

**ISSUED FOR:** DATE: PROJECT NO.: **BIDS AND CONSTRUCTION** JULY 26, 2023 232003

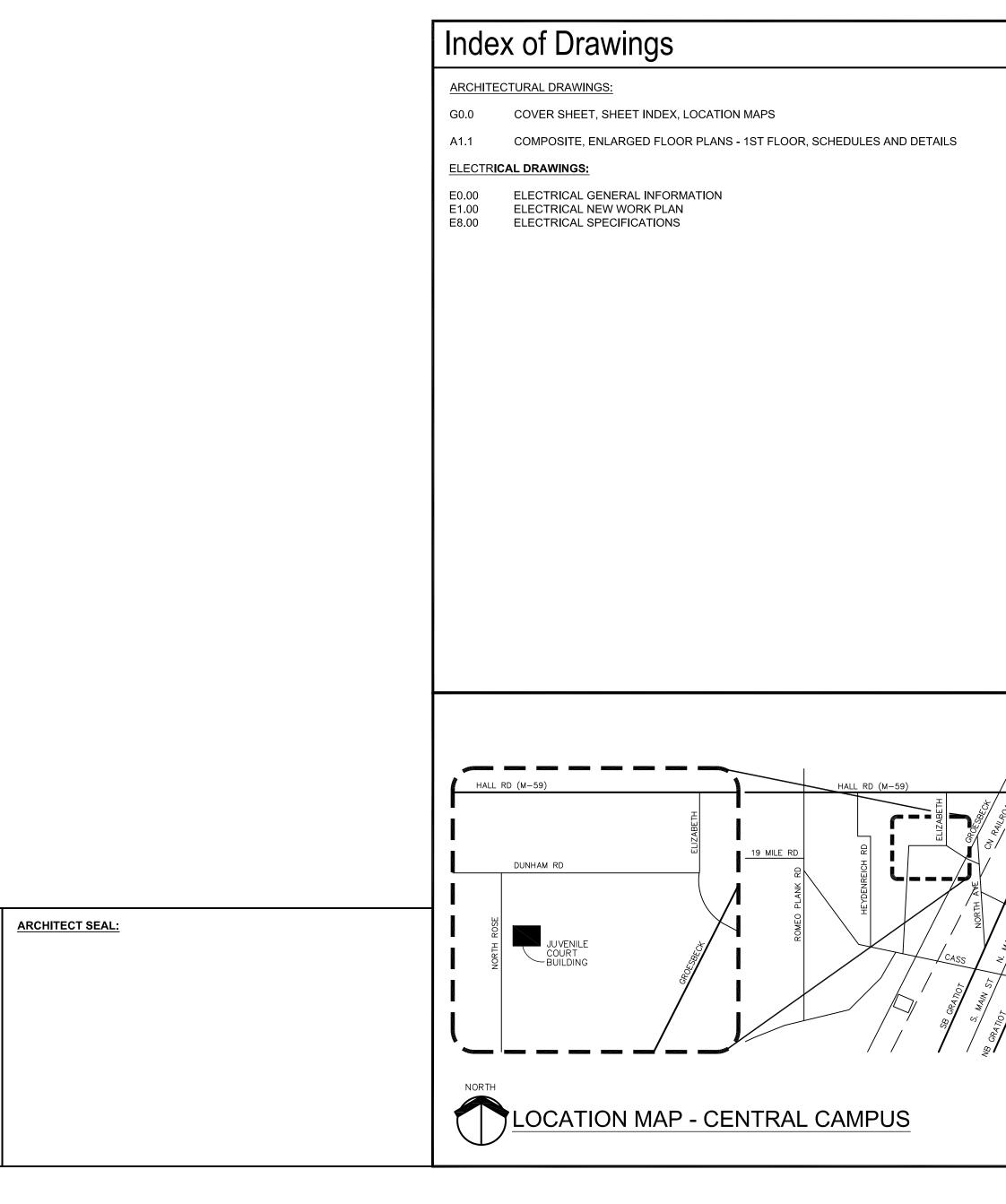
# **ARCHITECT:**

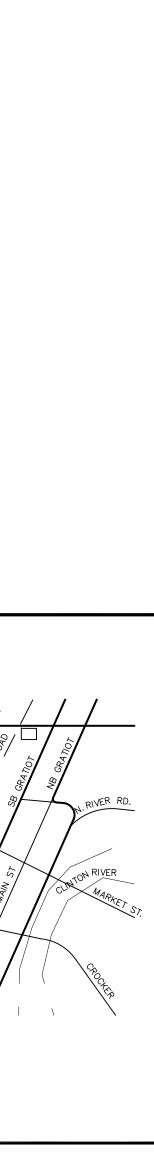
MECHANICAL/ELECTRICAL ENGINEER: VIFIED BUILDING SYSTEMS ENGINEERING, LLC 75 N. MAIN ST. SUITE 221, MT. CLEMENS, MI 48043, 248.804.1741

# MACOMB COUNTY JUVENILE JUSTICE CENTER J.J. UNIT SEPARATION DOOR JUVENILE COURT, MT. CLEMENS, MI

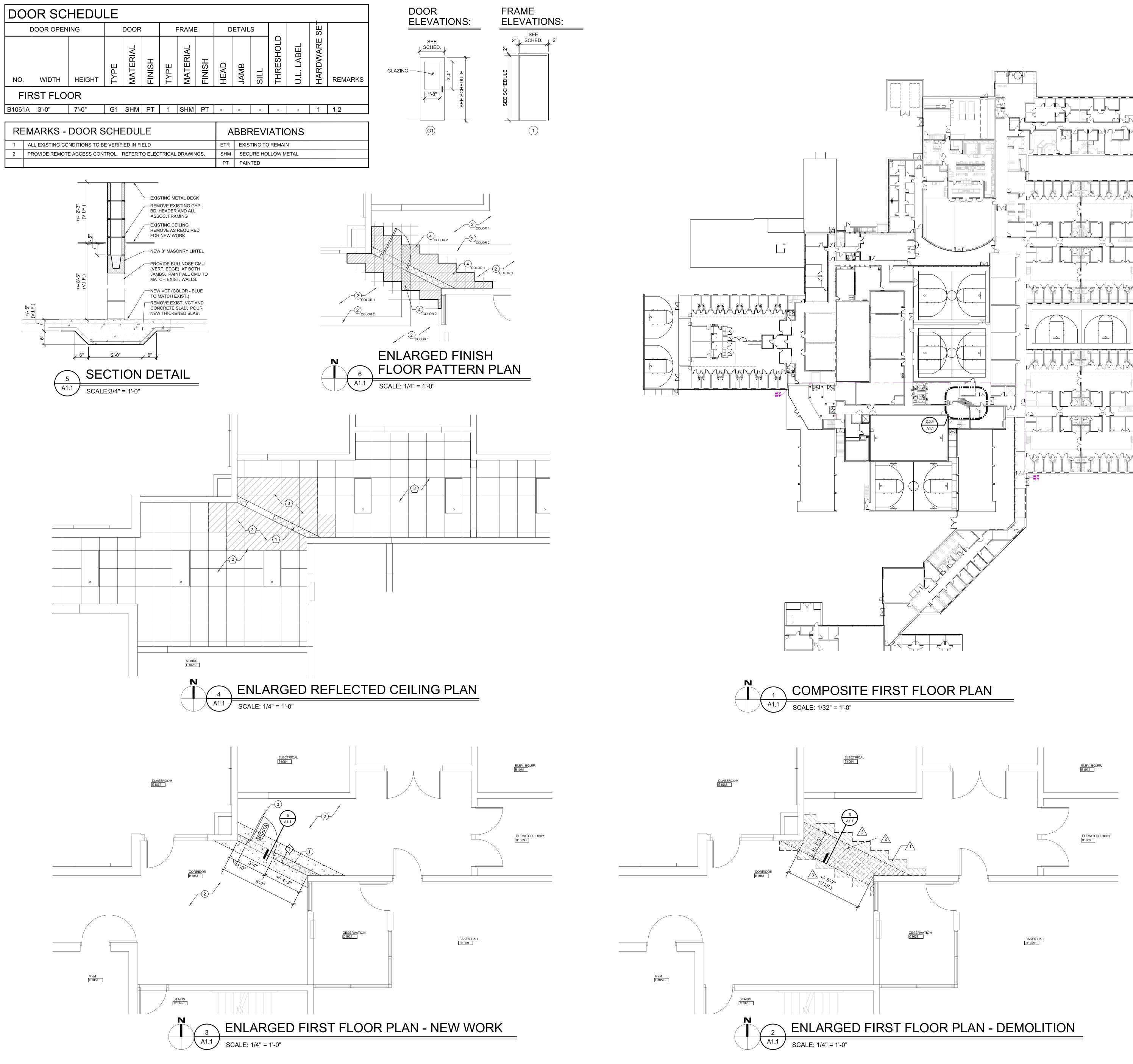
WAKELY ASSOCIATES, INC./ ARCHITECTS 30500 VAN DYKE AVE, SUITE 209, WARREN, MI 48093, 586.573.4100

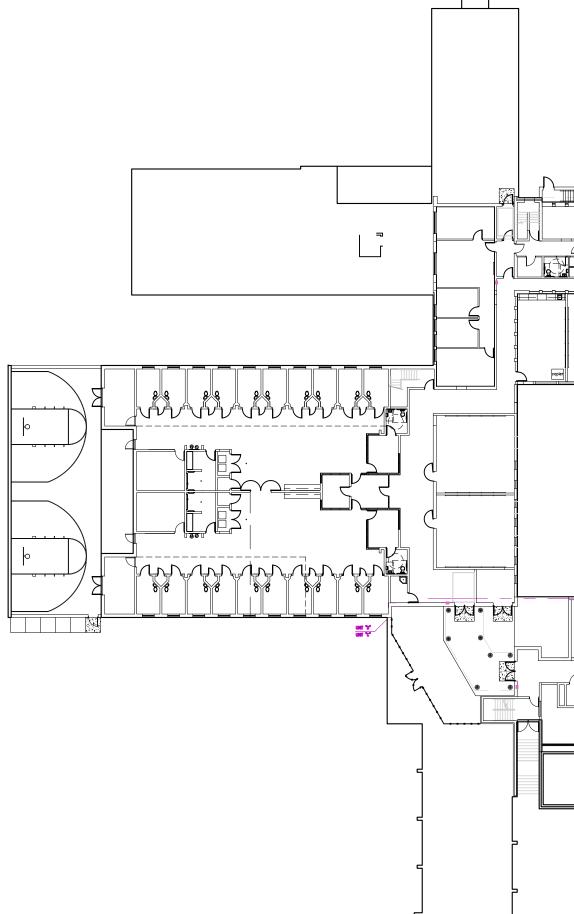
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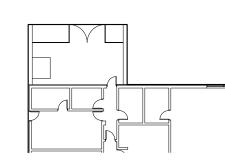




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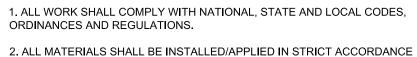


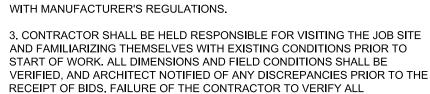






# TYPICAL CONSTRUCTION NOTES:





GROUNDS FOR AN EXTRA. 4. THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR INITIATING, MAINTAINING, AND SUPERVISING ALL SAFETY PRECAUTIONS AND PROGRAMS IN CONNECTION WITH THE PERFORMANCE OF THE CONTRACT. PROVIDE ALL NECESSARY TEMPORARY PROTECTION TO ENSURE THE SAFETY OF THE GENERAL PUBLIC DURING CONSTRUCTION.

5. ALL ITEMS SHALL BE AS SPECIFIED BY ARCHITECT. 6. SUBMIT SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES TO THE ARCHITECT FOR REVIEW PRIOR TO INSTALLATION/APPLICATION. 7. ALL DEBRIS SHALL BE LEGALLY DISPOSED OF OFF THE SITE BY THE CONTRACTOR.

8. ALL PRECAUTIONS SHALL BE TAKEN TO AVOID DAMAGE TO EXISTING MATERIALS AND CONSTRUCTION TO REMAIN.

9. CONTRACTOR SHALL CUT AND PATCH EXISTING WALLS, FLOORS, CEILINGS, ETC., SMOKE-TIGHT AS REQUIRED TO COMPLETE THE WORK. 10. CONTRACTOR SHALL KEEP NOISE, DUST, ETC., TO A MINIMUM STANDARD AS SET FORTH BY THE OWNER.

11. CONTRACTOR SHALL COORDINATE INSTALLATION AND PHASING OF WORK WITH THE ARCHITECT AND OWNER'S REPRESENTATIVE PRIOR TO THE START OF WORK.

# WALL TYPES:

DECK	 EXTEND TIGHT TO UNDERSIDE OF ND BE FIRE SPRAYED IN PLACE UNLI
$\langle 1 \rangle$	NOMINAL 8" CMU (ACTUAL WIDTH:

# **DEMOLITION KEY NOTES:**

REMOVE EXISTING VCT IN AREA SHOWN HATCHED FOR NEW WORK. REMOVE EXISTING CONCRETE SLAB FOR NEW WORK. EXISTING 12" x 12" ADHERED MINERAL FIBER ACOUSTICAL PANELS (SUSPENDED ON GYPSUM BOARD SUBSTRATE) TO BE REMOVED AS REQUIRED FOR DEMOLITION AND NEW WORK. REFER TO REFLECTED CEILING PLAN FOR MINIMUM AREA.

