NorthGlass Company Profile

Luoyang North Glass Technology Co., Ltd., simply called as "NorthGlass", was established by Mr. Gao Xuming, Chairman of the board, in Luoyang National High & New Technology Development Zone on 18th May, 1995. It is one of the earliest Chinese enterprises being engaged in the developing, design and manufacturing of glass deep-processing equipments. In 2011, NorthGlass created a precedent in glass deep processing machinery industry, going public at Shenzhen Stock Exchange (stock code: 002613). Today, NorthGlass have developed into a high-tech industry developer and manufacturer in the field of glass deep-processing equipments. Our major product, flat/bend glass tempering furnace, is ranking the first of worldwide industry within last 16 years since 2002, according to the production and sales quantity. The cumulative domestic market share is almost 50%, and more than 4000 NorthGlass glass tempering furnaces are running in 83 countries around the world. The Low-E coating line developed and produced by NorthGlass is becoming one of the global leaders in glass coating industry and led to a rapid development of coated glass industry in China. More than 20 coating machines have been put into production within last 10 years.

Another key product for NorthGlass is upscale deep-processed glass, which have been widely applied in a lot of famous construction projects all over the world, for example "Sun Valley" & "Shillupu Pier" of 2010 Shanghai Expo, "Bird Nest" & "Water Cube" of 2008 Beijing Olympics, China National Center for the performance arts, New Beijing South Railway Station, Beijing Capital International Airport, Shanghai Tower, Abu Dhabi International Airport, Singapore Changi Airport, Vietnam APEC Exhibition Center, Leadenhall Building in London, Van Gogh Museum in Amsterdam, etc. Meanwhile, NorthGlass is also one of two qualified architectural glass suppliers for the most famous electronics company in the world, for its dozens of retail stores in the world as well as new Headquarters Building in Silicon Valley.

NorthGlass's products have been sold not only in China, but also exported in more than 80 countries in the world, such as USA, UK, Germany, France, Japan, Russia, Middle East, Southeast Asia, etc., via NorthGlass's complete domestic and international sales and service network.

While meeting domestic markets with new products and constantly developing international market, NorthGlass gradually built up a global marketing & service network integrated with "Sales, Service and Technical Support", based in China and expanded to the world, which basically ensure the realization of the goal "Building NorthGlass as the industry's first brand".

NorthGlass has more than 20 sets of advanced production testing equipments and labs, get the certifications of ISO9001, 3C, CE, UL, etc., and own more than 100 patents. NorthGlass is awarded as "the Top Hundred Enterprises of Henan", "the Meritorious Enterprise of Henan" and "the Meritorious Enterprise of Luoyang".

The Chairman of NorthGlass, Mr. Gao Xuming, is awarded "Outstanding Contributor" of Luoyang, "the Representative of China Building Material Industry during 30 years' Reform and Opening" and "Outstanding Contributor" of Luoyang National High & New Technology Development Zone.
NorthGlass History

