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NASHVILLE ELECTRIC SERVICE
VAULT DESIGN GUIDE
(NETWORK)

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NETWORK VAULT DESIGN GUIDE

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NETWORK VAULT DESIGN GUIDE

1. Purpose

1.1. The purpose of this guide is to ensure the furnishing of an electrical vault for utility equipment. Once designed and constructed by the Customer and accepted by NES, the electrical vault will house utility transformers and other equipment required to serve the Customer's electrical needs.

1.2. It is intended that this document serve as a guide to the Customer in preparing a vault design rather than as a detailed specification. The Customer shall furnish complete descriptive information and specifications of the proposed vault.

1.3. This guide is intended for network vaults. See Appendix A for the map of network and non-network areas. If a location borders the yellow line, contact the NES Accounts Representative or the NES Engineer to confirm whether to use the network or non-network vault design guide.

2. Customer Responsibility

2.1. The word "Customer" in this document refers to the property owner or developer. Many steps will actually be completed by consultants or contractors (Customer's Architectural Team), but the ultimate responsibility rests with the Customer.

2.2. Doors, vents, removable vault tops, and grating shall be designed, constructed, and maintained by the Customer per NES requirements.

2.3. The Customer shall reimburse NES for the cost of any maintenance or cleanup performed in the vault by NES once equipment in the vault is energized.

2.4. The Customer shall have an "Application for New Commercial Service" turned into the NES Account Representative. The owner does need a reasonable estimation of the square footage of the building. At a minimum, the Customer shall provide a site plan, power distribution diagram, and service load calculations when signing up for service. The load calculation can be different than the calculation used to determine the vault size outlined in this guideline.

2.5. The vault shall pass final inspection by the NES Engineer including, but not limited to: Vault top removal and replacement before NES equipment can be installed.

2.6. Damage to existing NES facilities by the Customer shall be repaired by NES at the expense of the Customer. Damage to any NES equipment prior to full acceptance of the vault shall be at the expense of the customer.

2.7. Customer shall not locate vault below the footprint of the street.

2.8. Customer shall obtain permit with Metro Public Works for Customer-owned vaults and vault tops located in sidewalks. Contact the Permit Office at 615-862-8762; NES Engineer can provide contact names if necessary. Customer shall provide easements indicated on property documents.

2.9. All vaults are considered customer owned unless specified by NES as a grid vault. Customers shall be responsible for the cost of maintaining the structural integrity of the vault including but not limited to gratings, doors, and lift off slabs. The vault(s) shall be kept in safe working order. Maintenance and repairs to energized vaults shall be coordinated with NES.

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3. Drawings

3.1. Preliminary Design Drawings

3.1.1. Customer's Architectural Team shall provide preliminary vault layout drawings for NES review and comment. It is recommended that the preliminary design drawings be included in the design development package.

3.2. Construction/Approval Drawings

3.2.1. The Customer's Architectural Team shall submit electronic copies of the Vault Design Guide with the sheet numbers, note numbers, and details from the contract documents line by line where each item as applicable is addressed. Electronic copies of the contract documents that are indicated in the marked up Vault Design Guide shall be submitted for approval. The submittal shall illustrate compliance with ALL applicable requirements listed in this design guide. Architectural, Civil, Structural, Mechanical, Plumbing and Electrical shall be reviewed, not just Electrical. Provide PDF version of the same drawings and marked up Design Guide. The application will be rejected without marked up Design Guide. Work with the NES Engineer for the submittal requirements (quantity, size, format, etc.).

3.2.2. Re-submittal shall be required if the construction drawings lack enough detail for the NES Engineer to confirm that all requirements are satisfied.

3.2.3. It is recommended that the Customer submit construction drawings for review four (4) weeks before scheduled issue date of contract documents.

3.2.4. Structural, mechanical, architectural, civil and electrical drawings shall be sealed and signed by a Tennessee licensed engineer for each area of responsibility.

3.2.5. The Customer shall submit the construction drawings to the NES Account Representative and the NES Engineer for final approval before construction. Electronic PDF copies shall be submitted when vault plans are approved. Work with the NES Engineer for the submittal requirements (quantity, size, format, etc.).

3.2.6. The Customer shall notify the NES Engineer immediately of any proposed changes to the vault design after construction drawings have been approved. Any changes to the vault design after the initial design approval will require additional NES review and approval.

3.2.7. Customer shall submit an existing site plan and a final site plan to help coordinate lighting, recognizing existing underground lighting pull boxes, and underground electrical lines indicated on civil plans.

3.3. As-Built Record Drawings

3.3.1. An electronic copy (AutoCAD .dwg format) of the record drawings showing all As-Built revisions shall be provided to the NES Engineer before NES takes over the vault or pulls cable.

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3.3.2. As-Built drawings with significant revisions from the original construction/approval drawings shall be sealed and signed by a Tennessee licensed engineer for each area of responsibility.

3.3.3. The Customer's Architectural Team shall provide As-Built surveys in AutoCAD format and in plan view for infrastructure (duct bank and manholes) installed. Are required prior to cable installation through new duct banks.

4. Architectural Requirements

4.1. Vault Inspection and Acceptance (Architect shall include notes 4.1.1. - 4.1.9. on Architectural drawings)

4.1.1. The Customer shall notify the NES Engineer at least five (5) working days before the grounding inspection. This must be done before the vault walls and floors are poured. NES will not inspect the vault without construction drawings of the vault.

4.1.2. The Customer shall notify the NES Engineer at least five (5) working days before the proposed final vault inspection date.

4.1.3. The vault must be complete, secure, clean, and accessible for inspection to take place.

4.1.4. The Customer shall connect a temporary feed (a generator is acceptable) to the vault disconnect switch so NES can confirm that the light and receptacle circuits are operational.

4.1.5. The Customer shall remove and replace the vault tops (Functionality Test) in the presence of NES to obtain the acceptance of NES (vault shall be cleaned after lift-out test before handing over to electrical contractor). Rigging hardware and lifting means shall be provided by the customer.

4.1.6. All applicable components of this guide shall be satisfied before the vault can pass inspection and be accepted for use by NES. Vault shall be sprayed down to get rid of dust after electrical contractor completes work, before transition to NES. Installation of NES equipment is contingent on acceptance of the vault by NES.

4.1.7. Contractor to protect lift off slabs and gratings with a layer of plywood. Contractor to coordinate with NES how many sections of grating to leave unprotected for ventilation. Contractor to clean debris from grates prior to turning building over to the owner. Contractors are not to enter the vault after turning over vault to NES. (Omit if no lift off slabs).

4.1.8. Route Vault Miscellaneous Steel Shop Drawings as well as Switchboard Shop Drawings through the NES Account Representative and the NES Engineer for approval.

4.1.9. Vault floor is to be clean and smooth without any irregularities in the finish (slick machine/trowel finish required). Any expansion joints shall be saw cut.

4.1.10. Architect shall be responsible for sharing the NES Vault Design Guide to all design teams and applicable parties (general contractors, etc).

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4.1.11. Architect to provide codes sheet or sheet index that indicate square footage of each level of structure and total square footage of occupied or unoccupied space.

4.2. General Requirements

4.2.1. NES Service Area Descriptions

(a) See Figure 1 (Appendix A) for Network Area.

(b) Confirm with NES if not sure.

4.2.2. Transformer Size

(a) Transformer sizing and quantity shall be determined by the NES Account Representative and the NES Engineer. Customer to submit total building square footage (conditioned and non-conditioned), along with the breakdown for specific occupancy type (parking, office, retail, residential, hotel, restaurant, etc) in order for NES to provide the size and quantity of transformers for vault design.

4.2.3. Working Clearance Around Transformers

(a) See Table 2 (Appendix B) for the maximum standard transformer dimensions. See Table 3 (Appendix B) for the minimum working clearance required for one transformer.

(b) The transformers shall be arranged in a vault such that three feet (3') of working clearance is maintained around each unit once they are installed in the operating position. Two units can share common working space. There shall be no fixed objects located within the working space. Note that the "door open" length shall be used to determine the working clearance footprint.

(c) Twenty feet (20') horizontal clearance shall be provided between electrical utility vault and any above ground or underground generator vent exhausts, storage or fuel oil tank, fill valve, vent valve, or air intake in case of vault fires.

4.2.4. Installation Provisions for Equipment

(a) The vault shall be designed in such a way as to allow replacement of any one unit without disturbing the other units in service.

(b) Approval drawings shall illustrate the equipment can maneuver into the operating position around any obstacle while maintaining minimum clearances through the path of travel.

(c) Transformers will likely be moved into position by NES using roller skids or roller dollies. Therefore, the vault floor shall be clean and smooth without any irregularities in the finish (slick machine/trowel finish required). Any expansion joints shall be saw cut.

(d) Customer installed hoists will not be allowed.

(e) Vault floors shall all be one level. Multi-height vaults are not allowed.

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4.2.5. Working Clearances around Equipment Access Requirement

(a) The equipment access should be located in the sidewalk or building wall along a main street. Alleys less than thirty feet (30') wide will not be used for equipment access due to the limited space for trucks and cranes to set equipment. NES may consider equipment access locations other than main streets when an easement is recorded to provide the thirty feet (30') wide corridor for truck and crane access.

(b) The equipment access shall not be located within an area that, if blocked for an extended period of time, would negatively affect operations of the Customer's facility or other surrounding facilities. An example would be a parking area entry ramp.

(c) Provide six feet (6') horizontal working space on each side of the access door for Street Level Vaults or on at least three sides of the vault lid for Below Grade Vaults.

(d) Working space shall extend vertically from the surface of the sidewalk to forty feet (40') above the surface for all vaults.

(e) Working space shall extend from the back edge (building side) of the vault access to the street/curb (or other area where the truck or crane will be positioned).

(f) Fixed objects of any kind (fire hydrants, trees, planters, street light poles, building signs etc.) shall not be located within the working space detailed above.

(g) NES will not approve an overhang inside the working space unless it is fully retractable. Fixed awnings, signs, or balconies within the working space are not acceptable.

(h) Provide a 12" separation between any building face and the edge of the lift off slab for "swing room" for the lift off slab and gratings.

(i) Grating locations should be kept as far as possible from doors, windows, fire escapes, and combustible materials.

4.2.6. Street Level Vaults Equipment Access Requirements

(a) Provide a roll-up door or a set of hinged doors for equipment installation.

1. Roll-Up Door Requirements:

(i) Roll-up door "Drum Assembly" to be installed on the inside of the vault. Manual operation of the roll-up door is required in power outage situations.

(ii) The width of a roll-up door shall be a minimum of ten feet (10') wide

(iii) The height of a roll-up door shall be fourteen feet (14'). However, twelve foot (12') doors are acceptable if:

a. The vault floor is at least as high as the external grade.

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b. The area outside the vault is at finished grade at the time of transformer delivery

c. Approximately ten feet (10') x ten feet (10') reinforced flat concrete pad will need to be installed outside the roll-up door at the same height as the vault floor. The concrete pad shall be clean and smooth without any irregularities in the finish (slick machine/trowel finish required). If a lift out slab and grating combination is designed to sit above this area to bring area to final grade, civil or plumbing engineer to drain area to prevent water retention.

2. Hinged Door Requirements:

(i) All hinged doors shall meet the requirements of a personnel access door. See Section 4.2.8 for details.

(ii) Each hinged door shall be a min. five feet (5') wide x min. fourteen feet (14') high and open outward. If doors can only open 90°, the minimum clearance between set of door's panic hardware shall be min. ten feet (10').

(iv) Twelve foot (12') doors are acceptable if:

a. The vault floor is at least as high as the external grade.

b. The area outside the vault is at finished grade at the time of transformer delivery

c. Approximately ten feet (10') x ten feet (10') reinforced flat concrete pad will need to be installed outside the hinged door frame at the same height as the vault floor. The concrete pad shall be clean and smooth without any irregularities in the finish (slick machine/trowel finish required). If a lift out slab and grating combination is designed to sit above this area to bring area to final grade, civil or plumbing engineer to drain area to prevent water retention.

(b) Transformers shall not be installed through any access other than the roll-up or hinged door mentioned above.

(c) Fixed removable wall panels shall not be accepted.

(d) Area outside of vault dedicated for setting and moving transformers shall not have more than 1% slope.

4.2.7. Below Grade Vaults Equipment Access Requirements

(a) Vault depth should not be greater than twenty feet (20') from the elevation of the sidewalk at the sidewalk personnel access.

(b) Vault can be located entirely under the sidewalk or on the first level of a basement. Basement vaults shall extend under the sidewalk for equipment access.

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(c) Vault tops can be located within a public right-of-way or any other area subject to occasional non-deliberate vehicular traffic.

(d) Vault tops shall be poured in place. Pre-cast tops are not allowed.

(e) Vaults located in public right-of-ways must be approved by Metro and/or TDOT.

4.2.8. Personnel Access General Requirements

(a) Vaults require at least two personnel entrances, one at each end of the vault.

(b) Access for personnel shall be located such that the path of egress leads to an exit that does not open into an unsafe condition such as a driveway. Personnel doors typically lead to the exterior of the facility, electrical room, basement, parking garage, or other common space.

