



INSTITUT DE RECHERCHE INDUSTRIELLE INDUSTRIAL RESEARCH INSTITUTE

Certification of Solar Water Heaters
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Decree 5305

The Decree 5305 of 28th of October 2010

Makes the relative standards of conformity of Solar Water Heaters as mandatory requirements.

There are seven standards established by LIBNOR in compatibility with European standards



Applicable Standards & Certification Procedure

NL EN 12975 : Thermal solar systems and components - Solar Collectors

✓ Part 1 : General requirements

Visual Inspection (Marking);

Internal Pressure test ;

High temperature resistance test ;

Exposure test;

External thermal shock test;s

Internal thermal shock tests;

Rain penetration test; (Glazed collector)

Mechanical load test;

Impact resistance test;

Freeze resistance test;

Max stagnation temperature

Final Inspection

✓ Part 2 : Test Methods

EN 12975 was amended in 2010 in Europe; A revision is necessary for the Lebanese version



Applicable Standards & Certification Procedure

NL EN 12976 : Thermal solar systems and components -
Factory made system

❖ Part 1 : General requirements

General ;

Components and pipe work ;

Resistance to external influences;

Marking ;

Materials ;

Safety equipment;

Documentation ;

System performance.

❖ Part 2 : Test methods



Applicable Standards & Certification Procedure

NL ENV 12977 : Thermal solar systems and components - Custom Built Systems

❖ Part 1 : General requirements

System classification;

General;

Components and pipework;

Installations;

Initial operation and commissioning ;

System performance.

Requirements;

Materials;

Safety equipments and indicators;

Lightning;

Documentation;



Applicable Standards & Certification Procedure

- ❖ NL ENV 12977 : Thermal solar systems and components
Custom Built Systems
Part 2 : Test methods.
- ❖ NL EN 12977 : Thermal solar systems and components
Custom Built Systems
Part 3 : Performance characterisation of stores for solar heating systems.
 - Store classification;
 - Laboratory store testing ;
 - Store test combined with a system test according to ISO 9459-5;
 - Test report.

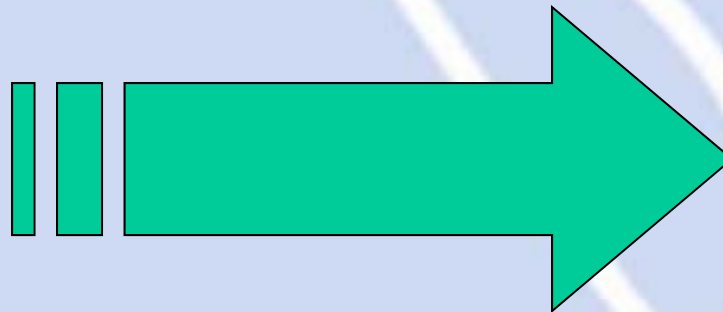
Note that Parts 1 and 2 have the European level to the status of experimental standard. While Part 3 is approved.



Applicable Standards & Certification Procedure

Certification procedure of Solar Water Heaters:

Two cases:





Inspection at Destination (Lebanon)



Merchandise
arrive at border

**FILE
DEPOSIT**

Importer

①



Certificate

⑤ **Products conforms**

Products non conforms

Notification to authorities :

