



# U.S. ARMY RESERVE NETWORK ENTERPRISE CENTER (ARNEC) INFRASTRUCTURE TECHNICAL CRITERIA





## FOREWORD

This criteria is a living document and will be periodically reviewed and updated. As part of the Army Reserve's responsibilities to provide technical criteria for infrastructure design and construction, this document and all updates will be made available to all users. The proponent for Army Reserve Information Technology is USARC G-6. Development and maintenance of this criteria is the responsibility of USARC G-6, in coordination with ARIM-D, USACE, and ISEC.

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## SUMMARY OF CHANGES

The following information summarizes the changes or additions to this version of the Infrastructure Technical Criteria.

### **General**

- Added acronym “ARNEC” to title page.
- Updated the Table of Contents.

### **Specific Criteria and Diagrams**

- 1.3.4.3 Revised list of rooms not considered useable floor space.
- 1.3.6 Added language regarding the location of telecommunication spaces.
- 1.4.1 Added design requirement for separate telecommunications design sheets.
- 1.4.3 Added option for RCDD to serve as project foreman.
- 2.1.3.1 Clarified OSP pathways requirements in locations where the Army Reserve is a tenant unit.
- 2.1.3.3 Added 12 inch sump is allowed in all maintenance holes.
- 2.1.3.8 Added IMC/RMC conduit requirement for extending OSP pathways.
- 2.1.4.3 Added requirement for conduit from TER to TE.
- 2.1.4.6 Added requirements for routing cabling thru electrical or mechanical rooms.
- 2.1.4.8.1 Revised horizontal cabling outside diameter to .29 inches.
- 2.1.4.8.2 Added criteria to allow daisy-chaining of up to three outlet boxes.
- 2.1.5.2.6 Revise cable tray initial fill capacity to 25 percent.
- 2.1.5.4.1 Added requirements for painting plywood backboard.
- 2.1.5.4.3 Added cable tray requirement above TE locations.
- 2.2.1.1.3 Revise rack static load capacity to 1000 lbs.
- 2.2.1.3 Clarified telecommunications enclosure requirements.
- 2.3.1 All fiber and copper backbone cable shall be homerun with no breaks or splices.
- 2.3.3 Added requirement for Ultra-Physical Contact (UPC) fiber termination.
- 2.3.4 Added requirement for 12 strands of SM fiber from EF to TER.
- 2.3.5 Revised copper backbone cabling rating to category 3.
- 2.3.7 Added requirement backbone copper cabling terminations using 110 style IDC termination.
- 2.3.10 Revised number of cat. 6 cables from EF to TER to 24.
- 2.4.1 Revised horizontal cabling requirement to category 6a.
- 2.4.4 Added requirement for protective plastic insert when using low-voltage mounting brackets.
- 2.4.9.4 Added requirement for WAP and WID outlet locations not to be located on exterior walls.
- 2.4.9.4.1 Clarified WAP outlet grid centering requirement.
- 2.4.12.1 Revised horizontal cabling slack to require figure 8 for J-hook slack.
- 2.6.4.2.1 Removed requirement to test both ends of SM fiber with OTDR.
- 2.6.4.2.2 Added minimum length requirement for fiber testing launch cable.
- 2.6.4.3.1 Revised backbone copper testing requirements.
- 2.7 Revised section title from SIPR to Secure Communications.
- 2.7 Revised Secure Communications infrastructure requirements.
- 2.11.1 Revised bonding criteria to remove specific version of TIA 607.
- 2.11.3.5 Added requirement for rack bus-bar (RBB) to be electrotin plated.



- 2.11.8 Added language prohibiting use of self-tapping screws.
- 2.11.10 Added clarification regarding routing of bonding conductors.
- 2.11.11 Added paint scraping requirement for all bonding conductor connections.
- Appendix A Added Secure Communications Access Area (SCAA) to glossary.
- Appendix A Added Ultra-Physical Contact (UPC) to glossary.
- Appendix A Added Primary Bus-Bar (PBB) to glossary.
- Appendix A Added Rack Bus-Bar (RBB) to glossary.
- Appendix A Added Secondary Bus-Bar (SBB) to glossary.
- Diagram B.02 Added 2 new symbols to the Symbols Legend.
- Diagram B.03 Added wall mounted FOC FOPP for 12 strand FOC to TER.
- Diagram B.04 Added wall mounted FOC FOPP for 12 strand FOC to TER.
- Diagram B.07 Added 12 strand FOC to EF from the rack mounted FOC FOPP.
- Diagram B.23 Added diagram for typical floor mounted cabinet.
- Diagram B.24 Added diagram for typical wall mounted cabinet (Hubbell RE4X).
- Diagram B.25 Revised wall mounted cabinet (Hubbell RE4X) wall elevation diagram.
- Diagram B.26 Revised SCAA wall elevation diagram.
- Diagram B.27 Revised SCAA aerial diagram.
- Diagram B.28 Revised SIPR-In-A-Box wall elevation diagram.
- Diagram B.29 Revised SIPR-In-A-Box aerial diagram.
- Diagram B.30 Revised SCAA enlarged components diagram.
- Diagram B.33 Revised terminology to comply with ANSI/TIA-607-D.
- Diagram B.34 Revised diagram to include the 12 strand FOC from the EF to the TER.
- Diagrams B.44 thru B.52 Revised to add language clarifying intent of the labeling diagrams.



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# 1. Chapter 1 – Introduction and General Overview

## 1.1. Purpose and Applicability of this Document

- 1.1.1. The purpose of this document is to define Army Reserve standards and requirements for telecommunications infrastructure, specifically standards and requirements for new sites and existing facilities as well as site and facility modernization. This document defines the requirements needed to ensure consistent and compliant design and construction of telecommunications infrastructure throughout the Army Reserve.
  - 1.1.2. Army Reserve telecommunications strategy will evolve over time and individual facilities may have unique requirements. The USARC G-6 Network Enterprise Center (NEC) reserves the right to issue Infrastructure Criteria Update Bulletins as needed. These bulletins will be used to supplement this document. The USARC G-6 Network Enterprise Center (NEC) has the responsibility for authorizing individual criteria updates, as well as additions to or variations from the criteria contained in this document.
  - 1.1.3. The USARC G-6 NEC is the proponent for all telecommunications infrastructure requirements and shall participate in individual project scope review, pre-design, charrette, and design meetings to review and define the infrastructure requirements for these projects. USARC G-6 NEC is also the proponent for quality control (QC) inspections for all initiatives, projects, efforts, etc. involving telecommunications infrastructure.
  - 1.1.4. This criteria, the Army Installation Information Infrastructure (I3A) criteria, and UFC 3-580-01 (Telecommunications Interior Infrastructure Planning and Design) are required documents and must be included and complied with in the design and specifications for all projects.
    - 1.1.4.1. For clarification on relationship between the I3A, UFC 3-580-01 and this criteria the following is to be adhered to:
      - 1.1.4.1.1. The I3A criteria is the governing document for Outside Plant (OSP) infrastructure design and construction.
      - 1.1.4.1.2. UFC 3-580-01 is the governing document for Inside Plant (ISP) infrastructure design and construction.
      - 1.1.4.1.3. This criteria supplements the I3A and UFC 3-580-01 with requirements unique to the Army Reserve.
      - 1.1.4.1.4. The USARC G-6 NEC Infrastructure Team Lead will address any conflicts between the I3A and this document.
      - 1.1.4.1.5. Refer to I3A and UFC 3-580-01 for all requirements not specifically addressed in this criteria.
  - 1.1.5. This document does not supersede any contract for design or construction of any individual Army Reserve project; if conflicts exist between this document and a contract, the conflict must be brought to the attention of the appropriate project manager for resolution.
- ## 1.2. Strategy for Delivery of Telecommunication Services for Army Reserve Facilities
- 1.2.1. When a Reserve Center is located off of an installation, camp, post, or station (e.g. Standalone USARC), the Army Reserve Command G-6 will provision both voice and data services.
  - 1.2.2. When a Reserve Center is located on an installation, camp, post, or station, the Army Reserve Command G-6 will provision data services to be delivered to the installation demarcation point. The service will then be extended thru the installation distribution backbone.
  - 1.2.3. When a Reserve Center is located on an installation, camp, post, or station, the Army Reserve prefers to obtain voice services from the installation. If the installation cannot provide voice services, USARC G-6 will provide direction on the way ahead with such services.



### 1.3. Information and Communications Technology Service and Distribution Spaces

- 1.3.1. Army Reserve telecommunications spaces are dedicated to housing voice and ARNet data services infrastructure and equipment.
- 1.3.2. Descriptions and requirements for Army Reserve telecommunications spaces are found in UFC 4-171-05 *Army Reserve Facilities Design Guide*. The information for telecommunications spaces listed in this document are in addition to what is specified in UFC 4-171-05.
- 1.3.3. Each site or campus shall have only one Entrance Facility (EF) (a.k.a. DEMARC).
  - 1.3.3.1. The EF is typically located in the main training building. However, the EF location can vary depending on the needs of the site or campus.
  - 1.3.3.2. When a Reserve Center is located on a military installation, camp, post, or station, the location of the site DEMARC shall be determined by the installation host (e.g. Active Army NEC).
  - 1.3.3.3. The voice and data services from the public service provider shall terminate in the EF and be extended from the EF to the Telecommunications Equipment Room (TER).
- 1.3.4. Unless a joint use site, each Army Reserve site or campus shall have only one TER.
  - 1.3.4.1. The TER is typically located in the main training building. However, the TER location can vary depending on the needs of the site or campus.
  - 1.3.4.2. If joint use site, provide a TER for each Service (e.g. Army Reserve, Army National Guard, USMC, etc.) occupying the site.
  - 1.3.4.3. Additional Telecommunications Rooms (TRs) are required for every 10,000 sq. ft. of usable floor space. Note that additional TRs may be required in larger buildings to maintain compliance with TIA/EIA 295 ft. (90 m.) horizontal link distance limit. Provide a TR for each Service (e.g. Army Reserve, Army National Guard, USMC, etc.) occupying a joint-use Reserve Center (AFRC). A TR is not required in buildings with no telecommunications requirements (e.g. Unheated Storage Building). When calculating the number of TRs required, note that the TER counts as a TR. The following spaces are not considered as useable floor space and do NOT need to be considered in the calculation of usable floor space:
    - 1.3.4.3.1. Corridors
    - 1.3.4.3.2. Vestibule
    - 1.3.4.3.3. Lobby
    - 1.3.4.3.4. Storage Room
    - 1.3.4.3.5. Kitchen (Except the Kitchen Office)
    - 1.3.4.3.6. Scullery
    - 1.3.4.3.7. Mechanical Room
    - 1.3.4.3.8. Electrical Room
    - 1.3.4.3.9. Janitors Closet
    - 1.3.4.3.10. Storage Closet
    - 1.3.4.3.11. Physical Readiness
    - 1.3.4.3.12. Assembly Hall
    - 1.3.4.3.13. Locker Rooms
    - 1.3.4.3.14. Restrooms
    - 1.3.4.3.15. Unit Storage Area
    - 1.3.4.3.16. Arms Vault
    - 1.3.4.3.17. Elevator
    - 1.3.4.3.18. Elevator Machine Room
    - 1.3.4.3.19. Stairwell
    - 1.3.4.3.20. Battery Room
    - 1.3.4.3.21. Fluid Distribution



- 1.3.4.3.22. Controlled Waste
- 1.3.4.3.23. Vending Area
- 1.3.4.3.24. Work Bay
- 1.3.4.3.25. Maintenance Bay

- 1.3.5. The TER and each TR shall be located as close as practical to the center of the area it serves. This will provide for better cabling distribution and will help minimize horizontal cabling lengths.
- 1.3.6. It is highly desirable that telecommunications spaces are not located adjacent to electrical rooms, mechanical rooms, elevator machine rooms, or restrooms.
- 1.3.7. There shall not be any equipment (piping, ductwork, machinery, etc.) that does not serve the EF, TER, TR installed above, below (e.g. in or below slab) or in the EF, TER, TR nor will this equipment pass-through or enter the EF, TER, TR spaces. Add the following note to the applicable Fire Safety, Plumbing, and Mechanical design sheets, design analysis, and specifications: "Equipment (piping, ductwork, machinery, etc.) that does not serve the EF, TER, or TR(s) shall not be installed above, below (e.g. in or under slab) or in these telecommunications spaces nor will this equipment pass through or enter the EF, TER, or TR(s)."
- 1.3.8. All motors, transformers, or other electrical devices greater than 5KVA are required to have a minimum of a 47" buffer from any wall of the EF, TER, TR(s) and Telecommunications Enclosure (TE) locations. Add the following note to the applicable Electrical and Mechanical design sheets, design analysis, and specifications: "Any motor, transformer, or other electrical device greater than 5KVA will have a minimum of a 47" buffer from any wall of the EF, TER, or TR(s)."
- 1.3.9. Cabling and equipment not directly needed in support of ARNet data and voice services shall not be terminated in, pass-thru, or be located in the TER, TR(s), or TE(s).
  - 1.3.9.1. The equipment and cabling for access control and mass notification head-end systems can be located in the TER if needed. If located in the TER, this equipment shall be rack-mount capable or shall be located in a flush wall mount panel. If rack-mounted, it shall be mounted in the rack in empty space as designated by USARC G-6. The access control and mass notification workstation(s) shall not be located in the TER or TR.
  - 1.3.9.2. CATV head-end equipment and cabling shall be located in and terminated in the EF.
- 1.3.10. Windows are not allowed on any wall or door, of the EF, TER, or TR(s).
- 1.3.11. Hard (gypsum board) ceilings are allowed in the EF, TER, or TR only when an open to the deck ceiling is not practical due to the height of the deck above (i.e. TRs in open maintenance bay areas). Minimum hard ceiling height is 12 feet AFF.
- 1.3.12. The minimum square footage requirements for telecommunications spaces as listed in UFC 4-171-05 have been superseded by the following:
  - 1.3.12.1. EF = 48 square feet (6' x 8')
  - 1.3.12.2. TER = 80 square feet (8' x 10')
  - 1.3.12.3. Standard TR = 80 square feet (8' x 10')
  - 1.3.12.4. Small TR = 48 square feet (6' x 8') – Note that the use of a small Telecommunications Room shall be limited to serving areas of 144 or fewer horizontal cabling terminations.
- 1.3.13. If a joint use facility, shared spaces (e.g. classrooms, assembly hall), will require separate telecommunications outlets for each DOD component (e.g. Army Reserve, Army National Guard). The telecommunications DOR can place the separate outlets in the same faceplate where appropriate.

## 1.4. Telecommunications Qualifications

- 1.4.1. All design submittals require a separate section labeled telecommunications. All telecommunications design sheets (both site and building interior) shall be included in this section.



- 1.4.2. The certified final design submittal is to be reviewed and approved by an active Building Industry Consulting Services International (BICSI) Registered Communications Distribution Designer (RCDD) and indicated as such with the RCDD's stamp and signature on the design submittal cover page.
- 1.4.3. The on-site foreman assigned to the installation of this system or any of its components shall be an active Building Industry Consulting Services International (BICSI) Registered Cabling Installer, Technician Level with a minimum of 5 years of experience in the installation of low-voltage cabling systems. Alternatively, an RCDD with a minimum of 5 years of experience managing the installation of low-voltage cabling systems can serve as project foreman. All other personnel assigned to the installation of this system must have a minimum of 3 years of experience in the installation of low-voltage cabling systems or any of its components. It is preferred that these personnel have a minimum of an active Building Industry Consulting Services International (BICSI) Registered Cabling Installer, Level 1. Documentation of current BICSI certification for each of the key personnel must be provided.



## 2. Chapter 2 – Infrastructure Requirements

### 2.1. Pathways

- 2.1.1. Provide a complete telecommunications pathway system that provides a flexible, re-usable, expandable pathway for premises and outside plant distribution of telecommunication services throughout the facility.
- 2.1.2. The preferred pathway for installing service entrance and campus outside plant (OSP) cables is underground duct bank. Aerial pathways will only be considered where the use of underground pathways is not a viable option. The use of aerial pathways must be explicitly approved by USARC G-6 prior to design and/or implementation.
- 2.1.3. Outside Plant (OSP) Pathways
  - 2.1.3.1. On a site where the Army Reserve is a tenant unit, the Designer of Record shall coordinate the OSP pathways criteria and design with the owning installation telecommunications infrastructure representative.
  - 2.1.3.2. The use of half-size (6 feet x 6 feet x 7 feet) maintenance holes is allowed.
  - 2.1.3.3. A 12 inch sump is allowed in all maintenance holes.
  - 2.1.3.4. The use of hand holes is not allowed on any OSP pathway. The only exception allowed is for the service provider point of connection and then only when specifically required by the local telephone company.
  - 2.1.3.5. Service Provider Point of Connection (SPPOC)
    - 2.1.3.5.1. Provide two 4-inch-conduits from the Entrance Facility (EF) to the local telephone company (a.k.a. Local Exchange Carrier (LEC)) point of connection.
    - 2.1.3.5.2. Designer of Record shall coordinate with the LEC to determine the point of connection location and conduit termination requirements (e.g. maintenance hole, hand hole, pedestal, telephone pole).
  - 2.1.3.6. For all buildings where ARNET and voice services are needed, provide two 4-inch conduits from the TER to other buildings TR or Telecommunications Enclosure (TE).
    - 2.1.3.6.1. Provide one 3 inch-3 cell fabric mesh inner-ducts with tracer wire in one of the two conduits.
  - 2.1.3.7. For all buildings where only voice services are needed, provide one 4-inch conduit from the TER to other buildings TR or TE.
    - 2.1.3.7.1. Provide one 3 inch-3 cell fabric mesh inner-duct with tracer wire in this conduit.
  - 2.1.3.8. For all projects where the NEC allows the OSP pathways to enter the building via an above ground entry point (i.e. NEMA box), the OSP pathways shall be extended to the appropriate EF, TER, TR, or TE using intermediate metal conduit (IMC) or rigid metal conduit (RMC).
- 2.1.4. Inside Plant (ISP) Pathways
  - 2.1.4.1. Provide a minimum of two 3-inch conduits from the EF to the TER. If the cable tray system extends to the corridor immediately outside the EF and TER, then this conduit may be omitted and backbone cable routed thru cable tray.
  - 2.1.4.2. Provide a minimum of two 3-inch conduits from the TER to each non-stacked TR. If the cable tray system extends to the corridor immediately outside the TER and TR, then this conduit may be omitted and backbone cable routed thru cable tray.
  - 2.1.4.3. Provide a minimum of two 3-inch conduits from the TER to each TE location. If the cable tray system extends to the corridor immediately outside the TER and TR, then this conduit may be omitted and backbone cable routed thru cable tray.



- 2.1.4.4. For stacked TRs in multi-story buildings, provide a minimum of 2-4" floor sleeves from each TR to open ceiling below.
- 2.1.4.5. No backbone or horizontal cabling is allowed to be exposed in any open ceiling area (i.e. assembly hall, work bays, garages, warehouses, unit storages areas). All cabling installed in these areas must be in conduit.
- 2.1.4.6. It is highly desired that backbone or horizontal cabling is not routed through mechanical or electrical rooms but, if there are no other routing options, then this cabling must be fully contained in EMT conduit (40% initial fill capacity) installed IAW TIA 569-D.
- 2.1.4.7. Floor and Wall Penetrations
  - 2.1.4.7.1. The initial fill capacity of each floor penetration or wall sleeve shall be 80 percent or less. One spare, empty penetration or sleeve shall also be provided.
  - 2.1.4.7.2. All wall penetrations in fire-rated walls shall require the use of self-sealing, re-enterable, mechanical fire-stop assemblies.
    - 2.1.4.7.2.1. If unable to determine fire-rating of the wall, then the use of self-sealing, re-enterable, mechanical fire-stop assemblies is required.
  - 2.1.4.7.3. All multi-story floor penetrations shall require the use of self-sealing, re-enterable, mechanical fire-stop assemblies.
  - 2.1.4.7.4. Removable, re-useable fire stopping plugs shall be used on all 2 and 4 inch sleeves and conduits requiring additional fire-stopping.
- 2.1.4.8. Horizontal cabling conduit requirements
  - 2.1.4.8.1. All conduits must be sized for an initial fill ratio of 40% or less. This 40% fill ratio must be based on a horizontal cabling outside diameter of .29 inches. The minimum size conduit is one inch.
  - 2.1.4.8.2. Up to three outlet boxes can be daisy-chained together.
  - 2.1.4.8.3. Modular furniture system connections (up to 8 Category 6a cables) require a 1.5 inch liquid-tight flexible metal conduit and fittings to connect each floor box or wall box to the acoustic panel raceway.
- 2.1.4.9. In-slab floor box requirements
  - 2.1.4.9.1. Up to two floor boxes can be daisy-chained together. The conduit supporting both floor boxes shall be installed in a homerun fashion and terminated directly in the TER or TR supporting the floor box location.
  - 2.1.4.9.2. Unless daisy-chained together, all conduits supporting in-slab floor boxes shall be installed in a homerun fashion and terminated directly in the TER or TR supporting the floor box location.
- 2.1.5. Cabling Support
  - 2.1.5.1. Where feasible and cost effective, all low-voltage signal cable from all low-voltage systems can share the same corridor pathway (e.g. cable tray, conduit). For all projects located on installations, camps, posts, and stations, NEC approval is required before using this approach.
  - 2.1.5.2. Cable tray
    - 2.1.5.2.1. Cable tray usage is for pathways and horizontal distribution outside of the telecommunications spaces. Cable tray cannot enter the EF, TER, or any TR.
    - 2.1.5.2.2. The cable tray system shall originate in the corridor outside of the TER and TR and shall serve the respective area served by that TER or TR. It shall support a minimum of 90% of the premise cabling.



- 2.1.5.2.3. Distance from conduit stub out to cable tray shall not exceed 40 feet.
- 2.1.5.2.4. Cable tray is not allowed in hard ceiling areas. All cabling routed through hard ceilings must be routed in conduit sized IAW the Horizontal cabling conduit section of this criteria.
- 2.1.5.2.5. Cable tray is not allowed in any below finished ceiling area, work bays, maintenance bays, unit storage areas, or warehouse areas.
- 2.1.5.2.6. Cable tray shall be sized so the sum of the cross-sectional areas of the low-voltage cabling will not exceed 25 percent of the interior cross-section of the cable tray
- 2.1.5.2.7. The minimum size cable tray allowed is 6 inches wide x 2 inches deep.
- 2.1.5.2.8. The maximum depth cable tray allowed is 6 inches
- 2.1.5.2.9. Provide 12-inch minimum clearance above the top of the cable tray and 3-inch minimum clearance below the cable tray
- 2.1.5.2.10. The use of center hung and cantilever mounting systems for cable tray is not allowed.
- 2.1.5.3. Non-continuous cable support
  - 2.1.5.3.1. J-hooks are the only approved non-continuous cable support method. They shall not replace cable tray, but can be used to provide cable support where the use of cable tray is not feasible.
  - 2.1.5.3.2. J-hooks shall be Category 6a rated and spaced at intervals that shall not exceed 60 inches from the conduit stub up or ceiling entry point to the cable tray.
  - 2.1.5.3.3. Each J-hook shall not exceed 50 percent of the J-hook fill capacity.
  - 2.1.5.3.4. J-hooks shall not be installed over, above, or through hard ceiling areas.
  - 2.1.5.3.5. J-hooks are not allowed to be used in any area below finished ceiling.
- 2.1.5.4. Telecommunications spaces
  - 2.1.5.4.1. All plywood backboard shall be painted with a fire-retardant paint. One fire-rated stamp must be left visible on each plywood sheet. Paint color shall match the color of the wall that the plywood is being attached to.
  - 2.1.5.4.2. Ladder rack is the only approved cabling support method allowed in the EF, TER and all TRs. Both horizontal and vertical style ladder rack shall be used. Basket style cable tray shall not enter or pass through the EF, TER, or any TR.
  - 2.1.5.4.3. In all TE locations with drop ceilings, cable tray shall be installed above the drop ceiling to support the required horizontal and backbone slack cabling. Sleeves shall be installed thru the drop ceiling for routing cabling to the cabinet and/or plywood backboard.
  - 2.1.5.4.4. Ladder rack shall be 1-1/2 inch x 3/8 inch stringers with 1/2 inch x 1 inch welded rungs at 12-inch intervals.
  - 2.1.5.4.5. The minimum width for all horizontal ladder rack is 18 inches.
  - 2.1.5.4.6. The minimum width for all vertical ladder rack is 12 inches.
  - 2.1.5.4.7. Ladder rack shall be secured to the wall and/or ceiling deck above. Use only wall mount or trapeze mounting systems.
  - 2.1.5.4.8. Ladder rack above equipment racks shall be fastened to these racks with 6 inch elevation kits and rack to runway mounting kits.
  - 2.1.5.4.9. Radius dropouts (waterfalls) shall be used in all locations where the premise cabling is routed to the equipment rack below. All radius dropouts for the telecommunications racks shall be attached to the ladder rack and shall be the same width as the ladder rack used.
  - 2.1.5.4.10. Use radius dropouts in all locations where the premise cabling is routed from the conduit or wall sleeve to the ladder rack below.
  - 2.1.5.4.11. If the distance from the exit point of the conduit/sleeve to the ladder rack below



exceeds 5 foot, then the cable must be supported from the exit point of the conduit/sleeve until it meets the ladder rack

- 2.1.5.4.12. Horizontal cabling shall be properly supported on the back of the patch panel. Support brackets shall be compatible with the Category 6a patch panels installed.
- 2.1.5.4.13. The use of plastic tie-wraps on all horizontal Category 6a cabling is NOT allowed. ¾ inch (minimum) size Velcro fasteners must be used.
- 2.1.5.4.14. Provide vertical and horizontal cable managers in the quantities as shown in Appendix B: Infrastructure Technical Criteria Diagrams and Details. Vertical cable managers shall be:
  - 2.1.5.4.14.1. Minimum 6 inches wide
  - 2.1.5.4.14.2. Double sided
  - 2.1.5.4.14.3. Double hinged
  - 2.1.5.4.14.4. Match the height of the rack
  - 2.1.5.4.14.5. Bolted to telecommunications racks (to both racks if placed in between two racks)

## 2.2. Racks and Cabinets

- 2.2.1.1. Provide two post, heavy-duty racks in quantities sufficient to accommodate the cabling systems and equipment for the project. At a minimum, provide the quantities as shown in Appendix B: Infrastructure Technical Criteria Diagrams and Details. Racks shall be:
  - 2.2.1.1.1. EIA-310-D compliant
  - 2.2.1.1.2. Supports 19 inch wide EIA rack mount equipment
  - 2.2.1.1.3. Equipment static load capacity of 1000 lbs.
  - 2.2.1.1.4. 45 U (7 feet) height
  - 2.2.1.1.5. EIA-310-D compliant, Universal hole pattern
  - 2.2.1.1.6. 5/8"-5/8"-1/2" vertical hole spacing
  - 2.2.1.1.7. Threaded #12-24 equipment mounting holes with included equipment-mounting screws
  - 2.2.1.1.8. Fixed in place
  - 2.2.1.1.9. Pre-marked and numbered rack-mount spaces
  - 2.2.1.1.10. Integrated bonding with a built-in attachment point for a bonding connection
- 2.2.1.2. If floor mounted lockable telecommunications cabinets are used in place of telecommunications racks they shall meet the minimum specifications for telecommunications racks and are to be 36" in depth and have adequate internal ventilation (louvers and fan kit). Fan kit shall be mounted to the interior, top of the cabinet. Multiple telecommunications cabinets used on the same site must all be keyed alike. If used to support separation of cabling for multiple components (i.e. AR, ARNG), the cabinets for each component must be keyed alike but shall be different from the keyset for the other component(s).
- 2.2.1.3. The use of telecommunications enclosure (TE) with telecommunications cabinet will only be allowed with USARC G-6 approval.
  - 2.2.1.3.1.1. For port densities of 48 ports or less, the Hubbell RE4X (or approved equivalent) cabinet shall be used. Cabinet shall include:
    - 2.2.1.3.1.1.1. Fan kit
    - 2.2.1.3.1.1.2. Sound dampening kit
    - 2.2.1.3.1.1.3. Padlock hasp kit
    - 2.2.1.3.1.1.4. Padlock
    - 2.2.1.3.1.1.5. Patch panel mounting bracket
    - 2.2.1.3.1.1.6. 20A power kit
    - 2.2.1.3.1.1.7. Equipment mounting bracket



- 2.2.1.3.1.1.8. Any other miscellaneous accessories/parts needed for a complete and operational system

## 2.3. Backbone cabling

- 2.3.1. All fiber and copper backbone cable shall be homerun with no breaks or splices.
- 2.3.2. All backbone fiber optic cabling shall be single-mode (SM) OS2 rated as defined in TIA 492CAAB.
- 2.3.3. All backbone fiber optic cabling shall be terminated using Ultra-Physical Contact (UPC) duplex SC style connectors.
- 2.3.4. A minimum of 12 strands of SM fiber backbone cabling is required from the TER to the EF, each TR and each TE.
- 2.3.5. All backbone copper cabling shall be category 3 rated.
- 2.3.6. A minimum of 25 pair of backbone copper cabling is required from the TER to each TR and TE.
- 2.3.7. All backbone copper cabling shall be terminated using 110 style IDC termination.
- 2.3.8. A minimum of 20 feet of slack cable is required in the TER, TR(s), and TE(s) for both SM fiber backbone cabling and copper backbone cabling. Loosely coil all slack cable and attach the slack to the plywood backboard.
- 2.3.9. A Siamese coaxial cable with RG59 BNC connectors is required from the TER to the EF.
  - 2.3.9.1. These cable shall be long enough so there is enough slack to reach the bottom of Rack 1 in the TER and have 20 ft. of slack in the EF.
  - 2.3.9.2. If the length of the coaxial cable will not exceed 250 feet, then a Siamese 735a coaxial cable is required.
  - 2.3.9.3. If the length of the coaxial cable will exceed 250 feet, then a Siamese 734 coaxial cable is required.
- 2.3.10. 24 Category 6a cables are required from the TER to the EF.
  - 2.3.10.1. Terminate these cables on a RJ45 Category 6a patch panels.
  - 2.3.10.2. In the EF, a wall mounted patch panel is required. Locate this patch panel near the SPPOC conduits
  - 2.3.10.3. In the TER, a separate rack mounted patch panel is required. Locate this patch panel in rack 1.
- 2.3.11. Refer to Appendix B: Infrastructure Technical Criteria Diagrams and Details for further details.

## 2.4. Horizontal cabling

- 2.4.1. All horizontal cabling shall be category 6a rated with an outside diameter no greater than .29 inches.
- 2.4.2. Refer to Appendix B: Infrastructure Technical Criteria Diagrams and Details for the type of telecommunications outlets and jacks required for each type of telecommunications outlet.
- 2.4.3. The use of multi-user telecommunications outlet assembly (MUTOA) or consolidation points is not allowed. All horizontal cabling must be installed in a homerun fashion from the jack to the appropriate TER, TR, or TE.
- 2.4.4. For standard, flush wall-mounted telecommunications outlets, the use of low-voltage mounting brackets (e.g., mud ring, plaster ring, square-drawn cover, and box eliminator) is an approved alternative to the use of standard outlet boxes with stub-up conduit (non-fire rated walls only). The use of a protective, plastic insert in the top stud is required prior to routing the cable(s) down to the low-voltage mounting bracket.
- 2.4.5. All cabling installed in conduit in or below a concrete slab that is in direct contact with the earth must be rated for use in wet locations.
- 2.4.6. Exterior Call Box Requirements
  - 2.4.6.1. Exterior call boxes shall be model CEECO WPP-531-F (analog model) or approved equivalent and are a contractor furnished, contractor installed (CFCI) item. The use of exterior VoIP call boxes is not allowed.
  - 2.4.6.2. Exterior call boxes and all cabling, conduit, and other associated hardware shall be



provided in the following areas;

2.4.6.2.1. Main building (i.e. Training Building) front entry door

2.4.6.2.2. Any main building exterior door that provides direct access to a privately owned vehicle (POV) parking lot

#### 2.4.7. Wall Phone Outlets

2.4.7.1. The following guidance concerning wall phone outlet requirements supersedes that found in the current version of UFC 4-171-05.

2.4.7.2. Wall phone Outlet Requirements Table

Typical Building Type	Typical Space Name	Outlet Location
Training	Vestibule	Locate just inside main door on side wall
Training	Unit Storage	Locate just inside main interior door
Training	Assembly	Locate just inside main interior door
Training	Physical Readiness	Locate just inside main entry door
Training	Locker Rooms (w/shower facilities)	Locate just inside main entry door
OMS, AMSA, TEMF	Work Bay/ Maintenance Bay	Locate just inside main interior door
Warehouse	Open Warehouse	Locate just inside main interior door

#### 2.4.8. Cable Jacket and Jack Colors

2.4.8.1. When a Reserve Center is located off of an installation, camp, post, or station (e.g. Standalone USARC), the cable jacket and jack color shall be blue.

2.4.8.2. When a Reserve Center is located on a military installation, camp, post, or station, the cable jacket and jack color shall be determined by the installation host (e.g. Active Army NEC).

2.4.8.3. If the facility is joint-use, the cable jacket and jack color(s) will be determined by USARC G-6 during the design process.

#### 2.4.9. Wireless Device Outlets

2.4.9.1. Facilities without an ARNet requirement (i.e. Unheated Storage) are excluded from this requirement.

2.4.9.2. Provide one Wireless Intrusion Detection (WID) outlet (1 jack) for each facility.

2.4.9.2.1. Locate this outlet on permanent building structure in the corridor or administrative area immediately adjacent to the main entry door.

2.4.9.3. Provide one Wireless Access Point (WAP) outlet (1 jack) for each 40 by 40-foot square grid of the following types of areas; administrative, office space, unit common, classroom, learning center, team room, assembly hall, physical readiness, simulator room, and break room.

2.4.9.4. With the exception of work bays, maintenance bays, unit storage areas, and warehouses, WID and WAP outlets shall not be located on exterior walls.

2.4.9.4.1. Locate each WAP outlet on permanent building structure as close as practical to the center of each 40 by 40-foot square grid.

2.4.9.5. Work Bay and Maintenance Bay Areas

2.4.9.5.1. Provide one WAP outlet every 40 feet on the wall immediately adjacent to the adjoining administrative area.

2.4.9.5.2. Provide one WAP outlet per work or maintenance bay roll-up door. Locate this outlet as close as practical to the work/maintenance bay roll-up door.

2.4.9.5.3. Locate all WAP outlets in an area free from obstructions (i.e. air handling units, pallet storage) above, below and in front of the outlet.



- 2.4.9.5.4. Refer to Appendix B: Infrastructure Technical Criteria Diagrams and Details for typical examples.
- 2.4.9.6. Unit Storage and Open Warehouse Areas
  - 2.4.9.6.1. Provide one WAP outlet for each corridor adjacent to or in between the shelving units. Locate this outlet as close as practical to the center of the wall facing the corridor.
  - 2.4.9.6.2. Locate all WAP outlets in an area free from obstructions (i.e. air handling units) above, below and in front of the outlet.
  - 2.4.9.6.3. Refer to Appendix B: Infrastructure Technical Criteria Diagrams and Details for typical examples.
- 2.4.9.7. WAP and WID Outlet Mounting
  - 2.4.9.7.1. 2-lug style (i.e. wall phone) mounting faceplate.
  - 2.4.9.7.2. Minimum of 12 inches of clearance on all sides of the outlet box.
  - 2.4.9.7.3. For all standard height (9 ft. or lower) accessible (i.e. drop) ceiling locations, mount the outlet 18 inches above finished ceiling.
  - 2.4.9.7.4. For all standard height (9 ft. or lower) non-accessible (i.e. hard) ceiling locations and high height (9 ft. 1 inch or higher) ceiling locations (e.g. assembly hall, work bay, maintenance bay, unit storage, warehouse area), mount the outlet 8 feet AFF.
- 2.4.10. Admin. Common Spaces Outlets
  - 2.4.10.1. 1 convenience outlet (1 jack) is required for each benching table. This outlet shall be located on a wall in the vicinity of the benching table.
  - 2.4.10.2. 1 outlet (1 jack) per workstation location is required for each desk intended for FTS use. This outlet shall be located directly adjacent to or under the desk.
- 2.4.11. Terminations
  - 2.4.11.1. All horizontal cabling shall be terminated using T568B pin-out configuration.
  - 2.4.11.2. The jack used shall be of the same color as the horizontal cabling jacket.
  - 2.4.11.3. Standard wall phone outlets shall consist of a single-gang box with a single-gang, lug-type faceplate suitable for direct wall mounting of a telephone instrument.
- 2.4.12. Horizontal Cabling Slack
  - 2.4.12.1. 10 feet of cable slack is required for each cable. This slack is to be stored in tear drop fashion on the ladder rack above the telecommunications rack(s) or cabinet(s).
  - 2.4.12.2. 3 feet of horizontal cable slack is required for each outlet location. Cable slack is to be stored within the nearest section of cable tray in its natural lay or in a tear drop fashion. In the event no cable tray was installed, cable slack shall be stored in a figure eight fashion on the J-hooks closest to the outlet. Each figure 8 shall be supported by a minimum of two J-hooks with each end of the figure 8 supported by one J-hook.
  - 2.4.12.3. Service loops are not allowed at any time.
- 2.5. Labeling
  - 2.5.1. All labeling shall be IAW the requirements as listed in ANSI/TIA 606 (Class 3 requirements) and the requirements in Appendix B: Infrastructure Technical Criteria Diagrams and Details.
  - 2.5.2. Hand written labels are not acceptable.
  - 2.5.3. All conduit labels must be self-laminating cable tags that are properly secured to the conduit. Self-laminating cable tags shall be installed on all backbone cabling immediately upon the exit of the floor/wall/or ceiling penetration and as close as practicable at the termination point.
  - 2.5.4. If the facility is joint-use, then each outlet shall be labeled with the branch of service as well (e.g. R for Army Reserve, G for Army National Guard). The exact additional labeling details will be determined by USARC G-6 during the design process.



