

IGP INSULATION GLASS & POLYCARBONATE Development of Window Unit

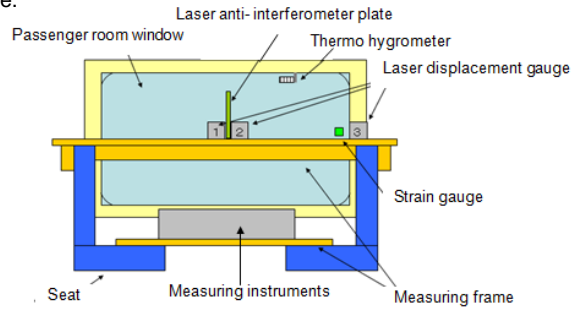
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OUTLINE Passenger room windows in a railway vehicle are made of safety glass or its equivalent in property according to Japanese laws. With the aim of reducing the number of injuries to passengers due to broken glass windows, the safety glass is processed sheet glass and also classified as tempered glass, laminated glass and double-glazing unit. Railway operators use double-glazing unit in many of their limited express train cars, intended to improve heat insulation properties.

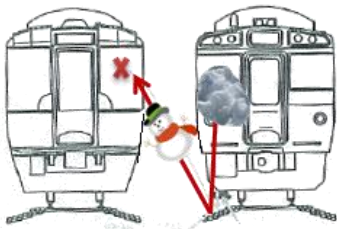


ON-TRACK TEST In IGP passenger room window in 261-series 1000 limited express train diesel car, the deflection and strain were measured in a running vehicle to examine the strength and rigidity properties. The changes in temperature and humidity in IGP's air layer were observed to confirm the quality and air tightness. In the performance test, the displacements were measured in the middle of outer polycarbonate plate and inner glass, and in the inner car body, from the passenger room, using laser displacement gauge. The deflection was determined from the difference among the displacements. Using a strain gauge placed between the polycarbonate plate and glass, each external stress was calculated from the measured data to find that it is within the allowable design value.



PURPOSE OF DEVELOPMENT

There have been many damage reports on the glass by a lump of snow attached to and frozen at a vehicle in winter that has fallen and hit on the ballast. In order to prevent such damages, our technical team developed Window Unit of Insulation Glass & Polycarbonate (IGP) by coating the window with polycarbonate.



Frozen snow at the window fell down to the ballast. Then it bounced and damaged the window.



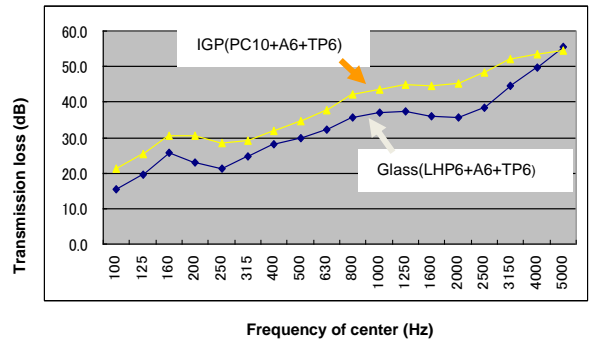
COMPARISON IN STRENGTH

Falling steel ball impact test **Glass and IGP**

	Sealed insulating glass	IGP
Structure	<p>30kg</p> <p>LHP6 + A6 + TP6</p>	<p>27kg</p> <p>PC10 + A6 + TP6</p>
Before Testing		
After Testing		
Magnified View	<p>Ball Weight: 2.08kg</p>	

The data obtained are as follows;

- The maximum deflection was +6.88mm in the outer polycarbonate plate and +5.82mm in the inner glass.
- In the 2-day performance test, the maximum deflection was found at the same point (while running in the tunnel).
- There was no stress problem in the results of strain measurement.
- The data in the air layer within double window was favorable from 7 to 11% RH in the results of temperature and humidity measurement.
- The maximum residual deflection was a small value at 0.4mm after the test, showing favorable window design and installation.



EXPECTED EFFECTS

- **PREVENTION OF DAMAGE TO GLASS WINDOWS**
 IGP protects the window from damage: outer surface consists of the polycarbonate resin plate which is over 30 times stronger than the glass window.
- **IMPROVEMENT IN ABRASION RESISTANCE**
 IGP, polycarbonate resin plate, is the silicon hard-coated window. It proves good abrasion resistance.
- **PRODUCTION OF LIGHTER RAILWAY VEHICLES**
 The weight of polycarbonate resin plate, its remarkable feature, is only 1/2 against the glass window and it makes railway vehicles lighter.
- **IMPROVEMENT IN HEAT INSULATION CAPACITY**
 The thermal conductivity in outer surface is one fourth against the glass window. Also, due to its multi-layered structure with high thermal resistance, IGP improves the heat insulation capacity.
- **IMPROVEMENT IN SOUND INSULATION PERFORMANCE**
 Sound insulation performance improves with a combination of different types of materials (polycarbonate and glass).