- Consumer Protection
- Customs
- Ministry of Industry

Non conforming products
are Re-exported



• **Documentation
Verification**
• **Preselection of
samples**

②

• **Inspection &
sampling**

③

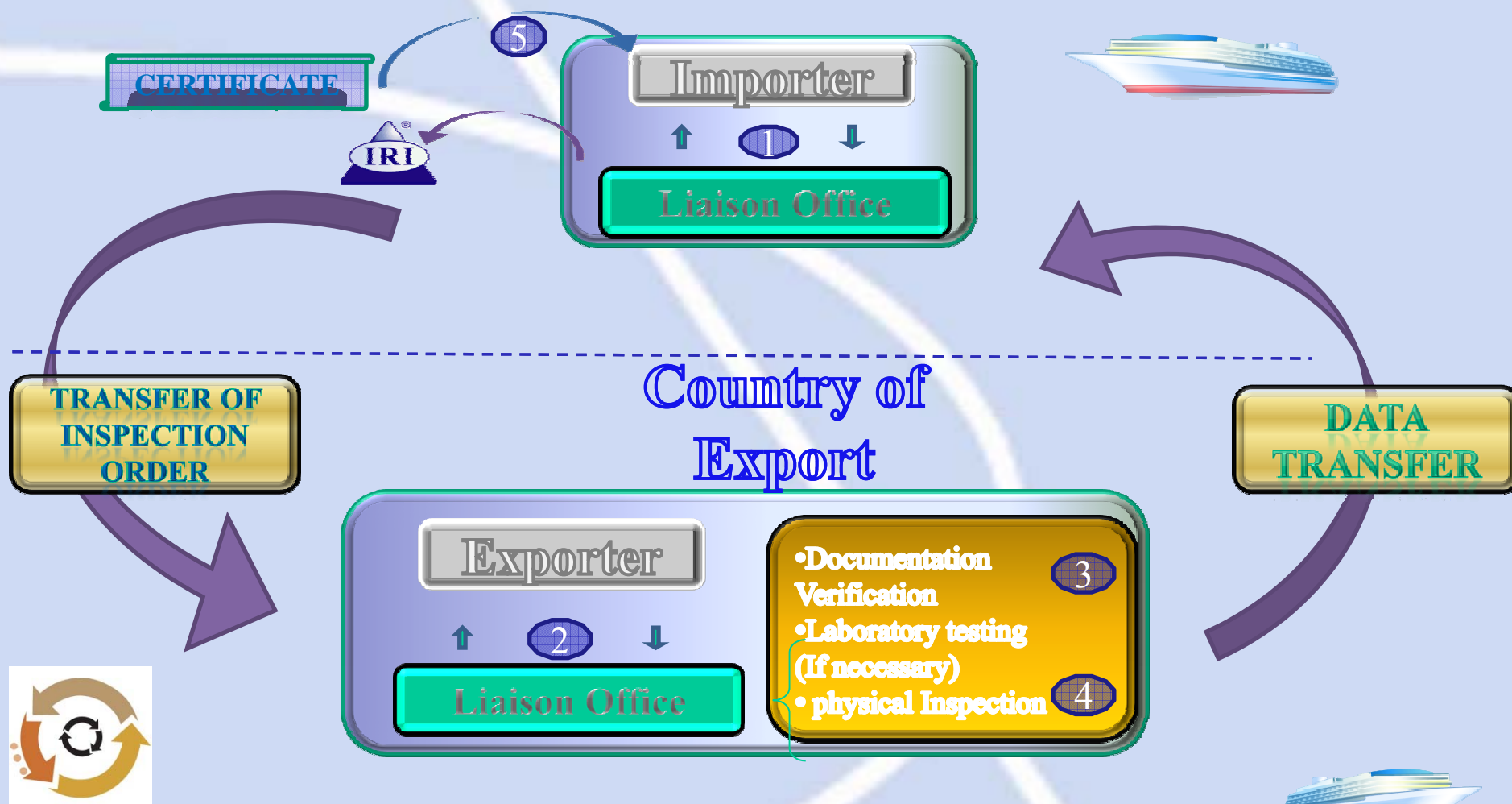
• **Laboratory
testing**

④

At border
or on
importer
warehouses



Pre-Shipment Inspection





Description of the collector

Preface:

➤ Collector technology:

- ❖ Flat Plate
- ❖ Vacuum Tubes (Evacuated tubes)



Photography of the collector





Description of the collector

Absorber:

- Area
- Material
- Thickness of the inner glass tube
- Outer diameter of the inner glass tube
- Kind of absorber coating
- Absorption coefficient α
- Thermal emission coefficient ε
- Number of riser tubes
- Hydraulic design
- Distance between 2 tubes
- Outer diameter of riser tubes
- Thickness of the wall of riser tubes
- Outer diameter of manifold tubes
- Thickness of the heat thickness sheet
- Length of the heat contact sheet



Description of the collector

Cover:

