

# Study of Existing Laboratory N151 for Proper Ventilation and Conditioned Air



Submitted to:

**Springborn Smithers Laboratories  
790 Main Street  
Wareham, MA 02571**

February 27, 2008

**HVAC CAD SYSTEMS LLC**

**Danvers, MA 01923 Tel # (978) 739-HVAC (4822) Fax # (978) 739-4818 Website: [hvac-cad.com](http://hvac-cad.com)**

# Table of Contents

<b>SECTION 1</b>	<b>Introduction</b>	<b>Page 1</b>
<b>SECTION 2</b>	<b>Existing Conditions:</b> <b>1. Laboratory N151</b> <b>2. Air Handling Unit</b>	<b>Page 1</b>
<b>SECTION 3</b>	<b>Findings:</b> <b>1. Laboratory N151</b> <b>2. Air Handling Unit</b>	<b>Page 2</b>
<b>SECTION 4</b>	<b>Recommendations:</b> <b>1. Option 1</b> <b>2. Option 2</b>	<b>Page 3</b>
<b>APPENDIX A</b>	<b>Existing Condition Drawing</b>	
<b>APPENDIX B</b>	<b>Option 1 New Drawing</b>	
<b>APPENDIX C</b>	<b>Option 2 New Drawing</b>	

## INTRODUCTION

Springborn Smithers Laboratories is a leading Contract Research Organization that provides a wide range of services to the worldwide chemical industry. HVAC CAD Systems LLC has been contracted by the Wareham, MA location to evaluate their existing laboratory N151 and provide recommendations for properly ventilating and conditioning this space. HVAC CAD Systems will analyze the existing conditions at Springborn Smithers Laboratories and determine how the existing laboratory can be satisfied.

## EXISTING CONDITIONS

The Wareham, MA Springborn Smithers Laboratories is a two story building which houses laboratory, research and office facilities.

The existing lab N151 (345 Sq. Ft., 2760 Ft<sup>3</sup>) has one fume hood and one bio-safety cabinet. The fume hood exhausts 1,240 CFM of room air up to an exhaust fan in the attic space and out through the roof. The bio-safety cabinet re-circulates the air from the room through the hood, over a HEPA filters and back into the room. There is one supply air inlet into the lab. This inlet provides approximately 200 CFM of conditioned air from an outdoor air handling unit.

The existing outdoor air handling unit is a Modine Weatherhawk gas fired furnace model number HFG225TMRHN23D2CE1GDA00. This unit has a maximum heating output capacity of approximately 180 MBH and a maximum air flow rate of 6,000 CFM. This unit is located on the ground adjacent to lab N151. This air handling unit provides 100% conditioned outside air to five separate lab spaces: Lab N151, Lab M150, Lab N148, Lab O150 and Lab O147.



Outdoor Air Handling Unit – Modine Weatherhawk

As seen in the above photo the unit is ducted from the ground up the attic space. The supply ductwork penetrates the roof into the attic space and enters a remote direct expansion cooling coil. From the cooling coil the ductwork enters a direct expansion / hot water dehumidifier. The ductwork is then distributed to the five labs. The condensing units for the cooling coil and dehumidifier are located outside on the ground in the vicinity of the air handling unit. See Appendix A for sketch (SKH-1) of the existing conditions.

Springborn Smithers Laboratories would like the lab N151 to have proper ventilation air for a lab space and use that ventilation air to properly heat and cool the lab. HVAC CAD Systems will analyze the existing conditions and determine whether the capacities of the existing outdoor air handling unit will be adequate to properly serve the lab N151 while still maintaining the other existing four labs.

## **FINDINGS**

HVAC CAD Systems has analyzed the existing outdoor air handling unit and associated cooling coil, performed total static pressure calculation on the conditioned air distribution system and performed heating and cooling load calculations on the existing lab N151. We have discovered the followings:

### ***STATIC PRESSURE***

The existing distribution system was not installed efficiently. There are several areas where the way the ductwork was installed dramatically increased the total static pressure of the system.

