

ELECTRICAL SYMBOL LEGEND

SOME SYMBOLS AND ABBREVIATIONS ON THIS LEGEND MAY NOT BE USED

CIRCUITING

	HOME RUN (2#12 1#12G UNO)
	INDICATES 2 PHASE, 1 N, & 1 GRD CONDUCTOR
	SPECIAL RUN: INDICATES SHARED CIRCUIT
	HOME RUN: INDICATES #10 CONDUCTORS ENTIRELY

UTILITIES

---	UNDERGROUND ELECTRICAL
---	OVERHEAD ELECTRICAL
---	TELECOMMUNICATIONS CONDUIT
---	UNDERGROUND TELECOMMUNICATIONS CONDUIT

LIGHTING

	GRID-MOUNTED TROFFER LIGHT FIXTURE
	STRIP LIGHT FIXTURE
	SURFACE/RECESSED LIGHT FIXTURE
	WALL-MOUNTED LIGHT FIXTURE
	POLE-MOUNTED LIGHT FIXTURE
	EXIT LIGHT
	BATTERY-OPERATED EMERGENCY LIGHT (WALL MTD)
	BATTERY-OPERATED EMERGENCY LIGHT (CEILING MTD)
	WALL-MOUNTED COMBINATION EXIT LIGHT/ BATTERY-OPERATED EMERGENCY LIGHT
	LIGHT SWITCH - SINGLE POLE
	LIGHT SWITCH - 3-WAY
	LIGHT SWITCH - 4-WAY
	LIGHT SWITCH - KEY
	LIGHT SWITCH - DIMMER
	LIGHT SWITCH - PILOT LIGHT
	LIGHT SWITCH - 2 POLE
	LIGHT SWITCH - 3-WAY DIMMER
	WALL-MOUNTED MOTION SWITCH
	CEILING-MOUNTED MOTION SWITCH
	SWITCHBANK - REFER TO DETAILS
	DIMMER BOARD
	REMOTE CONTROL SWITCH AS SCHEDULED
	TIMECLOCK - REFER TO PLANS / DETAILS

EQUIPMENT

	DISCONNECT SWITCH. RE: PLANS FOR INFORMATION.
	MAGNETIC MOTOR STARTER
	COMBINATION DISCONNECT SWITCH / MOTOR STARTER
	TOGGLE-TYPE DISCONNECT. FURNISH WITH THERMAL MOTOR PROTECTION WHERE SERVING FANS/PUMPS.
	SURFACE PANELBOARD
	RECESSED PANELBOARD
	DISTRIBUTION PANELBOARD
	SWITCHBOARD, FEEDER/MAIN CIRCUIT BREAKER SECTION AND DISTRIBUTION SECTION.

GENERAL SYMBOLS

	INDICATES CONNECT TO EXISTING
	INDICATES ELEVATION
	EQUIPMENT TAG. REFER TO CONNECTIONS SCHEDULE FOR ELECTRICAL CONNECTIONS AND LOAD INFO FOR KITCHEN, SHOP, ETC. EQUIPMENT

POWER DEVICES

	DUPLEX RECEPTACLE
	LINE THRU DEVICE INDICATES ABOVE COUNTER
	SPECIAL DUPLEX RECEPTACLE (GFI, ISOLATED GROUND, ETC.)
	QUADPLEX RECEPTACLE
	SIMPLEX RECEPTACLE W/NEMA CONFIG AS NOTED
	MULTI-POLE RECEPTACLE W/NEMA CONFIG AS NOTED
	CEILING MOUNTED RECEPTACLE
	RECEPTACLE/DEVICE MOUNTED IN "TOMBSTONE"
	POKE-THRU WITH POWER
	POKE-THRU WITH TELECOMMUNICATIONS
	POKE-THRU W/POWER AND TELECOM
	SINGLE GANG FLOOR BOX (2, 3, 4 GANG SIMILAR)
	DIVIDED POWER POLE
	CLOCK RECEPTACLE
	PLUG MOLD / WIRE MOLD AS SPECIFIED
	JUNCTION BOX
	THERMOSTAT - ELECTRIC
	PUSH BUTTON
	MOTOR

TELEPHONE/DATA

	TELEPHONE OUTLET (SINGLE-GANG BOX WITH (1) 3/4" CONDUIT TO ABOVE ACCESSIBLE CEILING)
	LINE THRU DEVICE INDICATES ABOVE COUNTER
	DATA OUTLET (DOUBLE-GANG BOX WITH (2) 3/4" CONDUITS TO ABOVE ACCESSIBLE CEILING)
	TELEPHONE/DATA OUTLET (DOUBLE-GANG BOX WITH (2) 3/4" CONDUITS TO ABOVE ACCESSIBLE CLG.)
	PHONE OUTLET WITH NUMBER OF PHONE JACKS AS INDICATED - SEE DETAILS FOR ADD'L INFO.
	DATA OUTLET WITH NUMBER OF PHONE JACKS AS INDICATED - SEE DETAILS FOR ADD'L INFO.
	PHONE/DATA OUTLET WITH NUMBER OF PHONE/DATA JACKS AS INDICATED - SEE DETAILS FOR ADD'L INFO.
	WALL-MOUNTED WIRELESS INTERNET TRANSMITTER
	CEILING-MOUNTED WIRELESS INTERNET TRANSMITTER

AUDIO/VISUAL

	TELEVISION OUTLET (SINGLE GANG BOX WITH (1) 3/4" CONDUIT TO ABOVE ACCESSIBLE CEILING)
	REVERSE TELEVISION OUTLET - CABLE TO HEAD END
	RECESSED COMBINATION AV AND POWER OUTLET COORD LOCATION OF DEVICE WITH TV MOUNT
	TEACHER'S DESK CONNECTIONS - RE: DETAILS
	WALL SPEAKER
	CEILING SPEAKER
	WALL SPEAKER - HORN TYPE
	CEILING SPEAKER - HORN TYPE
	CEILING SPEAKER - SUBWOOFER
	CEILING SPEAKER - SOUND SYSTEM
	VOLUME CONTROL
	INTERCOM CALL STATION
	INTERCOM HANDSET
	SOUND SYSTEM AUDIO JACK
	REMOTE MICROPHONE CONTROL
	PUBLIC ADDRESS SYSTEM AMPLIFIER
	INTERCOM MASTER STATION

FIRE ALARM

	MANUAL PULL STATION
	CEILING SMOKE DETECTOR
	DUCT SMOKE DETECTOR
	HEAT DETECTOR
	WATERFLOW SWITCH
	TAMPER SWITCH
	WALL-MOUNTED FA STROBE WITH CANDELA RATING. 15cd RATING UNLESS OTHERWISE NOTED ON PLANS.
	WALL-MOUNTED FA HORN
	WALL-MOUNTED FA SPEAKER
	CEILING-MOUNTED FA HORN/STROBE WITH CANDELA RATING. 15cd UNLESS OTHERWISE NOTED ON PLANS.
	CEILING-MOUNTED FA SPEAKER/STROBE WITH CANDELA RATING. 15cd UNLESS OTHERWISE NOTED ON PLANS.
	CEILING-MOUNTED FA STROBE WITH CANDELA RATING. MINIMUM OF 15cd RATING.
	CEILING-MOUNTED FA SPEAKER.
	CEILING-MOUNTED FA HORN/STROBE WITH CANDELA RATING. MINIMUM OF 15cd RATING.
	CEILING-MOUNTED FA SPEAKER/STROBE WITH CANDELA RATING. MINIMUM OF 15cd RATING.
	RELAY
	FIRE ALARM CONTROL PANEL
	FIRE ALARM ANNUNCIATOR PANEL
	REMOTE ANNUNCIATOR PANEL
	FIRE ALARM EXTENDER CABINET
	DOOR HOLDER
	SINGLE / MULTI-STATION 120V SMOKE ALARM
	ZONE ADDRESSABLE MODULE
	INDIVIDUAL ADDRESSABLE MODULE
	KITCHEN HOOD FIRE SUPPRESSION SYSTEM PANEL
	KITCHEN HOOD REMOTE PULL STATION
	AREA OF RESCUE ASSISTANCE STATION
	AREA OF RESCUE ASSISTANCE MASTER STATION

SECURITY

	FIXED CAMERA
	PAN/TILT/ZOOM CAMERA
	PROXIMITY TYPE CARD READER
	SWIPE CARD READER
	ELECTRIC STRIKE
	KEYPAD / MAG LOCK
	BUTTON / MAG LOCK

MECHANICAL AND PLUMBING SYMBOL LEGEND

SOME SYMBOLS AND ABBREVIATIONS ON THIS LEGEND MAY NOT BE USED

SHEET METAL

	HIGH EFFICIENCY ROUND DUCT TAKEOFF (WITH & WITHOUT MANUAL DAMPER)
	SPIN-IN ROUND DUCT TAKEOFF (WITH & WITHOUT MANUAL DAMPER)
	CONICAL BELLMOUTH ROUND TAKEOFF
	ROUND DUCT RUNOUT WITH FLEX DUCT
	DUCTWORK ELBOW (WITH & WITHOUT TURNING VANES)
	FD-FIRE DAMPER
	FS-FIRE/SMOKE DAMPER
	SD-SMOKE DAMPER
	BD-BACKDRAFT DAMPER (GRAVITY)
	AUTOMATIC MOTORIZED DAMPER
	SUPPLY DIFFUSER AND DIFFUSER CALLOUT (NECK SIZE, TYPE AND CFM)
	LINEAR/SLOT DIFFUSER
	RETURN GRILLE OR EXHAUST REGISTER
	SUPPLY AIR FLOW INDICATOR
	RETURN AND EXHAUST AIR FLOW INDICATOR
	THERMOSTAT
	TEMPERATURE SENSOR
	HUMIDISTAT
	CONTROL WIRING

PLUMBING FIXTURES/EQUIPMENT

	HOSE BIBB
	WALL HYDRANT
	CLEAN OUT
	REDUCED PRESSURE BACKFLOW PREVENTER
	DOUBLE CHECK BACKFLOW PREVENTER
	PLUMBING FIXTURE AND CALLOUT
	FD: FLOOR DRAIN, AD: AREA DRAIN, FS: FLOOR SINK
	RD: ROOF DRAIN
	ORD: OVERFLOW ROOF DRAIN

GENERAL SYMBOLS

	INDICATES CONNECT TO EXISTING
	INDICATES ELEVATION
	EQUIPMENT TAG. REFER TO CONNECTIONS SCHEDULE FOR MECHANICAL CONNECTIONS AND LOAD INFO FOR KITCHEN, SHOP, ETC. EQUIPMENT

MECHANICAL PIPING

RL	REFRIGERANT LIQUID
RS	REFRIGERANT SUCTION
D	DRAIN (CONDENSATE)
CA	COMPRESSED AIR
CWS	CHILLED WATER SUPPLY
CWR	CHILLED WATER RETURN
C/HWS	CHILLED/HOT WATER SUPPLY
C/HWR	CHILLED/HOT WATER RETURN
HWS	HOT WATER SUPPLY
HWR	HOT WATER RETURN
CTWS	COOLING TOWER SUPPLY
CTWR	COOLING TOWER RETURN
STM	STEAM (ANY #S DENOTE PRESSURE)
CR	CONDENSATE RETURN (#S DENOTE PRESSURE)
RV	REFRIGERANT VENT
RD	RUPTURE DISK

