more design choices. The Trifab™ Framing System platform and Storefront Framing Systems are flexible enough for a wide range of building projects.

Kawneer Storefronts Framing Systems featuring:
- Trifab™ VersaGlaze™ 450/451/451T Framing Systems
- Trifab™ 400 Framing System
- Trifab™ 451UT Framing System
- Trifab™ 601/601T/601UT Framing Systems
- EnCORE™ Framing System
- IR500/501 Framing
- IR501T/501UT Framing
- InFrame™ Interior Framing System

Kawneer storefront framing systems are generally installed within the building structure and are single span systems, spanning from slab to slab (floor to floor). Typically Storefront framing systems are used on the first and second floors of commercial buildings. The storefront framing systems include non-thermal, thermally improved, single thermal breaks and dual thermal breaks for increased energy efficiency.

Non-Thermal
- Product is not thermally broken
  - Trifab™ 400/450/451/601 Framing Systems
  - IR500/501 Framing
  - InFrame™ Interior Framing System

Thermally Improved
- Product is thermally improved
  - Uses thermal clip to provide a break
  - EnCORE™ Framing System

Thermal
- Product is thermally broken
  - Uses single lanced pour and debridged thermal break
  - Trifab™ 451T/601T Framing Systems
  - IR501T Framing

UltraThermal
- Product is thermally broken
  - Uses double lanced pour and debridged thermal break
  - Trifab™ 451UT/601UT Framing Systems
  - IR501UT Framing

Cross section of Trifab™ 451UT (Ultra Thermal) Framing System

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Performance Standards

Kawneer products are tested, certified and labeled for the following performance standards:

- AAMA/WDMA/CSA/101/IS2/A440) (NAFS—North American Fenestration Standard/Specification for windows, doors, and skylights) for the year of reference or newer or
- AAMA E283/NFRC 400 Air Infiltration
- ASTME330/1 and AAMA 501 Methods of Test
- AAMA 1503, AAMA 507 and NFRC 100 Thermal Transmittance – U-Factors
- AAMA 1503, CSA A440.2 and NFRC 500 Condensation Resistance (CRF,I,CR)
- AAMA 507 and NFRC 200 Overall Solar Heat Gain Coefficient and Visible Transmittance (SHGC) & (VT)
- AAMA 1801, ASTM E90 and ASTM E1425 Sound Transmission (STC, OITC)

Life Cycle Assessment

Declared Unit

The declared unit of the underlying life cycle assessment study was one square meter (1 m²) of window (including frame) meeting the performance standards noted below. The reference flow is 37.1 kg of window unit with framing, with a frame to glazing ration of 25.0% to 75.0% by mass. The 1.5m x 1.3m ribbon window standard size was used to derive the declared unit.

System Boundary

The system boundary for the declaration is cradle-to-gate per the guiding PCR. The product life cycle stages included within this boundary are illustrated in Figure 1.
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**Data Sources**

To cover these requirements and to ensure reliable results, first-hand industry data were used in combination with consistent background LCA information from the GaBi ts 2014 database. The data for aluminum billet, as well as externally sourced aluminum extrusions, are based on 2010 Aluminum Association studies and are the best available. Other LCI datasets were sourced from the GaBi LCA databases and are representative of years 2010-2013.

**Assumptions**

The manufacturing process and end product is essentially the same in all manufacturing sites. Impacts and inventories for storefront systems are calculated with a mass-based production-weighted average of each manufacturer’s impacts and inventories.

Float glass is insulated, laminated, or tempered and added to the finished assembly. At this time data does not include granularity to differentiate between insulate, laminated and tempered glass. As such, all glass is treated the same. Glass is only processed at the Cranberry facility. The remaining facilities produce and sell only the aluminum frames. For these facilities, the glass produced at the Cranberry facility was used as a proxy for the window glazing.

No significant assumptions have been made beyond the aforementioned. All of the raw materials and energy inputs have been modeled using processes and flows that closely follow actual production raw materials and processes. All of the material and energy flows have been accounted.
Sensitivity Analysis

Sensitivity analyses was performed because primary data from more than one location is averaged for a unit process.

In order to better understand the variation of impacts across locations for the manufacturing process, the coefficient of variation was calculated for the environmental impact categories. As shown in Table 1, the impacts were seen to vary between 23% and 46%, depending on location for the production of storefront framing. These variations are likely due primarily to the different scales of operations at each location, the different proportions of finishes used, as well as due to energy mixes used at each location.

