

2012 International Energy Conservation Code – Yossi Vinograd

- Section 303.1.3 of IECC 2012
 - VT and SHGC per NFRC 200 or be assigned default values from

TABLE C303.1.3(3)
 DEFAULT GLAZED FENESTRATION SHGC AND VT

	SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
	Clear	Tinted	Clear	Tinted	
SHGC	0.8	0.7	0.7	0.6	0.6
VT	0.6	0.3	0.6	0.3	0.6

- Section C402.3.1.1 of IECC 2012
 - **Fenestration (Prescriptive).** Fenestration shall comply with Table C402.3. Automatic daylighting controls specified by this section shall comply with Section C405.2.2.3.2.

Essentially:

- Increase daylight vertical area from 30% to 40% with daylighting control
- LSG ratio must be 1.1 or greater.



Intro to Translucent Panel VT Proposed NFRC Test Method

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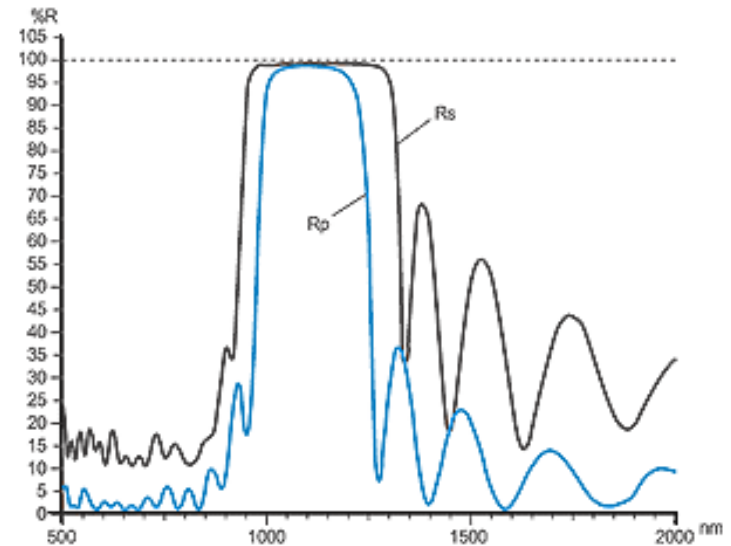
9 November 2011

In the Beginning

- **ASTM E-424** was published in 1971
- **Title:** *Standard Test Methods for Solar Energy Transmittance and Reflectance (Terrestrial) of Sheet Materials*
- The 2007 reapproved version retains the two methods available:
- **Method A:** spectrophotometric measurement of small, homogeneous samples in an integrating sphere spectrophotometer
- **Method B:** “Pyranometer Method” for outdoor tests with shallow black box

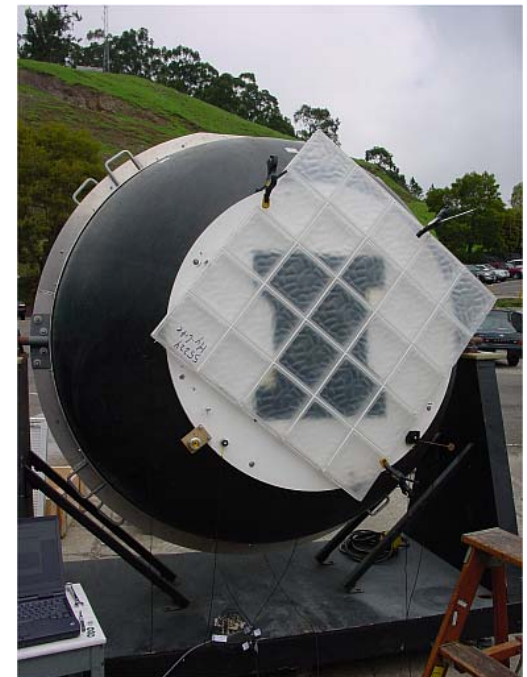
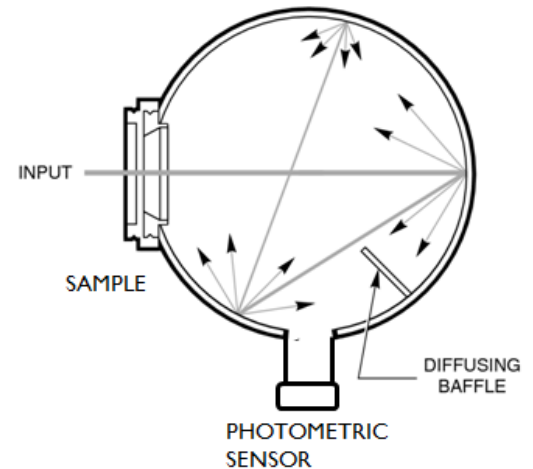


Hitachi U-4100 UV-Visible-NIR Spectrophotometer



Method B: “Pyranometer Method”

