



DESIGN GUIDE FOR CUSTOMER INSTALLED  
NETWORK & DISTRIBUTION VAULTS

Metro Major Design (MMD)- 6  
Effective January, 2025

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## 1. Definitions

- 1.1. AT-GRADE VAULT(S). A Vault whose floor surface is at the adjacent sidewalk grade and the room is recessed inside the Customer's building with the entrance at the property line.
- 1.2. BELOW-GRADE VAULT(S). A Vault whose floor surface is below the adjacent sidewalk grade and the room is recessed under the Customer's building with the entrance at the surface of the sidewalk in Right-of -Way (ROW).
- 1.3. COMPANY. Oncor Electric Delivery Company LLC, a Delaware limited liability company and its designated representatives.
- 1.4. COMPANY DESIGNER. A Company delegated person who is qualified to work in conjunction with a licensed Engineer or delegated person working for the Company.
- 1.5. COMPANY INSPECTOR. A representative identified by the Company that will inspect Customer's construction for the purpose of Company use.
- 1.6. CUSTOMER. The person, persons, or any institution applying for service including agents, successors, or assigns.
- 1.7. LABELED. A unit which has been rated by a fire rating laboratory and has a stamp or seal attached identifying the agency and the fire rating received.
- 1.8. NETWORK SYSTEM. *Tariff for Retail Delivery Service 6.1.2.2.3.1* Facilities serving other customers in the Central Business District (CBD) in downtown areas of Dallas and Fort Worth are operated per *Tariff for Retail Delivery Service*.
- 1.9. NETWORK SERVICE. *Tariff for Retail Delivery Service 6.2.1* A unique type of electrical service derived through one or more connections to an electrical bus or grid established by paralleling three or more primary, and / or secondary network circuits, providing an additional level of reliability due to the double contingency nature of the service. Electrical power networks must be designed and configured for that purpose and must be operated and maintained utilizing special methods. Company determines where Network Service will be provided, and Network Service is only available in limited areas.
- 1.10. PLANS. Engineering or architectural drawings used to construct the Vault sealed by a Professional Engineer or Architect licensed in the state of Texas. Plans must be approved by Company Designer prior to the start of construction.
- 1.11. PROPOSAL DRAWING. The drawing from the Company Designer showing the minimum and maximum physical dimensions and loading requirements for a suitable facility used for the sole purpose of housing Company equipment (including metering) based upon estimates of the electrical requirements.
- 1.12. VAULT. *Tariff for Retail Delivery Service 6.1.2.2.3.4* An isolated enclosure (walls, ceiling, and floor) secure room/structure within the Customer's building, building's footprint, or property, whose sole purpose is to house the Company's electrical Network and Distribution equipment. In this document, this definition includes At-Grade Vaults and Below-Grade Vaults.

## 2. Purpose

- 2.1. The purpose of this guide is to ensure the Vault used for housing Oncor Electric Delivery Network and Distribution equipment are designed to allow Oncor to safely operate its equipment and ensure the Customer receives reliable electrical service.
- 2.2. This guide is to be utilized as a checklist when reviewing proposed vault designs.
  - 2.2.a. The Customer is responsible to review this design guide in its entirety and then submit a marked-up copy of this design guide listing page numbers, note numbers, and details where each applicable item is addressed in Customer's contract drawings.
- 2.3. This design guide will be supplemented by a Proposal Drawing from the Company Designer. (Attachments provided separately)
  - 2.3.a. The Proposal Drawing is not a construction document and shall not be issued as a part of the Customer's contract drawings.
- 2.4. This guide is based on the latest edition of the *National Electric Safety Code (NESC)* and was prepared for the design, construction, operation, and maintenance of the Company's electric facilities.

## 3. Company Responsibility

- 3.1. Company shall furnish the MMD-6 Network and Distribution Vault Design Guide and Proposal Drawings to the Customer.
- 3.2. For Below-Grade Vaults, Company will furnish Americans with Disabilities Act (ADA) compliant standard H20 rated sidewalk Vault entrance frame(s) with grating(s), air inlet vent frame(s) and grating(s), entrance ladder(s), ventilation fan(s) and shroud(s), and sump pump(s).
- 3.3. Company shall furnish, install, and maintain its electrical equipment in the Vault.
- 3.4. Company shall inspect and preliminarily accept all Customer installed civil facilities associated with electrical service. Company will re-inspect prior to energization and give finalized acceptance of Customer installed civil facilities.
- 3.5. Company will provide an exclusive Vault easement allowing Company access and use of the Customer Vault. Company will not inspect Vault to begin installing electrical equipment until the easement has been executed by Customer. The easement shall include duct bank, Vault structures, and manholes as required.

## 4. Customer Responsibility

- 4.1. Customer shall design its electrical and civil facilities associated with electrical service in accordance to this design guide.
- 4.2. For Customer Vaults that extend into Right-Of-Way (ROW), Customer must obtain a license agreement with the applicable city for that portion of the Vault in ROW.
  - 4.2.a. Customer license agreement will not eliminate the need for an easement.
- 4.3. Customer will execute an exclusive Vault easement for the portion of Vault on private property.

- 4.4. Customer will be responsible for the cost to construct, install, own, repair, and replace Customer facilities including Vault structure(s) provided for Company use.
- 4.5. Customer will install one, two (2)-inch schedule 40 PVC conduit discharge line exit to curb per Vault.  
*Figure 3: Sump pump assembly.*
- 4.6. Customer will provide Company with 24-hour / 7-day Vault access.
- 4.7. Customer's civil and electrical design drawings necessary for the construction of Vault shall comply with authorities having jurisdiction. All plans shall have a Professional Engineer's seal and the engineer must be licensed in the State of Texas.
- 4.8. Customer's electrical service entrances extending into the Vault shall be approved by the Company and designed to comply with local and state electrical codes. The Customer shall submit plans showing all service entrances.
  - 4.8.a. Customer is responsible for providing service cable lugs as specified in the latest edition of the Companies *Electric Service Guidelines Book (ESG)*.
- 4.9. Customer or their contractor shall provide all material and labor for the construction of each Vault with the exception of those items furnished by the Company. Cost(s) associated with Company furnished items shall be the sole responsibility of the Customer.
- 4.10. Customer for its At-Grade Vault shall provide and install air intake and discharge louvers with frames (drop down fire-shutters are required) as shown in Plans. Doors, fire shutters, and all associated materials for the installation of this equipment shall have a three (3) hour minimum fire rating and be approved by the Company.
- 4.11. Customer to furnish and install all doors, hardware, panic bar, and handles. Customer to install Company provided lock cylinders.
  - 4.11.a. All doors must be latching only and have a dead bolt locking system with thumb turn for inside the Vault.
  - 4.11.b. Panic bar hardware must be latching only.
- 4.12. Customer shall operate and maintain their building such as to provide continuous and adequate security for Company facilities and shall promptly notify the Company of any unauthorized access to areas restricted for Company use only.
- 4.13. Customer installed duct banks that will be owned by the Company shall be designed and installed by the Customer following the *Distribution Construction Specification (DCS)-5* and Developer Installed Duct Bank Agreement.
- 4.14. Customer is responsible for the protection of equipment owned by Customer beyond the Points of Delivery, as specified in Company's Retail Delivery Tariff.
- 4.15. Customer shall provide to Company its one-line electrical diagram showing all permanent and fire pump service information prior to finalizing design of those facilities.
  - 4.15.a. Customer shall notify Company of any changes to electrical design during the design process.
- 4.16. Customer or Customer's contractor(s) shall provide a clear and safe work area for the Company to install its equipment.