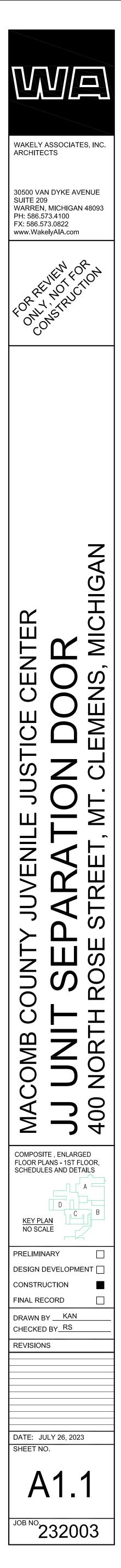
# NEW WORK KEY NOTES:

- 1 NEW WALL PARTITION. RUN WALL UP TO EXISTING METAL DECK. REFER TO WALL PARTITION.
- (2) EXISTING VCT TO REMAIN.
- (3) NEW DOOR, FRAME AND HARDWARE. REFER TO DOOR SCHEDULE. 4 NEW VCT IN AREA SHOWN. TWO COLORS VCT TILE TO BE USED TO MATCH EXISTING COLORS. REFER TO ENLARGED FINISHED FLOOR PATTERN PLAN.

- **REFLECTED CEILING PLAN KEY NOTES:** (1) EXISTING GYPSUM BOARD BULKHEAD AND ALL ASSOC. FRAMING TO BE
- REMOVED FOR NEW WALL.
- (2) EXISTING MINERAL FIBER ACOUSTICAL PANELS, LIGHTING, DIFFUSERS, ETC. TO REMAIN IN PLACE.
- 3 REMOVE EXISTING 12" x 12" ADHERED MINERAL FIBER ACOUSTICAL PANELS AT NEW WALL AS REQUIRED FOR DEMOLITION AND NEW WORK. PROVIDE NEW 12" x 12" MINERAL FIBER ACOUSTICAL PANELS ADHERED TO SUSPENDED GYPSUM BOARD SUBSTRATE CEILING SIMILAR TO "F" FISSURED ITEM NO. 101 BY USG. ADHERE PANEL TO SUSPENDED GYPSUM BOARD SUBSTRATE.

CONDITIONS PRIOR TO THE AWARD OF BID WILL NOT BE CONSIDERED AS

LESS 7 5/8")



# LIGHTING SYMBOL LIST

SYMBOL	DESCRIPTION	SYMBOL
	LIGHT FIXTURE – CEILING/GRID MOUNT	•
	LIGHT FIXTURE – INTERIOR WALL MOUNT LINEAR	С
ô	LIGHT FIXTURE – DOWNLIGHT WITH WALLWASH DIST.	4
$\bigcirc$	LIGHT FIXTURE - INTERIOR WALL SCONCE	4
-ф-	LIGHT FIXTURE – INTERIOR SURFACE MOUNT	4
Ю	LIGHT FIXTURE – INTERIOR WALL MOUNTED	
$\oplus$	LIGHT FIXTURE – INTERIOR PENDANT MOUNT	
•	LIGHT FIXTURE – INTERIOR PENDANT MOUNT CYLINDER	$\bullet$
<─	TRACK AND TRACK MOUNTED LIGHT FIXTURES	Ŧ
⊗	EXIT LIGHT – CEILING MOUNTED – ARROWS AS INDICATED ON PLAN (SHADED AREA INDICATES FACE(S) OF FIXTURE)	J
<b>9</b>	EXIT LIGHT – WALL MOUNTED – ARROWS AS INDICATED ON PLAN (SHADED AREA INDICATES FACE(S) OF FIXTURE)	→ J M
	EMERGENCY LIGHT FIXTURE – EMERGENCY BATTERY UNIT	$\mathcal{N}$
400	EMERGENCY LIGHT FIXTURE – BATTERY UNIT/EXIT SIGN	O
⊶⊡	LIGHT FIXTURE - EXTERIOR POLE MOUNT TYPE	
P	LIGHT FIXTURE – EXTERIOR WALL MOUNT TYPE	φ
×	LIGHT FIXTURE – EXTERIOR POST TOP TYPE	φ
۲	LIGHT FIXTURE – EXTERIOR BOLLARD TYPE	$\oplus$
	MBOLS AS INDICATED ON PLANS ARE NOT DRAWN TO SS NOTED OTHERWISE.	P <sub>usb</sub> ⊕

# LIGHTING CONTROLS LEGEND

SYMBOL	DESCRIPTION
\$	SWITCH SINGLE POLE
\$ <sub>0</sub>	OCCUPANCY SENSOR SWITCH
\$ <sub>v</sub>	VACANCY SENSOR SWITCH
\$ <sub>D</sub>	LOW VOLTAGE DIMMER SWITCH
\$ <sub>vD</sub>	VACANCY DIMMER SENSOR SWITCH
03	CEILING MOUNTED OCCUPANCY SENSOR
VS	CEILING MOUNTED VACANCY SENSOR
\$ <sub>3</sub>	SWITCH THREE-WAY
\$ <sub>ĸ</sub>	SINGLE POLE KEY SWITCH

I	POWER SYMBOL LIST	ELEC
SYMBOL	DESCRIPTION	ABBREV.
٠	CONDUIT DOWN	AFF
0	CONDUIT UP	А
С	CONTACTOR	AF
4	DISCONNECT SWITCH - NON FUSED	AWG
4	DISCONNECT SWITCH - FUSED	AT
4	DISCONNECT SWITCH - COMB. MOTOR STARTER	ATS
	ELECTRICAL PANEL – 208/240 VOLTS	AIC
	ELECTRICAL PANEL – 480 VOLTS	С
ullet	GROUNDING ROD	СВ
Ē	GROUND	CU
<del></del>	GROUNDING BAR	СТ
J	JUNCTION BOX	DIA
	JUNCTION BOX WITH HARDWIRED CONNECTION	DISC
Μ	METER	EMT
$\mathcal{O}$	MOTOR – SINGLE PHASE	EWC
$\mathbf{v}_{0}$	MOTOR – THREE PHASE	EPO
$\Phi$	MOTOR RATED SWITCH	(E)
φ	POWER RECEPTACLE – SIMPLEX TYPE	FA
₽	POWER RECEPTACLE - DUPLEX TYPE	FACP
<b>₽</b>	POWER RECEPTACLE - DUPLEX 6" ABOVE COUNTER	FLA
Ф <sub>USB</sub>	POWER RECEPTACLE - USB/DUPLEX COMBO. DEVICE	F
TT D	POWER RECEPTACLE – QUADRUPLEX TYPE POWER RECEPTACLE – RECESSED FLOOR TYPE	G/GRD GFCI/GFI
THE THE THE THE THE THE THE THE THE THE	POWER RECEPTACLE - SPECIALTY TYPE	HOA
	SURGE PROTECTION DEVICE	HP
ГС	TIME CLOCK	IG
Т	TRANSFORMER (REFER TO SCHEDULES FOR INFO)	KV
	VARIABLE SPEED DRIVE	KVA
NOTES:		KW
	E RATINGS/SIZES SHALL BE COORDINATED WITH PLANS	KWH
AND SCHE	JULES.	LP
		МСВ
AUXI	LIARY SYST. SYMBOL LIST	MDP
SYMBOL	DESCRIPTION	MLO
		MAX
	CAMERA	MIN
CR	CARD READER	NEC
_ <b>↓</b>	COMMUNICATIONS DEVICE - 6" ABOVE COUNTER	NEMA
	COMMUNICATIONS DEVICE – FLOOR	N/NEU
<b>V</b>	MAGNETIC DOOR HOLDER	NF
●	PUSH BUTTON	NC
S	SPEAKER	NO
	WALL CLOCK – SINGLE FACE	NIC
μĤ	WALL CLOCK – DOUBLE FACE	OF/CI
(HS)	WALL CLOCK AND SPEAKER UNIT	OF/OI
		PH. OR Ø
	CONTRACTOR SHALL BE RESPONSIBLE FOR BOX AND	P
2. LOW VOLTA	OR ALL DEVICES INDICATED. GE CONTRACTOR SHALL PROVIDE EXACT IONS AND LOCATIONS OF ALL DEVICES.	PF
JEUITIUAI	IVING AND LOVATIONS OF ALL DEVICES.	PVC (R)
FIE	RE ALARM SYMBOL LIST	(R)
		RMC
SYMBOL	DESCRIPTION	RP
Ś	DETECTION DEVICE	SPEC/SPECS
Ś	DETECTION DEVICE - DUCT MOUNTED	, TBB
(FS)	DETECTION DEVICE - FLOW SWITCH	

STWDUL	Deschi Hen
Ś	DETECTION DEVICE
< <u>\$</u>	DETECTION DEVICE - DUCT MOUNTED
FS	DETECTION DEVICE - FLOW SWITCH
TS	DETECTION DEVICE - TAMPER SWITCH
FAA	FIRE ALARM ANNUNCIATOR PANEL
FACP	FIRE ALARM CONTROL PANEL
$\bigtriangledown^{FD}$	FIRE DEPARTMENT COMMUNICATION OUTLET
F	MANUAL DEVICE - PULL STATION
F	NOTIFICATION DEVICE - WALL MOUNTED
	NOTIFICATION DEVICE - CEILING MOUNTED

NOTES: 1. DRAWINGS INDICATE DESIGN INTENT ONLY, FINAL LOCATIONS AND DEVICE SPECIFICATIONS SHALL BE PROVIDED BY FIRE ALARM MANUFACTURER. REFER TO PROJECT SPECIFICATIONS FOR APPROVED MANUFACTURERS.

# ELECTRICAL ABBREVIATIONS

USB

XFMR

ELEC	I RICAL ABBREVIATIONS
ABBREV.	DESCRIPTION
AFF	ABOVE FINISHED FLOOR
A	AMPERE
AF	AMPERE FUSE/AMPERE FRAME
AWG	AMERICAN WIRE GAUGE
AT	AMPERE TRIP
ATS	AUTOMATIC TRANSFER SWITCH
AIC	AVAILABLE INTERRUPTING CURRENT (AMPS)
С	CONDUIT OR CEILING MOUNTED
СВ	CIRCUIT BREAKER
CU	COPPER
CT	CURRENT TRANSFORMER
DIA	DIAMETER
DISC	DISCONNECT
EMT	ELECTRICAL METALLIC TUBING
EWC	ELECTRIC WATER COOLER
EPO	EMERGENCY POWER OFF
(E)	EXISTING ELECTRICAL EQUIPMENT OR WORK
FA	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FLA F	FULL LOAD AMPS FUSE
r G/GRD	GROUND
	GROUND FAULT CIRCUIT INTERRUPTER
HOA	HAND-OFF-AUTO
HP	HORSEPOWER
IG	ISOLATED GROUND
KV	KILOVOLT
KVA	KILOVOLT AMPERE
KW	KILOWATT
KWH	KILOWATT HOUR
LP	LIGHTING PANEL
МСВ	MAIN CIRCUIT BREAKER
MDP	MAIN DISTRIBUTION PANEL
MLO	MAIN LUG ONLY
MAX	MAXIMUM
MIN	MINIMUM
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
N/NEU	NEUTRAL
NF	NON-FUSIBLE
	NORMALLY CLOSED
NO	NORMALLY OPEN
NIC	NOT IN CONTRACT
	OWNER FURNISHED / CONTRACTOR INSTALLED
	OWNER FURNISHED / OWNER INSTALLED
H. OR Ø	
P	POULE POWER FACTOR
	POWER FACTOR POLYVINYL CHOLRIDE (PLASTIC)
	RELOCATED EXISTING ELECTRICAL EQUIPMENT
	REMOVE AND REINSTALL
RMC	RIGID METALLIC CONDUIT
	RECEPTACLE PANEL
	SPECIFICATIONS
	TELEPHONE BACKBOARD
TYP.	TYPICAL
UC	UNDER COUNTER
UL	UNDERWRITERS LABORATORIES
UPS	UNINTERRUPTIBLE POWER SUPPLY
USB	UNIVERSAL SERIAL BUS
V	VOLT
VA	VOLT AMPERE
W	WATT
WG	WIRE GUARD
WP	WEATHERPROOF
XFMR	TRANSFORMER

