architects + engineers
538 Broad Hollow Road, 4th Floor East
Melville, NY 11747 | tel 631.756.8000

ADDENDUM NUMBER ONE TO BIDDING DOCUMENTS

Vails Gate Fire District
New Storage Building (Phase I)
New Fire Station (Phase II)

Date:	August 24, 2022
Site Address:	872 Blooming Grove Turnpike New Windsor, NY 12553
Owner:	Vails Gate Fire District 872 Blooming Grove Turnpike New Windsor, NY 12553
Architect:	H2M architects + engineers 538 Broad Hollow Road, Fourth Floor East Melville, NY 11747

TOTAL PAGES (Including Cover Page and attachments): 97

NOTE: ALL BIDDERS MUST EMAIL kmargolies@h2m.com A CONFIRMATION OF RECEIPT OF THIS ADDENDUM. PLEASE PRINT COMPANY NAME, SIGN AND DATE THIS COVER PAGE AND EMAIL TO H2M architects + engineers.

Company Name _____
(Please Print)

Sign and Date_____

The information described herein as Addendum Number One, is hereby made addenda to all previously issued construction documents related to the Project and shall be incorporated into the Scope of the Base Bid. These pages shall be attached to the Project Manual.

QUESTIONS AND ANSWERS

Item #Q1:

Q. Just wanted to inquire about the above project. Does it include the full demolition of the existing firehouse building?

A. Yes, the project includes the full demolition of the existing firehouse building.

Item #Q2:

Q. On the notice to bidders it states the bidder shall hold their price from 45 days of bid opening. One page IB-4 there is a paragraph references we may terminate after 90 days if no contract is awarded. Please confirm 45 or 90 days. All please confirm the funds for this project are secured per the same paragraph.

A. Prices to be held for 45 days. Funds are secured through a bond referendum passed on June 22, 2021.

Item #Q3:

Q. Fireproofing specifications are indicated for phase #2, Drawing A2 020.00, Fire resistance rating requirements for building elements table call out '0' hours, please confirm if fireproofing is required, and if so, the and where?

A. Fireproofing is required at the steel columns exposed at the elevator shaft. Elevator shaft needs to be 1hr rated. See detail 3/A2501.00

Item #Q4:

Q. Drawing (CD 100.00) notes the complete demolition of existing building and Spec Section 024119, 3.07 A states complete demolition of existing building, however Spec Section 024119, 3.11 A also states exterior building restoration. Please clarify.

A. Existing fire station to be demolished in its entirety. There will be no exterior building restoration.

Item #Q5:

Q. Spec Section 024119, 3.07 states this project **does not include** any removal of asbestos and that this work would be completed prior to commencement of work under this Project. However Spec Sections 02 82 00 Asbestos Remediation (PHASE 2- FIREHOUSE) & 02 83 00 Lead Remediation (PHASE 2- FIREHOUSE) are included in project manual. Please clarify whether the asbestos and lead remediation is being completed under a separate contract or is this scope of work to be included as part of the Contract G General Construction Work bid.

A. Asbestos and lead remediation to be completed as part of the Contract G General Construction work. Please see report in Appendix 'C' of the project manual for scope.

Item #Q6:

Q. Spec. Section 024119, 1.04 states all historic items, relics, plaques, tables and other items should be carefully salvaged and prevent from damage. Will a list or schedule of the items be provided? Please advise.

A. All items to be salvaged, besides what is called to be reinstalled in the contract documents, will be removed by the Fire District.

Item #Q7:

Q. Master Sheet Dwg. G001 and the List of Drawings provided in the project manual include Dwg. E2-500. This drawing was not included in the bid documents. Please provide.

A. Please see attached E2-500 and E2-503 drawings.

Item #Q8:

Q. The Table of Contents list Spec. Sections 077200 Roof Accessories, 321216 Asphaltic Concrete Paving and 334416 Polymer Sloped Trench Drain Units. These specifications were not included in the project manual. Please provide.

A. 077200 was removed from the TOC- it is not part of the specifications. Spec sections 321216 and 334416 are attached to this addendum

Item #Q9:

Q. There are conflicts between the spec. section numbers noted in the Table of Contents and the actual specifications included in the project manual. Please review the following and confirm if we are correct to assume the numbering noted in the TOC are just typographical errors and that we should proceed in accordance with the actual specification section provided.

- TOC indicates Spec. Sections 12600 Alternates however Spec. Section 12300 Alternates were included in the project manual.
  A: Use 012300 for the Alternates
- TOC indicates Spec. Section 055133.33 Fixed Metal Ladders however Spec. Section 055133.13 were included in the project manual
  A. Use 055133.13
- TOC indicates Spec. Section 269117 for the Transfer Switches however Spec. Sections 262917 and 262917.11 were included in the project manual.
  A. Section 262917 is for the Storage Building and Section 262917.11 is for the Fire House.

Item #Q10:

Q. Dr. A1 200.00 East Elevation refer to det.5/A-002.00. Dr. A-002.00 is not provided. Should that be read as det. 5/A1 200.00? Please advise.

A. Yes, this should refer to 5/A1 200.00.

Item #Q11:

Q. Dr. A2 200.00 South Elevation shows 24”w x 12”h screened louver attic vent. Spec 07 62 25 – 2.04 Lovers calls for 36”w x 18”h. Please clarify.

A. Drawings are correct, size to be 24” x 12”

Item #Q12:

Q. Cupolas, Chimney Pots and Caps, Spires listed in Spec 07 62 25. Not shown on drawings. Please advise.

A. This is for the attic vent as depicted on 1/A2 200.00 (at radio tower)

Item #Q13:

Q. Type of insulation - specifications call for batt in the exterior walls- but detail 2B/A542 calls for mineral wool insulation. Then for interior walls - spec's call for mineral wool, but partitions call for batt.

A. Batt insulation to be installed at exterior walls except for the area of detail 2B/A542. This to stay mineral wool. For the interior walls, mineral wool insulation to only be installed at interior partitions/ceilings where sound attenuation is called for (as indicated in section 072116 2.03E). See wall types for locations.

Item #Q14:

Q. Sheet A2-300 shows the truss bottom cord below the ceiling, and the R-38 and metal ceiling system above- as if the ceiling is between the cords of the trusses? Please clarify.

A. Yes, the truss chords are to penetrate the metal panel ceiling as shown.

Item #Q15:

Q. Dr. A2.542 / 2B Exterior partition shows R-38 mineral wool insulation, however all exterior partitions on A2 030 shows R-21 batt insulation. Please clarify.

A. Batt insulation to be installed at exterior walls except for the area of detail 2B/A542. This to stay mineral wool.

Item #Q16:

Q. Spec 07 42 10.31 and detail dr. S2 500 calls for SMARTci (CFS) system, other wall details shows 5/8" sheathing with 3" rigid insulation. Please clarify with system should be used.

A. Smart Ci (Composite framing system) 2-1 to be used to support the continuous rigid insulation within all the exterior walls (along with 5/8" sheathing where shown in partition types). CFS as shown on detail 4/S2 500 stands for Cold Formed Steel

Item #Q17:

Q. Door #117 on scheduled as type 5, floor plan and size showing double door. Please clarify.

A. Door #117 shall be door type #2 with louver. Please see attached revised sheet A2 520.00

Item #Q18:

Q. Is this project Prevailing Wage or is there a PLA?

A. This project is a PLA – See Appendix B in the Project Manual.

Item #Q19:

Q. Is this project sales tax exempt?

A. Yes, this project is sales tax exempt

Item #Q20:

Q. Other than fire engines and fire fighting equipment, is any of the other interior furnishings, equipment, cabinets, display cases, etc. being removed prior to demolition?

A. All items to be salvaged, besides what is called to be reinstalled in the contract documents, will be removed by the Fire District.

Item #Q21:

Q. Can you provide drawings / as-builts of the existing building and foundations to be removed?

A. Existing building drawings will not be provided.

Item #Q22:

Q. New drainage manhole (DMH#1) has no inverts. Also, oil/water separator refers you back to the "P" drawings. There is nothing in Civil or Plumbing drawings that provide any information.

A. DMH #1 is intended to intercept the existing 12" HDPE pipe upon removal of the upstream drain inlet. The invert is approximately 262.05' based off existing invert elevations. Oil water separator (OS-1) information is on sheet P2 003.00.

Item #Q23:

Q. Phase 1 "S" drawings indicate that the exterior wall construction of the pre-engineered metal building is masonry. The "A" drawings, elevations indicate 4" insulated metal wall panels. Please clarify, also review if the shelf in the foundation wall will be required if the exterior walls are in fact 4" insulated metal wall panels.

A. There is a 3'-0" high masonry water table below the pre-engineered metal building panels as shown on the elevations (A1200) and sections (A1 300).

Item #Q24:

Q. Please confirm intent of phase 1 (storage building) and phase 2 (new fire station). Does Phase 1 need to be completed before phase 2 can begin?

A. Phase 1 to be completed before Phase 2 can begin. The storage building is an add alternate to Phase 1. Please refer to phasing plan on sheet G007.

Item #Q25:

Q. Please confirm award date and construction date?
A. Anticipated award date is September 23rd and construction start date is October 24th. Please note these dates are estimated.

Item #Q26:

Q. Are there any construction milestones?
A. The anticipate sequence is:

- *Construction on Phase 1 is anticipated to start October 24th. If Alt. 1 (storage building) is awarded this would also start Oct. 24th. Construction period for Phase 1 + Phase 1 Alt. is estimated to be about 10 months (roughly Aug. 2023).*
- *Fire District to move equipment and vehicles over to new storage building once completed.*
- *Construction on Phase 2 (main firehouse) is anticipated to begin in September 2023 and last approximately 14 months.*

Item #Q27:

Q. Are we required to include building permits?
A. Documents have been filed with the town, pending contractor information and insurances. Once awarded, contractor will be responsible to pull permits. District will pay for building permit fees directly.

Item #Q28:

Q. Spec 03 30 00 - 3.13F Concrete Protection & Curing calls for Euco Diamond Hard. Spec 03 35 00 – 2.01B Exposed Interior Slabs and Stair Treads calls for Seal Hard Concrete Sealer and references the finish schedule for locations. Finish Schedule is unclear which product should be used. Please clarify.
A. Concrete sealers as described in Spec 03 35 00 – 2.01B shall be used in this project.

Item #Q29:

Q. Spec 07 42 10.31 – 2.01 calls for SMART ci Plus 3-in-1 system. Dwg. S2 123.00 includes a note "CFS wall framing", however detail 10/A2 540.00 or any other details do not match SMART ci Plus 3-in-1 System. Please clarify where CFS wall framing is required and provide details.

*A. Smart Ci (Composite framing system) **2 in 1** to be used to support the continuous rigid insulation within all the exterior walls (along with 5/8" sheathing where shown in partition types). CFS as shown on detail 4/S2 500 stands for Cold Formed Steel. See attached revised spec section 074210.31*

Item #Q30:

Q. Dwg. ES 100 The underground electric service line from the new transformer to the New Storage Building crosses the Phasing line between Phase 1 and Phase 1 Alt. Please advise where these costs including the associated trenching costs should be carried, Base Bid or Phase 1 Alternate.

A. The trenching for the underground electrical service for the new storage building is part of the Phase 1 alternate. If the alternate is not awarded, there is no need for the utility trenching. See G007 where phase 1 utility work area is called out.

Item #Q31:

Q. Please indicate what sections of the Phase 2 building requires the SMARTci Plus 3-in1 System?

A. Smart Ci (Composite framing system) ***2 in 1*** *system to be used to support the continuous rigid insulation within all the exterior walls (along with 5/8" sheathing where shown in partition types). See attached revised spec section 074210.31*

Item #Q32:

Q. Please provide specification for Metal Panel Ceiling system at Apparatus Room #101, Gear Room #107 and Tool Alcove Room #110

A. Please see spec section 074216 – Metal Soffit Panels, section 2.02B

Item #Q33:

Q. Dwg A2.412 General Equipment schedule includes equipment listed as "existing" which the GC's is responsible to install. Who is responsible for the costs to remove this equipment from the existing fire station prior to demolition, store until the new building is complete and then relocate?

A. The GC will have the responsibility to remove and store the existing equipment indicated to be reinstalled in the General equipment schedule.

Item #Q34:

Q. Dwg A2.420 Equipment List includes item K04 double basin sink that is to be provided by the owner and installed by GC (plumber). Dwg. P2.120B shows Fixture Tag No. SK3, also a double basin sink, in the same location which is required to be furnished and installed by the Plumber. Please clarify whether the sink will be provided by the owner or GC.

A. K04 double basin sink to be provided by owner and installed by GC. Sheet P2 120B is incorrect.

Item #Q35:

Q. Spec 10 73 16 -.13 calls for MASA, Fenwall & Vestis Systems canopies. Neither MASA nor Vestis can provide the arched shaped canopies required for this project. Please provide the name of another acceptable manufacturer.

A. We confirmed with MASA that they can provide the arched canopies required for this project.

Item #Q36:

Q. Spec. 238318 Snow Melting System describes a system necessary to complete as indicated on the drawings. We have reviewed the drawings and cannot locate the system. Please advise.

A. This section has been revised to reflect requirements for the radiant flooring system. There is no snow melt system in this project. See revised spec section 238318 attached to the addendum.

Item #Q37:

Q. The spec makes reference to Stainless Steel CGs in the following locations, but none are shown on the drawings, elevations or finish schedule. Please indicate where these CGs are required.

A. See sheet plan on A2 101B.00 for note. Note located near Vendor Drop Off Room. Corner guards to be provided at all outside corners of stud partition walls.

Item #Q38:

Q. Spec Section 102826 indicates the AC-08 Touchless Hand Sanitizer Dispenser is provided by owner, installed by GC. Dwg A2.410 Toilet Accessory Schedule indicates AC-08 to be furnished and installed by GC. Please Clarify.

A. Hand sanitizer to be provided by owner, installed by GC

Item #Q39:

Q. Spec Section 102813 2.02 A.4. Provides information regarding an Air Freshener however the drawings do not indicate locations where the Air Fresheners are required. Please provide.

A. Please provide 1 air freshener per toilet room. Final location to be determined in field with owner and AOR

Item #Q40:

Q. Please advise if the window shown at the new storage building is fixed or a horizontal slider. Specification 085113 lists a horizontal sliding window as the basis of design, however the drawings to not indicate an operable sash.

A. Window to be horizontal sliding window

Item #Q41:

Q. Is the glass for new storage building to be per section 085113, 2.04-F or as listed under section 3.04-B in specification 088000?

A. Glazing for storage building to follow section 085113, 2.04-F

Item #Q42:

Q. Please advise if the blast mitigation performance is required as listed in specification 085113 section 2.02-N for which windows / doors, or ware required?

A. Blast mitigation is not required for the aluminum window

Item #Q43:

Q. Please confirm where the sealed bid is to be delivered on 9/2.

A. Please call Tom Lucchesi, the District Administrator at (845)234-0966, to coordinate bid drop off

Item #Q44:

Q. Qualification of bidders. At discretion of Owner, bidder may be required to complete and submit NYS Uniform Contracting Question after receipt of bids. Are we to assume these forms can be submitted after bid, if we are the low bidder?

A. Yes, these forms can be submitted after bid.

Item #Q45:

Q. Specification 099100 Painting lists (2) options for CMU pain block filler or epoxy. Please confirm which are to price.

A. Remove section 2.03E. Epoxy paint to be used on CMU.

Item #Q46:

Q. The specifications for Division 31 – Earthwork makes no mention of the site soils and any concerns about the bearing capacity. The Geotechnical report has expressed concerns that the existing site soils need to:
1) Be removed and replaced with Structural fill to proposed subgrades
2) Install Rammed Aggregate Piers – RAP to stabilize the site.
3) Use Rapid Impact Compaction – RIC to stabilize the site.

Can you clarify what the earthwork should entail with respect to the existing site soils.
If you are going to follow the Geotech Report recommendations can the owner select 1 method out of the 3 recommended and then have the area defined on a print so we know exactly what to bid.

A. Refer to 'Foundation Note' #9 on Sheet S2 100.00 for direction on earthwork.

Item #Q47:

Q. Please confirm we are to include GreenGirt's standard 2-in-1 system in lieu of the 3-in-1 system that is indicated in specification 074210.31

*A. Smart Ci (Composite framing system) **2 in 1** system to be used to support the continuous rigid insulation within all the exterior walls. See attached revised spec section 074210.31*

Item #Q48:

Q. With regards to the drainage shouldn't the following structures and the runs between them be labeled as Phase 2 work. DI 1, DI 2, DI 3, DI 4, and DI5, they convey the water from the proposed swale and the fire house roof leaders to the stormwater pond which is built in Phase 2. The structures and runs are currently labeled as Phase 1.

For the sanitary shouldn't the connection to the existing main and the first 2 runs of 53 lf and 65 lf be labeled as Phase 2? They pick up the oil/water separator and the new fire house service. They are currently labeled as Phase 1 work.

A. Please see revised sheet G 007.00. To clarify phasing, "Phase 1" will be any work which will be completed sequentially prior to "Phase 2" regardless of whether the "Phase 1 -Add Alternate #1" (i.e. new storage building) is completed. This includes all drainage noted as "Phase 1" on CD 100.00 and excludes all drainage and other improvements noted as "Phase 1 Alt.". The retention pond is now labeled as Phase 1 on G007. Similarly, the lengths of sanitary main referenced are included in the

work for "Phase 1". Any areas pertaining to the new storage building are in "Phase 1 Alt." and are noted as such.

Item #Q49:

Q. Spec Section 097720 indicates the use of Symmetrix Smart Seam Panels. There are several color options for the Classic Checkerboard (Square) product, each having different pricing. Please provide possible parameters for color selections being considered which are necessary to obtain a competitive bid for this product.

A. Pattern to be subway or rectangular. Finish to be BlueSky Classic, FRP color to be from manufacturer's standard line and will be selected during submittal review.

Item #Q50:

Q. What is the estimated Project Duration - Schedule for each phase?

A. Construction on Phase 1 is anticipated to start October 24th. If Alt. 1 (storage building) is awarded this would also start Oct. 24th. Construction period for Phase 1 + Phase 1 Alt. is estimated to be about 10 months (roughly Aug. 2023). Fire District to then move equipment and vehicles off site or to new storage building (if awarded) once completed. Construction on Phase 2 (main firehouse) is anticipated to begin in September 2023 and last approximately 14 months.

Item #Q51:

Q. Spec section 074210.31 calls for a Composite Framing Support (CFS) System. I do not see this on the drawings.

*A. Smart Ci (Composite framing system) **2 in 1** system to be used to support the continuous rigid insulation within all the exterior walls.*

Item #Q52:

Q. Spec section 097720 – calls for Fiber Reinforced Plastic Panels call for Symmetrix with BlueSky Advanced Finishing. I do not see this on the drawings.

A. Please refer to finish schedule. FRP panels to be installed in Vendor Drop of Area (112) and Kitchen (118). FRP also indicated on Kitchen elevation A/A2420.00

Item #Q53:

Q. Is there a possibility of another site visit? A few Subcontractors missed the first one.

A. Please coordinate with Tom Lucchesi, the District Administrator at (845)234-0966

Item #Q54:

Q. Is there a possibility for a bid extension? Due to the bid being so close to Labor Day, many Suppliers and Sub Contractors are on Vacation.

A. a Bid extension will not be entertained at this time. The bidding period is already 7 weeks long.

Item #Q55:

Q. There is no way for us to anticipate the amount of unsuitable material that will be required in the utility areas and under the new pavement. Please provide a quantity for basis of bid to be included or a unit price in our bid to account for unforeseen unsuitable material removal and replacement.

A. Soil only needs to be replaced in structural load bearing areas (building footprints). The existing fill does not need to be replaced in areas of trenching or new pavement

Item #Q56:

Q. Dynamic Sports Construction, Inc. requests the consideration, and approval of our DynaFit™ 3/8" Rubber Floor Tile in lieu of but equal to the product specified.

A. After review, Dynafit 3/8" rubber floor tile is an approved equal for use in this project.

Item #Q57:

Q. Detail 3 on sheet S2 501.00 shouldn't the slab to the right of the transition in the detail be a slab on compacted Type C Controlled fill and not poured on 6" of stone. This is based on the S2 notes on Sheet S2 110.00.

A. Provide minimum 6" crushed stone throughout building slab on grade areas, as depicted in the details. This is a recommendation of the geotechnical report (Page 11, Section 5.2.3).

Item #Q58:

Q. Please confirm that the Type C Controlled Fill is washed sand as described in Section 312323 Part 2 Paragraph 2.01 D.

A. Correct, this meets the controlled fill conditions (also referenced in the soil boring report).

Item #Q59:

Q. JCI is requesting to be listed as an approved equal with regard to our Simplex 4010ES fire alarm system.

A. Simplex 4010ES fire alarm will <u>not</u> be an approved equal. Fire Alarm system to be non-proprietary. Please see revised specification section 0283100 with alternate manufacturer.

Item #Q60:

Q. Can a footing schedule be added to the plan set?

A. Wall footing information is shown on the foundation details, as well as references back to the foundation plans that state the width of the wall footing. The column footings are indicated in the footing schedule on sheet S2 600.00.

Item #Q61:

Q. Spec Section 10 75 16 call for (1) 30' flagpole from grade & (2) 25' flagpole from grade. Drawing CS-100 shows only one location. Please identify other 2 locations.

A. Only one (1) 30' flagpole required from grade at location shown on CS-100.

Item #Q62:

Q. Please provide a specification and manufacturer for the Metal Panel Ceiling system.

A. Please see spec section 074216 – Metal Soffit Panels, section 2.02B

Item #Q63:

Q. The extent of the concrete slab with radiant floor system indicated as Type S1 slab on Drawing S2-111 does not reflect the same areas as shown on the mechanical drawing M2-100A. Please advise.

A. Sheet S2-111 has been revised to show a radiant floor system with both S1 and S2 slabs.

Item #Q64:

Q. Please advise if an alternate design will be accepted for the canopies. MASA will not provide the vertical posts and header beams.

A. Vertical posts and header beams for main entrance canopy to be provided and installed by GC (see 'A' and 'S' drawings). MASA will provide the arched canopies. Contractor to coordinate with canopy shop drawings during submittal review.

Item #Q65:

Q. Under the "Required Bid Submission" item within the Instructions to Bidders – Item #3 says to properly Completed Proposal forms (P-Sheets) and list of subcontractors (SCL) – we can list our proposed subcontractors for this project however to ask each subcontractor to fill out the SCL forms is unachievable as there will be more than 100 subcontractors on this project, please advise.

A. Provide information on your major subcontractors, not all. You should list them all, but just have the info filled out for your major ones.

Item #Q66:

Q. Please confirm that the tanks/equipment will be part of the Phase II of this project bidding on 9/2/22 and are as follows:
Highland Tank – 1,000 gallon fuel and accessories
Highland Tank – 350 gallon OWS

A. That is the correct equipment. Please see drawings and specifications. The fuel tank is part of the Phase 1 Add Alternate (Storage Building). The Oil/Water separator is part of Phase II (Firehouse).

SPECIFICATIONS

Item #S1
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- Table of Contents has been revised with corrected section names and numbers highlighted

Item #S2
283100-FIRE DETECTION AND ALARM
- Section has been revised to replace Manufacturer to Silent Knight or approved equal.

Item #S3
074210 COMPOSITE FRAMING SUPPORT (CFS) SYSTEM
- Section has been revised to reflect the 2-in-1 system in lieu of the 3 in -1.

Item #S4
238318-RADIANT FLOOR HEATING SYSTEM
- All references to the snow melt system have been removed. This specification section is for the radiant heating.

Item #S5
321216 015100-ASPHALTIC CONCRETE PAVING
- Section has been added to the project Manual

Item #S6
334416 013000-POLYMER SLOPED TRENCH DRAIN UNITS
- Section has been added to the project Manual

Item #S7
263214.11-NATURAL GAS ENGINE GENERATOR SYSTEMS
- Section has been revised to include Generator Load List

Item #S8
263214-NATURAL GAS ENGINE GENERATOR SYSTEMS-STORAGE BUILDING
- Section has been revised to include Generator Load List

DRAWINGS

Item #D1:
Drawing G 007.01 – ARCHITECTURE PHASING PLAN
- Phasing Plan has been updated for clarity and to match sheet CD100.00

Item #D2:
Drawing A2 520.01 – ARCHITECTURE DOOR SCHEDULE, DOOR AND FRAME TYPES NEW FIRE STATION PHASE 2
- Door schedule has been updated.

Item #D3:
Drawing A2 522.01 – ARCHITECTURE DOOR DETAILS NEW FIRE STATION PHASE 2
- Overhead door saddle detail added.

Item #D4:
Drawing E2 500.00 - MAIN FIRE HOUSE ELECTRICAL DETAILS PHASE 2
- Sheet has been added to the drawing set

Item #D5:
Drawing E2 503.00 - ELECTRICAL DETAILS NEW FIRE STATION PHASE 2
- Sheet has been added to the drawing set

Item #D6:

Drawing S2 110.01 – STRUCTURAL PARTIAL SLAB PLAN – SOUTH END

- Slab notes has been updated.

End of Addendum #1

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VAILS GATE FIRE DISTRICT
NEW STORAGE BUILDING (PHASE I)
NEW FIRE STATION (PHASE II)
872 Blooming Grove Turnpike, New Windsor, NY 12553
H2M project No.: VGFD2001

Front End Documents

Division 00 – Procurement and Contract Requirements

Division 01 – General Requirements

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Division 23 – Heating Ventilation and Air-Conditioning

Divisions 24-25

Not Used

Division 26 – Electrical

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PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Continuous insulation (CI) composite framing support (CFS) system integrated with brick veneer exterior wall cladding.
   1. Substrate: Exterior sheathing over metal stud framing or Concrete masonry units (CMU).

1.02 RELATED REQUIREMENTS

A. Section 042200 - CONCRETE UNIT MASONRY: Concrete masonry unit (CMU) wall substrate

B. Division 07: Wall cladding system

C. Section 079200 - JOINT SEALANTS: Perimeter sealant

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2019a.

B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2019.

C. ASTM C209 - Standard Test Methods for Cellulosic Fiber Insulating Board; 2020.

D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.

E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

F. ASTM D1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics; 2016.

G. ASTM D2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging; 2020.

H. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).

I. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor; 2013a.

J. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2018).

K. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2018.

L. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.

M. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics; 2015.

N. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between - 30 C and 30 C with a Vitreous Silica Dilatometer; 2016.

O. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2017.

P. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement; 2020.

Q. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; 2018.

R. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

S. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

T. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2019b.

U. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

V. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2019.

W. AAMA - American Architectural Manufacturers Association (www.aamanet.org)
   1. AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure; 2005

X. ASCE American Society of Civil Engineers (www.asce.org)
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures
   2. ASCE - Structural Plastics Design Manual

Y. ASHRAE American Society of Heating, Refrigerating, and Air-Conditioning Engineers (www.ashrae.org)
   1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings

Z. ASTM International (American Society for Testing and Materials; www.astm.org)
   1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   2. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
   3. ASTM D570 - Standard Test Method for Water Absorption of Plastics
   4. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
   5. ASTM D638 - Standard Test Method for Tensile Properties of Plastics
   6. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics
   7. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
   8. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics
   9. ASTM D2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
   10. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor

11. ASTM D4385 - Standard Practice for Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products
12. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
13. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
14. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials
15. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
16. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
17. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2009
18. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

AA. IBC - International Building Code (International Code Council)

AB. IECC - International Energy Conservation Code

AC. NFPA - National Fire Protection Association (www.nfpa.org)
1. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012

AD. Voluntary Product Standard; National Institute of Standards and Technology (NIST)
1. PS 1 - Structural Plywood

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate construction of wall cladding support system over substrate indicated for proper drainage, flashing, trim, back-up support, soffits, and other related Work.

1.05 SUBMITTALS

A. See Section 013300 - SUBMITTALS, for submittal procedures.

B. Product Data: Submit for each type of product indicated; include construction details, material descriptions, dimensions of individual components and profiles, and accessories as necessary for complete fully functioning and assembled system.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least five years of documented experience.
1. System Review: Manufacturer to provide engineering assessment based on CFS and cladding system design.

B. Installer: Company specializing in performing work of this section and the following:
1. Install system in strict compliance with manufacturer’s installation instructions.
2. Have not less than three years of documented experience.
3. Factory trained and approved by CFS system manufacturer.

C. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a licensed Structural Engineer experienced in design for this type of Work and licensed in State that Project is located.

D. Source Limitations: Obtain CI and CFS system from single source and single manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original unopened containers and packaging with labels clearly identifying product name and manufacturer.

B. Deliver components and other manufactured items or accessories without damage or deformation.

C. Storage: Store materials in clean, dry, and level interior areas or outdoor areas for limited duration in accordance with manufacturer's written instructions.

D. Protect components and auxiliary accessories during transportation, handling, and installation from moisture, excessive temperatures and other construction operations in accordance with manufacturer's written instructions.

E. Handle components in strict compliance with manufacturer's written instructions and recommendations, and in a manner to prevent bending, warping, twisting, and surface, edge or corner damage.

1.08 SITE CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of this Work in accordance with manufacturer's written installation instructions and warranty requirements.

1.09 WARRANTY

A. See Section 017800 - CLOSEOUT SUBMITTALS, for additional warranty requirements.

B. CFS System Warranty: Provide written warranty by manufacturer agreeing to correct defects in manufacturing within a five year period after Date of [Delivery] or [Substantial Completion].

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Advanced Architectural Products (A2P): SMARTci Plus 2-in-1 System
Address: 959 Industrial Drive, Allegan, Michigan 49010.
Phone: (269) 355-1818; Fax: (866) 858-5568; Website: www.smartcisystems.com

B. Other products shall be pre-submitted and approved products that meet materials and performance requirements with specified and validated third party testing.

2.02 DESCRIPTION

A. Attach CFS system components to exterior sheathing over metal stud framing and concrete masonry units (CMU).

B. Install CI panels and CFS system components vertically on masonry or concrete substrate with shims or horizontally on substrate system in compliance with specified requirements.