PLUMBING PIPING

---	DOMESTIC COLD WATER
---	DOMESTIC HOT WATER
---	RECIRCULATING DOMESTIC HOT WATER
SAN	WASTE ABOVE GRADE OR FLOOR
SAN	WASTE BELOW GRADE OR FLOOR
ST	STORM ABOVE GRADE OR FLOOR
ST	STORM BELOW GRADE OR FLOOR
ST/O	STORM OVERFLOW ABOVE GRADE OR FLOOR
ST/O	STORM OVERFLOW BELOW GRADE OR FLOOR
V	PLUMBING VENT
W	WATER SERVICE
G	GAS (NATURAL)
PD	FROM SUMP PUMP DISCHARGE
CA	COMPRESSED AIR
LP	PROPANE
SCW	SOFT DOMESTIC COLD WATER
SHW	SOFT DOMESTIC HOT WATER
SRW	SOFT RECIRCULATING HOT WATER
ACID	ACID WASTE
---	VACID
NP	NON-POTABLE
DI	DEIONIZED WATER
RO	REVERSE OSMOSIS WATER

PLUMBING RISER CALLOUT (REFERS TO RISER DIAGRAM)

	PLUMBING RISER CALLOUT (REFERS TO RISER DIAGRAM)
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PIPING SYMBOLS

	SHUTOFF VALVE
	SHUTOFF VALVE IN RISER
	BALANCING VALVE
	PLUG VALVE
	AUTO FLOW CONTROL VALVE
	PIPING ELBOW UP
	PIPING ELBOW DOWN
	PIPING TEE
	PIPING TEE UP
	PIPING TEE DOWN
	REDUCER / REDUCER
	UNION
	CAP
	PIPE FLEX
	STRAINER
	CHECK VALVE
	INLINE STRAINER
	TEST PLUG
	GUIDE
	ANCHOR
	TRIPLE DUTY VALVE
	AUTOMATIC 2-WAY CONTROL VALVE
	AUTOMATIC 3-WAY CONTROL VALVE
	SOLENOID VALVE

PIPING SPECIALTIES

	PRESS / TEMP GAUGE WITH COCK
	THERMOMETER
	PRESSURE REDUCING VALVE
	RELIEF VALVE
	WATER HAMMER ARRESTOR

FIRE SPRINKLER

	FIRE PROTECTION PIPING
	SPRINKLER HEAD
	SIDEWALL SPRINKLER HEAD
	FIRE PROTECTION SIMASE CONNECTION
	POST INDICATOR VALVE

COORDINATION NOTES

- COORDINATE REQUIREMENTS FOR INSTALLATION OF SYSTEMS AND EQUIPMENT WITH ALL OTHER TRADES.
- THE CONTRACTOR SHALL COORDINATE THE ROUTING AND PATH OF ALL SYSTEMS, CONDUITS, PIPES, DUCTS, ETC WITH THE POSITION AND LAYOUT OF THE STRUCTURE. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING NECESSARY OFFSETS, TURNS, RISES AND DROPS FOR SYSTEMS AND COMPONENTS AS NEEDED TO INSTALL THE MEP SYSTEMS TO CLARE STRUCTURE, CEILINGS, ETC AND OTHER SYSTEMS IN POTENTIAL CONFLICT WITH ROUTING.
- COORDINATE WORK WITH OTHER TRADES TO INSTALL SYSTEMS ABOVE CEILING HEIGHTS INDICATED ON ARCHITECTURAL PLANS.
- CHECK SPACE REQUIREMENTS WITH OTHER TRADES AND STRUCTURE/CONSTRUCTION TO ENSURE THAT ALL MATERIALS AND EQUIPMENT CAN BE INSTALLED IN THE SPACE ALLOTTED INCLUDING FINISHED SUSPENDED CEILINGS AND OTHER SPACES, CHASES, ETC WITHIN THE BUILDING. MAKE MODIFICATIONS THERETO AS REQUIRED AND APPROVED.
- TRANSMIT TO OTHER TRADES ALL INFORMATION REQUIRED FOR WORK TO BE PROVIDED UNDER THEIR RESPECTIVE SECTIONS IN AMLE TIME FOR INSTALLATION.
- WHEREVER WORK INTERCONNECTS WITH WORK OF OTHER TRADES, COORDINATE WITH THOSE TRADES TO ENSURE THAT ALL SUBCONTRACTORS HAVE THE INFORMATION NECESSARY SO THAT THEY MAY PROPERLY INSTALL ALL CONNECTIONS AND EQUIPMENT. IDENTIFY ALL ITEMS OF WORK THAT REQUIRE ACCESS SO THAT THE CEILING TRADE WILL KNOW WHERE TO INSTALL ACCESS DOORS AND PANELS.
- COORDINATE, PROJECT AND SCHEDULE WORK WITH OTHER TRADES IN ACCORDANCE WITH THE CONSTRUCTION SEQUENCE.
- DRAWINGS SHOW THE GENERAL RUNS OF CONDUITS, PIPING AND DUCTWORK AND APPROXIMATE LOCATION OF OUTLETS. ANY SIGNIFICANT CHANGES IN LOCATION OF ITEMS NECESSARY IN ORDER TO MEET FIELD CONDITIONS SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE ARCHITECT/ENGINEER AND RECEIVE HIS APPROVAL BEFORE SUCH ALTERATIONS ARE MADE. ALL SUCH MODIFICATIONS SHALL BE MADE WITHOUT ADDITIONAL COST TO THE OWNER.
- CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTION AND REPAIR OF SURFACES, AREAS AND PROPERTY THAT MAY BE DAMAGED AS A RESULT OF CONSTRUCTION ACTIVITIES.
- ADJUST LOCATION OF PIPING, DUCTWORK, ETC. TO PREVENT INTERFERENCES, BOTH ANTICIPATED AND UNENCOUNTERED. DETERMINE THE EXACT ROUTE AND LOCATION OF EACH ITEM PRIOR TO FABRICATION. MAKE OFFSETS, TRANSITIONS AND CHANGES IN DIRECTION IN SYSTEMS AS REQUIRED TO MAINTAIN ADEQUATE CLEARANCES AND HEADROOM.
- WHEREVER THE WORK IS OF SUFFICIENT COMPLEXITY, PREPARE ADDITIONAL COORDINATION DRAWINGS AND ORGANIZE ON-SITE MEETINGS WITH ALL RELATED SUBCONTRACTORS TO COORDINATE THE WORK BETWEEN TRADES. DRAWINGS SHALL CLEARLY SHOW THE WORK AND ITS RELATION TO THE WORK OF OTHER TRADES, AND BE SUBMITTED FOR REVIEW PRIOR TO COMMENCING SHOP FABRICATION OR ERECTION IN THE FIELD.
- COORDINATE WITH LOCAL UTILITY PROVIDERS FOR THEIR REQUIREMENTS FOR SERVICE CONNECTIONS AND PROVIDE ALL NECESSARY PAYMENTS, MATERIALS, LABOR AND TESTING TO ACCOMPLISH THE WORK.
- COORDINATE THE MOUNTING OF SUSPENDED LIGHT FIXTURES UTILIZING INDIRECT LIGHT SO THAT CONDUIT, DUCTWORK, STRUCTURAL MEMBERS, ETC. ARE NOT LOCATED DIRECTLY ABOVE THE LIGHT FIXTURE. MAINTAIN A MINIMUM OF 24" CLEARANCE FROM THESE ITEMS WHENEVER POSSIBLE.

FIRE SEALING NOTES

- COORDINATE CONSTRUCTION OF OPENINGS AND PENETRATING ITEMS TO ENSURE THAT THROUGH-PENETRATION FIRESTOP SYSTEMS ARE INSTALLED ACCORDING TO SPECIFIED AND APPLICABLE UL REQUIREMENTS.
- COORDINATE SIZING OF SLEEVES, OPENINGS, CORE-DRILLED HOLES, OR CUT OPENINGS TO ACCOMMODATE THROUGH-PENETRATION FIRESTOP SYSTEMS.
- DO NOT COVER UP THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATIONS UNTIL EXAMINED BY INSPECTOR, IF REQUIRED BY AUTHORITIES HAVING JURISDICTION.
- COMPATIBILITY: PROVIDE THROUGH-PENETRATION FIRESTOP SYSTEMS THAT ARE COMPATIBLE WITH ONE ANOTHER; WITH THE SUBSTRATES FORMING OPENINGS; AND WITH THE ITEMS, IF ANY, PENETRATING THROUGH-PENETRATION FIRESTOP SYSTEMS, UNDER CONDITIONS OF SERVICE AND APPLICATION, AS DEMONSTRATED BY TESTING-PENETRATION FIRESTOP SYSTEM MANUFACTURER BASED ON TESTING AND FIELD EXPERIENCE.
- PROVIDE COMPONENTS FOR EACH THROUGH-PENETRATION FIRESTOP SYSTEM THAT ARE NEEDED TO INSTALL FILL MATERIALS. USE ONLY COMPONENTS SPECIFIED BY THROUGH-PENETRATION FIRESTOP SYSTEM MANUFACTURER AND APPROVED BY QUALIFIED TESTING AND INSPECTING AGENCY FOR FIRESTOP SYSTEMS INDICATED.
- PROVIDE SLEEVES THROUGH ALL FIRE-RATED WALLS AND FILL VOIDS SURROUNDING SLEEVES AND INTERIOR TO SLEEVES AROUND PIPING WITH FIRE STOP PUTTY WITH UL LISTED 3 HOUR RATING INSTALLED AS PER MANUFACTURERS RECOMMENDATIONS.
- FIRE SEAL ALL PIPING, CONDUIT, CABLE, ETC PENETRATIONS ROUTED THROUGH FIRE RATED WALLS.
- PROVIDE FIRE RATED ENCLOSURES OR WRAPS ON LIGHT FIXTURES AND OTHER ITEMS PENETRATING FIRE RATED CEILINGS, FLOOR/CEILING/ CEILING/ROOF ASSEMBLIES TO MAINTAIN UL LISTING FOR CONSTRUCTION.

GENERAL ELECTRICAL NOTES

- COMPLETE INSTALLATION SHALL BE IN ACCORDANCE WITH THE LATEST ADOPTED VERSION OF THE NATIONAL ELECTRICAL CODE, LOCAL AND STATE CODES, AND REQUIREMENTS OF THE AHJ.
- COORDINATE LOCATIONS OF RECEPTABLES, SWITCHES, ETC. WITH ARCHITECTURAL CASEWORK AND ELEVATIONS.
- REFER TO MOUNTING HEIGHTS DETAIL FOR MOUNTING HEIGHTS OF ALL DEVICES NOT INDICATED OTHERWISE.
- PROVIDE ALL EMPTY CONDUITS WITH PULL STRINGS AND BUSHED ENDS.
- CONTRACTOR SHALL CONCEAL ALL CONDUIT, FITTINGS, AND DEVICES FROM VIEW WHERE REASONABLY POSSIBLE.

