ZAMBARANO HOSPITAL
ELEVATOR REPLACEMENT
2090 WALLUM LAKE ROAD
BURRILLVILLE, RHODE ISLAND

BLOUNT · BENNETT
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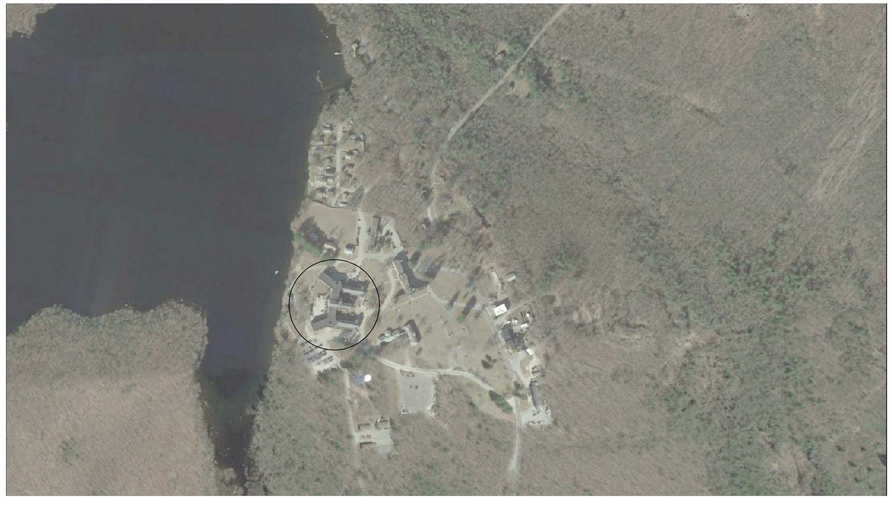
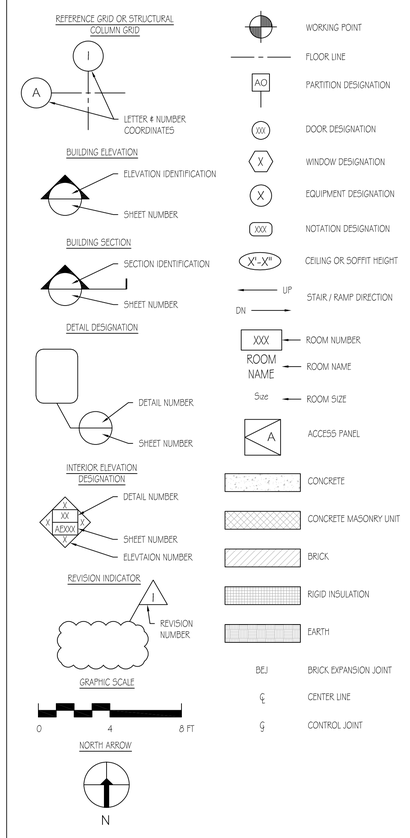


LOCUS MAP
SCALE: NTS

ARCHITECTURAL LEGEND



ARCHITECTURAL ABBREVIATIONS

ABBREVIATION	TERM
@	AT
"	FOOT (INDICATOR)
'	INCH (INDICATOR)
ACT	ACOUSTICAL CEILING TILE
ADDL	ADDITIONAL
ADH	ADHESIVE
ADJ	ADJACENT / ADJUSTABLE
AFF	ABOVE FINISHED FLOOR
AFS	ABOVE FINISHED SLAB
AHU	AIR HANDLING UNIT
ALT	ALTERNATE
ANOD	ANODIZED
AP	ACCESS PANEL
AWP	ACOUSTICAL WALL PANEL
BD	BOARD
BEJ	BRICK EXPANSION JOINT
BLDG	BUILDING
BLKG	BLOCKING
BO	BOTTOM OF
CB	CATCH BASIN
CJ	CONTROL JOINT
CL	CENTER LINE
CLG	CEILING
CLOS	CLOSET
CLR	CLEAR
CMU	CONCRETE MASONRY UNIT
CO	CLEAN OUT
COL	COLUMN
CONC	CONCRETE
CONT	CONTINUOUS
COORD	COORDINATE
CT	CERAMIC TILE
CTR	CENTER
CW	COLD WATER
DEMO	DEMOLITION
DIA	DIAMETER
DIM	DIMENSION
DN	DOWN
DS	DOWNSPOUT
DW	DISHWASHER
DWG	DRAWING
EA	EACH
EIFS	EXTERIOR INSULATION FINISH SYSTEM
EJ	EXPANSION JOINT
EL	ELEVATION
ELEC	ELECTRIC
ELEV	ELEVATOR
ENTR	ENTRANCE
EQ	EQUAL
EQUIP	EQUIPMENT
ETR	EXISTING TO REMAIN
EWC	ELECTRICAL WATER COOLER
EXIST	EXISTING
EXT	EXTERIOR
FD	FLOOR DRAIN
FDN	FOUNDATION
FE	FIRE EXTINGUISHER
FEC	FIRE EXTINGUISHER CABINET
FF	FACTORY FINISH
FLR	FLOOR
FOB	FACE OF BRICK
FOC	FACE OF CONCRETE
FOF	FACE OF FINISH
FOM	FACE OF MASONRY
FOS	FACE OF STUDS
FOW	FACE OF WALL
FS	FLOOR SINK
FT	FOOT / FEET
FTG	FOOTING
G	GAS
GA	GAGE
GALV	GALVANIZED
GFI	GROUND FAULT INTERRUPTER
GL	GLASS
GLZ	GLAZING
GWB / GYP BD	GYPSUM WALL BOARD

ABBREVIATION	TERM
HC	HOLLOW CORE
HDR	HEADER
HDWD	HARDWOOD
HDWR	HARDWARE
HTG	HEIGHT
HM	HOLLOW METAL
HVAC	HEATING VENTILATING AIR CONDITIONING
HW	HOT WATER
ID	INSIDE DIAMETER
IN	INCH
INFO	INFORMATION
INSTL	INSTALLATION
INSUL	INSULATION
INT	INTERIOR
JAN	JANITOR
JT	JOINT
KIT	KITCHEN
KO	KNOCKOUT
LAB	LABORATORY
LAM	LAMINATION
LAUN	LAUNDRY
LAV	LAVATORY
LB	POUND
LL	LIVE LOAD
LR	LIVING ROOM
LRG	LARGE
LT	LIGHT
LT WT	LIGHTWEIGHT
LTG	LIGHTING
MAINT	MAINTENANCE
MAS	MASONRY
MATL	MATERIAL
MAX	MAXIMUM
MDF	MEDIUM-DENSITY FIBERBOARD
MDO	MEDIUM-DENSITY OVERLAY
MECH	MECHANICAL
MEZZ	MEZZANINE
MFG	MANUFACTURING
MH	MANHOLE
MIN	MINIMUM
MIR	MIRROR
MISC	MISCELLANEOUS
MO	MASONRY OPENING
MTD	MOUNTED
MTL	METAL
NA	NOT APPLICABLE
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OFD	OVERFLOW DRAIN
OFF	OFFICE
OPNG	OPENING
OPP	OPPOSITE
OPT	OPTIONAL
ORD	OVERFLOW ROOF DRAIN
ORIG	ORIGINAL
OSB	ORIENTED STRAND BOARD
OVDH	OVERHEAD
OZ	OUNCE
PC	PRECAST
PL	PLATE / PROPERTY LINE
PLAM	PLASTIC LAMINATE
PLWD	PLYWOOOD
PMJF	PRE-MOLDED JOINT FILLER
PNT	PAINT
PREFAB	PREFABRICATED
PREP	PREPARATION
PROP	PROPERTY
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PT	PRESSURE TREATED
PTD	PAINTED / PAPER TOWEL DISPENSER
PVC	POLYVINYL CHLORIDE

ABBREVIATION	TERM
QT	QUARRY TILE
QTY	QUANTITY
R	RISER / THERMAL RESISTANCE
RA	RETURN AIR
RAD	RADIUS
RD	ROAD
REBAR	REINFORCING BAR
RECEP	RECEPTION
REF	REFERENCE
REINF	REINFORCE
REM	REMOVABLE
REQD	REQUIRED
RESIL	RESILIENT
REV	REVISE / REVISION
RM	ROOM
RO	ROUGH OPENING
ROW	RIGHT OF WAY
RV	ROOF VENT
SA	SUPPLY AIR
SAT	SUSPENDED ACOUSTICAL TILE
SC	SOLID CORE
SCHED	SCHEDULE
SCW	SOLID CORE WOOD
SECT	SECTION
SF	SQUARE FOOT / SQUARE FEET
SHR	SHOWER
SHT	SHEET
SIM	SIMILAR
SPEC	SPECIFICATION
SQ	SQUARE
ST	STREET
STC	SOUND TRANSMISSION COEFFICIENT
STD	STANDARD
STL	STEEL
STOR	STORAGE
STRUCT	STRUCTURAL
SUBFL	SUBFLOOR
SURF	SURFACE
SUSP	SUSPENDED
T&G	TONGUE AND GROOVE
TEL	TELEPHONE
TEMP	TEMPORARY
TMPD GL	TEMPERED GLASS
TO	TOP OF
TYP	TYPICAL
U	HEAT TRANSFER COEFFICIENT
UL	UNDERWRITERS LABORATORIES INC
UON	UNLESS OTHERWISE NOTED
UTIL	UTILITY
VB	VINYL BASE
VCT	VINYL COMPOSITION TILE
VEST	VESTIBULE
VWC	VINYL WALL COVERING
W/	WITH
W/O	WITHOUT
WAIN	WAINSCOT
WD	WOOD
WH	WATER HEATER
WT	WEIGHT
WWM	WELDED WIRE MESH

PROJECT TEAM INFORMATION:

MECHANICAL / PLUMBING

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VAN DEUSEN & ASSOCIATES

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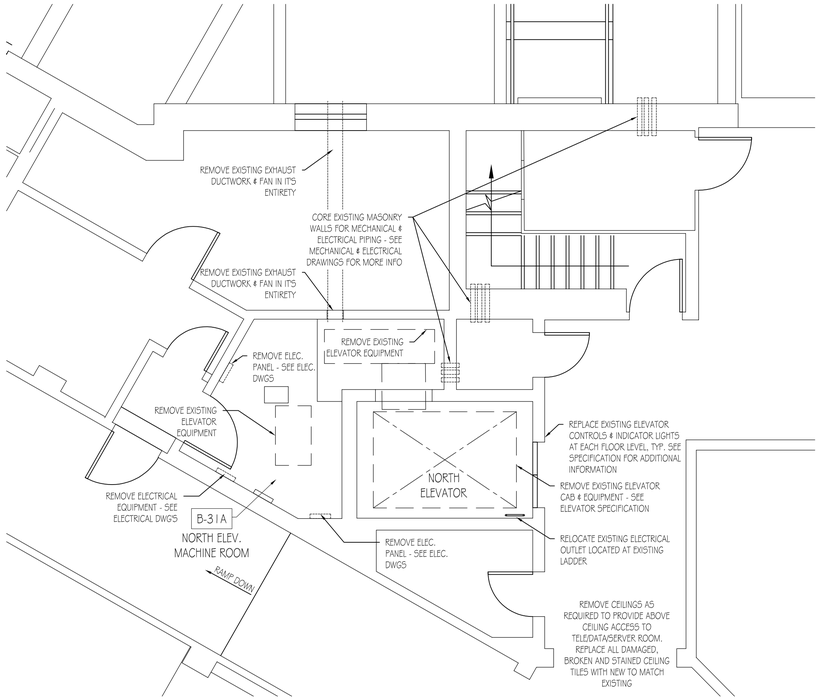
PROJECT TITLE:
ZAMBARANO HOSPITAL
ELEVATOR REPLACEMENT
2090 WALLUM LAKE ROAD
BURRILLVILLE, RHODE ISLAND

DATE ISSUED: 09-05-2019

PROJECT NO.: 1655

PROJECT STATUS: ISSUED FOR CONSTRUCTION

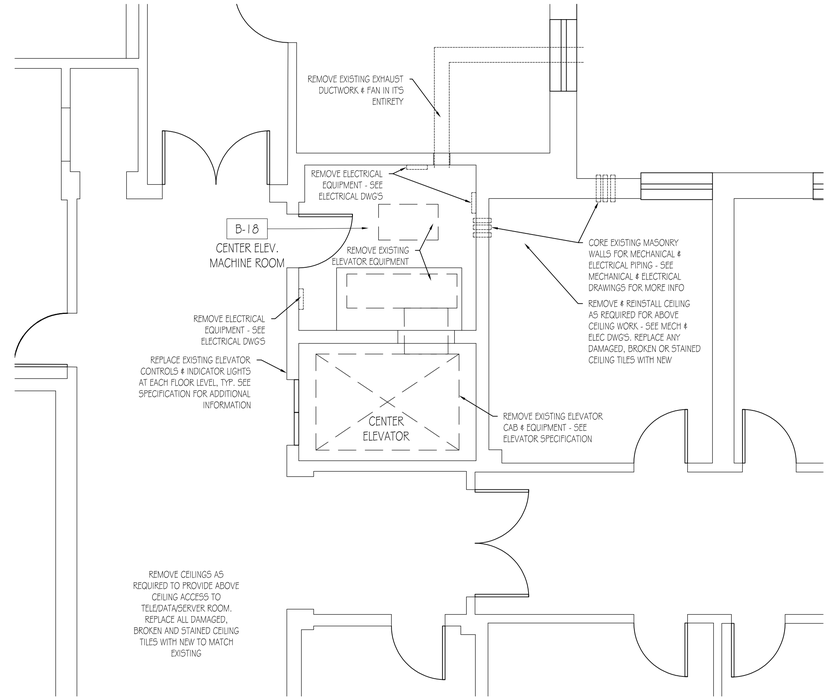
DRAWING SET:



01 AD100 NORTH ELEVATOR DEMO PLAN

1/4" = 1'-0"

0 4 8 12 FT



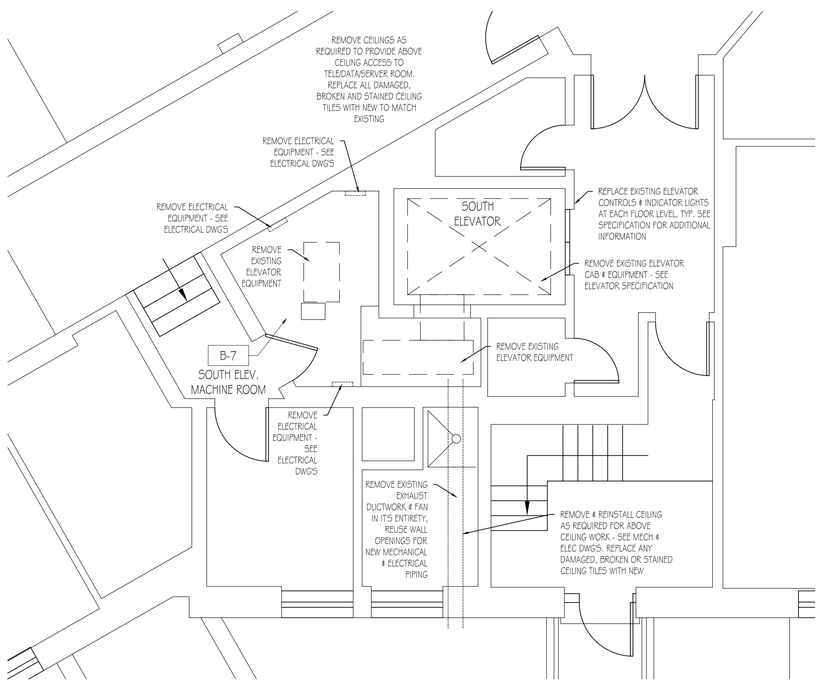
02 AD100 CENTER ELEVATOR DEMO PLAN

1/4" = 1'-0"

0 4 8 12 FT

GENERAL DEMOLITION NOTES:

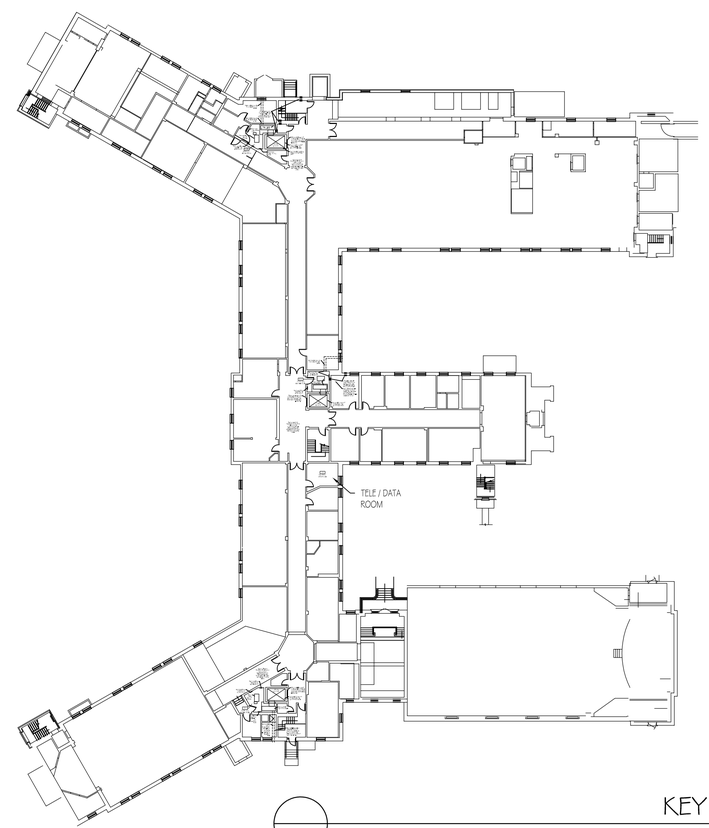
- G.C. IS TO VERIFY ALL EXISTING CONDITIONS PRIOR TO START OF CONSTRUCTION. NOTIFY ARCHITECT OF ANY VARIATION BETWEEN EXISTING CONDITIONS AND DRAWINGS.
- DEMOLITION DRAWINGS SHOWN ARE FOR BASEMENT LEVEL ONLY, REMOVAL OF CONTROLS, AND ELEVATOR EQUIPMENT WILL EXTEND THROUGH THE ENTIRE ELEVATOR SHAFT UP TO THE PENTHOUSE ON THE ROOF.
- SEE MECHANCIAL AND ELECTRICAL DRAWINGS FOR FULL SCOPE OF MECHANICAL AND ELECTRICAL DEMOLITION.
- SEE ELEVATOR SPECIFICATION FOR FULL EXTENT OF ELEVATOR DEMOLITION.
- TEMPORARY ENCLOSURES ARE NOT SHOWN ON THESE DRAWINGS FOR CLARITY. SEE PHASING & TEMPORARY ENCLOSURE DRAWINGS FOR ADDITIONAL INFORMATION.
- WRAP ALL EXISTING INSULATED PIPING WITHIN EACH MACHINE ROOM TO REMAIN TO PROTECT THEM FROM DAMAGE. NOTIFY ARCHITECT OF ANY DAMAGE OR DETERIORATED INSULATION PRIOR TO INSTALLATION OF PROTECTIVE WRAPPING.



03 AD100 SOUTH ELEVATOR DEMO PLAN

1/4" = 1'-0"

0 4 8 12 FT



KEY PLAN

NOT TO SCALE

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PROJECT NO.	1655
DRAWN BY	KWR
CHECKED BY	GAB
DATE ISSUED	09-05-19
REVISIONS	

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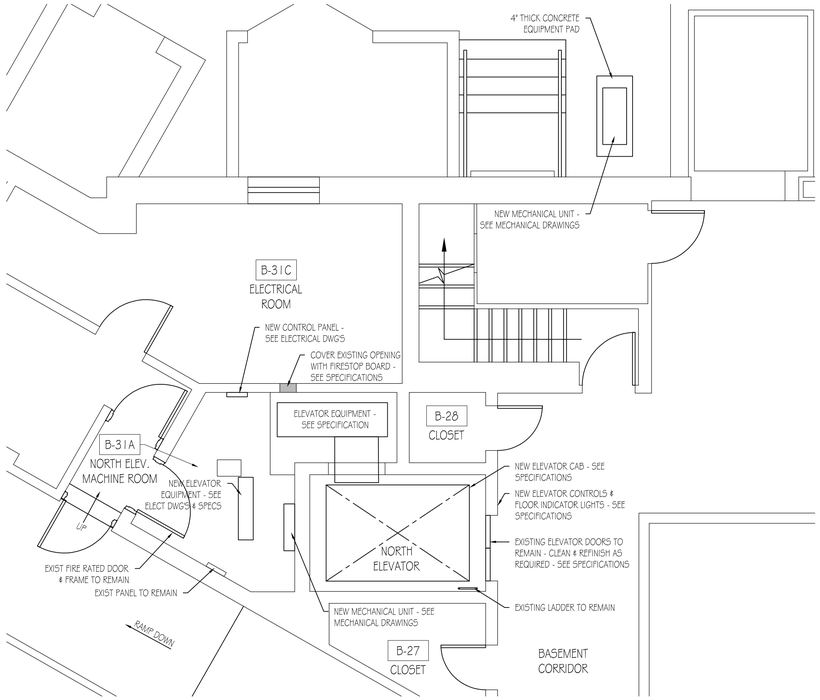
GEORGE A. BENNETT III
No. 1150
REGISTERED ARCHITECT

PROJECT TITLE
ZAMBARANO HOSPITAL
ELEVATOR REPLACEMENT
BURRILLVILLE, RI

DRAWING STATUS
ISSUED FOR CONSTRUCTION

DRAWING TITLE
DEMOLITION PLAN

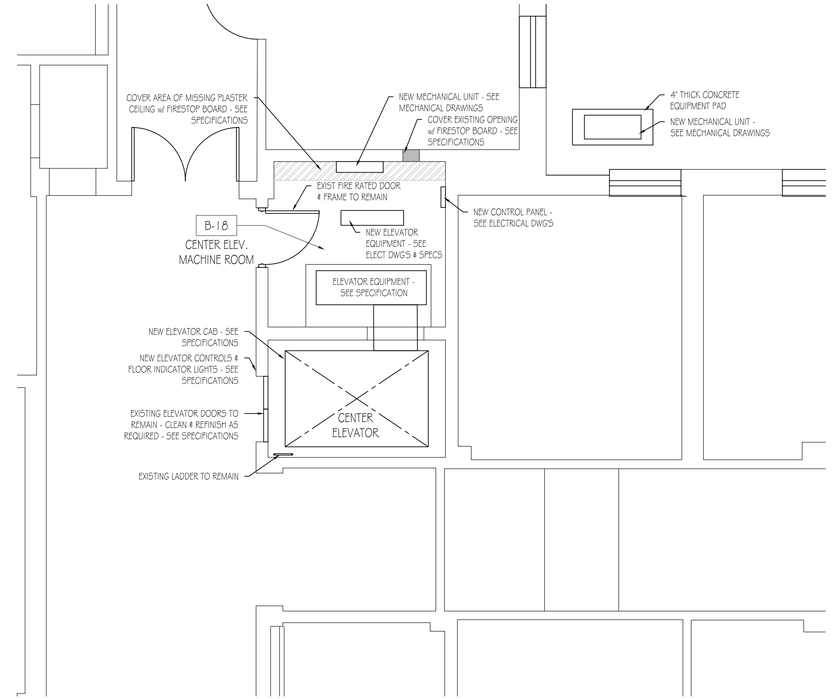
SHEET NO.
AD100



01 AE200 NORTH ELEVATOR DEMO PLAN

1/4" = 1'-0"

