ETV Verification Protocol
SolarVenti SV14

Danish Technological Institute
Refrigeration and Heat Pump Technology
J.no. 1201
Test no. 1 – Type-test

Version 1.0

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1 Introduction

Environmental technology verification (ETV) is an independent (third party) assessment of the performance of a technology or a product for a specified application under defined conditions and quality assurance.

DANETV is a Danish center for the verification of environmental technology.

This protocol describes the framework for the verification of the technology product and provides the information required for the test plan.

1.1 Name of the Product

SolarVenti SV14

1.2 Name and Contact of Vendor

SolarVenti A/S

Attn: Hans Jørgen Christensen
Fabriksvej 8,
DK-8881 Thorsø
Phone:+45 86 96 67 00
E-mail: hjc@solarventi.dk

1.3 Name of Center/Verification Responsible

Verification Center: Danish Technological Institute, Refrigeration and Heat Pump Technology, Building 2, Gregersensvej, DK-2630, Taastrup

Verification responsible: Emil Jacobsen (EMJA), e-mail: emil.jacobsen@teknologisk.dk
Phone: +45 7220 2323

Internal reviewer: Bjarke Paaske (BJPA), e-mail: bjarke.paaske@teknologisk.dk
Phone: +45 7220 2037

1.4 Verification and Test Organization

The verification will be conducted by Danish Technological Institute. The test organization is shown in figure 1.

The verification is planned and conducted in order to meet the requirements of the ETV scheme which is currently being established by the European Union (EU ETV).

Verification and tests will be performed by Danish Technological Institute in terms of DANETV under contract with SolarVenti.

The day to day operations of the verification and tests will be coordinated and supervised by personnel from Danish Technological Institute with the participation of the vendor, SolarVenti, Mr. Hans Jørgen Christensen.

The testing will be conducted at Danish Technological Institute, Gregersensvej, DK-2630 Taastrup.

The test subbody at Danish Technological Institute will perform all samplings during the verification.

SolarVenti, Mr. Hans Jørgen Christensen, will assist when necessary as described in the contract.

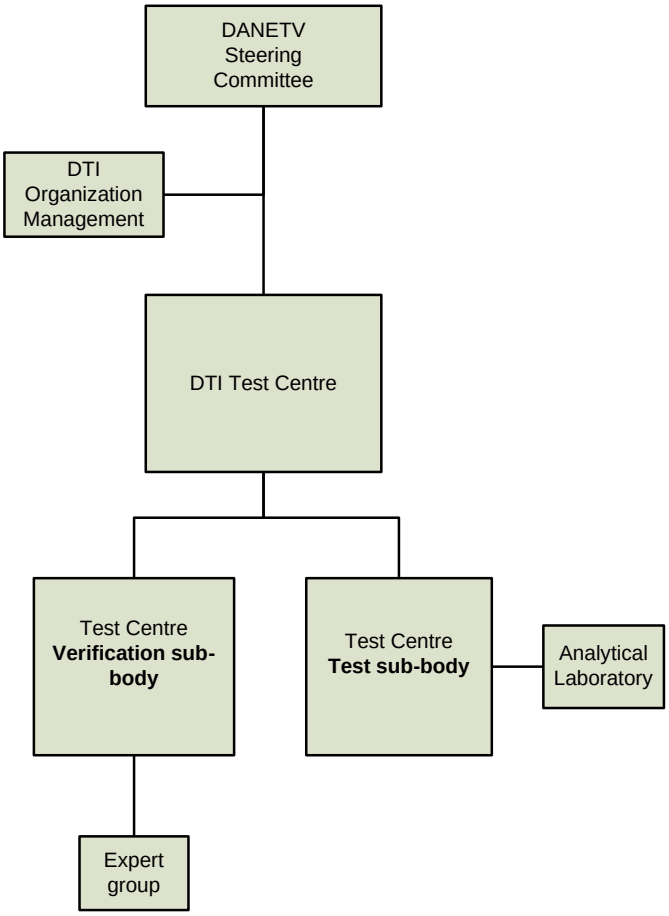

Figure 1 Verification organization

Table 1 - Responsible personnel in test organization

Unit in test organization	Responsible
DTI, Dan ETV steering committee member	Michael Poulsen
DTI, Energy and Climate division, organization management	Claus S. Poulsen
DTI, Energy and Climate division, Verification subbody	Emil Jacobsen
DTI, Energy and Climate division, Test subbody	Bjarke Paaske