- 4.17. Customer shall submit Plans for Company approval during the design process, containing details and shop drawings of the Vault footprint.

## 5. Vault Design

- 5.1. Vault shall meet the minimum height, width, and depth dimensions, those measurements will be provided by Company designer in an additional design layout proposal drawing. Any proposal drawing provided will show minimum distances.
- 5.2. All Vault ceilings regardless of the size shall be sixteen (16) feet from the finished ceiling to the finished floor.
- 5.3. Vault equipment shaft depth shall not exceed twenty (20) feet of depth from top of entrance grating to finished floor.
- 5.4. Vault finished floor elevations shall not be greater than the adjacent (sidewalk) grade.
- 5.5. Company shall design its facilities to meet or exceed the latest version of National Electric Safety Code (NESC) requirements.
- 5.6. Information regarding Company equipment and operations are proprietary to the Company and may not be released to the Customer.
- 5.7. Structural Design for all Vaults:
  - 5.7.a. Floors, walls, and ceiling shall be made of concrete.
  - 5.7.b. Walls shall not be cast directly against the earth and shall be free of honeycombing or irregular projections.
  - 5.7.c. The floor system shall be designed to limit Potential Vertical Movement to three-fourths (3/4) inch or less, in accordance with the Geotechnical recommendations.
  - 5.7.d. The vault shall be designed and constructed to support the entire combined weight of the equipment including conductors, switches, bus bar, transformers with oil, and any other equipment necessary to provide electrical service to the building. The customer's proposal drawing must indicate any additional loads.
- 5.8. For all Below Grade Vaults: Structural Design:
  - 5.8.a. Floors and Walls shall be designed to resist the lateral soil loads plus the maximum positive or negative hydrostatic pressure that could potentially be imposed. The structural design of the floor and walls shall not be dependent on any active or passive groundwater control system.
  - 5.8.b. Vault shall be designed and constructed with the capability of containing the combined weight of all equipment and complete submersion of water to street level.
  - 5.8.c. Waterproofing: Floors and Walls shall be waterproofed. Water stops are required at all joints. These requirements shall apply regardless of whether a hydrostatic pressure condition exists.
  - 5.8.d. Drainage: Foundation drains shall be designed and constructed for all Below-Grade Vaults. This requirement shall apply regardless of whether a hydrostatic pressure condition exists.

- 5.9. Vault shall be designed in accordance to the latest version of *NESC*, section 323 *Manholes, handholes, and vaults*.
- 5.10. Concrete strength shall be at least four thousand (4,000) pounds per square inch (psi).
- 5.11. Vault ceiling shall be designed and constructed to allow for additional attachment of electrical equipment to the ceiling with a minimum design loading of two hundred and seventy (270) pounds per square foot. The ceiling construction should allow fasteners / anchors to be installed with a maximum depth of six (6) inches.
- 5.12. Vault shall be designed to have an interior footprint free of columns or support footings.
- 5.13. Vault roof shall be vertically separated from any sidewalk or driveway by a minimum of twelve (12) inches of select fill.
- 5.14. Where the Vaults are in an area subject to vehicular traffic, the Vault shall be designed to support at minimum the latest version of H20 loading in accordance with the *American Association of State Highway Transportation Officials (AASHTO)*.
- 5.15. Vault floor shall have a medium broom finish and a gradual slope of one-sixteenth (1/16) inch per square foot to a dry sump (furnished and installed by the Customer), located as shown on the Proposal Drawing.
- 5.16. Vault dry sump size must be a minimum of eighteen (18) inches by eighteen (18) inches with a depth of at least twenty-four (24) inches. Dry sump must be constructed with a two (2)-inch by two (2)-inch offset at the floor surface to allow for safety grating. *See Figure 3: Sump pump assembly.*
- 5.17. All floors, walls, and ceilings must be constructed without expansion or control joints.
- 5.18. Protection of steel in reinforced concrete shall meet the requirements of American Concrete Institute (ACI) Code 216 Fire Resistance of Concrete and Masonry Construction or other applicable codes for fire protection.
- 5.19. Geotechnical report may be required for Vault designs; report must include ground water elevations and foundation recommendations.
- 5.20. Vault shall not be constructed within flood prone areas nor in high groundwater locations. If any drainage studies are performed for project site report shall be provided to the Company.
- 5.21. All forms, metal or wood, shall be removed prior to acceptance of the Vault.
- 5.22. Vault ceilings shall not be incorporated into parking garage floors. Parking garage floor shall not impose additional live loading on Vault ceiling.
- 5.23. Construction of Vault walls shall be cast-in-place.
- 5.24. Pre / Post-tension cable system construction is prohibited.
- 5.25. All conduit openings shall be installed in those locations indicated on the plans unless changes are approved by the Company designer.
- 5.26. No building drains, active drains, or any other drains foreign to the Vault are to be discharged into the Vault or the Vault's dry sump. The Vault dry sump is for Vault drainage / pumps only.

- 5.27. Roof or other building drains shall not discharge water such that water will flow toward the Vault gratings.
- 5.28. Foreign/building utility ducts, pipes, or lines within the slabs, walls, ceiling, or confines of the Vault are prohibited.
- 5.29. Combustible material shall not be installed on or near Vault.
- 5.30. Customer electrical loads must be finalized prior to Vault design final approval.
- 5.31. Multi-Vault room designs shall have three (3) hour fire rated doorways that latch but do not lock between each Vault room.