0 4 8 12 FT



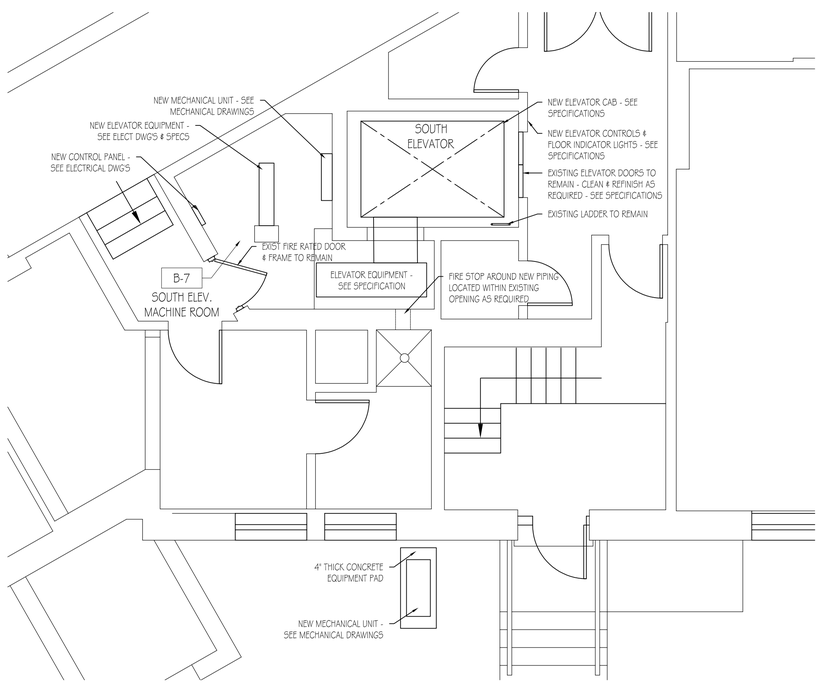
02 AE200 CENTER ELEVATOR DEMO PLAN

1/4" = 1'-0"

0 4 8 12 FT

GENERAL NOTES:

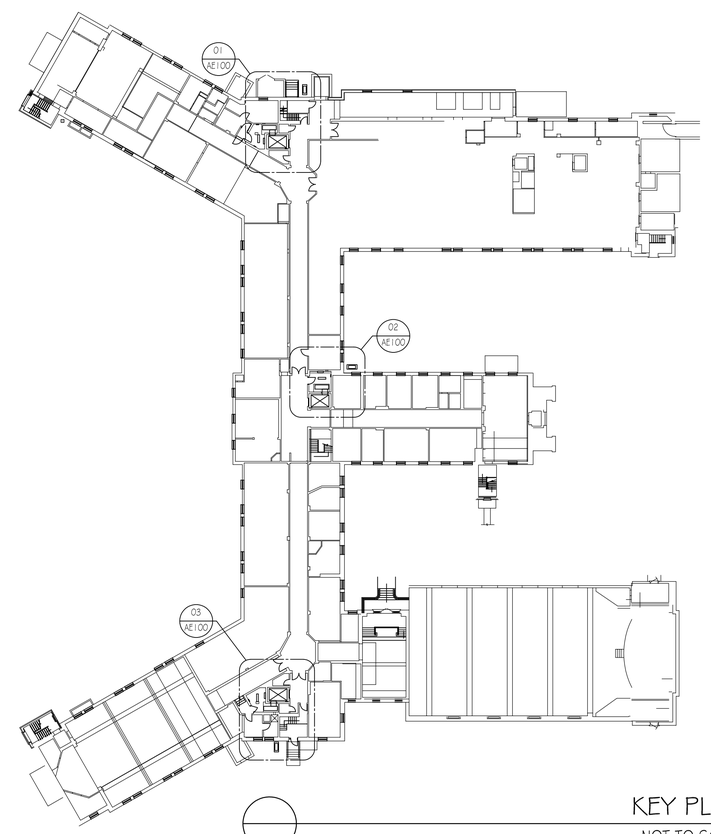
- GENERAL NOTES ARE TYPICAL FOR ALL THREE ELEVATOR LOCATIONS.
- G.C. IS TO FIRE STOP ALL EXISTING WALL PENETRATIONS WITHIN THE ELEVATOR MACHINE ROOM. THIS INCLUDES ALL NEW PIPING, WIRING PENETRATIONS AND ALL EXISTING PIPING, WIRING, AND OPEN PENETRATIONS THROUGHOUT THE ELEVATOR MACHINE ROOM. SEE SPECIFICATION FOR ADDITIONAL INFORMATION ON FIRE STOPPING.
- G.C. IS TO FIRE STOP ALL PENETRATIONS WITHIN THE ELEVATOR SHAFT, WITH THE EXCEPTION OF OPENINGS INTO THE ELEVATOR MACHINE ROOM, WITH APPROVED FIRE STOPPING MATERIAL. SEE SPECIFICATION FOR ADDITIONAL INFORMATION ON FIRE STOPPING.
- TEMPORARY ENCLOSURES ARE NOT SHOWN ON THESE DRAWINGS FOR CLARITY. SEE PHASING & TEMPORARY ENCLOSURE DRAWINGS FOR ADDITIONAL INFORMATION.



03 AE200 SOUTH ELEVATOR DEMO PLAN

1/4" = 1'-0"

0 4 8 12 FT



KEY PLAN

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DRAWN BY	KWR
CHECKED BY	GAB
DATE ISSUED	09-05-19
REVISIONS	

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GEORGE A. BENNETT III
No. 1100
REGISTERED ARCHITECT

PROJECT TITLE

ZAMBARANO HOSPITAL
ELEVATOR REPLACEMENT
BURRILLVILLE, RI

DRAWING STATUS

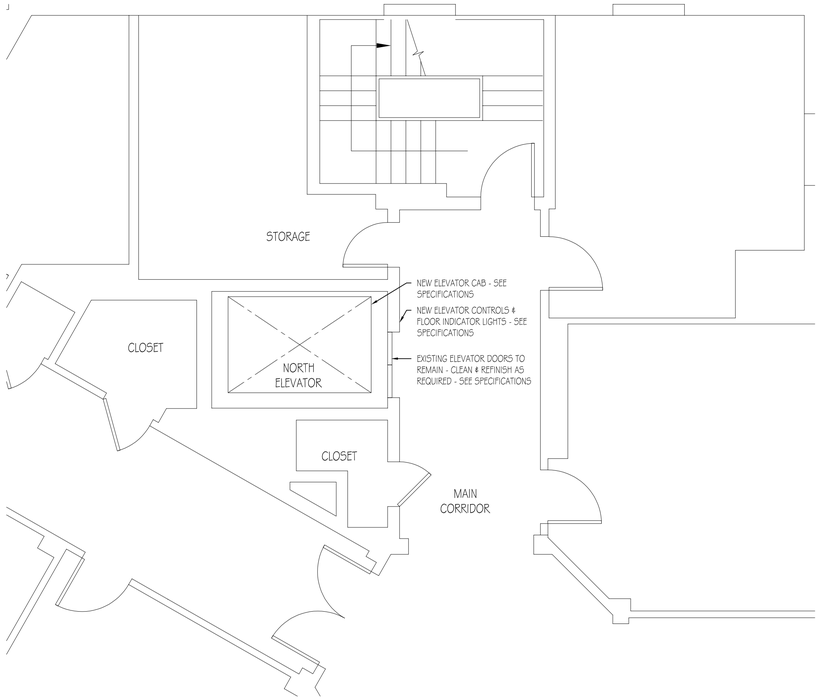
ISSUED FOR CONSTRUCTION

DRAWING TITLE

BASEMENT FLOOR PLAN

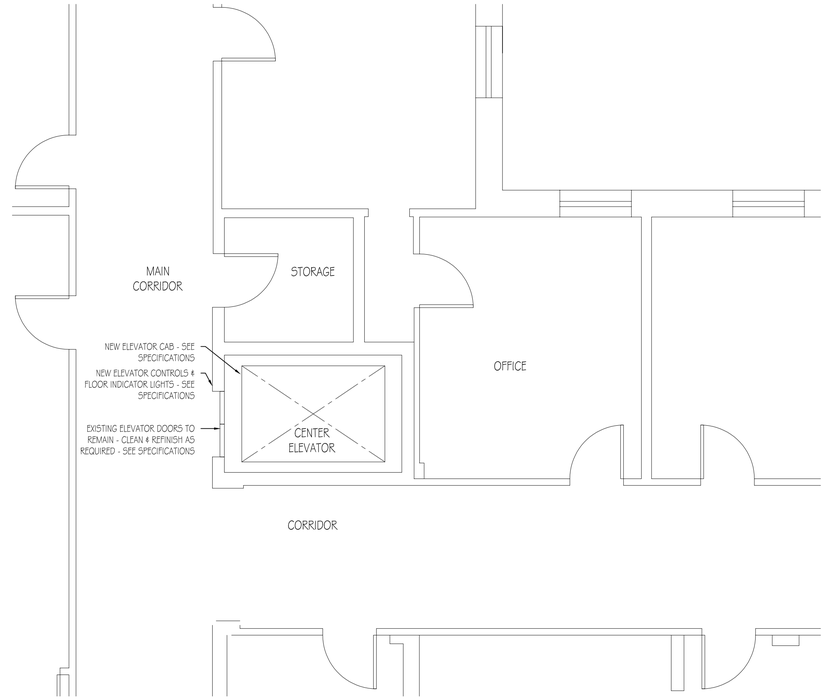
SHEET NO.

AE100



01 AE101 TYPICAL FLOOR PLAN - LEVEL 1-3

1/4" = 1'-0" 0 4 8 12 FT

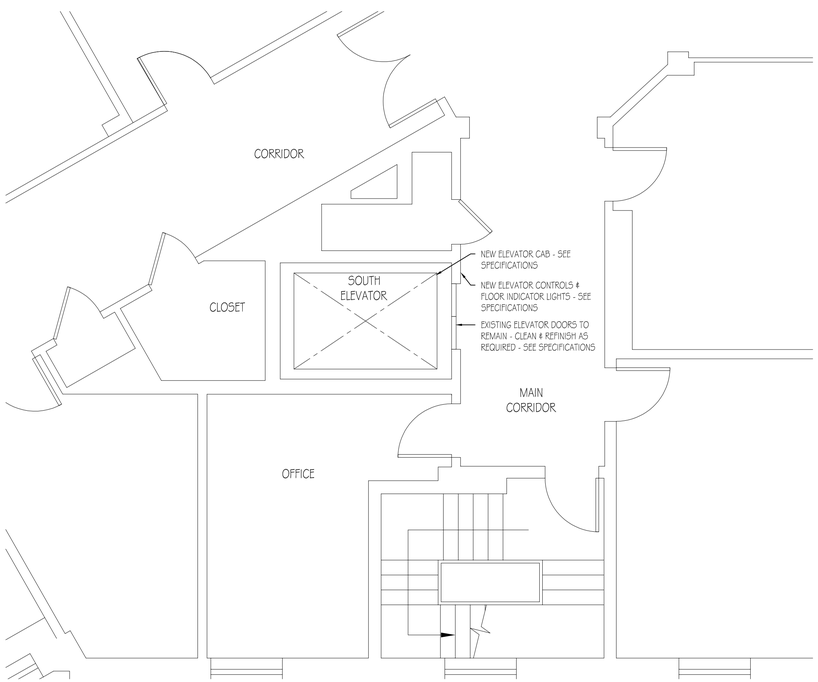


02 AE101 TYPICAL FLOOR PLAN - LEVEL 1-4

1/4" = 1'-0" 0 4 8 12 FT

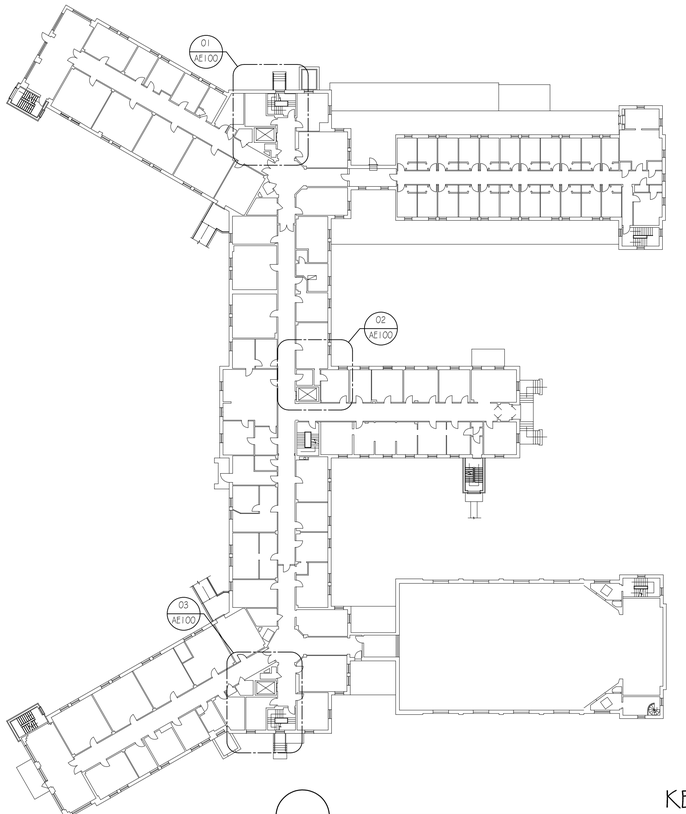
GENERAL NOTES:

- GENERAL NOTES ARE TYPICAL FOR ALL THREE ELEVATOR LOCATIONS.
- WORK INDICATED ON THESE PLANS ARE TYPICAL FOR ALL LEVELS, 1-3 AT THE NORTH AND SOUTH ELEVATORS AND 1-4 AT THE CENTER ELEVATOR. EXACT LAYOUT AND CONTROLS / EQUIPMENT PLACEMENT MAY VARY PER LEVEL. G.C. IS TO INSPECT EACH FLOOR LEVEL PRIOR TO START OF CONSTRUCTION AND NOTIFY THE ARCHITECT OF ANY DISCREPANCY OR ALTERATION NEEDED DUE TO DIFFERENCES AT EACH FLOOR LEVEL.
- PATCH / REPAIR / REPLACE ALL DAMAGED CORRIDOR FINISHES DAMAGED DURING THE INSTALLATION OF NEW ELEVATOR CONTROLS & EQUIPMENT. MATCH EXISTING FINISHES.
- TEMPORARY ENCLOSURES ARE NOT SHOWN ON THESE DRAWINGS FOR CLARITY. SEE PHASING & TEMPORARY ENCLOSURE DRAWINGS FOR ADDITIONAL INFORMATION.



03 AE101 TYPICAL FLOOR PLAN - LEVEL 1-3

1/4" = 1'-0" 0 4 8 12 FT



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GEORGE A. BENNETT JR. No. 1100 REGISTERED ARCHITECT

PROJECT TITLE

ZAMBARANO HOSPITAL
ELEVATOR REPLACEMENT
BURRILLVILLE, RI

DRAWING STATUS

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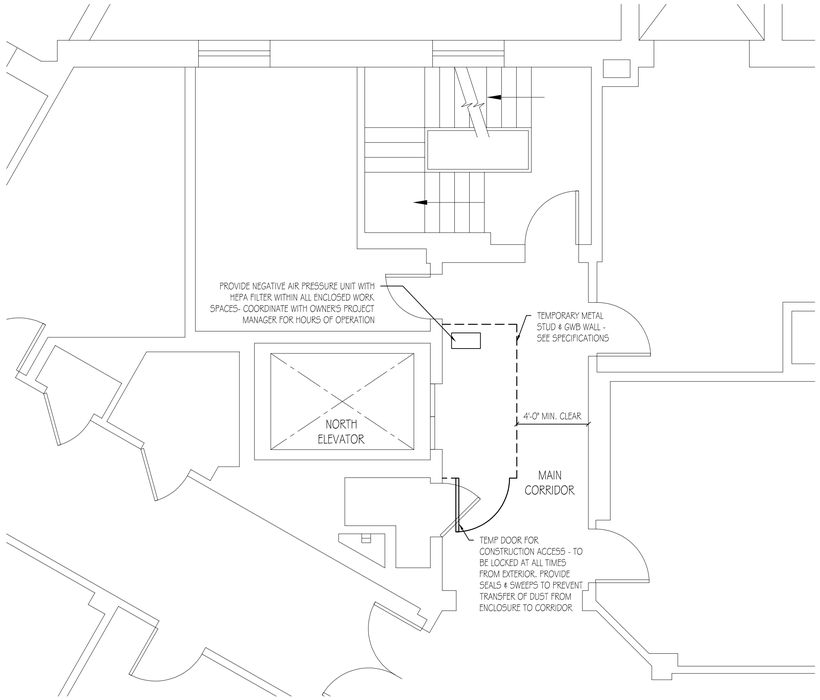
DRAWING TITLE

TYPICAL FLOOR PLAN

SHEET NO.

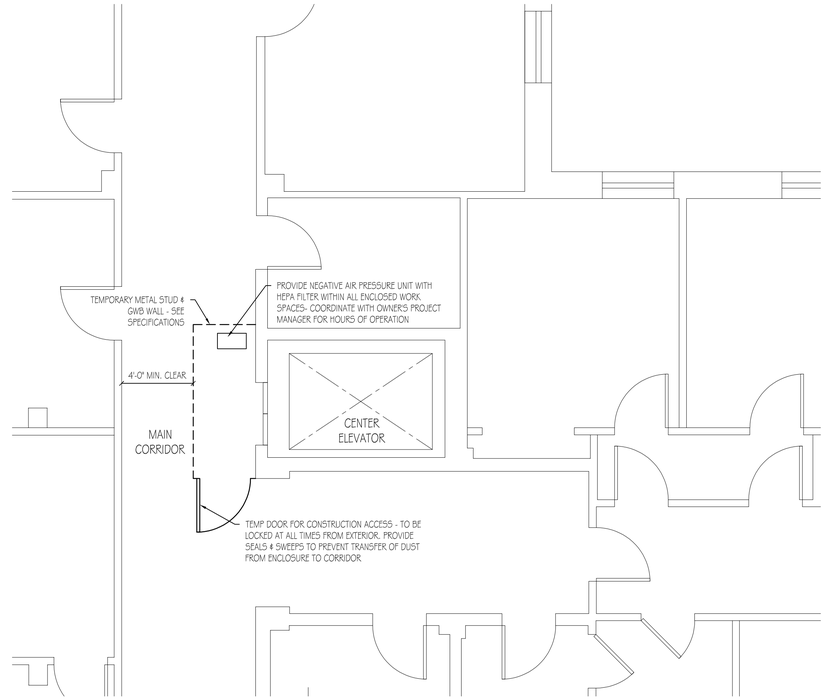
AE101



01 AE200 NORTH ELEVATOR DEMO PLAN

1/4" = 1'-0"

0 4 8 12 FT



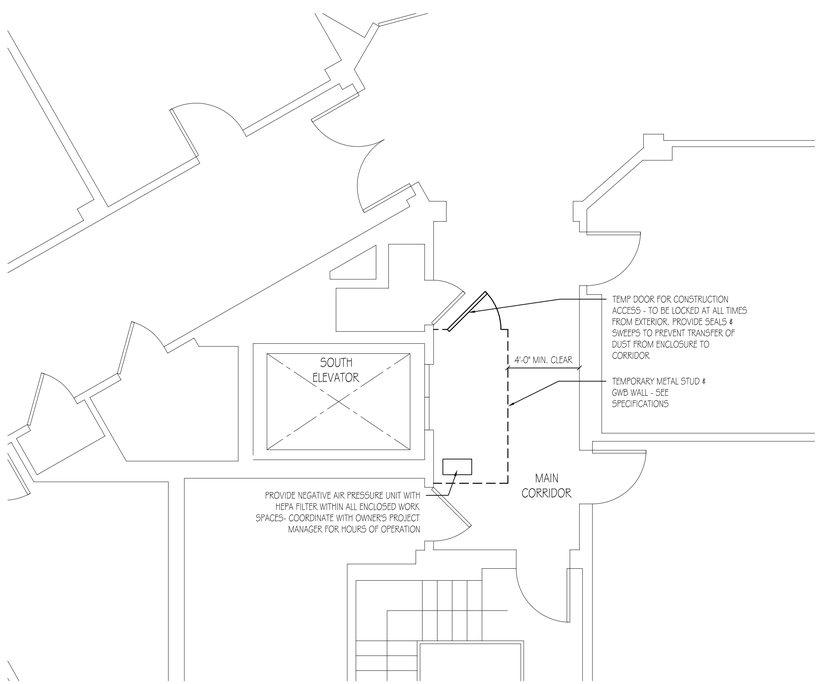
02 AE200 CENTER ELEVATOR DEMO PLAN

1/4" = 1'-0"

0 4 8 12 FT

GENERAL NOTES:

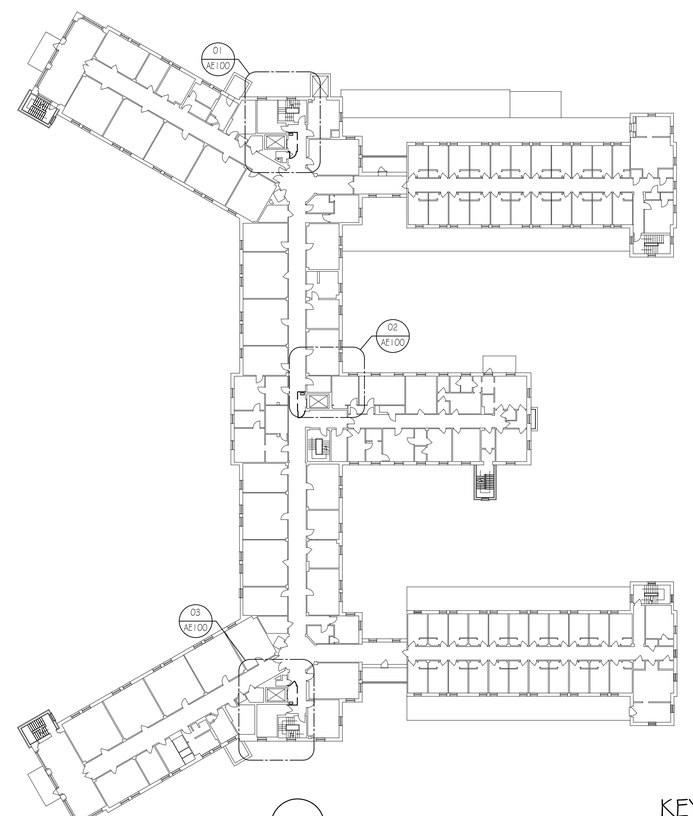
- GENERAL NOTES ARE TYPICAL FOR ALL THREE ELEVATOR LOCATIONS AT EACH FLOOR LEVEL.
- THE BUILDING WILL REMAIN OCCUPIED DURING CONSTRUCTION. ALL WORK MUST BE DONE IN ENCLOSED CONSTRUCTION AREAS THAT ARE UNDER NEGATIVE PRESSURE..
- G.C. IS TO MAINTAIN ACCESS TO EGRESS STAIRS AT THE NORTH AND SOUTH ELEVATORS AT ALL TIMES DURING CONSTRUCTION AND A MINIMUM OF 4'-0" CLEAR CORRIDOR WIDTH. IF AT ANY POINT DURING CONSTRUCTION THESE PARAMETERS CAN NOT BE MET A COORDINATION MEETING BETWEEN THE OWNER'S PROJECT MANAGER, ARCHITECT, CONTRACTOR, SUB-CONTRACTORS INVOLVED IN THE WORK AND BUILDING FACILITIES PERSONAL WILL NEED TO BE COORDINATED BY THE G.C. PRIOR TO PROCEEDING WITH WORK TO DETERMINE THE AFFECT THIS WORK WILL HAVE ON THE BUILDING OPERATION.
- TEMPORARY ENCLOSURES ARE TO BE METAL STUD AND GWB AND EXTEND FROM THE FLOOR TO CEILING. ALL EDGES ARE TO BE SEALED TO PREVENT TRANSMISSION OF DUST FROM CONSTRUCTION SITE TO OCCUPIED PORTIONS OF THE BUILDING. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS
- ALL WORK IS TO BE SEPARATED FROM OCCUPIED PORTIONS OF THE BUILDING AT ALL TIMES DURING CONSTRUCTION. G.C. IS TO PROVIDE A SEALED PLASTIC SHEET ON THE INSIDE OF THE ELEVATOR MACHINE ROOM DOORS OR SEAL THE MACHINE ROOM DOORS TO PREVENT THE PASSAGE OF DUST INTO OCCUPIED PORTIONS OF THE BUILDING. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS
- EXHAUST FROM AIR FILTER UNITS USED TO CREATE NEGATIVE AIR PRESSURE WITHIN THE TEMPORARY ENCLOSURES ARE TO BE VENTED UP THE ELEVATOR SHAFT. NO AIR, EVEN FILTERED AIR, IS TO BE EXHAUSTED INTO THE HOSPITAL.



