VFS
The Venture Funding Specialists
5827 Terex Clarkston, MI 48346

Date: 3-21-2022

Melanie Bachman, Executive Director
Connecticut Siting Council
Ten Franklin Square
New Britain, CT 06051

RE: VFS, LLC. Notice of Exempt Modification Pursuant to RCSA 16-50j-57(a) to
Existing Energy Facility Site at 44 Weaver Rd. Storrs, CT ("Notice of Exempt Modification")

Dear Ms. Bachman,

VFS, LLC. hereby gives notice to the Connecticut Siting Council of its intent to undertake an exempt modification in accordance with Section 16-50j-57(a) of the Regulations of Connecticut State Agencies ("RCSA") for the modification to VFS's fuel cell installation at UConn 44 Weaver Rd. Storrs, CT 06269.

Proposed Modification

The proposed modification would take place within the existing fenced area at the University of Connecticut 44 Weaver Rd., Storrs, CT. The existing facility consists of a combined heat and power installation utilizing one Doosan Fuel cell.

VFS, LLC. proposes the following modification to the facility:

- Removal of the existing fuel cell and associated cooling module and chiller.
- Installation of one (1) current generation Doosan Model 400 fuel Cells (direct replacement)
- Installation of new cooling module.
- Installation of new higher efficiency chiller.
- Replacement of feeder cable to comply with current electrical code.
- Replacement of obsolete distributed generation meter.

The proposed modification would not have a substantial adverse environmental effect or cause a significant adverse change or alteration in the physical or environmental characteristics of the facility because:

- The modification would be made within the facilities existing fenced area and would not impair the structural integrity of the facility.

- The new equipment would be a direct replacement for the existing equipment and is dimensionally the same as the existing equipment and would not cause any significant adverse change in the physical or environmental characteristics of the facility.

The existing facility layout with proposed modification is shown on Attachment 1 Drawing GA1.

The proposed modification would not have a substantial adverse environmental effect or cause a significant adverse change or alteration in the physical or environmental characteristics of the facility because:

- The modification would be made within the facilities existing fenced area and would not impair the structural integrity of the facility.
- The new equipment would be a direct replacement for the existing equipment and is dimensionally the same as the existing equipment and would not cause any significant adverse change in the physical or environmental characteristics of the facility.
- The modifications would not affect waterways or wetlands and the facility is not in a flood zone.
- There are no endangered, threatened or special concern species in the vicinity of the facility as listed in the NDDB.
- Sound pressure levels will not increase as a result of the modifications.
- There would be no television or radio interference as a result of the modifications.
- Electric and magnetic field levels will not be affected by the modification due to low or no export of power from the site and the low voltage produced by the fuel cells.

VFS, LLC. proposes to commence work on the modification in May 2022 and scheduled to be complete by July 2022.

Pursuant to CSC rules VFS, LLC, will provide one copy of this filing and fifteen hand delivered copies of the filing along with a check for $625.00 made payable to CT Siting Council.

A notice of this filing has been provided to the Town Manager of Mansfield and the property owners representative via certified mail.

Please direct all communications regarding this filing to Steve Pearson at 248.417.0674 or via email spearson@vfsmi.com

Signed _____

Steve Pearson

Installation Project Manager

VFS, LLC.

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VFS
The Venture Funding Specialists
5827 Terex Clarkston, MI 48346

Date 3-21-2022

Matt Hart, Town Manager
Town of Mansfield, CT
4 South Eagleville Rd.
Mansfield, CT 06269

RE: VFS, LLC. Notice of Exempt Modification Pursuant to RCSA 16-50j-57(a) to
Existing Energy Facility Site at 44 Weaver Rd. Storrs, CT ("Notice of Exempt Modification")

Dear Mr. Hart,

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-

5827 Terex Clarkston, MI 48346

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- Electric and magnetic field levels will not be affected by the modification.

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Please direct all communications regarding this filing to Steve Pearson at 248.417.0674 or via email spearson@vfsmi.com

Signed _____

Steve Pearson

Installation Project Manager

VFS, LLC.

5827 Terex Clarkston, MI 48346

Date 3-21-2022

Stanley L. Nolan
University of Connecticut | Facilities Operations & Building Services
Director of Utility Operations and Energy Management
25 LeDoyt Road | Unit 3252
Storrs, CT 06269-3252

RE: VFS, LLC. Notice of Exempt Modification Pursuant to RCSA 16-50j-57(a) to
Existing Energy Facility Site at 44 Weaver Rd. Storrs, CT ("Notice of Exempt Modification")

Dear Mr. Nolan,

VFS, LLC. hereby gives notice to the Connecticut Siting Council of its intent to undertake an exempt modification in accordance with Section 16-50j-57(a) of the Regulations of Connecticut State Agencies ("RCSA") for the modification to VFS's fuel cell installation at UConn 44 Weaver Rd. Storrs, CT 06269.

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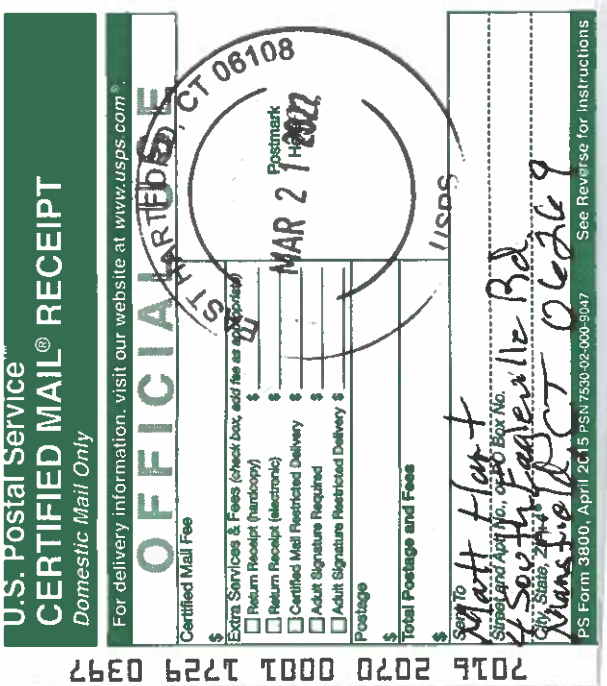
Signed _____

Steve Pearson

Installation Project Manager

VFS, LLC.



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Clerk: 6

Prepared For: Venture Financial Services, LLC

Point of Contact: Steve Pearson

Prepared by: Acoustical Technologies Inc.
50 Myrock Avenue
Waterford, CT 06385-3008

Subject: UCONN Fuel Cell
44 Weaver Road
Storrs, CT 06269
Airborne Noise Test

Author: Carl Cascio

Date: March 17, 2022

Revision: 0

Table of Contents

Summary

This document makes a positive acoustic assessment that should assist in meeting any acoustic noise concerns during the operation of the VFS, LLC 460 KW fuel cell at the UCONN Global Fuel Center site at 44 Weaver Road in Storrs, CT. An acoustic assessment plan was developed and executed to acquire airborne acoustic information useful in explaining and mitigating the potential airborne noise issues associated with operation of the Pure Cell 460 KW fuel cell. It is important to show that the airborne noise generated by the fuel cell will not significantly impact any of the facility's neighbors.

The airborne noise levels generated by the existing fuel cell operating at the Storrs site were measured on March 11, 2022. The existing fuel cell produced an overall average airborne noise level that varied depending on direction from 56 to 67 dBA (reference 20 microPascals) at a distance of 10 meters around the Cooling and Power Modules. (The Cooling Module is the dominant noise source by about 7 dB.) The airborne noise levels in the direction of the nearest neighbors varied from 42 to 60 dBA. The airborne noise from the existing 400 KW fuel cell is about 3 dB quieter than the airborne noise from a 460 KW fuel cell measured in Montville.

Airborne noise levels with the Storrs fuel cell operating were measured at distances of 15 to 112 meters from the fuel cell location at the nearby properties at airborne levels from 42 to 60 dBA. The highest background corrected level of 59.8 dBA was measured at the UCONN Global Fuel Cell Center Building sidewalk at 44 Weaver Road, the site for the fuel cell. The transmission loss from the fuel cell to the Fuel Cell Center Building was 2.3 dB. All the other nearby commercial measurement locations have airborne noise at or below 56 dBA with the fuel cell on. Analysis of the fuel cell data indicated propagation losses from 1 to 20 dB from the fuel cell location to the nearby Commercial (Business) property lines in the UCONN Institutional Zone (I).

Operation of the new fuel cell is expected to produce noise levels below the Commercial Zone noise limit of 62 dBA at all of the nearby Commercial property lines. The highest expected airborne noise level of 62.4 dBA was at the Global Fuel Center Building sidewalk. The other Commercial properties have levels no higher than 60 dBA. All nearby residential property lines are expected to be below both the day time and night time residential noise limits with the fuel cell on. **No acoustic issues** are expected during operation of the new 460 KW fuel cell.

The State of Connecticut's[1] and Mansfield's[2] Noise Codes call for review of the acoustic issues associated with impulse noise. Operation of the fuel cell is expected to meet all of the impulse noise requirements at all of the nearby properties. The CT Noise Code calls for review of acoustic issues associated with prominent discrete tones, infrasonic and ultrasonic noise. Operation of the fuel cell is expected to meet all of the discrete, infrasonic and ultrasonic noise requirements at all nearby properties except directly across the street from the fuel cell. Two frequencies are 0.8 and 1.6 dB above the 57 dBA discrete noise limit. This small exceedance in an open field near the road is not expected to be a problem. **No acoustic issues** with respect to the CT and Mansfield Noise Codes are expected during operation of the new fuel cell.

Note: The Town of Mansfield Tax Assessor website indicates that the eight nearby properties discussed in this report are all owned by the University of Connecticut.

Introduction

Acoustical Technologies Inc. was tasked as part of a Venture Financial Services (VFS), LLC site permitting process with an assessment of potential acoustic issues associated with fuel cell airborne noise reaching the properties adjacent to the UCONN Global Fuel Cell Center site at 44 Weaver Road in Storrs, CT. Responding to a request from Steve Pearson, a site visit was made on March 11, 2022. During the visit, surveys of the airborne noise levels produced by the existing fuel cell were made in order to identify any potential airborne noise issues. Airborne noise measurements were taken to quantify the propagation of the PureCell fuel cell's airborne noise to the adjacent properties. This document provides an acoustic assessment to assist in meeting acoustic noise concerns during the permitting process for the siting of a 460 KW fuel cell at 44 Weaver Road in Storrs, CT. This new unit will replace the existing Fuel Cell Power and Cooling Modules that are identified in Figures 1 and 2.