## **6. Vault Entrance and Ventilation Gratings**

- 6.1. Vault entrances and ventilation frames with removable panel and gratings shall not be cast as part of the Vault concrete structure.
- 6.2. Vault entrance and ventilation concrete shafts must be constructed such that the finished Vault frames at sidewalk can be adjusted to match sidewalk elevation.
- 6.3. Vault entrances and ventilation frames in a sidewalk area shall be set at a minimum slope of 1% away from grate opening in all directions for a minimum of two (2) feet horizontally.
- 6.4. Vault entrances that are remote shall be evaluated for equipment access by the Company.
- 6.5. Concrete sidewalks with a minimum width of thirty-six (36) inches are required in remote areas and must be installed to allow Company personnel safe passage to the Vault.
  - 6.5.a. When in a landscape area, the entrance and vent shall be raised on a curb six (6) inches above adjacent finished grade and have a five (5) foot concrete band around the full entrance and vent gratings.
  - 6.5.b. Entrance shall have no sprinkler heads surrounding the opening which project water into the Vault.
  - 6.5.c. Vault entrance areas near an elevated area or retaining wall must have removable handrail for personnel safety.
  - 6.5.d. Customer will do its best to prevent its fertilizer material from contaminating the Vault, equipment, and Company provided grating.
- 6.6. Company requires a temporary cover to be built over the entrance(s) and air inlet vent frame(s) during Customer's facility construction to protect personnel and entrance / vent frames from damage. Refer to Company designer for specifications.
- 6.7. Vault entrances, air inlets, and grating shall not be located where they may cause a safety hazard for the public or Company personnel. Some locations that may cause safety hazards include but are not limited to:
  - 6.7.a. Driveways, gutters, loading areas, emergency exits, or building offsets / canopies with overhead clearances less than forty (40) feet.
- 6.8. Building awnings or canopies must maintain vertical separation of forty (40) feet from the Vault grating, be easily removable, and material must be flame retardant.



- 6.9. Project site must be designed in such a way that adequate level concrete pavement parking access (no private curbs or stem walls) will be provided to allow Company full access for cranes, semitruck-sized cable trucks and crew trucks as required. *Approx. fifty (50) feet req. beside Vault*
  - 6.9.a. Concrete parking area shall be designed to support H20 loading per AASHTO.
  - 6.9.b. Project area must be free of elevated building structures, lighting / communication poles or towers, and any other items that may impair setting Company equipment.
  - 6.9.c. Landscaping in the project area that could prevent or impair vehicular access during construction or in the future is prohibited.
  - 6.9.d. If adequate operational space is not provided Company will not accept Vault design.
- 6.10. At-Grade Vault doors shall be self-latching with panic hardware and shall have a means of being locked, door must swing outward into Right-of-Way. The installation shall conform to the latest edition of the *National Fire Protection Association Standard NFPA 80*.
- 6.11. At-Grade Vault: An eight (8) inch removable solid brick sill shall be installed at fire door openings for oil containment after the transformers are installed. The sill shall be installed by the Customer or Customer's contractor at the direction of the Company. *See Figure 6: At-Grade Vaults clearance exhibit.*
- 6.12. Company requires emergency fire apparatus and roof drains be located such that they do not drain towards Vault entrance or grating.

## **7. Vault Ventilation**

- 7.1. Vault air flow study must be conducted by the Customer upon request by the Company at the initial design for any non-standard Vault design. If air flow study is conducted, results must be approved by the Company before it will accept the Customer proposed design.
- 7.2. Design requirement is to replace the full volume of Vault air every two (2) minutes.
- 7.3. Vault entrances and air inlet vents shall be located and installed such that there is no sheeting of water from the building, driveway, or gutter into the Vault.
- 7.4. At-Grade Vaults: ventilation openings shall be divided between openings near the floor and openings near the roof as specified on the Proposal Drawing.
- 7.5. Below-Grade Vaults: vent shafts shall be designed as shown *Figure 4: Fan ventilation shaft detail*.
- 7.6. Vent shaft shall have appropriate water drainage per the fan ventilation shaft detail to allow water to drain into the Vault and towards dry sump, *see Figure 4: Fan ventilation shaft detail*.
- 7.7. Ventilation equipment shall intake air from and exhaust air to the outside of any building structure. Ventilation shall not route through the building at any time.
- 7.8. Ventilation for Vaults shall be dedicated to ventilating the Vaults only, ventilation equipment / design will not be shared with any other ventilation.

## 8. Customers Building Ingress / Egress

- 8.1. All Vault entrances and ventilation gratings must be located as far as practical from all exterior building doors, windows, fire escapes, and combustible material. This is for the protection of the public and to allow Company to access and remove entire Vault entrance and / or grating for maintenance.
- 8.2. Passage doors between the building space and the Vault room is prohibited.
- 8.3. Customer will not temporarily or permanently install any type of items such as structures, stairs cases, seating / benches, dining tables, waste receptacles, bike racks, elevated shrubbery, or any other items that will impair Company's right to access and operate its facilities. Company requires fifteen (15) feet minimum clearance on the sides of the Vault entrance and Ventilation gratings. See *Figure 6: At-Grade Vaults clearance exhibit* and *Figure 7: Below-Grade Vault clearance exhibit*.

## 9. Special Vault Design

- 9.1. 4kV and greater Spot Network Systems: Any Vault containing Company transformers may be located At-Grade or Below-Grade. Company will provide additional design guidelines.
- 9.2. 4kV and greater Spot Network Systems: Any Vault containing Company switchgear shall be located At-Grade and designed with equipment access from the sidewalk. Company will provide additional design guidelines.
- 9.3. Two-Way feed Distribution System: Transformer Vault can be located Below-Grade; the Automatic Transfer Switch (ATS) switchgear Vault is preferred to be located At-Grade level adjacent to an outer wall of the building with separate equipment access from sidewalk area. Company will provide additional design guidelines.

## 10. Fire Rating

- 10.1. Vault structure shall be built to have a minimum fire rating of four (4) hours.
- 10.2. The Vault structure shall be designed and constructed such that it will not require a supplemental fire protection system in Vault and equipment rooms which house Company equipment.
- 10.3. Rebar inside the Vault structure shall have a minimum of three (3) inches of concrete cover to ensure the rebar will not be damaged during a fire or by water intrusion.
- 10.4. Paint, fabric, sheetrock, spray, or paint fire proofing etc. are prohibited.
- 10.5. All buildings with Vaults shall not have exposed structural metal building supports exposed inside the Vault.
- 10.6. Customer shall furnish hinged doors, tamper guards, and frames with a labeled three (3)-hour fire rating as described by the latest edition of the *NFPA 80*.

