



LandVac® | V玻®
www.landvac.com

100% Tempered Vacuum Insulated Glass *Redefining Safety, Energy Efficiency, and Comfort*
New Heights for the Industry! New Meanings for Life Style!

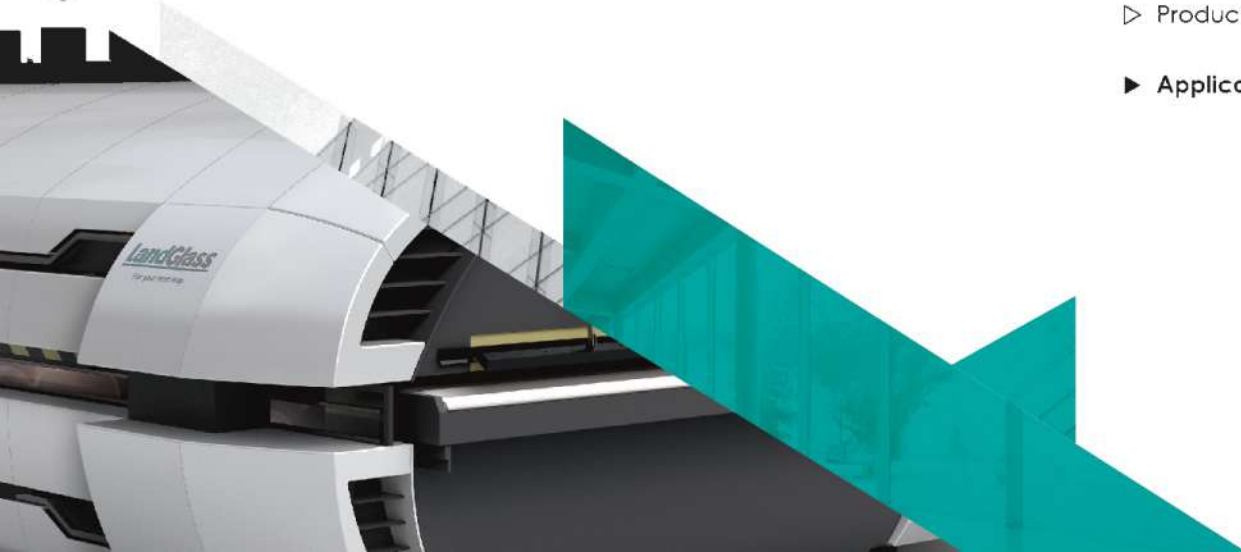
LandVac is wholly-owned brand by LandGlass Address: Guangjian Building, No.12 – Wangcheng Road, Luoyang, China Tel: 0379-65298899

Tempered Vacuumed Insulated Glass

DEFINE QUALITY OF LIFE WITH NEW STANDARD

LandVac®

Tempered Vacuum Insulated Glass



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01 About Us

► 01-1 LandGlass

LandGlass Technology Co., Ltd. (hereinafter "LandGlass") is a high tech enterprise specialized in the development and manufacturing of glass tempering furnaces and fully tempered vacuum insulated glass products. Since its formation, under the guidance of company values of integrity, quality, innovation, and service, LandGlass has become a leading company in the glass processing industry with distinctive characteristics.

LandGlass is committed to providing its customers the finest innovative technology and world leading glass tempering equipment that allow companies to challenge themselves and succeed. LandGlass' R&D team, consisting of nearly one hundred dedicated engineers and scientists, devoted eight years of hard work to the success of the fully tempered vacuum insulated glass and broke the myth that vacuum glass can't be tempered. The completion of the fully tempered vacuum insulated glass production line laid a solid foundation for the commercialization of this new product, making its contribution to environmental protection.

Today, the global marketing network of LandGlass is providing on-site technical consultation and customized solutions to all our customers. We now invite you to experience the improved safety and quality of life that our latest innovation brings to the market.