03 AE200 SOUTH ELEVATOR DEMO PLAN

1/4" = 1'-0"

0 4 8 12 FT



KEY PLAN

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GEORGE A. BENNETT III
No. 2104
REGISTERED ARCHITECT

PROJECT TITLE

ZAMBARANO HOSPITAL
ELEVATOR REPLACEMENT
BURRILLVILLE, RI

DRAWING STATUS

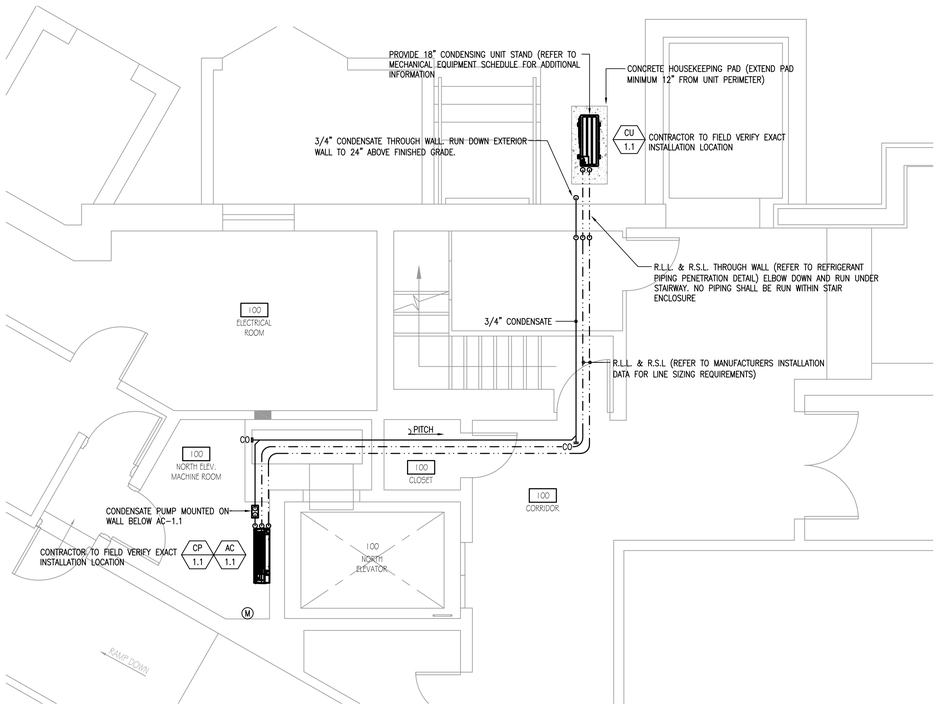
ISSUED FOR CONSTRUCTION

DRAWING TITLE

TEMPORARY PARTITION PLAN

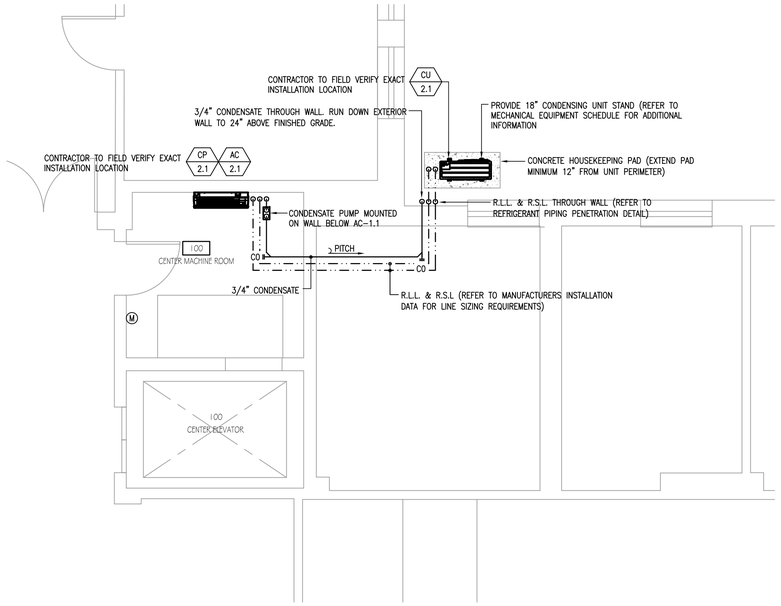
SHEET NO.

AE102



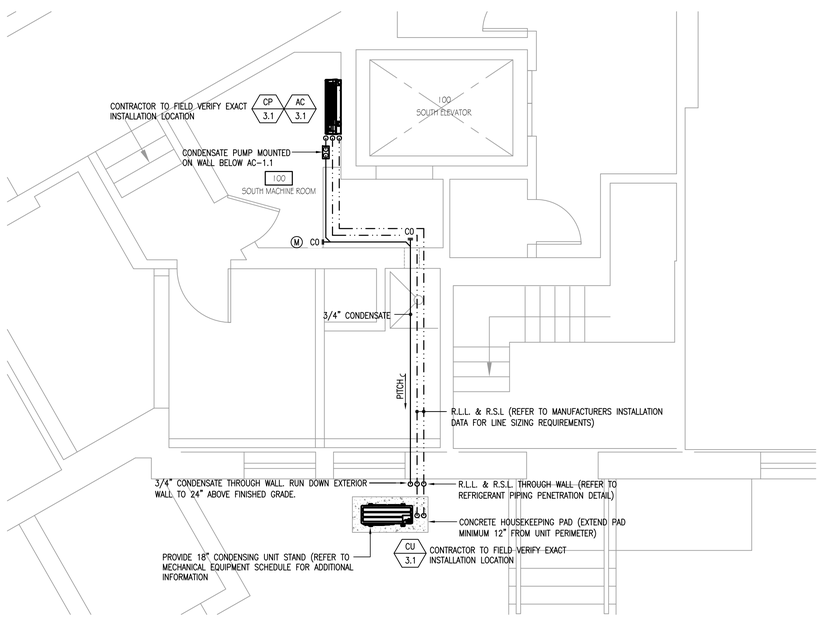
1 M1.0 PARTIAL FIRST FLOOR PLAN @ NORTH MACHINE ROOM 100

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



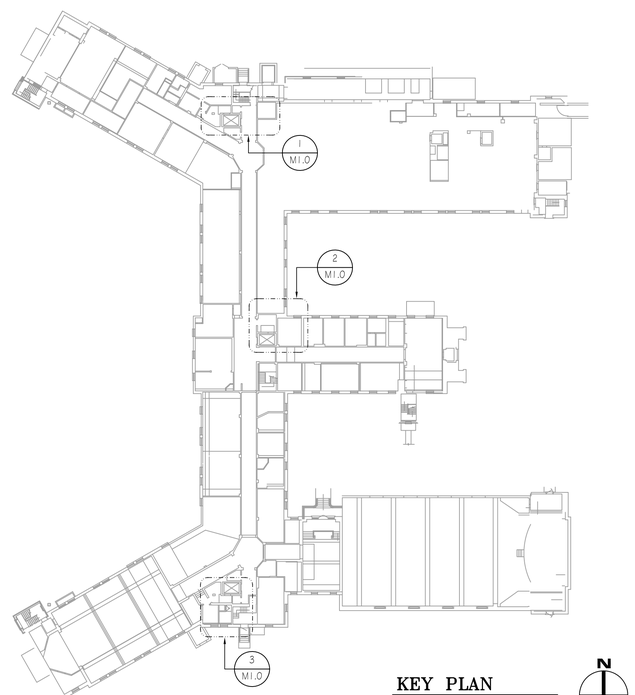
2 M1.0 PARTIAL FIRST FLOOR PLAN @ CENTER MACHINE ROOM 100

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



3 M1.0 PARTIAL FIRST FLOOR PLAN @ SOUTH MACHINE ROOM 100

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



KEY PLAN

NO SCALE

N

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GENERAL NOTES

The drawings are generally diagrammatic and are intended to convey the scope of work and indicate general arrangement of equipment. The locations of all indicated items that are not fixed by dimension are approximate only.

Maintain maximum space conditions at all points. Where space conditions appear inadequate, notify the Architect before proceeding with the installation.

Coordinate the exact location of all materials with the work of other trades and with the existing conditions prior to installation.

All materials to be removed shall be removed from the project site in their entirety, including all hangers, supports and appurtenances.

The piping layout as indicated is schematic and diagrammatic in scope and is not intended to show all offsets which may be required. The exact pipe route shall be field coordinated.

Refer to Architectural Reflected Ceiling Plans and Interior Elevations for the exact location of registers and diffusers.

All system shut-downs shall be with prior approval of the Architect and Owner. Interruptions to services shall be scheduled to minimize down time.

Refer to the PROJECT SPECIFICATION for additional requirements.

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Members AIA

PROJECT NO.	1655
DRAWN BY	JAA
CHECKED BY	RSW
DATE ISSUED	09/05/2019
REVISIONS	-

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BLOUNT BENNETT ARCHITECTS LTD.

ROBERT S. WILKINSON
STATE OF RHODE ISLAND
No. 4589
HOPE
REGISTERED PROFESSIONAL ENGINEER

PROJECT TITLE
ZAMBARANO HOSPITAL
ELEVATOR REPLACEMENT
BURRILLVILLE, RI

DRAWING STATUS
ISSUED FOR CONSTRUCTION

DRAWING TITLE
FIRST FLOOR PARTIAL PLANS
MECHANICAL NEW WORK

SHEET NO.
M100

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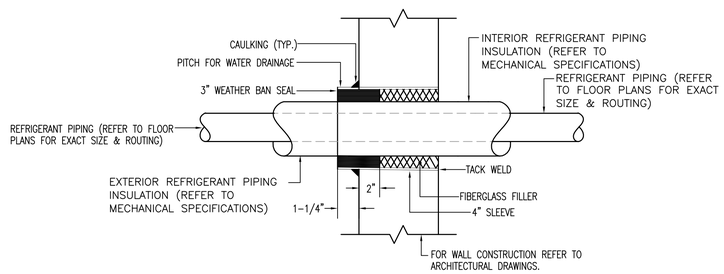
AC CU DUCTLESS SPLIT SYSTEM SCHEDULE

UNIT TAG No.	LOCATION/SERVICE	CFM	COOLING DATA @ 95'F			INDOOR UNIT ELECTRICAL DATA					REFRIG.	WEIGHT (LBS.) INDOOR	MANUFACTURERS MODEL No.	UNIT TAG No.	OUTDOOR UNIT ELECTRICAL DATA (EACH)					WEIGHT (LBS.) OUTDOOR	MANUFACTURERS MODEL No.	REMARKS
			TOTAL (BTU/H)	SENSIBLE (BTU/H)	SEER	MCA	FLA	VOLTS	PH	HZ					MCA	MOCP	VOLTS	PH	HZ			
AC-1.1	NORTH ELEVATOR MACHINE ROOM	335	12,000	9,720	20.8	1.0	0.33	208	1	60	R-410A	30	MITSUBISHI MODEL No. PKA-A12HA7	CU-1.1	11	28	208	1	60	100	MITSUBISHI MODEL No. PUYA-12NKA7	-
AC-2.1	CENTER ELEVATOR MACHINE ROOM	335	12,000	9,720	20.8	1.0	0.33	208	1	60	R-410A	30	MITSUBISHI MODEL No. PKA-A12HA7	CU-1.1	11	28	208	1	60	100	MITSUBISHI MODEL No. PUYA-12NKA7	-
AC-3.1	SOUTH ELEVATOR MACHINE ROOM	335	12,000	9,720	20.8	1.0	0.33	208	1	60	R-410A	30	MITSUBISHI MODEL No. PKA-A12HA7	CU-1.1	11	28	208	1	60	100	MITSUBISHI MODEL No. PUYA-12NKA7	-

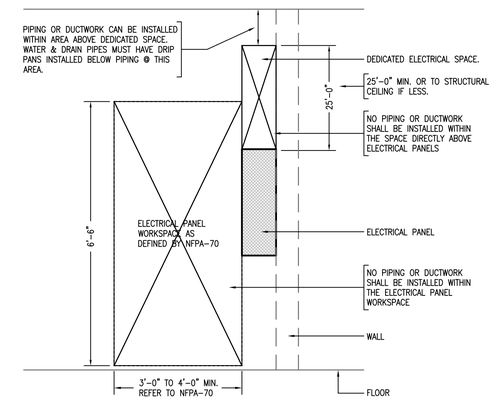
PROVIDE WITH THE FOLLOWING OPTIONS/ACCESSORIES: SIMPLE REMOTE CONTROLLER WITH PROGRAMMABLE 7-DAY HEATING/COOLING CAPABILITIES, UNIT MANUFACTURER TO PROVIDE 18" HIGH CONDENSING UNIT SUPPORT STAND, PROVIDE VIBRATION ISOLATION BENEATH SUPPORT STAND FEET & AND ON TOP OF SUPPORT STAND FEET AT FASTENER LOCATION. VIBRATION ISOLATION SHALL BE SIMILAR TO MASON INDUSTRIES SUPER "W" PAD, PROVIDE WITH WIND BAFFLES FOR OPERATION TO -20'F

CP CONDENSATE PUMP SCHEDULE

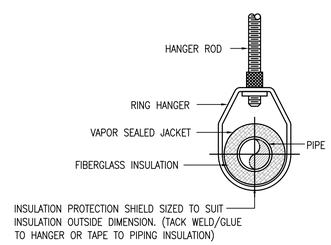
CP-1.1, 2.1, 3.1: PROVIDE CONDENSATE PUMP ASPEN MODEL 83939, 230V 0.18 AMPS, 16 WATTS. CONTRACTOR TO WIRE PUMP TO EVAPORATOR POWER SUPPLY IN STRICT ACCORDANCE WITH THE MANUFACTURES INSTALLATION INSTRUCTIONS.



1 M200 REFRIGERANT PIPING THRU WALL DETAIL
SCALE: NONE



3 M200 ELECTRICAL SYSTEMS COORD. DETAIL
SCALE: NONE

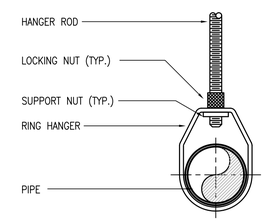


ADJ. RING HANGER
(FOR PIPES UP TO 1-1/4")

HANGER ROD SCHEDULE	
PIPE SIZE	ROD SIZE
UP TO 1-1/4"	3/8"

INSULATION INSERTS	
PIPE SIZE	LENGTH
UP TO 1-1/4"	10"

2 M200 TYPICAL PIPE HANGER DETAILS: INSULATED PIPING
SCALE: NONE



ADJ. RING HANGER
(FOR PIPES UP TO 1-1/4")

HANGER ROD SCHEDULE	
PIPE SIZE	ROD SIZE
UP TO 1-1/4"	3/8"

4 M200 TYPICAL PIPE HANGER DETAILS: UNINSULATED PIPING
SCALE: NONE

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ROBERT S. WILKINSON
STATE OF RHODE ISLAND
No. 4589
REGISTERED PROFESSIONAL ENGINEER

PROJECT TITLE
ZAMBARANO HOSPITAL
ELEVATOR REPLACEMENT
BURRILLVILLE, RI

DRAWING STATUS
ISSUED FOR CONSTRUCTION

DRAWING TITLE
DETAILS & SCHEDULES
MECHANICAL

SHEET NO.
M200

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GENERAL REQUIREMENTS – MECHANICAL:

A. DEFINITIONS:

The term "Mechanical" applies and refers to all work specified herein and as indicated on the Contract Drawings.

The term "Mechanical Contractor(s)" applies and refers to all those furnishing labor and materials for the completion of the work specified herein and as indicated on the Contract Drawings. All subcontractors and sub–subcontractors, as defined within the General Conditions, are collectively termed "Mechanical Contractor(s)". The requirements of these "Mechanical General Requirements" apply to all Mechanical Contractor(s).

Wherever the word "provide" is used, it shall mean "furnish and install complete and ready for use".

"Concealed" shall mean hidden from sight in trenches, chases, furred spaces, shafts, above hung ceilings, embedded in construction, in attic spaces or in crawl spaces.

"Work by others" shall mean "not by Mechanical Contractor but provided or installed by the General Contractor or any other sub–contractor performing their respective work within this contract.

B. INTENT:

The intention of these Specifications and Drawings is to call for finished work, tested and ready for operation.

The drawings are diagrammatic and not intended to show every pipe, offset, associated equipment or other minor detail. Provide such parts, materials, and appliances as required to complete the systems for operation.

Equipment and/or materials specified in the singular shall be provided in quantities as required for complete systems.

EXISTING CONDITIONS:

Prior to submitting a bid, visit the site, become familiar with the existing conditions, with the contract work of all trades, and become fully knowledgeable of how it relates to the Drawings and Specifications.

C. PROJECT MEETINGS:

Provide knowledgeable personnel to attend meetings scheduled (include all trades) as required.

D. COORDINATION / COOPERATION:

Cooperate with all other tradesmen, Contractors and Subcontractors to facilitate the completion of the work as a whole, as indicated on the drawings and specifications.

Wherever work interconnects with the work of other Contractors, coordinate the work with these Contractors to insure that all information is available such that all equipment and material may be installed properly with all necessary connections and appurtenances.

Coordinate the location of all openings required for apparatus and transmit this information sufficiently in advance, so that all openings in walls, slabs, roofs, piping supports, inserts and equipment including sleeves and access doors may be properly installed.

Where work will be installed in close proximity to, or interfere with the work of other trades, assist in coordinating space conditions to a satisfactory adjustment. If directed by the Owner/Engineer, provide composite working drawings indicating the proposed adjustment.

All distribution systems which require pitch or slope such as plumbing drains, sprinkler piping, and condensate drain piping shall have the right of way over those systems which do not. Where the work to be installed is located by detail and or elevation, that work shall have the right of way over items indicated as schematic or without indicated location (electrical conduits, control conduits etc). Confer, coordinate and cooperate with other trades as to the location of pipes, lights, and apparatus and install all work to avoid conflict and interference.

Work that is installed to interfere with the work of others prior to proper coordination and cooperation, shall be adjusted to correct the situation without extra compensation.

E. DELAYS:

Become fully informed as to availability dates of materials and equipment to be provided. Where availability dates interfere with the progress of the work or the Sequence of Operations, notify the Owner/Engineer and transmit all recommendations, including any changes in costs, to remedy the situation.

Final decisions as to the procedure in cases of delays, strikes, and acts of God shall be in writing by the Owner/Engineer. DO NOT alter work, materials or equipment without written authority by the Owner/Engineer.

Order equipment and materials in advance of the time of installation to avoid project delays.

F. WORKMANSHIP:

Workmanship shall be of the highest quality, in the best practice of the trade, and none but competent mechanics skilled in their respective trades shall be employed. Materials and apparatus shall be provided, delivered, erected, connected, and finished in every detail; and shall be so selected and arranged as to fit properly into building spaces.

G. DRAWINGS:

Refer to all Contract Drawings for a full comprehension of the extent and detail of the work. Drawings are supplementary to the specification and work indicated, mentioned or implied in either is considered as specified by both.

Work indicated on the drawings is intended to be approximately correct to scale, but dimensions and details are to assume precedence.

Typical details apply to every like item. They are not repeated in full on all of the drawings, which are diagrammatic only, but with the intention that such typical details are fully applicable.

H. INTERPRETATION OF PLANS AND SPECIFICATIONS:

Questions or disagreements as to the true intent of this specification and drawings shall be decided by the Owner/Engineer, whose interpretation thereof shall be final, conclusive and binding on all parties.

I. CODES, ORDINANCES, AGENCIES:

The State Building Code, Fire Code and local ordinances with all amendments to date, are hereby made a part of these specifications. Work shall conform to State Codes and Regulations.

The codes and ordinances shall be considered as a minimum requirement, and work specified or indicated on the drawings in excess of code requirements shall be provided.