ABBREVIATIONS

A/E	ARCHITECT / ENGINEER	ELEV	ELEVATION	MH	MANHOLE
AF	ABOVE FINISHED FLOOR	EM	EMERGENCY FIXTURE/DEVICE	MLO	MAIN LUGS ONLY
AFG	ABOVE FINISHED GRADE	ENT	ENTERING WATER TEMPERATURE	NFA	NET FREE AREA
AG	ABOVE GRADE	EX	EXISTING ITEM	NL	NIGHT LIGHT
AHJ	AUTHORITY HAVING JURISDICTION	FX	FROM FLOOR ABOVE	OA	OUTSIDE AIR
AHU	AIR HANDLING UNIT	FFB	FROM FLOOR BELOW	ORD	OVERFLOW ROOF DRAIN
ARCH	ARCHITECT	FFCO	FINISHED FLOOR CLEAN OUT	P/C	PLUMBING CONTRACTOR
BFP	BACKFLOW PREVENTER	FGCO	FLUSH GRADE CLEAN OUT	PSI	POUNDS PER SQUARE INCH
BG	BELOW GRADE	FL	FLOW LINE	PVC	POLYVINYLCHLORIDE
BLDG	BUILDING	FLR	FLOOR	RA	RETURN AIR
BMS	BUILDING MANAGEMENT SYSTEM	FR	FIRE PROTECTION	REF/RE	REFER / REFERENCE
C	CONDUIT	FPM	FEET PER MINUTE	REL	RELIEF FAN
CD	CANDELA	FWCO	FLUSH WALL CLEAN OUT	RL	RELOCATED ITEM
CG	COLD DECK	G	GROUND / GANG	RPZ	REDUCED PRESSURE ZONE
CLG	COOLING	G/C	GENERAL CONTRACTOR	RR	RESTROOM
CM	COORDINATE MOUNTING HEIGHT	GFI	GROUND FAULT CIRCUIT INTERRUPTER	SA	SUPPLY AIR
CN	CLEAN OUT	GPM	GALLONS PER MINUTE	SPD	SURGE PROTECTIVE DEVICE
CTE	CONNECT TO EXISTING	HD	HOT DECK	ST	TRANSFER AIR
DCV	DOUBLE CHECK VALVE ASSEMBLY	HT	HEATING	TFA	TO FLOOR ABOVE
DCC	DOMESTIC COLD WATER	IG	ISOLATED GROUND	TFB	TO FLOOR BELOW
DOW	DIRECT DIGITAL CONTROLS	JB	JUNCTION BOX	TP	TAMPERPROOF
DF	DRINKING FOUNTAIN	LD	LIGHT EMITTING DIODE	TP	TYPICAL
DHW	DOMESTIC HOT WATER	LWT	LEAVING WATER TEMPERATURE	UNO	UNLESS NOTED OTHERWISE
DHWR	DOMESTIC HOT WATER RETURN	M/C	MECHANICAL CONTRACTOR	VRF	VARIABLE REFRIGERANT FLOW
DM	DAMPER	MA	MIXED AIR	VTR	VENT THROUGH ROOF
DN	DOWN	MAU	MAKE UP AIR UNIT	WCO	WALL CLEANOUT
E/C	ELECTRICAL CONTRACTOR	MCB	MAIN CIRCUIT BREAKER	WG	WIRE GUARD
EA	EXHAUST AIR	MECH	MECHANICAL	WP	WEATHERPROOF
EDF	ELECTRIC DRINKING FOUNTAIN				

SHEET INDEX

MEP000	COVER SHEET
MEP100	GENERAL MEP SPECIFICATIONS
MEP101	ELECTRICAL SPECIFICATIONS

DE100	FIRST FLOOR PLAN - ELECTRICAL DEMOLITION
E100	FIRST FLOOR PLAN - LIGHTING
E200	FIRST FLOOR PLAN - POWER
E300	ELECTRICAL SCHEDULES/DETAILS



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NO.	ISSUE DESCRIPTION	DATE

NO.	REVISION DESCRIPTION	DATE

GENERAL MECHANICAL/ELECTRICAL SPECIFICATIONS

GENERAL MECHANICAL, ELECTRICAL AND PLUMBING REQUIREMENTS

1. **APPLICABILITY**
- A. These general requirements apply to all divisions (21, 22, 23, 26, 27, 28). Refer to individual divisions as included for specific information regarding each trade or scope of work.
2. **GENERAL REQUIREMENTS**
- A. Furnish & install all labor & materials required for complete, functioning, mechanical & plumbing systems w/ all associated equipment & apparatus as shown on plans.
- B. Obtain & pay for all permits required for execution of this work & shall make arrangements for modifications to water, gas & sewer connections to building as required.
- C. All materials shall be new & shall bare UL label where applicable.
- D. Visit site & observe conditions under which work will be done. Any discrepancies shall be called to architect's attention. No subsequent allowance will be made in contract for any error or negligence on contractor's part.
- E. Final acceptance of work shall be subject to condition that all systems, equipment, apparatus & appliances operate satisfactorily as designed & intended. Work shall include required adjustment of systems & control equipment installed under these specifications.
- F. Warrant to owner quality of materials, equipment, workmanship & operation of equipment provided under these specifications for one year from & after completion of building & acceptance of mechanical systems by owner.
- G. All materials installed in plenums shall be noncombustible or have flame/smoke index of no more than 25/50 in accordance w/ ASTM E 84.
- H. Requirements under Division one & general & supplementary conditions of these specifications shall be part of this section. Contractor shall become thoroughly acquainted w/ its contents as to requirements that affect this Division of work required under this section includes material, Equipment, appliances, Transportation, Services, & labor required to complete entire system as required by drawings & specifications.
- I. The specifications & drawings for project are complementary, & portions of work described in one, shall be provided as if described in both. In event of discrepancies, notify engineer & request clarification prior to proceeding w/ work involved.
3. **EXTENT OF CONTRACT WORK**
- A. Provide MEP systems indicated on drawings, specified or reasonably implied. In addition to specific equipment called out in plans and specified, provide & install every device, component, programming, interlocking and accessory necessary for proper operation and completion of total functional MEP systems.
- B. In no case will claims for "Extra Work" be allowed for work about which Contractor could have been informed before bids were taken.
- C. Contractor shall become familiar with equipment provided by other contractors that require plumbing connections and controls.
- D. Electrical work required to install and control plumbing equipment, which is not shown on plans or specified under Division 26, shall be included in Contractor's base bid proposal.
- E. All automatic temperature control devices shall be mounted as indicated in automatic temperature control section of specifications.
- F. The cost of larger wiring, conduit, control and protective devices resulting from installation of equipment which was not used for basis of design as outlined in specifications shall be paid for by the supplying Contractor at no cost to Owner or Architect Engineer.
- G. Contractor shall be responsible for providing supervision to other trade Contractors to insure that required connections, interlocking and interconnection of MEP equipment is made to attain intended control sequences and system operation.
- H. Contractor shall obtain complete MEP data on shop drawings and shall list this data on an approved form that shall be presented on request, to other trade Contractors. Data shall be complete with wiring diagrams received to date and shall contain necessary data on electrical components of plumbing equipment such as HP, voltage, amperes, watts, locked rotor current to allow other trade Contractors to order support or other equipment coordinated as required in his contract.
4. **DEFINITIONS**
- A. Whenever used in these specifications or drawings, following terms shall have indicated meanings:
- B. Furnish: term "Furnish" is used to mean "supply & deliver to project site. Ready for unloading, unpacking, assembly. Installation at similar operations.
- C. Install: term "Install" is used to describe operations at project site including actual unloading, unpacking, Assembly, Erection, Placing, Anchoring, Applying, working to dimension, Finishing, curing, protecting, cleaning, & similar operations."
- D. Provide: term "Provide" means "to Furnish & Install. Complete & ready for intended use." furnished by owner or furnished by others: item will be furnished by owner or others. It is to be installed & connected under requirements of this Division, complete & ready for operation, including items incidental to work, including services necessary for proper installation & operation. Installation shall be included under guarantee required by this Division.
- E. Engineer: where referenced in this Division, "Engineer" is engineer of record & design professional for work under this Division, & is consultant to, & authorized representative of, architect. As defined in general &/or supplementary conditions. When used in this Division, It means increased involvement by, & obligations to, engineer, in addition to involvement by, & obligations to, "Architect".
- F. AHJ: local code &/or inspection agency (authority) having jurisdiction over work.
- G. The terms "Approved equal," "Equivalent," Or "Equal" are used synonymously & shall mean "accepted by or acceptable to engineer as equivalent to item or manufacturer specified".
- H. The term "approved" shall mean labeled, listed, Or both. By nationally recognized testing laboratories (e.g. UL, ETL, CSA, & acceptable to AHJ over this project.
5. **PREBID SITE VISIT**
- A. Prior to submitting bid, Visit site of proposed work & become fully informed as to conditions under which work is to be done. Failure to do so will not be considered sufficient justification to request or obtain extra compensation over & above contract price.
6. **MATERIAL & WORKMANSHIP**
- A. Provide new material, equipment, & apparatus under this contract unless otherwise stated herein. Of best quality normally used for purpose in good commercial practice & free from defects. Model numbers listed in specifications or shown on drawings are not necessarily intended to designate required trim, written descriptions of trim govern model numbers.
- B. Pipes, fittings, specialties & valves shall be manufactured in USA. Work performed under this contract shall provide neat & "workmanlike" appearance when completed to satisfaction of architect & engineer. Workmanship shall be finest possible by experienced mechanics. Installations shall comply w/ applicable codes & laws. Complete installation shall function as designed & intended w/ respect to efficiency, capacity, noise level, etc. Abnormal noise caused by rattling equipment, piping, ducts, air devices & squeaks in rotating components will not be acceptable. In general materials & equipment shall be of commercial specification grade in quality. Light duty & residential equipment is not acceptable.
- C. Remove from premises waste material present from work, including cartons, crating, paper, stickers, &/or excavation material not used.
- D. Clean equipment installed under this contract to present neat & clean installation at completion.
- E. Repair or replace public & private property damaged as result of work performed under this contract to satisfaction of authorities & regulations having jurisdiction.
7. **COORDINATION**
- A. Coordinate work w/ other trades so various components of systems will be installed at proper time will fit available space & will allow proper service access for maintenance. Components which are installed without regard to above shall be relocated at no additional cost to owner.
- B. Obtain equipment submittal information for all pieces of equipment to be connected to from other trades that clearly indicates all connection requirements, locations, sizes, and similar requirements. Obtain this information in ample time to coordinate other trade submittals and equipment coordination. Where requirements differ from that on plans or differs from provisions made in the work, immediately notify the architect/engineer. Do not proceed with work that is incompatible with equipment provided.
- C. Unless otherwise indicated, general contractor will provide chases & openings in building construction required for installation of systems specified herein. Contractor shall furnish general contractor w/ information where chases & openings are required.

