Sub-slab Depressurization System Design
Former Labelon Corporation Facility
Site Code: C835016
10 Chapin Street
Canandaigua, New York

Prepared for:
2240 North Forest Road, LLC
2 Wendling Court
Lancaster, New York 14086

Prepared by:
Marsh Engineering DPC
271 Marsh Road, Suite 2
Pittsford, New York 14534

October 2021

994.001

Certification

I, Dixon Rollins, P.E, am currently a registered professional engineer licensed by the State of New York and certify that this Revised Remedial Design for a Sub-slab Depressurization System was prepared in full accordance with all applicable statues and regulations and in substantial conformance with the Division of Environmental Remediation Technical Guidance for Site Investigation and Remediation (DER-10)."

Dixon Rollins, P.E.

59206 — 10/26/21

NYS Professional Engineer # — Date

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1.0 INTRODUCTION

This document provides the design for a sub-slab depressurization system being constructed as a part of the remediation of the Former Labelon Corporation Facility property located at 10 Chapin Street in the City of Canandaigua (“Site”). Figure 1 is a Site location map. The property owner, 2240 North Forest Road LLC has entered the Site into the New York State Department of Environmental Conservation (“NYSDEC”) Brownfield Cleanup Program (“BCP”) to conduct the remediation of the Site following a March 21, 2018, Remedial Action Work Plan prepared by Ravi Engineers and Land Surveying, P.C. This document covers the design of a sub-slab depressurization system (“SSDS”) which will be installed into the first floor of the Site building.

Marsh Engineering DPC has prepared this design, which documents construction of the system, performance goals and reporting responsibilities of this project. This design plan was developed in general accordance with the New York State Department of Health (“NYSDOH”), “Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006.”

2.0 BACKGROUND

The Site is on a 1.63-acre property located immediately in the City of Canandaigua’s downtown district. The Site has one building with a footprint covering approximately 79,800 square feet. The building is vacant and most of the interior has been demolished, with most of the walls and ceilings and all mechanical and electrical systems demolished or removed. The property was used in the past as a manufacturer of films and labels.

In 2019 Leader Professional Services, Inc. (“Leader”) conducted the removal of an underground storage tank (“UST”) and the contaminated soil adjacent to the UST and injections of in-situ chemical reduction amendments into the soil and groundwater. Leader is conducting quarterly groundwater monitoring.

In April 2021, Leader coordinated the repair of the building’s concrete floor slab and debris removal on the first floor in preparation of the SSDS installment. The repairs included the backfilling and replacement of concrete flooring in the former boiler room where an exploratory test pit for a suspect underground storage tank was excavated by MacDonald Engineering in May 2016. The entire floor in the boiler room was raised to match the elevation of the remaining building floor. The preparation included concrete skim repair to exposed and/or deteriorated surfaces throughout the first floor and the removal of building debris staged along the southern interior wall of the facility.

3.0 SUB-SLAB DEPRESSURIZATION SYSTEM DESIGN

3.1 Basis for Design

The SSDS will be installed prior to the planned renovation of the Site building. The SSDS may require additions/changes once the design for the interior renovation of the building is finalized. Since the building does not have utilities (electric, gas or water), heating system or windows installed at this time, the NYSDEC agreed to allow the installation of the SSDS prior to building renovations. Once the building is enclosed and electric service is installed, the SSDS will be activated and tested to confirm the SSDS is applying a vacuum and capturing the area beneath the footprint of the building.

3.1.1 Pre-Design Communication Testing

The design parameters for the SSDS were obtained by conducting a series of sub-slab air flow tests in the building. The locations of the testing are shown on Figure 2. Testing was performed by Mitigation Tech of Brockport, New York, (National Environmental Health Association – National Radon Proficiency Program Certification Numbers 104867 (measurement) and 100722 (mitigation).

Mitigation Tech conducted the testing using ports ranging from 0.375 to 5.0-inches in diameter. The larger diameter ports were used to apply a vacuum to the subsurface, then a series of smaller diameter ports approximately 0.375 to 0.5 inches in diameter, radiating out from the larger port, were drilled to follow the sub-slab response to the vacuum. At each location, the vacuum was measured. In general, the starting point for measurements were 10 to 20 feet from the suction hole.

The larger suction port was in an area where the concrete was structurally sound and had limited visual indication of sub-surface interferences (foundations, walls, pits, elevators, etc.). Locating the suction port in locations where permanent suction cavities might be placed provides an assessment of how the actual system may respond. Measurement locations were placed in locations which provided a 360-degree image of the vacuum response.

Testing was conducted at a single vacuum to determine if there was a response over the variable distances. As data was obtained, the testing showed the subsurface response was favorable and did not require additional testing to evaluate air flow or vacuum changes. The goal of the testing was to define where 0.004 inches of water vacuum was located for any given extraction point. This area of influence ("AOI") or radius of influence ("ROI") for specific vacuums and air flows were used to design the SSDS and determine the number of extraction points needed. The USEPA guidance document "Radon Prevention in the Design and Construction of Schools and Other Large Buildings, (EPA/625/R-92/016, June 1994)," suggests a vacuum field be defined to 0.002 inches of water column to ensure capture of the sub-slab vapor by an extraction point. The exhaust air from the test fan was measured with a portable organic vapor analyzer using a photoionization detector ("PID"). The air was exhausted outside.

