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INTRODUCTION  
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This document shall include supplemental information about the ASHRAE Standard 140 tests performed. One S140outNotes document shall be provided for each set of tests (e.g., one for the building thermal and fabric load tests of Sections 5.2.1, 5.2.2, and 5.2.3; one for the space cooling equipment analytical verification tests of Sections 5.3.1 and 5.3.2; etc.) The types of information listed below shall be provided in this document, each in a separate section:

- a. Software information
- b. Alternative modeling methods
- c. Equivalent modeling methods
- d. Nonspecified inputs
- e. Omitted test cases and results
- f. Changes made to source code for the purpose of running the tests, where such changes are not available in publicly released versions of the software
- g. Anomalous results.

Notes in this document shall be limited to the topics shown above. Notes must be factual and objective and shall only refer to the software being tested. Notes shall not refer to any other software program.

INFORMATIVE NOTE: Text at the start of each section describes the content of the section for the reader and provides instructions for supplying the content. Sample notes are provided in a separate document (S140outNotes\_Examples.TXT).

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A. SOFTWARE INFORMATION  
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CONTENT: This section shall include reference information for the software - the vendor, name, and version of the software, plus operating system and computer hardware requirements.

INSTRUCTIONS: Information for items 1 through 7 below shall be provided. Information for Item 8 shall be permitted but is not required.

1. SOFTWARE VENDOR: Thermal Energy System Specialists, LLC with TESS Component Libraries
2. SOFTWARE NAME: TRNSYS
3. SOFTWARE VERSION (unique software version identifier): 18.05.0001
4. OPERATING SYSTEM REQUIREMENTS: Windows 10, Windows 11
5. APPROX HARD DISK SPACE REQUIRED FOR INSTALLATION: Maximum = 415 MB; Minimum (to run input files) = 51 MB
6. MINIMUM RAM REQUIRED FOR SOFTWARE OPERATION: 128 MB
7. MINIMUM DISPLAY MONITOR REQUIREMENTS: VGA with 600x800 resolution and 256 colors
8. OTHER HARDWARE OR SOFTWARE-RELATED REQUIREMENTS: None

INFORMATIVE NOTE: Item 8 can be used to supply additional relevant information.

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B. REPORT BLOCK FOR ALTERNATIVE MODELING METHODS

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CONTENT: If the software being tested provides alternative modeling methods or algorithms for performing the tests, this section shall describe modeling methods used for the tests.

INSTRUCTIONS: If alternative modeling methods are applicable, a separate note for each alternative modeling method or algorithm situation shall be provided. The standard format shown below and a separate number and title for each note shall be applied. If alternative modeling methods are not applicable, specify "NONE" in place of the information below.

NOTE 1 - Zone Behavior

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- 1.1 Describe the Effect Being Simulated:  
The reaction of the zone air to the air stream.
  
- 1.2 Optional Settings or Modeling Capabilities:
  - Type56 Multizone Building Component
  - Flow imposed on an airstream
  
- 1.2.1 Type56 Multizone Building Component:  
Physical Meaning: The Type56 Multizone building component simulations all of the zones of a building with a full energy balance.
- 1.2.2 Flow imposed on an airstream:  
Physical Meaning: The component calculates the effects on a airstream of the application of sensible and latent loads.
  
- 1.3 Setting or Capability Used:  
Flow imposed on an airstream - since the loads are given and there are no effects from the exterior weather conditions the flow imposed on an airstream is adequate for the tests and simpler to implement.