Development of the Acoustic Assessment Plan

The purpose of this effort is to acquire acoustic information useful in understanding the potential airborne noise issues associated with the operation of a new 460 KW fuel cell at the UCONN facility. The new unit will be placed on the site of the existing unit which will be removed. The Storrs site at 44 Weaver Road is located in an Institutional Zone (I) near CT Routes 32 and 44 and is surrounded by Rural Residential 90 Zones. The Storrs zoning map is given in Figure 3 below. It is important to determine whether the airborne noise generated by the new fuel cell will negatively impact the neighbors on Weaver Road as well as the surrounding areas.

The acoustic impact is assessed in the following way. The fuel cell operating airborne noise levels of an existing similar fuel cell were measured at the site on March 11, 2022. Using this data, adjustments are made to account for the performance of the new fuel cell. Transfer functions for eight adjacent locations are incorporated and the resulting noise level estimates are compared to the allowable noise levels in both the State of Connecticut Noise Ordinance[1] and the town of Mansfield Noise Ordinance[2]. With the new full cell operating at full power, this approach then follows the traditional "What is the airborne noise level at the neighbor's property line?". Is the airborne noise below the allowable airborne noise levels? This measured site data can also be used to estimate noise levels at other neighbor's property lines. The effect of background noise will also be considered by obtaining background noise (ambient) at a nearby site not influenced by the fuel cell. Because of the closeness of the UCONN fuel cell site to the nearest property lines noise mitigation may be recommended if the airborne noise estimated for the new fuel cell comes near or exceeds the airborne noise requirements at the neighbors' property lines. (The noise radiated from a similar new fuel cell has been recently measured at another VFS, LLC site[3] and will be used to adjust the results of the UCONN property line measurements that were taken in Storrs on the older currently operating fuel cell.)

Figure 1. Existing UCONN Fuel Cell Cooling Module at 44 Weaver Road in Storrs, CT

Figure 2. Existing UCONN Fuel Cell Power Module at 44 Weaver Road in Storrs, CT

Acoustic Measurement Program

The acoustic data necessary to assess the impact of the new 460 KW Fuel Cell are described below: Airborne sound pressure measurements and spectral analysis were conducted at the UCONN site on March 11, 2022 during the daylight hours. This testing established background airborne noise levels and fuel cell operating noise levels. The overall A-weighted airborne noise measurements were made with an ExTech model 407780A Digital Sound Level Meter (s/n 140401544) that had been calibrated prior to and just after the test with a Quest model QC-10 Calibrator (s/n Q19080194). Measurements were all taken with A-weighting (frequency filtering that corresponds to human hearing) and with the sound level meter in a Slow response mode. For reference, a noise level increase of 1 dB is equal to an airborne sound pressure increase of 12.2 per cent. The spectral analysis was made with a Hewlett Packard Dynamic Signal Analyzer (model 3561A s/n 2502A01592). The PCB microphone (model 130F20 s/n 53933) was powered by the Hewlett Packard analyzer. The high frequency PCB microphone (model 378C01 s/n 121246) was also powered by the Hewlett Packard analyzer. The PCB microphones were calibrated prior to and after the test with the Quest model QC-10 Calibrator (s/n Q19080194). All measurements were made with the microphones at a height above ground between five and six feet. The Hewlett Packard model HP3561A Dynamic Signal Analyzer was also used to perform narrow bandwidth and overall A-weighted spectral analysis that confirmed the ExTech readings at the 5- and 10-meter south side Cooling Module measurement locations.

At the Storrs site fuel cell operating and background airborne noise measurements were taken at the following nine nearby property locations in the Institutional Zone:

Location	**Business**	**Distance**	**Zone Type**
Fuel Cell – 44 Weaver Road	CT Global FC Center	5 &10 meters	Institutional (I)
P1 – 41 Weaver Road	Open Field	15 meters	Institutional (I)
P2 – 44 Weaver Road	CT Global FC Center	25 meters	Institutional (I)
P3 – 20 Weaver Road	H Building	40 meters	Institutional (I)
P4 – 270 Middle Turnpike	Longley Building	53 meters	Institutional (I)
P5 – 46 Weaver Road	Depot F Building	72 meters	Institutional (I)
P6 – Ahern Lane	Empty Lot	80 meters	Institutional (I)
P7 – 47 Weaver Road	Kennedy Building	90meters	Institutional (I)
P8 – 50 Walters Road	Walters Building	112 meters	Institutional (I)
P9 – 46 Weaver Road (Ambient)	Depot F Building	120 meters	Institutional (I)

The UCONN facility at 44 Weaver Road has an alarm system that often contributes to the airborne noise measured near the fuel cell. This noise source could not be turned off. On two occasions the sound measurements were halted while the alarm was operating. See the Google satellite map in Figure 3 below for all the approximate measurement locations. Measurements near the operating Cooling and Power Module sites were taken with the ExTech sound level meter and two microphones recording on the Hewlett Packard analyzer. Figures 5, 6 and 7 provide photographs of the site locations for the Cooling and Power Modules with sensors at 5, 10 and 25 meters. At each location, a one-minute record of the acoustic noise was analyzed.

Figure 3. Mansfield Zoning Map Near Weaver Road
https://www.mainstreetmaps.com/ct/mansfield/public.asp

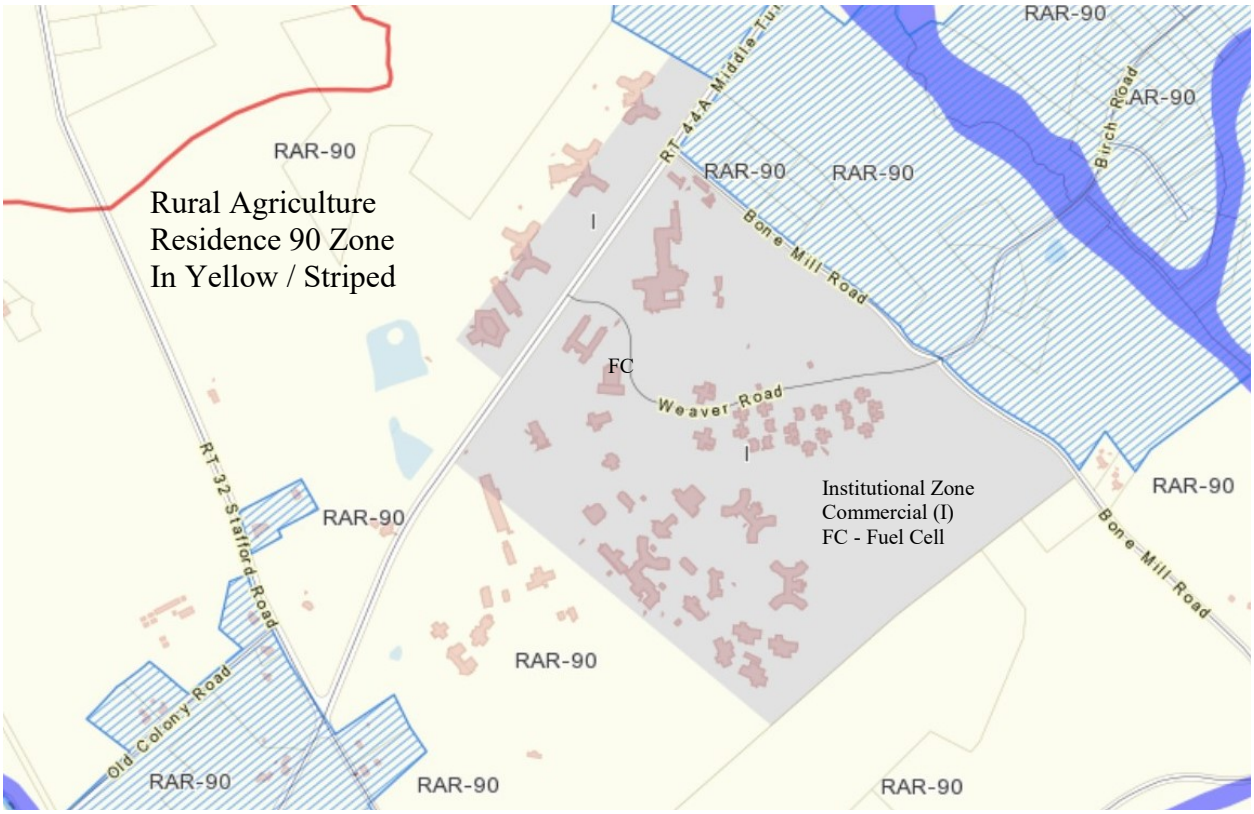


Figure 4. Storrs Weaver Road Site Map from Google Maps

Figure 5. South Side of Fuel Cell Power and Cooling Modules at the Storrs Site

Figure 6. North Side of Fuel Cell Power and Cooling Modules at the Storrs Site

Figure 7. The Adjacent Connecticut Global Fuel Cell Center Building at the Storrs Site

Airborne noise measurements taken outside are corrupted by rain and wind so a day was selected when the winds were expected to be 10 miles per hour or less. Table 1 provides the weather data at Bradley Airport (the closest data to Storrs) for the acoustic measurements on March 11, 2022. Measurements were taken over the time period from 9:15 am until 12:30 pm on March 11. The table below shows the temperature and wind speeds in hourly intervals. Wind conditions were very good with no wind gusts and no wind speeds above 10 mph during the testing. Acoustic measurements were suspended during truck, car and plane passing and these very short periods did not affect the operating airborne noise measurements. There was no rain during the testing. A few of the property line measurements had to be delayed until no traffic was present. Because the fuel cell could not be shut down the background measurement was taken behind the Depot F Building. Airborne noise from the fuel cell could not be heard at this location. The fuel cell could be heard at all the other measurement locations.

Table 1. Weather Data near Storrs on March 11, 2022
https://www.wunderground.com/history/daily/us/ct/h windsor-locks/KHFD/date/2022-3-11

Time (EST)	Temp. (°F)	Dew Point (°F)	Humidity (%)	Wind Direction	Wind Speed (mph)	Barometer (in HG)	Condition
7:51 AM	33 °F	28 °F	82 %	CALM	0 mph	29.93 in	Partly Cloudy
8:51 AM	37 °F	29 °F	73 %	CALM	0 mph	29.95 in	Mostly Cloudy
9:51 AM	42 °F	29 °F	60 %	CALM	0 mph	29.94 in	Mostly Cloudy
10:51 AM	47 °F	30 °F	52 %	VAR	3 mph	29.92 in	Mostly Cloudy
11:51 AM	51 °F	32 °F	48 %	SE	9 mph	29.87 in	Mostly Cloudy
12:51 PM	54 °F	31 °F	41 %	SSW	12 mph	29.84 in	Mostly Cloudy
1:51 PM	55 °F	30 °F	38 %	S	14 mph	29.82 in	Mostly Cloudy

Data Analysis

This section analyzes the airborne noise levels measured at the Storrs site and then estimates the source level and transmission loss to nearby property lines during fuel cell operation. These levels will be compared to the noise limits in the Connecticut and Mansfield noise ordinances. The measured fuel cell operating noise levels are reported in Table 2. These values include both background and fuel cell operating noise. The L90 and Leq levels will later be used to correct the measured operating airborne noise levels providing estimates of only the fuel cell noise contribution. Table 3 reports the background corrected fuel cell operating noise levels. Table 4 compares the Storrs fuel cell source levels at 5 and 10 meters with similar measurements made on a 460 KW Fuel cell at Montville, CT[3]. The newer Montville 460 KW fuel cell is slightly noisier and the existing Storrs 400 KW fuel cell airborne noise levels will be increased depending on direction by 0.4 to 4.5 dB. Comparing these Storrs 460 KW fuel cell estimated levels with the CT state and Mansfield noise limits will identify which nearby locations do or do not meet the airborne noise requirements.