3.1.2 Test Results

As a result of the testing, ROIs of 50 feet and more were found, with vacuums measured at 50-feet of 0.007 and 0.029 inches of water column. Table 1 summarizes the vacuum measurements and ROI from each sub-slab test location. See Figure 2 for test locations.

Table 1
Air Flow Results
Former Labelon Corp. Facility Site
Completed on August 29, 2019

Location Point to Point	Observed Vacuum (inches of water column)	Distance (Feet)
E	0.225	16 ft
N	0.007	50 ft
SE	0.014	45 ft
S	0.029	50 ft

The communication testing verified that SSD is a viable soil vapor intrusion mitigation strategy in reducing migration of sub-slab vapor into indoor air in the Site's building.

3.1.3 Vapor Monitoring

During the vacuum and air flow testing, the ambient air from within the floor ports and vacuum discharge were monitored with a PID. The monitoring was conducted primarily for Site health and safety reasons; however, no vapor concentrations were found above background levels.

3.2 Preliminary Design

The preliminary design of the SSDS was based on the ROI and the concept design of the renovated building. As the SSDS is constructed (suction points and vacuum measured) some changes may occur to accommodate the final interior design. Figure 3 shows the areas being addressed by this preliminary design. Since the building does not have utilities or a heating system at this time, additional design work will be completed and implemented, as needed, to eliminate a possible preferential pathway after the renovations are complete.

Changes occurring during construction will be documented along with the performance of the system upon completion. The contractor will show conformance to the SSDS vacuum criteria before NYSDEC acceptance.

Sub-slab vapor control will be conducted by applying a vacuum on suction cavities.

The discharge from the SSDS's will be directed through the roof or through adjacent exterior walls to a point above the roof and at least 10 feet away from any air intakes or open windows.

3.2.1 Suction Cavities and Piping

Suction cavities will be the primary means to create a vacuum on the subsurface, but as the design is implemented and vacuum is measured, additional suction points may be required to complete the vacuum capture. In general, most locations will use suction cavities, which are a 5-inch diameter port drilled through the concrete floor. Once the concrete is drilled, the material beneath the floor will be removed to create a space with a volume of approximately 1-cubic foot. If the soil is dense and cannot easily be removed, a larger rectangular port will be made. Once the cavity is made and the pipe inserted, the finished location will have the same outward appearance. If a higher vacuum is required, a smaller pipe size may be used. Figure 3 provides the approximate locations of the suction cavities to be used to capture the sub-slab vapors and depressurize the building.

In general, the SSDS will use three and four-inch diameter PVC schedule 40, solvent welded joint piping. Suction cavities will be constructed from a 5-inch or larger diameter hole cut through the concrete floor into the sub-slab aggregate or soil. This material will be removed to form an approximate 1-cubic foot cavity. The PVC piping will be inserted through the 5-inch hole and sealed in place with flexible urethane caulk and, or new cement and caulk. Where foundations or walls interrupt the most direct path of the piping, trenching in the concrete floor or cutting through a wall may be required to provide the most direct path to the roof exit.

If piping must be placed beneath the floor where future floor loads are uncertain, the pipe trench will be excavated to the width of approximately 2-inches greater than the diameter of the pipe. Any stones, cobbles, or fill material that could damage the pipe will be removed from the remaining subgrade material. The piping will be placed on a bedding layer of clean sand reaching a thickness of approximately 4-inches and tapped in place to form a compacted surface. Sand will be used to provide a 6-inch cover over the pipe. The floor will be replaced using the same thickness of concrete. The concrete used will be designed by the building's architect or structural engineer. Penetrations through walls will be sealed with a fire-resistant foam and have a finish coating consistent with the interior or exterior surfacing materials.

Following placement of the SSDS suction cavities, any significant cracking in the floor, open floor joints and other penetrations in the vicinity of the suction points will be filled with urethane caulk if additional cement or sealing type coatings will not be used. The sealants will be compatible with the piping and planned floor coatings/coverings and approved by the architect or construction engineer.

Risers from the suction cavities will be fitted with proportioning plates or valves when risers are manifolded together for one fan. The proportionating plates or valves provide a means to evenly apply the fans' vacuum or to increase vacuum to a specific region. All pipes will be labeled indicating it is part of the SSDS. Either oil filled vacuum "U-tube" manometers or dial gauges to be used to observe the applied vacuum on the risers. The location of the gauges will be determined based on the planned usage of the space. Horizontal pipe runs will be sloped to promote condensation to run back into the suction cavities. Pipe slopes will be approximately 1-inch per 100-feet. Horizontal and vertical pipe will be supported with hangers placed every 7-

feet or as recommended by the pipe manufacturer, architect, or mechanical engineer. Pipe hangers will be manufactured for the specific type of pipe, pipe diameter and purpose.

3.2.2 Fans and Electrical

The fan selected for this design is the FANTECH Rn4-EC. A total of four fans are planned. In the main area of the building two fans will be used and each connected to four suction cavities. The north side of the building will also use two fans, and each will be connected to three suction cavities. The fan's specifications are provided in Appendix 1, but these are subject to change based on the findings of further testing during installation.

Vacuum fans will be located on the exterior of the building, either on the roof or hung from a building wall. The discharge point of the fan will be located at least 10-feet from an air intake or window and rise above the elevation of the roof or any parapet wall. The City of Canandaigua Building Codes will be consulted for the minimum elevation to be used.