LandGlass

▷ 01-2 Intellectual Property Protection

Considering innovation as the driving force of our business development, LandGlass has established a state of the art R&D center that has been recognized in Henan Province as the "Provincial Technological Center", "the New Insulated Glass Technology and Equipment Engineering Laboratory", "the Insulated Glass Equipment Engineering Research Center", and "a R&D Base for Postdoctoral Research". Meanwhile, having positioned intellectual property as its core competitiveness, LandGlass has successfully built up its array of hundreds of national and international patents providing effective protection over Company's innovations. Through the assistance of Patent Cooperation Treaty, LandGlass has constructed a patent portfolio in dozen of regions and countries including U.S., Europe, and Japan, paving to its globalization. In 2015, LandGlass won "the National Intellectual Property Advanced Enterprise award" and it adhered to "Certified State Intellectual Property Management System", showing that LandGlass has met advanced national standards for its innovative competence and ability in IP management.

▷ 01-3 Unparalleled National Honors

In 2012 and 2013, by virtue of its core technologies, LandGlass' won the National Patent Gold Award, an honorable prize representing China's highest achievement in independent innovation. It not only made history in Henan Province, but is also unmatched by any enterprises in this industry.



A large industrial machine, likely a glass processing line, with rollers and structural components. The image is partially obscured by a teal geometric graphic in the bottom left corner.

02 Brand Overview

LandVac® (V玻® in Chinese) is a new generation Tempered Vacuum Insulated Glass developed and patented by LandGlass.

Built upon R&D results in various fields and LandGlass' exclusive low temperature sealing technology, the product offers outstanding performance in thermal and sound insulation while maintaining its strength and safety advantage against wind pressure. As greenhouse effect and pollution have become a rising concern in our society, it's an ongoing endeavor of people to pursue for healthier environment. LandVac is an innovative energy efficient Tempered Vacuum Insulated Glass engineered by LandGlass, born to lead the trend of glass applications in green building and upscale home appliances with a new standard for the quality of life.

▷ 02-1 LandVac® History

2007 –Formation of a R&D team to launch the Tempered Vacuum Insulated Glass project;

2009 –Development of LandGlass Low-Temperature Sealing Technology for Vacuum Insulated Glass;

2011 –Production of the first 1,000 × 650 mm prototype of Tempered Vacuum Insulated Glass;

2012 – The Tempered Vacuum Insulated Glass trial production rolled off the prototype line;

2013 – Designed and developed the automated Tempered Vacuum Insulated Glass production line;

2014 – The performance index of the Tempered Vacuum Insulated Glass received authorized third party certifications;

2015 - The automated Tempered Vacuum Insulated Glass production line was put into production.

▷ 02-2 LandVac and Its Meanings

LandVac®
Tempered Vacuum Insulated Glass

As a sub-brand of LandGlass, LandVac® continues its naming conventions by combining LandGlass and Vacuum into LandVac.

03

LandVac from LandGlass

▷ 03-2 Seven Advantages

- **Fully Tempered** —LandVac is a fully tempered vacuum insulated glass.

By adopting the low temperature sealing technology, LandVac perfectly retains the safety features of tempered glass against impact. The surface stress of any position in LandVac tempered vacuum insulated glass exceeds 90MPa, which totally meets safety glass standards.



- **Energy Savings** – The thermal insulation performance of LandVac is 2 to 4 times better than insulated glass

LandVac has a high vacuum interspace that eliminates any gas heat transfer. By using high-performance Low-E coating, it also considerably suppresses radiation heat transfer and reduces the U-value of LandVac to 0.08 Btu/hft²F. In the meantime, the thermal insulation performance of LandVac is 2 to 4 times better than insulated glass and 6 to 10 times than single pane glass. LandVac meets all international passive house heat transfer requirements on windows and doors in stand-alone applications.

