# Using Closed-Cell Spray Foam Insulation in Construction

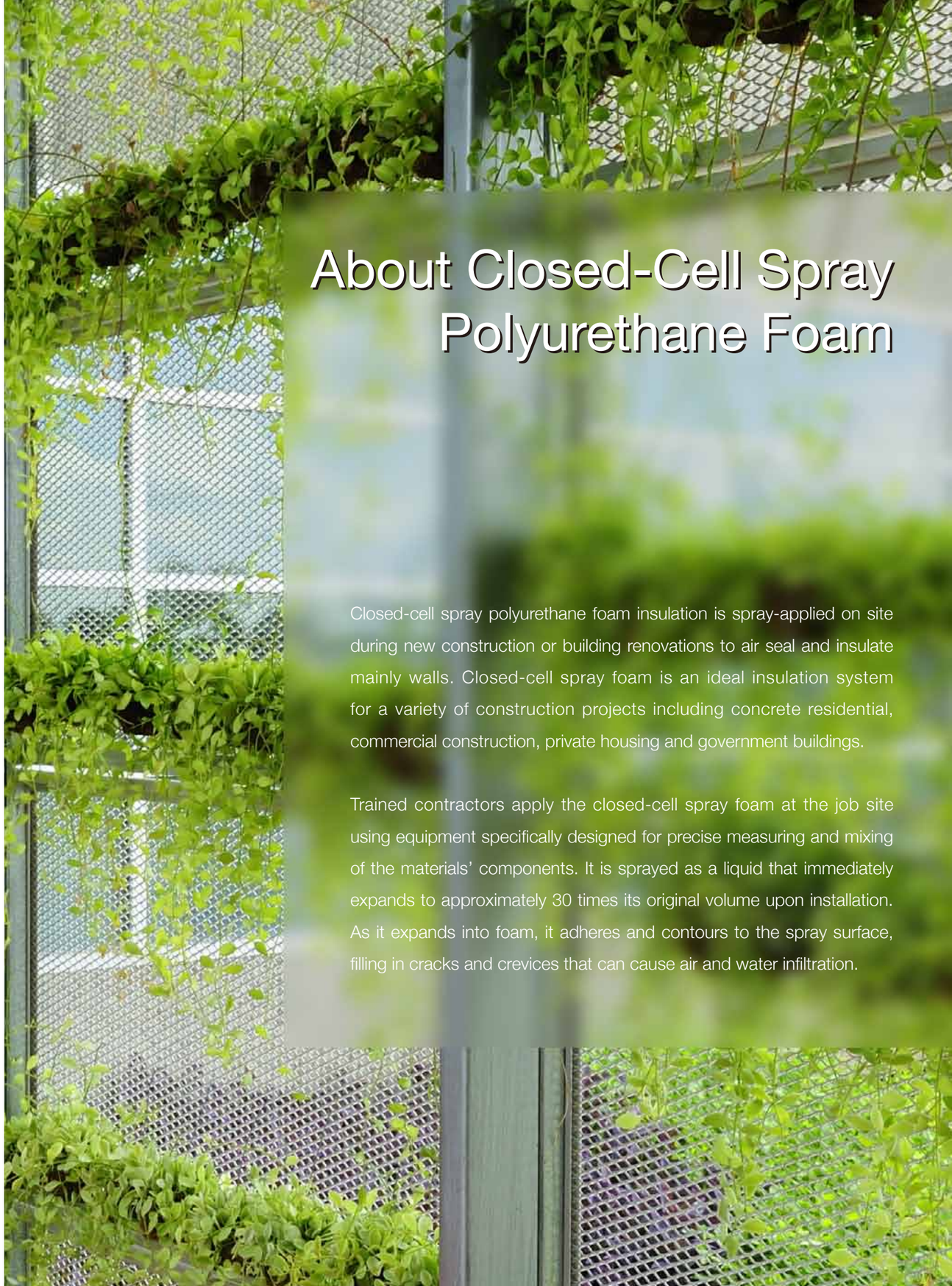
## Choosing the right insulation

Honeywell

# Improving Insulation Performance in Japan

Many contractors, builders and architects in Japan are seeking products and insulation systems that help improve the energy efficiency, structural strength and overall performance of their buildings. The need for more energy efficient buildings is being driven not only by the regulatory environment, but also as a result of significantly higher fuel costs.

Japan is committed to environmental responsibility and has introduced regulations that encourage low climate impact solutions in the building and construction industry. For example, a new energy standard mandates insulation for all buildings by 2020 and includes a higher thermal insulation requirement. Also, revisions have been made to emission management regulations intended to reduce green house gas emissions The government is actively supporting the development of net zero-energy buildings, which often rely on a combination of solar energy and high quality insulation systems. Advanced insulation systems remain an essential part of the solution.



## About Closed-Cell Spray Polyurethane Foam

Closed-cell spray polyurethane foam insulation is spray-applied on site during new construction or building renovations to air seal and insulate mainly walls. Closed-cell spray foam is an ideal insulation system for a variety of construction projects including concrete residential, commercial construction, private housing and government buildings.