(c) Each door (if provided) shall open in the direction of egress (doors open to outside of vault room) and be equipped with a flat bar exit device (panic door) with door closer on the vault side of the door. See Appendix E for required door hardware. The lock set shall be set up to operate as "storeroom" (ANSI 09) function. Hardware manufacturer notes that an easy field change is required to achieve the "storeroom" function with this trim kit. Details should be discussed with manufacturer's representative. Lock cylinder and core shall be provided and installed by NES. The Customer shall not have access to the vault after equipment has been energized. This hardware is mandatory, no substitutions accepted. All outswing doors shall be equipped with a steel security latch guard plate to protect from tampering and latch prying.

(d) Each doorway (if provided) leading into a vault from the building interior shall be provided with a tight-fitting UL listed door that has a minimum fire rating of 3 hours (Type A).

(e) Stairs shall not be permitted inside a vault. If stairs are required in the path of egress, they must be located outside the vault with no less than a 4' by 8' landing between the vault door and stairs.

(f) Each doorway (if provided) leading into a vault shall have OSHA approved permanent and conspicuous safety signs installed outside the door (min. 8.5" x 11") reading: DANGER – HIGH VOLTAGE – KEEP OUT. For roll up doors, the sign shall be placed on both left and right sides of the door opening.



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(g) An additional safety sign (min. 8.5" x 11") shall be posted below (g) at each doorway, outside the door, reading: WARNING – EMERGENCY EXIT – DO NOT BLOCK.



(h) All access locations and details shall be subject to NES approval.

4.2.9. Street Level Vaults Personnel Access

(a) Street level vaults require at least two personnel doors. The doors shall be on opposite ends of the vault.

(b) If hinged doors are utilized for equipment installation/removal, one of the required personnel doors may be deleted.

(c) At least one of the doors shall provide unrestricted access to NES personnel 24 hours a day, 7 days a week. Access shall not be restricted by doors or gates locked with a key other than NES vault key.

4.2.10. Below Grade Vaults Personnel Grating Access

(a) Below grade vaults shall have at least one sidewalk personnel access as described below. NES Engineer may require additional points of access for multiple transformer vaults.

(b) Access for personnel shall be located such that it is not above electric equipment or conductors in the vault.

(c) Customer must obtain Metro approval and Metro ADA Compliance Division approval for gratings installed in a public sidewalk.

(d) Clear opening for personnel access shall be 30" x 48". See Appendix E for hatch access panel.

(e) Each personnel access grating section shall weigh 100-150 pounds.

(f) If gratings have elongated openings, then they shall be placed such that the long dimension of the opening is perpendicular to the dominant direction of travel. There shall be no gaps greater than half inch (½") on all sides of the grating.

(g) Detailed design/shop drawings shall be submitted to the NES Account Representative and the NES Engineer for approval. Drawings shall include grating dimensions, weights, and lifting provisions.

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(h) A corrosion resistant fixed ship ladder meeting all current OSHA requirements shall be installed at a personnel access through the sidewalk. The ladder shall be installed with a 4:1 slope. See OSHA Standard 1926.1053, for "fixed ladders." Any deviation from the ship ladder requirement shall require approval from NES.

(i) Fixed ship ladder shall have an OSHA approved telescoping ladder extension post that locks in place to guide and provide stability to the user, see Appendix E for NES approved ladder extension. Customer shall make certain that the extension post is installed in such a way as to satisfy the applicable OSHA requirements.

(j) Fixed ship ladder to include a glide rail.

(k) The ladder shall not interfere with clearances required to move transformers into operating position or working clearances around transformers once they are placed into the operating position.

(l) Provide three feet (3') clear working space around all sides of personnel access through a sidewalk.

(m) Protect all exposed steel items from corrosion by hot dipped galvanizing.

5. Structural Engineer and Architectural Requirements

5.1. Fire Rating

5.1.1. The vault shall be designed and constructed in such a manner as to provide a 4-hour separation between the vault and the building (this includes the fan room if required). Two permitted exceptions to this 4-hour separation are listed below.

(a) One UL listed (Type A) 3-hour rated door is permitted into the interior of the building.

(b) Electric service entrance may be permitted to pass through the 4-hour wall, provided a UL listed firestop system with a 3-hour rating is installed by the Customer. Detailed drawings and specifications shall be submitted to NES for approval of system selected to maintain 3-hour fire rating.

5.1.2. The vault shall be constructed of solidly poured concrete wall meeting 4-hour fire rating. **Filled-Block or pre-cast wall vault room will not be accepted**.

5.1.3. Thermal insulation or fireproofing materials shall not be installed on the ceiling or wall of a vault.

5.1.4. Contractor to include fire caulking on both sides of seams between walls and structural beams, and around both sides of door frames.

5.2. Weights and sizes of equipment are listed in Appendix B.

5.3. Ceiling Height

5.3.1. Normal Vaults – Serve 1 to 3 switchboards

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(a) Ceiling height is determined by the number of services. (For example, a building with 2 switchboards and 1 retail service would be considered a 3 service building).

(b) Minimum height to be 14-ft for 1 service and 3-ft for each additional service. This height is to be clear of structural beams. Additional height might be required to get a vault floor level with a floor in order to have a man door for the path of egress out of the vault.

5.3.2. Abnormal Vaults (very large buildings) – 4 or more switchboards

(a) Building designed for 4 or more switchboards, a multi-level vault must be designed. A collector bus room must be designed preferably with the main electrical room on the level above it.

(b) The collector bus room shall be 12-ft x 12-ft x 12-ft with the back wall open, opening into the vault, centered on the vault.

(c) The collector bus room shall be of 4-hr construction solidly poured concrete floor to ceiling with a 3-hr door that does not open into traffic.

(d) A ladder will be required for entry between the collector bus and the vault.

6. Structural Requirements

6.1. Vault Inspection and Acceptance (Structural Engineer shall include notes 6.1.1 - 6.1.6 on Structural drawings)

6.1.1. The Customer shall notify the NES Engineer at least five (5) working days before the underground grounding inspection. This must be done before the vault walls and floors are poured.

6.1.2. The Customer shall remove and replace the vault tops (Functionality Test) in the presence of NES to obtain the acceptance of NES (vault shall be cleaned after lift-out test and demonstration before handing over to the electrical contractor for equipment installation). (Omit if no lift off slabs).

6.1.3. All applicable components of this guide shall be satisfied before the vault can pass inspection and be accepted for use by NES. Installation of NES equipment is contingent on acceptance of the vault by NES.

6.1.4. Vault floor is to be clean and smooth without any irregularities in the finish (slick machine/trowel finish required). Any expansion joints shall be saw cut.

6.1.5. Route Vault Miscellaneous Steel Shop Drawings through the NES Account Representative and the NES Engineer for approval.

6.1.6. Protect all exposed steel items from corrosion by hot dipped galvanizing.

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6.2. Street Level Vaults

6.2.1. Floor shall be sloped 1.0% to liquid containment pit. Containment pit shall have a 1% slope towards a sump pit on one end that is 24" x 24" wide x 6" deep for liquid extraction. The 1% slope elevations shall be constant. There shall be no need for steps in vault.

6.2.2. Containment pit shall be covered with grating of sufficient strength to support expected loads. Each section of grating shall weigh less than 150 pounds. There may be multiple pits connected by 4" PVC below slab if required.

6.2.3. Liquid containment capacity shall be greater than or equal to 110% of the volume of liquid in the largest transformer (See Appendix B Table 5).

6.2.4. Where a doorway leads into the vault, a door sill or curb that is of sufficient height to confine the liquid from the largest transformer within the vault shall be provided. In no case shall the height of the sill or curb be less than four inches (4") or greater than eight inches (8"). Door sill or curb (shall be painted yellow) shall be removable if the doorway is used for equipment installation or removal. Angled iron is suggested for removable curb. Sealant shall be installed between the door sill and the vault floor.

6.2.5. The liquid containment pit shall be within the footprint of the vault and not be on a different floor/level.

6.3. Pulling Irons

6.3.1. Structural Engineer shall show details and sections for compliance.

6.3.2. Pulling irons used to position transformers shall be located on each wall, one foot (1') above finished floor, recessed and centered on each transformer.

6.3.3. Additional pulling irons may be required by NES Engineer.

6.3.4. Pulling irons shall be designed and installed to withstand 12,000 pound load and have a minimum eye opening of 6".

6.3.5. The pulling irons are typically cast into a concrete wall. Other pulling iron designs shall be subject to approval by NES. Embedded plates are allowed.

6.3.6. Pulling irons shall be recessed into the face of the wall. Pulling irons shall not extend into clear working space around each transformer.

6.3.7. Pulling irons shall be protected from corrosion by hot dipped galvanizing.

6.3.8. For any conduits that enter through the floor, a pulling iron inserts shall be provided above on the wall four feet (4') above the top of the conduit or in the ceiling. Coordinate with Electrical Engineer.

6.3.9. Pulling irons are required to be placed at 9' above finished floor across from any wall "Bayouts" of conduit entrances (opposite wall or near column for cable pull leverage). Coordinate with Electrical Engineer. Location shall be in line with center bayout pipes. These are not required to be recessed.

6.3.10. See Appendix E for recessed pulling iron example.

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6.4. Concrete Support Beams

6.4.1. Once transformers are in position, they shall be placed on portable concrete support beams.

6.4.2. The customer shall provide two (2) portable concrete support beams per transformer. The final location of these support beams shall be determined by NES when the transformers are set inside the vault(s).

6.4.3. Support beam details are shown in NES drawing #UN-22304. Recommended part is provided in Appendix E.

6.5. Lift Off Slabs and Grating (Below Grade Vaults)

6.5.1. A typical vault layout for a single-transformer Network vault is illustrated in NES drawing #UN-41178 (provided by NES Engineer).

6.5.2. NES requires a design with "grating, cast in place concrete slabs, grating" (gratings on ends) design. Equipment must not be directly under gratings. Coordinate this with Electrical Engineer or NES Engineer.

6.5.3. Gratings may be accepted for equipment access if they are required for ventilation and site conditions will not allow for ventilation separate from the vault equipment access.

(a) Customer must obtain Metro and/or TDOT approval and Metro ADA Compliance Division approval for ventilation gratings installed in a public sidewalk.

(b) See Appendix E for required gratings.

(c) Gratings shall not be located above cable racking or other NES equipment to be installed in the vault.

(d) Ventilation gratings that will be used for personnel access through the sidewalk shall weigh 100-150 pounds.

(e) "Electric" Identification plate required on hatch if access is for ladder. Identification plate shall be installed flush with top of hatch, centered on opening edge (non-hinge side).

(f) If a section of grating (other than personnel access) weighs more than 150 pounds, some type of lifting provisions shall be provided.

(g) Detailed design and shop drawings shall be submitted to the NES Account Representative and the NES Engineer for approval. These drawings shall include all grating dimensions, weights, and lifting provisions.

6.5.4. Vault tops located within a public right-of-way or any other area subject to occasional non-deliberate vehicular traffic.

(a) Designs created by use of Allowable Stress Design (structural steel) or Working Stress Design (concrete) shall use AASHTO H-20 or HS-20 Design Loading (Engineer shall indicate on contract documents).

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(b) Designs created by use of Load and Resistance Factor Design (structural steel) or Ultimate Strength Design (concrete) shall use HL-93 (Engineer shall indicate on contract documents).

6.5.5. Removable concrete slabs should be provided for equipment installation and removal. Slabs shall be poured in place. Pre-casted slabs shall not be accepted.

6.5.6. Maximum weight of lift-off slab shall be 14,000 pounds. Maximum length of lift-off slab shall be fourteen feet (14') (Engineer shall indicate on contract documents).

6.5.7. Four (4) 1-1/4" hollow tube inserts shall be installed in each slab for lifting, see NES drawing #UN-41178, and Appendix E for required tube inserts.

6.5.8. Indicate to contractor to provide quarter inch to half inch (¼" to ½") expansion around slabs for tight gaps.

6.6. Large Lift-Out Grating Area

6.6.1. Access sections and end sections are required to be NES Standard Gratings per the latest edition of NES drawing #UGS-00033. In other cases areas where large areas of grating are used, non-standard size grating can be designed to reduce the number of "picks" from the opening. Coordinate with NES Engineer and Vendor for design options. Fewer "picks" is desired. Design and provide an access section over any sump pump that is under this grating section.

6.6.2. In vault areas where beams are used to support large grating sections, lifting provisions must be provided for the removal of the beams.

6.7. Electrical Bayout Wall Structural Details

6.7.1. Structural Engineer shall coordinate with Electrical Engineer for location of primary and secondary conduit/cable entrances. If expected to be in the wall, a bayout shall be required. If secondary conduit/cable entrances are from the ceiling, it must be near a wall and not in the middle of the room over electrical equipment.

