From: John Prinssen <john.prinssen@doosan.com>
Sent: Monday, May 20, 2024 2:06 PM
To: LaFountain, Dakota <Dakota.LaFountain@ct.gov>; Fontaine, Lisa <Lisa.Fontaine@ct.gov>; Mathews, Lisa A <Lisa.A.Mathews@ct.gov>
Cc: Walter Bonola <walter.bonola@doosan.com>
Subject: PE 1595 As Built drawing for UHART Project

Good afternoon

As part of our close out for this project for UHART (PE 1595), I have attached the as built set of construction drawings.

Thank you for all your assistance in making this project a success.

Any questions please let me know.

Thanks

John Prinssen
Project Manager - Installations
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UNIVERSITY OF HARTFORD

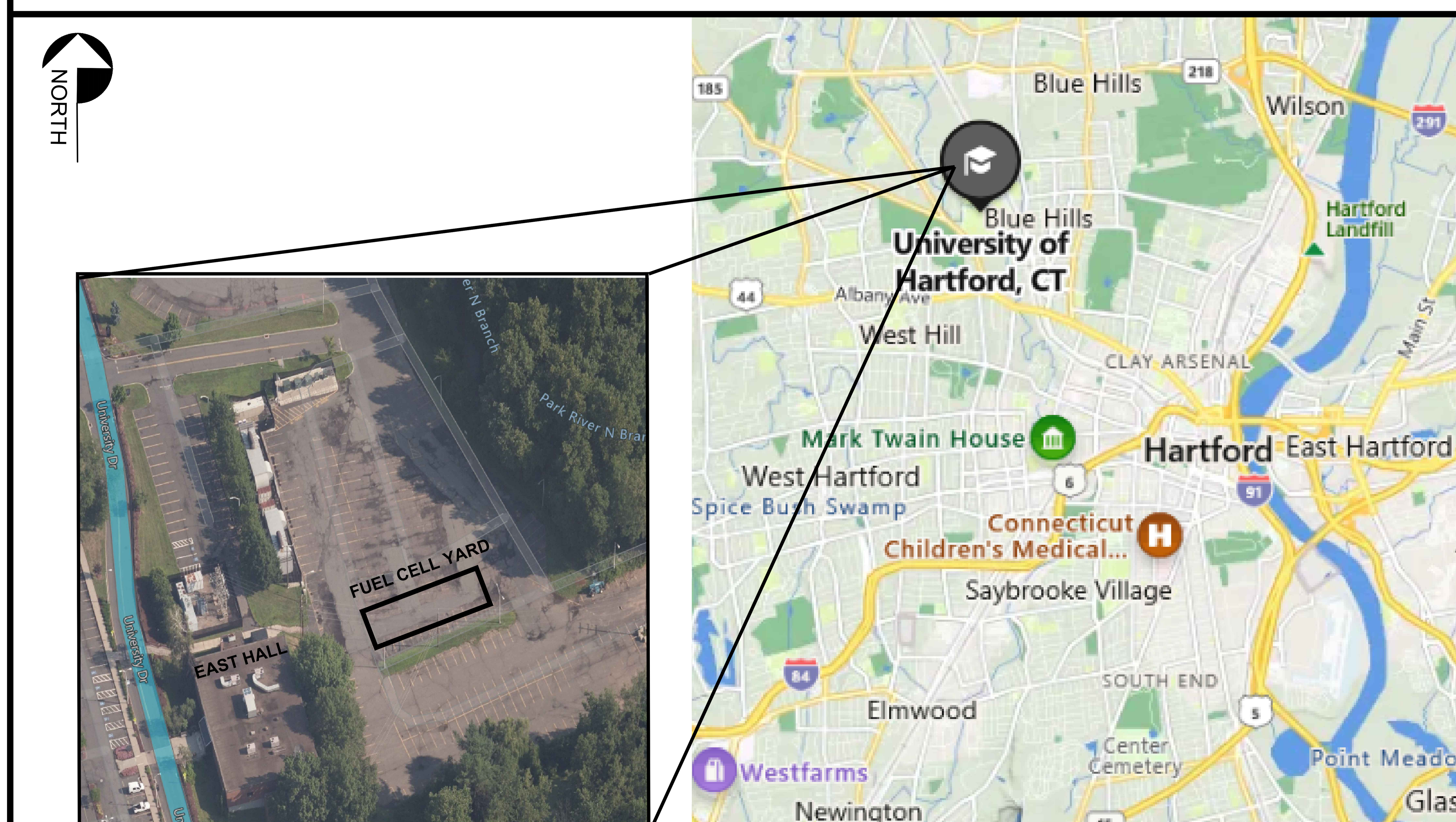
WEST HARTFORD, CONNECTICUT

HyAxiom
A Doosan Company

FUEL CELL INSTALLATION

SITE:	UNIVERSITY OF HARTFORD 200 BLOOMFIELD AVE WEST HARTFORD, CT 06117
ENGINEER:	INNOVATIVE CONSTRUCTION & DESIGN SOLUTIONS, LLC 10 WHITE WOOD LANE NORTH BRANFORD, CT 06471 (203) 453-8596
PROJECT CONTACT:	HyAXIOM, A DOOSAN COMPANY JOHN PRINSSEN 101 EAST RIVER DRIVE, EAST HARTFORD, CT 06108 (860) 727-2091

PROJECT SITE MAP



DRAWING INDEX

REFERENCE DOCUMENTS

FCMAN89412	DOOSAN INSTALLATION MANUAL
PRMAN69600	DOOSAN PRODUCT DATA AND APPLICATIONS GUIDE

LAND DEVELOPMENT PLANS FOR THE UNIVERSITY OF HARTFORD FUEL CELL INSTALLATION PREPARED FOR SUBMISSION TO THE GREATER HARTFORD FLOOD COMMISSION PREPARED BY BL COMPANIES.

DESIGN CODES

- 2022 CONNECTICUT STATE BUILDING CODE
- 2020 NATIONAL ELECTRICAL CODE (NFPA 70)
- 2021 INTERNATIONAL BUILDING CODE
- 2021 INTERNATIONAL MECHANICAL CODE
- 2021 INTERNATIONAL PLUMBING CODE
- 2015 NATIONAL FUEL GAS CODE (NFPA 54)

Rev.	Date	Description
F	07/31/23	UPDATED PER FLOOD COMM. REQUESTS
D	01/02/23	UPDATED EVERSOURCE CKT. NAMES
C	10/06/22	REISSUED FOR CONSTRUCTION
B	09/26/22	ISSUED FOR CONSTRUCTION
A	07/07/22	PRELIMINARY ISSUE

STATE OF CONNECTICUT ☆ SCOTT D FITCH 0019780 LICENSED PROFESSIONAL ENGINEER

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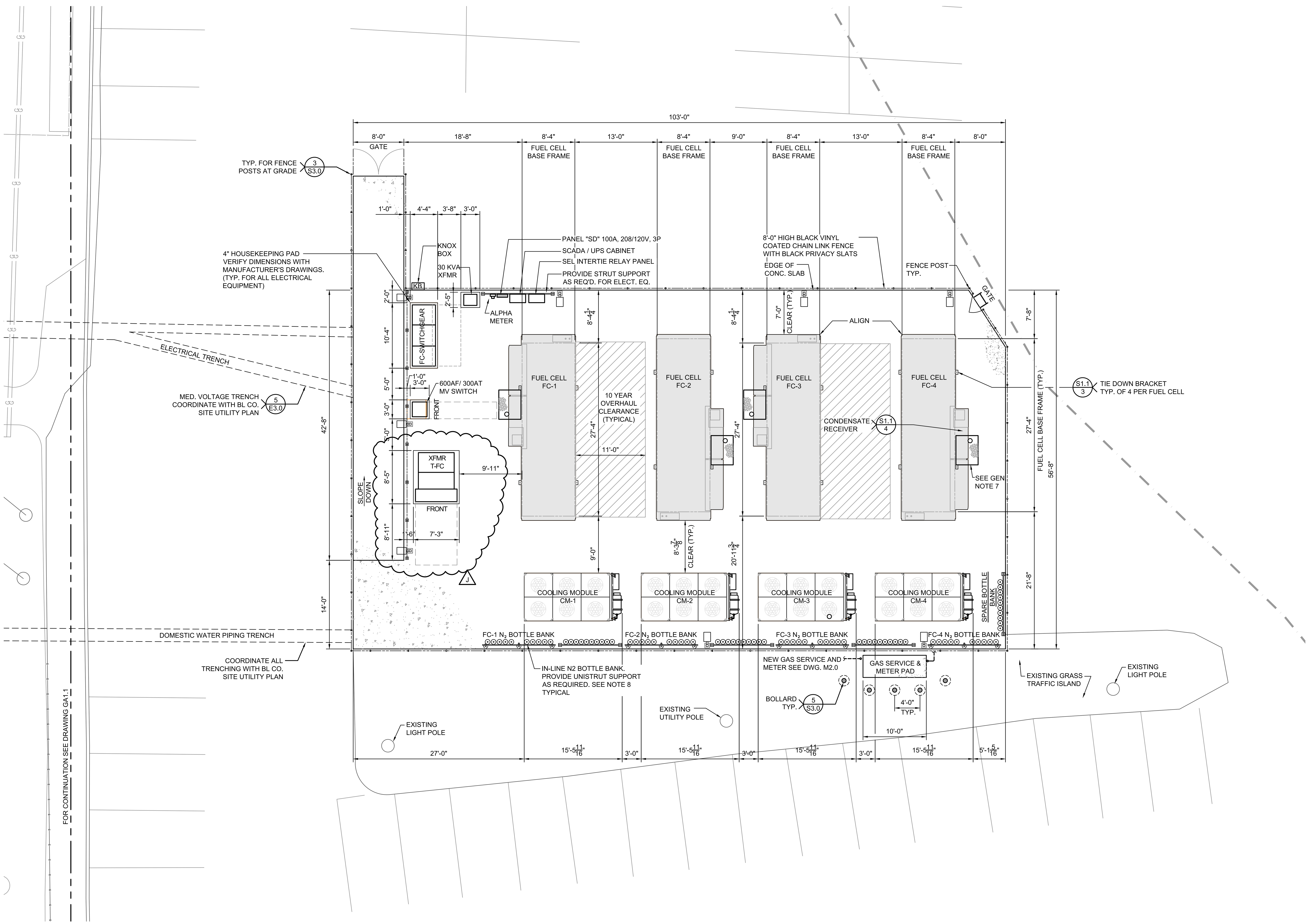
200 BLOOMFIELD AVE, WEST HARTFORD CT
FUEL CELL INSTALLATION

COVER SHEET

Project No.:	Drawn By: KFH
Date: 07/08/22	Design By: DSF
Scale: NTS	Check By: DSF

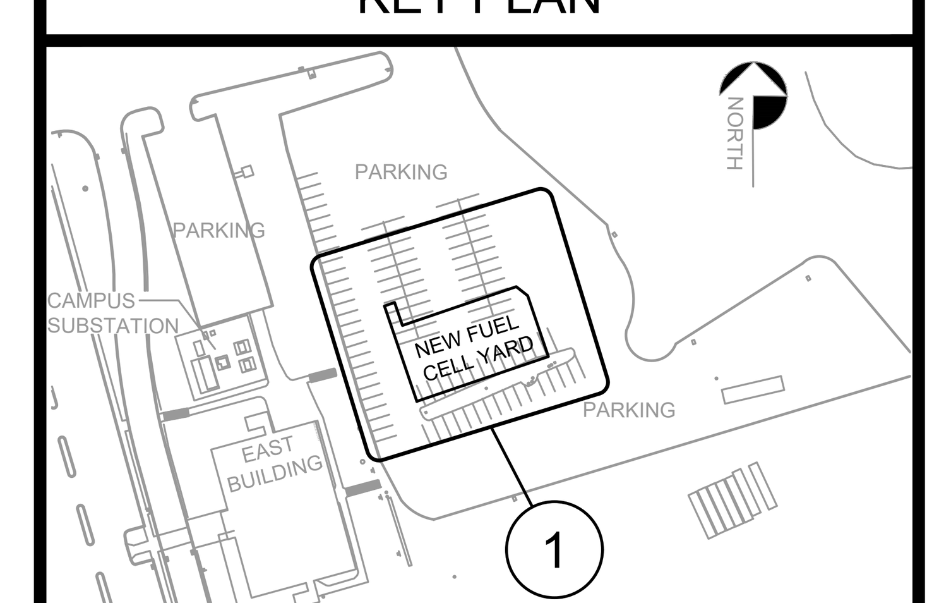
Drawing No.: CS1.0



1 GENERAL ARRANGEMENT PARTIAL PLAN

Scale: 1/8" = 1'-0"

KEY PLAN



Rev.	Date	Description
J	11/06/23	REVISED TRANSFORMER
I	09/15/23	REVISED AS NOTED
H	08/22/23	UPDATED PER HYAXIOM COMMENTS
F	07/31/23	UPDATED PER FLOOD COMM. REQUESTS
E	04/17/23	UPDATED PER MV XFMR SUBMITTAL
D	01/02/23	UPDATED EVERSOURCE CKT. NAMES
C	10/06/22	REISSUED FOR CONSTRUCTION
B	09/26/22	ISSUED FOR CONSTRUCTION
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STATE OF CONNECTICUT · SCOTT D. RICH · LICENSED PROFESSIONAL ENGINEER

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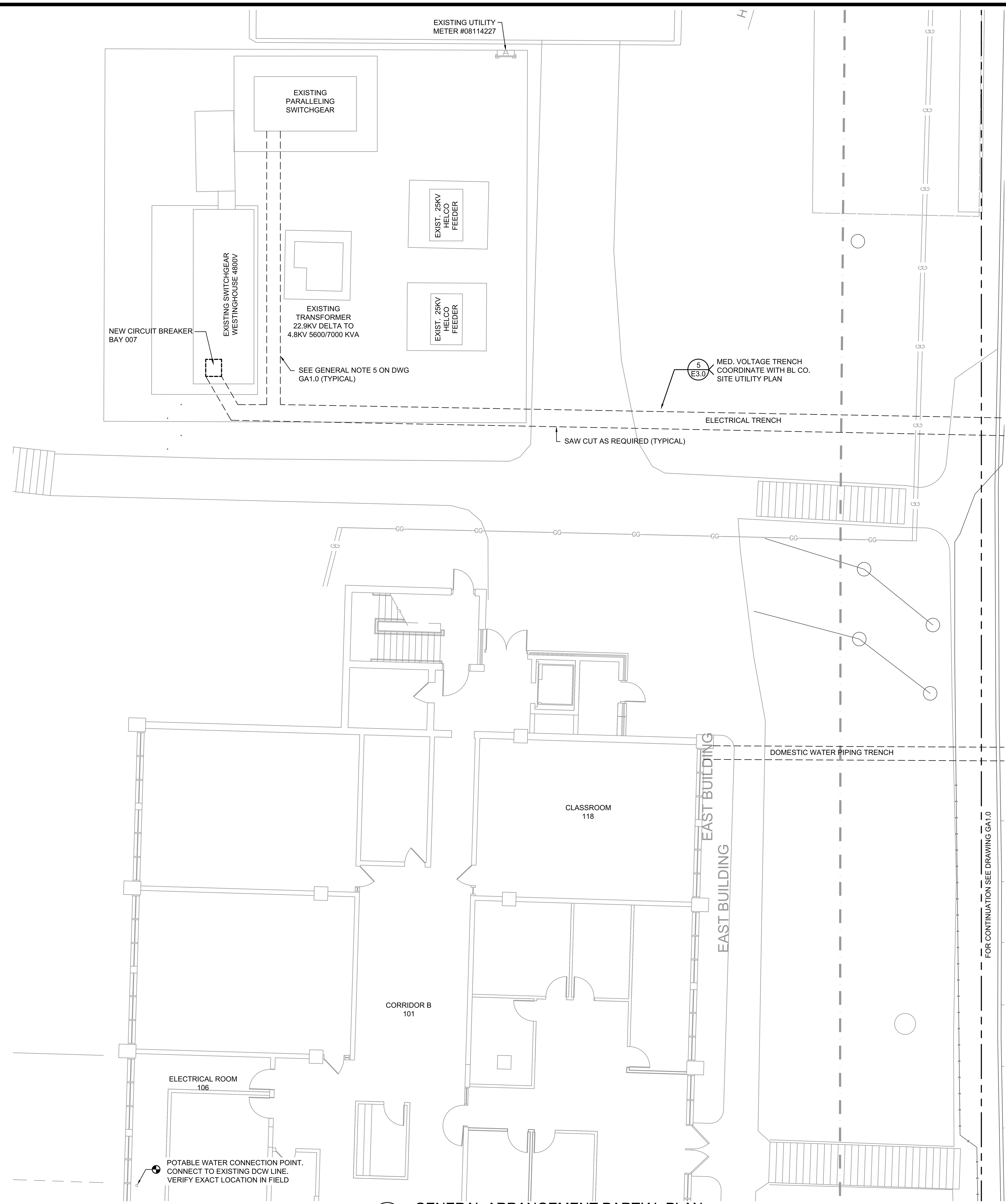
UNIVERSITY OF HARTFORD
200 BLOOMFIELD AVE, WEST HARTFORD CT
FUEL CELL INSTALLATION

GENERAL ARRANGEMENT

Project No.:	Drawn By: KFH
Date: 07/08/22	Design By: DSF
Scale: NTS	Check By: DSF

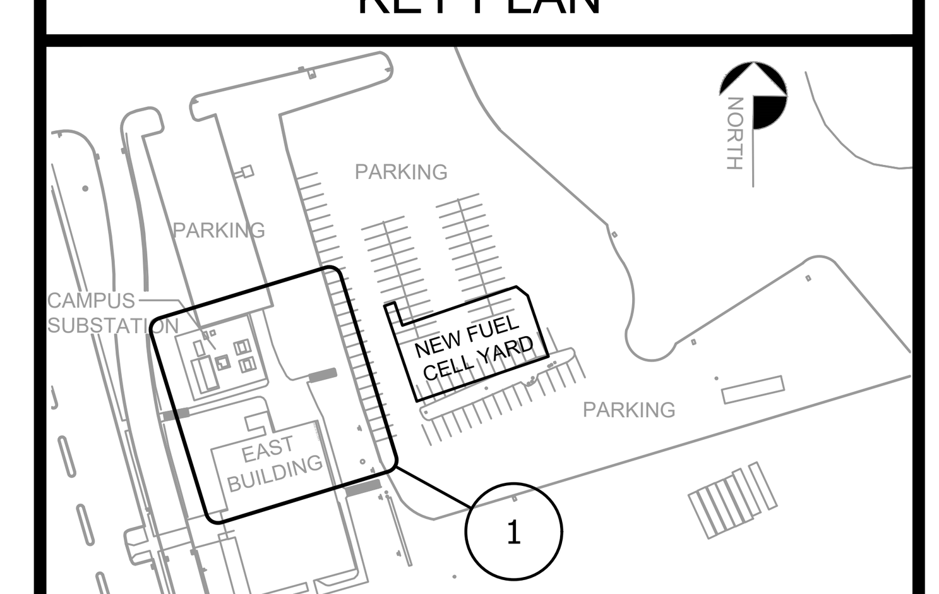
Drawing No.: GA1.0



1 GENERAL ARRANGEMENT PARTIAL PLAN

Scale: 1/8" = 1'-0"

KEY PLAN



Rev.	Date	Description
G	08/03/23	UPDATED AS NOTED
F	07/31/23	UPDATED PER FLOOD COMM. REQUESTS
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FUEL CELL INSTALLATION

GENERAL ARRANGEMENT

Project No.:	Drawn By: KFH
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Scale: NTS	Check By: DSF

Drawing No.:

GA1.1

GENERAL NOTES

1. THE STRUCTURAL DRAWINGS AND SPECIFICATIONS, TO THE BEST OF OUR KNOWLEDGE, COMPLY WITH THE APPLICABLE REQUIREMENTS OF THE 2022 CONNECTICUT STATE BUILDING CODE, AND AMENDMENTS TO THE 2018 INTERNATIONAL BUILDING CODE.

2. THE CONTRACTOR SHALL COMPLY WITH THE REQUIREMENTS OF THE 2018 INTERNATIONAL BUILDING CODE WITH STATE OF CONNECTICUT AMENDMENTS AND ALL APPLICABLE FEDERAL & STATE CODES, STANDARDS, REGULATIONS AND LAWS.

3. ALL REFERENCED STANDARDS REFER TO THE EDITION IN FORCE AT THE TIME THESE PLANS AND SPECIFICATIONS ARE ISSUED FOR PERMIT.

4. WORK NOT INDICATED ON A PART OF THE DRAWINGS BUT REASONABLY IMPLIED TO BE SIMILAR TO THAT SHOWN AT CORRESPONDING PLACES SHALL BE REPEATED.

5. IN ANY CASE OF CONFLICT BETWEEN THE NOTES, DETAILS AND SPECIFICATIONS, THE MOST RIGID REQUIREMENTS SHALL GOVERN. CONTRACTOR SHALL MAKE NO DEVIATION FROM CONTRACT DOCUMENTS WITHOUT WRITTEN APPROVAL OF THE ENGINEER.

6. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CONDITIONS AND COORDINATE WITH LAYOUT DRAWINGS, DRAWINGS FROM OTHER CONSULTANTS, PROJECT SHOP DRAWINGS AND FIELD CONDITIONS.

7. THE CONTRACTOR SHALL PROTECT EXISTING FACILITIES, STRUCTURES AND UTILITY LINES FROM ALL DAMAGE.

8. JOB SAFETY AND CONSTRUCTION PROCEDURES ARE THE RESPONSIBILITY OF THE CONTRACTOR.

9. THE STRUCTURES ARE DESIGNED FOR THE FOLLOWING LOADS:

SEISMIC LOADS:
SEISMIC PARAMETERS
-SPECTRAL ACCELERATIONS: Ss = 0.181, S1 = 0.064
-SEISMIC DESIGN CATEGORY: "D"

WIND LOADS
-ULTIMATE DESIGN WIND SPEED = 120 MPH.
-EXPOSURE "C"

SNOW LOADS
-GROUND SNOW LOAD = 30 PSF + DRIFT

FLOOD DESIGN DATA
-FLOOD ZONE: (LATER)
-GROUND ELEVATION: (LATER)

10. THE PLAN AND DETAILS HERE IN ARE BASED ON LIMITED SITE OBSERVATIONS AND EXISTING DRAWINGS. ANY DISCREPANCIES BETWEEN EXISTING FIELD CONDITIONS AND THE DRAWINGS SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE ENGINEER.

11. THE CONTRACTOR SHALL PERFORM ALL WORK WITH CARE SO THAT ANY EXISTING MATERIALS THAT ARE TO REMAIN SHALL NOT BE DAMAGED. IF THE CONTRACTOR DAMAGES ANY MATERIALS THAT ARE TO REMAIN IN PLACE, THE DAMAGED MATERIALS SHALL BE REPAIRED OR REPLACED IN A MANNER SATISFACTORY TO THE ENGINEER AT THE EXPENSE OF THE CONTRACTOR.

12. ALL AREAS DISTURBED BY THE CONTRACTOR WITHOUT AUTHORIZATION OF THE ENGINEER SHALL BE RESTORED BY THE CONTRACTOR AT NO ADDITIONAL EXPENSE.

FOUNDATION NOTES

1. FOUNDATION DESIGN PARAMETERS FROM GEOTECHNICAL INVESTIGATION REPORT PREPARED BY WELTI GEOTECHNICAL, INC. OF GLASTONBURY, CT. DATED MARCH 1, 2023.

2. FOUNDATION IS DESIGNED TO BE SUPPORTED ON BEARING PRESSURE OF 2,000 PSF OR HELICAL PILES AS SPECIFIED BY "HELICAL DRILLING" OUT OF BRAINTREE, MA.

3. CONTRACTOR SHALL BE FAMILIAR WITH THE SUBSURFACE CONDITIONS AND GEOTECHNICAL REPORT BEFORE COMMENCING EXCAVATION.

4. DOWELS FROM FOOTINGS INTO PIERS AND WALLS ABOVE SHALL BE THE SAME SIZE AND NUMBER AS VERTICAL REBAR IN PIERS AND WALLS, AND SHALL BE EXTENDED "LTE" INTO FOOTINGS AND "LTS" INTO PIERS AND WALLS UNLESS OTHERWISE SHOWN.

5. DROP BOTTOM OF WALLS AND PIERS TO TOP OF FOOTINGS TO OBTAIN FULL EXTENT OF CONTACT, UNLESS OTHERWISE SHOWN.

6. CENTERLINE OF FOOTINGS SHALL BE CENTERLINE OF WALLS, PIERS AND COLUMNS, UNLESS OTHERWISE SHOWN.

7. NO BACKFILLING SHALL BE DONE AGAINST FOUNDATION AND RETAINING WALLS UNTIL CONCRETE HAS ATTAINED AT LEAST 75% OF ITS DESIGN STRENGTH. BEFORE BACKFILLING, PROVIDE BRACING FOR WALLS SUSTAINING MORE THAN 3 FEET OF EARTH PRESSURE. THIS BRACING SHALL REMAIN IN PLACE UNTIL ALL SLABS AND BEAMS FRAMING INTO WALL HAVE BEEN PLACED AND SET.

8. IN NO CASE SHALL BULLDOZERS OR OTHER HEAVY EQUIPMENT BE PERMITTED CLOSER THAN 5 FEET FROM ANY FOUNDATION WALL. IF IT IS NECESSARY TO OPERATE SUCH EQUIPMENT CLOSER THAN 8 FEET TO THE WALL, THE CONTRACTOR SHALL BE THE SOLE RESPONSIBLE PARTY AND AT THEIR OWN EXPENSE SHALL PROVIDE ADEQUATE SUPPORTS OR BRACE THE WALL TO WITHSTAND THE ADDITIONAL LOADS SUPERIMPOSED FROM SUCH EQUIPMENT.

9. CONTRACTOR SHALL BE RESPONSIBLE TO ADEQUATELY PROTECT ALL EXCAVATION SLOPES. WHERE NECESSARY, SHEETING AND SHORING OF EXCAVATION SHALL BE PROVIDED WITH ALL REQUIRED TIEBACKS AND BRACING.

10. METHODS EMPLOYED IN ALL SHEETING AND SHORING SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF CONNECTICUT.

11. MATERIAL FOR CONTROLLED FILL SHALL MEET THE FOLLOWING CRITERIA: SELECT EXCAVATED GRAVEL OR STONE MATERIALS FREE OF ORGANIC MATERIAL, LOAM, TRASH, SNOW, ICE, FROZEN SOIL, AND OTHER OBJECTIONABLE MATERIAL, CONFORMING TO THE GRADATION REQUIREMENTS AS FOLLOWS:

SIEVE SIZE	%PASSING (BY WEIGHT)
3-1/2"	100 %
3/4"	50-100 %
#4	25-75 %

NOTE:
THE FRACTION PASSING THE NO. 200 SIEVE SHALL BE LESS THAN 15% OF THE FRACTION PASSING THE NO. 4 SIEVE

12. ON-SITE EXCAVATED MATERIAL MAY ONLY BE SUITABLE FOR USE AS GRANULAR FILL IF IT CONFORMS TO THE SPECIFICATIONS NOTED AND IS APPROVED FOR USE BY THE GEOTECHNICAL ENGINEER. REFER TO GEOTECHNICAL REPORT FOR MORE INFORMATION.

13. STRUCTURAL FILL MATERIAL SHOULD BE PLACED IN UNIFORM 12" THICK LOOSE LIFTS AND COMPACTED TO 95% OF ITS MAXIMUM DRY DENSITY, AT OPTIMUM MOISTURE CONTENT, IN ACCORDANCE WITH ASTM D1557-00. IN RESTRICTED AREAS WHERE ONLY HAND-OPERATED EQUIPMENT IS PERMITTED, THE MAXIMUM LOOSE LIFT SHALL BE 8".

14. SOIL COMPACTION SHALL BE CONTROLLED BY A QUALIFIED TESTING LABORATORY OR GEOTECHNICAL ENGINEER AS PART OF SPECIAL INSPECTIONS. TAKE A MINIMUM OF ONE FIELD DENSITY TEST FOR EACH LAYER. LOCATION OF TEST SHALL BE DETERMINED BY THE TESTING AGENCY.

REINFORCED CONCRETE NOTES

1. STRUCTURAL CONCRETE AND CONCRETING PRACTICES SHALL CONFORM WITH ACI-318, "AMERICAN CONCRETE INSTITUTE, BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE" LATEST EDITION. DETAILS SHALL BE IN ACCORDANCE WITH ACI-315, "DETAILS AND DETILING OF CONCRETE REINFORCEMENT" UNLESS OTHERWISE NOTED ON THE DRAWINGS. ALL ACI REQUIREMENTS FOR HOT AND COLD WEATHERING CONCRETING MUST BE ADHERED TO.

2. ALL CAST-IN-PLACE CONCRETE MIXES SHALL HAVE A MINIMUM 28 DAYS COMPRESSIVE STRENGTH AS FOLLOWS UNLESS OTHERWISE NOTED ON DRAWINGS:

		f'c (PSI) (28 DAY)
A.	SLABS, AREA PAVING, AND ROADS	4,000
B.	WATER TIGHT CONCRETE	4,000
C.	MACHINERY FOUNDATIONS	4,000
D.	STATIONARY EQUIPMENT FOUNDATIONS	4,000
E.	STRUCTURES AND THEIR FOUNDATIONS	4,000
F.	MISC CONCRETE FILL AND UNDERGROUND DUCT BANKS	2,000

3. ALL CONCRETE EXPOSED TO WEATHER SHALL HAVE AN AIR-ENTRAINING AGENT.

4. REINFORCING BARS SHALL CONFORM TO ASTM A615, GRADE 60 UNLESS REQUIRED TO BE WELDED AS SHOWN ON PLANS. ALL REINFORCING BARS REQUIRED TO BE WELDED SHALL CONFORM TO ASTM A706, GRADE 50.

5. WELDED WIRE FABRIC (W.W.F.) SHALL CONFORM TO ASTM A185. SUPPORT FABRIC WITH CHAIRS OR LIFTS DURING CONCRETE PLACEMENT TO ENSURE PROPER POSITION IN SLAB.

6. ALL REINFORCEMENT SHALL BE SECURELY HELD IN PLACE WHILE PLACING CONCRETE. IF RQUIRED, ADDITIONAL BARS OR STIRRUPS SHALL BE PROVIDED BY THE CONTRACTOR TO FURNISH SUPPORT FOR ALL BARS.

7. ALL REINFORCING BARS SHALL BE LAPPED AS SPECIFICALLY DETAILED ON THE DRAWINGS. SPLICING & EMBEDMENTS SHALL BE IN ACCORDANCE WITH ACI 318 WHERE NOT SPECIFICALLY DETAILED/ INDICATED ON THE DRAWINGS. ALL REINFORCING BARS SHALL BE LAPPED USING THE TENSION SPLICE (LTS) AND COMPRESSION SPLICE (LCS) LENGTHS NOTED IN THE LAP SPLICE SCHEDULE.

-LAP GRADE BEAM AND WALL TOP HORIZONTAL REINFORCEMENT AT CENTER OF SPAN
-LAP GRADE BEAM AND WALL BOTTOM HORIZONTAL REINFORCEMENT AT SUPPORT
-LAP INSIDE FACE WALL VERTICAL REINFORCEMENT AT SUPPORT
-LAP OUTSIDE FACE VERTICAL WALL REINFORCEMENT AT MID-HEIGHT OF WALL
-UNLESS NOTED OTHERWISE, TERMINATE BARS AT DISCONTINUOUS ENDS WITH STANDARD HOOKS
-ALL HOOKED BARS NOT DIMENSIONED SHALL BE STANDARD HOOKS

8. MINIMUM CONCRETE COVER SHALL BE AS FOLLOWS, UNLESS NOTED OTHERWISE ON THE DRAWINGS:
SLABS .... 3/4 IN.
WALLS .... 1 IN.
COLUMNS .... 1-1/2 IN.
ALL CONCRETE EXPOSED TO EARTH/ WEATHER................ 2 IN.
ALL CONCRETE CAST AGAINST EARTH (NO FORMWORK).... 3 IN.

9. PROVIDE CONSTRUCTION JOINTS IN ACCORDANCE WITH ACI-318, CHAPTER 6.4 SUBMIT SHOP DRAWINGS SHOWING CONSTRUCTION JOINT DETAILS, LOCATIONS AND THE SEQUENCE OF POURS FOR THE STRUCTURAL ENGINEER'S REVIEW PRIOR TO BEGINNING WORK.

10. WALL AND GRADE BEAM CONSTRUCTION JOINTS SHALL BE LOCATED TO PROVIDE A 60-FOOT MAXIMUM LENGTH OF CONCRETE PLACEMENT.

11. VERTICAL CONSTRUCTION JOINTS IN GRADE BEAMS AND WALLS SHALL BE USED ONLY WITH PRIOR APPROVAL OF THE ENGINEER (SEE NOTE 9 ABOVE) AND SHALL BE LOCATED AS FOLLOWS:

FOUNDATION WALLS: MINIMUM 8'-0" FROM ANY COLUMN LINE OR WALL OPENING
GRADE BEAMS: AT CENTERLINES BETWEEN SUPPORTS

12. NO HORIZONTAL CONSTRUCTION JOINTS WILL BE PERMITTED IN BEAMS, WALLS AND SLABS UNLESS SPECIFICALLY SHOWN ON THE DRAWINGS OR APPROVED IN WRITING PRIOR TO CONSTRUCTION BY THE ENGINEER.

13. NO CONCRETE TEST WILL BE ACCEPTED IF CONCRETE IS TAMPERED WITH IN ANY WAY AFTER SAID TEST IS PERFORMED. REPEAT TEST IF WATER IS ADDED AFTER INITIAL SAMPLING.

14. THE CONTRACTOR SHALL PROVIDE REINFORCING STEEL ERECTOR WITH A SET OF APPROVED SHOP DRAWINGS FOR FIELD USE.

15. ALL ADJOINING SURFACES NOT CAST MONOLITHICALLY SHALL BE ROUGHENED TO 1/4 INCH AMPLITUDE FOR THE ENTIRE INTERSECTING SURFACE ACCORDING TO ACI RECOMMENDATIONS AND APPLY A BONDING AGENT AS REQUIRED.

16. CONTRACTOR SHALL FIELD VERIFY DIMENSIONS AND LOCATIONS OF ALL OPENINGS, PIPE SLEEVES, CURBS, ETC., AS REQUIRED BY OTHER TRADES BEFORE CONCRETE IS PLACED.

17. CONTRACTOR SHALL COORDINATE LOCATION OF INSERTS, WELDED PLATES AND OTHER ITEMS TO BE EMBEDDED IN CONCRETE WITH ARCHITECTURAL, MECHANICAL AND STRUCTURAL DRAWINGS.

18. CONTRACTOR SHALL COORDINATE LOCATION OF FLOOR DRAINS, CURBS, CONCRETE PADS, FLOOR DEPRESSIONS, ETC. WITH ARCHITECTURAL AND MECHANICAL DRAWINGS.

19. HORIZONTAL PIPES OR CONDUITS PLACED IN SLABS SHALL NOT BE SPACED CLOSER THAN 3 x THE DIAMETER OF CENTER. PIPE AND CONDUITS PLACED IN SLABS SHALL NOT HAVE AN OUTSIDE DIAMETER LARGER THAN 1/3 OF SLAB THICKNESS. ALUMINUM CONDUITS SHALL NOT BE PLACED IN CONCRETE. NO CONDUITS SHALL BE PLACED IN THE SLAB WITHIN 12 INCHES OF ANY COLUMN FACE.