# DRAWING INDEX SHT. NO. DESCRIPTION E0.00 ELECTRICAL GENERAL INFORMATION E1.00 ELECTRICAL NEW WORK PLAN

E8.00 ELECTRICAL SPECIFICATIONS

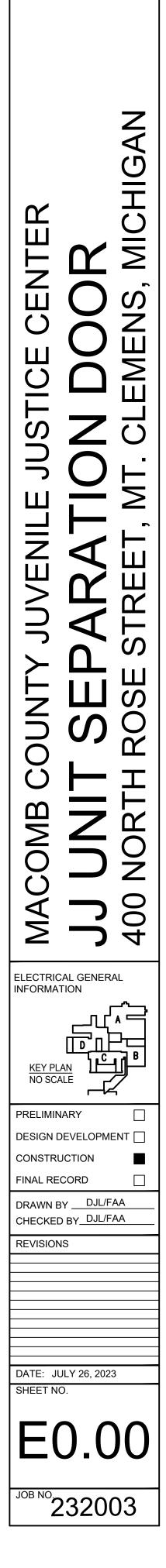
# DRAWING NOTATION

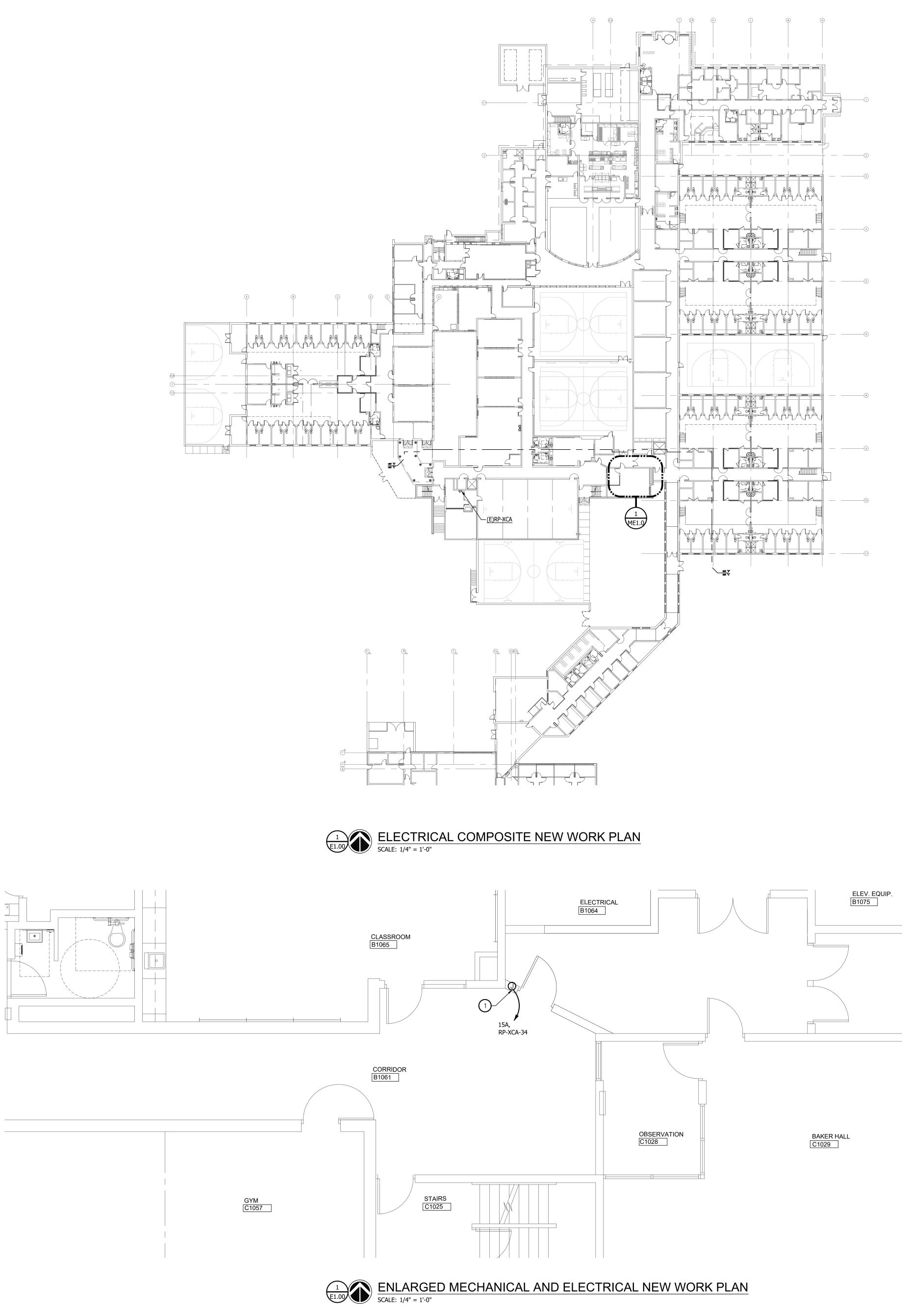
SYME	BOL DESCRIPTION	
LA	LIGHTING FIXTURE TAG	
	CONSTRUCTION KEY NOTE NUMBER 1	
DEMOLITION KEY NOTE NUMBER 1		
	FEEDER SIZE TAG (REFER TO FEEDER SCHEDULE ON THIS SHEET)	
	EQUIPMENT DESIGNATION, (I.E. EXHAUST FAN NUMBER 1)	
	EXISTING DEVICES OR EQUIPMENT	
	NEW OR MODIFIED DEVICES OR EQUIPMENT	
	NEW OR MODIFIED UNDERGROUND WIRING	
<del>\//////</del>	44445 EXISTING SYSTEM COMPONENT TO BE REMOVED	
	SECTION NUMBER 4	
	4 E5.2	
	SHEET E5.2 ON WHICH SECTION IS DRAWN	
	SECTION NO. 6	
$\left( \right)$		
	E5.2 SCALE: $1/4" = 1' - 0"$	
	SHEET E5.2 ON WHICH SECTION IS CUT (ENLARGED PARTIAL PLAN SIMILAR)	
	LIGHTING CONTROL TAG	
	SCENE SCHEDULE ID 'A'	
	NG CONTROL	
	ZONE '1' (MAY NOT APPEAR ON EVERY TAG)	
	AFFEAR ON EVERT TAG)	
	APPLICABLE CODES	
	AND REGULATIONS	
YEAR	CODE	
2015	MICHIGAN BUILDING CODE	
2015	MICHIGAN ENERGY CODE	
2014	MICHIGAN ELECTRICAL CODE RULES, PART 8	
2017	NATIONAL ELECTRICAL CODE (NFPA 70)	
2013	NFPA 20	
2013	NFPA 72	
2012	NFPA 101	
0047	NFPA 110	
2013		

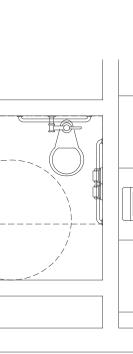


WAKELY ASSOCIATES, INC. ARCHITECTS

30500 VAN DYKE AVENUE SUITE 209 WARREN, MICHIGAN 48093 PH: 586.573.4100 FX: 586.573.0822 www.WakelyAIA.com



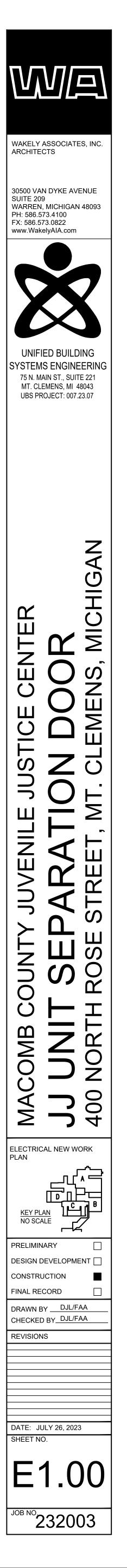




	POWER GENERAL NOTES
A	THESE DRAWINGS ARE DIAGRAMMAITC AND REPRESENT TH EXTENT OF THE WORK TO BE PERFORMED. PROVIDE AND EX HVAC SYSTEMS PER ENGINEER'S SPECIFICATION, AND LOCA CODES INCLUDING AMENDMENTS, BULLETINS, ETC. AS WEL STANDARDS OF INSTALLATION AND EQUIPMENT ESTABLISH BUILDINGS, AND REQUIREMENTS OF THE OWNER.
В	EXCEPT FOR CHANGES AS MAY BE SPECIFICALLY APPROVED ENGINEER OF RECORD. IN ACCORDANCE WITH ALTERNATES AS STATED HEREINAFTER, ALL WORK MUST BE IN FULL ACC WITH THE INTENT OF THE PLANS AND SPECIFICATIONS. SYS TO BE COMPLETE, EFFICIENT, AND SATISFACTORY OPERATI PROJECT IS DELIVERED TO THE OWNER.
D	CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS AND FROM GOVERNING AUTHORITIES AND FILE NECESSARY FOR INSPECTION FEES.
E	ELECTRICAL CONTRACTOR SHALL COMPLY WITH THE LATES ELECTRICAL CODE, LIFE SAFETY CODE AND APPLICABLE STA LOCAL CODES AND ORDINANCES.
F	ELECTRICAL EQUIPMENT AND WIRING SHALL BE NEW AND S FURNISHED AND INSTALLED BY ELECTRICAL CONTRACTOR, OTHERWISE NOTED.
G	WIRING SHALL BE IN CONDUIT. CONDUIT SHALL BE 3/4" CO MINIMUM. CONDUITS IN FINISHED AREAS SHALL BE CONCEA
н	NEW WIRES SHALL BE TYPE THHN. MINIMUM SIZE SHALL BE UNLESS OTHERWISE NOTED. FINAL CONNECTIONS TO EQUI FURNISHED AND INSTALLED BY OTHERS, SHALL BE PROVIDE CONTRACTOR.

$\left( \times \right)$	NEW WORK KEYED NOTES
1	EXTEND WIRING FROM NEW POWERED DOOR TO POWER PANEL XCA LOCATED IN STORAGE CLOSET ADJACENT TO GYM. ROUTE CONDUIT THRU EXISTING HARD CEILING. VERIFY SPARE CAPACITY IN PANEL PRIOR TO CONSTRUCTION AND REPORT ANY DISCREPANCIES TO ENGINEER.

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APPROVAL MS, PAY ALL	
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## BASIC ELECTRICAL REQUIREMENTS PART 1 GENERAL