As stated above, the complete set of overall A-weighted airborne noise levels that were measured in Storrs are provided in Tables 2 and 3. Figure 3 is a map showing the Storrs zoning districts in the UCONN area. The GPS range from the fuel cell to the microphone locations that are shown in Tables 2 and 3 were calculated with Google Maps. The estimates of the range are from the closest edge of the fuel cell in meters to each location as given in Table 2 and also in Table 3. The closest measurement location is P1, which is about 15 meters east to the open field across the street from the UCONN property at 44 Weaver Road. The next closest measurement location is P2, which is the UCONN Global Fuel Cell Center building sidewalk where the fuel cell is located. Other neighboring properties along Weaver Road are 40 to 112 meters away. The closest residential area is more than 300 meters away due west on CT route 44. At this distance

airborne noise from the operating fuel cell could not be heard. The residential area airborne noise levels are below 40 dBA when motor traffic is not present.

The ExTech model 407780A Digital Sound Level Meter provided the following acoustic calculations which have been recorded in Tables 2 and 3 for each sensor location. In the "Slow" measurement mode one second sound pressure samples are taken for a period of one minute and analyzed as follows:

Leq: Equivalent continuous sound level over one-minute measurement period.
SPL MAX: Maximum sound level over one-minute measurement period.
SPL MIN: Minimum sound level over one-minute measurement period.
L10: - 10% percentile sound level
L90: - 90% percentile sound level – **this is the level to be identified as estimated fuel cell noise (It excludes transient noise from traffic and other sources)**

Table 2. Existing UCONN Overall Sound Pressure Levels in dBA reference 20 microPascals

Location	Range in Meters	Direction	Leq	Max	Min	L10	L90
Cooling	5	West	59.8	60.4	59.5	60.1	59.6
Cooling	10	West	60.7	61.2	60.4	60.9	60.6
Cooling	5	South	66.3	66.7	65.9	66.5	66.2
Cooling	10	South	62.2	62.7	61.8	62.4	62.1
Power	5	North	67.2	68.0	66.4	67.6	66.9
Power	10	North	61.2	61.6	60.6	61.5	61.0
Power	5	South	67.0	67.6	66.4	67.3	66.6
Power	10	South	62.2	62.7	61.7	62.5	61.9
Power	5	East	59.1	60.0	58.4	59.5	58.6
Power	10	East	56.7	57.4	56.2	57.0	56.4
1 41 Weaver	15	East	55.7	62.3	55.1	56.3	55.4
2 44 Weaver	25	South	60.1	60.9	59.6	60.5	59.8
3 20 Weaver	40	West	56.5	62.0	55.7	56.6	56.1
4 270 M T	53	North	49.8	53.1	48.9	50.2	49.4
5 46 Weaver	72	South	50.0	61.9	48.7	50.9	49.0
6 Ahern Ln	80	South	51.2	66.7	50.2	51.9	50.6
7 47 Weaver	90	South East	44.3	46.4	43.1	45.2	43.5
8 50 Weaver	112	SSE	44.7	45.6	43.5	45.3	44.0
9 Ambient	120	South	39.5	51.8	36.8	40.6	37.5

The Connecticut State Noise Ordinance identifies the L90 calculation as useful in estimating background noise levels. We use it here to eliminate some of the background airborne noise from other sources that is combined with the fuel cell noise. L90 is the level that is exceeded 90% of the time. L90 eliminates the highest 10% of the measurements which is this case are predominantly due to vehicle traffic that cannot be seen because buildings block the line of sight. Because the fuel cell noise is essentially constant the L90 value also excludes some of the transient noise made by birds and other non-fuel cell sources. The L90 values average only a mere 0.2 dB lower than the Leq value due primarily to the lack of interfering transient noise.

Approximate estimates of the fuel cell transfer function from the existing fuel cell are shown in the last two columns of Table 3 for positions P1 through P8. Positions P1, P2 and P3 are close to the fuel cell (15 to 40 meters) and drop in level by 1 to 4.6 dB. Positions P4 through P8 are further away from the fuel cell (53 to 112 meters) and drop in level by 11.9 to 19.6 dB.

Table 3. Corrected Existing Overall Sound Pressure Level in dBA reference 20 microPascals

Location	Range	Leq	L90	Leq	L90	Direction	
	Meters	dBA	dBA	Bkgd	Corrected		
Cooling	5	59.8	59.6	59.8	**59.6**	West	
Cooling	10	60.7	60.6	60.7	**60.6**	West	
Cooling	5	66.3	66.2	66.3	**66.2**	South	
Cooling	10	62.2	62.1	62.2	**62.1**	South	
Power	5	67.2	66.9	67.2	**66.9**	North	
Power	10	61.2	61.0	61.2	**61**	North	
Power	5	67.0	66.6	67	**66.6**	South	
Power	10	62.2	61.9	62.2	**61.9**	South	
Power	5	59.1	58.6	59.1	**58.4**	East	
Power	10	56.7	56.4	56.6	**56.3**	East	
					10 meters	Transmission	Loss
						Leq	L90
1 41 Weaver	15	55.7	55.4	55.6	**55.3**	1.0	**1.0**
2 44 Weaver	25	60.1	59.8	60.1	**59.8**	2.4	**2.3**
3 20 Weaver	40	56.5	56.1	56.5	**56**	4.2	**4.6**
4 270 M T	53	49.8	49.4	49.4	**49.1**	11.8	**11.9**
5 46 Weaver	72	50.0	49.0	49.6	**48.7**	12.6	**13.2**
6 Ahern Ln	80	51.2	50.6	50.9	**50.4**	11.3	**11.5**
7 47 Weaver	90	44.3	43.5	42.6	**42.3**	19.6	**19.6**
8 50 Weaver	112	44.7	44.0	43.2	**42.9**	19.0	**19.0**
9 Ambient	120	39.5	37.5	x	x	dB	dB

Table 4. Comparison of Overall Sound Pressure Levels in dBA reference 20 microPascals

Location	Range in Meters	Direction	Leq	Min	L10	L90	Correct
Cooling 1 unit[3]	5	West	69.7	69.1	70.1	69.4	
UCONN Cooling	5	West	59.8	59.5	60.1	59.6	
Shadowed Height		Difference	9.9	9.6	10	9.8	
Cooling 1 unit[3]	10	West	64.2	63.7	64.4	64.0	
UCONN Cooling	10	West	60.7	60.4	60.9	60.6	
		Difference	**3.5**	**3.3**	**3.5**	**3.4**	**West**
Cooling 1 unit[3]	5	South	68.9	68.4	69.2	68.7	
UCONN Cooling	5	South	66.3	65.9	66.5	66.2	
		Difference	**2.6**	**2.5**	**2.7**	**2.5**	
Cooling 1 unit[3]	10	South	65.2	64.5	65.9	64.7	
UCONN Cooling	10	South	62.2	61.8	62.4	62.1	
		Difference	**3.0**	**2.7**	**3.5**	**2.6**	**South**
Cooling 1 unit[3]	10	North	64.4	60.7	64.7	61.4	
UCONN Power	10	North	62.1	60.6	61.5	61.0	
		Difference	**2.3**	**0.1**	**3.2**	**0.4**	**North**
Power 1 unit[3]	5	South	61.8	61.4	62.1	61.7	
UCONN Power	5	South	67.0	66.4	67.3	66.6	
Cooling Heard		Difference	**-5.2**	**-5.0**	**-5.2**	**-4.9**	
Power 1 unit[3]	10	South	61.2	60.5	61.9	60.8	
UCONN Power	10	South	62.2	61.7	62.5	61.9	
Cooling Heard		Difference	**-1.0**	**-1.2**	**-0.6**	**-1.1**	
Power 1 unit[3]	5	South	61.8	61.4	62.1	61.7	
Power #1	5	East	59.1	58.4	59.5	58.6	
		Difference	**2.7**	**3.0**	**2.6**	**3.1**	
Power 1 unit[3]	10	South	61.2	60.5	61.9	60.8	
Power #1	10	East	56.6	56.1	56.9	56.3	
		Difference	**4.6**	**4.4**	**5.0**	**4.5**	**East**

Table 4 provides a comparison of the airborne noise levels of the UCONN 400 KW fuel cell with that of a single 460 KW fuel cell that was measured in Montville CT[3] on July 13, 2020. In the direction to the East the L90 airborne noise of the newer 460 KW fuel cell was 4.5 dB higher. In the direction to the West the L90 airborne noise of the newer 460 KW fuel cell was 3.4 dB higher. In the direction to the South the L90 airborne noise of the newer 460 KW fuel cell was 2.6 dB higher. In the direction to the North the L90 airborne noise was 0.4 dB higher.

The estimated airborne noise levels produced by the new fuel cell are shown in Table 5. For each of the eight locations the position 9 measurement was used to eliminate some of the background noise. The background corrected measurements at the UCONN site were then added to the corrections for the new fuel cell given in Table 4. Close to the fuel cell at positions P1 through P3 the airborne noise values are expected to be in the 59 to 62 dBA range, near the business noise limit. Further away from the fuel cell at positions P4 through P8 the airborne noise values are expected to be in the 45 to 53 dBA range, well below the business noise limit. The closest business at 44 Weaver Road is expected to have an airborne noise level of 62.4 dBA just above the business noise limit. This is the UCONN Global Fuel Cell Center building that hosts the fuel cell. It is not expected that the that the Global Fuel Cell Center will have an issue with this airborne noise level. The other two nearby locations are a bit more than 2 dB below the business requirement. Other properties being more than 50 meters from the fuel cell are expected to hear the new fuel cell airborne noise at levels 9 dB or more below the requirement. All the nearby residential properties are expected to be well below the 45 dBA noise limit, the amount depending on how close the locations are to the fuel cell. The closest property line is about 315 meters away. (At a distance of 315 meters the new fuel cell should produce airborne noise levels below 43 dBA meeting both the day time and the night time noise limit.)