20. CONTRACTOR SHALL USE RIGID STEEL TEMPLATES (SUPPLIED BY THE STEEL FABRICATOR) TO INSTALL ANCHOR RODS.

21. ALL CONCRETE WORK, REINFORCING, PLACEMENT, AND FORMWORK SHALL BE INSPECTED BY AN INDEPENDENT TESTING AGENCY RETAINED BY THE OWNER FOR THE FOLLOWING ITEMS:

A. INSPECT BOTTOM OF FOOTING SOIL CONDITIONS
B. INSPECT FORMWORK AND PLACEMENT OF CONCRETE
C. TESTING FRESH CONCRETE IN THE FIELD PER ASTM C-172, MODIFIED FOR SLUMP BY ASTM C-94
D. SLUMP TEST PER ASTM C-143, ONE TEST AT POINT OF DISCHARGE FOR EACH DAYS POUR FOR EACH TYPE OF CONRETE.
E. TEST AIR CONTENT PER ASTM C-173 (VOLUMETRIC METHOD) OR ASTM C-231 (PRESSURE METHOD), ONE TEST FOR EACH DAYS POUR FOR EACH TYPE OF CONCRETE.
F. COMPRESSION TEST CYLINDERS PER ASTM C-31 (4-CYLINDERS)
G. TEST CONCRETE TEMPERATURE EACH TIME A SET OF CYLINDERS IS CAST
H. COMPRESSION STRENGTH TEST PER ASTM C-39:
ONE SET FOR EACH DAYS POUR + ADDITIONAL SETS FOR EACH 50-CUBIC YARDS OVER AND ABOVE THE IRST 25-CUBIC YARDS USING THE FOLLOWING ORDER:
a. ONE CYLINDER TESTED AT 7 DAYS
b. TWO CYLINDERS TESTED AT 28 DAYS
c. ONE CYLINDER RETAINED FOR LATER TESTING, IF REQUIRED

22. ANCHOR BOLT STEEL SHALL CONFORM TO ASTM SPECIFICATION A36 OR A307.

23. EMBEDDED STEEL MATERIAL SHALL CONFORM TO ASTM A36 UNLESS OTHERWISE NOTED ON THE DRAWINGS.

24. EMBEDDED PIPE SLEEVES SHALL BE ASTM A53 GRADE B UNLESS OTHERWISE NOTED ON THE DRAWINGS.

25. ALL EXPOSED CORNERS SHALL HAVE 3/4" CHAMFER UNLESS NOTED ON PLAN.

26. ALL EXTERIOR CONCRETE SHALL HAVE AIR-ENTRAINING ADMIXTURE PROVIDING 4% TO 6% TOTAL AIR CONTENT.

27. ALL EXPOSED CONCRETE SURFACES SHALL BE CURED IMMEDIATELY AFTER FINISHING. CONCRETE SHALL BE KEPT CONTINUOUSLY MOIST FOR A MINIMUM OF 7 DAYS OR APPLY TWO COATS OF CURING COMPOUND WITH A SECOND COAT APPLIED AT RIGHT ANGLE TO FIRST COAT. ALTERNATE METHODS MAY BE USED WITH PRIOR APPROVAL.

28. GROUT UNDER ALL STRUCTURAL COLUMNS, MISCELLANEOUS BASE PLATE SUPPORTS, EQUIPMENT BASES, AROUND ANCHOR BOLTS, AND INSIDE ANCHOR BOLT SLEEVES SHALL BE PREPACKAGED, CEMENTIOUS, NON-SHRINK, NON-METALIC TYPE.

29. WELDING OF REINFORCEMENT (INCLUDING TACK WELDS) SHALL NOT BE PERMITTED UNLESS NOTED ON PLAN.

30. DETAILING OF REINFORCEMENT SHALL BE PERFORMED USING STANDARD END HOOKS AND WITH LAP SPLICE & EMBEDMENT LENGTHS ONLY AS INDICATED ON DRAWINGS.

31. ALL EXTERIOR SLAB SURFACES SHALL HAVE A METAL FLOAT FINISH. EXTRA CARE IS REQUIRED UNDER THE FUEL CELLS. - REFER TO MANUFACTURER'S SPECIFICATIONS.

STRUCTURAL STEEL NOTES:

1. STRUCTURAL STEEL DESIGN, FABRICATION AND ERECTION SHALL BE IN ACCORDANCE WITH AISC "SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS - ALLOWABLE STRESS DESIGN AND PLASTIC DESIGN" AND "CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES" (LATEST EDITIONS).

2. HIGH STRENGTH BOLTING SHALL BE IN ACCORDANCE WITH AISC "SPECIFICATION FOR STRUCTURAL JOINTS USING ASTM A 325 OR A 490 BOLTS (LATEST EDITIONS).

3. ALL WELDING SHALL BE IN ACCORDANCE WITH AMERICAN WELDING SOCIETY D1.1 "STRUCTURAL WELDING CODE-STEEL" (LATEST EDITION).

CONNECTIONS

1. UNLESS SPECIFICALLY NOTED ON THE DRAWINGS, SHOP CONNECTIONS MAY BE ASSEMBLED BY EITHER BOLTING OR WELDING.

2. BOLTED CONNECTIONS FOR PRIMARY STRUCTURAL MEMBERS SHALL BE BOLTED WITH HIGH STRENGTH BOLTS CONFORMING TO ASTM A 325 UNLESS NOTED OTHERWISE ON THE DRAWINGS.

3. BOLTED CONNECTIONS FOR SECONDARY STRUCTURAL MEMBERS (PURLINS, GIRTS, STAIR FRAMING, STAIR BRACING, TOE PLATE, HANDRAIL, LADDERS, ETC) USING GREATER THAN 5/8" DIA. BOLTS SHALL BE BOLTED WITH HIGH STRENGTH BOLTS CONFORMING TO ASTM A 325, UNLESS NOTED OTHERWISE ON THE DRAWINGS.

4. ALL HIGH STRENGTH BOLTED CONNECTIONS SHALL BE BEARING TYPE WITH THREADS INCLUDED IN SHEAR.

5. HIGH STRENGTH BOLT SIZES SHALL BE 3/4 INCH DIAMETER MINIMUM (UNO).

6. THICKNESS OF GUSSET AND STIFFENER PLATES, IF NOT CALLED FOR ON THE DRAWINGS, SHALL BE INCH MINIMUM.

7. WORKING POINTS FOR HORIZONTAL BRACING CONNECTIONS SHALL BE THE CENTERLINE OF THE INTERSECTING HORIZONTAL BEAMS UNLESS NOTED OTHERWISE ON THE DRAWINGS. HORIZONTAL BRACING SHALL BE CONNECTED TO TWO (2) BEAMS WHEREVER POSSIBLE.

8. WORKING POINTS FOR VERTICAL BRACING CONNECTIONS SHALL BE THE CENTERLINE OF BEAM AND CENTERLINE OF COLUMN, UNLESS NOTED OTHERWISE ON THE DRAWINGS. VERTICAL BRACING SHALL BE CONNECTED TO BOTH BEAM & COLUMN.

9. GRATING SHALL BE CONNECTED TO SUPPORT BEAMS WITH SADDLE CLIPS & SELF-TAPPING SCREWS. FRICTION CLIPS ARE NOT PERMITTED.

10. USE 4-BOLT MINIMUM FOR WT BRACE CONNECTIONS AND 2-BOLT MINIMUM FOR ANGLE BRACE CONNECTIONS

11. SURFACES OF STRUCTURAL STEEL SHALL NOT RECEIVE SHOP-APPLIED PAINT WITHIN 4" OF FIELD WELDS.

12. WHERE FIELD WELDS WILL BE DONE ON EXISTING STEEL ALL EXISTING COATINGS SHALL BE CONSIDERED TO BE LEAD BASED. AN APPROVED CONTRACTOR SHALL STRIP EXISTING SURFACE COATINGS AND THE REMOVAL PROCEDURE SHALL COMPLY WITH OSHA STANDARD 1926.354. EXISTING COATING SHALL BE REMOVED A MINIMUM OF 4" FROM THE AREA TO BE WELDED. ALL EXPOSED AREAS SHALL BE PAINTED AFTER THE COMPLETION OF WORK.

13. IF BEAM REACTIONS ARE NOT SHOWN ON THE DRAWINGS, CONNECTIONS SHALL BE DETAILED TO SUPPORT ONE-HALF THE TOTAL UNIFORM LOAD CAPACITY SHOWN IN TABLES OF 'UNIFORM LOAD', FOR THE GIVEN BEAM, SPAN & GRADE OF STEEL SPECIFIED. THESE TABLES SHALL BE AS LISTED IN AISC 'MANUAL OF STEEL CONSTRUCTION'.

MATERIALS

1. STRUCTURAL STEEL "W" "WT" AND "S" SHAPES SHALL CONFORM TO ASTM A 992, GRADE 50. ALL CHANNELS, ANGLES AND PLATES SHALL CONFORM TO ASTM A 36 UNLESS NOTED OTHERWISE.

2. HIGH STRENGTH BOLTS, NUTS AND HARDENED WASHERS SHALL CONFORM TO ASTM A 325, ASTM A 563 DH, AND ASTM F 436 RESPECTIVELY. MACHINE BOLTS AND NUTS SHALL CONFORM TO ASTM A 307, AND PLAIN WASHERS SHALL CONFORM TO ANSI B18.22.1.

3. WELDING ELECTRODES USED FOR FIELD CONNECTIONS SHALL CONFORM TO AWS A5.1, CLASS E70XX UNLESS NOTED OTHERWISE ON THE DRAWINGS. WELDING ELECTRODES USED FOR SHOP CONNECTIONS SHALL CONFORM TO AWS A5.1. WITH A MINIMUM ELECTRODE TENSILE STRENGTH OF 70 KSI, UNLESS NOTED OTHERWISE ON THE DRAWINGS.

4. GRATING SHALL BE WELDED STEEL BAR TYPE WITH 1 INCH X INCH BEARING BARS SPACED AT 1 CENTER TO 4 16 16 CENTER, UNLESS NOTED OTHERWISE ON THE DRAWINGS. CROSS BARS SHALL BE SPACED AT 4 INCHES CENTER TO CENTER. ALL BEARING BARS AND CROSS BARS SHALL BE WELDING QUALITY MILD CARBON STEEL AND SHALL CONFORM TO ASTM A 569. GRATING SHALL BE HOT-DIPPED GALVANIZED.

5. CHECKERED FLOOR PLATE SHALL BE FOUR WAY RAISED PATTERN STEEL PLATE OF THE THICKNESS CALLED FOR ON THE DRAWINGS, PLATE MATERIAL SHALL CONFORM TO ASTM A 36 OR ASTM A786. HOLLOW STRUCTURAL STEEL (HSS): ASTM A500 GRADE B, MIN. YIELD STRENGTH OF 42 KSI FOR PIPES, 46 KSI FOR TUBES

6. ALL STRUCTURAL STEEL, MISCELLANEOUS STEEL, HANDRAIL AND LADDERS SHALL BE HOT DIP GALVANIZED AFTER FABRICATION (UNLESS NOTED OTHERWISE) IN ACCORDANCE WITH SPECIFICATION (LATER)

7. ALL BOLTS SHALL CONFORM TO ASTM A325 OR A490, NUTS SHALL CONFORM TO ASTM A563 AND WASHERS SHALL CONFORM TO ASTM A-F436.

8. ALL ANCHOR BOLTS/RODS SHALL CONFORM TO ASTM F-1554 GRADE 36 WITH WELD ABILITY

9. SUPPLEMENT S1, UNLESS OTHERWISE NOTED. SUBMIT GRADE CERTIFICATIONS FOR RECORD. STEEL SUPPLIER SHALL SUPPLY RIGID STEEL TEMPLATES FOR ANCHOR ROD INSTALLATION.

10. OVERSIZED OR SLOTTED HOLES SHALL NOT BE USED FOR ANY CONNECTIONS UNLESS SPECIFICALLY INDICATED ON THE DRAWINGS OR APPROVED IN WRITING BY THE ENGINEER.

11. ALL BUTT AND FULL PENETRATION WELDS SHALL BE MADE USING RUN OFF TABS WHICH SHALL BE REMOVED AND GROUND SMOOTH AFTER WELD IS COMPLETED.

12. ALL WELD BACK UP BARS SHALL BE REMOVED AND GROUND SMOOTH AFTER WELD IS COMPLETED, UNLESS NOTED OTHERWISE.

13. ALL WELDS INDICATED SHALL MEET THE MINIMUM WELD SIDE SPECIFIED BY THE AISC MANUAL OF STEEL DESIGN. (SINGLE PASS AS REQUIRED)

14. ALL WELDS SHALL BE PERFORMED BY QUALIFIED WELDERS IN ACCORDANCE WITH A.W.S. SPECIFICATIONS, LATEST EDITIONS. ALL WELDING ELECTRODES SHALL CONFORM TO A.W.S. A5.1 GRADE E-70. BARE ELECTRODES AND GRANULAR FLUX SHALL CONFORM TO A.W.S. A5.17, F70 A.W.S. FLUX CLASSIFICATION.

15. ALTERNATE CONNECTIONS WILL BE ACCEPTED ONLY WITH THE WRITTEN APPROVAL OF THE ENGINEER. HOWEVER, THE ENGINEER SHALL BE THE SOLE JUDGE OF THE ACCEPTABILITY AND THE CONTRACTOR'S BID SHALL ANTICIPATE THE USE OF THOSE SPECIFIC DETAILS SHOWN ON THE DRAWINGS. IN ANY EVENT THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN OF SUCH ALTERNATE DETAILS WHICH THEY PROPOSE.

16. SHOP AND FIELD CONNECTIONS NOT SPECIFICALLY DETAILED ON THE DRAWINGS SHALL BE BOLTED OR WELDED.

STRUCTURAL STEEL NOTES (CONT.)

15. WHEN NOT SPECIFICALLY DETAILED ELSEWHERE ON THE DRAWINGS, ALL BEAM TO BEAM AND BEAM TO COLUMN CONNECTIONS SHALL BE DETAILED AS SHOWN IN THE TYPICAL BEAM CONNECTION DETAILS.

16. ALL BEAM AND GIRDERS SHALL BE CONNECTED FOR 115% OF THE REACTION DENOTED BY THE " GRAVITY SHEAR REACTION" SYMBOL ON THE PLANS. PROVIDE A MINIMUM 2 BOLT CONNECTION.

17. FILLER BEAMS SHOULD BE SPACED EQUALLY BETWEEN THE SUPPORTS UNLESS OTHERWISE NOTED ON THE DRAWINGS.

18. ALL HOLES AND CUTS SHALL BE SHOWN ON THE SHOP DRAWINGS AND MADE IN THE SHOP. CUTS OR BURNING OF HOLES IN STRUCTURAL STEEL MEMBERS IN THE FIELD WILL NOT BE PERMITTED.

19. STEEL MEMBERS INDICATED ON THE DRAWINGS TO BE ENCASED IN CONCRETE SHALL BE UNPAINTED ON THE CONTACT SURFACES AND SHALL BE WRAPPED WITH A MINIMUM 6X6-W2.9xW2.9 W.W.F. REINFORCING UNLESS OTHERWISE NOTED.

20. THE STRUCTURAL STEEL CONTRACTOR SHALL COORDINATE THE BOTTOM OF BASE PLATE ELEVATION WITH THE TOP OF CONCRETE ELEVATION.

21. THE MAXIMUM LOAD HUNG FROM ANY BEAM FOR MEP DUCTWORK, PIPING ETC SHALL BE DISTRIBUTED TO THE BEAM'S TRIBUTARY AREA IN A WAY THAT THE ALLOWABLE DESIGN LOADS LISTED IN THE GENERAL NOTES ARE NOT EXCEEDED. THE CONTRACTOR SHALL COORDINATE THE LOADS OF ALL TRADES AND PROVIDE ADDITIONAL SUPPORT OR DISTRIBUTION FRAMING AS REQUIRED TO ACHIEVE THESE LOADS.

22. STRUCTURAL DRAWINGS SHALL BE USED IN CONJUNCTION WITH ARCHITECTURAL DRAWINGS, MECHANICAL DRAWINGS AND DRAWINGS RELATED TO OTHER TRADES. THE GENERAL CONTRACTOR IS RESPONSIBLE TO CHECK AND COORDINATE DIMENSIONS, CLEARANCES, ETC., WITH THE WORK OF THE OTHER TRADES.

23. PROVIDE ANY TEMPORARY BRACING OR GUYS TO PROVIDE LATERAL SUPPORT OF THE STRUCTURES AND INDIVIDUAL ELEMENTS UNTIL PERMANENT FRAME IS COMPLETELY INSTALLED.

24. ALL STRUCTURAL STEEL EXPOSED TO WEATHER SHALL BE GALVANIZED.

25. ALL TUBE & PIPE SECTIONS EXPOSED TO WEATHER SHALL HAVE OPEN ENDS CAPPED WITH 1/4" PLATE.

26. ALL STRUCTURAL STEEL TO RECEIVE SPRAY APPLIED FIRE PROTECTION SHALL BE LEFT UNCOATED.

27. FOR EXPOSED INTERIOR STRUCTURAL STEEL, REFER TO ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR SURFACE PREPARATION AND FINISH REQUIREMENTS.

28. STEEL FABRICATOR SHALL COORDINATE ALL HOLE LOCATIONS FOR SIMPSON TIE DOWN ANCHORS. ALL HOLES SHALL BE SHOP DRILLED THROUGH BEAM FLANGES.

CONSTRUCTION METHODS:

1. BOTTOM OF EXCAVATION FOR SPREAD FOUNDATIONS AND MATS SHALL BE INSPECTED BY A QUALIFIED GEOTECHNICAL ENGINEER. ADDITIONAL UNDERCUT DEPTHS, IF REQUIRED, SHALL THEN BE DETERMINED. LIMITS OF BACKFILL SHALL EXTEND BEYOND FOUNDATION PERIMETER 1.5 TIMES THE UNDERCUT DEPTH.

2. BACKFILL MATERIAL SHALL BE AS SPECIFIED AND PLACED IN 8" MAXIMUM LIFTS. ALL BACKFILL WILL BE COMPACTED TO THE FOLLOWING PERCENT OF THE MAXIMUM DENSITY OBTAINED ACCORDING TO ASTM DENSITY TEST D-1557C.
- 95 PERCENT OF MAXIMUM DRY DENSITY BELOW THE BASE OF FOOTINGS.
- 95 PERCENT OF MAXIMUM DRY DENSITY BELOW SLABS.

3. COORDINATE CONCRETE WORK WITH PLUMBING, PIPING, ELECTRICAL AND MECHANICAL WORK PRIOR TO PLACING CONCRETE.

4. CONSTRUCTION JOINTS SHALL BE MADE AT THE LOCATIONS AND IN ACCORDANCE WITH THE DETAILS SHOWN ON THE DRAWINGS. GRADE BEAM CONSTRUCTION JOINTS SHALL BE MADE NEAR THE MID-SPAN OF THE BEAM.

5. LOCATIONS AND DETAILS OF JOINTS FOR SLABS AT GRADE ARE SHOWN ON THE DRAWINGS. SAWED CONTROL JOINTS SHALL BE SAWED WITHIN 12 TO 24 HOURS AFTER PLACING CONCRETE.

EXCAVATION NOTES:

1. THE CONTRACTOR WILL DETERMINE THE LOCATION OF ALL EXISTING UNDERGROUND UTILITY LINES BEFORE EXCAVATION OPERATIONS. EXISTING UTILITY LINES KNOWN TO THE CONTRACTOR BEFORE EXCAVATION AND UTILITY LINES UNCOVERED DURING EXCAVATION OPERATIONS, WILL BE PROTECTED FROM DAMAGE DURING EXCAVATION AND BACK FILLING AND, IF DAMAGED, WILL BE REPAIRED BY THE CONTRACTOR TO THE SATISFACTION OF THE C/M, AT NO ADDITIONAL COST TO THE OWNER. NOTIFY THE C/M OF UNEXPECTED SUBSURFACE CONDITIONS AND STOP AFFECTED WORK IN AREA UNTIL NOTIFIED TO RESUME WORK.

2. THE CONTRACTOR IS RESPONSIBLE FOR THE DESIGN AND INSTALLATION OF TEMPORARY SHORING TO SUPPORT THE EXCAVATION AS REQUIRED. CONTRACTOR SHALL EXCAVATE WITH CARE SO NOT TO UNDERMINE EXISTING FOUNDATIONS.

SPECIAL INSPECTIONS

THE FOLLOWING CONTROLLED INSPECTIONS ARE REQUIRED TO BE PERFORMED IN ACCORDANCE WITH THE BUILDING CODE OF THE STATE OF CONNECTICUT, LATEST EDITION.

ITEM: HELICAL PILES
CONCRETE CONSTRUCTION
STEEL CONSTRUCTION

CONTRACTORS DESIGN RESPONSIBILITY

1. THE LISTED BELOW PROJECT ITEMS ASSOCIATED WITH FABRICATION, ERECTION AND CONTRACTORS MEANS AND METHODS AND REQUIRING STRUCTURAL DESIGN ARE THE RESPONSIBILITY OF THE CONTRACTOR.

2. THE CONTRACTOR SHALL RETAIN THE SERVICES OF STRUCTURAL PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF CONNECTICUT TO PERFORM THE DESIGN OF THESE ITEMS.

3. CALCULATIONS FOR ITEMS MARKED THUS (*) SHALL BE SUBMITTED FOR REVIEW AND APPROVAL TO THE ENGINEER OF RECORD, OTHERWISE THE ITEMS SHALL ONLY BE SUBMITTED FOR THE OWNERS RECORD:

A. STEEL SHOP DRAWING
B. CONCRETE MIX DESIGN
C. REINFORCING STEEL PLACEMENT PLAN
D. HELICAL PILES (APPROVAL BY THE GEOTECHNICAL ENGINEER)
E. FENCING
F. LADDER

Rev.	Date	Description
F	07/31/23	UPDATED PER FLOOD COMM. REQUESTS

STATE OF CONNECTICUT ☆ CLIFFORD A. BARONE 14849 LICENSED ☆ PROFESSIONAL ENGINEER

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UNIVERSITY OF HARTFORD
200 BLOOMFIELD AVE, WEST HARTFORD CT
FUEL CELL INSTALLATION

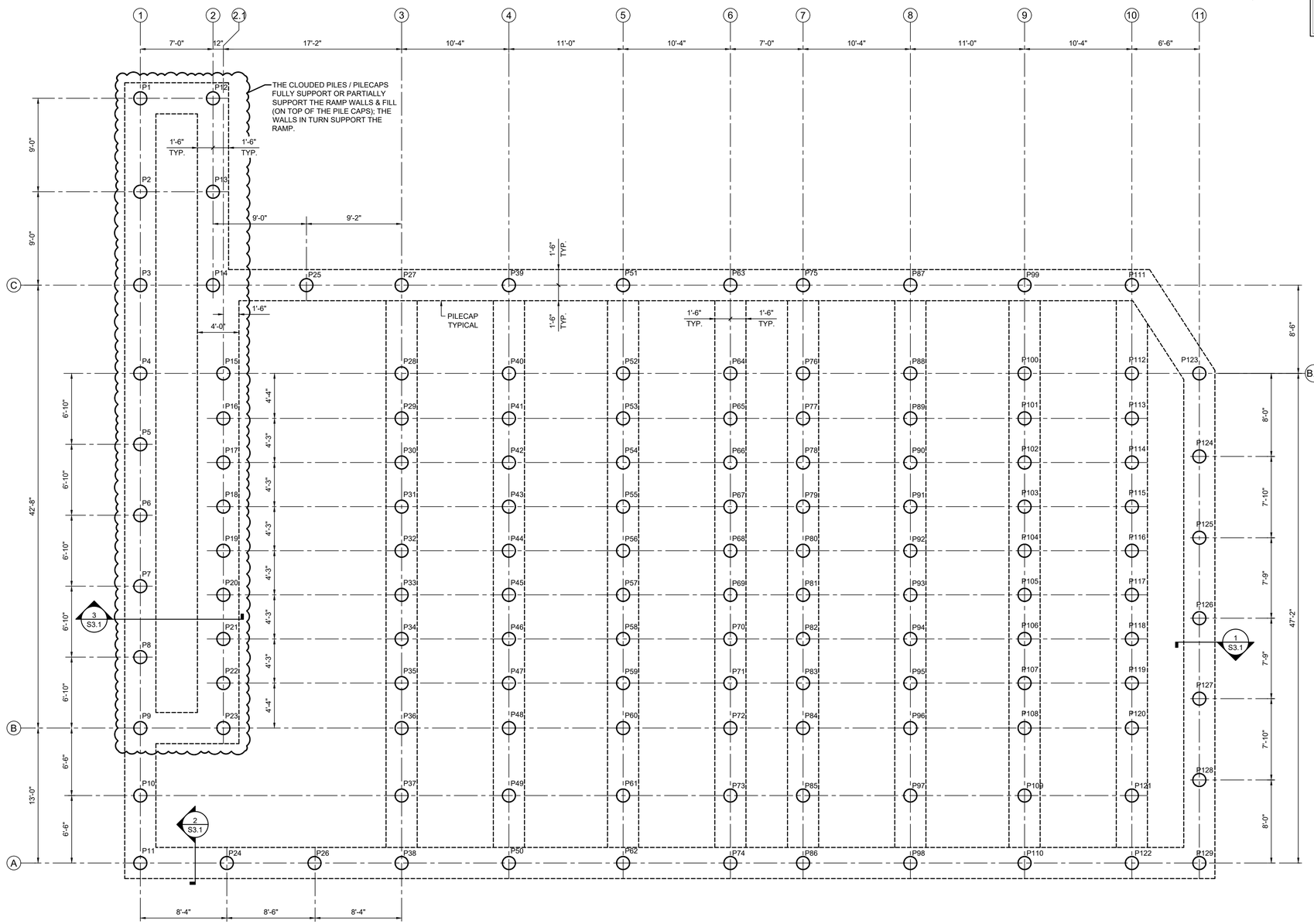
STRUCTURAL
STRUCTURAL NOTES

Project No.:	Drawn By: KFH
Date: 07/28/23	Design By: CAB
Scale: AS NOTED	Check By: DSF

Drawing No.:
S0.0

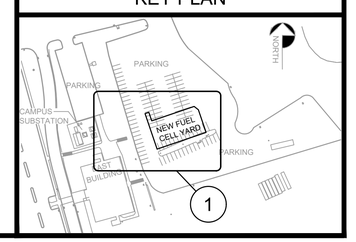
NOTES:

1. FOR ALL NOTES REFER TO DRAWING S0.0
2. REFER TO DRAWING S3.0 & S3.1 FOR SECTIONS AND DETAILS.
3. REFER TO DRAWING S1.1 FOR PILE CAPS & WALLS.
4. PILE CAPACITY TO BE 32 KIPS.
5. REFER TO GENERAL ARRANGEMENT AND ELECTRICAL DRAWINGS FOR ALL UNDERGROUND UTILITY LOCATIONS & GRADE BEAM SLEEVE PENETRATIONS.



1 PILE LOCATION PLAN
Scale: 3/16" = 1'-0"

KEY PLAN



Rev.	Date	Description
G	08/03/23	UPDATED AS NOTED
F	07/31/23	UPDATED PER FLOOD COMM. REQUESTS

STATE OF CONNECTICUT — CHRISTOPHER R. BARONE — 14040 — REGISTERED PROFESSIONAL ENGINEER

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FUEL CELL INSTALLATION

STRUCTURAL
PILE LOCATION PLAN

Project No.:	Drawn By: KFH
Date: 07/28 /23	Design By: CAB
Scale: AS NOTED	Check By: DSF

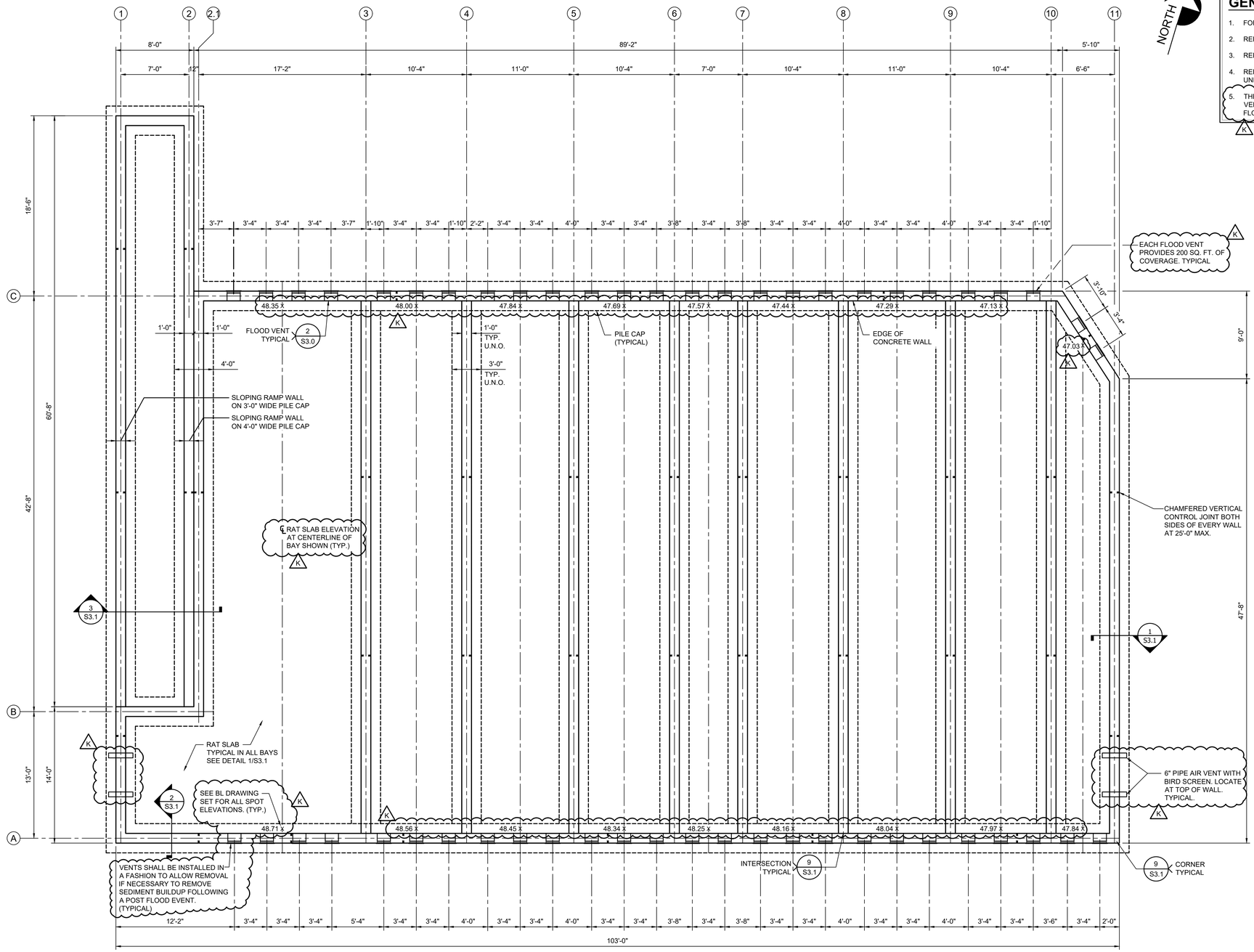
Drawing No.:

S1.0

GENERAL NOTES:

1. FOR ALL NOTES REFER TO DRAWING S0.0
2. REFER TO DRAWING S3.0 & S3.1 FOR SECTIONS AND DETAILS.
3. REFER TO DRAWING S1.2 & S2.0 FOR ELEVATED SLAB & STEEL.
4. REFER TO GENERAL ARRANGEMENT AND ELECTRICAL DRAWINGS FOR ALL UNDERGROUND UTILITY LOCATIONS & GRADE BEAM SLEEVE PENETRATIONS.
5. THE FOUNDATION AND STRUCTURE ARE DESIGNED TO WITHSTAND VELOCITIES AND / OR HYDROSTATIC PRESSURE ASSOCIATED WITH THE BASE FLOOD, INCLUDING THE EFFECT OF BUOYANCY.

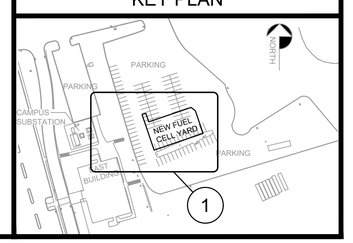
K



1 PILECAP AND CONCRETE WALL PLAN

Scale: 3/16" = 1'-0"

KEY PLAN



Rev.	Date	Description
K	11/21/23	UPDATED AS NOTED
H	08/22/23	UPDATED PER HYAXIOM COMMENTS
G	08/03/23	UPDATED AS NOTED
F	07/31/23	UPDATED PER FLOOD COMM. REQUESTS

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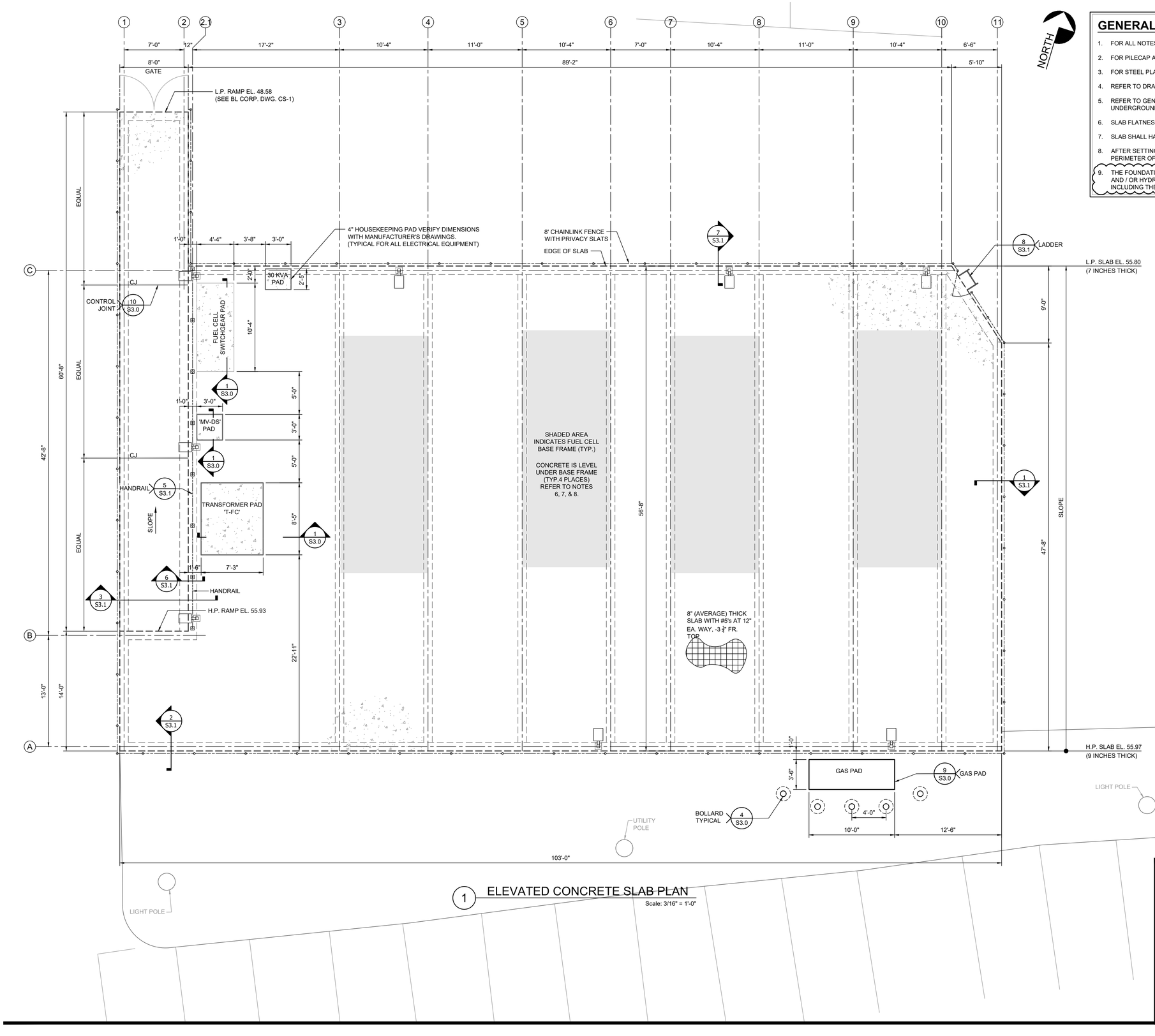
FUEL CELL INSTALLATION
STRUCTURAL
PILECAP AND CONCRETE WALL PLAN

Project No.:	Drawn By: KFH
Date: 07/28/23	Design By: CAB
Scale: AS NOTED	Check By: DSF

Drawing No.: S1.1



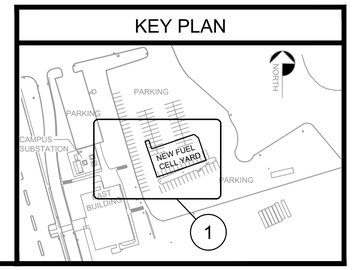
1 ELEVATED CONCRETE SLAB PLAN

Scale: 3/16" = 1'-0"

GENERAL NOTES:

1. FOR ALL NOTES REFER TO DRAWING S0.0
2. FOR PILECAP AND CONCRETE WALLS SEE DRAWING S1.1
3. FOR STEEL PLAN SEE DRAWING S2.0
4. REFER TO DRAWING S3.0 & S3.1 FOR SECTIONS AND DETAILS.
5. REFER TO GENERAL ARRANGEMENT AND ELECTRICAL DRAWINGS FOR ALL UNDERGROUND UTILITY LOCATIONS & GRADE BEAM SLEEVE PENETRATIONS.
6. SLAB FLATNESS TOLERANCE SHALL BE 1/4 INCH IN 10 FEET.
7. SLAB SHALL HAVE A MINIMUM OF 14 DAYS CURE BEFORE ANY LOADS ARE APPLIED.
8. AFTER SETTING DOWN THE POWER MODULE APPLY RTV CAULKING TO THE PERIMETER OF THE BASE FRAME, SEALING THE BASE FRAME TO THE PAD. K
9. THE FOUNDATION AND STRUCTURE ARE DESIGNED TO WITHSTAND VELOCITIES AND / OR HYDROSTATIC PRESSURE ASSOCIATED WITH THE BASE FLOOD; INCLUDING THE EFFECT OF BUOYANCY.