Notify authorities and agencies; obtain all permits; obtain all official licenses and certificates; obtain all necessary approvals of authorities having jurisdiction; file all necessary plans; perform all necessary testing; and transmit to the Owner/Engineer all certificates of inspection.

Materials provided and work installed shall comply with the National Fire Codes of the NFPA; with the requirements of local utility companies; and with the requirements of agencies having jurisdiction.

Electrical materials and equipment shall be U.L. Approved or listed.

J. FEES, PERMITS:

Include the following costs within the bid amount;

The payment of all fees in connection with obtaining necessary licenses, inspections, and permits.

The costs of all utility connections and extensions, to include the purchasing of meter(s) and appurtenances.

The payment of applicable taxes.

K. SPECIAL REQUIREMENTS:

This project requires that the building remain operational throughout the completion of renovations and alterations as indicated. See Contract documents for a complete knowledge of all special requirements.

L. SUBSTITUTIONS, CONTRACTOR'S OPTIONS:

Where only one product is specified, but is followed by the phrase "or approved equal" the Mechanical Contractor(s) must submit his base bid on the product specified. Proposed substitutions for equivalent products shall be submitted for review under SUBSTITUTION PROPOSALS.

Where two or more products are specified for one use, the Mechanical Contractor(s) shall select from those products mentioned. Where specific model of one manufacturer is specified and other manufacturers are listed, the products of listed manufacturers must be equal in all major respect.

It remains the responsibility of the Mechanical Contractor to review the dimensions, weights, required clearances, required supporting structure, etc. of the equipment of "other" manufacturer's relative to the proposed use. The Mechanical Contractor is responsible for any changes to the design and to the building fabric (i.e. supporting structure, mechanical spaces, piping or ductwork connections and routing, etc.) resulting from the use of equipment of the "other" manufacturers.

No proposal for extra charges resulting from the use of equipment of the "other" manufacturers will be entertained for approval.

Where products are specified by reference standard, select any product which meet the standards by any reputable manufacturer.

M. SHOP DRAWINGS:

Provide shop drawings (drawings, catalog cuts, spec sheets) for ALL equipment and products to be installed on the project.

Label all shop drawing submittals as follows:

Project Name
Contractor's Name
Specification paragraph

Mark in ink all catalog cuts, pamphlets to indicate options, accessories and model numbers.

Data submitted which is general and not labeled and marked as required above will not be accepted.

N. SHOP DRAWING REVIEW:

Review will be based on manufacturer's published data, and ratings. Any product, material or equipment submitted not in accordance with these specifications will be rejected.

Where substitute products are proposed and no exception is taken, the Mechanical Contractor shall assume the entire responsibility for any changes in the work required or occasioned by the use of the substitute.

Review of shop drawings is not a guarantee of suitable measurements, quantities required, or that other changes in the work are not required to permit proper installation. Review does not mean the submittal has been checked for every detail, or that the Contractor is relieved from responsibility of providing complete systems as required by the Contract Documents.

O. RECORD DRAWINGS:

Keep accurate construction drawings marked to indicate actual installation of all work of all of the trades covered by these Drawings and Specifications.

All underslab, concealed or underground piping shall be located by dimension sufficient for exact location determination in the future.

All concealed work shall be accurately located and all points of adjustment (dampers etc) shall be shown in actual locations.

Final Record Drawings shall be prepared by the Mechanical Contractor on a set of reproducible drawings that accurately indicate all of the work as installed.

Transmit originals and two sets of prints for review at project closeout.

P. OPERATING AND MAINTENANCE MANUALS:

Compile complete manuals including manufacturers data, bulletins, maintenance instructions, shop drawings, parts lists, warranties etc for all equipment and materials provided.

Assemble and index three copies of each manual within suitable binders.

Transmit manuals to the Owner/Engineer for review in advance of scheduled instruction periods.

Q. GUARANTEE:

Transmit to the Owner/Engineer a written guarantee from each of the Mechanical Contractors stating that the work provided under these specifications is guaranteed against defects in material and workmanship that shall become apparent during the period of one (1) year from acceptance of the systems.

Extended guarantee or warrantee of certain equipment may be required. See specification requirements for individual items.

R. PROTECTION AND STORAGE OF MATERIALS:

Equipment and materials furnished shall, at all times, be protected from weather, vandalism, and other construction phase exposures to include paint, plaster and dust.

Outdoor storage of equipment not intended for outdoor use will NOT be permitted.

Properly protect all pipe openings with temporary caps to prevent obstruction and damage. Post notices and prohibit use of fixtures, equipment and apparatus prior to the completion of the project.

S. RIGGING, HOISTING, STAGING:

Furnish rigging, hoisting equipment, staging and other services necessary for delivery and installation of any product provided. Remove rigging, staging from the site when no longer required.

T. FIELD MEASUREMENTS AND DISCREPANCIES:

Base all measurements, both horizontal and vertical, from referenced points established by the General Contractor.

Check drawings, field verify spaces, dimensions and clearances where materials and equipment will be installed. Where discrepancies arise which prevent or alter installation, notify the Owner/Engineer.

Where discrepancies between drawings and specifications; between different drawings; or where the work of others is effecting work under this Division notify the Owner/Engineer.

Where the work herein required is not clearly understood apply to the Owner/Engineer for further clarification.

In each instance above, the Owner/Engineer shall clarify the discrepancy and the Mechanical Contractor(s) shall complete the work at no additional cost to the Owner.

U. ACCESSIBILITY:

Install work so that parts requiring access are readily accessible for inspection, operation, maintenance, repair and removal. Minor deviations from the drawings may be made to accomplish this, but changes of magnitude shall not be made without written approval of the Owner/Engineer.

V. TEMPORARY OPENINGS:

Examine contract documents and ascertain whether special, temporary openings will be required for the installation of apparatus and notify the Owner/Engineer.

W. SOLDERING, BRAZING, WELDING:

Soldering, brazing, welding or other open flame operation shall be conducted only when a person, with approved firefighting equipment, trained in its use is on duty at the location of the operation.

X. INTERRUPTIONS TO SERVICES:

Where a temporary shutdown of an existing operating system is required, schedule the work at times designated by the Owner/Engineer. Work requiring an interruption shall be completed by continuous performance, including overtime, to minimize the shutdown interruption.

Y. USE OF INSTALLATION BY OWNER:

The Owner may use parts of the installation, including mechanical systems when complete, but such use shall not be considered as acceptance of the work in lieu of written certificate from the Owner/Engineer.

Schedule obnoxious, noisy, or otherwise objectionable portions of the work at times approved by the Owner/Engineer. Overtime work must be approved in writing.

Z. MATERIALS:

Provide new, first–class quality materials and apparatus, unless specifically directed otherwise by this specification or contract drawings.

AA. MANUFACTURER'S RECOMMENDATIONS, IDENTIFICATION:

Obtain necessary data on equipment and materials to insure proper installation and testing in accordance with manufacturers' recommendations.

Equipment and materials furnished for this work shall bear the manufacturers' nameplate, trademark or suitable identification permanently affixed. The nameplate of a contractor or distributor is not acceptable.

AB. COLOR SELECTION; MATERIALS/EQUIPMENT:

Exterior: Provide metal louvers, grilles, fans, intake units, etc of equal coloration as indicated for exterior metal trim for the project. All exterior metal trim shall match.

Interior: Product color shall be selected by the Owner/Engineer. Provide complete color selection charts, chips with product submittals. Equipment to be painted shall have prime coat, anti–rust as necessary, factory applied.

AC. QUIET OPERATION:

Equipment and apparatus provided shall operate under all conditions of load without sound or vibration which are considered objectionable be the Owner/Engineer: eliminate same in a manner approved by the Owner/Engineer.

AD. ELIMINATION OF TRANSMISSION OF VIBRATION:

Eliminate objectionable transmission of vibration from mechanical systems to building structure. Select and install equipment with proper vibration control equipment and provide isolators on piping, equipment, ductwork and apparatus where necessary to prevent transmission of sound and vibration. Isolate all rotating equipment from the building structure.

AE. BASES AND SUPPORTS:

Provide all bases and supports for mechanical equipment not part of the building structure of required size, type and strength, as approved by the Owner/Engineer.

Equipment, bases, and supports shall be anchored to the building structure to prevent shifting of position under all conditions. Attachments shall be strong and of a durable nature and any attachments, anchors, piers, bases, or other supports that are, in the opinion of the Owner/Engineer, not strong enough or durable shall be replaced as directed.

AF. SUPPLEMENTARY STEEL, CHANNELS AND SUPPORTS:

Provide steel members, channels as required for the proper installation, mounting and support of equipment provided. Pipe shall not be allowed for use as miscellaneous steel supports. All steel used for support shall be firmly attached to the building construction.

Size and type of supporting steel shall be determined by the installer and shall be of sufficient strength and size to allow only a minimum deflection under all conditions of load.

All steel provided for support shall be free from rust and shall be primed with antirust paint or shall be galvanized. All exterior steel shall be galvanized.

AG. SLEEVES, PLATES:

Provide and locate sleeves, plates, anchors, and inserts required; mark openings before floors and walls are constructed or core bored.

Provide sleeves for piping passing through floors, walls, roofs, partitions and masonry. Sleeves for concrete or masonry shall be Schedule 40 steel pipe of size to allow for pipe expansion and passage of vapor barrier insulation. Other sleeves shall be 20 gauge galvanized sheet steel with lockseam joint.

Terminate sleeves flush with walls, partitions, and ceiling.
Terminate sleeves 1/2" above finished floor where piping is exposed.

Where ceiling inserts are provided specifically for the use of the Owner, install all work, so as to not interfere, with a separate support system.

AH. PIPE ESCUTCHEONS:

Provide escutcheons for pipe penetrations of building construction exposed to view.

Escutcheons shall closely fit bare or insulated pipe and shall conceal pipe sleeves.

Escutcheons in unfinished areas shall be of solid or split pattern steel, cast iron or malleable iron. Escutcheons in finished areas shall be of chrome plated, solid pattern brass.

AI. FIRE SAFING: PIPING, DUCTWORK AND EQUIPMENT OPENINGS:

Fire Stop: Pack all piping, ductwork and equipment openings and sleeves full depth with approved fire safing material to fully seal all openings.

Seal all sleeves, core holes, etc. through floors, walls and ceilings with Nelson "Flame–seal" Fire Stop Putty, 3–M Systems, Hilti Systems, Metacaulk Firestopping or Dow Cording "Fire–Stop" Sealant. Install in accordance with manufacturer's printed instructions.

Firestopping is to meet UL ratings for each penetration type and material for floors, walls and ceilings. Coordinate with Owner/Engineerural Drawings for exact requirements and ratings at various conditions.

AJ. MACHINERY DRIVES:

V–belt drives shall be designed to transmit safely equal to or greater than 150% of motor horsepower rating, but not less than manufacturer's recommendation for type of service intended.

AK. PROTECTIVE GUARDS:

Provide protective guards at all belt drives, rotating shafts and rotating equipment. If not a part of equipment, guards shall be of galvanized angle frame with galvanized wire mesh, readily removable for service.

AL. PORTABLE OR DETACHABLE PARTS:

Retain and be responsible for all portable or detachable parts provided as a part of the work. Install these parts just prior to project close–out when the site is secure. Replace all lost, stolen or damaged items prior to project acceptance.

AM. PIPE AND EQUIPMENT IDENTIFICATION:

Provide identification labels, coordinated to the drawings (Unit 2B on drawings shall be labeled UNIT 2B) for all equipment and piping as follows:

Provide stencil pipe labels and flow direction arrows on exposed piping within the building. Arrange labels to be clearly readable from the floor. Glue on printed labels will not be accepted.

Label piping outside of mechanical spaces shall be at 40'–0" intervals. Piping in mechanical spaces and at equipment shall be labeled to insure clear and concise identification of all piping.

Provide stencil labels on major heating, air handling, and refrigeration equipment. Provide laminated plastic labels attached by screws at all electric motor starters indicating the designation of the equipment controlled.

Provide laminated plastic labels at all control equipment, relays, thermostats indicating the function and designation of the equipment controlled.

AN. ELECTRICAL CURRENT CHARACTERISTICS:

Refer to the Electrical Drawings and field coordinate the electrical components of the mechanical systems specified in this Division.

Building Electrical Service: 120/208V, single phase, 4 wire

Motors: 1/2 HP and larger: 208V, 3 phase
Smaller than 1/2 HP 120V, 1 phase

AO. ELECTRICAL CONNECTIONS AND WIRING:

The Electrical Contractor shall provide power wiring complete from power source to motor or equipment junction, including power wiring through starters and line voltage control apparatus. The Mechanical Contractor(s) shall furnish and the Electrical Contractor shall install all electric motor starters.

The Mechanical Contractor(s) shall provide all wiring, relays, devices, etc necessary (regardless of voltage) for automatic controls.

Wiring provided by Mechanical Contractor(s) shall be in accordance with the National Electric Code, local and state codes. Wiring shall be in conduit where exposed to view, regardless of voltage, unless noted otherwise.

AP. ELECTRICAL DEVICE COORDINATION:

Coordinate electrical devices, motors with the Electrical Contractor and electrical drawings as to voltage, starter location and control required. Provide electrical data and wiring diagrams to the Electrical Contractor.

Do NOT operate electrical devices until:

1. Voltage available on all phases is in accordance with nameplate.
2. Direction of rotation is checked.
3. Full load voltage reading is not less than nameplate.
4. Full load amperage reading is not greater than nameplate.

The Mechanical Contractor(s) shall furnish the Electrical Contractor with copies of the Mechanical System floor Plans, (Plumbing, Fire Protection and HVAC). These drawings shall have all equipment and systems requiring electrical connection clearly marked in red. Copies of these "Electrical Coordination Drawings" shall also be submitted for record.

AQ. MOTORS:

Motors shall be built in accordance with the latest standards of NEMA; tested in accordance with standards of A.S.A.C. 50; and conform thereto for insulation and dielectric strength. Each motor shall be provided with conduit terminal box, adequate starting and protective equipment under all conditions of load without overload. Horsepower shall be as indicated. Select motors for quiet operation. All motors shall be premium high efficiency type, equal to Magnatek, Toshiba, or General Electric, as follows:

AR. TESTING AND ADJUSTING:

Where testing leaks develop or the installation fails to function properly, make all necessary corrections and repeat tests until all defects have been remedied. Corrections made shall be to the satisfaction of the Owner/Engineer prior to the acceptance of the work.

Furnish labor, material, instruments, necessary for tests required. See respective Sections for test requirements.

In addition to required tests specified, provide qualified personnel to adjust all parts of systems such that proper, economical operation is achieved.

AS. OPERATION, MAINTENANCE INSTRUCTIONS:

Schedule and conduct, when mechanical electrical systems are complete and operational, instruction periods for Owner's personnel.

At the completion of instruction periods forward a letter (5 copies) stating the names of those giving and receiving instructions.

AT. LUBRICATION:

Lubricate as required, all motors, bearings, fans, etc. before operation of any equipment. Provide a final lubrication when system is accepted by Owner.

AU. CLEANING:

At completion, thoroughly clean all parts of the installation. Equipment, materials and apparatus shall be free of grease, paint, plaster and debris. Any damage to the building due to leakage or by other means shall be properly and immediately cleaned and repaired to the satisfaction of the Owner/Engineer.

At completion, replace, clean, such parts of systems as filters, strainers, and traps. This work shall be done after site is substantially free of dust.

AV. SCRATCHES, SCRAPES, DENTS:

Repair and correct, to the satisfaction of the Owner/Engineer, all minor equipment deficiencies such as scratches, scrapes, dents; where corrective methods are not satisfactory, replace the item.

AW. SERVICE:

At completion, provide the Owner/Engineer with a complete listing of all service contractors including 24 hour phone numbers.

Provide service on equipment furnished for a period of one year from the date of final acceptance. Render service promptly at the request of the Owner. This shall not be construed to include routine maintenance.

PRODUCTS – MECHANICAL:

A. GENERAL:

Provide new, standard products, materials and equipment which comply with the specification; are undamaged and unused at the time of installation; are complete with accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use.

B. COORDINATION WITH POWER DISTRIBUTION SYSTEMS:

No piping, ductwork, equipment, device or any apparatus shall be installed above any electrical power distribution panels, transformers or system components.

Piping, ductwork, equipment, etc. found to be installed contrary to this directive will be removed and relocated at no extra cost to the Owner.

C. ELECTRICAL EQUIPMENT APPURTENANCES:

Where electrical equipment is furnished, provide all necessary electrical appurtenances including motor starters, alternators, pilot lights, panels and mounting panels for same.

Provide wiring diagrams to the Electrical Contractor on all equipment.

D. VIBRATION CONTROL:

Provide proper methods and materials such that equipment with moving parts, reciprocating or rotational, does not transmit vibration to the building structure or to the space.

Tolerable limits of vibration will be determined by the owner and levels of vibration found to be excessive shall be corrected by the contractor at no additional cost to the owner.

E. TESTING AND ADJUSTING:

The HVAC Contractor shall conduct and be responsible for all testing and adjusting as herein specified, to include providing all labor and equipment required and the submission of all reports.

All defects and deficiencies or failing to operate properly shall be corrected by the Contractor and the systems shall be retested or readjusted prior to final acceptance.

Any and all damage caused by tests shall be the responsibility of the HVAC Contractor.

F. SYSTEM TESTS:

Scope: Subsequent to the final testing and balancing, all HVAC systems shall be tested to indicate that performance of all units is satisfactory and as intended.

G. PIPING: INSTALLATION, GENERAL:

Arrange and install piping approximately as indicated and as straight, plumb, and direct as possible. Form right angles or parallel lines with building wall. Keep pipe close to walls, partitions and ceilings. Offset only where necessary to follow walls. Where so indicated and wherever possible, conceal piping in building construction before erection of closing construction. When furred spaces are indicated, keep pipes as close to structural members as possible. Piping shall not interfere with openings, doors and windows. Allow for proper clearance at windows, doors, equipment and other building parts such that piping does not interfere with access and building use.

Piping shall be cut accurately to measurements established at the site and shall be installed without springing, forcing and excessive cutting or weakening of building structure. Pipes shall be installed in a manner permitting proper drainage, venting and free expansion and contraction. Changes in direction shall be made with factory–manufactured fittings.

Install pipe to allow for expansion without excessive stress on pipe, hangers and building.

Welding, brazing, soldering shall be with proper regard for fire prevention and safety.

Arrange piping passing through floors, walls and other partitions of building construction so that piping is centered in openings / sleeves and is rigidly supported on both sides of openings / sleeves.

Clean pipe, pipe fittings, and valves before erection. Cap or plug open ends of piping and equipment during construction to keep dirt and foreign material out of system.

Unions or flanges shall be used to facilitate piping installation, and shall be installed between shut–off valves and equipment to facilitate removal of equipment for repair.

Provide dielectric unions where pipes of dissimilar metals are joined together.

Grade gravity waste from cooling coil drain pans at uniform slope of 1/4" per foot.

Copper tube, of annealed or bending temper quality, where indicated to be installed without joints or fittings, shall be bent to accomplish changes of direction. Bending shall not collapse outside nor buckle inside of bend. Proper radius, method and tools required shall comply with Copper Tube Handbook.

Branch piping connections from mains to fixed equipment and connections from risers to horizontal mains shall have minimum of three (3) 90 degree elbows and be arranged in swing fashion to permit unrestricted expansion and contraction of piping and minimize stress at connections to risers and fixed equipment.

Do not route pipelines over switchboards, panels, motor control centers, individual motor starters and other electrical equipment.

Avoid routing pipelines over electrical raceways and bus ducts. If these locations cannot be avoided, provide drip pans under pipelines. Also provide drip pans where indicated on the Drawings. Drip pans shall be constructed of minimum 22 gauge stainless sheet metal with waterproof mastic applied to interior seams and joints. Pan width shall be minimum 2 times pipe diameter and with sides turned up minimum of 4" high and fitted with hemmed edge. Do not hang drip pans from pipe. Pitch pans minimum 1/8" per foot and provide 3/4" drain connection at low points. Pipe drains to nearest floor drain or as shown on the Drawings.

Provide pipe vents and pressure relief from equipment and piping systems in accordance with applicable codes. Unless otherwise specified, vent and relief piping shall match system to which attached.

H. CROSS AND INTER–CONNECTIONS:

No piping for equipment, device or any apparatus internal connection shall be installed which will provide a cross or interconnection, under any circumstance of operation, between a distributing supply for drinking or domestic purposes and a not–potable supply or a drainage system or a soil or sanitary waste pipe which will permit or make possible the back–flow of sewage, polluted water or waste into the domestic water supply system.

I. PIPING: REFRIGERANT

Material: Provide seamless, hard drawn, Copper refrigerant tube, ASTM B280, cleaned, dehydrated and sealed, marked ACR on hard temper straight lengths.

All joints shall be made with wrought copper or brass fittings, designed for use with high temperature solder and suitable for working pressure of 300 psi.

Coils shall be tagged ASTM B280 by the manufacturer.

Joints: Silver braze joints while nitrogen gas is blown through piping.

Sizing: Refrigerant pipe size shall conform to current standards of Air Conditioning and Refrigeration Machinery Association Inc and equipment manufacturer. Provide a SCHEMATIC PIPE SIZING AND APPURTENANCE DIAGRAM for approval prior to start of work.

Connections to Equipment: Provide flexible braided metal pipe connectors at direct connections to compressors. Refer to equipment installation data for additional requirements.

Workmanship: Provide experienced refrigeration mechanics to perform piping installation. Isolate piping for proper vibration and noise transmission control.

Testing: Evacuate system to 2.5 mm of mercury absolute; introduce dry nitrogen or dry carbon dioxide necessary to pressurize system to 300 psig. Inspect all joints with halide torch. Repair all leakage. Evacuate system to 2.5 mm of mercury absolute; seal; and check pressure maintained for 24 hours.

Start–Up: Install temporary dehydrator for a period of one week while under normal run conditions. Remove dehydrator and insulate piping.

J. PIPING: CONDENSATE DRAIN
Material: All piping shall be type "L" copper tubing with wrought copper fittings as manufactured by Revere, Anaconda or Chase.

Joints: All joints shall be made with 95–5 solder. All excess flux shall be removed from pipe.

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BLOUNT BENNETT ARCHITECTS LTD.

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No. 4589
REGISTERED PROFESSIONAL ENGINEER

PROJECT TITLE
ZAMBARANO HOSPITAL
ELEVATOR REPLACEMENT
BURRILLVILLE, RI

DRAWING STATUS
ISSUED FOR CONSTRUCTION

DRAWING TITLE
SPECIFICATIONS MECHANICAL

SHEET NO.
M300

Workmanship: All piping shall be reamed to full diameter before joining. Pipes shall be run perpendicular to building construction. Provide 1/8" per foot pitch on all horizontal drain piping, except as otherwise noted.