6.7.2. Bottom of bayout should be 7' above finished floor or as approved by NES.

6.7.3. Bottom row of conduits should be 8' above finished floor or as approved by NES.

6.7.4. See NES drawing #UN-41535 (provided by NES Engineer).

6.8. Below Grade Vaults

6.8.1. Floor shall be sloped 1.0% to sump pit for removal of water that may enter the vault through the ventilation gratings. The preferred location of sump is behind the access ladder and not in the work space or path of ingress or egress to the vault.

6.8.2. 1% slope elevation shall be constant. There shall be no need for steps in vault.

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6.8.3. Sump pit shall be 24" long x 24" wide x 24" deep with a grating cover of sufficient strength to support expected loads. Contractor to cut notch into grating for piping to pass through.

6.8.4. NES requires the installation of a sump pump in the vault to pump water to the nearest storm structure. NES required pump will be equipped with an oil sensing switch to prevent oil from being pumped into public storm water system. NES shall provide the required sump pump(s) for plumbing contractor to install.

6.8.5. The plumbing contract documents shall indicate the size of PVC drain from the sump location up and out through the vault wall to outside the vault. The Plumbing and the Civil design professionals shall coordinate to show the sump drain routed to nearest storm drainage structure for sump pump discharge and the route taken to the storm drainage structure to minimize the number of bends and elbows. The civil contract documents shall show the drain to the storm structure from the vault. See Appendix E for sump pump details.

6.8.6. Note for the contractor to coordinate the storm structure connection with Metro Water Services prior to connection. This connection needs to be routed outside of the building.

6.8.7. The plumbing contract documents to indicate a shut off Valve, a PVC to rubber union, check valve, and 1" piping up the wall to the storm drainage structure or building storm system all to be supplied and installed by customer.

6.8.8. The sump pump controller location shall not be located under gratings. Final location of controller shall be subject to NES approval.

6.8.9. The exterior walls must be waterproofed.

7. Mechanical Engineer Requirements

7.1. Ventilation and Equipment Cooling

7.1.1. Vaults shall be located where they can be ventilated to the outside environment without using flues or ducts wherever such an arrangement is practical.

7.1.2. Ventilation adequate to dispose of the transformer full-load losses (heat output) without creating a temperature rise that is in excess of the transformer rating shall be provided.

7.1.3. Ventilation outlets shall be located as far as possible from doors, windows, fire escapes, and combustible materials.

7.1.4. Ventilation inlet and outlet shall be at opposite ends of the vault room so ventilation system directs airflow across the vault to ensure uniform temperature and no hot spots.

7.1.5. Louvers utilized for ventilation shall include bird screens. Detailed drawings shall be submitted for approval. Louvers shall be fixed in the open position and shall not be controlled by fire or smoke detectors. Steel hot dipped galvanized bars will be required behind the louvers to prevent access to vault.

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7.1.6. Mechanical to refer to Sections 6.5 and 6.6 for grating design. Coordinate with Structural and Electrical design professionals.

7.1.7. Mechanical Engineer shall show calculations on the Contract Documents or coordinate with the Electrical Engineer to show. Mechanical Engineer to determine the area of gratings required and coordinate with the Structural Engineer.

7.2. Ventilation by Natural Circulation

7.2.1. A vault ventilated by natural circulation of air shall be permitted to have roughly half of the total area of openings required for ventilation in one or more openings near the floor and the remainder in one or more openings in or near the roof, or all of the area required for ventilation shall be permitted in one or more openings in or near the roof.

7.2.2. The combined net area of all ventilating openings, after deducting the area occupied by screens, gratings, or louvers, shall not be less than three square inches (3 sq-in) per kVA of transformer capacity. For vaults with multiple transformers (usually Network), the number of transformers equal (N-1), where N equals the total number of transformers installed in the vault.

7.3. Ventilation by Forced Air

7.3.1. The full load heat loss (heat output) for each transformer is listed in Table 5 (Appendix B).

7.3.2. Total full load heat loss of a vault with multiple transformers equals (N-1) multiplied by (full load heat loss of one transformer), where N equals the total number of transformers installed in the vault.

7.3.3. Vault Temperature

(a) The temperature of the cooling air (ambient vault temperature) shall not exceed 122°F (50°C), and the average temperature of the cooling air for any 24-hour period shall not exceed 104°F (40°C).

7.3.4. Vault shall only be accessible to qualified NES personnel.

7.3.5. Mechanical equipment (filters, fans) shall not be located within the vault structure, they shall be located such that they can be maintained by the customer from outside the vault.

7.3.6. A transformer fan room (adjacent to the transformer vault) will need to be 4-hour rated with 3-hour doors unless the room opens to the exterior of the building. Steel hot dipped galvanized bars will be required to separate this fan from the transformer vault room.

7.3.7. Ventilation registers/grilles shall not be located over electric equipment.

7.3.8. Ventilation equipment shall be standalone. Building heat, smoke, or fire detectors shall not interfere with the operation of the ventilation system. Fire dampers in the ducts are not allowed.

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7.3.9. Fans shall be controlled by one thermostat located within the vault. The thermostat shall be rated for installation in a damp environment. Mechanical Engineer to advise location of thermostat and set point to satisfy 7.3.3.

7.3.10. The exhaust should exit above grade in an area that does not interfere with pedestrian traffic. If the exhaust must exit through gratings in the sidewalk, care should be taken to ensure air velocities are low enough not to interfere with pedestrian traffic. It is recommended that these installations be approved by Metro Public Works.

7.3.11. If use of ventilation duct work cannot be avoided, the applicable requirements detailed below shall be satisfied.

(a) Ventilation duct shall be 4-hour rated construction.

(b) Ventilation ductwork that passes through the interior of the building (or parking garage) shall be routed through a 4-hour fire rated enclosure in order to maintain a 4-hour separation between the building and vault.

(c) Detailed drawings and specifications shall be submitted to NES for approval of system selected to maintain 4-hour fire rating.

(d) Customer shall provide drawings sealed and signed by a Tennessee licensed mechanical engineer as described in Section 3.

8. Plumbing Engineer, Fire Protection, Mechanical Requirements

8.1. Compliance Drawing(s). Provide drawing(s) to show compliance with following concerning the vault:

8.1.1. Piping unrelated to the functions of the electrical service shall not be routed through the vault.

8.1.2. Fire detection or suppression equipment shall not be located in the transformer vault.

8.1.3. Contract documents shall clearly indicate compliance with this section.

8.1.4. Plumbing contract documents to include documentation for Section 6.8.

8.1.5. Extra sprinkler heads should be considered near occupied space windows and open garage spaces that are up to 3 floors above in line with the vault gratings. Design of these locations are to be acknowledged and presented during the vault submission.

8.1.6. Plumbing engineer shall determine appropriate sump discharge size. NES sump model included in Appendix E. Refer to section 6.8.

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9. Electrical Engineer Requirements

9.1. Required General Notes (Electrical Engineer shall include notes 9.1.1. to 9.1.12 on Electrical contract documents)

9.1.1. The Customer shall notify the NES Engineer at least five (5) working days before the underground grounding inspection. This must be done before the vault walls and floors are poured.

9.1.2. The Customer shall connect a temporary feed (a generator is acceptable) to the vault disconnect switch so NES can confirm that the light and receptacle circuits are operational.

9.1.3. The location and quantities of light fixtures is for design intent and pricing only. Exact location of light fixtures and devices shall be spot located by NES personnel prior to installation. Contact NES C&M Supervisor five (5) working days prior to installation.

9.1.4. Listed rigid non-metallic conduit, fittings, and boxes shall be used throughout the installation. The entire conduit system shall be installed and equipped so as to prevent water from entering the conduit system. All supports, bolts, straps, screws, and so forth, shall be of corrosion-resistant materials or be protected against corrosion by approved corrosion-resistant materials.

9.1.5. All components of vault electrical system shall be surface mounted. Components of the vault electrical system shall not extend into path of egress or clear working space.

9.1.6. For the purpose of electrical design, vaults shall be considered “Wet Location” for any vault below grade, and “Damp Locations” for vaults at Street Level unless otherwise specified.

9.1.7. The luminaires shall be arranged so that persons changing lamps or making repairs on the lighting system are not endangered by live parts or other equipment. Luminaires shall not be located directly above electrical equipment or conduit penetrations. Luminaires shall not be installed on removable access panels.

9.1.8. It is recommended that the contractor order grounding inserts as early as possible. NES will not supply these inserts. These must be procured prior to vault wall pour. See Appendix E for the required inserts. See section 9.9 for insert details.

9.1.9. Route Service Switchboard(s) Shop Drawings to the NES Account Representative and the NES Engineer

9.1.10. Panelboard schedule should be completed (typed) before vault inspection is requested

9.1.11. Once the vault is accepted by NES, no admittance into the vault is allowed without NES approval.

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9.1.12. Contractor shall mark the area of the primary duct bank from the feeding manhole to the vault and make the general contractor aware of anyone working or planning to dig along or near its path during the morning contractor meetings and vice versa. The duct bank shall be discussed each week the duration of the project to stress its importance.

9.2. Distributed Generation on the Downtown Network

9.2.1. For Distributed Generation on the downtown Network, refer to the NES "Downtown Underground Network Secondary Services Guidelines," section 12.0. This document can be found online at www.nespower.com under Builders & Contractors / Guidelines & Manuals.

9.2.2. Provide two (2) 1 ½" conduits from the inverter to the vault to a NEMA 4X box with SEL-2505 remote I/O monitor. Provide SEL-2505 with multi-mode fiber option. Provide communication cable from the inverter to the vault in one (1) of the 1 ½" conduits, and provide a pull-string in the other 1 ½" conduit.

9.3. Disconnect Switch / Panelboard

9.3.1. A 120/240V, 60A/2P service entrance rated fused disconnect switch shall be installed as a main disconnect. The Customer shall contact a NES Engineer for fault current available and specify the panel to withstand the available fault. The panel shall not be positioned where it is under the grating.

9.3.2. The switch shall be heavy-duty type in a NEMA type 4X enclosure equipped with 60A, Class RK-1 current-limiting fuses and clips to reject other fuse types. The switch shall feed the branch circuit panel.

9.3.3. Provide a two inch (2") knockout in the side closest to the primary conduit entrance toward the top of the disconnect switch for termination of NES supply conduit.

9.3.4. A Square D NEMA Type 4X enclosure, 120/240V, 60A/2P branch circuit panel with Square D type QOB breakers shall be installed in the vault to be operated by utility personnel. Locate the fused disconnect and panel near or adjacent the primary entrance.

9.3.5. All receptacle circuits shall be provided and shall have ground fault circuit interrupting breakers or GFCI outlets for personnel protection.

9.3.6. Two spare 20A/1P breakers shall be installed for future use by NES personnel.

9.4. Illumination

9.4.1. Illumination shall be provided for all paths of egress and working spaces around electrical equipment. Illumination level shall be 60 foot-candles or greater.

9.4.2. Electrical engineer shall fill out foot-candle calculation sheet attached showing all calculations and determine number of light fixtures required (Appendix C).

9.4.3. At least two (2) lighting circuits shall be provided. Lights shall be wired in alternating fashion so that the vault is still evenly lit with one switch in the off position.

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9.4.4. Two (2) light switches shall be located adjacent to each personnel access. When a personnel access is provided through the sidewalk grating, two (2) light switches shall be accessible from the top of each ladder.

9.4.5. The lighting circuits shall be wired around the vault, with a junction box near each fixture location. A flex conduit shall connect each junction box to each fixture. See Appendix E for approved lighting fixtures.

9.4.6. Vault lighting/receptacle circuits shall be designed, provided, and installed by the Customer.

9.4.7. Installation shall comply with the latest edition of the National Electrical Code in effect.

9.4.8. Locations of all vault electrical equipment shall be subject to NES approval.

9.5. Receptacles

9.5.1. At least one receptacle shall be provided on each interior wall. Additional receptacles may be required by the NES Engineer. Receptacles shall be duplex type, 20A/125V, NEMA 5-20R.

9.5.2. One duplex type, 20A/125V NEMA 5-20R receptacle from a dedicated circuit shall be provided on the wall adjacent to the sump. A sump receptacle is not required for Street Level Vaults unless otherwise specified by NES Engineer.

9.5.3. Receptacles shall be installed at a height of sixty inches (60”) above finished floor in Below Grade Vaults, and thirty six inches (36”) above finished floor in Street Level Vaults.

9.5.4. One general use receptacle shall be no more than fifteen feet (15’) away from the sump.

9.5.5. Provide a dedicated receptacle for a fiber optic box. Indicate the word “Fiber” next to receptacle. Receptacle shall be installed at a height of sixty inches (60”) above finished floor. Location of receptacle to be specified by NES C&M Department.

9.6. Conduit Entrance

9.6.1. Customer should be mindful of vault/building structural members when laying out primary or secondary entrance.

9.6.2. Conduit entrance penetrating the floor shall not be located within a path of egress or clear working space. Conduit shall not be directly in front of ventilation louvers.

9.6.3. For conduit entrance penetrating the ceiling or floor, pulling irons shall be installed in the floor or ceiling (respectively) in line with the conduit entrance. Conduit entrance shall not be located such that pulling irons will be necessary in the floor within path of egress or clear working space.