KEY PLAN



Rev.	Date	Description
K	11/21/23	UPDATED AS NOTED
J	11/06/23	REVISED TRANSFORMER
H	08/22/23	UPDATED PER HYAXIOM COMMENTS
F	07/31/23	UPDATED PER FLOOD COMM. REQUESTS

STATE OF CONNECTICUT ☆ CHRISTOPHER A. BRONE ☆ 14040 ☆ REGISTERED PROFESSIONAL ENGINEER

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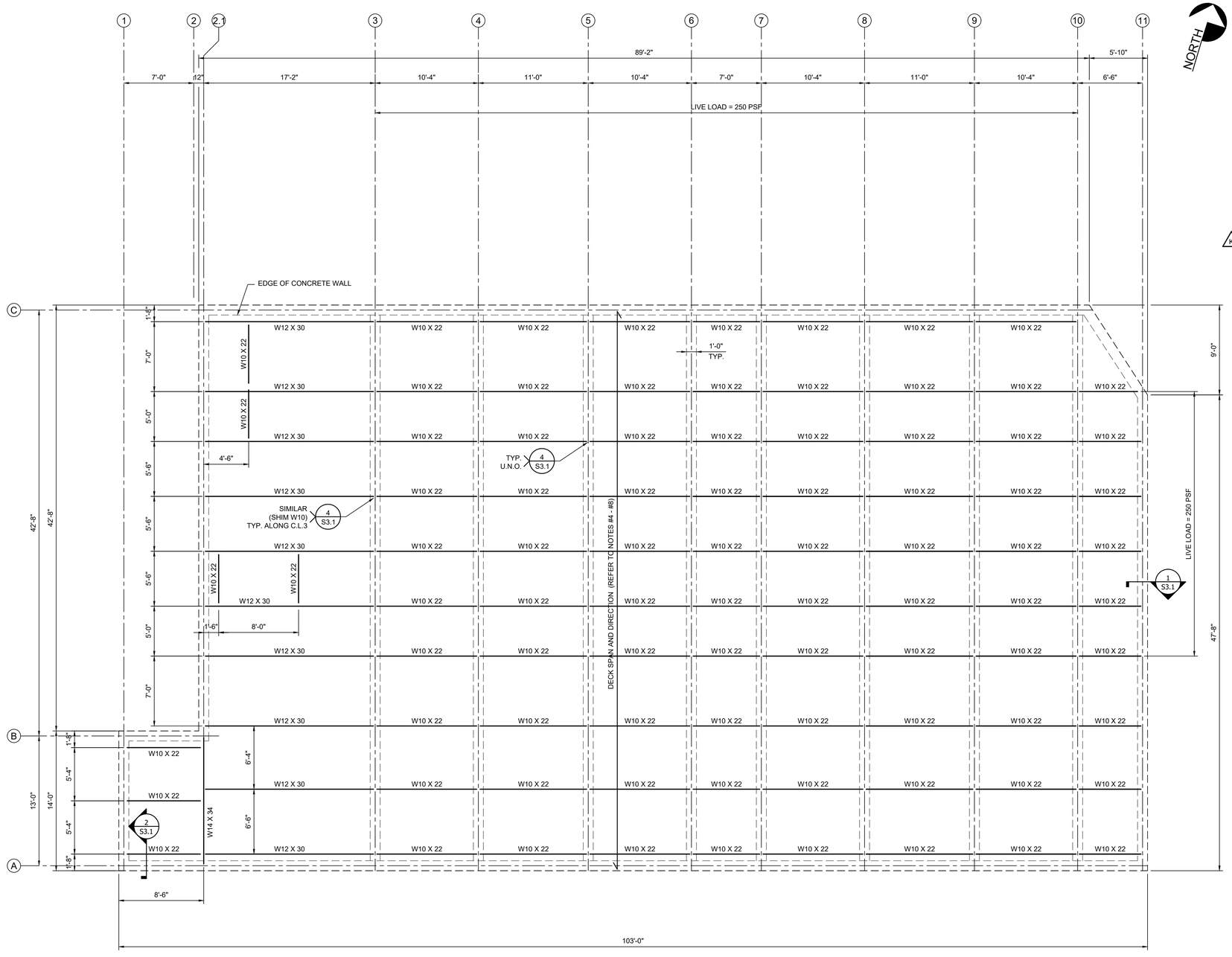
FUEL CELL INSTALLATION
STRUCTURAL
ELEVATED CONCRETE SLAB PLAN

Project No.:	Drawn By: KFH
Date: 07/28/23	Design By: CAB
Scale: AS NOTED	Check By: DSF

Drawing No.:

S1.2



1 STEEL FRAMING PLAN (T.O.S. -9" FR. H.P. T/CONC.)

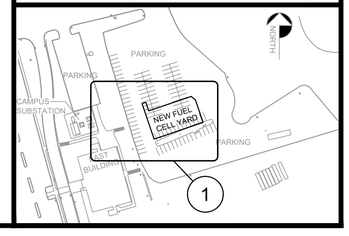
DEAD LOAD = 130 PSF
LIVE LOAD = 150 PSF (U.N.O.)

Scale: 3/16" = 1'-0"

GENERAL NOTES:

1. FOR GENERAL CONCRETE NOTES REFER TO DRAWING S0.0
2. REFER TO DRAWING S3.0 & S3.1 FOR SECTIONS AND DETAILS.
3. REFER TO GENERAL ARRANGEMENT AND ELECTRICAL DRAWINGS FOR ALL UNDERGROUND UTILITY LOCATIONS & GRADE BEAM SLEEVE PENETRATIONS.
4. METAL FLOOR DECK SHALL BE, 1½" DEEP X 18 GAGE (GALVANIZED), 1.5VLR18 AS MANUFACTURED BY VULCRAFT.
5. DECK SHALL BE WELDED AS PER SDI REQUIREMENTS.
6. ATTACHMENT OF DECK TO SUPPORTING STRUCTURAL MEMBERS SHALL BE AS FOLLOWS:
   - 5/8" DIAMETER PUDDLE WELDS AT 12" AT ALL CROSS MEMBERS (MINIMUM 4 PER SHEET, USE WELD PATTERN 36/4).
   - #12 SELF-DRILLING SCREWS AT MID-SPAN OF SIDE JOINTS (3'-0" O/C MAX.). 5/8" DIAMETER PUDDLE WELDS AT 2'-0" AT PERIMETERS. SPLIT OF PARTIAL PANELS SHALL BE ATTACHED TO SUPPORTING MEMBERS AT EACH VALLEY.
7. WELD WASHERS SHALL NOT BE USED FOR DECK WITH THICKNESS GREATER THAN 22 GAGE.
8. DESIGN OF DECK IS BASED ON UNSHORED CONDITIONS.
9. STEEL SHALL BE GALVANIZED. STEEL TO BE PAINTED WHERE FIELD WELDED.
10. K THE FOUNDATION AND STRUCTURE ARE DESIGNED TO WITHSTAND VELOCITIES AND / OR HYDROSTATIC PRESSURE ASSOCIATED WITH THE BASE FLOOD; INCLUDING THE EFFECT OF BUOYANCY.

KEY PLAN



Rev.	Date	Description
K	11/21/23	UPDATED AS NOTED
I	09/15/23	REVISED AS NOTED
H	08/22/23	UPDATED PER HYAXIOM COMMENTS
F	07/31/23	UPDATED PER FLOOD COMM. REQUESTS

STATE OF CONNECTICUT ☆ REGISTERED ☆ CHRISTOPHER A. SWEENEY 14040 ENGINEER ☆ PROFESSIONAL

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UNIVERSITY OF HARTFORD
200 BLOOMFIELD AVE, WEST HARTFORD CT
FUEL CELL INSTALLATION
STRUCTURAL
STEEL FRAMING PLAN

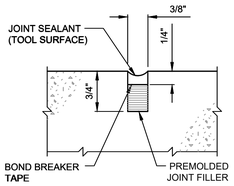
Project No.:	Drawn By: KFH
Date: 07/28/23	Design By: CAB
Scale: AS NOTED	Check By: DSF

Drawing No.:

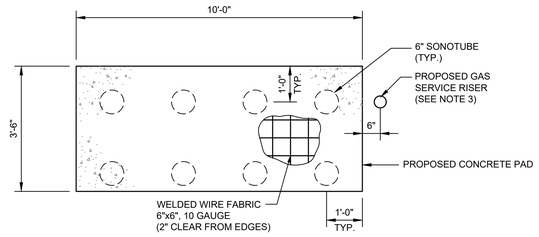
S2.0

NOTES:

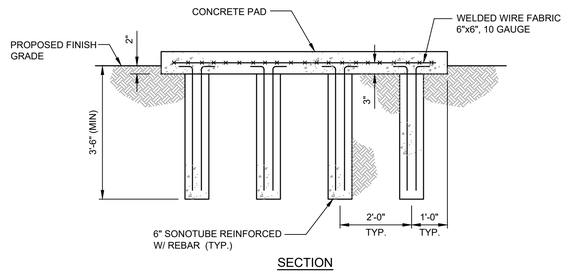
1. FOR GENERAL NOTES, CONCRETE NOTES, AND SOIL/SUBGRADE NOTES SEE DRAWING S0.0.



10 CONTROL JOINT DETAIL
SCALE: N.T.S.



PLAN

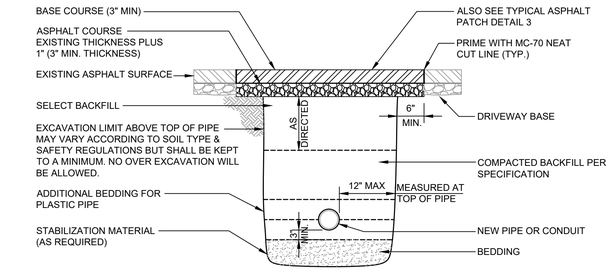


SECTION

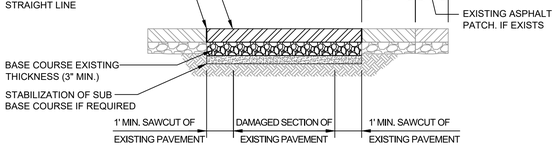
9 GAS METER PAD SECTION
SCALE: N.T.S.

NOTES:

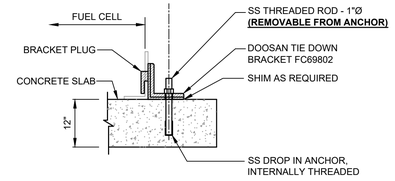
1. CONCRETE TO BE MINIMUM OF 2500 PSI STRENGTH
2. INSTALL CONTROL JOINTS EVERY 4'-0" WITH DEPTH OF 3/16".
3. VERIFY LOCATION OF CONCRETE PAD WITH CUSTOMER PRIOR TO INSTALLATION.
4. COORDINATE GAS METER PAD DETAIL WITH GAS UTILITY PRIOR TO INSTALLATION.



8 PIPING / CONDUIT INSTALLATION AND DRIVEWAY REPAIR
SCALE: N.T.S.

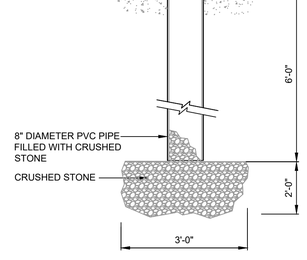


7 TYPICAL ASPHALT PATCH DETAIL
SCALE: N.T.S.

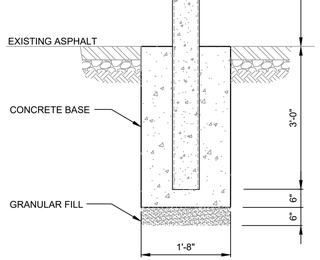


PLAN VIEW
(PLAN VIEW)

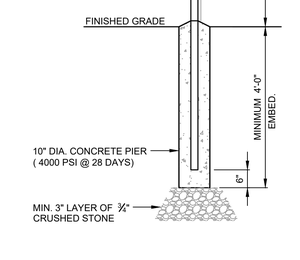
6 TYPICAL SEISMIC TIE DOWN DETAIL



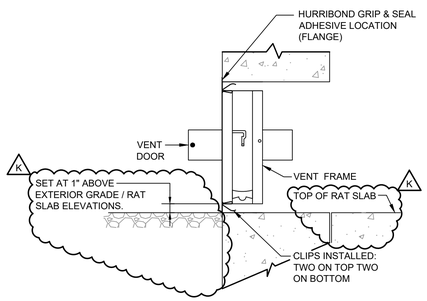
5 CONDENSATE RECEIVER DETAIL
SCALE: N.T.S.



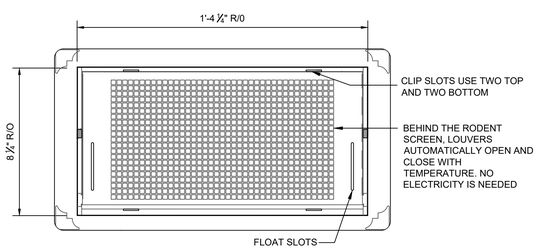
4 BOLLARD DETAIL
SCALE: N.T.S.



3 FENCE POST DETAIL
SCALE: N.T.S.



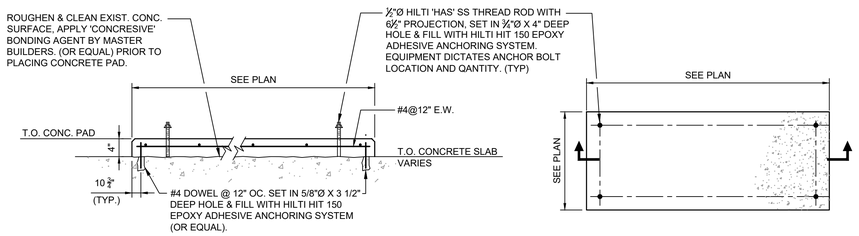
SIDE VIEW



FRONT VIEW

2 FLOOD VENT DETAIL
SCALE: N.T.S.

SMART VENT - DUAL FUNCTION FLOOD AND VENTILATION VENT MODEL 1540-510 OR APPROVED EQUAL. INSTALL PER MANUFACTURER'S INSTRUCTIONS



SECTION

PLAN VIEW

1 TYPICAL EQUIPMENT PAD SECTION
SCALE: 3/4" = 1'-0"

Rev.	Date	Description
K	11/21/23	UPDATED AS NOTED
H	08/22/23	UPDATED PER HYAXIOM COMMENTS
F	07/31/23	UPDATED PER FLOOD COMM. REQUESTS
D	01/02/23	UPDATED EVERSOURCE CKT. NAMES
C	10/06/22	REISSUED FOR CONSTRUCTION
B	09/26/22	ISSUED FOR CONSTRUCTION
A	07/07/22	PRELIMINARY ISSUE

STATE OF CONNECTICUT · CHRISTOPHER A. BROWNE · 14040 · REGISTERED · PROFESSIONAL ENGINEER

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UNIVERSITY OF HARTFORD
200 BLOOMFIELD AVE, WEST HARTFORD CT
FUEL CELL INSTALLATION

STRUCTURAL DETAILS

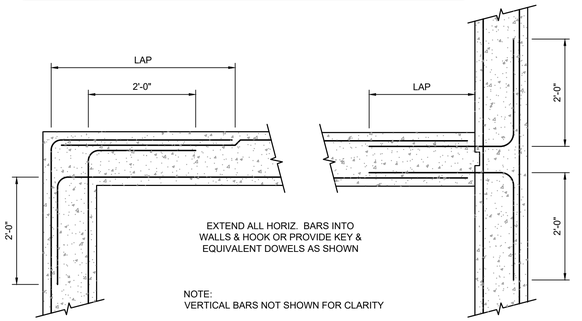
Project No.:	Drawn By: KFH
Date: 07/28/23	Design By: CAB
Scale: AS NOTED	Check By: DSF

Drawing No.:
S3.0

CONCRETE LAP SPLICE SCHEDULE

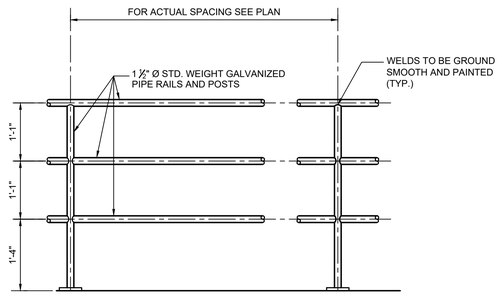
BAR SIZE	MINIMUM LAP SPLICE LENGTH [in]	
	TOP BARS	OTHER BARS
#4	25	19
#5	31	24
#6	37	29
#7	54	42
#8	62	48
#9	70	54

1. LAP SPLICE LENGTHS IS BASED ON UNCOATED OR ZINC-COATED REINFORCEMENT.
2. LAP SPLICE LENGTHS IS BASED ON NORMAL WEIGHT CONCRETE.
3. LAP SPLICE LENGTHS IS BASED ON 4000PSI CONCRETE AND GRADE 60 REINFORCING STEEL.
4. ALL REINFORCING SHALL HAS MINIMUM COVER EQUIVALENT TO ONE BAR DIAMETER AND MINIMUM CENTER ON CENTER SPACING OF THREE BAR DIAMETER, UON.
5. REINFORCING STEEL SHALL BE SPLICED AT LOCATIONS WITH LESS THAN 50% TENSILE STRESS.
6. TOP BARS ARE HORIZONTAL BARS WITH MORE THAN 12 INCHES OF CONCRETE CAST BELOW THE BARS.
7. FOR EPOXY COATED REINFORCING, INCREASE THE LAP SPLICE LENGTH BY 50%.

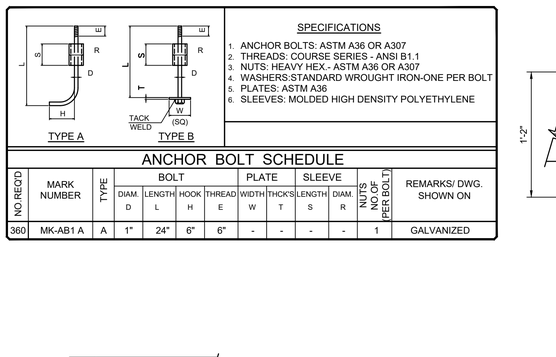


PLAN AT CORNERS — PLAN AT INTERSECTION

9 TYPICAL FOUNDATION WALL DETAILS
SCALE: 3/4" = 1'-0"



5 HAND RAIL ELEVATION
SCALE: ¾" = 1'-0"

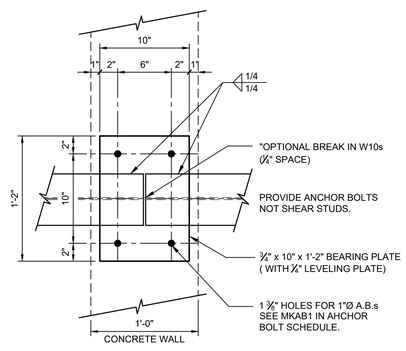


SPECIFICATIONS

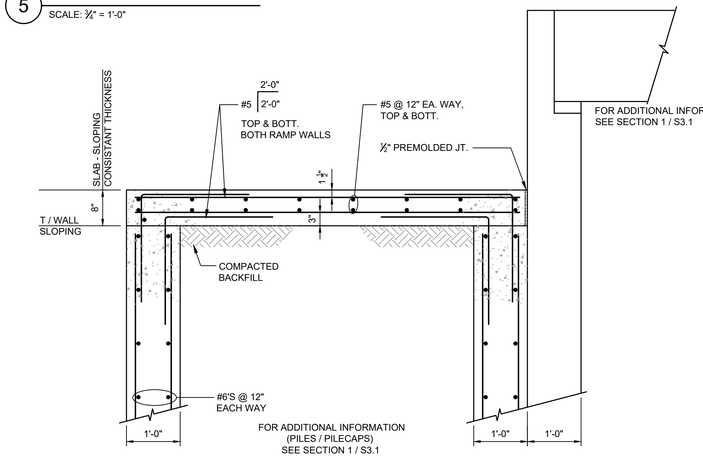
1. ANCHOR BOLTS: ASTM A36 OR A307
2. THREADS: COURSE SERIES - ANSI B1.1
3. NUTS: HEAVY HEX.- ASTM A36 OR A307
4. WASHERS:STANDARD WROUGHT IRON-ONE PER BOLT
5. PLATES: ASTM A36
6. SLEEVES: MOLDED HIGH DENSITY POLYETHYLENE

ANCHOR BOLT SCHEDULE

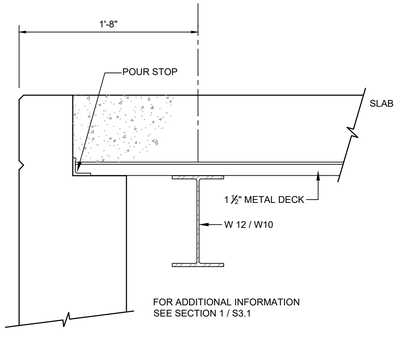
NO REQ'D	MARK NUMBER	TYPE	BOLT DIAM. D	BOLT LENGTH L	BOLT HOOK H	BOLT THREAD E	PLATE WIDTH W	PLATE THCK'S T	SLEEVE LENGTH S	SLEEVE DIAM. R	NUTS NO.OF PER BOLT	REMARKS/ DWG. SHOWN ON
360	MK-AB1 A	A	1"	24"	6"	6"	-	-	-	-	1	GALVANIZED



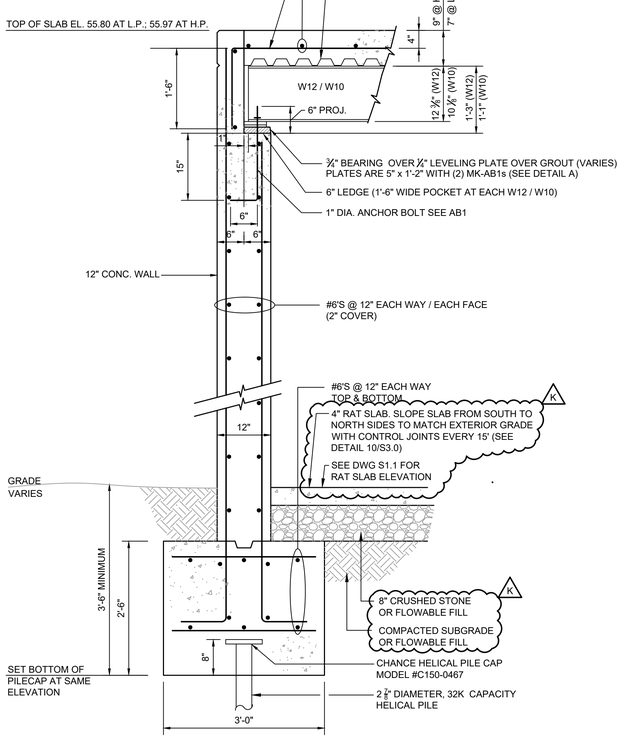
4 DETAIL
SCALE: 1 ½" = 1'-0"



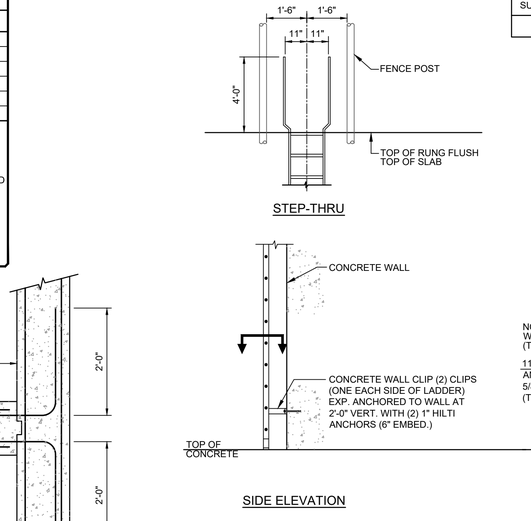
3 RAMP WALL SECTION
SCALE: 3/4" = 1'-0"



2 WALL SECTION
SCALE: 1 ½" = 1'-0"



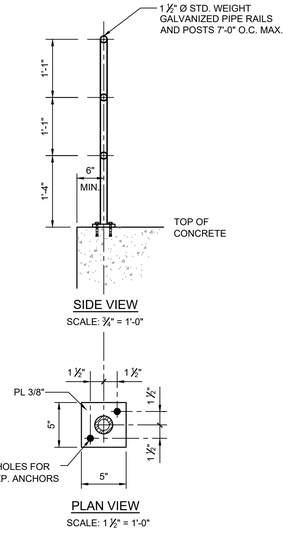
1 FOUNDATION WALL SECTION
SCALE: 3/4" = 1'-0"



7 SECTION AT FENCE POST
SCALE: 3/4" = 1'-0"

LADDER SIDE RAIL SCHEDULE	
SUPPORT SPACING	SIZE
12'-0 & LESS	L 3 x 3 x 3/8"

8 LADDER DETAILS
SCALE: N.T.S.



6 SECTION AT HAND RAIL POST
SCALE: AS NOTED

Rev.	Date	Description
K	11/21/23	UPDATED AS NOTED
H	08/22/23	UPDATED PER HYAXIOM COMMENTS
G	08/03/23	UPDATED AS NOTED
F	07/31/23	UPDATED PER FLOOD COMM. REQUESTS

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UNIVERSITY OF HARTFORD
200 BLOOMFIELD AVE, WEST HARTFORD CT
FUEL CELL INSTALLATION

STRUCTURAL DETAILS

Project No.:	Drawn By: KFH
Date: 07/28/23	Design By: CAB
Scale: AS NOTED	Check By: CAB

Drawing No.: S3.1

SCOPE OF WORK

1. FURNISH AND INSTALL ALL EQUIPMENT, PIPING, INSTRUMENTATION AND CONTROLS AS SHOWN ON THE M-SERIES DRAWINGS UNLESS OTHERWISE NOTED. FUEL CELLS SHALL BE PROVIDED BY HYAXIOM.
2. ANCHOR COOLING MODULE LEGS TO CONCRETE PAD.
3. INSTALL ALL HOODS AND DRIP EDGES, WITH HYAXIOM FURNISHED FASTENERS.
4. INSULATE PIPING FOR HEAT CONSERVATION AND COVER FOR WEATHER PROTECTION AS PER DRAWINGS. (NOT APPLICABLE)
5. INSULATE ABOVE GROUND COOLING MODULE PIPING FOR PERSONNEL PROTECTION AND COVER FOR WEATHER PROTECTION.
6. HYAXIOM SHALL FURNISH DOW FROST GLYCOL FOR COOLING MODULE AND FILL PIPING.
7. FURNISH AND INSTALL GAS PIPING FROM NEW UTILITY SERVICE TO FUEL CELL.
8. VENT REGULATOR BLEED LINE TO 15FT AWAY FROM ANY AIR INTAKES.
9. INSTALL (1) NITROGEN GAS BOTTLE RACK / SPARE BOTTLE RACK AND MANIFOLD SYSTEM AND ALL HARDWARE TO SECURE 10 BOTTLES EACH. TYPICAL FOR EACH FUEL CELL.
10. FURNISH AND INSTALL NITROGEN PIPING FROM MANIFOLD TO FUEL CELL PER DRAWINGS.
11. PROVIDE AND INSTALL CITY WATER MAKEUP COPPER PIPING TO FUEL CELL FROM EXISTING CUSTOMER SUPPLY.
12. HEAT TRACE AND INSULATE ABOVE GROUND WATER PIPING. REFER TO DRAWING E3.0 DETAIL 2 FOR SPECIFIC APPLICATIONS.
13. WATER DISCHARGE SYSTEM. PIPE TO CONDENSATE RECEIVER IN FUEL CELL YARD.
14. BREAK ALL PIPE LINES AT FUEL CELL EQUIPMENT AND FLUSH CLEAN IN ACCORDANCE WITH FUEL CELL INSTALLATION MANUAL.
15. BREAK ALL PIPE LINES AT EQUIPMENT AND BLANK. PRESSURE TEST WITH AIR OR N2 AND HOLD FOR 24HRS AND PROVIDE A REPORT. COORDINATE WITH LOCAL BUILDING INSPECTOR TO WITNESS TESTS AS NECESSARY.
16. LABEL ALL PIPELINES PER CUSTOMER STANDARDS. IF CUSTOMER STANDARDS ARE NOT AVAILABLE THEN LABEL IN ACCORDANCE WITH ANSI/ASME A13.1.
17. PAINT PIPELINES AND/OR INSULATION IN ACCORDANCE WITH CUSTOMER STANDARDS IF CUSTOMER STANDARDS ARE NOT AVAILABLE THEN PAINT THEM AS PER ANSIASME 13.1 SEE GENERAL NOTE 15.
18. BALANCE ALL WATER FLOWS PER SPECIFICATIONS AND PROVIDE HYAXIOM WITH A FINAL REPORT.
19. FABRICATE ALUMINUM DIAMOND PLATE BOX TO COVER CM AND WATER MAKE UP PIPING TO PROTECT PIPING AND INSULATION. BOX SHALL BE REMOVABLE TO ALLOW ACCESS TO VALVES BELOW AND MUST NOT OBSTRUCT FUEL CELL DOOR SWING CLEARANCE. PROVIDE DETAILED SHOP DRAWING OF DIAMOND PLATE BOX.

GENERAL INSTALLATION NOTES

1. THE INSTALLATION MUST BE IN STRICT ACCORDANCE WITH NFPA 853 STANDARD FOR THE INSTALLATION OF STATIONARY FUEL CELL POWER SYSTEMS.
2. THE FUEL CELL ENCLOSURE MUST BE PROTECTED AGAINST WELD, SOLDER, OR BRAZING SPLATTER DURING CONSTRUCTION.
3. REFER TO HYAXIOM POWER MODULE AND COOLING MODULE SUBMITTALS FOR ADDITIONAL INFORMATION.

DESIGN INTENT NOTES

1. THE FUEL CELL WASTE HEAT MAY BE UTILIZED IN THE FUTURE; HOWEVER, NO HEAT RECOVERY INFRASTRUCTURE IS INCLUDED IN THIS PROJECT.