It should be stated that these estimates assume the current fuel cell physical configuration is repeated with the new fuel cell. Because the cooling module is about 7 dB noisier than the power module the cooling module cannot be swapped with the power module without adding a noise mitigating barrier that the existing power modules currently provide for the property directly across Weaver Road.

Table 5. Expected Overall Sound Pressure Level in dBA reference 20 microPascals

Location	Range	Direction	Old L90	Correction	New L90	Over Spec
	Meters		dBA	dB	dBA	dB
1 41 Weaver	15	East	55.3	4.5	59.8	-2.2
2 44 Weaver	25	South	59.8	2.6	62.4	**0.4**
3 20 Weaver	40	West	56	3.4	59.4	-2.6
4 270 M T	53	North	49.1	0.4	49.5	-12.5
5 46 Weaver	72	South	48.7	2.6	51.3	-10.7
6 Ahern Ln	80	South	50.4	2.6	53.0	-9.0
7 47 Weaver	90	South	42.3	2.6	44.9	-17.1
8 50 Weaver	112	South	42.9	2.6	45.5	-16.5

The State of Connecticut Noise Ordinance (Reference 1) locates educational uses in Class B – Commercial Zones. The town of Mansfield (Reference 2) does not discuss the noise status of an Institutional Zone. The Mansfield Tax Assessor indicates that the Institutional Zone is Commercial. It is assumed the current fuel cell use would fall into a Business Zone category. The noise requirement for a commercial or business zone is 62 dBA in both noise ordinances.

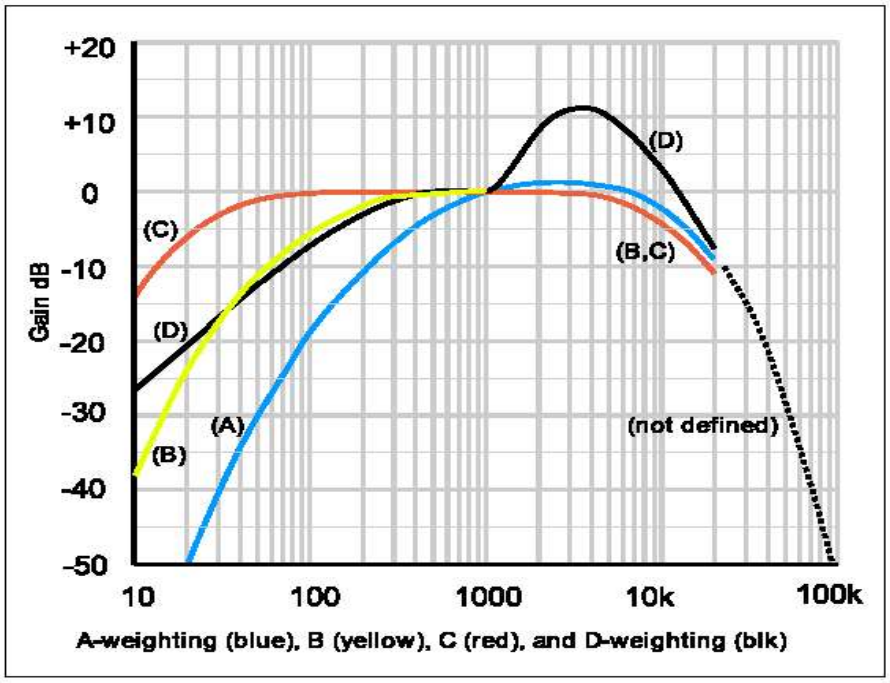
Allowable Noise Levels

The Connecticut regulation for the control of noise provides in *CT section 22a-69*-3 (Ref. 1) the requirements for noise emission in Connecticut. *CT section 22a-69*-3.1 states that no person shall cause or allow the emission of excessive noise beyond the boundaries of his/her Noise Zone so as to violate any provisions of these Regulations. The CT ordinance will be used to evaluate the noise generated by the 460 KW Fuel Cell. (The Mansfield noise ordinance uses the same noise levels.) Following sections discuss each type of noise using the results obtained from the March 11, 2022 fuel cell measurements at the UCONN site in Storrs and the 460 KW July 13, 2020 test in Montville.

The north western part of the Storrs zoning map is given in Figure 3. As stated above, the Storrs site at 44 Weaver Road is located in a Business Zone near CT Route 32 and 44 and is surrounded by Residential Zones to the east, west, north and south. The closest residential area is 315 meters away on Route 44. Based on the source levels at 5 and 10 meters the airborne noise from the new fuel cell should be below 43 dBA at about 315 meters from the fuel cell. Other nearby residential properties at greater distances are also expected to be well below the day time and night time Residential Zone noise limits for an emitter in a commercial zone. The airborne noise estimated at all the properties (besides the Fuel Cell Center itself) along Weaver Road in the business zone are well below the allowable noise level of 62 dBA in a commercial zone.

Figure 8. Acoustic Airborne Noise Weighting Curves

http://upload.wikimedia.org/wikipedia/commons/3/39/Acoustic_weighting_curves_(1).svg



1 of 1 1/25/2013 9:35 PM

Impulse Noise

The Connecticut noise code states in *CT section 22a-69*-3.2 (part a) *Impulse Noise* that no person shall cause or allow the emission of impulse noise in excess of 80 dB peak sound pressure level during the night time to any class A Noise Zone. Night time is defined as 10 pm to 7 am. *CT section 22a-69-3.2 (part b) Impulse Noise* states that no person shall cause or allow the emission of impulse noise in excess of 100 dB peak sound pressure level at any time to any Noise Zone. The Manchester noise ordinance has the same noise limits as the State of CT.

Impulse noise in excess of 100 dBA was not observed during any of the nine property line measurements of the fuel cell made at the Storrs site on March 11, 2022. A maximum level of 68 dBA was measured five meters from the north side of the power module. To the south on Ahern Lane the maximum measured level was 67 dBA. (These levels would increase to a maximum of 77 dB if not A-weighted.) Given the steady state nature of the fuel cell's noise signature there should be no acoustic issues with Connecticut's or Mansfield's impulse noise requirements at any neighboring property.

A few words are in order to discuss the difference between A-weighted and un-weighted impulse noise. A-weighting emphasizes the middle and higher frequencies while reducing the influence of the low frequencies. Figure 8 plots the A-weighting curve versus frequency in blue. Below a frequency of 1 kiloHertz the acoustic level is attenuated by increasing amounts. The reduction is about 10 dB at 200 Hertz, 20 dB at 90 Hertz and 30 dB at 50 Hertz. It also reduces the level at very high frequency being down in level by 10 dB at 20 kiloHertz. The fuel cell measurements show the unweighted overall levels to be about 9 dB higher than the A-weighted noise levels.

Prominent Discrete Tones

The Connecticut regulation for the control of noise states in *CT section 22a-69-3.3 Prominent discrete tones:* Continuous noise measured beyond the boundary of the Noise Zone of the noise emitter in any other Noise Zone which possesses one or more audible discrete tones shall be considered excessive noise when a level of 5 dBA below the levels specified in section 3 of these Regulations is exceeded. The CT Regulations establish different noise limits for different land use zones. Residential (homes and condominiums) and hotel uses are in Class A. Schools, business, parks, recreational activities and government services are in Class B. Forestry and related services are in Class C. By my reading of the regulations the UCONN site is a Class B emitter in a Business Zone. The noise zone standards in *CT section 22a-69-3.5* state that a Class B emitter cannot exceed the following overall sound pressure levels:

To Class C 62 dBA To Class B 62 dBA To Class A 55 dBA (day) 45 dBA (night)

The discrete tones limits are 5 dBA lower so that no tone may be higher than the following:

To Class C 57 dBA To Class B 57 dBA To Class A 50 dBA (day) 40 dBA (night)

The Mansfield noise requirements do not discuss discrete tones so the CT Noise Ordinance will be used. To address the discrete tone issue, we use measured spectral data from the Reference 3

Montville testing. The data is the maximum level received in 1/30 octave bands for frequencies from 0.32 to 100,000 Hz. Figure 9 plots the airborne noise measured 10 meters from the Cooling and Power Modules in 1-30th octave bands. This figure shows some discrete tones in the middle frequencies produced by the new Fuel Cell Cooling and Power Modules. The eight largest tones are given in Table 6. The highest is 58.6 dB reference 20 microPascals at 302 Hz. The second highest tone is at 213.8 Hz at a level of 57.8 dB reference 20 microPascals. All the remaining tones are below the 57 dBA requirement. The A-weighted discrete tone corrections are given in the 4th row of Table 6. Incorporating these corrections gives the A-weighted levels after the transmission loss in Table 3 and UCONN site corrections in Table 4 are included. The two frequencies across the street from the fuel cell have levels that are above the 57dBA requirement in a Commercial Zone by 0.8 and 1.6 dB. The other six frequencies in Table 6 meet all the discrete tone requirements. Operating the new fuel cell should produce airborne noise levels about 2.6 dB higher than the existing fuel cell in the easterly direction. (The old fuel cell is 2.6 dB lower and thus meets all the discrete tone requirements at all the nearby locations.) The residential zone is further away and the discrete tones should be below the 40 dBA night time limit at all the residences. There should be only a very minor acoustic issue with the CT discrete tone noise requirements at the very closest location in the open field across the street from the new fuel cell.