## 11. Emergency Generation

- 11.1. Company must approve in advance if an emergency generator is placed within twenty (20) feet the Vault. For the placement to be acceptable the following guidelines must be met:

- 11.1.a. Engine exhaust fumes must be directed away from all Vaults and not within twenty (20) feet of the Vault louvers, entrance(s), or gratings.
- 11.1.b. Engine fresh air intake should be located twenty (20) feet away from all Vault louvers, entrance(s), or gratings due to the possibility of smoke exhausting from the Vault being drawn into the building.
- 11.1.c. Generator room structure must be designed to have separation from Vault structure.
- 11.1.d. Generator room structural design must be provided detailing the wall and floor placement and thickness of the concrete planned.
- 11.2. Building refueling connections shall be placed such that hoses will not travel over the Vault entrance(s) or gratings.
- 11.3. All emergency generation must be open transition from Company's Electric Network or Distribution System.
- 11.4. Distributed Generation (DG): In no event shall on-site generation, at any time be interconnected or allow closed or soft transition to Company's Electric Network or Distribution System without a Distributed Generation (DG) interconnection agreement. If Customer requests a closed transition, Customer must secure a Distributed Generation (DG) interconnection agreement at Customer's expense for Company to allow a closed or soft transition to Company's Electric Network or Distribution System.

## **12. Equipment Grounding**

- 12.1. Vault must be constructed such that there is at least one wall or the floor that directly contacts earth to allow for proper grounding.
- 12.2. Customer shall furnish ground rods and install in earth, preferably vertically into the vault floor. If horizontal then the ground rods must be at eight to nine (8-9) feet from the finished floor. Two (2) five-eighths (5/8) inch diameter copper ground rods eight (8) feet in length for each Vault as indicated on the Plans.
  - 12.2.a. Company inspector must be on site during ground rod installation.
  - 12.2.b. Ground rod must protrude eight to ten (8-10) inches into the vault.
- 12.3. Each ground rod shall meet the resistance to earth at twenty-five (25) ohms or less. Customer's engineer must provide the resistance measurement to Company.
- 12.4. Company equipment grounding system cannot be connected to or touch the rebar inside the concrete walls or floor slab.
  - 12.4.a. It is recommended that a two (2)-inch schedule 40 PVC conduit sleeves be installed for the thickness of the wall or slab (typically eight to ten (8-10) inches). When installing the ground rod through the conduit, the opening (full length) must be filled with fire rated nonflammable epoxy grout to prevent from water entering or exiting the Vault.
- 12.5. Customer shall not connect their equipment grounding systems to the Company grounding system.

### 13. Metering

- 13.1. For each Customer's service, instrument rated meter bases shall be located in close proximity to Vault. Customer to provide Company approved meter base location.
- 13.2. Customer will provide Company approved location for routing an external metering antenna.
  - 13.2.a. For each service, the Customer shall install two (2) 2-inch metering conduits with pull tape and meter base (provided by Company).
  - 13.2.b. Meter conduits must enter into the Vault at nine (9) feet above finished floor and within two (2) feet of service entrance.
- 13.3. Customer will be responsible for all sub-metering downstream of Company metering devices.
- 13.4. Fire Pump service must have a separate meter and only one connection to Company's system in addition to the customer provided backup power source.
- 13.5. Company must approve the meter service Point of Delivery design and location.
- 13.6. Customer to provide access to meter locations at all times.

### 14. Customer Services

- 14.1. Services will be metered separately.
- 14.2. Company must approve Customer service(s) entrance(s) design and location.
- 14.3. Physical connection(s) between Company and Customer service will be located inside the Vault.
- 14.4. 4kV and greater Spot Network Systems: Customer must install its electrical switchgear in a separate room from Company switchgear. Customer will not have access to Company's switchgear.
- 14.5. Customer will be required to size its equipment based on the total fault current values provided by the Company.
- 14.6. Customer must not include Company fusing protection in its system protection scheme.
- 14.7. Customer may choose conduit/cable or bus duct type of service.
  - 14.7.a. For conduit/cable services, see Appendix A from the latest edition of the *Electric Service Guidelines Book (ESG)*.
  - 14.7.b. For bus duct service see *Figure 2: Bus bar termination details*.
- 14.8. All types of services must enter into the Vault at nine (9) feet above finished floor, see *Figure 1: Customer bus configuration detail*.
- 14.9. Customer services must enter into the Vault at a Company approved location.
  - 14.9.a. Conduit/cable or Bus-duct services shall not enter through the ceiling of the Vault.

- 14.9.b. Conduit/cable or Bus-duct services shall not enter through the floor in Below-Grade Vaults.
- 14.10. Customer services shall be serviceable without disturbing the Vault structure.
- 14.11. Customer service conduits must be liquid tight and free of any moisture.
- 14.12. Customer collection box and customer bus terminations shall be serviceable / removable from outside the vault, *see Figure 1: Customer bus configuration detail*.
- 14.13. Customer collection box and bus terminations details shall be provided by the Customer and approved by the Company.

## 15. Landscaping / Irrigation

- 15.1. Customer must provide landscaping design plans along with the Vault design at the beginning of the project.
  - 15.1.a. Design shall have positive drainage away from any Vault entrance(s) or grating(s).
  - 15.1.b. Design shall not be detrimental to the Vault structure, Company equipment, or Company operations.
  - 15.1.c. Company shall approve landscaping around Vault and is not obligated to accept city approved landscaping plan.
  - 15.1.d. Provide all locations of irrigation piping.
  - 15.1.e. Shrubbery, ground cover, planting beds and grass must be designed to maintain structural separation to channel any water away from the Vault structure and maintain a minimum of ten (10) feet separation from any part of the Vault structure unless approved by Company Designer.
  - 15.1.f. Tree canopies shall be maintained indefinitely to keep a twenty-five (25) foot separation horizontally from the Vault entrances to allow for raising and lowering of Vault equipment.
  - 15.1.g. **Be aware, that constant water intrusion to the Vault roofs, walls, and floors can have a detrimental impact to the Vault structure that can result in excessive repair cost to the Customer and long-term service outage.**

## 16. Materials

- 16.1. All concrete for Vault construction shall be mixed and placed in accordance with current practices of ACI 318.
- 16.2. Reinforcing steel shall be 60 ksi deformed bars and conform to current industry standard for structural steel reinforcing bars.
- 16.3. The type of oil / water stops shall be rated for exposure to petroleum-based products. Subject to Company review.