Switches for each fan will be located at a convenient location to the fan, but in a location to minimize the potential that the fan will be accidently turned off. Each switch will be labeled to identify the switch's purpose.

Pressure transducers as an adjustable high/low vacuum pressure switch will be installed at each blower system and wired to the control panel. If the pressure within the system falls below 0.25 inches of water column ("in. w.c.") or greater than 4.5 in. w.c, the pressure switch will send a signal to the control panel, illuminating a red warning indicator light on the control panel. If the vacuum is within the selected range for each blower, a green light will be illuminated. The components will be calibrated by the installer in accordance with the manufacturer requirements.

Conduits to and from switches, fans and panel boxes will be sealed using Sealtight® foam or epoxy fill appropriate for the purpose and the location of the switch, fan, or panel. Conduit or metal clad ("MC") wiring consistent with the City of Canandaigua Building Code will be used to convey wiring. All final electric connections will be made by a licensed electrician.

4.0 PERFORMANCE TESTING

Performance testing will be completed during and after the SSDS system is finalized. Performance testing during SSDS installation will include vacuum readings in the floor at temporary one-half inch diameter sub-slab monitoring points, vacuum readings in the pipes and pressure readings downstream of the fans to confirm that the spacing of the suction cavities is sufficient to achieve the vacuum coverage required to address the entire affected area. Vacuum and pressure readings will be taken using digital manometers which can read to 0.001 in. w.c.. Once the system is installed, additional vacuum readings will be taken to optimize the system by adjusting the proportionating valves. Twelve (12) of the temporary sub-slab monitoring points will be converted to permanent monitoring points (See Figure 3). Annual monitoring of vacuum levels at these twelve points will be used to confirm the continued effectiveness of the SSDS operation.

Measurements will be recorded for each suction cavity and fan location so system performance can be monitored. The objective of the performance testing will be to achieve 0.004 in. w.c. or greater vacuum beneath the floor slab.

Smoke testing will also be completed to inspect cracking and joints in the concrete floor, and around in system pipe joints if vacuum losses cannot be explained.

Indoor air monitoring (full TO-15 list) will be completed during the heating season after building renovations are completed (no sooner than 30-days after completion and prior to occupancy). The Indoor Air Quality and Building Inventory will be completed, and any potential indoor air sources will be removed or properly stored/contained. The sample locations will be provided to the NYSDEC and NYSDOH for review and approval prior to conducting the monitoring.

5.0 REPORTING

At the completion of this phase of the project a Construction Completion Report ("CCR") will be prepared. The CCR will summarize the construction activity, identify where design changes were made (the reason behind the change and the corrective action) and the post construction testing results. The CCR will include an as-built drawing showing the SSDS locations and components.

An Operations, Maintenance and Monitoring ("OM&M") Plan for the SSDS will be submitted with the CCR. The OM&M Plan will be provided to the owner and occupants to facilitate their understanding of the system's operation, maintenance, and monitoring.

6.0 MAINTENANCE & MONITORING

An Operation, Maintenance, and Monitoring Plan will be developed for the Site building. The purpose of the OM&M Plan is to provide operators with instructions on how the building's SSDS is operated and maintained in general accordance with the SSDS design. The routine monitoring will include system performance by instrument measurements, routine inspection of the system components for condition and proper operation, and review of changes in building use and conditions.

Pressure field extension tests using a micromanometer capable of resolution down to 0.001 of water column will be repeated if necessary due to final system modifications, repairs, or replacement of components, or if requested by the NYSDEC and/or NYSDOH.

7.0 PROJECT MANAGEMENT

A Marsh Engineering DPC staff will be present through the duration of the SSDS installment and initial startup, and will document the construction activity, startup operations to verify conformance with our design drawings and details. Marsh Engineering DPC will complete and certify a Construction Completion Report ("CCR"), and associated reports as Appendices to document the installation and its start-up operation. The NYSDEC Project Manager for this project is Danielle Miles, E.I.T. Ms. Miles can be contacted at 585-226-2466.

8.0 SCHEDULE

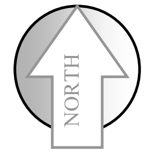
SSDS installation is estimated to begin within six weeks after regulatory acceptance of the SSDS design. This phase of the design and construction will take approximately three weeks to complete, with riser and fan installation to be determined during building renovations.