## 2.6. Testing

- 2.6.1. All testing shall be performed IAW the requirements as listed in I3A, UFC 3-580-01, ANSI/TIA-568 and this criteria.
- 2.6.2. All testing devices used must have been calibrated/recertified within one year of performing field testing. Proof of calibration/recertification is to be provided with the test plan and test results.
- 2.6.3. Prior to conducting any testing, the contractor shall submit a test plan to USARC G-6. This test plan shall indicate all test equipment, testing methodology, and plan of delivery of test results to USARC G-6. This test plan must be approved by USARC G-6 prior to conducting any testing.
- 2.6.4. Final Acceptance Testing is required for:
  - 2.6.4.1. Horizontal cabling
  - 2.6.4.2. Backbone fiber
    - 2.6.4.2.1. In addition to the requirements listed in ANSI/TIA-568, I3A and UFC 3-580-01, each strand of terminated fiber shall also be tested with an optical time domain reflectometer (OTDR).
    - 2.6.4.2.2. A minimum of 150 Meter launch cable on both ends is required for all fiber testing.
  - 2.6.4.3. Backbone copper
    - 2.6.4.3.1. Backbone copper shall be tested IAW ANSI/TIA-568 requirements. The requirements listed in I3A no longer apply.
  - 2.6.4.4. Primary Bus-Bar (PBB) and Secondary Bus-Bar (SBB)
    - 2.6.4.4.1. Each PBB and SBB installed shall be tested for earth to ground resistance. A passing result is a ground to earth resistance measurement of no more than 10 ohms.
  - 2.6.4.5. Splice case
    - 2.6.4.5.1. Each splice case installed in an underground vault or maintenance hole must be flash tested IAW the manufacturer's instructions. This test must be witnessed and verified by the U.S. Government approving authority.
  - 2.6.4.6. USARC G-6 is the approving authority for all of the above test results.
- 2.6.5. Test Results Delivery
  - 2.6.5.1. The test results for each project must be delivered as one consolidated PDF document.
  - 2.6.5.2. This document must include the following items in the following format.
    - 2.6.5.2.1. Title Page with low-voltage contractor's RCDD Stamp (only the title page needs this stamp)
    - 2.6.5.2.2. Table of Contents. The Table of Contents must indicate the page number that each chapter starts and should be indexed for ease of use.
    - 2.6.5.2.3. Separate chapters (with header page) for each building. Each chapter must contain the following.
      - 2.6.5.2.3.1. As-Build floor plans indicating the location and jack label(s) for each telecommunications outlet installed. Jack labels must be in computer generated format. Hand-written floor plans are not acceptable. Each jack label on the As-Build floor plans must match the actual label(s) that is on each telecommunications outlet.
      - 2.6.5.2.3.2. Category 6a cabling Test Results for each jack terminated in the EF, TER, TR(s) and TE(s). Both the summary test results and detailed test results must be included. The cable label for each test result must match the cable label on the As-Build floor plans.
      - 2.6.5.2.3.3. ISP Backbone fiber test results from the TER/main TR to each TR and TE
        - 2.6.5.2.3.3.1. Power meter tests. Both the summary test results and detailed test results must be included.



- 2.6.5.2.3.3.2. OTDR tests. Both the summary test results and detailed test results must be included.
- 2.6.5.2.3.4. ISP backbone copper test results from the TER/main TR to each TR
  - 2.6.5.2.3.4.1. Both the summary test results and detailed test results for each pair must be included.
- 2.6.5.2.4. Separate chapter (with header page) for the OSP backbone fiber test results from the site TER to each buildings main TR or TE.
  - 2.6.5.2.4.1. Power meter tests. Both the summary test results and detailed test results must be included.
  - 2.6.5.2.4.2. OTDR tests. Both the summary test results and detailed test results must be included.
- 2.6.5.2.5. Separate chapter (with header page) for the OSP backbone fiber test results from to each buildings main TR or TE to the site TER.
  - 2.6.5.2.5.1. Power meter tests. Both the summary test results and detailed test results must be included.
  - 2.6.5.2.5.2. OTDR tests. Both the summary test results and detailed test results must be included.
- 2.6.5.2.6. Separate chapter (with header page) for the OSP backbone copper test results from the site TER to each buildings main TR or TE.
  - 2.6.5.2.6.1. Both the summary test results and detailed test results for each pair must be included.
  - 2.6.5.2.6.2. Separate chapter (with header page) for the ground to earth resistance test results. Ground to earth resistance test results must be in tabular format for each TMGB and TGB installed in the EF, TER, TR(s), and TE(s).

## 2.7. Secure Communications

- 2.7.1. Encryption within the Secure Communications space will occur in an Information Processing System (IPS) container. If the site has a Secure Communications Access Area space (formerly known as SIPRNet Café), this container is a Government Furnished, Contractor Installed (GFCI) item that will be installed during construction. If the site has a SIPR-In-A-Box space, this container is a Government Furnished, Government Installed (GFGI) item that will be installed after the project is complete.
- 2.7.2. Telecommunications infrastructure requirements are:
  - 2.7.2.1. SIPR-In-A-Box Space
    - 2.7.2.1.1. Provide and install one standard outlet with one CAT6a cable. Cable jacket color and jack color shall be blue. Mount this box at standard outlet height. The location of this outlet shall be immediately adjacent to the designated location of the IPS container. Cable shall use standard horizontal cabling pathways to the nearest TER/TR and be terminated on a Category 6a patch panel.
  - 2.7.2.2. Secure Communications Access Area Space
    - 2.7.2.2.1. Provide and install one standard outlet with one CAT6a cable. Cable jacket color and jack color shall be blue. Mount this box at standard outlet height. The location of this outlet shall be immediately adjacent to the the IPS container. Cable shall use standard horizontal cabling pathways to the nearest TER/TR and be terminated on a Category 6a patch panel.
    - 2.7.2.2.2. IPS container junction box. This junction box shall be Contractor Furnished, Contractor Installed (CFCI) and shall be fully compatible with the GFCI IPS container.
    - 2.7.2.2.3. Empty surface mounted raceway with one outlet box (with blank faceplate) for



each Secure Communications workstation location.

2.7.2.2.3.1.1. Surface mounted raceway shall originate from the IPS container junction box.

2.7.2.2.3.1.2. Surface mounted raceway shall be dual-channel.

2.7.2.2.3.1.3. Surface mounted raceway shall be 4 inches wide by 2 inches high.

2.7.2.2.3.2. Center the outlets boxes on each workstation.

2.7.2.2.3.3. Mount the outlets boxes at 54 inches AFF.

2.7.2.2.4. Refer to Appendix B: Infrastructure Technical Criteria Diagrams and Details for further details and requirements.

## 2.8. Intrusion Detection System (IDS)

2.8.1. For each IDS control panel, provide and install two Category 6a cables from the IDS panel to the appropriate TER/TR. Install both cables in a single 1 inch EMT conduit. In the TER/TR, terminate these cables on the Category 6a patch panels. In the IDS Panel, terminate these cables with an 8P8C jack. Provide 8-12 inches of slack cable in the IDS panel.

2.8.2. Refer to Appendix B: Infrastructure Technical Criteria Diagrams and Details for further details.

## 2.9. HVAC

2.9.1. The EF, TER and all TR(s) shall be properly conditioned to meet the control, availability, temperature, and humidity requirements as listed in UFC 4-171-05, UFC 3-580-01, and ANSI/TIA/EIA-569. Back-up systems are not required, but if an emergency power source is available in the facility, connect the HVAC system that serves each telecommunications space to the emergency power source.

## 2.10. Electrical

2.10.1. The electrical panel that serves the EF, TER, and each TR must be located in and dedicated to the space it serves. This panel must meet the following minimum requirements:

2.10.1.1. 120/208 volt, 3-phase or 120/240 volt, 1-phase, 24-(or 20 for 1-phase) space panel with a minimum 100 ampere (A) bus rated capacity.

2.10.1.2. Feed all loads within the EF, TER, or TR, except lighting, from this dedicated panel. Loads must include, but are not limited to, convenience receptacles, dedicated rack or cabinet receptacles, and HVAC systems (including exterior units for split systems).

2.10.1.3. No other loads shall be fed from this panel.

2.10.1.4. Back-up systems are not required, but if an emergency power source is available in the facility, connect the panel that serves the EF, TER, and each TR to the emergency power source.

2.10.2. Provide and install one (1) dedicated 120V/20 circuit with one (1) double duplex NEMA 5-20 receptacle for each telecommunications rack or cabinet in the TER, each TR, and each wall-mounted telecommunications cabinet.

2.10.2.1. Mount the receptacle at 6 inches AFF on the side of the telecommunications rack within the vertical wire manager.

2.10.2.2. Mount the receptacle inside the telecommunications cabinet in the lower, left corner.

2.10.3. In the EF, provide and install the following:

2.10.3.1. One (1) dedicated 120V/20 circuit with one (1) double duplex NEMA 5-15 receptacle.

2.10.3.2. One (1) dedicated 120V/20 circuit with one (1) NEMA L5-15 receptacle.

2.10.3.3. If provided specific power requirements by the local service provider, provide and install electrical receptacles that meet these requirements. Each of these receptacles shall be on a dedicated circuit.

2.10.3.4. Mount all receptacles at 18 inches AFF on the plywood backboard immediately adjacent to the service provider conduits.

2.10.4. In each EF, TER, and TR, provide 125V, 20A duplex convenience receptacles at 6 feet intervals



on center around perimeter walls.

- 2.10.5. Provide and install one (1) dedicated 120V/20 circuit with one (1) double duplex NEMA 5-20 receptacle for the IPS container in the SCAA room or Team room designated for secure communications use. Mount the receptacle immediately adjacent to the IPS container at standard outlet height.
- 2.10.6. Refer to Appendix B: Infrastructure Technical Criteria Diagrams and Details for further details.

## 2.11. Bonding

- 2.11.1. The design for bonding of telecommunications components shall meet or exceed all requirements of ANSI/TIA-607 and NFPA 70 and shall include bonding for the following:
  - 2.11.1.1. EF, TER, TR(s), TE(s), and all metallic telecommunications components.
- 2.11.2. Primary bus-bar (PBB) and Secondary bus-bar (SBB) requirements are as follows:
  - 2.11.2.1. Mounting height of 6 feet 6 inches AFF.
  - 2.11.2.2. Minimum of 24 inches in length.
  - 2.11.2.3. Predrilled with standard 5/16" Holes in a 2 hole configuration.
  - 2.11.2.4. Listed insulators and mounting brackets.
  - 2.11.2.5. A minimum of 50.8 mm separation from the wall is required to allow access to the rear of the bus bar.
  - 2.11.2.6. Copper or a copper alloy with a minimum of 95% conductivity.
  - 2.11.2.7. Electrolytic-Plated (ETP).
- 2.11.3. Rack bus-bar (RBB) requirements are as follows:
  - 2.11.3.1. 1 per telecommunications rack.
  - 2.11.3.2. Locate at the top rear of the rack.
  - 2.11.3.3. Copper or a copper alloy with a minimum of 95% conductivity.
  - 2.11.3.4. Each telecommunications rack shall be bonded to its RBB with a minimum #6 AWG size bonding conductor. This bonding connection shall not impede the installation of other rack-mounted equipment.
  - 2.11.3.5. Electrolytic-Plated (ETP).
- 2.11.4. All bonding lugs for each bus-bar shall be 2 hole, long barrel type lugs with a minimum of (2) crimp points to the bonding conductor.
- 2.11.5. All bonding lugs shall have inspection windows so that bonding connections may be inspected for full conductor insertion.
- 2.11.6. Bonding connections to the bus-bar shall utilize listed compression two-hole lugs.
- 2.11.7. Bonding connections to metallic telecommunications infrastructure (i.e. racks, ladder rack, cable tray) shall utilize listed compression two-hole lugs wherever possible or equivalent one hole non-twisting lugs, or other irreversible compression type connections where the use of two-hole lugs is not possible (i.e. conduit bonding bushings).
- 2.11.8. The use of self-tapping screws is not allowed for any bonding conductor connection.
- 2.11.9. Prior to installing any bonding conductors an anti-oxidant compound shall be applied to all bonding surfaces that are not electrolytic-plated.
- 2.11.10. Bonding connections and wiring shall be installed such that these connections and wiring do not impede future bonding connections to the bus-bar.
- 2.11.11. Prior to making any bonding connection, paint shall be fully scraped from any painted surface such that the scraped surface is full visible after making the bonding connection.
- 2.11.12. Refer to Appendix B: Infrastructure Technical Criteria Diagrams and Details for further details.



## Appendix A – Glossary of Terms and Acronyms

1391 = MILCON Project authorization form  
 AFF – Above Finished Floor  
 ANSI = American National Standards Institute  
 AR = Army Reserve  
 ARNET = Army Reserve Network  
 AWG = American Wire Gauge  
 CATV = Community/Cable Access Television  
 EF = Entrance Facility  
 HDPE = High Density Polyethylene  
 HVAC = Heating, Ventilating and Air Conditioning  
 IDS = Intrusion Detection System  
 I3A = Technical Criteria for Installation Information Infrastructure Architecture  
 IPS= Information Processing Station  
 LEC= Local Exchange Carrier (a.k.a. Telephone Company)  
 NEC= Network Enterprise Center  
 NEMA = National Electrical Manufacturers Association  
 OSP = Outside Plant  
 OTDR = Optical Time Domain Reflectometer  
 PBB = Primary Bus-Bar  
 PVC = Polyvinyl Chloride  
 RBB = Rack Bus-Bar  
 RMU = Rack Management Unit  
 SBB = Secondary Bus-Bar  
 SCAA = Secure Communications Access Area  
 SIPRNet = Secret Internet Protocol Router Network  
 SM = Single Mode  
 TER = Telecommunications Equipment Room  
 TIA/EIA = Telecommunications Industry Association/Electronics Industries Alliance  
 TR = Telecommunications Room  
 UFC = Unified Facility Criteria  
 UHS = Unheated Storage  
 UPC = Ultra-Physical Contact  
 USARC = U.S. Army Reserve Command  
 VoIP = Voice-Over-Internet-Protocol



## Appendix B - Infrastructure Technical Criteria Diagrams and Details

The diagrams and figures provided in this appendix provide additional requirements and guidance. All Army Reserve infrastructure design and construction shall adhere to the requirements listed in these diagrams and details. The purpose of these diagrams is to show required components, mounting heights, typical wall and room layouts, etc.





U.S. ARMY RESERVE  
NETWORK ENTERPRISE CENTER  
INFRASTRUCTURE TECHNICAL CRITERIA  
APPENDIX B  
DIAGRAMS AND DETAILS



REVISIONS			
SYMBOL	DESCRIPTION	DATE	APPR.

DESIGNED BY: JOHN BABB	DATE: FEBRUARY 2020	
	DESIGNED BY: DEREK MITCHELL	APPROVED FOR PUBLIC RELEASE;
	REVIEWED BY: ROBERT BABB USARC G-6 RCDD	DISTRIBUTION UNLIMITED

USARC G-6  
NETWORKING AND  
INFRASTRUCTURE  
BRANCH  
INFRASTRUCTURE  
TEAM

U.S. ARMY RESERVE  
NETWORK ENTERPRISE CENTER  
INFRASTRUCTURE  
TECHNICAL CRITERIA  
DIAGRAM AND DETAILS



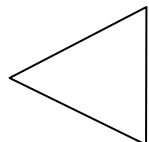
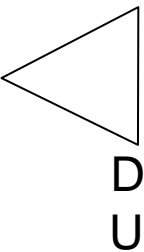
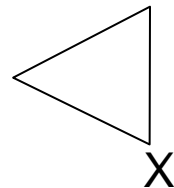
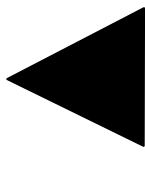
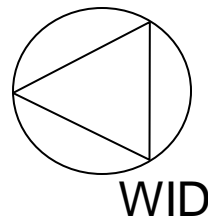
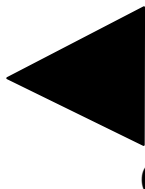
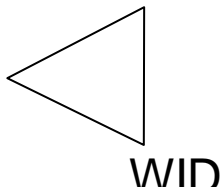
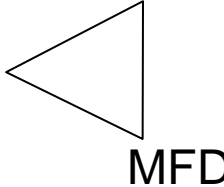
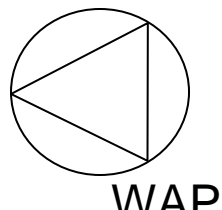
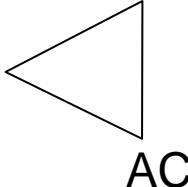
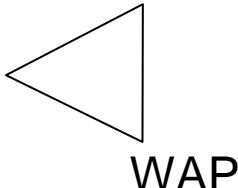
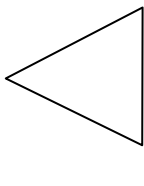
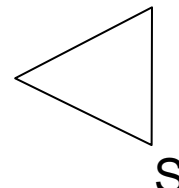
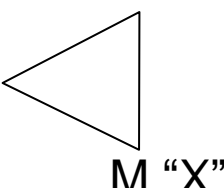
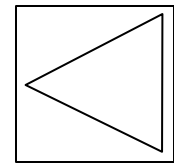
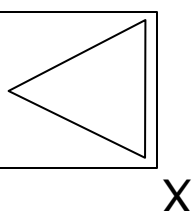
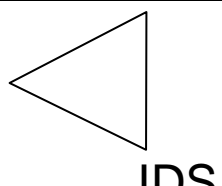
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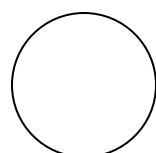
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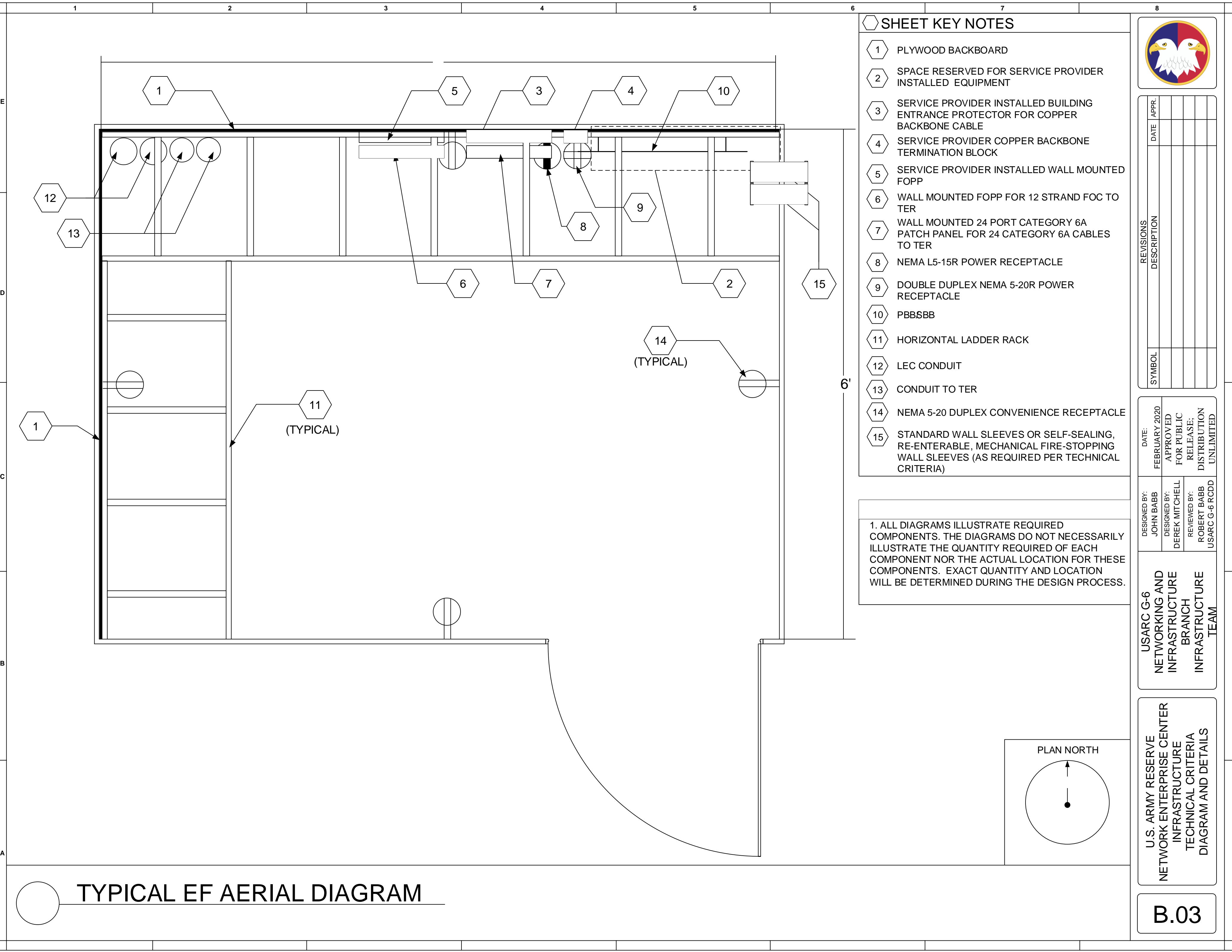
## B.02

SYMBOL	OUTLET DESCRIPTION	JACK QUANTITY	SYMBOL	OUTLET DESCRIPTION	JACK QUANTITY
	STANDARD TELECOMMUNICATIONS OUTLET	1 JACK		DDC/UMP TELECOMMUNICATIONS OUTLET. MOUNT AS CLOSE TO THE CONTROL PANEL AS POSSIBLE	1 JACK
	MULTI-JACK TELECOMMUNICATIONS OUTLET	"X" DENOTES NUMBER OF JACKS		WALL PHONE TELECOMMUNICATIONS OUTLET. 2 LUG WALL PHONE FACEPLATE	1 JACK
	WID TELECOMMUNICATIONS OUTLET IN ACCESSIBLE CEILING SPACE	1 JACK		EXTERIOR CALL BOX	1 JACK
	WID TELECOMMUNICATIONS OUTLET IN NON-ACCESSIBLE CEILING SPACE	1 JACK		MULTI-FUNCTIONAL DEVICE TELECOMMUNICATIONS OUTLET	2 JACKS
	WAP TELECOMMUNICATIONS OUTLET IN ACCESSIBLE CEILING SPACE	1 JACK		TELECOMMUNICATIONS OUTLET MOUNT 6 INCHES ABOVE COUNTER TOP	1 JACK
	WAP TELECOMMUNICATIONS OUTLET IN NON-ACCESSIBLE CEILING SPACE	1 JACK		MODULAR FURNITURE TELECOMMUNICATIONS OUTLET	1 JACK
	SIPRNET OUTLET	1 JACK		MULTI-JACK MODULAR FURNITURE TELECOMMUNICATIONS OUTLET	"X" DENOTES NUMBER OF JACKS
	STANDARD TELECOMMUNICATIONS FLOOR BOX	1 JACK		MULTI-JACK TELECOMMUNICATIONS FLOOR BOX	"X" DENOTES NUMBER OF JACKS
	IDS PANEL (2 CAT. 6 CABLES)	NA			



# STANDARD TELECOMMUNICATIONS SYMBOL LEGEND





SHEET KEY NOTES

- 1 PLYWOOD BACKBOARD
- 2 SPACE RESERVED FOR SERVICE PROVIDER INSTALLED EQUIPMENT
- 3 SERVICE PROVIDER INSTALLED BUILDING ENTRANCE PROTECTOR FOR COPPER BACKBONE CABLE
- 4 SERVICE PROVIDER COPPER BACKBONE TERMINATION BLOCK
- 5 SERVICE PROVIDER INSTALLED WALL MOUNTED FOPP
- 6 WALL MOUNTED FOPP FOR 12 STRAND FOC TO TER
- 7 WALL MOUNTED 24 PORT CATEGORY 6A PATCH PANEL FOR 24 CATEGORY 6A CABLES TO TER
- 8 NEMA L5-15R POWER RECEPTACLE
- 9 DOUBLE DUPLEX NEMA 5-20R POWER RECEPTACLE
- 10 PBB&SBB
- 11 HORIZONTAL LADDER RACK
- 12 LEC CONDUIT
- 13 CONDUIT TO TER
- 14 NEMA 5-20 DUPLEX CONVENIENCE RECEPTACLE
- 15 STANDARD WALL SLEEVES OR SELF-SEALING, RE-ENTERABLE, MECHANICAL FIRE-STOPPING WALL SLEEVES (AS REQUIRED PER TECHNICAL CRITERIA)

1. ALL DIAGRAMS ILLUSTRATE REQUIRED COMPONENTS. THE DIAGRAMS DO NOT NECESSARILY ILLUSTRATE THE QUANTITY REQUIRED OF EACH COMPONENT NOR THE ACTUAL LOCATION FOR THESE COMPONENTS. EXACT QUANTITY AND LOCATION WILL BE DETERMINED DURING THE DESIGN PROCESS.



SYMBOL	REVISIONS	
	DATE	APPR.

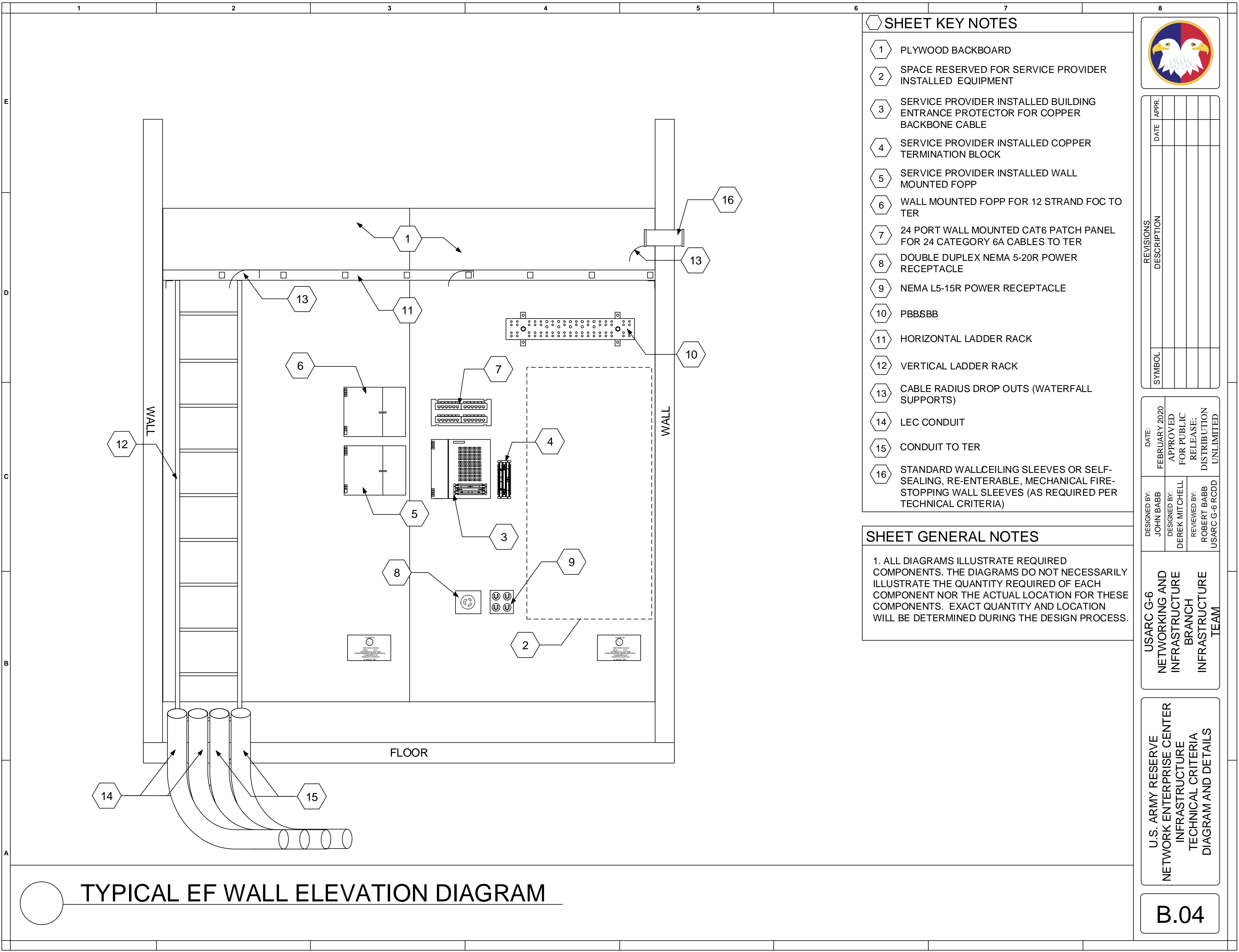
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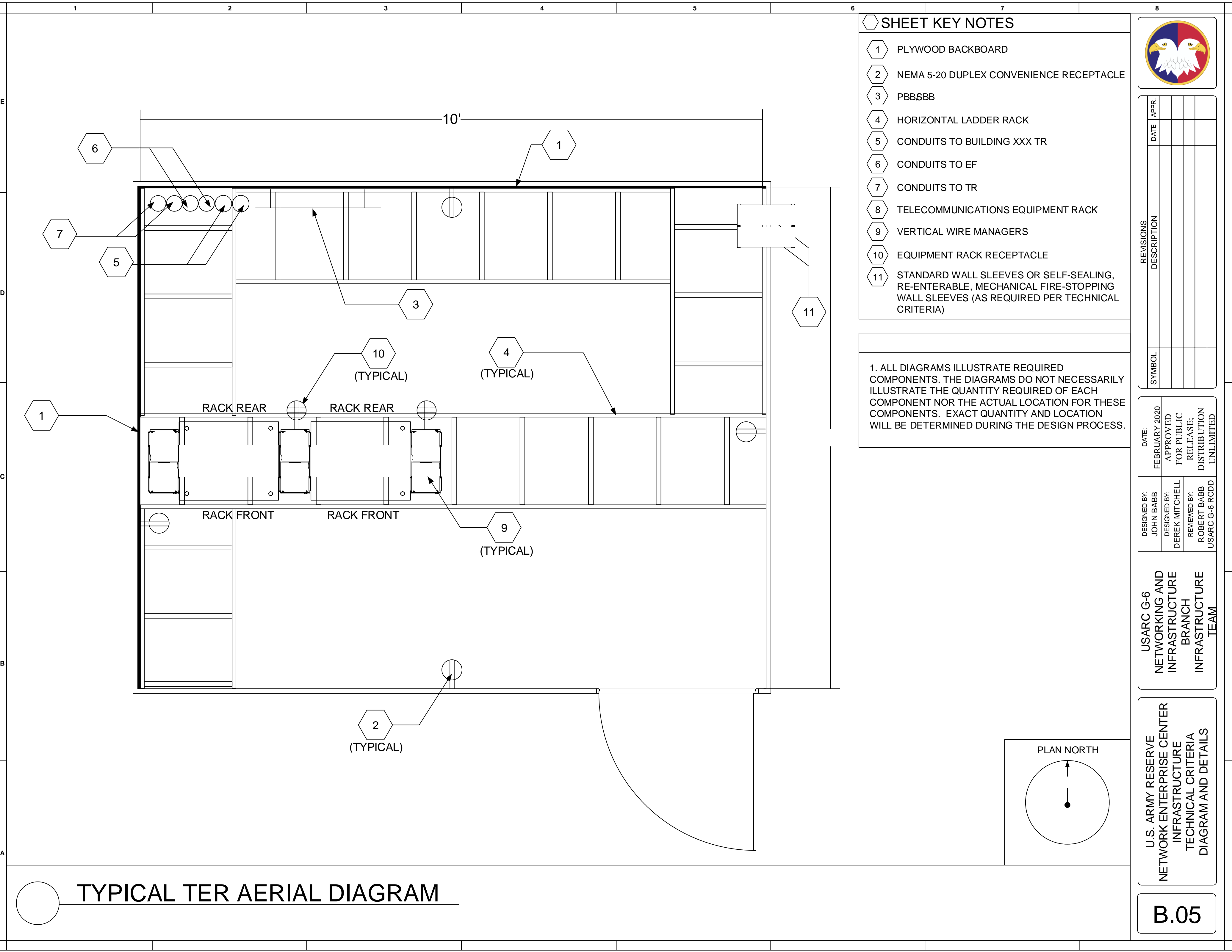
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B.03









SHEET KEY NOTES

- 1 PLYWOOD BACKBOARD
- 2 NEMA 5-20 DUPLEX CONVENIENCE RECEPTACLE
- 3 PBBSSBB
- 4 HORIZONTAL LADDER RACK
- 5 CONDUITS TO BUILDING XXX TR
- 6 CONDUITS TO EF
- 7 CONDUITS TO TR
- 8 TELECOMMUNICATIONS EQUIPMENT RACK
- 9 VERTICAL WIRE MANAGERS
- 10 EQUIPMENT RACK RECEPTACLE
- 11 STANDARD WALL SLEEVES OR SELF-SEALING, RE-ENTERABLE, MECHANICAL FIRE-STOPPING WALL SLEEVES (AS REQUIRED PER TECHNICAL CRITERIA)

1. ALL DIAGRAMS ILLUSTRATE REQUIRED COMPONENTS. THE DIAGRAMS DO NOT NECESSARILY ILLUSTRATE THE QUANTITY REQUIRED OF EACH COMPONENT NOR THE ACTUAL LOCATION FOR THESE COMPONENTS. EXACT QUANTITY AND LOCATION WILL BE DETERMINED DURING THE DESIGN PROCESS.



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	DESCRIPTION	DATE

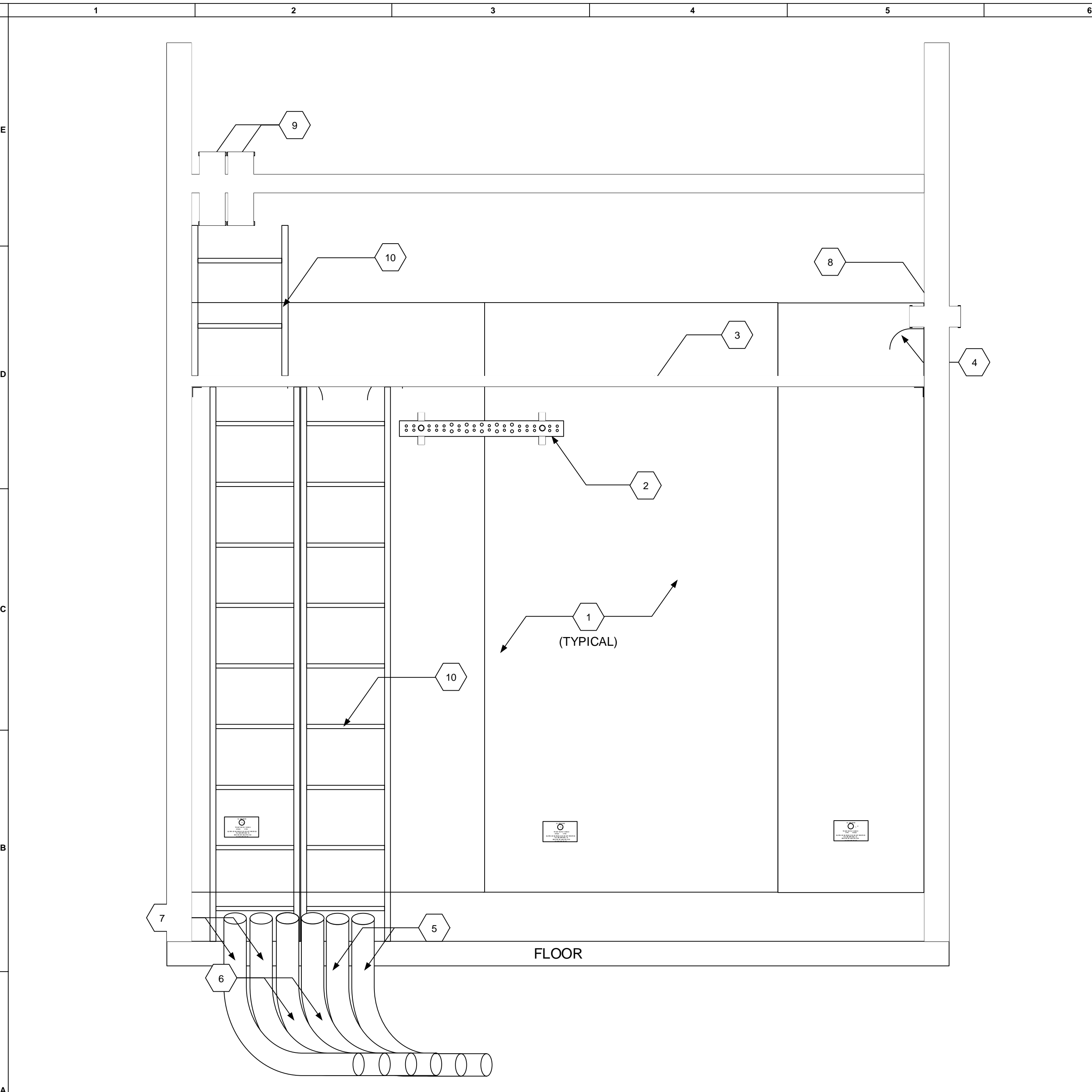
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B.05





SHEET KEY NOTES

- 1 PLYWOOD BACKBOARD
- 2 PBB&SBB
- 3 HORIZONTAL LADDER RACK
- 4 CABLE RADIUS DROP OUTS (WATERFALL SUPPORTS)
- 5 CONDUITS TO BUILDING XXXX TR
- 6 CONDUITS TO EF
- 7 CONDUITS TO TR
- 8 STANDARD WALL SLEEVES OR SELF-SEALING, RE-ENTERABLE, MECHANICAL FIRE-STOPPING WALL SLEEVES (AS REQUIRED PER TECHNICAL CRITERIA)
- 9 SELF-SEALING, RE-ENTERABLE, MECHANICAL FIRE-STOPPING FLOOR SLEEVES
- 10 VERTICAL LADDER RACK

SHEET GENERAL NOTES

1. ALL DIAGRAMS ILLUSTRATE REQUIRED COMPONENTS. THE DIAGRAMS DO NOT NECESSARILY ILLUSTRATE THE QUANTITY REQUIRED OF EACH COMPONENT NOR THE ACTUAL LOCATION FOR THESE COMPONENTS. EXACT QUANTITY AND LOCATION WILL BE DETERMINED DURING THE DESIGN PROCESS.