1. At inlet and outlet of the cooling coil the ductwork transition are too short.
2. At the inlet of the dehumidifier there are several elbows and hard transitions that allow the ductwork to enter the bottom of the unit (see photo below).
3. At the outlet of the dehumidifier there are several elbows and a by-pass duct with a motor operated damper.

The total static pressure for this system is approximately 2.0" W.C. This static pressure is calculated by totaling the pressures created by the above items, the cooling coil, the dehumidifier, the electric duct heater, the ductwork itself and the internal pressures in the unit.



Ductwork Connection to Dehumidifier

### ***OUTDOOR AIR HANDLING UNIT***

The outdoor air handing unit currently has a one and half horse power motor with a 9"x11" blower wheel. With 2" of static pressure in the system the maximum air flow that the unit can produce is approximately 1,670 CFM.

## **HEATING LOADS**

The heating load for the lab N151 is approximately 14,000 Btu/Hr. The existing outdoor air handling unit is capable of providing 180,000 Btu/Hr of heating. The existing unit appears capable of satisfying all five lab spaces as long as the outside air temperature remains above 18° F.

## **COOLING LOADS**

The cooling load for the lab is approximately 1.5 Tons. The existing direct expansion cooling coil and associated outdoor condensing unit are capable of providing 10 Tons of cooling. This system appears capable of satisfying all five lab spaces as long as the outside air temperature remains below 87° F DB and 73° F WB.

## **Laboratory N151**

Currently lab N151 has approximately 200 CFM of conditioned supply air from the outdoor air handling unit. This supply is providing approximately 4,300 Btu/Hr of heating and 0.5 Tons of cooling. The fume hood for the lab provides approximately 1240 CFM of exhaust air. The other four labs have approximately 20% more exhaust air in their spaces than supply air. Lab N151 has approximately 62% more exhaust air than supply air.

## **DEFICIENCIES**

1. Lab N151 is current under a considerable negative pressure. To get this system to a 20% greater exhaust would require 1000 CFM of supply air be brought into the lab.
2. The outdoor air handling unit is capable of this additional airflow but will require a larger motor to overcome the systems high static pressure.
3. The additional air flow will affect the heating discharge air temperature and would require the outdoor air temperature be a minimum of 36° F to satisfy the heating requirements of all five lab spaces.

## **RECOMMENDATIONS**

The existing outdoor air handling unit appears to be in fair condition and has the capacity required to support Springborn Smithers lab N151 and the other four lab areas. HVAC CAD Systems has the following recommendations:

### **General**

- Have a Testing and Balancing report done outlining the existing system's air flow and pressures. This will show the actual air flows delivered to each lab and total pressures.
- Have a new Testing, Adjusting and Balancing (TAB) report done after the new system is installed. This will outline the new system's air flow performance and system pressures.

### **Option 1**

- Provide 2,250 CFM of conditioned outside air from the existing outdoor air handling unit to the existing distribution system. With the existing system having 2.0" of static pressure the units motor horse power must be increased from a 1.5 HP to 3.0 HP motor. This increase will allow the unit to provide the required air flow.

- Provide a new 10" round ductwork take-off in the ductwork distribution system to supply an additional 380 CFM to lab N151.
- The lab N151 will now have 580 CFM of supply air. The lab will still be considerably negative but the supply air will provide the proper heating and cooling requirements for the lab space. If the proper exhaust to supply air ratio was achieved the five labs would not be able to maintain proper room temperatures.
- There is an existing 8" round take-off on the existing distribution system that is open to the attic. This open duct should be capped and made air tight.
- The existing 8" round ductwork that currently supplies the 200 CFM to lab N151 was dislodged from its diffuser. This ductwork should be re-attached so the supply air is delivered to the lab.
- This system shall operate 24 hours a day, 7 days a week. The hood exhaust and supply air shall operate continuously.
- See Appendix B for sketch (SKH-2) of this option.