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>CoV</th>
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</thead>
<tbody>
<tr>
<td><strong>TRACI 2.1</strong></td>
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</tr>
<tr>
<td>Global warming potential</td>
<td>23%</td>
</tr>
<tr>
<td>Ozone depletion potential</td>
<td>38%</td>
</tr>
<tr>
<td>Acidification potential</td>
<td>46%</td>
</tr>
<tr>
<td>Eutrophication potential</td>
<td>23%</td>
</tr>
<tr>
<td>Smog formation potential</td>
<td>33%</td>
</tr>
</tbody>
</table>

The coefficient of variation for each impact category was calculated by first determining the weighted standard deviation ($\sigma_w$) and the weighted average ($\bar{x}_w$) and then applying 

$$\text{CoV} = \frac{\sigma_w}{\bar{x}_w}.$$ 

The weighted average was calculated via 

$$\bar{x}_w = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i},$$

while the weighted standard deviation is determined by 

$$\sigma_w = \sqrt{\frac{\sum_{i=1}^{n} w_i (x_i - \bar{x}_w)^2}{\sum_{i=1}^{n} w_i}},$$

where $w_i$ is the weight, i.e. annual production, for each company and $x_i$ is the particular input or output for each location.
Life Cycle Impact Assessment Results

Table 1: Cradle-to-gate (manufacturing, glazing and frame) LCIA results of Kawneer Storefront Systems

<table>
<thead>
<tr>
<th></th>
<th>Units (per 1m²)</th>
<th>Manufacturing Impact (cradle to gate)</th>
<th>Glazing Impact (cradle to gate)</th>
<th>Frame Impact (cradle to gate)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Global Climate Change Potential (excluding biogenic carbon)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>kg CO₂ equivalent</td>
<td>1.77E+02</td>
<td>1.28E+02</td>
<td>4.95E+01</td>
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<tr>
<td><strong>Acidification Potential</strong></td>
<td></td>
<td>1.09E+00</td>
<td>7.01E-01</td>
<td>3.84E-01</td>
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<tr>
<td><strong>Eutrophication Potential</strong></td>
<td></td>
<td>2.80E-02</td>
<td>1.71E-02</td>
<td>1.09E-02</td>
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<td><strong>Stratospheric Ozone Depletion Potential</strong></td>
<td></td>
<td>4.35E-08</td>
<td>3.41E-08</td>
<td>9.44E-09</td>
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<tr>
<td><strong>Photochemical Smog Formation Potential</strong></td>
<td></td>
<td>9.04E+00</td>
<td>5.94E+00</td>
<td>3.09E+00</td>
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<tr>
<td><strong>Use of Material and Energy Resources</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fresh Water Consumption</strong> (excluding 143 L rain water)</td>
<td>Liters</td>
<td>2.40E+03</td>
<td>2.15E+03</td>
<td>2.46E+02</td>
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<tr>
<td><strong>Non-Renewable Primary Energy Demand</strong></td>
<td>MJ (HHV)</td>
<td>2.29E+03</td>
<td>1.62E+03</td>
<td>6.70E+02</td>
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<tr>
<td><strong>Renewable Primary Energy Demand</strong></td>
<td>MJ (HHV)</td>
<td>5.84E+02</td>
<td>4.95E+02</td>
<td>8.91E+01</td>
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<tr>
<td><strong>Non-Renewable Material Resources</strong></td>
<td>kg</td>
<td>5.32E+02</td>
<td>4.39E+02</td>
<td>9.31E+01</td>
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<tr>
<td><strong>Renewable Material Resources</strong></td>
<td>kg</td>
<td>6.76E+05</td>
<td>5.25E+05</td>
<td>1.51E+05</td>
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<td><strong>Waste Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Non-hazardous Waste Generated</strong></td>
<td>kg</td>
<td>3.40E+01</td>
<td>2.92E+01</td>
<td>4.81E+00</td>
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<td><strong>Hazardous Waste Generated</strong></td>
<td>kg</td>
<td>3.26E-02</td>
<td>3.24E-02</td>
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</tr>
</tbody>
</table>
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Additional Information

Disclosure of Windows Hazardous Content

There are no materials present in at least 0.1% of the storefront systems that are known to be hazardous to human health and the environment nor on the Candidate List Substances of Very High Concern [IERE 2015].

Recyclable Content

Aluminum is a highly efficient sustainable building material. Aluminum is 100% recycleable and can be recycled repeatedly. Recycled aluminum is identical to smelted aluminum but requires only 1/20 of the energy to manufacture. In building and construction aluminum scrap has a recycling rate of 95% [AA]. The remaining 5% is sent to landfill.

References

<table>
<thead>
<tr>
<th>Reference</th>
<th>Details</th>
</tr>
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</table>

The Life Cycle Assessment was conducted by thinkstep (formerly PE INTERNATIONAL) using GaBi data.