Cleanouts: Provide cleanouts at changes of flow direction or as required.

Supports: Condensate drain piping supports shall meet manufacturer's recommendations for pipe size provided.

K. INSULATION SYSTEM: REFRIGERATION PIPING

Material: Tubular close-celled, foamed plastic material:

Fire Rating: Self extinguishing
Conductivity: .26 at 70 deg F mean

Insulation shall be as manufactured by John-Mansville, Owens Corning, Certain-Teed or approved equal.

Workmanship: Slip tube insulation over open ends of piping during installation. Cover fittings with same material mitered and cemented to suit. At pipe hanger provide rigid insulation block. Only with approval of the Owner / Engineer shall insulation be slit and snapped over pipe. Insulation and vapor barrier shall pass uninterrupted through all hangers, supports and pipe sleeves.

Thickness: Nominal 1/2" thick.

Scope: All refrigerant piping (liquid and suction) and appurtenances.

L. INSULATION SYSTEM: CONDENSATE DRAINS

Materials: One piece piping insulation of long, fine, flame attenuated glass fibers, covered with factory applied all purpose jacket of white kraft bonded to aluminum foil and reinforced with fiberglass yarn.

Flame spread: 25
Smoke developed: 50
Conductivity: .25 at 100 deg mean

Insulation shall be as manufactured by Johns-Manville, Owens Corning, Certain-Teed, or approved equal.

Workmanship: Insulation shall be applied over clean, dry surfaces, with adjoining sections butting firmly together. Fittings on pipe shall be insulated with a submitted and approved insulating cement of equal thickness. Insulation and vapor barrier shall pass uninterrupted through all hangers, supports and pipe sleeves.

Thickness: 1/2" thick up to 2" pipe
1" thick on larger pipe

Scope: All new air conditioning unit condensate drains from drain pan to air gap discharge including trap. Provide premolded PVC coverings on exposed piping only.

M. SPLIT SYSTEM AIR CONDITIONING UNIT

1. System Description

The Air Conditioner system shall be a Mitsubishi Electric split system with Variable Speed Inverter Compressor technology. The system shall consist of a horizontal discharge, single phase outdoor unit, a matched capacity indoor section that shall be equipped with a wired wall mounted, wireless wall mounted and/or wireless hand held remote controller.

2. Quality Assurance

The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.

All wiring shall be in accordance with the National Electrical Code (N.E.C.) and local codes as required.

The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 210 and bear the ARI Certification label.

The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001, which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

A dry air holding charge shall be provided in the indoor section.

The outdoor unit shall be pre-charged with R-410a refrigerant for 70 feet (20 meters) of refrigerant tubing.- PUY-42NHA4 for 100 feet (30 meters) of refrigerant tubing

3. Delivery, Storage and Handling

Unit shall be stored and handled according to the manufacturer's recommendations.

The controller shall be shipped separately and shall be able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

4. Warranty

The units shall have a manufacturer's parts and defects warranty for a period five (5) year from date of installation. The compressor shall have a warranty of seven (7) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.

Manufacturer shall have over thirty (30) years of continuous experience in the U.S. market.

5. Outdoor Unit

The outdoor unit shall be compatible with the four different types of indoor units (PCA – ceiling suspending, PEA / PEAD – ducted, PKA – wall mounted and PLA – four way recessed ceiling cassette). The connected indoor unit shall be of the same capacity as the outdoor unit.

The outdoor unit shall be equipped with an electronic control board that interfaces with the indoor unit to perform all necessary operation functions.

The outdoor unit shall be capable of cooling operation down to 0°F (–18°C) ambient temperature without additional low ambient controls (optional wind baffle shall be required).

The outdoor unit shall be able to operate with a maximum height difference of 100 feet (30 meters) between indoor and outdoor units.

System shall operate at up to a maximum refrigerant tubing length of 100 feet

The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory.

6. Cabinet

The casing shall be constructed from galvanized steel plate, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection and have a Munsell 3Y 7.8/1.1 finish.

Mounting feet shall be provided and shall be welded to the base of the cabinet and be of sufficient size to afford reliable equipment mount and stability.

Easy access shall be afforded to all serviceable parts by means of removable panel sections.

The fan grill shall be of ABS plastic.

Cabinet mounting and construction shall be sufficient to withstand 155 MPH wind speed conditions for use in Hurricane condition areas. Mounting, base support, and other installation to meet Hurricane Code Conditions shall be by others.

7. Fan

Unit shall be furnished with a single DC fan motor.

The fan blade(s) shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated.

The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent external contact with moving parts

8. Coil

The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up and allow maximum airflow. The coil shall be protected with an integral metal guard.
3.4.2 Refrigerant flow from the condenser shall be controlled by means of an electronic linear expansion valve (LEV) metering device. The LEV shall be controlled by a microprocessor controlled step motor.

All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.27 BTU-inch/hour per Sq Ft / °F, a water vapor transmission equal to or better than 0.08 Perm-inch and superior fire ratings such that insulation will not contribute significantly to fire and up to 1" thick insulation shall have a – Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E 84 and CAN / ULC S-102.

9. Compressor

The compressor shall be a DC twin-rotor rotary compressor with Variable Speed Inverter Drive Technology.

3The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which shall result in significant energy savings.

To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant. No crankcase heater is to be used.

outdoor unit shall have an accumulator and high pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.

10. Electrical

The electrical power of the unit shall be 208volts or 230 volts, single phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 187 volts to 253 volts.

Power for the indoor unit shall be supplied from the outdoor unit via Mitsubishi Electric A-Control using three (3) fourteen (14) gauge AWG conductors plus ground wire connecting the units.

The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC.

The unit shall have Pulse Amplitude Modulation circuit to utilize 98% of input power supply.

11. Indoor Unit

The indoor unit shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board and fan motor. The unit, in conjunction with the wired wall-mounted controller, wireless wall-mounted controller or wireless handheld controller, shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with dry nitrogen before shipment from the factory.

12. Unit Cabinet

The cabinet shall be formed from high strength molded plastic with smooth finish, flat front panel design with access for filter. Cabinet color shall be white – Munsell 1.0Y 9.2/0.2. The unit shall be wall mounted by means of a factory supplied, pre-drilled, mounting plate.

13. Fan

The indoor unit fan shall be high performance, double inlet, forward curve, direct drive sirocco fan with a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall consist of three (3) speeds: Low, Mid, and Hi and Auto. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.

14. Vane

There shall be a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall significantly decrease downward air resistance for lower sound levels, and shall close the outlet port when operation is stopped. There shall also be a set of vertical vanes to provide horizontal swing airflow movement.

15. Filter

Return air shall be filtered by means of an easily removable washable filter.

16. Coil

The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All tube joints shall be brazed with PhosCopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil. An optional drain pan level switch (DPLS1), designed to connect to the control board, shall be provided if required, and installed on the condensate pan to prevent condensate from overflowing.

17. Electrical

The electrical power of the unit shall be 208 volts or 230 volts, 1 phase, 60 hertz. The system shall be capable of satisfactory operation within voltage limits of 187 volts to 253 volts. The power to the indoor unit shall be supplied from the outdoor unit, using the Mitsubishi Electric A-Control system. For A-Control, a three (3) conductor AWG-14 wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units.

18. System Control

The control system shall consist of a minimum of two (2) microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. The microprocessor located in the indoor unit shall have the capability of monitoring return air temperature and indoor coil temperature, receiving and processing commands from a wireless or wired controller, providing emergency operation and controlling the outdoor unit. The control signal between the indoor and outdoor unit shall be pulse signal 24 volts DC. Indoor units shall have the ability to control supplemental heat via connector CN152 and a 12 VDC output.

19. Remote Controllers

The Wired Remote Controller (PAR-21MAA) shall be approximately 5" x 5" in size and white in color with a light-green LCD display. The PAR-21MAA shall support a selection from multiple languages (Spanish, German, Japanese, Chinese, English, Russian, Italian, or French) for display information. There shall be a built-in weekly timer with up to 8 pattern settings per day. The controller shall consist of an On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Auto/Fan/Dry mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor. Temperature shall be displayed in either Fahrenheit (°F) or Celsius (°C), and Temperature changes shall be by increments of 1°F (0.5°C). The PAR-21MAA shall have the capability of controlling up to a maximum of 16 systems, as a group with the same mode and set-point for all, at a maximum developed control cable distance of 1,500 feet (500 meters).

The control voltage from the wired controller to the indoor unit shall be 12/24 volts, DC. Field wiring shall run directly from the indoor unit to the wall mounted controller with no splices. Up to two wired controllers shall be able to be used to control one unit.

TEMPERATURE CONTROLS – MECHANICAL:

A. SCOPE:

Provide labor, equipment and materials to complete the Automatic Control System including modulating (stepping) control.

Provide all equipment, accessories, wiring and instrument appurtenances required for a complete energy efficient functioning system.

The Controls Contractor (ATC) shall provide all power wiring, regardless of voltage, including line voltage wiring to all panels, control devices, not indicated on the Electrical Drawings.

The control system shall consist of, but not be limited to, all controls as specified herein including:

sensors
thermostats
switches
gradual switches
relays
wiring, regardless of voltage
wiring conduit systems

Provide required wiring components are not provided by the equipment manufacturers. Coordinate requirements with the HVAC subcontractor.

Provide all control and interlock wiring for heat pump units, air conditioning units, etc. unless specifically and clearly stated to be provided by others.

B. ELECTRIC WIRING: GENERAL:

Provide electric wiring and connections required for the automatic control system. Wiring shall be in conduit and shall comply with the Building Code and the NEC.

The ATC system shall be installed by skilled electricians who are properly trained and qualified for this work.

Supervision and checkout of the system shall be by the ATC contractor.

All electric wiring and wiring connections required for the installation of the temperature control system, as herein specified, shall be provided by the temperature control contractor unless specifically shown on the electrical drawings or called for in the electrical specifications.

Power wiring, including line voltage wiring for the control system shall be provided by the temperature control contractor. This power wiring shall be run to a source as directed by the Electrical Engineer.

C. SPACE TEMPERATURE THERMOSTATS:

Provide all labor and materials required to install, test and calibrate thermostats provided as a part of the VRF systems as furnished by the HVAC Contractor.

D. PANELS:

ATC control panels shall be fully enclosed cabinets with all steel construction. Cabinets shall have hinged door with locking latch on cover plate. All cabinet locks shall be common keyed. Cabinets shall be finished with two coats of enamel paint. Panel shall be wall mounted or free standing as located on mechanical drawings.

E. MISCELLANEOUS DEVICES:

Provide all necessary relays, low temperature detectors, positioners, electric switches, solenoid valves, clocks, transformers, etc., to make a complete and operable system.

F. SEQUENCE OF OPERATIONS, WALL MOUNTED SPLIT SYSTEM AIR CONDITIONING:

Provide all labor and material required to test and calibrate the automatic control systems provided by the HVAC contractor as a part of the HVAC systems.

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ZAMBARANO HOSPITAL
ELEVATOR REPLACEMENT
BURRILLVILLE, RI

DRAWING STATUS
ISSUED FOR CONSTRUCTION

DRAWING TITLE
SPECIFICATIONS MECHANICAL

SHEET NO.
M301

ELECTRICAL SYMBOL LEGEND

LIGHTING

A b	1'x4' LIGHTING FIXTURE–LETTER INDICATES TYPE, SUBSCRIPT DENOTES CONTROL AND CIRCUIT NUMBER
C b	WALL MOUNTED LIGHTING OUTLET–LETTER INDICATES TYPE, SUBSCRIPT DENOTES CONTROL AND CIRCUIT NUMBER
S	SINGLE POLE SWITCH MTD. 48" A.F.F. ("K" INDICATES KEY TYPE, "P" INDICATES WITH PILOT LIGHT)

FIRE ALARM

S	FIRE ALARM SMOKE DETECTOR. MATCH EXISTING SYSTEM.
RR	FIRE ALARM THERMODETECTOR, RATE–OF–RISE TYPE.
F	FIRE ALARM PULL STATION
F	HORN/STROBE COMBINATION, MTD 80" A.F.F. TO BOTTOM OF STROBE LENS. "CLG" INDICATES CEILING TYPE, "WP" INDICATES WEATHERPROOF. CANDELA RATING SHALL BE 15/75, UNLESS OTHERWISE NOTED.
S	FIRE ALARM STROBE ONLY, MTD. 80" A.F.F. TO BOTTOM OF STROBE LENS. "CLG" INDICATES CEILING TYPE. CANDELA RATING SHALL BE 15/75, UNLESS OTHERWISE NOTED.
FACP	FIRE ALARM CONTROL PANEL

POWER

J	JUNCTION BOX
	SINGLE RECEPTACLE
A/3	HOME RUN TO PANELBOARD. "A" DESIGNATES PANEL, "3" DESIGNATES CIRCUIT NUMBER
	CROSSHATCHING INDICATES NUMBER OF CURRENT CARRYING CONDUCTORS IF MORE THAN TWO ARE REQUIRED. LONGER MARK INDICATES NEUTRAL. GROUNDWIRE IS ALWAYS INSTALLED AND NEVER INDICATED. NO CROSSHATCHING INDICATES 1 HOT, 1 NEUTRAL AND 1 GROUND, ALL #12 THHN.
	DUPLEX RECEPTACLE MTD 18" A.F.F. TO CENTER. "C" INDICATES MTD 6" ABOVE COUNTER TOP. "GFI" INDICATES GROUND FAULT INTERRUPTING TYPE, "F" INDICATES FLOOR MOUNTED. "IG" INDICATES ISOLATED GROUND TYPE, "EWC" INDICATES ELECTRIC WATER COOLER.
	SAME AS ABOVE EXCEPT QUADRUPLEX
XX–XXR	SPECIAL PURPOSE OUTLET WITH NEMA CONFIGURATION TO MATCH EQUIPMENT
S_T	SINGLE POLE MOTOR RATED SWITCH W/ OVERLOAD HEATER (MANUAL MOTOR STARTER).
30/20/3/DE/1	FUSED DISCONNECT SWITCH WITH RATINGS NEMA RATING. "WP" INDICATES RAINTIGHT INDICATES DUAL ELEMENT FUSES NUMBER OF POLES FUSE SIZE. "NF" INDICATES NON FUSED SWITCH SIZE
30/20/3/DE/1	FUSED STARTER\DISCONNECT SWITCH WITH RATINGS NEMA RATING. "WP" INDICATES RAINTIGHT INDICATES DUAL ELEMENT FUSES NUMBER OF POLES FUSE SIZE. "NF" INDICATES NON FUSED SWITCH SIZE
	MAGNETIC MOTOR STARTER
	MOTOR
M	UTILITY COMPANY ELECTRIC METER, OR AS NOTED
	ELECTRIC PANEL, SURFACE MOUNTED
	ELECTRIC PANEL, FLUSH MOUNTED
T	TRANSFORMER
T	THERMOSTAT, MOUNTED 60" A.F.F.
	WIRING RUN TURNING UP
	WIRING RUN TURNING DOWN
	TEL/DATA OUTLET, PROVIDE A 4" SQUARE BOX WITH A SINGLE DEVICE RAISED COVER OPENING, MOUNTED 18" A.F.F. TO CENTER. "W" INDICATES 54" A.F.F., "P" INDICATES 47" A.F.F., "F" INDICATES FLOOR MOUNTED, "C" INDICATES MOUNTED 6" ABOVE COUNTER TOP. ALSO PROVIDE BLANK PLATE
	TELEPHONE OUTLET, PROVIDE A 4" SQUARE BOX WITH A SINGLE DEVICE RAISED COVER OPENING, MOUNTED 18" A.F.F. TO CENTER. "W" INDICATES 54" A.F.F., "P" INDICATES 47" A.F.F., "F" INDICATES FLOOR MOUNTED, "C" INDICATES MOUNTED 6" ABOVE COUNTER TOP. ALSO PROVIDE BLANK PLATE
	SAME AS ◀ EXCEPT FOR DATA CABLES

ABBREVIATIONS

A	AMPS
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHJ	AUTHORITY HAVING JURISDICTION
ATS	AUTOMATIC TRANSFER SWITCH
BFG	BELOW FINISHED GRADE
BOF	BOTTOM OF FIXTURE
C	CONDUIT
CAT	CATALOG
CB	CIRCUIT BREAKER
CBA	COLOR BY ARCHITECT
CD	CANDELA
CU	COPPER
DN	DOWN
DWG	DRAWING
ECPS	EMPTY CONDUIT W/ PULL STRING
EG	EQUIPMENT GROUND
EWC	ELECTRIC WATER COOLER
EX	EXISTING
FA	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FLA	FULL LOAD AMPS
G	GROUND
GFI	GROUND FAULT CIRCUIT INTERRUPTER
HOA	HAND–OFF–AUTOMATIC SWITCH
HP	HORSEPOWER
HVAC	HEATING, VENTILATING, AND AIR CONDITIONING
IG	ISOLATED GROUND
kW	KILOWATT
MTD	MOUNTED
N	NEUTRAL
NA	NOT APPLICABLE
NEC	NATIONAL ELECTRICAL CODE
NF	NOT FUSIBLE
NG	NATIONAL GRID (ELECTRIC UTILITY)
NIC	NOT IN CONTRACT
NL	NIGHT LIGHT
NTS	NOT TO SCALE
P	POLE
PH	PHASE
REC(S)	RECEPTACLE(S)
TEL	TELEPHONE
TTB	TELEPHONE TERMINAL BOARD
TYP	TYPICAL
UG	UNDERGROUND
UL	UNDERWRITERS LABORATORIES
UNO	UNLESS NOTED OTHERWISE
UTP	UNSHIELDED TWISTED PAIR
V	VOLT
VFD	VARIABLE FREQUENCY DRIVE
W	WATT
W/	WITH
WP	WEATHERPROOF
XFMR	TRANSFORMER

NOTES

1. DISCONNECT, REMOVE, AND MAKE SAFE ALL CONDUIT AND WIRING NOT IN SERVICE.
2. VERIFY ALL EQUIPMENT NAMEPLATE LOADS AND INSURE PROPER SIZING OF CONDUCTORS AND OVERCURRENT PROTECTION. NOTIFY ENGINEER OF DISCREPANCIES.
3. USE #10 CONDUCTORS FOR ALL HOMERUNS OVER 100 FEET IN LENGTH.
4. BALANCE THE PHASES IN EACH ELECTRICAL PANEL.
5. CONFIRM EXISTING CONDITIONS. NOTIFY ARCHITECT OF DISCREPANCIES.

GENERAL NOTES

1. LOCATIONS SHOWN FOR CONNECTIONS TO EQUIPMENT ARE DIAGRAMMATIC. INSTALL FOR EASE OF MAINTENANCE, TO SUIT EQUIPMENT, AND PER CODE.
2. PROVIDE ALL REQUIRED PULL BOXES, JUNCTION BOXES, AND DISCONNECT SWITCHES.
3. DO NOT INSTALL BOXES BACK TO BACK.
4. COLOR CODE ALL WIRING.
5. PROVIDE CONDUIT SLEEVES AS REQUIRED. THROUGH FIRE RATED SEPARATIONS, FIRE SEAL AFTER WIRING IS COMPLETE.
6. SUPPORT EACH LIGHTING FIXTURE INDEPENDENTLY OF THE CEILING SYSTEM AND COORDINATE LOCATIONS WITH OTHER TRADES TO AVOID CONFLICT.
7. PROVIDE A NYLON PULL CORD IN ALL EMPTY CONDUITS.
8. MAINTAIN CORRECT PHASE SEQUENCE OF ALL FEEDERS AND CIRCUITS BY ESTABLISHING PHASE IDENTIFICATION AND MAINTAINING CORRECT RELATIONSHIP THROUGHOUT THE SYSTEM. PROVIDE LINE BALANCE WITHIN 10% OF NORMAL LOADS.
9. THE LOCATIONS OF HVAC EQUIPMENT SHOWN ON THESE DRAWINGS ARE APPROXIMATE. FOR EXACT LOCATIONS REFER TO HVAC DRAWINGS AND SHOP DRAWINGS.
10. OBTAIN ALL NECESSARY PERMITS AND CERTIFICATES. PRESENT SATISFACTORY PROOF OF FINAL INSPECTION AND APPROVAL BY AUTHORITIES HAVING JURISDICTION.
11. PROVIDE ALL GROUNDING INCLUDING GREEN EQUIPMENT GROUND IN ALL RACEWAYS.
12. CIRCUIT NUMBERS INDICATE PANEL AND CIRCUIT BREAKER FOR EQUIPMENT CONNECTIONS. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO INSTALL ALL REQUIRED WIRING PER NATIONAL ELECTRIC CODE AND PROJECT SPECIFICATIONS TO PROPERLY ENERGIZE THE ELECTRICAL SYSTEM. ALL WIRING SHALL BE RUN IN A NEAT AND ORDERLY MANNER.
13. ALL CONDUIT AND CABLES SHALL BE RUN PARALLEL OR PERPENDICULAR TO WALLS. DO NOT RUN CABLES DIAGONALLY THROUGH ANY SPACE.
14. WHERE THE NUMBER OF CURRENT CARRYING CONDUCTORS IN A RACEWAY OR CABLE EXCEEDS THREE, THE ALLOWABLE AMPACITY SHALL BE REDUCED PER NATIONAL ELECTRIC CODE TABLE BASED ON NO DIVERSITY. CONSIDER NEUTRALS TO BE CURRENT CARRYING CONDUCTORS.
15. DO NOT COMBINE CIRCUITS OR USE COMMON NEUTRALS.
16. LABEL ("BROTHER P–TOUCH LABELING SYSTEM" OR APPROVED EQUAL) OR ENGRAVE EACH RECEPTACLE PLATE WITH PANEL DESIGNATION AND CIRCUIT NUMBER.
17. CONTRACTOR SHALL VISIT THE SITE AND FAMILIARIZE HIMSELF WITH THE EXISTING CONDITIONS. NO CLAIM FOR EXTRA COMPENSATION SHALL BE ENTERTAINED FOR WORK WHICH A PRELIMINARY EXAMINATION WOULD HAVE REVEALED. THE SUBMISSION OF A BID WILL BE CONSIDERED AS ACKNOWLEDGMENT ON THE PART OF THE BIDDER OF HIS VISITATION TO THE SITE.