### **Option 2**

- Provide 2,250 CFM of conditioned outside air from the existing outdoor air handling unit to the existing distribution system. With the existing system having 2.0" of static pressure the units motor horse power must be increased from a 1.5 HP to 3.0 HP motor. This increase will allow the unit to provide the required air flow.
- Provide a new 10" round ductwork take-off in the ductwork distribution system to supply an additional 380 CFM to lab N151. Provide a motor operate damper in this ductwork.
- The lab N151 will now have 580 CFM of supply air. The lab will still be considerably negative but the supply air will provide the proper heating and cooling requirements for the lab space. If the proper exhaust to supply air ratio was achieved the five labs would not be able to maintain proper room temperatures.
- The existing 8" round ductwork that currently supplies the 200 CFM to lab N151 was dislodged from its diffuser. This ductwork should be re-attached so the supply air is delivered to the lab.
- There is an existing 8" round take-off on the existing distribution system that is open to the attic. Provide a new 8" to 10" round transition. Provide new 10" round ductwork from the main to a diffuser located in the hall. Provide motor operated in this ductwork.
- Provide new 300 CFM exhaust fan in the attic space. Provide ductwork and exhaust grille for lab N151, provide ductwork from new exhaust fan up through the roof and terminate with weather cap.
- This system shall operate as required. When the lab technician operates the exhaust hood the hallway motor operated damper is closed, the lab motor operated damper is open and the general exhaust fan is off. In this condition the lab will have 580 CFM of supply air and 1,240 CFM of exhaust. No air is supplied to the hallway. When the lab technician shuts off the hood, the lab damper is closed, the hallway damper is open, the hood exhaust fan is off and the general exhaust fan is energized. In this condition the lab will have 200 CFM of supply air and 300 CFM of exhaust air. The hallway is pressurized with 380 CFM of supply air.
- See Appendix C for sketch (SKH-3) of this option.

HVAC CAD Systems recommends that Springborn Smithers Laboratories go with Option 2. This option will provide the ventilation and conditioning requirements as well as provide some energy savings when the hood is not being used.