4" - LGS - CU

- "APPLIES TO" MEDIA FLOW DIRECTION
- SIZE
- DESIGNATOR
- FLOW LABEL (S = SUPPLY, R = RETURN)
- MATERIAL
- "APPLIES TO" MATERIAL DIRECTION

P&ID PIPING SCHEDULE

SERVICE	DESIGNATOR	MATERIAL	CONNECTIONS	FLUID	INSULATION	JACKET	NOTES
POTABLE WATER	MU	ASTM B88 TYPE K COPPER	BRAZED	POTABLE WATER	2" FIBERGLASS	ABOVE GRADE PIPING SHALL HAVE ALUMINUM OUTSIDE, ALL SERVICE JACKET INSIDE. BELOW GRADE SHALL BE PITTWRAP CW PLUS JACKETING OR EQUAL	SEE ALTERNATE, SECTION 6.3
WASTE WATER	WW-CU	ASTM B88 TYPE K COPPER	BRAZED	WASTE WATER	1" FIBERGLASS	ALUMINUM OUTSIDE, PVC ALL SERVICE JACKET INSIDE.	
NATURAL GAS	NG-CS	A53 GR B ERW STEEL	WELDED	NATURAL GAS	N/A	BELOW GRADE PIPING SHALL HAVE AN EPOXY ADHESIVE & POLYETHYLENE COATING	SEE ALTERNATE, SECTION 5.5, WELD ALTERNATE - MEGAPRESS LISTED FOR GAS
NITROGEN GAS	N2-CU	ASTM B88 TYPE K COPPER	BRAZED	COMPRESSED NITROGEN	N/A	BELOW GRADE PIPING SHALL HAVE AN EPOXY ADHESIVE & POLYETHYLENE COATING	
COOLING MODULE	CM-CU	ASTM B88 TYPE K COPPER OR A53 GR B ERW SCHED. 40 STEEL	BRAZED / WELDED	40% GLYCOL - 60% DI WATER	2" FIBERGLASS	ABOVE GRADE PIPING SHALL HAVE ALUMINUM OUTSIDE, ALL SERVICE JACKET INSIDE. BELOW GRADE SHALL BE PITTWRAP CW PLUS JACKETING OR EQUAL	

PIPING SPECIFICATIONS

1. REFER TO P&ID PIPING SCHEDULE FOR APPLICABILITY OF PIPING MATERIALS.
2. QUALITY ASSURANCE:
   - 2.1. ASME COMPLIANCE: COMPLY WITH ASME B31.9, "BUILDING SERVICES PIPING," FOR MATERIALS, PRODUCTS, AND INSTALLATION. SAFETY VALVES AND PRESSURE VESSELS SHALL BEAR THE APPROPRIATE ASME LABEL. ALL PRESSURE VESSELS TO COMPLY WITH THE ASME BOILER AND PRESSURE VESSEL CODE, SECTION VIII, DIVISION 1.
   - 2.2. ALL EQUIPMENT INSTALLATION SHALL COMPLY WITH AND FOLLOW ALL MANUFACTURERS INSTALLATION REQUIREMENTS INCLUDING, BUT NOT LIMITED TO, TRAINING QUALIFICATIONS, INSTALLATION MANUALS, REQUIRED CLEARANCES, AND REQUIRED CERTIFICATIONS
3. COPPER PIPING SPECIFICATION:
   - 3.1. REFER TO THE APPLICABLE DETAIL DRAWING FOR PIPING CONNECTIONS, INSTRUMENTATION AND VALVE REQUIREMENTS.
   - 3.2. CONFIRM FLOW DIRECTIONS FOR SUPPLY AND RETURN LINES PRIOR TO INSTALLATION OF ANY WORK.
   - 3.3. ALL PIPING SHALL BE TYPE K COPPER, ASTM B-88, WITH CAST COPPER SOLDER JOINT FITTINGS. JOINTS SHALL BE SOLDERED USING ASTM B32, LEAD-FREE ALLOYS OR BRAZED USING AWS A5.8, BAg1, SILVER SOLDER.
   - 3.4. INSULATE PIPING AS PER THE P&ID SCHEDULE
   - 3.5. FOR EXTERIOR APPLICATION PROVIDE WITH EMBOSSED ALUMINUM (20 MIL) JACKETS AND WEATHER PROOF SEAL.
   - 3.6. PROVIDE DIELECTRIC CONNECTIONS AT ALL CONNECTIONS TO DISSIMILAR MATERIALS (I.E., COPPER AND STEEL).
   - 3.7. ROUTE PIPING SUCH THAT IT DOES NOT IMPEDE ACCESS TO ANY EQUIPMENT.
   - 3.8. SUPPORT PIPING AS SHOWN ON THE APPLICABLE DETAIL DRAWING
   - 3.9. SUPPORT NON ROOFTOP PIPING WITH LIGHT-DUTY CLEVIS HANGERS SUSPENDED FROM THE CEILING USING THREADED ROD ATTACHED TO A STRUCTURAL BEAM FLANGE OR SIDE BEAM BRACKET. PROVIDE VIBRATION ISOLATORS AS NECESSARY TO PREVENT STRUCTURE-BORNE NOISE. WHERE HANGING FROM THE CEILING IS NOT PRACTICAL, SUPPORT PIPE FROM THE FLOOR USING A THREADED ROD AND A PIPE CLAMP ANCHORED TO THE CONCRETE VIA A CEILING FLANGE. INSTALL CLAMP OR CLEVIS OVER INSULATION WITH PIPE PROTECTION SADDLES.
   - 3.10. PITCH ALL PIPING TOWARDS ITS EQUIPMENT SOURCE TO PROVIDE SELF-DRAINING TO THE MAXIMUM EXTENT POSSIBLE. PROVIDE 3/4" DRAIN BALL VALVES WITH CAPPED HOSE END CONNECTIONS AT ALL SYSTEM HIGH AND LOW-POINTS AND AS SHOWN ON THE DRAWINGS.
4. STEEL PIPING SPECIFICATION:
   - 4.1. REFER TO THE APPLICABLE DETAIL DRAWING FOR PIPING CONNECTIONS, INSTRUMENTATION AND VALVE REQUIREMENTS.
   - 4.2. CONFIRM FLOW DIRECTIONS FOR SUPPLY AND RETURN LINES PRIOR TO INSTALLATION OF ANY WORK.
   - 4.3. ALL NEW PIPING SHALL BE SCHEDULE 40, CUT GROOVED STEEL, ASTM A-53 Tp. S, DUCTILE IRON GROOVED-END FITTINGS AND COUPLINGS, VICTAULIC OR APPROVED EQUAL. GASKETS SHALL BE SUITABLE FOR HVAC SERVICE EXCEPT FOR HEAT MEDIUM PIPING WHICH SHALL REQUIRE EHP GASKETS. FOR ANY PIPE AND FITTINGS LESS THAN 3", TYPE L COPPER, ASTM B-88, WITH CAST COPPER SOLDER JOINT FITTINGS MAY BE SUBSTITUTED. JOINTS SHALL BE BRAZED USING APPROPRIATE SILVER SOLDER.
   - 4.4. INSULATE PIPING AS PER THE P&ID SCHEDULE
   - 4.5. FOR EXTERIOR APPLICATION PROVIDE WITH EMBOSSED ALUMINUM (20 MIL) JACKETS AND WEATHER PROOF SEAL.
   - 4.6. PROVIDE DIELECTRIC CONNECTIONS AT ALL CONNECTIONS TO DISSIMILAR MATERIALS (I.E., COPPER AND STEEL).
   - 4.7. SUPPORT PIPING AS SHOWN ON THE APPLICABLE DETAIL DRAWING
   - 4.8. SUPPORT NON ROOFTOP PIPING WITH LIGHT-DUTY CLEVIS HANGERS SUSPENDED FROM THE CEILING USING THREADED ROD ATTACHED TO A STRUCTURAL BEAM FLANGE OR SIDE BEAM BRACKET. PROVIDE VIBRATION ISOLATORS AS NECESSARY TO PREVENT STRUCTURE-BORNE NOISE. WHERE HANGING FROM THE CEILING IS NOT PRACTICAL, SUPPORT PIPE FROM THE FLOOR USING A THREADED ROD AND A PIPE CLAMP ANCHORED TO THE CONCRETE VIA A CEILING FLANGE. INSTALL CLAMP OR CLEVIS OVER INSULATION WITH PIPE PROTECTION SADDLES.
   - 4.9. ALL UNDERGROUND PIPING SHALL BE INSULATED AND WATER-PROOFED IN ACCORDANCE WITH THE DETAILS ON DRAWING M3.1 OR APPROVED EQUAL.
   - 4.10. PITCH ALL PIPING TOWARDS ITS EQUIPMENT SOURCE TO PROVIDE SELF-DRAINING TO THE MAXIMUM EXTENT POSSIBLE. PROVIDE 3/4" DRAIN VALVES WITH CAPPED HOSE END CONNECTIONS AT ALL SYSTEM HIGH AND LOW-POINTS AND AS SHOWN ON THE DRAWINGS.
5. NATURAL GAS PIPING SPECIFICATION:
   - 5.1. NATURAL GAS INSTALLATION SHALL COMPLY WITH NATIONAL FUEL GAS CODE (NFPA 54). INSTALL MANUAL GAS SHUTOFF VALVE WITH A 1/2" NPT PRESSURE TAP FOR TEST GAGE CONNECTION AT EACH FUEL CELL.
   - 5.2. NATURAL GAS PIPING SHALL BE STEEL PIPE ASTM A 53/A 53M, TYPE E OR S, GRADE B; SCHEDULE 40, BLACK. JOIN PIPING USING TAPES, GASKETS, AND BOLTS AND NUTS: SUITABLE FOR NATURAL GAS AND AS RECOMMENDED BY PIPING MANUFACTURER AND THE NATIONAL FUEL GAS CODE, ANSI Z223.1.
   - 5.3. VERIFY GAS PRESSURE AT EACH FUEL CELL IS AT LEAST 10" W.G. TO SUPPORT THE MINIMUM PRESSURE REQUIRED WHILE GAS IS FLOWING.
   - 5.4. MAXIMUM ALLOWABLE PRESSURE IS 14" W.G. PROVIDE LOCK-OUT PRESSURE REGULATOR AS SHOWN ON THE MECH DWGS.
   - 5.5. ALTERNATE UNDERGROUND GAS PIPING: POLYETHYLENE ASTM D2513; YELLOW MDPE 2406/2708 GAS DISTRIBUTION AND GAS SERVICE PIPING. PIPING MUST TRANSITION TO STEEL PIPE INSTALLED IN A PVC SLEEVE PRIOR TO EXITING THE GROUND. INSTALLATION OF MDPE GAS PIPING SHALL BE IN ACCORDANCE TO MANUFACTURER'S WRITTEN INSTRUCTIONS AND NFPA 54.
6. UNDERGROUND PIPING
   - 6.1 ALL UNDERGROUND PIPING SHALL BE ALL-WELDED (STEEL) OR ALL-BRAZED (COPPER) CONSTRUCTION.
   - 6.2 ALL UNDERGROUND PIPING SHALL BE INSULATED AND WATER-PROOFED IN ACCORDANCE WITH THE DETAILS ON DRAWING M3.1 OR APPROVED EQUAL.
   - 6.3 UNDERGROUND MAKE UP WATER: ROVANCO SOLDERED COPPER SYSTEM WITH FACTORY APPLIED HEAT TRACE TUBE WITH PULL ROPE, TYPE K ASTM B-88 CARRIER PIPE WITH ALUMINIZED TAPE WITH SS BANDING. BASIS OF DESIGN: ROVANCO SOLDERED COPPER SYSTEM OR EQUAL PRE-INSULATED PIPE SYSTEM TO ALLOW REPLACEMENT OF HEAT TRACE CABLES WHEN THEY FAIL.

COMMISSIONING REQUIREMENTS

1. THE CONTRACTOR SHALL INCLUDE AS PART OF THE BID (OR AS A SUBCONTRACT) COMMISSIONING SERVICES FOR PROPER OPERATION OF THE FUEL CELL. COMMISSIONING OF THE FUEL CELLS AND THE SUPPORTING SYSTEMS (COOLING MODULES, NITROGEN PURGE SYSTEM, AND HEAT RECOVERY MONITORING SYSTEM) SHALL BE BY OTHERS. THE PURPOSE OF THE COMMISSIONING SERVICES IS TO:
   - 1.1. VERIFY THAT APPLICABLE EQUIPMENT AND SYSTEMS ARE INSTALLED ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS AND TO INDUSTRY ACCEPTED MINIMUM STANDARDS AND THAT THEY RECEIVE ADEQUATE OPERATIONAL CHECKOUT BY INSTALLING CONTRACTORS.
   - 1.2. VERIFY AND DOCUMENT PROPER PERFORMANCE OF EQUIPMENT AND SYSTEMS.
   - 1.3. VERIFY THAT O&M DOCUMENTATION LEFT ON SITE IS COMPLETE.
   - 1.4. VERIFY THAT THE OWNER'S OPERATING PERSONNEL AND HYAXIOM ARE ADEQUATELY TRAINED.
2. SCOPE OF WORK
   - 2.1.1. INSPECT ALL INSTALLED WORK AND VERIFY THAT IT IS READY FOR START-UP / OPERATION
   - 2.1.1. PROVIDE DOCUMENTATION TO SUPPORT THIS BY PROVIDING REVIEW AND APPROVAL OF
   - 2.1.1.1. TEST REPORTS
   - 2.1.1.2. MFR PRE-START-UP CHECKLISTS
   - 2.1.1.3. CUSTOM GENERATED PRE-FUNCTIONAL CHECKLISTS (THIS IS REQUIRED IF EQUIPMENT DOES NOT HAVE MFR PROVIDED CHECKLISTS)
   - 2.2. REVIEW AND APPROVAL OF ALL START-UP REPORTS
   - 2.3. REVIEW AND APPROVAL OF TEST AND BALANCE REPORT
   - 2.4. REVIEW AND APPROVAL OF OPERATIONS AND MAINTENANCE MANUAL

GENERAL NOTES

1. THE MECHANICAL CONTRACTOR SHALL BE FAMILIAR WITH ALL CONTRACT DOCUMENTS FOR ALL TRADES AND SHALL COORDINATE WITH OTHER CONTRACTORS.
2. DRAWINGS ARE DIAGRAMMATIC ONLY, FINAL ROUTING OF PIPING AND EQUIPMENT LOCATIONS SHALL BE DETERMINED IN THE FIELD. ADDITIONAL OFFSETS, ELBOWS, ETC., SHALL BE PROVIDED AND INSTALLED WITHOUT ADDITIONAL COST TO THE OWNER.
3. THE MECHANICAL CONTRACTOR SHALL FURNISH AND INSTALL ALL INCIDENTAL ACCESSORIES NECESSARY TO MAKE THE FUEL CELL COMPLETE AND READY FOR OPERATION.
4. ALL MECHANICAL WORK SHALL BE IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE AND LOCAL CODES.
5. ALL MECHANICAL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
6. FURNISH AND INSTALL PIPING AS SIZED ON THE PLANS. REFER TO P&ID FOR PIPING CONNECTIONS, INSTRUMENTATION AND VALVE REQUIREMENTS. CONFIRM FLOW DIRECTIONS FOR SUPPLY AND RETURN LINES PRIOR TO INSTALLATION OF ANY WORK.
7. NATURAL GAS INSTALLATION SHALL COMPLY WITH LOCAL CODES. INSTALL MANUAL GAS SHUTOFF VALVE WITH A 1/2" NPT PRESSURE TAP FOR TEST GAUGE CONNECTION AT UNIT.
8. SUBJECT PIPING SYSTEM TO HYDROSTATIC TEST PRESSURE THAT IS NOT LESS THAN 1.5 TIMES THE DESIGN PRESSURE. TEST PRESSURE SHALL NOT EXCEED MAXIMUM TEST PRESSURE FOR ANY VESSEL, PUMP, VALVE, OR OTHER COMPONENT IN SYSTEM UNDER VERIFY THAT STRESS DUE TO PRESSURE AT BOTTOM OF VERTICAL RUNS DOES NOT EXCEED EITHER 90 PERCENT OF SPECIFIED MINIMUM YIELD STRENGTH OR 1.7 TIMES "SE" VALUE IN APPENDIX A OF ASME B31.9, "BUILDING SERVICES PIPING." AFTER HYDROSTATIC TEST PRESSURE HAS BEEN APPLIED FOR AT LEAST 10 MINUTES, EXAMINE PIPING, JOINTS, AND CONNECTIONS FOR LEAKAGE. ELIMINATE LEAKS BY TIGHTENING, REPAIRING, OR REPLACING COMPONENTS, AND REPEAT HYDROSTATIC TEST UNTIL THERE ARE NO LEAKS. COORDINATE FILLING & PRESSURIZING OF LG WITH OWNER. BLANK OFF THE FIELD-INSTALLED PIPING AT THE POWER MODULE AND COOLING MODULE BEFORE PRESSURE TESTING IS CONDUCTED. HYAXIOM MAY REQUEST TO WITNESS THE PRESSURE TEST. ALL COOLING AND HEAT RECOVERY PIPING SHALL BE THOROUGHLY CLEANED BEFORE PLACING IN OPERATION TO REMOVE ALL DIRT, PIPING COMPOUND, MILL SCALE, OIL AND ALL OTHER MATERIAL FOREIGN TO THE FLUID BEING CIRCULATED. THE POWER MODULE AND COOLING MODULE MUST BE ISOLATED WHEN FLUSHING THE PIPING. DO NOT FLUSH EITHER THE COOLING OR POWER MODULES. FLUSHING THROUGH EITHER MODULE MAY RESULT IN DAMAGE TO THE POWER MODULE AND COOLING MODULE. FLUSHING PROCEDURE SHOULD CONFORM TO THE DESIGN SPECIFICATIONS. IN ADDITION, THESE FLUSHING REQUIREMENTS ARE UNIQUE TO THIS FUEL CELL PRODUCT:
   - HYAXIOM PERSONAL SHALL BE NOTIFIED OF THE FLUSHING SCHEDULE FOR ALL PIPING.
   - DUE TO THE ISOLATION OF THE POWER MODULE AND COOLING MODULE DURING FLUSHING, A TEMPORARY BYPASS MAY BE NECESSARY AT THE SUPPLY AND RETURN CONNECTIONS TO PERMIT CIRCULATION THROUGH THE ENTIRE PIPING SYSTEM.
   - THE POWER MODULE WILL NOT BE AVAILABLE TO HEAT THE FLUSHING FLUID AS IT IS CIRCULATED DURING FLUSHING. THE BUILDING BACKUP HEATING, OR OTHER TEMPORARY HEATING SOURCE, WILL NEED TO BE USED.
   - ALL INSTRUMENTS, SUCH AS FLOW METERS, THERMOWELLS, AND GAUGES, MUST BE REMOVED FROM THE FLOW STREAM AS THE PIPES ARE BEING FLUSHED.
   - IF THE PIPING SYSTEM IS NOT TO BE FILLED IMMEDIATELY AFTER FLUSHING, THEN THE PIPING SYSTEM MUST BE DRAINED AND DRIED OUT WITH COMPRESSED AIR TO REMOVE ALL LIQUID.
9. COORDINATE WITH OWNER REGARDING POLICY OF DAILY WORK SITE CLEANUP, ADVANCED NOTICE FOR LOUD AND DISRUPTIVE WORK, AND SECURITY / SIGN-IN REQUIREMENTS. PROVIDE ALL MANUFACTURERS SAFETY DATA SHEETS (MSDS) FOR ALL MATERIALS BEING USED ON SITE FOR RECORD TO THE OWNER PRIOR TO SITE ARRIVAL OF RELATED MATERIALS. NO MATERIALS ARE TO BE LEFT REMAINING AT THE CLOSE OF PROJECT AND ARE TO BE REMOVED FROM THE SITE WHEN NO LONGER REQUIRED FOR THE WORK BEING DONE.
10. CONTRACTOR SHALL WARRANTY ALL WORKMANSHIP FOR A PERIOD OF ONE-YEAR FROM THE SUBSTANTIAL COMPLETION OF WORK. ALL MATERIALS SHALL BE SUBJECT TO THE MANUFACTURER'S WARRANTY PERIOD, BUT FOR NOT LESS THAN A PERIOD OF ONE-YEAR FROM SUBSTANTIAL COMPLETION.
11. TEST & BALANCE SHALL BE PROVIDED FOR ALL WATER FLOW RATES AS SHOWN. PROVIDE ALL TEST AND BALANCE SERVICES IN ACCORDANCE WITH THE NEBB OR AABC.
12. THE CONTRACTORS SHALL PROVIDE ELECTRONIC SUBMITTALS OF ALL INSTALLATION METHODS, MATERIALS AND ACCESSORIES FOR REVIEW AND APPROVAL. SUBMITTALS SHALL BE ASSEMBLED AND SUBMITTED PRIOR TO ANY INSTALLATION WORK, AND SHOULD INCLUDE:

A. PIPING AND TUBING MATERIALS
B. PIPE AND TUBING SUPPORTS
C. PIPING SPECIALTIES AND VALVES
D. NATURAL GAS REGULATORS AND UTILITY METER
E. UNDERGROUND PIPING/INSULATING MATERIALS
F. PIPE SHOP DRAWINGS
G. HARDWARE & INSTRUMENTATION SUBMITTALS
H. AS-BUILTS OF ALL ABOVE SUBMITTALS AT COMPLETION OF PROJECT

14. NATURAL GAS AND NITROGEN PIPING SHALL BE CLEARED OF FOREIGN MATERIAL USING COMPRESSED AIR, NITROGEN, OR OTHER NON FLAMMABLE GAS PRIOR TO CONNECTING TO THE FUEL CELL.
15. PIPING SHALL BE SHALL BE MARKED IN ACCORDANCE WITH ANSI / ASME A13.1
    NATURAL GAS - YELLOW/BLACK (PAINT)
    NITROGEN - BLUE / WHITE (PAINT)
    PROCESS WATER - GREEN / WHITE (PAINT)
    COOLING MODULE WATER - GREEN / WHITE (PAINT)
    WASTE WATER - GREEN / WHITE (PAINT)

MECHANICAL SYMBOLS

SYMBOL	DESCRIPTION
	GATE VALVE (NORM OPEN)
NC	GATE VALVE (NORM CLOSED)
	BALL VALVE (NORM OPEN)
	BALL VALVE (NORM CLOSED)
	GAS COCK
	PRESSURE RELIEF VALVE
	AIR RELIEF VALVE
	HOSE BIB
	PRESSURE REGULATOR
	BUTTERFLY VALVE (NORM OPEN)
	BUTTERFLY VALVE (NORM CLOSED)
	CALIBRATED BALANCE VALVE
	CONTROL VALVE (SEE VALVE SCH)
	REDUCER
	HOSE COUPLING
	DIELECTRIC UNION
	FLOW ARROW
	FLEXIBLE CONNECTOR
	THERMOWELL
PI	PRESSURE GAUGE - ASHCROFT 1009 SERIES 2 1/2" DIAL, STAINLESS STEEL CASE, RANGE 0-30" H_2O FOR GAS, O-100 PSIG FOR LIQUID, UNLESS OTHERWISE INDICATED.
U.O.N.	UNLESS OTHERWISE NOTED
FC	FUEL CELL
MUW	MAKE-UP WATER

Rev.	Date	Description
G	08/03/23	UPDATED AS NOTED
F	07/31/23	UPDATED PER FLOOD COMM. REQUESTS
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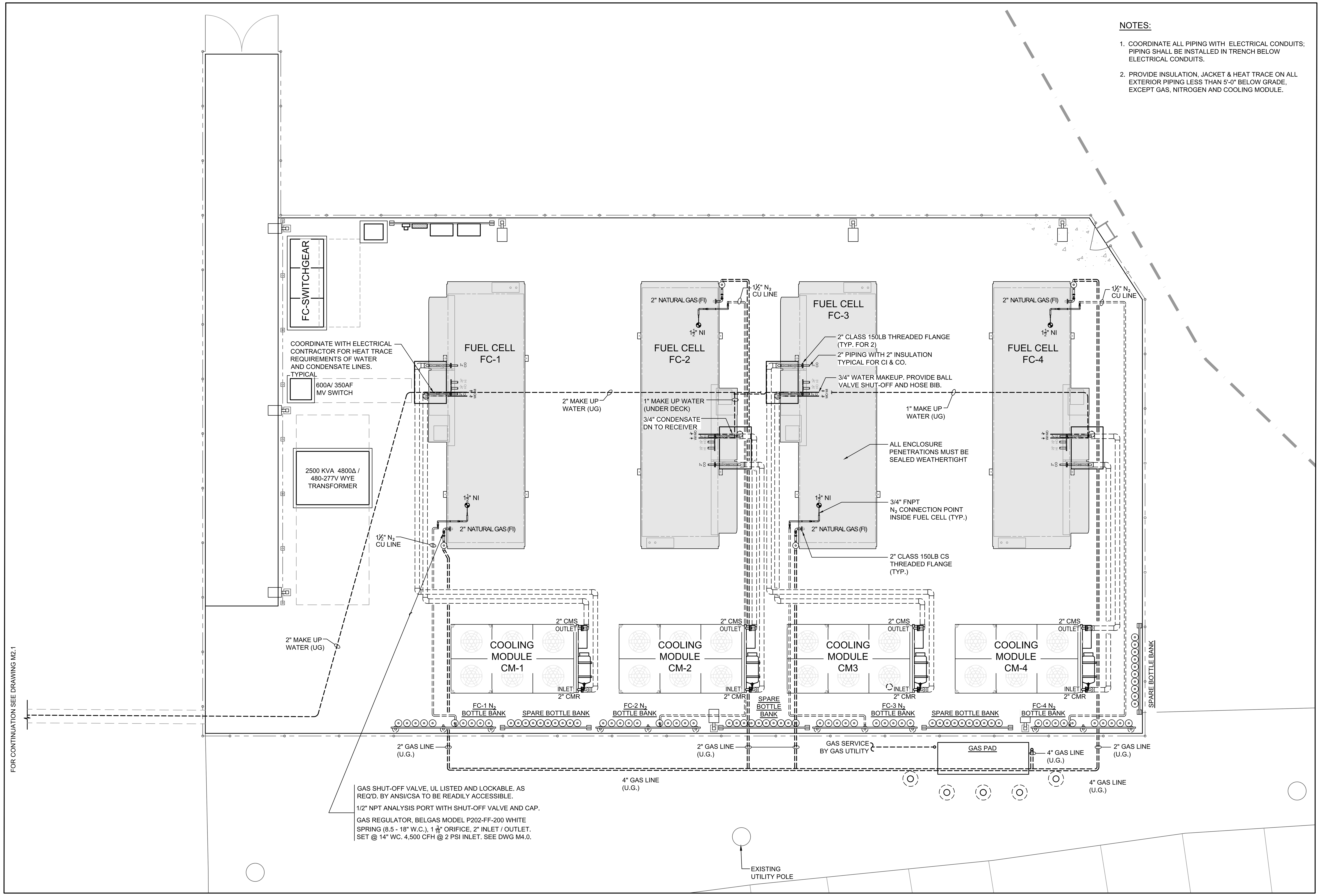
UNIVERSITY OF HARTFORD
200 BLOOMFIELD AVE, WEST HARTFORD CT
FUEL CELL INSTALLATION

MECHANICAL
GENERAL NOTES, SPECS & LEGEND

Project No.:	Drawn By: KFH
Date: 07/08/22	Design By: DSF
Scale: NTS	Check By: DSF

Drawing No.: M1.0



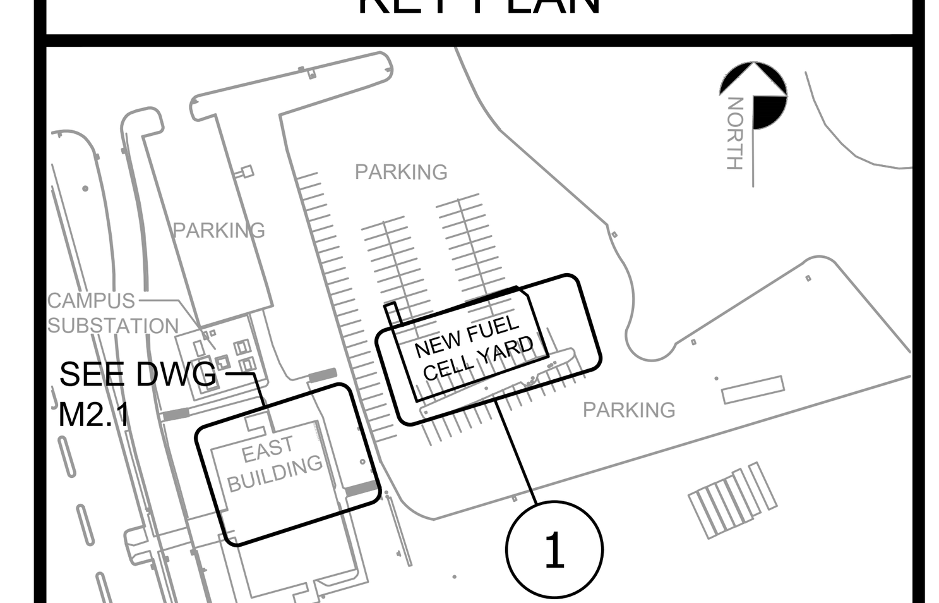
NOTES:

1. COORDINATE ALL PIPING WITH ELECTRICAL CONDUITS; PIPING SHALL BE INSTALLED IN TRENCH BELOW ELECTRICAL CONDUITS.
2. PROVIDE INSULATION, JACKET & HEAT TRACE ON ALL EXTERIOR PIPING LESS THAN 5'-0" BELOW GRADE, EXCEPT GAS, NITROGEN AND COOLING MODULE.

1 MECHANICAL PARTIAL PLAN

Scale: 3/16" = 1'-0"

KEY PLAN



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UNIVERSITY OF HARTFORD
200 BLOOMFIELD AVE, WEST HARTFORD CT
FUEL CELL INSTALLATION

MECHANICAL PARTIAL PLAN

Project No.:	Drawn By: KFH
Date: 07/08/22	Design By: DSF
Scale: NTS	Check By: DSF

Drawing No.:

M2.0

NOTES:

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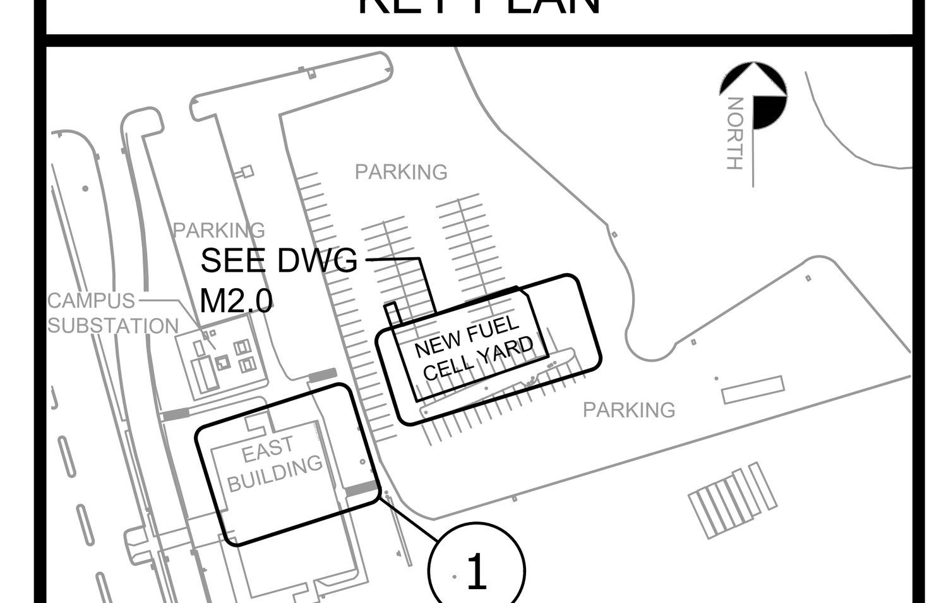

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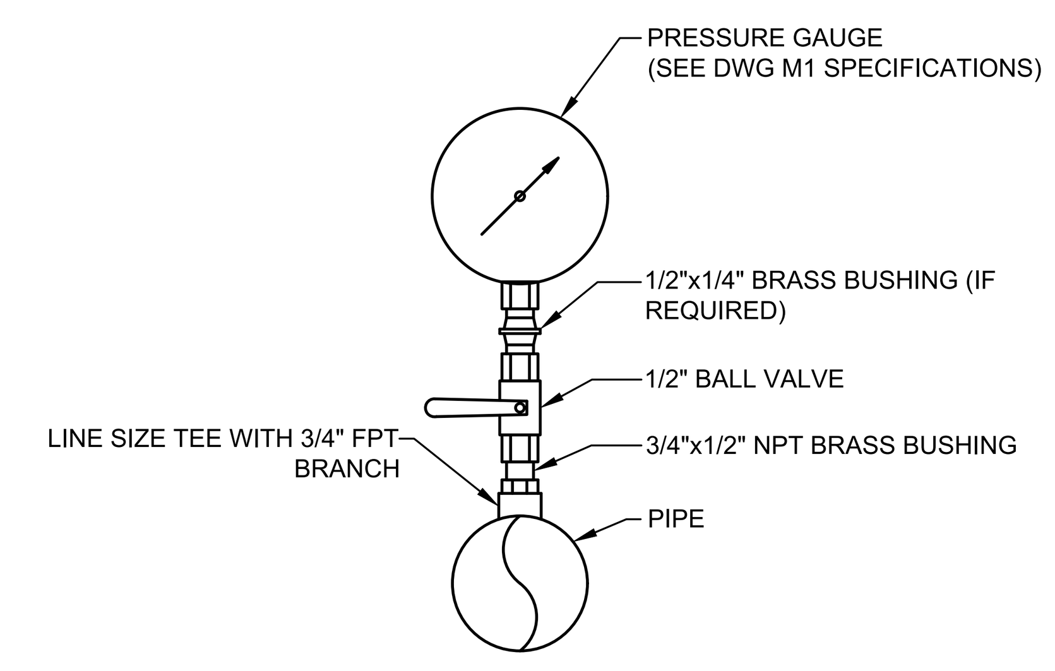
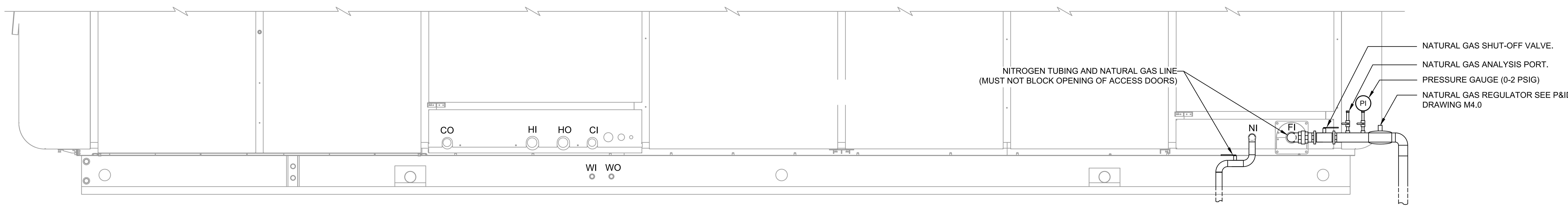
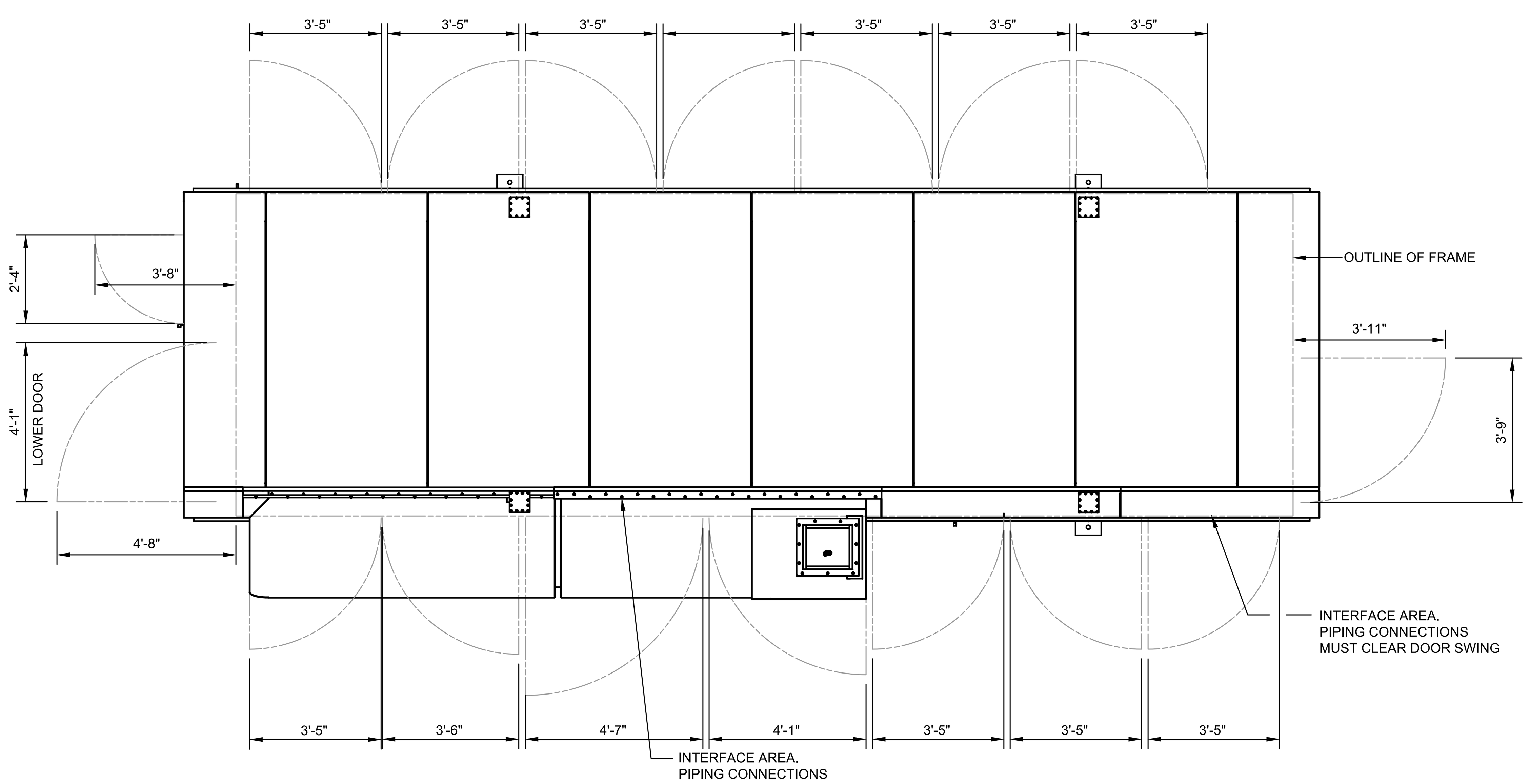
Drawing No.: M2.1