2.03 PERFORMANCE REQUIREMENTS

A. Structural: Provide system tested in accordance with ASTM E330/E330M and certified to be without permanent deformation or failure of structural members in accordance with design wind velocities for project geographic location and probability of occurrence based on data from wind velocity maps provided in ASCE 7 and as approved by authorities having jurisdiction (AHJ).
   1. Measure performance of assembly using test loads equal to 1-1/2 times design wind loads indicated and with 10 second duration at maximum pressure.
   2. CFS System: Structurally engineered to provide in excess of three (3) or four (4) times structural safety factor for lengthwise, longitudinal, and crosswise loading.
   3. Measure the performance of the factory formed joints using a minimum of 30 PSF per ASTM E72.

B. Air Infiltration Test: Maximum of 0.06 cfm/sq ft of wall area in accordance with ASTM E283 or ASTM E2357 at an air pressure differential of 6.27 lbf/sq ft across assembly.

C. System Thermal Design: Ensure installed CFS system, opening trim, sub-framing, clips and cladding attachment does not have thermal bridging of fasteners or framing that creates a continuous metal path from exterior surface of insulation to exterior face of stud framing.
   1. System thermal design shall meet or exceed thermal design requirements in compliance with ASHRAE 90.1, ASHRAE 189.1, IgCC, or IECC energy code.
   2. Thermal Resistance: Wall assembly R Value of as indicated on drawings.
   3. Thermal Performance Test: Provide thermal resistance (R-value) indicated, in compliance with ASTM C1363, corrected to 15 mph outside and still air inside, with installed condition including fastening and joints.
      a. Provide efficiency of no less than 93 to 98 percent, with a maximum temperature differential of 18 degrees F from interior wall surface to interior wall cavity and node locations with a 70 degrees F exterior to interior wall temperature delta.
      b. Provide test unit with at least one insulation panel horizontal and vertical joint length and height of test chamber area.
      c. Provide finite element analysis of three dimensional simulation of described wall assembly sealed by professional engineer in compliance with performance requirements and exceeding it by at least 3 percent.

D. Temperature: Comply with structural loading requirements within temperature range of minus 55 degrees F to 180 degrees F.

E. Fire-Test-Response Characteristics: Provide composite framing support system with fire-test results indicated as determined by test standard indicated and applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction.
   1. Surface Burning Characteristics: In compliance with ASTM E84, for foam insulation, steel fiber reinforced polymer (FRP) and interior surfaces as follows:
      a. Flame Spread Index (FSI): 25 or less.
      b. Smoke Developed Index (SDI): 450 or less.

2.04 COMPOSITE FRAMING SUPPORT (CFS) SYSTEM

A. CFS System: Provide CFS system consisting of polyester and vinyl ester bioresin matrix (FRP) with recycled materials, fire retardant additives and integral continuous metal inserts the length of profile. Reinforce CFS system with glass strand rovings used internally for longitudinal (lengthwise) strength and continuous strand glass mats or stitched reinforcements used internally for transverse (crosswise) strength.

1. Depth of GreenGirt: 3 inch high.
2. On Center Spacing: 16 inch.
3. Provide continuous non-corrosive steel insert for engagement of fasteners, 16 gage, minimum, with G90 galvanized coating designation in compliance with ASTM A653/A653M.
   a. Fully engage steel insert with adjacent CFS at ends.
   b. Anchor sub-girts and other wall cladding support accessories to steel insert set into and part of CFS.
   c. Provide screw pullout testing that meets or exceeds 210 pounds.
4. Provide integral 3-point compression seal in CFS sections to ensure insulation panel will not dislodge and to eliminate air and water movement throughout system.
5. Provide integral anti-siphon grooves on exterior and interior flanges of CFS.
6. Provide force distribution zones integrally designed into profile of CFS.
7. Provide spline seals for adjacent insulation units into profile of CFS.
8. Surface Burning Characteristics:
   a. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84.
   b. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
9. Flammability: Comply with ASTM E84.
10. Self-Extinguishing: Comply with ASTM D635.
11. Profile Visual Requirements: Comply with ASTM D4385.
12. Tensile Stress: Provide engineered lengthwise and crosswise tensile stress in compliance with performance loading criteria and specified safety factors, in accordance with ASTM D638.
13. Compressive Stress: Provide engineered lengthwise and crosswise compressive stress in compliance with performance loading criteria and specified safety factors, in accordance with ASTM D695.
14. Flexural Stress: Provide engineered lengthwise and crosswise flexural stress in compliance with performance loading criteria and specified safety factors, in accordance with ASTM D790.
15. Modulus of Elasticity: Engineered to meet performance loading criteria and specified safety factors.
16. Barcol Hardness: 45, in accordance with ASTM D2583.
17. Water Absorption: Less than 0.46 percent by weight, within 24 hours, in accordance with ASTM D570.
18. Density: Within range of 0.062 to 0.070 lbs/cubic inch, in accordance with ASTM D792.
19. Lengthwise Coefficient of Thermal Expansion: 7.0 x 10^{-6} inch/inch/degrees F, in accordance with ASTM D696.
20. Notched Izod Impact, Crosswise: 4 ft lbs/inch, in accordance with ASTM D256 within temperature range indicated.

2.05 INSULATION

A. Insulation Panel Edges: Provide factory formed edges on insulation panels that interlock with CFS system components.

B. Polyisocyanurate Panel Insulation: Rigid closed cell foam, complying with ASTM C1289; Type I with impermeable aluminum foil facing on both sides; Class 1 with non-reinforced foam core.
   1. Flame Spread Index (FSI): 25 or less, tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, tested in accordance with ASTM E84.
   3. Thermal Resistance: 3 inch, R-Value 19; ASTM C518 at 75 degrees F.
   4. Comply with fire-resistance requirements, as indicated on drawings, and as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
   5. Compressive Strength: Grade 1, 16 psi; tested in compliance with ASTM D1621.

6. Dimensional Stability: Less than 2 percent linear change after 7 days; ASTM D2126.
7. Moisture Vapor Permeance: Less than 0.05 perm; ASTM E96/E96M.
8. Water Absorption: Less than 0.05 percent by volume; ASTM C209.
9. Service Temperature: Range of minus 100 degrees F to 250 degrees F.
10. Acceptable Products:
    a. Basis of Design (BOD): Hunter Panels, LLC; Product Xci Foil (www.hunterxci.com)
    b. RMAX Operating, LLC; Product ECOMAXci Wall Solution (www.rmax.com)
    c. RMAX Operating, LLC; Product TSX-8500 (www.rmax.com)
    d. RMAX Operating, LLC; Product TSX-8510 (www.rmax.com <http://www.rmax.com>)
    e. Atlas Roof Insulation (www.atlasroofing.com)
    f. Firestone Building Products; Product Enverge ISO (www.firestonebpco.com)

2.06 COMPOSITE MATERIAL TRIM FOR OPENINGS

A. Composite Trim ; Provide composite trim at rough openings to properly transition CI system.
   1. Use trim angles and accessories sized to enclose CI system to provide thermally broken transition from opaque wall assemblies.
   2. Use sealant and tapes as required to transition vapor barrier from substrate onto trim.
   3. Trim to provide 90 degree transition of continuous insulated substrate for vapor barrier and exterior flashings.
   4. Trim to be covered by exterior panel construction and flashings.
   5. Tensile Stress: Provide engineered lengthwise and crosswise tensile stress in compliance with performance loading criteria and specified safety factors, in accordance with ASTM D638.
      a. Minimum crosswise and longitudinal: 33,000 ksi.
   6. Compressive Stress: Provide engineered lengthwise and crosswise compressive stress in compliance with performance loading criteria and specified safety factors, in accordance with ASTM D695.
      a. Minimum: 22,000 psi.
   7. Flexural Stress: Provide engineered lengthwise and crosswise flexural stress in compliance with performance loading criteria and specified safety factors, in accordance with ASTM D790.
      a. Minimum: 30,000 psi.
   8. Modulus of Elasticity: Engineered to meet performance loading criteria and specified safety factors.
      a. Minimum: 2,500,000 psi.
   9. Surface Burning Characteristics:
      a. Flame Spread Index (FSI): 25 or less, when tested in accordance with ASTM E84.
      b. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   10. Comply with fire-resistance requirements, as indicated on drawings, and as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
   11. Water Absorption: Less than 0.46 percent by weight, within 24 hours, tested in accordance with ASTM D570.
   12. Acceptable Products:
      a. SMARTci Trim
   13. Alternative:
      a. Performance CI system utilizing metal trim to provide spray foam insulation at a depth of 6” extending 32” around openings to reduce thermal transfer at wall transitions.

2.07 CONTINUOUS INSULATION SYSTEM ASSEMBLY

A. Assemble CI with CFS system using manufacturer’s standard procedures and processes identical to tested units and as necessary to comply with performance requirements indicated.

1. Comply with CFS system and dimensional and structural requirements as indicated on drawings.
2. Erect CFS system in established sequence in accordance with manufacturer's standard installation procedures.
3. CFS and CI panels shall create an air/water/vapor barrier system compliant with requirements for project.
4. Provide spray foam sealant on backside of cantilevered fasteners that completely puncture insulation layer.

2.08 ACCESSORIES

A. Provide accessories necessary for complete CFS system including metal closure trim, transition angle, strapping, or tie-in brackets and similar items.

B. Fasteners: Corrosion-resistant, self-tapping and self-drilling screws, bolts, nuts, and other fasteners as recommended by CFS system manufacturer for project application.
1. Cladding to CFS System: Use standard self-tapping metal screws.
2. CFS System to Metal Stud Wall Framing: Use standard self-tapping metal screws.
3. CFS System to Concrete/CMU: Use standard masonry or concrete screw anchors in predrilled hole.
4. DO NOT USE powder, air, or gas actuated fasteners or actuated fastener tools. DO NOT USE impact wrenches when fastening to or from the CFS.

C. Sealants: Provide sealants as recommended by CFS manufacturer for openings within CFS system and perimeter conditions.
1. Refer to Section 079200 - JOINT SEALANTS for sealant information.

D. Closure and Transition Accessories: Use metal or FRP angles and flat stock per standard system details.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas of this work, and project conditions with installer present for compliance with requirements for installation tolerances, substrates, CFS system conditions, and other conditions affecting performance of this Work.

B. Examine structural wall framing to ensure that angles, channels, studs, and other structural support members have been installed within alignment tolerances required by CFS system manufacturer.

C. Examine rough-in for components and systems penetrating CFS system to coordinate actual locations of penetrations relative to CFS systems joint locations prior to installation.

D. Verify that mechanical and electrical services for exterior walls have been installed and tested and, if appropriate, verify that adjacent materials and finishes are dry and ready to receive insulation.

E. Proceed with installation only after wall substrate surfaces have been properly prepared and unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by CFS manufacturer for achieving best result for substrate under project conditions.

C. Prepare sub-framing, base angles, sills, furring, and other CFS system members and provide anchorage in accordance with ASTM C754 for substrate type and wall cladding type in accordance with manufacturer’s installation instructions.

3.03 INSTALLATION

A. Install CFS system in accordance with manufacturer's installation instructions.

B. Install system to fill-in exterior spaces without gaps or voids, and do not compress insulation panels.

C. Trim insulation neatly to fit spaces and insulate miscellaneous gaps and voids.

D. Fit insulation tight in spaces and tight to exterior side of Mechanical/Electrical services within plane of insulation.

E. Seal gaps, voids or penetrations completely with approved expandable foam sealant on exterior and interior (if visible) before enclosing wall.

F. Provide spray foam to seal metal penetrations, including cantilevered fasteners, to prevent interstitial space condensation.

G. Exposed insulation must be protected from open flame.

H. Exterior wall insulation is not intended to be left exposed for periods of time in excess of 60 days without adequate protection.
   1. When extended exposure is anticipated, protect exposed insulation surfaces including corners, window and door openings with a compatible waterproof tape.

3.04 TOLERANCES

A. Shim and align CFS system within installed tolerances of 1/4 inch in 20 feet, non-cumulative, level, plumb, and on location lines as indicated.

3.05 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

B. Ensure that insulation panels are not exposed to moisture.
   1. Remove wet insulation panels or allow them to completely dry prior to installation of CFS system.

C. Replace damaged insulation panels prior to Date of Substantial Completion.

END OF SECTION 074210.31

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all labor, materials, and equipment as necessary to complete work as indicated on the Drawings and as specified herein. Section includes:
   1. Radiant Floor System Components
   2. Radiant Floor Manifold Enclosures
   3. Radiant floor Slab Insulation

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 079201 - Non-Fire Rated Sleeves and Seals

C. Section 230529 - Pipe Hangers and Supports

D. Section 230555 - Mechanical System Identification

E. Section 230594 - Balancing of Air and Hydronic Systems

F. Section 230700 - Pipe Insulation

G. Section 232000 - Pipe, Valves, and Fittings

1.03 REFERENCES

A. ASHRAE Handbook - 2019 HVAC Applications, Snow Melting and Freeze Protection.

1.04 SYSTEM DESCRIPTION

A. System shall be of hydronic type, field-assembled components including radiant floor tubing and direct buried distribution piping.

1.05 RADIANT FLOOR SYSTEM DESIGN CRITERIA

A. Radiant Floor System design criteria/parameters:

1.	HWH Supply Temperature	Max. 123.6ºF
2.	Working Fluid	100% Water
3.	Heat Source - Boiler Plant	256,490 BTU/Hr (Output)

1.06 EQUIPMENT AND SERVICES TO BE PROVIDED BY VENDOR

A. Equipment:
   1. The Vendor shall design, supply, deliver, supervise installation (as described here-in), startup, balance and test the radiant floor system, as rated and guaranteed in accordance with this Specification and as shown on the accompanying Drawings. The system shall consist of:
      a. Insulated zone distribution piping (direct buried). Above ground distribution piping to be provided by contract 'H' per section 230700 and 232000.
      b. Manifolds with all fittings, valves, test-kit, etc. as required for a fully functioning system.
      c. Radiant floor tubing, un-coiler, tube cutter, tube installation tool, fixing wire, etc. as required to properly install tubing and piping per vendor specifications.

d. Air temperature sensors.

B. Services to be provided by the Vendor shall consist in general of the following:
1. Delivery of equipment specified.
2. Preparation of shop drawings for equipment specified.
3. Preparation of operations and maintenance manuals.
4. Design, purchase, fabricate, assemble, and integrate components as described herein.
5. Furnish and deliver ancillary components to the site for field installation.
6. Startup of equipment and other items as indicated in this specification and attached drawings.
7. Train Owner's personnel in equipment operation and maintenance.

1.07 EQUIPMENT AND SERVICE BY OTHERS

A. The following work shall be performed by other trades (part of project - work to be provided by GC). Vendor shall provide supervision, inspection of installed systems, and technical assistance.
1. Offloading of equipment
2. Rigging, assembly and erection of equipment
3. External power supply wiring to equipment (by electrical contractor)
4. Radiant floor manifold safety barrier (size requirements to be specified by radiant floor system supplier)
5. Building floor cutting, pipe sleeves and tubing conduits at slab and foundation wall penetrations.
6. Site preparation (excavation, compacting of soil, rebar, concrete work, paving, etc.)
7. Slab insulation, expansion joint sleeves, etc.
8. Installation/construction of:
a. Installation of radiant floor tubing
9. Installation and wiring of field instrumentation and control valves (by controls contractor)
10. Connection to facility controls, data/communications, security and fire alarms

1.08 SUBMITTALS

A. Shop Drawings for Radiant Floor System: Include indoor manifolds (and minimum dimensions for manifold vaults), PEX tubing, sensor socket and sensor, performance data, components and accessories, wiring diagrams, dimensions, weights and loadings, field connections, installation details for PEX tubing, and required clearances.

B. Test Reports: Include operating test data submitted by the manufacturer's field service representative.

C. Operation and Maintenance Data: Include approved selection data, start-up instructions, maintenance data, part lists, accessories, control and wiring diagrams, and test reports.

D. Shop Drawings
1. Where deviations from the Drawings and Specifications are proposed for any reason, submit shop drawings identifying proposed deviations showing layout of all piping, fittings, materials, dimensions, and fabrication and installation details. Submit a comparison table of the specified features and ratings of the specified item and those of the proposed deviation to allow a direct comparison.
2. The review of deviations will be for pressure drop only. The review will not address clearances or accessibility. No dimensional or coordination check will be made.
3. The Contractor has the sole responsibility to review the Drawings, coordinate piping fabrication, and provide clearances and access for installation, maintenance and balancing of this Work, and Work of other trades. Unless specifically dimensioned, Drawings indicate

approximate locations only. The Contractor has the sole responsibility to locate and route the piping.

4. Submit all layout shop drawings on not less than ¼ inch equals 1 foot scale drawings.

1.09 START-UP AND OPERATING REQUIREMENTS

A. Do not operate system for any purpose, temporary or permanent, until piping connections have been verified, piping has been flushed, cleaned and pressure tested.

1.10 QUALITY ASSURANCE

A. Codes and Standards
   1. MMC 2003
   2. ASHRAE 90.1
   3. ASTM F876, “Standard Specification for Crosslinked Polyethylene (PEX) Tubing”.

1.11 WARRANTY

A. Manufacturer shall furnish, at the completion of installation, as described herein, a Certificate of Inspection signed by his authorized representative. The minimum five (5) year system warranty shall be provided to the Owner by the Contractor.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. A. Acceptable manufacturers of radiant floor systems are:
   1. Wirsbo / Uponor
   2. Heat Link
   3. Snow Technology, Inc.

2.02 PIPES, TUBING AND FITTINGS

A. Underground distribution loop shall be cross-linked polyethylene, PEX-A with an oxygen diffusion barrier, rated at minimum 180 deg. F. and 100 psi working pressure, conform to ASTM standards F876/F877, and marked "RADIANT FLOOR SYSTEM". Minimum tubing size is 5/8" nominal ID. Tubing shall have a minimum bend radius of not more than six times the tubing OD at 68 degree F. Tubing shall be UV stabilized. Approved Manufacturer: UPONOR he PEX plus, or approved equal.
   1. Tubing shall carry a twenty-five (25) year warranty. Warranty to be included with submittals.

B. Underground piping mains shall be pre-insulated PEX pipe. System shall consist of PEX pipe with an oxygen diffusion barrier, CFC free PEX closed cell foam insulation, and a corrugated twin wall HDPE protective sheath. Provide brass PEX compression x MPT adapters as necessary. Installer shall provide additional brass fittings as necessary for a complete system. Approved Manufacturer: ECOFLEX TWIN THERMAL pre-insulated pipe with jacket, or approved equal.

C. Mains above ground shall be Type L copper. See Section 232000 “Pipes, Valves, and Fittings”

D. Distribution manifolds shall be constructed of stainless steel, or approved equal. Provide isolation ball valves and thermometers in both the supply and return. Manifolds shall be compatible with tubing and shall have end caps tapped for manual air vents and a drain valve. Provide mini ball valves with PEX compression fittings for each loop for isolation and balancing.

Installer shall provide a ball valve and circuit balancing valve with full shutoff capability for each manifold set.

2.03 MISCELLANEOUS EQUIPMENT/INSTRUMENTS/DEVICES

A. Provide all ancillary components shown on drawings, flow diagrams or as necessary for a complete, fully functioning system, including balancing valves, isolation valves, multi-purpose (isolation & balancing) valves, pressure gauges, temperature gauges, temperature sensors, etc.

2.04 CONTROLS

A. Provide a central control panel with touch screen user interface, housing all controllers as required to control and interlock boiler, pumps, and zone controls for a completely automatic functioning system. Control panel shall be provided with a lockable disconnect switch in a wall mountable (minimum NEMA 12) enclosure. All field wiring for instrumentation or control shall be wired to this panel for all system inputs and control outputs. Control panel shall require a single 120VAC power feeder. All step-down transformers/power supplies shall be included in the control panel for all field devices. Pump motors and boilers shall have separate individual power feeders and noted on equipment schedules.

B. Control shall include outdoor temperature sensor, supply and return water temperature sensors, overheat protection, and control valves as required. System shall be turned on and off automatically. An HOA switch shall be provided for each zone in order to select each zone to operate in ‘Auto” mode, ‘Hand” mode (manually enabled) or ‘Off’ (manually disabled).

C. Microprocessor-based controller shall be provided that:
   1. Will indicate a general fault via a flashing red light at the main radiant floor panel.
   2. Has built-in hardware interface capable to communicate via BAC-Net protocol meeting the latest ISO 16484-5 standard for future remote monitoring and basic control (on/off/override) of the radiant floor system main controls. Programming and communication cabling will be performed at a future date. Only the physical communications interface hardware is required at this time.

D. Preliminary Control Sequence Minimum Requirements. The controller shall be capable of the following control sequences/parameters. All parameters shall be user adjustable with appropriate password protection. All parameters shall be programmable at the local control panel. The noted parameters / status items shall be available for remote control/monitoring upon installation of future BACnet communications.
   1. Viscosity Compensation (Alt. Temp. Delta T Max) - Max temperature overshoot during warm up.
   2. Run Time - time delay for system shut down once space temperature setpoint is achieved.
   3. Warm weather shut down temperature.
   4. Start-up idle temperature
   5. Space target temperature
   6. Purge timer
   7. Auto / Manual / Local / Remote Enable (local and remote capable)

E. Control Manufacturer: TACO iWORX, GREEN-LINK, or approved equal.

2.05 SLAB INSULATION

A. Insulation shall be provided below the radiant floor slab areas to provide thermal insulation between the heated slab and the sub-grade, sub-soil, aggregate base course, etc.

B. Provide Extruded Polystyrene Insulation board, installed per manufacturer’s instructions as follows:

1. Standard Duty Concrete Sidewalks: ASTM C578 Type VI, 40 PSI min. compressive. strength.
2. Heavy Duty Concrete Pavement: ASTM C578 Type V, 100 PSI min. compressive. strength.

C. Insulation shall be Owens Corning FOAMULAR, DOW Styrofoam, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Slab Preparation and Radiant Floor System
1. A complete radiant floor system including tubing loop, manifolds, fittings, and sensors shall be installed in accordance with the manufacturers' recommendations. The Contractor shall follow the Shop Drawings for tube layout, tube spacing, and manifold and sensor locations.
2. Stamp “Radiant Floor System” all along the edge of the heated surface. Review layout with Project Representative prior to stamping.
3. Distribution manifolds, attached to supply and return mains, shall be located inside a yard box adjacent to the heated slab section, as shown on drawings.
4. A minimum of one supply and one return manifold is required for each zone as shown on drawings. Locate main piping under the walk as much as possible. Main piping located outside the walk shall be at least 36" below ground, and shall be protected by indicator warning tape. Provide flow balance for entire system.
5. Reinforcing steel (6 x 6 - W1.4 x W1.4 minimum) shall be furnished by the Contractor and supported as required over entire heated area. All areas where radiant floor system is to be installed shall have the required preparation including grading, compaction and under-slab insulation completely installed.
6. 5/8”- inch pipe circuits shall be attached to reinforcing steel on 9" centers using 12 inch minimum return bends without fittings. All circuits shall be approximately 100 feet in length and form a continuous conduit without joints from supply to return manifolds. Maximum loop length shall not exceed 300 ft. All loops shall be of similar length with no more than +/- 10% variation from average loop length
7. Pipe circuits shall be embedded in concrete at specified depth. All pipe connections, fittings and distribution manifolds shall be free of concrete and arranged so as to be easily serviced by removal of access box cover.
8. Distribution loop shall be pressure tested with water or air in accordance with the manufacturer's recommendations prior to concrete cover. The system shall remain at thispressure during the concrete installation and for a minimum of 24 hours thereafter to insure system integrity.
9. Outdoor sensor shall be installed on the north or west wall with shield.
10. Connections
    a. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
    b. Install piping adjacent to machine to allow service and maintenance.
    c. Install pressure gages on pump suction and discharge, at integral pressure-gage tapping, or install single gage with multiple input selector valve.
    d. Install electrical connections for power, controls, and devices.

3.02 FIELD QUALITY CONTROL

A. Manufacturer shall provide inspection service and technical assistance for the installation:
1. Site preparation
2. Testing
3. Start-up and balance

4. Annual maintenance shall be available for inspection, adjustment and lubrication of system equipment.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Packaged engine generator set.

B. Exhaust piping, fittings, silencer and insulation.

C. Control panels.

D. Battery and charger.

E. Vibration isolation.

1.02 RELATED SECTIONS

A. Section 262917 – Wall Mount Transfer Switch.

1.03 REFERENCES

A. NEMA AB1 - Molded Case Circuit Breakers.

B. NEMA MG1 - Motors and Generators.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. ANSI/NFPA 70 - National Electric Code.

E. NFPA 110 - Emergency Standby Systems.

F. NFPA 30 - Flammable and Combustible Liquids Code.

G. NFPA 37 - Installation of Stationary Engines.

H. NFPA 101 - Life Safety Code.

1.04 SUBMITTALS

A. Submit product data under provisions of Section 013300.

B. Shop Drawings: Indicate electrical characteristics and connection requirements. Show plan and elevation views with overall and interconnection point dimensions, fuel consump-tion rate curves at various loads, ventilation and combustion air requirements, electrical diagrams including schematic and interconnection dia-grams.

C. Product Data: Provide data showing dimensions, weights, ratings, interconnection points and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, radiator and derating schedules, operating performance, exhaust flow data, and cooling system data. Submit generator alternator output curves, deration curves and temperature data on the complete genset individual components.

D. Test Reports: Indicate results of performance testing including 0.8 power factor test at 100 percent load.

E. Prototype Test Reports: Submittals will not be received without submission of prototype test reports. No exceptions.

F. Manufacturer's Installation Instructions: Indicate applica-tion conditions and limita-tions of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation and starting of product. Provide typical system interconnection wiring diagrams.

G. Manufacturer's Certificate: Certify that products meet or exceed specified require-ments.

H. Manufacturer's Field Reports: Indicate procedures and findings.

1.05 OPERATION AND MAINTENANCE DATA

A. Operation Data: Include instructions for normal operation.

B. Maintenance Data: Include instructions for routine maintenance requirements, ser-vice manuals for engine and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 110.

1.07 1.07 - QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten years experience, and with an authorized distributor offering 24-hour parts and service avail-ability within 50 miles of the project. The manufacturer shall fabricate the engines, generators and control panel. Automatic transfer switches and generator enclosures shall be supplied, warranted and serviced by a single system source supplier.

B. Supplier: Authorized distributor of specified manufacturer with minimum six years documented experience with specified products and factory-trained service technicians. The supplier must be factory authorized to perform warranty service on the entire system, including but not limited to, the engines, generators, control panels and automatic transfer switches. The supplier must show proof of factory trained service technicians on all components.

C. The complete engine generator system shall be standard of a single manufacturer. It shall be factory built, tested and shipped by this single manufacturer.

1.08 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70 and NFPA 110.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

1.09 EXTRA SERVICES

A. The single source supplier shall provide as part of the package a 5-year warranty and 5-year planned maintenance agreement at no additional cost to the Owner. This warranty shall cover the generator system and transfer switches. Agreement shall include, as a minimum, one service call per year. The services must be performed by the authorized distributor of the equipment furnished, and may not be subcontracted. The following services shall be performed once a year.
   1. Replace engine-lubricating oil and remove used oil from premises.
   2. Replace oil and fuel filters.

3. Check coolant system for proper levels and condition. Replace coolant filters and add corrosion inhibitor as needed.
4. Check air filter.
5. Check and clean crankcase breathers.
6. Check turbocharger free-spin and end play.
7. Check and adjust belts as required.
8. Check engine for loose, bare or broken wiring. Replace as needed.
9. Check entire equipment for fuel or water leaks.
10. Check condition of batteries and report any action necessary for recharging or replacing.
11. Start and run all engines, check temperatures and pressures.
12. Test engine safety shutdown systems.
13. Test all transfer switches operation and time delays.
14. Submit a report of this inspection to the Owner and advise of any further work required.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. ONAN CORPORATION, Minneapolis, Minnesota, or specifically approved equal.

B. Proposal for any substitute equipment shall provide complete submittal data and specified herein, to the Engineer for approval or disapproval. The supplier must submit detailed sizing calculations for each generator to verify models are capable of picking up the entire loads with voltage dips as herein specified.

C. Approval of Substitute Equipment: Design has been based on ONAN Model Generators. If substitute equipment is approved, the contractor shall be responsible for the charges of any necessary revisions to the plans and specifications, drawings, and project documentation; and charges related to equipment spacing, enclosure sizes, foundation sizes, mounts, electrical wiring, ventilation equipment, fuel, exhaust components, etc., as well as any engineering costs. Also, the supplier must furnish a list of completed installations, including name, address and telephone number of at least five comparable installations which can prove the proposed products have operated satisfactorily for three years.

D. It is intended that all products specified herein be of standard ratings, therefore, the KW and KVA, starting KVA and maximum allowable voltage dip, ratings, etc., shall be the manufacturer’s next size or rating to exactly meet the specifications. No exceptions.

2.02 SYSTEM REQUIREMENTS

A. The engine generator shall start and provide continuous power to the loads with 100 percent block loading at the time of transfer.

2.03 NATURAL GAS ENGINE GENERATOR SET

A. Rating: The AC engine generator set, ONAN Model C150N6 and shall be rated by the manufacturer for standby operation at 150KW/188 KVA at 0.8 PF, 60 Hz, 1800 RPM for use at 120/208 volts, 3 phase, 4 wire. Ratings shall be at an elevation of 150 feet above sea level, and at 105 degrees F.
   1. Voltage regulation shall be +/- 1.0 percent of rated voltage for any constant load between no load and rated load.
   2. Frequency regulation shall be isochronous under varying from no load to 100% rated load.
   3. Random Voltage Variation: The cyclic variations in RMS voltage shall not exceed +/- 1.0% of rated speed for constant loads from no load to rated load, with constant ambient and operating temperature.