Figure 9. Montville Tones 460 KW Fuel Cell Cooling & Power Modules in 1-30th octave bands

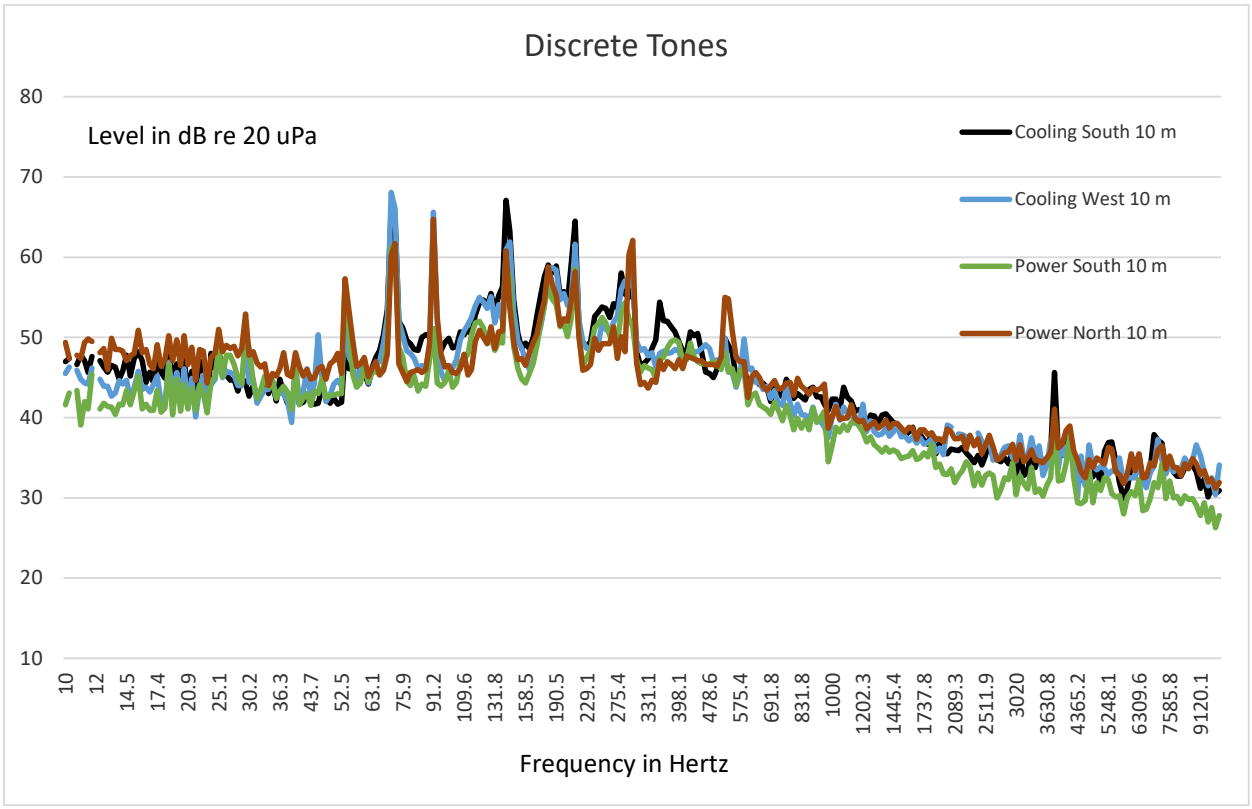


Table 6. Montville Peak Discrete Sound Pressure Levels in dB ref. 20 microPascals

Location	Range Meters	53.7 Hz	70.8 Hz	91.2 Hz	141.3 Hz	213.8 Hz	302 Hz	3801 Hz	4169 Hz
Allowed - I		**57**	**57**	**57**	**57**	**57**	**57**	**57**	**57**
Montville	10	57.3	68.1	65.6	67.1	64.5	62.1	45.6	39
A Weighting		-29.0	-24.3	-20.5	-14.7	-10.2	-7.0	1.0	0.9
UCONN Est	10	28.3	43.8	45.1	52.4	54.3	55.1	46.6	39.9
1 41 Weaver	15	31.8	47.3	48.6	55.9	**57.8**	**58.6**	50.1	43.4
2 44 Weaver	25	28.6	44.1	45.4	52.7	54.6	55.4	46.9	40.2
3 20 Weaver	40	27.1	42.6	43.9	51.2	53.1	53.9	45.4	38.7
4 270 M T	53	16.8	32.3	33.6	40.9	42.8	43.6	35.1	28.4
5 46 Weaver	72	17.7	33.2	34.5	41.8	43.7	44.5	36.0	29.3
6 Ahern Ln	80	19.4	34.9	36.2	43.5	45.4	46.2	37.7	31.0
7 47 Weaver	90	11.3	26.8	28.1	35.4	37.3	38.1	29.6	22.9
8 50 Weaver	112	11.9	27.4	28.7	36.0	37.9	38.7	30.2	23.5

Infrasonic and Ultrasonic Noise

The Connecticut regulation for the control of noise states in *CT section 22a-69-3.4 Infrasonic and Ultrasonic* that no person shall emit beyond his/her property infrasonic or ultrasonic sound in excess of 100 dB at any time. 100 dB with respect to the reference of 20 microPascals is a sound pressure of 2 Pascals or 0.00029 psi. Infrasonic sounds are sound pressure fluctuations below a frequency of 20 Hertz. Ultrasonic sounds are sound pressure fluctuations at frequencies above 20,000 Hertz. There is no Mansfield Noise Ordinance to limit infrasonic or ultrasonic noise so the State of CT Noise Ordinance will be discussed.

Narrow bandwidth sound pressure spectrums in dB reference 20 microPascals made at the western 10-meter Cooling Module location can be used to compare with the infrasonic and ultrasonic noise requirements. The Montville airborne noise data were processed in the 0 to 200 Hertz and 0 to 100,000 Hertz frequency ranges. The bandwidth of each data point is 0.75 Hertz for the 200 Hertz range and 375 Hertz for the 100,000 Hertz frequency range. The infrasonic noise for frequencies up to 20 Hertz is shown in Figure 10 for the 460 KW unit at Montville[3]. The maximum level at 10 meters is 48 dB reference 20 microPascals at Montville. The entire 20 Hertz band can be power summed and never exceeds 70 dB reference 20 microPascals at 10 meters in Montville. After adding 4.5 dB for the maximum correction at UCONN the levels are well below the requirement of 100 dB for a commercial property. The minimum transmission loss to the nearest property line is at least 1 dB so the maximum possible infrasonic noise at the eastern property line would be less than 74 dB. There should be no issue with the infrasonic noise requirement at any of the neighboring properties.

The ultrasonic noise for frequencies up to 100 KiloHertz is given in Figure 11. The Montville data uses a microphone with flat high frequency performance and provides a good estimate for

the newer 460 KW fuel cell. The entire 80 KiloHertz band from 20 to 100 kiloHertz has been power summed and never exceeds a noise level of 62 dB reference 20 microPascals 10 meters from the fuel cell at Montville. Adding 4.5 dB to account for the fuel cell correction at UCONN plus the minimum transmission loss to the nearest commercial property line of 1 dB leads to a maximum possible ultrasonic noise at the eastern property line of 65 dB. The noise levels at the other nearby neighbors will be lower and there should be no issue with ultrasonic noise at any of the neighboring properties.

It should be noted that the spectrum analysis covers frequencies up to 100 kiloHertz and the PCB microphone model 378C01 s/n 121246 in the Montville test has a sensor that can measure up to 100 KHz. The more sensitive PCB model 130F20 s/n 53933 microphone has a sensor with a much lower noise floor better capable of handling frequencies below 25 KiloHertz.

Figure 10. Infrasonic Noise from Montville Fuel Cell Cooling Modules in 1-30th octave bands

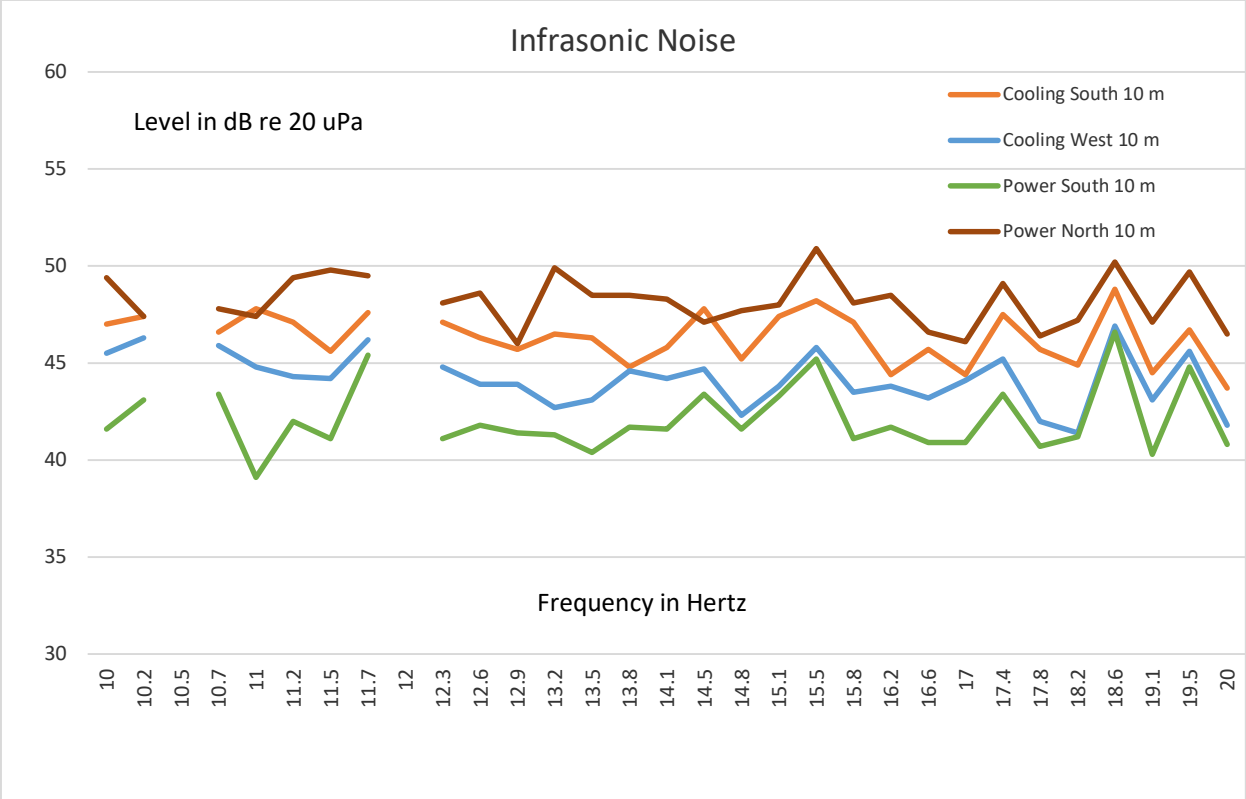
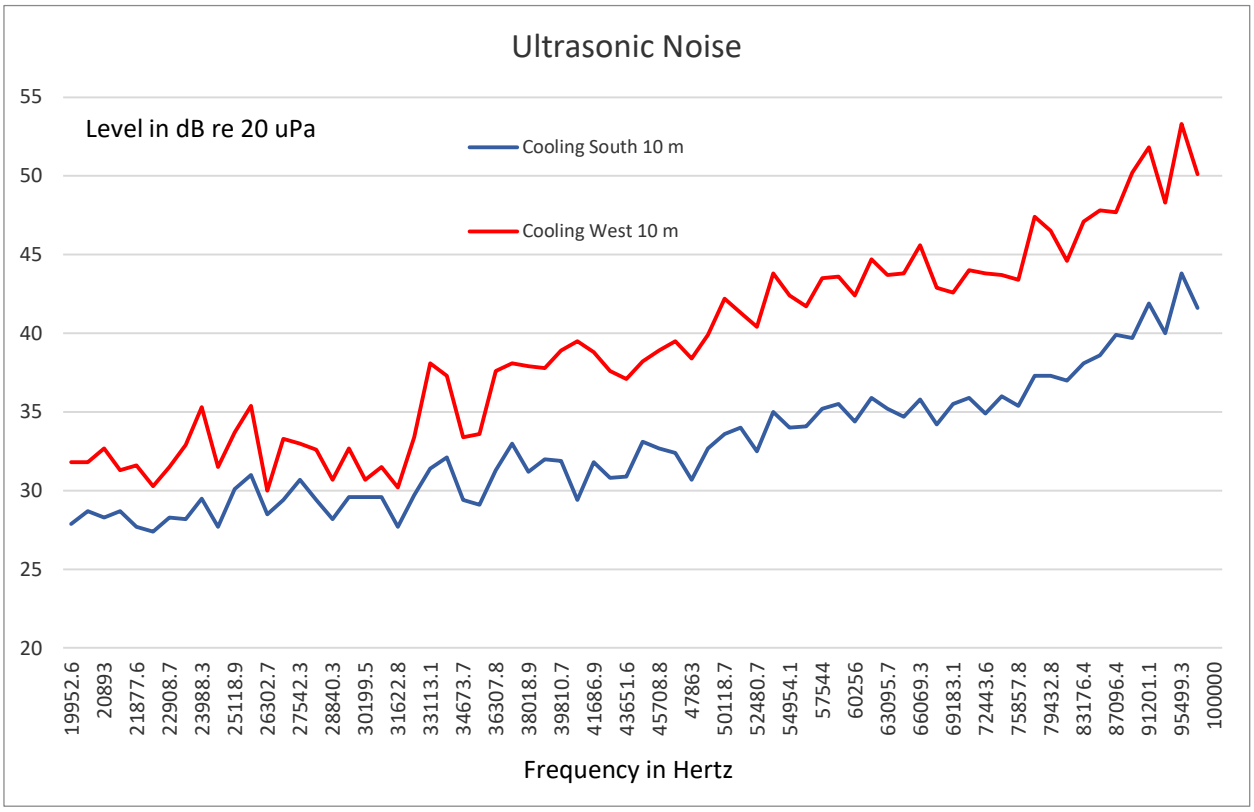