- D. Keep informed as to work of other trades engaged in construction of project & execute work in manner as to not interfere w/ or delay work of other trades. Figured dimensions shall be taken in preference to scale dimensions.
- E. Contractor shall take his own measurements at building, as variations may occur. Contractor will be held responsible for errors that could have been avoided by proper checking & inspection.
- F. Provide materials w/ trim that will properly fit types of ceiling, wall, Or floor finishes actually installed. Model numbers listed in specifications or shown on drawings are not intended to designate required trim.
- G. Coordinate construction operations included in different sections of the specifications to ensure efficient and orderly installation of each part of the work. Coordinate construction operations, included in different sections, that depend on each other for proper installation, connection, and operation.
- H. Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the work. Each contractor shall coordinate its operations with operations, included in different sections, that depend on each other for proper installation, connection, and operation.
- I. Schedule construction operations in sequence required to obtain the best results where installation of one part of the work depends on installation of other components, before or after its own installation.
- J. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
- K. Make adequate provisions to accommodate items scheduled for later installation.
- L. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
- M. Prepare coordination drawings if limited space availability necessitates maximum utilization of space for installation of different components or if coordination is required for installation of products and materials fabricated by separate entities. Content: project-specific information, drawn accurately to scale. Do not base coordination drawings on reproductions of the contract documents or standard printed data. Include the following information, as applicable:
- 1) Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
- 2) Indicate required installation sequences.
- 3) Indicate dimensions shown on the contract drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the project.
- N. Meetings: conduct project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
- 1) Attendees: each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at the meetings. All participants at the conference shall be familiar with project and authorized to conclude matters relating to the work. Notify architect of meeting.
- 2) Agenda: review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress.
- 3) Combined contractor's construction schedule: review progress since the last coordination meeting. Determine whether each contractor is on time, ahead or behind schedule, in relation to construction schedule. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the contract time. Discuss impact of various contractor schedules upon other contractors and how to remedy impacts.
- 4) Review present and future needs of each contractor present
- O. After shop drawings have been reviewed and approved by all parties, transmit a set of submittals to each other trade (eg Plumbing, Mechanical, Electrical, Controls, etc.) that will interface with installation. Each other contractor shall review the submittal for coordination and return a stamped submittal indicating they have reviewed the submittal for coordination purposes.
8. **ARCHITECTURAL VERIFICATION AND RELATED DOCUMENTS**
- A. Contractor shall consult all Architectural Drawings and specifications in their entirety incorporating and certifying all millwork, furniture, and equipment rough-in including utility characteristics such as voltage, phase, amperage, pipe sizes, duct sizes, including height, location and orientation. Shop drawings incorporating these requirements should be submitted to the Architect for approval prior to installation or rough in.
9. **ORDINANCES & CODES**
- A. Work performed under this contract shall, At minimum, be in conformance w/ applicable national, state & local codes having jurisdiction.
- B. Installation work performed under this contract shall be in strict compliance w/ current applicable codes adopted by local AHJ including any amendments & use standards as set forth by National Fire Protection Association, Underwriters Laboratories (UL), Occupational Safety & Health Administration (OSHA), American Society of Mechanical Engineers (ASME), American Society of Heating, Refrigeration, & Air Conditioning Engineers (ASHRAE), American National Standards Institute (ANSI), American Society of Testing Materials (ASTM) & other national standards & codes where applicable.
- C. Where contract documents exceed requirements of referenced codes. Standards, etc., contract documents shall take precedence.
- D. Procure & pay for permits & licenses required for accomplishment of work herein described. Where required, obtain. Pay for & furnish certificates of inspection to owner. Contract documents will be held responsible for violations of law.
10. **STANDARDS**
- A. Drawings and specifications indicate minimum construction standard. Should any work indicated be sub standard to any ordinances, laws, codes, rules or regulations bearing on work, Contractor shall promptly notify Architect Engineer in writing before proceeding with work so that necessary changes can be made. However, if the Contractor proceeds with work knowing it to be contrary to any ordinances, laws, rules, and regulations, Contractor shall thereby have assumed full responsibility for and shall bear all costs required to correct non complying work.
11. **PROTECTION OF EQUIPMENT & MATERIALS**
- A. Store & protect from damage equipment & materials delivered to job site. Cover as required to protect from dirt & damage. Plug or cap open ends of ductwork & piping systems while stored & installed during construction when not in use to prevent entrance of debris into systems. Equipment & material that has been damaged by construction activities will be rejected, & contractor is obligated to furnish new equipment & material of like kind. Keep premises broom clean from foreign material created during work performed under this contract. Piping, equipment, etc. Shall have neat & clean appearance at completion.
12. **SUBSTITUTIONS**
- A. The base bid shall include only products from manufacturers specifically named in drawings & specifications. No substitute will be considered prior to receipt of bids unless written request for approval to bid has been received by engineer at least ten calendar days prior to date for receipt of bids. Request shall include name of material or equipment for substitution & complete description of proposed substitute including drawings, cuts, performance & test data & other information for evaluation. Statement setting forth changes in other materials, equipment or other work that incorporation of substitute would require shall be included.
- B. The intent of these specifications is to allow ample opportunity for Contractor to use his ingenuity and abilities to perform the work to his and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.
- C. Material and equipment installed under this contract shall be first class quality, new, unused and without damage.
- D. In general, these specifications identify required materials and equipment by naming one or more manufacturer's brand, model, catalog number and/or other identification. The first named manufacturer or product is used as the basis for design; other manufacturers named must furnish products consistent with specifications of first named product as determined by Engineer. Base bid proposal shall be based only on materials and equipment by manufacturers named, except as hereinafter provided.
- E. Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to Architect Engineer for review prior to procurement.
- F. Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color as

determined by Architect Engineer whose decision shall be final and without further recourse. Physical scale of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by complete descriptive and technical data including manufacturer's name, model and catalog number, photographs or cuts, physical dimensions, operating characteristics and any other information needed for comparison.

G. The burden of proof of merit of proposed substitute is upon proposer. Engineer's decision of approval or disapproval to bid of proposed substitution shall be final. Terms approved, "approved equal," and "equal" refer to approval by engineer as an acceptable alternate bid. No substitutions will be considered that are not bid as an alternate.

H. No material substitutions shall be considered for approval after to award of contract. Coordinate & verify w/ other trades whether or not substituted equipment can be installed as shown on construction drawings without modification to associated systems or architectural or engineering design. Include additional costs for architectural & engineering design fees in bid if drawing modifications are required because of substituted equipment.

13. **SHOP DRAWINGS**
- A. Equipment to be furnished under this contract, items requiring coordination between contractors & sheet metal ductwork fabrication drawings. Before submitting shop drawings verify equipment submitted is mutually compatible & suitable for intended use & will fit available space & allow ample room for maintenance. Engineer's checking & subsequent approval of such shop drawings will not relieve contractor from responsibility for errors in dimensions, details, size of members, quantities, omissions of components or fittings; coordination of electrical requirements; or for coordinating items w/ actual building conditions. Proceed w/ procurement & installation of equipment only after receiving approved shop drawings relative to each item.
- B. Submittal data shall be neatly organized, identified & indexed. Each item or model number shall be clearly marked & accessories indicated. Label catalog data w/ equipment identification acronym or number as used on drawings & include performance curves, capacities, sizes, materials, finishes, wiring diagrams & deviations from specified equipment or materials. Mark out incompatible items. Shop drawings will be returned without review if above mentioned requirements are not met.
- C. Requirements shall be met electronically & submitted as pdf in files less than 10mb.
- D. Contractor's stamp, which shall certify that stamped drawings have been checked by contractor, comply w/ drawings & specifications, & have been coordinated w/ other trades.
- E. Transmit submittals as early as required to support project schedule. Allow for two weeks a review time, plus duplication of this time for resubmittals, if required. Transmit submittals as soon as possible after notice to proceed & before construction starts. Engineer's submittal reviews will not relieve contractor from responsibility for errors in dimensions, details, size of members, or quantities; or for omitting components or fittings; or for not coordinating items w/ actual building conditions.
- F. Final copies shall be furnished to owner as part of O&M documents in hard & electronic formats.
14. **OPERATION & MAINTENANCE INSTRUCTIONS**
- A. Collect & compile complete brochure of equipment furnished & installed on this project. Include operational & maintenance instructions, manufacturer's catalog sheets, wiring diagrams, parts lists, approved shop drawings, test & balance reports, & descriptive literature as furnished by equipment manufacturer. Include an inside cover sheet that lists project name, date, owner, architect, consulting engineer, general contractor, sub-contractor, & an index of contents. Submit three copies of literature bound in ring binders w/ index & tabs separating equipment types to architect at termination of work. Final approval of plumbing systems will be withheld until manual is received & deemed complete by architect & engineer. Provide "as-built" drawings (see Division 1 & general conditions).
- B. These requirements may shall also be provided to the owner in a well organized pdf electronic submission & delivered on a DVD or USB thumbdrive.
15. **TRAINING**
- A. Provide factory trained & authorized representative to train owner's designated personnel on operation & maintenance of equipment provided for this project. Provide training to include but not be limited to an overview of system &/or equipment as it relates to facility as whole; operation & maintenance procedures & schedules related to startup & shutdown, troubleshooting, servicing, preventive maintenance & appropriate operator intervention; & review of data included in operation & maintenance manuals. Submit certification letter to architect stating that owner's designated representative has been trained as specified herein. Letter shall include date, time, attendees & subject of training. Contractor & owner's representative shall sign certification letter indicating agreement that training has been provided. Schedule owner training w/ at least 7 days' advance notice.
16. **SPARE PARTS**
- A. Furnish to owner, w/ receipt one set of spare filters of each type required for each unit. In addition to spare set of filters, install new filters prior to testing, adjusting, & balancing work & before turning system over to owner.
- B. Furnish one complete set of belts for each fan.
17. **EQUIPMENT LABELS:**
- A. Material and thickness: multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware. Black letters on white background.
- B. Minimum label size: length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- C. Minimum letter size: 1/4" for name of units if viewing distance is less than 24 inches, 1/2" for viewing distances up to 72" & proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
18. **WARRANTIES**
- A. Warrant each system & each element thereof against all defects due to faulty workmanship design or material for period of 12 months from date of substantial completion unless specific items are noted to carry longer warranty in construction documents or manufacturer's standard warranty exceeds 12 months. Remedy all defects, occurring within warranty period(s) stated in general conditions & Division 1. Warranties shall include labor & material. Make repairs or replacements without any additional costs to owner. Perform remedial work promptly, upon written notice from engineer or owner.
- B. At time of substantial completion, deliver to owner all warranties in writing & properly executed including term limits for warranties extending beyond one year period. Each warranty instrument being addressed to owner & stating commencement date & term.
19. **CUTTING & PATCHING**
- A. Perform cutting of walls, floors, ceilings, etc. As required to install work under this section. Obtain permission from architect prior to cutting. Do not cut or disturb structural members without prior approval from architect. Cut holes as small as possible. General contractor shall patch walls, floors, etc. As required by work under this section. Patching shall match original material's construction. Repair & refresh areas disturbed by work to condition of adjoining surfaces in manner satisfactory to architect.
20. **EXCAVATION AND BACKFILL**
- A. Perform necessary excavation to receive work. Provide necessary sheathing, shoring, cribbing, tarpaulins, etc. For this operation, and remove it at completion of work. Perform excavation in accordance with appropriate section of these specifications, and in compliance with osha safety standards.
- B. Excavate trenches of sufficient width to allow ample working space, and no deeper than necessary for installation work.
- C. Conduct excavations so no walls or footings are disturbed or injured. Backfill excavations made under or adjacent to footing with selected earth or sand and tamp to compaction required by architect/engineer. Mechanically tamp backfill under concrete and pavings in six inch layers to 95% standard density, reference Division 2.
- D. Backfill trenches and excavations to required heights with allowance made for settling. Tamp fill material thoroughly and moistened as required to specified compaction density. Dispose of excess earth, rubble and debris as directed by architect.
- E. When available, refer to test hole information on architectural or civil drawings or specifications for types of soil to be encountered in excavations.
21. **ROUGH-IN**
- A. Coordinate rough-in w/ general construction & other trades. Conceal piping & conduit rough-in except in unfinished areas & where otherwise shown.
22. **STRUCTURAL STEEL**
- A. Structural steel used for support of equipment, ductwork & piping shall be new,