4 PRESSURE GAUGE CONNECTION DETAIL
SCALE: NTS



3 ELEVATION SHOWING PIPING OPENINGS
SCALE: NTS



2 DOOR SWING CLEARANCE PLAN
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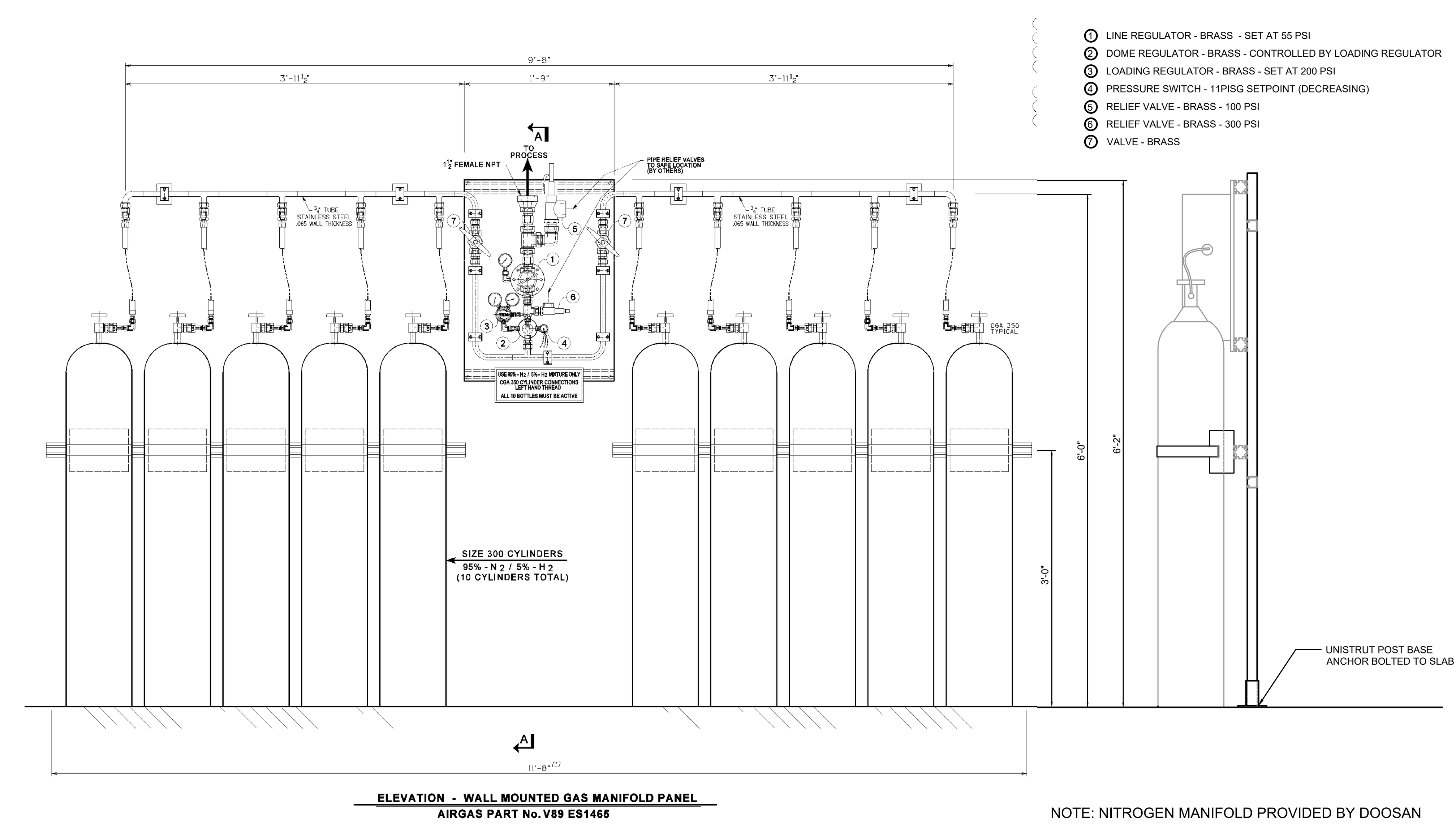

NOTE: NITROGEN MANIFOLD PROVIDED BY DOOSAN

1 NITROGEN BOTTLES, MANIFOLD AND BOTTLE MOUNTING FRAME DETAIL
SCALE: NTS

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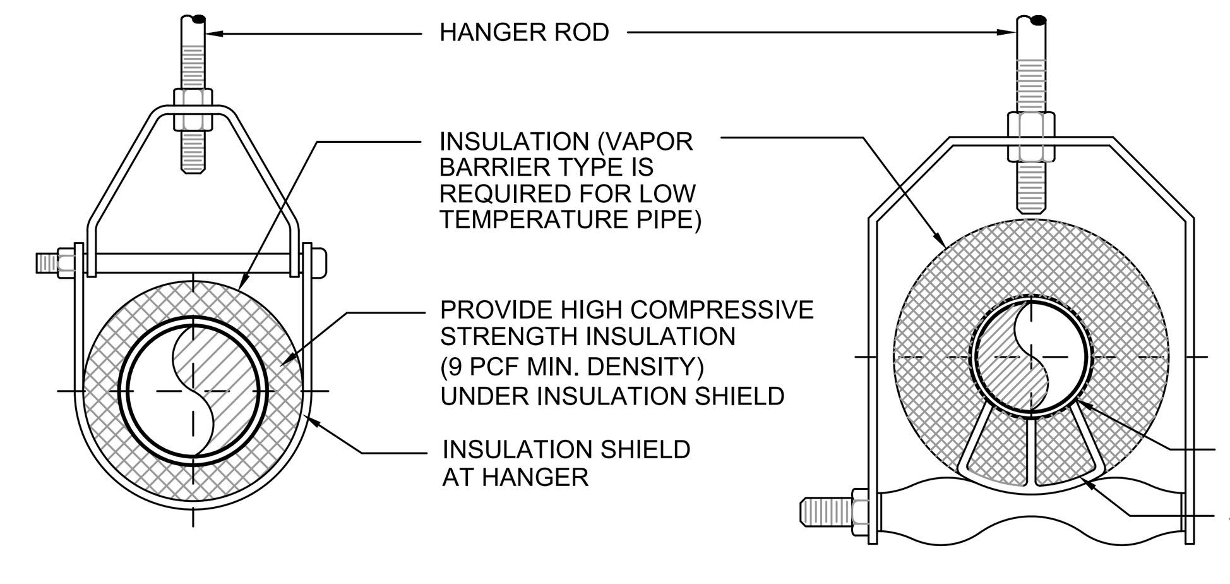
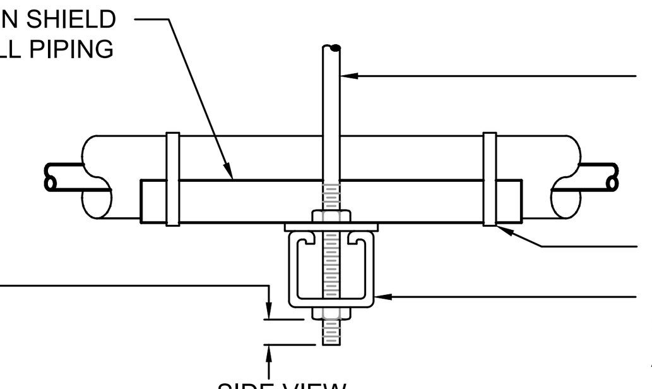
Drawing No.:
M3.0





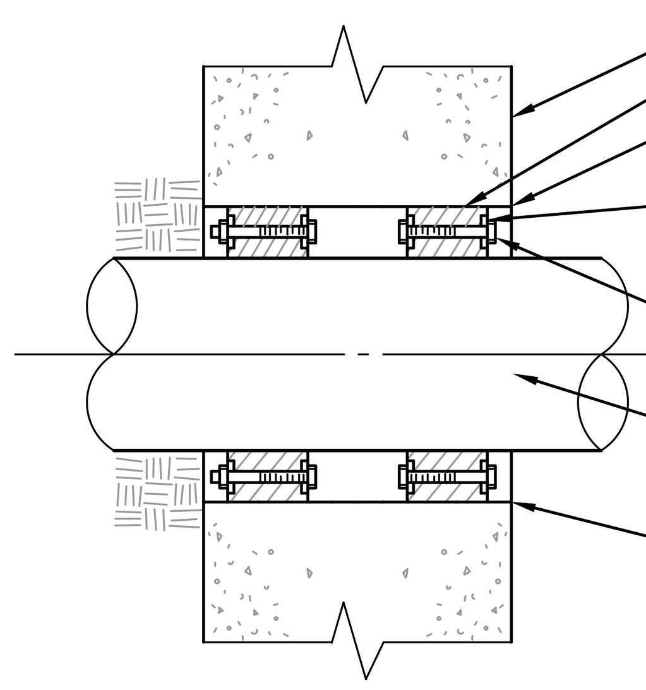
TYPICAL PIPE HANGERS

NOTE:
ALL EXTERIOR PIPE HANGERS SHALL BE GALVANIZED

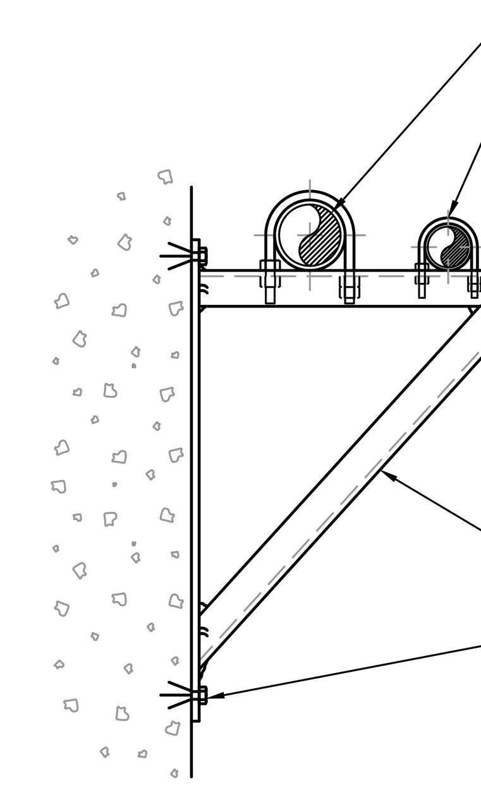
MAXIMUM PIPE/TUBING SUPPORT SPACING																	
NOM. SIZE IN.	THRU 3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10	12	14	16	18	20	24
PIPE FT.	7	7	7	9	10	11	12	14	16	17	19	22	23	25	27	28	30	32
TUBING FT.	5 FT	6	7	8	8	9	10	12	13	14	16	-	-	-	-	-	-	-

NOTE: FOR TRAPEZE HANGER TAKE SPACING OF SMALLEST SIZE ON TRAPEZE.

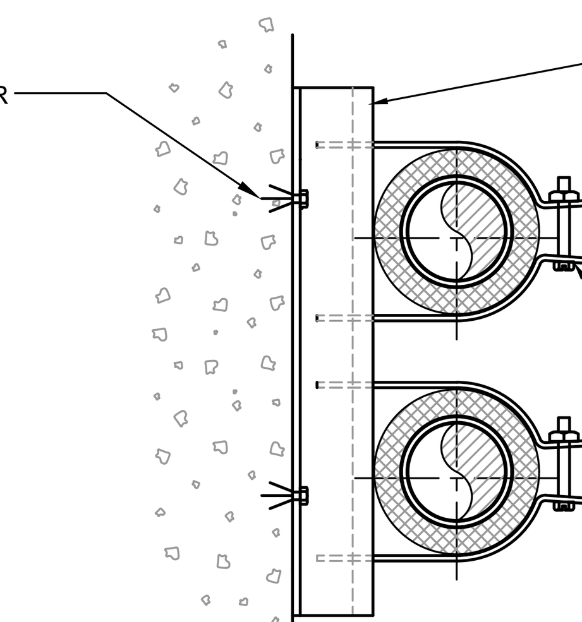
9 PIPE SUPPORT DETAIL
SCALE: NTS



10 PIPE THRU EXTERIOR WALL
SCALE: NTS



8 WALL-MOUNT PIPE SUPPORT
SCALE: NTS

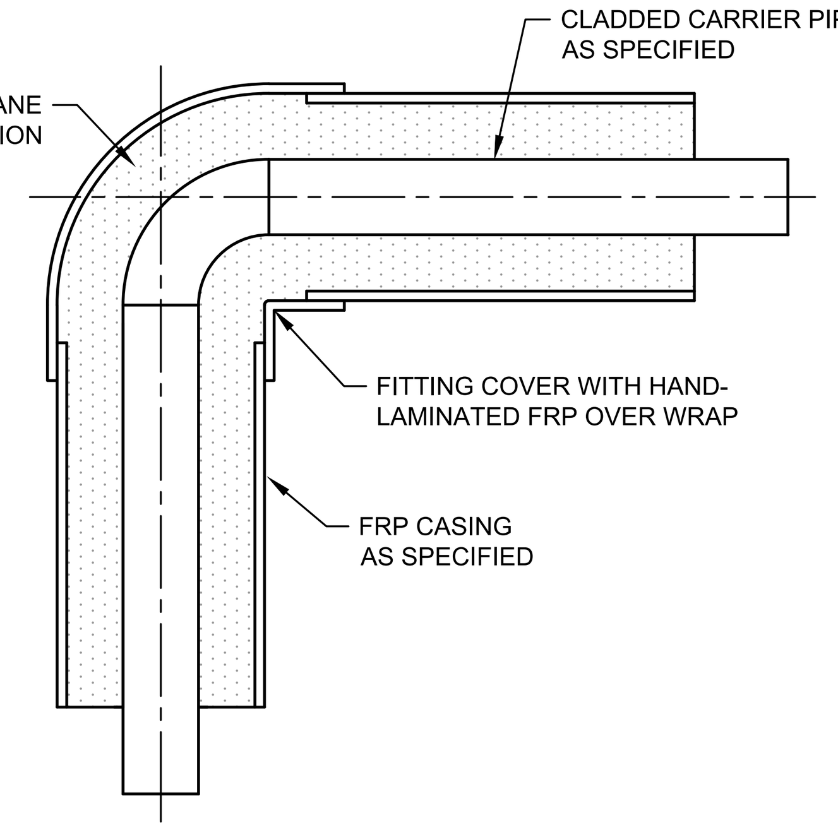


7 WALL-MOUNT PIPE SUPPORT
SCALE: NTS

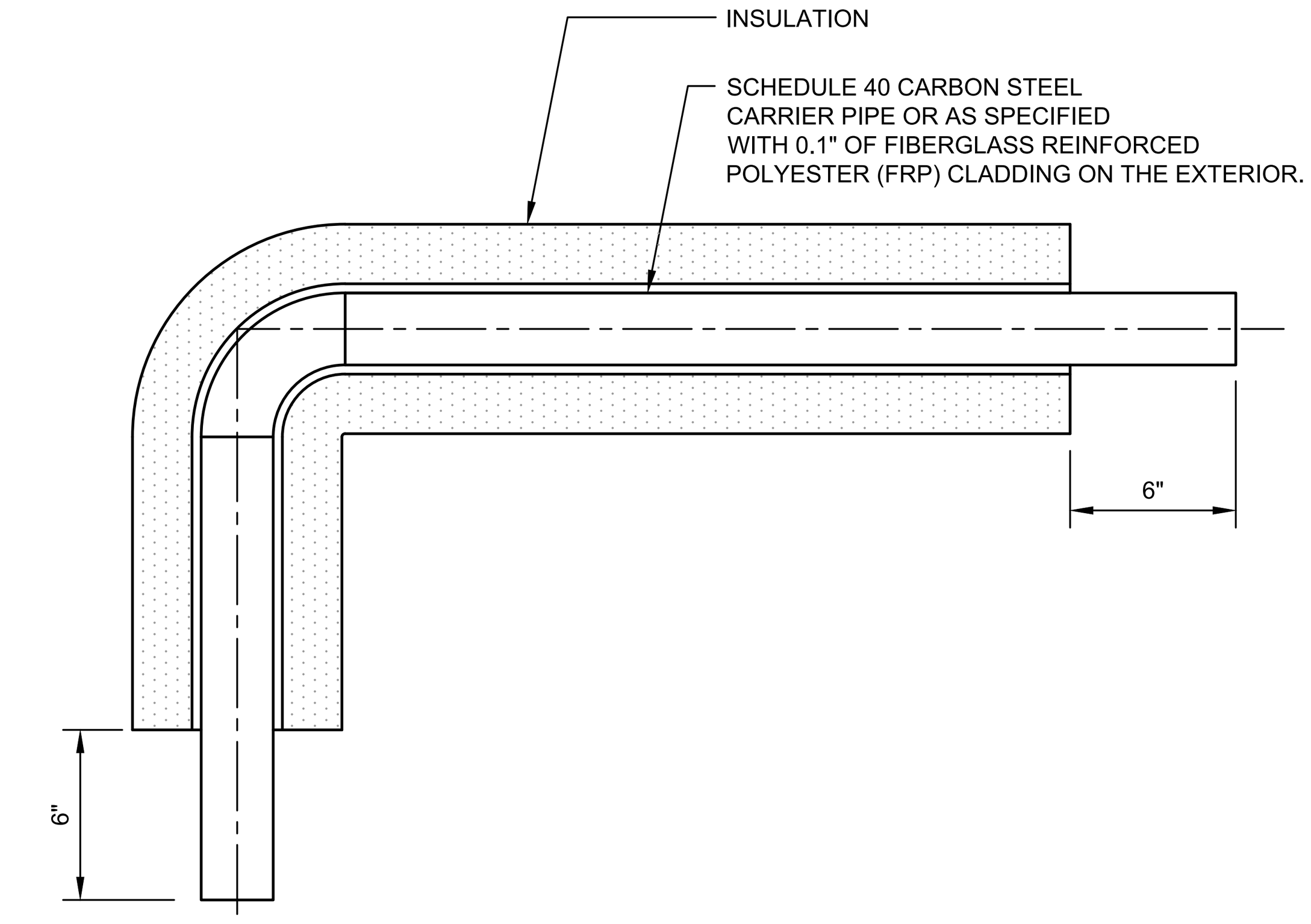
SYMBOL:	DESCRIPTION:
─⊖	90° ELBOW TURNED UP
─)	90° ELBOW TURNED DOWN
×	ANCHOR
[	END SEAL (WELD, GLAND, OR HEAT SHRINK)
▬	EXPANSION PIPING
+	FIELD JOINT

UNDERGROUND PIPING SPECIFICATION

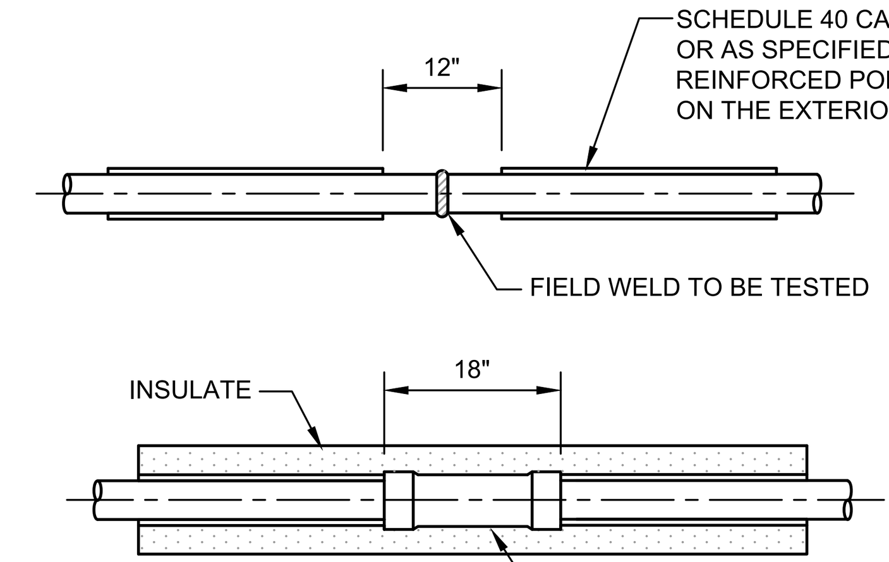
- CARRIER PIPE: SCHEDULE 40 A-53 GRADE B ERW CARBON STEEL
- FRP CLADDING: CLADDING ON STRAIGHT SECTIONS CONSIST OF MULTIPLE LAYERS OF FIBERGLASS REINFORCED PLASTIC (FRP) 90-100 MILS THICK WOUND DIRECTLY ON THE CARRIER PIPE OR OVER THE SPRAY-IN POLYURETHANE FOAM INSULATION.
- FITTINGS: PREFABRICATED FITTINGS UTILIZING BUTT WELD FITTINGS, WITH HAND LAMINATED GLASS MATT SATURATED WITH RESIN AND CATALYST TO A MINIMUM THICKNESS OF 100 MILS APPLIED DIRECTLY ONTO THE STEEL CARRIER PIPE AND FITTINGS.
- ANCHORS: PREFABRICATED UTILIZING 3/8" STEEL PLATE WELDED TO THE CARRIER PIPE. THE ANCHOR PLATE SHALL BE 6"LARGER THAN THE PIPE AND POURED IN CONCRETE BY THE INSTALLING CONTRACTOR.
- FIELD JOINTS: FIELD JOINTS SHALL CONSIST OF HAND LAY-UP FIBERGLASS MAT SATURATED WITH A RESIN AND CATALYST. THICKNESS SHALL BE 100 MILS THICK IDENTICAL TO THE STRAIGHT LENGTH SECTIONS.
- INSULATION SHALL BE 2" THICK POLYURETHANE FOAM WITH FRP CASING
- ALTERNATE: MEGAPRESS (IF STEEL).



6 90° EXPANSION ELBOW DETAIL
SCALE: NTS

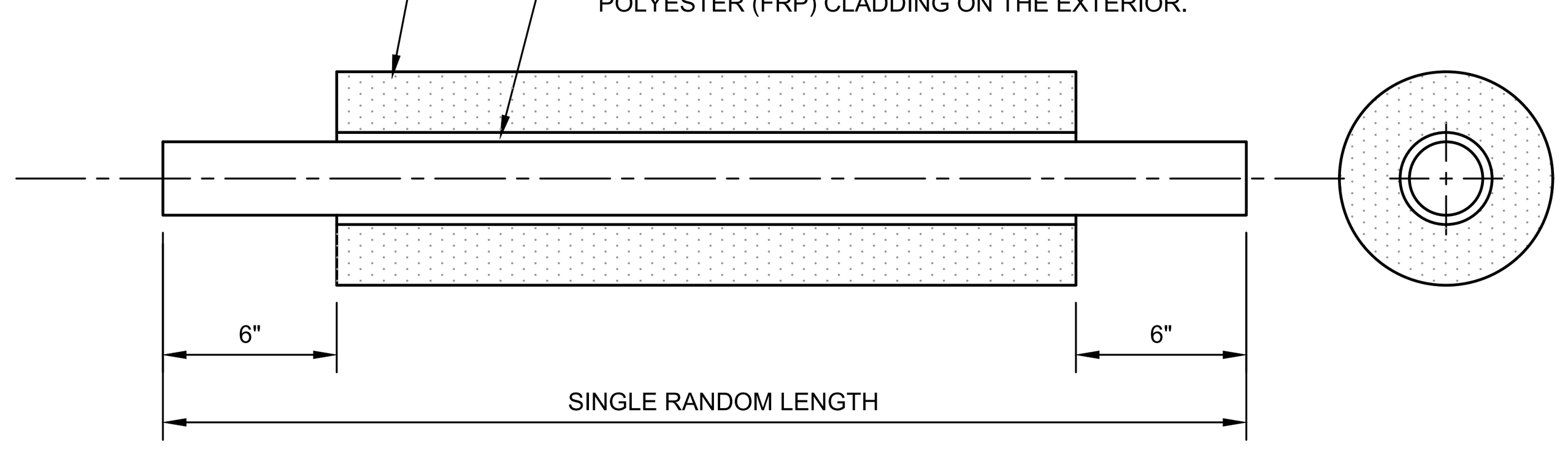


5 PRE-FABRICATED FITTING W/ FRP CLADDING
SCALE: NTS

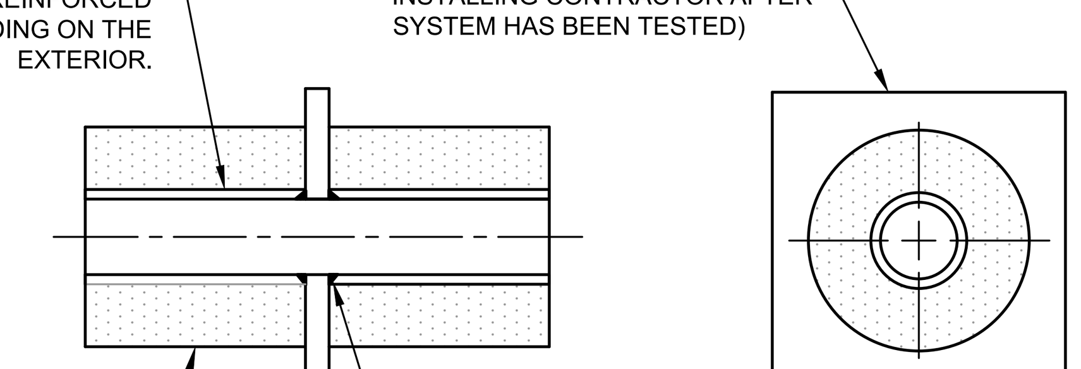


NOTES:
1. WELD THE CARRIER PIPE.
2. TEST AS REQUIRED.
3. COVER WITH A HEAT SHRINK SLEEVE.
4. INSULATE

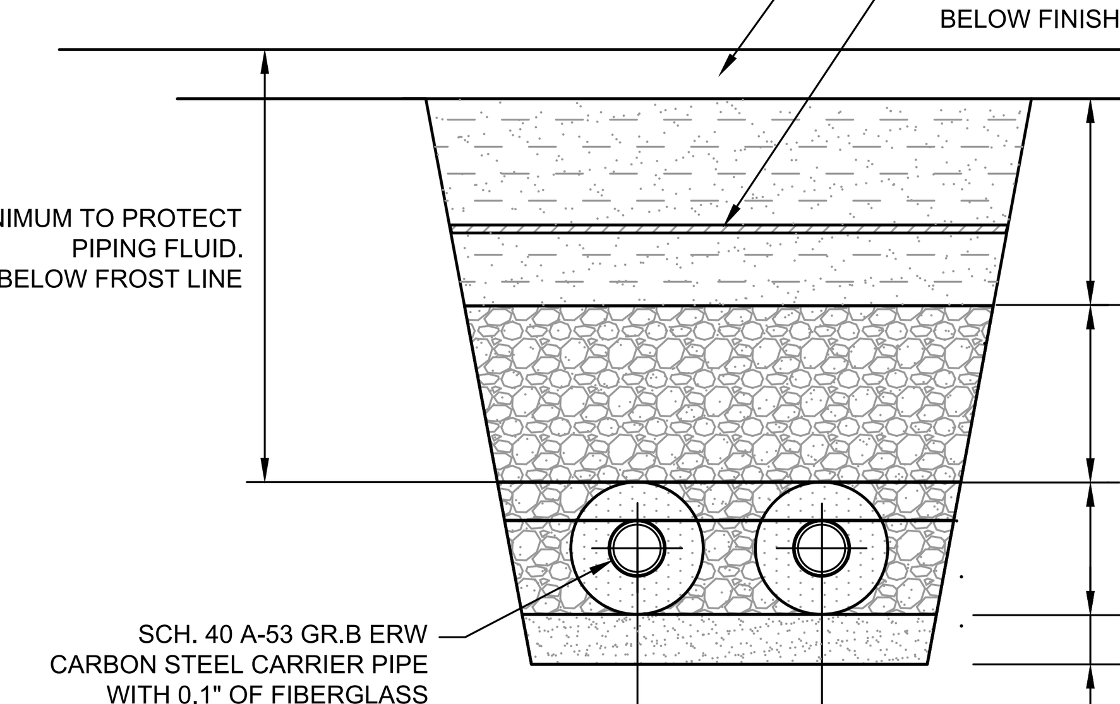
4 FIELD JOINT W/ FRP CLADDING
SCALE: NTS



3 SINGLE RANDOM PIPE W/ FRP CLADDING
SCALE: NTS



2 ANCHOR DETAILS
SCALE: NTS



1 TYPICAL TRENCH DETAIL
SCALE: NTS

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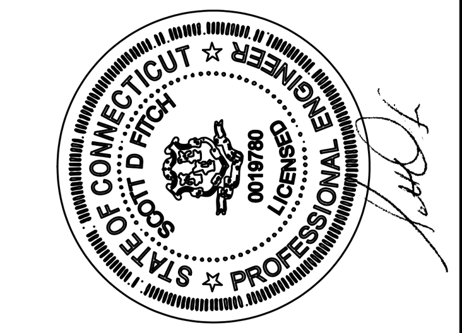

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FUEL CELL INSTALLATION

MECHANICAL DETAILS

Project No.:	Drawn By: KFH
Date: 07/08/22	Design By: DSF
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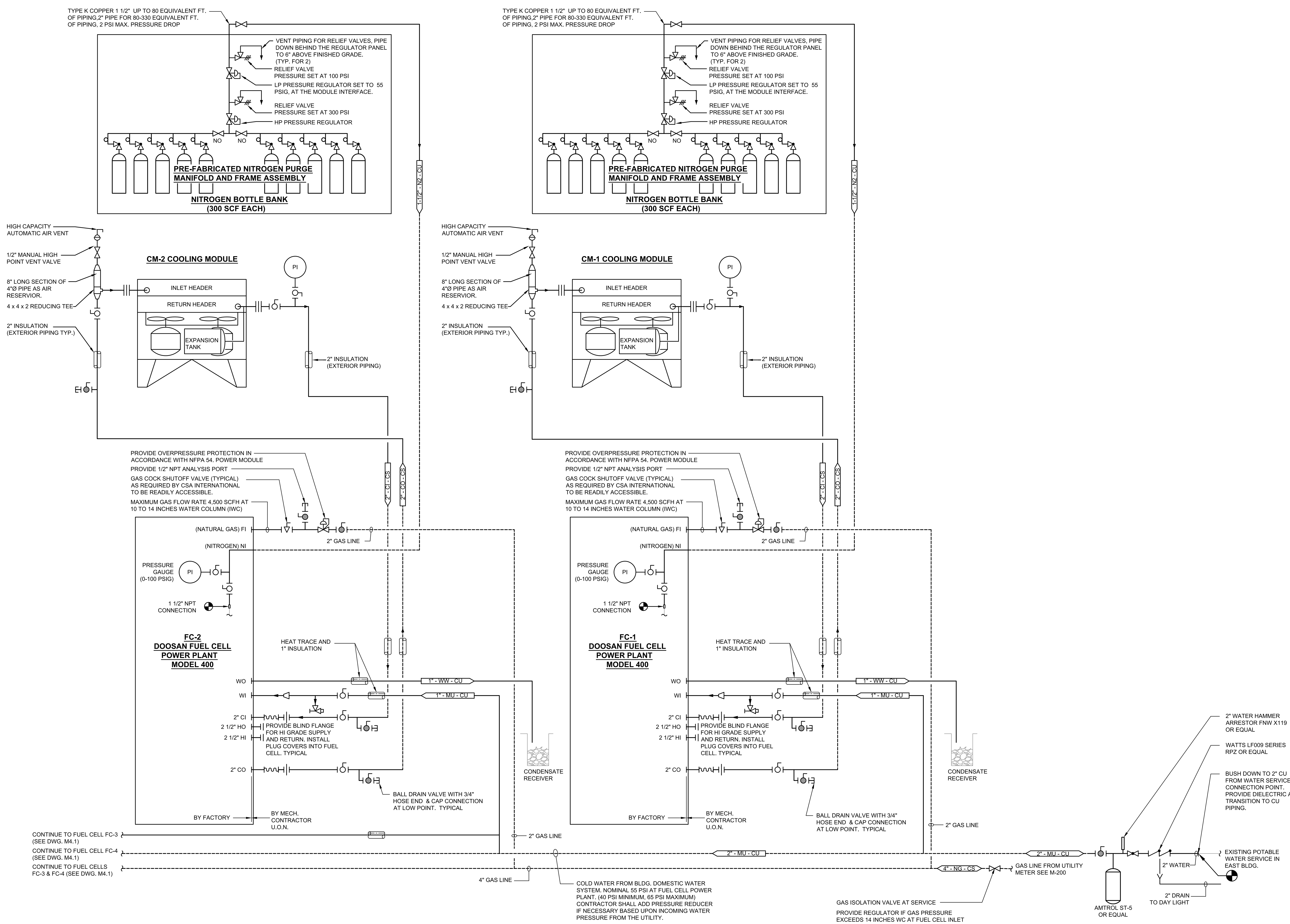
Drawing No.:
M3.1



TYPE K COPPER 1 1/2" UP TO 80 EQUIVALENT FT. OF PIPING,2" PIPE FOR 80-330 EQUIVALENT FT. OF PIPING, 2 PSI MAX. PRESSURE DROP
VENT PIPING FOR RELIEF VALVES, PIPE DOWN BEHIND THE REGULATOR PANEL TO 6" ABOVE FINISHED GRADE. (TYP. FOR 2)
RELIEF VALVE PRESSURE SET AT 100 PSI
LP PRESSURE REGULATOR SET TO 55 PSIG, AT THE MODULE INTERFACE.
RELIEF VALVE PRESSURE SET AT 300 PSI
HP PRESSURE REGULATOR
NO
NO
PRE-FABRICATED NITROGEN PURGE MANIFOLD AND FRAME ASSEMBLY
NITROGEN BOTTLE BANK (300 SCF EACH)
1-1/2" - N2 - CU
HIGH CAPACITY AUTOMATIC AIR VENT
1/2" MANUAL HIGH POINT VENT VALVE
8" LONG SECTION OF 4"Ø PIPE AS AIR RESERVIOR.
4 x 4 x 2 REDUCING TEE
2" INSULATION (EXTERIOR PIPING TYP.)
CM-2 COOLING MODULE
INLET HEADER
RETURN HEADER
EXPANSION TANK
PI
2" INSULATION (EXTERIOR PIPING)
2" - CI - CS
2" - CO - CS
PROVIDE OVERPRESSURE PROTECTION IN ACCORDANCE WITH NFPA 54. POWER MODULE
PROVIDE 1/2" NPT ANALYSIS PORT
GAS COCK SHUTOFF VALVE (TYPICAL) AS REQUIRED BY CSA INTERNATIONAL TO BE READILY ACCESSIBLE.
MAXIMUM GAS FLOW RATE 4,500 SCFH AT 10 TO 14 INCHES WATER COLUMN (IWC)
(NATURAL GAS) FI
(NITROGEN) NI
2" GAS LINE
PRESSURE GAUGE (0-100 PSIG)
PI
1 1/2" NPT CONNECTION
FC-2 DOOSAN FUEL CELL POWER PLANT MODEL 400
HEAT TRACE AND 1" INSULATION
WO
WI
1" - WW - CU
1" - MU - CU
2" CI
2 1/2" HO
2 1/2" HI
PROVIDE BLIND FLANGE FOR HI GRADE SUPPLY AND RETURN. INSTALL PLUG COVERS INTO FUEL CELL. TYPICAL
2" CO
CONDENSATE RECEIVER
BALL DRAIN VALVE WITH 3/4" HOSE END & CAP CONNECTION AT LOW POINT. TYPICAL
BY FACTORY
BY MECH. CONTRACTOR U.O.N.
2" GAS LINE
CONTINUE TO FUEL CELL FC-3 (SEE DWG. M4.1)
CONTINUE TO FUEL CELL FC-4 (SEE DWG. M4.1)
CONTINUE TO FUEL CELLS FC-3 & FC-4 (SEE DWG. M4.1)
4" GAS LINE
TYPE K COPPER 1 1/2" UP TO 80 EQUIVALENT FT. OF PIPING,2" PIPE FOR 80-330 EQUIVALENT FT. OF PIPING, 2 PSI MAX. PRESSURE DROP
VENT PIPING FOR RELIEF VALVES, PIPE DOWN BEHIND THE REGULATOR PANEL TO 6" ABOVE FINISHED GRADE. (TYP. FOR 2)
RELIEF VALVE PRESSURE SET AT 100 PSI
LP PRESSURE REGULATOR SET TO 55 PSIG, AT THE MODULE INTERFACE.
RELIEF VALVE PRESSURE SET AT 300 PSI
HP PRESSURE REGULATOR
NO
NO
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NITROGEN BOTTLE BANK (300 SCF EACH)
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1/2" MANUAL HIGH POINT VENT VALVE
8" LONG SECTION OF 4"Ø PIPE AS AIR RESERVIOR.
4 x 4 x 2 REDUCING TEE
2" INSULATION (EXTERIOR PIPING TYP.)
CM-1 COOLING MODULE
INLET HEADER
RETURN HEADER
EXPANSION TANK
PI
2" INSULATION (EXTERIOR PIPING)
2" - CI - CS
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PRESSURE GAUGE (0-100 PSIG)
PI
1 1/2" NPT CONNECTION
FC-1 DOOSAN FUEL CELL POWER PLANT MODEL 400
HEAT TRACE AND 1" INSULATION
WO
WI
1" - WW - CU
1" - MU - CU
2" CI
2 1/2" HO
2 1/2" HI
PROVIDE BLIND FLANGE FOR HI GRADE SUPPLY AND RETURN. INSTALL PLUG COVERS INTO FUEL CELL. TYPICAL
2" CO
CONDENSATE RECEIVER
BALL DRAIN VALVE WITH 3/4" HOSE END & CAP CONNECTION AT LOW POINT. TYPICAL
BY FACTORY
BY MECH. CONTRACTOR U.O.N.
2" GAS LINE
2" - MU - CU
2" - MU - CU
4" - NG - CS
COLD WATER FROM BLDG. DOMESTIC WATER SYSTEM. NOMINAL 55 PSI AT FUEL CELL POWER PLANT. (40 PSI MINIMUM, 65 PSI MAXIMUM) CONTRACTOR SHALL ADD PRESSURE REDUCER IF NECESSARY BASED UPON INCOMING WATER PRESSURE FROM THE UTILITY.
GAS ISOLATION VALVE AT SERVICE
PROVIDE REGULATOR IF GAS PRESSURE EXCEEDS 14 INCHES WC AT FUEL CELL INLET
GAS LINE FROM UTILITY METER SEE M-200
AMTROL ST-5 OR EQUAL
2" WATER HAMMER ARRESTOR FNW X119 OR EQUAL
WATTS LF009 SERIES RPZ OR EQUAL
BUSH DOWN TO 2" CU FROM WATER SERVICE CONNECTION POINT. PROVIDE DIELECTRIC AT TRANSITION TO CU PIPING.
EXISTING POTABLE WATER SERVICE IN EAST BLDG.
2" WATER
2" DRAIN TO DAY LIGHT

