

## GLASS TEST REPORT

**Question:** There are many options for transit glass, some offering energy rejecting properties they say are comparable to ThermoGUARD glass. ThermoGUARD glass advertises it will save fuel and battery energy, reduce heater and AC usage, reduce AC breakdown, and reduce emissions because of its superior energy rejecting properties. Is ThermoGUARD glass better than the Industry Energy Rejecting Glass?

**Hypothesis:** Not all glass is created equal. Standard glass allows Infrared heat, UV and varying amounts of visual light to pass through. Customized high performance energy rejection glass prevents heat causing energy to pass through while allowing the maximum amount of light to pass through. There are glass combinations that yield superior properties that reject infra-red heat, stop 100% of the UV light from passing through the glass, and allows the most amount of visual light to pass.

**Experiment:** Our focus is on AS2 and AS3 for bus or rail. AS2 requires 70% or greater visual light transmission. AS3 tinted glass can only be located behind the driver area. The goal is to compare various types of glass by subjecting them to a heat lamp and measuring the BTU thermo-properties with a solar power meter. All sample glass properties are subjected to two different temperature tests.

- Test One: The meter is positioned 16 inches away from the heat source measuring 100 BTU with no glass barrier. Each glass sample was placed between the Portable Heat Lamp and Solar Power Meter and the BTU thermo-properties were measured for comparison.
- Test Two: The meter is positioned 10 inches away from the heat source measuring 300 BTU with no glass barrier. Each glass sample is positioned between the Portable Heat Lamp and Solar Power Meter for 20 minutes while recording the BTU thermo-properties at specific intervals.

### **Equipment required to complete the evaluation test:**

- Portable Heat Lamp
- EDTM WP4500 Window Energy Profiler measuring UV, LT, IR, and SHGC
- EDTM SP1065 BTU Meter measuring BTU/HR\*FT<sup>2</sup>
- Tape Measure
- Glass Stand - fixed distance(s)
- Stop Watch
- Glass Samples
  - RCCT-4 (Industry Energy Rejecting Glass) [AS2/AS3]
  - ThermoGUARD BS70L [AS2/AS3]
  - ThermoGUARD BS65L [AS3]
  - ThermoGUARD BS55L-X [AS3]



**Test One:** The meter is positioned 16 inches away from the heat source measuring 100 BTU with no glass barrier. Each glass sample was placed between the Portable Heat Lamp and Solar Power Meter and the BTU thermo-properties were measured for comparison.

**Data Test One:**

GLASS	BTU/HR*FT <sup>2</sup>	UV	LT	IR	SHGC	
NONE	100					
RCCT-4	12	47		73	12	0.45
BS70L	8	0		70	7	0.38
BS65L	4	0		65	3	0.33
BS55L-X	0	0		54	0	0.28

**Analysis Test One:**

**AS2:**

- BS70L reduced the BTU by 33% when compared to RCCT-4 (Industry Energy Rejecting Glass)
- BS70L outperformed RCCT-4 (Industry Energy Rejecting Glass) by also blocking 100% of cancer causing UV
- BS70L blocks 3% more visible light. The light blue tint reduces glare while still allowing security teams excellent vision into the bus
- Solar Heat Gain (SHGC) is influenced by the IR value and contributes to interior temperatures. The lower the Solar Heat Gain the cooler the interior will stay. **ThermoGUARD** BS70L outperforms RCCT-4 (Industry Energy Rejecting Glass) by 17%.

**AS3:**

- All 3 **ThermoGUARD** options reduced BTU/HR\*FT<sup>2</sup>. BS70L outperformed by 33%, BS 65L by 66%, and BS55L-X blocked 100% of energy.
- All 3 **ThermoGUARD** options stopped 100% of the UV compared to the Industry Energy Rejecting Glass that stopped 47% of cancer causing UV
- BS55L-X rejected 100% IR, BS65L blocked 97% IR, and BS70L stopped 93% IR energy compared to the Industry Energy Rejecting Glass which allowed 12% IR to pass through
- Solar Heat Gain (SHGC) is influenced by the IR value and contributes to interior temperatures. The lower the Solar Heat Gain the cooler the interior will stay. **ThermoGUARD** outperforms Industry Energy Rejecting Glass by up to 38% when compared to BS53L-X

