AECOM

NC ANG Security Forces Building
Charolotte, NC

July 01, 2026

Addendum 01

VIA ELECTRONIC TRANSMISSION

TO THE DRAWINGS AND SPECIFICATIONS FOR:

New Security Forces Building

for
North Caroline Air Nation Guard
124th fighter wing
Charlotte, NC

This Addendum supplements and amends the original Plans and Specifications and shall be taken into account in preparing proposals and shall become a part of the contract documents.

1.0 PROJECT MANUAL REVISIONS

1. Specification 22 00 00 PLUMBING, GENERAL PURPOSE
   a. Added PVC as an acceptable pipe material for underground non-pressure piping.
2. Specification 261219 PAD MOUNTED TRANSFORMERS
   a. Added
3. Specification 263623 AUTOMATIC TRANSFER SWITCHES AND BY-PASS/ISOLATION.
   a. Added
4. Specifications 33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP)
   a. Added

2.0 DRAWINGS REVISIONS

1. Drawing G001 ABBREVIATIONS, LEGENDS, & SHEET INDEX
   a. Added Sheet E002
   b. Added Sheet E003
2. Drawing C001 DEMOLITION PLAN
   a. Added temporary construction perimeter fence
   b. Updated Underground electrical removals
3. Drawing C201 UTILITY PLAN
   a. Updated underground electrical
   b. Updated underground telecommunications
4. Drawing S102 STRUCTURAL SECOND FLOOR FRAMING PLAN
   a. Removed reference to OLI#2 near section mark
5. Drawing S303 STRUCTURAL DETAILS
   a. Added labels to Section 3 clarifying which portions apply to the base bid versus OLI#2
6. Drawing E100 ELECTRICAL SITE PLAN
   a. Removed
7. Drawing A680 DOOR SCHEDULE

a. Removed fire rating from door 208

8. Drawing E002 ELECTRICAL SITE DEMOLITION PLAN
   a. Added
9. Drawing E003 ELECTRICAL SITE NEW WORK PLAN
   a. Added
10. Drawing E101 POWER PLAN - LEVEL 1
   a. Showed branch circuits for control panels in Mech Room 107; Re-arranged Electrical Room 105, called for transformers to be mounted on the wall above their panelboards, moved the Main Service Circuit Breaker, Meter and ATS into the Electrical Room.
11. Drawing E102 POWER PLAN – LEVEL 2
   a. Showed a disconnect and dedicated circuit for the Elevator Cab lighting, in the Print/Copy/Elev Eq Rm.
12. Drawing E201 LIGHTING PLAN – LEVEL 1
   a. updated lighting controls to use a symbol in the legend, and show life safety luminaires with hatching. Deleted downlights that are above lockers. Added occupancy sensors for better coverage. Added move exterior lighting at the north stairs.
13. Drawing E202 LIGHTING PLAN – LEVEL 2
   a. updated lighting controls to use a symbol in the legend, and show life safety luminaires with hatching. Deleted downlights that are above lockers. Added occupancy sensors for better coverage. Added move exterior lighting at the north stairs.
14. Drawing E501 ELECTRICAL DETAILS
   a. update the Concrete Encased Ductbank detail for the Medium Voltage Feeder, removed the Meter Socket detail, added ductbank detail for the Service Transformer Secondaries and Generator to the Building.
15. Drawing E601 ELECTRICAL ONE-LINE DIAGRAM
   a. Remove utility meter and CT cabinet, call for metering at the Main Service Circuit Breaker, added conduits for Medium Voltage feeder from Building #1 transformer, primary loop connections. Show conduits ATS to Generator control wiring, and Battery Charger feed. Changed the Distribution Panel Schedule EM1 to a 100 amp Main Circuit Breaker and 100 amp buss.
16. Drawing E701 ELECTRICAL SCHEDULES
   a. added luminaire types R1E, T2E and W1E to luminaire schedule, all with integral emergency battery packs.
17. Drawing E702 ELECTRICAL PANEL SCHEDULES
   a. Panelboard RP1 changed circuit breaker for RP2 to 60 amp. Added 3 pole 60 amp circuit breaker for Generator Block Heater. Panelboard LP1 to a 100 amp Main Circuit Breaker and 100 amp buss.
18. Drawing T001
   a. Notes and annotations were added for cameras, access control and public address system.
19. Drawing T101
   a. Changes to OSP conduit notes.
   b. Added annotations for cameras, PA and access control systems.
20. Drawing T102
   a. Added annotations for cameras, PA and access control systems.
21. Drawing T200
   a. Sheet was added to show OSP ductbank routing.
22. Drawing T201
   a. Sheet was altered to show OSP ductbank routing.
23. Drawing T202
   a. Sheet was added to show OSP ductbank routing.
24. Drawing T203
   a. Sheet was added to show existing ductbank routing.
25. Drawing T301
   a. Sheet was altered to show changed TR layout and rack layout.
26. Drawing T503
   a. Sheet was added to show telecom site details.

27. Drawing T601
    a. Service provider note was removed.
28. Drawing T602
    a. Sheet was added to show proposed OSP routing.

Attachments

1. Specification 22 00 00 PLUMBING, GENERAL PURPOSE
2. Specification 261219 PAD MOUNTED TRANSFORMERS
3. Specification 263623 AUTOMATIC TRANSFER SWITCHES AND BY-PASS/ISOLATION.
4. Specifications 33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP)
5. Drawing G001 ABBREVIATIONS, LEGENDS, & SHEET INDEX
6. Drawing C001 DEMOLITION PLAN
7. Drawing C201 UTILITY PLAN
8. Drawing S102 STRUCTURAL SECOND FLOOR FRAMING PLAN
9. Drawing S303 STRUCTURAL DETAILS
10. Drawing A680 DOOR SCHEDULE
11. Drawing E100 ELECTRICAL SITE PLAN
12. Drawing E002 ELECTRICAL SITE DEMOLITION PLAN
13. Drawing E003 ELECTRICAL SITE NEW WORK PLAN
14. Drawing E101 POWER PLAN - LEVEL 1
15. Drawing E102 POWER PLAN – LEVEL 2
16. Drawing E201 LIGHTING PLAN – LEVEL 1
17. Drawing E202 LIGHTING PLAN – LEVEL 2
18. Drawing E501 ELECTRICAL DETAILS
19. Drawing E601 ELECTRICAL ONE-LINE DIAGRAM
20. Drawing E701 ELECTRICAL SCHEDULES
21. Drawing E702 ELECTRICAL PANEL SCHEDULES
22. Drawing T001
23. Drawing T101
24. Drawing T102
25. Drawing T200
26. Drawing T201
27. Drawing T202
28. Drawing T203
29. Drawing T301
30. Drawing T503
31. Drawing T601
32. Drawing T602

END OF ADDENDUM 01

SECTION TABLE OF CONTENTS

DIVISION 22 - PLUMBING

SECTION 22 00 00

PLUMBING, GENERAL PURPOSE

11/15, CHG 4: 05/21

PART 1 GENERAL

1.1 REFERENCES
1.2 SUBMITTALS
1.3 STANDARD PRODUCTS
1.3.1 Alternative Qualifications
1.3.2 Service Support
1.3.3 Manufacturer's Nameplate
1.3.4 Modification of References
1.3.4.1 Definitions
1.3.4.2 Administrative Interpretations
1.4 DELIVERY, STORAGE, AND HANDLING
1.5 PERFORMANCE REQUIREMENTS
1.5.1 Welding
1.6 REGULATORY REQUIREMENTS
1.7 PROJECT/SITE CONDITIONS
1.8 INSTRUCTION TO GOVERNMENT PERSONNEL
1.9 ACCESSIBILITY OF EQUIPMENT

PART 2 PRODUCTS

2.1 MATERIALS
2.1.1 Pipe Joint Materials
2.1.2 Miscellaneous Materials
2.1.3 Pipe Insulation Material
2.2 PIPE HANGERS, INSERTS, AND SUPPORTS
2.3 VALVES
2.3.1 Backwater Valves
2.3.2 Wall Faucets
2.3.3 Wall Hydrants (Frostproof)
2.3.4 Relief Valves
2.3.5 Thermostatic Mixing Valves
2.4 FIXTURES
2.5 BACKFLOW PREVENTERS
2.6 DRAINS
2.6.1 Floor and Shower Drains
2.6.1.1 Metallic Shower Pan Drains
2.6.1.2 Drains and Backwater Valves
2.6.2 Floor Sinks
2.6.3 Roof Drains and Expansion Joints
2.7 TRAPS
2.8 WATER HEATERS
2.9 PUMPS
2.9.1 Sump Pumps
2.9.2 Circulating Pumps
2.9.3 Flexible Connectors

2.10 DOMESTIC WATER SERVICE METER
2.11 ELECTRICAL WORK
2.12 Clean-outs
2.13 MISCELLANEOUS PIPING ITEMS
2.13.1 Escutcheon Plates
2.13.2 Pipe Sleeves
2.13.2.1 Sleeves in Masonry and Concrete
2.13.2.2 Sleeves Not in Masonry and Concrete
2.13.3 Pipe Hangers (Supports)
2.13.4 Nameplates

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS
3.1.1 Water Pipe, Fittings, and Connections
3.1.1.1 Utilities
3.1.1.2 Cutting and Repairing
3.1.1.3 Protection of Fixtures, Materials, and Equipment
3.1.1.4 Mains, Branches, and Runouts
3.1.1.5 Pipe Drains
3.1.1.6 Expansion and Contraction of Piping
3.1.1.7 Thrust Restraint
3.1.1.8 Commercial-Type Water Hammer Arresters
3.1.2 Joints
3.1.2.1 Threaded
3.1.2.2 Mechanical Couplings
3.1.2.3 Unions and Flanges
3.1.2.4 Grooved Mechanical Joints
3.1.2.5 Cast Iron Soil, Waste and Vent Pipe
3.1.2.6 Copper Tube and Pipe
3.1.2.7 Plastic Pipe
3.1.2.8 Glass Pipe
3.1.2.9 Corrosive Waste Plastic Pipe
3.1.2.10 Polypropylene Pipe
3.1.2.11 Other Joint Methods
3.1.3 Dissimilar Pipe Materials
3.1.4 Corrosion Protection for Buried Pipe and Fittings
3.1.5 Pipe Sleeves and Flashing
3.1.5.1 Sleeve Requirements
3.1.5.2 Flashing Requirements
3.1.5.3 Waterproofing
3.1.5.4 Optional Counterflashing
3.1.5.5 Pipe Penetrations of Slab on Grade Floors
3.1.5.6 Pipe Penetrations
3.1.6 Fire Seal
3.1.7 Supports
3.1.7.1 General
3.1.7.2 Pipe Supports and Structural Bracing, Seismic Requirements
3.1.7.3 Pipe Hangers, Inserts, and Supports
3.1.7.4 Structural Attachments
3.1.8 Welded Installation
3.1.9 Pipe Cleanouts
3.2 WATER HEATERS AND HOT WATER STORAGE TANKS
3.2.1 Relief Valves
3.2.2 Heat Traps
3.2.3 Connections to Water Heaters
3.2.4 Expansion Tank
3.3 FIXTURES AND FIXTURE TRIMMINGS
3.3.1 Fixture Connections

3.3.2 Flushometer Valves
3.3.3 Height of Fixture Rims Above Floor
3.3.4 Shower Bath Outfits
3.3.5 Fixture Supports
3.3.5.1 Support for Solid Masonry Construction
3.3.5.2 Support for Concrete-Masonry Wall Construction
3.3.5.3 Support for Steel Stud Frame Partitions
3.3.5.4 Support for Wood Stud Construction
3.3.5.5 Wall-Mounted Water Closet Gaskets
3.3.6 Backflow Prevention Devices
3.3.7 Access Panels
3.3.8 Sight Drains
3.3.9 Traps
3.3.10 Shower Pans
3.3.10.1 General
3.3.10.2 Metal Shower Pans
3.3.10.3 Plasticized Chlorinated Polyethylene Shower Pans
3.3.10.4 Nonplasticized Polyvinyl Chloride (PVC) Shower Pans
3.4 VIBRATION-ABSORBING FEATURES
3.5 WATER METER REMOTE READOUT REGISTER
3.6 IDENTIFICATION SYSTEMS
3.6.1 Identification Tags
3.6.2 Pipe Color Code Marking
3.6.3 Color Coding Scheme for Locating Hidden Utility Components
3.7 ESCUTCHEONS
3.8 PAINTING
3.8.1 Painting of New Equipment
3.8.1.1 Factory Painting Systems
3.8.1.2 Shop Painting Systems for Metal Surfaces
3.9 TESTS, FLUSHING AND DISINFECTION
3.9.1 Plumbing System
3.9.1.1 Test of Backflow Prevention Assemblies
3.9.1.2 Shower Pans
3.9.2 Defective Work
3.9.3 System Flushing
3.9.3.1 During Flushing
3.9.3.2 After Flushing
3.9.4 Operational Test
3.9.5 Disinfection
3.10 POSTED INSTRUCTIONS
3.11 PERFORMANCE OF WATER HEATING EQUIPMENT
3.11.1 Storage Water Heaters
3.11.1.1 Electric
3.12 TABLES

-- End of Section Table of Contents --

SECTION 22 00 00

PLUMBING, GENERAL PURPOSE
11/15, CHG 4: 05/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.22/CSA 4.4	(2015; R 2020) Relief Valves for Hot Water Supply Systems

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.1.2	(2012; R 2017; R 2022) Air Gaps in Plumbing Systems (For Plumbing Fixtures and Water-Connected Receptors)
ASME A112.6.1M	(1997; R 2017) Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.6.3	(2019) Standard for Floor and Trench Drains
ASME A112.6.4	(2003: R 2012) Roof, Deck and Balcony Drains
ASME A112.14.1	(2003; R 2017; R 2022) Backwater Valves
ASME A112.36.2M	(1991; R 2017) Cleanouts
ASME B1.20.1	(2013; R 2018) Pipe Threads, General Purpose (Inch)
ASME B16.3	(2021) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.5	(2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.15	(2018) Cast Copper Alloy Threaded Fittings Classes 125 and 250
ASME B16.18	(2021) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2021) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2021) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASME B16.23	(2021) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.24	(2022) Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves Classes 150, 300, 600, 900, 1500, and 2500
ASME B16.29	(2017) Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings - DWV
ASME B16.34	(2021) Valves - Flanged, Threaded and Welding End
ASME B16.39	(2020) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
ASME B16.50	(2021) Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings
ASME B16.51	(2013) Copper and Copper Alloy Press-Connect Pressure Fittings
ASME B31.1	(2020) Power Piping
ASME B31.5	(2020) Refrigeration Piping and Heat Transfer Components
ASME B40.100	(2013) Pressure Gauges and Gauge Attachments
ASME BPVC SEC IV	(2017) BPVC Section IV-Rules for Construction of Heating Boilers
ASME BPVC SEC IX	(2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications
ASME CSD-1	(2021) Control and Safety Devices for Automatically Fired Boilers

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1001	(2021) Performance Requirements for Atmospheric Type Vacuum Breakers
ASSE 1003	(2020) Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems - (ANSI approved 2010)
ASSE 1010	(2021) Performance Requirements for Water Hammer Arresters
ASSE 1011	(2017) Performance Requirements for Hose Connection Vacuum Breakers
ASSE 1012	(2021) Performance Requirements for

	Backflow Preventer with an Intermediate Atmospheric Vent
ASSE 1013	(2021) Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies
ASSE 1018	(2001; R 2021) Performance Requirements for Trap Seal Primer Valves - Potable Water Supplied (ANSI Approved 2002
ASSE 1019	(2011; R 2016) Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance
ASSE 1020	(2020) Performance Requirements for Pressure Vacuum Breaker Assemblies

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(2018) Hypochlorites
AWWA B301	(2018) Liquid Chlorine
AWWA C203	(2020) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C606	(2015) Grooved and Shouldered Joints
AWWA C651	(2014) Standard for Disinfecting Water Mains
AWWA C652	(2019) Disinfection of Water-Storage Facilities
AWWA C700	(2020) Cold-Water Meters - Displacement Type, Metal Alloy Main Case
AWWA C701	(2019) Cold-Water Meters - Turbine Type for Customer Service

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M	(2019) Specification for Filler Metals for Brazing and Braze Welding
AWS B2.2/B2.2M	(2016) Specification for Brazing Procedure and Performance Qualification

ASTM INTERNATIONAL (ASTM)

ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2022) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A74	(2021) Standard Specification for Cast Iron Soil Pipe and Fittings
ASTM A105/A105M	(2021) Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A183	(2014; R 2020) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A193/A193M	(2020) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A515/A515M	(2017) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A516/A516M	(2017) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A536	(1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings
ASTM A733	(2016) Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A888	(2021a) Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B32	(2020) Standard Specification for Solder Metal
ASTM B42	(2020) Standard Specification for Seamless Copper Pipe, Standard Sizes
ASTM B43	(2020) Standard Specification for Seamless Red Brass Pipe, Standard Sizes
ASTM B88	(2020) Standard Specification for Seamless Copper Water Tube
ASTM B88M	(2020) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B306	(2020) Standard Specification for Copper Drainage Tube (DWV)
ASTM B370	(2022) Standard Specification for Copper Sheet and Strip for Building Construction

ASTM B584	(2014; R 2022) Standard Specification for Copper Alloy Sand Castings for General Applications
ASTM B813	(2016) Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM B828	(2016) Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM C564	(2020a) Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM D1248	(2016) Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
ASTM D2000	(2018) Standard Classification System for Rubber Products in Automotive Applications
ASTM D2657	(2007; R 2015) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D2665	(2014) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2822/D2822M	(2005; R 2011; E 2011) Standard Specification for Asphalt Roof Cement, Asbestos-Containing
ASTM D2846/D2846M	(2019) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM D3138	(2004; R 2016) Standard Specification for Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components
ASTM D3139	(2019) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3212	(2020) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3311	(2017) Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns

ASTM E1	(2014) Standard Specification for ASTM Liquid-in-Glass Thermometers
ASTM F437	(2021) Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F438	(2017) Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F439	(2019) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F441/F441M	(2020) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F442/F442M	(2020) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
ASTM F477	(2014; R 2021) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F493	(2020) Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
ASTM F891	(2016) Standard Specification for Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core
ASTM F1290	(2019) Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings
ASTM F1760	(2016; R 2020) Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
ASTM F2389	(2021) Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	(2018) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	(2012) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015	(2016; 14/17) Copper Tube Handbook

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

IAPMO PS 117	(2005b) Press Type Or Plain End Rub Gasketed W/ Nail CU & CU Alloy Fittings 4 Install On CU Tubing
IAPMO UPC	(2003) Uniform Plumbing Code

INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1	(2017) Standard And Commentary Accessible and Usable Buildings and Facilities
ICC IPC	(2021) International Plumbing Code

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(2018) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-44	(2019) Steel Pipeline Flanges
MSS SP-58	(2018) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-67	(2022) Butterfly Valves
MSS SP-70	(2011) Gray Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(2018) Gray Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-72	(2010a) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-78	(2011) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(2019) Bronze Gate, Globe, Angle and Check Valves
MSS SP-83	(2014) Class 3000 Steel Pipe Unions Socket Welding and Threaded
MSS SP-85	(2011) Gray Iron Globe & Angle Valves Flanged and Threaded Ends
MSS SP-110	(2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

NACE INTERNATIONAL (NACE)

NACE SP0169	(2013) Control of External Corrosion on Underground or Submerged Metallic Piping Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA MG 1	(2021) Motors and Generators
NEMA MG 11	(1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A	(2021) Standard for the Installation of Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF 372	(2016) Drinking Water System Components - Lead Content
NSF/ANSI 14	(2021) Plastics Piping System Components and Related Materials
NSF/ANSI 61	(2022) Drinking Water System Components - Health Effects

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA Fire Man	(2016) Firestopping: Plastic Pipe in Fire Resistive Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201	(2010) Water Hammer Arresters Standard

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1508	(2009) Hose Clamp Specifications

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SM 9223	(2004) Enzyme Substrate Coliform Test
PL 93-523	(1974; A 1999) Safe Drinking Water Act

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 141.80	National Primary Drinking Water Regulations; Control of Lead and Copper; General Requirements

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Backflow Prevention Assemblies

Fixtures

List of installed fixtures with manufacturer, model, and flow rate.

Water Heaters

Pumps

Welding

A copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

Vibration-Absorbing Features

Details of vibration-absorbing features, including arrangement, foundation plan, dimensions and specifications.

Plumbing System

Diagrams, instructions, and other sheets proposed for posting. Manufacturer's recommendations for the installation of bell and spigot and hubless joints for cast iron soil pipe.

SD-06 Test Reports

Tests, Flushing and Disinfection

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Test of Backflow Prevention Assemblies.

Certification of proper operation shall be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests. If no state requirement exists, the Contractor shall have the manufacturer's representative test the device, to ensure the unit is properly installed and performing as intended. The Contractor shall provide written documentation of the tests performed and signed by the individual performing the tests.

SD-07 Certificates

Materials and Equipment

Where equipment is specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

Bolts

Written certification by the bolt manufacturer that the bolts furnished comply with the specified requirements.

SD-10 Operation and Maintenance Data

Plumbing System

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.3 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

1.3.1 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.3.2 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.3.3 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.3.4 Modification of References

In each of the publications referred to herein, consider the advisory

provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

1.3.4.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

1.3.4.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.4 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.5 PERFORMANCE REQUIREMENTS

1.5.1 Welding

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record.

1.6 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work shall be in accordance with ICC IPC.

1.7 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.8 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work.

Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with the equipment or system.

When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

1.9 ACCESSIBILITY OF EQUIPMENT

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement shall meet NSF/ANSI 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW." Polypropylene pipe and fittings shall conform to dimensional requirements of Schedule 40, Iron Pipe size and shall comply with NSF/ANSI 14, NSF/ANSI 61 and ASTM F2389. Polypropylene piping that will be exposed to UV light shall be provided with a Factory applied UV resistant coating. Pipe threads (except dry seal) shall conform to ASME B1.20.1. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in accordance with NSF/ANSI 61, Annex G or NSF 372. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with PL 93-523 and NSF/ANSI 61, Section 8. End point devices such as drinking water fountains, lavatory faucets, kitchen and bar faucets, residential ice makers, supply stops and end point control valves used to dispense water for drinking must meet the requirements of NSF/ANSI 61, Section 9. Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

2.1.1 Pipe Joint Materials

Grooved pipe and hubless cast-iron soil pipe shall not be used underground. Solder containing lead shall not be used with copper pipe. Cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Institute. Joints and gasket materials shall conform to the following:

a. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A74, AWWA C606. For hubless type: CISPI 310

b. Coupling for Steel Pipe: AWWA C606.

c. Couplings for Grooved Pipe: Ductile Iron ASTM A536 (Grade 65-45-12) ..

d. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1/16 inch thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.

e. Brazing Material: Brazing material shall conform to AWS A5.8/A5.8M, BCuP-5.

f. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides.

g. Solder Material: Solder metal shall conform to ASTM B32.

h. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B813, Standard Test 1.

i. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe.

j. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type and hubless type): ASTM C564.

k. Rubber Gaskets for Grooved Pipe: ASTM D2000, maximum temperature 230 degrees F.

l. Flexible Elastomeric Seals: ASTM D3139, ASTM D3212 or ASTM F477.

m. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A183.

n. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D3138.

o. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F493.

p. Flanged fittings including, but not limited to, flanges, bolts, nuts and bolt patterns shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A105/A105M. Blind flange material shall conform to ASTM A516/A516M cold service and

ASTM A515/A515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A193/A193M.

q. Press fittings for Copper Pipe and Tube: Copper press fittings shall conform to the material and sizing requirements of ASME B16.51 and performance criteria of IAPMO PS 117. Sealing elements for copper press fittings shall be EPDM, FKM or HNBR. Sealing elements shall be factory installed or an alternative supplied fitting manufacturer. Sealing element shall be selected based on manufacturer's approved application guidelines.

r. Copper tubing shall conform to ASTM B88, Type K, L or M.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

a. Water Hammer Arrester: PDI WH 201. Water hammer arrester shall be bellows type.

b. Copper, Sheet and Strip for Building Construction: ASTM B370.

c. Asphalt Roof Cement: ASTM D2822/D2822M.

d. Hose Clamps: SAE J1508.

e. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.

f. Metallic Cleanouts: ASME A112.36.2M.

g. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.

h. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.

i. Hypochlorites: AWWA B300.

j. Liquid Chlorine: AWWA B301.

k. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.100.

l. Thermometers: ASTM E1. Mercury shall not be used in thermometers.

2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves

2-1/2 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 3 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	MSS SP-110
Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Backwater Valves	ASME A112.14.1
Vacuum Relief Valves	ANSI Z21.22/CSA 4.4
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASME BPVC SEC IV, Part HLW-810: Requirements for Potable-Water Heaters Bottom Drain Valve
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22/CSA 4.4

Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code No., Part CW, Article 5

2.3.1 Backwater Valves

Backwater valves shall be either separate from the floor drain or a combination floor drain, P-trap, and backwater valve, as shown. Valves shall have cast-iron bodies with cleanouts large enough to permit removal of interior parts. Valves shall be of the flap type, hinged or pivoted, with revolving disks. Hinge pivots, disks, and seats shall be nonferrous metal. Disks shall be slightly open in a no-flow no-backwater condition. Cleanouts shall extend to finished floor and be fitted with threaded countersunk plugs.

2.3.2 Wall Faucets

Wall faucets with vacuum-breaker backflow preventer shall be brass with 3/4 inch male inlet threads, hexagon shoulder, and 3/4 inch hose connection. Faucet handle shall be securely attached to stem.

2.3.3 Wall Hydrants (Frostproof)

ASSE 1019 with vacuum-breaker backflow preventer shall have a nickel-brass or nickel-bronze wall plate or flange with nozzle and detachable key handle. A brass or bronze operating rod shall be provided within a galvanized iron casing of sufficient length to extend through the wall so that the valve is inside the building, and the portion of the hydrant between the outlet and valve is self-draining. A brass or bronze valve with coupling and union elbow having metal-to-metal seat shall be provided. Valve rod and seat washer shall be removable through the face of the hydrant. The hydrant shall have 3/4 inch exposed hose thread on spout and 3/4 inch male pipe thread on inlet.

2.3.4 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22/CSA 4.4. Relief valves for systems where the maximum rate of heat input is less than 200,000 Btuh shall have 3/4 inch minimum inlets, and 3/4 inch outlets. Relief valves for systems where the maximum rate of heat input is greater than 200,000 Btuh shall have 1 inch minimum inlets, and 1 inch outlets. The discharge pipe from the relief valve shall be the size of the valve outlet.

2.3.5 Thermostatic Mixing Valves

Provide thermostatic mixing valve for lavatory faucets. Mixing valves,

thermostatic type, pressure-balanced or combination thermostatic and pressure-balanced shall be line size and shall be constructed with rough or finish bodies either with or without plating. Each valve shall be constructed to control the mixing of hot and cold water and to deliver water at a desired temperature regardless of pressure or input temperature changes. The control element shall be of an approved type. The body shall be of heavy cast bronze, and interior parts shall be brass, bronze, corrosion-resisting steel or copper. The valve shall be equipped with necessary stops, check valves, unions, and sediment strainers on the inlets. Mixing valves shall maintain water temperature within 5 degrees F of any setting.

2.4 FIXTURES

Refer to Drawings for Plumbing Fixture Schedule.

2.5 BACKFLOW PREVENTERS

Backflow prevention devices must be approved by the State or local regulatory agencies. If there is no State or local regulatory agency requirements, the backflow prevention devices must be listed by the Foundation for Cross-Connection Control & Hydraulic Research, or any other approved testing laboratory having equivalent capabilities for both laboratory and field evaluation of backflow prevention devices and assemblies.

Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be meet the above requirements.

Backflow preventers with intermediate atmospheric vent shall conform to ASSE 1012. Reduced pressure principle backflow preventers shall conform to ASSE 1013. Hose connection vacuum breakers shall conform to ASSE 1011. Pipe applied atmospheric type vacuum breakers shall conform to ASSE 1001. Pressure vacuum breaker assembly shall conform to ASSE 1020. Air gaps in plumbing systems shall conform to ASME A112.1.2.

2.6 DRAINS

2.6.1 Floor and Shower Drains

Floor and shower drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded connection. Between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.6.3. Provide drain with trap primer connection, trap primer, and connection piping. Primer shall meet ASSE 1018.

2.6.1.1 Metallic Shower Pan Drains

Where metallic shower pan membrane is installed, polyethylene drain with corrosion-resistant screws securing the clamping device shall be provided. Polyethylene drains shall have fittings to adapt drain to waste piping. Polyethylene for floor drains shall conform to ASTM D1248. Drains shall have separate cast-iron "P" trap, circular body, seepage pan, and strainer, unless otherwise indicated.

2.6.1.2 Drains and Backwater Valves

Drains and backwater valves installed in connection with waterproofed floors or shower pans shall be equipped with bolted-type device to securely clamp flashing.

2.6.2 Floor Sinks

Floor sinks shall be square, with 12 inch nominal overall width or diameter and 10 inch nominal overall depth. Floor sink shall have an acid-resistant enamel interior finish with cast-iron body, aluminum sediment bucket, and perforated grate of cast iron in industrial areas and stainless steel in finished areas. The outlet pipe size shall be as indicated or of the same size as the connecting pipe.

2.6.3 Roof Drains and Expansion Joints

Roof drains shall conform to ASME A112.6.4, with dome and integral flange, and shall have a device for making a watertight connection between roofing and flashing. The whole assembly shall be galvanized heavy pattern cast iron. For aggregate surface roofing, the drain shall be provided with a gravel stop. On roofs other than concrete construction, roof drains shall be complete with underdeck clamp, sump receiver, and an extension for the insulation thickness where applicable. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or membrane shall be provided when required to suit the building construction. Strainer openings shall have a combined area equal to twice that of the drain outlet. The outlet shall be equipped to make a proper connection to threaded pipe of the same size as the downspout. An expansion joint of proper size to receive the conductor pipe shall be provided. The expansion joint shall consist of a heavy cast-iron housing, brass or bronze sleeve, brass or bronze fastening bolts and nuts, and gaskets or packing. The sleeve shall have a nominal thickness of not less than 0.134 inch. Gaskets and packing shall be close-cell neoprene, O-ring packing shall be close-cell neoprene of 70 durometer. Packing shall be held in place by a packing gland secured with bolts.

2.7 TRAPS

Unless otherwise specified, traps shall be copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be without a cleanout. Provide traps with removable access panels for easy clean-out at sinks and lavatories. Tubes shall be copper alloy with walls not less than 0.032 inch thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal or metal-to-plastic type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required

for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

2.8 WATER HEATERS

Electric type water heaters shall conform to UL 174 with dual heating elements. Each element shall be 12 KW. The elements shall be wired so that only one element can operate at a time. The Operating Set Point shall be adjustable from 90°F/42°C to 190°F/88°C. Each element shall be constantly monitored and current on/off state is displayed, any element failure shall be reported and exact location shall be shown, eliminates needs for field testing of elements. Heater shall be listed with Underwriters' Laboratories and classified to The National Sanitation Foundation Standard No. 5. All internal surfaces of the tank shall be glass-lined with an alkaline borosilicate composition that has been fused-to-steel by firing at a temperature of 1600°F. Tank shall be cathodically protected with a combination of sacrificial and powered anodes. The entire vessel is to be enclosed in a round steel enclosure with baked enamel finish. Water heater shall have an electronic control with large LCD displaying current water heater status; provide real time element status and sensing, low water cutoff and economy mode operation. Heater shall have 120 volt control circuit transformer, transformer fusing, magnetic contactor(s), element fusing per N.E.C., and commercial grade Incoloy elements. Temperature controls shall include limiting switch which will require resetting manually in the event the temperature reaches 202°F. Foam insulation shall meet the thermal efficiency and/or standby loss requirements of the U. S. Department of Energy and current edition of ASHRAE/IES 90.1. Heater shall include a CSA Certified and ASME Rated T&P relief valve and a drain valve. Water heater units(s) shall be compatible with building management systems using Modbus or BACnet with optional ICC interface.

2.9 PUMPS

2.9.1 Sump Pumps

Sump pumps shall be of capacities indicated. The pumps shall be of the automatic, electric motor-driven, submerged type, complete with necessary control equipment and with a split or solid cast-iron or steel cover plate. The pumps shall be direct-connected by an approved flexible coupling to a vertical electric motor having a continuous oiling device or packed bearings sealed against dirt and moisture. Motors shall be totally enclosed, fan-cooled of sizes as indicated and shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 4 enclosure. Integral size motors shall be the premium efficiency type in accordance with NEMA MG 1. Each pump shall be fitted with a high-grade thrust bearing mounted above the floor. Each shaft shall have an alignment bearing at each end, and the suction inlet shall be between 3 and 6 inches above the sump bottom. The suction side of each pump shall have a strainer of ample capacity. A float switch assembly, with the switch completely enclosed in a NEMA 250, Type 4 enclosure, shall start and stop each motor at predetermined water levels. Duplex pumps shall be equipped with an automatic alternator to change the lead operation from one pump to

the other, and for starting the second pump if the flow exceeds the capacity of the first pump. The discharge line from each pump shall be provided with a union or flange, a nonclog swing check valve, and a stop valve in an accessible location near the pump.

2.9.2 Circulating Pumps

Domestic hot water circulating pumps shall be electrically driven, single-stage, centrifugal, with mechanical seals, suitable for the intended service. Pump and motor shall be supported by the piping on which it is installed. The shaft shall be one-piece, heat-treated, corrosion-resisting steel with impeller and smooth-surfaced housing of bronze.

Motor shall be totally enclosed, fan-cooled and shall have sufficient horsepower for the service required. Each pump motor shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 1 enclosure with "START-STOP" switch in cover.

2.9.3 Flexible Connectors

Flexible connectors shall be provided at the suction and discharge of each pump that is 1 hp or larger. Connectors shall be constructed of neoprene, rubber, or braided bronze, with Class 150 standard flanges. Flexible connectors shall be line size and suitable for the pressure and temperature of the intended service.

2.10 DOMESTIC WATER SERVICE METER

Cold water meters 2 inches and smaller shall be positive displacement type conforming to AWWA C700. Cold water meters 2-1/2 inches and larger shall be turbine type conforming to AWWA C701. Meter register may be round or straight reading type, as provided by the local utility. Meter shall be provided with a pulse generator, remote readout register and all necessary wiring and accessories.

Meters must be connected to the base wide energy and utility monitoring and control system (if this system exists) using the installation's advanced metering protocols.

2.11 ELECTRICAL WORK

Provide electrical motor driven equipment specified complete with motors, motor starters, and controls as specified herein and in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide high efficiency type, single-phase, fractional-horsepower alternating-current motors, including motors that are part of a system, corresponding to the applications in accordance with NEMA MG 11. In addition to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, provide polyphase, squirrel-cage medium induction motors with continuous ratings, including motors that are part of a system, that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 1. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor.

Motors shall be rated for continuous duty with the enclosure specified. Motor duty requirements shall allow for maximum frequency start-stop

operation and minimum encountered interval between start and stop. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of the enclosure.

Controllers and contactors shall have auxiliary contacts for use with the controls provided. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided. For packaged equipment, the manufacturer shall provide controllers, including the required monitors and timed restart.

Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.12 Clean-outs

Finished Floor Clean-outs: Cast iron body and frame with round adjustable scoriated nickel bronze top. Provide nickle bronze carpet clamping frame with vandal proof screw in carpeted areas.

Unfinished Floor and Equipment Area Floor: DCast iron body and frame with round adjustable scoriated cast iron top.

Corrosion Resistant: ABS body with round coated cast iron top.

Wall cleanouts: Cast iron caulk ferrule with vast bronze taper thread plug and prime-coated steel shallow cover. Vandalproof screws.

2.13 MISCELLANEOUS PIPING ITEMS

2.13.1 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide chromium-plated on copper alloy plates or polished stainless steel finish in finished spaces. Provide paint finish on plates in unfinished spaces.

2.13.2 Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade, except where penetrating a membrane waterproof floor.

2.13.2.1 Sleeves in Masonry and Concrete

Provide steel pipe sleeves or schedule 40 PVC plastic pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

2.13.2.2 Sleeves Not in Masonry and Concrete

Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

2.13.3 Pipe Hangers (Supports)

Provide MSS SP-58 Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joists with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shield for insulated piping.

2.13.4 Nameplates

Provide 0.125 inch thick melamine laminated plastic nameplates, black matte finish with white center core, for equipment, gages, thermometers, and valves; valves in supplies to faucets will not require nameplates. Accurately align lettering and engrave minimum of 0.25 inch high normal block lettering into the white core. Minimum size of nameplates shall be 1.0 by 2.5 inches. Key nameplates to a chart and schedule for each system. Frame charts and schedules under glass and place where directed near each system. Furnish two copies of each chart and schedule.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to NFPA 90A requirements. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA Fire Man. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 5 feet outside the building, unless otherwise indicated. A full port ball valve and drain shall be installed on the water service line inside the building approximately 6 inches above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 12 inches below the average local frost depth or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to

prevent movement.

3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Pipe Drains

Pipe drains indicated shall consist of 3/4 inch hose bibb with renewable seat and ball valve ahead of hose bibb. At other low points, 3/4 inch brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.1.1.6 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets and changes in direction where indicated and required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about

midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

3.1.1.7 Thrust Restraint

Plugs, caps, tees, valves and bends deflecting 11.25 degrees or more, either vertically or horizontally, in waterlines 4 inches in diameter or larger shall be provided with thrust blocks, where indicated, to prevent movement. Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust block shall be poured against undisturbed earth. The side of the thrust block not subject to thrust shall be poured against forms. The area of bearing will be as shown. Blocking shall be placed so that the joints of the fitting are accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.1.8 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located as generally indicated, with precise location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall conform to ASSE 1010. Vertical capped pipe columns will not be permitted.

3.1.2 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

3.1.2.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.1.2.2 Mechanical Couplings

Mechanical couplings may be used in conjunction with grooved pipe for aboveground, ferrous or non-ferrous, domestic hot and cold water systems, in lieu of unions, brazed, soldered, welded, flanged, or threaded joints.

Mechanical couplings are permitted in accessible locations including behind access plates. Flexible grooved joints will not be permitted, except as vibration isolators adjacent to mechanical equipment. Rigid

grooved joints shall incorporate an angle bolt pad design which maintains metal-to-metal contact with equal amount of pad offset of housings upon installation to ensure positive rigid clamping of the pipe.

Designs which can only clamp on the bottom of the groove or which utilize gripping teeth or jaws, or which use misaligned housing bolt holes, or which require a torque wrench or torque specifications will not be permitted.

Grooved fittings and couplings, and grooving tools shall be provided from the same manufacturer. Segmentally welded elbows shall not be used. Grooves shall be prepared in accordance with the coupling manufacturer's latest published standards. Grooving shall be performed by qualified grooving operators having demonstrated proper grooving procedures in accordance with the tool manufacturer's recommendations.

The Contracting Officer shall be notified 24 hours in advance of test to demonstrate operator's capability, and the test shall be performed at the work site, if practical, or at a site agreed upon. The operator shall demonstrate the ability to properly adjust the grooving tool, groove the pipe, and to verify the groove dimensions in accordance with the coupling manufacturer's specifications.

3.1.2.3 Unions and Flanges

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 2-1/2 inches and smaller; flanges shall be used on pipe sizes 3 inches and larger.

3.1.2.4 Grooved Mechanical Joints

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations.

3.1.2.5 Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

3.1.2.6 Copper Tube and Pipe

a. Brazed. Brazed joints shall be made in conformance with AWS B2.2/B2.2M, ASME B16.50, and CDA A4015 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.

b. Soldered. Soldered joints shall be made with flux and are only acceptable for piping 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA A4015. Soldered joints shall not be used in compressed air piping between the air compressor and the receiver.

c. Copper Tube Extracted Joint. Mechanically extracted joints shall be made in accordance with ICC IPC.

d. Press connection. Copper press connections shall be made in **strict** accordance with the manufacturer's installation instructions for manufactured rated size. The joints shall be pressed using the tool(s) approved by the manufacturer **of that joint**. Minimum distance between fittings shall be in accordance with the manufacturer's requirements.

3.1.2.7 Plastic Pipe

Acrylonitrile-Butadiene-Styrene (ABS) pipe shall have joints made with solvent cement. PVC and CPVC pipe shall have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

3.1.2.8 Glass Pipe

Joints for corrosive waste glass pipe and fittings shall be made with corrosion-resisting steel compression-type couplings with acrylonitrile rubber gaskets lined with polytetrafluoroethylene.

3.1.2.9 Corrosive Waste Plastic Pipe

Joints for polyolefin pipe and fittings shall be made by mechanical joint or electrical fusion coil method in accordance with ASTM D2657 and ASTM F1290. Joints for filament-wound reinforced thermosetting resin pipe shall be made in accordance with manufacturer's instructions. Unions or flanges shall be used where required for disconnection and inspection.

3.1.2.10 Polypropylene Pipe

Joints for polypropylene pipe and fittings shall be made by heat fusion welding socket-type or butt-fusion type fittings and shall comply with ASTM F2389.

3.1.2.11 Other Joint Methods

3.1.3 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.4 Corrosion Protection for Buried Pipe and Fittings

Ductile iron, cast iron, and steel pipe, fittings, and joints shall have a protective coating. Additionally, ductile iron, cast iron, and steel pressure pipe shall have a cathodic protection system and joint bonding. The cathodic protection system, protective coating system, and joint bonding for cathodically protected pipe shall be in accordance with . Coatings shall be selected, applied, and inspected in accordance with NACE SP0169 and as otherwise specified. The pipe shall be cleaned and the coating system applied prior to pipe tightness testing. Joints and fittings shall be cleaned and the coating system applied after pipe tightness testing. For tape coating systems, the tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer utilized with tape type coating systems shall be as recommended by the tape manufacturer.

3.1.5 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.5.1 Sleeve Requirements

Unless indicated otherwise, provide pipe sleeves meeting the following requirements:

a. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors.

b. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved.

c. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor.

d. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type

longitudinal seam, or plastic.

e. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C920 and with a primer, backstop material and surface preparation as specified in Section 07 92 00 JOINT SEALANTS. The annular space between pipe and sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated.

f. Sleeves through below-grade walls in contact with earth shall be recessed 1/2 inch from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and concrete wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls shall conform to the requirements in Section 07 84 00 FIRESTOPPING.

3.1.5.2 Flashing Requirements

Pipes passing through roof shall be installed through a 16 ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

3.1.5.3 Waterproofing

Waterproofing at floor-mounted water closets shall be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet shall be perforated and turned down approximately 1-1/2 inches to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard shall be embedded in sealant to a depth of approximately 1-1/2 inches; then the sealant shall be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper shall extend not less than 8 inches from the drainpipe and shall be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe shall be sealed with sealant and the flashing guard shall be upturned approximately 1-1/2 inches to fit the outside diameter of the drainpipe and the inside diameter of

the water closet floor flange. The upturned portion of the sheet fitted into the floor flange shall be sealed.

3.1.5.4 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

a. A standard roof coupling for threaded pipe up to 6 inches in diameter.

b. A tack-welded or banded-metal rain shield around the pipe.

3.1.5.5 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs FLASHING REQUIREMENTS and WATERPROOFING, a groove 1/4 to 1/2 inch wide by 1/4 to 3/8 inch deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in Section 07 92 00 JOINT SEALANTS.

3.1.5.6 Pipe Penetrations

Provide sealants for all pipe penetrations. All pipe penetrations shall be sealed to prevent infiltration of air, insects, and vermin.

3.1.6 Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07 84 00 FIRESTOPPING.

3.1.7 Supports

3.1.7.1 General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

3.1.7.2 Pipe Supports and Structural Bracing, Seismic Requirements

Piping and attached valves shall be supported and braced to resist seismic loads as specified in Section 13 48 73 SEISMIC CONTROL FOR MISCELLANEOUS EQUIPMENT. Structural steel required for reinforcement to properly support piping, headers, and equipment, but not shown, shall be provided. Material used for supports shall be as specified in Section 05 12 00 STRUCTURAL STEEL.

3.1.7.3 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 except as modified herein.

a. Types 5, 12, and 26 shall not be used.

b. Type 3 shall not be used on insulated pipe.

c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.

d. Type 19 and 23 C-clamps shall be torqued per MSS SP-58 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.

f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

g. Type 39 saddles shall be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 39 saddles shall be welded to the pipe.

h. Type 40 shields shall:

(1) Be used on insulated pipe less than 4 inches.

(2) Be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or less.

(3) Have a high density insert for all pipe sizes. High density inserts shall have a density of 8 pcf or greater.

i. Horizontal pipe supports shall be spaced as specified in MSS SP-58 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Operating temperatures in determining hanger spacing for PVC or CPVC pipe shall be 120 degrees F for PVC and 180 degrees F for CPVC. Horizontal pipe runs shall include allowances for expansion and contraction.

j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 15 feet nor more than 8 feet from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.

k. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:

(1) On pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.

(2) On pipe less than 4 inches a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

(3) On pipe 4 inches and larger carrying medium less that 60 degrees F a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

l. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.

m. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.

n. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

3.1.7.4 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floor or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only.

3.1.8 Welded Installation

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.9 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with

the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including 4 inches. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single story buildings with slab-on-grade construction or where less than 18 inches of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron or plastic.

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 6 inches above the top of the tank or water heater.

3.2.2 Heat Traps

Piping to and from each water heater and hot water storage tank shall be routed horizontally and downward a minimum of 2 feet before turning in an upward direction.

3.2.3 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

3.2.4 Expansion Tank

A pre-charged expansion tank shall be installed on the cold water supply between the water heater inlet and the cold water supply shut-off valve. The Contractor shall adjust the expansion tank air pressure, as recommended by the tank manufacturer, to match incoming water pressure.

3.3 FIXTURES AND FIXTURE TRIMMINGS

Polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Angle stops, straight stops, stops integral with

the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.3.2 Flushometer Valves

Flushometer valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket. Flushometer valves for water closets shall be installed 39 inches above the floor, except at water closets intended for use by the physically handicapped where flushometer valves shall be mounted at approximately 30 inches above the floor and arranged to avoid interference with grab bars. In addition, for water closets intended for handicap use, the flush valve handle shall be installed on the wide side of the enclosure.

3.3.3 Height of Fixture Rims Above Floor

Lavatories shall be mounted with rim 31 inches above finished floor. Wall-hung drinking fountains and water coolers shall be installed with rim 42 inches above floor. Wall-hung service sinks shall be mounted with rim 28 inches above the floor. Installation of fixtures for use by the physically handicapped shall be in accordance with ICC A117.1.

3.3.4 Shower Bath Outfits

The area around the water supply piping to the mixing valves and behind the escutcheon plate shall be made watertight by caulking or gasketing.

3.3.5 Fixture Supports

Fixture supports for off-the-floor lavatories, urinals, water closets, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor

slab.

3.3.5.1 Support for Solid Masonry Construction

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

3.3.5.2 Support for Concrete-Masonry Wall Construction

Chair carrier shall be anchored to floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be fastened to the concrete wall using through bolts and a back-up plate.

3.3.5.3 Support for Steel Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining steel partition studs are suitably reinforced to support a wall plate bolted to these studs.

3.3.5.4 Support for Wood Stud Construction

Where floor is a concrete slab, a floor-anchored chair carrier shall be used. Where entire construction is wood, wood crosspieces shall be installed. Fixture hanger plates, supports, brackets, or mounting lugs shall be fastened with not less than No. 10 wood screws, 1/4 inch thick minimum steel hanger, or toggle bolts with nut. The wood crosspieces shall extend the full width of the fixture and shall be securely supported.

3.3.5.5 Wall-Mounted Water Closet Gaskets

Where wall-mounted water closets are provided, reinforced wax, treated felt, or neoprene gaskets shall be provided. The type of gasket furnished shall be as recommended by the chair-carrier manufacturer.

3.3.6 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with IAPMO UPC at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

3.3.7 Access Panels

Access panels shall be provided for concealed valves and controls, or any

item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified in Section 08 31 00 ACCESS DOORS AND PANELS.

3.3.8 Sight Drains

Sight drains shall be installed so that the indirect waste will terminate 2 inches above the flood rim of the funnel to provide an acceptable air gap.

3.3.9 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps installed on plastic pipe may be plastic conforming to ASTM D3311. Traps for acid-resisting waste shall be of the same material as the pipe.

3.3.10 Shower Pans

Before installing shower pan, subfloor shall be free of projections such as nail heads or rough edges of aggregate. Drain shall be a bolt-down, clamping-ring type with weepholes, installed so the lip of the subdrain is flush with subfloor.

3.3.10.1 General

The floor of each individual shower, the shower-area portion of combination shower and drying room, and the entire shower and drying room where the two are not separated by curb or partition, shall be made watertight with a shower pan fabricated in place. The shower pan material shall be cut to size and shape of the area indicated, in one piece to the maximum extent practicable, allowing a minimum of 6 inches for turnup on walls or partitions, and shall be folded over the curb with an approximate return of 1/4 of curb height. The upstands shall be placed behind any wall or partition finish. Subflooring shall be smooth and clean, with nailheads driven flush with surface, and shall be sloped to drain. Shower pans shall be clamped to drains with the drain clamping ring.

3.3.10.2 Metal Shower Pans

When a shower pan of required size cannot be furnished in one piece, metal pieces shall be joined with a flintlock seam and soldered or burned. The corners shall be folded, not cut, and the corner seam shall be soldered or burned. Pans, including upstands, shall be coated on all surfaces with one brush coat of asphalt. Asphalt shall be applied evenly at not less than 1 gallon per 50 square feet. A layer of felt covered with building paper shall be placed between shower pans and wood floors. The joining surfaces of metal pan and drain shall be given a brush coat of asphalt after the pan is connected to the drain.

3.3.10.3 Plasticized Chlorinated Polyethylene Shower Pans

Corners of plasticized chlorinated polyethylene shower pans shall be folded against the upstand by making a pig-ear fold. Hot-air gun or heat lamp shall be used in making corner folds. Each pig-ear corner fold shall be nailed or stapled 1/2 inch from the upper edge to hold it in place.