- 1.01 RELATED DOCUMENTS A. DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS, SPECIAL CONDITIONS AND DIVISION 1 SPECIFICATION
- SECTIONS, APPLY TO WORK OF THIS SECTION. B. PROVIDE ALL ITEMS, ARTICLES, MATERIALS, OPERATIONS OR METHODS LISTED, MENTIONED OR SCHEDULED ON DRAWINGS AND/OR HEREIN, INCLUDING ALL LABOR, MATERIALS, EQUIPMENT AND INCIDENTALS NECESSARY AND REQUIRED FOR THEIR COMPLETION. 1.02 DRAWINGS
- A. THE DRAWINGS SHOW THE LOCATION AND GENERAL ARRANGEMENT OF EQUIPMENT, ELECTRICAL SYSTEMS AND RELATED ITEMS. THEY SHALL BE FOLLOWED AS CLOSELY AS ELEMENTS OF THE CONSTRUCTION WILL PERMIT.
- B. EXAMINE THE DRAWINGS OF OTHER TRADES AND VERIFY THE CONDITIONS GOVERNING THE WORK ON THE JOB SITE. ARRANGE WORK ACCORDINGLY, PROVIDING SUCH FITTINGS, CONDUIT, JUNCTION BOXES AND ACCESSORIES AS MAY BE REQUIRED TO MEET SUCH CONDITIONS. C. DEVIATIONS FROM THE DRAWINGS, WITH THE EXCEPTION OF MINOR CHANGES IN ROUTING AND OTHER SUCH INCIDENTAL CHANGES THAT DO NOT AFFECT THE FUNCTIONING
- OR SERVICEABILITY OF THE SYSTEMS, SHALL NOT BE MADE WITHOUT THE WRITTEN APPROVAL OF THE ARCHITECT/ENGINEER. D. THE ARCHITECTURAL AND STRUCTURAL DRAWINGS TAKE PRECEDENCE IN ALL MATTERS PERTAINING TO THE BUILDING STRUCTURE, MECHANICAL DRAWINGS IN ALL MATTERS
- PERTAINING TO MECHANICAL TRADES AND ELECTRICAL DRAWINGS IN ALL MATTERS PERTAINING TO ELECTRICAL TRADES. WHERE THERE ARE CONFLICTS OR DIFFERENCES BETWEEN THE DRAWINGS FOR THE VARIOUS TRADES, REPORT SUCH CONFLICTS OR DIFFERENCES TO THE ARCHITECT/ENGINEER FOR RESOLUTION. 1.03 CODES, PERMITS AND FEES
- A. UNLESS OTHERWISE INDICATED, ALL REQUIRED PERMITS, LICENSES, INSPECTIONS, APPROVALS AND FEES FOR ELECTRICAL WORK SHALL BE SECURED AND PAID FOR BY THE CONTRACTOR. ALL WORK SHALL CONFORM TO ALL APPLICABLE CODES, RULES AND REGULATIONS. B. RULES OF LOCAL UTILITY COMPANIES SHALL BE COMPLIED WITH. CHECK WITH THE UTILITY COMPANY SUPPLYING SERVICE TO THE INSTALLATION AND DETERMINE ALL
- DEVICES INCLUDING, BUT NOT LIMITED TO, ALL CURRENT AND POTENTIAL TRANSFORMERS, METER BOXES, C.T. CABINETS AND METERS WHICH WILL BE REQUIRED AND INCLUDE THE COST OF ALL SUCH ITEMS IN PROPOSAL.
- C. ALL WORK SHALL BE EXECUTED IN ACCORDANCE WITH THE RULES AND REGULATIONS SET FORTH IN LOCAL AND STATE CODES. PREPARE ANY DETAILED DRAWINGS OR DIAGRAMS WHICH MAY BE REQUIRED BY THE GOVERNING AUTHORITIES. WHERE THE DRAWINGS AND/OR SPECIFICATIONS INDICATE MATERIALS OR CONSTRUCTION IN EXCESS OF CODE REQUIREMENTS, THE DRAWINGS AND/OR SPECIFICATIONS SHALL GOVERN. 1.04 STANDARDS OF MATERIAL AND WORKMANSHIP:
- A. ALL MATERIALS SHALL BE NEW. THE ELECTRICAL AND PHYSICAL PROPERTIES OF ALL MATERIALS, AND THE DESIGN, PERFORMANCE CHARACTERISTICS, AND METHODS OF CONSTRUCTION OF ALL ITEMS OF EQUIPMENT, SHALL BE IN ACCORDANCE WITH THE LATEST ISSUE OF THE VARIOUS, APPLICABLE STANDARD SPECIFICATIONS OF THE FOLLOWING RECOGNIZED AUTHORITIES: 1. A.N.S.I.AMERICAN NATIONAL STANDARDS INSTITUTE 2. A.S.T.M.AMERICAN SOCIETY FOR TESTING MATERIALS
- 3. I.C.F.A.INSULATED CABLE ENGINEERS ASSOCIATION 4. I.E.E.INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
- 5. N.E.C.NATIONAL ELECTRICAL CODE 6. N.E.M.A.NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION
- 7. U.L.UNDERWRITERS LABORATORIES, INC. B. ALL EQUIPMENT OF THE SAME OR SIMILAR SYSTEMS SHALL BE BY THE SAME MANUFACTURER.
- 1.05 RECORD DRAWINGS A. PROVIDE COMPLETE OPERATING AND MAINTENANCE INSTRUCTION MANUALS COVERING ALL ELECTRICAL EQUIPMENT HEREIN SPECIFIED, TOGETHER WITH PARTS LISTS. ALL LITERATURE SHALL BE SUBMITTED TO THE ARCHITECT IN AN ELECTRONIC FORMAT. B. THE OPERATING AND MAINTENANCE INSTRUCTIONS SHALL INCLUDE A BRIEF, GENERAL DESCRIPTION FOR ALL ELECTRICAL SYSTEMS INCLUDING, BUT NOT LIMITED TO; ROUTINE MAINTENANCE PROCEDURES, TROUBLE-SHOOTING PROCEDURES AND SHOP DRAWINGS.
- C. ANY EQUIPMENT OFFERED AS A SUBSTITUTION SHALL BE EQUAL IN QUALITY, DURABILITY, APPEARANCE, AMPACITY, AND EFFICIENCY THROUGH ALL RANGES OF OPERATION SHALL CONFORM WITH ARRANGEMENTS AND SPACE LIMITATIONS OF THE EQUIPMENT SHOWN ON THE PLANS AND/OR SPECIFIED, SHALL BE COMPATIBLE WITH THE OTHER COMPONENTS OF THE SYSTEM. ALL COSTS TO MAKE THESE ITEMS OF EQUIPMENT COMPLY WITH THESE REQUIREMENTS INCLUDING, BUT NOT LIMITED TO, CONDUIT, WIRING, BUS WORK, ENCLOSURES AND BUILDING ALTERATIONS SHALL BE INCLUDED IN THE ORIGINAL BID. SIMILAR EQUIPMENT SHALL BE BY ONE MANUFACTURER.
- 1.06 SHOP DRAWINGS/SUBMITTALS A. ALL SHOP DRAWINGS SHALL BE SUBMITTED IN GROUPINGS OF SIMILAR AND/OR RELATED ITEMS (LIGHTING FIXTURES, SWITCHGEAR, ETC.). INCOMPLETE SUBMITTAL GROUPINGS WILL BE RETURNED UNCHECKED.
- B. SUBMIT FOR APPROVAL SHOP DRAWINGS FOR ALL ELECTRICAL SYSTEMS OR EQUIPMENT BUT NOT LIMITED TO THE SECTIONS OF SPECIFICATIONS. WHERE ITEMS ARE REFERRED TO BY SYMBOLIC DESIGNATION ON THE DRAWINGS AND SPECIFICATIONS, ALL SUBMITTALS SHALL BEAR THE SAME DESIGNATION (LIGHT FIXTURES). REFER TO OTHER SECTIONS OF THE ELECTRICAL SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS. 1.07 MANUFACTURERS LISTED
- A. THE LISTING OF SPECIFIC MANUFACTURERS DOES NOT IMPLY ACCEPTANCE OF THEIR PRODUCTS THAT DO NOT MEET THE SPECIFIED RATINGS, FEATURES AND FUNCTIONS. MANUFACTURERS LISTED ARE NOT RELIEVED FROM MEETING THESE SPECIFICATIONS IN THEIR ENTIRETY. B. PRODUCTS IN COMPLIANCE WITH THE SPECIFICATION AND MANUFACTURED BY OTHERS NOT NAMED WILL BE CONSIDERED ONLY IF PRE-APPROVED BY THE ENGINEER TEN (10) DAYS PRIOR TO BID DATE. 1.08 USE OF EQUIPMENT
- A. THE USE OF ANY EQUIPMENT, OR ANY PART THEREOF FOR PURPOSES OTHER THAN TESTING EVEN WITH THE OWNER'S CONSENT, SHALL NOT BE CONSTRUED TO BE AN ACCEPTANCE OF THE WORK ON THE PART OF THE OWNER, NOR BE CONSTRUED TO OBLIGATE THE OWNER IN ANY WAY TO ACCEPT IMPROPER WORK OR DEFECTIVE B. DO NOT USE OWNER'S LAMPS FOR TEMPORARY LIGHTING EXCEPT AS ALLOWED AND DIRECTED BY THE OWNER. EQUIP LIGHTING FIXTURES WITH NEW LAMPS WHEN THE PROJECT IS TURNED OVER TO THE OWNER.
- PART 2 EXECUTION 2.01 INSTALLATION OF EQUIPMENT
- A. INSTALL ALL EQUIPMENT IN STRICT ACCORDANCE WITH ALL DIRECTIONS AND RECOMMENDATIONS FURNISHED BY THE MANUFACTURER. WHERE SUCH DIRECTIONS ARE IN CONFLICT WITH THE DRAWINGS AND SPECIFICATIONS, REPORT SUCH CONFLICTS TO THE ARCHITECT/ENGINEER FOR RESOLUTION. B. DO NOT PENETRATE OR OTHERWISE NOTCH OR CUT STRUCTURAL MEMBERS, INCLUDING FOOTINGS AND GRADE BEAMS, WITHOUT APPROVAL OF STRUCTURAL ENGINEER.
- C. MAKE PENETRATIONS PERPENDICULAR TO SURFACES UNLESS OTHERWISE INDICATED. D. PROVIDE SLEEVES FOR PENETRATIONS AS INDICATED OR AS REQUIRED TO FACILITATE INSTALLATION. SET SLEEVES FLUSH WITH EXPOSED SURFACES UNLESS OTHERWISE INDICATED OR REQUIRED. E. CONCEAL BENDS FOR CONDUIT RISERS EMERGING ABOVE GROUND.
- F. SEAL INTERIOR OF CONDUITS ENTERING THE BUILDING FROM UNDERGROUND AT FIRST ACCESSIBLE POINT TO PREVENT ENTRY OF MOISTURE AND GASES. G. WHERE CONDUITS PENETRATE WATERPROOF MEMBRANE, SEAL AS REQUIRED TO MAINTAIN INTEGRITY OF MEMBRANE.
- H. MAKE PENETRATIONS FOR ROOF-MOUNTED EQUIPMENT WITHIN ASSOCIATED EQUIPMENT OPENINGS AND CURBS WHERE POSSIBLE TO MINIMIZE ROOFING SYSTEM PENETRATIONS. WHERE PENETRATIONS ARE NECESSARY, SEAL AS INDICATED OR AS REQUIRED TO PRESERVE INTEGRITY OF ROOFING SYSTEM AND MAINTAIN ROOF WARRANTY. INCLUDE PROPOSED LOCATIONS OF PENETRATIONS AND METHODS FOR SEALING WITH SUBMITTALS. 2.02 COORDINATION
- A. INSTALL WORK TO AVOID INTERFERENCE WITH WORK OF OTHER TRADES. REMOVE AND RELOCATE ANY WORK THAT CAUSES AN INTERFERENCE AT CONTRACTOR'S EXPENSE. DISPUTES REGARDING THE CAUSE OF AN INTERFERENCE WILL BE RESOLVED BY THE CONSTRUCTION MANAGER OR ARCHITECT/ENGINEER. 2.03 CHASES AND RECESSES A. PROVIDED BY THE ARCHITECTURAL TRADES, BUT THE CONTRACTOR SHALL BE RESPONSIBLE FOR THEIR ACCURATE LOCATION AND SIZE.
- 2.04 CUTTING, PATCHING AND DAMAGE TO OTHER WORK A. REFER TO GENERAL CONDITIONS FOR REQUIREMENTS.
- B. ALL CUTTING, PATCHING AND REPAIR WORK SHALL BE PERFORMED BY THE CONTRACTOR THROUGH APPROVED, QUALIFIED SUBCONTRACTORS. CONTRACTOR SHALL INCLUDE FULL COST OF SAME IN BID. 2.05 EXCAVATION AND BACKFILLING A. PROVIDE ALL EXCAVATION, TRENCHING, TUNNELING, DEWATERING AND BACKFILLING REQUIRED FOR THE ELECTRICAL WORK. COORDINATE THE WORK WITH OTHER EXCAVATING
- AND BACKFILLING IN THE SAME ARFA B. WHERE CONDUIT IS INSTALLED LESS THAN 2"6" BELOW THE SURFACE OF PAVEMENT, PROVIDE CONCRETE ENCASEMENT, 4" MINIMUM COVERAGE, ALL AROUND OR AS SHOWN ON THE ELECTRICAL DRAWINGS.
- C. BACKFILL ALL EXCAVATIONS INSIDE BUILDING, UNDER DRIVES AND PARKING AREAS WITH WELL-TAMPED GRANULAR MATERIAL. BACKFILL ALL EXCAVATIONS UNDER WALL FOOTINGS WITH LEAN MIX CONCRETE UP TO UNDERSIDE OF FOOTINGS AND EXTEND CONCRETE WITHIN EXCAVATION A MINIMUM OF FOUR (4) FEET EACH SIDE OF FOOTING. GRANULAR BACKFILL SHALL BE PLACED IN LAYERS NOT MORE THAN 8 INCHES IN THICKNESS, 95 PERCENT COMPACTION THROUGHOUT WITH APPROVED COMPACTION EQUIPMENT. TAMP, ROLL AS REQUIRED. EXCAVATED MATERIAL SHALL NOT BE USED. D. BACKFILL OUTSIDE BUILDING WITH GRANULAR MATERIAL TO A HEIGHT 12 INCHES OVER TOP OF PIPE COMPACTED TO 95 PERCENT COMPACTION AS SPECIFIED ABOVE.
- BACKFILL REMAINDER OF EXCAVATION WITH UNFROZEN, EXCAVATED MATERIAL IN SUCH A WAY TO PREVENT SETTLING. TAMP, ROLL AS REQUIRED. 2.06 EQUIPMENT FOUNDATION AND SUPPORTS A. SHALL BE AS REQUIRED OR AS SHOWN ON PLANS OR SPECIFIED.
- B. PROVIDE CONCRETE BASES AND SUPPORTS FOR FLOOR MOUNTED ELECTRICAL EQUIPMENT.
- C. PROVIDE CONCRETE HOUSE KEEPING BASES 4" ABOVE FINISHED FLOOR, WITH LEVELING CHANNELS, WHERE NOTED, FOR FLOOR-MOUNTED EQUIPMENT. D. FOR EQUIPMENT SUSPENDED FROM CEILINGS OR WALLS, FURNISH AND INSTALL ALL INSERTS, RODS, STRUCTURAL STEEL FRAMES, BRACKETS AND PLATFORMS REQUIRED. 2.07 FQUIPMENT CONNECTIONS
- A. MAKE CONNECTIONS TO EQUIPMENT, MOTORS, LIGHTING FIXTURES, AND OTHER ITEMS INCLUDED IN THE WORK IN ACCORDANCE WITH THE APPROVED SHOP DRAWINGS AND ROUGH-IN MEASUREMENTS FURNISHED BY THE MANUFACTURERS OF THE PARTICULAR EQUIPMENT FURNISHED. ALL ADDITIONAL CONNECTIONS NOT SHOWN ON THE DRAWINGS, BUT CALLED OUT BY THE EQUIPMENT MANUFACTURER'S SHOP DRAWINGS SHALL BE PROVIDED. 2.08 ACCESS DOORS
- A. COORDINATE REQUIREMENTS FOR ACCESS DOORS WITH ARCHITECT. 2.09 CLEANING
- A. ALL DEBRIS SHALL BE REMOVED DAILY AS REQUIRED TO MAINTAIN THE WORK AREA IN A NEAT, ORDERLY CONDITION. B. FINAL CLEANUP SHALL INCLUDE, BUT NOT BE LIMITED TO, WASHING OF FIXTURE LENSES OR LOUVERS, SWITCHBOARDS, SUBSTATIONS, MOTOR CONTROL CENTERS, PANELS, ETC. FIXTURE REFLECTORS AND LENSES OR LOUVERS SHALL BE LEFT WITH NO WATER MARKS OR CLEANING STREAKS. 2.10 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS
- A. EQUIPMENT AND MATERIALS SHALL BE PROTECTED FROM THEFT. INJURY OR DAMAGE B. PROTECT CONDUIT OPENINGS WITH TEMPORARY PLUGS OR CAPS.
- C. PROVIDE ADEQUATE STORAGE FOR ALL EQUIPMENT AND MATERIALS DELIVERED TO THE JOB SITE. LOCATION OF THE SPACE WILL BE DESIGNATED BY THE CONSTRUCTION MANAGER OR ARCHITECT/ENGINEER. EQUIPMENT SET IN PLACE IN UNPROTECTED AREAS MUST BE PROVIDED WITH TEMPORARY PROTECTION. 2.11 EXTRA WORK A. FOR ANY EXTRA ELECTRICAL WORK WHICH MAY BE PROPOSED, THIS CONTRACTOR SHALL FURNISH TO THE CONSTRUCTION MANAGER, AN ITEMIZED BREAKDOWN OF THE
- ESTIMATED COST OF THE MATERIALS AND LABOR REQUIRED TO COMPLETE THIS WORK. THE CONTRACTOR SHALL PROCEED ONLY AFTER RECEIVING A WRITTEN ORDER FROM THE CONSTRUCTION MANAGER ESTABLISHING THE AGREED PRICE AND DESCRIBING THE WORK TO BE DONE. 2.12 DRAWINGS AND MEASUREMENTS A. THESE SPECIFICATIONS AND ACCOMPANYING DRAWINGS ARE INTENDED TO DESCRIBE AND PROVIDE FOR FINISHED WORK. THEY ARE INTENDED TO BE COOPERATIVE, AND WHAT IS CALLED FOR BY EITHER SHALL BE AS BINDING AS IF CALL FOR BY BOTH. THE CONTRACTOR WILL UNDERSTAND THAT THE WORK HEREIN DESCRIBED SHALL BE
- COMPLETE IN EVERY DETAIL. B. THE DRAWINGS ARE NOT INTENDED TO BE SCALED FOR ROUGH-IN MEASUREMENTS NOR TO SERVE AS SHOP DRAWINGS. FIELD MEASUREMENTS NECESSARY FOR ORDERING MATERIALS AND FITTING THE INSTALLATION TO THE BUILDING CONSTRUCTION AND ARRANGEMENT SHALL BE TAKEN BY THE CONTRACTOR. THE CONTRACTOR SHALL CHECK LATEST ARCHITECTURAL DRAWINGS AND LOCATE LIGHT SWITCHES FROM SAME WHERE DOOR SWINGS ARE DIFFERENT FROM ELECTRICAL DRAWINGS.

# LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 PRODUCTS 1.01 CONDUCTOR AND CABLE APPLICATIONS

- A. DO NOT USE CONDUCTORS AND CABLES FOR APPLICATIONS OTHER THAN AS PERMITTED BY NFPA 70 AND PRODUCT LISTING. B. PROVIDE SINGLE CONDUCTOR BUILDING WIRE INSTALLED IN SUITABLE RACEWAY UNLESS OTHERWISE INDICATED, PERMITTED, OR REQUIRED.
- C. NONMETALLIC-SHEATHED CABLE IS NOT PERMITTED. D. UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE IS NOT PERMITTED.
- E. SERVICE ENTRANCE CABLE IS NOT PERMITTED. F. ARMORED CABLE IS NOT PERMITTED.
- G. METAL-CLAD CABLE IS PERMITTED ONLY AS FOLLOWS 1. WHERE NOT OTHERWISE RESTRICTED, MAY BE USED
- a. WHERE CONCEALED ABOVE ACCESSIBLE CEILINGS FOR FINAL CONNECTIONS FROM JUNCTION BOXES TO LUMINAIRES. 1) MAXIMUM LENGTH: 6 FEET.
- b. WHERE CONCEALED IN HOLLOW STUD WALLS, ABOVE ACCESSIBLE CEILINGS, AND UNDER RAISED FLOORS FOR BRANCH CIRCUITS UP TO 20 A. 1) EXCEPTION: PROVIDE SINGLE CONDUCTOR BUILDING WIRE IN RACEWAY FOR CIRCUIT HOMERUN FROM FIRST OUTLET TO PANELBOARD.
- 2. IN ADDITION TO OTHER APPLICABLE RESTRICTIONS, MAY NOT BE USED: a. WHERE EXPOSED TO DAMAGE. b. FOR DAMP, WET, OR CORROSIVE LOCATIONS, UNLESS PROVIDED WITH A PVC JACKET LISTED AS SUITABLE FOR THOSE LOCATIONS.
- H. MANUFACTURED WIRING SYSTEMS ARE NOT PERMITTED.
- 1.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS A. PROVIDE PRODUCTS THAT COMPLY WITH REQUIREMENTS OF NFPA 70.
- B. PROVIDE PRODUCTS LISTED, CLASSIFIED, AND LABELED AS SUITABLE FOR THE PURPOSE INTENDED. C. UNLESS SPECIFICALLY INDICATED TO BE EXCLUDED, PROVIDE ALL REQUIRED CONDUIT, BOXES, WIRING, CONNECTORS, ETC. AS REQUIRED FOR A COMPLETE OPERATING D. COMPLY WITH NEMA WC 70

1. PROVIDE COPPER CONDUCTORS EXCEPT WHERE ALUMINUM CONDUCTORS ARE SPECIFICALLY INDICATED. SUBSTITUTION OF ALUMINUM CONDUCTORS FOR COPPER IS NOT PERMITTED. CONDUCTOR SIZES INDICATED ARE BASED ON COPPER UNLESS SPECIFICALLY INDICATED AS ALUMINUM. CONDUCTORS DESIGNATED WITH THE ABBREVIATION "AL" INDICATE ALUMINUM. 2. COPPER CONDUCTORS: SOFT DRAWN ANNEALED, 98 PERCENT CONDUCTIVITY, UNCOATED COPPER CONDUCTORS COMPLYING WITH ASTM B3, ASTM B8, OR ASTM

B787/B787M UNLESS OTHERWISE INDICATED 3. TINNED COPPER CONDUCTORS: COMPLY WITH ASTM B33

4. ALUMINUM CONDUCTORS (ONLY WHERE SPECIFICALLY INDICATED OR PERMITTED FOR SUBSTITUTION): AA-8000 SERIES ALUMINUM ALLOY CONDUCTORS RECOGNIZED BY ASTM B800 AND COMPACT STRANDED IN ACCORDANCE WITH ASTM B801 UNLESS OTHERWISE INDICATED. H. CONDUCTOR COLOR CODING 1. COLOR CODE CONDUCTORS AS INDICATED UNLESS OTHERWISE REQUIRED BY THE AUTHORITY HAVING JURISDICTION. MAINTAIN CONSISTENT COLOR CODING THROUGHOUT 2. COLOR CODING METHOD: INTEGRALLY COLORED INSULATION.

a. 240/120 V, 3 PHASE, 4 WIRE SYSTEM: 1) PHASE A: BLACK. 2) PHASE B: RED.

G. CONDUCTOR MATERIAL

3. COLOR CODE:

D. INSULATION:

PART 2 EXECUTION

2.01 INSTALLATION

PART 1 PRODUCTS

1.02 GROUNDING AND BONDING COMPONENTS

a. EXCEPTIONS:

PART 2 EXECUTION

2.01 EXAMINATION

2.02 INSTALLATION

DRY CONDITIONS

PART 1 GENERAL

1.02 COORDINATION

PART 2 PRODUCTS

1.01 SUMMARY

1.04 METAL-CLAD CABLE

3) PHASE C: BLUE. 4) NEUTRAL/GROUNDED: WHITE c. EQUIPMENT GROUND, ALL SYSTEMS: GREEN 1.03 SINGLE CONDUCTOR BUILDING WIRE A. DESCRIPTION: SINGLE CONDUCTOR INSULATED WIRE.

B. CONDUCTOR STRANDING: 1. FEEDERS AND BRANCH CIRCUITS: a. SIZE 12 AWG AND SMALLER: STRANDED. b. SIZE 10 AWG AND LARGER: STRANDED.

C. INSULATION VOLTAGE RATING: 600 V.

1. COPPER BUILDING WIRE: TYPE THHN/THWN OR THHN/THWN-2, EXCEPT AS INDICATED BELOW.

A. DESCRIPTION: NFPA 70, TYPE MC CABLE LISTED AND LABELED AS COMPLYING WITH UL 1569, AND LISTED FOR USE IN CLASSIFIED FIRESTOP SYSTEMS TO BE USED. B. CONDUCTOR STRANDING: 1. SIZE 12 AWG AND SMALLER: STRANDED

2. SIZE 10 AWG AND LARGER: STRANDED. C. INSULATION VOLTAGE RATING: 600 V. D. INSULATION: TYPE THHN, THHN/THWN, OR THHN/THWN-2.

E. GROUNDING: FULL-SIZE INTEGRAL EQUIPMENT GROUNDING CONDUCTOR. F. ARMOR: STEEL, INTERLOCKED TAPE.

G. PROVIDE PVC JACKET APPLIED OVER CABLE ARMOR WHERE INDICATED OR REQUIRED FOR ENVIRONMENT OF INSTALLED LOCATION. 1.05 WIRING CONNECTORS A. DESCRIPTION: WIRING CONNECTORS APPROPRIATE FOR THE APPLICATION, SUITABLE FOR USE WITH THE CONDUCTORS TO BE CONNECTED, AND LISTED AS COMPLYING WITH UL 486A-486B OR UL 486C AS APPLICABLE.

A. CIRCUITING REQUIREMENTS: 1. UNLESS DIMENSIONED, CIRCUIT ROUTING INDICATED IS DIAGRAMMATIC.

2. WHEN CIRCUIT DESTINATION IS INDICATED WITHOUT SPECIFIC ROUTING, DETERMINE EXACT ROUTING REQUIRED. 3. ARRANGE CIRCUITING TO MINIMIZE SPLICES.

4. INCLUDE CIRCUIT LENGTHS REQUIRED TO INSTALL CONNECTED DEVICES WITHIN 10 FT OF LOCATION INDICATED. 5. MAINTAIN SEPARATION OF CLASS 1, CLASS 2, AND CLASS 3 REMOTE-CONTROL, SIGNALING, AND POWER-LIMITED CIRCUITS IN ACCORDANCE WITH NFPA 70. 6. MAINTAIN SEPARATION OF WIRING FOR EMERGENCY SYSTEMS IN ACCORDANCE WITH NFPA 70. B. PERFORM WORK IN ACCORDANCE WITH NECA 1 (GENERAL WORKMANSHIP).

C. INSTALL ALUMINUM CONDUCTORS IN ACCORDANCE WITH NECA 104. D. INSTALL METAL-CLAD CABLE (TYPE MC) IN ACCORDANCE WITH NECA 120. E. INSTALLATION IN RACEWAY

3. DO NOT REMOVE CONDUCTOR STRANDS TO FACILITATE INSERTION INTO CONNECTOR.

1. TAPE ENDS OF CONDUCTORS AND CABLES TO PREVENT INFILTRATION OF MOISTURE AND OTHER CONTAMINANTS. 2. PULL ALL CONDUCTORS AND CABLES TOGETHER INTO RACEWAY AT SAME TIME.

3. DO NOT DAMAGE CONDUCTORS AND CABLES OR EXCEED MANUFACTURER'S RECOMMENDED MAXIMUM PULLING TENSION AND SIDEWALL PRESSURE. 4. USE SUITABLE WIRE PULLING LUBRICANT WHERE NECESSARY, EXCEPT WHEN LUBRICANT IS NOT RECOMMENDED BY THE MANUFACTURER.

F. PARALLELED CONDUCTORS: INSTALL CONDUCTORS OF THE SAME LENGTH AND TERMINATE IN THE SAME MANNER. G. SECURE AND SUPPORT CONDUCTORS AND CABLES IN ACCORDANCE WITH NFPA 70 USING SUITABLE SUPPORTS AND METHODS APPROVED BY THE AUTHORITY HAVING JURISDICTION. PROVIDE INDEPENDENT SUPPORT FROM BUILDING STRUCTURE. DO NOT PROVIDE SUPPORT FROM RACEWAYS, PIPING, DUCTWORK, OR OTHER SYSTEMS. H. TERMINATE CABLES USING SUITABLE FITTINGS. 1. METAL-CLAD CABLE (TYPE MC):

a. USE LISTED FITTINGS. b. CUT CABLE ARMOR ONLY USING SPECIALIZED TOOLS TO PREVENT DAMAGING CONDUCTORS OR INSULATION. DO NOT USE HACKSAW OR WIRE CUTTERS TO CUT ARMOR. . INSTALL CONDUCTORS WITH A MINIMUM OF 12 INCHES OF SLACK AT EACH OUTLET. J. NEATLY TRAIN AND BUNDLE CONDUCTORS INSIDE BOXES, WIREWAYS, PANELBOARDS AND OTHER EQUIPMENT ENCLOSURES.

