

**University of Saskatchewan
Department of Mechanical Engineering
Standard Operating Procedure # HT0006**

Procedure Title: Thunder Scientific Humidity Generator

Minimum Review Requirements: **Annually**

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Table of Contents

1. Version History.....	2
2. Introduction	3
3. Definitions	3
4. Personnel	3
5. Safety	5
6. Procedure	5
6.1 Power Up	5
6.2 Generate Mode	6
6.3 Automated Mode	6
6.4 Data Storage and Retrieval	7
6.5 Additional Information	8
6.6 Shutdown	8
7. Equipment or Materials Required.....	8
8. Trouble Shooting	8
9. References	9

**University of Saskatchewan
Department of Mechanical Engineering
Standard Operating Procedure # HT0006**

1. Version History

Version #: 1.0
Supersedes: n/a

Handwritten amendments to the official procedures can be made by a single line through the text, along with the date, and initialed by the authorized individual making the correction. Changes are to be noted below. Formal changes to this SOP are made on the date of revision or sooner, where required.

Section	Changes made to official copy	Date	Initials

Reference Only

**University of Saskatchewan
Department of Mechanical Engineering
Standard Operating Procedure # HT0006**

2. Introduction

This procedure outlines the proper operation of the Thunder Scientific Series 1200 Mini Two-Pressure Humidity Generator. The humidity generator produces known humidity values inside a regulated chamber for instrument calibration and evaluation using the fundamental principle of the “two pressure” generator originally developed by NIST. The machine is able to generate manually entered humidity and temperature set-points as well as multipoint profiles completely unattended, while continuously recording and printing system data. Virtually all functions are controlled automatically through the use of an embedded computer. Operator interaction is through the integral touch panel or USB keyboard and mouse.

3. Definitions

Assurance	If selected, forces the system to wait until the measured parameters and the set point values are within specified tolerances before beginning the soak time
Pc	Chamber pressure
PPMv	Parts per million by volume
PPMw	Parts per million by weight
ramp time	The time allowed for the system to transition from one set point to the next set point
RH	Relative humidity
RH @PcTc	Relative humidity calculated at test chamber pressure and test chamber temperature
RH @Pc	Relative humidity calculated at test chamber pressure (ignoring possible differences between saturation temperature and chamber temperature)
soak time	The time that the system will remain at a particular set point before proceeding to the next set point
Tc	Chamber temperature

4. Personnel

Persons authorized to perform this SOP:

By signing this form I acknowledge that I have read and understand this SOP, as well as the applicable MSDS's and that I will conduct myself in accordance with this SOP and the general laboratory rules.

NOTE: ALL SIGNATURES MUST BE PRESENT ON THE SOP LOCATED IN THE YELLOW BINDER IN ROOM 1B39.1.1 – the Heat Transfer Departmental Assistant's Office. Digital copies of SOP's are made available for reference and convenience only. Printed SOP's are valid for 24 hours only, after that time their accuracy must be

**University of Saskatchewan
Department of Mechanical Engineering
Standard Operating Procedure # HT0006**

5. Safety

- The operating range of the humidity generator is 10% RH to 95% RH and 10°C to 60°C.
- Ensure the water reservoir has enough water to perform the entire test.
- Do not overfill the water reservoir.

6. Procedure

6.1 Power Up

- Turn on the computer (back panel of the humidity chamber) and the air compressor (back of the air compressor on the bottom of the cart).
- The software program will automatically launch on start-up. If it does not, or if the program has been closed, launch the Mini 1200 program from the desktop.
- At the end of the power-up sequence a window showing the water level and supply pressure will appear.
 - If the distilled water reservoir is at least half full the “Presaturator” indicator will be green. This means the system is ready to be used.
 - If the water level is low, add more water to the reservoir.
 - Remove the reservoir cap on the top of the machine with an 11/16 in wrench.
 - Fill the reservoir with distilled water. While filling, the water level gauge will update to reflect the present level. **Note: the water level updates sporadically. Add a small amount of water then wait for the water level to update before adding more.**
 - Once the reservoir is full, replace the reservoir cap. Be sure not to over tighten the cap. You should be able to tighten it with your fingers and then give it one small turn with the wrench.
 - The supply pressure should be approximately 160 psiG.

The humidity generator can run in two modes: generate and automated. The generate mode is used to generate a desired relative humidity and/or temperature inside the chamber. In automated mode, the user can create a profile containing multiple set points and set the length of time the generator will remain at each set point.

To begin, insert the sensors into the chamber. If the sensors are stand-alone units they can be placed inside the door to the chamber. If the sensors are connected to data acquisition cables or other wires, they will need to be fed into the chamber through the hole in the right side. Ensure that the hole is closed with a Styrofoam block to prevent leakage. Ensure that the chamber door is closed and latched properly.