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FUEL CELL INSTALLATION

MECHANICAL
PIPING & INSTUMENTATION DIAGRAM

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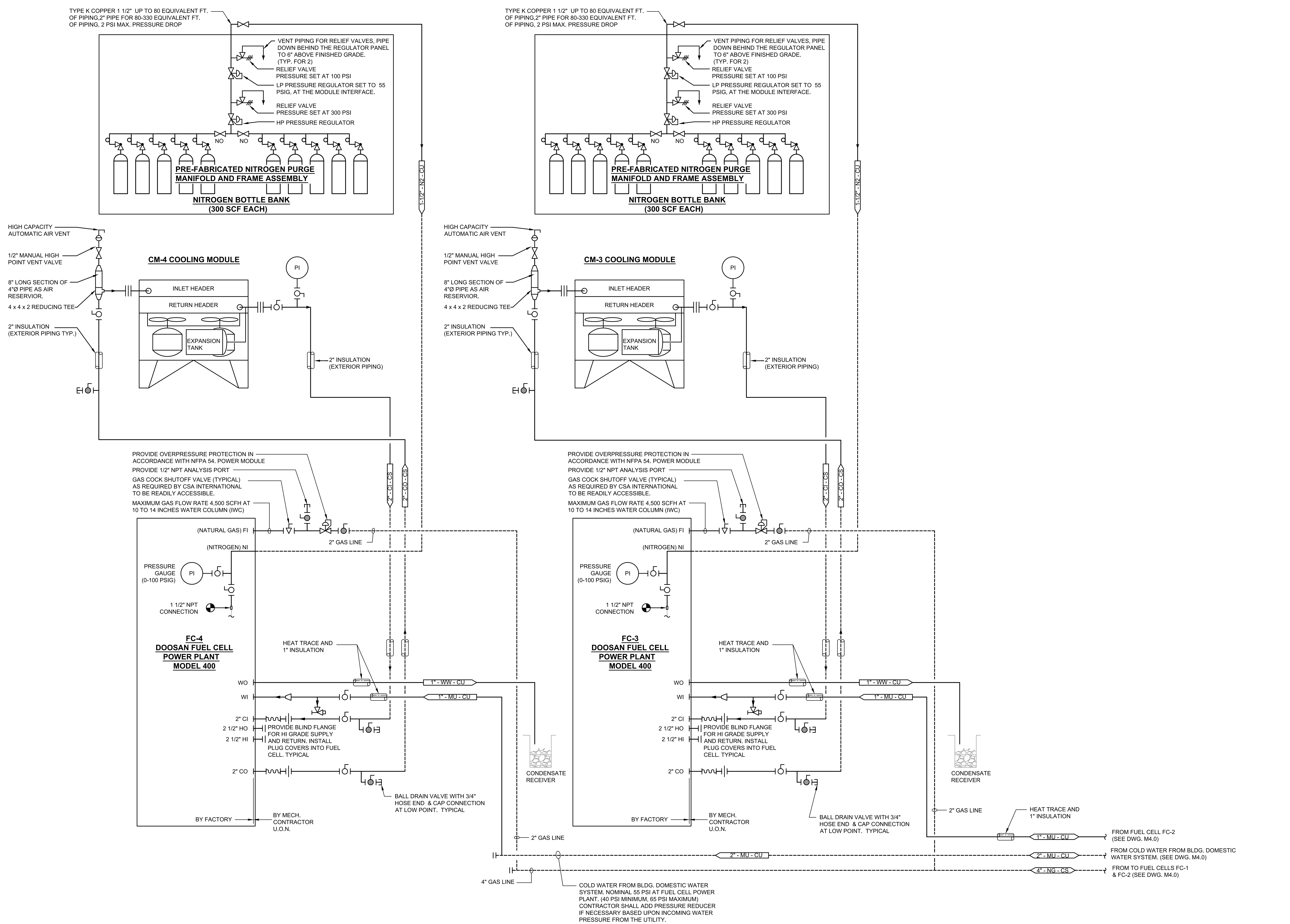
M4.0



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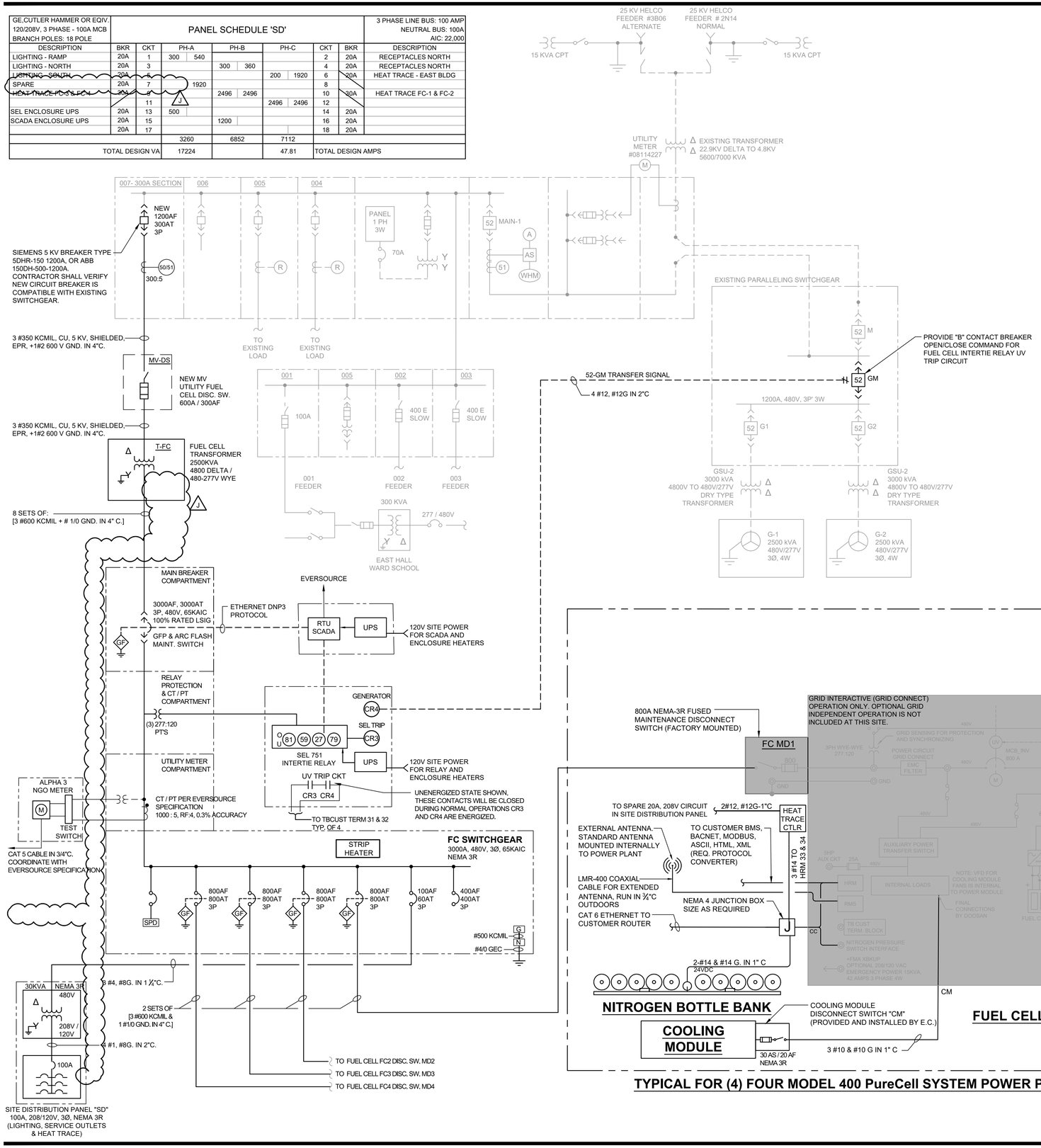
UNIVERSITY OF HARTFORD
200 BLOOMFIELD AVE, WEST HARTFORD CT
FUEL CELL INSTALLATION

MECHANICAL
PIPING & INSTUMENTATION DIAGRAM

Project No.:	Drawn By: KFH
Date: 07/08/22	Design By: DSF
Scale: NTS	Check By: DSF

Drawing No.:
M4.1

GE,CUTLER HAMMER OR EQIV. 120/208V, 3 PHASE - 100A MCB BRANCH POLES: 18 POLE	PANEL SCHEDULE 'SD'								3 PHASE LINE BUS: 100 AMP NEUTRAL BUS: 100A AIC: 22,000
DESCRIPTION	BKR	CKT	PH-A		PH-B		PH-C		CKT	BKR	DESCRIPTION
LIGHTING - RAMP	20A	1	300	540					2	20A	RECEPTACLES NORTH
LIGHTING - NORTH	20A	3			300	360			4	20A	RECEPTACLES NORTH
LIGHTING - SOUTH	20A	5					200	1920	6	20A	HEAT TRACE - EAST BLDG
SPARE	20A	7		1920					8		
HEAT TRACE FC-3 & FC-4	30A	9	J		2496	2496			10	30A	HEAT TRACE FC-1 & FC-2
		11					2496	2496	12		
SEL ENCLOSURE UPS	20A	13	500						14	20A	
SCADA ENCLOSURE UPS	20A	15			1200				16	20A	
	20A	17							18	20A	
			3260		6852		7112				
TOTAL DESIGN VA			17224				47.81		TOTAL DESIGN AMPS		



TYPICAL FOR (4) FOUR MODEL 400 PureCell SYSTEM POWER PLANTS

GENERAL NOTES

1. PROVIDE SIGNAGE AS REQUIRED BY CODE AND AS INDICATED ON DWG E2.0.
2. CONSULT DOOSAN MODEL 400 INSTALLATION DESIGN GUIDE (FUEL CELL POWER PLANT) AND STANDARD INSTALLATION DRAWINGS FOR TECHNICAL REFERENCE.

TABLE A - SEL547 RELAY
IEEE1547 / UL 1741SA GRID PROTECTION PARAMETER SETTINGS

THE REQUIRED GRID PROTECTION FUNCTIONS AND SETTINGS PER UL1741SA/IEEE1547 RESIDE IN THE INTERNAL SEL547 RELAY WITH SETTING NAMES AS SHOWN BELOW.

SETTING NAME	DESCRIPTION	GROUP 1 - "SUPPORT" 60 Hz SETTING 480Vac Tx RATIO 2.31 : 1	VOLTAGE P.U.	ANSI C37 DEVICE NUMBER
27P1P	UNDER VOLTAGE LEVEL 88%(V)	106	0.88	27
27P2P	MID UNDER VOLTAGE	106	0.88	
27P3P	UNDER VOLTAGE LEVEL 50% (V)	60	0.50	27
59P1P	OVER VOLTAGE LEVEL 110% (V)	132	1.1	59
59P2P	OVER VOLTAGE LEVEL 120% (V)	144	1.2	59
81D1P	FAST UNDER FREQUENCY LEVEL (Hz)	56.5		81U
81D2P	SLOW UNDER FREQUENCY LEVEL (Hz)	58.5		81U
81D3P	SLOW OVER FREQUENCY LEVEL (Hz)	61.2		81O
81D4P	FAST OVER FREQUENCY LEVEL (Hz)	62		81O
SV1PU	RECONNECTION TIME DELAY (CYCLES)	18,000		
SV2PU	FAST OVER FREQUENCY CLEARING TIME (CYCLES)	*5		
SV3PU	SLOW OVER FREQUENCY CLEARING TIME (CYCLES)	18,000		
SV4PU	FAST UNDERFREQUENCY CLEARING TIME (CYCLES)	18,000		
SV5PU	FAST UNDER FREQUENCY CLEARING TIME (CYCLES)	*5		
SV6PU	OVER VOLTAGE 120% CLEARING TIME (CYCLES)	*5		
SV7PU	OVER VOLTAGE 110% CLEARING TIME (CYCLES)	120		
SV8PU	UNDER VOLTAGE 88% CLEARING TIME (CYCLES)	120		
SV9PU	MID UNDER VOLTAGE 88% CLEARING TIME (CYCLES)	120		
SV10PU	UNDER VOLTAGE 50% CLEARING TIME (CYCLES)	66		
SV12PU	DELAY BETWEEN GRID OK STATUS AND BREAKER OPENING (CYCLES)	0		

★ NOTE 1: THE ACTUAL (TOTAL) 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 CURRENT CLEARING TIME EQUALS PARAMETER SV6PU 5 CYCLES SETTING PLUS THE 5 CYCLE BREAKER CLEARING TIME FOR A TOTAL CLEARING TIME OF 10 CYCLES (0.16 SEC)

NOTE 2: GROUP 1 SETTINGS ARE FOR THE UL1741SA "GRID SUPPORT" AND GROUP 2 SETTINGS ARE FOR IEEE1547-2003 NON-SA SETTINGS - USE GROUP 1 FOR UL1741SA SITES.

NOTE 3: FOR DOOSAN ON-SITE PERSON - GROUP 1 OR GROUP 2 IS SET BY GROUP 9 PARAMETER "INVERTER MODE"

GROUP 1 = GRID SUPPORT (INVERTER MODE = 0 = FALSE) =UL1741SA

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.

CERTIFICATION:

POWER PLANT IS CERTIFIED TO: ANSI/CSA AMERICA FC 1 - 2014 (FORMALLY ANSI Z21.L83) "AMERICAN NATIONAL STANDARD FOR STATIONARY FUEL CELL POWER SYSTEM" INCLUDING,

A. UL1741SA "INVERTERS, CONVERTERS, CONTROLLERS AND INTERCONNECTION SYSTEM EQUIPMENT FOR USE WITH DISTRIBUTED ENERGY RESOURCES."
B. IEEE 1547 "STANDARD FOR INTERCONNECTING DISTRIBUTED RESOURCES WITH ELECTRIC POWER SYSTEMS."
C. NFPA 70 NATIONAL ELECTRIC CODE (FOR INTERFACES TO CUSTOMER WIRING AND WIRING BETWEEN MODULES).

POWER PLANT SPECIFICATIONS

RATED POWER OUTPUT	460 kW / 532 kVA
OUTPUT TYPE	480VAC, 60 HZ, 3 PHASE, 3 WIRE
RATED OUTPUT CURRENT	639 AMPS AT RATED kVA

LEGEND

	LIGHT INDICATES EXISTING
	BOLD INDICATES NEW
GC	GRID CONNECT
GI	GRID INDEPENDENT

Rev.	Date	Description
J	11/08/23	REVISED TRANSFORMER
H	08/22/23	UPDATED PER HYAXIOM COMMENTS
F	07/31/23	UPDATED PER FLOOD COMM. REQUESTS
E	04/17/23	UPDATED PER MV XFMR SUBMITTAL
D	01/02/23	UPDATED EVERSOURCE CKT. NAMES
C	10/06/22	REISSUED FOR CONSTRUCTION
B	09/26/22	ISSUED FOR CONSTRUCTION
A	07/07/22	PRELIMINARY ISSUE

STATE OF CONNECTICUT ★ MECHANICAL ENGINEER ★ PROFESSIONAL ENGINEER

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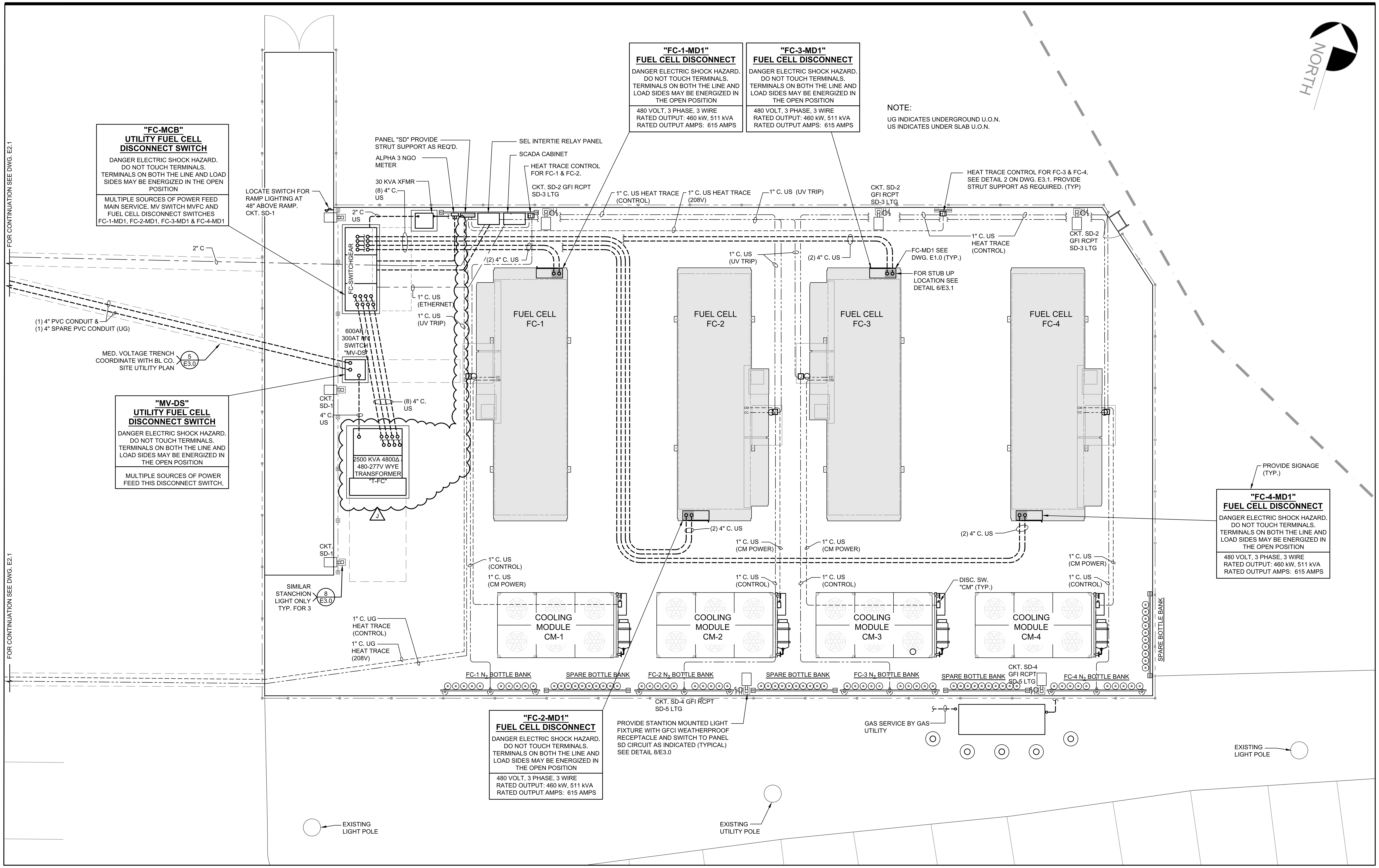
FUEL CELL INSTALLATION

ELECTRICAL ONE-LINE DIAGRAM

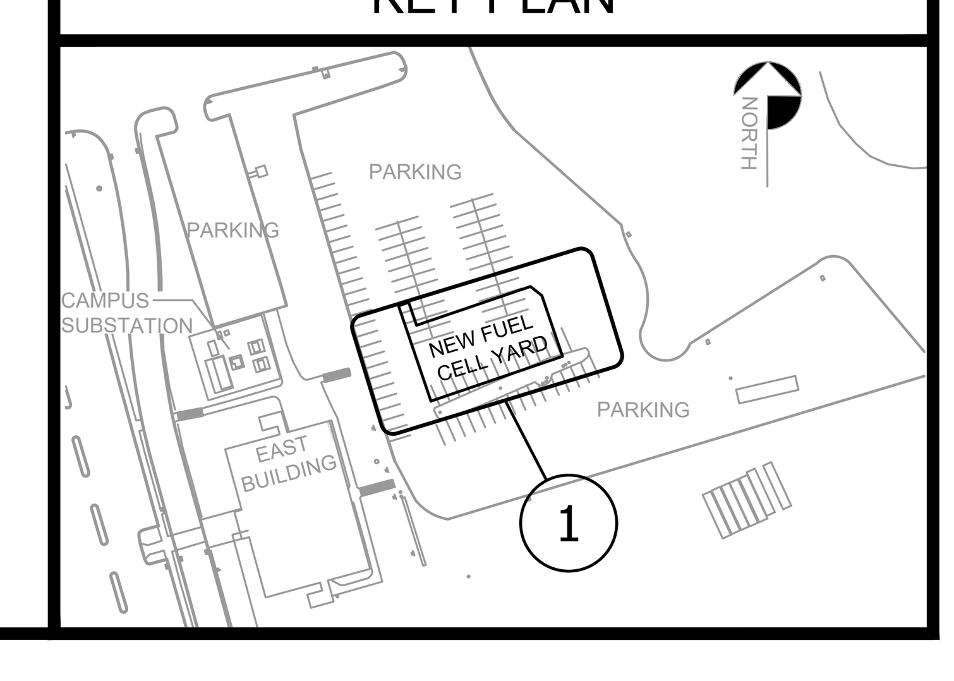
Project No.:	Drawn By: KFH
Date: 07/08/22	Design By: DSF
Scale: NTS	Check By: DSF

Drawing No.: **E1.0**



1 ELECTRICAL PARTIAL PLAN
Scale: 3/16" = 1'-0"

KEY PLAN



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FUEL CELL INSTALLATION
ELECTRICAL PARTIAL PLAN

Project No.:	Drawn By: KFH
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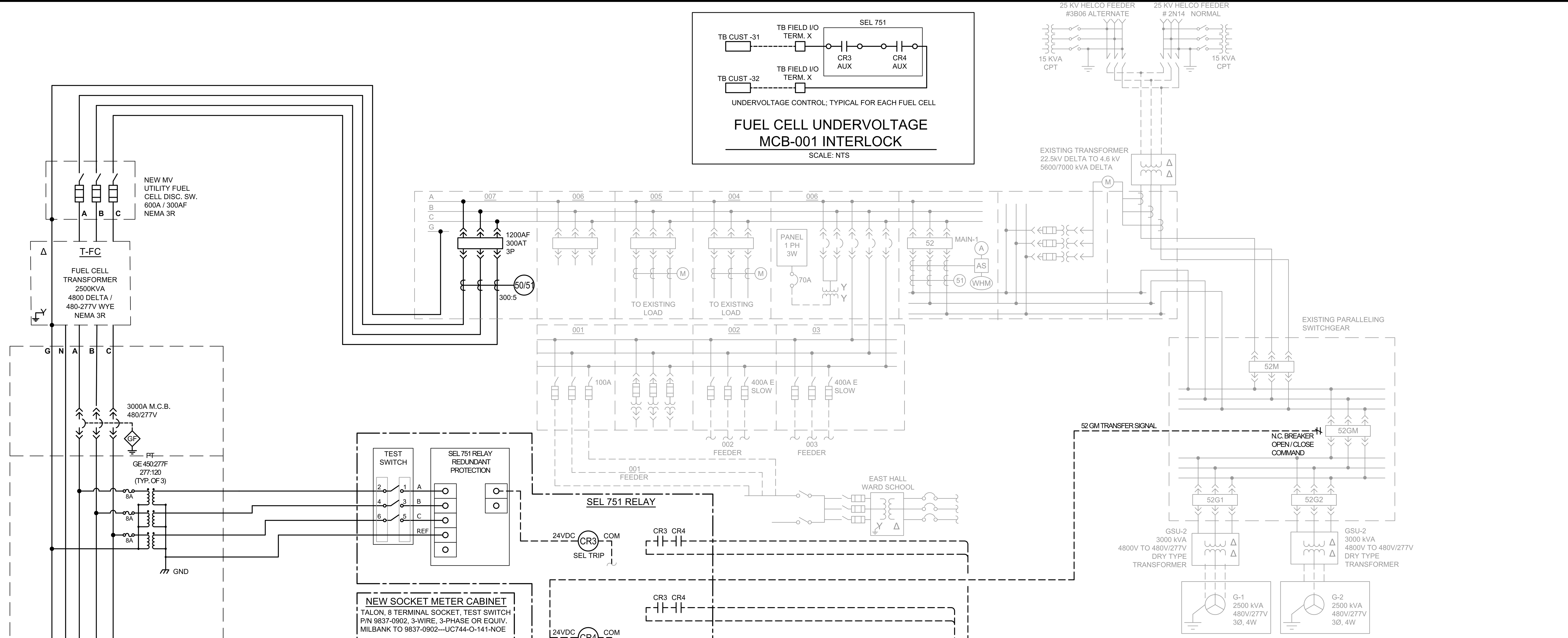

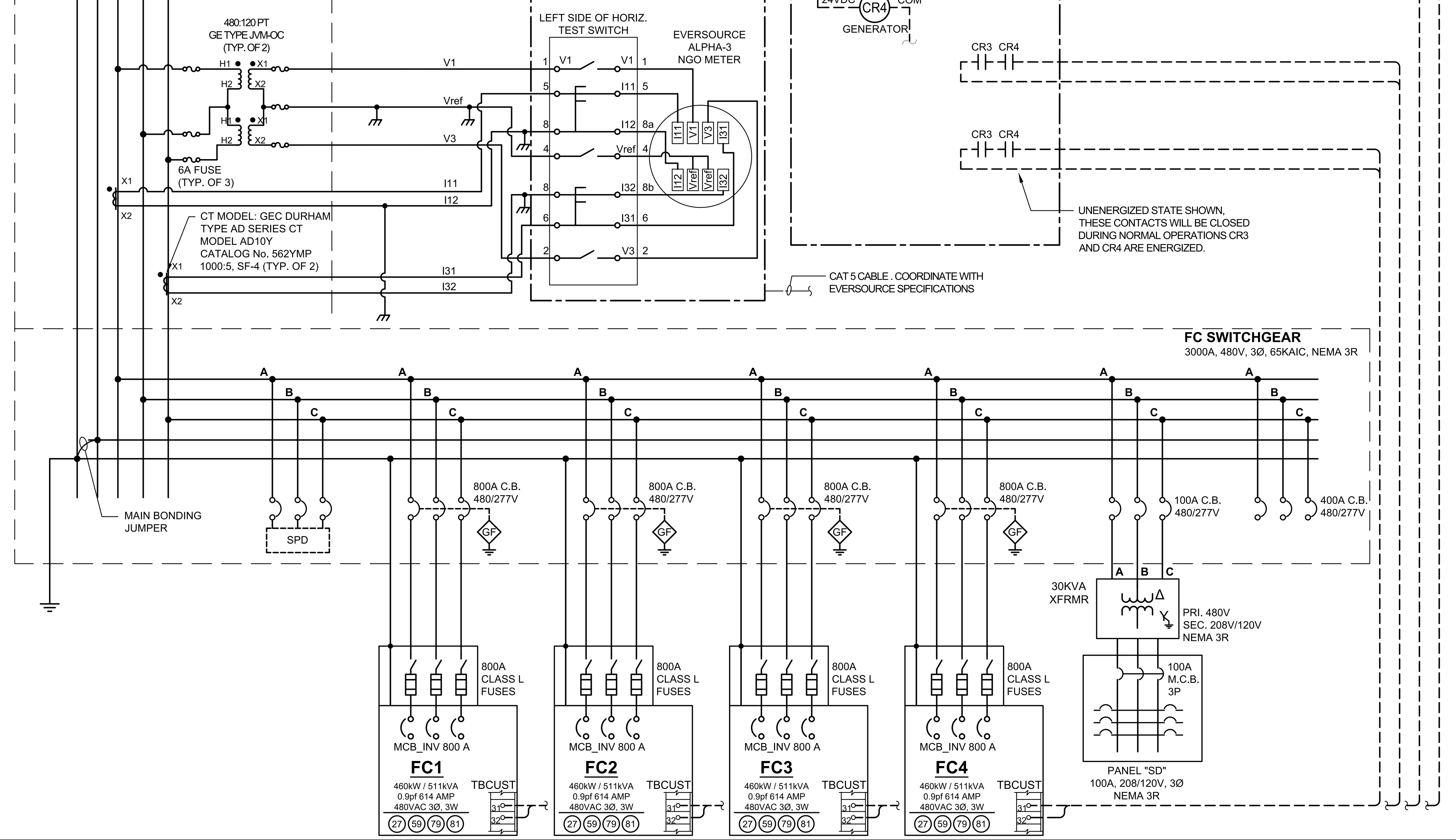

SEQUENCE OF OPERATION

FUEL CELL CONFIGURATION OVERVIEW: THE 4 PURECELL MODEL 400 UNITS AT THE UNIVERSITY OF HARTFORD ARE UL1741 SA CERTIFIED 460KW/511 KVA “DUAL MODE” FUEL CELLS THAT CAN OPERATE EITHER GRID-INTERACTIVE (AKA GRID CONNECTED) OR GRID-INDEPENDENT WITH THE ADDITION OF AN OPTIONAL HYAXIOM SUPPLIED “GRID INDEPENDENT (“GI”) SWITCHBOARD” WHICH CONTAINS A 52-B GRID TIE BREAKER AND A 52-A LOAD TIE BREAKER. AT UNIVERSITY OF HARTFORD IT WILL BE EMPLOYED ONLY AS GRID INTERACTIVE AND THE OPTIONAL GI SWITCHBOARD IS NOT PROVIDED.

SITE CONFIGURATION OVERVIEW:

THE UNIVERSITY OF HARTFORD IS SERVED BY TWO FEEDERS (#3806 NORMAL & 02N14 ALTERNATIVE) WHICH FEEDS A 5 KV SWITCHGEAR.

FOR GRID CONNECTED OPERATION, EACH FUEL CELL’S 3 PHASE, 3 WIRE 480 VOLT AC GRID OUTPUT TERMINALS ARE CONNECTED TO A 480 VOLT, 3 PHASE 4 WIRE 3000 AMP SWITCHBOARD VIA AN 800 AMP BRANCH CIRCUIT BREAKER. THIS SWITCHBOARD IS SUPPLIED BY A2500 KVA STEP-UP TRANSFORMER WITH A PRIMARY VOLTAGE OF 4800 V DELTA AND A SECONDARY VOLTAGE OF 480/277 VOLT GROUNDED WYE.

THE FUEL CELL IS INVERTER BASED AND WILL AUTOMATICALLY SYNCHRONIZE TO THE UTILITY GRID.

THE FUEL CELL CONTAINS ITS OWN UL1741SA CERTIFIED UTILITY VOLTAGE AND FREQUENCY PROTECTION UTILIZING A SCHWEITZER MODEL SEL547 RELAY CONNECTED TO AN 800 A DISCONNECTING CIRCUIT BREAKER.

EACH FUEL CELL HAS ITS OWN VISIBLE BREAK DISCONNECT SWITCH MD-1 TO ISOLATE THE FUEL CELL FROM THE UTILITY. THE FUEL CELLS CAN BE ISOLATED BY THE SWITCHBOARD’S MV SUPPLY TRANSFORMER’S PRIMARY DISCONNECT SWITCH.

A REDUNDANT INTERTIE RELAY IS PROVIDED TO MONITOR THE 3000A, 480V SWITCHBOARD WITH A TRIP SIGNAL TIED TO THE 3000A C.B.

MODES OF OPERATION

1. IDLE MODE: THE FUEL CELL IS ISOLATED FROM THE UTILITY. IN THIS MODE, THE FUEL CELL PRODUCES ELECTRICAL POWER FOR ITS INTERNAL LOADS BUT ITS AC OUTPUT TERMINALS ARE NOT ENERGIZED. IT’S INTERNAL OUTPUT BREAKER MCB_INV IS OPEN.

2. STARTUP: DURING STARTUP, THE PURECELL MODEL 400 UNITS EACH CONSUME APPROXIMATELY 158KW (APPROX. 70 KW AVERAGE) OF 480 VOLT 3 PHASE POWER FOR 5 HOURS THROUGH ITS GRID OUTPUT TERMINALS, WHICH ALSO SERVE AS INPUT TERMINALS DURING STARTUP. TYPICALLY THE 4 UNITS ARE NOT SIMULTANEOUSLY STARTED, SO THE 158KW REPRESENTS THE MAXIMUM STARTUP POWER CONSUMED AT ANY ONE MOMENT AS A SINGLE FUEL CELL IS BEING STARTED.

3. GRID-CONNECTED OPERATION: ONCE STARTED IN GRID-CONNECTED OPERATING MODE INTERNAL BREAKER MCB_INV IS CLOSED AND THE FUEL CELL DELIVERS UP TO 460 KW CONTINUOUSLY THROUGH ITS OUTPUT TERMINALS TO THE UNIVERSITY'S MV DISTRIBUTION SYSTEM SWITCHBOARD. FROM THERE THE POWER WILL BE EXPORTED TO EVERSOURCE.

FUEL CELL PROTECTION:

EACH MODEL 400 FUEL CELL SYSTEM EMPLOYS ITS OWN UL 1741 SA CERTIFIED GRID PROTECTION WITH AN SEL547 RELAY. THERE IS ALSO A REDUNDANT SITE INTERTIE RELAY IN THE MV SWITCHGEAR THAT WILL TRIP THE FUEL CELL OFFLINE BY OPENING THE MEDIUM VOLTAGE 52 BREAKER.

THE FUEL CELL IS INVERTER BASED AND WILL AUTOMATICALLY SYNCHRONIZE TO THE UTILITY GRID.

LOSS OF UTILITY SUPPLY: THE FUEL CELL’S UL1741 CERTIFIED PROTECTION (USING AN SEL547 RELAY) DETECTS THE LOSS OF COMMERCIAL POWER AUTOMATICALLY AND ISOLATES THE FUEL CELL FROM THE UTILITY. THE REDUNDANT SITE PROTECTION RELAY PERFORMS THE SAME FUNCTION AND SENDS A TRIP SIGNAL TO EACH FUEL CELL. UPON ISOLATING FROM THE UTILITY, THE FUEL CELL IS IN IDLE MODE WITH ITS INTERNAL BREAKER MCB_INV OPEN.

RETURN TO GRID CONNECTED MODE: UPON RESTORATION OF GRID POWER, EACH FUEL CELL WILL DETECT COMMERCIAL POWER, AUTOMATICALLY SYNCHRONIZE, RECONNECT (RECLOSE MCB_INV) AND RETURN TO PARALLEL OPERATION AFTER A 5-MINUTE DELAY AND ALSO RESET OF THE EXTERNAL REDUNDANT PROTECTION RELAY. UPON RECONNECTION WITH THE UTILITY, EACH FUEL CELL WILL BEGIN AT 0KW AND INCREASE POWER AT 10KW/SECOND BACK TO THE DISPATCH SETTING OF 460KW.