- In 1994, NorthGlass produced the first domestic "Horizontal Roller Flat/Bent Glass Tempering Furnace".
- In 1995, Luoyang North Glass Technology Co., Ltd. was established.
- In 1999, Beijing North Glass Safety Glass Co., Ltd. was established.
- In 2004, NorthGlass’ new generation glass tempering furnace with "Super Flat & Spotless" technology was developed, which changed the old history that tempered glass must have inherent defects of serious iridescence and distortion, and bring a new quality standard to the world’s industry.
- In 2005, Shanghai North Glass Technology Industrial Co., Ltd. was established.
- In 2008, the first Low-E glass coating machine independently developed by Shanghai NorthGlass Coating Technology Co., Ltd. was put into commercial production, which ended the history of no China domestic Low-E coating equipment.
- In 2009, the world’s most famous electronics company decided to build their Asian Flagship Store in Shanghai, and through the cooperation with NorthGlass of supplying architectural glass for totally 58 Stores up to now.
- In 2009, NorthGlass successfully developed the world’s first super-large bent glass tempering furnace, which can produce the bent tempered glass with size up to 18 meters height and 3.6 meters bent edge. This furnace pushes the world’s glass tempering technology to a new high level.
- In 2011, NorthGlass went public at Shenzhen Stock Exchange, simply called as "NorthGlass Corp." with stock code 002613.
- In 2012, Tianjin North Glass Industrial Technical Co., Ltd. was established with a total investment of 500 million RMB, and rapidly becomes the world’s leading architectural glass supplier.
- In 2014, as NorthGlass subsidiary, Tianjin North Glass Industrial Technical Co., Ltd. signed the contract with the world’s most famous electronics company and will provide the special architecture structural glass to their new headquarters office building.
- In 2015, NorthGlass invested and established Shanghai North Glass Automation Technology Co., Ltd., who opened a new chapter in glass deep processing industry 4.0.
- In 2015, NorthGlass celebrated her 20th Anniversary and changed the new LOGO.
- In 2015, NorthGlass merged partial business of Shenzhen Juisun Screen Printing Machinery Co., Ltd. and whole business of Dongguan Byronic Machinery and Equipment Co., Ltd., then established a new subsidiary – Guangdong NorthGlass.
- In 2016, Together with Lianxun Capital, NorthGlass set up an industrial fund-“NorthGlass Fund”, and took the first step to march toward eco-friendly architecture industry, starting new business of microcrystalline foaming material recycled from tailings and establishing a new company called ‘Beijing NorthGlass Si-Nest Technology Co., Ltd.”
- In 2017, NorthGlass merged the business of Dongguan Henghechang Glass Co., Ltd., setting foot in consumer electronics market.
Luoyang NorthGlass
Full name: "Luoyang North Glass Technology Co., Ltd.", the headquarters and parent company of NorthGlass:

Tempering Furnace Business Unit
As the largest and core BU of NorthGlass, "Tempering Furnace" developed the first domestic "Horizontal Roller Hearth Flat/Bent Glass Tempering Furnace", as well as the world's largest bent glass tempering furnace which has been used to produce super-oversized curved tempered glass for retail flagship stores of the world's most famous consumer electronics company. TG1 series tempering furnace recently developed by TFBU is NorthGlass's latest and top level product which has the significant advantages of intelligence and energy-saving with world's leading quality level.

Luoyang Glass Division
Mainly producing Low-E coated glass, "super flat & spotless" tempered glass, curved tempered glass with large arc length, SGP laminated glass, screen printed glass and insulated glass. NorthGlass pioneered the "super flat & spotless" glass tempering technology, which is the perfect quality state of flat tempered glass. It has the most complete kit factory in Middle West regions with the strongest processing capability of high-end architectural glass. Supplying oversize curtain wall glass for well-known landmark buildings, such as Xi'an Twin Towers, China Railway Center of Xi'an, etc.

Luoyang NorthGlass Taixin Fan Technology Co., Ltd.
Engaged in manufacture of various general & industrial fans, with main products of high-speed train cooling fan, convention hot fan, motor sweeper fan, etc. NorthGlass's high-speed train cooling fan is equipped in the most advanced CRH380 high-speed train as the transformer cooling, contributing to the fast development of Chinese high-speed train industry.

Tianjin NorthGlass
Full name: "Tianjin North Glass Industrial Technical Co., Ltd.", the headquarters and main production base of NorthGlass:

With a total investment RMB 500 million and plant area 100’000 sqm, plus NorthGlass's advanced technology and professional R&D team, Tianjin NorthGlass is being developed to the world's leading supplier of architectural glass, specialized in producing super-oversized tempered, laminated, insulated, digital printed glass with high quality. Up to now, Tianjin NorthGlass have undertaken and completed a number of domestic & international landmark construction projects, for example the new headquarters and 58 Stores of the world's most famous consumer electronics company, NationBank of Kuwait, etc. Tianjin NorthGlass's main production equipments, such as Low-E coating line (annual productivity 8 million sqm), flat/bent glass tempering furnace, laminating line, printing line and other auxiliary equipments are all with super-oversize of maximum glass length 18m.