K. GROUP OR OTHERWISE IDENTIFY NEUTRAL/GROUNDED CONDUCTORS WITH ASSOCIATED UNGROUNDED CONDUCTORS INSIDE ENCLOSURES IN ACCORDANCE WITH NFPA 70. L. MAKE WIRING CONNECTIONS USING SPECIFIED WIRING CONNECTORS. 1. MAKE SPLICES AND TAPS ONLY IN ACCESSIBLE BOXES. DO NOT PULL SPLICES INTO RACEWAYS OR MAKE SPLICES IN CONDUIT BODIES OR WIRING GUTTERS. 2. REMOVE APPROPRIATE AMOUNT OF CONDUCTOR INSULATION FOR MAKING CONNECTIONS WITHOUT CUTTING, NICKING OR DAMAGING CONDUCTORS.

4. CLEAN CONTACT SURFACES ON CONDUCTORS AND CONNECTORS TO SUITABLE REMOVE CORROSION, OXIDES, AND OTHER CONTAMINATES. DO NOT USE WIRE BRUSH ON PLATED CONNECTOR SURFACES 5. CONNECTIONS FOR ALUMINUM CONDUCTORS: FILL CONNECTORS WITH OXIDE INHIBITING COMPOUND WHERE NOT PRE-FILLED BY MANUFACTURER. M. INSULATE SPLICES AND TAPS THAT ARE MADE WITH UNINSULATED CONNECTORS USING METHODS SUITABLE FOR THE APPLICATION, WITH INSULATION AND MECHANICAL STRENGTH AT LEAST EQUIVALENT TO UNSPLICED CONDUCTORS. N. INSULATE ENDS OF SPARE CONDUCTORS USING VINYL INSULATING ELECTRICAL TAPE.

O. INSTALL FIRESTOPPING TO PRESERVE FIRE RESISTANCE RATING OF PARTITIONS AND OTHER ELEMENTS. P. UNLESS SPECIFICALLY INDICATED TO BE EXCLUDED, PROVIDE FINAL CONNECTIONS TO ALL EQUIPMENT AND DEVICES, INCLUDING THOSE FURNISHED BY OTHERS, AS REQUIRED FOR A COMPLETE OPERATING SYSTEM

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1.01 GROUNDING AND BONDING REQUIREMENTS A. EXISTING WORK: WHERE EXISTING GROUNDING AND BONDING SYSTEM COMPONENTS ARE INDICATED TO BE REUSED, THEY MAY BE REUSED ONLY WHERE THEY ARE FREE FROM CORROSION, INTEGRITY AND CONTINUITY ARE VERIFIED, AND WHERE ACCEPTABLE TO THE AUTHORITY HAVING JURISDICTION. B. DO NOT USE PRODUCTS FOR APPLICATIONS OTHER THAN AS PERMITTED BY NFPA 70 AND PRODUCT LISTING.

C. UNLESS SPECIFICALLY INDICATED TO BE EXCLUDED. PROVIDE ALL REQUIRED COMPONENTS, CONDUCTORS, CONNECTORS, CONDUIT, BOXES, FITTINGS, SUPPORTS, ACCESSORIES, ETC. AS NECESSARY FOR A COMPLETE GROUNDING AND BONDING SYSTEM. D. WHERE CONDUCTOR SIZE IS NOT INDICATED, SIZE TO COMPLY WITH NFPA 70 BUT NOT LESS THAN APPLICABLE MINIMUM SIZE REQUIREMENTS SPECIFIED.

E. GROUNDING SYSTEM RESISTANCE: 1. GROUNDING ELECTRODE SYSTEM: NOT GREATER THAN 5 OHMS TO GROUND, WHEN TESTED ACCORDING TO IEEE 81 USING "FALL-OF-POTENTIAL" METHOD.

F. GROUNDING ELECTRODE SYSTEM: 1. PROVIDE CONNECTION TO REQUIRED AND SUPPLEMENTAL GROUNDING ELECTRODES INDICATED TO FORM GROUNDING ELECTRODE SYSTEM.

a. PROVIDE CONTINUOUS GROUNDING ELECTRODE CONDUCTORS WITHOUT SPLICE OR JOINT. b. INSTALL GROUNDING ELECTRODE CONDUCTORS IN RACEWAY WHERE EXPOSED TO PHYSICAL DAMAGE. BOND GROUNDING ELECTRODE CONDUCTOR TO METALLIC RACEWAYS AT EACH END WITH BONDING JUMPER. 2. PROVIDE ADDITIONAL GROUND ELECTRODE(S) AS REQUIRED TO ACHIEVE SPECIFIED GROUNDING ELECTRODE SYSTEM RESISTANCE.

A. GENERAL REQUIREMENTS: 1. PROVIDE PRODUCTS LISTED, CLASSIFIED, AND LABELED AS SUITABLE FOR THE PURPOSE INTENDED. 2. PROVIDE PRODUCTS LISTED AND LABELED AS COMPLYING WITH UL 467 WHERE APPLICABLE.

B. CONDUCTORS FOR GROUNDING AND BONDING, IN ADDITION TO REQUIREMENTS OF SECTION 26 0526: 1. USE INSULATED COPPER CONDUCTORS UNLESS OTHERWISE INDICATED.

1) USE BARE COPPER CONDUCTORS WHERE INSTALLED UNDERGROUND IN DIRECT CONTACT WITH EARTH. 2) USE BARE COPPER CONDUCTORS WHERE DIRECTLY ENCASED IN CONCRETE (NOT IN RACEWAY).

C. CONNECTORS FOR GROUNDING AND BONDING: 1. DESCRIPTION: CONNECTORS APPROPRIATE FOR THE APPLICATION AND SUITABLE FOR THE CONDUCTORS AND ITEMS TO BE CONNECTED; LISTED AND LABELED AS COMPLYING WITH UL 467.

2. UNLESS OTHERWISE INDICATED, USE EXOTHERMIC WELDED CONNECTIONS FOR UNDERGROUND, CONCEALED AND OTHER INACCESSIBLE CONNECTIONS. 3. UNLESS OTHERWISE INDICATED, USE MECHANICAL CONNECTORS, COMPRESSION CONNECTORS, OR EXOTHERMIC WELDED CONNECTIONS FOR ACCESSIBLE CONNECTIONS.

A. VERIFY THAT WORK LIKELY TO DAMAGE GROUNDING AND BONDING SYSTEM COMPONENTS HAS BEEN COMPLETED. B. VERIFY THAT CONDITIONS ARE SATISFACTORY FOR INSTALLATION PRIOR TO STARTING WORK.

A. PERFORM WORK IN ACCORDANCE WITH NECA 1 (GENERAL WORKMANSHIP). B. GROUND ROD ELECTRODES: UNLESS OTHERWISE INDICATED, INSTALL GROUND ROD ELECTRODES VERTICALLY. WHERE ENCOUNTERED ROCK PROHIBITS VERTICAL INSTALLATION, INSTALL AT 45 DEGREE ANGLE OR BURY HORIZONTALLY IN TRENCH AT LEAST 30 INCHES (750 MM) DEEP IN ACCORDANCE WITH NFPA 70 OR PROVIDE GROUND PLATES. C. MAKE GROUNDING AND BONDING CONNECTIONS USING SPECIFIED CONNECTORS. 1. REMOVE APPROPRIATE AMOUNT OF CONDUCTOR INSULATION FOR MAKING CONNECTIONS WITHOUT CUTTING, NICKING OR DAMAGING CONDUCTORS. DO NOT REMOVE

CONDUCTOR STRANDS TO FACILITATE INSERTION INTO CONNECTOR. 2. REMOVE NONCONDUCTIVE PAINT, ENAMEL, OR SIMILAR COATING AT THREADS, CONTACT POINTS, AND CONTACT SURFACES. 3. EXOTHERMIC WELDS: MAKE CONNECTIONS USING MOLDS AND WELD MATERIAL SUITABLE FOR THE ITEMS TO BE CONNECTED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS

4. MECHANICAL CONNECTORS: SECURE CONNECTIONS ACCORDING TO MANUFACTURER'S RECOMMENDED TORQUE SETTINGS. 5. COMPRESSION CONNECTORS: SECURE CONNECTIONS USING MANUFACTURER'S RECOMMENDED TOOLS AND DIES.

2.03 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.

C. PERFORM GROUND ELECTRODE RESISTANCE TESTS UNDER NORMALLY DRY CONDITIONS. PRECIPITATION WITHIN THE PREVIOUS 48 HOURS DOES NOT CONSTITUTE NORMALLY D. INVESTIGATE AND CORRECT DEFICIENCIES WHERE MEASURED GROUND RESISTANCES DO NOT COMPLY WITH SPECIFIED REQUIREMENTS.

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

A. THE WORK COVERED UNDER THIS SECTION CONSISTS OF THE FURNISHING OF ALL NECESSARY LABOR, SUPERVISION, MATERIALS, EQUIPMENT, AND SERVICES TO COMPLETELY EXECUTE THE SYSTEM OF CONDUIT HANGERS AND SUPPORTS AS DESCRIBED IN THIS SPECIFICATION. B. RATED STRENGTH: ADEQUATE IN TENSION, SHEAR, AND PULLOUT FORCE TO RESIST MAXIMUM LOADS CALCULATED OR IMPOSED FOR THIS PROJECT, WITH A MINIMUM STRUCTURAL SAFETY FACTOR OF FIVE TIMES THE APPLIED FORCE.

A. COORDINATE INSTALLATION OF ROOF CURBS, EQUIPMENT SUPPORTS, AND ROOF PENETRATIONS.

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. GENERAL REQUIREMENTS: 1. PROVIDE ALL REQUIRED HANGERS, SUPPORTS, ANCHORS, FASTENERS, FITTINGS, ACCESSORIES, AND HARDWARE AS NECESSARY FOR THE COMPLETE INSTALLATION OF ELECTRICAL WORK

3. WHERE SUPPORT AND ATTACHMENT COMPONENT TYPES AND SIZES ARE NOT INDICATED, SELECT IN ACCORDANCE WITH MANUFACTURER'S APPLICATION CRITERIA AS REQUIRED FOR THE LOAD TO BE SUPPORTED. INCLUDE CONSIDERATION FOR VIBRATION, EQUIPMENT OPERATION, AND SHOCK LOADS WHERE APPLICABLE. 4. DO NOT USE PRODUCTS FOR APPLICATIONS OTHER THAN AS PERMITTED BY NFPA 70 AND PRODUCT LISTING. 5. STEEL COMPONENTS: USE CORROSION RESISTANT MATERIALS SUITABLE FOR THE ENVIRONMENT WHERE INSTALLED. a. ZINC-PLATED STEEL: ELECTROPLATED IN ACCORDANCE WITH ASTM B633.

- b. GALVANIZED STEEL: HOT-DIP GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH ASTM A123/A123M OR ASTM A153/A153M. B. CONDUIT AND CABLE SUPPORTS: STRAPS, CLAMPS, ETC. SUITABLE FOR THE CONDUIT OR CABLE TO BE SUPPORTED. 1. CONDUIT STRAPS: ONE-HOLE OR TWO-HOLE TYPE; STEEL OR MALLEABLE IRON. 2. CONDUIT CLAMPS: BOLTED TYPE UNLESS OTHERWISE INDICATED
- C. OUTLET BOX SUPPORTS: HANGERS, BRACKETS, ETC. SUITABLE FOR THE BOXES TO BE SUPPORTED. D. METAL CHANNEL (STRUT) FRAMING SYSTEMS: FACTORY-FABRICATED CONTINUOUS-SLOT METAL CHANNEL (STRUT) AND ASSOCIATED FITTINGS, ACCESSORIES, AND HARDWARE REQUIRED FOR FIELD-ASSEMBLY OF SUPPORTS. 1. COMPLY WITH MFMA-4.
- 2. CHANNEL (STRUT) USED AS RACEWAY (ONLY WHERE SPECIFICALLY INDICATED): LISTED AND LABELED AS COMPLYING WITH UL 5B. E. HANGER RODS: THREADED ZINC-PLATED STEEL UNLESS OTHERWISE INDICATED. 1. MINIMUM SIZE, UNLESS OTHERWISE INDICATED OR REQUIRED: a. EQUIPMENT SUPPORTS: 1/2 INCH DIAMETER.
- b. SINGLE CONDUIT UP TO 1 INCH (27 MM) TRADE SIZE: 1/4 INCH DIAMETER F. ANCHORS AND FASTENERS:
- 1. UNLESS OTHERWISE INDICATED AND WHERE NOT OTHERWISE RESTRICTED, USE THE ANCHOR AND FASTENER TYPES INDICATED FOR THE SPECIFIED APPLICATIONS. G. HANGERS, SUPPORTS, ANCHORS, AND FASTENERS - GENERAL: 1. PROTECTIVE ZINC COATING EITHER ELECTRO-PLATED (ASTM B633 SCI OR SC3), PRE-GALVANIZED (ASTM A525 COATING DESIGNATION G90) OR HOT-DIP GALVANIZED
- AFTER FABRICATION (ASTM A123). THE MINIMUM THICKNESS OF ZINC COATING SHALL BE 0.2 MILL (5 MICROMETERS).. H. PROVIDE MATERIALS OF SIZE AND TYPE ADEQUATE TO CARRY THE LOADS OF EQUIPMENT AND CONDUIT, INCLUDING WEIGHT OF WIRE IN CONDUIT I. CONDUIT HANGERS: 1. SHALL HAVE A VERTICAL LOAD LIMIT OF 100 LBS, AND A HORIZONTAL LOAD LIMIT OF 25 LBS.. 2. SHALL BE AVAILABLE WITH EITHER A PLAIN HOLE FOR 1/4" BOLT OR A 1/4-20 THREAD IMPRESSION.
- 3. SHALL BE AVAILABLE FOR 3/8" THROUGH 2" EMT, RIGID, AND ALUMINUM CONDUIT. 4. SHALL BE AVAILABLE PRE-ASSEMBLED WITH MANUFACTURER'S SPECIALTY FASTENERS FOR CONNECTION TO BUILDING STRUCTURES LIKE BEAM, FLANGE, DROP WIRE/ROD, WOOD STRUCTURE, CONCRETE AND ACOUSTICAL TEE GRID. J. WIRE ROPE HANGERS 1. WIRE ROPE HANGER ASSEMBLIES SHALL BE MADE OF GALVANIZED STEEL.
- 2. HANGER SHALL MEET THE FIRE RATING REQUIREMENTS FOR DIN 4102-2 FOR 30 MINUTES AT 30 PERCENT OF RATED LOAD. 3. ROPE HANGERS SHALL HAVE A MINIMUM SAFETY FACTOR OF 5:1. 4. ROPE HANGERS ARE NOT PERMITTED TO SUPPORT CONDUITS. 5. ROPE HANGERS ARE PERMITTED TO HANG LIGHT FIXTURES, WERE APPLICABLE