Trained contractors apply the closed-cell spray foam at the job site using equipment specifically designed for precise measuring and mixing of the materials' components. It is sprayed as a liquid that immediately expands to approximately 30 times its original volume upon installation. As it expands into foam, it adheres and contours to the spray surface, filling in cracks and crevices that can cause air and water infiltration.

# Benefits of closed-cell spray foam insulation with high performance blowing agent

Closed-cell spray foam formulated with hydrofluorocarbon (HFC) blowing agents provides excellent insulation performance, which contributes to energy savings. However HFCs are greenhouse gasses, so they impact the environment. The spray foam Industry is facing challenges to achieve a perfect balance between energy savings and environmental impact of spray foam.

When specifying closed-cell spray foam, it is important for the foam to be formulated with a blowing agent that can improve insulation performance. See the table for the benefits of closed-cell spray foam insulation.

## What is a Foam Blowing Agent?

Foam blowing agents make foam expand during application. Encased within millions of foam cells, the blowing agent is the main contributing factor to thermal insulation performance in closed-cell spray polyurethane foam.

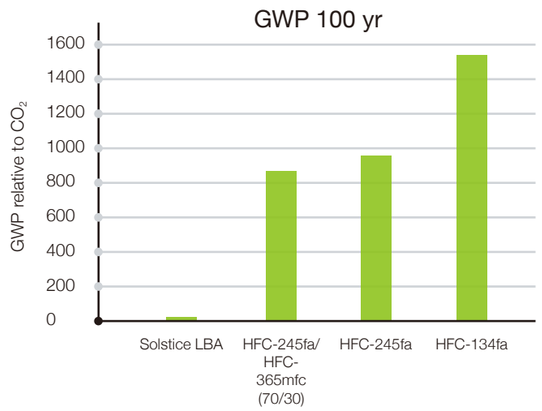
| Closed-Cell Spray Foam Capability | Building Design Benefits | Builder Benefits | Occupant Benefits |
|---|---|---|---|
| Impermeable to air | Controls airflow | Combined insulation and air barrier | Improves overall comfort |
| Expands and adheres | Creates an air seal; reduces leakage | Fills voids: Ensures contact with wall for better insulation | Provides superior thermal performance |
| Lower thermal conductivity | Design flexibility with compact wall assemblies | Improves insulation value for small wall cavities | Can reduce HVAC energy required |
| Resists water vapor | Reduces condensation problems | Additional vapor retarder not needed | Protects moisture sensitive materials from condensation |
| Impermeable to water | Flood resistant | Acts as waterproofing and secondary rainwater barrier | Controls and protects against leakage |

The choice of foam blowing agent can have a significant impact on spray foam performance. Consider specifying a closed-cell spray foam insulation that uses an advanced blowing agent, such as Solstice® Liquid Blowing Agent (LBA).

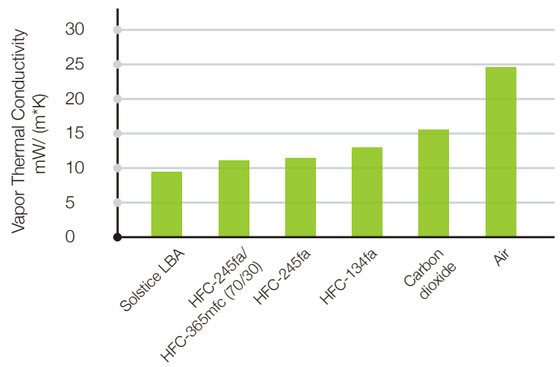
# Consider Solstice® Liquid Blowing Agent

Honeywell's Solstice® Liquid Blowing Agent (LBA), is a next-generation blowing agent with a global warming potential (GWP) of 1 (compared to a GWP of greater than 1000 for HFC alternatives). This GWP is equal to carbon dioxide ($CO_2$).

**Comparison of Global Warming Potential**




**Comparison of Vapor Phase Thermal Conductivity**




Solstice LBA has proven to be a superior blowing agent compared to HFC-245fa. Solstice LBA is compatible with existing equipment and offers significant energy efficiency and climate impact benefits to building owners at costs that are comparable to other blowing agents. Solstice LBA also demonstrates approximately 25% better thermal insulation performance than water-blown systems, which is another low GWP solution. The thermal conductivity of spray polyurethane foam improved from 0.034 mW/mK using the water-blown system to 0.026 mW/mK using the Solstice LBA system. A lower number means improved thermal insulation performance.

The thermal conductivity of the cell gas is responsible for 60% to 65% of the heat transfer through the foam, which is important for the properties as an insulating material. The lower the thermal conductivity, the greater the insulating power. The comparison of vapor phase thermal conductivity chart shows Solstice LBA with the lowest vapor phase thermal conductivity of the most commonly used blowing agents in Japan.

Solstice LBA is commercially available in Japan and can help you meet the green house gas emission reduction plan. While general contractors, developers or building owners are not currently monitored by their HFC consumption, there is a growing emphasis on designing low climate impact buildings.