9.6.4. For conduit entrance penetrating a wall, see section 6.3.9 regarding pulling iron location.

9.6.5. Provide bayouts for all conduit penetrations in the wall or ceiling.

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9.6.6. See NES drawing #UN-41535 (provided by NES Engineer) for typical conduit bayout details.

9.6.7. Bayout shall not be located under ventilation gratings. Concrete encasement is permissible to extend bayout so no conductor is exposed under a grating. Conduit sleeves shall be permitted under grating if concrete encasement is an obstacle.

9.6.8. Locate bayouts to minimize the amount of cable that passes under ventilation gratings.

9.6.9. Electrical service conduits shall not be located within ten feet (10') of any above ground or underground storage tank, fill valve, or vent valve.

9.6.10. (Below Grade Vaults) Unused conduits shall be filled with duct seal.

9.6.11. (At Grade Vaults) Unused conduits shall be filled with fire stop.

9.7. Primary Entrance

9.7.1. When manholes are involved, primary ducts shall extend from the vault to within ten feet (10') of the manhole (existing or energized) specified by NES Engineer. Customer shall be responsible for excavation from the vault to the manhole. Customer shall complete the duct run to the manhole coordinating with NES (NES may have manhole work to complete to make the manhole ready to accept the duct run).

9.7.2. Primary ducts shall be encased in red dye concrete. See NES drawing #UN-42979 (provide by NES Engineer) for additional duct run requirements.

9.7.3. One transformer per vault - one bank of four (4) - four inch (4") ducts shall be provided for the transformer primary.

9.7.4. Multiple transformers per vault - one bank of three (3) - four inch (4") ducts shall be provided for each transformer to be installed in the vault. All primary ducts shall be grouped into one bayout unless otherwise specified in writing by NES Engineer.

9.7.5. Primary ducts entering a vault through the floor shall be 8" - 10" from vault wall and extend six to eight feet above finished floor and shall be galvanized rigid steel conduit. Conduits shall be encased in concrete up to two feet (2') above finished floor with 3" of cover. Tops of conduits shall be threaded with ground bushing. Conduits shall be straight and square with the walls.

9.7.6. Additional ducts may be required. Verify final arrangement and quantity of ducts with NES Engineer.

9.7.7. Where primary conduits enter the floor, elbows (90°) and turn ups shall be galvanized rigid steel conduit as well as 10' back from the elbow.

9.8. Secondary Entrance

9.8.1. One bank of conduits shall be provided for secondary service entrance cables unless otherwise approved by NES Engineer in writing.

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9.8.2. Primary and secondary cable racking shall be procured and installed by NES. Electrical contractor shall pull a minimum of fifteen feet (15') of secondary cable into the vault from each service entrance.

9.8.3. The consulting engineer shall specify the service cable be provided with color insulation per Table 6 (see Appendix B).

9.8.4. Conductors shall be XHHW-2 500 MCM copper or 4/0 MCM copper. Only these two sizes shall be accepted.

9.8.5. Secondary conduits which enter through the floor shall extend six feet above finished floor and shall be galvanized rigid steel conduit. Conduits shall be encased in concrete up to three feet above finished floor with 3" of cover. Tops of conduits shall be threaded with ground bushings. The turn up and 10' back from the elbow shall be rigid galvanized. This shall be inspected before it is poured. Entry shall not be designed or installed in the clear space. Conduits shall be straight and square with the walls.

9.9. Grounding Provisions

9.9.1. NEMA Std 4-hole ground inserts shall be provided and cast into the concrete structure by the Customer, see Appendix E for required inserts.

9.9.2. At a minimum, ground inserts shall be installed within 12" of where the primary electrical conduits bayout, and in the closest wall 24" above finished floor near the pulling iron for each transformer.

9.9.3. Additional ground inserts may be required by NES Engineer.

9.9.4. Install 4/0 AWG – 19 STR bare soft drawn copper just inside the vault wall to form a ring inside the vault walls. Cross the room between each transformer. Cross the room down the middle. Bond at each intersection of cable. Bond to the rebar at 8 to 10-ft intervals. Provide Brundy KS39 for cable to cable connections. Provide Brundy GAR6429 for cable to rebar connections.

9.9.5. Branch off from the Ground Ring to the ground inserts with 4/0 AWG -19 STR bare soft drawn copper conductor conforming to latest revision of ASTM B8. Bond to the nearest substantial piece of rebar at the insert.

9.9.6. Customer shall coordinate grounding inspection per Section 4.1.

9.9.7. The service trench ground shall be bonded to the vault ground ring. For vaults that contain an incoming bayout, the trench ground conductor, (one of the two trench conductors for Network, shall attach to the grounding insert on its way down to the vault ground ring.

9.9.8. One substantial piece of rebar from a building column shall be bonded and connected to the vault ground ring with 4/0 AWG -7 STR bare soft drawn copper conductor.

9.9.9. Provide a 10-ft "pig-tail" from the vault ground ring at the exterior corners, and from each corner of a sidewalk vault, left out visible after "partial" backfill for NES to bond to a NES provided ground wire along the exterior of the vault.

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9.10. Cable Limiters

9.10.1. Cable limiters shall be indicated by the Electrical Engineer at both the switchboard and in the vault.

9.10.2. See Appendix E for required cable limiters.

9.10.3. Cable limiters shall be flat bar/bus bar type in customer gear.

9.10.4. Electrical Engineer to specify cable to cable type for NES. Vault quantity shall equal 1.5 times number of cables being sent to the vault. Do not include neutral in count, (NES will use more sets than contractor).

9.10.5. Electrical Engineer shall specify cold shrink for each cable limiter. The same quantity as cable limiters shall be supplied to NES. See Appendix E for required cold shrink connector insulators.

9.11. NES Meter Information

9.11.1. Meter locations, room/space requirements, bases, and general information shall be coordinated with NES Meter Department at 615-415-6770.

9.11.2. Meter information is available on the NES website at www.nespower.com under the Builders & Contractors pulldown menu. Download the "Electrical Service Guidelines" under the Guidelines & Manuals pull down. Refer to the Meter section of this manual. For more detailed meter information contact the NES engineer.

9.11.3. NES recommends that businesses who have unknown retail spaces with separate meter type loads, install an adequately sized fused disconnect and a NES approved terminating cabinet with adequate space for meter installations around this equipment. Coordinating space requirements with NES Meter Department.

9.11.4. Coordinate with NES Metering Department for meter base types (Network meter requires an extra terminal on all single-phase services).

9.11.5. Architect will need to specify a stainless steel key box (~4"x4"x1") with provisions for an NES padlock (7/16" shank) adjacent to each Electrical Meter Room for NES personnel to gain access.

9.11.6. Refer to latest revision of Sheet NWS-00004 for example layouts and notes.

9.12. Electrical Switchboard Room Plan Submission

9.12.1. Shall include a ¼ scale drawing or isometric of the switchboard room. This drawing shall indicate transition sections of the gear if the gear is fed overhead from the vault, the fire pump sections if hot sequenced, and the meter equipment space to satisfy the meter requirements of section 9.11.

9.12.2. Coordinate with the Civil Engineer that the site plan and the electrical drawings have no gaps in scope between disciplines from the primary duct banks to the entrance into the electrical vault.

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NETWORK VAULT DESIGN GUIDE

APPENDIX A

NETWORK MAP (AREA INSIDE CIRCLED Yellow AREA)

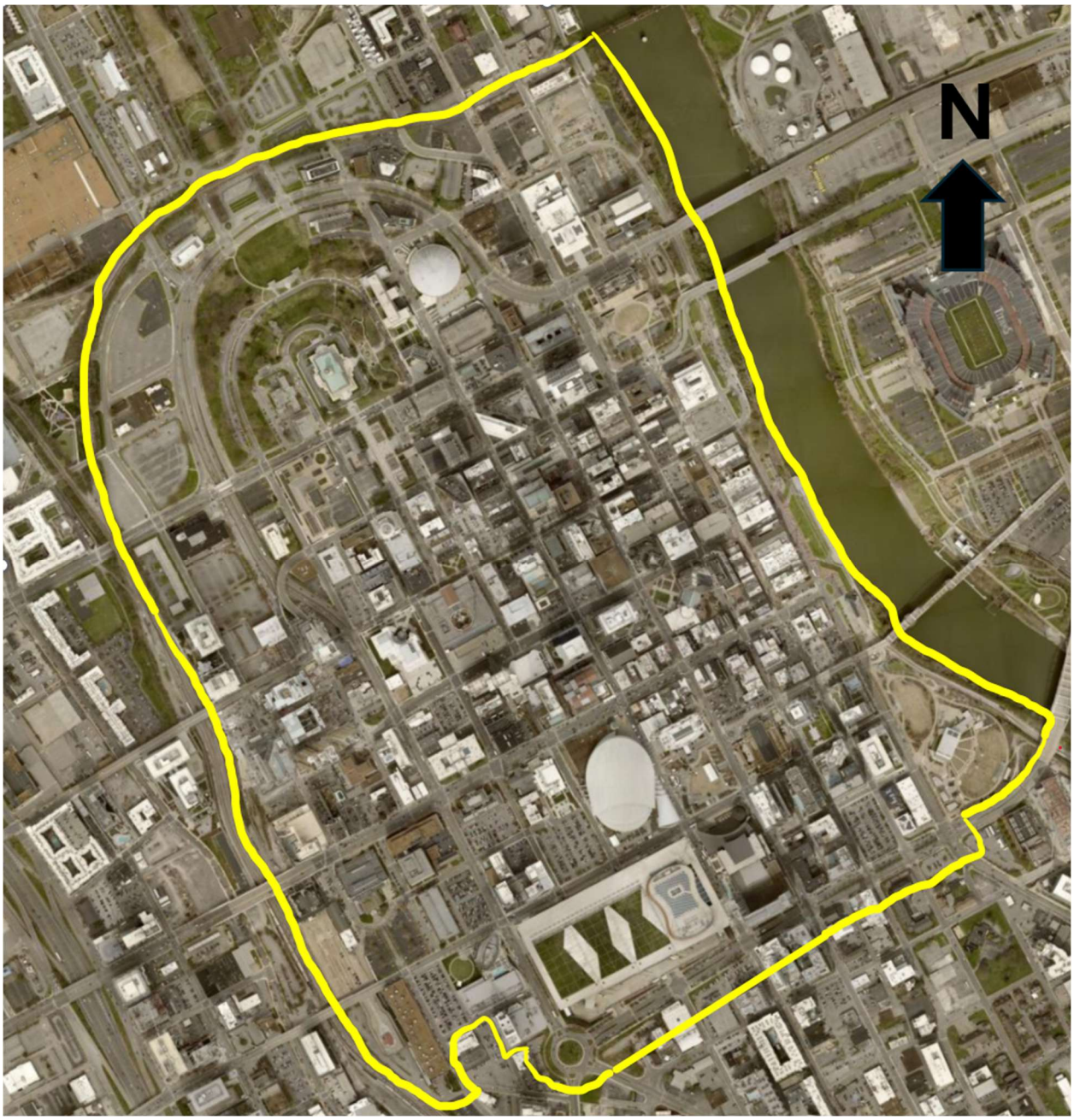


FIGURE 1: NES Network Area

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APPENDIX B

NETWORK TRANSFORMER SPECIFICATIONS

TABLE 1: Network Transformer Requirements for Standard Service Ratings

Secondary Voltage	Typical Service Rating		Quantity and Rating of Transformers		Maximum Available Fault Current
	Size (min)	Size (max)			
(V)	(kVA)	(kVA)	(units)	(kVA)	(kA)
125/216	min	750	(2)	750	87
125/216	751	1125	(3)	750	131
277/480	500	750	(2)	750	40
277/480	751	1500	(3)	750	60
277/480	1501	2000	(3)	1000	78
277/480	2001	3000	(3)	1500	84
277/480	3001	4500	(4)	1500	112
277/480	4500	6000	(4)	2000	149
277/480	6001	7500	(4)	2500	186

TABLE 2: Maximum Standard Network Transformer Dimensions

Rated Power	Secondary Voltage	Rated Current	Width			Length (door closed)			Length (door open)			Height		
(kVA)	(V)	(A)	(In.)	(Ft.	In.)	(In.)	(Ft.	In.)	(In.)	(Ft.	In.)	(In.)	(Ft.	In.)
750	125/216	2005	60	5	0	137	11	5	175	14	7	94	7	10
750	277/480	902	60	5	0	130	10	10	164	13	8	84	7	0
1000	277/480	1203	66	5	6	136	11	4	170	14	2	90	7	6
1500	277/480	1804	66	5	6	143	11	11	181	15	1	94	7	10
2000	277/480	2406	66	5	6	143	11	11	181	15	1	97	8	1
2500	277/480	3007	66	5	6	152	12	8	203	16	11	102	8	6

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TABLE 3: Minimum Working Clearance Required for a Network Transformer