6. HANGERS SHALL BE FULLY ADJUSTABLE. PART 3 EXECUTION

- 3.01 INSTALLATION A. PROVIDE INDEPENDENT SUPPORT FROM BUILDING STRUCTURE. DO NOT PROVIDE SUPPORT FROM PIPING, DUCTWORK, OR OTHER SYSTEMS. B. UNLESS SPECIFICALLY INDICATED OR APPROVED BY STRATEGIC ENERGY SOLUTIONS, INC., DO NOT PROVIDE SUPPORT FROM SUSPENDED CEILING SUPPORT SYSTEM OR C. UNLESS SPECIFICALLY INDICATED OR APPROVED BY STRATEGIC ENERGY SOLUTIONS, INC., DO NOT PROVIDE SUPPORT FROM ROOF DECK. D. EQUIPMENT SUPPORT AND ATTACHMENT:
- 1. USE METAL FABRICATED SUPPORTS OR SUPPORTS ASSEMBLED FROM METAL CHANNEL (STRUT) TO SUPPORT EQUIPMENT AS REQUIRED. 2. USE METAL CHANNEL (STRUT) SECURED TO STUDS TO SUPPORT EQUIPMENT SURFACE-MOUNTED ON HOLLOW STUD WALLS WHEN WALL STRENGTH IS NOT SUFFICIENT TO RESIST PULL-OUT.
- 3. USE METAL CHANNEL (STRUT) TO SUPPORT SURFACE-MOUNTED EQUIPMENT IN WET OR DAMP LOCATIONS TO PROVIDE SPACE BETWEEN EQUIPMENT AND MOUNTING 4. SECURELY FASTEN FLOOR-MOUNTED EQUIPMENT. DO NOT INSTALL EQUIPMENT SUCH THAT IT RELIES ON ITS OWN WEIGHT FOR SUPPORT.
- E. SECURE FASTENERS ACCORDING TO MANUFACTURER'S RECOMMENDED TORQUE SETTINGS. F. REMOVE TEMPORARY SUPPORTS.

<u>CONDUIT</u> PART 1 GENERAL

- 1.01 DELIVERY, STORAGE, AND HANDLING A. RECEIVE, INSPECT, HANDLE, AND STORE CONDUIT AND FITTINGS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS B. PROTECT CONDUIT FROM CORROSION AND ENTRANCE OF DEBRIS BY STORING ABOVE GRADE. PROVIDE APPROPRIATE COVERING. C. PROTECT PVC CONDUIT FROM SUNLIGHT.
- PART 2 PRODUCTS 2.01 CONDUIT APPLICATIONS
- A. DO NOT USE CONDUIT AND ASSOCIATED FITTINGS FOR APPLICATIONS OTHER THAN AS PERMITTED BY NFPA 70 AND PRODUCT LISTING. B. UNLESS OTHERWISE INDICATED AND WHERE NOT OTHERWISE RESTRICTED, USE THE CONDUIT TYPES INDICATED FOR THE SPECIFIED APPLICATIONS. WHERE MORE THAN ONE LISTED APPLICATION APPLIES, COMPLY WITH THE MOST RESTRICTIVE REQUIREMENTS. WHERE CONDUIT TYPE FOR A PARTICULAR APPLICATION IS NOT SPECIFIED, USE GALVANIZED STEEL RIGID METAL CONDUIT. 2.02 CONDUIT REQUIREMENTS
- A. PROVIDE PRODUCTS LISTED, CLASSIFIED, AND LABELED AS SUITABLE FOR THE PURPOSE INTENDED. B. WHERE CONDUIT SIZE IS NOT INDICATED, SIZE TO COMPLY WITH NFPA 70 BUT NOT LESS THAN APPLICABLE MINIMUM SIZE REQUIREMENTS SPECIFIED. 2.0.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC) A. DESCRIPTION: NFPA 70, TYPE RMC GALVANIZED STEEL RIGID METAL CONDUIT COMPLYING WITH ANSI C80.1 AND LISTED AND LABELED AS COMPLYING WITH UL 6.
- B. FITTINGS: 1. NON-HAZARDOUS LOCATIONS: USE FITTINGS COMPLYING WITH NEMA FB 1 AND LISTED AND LABELED AS COMPLYING WITH UL 514B. 2. MATERIAL: USE STEEL OR MALLEABLE IRON. 3. CONNECTORS AND COUPLINGS: USE THREADED TYPE FITTINGS ONLY. THREADLESS SET SCREW AND COMPRESSION (GLAND) TYPE FITTINGS ARE NOT PERMITTED.
- 2.04 ELEXIBLE METAL CONDUIT (EMC) A. DESCRIPTION: NFPA 70, TYPE FMC STANDARD WALL STEEL FLEXIBLE METAL CONDUIT LISTED AND LABELED AS COMPLYING WITH UL 1, AND LISTED FOR USE IN CLASSIFIED FIRESTOP SYSTEMS TO BE USED. B. FITTINGS: 1. DESCRIPTION: FITTINGS COMPLYING WITH NEMA FB 1 AND LISTED AND LABELED AS COMPLYING WITH UL 514B.

2. MATERIAL: USE STEEL OR MALLEABLE IRON. C. DESCRIPTION: INTERLOCKED STEEL CONSTRUCTION. D. FITTINGS: NEMA FB 1

- 2.05 ELECTRICAL METALLIC TUBING (EMT) A. DESCRIPTION: NFPA 70, TYPE EMT STEEL ELECTRICAL METALLIC TUBING COMPLYING WITH ANSI C80.3 AND LISTED AND LABELED AS COMPLYING WITH UL 797. B. FITTINGS: 1. DESCRIPTION: FITTINGS COMPLYING WITH NEMA FB 1 AND LISTED AND LABELED AS COMPLYING WITH UL 514B. 2. MATERIAL: USE STEEL OR MALLEABLE IRON. 3. CONNECTORS AND COUPLINGS: USE COMPRESSION (GLAND) OR SET-SCREW TYPE. a. DO NOT USE INDENTER TYPE CONNECTORS AND COUPLINGS.
- C. DESCRIPTION: ANSI C80.3; GALVANIZED TUBING. D. FITTINGS AND CONDUIT BODIES: NEMA FB 1; STEEL OR MALLEABLE IRON COMPRESSION TYPE. 2.06 ELECTRICAL NONMETALLIC TUBING (ENT) A DESCRIPTION: NFPA 70, TYPE ENT ELECTRICAL NONMETALLIC TUBING COMPLYING WITH NEMA TC 13 AND LISTED AND LABELED AS COMPLYING WITH UL 1653.
- B. FITTINGS: 1. MANUFACTURER: SAME AS MANUFACTURER OF ENT TO BE CONNECTED. 2. USE SOLVENT-WELDED TYPE FITTINGS.
- 3. SOLVENT-WEIDED FITTINGS: RIGID PVC FITTINGS COMPLYING WITH NEMA TO 3 AND LISTED AND LABELED AS COMPLYING WITH UL 651: SUITABLE FOR USE WITH ENT. PART 3 EXECUTION 3.01 EXAMINATION A. VERIFY THAT MOUNTING SURFACES ARE READY TO RECEIVE CONDUITS.
- B. VERIFY THAT CONDITIONS ARE SATISFACTORY FOR INSTALLATION PRIOR TO STARTING WORK. C. VERIFY ROUTING AND TERMINATION LOCATIONS OF CONDUIT PRIOR TO ROUGH-IN. D. CONDUIT ROUTING IS SHOWN ON DRAWINGS IN APPROXIMATE LOCATIONS UNLESS DIMENSIONED. ROUTE AS REQUIRED TO COMPLETE WIRING SYSTEM.
- 3.02 INSTALLATION A. INSTALL GALVANIZED STEEL RIGID METAL CONDUIT (RMC) IN ACCORDANCE WITH NECA 101. B. INSTALL ELECTRICAL NONMETALLIC TUBING (ENT) IN ACCORDANCE WITH NECA 111. C. CONDUIT SUPPORT
- 1. SECURE AND SUPPORT CONDUITS IN ACCORDANCE WITH NFPA 70 AND SECTION 26 0529 USING SUITABLE SUPPORTS AND METHODS APPROVED BY THE AUTHORITY HAVING JURISDICTION. 2. PROVIDE INDEPENDENT SUPPORT FROM BUILDING STRUCTURE. DO NOT PROVIDE SUPPORT FROM PIPING, DUCTWORK, OR OTHER SYSTEMS. D. CONNECTIONS AND TERMINATIONS:
- 1. USE APPROVED ZINC-RICH PAINT OR CONDUIT JOINT COMPOUND ON FIELD-CUT THREADS OF GALVANIZED STEEL CONDUITS PRIOR TO MAKING CONNECTIONS. 2. WHERE TWO THREADED CONDUITS MUST BE JOINED AND NEITHER CAN BE ROTATED, USE THREE-PIECE COUPLINGS OR SPLIT COUPLINGS. DO NOT USE RUNNING 3. USE SUITABLE ADAPTERS WHERE REQUIRED TO TRANSITION FROM ONE TYPE OF CONDUIT TO ANOTHER.
- I OCATIONS 5. PROVIDE INSULATING BUSHINGS OR INSULATED THROATS AT ALL CONDUIT TERMINATIONS TO PROTECT CONDUCTORS. 6. SECURE JOINTS AND CONNECTIONS TO PROVIDE MAXIMUM MECHANICAL STRENGTH AND ELECTRICAL CONTINUITY.
- ENCLOSED CONDUCTORS OR CONNECTED EQUIPMENT. THIS INCLUDES, BUT IS NOT LIMITED TO: 1. WHERE CONDUITS CROSS STRUCTURAL JOINTS INTENDED FOR EXPANSION, CONTRACTION, OR DEFLECTION. 2. WHERE CONDUITS ARE SUBJECT TO EARTH MOVEMENT BY SETTLEMENT OR FROST. F. CONDENSATION PREVENTION: WHERE CONDUITS CROSS BARRIERS BETWEEN AREAS OF POTENTIAL SUBSTANTIAL TEMPERATURE DIFFERENTIAL, PROVIDE SEALING FITTING OR
- 1. WHERE CONDUITS PASS FROM OUTDOORS INTO CONDITIONED INTERIOR SPACES. 2. WHERE CONDUITS PASS FROM UNCONDITIONED INTERIOR SPACES INTO CONDITIONED INTERIOR SPACES.