Figure 11. Ultrasonic Noise from Montville Fuel Cell Cooling Modules in 1-30th octave bands



Overall Sound Pressure Levels

The Connecticut regulations for the control of noise state that
(a) No person in a Class B Noise Zone shall emit noise exceeding the levels below:

To Class C 62 dBA To Class B 62 dBA To Class A 55 dBA (day) 45 dBA (night)

The UCONN site is in a Business Zone that has surrounding Residential Zones. The nearby neighbors are classified as commercial with commercial noise limits of 62 dBA.

The estimated overall A-weighted sound pressure level measurements in dBA reference 20 microPascals are given in Table 5 above for the background corrected measurements made on March 11, 2022. The second column gives the approximate distance from the fuel cell to the measurement location, with locations identified by a P number in Figure 4. Column 3 gives the direction to the property line. The airborne noise values given in column 6 are the estimated fuel cell level (L90) for the new 460 KW fuel cell. Column 7 tells whether the measured levels are above or below the requirements. The values are all below the business zone noise limit except for P2, the UCONN property that houses the Global Fuel Cell Center. The value at the Fuel Cell Center sidewalk on Weaver Road is only 0.4 dB above the noise requirement (62 dBA). The other locations are at least 2 dB below the noise requirement. Because of the increasing loss with distance the surrounding residential properties should all be lower than 43 dBA. All the

other property line estimates should meet the 62 dBA Commercial, 55 dBA day time residential and 45 dBA night time residential noise limits.

Operation of the fuel cell will have no significant acoustic impact at all of the nearby properties adjacent to the UCONN site at 44 Weaver Road. The commercial properties close to UCONN Global Fuel Cell Center should see overall airborne noise levels from the fuel cell at least 2 dB below the airborne noise requirement. Commercial properties further away from the fuel cell along Weaver Road and Middle Turnpike (Route 44) that do not currently hear the fuel cell are expected to continue in this condition. The nearby properties should not be affected by the operation of the fuel cell.

Conclusions

The purpose of this effort is to evaluate the acoustical environment at the Storrs UCONN site during operation of the new 460 KW fuel cell. This effort has been accomplished and the results show that the operation of the 460 KW fuel cell will meet all of the State of Connecticut airborne noise requirements at all the nearby properties except for a small excursion immediately across the street. Residences in all directions are expected to meet all the noise requirements because they are at least 315 meters away from the new fuel cell with airborne noise levels below 43 dBA. Locations at distances greater than 120 meters do not hear the currently operating 400 KW fuel cell that is estimated to be about 0.4 to 4.5 dB quieter than the new 460 KW fuel cell.

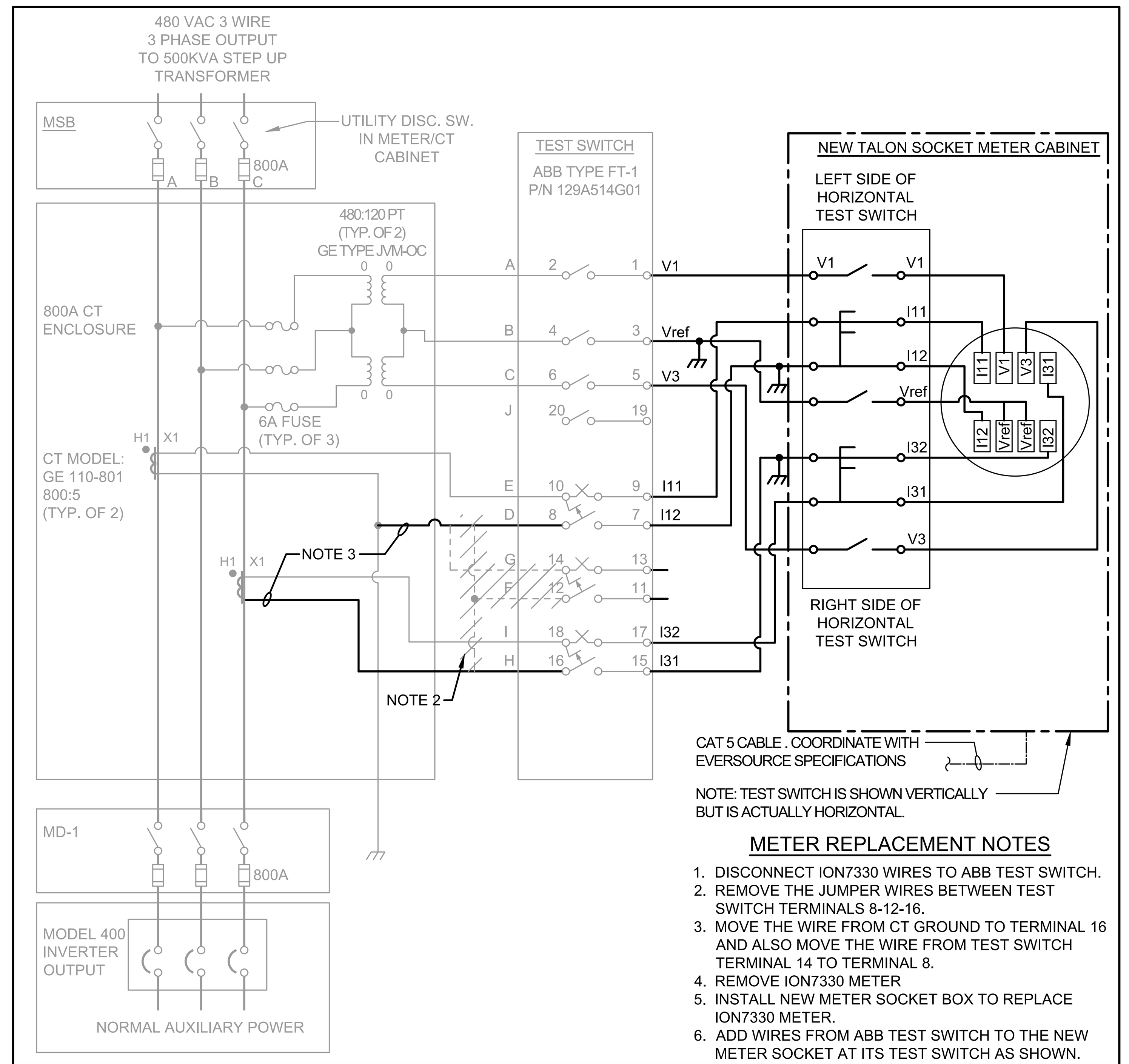
References

1) CT DE&EP *Noise Control Regulation RCSA Section 22a-69*-1 to 22a-69-7.4 http://www.ct.gov/dep/lib/dep/regulations/22a/22a-69-1through7.pdf