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NOTE 2 - Humidity Calculations

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- 2.1 Describe the Effect Being Simulated:  
The properties used to calculate the air properties input to the components
  
- 2.2 Optional Settings or Modeling Capabilities:
  - Humidity Mode = 1
  - Humidity Mode = 2
  
- 2.2.1 Humidity Mode = 1:  
Physical Meaning: the properties of air input to a component model will be calculated using the drybulb temperature and the absolute humidity ratio

2.2.2 Humidity Mode = 2:

Physical Meaning: the properties of the air input to a component model will be calculated using the drybulb temperature and the relative humidity

2.3 Setting or Capability Used:

Humidity Mode = 1

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NOTE 3 - Cooling Coil Control Mode

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3.1 Describe the Effect Being Simulated:

The cooling coil model (Type 752) can control the leaving air conditions based on different air properties

3.2 Optional Settings or Modeling Capabilities:

Control Mode = 1  
Control Mode = 2  
Control Mode = 3  
Control Mode = 4

3.2.1 Control Mode = 1

Physical Meaning: the coil is controlled based on the leaving air temperature.

3.2.2 Control Mode = 2

Physical Meaning: the coil is controlled based on the leaving air temperature and absolute humidity ratio

3.2.3 Control Mode = 3

Physical Meaning: the coil is controlled based on the leaving air temperature and relative humidity

3.2.4 Control Mode = 4

Physical Meaning: the coil is controlled based on the leaving air absolute humidity ratio

3.3 Setting or Capability Used:

Control Mode = 1

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NOTE 4 - Simulation time step

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4.1 Describe the Effect Being Simulated:

Simulation time step

4.2 Optional Settings or Modeling Capabilities:

userdefined constant value

4.2.1 userdefined constant value

Physical Meaning: Simulation time step

4.3 Setting or Capability Used:

The simulation time step is one hour: Time step = 1

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NOTE 5 - Simulation convergence tolerances  
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5.1 Describe the Effect Being Simulated:

Convergence tolerances

5.2 Optional Settings or Modeling Capabilities:

Absolute Tolerances

Relative Tolerances

5.2.1 Absolute tolerances

Physical Meaning: Specifying an absolute tolerance indicates that TRNSYS should not converge until all connected outputs are changing by a value of TolA and all integration outputs are changing by a value of TolD

5.2.1 Relative tolerances

Physical Meaning: Specifying a relative tolerance indicates that TRNSYS should not move on to the next time step until all connected outputs are changing by less than (100 TolA) percent of their absolute value and all integrated outputs are changing by (100 TolD) percent of their absolute value.

5.3 Setting or Capability Used:

Relative Tolerances: 0.001 0.001

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C. REPORT BLOCK FOR EQUIVALENT MODELING METHODS  
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CONTENT: This section shall describe equivalent modeling methods used to perform the tests. When the software does not model an effect exactly as stated in the standard or does not permit the input values required, equivalent modeling methods shall be permitted to perform the test.

INSTRUCTIONS: If equivalent modeling methods are applied, a separate note for each instance of equivalent modeling shall be provided. The standard format shown below and a separate number and title for each note shall be applied. If equivalent modeling methods are not applicable, specify "NONE" in place of the information below.

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NOTE 1 - Zone temperature  
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1.1 Describe the Effect Being Simulated:

The zone setpoint temperature

1.2 Section(s) of the Standard where Relevant Inputs are Specified:

5.5

1.3 Equivalent Input(s) Used:

The cooling coil leaving air setpoint was varied until the calculated zone temperature met the specification.

1.4 Physical, Mathematical or Logical Justification of the Equivalent Input(s) - provide supporting calculations, if relevant:

The load imposed on an airstream component works by calculating the resulting temperature from applying the loads to an air stream. It does not calculate the load needed to maintain a setpoint. So the cooling coil leaving air setpoint was varied to change the entering air conditions until the resulting temperature for the airstream equaled that in the test specification.