- Aperture area
- Material of the cover
- Outer diameter of the outer glass tube
- Thickness of the cover tube
- Length of the outer glass tube
- Transmission of the cover



Description of the collector

Heat transfer liquid:

- Type
- Specification



Description of the collector

Casing:

- Material
- Depth
- Material of the sidewise cover
- Sealing material



Description of the collector

Thermal insulation:

- Thickness of the insulation in the header
- Material of insulation



Description of the collector

Limitations:

- Max. operating temperature
- Max. operating pressure
- Max. Wind Load
- Max. Snow Load
- Recommended Tilt angle
- Recommended flow range



Description of the collector

Collector mounting:

- Flat roof – Angular rack
- Slopped roof – On roof
- Slopped roof – Integrated in roof
- Façade

Related to manufacturers specification



Documentation of the collector

Type plate (NL 12975-1 clause 7.2):

- Manufacturer
- Brand name
- Serial number
- Year of production
- Dimensions in mm
- Gross area
- Max. operating pressure
- Stagnation temperature at $G_{\text{glob}} = 1000 \text{ W/m}^2$ and $t_{\text{amb}} = 30 \text{ °C}$
- Volume of the absorber
- Weight (empty)
- Made in ...





Documentation of the collector

Installation guidelines (NL 12975-1 clause 7.3):

- Dimensions and weight of the collector
- Description of mounting
- Recommendation on lightning protection
- Instructions about the coupling of the collectors one to another up to 20 m²
- Recommendations about the transfer Media
- Max. operating pressure
- Pressure losses
- Max. & Min. mounting angle
- Max. wind or snow load
- Requirements for maintenance



Documentation of the collector

Constructional drawings:

- Number of the constructional drawings.
- Documentation concerning personal safety, maintenance and handling of the product shall be made available to the customer in one of 3 languages: Arabic, French or English.



Internal pressure test:

Must be 1.5 times max pressure indicated by the manufacturer on a temperature $t: 5 \leq t \leq 30 \text{ }^{\circ}\text{C}$ for 15 minutes.

1: Hydraulic pressure source

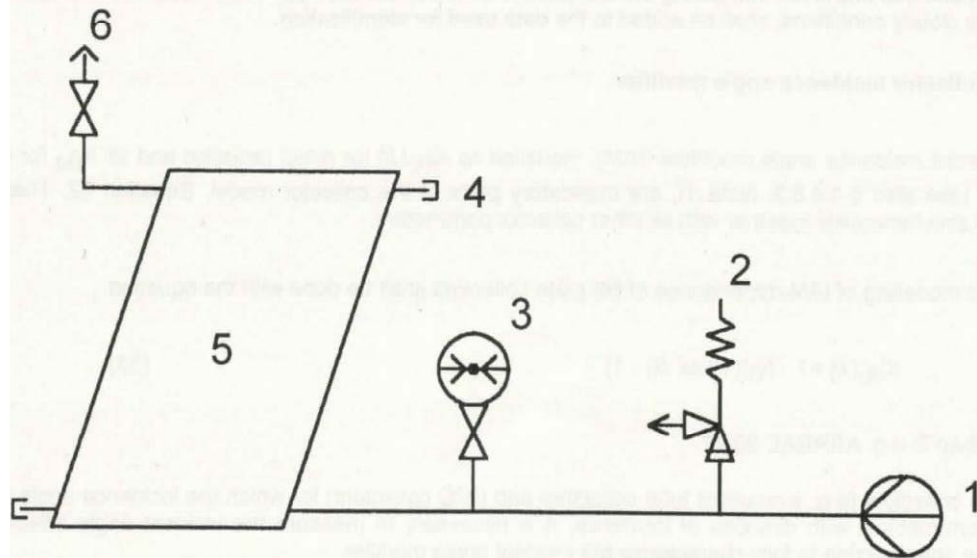
2: Safety valve (Option)

3: Pressure gauge

4: Fluid pipe sealed with cup nut

5: Collector with inorganic absorber

6: Air-bleed valve





High temperature resistance test

The global solar irradiance on the collector plan shall be more than 1000 W/m^2 , the surrounding air temperature t : is $20 \leq t \leq 40 \text{ }^\circ\text{C}$ and its speed $< 1 \text{ m/s}$ for 1 hour minimum after steady-state conditions.