clean, & conform to ASTM A-36. Support mechanical components from building structure. Do not support mechanical components from ceilings, other mechanical or electrical components, & other non-structural elements.

23. **ACCESS DOORS**
- A. Provide access doors in ceilings, walls, etc. Where indicated or required for access or maintenance to concealed valves & equipment installed under this section. Provide concealed hinges, screwdriver-type lock, anchor straps, manufactured by Milcor, Zurn, Tilus, or equal. Obtain architect's approval of type, size, Location & color before ordering.
24. **PENETRATIONS**
- A. Seal mechanical floor, exterior wall & roof penetrations watertight & weathertight. Seal around mechanical penetrations w/ 3M CP-25 fire barrier caulk (thickness as required & recommended by manufacturer) to maintain resistance rating of fire-rated assemblies. Provide prefabricated roof curbs manufactured by Custom Curb, Pate, Thycurb or approved equal. Provide roof curb w/ factory installed wood nailer, welded, 18 gauge galvanized steel shell, base plate & flashing. 1-1/2" thick, 3 pound rigid insulation; fully mitered 3-inch raised cant, cover of weather-resistant, weather-proof material & pipe collar of weather-resistant material w/ stainless steel pipe clamps. Make roof penetrations by authorized roofing contractor when required.
25. **MOTORS & STARTERS**
- A. Provide motors & starting equipment where not furnished w/ equipment package. Motors shall have copper windings, class B insulation, & standard squirrel cage w/ starting torque characteristics suitable for equipment served. Motors for air handling equipment shall be selected for quiet operation. Each motor shall be checked for proper rotation after electrical connection has been completed. Provide drip-proof enclosure for locations protected from weather & not in air stream of fan; & totally enclosed fan cooled enclosure for motors exposed to weather. Motors shall be manufactured by Century, GE, Westinghouse, or approved equal. Provide drip-proof enclosure for totally enclosed fan cooled motors w/ an approved type of "built-in" thermal overload protection, w/ motor starter. Each starter shall be provided w/ overload heaters sized to motor rating, & every three phase motor starter shall have overload heaters in each phase. Ambient compensated heaters shall be installed wherever necessary. Unless noted otherwise, motor starters shall be furnished by Division 22/23 contractor for installation & connection by Division 26 contractor. Starters shall be Allen-Bradley, Clark, Furnas, Square D, or approved equal.
26. **ELECTRICAL WIRING**
- A. Line voltage wiring shall be provided by Division 26. Line voltage control & interlock wiring for mechanical systems shall also be provided by Division 26 contractor. Low voltage control wiring shall be provided by Division 22/23 contractor. Furnish wiring diagrams to Division 26 contractor as required for proper equipment hookup. Coordinate w/ Division 26 contractor actual wire sizing amps for submitted mechanical equipment to ensure proper installation.
27. **DISCONNECT SWITCHES**
- A. Provide heavy-duty horsepower rated safety switches rated in accordance with NEMA enclosed switch standard KS 1_1969 and I98 standard.
- B. Each piece of electrical equipment shall be provided with a disconnecting means. C. Equivalents by: GE, Eaton, Siemens, Square D.
28. **REFRIGERANT & OIL**
- A. Provide full refrigerant & oil charge in refrigeration systems. Maintain for full term of warranty.
29. **EQUIPMENT FURNISHED BY OTHERS**
- A. Provide necessary equipment & accessories that are not provided by equipment supplier or owner to complete installation of cooling equipment, heating equipment, etc., furnished by others, in locations as indicated on drawings &/or described in general notes to this contractor. Equipment & accessories not provided by equipment supplier may include flues, vents, intakes, associated roof jacks & caps to outdoors, dampers, in-line fans, roof fans, control interlocks, etc. As required for proper operation of complete system in accordance w/ manufacturer's instructions. Contractor shall be responsible for correct rough-in dimensions, & shall verify same w/ architect &/or equipment supplier prior to service installations.
30. **SETTING, ADJUSTMENT AND EQUIPMENT SUPPORTS**
- A. Work shall include mounting, alignment and adjustment of systems and equipment. Set equipment level on adequate foundation and provide proper anchor bolts and isolation as shown, specified or required by manufacturers in installation instructions. Level, shim and grout equipment bases as recommended by manufacturer. Mount motors, and align and adjust drive shafts and belts according to manufacturer's instructions.
- B. Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by Contractor at no cost to Owner.
- C. Floor or pad mounted equipment shall not be held in place solely by its own dead weight. Include anchor fastening in all cases.
- D. Provide floor or slab mounted equipment with 3, 1/2" high concrete bases unless specified otherwise. Individual concrete pad shall be no less than 4" wide and 4" longer than equipment, and shall extend no less than 2" from each side of equipment.
- E. Provide each piece of equipment or apparatus suspended from ceiling or mounted above floor level with suitable structural support, platform or carrier in accordance with best-recognized practice. Verify that structural members of buildings are adequate to support equipment and unless otherwise indicated on plans or specified, arrange for their inclusion and attachment to building structure. Provide hangers with vibration isolators.
- F. Submit details of hangers, platforms and supports together with total weights of mounted equipment to Architect/Engineer for review before proceeding with fabrication or installation.
31. **MISCELLANEOUS REMODELING WORK**
- A. Remove all unused equipment, ductwork, piping & associated supports. Cap ductwork & piping at mains & install air & water tight. Provide items of HVAC systems modification required because of building remodeling as noted on drawings or necessary for proper operation. Match existing materials & construction techniques when modifying existing systems unless specified otherwise. Coordinate additional requirements with general contractor & architect. Seal airtight existing ductwork required to be abandoned in place or not in use at termination of work. Cap & seal weathertight existing roof curbs & roof openings to be abandoned in place as result of equipment removal. Clean & rebalance existing ductwork, diffusers, registers, & grilles intended for reuse as required or as indicated on drawings. Clean & refurbish existing HVAC equipment intended for reuse as required for proper operation including replacement of filters, belts, motors, remote controls, & safety interlocks.
32. **BUILDING OPERATION**
- A. Comply w/ schedule of operations as outlined in architectural portions of this specification. Building shall be in continuous operation. Accomplish work requiring interruption of building operation at time when building is not in operation, & only w/ written approval of building owner &/or tenant. Coordinate interruption of building operation w/ owner &/or tenant minimum of seven days in advance of work.
- B. The following Work shall be performed at night or weekend other than holiday weekends as directed and coordinated with the Owner. All tie-in, cut-over and modifications to the existing electrical system and other existing system requiring tie-ins or modifications shall be arranged and scheduled with the Owner to be done at a time as to maintain continuity of the service and not interfere with normal building operations.
33. **VIBRATION ISOLATION**
- A. Provide vibration isolation equipment & materials by single manufacturer. Amber booth, kinetics noise control, mason industries, inc., vibration eliminator co., inc., & vibration mounting & controls. General requirements: select vibration isolators by weight distribution to produce uniform deflection. Isolators shall operate in linear portion of their load versus deflection curves. Spring isolators shall have 50 percent excess capacity without becoming coil bound. Coar vibration isolators w/ factory-applied paint. Coar vibration isolators exposed to weather & corrosion w/ factory-applied protection. Install & adjust isolators in accordance w/ manufacturers instructions.
34. **FIRE BARRIERS**
- A. General: for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
35. **WELDING**
- A. Contractor shall be responsible for quality of welding and suitability of welding procedures. All welding shall be in accordance with American Welding Society standard B3.0 and ANSI standard b31.1.
- B. Welded pipe joints shall be made by certified welding procedures and welders.

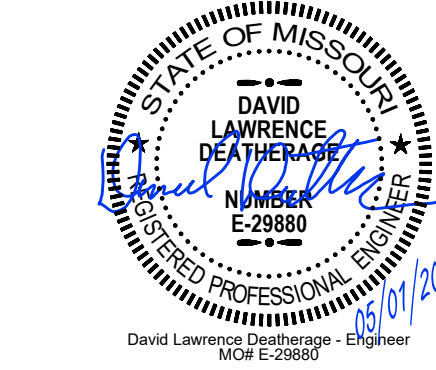
Welding electrodes shall be type and material recommended by electrode manufacturer for materials to be welded. All pipe and fittings ends shall be beveled a minimum of 30 degrees prior to welding.

C. Only welders who have successfully passed welder qualifications tests in previous 12 months for type of welding required shall do welding. Each welder shall identify his work with a code marking before starting any welded pipe fabrication. Contractor shall submit three copies of a list of welders who will work on project listing welders' code, date and types of latest qualification test passed by each welder.

D. Welded joints shall be fusion welded in accordance with level AR3 of American Welding Society standard AWS D10.9 "Standard For Qualification of Welding Procedures And Welders For Pipe And Tubing". Welders qualified under national certified pipe welding bureau will be acceptable.

E. Bevel all piping and fittings in accordance with recognized standards by flame cutting or mechanical means. Align and position parts so that branches and fittings are set true. Make changes in direction of piping systems with factory made welding fittings. Make branch connections with welding tees or forged weldolet.