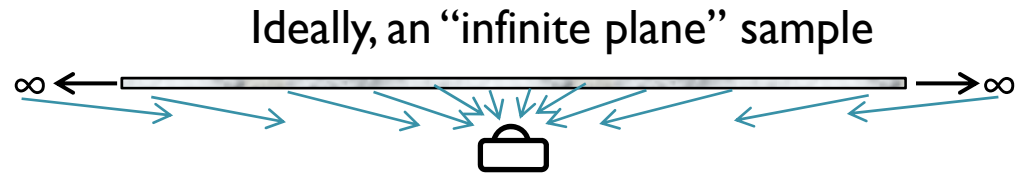
- Ideally, the test would be done:
 - Outdoors
 - with a relatively large sheet of the thick, spatially-variable-transmittance, possibly corrugated, sample
 - on the entrance port of a large integrating sphere
 - With a solar pyranometer inside,
 - replaced by a photometric sensor for VT measurements
- Integrating sphere demo



LBNL 2m integrating sphere

However

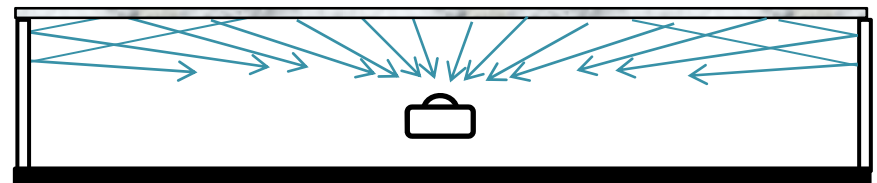
- The integrating sphere should be much larger than the sample port
- Samples as large as 24" across should be accommodated
- Large integrating spheres are expensive
- It was decided that a simpler, cheaper substitute could work



Small radiometric or photometric sensor "sees" all angles of emergence from the infinite sheet, so yields results similar to what an integrating sphere would provide

"Infinite sheets" of material are difficult to come by

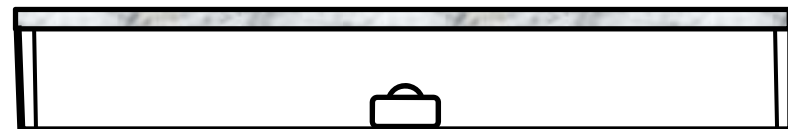
Alternative:



Mirror walls turn a finite sheet into an infinite one. Black base absorbs incident flux, preventing reflections back to the sample

E424 Method B

- Shallow black box test apparatus used outdoors in the sun
- Positioned to face the sun during measurements
- Pyranometer replaced by a photometric sensor
- $$VT = \frac{\text{Covered signal}}{\text{Uncovered signal}}$$