Guangdong NorthGlass
Guangdong NorthGlass and Juisun Technology Industry Co., Ltd.
A new glass technology company invested by NorthGlass Group, mainly engaging in the R&D and manufacture of glass screen printing machine and automotive glass pre-processing line. By integrating the advanced resources of NorthGlass and Juisun, Guangdong NorthGlass are aiming to build the first-class automotive glass pre-processing equipments in China.

Guangdong NorthGlass Electronic Glass Co., Ltd.
Invested by NorthGlass and established at the end of 2016, Guangdong North Glass Electronic Glass Co., Ltd. independently develops and manufactures a variety of core and competitive tablet PC, laptop, all-in-one computer touch screen, educational machine, large-scale display screen, AG/AF/AR glass cover and other products. Being a leading and influential enterprise in the industry of touch screen cover, it has the most extensive business scope and the highest yield rate in its class.

Shanghai NorthGlass
Full name: "Shanghai North Glass Technology Industrial Co., Ltd.", a specialized vacuum coating equipment manufacturer with rich experience in large area deposition. We can not only provide customized coating equipment, but also vertical display coating machine and sputtering devices (end block and magnet bar etc.), but also complete vacuum technology upgrading and automation system renovation.

Shanghai Coated Glass Division, is a company with main products including Float Low-E glass, Tempered Low-E glass and so on.
Shanghai North Glass Automation Technology Co., Ltd., engaged in R&D and manufacture of glass storage, cutting, printing, cleaning and complete automation solutions for glass processing factory.
Shanghai Glass Division, which is the subsidiary company of NorthGlass, with the strong support of R&D and equipment manufacuturing capabilities from its headquarters, puts NorthGlass's "super flat & spotless" tempering furnace into producing different types of special glass, such as irregular glass, hyperbolic glass, ultra-wide glass, super thick glass, etc. Its main projects include Shanghai Center Ski Building, Disney Tomorrowland, etc.
Shanghai Equipment Manufacturing Division, is a large, comprehensive high-tech company, engaging in equipment manufacturing for glass deep processing as well as other machinery products.

Beijing NorthGlass. Full name: "Beijing North Glass Safety Glass Co., Ltd."
Featured products: insulated glass, tempered glass, laminated glass, screen printing glass and printing glass, being used in such building projects as 'Bird’ s Nest’. "Water Cube" of 2008 Beijing Olympics and China National Center for the Performing Arts, etc., sparing no effort in fast technology upgrading and automation system renovation.

Shanghai NorthGlass, full name of "Shanghai North Glass Technology Industrial Co., Ltd.", a specialized vacuum coating equipment manufacturer with rich experience in large area deposition. We can not only provide customized coating equipment, but also vertical display coating machine and sputtering devices (end block and magnet bar etc.), but also complete vacuum technology upgrading and automation system renovation.
Tempering Furnace Business Unit Introduction

As the first BU, Tempering Furnace Business Unit is always the core sector of NorthGlass with the largest sales value since 20 years ago. From the development and sales of the first glass tempering furnace in 1995, TFD has totally produced and sold 4000 glass tempering furnaces. These furnaces were sold not only in China with cumulative market share of almost 50%, but also exported to more than 80 foreign countries, including USA, Germany, Switzerland, UK, France, Russia, Turkey, Saudi Arabia, UAE, Japan, Australia, South Korea, India, Singapore, Africa, Southeast Asia, etc. We have repeatedly created and broken our own world records, such as 2.85×5 m bent tempering furnace, 4.5×2.85 m bent glass tempering furnace, 3.6×18 m flat/bent glass tempering furnace. NorthGlass’s continuous glass tempering furnace is taking an absolute leading position in the market, the cumulative sales is more than 100 sets including more than 50 sets sold in last three years. In whatever capacity, energy consumption, or product quality and equipment stability, NorthGlass continuous tempering furnaces are significantly ahead of the other competitors, becoming the first choice for photovoltaic industry and other industrial glass processors.