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ZAMBARANO HOSPITAL
ELEVATOR REPLACEMENT
BURRILLVILLE, RI

ISSUED FOR CONSTRUCTION

ELECTRICAL SYMBOL LEGEND and NOTES

E001

PANEL: DPE2 — 100 A 208Y/120 V 3PH 4W 60HZ

10,000 AIC
CIRCUITS: 30
BUS RATING:

MAIN LUG ONLY: X
MAIN CIRCUIT BREAKER:
SURFACE MOUNTED: X
FLUSH MOUNTED:
FLOOR MOUNTED:

NOTE	DESCRIPTION
A	AFCI
G	GFCI - 5mA TRIP
P	GFPE - 30 mA TRIP
S	SHUNT TRIP
L	LOCK ON
IG	ISOLATED GROUND
C	VIA LIGHTING CONTROL PANEL

SHUNT TRIP MAIN:
200% RATED NEUTRAL:
ISOLATED GROUND:
FEED THRU LUGS:
100% RATED MAIN BREAKER:
GROUND FAULT MAIN C.B.:

CKT No.	Load Type	LOAD DESCRIPTION	Note	WIRE SIZE	LOAD kVA	CIRCUIT BREAKER 20/1	CIRCUIT BREAKER 40/2	CKT No.	Load Type	LOAD DESCRIPTION	Note	WIRE SIZE	LOAD kVA	CIRCUIT BREAKER 20/1	CIRCUIT BREAKER 40/2
1	M	CU-1.1		8	5.4	1		2		SPARE				1	
3	M	"		8	0			4		SPARE				1	
5	M	CU-2.1		8	5.4	1		6		SPARE				1	
7	M	"		8	0			8		SPARE				1	
9	M	CU-3.1		8	5.4	1		10		SPARE				1	
11	M	"		8	0			12		SPARE				1	
13	R	COMPUTER RECEPTACLE NORTH		12	0.5	1		14		SPARE				1	
15	R	COMPUTER RECEPTACLE CENTER		12	0.5	1		16		SPACE					
17	R	COMPUTER RECEPTACLE SOUTH		12	0.5	1		18		SPACE					
19		SPARE				1		20		SPACE					
21		SPARE				1		22		SPACE					
23		SPARE				1		24		SPACE					
25		SPARE				1		26		SPACE					
27		SPARE				1		28		SPACE					
29		SPARE				1		30		SPACE					
31								32							
33								34							
35								36							
37								38							
39								40							
41								42							

Connected Load 17.7 KVA

R	Receptacle Load	1.5 KVA	Noncontinuous	1.5 KVA
L	Lighting Load	0.0 KVA	Continuous	0.0 KVA
M	Mechanical and Power Load	16.2 KVA	Noncontinuous	16.2 KVA
			TOTAL LOAD	**17.7 KVA**

CIRCUIT BREAKER SIZE	20/1	40/2	0	0	0	0	0	0
CIRCUIT BREAKER COUNT	16	3	0	0	0	0	0	0

AMPERAGE: 49 AMP

PANEL: 24 — 100 A 208Y/120 V 3PH 4W 60HZ

10,000 AIC
CIRCUITS: 42
BUS RATING:

MAIN LUG ONLY: X
MAIN CIRCUIT BREAKER:
SURFACE MOUNTED: X
FLUSH MOUNTED:
FLOOR MOUNTED:

NOTE	DESCRIPTION
A	AFCI
G	GFCI - 5mA TRIP
P	GFPE - 30 mA TRIP
S	SHUNT TRIP
L	LOCK ON
IG	ISOLATED GROUND
C	VIA LIGHTING CONTROL PANEL

SHUNT TRIP MAIN:
200% RATED NEUTRAL:
ISOLATED GROUND:
FEED THRU LUGS:
100% RATED MAIN BREAKER:
GROUND FAULT MAIN C.B.:

CKT No.	Load Type	LOAD DESCRIPTION	Note	WIRE SIZE	LOAD kVA	CIRCUIT BREAKER 20/1	CIRCUIT BREAKER 40/2	CKT No.	Load Type	LOAD DESCRIPTION	Note	WIRE SIZE	LOAD kVA	CIRCUIT BREAKER 20/1	CIRCUIT BREAKER 40/2
1	L	N. ELEVATOR MACH. RM. LIGHT		12	0.1	1		2	R	OUTDOOR REC.		10	0.54	1	
3	R	N. ELEVATOR MACH. RM. REC.		12	0.18	1		4		SPARE				1	
5	L	N. ELEVATOR PIT LIGHT		12	0.1	1		6		SPARE				1	
7	R	N. ELEVATOR PIT REC.		12	0.18	1		8		SPARE				1	
9	L	C. ELEVATOR MACH. RM. LIGHT		12	0.1	1		10		SPARE				1	
11	R	C. ELEVATOR MACH. RM. REC.		12	0.18	1		12		SPARE				1	
13	L	C. ELEVATOR PIT LIGHT		12	0.1	1		14		SPARE				1	
15	R	C. ELEVATOR PIT REC.		12	0.18	1		16		SPARE				1	
17	L	S. ELEVATOR MACH. RM. LIGHT		12	0.1	1		18		SPARE				1	
19	R	S. ELEVATOR MACH. RM. REC.		12	0.18	1		20		SPARE				1	
21	L	S. ELEVATOR PIT LIGHT		12	0.1	1		22		SPARE				1	
23	R	S. ELEVATOR PIT REC.		12	0.18	1		24		SPARE				1	
25		SPARE				1		26		SPACE					
27		SPARE				1		28		SPACE					
29		SPARE				1		30		SPACE					
31		SPARE				1		32		SPACE					
33		SPARE				1		34		SPACE					
35		SPARE				1		36		SPACE					
37		SPARE				1		38		SPACE					
39		SPARE				1		40		SPACE					
41		SPARE				1		42		SPACE					

Connected Load 2.2 KVA

R	Receptacle Load	1.6 KVA	Noncontinuous	1.6 KVA
L	Lighting Load	0.6 KVA	Continuous	0.8 KVA
M	Mechanical and Power Load	0.0 KVA	Noncontinuous	0.0 KVA
			TOTAL LOAD	**2.4 KVA**

CIRCUIT BREAKER SIZE	20/1	40/2	0	0	0	0	0	0
CIRCUIT BREAKER COUNT	33	0	0	0	0	0	0	0

AMPERAGE: 7 AMP

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER	MOUNTING	LAMPS WATTS	LAMPS TYPE	REMARKS
A	LUMAX LIGHTING VTMXLED-45L-5K-48-9 W/ WIRE GUARD	SURFACE	48	LED	REQUEST WIRE GUARD
B	INDATECH LIGHTING VCL-W-TG	WALL	20	LED	

LIGHTING FIXTURE SCHEDULE NOTES:

1. PROVIDE ALL LAMPS FOR ALL LIGHTING FIXTURES. LAMP COLOR SHALL BE 3500K.
2. PROVIDE UNISTRUT WHERE NEEDED TO MOUNT LIGHTING FIXTURE.

FEEDERS TO NEW PANELS

MECH (ID#)	DESCRIPTION	EQUIPMENT CHARACTERISTICS VOLTS	PH	AMPS	HP	kW	MCA	MOCP	CFM	PANEL	CIRCUIT	BREAKER SIZE	FEEDER AND CONDUIT	EQUIPMENT LOCATION	DISCONNECT SWITCH SIZE	FUSE	POLES	NEMA		NOTES
a	NEW PANEL "24"	208	3	100	–	–	–	–	–	9	24	100	4#1+1#8G IN 1.5"C		NA	NA	NA	NA		1,2
b	NEW PANEL DPE2	208	3	100	–	–	–	–	–	DPE	14,16,18	100	4#1+1#8G IN 1.5"C		NA	NA	NA	NA		1,2

NOTES:
1. SEE PANEL SCHEDULE.
2. USE EXISTING CIRCUIT BREAKER.

ELECTRICAL CONNECTION SCHEDULE FOR MECHANICAL EQUIPMENT- ON LIFE SAFETY TRANSFER SWITCH

MECH (ID#)	DESCRIPTION	EQUIPMENT CHARACTERISTICS VOLTS	PH	AMPS	HP	kW	MCA	MOCP	CFM	PANEL	CIRCUIT	BREAKER SIZE	FEEDER AND CONDUIT	EQUIPMENT LOCATION	DISCONNECT SWITCH SIZE	FUSE	POLES	NEMA	MOTOR CONTROL	NOTES
A	N CAB POWER (SHEET NOTE B)	120	1	6	–	–	–	–	–	DPEC	14	20	2#12+1#12G IN 1/2"C		NA	NA	NA	NA		1,2
B	C CAB POWER (SHEET NOTE B)	120	1	6	–	–	–	–	–	DPEC	16	20	2#12+1#12G IN 1/2"C		NA	NA	NA	NA		1,2
C	S CAB POWER (SHEET NOTE B)	120	1	6	–	–	–	–	–	DPEC	18	20	2#12+1#12G IN 1/2"C		NA	NA	NA	NA		1,2
D	N SECURITY (SHEET NOTE C)	120	1	4	–	–	–	–	–	DPEC	20	20	2#12+1#12G IN 1/2"C		NA	NA	NA	NA		1,3
E	C SECURITY (SHEET NOTE C)	120	1	4	–	–	–	–	–	DPEC	22	20	2#12+1#12G IN 1/2"C		NA	NA	NA	NA		1,3
F	S SECURITY (SHEET NOTE C)	120	1	4	–	–	–	–	–	DPEC	24	20	2#12+1#12G IN 1/2"C		NA	NA	NA	NA		1,3

NOTES:
1. PROVIDE NEW SQUARE D CIRCUIT BREAKER.
2. PROVIDE A MANUAL MOTOR STARTER, WITH OVERLOAD ELEMENT.
3. PROVIDE RECEPTACLE.

ELECTRICAL CONNECTION SCHEDULE FOR MECHANICAL EQUIPMENT- ON EQUIPMENT BRANCH (OPTIONAL STANDBY) TRANSFER SWITCH

MECH (ID#)	DESCRIPTION	EQUIPMENT CHARACTERISTICS VOLTS	PH	AMPS	HP	kW	MCA	MOCP	CFM	PANEL	CIRCUIT	BREAKER SIZE	FEEDER AND CONDUIT	EQUIPMENT LOCATION	DISCONNECT SWITCH SIZE	FUSE	POLES	NEMA	MOTOR CONTROL	NOTES
1	ELEVATOR NORTH	208	3	75	25	–	–	–	–	DPE	1,3,5	100	4#1+1#8 IN 1.5"C	–	100	100	3	1		2
2	ELEVATOR CENTER	208	3	75	25	–	–	–	–	DPE	25,27,29	100	4#1+1#8 IN 1.5"C	–	100	100	3	1		3
3	NORTH ELEVATOR	208	3	75	25	–	–	–	–	DPE	2,4,6	100	4#1+1#8 IN 1.5"C	–	100	100	3	1		2
4A	CU-1.1	208	1	–	–	5.4	11	28	–	DPE2	1,3	40	3#8+1#10G IN 3/4"C	NORTH	60	35	2	3R		
4B	AC-1.1	208	1	0.33		–	1	–	335	–	–	–	5#14+1#14G IN 1/2"C	NORTH	NA	NA	NA	NA		1
5A	CU-2.1	208	1	–	–	5.4	11	28	–	DPE2	5,7	40	3#8+1#10G IN 3/4"C	CENTER	60	35	2	3R		
5B	AC-2.1	208	1	0.33		–	1	–	335	–	–	–	5#14+1#14G IN 1/2"C	CENTER	NA	NA	NA	NA		1
6A	CU-3.1	208	1	–	–	5.4	11	28	–	DPE2	9,11	40	3#8+1#10G IN 3/4"C	SOUTH	60	35	2	3R		
6B	AC-3.1	208	1	0.33		–	1	–	335	–	–	–	5#14+1#14G IN 1/2"C	SOUTH	NA	NA	NA	NA		1
7	COMPUTER RECEPTACLE N	120	1	3	–	–	–	–	–	DPE2	13	20	2#12+1#12G IN 1/2"C	NORTH	NA	NA	NA	NA		
8	COMPUTER RECEPTACLE C	120	1	3	–	–	–	–	–	DPE2	15	20	2#12+1#12G IN 1/2"C	CENTER	NA	NA	NA	NA		
9	COMPUTER RECEPTACLE S	120	1	3	–	–	–	–	–	DPE2	17	20	2#12+1#12G IN 1/2"C	SOUTH	NA	NA	NA	NA		

NOTES:
1. PROVIDE PIN & SOCKET CONNECTOR (TYCO 770275 SERIES PLUG & RECEPTACLE) FOR MANUAL DISCONNECTING MEANS. THIS UNIT IS POWERED BY THE OUTDOOR UNIT.
2. PROVIDE NEW SQUARE D CIRCUIT BREAKER.
3. USE EXISTING CIRCUIT BREAKER.

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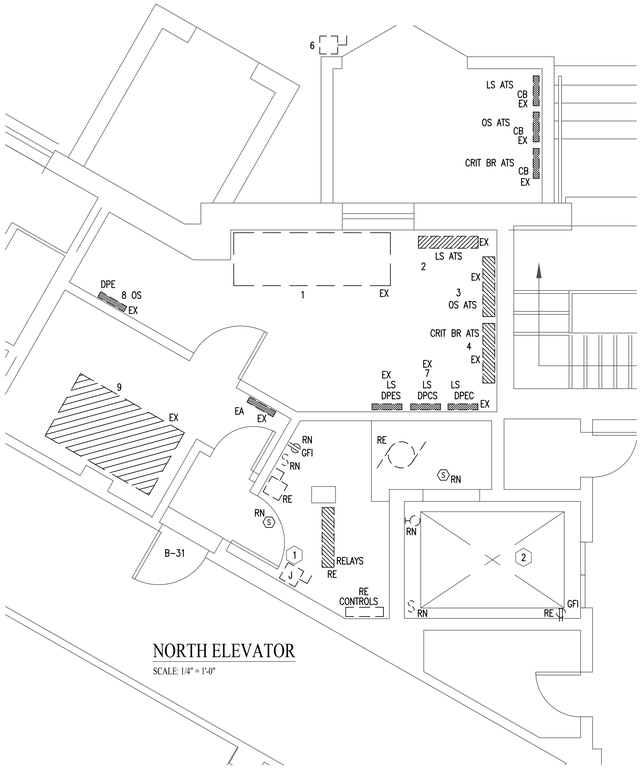
ELEVATOR REPLACEMENT
BURRILLVILLE, RI

ISSUED FOR CONSTRUCTION

PANEL, CONNECTION, and LIGHTING FIXTURE SCHEDULES

E002



NORTH ELEVATOR

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

ELECTRICAL DEMOLITION ABBREVIATIONS:

EX EXISTING TO REMAIN.

ERC EXISTING TO REMAIN. CONNECT TO NEW SWITCH.

RE REMOVE EXISTING.

RB EXISTING TO BE REMOVED. PROVIDE NEW BLANK PLATE.

RL RELOCATE EXISTING. EXTEND BRANCH CIRCUIT AS NEEDED.

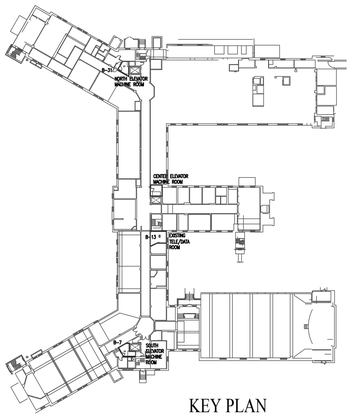
RN EXISTING TO BE REMOVED AND REPLACED WITH NEW.

RR REMOVE AND REINSTALLED ON NEW SURFACE.

NR EXISTING DEVICE AT NEW LOCATION.

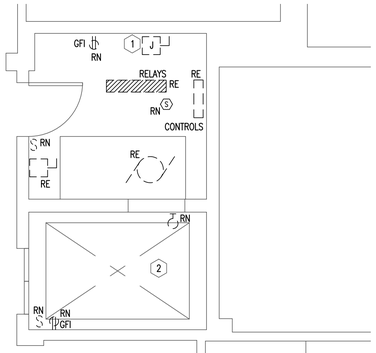
SHEET NOTES:

1. FORMER DISCONNECT SWITCH, NOW A JUNCTION BOX: DISCONNECT AND REMOVE FEEDER BACK TO SOURCE. REMOVE WIRING TO DISCONNECT SWITCH, CONTROLS, MOTOR, ETC.
2. REPLACE FIRE ALARM SYSTEM DETECTOR AT TOP OF SHAFT. MATCH EXISTING.



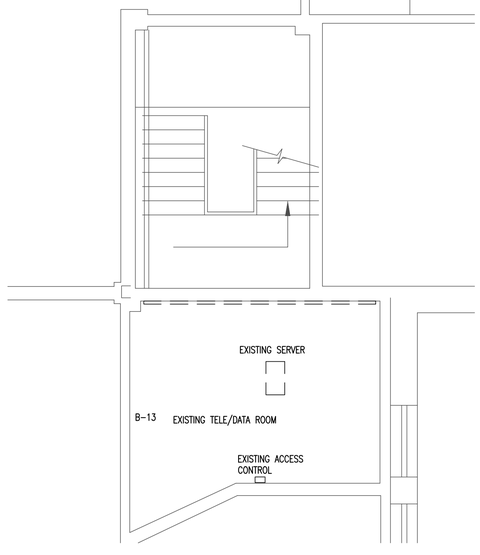
KEY PLAN

SCALE: 1/64" = 1'-0"



CENTER ELEVATOR

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



SOUTH ELEVATOR

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

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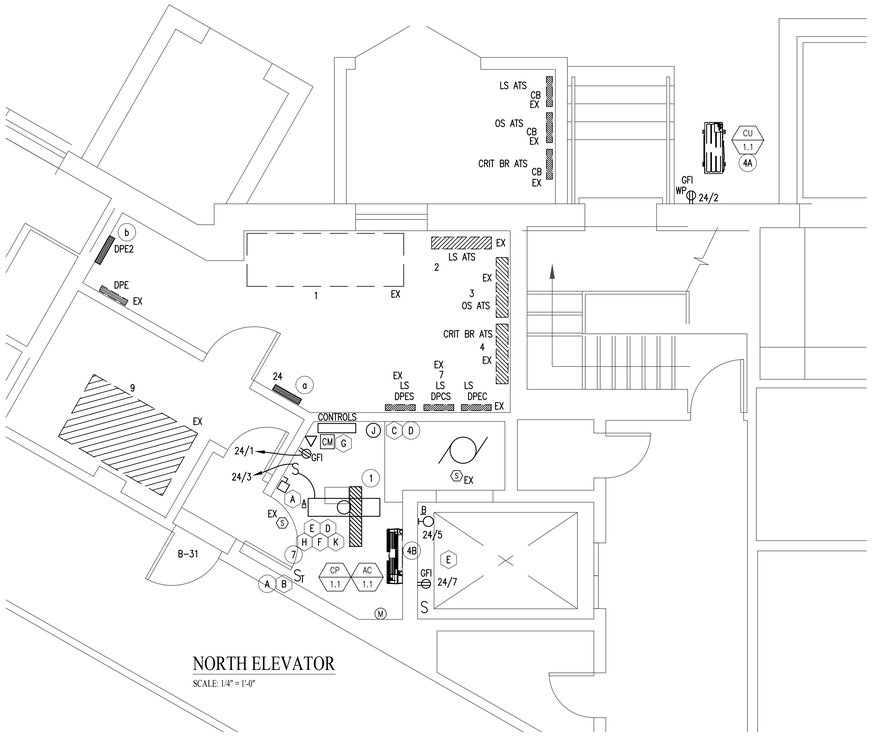
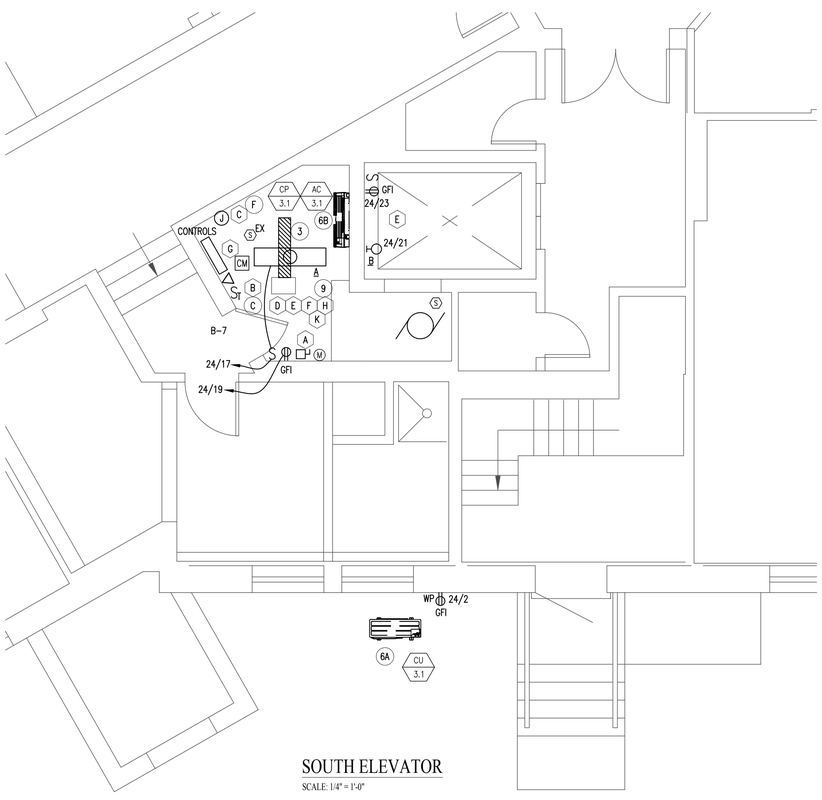
DEMOLITION: FLOOR PLANS

E101



NORTH ELEVATOR

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



SOUTH ELEVATOR

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

NOTE:
INDICATES MECHANICAL EQUIPMENT TAG. SEE MECHANICAL CONNECTION SCHEDULE ON X-XXX FOR DETAILS.

SHEET NOTES:

A. PROVIDE A NEW HEAVY DUTY DISCONNECT SWITCH WITH AUXILLIARY CONTACTS AS NEEDED, AND A NEW FEEDER BACK TO PANEL DPE. EXTEND WIRING TO ELEVATOR CONTROLS AND MOTOR.

B. PROVIDE A DEDICATED BRANCH CIRCUIT AND A 15 AMP MANUAL MOTOR STARTER WITH OVERLOAD ELEMENT THAT CAN BE LOCKED IN THE OFF POSITION (FOR THE CAB).

C. PROVIDE A TERMINAL CABINET AND CONDUIT PER VENDOR FOR SECURITY WIRING AND VIDEO WIRING. SEE SPECIFICATIONS SECTION 142123 2.4/M/9.

D. COORDINATE NEW CONDUIT, WIRING, AND JUNCTION BOX TO CONNECT NEW CAB TELEPHONE LINE TO EXISTING TELEPHONE POTS LINE.

E. REPLACE EXISTING SWITCH, LIGHTING FIXTURE, AND GFI RECEPTACLE AT EXISTING LOCATIONS. PROVIDE TWO NEW BRANCH CIRCUITS, ONE FOR THE LIGHT AND ONE FOR THE RECEPTACLE.