END OF GENERAL MEP REQUIREMENTS



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CONSULTANTS

NO.	ISSUE DESCRIPTION	DATE

NO.	REVISION DESCRIPTION	DATE

PROJECT: E-SPORTS

MISSOURI WESTERN
STATE UNIVERSITY

4525 DOWNS DRIVE
ST. JOSEPH, MO

GENERAL MEP SPECIFICATIONS

SHEET:
MEP100

OF: DATE: MAY 2020



ELECTRICAL SPECIFICATIONS

SECTION 26000 - ELECTRICAL

1. GENERAL ELECTRICAL REQUIREMENTS

- A. Refer to GENERAL MECHANICAL, ELECTRICAL & PLUMBING requirements.
B. Wiring of Mechanical Equipment

- 1) Provide all raceways & power wiring for all division 23 equipment requiring electrical connections, including, but not limited to, pumps, water heaters, & HVAC equipment, & all line voltage control & interlock wiring not provided under division 23. Connect per manufacturers' wiring diagrams. Coordinate with division 23 for disconnects furnished w/ equipment, & provide all disconnect switches as required. After installing wiring, verify that each motor load has correct phase rotation.
- 2) Verify actual "maximum overcurrent protection" (MOCP) device ratings & "minimum circuit ampacity" (MCA) conductor sizing for mechanical equipment from equipment nameplate. Base electrical installations on actual required ampereages, which may vary somewhat from conductor & equipment sizes shown on drawings; however, in no case, reduce size of conductors indicated on drawings without authorization from engineer. Provide properly sized electrical wiring & equipment without extra cost to owner. Notify engineer of all changes required in electrical installation due to equipment variances so that effects on feeders, branch circuits, panelboards, fuses & circuit breakers can be checked prior to purchasing & installation. Be responsible for coordinating w/ division 23 to verify actual ampacities & correct sizes of all conductors & overcurrent protective devices for all equipment, & correct overload heaters for all motors, when starters are provided under division 26.
- C. Wiring of Thermostats. Time, & Temperature Controls

- 1) Provide all raceways, power wiring, & line-voltage control and interlock wiring not provided under division 23, for all thermostats, temperature control devices, & controls, including, but not limited to, night-stats, water heater interlocks, time switches & override timers. See mechanical drawings for locations & temperature control diagrams. Low-voltage conductors for thermostats & temperature control system may be run exposed above finished accessible ceilings, if approved & listed for this purpose, but shall be installed in conduit within walls & where exposed in work areas.
2. CONDUIT & CONDUCTORS
- A. Follow circuiting shown on plans. Use no conduit smaller than 3/4" & no conductors smaller than #12 g.c. Unless noted otherwise.
- B. Conductors #10 and smaller shall be solid.
- C. If no conductor size is indicated on drawings for branch circuit, provide conductors & conduit sized per NFPA 70 & based on indicated branch circuit overcurrent protective device (OCPD) rating & number of poles.
- D. Wire shall be in non-flexible metallic conduit (EMT, IMC or RMC) for:
- 1) All circuits & feeders greater than 30A.
- 2) Kitchen circuits.
- 3) Home runs.
- E. MC cable acceptable for branch convenience circuits & lighting circuits. Do not daisy chain light fixtures. Provide cable whips of sufficient lengths to allow for relocating each light fixture within 5-foot radius of its installed location, but not exceeding 6 feet in unsupported lengths.

- 1) Do not use MC cable for following: homeruns to panelboards, where exposed to view or damage, hazardous locations, in concrete, block walls or wet locations, & when disallowed by local AHJ or landlord.
- 2) Provide health care rated MC for patient care areas (as defined by the NEC) when not in conduit.
- F. Lighting & receptacle circuit conductors shall be copper THHN-THWN-2 600 volt, 75 deg c, color coded as described under applicable codes. No romex, plastic flex tubing etc permitted. Light fixture wire insulation shall have temp rating not less than individual fixture manufacturers recommended rating.
- G. Circuits w/ no. 8 or larger conductors, motor circuits, power & feeder circuits & building service feeders shall be copper THHN-THWN-2 600 volt, 75 deg c.
- H. All materials used to terminate, splice or tap conductors: designed for, properly sized for, & UL listed for specific application & conductors involved, & installed in strict accordance w/ manufacturer's recommendations, using the manufacturer's recommended tools.
- I. Where wiring is indicated as installed, but connection is indicated "future" or "by other division, trades, or contractors", leave minimum 3-foot "pigtail" at box, tape ends of conductors, & cover box.
- J. Number of conductors in specific raceway "home run" is indicated w/ cross lines (tick marks) on each "circuit run" on drawings. In general, direction of branch circuit "home run" routing is indicated on drawings, complete w/ circuit numbers & panelboard designation. Continue all such "home run" wiring to designated panelboard, as though "circuit runs" were indicated in their entirety.
- K. Wiring shall have insulation of proper color to match NEC color code. In larger sizes, where properly colored insulation is not available, use vinyl electrical tape of appropriate color around each conductor at all termination points, junction & pull boxes.

3. GROUNDING

- A. Supplement grounded neutral of secondary distribution system w/ equipment grounding system, installed so that metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, portable equipment & other conductive items operate continuously at ground potential & provide low impedance path for ground fault currents.
- B. System shall comply w/ national electrical code, drawings & as specified.
- C. Provide equipment ground bus in base of low voltage, switchgear brazed or otherwise adequately connected by an approved method to ground rods.
- D. Provide in conduit green insulated copper ground conductor to main metallic water service entrance & connect by means of adequate ground clamps.
- E. Equipment grounding conductors for branch circuit home runs shown on drawings shall indicate an individual & separate ground conductor for that branch circuit which shall be terminated at branch circuit panelboard, switchboard, or other distribution equipment.
- F. Provide low voltage distribution system w/ separate green insulated equipment grounding conductor for each single or three-phase feeder. Single phase 120 volt branch circuits for lighting & power shall consist of phase & neutral conductors & green ground conductor installed in common conduit which shall serve as grounding conductor.
- G. Grounding conductors shall be as shown on plans or if not specifically shown shall be no smaller than that required by NEC.

4. RACEWAY INSTALLATION

- A. Install all conductors & cable in raceways continuous without taps or splices. Splice or tap only in approved boxes & enclosures w/ approved solderless connectors, or crimp connectors & terminal blocks for control wiring, & keep to minimum required. Insulate all splices, taps, & joints as required by codes.
- B. Install all circular raceways concealed above suspended ceilings or concealed in walls or floors wherever possible except where otherwise indicated.
- 1) All conduit, junction boxes, etc. Above ceilings shall be supported from structure. Pipe sleeves, hangers & supports shall be furnished & set & contractor shall be responsible for proper & permanent locations.
- 2) Support all conductors & cables in vertical installations, as required by NFPA 70, by installing cable supports or plug-type conduit riser supports, or wire-mesh safety grips.
- C. Conduit installed below grade shall be Schd. 80 PVC heavy wall plastic conduit meeting NEMA standards & UL listed for underground & exposed use. Provide GRS radius bends & risers as conduits rise above grade or above floor slab.
- D. Provide GRS for all conduits run exposed to weather or exposed to other hazardous conditions. Provide any GRS installed below grade w/ corrosion resistant bonded-plastic or approved mastic coating. This shall include 90-degree elbow below grade & entire vertical transition to above grade.
- E. Provide interlocking spacers for multiple runs of UG conduits in same trench.
- F. All other raceway may be EMT where approved by local code. Use compression type fittings for EMT, w/ all fittings UL listed for environment in which they are used.
- G. Use FMC for final connection to each motor & transformer, & to any device that would otherwise transmit motion, vibration, or noise. Use LPMC where exposed to liquids, vapors or sunlight.
- 1) Provide all FMC & LPMC w/ an insulated bonding conductor.
- H. Install raceways parallel & perpendicular to building lines.
- I. Install raceways to requirements of structure & to requirements of all other work on project. Install raceway to clear all openings, depressions, pipes, ducts, reinforcing steel, & other immovable obstacles. Install raceways set in forms for concrete structure in such manner that installation will not affect strength of structure.
- J. Install raceways continuous between connections to outlets, boxes & cabinets w/ minimum possible number of bends & not more than equivalent of four 90-degree bends between connections. Use manufactured elbows for all 45- & 90-degree bends, unless approved by engineer in advance. Make other bends smooth & even & without flattening raceway or flaking galvanizing or enamel. Radii of bends shall be as long as possible & never shorter than corresponding trade elbow. Use long radius elbows where necessary, indicated, or both.
- K. Securely fasten raceways in place w/ approved straps, hangers & steel supports as required. Attach raceway supports to building structure. Hang single raceways for feeders w/ malleable spill ring hangers w/ rod & turnbuckle suspension from

- inserts spaced not over 10 feet apart in construction above.
- L. Clamp groups of horizontal feeder raceways to steel channels that are suspended from inserts spaced not over 10 feet apart in construction above. Securely clamp vertical feeder raceways to structural steel members attached to structure. Install cable clamps for support of vertical feeders where required. Add raceway supports within 12 inches of all bends, on both sides of bends. Do not support raceways from suspended ceiling components.
- M. Ream raceway ends, thoroughly clean raceways before installation, & keep clean after installation. Plug or cover openings & boxes as required to keep raceways clean during construction & fish all raceways clear of obstructions before pulling conductors wires. Provide raceways of ample size for pulling of wire & not smaller than code requirements & not less than 3/4", unless indicated otherwise on drawings.
- N. Protect all raceway installations against damage during construction. Repair all raceways damaged or moved out of line after roughing-in to meet engineer's approval without additional cost to owner.
- O. Align & install true & plumb all raceway terminations at panelboards, switchboards, motor control equipment & junction boxes.
- P. Install approved expansion/deflection fittings where raceways pass through (if embedded) or across (if exposed) expansion joints.
- Q. Install pull wire in each empty raceway that is left for installation of conductors or cables under other divisions or contracts. Use polypropylene or monofilament plastic line. Leave min. 24" stick at each end.
- R. Make all joints & connections in manner that will ensure mechanical strength & electrical continuity.
- S. Effectively seal raceways, by installing conduit fitting at boundary of two spaces, & filling it w/ an approved pliable material, after conductors or cables have been installed & tested, wherever raceways pass from non-cooled to cooled spaces or transition from outside facility or enclosure to inside, whether buried or exposed.

5. BUSHINGS & LOCKNUTS

- A. Rigidly terminate conduits entering sheet metal enclosures to enclosure w/ bushing & locknut on inside & locknut or an approved hub on outside. Conduit shall enter enclosure squarely.
- B. Provide bushings & locknuts made of galvanized malleable iron w/ sharp, clean-cut threads. Where EMT enters box, provide approved EMT compression connectors.
- C. Use insulated, grounding, or combination, bushings wherever connection is subject to vibration or moisture when required by NFPA 70, or both.

6. JUNCTION & OUTLET BOXES

- A. All boxes including light fixture, switch, receptacle, & similar outlet boxes: National Electrical, Appleton, Steel City, Raco, or approved equal, galvanized steel knockout boxes, suitable in design to purpose they serve & space they occupy. Size as required for specific function or as required by NFPA 70, whichever is larger.
- 1) Lighting fixture boxes in ceilings shall not be less than 4" octagonal knockout type.
- B. Set all outlet boxes in walls, columns, floors, or ceilings so they are flush w/ finished surface, accurately set, & rigidly secured in position. Provide plaster rings, extension rings &/or masonry rings as req'd for flush mounting. Provide approved cast outlet boxes, w/ hubs & weatherproof covers, in all areas subject to damp, wet, or harsh conditions.
- C. Coordinate locations of outlet boxes. Outlets are only approx located on small scale drawings. Use great care in actual location by consulting various large scale detailed drawings used by other division trades, & by securing definite locations from architect.
- D. All outlets, shall be mounted w/ bottom at 18" AFF & switches w/ bottom at 44" AFF floor unless noted otherwise on plans. Refer to arch for other required elevations & cabinetry coordination.