4. Random Frequency Variation: Speed variations for constant loads from no load to rated load shall not exceed plus or minus 0.25% of rated speed, with constant ambient and operating temperature.
5. Telephone Harmonic Distortion: The sum of AC voltage waveform harmonics, from no load to full linear load, shall not exceed 5% of rated voltage (L-N, L-L, L-L-L) and no single harmonic shall exceed 3% of rated voltage.
6. Telephone Influence Factor: TIF shall be less than 50 per NEMA MG1-22.43.
7. The natural engine generator set shall be capable of picking up 100% of nameplate KW and power factor in one step with the engine generator set at operating temperature, in accordance with NFPA Standard 110, Paragraph 5-13.2.6.
8. The maximum allowable engine BMEP on the engine shall not exceed 224 psi at 100% rated load.
9. The engine generator shall start and provide power to the loads in the following step starting sequence with a maximum instantaneous voltage dip of 30% and a maximum frequency dip of 10%.
10. The generator shall at a minimum provide the following performance. Refer to generator load list.

B. The alternator performance shall be designed to provide a minimum of 840 locked rotor KVA at a maximum voltage dip of 30%.

C. The following performance verifications shall be provided for substitute generators.
1. Submit generator sizing program based upon the specified step/starting sequence and associated voltage/frequency dips and required starting KVA.
2. As part of the substitution requirements the contractor shall enter all design step/starting sequence loads into the manufacturer's generator sizing program to verify model proposed by substitute manufacturer meets the specified requirements for ambient temperature, site altitude, voltage dip, frequency dip, and starting KVA. Contractor shall provide generator sizing program to engineer for review and approval.

2.04 AC GENERATOR, REGULATOR AND EXCITER UNIT

A. The AC generator, exciter and voltage regulator shall be designed and manufac-tured by the engine generator set manufacturer as a complete generator system.

B. The AC generator shall be synchronous, four pole, revolving field, dripproof con-struction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan and directly connected to the engine with flexible drive discs. The arma-ture shall have skewed laminations of insulated electrical grade steel, two-thirds pitch windings in order to minimize field heating and voltage harmonics. The rotors shall have amortissuer (damper windings) layer wound mechanically wedged winding construction. The rotors shall be dynamically bal-anced. The exciters shall be brush-less, three phase, with full wave silicon diodes mounted on the rotating shaft and a surge suppressor connected in parallel with the field winding. Field discharge resistors shall not be acceptable. Systems using three wire solid state devices (such as SCRs or transistors) mounted on the rotor shaft shall not be acceptable.

C. All insulation system components shall meet NEMA MG1 standard temperature limits for Class H insulation system. Actual temperature rise measured by resis-tance method at full load shall not exceed 105 degrees C to provide additional allowance for internal hot spots. The main generator and exciter insulation systems must be suitably impregnated for operation in severe environments for resis-tance to sand, salt and sea spray.

D. Generator shall be a Permanent Magnet Generator (PMG). Permanent magnet generators shall provide excitation power to the auto-matic voltage regulator for immunity from voltage distortion caused by nonlinear SCR controlled loads on the generator. The PMG's shall sustain

main field excita-tion power for optimum motor starting and to sustain short circuit current for selective operation and coordination of system overcurrent devices.

2.05 ENGINE GENERATOR SET CONTROLS

A. The generator sets shall be provided with microprocessor-based control systems which are designed to provide automatic staring, monitoring, and control functions for the generator set. The control systems shall also be designed to allow local monitoring and control of the generator sets, and remote monitoring and control as described in this specification. The controls shall be mounted on the generator sets, and shall be vibration isolated and prototype tested to verify the durability of all components in the system under vibration conditions encountered. The controls shall be UL-508 labeled, CSA282-M1989 certified, and meet IEC-8528 part 4. All switches, lamps and meters shall be oil-tight and dust-tight, and the enclosure doors shall be gasketed. There shall be no exposed points in the controls (with the door open) that operate in excess of 50 volts. The controls shall meet or exceed the requirements of Mil-Std 461C part 9, and IEC Std. 801.2, 801.3 and 801.5 for susceptibility, conducted and radiated electromagnetic emissions. The entire controls shall be tested and meet the requirements of IEEE587 for voltage surge resistance. The generator set mounted controls shall include the following features and functions:
   1. Three position control switch labeled RUN/OFF/AUTO. In the RUN position the generator set shall automatically start, and accelerate to rated speed and voltage. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
   2. Red “mushroom-head” push-button EMERGENCY STOP switch. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
   3. Push-button RESET Switch: The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
   4. Generator Set AC Output Metering: The generator set shall be provided with a metering set with the following features and functions:
      a. Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three phase voltages (line to neutral or line to line) simultaneously.
   5. Generator Set Alarm and Status Message Display: The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing alarm and shutdown conditions. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of the following alarm and shutdown conditions on a digital display panel:
      a. Low Oil Pressure (alarm)
      b. Low Oil Pressure (shutdown)
      c. Oil Pressure Sender Failure (alarm)
      d. Low Coolant Temperature (alarm)
      e. High Coolant Temperature (alarm)
      f. High Coolant Temperature (shutdown)
      g. Engine Temperature Sender Failure (alarm)
      h. Fail to Crank (shutdown)
      i. Overcrank (shutdown)
      j. Overspeed (shutdown)
      k. Low DC Voltage (alarm)
      l. Low Coolant Level (alarm or shutdown-selectable)
      m. High DC Voltage (alarm)
      n. Weak Battery (alarm)

o. Low Fuel-Daytank (alarm)
p. High AC Voltage (shutdown)
q. Low AC Voltage (shutdown)
r. Under Frequency (shutdown)
s. Over Current (warning)
t. Over Current (shutdown)
u. Short Circuit (shutdown)
v. Ground Fault (alarm)
w. Over Load (alarm)
x. Emergency Stop (shutdown)
y. In addition, provisions shall be made for indication of two customer-specified or future alarm or shutdown conditions. These two alarm conditions shall be interfaced with leak detection/overfill alarm panel for overfill and leak detection. Labeling of the customer specified or future alarm or shutdown conditions shall be of the same type and quality as the above specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate the generator set is not able to automatically respond to a command to start from a remote location.

6. Engine Status Monitoring: The following information shall be available from a digital status panel on the generator set control:
   a. Engine Oil Pressure (psi of kPA)
   b. Engine Coolant Temperature for left and right block temperatures (degrees F or C; both)
   c. Engine Oil Temperature (degrees F or C)
   d. Engine Speed (rpm)
   e. Number of Hours of Operation (hours)
   f. Number of Start Attempts
   g. Battery Voltage (DC volts)
7. Control Functions: The control system shall provide for the following functions:
   a. The control system provided shall include a cycle cranking system, which allows for user selected crank time, reset time, and number of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15 second rest period between cranking periods.
   b. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.
   c. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and ramping function to control engine speed and limit exhaust smoke while the unit is starting. The governor control shall be suitable for use in paralleling applications without component changes.
   d. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
   e. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure condition.
8. Alternator Control Functions: The generator set control shall include the following alternator control functions:
   a. The generator set shall include an automatic voltage regulation system which is matched and prototype tested with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control build up of AC generator voltage to provide a linear rise and limit overshoot. The systems shall include a torque-matched characteristic, which shall reduce output voltage in

proportion to frequency below a threshold of [58-59] HZ. The voltage regulator shall include adjustments for gain, damping and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alpha-numeric LED readout to indicate setting level.

b. The voltage regulation system shall include provisions for reactive load sharing and electronic voltage matching for paralleling applications. Motorized voltage adjust pot is not acceptable for voltage matching.
c. Controls shall be provided to monitor the output current of the generator set and initiate an alarm when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator.
d. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition when total load on the generator set exceeds the generator set rating for in excess of 5 seconds.
e. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.
f. An AC over/under voltage monitoring system which responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.
g. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32VDC. During engine starting, the low voltage limit shall be disabled, and if DC voltage drops to less than 14.4 volts for more than two seconds a “weak battery” alarm shall be initiated.
h. The control system shall include a ground fault monitoring relay. The relay shall be adjustable from 100-1200 amps, and include adjustable time delay of 0-1.0 seconds. The relay shall be for indication only, and not trip or shut down the generator set. Note bonding and grounding requirements for the generator set, and provide relay which will function correctly in system as installed.

9. Control Interfaces for Remote Monitoring: All control and interconnection points from the generator set to remote components shall be brought to a separate connection box. No field connections shall be made in the control enclosure or in the AC power output enclosure. Provide the following features in the control system:
   a. Form “C” dry common alarm contact set rated 2A @ 30VDC to indicate existence of any alarm or shutdown condition on the generator set.
   b. One set of contacts rated 2A @ 30VDC to indicate generator set is ready to load. The contacts shall operate when voltage and frequency are greater than 90% of rated condition.
   c. A fused 10 amp switched 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.
   d. A fused 20 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.
   e. The control shall be provided with provisions for connection of remote monitoring equipment as described herein or shown on the drawings.

2.06 ENGINES

A. The natural gas engine shall be manufactured by Cummins Engine Company and designed specifically for generator set duty. The natural engine shall be 4 cycle, natural gas fueled, direct injection, 1800 RPM, with forged steel crankshaft and connecting rods. Minimum engines shall be 543 cubic inches. Engines shall have a minimum of 6 cylinders. The cylinder blocks shall

be cast iron with replaceable wet liners and have four valves per cylinder. The engines shall be turbocharged and aftercooled.

B. Two cycle engines will not be acceptable.

C. Electronic governor systems shall provide automatic isochronous frequency regulation. The engine governing systems shall not utilize any exposed operating linkage.

D. The engines shall be cooled by a unit-mounted closed loop radiator system including belt-driven pusher fan, coolant pump and thermostat temperature control. The cooling systems shall be rated for full rated load operation in 104 degrees F (40 degrees C) ambient condition. The cooling capability of the generator sets shall be demonstrated by prototype tests on a representative generator set model conducted by the generator set manufacturer; calculated data from the radiator manufacturer only is not sufficient. Radiators shall be provided with a duct adapter flange permitting the attachment of an air discharge duct to direct the radiator air outside according to the manufacturer's instructions.

E. Rotating parts shall be guarded against accidental contact per OSHA requirements.

F. The maximum radiator cooling air shall not exceed 8,800 scfm. The maximum allowable static restriction shall not exceed 0.5 inches of water. The entire cooling air system is based on the above data. All costs incurred if an alternate manufacturer is purchased shall be the responsibility of the electrical contractor. These costs shall include costs to all other trades as well as any associated engineering fees.

2.07 ENGINE ACCESSORY EQUIPMENT

A. The engine generator sets shall include the following accessories:
   1. Electric starters capable of three complete cranking attempts without overheating, before overcrank shutdown (75 seconds).
   2. Positive displacement, mechanical, full pressure, lubrication oil pumps. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicators. Provide bypass oil filters.
   3. Replaceable heavy duty dry element air cleaners with restriction indicators and safety element.
   4. Engine mounted battery charging alternators, 100 ampere and solid-state voltage regulators.
   5. Anti-condensation heater for alternator.

2.08 BASES

A. The engine-generator set shall be mounted on a heavy duty steel base to maintain proper alignment between components. The engine-generator set shall incorporate battery trays with battery holddown clamps on the base rails. Provisions for stub up of electrical connections shall be within the footprint of the generator set base rails and within the basetanks as specified in the housing section of the specification. Vibration isolators, spring type, shall be provided to be mounted under the generator set base.

2.09 GENERATOR SETS CIRCUIT BREAKERS

A. Generator main circuit breaker shall be solid state UL listed, molded case type, rated as listed below. Circuit breakers shall be mounted in a separate NEMA 1 enclosure and be shipped completely wired to the gensets. No exceptions. Enclosures shall include neutral blocks for field connection.

B. Solid State circuit breakers shall be 100% rated: Refer to drawings for sizes.

C. Circuit breaker (CB) shall be long time current and instantaneous pickup with solid state trip unit. CB shall have visible mechanical fault indicator and push button trip.

D. Circuit breakers shall be rated at 65,000 AIC.

E. Provide auxiliary contacts on breaker position.

2.10 EXHAUST SYSTEMS

A. One exhaust silencer shall be provided for the generator set. The silencer shall be super critical grade. The silencer shall reduce total noise a minimum of 71.3 dB(A) at twenty-three feet.

B. The exhaust silencer shall be bottom inlet/top outlet and shall be mounted inside the sound attenuated enclosure. Provide all fittings, reducers, couplings elbows and spool pieces.

C. All exterior fittings, accessories and bolts shall be type 304 stainless steel. Provide heat resistant gaskets between all flanged connections to serve as dielectric protectors.

D. The maximum gas flow shall not exceed 1,431 cfm (at full stand by). The exhaust gas temperature shall not exceed 1186 degrees F (at full stand by). The maximum back pressure shall not exceed 36.1 inches of water. The design of the entire exhaust system is based on the above data. If a substitution of model specified is made, all costs incurred to redesign as well as costs to other trades to modify the layout shall be the complete responsibility of the electrical contractor.

E. Provide stainless steel flexible exhaust connections for the engine as required for connection between the engine exhaust manifolds and exhaust lines in compliance with applicable codes and standards.

F. Provide an exhaust system condensation trap with manual drain valve to trap and drain off exhaust condensation and to prevent condensation from enter-ing the engine.

G. Provide a suitable weather cap at the stack outlet with all necessary flanges and fittings for proper installa-tion. The weather cap shall have the proper counter weights attached to prevent banging while generator is unloaded.

H. Thermal jacket for interior exhaust lines and silencer by FIRWIN CORP. or engineered approved equal. Jacket thickness shall be sufficient to maintain a surface temperature of less than 200 degrees F.

I. Exhaust mufflers shall be installed by enclosure manufacturer so their weight is not supported by the engines.

2.11 ACCESSORIES

A. Vibration isolators: Spring type.

B. Starting and control Batteries: Two (2) 24 volt starting batteries each genset, lead acid type, 24 volt DC (12 volt DC will not be accepted), sized to accommodate 45 seconds of cranking at an ambient of 0 degrees F without being recharged.

C. Battery Chargers: One 10 amp voltage regulated battery charger shall be provided for each engine-generator set. Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with float, taper and equalize charge settings. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps, 120 VAC, 30 VDC for remote indication of :

1. Loss of AC Power - red light.
2. Low Battery Voltage - red light.
3. High Battery Voltage - red light.
4. Power ON - green light (no relay contact).

D. Block Heaters: Thermostatically controlled jacket water heater shall be supplied for each genset with a minimum size shall be 4990 watts. Input voltage of heaters shall be 480 VAC 1 phase.

E. Provide generator 20 light remote annunciator located inside the Electrical Room (ATS Room) on the ATS Cubicle. Interface generator set controls with battery charger and fuel tank alarms for all status conditions. Provide all power, control wiring including conduits.

2.12 ENCLOSURE

A. The generator set shall be provided with a factory-installed sound attenuated housing which allows the generator set to operate at full rated load in the ambient conditions previously specified. The enclosure shall reduce the sound level of the generator set while operating at full rate load to a maximum of 71.3 dBA at any location 7 meters from the generator set in a free field environment. Housing materials used shall be steel. Fiberglass and plastic are not acceptable. Acoustical materials used shall be oil and water resistant. No foam materials shall be used.

B. The enclosure shall include hinged doors for access to both sides of the engine and alternator, and the control equipment and a hinged rear see-through control door. Key-locking and padlockable door latches shall be provided for all doors. Door hinges shall be stainless steel.

C. The enclosure shall be provided with an exhaust silencer which is mounted on top of the enclosure, and allows the generator set package to meet specified sound level requirements. Silencer and exhaust shall include a rain cap and rain shield.

D. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color using a two step electrocoating paint process, or equal meeting the performance requirements specified below. Metal part surfaces shall be prepared, primed and painted. The painting process shall result in a coating which meets the following requirements:
   1. Primer thickness, 0.5-2.0 mils. Top coat thickness, 0.8-1.2 mils.
   2. Gloss, per ASTM D523, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.
   3. Crosshatch adhesion, per ASTM D3359, 4B-5B.
   4. Impact resistance, per ASTM D2794, 120-160 inch pounds.
   5. Salt spray, per ASTM B117, 1000+ hours.
   6. Humidity, per ASTM D2247, 1000+ hours.
   7. Water Soak, per ASTM D2247, 1000+ hours.

E. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts will not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work. The enclosure shall be built and tested by the engine generator manufacturer.

2.13 SOURCE QUALITY CONTROL

A. To provide proven reliability of the system, three series of tests shall be performed: prototype model tests, production model tests and field tests. The manufacturer shall provide documentation demonstrating satisfactory prototype and production test results. Generator sets that have not been prototype tested and factory tested at 0.8 PF will not be acceptable.

B. Generator Set Factory Production Tests and Evaluation: These tests and evaluations must have been performed on a prototype generator set representative of the Model specified. A summary of the generator set testing results shall be submitted for review. The manufacturer's standard series of components development tests on the generator system, engine and other major components shall also be performed and available for review, but shall not be acceptable as a substitute for prototype testing on the complete representative generator set prototype.

C. Torsiograph Analysis and Test: The manufacturer of the generator set shall verify that the engine generator set, as configured, is free from harmful torisional stresses. The analysis shall include correlation of empirical data from tests on a representative prototype. The empirical data must include spectrum analysis of the torsional transducer output within the operating speed range of the engine generator set. Calculations based on engine and generator separately are not acceptable.

D. Temperature Rise Test: Complete thermal evaluation of a prototype generator rotor and starter must include actual measurement of internal generator and exciter temperatures by embedded detector method, and measurement of average temperature rise by resistance method. No position measured any place in the windings may exceed the temperature rise limits of NEMA for the particular type of insulation system used. Resistance method temperature rise data shall be confirmed by a full load test on the generator set prototype to include conducted and radiated heat from the engine.

E. Short Circuit Test: A test on a prototype generator set shall have demonstrated that the generator set is designed to withstand the mechanical forces associated with a short circuit condition. With the generator set operating at rated load and speed, the generator terminals must be short circuited on all three phases for a duration of 20 seconds. At the conclusion of this test, the generator set must be capable of full load operation.

F. Endurance Run Test: A minimum of 500 continuous hours of endurance testing with a representative generator set prototype operating as defined by the manufacturer's standby rating shall have been performed. Endurance testing shall be used to verify structural soundness and durability.

G. Maximum Power Test: With the prototype generator set at normal operating temperature and with all power consuming auxiliaries in place, the maximum power available at rated speed shall be determined with the governor set at its fuel stop. The generator set shall maintain this power for a minimum of two minutes.

H. Linear Vibration Test: A test for in-line motion of components occurring along a repeatable path shall meet the manufacturer's acceptance criteria.

I. Cooling System Test: A cooling system test shall demonstrate the ability of the generator set cooling system to maintain normal operating temperature while operating at full rated load and power factor at the highest ambient temperature (122°F) of the system rating. Cooling air requirements, radiator air flow and maximum allowable restriction at radiator discharge, shall be verified by this test.

J. Maximum Motor Starting KVA: Motor starting KVA shall be determined by test, based on a sustained RMS recovery voltage of at least 90 percent of no load voltage with the specified load KVA at near zero power factor applied to the generator set.

K. Transient Response, Steady State Speed Control and Voltage Regulation: Prototype generator set tests shall demonstrate consistent performance as follows; stable voltage and frequency at all loads from no load to full rated load, consistent frequency backwidth with steady state load, maximum voltage and frequency kp on load acceptance and rejection and restoration to steady state after sudden load changes. Transient response is a complete generator set (engine,

generator, exciter, and regulator) performance criteria and cannot be established on generator data alone.

L. Witnessed Generator Set Factory Production Tests: On the equipment to be shipped, an 8-hour test shall be performed at rated load and 0.8 PF. These tests shall include certified data to document the following: run at full load, maximum power, voltage regulation, transient and steady state governing, single step load pickup and safety shutdowns. Provide a factory certified test record of the production testing. Certified test record shall be sealed by a licensed professional engineer.

2.14 WARRANTY

A. Provide a 5-year manufacturer's limited warranty, including 100% parts and labor. The complete electrical power system, including but not limited to, generator set, controls, associated switches, enclosures, and accessories, as provided by the single source manufacturer, shall be warranted by the manufacturer against defects in materials and workmanship for a period of five (5) years from the date of system startup. Coverage shall include parts, labor, travel expenses, and labor to remove/reinstall the equipment, as standard published limited warranty. Supplier must be factory authorized to perform warranty service on the entire system, including, but not limited to, the engine, the generator, the control panels, and the automatic transfer switches.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install engine generator and all appurtenances in accordance with manufacturer's recommendations.

B. Enclosure manufacturer shall install all exhaust components as shown on the drawings and as required to comply with NFPA 37 and local codes and regulations. Components shall be sized to assure full load operation without excessive backpressure sized as per manufacturer’s recommendations with actual site dimensions when installed as shown on the drawing. Make provisions as required for pipe expansion and contraction.

C. Coordinate installation of anchor bolts with generator enclosure manufacturer.

D. Installation shall comply with applicable State and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer’s instructions and instructions included in the listing or labeling of UL listed products.

3.02 FIELD QUALITY CONTROL

A. Initial startup and field acceptance tests are to be conducted by the authorized rep-resentative of the system manufacturer who supplies the equipment.

B. Test data shall be collected and recorded on the following: time of day, coolant temperature, operating oil pressure, battery charging rate, cranking time, crank-to-rated frequency time, voltage and frequency overshoot, load assumption-to-steady state voltage and frequency stabiliza-tion time, operating voltage, frequency, current, kilowatts and power factor. All data shall be taken every fifteen (15) minutes.

C. Procedure: Generator manufacturer shall conduct a six (6) hour load bank test at 1.0 power factor for each generator set. Contractor shall provide load bank for testing generator set at 100% load. Contractor is not permitted to use load bank specified as part of the testing requirements. Load bank test shall test generator at full nameplate KW rating. Generator manufacturer's representative shall record test data, as described in (B) above. Test data shall be tabulated and typed for submission and approval by the engineer for final acceptance. No handwritten field notes will be allowed.

GENERATOR LOAD LIST

Step Number	Load Description	Load Type	Volts/Phase	Load	Efficency	Starting Method
1	General Lighting	LED - Ltg	208/3	10 KVA		Full Voltage
1	GDS-1,2	General Receptacle	120/1	2.22 KVA		Full Voltage
1	Block Heater	General Receptacle	208/1	5.56 KVA		Full Voltage
2	General Rec. Load	General Receptacle	208/3	10 KVA		Full Voltage
3	Cord Reel	General Receptacle	120/1	5 KVA		Full Voltage
4	Garage Door #1	General Receptacle	120/1	0.74 KVA		Full Voltage
4	Garage Door #2	General Receptacle	120/1	0.74 KVA		Full Voltage
4	Garage Door #3	General Receptacle	120/1	0.74 KVA		Full Voltage
4	Garage Door #4	General Receptacle	120/1	0.74 KVA		Full Voltage
4	Garage Door #5	General Receptacle	120/1	0.74 KVA		Full Voltage
4	Garage Door #6	General Receptacle	120/1	0.74 KVA		Full Voltage
5	MAU-1	AC	208/3	3 Tons	10 EER	Full Voltage
5	MAU-1 Fan	Motor	208/3	1 HP		Full Voltage
5	LRS-1	General Receptacle	120/1	0.96 KVA		Full Voltage
6	BL-1	User Defined	120/1	1.86 KVA		Full Voltage
6	BL-2	User Defined	120/1	1.86 KVA		Full Voltage
6	HHWP-1,2	Motor	208/3	3 HP		Full Voltage
6	HHWP-3,4	Motor	208/1	1 HP		Full Voltage
6	HHWP-5,6	Motor	208/1	0.6 HP		Full Voltage
7	HVLS-1	Motor	208/3	1 HP		Full Voltage
7	HVLS-2	Motor	208/3	1 HP		Full Voltage
7	HVLS-3	Motor	208/3	1 HP		Full Voltage
8	GX-1	Motor	208/3	3 HP		Full Voltage
8	GX-2,3,4	Motor	120/1	0.3 HP		Full Voltage
8	BC-1,2,3,4	General Receptacle	120/1	0.56 KVA		Full Voltage
9	EU-114	User Defined	208/1	0.05 KVA		Full Voltage
9	EU-118	User Defined	208/1	0.05 KVA		Full Voltage
9	EU-120	User Defined	208/1	0.05 KVA		Full Voltage
9	EU-203	User Defined	208/1	0.05 KVA		Full Voltage
9	EU-212	User Defined	208/1	0.05 KVA		Full Voltage
9	EU-213	User Defined	208/1	0.05 KVA		Full Voltage
9	EU-214	User Defined	208/1	0.05 KVA		Full Voltage
9	EU-215	User Defined	208/1	0.05 KVA		Full Voltage
9	EU-216	User Defined	208/1	0.05 KVA		Full Voltage
9	EU-125A	User Defined	208/1	0.05 KVA		Full Voltage
9	EU-202	User Defined	208/1	0.05 KVA		Full Voltage
9	EU-211	User Defined	208/1	0.05 KVA		Full Voltage
9	FCU-102	User Defined	208/1	0.42 KVA		Full Voltage
9	FCU-116-1	User Defined	208/1	0.6 KVA		Full Voltage
9	FCU-116-2	User Defined	208/1	0.6 KVA		Full Voltage

GENERATOR LOAD LIST

Step Number	Load Description	Load Type	Volts/Phase	Load		Starting Method
9	FCU-116-3	User Defined	208/1	0.6 KVA		Full Voltage
9	FCU-206	User Defined	208/1	0.6 KVA		Full Voltage
9	FCU-204A	User Defined	208/1	0.64 KVA		Full Voltage
9	CUH-A	User Defined	120/1	0.12 KVA		Full Voltage
9	CUH-B	User Defined	120/1	0.12 KVA		Full Voltage
9	CUH-112	User Defined	120/1	0.12 KVA		Full Voltage
9	CUH-126	User Defined	120/1	0.12 KVA		Full Voltage
9	CU-1	AC	208/3	168000 BTU	10.8 EER	Full Voltage
9	CU-2	AC	208/3	168000 BTU	10.8 EER	Full Voltage
10	WH-1	User Defined	208/1	3 KVA		Full Voltage
10	Heat Enclosure	User Defined	120/1	0.09 KVA		Full Voltage
11	KX-1	User Defined	208/1	1.35 KVA		Full Voltage
11	TX-1	Motor	120/1	0.25 HP		Full Voltage
11	TX-2,3	Motor	120/1	0.13 HP		Full Voltage
12	RTU-208 AC	AC	208/3	3 Tons	13 EER	Full Voltage
12	RTU-208 Fan	Motor	208/3	2.02 HP		Full Voltage
12	RTU-208 Power Exh	Motor	208/1	1.23 HP		Full Voltage
12	RTU-208 OD Fan	Motor	208/1	0.38 HP		Full Voltage
13	VXF-1	Motor	208/3	10 HP		Full Voltage
14	DOAS-1	AC	208/3	25 Tons	8.5 EER	Full Voltage

END OF SECTION 263214.11

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Packaged engine generator set.

B. Exhaust piping, fittings, silencer and insulation.

C. Control panels.

D. Battery and charger.

E. Vibration isolation.

1.02 RELATED SECTIONS

A. Section 012500 - Substitution Procedures.

B. Section 262917 - Transfer Switch (Wall Mount)

1.03 REFERENCES

A. NEMA AB1 - Molded Case Circuit Breakers.

B. NEMA MG1 - Motors and Generators.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. ANSI/NFPA 70 - National Electric Code.

E. NFPA 110 - Emergency Standby Systems.

F. NFPA 30 - Flammable and Combustible Liquids Code.

G. NFPA 37 - Installation of Stationary Engines.

H. NFPA 101 - Life Safety Code.

1.04 SUBMITTALS

A. Submit product data under provisions of Section 013300.

B. Shop Drawings: Indicate electrical characteristics and connection requirements. Show plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, electrical diagrams including schematic and interconnection dia-grams.

C. Product Data: Provide data showing dimensions, weights, ratings, interconnection points and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, radiator and derating schedules, operating performance, exhaust flow data, and cooling system data. Submit generator alternator output curves, deration curves and temperature data on the complete genset individual components.

D. Test Reports: Indicate results of performance testing including 0.8 power factor test at 100 percent load.

E. Prototype Test Reports: Submittals will not be received without submission of prototype test reports. No exceptions.

F. Manufacturer's Installation Instructions: Indicate applica-tion conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation and starting of product. Provide typical system interconnection wiring diagrams.

G. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

H. Manufacturer's Field Reports: Submit under provisions of Section 017500. Indicate procedures and findings.

1.05 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 017823.

B. Operation Data: Include instructions for normal operation.

C. Maintenance Data: Include instructions for routine maintenance requirements, service manuals for engine and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 110.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten years experience, and with an authorized distributor offering 24-hour parts and service availability within 50 miles of the project. The manufacturer shall fabricate the engines, generators and control panel. Automatic transfer switches and generator enclosures shall be supplied, warranted and serviced by a single system source supplier.

B. Supplier: Authorized distributor of specified manufacturer with minimum six years documented experience with specified products and factory-trained service technicians. The supplier must be factory authorized to perform warranty service on the entire system, including but not limited to, the engines, generators, control panels and automatic transfer switches. The supplier must show proof of factory trained service technicians on all components.

C. The complete engine generator system shall be standard of a single manufacturer. It shall be factory built, tested and shipped by this single manufacturer.

1.08 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70 and NFPA 110.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

1.09 EXTRA SERVICES

A. The single source supplier shall provide as part of the package a 5-year warranty and 5-year planned maintenance agreement at no additional cost to the Owner. This warranty shall cover the generator system, transfer switches and generator enclosures. Agreement shall include, as

a minimum, one service call per year. The services must be performed by the authorized distributor of the equipment furnished, and may not be subcontracted. The following services shall be performed once a year.