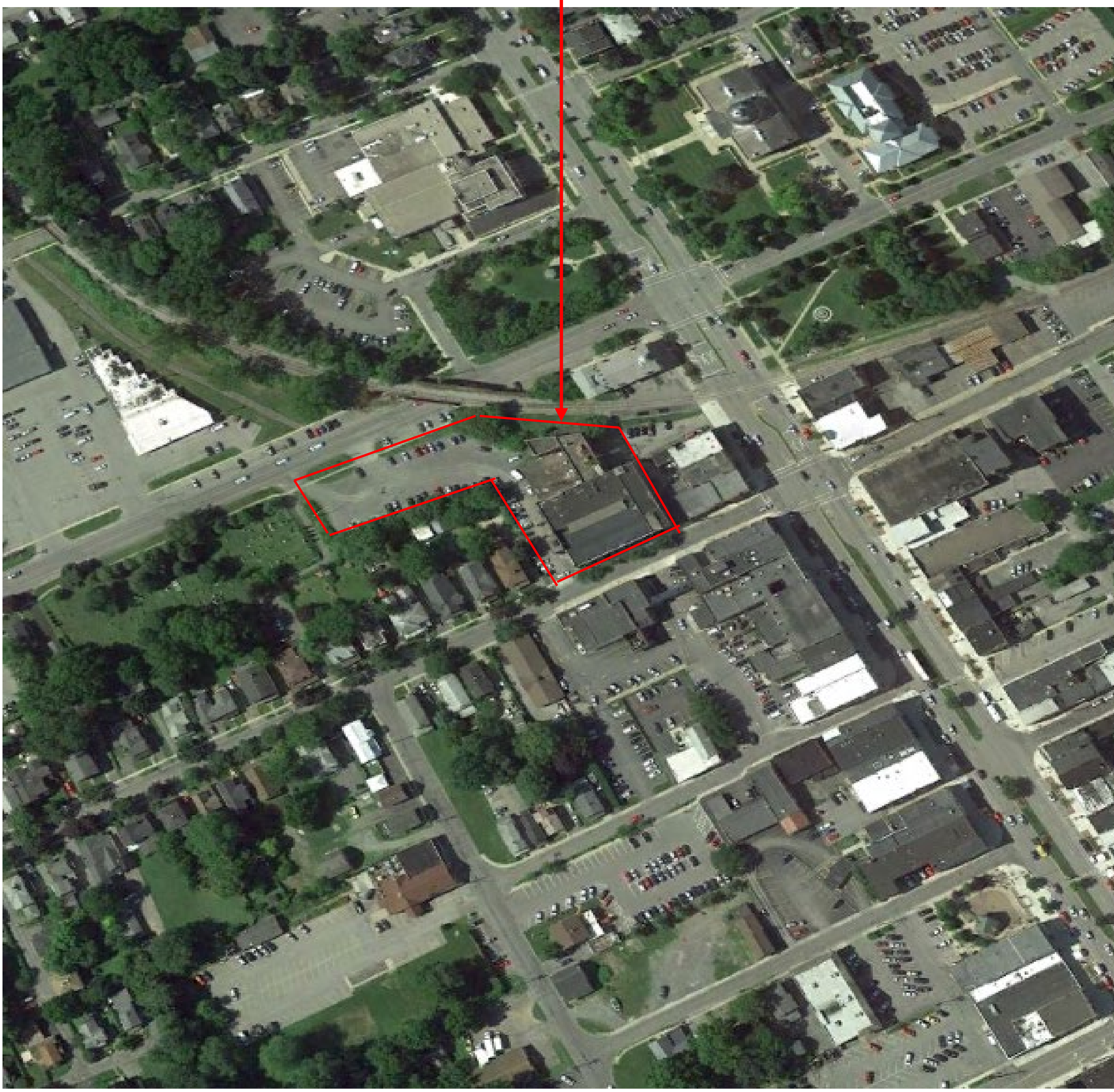
9.0 HEALTH AND SAFETY

Each of the contractors working on this project will be required to have a site-specific Health and Safety plan ("HASP") which, at a minimum follows the Site HASP. The HASP will address all the known and potential environmental and workplace hazards.

FIGURES

SITE LOCATION





Title
Site Location
Former Labelon Corp. BCP Site #C835016
10 Chapin Street, Canandaigua, New York