Nails shall be galvanized large-head roofing nails. On metal framing or studs, approved duct tape shall be used to secure pig-ear fold and membrane. Where no backing is provided between the studs, the membrane slack shall be taken up by pleating and stapling or nailing to studding 1/2 inch from upper edge. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it will be applied shall be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after which the membrane shall be pressed into place. Surfaces to be solvent-welded shall be clean. Surfaces to be joined with xylene shall be initially sprayed and vigorously cleaned with a cotton cloth, followed by final coating of xylene and the joining of the surfaces by roller or equivalent means. If ambient or membrane temperatures are below 40 degrees F the membrane and the joint shall be heated prior to application of xylene. Heat may be applied with hot-air gun or heat lamp, taking precautions not to scorch the membrane. Adequate ventilation and wearing of gloves are required when working with xylene. Membrane shall be pressed into position on the drain body, and shall be cut and fit to match so that membrane can be properly clamped and an effective gasket-type seal provided. On wood subflooring, two layers of 15 pound dry felt shall be installed prior to installation of shower pan to ensure a smooth surface for installation.

3.3.10.4 Nonplasticized Polyvinyl Chloride (PVC) Shower Pans

Nonplasticized PVC shall be turned up behind walls or wall surfaces a distance of not less than 6 inches in room areas and 3 inches above curb level in curbed spaces with sufficient material to fold over and fasten to outside face of curb. Corners shall be pig-ear type and folded between pan and studs. Only top 1 inch of upstand shall be nailed to hold in place. Nails shall be galvanized large-head roofing type. Approved duct tape shall be used on metal framing or studs to secure pig-ear fold and membrane. Where no backing is provided between studs, the membrane slack shall be taken up by pleating and stapling or nailing to studding at top inch of upstand. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it is to be applied shall be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after which the membrane shall be pressed into place. Trim for drain shall be exactly the size of drain opening. Bolt holes shall be pierced to accommodate bolts with a tight fit. Adhesive shall be used between pan and subdrain. Clamping ring shall be bolted firmly. A small amount of gravel or porous materials shall be placed at weepholes so that holes remain clear when setting bed is poured. Membrane shall be solvent welded with PVC solvent cement. Surfaces to be solvent welded shall be clean (free of grease and grime). Sheets shall be laid on a flat surface with an overlap of about 2 inches. Top edge shall be folded back and surface primed with a PVC primer. PVC cement shall be applied and surfaces immediately placed together, while still wet. Joint shall be lightly rolled with a paint roller, then as the joint sets shall be rolled firmly but not so hard as to distort the material. In long lengths, about 2 or 3 feet at a time shall be welded. On wood subflooring, two layers of 15 pound felt shall be installed prior to installation of shower pan to ensure a smooth surface installation.

3.4 VIBRATION-ABSORBING FEATURES

Mechanical equipment, including compressors and pumps, shall be isolated from the building structure by approved vibration-absorbing features, unless otherwise shown. Each foundation shall include an adequate number of standard isolation units. Each unit shall consist of machine and floor

or foundation fastening, together with intermediate isolation material, and shall be a standard product with printed load rating. Piping connected to mechanical equipment shall be provided with flexible connectors. Vibration isolators shall have a minimum isolation efficiency of 90 percent at the lowest disturbing frequency.

3.5 WATER METER REMOTE READOUT REGISTER

The remote readout register shall be mounted at the location indicated or as directed by the Contracting Officer.

3.6 IDENTIFICATION SYSTEMS

3.6.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 1-3/8 inch minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

3.6.2 Pipe Color Code Marking

Color code marking of piping shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.6.3 Color Coding Scheme for Locating Hidden Utility Components

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of operable components which are not visible from the finished space and installed in the space directly above the suspended grid ceiling. The operable components shall include valves, dampers, switches, linkages and thermostats. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 3/8 inch in diameter and secured to removable ceiling panels with fasteners. The fasteners shall be inserted into the ceiling panels so that the fasteners will be concealed from view. The fasteners shall be manually removable without tools and shall not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall have the approximate dimensions of 3 foot width, 30 inches height, and 1/2 inch thickness. The board shall be made of wood fiberboard and framed under glass or 1/16 inch transparent plastic cover. Unless otherwise directed, the color code symbols shall be approximately 3/4 inch in diameter and the related lettering in 1/2 inch high capital letters. The color code board shall be mounted and located in the mechanical or equipment room. The color code system shall match the Base standard. Coordinate with COR.:

3.7 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or

polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.8 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09 90 00 PAINTS AND COATINGS.

3.8.1 Painting of New Equipment

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

3.8.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system shall be designed for the temperature service.

3.8.1.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees F shall be cleaned to bare metal.

Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.

a. Temperatures Less Than 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 120 degrees F shall receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of one mil; and two coats of enamel applied to a minimum dry film thickness of one mil per coat.

b. Temperatures Between 120 and 400 Degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F shall receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of 2 mils.

c. Temperatures Greater Than 400 Degrees F: Metal surfaces subject to temperatures greater than 400 degrees F shall receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

3.9 TESTS, FLUSHING AND DISINFECTION

3.9.1 Plumbing System

The following tests shall be performed on the plumbing system in accordance with IAPMO UPC, except that the drainage and vent system final test shall include the smoke test. The Contractor has the option to perform a peppermint test in lieu of the smoke test. If a peppermint test is chosen, the Contractor must submit a testing procedure and reasons for choosing this option in lieu of the smoke test to the Contracting Officer for approval.

a. Drainage and Vent Systems Test. The final test shall include a smoke test.

b. Building Sewers Tests.

c. Water Supply Systems Tests.

3.9.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies.

Backflow prevention assembly test gauges shall be tested annually for accuracy in accordance with the requirements of State or local regulatory agencies. If there is no State or local regulatory agency requirements, gauges shall be tested annually for accuracy in accordance with the requirements of University of Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14), or any other approved testing laboratory having equivalent capabilities for both laboratory and field evaluation of backflow prevention assembly test gauges. Report form for each assembly shall include, as a minimum, the following:

Data on Device	Data on Testing Firm
Type of Assembly	Name
Manufacturer	Address
Model Number	Certified Tester
Serial Number	Certified Tester No.
Size	Date of Test
Location	

Test Pressure Readings	Serial Number and Test Data of Gauges

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

3.9.1.2 Shower Pans

After installation of the pan and finished floor, the drain shall be temporarily plugged below the weep holes. The floor area shall be flooded with water to a minimum depth of 1 inch for a period of 24 hours. Any drop in the water level during test, except for evaporation, will be reason for rejection, repair, and retest.

3.9.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

3.9.3 System Flushing

3.9.3.1 During Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 4 fps through all portions of the piping system. In the event that this is impossible due to size of system, the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. All faucets and drinking water fountains, to include any device considered as an end point device by NSF/ANSI 61, Section 9, shall be flushed a minimum of 0.25 gallons per 24 hour period, ten times over a 14 day period.

3.9.3.2 After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation according to manufacturer's instructions. Flow rates on fixtures must not exceed those stated in PART 2 of this Section. Unless more stringent local requirements exist, lead levels shall not exceed limits established by 40 CFR 141.80 (c)(1). The water supply to the building shall be tested

separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.

3.9.4 Operational Test

Upon completion of flushing and prior to disinfection procedures, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory installation, connections, adjustments, and functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

a. Time, date, and duration of test.

b. Water pressures at the most remote and the highest fixtures.

c. Operation of each fixture and fixture trim.

d. Operation of each valve, hydrant, and faucet.

e. Pump suction and discharge pressures.

f. Temperature of each domestic hot-water supply.

g. Operation of each floor and roof drain by flooding with water.

h. Operation of each vacuum breaker and backflow preventer.

i. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.

3.9.5 Disinfection

After all system components are provided and operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. Before introducing disinfecting chlorination material, entire system shall be flushed with potable water until any entrained dirt and other foreign materials have been removed.

Water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652 as modified and supplemented by this specification. The chlorinating material shall be hypochlorites or liquid chlorine. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). Feed a properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or inject liquid chlorine into the system through a solution-feed chlorinator and booster pump until the entire system is completely filled.

Test the chlorine residual level in the water at 6 hour intervals for a continuous period of 24 hours. If at the end of a 6 hour interval, the chlorine residual has dropped to less than 25 ppm, flush the piping including tanks with potable water, and repeat the above chlorination procedures. During the chlorination period, each valve and faucet shall be opened and closed several times.

After the second 24 hour period, verify that no less than 25 ppm chlorine residual remains in the treated system. The 24 hour

chlorination procedure must be repeated until no less than 25 ppm chlorine residual remains in the treated system.

Upon the specified verification, the system including tanks shall then be flushed with potable water until the residual chlorine level is reduced to less than one part per million. During the flushing period, each valve and faucet shall be opened and closed several times.

Take additional samples of water in disinfected containers, for bacterial examination, at locations specified by the Contracting Officer. Test these samples for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with EPA SM 9223. The testing method used shall be EPA approved for drinking water systems and shall comply with applicable local and state requirements.

Disinfection shall be repeated until bacterial tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.10 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

3.11 PERFORMANCE OF WATER HEATING EQUIPMENT

Standard rating condition terms are as follows:

EF = Energy factor, minimum overall efficiency.

ET = Minimum thermal efficiency with 70 degrees F delta T.

SL = Standby loss is maximum (Btu/h) based on a 70 degrees F temperature difference between stored water and ambient requirements.

V = Rated volume in gallons

Q = Nameplate input rate in kW (Btu/h)

3.11.1 Storage Water Heaters

3.11.1.1 Electric

a. Storage capacity of 60 gallons shall have a minimum energy factor (EF) of 0.93 or higher per FEMP requirements.

b. Storage capacity of 60 gallons or more shall have a minimum energy factor (EF) of 0.91 or higher per FEMP requirements.

3.12 TABLES

TABLE I								
PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, VENT AND CONDENSATE DRAIN PIPING SYSTEMS								
Itm #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F	SERVICE G
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A74 with compression gaskets. Pipe and fittings shall be marked with the CISPI trademark.	X	X	X	X	X		
2	Cast iron soil pipe and fittings hubless, CISPI 301 and ASTM A888. Pipe and fittings shall be marked with the CISPI trademark.		X	X	X	X		
16	Copper drainage tube, (DWV), ASTM B306	X*	X	X*	X	X		X
17	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X	X		X
18	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	X	X		X
20	**Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D2665, ASTM F891, (Sch 40) ASTM F1760 [ADD01]**	**X**	**X**	**X**	**X**	**X**	**X**	**X**

TABLE I

PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, VENT AND CONDENSATE DRAIN PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F	SERVICE G

SERVICE:

A - Underground Building Soil, Waste and Storm Drain
B - Aboveground Soil, Waste, Drain In Buildings
C - Underground Vent
D - Aboveground Vent
E - Interior Rainwater Conductors Aboveground
F - Corrosive Waste And Vent Above And Belowground
G - Condensate Drain Aboveground

* - Hard Temper

TABLE II

PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
1	Malleable-iron threaded fittings:				
	a. Galvanized, ASME B16.3 for use with Item 4a	X	X	X	X
	b. Same as "a" but not galvanized for use with Item 4b			X	
2	Grooved pipe couplings, ferrous pipe ASTM A536 and ASTM A47/A47M, non-ferrous pipe, ASTM A536 and ASTM A47/A47M	X	X	X	
3	Ductile iron grooved joint fittings for ferrous pipe ASTM A536 and ASTM A47/A47M, for use with Item 2	X	X	X	
4	Steel pipe:				
	a. Seamless, galvanized, ASTM A53/A53M, Type S, Grade B	X	X	X	X
	b. Seamless, black, ASTM A53/A53M, Type S, Grade B			X	

TABLE II					
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS					
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
5	Seamless red brass pipe, ASTM B43	X	X		X
6	Bronze flanged fittings, ASME B16.24 for use with Items 5 and 7	X	X		X
7	Seamless copper pipe, ASTM B42	X	X		X
8	Seamless copper water tube, ASTM B88, ASTM B88M	X**	X**	X**	X***
9	Cast bronze threaded fittings, ASME B16.15 for use with Items 5 and 7	X	X		X
10	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 5, 7 and 8	X	X	X	X
11	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Item 8	X	X	X	X
12	Bronze and sand castings groovedjoint pressure fittings for non-ferrous pipe ASTM B584, for use with Item 2	X	X	X	
19	Chlorinated polyvinyl chloride (CPVC) plastic hot and cold water distribution system, ASTM D2846/D2846M	X	X		X
20	Chlorinated polyvinyl chloride (CPVC) plastic pipe, Schedule 40 and 80, ASTM F441/F441M	X	X		X
21	Chlorinated polyvinyl chloride (CPVC) plastic pipe (SDR-PR) ASTM F442/F442M	X	X		X

TABLE II					
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS					
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
22	Threaded chlorinated polyvinyl chloride (chloride CPVC) plastic pipe fittings, Schedule 80, ASTM F437, for use with Items 20, and 21	X	X		X
23	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings, Schedule 40, ASTM F438 for use with Items 20, 21, and 22	X	X		X
24	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings Schedule 80, ASTM F439 for use with Items 20, 21, and 22	X	X		X
32	Steel pipeline flanges, MSS SP-44	X	X		
33	Fittings: brass or bronze; ASME B16.15, and ASME B16.18 ASTM B828	X	X		
34	Carbon steel pipe unions, socket-welding and threaded, MSS SP-83	X	X	X	
35	Malleable-iron threaded pipe unions ASME B16.39	X	X		
36	Nipples, pipe threaded ASTM A733	X	X	X	
38	Press Fittings	X	X		

TABLE II					
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS					
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
	SERVICE: A - Cold Water Service Aboveground B - Hot and Cold Water Distribution 180 degrees F Maximum Aboveground C - Compressed Air Lubricated D - Cold Water Service Belowground Indicated types are minimum wall thicknesses. ** - Type L - Hard *** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors **** - In or under slab floors only brazed joints				

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 26 - ELECTRICAL

SECTION 26 12 19

PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS **[ADD01]**

05/24

PART 1 GENERAL

1.1 REFERENCES
1.2 RELATED REQUIREMENTS
1.3 DEFINITIONS
1.4 SUBMITTALS
1.4.1 Reduced Submittal Requirements
1.5 QUALITY ASSURANCE
1.5.1 Pad-Mounted Transformer Drawings
1.5.2 Regulatory Requirements
1.5.3 Standard Products
1.5.3.1 Alternative Qualifications
1.5.3.2 Material and Equipment Manufacturing Date
1.6 MAINTENANCE
1.6.1 Additions to Operation and Maintenance Data

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION
2.2 THREE-PHASE PAD-MOUNTED TRANSFORMERS
2.2.1 Compartments
2.2.1.1 High Voltage, Dead-Front
2.2.1.2 Low Voltage
2.2.2 Transformer
2.2.2.1 Specified Transformer Efficiencies
2.2.3 Insulating Liquid
2.2.3.1 Liquid-Filled Transformer Nameplates
2.2.4 Corrosion Protection
2.3 WARNING SIGNS AND LABELS
2.4 ARC FLASH WARNING LABEL
2.5 GROUNDING AND BONDING
2.6 PADLOCKS
2.7 CAST-IN-PLACE CONCRETE
2.8 SOURCE QUALITY CONTROL
2.8.1 Transformer Test Schedule
2.8.2 Design Tests
2.8.3 Routine and Other Tests

PART 3 EXECUTION

3.1 INSTALLATION
3.2 GROUNDING
3.2.1 Grounding Electrodes
3.2.2 Pad-Mounted Transformer Grounding
3.2.3 Connections
3.2.4 Grounding and Bonding Equipment

3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES
3.4 FIELD APPLIED PAINTING
3.5 WARNING SIGN MOUNTING
3.6 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES
3.6.1 Cast-In-Place Concrete
3.6.2 Sealing
3.7 FIELD QUALITY CONTROL
3.7.1 Performance of Acceptance Checks and Tests
3.7.1.1 Pad-Mounted Transformers
3.7.1.2 Grounding System
3.7.1.3 Surge Arresters, Medium- and High-Voltage
3.7.2 Follow-Up Verification

-- End of Section Table of Contents --

SECTION 26 12 19

PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS **[ADD01]**
05/24

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 318	(2019; R 2022) Building Code Requirements for Structural Concrete (ACI 318-19) and Commentary (ACI 318R-19)

ASTM INTERNATIONAL (ASTM)

ASTM C260/C260M	(2024) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM D92	(2012a) Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester
ASTM D97	(2017b) Standard Test Method for Pour Point of Petroleum Products
ASTM D877/D877M	(2019) Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes
ASTM D1535	(2014; R 2018) Standard Practice for Specifying Color by the Munsell System

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide https://www.approvalguide.com/

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 386	(2016) Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV
IEEE C2	(2023; ERTA 1 2023; ERTA 2-3 2025) National Electrical Safety Code
IEEE C57.12.00	(2021) General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.12.28	(2023) Standard for Pad-Mounted Equipment - Enclosure Integrity

IEEE C57.12.29	(2023) Standard for Pad-Mounted Equipment - Enclosure Integrity for Coastal Environments
IEEE C57.12.34	(2022) Standard Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers, 10 MVA and Smaller; High Voltage, 34.5 kV Nominal System Voltage and Below; Low Voltage, 15 kV Nominal System Voltage and Below
IEEE C57.12.80	(2024) Standard Terminology for Power and Distribution Transformers
IEEE C57.12.90	(2021) Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers
IEEE C57.98	(2011) Guide for Transformer Impulse Tests
IEEE C62.11	(2020) Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1kV)
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2025) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 260	(1996; R 2004) Safety Labels for Pad-Mounted Switchgear and Transformers Sited in Public Areas
NEMA Z535.4	(2023) Product Safety Signs and Labels

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2026; TIA 26-1; ERTA 26-1; TIA 26-2; TIA 26-3; TIA 26-4; TIA 26-5; TIA 26-6; TIA 26-7; ERTA 26-2; ERTA 26-3) National Electrical Code

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD)

OECD Test 203	(1992) Fish Acute Toxicity Test

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 712-C-98-075	(1998) Fate, Transport and Transformation Test Guidelines - OPPTS 835.3100- "Aerobic Aquatic Biodegradation"

EPA 821-R-02-012	(2002) Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 431	Energy Efficiency Program for Certain Commercial and Industrial Equipment

UL SOLUTIONS (UL)

UL 467	(2022) UL Standard for Safety Grounding and Bonding Equipment

1.2 RELATED REQUIREMENTS

Section 26 08 00 APPARATUS INSPECTION AND TESTING applies to this section, with the additions and modifications specified herein.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE Stds Dictionary.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Pad-mounted Transformer Drawings; G

SD-03 Product Data

Pad-mounted Transformers; G

SD-06 Test Reports

Acceptance Checks and Tests; G

SD-07 Certificates

Transformer Efficiencies; G

SD-09 Manufacturer's Field Reports

Transformer Test Schedule; G

Pad-mounted Transformer Design Tests; G

Pad-mounted Transformer Routine and Other Tests; G

SD-10 Operation and Maintenance Data

Transformer(s), Data Package 5; G

1.4.1 Reduced Submittal Requirements

Transformers designed and manufactured by ABB/Hitachi Energy in Jefferson City, MO; by Eaton's Cooper Power Series Transformers in Waukesha, WI; by ERMCO in Dyersburg, TN; or by Howard Industries in Laurel, MS need not submit the entire submittal package requirements of this contract. Instead, submit the following items:

a. A certification, signed by the manufacturer, stating that the manufacturer will meet the technical requirements of this specification.

b. An outline drawing of the transformer with devices identified (paragraph PAD-MOUNTED TRANSFORMER DRAWINGS, item a).

c. ANSI nameplate data of the transformer (paragraph PAD-MOUNTED TRANSFORMER DRAWINGS, item b).

d. Manufacturer's published time-current curves in PDF format and in electronic format suitable for import or updating into the SKM PowerTools for Windows (Latest Version) computer program of the transformer high side fuses (paragraph PAD-MOUNTED TRANSFORMER DRAWINGS, item e).

e. Provide transformer test schedule and routine and other tests required by submittal item "SD-09 Manufacturer's Field Reports".

f. Provide acceptance test reports required by submittal item "SD-06 Test Reports".

g. Provide operation and maintenance manuals required by submittal item "SD-10 Operation and Maintenance Data".

1.5 QUALITY ASSURANCE

1.5.1 Pad-Mounted Transformer Drawings

Include the following as a minimum:

a. An outline drawing, including front, top, and side views.

b. IEEE nameplate data.

c. Elementary diagrams and wiring diagrams with terminals identified of watthour meter and current transformers.

d. One-line diagram, including switch(es, current transformers, meters, and fuses.

e. Manufacturer's published time-current curves in PDF format and in electronic format suitable for import or updating into the SKM PowerTools for Windows (Latest Version) computer program of the transformer high side fuses.

1.5.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory

provisions to be mandatory, except of NFPA 70 when more stringent requirements are specified or indicated, as though the word "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Provide equipment, materials, installation, and workmanship in accordance with NFPA 70 unless more stringent requirements are specified or indicated.

1.5.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship, and:

a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable.

1.6 MAINTENANCE

1.6.1 Additions to Operation and Maintenance Data

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein. In addition to requirements of Data Package 5, include the following on the actual transformer(s) provided:

a. An instruction manual with pertinent items and information highlighted

b. An outline drawing, front, top, and side views

c. Prices for spare parts and supply list

d. Routine and field acceptance test reports

e. Fuse curves for primary fuses

f. Information on watthour demand meter, CT's, and fuse block

g. Actual nameplate diagram

h. Date of purchase

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be pad-mounted transformers and related accessories are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM,and Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.2 THREE-PHASE PAD-MOUNTED TRANSFORMERS

IEEE C57.12.34, IEEE C57.12.28 and as specified herein. Submit manufacturer's information for each component, device, insulating fluid, and accessory provided with the transformer.

2.2.1 Compartments

Provide high- and low-voltage compartments separated by steel isolating barriers extending the full height and depth of the compartments. Compartment doors: hinged lift-off type with stop in open position and three-point latching.

2.2.1.1 High Voltage, Dead-Front

High-voltage compartment contains: the incoming line, insulated high-voltage load-break connectors, bushing well inserts, feed-thru inserts, six high-voltage bushing wells configured for loop feed application, load-break switch handle(s), access to oil-immersed bayonet fuses, dead-front surge arresters, tap changer handle, connector parking stands with insulated standoff bushings, protective caps, and ground pad.

Minimum high-voltage compartment dimensions: IEEE C57.12.34, Figures 16 and 17.

a. Insulated high-voltage load-break connectors: IEEE 386, rated 15 kV, 95 kV BIL. Current rating: 200 amperes rms continuous. Short time rating: 10,000 amperes rms symmetrical for a time duration of 0.17 seconds. Connector must have a steel reinforced hook-stick eye, grounding eye, test point, and arc-quenching contact material.

b. Bushing well inserts and feed-thru inserts: IEEE 386, 200 amperes, 15 kV Class. Provide a bushing well insert for each bushing well unless indicated otherwise.

c. One-piece bushings: IEEE 386, 200 amperes, 15 kV Class.

d. Surge arresters: IEEE C62.11, rated 15 kV, fully shielded, dead-front, metal-oxide-varistor, elbow type with resistance-graded gap.

e. Parking stands: Provide insulated standoff bushings for parking of energized high-voltage connectors on parking stands.

f. Protective caps: IEEE 386, 200 amperes, 15 kV Class. Provide insulated protective caps (not shipping caps) for insulating and

sealing out moisture from unused bushings.

2.2.1.2 Low Voltage

Low-voltage compartment contains: low-voltage bushings with NEMA spade terminals, accessories, metering, stainless steel or laser-etched anodized aluminum diagrammatic transformer nameplate, and ground pad.

a. Include the following accessories: drain valve with sampler device, fill plug, pressure relief device, liquid level gage, pressure-vacuum gage, and dial type thermometer with maximum temperature indicator.

2.2.2 Transformer

a. Less-flammable bio-based liquid-insulated, two winding, 60 hertz, 65 degrees C rise above a 30 degrees C average ambient, self-cooled type.

b. Transformer rated 250 kVA.

c. Transformer voltage ratings: 12.47 KV Delta, 3 Phase, 3 wire - 480/277 V, 3 Phase, 4 wire, WYE. Cooling via ONAN (Oil Natural, Air Natural).

d. Tap changer: externally operated, manual type for changing tap setting when the transformer is de-energized. Provide four 2.5 percent full capacity taps, two above and two below rated primary voltage. Indicate which tap setting is in use, clearly visible when the compartment is opened.

e. Minimum tested percent impedance at 85 degrees C:

(1) .50 for units rated 75kVA and below
(2) .87 for units rated 112.5kVA to 300kVA
(3) .03 for 500kVA rated units
(4) .32 for units rated 750kVA and above

f. Comply with the following audible sound level limits:

kVA	DECIBELS (MAX
75	51
112.5	55
150	55
225	55
300	55
500	56
750	57
1000	58
1500	60

2000	61
2500	62

g. Include:

(1) Lifting lugs and provisions for jacking under base, with base construction suitable for using rollers or skidding in any direction.

(2) An insulated low-voltage neutral bushing with NEMA spade terminal, and with removable ground strap.

(3) kVA rating conspicuously displayed on its enclosure.

2.2.2.1 Specified Transformer Efficiencies

Provide transformer efficiency calculations utilizing the actual no-load and load loss values obtained during the routine tests performed on the actual transformer(s) prepared for this project. Reference no-load losses (NLL) at 20 degrees C. Reference load losses (LL) at 55 degrees C and at 50 percent of the nameplate load. The transformer is not acceptable if the calculated transformer efficiency is less than the efficiency indicated in the "KVA / Efficiency" table below. The table is based on requirements contained within 10 CFR 431, Subpart K. Submit certification, including supporting calculations, from the manufacturer indicating conformance.

kVA	EFFICIENCY (percent)
15	98.65
30	98.83
45	98.92
75	99.03
112.5	99.11
150	99.16
225	99.23
300	99.27
500	99.35
750	99.40
1000	99.43

1500	99.48
2000	99.51
2500	99.53
above 2500	99.54

2.2.3 Insulating Liquid

a. Less-flammable transformer liquids: NFPA 70 and FM APP GUIDE for less-flammable liquids having a fire point not less than 300 degrees C tested per ASTM D92 and a dielectric strength not less than 33 kV tested per ASTM D877/D877M. Provide identification of transformer as "non-PCB" and "manufacturer's name and type of fluid" on the nameplate.

Provide a fluid that is a biodegradable, electrical insulating, and cooling liquid classified by UL and approved by FM as "less flammable" with the following properties:

(1) Pour point: ASTM D97, less than -15 degree C

(2) Aquatic biodegradation: EPA 712-C-98-075, ultimately biodegradable as designated by EPA.

(3) Trout toxicity: OECD Test 203, zero mortality of EPA 821-R-02-012, pass

2.2.3.1 Liquid-Filled Transformer Nameplates

Provide nameplate information in accordance with IEEE C57.12.00 and as modified or supplemented by this section.

2.2.4 Corrosion Protection

Paint entire transformer assembly Munsell 7GY3.29/1.5 green, with paint coating system complying with IEEE C57.12.28 and IEEE C57.12.29 regardless of base, cabinet, and tank material. The Munsell color notation is specified in ASTM D1535.

2.3 WARNING SIGNS AND LABELS

Provide warning signs for the enclosures of pad-mounted transformers having a nominal rating exceeding 600 volts in accordance with NEMA Z535.4 and NEMA 260.

a. When the enclosure integrity of such equipment is specified to be in accordance with IEEE C57.12.28, such as for pad-mounted transformers, provide self-adhesive warning labels on the outside of the high voltage compartment door(s)with nominal dimensions of 7 by 10 inches with the legend "WARNING HIGH VOLTAGE" printed in two lines of nominal 2 inch high letters. Include the work "WARNING" in white letters on an orange background and the words "HIGH VOLTAGE" in black letters on a white background.

2.4 ARC FLASH WARNING LABEL

Provide arc flash warning label for the enclosure of pad-mounted

transformers. Locate this self-adhesive warning label on the outside of the high voltage compartment door warning of potential electrical arc flash hazards and appropriate PPE required. Provide label format as indicated.

2.5 GROUNDING AND BONDING

UL 467. Provide grounding and bonding as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.6 PADLOCKS

Provide padlocks for pad-mounted equipment, keyed as directed by the Contracting Officer. Comply with Section 08 71 00 DOOR HARDWARE.

2.7 CAST-IN-PLACE CONCRETE

Provide concrete associated with electrical work for other than encasement of underground ducts rated for 4000 psi minimum 28-day compressive strength unless specified otherwise. Conform to the requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE.

Provide concrete associated with electrical work as follows:

a. Composed of fine aggregate, coarse aggregate, portland cement, and water so proportioned and mixed as to produce a plastic, workable mixture.

b. Fine aggregate: hard, dense, durable, clean, and uncoated sand.

c. Coarse aggregate: reasonably well graded from 3/16 inch to 1 inch.

d. Fine and coarse aggregates: free from injurious amounts of dirt, vegetable matter, soft fragments or other deleterious substances.

e. Water: fresh, clean, and free from salts, alkali, organic matter, and other impurities.

f. Concrete associated with electrical work for other than encasement of underground ducts: 4000 psi minimum 28-day compressive strength unless specified otherwise.

g. Slump: Less than 4 inches. Retempering of concrete will not be permitted.

h. Exposed, unformed concrete surfaces: smooth, wood float finish.

i. Concrete must be cured for a period of not less than 7 days, and concrete made with high early strength portland cement must be repaired by patching honeycombed or otherwise defective areas with cement mortar as directed by the Contracting Officer.

j. Air entrain concrete exposed to weather using an air-entraining admixture conforming to ASTM C260/C260M.

k. Air content: between 4 and 6 percent.

2.8 SOURCE QUALITY CONTROL

2.8.1 Transformer Test Schedule

The Government reserves the right to witness tests. Provide transformer test schedule for tests to be performed at the manufacturer's test facility. Submit required test schedule and location, and notify the Contracting Officer 30 calendar days before scheduled test date. Notify Contracting Officer 15 calendar days in advance of changes to scheduled date.

a. Test Instrument Calibration

(1) Provide a calibration program which assures that all applicable test instruments are maintained within rated accuracy.

(2) Accuracy: Traceable to the National Institute of Standards and Technology.

(3) Instrument calibration frequency schedule: less than or equal to 12 months for both test floor instruments and leased specialty equipment.

(4) Dated calibration labels: visible on all test equipment.

(5) Calibrating standard: higher accuracy than that of the instrument tested.

(6) Keep up-to-date records that indicate dates and test results of instruments calibrated or tested. For instruments calibrated by the manufacturer on a routine basis, in lieu of third party calibration, include the following:

(a) Maintain up-to-date instrument calibration instructions and procedures for each test instrument.

(b) Identify the third party/laboratory calibrated instrument to verify that calibrating standard is met.

2.8.2 Design Tests

IEEE C57.12.00, and IEEE C57.12.90. Section 5.1.2 in IEEE C57.12.80 states that "design tests are made only on representative apparatus of basically the same design." Submit design test reports (complete with test data, explanations, formulas, and results), in the same submittal package as the catalog data and drawings for the specified transformer(s), with design tests performed prior to the award of this contract.

a. Tests: certified and signed by a registered professional engineer.

b. Temperature rise: "Basically the same design" for the temperature rise test means a pad-mounted transformer with the same coil construction (such as wire wound primary and sheet wound secondary), the same kVA, the same cooling type (KNAN), the same temperature rise rating, and the same insulating liquid as the transformer specified.

c. Lightning impulse: "Basically the same design" for the lightning impulse dielectric test means a pad-mounted transformer with the same BIL, the same coil construction (such as wire wound primary and sheet

wound secondary), and a tap changer, if specified. Design lightning impulse tests includes the primary windings only of that transformer.

(1) IEEE C57.12.90, paragraph 10.3 entitled "Lightning Impulse Test Procedures," and IEEE C57.98.

(2) State test voltage levels.

(3) Provide photographs of oscilloscope display waveforms or plots of digitized waveforms with test report.

d. Lifting and moving devices: "Basically the same design" requirement for the lifting and moving devices test means a test report confirming that the lifting device being used is capable of handling the weight of the specified transformer in accordance with IEEE C57.12.34.

e. Pressure: "Basically the same design" for the pressure test means a pad-mounted transformer with a tank volume within 30 percent of the tank volume of the transformer specified.

f. Short circuit: "Basically the same design" for the short circuit test means a pad-mounted transformer with the same kVA as the transformer specified.

2.8.3 Routine and Other Tests

IEEE C57.12.00. Routine and other tests: performed in accordance with IEEE C57.12.90 by the manufacturer on the actual transformer(s) prepared for this project to ensure that the design performance is maintained in production. Submit test reports, by serial number and receive approval before delivery of equipment to the project site. Required tests and testing sequence as follows:

a. Phase relation

b. Ratio

c. No-load losses (NLL) and excitation current

d. Load losses (LL) and impedance voltage

e. Dielectric

(1) Impulse

(2) Applied voltage

(3) Induced voltage

f. Leak

PART 3 EXECUTION

3.1 INSTALLATION

Conform to IEEE C2, NFPA 70, and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

3.2 GROUNDING

NFPA 70 and IEEE C2, except provide grounding systems with a resistance to solid earth ground not exceeding 25 ohms.

3.2.1 Grounding Electrodes

Provide driven ground rods as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Connect ground conductors to the upper end of ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

3.2.2 Pad-Mounted Transformer Grounding

Provide a ground ring around the transformer with 1/0 AWG bare copper. Provide four ground rods in the ground ring, one per corner. Install the ground rods at least 10 feet apart from each other. Provide separate copper grounding conductors and connect them to the ground loop as indicated. When work in addition to that indicated or specified is required to obtain the specified ground resistance, the provision of the contract covering "Changes" applies.

3.2.3 Connections

Make joints in grounding conductors and loops by exothermic weld or compression connector. Install exothermic welds and compression connectors as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.2.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise.

3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

Install and connect pad-mounted transformers furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

3.4 FIELD APPLIED PAINTING

Where field painting of enclosures is required to correct damage to the manufacturer's factory applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

3.5 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

3.6 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

Mount transformer on concrete slab as follows:

a. Unless otherwise indicated, provide the slab with dimensions at least 8 inches thick, reinforced with a 6 by 6 inches - W2.9 by W2.9 mesh placed uniformly 4 inches from the top of the slab.

b. Place slab on a 6 inch thick, well-compacted gravel base.

c. Install slab such that top of concrete slab is approximately 4 inches above the finished grade with gradual slope for drainage.

d. Provide edges above grade with 1/2 inch chamfer.

e. Provide slab of adequate size to project at least 8 inches beyond the equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

3.6.1 Cast-In-Place Concrete

Provide cast-in-place concrete work in accordance with the requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE ACI 318.

3.6.2 Sealing

When the installation is complete, seal all entries into the equipment enclosure with an approved sealing method. Provide seals of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.7 FIELD QUALITY CONTROL

3.7.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS. Submit reports, including acceptance criteria and limits for each test in accordance with NETA ATS "Test Values".

3.7.1.1 Pad-Mounted Transformers

a. Visual and mechanical inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition. Check for damaged or cracked insulators and leaks.

(3) Inspect anchorage, alignment, and grounding.

(4) Verify the presence of PCB content labeling.

(5) Verify the bushings and transformer interiors are clean.

(6) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(7) Verify correct liquid level in tanks and bushings.

(8) Verify that positive pressure is maintained on gas-blanketed transformers.

(9) Perform specific inspections and mechanical tests as recommended by manufacturer.

(10) Verify de-energized tap changer position is left as specified.

(11) Verify the presence of transformer surge arresters.

b. Electrical tests

(1) Perform resistance measurements through all bolted connections with low-resistance ohmmeter.

(2) Verify proper secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.

(3) Perform insulation-resistance tests, winding-to-winding and each winding-to-ground. Calculate polarization index. Verify that the tap changer is set at the specified ratio.

(4) Perform turns-ratio tests at all tap positions.

(5) Perform insulation power-factor or dissipation-factor tests on all windings in accordance with test equipment manufacturer’s published data.

(6) Perform power-factor or dissipation-factor tests on each bushing equipped with a power-factor/capacitance tap. In the absence of a power-factor/capacitance tap, perform hot-collar tests.

(7) Measure the resistance of each high-voltage winding in each de-energized tap-changer position. Measure the resistance of each low-voltage winding in each de-energized tap-changer position, if applicable.

(8) Remove and test a sample of insulating liquid for the following: Dielectric breakdown voltage, Acid neutralization number, Specific gravity, Interfacial tension, Color, Visual Condition, Water in insulating liquids (Required on 25 kV or higher voltages and on all silicone-filled units.), and Power factor or dissipation factor.

(9) Perform dissolved-gas analysis (DGA) on a sample of insulating liquid.

3.7.1.2 Grounding System

a. Visual and mechanical inspection

(1) Inspect ground system for compliance with contract plans and specifications.

b. Electrical tests

(1) Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections

are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground resistance tester in accordance with manufacturer's instructions to test each ground or group of grounds. Use an instrument equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

(2) Submit the measured ground resistance of each ground rod and grounding system, indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

3.7.1.3 Surge Arresters, Medium- and High-Voltage

a. Visual and mechanical inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Inspect anchorage, alignment, grounding, and clearances.

(4) Verify the arresters are clean.

(5) Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.

(6) Verify that the ground lead on each device is individually attached to a ground bus or ground electrode.

b. Electrical tests

(1) Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.

(2) Perform an insulation-resistance test on each arrester, phase terminal-to-ground.

(3) Test grounding connection.

3.7.2 Follow-Up Verification

Upon completion of acceptance checks and tests, show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, notify the Contracting Officer 5 working days in advance of the dates and times of checking and testing.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 26 - ELECTRICAL

SECTION 26 36 23

AUTOMATIC TRANSFER SWITCHES AND BY-PASS/ISOLATION SWITCH **[ADD01]**

02/26

PART 1 GENERAL

1.1 REFERENCES
1.2 SUBMITTALS
1.3 OPERATION AND MAINTENANCE MANUAL
1.3.1 Additions to Operation and Maintenance Manuals
1.3.2 Spare Parts
1.4 QUALITY ASSURANCE
1.4.1 Proof of Listing
1.4.2 Automatic Transfer Switch Drawings
1.4.3 Regulatory Requirements
1.4.4 Standard Product
1.4.4.1 Alternative Qualifications
1.4.4.2 Material and Equipment Manufacturing Date
1.5 DELIVERY AND STORAGE
1.6 ENVIRONMENTAL CONDITIONS
1.7 SEISMIC REQUIREMENTS

PART 2 PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCHES
2.1.1 Undervoltage Sensing - Normal/Preferred Source
2.1.2 Adjustable Time Delay - Transfer to Alternate/Emergency Power Source
2.1.3 Adjustable Time Delay- Re-transfer to Normal/Preferred Source
2.1.4 Engine-Generator Exerciser
2.1.5 Engine Starting Contacts
2.1.6 Unassigned Auxiliary Contacts
2.1.7 Front Panel Devices
2.1.8 Voltage Unbalance
2.1.9 In-Phase Monitor
2.2 ENCLOSURE
2.2.1 Construction
2.2.2 Cleaning and Painting
2.2.3 Field Fabricated Nameplates
2.3 REMOTE ANNUNCIATOR PANEL
2.4 FACTORY TESTING
2.4.1 Prototype Factory Testing
2.4.2 Factory Test Reports

PART 3 EXECUTION

3.1 INSTALLATION
3.2 PREREQUISITES FOR FUNCTIONAL ACCEPTANCE TESTING
3.2.1 Performance of Acceptance Checks and tests
3.2.2 Manufacturers O&M Information

3.2.3 Test Equipment
3.3 FIELD QUALITY CONTROL
3.3.1 Automatic Transfer Switch Acceptance Checks and Tests
3.3.2 Functional Acceptance Tests
3.3.3 Infrared Scanning
3.4 TRAINING

-- End of Section Table of Contents --

SECTION 26 36 23

AUTOMATIC TRANSFER SWITCHES AND BY-PASS/ISOLATION SWITCH **[ADD01]**
02/26

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2025) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2025) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2015) Application Guideline for Terminal Blocks
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2026; TIA 26-1; ERTA 26-1; TIA 26-2; TIA 26-3; TIA 26-4; TIA 26-5; TIA 26-6; TIA 26-7; ERTA 26-2; ERTA 26-3) National Electrical Code
NFPA 110	(2025) Standard for Emergency and Standby Power Systems

UL SOLUTIONS (UL)

UL 508	(2018; Reprint Jul 2021) UL Standard for Safety Industrial Control Equipment

UL 1008	(2022) UL Standard for Safety Transfer Switch Equipment
UL 1066	(2022) UL Standard for Safety Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

1.2 SUBMITTALS

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SD-02 Shop Drawings

Automatic Transfer Switch Drawings; G

SD-03 Product Data

Automatic Transfer Switches; G

Remote Annunciator Panel; G

SD-06 Test Reports

Acceptance Checks and Tests; G

Functional Acceptance Tests; G

Factory Testing; G

Factory Test Reports; G

SD-07 Certificates

Proof of Listing; G

SD-10 Operation and Maintenance Data

Operation and Maintenance Manual; G

1.3 OPERATION AND MAINTENANCE MANUAL

Assemble and bind manuals in durable, hard-covered, water resistant binders. Assemble and index the manuals per the following table of contents:

a. Manufacturer's O&M per "SD-10 Operation and Maintenance Data".

b. Catalog data required by "SD-03 Product Data"

c. Drawings required by "SD-02 Shop Drawings".

1.3.1 Additions to Operation and Maintenance Manuals

In addition to requirements of SD-10 Data Package 5, include the followings on the actual equipment provided:

a. An outline drawing, front, top, and side views.

b. Prices for spare parts and supply list.

c. Date of Purchase.

d. Corrective maintenance procedures.

e. Operating manual outlining step-by-step procedures for system startup, operation, and shutdown.

f. Include simplified wiring and control diagrams in the manual for system as installed.

g. Provide typical contact voltage drop readings under specified conditions for use during periodic maintenance. Provide instructions for determination of contact integrity.

1.3.2 Spare Parts

Furnish the following the following minimum spare parts and any other spare parts required in one-year operation, of the same material and workmanship, meeting the same requirements, and interchangeable with the corresponding original parts.

a. Fuses: Two of each type and rating.

1.4 QUALITY ASSURANCE

1.4.1 Proof of Listing

Submit proof of listing by UL 1008.

1.4.2 Automatic Transfer Switch Drawings

Include the following as a minimum:

a. An outline drawing, including front, top, and side views.

b. Provide a nameplate of corrosion-resistant material with not less than 1/8 inch tall characters showing manufacturer's name and equipment ratings. Mount nameplate to front of enclosure and meet the nameplate requirements of NEMA ICS 2.

c. Provide detail drawings that include manufacturer's name and catalog number, electrical ratings, total system transfer statement, reduced normal supply voltage at which transfer to the alternate supply is initiated, transfer delay times, short-circuit current rating, wiring diagram, description of interconnections, testing instructions, acceptable conductor type for terminals, tightening torque for each wire connector, and other required UL 1008 markings.

d. Submit interface equipment connection diagram showing conduit and wiring between ATS and related equipment. Provide diagrams showing interlocking provisions and cautionary notes, if any.

e. Drawings are to indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship must be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated

1.4.4 Standard Product

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship, and:

a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.4.1 Alternative Qualifications

Products having less than a 2-year field service record are acceptable if the manufacturer has been regularly engaged in the design and production of automatic transfer switches and if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 1 years prior to date of delivery to site are not acceptable.

1.5 DELIVERY AND STORAGE

Protect equipment placed in storage from humidity and temperature variations, moisture, water intrusion, dirt, dust, or other contaminants. In harsh environments where temperatures exceed non-operational parameters established within this specification, provide an environmentally controlled equipment storage facility to ensure temperature parameters are within equipment specification. Provide documentation of same to the Government when storage is implemented.

1.6 ENVIRONMENTAL CONDITIONS

Provide an ATS that is suitable for prolonged performance under following service conditions:

a. Operating altitude: Sea level to 1,500 ft. (Systems applied at higher altitudes are to be derated in accordance with the manufacturer's

instructions).

b. Operating ambient temperature range: 24.8 to 104 degrees F.

c. Operating relative humidity: 0 to 90 percent, without condensation.

1.7 SEISMIC REQUIREMENTS

Provide seismic details conforming to Section 13 48 73, SEISMIC CONTROL FOR NONSTRUCTURAL COMPONENTS and to Section 26 05 48, SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT.

PART 2 PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCHES

Each automatic transfer switch must be rated and marked for total system transfer and have the current and voltage ratings as indicated. Provide a switch operating mechanism that is electrically operated, have quick-make, quick-break, load break contacts, and be mechanically held in both positions. Provide an ATS that is UL listed. ATS must be manufactured and tested in accordance with applicable requirements of NEMA ICS 2, UL 1008 and UL 1066. ATS must conform to NFPA 110. Provide the ATS with the following characteristics:

a. Voltage: 480/277 volts ac.

b. Amperage: 240 amps ac. Provide an ATS with a continuous load current rating of the switch rating.

c. Number of Phases: Three.

d. Number of Wires: Four.

e. Frequency: 60 Hz.

f. Poles: Three switched. Solid Neutral.

g. ATS Withstand Current Rating: ATS must be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS terminals. The ATS must be listed in accordance with UL 1008 for 3 cycle close and withstand ratings. Minimum UL listed close and withstand ratings at 480 VAC must be 65 kA.

h. Nonwelding Contacts: Provide contacts that are nonwelding at the available fault current rating. Contacts must be suitable for repetitive power transfer switching. Switches rated 800 amps and above must have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.

i. Phase and Neutral Contacts: Provide contacts with silver alloy composition. Provide neutral contacts with the same continuous current rating as main or phase contacts.

j. Configuration. Provide an ATS for use in optional standby systems described in NFPA 70.

k. ATS Configuration. Provide an open transition ATS. Solid Neutral

2.1.1 Undervoltage Sensing - Normal/Preferred Source

Undervoltage Sensing - Normal Source. Provide undervoltage sensing for each phase in the normal/preferred source. Sense low phase-to-ground voltage on each phase. Provide sensing circuit with adjustable dropout, 75-98 percent of nominal value and adjustable pickup, 85-100 percent of nominal value. Factory set dropout value to 85percent. Factory set pickup value to 95 percent.

2.1.2 Adjustable Time Delay - Transfer to Alternate/Emergency Power Source

Adjustable Time Delay - Transfer to Alternate Power Source. Transfer to alternate power source time delay for transfer switches as indicated, adjustable 0-5 minutes. Factory set to 0 seconds. ATS is to monitor the frequency and voltage of alternate power source and transfer when frequency and voltage are stabilized.

2.1.3 Adjustable Time Delay- Re-transfer to Normal/Preferred Source

Adjustable Time Delay- Transfer to Source. Re-transfer to normal source time delay, adjustable 0-30 minutes. Factory set at 10 minutes. Time delay is automatically defeated upon loss or sustained undervoltage of alternate power source, provided that normal source has been restored.

2.1.4 Engine-Generator Exerciser

Exerciser. Solid-state, programmable-time switch exerciser to allow automatic starting of the generator set, subsequent load transfer, retransfer of load and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from on a daily, weekly, bi-weekly or monthly basis.. Running periods are adjustable from 10-30 minutes. Factory settings are for 7-day exercise cycle, 20 minute running period and 5-minute cool-down period. Exerciser features include the following:

a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer or dual independent exercisers that allow for unloaded and loaded schedule testing.

b. Push-button programming control with digital display of settings.

c. Integral battery operation of time switch when normal control power is not available.

2.1.5 Engine Starting Contacts

Provide 2 isolated normally closed and 2 isolated normally open contact that is rated 5 A at 250 VAC/30 VDC minimum.

2.1.6 Unassigned Auxiliary Contacts

Provide two normally open and two normally closed, single-pole, double-throw auxiliary contacts for each switch position rated at 15 amperes at 120 volts.

2.1.7 Front Panel Devices

Provide devices mounted on cabinet front consisting of:

a. Mode selector switch with the following positions and associated functions. Selector switch can be part of the microprocessor controller consisting of an LCD screen with a graphical interface or as a stand-alone test switch.

(1) TEST - Simulates loss of normal/preferred source system operation.

(2) NORMAL - Transfers system to normal/preferred source bypassing re-transfer time delay.

b. Switch position indicating lights or graphical LCD display. Indicate source to which load is connected.

c. Source-Available Monitor. Provide source-available indicating lights or graphical LCD display monitor that is labeled to show when one or both sources of power are available. If indicating lights are used, then the preference is to have Green be normal/preferred power and Red be for alternate/emergency power; however, other color schemes are allowed if clearly marked.

d. Provide a transfer override switch. Provide automatic transfer switch microprocessor based controller, which offers field selectable/adjustable inputs and outputs for transfer switch operation. Override switch must bypass automatic transfer controls so ATS will transfer and remain connected to generator power source, regardless of condition of normal/preferred source. Provide an indicating light to show override status.

e. Lamp test button.

2.1.8 Voltage Unbalance

Provide automatic transfer switch controller or control logic to include positive and negative sequence voltage detection to identify a phase loss condition that can adversely effect motor loads.

2.1.9 In-Phase Monitor

Provide an in-phase monitor that consists of a factory-wired, internal relay that controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 5 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage Manufacturer is to provide information regarding what conditions a transfer cannot be accomplished.

2.2 ENCLOSURE

Provide an enclosure that meets the following:

a. Provide ATS and accessories in a free-standing, floor-mounted, ventilated NEMA 250, Type 1, smooth sheet metal enclosure constructed in accordance with applicable requirements of NEMA ICS 6, UL 508, UL 1066, and UL 1008. Provide at least No. 14 metal gauge.

b. Factory wiring within enclosure and field wiring terminating within enclosure must comply with NFPA 70. Provide wire that is permanently

tagged or marked near terminal at each end with wire number shown on approved detail drawing, when wiring is not color coded. Conform terminal block to NEMA ICS 4. Arrange terminals for entrance of external conductors from top and bottom of enclosure as shown. Main switch terminals, including neutral terminal if used, must be pressure type suitable for termination of external copper conductors shown.

c. Provide thermostatically controlled heater within enclosure to prevent condensation over temperature range stipulated in paragraph ENVIRONMENTAL CONDITIONS.

2.2.1 Construction

Construct enclosure for ease of removal and replacement of ATS components and control devices from front without disconnection of external power conductors or removal or disassembly of major components.