1. Replace engine-lubricating oil and remove used oil from premises.
2. Replace oil and fuel filters.
3. Check coolant system for proper levels and condition. Replace coolant filters and add corrosion inhibitor as needed.
4. Check air filter.
5. Check and clean crankcase breathers.
6. Check turbocharger free-spin and end play.
7. Check and adjust belts as required.
8. Check engine for loose, bare or broken wiring. Replace as needed.
9. Check entire equipment for fuel or water leaks.
10. Check condition of batteries and report any action necessary for recharging or replacing.
11. Start and run all engines, check temperatures and pressures.
12. Test engine safety shutdown systems.
13. Test all transfer switches operation and time delays.
14. Submit a report of this inspection to the Owner and advise of any further work required.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. ONAN CORPORATION, Minneapolis, Minnesota, or specifically approved equal.

B. Proposal for any substitute equipment shall provide complete submittal data, as specified in Section 012500 - Substitution Procedures and specified herein, to the Engineer for approval or disapproval. The supplier must submit detailed sizing calculations for each generator to verify models are capable of picking up the entire loads with voltage dips as herein specified.

C. Approval of Substitute Equipment: Design has been based on ONAN Model Generators. If substitute equipment is approved, the contractor shall be responsible for the charges of any necessary revisions to the plans and specifications, drawings, and project documentation; and charges related to equipment spacing, enclosure sizes, foundation sizes, mounts, electrical wiring, ventilation equipment, fuel, exhaust components, etc., as well as any engineering costs. Also, the supplier must furnish a list of completed installations, including name, address and telephone number of at least five comparable installations which can prove the proposed products have operated satisfactorily for three years.

D. It is intended that all products specified herein be of standard ratings, therefore, the KW and KVA, starting KVA and maximum allowable voltage dip, ratings, etc., shall be the manufacturer’s next size or rating to exactly meet the specifications. No exceptions.

2.02 SYSTEM REQUIREMENTS

A. The engine generator shall start and provide continuous power to the loads with 100 percent block loading at the time of transfer.

2.03 NATURAL GAS ENGINE GENERATOR SET

A. Rating: The AC engine generator set, ONAN Model C60 N6 and shall be rated by the manufacturer for standby operation at 60 KW/75 KVA at 0.8 PF, 60 Hz, 1800 RPM for use at 120/208 volts, 3 phase, 4 wire. Ratings shall be at an elevation of 500 feet above sea level, and at 104 degrees F.

1. Voltage regulation shall be plus or minus 1 percent of rated voltage for any constant load between no load and rated load.

2. Frequency regulation shall be isochronous under varying from no load to 100% rated load.
3. Random Voltage Variation: The cyclic variations in RMS voltage shall not exceed plus or minus 1% of rated speed for constant loads from no load to rated load, with constant ambient and operating temperature.
4. Random Frequency Variation: Speed variations for constant loads from no load to rated load shall not exceed plus or minus 0.25% of rated speed, with constant ambient and operating temperature.
5. Telephone Harmonic Distortion: The sum of AC voltage waveform harmonics, from no load to full linear load, shall not exceed 5% of rated voltage (L-N, L-L, L-L-L) and no single harmonic shall exceed 3% of rated voltage.
6. Telephone Influence Factor: TIF shall be less than 50 per NEMA MG1-22.43.
7. The diesel engine generator set shall be capable of picking up 100% of nameplate KW and power factor in one step with the engine generator set at operating temperature, in accordance with NFPA Standard 110, Paragraph 5-13.2.6.
8. The maximum allowable engine BMEP on the engine shall not exceed 224 psi at 100% rated load.
9. The engine generator shall start and provide power to the loads in the following step starting sequence with a maximum instantaneous voltage dip of 30% and a maximum frequency dip of 10%.
10. The generator shall at a minimum provide the following performance.

B. The alternator performance shall be designed to provide a minimum of 350 locked rotor KVA at a maximum voltage dip of 35%.

C. The following performance verifications shall be provided for substitute generators.
1. Submit five copies of generator sizing program based upon the specified step/starting sequence and associated voltage/frequency dips and required starting KVA.
2. As part of the substitution requirements the contractor shall enter all design step/starting sequence loads into the manufacturer’s generator sizing program in the presence of the engineer to verify model proposed by substitute manufacturer meets the specified requirements for ambient temperature, site altitude, voltage dip, frequency dip, and starting KVA.

2.04 AC GENERATOR, REGULATOR AND EXCITER UNIT

A. The AC generator, exciter and voltage regulator shall be designed and manufactured by the engine generator set manufacturer as a complete generator system.

B. The AC generator shall be synchronous, four pole, revolving field, dripproof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan and directly connected to the engine with flexible drive discs. The armature shall have skewed laminations of insulated electrical grade steel, two-thirds pitch windings in order to minimize field heating and voltage harmonics. The rotors shall have amortissuer (damper windings) layer wound mechanically wedged winding construction. The rotors shall be dynamically balanced. The exciters shall be brushless, three phase, with full wave silicon diodes mounted on the rotating shaft and a surge suppressor connected in parallel with the field winding. Field discharge resistors shall not be acceptable. Systems using three wire solid state devices (such as SCRs or transistors) mounted on the rotor shaft shall not be acceptable.

C. All insulation system components shall meet NEMA MG1 standard temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 105 degrees C to provide additional allowance for internal hot spots. The main generator and exciter insulation systems must be suitably impregnated for operation in severe environments for resis-tance to sand, salt and sea spray.

D. Generator shall be a Permanent Magnet Generator (PMG). Permanent magnet generators shall provide excitation power to the automatic voltage regulator for immunity from voltage distortion caused by nonlinear SCR controlled loads on the generator. The PMG's shall sustain main field excitation power for optimum motor starting and to sustain short circuit current for selective operation and coordination of system overcurrent devices.

2.05 ENGINE GENERATOR SET CONTROLS

A. The generator sets shall be provided with microprocessor-based control systems which are designed to provide automatic staring, monitoring, and control functions for the generator set. The control systems shall also be designed to allow local monitoring and control of the generator sets, and remote monitoring and control as described in this specification. The controls shall be mounted on the generator sets, and shall be vibration isolated and prototype tested to verify the durability of all components in the system under vibration conditions encountered. The controls shall be UL-508 labeled, CSA282-M1989 certified, and meet IEC-8528 part 4. All switches, lamps and meters shall be oil-tight and dust-tight, and the enclosure doors shall be gasketed. There shall be no exposed points in the controls (with the door open) that operate in excess of 50 volts. The controls shall meet or exceed the requirements of Mil-Std 461C part 9, and IEC Std. 801.2, 801.3 and 801.5 for susceptibility, conducted and radiated electromagnetic emissions. The entire controls shall be tested and meet the requirements of IEEE587 for voltage surge resistance. The generator set mounted controls shall include the following features and functions:
   1. Three position control switch labeled RUN/OFF/AUTO. In the RUN position the generator set shall automatically start, and accelerate to rated speed and voltage. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
   2. Red "mushroom-head" push-button EMERGENCY STOP switch. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
   3. Push-button RESET Switch: The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
   4. Generator Set AC Output Metering: The generator set shall be provided with a metering set with the following features and functions:
      a. 2.5-inch, 90 degree scale analog voltmeter, ammeter, frequency meter, and kilowatt (KW) meter. These meters shall be provided with a phase select switch and an indicating lamp for upper and lower scale on the meters. Ammeter and KW meter scales shall be color coded in the following fashion: readings from 0-90% of generator set standby rating: green; readings from 90-100% of standby rating: amber; readings in excess of 100%: red.
      b. Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three phase voltages (line to neutral or line to line) simultaneously.
   5. Generator Set Alarm and Status Message Display: The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing alarm and shutdown conditions. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of the following alarm and shutdown conditions on a digital display panel:
      a. Low Oil Pressure (alarm)
      b. Low Oil Pressure (shutdown)
      c. Oil Pressure Sender Failure (alarm)
      d. Low Coolant Temperature (alarm)
      e. High Coolant Temperature (alarm)

f. High Coolant Temperature (shutdown)
g. Engine Temperature Sender Failure (alarm)
h. Fail to Crank (shutdown)
i. Overcrank (shutdown)
j. Overspeed (shutdown)
k. Low DC Voltage (alarm)
l. Low Coolant Level (alarm or shutdown-selectable)
m. High DC Voltage (alarm)
n. Weak Battery (alarm)
o. Low Fuel-Daytank (alarm)
p. High AC Voltage (shutdown)
q. Low AC Voltage (shutdown)
r. Under Frequency (shutdown)
s. Over Current (warning)
t. Over Current (shutdown)
u. Short Circuit (shutdown)
v. Ground Fault (alarm)
w. Over Load (alarm)
x. Emergency Stop (shutdown)
    1) In addition, provisions shall be made for indication of two customer-specified or future alarm or shutdown conditions. These two alarm conditions shall be interfaced with leak detection/overfill alarm panel for overfill and leak detection. Labeling of the customer specified or future alarm or shutdown conditions shall be of the same type and quality as the above specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate the generator set is not able to automatically respond to a command to start from a remote location.

6. Engine Status Monitoring: The following information shall be available from a digital status panel on the generator set control:
    a. Engine Oil Pressure (psi of kPA)
    b. Engine Coolant Temperature for left and right block temperatures (degrees F or C; both)
    c. Engine Oil Temperature (degrees F or C)
    d. Engine Speed (rpm)
    e. Number of Hours of Operation (hours)
    f. Number of Start Attempts
    g. Battery Voltage (DC volts)
7. Control Functions: The control system shall provide for the following functions:
    a. The control system provided shall include a cycle cranking system, which allows for user selected crank time, reset time, and number of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15 second rest period between cranking periods.
    b. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.
    c. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and ramping function to control engine speed and limit exhaust smoke while the unit is starting. The governor control shall be suitable for use in paralleling applications without component changes.
    d. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.

e. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure condition.

8. Alternator Control Functions: The generator set control shall include the following alternator control functions:
   a. The generator set shall include an automatic voltage regulation system which is matched and prototype tested with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control build up of AC generator voltage to provide a linear rise and limit overshoot. The systems shall include a torque-matched characteristic, which shall reduce output voltage in proportion to frequency below a threshold of 58-59 HZ. The voltage regulator shall include adjustments for gain, damping and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alpha-numeric LED readout to indicate setting level.
   b. The voltage regulation system shall include provisions for reactive load sharing and electronic voltage matching for paralleling applications. Motorized voltage adjust pot is not acceptable for voltage matching.
   c. Controls shall be provided to monitor the output current of the generator set and initiate an alarm when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator.
   d. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition when total load on the generator set exceeds the generator set rating for in excess of 5 seconds.
   e. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.
   f. An AC over/under voltage monitoring system which responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.
   g. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32VDC. During engine starting, the low voltage limit shall be disabled, and if DC voltage drops to less than 14.4 volts for more than two seconds a “weak battery” alarm shall be initiated.
   h. The control system shall include a ground fault monitoring relay. The relay shall be adjustable from 100-1200 amps, and include adjustable time delay of 0-1.0 seconds. The relay shall be for indication only, and not trip or shut down the generator set. Note bonding and grounding requirements for the generator set, and provide relay which will function correctly in system as installed.

9. Control Interfaces for Remote Monitoring: All control and interconnection points from the generator set to remote components shall be brought to a separate connection box. No field connections shall be made in the control enclosure or in the AC power output enclosure. Provide the following features in the control system:
   a. Form “C” dry common alarm contact set rated 2A @ 30VDC to indicate existence of any alarm or shutdown condition on the generator set.
   b. One set of contacts rated 2A @ 30VDC to indicate generator set is ready to load. The contacts shall operate when voltage and frequency are greater than 90% of rated condition.
   c. A fused 10 amp switched 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

d. A fused 20 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.
e. The control shall be provided with provisions for connection of remote monitoring equipment as described herein or shown on the drawings.

2.06 ENGINES

A. The natural gas engine shall be manufactured by Cummins Engine Company and designed specifically for generator set duty. The natural gas engine shall be 4 cycle, natural gas fueled, direct injection, 1800 RPM, with forged steel crankshaft and connecting rods. Minimum engines shall be 359 cubic inches. Engines shall have a minimum of 6 cylinders. The cylinder blocks shall be cast iron with replaceable wet liners and have four valves per cylinder. The engines shall be turbocharged and aftercooled.

B. Two cycle engines will not be acceptable.

C. Electronic governor systems shall provide automatic isochronous frequency regulation. The engine governing systems shall not utilize any exposed operating linkage.

D. The engines shall be cooled by a unit-mounted closed loop radiator system including belt-driven pusher fan, coolant pump and thermostat temperature control. The cooling systems shall be rated for full rated load operation in 104 degrees F (40 degrees C) ambient condition. The cooling capability of the generator sets shall be demonstrated by prototype tests on a representative generator set model conducted by the generator set manufacturer; calculated data from the radiator manufacturer only is not sufficient. Radiators shall be provided with a duct adapter flange permitting the attachment of an air discharge duct to direct the radiator air outside according to the manufacturer's instructions.

E. Rotating parts shall be guarded against accidental contact per OSHA requirements.

F. The maximum radiator cooling air shall not exceed 5600 scfm. The maximum alternator cooling air shall not exceed 149.1 cfm for the genset. The maximum allowable static restriction shall not exceed 0.5 inches of water. The entire cooling air system is based on the above data. All costs incurred if an alternate manufacturer is purchased shall be the responsibility of the electrical contractor. These costs shall include costs to all other trades as well as any associated engineering fees.

2.07 ENGINE ACCESSORY EQUIPMENT

A. The engine generator sets shall include the following accessories:
1. Electric starters capable of three complete cranking attempts without overheating, before overcrank shutdown (75 seconds).
2. Positive displacement, mechanical, full pressure, lubrication oil pumps. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicators. Provide bypass oil filters.
3. Replaceable heavy duty dry element air cleaners with restriction indicators and safety element.
4. Engine mounted battery charging alternators, 45 ampere and solid-state voltage regulators.
5. Anti-condensation heater for alternator.

2.08 BASES

A. The engine-generator set shall be mounted on a heavy duty steel base to maintain proper alignment between components. The engine-generator set shall incorporate battery trays with

battery holddown clamps on the base rails. Provisions for stub up of electrical connections shall be within the footprint of the generator set base rails and within the basetanks as specified in the housing section of the specification. Vibration isolators, spring type, shall be provided to be mounted under the generator set base.

2.09 GENERATOR SETS CIRCUIT BREAKERS

A. Generator main circuit breaker shall be solid state UL listed, molded case type, rated as listed below. Circuit breakers shall be mounted in a separate NEMA 1 enclosure and be shipped completely wired to the gensets. No exceptions. Enclosures shall include neutral blocks for field connection.

B. Solid State circuit breakers shall be 100% rated: Refer to drawings for sizes.

C. Circuit breaker (CB) shall be long time current and instantaneous pickup with solid state trip unit. CB shall have visible mechanical fault indicator and push button trip.

D. Circuit breakers shall be rated at 65,000 AIC.

E. Provide auxiliary contacts on breaker position.

2.10 EXHAUST SYSTEMS

A. One exhaust silencer shall be provided for the generator set. The silencer shall be super critical grade. The silencer shall reduce total noise a minimum of 40 dBA at three feet.

B. The exhaust silencer shall be HARCO super critical bottom inlet/side outlet Model 5214-SFH-8 shall be mounted inside the sound attenuated enclosure. Provide all fittings, reducers, couplings elbows and spool pieces.

C. All exterior fittings, accessories and bolts shall be type 304 stainless steel. Provide heat resistant gaskets between all flanged connections to serve as dielectric protectors.

D. The maximum gas flow shall not exceed 476 cfm. The exhaust gas temperature shall not exceed 1286 degrees F. The maximum back pressure shall not exceed 28.1 inches of water. The design of the entire exhaust system is based on the above data. If a substitution of model specified is made, all costs incurred to redesign as well as costs to other trades to modify the layout shall be the complete responsibility of the electrical contractor.

E. Provide stainless steel flexible exhaust connections for the engine as required for connection between the engine exhaust manifolds and exhaust lines in compliance with applicable codes and standards.

F. Provide an exhaust system condensation trap with manual drain valve to trap and drain off exhaust condensation and to prevent condensation from enter-ing the engine.

G. Provide a suitable weather cap at the stack outlet with all necessary flanges and fittings for proper installa-tion. The weather cap shall have the proper counter weights attached to prevent banging while generator is unloaded.

H. Thermal jacket for interior exhaust lines and silencer by FIRWIN CORP. or engineered approved equal. Jacket thickness shall be sufficient to maintain a surface temperature of less than 200 degrees F.

I. Exhaust mufflers shall be installed by enclosure manufacturer so their weight is not supported by the engines.

2.11 ACCESSORIES

A. Vibration isolators: Spring type.

B. Starting and control Batteries: Two (2) 24 volt starting batteries each genset, lead acid type, 24 volt DC (12 volt DC will not be accepted), sized to accommodate 45 seconds of cranking at an ambient of 0 degrees F without being recharged.

C. Battery Chargers: One 10 amp voltage regulated battery charger shall be provided for each engine-generator set. Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with float, taper and equalize charge settings. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps, 120 VAC, 30 VDC for remote indication of :
   1. Loss of AC Power - red light.
   2. Low Battery Voltage - red light.
   3. High Battery Voltage - red light.
   4. Power ON - green light (no relay contact).

D. Block Heaters: Thermostatically controlled jacket water heater shall be supplied for each genset with a minimum size shall be 4990 watts. Input voltage of heaters shall be 208 VAC 1 phase.

E. Provide generator 20 light remote annunciator located inside the electrical room on the ATS Cubicle. Interface generator set controls with battery charger and fuel tank alarms for all status conditions. Provide all power, control wiring including conduits.

2.12 ENCLOSURE

A. The generator set shall be provided with a factory-installed sound attenuated housing which allows the generator set to operate at full rated load in the ambient conditions previously specified. The enclosure shall reduce the sound level of the generator set while operating at full rate load to a maximum of 75 dBA at any location 7 meters from the generator set in a free field environment. Housing materials used shall be steel. Fiberglass and plastic are not acceptable. Acoustical materials used shall be oil and water resistant. No foam materials shall be used.

B. The enclosure shall include hinged doors for access to both sides of the engine and alternator, and the control equipment and a hinged rear see-through control door. Key-locking and padlockable door latches shall be provided for all doors. Door hinges shall be stainless steel.

C. The enclosure shall be provided with an exhaust silencer which is mounted on top of the enclosure, and allows the generator set package to meet specified sound level requirements. Silencer and exhaust shall include a rain cap and rain shield.

D. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color using a two step electrocoating paint process, or equal meeting the performance requirements specified below. Metal part surfaces shall be prepared, primed and painted. The painting process shall result in a coating which meets the following requirements:
   1. Primer thickness, 0.5-2.0 mils. Top coat thickness, 0.8-1.2 mils.
   2. Gloss, per ASTM D523, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.
   3. Crosshatch adhesion, per ASTM D3359, 4B-5B.
   4. Impact resistance, per ASTM D2794, 120-160 inch pounds.
   5. Salt spray, per ASTM B117, 1000+ hours.
   6. Humidity, per ASTM D2247, 1000+ hours.
   7. Water Soak, per ASTM D2247, 1000+ hours.

E. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts will not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work. The enclosure shall be built and tested by the engine generator manufacturer.

2.13 SOURCE QUALITY CONTROL

A. To provide proven reliability of the system, three series of tests shall be performed: prototype model tests, production model tests and field tests. The manufacturer shall provide documentation demonstrating satisfactory prototype and production test results. Generator sets that have not been prototype tested and factory tested at 0.8 PF will not be acceptable.

B. Generator Set Factory Production Tests and Evaluation: These tests and evaluations must have been performed on a prototype generator set representative of the Model specified. A summary of the generator set testing results shall be submitted for review. The manufacturer's standard series of components development tests on the generator system, engine and other major components shall also be performed and available for review, but shall not be acceptable as a substitute for prototype testing on the complete representative generator set prototype.

C. Torsiograph Analysis and Test: The manufacturer of the generator set shall verify that the engine generator set, as configured, is free from harmful torisional stresses. The analysis shall include correlation of empirical data from tests on a representative prototype. The empirical data must include spectrum analysis of the torsional transducer output within the operating speed range of the engine generator set. Calculations based on engine and generator separately are not acceptable.

D. Temperature Rise Test: Complete thermal evaluation of a prototype generator rotor and starter must include actual measurement of internal generator and exciter temperatures by embedded detector method, and measurement of average temperature rise by resistance method. No position measured any place in the windings may exceed the temperature rise limits of NEMA for the particular type of insulation system used. Resistance method temperature rise data shall be confirmed by a full load test on the generator set prototype to include conducted and radiated heat from the engine.

E. Short Circuit Test: A test on a prototype generator set shall have demonstrated that the generator set is designed to withstand the mechanical forces associated with a short circuit condition. With the generator set operating at rated load and speed, the generator terminals must be short circuited on all three phases for a duration of 20 seconds. At the conclusion of this test, the generator set must be capable of full load operation.

F. Endurance Run Test: A minimum of 500 continuous hours of endurance testing with a representative generator set prototype operating as defined by the manufacturer's standby rating shall have been performed. Endurance testing shall be used to verify structural soundness and durability.

G. Maximum Power Test: With the prototype generator set at normal operating temperature and with all power consuming auxiliaries in place, the maximum power available at rated speed shall be determined with the governor set at its fuel stop. The generator set shall maintain this power for a minimum of two minutes.

H. Linear Vibration Test: A test for in-line motion of components occurring along a repeatable path shall meet the manufacturer's acceptance criteria.

I. Cooling System Test: A cooling system test shall demonstrate the ability of the generator set cooling system to maintain normal operating temperature while operating at full rated load and power factor at the highest ambient temperature (122°F) of the system rating. Cooling air

requirements, radiator air flow and maximum allowable restriction at radiator discharge, shall be verified by this test.

J. Maximum Motor Starting KVA: Motor starting KVA shall be determined by test, based on a sustained RMS recovery voltage of at least 90 percent of no load voltage with the specified load KVA at near zero power factor applied to the generator set.

K. Transient Response, Steady State Speed Control and Voltage Regulation: Prototype generator set tests shall demonstrate consistent performance as follows; stable voltage and frequency at all loads from no load to full rated load, consistent frequency backwidth with steady state load, maximum voltage and frequency kp on load acceptance and rejection and restoration to steady state after sudden load changes. Transient response is a complete generator set (engine, generator, exciter, and regulator) performance criteria and cannot be established on generator data alone.

L. Witnessed Generator Set Factory Production Tests: On the equipment to be shipped, an 8-hour test shall be performed at rated load and 0.8 PF. These tests shall include certified data to document the following: run at full load, maximum power, voltage regulation, transient and steady state governing, single step load pickup and safety shutdowns. Provide a factory certified test record of the production testing. Certified test record shall be sealed by a licensed professional engineer.

2.14 WARRANTY

A. Provide a 5-year manufacturer's limited warranty, including 100% parts and labor. The complete electrical power system, including but not limited to, generator set, controls, associated switches, enclosures, and accessories, as provided by the single source manufacturer, shall be warranted by the manufacturer against defects in materials and workmanship for a period of five (5) years from the date of system startup. Coverage shall include parts, labor, travel expenses, and labor to remove/reinstall the equipment, per ONAN’s standard published limited warranty. Supplier must be factory authorized to perform warranty service on the entire system, including, but not limited to, the engine, the generator, the control panels, and the automatic transfer switches.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install engine generator and all appurtenances in accordance with manufacturer's recommendations.

B. Enclosure manufacturer shall install all exhaust components as shown on the drawings and as required to comply with NFPA 37 and local codes and regulations. Components shall be sized to assure full load operation without excessive backpressure sized as per manufacturer’s recommendations with actual site dimensions when installed as shown on the drawing. Make provisions as required for pipe expansion and contraction.

C. Coordinate installation of anchor bolts with generator enclosure manufacturer.

D. Installation shall comply with applicable State and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer’s instructions and instructions included in the listing or labeling of UL listed products.

3.02 FIELD QUALITY CONTROL

A. Initial startup and field acceptance tests are to be conducted by the authorized rep-resentative of the system manufacturer who supplies the equipment.

B. Test data shall be collected and recorded on the following: time of day, coolant temperature, operating oil pressure, battery charging rate, cranking time, crank-to-rated frequency time, voltage and frequency overshoot, load assumption-to-steady state voltage and frequency stabiliza-tion time, operating voltage, frequency, current, kilowatts and power factor. All data shall be taken every fifteen (15) minutes.

C. Procedure: Generator manufacturer shall conduct a six (6) hour load bank test at 1.0 power factor for each generator set. Contractor shall provide load bank for testing generator set at 100% load. Contractor is not permitted to use load bank specified as part of the testing requirements. Load bank test shall test generator at full nameplate KW rating. Generator manufacturer's representative shall record test data, as described in (B) above. Test data shall be tabulated and typed for submission and approval by the engineer for final acceptance. No handwritten field notes will be allowed.

GENERATOR LOAD LIST

Step Number	Load Description	Load Type	Volts/Phase	Load	Efficency	Starting Method
1	General Lighting	LED - Ltg	208/3	7.89 KVA		Full Voltage
1	GDS-1	General Receptacle	120/1	1.11 KVA		Full Voltage
1	Block Heater	User Defined	208/1	6.24 KVA		Full Voltage
2	General Rec. Load	General Receptacle	208/3	3.6 KVA		Full Voltage
3	Cord Reel	General Receptacle	208/3	5 KVA		Full Voltage
4	Garage Door #1	Motor	120/1	0.5 HP		Full Voltage
4	Garage Door #2	Motor	120/1	0.5 HP		Full Voltage
4	Garage Door #3	Motor	120/1	0.5 HP		Full Voltage
4	Garage Door #4	Motor	120/1	0.5 HP		Full Voltage
4	Garage Door #5	Motor	120/1	0.5 HP		Full Voltage
5	GXF-1	Motor	208/1	2.0 HP		Full Voltage
6	GFRH-1,2,3	General Receptacle	120/1	0.65 KVA		Full Voltage
7	GXF-2	Motor	120/1	0.1 HP		Full Voltage
7	GXF-1	Motor	208/1	2 HP		Full Voltage
8	WMH-1	General Receptacle	120/1	1.67 KVA		Full Voltage
9	WMH-2	General Receptacle	120/1	1.67 KVA		Full Voltage
10	WMH-3	General Receptacle	120/1	1.67 KVA		Full Voltage
11	WMH-4	General Receptacle	120/1	1.67 KVA		Full Voltage
12	WMH-5	General Receptacle	120/1	1.67 KVA		Full Voltage
13	ACCU-1	AC	208/1	10330 BTU	9 EER	Full Voltage
14	VXF	Motor	208/3	10 HP		Full Voltage

END OF SECTION 263214

PART 1 -GENERAL

1.01 SECTION INCLUDES

A. Fire Alarm Control Panels (FACP).

B. Remote Annunciator.

C. Addressable Manual Fire Alarm Stations.

D. Addressable Area Smoke Detectors.

E. Addressable Duct Mounted Smoke Detectors.

F. Remote for Smoke Alarms.

G. Heat Sensors.

H. Audio/Visuals.

I. Visual Devices.

J. Pull Stations.

K. Addressable Carbon Monoxide Detectors

L. IP / Cellular Digital Communicator

1.02 RELATED SECTIONS

A. Section 260533 - Raceways and Boxes for Electrical Systems.

1.03 REFERENCES

A. NFPA 70 - National Electrical Code.

B. NFPA 72 - National Fire Alarm Code.

C. NFPA 101 - Life safety code.

1.04 WORK INCLUDED

A. Furnish and install as described in these specifications and as indicated on the drawings, fire alarm and smoke detection equipment with battery backup.
   1. All equipment shall be UL listed under category UOJZ as an integrated control system; equipment listed under category UOXX as a control unit accessory shall not be acceptable. The installation shall meet the applicable requirements of NFPA 72 and New York State Code, as well as those standards set by the authorities having jurisdiction.
   2. All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name on each component. The catalog numbers specified under this section constitute the type, product quality, material and desired operating features.
   3. Provide all labor, materials and services to perform all operations required for the complete installation and related work shown on the drawings and as specified herein.
   4. All electrical work and equipment shall meet the requirements of NFPA 70 and 72.

5. Existing fire alarm system to be disconnected and removed in its entirety once new system is installed, operational and tested. Contractor to patch and paint all openings as a result of removed equipment. Contractor to provide and install new ceiling tiles to match existing where damaged or holes are left from removed equipment.

1.05 SUBMITTALS

A. Submit product data as required by Section 013300.
   1. Two copies of all submittals shall be submitted to the Architect/Engineer for review.
   2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality.
   3. Equivalent equipment (compatible UL-Listed) from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met, and upon approval of the Architect/Engineer.

B. Shop drawings:
   1. Provide a list (bill of materials) of all types of equipment and components provided.
   2. Provide annunciator layout and system wiring diagram showing each device and wiring connection required, including existing equipment. Provide a description of operation of the system. Provide system ampere load and time calculations to substantiate compliance with battery back-up (24 hours in non-alarm condition followed by 5 minutes in alarm, after normal power loss)
   3. Sufficient information, clearly presented shall be included to determine compliance with drawings and specifications.
   4. Include manufacturer's printed product data with name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.

C. Manuals:
   1. Submit simultaneously with the shop drawings, complete operating and maintenance manual listing the manufacturers name(s) including technical data sheets.
   2. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.
   3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.
   4. Indicate application conditions and limitations of use stipulated by product testing agency.
   5. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products

D. Test Reports and Certifications:
   1. Indicate satisfactory completion of required tests and inspections.
   2. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.
   3. Contractor shall provide Engineer with a complete set of drawings (including all floors, crawl spaces, closets, open spaces) showing a complete survey of all new fire equipment devices and appliances prior to submission to Fire Marshal. Contractor shall provide Engineer with a complete list of all HVAC equipment to remain, including their associated CFM ratings and all associated duct smoke detectors. Upon approval from Engineer, Contractor shall submit complete package, with New York professional engineer's stamp, to Fire Marshal as per local requirements. The Contractor shall have a licensed New York State Professional Engineer stamp all drawings and applications, including submittals for approval from H2M. Pay for all fees to obtain permits and approval.