SHUTDOWN: UPON OPERATOR SELECTION OF A MANUAL SHUTDOWN, OR AUTOMATIC SHUTDOWN DUE TO CERTAIN INTERNAL POWER PLANT PROTECTION EQUIPMENT, THE POWER PLANT WILL CEASE PRODUCING ELECTRICAL POWER. ITS INTERNAL OUTPUT BREAKER MCB_INV WILL OPEN AND THE GAS SUPPLY WILL SHUT OFF. AT THIS POINT THE POWER PLANT BEINGS AN AUTOMATIC “COOL DOWN” DURING WHICH THE CSA COOLANT TEMPERATURE IS REDUCED FROM ITS 350 DEGREE OPERATING TEMPERATURE BACK TO ITS 130 DEGREE STANDBY TEMPERATURE. COOL DOWN IS ACCOMPLISHED BY REJECTING HEAT TO THE POWER PLANT COOLING MODULE. DURING THIS COOL DOWN, THE POWER PLANT WILL CONSUME ABOUT 6 TO 25 KW OF PARASITE POWER FOR ITS COOLING PUMPS, ELECTRIC HEATERS, AND FANS

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F	07/31/23	UPDATED PER FLOOD COMM. REQUESTS
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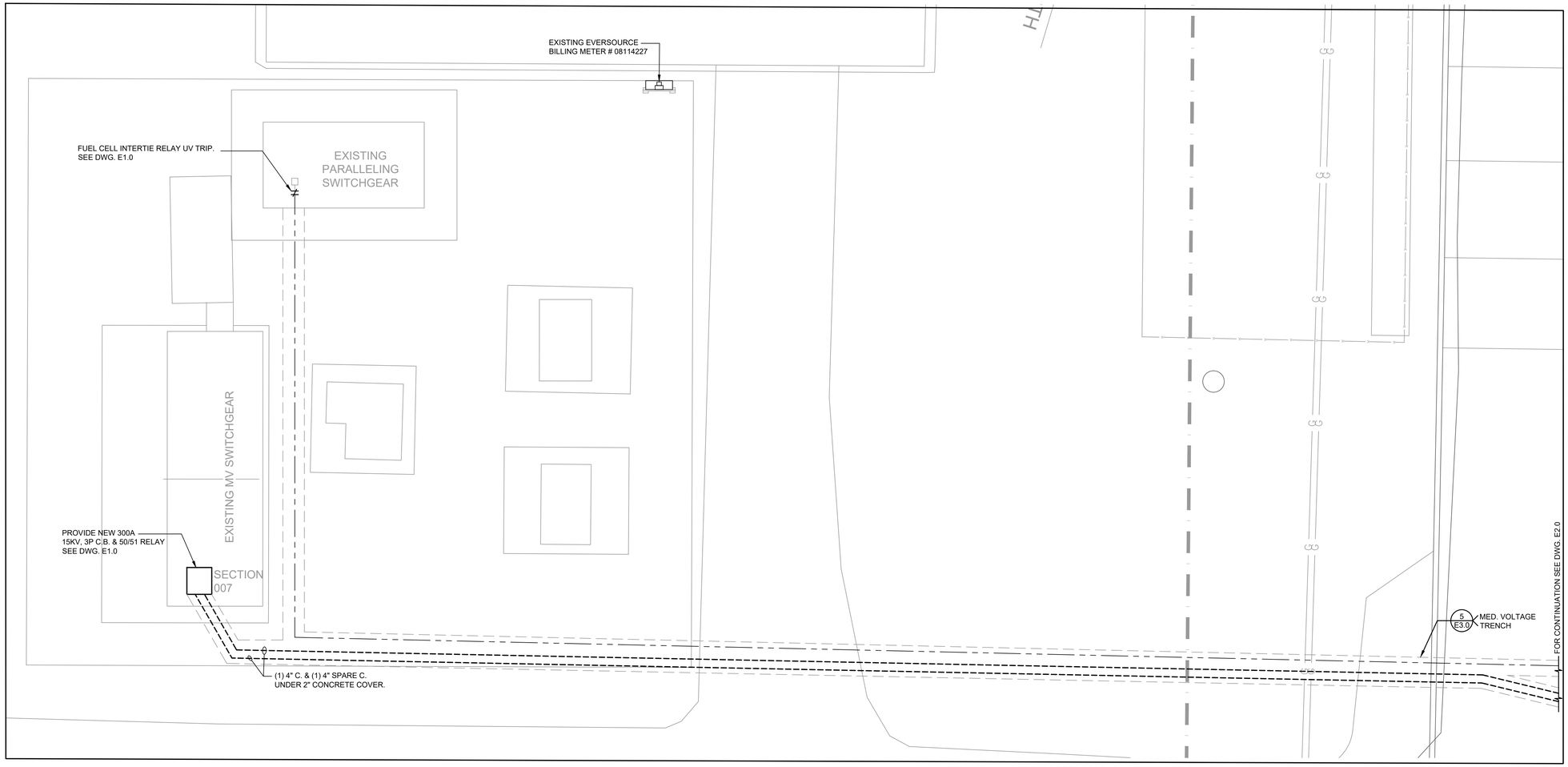
FUEL CELL INSTALLATION

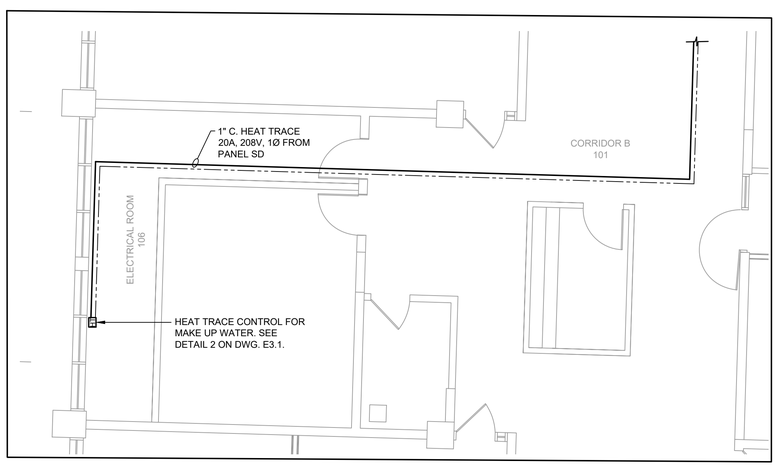
ELECTRICAL THREE-LINE DIAGRAM

Project No.:
Drawn By: KFH
Date: 07/08/22
Design By: DSF
Scale: NTS
Check By: DSF
Drawing No.: E1.1



① ELECTRICAL PARTIAL PLAN

Scale: 3/16" = 1'-0"



③ ELECTRICAL PARTIAL PLAN

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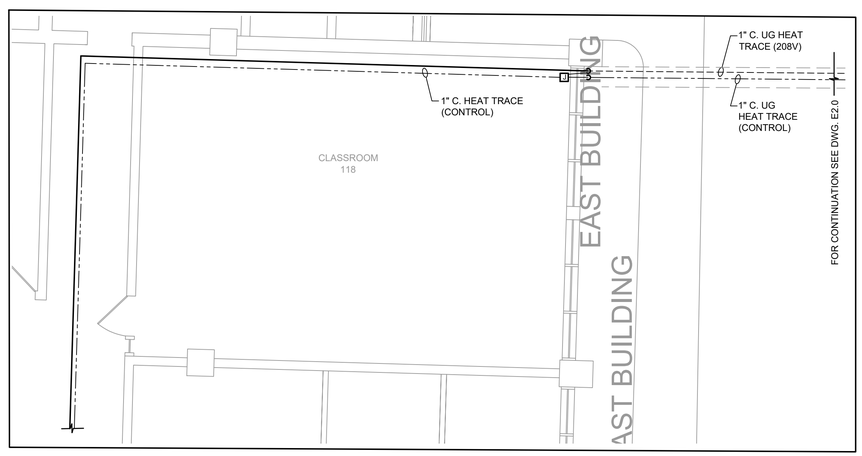
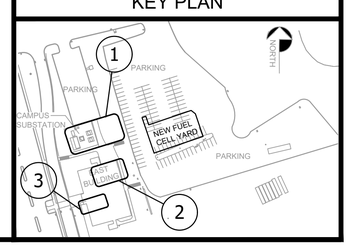


② ELECTRICAL PARTIAL PLAN

Scale: 3/16" = 1'-0"

KEY PLAN



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SCOTT D FITCH
0019780

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ELECTRICAL PARTIAL PLAN

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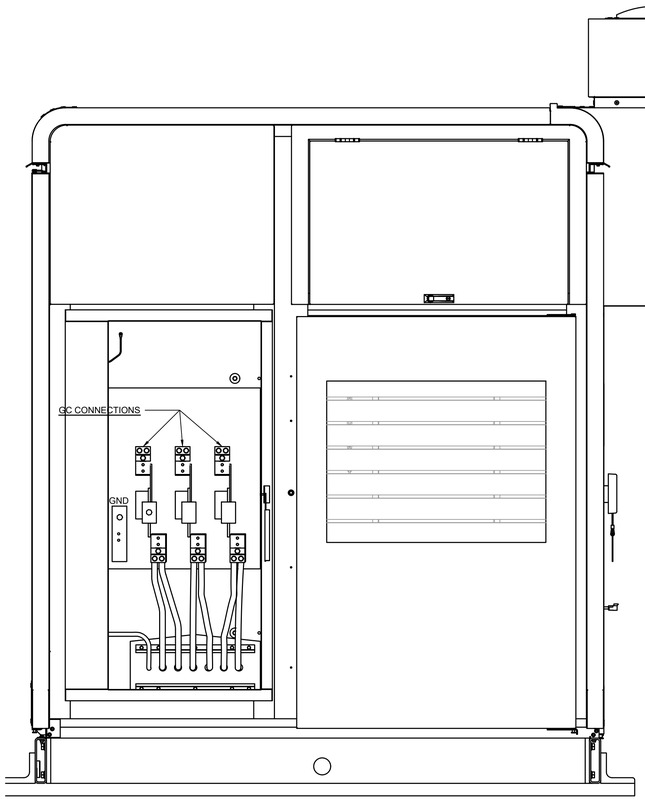
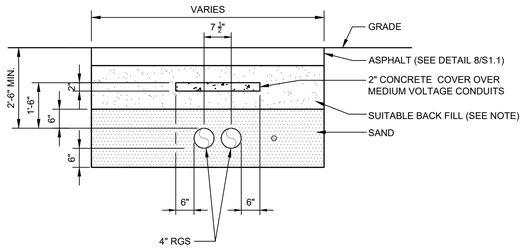
Drawing No.:
E2.1

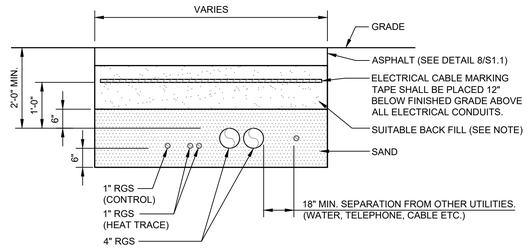


7 OUTPUT POWER INTERFACE
SCALE: NTS



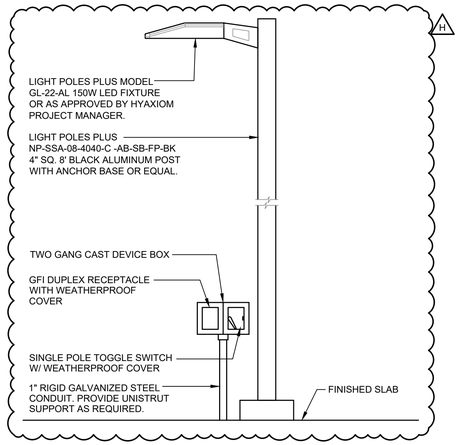
NOTE:
1. SUITABLE BACKFILL SHALL NOT CONTAIN SHARP STONES, ASHES, CINDERS, SHELL, FROZEN MATERIAL. LOOSE DEBRIS OR STONE LARGER THAN 2" IN DIAMETER.

5 MEDIUM VOLTAGE UNDERGROUND CONDUIT TRENCH DETAIL
SCALE: NTS

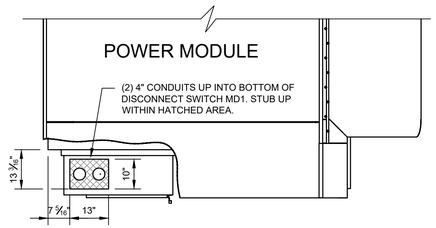


NOTE:
1. SUITABLE BACKFILL SHALL NOT CONTAIN SHARP STONES, ASHES, CINDERS, SHELL, FROZEN MATERIAL. LOOSE DEBRIS OR STONE LARGER THAN 2" IN DIAMETER.
2. UNDERGROUND CONDUIT CAN BE SCHEDULE 40 PVC WITH RGS STUBBED UP TO CONNECTION POINT (TYPICAL)

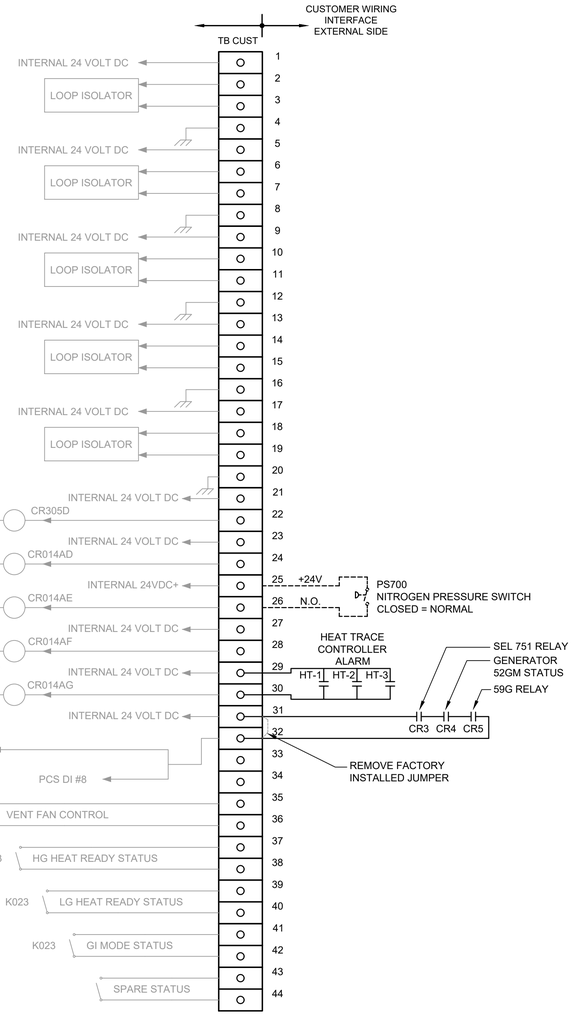
4 TYP. UNDERGROUND CONDUIT TRENCH DETAIL
SCALE: NTS



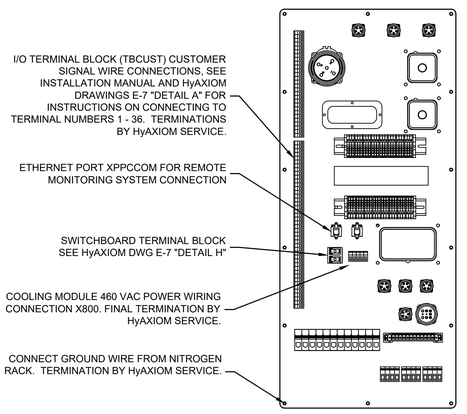
8 STANCHION MTD LIGHT/RECEPTACLE
SCALE: NTS



6 GC CONDUIT STUB UP LOCATION DETAIL
SCALE: NTS



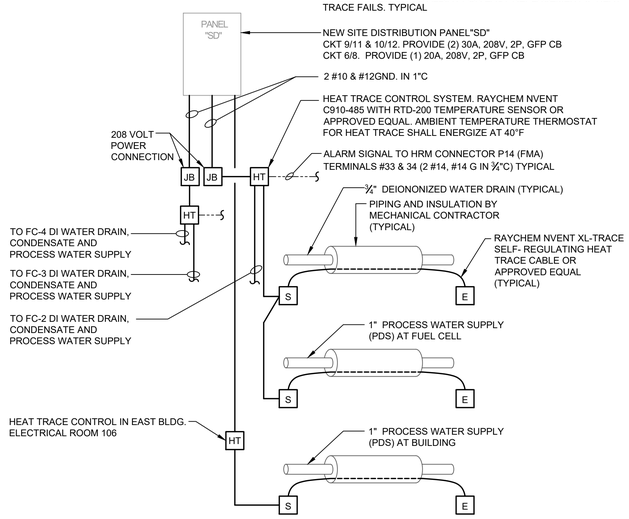
1 FUEL CELL MODEL 400 TB CUST I/O TERMINAL BLOCK CONNECTIONS
SCALE: NTS



TERMINAL BLOCK LAYOUT MAY VARY BASED ON POWER MODULE SERIAL NUMBER. LEAVE 15 FEET OF COILED AND LABELED WIRES, (CONTROL WIRES, 120 VAC, AND 460 VAC POWER WIRES) INSIDE THE POWER MODULE AT OPENINGS "CC", "R" AND "CM" RESPECTIVELY, FOR FINAL TERMINATION BY HyAXIOM.

3 SIGNAL WIRE CONNECTIONS WORK BY HyAXIOM
SCALE: NTS

NOTE:
1. HEAT TRACE IS REQUIRED ON ALL PIPING EXPOSED TO AMBIENT CONDITIONS STARTING AT THE PIPE RISE FROM THE BOTTOM OF THE TRENCH, NOT ON PIPE WHEN BURIED AT 5'-0" DEEP. TYPICAL
2. HEAT TRACE SHALL BE INSTALLED IN TUBE OF PREINSULATED PIPE IN A FASHION TO ALLOW FOR EASY REPLACEMENT IF HEAT TRACE FAILS. TYPICAL



2 HEAT TRACE DETAIL
SCALE: NTS

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ELECTRICAL DETAILS

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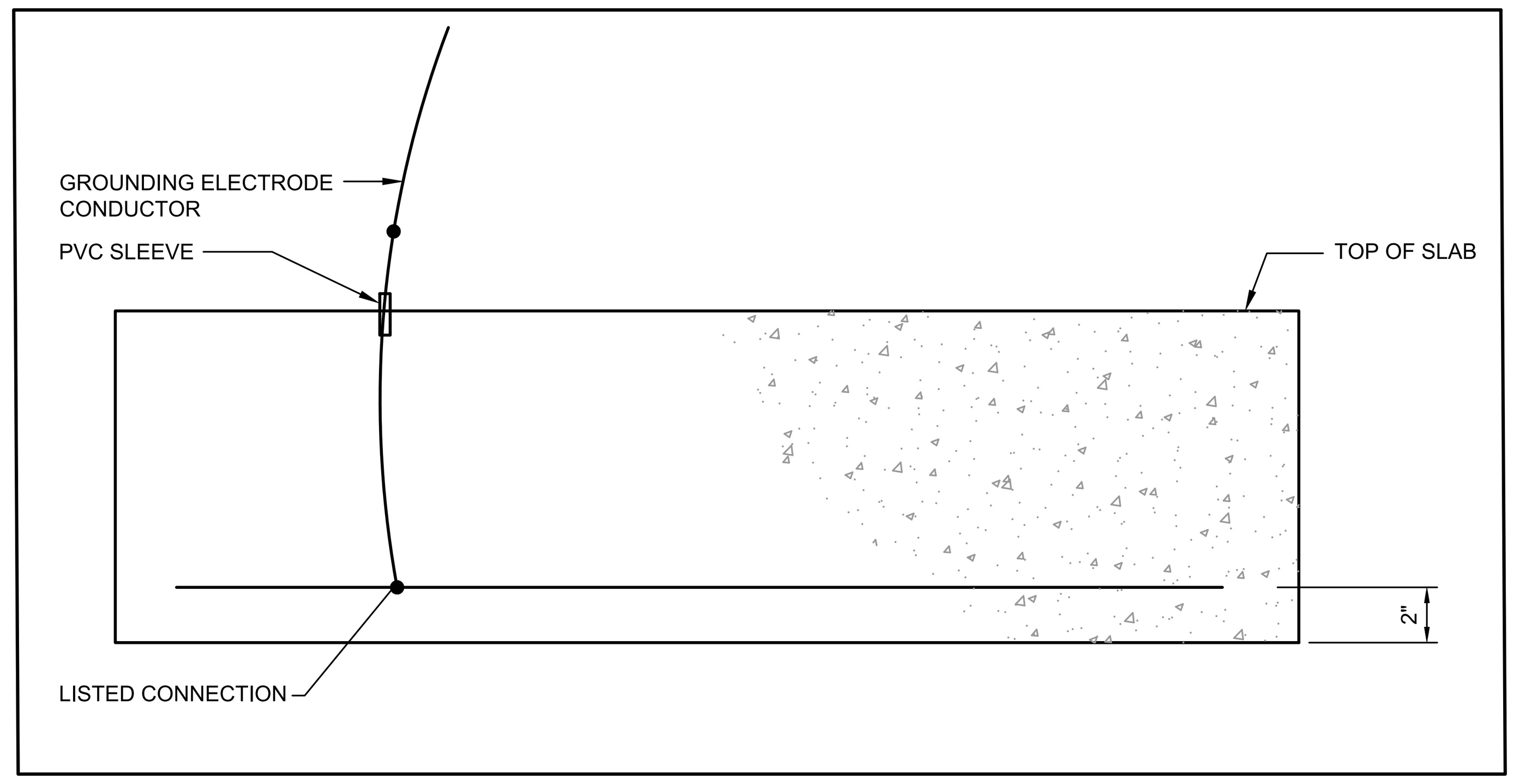
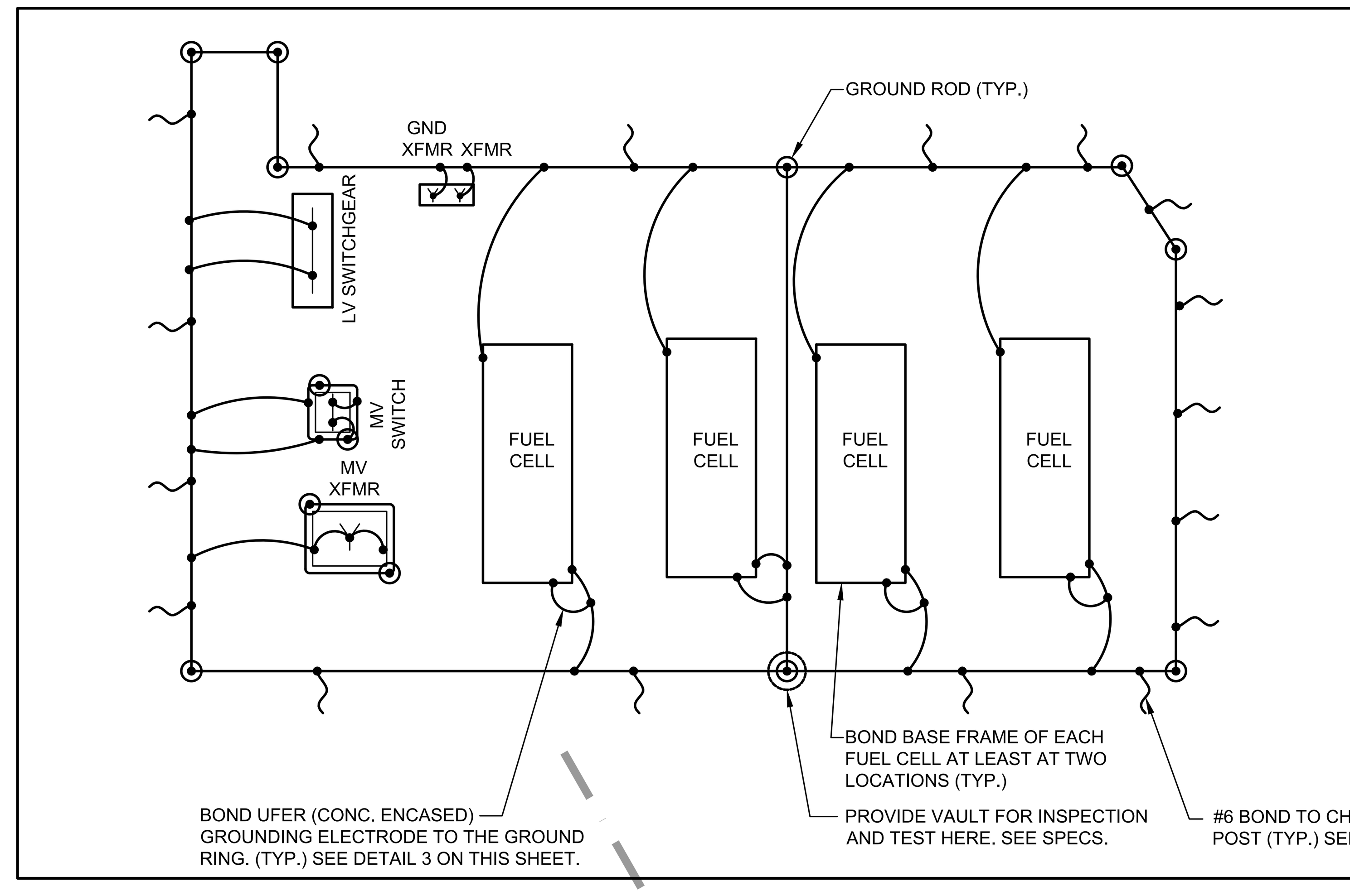
Drawing No.:
E3.0



3 CONC. ENCASED ELECTRODE IN CONC. SLAB

Scale: N.T.S.

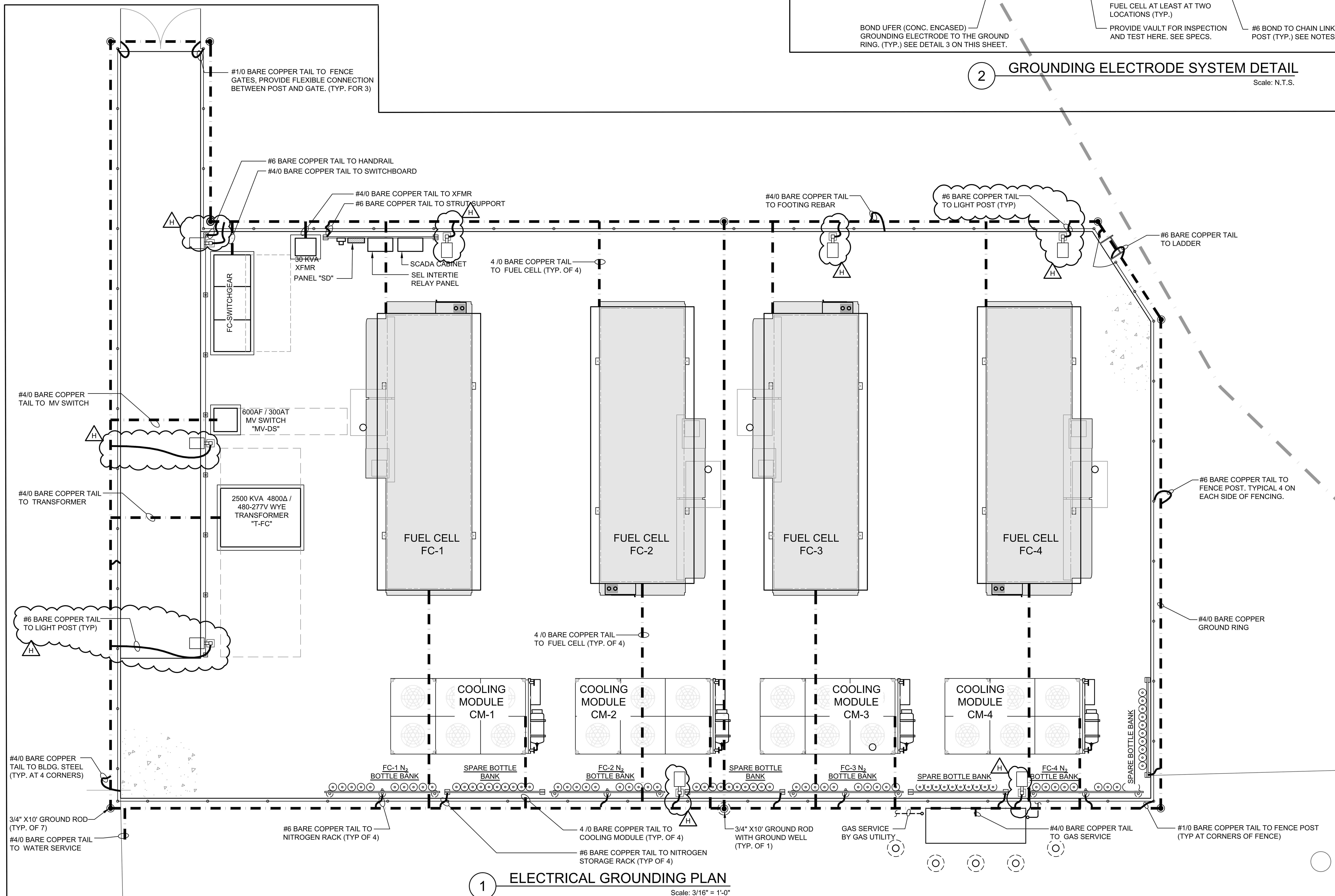


2 GROUNDING ELECTRODE SYSTEM DETAIL

Scale: N.T.S.

GROUNDING DETAIL NOTES:

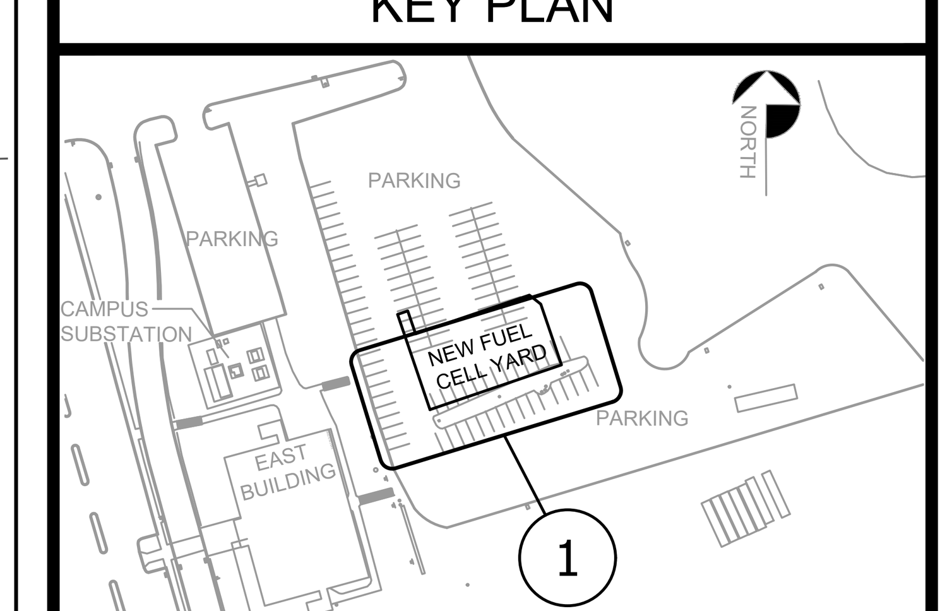
1. GROUND RING CONDUCTOR SIZE SHALL BE #4/0 AWG BARE, COPPER, U.N.O. BURIED AT LEAST 24" BELOW GRADE.
2. ALL GROUNDING ELECTRODE CONDUCTORS FROM GROUNDING RING TO THE EQUIPMENT GROUND BUS SHALL BE #3/0 AWG MIN.
3. CONNECTORS SHALL BE MECHANICAL, HI-PRESS, UL LISTED FOR INTENDED USE.
4. GROUND RODS SHALL BE 3/4"Ø x 10 FT. COPPER CLAD STEEL.
5. MINIMUM DISTANCE BETWEEN ADJACENT GROUND RODS IS 10 FT. MAXIMUM 50 FT.
6. GROUND RING IS INSTALLED ALONG THE WALL PERIMETER.
7. BOND CHAIN LINK FENCE POSTS TO THE GROUND RING USING #6 BARE COPPER CONDUCTORS, AT NO MORE THAN 40 FT SPACING.
8. COMPLY WITH NEC 250.
9. TEST GROUNDING ELECTRODE SYSTEM PER NETA-ATS USING FALL OF POTENTIAL METHOD. AUGMENT GROUNDING ELECTRODE SYSTEM UNTIL SATISFACTORY RESULTS ARE ACHIEVED. (LESS THAN 3 OHMS GROUND RESISTANCE)



1 ELECTRICAL GROUNDING PLAN

Scale: 3/16" = 1'-0"

KEY PLAN



Rev.	Date	Description
H	08/22/23	UPDATED PER HYAXIOM COMMENTS
F	07/31/23	UPDATED PER FLOOD COMM. REQUESTS
D	01/02/23	UPDATED EVERSOURCE CKT. NAMES
C	10/06/22	REISSUED FOR CONSTRUCTION
B	09/26/22	ISSUED FOR CONSTRUCTION
A	07/07/22	PRELIMINARY ISSUE

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ELECTRICALGROUNDING PLAN & DETAILS

Project No.:	Drawn By: KFH
Date: 07/08/22	Design By: DSF
Scale: NTS	Check By: DSF

Drawing No.:

E3.1

BASIC ELECTRICAL REQUIREMENTS

A. NOTES

1. DRAWINGS AND GENERAL PROVISIONS OF CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND ALL OTHER SPECIFICATION SECTIONS, APPLY TO THIS SECTION.

2. THE CONTRACTOR FOR THIS WORK IS REQUIRED TO READ THE SPECIFICATIONS AND REVIEW DRAWINGS FOR ALL DIVISIONS OF WORK AND IS RESPONSIBLE FOR THE COORDINATION OF THIS WORK AND THE WORK OF ALL DIVISIONS. IT IS THIS CONTRACTOR'S RESPONSIBILITY TO PROVIDE SUBCONTRACTORS WITH A COMPLETE SET OF BID DOCUMENTS.

3. THE CONTRACTOR IS RESPONSIBLE FOR SCHEDULING THE COMPLETION AND INSPECTION OF THIS WORK AND THE SUBCONTRACTORS WORK TO COMPLY WITH OWNER'S SCHEDULE AND THE PROJECT COMPLETION DATE.

4. THE CONTRACTOR SHALL VISIT THE SITE PRIOR TO SUBMITTAL OF BID TO DETERMINE CONDITIONS AFFECTING THE WORK. ANY ITEMS WHICH ARE NOT COVERED IN THE BID DOCUMENTS OR ANY PROPOSED SUBSTITUTIONS SHALL BE LISTED SEPARATELY AND QUALIFIED IN THE CONTRACTOR'S BID. SUBMITTAL OF BID SHALL SERVE AS EVIDENCE OF KNOWLEDGE OF EXISTING CONDITIONS AND ANY MODIFICATIONS WHICH ARE REQUIRED TO MEET THE INTENT OF THE DRAWINGS AND SPECIFICATIONS. FAILURE TO VISIT THE SITE DOES NOT RELIEVE THE CONTRACTOR OF RESPONSIBILITY IN PERFORMANCE OF WORK.

B. GENERAL REQUIREMENTS

1. THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, EQUIPMENT, SERVICES, TOOLS, TRANSPORTATION, INCIDENTALS AND DETAILS NECESSARY TO PROVIDE COMPLETE ELECTRICAL SYSTEMS AS SHOWN ON THE DRAWINGS, CALLED FOR IN THE SPECIFICATIONS, AND AS REQUIRED BY JOB CONDITIONS. ALL WORK NOT SPECIFICALLY NOTED AS BEING BY POWER COMPANY SHALL BE PROVIDED BY THE ELECTRICAL CONTRACTOR. CLOSELY COORDINATE THE ENTIRE INSTALLATION WITH THE POWER COMPANY AND WITH DOOSAN AS REQUIRED. FURNISH AND INSTALL EQUIPMENT THAT IS RATED FOR AVAILABLE FAULT CURRENT LEVELS. FURNISH AND INSTALL "CABLE LIMITERS" IF NECESSARY TO LIMIT FAULT CURRENT. FIELD VERIFY THE EXACT TYPE, SIZE, LOCATION, REQUIREMENTS, ETC. OF EXISTING POWER AND TELEPHONE FACILITIES PRIOR TO SUBMISSION OF BID.

2. ALL MATERIALS, PRODUCTS, AND EQUIPMENT, INCLUDING ALL COMPONENTS THEREOF, SHALL BE NEW. RECONDITIONED OR RE-CERTIFIEDEQUIPMENT SHALL NOT BE USED UNLESS SPECIFICALLY APPROVED BY DOOSAN. EQUIPMENT SHALL BE UNDERWRITERS LABORATORIES LISTED FOR IT'S APPLICATION, AND BEAR THE UL LABEL. EQUIPMENT SHALL BE SIZED IN CONFORMITY WITH REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE, STATE AND LOCAL CODES, WHICHEVER IS MORE STRINGENT.