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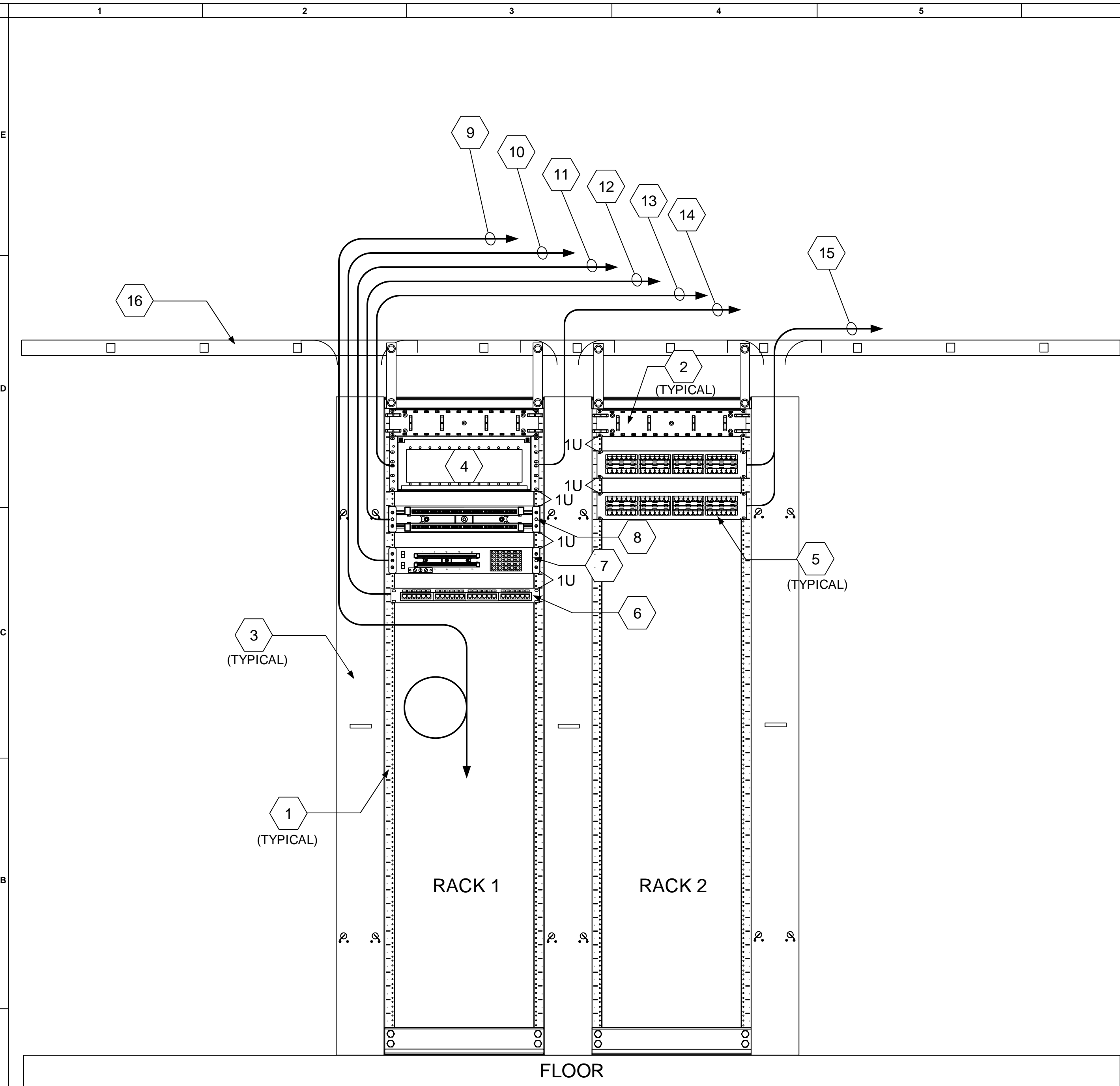
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B.06

TYPICAL TER WALL ELEVATION DIAGRAM





SHEET KEY NOTES

- 1 2 POST EQUIPMENT RACK
- 2 2U HORIZONTAL WIRE MANAGER
- 3 VERTICAL WIRE MANAGER
- 4 4U FIBER PATCH PANEL
- 5 48 PORT PATCH PANEL FOR CATEGORY 6A CABLES
- 6 24 PORT PATCH PANEL FOR 24 CATEGORY 6A CABLES TO EF
- 7 BET FOR COPPER BACKBONE CABLE TO BUILDING XXX TR XXX
- 8 110 BLOCK FOR COPPER BACKBONE CABLE TO TR XXX
- 9 DS3 EXTENSION COAXIAL CABLE
- 10 (24) CATEGORY 6A CABLES TO EF
- 11 OSP COPPER BACKBONE CABLE TO BUILDING XXX TR XXX
- 12 ISP COPPER BACKBONE CABLE TO TR XXX
- 13 OSP/ISP FOC TO OTHER TR(S)
- 14 12 STRAND FOC TO EF
- 15 CATEGORY 6A HORIZONTAL CABLE
- 16 HORIZONTAL LADDER RACK

SHEET GENERAL NOTES

1. ALL DIAGRAMS ILLUSTRATE REQUIRED COMPONENTS. THE DIAGRAMS DO NOT NECESSARILY ILLUSTRATE THE QUANTITY REQUIRED OF EACH COMPONENT NOR THE ACTUAL LOCATION FOR THESE COMPONENTS. EXACT QUANTITY AND LOCATION WILL BE DETERMINED DURING THE DESIGN PROCESS.



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B.07

TYPICAL TER RACK FRONT ELEVATION DIAGRAM



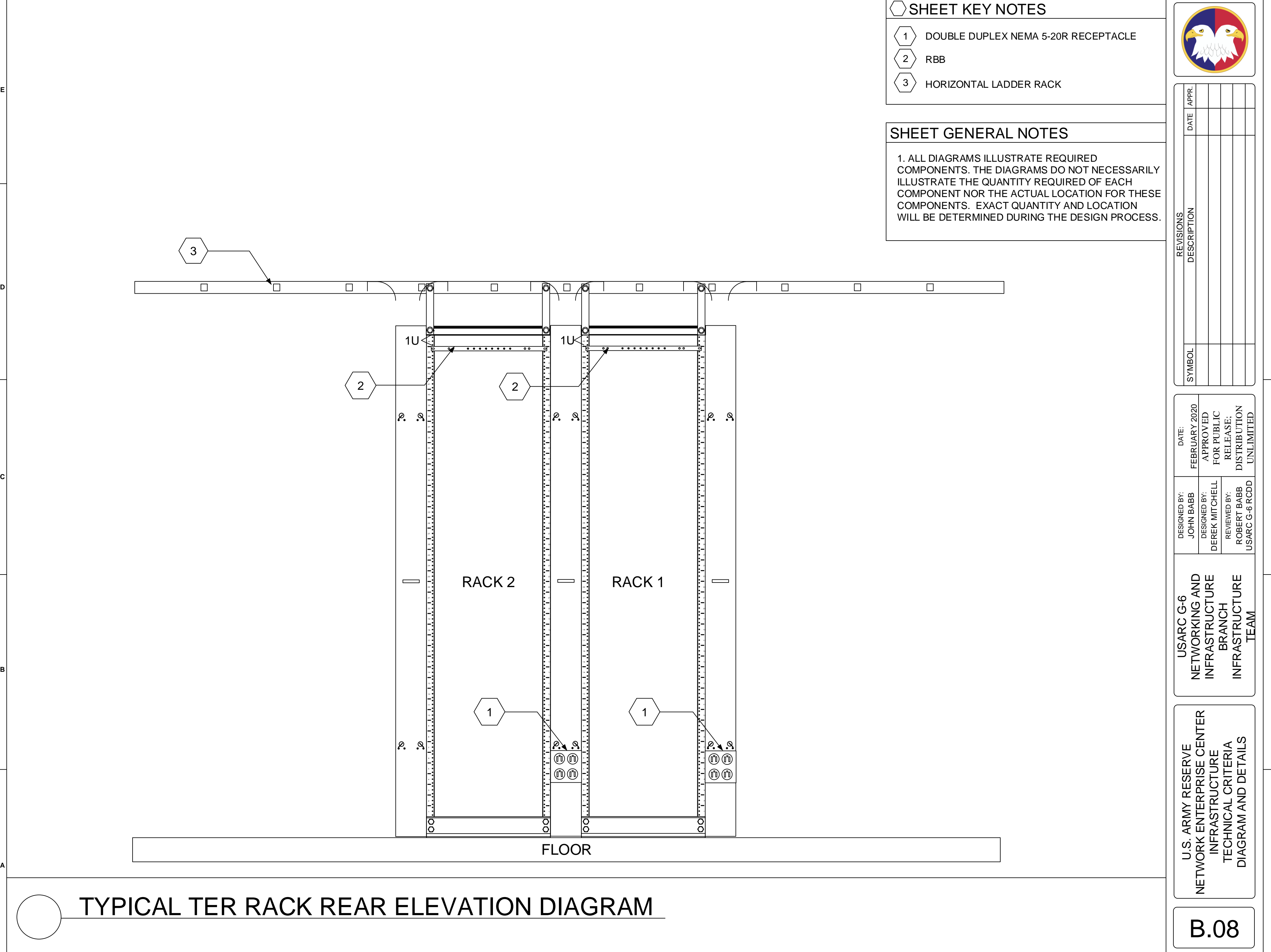
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D

C

B

A



SHEET KEY NOTES

1

DOUBLE DUPLEX NEMA 5-20R RECEPTACLE

2

RBB

3

HORIZONTAL LADDER RACK

SHEET GENERAL NOTES

1. ALL DIAGRAMS ILLUSTRATE REQUIRED COMPONENTS. THE DIAGRAMS DO NOT NECESSARILY ILLUSTRATE THE QUANTITY REQUIRED OF EACH COMPONENT NOR THE ACTUAL LOCATION FOR THESE COMPONENTS. EXACT QUANTITY AND LOCATION WILL BE DETERMINED DURING THE DESIGN PROCESS.



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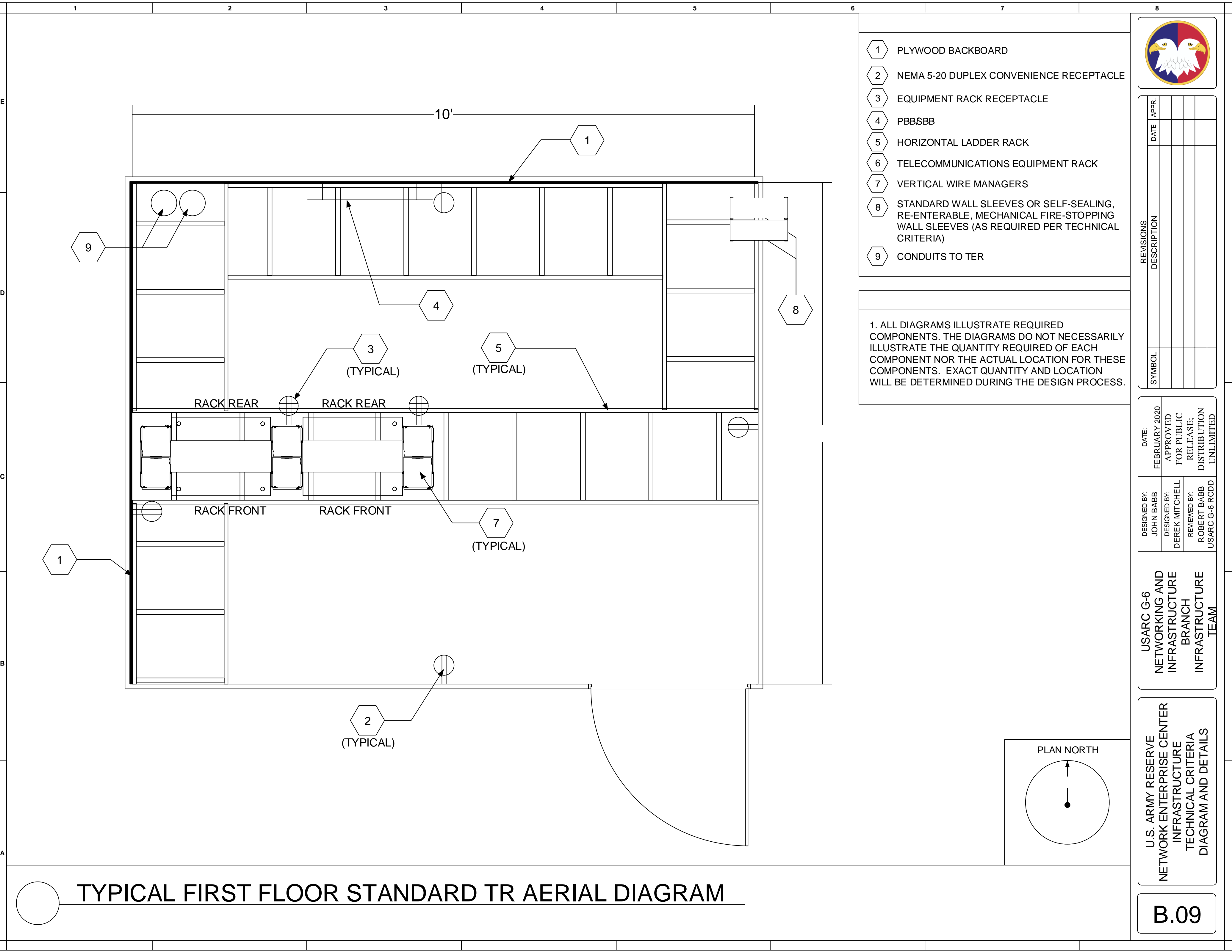
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B.08





- 1 PLYWOOD BACKBOARD
- 2 NEMA 5-20 DUPLEX CONVENIENCE RECEPTACLE
- 3 EQUIPMENT RACK RECEPTACLE
- 4 PBB&SBB
- 5 HORIZONTAL LADDER RACK
- 6 TELECOMMUNICATIONS EQUIPMENT RACK
- 7 VERTICAL WIRE MANAGERS
- 8 STANDARD WALL SLEEVES OR SELF-SEALING, RE-ENTERABLE, MECHANICAL FIRE-STOPPING WALL SLEEVES (AS REQUIRED PER TECHNICAL CRITERIA)
- 9 CONDUITS TO TER

1. ALL DIAGRAMS ILLUSTRATE REQUIRED COMPONENTS. THE DIAGRAMS DO NOT NECESSARILY ILLUSTRATE THE QUANTITY REQUIRED OF EACH COMPONENT NOR THE ACTUAL LOCATION FOR THESE COMPONENTS. EXACT QUANTITY AND LOCATION WILL BE DETERMINED DURING THE DESIGN PROCESS.



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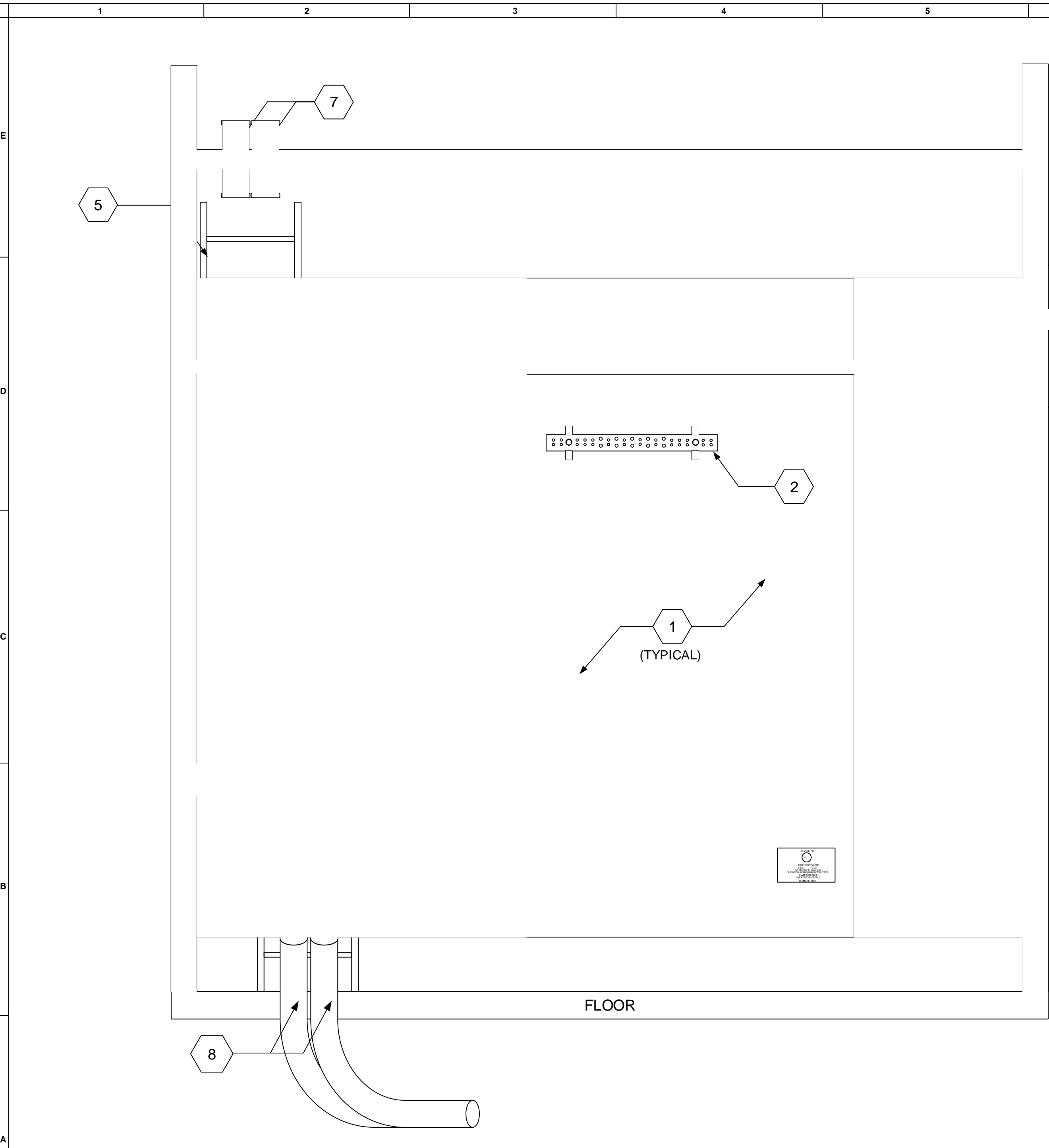
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B.09



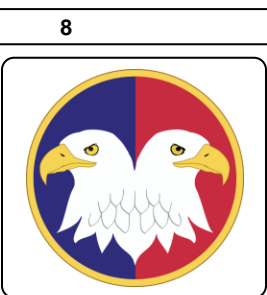


SHEET KEY NOTES

- 1 PLYWOOD BACKBOARD
- 2 PBB\$BB
- 3 HORIZONTAL LADDER RACK
- 4 CABLE RADIUS DROP OUTS (WATERFALL SUPPORTS)
- 5 VERTICAL LADDER RACK
- 6 SELF-SEALING, RE-ENTERABLE, MECHANICAL FIRE-STOPPING FLOOR SLEEVES
- 7 STANDARD WALL SLEEVES OR SELF-SEALING, RE-ENTERABLE, MECHANICAL FIRE-STOPPING WALL SLEEVES (AS REQUIRED PER TECHNICAL CRITERIA)
- 8 CONDUITS TO TER

SHEET GENERAL NOTES

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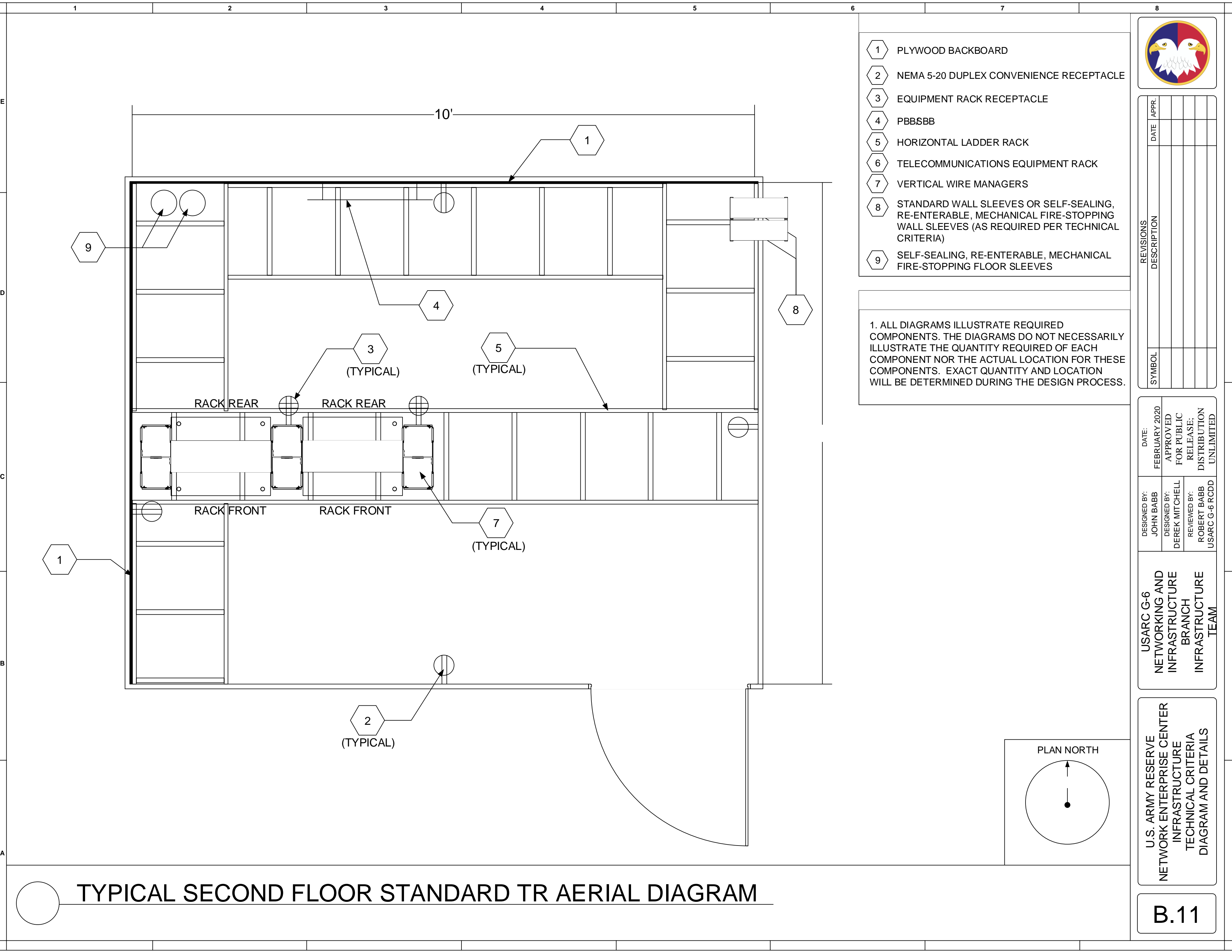
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B.10





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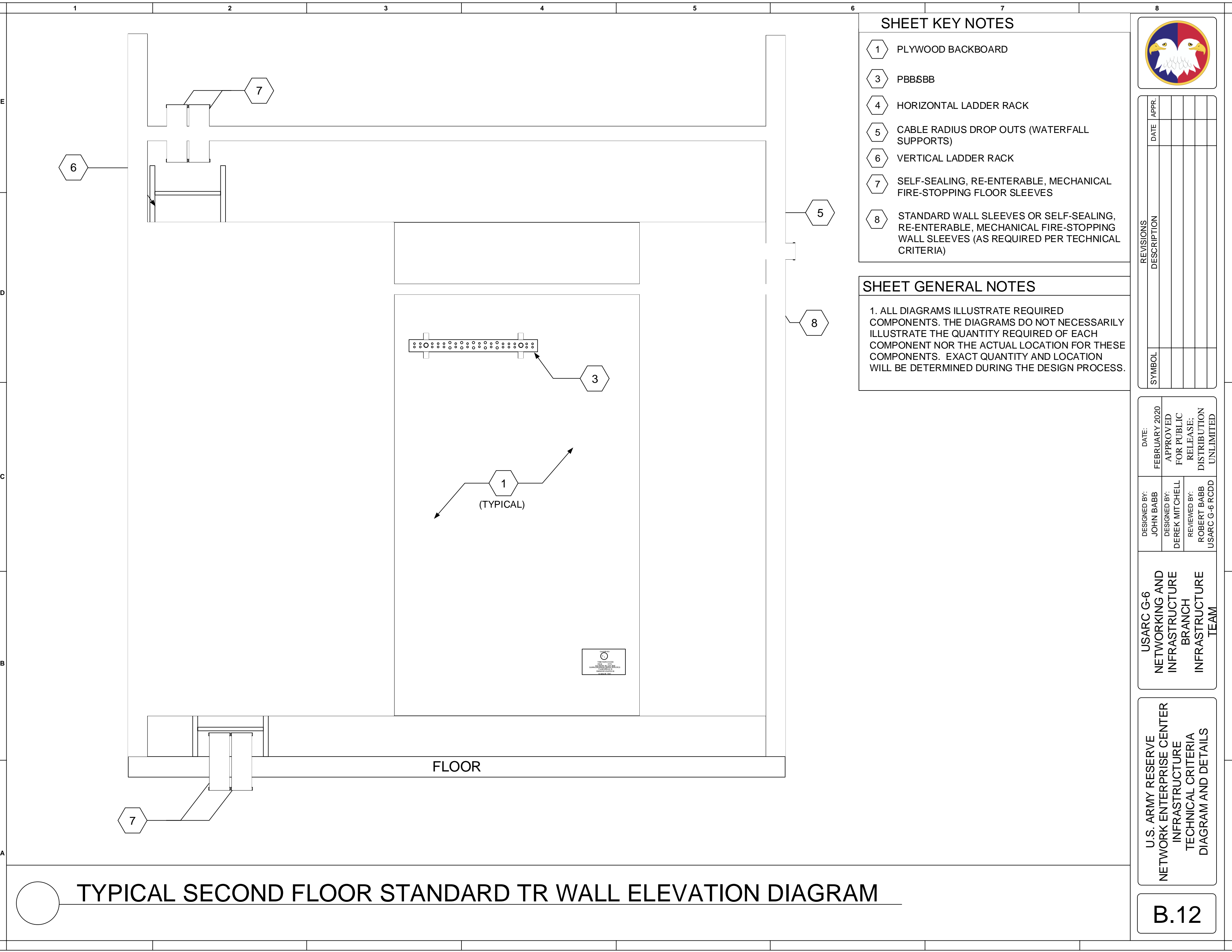
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B.11



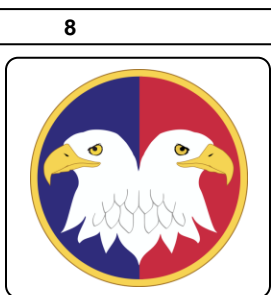


SHEET KEY NOTES

- 1 PLYWOOD BACKBOARD
- 3 PBB&BB
- 4 HORIZONTAL LADDER RACK
- 5 CABLE RADIUS DROP OUTS (WATERFALL SUPPORTS)
- 6 VERTICAL LADDER RACK
- 7 SELF-SEALING, RE-ENTERABLE, MECHANICAL FIRE-STOPPING FLOOR SLEEVES
- 8 STANDARD WALL SLEEVES OR SELF-SEALING, RE-ENTERABLE, MECHANICAL FIRE-STOPPING WALL SLEEVES (AS REQUIRED PER TECHNICAL CRITERIA)

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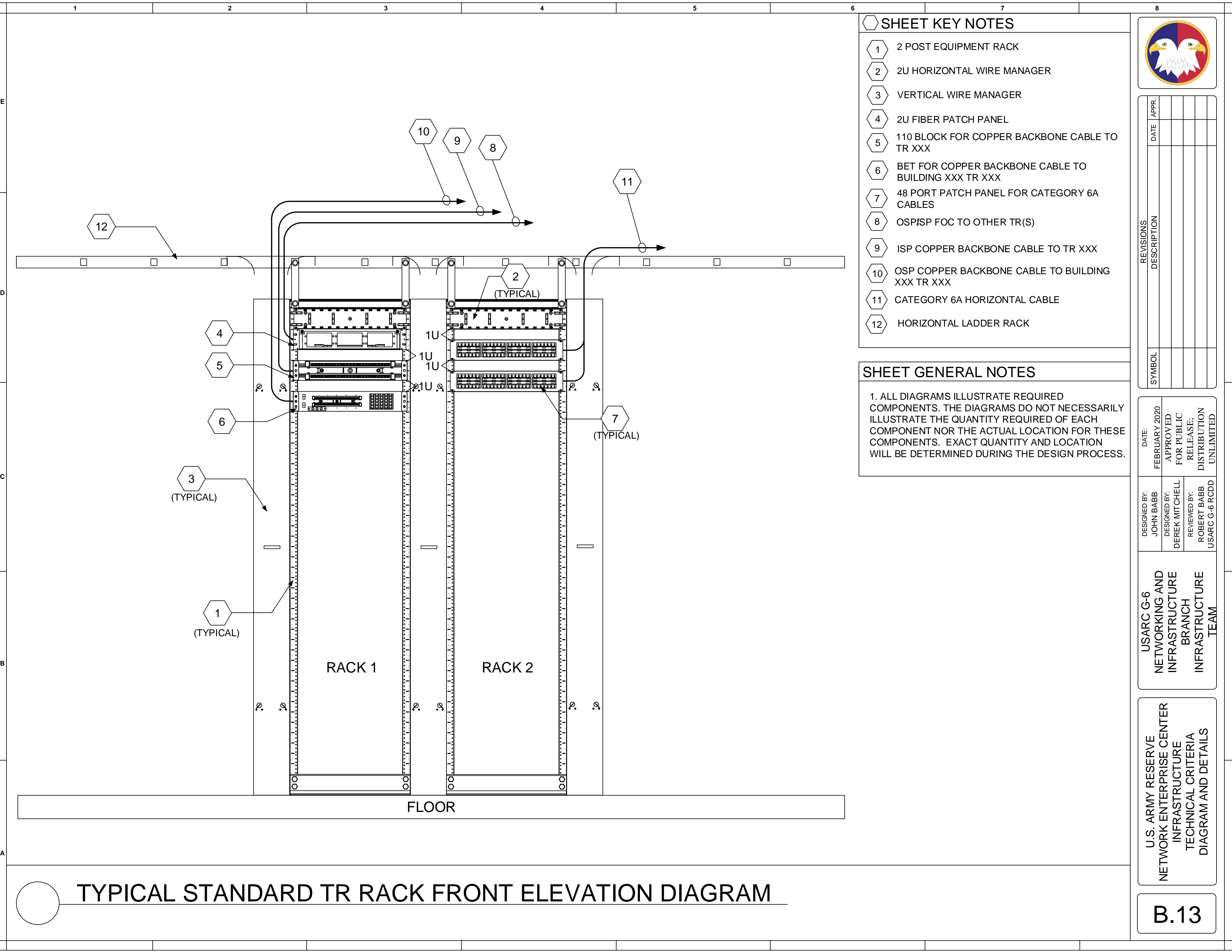
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B.12





SHEET KEY NOTES

- 1 2 POST EQUIPMENT RACK
- 2 2U HORIZONTAL WIRE MANAGER
- 3 VERTICAL WIRE MANAGER
- 4 2U FIBER PATCH PANEL
- 5 110 BLOCK FOR COPPER BACKBONE CABLE TO TR XXX
- 6 BET FOR COPPER BACKBONE CABLE TO BUILDING XXX TR XXX
- 7 48 PORT PATCH PANEL FOR CATEGORY 6A CABLES
- 8 OSP/ISP FOC TO OTHER TR(S)
- 9 ISP COPPER BACKBONE CABLE TO TR XXX
- 10 OSP COPPER BACKBONE CABLE TO BUILDING XXX TR XXX
- 11 CATEGORY 6A HORIZONTAL CABLE
- 12 HORIZONTAL LADDER RACK

SHEET GENERAL NOTES

1. ALL DIAGRAMS ILLUSTRATE REQUIRED COMPONENTS. THE DIAGRAMS DO NOT NECESSARILY ILLUSTRATE THE QUANTITY REQUIRED OF EACH COMPONENT NOR THE ACTUAL LOCATION FOR THESE COMPONENTS. EXACT QUANTITY AND LOCATION WILL BE DETERMINED DURING THE DESIGN PROCESS.



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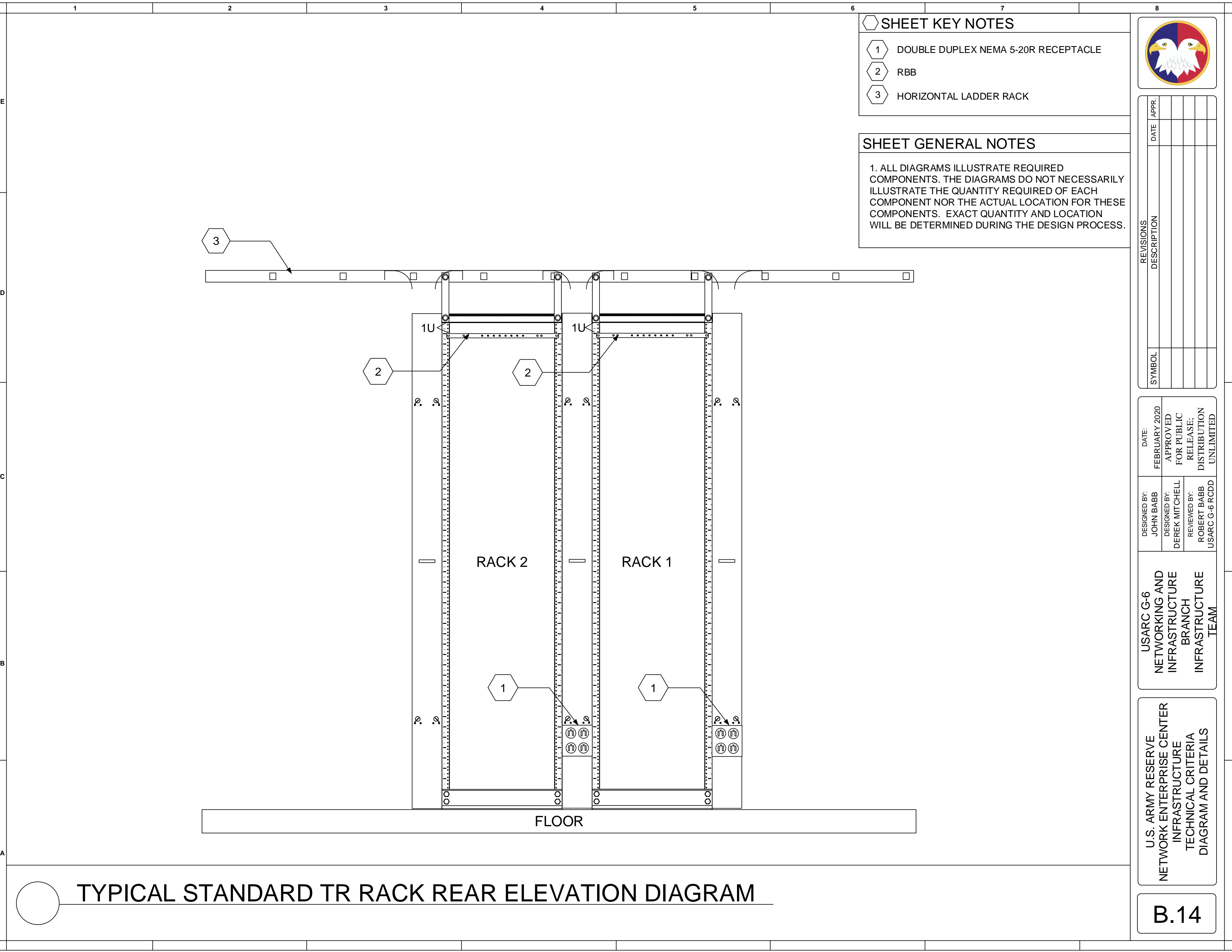
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B.13

TYPICAL STANDARD TR RACK FRONT ELEVATION DIAGRAM





SHEET KEY NOTES

- 1 DOUBLE DUPLEX NEMA 5-20R RECEPTACLE
- 2 RBB
- 3 HORIZONTAL LADDER RACK

SHEET GENERAL NOTES

1. ALL DIAGRAMS ILLUSTRATE REQUIRED COMPONENTS. THE DIAGRAMS DO NOT NECESSARILY ILLUSTRATE THE QUANTITY REQUIRED OF EACH COMPONENT NOR THE ACTUAL LOCATION FOR THESE COMPONENTS. EXACT QUANTITY AND LOCATION WILL BE DETERMINED DURING THE DESIGN PROCESS.