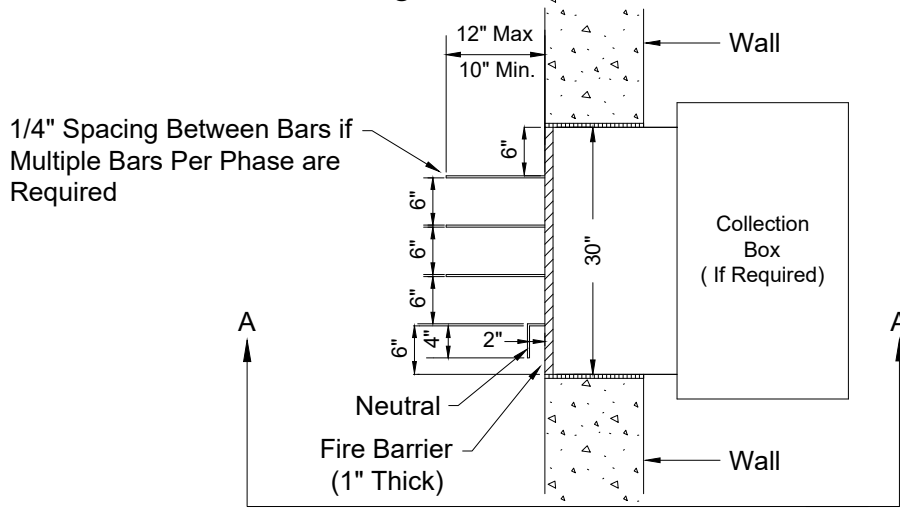
## **17. Inspection**

- 17.1. Company must approve all Plans for the construction of the Vault prior to construction.
- 17.2. Prior to construction of the Vault a meeting will be scheduled by the Company Designer to review Plans and Vault standards with the Customer.
- 17.3. The Company Inspector must inspect each step of the construction of the Vault and any Customer constructed duct line. Company Inspector shall have the right to reject any work not done in compliance with Company standards.
- 17.4. Any material testing which is deemed necessary by the Company Inspector shall be performed at the Company's expense and in accordance with the latest industry testing and material standards.
- 17.5. Inspection and approval by the Company does not relieve the Customer or Customer's contractor from the responsibility of securing all other required permits, approvals, and inspections.
- 17.6. Upon completion of Vault construction, the Company shall perform a preliminary inspection for acceptance. Installation of Company equipment will begin only after the Vault construction is preliminarily accepted by the Company.
- 17.7. Company will perform a final inspection prior to energizing its facilities. If water intrusion or other issues have developed during Company's installation, Company will not energize any of its facilities until Customer has addressed the issues.

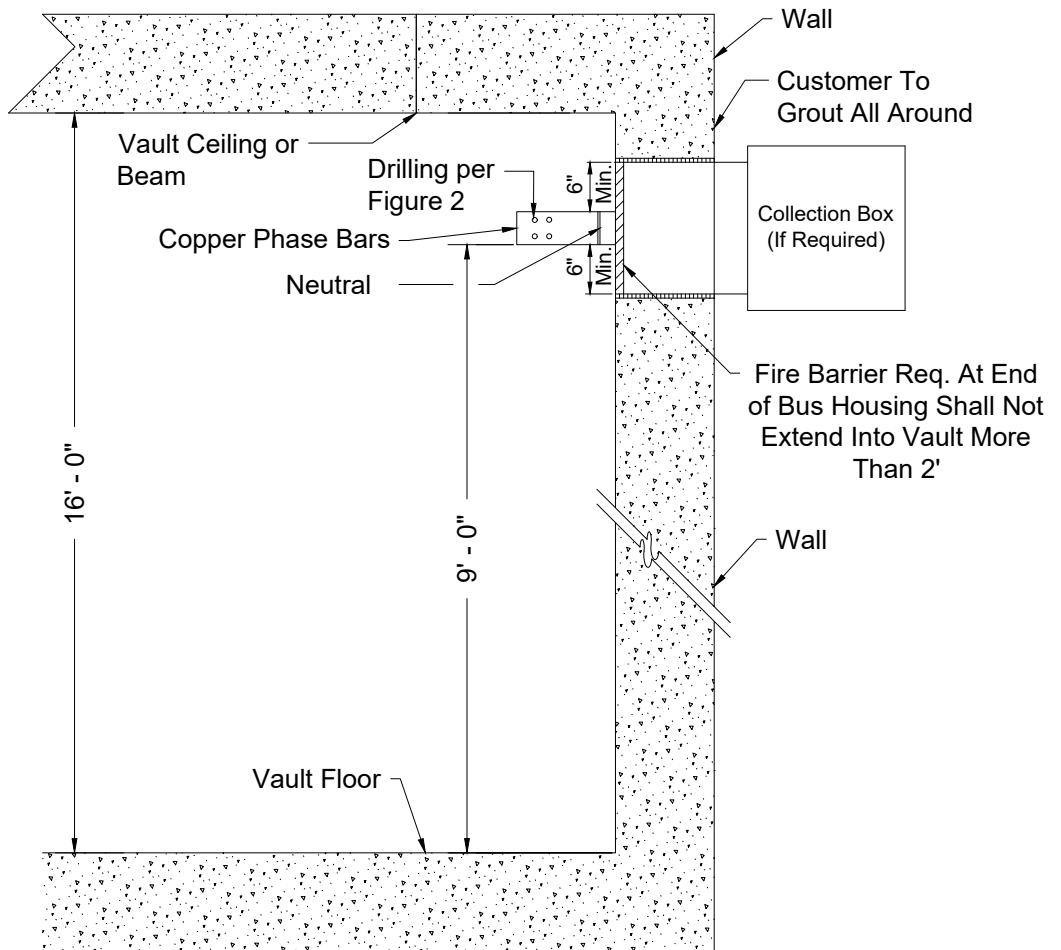
## **18. Other Items**

- 18.1. Variance(s) verbal and written to these guidelines shall be submitted in writing and / or integrated into the Plans for approval by the Company.
- 18.2. Outdated MMD-6 design guides must be discarded and are not to be used for design purposes. If Customer designs their project with outdated guidelines, Company reserves the right to refuse the Customer design.