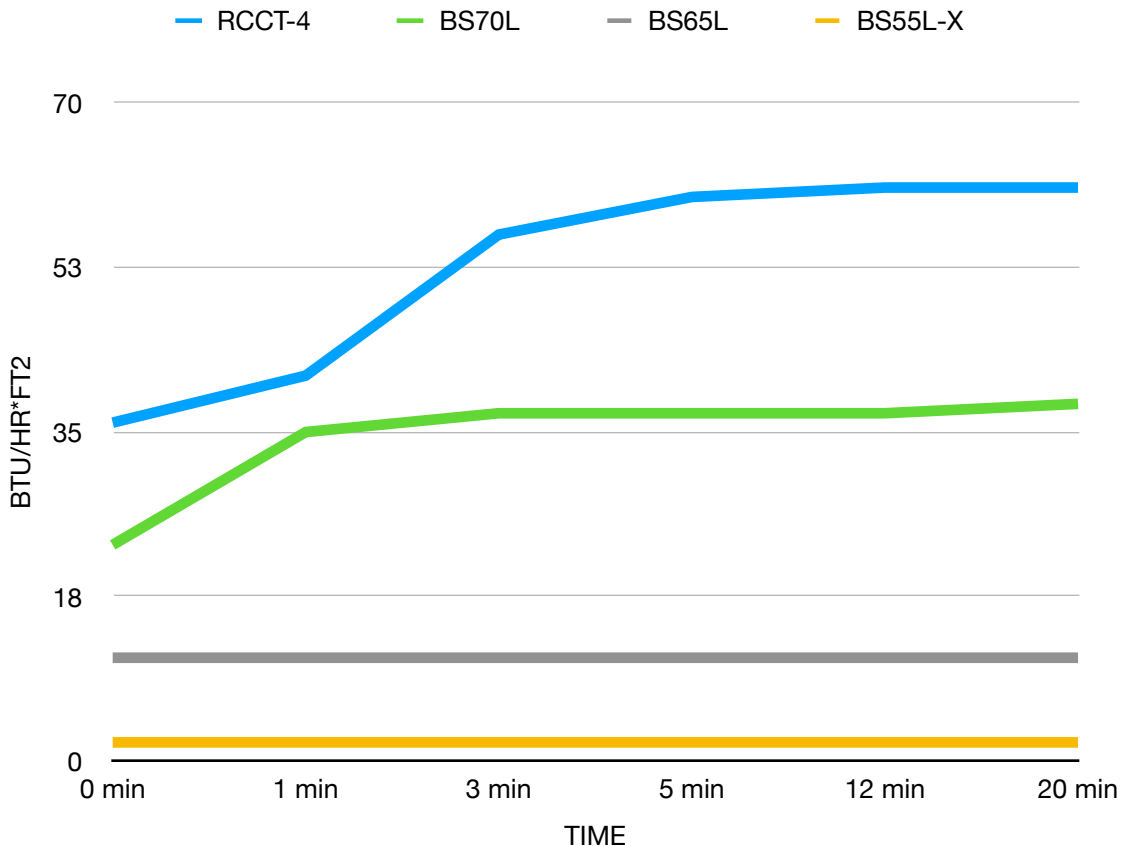


**Test Two:** The meter is positioned 10 inches away from the heat source measuring 300 BTU with no glass barrier. Each glass sample is positioned between the Portable Heat Lamp and Solar Power Meter for 20 minutes while recording the BTU thermo-properties at specific intervals.

**Data Test Two:**

BTU/ HR*FT <sup>2</sup>	300		300		300		300	
TIME	0	1m	3m	5m	12m	20m		
GLASS								
RCCT-4	36	41	56	60	61	61		
BS70L	23	35	37	37	37	38		
BS65L	11	11	11	11	11	11		
BS55L-X	2	2	2	2	2	2		

**Analysis Test Two:**



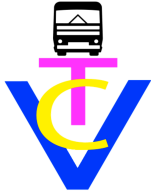
**AS2:**

- RCCT-4 (Industry Energy Rejecting Glass) increased in BTU until 12min when it held steady
- BS70L started off rejecting 36% more energy and even as the BTU increased it continued to reject 36% more at the 20 minute mark

**AS3:**

- BS65L blocked 88% more energy and held steady for 20min when compared to RCCT-4 (Industry Energy Rejecting Glass)
- BS55L-X rejected 97% more energy when compared to RTCC-4 (Industry Energy Rejecting Glass) for the entire 20min test

**Conclusion:** When subjected to the same temperature conditions, **ThermoGUARD** glass is superior to the industry energy rejecting glass. The more energy that comes into the bus the warmer the bus will stay and the more the driver will have to keep the AC on. The Industry Energy Rejecting Glass provides the least amount of heat protection and no protection from cancer causing UV to passengers or drivers. By lowering the infrared heat and solar heat gain, **ThermoGUARD** glass can keep the occupants more comfortable, reduce heater and AC usage and reduce AC breakdown. Keeping the interior cool and rejecting energy loss saves fuel and battery energy, reduces emissions. When compared to those claiming to be equal, **ThermoGUARD** high performance heat rejection glass significantly out performed the competition.



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Reference: Glass Performance Test  
Date: 5/9/22  
Subject: Statement

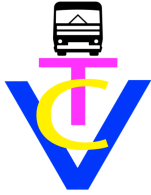
Dear Mike Candelaria,

I would like to take this opportunity to verify the three glass performance tests and the data on page 2. I was present as the tests were performed utilizing the test equipment provided. I did verify the numbers as presented to me.

	<b>Description</b>	<b>Equipment</b>
Test One	Properties Measurement - LT, UV, IR, SHGC	EDTM WP4500 Window Energy Profiler
Test Two	BTU Performance Test 16 inches	100 BTU Solar Lamp, EDTM SP1065 BTU Meter
Test Three	BTU Performance Test Over 20 minutes, 10 inches	300 BTU Solar Lamp, EDTM SP1065 BTU Meter

Sincerely,

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Data Test One & Test Two

GLASS	BTU	UV	LT	IR	SHGC	INCHES
	100					16
RCCT-4	12	47	73	12	0.45	
BS70L	8	0	70	7	0.38	
BS65L	4	0	65	3	0.33	
BS55L-X	0	0	54	0	0.28	

Data Test Three

BTU	300	300	300	300	300	300	INCHES
							10
TIME	0d	1m	3m	5m	12m	20m	
RCCT-4	36	41	56	60	61	61	
BS70L	23	35	37	37	37	38	
BS65L	11	11	11	11	11	11	
BS55L-X	2	2	2	2	2	2	