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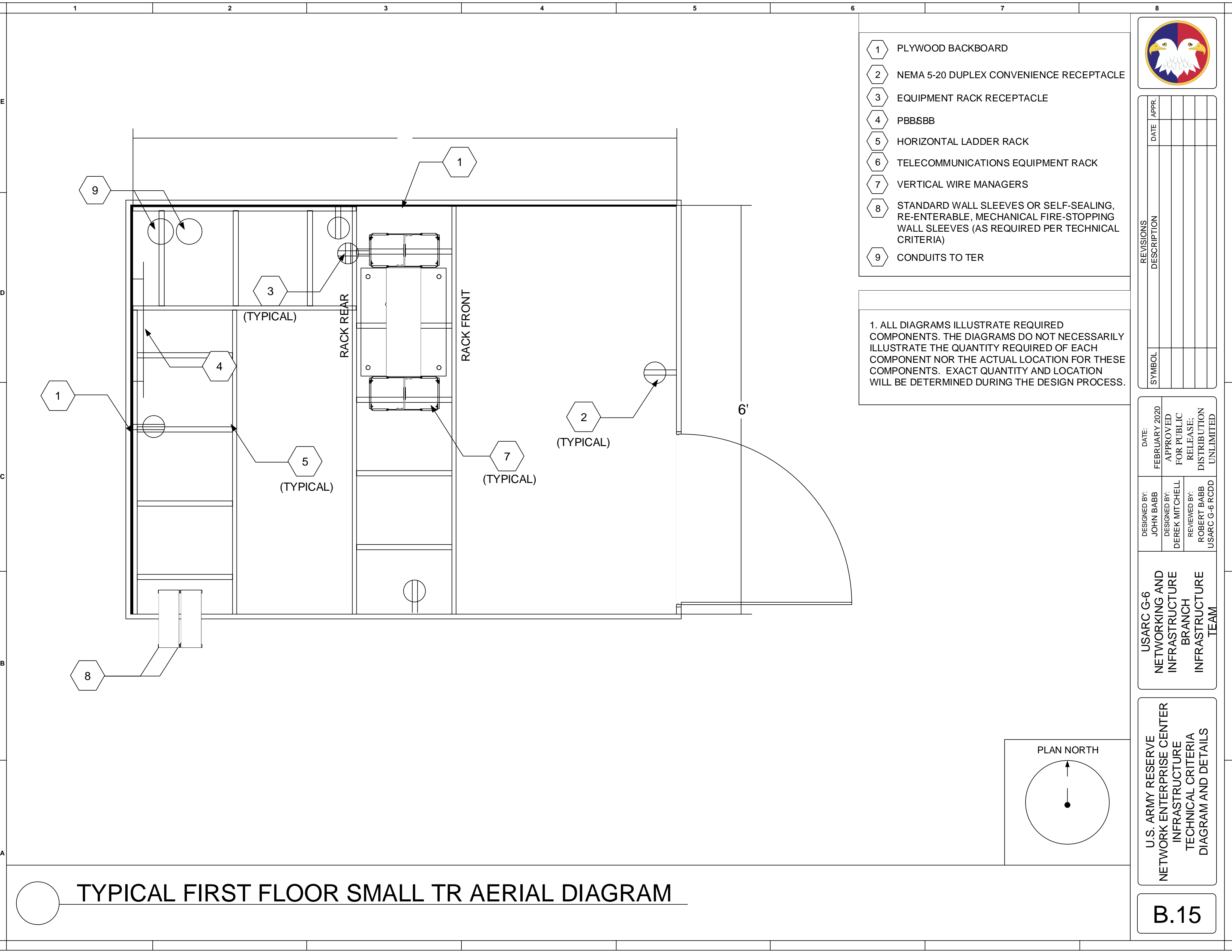
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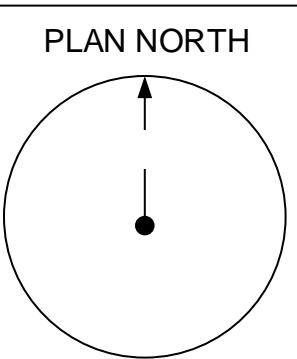
TYPICAL STANDARD TR RACK REAR ELEVATION DIAGRAM



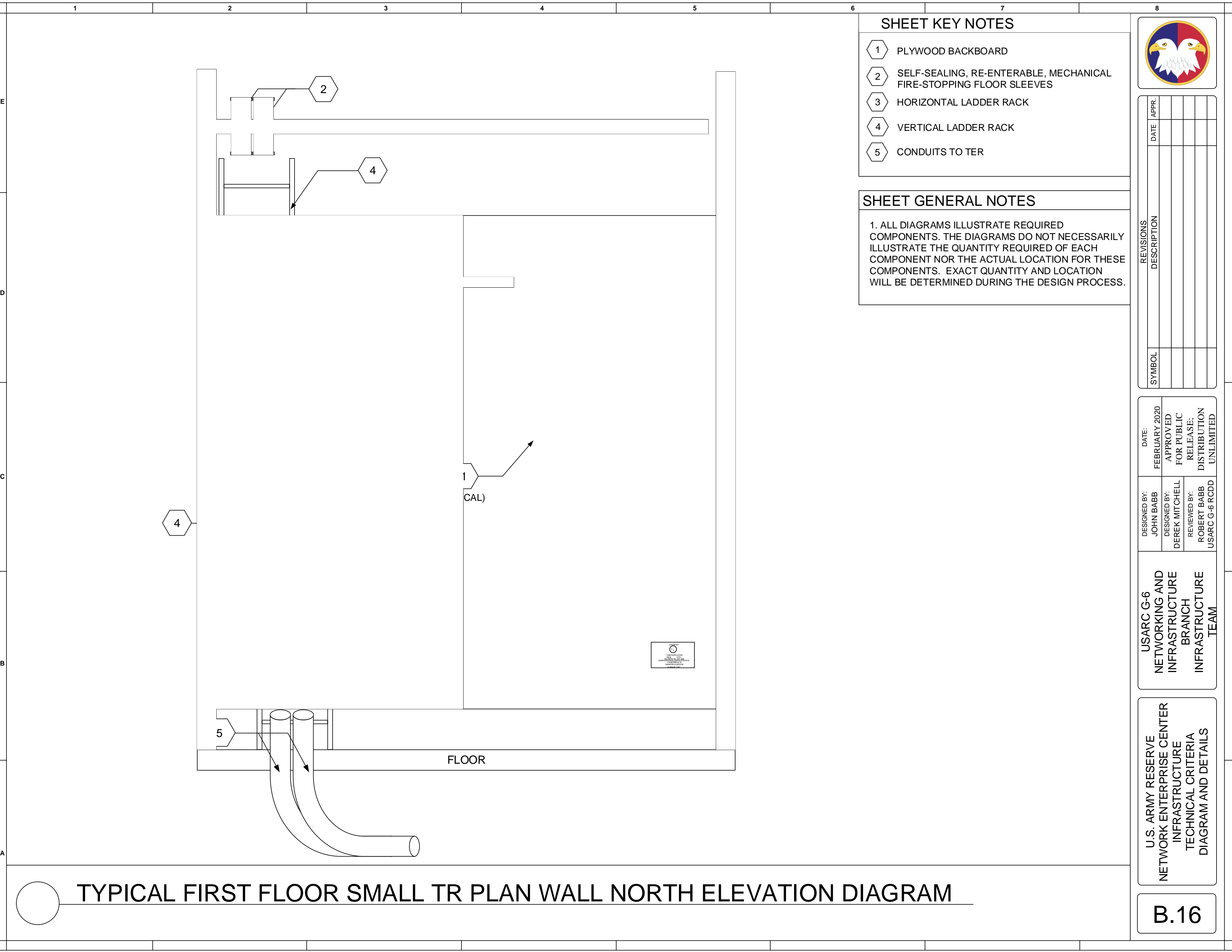


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DESIGNED BY: DEREK MITCHELL	APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED
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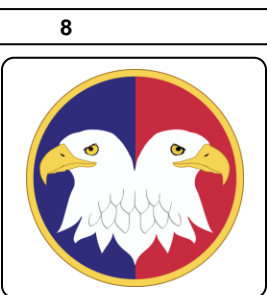


SHEET KEY NOTES

- 1 PLYWOOD BACKBOARD
- 2 SELF-SEALING, RE-ENTERABLE, MECHANICAL FIRE-STOPPING FLOOR SLEEVES
- 3 HORIZONTAL LADDER RACK
- 4 VERTICAL LADDER RACK
- 5 CONDUITS TO TER

SHEET GENERAL NOTES

1. ALL DIAGRAMS ILLUSTRATE REQUIRED COMPONENTS. THE DIAGRAMS DO NOT NECESSARILY ILLUSTRATE THE QUANTITY REQUIRED OF EACH COMPONENT NOR THE ACTUAL LOCATION FOR THESE COMPONENTS. EXACT QUANTITY AND LOCATION WILL BE DETERMINED DURING THE DESIGN PROCESS.



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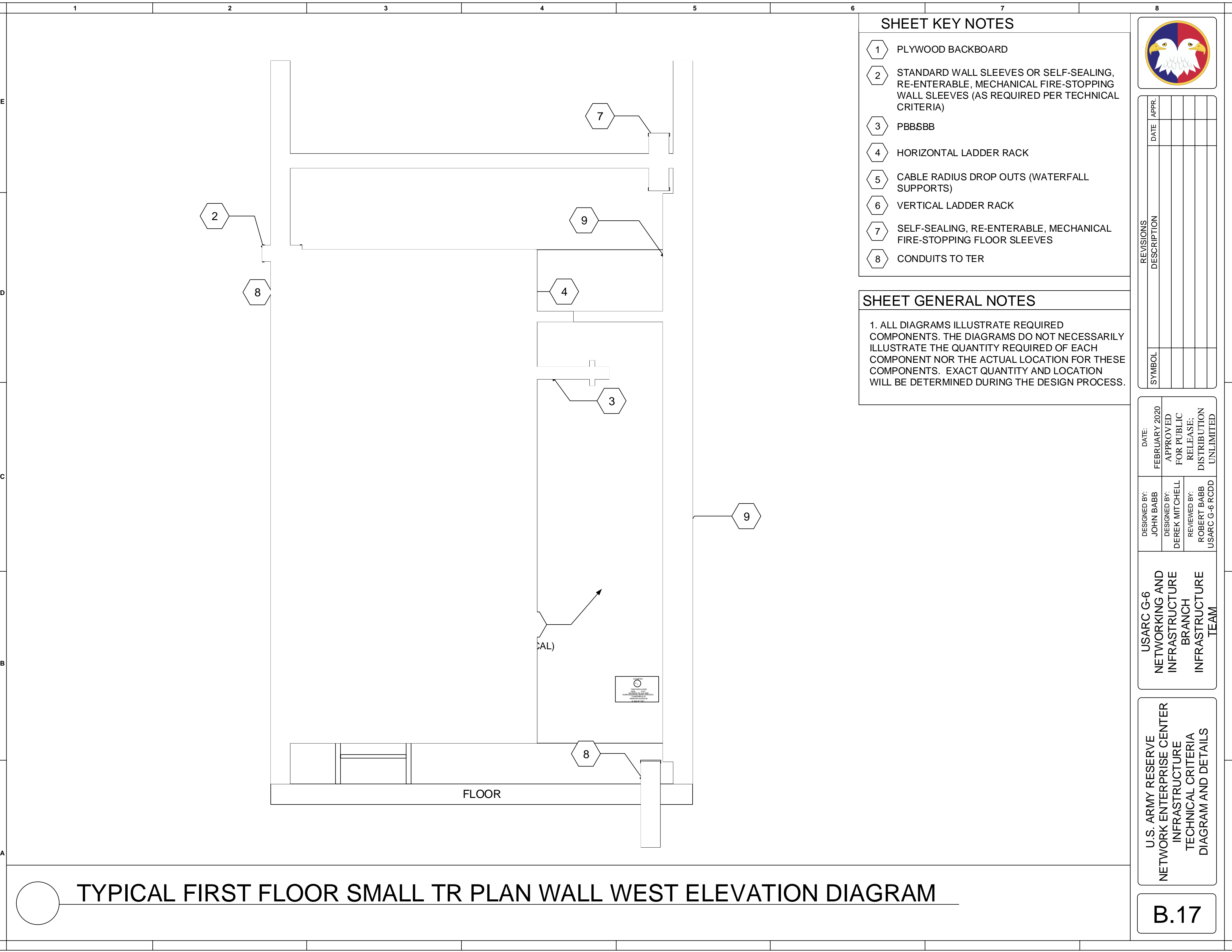
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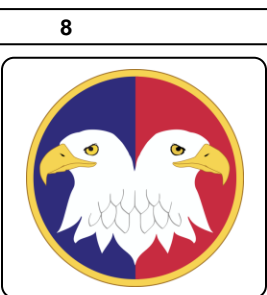


SHEET KEY NOTES

- 1 PLYWOOD BACKBOARD
- 2 STANDARD WALL SLEEVES OR SELF-SEALING, RE-ENTERABLE, MECHANICAL FIRE-STOPPING WALL SLEEVES (AS REQUIRED PER TECHNICAL CRITERIA)
- 3 PBB/BBB
- 4 HORIZONTAL LADDER RACK
- 5 CABLE RADIUS DROP OUTS (WATERFALL SUPPORTS)
- 6 VERTICAL LADDER RACK
- 7 SELF-SEALING, RE-ENTERABLE, MECHANICAL FIRE-STOPPING FLOOR SLEEVES
- 8 CONDUITS TO TER

SHEET GENERAL NOTES

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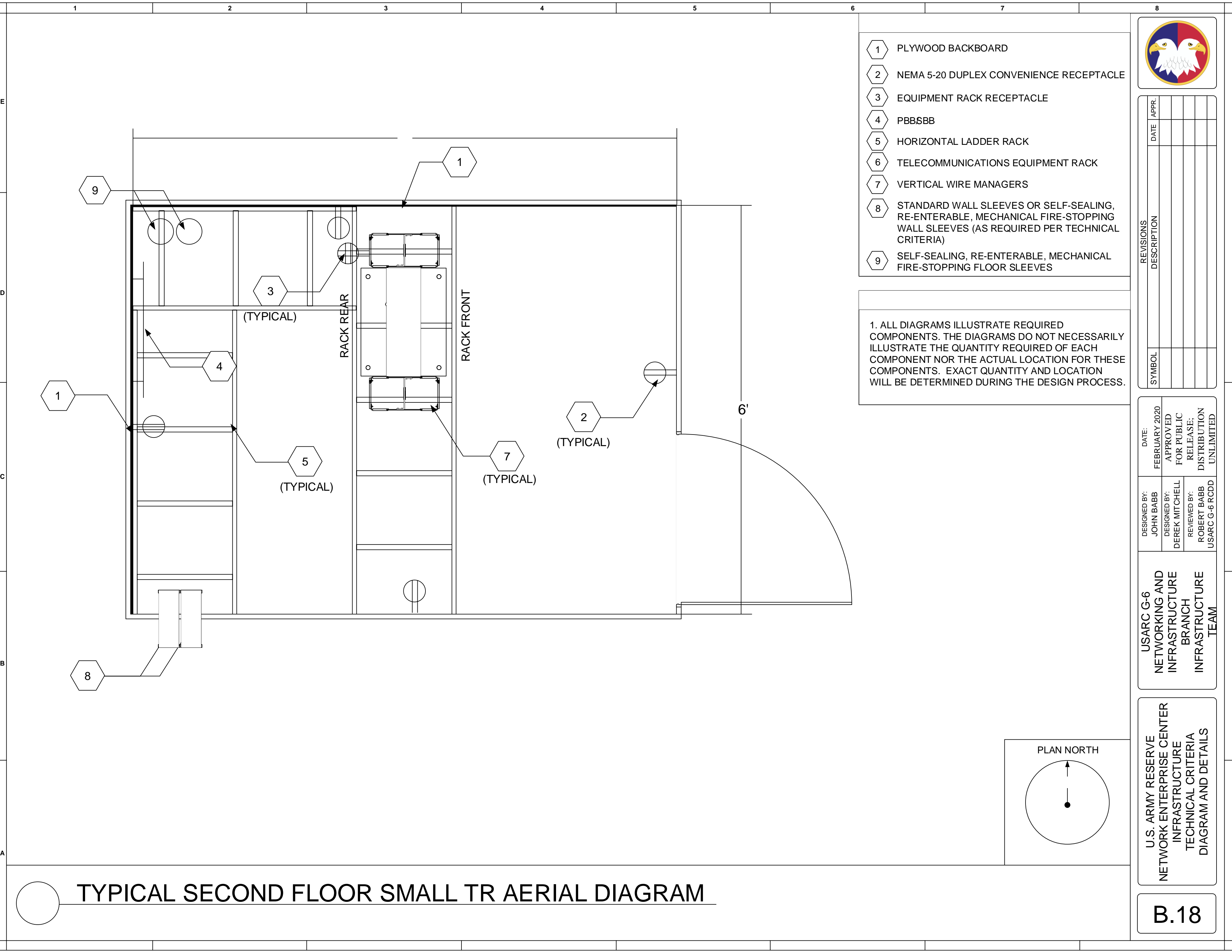
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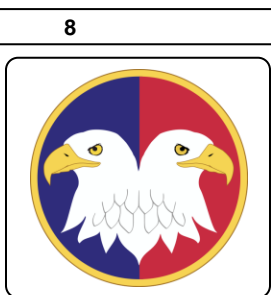
B.17





- 1 PLYWOOD BACKBOARD
- 2 NEMA 5-20 DUPLEX CONVENIENCE RECEPTACLE
- 3 EQUIPMENT RACK RECEPTACLE
- 4 PBB&BB
- 5 HORIZONTAL LADDER RACK
- 6 TELECOMMUNICATIONS EQUIPMENT RACK
- 7 VERTICAL WIRE MANAGERS
- 8 STANDARD WALL SLEEVES OR SELF-SEALING, RE-ENTERABLE, MECHANICAL FIRE-STOPPING WALL SLEEVES (AS REQUIRED PER TECHNICAL CRITERIA)
- 9 SELF-SEALING, RE-ENTERABLE, MECHANICAL FIRE-STOPPING FLOOR SLEEVES

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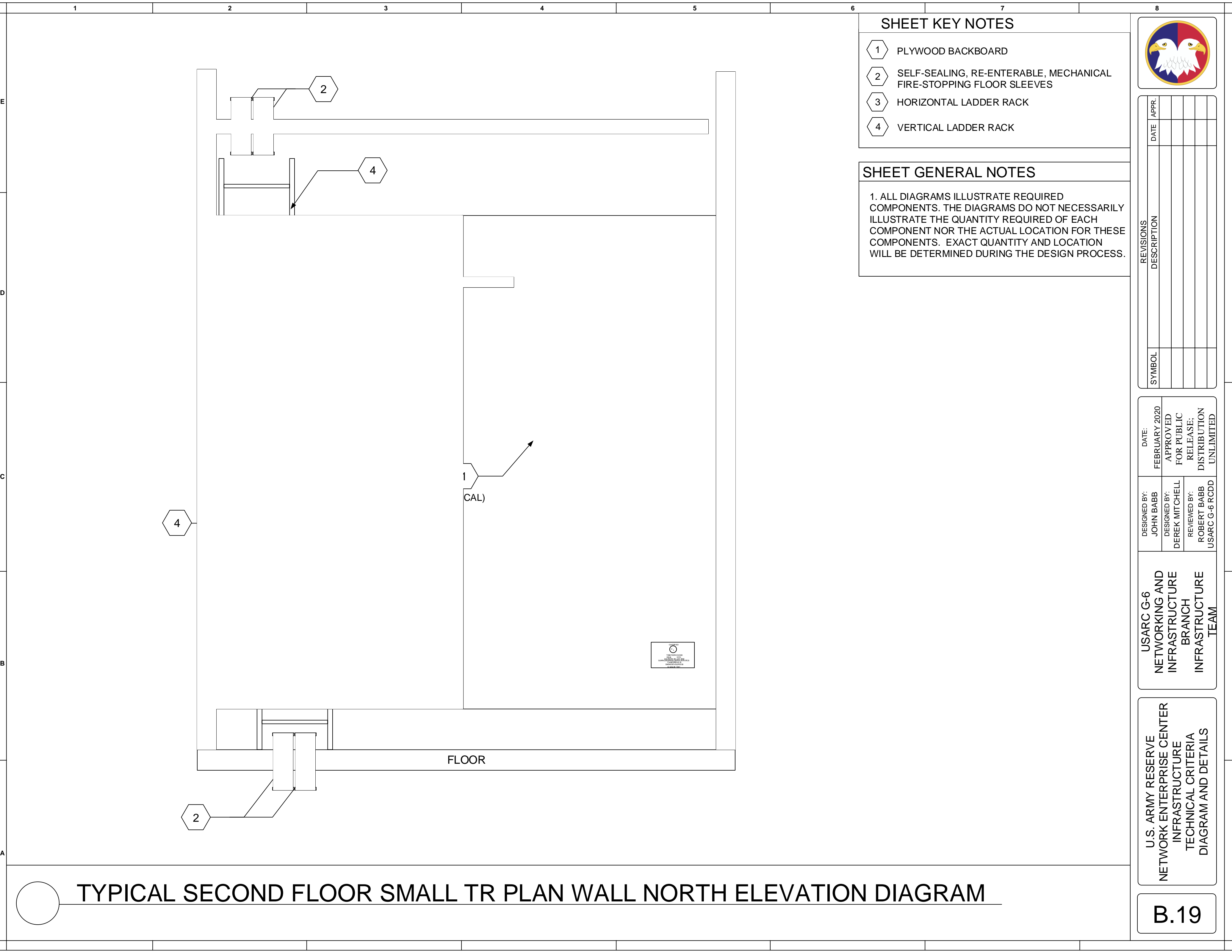
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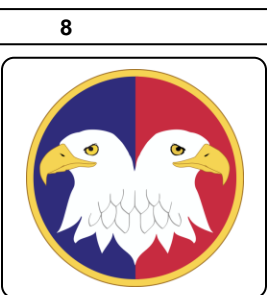


SHEET KEY NOTES

- 1 PLYWOOD BACKBOARD
- 2 SELF-SEALING, RE-ENTERABLE, MECHANICAL FIRE-STOPPING FLOOR SLEEVES
- 3 HORIZONTAL LADDER RACK
- 4 VERTICAL LADDER RACK

SHEET GENERAL NOTES

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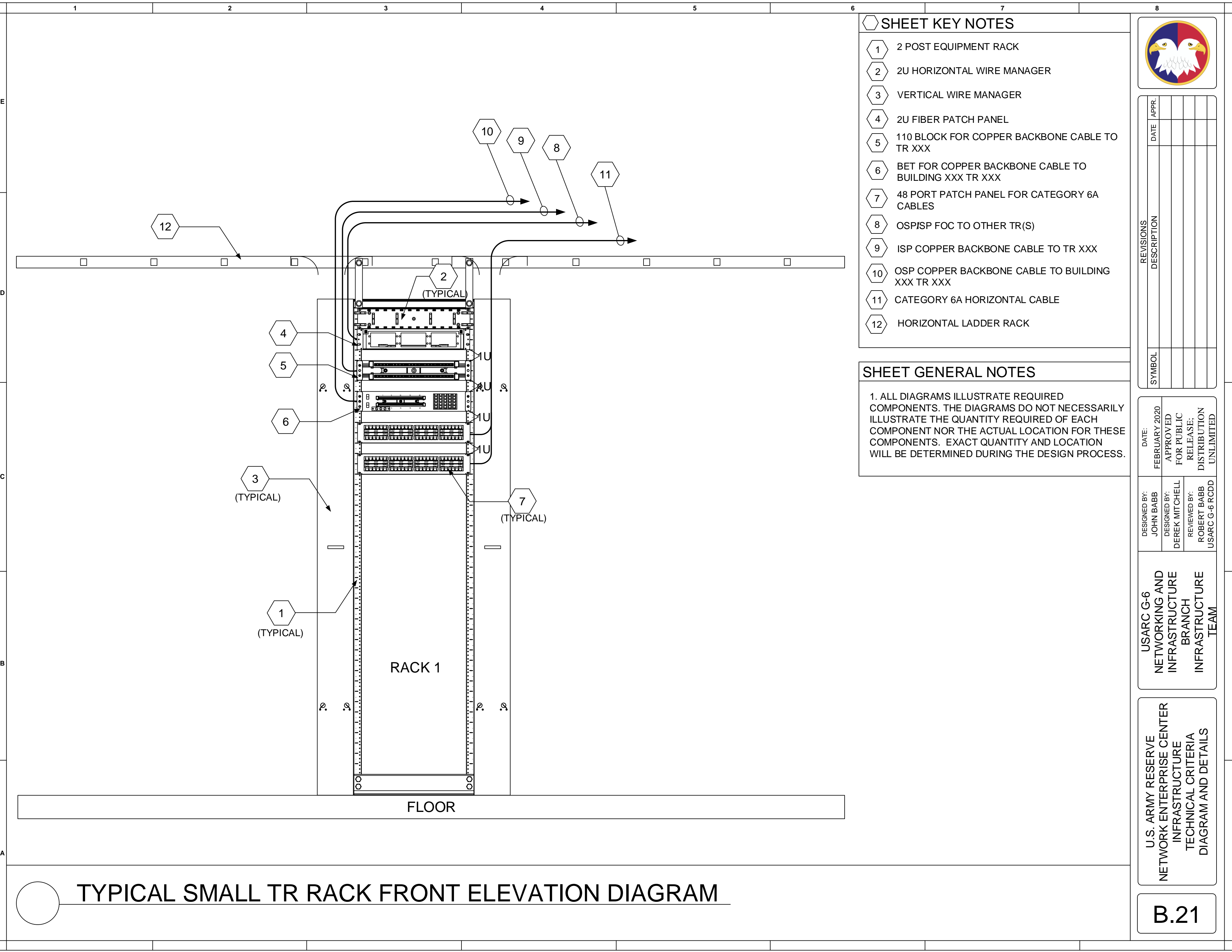
B.19

TYPICAL SECOND FLOOR SMALL TR PLAN WALL NORTH ELEVATION DIAGRAM









SHEET KEY NOTES

- 1 2 POST EQUIPMENT RACK
- 2 2U HORIZONTAL WIRE MANAGER
- 3 VERTICAL WIRE MANAGER
- 4 2U FIBER PATCH PANEL
- 5 110 BLOCK FOR COPPER BACKBONE CABLE TO TR XXX
- 6 BET FOR COPPER BACKBONE CABLE TO BUILDING XXX TR XXX
- 7 48 PORT PATCH PANEL FOR CATEGORY 6A CABLES
- 8 OSP/ISP FOC TO OTHER TR(S)
- 9 ISP COPPER BACKBONE CABLE TO TR XXX
- 10 OSP COPPER BACKBONE CABLE TO BUILDING XXX TR XXX
- 11 CATEGORY 6A HORIZONTAL CABLE
- 12 HORIZONTAL LADDER RACK

SHEET GENERAL NOTES

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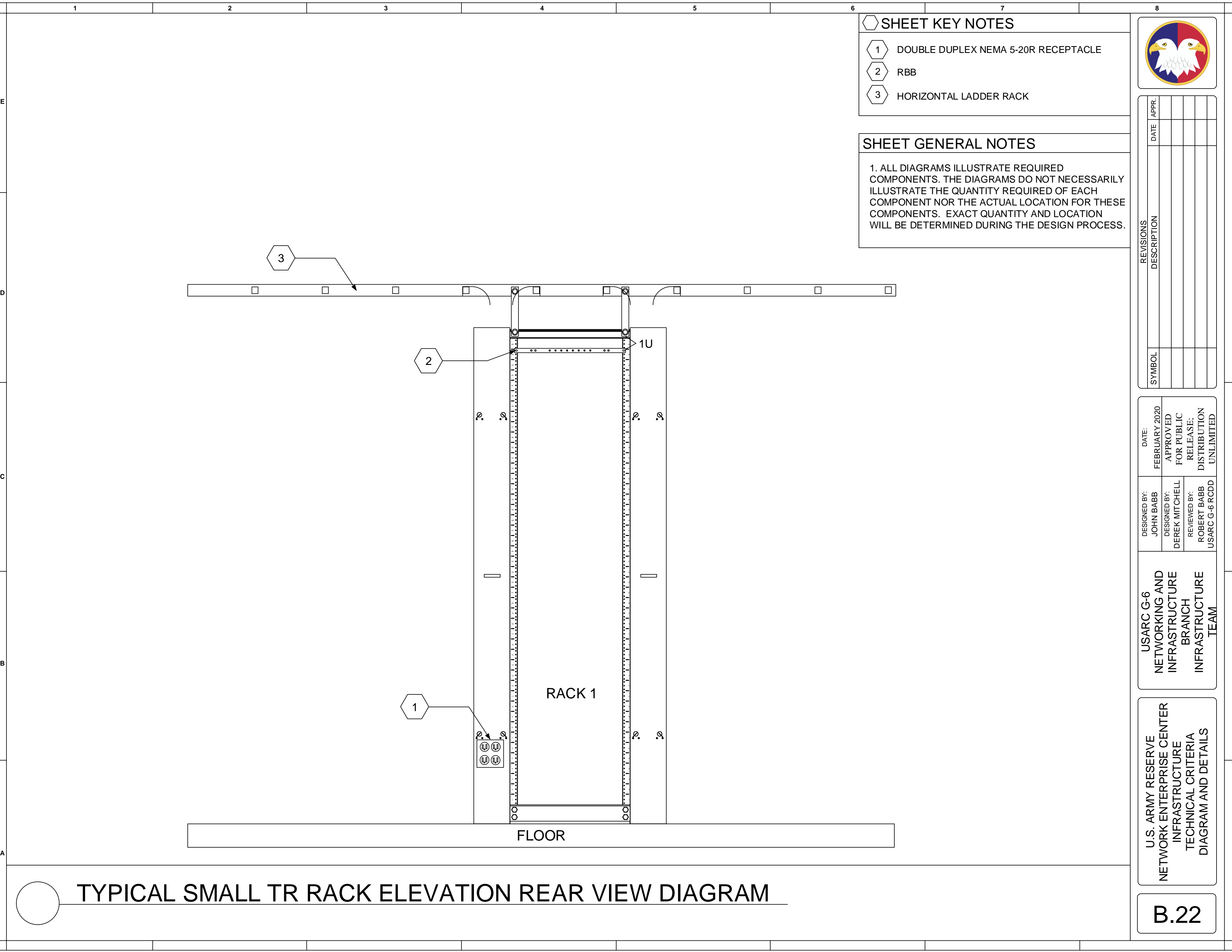
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B.21

TYPICAL SMALL TR RACK FRONT ELEVATION DIAGRAM





SHEET KEY NOTES

- 1 DOUBLE DUPLEX NEMA 5-20R RECEPTACLE
- 2 RBB
- 3 HORIZONTAL LADDER RACK

SHEET GENERAL NOTES

1. ALL DIAGRAMS ILLUSTRATE REQUIRED COMPONENTS. THE DIAGRAMS DO NOT NECESSARILY ILLUSTRATE THE QUANTITY REQUIRED OF EACH COMPONENT NOR THE ACTUAL LOCATION FOR THESE COMPONENTS. EXACT QUANTITY AND LOCATION WILL BE DETERMINED DURING THE DESIGN PROCESS.



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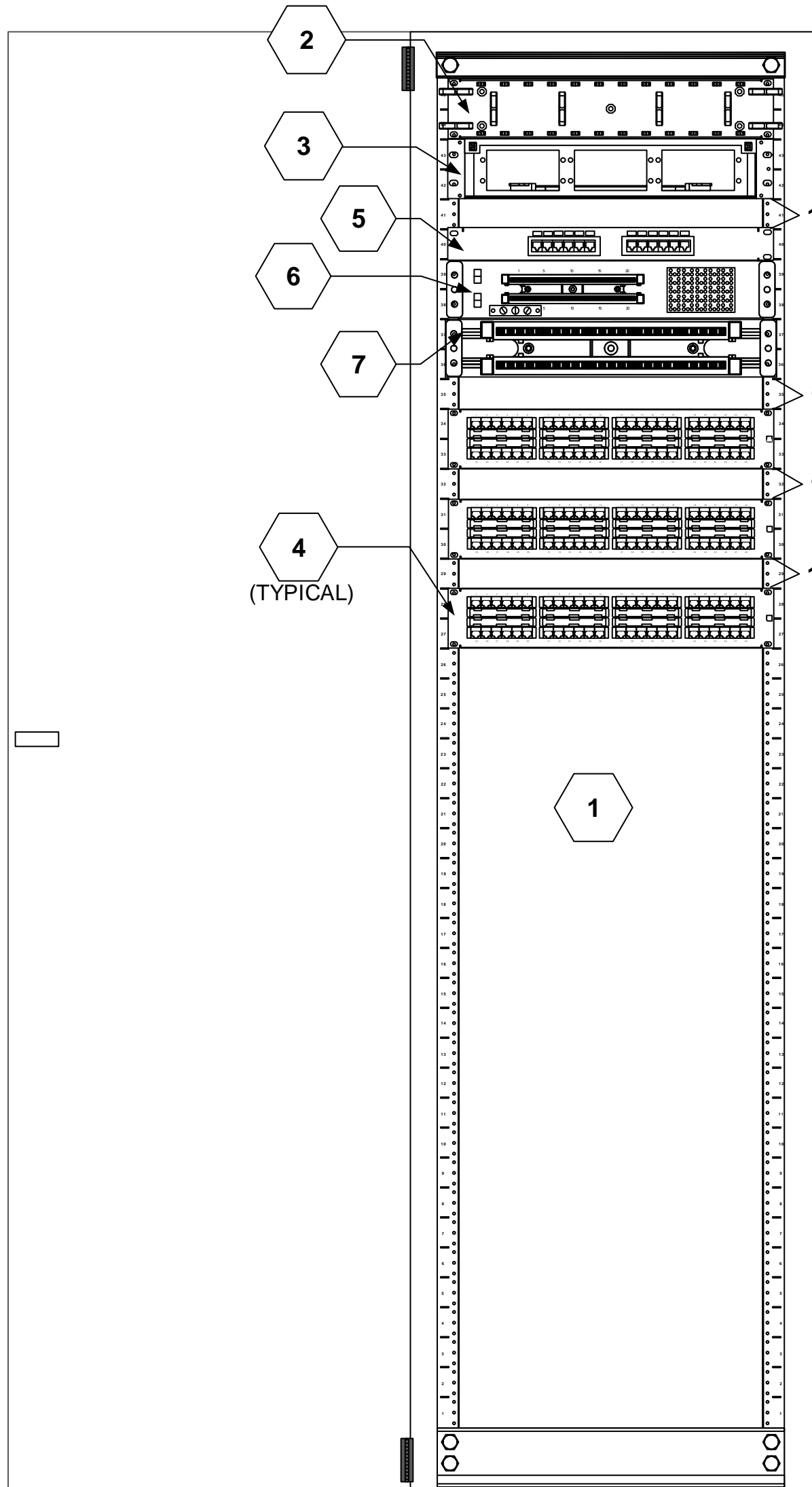
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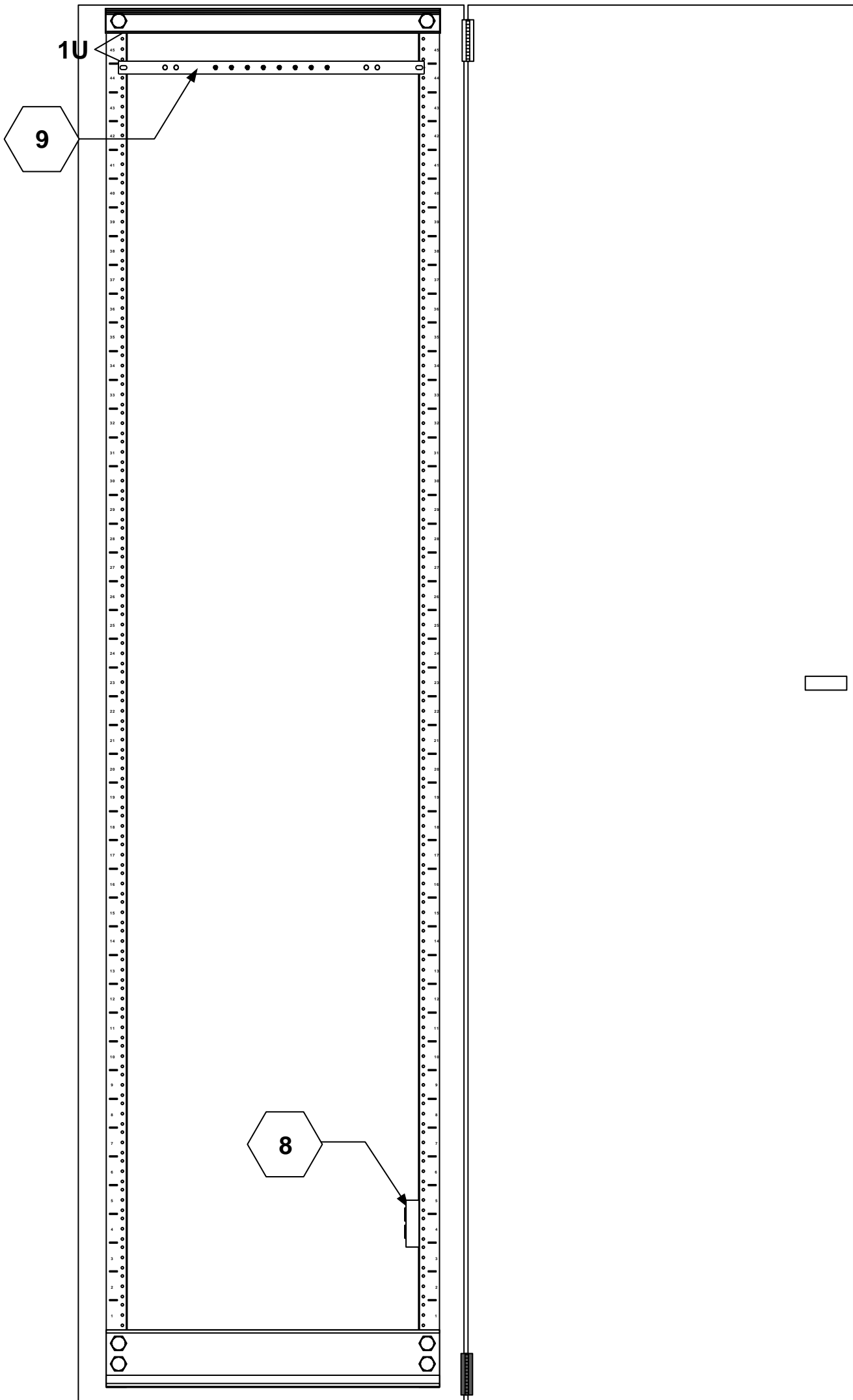
B.22

TYPICAL SMALL TR RACK ELEVATION REAR VIEW DIAGRAM





TELECOMMUNICATIONS CABINET FRONT VIEW



TELECOMMUNICATIONS CABINET REAR VIEW

**SHEET KEY NOTES**

- 1 TELECOMMUNICATIONS FLOOR MOUNTED CABINET
- 2 2U HORIZONTAL WIRE MANAGEMENT
- 3 2U FIBER PATCH PANEL
- 4 CATEGORY 6A PATCH PANEL
- 5 RACK MOUNTED 12 PORT PATCH PANEL
- 6 RACK MOUNTED BET FOR OSP COPPER BACKBONE CABLE
- 7 RACK MOUNTED 110 FOR ISP COPPER BACKBONE CABLE
- 8 DEDICATED DOUBLE DUPLEX NEMA 5-20R RECEPTACLE. MOUNT AT 6-8" AFF ON THE SIDE WITHIN THE CHANNEL OF THE CABINET
- 9 RBB

**SHEET GENERAL NOTES**

1. ALL DIAGRAMS ILLUSTRATE REQUIRED COMPONENTS. THE DIAGRAMS DO NOT NECESSARILY ILLUSTRATE THE QUANTITY REQUIRED OF EACH COMPONENT NOR THE ACTUAL LOCATION FOR THESE COMPONENTS. EXACT QUANTITY AND LOCATION WILL BE DETERMINED DURING THE DESIGN PROCESS.