Leading glass tempering process technology, advanced equipment R&D capability, strong production bases, complete sales & service network, all these are not only NorthGlass’s core competence, but also the powerful guarantee to NorthGlass furnaces’ efficient and stable running all over the world.

NorthGlass’s domestic reference customers are CSG, XYG, FUYAO, SYP, Taiwan Glass, FGG, etc., and the international reference customers are SGG, AGC, GUARDIAN, GLAS TROESCH, SCHOLLGLASS, SINGGLASS, VALENTINI, VITRO, etc. Multiple glass deep-processing technologies developed by NorthGlass have been successfully applied in a lot of famous construction projects all over the world. Several classic and representative projects with glass produced by NorthGlass and our furnaces are briefly introduced on Page 22-24.
Tempering Furnace Series

Top series (T-Series)

T-Series: Equipped standard with “Finer Heating Control Partition” and “Intelligent Heating Control System based on glass exit-chamber temperature”, suitable to produce highest quality tempered glass at large-scale production with high efficiency and stability. It is the ideal choice of domestic & foreign leading glass processors for industrial upgrading.

Advanced Series (A-Series)

A-Series: Equipped standard with “Intelligent Heating Control Module” and “Super Flat & Spotless technology” and optional with “Gapless Forced Convection technology”. A-series tempering furnace can efficiently & stably temper almost all glass with minor optical distortion and slight iridescence. It is the most popular choice of main tempered glass production furnace for all glass processors.

Basic Series (B-Series)

B-Series: After 20 years experience accumulation, B-series is the most mature tempering furnace who can produce domestic first-class quality tempered glass. With advantages of simple operating, easy maintenance and low investment, it is an affordable choice for small & medium-size glass processors.
Top Series (T-Series)

Ideal combined feature of accurate heating control by longitudinal convection pipes and uniform stress distribution by lateral convection arrangement ensure top quality large tempered glass curtain wall with both clear float and Low-E coated glass.

Significant advantages of high efficiency, energy saving and stability, guaranteed performance by adaptation of aerospace alloys material, thermal blocking bridge and passive cooling technologies.

Gapless Forced Convection technology

Convection Fan exclusively manufactured by NorthGlass

Significant advantages of high efficiency, energy saving and stability, guaranteed performance by adaptation of aerospace alloys material, thermal blocking bridge and passive cooling technologies.

Intelligent Heating Control Module

An innovative design of the heating process control, successfully eliminates the glass temperature deviation caused by thickness tolerance with real-time monitoring and control when the glass ends the heating chamber, resulting in higher glass processing efficiencies and a higher glass quality.

Staggered arrangement of 8-rows blowing nozzles combined with patented spraying section lateral swing structure are adopted for even quenching thereby reducing iridescence which allows North Glass to produce the world’s top quality glass.

Electrical control cabinets, co-designed by NorthGlass & SIEMENS, provides greater EMC and heat dissipation performances. The IPC with passive cooling book-type radiator, the electrical control system is stable and reliable.
NorthGlass’s long history of innovations in glass tempering technologies has been confirmed on the factory floor by several ultra-wide & super-long glass tempering furnaces being operated daily throughout the world, setting multiple world records with maximum glass size of 3.6x18m for both flat and bent tempered glass and 6.0x4.0m for bent tempered glass.

Ultra-wide & Super-long Tempered Glass

The radiation heating plates made of heat-resistant cast steel can bring more uniform and gentle heating to tempered glass, which ensures an extremely high quality of tempered glass, especially to large and thick glass panels, suitable for applications of household appliance glass, furniture glass and architectural glass.

Radiation Heating Plate

The cylindrical pathway formed by upper and lower rigid conveyor rollers, curvature along production direction, can produce the curved & tempered glass with fit and performance without bearing excess force during formation.