**University of Saskatchewan
Department of Mechanical Engineering
Standard Operating Procedure # HT0006**

6.2 Generate Mode

- Using a stylus or the mouse, click on the *%RH @PcTc - Set Point* field of the Main Screen window.
- Enter the desired set point in the dialog box that appears. Use either a stylus, a mouse with the on-screen keyboard, or the attached USB keyboard. The acceptable range is 10% RH to 95% RH.
- Click *OK*.
- Click on the *Saturation Temp – Set Point* field.
- Enter the chosen set point value. The acceptable range is 10°C to 60°C.
- Click *OK*.
- Click on the *Mass Flow Rate – Set Point* field.
- Enter the chosen set point value. This is typically set to 10 L/min for best performance.
- Click *OK*.
- Select **Run → Generate** from the Top Menu.
 - All fields on the Main Screen will begin to update with current data.
 - Stabilization time of the control points will vary based on distance from set points and distance of the set points from ambient conditions. Ample time should be allowed for the system and instrumentation being calibrated to stabilize and equilibrate to the set point.
- To change any of the set point values, click on the appropriate Set Point field and enter a new value. Click *OK*.
- When the test is complete, select **Run → Shutdown** from the Top Menu.
 - After shut down is complete, the program will prompt the user to save the data. Choose *Yes* and enter a valid file name or choose *No* to exit without saving. If you are going to save the data, create a folder with your name and save the data file in that folder.

6.3 Automated Mode

- To create a new profile, select **Profile → New Profile** from the Top Menu.
- Enter the required values for:
 - *%RH @PcTc*
 - Saturation fluid temperature
 - mass flow rate – typically 10 L/min
 - ramp time (in hours) – typically set to 0 hrs.
 - soak time (in hours) – depends on the response time of the instrumentation being calibrated, typically 1 hr.

**University of Saskatchewan
Department of Mechanical Engineering
Standard Operating Procedure # HT0006**

- a “Y” or a “N” for assured soak – set to “Y” to ensure the chamber reaches the set point values before beginning the soak time. If “N” is selected, it is possible that the system will move on to the next set point before the instrument being calibrated has reached equilibrium.
- Use the < and > buttons on the panel to move between set points.
- If Assured Soak is selected, the user will be prompted to enter Assurance Conditions. These tolerances must be met before the Soak phase will begin. If the window does not automatically open it can be found under **Profile → Assurance Conditions**. Typical values are:
 - 0.2 %RH,
 - 0.1°C, and
 - 0.5 L/min.
- After entering all set points, select **Profile → Save Profile**. Enter a valid file name and click *OK*. Create a folder with your name and save the profile to this folder.
- To open an existing profile, select **Profile → Open Profile**. Choose an existing profile and click *OK*.
- To run the humidity generator using a profile, select **Run → Auto Profile**.
- A dialog box showing the current profile will appear. If this is the correct profile select the starting set point, then click *OK*.
 - If this is not the correct profile, click *Cancel* and then open an existing profile or create a new profile with the correct information.
- The actual values boxes will turn yellow until the values agree with the set point values, within the selected Assurance Conditions.
- Manual Control (from the Run Menu)
 - *Hold Point* – used to hold the humidity generator at the current set point, ignoring the pre-set time limits. To resume the profile, select *Hold Point* again.
 - *Next Point* – allows the user to skip to the next set point
- The program will display the current step out of the total number of steps in the profile in the bottom of the window. It will also list if the program is in the Assurance or Soak portion of the profile.
- After the last soak phase has completed, the humidity generator will automatically go into shutdown mode.
- To shut down the program prior to the last set point, select **Run → Shutdown** from the Top Menu.

6.4 Data Storage and Retrieval

- To save a copy of the current data file select **File → Save Data As**. Enter an appropriate file name, then click *OK*. Create a folder with your name and save the data to this folder.
- The data interval determines when the data is stored. The default is one minute.

**University of Saskatchewan
Department of Mechanical Engineering
Standard Operating Procedure # HT0006**

- To change the data storage interval, select **File → Data Storage Interval**.
- Enter the new time interval and click **OK**.

6.5 Additional Information

- To view a log of the system status, logging start times, set point changes and runtime errors, select **Window → Status Log**.
- To check the water level and supply pressure, select **Window → Water Level and Supply Pressure**.
 - If the water level is low, ensure that the machine is not generating a set point before refilling the water level.
 - The supply pressure should be a maximum of 150 psiG while the machine is in use (actively generating a set point) and approximately 160 psiG when the system is idle.
- The humidity generator is typically controlled based on the %RH @PcTc.
 - It may also be controlled based on %RH @Pc, frost point, dew point, PPMv, PPMw or saturation pressure.
 - To change the control mode select a different parameter under the **Mode** menu.

6.6 Shutdown

- If the program is currently running a profile, wait until the profile is complete, or select shut down from the **Run** menu.
- Once the machine has stopped actively generating a set point, it can be shut down.
- Click on the small X in the upper right corner of the program window. You will be prompted to save data at this point.
- Once the program has closed, select **Start → Shutdown**.
- The computer will tell you when it is acceptable to turn off the power.
- Turn off the power to the computer and the air compressor.

7. Equipment or Materials Required

- Sensor or instrumentation for calibration
- 11/16 in wrench to remove the reservoir cap
- Distilled water to fill the reservoir

8. Trouble Shooting

If you encounter problems that you are unsure how to deal with, consult the Departmental Assistant in the lab. The following is a list of some possible problems that might occur and how to solve them.

**University of Saskatchewan
Department of Mechanical Engineering
Standard Operating Procedure # HT0006**

Problem:	Look for
Supply Pressure Low	Ensure the air compressor is on Select a different RH set point
Reservoir Water Empty	Fill the reservoir with water
Flow Rate Min Value Limit	Select a higher flow rate

9. References

Thunder Scientific Corporation, 2004. Mini 1200 Two-Pressure Humidity Generator Operation and Maintenance Manual. Albuquerque, NM.

Reference Only