Covered – transmitted illuminance



Uncovered – incident illuminance

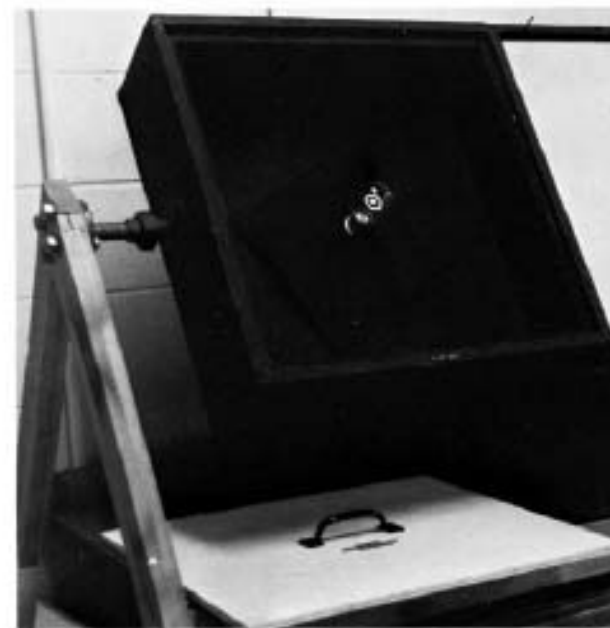


FIG. 1 Typical Unit with Pyranometer Mounted in Black Box

E424 1971 Method B photograph

The ASTM E-44 Solar Energy Committee

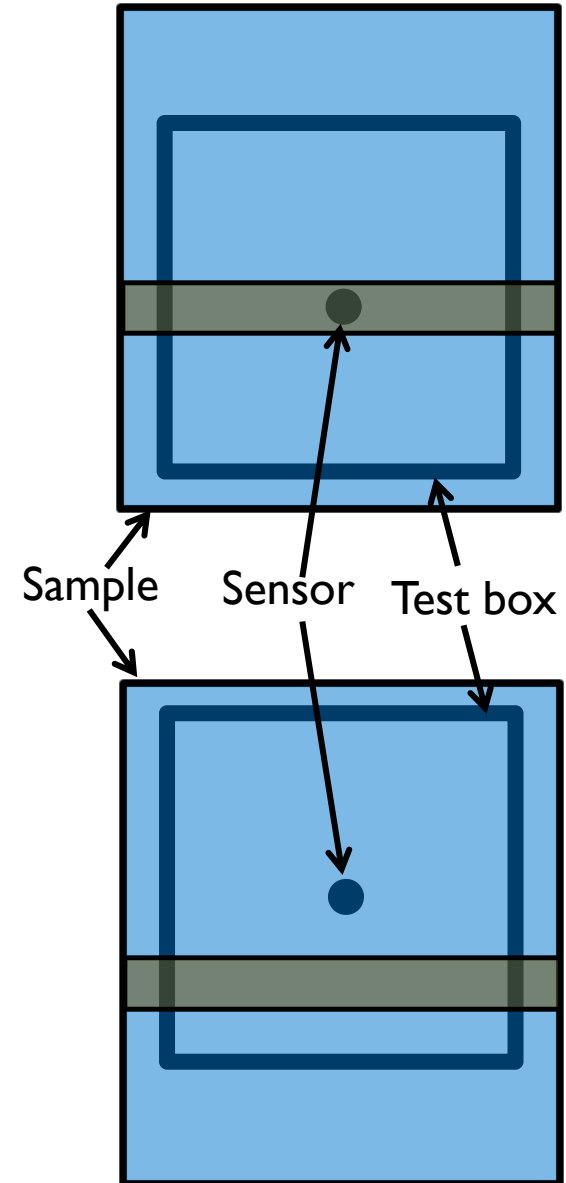
- I joined E-44 in the mid-80s
- They were in the midst of replacing Methods A and B of E424 with some new and revised standards
- E903 was for the (spectral) *Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres*
- E1175 Described a large diameter integrating sphere standard solar transmittance test
- **E1084** Dealt with the E424 Method B, the “Pyranometer Method” and was published in 1986, reapproved in 1996 and again in 2009
- **E972** specified a replacement of the pyranometer in standards E1084 and E1175 with a photometric sensor
- Footnote: E424 was never withdrawn!

NFRC: Visible Transmittance Testing of Translucent Panels

- It seemed obvious to us that either
 1. the E1175 large integrating sphere solar transmittance test **or**
 2. the Method B mirrored black box test of E1084

would be ideally suited for translucent panels

- E1084 was less expensive and more practical
- E1084 anticipated the potential for dark inhomogeneities in the sample producing different VT values if positioned over the top of the sensor or away from it
- Solution: Translate the sample a little and take another VT reading, then repeat the sequence several times, averaging the resulting VT values
- This stipulation is in the ASTM standard



What our Translucent Panel TG Did

- Wrote a draft test procedure for NFRC to use E 1084 and E 972 to do the test
- Added a list of products to be tested with this method and products that can not be tested with this method
- Provided a 39" x 39" sample size limit, to match an existing NFRC standard size
- Gave more detail on the method of translation between repeated measurements

Where We Ran Into Trouble

- **Issue over research projects:**
 - **The “complex products long-term research project”**
 - A large, slow program being done by LBNL – Not appropriate nor timely enough for this test method
 - **Testing of products on LBNL 2 m integrating sphere this summer**
 - There is no official NFRC research project to validate our black box procedure. The tests LBNL did this summer were informal and used the integrating sphere method only, not the draft standard test box. The results will be of engineering interest but will not directly validate or invalidate the proposed procedure.
 - However, LBNL is looking at ways to do area-weighted calculations of clear and opaque portions of inhomogeneous specimens. This can lead to simplifications in future testing, if proven possible.
 - **Is the E1084 test reliable and good enough?**
 - The history of this basic test within ASTM, dating back to 1971, and its use by industry over the years should be sufficient justification for the approach
 - If not, someone has to get into ASTM records and other ancient history to see what, if any, validation or verification tests were performed
 - Or we could switch to the E1175 large diameter integrating sphere approach, in which case a 3 to 5 meter sphere might be needed

Questions on “Calibration”

- Distinction between Specifications and Calibration
- Measuring equipment specifications:
 - Closeness of sensor spectral response to $V(\lambda)$ function
 - Closeness of angular response to cosine function
 - Absolute calibration of photometer not needed
 - Tolerance on the linear response of sensor and electronics is critical
- Annual recalibrations are required for linear response of sensor and electronics
- Routine measurements of dark signal have been added to the test requirements to match current standard practice in photometry

Miscellaneous

- **Should tests for SHGC and VT be done on the same or identical samples?**
 - Discussion is converging to an acceptable procedure for handling this
- **Defining the samples and the tests**
 - Splitting the samples into categories
 - Slightly different test procedures for each
 - A meeting of the minds seems to be coming together on this

Bottom Line

- New material not on the balloted version is being added to the draft standard test procedure
- The changes are too significant in the test procedure to approve it now
- We are making good progress at coming up with an acceptable document that should pass the next ballot
- Thanks for helping us try to fast-track this work