1.06 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 017839.

B. Record actual locations of initiating devices, signaling appliances, and end-of-line devices as they are installed.

1.07 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 017839.

B. Minimum maintenance, inspection and testing must be in accordance with provisions in NFPA 72: National Fire Alarm and Signaling Code Fire Code. A preventive maintenance schedule shall be provided by the Contractor that shall describe the protocol for preventative maintenance. The schedule shall include:
   1. Systematic examination, adjustments and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays and all accessories of the fire alarm system.
   2. Each circuit in the fire alarm system shall be tested semiannually.
   3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72 Chapter 7.

1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten (10) years documented experience, and with service facilities within fifty (50) miles of project location.

B. Installer: Company specializing in installing the products specified in this section with minimum three (3) years documented experience, and certified by the State of New York as fire alarm installer.

1.09 PERMITTING

A. The Contractor shall submit to the local Fire Marshal all necessary drawings, equipment specifications, and applications required for a complete Fire Marshal approved system.

B. The Contractor shall have a licensed New York State Professional Engineer stamp all drawings, complete all applications, and pay for all fees to obtain permits and approvals.

PART 2 - PRODUCTS

2.01 2.01 - MANUFACTURERS

A. SILENT KNIGHT (OR APPROVED EQUAL)

2.02 GENERAL

A. All equipment and components shall be new, and the manufacturer’s current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approval agency for use as part of a protected premises protective signaling (fire alarm) system.

B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning equipment installation.

C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

D. All equipment locations shall comply with ADA requirements for mounting heights and accessibility.

2.03 CONDUIT AND WIRE

A. Conduit:
   1. Conduit shall be in accordance with the National Electric Code (NEC), local and state requirements.
   2. All wiring shall be installed using plenum rated cable. Refer to the conduit specification for additional conduit requirements.
   3. Cable must be separated from any open conductors, as per NEC Article 760-29.
   4. Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals
   5. Conduit shall enter the Fire Alarm Control Panel, Remote Annunciator Panel and/or backboxes where conduit entry is designated and permitted by the FACP manufacturer.
   6. Conduit shall be ¾ inch (19.1 mm) minimum.
   7. In finished areas where conduit cannot be concealed, surface mounted raceway is to be used and shall be painted to match wall color.

B. Wire:
   1. All fire alarm system wiring shall be new.
   2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760), and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and not less than 14 AWG (1.63mm) for Notification Appliance Circuits. All wiring shall be of the type recommended by the manufacturer.
   3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
   4. All wire and cable shall have a fire resistance rating suitable for the installation as indicated in NFPA 70, and shall test free from grounds or crosses between conductors.
   5. Wiring used for the multiplex communication loop shall be twisted and shielded and installed in conduit unless specifically excepted by the fire alarm equipment manufacturer. The system shall permit use of IDC and NAC wiring in the same conduit with the communication loop
   6. All field wiring shall be completely supervised.

C. Terminal Boxes, Junction Boxes and Cabinets:
   1. All boxes and cabinets shall be UL listed for their use and purpose.

D. Circuits shall be arranged to serve like categories (manual, smoke, horn, strobe). Mixed category circuitry shall not be permitted except on signaling line circuits connected to addressable reporting devices.

2.04 SEQUENCE OF OPERATIONS

A. Basic Addressing and Circuiting Guidelines
   1. The addressable fire alarm system shall provide an individual multiplex data address for each addressable manual fire alarm station, addressable area smoke detector, addressable duct smoke detector, addressable heat detector, Monitor Zone Addressable Module (MZAM), Control Zone Addressable Module (CZAM) or Signal Zone Addressable Module (SZAM).
   2. The FACP shall provide NFPA Standard 72A, Style 4 (Class B, two wire) addressable data communications circuits to provide connection of and communication with the addressable devices, as required by these Specifications and/or as shown on the Drawings. Each addressable data communications circuit shall provide the capability of communicating with up to ninety nine (99) addressable devices.

B. Fire Alarm System Sequence of Operation
   1. The FACP central processing unit (CPU) shall provide for the monitoring of addressable, smoke sensors. Each smoke sensor shall be individually monitored for its normal output voltage level, which is a function of accumulating environmental factors such as dirt and dust. The normal output voltage level shall be digitized and transmitted to the FACP CPU every four (4) seconds. The FACP CPU shall maintain a moving average of these normal voltage outputs in an individual sensor average file. When smoke enters the sensor, the output voltage rises in direct proportion to the density of the smoke and the alarm condition of each smoke sensor is determined at the FACP CPU by comparing the current actual value with the sensor's normal average value combined with the alarm threshold programmed for that sensor. The alarm threshold may be individually programmed for each smoke sensor as a sensitivity percentage (0.5%, 1.0%, 1.5%, 2.0%, 2.5%, 3.0% and 3.7%) above its normal average value. The sensitivity percentage for each sensor may also be programmed to change as a function of the time of day and day of week. When an individual sensor's normal average value rises to a fixed, preset level due to excess accumulation of dirt and dust, a system trouble condition shall be generated and a "sensor dirty" message shall be displayed, for that sensor, on the FACP LCD display and entered into the system historical trouble log. If the sensor is not cleaned and further accumulation occurs that would degrade proper sensor operation, a second system trouble condition shall be generated and a "sensor excessively dirty" message shall be displayed and entered into the system historical trouble log.
   2. Operation of any manual fire alarm station or activation of any smoke sensor, area smoke detector, duct smoke detector, or heat detector throughout the building shall automatically:
      a. Sound all horns (except the exterior sprinkler horn/strobe) throughout the building with an individual Temporal ‘3’ Code. The alarm signals may be silenced during the alarm condition by operation of the FACP alarm silence switch. Subsequent alarm conditions shall re-sound the alarm horns.
      b. Flash all alarm strobe lights (except the exterior sprinkler horn/strobe) throughout the building. The alarm strobe lights shall be turned off when the system is reset.
      c. Display a general alarm indication and system status summary (numbers of alarm, supervisory and/or trouble conditions) on the FACP liquid crystal display (LCD). Pressing the alarm acknowledge key shall display, for thirty (30) seconds, the individual device or circuit display, to include the "alarm" status and custom label (up to forty characters and spaces) for the addressable device or circuit of alarm initiation on the liquid crystal display (LCD). At the end of the thirty (30) second period, the general alarm indication and system status summary shall again be displayed. The individual device/circuit display may be recalled at any time by repressing the alarm acknowledge key or until the alarm condition is reset to normal.
      d. Enter the alarm condition custom label with time and date of occurrence into the FACP historical alarm log for future recall.
      e. Shutdown all fans over 1000 CFM.

f. Release Magnetic Door Hold Opens.
g. Activate circuit for to initiate alarm to central station. The Central station monitoring shall be furnished by owner.

3. Operation of sprinkler waterflow switch shall automatically:
   a. Sound all horns throughout the building including the exterior sprinkler horn/strobe with an individual Temporal Code. The alarm signals may be silenced during the alarm condition by operation of the FACP alarm silence switch. Subsequent alarm conditions shall resound the alarm horns.
   b. Flash all alarm strobe lights including the exterior sprinkler horn/strobe throughout the building. The alarm strobe lights shall be turned off when the system is reset.
   c. Display a general alarm indication and system status summary (numbers of alarm, supervisory and/or trouble conditions) on the FACP liquid crystal display (LCD). Pressing the alarm acknowledge key shall display, for thirty (30) seconds, the individual device or circuit display, to include the "alarm" status and custom label (up to forty characters and spaces) for the addressable device or circuit of alarm initiation on the liquid crystal display (LCD). At the end of the thirty (30) second period, the general alarm indication and system status summary shall again be displayed. The individual device/circuit display may be recalled at any time by repressing the alarm acknowledge key or until the alarm condition is reset to normal.
   d. Enter the alarm condition custom label with time and date of occurrence into the FACP historical alarm log for future recall.
   e. Shutdown all fans over 1000 CFM.
   f. Release Magnetic Door Hold Opens.
   g. Activate circuit for to initiate alarm to central station. The Central station monitoring shall be furnished by owner.
4. Operation of sprinkler tamper switch shall automatically:
   a. Display a general trouble indication and system status summary (numbers of alarm, supervisory and/or trouble conditions) on the FACP liquid crystal display (LCD). Pressing the alarm acknowledge key shall display, for thirty (30) seconds, the individual device or circuit display, to include the "trouble" status and custom label (up to forty characters and spaces) for the addressable device or circuit of alarm initiation on the liquid crystal display (LCD). At the end of the thirty (30) second period, the general alarm indication and system status summary shall again be displayed. The individual device/circuit display may be recalled at any time by repressing the alarm acknowledge key or until the trouble condition is reset to normal.
   b. Enter the trouble condition custom label with time and date of occurrence into the FACP historical alarm log for future recall.
   c. Activate circuit for to initiate trouble to central station. The Central station monitoring shall be furnished by owner.
5. Operation of any carbon monoxide detector the building shall automatically:
   a. Sound the integral sounder base on the carbon monoxide detector in alarm only, with an individual Temporal ‘4’ Code. The alarm signals shall only be silenced when carbon monoxide detector is no longer in alarm.
   b. Display/sound an alarm indication and system status summary (numbers of alarm, supervisory and/or trouble conditions) on the FACP liquid crystal display (LCD) stating “Carbon Monoxide Alarm”. Pressing the alarm acknowledge key shall display, for thirty (30) seconds, the individual device or circuit display, to include the "alarm" status and custom label (up to forty characters and spaces) for the addressable device or circuit of alarm initiation on the liquid crystal display (LCD). At the end of the thirty (30) second period, the general alarm indication and system status summary shall again be displayed. The individual device/circuit display may be recalled at any time by repressing the alarm acknowledge key or until the alarm condition is reset to normal.
   c. Enter the alarm condition custom label with time and date of occurrence into the FACP historical alarm log for future recall.
   d. Shutdown all fans over 1000 CFM.

e. Release Magnetic Door Hold Opens.
f. Activate circuit for to initiate alarm to central station stating “Carbon Monoxide Alarm”. The Central station monitoring shall be furnished by owner.

2.05 MAIN FIRE ALARM CONTROL PANEL

A. The fire alarm control panel (FACP) shall be the Silent Knight 6820 control panel.

B. The following FACP hardware shall be provided:
1. The FACP must have a 6 amp power supply and be capable of expansion to a maximum of 54 total amps via bus connected expander modules that supervise low battery, loss off AC and loss of communication.
2. The FACP must have Drift Compensation sensitivity capabilities on detectors and be capable of supporting 99 detectors and 99 analog addressable modules and expandable to a maximum of 396 detectors and 396 modules. This shall be accomplished via four signaling line circuits (SLC) capable of supporting a minimum of 99 detectors and 99 addressable module devices each. The communication protocol on the SLC loop must be digital.
3. The FACP must support a minimum of six programmable “Flexputs”. The panel must have a built in 80 character LCD annunciator with the capability of having an additional eight supervised remote annunciators connected in the field.
4. The FACP must have a built in UL approved digital communicator. The communicator must allow local and remote up/downloading of system operating options, event history, and detector sensitivity data.
5. The FACP must automatically test the smoke detectors in compliance with NFPA standards to ensure that they are within listed sensitivity parameters and be listed with Underwriters Laboratories for this purpose.
6. The FACP must compensate for the accumulation of contaminants that affect detector sensitivity. The FACP must have maintenance alert feature (differentiated from trouble condition), detector sensitivity selection, auto-programming mode (Jumpstart) and the ability to upgrade the core operating software on site or over the telephone.
7. The FACP shall have a Jumpstart feature that can automatically enroll all properly connected accessories into a functional system within 60 seconds of powering up the panel. Panels that do not have these capabilities will not be accepted.
8. The main communication bus (S-Bus RS485) shall be capable of class A or class B configuration with a total Bus length of 6,000 feet.
9. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to from a complete control unit, provide exactly matching modular unit enclosures. The system cabinet shall be red and can be either surface or flush mounted. The cabinet door shall be easily removable to facilitate installation and service
10. The main control must have a built in annunciator with an 80-character LCD display and feature LED’s for General alarm, Supervisory, System trouble, System Silence and Power. When in the normal condition the LCD shall display time and date based on a 200 year clock which is capable of automatic daylight savings time adjustments. All controls and programming keys are silicone mechanical type with tactile and audible feedback. Keys have a travel of .040 inches. No membrane style buttons will be permissible. The annunciator must be able to silence and reset alarms through the use of a keypad entered code, or by using a firefighter’s key. The annunciators must have twenty levels of user codes that will allow the limitation of operating system programming to authorized individuals.
11. The fire system shall be able to support up to eight I/O modules (SK5880) that shall be used to drive remote LED graphic style displays and accommodate up to eight dry contact type switch inputs. The I/O modules shall each drive up to 40 LEDs without requiring external power connections. The I/O module inputs shall be supervised and be suitable

for alarm and trouble circuits as well as reset and silence switches. The system shall also support up to 40 LED drivers that reside on the two-wire SLC loop. These driver boards shall contain 80 LED outputs that are powered by an external power source.

12. An audible system trouble sounder shall be an integral part of the control unit. Provisions shall also be provided for an optional supervised remote trouble signal.
13. The entire system shall operate on 24 VDC, filtered switch mode power supply with the rated current available of 6 Amps. The FACP must have a battery charging circuit capable of complying with the following requirements:
    a. Twenty Four (24) hours of battery standby with five (5) minutes of alarm signaling at the end of this twenty four (24) hour period (as required per NFPA 72 remote station signaling requirements) using rechargeable batteries with automatic charger to maintain standby gel-cell batteries in a fully charged condition. Battery shall be sized for all devices shown on the drawings plus 20% additional expansion.
    b. The power supply shall comply with U.L. Standard 864 for power limiting.
    c. The FACP will indicate a trouble condition if there is a loss of AC power or if the batteries are missing or of insufficient capacity to support proper system operation in the event of AC failure. A “Battery Test” will be performed automatically every minute to check the integrity of the batteries. The test must disconnect the batteries from the charging circuit and place a load on the battery to verify the battery condition.
    d. In the event that it is necessary to provide additional power one or more of the model 5895XL or 5496 Distributed Power Modules shall be used to accomplish this purpose.
    e. The FACP shall be capable to be networked to the existing data network via a Silent Knight Gateway. See Section 2.31 for additional information.

2.06 PERIPHERAL DEVICES

A. Manual Fire Alarm Stations (Model #: SK-Pull-SA) shall be addressable, single action type, with a key operated test-reset lock in order that they may be tested, and so designed that after actual emergency operation, they cannot be restored to normal except by use of a key. The reset key shall be so designed that it will reset manual station and open FACP without use of another key.

B. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of fifty feet, front or side.

C. Manual stations shall be constructed of red LEXAN or die cast metal with clearly visible operating instructions on the front of the stations in raised letters.

D. Stations shall be suitable for surface mounting on matching backbox, or semi-flush mounting on a standard single-gang box, and shall be installed within the limits defined by the Americans with Disabilities Act (ADA) dependent on manual station accessibility or per local requirements

E. Protective Shield shall be STI Model 1100 with tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations. When shield is lifted to gain access to the station a battery powered piercing warning horn shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.

2.07 SMOKE SENSORS

A. Smoke detectors shall be Silent Knight (Model SK-PHOTO) ceiling mounted, addressable photoelectric smoke detectors.

B. The combination detector head and twist lock base shall be U.L. listed compatible with the Silent Knight 6820 fire alarm control panel.

C. The base shall permit direct interchange with Silent Knight's SK-Ion ionization smoke detector, SK-Acclimate multi-criteria smoke detector or the SK-Heat detector. The base shall be the appropriate twist lock base B210LP.

D. The smoke detector shall have a flashing status LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady at full brilliance. The detector may be reset by actuating the control panel's reset switch.

E. The sensitivity of the detector shall be capable of being selected and measured by the control panel without the need for external test equipment.

F. It shall be possible to perform a sensitivity test of the detector without the need of generating smoke. The test method shall simulate the effects of products of combustion in the chamber to ensure testing of the detector circuits. Detectors shall have completely closed back to restrict entry of dust and air turbulence and have a 30 mesh insect screen.

G. Electronics of the unit shall be shielded to protect against false alarms from E.M.I. and R.F.I.

2.08 MULTI-CRITERIA DETECTOR WITH CARBON MONOXIDE SENSING AND INTEGRAL SOUNDER BASE.

A. Carbon Monoxide Detector (with integral fire detection) shall be Silent Knight (Model SK-FIRE-CO), addressable carbon monoxide detector.

B. Each carbon monoxide shall be provided with a sounder base (Model B200S, sold separately).

C. When a carbon monoxide sensor is in alarm, that carbon monoxide sounder base only shall sound a 'Temporal 4' code pattern.

2.09 DUCT SMOKE SENSORS

A. Interior Duct Smoke Detectors (sensors) shall be Silent Knight (Model SK-Duct) with the Model SK-Photo Smoke detectors. Exterior Duct Smoke Detectors shall have a weatherproof enclosure (Model DH400OE-1) and shall be compatible with SK-Photo Smoke detectors.

B. Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied.

C. Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.

D. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.

E. Each duct sensor shall have a Remote Test Station with an alarm LED and test switch.

F. All duct smoke detectors installed above a finished ceiling shall have a remote LED installed flush with the ceiling below the unit.

2.10 HEAT SENSORS

A. Heat Sensors shall be Silent Knight (model SK-Heat) ceiling mounted, addressable fixed temperature at 135 degrees Celsius.

B. The combination heat detector and twist lock base shall be U.L. listed compatible with the Silent Knight 6820 fire alarm control panel.

C. The base shall permit direct interchange with the Silent Knight SK-Ion smoke detector, SK-Acclimate smoke detector and the SK-Photo photoelectric smoke detector. The base shall be appropriate twist lock base B210LP.

D. The heat detector shall have a flashing status LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady at full brilliance. The detector may be reset by actuating the control panel's reset switch.

E. Electronics of the unit shall be shielded to protect against false alarms from E.M.I. and R.F.I.

F. Weather Proof Heat Detectors (Honeywell Model 302-EPM-194 or approved equal) - Shall be installed with a remotely located addressable module. Module shall be located as stated on drawings.

2.11 ANNUNCIATION (NOTIFICATION) DEVICES

A. The visual and audio/visual signaling devices shall be compatible with the 6820 as stated in the installation manuals and be Listed with Underwriters Laboratories Inc. per UL 1971 and/or 1638.

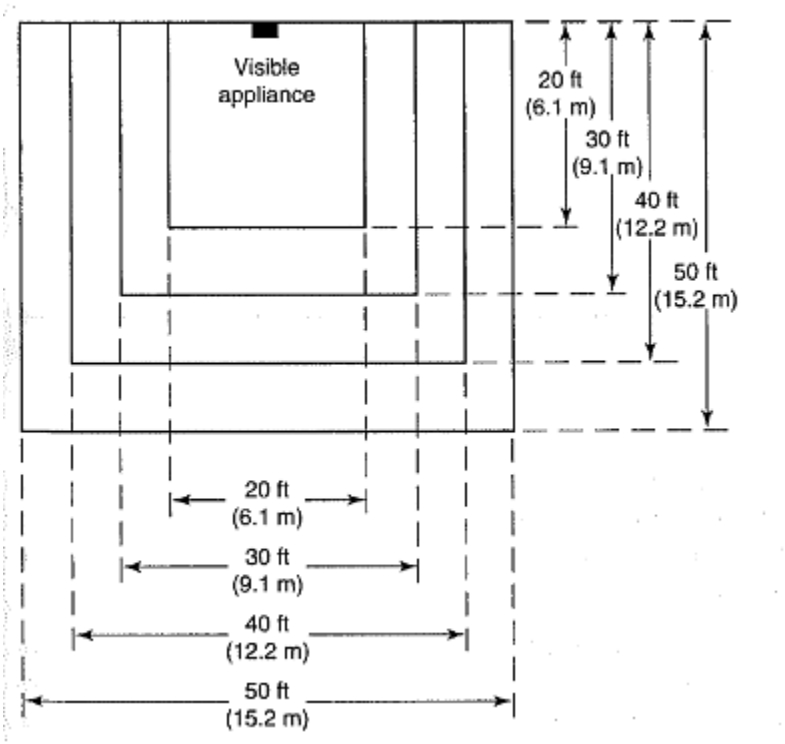
B. The visual and audio/visual signaling devices shall be wall mounted to meet ADA requirements.

C. Each indicating appliance circuit shall be electrically supervised for opens, grounds and short circuit faults, on the circuit wiring, and shall be so arranged that a fault condition on any indicating appliance circuit or group of circuits will not cause an alarm to sound. The occurrence of any fault will light the trouble LED and sound the system trouble sounder, but will not interfere with the proper operation of any circuit which does not have a fault condition.

D. The notification appliance (combination audio/visual units only) shall produce a peak sound output of 90dba or greater as measured in an anechoic chamber.

E. The notification appliance (combination audio/visual units and visual only units) shall provide field selectable flash intensities of 15cd, 30cd, 75cd, 110cd. The appliance shall be capable of meeting the candela requirements of ADA. Provide, adjust and install audio/visual units and visual units to meet the requirements of NFPA 72, defined in Room Spacing for Wall-Mounted Visible Appliances Table and Figure below:

Maximum Room Size		*Minimum Required Light Output [Effective Intensity (cd)]*		
ft	*m*	*One Light per Room*	*Two Lights per Room (Located on Opposite Walls)*	*Four Lights per Room (One Light per Wall)*
20 × 20	6.10 × 6.10	15	NA	NA
28 × 28	8.53 × 8.53	30	Unknown	NA
30 × 30	9.14 × 9.14	34	15	NA
40 × 40	12.2 × 12.2	60	30	15
45 × 45	13.7 × 13.7	75	Unknown	19
50 × 50	15.2 × 15.2	94	60	30
54 × 54	16.5 × 16.5	110	Unknown	30
55 × 55	16.8 × 16.8	115	Unknown	28
60 × 60	18.3 × 18.3	135	95	30
63 × 63	19.2 × 19.2	150	Unknown	37
68 × 68	20.7 × 20.7	177	Unknown	43
70 × 70	21.3 × 21.3	184	95	60
80 × 80	24.4 × 24.4	240	135	60
90 × 90	27.4 × 27.4	304	185	95
100 × 100	30.5 × 30.5	375	240	95
110 × 110	33.5 × 33.5	455	240	135
120 × 120	36.6 × 36.6	540	305	135
130 × 130	39.6 × 39.6	635	375	185



F. The appliance shall be polarized to allow for electrical supervision of the system wiring. The unit shall be provided with terminals with barriers for input/output wiring and be able to mount a single gang or double gang box or double workbox with the use of an adapter plate.

G. Power supplies and batteries shall be sized to accommodate 110 cd at each strobe.

H. Sprinkler horn/strobe shall be Wheelock #MTWPB-24MCCH-NW or approved equal that is compatible with the 6820. Sprinkler horn/strobe shall have a blue lens.

2.12 REMOTE LCD ANNUNCIATOR

A. The fire system shall be capable of supporting up to eight remote annunciators. Remote Annuciators shall be Silent Knight (Model 5860).

B. LCD Remote annunciators shall have the same control and display layout so that they match identically to the built in annunciator.

C. Remote annunciators shall be capable of operating at a distance of 6000 feet from the main control panel on unshielded non-twisted cable.

D. Under normal conditions the LCD shall display a "SYSTEM IS NORMAL" message and the current time and date.

E. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.

F. The LCD shall display the following information relative to the abnormal condition of a point in the system:
   1. 40 character custom location label.
   2. Type of device (e.g smoke, pull station, heat)
   3. Point status (e.g. alarm, trouble)
   4. Operator keys shall be key switch enabled to prevent unauthorized use. The key shall only be removable in the disabled position. Acknowledge. Silence and Reset operation shall be the same as the FACP.

2.13 GRAPHIC MAP

A. Contractor shall provide and install a weather proof map of the facility. Map shall be on 24” by 36” laminated paper, minimum. Contractor shall program descriptions for detection devices to include room number, name and device address. Contractor shall coordinate with Village for exact descriptions prior to programming. Map shall be provided with and installed in a weatherproof lockable enclosure, with a clear display window (41” x 42-1/4” x 2”, minimum) (Displays 260 Model ODNBCB12BK or approved equal) located adjacent to each remote annunciator and fire alarm control panel. Village will provide contractor with a drawing of the facility in AutoCAD 2000 format.

2.14 DISTRIBUTED POWER MODULE

A. The contractor shall supply (where required) a power module (model 5895XL) compatible with the 6820 fire alarm control panel.

B. The power module must have 6 amps of output power, six notification circuits rated at 3 amps each, and two form C relay circuits rated at 2.5 amps at 24 volts DC. The six notification circuits shall have the same functionality as the notification circuits on the main panel.

C. The 5895XL shall be capable of being connected via a RS-485 system bus (SBUS) at a maximum distance of 6000 feet from the main control panel. The power module shall contain an additional RS-485 bus that is completely compatible with all 6820 add on modules including

5860 Remote Annunciators, 5824 serial/parallel modules and addressable devices. The power module will also act as a bus repeater so that additional RS-485 (modules) devices can be connected at a maximum distance of 6000ft. from the power module.

D. The 6820 shall be capable of supporting up to eight (8) of the Distributed Power Modules in any combination.

E. The power module's RS-485 bus shall be electrically isolated providing ground loop isolation and transient protection.

2.15 DIGITAL COMMUNICATOR

A. IP / Cellular Digital Communicator shall be Honeywell (Model: IPGSM-4G).

B. Digital communicator shall communicate with central station via both IP networked and cellular connections (IP primary, cellular backup).

C. Fire alarm control panel shall be provided with Digital Alarm Communicator Transmitter (DACT) compatible with the IP / Cellular Digital Communicator.

D. The digital communicator must be capable of reporting all zones or points of alarm, supervisory, and trouble as well as all system information such as loss of AC, low battery, ground fault, loss of supervision to any remote devices with individual and distinct messages to a central station or remote station.

E. The communicator must also be capable of up/downloading all system programming options, event history, and sensitivity compiance information to a PC on site or at a remote location.

F. The communicatior must be capable of reporting via SIA and Contact ID formats. The communicator shall have a delayed AC loss report function which will provide a programmable report delay plus 10-25 min random component to help ease traffic to the central station during a power outage.

G. Controls that use external modems for remote programming and diagnostics shall not be accepted.

H. Digital communicators that communicate via POTS telephone lines or mesh radio networks shall not be accepted.

I. Controls that use External modems for remote programming and diagnostics shall not be accepted.

2.16 DRY CONTACTS

A. The FACP will have three form "C" dry contacts, one will be dedicated to trouble conditions, the other two will be programmable for alarm, trouble, notification, pre-alarm, manual pull, aux. 1 or aux. 2. The trouble contact shall be normal in an electrically energized state so that any total power loss (AC and Backup) will cause a trouble condition. In the event that the Microprocessor on the FACP fails the trouble contacts shall also indicate a trouble condition.

2.17 GROUND FAULT DETECTION

A. A ground fault detection circuit, to detect positive and negative grounds on all field wiring. The ground fault detector shall operate the general trouble devices as specified but shall not cause an alarm to be sounded. Ground fault will not interfere with the normal operation, such as alarm, or other trouble conditions.

2.18 OVER CURRENT PROTECTION

A. All low voltage circuits will be protected by microprocessor controlled power limiting or have self restoring polyswitches for the following: smoke detector power, main power supply, indicating appliance circuits, battery standby power and auxiliary output.

2.19 TEST FUNCTIONS

A. A “Lamp Test” mode shall be a standard feature of the fire alarm control panel and shall test all LED’s and the LCD display on the main panel and remote annunciators.

B. A “Walk Test” mode shall be a standard feature of the fire alarm control panel. The walk test feature shall function so that each alarm input tested will operate the associated notification appliance for two seconds. The FACP will then automatically perform a reset and confirm normal device operation. The event memory shall contain the information on the point tested. the zone tripped, the zone restore and the individual points return to normal.

C. A “Fire Drill” mode shall allow the manual testing of the fire alarm system notification circuits. The “Fire Drill” shall be capable of being controlled at the main annunciator, remote annunciators and via a remote contact input.

D. A “Bypass Mode” shall allow for any point or nac circuit to be bypassed without effecting the operation of the total fire system.

2.20 REMOTE INPUT CAPABILITIES

A. The control panel shall have provisions for supervised switch inputs for the purpose of Alarm reset and Alarm and trouble restore.

2.21 NOTIFICATION APPLIANCE MAPPING STRUCTURE

A. All notification circuits and modules shall be programmable via a mapping structure that allows for a maximum of 250 output groups. Each of these groups shall have the ability to be triggered by any of the panels 125 Zones. A zone may trigger from groups individually, or may contain a global trigger for manual pull stations, fire drills and two different system alarms. Additionally each Zone will individually control the cadence pattern of each of the Groups that it is “Mapped” to so that sounders can indicate a variety of conditions. The Zone shall be capable of issuing a different cadence pattern for each of the Groups under it’s control. The mapping structure must also allow a group to be designated to “ignore cadence” for use with strobes and other continuous input devices. Zones shall have eight different output categories; Detector alarm, Trouble, Pre-alarm, Manual pull, Zone auxiliary one and Zone Auxiliary two. Each of the categories shall have the ability to control from 1 to 8 output groups with a cadence pattern. The patterns are; March code, ANSI 3.41, Single Stroke Bell Temporal, California code, Zone 1 coded, Zone 2 coded, Zone 3 coded, Zone 4 coded, Zone 5 coded, Zone 6 coded, Zone 7 coded, Zone 8 coded, Custom output pattern 1, Custom output pattern 2, Custom output pattern 3, Custom output pattern 4, and Constant. This mapping/cadence pattern shall be supported by all system power supplies and Notification Expander Modules.

2.22 ON BOARD PROGRAMMER

A. The FACP shall have an on board programmer which will allow for all system functions and options to be programmed via the on board annunciator keypad. Any panel that does not have this capability will not be accepted.