Bending & Tempering technology by Rigid Rollers

The new nanoscale thermal insulation material, co-developed by NorthGlass and a national scientific research institute, provides better heat retention and energy savings by blocking the internal micro air convection.

Nanoscale Thermal Insulation Material

Ideal combined features of accurate heating control by longitudinal convection pipes and uniform stress distribution by lateral convection arrangement ensure top quality large tempered glass curtain wall with both clear float and Low-e coated glass.

Gapless Forced Convection technology

Significant advantages of high efficiency, energy saving and stable, parametric performance by adoption of aerospace alloys material, thermal blocking bridge and passive cooling technologies.

Convection Fan exclusively made by NorthGlass

The independent intelligent Heating Control Module, co-developed by NorthGlass and our professional partners, enables a precise & stable heating control with distinct advantages of agility, anti-interference and with a quick response time.

Intelligent Heating Control Module

Heating control partition and more heaters ensure an accurate and better heating method for tempered glass. Resulting higher quality tempered glass.

Finer Heating Control Partition

Staggered arrangement of 8-rows blowing nozzles combined with patented operation section lateral swing structure are adopted for even operating thereby reducing turbulence which allows North Glass to produce the world’s top quality glass.

Super Flat & Spotless technology

Double measurements, two calculating methods, selection allows for more accuracy of glass length measurement thereby assisting with the continuity and stability of glass production.

Dual Photoelectric Sensors
glass length measurement

The cylindrical surface formed by flexible conveyor rollers, curvature perpendicular to production direction, can produce the curved & tempered glass with longer straight line exceeding the limitation of furnace width. The upward and/or downward formation methods can meet different processing requests for bent & tempered coated glass.

Upward / Downward Bending & Tempering technology by Flexible Rollers

The independent intelligent Heating Control Module, co-developed by NorthGlass and our professional partners, enables a precise & stable heating control with distinct advantages of agility, anti-interference and with a quick response time.

The new nanoscale thermal insulation material, co-developed by NorthGlass and a national scientific research institute, provides better heat retention and energy savings by blocking the internal micro air convection.

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Upward / Downward Bending & Tempering technology by Flexible Rollers

The new nanoscale thermal insulation material, co-developed by NorthGlass and a national scientific research institute, provides better heat retention and energy savings by blocking the internal micro air convection.

Nanoscale Thermal Insulation Material

Each section of NorthGlass furnace is controlled by a distributed sub-station, easy for assembling and maintenance, stable & reliable glass processing.

Control System by Sub-stations

NorthGlass’s long history of innovations in glass tempering technologies has been confirmed on the factory floor by several ultra-wide & super-long glass tempering furnaces being operated daily throughout the world, setting multiple world records with maximum glass size of 3.6x18m for both flat and bent tempered glass and 6.0x4.0m for bent tempered glass.
A-Series Furnace Specifications

<table>
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<tr>
<th>Width Code</th>
<th>Max. Glass Width (mm)</th>
<th>Local Bow (mm/300mm)</th>
<th>General Bow (‰)</th>
<th>Capacity (batch/hour)</th>
<th>Energy Consumption (kW·h/m²)</th>
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<td>0.08</td>
<td>3300</td>
<td>4.10</td>
</tr>
</tbody>
</table>

Optional Quench Sections

- 1-Type
- 2-Type
- 3-Type
- 5-Type
- 7-Type
- X1-Type
- X2-Type

Typical Furnace Assembly Examples

One-Way Furnace

Two-Way Furnace

Continuous Furnace
Significant advantages of high efficiency, energy saving and stability, guaranteed by adoption of aerospace alloys material, thermal blocking bridge and passive cooling technologies.

Convection Fan exclusively made by NorthGlass

The cylindrical pathway formed by upper and lower rigid conveyor rollers, curvature along production direction, can produce the curved & tempered glass with best goodness of fit without bearing excess force during formation.

The cylindrical surface formed by flexible conveyor rollers, curvature perpendicular to production direction, can produce the curved & tempered glass with longer straight line exceeding the limitation of furnace width. The upward and/or downward formation methods can meet different processing requests to bent & tempered coated glass.