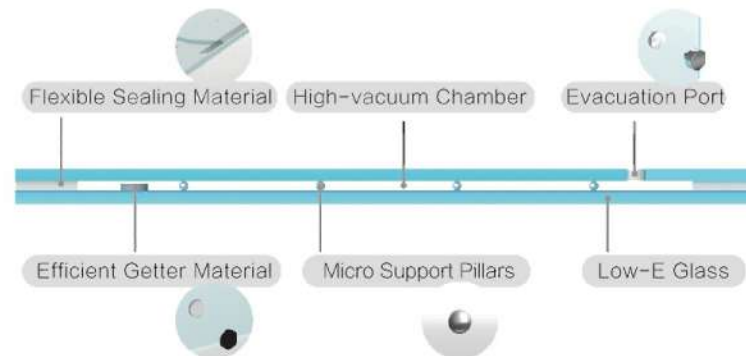
U-Value Comparison



- **Super Long Life** —The life expectancy of LandVac exceeds 25 years.

The flexible edge sealing materials wakens the shear forces around the seams, avoiding the sealing failure caused by the brittle edge sealing material especially in the environment with big temperature difference between indoor and outdoor. With the assistance of built-in high efficiency getter material, LandVac can sustain its superior performance against harsh environments and material aging for a long time.

Aging Chart for Change of Absolute Pressure in LandVac Chamber





- **Thin Structure** – LandVac has a structure thinner and lighter than insulated glass. In comparison with triple-pane insulated glass, LandVac has merely one sixth of its thickness and weighs 10 kg less per square meter while managing a much better U-value. Meanwhile, less Low-E glass layers also allow higher transmittance and improved optical transparency.

Type	U- value (W/m²K)	Visible Light Transmittance (%)	Thickness (mm)	Weight (Kg/m²)
LandVac 4TL*+0.3V+4T	0.48 0.08 Btu/hft²F	71	8.3	20
Insulated glass 4TL*+12Ar+4TL*+12Ar+4T	0.75 0.13 Btu/hft²F	50	36	32

* Note: provided radiation rate of Low-E glass at 0.05



- **Ultimate Dewpoint** –LandVac effectively eliminates dew condensation between glass layers.

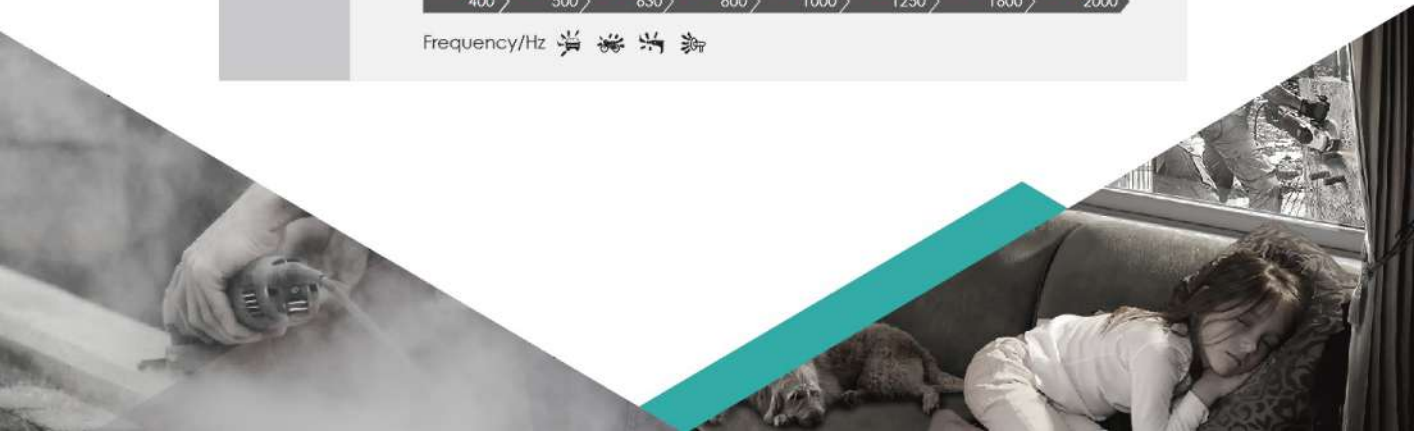
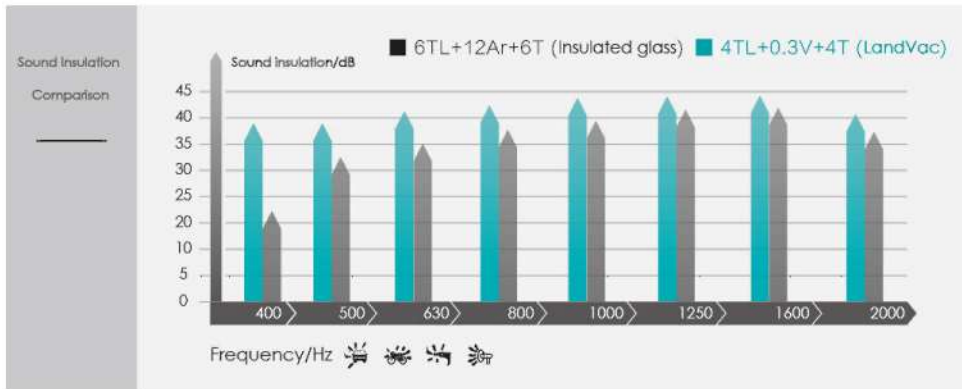
Dew condensation is caused by the temperature difference between the inner and outer surfaces of insulated glass. The high vacuum interspace of LandVac effectively eliminates the dew condensation phenomenon, while the outstanding thermal insulation performance ensures interior glass surface free of condensation even when the outdoor temperature falls to -40°C .