2.23 DOWNLOADING SOFTWARE

A. The fire alarm control panel must support up/downloading of system programming from a PC under Windows7, Windows 8, Windows 98, Windows XP, Windows N/T, or Windows Vista. The FACP must also be able to download the detector sensitivity test results and a 1000 event system event buffer to the PC.

B. Communication shall take place over a direct connection to the PC and/or via the same telephone lines as the built in digital communicator and shall not require an external modem to be connected to the panel. The downloading software shall contain a code that will block unauthorized persons from accessing the panel via direct connection or over the phone lines.

2.24 FACILITY MANAGEMENT SOFTWARE

A. The FACP must support a facility management software capable of providing off site access to FACP data that is necessary to manage fire system operation. A software package capable of uploading the detector sensitivity test results and the 1000 event system event buffer to the PC shall be required as part of the bid package.

B. Communication shall take place over a direct connection to the PC and/or via the same telephone lines as the built in digital communicator. The facility management package must be separate from the downloader package and must not be capable of affecting programmed system options.

2.25 SERVICE REMINDER

A. The FACP shall be capable of automatically generating textual service reminder and the main and remote annunciator LCD's to inform the user of required testing or service. The service reminder shall not interfere with the normal operation of the FACP.

2.26 ENGLISH LANGUAGE DESCRIPTIONS

A. The FACP shall provide the ability to have a text description of each system device, input zone and output group on the system. The use of individual lights to provide descriptions will not be acceptable.

2.27 ADDRESSABLE NOTIFICATION MODULE (INDIVIDUAL ADDRESSABLE MODULE)

A. The contractor shall furnish and install where indicated on the plans, addressable notification modules, Silent Knight model SK-Control. The modules shall be U.L. listed compatible with Silent Knight's 6820 fire alarm control panel. The notification module must provide one class A (Style Z) or class B (Style Y) notification output with one auxiliary power input. The notification module must be suitable for mounting in a standard 4 square electrical box and must include a plastic cover plate. The notification module must provide an LED that is visible from the outside of the cover plate. The notification module must be fully programmable for such applications as required by the installation. The SK-Control shall reside on the SLC loop and can be placed up to 10,000ft.from the control or 5815XL SLC loop module.

2.28 REMOTE POWER SUPPLIES

A. The Remote Power Supplies for Notification appliances shall be the Silent Knight Models 5496 and/or 5895XL. The 5496 and 5895XL Intelligent Power Supplies shall hang on the main S-Bus and be programmed through the 6820 control. The 5496 will support 6 amps of 24 volt DC power with 4 notification circuits rated at 3 amps each. The 5895XL will support 6amps of 24 volt DC power, with 6 Flexput circuits, rated at 3amps each. Two additional 5815 SLC loop

expanders shall be capable of being installed in the cabinet, to allow an additional 396 points. The power supply will also regenerate the S-Bus for an additional 6000'.

B. The remote power supply model 5495 or 5499 may also be used on the system. These power supplies support 6amps or 9amps of 24VDC power with 4 notification circuits rated at 3amps each. These power boosters may also be activated from another notification circuit from either the fire alarm control or the Distributed Power Modules.

C. Provide all 120Volt wiring in conduit and as required.

2.29 REMOTE CRTS AND PRINTERS (SERIAL/PARALLEL INTERFACE)

A. The fire system shall be capable of supporting up to two serial / parallel interfaces (SK5824) that are capable of driving standard computer style printers. The interface shall be programmable as to what information is sent to it and shall include the ability to print out Detector Status by point, Event History by point and System Programming.

PART 3 - EXECUTION

3.01 INSTALLATION

A. No installation shall begin without approved plans from the engineer. All submittals shall be stamped by a N.Y. State Professional Engineer.

B. The entire system shall be installed in a workmanlike manner, in accordance with approved manufacturer's wiring diagrams. The Contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation.

C. All penetrations of floor slabs and fire walls shall be fire stopped in accordance with all local fire codes.

D. End of Line Devices (Resistors/Diodes/Capacitors): Shall be furnished as required for mounting as directed by the manufacturer.

E. All wiring shall be color coded throughout, to National Electrical Code standards and a minimum of No. 18 AWG., unless otherwise noted. All wiring shall be of the type recommended by the manufacturer.

F. All wires shall test free from grounds or crosses between conductors.

G. Fire alarm system terminal and junction locations shall be identified in accordance with NFPA Standard 70, Section 760-3. Terminal and junction boxes shall be painted red and stenciled in white letters "FIRE ALARM", preventing unintentional interference with the fire alarm system wiring during testing, servicing and additional modifications to the system.

H. The system shall be arranged to receive power from two/three-wire, 30 Ampere, 120 volt, 60 cycle alternating current supply through fused cut-out. All low voltage operation shall be provided from the FACP(s).

I. All final connections between system equipment and the wiring shall be made under the supervision of a trained manufacturer's technical representative.

J. The contractor shall submit to the Authority Having Jurisdiction (AHJ), all necessary drawings and equipment specifications required for a complete AHJ approved system. Drawings shall be prepared by the Contractor.

K. The Contractor shall have a licensed New York State Professional Engineer Stamp all submittals, drawings and applications. Pay for all fees to obtain all necessary permits.

L. All junction boxes housing relays must be labeled with P-Touch type labeler with relay point number and device it serves, i.e. (0001-Smoke 1).

M. Contractor to review points list prior to programming with Owner. Contractor only to program approved points list. Any changes to program not previously approved by Owner will be done at Contractor's expense.

3.02 CLEAN UP

A. Upon completion of the installation, all debris created by the installation shall be removed from the premises or disposed of as directed by the Owner.

B. It shall be the responsibility of the installing contractor to assure that construction debris does not adversely affect any sensing devices installed as part of this project. Should it be deemed necessary by the engineer, owner or AHJ, the installing contractor shall be responsible for the clearing of all devices prior to final acceptance.

3.03 TESTS

A. Prior to the final acceptance test, the Contractor and a trained manufacturer's technical representative shall test the completed system for proper operation. The system shall be demonstrated to perform all of the functions as below listed in 3.04. Any system, equipment or wiring failures discovered during said test shall be repaired or replaced before requesting scheduling of the final acceptance test.

B. The system shall be tested for final acceptance in the presence of the Owner's representative, Architect's representative, Engineer's representative, the local Code enforcement official, Contractor's representative and the Manufacturer's representative.

C. At least 50% of the test shall be performed while on battery back-up only.

D. During the final acceptance test:
   1. Every manual fire alarm station shall be tested.
   2. Every smoke detector shall be tested using Silent Knight tester or equivalent device.
   3. Every audible alarm signaling device shall be sounded.
   4. Every visual alarm signaling device shall be lit or flashed.
   5. Every system control function shall be tested for its proper operation.
   6. All supervised circuits shall be opened at two (2) locations to test for proper supervision.

E. Upon successful completion of all final acceptance tests, the Contractor's and Manufacturer's representatives shall each author and sign a letter confirming the successful completion of testing. Two (2) copies of each letter shall be forwarded to the Owner's representative, the Architect's representative, the Engineer's representative and the local Code enforcement official.

F. All final acceptance testing shall be done at a time convenient to the local Code enforcement official and the Owner's representatives and all testing costs shall be born by the Contractor as part of this Contract.

3.04 DOCUMENTATION AND TRAINING

A. The Contractor shall provide the services of a trained manufacturer's employee for 2 training periods of four (4) hours each, during normal business hours, to instruct the Owner's designated personnel on the operation and maintenance of the entire system.

3.05 MAINTENANCE AND TESTING AGREEMENT

A. The equipment manufacturer shall provide to the Owner a price quotation for a one (1) year and five (5) fire alarm system maintenance and testing agreement to begin after one (1) year warranty expires. System Supplier shall have a local service organization with a minimum of 20 factory trained technicians. Technicians shall be NICET Level 2 certified.

B. The equipment manufacturer shall make available a fully equipped service organization, capable of guaranteeing an on-site service response time within eight (8) hours to a service request call. Said service shall be available twenty-four (24) hours per day and seven (7) days per week.

3.06 SERVICE AND MAINTENANCE

A. The equipment manufacturer shall make available a fully equipped service organization, capable of guaranteeing an on-site service response time within eight (8) hours to a service request call. Said service shall be available twenty-four (24) hours per day and seven (7) days per week.

B. The equipment manufacturer shall make available, to the Owner, a price quotation for a one (1) year maintenance and testing agreement, to take effect on the date of final acceptance.

3.07 DEMONSTRATION

A. Provide systems demonstration under provisions of Section 016500.

B. Provide instruction as required for operating the system. “Hands-on” demonstration of the operation of all system components and the entire system including program changes and functions shall be provided

C. Demonstrate normal and abnormal modes of operation and required responses to each.

D. The Contractor and/or the Systems Manufacturer’s representative shall provide a typewritten “Sequence of Operation” to the Owner at the time of demonstration.

E. Contractor to provide O&M manuals for the fire alarm equipment on disk format.

3.08 FAN SHUT DOWN

A. The contractor shall provide fan shutdown for all equipment shown on the drawings. All ducted equipment, with a rating of 2000 CFM or greater shall have return duct smoke detectors, remote LED indicators and fan shutdown control. All ducted equipment, shown on the drawings, rated 15,000 CFM of greater shall have supply and return duct smoke detectors, remote LED indicators and fan shutdown control.

B. All fan reset control shall be independent of fire alarm panel reset control.

C. Provide all control modules; independent reset control modules and duct smoke detectors as required. Provide all required power and control wiring including motor starters.

D. Contractor shall submit control drawings for architect/engineer approval.

3.09 GUARANTEE

A. The Contractor shall guarantee all material and installation to be free from inherent mechanical and electrical defects for one (1) year. Manufacturer shall make available to the Owner a local service department, which shall stock standard parts on the premises. Maintenance is to be provided during normal working hours, at no cost to the owner, for a period of twelve (12) months from the date of acceptance of the installation, unless damage is caused by misuse, abuse or accident.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Asphaltic concrete paving; wearing, binder or base course.

1.02 RELATED SECTIONS

A. Section 321123 - Aggregate Base Course.

1.03 REFERENCES

A. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot Mix Types.

B. AI MS-8 - Asphalt Paving Manual.

C. ASTM D242 - Mineral Filler for Bituminous Paving Mixtures.

D. ASTM D546 - Test Method for Sieve Analysis of Mineral Filler for Road and Paving Materials.

E. NYSDOT Standard Specificatuons - Section 702.

1.04 SUBMITTALS

A. Supplier: Submit name of asphalt supplier to be used on the project prior to placement of any asphalt on the project.

B. Design Data: Submit asphalt mix design for each asphalt type to be used.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle products to the site under provisions of Section 016500.

B. Deliver asphalt in sealed, metal containers covered with suitable material to protect the asphalt from the elements.

C. Lightly lubricate the inside surface of the container with a thin oil or soap solution before loading asphalt.

D. All containers must be cleaned of all foreign materials prior to loading.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt when base surface temperature is less than 40 degrees F, or if surface is wet or frozen.

B. Do not place asphalt when precipitation is occurring.

C. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials and 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Rollers: Minimum weight of 10 tons; equipped with lubricating devices for the roller wheels.

B. Pavers: Equipped with a vibratory device.

2.02 ACCESSORIES

A. Tack Coat: Homogeneous, medium curing, liquid asphalt.

B. Wheel Lubricant: Oil-water mixture containing maximum 10 percent lubricating oil.

2.03 MIXES

A. Use dry material to avoid foaming. Mix uniformly.

B. **Binder Course: NYSDOT Type 3; 4.5 to 6.5 percent of asphalt cement by weight in mixture in accordance with the following gradation refer to plans for thickness.**

C. Wearing Course: NYSDOT Type 6; 5.8 to 7.0 percent of asphalt cement by weight in mixture in accordance with the following gradatio. Refer to plans for thickness.

2.04 SOURCE QUALITY CONTROL

A. Obtain asphalt materials from same source throughout the project.

B. Provide asphalt in accordance with the approved mix design for each type of asphalt.

C. Test samples in accordance with AI MS-2.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and substrate.

B. Verify that compacted subbase is dry and ready to receive work of this section.

C. Verify gradients and elevations of base are correct.

D. Verify that all castings are properly installed and are at the correct elevations.

E. Beginning of installation means installer accepts existing conditions.

3.02 PREPARATION

A. Apply tack coat at uniform rate of 0.03 to 0.07 gal/sq. yd. to contact surfaces of castings, curbs, gutters and any asphalt or concrete material.

B. Do not apply tack coat to wet or frozen surfaces.

C. Coat top surfaces of castings with oil to prevent bond with asphalt pavement.

3.03 INSTALLATION

A. Install work in accordance with AI MS-8 and NYSDOT Standard Specifications.

B. Maintain asphalt temperature between 250 and 325 degrees F during placement.

C. Place asphalt within 24 hours of applying tack coat.

D. Place asphalt to compacted thicknesses as identified on plans. If a multiple course pavement is to be used, place top course within 24 hours of placing bottom course. If more than 24 hours elapse, a tack coat will be required to be placed over the entire surface of the bottom course prior to any additional paving.

E. Utilize the vibratory device on the paver at all times.

F. Compact pavement by rolling. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

G. Compact pavement to a minimum of 94% maximum density.

H. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks.

I. Seal all joints between new pavement and existing pavement with asphalt cement.

3.04 TOLERANCES

A. Maximum Variation From Flatness: 1/8 inch measured with 10 foot straight edge.

B. Maximum Variation From Scheduled Compacted Thickness: 1/8 inch.

C. Maximum Variation from True Elevation: 1/4 inch.

3.05 PROTECTION

A. Protect finished work under provisions of Section 015000.

B. Immediately after placement, protect pavement from mechanical injury until project is accepted by the Owner.

END OF SECTION 321216

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Polymer Cast Sloped Trench Drain Units.

B. Removable Grating Systems.

1.02 RELATED SECTIONS

A. Section 033000 - CAST-IN PLACE CONCRETE.

B. Section 079200 - JOINT SEALANTS.

C. Section 312316 - EXCAVATION.

D. Section 312323 - FILL.

E. Section 334123 - PVC DRAINAGE PIPE.

1.03 REFERENCES

A. AASHTO (American Association of State Highway and Transportation Officials)

B. ASTM D3212 - Specification for joints for drain and sewer plastic pipes using flexible elastomeric seals.

C. ASTM F1336 - Specification for PVC fittings.

1.04 SUBMITTALS

A. Submit under provisions of Section 013300 - SUBMITTALS.

B. Shop Drawings: Indicate dimensions and details of complete Trench Drain System including but not limited to: Catch basins, Gratings, accessories and connections to drainage facilities.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle products to the site under provisions of Section 016500 - PRODUCT DELIVERY, STORAGE AND HANDLING.

B. Store products on firm and level ground.

C. Handle products in such a manner which will not induce unnecessary stresses, cause cracks to occur or damage the product in any way.

D. Any cracked or otherwise defective or damaged materials will be rejected.

1.06 COORDINATION

A. Coordinate work under provisions of Section 013100 - PROJECT MANAGEMENT AND COORDINATION.

B. Coordinate with excavation, forming and installation, concrete encasement, backfilling, installation of connections to drainage piping and all other work for a complete drainage system.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. ACO DRAIN: KlassikDrain K200 Galvanized Steel Edge Rail Channel System as manufactured by Aco Polycrete Pty. Ltd. or approved equal.

B. Substitutions shall be permitted only after receiving written approval from the Engineer.

2.02 MATERIALS

A. Polymer Tench Drain units: Polymer cast channel units with a nominal clear opening of 12 inches; and 0.5% min. slopes. Each unit will have a partial radius in the trench bottom and male to female interconnecting end sections. Units shall have integrally cast in place galvanized 3/32 inch thick steel edge rails. Units shall be capable of supporting AASHTO HS-20 highway loading. Provide number of sections and depths with associated inverts as indicated on the drawings.
   1. Physical Characteristics of polyester polymer concrete material:

Compressive Strength	14,000 psi
Flexural Strength	4,000 psi
Water Absorption	0.07%
Frost Proof	Yes
Salt Proof	Yes
Dilute acid and Alkali resistant	Yes

   2. Grates: Ductile Iron, 1, Grade 65-45-12; Type 661Q , Iron Slotted, Heelsafe and Anti-Slip (P4 Slip resistance classification for Wet Pendulum Test), 500mm lengths, Model 10351, 28 plf. with QuickLok stainless steel and high density nylon spigot capable of supporting the AASHTO HS-20-44 highway loading; Provide units with stainless steel QuickLok locking bar and Grate removal tool.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing site conditions under provisions of Section 013100 - PROJECT MANAGEMENT AND COORDINATION.

B. Verify existing grades are as indicated on the plans.

C. Verify items provided by other sections of work are properly sized and located.

D. Verify that rough openings for piping are as required.

3.02 INSTALLATION

A. Form bottom of excavation clean and smooth to correct elevation. Compact bottom of the excavation to a minimum of 95 percent of maximum dry density.

B. Place drainage inlets, secure and level, to the proper elevation. Utilize a placement method which will not damage the inlet.

C. Place drainage trench sections plumb and level, trim to correct elevations.

D. Establish elevations and pipe inverts for inlets and outlets as indicated on the plans.

E. Provide thickness of concrete encasement to achieve For H-25 loading as per the manufacturer's recommendations.

F. All drainage inlets must be installed in accordance with all applicable local, state and federal regulations. Refer to manufacturer's installation guidelines.

G. Connect system to drainage piping and site basin as indicated on the drawings.

3.03 TOLERANCES

A. Maximum Variation from Proposed Rim Elevation: 1/8 inch.

B. Maximum Variation from Proposed Location: 1/4 inch.

3.04 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 014500 - QUALITY CONTROL.

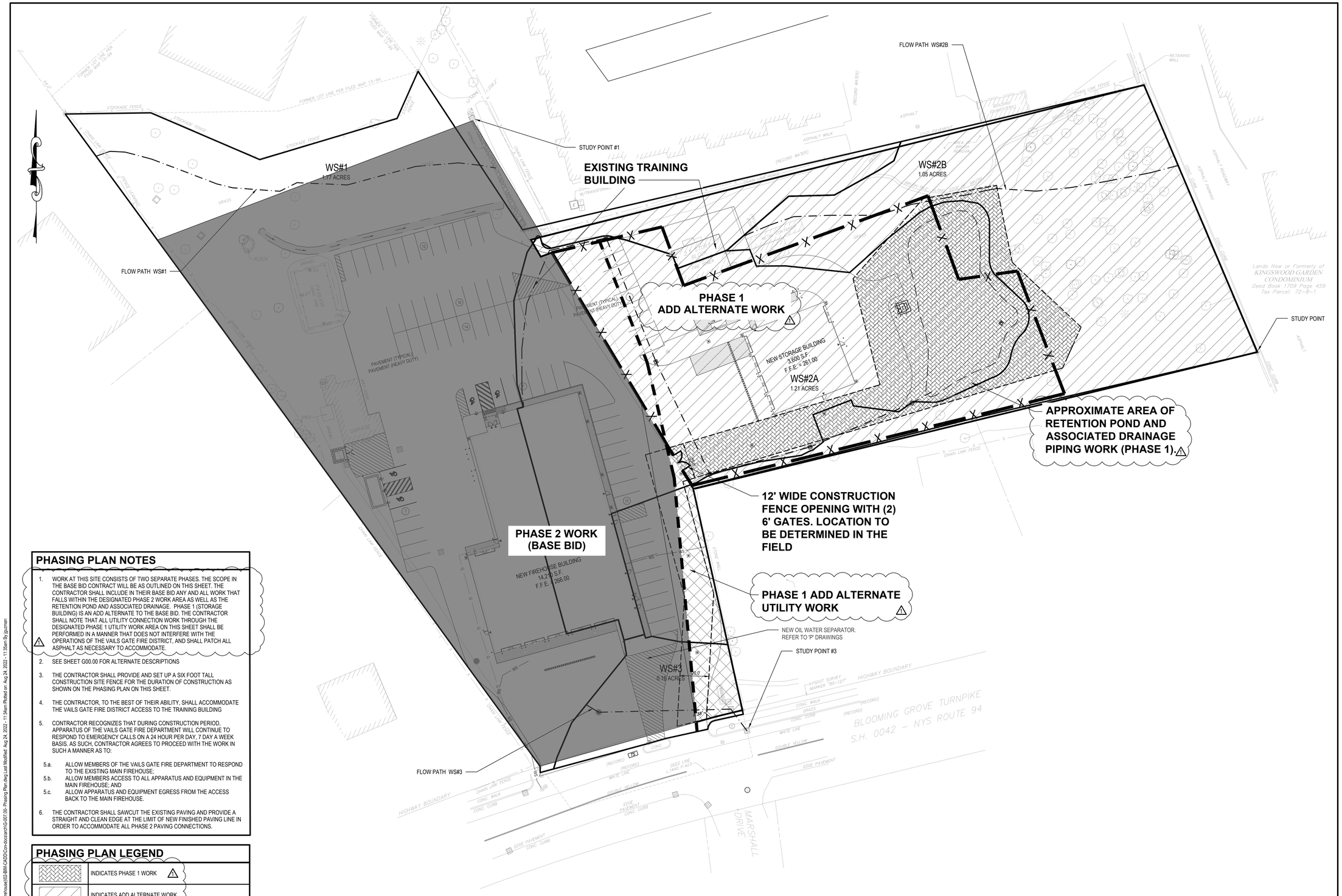
B. Request inspection prior to backfilling around chambers and prior to concrete encasement.

3.05 PROTECTION

A. Protect finished work under provisions of Section 015000 - TEMPORARY FACILITIES AND CONTROLS.

B. Protect drainage inlets from damage or displacement until project is accepted by the Owner.

END OF SECTION 334416



PHASING PLAN NOTES

1. WORK AT THIS SITE CONSISTS OF TWO SEPARATE PHASES. THE SCOPE IN THE BASE BID CONTRACT WILL BE AS OUTLINED ON THIS SHEET. THE CONTRACTOR SHALL INCLUDE IN THEIR BASE BID ANY AND ALL WORK THAT FALLS WITHIN THE DESIGNATED PHASE 2 WORK AREA AS WELL AS THE RETENTION POND AND ASSOCIATED DRAINAGE. PHASE 1 (STORAGE BUILDING) IS AN ADD ALTERNATE TO THE BASE BID. THE CONTRACTOR SHALL NOTE THAT ALL UTILITY CONNECTION WORK THROUGH THE DESIGNATED PHASE 1 UTILITY WORK AREA ON THIS SHEET SHALL BE PERFORMED IN A MANNER THAT DOES NOT INTERFERE WITH THE OPERATIONS OF THE VAILS GATE FIRE DISTRICT, AND SHALL PATCH ALL ASPHALT AS NECESSARY TO ACCOMMODATE. ⚠1
2. SEE SHEET G00.00 FOR ALTERNATE DESCRIPTIONS
3. THE CONTRACTOR SHALL PROVIDE AND SET UP A SIX FOOT TALL CONSTRUCTION SITE FENCE FOR THE DURATION OF CONSTRUCTION AS SHOWN ON THE PHASING PLAN ON THIS SHEET.
4. THE CONTRACTOR, TO THE BEST OF THEIR ABILITY, SHALL ACCOMMODATE THE VAILS GATE FIRE DISTRICT ACCESS TO THE TRAINING BUILDING
5. CONTRACTOR RECOGNIZES THAT DURING CONSTRUCTION PERIOD, APPARATUS OF THE VAILS GATE FIRE DEPARTMENT WILL CONTINUE TO RESPOND TO EMERGENCY CALLS ON A 24 HOUR PER DAY, 7 DAY A WEEK BASIS. AS SUCH, CONTRACTOR AGREES TO PROCEED WITH THE WORK IN SUCH A MANNER AS TO:
   - 5.a. ALLOW MEMBERS OF THE VAILS GATE FIRE DEPARTMENT TO RESPOND TO THE EXISTING MAIN FIREHOUSE;
   - 5.b. ALLOW MEMBERS ACCESS TO ALL APPARATUS AND EQUIPMENT IN THE MAIN FIREHOUSE; AND
   - 5.c. ALLOW APPARATUS AND EQUIPMENT EGRESS FROM THE ACCESS BACK TO THE MAIN FIREHOUSE.
6. THE CONTRACTOR SHALL SAWCUT THE EXISTING PAVING AND PROVIDE A STRAIGHT AND CLEAN EDGE AT THE LIMIT OF NEW FINISHED PAVING LINE IN ORDER TO ACCOMMODATE ALL PHASE 2 PAVING CONNECTIONS.

PHASING PLAN LEGEND

	INDICATES PHASE 1 WORK ⚠1
	INDICATES ADD ALTERNATE WORK
	INDICATES APPROXIMATE LOCATION OF PHASE 1 UTILITY WORK AND ASPHALT PATCH
	INDICATES PHASE 2 WORK
— X —	INDICATES APPROXIMATE LOCATION OF PHASE 1 SIX FOOT TALL CONSTRUCTION FENCE WITH A 12' WIDE CONSTRUCTION FENCE OPENING WITH (2) 6' GATES
— — —	INDICATES APPROXIMATE LIMIT OF PHASE 1 FINISH ASPHALT PAVING

GRAPHIC SCALE
30 0 15 30
(IN FEET)
1 inch = 30 ft.

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CONSULTANTS:

MARK	DATE	DESCRIPTION
⚠1	08/19/2022	ADDENDUM #1

DESIGNED BY:	DRAWN BY:	CHECKED BY:	REVIEWED BY:
KWS	JHG		

PROJECT No.:	DATE:	SCALE:
VGFD2001	JULY 2022	AS SHOWN

CLIENT
VAILS GATE FIRE DISTRICT

New Storage Building (Phase I)
New Fire Station (Phase II)

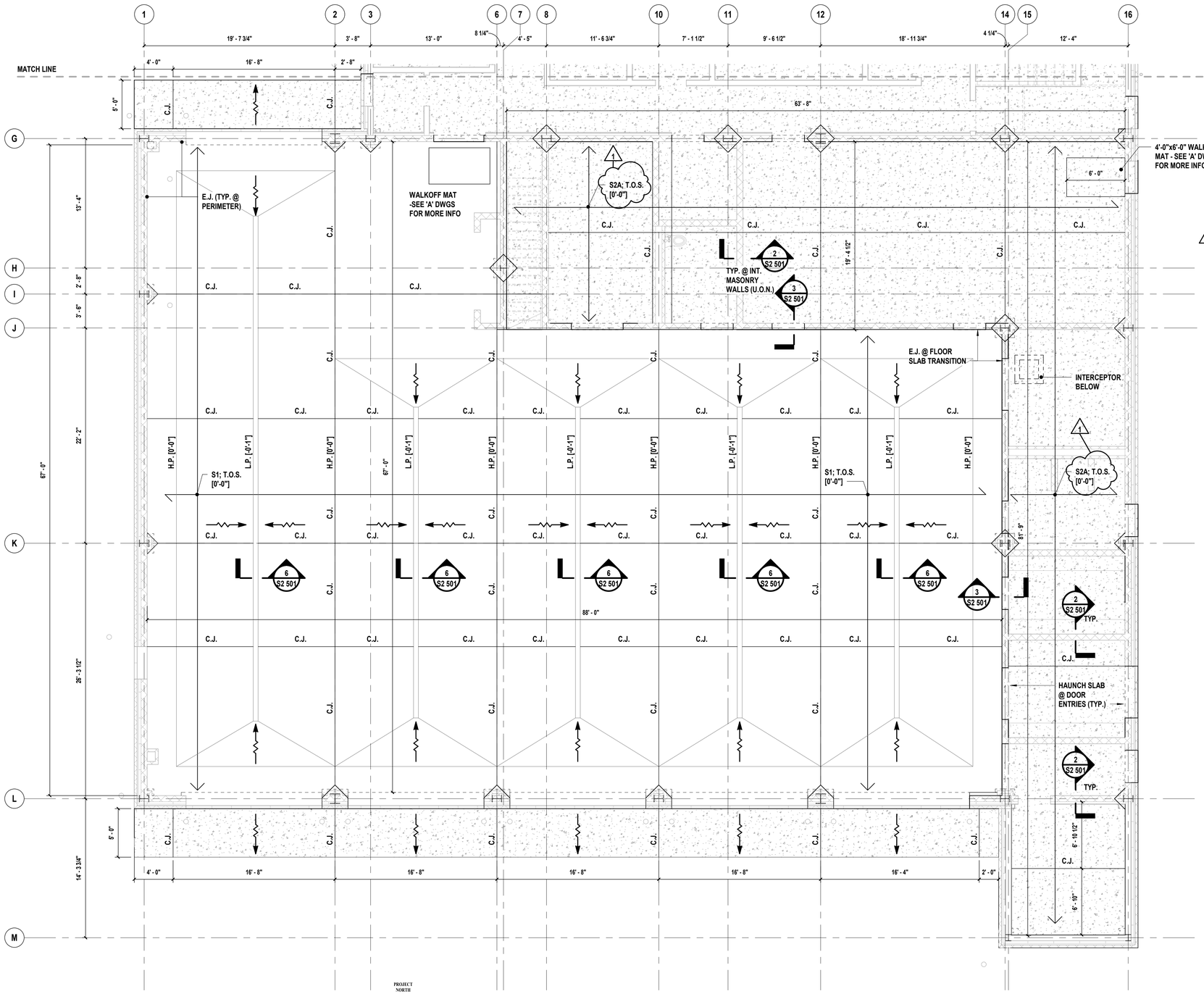
872 Blooming Grove Turnpike
New Windsor, NY 12553

CONTRACT
CONTRACT G
GENERAL CONSTRUCTION

STATUS
FINAL BID DOCUMENT

SHEET TITLE
ARCHITECTURE
PHASING PLAN

DRAWING No.
G 007.01



1 Partial First Floor Slab Plan - South End
SCALE: 3/16" = 1'-0"

PROJECT NORTH

LEGEND:

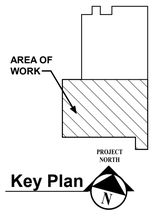
C.J. = CONTROL JOINT
E.J. = EXPANSION JOINT
E.O.S. = EDGE OF SLAB
T.O.S. = TOP OF SLAB
U.O.N. = UNLESS OTHERWISE NOTED
H.P. = HIGH POINT OF PITCHED SLAB
L.P. = LOW POINT OF PITCHED SLAB
INDICATES PITCH DIRECTION OF SLAB

SLAB NOTES:

1. ELEVATIONS SHOWN THUS [ ] ARE RELATIVE TO FINISHED FIRST FLOOR DATUM ELEVATION [0'-0"] (EQUIVALENT TO 266.00' ON CIVIL DWGS).
2. S1 — INDICATES SPAN ON 8" CONCRETE SLAB ON GRADE REINFORCED WITH (2) LAYERS OF 6x6-W4.0xW4.0 W.W.M. W/ RADIANT HEAT TUBES
3. S2A — INDICATES SPAN ON 6" CONCRETE SLAB ON GRADE REINFORCED WITH 6x6-W2.9xW2.9 W.W.M. W/ RADIANT HEAT TUBES
4. PROVIDE 1/2" PRE-MOLDED EXPANSION JOINT AROUND PERIMETER OF CONCRETE SLAB ON GRADE WHERE IT ABUTS THE FOUNDATION WALL OF THE BUILDING.