F. PROVIDE CONDUIT AND WIRE FROM THE NEW GENERATOR CONTROL PANEL (OR ATS) TO ELEVATOR MACHINE ROOM WITH RELAYS AND DRY CONTACTS TO SIGNAL EMERGENCY POWER PRE-TRANSFER, EMERGENCY POWER ON, NORMAL POWER PRE-TRANSFER, ETC. COORDINATE REQUIREMENTS WITH THE ELEVATOR VENDOR.

G. PROVIDE ADDITIONAL FIRE ALARM SYSTEM CONTROL MODULE(S) FOR BYPASS OF SECURITY CONTROLS AND AS NEEDED FOR OTHER FUNCTIONS.

H. PROVIDE A DUPLEX RECEPTACLE POWERED FROM THE EQUIPMENT BRANCH ATS AT THE LOCATION OF THE ELEVATOR CONTROL LAPTOP COMPUTER.

K. PROVIDE ONE CAT6 CABLE IN 1/2" CONDUIT FROM THE SECURITY SERVER ON THE RACK IN ROOM B-13 TO THIS ROOM; COORDINATE LOCATION WITH ELEVATOR VENDOR. TERMINATE AND TEST CABLE.

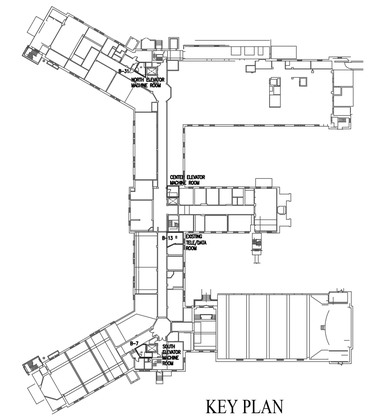
L. PROVIDE ONE 22/6 OAS (SHIELDED) CABLE WITH ONE 18/4 CABLE IN 1/2" CONDUIT FROM THE ACCESS CONTROL PANEL IN ROOM B-13 TO THIS ROOM; COORDINATE LOCATION WITH ELEVATOR VENDOR. TEST CABLE. TERMINATIONS ARE BY OTHERS.

GENERAL NOTES:

1. OBSERVE ALL ELEMENTS OF 2014 NEC 70, ARTICLE 620, INCLUDING LOCKABLE HEAVY DUTY DISCONNECT SWITCH WITH AUXILIARY CONTACTS.
2. COMPLY WITH ALL REQUIREMENTS IN SPECIFICATION SECTION 142123, ELECTRIC TRACTION PASSENGER ELEVATORS.

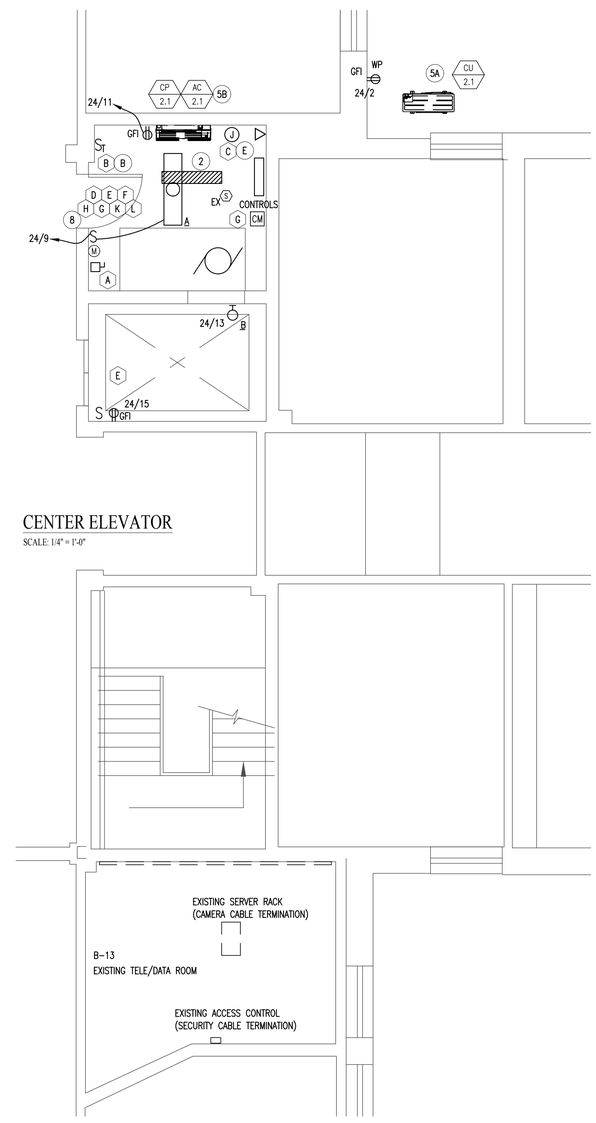
SECURITY AND ACCESS CONTROL NOTES:

PROVIDE SECURITY AND ACCESS CONTROL CONDUIT AND WIRING AS NOTED. HOWEVER, THE SECURITY CONTRACTOR, HARDWARE, AND PROGRAMMING ARE PART OF A SEPARATELY CONTRACTED SCOPE/PURCHASE ORDER WITH THE STATE. PROVIDE COORDINATION.



KEY PLAN

SCALE: 1/64" = 1'-0"



CENTER ELEVATOR

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

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BURRILLVILLE, RI

ISSUED FOR CONSTRUCTION

NEW WORK: FLOOR PLANS

E201

SPECIFICATIONS

SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS
PART 1 - GENERAL
1.1 SUMMARY
A. This Section includes the following:
1. Work that applies to all sections of DIVISION 16
2. Supporting devices for electrical components
3. Removals (demolition) and relocations
1.2 RELATED DOCUMENTS
A. The General Conditions, Supplementary Conditions, and applicable portions of Division 1 of the specification are part of this section which shall consist of all labor, equipment, materials and other costs necessary to complete all BASIC ELECTRICAL MATERIALS AND METHODS work indicated on the drawings, herein specified or both.
1.3 DEFINITIONS
A. Provide: Furnish and install.
B. Wiring: Wire, raceways, boxes, fittings, anchors, etc.
1.4 SUBMITTALS
A. Product Data: For each product indicated
B. Shop Drawings: Wiring and connection diagrams
C. Manufacturers: Where the drawings or specifications list specific brands or catalog numbers, only these products may be used unless the words: "or approved equal" or "but are not limited to" are included.
D. Limitations of approval: The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Engineer's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Engineer in writing of such deviation, in a separate cover letter on Contractor's letterhead, at the time of submittal and the Engineer has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Engineer's approval thereof.
E. Contractor's responsibility: It is the responsibility of the Contractor to check all dimensions and details on shop drawings, before submission to the Engineer, reject same if necessary and only forward to the Engineer shop drawings which he is reasonably certain fulfill the requirements of the contract documents and the work. The approval of shop drawings by the Engineer shall be general only in character and not mean dimensions on drawings have been checked, and will in no way relieve the Contractor of the responsibility for proper fitting and construction of the work, nor from the necessity of furnishing materials or doing the work required by the drawings and/or specifications, which may not be indicated on the shop drawings when approved. All shop drawings shall be checked by the Contractor, and must bear the Contractor's stamp of approval; drawings submitted without this stamp of approval will not be considered.
F. Samples: Provide all samples requested by the Engineer.
G. Tests: Test the complete installation to prove it free from shorts, grounds, opens and faulty connections. Make any corrections necessary before acceptance.
1. Test each function of each system including each device.
H. Certification: Upon request, provide "Certification" (by a recognized testing agency or a Professional Engineer registered in the state where the project is located) that submitted items of equipment are suitable for their intended use.
I. Record of Addenda and Change Orders: To avoid overlooking addenda and change order modifications, mark all changes on all copies of drawings and specifications, in a manor acceptable to the Engineer. One method of accomplishing this is to make copies and tape them on the back of the preceding page (tape all edges). Also, circle the changed area and note: see addenda #1, etc. If whole pages or sheets change, either remove the superseded document or put a bold **"X"** through it.
J. Record Drawings: Owner's record drawings shall be updated as the project progresses. Maintain documents in a safe, dry location. Indicate clearly and accurately any changes necessitated by field conditions and dimension all raceways built into or under concrete slabs or buried under ground. Contractor to prepare as-built drawings in CAD format at contractor's expense. Contract drawings in CAD format to be furnished to contractor at no cost to contractor. Contractor to provide two compact discs and two hard copies of final as-built drawings.
K. Operating Instructions and Manuals: Provide the Owner or his representative with complete operating instructions by qualified personnel of all electrical systems. Provide three (3) bound sets (indexed and bound in three sturdy three-ring binders) of operating and maintenance instructions of all electrical systems employed and all shop drawings.
L. Manuals: Provide one (1) extra bound set of all shop drawings. Bind in a sturdy 3-ring binder.
M. Letter of Confirmation: Include in the above manuals a letter confirming that the following items have been completed. Provide written receipt signed by the Owner or his representative indicating that the first 4 items listed below have been received.
1. Keys have been provided for all locked electrical equipment.
2. The provisions of the "Operating Instructions and Manuals" paragraph of these specifications have been met.
3. Spare fuses have been provided.
4. Identification is complete and in accordance with these specifications.
5. As-built electrical drawings have been completed and submitted.
6. All tests are complete and in accordance with these specifications.
7. All required shop drawings have been submitted and approved.
8. The entire installation has been accepted by all authorities.
1.5 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Do all wiring and provide all equipment in accordance with the prevailing issue of the National Electrical Code, State Building Code, State Fire Code, OSHA and any additional local rules or requirements.
C. Obtain and pay for all necessary permits, certificates, etc. Present satisfactory proof of final inspection and approval by all inspection authorities.
D. Consider the following Industry Standards as minimum requirements for all materials, equipment and systems where such standards are established for materials in question:
1. National Board of Fire Underwriters
2. National Electrical Manufacturers Association
3. National Fire Protection Association
4. Institute of Electrical and Electronic Engineers
5. A nationally recognized testing laboratory (UL, ETL, etc.)
6. Factory Mutual
7. Americans with Disabilities Act
E. Where applicable, this installation shall comply with the following NECA (National Electrical Contractors Association) "National Electrical Installation Standards." Except, if there is a conflict between this specification and these standards, the requirements of this specification shall prevail.
1. NECA 1-2000 Standard Practices for Good Workmanship in Electrical Contracting
2. NECA 101-2001 Standard for Installing Steel Conduit (Rigid, EMT)
F. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work.
G. Coordinate electrical service connections to components furnished by utility companies.
1.6 SCHEDULING AND SHUTDOWNS:
A. All work must be scheduled to allow the least interference with the normal operation of the existing facility. Schedule must be arranged to meet the approval of the Owner. All shutdowns of services (power, etc.) must be approved in writing by the Owner.
1.7 CHANGE ORDERS/PROPOSAL REQUESTS:
A. During the course of construction, changes in the work may occur. When a significant change is to be made, a Proposal Request will be issued.
B. Provide a complete cost breakdown when responding to each Proposal Request.
C. Price each item of work separately.
D. Break down each line item, including quantities and list labor and material separately.
E. Both credits and extras shall be separately and clearly quantified.
F. Allowances for overhead and profit shall be as listed in the supplementary conditions.
G. If you become aware of a field condition, code requirement, error, or omission that you feel should result in a change to the work, please contact the Engineer for discussion. The Engineer may be able to clarify the situation and avoid unnecessary paperwork.
H. It is recognized that the Owner benefits when the construction process is a cooperative effort instead of an adversarial relationship. Reasonable give-and-take allows the construction process to move smoothly. Your efforts in this regard will be appreciated by all parties.
1.8 INSPECTIONS/SITE OBSERVATIONS
A. The authority having jurisdiction (usually the Municipal Electrical Inspector) shall be notified at periodic intervals that an inspection is requested. Inspections shall be requested at points of progress, meeting the approval of the inspector and as a minimum include the following:
1. Prior to installation of panel/switchgear trims/covers.
2. For observation of connections and grounding.
B. Do not cover the work before the Engineer has had a chance to observe it in completed form. The electrical foreman shall request a meeting with the Engineer within 10 days after the start of electrical construction to assure that there is agreement on the scope of work and to answer questions.
C. The electrical foreman shall provide assistance to the Engineer during site observations:
1. Describe the progress of the electrical work in detail.
2. Accompany the Engineer on his tour of the site, upon request.
3. Provide use of a suitable ladder, scaffolding, or bucket truck to observe the work, upon request.
4. Remove panel trims, junction box covers, etc. for observation of the work, upon request.
5. Provide use of project drawings, specifications and shop drawings.
1.9 GUARANTEES/WARRANTIES:
A. See other portions of the Project Manual for details on Guarantees and Warranties. However, minimum shall be one year from date of acceptance by the Engineer.
B. The Owner reserves the right to make appropriate modifications or extensions of systems and equipment furnished under this contract during the guarantee/warranty period without "voiding" or modifying the guarantee/warranty of equipment and wiring installed under this contract. If manufacturer voids guarantee, it shall not relieve this contractor of his responsibilities for guarantee/warranty period.
1.10 MISCELLANEOUS
A. Provide all systems complete. Drawings and Specifications form complementary requirements; provide work specified and not shown, and work shown and not specified as though explicitly required by both.
B. Although work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices and materials obviously necessary for a sound, secure and complete installation.
C. De-energize circuit before beginning work.
PART 2 - PRODUCTS
2.1 MATERIALS - General:
A. All materials and equipment shall be new unless specifically stated otherwise.
B. Materials and equipment shall be suitable for their intended use and for the environment in which they are installed. For example, equipment located outside shall be weatherproof and constructed of materials that will not rust. This includes brackets, screws, etc.
C. Coordinate all dimensions to make sure that boxes, raceways, equipment, fixtures, etc., fit properly in the finished construction. If special provisions, such as shallow boxes, are required, they shall be provided at no increase in contract price, regardless of catalog numbers listed in contract documents or on shop drawings.
D. As it is not practical to enumerate in these specifications (or show on the drawings) all details of fittings and accessory equipment required for proper operation of the various electrical systems herein described, it is understood that they will be supplied without extra compensation. Provide all fittings, terminations, relays, components of panels and equipment, etc., needed for the best performance possible at the present state-of-the-art.
2.2 SUPPORTING DEVICES
A. Material: Cold-formed steel, with corrosion-resistant coating.
B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
C. Slotted-Steel Channel: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs. Strength rating to suit structural loading.
D. Slotted Channel Fittings and Accessories: Recommended by the manufacturer for use with the type and size of channel with which used.
1. Materials: Same as channels and angles, except metal items may be stainless steel.
E. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
F. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
G. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
H. Expansion Anchors: Carbon-steel wedge or sleeve type.
I. Toggle Bolts: All-steel springhead type.
PART 3 - EXECUTION
3.1 ELECTRICAL EQUIPMENT INSTALLATION
A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom.
B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
D. Right of Way: Give to raceways and piping systems installed at a required slope.
3.2 LAYOUTS
A. The electrical system layouts indicated are generally diagrammatic and locations of outlets and equipment are approximate only; govern exact routing of wiring and locations of outlets and equipment by structural conditions and obstructions. This is not to be construed to permit redesigning systems. Interconnect as shown.
B. Locate all equipment requiring maintenance and operation so that it will be readily accessible. The right is reserved to make any reasonable change in location of outlets and equipment prior to roughing-in without involving additional expense. This may involve slightly longer wiring runs, longer stems, additional mounting provisions, etc. Allow for this in your bid because additional compensation will not be provided. Items not specifically located on the plans shall (for the purposes of bidding) be assumed to be in the farthest, most difficult location. Exact location to be as directed in the field.
3.3 ELECTRICAL SUPPORTING DEVICE APPLICATION
A. Damp Locations and Outdoors: Hot-dip galvanized materials, slotted channel system components.
B. Dry Locations: Steel materials.
C. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four with, 200-lb (90-kg) minimum per attachment.
3.4 SUPPORT INSTALLATION
A. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
B. Size supports for multiple raceway or cable runs so capacity can be increased by a 25 percent minimum in the future.
C. Support individual horizontal single raceways with separate, malleable-iron pipe hangers or clamps except use spring-steel fasteners for 1-1/2-inch (38-mm) and smaller single raceways above suspended ceilings and for fastening raceways to slotted channel and angle supports.
D. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
E. Secure electrical items and their supports to building structure, using the following methods unless other fastening methods are indicated:
1. Wood: Wood screws or screw-type nails.
2. Gypsum Board: Toggle bolts. Seal around sleeves with joint compound, both sides of wall.
3. Masonry: Toggle bolts on hollow block and expansion bolts on solid block. Seal around sleeves with mortar, both sides of wall.
4. New Concrete: Concrete inserts with machine screws and bolts.
5. Existing Concrete: Expansion bolts.
6. Structural Steel: Welded threaded studs or Spring-tension clamps.
a. Comply with AWS D1.1 for field welding.
7. Fasteners for Damp, Wet, or Weather-Exposed Locations: Stainless steel.
8. Light Steel: Sheet-metal screws.
9. Fasteners: Select so load applied to each fastener does not exceed 25 percent of its proof-test load.
10. Light Steel Framing: sheet metal screws.
3.5 SEQUENCE AND BALANCE:
A. Maintain correct phase sequence of all feeders and circuits by establishing phase identification and maintaining correct relationship throughout the system. Provide line balance within 10% of normal loads.
3.6 FIRESTOPPING
A. Apply firestopping to cable and raceway sleeves and other penetrations of fire-rated floor and wall assemblies to restore original undisturbed fire-resistance ratings of assemblies.
B. Penetrations through exterior surfaces shall be made watertight.
C. Floor boxes, fed from floor below, shall be fire-rated, poke-through type with UL labeled fire rating to match floor rating.
3.7 WORK INTERFERING WITH EXISTING WIRING:
A. Make any necessary re-circuiting, extensions of existing circuits and relocations required to properly re-energize remaining existing devices or equipment that may be interfered with by new construction or removals.
3.8 REMOVALS (DEMOLITION) AND RELOCATIONS:
A. Coordinate with DIVISION 1 section "Selective Demolition."
B. Do all removal work in a neat and orderly manner so as not to endanger lives nor cause damage. Removal work to include all associated hangers, couplings, supports, raceway and wiring, etc., and shall be complete in every way.
C. Remove and dispose of, off-site in a legal manner, all raceways and wire indicated to be removed.
D. Carefully remove and store on-site, where directed by the Owner, all electrical equipment indicated to be REMOVED. After the Owner has examined this equipment, remove and dispose of, off-site in a legal manner, all of this equipment that the Owner does not want. All remaining equipment shall remain the property of the Owner. Relocate the remaining equipment to a permanent storage location on site where directed by the Owner.
E. The electrical removal (demolition) drawings show the general extent of removals. However it is impractical to show every item; some of which may be concealed. Therefore, assume that you will be required to perform an additional 10% of removal work, without additional compensation. Items not shown to be removed or to remain shall remain or be removed, as directed.
F. Prior to removing any electrical equipment, properly de-energize all associated wiring. Remove wires from terminals of supply switches or circuit breakers. Properly tape supply and load end conductors of all wiring remaining and not re-used. Properly tag both ends.
G. Provide outlet boxes, knock-out seals, receptacle cover plates, etc. to leave remaining installation in finished condition.
H. Take special care in removing equipment indicated to be RELOCATED and properly and thoroughly clean and lubricate this equipment. Renew fuses and overload elements in starters and switches being relocated, if required to properly serve the new installation.
I. Adjust outlet and junction boxes as required to suit new finished surfaces.
J. When necessary to perform your work, carefully remove ceiling tiles and properly re-install them. Make sure that hands are clean and take special care to avoid damage. If tiles become damaged, provide new tiles to exactly match existing. If exiting tiles have yellowed with age, it may be necessary to relocate existing undamaged tiles from utility spaces (closets, etc.) and install new tiles in their place.
K. For relocation of lighting fixtures, see sections entitled "Interior Lighting" and "Exterior Lighting."
L. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
M. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
N. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches (50 mm) below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
O. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.
3.9 CUTTING AND PATCHING
A. This trade (specification section) is responsible for its respective cutting and patching.
B. Do not endanger any work by cutting or altering work or any part of it.
C. Do not cut or alter work of another Contractor without written consent of the Engineer.
D. Prior to cutting which affects structural safety of project, or work of another Contractor, submit written notice to the Engineer, requesting consent to proceed with cutting.
E. Perform all work of fitting, adjustment, cutting, patching, finishing and restoration to perfectly match the quality as specified throughout these specifications.
3.10 CORE DRILLING:
A. All holes through masonry surfaces must be "core drilled". This trade (specification section) is responsible for its respective core drilling, if any.
B. Do not endanger any work by drilling or altering work or any part of it.
C. Do not drill or alter work of another Contractor without written consent of the Engineer.
D. Prior to drilling which affects structural safety of project, or work of another Contractor, submit written notice to the Engineer, requesting consent to proceed with cutting.
E. Perform all work of core drilling to perfectly match the quality as specified throughout these specifications.
3.11 CLEANING, PAINTING AND REFINISHING:
A. Paint all new plywood backboards on all sides and edges before mounting.
B. Thoroughly clean all new electrical equipment, devices and enclosures upon completion of all work.
C. Refinish any new electrical equipment whose finish is damaged or rusted, as determined by the Engineer.