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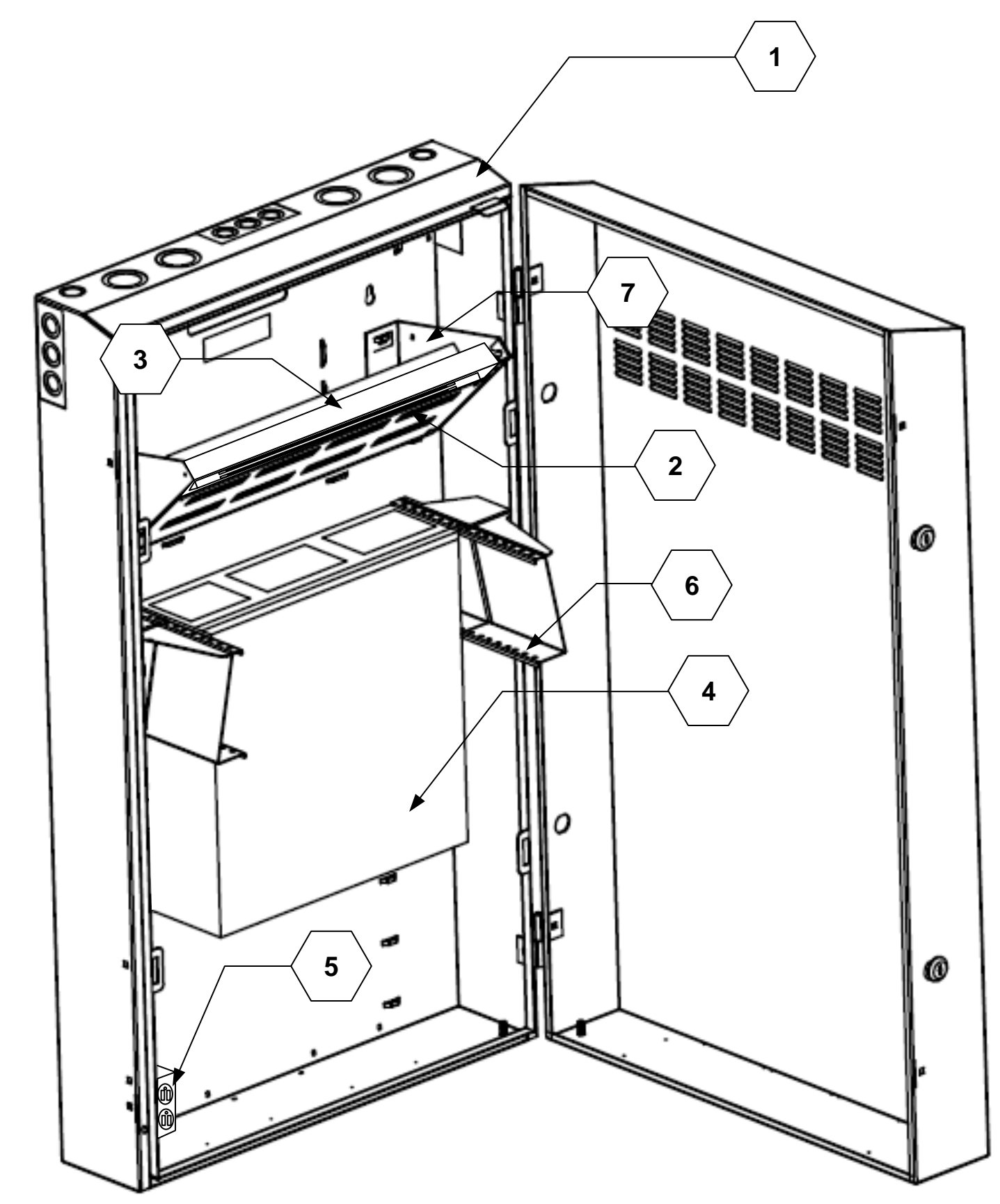
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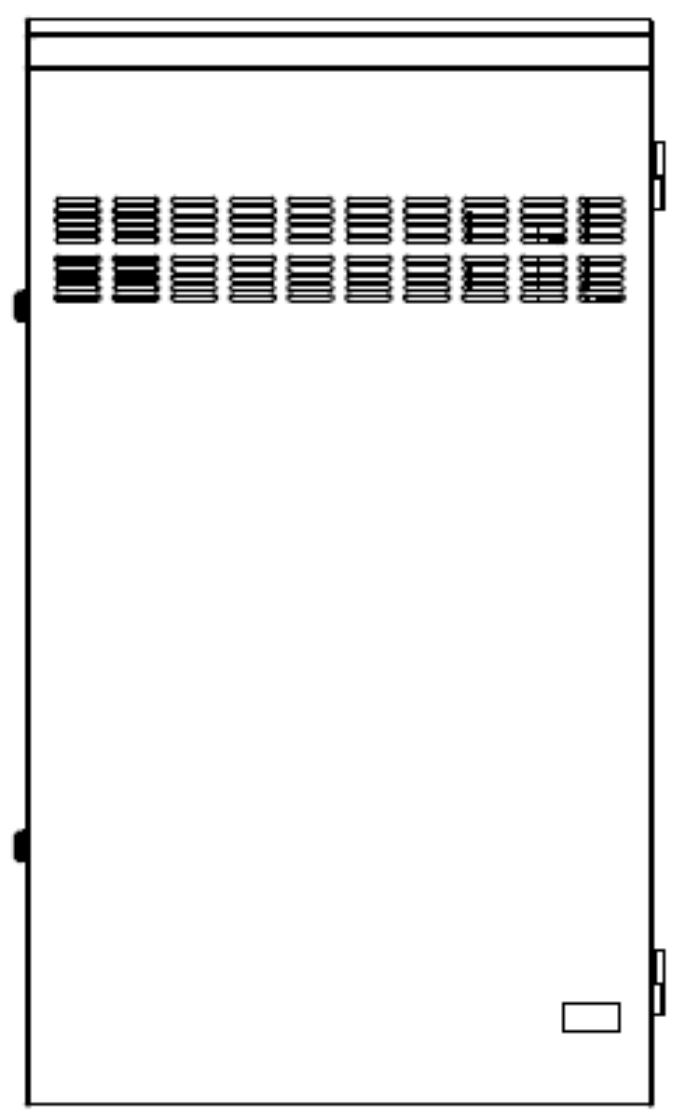
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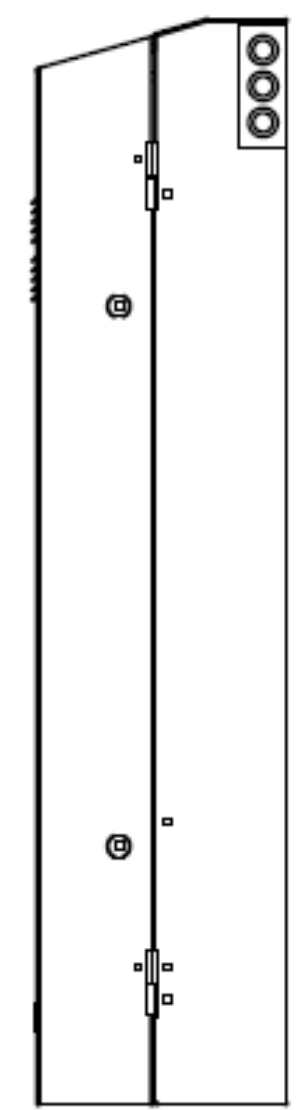
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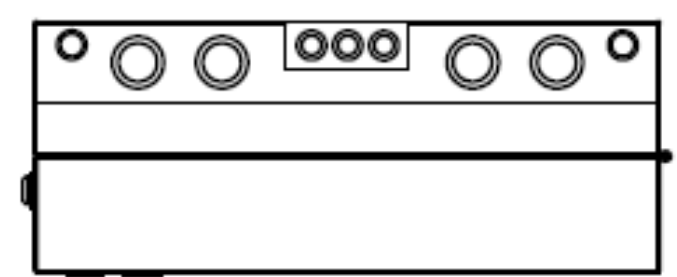
TELECOMMUNICATIONS CABINET ISOMETRIC VIEW OPEN WITH TELECOMMUNICATIONS COMPONENTS INSTALLED



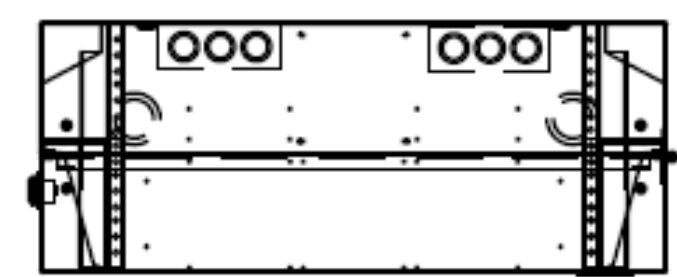
TELECOMMUNICATIONS CABINET CLOSED FRONT VIEW



TELECOMMUNICATIONS CABINET CLOSED SIDE VIEW



TELECOMMUNICATIONS CABINET CLOSED TOP VIEW



TELECOMMUNICATIONS CABINET CLOSED BOTTOM VIEW

SHEET KEY NOTES

- 1 HUBBLE RE4X TELECOMMUNICATIONS CABINET OR APPROVED EQUIVALENT WITH THE HUBBLE OR APPROVED EQUIVALENT FAN KIT, SOUND DAMPENING KIT, PADLOCK HASP KIT, PATCH PANEL MOUNTING BRACKET, EQUIPMENT MOUNTING BRACKET, NEMA 5-20R RECEPTACLE KIT, AND ANY OTHER MISCELLANEOUS ACCESSORIESPARTS FOR A COMPLETE AND OPERATIONAL SYSTEM
- 2 CATEGORY 6A PATCH PANEL
- 3 RACK MOUNTED BACKBONE COPPER TERMINATION BLOCK (BET FOR OSP, 110 BLOCK FOR ISP BACKBONE COPPER CABLE). MOUNT IMMEDIATELY ABOVE THE CAT6A PATCH PANEL
- 4 1 RU RACK MOUNTED FIBER OPTIC CABLE PATCH PANEL. MOUNT PATCH PANEL VERTICALLY AS FAR TO THE REAR OF THE CABINET AS POSSIBLE TO MAKE ROOM FOR GFGI NETWORK EQUIPMENT
- 5 DEDICATED NEMA 5-20R RECEPTACLE KIT
- 6 EQUIPMENT MOUNTING BRACKET
- 7 PATCH PANEL MOUNTING BRACKET



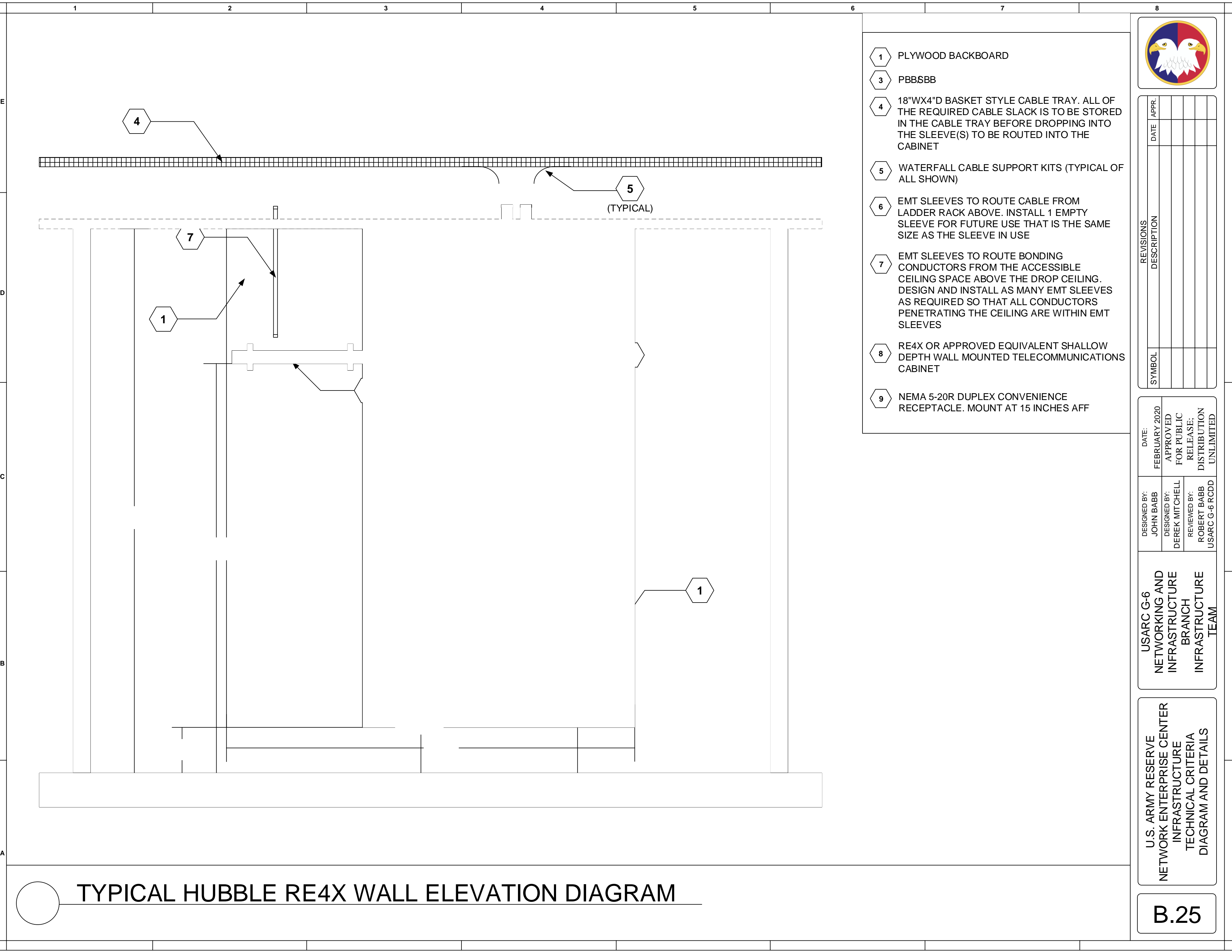
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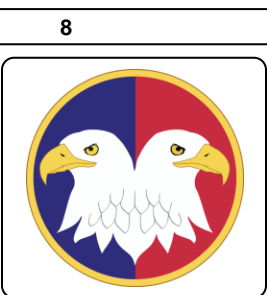
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 TYPICAL HUBBLE RE4X WALL ELEVATION DIAGRAM

- 1** PLYWOOD BACKBOARD
- 3** PBBSBB
- 4** 18"WX4"D BASKET STYLE CABLE TRAY. ALL OF THE REQUIRED CABLE SLACK IS TO BE STORED IN THE CABLE TRAY BEFORE DROPPING INTO THE SLEEVE(S) TO BE ROUTED INTO THE CABINET
- 5** WATERFALL CABLE SUPPORT KITS (TYPICAL OF ALL SHOWN)
- 6** EMT SLEEVES TO ROUTE CABLE FROM LADDER RACK ABOVE. INSTALL 1 EMPTY SLEEVE FOR FUTURE USE THAT IS THE SAME SIZE AS THE SLEEVE IN USE
- 7** EMT SLEEVES TO ROUTE BONDING CONDUCTORS FROM THE ACCESSIBLE CEILING SPACE ABOVE THE DROP CEILING. DESIGN AND INSTALL AS MANY EMT SLEEVES AS REQUIRED SO THAT ALL CONDUCTORS PENETRATING THE CEILING ARE WITHIN EMT SLEEVES
- 8** RE4X OR APPROVED EQUIVALENT SHALLOW DEPTH WALL MOUNTED TELECOMMUNICATIONS CABINET
- 9** NEMA 5-20R DUPLEX CONVENIENCE RECEPTACLE. MOUNT AT 15 INCHES AFF



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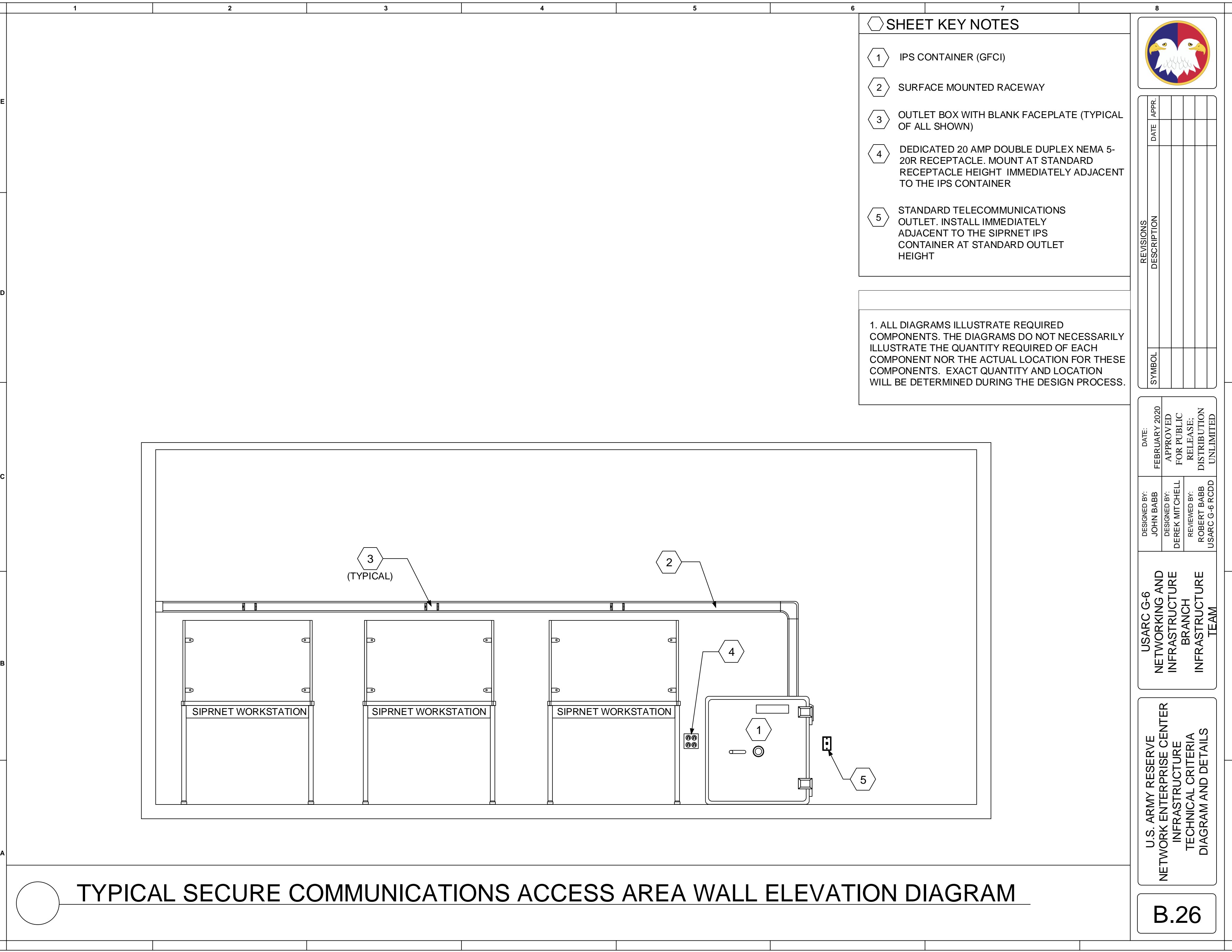
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B.25





### SHEET KEY NOTES

1

IPS CONTAINER (GFCI)

2

SURFACE MOUNTED RACEWAY

3

OUTLET BOX WITH BLANK FACEPLATE (TYPICAL OF ALL SHOWN)


4

DEDICATED 20 AMP DOUBLE DUPLEX NEMA 5-20R RECEPTACLE. MOUNT AT STANDARD RECEPTACLE HEIGHT IMMEDIATELY ADJACENT TO THE IPS CONTAINER

5

STANDARD TELECOMMUNICATIONS OUTLET. INSTALL IMMEDIATELY ADJACENT TO THE SIPRNET IPS CONTAINER AT STANDARD OUTLET HEIGHT

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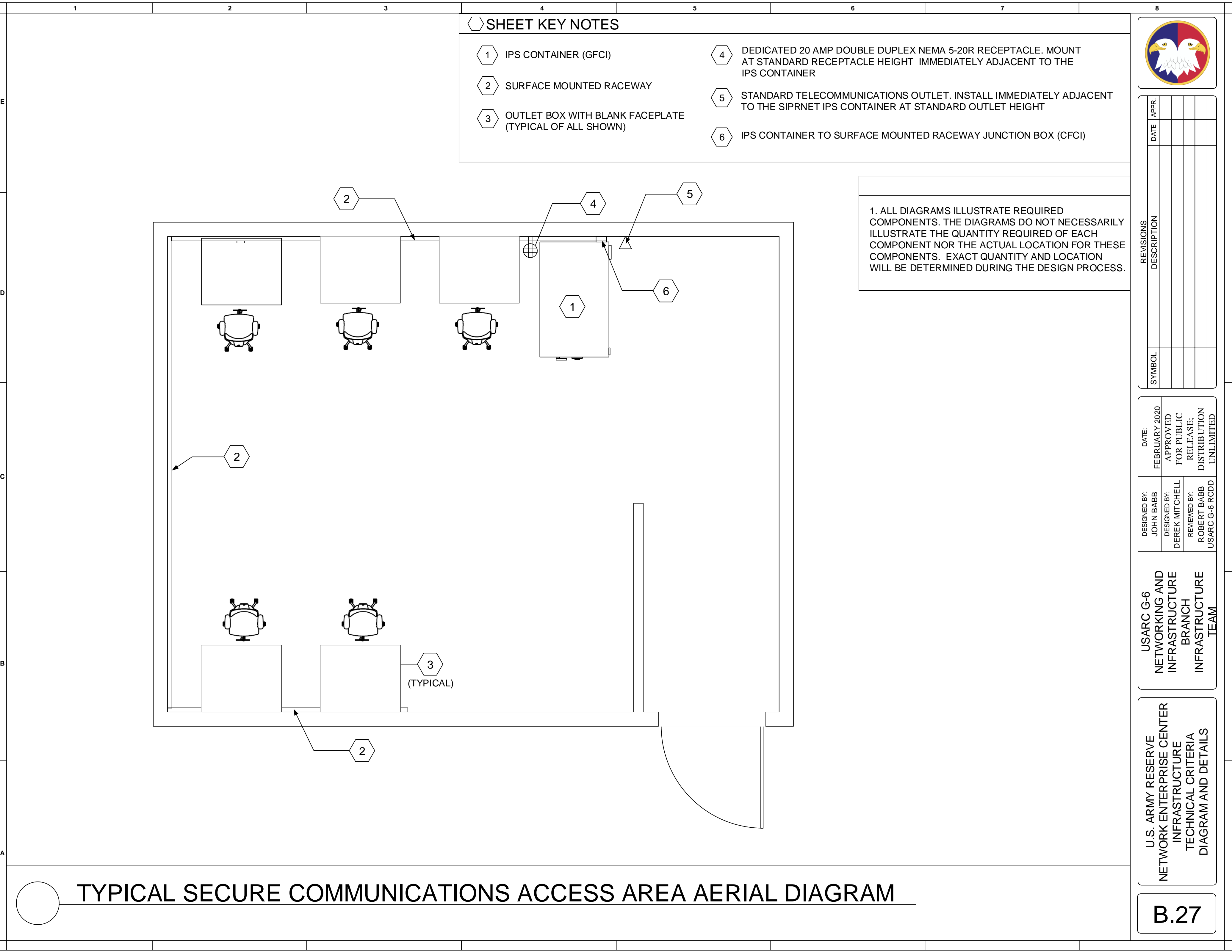
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B.26

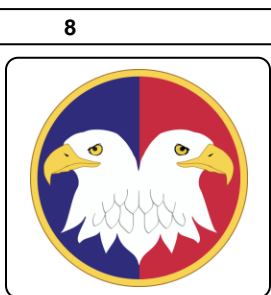




SHEET KEY NOTES	
1	IPS CONTAINER (GFCI)
2	SURFACE MOUNTED RACEWAY
3	OUTLET BOX WITH BLANK FACEPLATE (TYPICAL OF ALL SHOWN)
4	DEDICATED 20 AMP DOUBLE DUPLEX NEMA 5-20R RECEPTACLE. MOUNT AT STANDARD RECEPTACLE HEIGHT IMMEDIATELY ADJACENT TO THE IPS CONTAINER
5	STANDARD TELECOMMUNICATIONS OUTLET. INSTALL IMMEDIATELY ADJACENT TO THE SIPRNET IPS CONTAINER AT STANDARD OUTLET HEIGHT
6	IPS CONTAINER TO SURFACE MOUNTED RACEWAY JUNCTION BOX (CFCI)

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TYPICAL SECURE COMMUNICATIONS ACCESS AREA AERIAL DIAGRAM



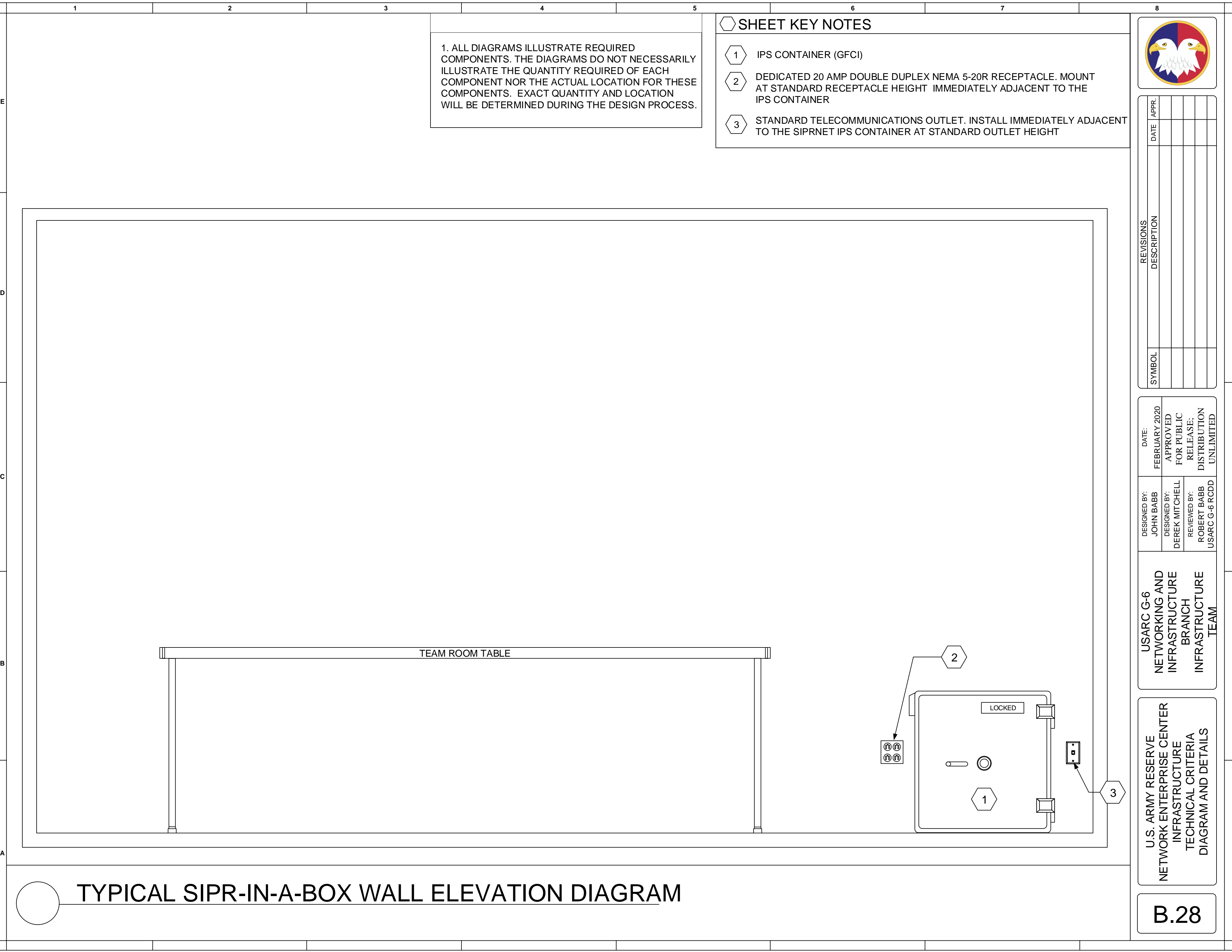
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B.27
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- ### SHEET KEY NOTES
- 1 IPS CONTAINER (GFCI)
  - 2 DEDICATED 20 AMP DOUBLE DUPLEX NEMA 5-20R RECEPTACLE. MOUNT AT STANDARD RECEPTACLE HEIGHT IMMEDIATELY ADJACENT TO THE IPS CONTAINER
  - 3 STANDARD TELECOMMUNICATIONS OUTLET. INSTALL IMMEDIATELY ADJACENT TO THE SIPRNET IPS CONTAINER AT STANDARD OUTLET HEIGHT



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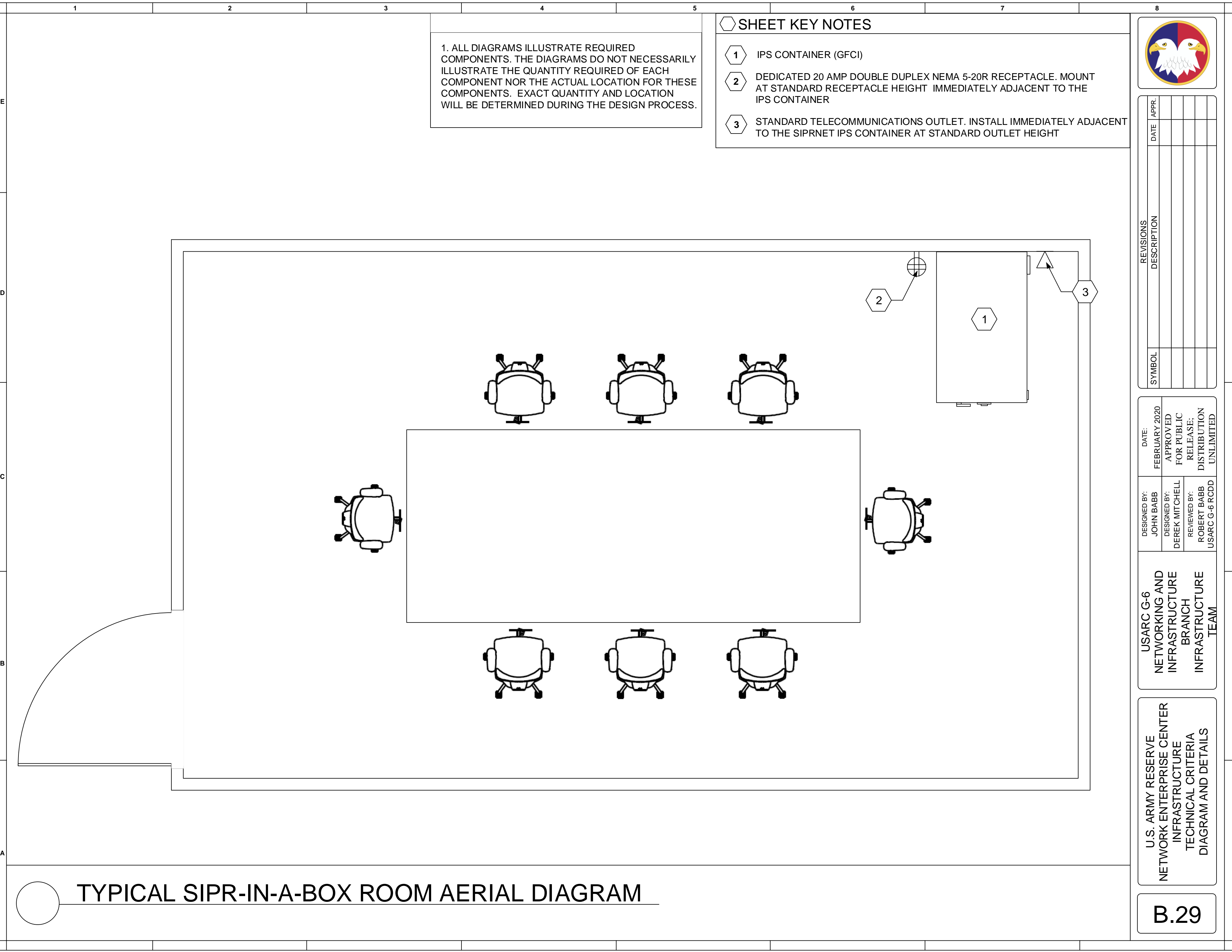
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B.28

TYPICAL SIPR-IN-A-BOX WALL ELEVATION DIAGRAM





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- ### SHEET KEY NOTES
- 1 IPS CONTAINER (GFCI)
  - 2 DEDICATED 20 AMP DOUBLE DUPLEX NEMA 5-20R RECEPTACLE. MOUNT AT STANDARD RECEPTACLE HEIGHT IMMEDIATELY ADJACENT TO THE IPS CONTAINER
  - 3 STANDARD TELECOMMUNICATIONS OUTLET. INSTALL IMMEDIATELY ADJACENT TO THE SIPRNET IPS CONTAINER AT STANDARD OUTLET HEIGHT



