

SAFETY GLASS | ARCHITECTURAL PROCESSING | IS 2553 | EN 12150 | ASTM C1048

# Toughened / Fully Tempered Glass

Strength, Safety & Design — Without Compromise

IPH Glasses processes toughened glass across a full range of substrates and coatings — a compliant, high-performance safety glazing solution for every project type, from residential balustrades to high-rise curtain walls.

## PRODUCT CATEGORY

Safety Glass  
Architectural Processing  
IS 2553  
EN 12150  
ASTM C1048

## AUTHORIZED DISTRIBUTOR

Guardian Glass | Saint-Gobain  
Kuraray | Technoform | Fenzi

PRODUCT OVERVIEW

# Toughened / Fully Tempered Glass

Engineered for safety, performance, and architectural excellence.

Toughened — also called Fully Tempered — glass is a thermally processed safety glass manufactured by heating annealed glass to approximately 620°C then rapidly cooling it with forced convection air jets. This controlled quenching introduces high compressive stresses into the glass surface, producing a product typically **4 to 5 times stronger** than standard annealed glass of equivalent thickness. When broken, it fractures into small, blunt-edged fragments rather than sharp shards — a fundamental safety characteristic mandated by building codes worldwide.

|                                                         |                                                             |                                               |                                                         |
|---------------------------------------------------------|-------------------------------------------------------------|-----------------------------------------------|---------------------------------------------------------|
| <div>4–5×</div> <div>Stronger than annealed glass</div> | <div>69–110 MPa</div> <div>Surface compressive stress</div> | <div>4–12 mm</div> <div>Thickness range</div> | <div>2850 × 6000 mm</div> <div>Maximum panel size</div> |
|---------------------------------------------------------|-------------------------------------------------------------|-----------------------------------------------|---------------------------------------------------------|

PRODUCT FEATURES

## Key Features

|                                                                                                                                                                                                                 |                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div><b>Superior Mechanical Strength</b></div> <div>Compressive surface stress of 69–110 MPa gives toughened glass exceptional resistance to mechanical loads, wind pressure, and thermal stress.</div>         | <div><b>Safe Breakage Pattern</b></div> <div>Fractures into thousands of small, cuboid fragments with no sharp edges — dramatically reducing the risk of laceration injuries on failure.</div>                |
| <div><b>Broad Substrate Compatibility</b></div> <div>Processed across clear, extra clear, ultra clear, tinted, solar-control coated, and low-E coated glass — single, double, and triple silver coatings.</div> | <div><b>Surface Treatment Versatility</b></div> <div>Compatible with ceramic-frit printing, digital printing, sandblasting, and acid etching — enabling full aesthetic and solar-control customisation.</div> |
| <div><b>Thermal Resistance</b></div> <div>Withstands greater thermal differentials than annealed glass — suitable for solar-exposed and partially shaded facade applications.</div>                             | <div><b>Single-Source Upgrade Path</b></div> <div>Upgradeable to Insulated Glass Units or Laminated Glass within IPH Glasses' own processing line.</div>                                                      |
| <div><b>Wide Thickness Range</b></div> <div>4 mm to 12 mm to meet structural, safety, and aesthetic requirements across diverse architectural applications.</div>                                               | <div><b>Edge Finish Options</b></div> <div>Rough grind, arrissed, or super polished edges — for exposed, frameless, and point-fixed glazing applications.</div>                                               |