2.2.2 Cleaning and Painting

Protect both the inside and outside surfaces of an enclosure, including means for fastening against corrosion by enameling, galvanizing, plating, powder coating, or other equivalent means. Protection is not required for metal parts that are inherently resistant to corrosion, bearings, sliding surfaces of hinges, or other parts where such protection is impractical. Provide manufacturer's standard finish material, process, and color that is free from runs, sags, peeling, or other defects. An enclosure marked Type 1, 3R, 4 or 12 is acceptable if there is no visible rust at the conclusion of a salt spray (fog) test using the test method in ASTM B117, employing a 5 percent by weight, salt solution for 24 hours. Type 4X enclosures are acceptable following performance of the above test with an exposure time of 200 hours.

2.2.3 Field Fabricated Nameplates

Nameplate is to comply with ASTM D709. Provide laminated plastic nameplates for each equipment enclosure as specified or as indicated on the drawings. Provide an inscription on each nameplate that identifies the name of the equipment, sources of power, calculated short circuit with date and the location e.g. 'SWB-1 Electrical Room 103'. Provide nameplates that are made of melamine plastic, 0.125 inch thick, white with black center core. Provide the nameplate with a surface that is matte finished and that has square corners.. Accurately align lettering and engrave into the core. Provide nameplates that are at least 1.0 by 2.5 inches with a minimum lettering size of 0.25 inch high normal block style.

2.3 REMOTE ANNUNCIATOR PANEL

Provide remote annunciation with LED indicating lights, an audible alarm with silence switch as well as all appropriate labeling. Provide a remote annunciator panel that utilizes a touchscreen human machine interface (HMI). Minimum screen size is 7 inches. The annunciator is to be configured to handle 1 transfer switches. Provide a surface mounted cabinet. Provide built-in power supply that accepts either 24 VDC or 120VAC. Provide 120 v, 20 ampere, 1 phase circuit to power remote annunciator from nearest branch circuit panel. Provide all communication cabling, installed in conduit, between remote annuciator and its location. Assume 100 linear feet of cabling between ATS and remote annunciator. Field verify location of remote annunciator. Provide communications module to support monitoring of ATS. Module must provide

status, analog parameters, event logs, equipment settings, and configurations over embedded webpage, open protocol, and automated email while utilizing AES 128-bit encryption. Provide a remote annunciation panel to annunciate the following conditions for the indicated transfer switch(es).

a. Sources available

b. Switch position.

c. Switch in test mode.

d. Failure of communication link.

2.4 FACTORY TESTING

Submit a description of proposed field test procedures, including proposed date and steps describing each test, its duration and expected results, not less than 2 weeks prior to test date. Submit certified factory and field test reports, within 14 days following completion of tests. Provide reports that are certified and dated and that demonstrate that tests were successfully completed prior to shipment of equipment.

2.4.1 Prototype Factory Testing

A prototype of specified ATS is to be factory tested in accordance with UL 1008. In addition, perform factory tests on each ATS as follows:

a. Insulation resistance test to ensure integrity and continuity of entire system

b. Main switch contact resistance test.

c. Visual inspection to verify that each ATS is as specified.

d. Mechanical test to verify that ATS sections are free of mechanical hindrances.

e. Electrical tests to verify complete system electrical operation and to set up time delays and voltage sensing settings.

2.4.2 Factory Test Reports

Provide three certified copies of factory test reports from the manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

Installation must conform to the requirements of NFPA 70 and manufacturer's recommendation.

3.2 PREREQUISITES FOR FUNCTIONAL ACCEPTANCE TESTING

Completion of the following requirements is mandatory prior to scheduling functional acceptance tests for the automatic transfer switch.

3.2.1 Performance of Acceptance Checks and tests

Complete as specified in paragraph entitled AUTOMATIC TRANSFER SWITCH ACCEPTANCE CHECKS AND TESTS. The Acceptance Checks and Tests are to be accomplished by the Testing organization as described in Section 26 08 00 APPARATUS INSPECTION AND TESTING.

3.2.2 Manufacturers O&M Information

The manufacturers O&M information required by the paragraph entitled "SD-10 Operation and Maintenance Data", is to be submitted to and approved by the Contracting Officer.

3.2.3 Test Equipment

Ensure all test equipment and instruments is on hand prior to scheduling field tests, or subject to Contracting Officer's approval, evidence must be provided to show that arrangements have been made to have the necessary equipment and instruments on site prior to field testing.

3.3 FIELD QUALITY CONTROL

Give Contracting Officer 15 days notice of dates and times scheduled for tests which require the presence of the Contracting Officer. The Contracting Officer will coordinate with the using activity and schedule a time that will eliminate or minimize interruptions and interference with the activity operations. The contractor is responsible for costs associated with conducting tests outside of normal working hours and with incorporating special arrangements and procedures, including temporary power conditions. The contractor provides labor, equipment, apparatus, including test load, and consumables required for the specified tests. Calibration of all measuring devices and indicating devices must be certified. Provide the services of a qualified factory-trained manufacturer's representative to assist the contractor in installation and start-up of the equipment specified under this section. The manufacturer's representative is to provide technical direction and assistance to the contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly components contained herein. Provide a test load that is a cataloged product in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Perform the following field tests in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.3.1 Automatic Transfer Switch Acceptance Checks and Tests

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Confirm correct application of manufacturer's recommended lubricants.

(4) Verify that manual transfer warnings are attached and visible.

(5) Verify tightness of all control connections.

(6) Verify tightness of accessible bolted connections by calibrated torque-wrench method. Thermographic survey is not required.

(7) Perform manual transfer operation.

(8) Verify positive mechanical interlocking between normal and alternate sources.

b. Electrical Tests

(1) Measure contact-resistance. Correct values that exceed 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.

(2) Perform insulation-resistance on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole for one minute. Perform tests in both source positions.

(3) Verify settings and operations of control devices.

(4) Calibrate and set all relays and timers.

3.3.2 Functional Acceptance Tests

Functional Acceptance Tests must be coordinated with Section 26 32 15 ENGINE-GENERATOR SET STATIONARY 15-2500 KW, WITH AUXILIARIES. 30 00 FIRE PUMPS. Include simulating power failure and demonstrating the following operations for each automatic transfer switch. Demonstrate in service that the automatic transfer switches are in good operating condition, and function not less than five times.

a. Perform automatic transfer tests:

(1) Simulate loss of normal/preferred power.

(2) Return to normal/preferred power.

(3) Simulate loss of emergency/alternate power.

(4) Simulate all forms of single-phase conditions.

b. Verify correct operation and timing of the following functions:

(1) Normal source voltage-sensing relays.

(2) Engine start sequence.

(3) Time delay upon transfer.

(4) Alternate source voltage-sensing relays.

(5) Automatic transfer operation.

(6) Interlocks and limit switch function.

(7) Time delay and retransfer upon normal power restoration.

(8) By-pass/isolation functional modes and related automatic transfer switch operations.

3.3.3 Infrared Scanning

After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after acceptance.

b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

c. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 TRAINING

Provide 4 hours of training to maintenance personnel on the proper operation, maintenance and adjustment of the automatic transfer switch.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 33 - UTILITIES

SECTION 33 82 00

TELECOMMUNICATIONS OUTSIDE PLANT (OSP)**[ADD01]**

02/26

PART 1 GENERAL

1.1 REFERENCES
1.2 RELATED REQUIREMENTS
1.3 DEFINITIONS
1.3.1 Campus Distributor (CD)
1.3.2 Entrance Facility (EF) (Telecommunications)
1.3.3 Entrance Room (ER) (Telecommunications)
1.3.4 Building Distributor (BD)
1.3.5 Pathway
1.4 SYSTEM DESCRIPTION
1.5 SUBMITTALS
1.6 QUALITY ASSURANCE
1.6.1 Shop Drawings
1.6.1.1 Telecommunications Outside Plant Shop Drawings
1.6.1.2 Telecommunications Entrance Facility Drawings
1.6.2 Telecommunications Qualifications
1.6.2.1 Telecommunications Contractor Qualifications
1.6.2.2 Key Personnel Qualifications
1.6.2.3 Minimum Manufacturer's Qualifications
1.6.3 Outside Plant Test Plan
1.6.4 Standard Products
1.6.4.1 Alternative Qualifications
1.6.4.2 Material and Equipment Manufacturing Date
1.6.5 Regulatory Requirements
1.6.5.1 Independent Testing Organization Certificate
1.7 DELIVERY, STORAGE, AND HANDLING
1.8 MAINTENANCE
1.8.1 Record Documentation
1.8.2 Spare Parts
1.9 WARRANTY

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT
2.2 TELECOMMUNICATIONS ENTRANCE FACILITY
2.2.1 Building Protector Assemblies
2.2.2 Protector Modules
2.2.3 Fiber Optic Terminations
2.3 CLOSURES
2.3.1 Copper Conductor Closures
2.3.1.1 Underground Cable Closures
2.3.2 Fiber Optic Closures
2.3.2.1 In Vault or Manhole
2.4 CABLE SPLICES, AND CONNECTORS
2.4.1 Copper Cable Splices

2.4.2 Copper Cable Splice Connector
2.4.3 Fiber Optic Cable Splices
2.4.4 Fiber Optic Splice Organizer
2.4.5 Shield Connectors
2.5 CONDUIT
2.6 PLASTIC INSULATING TAPE
2.7 WIRE AND CABLE
2.7.1 Copper Conductor Cable
2.7.1.1 Underground
2.7.1.2 Screen
2.7.2 Fiber Optic Cable
2.7.2.1 Strength Members
2.7.2.2 Performance Requirements
2.7.3 Grounding and Bonding Conductors
2.8 T-SPAN LINE TREATMENT REPEATERS
2.9 POLES AND HARDWARE
2.10 CABLE TAGS IN MANHOLES, HANDHOLES, AND VAULTS
2.10.1 Polyethylene Cable Tags
2.11 BURIED WARNING AND IDENTIFICATION TAPE
2.12 GROUNDING BRAID
2.13 MANUFACTURER'S NAMEPLATE
2.14 FIELD FABRICATED NAMEPLATES
2.15 TESTS, INSPECTIONS, AND VERIFICATIONS
2.15.1 Factory Reel Test Data

PART 3 EXECUTION

3.1 INSTALLATION
3.1.1 Contractor Damage
3.1.2 Cable Inspection and Repair
3.1.3 Cable Protection
3.1.3.1 Cable End Caps
3.1.4 Underground Duct
3.1.5 Reconditioning of Surfaces
3.1.6 Penetrations
3.1.7 Cable Pulling
3.1.7.1 Cable Tensions
3.1.7.2 Pulling Eyes
3.1.7.3 Installation of Cables in Manholes, Handholes, and Vaults
3.1.8 Cable Splicing
3.1.8.1 Copper Conductor Splices
3.1.8.2 Fiber Optic Splices
3.1.9 Surge Protection
3.1.10 Grounding
3.1.10.1 Telecommunications Master Ground Bar (TMGB)
3.1.10.2 Incoming Cable Shields
3.1.10.3 Campus Distributor Grounding
3.1.11 Cut-Over
3.2 LABELING
3.2.1 Labels
3.2.2 Cable Tag Installation
3.2.3 Termination Hardware
3.3 FIELD APPLIED PAINTING
3.4 FIELD FABRICATED NAMEPLATE MOUNTING
3.5 FIELD QUALITY CONTROL
3.5.1 Pre-Installation Tests
3.5.1.1 Cable Capacitance
3.5.1.2 Loop Resistance
3.5.1.3 Pre-Installation Test Results

3.5.2 Acceptance Tests
3.5.2.1 Copper Conductor Cable
3.5.2.2 Fiber Optic Cable
3.5.3 Soil Density Tests

-- End of Section Table of Contents --

SECTION 33 82 00

TELECOMMUNICATIONS OUTSIDE PLANT (OSP)**[ADD01]**
02/26

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B1	(2013) Standard Specification for Hard-Drawn Copper Wire
ASTM B8	(2023) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2023; ERTA 1 2023; ERTA 2-3 2025) National Electrical Safety Code

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-87-640	(2023) Optical Fiber Outside Plant Communications Cable; 4th Edition
ICEA S-98-688	(2012) Broadband Twisted Pair Telecommunication Cable, Aircore, Polyolefin Insulated, Copper Conductors Technical Requirements
ICEA S-99-689	(2012) Broadband Twisted Pair Telecommunication Cable Filled, Polyolefin Insulated, Copper Conductors Technical Requirements

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C62.61	(1993) American National Standard for Gas Tube Surge Arresters on Wire Line Telephone Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2026; TIA 26-1; ERTA 26-1; TIA 26-2; TIA

26-3; TIA 26-4; TIA 26-5; TIA 26-6; TIA 26-7; ERTA 26-2; ERTA 26-3) National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

ANSI/TIA-526-7	(2015a; R 2022) Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, Adoption of IEC 61280-4-2 edition 2: Fibre-Optic Communications Subsystem Test Procedures - Part 4-2: Installed Cable Plant - Single-Mode Attenuation and Optical Return Loss Measurement
ANSI/TIA-526-14	(2023d) OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
ANSI/TIA-568.1	(2020e) Commercial Building Telecommunications Infrastructure Standard
ANSI/TIA-568.2	(2024e) Balanced Twisted-Pair Telecommunications Cabling and Components Standards
ANSI/TIA-568.3	(2022e) Optical Fiber Cabling Components Standard
ANSI/TIA-569	(2019e; Add 1 2022) Telecommunications Pathways and Spaces
ANSI/TIA-606	(2021d) Administration Standard for Telecommunications Infrastructure
ANSI/TIA-607	(2019d) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
TIA-455-78-B	(2020c; R 2024) FOTP-78 Optical Fibres - Part 1-40: Measurement Methods and Test Procedures - Attenuation
TIA-455-107	(1999a) FOTP-107 Determination of Component Reflectance or Link/System Return Loss using a Loss Test Set
TIA-472D000	(2007b) Fiber Optic Communications Cable for Outside Plant Use
TIA-492CAAA	(1998; R 2002) Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers
TIA-590	(1997a) Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant
TIA-758	(2012b) Customer-Owned Outside Plant

	Telecommunications Infrastructure Standard
TIA/EIA-455	(1998b) Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fiber Optic Components
TIA/EIA-455-204	(2024b) Standard for Measurement of Bandwidth on Multimode Fiber
TIA/EIA-598	(2014D; Add 2 2018) Optical Fiber Cable Color Coding

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS 1755	Telecommunications Standards and Specifications for Materials, Equipment and Construction
RUS Bull 345-50	(1979) Trunk Carrier Systems (PE-60)
RUS Bull 345-65	(1985) Shield Bonding Connectors (PE-65)
RUS Bull 345-72	(1985) Filled Splice Closures (PE-74)
RUS Bull 345-83	(1979; Rev Oct 1982) Gas Tube Surge Arrestors (PE-80)
RUS Bull 1751F-630	(1996) Design of Aerial Plant
RUS Bull 1751F-643	(2002) Underground Plant Design
RUS Bull 1751F-815	(1979) Electrical Protection of Outside Plant
RUS Bull 1753F-201	(1997) Acceptance Tests of Telecommunications Plant (PC-4)
RUS Bull 1753F-401	(1995) Splicing Copper and Fiber Optic Cables (PC-2)

UL SOLUTIONS (UL)

UL 83	(2017; Reprint Oct 2025) UL Standard for Safety Thermoplastic-Insulated Wires and Cables
UL 497	(2001; Reprint Jul 2022) UL Standard for Safety Protectors for Paired Conductor Communication Circuits
UL 510	(2020; Dec 2022) UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape

1.2 RELATED REQUIREMENTS

Section 27 10 00, BUILDING TELECOMMUNICATIONS CABLING SYSTEM, , and Section 33 71 02, UNDERGROUND ELECTRICAL DISTRIBUTION apply to this

section with additions and modifications specified herein.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification must be as defined in ANSI/TIA-568.1, ANSI/TIA-568.2, ANSI/TIA-568.3, ANSI/TIA-569, ANSI/TIA-606, and IEEE 100 and herein.

1.3.1 Campus Distributor (CD)

A distributor from which the campus backbone cabling emanates. (International expression for main cross-connect - (MC).)

1.3.2 Entrance Facility (EF) (Telecommunications)

An entrance to the building for both private and public network service cables (including antennae) including the entrance point at the building wall and continuing to the entrance room or space.

1.3.3 Entrance Room (ER) (Telecommunications)

A centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.

1.3.4 Building Distributor (BD)

A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect - (IC).)

1.3.5 Pathway

A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.4 SYSTEM DESCRIPTION

The telecommunications outside plant consists of cable, conduit, manholes, poles, etc. required to provide signal paths from the closest point of presence to the new facility, including free standing frames or backboards, interconnecting hardware, terminating cables, lightning and surge protection modules at the entrance facility. The work consists of providing, testing and making operational cabling, interconnecting hardware and lightning and surge protection necessary to form a complete outside plant telecommunications system for continuous use.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telecommunications Outside Plant; G

Telecommunications Entrance Facility Drawings; G

SD-03 Product Data

Wire and Cable; G

Cable Splices, and Connectors; G

Closures; G

Building Protector Assemblies; G

Protector Modules; G

Spare Parts; G

SD-06 Test Reports

Pre-installation Tests; G

Acceptance Tests; G

Outside Plant Test Plan; G

SD-07 Certificates

Telecommunications Contractor Qualifications; G

Key Personnel Qualifications; G

Minimum Manufacturer's Qualifications; G

SD-08 Manufacturer's Instructions

Building Protector Assembly Installation; G

Cable Tensions; G

Fiber Optic Splices; G

SD-09 Manufacturer's Field Reports

Factory Reel Test Data; G

SD-10 Operation and Maintenance Data

Telecommunications Outside Plant (OSP), Data Package 5; G

SD-11 Closeout Submittals

Record Documentation; G

1.6 QUALITY ASSURANCE

1.6.1 Shop Drawings

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a

coordinated installation. Wiring diagrams must identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings must indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals must include the nameplate data, size, and capacity. Submittals must also include applicable federal, military, industry, and technical society publication references.

1.6.1.1 Telecommunications Outside Plant Shop Drawings

Provide Outside Plant Design in accordance with TIA-758, RUS Bull 1751F-630 for aerial system design, and RUS Bull 1751F-643 for underground system design. Provide T0 shop drawings that show the physical and logical connections from the perspective of an entire campus, such as actual building locations, exterior pathways and campus backbone cabling on plan view drawings, major system nodes, and related connections on the logical system drawings in accordance with ANSI/TIA-606. Drawings must include wiring and schematic diagrams for fiber optic and copper cabling and splices, copper conductor gauge and pair count, fiber pair count and type, pathway duct and innerduct arrangement, associated construction materials, and any details required to demonstrate that cable system has been coordinated and will properly support the switching and transmission system identified in specification and drawings. Provide Registered Communications Distribution Designer (RCDD) approved drawings of the telecommunications outside plant. Update existing telecommunication Outside Plant T0 drawings to include information modified, deleted or added as a result of this installation in accordance with ANSI/TIA-606. The telecommunications outside plant (OSP) shop drawings must be included in the operation and maintenance manuals.

1.6.1.2 Telecommunications Entrance Facility Drawings

Provide T3 drawings for EF Telecommunications as specified in the paragraph TELECOMMUNICATIONS SPACE DRAWINGS of Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEMS. The telecommunications entrance facility shop drawings must be included in the operation and maintenance manuals.

1.6.2 Telecommunications Qualifications

Work under this section must be performed by and the equipment must be provided by the approved telecommunications contractor and key personnel. Qualifications must be provided for: the telecommunications system contractor, the telecommunications system installer, the supervisor (if different from the installer), and the cable splicing and terminating personnel. A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

1.6.2.1 Telecommunications Contractor Qualifications

The telecommunications contractor must be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment. The telecommunications contractor must demonstrate experience in providing successful telecommunications systems that include outside plant and broadband cabling within the past 3 years. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor. Each of the key

personnel must demonstrate experience in providing successful telecommunications systems in accordance with TIA-758 within the past 3 years.

1.6.2.2 Key Personnel Qualifications

Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. There may be one key person or more key persons proposed for this solicitation depending upon how many of the key roles each has successfully provided. Each of the key personnel must demonstrate experience in providing successful telecommunications systems within the past 3 years.

a. Cable splicing and terminating personnel assigned to the installation of this system or any of its components must have training in the proper techniques and have a minimum of 3 years experience in splicing and terminating the specified cables. Modular splices must be performed by factory certified personnel or under direct supervision of factory trained personnel for products used.

b. Supervisors and installers assigned to the installation of this system or any of its components must have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products.

Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for each of the key personnel. Documentation for each key person must include at least two successful system installations provided that are equivalent in system size and in construction complexity to the telecommunications system proposed for this solicitation. Include specific experience in installing and testing telecommunications outside plant systems, including broadband cabling, and provide the names and locations of at least two project installations successfully completed using optical fiber and copper telecommunications cabling systems. All of the existing telecommunications system installations offered by the key persons as successful experience must have been in successful full-time service for at least 18 months prior to the issuance date for this solicitation. Provide the name and role of the key person, the title, location, and completed installation date of the referenced project, the referenced project owner point of contact information including name, organization, title, and telephone number, and generally, the referenced project description including system size and construction complexity.

a. Indicate that all key persons are currently employed by the telecommunications contractor, or have a commitment to the telecommunications contractor to work on this project. All key persons must be employed by the telecommunications contractor at the date of issuance of this solicitation, or if not, have a commitment to the telecommunications contractor to work on this project by the date that the bid was due to the Contracting Officer.

b. Note that only the key personnel approved by the Contracting Officer in the successful proposal must do work on this solicitation's telecommunications system. Key personnel must function in the same roles in this contract, as they functioned in the offered successful experience. Any substitutions for the telecommunications contractor's key personnel requires approval from The Contracting Officer.

1.6.2.3 Minimum Manufacturer's Qualifications

Cabling, equipment and hardware manufacturers must have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of components which comply with, ANSI/TIA-568.1, ANSI/TIA-568.2 and ANSI/TIA-568.3. In addition, cabling manufacturers must have a minimum of 3 years experience in the manufacturing and factory testing of cabling which comply with ICEA S-87-640, ICEA S-98-688, and ICEA S-99-689.

1.6.3 Outside Plant Test Plan

Prepare and provide a complete and detailed test plan for field tests of the outside plant including a complete list of test equipment for the copper conductor and optical fiber cables, components, and accessories for approval by the Contracting Officer. Include a cut-over plan with procedures and schedules for relocation of facility station numbers without interrupting service to any active location. Submit the plan at least 30 days prior to tests for Contracting Officer approval. Provide outside plant testing and performance measurement criteria in accordance with ANSI/TIA-568.1 and RUS Bull 1753F-201. Include procedures for certification, validation, and testing that includes fiber optic link performance criteria.

1.6.4 Standard Products

Provide materials and equipment that are standard products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and must be the manufacturer's latest standard design that has been in satisfactory commercial or industrial use for at least 2 years prior to bid opening. The 2-year period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Products supplied must be specifically designed and manufactured for use with outside plant telecommunications systems. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.6.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is provided.

1.6.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site must not be used, unless specified otherwise.

1.6.5 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of

similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship must be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.5.1 Independent Testing Organization Certificate

In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate must state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.7 DELIVERY, STORAGE, AND HANDLING

Ship cable on reels in 2000 feet length with a minimum overage of 10 percent. Radius of the reel drum must not be smaller than the minimum bend radius of the cable. Wind cable on the reel so that unwinding can be done without kinking the cable. Two meters of cable at both ends of the cable must be accessible for testing. Attach permanent label on each reel showing length, cable identification number, cable size, cable type, and date of manufacture. Provide water resistant label and the indelible writing on the labels. Apply end seals to each end of the cables to prevent moisture from entering the cable. Reels with cable must be suitable for outside storage conditions when temperature ranges from minus 40 degrees C to plus 65 degrees C, with relative humidity from 0 to 100 percent. Equipment, other than cable, delivered and placed in storage must be stored with protection from weather, humidity and temperature variation, dirt and dust, or other contaminants in accordance with manufacturer's requirements.

1.8 MAINTENANCE

1.8.1 Record Documentation

Provide the activity responsible for telecommunications system maintenance and administration a single complete and accurate set of record documentation for the entire telecommunications system with respect to this project.

Provide record documentation as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

1.8.2 Spare Parts

In addition to the requirements of Section 01 78 23 OPERATION AND MAINTENANCE DATA, provide a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking. Spare parts must be provided no later than the start of field testing.

1.9 WARRANTY

The equipment items must be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis

during the warranty period of the contract.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Products supplied must be specifically designed and manufactured for use with outside plant telecommunications systems.

2.2 TELECOMMUNICATIONS ENTRANCE FACILITY

2.2.1 Building Protector Assemblies

Provide self-contained 5 pin screw type unit supplied with a field cable stub factory connected to protector socket blocks to terminate and accept protector modules for 25 pairs of outside cable. Building protector assembly must have interconnecting hardware for connection to interior cabling at full capacity. Provide manufacturers instructions for building protector assembly installation. Provide copper cable interconnecting hardware as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.2.2 Protector Modules

Provide in accordance with UL 497 three-electrode gas tube or solid state type 5 pin rated for the application. Provide gas tube protection modules in accordance with RUS Bull 345-83 and must be heavy duty, A>10kA, B>400, C>65A where A is the maximum single impulse discharge current, B is the impulse life and C is the AC discharge current in accordance with ANSI C62.61. The gas modules must shunt high voltage to ground, fail short, and be equipped with an external spark gap and heat coils in accordance with UL 497. Provide the number of surge protection modules equal to the number of pairs of exterior cable of the building protector assembly.

2.2.3 Fiber Optic Terminations

Provide fiber optic cable terminations as specified in 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

2.3 CLOSURES

2.3.1 Copper Conductor Closures

2.3.1.1 Underground Cable Closures

a. In vault or manhole: Provide underground closure suitable to house a straight, butt, and branch splice in a protective housing into which can be poured an encapsulating compound. Closure must be of suitable thermoplastic, thermoset, or stainless steel material supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. Encapsulating compound must be reenterable and must not alter the chemical stability of the closure. Provide filled splice cases in accordance with RUS Bull 345-72.

2.3.2 Fiber Optic Closures

2.3.2.1 In Vault or Manhole

Provide underground closure suitable to house splice organizer in a protective housing into which can be poured an encapsulating compound. Closure must be of thermoplastic, thermoset, or stainless steel material supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. Encapsulating compound must be reenterable and must not alter the chemical stability of the closure.

2.4 CABLE SPLICES, AND CONNECTORS

2.4.1 Copper Cable Splices

Provide multipair, foldback splices of a moisture resistant, two-wire insulation displacement connector held rigidly in place to assure maximum continuity in accordance with RUS Bull 1753F-401. Cables greater than 25 pairs must be spliced using multipair splicing connectors, which accommodate 25 pairs of conductors at a time. Provide correct connector size to accommodate the cable gauge of the supplied cable.

2.4.2 Copper Cable Splice Connector

Provide splice connectors with a polycarbonate body and cap and a tin-plated brass contact element. Connector must accommodate 22 to 26 AWG solid wire with a maximum insulation diameter of 0.065 inch. Fill connector with sealant grease to make a moisture resistant connection, in accordance with RUS Bull 1753F-401.

2.4.3 Fiber Optic Cable Splices

Provide fiber optic cable splices and splicing materials for fusion methods at locations shown on the construction drawings. The splice insertion loss must be 0.3 dB maximum when measured in accordance with TIA-455-78-B using an Optical Time Domain Reflectometer (OTDR). Splices must be designed for a return loss of 40.0 db max for single mode fiber when tested in accordance with TIA-455-107. Physically protect each fiber optic splice by a splice kit specially designed for the splice.

2.4.4 Fiber Optic Splice Organizer

Provide splice organizer suitable for housing fiber optic splices in a neat and orderly fashion. Splice organizer must allow for a minimum of 3 feet of fiber for each fiber within the cable to be neatly stored without kinks or twists. Splice organizer must accommodate individual strain relief for each splice and allow for future maintenance or modification, without damage to the cable or splices. Provide splice organizer hardware, such as splice trays, protective glass shelves, and shield bond connectors in a splice organizer kit.

2.4.5 Shield Connectors

Provide connectors with a stable, low-impedance electrical connection between the cable shield and the bonding conductor in accordance with RUS Bull 345-65.

2.5 CONDUIT

Provide conduit as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.6 PLASTIC INSULATING TAPE

UL 510.

2.7 WIRE AND CABLE

2.7.1 Copper Conductor Cable

Solid copper conductors, covered with an extruded solid insulating compound. Insulated conductors must be twisted into pairs which are then stranded or oscillated to form a cylindrical core. For special high frequency applications, the cable core must be separated into compartments. Cable must be completed by the application of a suitable core wrapping material, a corrugated copper or plastic coated aluminum shield, and an overall extruded jacket. Telecommunications contractor must verify distances between splice points prior to ordering cable in specific cut lengths. Gauge of conductor must determine the range of numbers of pairs specified; 19 gauge (6 to 400 pairs), 22 gauge (6 to 1200 pairs), 24 gauge (6 to 2100 pairs), and 26 gauge (6 to 3000 pairs). Copper conductor must conform to the following:

2.7.1.1 Underground

Provide filled cable meeting the requirements of ICEA S-99-689 and RUS 1755.390 .

2.7.1.2 Screen

Provide screen-compartmental core cable filled cable meeting the requirements of ICEA S-99-689 and RUS 1755.390.

2.7.2 Fiber Optic Cable

Provide single-mode, 8/125-um, 0.10 aperture 1310 nm fiber optic cable in accordance with TIA-492CAAA, TIA-472D000, and ICEA S-87-640 including any special requirements made necessary by a specialized design. Provide optical fibers as indicated. Fiber optic cable must be specifically designed for outside use with loose buffer construction. Provide fiber optic color code in accordance with TIA/EIA-598

2.7.2.1 Strength Members

Provide central, non-metallic strength members with sufficient tensile strength for installation and residual rated loads to meet the applicable performance requirements in accordance with ICEA S-87-640. The strength member is included to serve as a cable core foundation to reduce strain on the fibers, and must not serve as a pulling strength member.

2.7.2.2 Performance Requirements

Provide fiber optic cable with optical and mechanical performance requirements in accordance with ICEA S-87-640.

2.7.3 Grounding and Bonding Conductors

Provide grounding and bonding conductors in accordance with RUS 1755.200, ANSI/TIA-607, IEEE C2, and NFPA 70. Solid bare copper wire meeting the requirements of ASTM B1 for sizes No. 8 AWG and smaller and stranded bare copper wire meeting the requirements of ASTM B8, for sizes No. 6 AWG and larger. Insulated conductors must have 600-volt, Type TW insulation meeting the requirements of UL 83.

2.8 T-SPAN LINE TREATMENT REPEATERS

Provide as indicated. Repeaters must be pedestal mounted with non-pressurized housings, sized as indicated and must meet the requirements of RUS Bull 345-50.

2.9 POLES AND HARDWARE

Provide poles and hardware as specified in Section 33 71 01 OVERHEAD TRANSMISSION AND DISTRIBUTION.

2.10 CABLE TAGS IN MANHOLES, HANDHOLES, AND VAULTS

Provide tags for each telecommunications cable or wire located in manholes, handholes, and vaults. Cable tags must be polyethylene and labeled in accordance with ANSI/TIA-606. Handwritten labeling is unacceptable.

2.10.1 Polyethylene Cable Tags

Provide tags of polyethylene that have an average tensile strength of 3250 pounds per square inch; and that are 0.08 inch thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 170 degrees F. Provide 0.05 inch (minimum) thick black polyethylene tag holder. Provide a one-piece nylon, self-locking tie at each end of the cable tag. Ties must have a minimum loop tensile strength of 175 pounds. The cable tags must have black block letters, numbers, and symbols one inch high on a yellow background. Letters, numbers, and symbols must not fall off or change positions regardless of the cable tags' orientation.

2.11 BURIED WARNING AND IDENTIFICATION TAPE

Provide fiber optic media marking and protection in accordance with TIA-590. Provide color, type and depth of tape as specified in paragraph BURIED WARNING AND IDENTIFICATION TAPE in Section 31 00 00, EARTHWORK.

2.12 GROUNDING BRAID

Provide grounding braid that provides low electrical impedance connections for dependable shield bonding in accordance with RUS 1755.200. Braid must be made from flat tin-plated copper.

2.13 MANUFACTURER'S NAMEPLATE

Each item of equipment must have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.14 FIELD FABRICATED NAMEPLATES

Provide laminated plastic nameplates in accordance with ASTM D709 for each patch panel, protector assembly, rack, cabinet and other equipment or as indicated on the drawings. Each nameplate inscription must identify the function and, when applicable, the position. Nameplates must be melamine plastic, 0.125 inch thick, white with black center core. Surface must be matte finish. Corners must be square. Accurately align lettering and engrave into the core. Minimum size of nameplates must be one by 2.5 inches. Lettering must be a minimum of 0.25 inch high normal block style.

2.15 TESTS, INSPECTIONS, AND VERIFICATIONS

2.15.1 Factory Reel Test Data

Test 100 percent OTDR test of FO media at the factory in accordance with ANSI/TIA-568.1 and ANSI/TIA-568.3. Use ANSI/TIA-526-7 for single mode fiber and ANSI/TIA-526-14 Method B for multi mode fiber measurements. Calibrate OTDR to show anomalies of 0.2 dB minimum. Enhanced performance filled OSP copper cables, referred to as Broadband Outside Plant (BBOSP), must meet the requirements of ICEA S-99-689. Enhanced performance air core OSP copper cables must meet the requirements of ICEA S-98-688. Submit test reports, including manufacture date for each cable reel and receive approval before delivery of cable to the project site.

PART 3 EXECUTION

3.1 INSTALLATION

Install all system components and appurtenances in accordance with manufacturer's instructions IEEE C2, NFPA 70, and as indicated. Provide all necessary interconnections, services, and adjustments required for a complete and operable telecommunications system.

3.1.1 Contractor Damage

Promptly repair indicated utility lines or systems damaged during site preparation and construction. Damages to lines or systems not indicated, which are caused by Contractor operations, must be treated as "Changes" under the terms of the Contract Clauses. When Contractor is advised in writing of the location of a nonindicated line or system, such notice must provide that portion of the line or system with "indicated" status in determining liability for damages. In every event, immediately notify the Contracting Officer of damage.

3.1.2 Cable Inspection and Repair

Handle cable and wire provided in the construction of this project with care. Inspect cable reels for cuts, nicks or other damage. Damaged cable must be replaced or repaired to the satisfaction of the Contracting Officer. Reel wraps must remain intact on the reel until the cable is ready for placement.

3.1.3 Cable Protection

Provide direct burial cable protection in accordance with NFPA 70 and as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Galvanized conduits which penetrate concrete (slabs, pavement, and walls) must be PVC coated and must extend from the first coupling or fitting

outside either side of the concrete minimum of 6 inches per 12 inches burial depth beyond the edge of the surface where cable protection is required; all conduits must be sealed on each end. Where additional protection is required, cable may be placed in galvanized iron pipe (GIP) sized on a maximum fill of 40 percent of cross-sectional area, or in concrete encased 4 inches PVC pipe. Conduit may be installed by jacking or trenching. Trenches must be backfilled with earth and mechanically tamped at 6 inches lift so that the earth is restored to the same density, grade and vegetation as adjacent undisturbed material.

3.1.3.1 Cable End Caps

Cable ends must be sealed at all times with coated heat shrinkable end caps. Cables ends must be sealed when the cable is delivered to the job site, while the cable is stored and during installation of the cable. The caps must remain in place until the cable is spliced or terminated. Sealing compounds and tape are not acceptable substitutes for heat shrinkable end caps. Cable which is not sealed in the specified manner at all times will be rejected.

3.1.4 Underground Duct

Provide underground duct and connections to existing manholes, handholes, and existing ducts as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION with any additional requirements as specified herein.

3.1.5 Reconditioning of Surfaces

Provide reconditioning of surfaces as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.1.6 Penetrations

Caulk and seal cable access penetrations in walls, ceilings and other parts of the building. Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings in accordance with Section 07 84 00 FIRESTOPPING.

3.1.7 Cable Pulling

Test duct lines with a mandrel and swab out to remove foreign material before the pulling of cables. Avoid damage to cables in setting up pulling apparatus or in placing tools or hardware. Do not step on cables when entering or leaving the manhole. Do not place cables in ducts other than those shown without prior written approval of the Contracting Officer. Roll cable reels in the direction indicated by the arrows painted on the reel flanges. Set up cable reels on the same side of the manhole as the conduit section in which the cable is to be placed. Level the reel and bring into proper alignment with the conduit section so that the cable pays off from the top of the reel in a long smooth bend into the duct without twisting. Under no circumstances must the cable be paid off from the bottom of a reel. Check the equipment set up prior to beginning the cable pulling to avoid an interruption once pulling has started. Use a cable feeder guide of suitable dimensions between cable reel and face of duct to protect cable and guide cable into the duct as it is paid off the reel. As cable is paid off the reel, lubricate and inspect cable for sheath defects. When defects are noticed, stop pulling operations and notify the Contracting Officer to determine required corrective action. Cable pulling must also be stopped when reel binds or does not pay off

freely. Rectify cause of binding before resuming pulling operations. Provide cable lubricants recommended by the cable manufacturer. Avoid bends in cables of small radii and twists that might cause damage. Do not bend cable and wire in a radius less than 10 times the outside diameter of the cable or wire.

3.1.7.1 Cable Tensions

Obtain from the cable manufacturer and provide to the Contracting Officer, the maximum allowable pulling tension. This tension must not be exceeded.

3.1.7.2 Pulling Eyes

Equip cables 1.25 inches in diameter and larger with cable manufacturer's factory installed pulling-in eyes. Provide cables with diameter smaller than 1.25 inches with heat shrinkable type end caps or seals on cable ends when using cable pulling grips. Rings to prevent grip from slipping must not be beaten into the cable sheath. Use a swivel of 3/4 inch links between pulling-in eyes or grips and pulling strand.

3.1.7.3 Installation of Cables in Manholes, Handholes, and Vaults

Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support cables on brackets and cable insulators at a maximum of 4 feet. In existing manholes, handholes, and vaults where new ducts are to be terminated, or where new cables are to be installed, modify the existing installation of cables, cable supports, and grounding as required with cables arranged and supported as specified for new cables. Identify each cable with corrosion-resistant embossed metal tags.

3.1.8 Cable Splicing

3.1.8.1 Copper Conductor Splices

Perform splicing in accordance with requirements of RUS Bull 1753F-401 except that direct buried splices and twisted and soldered splices are not allowed. Exception does not apply for pairs assigned for carrier application.

3.1.8.2 Fiber Optic Splices

Fiber optic splicing must be in accordance with manufacturer's recommendation and must exhibit an insertion loss not greater than 0.2 dB for fusion splices.

3.1.9 Surge Protection

All cables and conductors, except fiber optic cable, which serve as communication lines through off-premise lines, must have surge protection installed at each end which meet the requirements of RUS Bull 1751F-815.

3.1.10 Grounding

Provide grounding and bonding in accordance with RUS 1755.200, ANSI/TIA-607, IEEE C2, and NFPA 70. Ground exposed noncurrent carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals.

3.1.10.1 Telecommunications Master Ground Bar (TMGB)

The TMGB is the hub of the basic telecommunications grounding system providing a common point of connection for ground from outside cable, CD, and equipment. Establish a TMGB for connection point for cable stub shields to connector blocks and CD protector assemblies as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.1.10.2 Incoming Cable Shields

Shields must not be bonded across the splice to the cable stubs. Ground shields of incoming cables in the EF Telecommunications to the TMGB.

3.1.10.3 Campus Distributor Grounding

a. Protection assemblies: Mount CD protector assemblies directly on the telecommunications backboard. Connect assemblies mounted on each vertical frame with No. 6 AWG copper conductor to provide a low resistance path to TMGB.

b. TMGB connection: Connect TMGB to TGB with copper conductor with a total resistance of less than 0.01 ohms.

3.1.11 Cut-Over

All necessary transfers and cut-overs, must be accomplished by the telecommunications contractor.

3.2 LABELING

3.2.1 Labels

Provide labeling for new cabling and termination hardware located within the facility in accordance with ANSI/TIA-606. Handwritten labeling is unacceptable. Stenciled lettering for cable and termination hardware must be provided using thermal ink transfer process.

3.2.2 Cable Tag Installation

Install cable tags for each telecommunications cable or wire located in manholes, handholes, and vaults including each splice. Tag only new wire and cable provided by this contract. The labeling of telecommunications cable tag identifiers must be in accordance with ANSI/TIA-60. Do not provide handwritten letters. Install cable tags so that they are clearly visible without disturbing any cabling or wiring in the manholes, handholes, and vaults.

3.2.3 Termination Hardware

Label patch panels, distribution panels, connector blocks and protection modules using color coded labels with identifiers in accordance with ANSI/TIA-606.

3.3 FIELD APPLIED PAINTING

Provide ferrous metallic enclosure finishes as specified in Section 09 90 00 PAINTS AND COATINGS.

3.4 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.5 FIELD QUALITY CONTROL

Provide the Contracting Officer 10 working days notice prior to each test. Provide labor, equipment, and incidentals required for testing. Correct defective material and workmanship disclosed as the results of the tests. Furnish a signed copy of the test results to the Contracting Officer within 3 working days after the tests for each segment of construction are completed. Perform testing as construction progresses and do not wait until all construction is complete before starting field tests.

3.5.1 Pre-Installation Tests

Perform the following tests on cable at the job site before it is removed from the cable reel. For cables with factory installed pulling eyes, these tests must be performed at the factory and certified test results must accompany the cable.

3.5.1.1 Cable Capacitance

Perform capacitance tests on at least 10 percent of the pairs within a cable to determine if cable capacitance is within the limits specified.

3.5.1.2 Loop Resistance

Perform DC-loop resistance on at least 10 percent of the pairs within a cable to determine if DC-loop resistance is within the manufacturer's calculated resistance.

3.5.1.3 Pre-Installation Test Results

Provide results of pre-installation tests to the Contracting Officer at least 5 working days before installation is to start. Results must indicate reel number of the cable, manufacturer, size of cable, pairs tested, and recorded readings. When pre-installation tests indicate that cable does not meet specifications, remove cable from the job site.

3.5.2 Acceptance Tests

Perform acceptance testing in accordance with RUS Bull 1753F-201 and as further specified in this section. Provide personnel, equipment, instrumentation, and supplies necessary to perform required testing. Notification of any planned testing must be given to the Contracting Officer at least 14 days prior to any test unless specified otherwise. Testing must not proceed until after the Contractor has received written Contracting Officer's approval of the test plans as specified. Test plans must define the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans must define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans must identify the capabilities and functions to be tested. Provide test reports in booklet form showing all field tests performed, upon completion and testing of the installed system. Measurements must be tabulated on a pair by pair or strand by strand basis.

3.5.2.1 Copper Conductor Cable

Perform the following acceptance tests in accordance with TIA-758:

a. Wire map (pin to pin continuity)

b. Continuity to remote end

c. Crossed pairs

d. Reversed pairs

e. Split pairs

f. Shorts between two or more conductors

3.5.2.2 Fiber Optic Cable

Test fiber optic cable in accordance with TIA/EIA-455 and as further specified in this section. Two optical tests must be performed on all optical fibers: Optical Time Domain Reflectometry (OTDR) Test, and Attenuation Test. In addition, a Bandwidth Test must be performed on all multimode optical fibers. These tests must be performed on the completed end-to-end spans which include the near-end pre-connectorized single fiber cable assembly, outside plant as specified, and the far-end pre-connectorized single fiber cable assembly.

a. OTDR Test: The OTDR test must be used to determine the adequacy of the cable installations by showing any irregularities, such as discontinuities, micro-bendings or improper splices for the cable span under test. Hard copy fiber signature records must be obtained from the OTDR for each fiber in each span and must be included in the test results. The OTDR test must be measured in both directions. A reference length of fiber, 66 feet minimum, used as the delay line must be placed before the new end connector and after the far end patch panel connectors for inspection of connector signature. Conduct OTDR test and provide calculation or interpretation of results in accordance with ANSI/TIA-526-7 for single-mode fiber and ANSI/TIA-526-14 for multimode fiber. Splice losses must not exceed 0.3 db.

b. Attenuation Test: End-to-end attenuation measurements must be made on all fibers, in both directions, using a 1310 nanometer light source at one end and the optical power meter on the other end to verify that the cable system attenuation requirements are met in accordance with ANSI/TIA-526-7 for single-mode fiber optic cables. The measurement method must be in accordance with TIA-455-78-B. Attenuation losses must not exceed 0.5 db/km at 1310 nm and 1550 nm for single-mode fiber. Attenuation losses must not exceed 5.0 db/km at 850 nm and 1.5 db/km at 1300 nm for multimode fiber.

c. Bandwidth Test: The end-to-end bandwidth of all multimode fiber span links must be measured by the frequency domain method. The bandwidth must be measured in both directions on all fibers. The bandwidth

measurements must be in accordance with TIA/EIA-455-204.

3.5.3 Soil Density Tests

a. Determine soil-density relationships as specified for soil tests in Section 31 00 00 EARTHWORK.