Rated Power	Secondary Voltage	Rated Current	Width			Length			Height (see Sec 5.2)		
(kVA)	(V)	(A)	(In.)	(Ft.	In.)	(In.)	(Ft.	In.)	(In.)	(Ft.	In.)
750	125/216	2005	132	11	0	247	20	7	156	14	0
750	277/480	902	132	11	0	236	19	8	156	14	0
1000	277/480	1203	138	11	6	242	20	2	156	14	0
1500	277/480	1804	138	11	6	253	21	1	156	14	0
2000	277/480	2406	138	11	6	253	21	1	156	14	0
2500	277/480	3007	138	11	6	275	22	11	156	14	0

TABLE 4: Minimum Clearance Required for Moving a Network Transformer

Rated Power	Secondary Voltage	Rated Current	Width			Length			Height		
(kVA)	(V)	(A)	(In.)	(Ft.	In.)	(In.)	(Ft.	In.)	(In.)	(Ft.	In.)
750	125/216	2005	84	7	0	161	13	5	120	10	0
750	277/480	902	84	7	0	154	12	10	110	9	2
1000	277/480	1203	90	7	6	160	13	4	116	9	8
1500	277/480	1804	90	7	6	167	13	11	120	10	0
2000	277/480	2406	90	7	6	167	13	11	123	10	3
2500	277/480	3007	90	7	6	176	14	8	128	10	8

TABLE 5: Miscellaneous Network Transformer Information

Rated Power	Secondary Voltage	Rated Current	Unit Weight	Liquid Capacity of One Unit	Full Load Heat Loss
(kVA)	(V)	(A)	(lbs.)	(gal)	(kW)
750	125/216	2005	12050	320	8.25
750	277/480	902	10400	320	8.25
1000	277/480	1203	13000	450	11.00
1500	277/480	1804	18950	570	16.50
2000	277/480	2406	22550	680	22.00
2500	277/480	3007	29050	760	27.50

TABLE 6: Secondary Cable Color Code

PHASE	VOLTAGE	
	216Y/125V	**480Y/277V**
Neutral	White	Gray
A	Black	Brown
B	Red	Orange
C	Blue	Yellow

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APPENDIX C

STANDARD LIGHTING CALCULATION

ROOM NAME: TRANSFORMER VAULT

DATA REQUIRED:

ROOM LENGTH (RL): _____
ROOM WIDTH (RW): _____
ROOM AREA (RL X RW): _____
CEILING HEIGHT: _____
FIXTURE HEIGHT ABOVE WORK PLACE (HAWP): 7'
MAINTENANCE FACTOR (MF): .85
LAMP LUMENS (LL) (OBSTAINED FROM CATALOG): _____

$$\text{ROOM CAVITY RATIO (RCR)} = \frac{(5)\,(7)\,(RL+RW)}{(RL)\,(RW)}$$

COEFFICIENT OF UTILIZATION (CU) (OBTAINED FROM CATALOG): _____

$$\#\text{FIXTURES} = \frac{60\,(RL)\,(RW)}{(2)\,(LL)\,(CU)\,(.85)}$$

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NETWORK VAULT DESIGN GUIDE

APPENDIX D

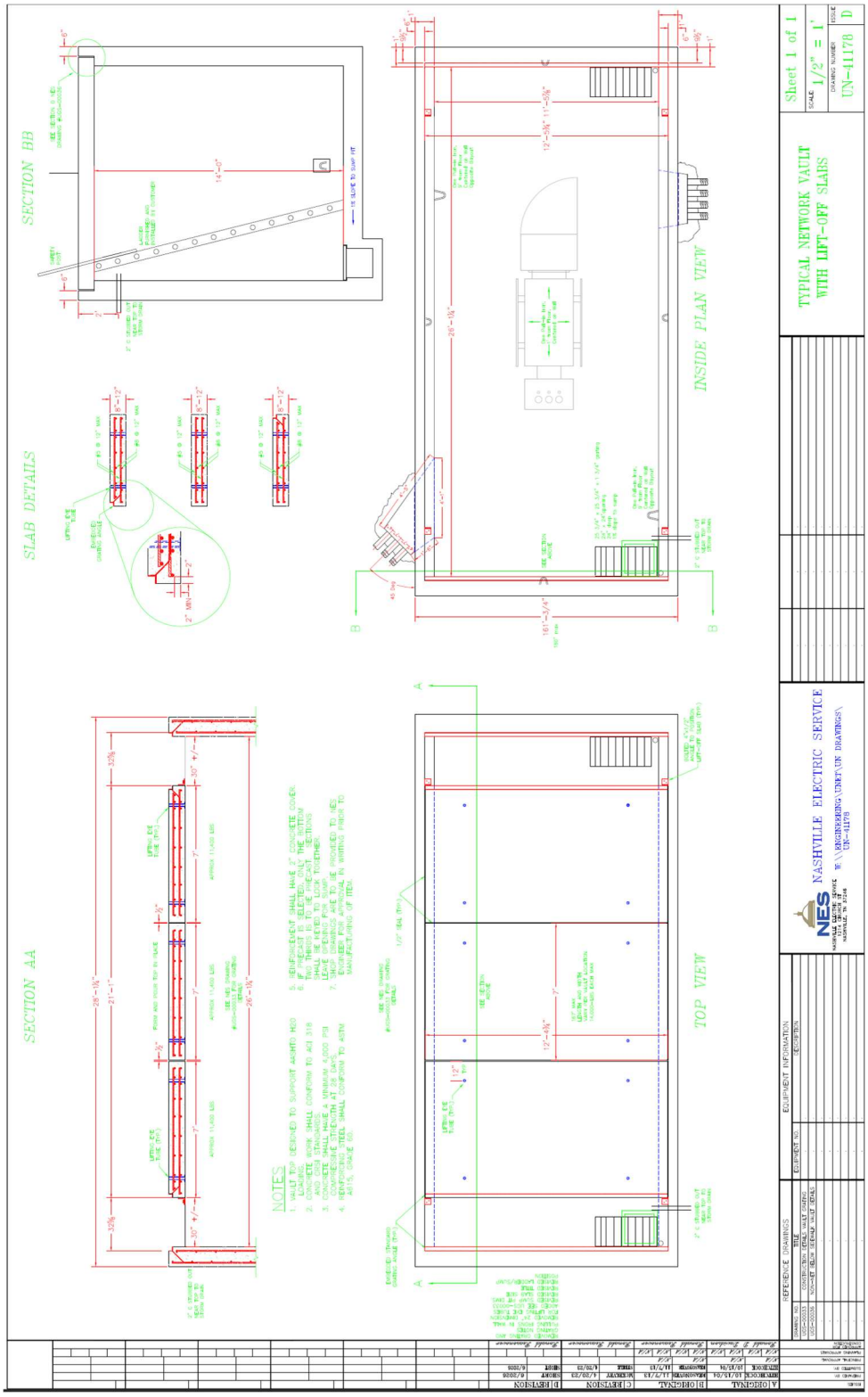
STANDARD DRAWINGS (Have NES Engineer provide larger or updated drawing)

p. 29 NES Drawing #UN-41178 - Standard Vault Top Design - Lift-Off Slabs
p. 30 NES Drawing #UGS-00033 - Vault Grating
p. 31 NES Drawing #UN-22304 - Concrete Support Beams for Vault Transformer
pp. 32-35 NES Drawing #UN-42979 - Network Conduit System Details
p. 36 NES Drawing #UN-41535 - Standard Vault Bayout Detail
p. 37 NES Drawing #NWS-00004 – Network Meter Diagram
p. 38 NES Drawing #NWS-00006 – Network Vault Grounding Detail

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NETWORK VAULT DESIGN GUIDE

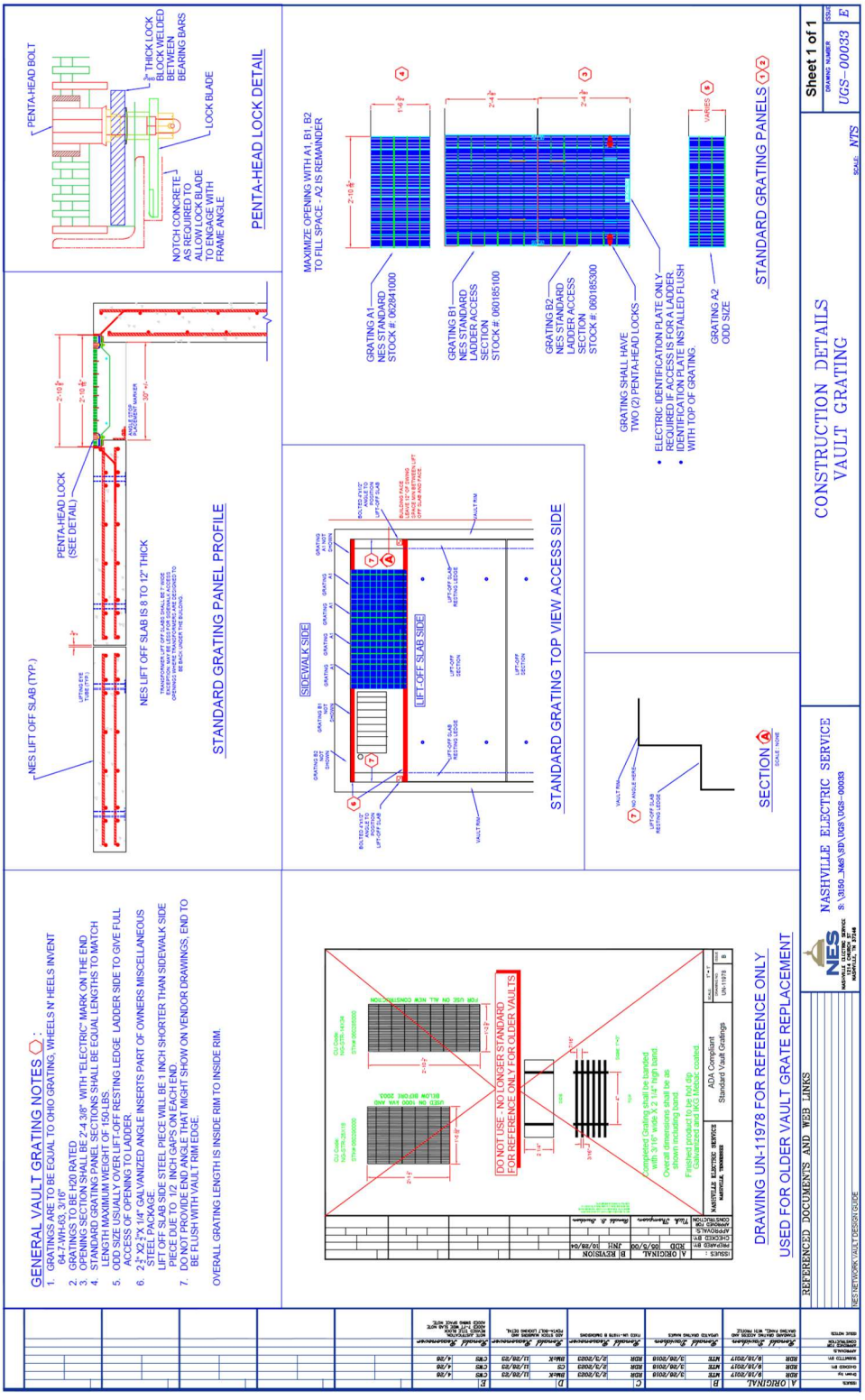
NES Drawing #UN-41178 – Standard Vault Top Design – Lift-Off Slabs