When comparing foam blown with Solstice LBA to water-blown foam, here are some other key considerations:

- Water-blown foams are often considered "medium to low density" foam
- Significantly more water-blown foam must be applied to achieve thermal insulation performance comparable to closed-cell spray foam. This can result in increased labor and material costs.
- Foams formulated with Solstice LBA can be applied in colder conditions, offering a wider application window.
- Better yields with no additional equipment cost, unlike water-blown or liquid $CO_2$ spray alternatives.

**Additional Facts for Solstice LBA**

- Solstice LBA is listed as one of the low GWP molecules to replace HFC blowing agents in the published summary document issued by the Japan Ministry of Environment and Ministry of Economy Trade and Industry
- Solstice LBA has been approved by the U.S. Environmental Protection Agency (EPA) and is listed under the U.S. EPA's Significant New Alternatives Policy (SNAP)
- International organizations also recognize Solstice LBA as a suitable replacement for high GWP HFCs as well as HCFCs

# Honeywell's Commitment to Health, Safety and the Environment

At Honeywell, our commitment to continuous health, safety and environmental performance improvement is evident at our facilities around the world – it is the way we do business. We provide technical support and service on all aspects of our products, including safe use and handling guidance.

## The Evolving Regulatory Landscape for Blowing Agents

The Japan Urethane Foam Association (JUFA), the Ministry of Economy, Trade and Industry (METI), the Ministry of Construction, industry representatives and others are engaged in discussions to define HFC phase-down steps starting as early as 2015.

Honeywell has developed the 4th generation of fluorine-based molecules, hydro-fluoro-olefins (HFOs), to respond the growing demand of climate change. Honeywell's HFOs have short atmospheric lifetimes, have very low global warming potentials and are marketed under the Solstice brand name. Solstice LBA will help our customers meet the target of the green house gas emission reductions steps defined by each country who has signed the Kyoto Protocol.

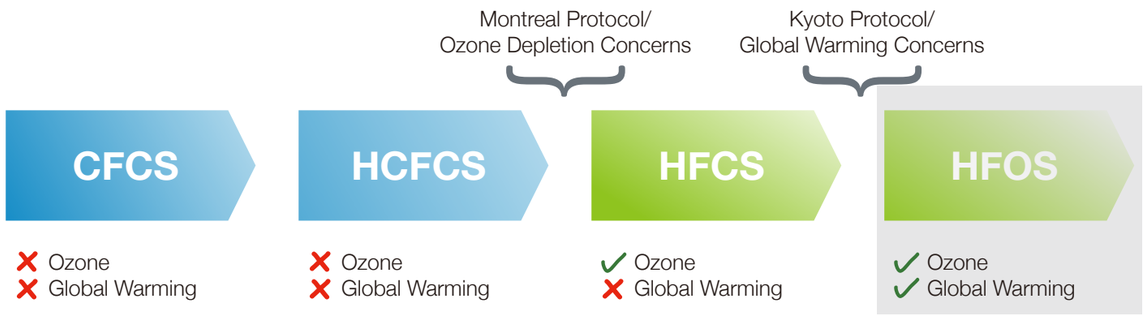
### Responding to Safety and Environmental Concerns

| | Solstice LBA | HFC-245fa | HFC-365mfc | HFC-245fa/ HFC-365mfc (70/30) |
|---|---|---|---|---|
| Atmospheric Life | 26 days | 7.7 years | 8.7 years | ND |
| ODP | 0 | 0 | 0 | 0 |
| GWP 100 | 1 | 858 | 794 | 959 |
| Flammable | No | No | Yes | No |
| Exposure Limit (OEL), ppm | 800 | 500 | 200 | ND |

### Solstice Liquid Blowing Agent Outperforms the Competition

| | | HFC 245fa | Water ($Co_2$) | HFC 245fa/ HFC-365mfc (70/30) | Solstice LBA |
|---|---|---|---|---|---|
| Performance | Thermal Conductivity | 🟢 | 🔴 | 🟢 | 🟢 |
| Cost | Using Existing Equipment | 🟢 | 🟡 | 🟢 | 🟢 |
| | Yield | 🟢 | 🔴 | 🟢 | 🟢 |
| Environment | Application Window | 🟢 | 🔴 | 🟢 | 🟢 |
| | Global Warming Impact | 🟡 | 🟢 | 🟡 | 🟢 |
| | Ozone Depletion Impact | 🟢 | 🟢 | 🟢 | 🟢 |
| Safety | Toxicity | | Meets Requirements | | |

### Responding to Regulatory Requirements

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Honeywell Fluorine Products is part of Honeywell Performance Materials and Technologies, a global leader in developing and manufacturing advanced materials and process technologies. These materials and technologies are used by people every day in a wide range of industries and applications, from petroleum refining to environmentally friendlier refrigerants to bullet-resistant vests. Our advanced materials are critical in the manufacture of products ranging from nylon to computer chips to pharmaceutical packaging. Process technologies developed by our UOP business form the foundation for most of the world's refiners, efficiently producing gasoline, diesel, jet fuel and petrochemicals. UOP is now pioneering technology to produce real fuels from renewable energy sources.

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