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  
   a) Indoor testing with a solar irradiance simulator.  
   b) Non-irradiated collector test procedure

2. Performance test for solar only systems

3. System test for solar plus supplementary systems

4. Component tests and computer simulation

5. System tests and parameter identification

ISO 9459-1  
ISO 9459-2  
ISO 9459-3  
ISO 9459-4  
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

\[
f = a + b \frac{T_o - T_a}{L} \cdot \frac{H}{L} + c \frac{T_o - T_a}{L}
\]
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)