1.5 Expert Group

The expert group assigned to this verification and responsible for the review of the verification plan and report documents includes:

Simon Furbo (SF), DTU Civil Engineering, phone +45 45251857, e-mail: sf@byg.dtu.dk

1.6 Verification Process

Verification and tests will be conducted in two separate steps by the verification subbody and the test subbody, respectively.

The verification subbody is responsible for the preparation and compilation of the verification protocol and the test report.

The test subbody is responsible for the test plan and the test report.

The verification steps are shown in figure 2.

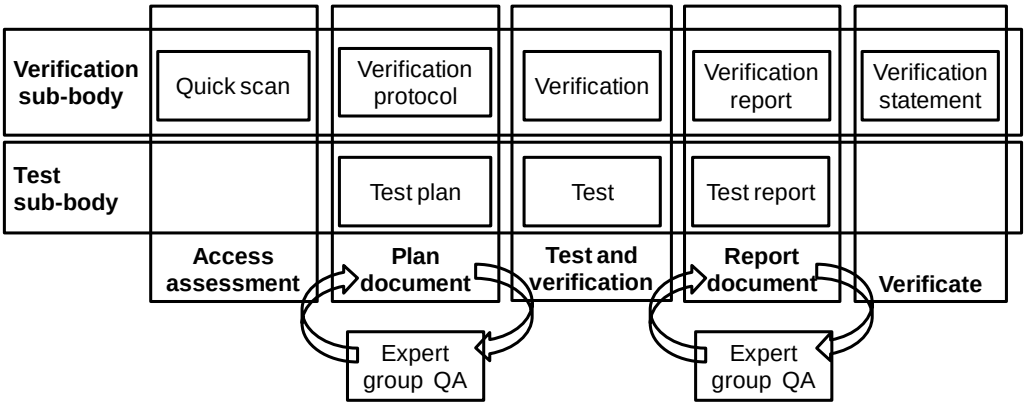

Figure 2 - Verification steps

A DANETV verification statement will be issued after the completion of the verification.

2 Description of Technology

Solar Air Heaters

Open loop solar air heaters are characterized by simple devices which consist of three major parts:
1) Either a cabinet with a translucent cover or a fixture with a heat pipe array
2) A solar cell
3) A ventilator with or without a controller

When the solar cell powers the ventilator, cold outdoor air is driven through air channels which are irradiated whereby the air is heated. Subsequently, the heated air is channeled into the summer house or garage whereby it is ventilated, heated, dried, or a combination these.

If the air heater has a controller connected to the ventilator, the amount of air being driven through the air heater can typically be controlled and set-points for minimum or maximum start or stop temperatures can be adjusted.

3 Description of Product

SolarVenti SV14
The SolarVenti SV14 is designed to deliver supplementary heating and ventilation to houses up to 70 m2. The dimensions of the solar heater are 70 x 197 x 5.5 cm (H x W x D). The solar heater is made from an anodized aluminum frame and a polycarbonate cover with built-in solar powered ventilator. Moreover, it is equipped with a controller with set-points for minimum air outlet temperatures, which negates the possibility of driving cold air through the air outlet. In addition, the controller allows for reversed operation which draws hot air out of the building, i.e. on a hot summer day.

4 Application and Performance Parameter Definitions

4.1 Matrix/Matrices

The matrix is the type of material which the product is intended for.

- Residential houses up to 70 m^2

4.2 Target(s)

A target is defined as the property affected by the product

The target of the product is:

- Supplementary heating and ventilation

4.3 Effects

The effects are described as the way the target is affected

- Improved indoor climate in unheated humid buildings.

4.4 Performance Parameters for Verification

The ranges of performance relevant for the application, as derived in Appendix 3, are presented below. These ranges are only used for planning the verification and testing.