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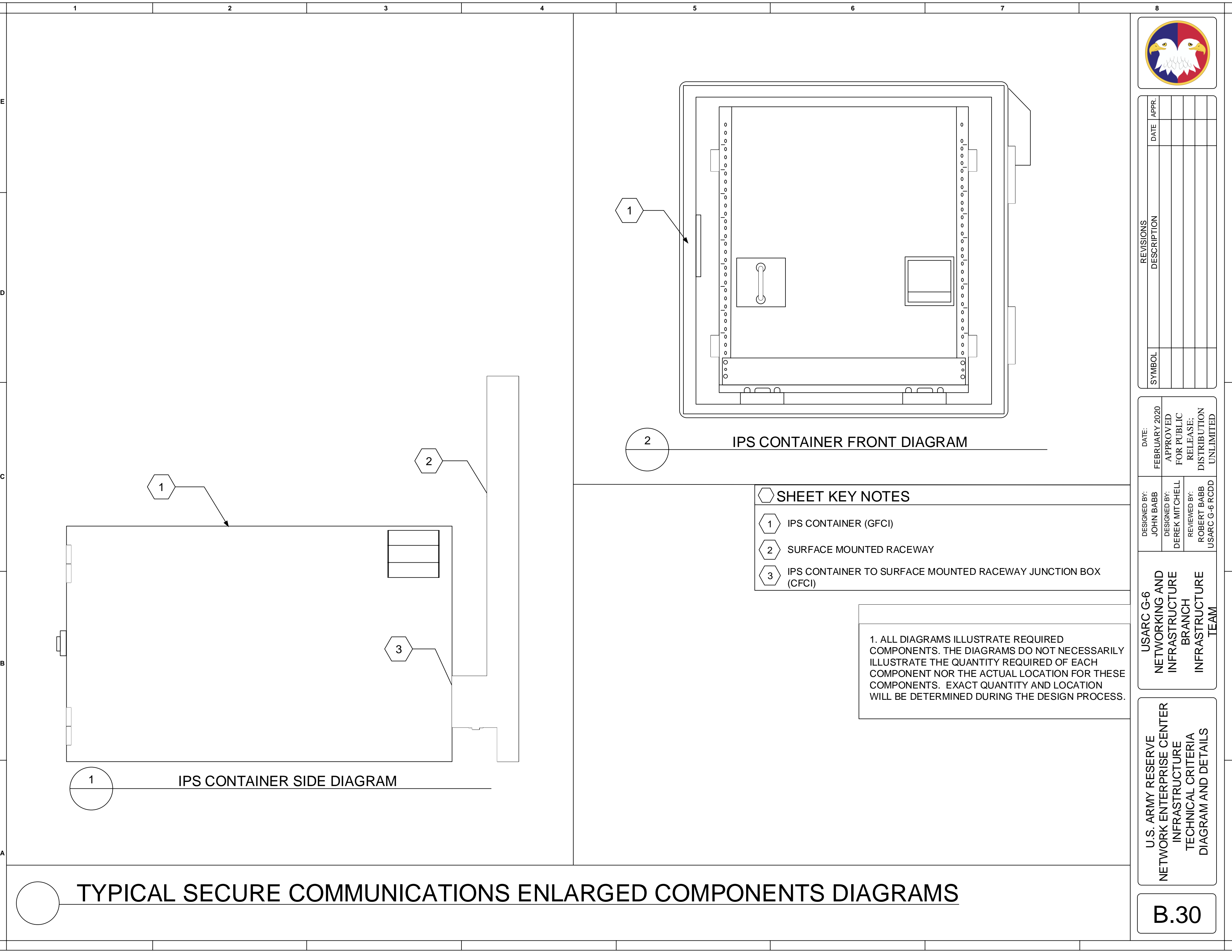
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DIAGRAM AND DETAILS

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**SHEET KEY NOTES**

1 IPS CONTAINER (GFCI)

2 SURFACE MOUNTED RACEWAY

3 IPS CONTAINER TO SURFACE MOUNTED RACEWAY JUNCTION BOX (CFCI)

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DIAGRAM AND DETAILS

B.30



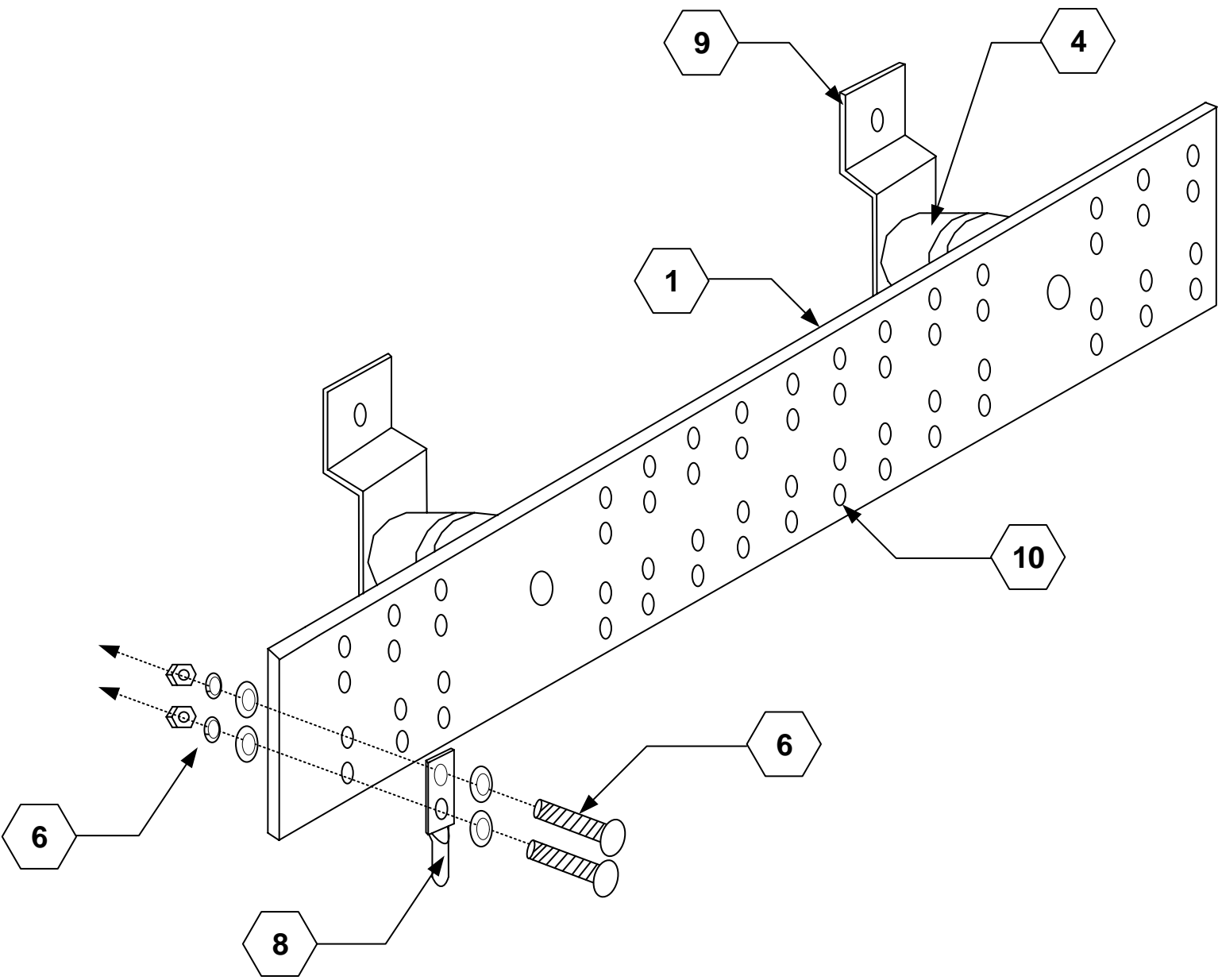
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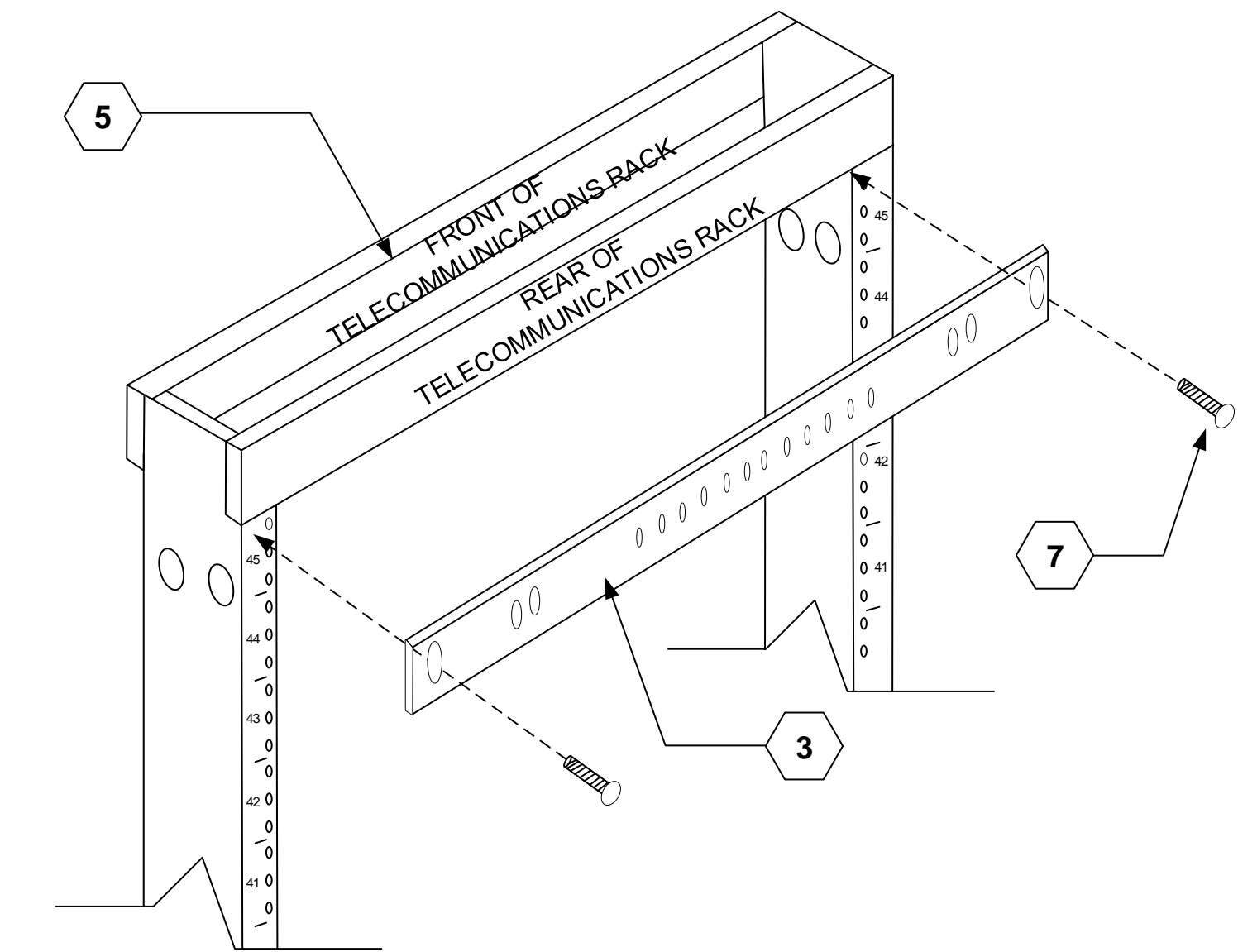
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- 1 PBB
- 2 SBB
- 3 RBB
- 4 INSULATOR
- 5 TELECOMMUNICATIONS RACK
- 6 STANDARD HARDWARE
- 7 STANDARD RACK HARDWARE
- 8 GROUNDING CONNECTOR WITH INSPECTION WINDOW
- 9 MOUNTING BRACKET

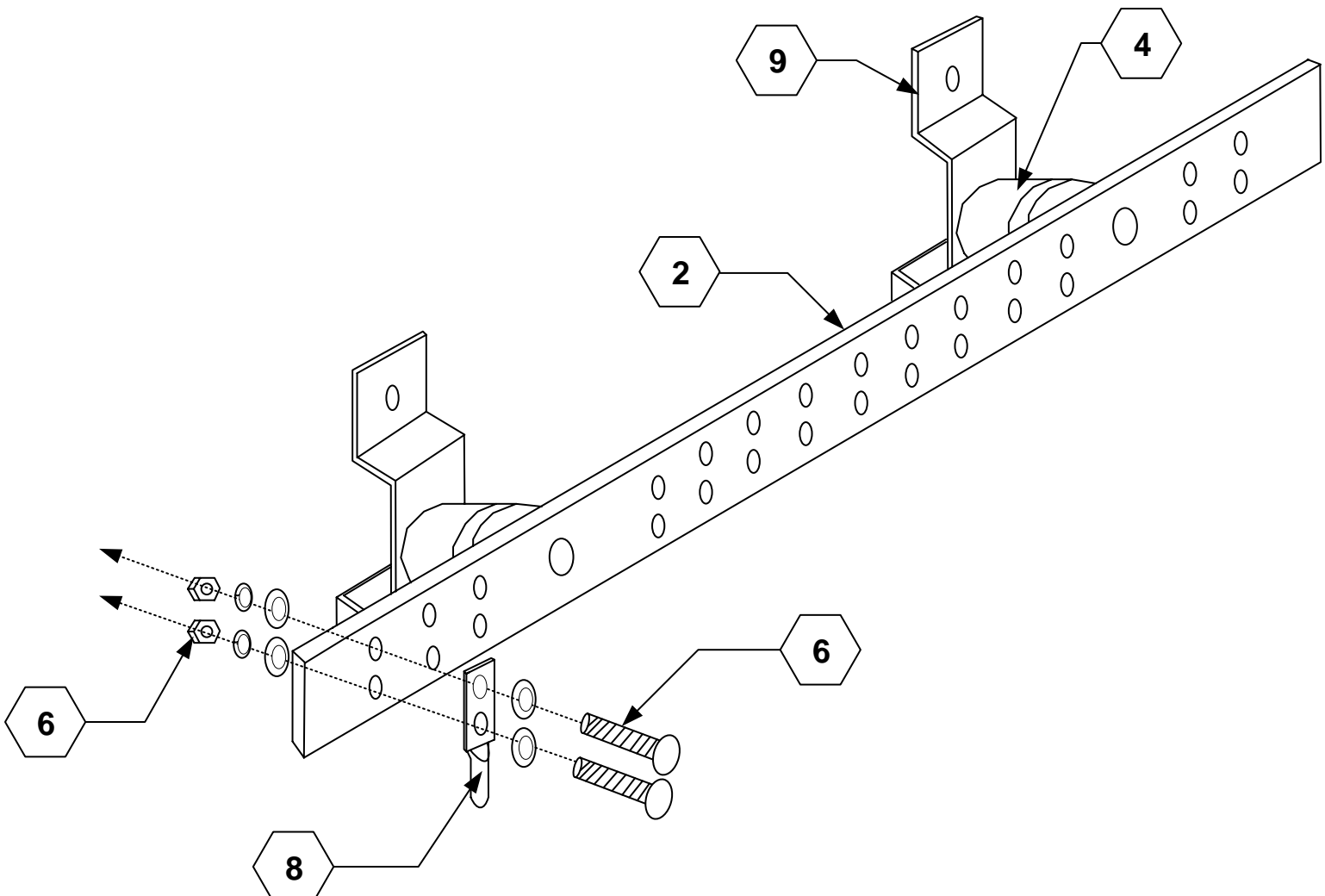
1

PBB ENLARGED DETAIL



2

RBB ENLARGED DETAIL



3

SBB ENLARGED DETAIL

TYPICAL TELECOMMUNICATION BUS-BAR ENLARGED DIAGRAMS



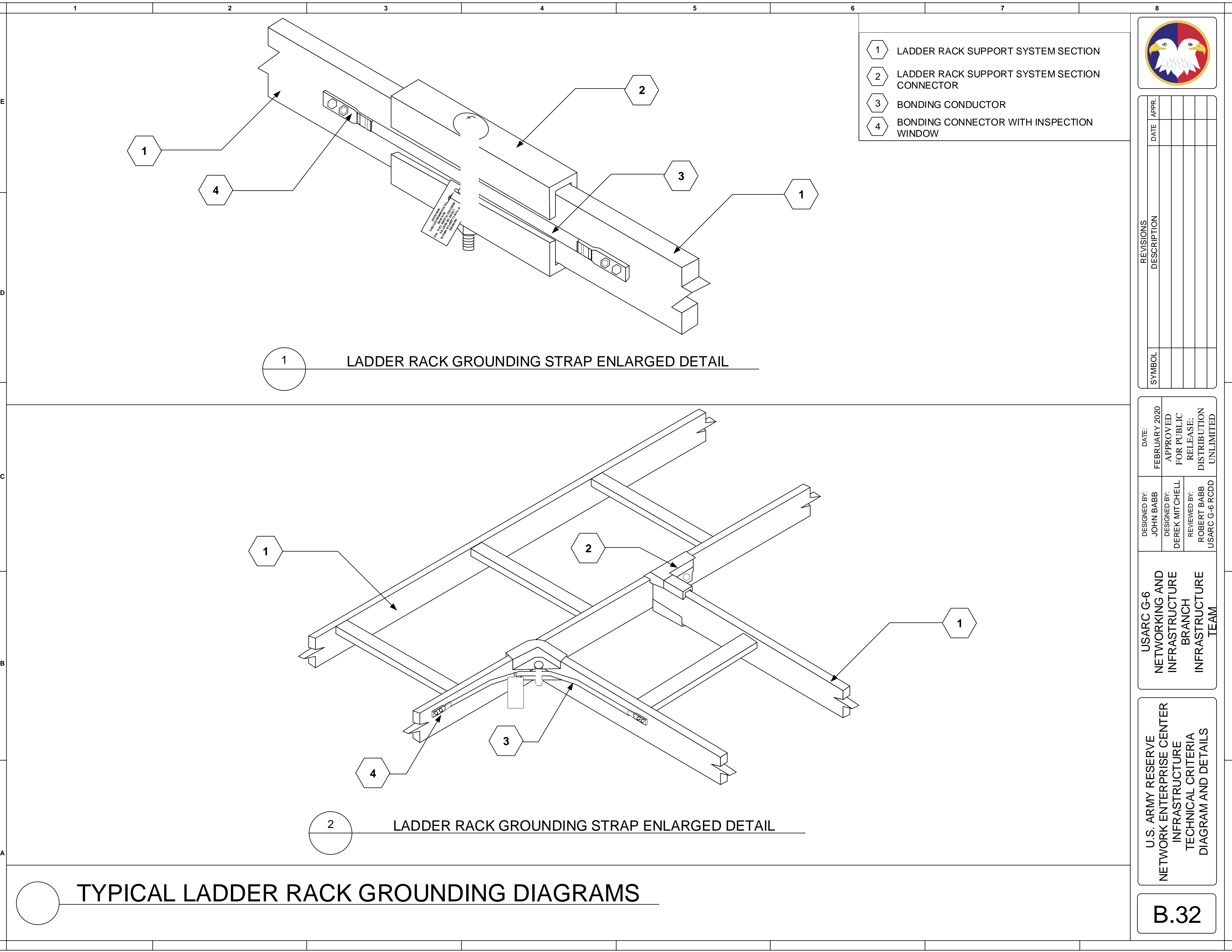
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SYMBOL	DESCRIPTION				

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DIAGRAM AND DETAILS





- 1 LADDER RACK SUPPORT SYSTEM SECTION
- 2 LADDER RACK SUPPORT SYSTEM SECTION CONNECTOR
- 3 BONDING CONDUCTOR
- 4 BONDING CONNECTOR WITH INSPECTION WINDOW

1 LADDER RACK GROUNDING STRAP ENLARGED DETAIL

2 LADDER RACK GROUNDING STRAP ENLARGED DETAIL

TYPICAL LADDER RACK GROUNDING DIAGRAMS



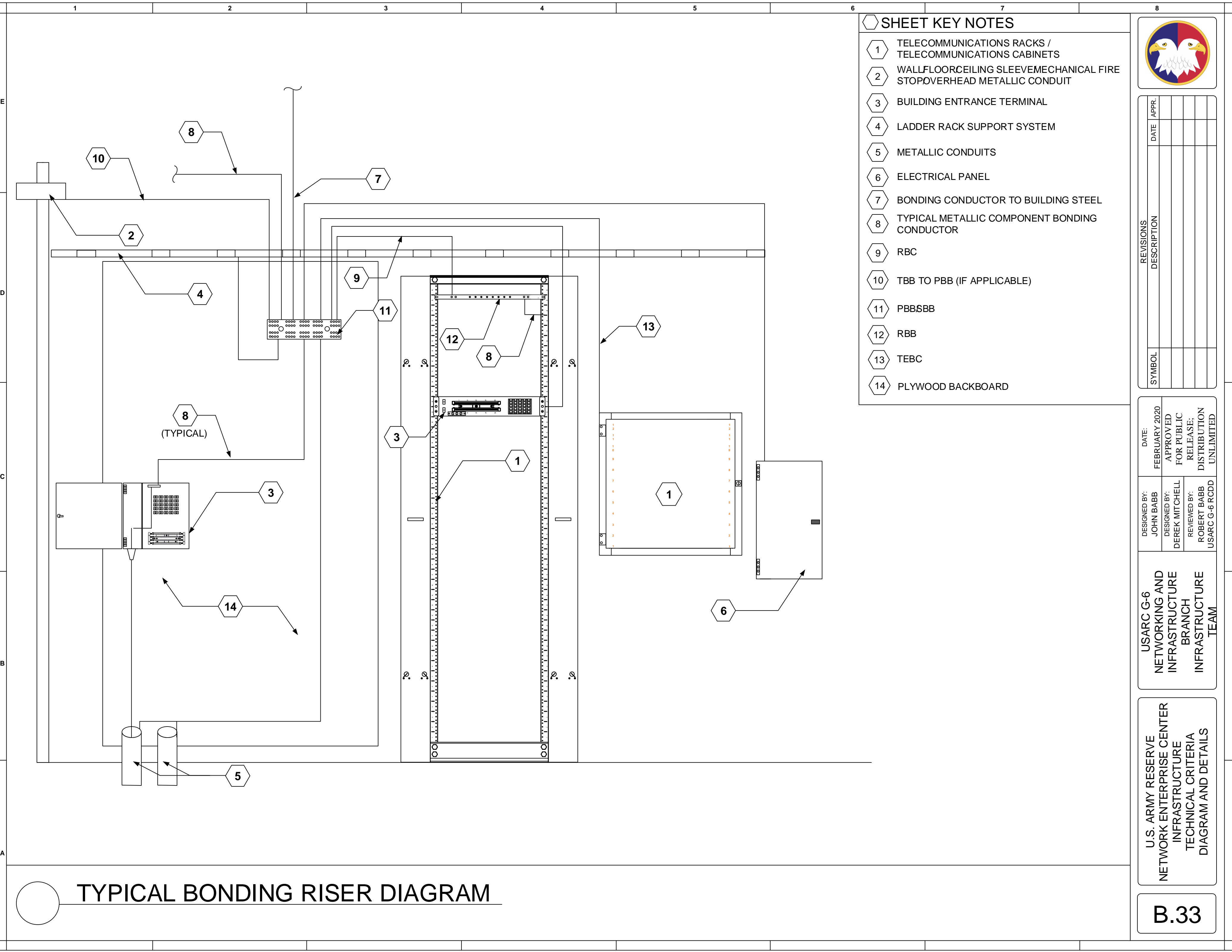
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DIAGRAM AND DETAILS





SHEET KEY NOTES

- 1 TELECOMMUNICATIONS RACKS / TELECOMMUNICATIONS CABINETS
- 2 WALLFLOORCEILING SLEEVE MECHANICAL FIRE STOP OVERHEAD METALLIC CONDUIT
- 3 BUILDING ENTRANCE TERMINAL
- 4 LADDER RACK SUPPORT SYSTEM
- 5 METALLIC CONDUITS
- 6 ELECTRICAL PANEL
- 7 BONDING CONDUCTOR TO BUILDING STEEL
- 8 TYPICAL METALLIC COMPONENT BONDING CONDUCTOR
- 9 RBC
- 10 TBB TO PBB (IF APPLICABLE)
- 11 PBB SBB
- 12 RBB
- 13 TEBC
- 14 PLYWOOD BACKBOARD



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TECHNICAL CRITERIA  
DIAGRAM AND DETAILS

B.33

TYPICAL BONDING RISER DIAGRAM

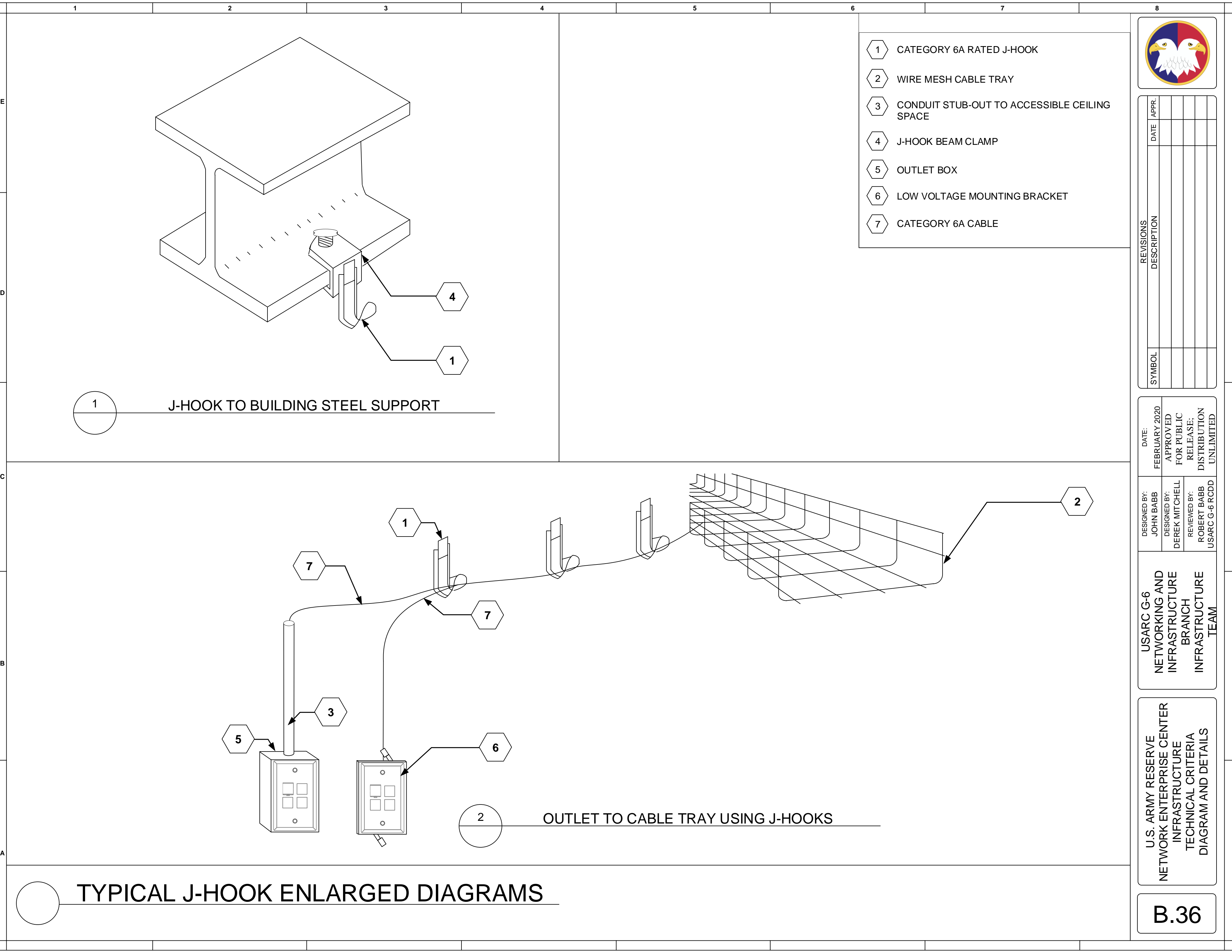












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TECHNICAL CRITERIA  
DIAGRAM AND DETAILS

B.36



E

D

C

B

A

SHEET KEY NOTES

- 1

ONE 1 INCH MINIMUM EMT CONDUIT HOMERUN TO TER/TR
- 2

TELECOMMUNICATIONS FLOOR BOX

1. ALL DIAGRAMS ILLUSTRATE REQUIRED COMPONENTS. THE DIAGRAMS DO NOT NECESSARILY ILLUSTRATE THE QUANTITY REQUIRED OF EACH COMPONENT NOR THE ACTUAL LOCATION FOR THESE COMPONENTS. EXACT QUANTITY AND LOCATION WILL BE DETERMINED DURING THE DESIGN PROCESS.



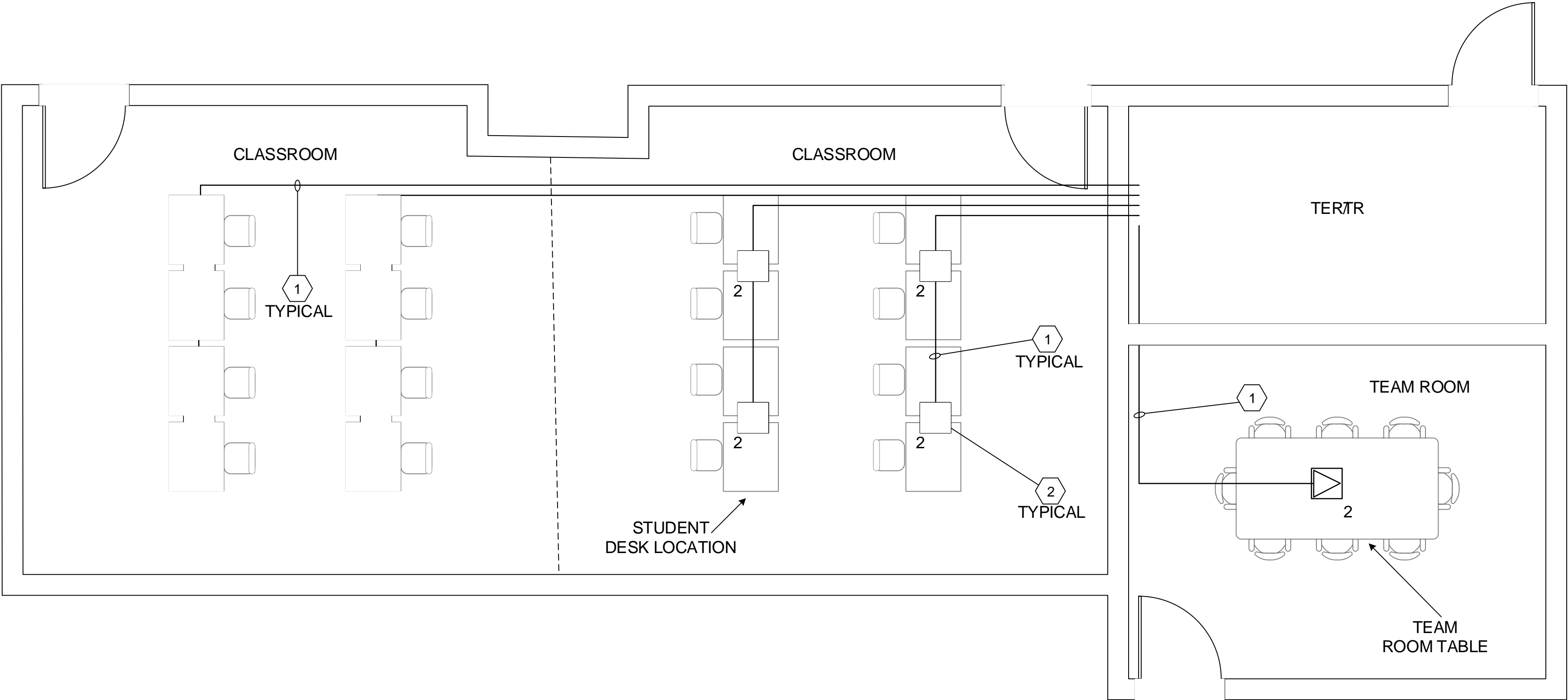
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DIAGRAM AND DETAILS

B.37



TYPICAL FLOOR BOX HOMERUN CONDUIT AERIAL DIAGRAM



## SHEET KEY NOTES

- 1 ONE 1 INCH MINIMUM EMT CONDUIT HOMERUN TO TERT/R
- 2 TELECOMMUNICATIONS FLOOR BOX
- 3 PLYWOOD BACKBOARD
- 4 HORIZONTAL LADDER RACK
- 5 VERTICAL LADDER RACK

## SHEET GENERAL NOTES

1. ALL DIAGRAMS ILLUSTRATE REQUIRED COMPONENTS. THE DIAGRAMS DO NOT NECESSARILY ILLUSTRATE THE QUANTITY REQUIRED OF EACH COMPONENT NOR THE ACTUAL LOCATION FOR THESE COMPONENTS. EXACT QUANTITY AND LOCATION WILL BE DETERMINED DURING THE DESIGN PROCESS.