# **APPENDIX A**

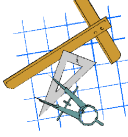
## **Existing Conditions**

# SPRINGBORN SMITHERS LABORATORY

790 MAIN STREET  
WAREHAM, MA 02571

## HVAC CAD SYSTEMS LLC

185 CENTRE STREET  
DANVERS, MA 01923  
TEL: (978) 739-HVAC (4822)  
FAX: (978) 739-4818



Job # 2008-007

Drawn by: **DHM** Ckd by: **JEC**

Date: 2-26-08 Scale: NONE

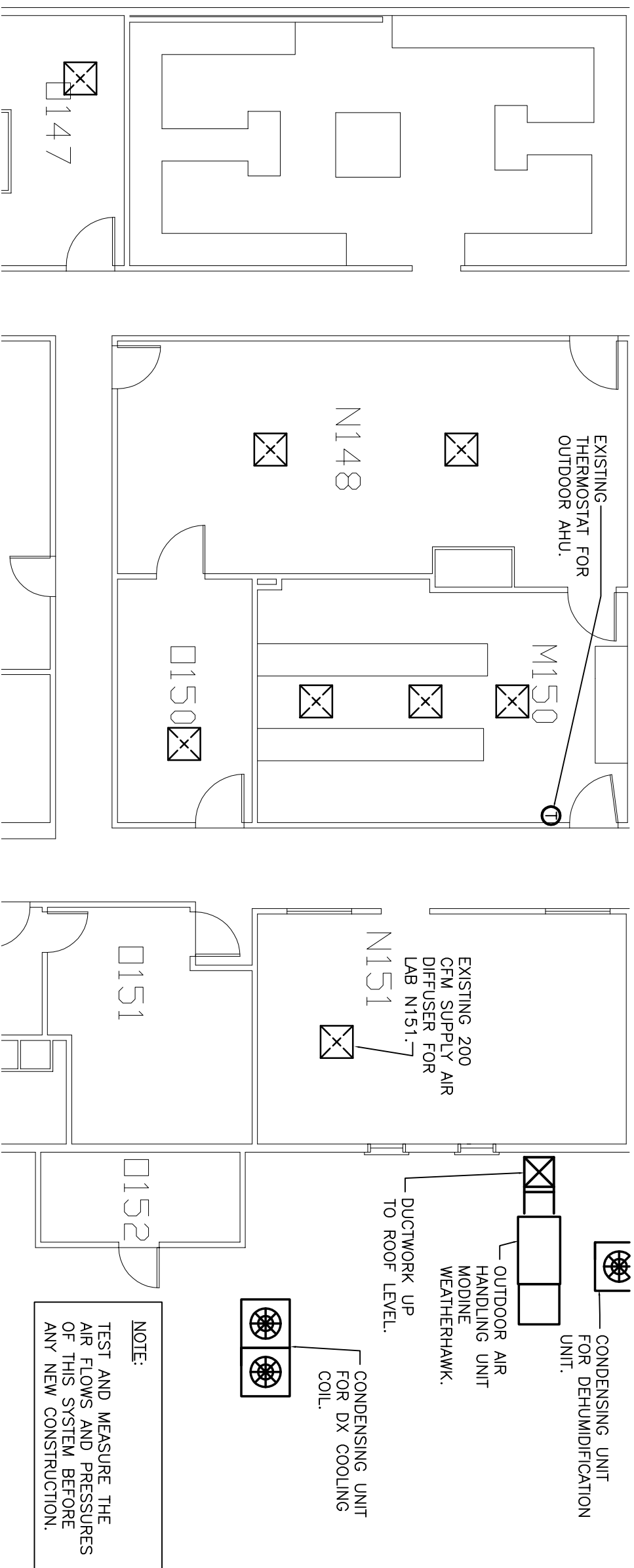
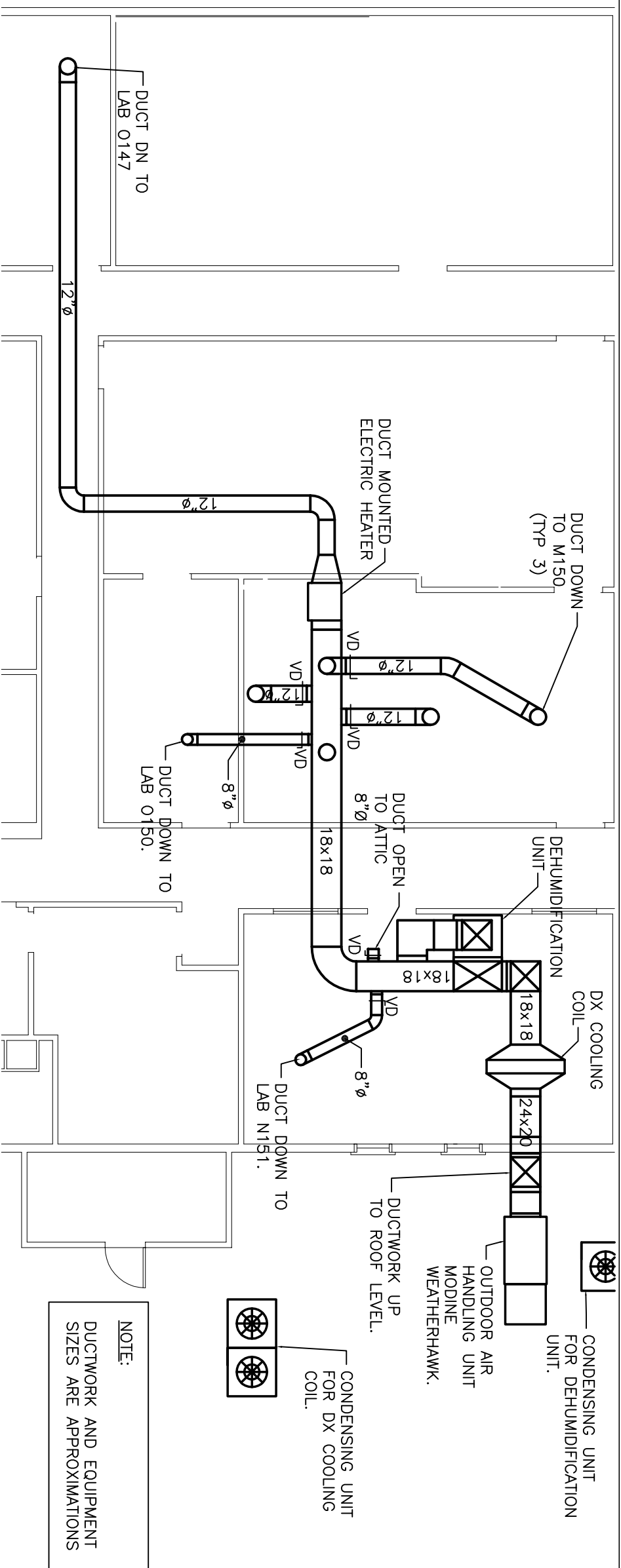
STUDY OF EXISTING LAB N151