TECHNICAL DATA

## Technical Specifications

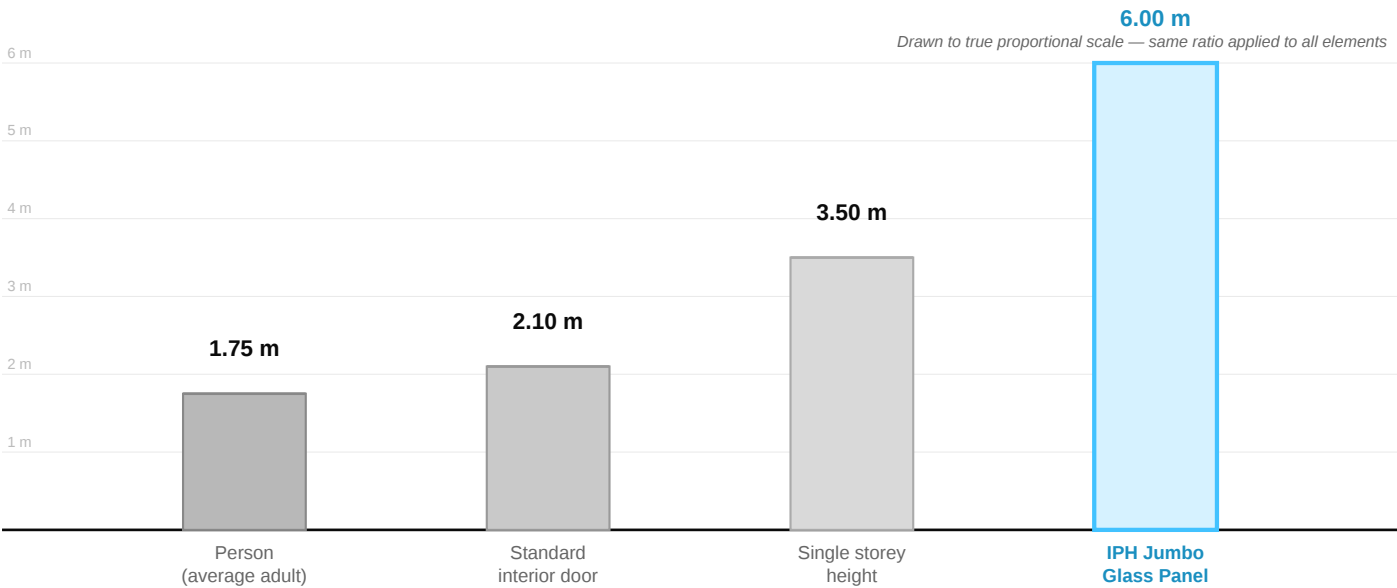
| Parameter | Specification |
|-----------|---------------|
|-----------|---------------|

|                            |                                                                                                               |
|----------------------------|---------------------------------------------------------------------------------------------------------------|
| Process Type               | Horizontal Roller — Forced Convection Furnace                                                                 |
| Glass Substrate Types      | Clear, Extra Clear, Ultra Clear, Tinted, Solar-Control Coated, Low-E Coated (Single / Double / Triple Silver) |
| Surface Treatments         | Ceramic Frit Printing, Digital Printing, Sandblasting, Acid Etching                                           |
| Upgrade Path               | Insulated Glass Unit   Laminated Glass                                                                        |
| Thickness Range            | 4 mm / 5 mm / 6 mm / 8 mm / 10 mm / 12 mm                                                                     |
| Edge Finishes              | Rough Grind   Arrissed   Super Polished                                                                       |
| Surface Compressive Stress | 69 MPa – 110 MPa (10,000 – 16,500 psi)                                                                        |
| Emissivity                 | Minimum 0.01 (with low-E coated substrates)                                                                   |
| Safety Classification      | Safety Glass — Class A per applicable standards                                                               |
| Maximum Dimensions         | 2,850 mm × 6,000 mm (subject to thickness)                                                                    |

MAXIMUM DIMENSIONS

Jumbo Glass Capability & Scale

IPH Glasses processes panels up to **2,850 mm × 6,000 mm** — enabling large, uninterrupted glass surfaces that reduce joint lines and elevate the visual quality of architectural facades, atriums, and interior spaces. The scale diagram below is drawn to true proportion: every bar uses the same fixed scale factor.



**Maximum panel width:** 2,850 mm — shown separately from height, as glass panels are supplied to project-specific width and height combinations up to these maximum dimensions.

| Reference Object              | Typical Dimensions | How IPH Glass Compares                                                    |
|-------------------------------|--------------------|---------------------------------------------------------------------------|
| Standard interior door        | 900 × 2,100 mm     | IPH panel height is 2.9× a standard door height                           |
| Typical floor-to-floor height | 3,000 – 3,600 mm   | A single IPH panel can span the full floor-to-ceiling height in one piece |
| Average adult height          | ~1,750 mm          | IPH panel height is 3.4× the height of an average adult                   |

|                                          |                 |                                                                                                    |
|------------------------------------------|-----------------|----------------------------------------------------------------------------------------------------|
| ISO shipping container height            | <b>2,591 mm</b> | IPH panel height is 2.3× the height of a standard shipping container                               |
| Maximum panel width (separate dimension) | <b>2,850 mm</b> | Width and height are supplied independently up to these maximums, in project-specific combinations |

- A single toughened glass panel at maximum dimensions covers the full facade width of most residential floor plans.
- Larger panel sizes reduce the number of visible joints in a curtain wall — improving facade aesthetics and weather-tightness.
- Available in thicknesses from 4 mm (lightweight partitions) to 12 mm (structural facades and frameless balustrades).