MASONRY NOTES:

1. ALL VERTICAL MASONRY WALL REINFORCEMENT SHALL BE #6 BARS SPACED AT MAXIMUM OF 32" O.C., TYP. UNLESS OTHERWISE NOTED. PROVIDE #5 @ 48" O.C. FOR NON-LOAD BEARING CMU PARTITIONS.
2. THE FIRST CELL ADJACENT TO MASONRY OPENINGS, AS WELL AS ALL CORNERS, SHALL CONTAIN (1) CONT. #5 BAR, TYP. AT EACH SIDE OF OPENING.
3. FILL ALL MASONRY CELLS CONTAINING REINFORCEMENT SOLID WITH MORTAR, TYP.
4. REFER TO 'A' DWGS AND SPECIFICATIONS FOR ADDITIONA REQUIREMENTS NOT OUTLINED HERE, INCLUDING HORIZONTAL REINFORCEMENT AND BRICK TIES.
5. ALL VERTICAL REINFORCEMENT INTERRUPTED BY STRUCTURAL STEEL SHALL BE WELDED TO TOP OF STEEL MEMBERS, TYP.
6. COORDINATE PLACEMENT OF VERTICAL WALL DOWELS EMBEDDED INTO FOUNDATION WALL WITH CELLS OF MASONRY WALL. DOWEL SPACING TO MATCH SPACING OF VERTICAL REINFORCEMENT IN WALLS, TYP.



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CONSULTANTS:

MARK	DATE	DESCRIPTION
1	8/24/2022	ADDENDUM #1

DESIGNED BY:	DRAWN BY:	CHECKED BY:	REVIEWED BY:
MDH	MDH		

PROJECT No:	DATE:	SCALE:
VGFD2001	JULY 2022	AS SHOWN

CLIENT

VAILS GATE FIRE DISTRICT

New Storage Building (Phase I)
New Fire Station (Phase II)

872 Blooming Grove Turnpike
New Windsor, NY 12553

CONTRACT
CONTRACT G
GENERAL CONSTRUCTION

STATUS
FINAL BID DOCUMENT

SHEET TITLE
STRUCTURAL
PARTIAL SLAB PLAN - SOUTH END

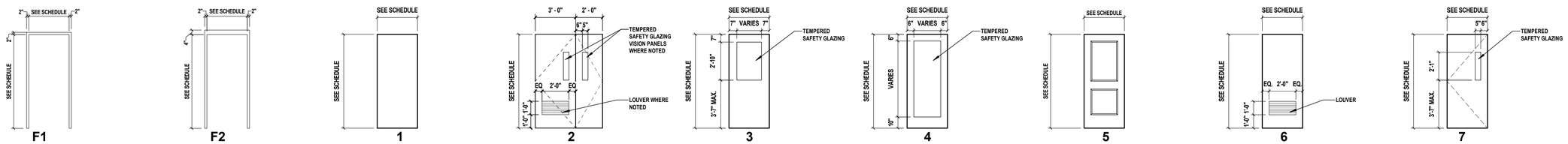
DRAWING No.
S2 110.01

DOOR SCHEDULE

DOOR NO.	FROM ROOM NAME	FROM ROOM NUMBER	TO ROOM NAME	TO ROOM NUMBER	DOOR SIZE WIDTH	DOOR SIZE HEIGHT	DOOR SIZE THICKNESS	DOOR TYPE	DOOR MATERIAL	DOOR FINISH	FRAME TYPE	FRAME MATERIAL	FRAME FINISH	DETAILS HEAD	DETAILS JAMB	DETAILS SADDLE	FIRE RATING	HARDWARE SET	SECURITY ACCESS	SELF CLOSING	DOOR SIGNAGE	WEATHER STRIPPING	PANIC HARDWARE	COMMENTS
101A	EXTERIOR	EXT.	APPARATUS ROOM	101	36"	84"	1 3/4"	7	HM	PAINT	F2	HM	PAINT	DH1	DJ1	DS7	-	HS1	-	•	-	•	•	
101B	EXTERIOR	EXT.	APPARATUS ROOM	101	36"	84"	1 3/4"	7	HM	PAINT	F2	HM	PAINT	DH1	DJ1	DS7	-	HS1	-	•	-	•	•	
101C	APPARATUS ROOM	101	CORRIDOR	113	(2) 36" + 24"	84"	1 3/4"	2	HM	PAINT	F2	HM	PAINT	DH4	DJ4	DS6	1 HR	HS7	-	•	•	-	-	VISION PANEL
102	APPARATUS ROOM	101	RADIO ROOM	102	36"	84"	1 3/4"	7	HM	PAINT	F2	HM	PAINT	DH4	DJ4	DS6	1 HR	HS5A	-	•	•	•	-	
103A	APPARATUS ROOM	101	STORAGE 1	103	(2) 36" + 24"	84"	1 3/4"	2	HM	PAINT	F2	HM	PAINT	DH3	DJ3	-	1 HR	HS7	-	•	•	-	-	
103B	EXTERIOR	EXT.	STORAGE 1	103	(2) 36" + 24"	84"	1 3/4"	2	HM	PAINT	F2	HM	PAINT	DH1	DJ1	DS7	-	HS7A	-	-	-	•	-	
104	APPARATUS ROOM	101	STORAGE 2	104	36"	84"	1 3/4"	1	HM	PAINT	F2	HM	PAINT	DH3	DJ3	-	1 HR	HS3B	-	•	•	-	-	
105A	APPARATUS ROOM	101	DECON ROOM	105	36"	84"	1 3/4"	6	HM	PAINT	F2	HM	PAINT	DH3	DJ3	-	1 HR	HS4	-	•	•	-	-	
105B	EXTERIOR	EXT.	DECON ROOM	105	36"	84"	1 3/4"	1	HM	PAINT	F2	HM	PAINT	DH1	DJ1	DS7	-	HS14	-	•	•	-	-	
106	APPARATUS ROOM	101	LAUNDRY	106	(2) 36" + 24"	84"	1 3/4"	2	HM	PAINT	F2	HM	PAINT	DH3	DJ3	-	-	HS7	-	-	•	-	-	VISION PANEL AND LOUVER
107A	APPARATUS ROOM	101	GEAR ROOM	107	36"	84"	1 3/4"	7	HM	PAINT	F2	HM	PAINT	DH3	DJ3	-	1 HR	HS2	-	•	•	•	-	
107B	APPARATUS ROOM	101	GEAR ROOM	107	36"	84"	1 3/4"	7	HM	PAINT	F2	HM	PAINT	DH3	DJ3	-	1 HR	HS2	-	•	•	•	-	
107C	EXTERIOR	EXT.	GEAR ROOM	107	36"	84"	1 3/4"	7	HM	PAINT	F2	HM	PAINT	DH1	DJ1	DS7	-	HS1	-	•	-	•	•	
107D	GEAR ROOM	107	CORRIDOR	113	36"	84"	1 3/4"	7	HM	PAINT	F2	HM	PAINT	DH4	DJ4	DS6	-	HS2	-	•	•	-	-	
108	APPARATUS ROOM	101	TOILET ROOM	108	36"	84"	1 3/4"	6	HM	PAINT	F2	HM	PAINT	DH3	DJ3	DS6	-	HS4	-	•	•	-	-	
109	APPARATUS ROOM	101	SCBA	109	(2) 36" + 24"	84"	1 3/4"	2	HM	PAINT	F2	HM	PAINT	DH3	DJ3	DS6	-	HS7	-	-	•	-	-	VISION PANEL AND LOUVER
111	CORRIDOR	113	SPARE TURNOUT GEAR	111	36"	84"	1 3/4"	6	HM	PAINT	F1	HM	PAINT	DH4	DJ4	DS6	1 HR	HS3	-	•	•	-	-	
112A	EXTERIOR	EXT.	VENDOR DROP OFF	112	36"	84"	1 3/4"	3	HM	PAINT	F2	HM	PAINT	DH2	DJ2	DS5	-	HS14	-	•	•	•	-	
112B	VENDOR DROP OFF	112	CORRIDOR	113	36"	84"	1 3/4"	3	HM	PAINT	F1	HM	PAINT	DH5	DJ5	-	-	HS3A	-	-	•	-	-	NOT AN EXIT SIGNAGE
113A	CORRIDOR	113	STAIR 'A'	A	36"	84"	1 3/4"	7	WD	STAIN	F1	HM	PAINT	DH5	DJ5	-	1 HR	HS6	-	•	•	-	•	
113B	EXTERIOR	EXT.	STAIR 'A'	A	36"	84"	1 3/4"	7	HM	PAINT	F2	HM	PAINT	DH2	DJ2	DS5	-	HS1	-	•	-	•	•	
114	CORRIDOR	113	QUARTERMASTER	114	36"	84"	1 3/4"	6	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	1 HR	HS3B	-	•	•	-	-	
115	CORRIDOR	113	JANITORS CLOSET	115	36"	84"	1 3/4"	6	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS4	-	HS3B	-	-	•	-	-	
116A	CORRIDOR	113	MEETING ROOM	116	36"	84"	1 3/4"	5	WD	STAIN	F1	HM	PAINT	DH5	DJ5	-	-	HS3A	-	•	•	-	-	NOT AN EXIT SIGNAGE
116B	EXTERIOR	EXT.	MEETING ROOM	116	36"	84"	1 3/4"	7	WD	STAIN	F1	HM	PAINT	DH2	DJ2	DS5	-	HS1	-	•	-	•	•	
116C	LOBBY	125A	MEETING ROOM	116	(2) 36"	84"	1 1/2"	5	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS8	-	HS10	-	•	•	-	•	
117	MEETING ROOM	116	STORAGE	117	(2) 36" + 24"	84"	1 3/4"	2	WD	STAIN	F1	HM	PAINT	DH5	DJ5	-	1 HR	HS7	-	•	•	-	-	LOUVER
118A	CORRIDOR	113	KITCHEN	118	36"	84"	1 3/4"	1	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS2	-	HS3A	-	•	•	-	-	NOT AN EXIT SIGNAGE
118B	MEETING ROOM	116	KITCHEN	118	36"	84"	1 3/4"	5	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS2	-	HS5A	-	-	•	-	-	
119	KITCHEN	118	PANTRY	119	36"	84"	1 3/4"	6	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS2	1 HR	HS3	-	•	•	-	-	
120	CORRIDOR	113	READY ROOM	120	36"	84"	1 3/4"	3	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	-	HS5	-	-	•	-	-	
121	CORRIDOR	113	MECHANICAL ROOM	121	(2) 36" + 24"	84"	1 3/4"	2	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS4	1 HR	HS7	-	•	•	-	-	
122	CORRIDOR	113	ELECTRICAL ROOM	122	36"	84"	1 3/4"	1	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS4	1 HR	HS8	-	•	•	-	-	
123	CORRIDOR	113	ELEVATOR LOBBY	123	36"	84"	1 3/4"	7	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	-	HS6A	-	•	-	-	•	
125A	LOBBY	125A	ELEVATOR LOBBY	123	36"	84"	1 3/4"	7	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	-	HS6	-	•	-	-	•	
125B	LOBBY	125A	CLOSET	125B	(2) 30"	84"	1 3/4"	6	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	-	HS9	-	-	•	-	-	
126A	EXTERIOR	EXT.	VESTIBULE	126	72"	84"	1 3/4"	4	ALM	AN	F1	ALM	AN	DH5	DJ5	DS1	-	HS11	-	•	-	•	•	STOREFRONT SYSTEM - 1" INSULATED GLAZING
126B	LOBBY	125A	VESTIBULE	126	72"	84"	1 3/4"	4	ALM	AN	F1	ALM	AN	DH5	DJ5	DS3		HS11A	-	•	-	-	-	STOREFRONT SYSTEM - 1/4" GLAZING
127	LOBBY	125A	MEN'S TOILET ROOM	127	36"	84"	1 3/4"	6	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS3	-	HS2	-	•	•	-	-	
128	LOBBY	125A	WOMEN'S TOILET ROOM	128	36"	84"	1 3/4"	6	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS3	-	HS2	-	•	•	-	-	
OH1	EXTERIOR	EXT.	APPARATUS ROOM	101	168"	168"	3"	O-1	MFR.	MFR.	MFR.	MFR.	MFR.	1/A2 522	2/A2 522	3/A2 522	-	-	-	-	-	-	-	
OH2	EXTERIOR	EXT.	APPARATUS ROOM	101	168"	168"	3"	O-1	MFR.	MFR.	MFR.	MFR.	MFR.	1/A2 522	2/A2 522	3/A2 522	-	-	-	-	-	-	-	
OH3	EXTERIOR	EXT.	APPARATUS ROOM	101	168"	168"	3"	O-1	MFR.	MFR.	MFR.	MFR.	MFR.	1/A2 522	2/A2 522	3/A2 522	-	-	-	-	-	-	-	
OH4	EXTERIOR	EXT.	APPARATUS ROOM	101	168"	168"	3"	O-1	MFR.	MFR.	MFR.	MFR.	MFR.	1/A2 522	2/A2 522	3/A2 522	-	-	-	-	-	-	-	
OH5	EXTERIOR	EXT.	APPARATUS ROOM	101	168"	168"	3"	O-1	MFR.	MFR.	MFR.	MFR.	MFR.	1/A2 522	2/A2 522	3/A2 522	-	-	-	-			-	
OH6	EXTERIOR	EXT.	APPARATUS ROOM	101	168"	168"	3"	O-2	MFR.	MFR.	MFR.	MFR.	MFR.	1/A2 522	2/A2 522	3/A2 522	-	-	-	-	-	-	-	
201	CORRIDOR	201	STAIR 'B'	B	36"	84"	1 3/4"	1	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	1 HR	HS6	-	•	•	-	•	
202	CORRIDOR	201	CONFERENCE ROOM	202	36"	84"	1 3/4"	1	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	-	HS5A	-	-	•	-	-	
203A	COMPANY ROOM	203A	CORRIDOR	201	36"	84"	1 3/4"	1	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	-	HS5	-	-	•	-	-	
203B	COMPANY ROOM	203A	TRAINING ROOM	206	36"	84"	1 3/4"	7	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	-	HS5A	-	-	•	-	-	
204	COMPANY ROOM	203A	STORAGE	204	36"	84"	1 3/4"	6	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	1 HR	HS3	-	•	•	-	-	
205	TRAINING ROOM	206	STORAGE	205	(2) 36" + 24"	84"	1 3/4"	2	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	1 HR	HS7	-	•	•	-	-	
206A	CORRIDOR	201	TRAINING ROOM	206	36"	84"	1 3/4"	7	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	-	HS5	-	•	•	-	•	
206B	TRAINING ROOM	206	STAIR 'A'	A	36"	84"	1 3/4"	7	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	-	HS6A	-	•	•	-	•	
207A	CORRIDOR	210	EXCERCISE ROOM	207	(2) 36"	84"	1 1/2"	4	ALM	AN	F1	ALM	AN	DH5	DJ5	DS6	-	HS12	-	•	•	-	-	STOREFRONT SYSTEM - 1/4" GLAZING
207B	CORRIDOR	201	EXCERCISE ROOM	207	36"	84"	1 3/4"	4	ALM	AN	F1	ALM	AN	DH5	DJ5	DS6	-	HS13	-	•	•	-	-	STOREFRONT SYSTEM - 1/4" GLAZING
208	CORRIDOR	201	BATHROOM	208	36"	84"	1 3/4"	6	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS2	-	HS4	-	•	•	-	-	
209	CORRIDOR	201	BATHROOM	209	36"	84"	1 3/4"	6	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS2	-	HS4	-	•	•	-	-	
210A	CORRIDOR	210	CORRIDOR	201	36"	84"	1 3/4"	7	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	-	HS6A	-	•	-	-	•	
210B	CORRIDOR	210	STAIR 'A'	A	36"	84"	1 3/4"	7	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	-	HS6	-	•	•	-	•	
211	COMISSIONERS OFFICE	211	CORRIDOR	210	36"	84"	1 3/4"	1	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	-	HS15	-	-	•	-	-	
211B	CORRIDOR	210	MEZZANINE	221	(2) 36" + 24"	80"	1 3/4"	2	HM	PAINT	F2	HM	PAINT	DH5	DJ5	DS6	1 HR	HS7	-	•	•	•	-	VISION PANEL
212	CORRIDOR	210	TRUSTEES OFFICE	212	36"	84"	1 3/4"	1	WD	STAIN	F1	WD	PAINT	DH5	DJ5	DS6	-	HS15	-	-	•	-	-	
213	CORRIDOR	210	COMPANY OFFICERS	213	36"	84"	1 3/4"	1	WD	STAIN	F1	WD	PAINT	DH5	DJ5	DS6	-	HS15	-	-	•	-	-	
214	CORRIDOR	210	ASST. CHIEF OFFICE	214	36"	84"	1 3/4"	1	WD	STAIN	F1	WD	PAINT	DH5	DJ5	DS6	-	HS15	-	-	•	-	-	
215	CORRIDOR	210	CHIEF OFFICE	215	36"	84"	1 3/4"	1	WD	STAIN	F1	WD	PAINT	DH5	DJ5	DS6	-	HS15	-	-	•	-	-	
216	CORRIDOR	210	ADMIN STORAGE	216	36"	84"	1 3/4"	6	WD	STAIN	F1	WD	PAINT	DH5	DJ5	DS6	1 HR	HS3C	-	•	•	-	-	
217	CORRIDOR	210	RATED STORAGE 1	217	36"	84"	1 3/4"	6	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	1 HR	HS3A	-	•	•	-	-	
218	CORRIDOR	210	RATED STORAGE 2	218	36"	84"	1 3/4"	6	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	1 HR	HS3A	-	•	•	-	-	
219	CORRIDOR	210	NETWORK I.T.	219	36"	84"	1 3/4"	1	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	-	HS3C	-	-	•	-	-	
220	CORRIDOR	210	JANITORS CLOSET	220	36"	84"	1 3/4"	6	WD	STAIN	F1	HM	PAINT	DH5	DJ5	DS6	-	HS3B	-	-	•	-	-	

ABBREVIATIONS & SYMBOLS:

AN = ANODIZED | ALM = ALUMINUM | HM = HOLLOW METAL | WD = WOOD | • = APPLICABLE | - = NOT APPLICABLE



1 Door & Frame Types

SCALE: 1/4" = 1'-0"

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KEM	JHG		

PROJECT No:	DATE:	SCALE:
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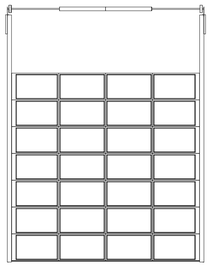
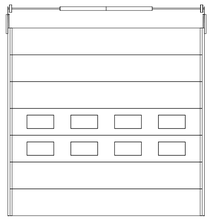
ARCHITECTURE
DOOR SCHEDULE, DOOR AND FRAME TYPES
NEW FIRE STATION
PHASE 2

DRAWING No.

A2 520.01



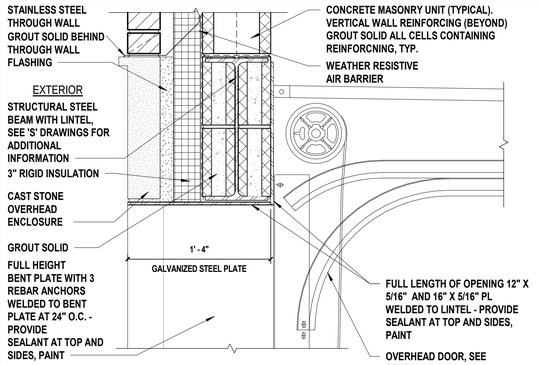
TYPE O-1



TYPE O-2

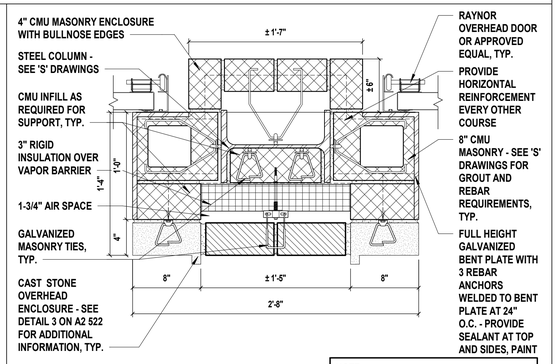
Overhead Door Types

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



1 O.H. Door - Head Detail

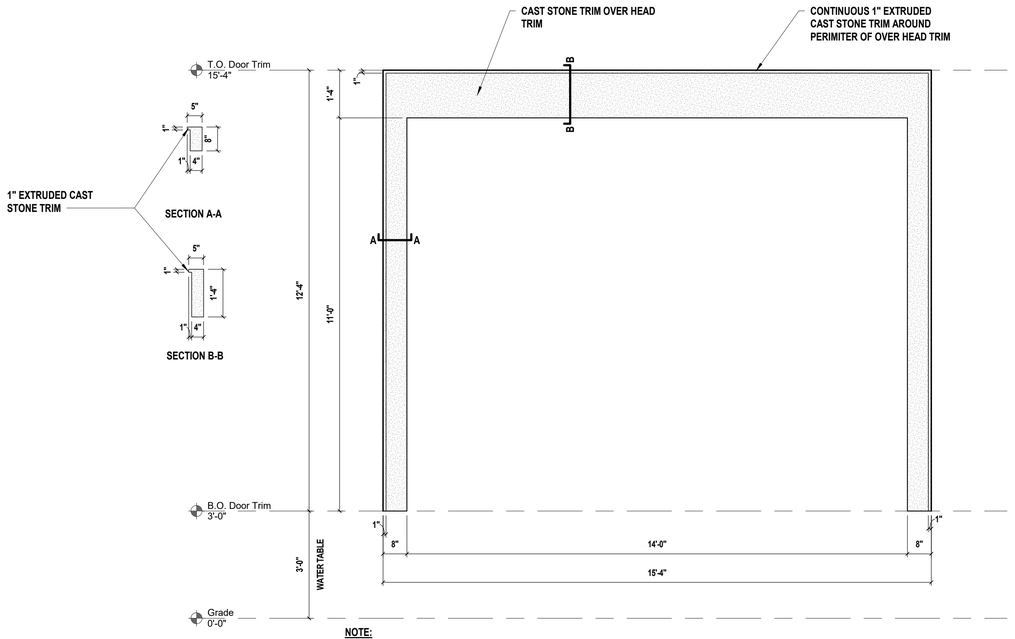
SCALE: 1 1/2" = 1'-0"



2 O.H. Door - Jamb Detail

SCALE: 1 1/2" = 1'-0"

NOTE:
SEE 'P' DRAWINGS FOR HOSE BIB LOCATIONS WITHIN COLUMN ENCLOSURES

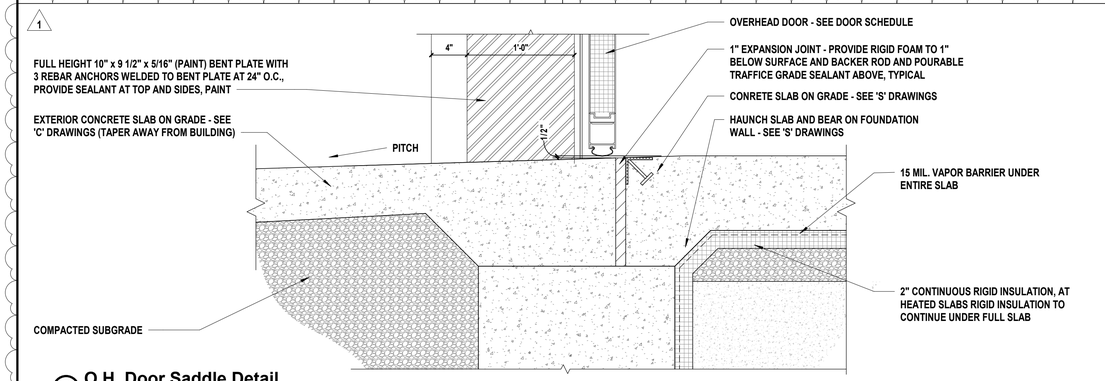


4 Cast Stone O.H. Door Trim

SCALE: 1/2" = 1'-0"

NOTE:

1. FINAL COLOR, AND FINISH TEXTURE TO BE SELECTED BY OWNER AND ARCHITECT DURING SHOP DRAWING REVIEW. DISPLAYED INFORMATION IS FOR REFERENCE ONLY.
2. CONTRACTOR TO INSTALL CAST STONE AS PER MANUFACTURERS REQUIREMENTS AND TO PROVIDE A WEATHERTIGHT SEAL
3. REFER TO CONCRETE NCMA TEK GUIDELINES FOR INSTALLATION METHODS FOR BRICK MASONRY / CAST STONE JOINTS.



3 O.H. Door Saddle Detail

SCALE: 1 1/2" = 1'-0"

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KEM	JHG		

PROJECT No:	DATE:	SCALE:
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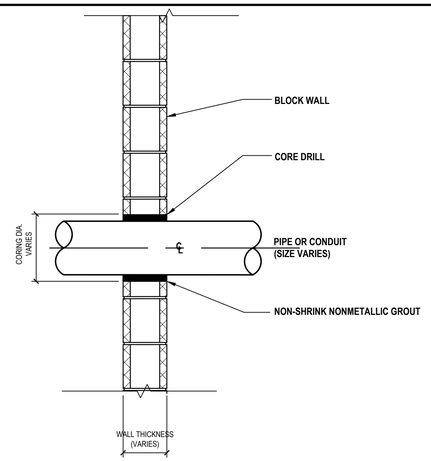
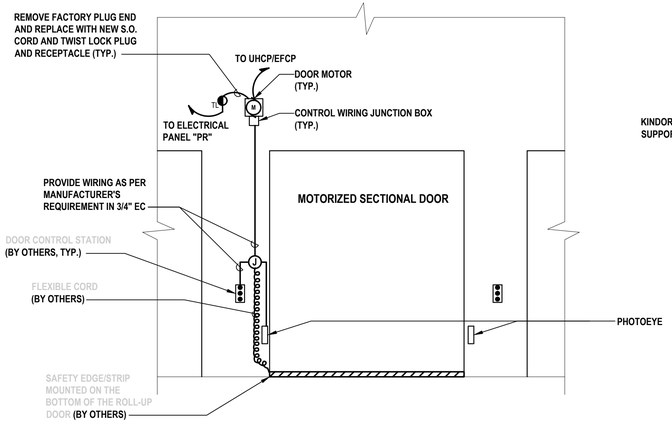
ARCHITECTURE
DOOR DETAILS
NEW FIRE STATION
PHASE 2

DRAWING No.

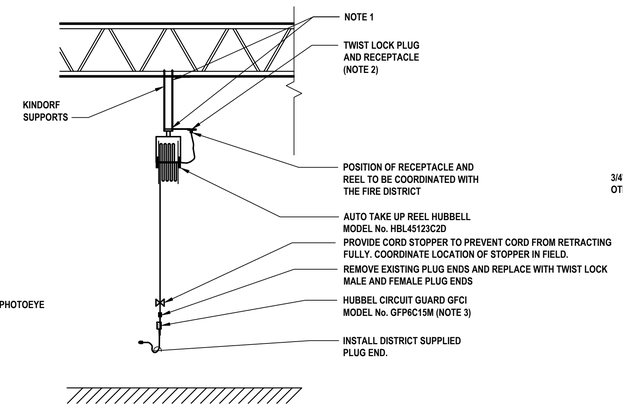
A2 522.01



1 Typical Penetration Through Block Wall
SCALE: NTS



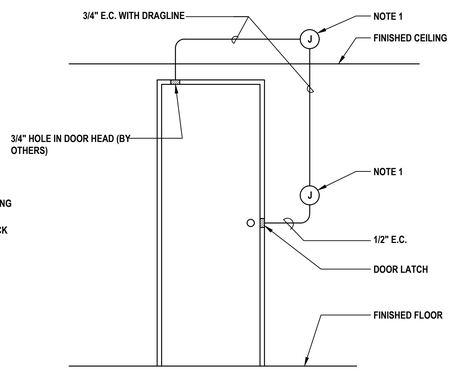
2 Garage Door Control - Elevation Plan
SCALE: NTS



3 Charge Reel Receptacle Detail
SCALE: NTS

NOTES:

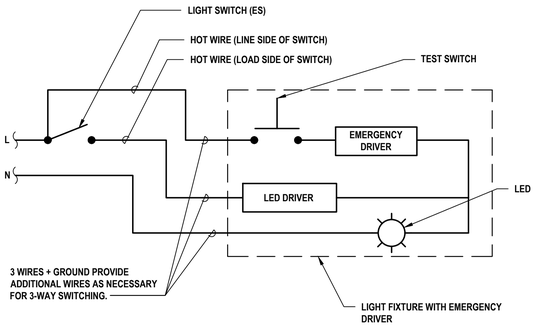
1. CONTRACTOR SHALL PROVIDE AND INSTALL ALL MOUNTING HARDWARE AND ACCESSORIES AS REQUIRED TO MOUNT CORD REEL TO CEILING.
2. CONTRACTOR SHALL COORDINATE FINAL MOUNTING LOCATION WITH DISTRICT.
3. COORDINATE FINAL PLUG END WIT DISTRICT/ OWNER IN FIELD.