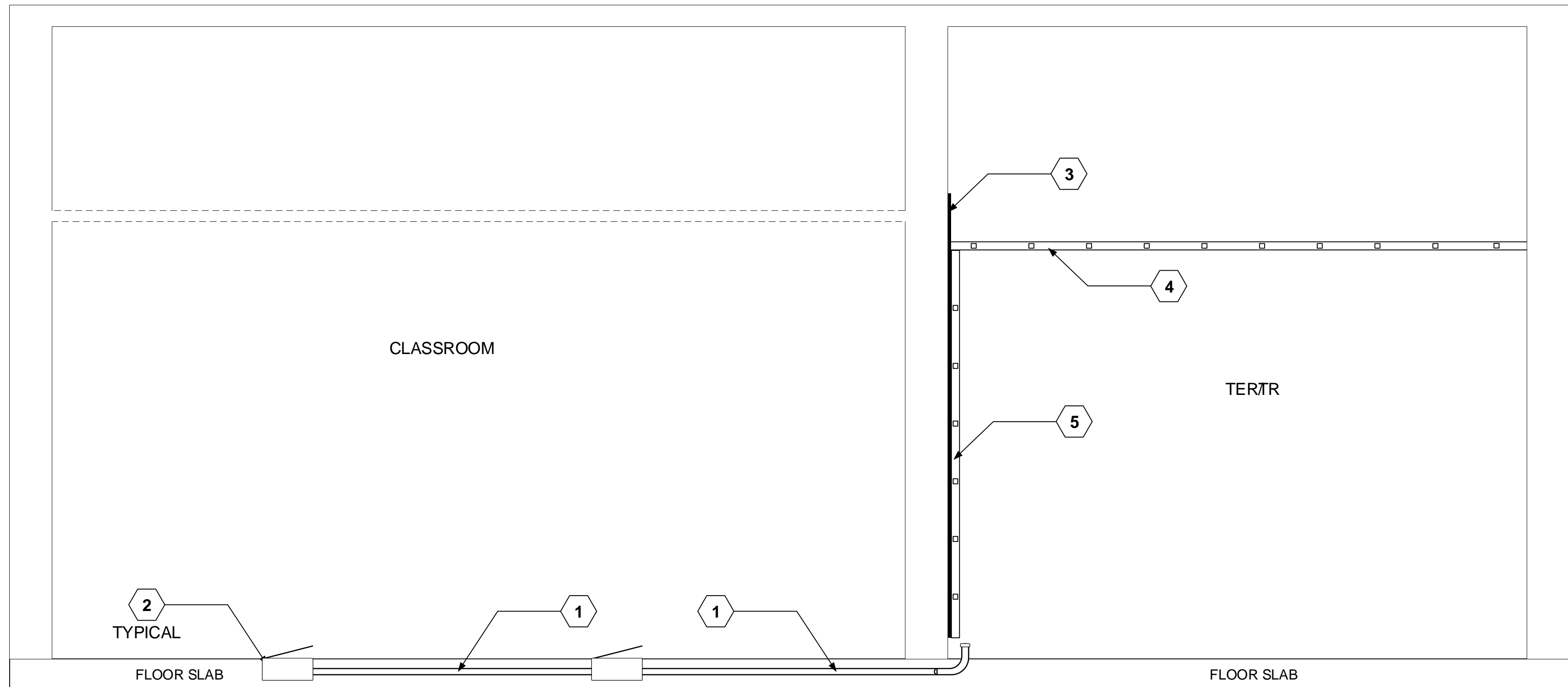
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DIAGRAM AND DETAILS

**B.38**



## TYPICAL FLOOR BOX HOMERUN CONDUIT ELEVATION DIAGRAM



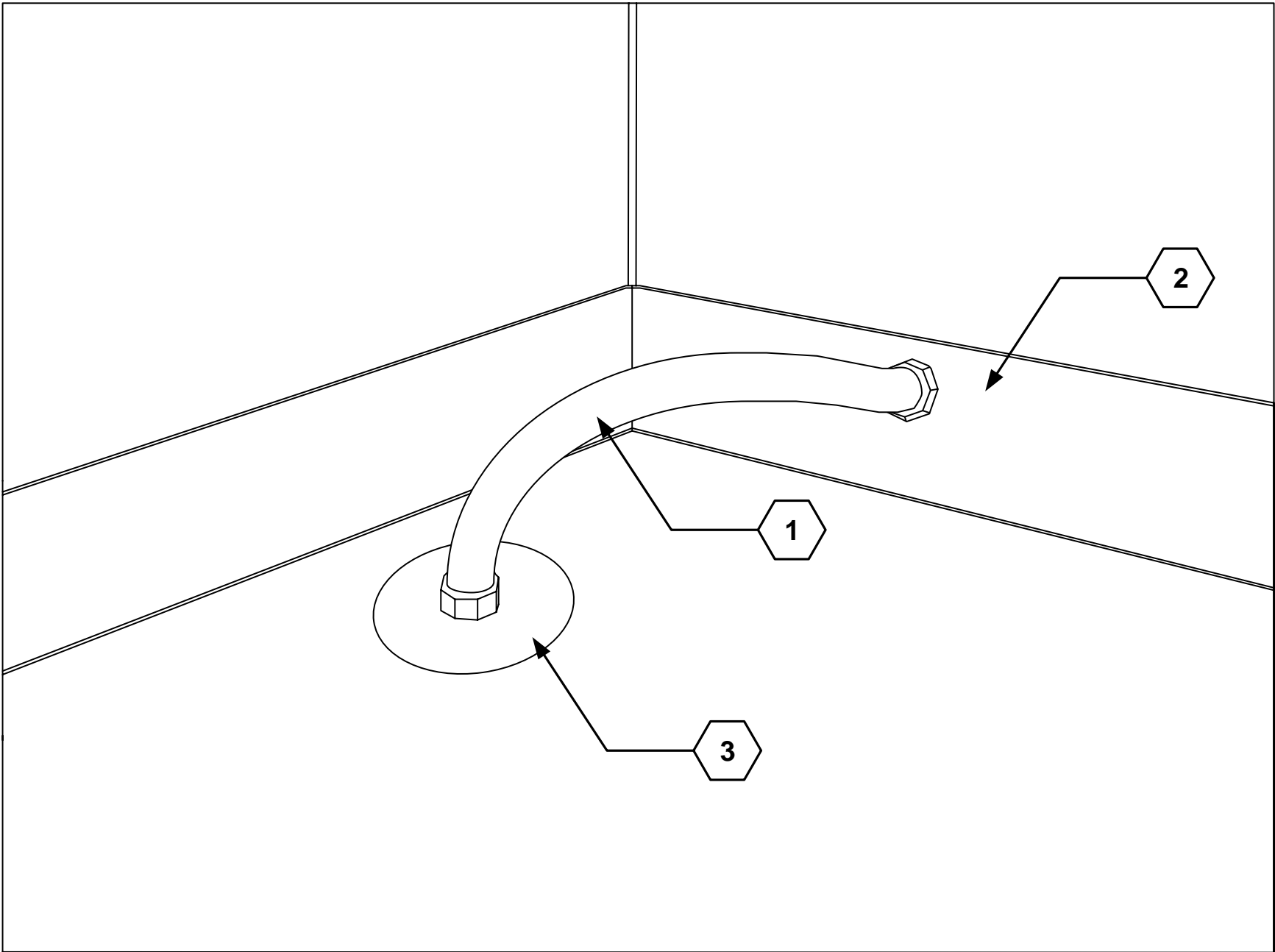
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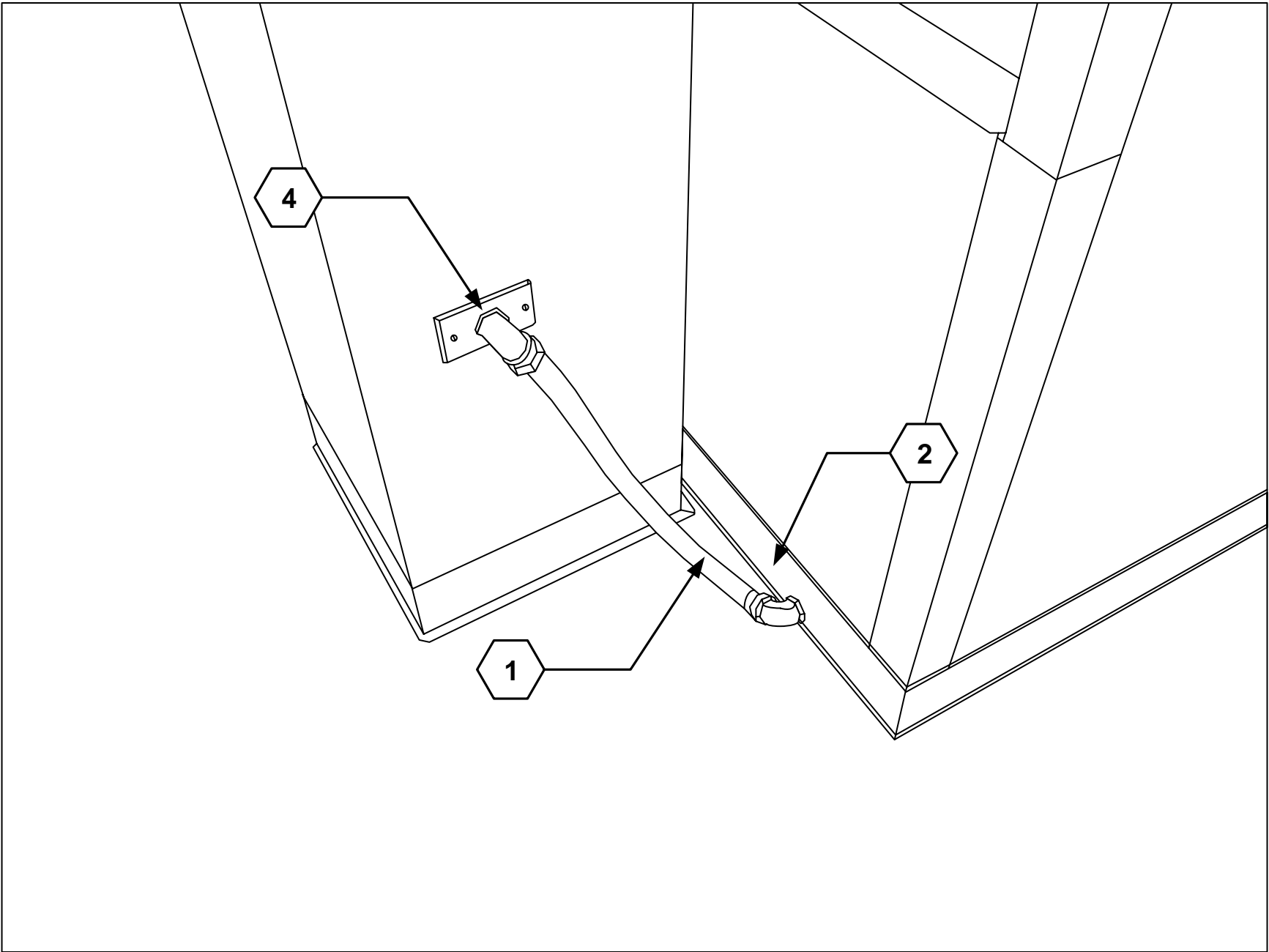
C

B

A



1 WHIP FROM FLOOR BOXPOKE-THRU TO KICK PLATE



2 WHIP FROM JUNCTION BOX TO KICK PLATE

- 1 FLEXIBLE METAL CONDUIT FROM FLOOR BOX TO ACOUSTIC PANEL RACEWAY
- 2 FURNITURE ACOUSTIC RACEWAY
- 3 FLOOR BOX OR POKE-THRU
- 4 WALL MOUNTED JUNCTION BOX



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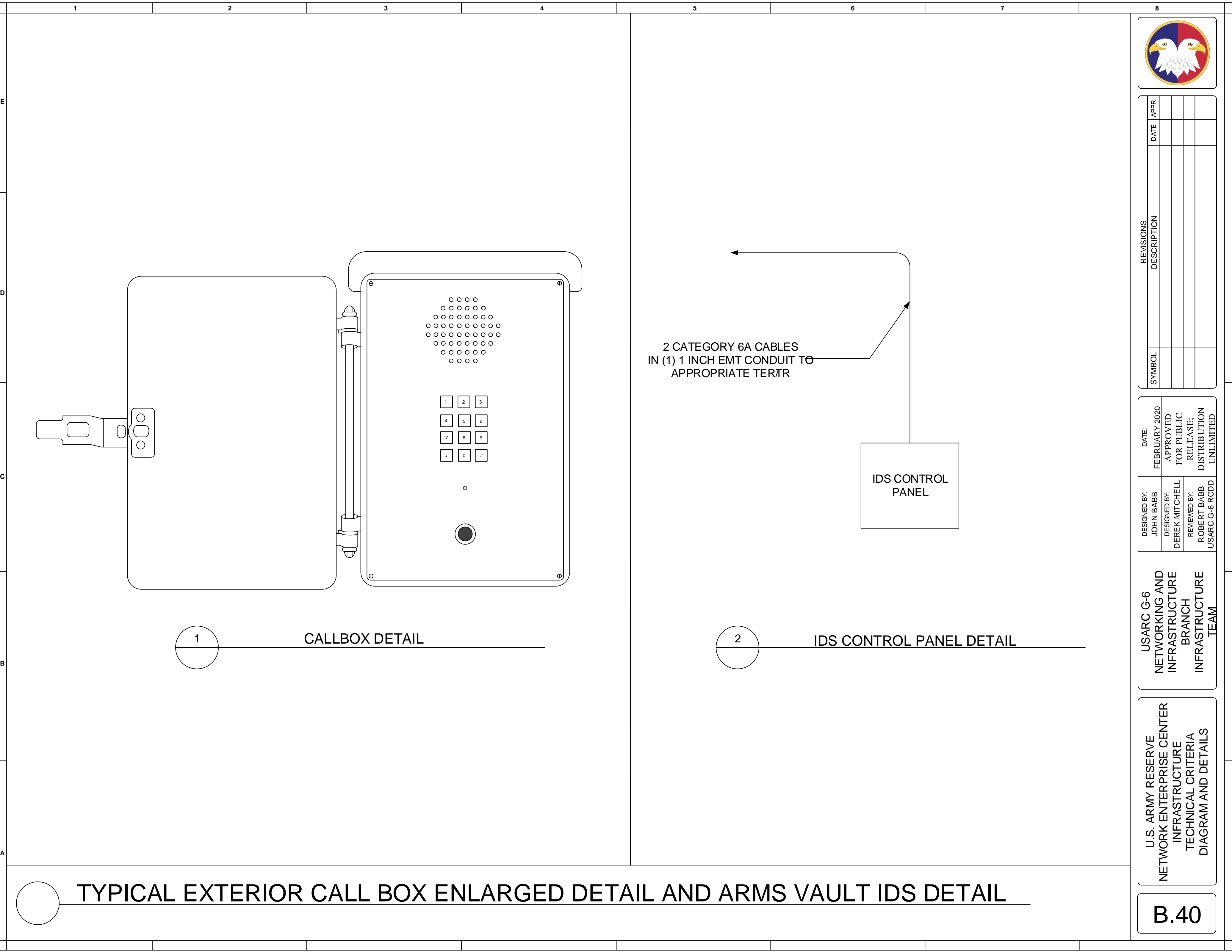
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B.39

TYPICAL FURNITURE WHIP DETAILS





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DIAGRAM AND DETAILS

B.40



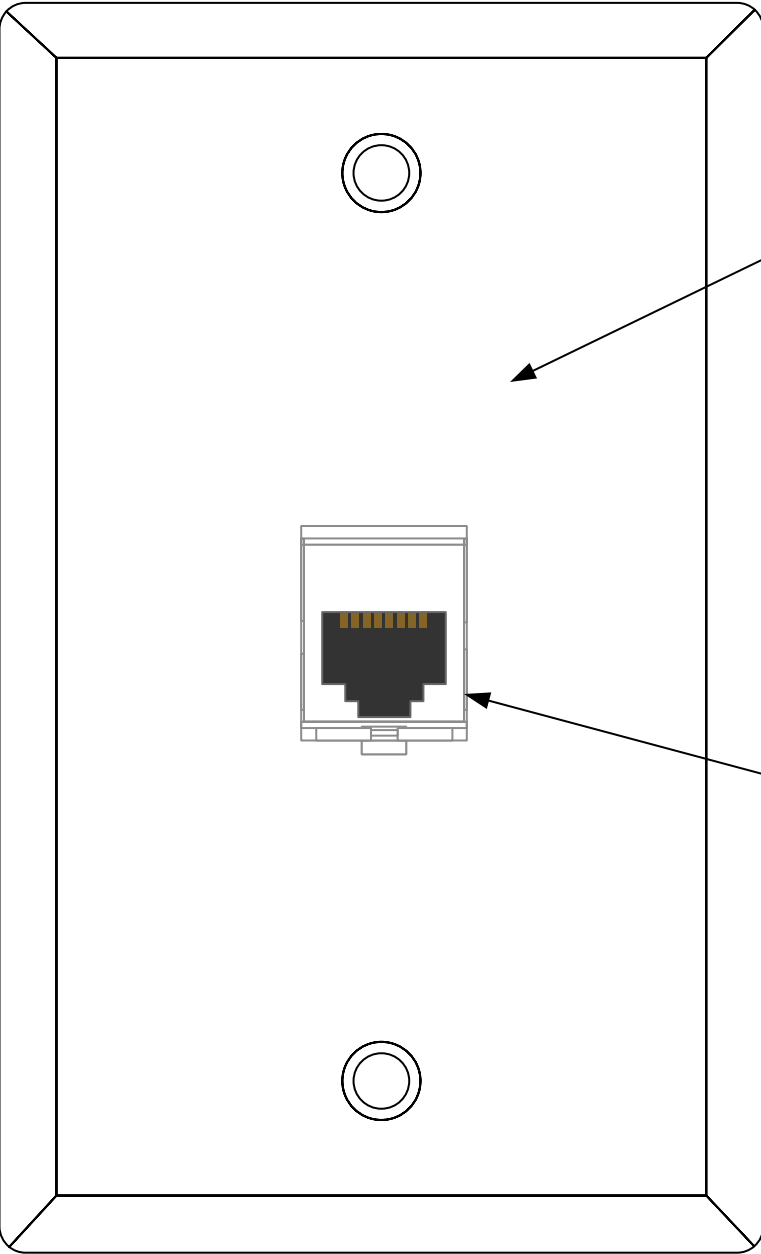
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D

C

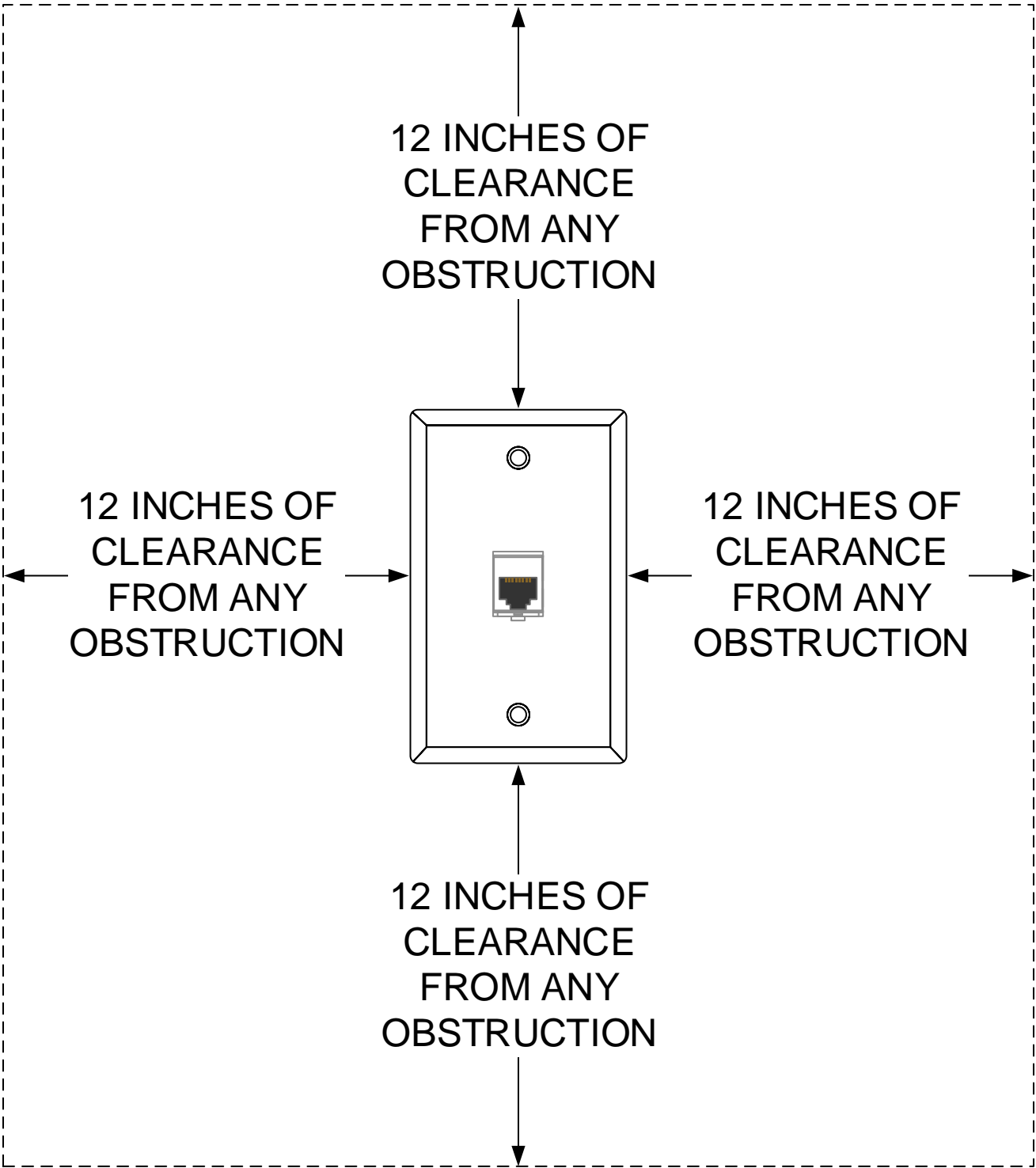
B

A



STANDARD 2 LUG  
WALL PHONE  
OUTLET  
FACEPLATE

STANDARD  
CATEGORY 6A  
JACK

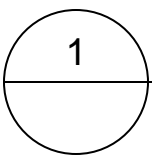


12 INCHES OF  
CLEARANCE  
FROM ANY  
OBSTRUCTION

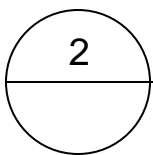
12 INCHES OF  
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FROM ANY  
OBSTRUCTION

12 INCHES OF  
CLEARANCE  
FROM ANY  
OBSTRUCTION

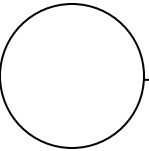
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CLEARANCE  
FROM ANY  
OBSTRUCTION



ABOVE AND BELOW CEILING WAP OUTLET



WAP OUTLET CLEARANCE DIAGRAM



WAP OUTLET AND WAP OUTLET CLEARANCE DIAGRAMS



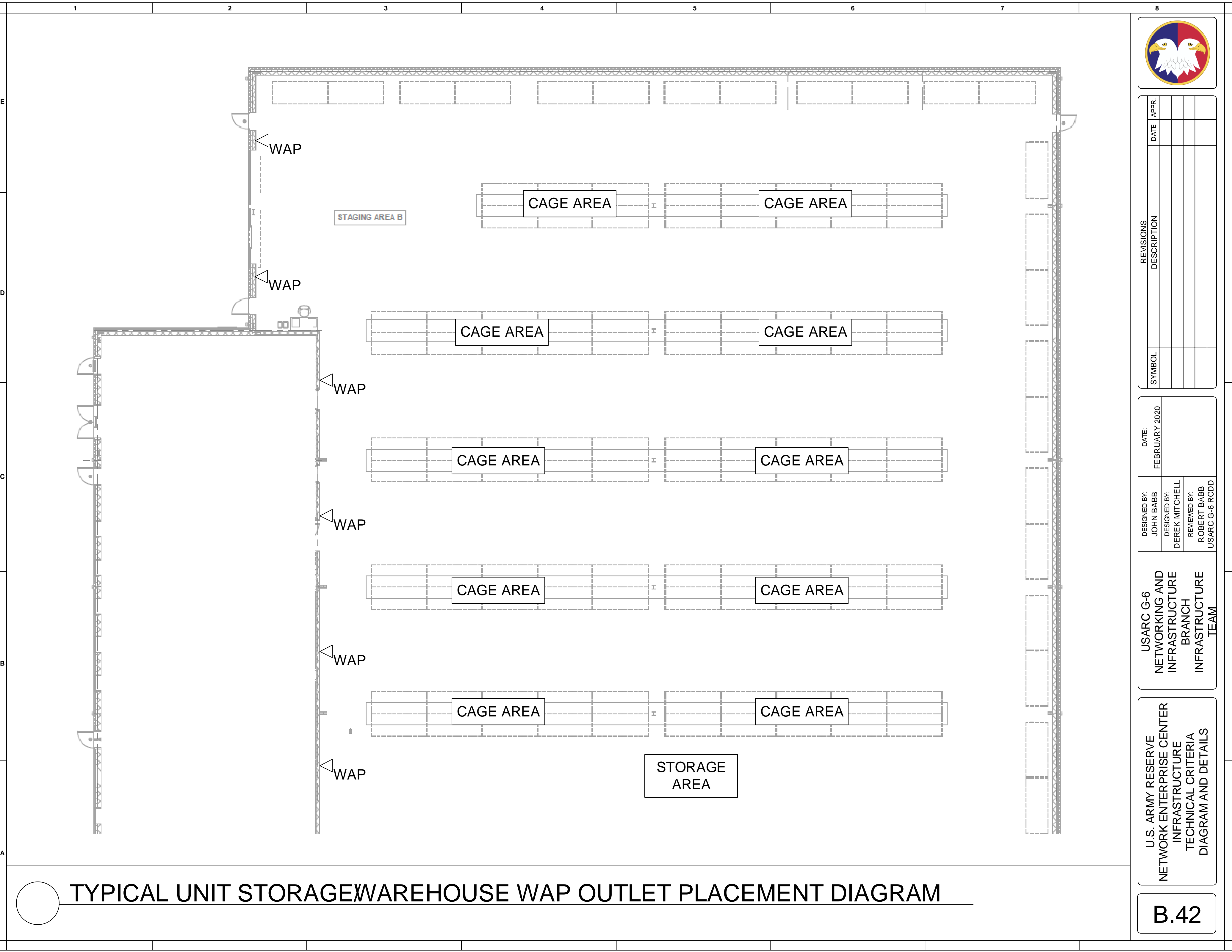
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DIAGRAM AND DETAILS





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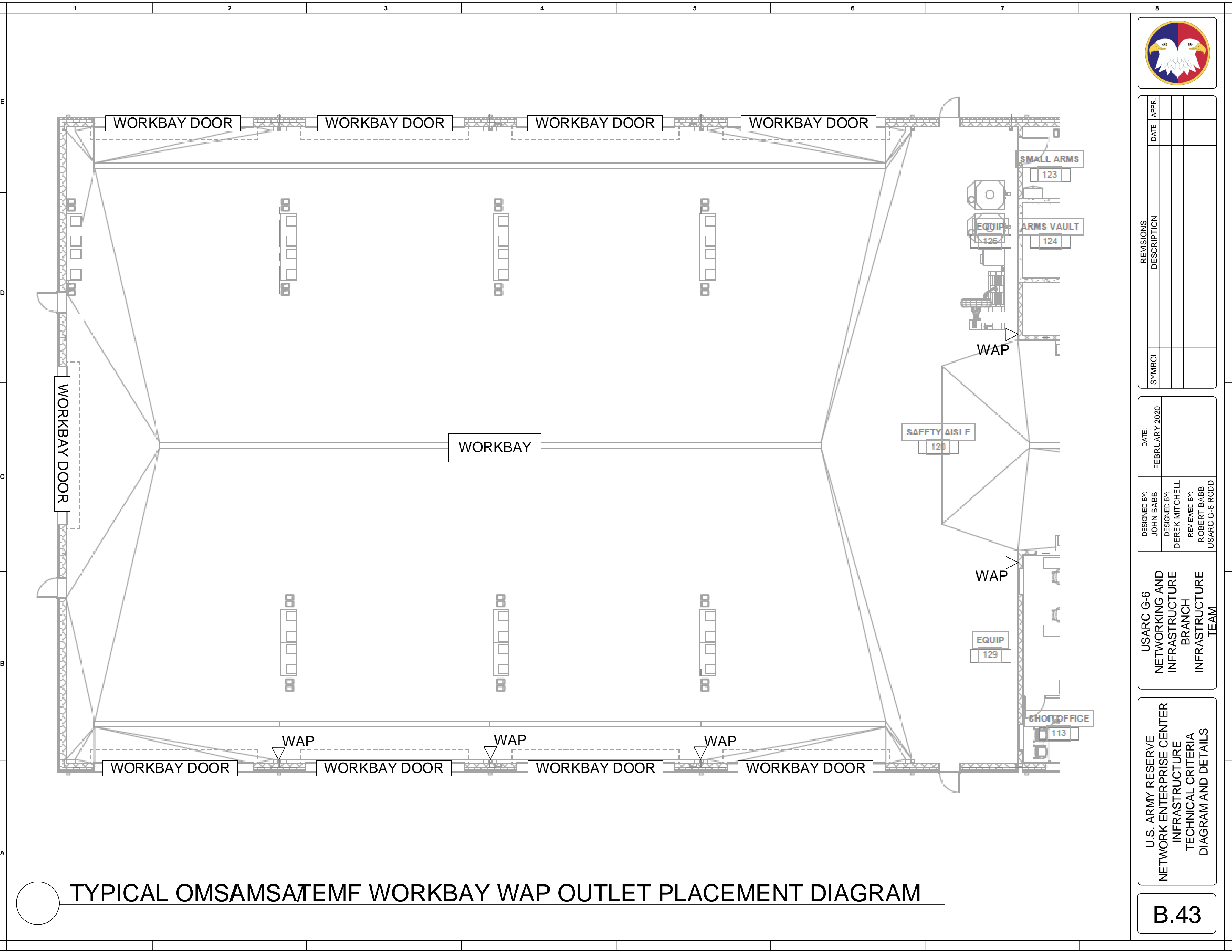
DESIGNED BY: JOHN BABB	DATE: FEBRUARY 2020
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REVIEWED BY: ROBERT BABB USARC G-6 RCDD	

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TECHNICAL CRITERIA  
DIAGRAM AND DETAILS

B.42





SYMBOL	REVISIONS	
	DATE	APPR.

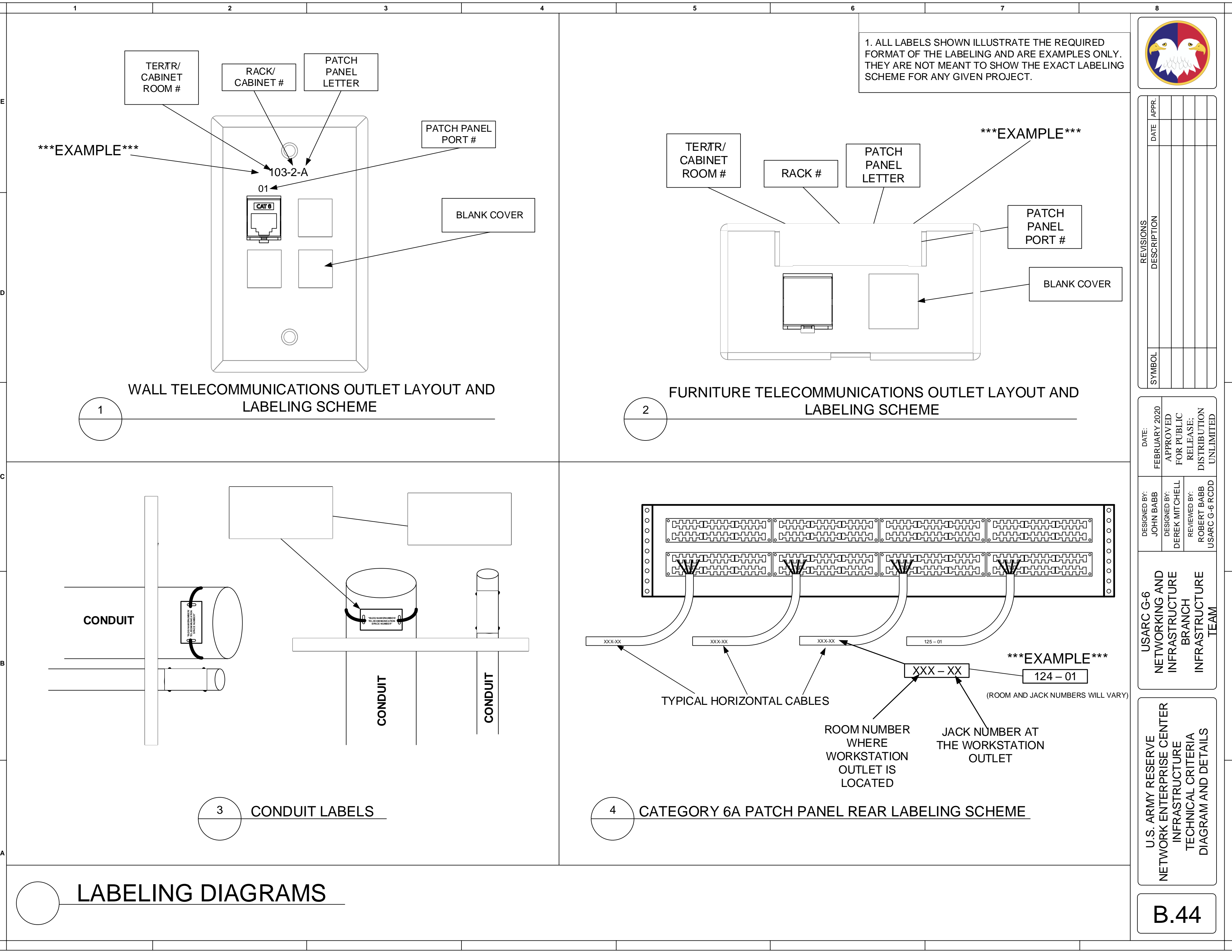
USARC G-6 NETWORKING AND INFRASTRUCTURE BRANCH INFRASTRUCTURE TEAM	DESIGNED BY: JOHN BABB	DATE: FEBRUARY 2020
	DESIGNED BY: DEREK MITCHELL	
	REVIEWED BY: ROBERT BABB USARC G-6 RCDD	

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DIAGRAM AND DETAILS

B.43

TYPICAL OMSAMSATEMF WORKBAY WAP OUTLET PLACEMENT DIAGRAM





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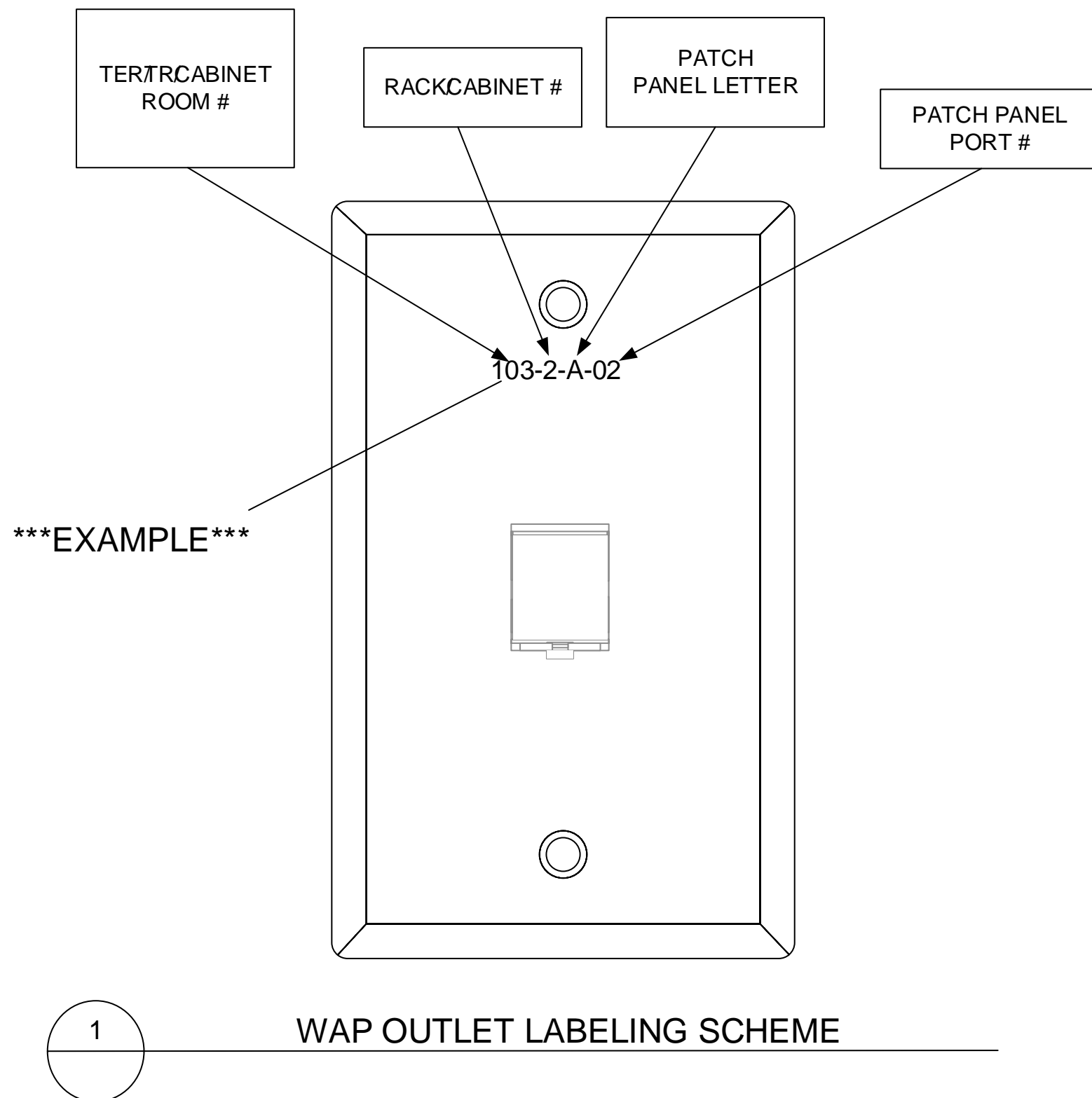
USARC G-6  
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BRANCH  
INFRASTRUCTURE  
TEAM

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DIAGRAM AND DETAILS

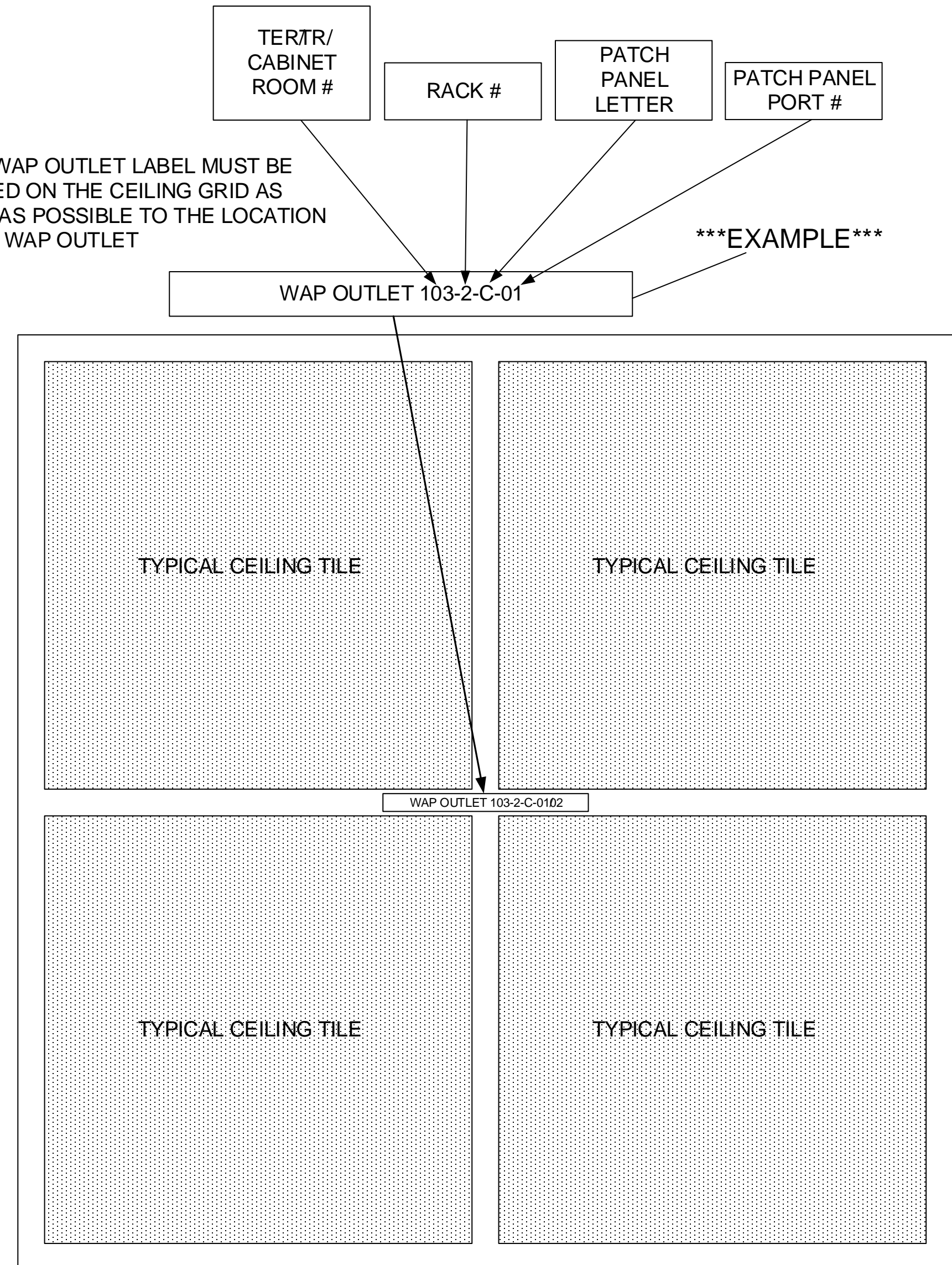


SHEET GENERAL NOTES

1. ALL LABELS SHOWN ILLUSTRATE THE REQUIRED FORMAT OF THE LABELING AND ARE EXAMPLES ONLY. THEY ARE NOT MEANT TO SHOW THE EXACT LABELING SCHEME FOR ANY GIVEN PROJECT.