#### STANDARDS & COMPLIANCE

## Applicable Standards

IPH Glasses processes and supplies this product in compliance with the following Indian (IS/BIS), European (EN/ISO), American (ASTM/UL/NIJ), and Australian/New Zealand (AS/NZS) standards:

| Standard Code                                                         | Title & Scope                                                                                                                  |
|-----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>Indian Standards — Bureau of Indian Standards (BIS)</b>            |                                                                                                                                |
| <b>IS 2553 Part 1 : 1990</b>                                          | Safety glass — General requirements and test methods (India)                                                                   |
| <b>IS 14900 : 2000</b>                                                | Transparent float glass — Specification (India)                                                                                |
| <b>IS 10217 : 1982</b>                                                | Glass for glazing — Specification (India)                                                                                      |
| <b>European Standards — CEN</b>                                       |                                                                                                                                |
| <b>EN 12150-1 : 2015</b>                                              | Glass in building — Thermally toughened soda lime silicate safety glass — Definition and description                           |
| <b>EN 12150-2 : 2004</b>                                              | Glass in building — Thermally toughened soda lime silicate safety glass — Evaluation of conformity                             |
| <b>EN 572-1 : 2012</b>                                                | Glass in building — Basic soda lime silicate glass products — Part 1: Definitions and general physical properties              |
| <b>EN 572-2 : 2012</b>                                                | Glass in building — Float glass                                                                                                |
| <b>EN 1863-1 : 2011</b>                                               | Glass in building — Heat strengthened soda lime silicate glass — Part 1: Definition and description (for reference comparison) |
| <b>EN 14179-1 : 2005</b>                                              | Glass in building — Heat soaked thermally toughened soda lime silicate safety glass                                            |
| <b>European Standards — CEN / ISO</b>                                 |                                                                                                                                |
| <b>EN ISO 12543-1 : 2011</b>                                          | Glass in building — Laminated glass and laminated safety glass — Part 1: Definitions and description                           |
| <b>ASTM International — USA</b>                                       |                                                                                                                                |
| <b>ASTM C1048 : 2018</b>                                              | Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass — Kind FT (Fully Tempered)                          |
| <b>ASTM C1036 : 2016</b>                                              | Standard Specification for Flat Glass                                                                                          |
| <b>ASTM E1300 : 2016</b>                                              | Standard Practice for Determining Load Resistance of Glass in Buildings                                                        |
| <b>ASTM C1172 : 2014</b>                                              | Standard Specification for Laminated Architectural Flat Glass                                                                  |
| <b>Australian / New Zealand Standards — Standards Australia / SNZ</b> |                                                                                                                                |
| <b>AS/NZS 2208 : 1996</b>                                             | Safety glazing materials in buildings — Australian/New Zealand Standard                                                        |
| <b>AS 1288 : 2006</b>                                                 | Glass in buildings — Selection and installation — Australian Standard                                                          |
| <b>AS/NZS 4667 : 2000</b>                                             | Quality requirements for cut-to-size and processed glass                                                                       |
| <b>AS/NZS 4666 : 2012</b>                                             | Insulating glass units — Australian/New Zealand Standard (reference for IGU upgrade)                                           |

#### ARCHITECTURAL APPLICATIONS

## Applications

|                                                                                                                                                                                 |                                                                                                                                               |                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>Commercial Facades</b><br><br>High-rise curtain walls, unitised systems, structural glazing, and frameless shopfronts requiring wind load compliance and safety performance. | <b>Residential Buildings</b><br><br>Balcony balustrades, floor-to-ceiling windows, sliding doors, shower enclosures, and internal partitions. | <b>Hospitality &amp; Hotels</b><br><br>Glass facades, pool enclosures, lobby partitions, and architectural feature walls. |
| <b>Airports &amp; Transport</b><br><br>Roof glazing, atrium structures, boarding bridges, and passenger partitions where overhead safety is paramount.                          | <b>Retail &amp; Commercial</b><br><br>Frameless display cases, glass flooring, staircases, and mezzanine balustrades.                         | <b>Healthcare Facilities</b><br><br>Hygienic glass partitions, observation windows, and easy-clean clinical areas.        |
| <b>Educational Buildings</b><br><br>Classroom partitions, sports hall glazing, and canopy structures.                                                                           | <b>Solar &amp; Energy</b><br><br>Photovoltaic cover glass, solar thermal collectors, and energy-efficient facades.                            | <b>Industrial Applications</b><br><br>Machine guards, control room glazing, cleanroom partitions.                         |