-- End of Section --

ABBREVIATIONS

AAF	ABOVE ACCESS FLOOR
ABUT	ABUTMENT
ACST	ACOUSTICAL
ACT	ACOUSTICAL CEILING TILE
ADA	AMERICANS WITH DISABILITIES ACT
ADJ	ADJACENT
ADJT	ADJUST (ADJUSTABLE)
AF	ACCESS FLOOR
AFF	ABOVE FINISH FLOOR
AHU	AIR HANDLING UNIT
ALT	ALTERNATE
ALUM	ALUMINUM
ANOD	ANODIZE (ANODIZED)
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
AP	ACCESS PANEL
APPROX	APPROXIMATE
ARCH	ARCHITECTURAL
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
ATTEN	ATTENUATION
AUX	AUXILIARY
AWP	ACOUSTICAL WALL PANEL
B/	BOTTOM OF
BD	BOARD
BF	BOTH FACES
BLDG	BUILDING
BLK	BLOCK
BLKG	BLOCKING
BOD	BASIS OF DESIGN
BOT	BOTTOM
BRDG	BRIDGING
BRG	BEARING
BRKT	BRACKET
BSMT	BASEMENT
BTWN / B/N	BETWEEN
C/C	CENTER TO CENTER
CAB	CABINET
CERT	CERTIFIED
CFCI	CONTRACTOR FURNISHED CONTRACTOR INSTALLED
CFOI	CONTRACTOR FURNISHED OWNER INSTALLED
CG	CORNER GUARD
CIP	CAST IN PLACE
CJ	CONTROL JOINT
CL	CENTERLINE
CLG	CEILING
CLR	CLEAR
CM	CENTIMETER
CMU	CONCRETE MASONRY UNIT
CNTR	COUNTER
CO	CLEAN OUT
COL	COLUMN
COMPR	COMPRESSIBLE
CONC	CONCRETE
CONN	CONNECTOR
CONST	CONSTRUCTION
CONT	CONTINUOUS
CONTR	CONTRACTOR
COORD	COORDINATE
CORR	CORRIDOR
CPT	CARPET TILE
CR	CARD READER
CSK	COUNTERSINK
CSWK	CASEWORK
CT	CERAMIC TILE
CTR	CENTER
CW	CURTAINWALL
DAT	DATUM
DB	DOOR BASE CABINET
DBL	DOUBLE
DD	DOOR/DRAWER BASE CABINET
DEG	DEGREE
DEMO	DEMOLITION
DET	DETAIL
DFB	DRAWER/FILE BASE CABINET
DIA	DIAMETER
DIAG	DIAGONAL
DIFF	DIFFUSER
DIM	DIMENSION
DISPEN	DISPENSER
DKG	DECKING
DL	DEAD LOAD
DN	DOWN
DO	DOOR/OPEN BASE CABINET
DR	DOOR
DS	DOWN SPOUT
DW	DISHWASHER
DWG	DRAWING
DWR	DRAWER
E	EAST
EA	EACH
EF	EACH FACE
EHD	ELECTRIC HAND DRYER
EIFS	EXTERIOR INSULATION FINISH SYSTEM
EJ	EXPANSION JOINT
EL	ELEVATION
ELEC	ELECTRICAL
ELEV	ELEVATOR
ENCL	ENCLOSURE
ENG	ENGINEER
EOD	EDGE OF DECK
EOS	EDGE OF SLAB
EPT	EPOXY PAINT
EQ	EQUAL
EQUIP	EQUIPMENT
ES	EACH SIDE
EW	EACH WAY
EWC	ELECTRIC WATER COOLER
EXG	EXISTING
EXP	EXPOSED
EXP STR	EXPOSED TO STRUCTURE
EXT	EXTERIOR
F	FILLER PIECE (3/4" MIN - 2 1/2" MAX)
F/	FACE OF
F/F	FACE TO FACE
F/M	FACE OF MULLION
FACT	FACTORY
FD	FLOOR DRAIN
FDC	FIRE DEPARTMENT CONNECTION
FE	FIRE EXTINGUISHER
FEC	FIRE EXTINGUISHER CABINET
FF	FINISH FACE
FIN	FINISH
FIXT	FIXTURE
FL	FLOOR
FLUOR	FLUORESCENT
FNDN	FOUNDATION
FRP	FIBERGLASS REINFORCED PLASTIC
FRT	FIRE RESISTANT TREATED
FT	FEET / FOOT
FTG	FOOTING
FURN	FURNITURE
FUT	FUTURE

ABBREVIATIONS

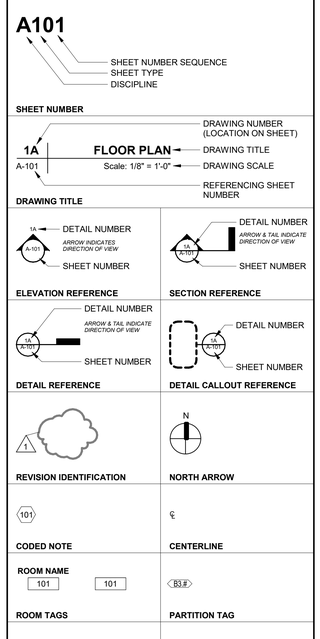
GA	GAUGE
GAL	GALLON
GALV	GALVANIZED
GB	GRAB BAR
GEN	GENERAL
GFCI	GOVERNMENT FURNISHED CONTRACTOR INSTALLED
GFGI	GOVERNMENT FURNISHED GOVERNMENT INSTALLED
GLAZ	GLAZING
GYP	GYPSUM
GYP BD	GYPSUM BOARD
HDR	HEADER
HDW	HARDWARE
HM	HOLLOW METAL
HORIZ	HORIZONTAL
HP	HIGH POINT
HPL	HIGH PRESSURE LAMINATE
HR	HOUR
HT	HEIGHT
HVAC	HEATING-VENTILATING-AIR CONDITIONING
ID	INSIDE DIAMETER
IN	INCH(ES)
INCL	INCLUDE(ED)(ING)
INSUL	INSULATED
INT	INTERIOR
JAN	JANITOR
JST	JOIST
JT	JOINT
KO	KNOCKOUT
LAM	LAMINATE(D)
LAV	LAVATORY
LB	POUND
LEVPL	LEVELING PLATE
LF	LINEAR FOOT (FEET)
LKR	LOCKER
LL	LIVE LOAD
LOC	LOCATION
LONG	LONGITUDINAL
LP	LOW POINT
LTG	LIGHTING
LVL	LEVEL
LVR	LOUVER
M	METER (METRIC MEASURE)
MAS	MASONRY
MATL	MATERIAL
MAX	MAXIMUM
MB	MARKER BOARD
MC	MICROWAVE CABINET
MDF	MEDIUM DENSITY FIBERBOARD
MECH	MECHANICAL
MEZZ	MEZZANINE
MF	MOBILE DRAWER/FILE CABINET
MFR	MANUFACTURER
MHO	MAGNETIC HOLD OPEN
MID	MIDDLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MM	MILLIMETER
MO	MASONRY OPENING
MRT	MOISTURE/MILDEW RESISTANT TREATED
MTL	METAL
MTR	METER (UTILITIES)
N	NORTH
N/A	NOT APPLICABLE
NIC	NOT IN CONTRACT
NOM	NOMINAL
NTS	NOT TO SCALE
O/O	OUT TO OUT
OC	ON CENTER
OD	OUTSIDE DIAMETER
OFC	OPEN FACE CABINET
OFD	OVERFLOW DRAIN
OHC	OVERHEAD COILING DOOR
OHD	OVERHEAD
OHS	OPEN CABINET W/ HORIZONTAL SLOTS
OPNG	OPENING
OPP	OPPOSITE
OSC	OPEN SINK CABINET
OVS	OPEN CABINET W/ VERTICAL SLOTS
P/L	PROPERTY LINE
PC	PRECAST CONCRETE
PCF	POUNDS PER CUBIC FOOT
PERIM	PERIMETER
PL	PLATE
PLAM	PLASTIC LAMINATE
PLAS	PLASTIC
PLMB	PLUMBING
PLSTR	PLASTER
PLY	PLYWOOD
PNL	PANEL
POL	POLISHED
PREFAB	PREFABRICATED
PREFIN	PREFINISHED
PROJ	PROJECTION
PROP	PROPERTY
PRTBD	PARTICAL BOARD
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PT	POINT
PTN	PARTITION (WALL)
PVC	POLYVINYL CHLORIDE
PYC	POLYURETHANE COATING
QT	QUARRY TILE
QTY	QUANTITY
R	RISER
RAD	RADIUS
RB	RUBBER BASE
RCP	REFLECTED CEILING PLAN
RD	ROOF DRAIN
REBAR	REINFORCING BAR
RECT	RECTANGULAR
REF	REFERENCE
REINF	REINFORCE(ING)
REQ	REQUIRE(D)
RESIN	RESINOUS
REV	REVISE (REVISION)
RM	ROOM
RND	ROUND
RO	ROUGH OPENING

ABBREVIATIONS

S	SOUTH
SB	SCUPPER BOX
SBC	SINK BASE CABINET
SC	SEALED CONCRETE
SCHED	SCHEDULE
SD	SOAP DISPENSER
SDC	SLIDING DOOR CABINET
SECT	SECTION
SF	SQUARE FOOT (FEET)
SHT	SHEET
SI	SQUARE INCH(ES)
SIM	SIMILAR
SLD	SOLID SURFACE
SLV	SLEEVE
SOG	SLAB ON GRADE
SPEC	SPECIFICATION(S)
SPKR	SPEAKER
SQ	SQUARE
SS/EE	SAFETY SHOWER / EMERGENCY EYEWASH
ST STL	STAINLESS STEEL
STD	STANDARD
STIFF	STIFFEN(ER)
STL	STEEL
STOR	STORAGE
STRUCT	STRUCTURE(AL)
SUSP	SUSPENDED
SYM	SYMMETRICAL
T	TREAD
T&B	TOP AND BOTTOM
T&G	TONGUE AND GROOVE
T/	TOP OF
T/M	TOP OF MULLION
TBD	TO BE DETERMINED
TEMP	TEMPERATURE
TERM	TERMINATION
TLT	TOILET
TPO	THERMPLASTIC POLYOLEFIN
TPTN	TOILET PARTITION
TV	TELEVISION
TYP	TYPICAL
UL	UNDERWRITERS LABORATORY
UON	UNLESS OTHERWISE NOTED
VCT	VINYL COMPOSITE TILE
VERT	VERTICAL
VIF	VERIFY IN FIELD
VNR	VENEER
VPR	VAPOR
W	WEST
W/	WITH
W/O	WITHOUT
WC	WATER CLOSET
WD	WOOD
WL	WIND LOAD
WP	WALL PROTECTION
WWF	WELDED WIRE FABRIC
WWM	WELDED WIRE MESH
YD	YARD
YR	YEAR

PROJECT LOCATION

SYMBOLOGY LEGEND



DRAWING INDEX

NUMBER	NAME
GENERAL	
G000	COVER SHEET
G001	ABBREVIATIONS, LEGENDS, & SHEET INDEX
G002	CODE INFORMATION
G101	LIFE-SAFETY PLANS
CIVIL	
C001	DEMOLITION PLAN
C002	EROSION CONTROL PLAN
C003	SESC DETAILS
C101	SITE LAYOUT PLAN
C102	LANDSCAPE PLAN
C201	UTILITY PLAN
C301	GRADING AND DRAINAGE PLAN
C501	DETAILS
C502	DETAILS
STRUCTURE	
S001	ABBREVIATIONS, LEGENDS, & SYMBOLS
S002	GENERAL NOTES
S003	GENERAL NOTES
S007	TYPICAL DETAILS
S008	TYPICAL DETAILS
S009	TYPICAL DETAILS
S010	TYPICAL DETAILS
S011	TYPICAL DETAILS
S101	STRUCTURAL FOUNDATION PLAN
S102	STRUCTURAL SECOND FLOOR FRAMING PLAN
S103	STRUCTURAL ROOF FRAMING PLAN
S200	STRUCTURAL ELEVATIONS
S201	STRUCTURAL ELEVATIONS
S300	STRUCTURAL DETAILS
S301	STRUCTURAL DETAILS
S302	STRUCTURAL DETAILS
S303	STRUCTURAL DETAILS
S304	STRUCTURAL DETAILS
S305	STRUCTURAL DETAILS
ARCHITECTURE	
A101	FLOOR PLAN - LEVEL 1
A102	FLOOR PLAN - LEVEL 2
A103	ROOF PLAN
A150	REFLECTED CEILING PLAN - LEVEL 1
A151	REFLECTED CEILING PLAN - LEVEL 2
A200	EXTERIOR PERSPECTIVES
A201	EXTERIOR ELEVATIONS
A220	ENLARGED EXTERIOR ELEVATIONS
A240	CURTAINWALL / WINDOW ELEVATIONS
A300	BUILDING SECTIONS
A320	WALL SECTIONS
A321	WALL SECTIONS
A400	ENLARGED FLOOR PLANS
A420	ENLARGED REFLECTED CEILING PLANS
A500	EXTERIOR PLAN DETAILS
A501	EXTERIOR PLAN DETAILS
A502	EXTERIOR PLAN DETAILS
A520	EXTERIOR SECTION DETAILS
A521	EXTERIOR SECTION DETAILS
A530	ROOF DETAILS
A600	TYPICAL MOUNTING HEIGHTS
A601	INTERIOR ELEVATIONS
A602	INTERIOR ELEVATIONS
A610	SIGNAGE
A611	SIGNAGE
A630	INTERIOR CEILING DETAILS
A640	INTERIOR MILLWORK ELEVATIONS AND DETAILS
A670	PARTITION TYPE SCHEDULE, NOTES AND DETAILS
A680	DOOR SCHEDULE
A700	ENLARGED STAIR PLANS AND SECTIONS - STAIR 01
A701	ENLARGED ELEVATOR PLANS WALL SECTIONS - ELEV 01
A702	TYPICAL STAIR DETAILS
A800	FINISH LEGENDS AND SCHEDULES
A900	OLI #1 - PEDESTRIAN BRIDGE

DRAWING INDEX

NUMBER	NAME
FIRE PROTECTION	
FA001	FIRE ALARM SYMBOLS, LEGEND, ABBREVIATIONS AND NOTES
FA101	FIRST FLOOR PLAN - FIRE ALARM
FA201	SECOND FLOOR PLAN - FIRE ALARM
FA501	FIRE ALARM DETAILS
FA502	FIRE ALARM DETAILS
FA503	FIRE ALARM DETAILS
FX001	FIRE SUPPRESSION SYMBOLS, LEGEND, ABBREVIATIONS AND NOTES
FX101	FIRST FLOOR PLAN - FIRE SUPPRESSION
FX201	SECOND FLOOR PLAN - FIRE SUPPRESSION
FX501	FIRE SUPPRESSION DETAILS
FX801	FIRE EXTINGUISHER LAYOUT
PLUMBING	
P001	GENERAL INFO - PLUMBING
P100	UNDERGROUND PLUMBING PLAN
P101	FIRST FLOOR PLUMBING PLAN
P102	SECOND FLOOR PLUMBING PLAN
P103	ROOF PLUMBING PLAN
P301	PLUMBING ENLARGED PLANS
P601	PLUMBING DETAILS
P602	PLUMBING DETAILS
P701	PLUMBING SCHEDULES
P801	PLUMBING STACK DIAGRAM
P802	DOMESTIC RISER DIAGRAM
MECHANICAL	
M001	GENERAL INFORMATION - HVAC
M002	HVAC ZONING PLANS
M101	FIRST FLOOR HVAC DUCTWORK PLAN
M102	SECOND FLOOR HVAC DUCTWORK PLAN
M401	HVAC SECTIONS
M601	HVAC DETAILS
M602	HVAC DETAILS
M701	HVAC SCHEDULES
M801	HVAC SEQUENCE OF OPERATIONS
M802	HVAC SEQUENCE OF OPERATIONS
ELECTRICAL	
E001	ABBREVIATIONS, LEGENDS & GENERAL NOTES - ELECTRICAL
E002	ELECTRICAL SITE DEMOLITION PLAN
E003	ELECTRICAL SITE NEW WORK
E090	GROUNDING AND LIGHTNING PROTECTION PLANS
E100	ELECTRICAL SITE PLAN
E101	POWER PLAN - LEVEL 1
E102	POWER PLAN - LEVEL 2
E201	LIGHTING PLAN - LEVEL 1
E202	LIGHTING PLAN - LEVEL 2
E203	PHOTOMETRIC CALCULATIONS
E501	ELECTRICAL DETAILS
E502	ELECTRICAL DETAILS
E503	ELECTRICAL DETAILS
E601	ELECTRICAL ONE-LINE DIAGRAM
E701	ELECTRICAL SCHEDULES
E702	ELECTRICAL PANEL SCHEDULES
TELECOM	
T001	TELECOMMUNICATIONS LEGEND. ABBREVIATIONS AND SYMBOLS
T101	TELECOMMUNICATIONS FIRST FLOOR PLAN
T102	TELECOMMUNICATIONS SECOND FLOOR PLAN
T201	TELECOMMUNICATIONS SITE PLAN
T301	ENLARGED COMMUNICATIONS ROOM FLOOR PLAN
T501	TELECOMMUNICATIONS DETAILS
T502	TELECOMMUNICATIONS DETAILS
T601	TECHNOLOGY RISER DIAGRAMS

GENERAL NOTES

1. THE CONSTRUCTION DRAWINGS ILLUSTRATE THE DESIGN INTENT OF THE WORK. THEY INDICATE LOCATION, DIMENSIONS AND TYPICAL DETAILS. THE ARCHITECTURAL DRAWINGS ARE PART OF A LARGER SET OF DRAWINGS WHICH, WHEN COMPLETE, CONSIST OF ALL DRAWINGS LISTED BY THE INDEX OF DRAWINGS AND THE PROJECT SPECIFICATIONS. CONSEQUENTLY, THE WORK DESCRIBED BY THE DRAWINGS OF ANY ONE DISCIPLINE MAY AFFECT THE WORK DESCRIBED ON THE DRAWINGS OF ANOTHER DISCIPLINE, AND MAY REQUIRE REFERENCE TO THE DRAWINGS OF ANOTHER DISCIPLINE. THEREFORE, PARTIAL SETS OF DRAWINGS ARE INCOMPLETE AND SHALL NOT BE DISTRIBUTED OR UTILIZED BY ANYONE.
2. ALL WORK SHALL CONFORM TO THE REQUIREMENTS OF ALL APPLICABLE STATE AND/OR LOCAL CODES, LAWS, AMENDMENTS, ORDINANCES, INCLUDING ALL CODES LISTED IN THE APPLICABLE CODES SECTION.
3. DO NOT SCALE DRAWINGS.
4. FIELD VERIFY ALL DIMENSIONS PRIOR TO START OF WORK.
5. CONTACT THE ARCHITECT FOR DETERMINING A REQUIRED DIMENSION THAT CANNOT BE OBTAINED BASED ON DRAWING INFORMATION, BEFORE PROCEEDING WITH THE WORK.
6. WHERE DISCREPANCIES OCCUR BETWEEN FLOOR PLANS, DETAILS, AND LARGE SCALE PLANS, OR WHERE DISCREPANCIES OCCUR BETWEEN ARCHITECTURAL DRAWINGS AND ENGINEERING DRAWINGS, CONTACT THE ARCHITECT FOR CLARIFICATION BEFORE PROCEEDING WITH THE WORK.
7. CONSTUCTION JOINTS ARE LOCATED AT THE EXTERIOR STAIR AND BRIDGE. SEE DRAWINGS FOR MORE INFORMATION.
8. THE CONTRACTOR SHALL INSTALL OWNER FURNISHED EQUIPMENT IDENTIFIED AS "GFCI" IN THE EQUIPMENT SCHEDULES.
9. THE OWNER IS INSTALLING OWNER FURNISHED EQUIPMENT IDENTIFIED AS "GFGI" IN THE EQUIPMENT SCHEDULES.
10. THE CONTRACTOR SHALL FURNISH AND INSTALL EQUIPMENT IDENTIFIED AS "CFCI" IN THE EQUIPMENT SCHEDULES.
11. REFERENCE THE DRAWING SERIES LEGEND FOR INFORMATION CONTAINED IN EACH ARCHITECTURAL DRAWING SERIES.
12. THE RELATIVE DESIGN REFERENCE ELEVATION OF +0'-0", AS INDICATED ON THE DRAWINGS, CORRESPONDS TO THE FINISH FLOOR ELEVATION OF THE FLOOR IN QUESTION.

AECOM

PROJECT

NEW SECURITY FORCES BUILDING

PAYNE BLVD.
CHARLOTTE, NORTH CAROLINA 28208

CLIENT

NORTH CAROLINA AIR NATIONAL GUARD - 145TH AIRLIFT WING

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4930 MINUTEMAN WAY
CHARLOTTE, NORTH CAROLINA 28208

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CONSULTANTS

REGISTRATION

KEY PLAN

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	07-01-2026	ADDENDUM 01
	5/30/2025	B-3 SUBMITTAL - FINAL

PROJECT NUMBER

60637899
FJRP229030

SHEET TITLE

ABBREVIATIONS, LEGENDS, & SHEET INDEX

SHEET NUMBER

G001

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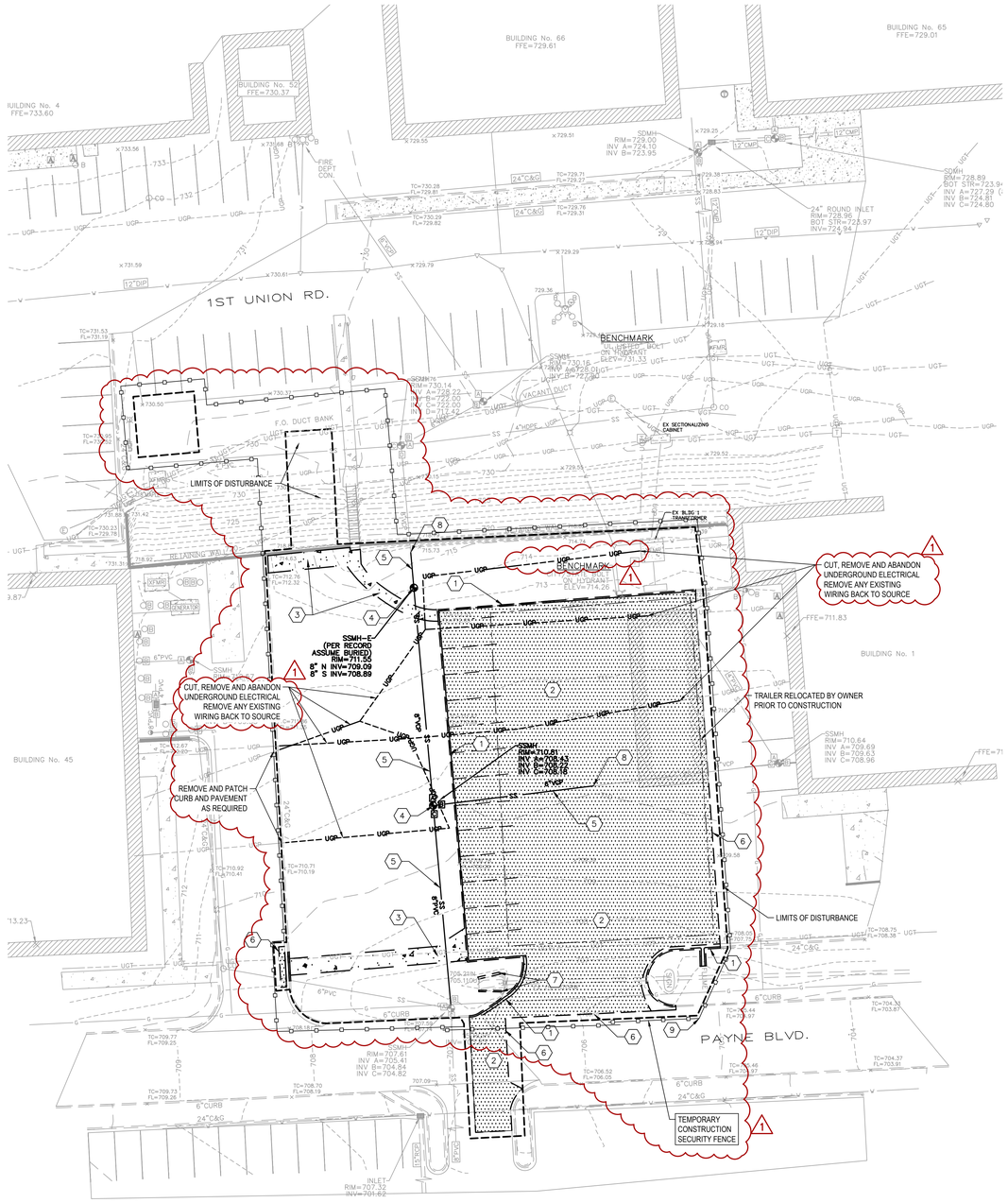

SITE REMOVAL NOTES

1. CONTRACTOR SHALL VERIFY EXISTING CONDITIONS PRIOR TO CONSTRUCTION. ANY DISCREPANCIES FOUND ARE TO BE BROUGHT TO THE ENGINEER'S ATTENTION PRIOR TO COMMENCEMENT OR CONTINUATION OF CONSTRUCTION ACTIVITIES.
2. CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE DIVISION OF INDUSTRIAL REGULATIONS (OSHA) SAFETY STANDARDS. IF REQUESTED BY THE INSPECTOR, THE CONTRACTOR SHALL PROVIDE PROOF OF A PERMIT FROM SAID DIVISION.
3. CONTRACTOR SHALL NOTIFY THE CONTRACTING OFFICER AND/OR CONTRACTING OFFICER REPRESENTATIVE 48 HOURS PRIOR TO COMMENCING CONSTRUCTION AND 24 HOURS IN ADVANCE OF SPECIFIC INSPECTION NEEDS DURING THE COURSE OF THE WORK. ALL WORK SHALL BE PERFORMED DURING NORMAL WORKING HOURS. WHERE OVERTIME INSPECTION IS NEEDED, SUBJECT TO THE AVAILABILITY OF AN INSPECTOR, AND APPROVED BY THE ENGINEER, THE CONTRACTOR WILL BE BILLED FOR SAID INSPECTION SERVICES AS PROVIDED IN THE MOST RECENTLY ADOPTED RESOLUTION WHICH ESTABLISHES THE FEES FOR SUCH SERVICES.
4. UTILITY LOCATIONS AND DEPTHS SHOWN HEREON HAVE BEEN PLOTTED IN ACCORDANCE WITH DATA FURNISHED BY THE UTILITY COMPANIES, THE MUNICIPALITIES, AND A SITE SURVEY. ANY DISCREPANCIES DISCOVERED IN THE FIELD DURING CONSTRUCTION THAT HAVE AN IMPACT ON THE DESIGN INTENT ARE TO BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING ALL PUBLIC AND PRIVATE PROPERTY INSOFAR AS IT MAY BE AFFECTED BY THESE OPERATIONS. ALL COSTS FOR PROTECTING, REMOVING, AND RESTORING EXISTING IMPROVEMENTS SHALL BE BORNE, SOLELY, BY THE CONTRACTOR.
6. CONSTRUCTION WORK ZONE TRAFFIC SIGNS AND STRIPING SHALL BE FURNISHED, INSTALLED, AND MAINTAINED IN ACCORDANCE WITH APPLICABLE REGULATORY AGENCIES HAVING JURISDICTION. A TRAFFIC CONTROL PLAN, PREPARED BY THE CONTRACTOR, MAY BE REQUIRED BY THE CONTRACTING OFFICER AND/OR CONTRACTING OFFICER REPRESENTATIVE. "CONSTRUCTION AHEAD" WARNING SIGNS ARE TO BE INSTALLED ALONG ADJACENT DRIVEWAYS OR ROADS. FLASHERS WITH CAUTION TAPE ARE TO BE INSTALLED WHERE ANY CONSTRUCTION ACTIVITY CROSSES A SIDEWALK OR PEDESTRIANS PATH IN ACCORDANCE WITH THE SPECIFICATIONS AND ANY/ALL LOCAL REGULATIONS.
7. NO STOPPING, PARKING, OR STORING OF CONSTRUCTION MATERIALS IN THE PUBLIC STREETS OR ANY DRIVEWAY.
8. CONTRACTOR SHALL CONTACT NC811 AT 1-800-632-4949, AT LEAST 3 WORKING DAYS PRIOR TO THE COMMENCEMENT OF CONSTRUCTION ACTIVITIES TO SCHEDULE THE MARKING OF EXISTING UTILITY LOCATIONS. CONTRACTOR RESPONSIBLE FOR LOCATE PRIVATE UTILITIES LINES.
9. CONTRACTOR SHALL REMOVE, ABANDON IN PLACE, ADJUST OR RECONSTRUCT EXISTING UNDERGROUND PUBLIC & PRIVATE INFRASTRUCTURE INCLUDING WATER MAIN, SANITARY SEWER AND STORM SEWER WITHIN THE PROJECT AREA.
10. EXISTING BELOW GROUND UTILITIES TO REMAIN SHALL BE LOCATED BY THE CONTRACTOR, INCLUDING HAND EXCAVATION AND OTHER MEANS NECESSARY, PRIOR TO CONSTRUCTION.
11. UTILITY STRUCTURES WITHIN REMOVAL BOUNDARY TO REMAIN SHALL BE RAISED OR LOWERED TO MATCH FINISHED GRADE. REFER TO SHEET C301 FOR GRADES. THIS INCLUDES, BUT IS NOT LIMITED TO, SANITARY, STORM, WATER, ELECTRICAL, TELECOM STRUCTURES, GATE VALVE BOXES, & HAND HOLES.
12. ELECTRICAL & TELECOM UTILITIES SERVICING ITEMS TO REMAIN SHALL BE FIELD VERIFIED & RELOCATED, AS NECESSARY, PRIOR TO DEMOLITION SUCH THAT THE OWNER DOES NOT EXPERIENCE ANY "OUTAGES" OR "FAILURES" WITH THEIR INTERNAL ELECTRICAL, TELEPHONE, SECURITY OR COMPUTER SYSTEMS. DAMAGE TO ANY OF THESE UNDERGROUND UTILITIES OR ELECTRICAL SYSTEMS SHALL RESULT IN THE CONTRACTOR HAVING TO MAKE THE NECESSARY REPAIRS TO THE OWNER'S SATISFACTION & AT NO COST TO THE OWNER.
13. COORDINATE ALL ELECTRICAL, GAS, AND TELECOM UTILITY REMOVAL/RELOCATION WITH APPROPRIATE UTILITY COMPANY.
14. UNDERGROUND SERVICE UTILITIES SHOWN TO BE REMOVED SHALL BE DONE SO ENTIRELY WITH THE REMAINING PORTIONS TO BE CAPPED/BULKHEADED (WHEN APPLICABLE) PER CITY/MUNICIPAL/UTILITY COMPANY STANDARDS.
15. CONCRETE WALKS & CURB & GUTTER SHOWN TO BE REMOVED SHALL BE DONE SO TO FULL DEPTH & SHALL BE SAWCUT AT THE NEAREST EXISTING JOINT.
16. CONCRETE & BITUMINOUS PAVEMENT AREAS SHOWN TO BE REMOVED SHALL BE DONE SO TO FULL DEPTH & SHALL BE SAWCUT ALONG THE REMOVAL BOUNDARY UNLESS OTHERWISE NOTED.
17. EXISTING TRAFFIC SIGNS ARE NOT TO BE REMOVED WITHOUT PRIOR NOTIFICATION AND APPROVAL OF THE CONTRACTING OFFICER OR CONTRACTING OFFICER'S REPRESENTATIVE. ANY SIGNS DAMAGED DURING CONSTRUCTION ACTIVITY SHALL BE REPLACED TO THE GOVERNMENT'S SATISFACTION, AT THE CONTRACTOR'S EXPENSE.
18. CONTRACTOR SHALL PROVIDE TRAFFIC CONTROL MEASURES AND PEDESTRIAN DETOUR SIGNAGE.
19. CONTRACTOR SHALL PROVIDE TEMPORARY SANITARY SEWER BYPASS DURING REMOVAL OF SANITARY SEWER AND CONSTRUCTION OF NEW SANITARY SEWER. SEE SANITARY SEWER LAYOUT ON UTILITY PLAN SHEET.

REMOVAL LEGEND

- CURB AND GUTTER REMOVAL
- ASPHALT PAVEMENT REMOVAL
- CONCRETE PAVEMENT REMOVAL
- LIMITS OF DISTURBANCE
- SANITARY SEWER REMOVAL
- UGP — UNDERGROUND POWER REMOVAL, REFER TO ELECTRICAL PLANS
- SANITARY MANHOLE REMOVAL
- LAYDOWN AREA
- TEMPORARY CONSTRUCTION PERIMETER FENCE

CODED NOTES

1. REMOVE CURB & GUTTER INCLUDING UNDERLYING BASE
2. FULL DEPTH ASPHALT PAVEMENT REMOVAL INCLUDING UNDERLYING BASE
3. CONCRETE SIDEWALK REMOVAL INCLUDING UNDERLYING BASE
4. REMOVE SANITARY SEWER MANHOLE
5. REMOVE SANITARY SEWER PIPE
6. SAWCUT PAVEMENT FULL DEPTH
7. REMOVE CONCRETE WINGWALL AS NEEDED TO INSTALL WATER MAIN
8. TEMPORARY PROTECT AND/OR PLUG EXISTING UTILITY LINE
9. TEMPORARY CONSTRUCTION PERIMETER FENCE PER SPEC SECTION 01 50 00

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KEY PLAN

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	07/01/26	ADDENDUM 01
	05/30/25	B-3 SUBMITTAL - FINAL

PROJECT NUMBER
60637899
FJRP229030

SHEET TITLE
DEMOLITION PLAN

SHEET NUMBER
C001

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08-ARCHITECTURE-A300-BUILDING SECTIONS ARCH E1 30"x42"
Project Management Initials: Designer: MCL Checked: GHF Approved: JRO
Last Plotted: 6/29/2026 3:26:33 PM
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08-ARCHITECTURE-A300-BUILDING SECTIONS
Designer: MCL Checked: GHF Approved: JRO ARCH E1 30"x42"
Project Management Initials:

UTILITY CROSSING TABLE

(A) PROPOSED 2" ELECTRIC TO CROSS OVER
PROPOSED 12" STRM
GRADE EL: 711.00'
ELECTRIC BO 707.50'
STRM TOP: 706.50'
CLEARANCE: 1.00'

(B) PROPOSED 8" SSWR TO CROSS OVER
PROPOSED 12" STRM
GRADE EL: 711.00'
SSWR BOT: 709.02'
STRM TOP: 706.14'
CLEARANCE: 2.88'

(C) EXISTING 6" SSWR TO CROSS OVER
PROPOSED 12" STRM
GRADE EL: 710.10'
SSWR BOT: 708.54'
STRM TOP: 705.67'
CLEARANCE: 2.87'

(D) PROPOSED 2" ELECTRIC TO CROSS OVER
PROPOSED 6" WATR
GRADE EL: 711.15'
ELECTRIC BO 707.98'
WATR TOP: 706.90'
CLEARANCE: 1.08'

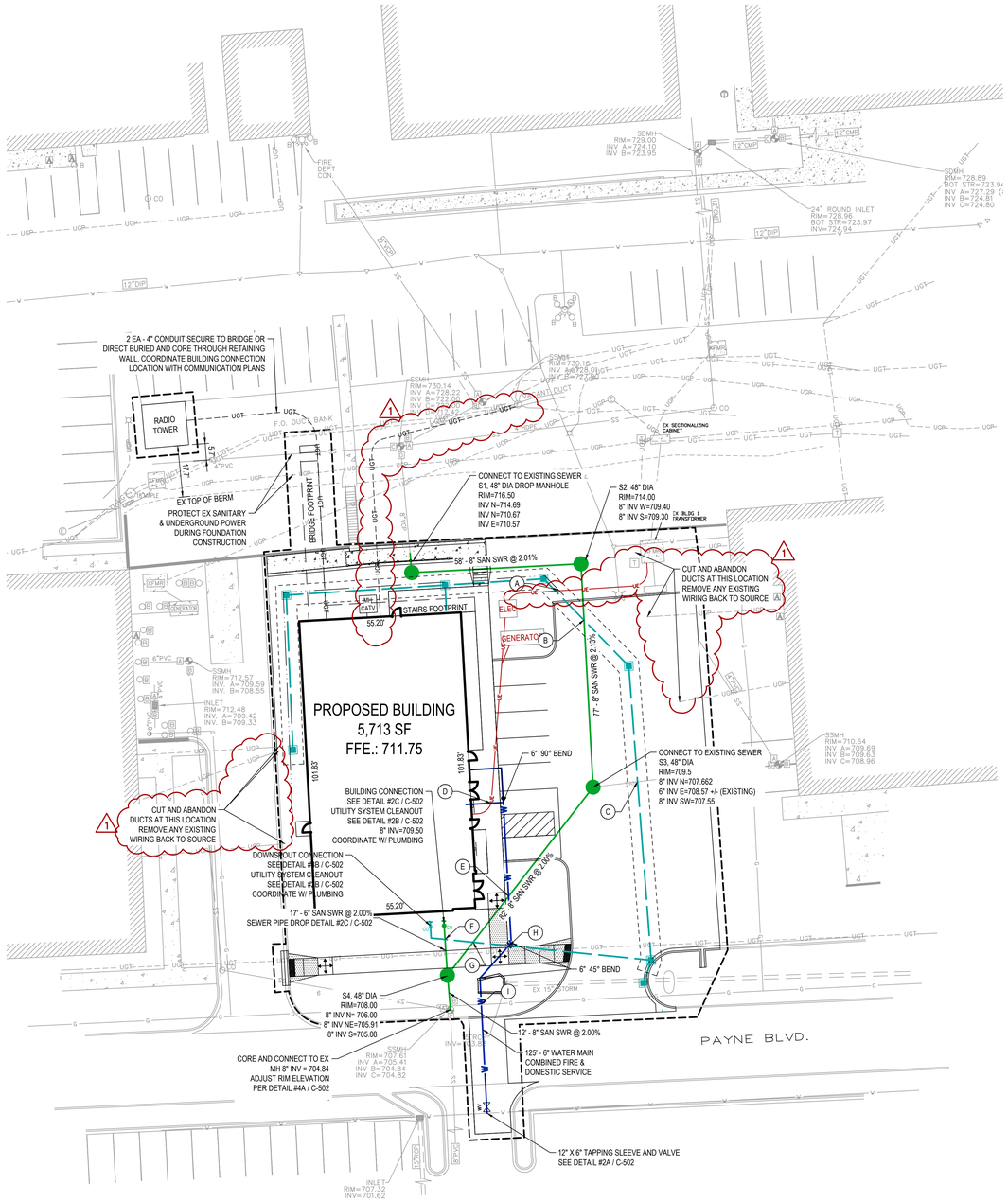
(E) PROPOSED 8" SSWR TO CROSS OVER
PROPOSED 6" WATR
GRADE EL: 711.22'
SSWR BOT: 706.69'
WATR TOP: 705.10'
CLEARANCE: 1.59'

(F) PROPOSED 6" STRM TO CROSS OVER
PROPOSED 8" SSWR
GRADE EL: 710.00'
STRM BOT: 707.47'
SSWR TOP: 705.91'
CLEARANCE: 1.56'

(G) PROP.6" STRM TO CROSS OVER
PROP.8" SSWR
GRADE EL: 710.00'
STRM BOT: 706.97'
SSWR TOP: 705.96'
CLEARANCE: 1.01'

(H) PROPOSED 6" STRM TO CROSS OVER
PROPOSED 6" WATR
GRADE EL: 710.60'
STRM BOT: 706.01'
WATR TOP: 704.10'
CLEARANCE: 1.91'

(I) PROPOSED 6" WATR TO CROSS OVER
EXISTING 6" GAS
GRADE EL: 707.10'
WATR BOT: 703.53'
GAS TOP: 701.00'
CLEARANCE: 2.52'



SITE UTILITY NOTES

1. PRIOR TO PROCEEDING WITH UTILITY CONSTRUCTION, CONTRACTOR SHALL UNCOVER ALL EXISTING UTILITIES TO REMAIN AND REPORT TOP OF PIPE ELEVATION TO OWNER AND ENGINEER.
2. CONTRACTOR SHALL ADJUST ALL UNDERGROUND STRUCTURES AND CORRESPONDING SURFACE FEATURES TO PROPOSED GRADES IN ACCORDANCE WITH THE SPECIFICATIONS.
3. COMMUNICATIONS & ELECTRICAL CONDUITS, PLACEMENT OF ELECTRICAL LIGHT POLES, AND LOCATION OF COMMUNICATION & ELECTRICAL SURFACE FEATURES ARE SHOWN FOR REFERENCE ONLY. CONTRACTOR SHALL COORDINATE THESE UTILITIES WITH ELECTRICAL AND TELECOMMUNICATION DRAWINGS.
4. CONTRACTOR SHALL COORDINATE PLACEMENT OF ALL ELECTRICAL/ COMMUNICATION AND IRRIGATION CONDUITS & HAND HOLES AS SHOWN ON ELECTRICAL AND IRRIGATION DRAWINGS.
5. CONTRACTOR SHALL REFER TO PLUMBING DRAWINGS FOR BUILDING CONNECTIONS.
6. ALL PERFORATED STORM PIPE, STORM UNDERDRAIN, BELL AND SPIGOT ENDS AS CALLED OUT ON THE PLANS SHALL COMPLY WITH ASTM F2306 AND ASTM F2648.
7. ALL MANHOLE STRUCTURE JOINTS WITH PIPES SHALL HAVE MANHOLE WATERSTOP CONSISTING OF A CONNECTOR CONFORMING TO ASTM C923.
8. ALL BUILDING FOOTING UNDERDRAINS SHALL BE RIGID, PERFORATED PVC PIPE.
9. MANHOLE NORTHING AND EASTING IDENTIFIES CENTERLINE OF PIPE AND MANHOLE STRUCTURE. CONTRACTOR SHALL ASSURE THAT MANHOLES WITH ECCENTRIC CONES ARE ADJUSTED AS NECESSARY TO ASSURE THAT THE CASTING IS INSTALLED PER PLAN.
10. FOR STORM CATCH BASINS (CB), REFER TO DETAILS 1A/C502.
11. FOR STORM MANHOLES (MH), REFER TO DETAIL 1B/C502.
12. STORM MANHOLE CASTINGS SHALL BE AS FOLLOWS:
    - STORM MANHOLE CASTINGS AND COVERS SHALL BE EJIW #1040 WITH TYPE "A" SOLID COVER LABELED "STORM".
    - STORM CATCH BASIN CASTINGS AND GRATES IN 6" BARRIER CURB AND GUTTER (PUBLIC STREETS) SHALL BE EJIW #7045 FRAME WITH TYPE M1 GRATE AND T1 BACK.
    - STORM CATCH BASIN CASTINGS AND GRATES IN PAVED SUMP AREAS SHALL BE EJIW #1040 WITH TYPE "M" FLAT GRATE LABELED "STORM".
    - STORM CATCH BASIN CASTINGS AND GRATES IN LANDSCAPED SUMP AREAS SHALL BE EJIW #1000 WITH TYPE "M" GRATE.
16. CONTRACTOR SHALL CLEAN ALL ON-SITE STORM DRAIN PIPE & BASINS PRIOR TO CLOSE OF CONSTRUCTION WITHIN LIMITS OF DISTURBANCE.
17. FOR ALL WATERMAIN VALVES AND VALVE BOXES REFER TO DETAIL 2A/C502, TYPICAL VALVE BOX INSTALLATION.
18. CONTRACTOR WILL FURNISH TAPPING SLEEVE , WITH A FULL-OPEN DOUBLE DISC GATE TAPPING VALVE AND BOX. THE CONTRACTOR WILL INSTALL AND PRESSURE TEST THE SLEEVE.
19. CONTRACTOR SHALL COORDINATE WITH CONTRACTING OFFICER OR CONTRACTING OFFICER'S REPRESENTATIVE PRIOR TO SHUT-DOWN OF ANY WATER LINE.
20. FOR ALL UTILITY CROSSING, 10 FEET OF NO JOINT IN ANY DIRECTION IS REQUIRED.
21. TRENCHING FOR PROPOSED UNDERGROUND UTILITIES SEE DETAILS 3C AND 3D ON SHEET C-502.

PROPOSED UTILITY LEGEND

- WATER LINE
- SANITARY SEWER LINE
- ELECTRIC LINE
- TELECOMMUNICATIONS DUCTBANK
- STORM LINE (WITH 6" PERFORATED UNDERDRAIN UNDER PAVEMENT)
- VEGETATED SWALE
- PROPOSED PIV

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PROJECT NUMBER
60637899
FJRP229030

SHEET TITLE
UTILITY PLAN

SHEET NUMBER
C201

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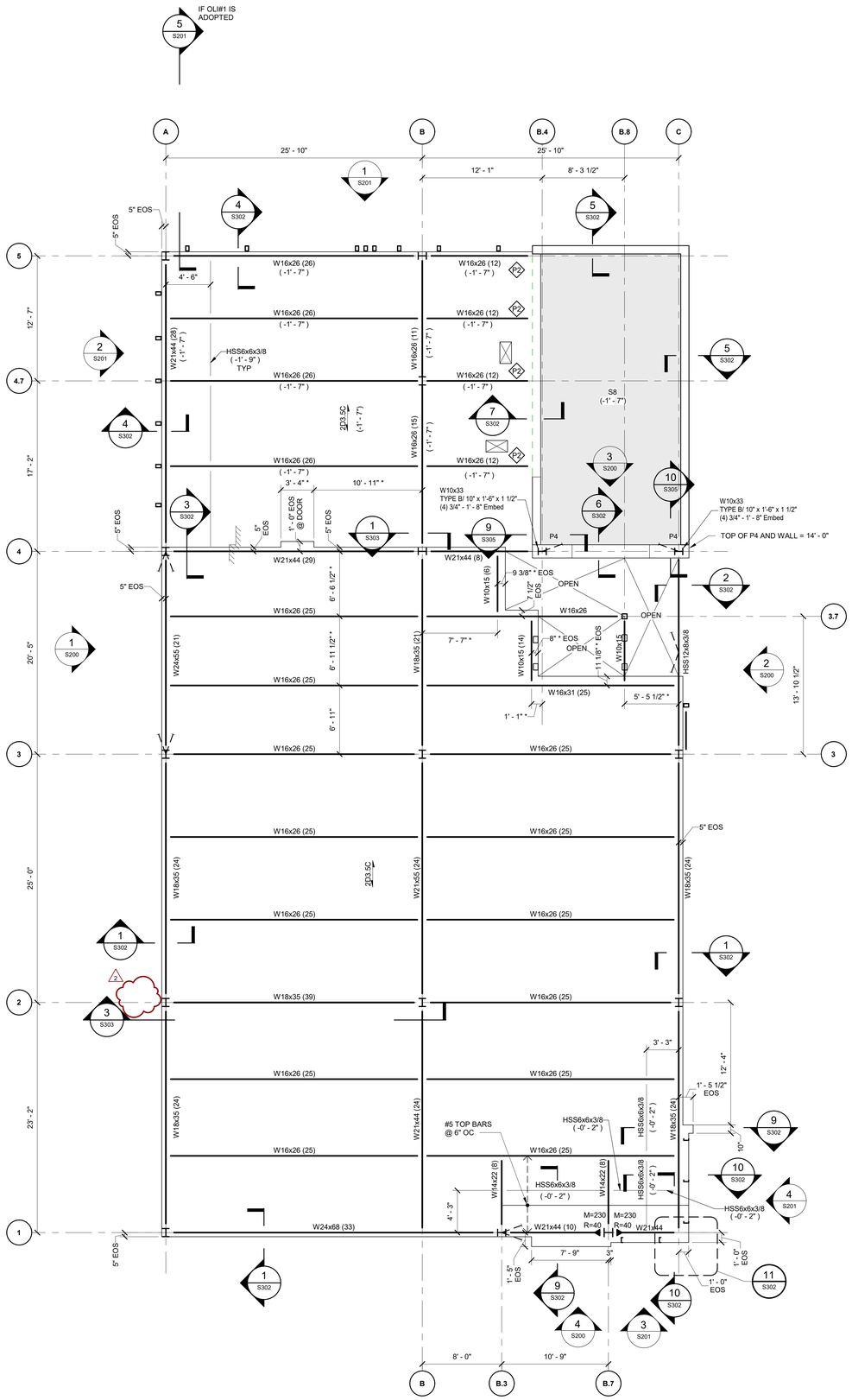

1 | SECOND FLOOR FRAMING PLAN
S102 | Scale: 3/16" = 1'-0"

SECOND FLOOR STEEL FRAMING PLAN NOTES:

1. FLOOR CONSTRUCTION:
   A. FLOORS LABELED AS 2D3.5C = 3 1/2" CONCRETE SLAB WITH 4.5LB/CY SYNTHETIC MACRO-FIBER REINFORCING ON 2"x 20 GAGE GALVANIZED COMPOSITE STEEL DECK WELDED TO SUPPORT STEEL. TOTAL SLAB THICKNESS = 5 1/2".
   B. SHADED FLOOR REGIONS LABELED AS S8 ON PLAN INDICATE 8" THICK CONCRETE SLAB WITH #6 @ 8" OC TOP AND BOTTOM EA WAY REINF.
2. TYPICAL ELEVATIONS, UNO:
   A. TOP OF STEEL REFERENCE ELEVATION = 13' - 6 1/2" UNLESS NOTED THUS (± ##' - ##"), WHICH INDICATES CHANGE IN ELEVATION FROM TOP OF STEEL REFERENCE ELEVATION.
   B. TOP OF SLAB REFERENCE ELEVATION = 14' - 0" UNLESS NOTED THUS (± ##' - ##"), WHICH INDICATES CHANGE IN ELEVATION FROM TOP OF SLAB REFERENCE ELEVATION.
3. BEAMS ARE UNIFORMLY SPACED BETWEEN COLUMNS OR INTERSECTING GIRDERS UNO.
4. COORDINATE WITH ALL DRAWINGS FOR LOCATION OF OPENINGS, SLEEVES, AND UNDER FLOOR PIPES, CONDUITS, DRAINS, DEPRESSIONS, ETC.
5. CENTER OF MEP OPENINGS IN VAULT WALL SHALL BE PLACED AT MIDPOINT BETWEEN BEAMS. DO NOT CORE DRILL WALLS. SEE 9 / S007 FOR ALL OPENINGS IN WALL, INCLDING DOORS AND WINDOWS.
6. REFERENCES:
   A. ABBREVIATIONS - S001
   B. GENERAL STRUCTURAL NOTES - S002 & S003
   C. TYPICAL DETAILS - S007 THRU S011
   D. PIER DETAILS - S300
   E. VERTICAL BRACING ELEVATIONS - S200
   F. COLUMN BASE PLATE DETAILS - S300

FRAMING PLAN LEGEND:

	INDICATES STEP OR CHANGE IN SLAB ELEVATION. SEE SECTION.
S#	INDICATES ROOF/FLOOR CONSTRUCTION. SEE SCHEDULE.
	INDICATES FRAMED OPENING. COORDINATE SIZE AND LOCATION WITH MECHANICAL AND ARCHITECTURAL REQUIREMENTS AND DRAWINGS.
	INDICATES MOMENT CONNECTION ON PLAN. MOMENT CONNECTION SYMBOLS WITH THE LETTER "NS" BESIDE IT INDICATES A MOMENT CONNECTION THAT DOES NOT REQUIRE COLUMN STIFFENER PLATES.
	INDICATES SLAB OR DECK SPAN DIRECTION.
*	INDICATES DIMENSION TO BE COORDINATED WITH OTHER DISCIPLINES AND/OR EQUIPMENT MANUFACTURER.
P#9	INDICATES EMBED PLATE LABEL, SEE 13 / S009 SEE RELEVANT SECTIONS FOR EMBED PLATES NOT LABELED ON PLAN.