Figure 1: Customer Bus Configuration Detail

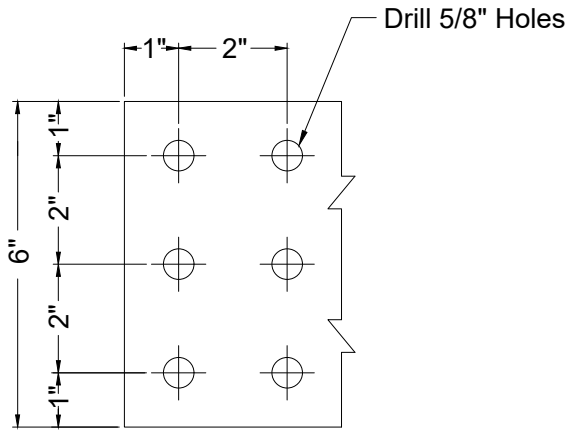


Plan View

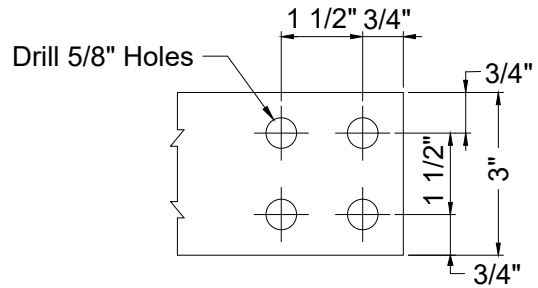


Section "A - A"