# 2. PROVIDE PRODUCTS LISTED, CLASSIFIED, AND LABELED AS SUITABLE FOR THE PURPOSE INTENDED, WHERE APPLICABLE.

4. TERMINATE THREADED CONDUITS IN BOXES AND ENCLOSURES USING THREADED HUBS OR DOUBLE LOCK NUTS FOR DRY LOCATIONS AND RAINTIGHT HUBS FOR WET

E. CONDUIT MOVEMENT PROVISIONS: WHERE CONDUITS ARE SUBJECT TO MOVEMENT, PROVIDE EXPANSION AND EXPANSION/DEFLECTION FITTINGS TO PREVENT DAMAGE TO

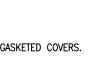
APPROVED SEALING COMPOUND AT AN ACCESSIBLE POINT NEAR THE PENETRATION TO PREVENT CONDENSATION. THIS INCLUDES, BUT IS NOT LIMITED TO:

<u>BOXES</u>

- PART 1 PRODUCTS 1.01 BOXES A. GENERAL REQUIREMENTS:
- 1. DO NOT USE BOXES AND ASSOCIATED ACCESSORIES FOR APPLICATIONS OTHER THAN AS PERMITTED BY NFPA 70 AND PRODUCT LISTING. 2. PROVIDE PRODUCTS LISTED, CLASSIFIED, AND LABELED AS SUITABLE FOR THE PURPOSE INTENDED. 3. WHERE BOX SIZE IS NOT INDICATED, SIZE TO COMPLY WITH NFPA 70 BUT NOT LESS THAN APPLICABLE MINIMUM SIZE REQUIREMENTS SPECIFIED.
- 4. PROVIDE GROUNDING TERMINALS WITHIN BOXES WHERE EQUIPMENT GROUNDING CONDUCTORS TERMINATE. B. OUTLET AND DEVICE BOXES UP TO 100 CUBIC INCHES, INCLUDING THOSE USED AS JUNCTION AND PULL BOXES: 1. USE SHEET-STEEL BOXES FOR DRY LOCATIONS UNLESS OTHERWISE INDICATED OR REQUIRED
- 2. USE CAST IRON BOXES OR CAST ALUMINUM BOXES FOR DAMP OR WET LOCATIONS UNLESS OTHERWISE INDICATED OR REQUIRED; FURNISH WITH COMPATIBLE WEATHERPROOF GASKETED COVERS. 3. USE SUITABLE CONCRETE TYPE BOXES WHERE FLUSH-MOUNTED IN CONCRETE. 4. USE SUITABLE MASONRY TYPE BOXES WHERE FLUSH-MOUNTED IN MASONRY WALLS.
- 5. USE RAISED COVERS SUITABLE FOR THE TYPE OF WALL CONSTRUCTION AND DEVICE CONFIGURATION WHERE REQUIRED. 6. USE SHALLOW BOXES WHERE REQUIRED BY THE TYPE OF WALL CONSTRUCTION. 7. DO NOT USE "THROUGH-WALL" BOXES DESIGNED FOR ACCESS FROM BOTH SIDES OF WALL
- 8. SHEET-STEEL BOXES: COMPLY WITH NEMA OS 1, AND LIST AND LABEL AS COMPLYING WITH UL 514A. 9. CAST METAL BOXES: COMPLY WITH NEMA FB 1, AND LIST AND LABEL AS COMPLYING WITH UL 514A; FURNISH WITH THREADED HUBS.
- 10.BOXES FOR SUPPORTING LUMINAIRES AND CEILING FANS: LISTED AS SUITABLE FOR THE TYPE AND WEIGHT OF LOAD TO BE SUPPORTED; FURNISHED WITH FIXTURE STUD TO ACCOMMODATE MOUNTING OF LUMINAIRE WHERE REQUIRED. 11.BOXES FOR GANGED DEVICES: USE MULTIGANG BOXES OF SINGLE-PIECE CONSTRUCTION. DO NOT USE FIELD-CONNECTED GANGABLE BOXES.
- C. CABINETS AND ENCLOSURES, INCLUDING JUNCTION AND PULL BOXES LARGER THAN 100 CUBIC INCHES: D. COMPLY WITH NEMA 250, AND LIST AND LABEL AS COMPLYING WITH UL 50 AND UL 50E, OR UL 508A. E. BOX LOCATIONS:
- 1. LOCATE BOXES TO BE ACCESSIBLE.
- 2. UNLESS DIMENSIONED, BOX LOCATIONS INDICATED ARE APPROXIMATE. 3. LOCATE BOXES SO THAT WALL PLATES DO NOT SPAN DIFFERENT BUILDING FINISHES. 4. LOCATE BOXES SO THAT WALL PLATES DO NOT CROSS MASONRY JOINTS.
- 5. UNLESS OTHERWISE INDICATED, WHERE MULTIPLE OUTLET BOXES ARE INSTALLED AT THE SAME LOCATION AT DIFFERENT MOUNTING HEIGHTS, INSTALL ALONG A COMMON VERTICAL CENTER LINE. 6. FIRE RESISTANCE RATED WALLS: INSTALL FLUSH-MOUNTED BOXES SUCH THAT THE REQUIRED FIRE RESISTANCE WILL NOT BE REDUCED. H. BOX SUPPORTS: 1. SECURE AND SUPPORT BOXES IN ACCORDANCE WITH NFPA 70 AND SECTION 26 0529 USING SUITABLE SUPPORTS AND METHODS APPROVED BY THE AUTHORITY HAVING JURISDICTION.
- 2. PROVIDE INDEPENDENT SUPPORT FROM BUILDING STRUCTURE EXCEPT FOR CAST METAL BOXES (OTHER THAN BOXES USED FOR FIXTURE SUPPORT) SUPPORTED BY THREADED CONDUIT CONNECTIONS IN ACCORDANCE WITH NFPA 70. DO NOT PROVIDE SUPPORT FROM PIPING, DUCTWORK, OR OTHER SYSTEMS. . INSTALL BOXES PLUMB AND LEVEL. J. FLUSH-MOUNTED BOXES:
- 1. INSTALL BOXES IN NONCOMBUSTIBLE MATERIALS SUCH AS CONCRETE, TILE, GYPSUM, PLASTER, ETC. SO THAT FRONT EDGE OF BOX OR ASSOCIATED RAISED COVER IS NOT SET BACK FROM FINISHED SURFA MORE THAN 1/4 INCH OR DOES NOT PROJECT BEYOND FINISHED SURFACE. 2. INSTALL BOXES IN COMBUSTIBLE MATERIALS SUCH AS WOOD SO THAT FRONT EDGE OF BOX OR ASSOCIATED RAISED COVER IS FLUSH WITH FINISHED SURFACE. 3. REPAIR ROUGH OPENINGS AROUND BOXES IN NONCOMBUSTIBLE MATERIALS SUCH AS CONCRETE, TILE, GYPSUM, PLASTER, ETC. SO THAT THERE ARE NO GAPS OR OPEN SPACES GREATER THAN 1/8 INCH / THE EDGE OF THE BOX. K INSTALL BOXES AS REQUIRED TO PRESERVE INSULATION INTEGRITY
- L. INSTALL PERMANENT BARRIER BETWEEN GANGED WIRING DEVICES WHEN VOLTAGE BETWEEN ADJACENT DEVICES EXCEEDS 300 V. M. INSTALL FIRESTOPPING TO PRESERVE FIRE RESISTANCE RATING OF PARTITIONS AND OTHER ELEMENTS.
- N. CLOSE UNUSED BOX OPENINGS O. INSTALL BLANK WALL PLATES ON JUNCTION BOXES AND ON OUTLET BOXES WITH NO DEVICES OR EQUIPMENT INSTALLED OR DESIGNATED FOR FUTURE USE.

IDENTIFICATION FOR ELECTRICAL SYSTEMS

- PART 1 PRODUCTS 1.01 IDENTIFICATION REQUIREMENT
- A. IDENTIFICATION FOR EQUIPMENT: 1. USE IDENTIFICATION NAMEPLATE TO IDENTIFY EACH PIECE OF ELECTRICAL DISTRIBUTION AND CONTROL EQUIPMENT AND ASSOCIATED SECTIONS, COMPARTMENTS, AND COMPONENTS. a. PANELBOARDS: 1) IDENTIFY POWER SOURCE AND CIRCUIT NUMBER. INCLUDE LOCATION WHEN NOT WITHIN SIGHT OF EQUIPMENT.
- 2) USE TYPEWRITTEN CIRCUIT DIRECTORY TO IDENTIFY LOAD(S) SERVED FOR PANELBOARDS WITH A DOOR. IDENTIFY SPARES AND SPACES USING PENCIL. 3) FOR POWER PANELBOARDS WITHOUT A DOOR, USE IDENTIFICATION NAMEPLATE TO IDENTIFY LOAD(S) SERVED FOR EACH BRANCH DEVICE. DO NOT IDENTIFY SPARES AND SPACES. 2. SERVICE EQUIPMENT:
- a. USE IDENTIFICATION NAMEPLATE TO IDENTIFY EACH SERVICE DISCONNECTING MEANS. b. USE IDENTIFICATION NAMEPLATE AT EACH PIECE OF SERVICE EQUIPMENT TO IDENTIFY THE AVAILABLE FAULT CURRENT AND THE DATE CALCULATIONS WERE PERFORMED. 3. USE IDENTIFICATION LABEL TO IDENTIFY OVERCURRENT PROTECTIVE DEVICES FOR BRANCH CIRCUITS SERVING FIRE ALARM CIRCUITS. IDENTIFY WITH TEXT "FIRE ALARM CIRCUIT". 4. AVAILABLE FAULT CURRENT DOCUMENTATION: USE IDENTIFICATION LABEL TO IDENTIFY THE AVAILABLE FAULT CURRENT AND DATE CALCULATIONS WERE PERFORMED AT LOCATIONS REQUIRING DOCUMENTATION
- NFPA 70, INCLUDING BUT NOT LIMITED TO THE FOLLOWING. a. SERVICE EQUIPMENT.
- b. INDUSTRIAL CONTROL PANELS. c. MOTOR CONTROL CENTERS. d. ELEVATOR CONTROL PANELS
- e. INDUSTRIAL MACHINERY. 5. ARC FLASH HAZARD WARNING LABELS: USE WARNING LABELS TO IDENTIFY ARC FLASH HAZARDS FOR ELECTRICAL EQUIPMENT, SUCH AS SWITCHBOARDS, PANELBOARDS, INDUSTRIAL CONTROL PANELS, METEL SOCKET ENCLOSURES, AND MOTOR CONTROL CENTERS THAT ARE LIKELY TO REQUIRE EXAMINATION, ADJUSTMENT, SERVICING, OR MAINTENANCE WHILE ENERGIZED. B. IDENTIFICATION FOR CONDUCTORS AND CABLES:
- 1. USE IDENTIFICATION NAMEPLATE OR IDENTIFICATION LABEL TO IDENTIFY COLOR CODE FOR UNGROUNDED AND GROUNDED POWER CONDUCTORS INSIDE DOOR OR ENCLOSURE AT EACH PIECE OF FEEDER OR BRANCH-CIRCUIT DISTRIBUTION EQUIPMENT WHEN PREMISES HAS FEEDERS OR BRANCH CIRCUITS SERVED BY MORE THAN ONE NOMINAL VOLTAGE SYSTEM. C. IDENTIFICATION FOR DEVICES 1.02 IDENTIFICATION NAMEPLATES AND LABELS
- A. IDENTIFICATION NAMEPLATES: 1. MATERIALS:
- a. INDOOR CLEAN, DRY LOCATIONS: USE PLASTIC NAMEPLATES. b. OUTDOOR LOCATIONS: USE PLASTIC, STAINLESS STEEL, OR ALUMINUM NAMEPLATES SUITABLE FOR EXTERIOR USE.
- 3. IDENTIFICATION LABELS 1. MATERIALS: USE SELF-ADHESIVE LAMINATED PLASTIC LABELS; UV, CHEMICAL, WATER, HEAT, AND ABRASION RESISTANT 2. TEXT: USE FACTORY PRE-PRINTED OR MACHINE-PRINTED TEXT. DO NOT USE HANDWRITTEN TEXT UNLESS OTHERWISE INDICATED.
- C. NAMEPLATES: ENGRAVED THREE-LAYER LAMINATED PLASTIC, BLACK LETTERS ON WHITE BACKGROUND. D. LABELS: EMBOSSED ADHESIVE TAPE, WITH 3/16 INCH WHITE LETTERS ON BLACK BACKGROUND. USE ONLY FOR IDENTIFICATION OF INDIVIDUAL WALL SWITCHES AND RECEPTACLES, CONTROL DEVICE STATIONS.
- PART 2 EXECUTION 2.01 PREPARATION
- A. CLEAN SURFACES TO RECEIVE ADHESIVE PRODUCTS ACCORDING TO MANUFACTURER'S INSTRUCTIONS. B. DEGREASE AND CLEAN SURFACES TO RECEIVE NAMEPLATES AND LABELS.
- 2.02 INSTALLATION A. INSTALL PRODUCTS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
- B. INSTALL IDENTIFICATION PRODUCTS TO BE PLAINLY VISIBLE FOR EXAMINATION, ADJUSTMENT, SERVICING, AND MAINTENANCE. C. INSTALL IDENTIFICATION PRODUCTS CENTERED, LEVEL, AND PARALLEL WITH LINES OF ITEM BEING IDENTIFIED.
- D. SECURE NAMEPLATES TO EXTERIOR SURFACES OF ENCLOSURES USING STAINLESS STEEL SCREWS AND TO INTERIOR SURFACES USING SELF-ADHESIVE BACKING OR EPOXY CEMENT. E. INSTALL SELF-ADHESIVE LABELS AND MARKERS TO ACHIEVE MAXIMUM ADHESION, WITH NO BUBBLES OR WRINKLES AND EDGES PROPERLY SEALED. F. MARK ALL HANDWRITTEN TEXT, WHERE PERMITTED, TO BE NEAT AND LEGIBLE.



NAKELY ASSOCIATES, INC

30500 VAN DYKE AVENUE

WARREN, MICHIGAN 48093

UNIFIED BUILDING

YSTEMS ENGINEERING

75 N. MAIN ST., SUITE 221

MT. CLEMENS, MI 48043

UBS PROJECT: 007.23.07

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ARCHITECTS

SUITE 209

PH: 586.573.4100

FX: 586.573.0822

www.WakelyAIA.com

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