### Revisions

NO.	DATE	DESCRIPTION

## LABORATORY N151 EXISTING CONDITIONS

# SKH-1



EXISTING FLOOR PLAN

# APPENDIX B

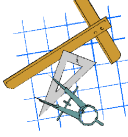
## Proposed Option #1

# SPRINGBORN SMITHERS LABORATORY

790 MAIN STREET  
WAREHAM, MA 02571

## HVAC CAD SYSTEMS LLC

185 CENTRE STREET  
DANVERS, MA 01923  
TEL: (978) 739-HVAC (4822)  
FAX: (978) 739-4818



**NOTE:**  
DUCTWORK AND EQUIPMENT SIZES ARE APPROXIMATIONS

Job # 2008-007

Drawn by: **DHM** Ckd by: **JEC**

Date: 2-26-08 Scale: NONE

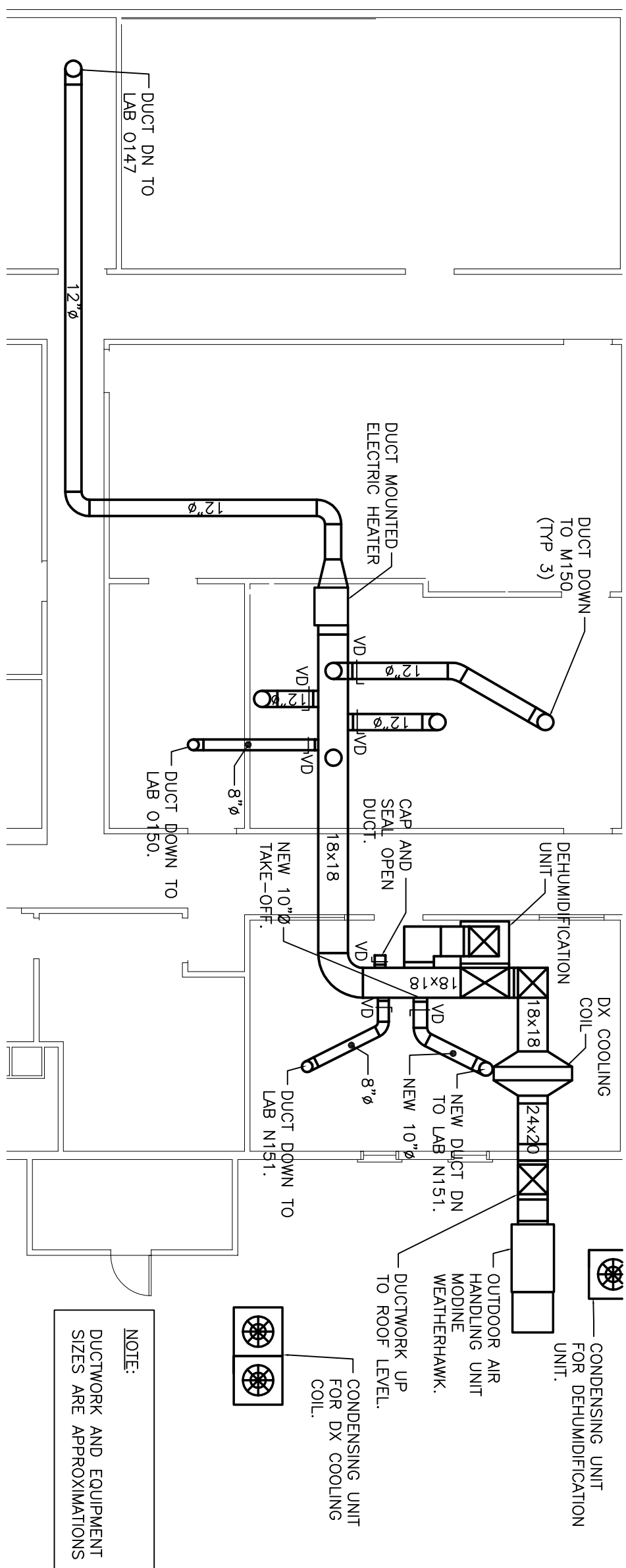
STUDY OF EXISTING LAB N151

**Revisions**

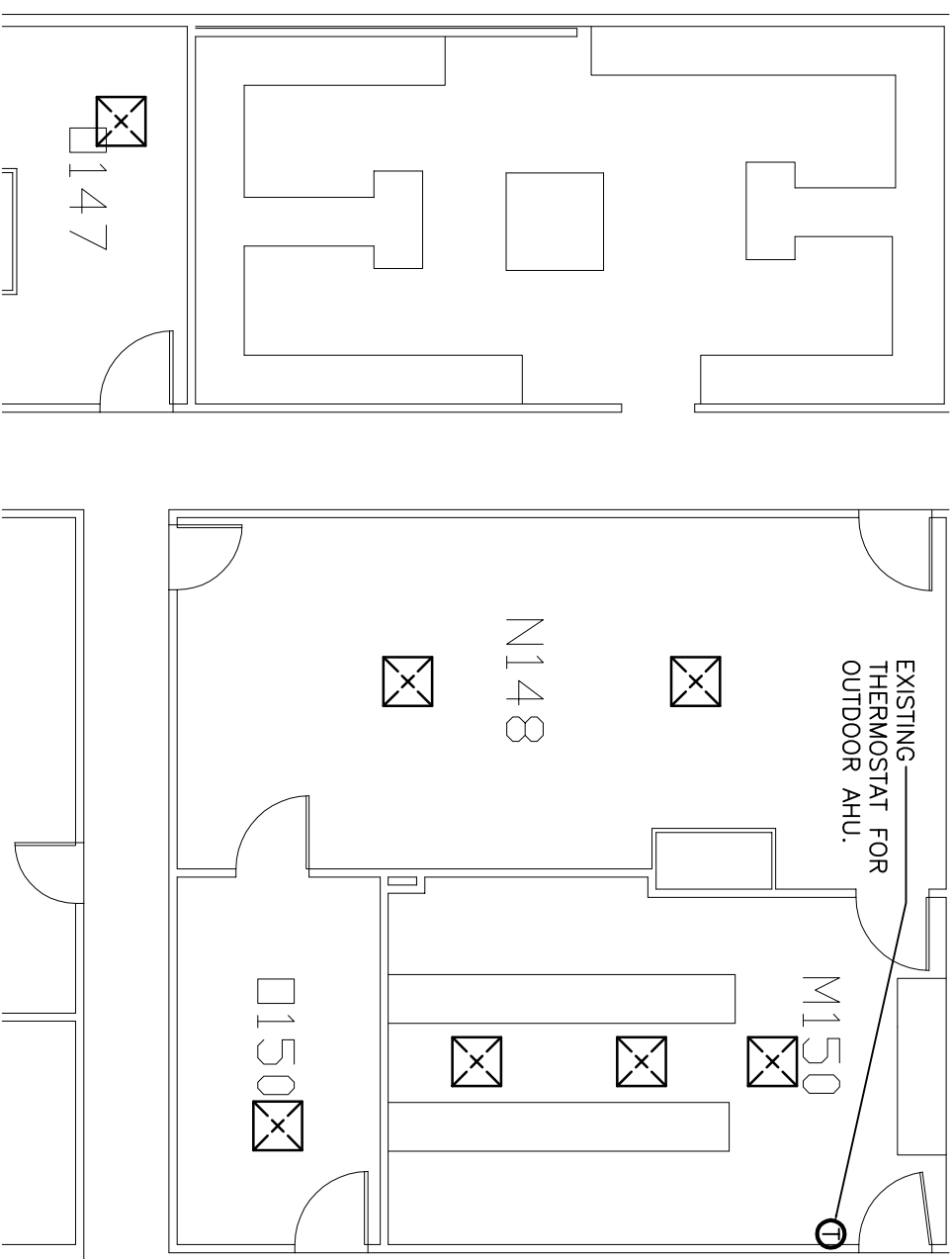