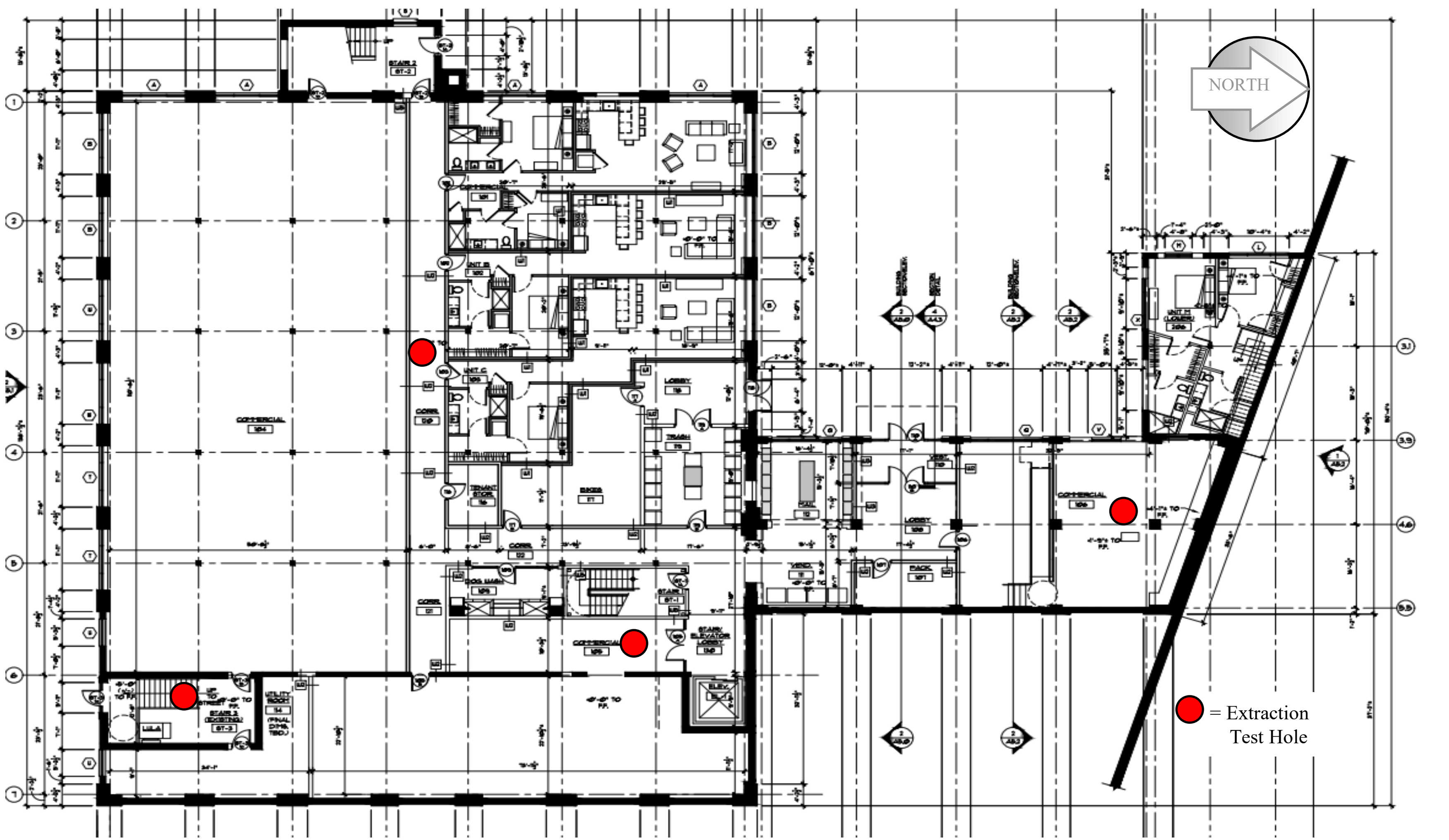
Prepared For
2240 North Forest Road, LLC
500 Seneca Street, Suite 508
Buffalo, New York

Marsh Engineering, D.P.C.
271 Marsh Road, Suite 2
Pittsford, NY 14534
(585) 248-2413
FAX (585) 248-2834

Project
994.001
Date
7/21/2021
Scale
As shown

Drawn
FRT
Checked
DMR
File Name
Site Location

Figure
1



Title: Sub-Slab Test Locations
Former Labelon Corp. BCP Site #C835016
10 Chapin Street, Canandaigua, New York

Prepared For: 2240 North Forest Road, LLC
2 Wendling Court
Lancaster, New York 14086

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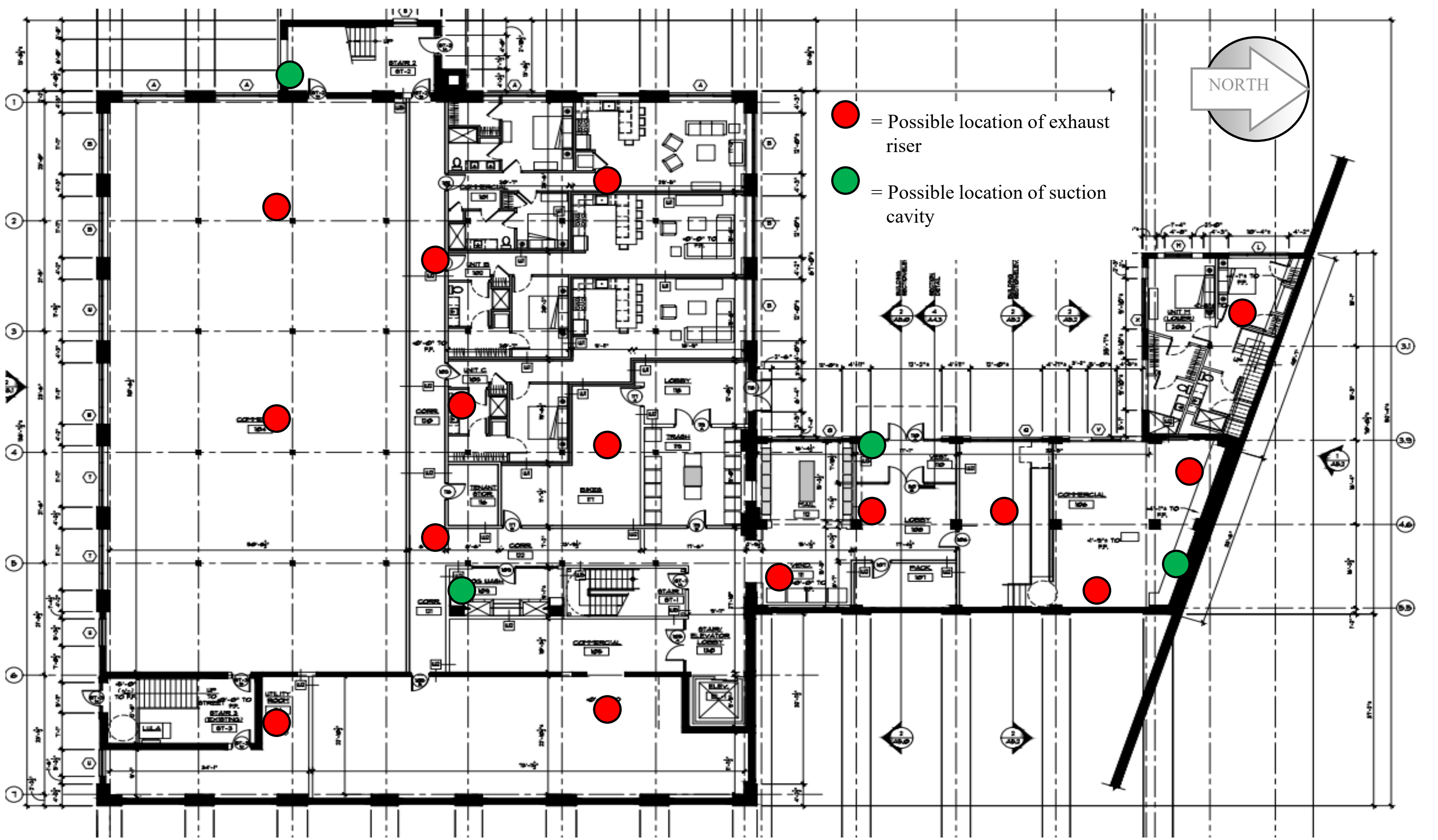
Project	994.001
Date	7/21/2021
Scale	NTS
Drawn	FRT
Checked	DMR
File Name	Site drawing
Figure	2