COMPARISON

## Product Comparison

| Performance Attribute | Standard Float Glass                            | Toughened / Fully Tempered Glass                                      |
|-----------------------|-------------------------------------------------|-----------------------------------------------------------------------|
| Breakage Pattern      | ✗ Sharp, dangerous shards — serious injury risk | ✓ Small, blunt fragments — safe breakage per IS/EN/ASTM/AS NZS        |
| Mechanical Strength   | ✗ Baseline flexural strength — limited span     | ✓ 4–5× stronger — enables larger spans, thinner profiles              |
| Thermal Resistance    | ✗ Low — prone to thermal breakage               | ✓ High — suitable for solar-exposed facades in India's climate        |
| Wind Load Capacity    | ✗ Limited — requires heavy profiles             | ✓ Higher capacity — enables thinner, lighter framing                  |
| Surface Treatment     | ✗ Limited compatibility with post-processing    | ✓ Ceramic frit, digital print, sandblast, acid etch — all compatible  |
| Safety Compliance     | ✗ Not compliant for regulated applications      | ✓ IS 2553   EN 12150   ASTM C1048   AS/NZS 2208 compliant             |
| Upgrade Path          | ✗ No upgrade available                          | ✓ Upgradeable to Insulated or Laminated Glass within IPH supply chain |

MANUFACTURING EXCELLENCE

## Quality Assurance

Every panel processed at IPH Glasses passes through a structured, multi-stage quality control process — from incoming raw material to final pre-dispatch inspection.

### Raw Material Verification

Incoming float glass and component materials (interlayers, spacers, sealants) are checked against supplier specification before entering production.

### Optical Quality Inspection

Glass surfaces are visually inspected for distortion, bow, roller wave, and coating defects prior to dispatch.

### Edge Quality Inspection

Edge finish (rough grind, arissed, or super polished) is checked for consistency and conformance to the specified finish.

### Batch Traceability

Production records link each panel batch to its raw material source, processing parameters, and quality check results.

### Process-Controlled Manufacturing

Furnace temperature, cooling rate, lamination pressure, and IGU assembly parameters are monitored and logged at each processing stage.

### Dimensional Accuracy Checks

Panel dimensions, squareness, and thickness are verified against project specification tolerances.

### Toughening Process Validation

Surface compressive stress and fragmentation pattern are verified on sample panels from each production batch to confirm heat treatment compliance.

### Final Pre-Dispatch Sign-Off

A final inspection is carried out before packing and dispatch, confirming the panel meets project specification and IPH Glasses' internal quality criteria.

#### OUR CAPABILITY

## Why Choose IPH Glasses?

IPH Glasses — operating as Mahavir Glass Enterprise — is one of Gujarat's most trusted architectural glass processors and authorized distributors for Guardian Glass and Saint-Gobain. We serve architects, developers, facade consultants, and PMC teams from our facility in Kheda, Gujarat.

### Authorized Distributor

Guardian Glass and Saint-Gobain — certified supply chain, authentic products with full traceability.

### Complete Product Range

Toughened, laminated, insulated, digital printed, curved, anti-burglar, and bullet-resistant glass — all from one processor.

### Multi-Stage Quality Control

Raw material verification, in-process inspection, optical and dimensional accuracy checks, and final pre-dispatch quality sign-off on every batch.

### Advanced Processing

Horizontal roller furnace, autoclave lamination, and fully automatic IGU assembly line.

### Technical Support

In-house team for glass selection, specification writing, performance calculations, and full project delivery support.

### Export Experience

Supplying projects across India, East Africa, Congo, Sri Lanka, and expanding international markets.

#### CONTACT & TECHNICAL SUPPORT

## Get in Touch

| Head Office & Factory                                          | Sales & Technical                                         | Digital Presence                                                                  |
|----------------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------------------------------|
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Our technical team is available to assist with glass selection, specification writing, performance calculations, and project-specific requirements. Contact us to schedule a technical consultation or to request samples and project pricing.

This catalogue is for reference purposes. Specifications subject to change. Consult IPH Glasses technical team for project-specific recommendations.