Dew Point Temperature Comparison





Note: indoor temperature 20°C , relative humidity 60%

- **Noise Reduction** –LandVac effectively blocks medium and low frequency penetrating noises. The high vacuum interspace of LandVac effectively blocks sound transmission. Human ear is quite sensitive. For every 5 dB, of noise increase, the effect on auditory experiences differs by 3 to 4 times. The weighted sound insulation measurement indicates that an outdoor noise level of 75 dB, can be reduced by 39 dB by LandVac, while the typical reduction by regular laminated glass is only 29 dB. It has a remarkable soundproofing effect against medium and low frequency noise such as traffic and construction noise that disturb our daily lives the most.



- **Flexibility** — Factors such as geographical location, elevation, and installation angle do not affect the performance of LandVac.

Thanks to the high vacuum interspace of LandVac, there is no thermal expansion or contraction even if the elevation of the location where it's used is largely different from where it's manufactured. The heat transfer coefficient of LandVac remains constant regardless of whether it's mounted horizontally or with an angle, making it suitable for energy efficient roofing or slope installation.

U-Value W/m ² ·K Of Different Types Of Glass	Acute Angle / °  0°	 30°	 60°	 90°
LandVac 4TL+0.3V+4T	0.48 0.08 Btu/hft2F	0.48 0.08 Btu/hft2F	0.48 0.08 Btu/hft2F	0.48 0.08 Btu/hft2F
Insulated Glass 6TL+12Ar+6T	2.14	1.98	1.66	1.45

Deflection of Insulated Glass



► 03-3 Five Major Technologies

◆ Low Temperature Sealing Technology

With LandGlass' exclusive low temperature sealing technology, the surface stress of any position in LandVac tempered vacuum insulated glass exceeds 90MPa, perfectly retaining the safety features of tempered glass against impact.

Teamed up with talents around the world, the core R&D group at LandGlass devoted eight years of hard work to this world-class challenge. Through tens of thousands of processing tests, they have successfully resolved the problem regarding tempered glass annealing in the sealing process and brought the vacuum glass technology to a new level.

◆ High Vacuum Sealing off Technology

Sealed in a UHV chamber, LandVac is able to maintain the consistency of a high degree vacuum between the layers, therefore ensures its outstanding performance and remarkable durability.

◆ Flat Sealing Technology

By using flat edge sealing technology, LandVac' s sealing does not protrude above the glass surface. This feature ensures easy and safe transportation. It looks even more elegant when mounted in window frames.

◆ Flexible Edge Sealing Technology

Unlike traditional sealing technology using fragile materials, LandVac adopts flexible edge sealing materials that have a much higher thermal resistance against thermal expansion or contraction, making it far more durable and robust against sealing failure caused by temperature difference between the inner and outer surfaces and materials aging.