Title: Sub-Slab Depressurization System Layout
Former Labelon Corp. BCP Site #C835016
10 Chapin Street, Canandaigua, New York

Prepared For: 2240 North Forest Road, LLC
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Project	994.001
Date	7/21/2021
Scale	NTS
Drawn	FRT
Checked	DMR
File Name	Site drawing
Figure	3

Appendix A

Fan Specifications

fantech®
a systemair company

Rn 4EC-4 Inline Radon Fan

Item Number: 99923
Variant: 120V 1~ 60Hz

• Use for **High Suction, High Airflow** applications
• Equipped with EC Motor
• Speed Control Included
• LDVI™ Couplings Included
• Airtight Housing Guaranteed
• Large Electrical Box
• Zero Leakage

Active radon mitigation systems employ specialized fans to exhaust radioactive radon gas from underneath building structures via a sealed pipe system. These systems are designed to remove radon gas before it migrates into the building envelope.

As the most powerful model in Fantech's family of Radon Mitigation fans, the **Rn4EC** can create 4.3" of suction while moving 20 cfm, as well as move 490 cfm when operating at only 0.5" of suction. High air flow, high suction.

Rn4EC features an electronically commutated (EC) motor. Inherently efficient and operationally stable at full and reduced speeds, the EC motor arms the radon professional with installation methods not previously practical. Integrated control system allows for "dialling in" the fan speed necessary to achieve either the required sub-slab depressurization or required system air flow rate. For demand-controlled systems, the potentiometer can be removed from the wiring terminal block to accommodate an externally-provided 0-10Vdc speed command.

The **Rn 4-4EC** is constructed with UL certified, UV protected polycarbonate material. The inlet and outlet pieces of the fan's housing are vibration welded for 100% leak-proof housing construction. Totally enclosed motors are designed with extra moisture protection in various radon applications.

Performance certified by **HVI**; safety certified by **UL**.

NOTE:

Installations that will result in condensate forming in the outlet ducting should have a condensate bypass installed to route the condensate outside of the fan housing. Conditions that are likely to produce condensate include but are not limited to: outdoor installations in cold climates, long lengths of outlet ducting, high moisture content in soil and thin wall or aluminum outlet ducting. Failure to install a proper condensate bypass may void any warranty claims