Exposure test

- Part A: exposition of the collector for at least 30 days (which need not to be consecutive) with a minimum daily irradiation $H \geq 14 \text{ MJ/m}^2$
- Part B: exposition for at least 30 hours at irradiance $G \geq 850 \text{ W/m}^2$ and ambient temperature $T_{\text{amb}} \geq 10 \text{ }^\circ\text{C}$. Minimum duration of every high-irradiance period is $\Delta t \geq 30 \text{ min}$.

1: Fluid pipe left open

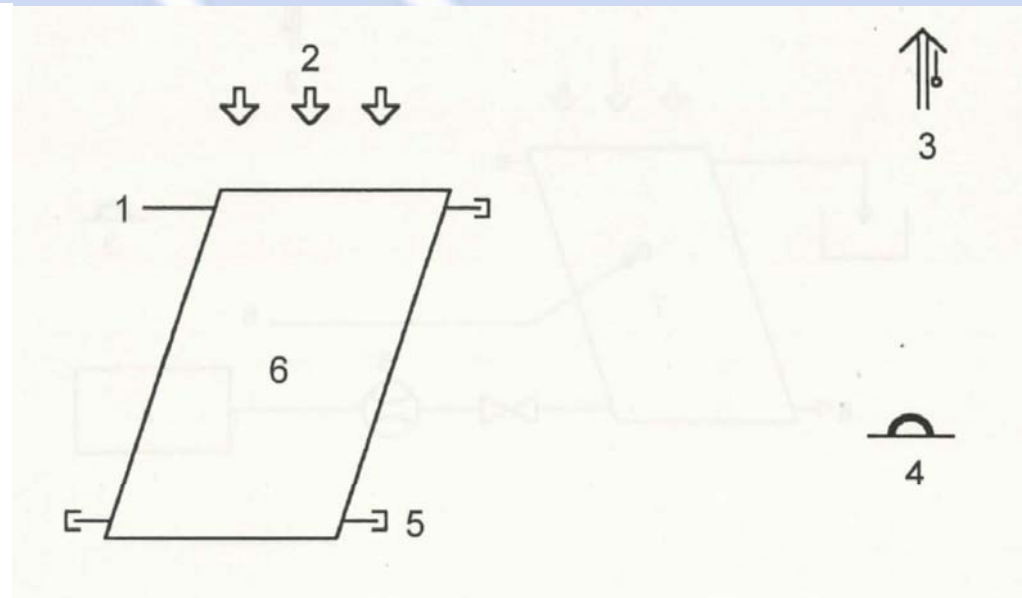
2: Solar radiation

3: Ambient temp. sensor

4: Pyranometer on collector plane

5: Fluid pipe sealed with cap nut

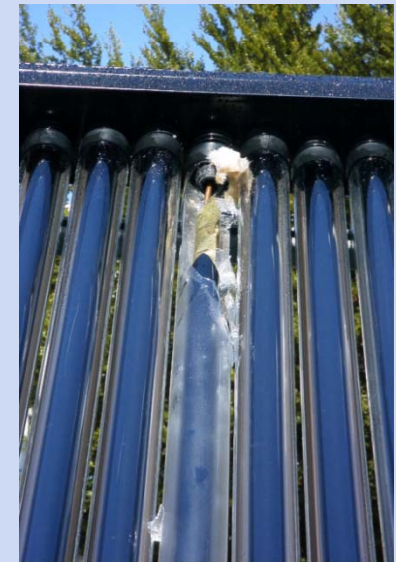
6: Collector





External thermal shock tests

The collector shall be exposed for 1 hour of irradiance $G \geq 850 \text{ W/m}^2$ and ambient temperature $T_{\text{amb}} \geq 10 \text{ }^\circ\text{C}$ before spraying the water that have a temperature of $< 25 \text{ }^\circ\text{C}$ and a flow rate in the range of 0.03 kg/s and 0.05 kg/s per square meter of collector aperture.