In connection with the performance of the solar air heater, the following parameters are measured at different irradiation levels:

- Ambient temperature and air heater outlet temperatures, T_{amb} and T_{out}
- Air velocity of air through outlet channel, v_{out}
- Solar irradiance planar to the air heater, G

All parameters are measured every two seconds and with a tolerance according to EN 12975 - 2.

4.5 Additional Parameters

No additional parameters are required as part of the verification.

5 Existing data

5.1 Summary of Existing Data

Previously, the vendor has made a test of the functioning and capabilities of the SolarVenti SV14.

5.2 Quality of Existing Data

Documentation of previous experiments exists, but these experiments were not intended as an actual type-test.

5.3 Accepted Existing Data

Data from previous experiments is not usable for this verification process.

6 Test plan requirements

6.1 Test Design

The DANETV solar air heater test is developed with the specific aim of making the test results as applicable, transparent and comprehensible as possible for the intended end user/homeowner/buyer.

Even though the EN 12975 standard for testing liquid heating collectors exits, this standard mainly deals with the robustness and thermal effectiveness of liquid heating collectors. Therefore, it is not applicable for open loop solar air heaters. Other previous tests of open loop air heaters, mainly centered on the effectiveness of the air heater, are very technical and not directly applicable for the intended end user/homeowner. Therefore, the DANETV test focuses on verification of the vendor claims. The vendor claims are often related to energy savings, improved ventilation, improved indoor climate, or the like.

Furthermore, in order to give a better idea of how the solar air heater performs in an actual setting, a test rig has been built to simulate real running conditions comparable to those present when the air heater is mounted vertically on the side of a house or garage. Establishing the actual performance characteristics of the air heater has a great advantage over laboratory tests with forced ventilation through the solar air heater as the fans are known to be very sensitive to pressure losses, both related to the heater itself and the downstream hot air channel. Tests performed on different models and makes are comparable by means of calculations based on data from the test rig and on regional climate data (design reference year data).

6.2 Reference Analysis

No references are used for this verification process.

6.3 Data Management

Data storage, transfer and control must be done in accordance with the requirements of the ETV Quality Manual in order to enable full control and retrieval of documents and records.

6.4 Quality Assurance

The quality assurance of the tests must include control of the test system as well as control of the data quality and integrity.

The test plan and the test report were subject to review by the expert group as part of the review of this verification protocol and the verification report, see Figure 2.

6.5 Test Report

The test report must follow the template of the TI verification Center Quality Manual with data and records from the presented tests.

7 Evaluation

The evaluation includes calculation of the performance parameters, see chapter 4.4 for a definition, evaluation of the data quality based upon the test quality assurance, see chapter 6.4 for requirements, and compilation of the additional parameters, as specified in chapter 4.5.

7.1 Calculation of Performance Parameters

All parameters of interest are analyzed and performance parameters concerning annual energy output, ventilation, relative humidity, moisture content of material and temperature lift etc. are held up against established acceptance/rejection criteria.

7.2 Evaluation of Test Data Quality

The test report must follow the template of the TI Verification Center Quality Manual.

7.3 Compilation of Additional Parameters

7.3.1 User Manual

The user manual must include information about the system description. In particular, it should contain instructions for:

- Intended use
- Product installation

- Product operation
- Function test
- Prevention of accidents
- Service and maintenance

7.3.2 Occupational Health and Environment

Occupational health and safety issues are not evaluated as part of the verification, but the solar air heater does not appear to pose a danger for the intended user.

8 Verification Schedule

The verification is planned for 2011/2012. The overall schedule is given in Table 2.

Task	Timing
Application definition document	Oct. 2011
Verification protocol with test plan	Feb. - Apr. 2012
Test	March 2012
Test reporting	April 2012
Verification	April 2012
Verification report	April 2012
Verification statement	April 2012

Table 2 Verification schedule

9 Quality assurance

The test protocol, test plan, test report and verification report will be reviewed by internal and external experts according to the Quality plan for the verification, see table 3.

