

SOLAR WATER HEATER PERFORMANCE RATING – ISO STANDARDS

Procedures adopted as ISO standards cover three broad categories

- 1. Rating test based on indoor test data**
- 2. Outdoor testing procedures**

Performance test for solar only systems

Performance test for solar plus supplementary systems

- 3. Outdoor testing and annual performance modelling**

Component testing and computer simulation

System tests and computer simulation



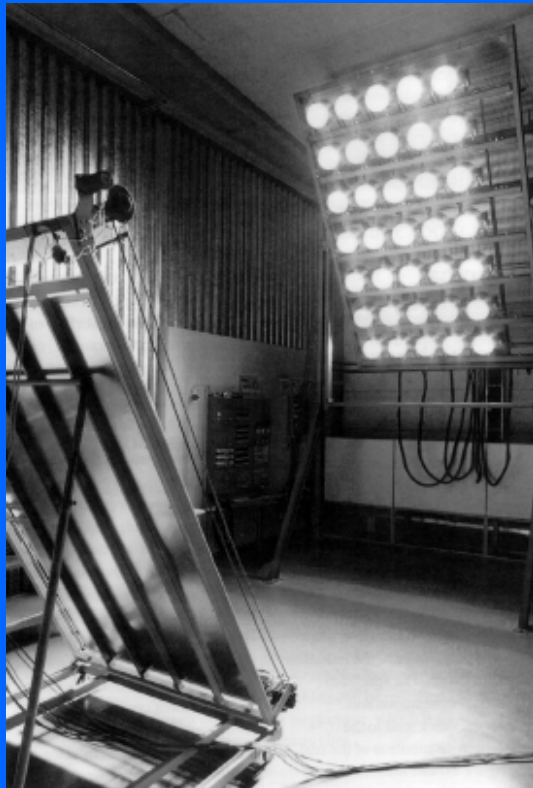
TEST PROCEDURES

- | | |
|--|------------|
| 1. Indoor rating procedure | ISO 9459-1 |
| a) Indoor testing with a solar irradiance simulator. | |
| b) Non-irradiated collector test procedure | |
| 2. Performance test for solar only systems | ISO 9459-2 |
| 3. System test for solar plus supplementary systems | ISO 9459-3 |
| 4. Component tests and computer simulation | ISO 9459-4 |
| 5. System tests and parameter identification | ISO 9459-5 |

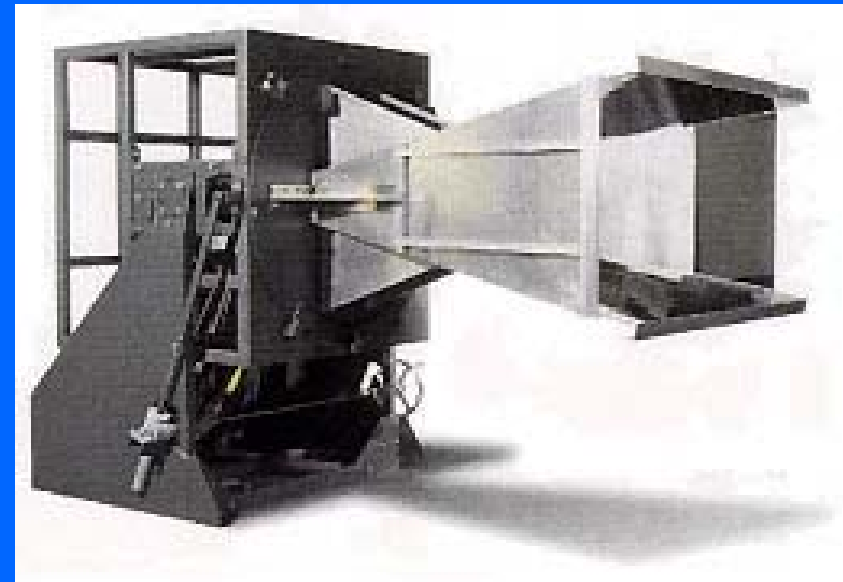


ISO 9459-1 SOLAR SIMULATOR TEST PROCEDURE

**Multi-lamp irradiance
simulator**



**Point source discharge
arc irradiance simulator**



ISO 9459-2 SOLAR PREHEATER TEST PROCEDURE

Daily energy collection and ambient conditions
measured over 10 to 15 days



Performance
correlated using
simple model

$$Q_u = a H + b \Delta T + c$$

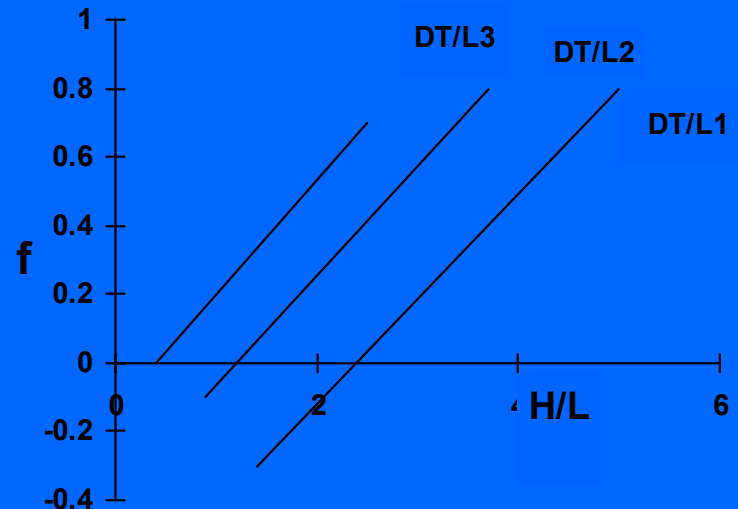


ISO 9459 -3 SINGLE TANK SOLAR + AUXILIARY SYSTEM TEST

Black box test, inputs and outputs monitored over period of 6 to 8 weeks – no details of component performance required.

System monitored under typical load cycle operation, daily solar contribution correlated as

$$f = a + b \frac{T_o - T_a}{L} * \frac{H}{L} + c \frac{T_o - T_a}{L}$$



ISO 9459 -4 COMPONENT TESTS & PERFORMANCE SIMULATION

Component tests

- Collector efficiency test
- Tank heat loss and mixing test
- Heat exchanger characterisation
- Heat pump characterisation

Annual performance simulation using TRNSYS.



ISO 9459-3 DYNAMIC SYSTEM TEST & PERFORMANCE SIMULATION

- Short time step system performance monitoring over period of a few weeks.
- Simulation of performance for measured weather conditions.
- Identification of system parameters to match simulated and measured performance.
- Annual performance simulation - TRNSYS



ADOPTION OF ISO PROCEDURES

- Australia - ISO 9459-4
- Europe - ISO 9459-5
- China - ISO 9459-2 (simplified)
- USA - ISO 9459-1 & ISO 9459-4
- Taiwan, Korea, Japan – ISO 9459-2

(modified)



ADVANTAGES OF ISO 9459-4 (& ISO 9459-5)

- Based on outdoor testing (short term)
- Annual performance for location of interest
- Evaluation of performance of family of products (mix of collectors and tanks) without testing each model
- Detailed performance information for designer



DISADVANTAGES OF ISO 9459-4 (& ISO 9459-5)

- Complex software - TRNSYS
- New simulation models needed to assess product innovations (eg air-source heat pumps, evacuated tubes)
- Performance evaluations require long term solar radiation data (>10 years)