**NOTE:** WAP OUTLET LABEL MUST BE LOCATED ON THE CEILING GRID AS CLOSE AS POSSIBLE TO THE LOCATION OF THE WAP OUTLET



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INFRASTRUCTURE  
TECHNICAL CRITERIA  
DIAGRAM AND DETAILS

**B.45**

## LABELING DIAGRAMS



E

D

C

B

A

SHEET GENERAL NOTES

1. ALL LABELS SHOWN ILLUSTRATE THE REQUIRED FORMAT OF THE LABELING AND ARE EXAMPLES ONLY. THEY ARE NOT MEANT TO SHOW THE EXACT LABELING SCHEME FOR ANY GIVEN PROJECT.



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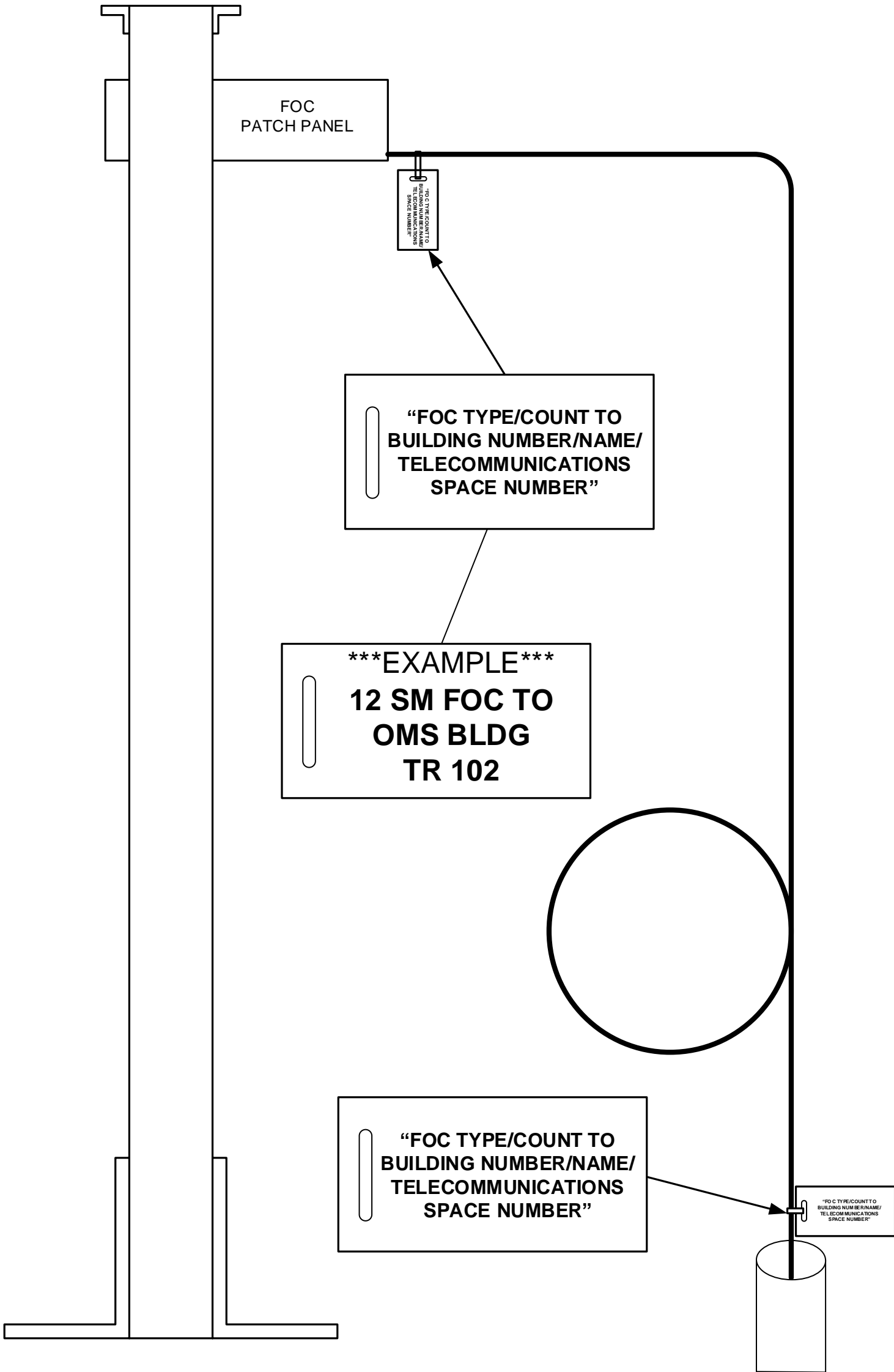
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INFRASTRUCTURE  
TECHNICAL CRITERIA  
DIAGRAM AND DETAILS

B.46

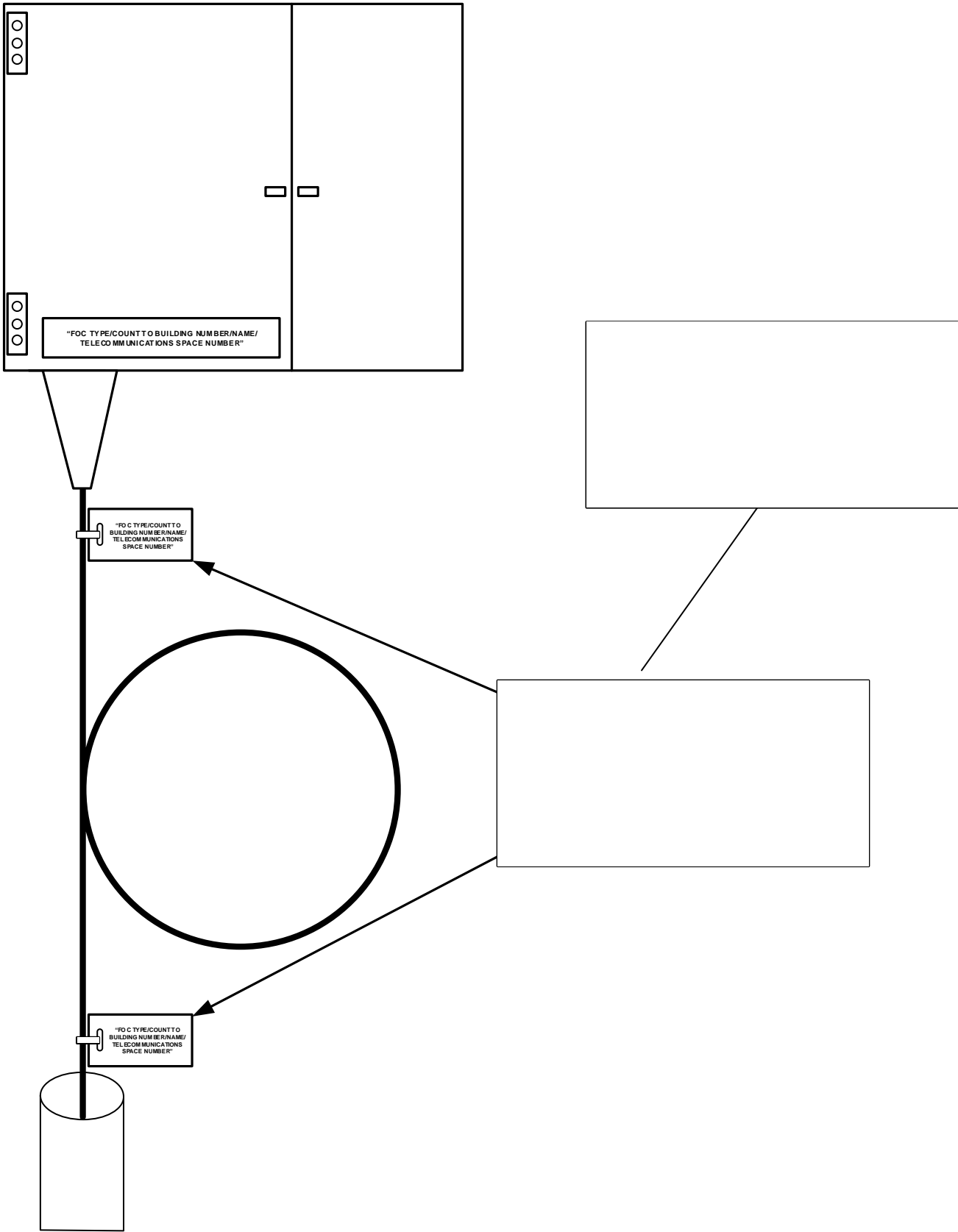
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FOC CABLE AND RACK MOUNTED FOC PATCH PANEL LABELS



2

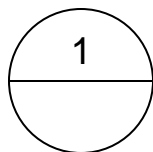
FOC CABLE AND WALL MOUNTED FOC PATCH PANEL LABELS



LABELING DIAGRAMS



A

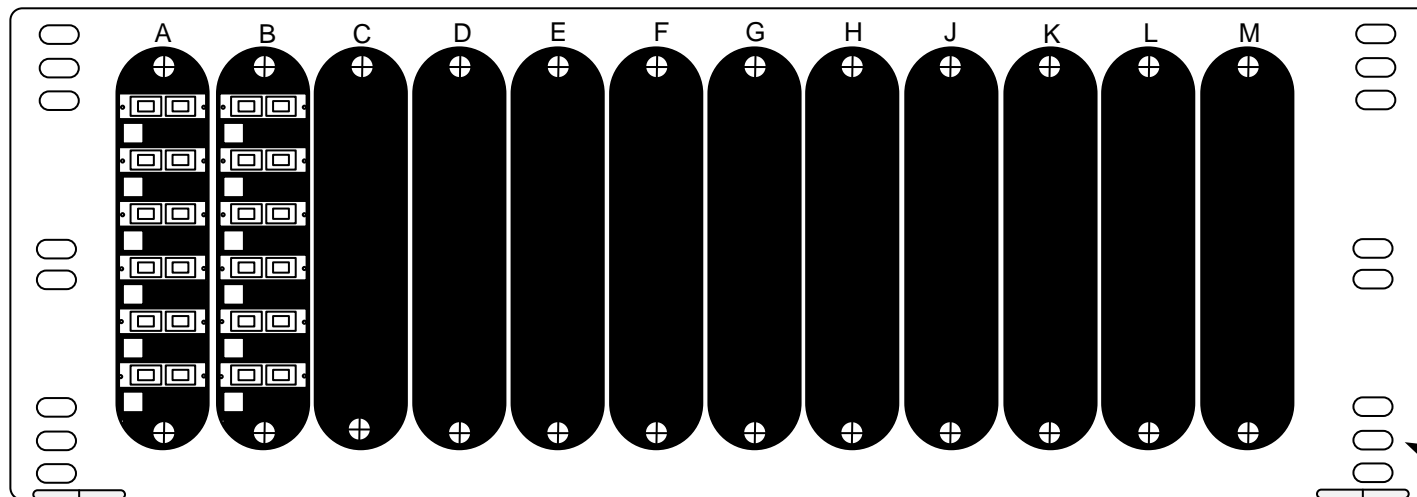




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## ENLARGED FOC PATCH PANEL DIAGRAM



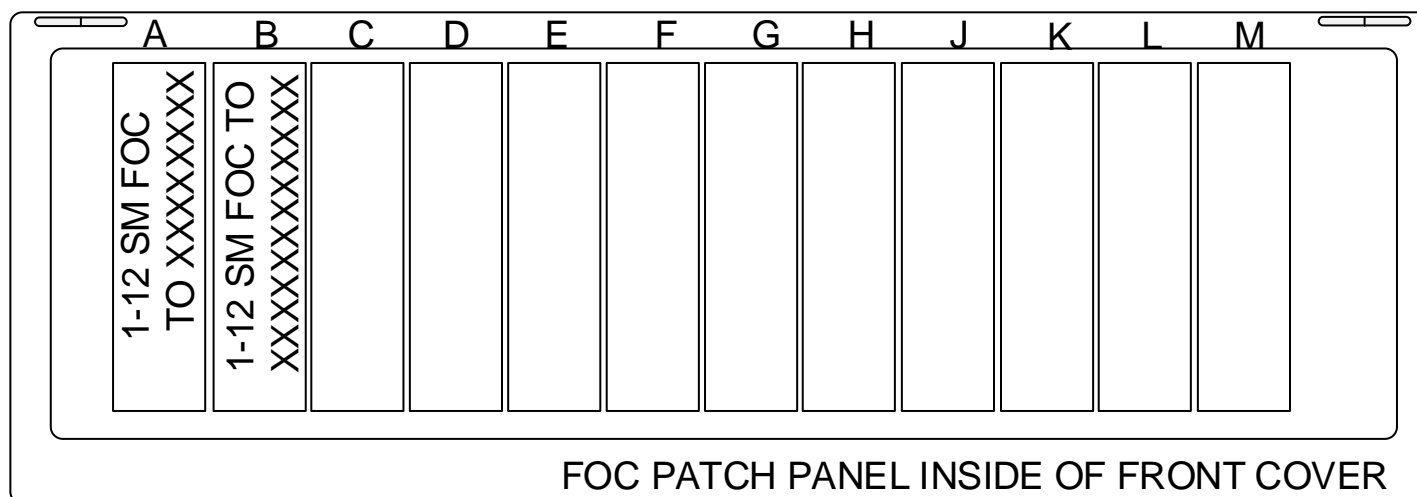
A: 1-12 SM FOC TO TELECOMMUNICATION SPACE NUMBER

B: 1-12 SM FOC TO BUILDING NAMENUMBER/  
TELECOMMUNICATIONS SPACE NUMBER

\*\*\*EXAMPLE\*\*\*

B: 1-12 SM FOC TO OMS BUILDING /TR 102

## FOC PATCH PANEL OUTSIDE OF FRONT COVER

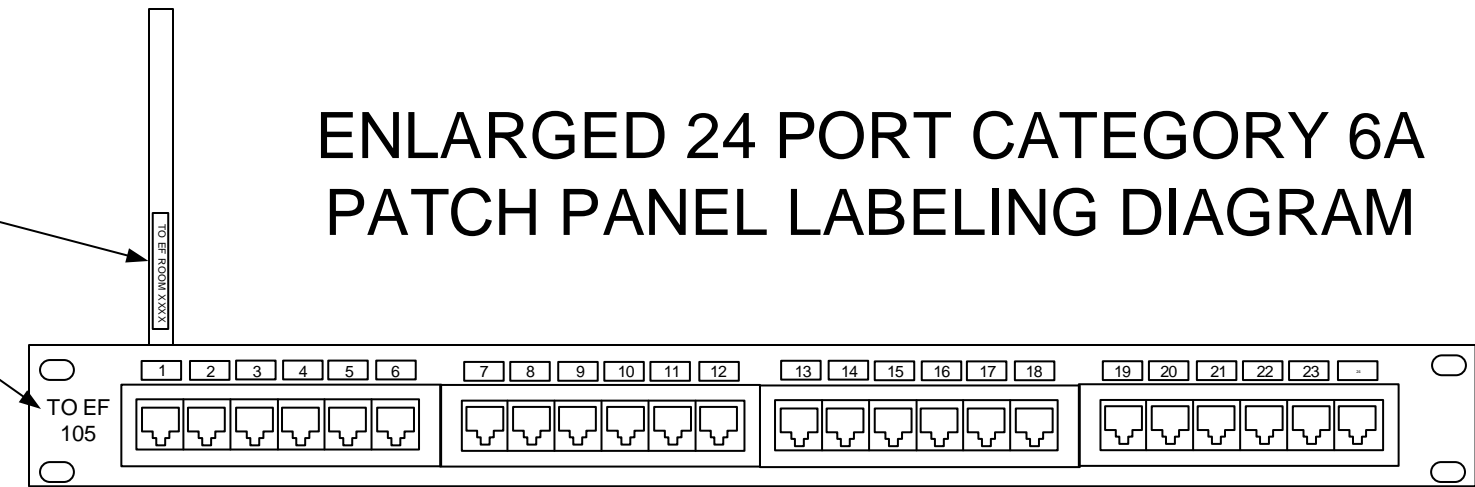


## FOC PATCH PANEL INSIDE OF FRONT COVER

\*\*\*EXAMPLE\*\*\*

TO EF 105

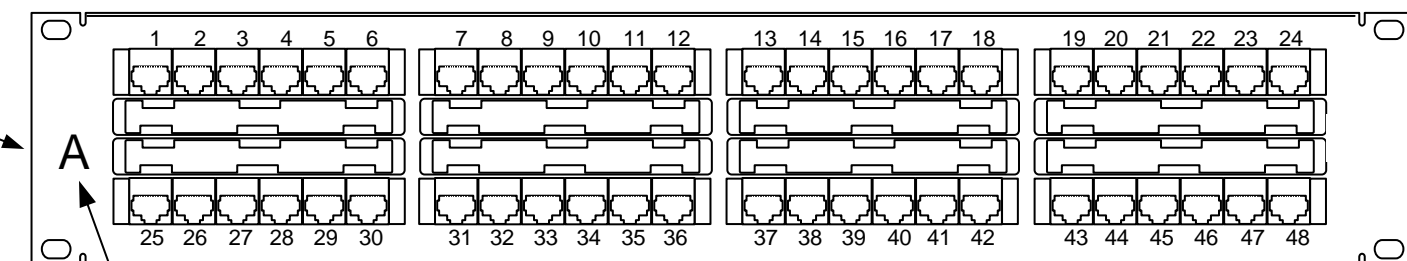
## ENLARGED 24 PORT CATEGORY 6A PATCH PANEL LABELING DIAGRAM



## RACK FRONT

## RACK REAR

## ENLARGED 48 PORT CATEGORY 6A PATCH PANEL LABELING DIAGRAM



\*\*\*EXAMPLE\*\*\*

## LABELING DIAGRAMS



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		DESCRIPTION		

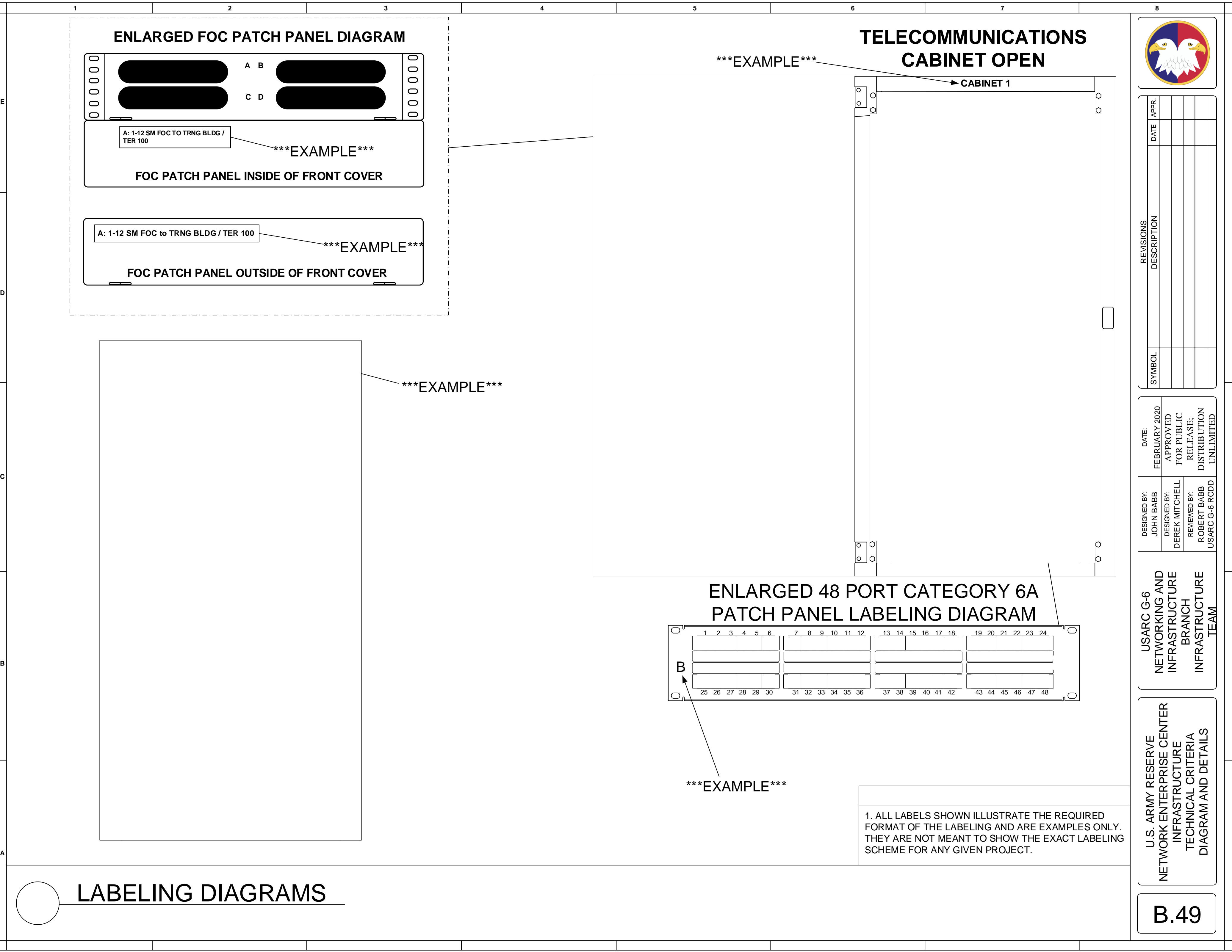
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**B.48**





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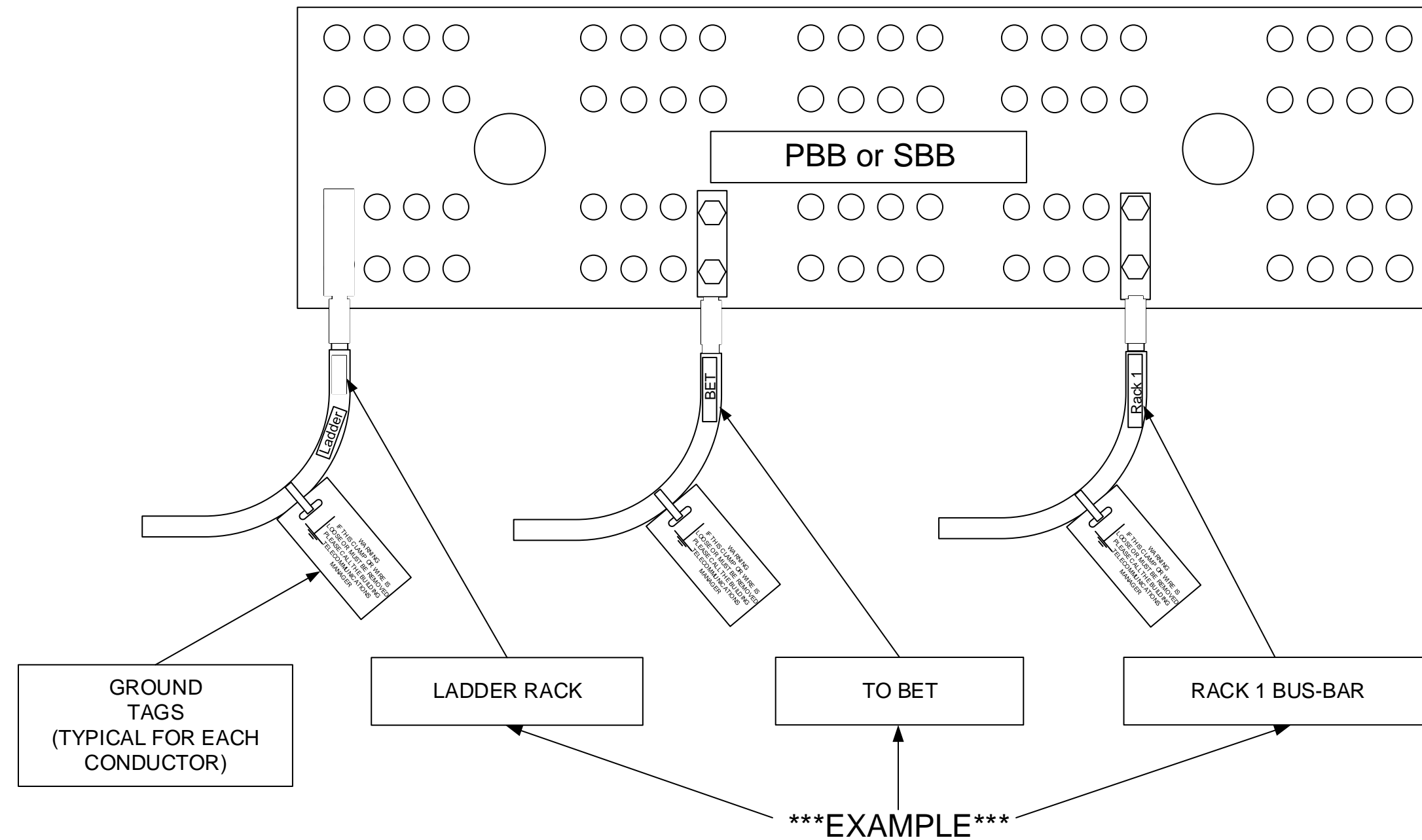
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DIAGRAM AND DETAILS

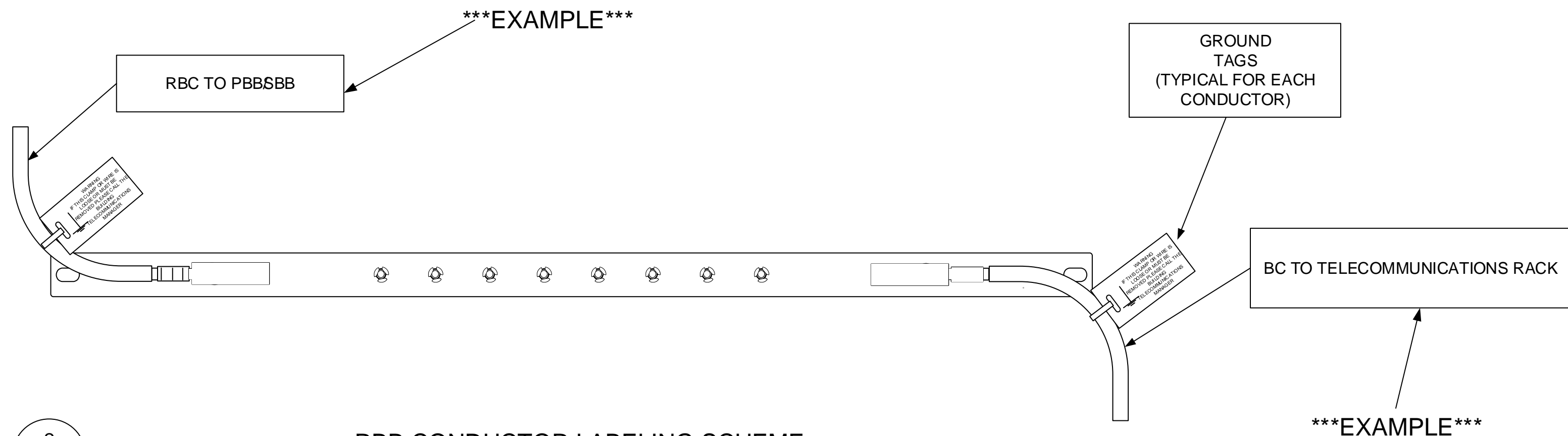


SHEET GENERAL NOTES

1. ALL LABELS SHOWN ILLUSTRATE THE REQUIRED FORMAT OF THE LABELING AND ARE EXAMPLES ONLY. THEY ARE NOT MEANT TO SHOW THE EXACT LABELING SCHEME FOR ANY GIVEN PROJECT.



### WALL MOUNTED PBB\$BB, RBC, BC LABELING SCHEME



## RBB CONDUCTOR LABELING SCHEME

## LABELING DIAGRAMS



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		DESCRIPTION		

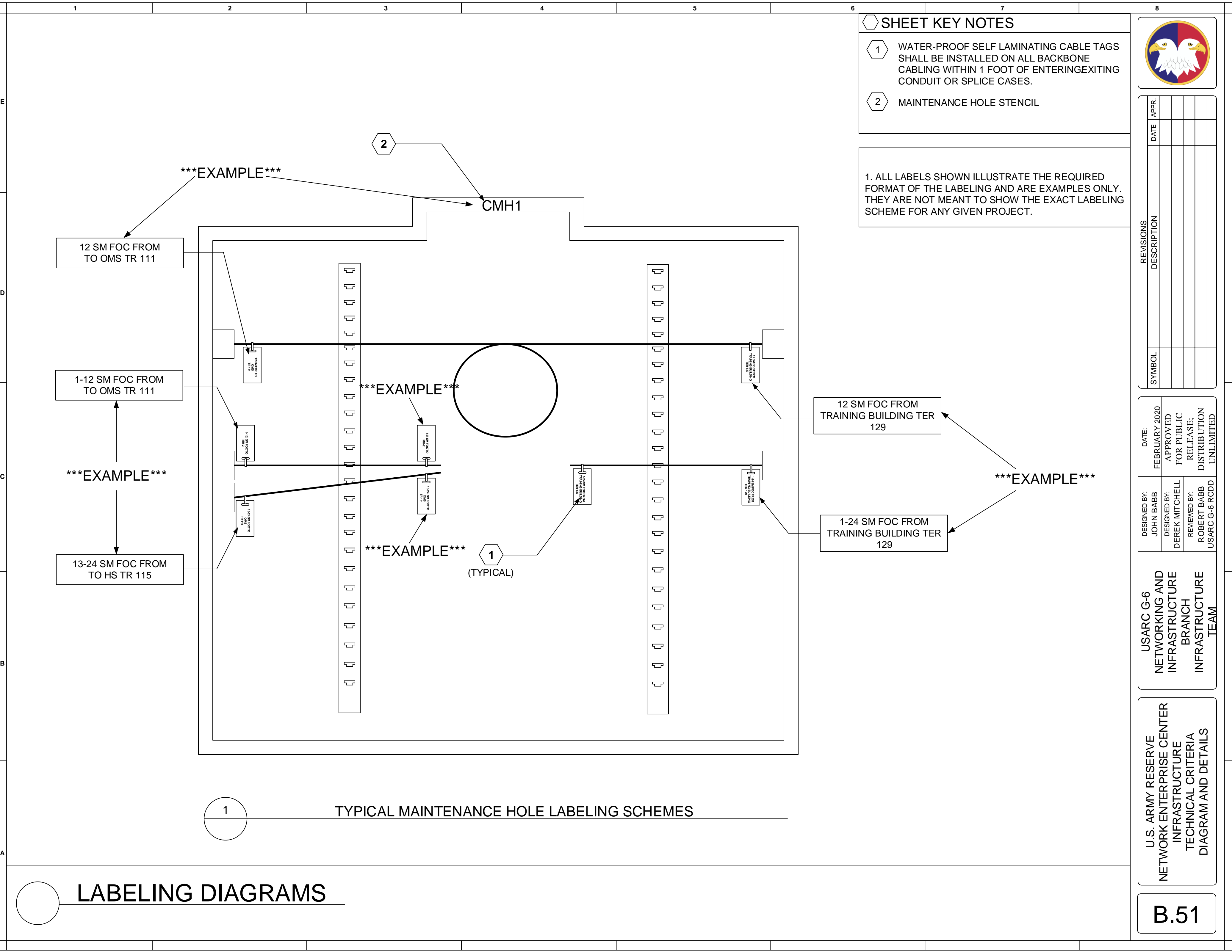
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INFRASTRUCTURE  
TECHNICAL CRITERIA  
DIAGRAM AND DETAILS

## B.50





SHEET KEY NOTES

- 1 WATER-PROOF SELF LAMINATING CABLE TAGS SHALL BE INSTALLED ON ALL BACKBONE CABLING WITHIN 1 FOOT OF ENTERINGEXITING CONDUIT OR SPLICE CASES.
- 2 MAINTENANCE HOLE STENCIL

1. ALL LABELS SHOWN ILLUSTRATE THE REQUIRED FORMAT OF THE LABELING AND ARE EXAMPLES ONLY. THEY ARE NOT MEANT TO SHOW THE EXACT LABELING SCHEME FOR ANY GIVEN PROJECT.



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INFRASTRUCTURE  
TECHNICAL CRITERIA  
DIAGRAM AND DETAILS

B.51

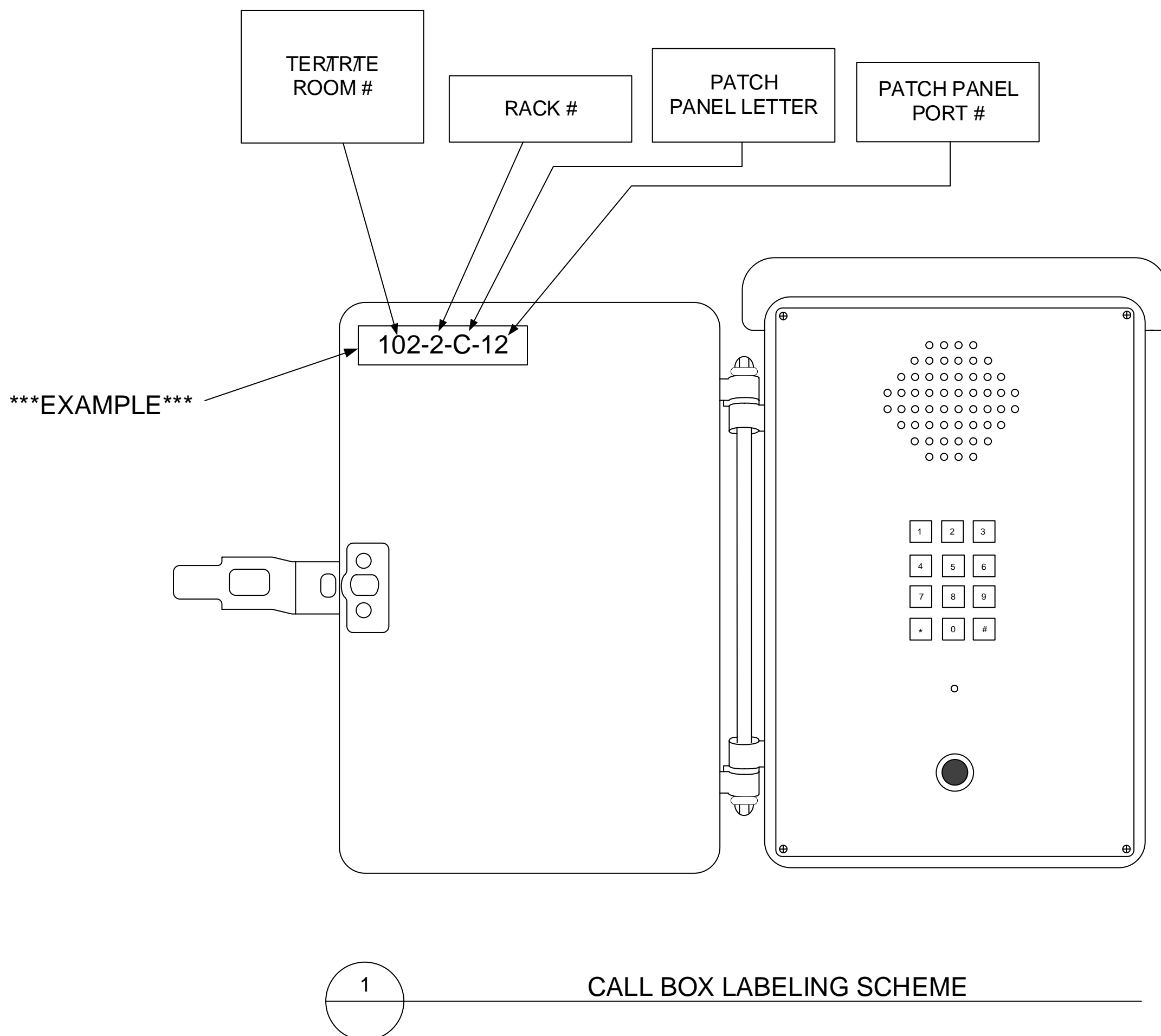


SHEET GENERAL NOTES

1. ALL LABELS SHOWN ILLUSTRATE THE REQUIRED FORMAT OF THE LABELING AND ARE EXAMPLES ONLY. THEY ARE NOT MEANT TO SHOW THE EXACT LABELING SCHEME FOR ANY GIVEN PROJECT.

[illegible]

DESIGNED BY: JOHN BABB	DATE: FEBRUARY 2020
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# LABELING DIAGRAMS