3. THE DRAWINGS AND SPECIFICATIONS ARE INTENDED TO SUPPLEMENT EACH OTHER AND ANY MATERIAL OR LABOR CALLED FOR IN ONE SHALL BE PROVIDED EVEN THOUGH NOT SPECIFICALLY MENTIONED IN BOTH. ANY MATERIAL OR LABOR WHICH IS NEITHER SHOWN ON THE DRAWINGS NOR CALLED FOR IN THE SPECIFICATIONS, BUT WHICH IS OBVIOUSLY NECESSARY TO COMPLETE THE WORK OR WHICH IS USUALLY INCLUDED IN WORK OF SIMILAR CHARACTER, SHALL BE PROVIDED AS PART OF CONTRACT.

4. WHERE THE DRAWINGS OR SPECIFICATIONS CALL FOR ITEMS WHICH EXCEED CODES. THE CONTRACTOR IS RESPONSIBLE FOR FURNISHING AND INSTALLING THE SYSTEM WITH THE MORE STRINGENT REQUIREMENTS AS DESIGNED AND DESCRIBED ON THESE DRAWINGS, UNLESS NOTED OTHERWISE.

5. ALL ELECTRICAL WORK SHALL BE INSTALLED SO AS TO BE READILY ACCESSIBLE FOR OPERATING, SERVICING, MAINTAINING AND REPAIRING. THIS CONTRACTOR IS RESPONSIBLE FOR PROVIDING SUFFICIENT SERVICE ACCESS TO ALL EQUIPMENT.

6. THE CONTRACTOR SHALL DO ALL CUTTING, CHASING, OR CHANNELING AND PATCHING REQUIRED FOR ANY WORK UNDER THIS DIVISION. ALL CUTTING SHALL HAVE PRIOR APPROVAL BY THE OWNER. ALL PATCHING IS TO MATCH SURROUNDING SURFACES.

7. EXISTING MANHOLE MAY HAVE STANDING WATER. PLAN ON PUMPING OUR THE WATER AS NECESSARY. COMPLY WITH APPLICABLE OSHA SAFETY REQUIREMENTS FOR WORKING IN A MANHOLE.
8. EXCAVATION: COORDINATE WITH EXISTING UNDERGROUND INSTALLATION. USE SERVICES OF CALL BEFORE YOU DIG OR SIMILAR. EXCAVATE WITH CARE AND BY HAND WHERE NECESSARY, ESPECIALLY EXCAVATING NEAR ELECTRICAL LINES AND GAS PIPING.

9. THE CONTRACTOR SHALL MAKE ALL FINAL ELECTRICAL CONNECTIONS AS REQUIRED FOR A COMPLETE AND OPERATING SYSTEM.

C. TEMPORARY LIGHT AND POWER

1. THE CONTRACTOR SHALL FURNISH AND INSTALL ALL TEMPORARY WIRING AND RELATED GROUND FAULT INTERRUPTION PROTECTION FOR LIGHT AND FOR ALL CONTRACTORS POWER REQUIREMENTS AND IS RESPONSIBLE FOR IT'S REMOVAL.

D. CODES

1. ALL WORK SHALL BE PERFORMED IN A NEAT AND PROFESSIONAL MANNER AND CONFORM TO THE LATEST ADOPTED EDITION OF THE NATIONAL ELECTRICAL CODE, THE STATE'S, COUNTY'S, CITY'S AND LOCAL CODES AND ORDINANCES, SAFETY AND HEALTH CODES, NFPA CODES, ENERGY CODES, AND ALL OTHER APPLICABLE CODES AND REQUIREMENTS. THE CONTRACTOR SHALL INQUIRE INTO AND COMPLY WITH ALL APPLICABLE CODES, ORDINANCES, AND REGULATIONS. THE CONTRACTOR SHALL INCLUDE ANY CHANGES REQUIRED BY CODES IN THE BID AND IF THESE CHANGES ARE NOT INCLUDED IN THE BID, THEY MUST BE QUALIFIED AS A SEPARATE LINE ITEM IN THE BID. AFTER CONTRACT IS ISSUED, NO ADDITIONAL COST DUE TO CODE ISSUES SHALL BE REIMBURSED TO THE CONTRACTOR.
2. COMPLY WITH 2022 STATE OF CONNECTICUT BUILDING CODE AND NEC 2020 AND APPLICABLE AMENDMENTS.

E. LICENSES, PERMITS, INSPECTIONS AND FEES

1. THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL LICENSES, PERMITS, INSPECTIONS, AND FEES REQUIRED OR RELATED TO HIS WORK.

2. FURNISH TO OWNER ALL CERTIFICATES OF INSPECTION AND FINAL INSPECTION APPROVAL AT COMPLETION OF PROJECT.

F. TRADE NAMES, MANUFACTURERS AND SHOP DRAWINGS

1. WHERE TRADE NAMES AND MANUFACTURERS ARE USED ON THE DRAWINGS OR IN THE SPECIFICATIONS, THE EXACT EQUIPMENT SHALL BE USED AS A MINIMUM FOR THE BASE BID. MANUFACTURERS CONSIDERED AS AN EQUAL OR BETTER IN ALL ASPECTS TO THAT SPECIFIED WILL BE SUBJECT TO APPROVAL IN WRITING, THROUGH SHOP DRAWING SUBMITTAL PROCESS, BY THE CONSTRUCTION MANAGER PRIOR TO ACCEPTANCE. THE USE OF ANY UNAUTHORIZED EQUIPMENT SHALL BE SUBJECT TO REMOVAL AND REPLACEMENT AT THE CONTRACTOR'S EXPENSE.

2. THE CONTRACTOR SHALL PROVIDE SUBMITTALS FOR ALL EQUIPMENT TO DOOSAN/OWNER FOR APPROVAL. SUBMISSIONS SHALL BE MADE EARLY ENOUGH IN PROJECT TO ALLOW FOR (7) WORKING DAYS FOR DOOSAN AND ENGINEER REVIEW WITHOUT CAUSING DELAYS OR CONFLICTS TO THE JOB'S PROGRESS. SUBMITTALS SHALL BEAR THE STAMP OF THE ARCHITECT/ENGINEER OFFICE AND SUB-CONTRACTOR SHOWING THAT HE HAS REVIEWED AND CONFIRMED THAT THE SUBMITTALS ARE IN CONFORMANCE WITH THE CONTRACT DRAWINGS AND SPECIFICATIONS OR INDICATE WHERE EXCEPTIONS HAVE BEEN TAKEN.

G. GUARANTEE

1. THE CONTRACTOR SHALL GUARANTEE ALL MATERIALS AND WORK PROVIDED UNDER HIS CONTRACT AND SHALL MAKE GOOD, REPAIR OR REPLACE AT HIS OWN EXPENSE, ANY DEFECTIVE WORK, MATERIAL, REQUIREMENT WHICH MAY BE DISCOVERED WITHIN A PERIOD OF 12 MONTHS FROM THE DATE OF ACCEPTANCE (IN WRITING) OF THE INSTALLATION BY THE OWNER. EXTENDED WARRANTIES ARE SPECIFIED WITH INDIVIDUAL EQUIPMENT.

H. RECORD DRAWINGS

1. THE CONTRACTOR SHALL MAINTAIN ONE COPY OF DRAWINGS ON THE JOB SITE TO RECORD DEVIATIONS FROM CONTRACT DRAWINGS, SUCH AS:
   a. LOCATION OF JUNCTION BOXES AND RECEPTACLES.
   b. LOCATION OF ALL HOMERUNS SHOWING WIRE/CONDUIT SIZES.
   c. REVISIONS, ADDENDUMS, AND CHANGE ORDERS.
   d. SIGNIFICANT DEVIATIONS MADE NECESSARY BY FIELD CONDITIONS, APPROVED EQUIPMENT SUBSTITUTIONS, AND CONTRACTOR'S COORDINATION WITH OTHER TRADES.

2. AT COMPLETION OF PROJECT AND BEFORE FINAL APPROVAL, THE CONTRACTOR SHALL MAKE ANY FINAL CORRECTIONS TO DRAWINGS AND CERTIFY THE ACCURACY OF EACH PRINT BY SIGNATURE THEREON.

3. A COPY OF THESE ASBUILT DRAWINGS WILL BE GIVEN TO DOOSAN / OWNER.

I. DISCREPANCIES IN DOCUMENTS

1. DRAWINGS (PLANS, SPECIFICATIONS, AND DETAILS) ARE DIAGRAMMATICAL AND INDICATE THE GENERAL LOCATION AND INTENT OF THE ELECTRICAL SYSTEMS. WHERE DRAWINGS, EXISTING SITE CONDITIONS, SPECIFICATIONS OR OTHER TRADES CONFLICT OR ARE UNCLEAR, ADVISE THE CONSTRUCTION MANAGER IN WRITING PRIOR TO SUBMITTAL OF BID. OTHERWISE,OWNER'S INTERPRETATION OF CONTRACT DOCUMENTS OR COMMENTS SHALL BE FINAL WITH NO ADDITIONAL COMPENSATION PERMITTED.

2. THE LOCATION OF OUTLETS AND EQUIPMENT SHOWN ON THE DRAWINGS ARE APPROXIMATE AND SCHEMATIC IN NATURE. OWNER SHALL HAVE THE RIGHT TO RELOCATE ANY OUTLETS OR FIXTURES BEFORE THEY ARE INSTALLED WITHOUT ADDITIONAL COST.

3. HOMERUNS SHOWN ARE SCHEMATIC. ELECTRICAL CONTRACTOR MAY ORIGINATE HOMERUNS FROM DIFFERENT LOCATIONS.

J. DEMOLITION

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE COORDINATION OF EQUIPMENT REMOVAL AND EXISTING WORK . COORDINATE WITH OWNER, EXISTING EQUIPMENT REQUIRED TO BE LEFT INTACT.

K. SLEEVES

1. THE CONTRACTOR SHALL PROVIDE SLEEVES TO PROTECT EQUIPMENT OR FACILITIES IN THE INSTALLATION. EACH SLEEVE SHALL EXTEND THROUGH IT'S RESPECTIVE FLOOR, WALL OR PARTITION AND SHALL BE CUT FLUSH WITH EACH SURFACE EXCEPT SLEEVES THAT PENETRATE THE FLOOR, WHICH SHALL EXTEND 4" ABOVE THE FLOOR.

2. ALL SLEEVES AND OPENINGS THROUGH FIRE RATED WALLS AND/OR FLOORS SHALL BE FIRE SEALED WITH CALCIUM SILICATE, SILICONE "RTV" FOAM, "3M" FIRE RATED SEALANTS OR EQUAL, SO AS TO RETAIN THEIR FIRE RATING.

3. SLEEVES IN BEARING AND MASONRY WALLS, FLOORS AND PARTITIONS SHALL BE STANDARD WEIGHT STEEL PIPE FINISHED WITH SMOOTH EDGES. FOR OTHER THAN MASONRY PARTITIONS, THROUGH SUSPENDED CEILINGS, OR FOR CONCEALED VERTICAL CONDUIT, SLEEVES SHALL BE NO. 22 U.S.G. GALVANIZED STEEL MINIMUM.

L. HANGERS

1. HANGERS SHALL INCLUDE ALL MISCELLANEOUS STEEL SUCH AS IRON, WIRE, UNISTRUT, C-CLAMPS WITH RETAINING CLIPS, CHANNELS, HANGER RODS, ETC., NECESSARY FOR THE INSTALLATION OF WORK.

2. HANGERS SHALL BE FASTENED TO BUILDING STEEL, CONCRETE, OR MASONRY, BUT NOT TO OTHER CONDUIT OR PIPING. HANGERS UPPER ATTACHMENT MUST BE SUPPORTED FROM THE TOP OF THE BAR JOIST. HANGING FROM METAL DECK IS NOT PERMITTED. WHERE INTERFERENCE OCCUR, IN ORDER TO SUPPORT CONDUIT, THE CONTRACTOR MUST INSTALL TRAPEZE TYPE HANGERS OR SUPPORTS WHICH SHALL BE LOCATED WHERE THEY DO NOT INTERFERE WITH ACCESS TO FIRE DAMPERS, VALVES, JUNCTION BOXES, ACCESS DOORS, OTHER EQUIPMENT SERVICE REQUIREMENTS AND/OR OTHER TRADES.

BASIC ELECTRICAL MATERIALS AND METHODS

M. SCOPE OF WORK

1. THE CONTRACTOR SHALL FURNISH ALL LABOR, MATERIALS, EQUIPMENT, SERVICES, TOOLS,TRANSPORTATION NECESSARY FOR EQUIPMENT, SERVICES, TOOLS, TRANSPORTATION, AND FACILITIES NECESSARY FOR, REASONABLY IMPLIED AND INCIDENTAL TO, THE FURNISHING, INSTALLATION, COMPLETION AND TESTING OF ALL THE WORK FOR THE ELECTRICAL SYSTEMS AS SHOWN ON THE DRAWINGS, CALLED FOR IN THE SPECIFICATIONS, AND AS REQUIRED BY JOB CONDITIONS, TO INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING:
   a. A COMPLETE ELECTRICAL DISTRIBUTION SYSTEM INCLUDING THE INSTALLATION OF PANELBOARDS, SAFETY AN DISCONNECT SWITCHES, LIGHTING AND RECEPTACLES. IT IS THE ELECTRICAL CONTRACTOR'S RESPONSIBILITY TO INCLUDE IN HIS BID FOR PROVIDING SERVICE EQUIPMENT NECESSARY TO OBTAIN SERVICE FROM LOCAL UTILITY COMPANY. REFER TO ELECTRICAL ONE-LINE DIAGRAM FOR ADDITIONAL INFORMATION.
   b. THE CONTRACTOR MUST ALSO INCLUDE IN BID ALL NECESSARY MATERIALS REQUIRED TO COMPLETE THE SYSTEM INCLUDING, BUT NOT LIMITED TO, FEEDERS, BRANCH CIRCUITS, JUNCTION BOXES, OUTLET BOXES, WIRING DEVICES, COVERPLATES, CONDUITS, ETC.
   c. METERING AND CURRENT TRANSFORMERS AS REQUIRED BY DRAWINGS, UTILITY COMPANY.
   d. THE WIRING OF MECHANICAL EQUIPMENT AS OUTLINED ON THE DRAWINGS AND IN THE SPECIFICATIONS. WORK SHALL INCLUDE WIRING OF ALL STARTERS, DISCONNECTS, AND POWER WIRING OF MECHANICAL EQUIPMENT EXCEPT AS SPECIFICALLY NOTED OTHERWISE. ALL LOW VOLTAGE (24 VOLT) TEMPERATURE CONTROL WIRING SHALL BE THE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR UNLESS NOTED SPECIFICALLY ON DRAWING.
   e. INSTALLATION OF LIGHT FIXTURES AND LAMPS AS SHOWN ON THE DRAWINGS INCLUDING ALL DEVICES, EQUIPMENT, ETC. REQUIRED FOR MOUNTING.
   f. TEMPORARY SERVICE AS INDICATED IN THE SPECIFICATIONS, INCLUDING IT'S REMOVAL.
   g. SMOKE/FIRE ALARM WIRING, DEVICES AND CONDUIT, AS SHOWN OR DESCRIBED ON DRAWINGS OR AS NECESSARY TO MEET STATE, LOCAL, INSURANCE AND FIRE DEPARTMENT REQUIREMENTS.
   h. INSTALLATION OF CONDUITS AND WIRING TO CONTROL PANEL, CABLES ARE NOT PERMITTED. SEE SECTION G FOR LOW VOLTAGE CONTROLS REQUIREMENTS.
   i. VERIFY FUEL CELL PHASE ROTATION MATCHES THE BUILDING ELECTRICAL SERVICE. MEASURE VOLTAGE ACROSS EACH PHASE OF MCB001AND VERIFY THAT EACH PHASE IS SIMILAR IN MAGNITUDE.
   j. CONDUCTOR MARKING SHALL BE IN ACCORDANCE TO NEC 408.3(E) REGARDING PHASE ROTATION.

2. THE FOLLOWING ITEMS OF ELECTRICAL CONSTRUCTION ARE NOT INCLUDED IN THIS CONTRACT:
   a. 24 VOLT TEMPERATURE CONTROL WIRING UNLESS NOTED OTHERWISE
   b. TELEPHONE INSTRUMENTS AND WIRING UNLESS NOTED OTHERWISE

3. BEFORE STARTING WORK, THE CONTRACTOR SHALL EXAMINE THE STRUCTURAL AND MECHANICAL PLANS, SHOP DRAWINGS AND SPECIFICATIONS TO SEQUENCE, COORDINATE, AND INTEGRATE THE VARIOUS ELEMENTS OF THE ELECTRICAL SYSTEM, MATERIALS AND EQUIPMENT WITH OTHER CONTRACTORS TO AVOID INTERFERENCES AND CONFRONTATIONS.

B. CONDUIT

1. THE CONTRACTOR SHALL FURNISH AND INSTALL ALL CONDUITS SERVING ALL EQUIPMENT, INCLUDING BUT NOT LIMITED TO, LIGHTING, RECEPTACLES, HEATING AIR CONDITIONING, MECHANICAL EQUIPMENT, TELEPHONE, DATA AND ELECTRICAL EQUIPMENT.

2. ALL CONDUITS SHALL BE GALVANIZED RMC OR EMT UNLESS OTHERWISE SPECIFIED. ALL CONDUIT IS TO BE UL LABELED. ALL CONDUIT SHALL RECEIVE A SUPPLENTARY CORROSION PROTECTION COATING OF ZINC-RICH PAINT, ACRYLIC OR WEATHER-STABLE EPOXY-BASED RESIN, APPROVED FOR THIS PURPOSE. THE CONDUIT SHOULD BE PREPARED FOR COATING PER ASTM D6386. ALL FIELD CUT THREADS SHALL BE PROTECTED AGAINST CORROSION WITH CONDUCTIVE RUST-RESISTANT ZINC-RICH PAINT.

EMT SHALL BE FOR INDOOR USE ONLY. EMT CONNECTORS SHALL BE STEEL COMPRESSION TYPE

CONDUIT UNDER SLAB ON GRADE SHALL BE GALVANIZED RIGID STEEL, OR SCHEDULE 40 PVC WITH RIGID STEEL ELLS WHERE PERMITTED BY CODE.

UNDERGROUND CONDUITS SHALL BE PVC SCH. 40. EXPOSED OUTDOOR CONDUITS SHALL BE RGS. PROVIDE METAL SWEEPS WHERE PVC CONDUIT EMERGES FROM GRADE.

ALL CONDUIT INSTALLATIONS SHALL BE COMPLIANT WITH OWNERS BUILDING STANDARD. MINIMUM SIZE OF CONDUIT SHALL BE 3/4 INCH.

SPARE CONDUITS SHALL HAVE NYLON PULL WIRES INSTALLED IN THEM.

3. SUPPORT ALL CONDUIT, INCLUDING SEISMIC AND SWAY BRACING, IN ACCORDANCE WITH THE NEC AND LOCAL CODES.

4. GENERALLY, ALL CONDUIT SHALL BE CONCEALED EXCEPT FOR UNFINISHED AREAS, SUCH AS EQUIPMENT ROOMS. EXPOSED CONDUIT SHALL BE ALLOWED ONLY AS NOTED ON PLAN AND AS APPROVED BY DOOSAN.

5. LIQUID TIGHT FLEXIBLE CONDUIT (LTFC)
   a. LIQUID TIGHT FLEXIBLE CONDUIT AND ASSOCIATED FITTINGS SHALL BE INSTALLED PER MANUFACTURER'S GUIDELINES WITH SPECIAL ATTENTION TO FITTING TORQUES.
   b. LIQUID TIGHT FLEXIBLE CONDUIT SHALL BE USED FOR THE FOLLOWING APPLICATIONS:
      FINAL CONNECTIONS TO MOTORS.
      FINAL CONNECTIONS TO VIBRATING EQUIPMENT.
   c. LIQUID TIGHT FLEXIBLE CONDUIT MUST BE THE SAME SIZE AS THE RMC OR EMT CONDUIT TO WHICH IT IS CONNECTED. BOTH THE FLEXIBLE METAL CONDUIT AND IT'S FITTINGS ARE TO BE LISTED FOR GROUNDING. A GREEN GROUNDING CONDUCTOR SHALL BE INSTALLED. ALL CONNECTORS ARE TO BE OF A NEMA APPROVED TYPE.
   d. THE USE OF MC CABLE OR GREENFIELD IS NOT PERMITTED.e. CONNECTION TO OUTDOOR EQUIPMENT MUST BE WEATHERPROOF(LIQUID TIGHT OR SEALTIGHT).

7. PROVIDE PULL-WIRE IN ALL EMPTY CONDUITS EXCEPT AS NOTED OTHERWISE ON DRAWINGS.

8. HOME RUNS AND MAIN CONDUIT RUNS ARE TO BE HELD TIGHT TO STRUCTURE ABOVE OR AS REQUIRED TO ALLOW PROPER SERVICE ACCESS AND OTHER TRADES WORK.

9. ALL CONDUITS MUST BE SIZED PER NEC AND LOCAL CODES.

10. ALL CONDUIT SUPPORTS, BOLTS, STRAPS, SCREWS ETC. SHALL BE GALVANIZED / CORROSION RESISTANT.

C. OUTLET BOXES

1. ALL OUTLET BOXES SHALL BE GALVANIZED PRESSED STEEL OF THE, STANDARD KNOCKOUT TYPE. NO ROUND OUTLET BOXES SHALL BE PERMITTED, EXCEPT AS SPECIFICALLY NOTED ON DRAWINGS BOXES SHALL NOT BE LESS THAN 4" SQUARE AND 1 1/2" DEEP.

2. ALL KNOCKOUT BOXES, UPON WHICH LIGHTING FIXTURES ARE TO BE INSTALLED, SHALL BE EQUIPPED WITH 3/8" FIXTURE STUDS.

3. EXTERIOR BOXES SHALL BE CAST RUST-RESISTING METAL WITH GASKETED COVERS.

4. INSTALL BOXES RIGIDLY FROM BUILDING STRUCTURE AND SUPPORT INDEPENDENTLY OF THE CONDUIT SYSTEM. ALSO PROVIDE SUITABLE BOX EXTENSIONS TO EXTEND BOXES TO FINISHED FACE OF CEILINGS. ALL OUTLET BOXES TO BE PROVIDED WITH CADDY "QICK-MOUNT BOX SUPPORT" TO MINIMIZE THE DEFLECTION THAT OCCURS WHEN PLUGGING/UNPLUGGING INTO THESE DEVICES.

5. UNLESS OTHERWISE NOTED ON DRAWINGS OR OTHERWISE REQUIRED BY THE NATIONAL ELECTRICAL CODE, HANDICAP CODES OR LOCAL CODES, OUTLET HEIGHTS SHALL BE AS FOLLOWS:
   a. SWITCH HEIGHT 48" FROM FINISHED FLOOR TO CENTERLINE OF OUTLET.
   b. CONVENIENCE OUTLETS: 24" FROM FINISHED FLOOR TO CENTERLINE OF OUTLET.

D. JUNCTION AND PULL BOXES

1. THE DRAWINGS INDICATE SCHEMATIC ROUTINGS FOR CONDUIT RUNS. CONTRACTOR SHALL FURNISH AND INSTALL ADDITIONAL BOXES WHERE REQUIRED BY FIELD CONDITIONS OR BY CODE.

2. BOXES AND COVERS SHALL BE GALVANIZED/PAINTED STEEL OF CODE GAUGE SIZE.

3. INSTALL BOXES RIGIDLY SUPPORTED FROM THE BUILDING STRUCTURE AND SUPPORTED INDEPENDENT OF THE CONDUIT SYSTEM.

4. ARRANGE CIRCUITS TO AVOID THE USE OF JUNCTION BOXES IN INACCESSIBLE LOCATIONS.

5. JUNCTION AND PULL BOXES MUST BE LABELED WITH CIRCUIT NUMBER IDENTIFICATION AND SYSTEM TYPE ON COVER.

E. WIRING (600V AND LESS)

1. CONDUCTORS FOR FEEDERS AND BRANCH CIRCUITS SHALL BE COPPER AND THE AWG SIZE AND TYPE AS SHOWN ON DRAWINGS. MINIMUM WIRE SIZE #12. THE CONDUCTORS SHALL BE 600 VOLT INSULATION TYPE THW, THWN OR THHN.

2. FUEL CELL FEEDER CONDUCTORS FROM THE FUEL CELL TO FC-MD2 SHALL BE ALUMINUM AND THE WIRE SIZE SHOWN ON DRAWINGS. THE CONDUCTORS SHALL BE 600V INSULATION TYPE XHHW.

3. ON ALL 20 AMP BRANCH CIRCUITS, CONDUCTORS LARGER THAN #10 AWG SHALL BE REDUCED TO #10 AWG WITHIN 10 FEET OF PANEL BOARD AND DEVICE IN JUNCTION BOXES ON RATED TERMINAL STRIPS.

4. CONDUCTORS SHALL BE STRANDED.

5. ALL WIRING SHALL BE IN CONDUIT, UNLESS SPECIFICALLY NOTED OTHERWISE (IE. LOW VOLTAGE PLENUM RATED WIRE)

6. EACH CIRCUIT SHALL HAVE A DEDICATED NEUTRAL CONDUCTOR WHEN REQUIRED AND SHALL SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND LOCAL CODES.

7. THE USE OF MC CABLE, ETC. IS NOT PERMITTED.

8. WIRE CONNECTORS SHALL BE EQUAL TO "SCOTCH LOCK" FOR #8 AWG WIRE AND SMALLER AND EQUAL TO T & B "LOCKTIGHT" FOR #6 AWG AND LARGER.

9. ALL WIRING TO BE COLOR-CODED AS FOLLOWS:

120/208 VOLT SYSTEM	277/480 VOLT SYSTEM
NEUTRAL - WHITE	NEUTRAL - GREY
PHASE A - BLACK	PHASE A - BROWN
PHASE B - RED	PHASE B - ORANGE
PHASE C - BLUE	PHASE C - YELLOW
GROUND - GREEN	GROUND - GREEN

F. WIRING DEVICES

1. CONTRACTOR SHALL FURNISH AND INSTALL SWITCHES AND RECEPTACLES, UNLESS NOTED OTHERWISE, AS NECESSARY FOR A COMPLETE INSTALLATION. COLOR OF DEVICES AND PLATES SHALL BE WHITE UNLESS OTHERWISE NOTED. THE DEVICES SHALL BE OF THE TYPES AND RATINGS LISTED, OR EQUALS BY HUBBELL, BRYANT OR PASS & SEYMOUR. WEATHERPROOF GFI RECEPTACLES SHALL BE INSTALLED WHERE SHOWN ON DRAWINGS OR AS REQUIRED BY CODE.

2. ALL WIRING DEVICES SHALL BE HEAVY DUTY GRADE, CONFIGURATION TO SUIT SERVICE.

G. HEATING, VENTILATION, PROCESS AND CONTROLS WIRING

1. THE ELECTRICAL CONTRACTOR SHALL REFER TO MECHANICAL AND CONTROL DETAILS ON MECHANICAL DRAWINGS FOR ADDITIONAL ELECTRICAL WORK TO BE INCLUDED IN HIS BID.

2. ELECTRICAL CONTRACTOR SHALL DO ALL POWER WIRING, LINE VOLTAGE WIRING, AND LINE VOLTAGE CONTROL WIRING INDICATED UNDER THE HEATING AND VENTILATION SPECIFICATIONS AND DRAWINGS. THIS CONTRACTOR SHALL ALSO DO ALL INTERCONNECTING LINE VOLTAGE WIRING BETWEEN RELAYS AND DEVICES AS REQUIRED.

3. ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR FURNISHING AN INSTALLING CONDUIT FOR HVAC CONTROL WIRING. ELECTRICAL CONTRACTOR SHALL GROUP DEVICES TOGETHER AS NEEDED TO MINIMIZE THE QUANTITY OF CONTROL CONDUITS. SIZE CONDUITS IN ACCORDANCE WITH NEC.

H. SAFETY AND DISCONNECT SWITCHES

1. SAFETY AND DISCONNECT SWITCHES SHALL BE HEAVY DUTY TYPE, QUICK-MAKE, QUICK-BREAK FUSED OR NON-FUSIBLE WITH RATINGS AND SIZES AS NOTED ON PLANS AND REQUIRED BY CODES.

2. AT SERVICE ENTRANCE, DISCONNECT SHALL BEAR THE MANUFACTURER'S LABEL INDICATING THE EQUIPMENT IS UL RATED FOR APPLICATION IN ACCORDANCE WITH ALL CODES.

3. MANUFACTURER SHALL BE GENERAL ELECTRIC, SQUARE D, EATON OR APPROVED EQUAL.

I. GROUNDING

1. FURNISH AND INSTALL COMPLETE WIRED GROUNDING CONDUCTOR SYSTEM, #12 AWG MINIMUM, SIZED AND INSTALLED IN ACCORDANCE WITH THE LATEST ADOPTED EDITION OF THE NATIONAL ELECTRICAL CODE, STATE AND LOCAL CODES, AND AS NOTED IN THE SPECIFICATIONS AND AS INDICATED ON THE DRAWINGS.

2. ALL CONDUIT, INCLUDING FLEXIBLE CONDUIT, SHALL BE GROUNDED WITH A GREEN GROUNDING CONDUCTOR.

3. GROUNDING CONNECTIONS MADE TO THE WATER PIPING SYSTEM SHALL BE COORDINATED WITH THE PLUMBING CONTRACTOR AND A BONDING JUMPERS INSTALLED AROUND WATER METER PER CODES AND AS INDICATED ON DRAWINGS.

4. ALL DEVICES SHALL BE BONDED TO THE CONDUIT SYSTEM. USE A BONDING JUMPER BETWEEN THE OUTLET BOX AND THE DEVICE GROUNDING TERMINAL. METAL-TO-METAL CONTACT BETWEEN THE DEVICE YOKE AND THE OUTLET BOX IS NOT ACCEPTABLE AS A BOND FOR EITHER SURFACE MOUNTED BOXES OR FLUSH TYPE BOXES. ALL JUNCTION BOXES, OUTLET BOXES, AND PULL BOXES SHALL BE BONDED TO THE CONDUIT SYSTEM.

5. FOR PANEL FEEDERS, BOND THE GROUNDING CONDUCTOR TO THE CONDUIT, WHERE ENTERING AND LEAVING THE CONDUIT. THE GROUNDING CONDUCTOR SHALL BE COPPER WITH GREEN IDENTIFICATION AND SIZED PER N.E.C.

6. ALL ENCLOSURES AND NON-CURRENT CARRYING METAL PARTS ARE TO BE GROUNDED. CONDUIT SYSTEM IS TO BE ELECTRICALLY CONTINUOUS. ALL LOCKNUTS MUST CUT THROUGH ENAMELED OR PAINTED SURFACES ON ENCLOSURES. WHERE ENCLOSURES ANDNON-CURRENT CARRYING METAL PARTS ARE ISOLATED FROM THE CONDUIT SYSTEM, USE BONDING JUMPERS WITH APPROVED CLAMPS. ALL GROUND CLAMPS SHALL BE "PENN-UNION" OR EQUAL, SIMILAR TO "GPL" TYPE.

J. LIGHTING FIXTURES

1. THE CONTRACTOR SHALL INSTALL ALL LIGHTING FIXTURES AND LAMPS AS SHOWN ON THE DRAWINGS.CONTRACTOR IS TO REPLACE ALL NON-WORKING LAMPS PRIOR TO ACCEPTANCE BY DOOSAN/OWNER.

K. SUBMITTALS

1. THE CONTRACTOR SHALL PROVIDE 5 COPIES OF (AS WELL AS ELECTRONIC) SUBMITTALS OF ALL INSTALLATION METHODS, MATERIALS AND ACCESSORIES FOR REVIEW AND APPROVAL.SUBMITTALS FOR EQUIPMENT SHALL SPECIFICALLY STATE "NEW" OR "RECONDITIONED" FOR EACH ITEM. RECONDITIONED EQUIPMENT SHALL REQUIRE SPECIFIC APPROVAL BY DOOSAN. SUBMITTALS SHALL BE ASSEMBLED AND SUBMITTED PRIOR TO ANY INSTALLATION WORK, AND SHOULD INCLUDE:
- WIRE
- CONDUIT
- DISCONNECT SWITCH
- SWITCHBOARD AND SWITCHGEAR - NEW AND MODIFICATIONS AND ACCESSORIES
- ENCLOSURES
- CURRENT TRANSFORMERS, POTENTIAL TRANSFORMERS AND TEST BLOCKS
- HEAT TRACE
- UTILITY METER
- WIREWAY, PULL BOX

L. TESTS AND ADJUSTMENTS

1. ACCEPTANCE TESTS:

TEST THE FOLLOWING IN ACCORDANCE WITH APPLICABLE SECTIONS OF THE LATEST NETA-ACCEPTANCE TESTING STANDARD. PROVIDE SERVICES OF A QUALIFIED ELECTRICAL TESTING COMPANY AS REQUIRED.
- TRANSFORMER
- SWITCHBOARD
- BREAKERS, RATED 250 A AND LARGER - BREAKERS SHALL BE TESTED USING PRIMARY INJECTION METHOD, WITH FINAL SETTINGS ADVISED BY THE ENGINEER IN A COORDINATION STUDY.
- PROTECTIVE RELAYS - BENCH TEST WITH FINAL SETTINGS. ALSO PROVIDE WITNESS TESTING AS REQUIRED BY THE UTILITY COMPANY AND AHJ. ALSO INCLUDE THE SEL RELAYS PROVIDED IN THE FUEL CELLS.
- CONDUCTORS- MV CONDUCTORS SHALL BE HI-POT TESTED.
- PANELBOARDS
- DISCONNECT SWITCHES
- CT AND PTS.
- GROUNDING- USE FALL OF POTENTIAL METHOD AND CONTINUITY CHECKS.

2. ALL CONNECTIONS AT PANELS AND SWITCHES ARE TO BE MADE, ALL SPLICES COMPLETE, ALL FUSES IN PLACE, AND ALL CIRCUITS CONTINUOUS FROM POINT OF SERVICE CONNECTION TO ITS FINAL DESTINATION, AND ALL COVERS AND PLATES INSTALLED PRIOR TO THE TIME OF FINAL INSPECTION BY OWNERS ENGINEER.

3. UPON COMPLETION OF THE WORK, ALL PARTS OF THE ELECTRICAL INSTALLATION SHALL BE TESTED AND PROVED FREE OF UNWANTED GROUNDS AND OTHER DEFECTS.

4. ALL OVERLOAD DEVICES, INCLUDING EQUIPMENT FURNISHED UNDER OTHER CONTRACTS, SHALL BE SET AND ADJUSTED TO SUIT THE LOAD CONDITIONS.

5. TEST AND MAKE CORRECTIONS/ADJUSTMENTS FOR PHASE BALANCING.

6. PROVIDE FINAL REPORT TO DOOSAN AT TIME OF PUNCH-OUT.

M. CLEANING

1. AT THE END OF THE PROJECT, THE CONTRACTOR SHALL CLEAN ALL EQUIPMENT, TO THE SATISFACTION OF OWNER. ALL DUST, DIRT, DEBRIS, AND FOREIGN MATTER SHALL BE REMOVED FROM ALL EQUIPMENT.

Rev.	Date	Description
F	07/31/23	UPDATED PER FLOOD COMM. REQUESTS
D	01/02/23	UPDATED EVERSOURCE CKT. NAMES
C	10/06/22	REISSUED FOR CONSTRUCTION
B	09/26/22	ISSUED FOR CONSTRUCTION
A	07/07/22	PRELIMINARY ISSUE

STATE OF CONNECTICUT ★ SCOTT D FITCH 0019780 LICENSED PROFESSIONAL ENGINEER

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FUEL CELL INSTALLATION

ELECTRICAL ONE-LINE DIAGRAM

Project No.:	Drawn By: KFH
Date: 07/08/22	Design By: DSF
Scale: NTS	Check By: DSF

Drawing No.: E4.0