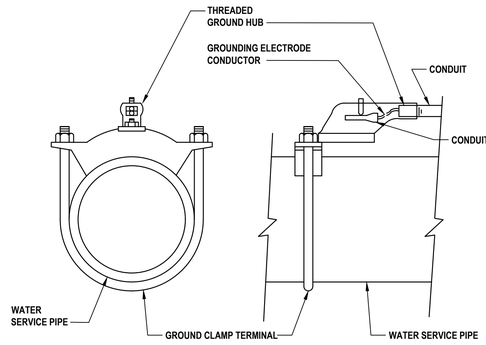
4 Security System Conduit Detail (Single Door)
SCALE: NTS

NOTES:

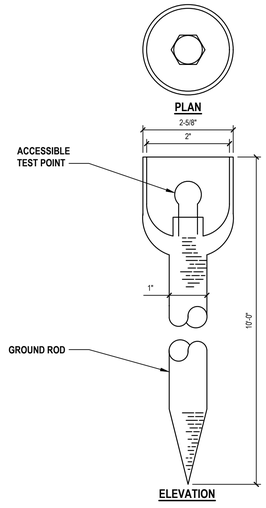
1. CONTRACTOR SHALL INSTALL JUNCTION BOX SUPPLIED BY OTHERS.
2. COORDINATE INSTALLATION AND EXACT MOUNTING HEIGHT AND LOCATION WITH ARCHITECT/ENGINEER IN FIELD.



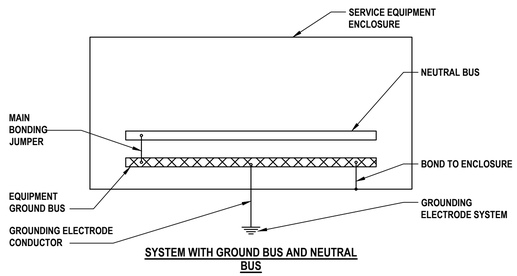
5 Typical Detail of Light Fixture with Emergency Driver
SCALE: NTS



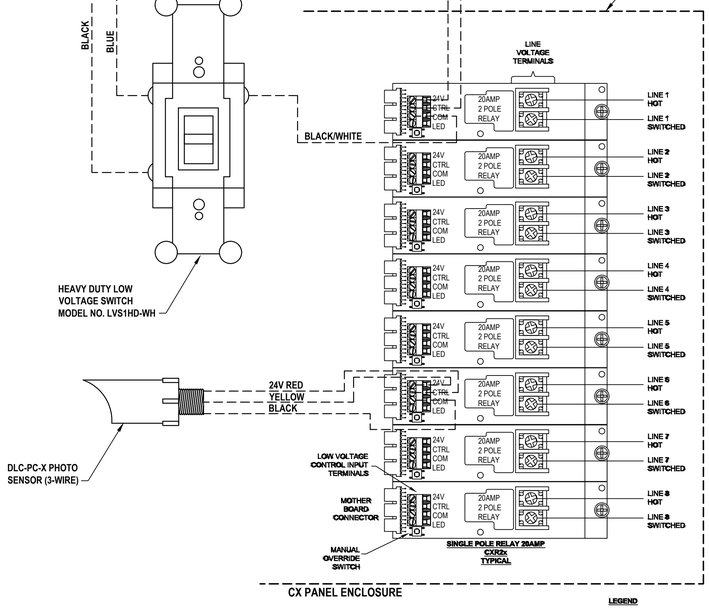
6 Water Pipe Electrode Connection
SCALE: NTS



7 Accessible Ground Rod
SCALE: NTS



8 Basic System Grounding
SCALE: NTS



9 EXTERIOR LIGHTING CONTROL PANEL
SCALE: NTS

CX NOTES:

CX1. DETAIL ONLY SHOWS RELAYS FOR SCHEMATIC PURPOSES. EXACT NUMBER OF RELAYS SHALL BE BASED OFF OF PRODUCT MODEL NUMBER UNDER LIGHTING CONTROLS SCHEDULE.

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MAIN FIRE HOUSE ELECTRICAL DETAILS PHASE 2

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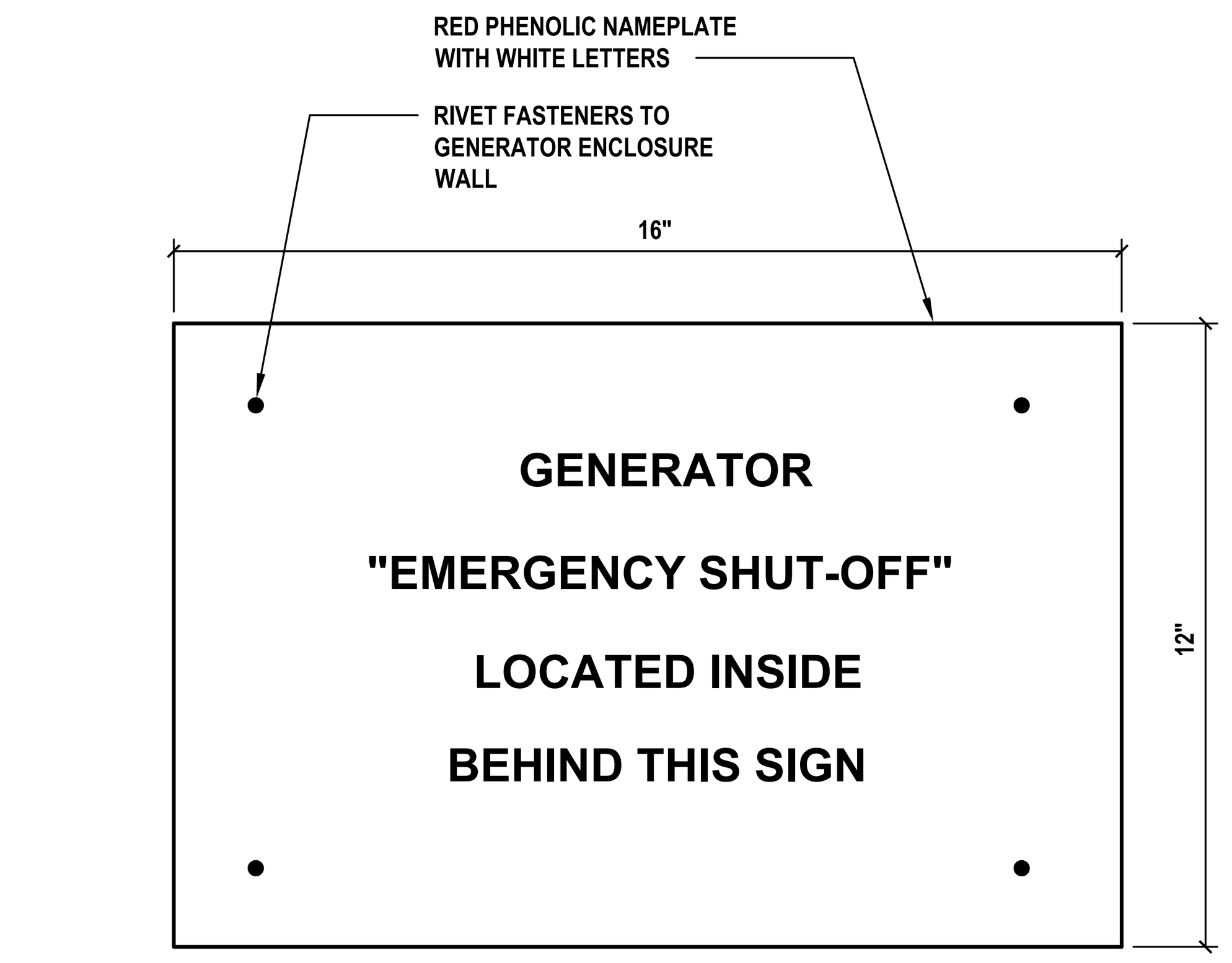
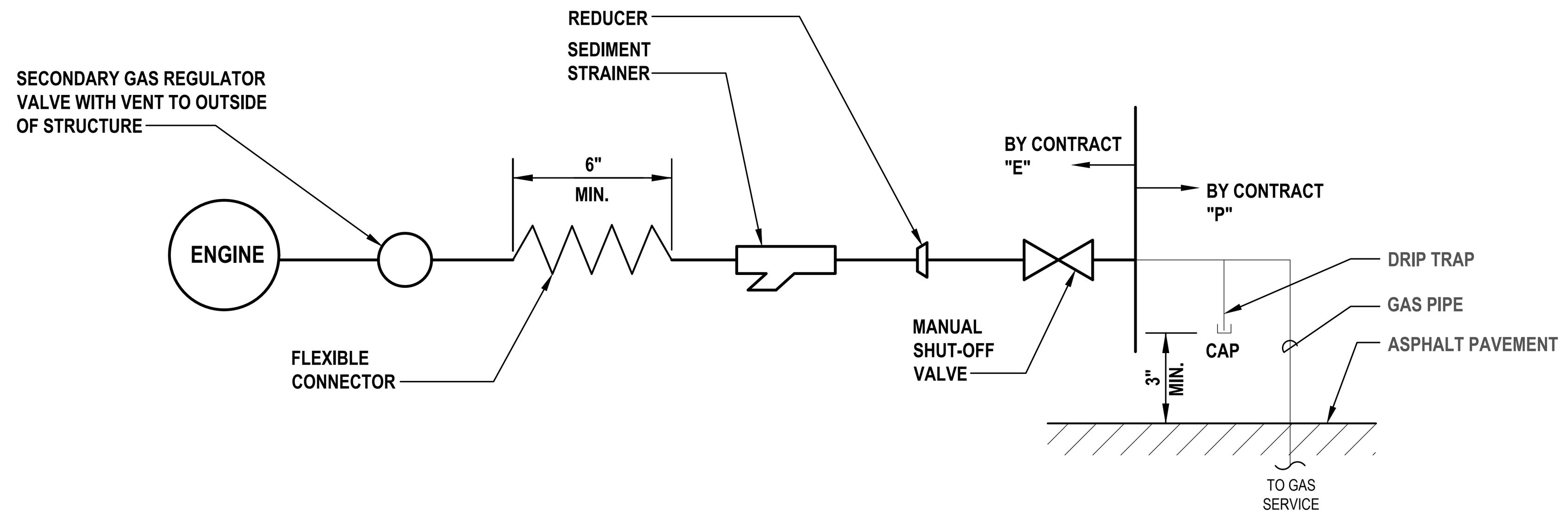
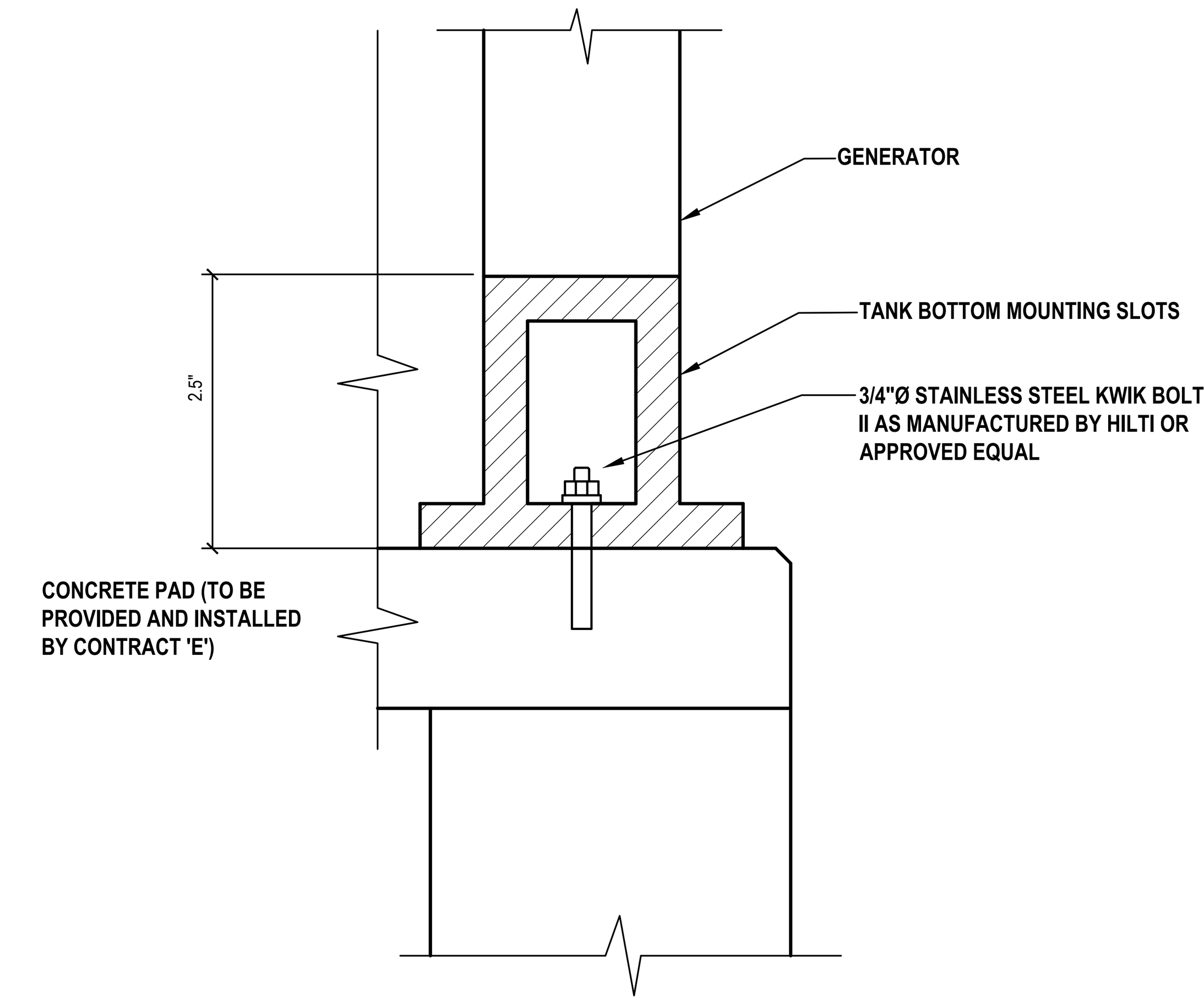
E2 500.00



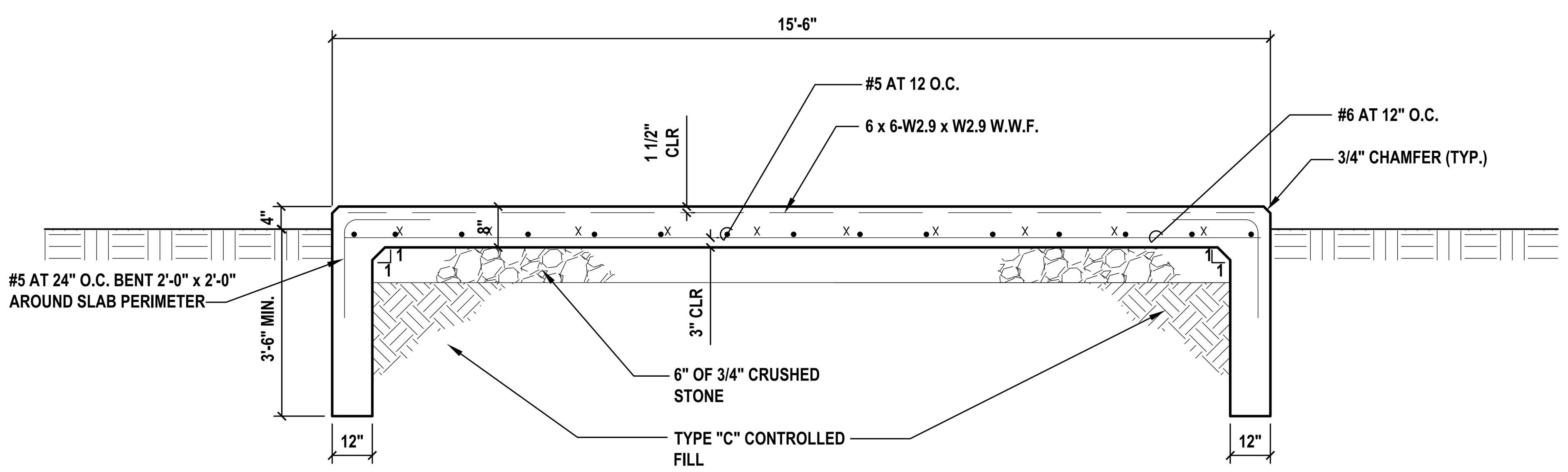
1 **Emergency Shut-Off Name Plate**
SCALE:NTS



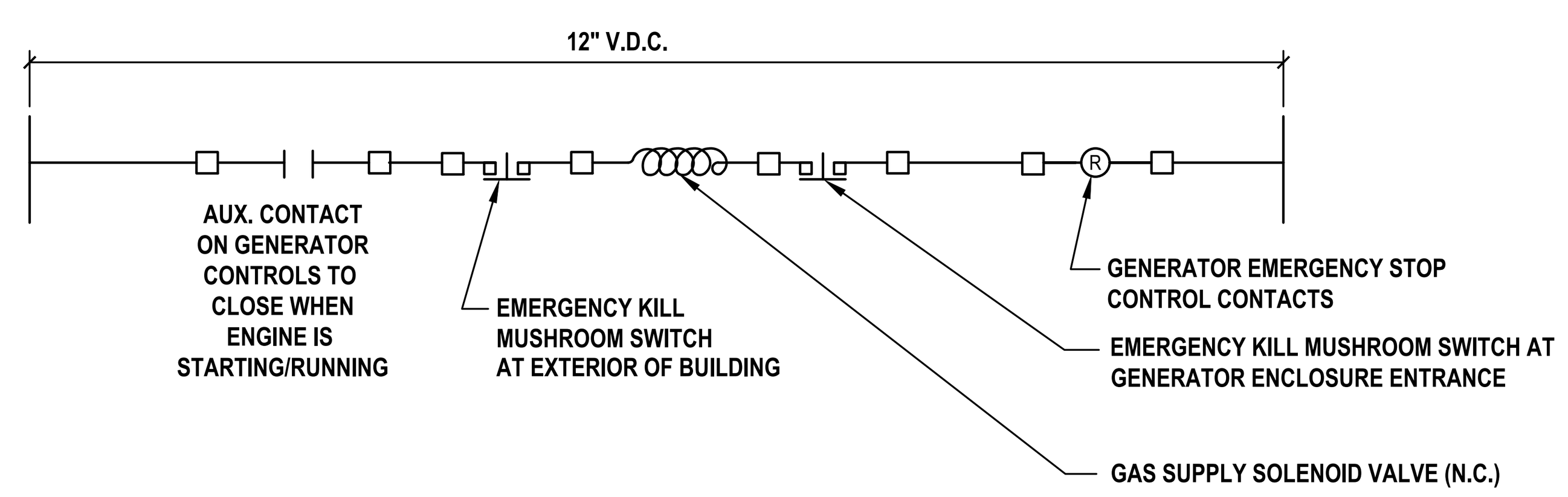
2 **Fuel Supply Schematic**
SCALE:NO SCALE



3 **Generator Enclosure Anchoring Detail**
SCALE:NTS



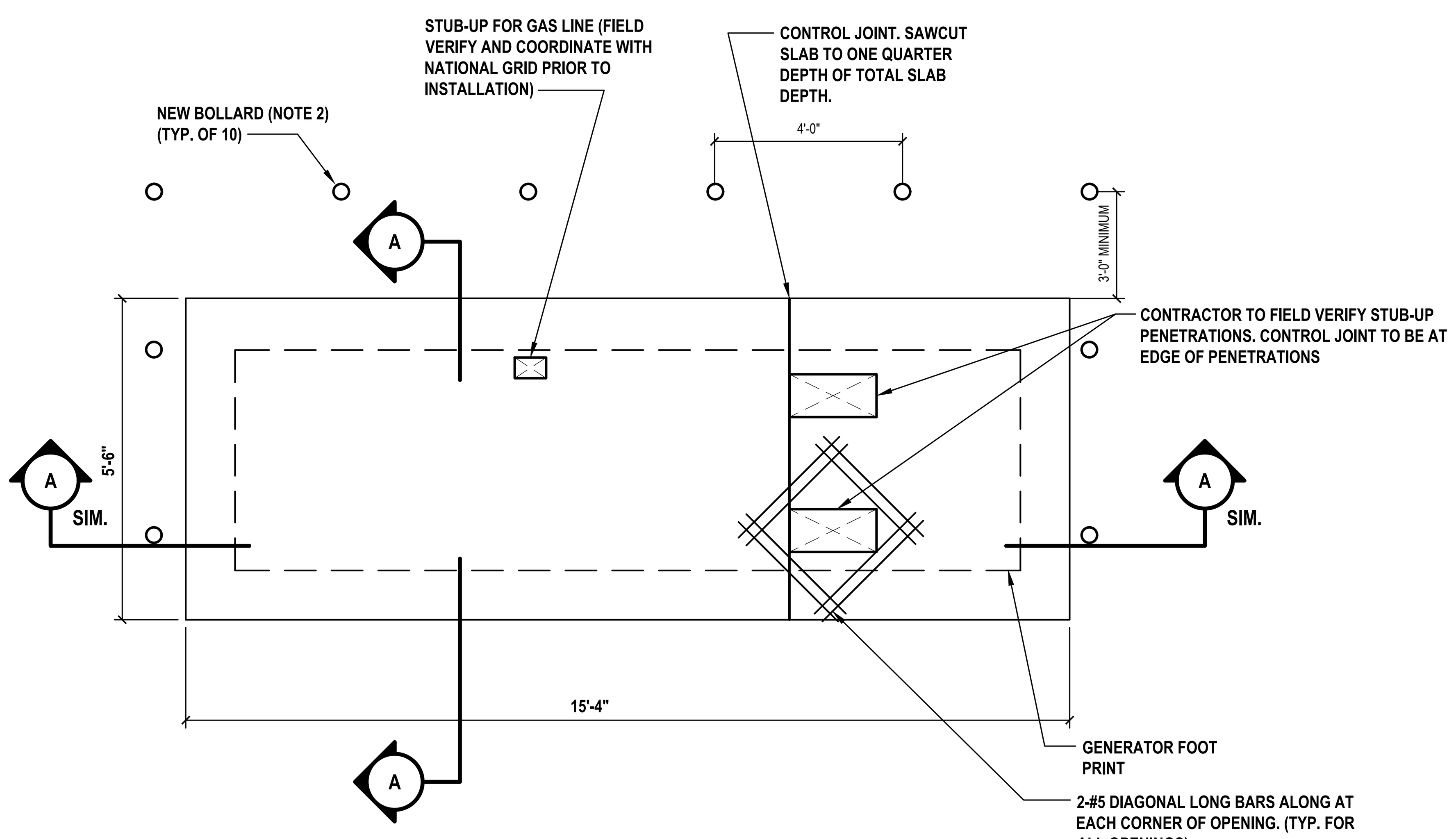
4 **Section A-A**
SCALE:NO SCALE



5 **Generator Emergency Shutoff Control Circuit**
SCALE:NO SCALE

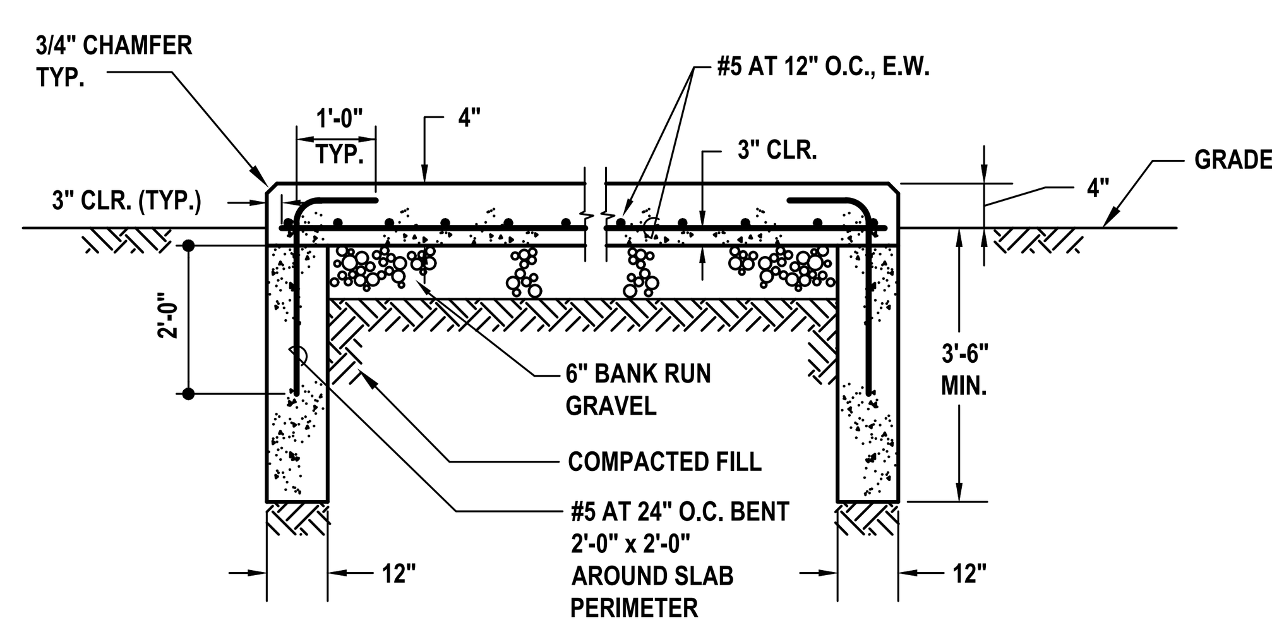
6 **No Smoking Sign Detail**
SCALE:NTS

NOTE:
1. "NO SMOKING" SIGNS SHALL BE PLACED CONSPICUOUSLY ON GENERATOR ENCLOSURE.

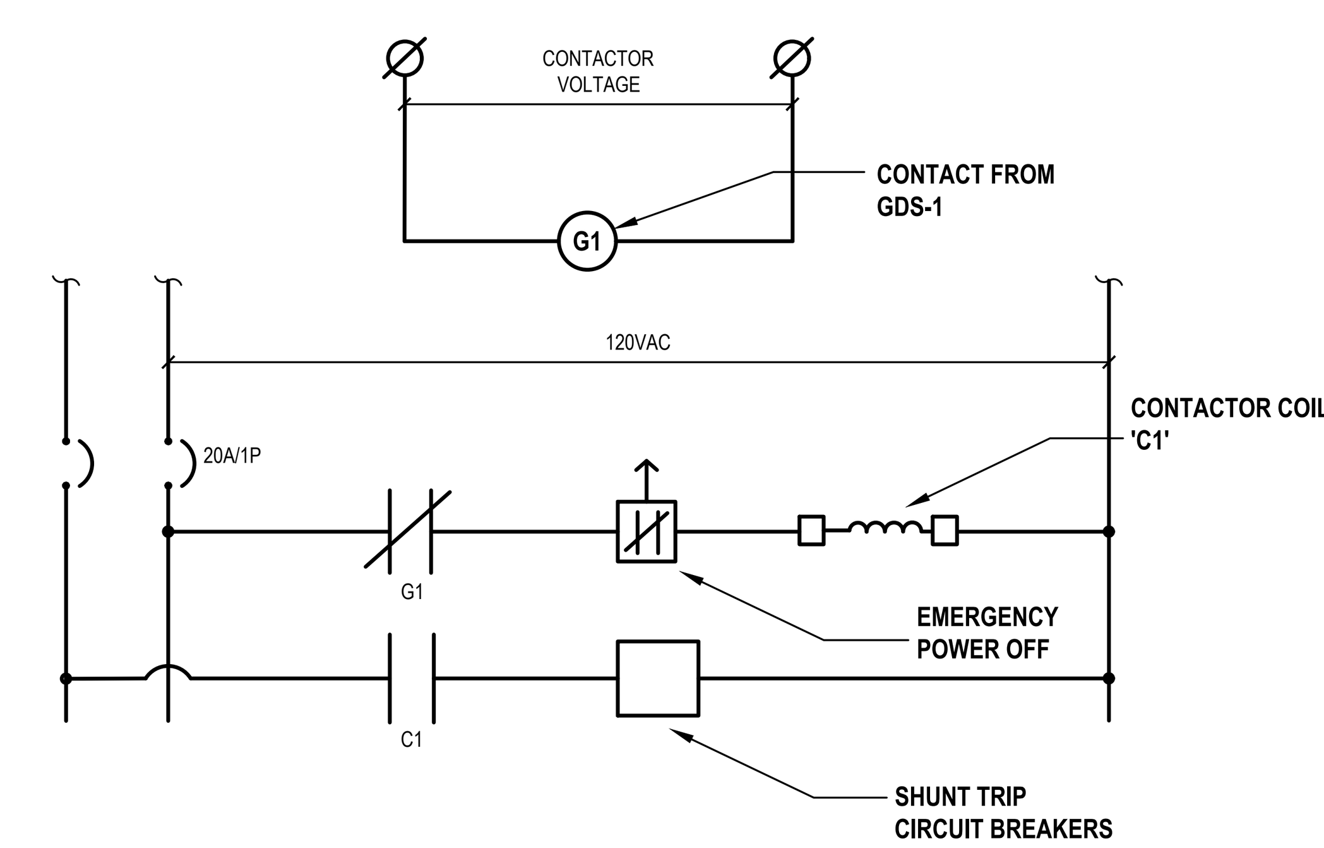


7 **Generator Pad Plan**
SCALE:NO SCALE

NOTES:
1. PAD DIMENSION BASED ON SPECIFIED EQUIPMENT. 1'-0" MIN ALL AROUND



8 **Section B-B**
SCALE:NTS



9 **GDS/EPO Wiring Schematic**
SCALE:NTS

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