Radiation Heating Plates

The radiation heating plates made of heat-resistant cast steel can bring more uniform and gentle heating to tempered glass, which ensures an extremely high quality of tempered glass. The radiation heat transfer makes the product safer and ensures good control over the expansion and contraction of the glass.

Grid-Array Forced Convection technology

Significant advantages of efficiency, energy-saving and stability, guaranteed by adoption of aerospace alloys material, thermal blocking bridge and passive cooling technologies.

Bending & Tempering technology by Rigid Rollers

The cylindrical surface formed by rigid rollers ensures accurate and precise bending and tempering. The design ensures that the glass is subjected to uniform stress, ensuring the highest quality of the finished product.

Bending & Tempering technology by Flexible Rollers

The cylindrical surface formed by flexible rollers allows for more precise and controlled bending and tempering. The flexibility of the rollers allows for the creation of more complex shapes.

Layered Thermal Insulation Materials

The heating chamber thermal insulation consists of different layers with progressive insulation performance and nano-titanium dioxide inorganic coating, which helps to ensure a more energy-efficient and environmentally-friendly operation.
B-Series Furnace Specifications

<table>
<thead>
<tr>
<th>Width Code</th>
<th>Max. Glass Width (mm)</th>
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<td>E</td>
<td>2850</td>
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<td>S</td>
<td>3300</td>
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</tbody>
</table>

Optional Quench Sections

1-Type
2-Type
5-Type
7-Type
X1-Type
X2-Type

B-Series Furnace Assembly Examples

B12B5012
B15B50
Typical Applications of Different Quenching Sections

1-Type
- Quenching section for flat tempered glass

2-Type
- Bent forming & quenching section by rigid rollers for cylindrical bent tempered glass with straight edge perpendicular to production direction.

3-Type
- Bent forming & quenching section by mould for multi-curvature bent tempered glass.

5-Type
- Bent forming & quenching section by flexible rollers for cylindrical bent tempered glass with straight edge parallel to production direction.

7-Type
- Bent forming & quenching section by flexible rollers for single surface but multi-curvatures bent tempered glass.

X1-Type
- Quenching section for one-way transmission continuous flat tempering

X2-Type
- Bent forming & quenching section by rigid rollers for one-way transmission continuous bent tempering with straight edge perpendicular to production direction.

Reference Glass Applications & Tempering Furnace Used

Shanghai Tower
Glass makeup: 6mm Glazed glass HS + 1.52PVB + 6mm Solar control coated glass + 6mm +16 AR + 6mm Clear glass + 0.38PVB + 6mm Clear glass
Furnace used: B2252536 & B158050

National Bank of Kuwait
Glass makeup: 8mm Heat reflective glass + 1.52PVB + 8mm clear glass HS + 16A + 6mm double Ag Low-E glass
8mm Heat reflective glass + 1.52PVB + 8mm clear glass Tempered + 16A + 6mm double Ag Low-E glass + 1.52PVB + 6mm Tempered glass
Furnace used: AG15B50 (bending upwards & downwards)
Reference Glass Applications & Tempering Furnace Used

Headquarters of the world’s most famous consumer electronics company, US
Furnace used: AU15M180, SC15K15050, AG1T165

London Leiden Building, UK
Glass makeup: 6mm glazed glass HS+1.52PVB+6mm SunGuard SN51/28 Low-E glass HS (4#) +16 AR + 6mm clear glass+0.38 PVB + 6mm Clear glass
Furnace used: AD15B80-GUD

Manchester Town Hall, UK
Glass makeup: 3×12mm low iron glass curved tempered HST+2×1.52 SGP
Furnace used: AC15E128

Abu Dhabi Airport, UAE
Glass makeup: 6mm glazed glass HS+1.52 PVB+6mm Low-E coated glass HS+12A+6mm glass HS+1.52 PVB+6mm glass HS
Furnace used: AG12S9042
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