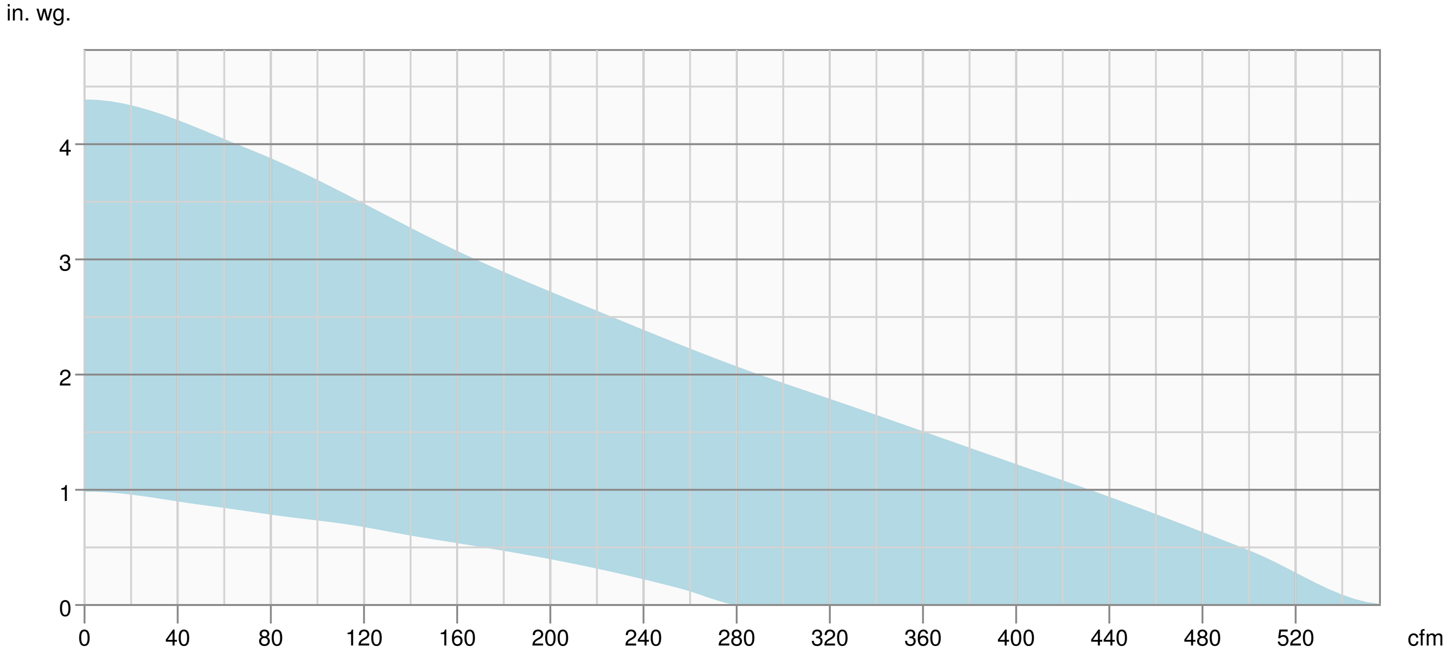
Technical parameters

Norminal data		
Voltage (nominal)	120	V
Frequency	60	Hz
Phase(s)	1~	
Input power	169	W
Input current	2.1	A
Impeller speed	4,084	r.p.m.
Air flow	max 555.0	cfm

Protection/Classification		
Enclosure class, motor	IP54	
Insulation class	B	
Certificate	HVI, cULus	

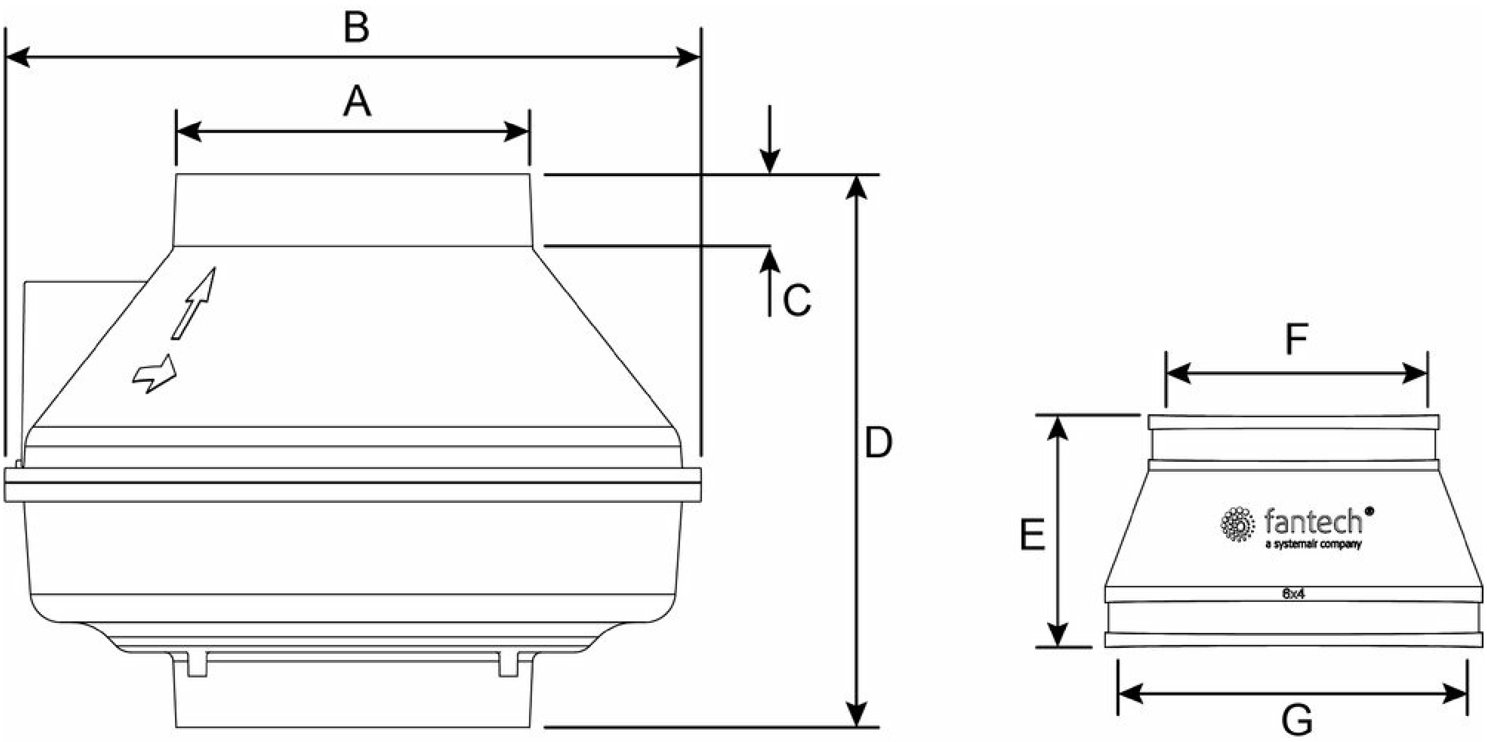
Dimensions and weights		
Weight	7.3	lb

Performance curve



Hydraulic data	
Required air flow	-
Required static pressure	-
Working air flow	-
Working static pressure	-
Air density	0.075 lb/ft³
Power	-
Fan control - RPM	-
Current	-
SFP	-
Control voltage	-
Supply voltage	-