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60637899
FJRP229030

SHEET TITLE

STRUCTURAL SECOND FLOOR FRAMING PLAN

SHEET NUMBER

S102

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Checked: PA
Designer: AA
Project Management Initials: MR
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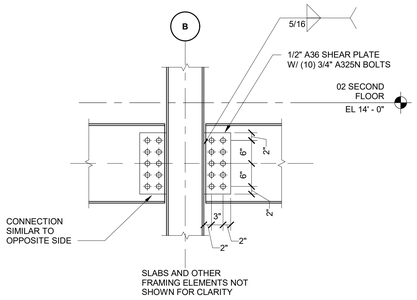
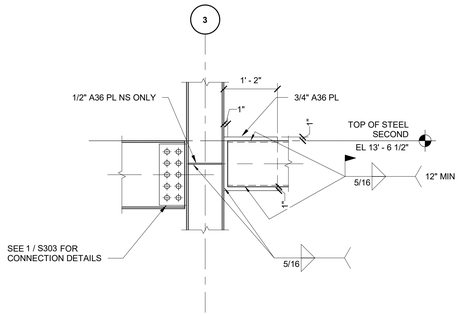


1 S303 — **SECTION**
Scale: 3/4" = 1'-0"



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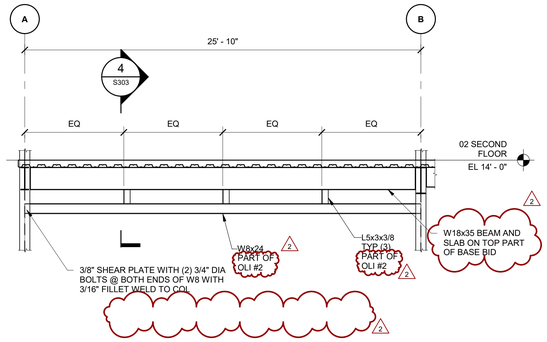
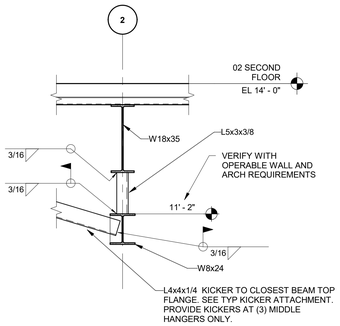


3 S303 — **OPERABLE WALL SUPPORT FRAMING**
Scale: 1/4" = 1'-0"



4 S303 — **SECTION**
Scale: 3/4" = 1'-0"

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STRUCTURAL DETAILS

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S303

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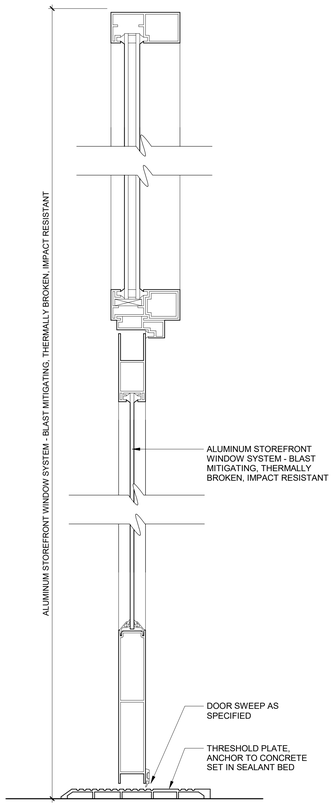
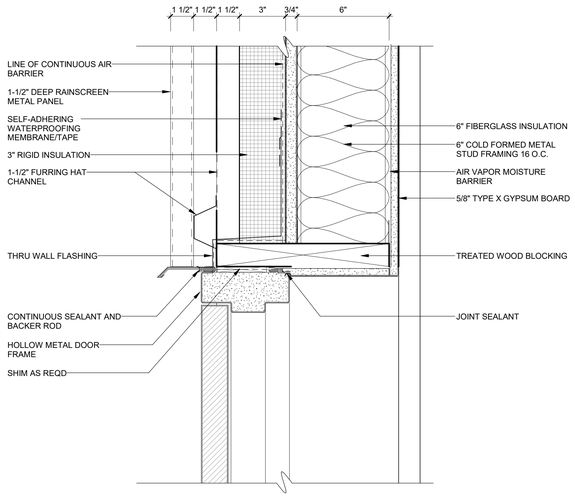


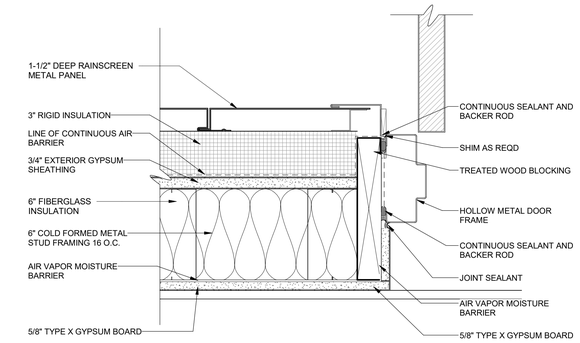
7 HEAD & SILL - EXTERIOR STOREFRONT
Scale: 3" = 1'-0"



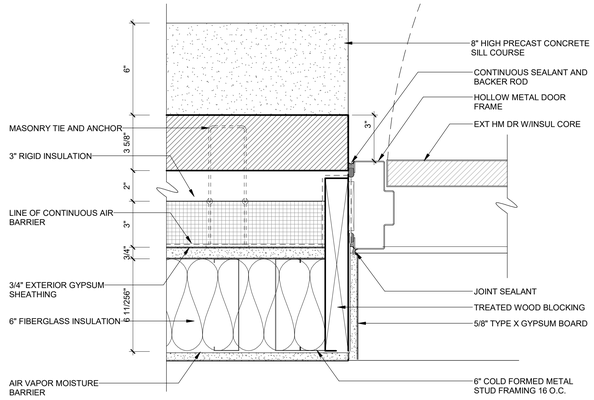
6 HEAD DETAIL - EXTERIOR HOLLOW METAL DOOR (METAL PANEL)
A321
Scale: 3" = 1'-0"

DOOR SCHEDULE

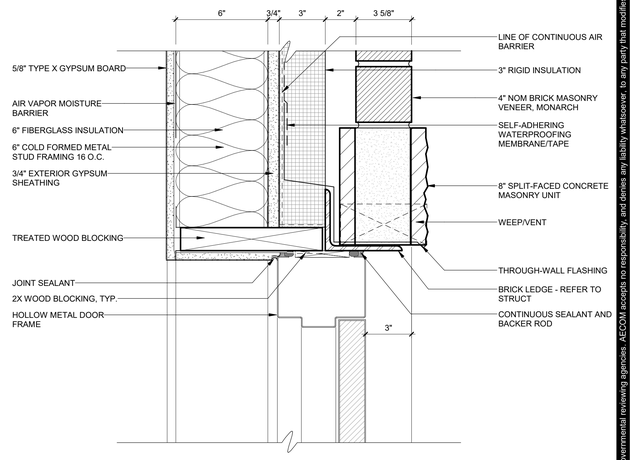
MARK	ROOM NAME	DOOR SIZE W	DOOR SIZE H	DOOR MATERIAL	DOOR TYPE	DOOR GLAZING	FRAME MATERIAL	FRAME TYPE	FRAME DETAIL HEAD	FRAME DETAIL JAMB	FRAME DETAIL SILL	FIRE RATING LABEL	HARDWARE SET	COMMENTS
100A	VEST	6' - 0"	7' - 4 3/4"	ALUM./GLASS	FG2	TEMPERED	ALUM./GLASS		7/A680	8/A680	7/A680		01	
100B	VEST	3' - 0"	7' - 0"	HM	F		HM	1	1/A680	2/A680			02	ELECTRIFIED
101	ID ENTRY	3' - 0"	7' - 0"	ALUM	F		HM	1	1/A680	2/A680			03	ELECTRIFIED
102A	ACTIVE TRAINING	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			04	
102C	TRAINING	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			04	
103	PASS ID	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			05	ELECTRIFIED
104	PPE STO/WEAPONS CLEANING	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			06	
105	ELEC ROOM	3' - 0"	7' - 0"	HM	F		HM	2	3/A680	4/A680			07	ELECTRIFIED
107	MECH ROOM	6' - 0"	7' - 0"	HM	F2		HM	2	3/A680	4/A680			08	ELECTRIFIED
108A	STAIR	3' - 0"	7' - 2"	HM	F		HM	1	3/A680	4/A680		45 MINUTE	09	ELECTRIFIED
108B	STAIR	3' - 0"	7' - 0"	HM	F		HM	1	1/A680	2/A680		45 MINUTE	10	
109	HOUSE KEEPING	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			11	
110	MENS	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			12	
111	WOMENS	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			12	
112	WEAPONS VAULT	3' - 0"	7' - 0"	HM	F		HM	2	3/A680	4/A680			05	ELECTRIFIED, CLASS 5 VAULT DOOR, S&G 2937 MECHANICAL LOCK
113	LOCKERS	3' - 0"	7' - 0"	HM	F		HM	2	3/A680	4/A680			13	ELECTRIFIED
114	COMMUNICATIONS ROOM	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			05	ELECTRIFIED
115	BDOC	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			05	ELECTRIFIED
115A	UNISEX TOILET	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			16	
200	CONF. ROOM	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			14	
201	COMMANDER	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			15	
202	EXECUTIVE OFFICER	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			15	
203	FIRST SERGEANT	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			15	
204	SECURITY MGR/INVEST S2	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			15	
205	SECURITY FORCES MGR	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			15	
206	UNISEX TOILET	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			16	
208	PRINT/COPY/ ELEV.EQ.RM.	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			14	
210A	VEST	3' - 0"	7' - 0"	WD.	F		HM	1	6/A680	5/A680			17	ELECTRIFIED
210B	VEST	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			18	ELECTRIFIED
211	QC/STAN/ EVAL/ TESTING	3' - 0"	7' - 0"	WD.	F		HM	1	1/A680	2/A680			15	
212	STAIR	3' - 0"	7' - 0"	HM	F		HM	1	1/A680	2/A680		45 MINUTE	10	



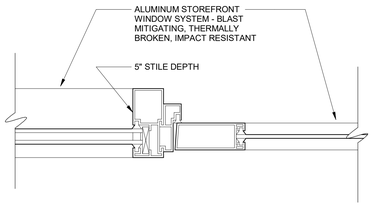
5 JAMB DETAIL - EXTERIOR HOLLOW METAL DOOR (METAL PANEL)
A502
Scale: 3" = 1'-0"



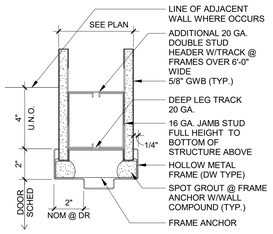
4 JAMB DETAIL - EXTERIOR HOLLOW METAL DOOR (BRICK)
A501
Scale: 3" = 1'-0"



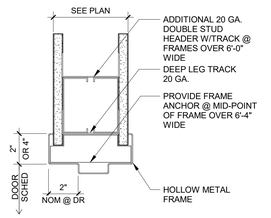
3 HEAD DETAIL - EXTERIOR HOLLOW METAL DOOR (BRICK)
A521
Scale: 3" = 1'-0"



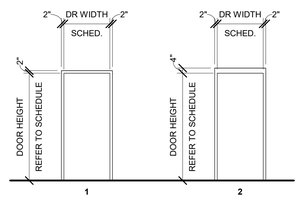
8 JAMB - EXTERIOR STOREFRONT
Scale: 3" = 1'-0"



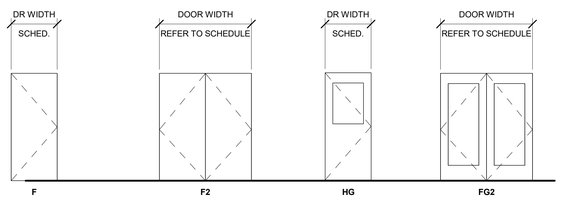
2 JAMB DETAIL - HOLLOW METAL DOOR
Scale: 3" = 1'-0"



1 HEAD DETAIL - HOLLOW METAL DOOR
Scale: 3" = 1'-0"



DOOR FRAME LEGEND
Scale: 1/4" = 1'-0"



DOOR PANEL LEGEND
Scale: 1/4" = 1'-0"

AECOM

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5/30/2025

KEY PLAN

ISSUE/REVISION

I/R	DATE	DESCRIPTION
1	07-01-2026	ADDENDUM 01
	5/30/2025	B-3 SUBMITTAL - FINAL

PROJECT NUMBER
60637899
FJRP229030

SHEET TITLE
DOOR SCHEDULE

SHEET NUMBER
A680

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15-ELECTRICAL-15.00-E001-ABBREVIATIONS, LEGENDS & GENERAL NOTES - ELECTRICAL
Project Management Initials: Designer: Designer Checker: Checker Approved: Approver4RCH E1 30"x42"

ELECTRICAL ABBREVIATIONS

NOTE: NOT ALL ABBREVIATIONS MAY BE USED.

ABBREVIATION	DESCRIPTION
1P	1 POLE (2P,3P,4P, ETC.)
1PH	SINGLE-PHASE
2/C	2 CONDUCTOR (3/C, 4/C, ETC.)
2W	2-WIRE (3W, 4W, ETC.)
3PH	THREE-PHASE
A	AMPERE
A/C	AIR CONDITIONING UNIT
A/E	ARCHITECT/ENGINEER
A/V	AUDIO / VISUAL
AC	ALTERNATING CURRENT
ACT	ABOVE COUNTERTOP
ADDL	ADDITIONAL
ADJ	ADJACENT, ADJOINING
ADO	AUTOMATIC DOOR OPENER
AF	AMPERE FRAME OR AMP FUSE
AFC	AVAILABLE FAULT CURRENT
AFCI	ARC FAULT CIRCUIT INTERRUPTER
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHJ	AUTHORITY HAVING JURISDICTION
AHU	AIR HANDLING UNIT
AIC	AMPERE INTERRUPTING CAPACITY
AL	ALUMINUM
ALT	ALTERNATE
AMB	AMBIENT
AMP	AMPLIFIER
APPROX	APPROXIMATELY
ARCH	ARCHITECT, ARCHITECTURAL
AT	AMPERE TRIP
ATS	AUTOMATIC TRANSFER SWITCH
AUTO	AUTOMATIC
AUX	AUXILIARY
AWG	AMERICAN WIRE GAUGE
BAT	BATTERY
BKR	BREAKER
BLDG	BUILDING
BMS	BUILDING MANAGEMENT SYSTEM
BYP	BYPASS
C	CONDUIT
CAP	CAPACITY
CAT	CATALOG
CATV	COMMUNITY ANTENNA TELEVISION
CB	CIRCUIT BREAKER
CCTV	CLOSED CIRCUIT TELEVISION
CD	CANDELA
CD	CONSTRUCTION DOCUMENTS
CFCI	CONTRACTOR FURNISHED, CONTRACTOR INSTALLED
CFOI	CONTRACTOR FURNISHED, OWNER INSTALLED
CKT	CIRCUIT
CLF	CURRENT LIMITING FUSE
CLG	CEILING
CMU	CONCRETE MASONRY UNIT
COAX	COAXIAL CABLE
COMB	COMBINATION
COMM	COMMUNICATION
CONC	CONCRETE
CONN	CONNECTION
CONST	CONSTRUCTION
CONT	CONTINUE, CONTINUATION
CONTR	CONTRACTOR
CPT	CONTROL POWER TRANSFORMER
CR	CRITICAL
CRI	COLOR RENDERING INDEX
CT	CURRENT TRANSFORMER
CTR	CENTER
CU	COPPER
DB	DUCTBANK
DBA	DECIBEL
DC	DIRECT CURRENT
DEG C	DEGREES CELSIUS
DEG F	DEGREES FAHRENHEIT
DEMO	DEMOLITION
DIA	DIAMETER
DIAG	DIAGRAM
DISC	DISCONNECT
DIST	DISTRIBUTION
DN	DOWN
DPDT	DOUBLE POLE, DOUBLE THROW
DPST	DOUBLE POLE, SINGLE THROW
DS	DISCONNECT SWITCH
DWG	DRAWING
E.O.	ELECTRICALLY OPERATED
EC	ELECTRICAL CONTRACTOR
EG	EQUIPMENT GROUND
EL	ELEVATION
ELEC	ELECTRIC, ELECTRICAL
EM	EMERGENCY
EMI	ELECTROMAGNETIC INTERFERENCE
EMT	ELECTRICAL METALLIC TUBING
EPMS	ELECTRICAL POWER MANAGEMENT SYSTEM
EPO	EMERGENCY POWER OFF
EWC	ELECTRIC WATER COOLER
EWH	ELECTRIC WATER HEATER
EXIST	EXISTING
EXP	EXPLOSION PROOF
FA	FIRE ALARM
FAAP	FIRE ALARM ANNUNCIATOR PANEL
FABP	FIRE ALARM BOOSTER POWER SUPPLY PANEL
FACP	FIRE ALARM CONTROL PANEL
FBO	FURNISHED BY OTHERS
FC	FOOTCANDLE
FCU	FAN COIL UNIT
FIXT	FIXTURE
FLA	FULL LOAD AMPS
FLEX	FLEXIBLE METALLIC CONDUIT
FLR	FLOOR
FLT	FLOODLIGHT
FLUOR	FLUORESCENT
FT	FEET OR FOOT
FU	FUSE
G/GRD/GND	GROUND
GA	GAUGE
GAL	GALLON
GC	GENERAL CONTRACTOR
GEN	GENERATOR
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GRC	GALVANIZED RIGID CONDUIT
GTB	GROUND TERMINAL BOX
HH	HANDHOLE
HOA	HAND-OFF-AUTOMATIC
HP	HORSEPOWER
HRG	HIGH RESISTANCE GROUND
HV	HIGH VOLTAGE
HVAC	HEATING, VENTILATING AND AIR CONDITIONING
HZ	HERTZ
I/O	INPUT / OUTPUT
ICCB	INSULATED CASE CIRCUIT BREAKER
IESNA	ILLUMINATION ENGINEERING SOCIETY OF NORTH AMERICA
IG	ISOLATED GROUND
IMC	INTERMEDIATE METAL CONDUIT
IR	INFRARED
J-BOX	JUNCTION BOX
kV	KILOVOLT
kV/H	KILOVOLT AMPERE PER HOUR
kVA	KILOVOLT AMPERE
kVAR	KILOVOLT AMPERE REACTIVE
kW	KILOWATT
kWH	KILOWATT HOUR
LAN	LOCAL AREA NETWORK
LCP	LIGHTING CONTROL PANEL

ELECTRICAL ABBREVIATIONS

NOTE: NOT ALL ABBREVIATIONS MAY BE USED.

ABBREVIATION	DESCRIPTION
LED	LIGHT EMITTING DIODE
LF	LINEAR FEET (FOOT)
LP	LIGHT POLE
LRA	LOCKED ROTOR AMPS
LRP	LIGHTING RELAY PANEL
LS	LIFE SAFETY
LSIG	LONG, SHORT, INSTANTANEOUS, GROUND
LTG	LIGHTING
LTNG	LIGHTNING
LV	LOW VOLTAGE
MAX	MAXIMUM
MC	METAL-CLAD
MCA	MINIMUM CIRCUIT AMPS
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MCCB	MOLDED CASE CIRCUIT BREAKER
MDP	MAIN DISTRIBUTION PANEL
MECH	MECHANICAL
MFR	MANUFACTURER
MH	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MLO	MAIN LUGS ONLY
MOCP	MAXIMUM OVERCURRENT PROTECTION
MSB	MAIN SWITCHBOARD
MT,MTD,MTG	MOUNT, MOUNTED, MOUNTING
MTR	MOTOR, MOTORIZED
MTS	MANUAL TRANSFER SWITCH
MV	MEDIUM VOLTAGE
MVA	MEGAVOLT-AMPERE
MW	MEGAWATT
N.C.	NORMALLY CLOSED
N.O.	NORMALLY OPEN
N/A	NOT APPLICABLE
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NEUT OR N	NEUTRAL
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NIC	NOT IN CONTRACT
NL	NIGHT LIGHT
NTS	NOT TO SCALE
OC	ON CENTER
OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
OFOI	OWNER FURNISHED, OWNER INSTALLED
OL	OVERLOAD
P	POLE
PA	PUBLIC ADDRESS
PB	PULL BOX, OR PUSHBUTTON
PF	POWER FACTOR
PH	PHASE
PIV	POST INDICATOR VALVE
PLC	PROGRAMMABLE LOGIC CONTROLLER
PNL	PANEL
PP	POWER POLE
PR	PAIR
PRI	PRIMARY
PT	POTENTIAL TRANSFORMER
PVC	POLYVINYL CHLORIDE (PLASTIC)
PWR	POWER
QTY	QUANTITY
RCP	REFLECTED CEILING PLAN
RCPT	RECEPTACLE
RGS	RIGID GALVANIZED STEEL
RMS	ROOT MEAN SQUARE
RTU	ROOF TOP UNIT
SA	SURGE ARRESTER
SCC	SHORT CIRCUIT CAPACITY
SEC	SECONDARY
SF	SQUARE FOOT (FEET)
SP	SPARE
SPD	SURGE PROTECTIVE DEVICE
SPEC	SPECIFICATION
SPST	SINGLE POLE, SINGLE THROW
STD	STANDARD
SW	SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
SYM	SYMMETRICAL
SYS	SYSTEM
T/C	TIME CLOCK
TL	TWIST LOCK
TR	TAMPER RESISTANT
TTB	TELEPHONE TERMINAL BOARD
TV	TELEVISION
TYP	TYPICAL
UC	UNDER COUNTER
UG	UNDERGROUND
UL	UNDERWRITERS LABORATORY
UNO	UNLESS NOTED OTHERWISE
UPS	UNINTERRUPTIBLE POWER SUPPLY
UTIL	UTILITY
V	VOLT, VOLTAGE
VA	VOLT AMPERE
VAR	VOLT AMPERE REACTIVE
VFD	VARIABLE FREQUENCY DRIVE
W	WATT
W/	WITH
W/O	WITHOUT
WG	WIRE GUARD
WH	WATER HEATER
WP	WEATHERPROOF
XFER	TRANSFER
XFMR	TRANSFORMER

LIGHTING PLAN SYMBOLS

NOTE: NOT ALL SYMBOLS MAY BE USED.

SYMBOL	DESCRIPTION
x $Y	WALL SWITCH WITH COVERPLATE, STANDARD MOUNTING HEIGHT 48" A.F.F. : x INDICATES SWITCH AND LUMINAIRE GROUPS, Y INDICATES THE FOLLOWING: BLANK =SINGLE POLE 2 =DOUBLE POLE (2-WAY) 3 =THREE POLE (3-WAY) 4 =FOUR POLE (4-WAY) D =DIMMER SWITCH T =TIMER SWITCH WP =WEATHERPROOF SWITCH
$3,D	WALL MOUNTED DIMMER SWITCH WITH "TRUE" 3-WAY DIMMING CAPABILITIES
$OS	WALL MOUNTED SENSOR, SINGLE SWITCHING CONTROL
$OSD	WALL MOUNTED SENSOR W/DIMMING
$LV	WALL MOUNTED LOW VOLTAGE MOMENTARY SWITCH
$LVD	WALL MOUNTED LOW VOLTAGE LIGHT SWITCH WITH ON/OFF AND RAISE/LOWER
OS	CEILING MOUNTED OCCUPANCY/VACANCY SENSOR
DS	CEILING MOUNTED DAYLIGHT SENSOR
	EMERGENCY BATTERY PACK (SEE FIXTURE SCHEDULE)
	WALL / CEILING MOUNTED EXIT SIGN (SEE FIXTURE SCHEDULE), DIRECIONAL ARROW(S) AS INDICATED ON PLANS, SHADED AREA INDICATES ILLUMINATED FACE(S).
	LIGHTING FIXTURES
	CEILING MOUNTED (SEE FIXTURE SCHEDULE).
	CEILING MOUNTED DOWNLIGHT (SEE FIXTURE SCHEDULE).
	WALL MOUNTED (SEE FIXTURE SCHEDULE).
	LIGHTING FIXTURE ON CRITICAL BRANCH (HOSP.) OR OPTIONAL STANDBY (CLINIC)
N/L	LIGHTING FIXTURE ON LIFE SAFETY BRANCH (HOSP.) OR EMERGENCY (CLINIC). (N/L INDICATES NIGHT LIGHT)
	XX x,y — SWITCH CONTROL CIRCUIT NUMBER — # FIXTURE TYPE

ONE-LINE DIAGRAM SYMBOLS

NOTE: NOT ALL SYMBOLS MAY BE USED.

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
X, Y	DISCONNECT SWITCH X INDICATES SIZE, Y INDICATES NUMBER OF POLES IF OTHER THAN 3.	Z X Y	CIRCUIT BREAKER X INDICATES FRAME SIZE, Y INDICATES TRIP RATING, Z INDICATES NUMBER OF POLES IF OTHER THAN 3.
X, Z Y	FUSED SWITCH X INDICATES SWITCH SIZE, Y INDICATES FUSE SIZE, Z INDICATES NUMBER OF POLES IF OTHER THAN 3.	Z X LSI Y	DRAWOUT CIRCUIT BREAKER X INDICATES FRAME SIZE, Y INDICATES TRIP RATING, Z INDICATES NUMBER OF POLES IF OTHER THAN 3.
Y	TRANSFER SWITCH AMP RATING, NUMBER OF POLES, ETC. AS INDICATED OR SPECIFIED.	52 X Y	MEDIUM VOLTAGE DRAWOUT CIRCUIT BREAKER X INDICATES CT RATIO, Y INDICATES FRAME SIZE
	AUTOMATIC TRANSFER SWITCH WITH BYPASS ISOLATION. AMP RATING, NUMBER OF POLES, ETC. AS INDICATED OR SPECIFIED.		TRANSFORMER KVA, PRI & SEC VOLTAGE, K-RATING, ETC. AS INDICATED OR SPECIFIED. ISOLATION TRANSFORMER KVA, PRI & SEC VOLTAGE, K-RATING, ETC. AS INDICATED OR SPECIFIED.
	FUSED POTENTIAL TRANSFORMER		CURRENT TRANSFORMER
SA	SURGE ARRESTER (QUANTITY OF 3 U.N.O.)	X	FUSE X INDICATES SIZE
	EARTH GROUND	XX Y	MOTOR CONTROLLER: XX INDICATES TYPE, Y INDICATES NEMA SIZE (00,0,1,2,3,4,5, ETC.) NR= FULL VOLTAGE, NON-REVERSING STARTER R= FULL VOLTAGE, REVERSING STARTER SS = SOLID STATE STARTER VF= VARIABLE FREQUENCY DRIVE
AS	AMMETER SWITCH		
VS	VOLTMETER SWITCH		
GFP	GROUND FAULT PROTECTOR		
SPD	SURGE PROTECTIVE DEVICE		
EPO	EMERGENCY POWER OFF		
CP	CONTROL PANEL		
A	AMMETER		
DM	DIGITAL MULTIFUNCTION METER		
V	VOLTMETER		
W	WATT METER	K	KEYED INTERLOCK
G	GENERATOR	XXX	PANELBOARD
M	MOTOR (M=HP)		

POWER PLAN SYMBOLS

NOTE: NOT ALL SYMBOLS MAY BE USED.

SYMBOL	DESCRIPTION
X Y Z	NORMAL POWER DUPLEX RECEPTACLE WITH COVERPLATE, NEMA 5-20R, STANDARD MOUNTING HEIGHT 18" A.F.F. UNLESS OTHERWISE NOTED: X INDICATES CIRCUIT NUMBER, Y INDICATES NON-STANDARD MOUNTING HEIGHT, AND Z INDICATES THE FOLLOWING: COPY = COPIER; MTD 42" A.F.F. REF = REFRIGERATOR; MTD 48" A.F.F. T = TAMPER RESISTANT TV = TELEVISION; MTD 72" A.F.F. U = USB UC = UNDER COUNTER V = VENDING, MTD 48" A.F.F. WP = WEATHER PROOF XX" = MTD AT XX" AFF
	ABOVE COUNTER RECEPTACLE, MOUNT AT 4' UON.
	EMERGENCY DUPLEX RECEPTACLE, SAME NOTATION AS ABOVE.
	CRITICAL UPS DUPLEX RECEPTACLE, SAME NOTATION AS ABOVE.
	GFCI RECEPTACLE INSTALLED IN READILY ACCESSIBLE LOCATION, SAME NOTATION AS ABOVE.
	EMERGENCY GFCI RECEPT. INSTALLED IN READILY ACCESSIBLE LOCATION, SAME NOTATIONS AS ABOVE.
	CRITICAL UPS GFCI RECEPTACLE. INSTALLED IN READILY ACCESSIBLE LOCATION, SAME NOTATIONS AS ABOVE.
	DOUBLE DUPLEX RECEPTACLE , SAME NOTATION AS ABOVE.
	EMERGENCY DOUBLE DUPLEX RECEPTACLE, SAME NOTATION AS ABOVE.
	CRITICAL UPS DOUBLE DUPLEX RECEPTACLE, SAME NOTATION AS ABOVE.
	SIMPLEX RECEPTACLE, SAME NOTATION AS ABOVE.
	EMERGENCY SIMPLEX RECEPTACLE, SAME NOTATION AS ABOVE.
	CRITICAL UPS SIMPLEX RECEPTACLE, SAME NOTATION AS ABOVE.
	SPECIAL RECEPTACLE, SAME NOTATION AS ABOVE.
	EMERGENCY SPECIAL RECEPTACLE, SAME NOTATION AS ABOVE.
	CRITICAL UPS SPECIAL RECEPTACLE, SAME NOTATION AS ABOVE.
	COMBINATION ROOF MOUNTED LIGHT AND WEATHERPROOF RECEPTACLE
	FLOOR BOX WITH FLUSH MOUNTED DEVICE
	CEILING MOUNTED DUPLEX RECEPTACLE
J	JUNCTION BOX / EQUIPMENT CONNECTION
M	1-PHASE MOTOR CONNECTION
M	3-PHASE MOTOR CONNECTION
	MANUAL MOTOR STARTER, TOGGLE TYPE, WITH THERMAL OVERLOAD DEVICE
	MAGNETIC STARTER
	NON-FUSED DISCONNECT SWITCH
	FUSED DISCONNECT SWITCH, FUSE SIZE AS SHOWN
	COMBINATION MOTOR STARTER/DISCONNECT
	CONTROL STATION: SEE CONTROL DIAGRAMS OR PLAN SHEETS FOR TYPE AND QUANTITY OF DEVICES
	PANELBOARD (SIZED TO SCALE)
	POWER TRANSFORMER (SIZED TO SCALE)
	GROUND ROD
	GROUND BONDING POINT TO STEEL STRUCTURE, REBAR, PIPE, ETC.
	GROUNDING CONNECTION (TYPE AS SHOWN OR NOTED)
	UNDERGROUND OR UNDERSLAB CONDUIT
	BARE COPPER GROUND CONDUCTOR, SIZE AS SHOWN
	GROUND BAR
MH X	MANHOLE: X INDICATES TYPE AS FOLLOWS P = POWER MANHOLE T = TELECOMMUNICATIONS MANHOLE

FIRE ALARM SYMBOLS

NOTE: NOT ALL SYMBOLS MAY BE USED.

SYMBOL	DESCRIPTION
S	SMOKE DETECTOR
H	HEAT DETECTOR
F F	WALL / CEILING MOUNTED HORN/SPEAKER WITH STROBE
F F	WALL / CEILING MOUNTED FIRE ALARM STROBE
F F	WALL / CEILING MOUNTED HORN/SPEAKER
S S	WALL / CEILING MOUNTED FIRE ALARM SPEAKER
F	WALL MOUNTED FIRE ALARM CHIME WITH STROBE
F	WALL MOUNTED FIRE ALARM CHIME
F	WALL MOUNTED FIRE ALARM BELL
F	WALL MOUNTED MANUAL STATION
D	WALL MOUNTED MAGNETIC DOOR HOLDER
S	DUCT SMOKE DETECTOR
F	FLOW SWITCH
T	TAMPER SWITCH
D	DAMPER OPERATOR
FABP	FIRE ALARM BOOSTER POWER SUPPLY PANEL
FACP	FIRE ALARM CONTROL PANEL
FAAP	FIRE ALARM ANNUNCIATOR PANEL

DATA / SYSTEMS SYMBOLS

NOTE: NOT ALL SYMBOLS MAY BE USED.

SYMBOL	DESCRIPTION
	ROUGH-IN FOR DATA DEVICE MOUNTED AT 18" A.F.F., UNLESS NOTED OTHERWISE
	ROUGH-IN FOR PHONE MOUNTED AT 54" A.F.F., UNLESS NOTED OTHERWISE
	ROUGH-IN FOR PHONE/DATA DEVICE MOUNTED AT 18" A.F.F., UNLESS NOTED OTHERWISE
CR	ROUGH-IN FOR ACCESS CONTROL CREDENTIAL READER DEVICE MOUNTED AT 48" A.F.F., UNLESS NOTED OTHERWISE
DC	ROUGH-IN FOR ACCESS DOOR CONTACT
DS	ROUGH-IN FOR DOOR POSITION SWITCH
ES	ROUGH-IN FOR ELECTRIC STRIKE
IM	ROUGH-IN FOR INTERFACE MODULE
RX	ROUGH-IN FOR REQUEST TO EXIT DEVICE MOUNTED AT 48" A.F.F., UNLESS NOTED OTHERWISE
CCTV	ROUGH-IN FOR CCTV CAMERA DEVICE. COORDINATE MOUNTING HEIGHT WITH SYSTEM VENDOR PRIOR TO ROUGH-IN.

ELECTRICAL SHEET INDEX

SHEET NUMBER	Sheet Name
E001	ABBREVIATIONS, LEGENDS & GENERAL NOTES - ELECTRICAL
E002	ELECTRICAL SITE DEMOLITION PLAN
E003	ELECTRICAL SITE NEW WORK
E090	GROUNDING AND LIGHTNING PROTECTION PLANS
E101	POWER PLAN - LEVEL 1
E102	POWER PLAN - LEVEL 2
E201	LIGHTING PLAN - LEVEL 1
E202	LIGHTING PLAN - LEVEL 2
E203	PHOTOMETRIC CALCULATIONS
E501	ELECTRICAL DETAILS
E502	ELECTRICAL DETAILS
E503	ELECTRICAL DETAILS
E601	ELECTRICAL ONE-LINE DIAGRAM
E701	ELECTRICAL SCHEDULES
E702	ELECTRICAL PANEL SCHEDULES

WHERE NOT INDICATED ON THE PLANS, BRANCH CIRCUIT CONDUCTORS AND CONDUITS SHALL BE SIZED, AT MINIMUM, BASED ON THE SCHEDULE BELOW. BRANCH CIRCUIT LENGTH SHALL BE LIMITED TO 75'-0" WHERE POSSIBLE. THE WIRING FOR ANY BRANCH CIRCUIT EXCEEDING 75'-0" IN LENGTH SHALL BE UPSIZED TO MAINTAIN < 3% VOLTAGE DROP.

BRANCH CIRCUIT WIRING MINIMUM REQUIREMENTS

	WIRE SIZE (AWG)		CONDUIT SIZE	
OCPD SIZE	PHASE/NEUTRAL	GROUND	3W+GRD	4W+GRD
20A	#12	#12	3/4"	3/4"
30A	#10	#12	3/4"	3/4"
40A	#8	#10	3/4"	3/4"
55A	#6	#10	3/4"	1"
60A	#4	#10	1"	1-1/4"

ELECTRICAL GENERAL NOTES

1. THIS IS A STANDARD LEGEND SHEET. SOME SYMBOLS OR ABBREVIATIONS APPEAR ON THIS SHEET AND NOT ON PROJECT DRAWINGS.
2. UNLESS OTHERWISE INDICATED, MOUNTING ELEVATIONS ARE CENTERLINE ELEVATIONS.
3. CONDUIT HOMERUNS NOT OTHERWISE MARKED SHALL BE CONSIDERED 2#12 AND 1#12 GROUND IN 3/4" MIN. CONDUIT.
4. CIRCUITS ARE RATED FOR INDOOR OVERHEAD ROUTING. OBTAIN ENGINEER APPROVAL ON OPERATING FOR UNDERGROUND, TRAY, PLENUM AND ROOF-MOUNTED INSTALLATIONS. LIMIT VOLTAGE DROP TO 2% FOR FEEDERS AND 3% FOR BRANCH CIRCUITS.
5. CONTRACTOR SHALL NOT BE PERMITTED TO CONSOLIDATE INDIVIDUAL BRANCH CIRCUIT HOME RUNS EXCEPT AS FOLLOWS:
   A: WHEN SHOWN ON DRAWINGS
   B: WITH PRIOR WRITTEN APPROVAL BY THE ENGINEER
   C: ABOVE ACCESSIBLE CEILING NEAR PANEL.
   ALL 120V & 277V BRANCH CIRCUITS SHALL HAVE DEDICATED NEUTRAL CONDUCTORS. CONSOLIDATED HOMERUNS SHALL HAVE A MAXIMUM OF 3 SEPARATE PHASE CONDUCTORS.
6. WIRE AND CONDUIT SIZES AND QUANTITIES FOR FEEDERS AND BRANCH CIRCUITS WHICH ARE SHOWN ON ONE-LINE DIAGRAM APPLY TO PLAN SHEETS.
7. ALL WALL AND FLOOR PENETRATIONS FOR CONDUIT INSTALLATION SHALL BE PROPERLY SEALED AND FIRE STOPPED.
8. NEMA 1 UNLESS INDICATED OTHERWISE, 3R=NEMA 3R, 4X=NEMA 4X.
9. TRAVELERS FOR MULTIPLE LOCATION SWITCHING ARE NOT MARKED ON THE PLANS. CONTRACTOR SHALL PROVIDE QUANTITY OF CONDUCTORS REQUIRED FOR THE INDICATED SWITCHING.
10. CIRCUIT IDENTIFICATION SHALL BE AS FOLLOWS:
    A-2 INDICATES A CIRCUIT AT CIRCUIT 2 OF PANELBOARD A. REFER TO PANEL SCHEDULE FOR BREAKER INFORMATION.
    A-5,7 INDICATES A SINGLE PHASE, 2-POLE CIRCUIT AT CIRCUITS 5 & 7 OF PANELBOARD A. REFER TO PANEL SCHEDULE FOR BREAKER INFORMATION.
11. SERIES OR CASCADED RATINGS ARE NOT ALLOWED UNLESS SPECIFICALLY NOTED.
12. NO WIRING DEVICES OR OUTLET BOXES SHALL BE INSTALLED BACK-TO-BACK. CONTRACTOR SHALL CORRDINATE ALL RECEPTACLE MOUNTING HEIGHTS WITH APPROVED CASEWORK SHOP DRAWINGS PRIOR TO INSTALLATION OF AFFECTED RECEPTACLES.
13. WALL-MOUNTED EXIT SIGNS INDICATED ABOVE DOORS SHALL BE CENTERED BETWEEN THE TOP OF DOOR FRAME AND CEILING IF VERTICAL DISTANCE BETWEEN THE TWO IS 24 INCHES OR LESS; OTHERWISE, MOUNT BOTTOM OF EXIT SIGN 6 INCHES ABOVE TOP OF DOOR FRAME.
14. CONSTRUCTION DETAILS SHOWN ON DRAWINGS SHOW TYPICAL INSTALLATION UNLESS OTHERWISE NOTED AND APPLY TO ELECTRICAL WORK INCLUDED IN THIS PACKAGE EVEN THOUGH NOT SPECIFICALLY REFERENCED ON THE PLAN DRAWINGS.
15. COORDINATE LOCATIONS OF DEVICES WITH ARCHITECTURAL ELEVATIONS AND DETAILS. ARCHITECTURAL ELEVATIONS AND DETAILS TAKE PRECEDENCE OVER LOCATIONS SHOWN ON ELECTRICAL DRAWINGS.
16. DRAWINGS REPRESENT ELECTRICAL DESIGN INTENT. CONTRACTOR SHALL FURNISH, INSTALL AND SIZE ALL SLEEVES, HOLES, CORES, PATCHING, SLOTS, ANCHORS, BRACKETS, SUPPORTS, JUNCTION BOXES, PULL BOXES, AND OTHER APPURTENANCES NECESSARY TO EXECUTE THE CONTRACT DOCUMENTS COMPLETE. SOME OF THESE ITEMS MAY BE SHOWN ON THE DRAWINGS FOR CLARITY OR DESIGN PREFERENCE. HOWEVER, NOT ALL OF THE ITEMS, NECESSARY FOR COMPLETE EXECUTION AND INSTALLATION, ARE SHOWN.
17. ALL ELECTRICAL WORK SHALL BE INSTALLED IN STRICT COMPLIANCE WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL CODES, PARTICULARLY THE NATIONAL ELECTRICAL CODE (NEC) - NFPA 70.
18. THE WORD PROVIDE IS SYNONOMOUS WITH FURNISH AND INSTALL.
19. THE WORD DEMOLISH IS SYNONOMOUS WITH REMOVE AND DISPOSE.
20. CONSIDER SECTIONS OF CONDUIT RUNS NOT MARKED, AND NOT SHOWN ON THE ONE LINE DIAGRAMS, TO BE THE SAME AS THE HOME RUN OR THE LAST SECTION IN THE RUN THAT IS MARKED.
21. WHERE TWO SWITCHES ARE SHOWN TO BE CONNECTED TO THE SAME LIGHT FIXTURE, WIRE THE FIXTURES TO PROVIDE MULTI-LEVEL LIGHTING, ONE SWITCH CONTROLLING THE INBOARD LAMPS AND THE OTHER CONTROLLING THE OUTBOARD LAMPS.
22. PROVIDE A 4" THICK CONCRETE PAD UNDER ALL FLOOR MOUNTED ELECTRICAL DISTRIBUTION EQUIPMENT AND CONTROL PANELS.
23. CONDUIT RUNS WHERE SHOWN, ARE DIAGRAMMATIC ONLY. INSTALL AS REQUIRED TO AVOID CONFLICTS WITH EQUIPMENT OR STRUCTURAL CONDITIONS.
24. ONLY MAJOR PULL BOXES ARE SHOWN. PROVIDE ADDITIONAL PULL BOXES AS REQUIRED TO MEET CODE REQUIREMENTS AND TO PROVIDE A WORKABLE INSTALLATION.
25. VERIFY THE LOCATION OF CONDUIT ENTRANCES FOR ALL EQUIPMENT USING THE APPROVED SHOP DRAWINGS PRIOR TO INSTALLING CONDUITS AND BOXES TO SERVE THE EQUIPMENT. CONDUIT STUB-UPS SHALL NOT BE MORE THAN 6" FROM THE CENTERLINE OF EQUIPMENT CONDUIT ENTRANCE.
26. THE CONTROL DIAGRAMS AND THE QUANTITY AND SIZE OF WIRE/CONDUIT REPRESENT A SUGGESTED ARRANGEMENT BASED UPON SELECTED ELECTRICAL EQUIPMENT. MODIFICATIONS ACCEPTABLE TO THE OWNER MAY BE MADE TO ACCOMMODATE EQUIPMENT ACTUALLY PURCHASED. MAINTAIN THE BASIC SEQUENCE AND METHOD OF CONTROL INDICATED ON THE DRAWINGS AND SPECIFICATIONS.
27. PROVIDE SUITABLE BARRIERS IN MANHOLES, HANDHOLES, PULL BOXES, AND JUNCTION BOXES TO SEPARATE INSTRUMENTATION AND COMMUNICATION CABLES FROM OTHER WIRING WHERE SEPARATE BOXES ARE NOT SHOWN ON THE DRAWINGS.

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CHARLOTTE, NORTH CAROLINA 28208

CLIENT

NORTH CAROLINA AIR NATIONAL GUARD - 145TH AIRLIFT WING

145TH AIRLIFT WING
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10/14/2025

KEY PLAN

ISSUE/REVISION

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1	6-19-2025	B-3 SUBMITTAL - FINAL REV1
	11/30/16	B-3 SUBMITTAL - FINAL

PROJECT NUMBER

60637899

SHEET TITLE

ABBREVIATIONS, LEGENDS & GENERAL NOTES - ELECTRICAL

SHEET NUMBER

E001

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15_ 15.00_ ELECTRICAL_ E001

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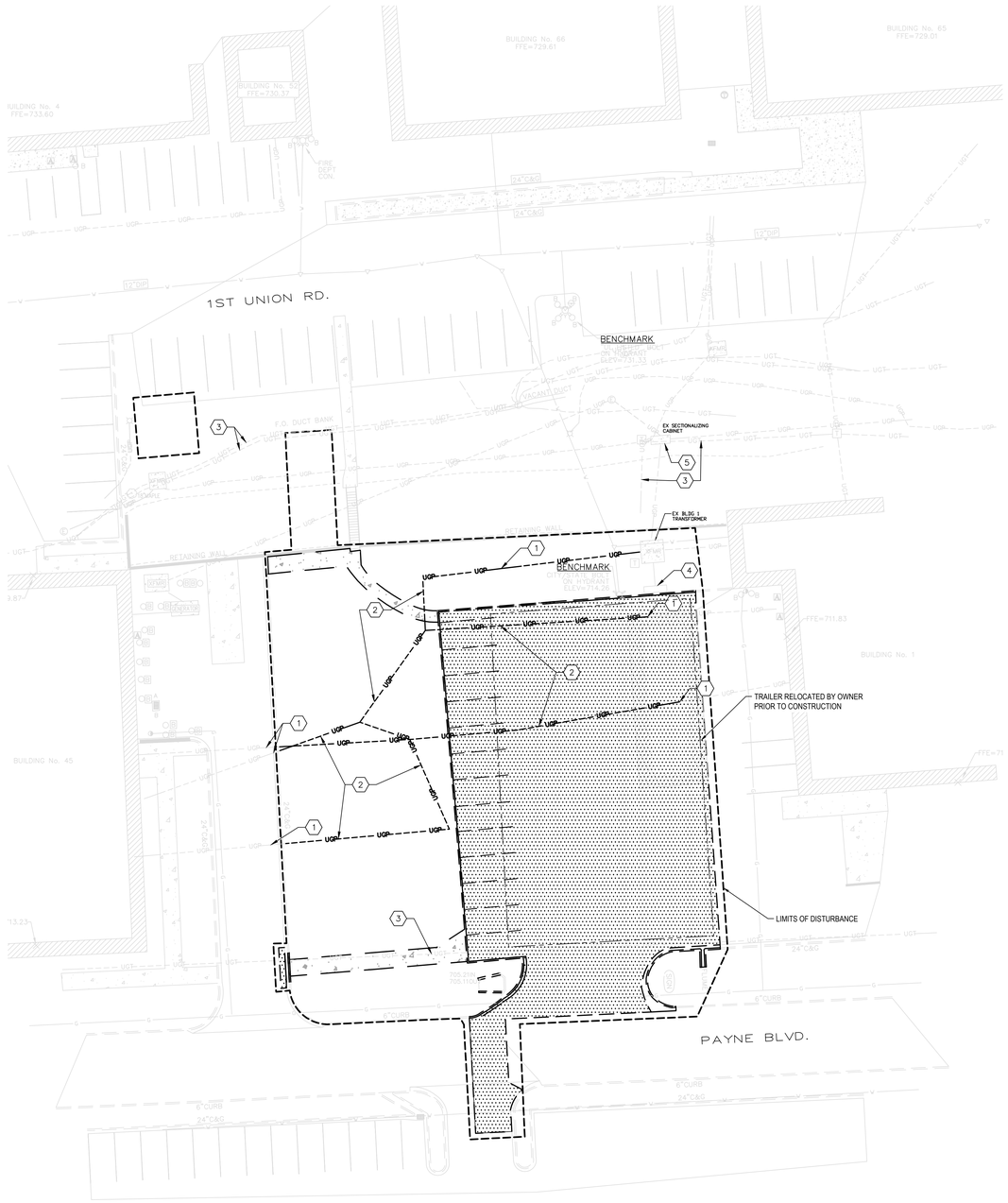
08-ARCHITECTURE-A300-BUILDING SECTIONS
Project Management Initials: Designer: MCL Checked: GHF Approved: JRO ARCH E1 30"x42"

ELECTRICAL SITE REMOVAL NOTES

1. REFER TO CIVIL PLANS FOR COORDINATION AND FURTHER INFORMATION



ELECTRICAL SITE DEMOLITION PLAN

REMOVAL LEGEND

- CURB AND GUTTER REMOVAL
- ASPHALT PAVEMENT REMOVAL
- CONCRETE PAVEMENT REMOVAL
- LIMITS OF DISTURBANCE
- UGR — UNDERGROUND ELECTRICAL
- LAYDOWN AREA

CODED NOTES

1. LOCATION WHERE UNDERGROUND ELECTRICAL SHALL BE CUT.
2. REMOVE THIS SECTION OF UNDERGROUND CONDUIT AND DUCT, FOR NEW BUILDING.
3. PROTECT EXISTING UNDERGROUND TELECOMMUNICATIONS CONDUITS TO REMAIN.
4. PROTECT EXISTING PANELBOARD AND RECEPTACLES FOR PORTABLE TRAILERS TO REMAIN.
5. EXISTING 15KV SECTIONALIZER.

Know what's below. Call before you dig.

0 20 40 60
SCALE: 1"=20'

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07/01/2026

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I/R	DATE	DESCRIPTION
2	07/01/26	ADDENDUM 01
1	05/30/25	B-3 SUBMITTAL - FINAL

PROJECT NUMBER
60637899
FJRP229030

SHEET TITLE
ELECTRICAL SITE DEMOLITION PLAN

SHEET NUMBER
1
E002

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08-ARCHITECTURE-A300-BUILDING SECTIONS ARCH E1 30"x42"
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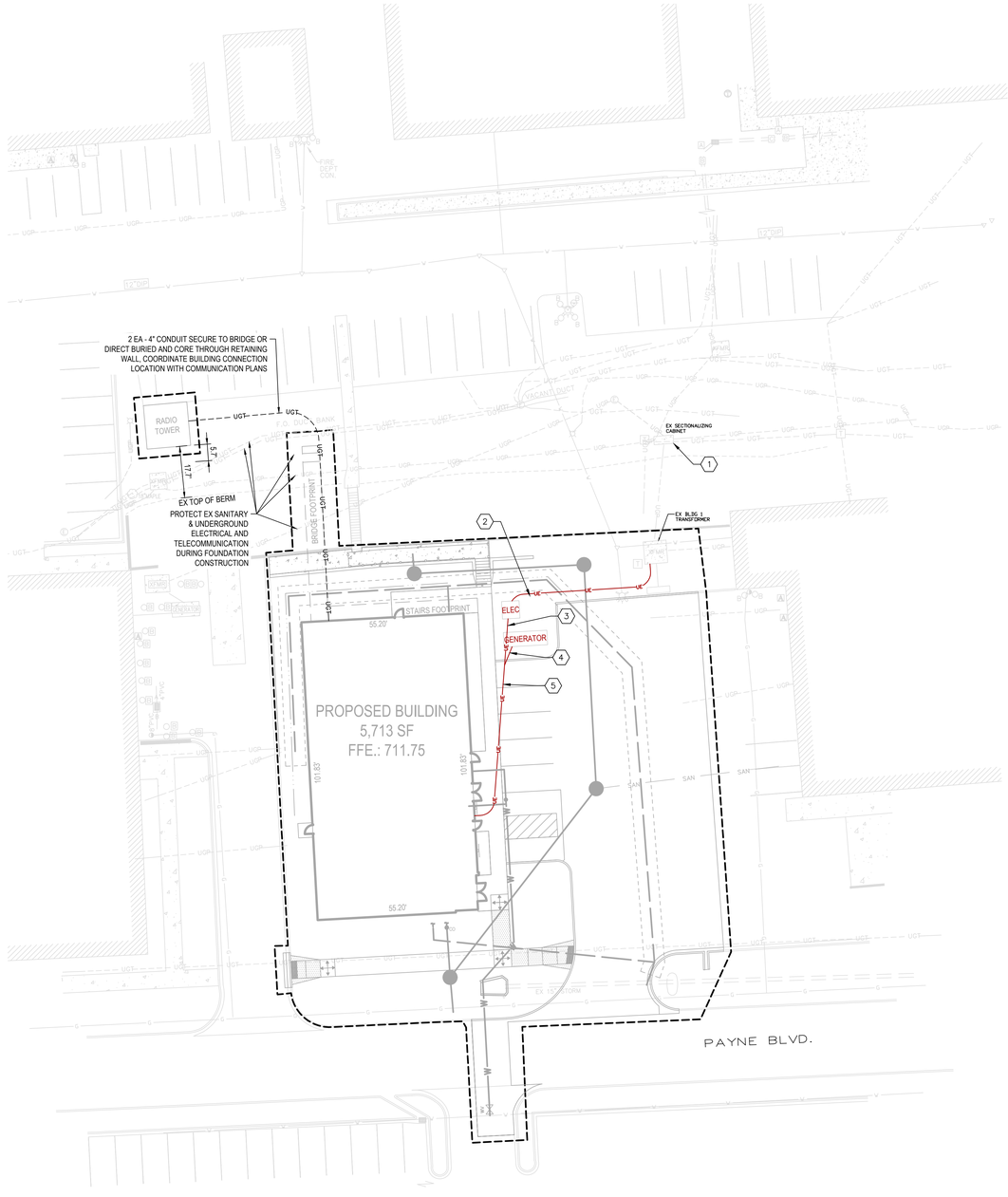

ELECTRICAL SITE NEW WORK DEMOLITION PLAN

ELECTRICAL SITE NEW WORK NOTES

1. REFER TO CIVIL PLANS FOR COORDINATION AND FURTHER INFORMATION

PROPOSED UTILITY LEGEND

- W — WATER LINE
- SANITARY SEWER LINE
- UGP — EXISTING UNDERGROUND ELECTRICAL
- UE — NEW UNDERGROUND ELECTRICAL
- STORM LINE (WITH 6" PERFORATED UNDERDRAIN UNDER PAVEMENT)
- VEGETATED SWALE

CODED NOTES

1. COORDINATE SHUT DOWNS WITH FACILITY PERSONNEL.
2. MEDIUM VOLTAGE CONCRETE DUCTBANK, SEE ONE LINE DIAGRAM AND MEDIUM VOLTAGE CONCRETE ENCASED DUCTBANK DETAIL.
3. TRANSFORMER SECONDARY CONDUITS, (1) 4" FOR POWER WIRING, (1) 4" SPARE, AND (1) 2" SPARE. CONCRETE ENCASED.
4. GENERATOR CONDUITS, (1) 4" FOR POWER, (1) 2" FOR GENERATOR ANCILLARIES, AND (1) 2" FOR BLOCK HEATER POWER. CONCRETE ENCASED.
5. COMBINED DUCTBANK WITH TRANSFORMER SECONDARIES AND GENERATOR CONDUITS. REFER TO DUCTBANK DETAIL "A-A". CONCRETE ENCASED.