END OF SECTION 16050

SECTION 16075 - IDENTIFICATION FOR ELECTRICAL SYSTEMS
PART 1 - GENERAL
1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
1.2 SUMMARY
A. Section Includes:
1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.
1.3 SUBMITTALS
A. Product Data: For each type of electrical identification product installed.
B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.
1.4 QUALITY ASSURANCE
A. Comply with ANSI A13.1.
B. Comply with NFPA 70.
C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
D. Comply with ANSI Z535.4 for safety signs and labels.
E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
1.5 COORDINATION
A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
C. Coordinate installation of identifying devices with location of access panels and doors.
D. Install identifying devices before installing acoustical ceilings and similar concealment.
PART 2 - PRODUCTS
2.1 POWER RACEWAY IDENTIFICATION MATERIALS
A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
B. Colors for Raceways Carrying Circuits at 600 V or Less:
1. Black letters on a yellow field.
2. Legend: Indicate voltage.
C. Colors for Raceways Carrying Circuits at More Than 600 V:
1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm) high letters on 20-inch (500-mm) centers.
D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action, and angle supports.
F. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers diagonally over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stop stripes at legends.
2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS
A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
B. Colors for Raceways Carrying Circuits at 600 V and Less:
1. Black letters on a yellow field.
2. Legend: Indicate voltage.
C. Colors for Raceways Carrying Circuits at More Than 600 V:
1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm) high letters on 20-inch (500-mm) centers.
D. Indoor: Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
E. Outdoor: Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.
2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS
A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
2.6 WARNING LABELS AND SIGNS
A. Comply with NFPA 70 and 29 CFR 1910.145, Chapter XVII. Colors, legend, and size appropriate to each application.
1. Interior Units: Aluminum, baked-enamel-finish, punched or drilled for mechanical fasteners.
2. Exterior Units: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate with 0.0396-inch (1-mm), galvanized-steel backing. 1/4-inch (6-mm) grommets in corners for mounting.
B. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.
C. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
D. Metal-Backed, Butyrate Warning Signs:
1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).
E. Warning label and sign shall include, but are not limited to, the following legends:
1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
2.7 INSTRUCTION SIGNS
A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
1. Engraved legend with white letters on black face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
2.8 EQUIPMENT IDENTIFICATION LABELS
A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.
B. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch (1.6-mm) minimum thickness for signs up to 20 sq. in. (129 sq. cm) and 1/8-inch (3.2-mm) minimum thickness for larger sizes. Engraved legend in black letters on white background, unless otherwise indicated. Minimum letter height shall be 3/8 inch (10 mm).
C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).
2.9 CABLE TIES
A. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.
2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS
A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.
PART 3 - EXECUTION
3.1 INSTALLATION
A. Verify identity of each item before installing identification products.
B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
C. Apply identification devices to surfaces that require finish after completing finish work.
D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.
I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
J. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.
3.2 IDENTIFICATION SCHEDULE
A. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Self-adhesive vinyl labels. Install labels at [10-foot (3-m)] [30-foot (10-m)] maximum intervals.
B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A, and 120V to ground: Identify with self-adhesive vinyl label. Install labels at 10-foot (3-m) maximum intervals.
C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
1. Power.
2. Telephone.
3. Cable.
4. Spare.
D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
E. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.
F. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
G. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box.
H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
J. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
K. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels and outdoor: metal-backed, butyrate warning signs.
1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
L. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
M. At each pull box, junction box and outlet box, each circuit contained therein shall be identified by panel designation and circuit number. This shall be accomplished by attaching hand written cardboard labels with string to each set of wires or by other agreed upon methods. In addition, where boxes are concealed, covers shall be marked with the same information using magic marker or other agreed upon means.
N. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
a. Indoor Equipment: Adhesive film label with clear protective overlay. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
2. Equipment To Be Labeled:
a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Information shall include circuit numbers, type of load served and location of load served. For example: #1 Receptacles in rooms 5 & 6. Panelboard identification shall be engraved, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Switchgear.
e. Switchboards.
f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
g. Enclosed switches.
h. Enclosed circuit breakers.

END OF SECTION 16075

SECTION 16120 - CONDUCTORS AND CABLES
PART 1 - GENERAL
1.1 SUMMARY
A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.
1.2 RELATED DOCUMENTS:
A. The General Conditions, Supplementary Conditions, and applicable portions of Division 1 of the specification are part of this section which shall consist of all labor, equipment, materials and other costs necessary to complete all CONDUCTORS AND CABLES work indicated on the drawings, herein specified or both.
B. The applicable portions of section 16050 BASIC ELECTRICAL MATERIALS AND METHODS are hereby make a part of this section. It is important that you read that section carefully because it expands upon the requirements herein.
1.3 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.
PART 2 - PRODUCTS
2.1 MANUFACTURERS
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2.2 CONDUCTORS AND CABLES
A. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
B. Conductor Material: Copper complying with NEMA WC 5 solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
C. Conductor Insulation Types: Type THHN-THWN or XHHW complying with NEMA WC 5.
D. Multiconductor Cable: Metal-clad cable, Type MC.
2.3 CONNECTORS AND SPLICES
A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
B. Plug-in type connectors are not allowed.

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BURRILLVILLE, RI

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ELECTRICAL SPECIFICATIONS
SHEET 1

E301

CONTINUED FROM SHEET 1

PART 3 - EXECUTION
3.1 CONDUCTOR AND INSULATION APPLICATIONS
A. Service Entrance: Type THHN-THWN, single conductors in raceway, or XHHW, single conductors in raceway.
B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
C. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspaces: Type THHN-THWN, single conductors in raceway.
D. Branch Circuits Exposed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
E. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway.
F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.
G. Fire Alarm Circuits: see FIRE ALARM SECTION.
3.2 INSTALLATION
A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
D. Install cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
E. Support cables according to Division 16 Section "Basic Electrical Materials and Methods."
F. Seal around cables penetrating fire-rated elements according to Division 7 Section "Through-Penetration Firestop Systems."
G. Identify and color-code conductors and cables according to Division 16 Section "Basic Electrical Materials and Methods."
H. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.
I. Where the number of current-carrying conductors in a raceway or cable exceeds three, the allowable ampacity shall be reduced per NEC table, based on no diversity. Consider neutrals to be current carrying conductors.
J. When branch circuits are combined using a common neutral, oversize the neutral to accommodate possible harmonic currents. On 20 amp (#12) branch circuits, use a #10 neutral.
3.3 CONNECTIONS
A. Make all final connections required for a complete and fully operational facility.
B. Wiring connections to equipment shall include connections to all accessories. For example, if a fan has an associated damper, the wiring must be extended from the fan to the damper at no additional charge. Another example is interconnection of equipment. Some items of equipment consist of several pieces, which must be interconnected before connecting to the circuit. No additional compensation will be paid for interconnections.
C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486 B.
D. Avoid splices and taps, where feasible. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
E. Locations of junction boxes, stub-ups and disconnects are diagrammatic. At the time of design, the exact brand of equipment is usually not known. Therefore, the exact locations of connections are not known. For the purposes of bidding assume the worst, farthest locations. During construction, coordinate connections with final approved shop drawings and coordinate with other trades. Conform to manufactures written installation instructions. Provide working space in compliance with code.
3.4 FIELD QUALITY CONTROL
A. All cables installed under this contract are shall protected from damage prior to installation, during installation and after installation. Store cable in a dry area protected from physical damage. Before installing cable, raceway shall clear, dry and free from burs or sharp edges. When cables pass through metal partitions provide permanently installed insulating bushings. This applies to all cables installed under this contract (systems, communications, etc.). Insulated bushings are shall installed prior to pulling in of cable. Cables shall be installed back from edge of studs as required by Code.

END OF SECTION 16120

SECTION 16123 - WIRE CONNECTIONS AND DEVICES

PART 1 GENERAL
1.01 WORK INCLUDED
A. Provide proper connections and termination at all points requiring same.
1.02 RELATED REQUIREMENTS
A. Specification Section:
1. 16050 - Basic Materials and Methods
2. 16120 - Wire and Cable
1.03 SHOP DRAWINGS AND PRODUCT DATA
A. Submit in accordance with Section 01300.
PART 2 PRODUCTS
2.01 MATERIALS
A. Wire nuts shall be Ideal Industries "Wing-Nut" Series 451 through 454 or Buchanan "W-Cap"
B. Insulated spade terminals shall be Ideal Industries Series SN16X or SN12X, T & B Series RB14 or RC10
C. Electrical Tape shall be Scotch No. 33+ and Plymouth No. 4453. Color Coding Tape shall be Scotch No. 35 or Plymouth No. 37.
D. Cables Ties shall be Ideal Industries Series 41-609 through 41-669 or T & B Series TY-523MX through TY0529MX
E. Mechanical lugs for connection of service conductors to the pad mounted transformer shall be NEMA 4-hole spade type bronze connectors equal to Greaves, Inc. type JJA or JJAR series connectors with silicon bronze ½" machine bolts, silicon bronze flat washers, silicon bronze lockwashers, and silicon bronze nuts. Bolted connections shall be torqued to 480 in-lbs.
F. Conductive anti-seize compound shall be "Kopr-Shield" as manufactured by T & B.
G. Caulking and sealing compound for conduits and ducts shall be of putty-like consistency workable with the hand at temperatures as low as 35 degrees F., shall not slump at a temperature of 300 degrees F., and shall not harden materially when exposed to air. The compound shall readily caulk and adhere to clean surfaces of fiber conduit, concrete, masonry, lead, rubber, poly-chloroprene, poly-vinylchloride and the common metals. The compound shall form a seal with the above mentioned materials without dissolving, noticeable changing characteristics or removing any of the ingredients.
H. Insulating compounds, unless indicated or specified otherwise, for cable joints, boxes, terminals and other similar items shall have a bituminous base and shall be free form granular constituents, creosote, alkali, acid, sulfur and water. The compound shall adhere closely to concrete, porcelain and metal surfaces, shall not check or crack after solidifying; and shall remain in permanent contact with all parts. The compound shall contain no ingredients injurious to the cable insulation covering or jackets. Compound shall have the electrical and physical characteristics necessary for the condition under which it is to be used in accordance with the recommendations of the manufacturer of the equipment.
PART 3 INSTALLATION
3.01 GENERAL
A. Splices, taps and terminations in conductors No. 6AWG and larger shall be made with UL listed mechanical lugs. Connectors and lugs shall be installed with the proper torque. Insulate splices and taps with equal insulation thickness and temperature rating as conductors spliced. Heat shrink insulating tubing of equal insulating value as that of the conductor may be utilized.
B. Joints between conductors No. 14AWG through No. 8AWG at fixtures, devices and junction points shall be made with insulated spring type wire nuts of the wing-nut design.
C. Conductive anti-seize compound shall be used on all fused ferrules and blades, switch wiping contacts, ground connections, and all copper to copper lugs and connections.

END OF SECTION 16123

SECTION 16130 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
PART 1 - GENERAL
1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
1.2 SUMMARY
A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
1.3 DEFINITIONS
A. EMT: Electrical metallic tubing.
B. ENT: Electrical nonmetallic tubing.
C. EPDM: Ethylene-propylene-diene terpolymer rubber.
D. FMC: Flexible metal conduit.
E. IMC: Intermediate metal conduit.
F. LFMC: Liquidtight flexible metal conduit.
G. LFNC: Liquidtight flexible nonmetallic conduit.
H. NBR: Acrylonitrile-butadiene rubber.
I. RNC: Rigid nonmetallic conduit.
J. RGS: Rigid galvanized steel conduit.
1.4 SUBMITTALS
A. Product Data: For surface raceways, wireways, fittings, floor boxes, hinged-cover enclosures, and cabinets.
B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
1. Custom enclosures and cabinets.
2. For handholes and boxes for underground wiring, including the following:
a. Duct entry provisions, including locations and duct sizes.
b. Frame and cover design.
c. Grounding details.
d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
C. Samples for Verification: For each type of exposed finish required for wireways and surface raceways, prepared on Samples of size indicated below.
1. Size: 24"x13".
D. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
1. Underground electrical conduit.
2. Water, sewer, and drain pipes.
E. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."
F. Source quality-control test reports.
1.5 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.
PART 2 - PRODUCTS
2.1 METAL CONDUIT AND TUBING
Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.
10. Equal approved by Engineer.
B. Rigid Steel Conduit: ANSI C80.1.
C. Aluminum Rigid Conduit: ANSI C80.5.
D. IMC: ANSI C80.6.
E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.
F. EMT: ANSI C80.3.
G. FMC: Zinc-coated steel.
H. LFMC: Flexible steel conduit with PVC jacket.
I. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel, set-screw type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
J. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.
2.2 METAL WIREWAYS
A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.
4. Equal approved by Engineer.
C. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, 12, or 3R, as indicated or required by environmental conditions.
D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
E. Wireway Covers: Hinged type, screw-cover type, or flanged-and-gasketed type, as indicated.
F. Finish: Manufacturer's standard enamel finish.
2.3 SURFACE RACEWAYS
A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Thomas & Betts Corporation.
b. Walker Systems, Inc.; Wiremold Company (The).
c. Wiremold Company (The); Electrical Sales Division.
d. Equal approved by Engineer.
2.4 BOXES, ENCLOSURES, AND CABINETS
A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
14. Equal approved by Engineer.
B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
D. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.
F. Cabinets:
1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
2.5 SLEEVES FOR RACEWAYS
A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.
D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section on penetration firestopping.

PART 3 - EXECUTION
3.1 RACEWAY APPLICATION
A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
1. Exposed Conduit: Rigid steel conduit.
2. Concealed Conduit, Aboveground: EMT.
3. Underground Conduit, over 600 volts: RNC, Type EPC-80-PVC, direct buried.
4. Underground Conduit, under 600 volts: RNC, Type EPC-40-PVC, direct buried.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): In dry conditions, use FMC. Use LFMC in damp, wet, or dirty conditions.
6. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R or 4, as indicated.
7. Application of Handholes and Boxes for Underground Wiring:
a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.
B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
a. Loading dock.
b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
c. Mechanical rooms.
d. Per drawings.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp, wet, or dirty locations.
5. Damp or Wet Locations: Rigid steel conduit.
6. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
7. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
8. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
C. Minimum Raceway Size: 1/2-inch (16-mm) trade size.
D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
E. Do not install aluminum conduits in contact with concrete.
3.2 INSTALLATION
A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
B. Keep raceways at least 12 inches (300 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
C. Complete raceway installation before starting conductor installation.
D. Support raceways as specified in "Hangers and Supports for Electrical Systems."
E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors of all sizes.
J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.
K. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
1. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated or heated spaces.
2. Where otherwise required by NFPA 70.
M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).
1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
d. Attics: 135 deg F (75 deg C) temperature change.
2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
N. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject.
O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
P. Set metal floor boxes level and flush with finished floor surface.
Q. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
3.5 PROTECTION
A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.
END OF SECTION 16130

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ELECTRICAL SPECIFICATIONS
SHEET 2

E302

CONTINUED FROM SHEET 2

SECTION 16410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).

1.3 DEFINITIONS

A. NC: Normally closed.
B. NO: Normally open.
C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Field quality-control reports.
1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Manufacturer's field service report.

G. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended application.

E. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

B. Interruption of Existing Electric Service: Coordinate with Owner.

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.
5. Equal approved by Engineer.

B. Type GD, General Duty: not allowed.

C. Type HD, Heavy Duty, Single Throw, 240 or 600-V AC, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Six Pole, Single Throw, 240 or 600-V AC, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Double Throw, 240 or 600-V AC, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F. Fusible switches, 800 amps and above: NEMA bolted pressure contact switches made by firmly bolting the switchblades to the stationary contact terminals and to the hinge terminals and meet UL 977.

G. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Compression type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.
9. Accessory Control Power Voltage: Remote mounted and powered; **[24-V ac]** **[120-V ac]**

H. All fusible switches: shall be rated for the application voltage specified and have a UL listed short circuit rating to match the fuse installed.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.
5. Equal approved by Engineer.

B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Six Pole, Single Throw, 240 or 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Type HD, Heavy Duty, Double Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F. Accessories:
1. Same as Fusible Switches/Accessories.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.
5. Equal approved by Engineer.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

E. Electronic Trip Circuit Breakers: Where indicated or required, 100% rated, with RMS sensing, field-replaceable rating plug, trip indication (showing which adjustment caused trip), with interrupting capacity to meet available fault current, and with the following field-adjustable settings:
1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I2t response.

F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

G. Switching Duty: All single pole circuit breakers shall be rated SWD.

H. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits; Type HACR for heating, air-conditioning, and refrigerating equipment..
4. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
5. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Anchor floor-mounting switches to concrete base.

C. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Install fuses in fusible devices.

F. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

G. Most manufactures of bolted pressure switches make for line entering top and load exiting bottom. Verify shop drawings before running conduits.

H. Do not mount switches or circuit breakers upside down or side ways.

I. Aluminum Cable Connections: If aluminum wire is permitted, section "Conductors and Cables", circumferential compression type lugs are required for all terminations on aluminum wire. Where screw type lugs are used, it will be necessary to convert from aluminum to copper wiring before connection. This can be done by use of T & B or similar cast, compression connectors. Adequate wiring space must be provided for connectors, if used.

3.3 IDENTIFICATION

A. Comply with requirements in Section "Identification for Electrical Systems."
1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:
1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.
3. Inspect mechanical and electrical connections.
4. Verify switch and relay type and labeling verification.
5. Verify rating of installed fuses.

E. Tests and Inspections:
1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

C. Thermal-magnetic circuit breakers:
1. Test circuit and correct deficiencies
2. Set magnetic trip at minimum.
3. Turn associated loads "on".
4. Turn breaker on/off a minimum of six (6) times.
5. If nuisance tripping occurs, set "up" one notch and repeat test.
6. Repeat steps 4 and 5 until nuisance tripping no longer occurs.

D. Electronic trip-unit circuit breakers:
1. Test circuit and correct deficiencies.
2. Set "long time pickup" at 1.0 (Do not change)
3. Set other adjustments at minimum.
4. Turn associated loads "on".
5. Turn breaker on/off a minimum of six (6) times.
6. If nuisance tripping occurs, adjust setting that caused trip "up" one notch and repeat test.
7. Repeat steps 5 and 6 until nuisance tripping no longer occurs.

END OF SECTION 16410

SECTION 16416 PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 RELATED DOCUMENTS.

A. The General Conditions, Supplementary Conditions, and applicable portions of Division 1 of the specification are part of this section which shall consist of all labor, equipment, materials and other costs necessary to complete all PANELBOARDS work indicated on the drawings, herein specified or both.

B. The applicable portions of section BASIC ELECTRICAL MATERIALS AND METHODS are hereby make a part of this section.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
a. Enclosure types and details for types other than NEMA 250, Type 1.
b. Bus configuration, current, and voltage ratings.
c. Short-circuit current rating of panelboards and overcurrent protective devices.
d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
2. Wiring Diagrams: Power, signal, and control wiring.
3. Field quality-control test reports.
4. Operation and maintenance data.

C. When used as "Service Entrance Equipment", it is the Contractor's responsibility to submit all shop drawings to the local power company and electrical inspector and obtain their approval (including main circuit breakers characteristics) prior to fabrication.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
a. Square D.
b. Eaton Corporation; Cutler-Hammer Products.
c. General Electric Co.; Electrical Distribution & Protection Div.
d. Siemens Energy & Automation, Inc.

2.2 MANUFACTURED UNITS

A. Enclosures: NEMA PB 1, Type 1.
1. Rated for environmental conditions at installed location.
a. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
b. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
c. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.
2. Door-In-Trim: Provide with piano hinge on left side of trim, so that trim (and door) can be swung open for easy access to wiring terminals (rather than removed).
3. Equip door with spring latch and tumbler-lock with all locks keyed alike.

B. Phase and Ground Buses: Copper.

C. Conductor Connectors: Suitable for use with conductor material.

D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect breakers.

E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

F. Panelboard Short-Circuit Rating:
1. Fully rated to interrupt symmetrical short-circuit current available at terminals.
2. Unless otherwise indicated, a "series-combination system" of interrupting capacity rating shall <u>not</u> be used.

G. Service Entrance Equipment: When used as service entrance equipment, so rate.

H. Provide typed circuit directory card mounted in frame with clear plastic covering.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Bolt-on full size circuit breakers, replaceable without disturbing adjacent units.

B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike. See 2.2A2

C. Circuit Breaker Locks: Provide thirty (30).

2.4 OVERCURRENT PROTECTIVE DEVICES

A. Provide circuit breakers, per Section 262816 "Enclosed switches and circuit breakers".

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Comply with mounting and anchoring requirements specified in Division 16 Section "Seismic Controls for Electrical Work."

C. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
1. Set field-adjustable and circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

G. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section "Basic Electrical Materials and Methods".

H. Panelboard Nameplates: Label each panelboard with engraved laminated-plastic nameplate mounted with corrosion-resistant screws.

I. Ground equipment according to Section "Grounding, Bonding and Surge Protection Devices."

J. Connect wiring according to Section "Conductors and Cables."

K. Re-Torque: Once in final location, carefully re-torque all connections with a torque wrench, to match manufacturers recommendations. If equipment is dismantled, it must be re-inspected and re-certified by a nationally recognized testing laboratory, acceptable to the Engineer and the Authority Having Jurisdiction.

L. Aluminum Cable Connections: If aluminum wire is permitted in Division 16, section "Conductors and Cables", circumferential compression type lugs are required for all terminations on aluminum wire. Where screw type lugs are used, it will be necessary to convert from aluminum to copper wiring before connection. This can be done by use of T & B or similar cast, compression connectors. Adequate wiring space must be provided for connectors, if used.

3.2 CIRCUIT BREAKER ADJUSTMENTS

A. Adjust as described in Section "Enclosed Switches and Circuit Breakers".

3.3 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:
1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Perform the following inspections:
1. Perform each visual and mechanical inspection stated in NETA ATS, section 7.6.

C. Perform the following field tests and inspections and prepare test reports:
1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION

SECTION 16450 - GROUNDING AND BONDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding electrodes and conductors.
B. Equipment grounding conductors.
C. Bonding.

1.2 RELATED SECTIONS

A. Section 02781 - Site Grounding Systems.
B. Section 03200 - Concrete Reinforcement.
C. Section 03300 - Cast-In-Place Concrete.

1.3 REFERENCES

A. Section 01400 - Quality Control:] [01090 - Reference Standards: Requirements for references and standards.

B. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).

C. NFPA 70 - National Electrical Code.

1.4 GROUNDING SYSTEM DESCRIPTION

A. Metal underground water pipe.
B. Concrete-encased electrode.
C. Metal underground gas piping system.
D. Rod electrode.

1.5 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 25 ohms.

1.6 SUBMITTALS FOR REVIEW

A. Section 01300 - Submittals: Procedures for submittals.
B. Product Data: Provide for grounding electrodes and connections.

1.7 SUBMITTALS FOR INFORMATION

A. Section 01300 - Submittals: Submittals for information.
B. Test Reports: Indicate overall resistance to ground.

1.8 SUBMITTALS FOR CLOSEOUT

A. Section 01700 - Contract Closeout: Procedures for submittals.
B. Project Record Documents: Record actual locations of components and grounding electrodes.
C. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum years experience.

1.10 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

A. Material: Copper-clad steel.
B. Diameter: 1/2 inch (13 mm).
C. Length: 8 feet (2400 mm).

2.2 WIRE

A. Material: Stranded copper.
B. Foundation Electrodes: 2/0 AWG.
C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01039 - Coordination and Meetings: Verification of existing conditions prior to beginning work.
B. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

A. Section 01400 - Quality Control: Manufacturer's instructions.
B. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.
C. Provide grounding electrode conductor and connect to reinforcing steel. Bond steel together.
D. Provide bonding to meet Regulatory Requirements.
E. Bond together metal siding not attached to grounded structure; bond to ground.
F. Bond together reinforcing steel and metal accessories in pool and fountain structures.
G. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
H. Interface with site grounding system installed.
I. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.
B. Perform inspections and tests listed in NETA ATS, Section 7.13.

END OF SECTION 16450

END OF ELECTRICAL SPECIFICATIONS

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ELECTRICAL SPECIFICATIONS
SHEET 3

E303