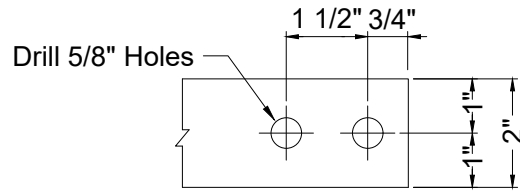
Figure 2: Bus Bar Termination Details



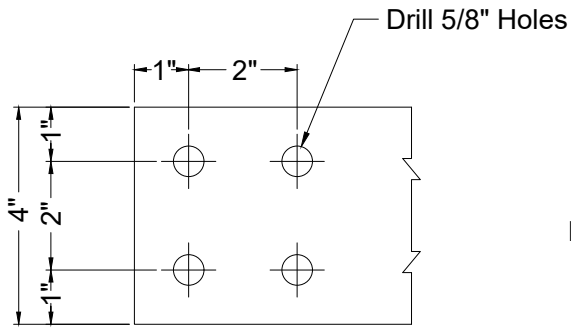
Drilling Details 6"  
Copper Bus Bar



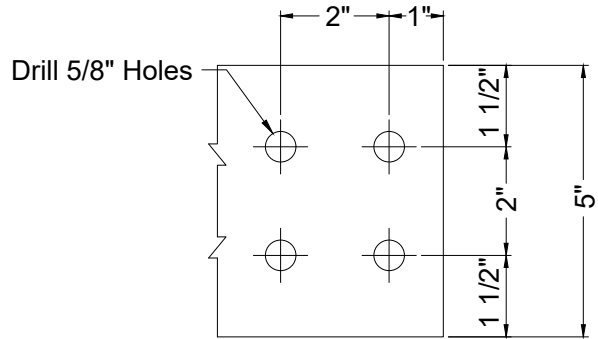
Drilling Details 3"  
Copper Bus Bar



Drilling Details 2"  
Copper Bus Bar



Drilling Details 4"  
Copper Bus Bar



Drilling Details 5"  
Copper Bus Bar



Figure 3: Sump Pump Assembly

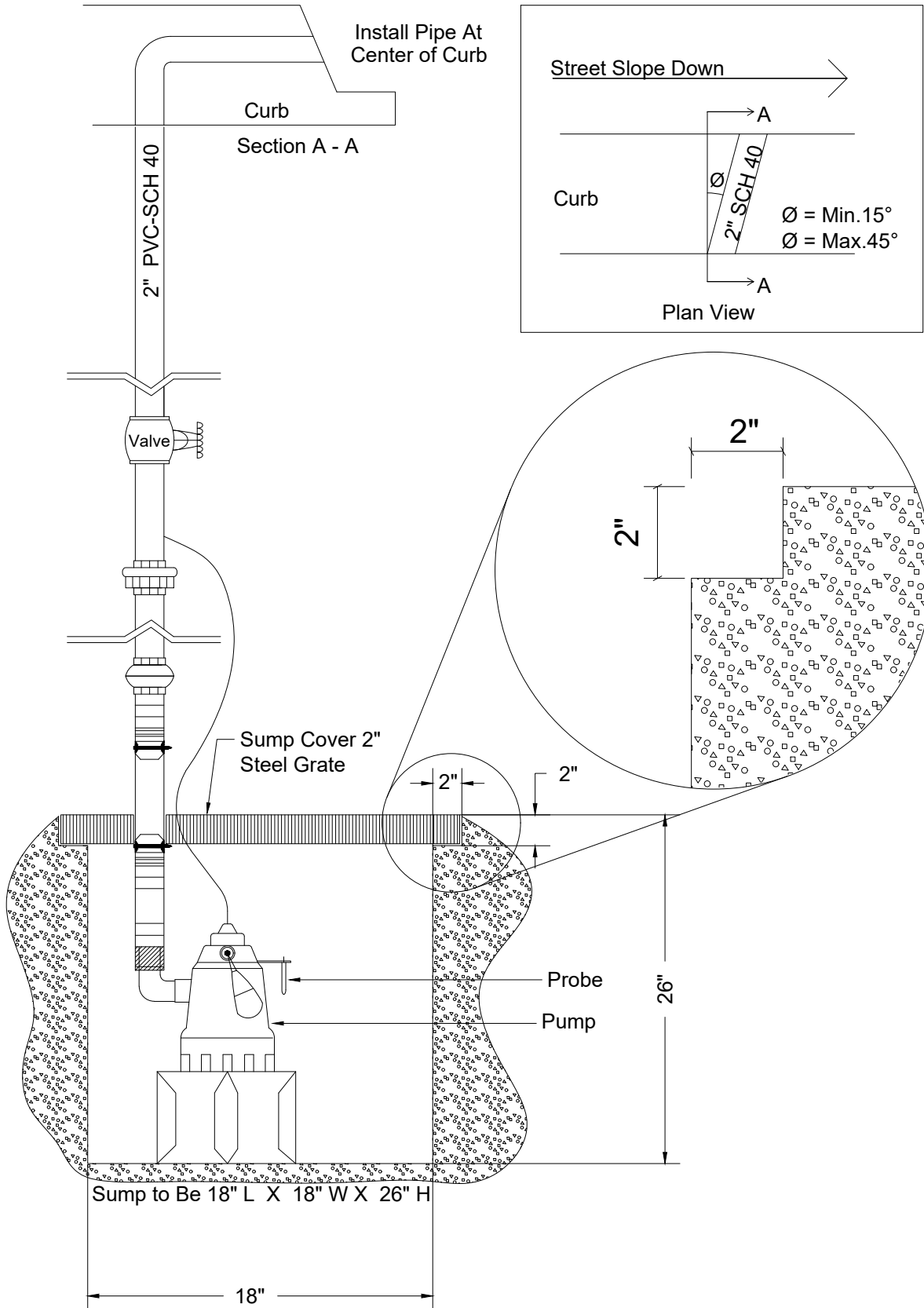
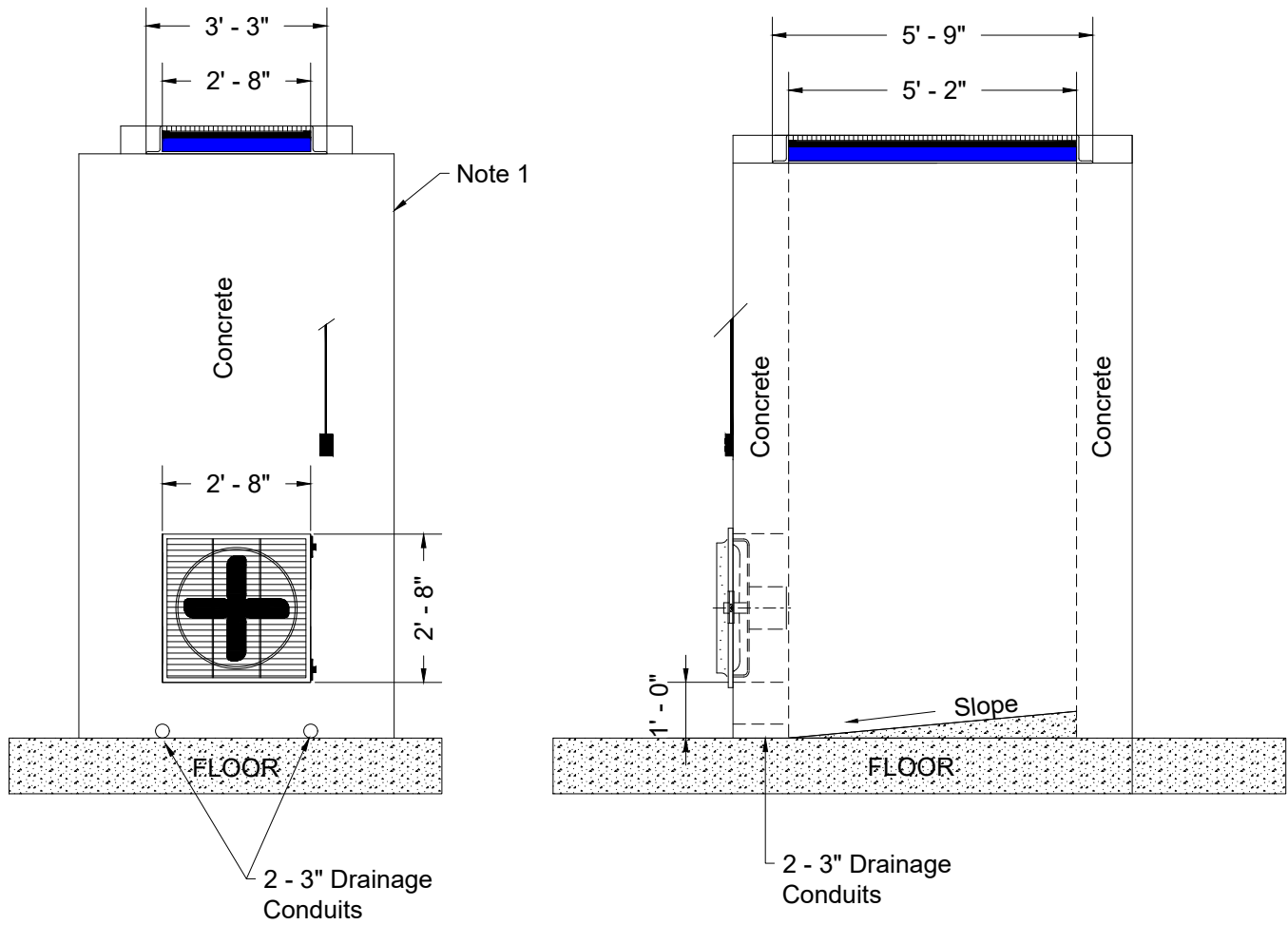