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NETWORK VAULT DESIGN GUIDE

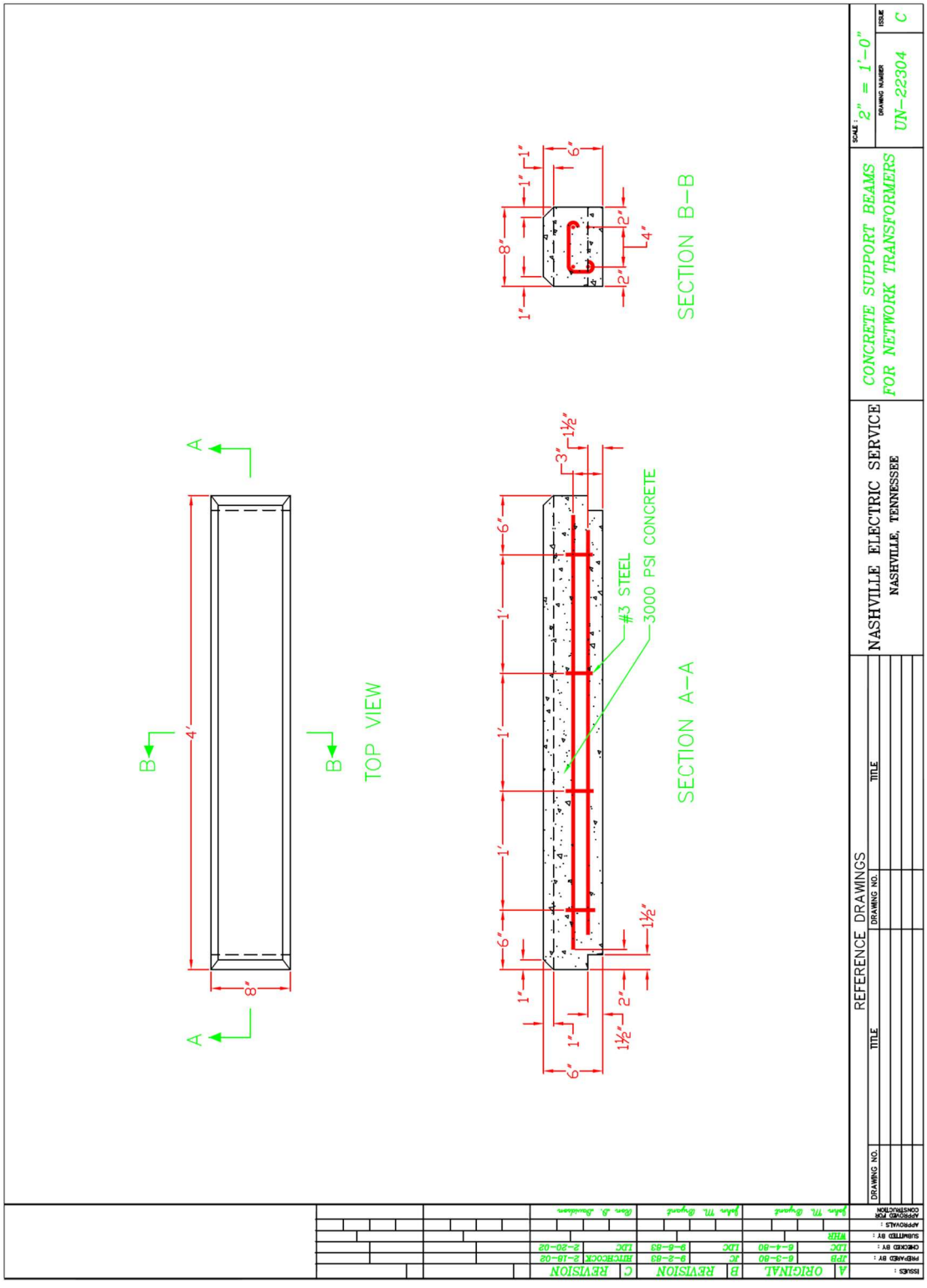
NES Drawing #UGS-00033 - Vault Grating



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NETWORK VAULT DESIGN GUIDE

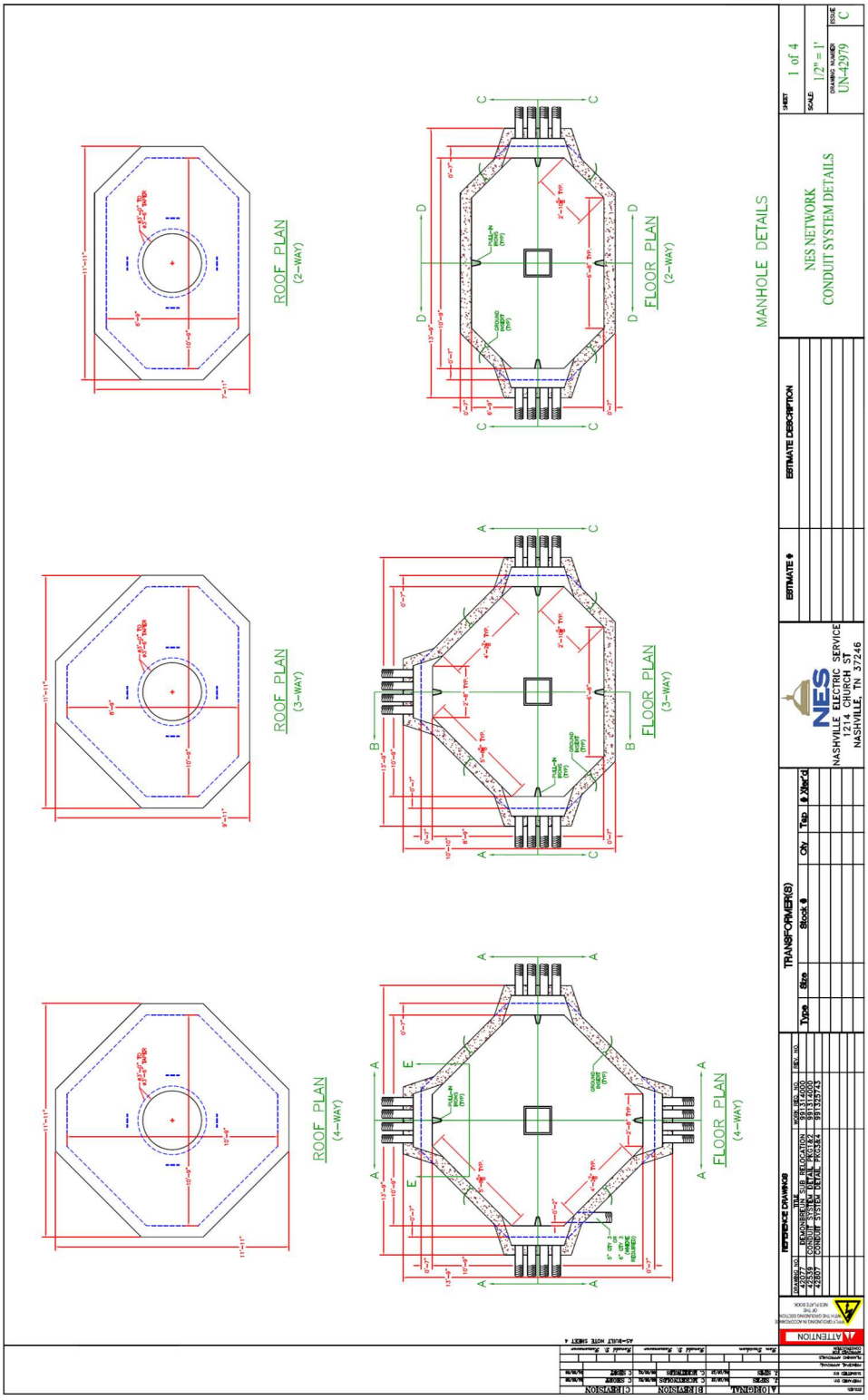
NES Drawing #UN-22304 - Concrete Support Beams for Vault Transformer



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NETWORK VAULT DESIGN GUIDE

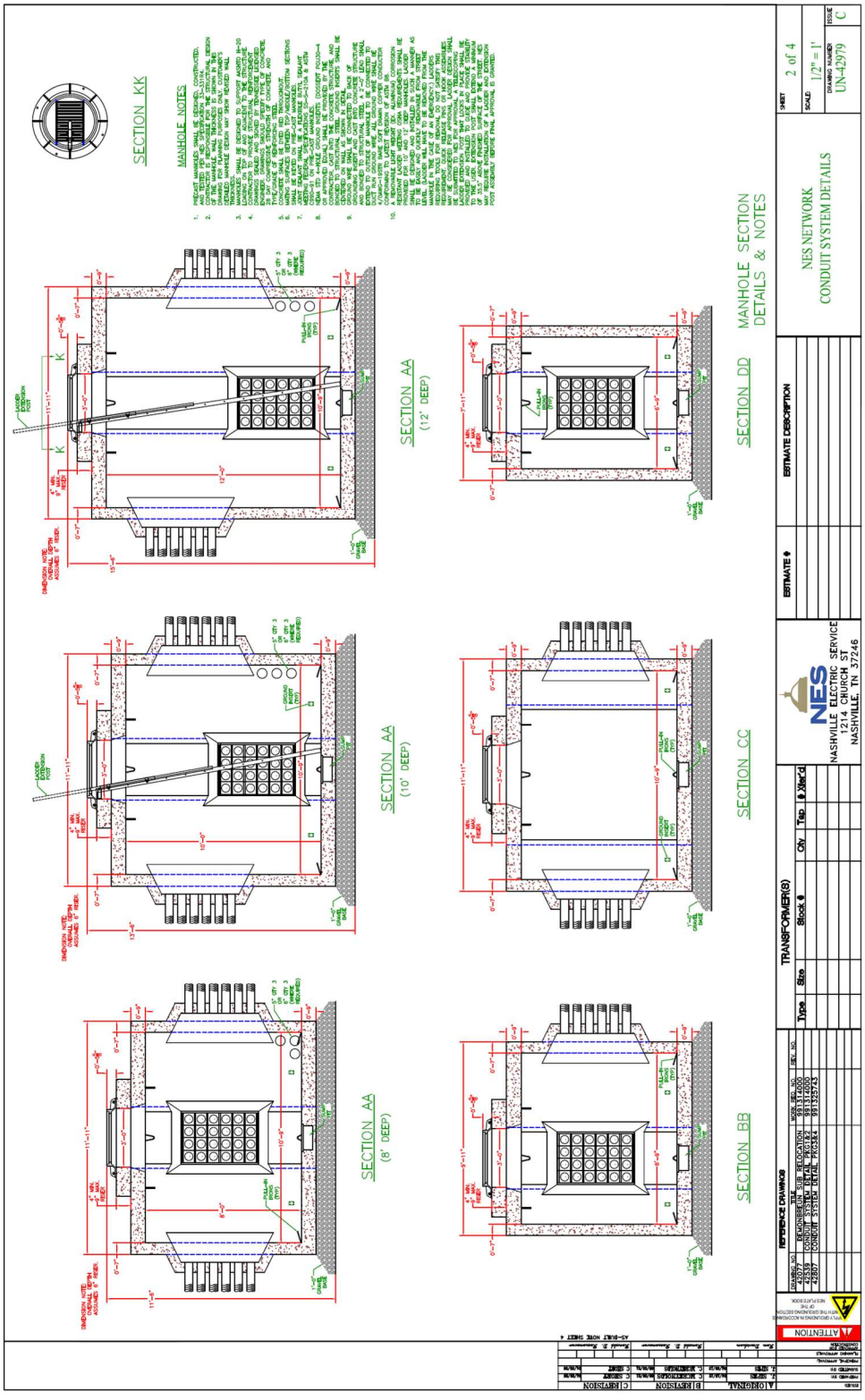
NES Drawing #UN-42979 - Network Conduit System Details



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NETWORK VAULT DESIGN GUIDE

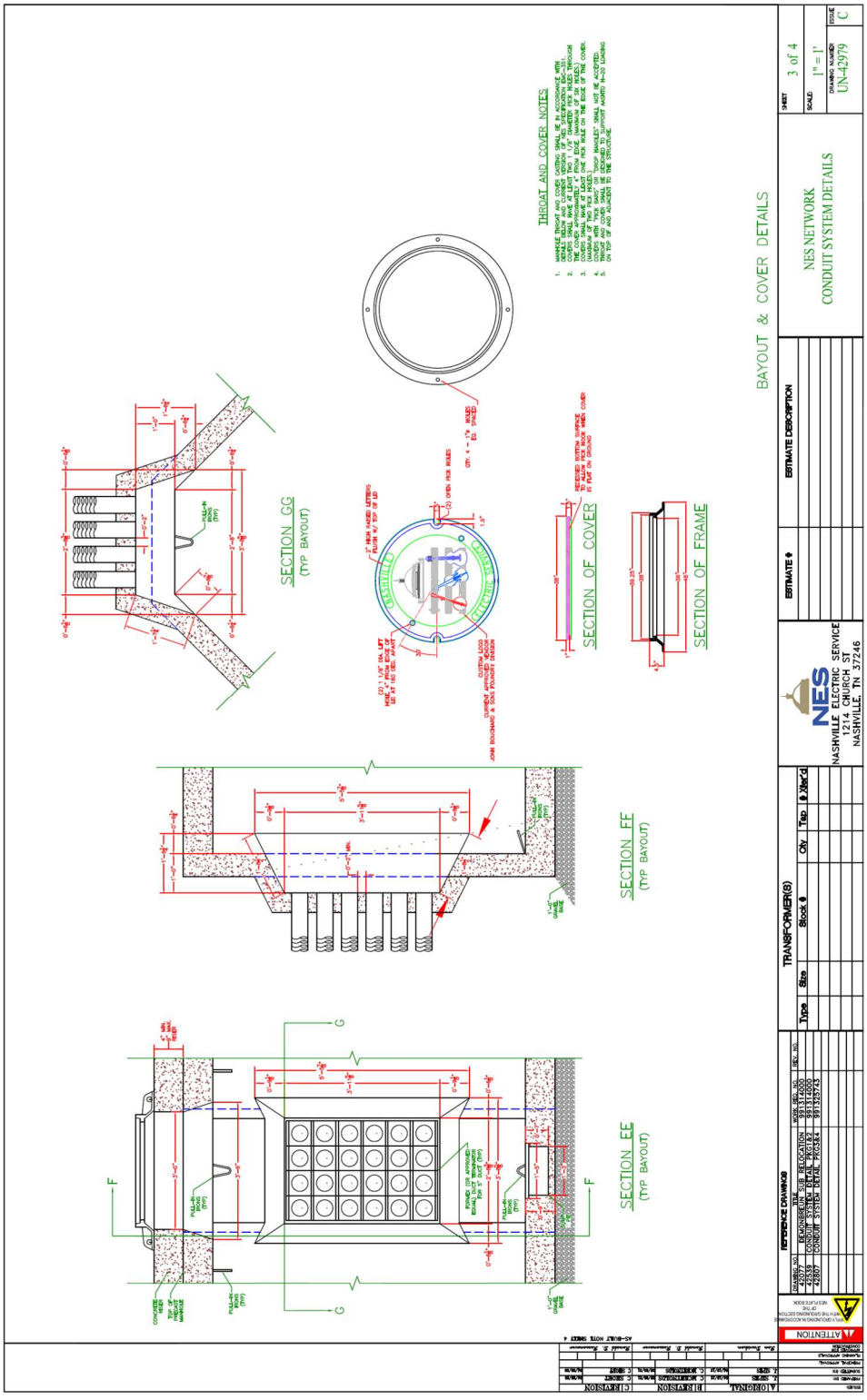
NES Drawing #UN-42979 - Network Conduit System Details