Know what's **below.** **Call** before you dig.

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SCALE: 1"=20'

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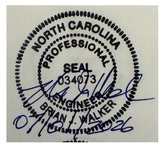

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2	07/01/26	ADDENDUM 01
1	05/30/25	B-3 SUBMITTAL - FINAL

PROJECT NUMBER
60637899
FJRP229030

SHEET TITLE
ELECTRICAL SITE NEW WORK PLAN

2

SHEET NUMBER
E003

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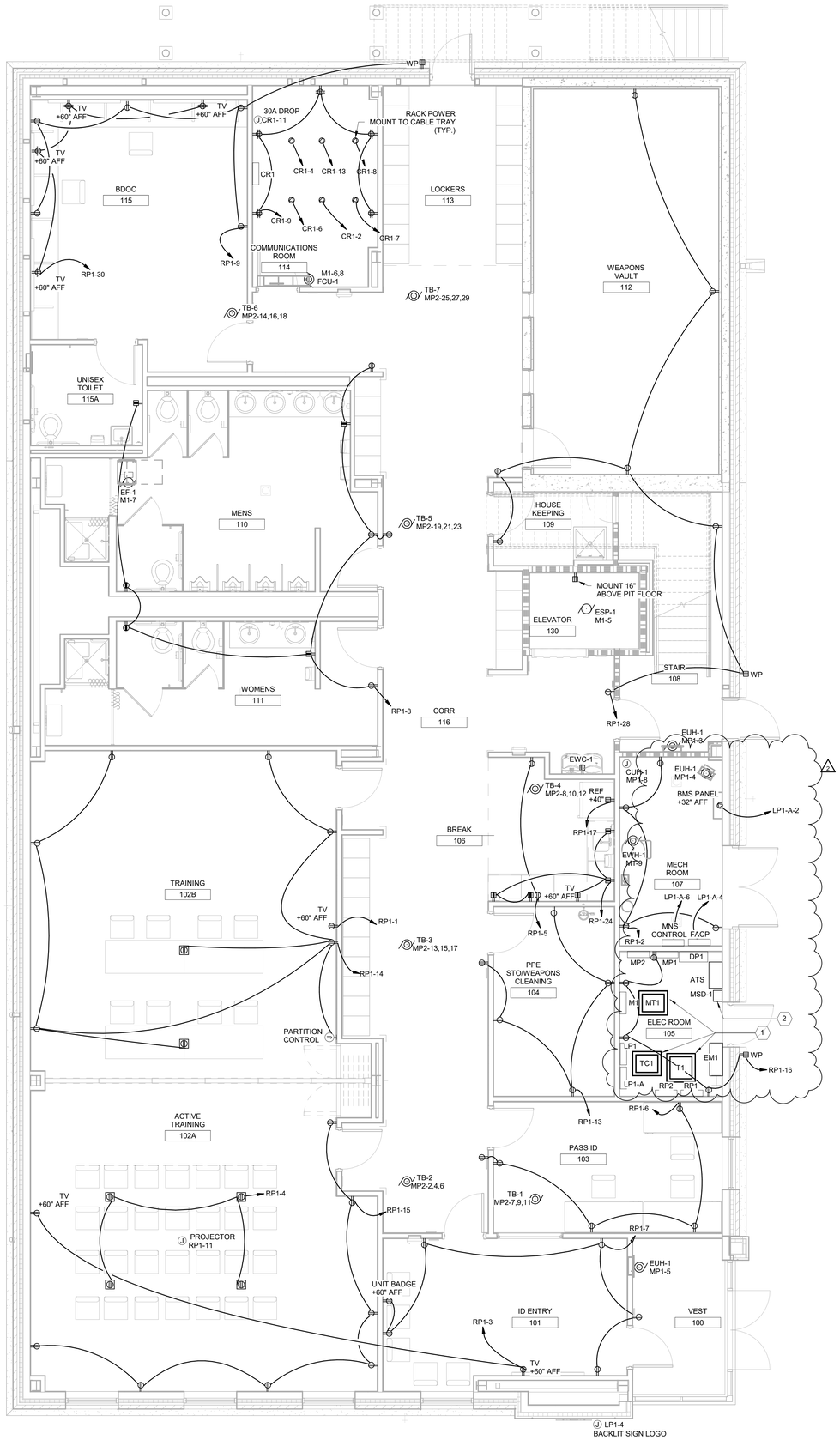
15-ELECTRICAL-15.10-E101-POWER PLAN - LEVEL 1
Project Management Initials: Designer: Designer Checked: Checker Approved: Approver/ARCH E1 30"x42"



1
E101

FIRST FLOOR POWER PLAN

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

GENERAL NOTES

A. PROVIDE DISCONNECTING MEANS TO EQUIPMENT WHERE INDICATED. SIZE DISCONNECTS PER MANUFACTURER'S RECOMMENDATIONS. REFER TO SHEET E701 FOR MORE INFORMATION ON DISCONNECTING MEANS FOR EACH PIECE OF EQUIPMENT.

KEYED NOTES

1. WALL MOUNT TRANSFORMER ABOVE PANEL IT SERVES.
2. PROVIDE SEPARATE ENCLOSURE FOR CT'S AND METERING EQUIPMENT.

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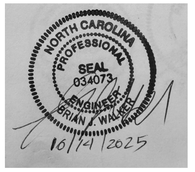

KEY PLAN

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1	6-19-2025	B-3 SUBMITTAL - FINAL REV1
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SHEET TITLE

POWER PLAN - LEVEL 1

SHEET NUMBER

E101

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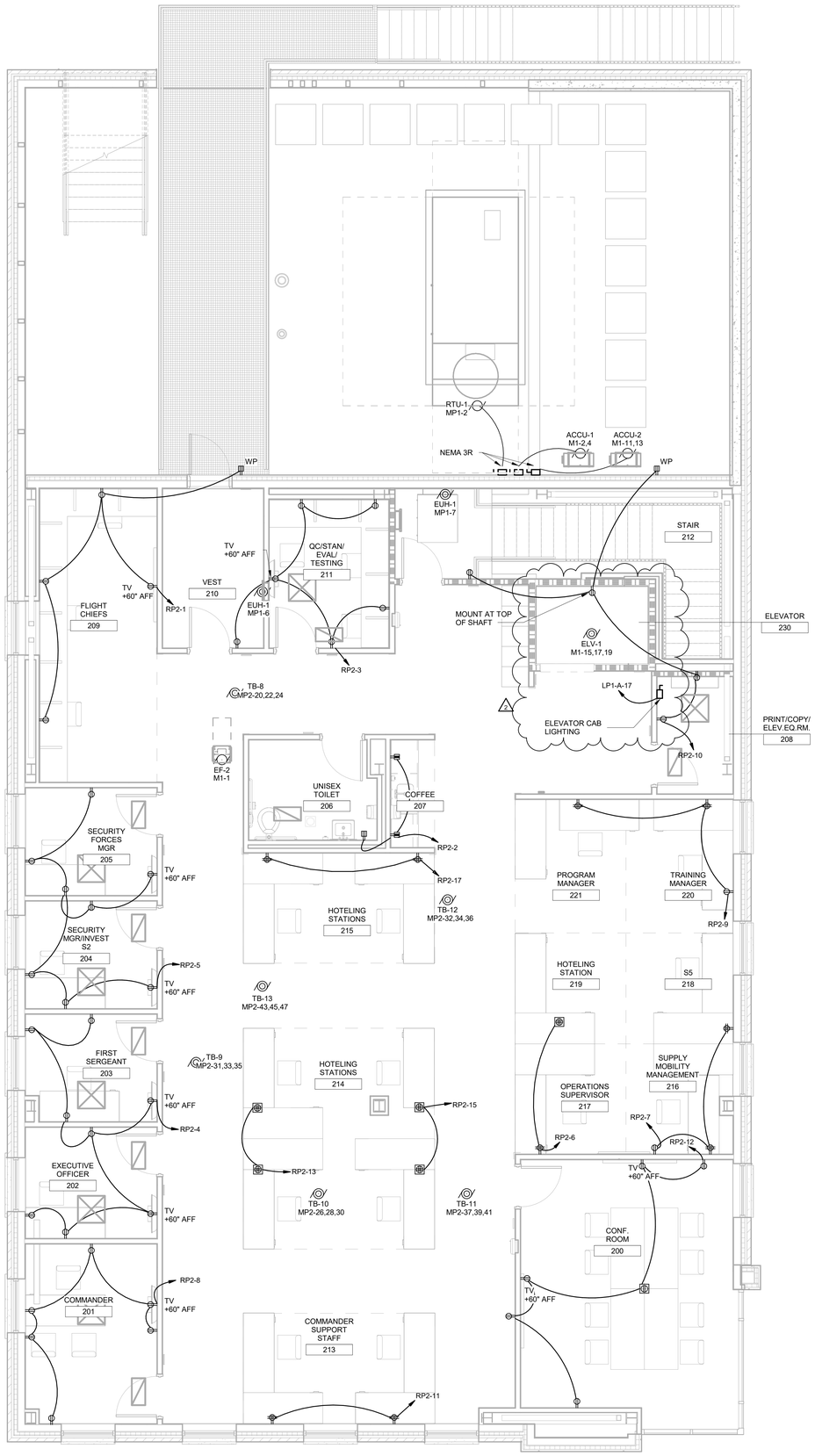
15_ 15.10_ ELECTRICAL_ E101

15-ELECTRICAL-15.10-E102-POWER PLAN - LEVEL 2
Project Management Initials: Designer: Designer Checker: Checker Approved: Approver/ARCH E1 30"x42"

GENERAL NOTES

A. PROVIDE DISCONNECTING MEANS TO EQUIPMENT WHERE INDICATED. SIZE DISCONNECTS PER MANUFACTURER'S RECOMMENDATIONS.



1
E102

SECOND FLOOR POWER PLAN

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

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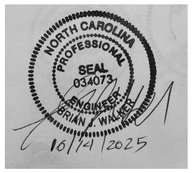

KEY PLAN

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2	07-01-2026	ADDENDUM #1
1	6-19-2025	B-3 SUBMITTAL - FINAL REV1
	09/06/23	B-3 SUBMITTAL - FINAL

PROJECT NUMBER

60637899

SHEET TITLE

POWER PLAN - LEVEL 2

SHEET NUMBER

E102

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15_ 15.10_ ELECTRICAL_ E102

15-ELECTRICAL-15.20-E201-LIGHTING PLAN - LEVEL 1

Project Management Initials:

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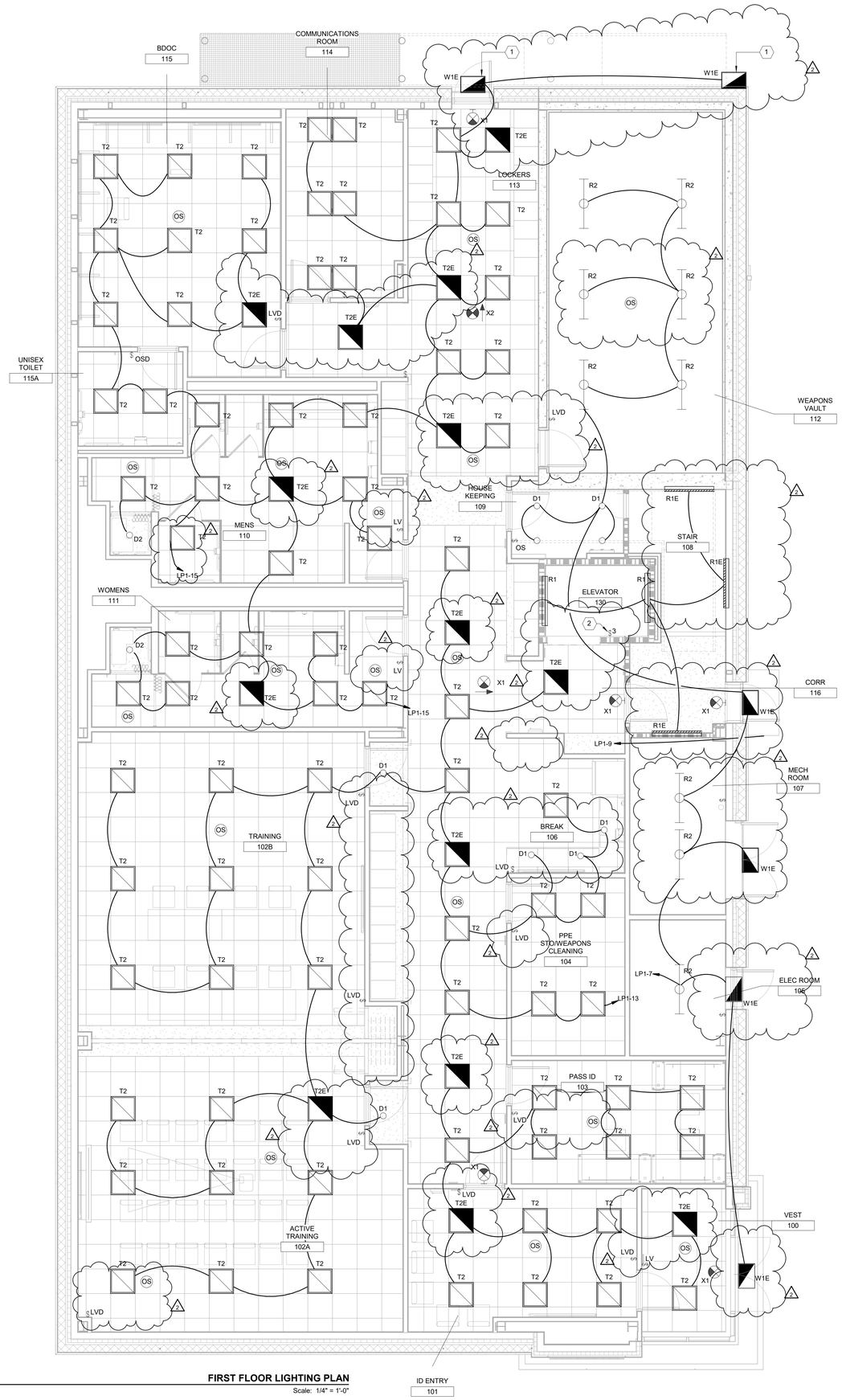

1
E201

FIRST FLOOR LIGHTING PLAN

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

GENERAL NOTES

A. EXIT SIGNS SHALL BE CIRCUITED TO THE SAME BRANCH CIRCUIT AS THE NEAREST LUMINAIRE.

KEYED NOTES

1. LUMINAIRE IS ABOVE THE SPLIT FACE BANDING APPROXIMATELY 9' ABOVE THE STAIRS AT THIS LOCATION.

2. 3-WAY TOGGLE SWITCH SHALL CONNECT TO OTHER 3-WAY TOGGLE SWITCH AT THE TOP OF THE SHAFT AND CONTROL ALL LUMINAIRES IN THE SHAFT.

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10/7/2025

KEY PLAN

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2	07-01-2026	ADDENDUM #1
1	6-19-2025	B-3 SUBMITTAL - FINAL REV1
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PROJECT NUMBER

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SHEET TITLE

LIGHTING PLAN - LEVEL 1

SHEET NUMBER

E201

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15-ELECTRICAL-15.20-E202-LIGHTING PLAN - LEVEL 2

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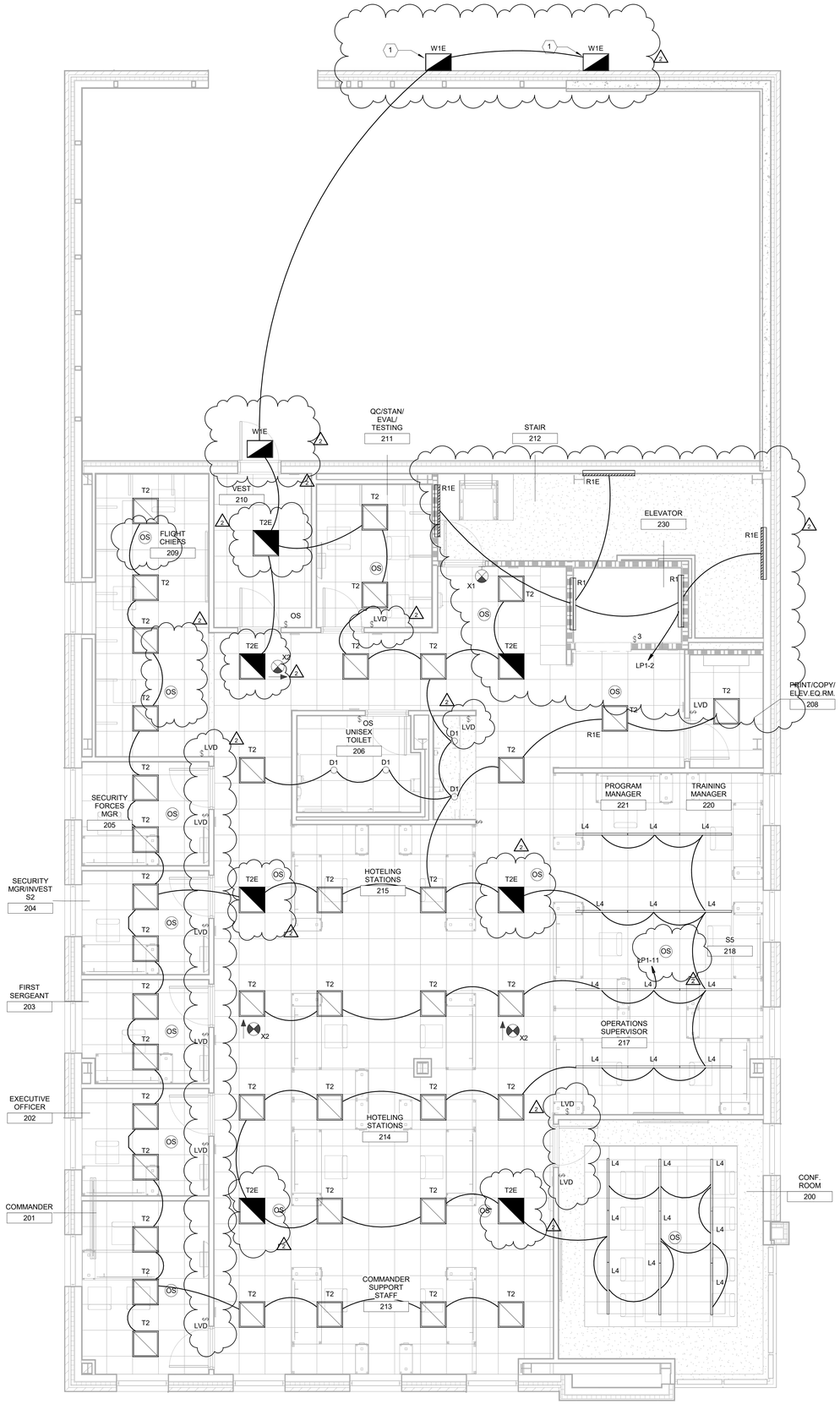

1 E202 **SECOND FLOOR LIGHTING PLAN**

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

GENERAL NOTES

A. EXIT SIGNS SHALL BE CIRCUITED TO THE SAME BRANCH CIRCUIT AS THE NEAREST LUMINAIRE.

KEYED NOTES

1. LUMINAIRE IS ABOVE THE SPLIT FACE BANDING APPROXIMATELY 9' ABOVE THE STAIRS AT THIS LOCATION.

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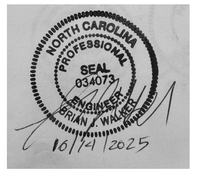

KEY PLAN

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1	6-19-2025	B-3 SUBMITTAL - FINAL REV1
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PROJECT NUMBER

60637899

SHEET TITLE

LIGHTING PLAN - LEVEL 2

SHEET NUMBER

E202

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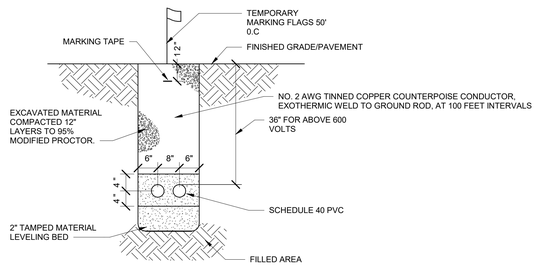
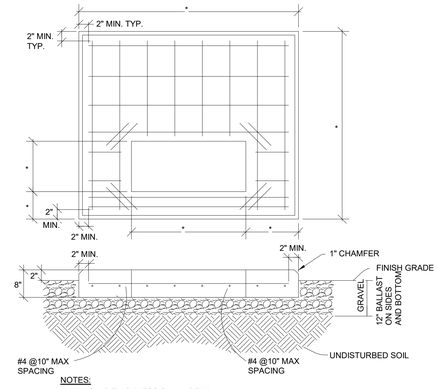
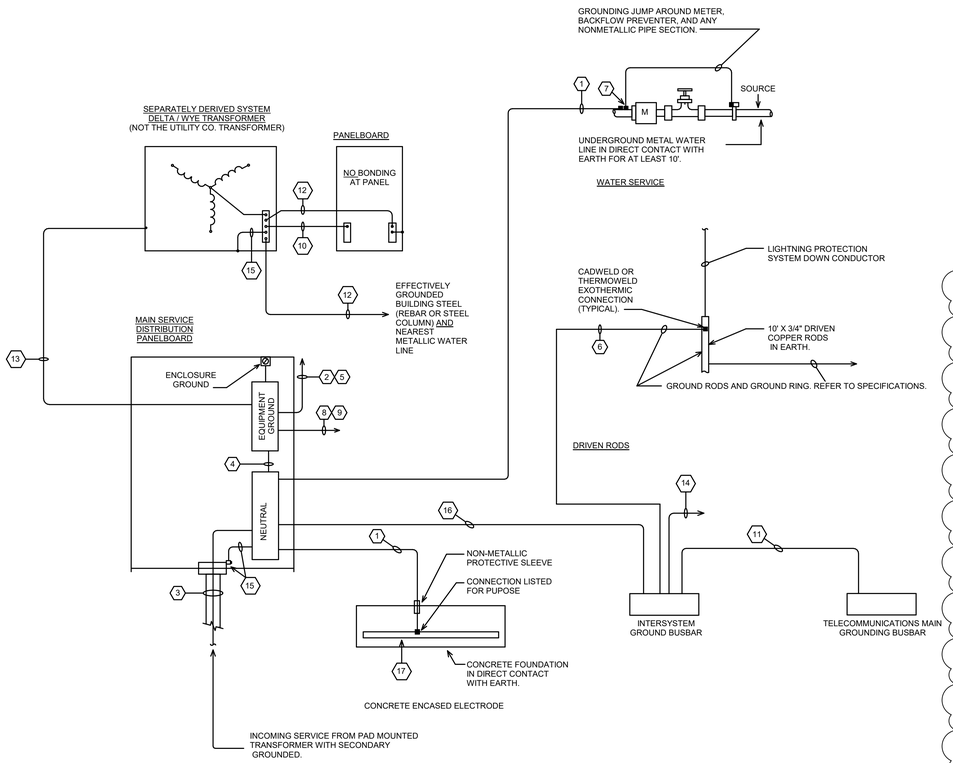


2 MEDIUM VOLTAGE CONCRETE ENCASED DUCTBANK
E501 NTS



NOTES:
1. MIN. SLAB THICKNESS SHALL BE 8".
2. REINFORCE WITH #4 REBAR, 4" FROM BOT. OF SLAB, WITH 2" MIN. CLEARANCE FROM EDGE OF PAD.
3. REBAR REINFORCEMENT LOCATIONS TYPICAL OF PAD REQUIREMENT AS SHOWN.
4. 12" DEEP COMPACTED SAND OR GRAVEL BED MINIMUM.
5. CHAMFER ALL EDGES.
6. VERIFY CORRECT DIMENSIONS AND COORDINATE WITH PROVIDED TRANSFORMER.
7. HAND COMPACT GRAVEL BED.
8. PRECAST ACTUNETACT PAD BASE MAY BE SUBSTITUTED IN-LIEU OF CAST-IN-PLACE PADS - SUBJECT TO ARCHITECTS APPROVAL.
9. EXTEND PAD 4" BEYOND ENCLOSURE AND COOLING FIN OF TRANSFORMER.

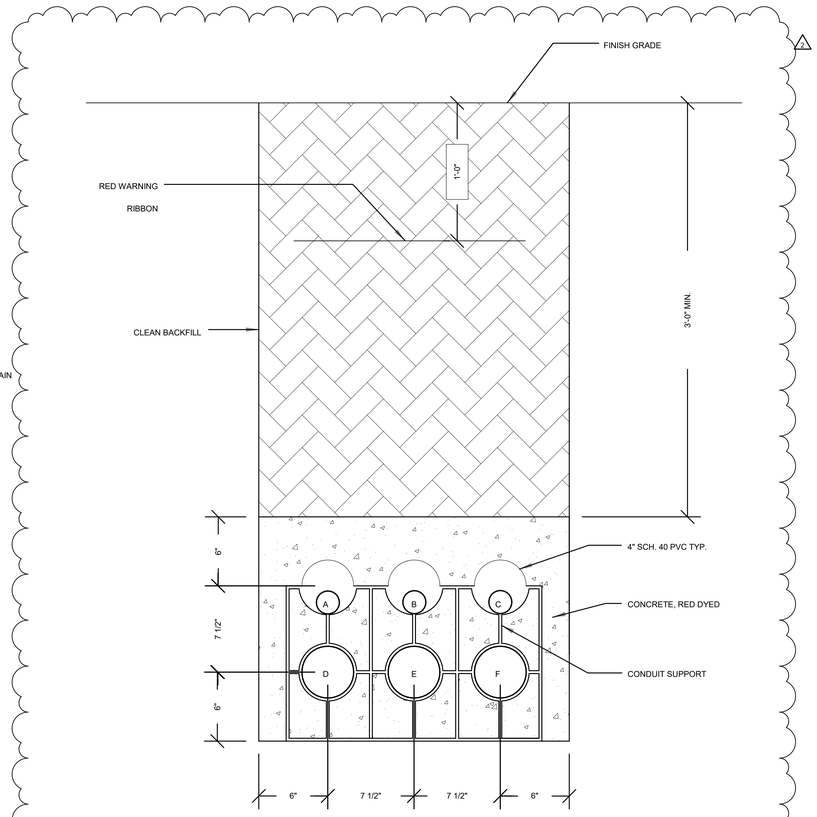
3 TRANSFORMER PAD PLAN (TYP.)
E501 NTS



SERVICE GROUNDING ELECTRODE SYSTEM NOTES:

1. THE GROUNDING ELECTRODE CONDUCTORS SHALL BE 3/0 AWG. THE CONDUCTOR SHALL BE CONNECTED TO AN APPROVED GROUNDING ELECTRODE.
2. GROUND CONDUCTORS TO OTHER POINTS AND EQUIPMENT, AS REQUIRED BY NEC ARTICLE 250 AND ELECTRICAL SERVICE AND POWER DISTRIBUTION SPECIFICATIONS.
3. SERVICE ENTRANCE PHASE CONDUCTORS (UNGROUNDED) WITH GROUNDED (SERVICE) CONDUCTOR.
4. MAIN BONDING JUMPER SHALL BE 3/0 AWG.
5. EQUIPMENT GROUND CONDUCTOR SIZED PER TABLE 250.122 OF THE NEC.
6. GROUND ROD ELECTRODE PROVIDE 1/0 AWG. COPPER GROUNDING ELECTRODE CONDUCTOR.
7. CONNECTION SHALL BE MADE WITH 5' OF BUILDING ENTRANCE PER NEC 250.52(A)(1).
8. METAL WATER PIPING AND STRUCTURAL STEEL NOT INTENTIONALLY GROUNDED SHALL BE BONDED PER NEC 250.104(A) AND NEC TABLE 250.66.
9. OTHER METAL PIPING (GAS,ECT.) SHALL BE BONDED PER NEC 250.104(B) AND NEC TABLE 250.122.
10. ELECTRODE GROUND CONDUCTOR FOR SEPARATELY DERIVED SYSTEM. SIZE PER NEC TABLE 250.66.
11. GROUND CONDUCTOR TO TELECOMMUNICATIONS MAIN GROUNDING BUSBAR SIZED PER TELECOMMUNICATION AND SPECIFICATION REQUIREMENTS.
12. SYSTEM BONDING JUMPER FOR SEPARATELY DERIVED SYSTEMS SHALL BE SIZED PER NEC 250.30(A)(1).
13. EQUIPMENT GROUND CONDUCTOR FOR SEPERATELY DERIVED SYSTEM. SIZE PER NEC TABLE 250.122.
14. INTERSYSTEM GROUND CONDUCTORS PER NEC 250.94 FOR RADIO, TV, CABLE TV, ETC. GROUND CONDUCTORS SHALL BE #6 AWG.
15. SUPPLY SIDE EQUIPMENT BONDING JUMPER PER NEC 250.92(A). THE NON-CURRENT CARRYING METALLIC PARTS OF SERVICE RACEWAYS SHALL BE BONDED. BONDING METHODS SHALL BE IN ACCORDANCE TO NEC 250.92(B).
16. PROVIDE INTERSYSTEM BONDING & ELECTRODE CONDUCTOR PER NEC 250.94. GROUND CONDUCTOR SHALL BE #1/0 AWG.
17. CONCRETE ENCASED ELECTRODE AS DESIGNATED IN THE NEC 250.52(A)(3) SHALL BE CONSIDERED A GROUNDING ELECTRODE AND SHALL BE BONDED TOGETHER WITH THE OTHER GROUNDING ELECTRODES TO CREATE A GROUNDING ELECTRODE SYSTEM. GROUND MINIMUM 20' OF STEEL.

1 SERVICE GROUNDING ELECTRODE SYSTEM WIRING DIAGRAM DETAIL
E501 NTS



NOTES:
A = 2"C. SPARE
B = 2"C. FOR ATS TO GENERATOR CONTROL
C = 2"C. FOR POWER FOR GENERATOR ANCILLARIES
D = 4"C. FOR POWER TO BUILDING
E = 4"C. SPARE TO TRANSFORMER
F = 4"C. FOR GENERATOR POWER TOATS.

4 DUCT BACK SECTION
E501 NTS

AECOM

PROJECT

NEW SECURITY FORCES BUILDING

PAYNE BLVD.
CHARLOTTE, NORTH CAROLINA 28208

CLIENT

NORTH CAROLINA AIR NATIONAL GUARD - 145TH AIRLIFT WING

145TH AIRLIFT WING
4930 MINUTEMAN WAY
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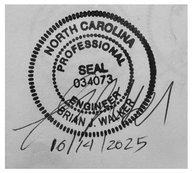
REGISTRATION



KEY PLAN

N

ISSUE/REVISION

I/R	DATE	DESCRIPTION
2	07-01-2026	ADDENDUM #1
1	6-19-2025	B-3 SUBMITTAL - FINAL REV1
	09/06/23	B-3 SUBMITTAL - FINAL

PROJECT NUMBER

60637899

SHEET TITLE

ELECTRICAL DETAILS

SHEET NUMBER

E501

Last Plotted: 6/30/2026 10:39:11 AM
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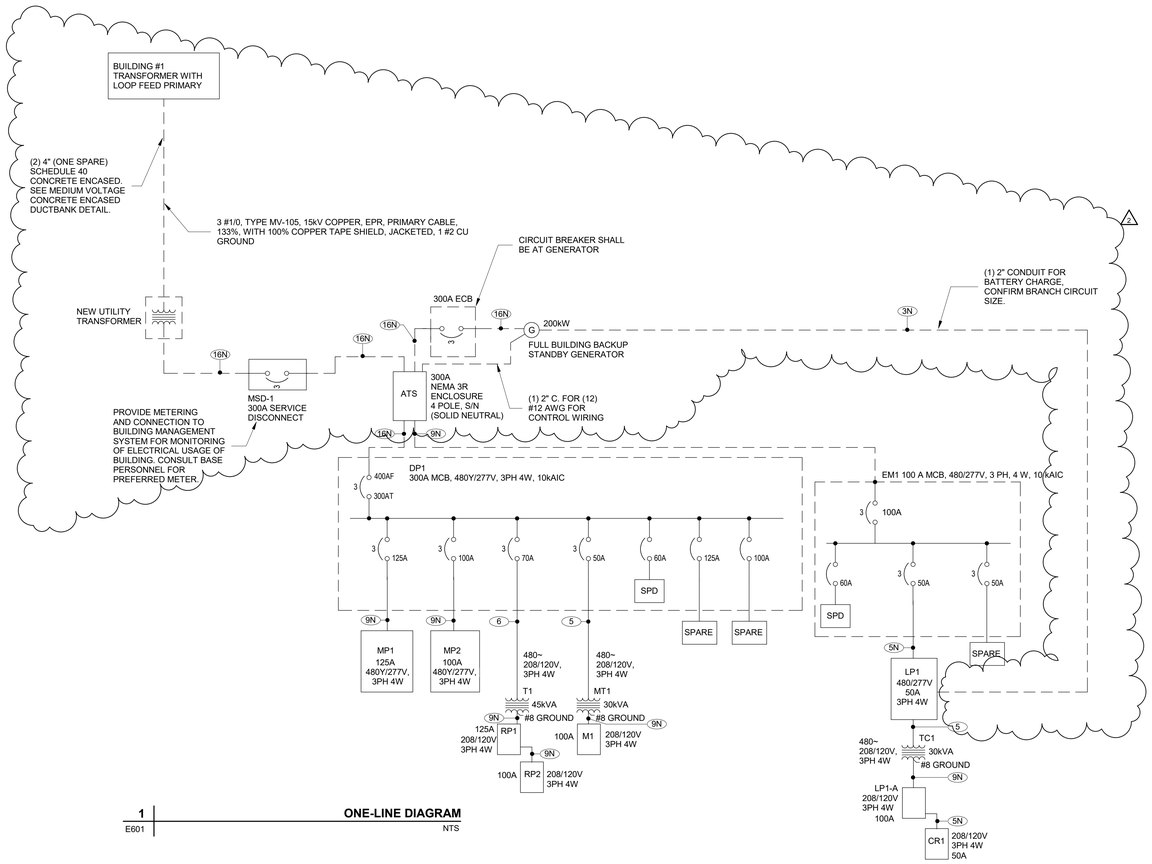
15_ 15.50_ ELECTRICAL_ E501

15-ELECTRICAL-15.60-E601-ELECTRICAL ONE-LINE DIAGRAM
Project Management Initials: Designer: Designer Checker: Checker Approved: Approver ARCH E1 30"x42"

GENERAL NOTES

A. REFER TO 600V FEEDER SCHEDULE ON SHEET E701 FOR MORE INFORMATION ON WIRE SIZING.



1 ONE-LINE DIAGRAM
E601 NTS

DISTRIBUTION PANEL: EM1

LOCATION:
FED FROM:
MOUNTING: SURFACE - NEMA 1
MAIN DEVICE: 100 A MCB
BUS AMPS: 100 A

VOLTAGE: 480/277 Wye V. 3 Ø 4 W.
A.I.C. RATING: 10k
NOTES:

CKT	LOAD DESCRIPTION	WIRE SIZE & CONDUIT	POLES	FRAME	TRIP	LOAD	LOAD TYPE
1	SPD	--	3	60 A	60 A	0.0 kVA	--
2	LP1	--	3	50 A	50 A	21.1 kVA	Power; Spare;...
3	SPARE	--	3	50 A	50 A	0.0 kVA	--
4	SPACE	--	1	--	--	--	--
5	SPACE	--	1	--	--	--	--
6	SPACE	--	1	--	--	--	--

TOTAL LOAD: 21078 VA
TOTAL AMPS: 25 A

CONN. LOAD		TYPE DESCRIPTION	DIVERSITY	N.E.C. LOAD
	HT	Electric Heat	0%	0 VA
	AC	A/C Refrigeration...	0%	0 VA
	MM	Misc. Motors	100%	0 VA
	WH	Water Heating	100%	0 VA
90 VA	OL	Outdoor Lighting	125%	112.5 VA
1488 VA	LT	Indoor Lighting	125%	1860 VA
10380 VA	RP	Receptacles	NEC 220-13	10190 VA
	EX	Existing Demand	125%	0 VA
	MC	Misc. Continuous	125%	0 VA
4920 VA	MN	Misc. Non-Continuous	100%	4920 VA
	KT	Kitchen Equipment	65%	0 VA
		Largest Connected Motor	125%	0 VA

PANEL TOTALS	
CONNECTED LOAD:	21078 VA
N.E.C. LOAD:	17082.5 VA
N.E.C. CURRENT	
AT PANEL VOLTAGE:	20 A

NOTES:

DISTRIBUTION PANEL: DP1

LOCATION: Electrical Room 233
FED FROM:
MOUNTING: SURFACE - NEMA 1
MAIN DEVICE: 300 A MCB
BUS AMPS: 400 A

VOLTAGE: 480/277 Wye V. 3 Ø 4 W.
A.I.C. RATING: 10k
NOTES:

CKT	LOAD DESCRIPTION	WIRE SIZE & CONDUIT	POLES	FRAME	TRIP	LOAD	LOAD TYPE
1	SPD	--	3	200 A	200 A	0.0 kVA	--
2	T1		3	70 A	70 A	37.6 kVA	Spare; RP; MN
3	MT1		3	30 A	30 A	15.9 kVA	Motor; Spare
4	MP1		3	125 A	125 A	66.6 kVA	Motor; Spare;...
5	MP2		3	100 A	100 A	30.9 kVA	Motor; Spare
6	SPARE	--	3	100 A	100 A	0.0 kVA	--
7	SPARE	--	3	125 A	125 A	0.0 kVA	--
8	SPACE	--	1	--	--	--	--
9	SPACE	--	1	--	--	--	--
10	SPACE	--	1	--	--	--	--

TOTAL LOAD: 145536.22 VA
TOTAL AMPS: 175 A

CONN. LOAD		TYPE DESCRIPTION	DIVERSITY	N.E.C. LOAD
	HT	Electric Heat	0%	0 VA
	AC	A/C Refrigeration...	0%	0 VA
	MM	Misc. Motors	100%	0 VA
	WH	Water Heating	100%	0 VA
	OL	Outdoor Lighting	125%	0 VA
	LT	Indoor Lighting	125%	0 VA
36420 VA	RP	Receptacles	NEC 220-13	23210 VA
	EX	Existing Demand	125%	0 VA
	MC	Misc. Continuous	125%	0 VA
4200 VA	MN	Misc. Non-Continuous	100%	4200 VA
	KT	Kitchen Equipment	65%	0 VA
110985 VA		Largest Connected Motor	125%	138731.25 VA

PANEL TOTALS	
CONNECTED LOAD:	145536.22 VA
N.E.C. LOAD:	166141.25 VA
N.E.C. CURRENT	
AT PANEL VOLTAGE:	180 A

NOTES:

DISTRIBUTION PANEL: MP1

LOCATION:
FED FROM: DP1
MOUNTING: SURFACE - NEMA 1
MAIN DEVICE: 125 A MCB
BUS AMPS: 125 A

VOLTAGE: 480/277 Wye V. 3 Ø 4 W.
A.I.C. RATING: 10k
NOTES:

CKT	LOAD DESCRIPTION	WIRE SIZE & CONDUIT	POLES	FRAME	TRIP	Load	LOAD TYPE
1	SPD	--	3	60 A	60 A	0.0 kVA	--
2	RTU-1 - OUTDOOR/LOW ROOF		3	90 A	90 A	45.7 kVA	Motor
3	EUH-1 108		3	20 A	20 A	3.7 kVA	Motor
4	EUH-1 107		3	20 A	20 A	3.7 kVA	Motor
5	EUH-1 100		3	20 A	20 A	3.7 kVA	Motor
6	EUH-1 210		3	20 A	20 A	3.7 kVA	Motor
7	EUH-1 212		3	20 A	20 A	3.7 kVA	Motor
8	CUH-1 107		3	20 A	20 A	3.0 kVA	MN
9	SPARE	--	3	90 A	90 A	0.0 kVA	--
10	SPARE	--	3	20 A	20 A	0.0 kVA	--
11	SPACE	--	1	--	--	--	--
12	SPACE	--	1	--	--	--	--

TOTAL LOAD: 66629.32 VA
TOTAL AMPS: 80 A

CONN. LOAD		TYPE DESCRIPTION	DIVERSITY	N.E.C. LOAD
	HT	Electric Heat	0%	0 VA
	AC	A/C Refrigeration...	0%	0 VA
	MM	Misc. Motors	100%	0 VA
	WH	Water Heating	100%	0 VA
	OL	Outdoor Lighting	125%	0 VA
	LT	Indoor Lighting	125%	0 VA
	RP	Receptacles	NEC 220-13	0 VA
	EX	Existing Demand	125%	0 VA
	MC	Misc. Continuous	125%	0 VA
3000 VA	MN	Misc. Non-Continuous	100%	3000 VA
	KT	Kitchen Equipment	65%	0 VA
64205 VA		Largest Connected Motor	125%	80256.25 VA

PANEL TOTALS	
CONNECTED LOAD:	66629.32 VA
N.E.C. LOAD:	83256.25 VA
N.E.C. CURRENT	
AT PANEL VOLTAGE:	95 A

NOTES:

PANELBOARD: MP2

LOCATION:
MOUNTING: SURFACE NEMA 1
MAIN DEVICE: 100 A MCB
BUS AMPS: 100 A

VOLTAGE: 480/277 Wye V. 3 ø 4 W.
A.I.C. RATING: 10k
SPECIAL:

LOAD DESCRIPTION	TYP.	WIRE	BKR	PLS	#	A		B		C		#	PLS	BKR	WIRE	TYP.	LOAD DESCRIPTION
					1	0.0	1.8					2					
SPD	--	--	60 A	3	3			0.0	1.8			4	3	20 A		Motor	TB-2 116
					5					0.0	1.8	6					
					7	0.6	0.3					8					
TB-1 103	Motor		20 A	3	9			0.6	0.3			10	3	20 A		Motor	TB-4 106
					11					0.6	0.3	12					
					13	1.8	0.5					14					
TB-3 116	Motor		20 A	3	15			1.8	0.5			16	3	20 A		Motor	TB-6 115
					17					1.8	0.5	18					
					19	0.7	0.4					20					
TB-5 116	Motor		20 A	3	21			0.7	0.4			22	3	20 A		Motor	TB-8 222
					23					0.7	0.4	24					
					25	0.4	0.6					26					
TB-7 116	Motor		20 A	3	27			0.4	0.6			28	3	20 A		Motor	TB-10 214
					29					0.4	0.6	30					
					31	0.5	0.9					32					
TB-9 222	Motor		20 A	3	33			0.5	0.9			34	3	20 A		Motor	TB-12 222
					35					0.5	0.9	36					
					37	0.5	0.0					38					
TB-11 222	Motor		20 A	3	39			0.5	0.0			40	3	20 A	--	--	SPARE
					41					0.5	0.0	42					
					43	1.3	0.0					44					
TB-13 222	Motor		20 A	3	45			1.3	0.0			46	3	20 A	--	--	SPARE
					47					1.3	0.0	48					
SPACE	--	--	--	1	49	--	--					50	1	--	--	--	SPACE
SPACE	--	--	--	1	51			--	--			52	1	--	--	--	SPACE
SPACE	--	--	--	1	53					--	--	54	1	--	--	--	SPACE
			TOTAL LOAD:		10 kVA			10 kVA		10 kVA							
			TOTAL AMPS:		37 A			37 A		37 A							

CONN....		TYPE DESCRIPTION	DIVERSITY	
0 VA	HT	Electric Heat	0%	0 VA
0 VA	AC	A/C Refrigeration	0%	0 VA
0 VA	...	Misc. Motors	100%	0 VA
0 VA	...	Water Heating	100%	0 VA
0 VA	OL	Outdoor Lighting	125%	0 VA
0 VA	LT	Indoor Lighting	125%	0 VA
0 VA	RP	Receptacles	NEC 220-13	0 VA
0 VA	EX	Existing Demand	125%	0 VA
0 VA	MC	Misc. Continuous	125%	0 VA
0 VA	MN	Misc. Non-Continuous	100%	0 VA
0 VA	KT	Kitchen Equipment	65%	0 VA
30900 VA		Largest Connected Motor	125%	38625 VA

PANEL TOTALS	
CONNECTED LOAD:	30900 VA
N.E.C. LOAD	38625 VA
N.E.C. CURRENT	
AT PANEL VOLTAGE	39 A

NOTES:

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PROJECT

NEW SECURITY FORCES BUILDING

PAYNE BLVD.
CHARLOTTE, NORTH CAROLINA 28208

CLIENT

NORTH CAROLINA AIR NATIONAL GUARD - 145TH AIRLIFT WING

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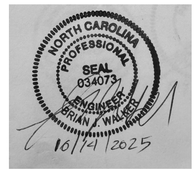

KEY PLAN

ISSUE/REVISION

I/R	DATE	DESCRIPTION
2	07-01-2026	ADDENDUM #1
1	6-19-2025	B-3 SUBMITTAL - FINAL REV1
	09/06/23	B-3 SUBMITTAL - FINAL

PROJECT NUMBER

60637899

SHEET TITLE

ELECTRICAL ONE-LINE DIAGRAM

SHEET NUMBER

E601

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15_ 15.60_ ELECTRICAL_ E601

MECHANICAL ELECTRICAL REQUIREMENTS

Mark	VOLTAGE	PHASE	HORSEPOWER/ WATTS	LOCATION/ROOM NUMBER	PANEL	CIRCUIT NO.	CIRCUIT PROTECTION DEVICE	CIRCUIT SIZE	CONTROLLER DISCONNECT				CONTROLLER				DISCONNECT AT MOTOR			REMARKS
									TYPE	SIZE	BY	LOCATE	TYPE	SIZE	BY	LOCATE	TYPE	SIZE	BY	
ACCU-1	208.0 V	1	17A	OUTDOOR/LOW ROOF	M1	2,4	20/2 CB	2#12,12G,3/4"C	NFDS 3R	30/2	DIV. 26	NEAR UNIT	BMS CONT	---	DIV. 23	---	SEE	CONTROLLER	DISCONNECT	
ACCU-2	208.0 V	1	17A	OUTDOOR/LOW ROOF	M1	11,13	20/2 CB	2#12,12G,3/4"C	NFDS 3R	30/2	DIV. 26	NEAR UNIT	BMS CONT	---	DIV. 23	---	SEE	CONTROLLER	DISCONNECT	
EF-1	120.0 V	1	3.HP	MENS RR 110	M1	7	15/1 CB	2#12,12G,3/4"C	MMS	00	DIV. 26	NEAR UNIT	BMS CONT	---	DIV. 23	---	NFDS	30/1	DIV. 26	
EF-2	120.0 V	1	0.07 HP	CORRIDOR 222	M1	1	15/1 CB	2#12,12G,3/4"C	MMS	00	DIV. 26	NEAR UNIT	BMS CONT	---	DIV. 23	---	NFDS	30/1	DIV. 26	
ELV-1	208.0 V	3		ELEVATOR	M1	15,17,19	15/3 CB	3#12, 12G, 3/4"C	NFDS	30/3										
ESP-1	120.0 V	1	0.5HP	ELEVATOR PIT (SUMP PUMP)	M1	5	20/1 CB	2#12,12G,3/4"C	FDS	30/1	DIV. 26	NEAR UNIT	FLOAT SWITCH	---	DIV.22	---	SEE	CONTROLLER	DISCONNECT	
EUH-1	480.0 V	3	3KW	MECH RM 107	MP1	3	15/3 CB	3#12, 12G, 3/4"C	NFDS	30/3	DIV. 26	ON UNIT	TSTAT	---	DIV. 23	---	SEE	CONTROLLER	DISCONNECT	
EUH-1	480.0 V	3	3.7KW	STAIR 108	MP1	4	15/3 CB	3#12, 12G, 3/4"C	NFDS	30/3	MANUFACTURER	ON UNIT	TSTAT	---	DIV. 23	---	SEE	CONTROLLER	DISCONNECT	
EUH-1	480.0 V	3	3KW	VEST 100	MP1	5	15/3 CB	3#12, 12G, 3/4"C	NFDS	30/3	DIV. 26	ON UNIT	TSTAT	---	DIV. 23	---	SEE	CONTROLLER	DISCONNECT	
EUH-1	480.0 V	3	3KW	VEST 210	MP1	6	15/3 CB	3#12, 12G, 3/4"C	NFDS	---	MANUFACTURER	ON UNIT	BMS CONT	---	DIV 23	---	SEE	CONTROLLER	DISCONNECT	
EUH-1	480.0 V	3	3KW	STAIR 212	MP1	7	15/3 CB	3#12, 12G, 3/4"C	NFDS	---	MANUFACTURER	ON UNIT	BMS CONT	---	DIV 23	---	SEE	CONTROLLER	DISCONNECT	
EWH-1	120.0 V	3	29A	MECH RM 107	M1	9	60/3 CB	3#6,#10G, 1"C	NFDS	60/3	DIV. 26	NEAR UNIT	BMS CONT	---	DIV. 23	---	SEE	CONTROLLER	DISCONNECT	
RTU-1	480.0 V	3	84A	OUTDOOR/LOW ROOF	MP1	2	90/3 CB	3#3, #8G,1-1/4"C	VFD	---	DIV. 23	---	VFD	---	DIV 23	---	SEE	CONTROLLER	DISCONNECT	PROVIDE 120V CIRCUIT FOR FACTORY MOUNTED RECPT
TB-1	480.0 V	3	2.4KW	PASS/ID 103	MP2	7,9,11	15/3 CB	3#12, 12G, 3/4"C	NFDS	---	MANUFACTURER	ON UNIT	BMS CONT	---	DIV 23	---	SEE	CONTROLLER	DISCONNECT	
TB-2	480.0 V	3	5.1KW	CORRIDOR 116	MP2	2,4,6	15/3 CB	3#12, 12G, 3/4"C	NFDS	---	MANUFACTURER	ON UNIT	BMS CONT	---	DIV 23	---	SEE	CONTROLLER	DISCONNECT	
TB-3	480.0 V	3	3.9KW	CORRIDOR 116	MP2	13,15,17	15/3 CB	3#12, 12G, 3/4"C	NFDS	---	MANUFACTURER	ON UNIT	BMS CONT	---	DIV 23	---	SEE	CONTROLLER	DISCONNECT	
TB-4	480.0 V	3	6.6KW	BREAK 106	MP2	8,10,12	15/3 CB	3#12, 12G, 3/4"C	NFDS	---	MANUFACTURER	ON UNIT	BMS CONT	---	DIV 23	---	SEE	CONTROLLER	DISCONNECT	
TB-5	480.0 V	3	8.9KW	CORRIDOR 116	MP2	19,21,23	15/3 CB	3#12, 12G, 3/4"C	NFDS	---	MANUFACTURER	ON UNIT	BMS CONT	---	DIV 23	---	SEE	CONTROLLER	DISCONNECT	
TB-6	480.0 V	3	2.6KW	BDOC 115	MP2	14,16,18	15/3 CB	3#12, 12G, 3/4"C	NFDS	--	MANUFACTURER	ON UNIT	BMS CONT	---	DIV 23	---	SEE	CONTROLLER	DISCONNECT	
TB-7	480.0 V	3	4.6KW	CORRIDOR 116	MP2	25,27,29	15/3 CB	3#12, 12G, 3/4"C	NFDS	---	MANUFACTURER	ON UNIT	BMS CONT	---	DIV 23	---	SEE	CONTROLLER	DISCONNECT	
TB-8	480.0 V	3	4.5KW	CORRIDOR 222	MP2	20,22,24	15/3 CB	3#12, 12G, 3/4"C	NFDS	---	MANUFACTURER	ON UNIT	BMS CONT	---	DIV 23	---	SEE	CONTROLLER	DISCONNECT	
TB-9	480.0 V	3	4.1KW	CORRIDOR 222	MP2	31,33,35	15/3 CB	3#12, 12G, 3/4"C	NFDS	---	MANUFACTURER	ON UNIT	BMS CONT	---	DIV 23	---	SEE	CONTROLLER	DISCONNECT	
TB-10	480.0 V	3	1.2KW	HOTELING STATIONS 214	MP2	26,28,30	15/3 CB	3#12, 12G, 3/4"C	NFDS	---	MANUFACTURER	ON UNIT	BMS CONT	---	DIV 23	---	SEE	CONTROLLER	DISCONNECT	
TB-11	480.0 V	3	3.9KW	CORRIDOR 222	MP2	37,39,41	15/3 CB	3#12, 12G, 3/4"C	NFDS	---	MANUFACTURER	ON UNIT	BMS CONT	---	DIV 23	---	SEE	CONTROLLER	DISCONNECT	
TB-12	480.0 V	3	5.4KW	CORRIDOR 222	MP2	32,34,36	15/3 CB	3#12, 12G, 3/4"C	NFDS	---	MANUFACTURER	ON UNIT	BMS CONT	---	DIV 23	---	SEE	CONTROLLER	DISCONNECT	
TB-13	480.0 V	3	2.6KW	CORRIDOR 222	MP2	43,45,47	15/3 CB	3#12, 12G, 3/4"C	NFDS	---	MANUFACTURER	ON UNIT	BMS CONT	---	DIV 23	---	SEE	CONTROLLER	DISCONNECT	