Internal thermal shocks tests

The collector shall be exposed for 1 hour of irradiance irradiance $G \geq 850 \text{ W/m}^2$ and ambient temperature $T_{\text{amb}} \geq 10^\circ\text{C}$ and the heat transfer fluid shall have a temperature of $< 25^\circ\text{C}$ and a flow rate at least 0.02 kg/s per square meter of collector aperture (unless otherwise specified by the manufacturer) for at least 5 minutes.

1: Natural solar radiation

2: Ambient temp. sensor

3: Pyranometer on c. plane

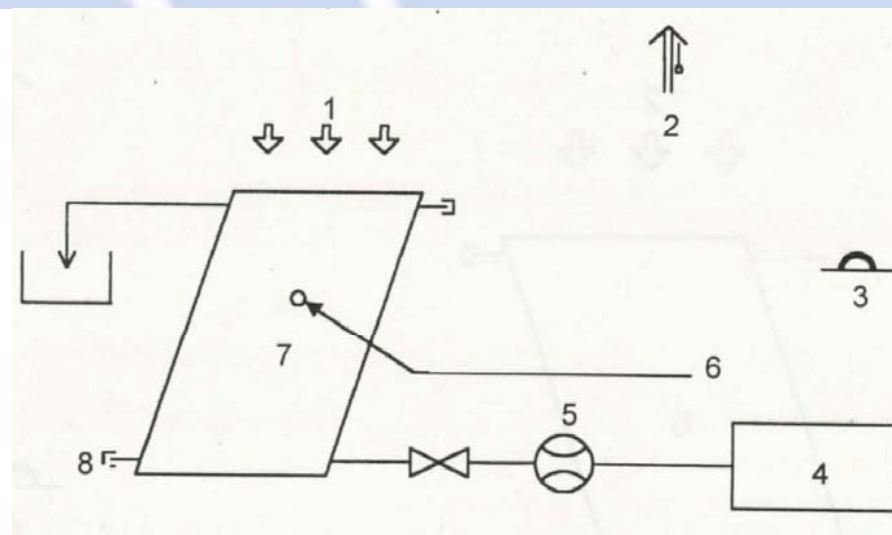
4: Heat transfer fluid source

5: Flowmeter

6: Temp. Sensor attached to absorber

7: Collector

8: Fluid pipe with cap nut





External & Internal thermal shock tests

The two external & internal thermal shock tests may be combined with the exposure test or the high temperature resistance test.



Rain penetration test

It shall be carried out only for glazed collectors while the absorber's temperature is $> 50^{\circ}\text{C}$, and it will be performed when the collector is mounted on open frame and exposed to solar radiation while the flow rate of water spray (temperature $< 30^{\circ}\text{C}$) is more than $0.05 \text{ l/m}^2\text{s}$ for 4 hours.





Freeze resistance test

2 test procedures are recommended:

- One for collectors which are claimed to be freeze-resistant when filled.
- One for collectors which are claimed to resist freezing after being drained.

The contents of the absorber shall be maintained at $(-20 \pm 2 \text{ }^{\circ}\text{C})$ at least for 30 min during the freeze part of the cycle and are raised above $10 \text{ }^{\circ}\text{C}$ during the thawing part. The duration of the thawing part of the cycle shall be at least 30 min. The collector shall be subjected to three freeze-thaw cycles.