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NETWORK VAULT DESIGN GUIDE

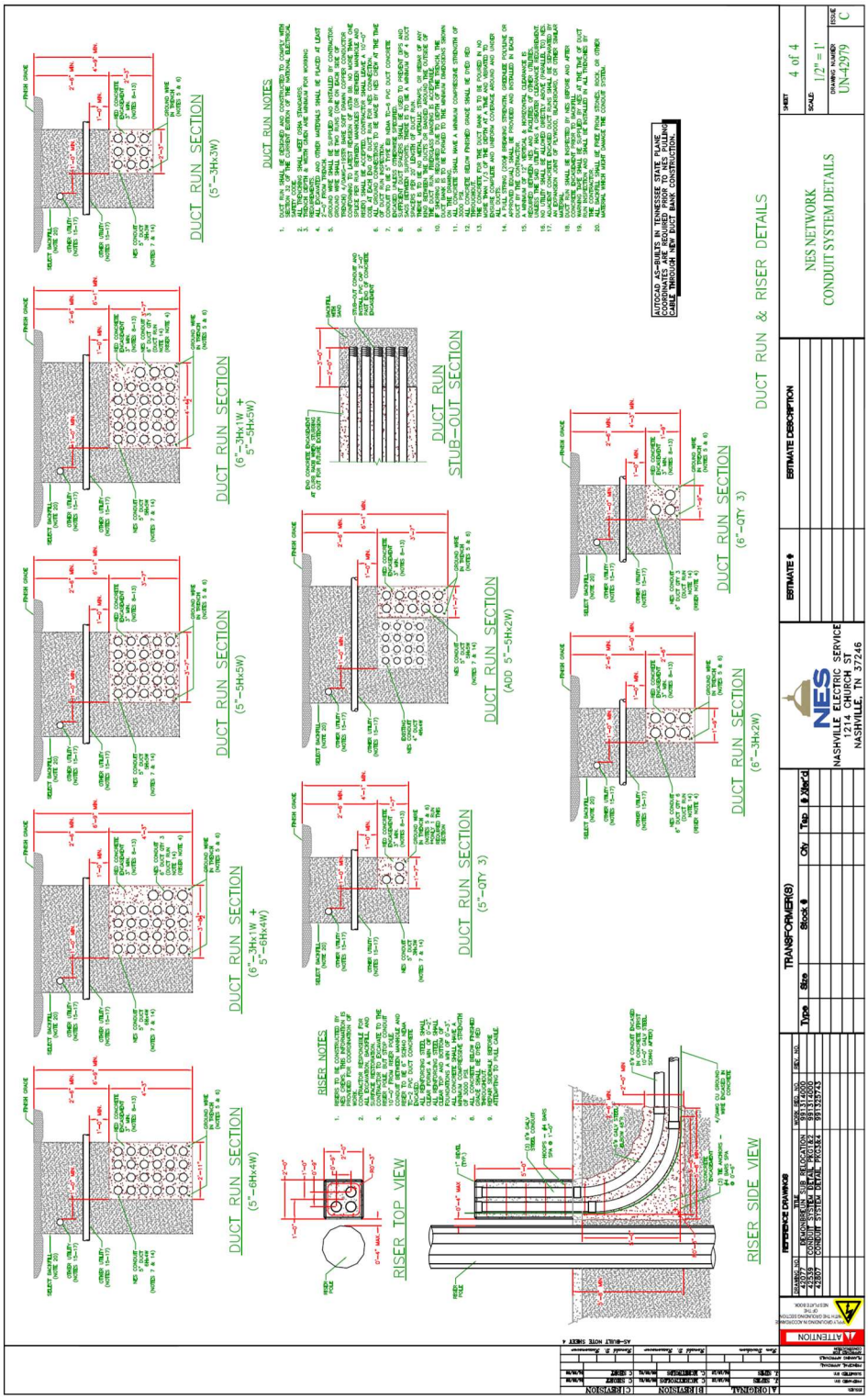
NES Drawing #UN-42979 - Network Conduit System Details



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NETWORK VAULT DESIGN GUIDE

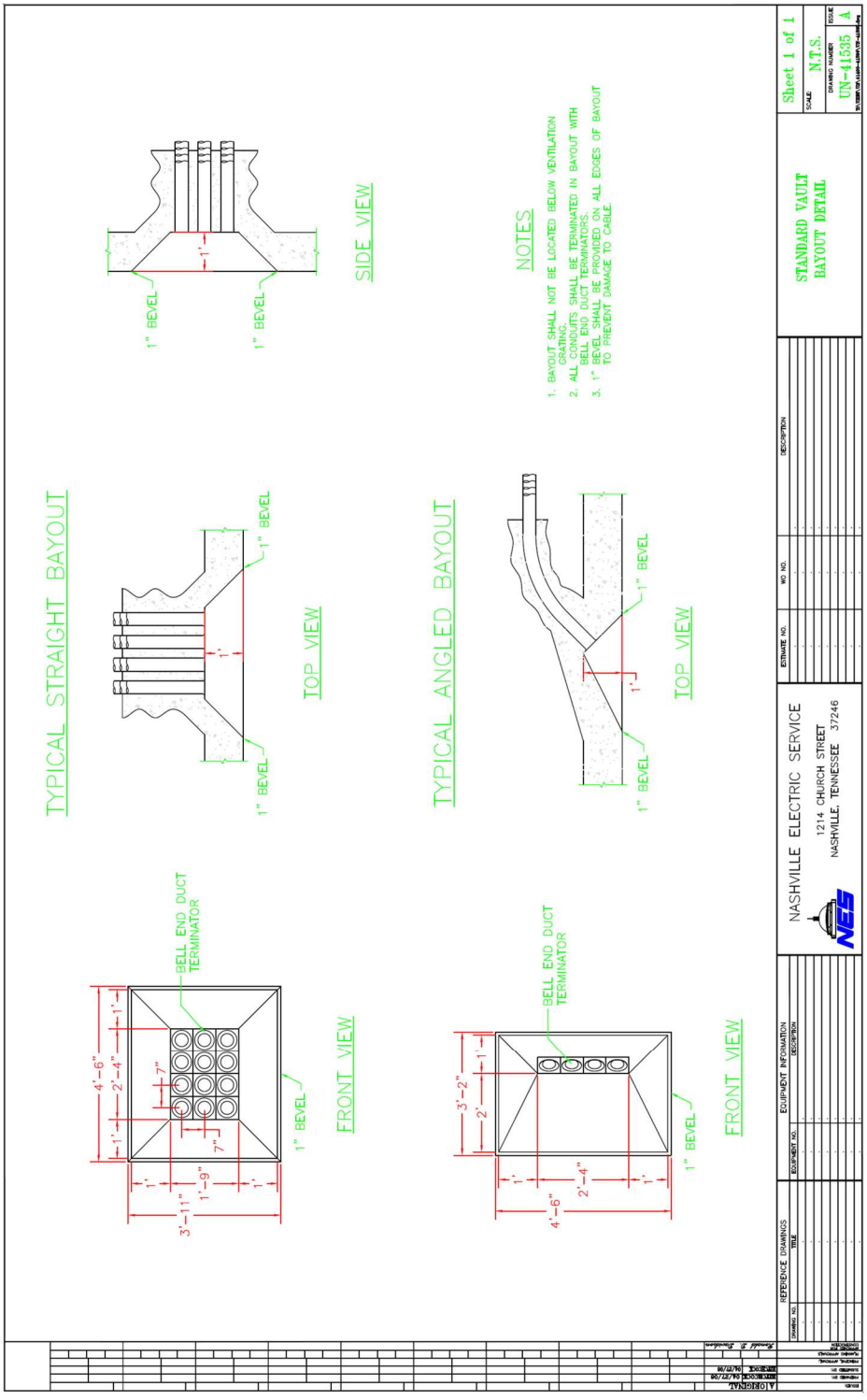
NES Drawing #UN-42979 - Network Conduit System Details



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NETWORK VAULT DESIGN GUIDE

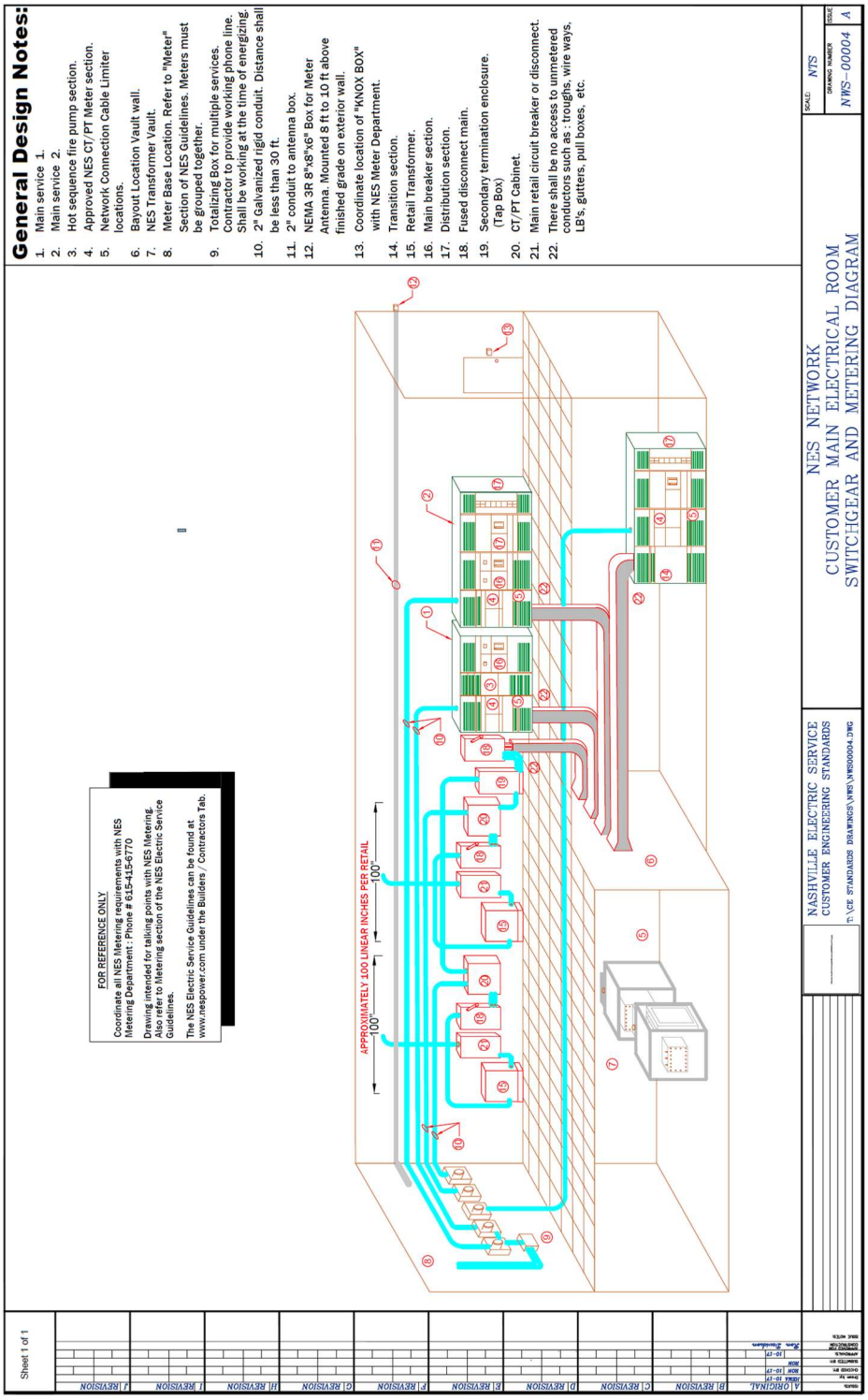
NES Drawing #UN-41535 - Standard Vault Bayout Detail