BOD LIGHTING FIXTURE SCHEDULE

LUMINAIRE ID	VOLTAGE	WATTAGE	MANUFACTURER	MODEL	DESCRIPTION
D1	277	9	COOPER LIGHTING SOLUTIONS - HALO	RL3059FSD2W1EWH -500LM -3500K	6" LED ROUND DOWNLIGHT.
D2	277	9	COOPER LIGHTING SOLUTIONS - HALO		SAME AS D1 EXCEPT PROVIDE WATER TIGHT HOUSING FOR USE IN WET AREAS (SHOWERS).
L4	277	15	PRUDENTIAL LIGHTING	BPRO3-REC-LED35-LO-4FT-LGP	RECESSED LIGHTING FIXTURE, 4' LENGTH PROVIDE IN SERIES AS SHOWN ON PLANS.
R1	277	15	PRUDENTIAL LIGHTING	BPRO3-REC-LED35-MO-4FT-LGP	SAME AS L4 EXCEPT WALL FLUSH MOUNTED.
R1E	277	20	PRUDENTIAL LIGHTING	BPRO3-REC-LED35-MO-4FT-LGP	SAME AS R1 EXCEPT WITH EMERGENCY BATTERY PACK.
R2	277	40	LITHONIA LIGHTING	CPANL Switchable Lumen LED FlatPanel, 1x4,24/33/44LM, 3500 K CCT, - 44LM	1X4 LED FLATPANEL
T2	277	20	LITHONIA LIGHTING	CPANL Switchable Lumen LED Flat Panel, 2x2, 24/33/44LM, 3500 K CCT, - 24LM	GENERAL PURPOSE LED TROFFER 2'X2' WITH 2000 NOMINAL LUMENS #4/12 ACRYLIC LENS AND 3560K LEDS
T2E	277	25	LITHONIA LIGHTING	CPANL 2X2 AL01 SWW7 M4 2X2 2400-4400 LUMENS 35-50K MVOLT ILBLP CP20 HE SD A	SAME AS LUMINAIRE TYPE T2, EXCEPT WITH 20 WATT EMERGENCY BATTERY PACK.
W1E	277	16	LITHONIA LIGHTING	ARC1 P1 40K MVOLT E4WH	LED WALL PACK, WATER TIGHT HOUSING, WITH 4 WALL EMERGENCY BATTERY PACK.
X1	UNIV	3	LITHONIA LIGHTING	LQC SERIES	WALL MOUNT EXIT SIGN, RED LETTERS.
X2	UNIV	3	LITHONIA LIGHTING	EDGRC EXIT SERIES	RECESSED, A/C POWERED, UNIVERSAL MOUNT EDGE-LIT LED EXIT SIGN WITH RED LETTERS, BRUSHED ALUMINUM HOUSING, DOUBLE FACE FIXTURE SHALL BE FURNISHED WITH DIRECTIONAL CHEVRONS PER PLANS

600V FEEDER SCHEDULE

BASED ON COPPER CONDUCTORS, THHN/THWN

MAXIMUM AMPACITY	FEEDER NUMBER	NUMBER OF SETS	CONDUCTOR SIZE			CONDUIT SIZE	MAXIMUM AMPACITY	FEEDER NUMBER	NUMBER OF SETS	CONDUCTOR SIZE			CONDUIT SIZE
			PHASE(3/C)	NEUTRAL	EQUIPMENT GROUND					PHASE(3/C)	NEUTRAL	EQUIPMENT GROUND	
15	1	1	12	--	12	3/4"	380	18	1	500KCMIL	--	3	3"
	1N			12				18N			500KCMIL		3-1/2"
20	2	1	12	--	12	3/4"	420	19	1	600KCMIL	--	2	3"
	2N			12				19N			600KCMIL		3-1/2"
30	3	1	10	--	10	3/4"	460	20	2	4/0	--	2	2"
	3N			10				20N			4/0		2-1/2"
40	4	1	8	--	10	3/4"	510	21	2	250KCMIL	--	1	2-1/2"
	4N			8				21N			250KCMIL		
55	5	1	6	--	10	3/4"	620	22	2	350KCMIL	--	1/0	2-1/2"
	5N			6		1"		22N			350KCMIL		3"
70	6	1	4	--	8	1"	670	23	2	400KCMIL	--	1/0	3"
	6N			4		1-1/4"		23N			400KCMIL		
85	7	1	3	--	8	1-1/4"	760	24	2	500KCMIL	--	1/0	3"
	7N			3				24N			500KCMIL		3-1/2"
95	8	1	2	--	8	1-1/4"	840	25	2	600KCMIL	--	1/0	3"
	8N			2		1-1/2"		25N			600KCMIL		3-1/2"
110	9	1	1	--	6	1-1/2"	1005	26	3	400KCMIL	--	2/0	3"
	9N			1				26N			400KCMIL		
150	10	1	1/0	--	6	1-1/2"	1260	27	3	600KCMIL	--	3/0	3-1/2"
	10N			1/0		2"		27N			600KCMIL		
175	11	1	2/0	--	6	1-1/2"	1680	28	4	600KCMIL	--	4/0	3-1/2"
	11N			2/0		2"		28N			600KCMIL		
200	12	1	3/0	--	6	2"	2100	29	5	600KCMIL	--	250KCMIL	3-1/2"
	12N			3/0				29N			600KCMIL		4"
230	13	1	4/0	--	4	2"	2520	30	6	600KCMIL	--	350KCMIL	3-1/2"
	13N			4/0		2-1/2"		30N			600KCMIL		4"
255	14	1	250KCMIL	--	4	2"	3040	31	8	500KCMIL	--	400KCMIL	3-1/2"
	14N			250KCMIL		2-1/2"		31N			500KCMIL		4"
285	15	1	300KCMIL	--	4	2-1/2"	4200	32	10	600KCMIL	--	500KCMIL	3-1/2"
	15N			300KCMIL		3"		32N			600KCMIL		4"
310	16	1	350KCMIL	--	3	2-1/2"	5040	33	12	600KCMIL	--	700KCMIL	4"
	16N			350KCMIL		3"		33N			600KCMIL		
335	17	1	400KCMIL	--	3	2-1/2"	6300	34	15	600KCMIL	--	800KCMIL	4"
	17N			400KCMIL		3"		34N			600KCMIL		

FEEDER SCHEDULE NOTES:

1. CONDUCTOR SIZING BASED ON COPPER CONDUCTORS.

2. ALL CONDUCTOR SIZES ARE BASED ON CONDUIT LENGTHS OF 65 FEET FOR 120 VOLT BRANCH CIRCUITS AND 150 FEET FOR 277 VOLT BRANCH CIRCUITS. IF LENGTH EXCEEDS 65 FEET (120V, 20A CIRCUITS) OR 150 FEET (277V, 20A CIRCUITS), THEN USE WIRE SIZE DENOTED AND INCREASE CONDUIT SIZE AS REQUIRED BY NATIONAL ELECTRICAL CODE.

WIRE SIZE	CONDUCTORS	
	120V, 20A CIRCUIT	277V, 20A CIRCUIT
#10	65' TO 120'	150' TO 240'
#8	120' TO 180'	ABOVE 240'
#6	180' AND ABOVE	-

AECOM

PROJECT

NEW SECURITY FORCES BUILDING

PAYNE BLVD.
CHARLOTTE, NORTH CAROLINA 28208

CLIENT

NORTH CAROLINA AIR NATIONAL GUARD - 145TH AIRLIFT WING

145TH AIRLIFT WING
4930 MINUTEMAN WAY
CHARLOTTE, NORTH CAROLINA 28208

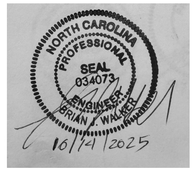
ARCHITECT/DESIGNER

AECOM

277 W NATIONWIDE BLVD
COLUMBUS, OH 43215
614-464-4500

CONSULTANTS

REGISTRATION



KEY PLAN

N

ISSUE/REVISION

I/R	DATE	DESCRIPTION
2	07-01-2026	ADDENDUM #1
1	6-19-2025	B-3 SUBMITTAL - FINAL REV1
	09/06/23	B-3 SUBMITTAL - FINAL

PROJECT NUMBER

60637899

SHEET TITLE

ELECTRICAL SCHEDULES

SHEET NUMBER

E701

15-ELECTRICAL-15.70-E701-ELECTRICAL SCHEDULES
Designer: Designer Checker: Checker Approved: Approver ARCH E1 30"x42"
Project Management Initials:
Last Plotted: 6/30/2026 10:39:15 AM
Filename: Autodesk Docs://P-AMER (USA) 60637899-SF NC AND 145th 60637899_SF-NC_AND_R21_E.rvt
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15_ 15.70_ ELECTRICAL_ E701

PANELBOARD: RP1

LOCATION: Electrical Room 233 **VOLTAGE:** 208/120 Wye V. 3 ø 4 W.
MOUNTING: SURFACE NEMA 1 **A.I.C. RATING:** 10k
MAIN DEVICE: 125 A MCB **SPECIAL:**
BUS AMPS: 125 A

LOAD DESCRIPTION	TYP.	WIRE	BKR	PLS	#	A		B		C		#	PLS	BKR	WIRE	TYP.	LOAD DESCRIPTION
TV 102B	RP		20 A	1	1	0.2	0.7					2	1	20 A		RP	RP 107
TV 102A	RP		20 A	1	3			0.4	0.7			4	1	20 A		RP	RP FLOOR 102A
TV AND RP 106	RP		20 A	1	5					0.4	0.9	6	1	20 A		RP	RP 103
RP 100, 101	RP		20 A	1	7	1.1	1.6					8	1	20 A		RP	RP RESTROOMS 1F
RP 114, 115	RP		20 A	1	9			1.1	0.0			10	1	20 A	--	--	SPARE
PROJECTOR 102A	MN		20 A	1	11					1.2	0.0	12	1	20 A	--	--	SPARE
RP 104	RP		20 A	1	13	0.9	1.4					14	1	20 A		RP	RP 105
RP 102A	RP		20 A	1	15			1.3	0.9			16	1	20 A		RP	RP 108
REFRIGERATOR 106	RP		20 A	1	17					1.2	6.6	18				Spare; RP	
SPARE	--	--	20 A	1	19	0.0	6.5					20	3	60 A			RP2
SPARE	--	--	20 A	1	21			0.0	6.8			22					
SPARE	--	--	20 A	1	23					0.0	0.9	24	1	20 A		RP	RP COUNTER 100
SPARE	--	--	20 A	1	25	0.0						26					
SPARE	--	--	20 A	1	27			0.0	1.4			28	1	20 A		RP	RP 108, 109, 112
SPARE	--	--	20 A	1	29					0.0	1.4	30	1	20 A			TV BDOC 115
SPARE	--	--	20 A	1	31	0.0	0.0					32	1	20 A	--	--	SPARE
SPACE	--	--	--	1	33			--	--			34	1	--	--	--	SPACE
SPACE	--	--	--	1	35					--	--	36	1	--	--	--	SPACE
SPACE	--	--	--	1	37	--	0.0					38					
SPACE	--	--	--	1	39			--	0.0			40	3	30 A	--	--	GEN BLOCK HTR
SPACE	--	--	--	1	41					--	0.0	42					
			TOTAL LOAD:			12 kVA		13 kVA		13 kVA							
			TOTAL AMPS:			104 A		105 A		105 A							

CONN....	TYPE DESCRIPTION	DIVERSITY	
0 VA	HT Electric Heat	0%	0 VA
0 VA	AC A/C Refrigeration	0%	0 VA
0 VA	... Misc. Motors	100%	0 VA
0 VA	... Water Heating	100%	0 VA
0 VA	OL Outdoor Lighting	125%	0 VA
0 VA	LT Indoor Lighting	125%	0 VA
36420 VA	RP Receptacles	NEC 220-13	23210 VA
0 VA	EX Existing Demand	125%	0 VA
0 VA	MC Misc. Continuous	125%	0 VA
1200 VA	MN Misc. Non-Continuous	100%	1200 VA
0 VA	KT Kitchen Equipment	65%	0 VA
0 VA	Largest Connected Motor	125%	0 VA

PANEL TOTALS

CONNECTED LOAD:	37620 VA
N.E.C. LOAD	24410 VA
N.E.C. CURRENT	
AT PANEL VOLTAGE	68 A

NOTES:

PANELBOARD: RP2

LOCATION: Electrical Room 233 **VOLTAGE:** 208/120 Wye V. 3 ø 4 W.
MOUNTING: SURFACE NEMA 1 **A.I.C. RATING:** 10k
MAIN DEVICE: 100 A MCB **SPECIAL:**
BUS AMPS: 100 A

LOAD DESCRIPTION	TYP.	WIRE	BKR	PLS	#	A		B		C		#	PLS	BKR	WIRE	TYP.	LOAD DESCRIPTION
RP 209, 210, 211	RP		20 A	1	1	0.9	1.6					2	1	20 A		RP	RP 206, 207, COFFEE...
RP	RP		20 A	1	3			1.1	1.4			4	1	20 A		RP	RP 202, 203
RP 204, 205	RP		20 A	1	5					1.4	1.4	6	1	20 A		RP	RP WORKSTATION...
RP WORKSTATION...	RP		20 A	1	7	1.6	1.1					8	1	20 A		RP	RP 201
RP WORKSTATION...	RP		20 A	1	9			1.6	0.9			10	1	20 A		RP	RP 208, 212....
RP WORKSTATIONS...	RP		20 A	1	11					1.4	1.1	12	1	20 A		RP	RP AND TV 200
RP WORKSTATIONS...	RP		20 A	1	13	1.4	0.0					14	1	20 A	--	--	SPARE
RP WORKSTATIONS...	RP		20 A	1	15			1.4	0.0			16	1	20 A	--	--	SPARE
RP WORKSTATIONS...	RP		20 A	1	17					1.4	0.0	18	1	20 A	--	--	SPARE
SPARE	--	--	20 A	1	19	0.0	0.0					20	1	20 A	--	--	SPARE
SPARE	--	--	20 A	1	21			0.0	0.0			22	1	20 A	--	--	SPARE
SPARE	--	--	20 A	1	23					0.0	0.0	24	1	20 A	--	--	SPARE
SPARE	--	--	20 A	1	25	0.0	0.0					26	1	20 A	--	--	SPARE
SPARE	--	--	20 A	1	27			0.0	0.0			28	1	20 A	--	--	SPARE
SPARE	--	--	20 A	1	29					0.0	0.0	30	1	20 A	--	--	SPARE
SPACE	--	--	--	1	31	--	--					32	1	--	--	--	SPACE
SPACE	--	--	--	1	33			--	--			34	1	--	--	--	SPACE
SPACE	--	--	--	1	35					--	--	36	1	--	--	--	SPACE
SPACE	--	--	--	1	37	--	--					38	1	--	--	--	SPACE
SPACE	--	--	--	1	39			--	--			40	1	--	--	--	SPACE
SPACE	--	--	--	1	41					--	--	42	1	--	--	--	SPACE
			TOTAL LOAD:			7 kVA		6 kVA		7 kVA							
			TOTAL AMPS:			55 A		54 A		57 A							

CONN....	TYPE DESCRIPTION	DIVERSITY	
0 VA	HT Electric Heat	0%	0 VA
0 VA	AC A/C Refrigeration	0%	0 VA
0 VA	... Misc. Motors	100%	0 VA
0 VA	... Water Heating	100%	0 VA
0 VA	OL Outdoor Lighting	125%	0 VA
0 VA	LT Indoor Lighting	125%	0 VA
19920 VA	RP Receptacles	NEC 220-13	14960 VA
0 VA	EX Existing Demand	125%	0 VA
0 VA	MC Misc. Continuous	125%	0 VA
0 VA	MN Misc. Non-Continuous	100%	0 VA
0 VA	KT Kitchen Equipment	65%	0 VA
0 VA	Largest Connected Motor	125%	0 VA

PANEL TOTALS

CONNECTED LOAD:	19920 VA
N.E.C. LOAD	14960 VA
N.E.C. CURRENT	
AT PANEL VOLTAGE	42 A

NOTES:

PANELBOARD: M1

LOCATION: Electrical Room 233 **VOLTAGE:** 208/120 Wye V. 3 ø 4 W.
MOUNTING: SURFACE NEMA 1 **A.I.C. RATING:** 10k
MAIN DEVICE: 100 A MCB **SPECIAL:**
BUS AMPS: 100 A

LOAD DESCRIPTION	TYP.	WIRE	BKR	PLS	#	A		B		C		#	PLS	BKR	WIRE	TYP.	LOAD DESCRIPTION
EF-2 222	Mo...		20 A	1	1	0.2	1.5					2	2	20 A		Motor	ACCU-1 OUTDOOR
SPARE	--	--	20 A	1	3			0.0	1.5			4					
ESP-1 - ELEVATOR	Mo...		20 A	1	5					1.2	0.7	6	2	20 A		Motor	FCU-1 114
EF-1 MENS' 110	Mo...		20 A	1	7	0.6	0.7					8					
EWH-1 107	Mo...		20 A	1	9			1.8	0.0			10	1	20 A	--	--	SPARE
ACCU-2 OUTDOOR	Motor		20 A	2	11					1.5	0.0	12	1	20 A	--	--	SPARE
					13	1.5	0.0					14	1	20 A	--	--	SPARE
					15			1.7	0.0			16	1	20 A	--	--	SPARE
ELV-1 - ELEVATOR	Motor		20 A	3	17					1.7	0.0	18	1	20 A	--	--	SPARE
					19	1.7	0.0					20	1	20 A	--	--	SPARE
SPARE	--	--	20 A	1	21			0.0	0.0			22	1	20 A	--	--	SPARE
SPARE	--	--	20 A	1	23					0.0	0.0	24	1	20 A	--	--	SPARE
SPARE	--	--	20 A	1	25	0.0	0.0					26	1	20 A	--	--	SPARE
SPACE	--	--	--	1	27			--	--			28	1	--	--	--	SPACE
SPACE	--	--	--	1	29					--	--	30	1	--	--	--	SPACE
			TOTAL LOAD:			6 kVA		5 kVA		5 kVA							
			TOTAL AMPS:			50 A		41 A		41 A							

CONN....	TYPE DESCRIPTION	DIVERSITY	
0 VA	HT Electric Heat	0%	0 VA
0 VA	AC A/C Refrigeration	0%	0 VA
0 VA	... Misc. Motors	100%	0 VA
0 VA	... Water Heating	100%	0 VA
0 VA	OL Outdoor Lighting	125%	0 VA
0 VA	LT Indoor Lighting	125%	0 VA
0 VA	RP Receptacles	NEC 220-13	0 VA
0 VA	EX Existing Demand	125%	0 VA
0 VA	MC Misc. Continuous	125%	0 VA
0 VA	MN Misc. Non-Continuous	100%	0 VA
0 VA	KT Kitchen Equipment	65%	0 VA
15880 VA	Largest Connected Motor	125%	19850 VA

PANEL TOTALS

CONNECTED LOAD:	15880 VA
N.E.C. LOAD	19850 VA
N.E.C. CURRENT	
AT PANEL VOLTAGE	48 A

NOTES:

PANELBOARD: LP1

LOCATION: Electrical Room 233 **VOLTAGE:** 480/277 Wye V. 3 ø 4 W.
MOUNTING: SURFACE NEMA 1 **A.I.C. RATING:** 10k
MAIN DEVICE: 100 A MCB **SPECIAL:**
BUS AMPS: 100 A

LOAD DESCRIPTION	TYP.	WIRE	BKR	PLS	#	A		B		C		#	PLS	BKR	WIRE	TYP.	LOAD DESCRIPTION
					1	0.0	0.1					2	1	20 A		LT	LTG ELEVATOR SHA...
SPD	--	--	60 A	3	3			0.0	0.5			4	1	20 A		LT	BACKLIT SIGN, EXT
					5					0.0	4.8	6					
LTG EAST LEVEL 1	OL		20 A	1	7	0.5	4.5					8	3	20 A		Spare; RP...	TC1
LTG ELEVATOR SHA...	LT		20 A	1	9			0.1	6.0			10					
LTG LEVEL 2	Po...		20 A	1	11					1.8	0.0	12	1	20 A	--	--	SPARE
LTG TRAINING AND...	Po...		20 A	1	13	1.5	0.0					14	1	20 A	--	--	SPARE
LTG NORTHWEST....	Po...		20 A	1	15			1.4	0.0			16	1	20 A	--	--	SPARE
SPARE	--	--	20 A	1	17					0.0	0.0	18	1	20 A	--	--	SPARE
SPARE	--	--	20 A	1	19	0.0	0.0					20	1	20 A	--	--	SPARE
SPACE	--	--	--	1	21			--	--			22	1	--	--	--	SPACE
SPACE	--	--	--	1	23					--	--	24	1	--	--	--	SPACE
SPACE	--	--	--	1	25	--	--					26	1	--	--	--	SPACE
SPACE	--	--	--	1	27			--	--			28	1	--	--	--	SPACE
SPACE	--	--	--	1	29					--	--	30	1	--	--	--	SPACE
			TOTAL LOAD:			7 kVA		8 kVA		7 kVA							
			TOTAL AMPS:			24 A		29 A		24 A							

CONN....	TYPE DESCRIPTION	DIVERSITY	
0 VA	HT Electric Heat	0%	0 VA
0 VA	AC A/C Refrigeration	0%	0 VA
0 VA	... Misc. Motors	100%	0 VA
0 VA	... Water Heating	100%	0 VA
90 VA	OL Outdoor Lighting	125%	112.5 VA
1488 VA	LT Indoor Lighting	125%	1860 VA
10380 VA	RP Receptacles	NEC 220-13	10190 VA
0 VA	EX Existing Demand	125%	0 VA
0 VA	MC Misc. Continuous	125%	0 VA
4920 VA	MN Misc. Non-Continuous	100%	4920 VA
0 VA	KT Kitchen Equipment	65%	0 VA
0 VA	Largest Connected Motor	125%	0 VA

PANEL TOTALS

CONNECTED LOAD:	21078 VA
N.E.C. LOAD	17082.5 VA
N.E.C. CURRENT	
AT PANEL VOLTAGE	20 A

NOTES:

PANELBOARD: LP1-A

LOCATION: PPE STO/WEAPONS... **VOLTAGE:** 208/120 Wye V. 3 ø 4 W.
MOUNTING: SURFACE NEMA 1 **A.I.C. RATING:** 10k
MAIN DEVICE: 100 A MCB **SPECIAL:**
BUS AMPS: 100 A

LOAD DESCRIPTION	TYP.	WIRE	BKR	PLS	#	A		B		C		#	PLS	BKR	WIRE	TYP.	LOAD DESCRIPTION
					1	0.0	1.2					2	1	20 A		RP	BMS PANEL 107
SPD	--	--	60 A	3	3			0.0	1.5			4	1	20 A		MN	FACP 107
					5					0.0	1.5	6	1	20 A		MN	MNS CP 107
SPACE	--	--	--	1	7	--	0.0					8	1	20 A	--	--	SPARE
CR1	Spare; RP		50 A	3	9			3.0	0.0			10	1	20 A	--	--	SPARE
					11					2.6	0.0	12	1	20 A	--	--	SPARE
					13	3.6	0.0					14	1	20 A	--	--	SPARE
SPACE	--	--	--	1	15			--	--			16	1	--	--	--	SPACE
ELEVATOR CAB LTG	MN		20 A	1	17					1.9	--	18	1	--	--	--	SPACE
			TOTAL LOAD:			5 kVA		5 kVA		6 kVA							
			TOTAL AMPS:			41 A		38 A		50 A							

CONN....	TYPE DESCRIPTION	DIVERSITY	
0 VA	HT Electric Heat	0%	0 VA
0 VA	AC A/C Refrigeration	0%	0 VA
0 VA	... Misc. Motors	100%	0 VA
0 VA	... Water Heating	100%	0 VA
0 VA	OL Outdoor Lighting	125%	0 VA
0 VA	LT Indoor Lighting	125%	0 VA
10380 VA	RP Receptacles	NEC 220-13	10190 VA
0 VA	EX Existing Demand	125%	0 VA
0 VA	MC Misc. Continuous	125%	0 VA
4920 VA	MN Misc. Non-Continuous	100%	4920 VA
0 VA	KT Kitchen Equipment	65%	0 VA
0 VA	Largest Connected Motor	125%	0 VA

PANEL TOTALS

CONNECTED LOAD:	15300 VA
N.E.C. LOAD	15110 VA
N.E.C. CURRENT	
AT PANEL VOLTAGE	42 A

NOTES:

PANELBOARD: CR1

LOCATION: Communication Room 225 **VOLTAGE:** 208/120 Wye V. 3 ø 4 W.
MOUNTING: SURFACE NEMA 1 **A.I.C. RATING:** 10k
MAIN DEVICE: 50 A MCB **SPECIAL:**
BUS AMPS: 50 A

LOAD DESCRIPTION	TYP.	WIRE	BKR	PLS	#	A		B		C		#	PLS	BKR	WIRE	TYP.	LOAD DESCRIPTION
					1	0.0	0.8					2	1	20 A		RP	RACK 114
SPD	--	--	60 A	3	3			0.0	0.8			4	1	20 A		RP	RACK 114
					5					0.0	0.8	6	1	20 A		RP	RACK 114
RACK 114	RP		20 A	1	7	0.8	0.8					8	1	20 A		RP	RACK 114
RP 114	RP		20 A	1	9			1.8	0.0			10	1	30 A	--	--	SPARE
30A COMMS 114	RP		30 A	1	11					2.9	0.0	12	1	20 A	--	--	SPARE
RACK 114	RP		20 A	1	13	0.8	0.0					14	1	20 A	--	--	SPARE
SPACE	--	--	--	1	15			--	--			16	1	--	--	--	SPACE
SPACE	--	--	--	1	17					--	--	18	1	--	--	--	SPACE
			TOTAL LOAD:			3 kVA		3 kVA		4 kVA							
			TOTAL AMPS:			26 A		21 A		31 A							

CONN....	TYPE DESCRIPTION	DIVERSITY	
0 VA	HT Electric Heat	0%	0 VA
0 VA	AC A/C Refrigeration	0%	0 VA
0 VA	... Misc. Motors	100%	0 VA
0 VA	... Water Heating	100%	0 VA
0 VA	OL Outdoor Lighting	125%	0 VA
0 VA	LT Indoor Lighting	125%	0 VA
9180 VA	RP Receptacles	NEC 220-13	9180 VA
0 VA	EX Existing Demand	125%	0 VA
0 VA	MC Misc. Continuous	125%	0 VA
0 VA	MN Misc. Non-Continuous	100%	0 VA
0 VA	KT Kitchen Equipment	65%	0 VA
0 VA	Largest Connected Motor	125%	0 VA

PANEL TOTALS

CONNECTED LOAD:	9180 VA
N.E.C. LOAD	9180 VA
N.E.C. CURRENT	
AT PANEL VOLTAGE	25 A

NOTES:

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PROJECT

NEW SECURITY FORCES BUILDING

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10/21/2025

KEY PLAN

N

ISSUE/REVISION

I/R	DATE	DESCRIPTION
2	07-01-2026	ADDENDUM #1
1	6-19-2025	B-3 SUBMITTAL - FINAL REV1
	03/08/24	B-3 SUBMITTAL - FINAL

PROJECT NUMBER

60637899

SHEET TITLE

ELECTRICAL PANEL SCHEDULES

SHEET NUMBER

E702

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15_ 15.70_ ELECTRICAL_ E702

15-ELECTRICAL-15.70-E702-ELECTRICAL PANEL SCHEDULES
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ABBREVIATIONS

%	PERCENT
&	AND
Ω	OHMS
¢	CENTERLINE
A/V	AUDIO/VISUAL
AC	ALTERNATING CURRENT
ACS	ACCESS CONTROL SYSTEM
AFF	ABOVE FINISHED FLOOR
AM	AMPLITUDE MODULATION
ANSI	AMERICAN NATIONAL STANDARD INSTITUTE
ARMM	RISER CABLE WITH OUTER SHIELD
AUX	AUXILIARY
AWG	AMERICAN WIRE GAUGE
BAS	BUILDING AUTOMATION SYSTEM
BET	BUILDING ENTRANCE TERMINAL
BICSI	BUILDING INDUSTRY CONSULTING SERVICES INTERNATIONAL
BMS	BUILDING MANAGEMENT SYSTEM
C	CONDUIT
CAT	CATEGORY
CATEGORY 3	CATEGORY 3
CATEGORY 6A	CATEGORY 6A
CLG	CEILING
CMR	COMPUTER ROOM
CO	CENTRAL OFFICE
CODEC	CODER/DECODER
CONC	CONCRETE
CP	CONSOLIDATION POINT
CPU	CENTRAL PROCESSING UNIT
D	DATA
D/A	DIGITAL TO ANALOG
DAS	DUAL ATTACHMENT STATION
dB	DECIBEL
DC	DIRECT CURRENT
DD	DATA DISTRIBUTION
DIA	DIAMETER
DIST	DISTRIBUTION
DPP	DATA PATCH PANEL
DTL	DETAIL
DTLS	DETAILS
E	EAST
EIA	ELECTRONIC INDUSTRIES ALLIANCE
EMI	ELECTROMAGNETIC INTERFERENCE
EMT	ELECTRICAL METALLIC TUBING
EQUIP	EQUIPMENT
ER	EQUIPMENT ROOM
FAX	FACSIMILE
FDF	FIBER DISTRIBUTION FRAME
FDU	FIBER DISTRIBUTION UNIT
FEXT	FAR END CROSSTALK
FO	FIBER OPTIC
FPC	FIBER PATCH CABLE
FPP	FIBER PATCH PANEL
FR	FIBER RISER
Gpbs	GIGA BITS PER SECOND
GHz	GIGAHERTZ
GND	GROUND
HC	HORIZONTAL CROSS-CONNECT
HH	HANDHOLE
HRZ	HORIZONTAL
HVB	HORIZONTAL VOICE BLOCK
HVP	HORIZONTAL VOICE PATCH PANEL
Hz	HERTZ
IAW	IN ACCORDANCE WITH
IC	INTERMEDIATE CROSS-CONNECT
IDC	INSULATION DISPLACEMENT CONNECTORS
IDF	INTERMEDIATE DISTRIBUTION FRAME
IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
ISDN	INTEGRAGED SERVICES DIGITAL NETWORK
KB	KEY BACKUP
Kbps	KILO BITS PER SECOND
kHz	KILOHERTZ
km	KILOMETER
LAN	LOCAL AREA NETWORK
LCD	LIQUID CRYSTAL DISPLAY
LEC	LOCAL EXCHANGE CARRIER

ABBREVIATIONS

LED	LIGHT EMITTING DIODE
MAN	METROPOLITAN AREA NETWORK
MAX	MAXIMUM
Mbps	MEGA BITS PER SECOND
MC	MAIN CROSS-CONNECT
MDF	MAIN DISTRIBUTION FRAME
MHz	MEGAHERTZ
MH	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MM	MULTIMODE
MPOP	MINIMUM POINT OF PRESENCE
MTD	MOUNTED
mm	MILLIMETER
N/A	NOT APPLICABLE
W/	WITH
N	NORTH
NEC	NATIONAL ELECTRICAL CODE
NEG	NEGATIVE
NEXT	NEAR END CROSSTALK
NFPA	NATIONAL FIRE AND PROTECTION AGENCY
NIC	NOT IN CONTRACT
OC	ON CENTER
OPT	OPTICAL
OSP	OUTSIDE PLANT
OTDR	OPTICAL TIME DOMAIN REFLECTOMETER
PB	PULL BOX
PBX	PRIVATE BRANCH EXCHANGE
PC	PERSONAL COMPUTER
PDS	PROTECTIVE DISTRIBUTION SYSTEM
PNL	PANEL
POS	POSITIVE
POTS	PLAIN OLD TELEPHONE SERVICE
PP	PATCH PANEL
PR	PAIR
PVC	POLYVINYL CHLORIDE
R	RISER
RAF	RAISED ACCESS FLOOR
RF	RADIO FREQUENCY
RFI	RADIO FREQUENCY INTERFERENCE
RU	RACK MOUNTING UNIT (1.75")
RX	RECEIVE/RECEIVER
S	SOUTH
SHT	SHEET
SM	SINGLEMODE
SNR	SIGNAL-TO-NOISE RATIO
SP	SERVICE PROVIDER
SRG	SIGNAL REFERENCE GRID
STP	SHIELDED TWISTED PAIR/CABLES
STR	STRAND
SW	NETWORK SWITCH
SYS	SYSTEM
TBB	TELECOMMUNICATIONS BONDING BACKBONE
TEL	TELEPHONE
TELCO	TELEPHONE COMPANY
TELECOM	TELECOMMUNICATIONS
TERM	TERMINATION
TGB	TELECOMMUNICATIONS GROUNDING BUSBAR
TIA	TELECOMMUNICATIONS INDUSTRIES ASSOCIATION
TMGB	TELECOMMUNICATIONS MAIN GROUNDING BUSBAR
TR	TELECOMMUNICATIONS ROOM
TX	TRANSMIT/TRANSMITTER
TYP	TYPICAL
UG	UNDERGROUND
UL	UNDERWRITERS LABORATORIES
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SYSTEM
UTP	UNSHIELDED TWISTED PAIR
V	VOICE
VBB	VOICE BACKBONE
VHD	VOICE HORIZONTAL DISTRIBUTION
W	WEST
WAN	WIDE AREA NETWORK
WAP	WIRELESS ACCESS POINT
WP	WEATHERPROOF

GENERAL DRAWING NOTES

1. THE DRAWINGS ARE DIAGRAMMATIC ONLY AND MAY NOT SHOW ALL COMPONENTS, MATERIALS, OFFSETS, BENDS, ELBOWS AND OTHER SPECIFIC ELEMENTS THAT MAY BE REQUIRED FOR A COMPLETE INSTALLATION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING MATERIALS NEEDED FOR A COMPLETE AND FUNCTIONAL INSTALLATION.
2. PRIOR TO INSTALLATION OF DEVICES, FIELD-VERIFY DEVICE LOCATIONS WITH DUE REGARD TO AS-BUILT CONDITIONS, COORDINATION WITH THE WORK OF OTHER TRADES AND MANUFACTURERS' RECOMMENDATIONS.
3. COMMON LOW VOLTAGE CABLE TRAY IS SIZED AS INDICATED ON THE DRAWINGS. PROVIDE ALL MATERIALS AS NEEDED FOR A COMPLETE, MANUFACTURER-APPROVED SYSTEM USING CABLE TRAY MANUFACTURERS' MATERIALS AND PARTS WHEN AVAILABLE FROM THE MANUFACTURER, AND AS INTENDED. CHANGES IN DIRECTION AND INTERSECTIONS SHALL USE PRE-MANUFACTURED OR FIELD-INSTALLED SWEEPS AND TEES. SWEEPS AND TEES SHALL MAINTAIN A 1 FOOT MINIMUM RADIUS IN CHANGES OF DIRECTION.
4. CONDUIT BENDS SHALL BE SWEEPS TO MAINTAIN PROPER CABLE BEND RADIUS.CONDUITS SHALL BE DEBURRED, HAVE 200LB PULLSTRINGS AND BUSHINGS INSTALLED. CONDUIT SHALL TERMINATE WITH METAL BOND BUSHING TO BE BONDED TO GROUND AND PREVENT BURRS FROM DAMAGING CABLES.
5. UNLESS OTHERWISE NOTED, WORK AREA OUTLET CONDUITS SHALL BE A MINIMUM OF 1-1/4"DIAMETER EMT, STUB UP TO ABOVE ACCESSIBLE CEILING (IF AVAILABLE), AND ROUTED OVER TO THE NEAREST CABLE TRAY USING J-HOOKS
6. ALL CONDUIT TO TELECOMMUNICATIONS ROOM(S) FOR TELECOMMUNICATIONS CABLING SHALL TURN DOWN OR UP WITHIN 12" OF WALL OR IN AREA AS INDICATED ON FLOOR PLANS WHERE CABLE TRAY IS INSTALLED. CONDUITS FROM BELOW SHALL STUB UP 3" AFF. CONDUITS FROM ABOVE SHALL STUB DOWN TO 3" BELOW CEILING.
7. PULL BOXES AND JUNCTION BOXES SHALL BE PROVIDED PER LOCAL CODES AND STANDARDS TO FACILITATE THE EASE IN PULLING OF FUTURE CABLING. NO MORE THAN 180 DEGREES IN CONDUIT BENDS IS ALLOWED IN ANY CONDUIT RUN BETWEEN PULL BOXES. CONDUIT SHALL NOT EXCEED MORE THAN 100' IN LENGTH BETWEEN PULL BOXES. CONDUIT WILL NOT ENTER/EXIT ANY PULL BOX AT 90 DEGREEES OF ANY OTHER CONDUIT ENTERING THE PULL BOX. SIZED AND LOCATED PER TIA/EIA.
8. 120 VAC INPUT POWER CONDUCTORS SHALL NOT BE INSTALLED IN THE SAME CONDUIT AS LOW VOLTAGE AUDIO, VIDEO, CONTROL, DC POWER OR ANY OTHER LOW VOLTAGE CABLES. ELECTRICAL CONTRACTOR TO ENSURE PROPER SEPARATION OF CLASS 1, CLASS 2, AND CLASS 3 PER NEC 725-54 (D) AND OR AHJ.
9. CABLES SHALL BE SUPPORTED FROM THE BUILDING STRUCTURE BY APPROVED J-HOOKS OR SLINGS WHEN NOT IN CONDUIT OR COMMON LOW VOLTAGE CABLE TRAY. CABLES TRANSITIONING FROM CABLE TRAY TO CONDUIT SPANNING MORE THAN 3 FEET SHALL BE SUPPORTED.
10. ALL CABLING PASSING THROUGH WALL STRUCTURE SHALL BE SUPPORTED WITH CONDUIT, SLEEVE, FIRESTOP ASSEMBLY, ETC, AS REQUIRED THROUGH THE WALL STRUCTURE. PATHWAY SIZING SHALL ADHERE TO THE REFERENCED STANDARDS AND FILL RATIO REQUIREMENTS.
11. ALL INSTALLED CONDUITS, CABLETRAY, SLEEVES/SLOTS THAT PENETRATE FIRE RATED WALLS, FLOORS AND CEILINGS SHALL BE PROPERLY FIRESTOPPED PER CODE.LISTED FIRESTOP ASSEMBLIES SHALL BE USED TO PENETRATE FIRE & SMOKE WALLS FOR CABLE PATHWAYS.
12. PROVIDE DATA/SIGNAL CABLES, TERMINATION EQUIPMENT, TERMINATIONS, ETC., FROM THE VARIOUS DEVICES TO THE TR AS REPRESENTED IN THE TECHNOLOGY PLANS.
13. CABLES WITHIN CABLE TRAY SHALL BE PLACED IN A RANDOM FASHION WITHOUT BUNDLING THE CABLES. CABLE TIES SHALL NOT BE USED.
14. CABLES SHALL EXIT CABLE TRAY BY MEANS OF CABLE TRAY RADIUS DROP (I.E., WATERFALL).
15. HORIZONTAL CABLE SHALL BE PLENUM RATED WHEN INSTALLED IN A PLENUM SPACE OR WHEN INSTALLED ABOVE CEILING OR BELOW DROPPED FLOOR.
16. WALL BACK BOXES SHALL BE FLUSH MOUNT, 5" x 5" x 2-1/2" DEEP, WITH PLASTER REDUCING RINGS UNLESS OTHERWISE NOTED.
17. PROVIDE BLANK PLATES FOR BOXES LEFT EMPTY OR DENOTED AS "BLANK" FOR FUTURE INSTALLATIONS.
18. PRIOR TO ORDER, SUBMIT FACEPLATE, JACK, AND DEVICE COLOR SAMPLES TO ARCHITECT FOR REVIEW.
19. REFER TO ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR PROPER OUTLET MOUNTING HEIGHTS AND LOCATIONS PRIOR TO ROUGH-IN.
20. REFER TO ELECTRICAL DRAWINGS AND SPECIFICATIONS FOR POWER CONDUITS,CIRCUITS, RECEPTACLES, CABLES, ETC.
21. REFER TO ELECTRICAL DRAWINGS AND SPECIFICATIONS FOR SHARED FLOOR BOXES AND POKETHRUS. REFER TO ELECTRICAL DRAWINGS FOR CONDUITS TO SUPPORT OTHER TECHNOLOGY SYSTEMS (ESS AND ADVANTOR CABLING INFRASTRUCTURE AND EQUIPMENT TO BE PROVIDED BY OTHERS).
22. REFER TO STRUCTURAL DRAWINGS AND SPECIFICATIONS FOR DIMENSIONED CORE HOLE PENETRATIONS.
23. REFER TO LIFE SAFETY DRAWINGS FOR FIRE & SMOKE WALL LOCATIONS.
24. FIELD VERIFY DIMENSIONS PRIOR TO INSTALLATION. NOTIFY THE DESIGNER OF ANY DEVIATIONS EXCEEDING 6 INCHES.
25. CONTRACTOR IS RESPONSIBLE FOR PRE-CONSTRUCTION SITE SURVEY AND STUDY TO VERIFY WIRELESS COVERAGE, AS WELL AS POST-CONSTRUCTION TO INSURE DESIRED COVERAGE AND PERFORM ANY MODIFICATIONS TO MAKE SYSTEM FULLY FUNCTIONAL PRIOR TO INSTALLATION
26. FOLLOW ANSI, BICSI, EIA/TIA STANDARDS, NEC, AND OTHER APPLICABLE STANDARDS AND CODES SHOWN IN SPECIFICATIONS.
27. FIBER PATCH CORDS PROVIDED BY OWNER.
28. CATEGORY 6A PATCH CORDS PROVIDED BY CONTRACTOR; SEE SYMBOL LIST FOR DETAILS.
29. TELECOM / IT STRUCTURED CABLING CONTRACTOR TO PROVIDE ALL ROOM TO ROOM CATEGORY 6A CABLING; REFER TO TA DRAWINGS FOR QUANTITIES AND LOCATIONS.
30. CATEGORY 6A CABLING PERMANENT LINK SHALL NOT EXCEED 90 m (295').
31. ESS, IDS, ACS, AND ADVANTOR CABLING INFRASTRUCTURE AND EQUIPMENT TO BE PROVIDED BY OTHERS.
32. PUBLIC ADDRESS SYSTEM MAY UTILIZE THE FIRE ALARM SYSTEM SPEAKERS TO ELIMINATE DUPLICATION OF SPEAKERS. PUBLIC ADDRESS SYSTEM SHALL NOT BE ROUTED THROUGH THE TELEPHONE HANDSETS. SYSTEM CABLING TO BE PROVIDED BY OTHERS. FIRE ALARM/MASS NOTIFICATION SYSTEM PANEL THAT CONTROLS THE SPEAKER IS LOCATED IN VESTIBULE 100.
33. PAGING SYSTEM MUST INTERFACE WITH EXISTING VALCOM SYSTEM.

SYMBOLS

W	WALL-MOUNTED WALLPHONE; (1) CATEGORY 6A CABLE TERMINATED ON NETWORK (RACK) PATCH PANEL IN TR; (1) 5" x 5" x 2-1/2" DEEP, FLUSH MOUNTED BACK BOX FITTED WITH SINGLE GANG REDUCER RING WITH (1) 1-1/4" CONDUIT STUBBED TO ABOVE ACCESSIBLE CEILING OR DIRECTLY TO LOCAL TR WHERE ACESSIBLE CEILING IS NOT AVAILABLE; MOUNT 4'-6" AFF UON; PROVIDE (1) CATEGORY 6A PLENUM RATED PATCH CORD PER JACK FOR BETWEEN JACK AND NETWORK SWITCH IN TR, PATCH CORD COLOR TO MATCH JACK COLOR
2	WALL-MOUNTED WAO; (2) CATEGORY 6A CABLES TERMINATED ON NETWORK (RACK) PATCH PANEL; (1) 5" x 5" x 2-1/2" DEEP, FLUSH MOUNTED BACK BOX FITTED WITH SINGLE GANG REDUCER RING WITH (1) 1-1/4" CONDUIT STUBBED TO ABOVE ACCESSIBLE CEILING OR DIRECTLY TO LOCAL TR WHERE ACESSIBLE CEILING IS NOT AVAILABLE; MOUNT 18" AFF UON; PROVIDE (2) 6' CATEGORY 6A PATCH CORD AT WAO FOR DEVICE AND (2) CATEGORY 6A PATCH CORD AT NETWORK SWITCH IN TR PER JACK, COLOR OF PATCH CORDS TO MATCH JACK COLOR
4	WALL-MOUNTED WAO; (4) CATEGORY 6A CABLES TERMINATED ON NETWORK (RACK) PATCH PANEL; (1) 5" x 5" x 2-1/2" DEEP, FLUSH MOUNTED BACK BOX FITTED WITH SINGLE GANG REDUCER RING WITH (1) 1-1/4" CONDUIT STUBBED TO ABOVE ACCESSIBLE CEILING OR DIRECTLY TO LOCAL TR WHERE ACESSIBLE CEILING IS NOT AVAILABLE; MOUNT 18" AFF UON; PROVIDE (4) 6' CATEGORY 6A PATCH CORD AT WAO FOR DEVICE & (4) CATEGORY 6A PATCH CORD AT NETWORK SWITCH IN TR PER JACK, COLOR OF PATCH CORDS TO MATCH JACK COLOR
2	FLOOR BOX-MOUNTED WAO; (2) CATEGORY 6A CABLES TERMINATED ON NETWORK (RACK) PATCH PANEL IN TR; (1) 5" x 5" x 2-1/2" DEEP, FLUSH MOUNTED BACK BOX FITTED WITH SINGLE GANG REDUCER RING WITH (1) 1-1/4" CONDUIT STUBBED TO ABOVE ACCESSIBLE CEILING OR DIRECTLY TO LOCAL TR WHERE ACESSIBLE CEILING IS NOT AVAILABLE; MOUNT 18" AFF UON; PROVIDE (2) 6' CATEGORY 6A PATCH CORD AT WAO FOR DEVICE AND (2) CATEGORY 6A PATCH CORD AND NETWORK SWITCH IN TR PER JACK, COLOR OF PATCH CORDS TO MATCH JACK COLOR
4	FLOOR BOX-MOUNTED WAO; (4) CATEGORY 6A CABLES TERMINATED ON NETWORK (RACK) PATCH PANEL IN TR; (1) 5" x 5" x 2-1/2" DEEP, FLUSH MOUNTED BACK BOX FITTED WITH SINGLE GANG REDUCER RING WITH (1) 1-1/4" CONDUIT STUBBED TO ABOVE ACCESSIBLE CEILING OR DIRECTLY TO LOCAL TR WHERE ACESSIBLE CEILING IS NOT AVAILABLE; MOUNT 18" AFF UON; PROVIDE (4) 6' CATEGORY 6A PATCH CORD AT WAO FOR DEVICE AND (4) CATEGORY 6A PATCH CORD AND NETWORK SWITCH IN TR PER JACK, COLOR OF PATCH CORDS TO MATCH JACK COLOR
WAP	CEILING-MOUNTED WIRELESS ACCESS POINT WAO; (2) CATEGORY 6A CABLES TERMINATED ON WIRELESS ACCESS POINT PATCH PANEL IN TR AND TERMINATED IN A SURFACE-MOUNT BOX ON DEVICE END WITH (1) 1-1/4" CONDUIT TO LOCAL TR WHERE ACESSIBLE CEILING IS NOT AVAILABLE; COORDINATE CABLE TERMINATIONS WITH EXACT WAP LOCATION AND INSTALLATION; PROVIDE (2) 25' CATEGORY 6A PATCH CORD AT WAO FOR DEVICE AND (2) CATEGORY 6A PATCH CORD FOR BETWEEN JACK AND NETWORK SWITCH IN TR PER JACK, COLOR OF PATCH CORDS TO MATCH JACK COLOR
TV3	WALL-MOUNTED CATV OUTLET; (2) CATEGORY 6A CABLES TERMINATED ON NETWORK (RACK) PATCH PANEL AND (1) RG-6 COAX CABLES; (1) 5" x 5" x 2-1/2" DEEP, FLUSH MOUNTED BACK BOX FITTED WITH SINGLE GANG REDUCER RING WITH (1) 1-1/4" CONDUIT STUBBED TO ABOVE ACCESSIBLE CEILING OR DIRECTLY TO LOCAL TR WHERE ACESSIBLE CEILING IS NOT AVAILABLE; MOUNT 60" AFF UON; PROVIDE (2) 6' CATEGORY 6A PATCH CORD & (1) RG-6 COAX CABLES TO TV DISPLAY AND (2) CATEGORY 6A PATCH CORD AND NETWORK SWITCH IN TR AND (1) RG-6 PATCH CABLE TO COAX PATCH PANEL PER JACK, COLOR OF PATCH CORDS TO MATCH JACK COLOR. FIELD VERIFY HEIGHTS. COORDINATE OUTLETS WITH ELECRICAL OUTLET HEIGHT.
2	CEILING-MOUNTED PROJECTOR OUTLET. (2) CATEGORY 6A CABLES TERMINATED ON NETWORK (RACK) PATCH PANEL IN TR AND TERMINATED IN A SURFACE-MOUNTED BOX AT DEVICE END WITH A 1 ½" CONDUIT STUBBED TO LOCAL TR WHERE ACESSIBLE CEILING IS NOT AVAILABLE. COORDINATE CABLE TERMINATIONS WITH EXACT LOCATION AND INSTALLATION.
R	WALL-MOUNTED RADIO COMMUNCATIONS OUTLET. (1) RG-6 50 OHM COAXIAL CABLE N-FEMALE TERMINATION. (1) 5" X 5" X 2-1/2" DEEP, FLUSH MOUNTED BACK BOX FITTED WITH (1) 1-1/4" CONDUIT STUBBED TO ABOVE ACCESSIBLE CEILING. MOUNT 18" ABOVE FINISHED FLOOR.
CR	CARD READER TO BE PROVIDED BY ADVANTOR CONTRACTOR. BACKBOX AND PATHWAY INCLUDED. COORDINATE WITH ADVANTOR ON EXACT LOCATIONS.
	CAMERA TO BE PROVIDED BY ADVANTOR CONTRACTOR. BACKBOX AND PATHWAYS INCLUDED. COORDINATE WITH ADVANTOR ON EXACT LOCATIONS.
S	PUBLIC ADDRESS SYSTEM SPEAKERS WILL USE THE FIRE ALARM MASS NOTIFICATION SYSTEM SPEAKERS. THE EMERGENCY MNS SYSTEM WILL OVERRIDE ANY PUBLIC ADDRESSING FUNCTIONALITY.
V	PUBLIC ADDRESS SYSTEM VOLUME CONTROL WILL BE ROUTED FROM LOCATION TO RACK MOUNTED COMM ROOM 114 PUBLIC ADDRESS EQUIPMENT.