2) Mansfield Chapter 134 Noise, https://ecode360.com/11768146

3) Town of Montville Water Pollution Control Authority Airborne Noise Test

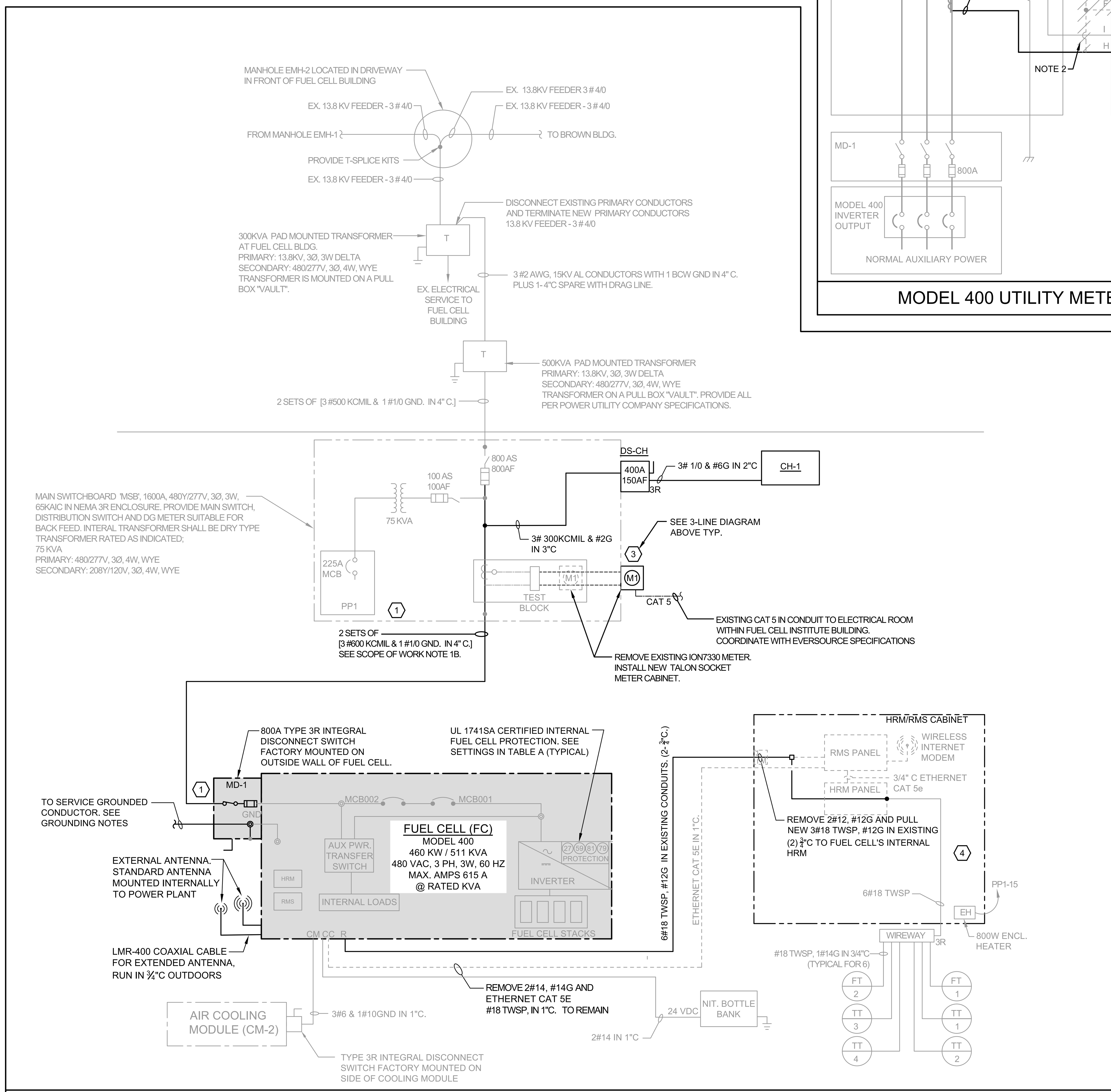
   At 83 Pink Row, Acoustical Technologies Inc., July 13, 2020 for VLS, LLC



METER REPLACEMENT NOTES

1. DISCONNECT ION7330 WIRES TO ABB TEST SWITCH.
2. REMOVE THE JUMPER WIRES BETWEEN TEST SWITCH TERMINALS 8-12-16.
3. MOVE THE WIRE FROM CT GROUND TO TERMINAL 16 AND ALSO MOVE THE WIRE FROM TEST SWITCH TERMINAL 14 TO TERMINAL 8.
4. REMOVE ION7330 METER
5. INSTALL NEW METER SOCKET BOX TO REPLACE ION7330 METER.
6. ADD WIRES FROM ABB TEST SWITCH TO THE NEW METER SOCKET AT ITS TEST SWITCH AS SHOWN.

MODEL 400 UTILITY METERING 3-LINE DIAGRAM



SINGLE LINE DIAGRAM

SCOPE OF WORK

1. PROVIDE AND INSTALL ALL NEW ELECTRICAL WORK INDICATED ON DRAWINGS UNLESS OTHERWISE NOTED. INCLUDING BUT NOT LIMITED TO THE FOLLOWING:
   A. REMOVE EXISTING ION 7330 METER IN METER. INSTALL NEW TALON SOCKET METER CABINET AT MAIN SWITCHBARD 'MSB'. EXISTING TEST SWITCHES TO REMAIN. WIRE AS SHOWN IN 3-LINE DIAGRAM BELOW.
   B. CONTRACTOR SHALL REPLACE EXISTING 2 SETS OF [3 #500 KCMIL & 1/0G] FROM FC TO MSB WITH 2 SETS OF [3 #600 KCMIL & 1/0G] IN EXISTING CONDUITS.
   C. REMOVE EXISTING RMS / HRM CONTROLER. ENCLOSURE SHALL REMAIN TO BE REUSED AS PULL BOX.
   D. REUSE EXISTING 1"C. TO PULL 3 #18 TWSP, #12G FOR HEAT RECOVERY INSTRUMENTATION BACK TO FUEL CELL INTERNAL HRM.

KEYED NOTES

1. PROVIDE PLAQUE AT MAIN SWITCHBOARD "MSB' INDICATING BUILDING HAS MULTIPLE POWER SOURCES. PROVIDE SIGNAGE PER NEC AT SERVICE & FUEL CELL MAIN DISCONNECT. PLAQUE AT 'MSB' SHALL DENOTE THE LOCATION OF THE FUEL CELL DISCONNECT (MD-1).
2. CONSULT DOOSAN MODEL 400 INSTALLATION DESIGN GUIDE (FUEL CELL POWER PLANT) AND STANDARD INSTALLATION DRAWINGS FOR TECHNICAL REFERENCE.
3. UTILITY DG METER (M1)
   METER FURNISHED BY EVERSOURCE, INSTALLED BY CONTRACTOR. METER SOCKET FURNISHED AND INSTALLED BY CONTRACTOR
   MANUFACTURER / MODEL : SIEMENS TALON METER CABINET
   COORDINATE DISCONNECT LINE AND LOAD LUG CONFIGURATIONS BASED UPON CONDUCTOR SIZES AND QUANTITIES ON THIS DWG.
   CT: GE MODEL 110-801, 800:5 (EXISTING)
   PT: GE TYPE JVM-OC (EXISTING)
4. REMOVE RMS AND HRM INTERNAL COMPONENTS. NEMA 3R ENCLOSURE TO REMAIN AS PULL BOX.

GROUNDING NOTES

1. THE FUEL CELL GROUND LUG INSIDE DISCONNECT SWITCH MD-1 SHALL BE CONNECTED TO AN EXTERNAL #1/0 COPPER EQUIPMENT GROUNDING CONDUCTOR FROM MAIN SWITCHBOARD'S GROUNDED CONDUCTOR PER NEC ART 692.44, IN ORDER TO PROVIDE THE REQUIRED SINGLE POINT GROUND PER NEC ART 250.24.A & D.
2. NOTE THAT THE FUEL CELL GROUND LUG INSIDE MD-1 IS BONDED TO ALL METALLIC NON-CURRENT CARRYING METAL PARTS BOTH INSIDE THE FUEL CELL AND ALSO AT EXTERNAL FUEL CELL ASSEMBLIES SUCH AS THE COOLING MODULE, SO ALL FUEL CELL PARTS ARE CONNECTED TO THE EQUIPMENT GROUNDING CONDUCTOR AS REQUIRED BY ART. 250.110.
3. NOTE ALSO THAT THERE IS TO BE NO OTHER GROUNDING ELECTRODE AT THE FUEL CELL OR ANY OF ITS EXTERNAL SUBASSEMBLIES SUCH AS THE COOLING MODULE. ALL OF THE SUBASSEMBLIES ARE TO BE CONNECTED TO THE EQUIPMENT GROUNDING CONDUCTOR INCLUDED WITH THE CIRCUIT CONDUCTORS FROM THE FUEL CELL PER ART. 250.134.B, WHERE THE FUEL CELL GROUND LUG IN MD-1 CARRIES THESE GROUND WIRES BACK TO THE GROUNDED SERVICE CONDUCTOR AT THE MAIN SWITCHBOARD.
4. ANY SUBASSEMBLY ELECTRICAL PANELS CONNECTED TO THE FUEL CELL SHALL BE GROUNDED TO THE EQUIPMENT GROUNDING CONDUCTOR FROM THE FUEL CELL PER ART 250.148 AND SHALL NOT HAVE THEIR OWN GROUND ELECTRODE.
5. THE EXTERNAL NITROGEN RACK IS NOT EXPOSED TO ENERGIZED CIRCUITS GREATER THAN 24 VOLTS DC AND THUS CAN HAVE ITS OWN GROUNDING ELECTRODE.

CERTIFICATION:

POWER PLANT IS CERTIFIED TO: ANSI/CSA AMERICA FC 1 - 2004 (FORMALLY ANSI Z21.L83) "AMERICAN NATIONAL STANDARD FOR STATIONARY FUEL CELL POWER SYSTEM" INCLUDING,

A. UL1741SA "INVERTERS, CONVERTERS AND CONTROLLERS FOR USE IN INDEPENDENT POWER SYSTEMS - GRID CONNECTION"

B. IEEE 1547 "STANDARD FOR INTERCONNECTING DISTRIBUTED RESOURCES WITH ELECTRIC POWER"

C. NFPA 70 NATIONAL ELECTRIC CODE (FOR INTERFACES TO CUSTOMER WIRING AND WIRING BETWEEN MODULES).

LEGEND

- EXISTING
- NEW
- EXISTING TO BE REMOVED

TABLE A - SEL547 RELAY
IEEE1547 / UL1741SA GRID PROTECTION PARAMETER SETTINGS

THE REQUIRED GRID PROTECTION FUNCTIONS AND SETTINGS RESIDE IN THE INTERNAL SEL547 RELAY WITH SETTING NAMES AS SHOWN BELOW. THE SEL547 RELAY USES GROUP 1 (SEE NOTE 2) SETTINGS FOR UL174SA, AND ONLY THOSE GROUP 1 SETTINGS ARE LISTED IN THIS TABLE. THE SETTINGS IN THIS TABLE ARE COMPLIANT WITH EVERSOURCE / UI UL1741SA SETTINGS PER APRIL 5, 2019 EXHIBIT B TECHNICAL REQUIREMENTS APPENDIX C.