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NETWORK VAULT DESIGN GUIDE

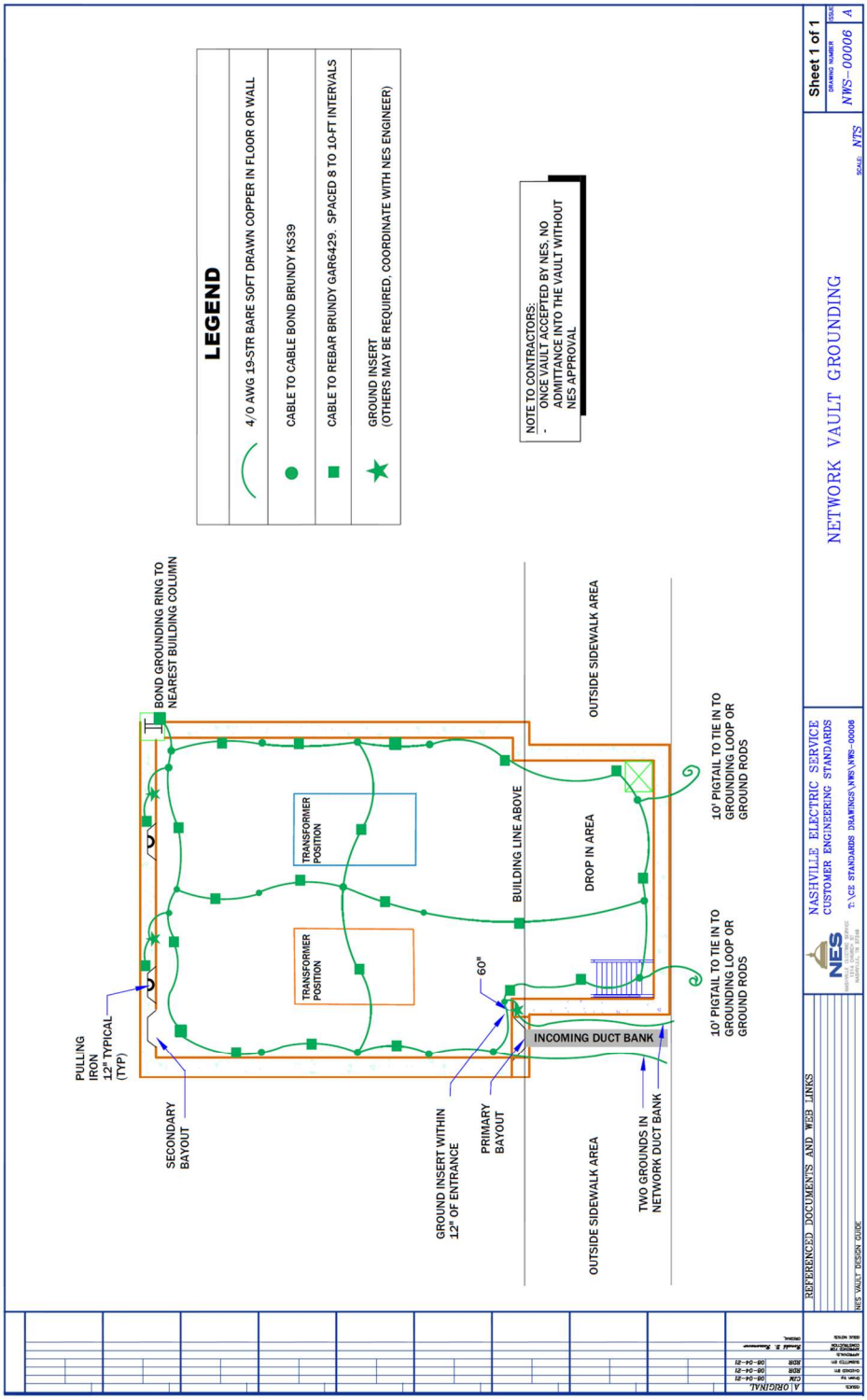
NES Drawing #NWS-00004 - Network Meter Diagram



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NETWORK VAULT DESIGN GUIDE

NES Drawing #NWS-00006 - Network Vault Grounding Detail



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APPENDIX E

REQUIRED HARDWARE (not an exhaustive list)
CUSTOMER PROCURED AND INSTALLED

Grounding Provisions - Ground Inserts

Manufacturer: Burndy®

Product: YGF29-4N Drawing Number SD082518-01
Cable Range: Min. #2 STR. 292 D - MAX. 250 MCM - 575 D

Vault Lift Off Slab – Steel Tube Insert

Manufacturer: N/A

Product: 1-¼”- Galvanized Steel Tube cut to the approximate thickness of the lift off slab

Grating

Manufacturer: Ohio Gratings Inc.®

Product: Wheels n’ Heels® InVent 64-7-WH-63 3/16” Galvanized

Vault Door - Panic Hardware

Manufacturer: Yale®

Product: 7100 Series flat bar exit device with door closer

Outside Trim: Augusta trim lever Type 626(F) Series wide escutcheon trim

Lock Set: Setup to operate as “Storeroom” (ANSI 09) function

Lock Rim Cylinder and Core: Shall be provided and installed by NES

Personnel Access - Ladder

Corrosion resistant, per OSHA Standard 1926.1053, for “Fixed Ladders”

Personnel Access - Ladder Safety Post

Manufacturer: Bilco®

Product: LadderUp® Safety Post model LU-2

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Hatch Access Panel

Manufacturer: Inwesco

Product: 3048AL-CWSH-020L or equivalent with same opening size and operation. Hatch must use Penta head bolt and have "Electric" stamped on the lid.

Cable Limiters (Network)

Manufacturer: Cooper Bussmann®	OR	Ferraz Shawmut®
Product: 4/0 KCF, 500 KCM		Amp-Trap® CP4/0C1, CP500C1

Cable Limiters – Molded Rubber Insulating Sleeves for Cable Limiters (Network)

Manufacturer: Mersen

Product: 4/0CCR for 4/0 MCM, 500CCR for 500 MCM

Lighting

Manufacturer: Lithonia Lighting®

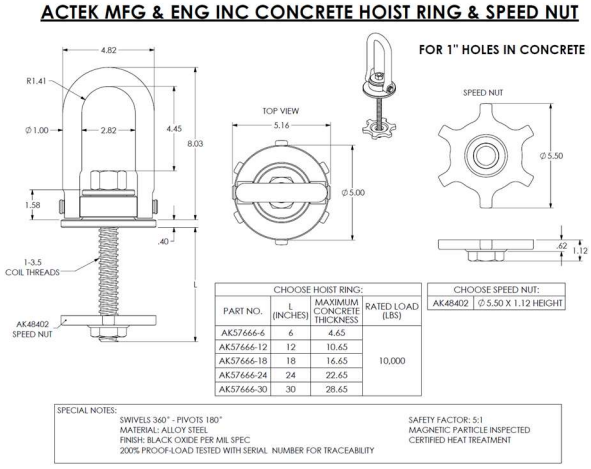
Product: CSVT L48 5000LM MVOLT 40K 80CRI Wet Rated.

Manufacturer: Columbia Lighting
Product: LXEM-4-40ML-RFA-EDU

Manufacturer: Cooper
Product: 4VT3-LD5-6-G-UNV-L840-CD1-U

Typical Rigging Assembly

Provide 4. Provide a base to set the lift off slabs on prior to lifting so the bolts are not damaged when setting the slab down. Order with screws that are at least 6 inches longer than the depth of the slab. Contact www.mazzellacompanies.com or 615-256-8658 local or 1-800-752-7229.



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Concrete Support Beams

Manufacturer: Oldcastle Precast

Product: 8”x4’x6” Precast NES Network Vault Support, Special #98617-1 Item #2500035

Sump Pump (provided by NES)

Manufacturer: Stancor, Product: Avenger Series – Model: SE-50

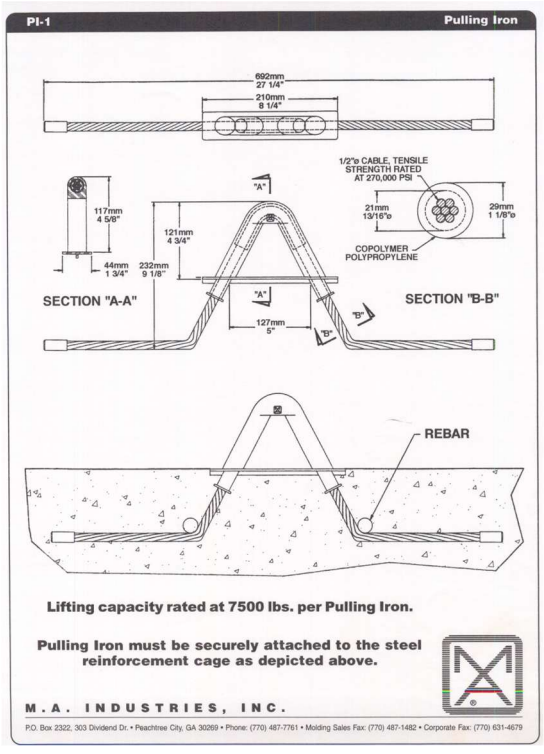
Manufacturer: Zoeller, Model: 940-003

Manufacturer: Fluid Systems, Model: 153-00271 OSS-100

Recessed Pulling Iron Example







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NETWORK VAULT DESIGN GUIDE

Revision Date	Revision History	Approvals
07/02/2015	Original issue – based on Network Vault Design Guide and Dry Vault Design Guide.	*Wes Suddarth* Created By *Ron Davidson* Supervisor *Nick Thompson* Manager
11/3/2016	Combined Non-Network & Network vault design guides.	Created By Supervisor Manager
8/27/2020	Separated guide between Network/Non-Network. Overall clarification of requirements.	*GS|RR|TV* Created By Supervisor Manager
08/06/2021	- Updated Sections - 1.3, 2.9, 3.2, 4.1, 4.2, 5.1, 6.5, 6.8, 9.1, 9.7, 9.8 - Appendix D – Updated Standard Drawings - Appendix E – Updated hardware list and added photos	Created By Supervisor Manager

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7/01/2026	"Refer to" references changed to "See…" - Took out NES department references (since several have changed names) to NES Engineer, NES Account Representative…. 2.4 3.2.5 4.1.8, 4.2.2(a), 4.2.10(d), (g), (h) 6.1.5, 6.2.3, 6.5.3(g), 6.7.4 9.1.9 Specific Changes - 1.3 Changed red to yellow - 3.2.1 Changed some of the grammar. Indicated they could send electronic copies. - 3.2.2 Changed the wording are being satisfied to are satisfied. - 3.3.1 Deleted the printed copy, Indicated NES would not take over the vault or pull cable until we had "As-Builts". - 3.3.3 Changed ductbank to duct bank. - 4.1.1 Indicated we would not inspect the vault without Construction Drawings. (Crew request). Make sure you get the construction drawings for the crew. - 4.1.10 Changed wording to share this to for sharing the. - 4.2.2 Changed wording break down to breakdown. - 4.2.4(c) Changed transformer to plural. - 6.1 Changed notes to include through 6.1.6. Deleted note 6.1.4 about the lift off inserts. Prior note was to 6.1.8 which did not exist. Remaining notes decreased a number. - 6.2.1 Sump pit changed to 24"x24". - 6.5.7 Removed the Dayton Lifting Inserts and replaced it with a hollow tube at the Crew's request. - 6.6.1 Changed the drawing numbers to UGS-00033. - 6.8.3 Changed the sump dimensions to 24"x24"x24" - 6.8.5 Changed the wording to indicate size to shall indicate the size, shall be chosen to minimize the amount of bends and elbows to minimize the number of bends and elbows. - 6.8.6 Changed the wording Note for contractor to Note for the contractor, coordinate storm structure, to coordinate the storm structure, Needs to be routed to - This connection needs to be routed. Added - This needs to be routed outside of the building. - 9.1.6 Changed the wording vaults at grade, to vaults at Street Level. - 9.1.12 Added Paragraph to protect to feeding duct bank into the vault into the hands of the Electrical Contractor and General Contractor to focus on the area every weekly meeting.	*Cedric Short* Created By *Ronald Reasonover* Supervisor *Tony Richman* Manager

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	Appendix A Revised the Map (area around the round-about/Cummins Station, and Central Sub to the railroad bridge changed. Appendix B Table 1. 500-kVA added as the minimum size for a 480V – Service. Appendix D Indicated to get the drawings from the NES Engineer, and the page number. Changed the order of the drawings. UN-41178 Standard Vault Top Desing – Lift Off Slabs -Added the 2nd row of rebar. (was changed not issued), Removed the grating. Grating is shown on the next sheet. Made the slabs 7-ft wide. Adjusted the vault length due to the increase. UGS-00033 Construction Details Vault Grating Justified the notes. Added a 7ft Wide note for the slabs. Added a swing space note. UN-42979 Network Conduit Systems Details Added As-Built Note to Sheet 4 Appendix E Removed the Dossert Insert. Indicated a Steel Tube Insert for the Lift Off Lids. Added detail Typical Rigging Assembly. Added a second / third sump pump manufacturer. Revised the photo of the Pulling Iron.	
10/15/2026	9.3.4 Added NEMA Type 4X enclosure to the requirement.	DocuSigned by: Cedric Short 59CF5153311D40F... Created By DocuSigned by: Ronald Reasonover D08B36F0953F4B6... Supervisor DocuSigned by: Tony Richman AA2ACBBD668B45D... Manager