24" WIDE LADDER TYPE CABLE TRAY

BASKET TYPE CABLE TRAY, 18" WIDE BY 4" DEEP

CONDUIT ROUTE, 4" DIA UON.

PULL BOX, SIZED PER LATEST TIA 569.

8'H X 4'W X 3/4" THICK A/C GRADE FIRE RATED PLYWOOD MOUNTED 1' AFF

N

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PROJECT

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CHARLOTTE, NORTH CAROLINA 28208

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05/30/2025

KEY PLAN

ISSUE/REVISION

I/R	DATE	DESCRIPTION
3	07-01-2026	ADDENDUM 01
2	05/30/2025	B-3 SUBMITTAL - FINAL
1	03/14/2025	B-2 SUBMITTAL
	09/29/2023	B-1 SUBMITTAL
	09/15/23	B-1 SUBMITTAL

PROJECT NUMBER

60637899
FJRP229030

SHEET TITLE

TELECOMMUNICATIONS LEGEND. ABBREVIATIONS AND SYMBOLS

SHEET NUMBER

T001

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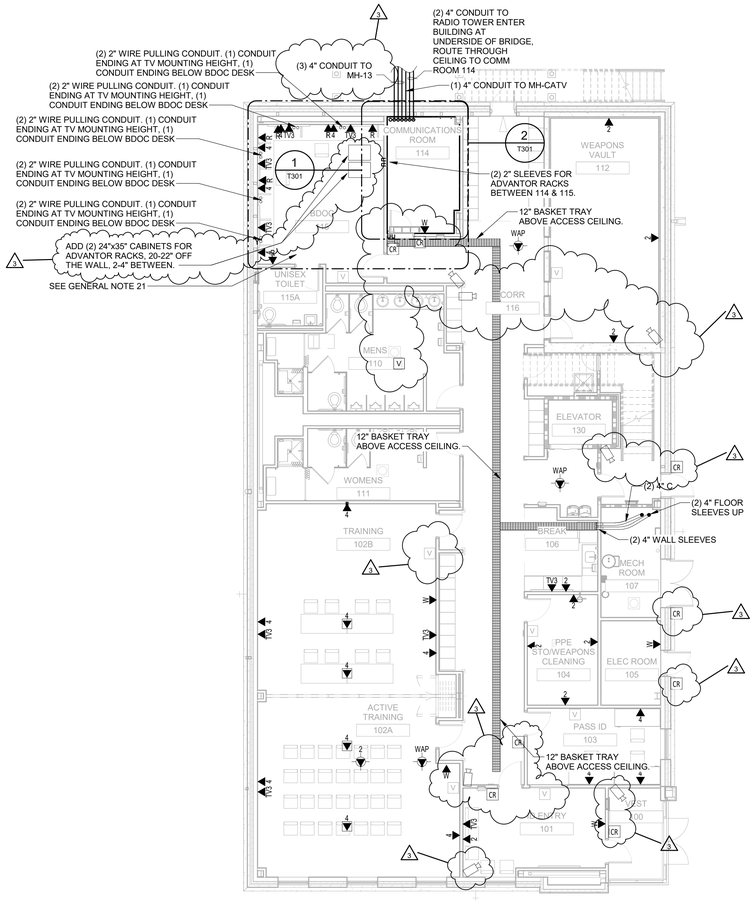

1 T101 **01 FIRST FLOOR**

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

GENERAL NOTES

1. THE DRAWINGS ARE DIAGRAMMATIC ONLY AND MAY NOT SHOW ALL COMPONENTS, MATERIALS, OFFSETS, BENDS, ELBOWS AND OTHER SPECIFIC ELEMENTS THAT MAY BE REQUIRED FOR A COMPLETE INSTALLATION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING MATERIALS NEEDED FOR A COMPLETE AND FUNCTIONAL INSTALLATION.

2. PRIOR TO INSTALLATION OF DEVICES, FIELD-VERIFY DEVICE LOCATIONS WITH DUE REGARD TO AS-BUILT CONDITIONS, COORDINATION WITH THE WORK OF OTHER TRADES AND MANUFACTURER'S RECOMMENDATIONS.

3. CONDUIT BENDS SHALL BE SWEEPS TO MAINTAIN PROPER CABLE BEND RADIUS. CONDUITS SHALL BE DEBURRED, HAVE 200LB PULLSTRINGS AND BUSHINGS INSTALLED. CABLE SHALL NOT BE PLACED INTO CONDUITS OR SLEEVES WITHOUT FIRST DEBURRING AND INSTALLING BUSHINGS.

4. CONDUIT STUB-OUTS SHALL BE EXTENDED TO NEAREST ACCESSIBLE CEILING SPACE FOR ROOMS WITH HARD CEILINGS, CONDUIT SHALL BE ROUTED TO ADJOINING CORRIDOR IN COMMON WITH A ROOM DOOR. CONDUITS SHALL NOT PASS THROUGH OTHER ROOMS TO REACH A CORRIDOR, UNLESS THE ROOM IS COMPLETELY SURROUNDED BY OTHER ROOMS OR SPACES (E.G., ELEVATORS AND INACCESSIBLE CHASES).

5. PULL BOXES AND JUNCTION BOXES SHALL BE PROVIDED PER LOCAL CODES AND STANDARDS TO FACILITATE THE EASE IN PULLING OF FUTURE CABLING. AT A MINIMUM, PROVIDE ONE (1) PULL BOX FOR EVERY 100 FEET OF STRAIGHT CONDUIT RUN, AND ONE (1) PULL BOX AFTER TWO (2) 90-DEGREE BENDS.

6. ROUTING OF CONDUIT SHOWN FOR DESIGN INTENT ONLY. COORDINATE EXACT ROUTE BASED ON FIELD CONDITIONS.

7. CABLES WITHIN CABLE TRAY SHALL BE PLACED IN A RANDOM FASHION WITHOUT BUNDLING THE CABLES. CABLE TIES SHALL NOT BE USED.

8. CABLES SHALL EXIT CABLE TRAY BY MEANS OF CABLE TRAY RADIUS DROP (I.E., WATERFALL).

9. CABLES SHALL BE SUPPORTED FROM THE BUILDING STRUCTURE BY APPROVED J-HOOKS OR SLINGS WHEN NOT IN CONDUIT OR COMMON LOW VOLTAGE CABLE TRAY. CABLES TRANSITIONING FROM CABLE TRAY TO CONDUIT SPANNING MORE THAN 3 FEET SHALL BE SUPPORTED.

10. WORK AREA OUTLET CONDUIT SHALL BE A MINIMUM OF 1 TRADE SIZE EMT, UNLESS OTHERWISE NOTED.

11. SINGLE GANG PLASTER REDUCING RINGS SHALL BE PROVIDED WITH DOUBLE-GANG BACKBOXES, UNLESS OTHERWISE NOTED.

12. HORIZONTAL CABLE SHALL BE PLENUM RATED.

13. PROVIDE BLANK PLATES FOR BOXES LEFT EMPTY OR DENOTED AS "BLANK" FOR FUTURE INSTALLATIONS.

14. NOTES FOR CABLE, FACEPLATE AND JACK COLORS.

15. PRIOR TO ORDER, SUBMIT FACEPLATE, JACK, AND DEVICE COLOR SAMPLES TO ARCHITECT FOR REVIEW.

16. REFER TO ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR PROPER OUTLET MOUNTING HEIGHTS AND LOCATIONS PRIOR TO ROUGH-IN.

17. REFER TO ELECTRICAL DRAWINGS AND SPECIFICATIONS FOR POWER CONDUITS, CIRCUITS, RECEPTACLES, CABLES, ETC.

18. REFER TO STRUCTURAL DRAWINGS AND SPECIFICATIONS FOR DIMENSIONED CORE HOLE PENETRATIONS.

19. REFER TO LIFE SAFETY DRAWINGS FOR FIRE & SMOKE WALL LOCATIONS. CONDUIT PENETRATIONS SHALL BE PROPERLY FIRESTOPPED PER CODE. CABLE TRAY SHALL NOT PENETRATE FIRE & SMOKE WALLS. LISTED FIRESTOP ASSEMBLIES SHALL BE USED TO PENETRATE FIRE & SMOKE WALLS FOR CABLE TRAY PATHWAYS.

20. REFER TO ELECTRICAL DRAWINGS FOR THE CONDUIT AND BACKBOXES FOR THE ESS AND ADVANTOR SYSTEMS. EQUIPMENT AND CABLING INFRASTRUCTURE TO BE PROVIDED BY OTHERS.

21. ROOM 115 BDOC - ADVANTOR SYSTEM EQUIPMENT AND RACK TO BE PROVIDED BY OTHERS. COORDINATE EXACT LOCATION WITH ADVANTOR VENDOR.

22. PAGING EQUIPMENT WILL BE RACK MOUNTED IN COMMUNICATIONS ROOM 114. CONNECTION TO FIRE ALARM SYSTEM WILL BE CONNECTED TO FIRE ALARM PANEL IN BDOC ROOM 115.

23. PAGING STATION WILL BE LOCATED IN THE BDOC ROOM 115.

24. COORDINATE WITH TELECOMMUNICATIONS CONTRACTORS IF ADVANTOR EQUIPMENT IS CHANGED FROM CURRENT DRAWING LOCATION. (I.E. RELOCATED FROM BDOC 115 TO COMMUNICATIONS ROOM 114)

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CHARLOTTE, NORTH CAROLINA 28208

CLIENT

NORTH CAROLINA AIR NATIONAL GAURD - 145TH AIRLIFT WING

145th AIRLIFT WING
4930 MINUTEMAN WAY
CHARLOTTE, NORTH CAROLINA 28208

ARCHITECT/DESIGNER

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Bicsi
P Joie Koenders
BICSI ID # 118551
Expires 12-31-26
RCDD

Signature

05/30/2025

KEY PLAN

ISSUE/REVISION

I/R	DATE	DESCRIPTION
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1	03/14/2025	B-2 SUBMITTAL
	09/29/2023	B-1 SUBMITTAL
	09/15/23	B-1 SUBMITTAL

PROJECT NUMBER

60637899
FJRP229030

SHEET TITLE

TELECOMMUNICATIONS FIRST FLOOR PLAN

SHEET NUMBER

T101

Project Management Initials: MR Designer: Designer Checker: Checker Approved: Approver/ARCH E1 30"x42"
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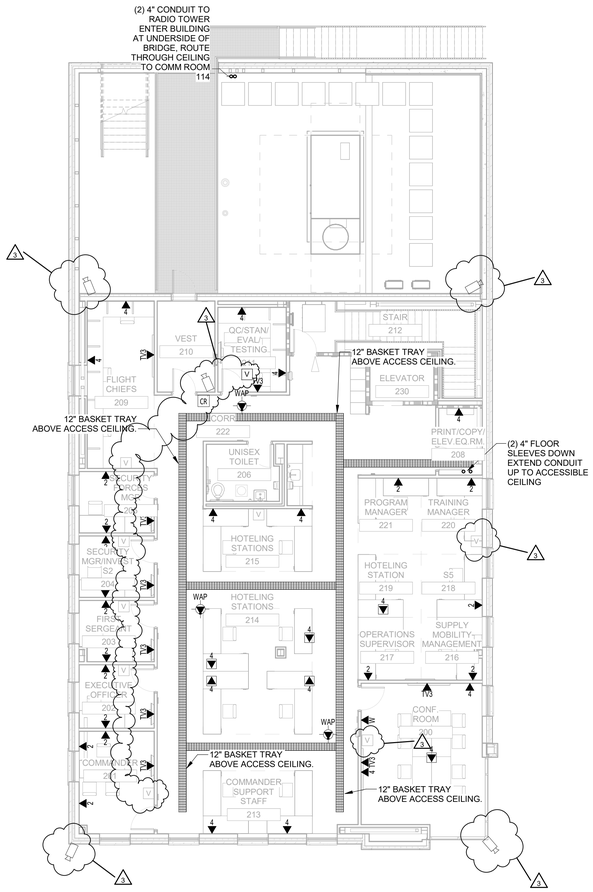

1 T102 **02 SECOND FLOOR**

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

GENERAL NOTES

1. THE DRAWINGS ARE DIAGRAMMATIC ONLY AND MAY NOT SHOW ALL COMPONENTS, MATERIALS, OFFSETS, BENDS, ELBOWS AND OTHER SPECIFIC ELEMENTS THAT MAY BE REQUIRED FOR A COMPLETE INSTALLATION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING MATERIALS NEEDED FOR A COMPLETE AND FUNCTIONAL INSTALLATION.
2. PRIOR TO INSTALLATION OF DEVICES, FIELD-VERIFY DEVICE LOCATIONS WITH DUE REGARD TO AS-BUILT CONDITIONS, COORDINATION WITH THE WORK OF OTHER TRADES AND MANUFACTURER'S RECOMMENDATIONS.
3. CONDUIT BENDS SHALL BE SWEEPS TO MAINTAIN PROPER CABLE BEND RADIUS. CONDUITS SHALL BE DEBURRED, HAVE 200LB PULLSTRINGS AND BUSHINGS INSTALLED. CABLE SHALL NOT BE PLACED INTO CONDUITS OR SLEEVES WITHOUT FIRST DEBURRING AND INSTALLING BUSHINGS.
4. CONDUIT STUB-OUTS SHALL BE EXTENDED TO NEAREST ACCESSIBLE CEILING SPACE. FOR ROOMS WITH HARD CEILINGS, CONDUIT SHALL BE ROUTED TO ADJOINING CORRIDOR IN COMMON WITH A ROOM DOOR. CONDUITS SHALL NOT PASS THROUGH OTHER ROOMS TO REACH A CORRIDOR, UNLESS THE ROOM IS COMPLETELY SURROUNDED BY OTHER ROOMS OR SPACES (E.G., ELEVATORS AND INACCESSIBLE CHASES).
5. PULL BOXES AND JUNCTION BOXES SHALL BE PROVIDED PER LOCAL CODES AND STANDARDS TO FACILITATE THE EASE IN PULLING OF FUTURE CABLING. AT A MINIMUM, PROVIDE ONE (1) PULL BOX FOR EVERY 100 FEET OF STRAIGHT CONDUIT RUN, AND ONE (1) PULL BOX AFTER TWO (2) 90-DEGREE BENDS.
6. ROUTING OF CONDUIT SHOWN FOR DESIGN INTENT ONLY. COORDINATE EXACT ROUTE BASED ON FIELD CONDITIONS.
7. CABLES WITHIN CABLE TRAY SHALL BE PLACED IN A RANDOM FASHION WITHOUT BUNDLING THE CABLES. CABLE TIES SHALL NOT BE USED.
8. CABLES SHALL EXIT CABLE TRAY BY MEANS OF CABLE TRAY RADIUS DROP (I.E., WATERFALL).
9. CABLES SHALL BE SUPPORTED FROM THE BUILDING STRUCTURE BY APPROVED J-HOOKS OR SLINGS WHEN NOT IN CONDUIT OR COMMON LOW VOLTAGE CABLE TRAY. CABLES TRANSITIONING FROM CABLE TRAY TO CONDUIT SPANNING MORE THAN 3 FEET SHALL BE SUPPORTED.
10. WORK AREA OUTLET CONDUIT SHALL BE A MINIMUM OF 1 TRADE SIZE EMT, UNLESS OTHERWISE NOTED.
11. SINGLE GANG PLASTER REDUCING RINGS SHALL BE PROVIDED WITH DOUBLE-GANG BACKBOXES, UNLESS OTHERWISE NOTED.
12. HORIZONTAL CABLE SHALL BE PLENUM RATED.
13. PROVIDE BLANK PLATES FOR BOXES LEFT EMPTY OR DENOTED AS "BLANK" FOR FUTURE INSTALLATIONS.
14. NOTES FOR CABLE, FACEPLATE AND JACK COLORS.
15. PRIOR TO ORDER, SUBMIT FACEPLATE, JACK, AND DEVICE COLOR SAMPLES TO ARCHITECT FOR REVIEW.
16. REFER TO ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR PROPER OUTLET MOUNTING HEIGHTS AND LOCATIONS PRIOR TO ROUGH-IN.
17. REFER TO ELECTRICAL DRAWINGS AND SPECIFICATIONS FOR POWER CONDUITS, CIRCUITS, RECEPTACLES, CABLES, ETC.
18. REFER TO STRUCTURAL DRAWINGS AND SPECIFICATIONS FOR DIMENSIONED CORE HOLE PENETRATIONS.
19. REFER TO LIFE SAFETY DRAWINGS FOR FIRE & SMOKE WALL LOCATIONS. CONDUIT PENETRATIONS SHALL BE PROPERLY FIRESTOPPED PER CODE. CABLE TRAY SHALL NOT PENETRATE FIRE & SMOKE WALLS. LISTED FIRESTOP ASSEMBLIES SHALL BE USED TO PENETRATE FIRE & SMOKE WALLS FOR CABLE TRAY PATHWAYS.
20. REFER TO ELECTRICAL DRAWINGS FOR THE CONDUIT AND BACKBOXES FOR THE ESS AND ADVANTOR SYSTEMS. EQUIPMENT AND CABLING INFRASTRUCTURE TO BE PROVIDED BY OTHERS.
21. ROOM 115 BDOC - ADVANTOR SYSTEM EQUIPMENT AND RACK TO BE PROVIDED BY OTHERS. COORDINATE EXACT LOCATION WITH ADVANTOR VENDOR.
22. PAGING EQUIPMENT WILL BE RACK MOUNTED IN COMMUNICATIONS ROOM 114. CONNECTION TO FIRE ALARM SYSTEM WILL BE CONNECTED TO FIRE ALARM PANEL IN BDOC ROOM 115.
23. PAGING STATION WILL BE LOCATED IN THE BDOC ROOM 115.
24. COORDINATE WITH TELECOMMUNICATIONS CONTRACTORS IF ADVANTOR EQUIPMENT IS CHANGED FROM CURRENT DRAWING LOCATION. (I.E. RELOCATED FROM BDOC 115 TO COMMUNICATIONS ROOM 114)

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145th AIRLIFT WING
4930 MINUTEMAN WAY
CHARLOTTE, NORTH CAROLINA 28208

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	09/15/23	B-1 SUBMITTAL

PROJECT NUMBER

60637899
FJRP229030

SHEET TITLE

TELECOMMUNICATIONS SECOND FLOOR PLAN

SHEET NUMBER

T102

Project Management Initials: MR Designer: Designer Checked: Checker Approved: ApproverARCH E1 30"x42"
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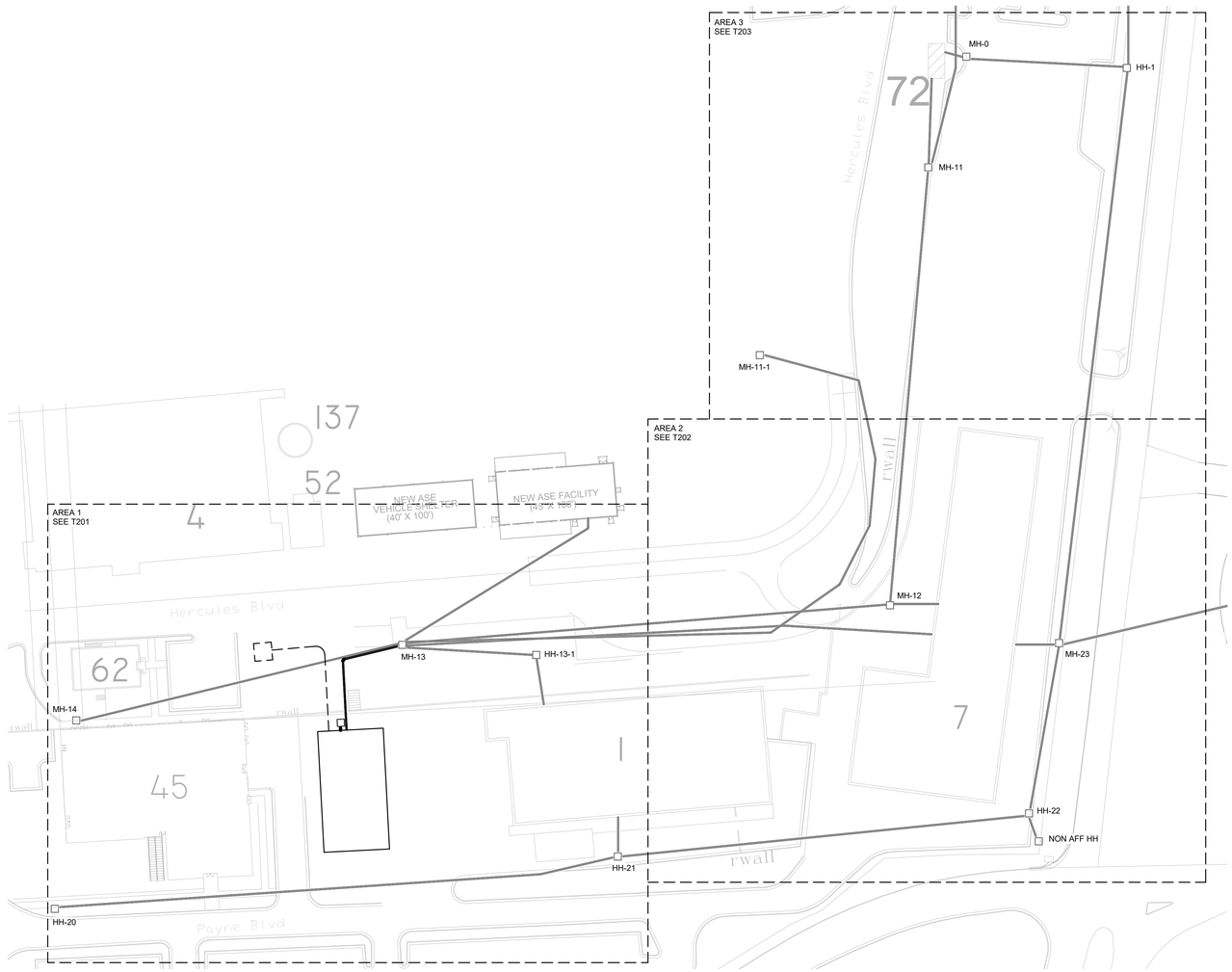
GENERAL NOTES

1. COORDINATE ALL EXISTING COMM CONDUIT PATHWAYS WITH CIVIL UTILITY DRAWINGS. ADDITIONAL COORDINATION WITH THE SITE WILL BE REQUIRED FOR ACTUAL MANHOLE AND PATHWAY.
2. COORDINATE ALL NEW TELECOMMUNICATIONS PATHWAYS FOR THE RADIO TOWER AND OSP CABLING WITH CIVIL UTILITY DRAWINGS.



1 T200 **TELE SITE PLAN - OVERALL**

Scale: 1" = 50'-0"

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PROJECT NUMBER

60637899
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SHEET TITLE

TELECOMMUNICATIONS SITE PLAN - OVERALL

SHEET NUMBER

T200

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GENERAL NOTES

1. COORDINATE ALL EXISTING COMM CONDUIT PATHWAYS WITH CIVIL UTILITY DRAWINGS. ADDITIONAL COORDINATION WITH THE SITE WILL BE REQUIRED FOR ACTUAL MANHOLE AND PATHWAY.
2. COORDINATE ALL NEW TELECOMMUNICATIONS PATHWAYS FOR THE RADIO TOWER AND OSP CABLING WITH CIVIL UTILITY DRAWINGS.

2 T201 **TELE SITE PLAN - AREA 1**
Scale: 1" = 20'-0"

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PROJECT NUMBER

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SHEET TITLE

TELECOMMUNICATIONS SITE PLAN

SHEET NUMBER

T201

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1 T202 **TELE SITE PLAN - AREA 2**
Scale: 1" = 20'-0"

GENERAL NOTES

1. COORDINATE ALL EXISTING COMM CONDUIT PATHWAYS WITH CIVIL UTILITY DRAWINGS. ADDITIONAL COORDINATION WITH THE SITE WILL BE REQUIRED FOR ACTUAL MANHOLE AND PATHWAY.
2. COORDINATE ALL NEW TELECOMMUNICATIONS PATHWAYS FOR THE RADIO TOWER AND OSP CABLING WITH CIVIL UTILITY DRAWINGS.

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PROJECT NUMBER

60637899
FJRP229030

SHEET TITLE

TELECOMMUNICATIONS SITE PLAN

SHEET NUMBER

T202 2

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1 T203 **TELE SITE PLAN - AREA 3**

Scale: 1" = 20'-0"

GENERAL NOTES

1. COORDINATE ALL EXISTING COMM CONDUIT PATHWAYS WITH CIVIL UTILITY DRAWINGS. ADDITIONAL COORDINATION WITH THE SITE WILL BE REQUIRED FOR ACTUAL MANHOLE AND PATHWAY.
2. COORDINATE ALL NEW TELECOMMUNICATIONS PATHWAYS FOR THE RADIO TOWER AND OSP CABLING WITH CIVIL UTILITY DRAWINGS.

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PROJECT NUMBER

60637809
FJRP229030

SHEET TITLE

TELECOMMUNICATIONS SITE PLAN

SHEET NUMBER

T203 1

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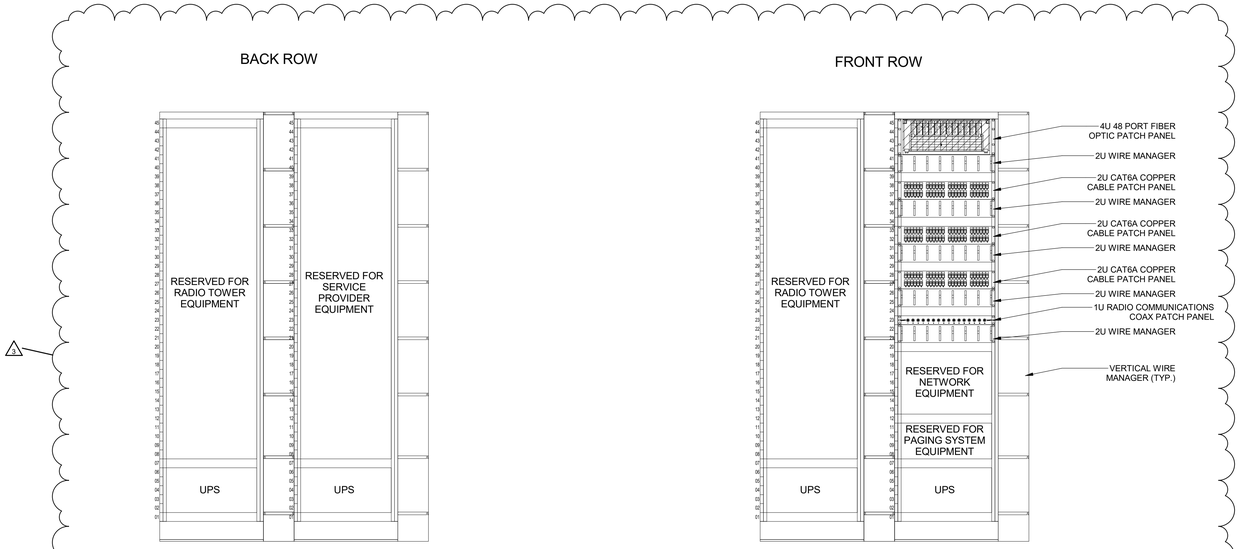
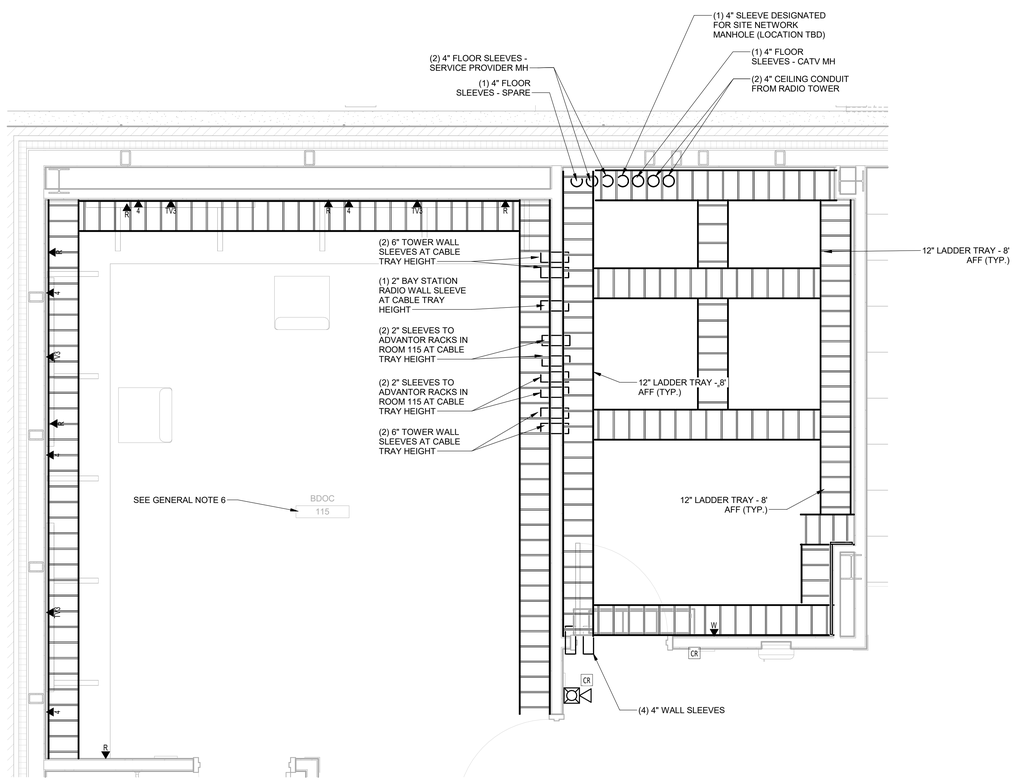


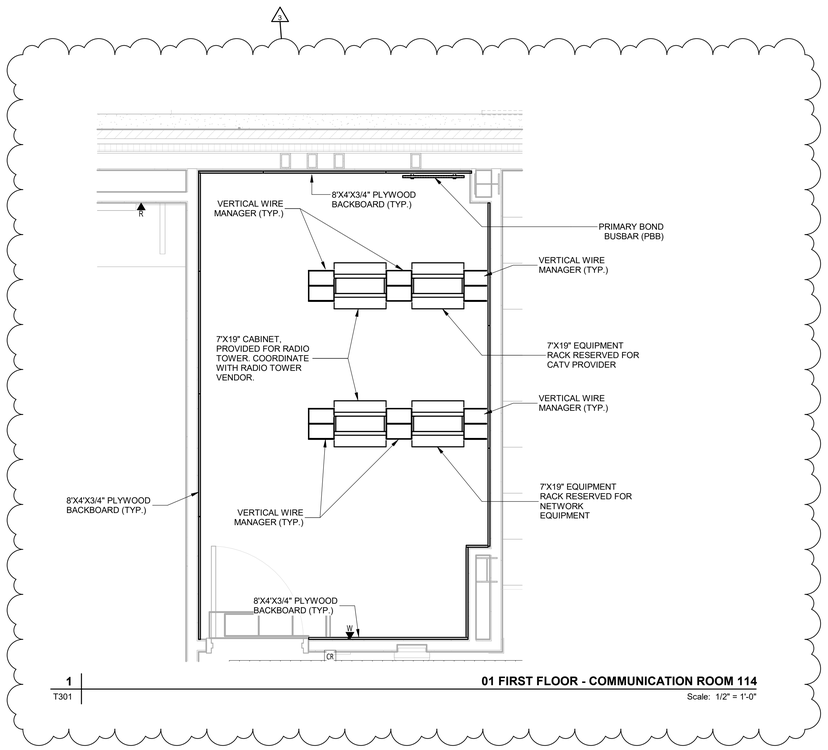
3 T301 **RACK ELEVATIONS**
Scale: 1" = 1'-0"

GENERAL NOTES

1. ROUTE CABLE WITHIN THE CABLE TRAY SUCH AS TO PROVIDE 10 FEET OF MINIMAL SERVICE LOOP WITHOUT FORMING COILS IN THE TRAY. CIRCLE THE ROOM FROM THE POINT OF ENTRANCE BEFORE DROPPING TO THE RACKS OR WALL FIELD.
2. PROVIDE 4 FOOT WIDE, BY 8 FOOT HIGH, BY 3/4 INCH THICK, A/C-GRADE OR BETTER, VOID-FREE PLYWOOD, BACK BOARDS, PER LOCAL FIRE CODES. PAINT BOTH SIDES AND EDGES WITH TWO COATS OF INTUMESCENT PAINT. MOUNT WITH WALL ANCHORS AT 2 FOOT INTERVALS AROUND BOARD PERIMETER WITH NO ANCHORS MORE THAN 6 INCHES FROM THE BOARD EDGE. COUNTER-SINK BOLT HEADS TO BELOW FACE OF BOARD. MOUNT 8 INCHES AFF TO BOTTOM EDGE, UNLESS OTHERWISE NOTED.
3. BONDING CONDUCTORS SHALL BE CONTINUOUS FROM PBB TO MOST DISTANT TECHNOLOGY ROOM. SPLICES WITHIN THE TBB ARE ALLOWED IF REQUIRED CONDUCTOR LENGTHS ARE TOO EXCESSIVE FOR AVAILABLE SPOOL SIZES. SPLICES OF TBB SHALL BE STRAIGHT SPLICES WITH EXOTHERMIC WELDS. BUSBARS SHALL CONNECT TO A TBB USING ADDITIONAL CONDUCTORS (I.E., PIGTAILS) FROM A TBB TO SBB. PIGTAILS SHALL BE OF THE SAME SIZE AS THE TBB.
4. DO NOT CONNECT BONDING CONDUCTORS FOR TELECOMMUNICATIONS TO VERTICAL STRUCTURAL STEEL USED AS LIGHTNING DOWN CONDUCTORS. EXTEND CONDUCTORS AS REQUIRED TO MAINTAIN 20 FEET OF HORIZONTAL CLEARANCE FROM ANY LIGHTNING DOWN CONDUCTOR STRUCTURE STEEL COLUMNS AND TELECOMMUNICATIONS GROUND CONDUCTOR BONDS TO STRUCTURAL STEEL.
5. ROUTE TBB TO MINIMIZE TOTAL LENGTH. TBB SHALL BE INSTALLED USING THE BROADEST SWEEPS POSSIBLE. CABLE SHALL BE INSTALLED WITH MINIMUM NUMBER OF BENDS.
6. ROOM 115 BDOC - ADVANTOR SYSTEM EQUIPMENT AND RACK TO BE PROVIDED BY OTHERS. CLIENT TO PROVIDE ADDITIONAL DETAIL ON CABINET SIZE AND LOCATION



2 T301 **01 FIRST FLOOR - BDOC ROOM 115 & COMM ROOM 114 PATHWAY**
Scale: 1/2" = 1'-0"



1 T301 **01 FIRST FLOOR - COMMUNICATION ROOM 114**
Scale: 1/2" = 1'-0"

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CLIENT

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ARCHITECT/DESIGNER

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P Joie Koenders
BICSI ID # 118551
Expires 12-31-26
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Signature

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	09/15/23	B-1 SUBMITTAL

PROJECT NUMBER

60637899
FJRP229030

SHEET TITLE

ENLARGED COMMUNICATIONS ROOM FLOOR PLAN

SHEET NUMBER

T301

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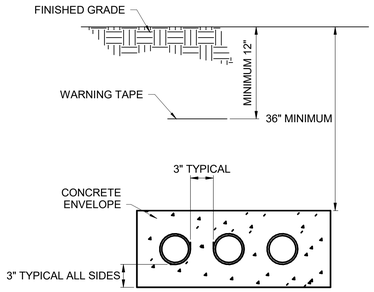
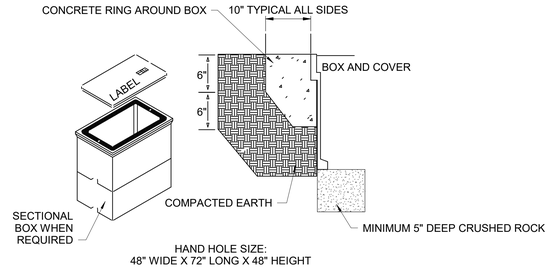


1 T503 **3-WAY CONCRETE ENCASED DUCTBANK**

Scale: N.T.S.



HAND HOLE SIZE:
48" WIDE X 72" LONG X 48" HEIGHT

HANDHOLE REQUIREMENTS:

1. HOUSING SHALL BE A POLYMER CONCRETE REINFORCED WITH A HEAVY WEAVE FIBERGLASS REINFORCING WITH COMPRESSIVE STRENGTH OF NO LESS THAN 10,000 PSI.
2. COVER AND BOX SHALL WITHSTAND A SERVICE LOAD OF NO LESS THAN 22,500 LBS OVER A 10" X 10" AREA.
3. PROVIDE STAINLESS STEEL BOLTS AND INSERTS.
4. SIZE KNOCKOUTS FOR INCOMING 4" CONDUITS.
5. PROVIDE LABEL "TELECOM".

2 T503 **STANDARD HANDHOLE**

Scale: N.T.S.

N

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CHARLOTTE, NORTH CAROLINA 28208

CLIENT

NORTH CAROLINA AIR NATIONAL GAURD - 145TH AIRLIFT WING

145th AIRLIFT WING
4930 MINUTEMAN WAY
CHARLOTTE, NORTH CAROLINA 28208

ARCHITECT/DESIGNER

AECOM

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COLUMBUS, OH 43215
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CONSULTANTS

REGISTRATION

KEY PLAN

ISSUE/REVISION

I/R	DATE	DESCRIPTION
3	07-01-2026	ADDENDUM 01
2	05/30/2025	B-3 SUBMITTAL - FINAL
1	03/14/2025	B-2 SUBMITTAL
	09/29/2023	B-1 SUBMITTAL
	09/15/23	B-1 SUBMITTAL

PROJECT NUMBER

60637899
FJRP229030

SHEET TITLE

TELECOMMUNICATIONS DETAILS

SHEET NUMBER

T503 3

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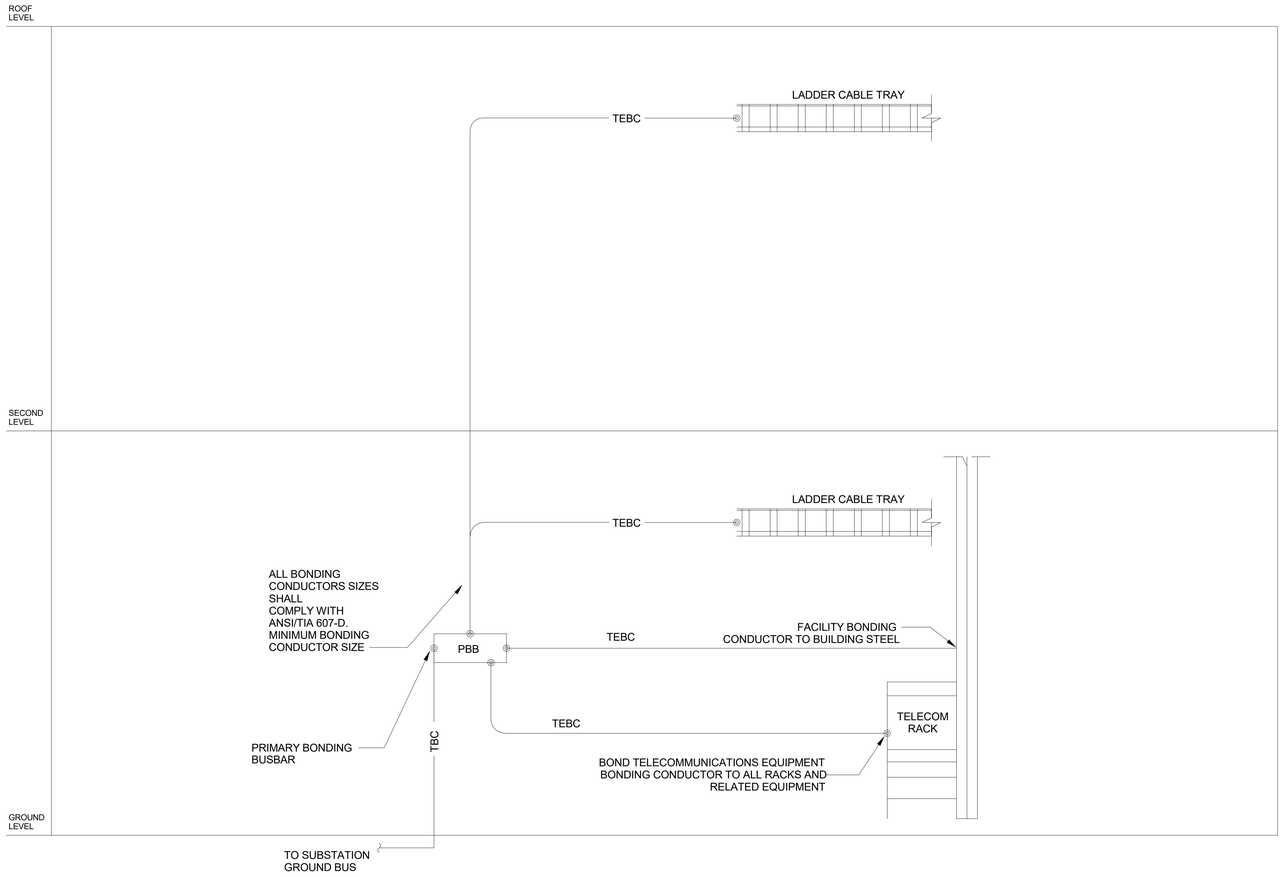
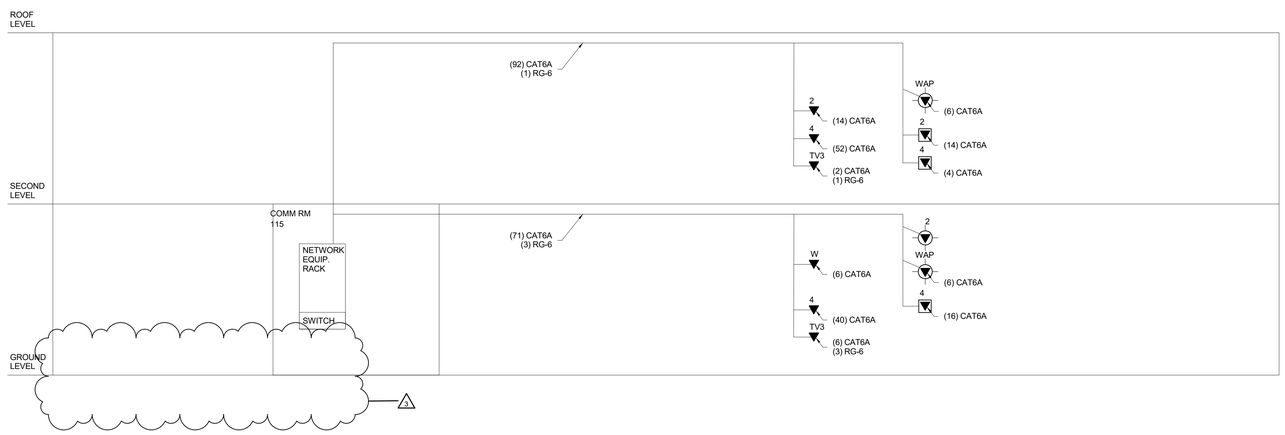


2 T601 **TECHNOLOGY BONDING RISER DIAGRAM**

Scale: N.T.S.



1 T601 **TECHNOLOGY RISER DIAGRAM**

Scale: N.T.S.

GENERAL NOTES

1. GROUNDING CONDUCTORS SHALL BE CONTINUOUS FROM TMGB TO MOST DISTANT TECHNOLOGY ROOM. SPLICES WITHIN THE TBB ARE ALLOWED IF REQUIRED CONDUCTOR LENGTHS ARE TOO EXCESSIVE FOR AVAILABLE SPOOL SIZES. SPLICES OF TBB SHALL BE STRAIGHT SPLICES WITH EXOTHERMIC WELDS. BUSBARS SHALL CONNECT TO A TBB USING ADDITIONAL CONDUCTORS (I.E., PIGTAILS) FROM A TBB TO TGB. PIGTAILS SHALL BE OF THE SAME SIZE AS THE TBB.

2. DO NOT CONNECT GROUNDING CONDUCTORS FOR TELECOMMUNICATIONS TO VERTICAL STRUCTURAL STEEL USED AS LIGHTNING DOWN CONDUCTORS. EXTEND CONDUCTORS AS REQUIRED TO MAINTAIN 20 FEET OF HORIZONTAL CLEARANCE FROM ANY LIGHTNING DOWN CONDUCTOR STRUCTURE STEEL COLUMNS AND TELECOMMUNICATIONS GROUND CONDUCTOR BONDS TO STRUCTURAL STEEL.

3. ROUTE TBB TO MINIMIZE TOTAL LENGTH. TBB SHALL BE INSTALLED USING THE BROADEST SWEEPS POSSIBLE. CABLE SHALL BE INSTALLED WITH MINIMUM NUMBER OF BENDS.

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REGISTRATION

REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
Bicsi
P Joie Koenders
BICSI ID # 118551
Expires 12-31-26
RCDD

Signature

05/30/2025

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TECHNOLOGY RISER DIAGRAMS

SHEET NUMBER

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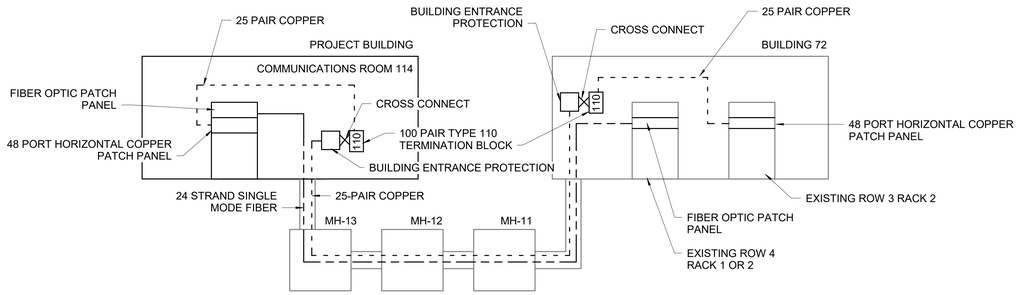

NOTES:

1. COORDINATE WITH BASE COMMUNICATIONS OFFICER AND FACILITIES ON ROUTING OF OSP CABLES AND ON EXACT LOCATION OF EQUIPMENT IN EXISTING BUILDING 72. AVAILABILITY OF EXISTING PATHWAYS TO BE DETERMINED.
2. PROVIDE A 3-CELL FABRIC MESH INNER DUCT IN EACH DUCT PROVIDED WHERE FIBER OPTIC CABLES ARE INSTALLED.

1 / T602 **OSP RISER DIAGRAM**

Scale: N.T.S.

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Bicsi
P Joie Koenders
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SHEET TITLE

TECHNOLOGY RISER DIAGRAMS

SHEET NUMBER

T602 3

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