NO.	DESCRIPTION	DATE

## LABORATORY N151 OPTION 1

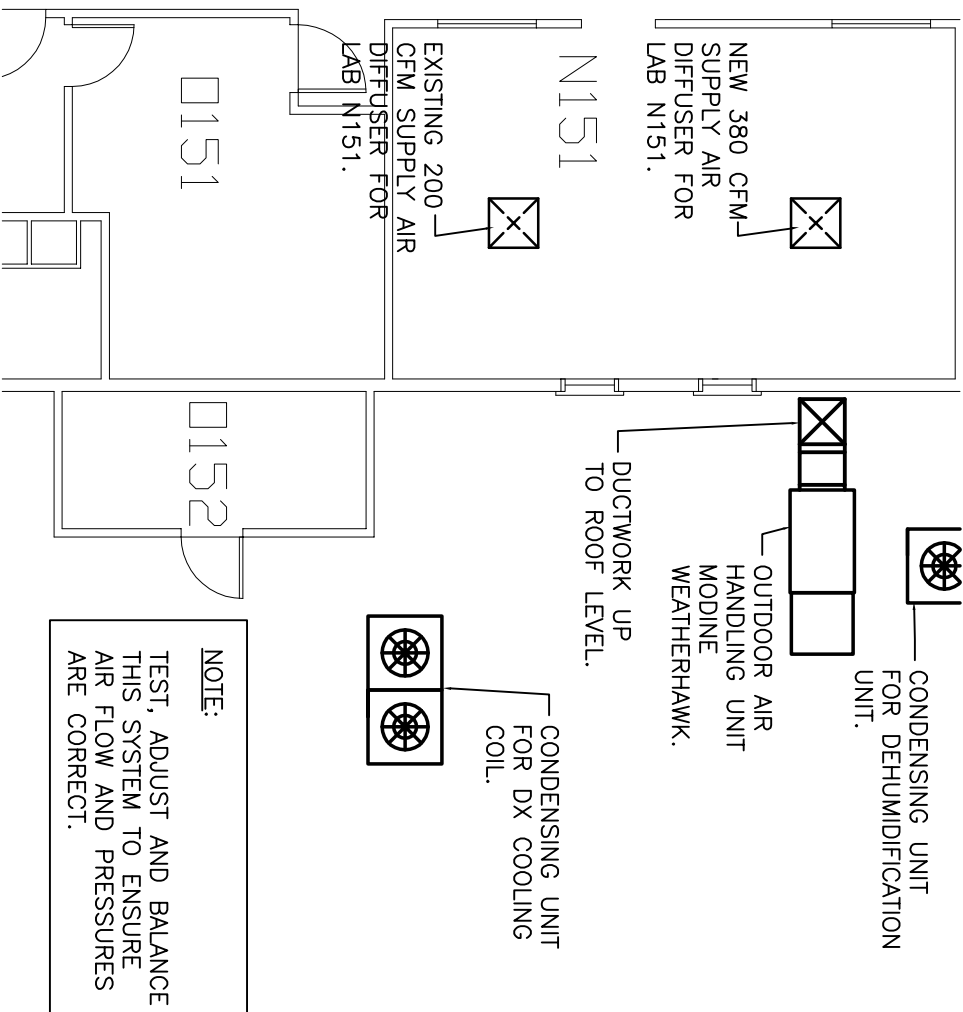
# SKH-2



EXISTING ATTIC PLAN



EXISTING FLOOR PLAN



**NOTE:**  
TEST, ADJUST AND BALANCE THIS SYSTEM TO ENSURE AIR FLOW AND PRESSURES ARE CORRECT.

# APPENDIX C

## Proposed Option #2