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D. REPORT BLOCK FOR USE OF NON-SPECIFIED INPUTS  
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CONTENT: This section shall describe nonspecified inputs used to perform the tests. Use of nonspecified inputs shall be permitted only for the following specified sections relating to the following topics:

- \* Alternative constant exterior surface coefficients in Sections 5.2.1.9.3, 5.2.3.1.4.3, 5.2.3.3.2, and 5.3.1.8
- \* Alternative constant interior surface coefficients in Sections 5.2.1.10.3, 5.2.3.1.4.4, 5.2.3.2.2, and 5.3.1.9
- \* Alternative constant interior solar distribution fractions in Sections 5.2.1.12, 5.2.2.1.2.2, 5.2.2.1.6.2, 5.2.2.1.7.2, 5.2.2.2.7.4, 5.2.3.9.3, 5.2.3.10.2, and 5.2.3.12.2
- \* Air density given at specific altitudes for the space-cooling and space- heating equipment cases in Sections 5.3.1.4.3, 5.3.3.4.3, and 5.4.1.4.3.

INSTRUCTIONS: If nonspecified inputs are applied, a separate note for each use of nonspecified inputs shall be provided. The standard format shown below and a separate number and title for each note shall be applied. If nonspecified inputs are not applied, specify "NONE" in place of the information below.

NONE

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E. REPORT BLOCK FOR OMITTED TEST CASES AND RESULTS  
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CONTENT: This section shall describe test cases that were omitted and/or individual results of test cases that were omitted along with the reason for the omission.

INSTRUCTIONS: If test cases were omitted, a separate note to describe each type of omission shall be provided. The standard format shown below and a separate number and title for each note shall be applied. If there are no omitted test cases, specify "NONE" in place of the information below.

NONE

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F. REPORT BLOCK FOR CHANGES TO SOURCE CODE FOR THE PURPOSE OF RUNNING THE TESTS, WHERE SUCH CHANGES ARE NOT AVAILABLE IN PUBLICLY RELEASED VERSIONS OF THE SOFTWARE

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CONTENT: This section shall describe changes to software source code made to allow the software to run a test, where such changes are not available in a publicly released version of the software.

INFORMATIVE NOTE: This section addresses special situations where a change to source code is necessary to activate a feature or to permit inputs needed for a test when these features are not available in the publicly released version of the software.

INSTRUCTIONS: If changes to the source code for the purpose of running a test are applied, separate notes to describe each source code modification shall be provided. The standard format shown below and a separate number and title for each note shall be applied. If changes to source code are not applied, specify "NONE" in place of the information below.

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NOTE 1 - Fan Power Calculations

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1.1 List the Change(s) to the Source Code:

The constant speed and variable speed fan models were modified to calculate the fan power using the specified fan efficiency rather than specifying a power.

1.2 List the Test Case(s) Relevant to the Change(s) in the Source Code:  
5.5

1.3. Explanation of Why the Change is Not Included in the Publicly Released Version of the Software:

The models are equivalent with different parameter specified for the model.

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NOTE 2 - Zone Latent Loads

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2.1 List the Change(s) to the Source Code:

The TRNSYS load on an airstream component was changed to calculate the leaving air humidity ratio based on the enthalpy of the water vapor rather than the heat of vaporization of the water vapor.

2.2 List the Test Case(s) Relevant to the Change(s) in the Source Code:  
5.5

2.3. Explanation of Why the Change is Not Included in the Publicly Released Version of the Software:

The assumption of using the heat of vaporization of the water vapor is more typical when latent loads are added to an airstream.

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NOTE 3 - VAV Box Model

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2.1 List the Change(s) to the Source Code:

A new TRNSYS component model for VAV boxes (Type 4503) was written to model a VAV box that modulates the airflow and/or reheat to maintain a zone setpoint.

2.2 List the Test Case(s) Relevant to the Change(s) in the Source Code:  
5.5.4

2.3. Explanation of Why the Change is Not Included in the Publicly Released Version of the Software:

The model is under development for inclusion.

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G. REPORT BLOCK FOR ANOMALOUS RESULTS  
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CONTENT: Describing anomalous results shall be permitted but is not required. If anomalous test results are described, this section shall be used.

INSTRUCTIONS: If anomalous test results are described, each type of anomalous result shall be described in a separate note. The standard format shown below and a separate number and title for each note item shall be applied. If anomalous results are not discussed, it shall be permitted to specify "NONE" in place of the information below.

NONE