7. ELECTRICAL IDENTIFICATION

- A. Manufactured labels for each Panelboard & Transformer. Typewritten panel schedules mounted in panels. Where electrical equipment is installed as service entrance equipment, contractor shall furnish & install nameplate listing the following: Equip Short-Circuit Current Rating in Amps (RMS S YM), as indicated on the drawings, Whether or not equipment is fully or series-rated, Available Fault Current in Amps. Contractor shall perform available fault current calculation to obtain available fault at Service Equipment, Date fault current calculations were performed.
- B. Printed tape style label for each receptacle indicating Panel & Ckt #.
- C. Manufactured labels for all disconnect switches indicating equipment served.
- D. Branch circuits - identify each circuit w/ wire markers when enclosure label & wire colors do not provide enough information to identify each circuit without tracing. Feeders & branch circuit home runs w/ wire marker w/ Panel & Ckt #. Box covers above lay-in ceilings neatly marked w/ indelible marker.
- E. Fire alarm - nameplate on each fire alarm terminal cabinet. Label all wiring.

8. DIGITAL LIGHTING CONTROLS

- A. Provide DLM systems consisting of lighting control panels, room controllers, motion sensors, daylight sensors, & other other controls as necessary to achieve lighting switching & dimming control indicated on the drawings.
- B. Provide all interconnecting wiring, controls, programming & owner training for the system(s).
- C. Provide systems by: Cooper, Hubbell, Leviton, Phillips, Sensor Switch, Watt Stopper, Lutron, nLight.
- D. Execution:

- 1) Calibrate all sensor time delays & sensitivity for proper detection of occupants & energy savings. Adjust time delays.
- 2) Provide documentation of room by room system configuration including: sensor parameters, time delays, sensitivities, & daylighting setpoints, sequence of operation, load parameters.
- 3) Post start-up tuning - 30 days after occupancy contractor shall adjust sensors to meet the owner's requirements. Provide a detailed report to the architect / owner of post start-up activity.

9. TRANSFORMERS

- A. Dry-type as scheduled. Sound level shall not exceed db per ANSI C89.2 & NEMA t-1 (2)2-1/2% taps below & (2)2-1/2% taps above primary voltage. Aluminum windings. 150 deg c. Minimum impedance of 2.5%. Ventilated enclosure. Suspend as req'd.

10. PANELBOARDS

- A. Branch circuit 208/240v panels shall be capacity shown w/ tin plated copper bussing & braced for minimum of 10,000a aic or as otherwise noted or required (series rated acceptable). Bolt on circuit breakers. 480v panels same except 14,000a aic min. or as otherwise noted. Minimum 20" wide w/ galv steel enclosure w/ hinged door & keyed lock. Coord trim w/ mounting location. Typewritten card directory.
- B. Distribution panels shall be capacity shown & shall be Square D i-Line w/ tin plated copper bussing, 65kAic min or as otherwise noted req'd. Bolt on circuit breakers (series rated acceptable). Galv steel enclosure. CB's labeled w/ plastic printed labels to load served.
- C. Equivalent by Square D, Siemens, Cutler Hammer, or GE.

11. CIRCUIT BREAKERS IN EXISTING PANELBOARDS

- A. Provide new circuit breakers, for installation in existing panelboards, of same manufacturer, type & short circuit current interrupting ratings as existing panelboard circuit breakers.

12. WIRING DEVICES

- A. Color of devices as directed by architect.
- B. Convenience outlets:
- 1) Spec grade 20 amp duplex w/ ground & SS wall plates. Other outlets shall be verified w/ equipment suppliers for proper NEMA configurations. Provide GFCI rated devices where indicated & as req'd per code.
- 2) Equivalent devices by Cooper/Eaton, Hubbell, Leviton, Pass & Seymour/Legrand
- C. Switches:
- 1) Light switches - spec grade 20 amp toggle switches w/ SS wall plates.
- 2) Wall motion switches - spec grade, pir, override.
- 3) Ceiling motion switches - spec grade, dual technology, model as req'd by room configuration, all necessary power packs & relays.
- 4) Wall motion switches (bathroom) - dual relay, spec grade, PIR, 2nd relay for operation of exhaust fan delay.
- 5) Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters. Continuously adjustable slider with single-pole or three-way switching. Comply with UL 1472. 600W or 1200W as required by load.
- Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
- LED Dimmers: Modular; compatible with dimming drivers in fixture(s); if other than 0-10V dimming is provided, verify dimmer is compatible with driver for full range of dimming (100-10%).
- 6) Equivalent devices by Leviton, Bryant, Hubbell, Wattsstopper, Lithonia, Sensor Switch.
- D. Weatherproof cover plates:
- 1) Provide GFCI receptacles for weatherproof receptacles.

- 2) For wet locations: in-use NEMA 3R, UL-labeled plates die cast metal and lockable.
- 3) For damp locations: UL-listed for wet locations w/ cover(s) closed; die-cast aluminum or type 302 SS; single-cover for switches & vertically mounted receptacles; double-cover for horizontally mounted receptacles; self-closing covers.

13. DISCONNECT (SAFETY) SWITCHES

- A. Disconnect (safety) switches: Square D, Siemens, Cutler Hammer, or General Electric fused or non-fused (as indicated on drawings or required) NEMA KS1, heavy duty, externally operated, visible-blade safety switches; NEMA enclosure type indicated on drawings or suitable for environment in which installed. Based on fusible switch & fuse sizes indicated, include class R, J, or L fuse provisions as applicable.
- B. Where indicated, provide fusible switches permanently labeled as suitable for use as service entrance equipment, w/ integral & separate neutral & ground assemblies, suitable for sizes of conductors indicated. Do not double-lug any terminations not specifically listed as suitable for more than one conductor.
- C. Provide switches where not furnished w/ starting equipment, at all other points required by NFPA 70, & where indicated on drawings.

14. LUMINAIRES, LAMPS & BALLASTS

- A. Refer to lighting fixture schedule plans for fixture types.
- B. Equivalent luminaires by Hubbell, Infinity, Lithonia, Williams, Eaton [Cooper].
- C. Fluorescent Fixtures:

- 1) Lamps shall be type recommended by fixture manuf. Lamp none above manuf. recommended max wattage. Color temperature shall be coordinated through project, with generally 4100K interior lamps and min 85 CRI. Equivalent lamps by G.E., Venture, Philips Or Sylvania.
- 2) Ballasts - Fluorescent - electronic, <20%THD, Equivalent by Advance, G.E., Motorola, Or Magnelek.

D. LED Fixtures:

- 1) Lamps & modules: Philips, General Electric, Osram/Sylvania, Cree, Nichia.
- 2) LED components, lamps, drivers, and fixtures shall comply with: PCC 47 CFR Part 15; UL 8750; ANSINEMA Standards C78.377, NEMA SSL-1, C82.77, IESNA Standards TM-15-05, RP-16, LM-79, LM-80 and TM-21.
- 3) Drivers shall be integral to the fixture unless otherwise shown or specified.

- E. Emergency ballast/drivers/batteries/inverters - shall be Bodine, Iota. Coordinate voltages and outputs for min. 90 minute operation with fixtures scheduled and controls indicated and provided.

F. Execution:

- 1) Provide lighting fixtures w/ lamps & accessories req'd for hanging. Coord mounting of lighting fixtures w/ architect & G/C. Additional fixture supports shall be provided by E/C. Supports shall comply w/ latest edition of NEC. Provide lighting fixture securing clips as required. Consult arch plans for ceiling types & provide surface & recessed lighting fixtures w/ appropriate mounting components & accessories.
- 2) Fixtures mounted in fire rated ceilings shall be provided & installed w/ fire rated enclosures to maintain ceiling integrity.
- 3) Poles & support components: comply w/ AASHTO LTS-4. Provide steel poles in color as specified or selected by architect. Provide bolt covers. Provide concrete base for pole & ground rod.

15. ADJUSTING, ALIGNING & TESTING

- A. Adjust, align, & test all electrical equipment on this project provided under this division & all electrical equipment furnished by others for installation or wiring under this division for proper operation. Test all systems & equipment according to requirements in NETA ATS (latest edition) & all additional requirements specified.
- B. In following sections. Maintain following on project premises at all times: true RMS reading voltmeter, true RMS reading ammeter, & megohmmeter insulation resistance tester. Provide test data readings as requested or as required by engineer.

16. SYSTEM START UP

- A. Prior to starting up electrical systems:
- 1) Check all components & devices.
- 2) Lubricate items accordingly.
- 3) Tighten screws & bolts for connectors & terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486a & UL 486b.
- 4) Check & record building's service entrance voltage, grounding conditions, grounding resistance, & proper phasing.
- B. Replace all burned-out lamps & lamps used for temporary construction lighting in permanent light fixtures.
- C. After all systems have been inspected & adjusted, confirm all operating features required by drawings & specifications & make final adjustments as necessary.

END OF DIVISION 26000

SECTION 27000 - COMMUNICATIONS

1. GENERAL ELECTRICAL REQUIREMENTS

- A. Refer to GENERAL MECHANICAL, ELECTRICAL & PLUMBING requirements.

2. TELECOMMUNICATIONS SYSTEMS PROVISIONS

- A. Provide incoming telephone and/or data service raceways as indicated on drawings or as required by serving telecommunications company.
- B. Provide 3/4-inch thick plywood board, fire-retardant: treated & stamped FRT, securely anchored to wall, at location & of size as indicated on drawings.
- C. Provide flush mounted telephone and/or data outlet boxes w/ 3/4-inch EMT stub-up concealed to accessible ceiling space at locations as indicated on drawings.

3. QUALITY ASSURANCE

- A. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- B. Grounding: Comply with ANSI-J-STD-607-A.

END OF DIVISION 27000

SECTION 28000 - SAFETY & SECURITY

1. GENERAL ELECTRICAL REQUIREMENTS

- A. Refer to GENERAL MECHANICAL, ELECTRICAL & PLUMBING requirements.

2. EXISTING FIRE ALARM SYSTEM MODIFICATIONS

- A. Provide following new equipment, compatible w/, or of same manufacturer as, existing fire alarm control panel & system, at locations indicated on drawings, as required by building codes, landlord, or all three, & connect to existing fire alarm control panel:

- 1) Additional initiating devices, indicating appliances, & interconnecting circuits.
- 2) Additional zone modules required by new zoning.
- 3) New amplifiers & other equipment that may be required to incorporate new initiating devices & indicating appliances into existing system.
- 4) A new zone map, including all existing zones & all new zones, framed, mounted under glass, & installed adjacent to fire alarm control panel. Horn/strobes shall meet all requirements of ADA.
- B. Install all wiring in raceway.
- C. Where acceptable to AHJ, plenum rated cables may be used above suspended accessible ceilings.