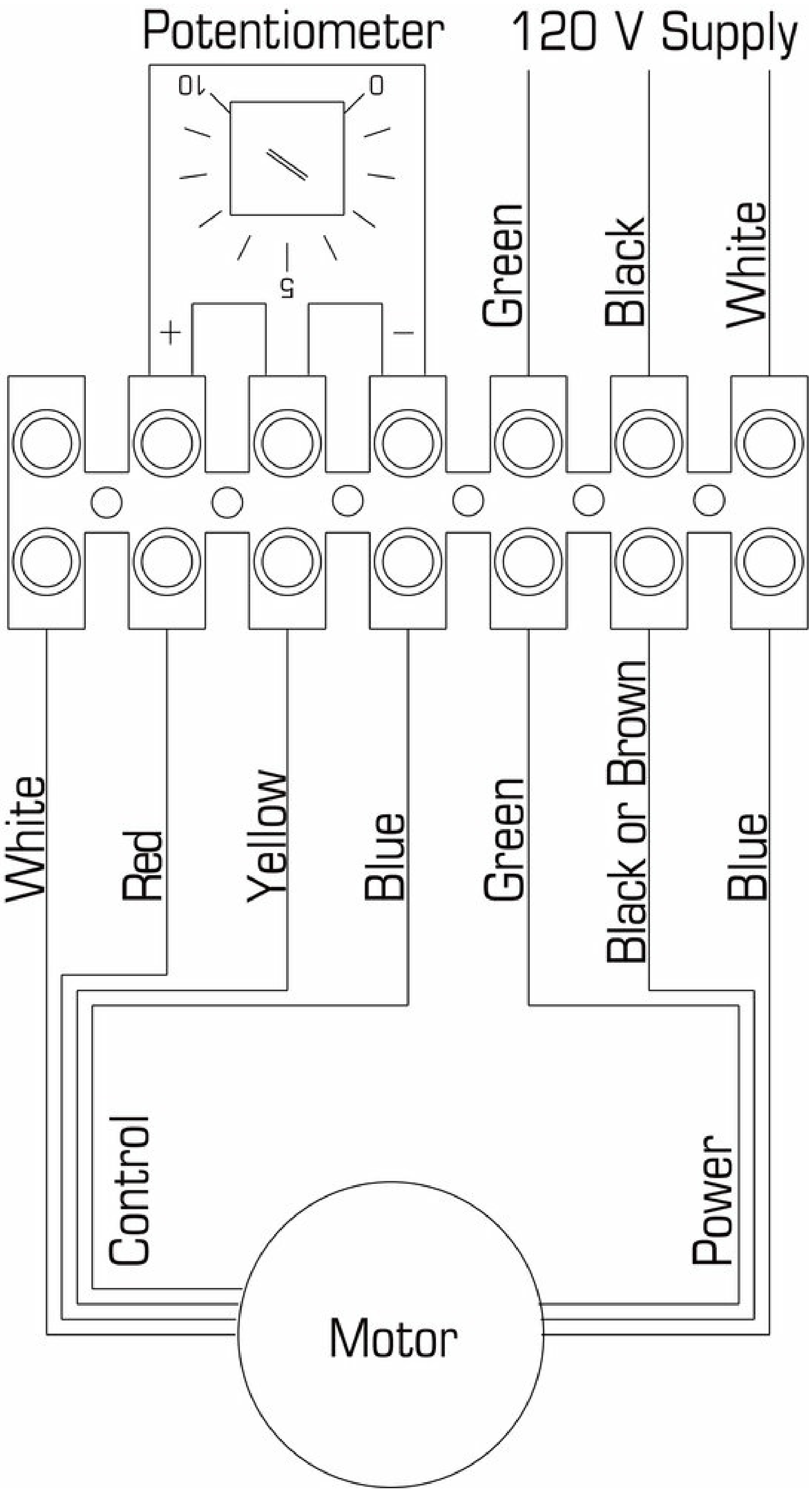
Dimensions



Model	A	B	C	D	E	F	G
Rn2EC	4 15/32 (114)	10 (254)	1 1/4 (32)	9 1/4 (235)	-	-	-
Rn4EC-3	5 7/8 (149)	11 1/2 (292)	1 1/4 (32)	9 1/4 (235)	4 (102)	3 1/2 (89)	6 (152)
Rn4EC-4	5 7/8 (149)	11 1/2 (292)	1 1/4 (32)	9 1/4 (235)	4 (102)	4 1/2 (114)	6 (152)

Dimensions in inches (mm).

Wiring



Potentiometer
120 V Supply
10
0
5
+
−
Green
Black
White
White
Red
Yellow
Blue
Green
Black or Brown
Blue
Control
Power
Motor

Documents

- 142001 Rn2EC-Rn4-EC OIPM EN FR.PDF