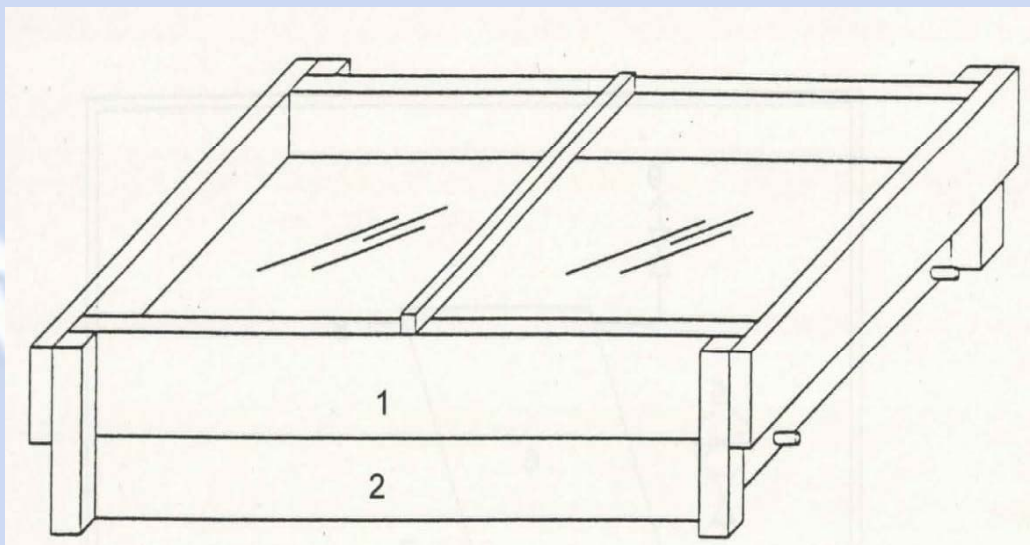


Mechanical load test

- **Positive pressure test of the collector cover:** the test pressure shall be increased in steps of 100 Pa to the recommended maximum test pressure, which shall be at least 1000 Pa or optional above load test above 1000 Pa up to the value specified by the manufacturer.
- **Negative pressure test of fixings between the cover and the casing:** the test pressure shall be increased in steps of 100 Pa to the recommended maximum test pressure. The maximum test pressure may be specified to suit particular climate conditions; otherwise a pressure of 1000 Pa shall be used.
- **Negative pressure tests of the mountings:** the test pressure shall be increased in steps of 100 Pa to the recommended maximum test pressure. The maximum test pressure may be specified to suit particular climate conditions, but shall be at least 1000 Pa.



Mechanical load test





Mechanical load test





Impact resistance test

This test includes 2 methods which are described in the standard under clause 5.10:

- **Method 1:** by using a steel ball which shall have a weight of $150 \text{ g} \pm 10 \text{ g}$ and the following series of test heights shall be used: 0.4m, 0.6m, 0.8m, 1.0m, 1.2m, 1.4m, 1.6m, 1.8m, and 2.0m.
- **Method 2:** by using an ice ball which shall have a diameter of $25 \text{ mm} \pm 5 \%$, a mass of $7.53 \text{ g} \pm 5\%$ and its velocity shall be $23 \text{ m/s} \pm 5 \%$.





Max stagnation temperature

Must be measured outside, while the collector is empty and exposed to an irradiation of $1000 \text{ W/m}^2 \pm 10\%$, the absorber prevented against cooling by circulation. These data will be extrapolated to an irradiance of 1000 W/m^2 and an ambient temperature of 30°C .



Final inspection

Collector casing/fasteners: cracking/ wrapping/ corrosion/ rain penetration

- **Mountings/supports:** strength/safety
- **Seals/ Gaskets:** cracking/ adhesion/ elasticity
- **Cover/reflector:** cracking/ crazing/ buckling/ delamination/ wrapping/ outgassing
- **Absorber coating:** cracking/ crazing, blistering
- **Absorber tubes and headers:** deformation/ corrosion/ leakage/ loss of bonding
- **Absorber mountings:** deformation/ corrosion
- **Insulation:** water retention/ outgassing/ degradation)
 - 0: No problem
 - 1: Minor problem
 - 2: Severe problem
 - X: Inspection was not possible.



Final inspection





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RECENT NEWS

Technical Collaboration Agreement between Lebanon and Qatar
On January 6, 2009 Lebanon signed a collaboration agreement with Qatar during an official visit to Doha. [More >>](#)

Accreditation Project:
New accredited activities at IRI by

RECENT EVENTS

IRI et L'ORDRE des INGENIEURS et ARCHITECTES- Beyrouth, ont organisé un séminaire sur le Développement et la Construction Parasismique et l'Adaptation des normes. Mars 3 - 4, 2009
[more >>](#)

IRI hosted a ceremony for distributing certificates to 40 members of the Lebanese Army for completing a week-long training session in welding on December 18, 2008.
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Thank You for your attention