Table 3 - QA plan for the verification

Reviewers	DTI	Experts
Plan document with application definition, verification protocol and test plan	BJPA	SF
Report document with test report and verification report	BJPA	SF

Reviews will be done using the TI review report template.

Appendix 1 Terms and definitions used in the verification protocol

Terms and definitions used in the protocol are explained in
Table **1**:

Table 1 - Terms and definitions used by the DANETV test centers

Word	**DANETV**	**Comments on the DANETV approach**
Analytical laboratory	Independent analytical laboratory used to analyze test samples	The test center may use an analytical laboratory as subcontractor
Application	The use of a product specified with respect to matrix, target, effect and limitations	The application must be defined with a precision that allows the user of a product verification to judge whether his needs are comparable to the verification conditions
DANETV	Danish center for verification of environmental technologies	None
(DANETV) test center	Preliminary name for the verification bodies in DANETV with a verification and a test subbody	Name will be changed, when the final nomenclature in the EU ETV has been set.
Effect	The way the target is affected	The effect could be reduced energy consumption, better cooling performance etc.
(Environmen-tal) product	Ready to market or prototype stage product, process, system or service based upon an environmental technology	The product is the item produced and sold, i.e. the item that a vendor submit for verification
Environmental technology	The practical application of knowledge in the environmental area	The term technology is covering a variety of products, processes, systems and services.
Evaluation	Evaluation of test data for a technology product for performance and data quality	None
Experts	Independent persons qualified for the technology in the verification	These experts may be technical experts, QA experts for other ETV systems or regulatory experts

Word	DANETV	Comments on the DANETV approach
Matrix	The type of material that the product is intended for	Matrices could be cooling systems, cabinets, heat exchangers etc.
Method	Generic document that provides rules, guidelines or characteristics for tests or analysis	An in-house method may be used in the absence of a standard, if prepared in compliance with the format and contents required for standards.
Performance claim	The effects foreseen by the vendor on the target(s) in the matrix of intended use	None
Performance parameters	Parameters that can be documented quantitatively in tests and that provide the relevant information on the performance of an environmental technology product	The performance parameters must be established considering the application(s) of the product, the requirements of society (regulations), customers (needs) and vendor claims
Procedure	Detailed description of the use of a standard or a method within one body	The procedure specifies implementing a standard or a method in terms of e.g.: equipment used
Producer	The party producing the product	None
Standard	Generic document established by consensus and approved by a recognized standardization body that provides rules, guidelines or characteristics for tests or analysis	None
Target	The property that is affected by the product	Targets could be temperature [° C], energy [kWh] etc.
Test center, test subbody	Subbody of the test center that plans and performs test	None
Test center, verification	Subbody of the test center that plans and performs the	None

Word	DANETV	Comments on the DANETV approach
subbody	verification	
Test/testing	Determination of the performance of a product for parameters defined for the application	None
Vendor	The party delivering the product to the customer	Can be the producer
Verification	Evaluation of product performance parameters for a specified application under defined conditions and adequate quality assurance	None

Appendix 2 References

(verification protocols, requirement documents, standards, methods)

1. DANETV. Center Quality Manual, 2008

2. EN 12975-2:2006 Thermal solar systems and components - Solar collectors - Part 2: Test methods

3. DTU (2007): Effektivitet af luft/væskesolfanger, ISSN 1601-8605

4. By og Byg Anvisning 204 – Undersøgelse og vurdering af fugt og skimmelsvampe i bygninger (Investigation and Assessment of humidity and mold in Buildings)

5. SBi anvisning 224 – Fugt i bygning (Humidity in Buildings)

Appendix 3 Application and Performance Parameter Definitions

This appendix defines the application and the relevant performance parameters application as input for the verification and test of an environmental technology according to the DANETV method.

A3.1 Applications

A3.1.1 *The matrix is the type of material which the product is intended for.*

- Residential houses up to 70 m^2

A3.1.2 Target(s)

A target is defined as the property affected by the product

The target of the product is:

- Supplementary heating and ventilation

A3.1.3 Effects

The effect of this application is primarily:

- Improved indoor climate in unheated humid buildings.