SETTING NAME	DESCRIPTION SEE 3-LINE DIAGRAM ABOVE TYP.	GROUP 1 "SUPPORT" 60 Hz SETTING 480VAC Tx RATIO 2.31 : 1	VOLTAGE P.U.	ANSI/IEEEF FUNCTION NUMBERS
27P1P	SLOW UNDER VOLTAGE LEVEL (V)	106	0.88	27
27P2P	MID UNDER VOLTAGE	106	0.88	
27P3P	FAST UNDER VOLTAGE LEVEL (V)	60	0.50	27
59P1P	SLOW OVER VOLTAGE LEVEL (V)	132	1.1	59
59P2P	FAST OVER VOLTAGE LEVEL (V)	144	1.21	59
81D1P	FAST UNDER FREQUENCY LEVEL (Hz)	56.5		81U
81D2P	SLOW UNDER FREQUENCY LEVEL (Hz)	58.5		81U
81D3P	SLOW OVER FREQUENCY LEVEL	61.2		81O
81D4P	FAST OVER FREQUENCY LEVEL	62		81O
SV1PU	RECONNECTION TIME DELAY (CYCLES)	18000		
SV2PU	FAST OVER FREQUENCY CLEARING TIME (CYCLES)	*5		
SV3PU	SLOW OVER FREQUENCY CLEARING TIME (CYCLES)	18000		
SV4PU	SLOW UNDER FREQUENCY CLEARING TIME (CYCLES)	18000		
SV5PU	FASTUNDER FREQUENCY CLEARING TIME (CYCLES)	*5		
SV6PU	FAST OVER VOLTAGE 120% CLEARING TIME (CYCLES)	*5		
SV7PU	SLOW OVER VOLTAGE 110% CLEARING TIME (CYCLES)	120		
SV8PU	SLOW UNDER VOLTAGE 88% CLEARING TIME(CYCLES)	120		
SV9PU	MID UNDER VOLTAGE 88% CLEARING TIME (CYCLES)	120		
SV10PU	FAST UNDER VOLTAGE 50% CLEARING TIME (CYCLES)	66		
SV12PU	DELAY BETWEEN GRID OK STATUS AND BREAKER OPENING (CYCLES)	0		

NOTE 1: THE ACTUAL (TOATAL) PROTECTION CLEARING TIME EQUALS THE SUM OF THE PARAMETER CLEARING TIME SETTING IN THE TABLE PLUS 5 CYCLE BREAKER'S TRIPPING TIME--FOR EXAMPLE ACTUAL (TOTAL) FAST OVER VOLTAGE CLEARING TIME EQUALS PARAMETER SV6PU 5 CYCLES SETTING PLUS THE 5 CYCLE CYCLE BREAKER CLEARING TIME FOR A TOTAL TIME OF 10 CYCLES (0.16 SEC).

NOTE 2: GROUP 1 SETTINGS ARE FOR UL1741SA "GRID SUPPORT" AND GROUP 2 SETTINGS (NOT SHOWN IN THIS TABLE) ARE FOR IEEE1547-2003 NON-SA SETTINGS - USE GROUP 1 FOR UL1741SA SITES

NOTE 3: FOR DOOSAN ON-SITE PERSON - GROUP1 OR GROUP 2 IS SET BY THE GROUP 9 PARAMETER "INVERTERMODE" GROUP 1 = GRID SUPPORT (INVERTER MODE=0=FALSE) =UL1741SA

Rev.	Date	Description
A	03/10/22	UTILITY INTERCONNECTION

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UNIVERSITY OF CONNECTICUT
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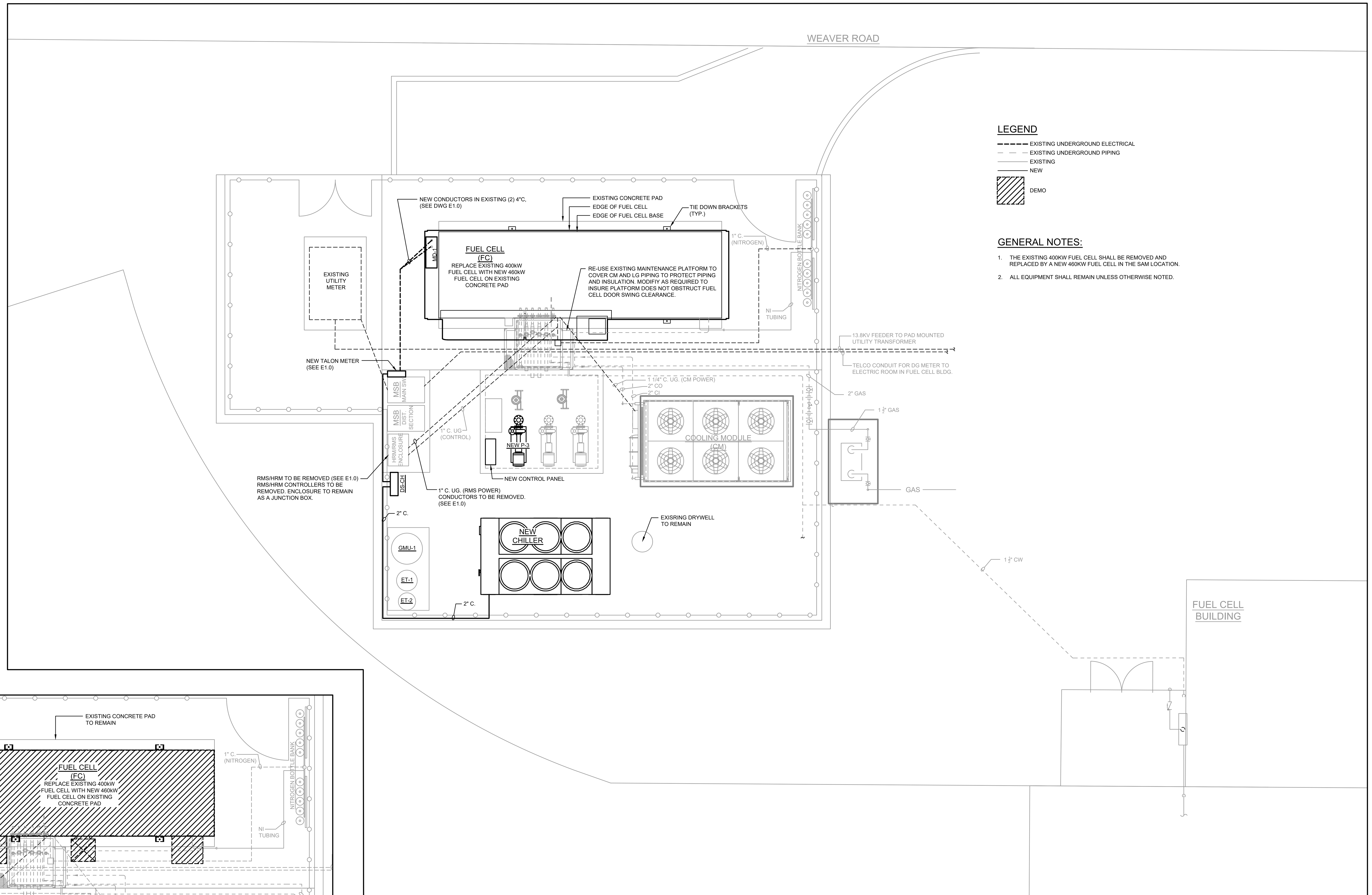
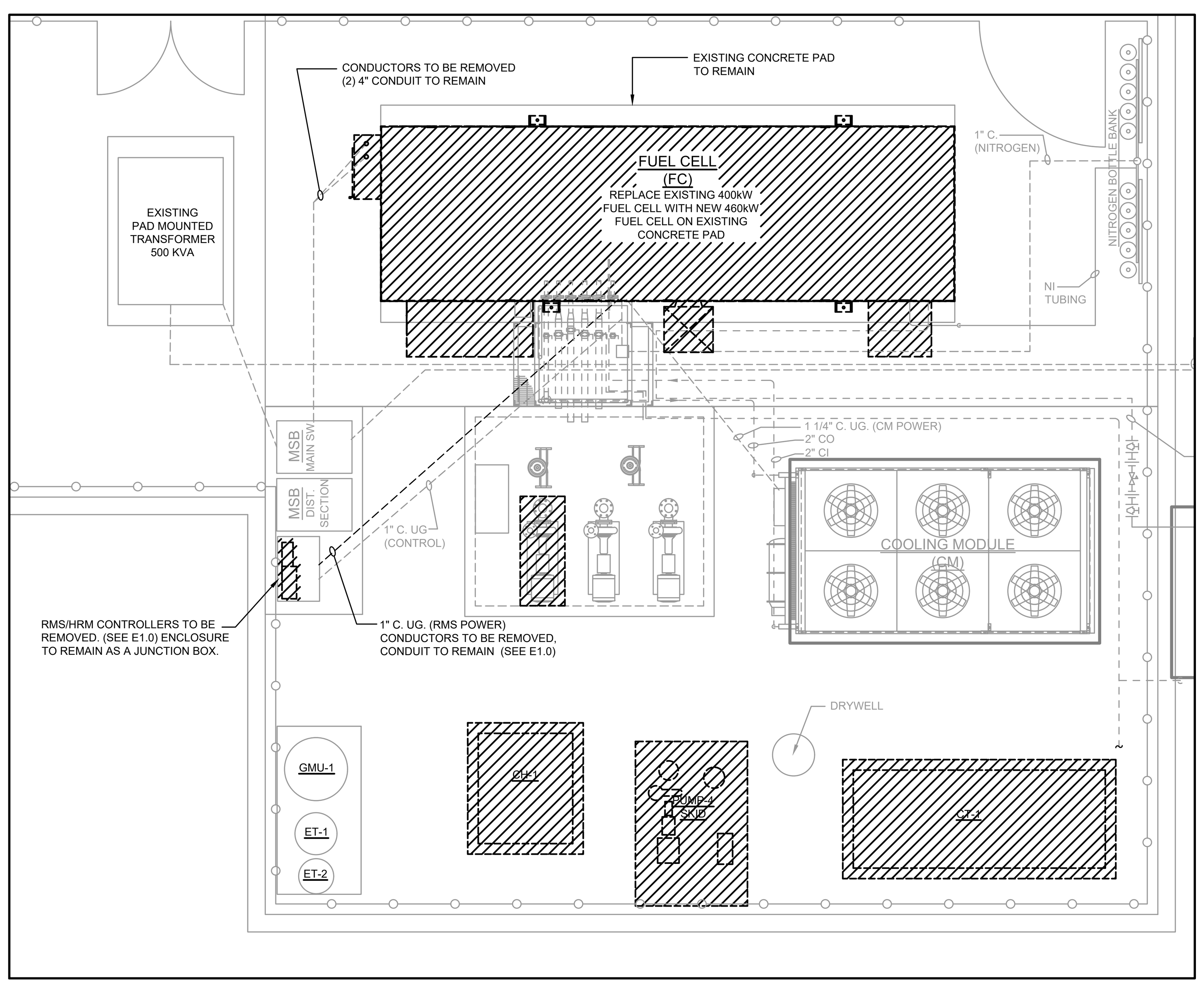
44 WEAVER ROAD, STORRS CT

ELECTRICAL SINGLE LINE DIAGRAM

Project No.:	Drawn By: KFH
Date: 03/10 /22	Design By: DSF
Scale: N.T.S.	Check By: SDF
Drawing No.: E1.0	



1 FUEL CELL YARD GENERAL ARRANGEMENT
SCALE: 3/16" = 1'-0"



2 PARTIAL DEMO PLAN
SCALE: 3/16" = 1'-0"

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GENERAL ARRANGEMENT

Project No.:	Drawn By: KFH
Date: 03/10/22	Design By: DSF
Scale: AS NOTED	Check By: SDF

Drawing No.:
GA1.0