Flexible Metal Sealing



▷ 03-4 Product Types

Product Type	Structure	Thickness mm
LandVac	4TL+0.3V+4T	8.3
Triple Glazing (LandVac Plus Insulated)	5T+12A+4TL+0.3V+4T	25.3

Product Type	U- value (W/m ² K)	Solar Heat Gain Coefficient (SHGC)	Shading Coefficient (SC)	Sound Isolation (dB)	Max. Dimension mm
LandVac	0.48 0.08 Btu/hft ² F	0.39	0.45	39	1500*2500
Triple Glazing (LandVac Plus Insulated)	0.43 0.07 Btu/hft ² F	0.35	0.40	42	1500*2500

Note:

1.Main parameters by product type: 4TL – 4 mm thick tempered Low-E glass; 4T – 4 mm thick clear float glass; 0.3V – 0.3mm thickness of vacuum space; 0.38P – 0.38 mm thickness of PVB film; 12A – 12 mm thickness of air space.

2.Data in the table are calculated in Window 7 based on ISO9050 & ASHRAE standards ; Parameter error : Light properties ±2% ; U-values ±0.1 W/m²·K; The data displayed above are for reference only . The values for a specific product may vary and need to be recalculated .Please refer to the data provided by LandGlass.

Triple Glazing
(LandVac Plus Insulated)

LandVac

04 Applications

▷ 04-1 Architecture

LandVac is thin, lightweight, and safe. The remarkable features including thermal and sound insulation make it a perfect fit for green buildings.

Applications:

Doors, windows, curtain walls, and skylights for upscale commercial and residential buildings, public facilities, as well as landmark structures.

Prospects for future development:

The annual building construction and property renovation worldwide sum up a huge number thanks to the sheer size of the domain. Our domestic new housing area is close to 2 billion square meters each year. Moreover, the glass needed in the next ten years for existing window replacements is expected to be more than 11 billion square meters.

▷ 04-2 Vehicles

In addition to the excellent thermal insulation, soundproofing and condensation-free features of LandVac, its optical transparency performance makes LandVac the best choice for automobile windows.

Applications:

Suitable as flat window materials for automobiles, high-speed rail, aircraft, and vessels.

Prospects for future development:

Prospects for future development: While the quality of travel has been improved tremendously, people's expectation for the interior comfort of the vehicle is also rising. The remarkable features LandVac has in safety, energy savings, soundproofing, and super low dew condensation makes it the best choice for various vehicle windows.





▷ 04-3 Home Appliances

The advantages LandVac has in energy savings, weight, thickness, safety, and condensation-free will help home appliances to upgrade.

Applications:

Ideal for freezers, wine cabinets, and display cases.

Prospects for future development:

Prospects for future development: The appearance and transparency of traditional cabinet glass doors are often compromised due to frosting and dew condensation. Electric defrost system consumes additional energy. LandVac can make the good looking appliances more environmental friendly.

▷ 04-4 Agriculture

The distinguishing traits of LandVac in thermal insulation and optical transparency are just right for precision agriculture.

Applications:

Modern greenhouse farming.

Prospects for future development:

Prospects for future development: In recent years, modern agriculture is vigorously promoted in our country to expedite the transformation of traditional farming into development patterns that are more efficient, worry-free in product safety, resource conserving, and environmentally friendly. LandVac will definitely play an important role in this process.

▷ 04-5 BIPV

LandVac's performance in thermal insulation and sloped installation makes it a perfect candidate as the lining glass in solar power generation applications.

Applications:

Solar photovoltaic buildings.

Prospects for future development:

Prospects for future development: At present, environment protection and sustainable development have become the common goals of every country around the world. Clean energy, especially solar photovoltaic power plays an essential role in power sector. BIPV is being promoted worldwide beyond the industrial fields. The superior energy efficiency will make LandVac the choice for next generation building construction and PV energy technology worldwide.