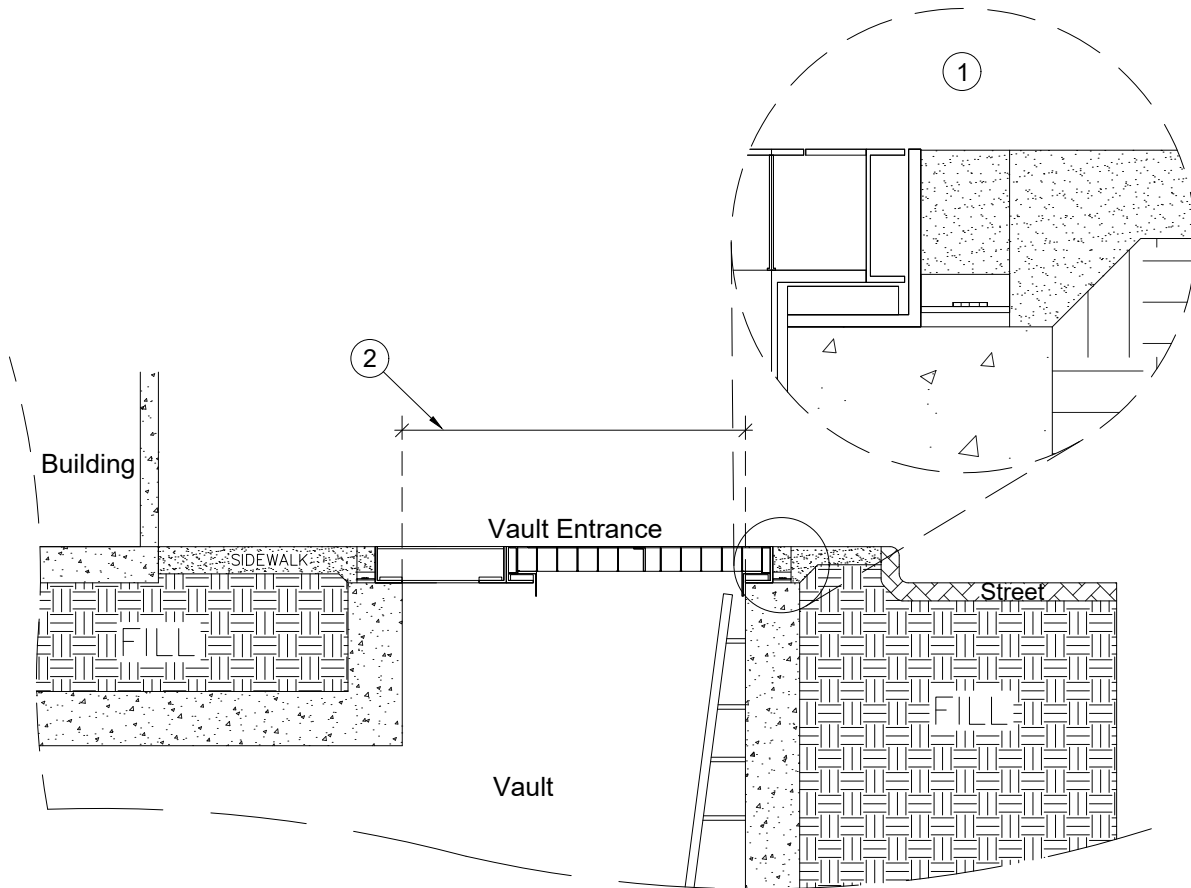
Figure 4: Fan Ventilation Shaft Detail



Note:

1. Cast-in-place concrete construction.

Figure 5: Equipment / Personnel Entrance Placement



Notes:

1. Entrance frame not anchored to vault shaft wall.
2. See proposal drawing packet for vault shaft clear opening dimensions.

Figure 6: At-Grade Vaults Clearance Exhibit

Callouts [#.#] can be found in the MMD-6 Vault Design Guide

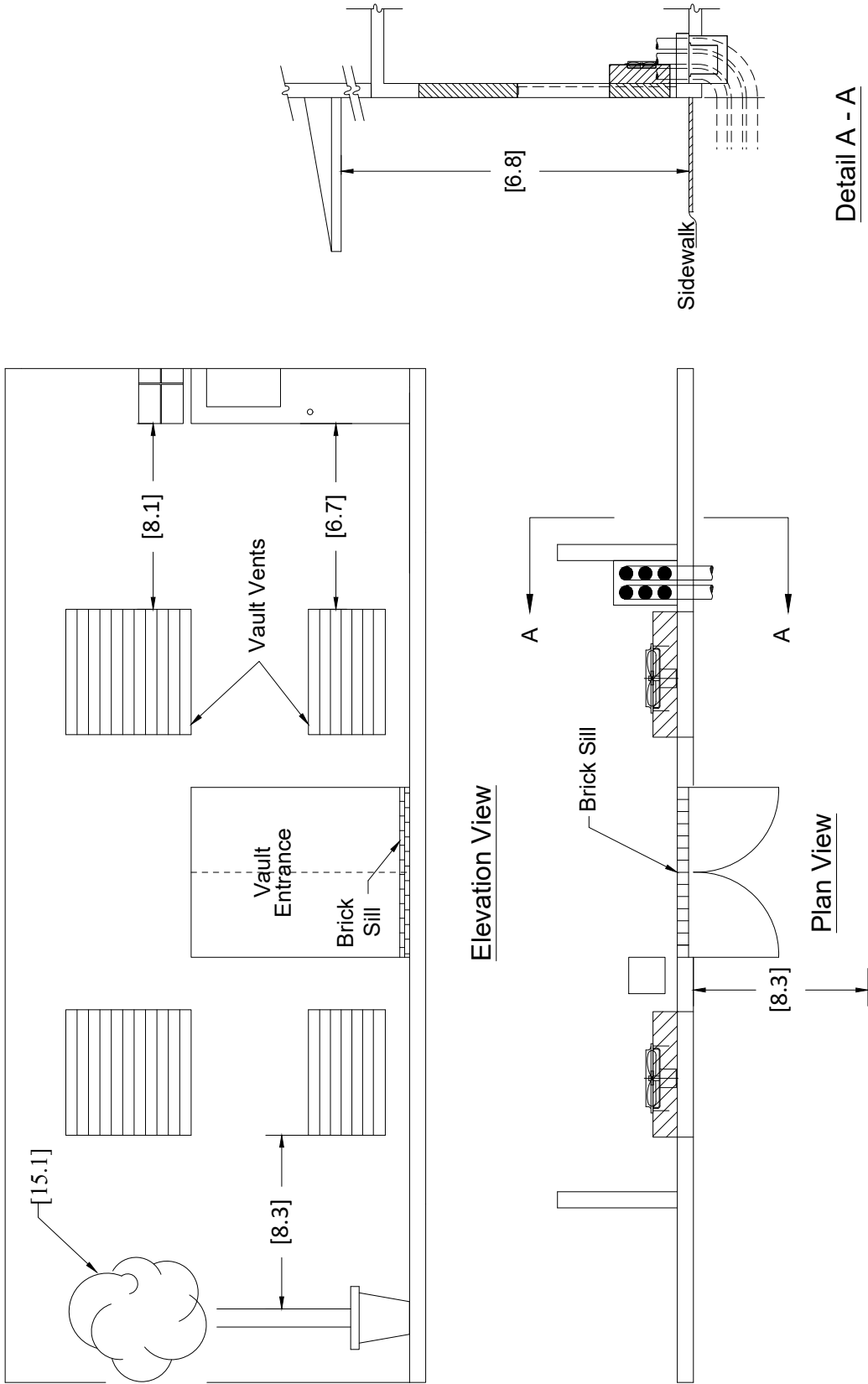


Figure 7: Below-Grade Vault Clearance Exhibit