D. Execution:

- 1) Submit shop drawings w/ wiring diagrams & battery calcs for approval to Fire Marshal & AHJ.
- 2) Coordinate to provide power & shutdown or operation of fire/smoke dampers, door hold opens, power to door locks & access control & other similar systems.
- 3) Installed & tested per NFPA 72 & applicable sections of NFPA 70. Provide complete fire alarm system as described herein & shown to be wired, connected, & in first class condition. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible & visible notification appliances, wiring, terminations, electrical boxes, & all necessary material for complete operating system.

END OF DIVISION 28000



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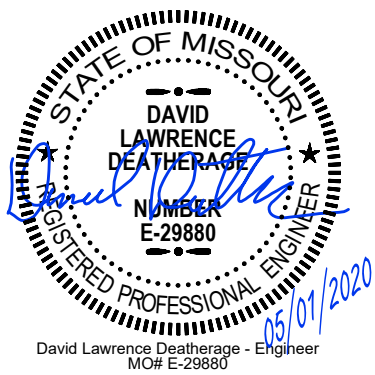
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PROJECT: E-SPORTS
MISSOURI WESTERN
STATE UNIVERSITY
4525 DOWNS DRIVE
ST. JOSEPH, MO

ELECTRICAL
SPECIFICATIONS

SHEET:
MEP101

OF: DATE: MAY 2020



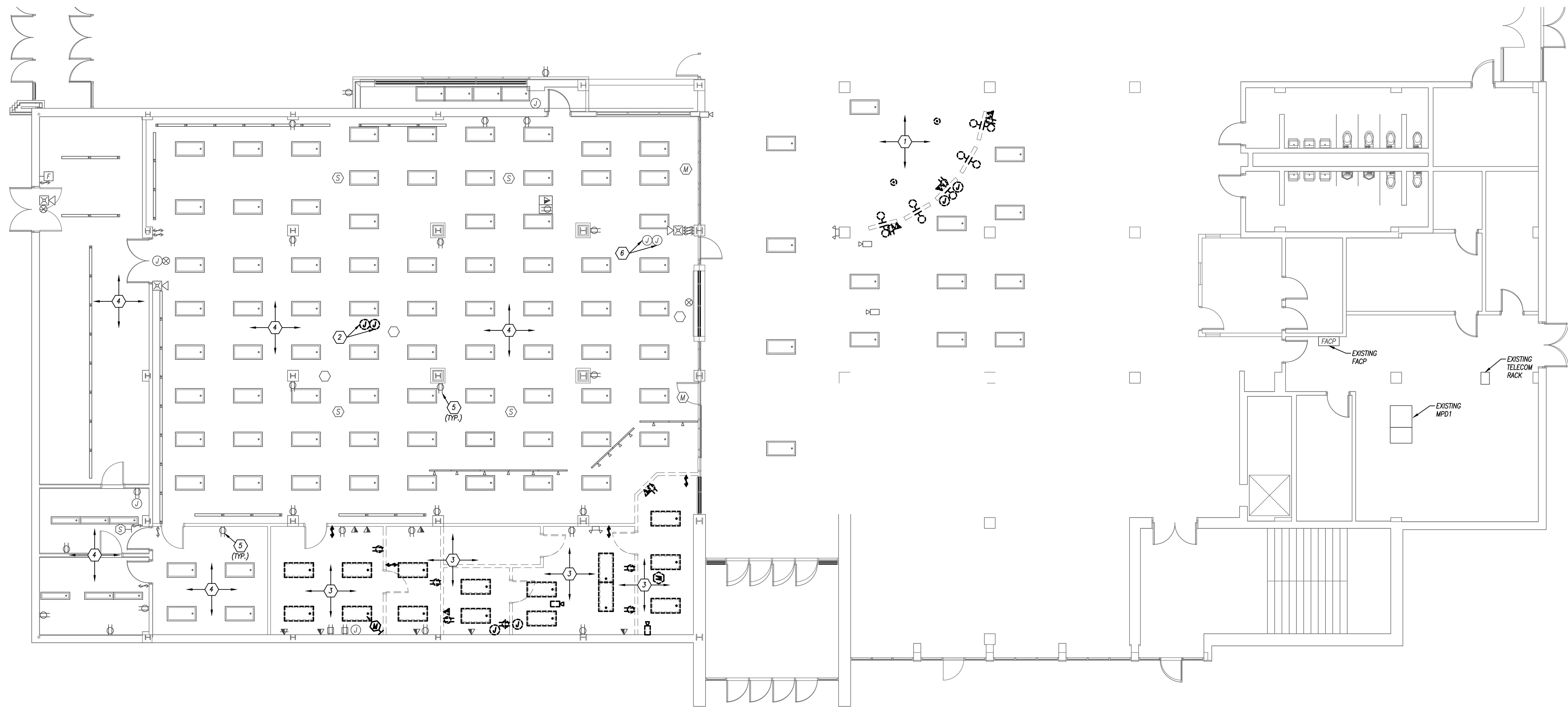
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GENERAL DEMOLITION NOTES

1. REFER TO GENERAL DEMOLITION NOTES ON MEP COVER SHEET FOR ADDITIONAL REQUIREMENTS OF WORK.
2. DEMOLISHED ITEMS THAT ARE NOT BEING REUSED (I.E. CAMERAS, SPEAKERS, FIRE ALARM DEVICES, ETC.), ARE TO BE SALVAGED AND TURNED OVER TO OWNER. COORDINATE WITH OWNER.

DEMOLITION PLAN KEYED NOTES

- 1 DISCONNECT AND REMOVE EXISTING LIGHT FIXTURES AND RELATED CIRCUITS UNLESS NOTED OTHERWISE. REMOVE CONDUIT AND WIRING BACK TO SOURCE. PREPARE AREA FOR REWORK.
- 2 REMOVE EXISTING IN FLOOR DEVICES. PATCH FLOOR AS REQUIRED.
- 3 EXISTING LIGHT FIXTURE TO BE RELOCATED AND REUSED IN NEW WORK. PROTECT FIXTURE FOR REUSE. RE: NEW WORK PLAN. FIELD VERIFY.
- 4 EXISTING LIGHTING AND ASSOCIATED CONTROLS THIS AREA TO REMAIN.
- 5 EXISTING TO REMAIN. (TYPICAL)
- 6 EXISTING FLOOR DEVICES TO REMAIN.



 **FIRST FLOOR PLAN - ELECTRICAL - DEMOLITON**
1/8" = 1'-0"



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NO.	REVISION DESCRIPTION	DATE

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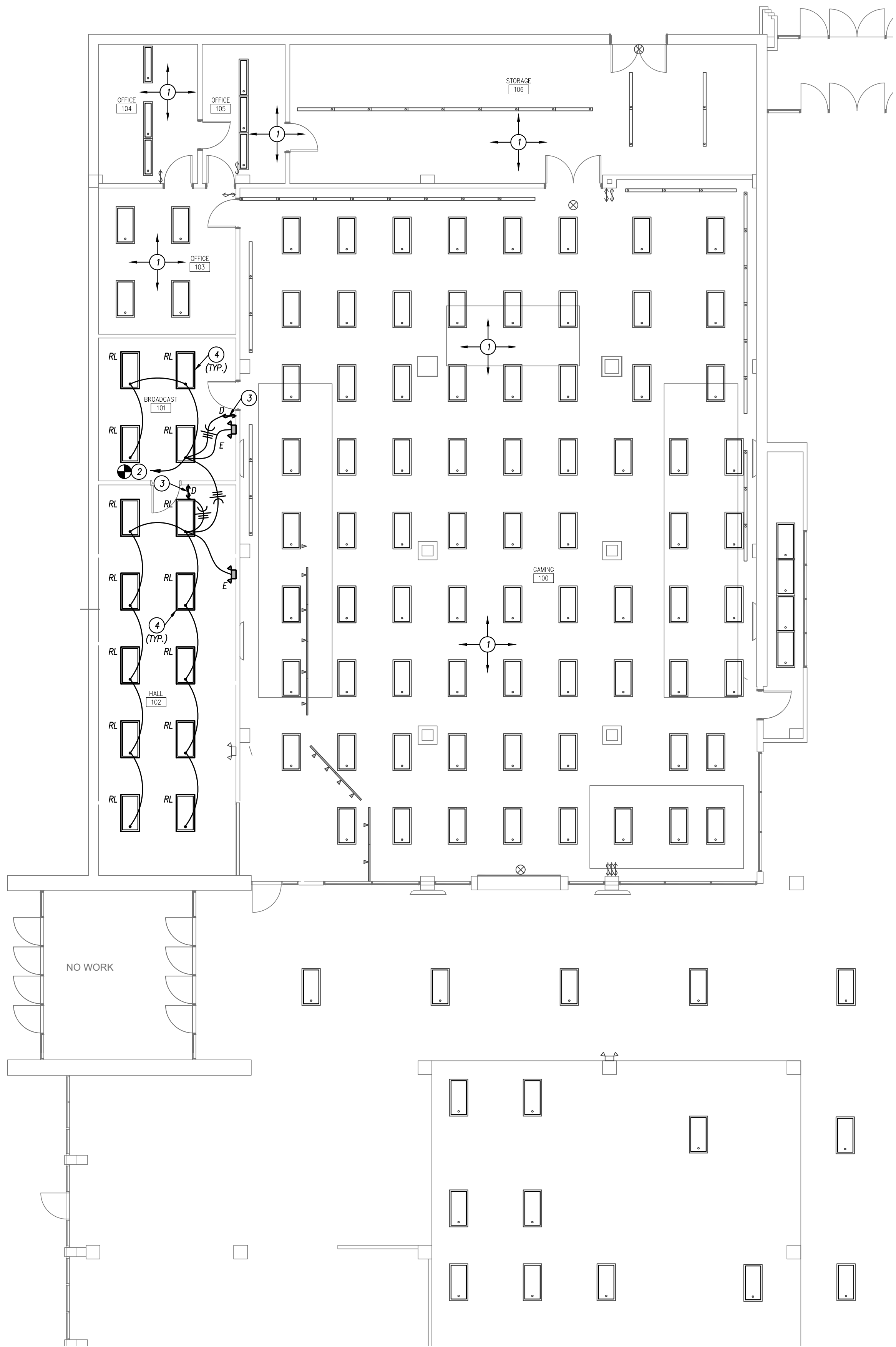
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ST. JOSEPH, MO

FIRST FLOOR PLAN -
ELECTRICAL -
DEMOLITION

SHEET:
DE100

OF: DATE: MAY 2020



 **FIRST FLOOR PLAN - LIGHTING**
1/8" = 1'-0"

GENERAL ELECTRICAL NOTES

1. REFER TO GENERAL NOTES ON MEP COVER SHEET FOR ADDITIONAL REQUIREMENTS OF WORK.
2. LIGHT FIXTURES INDICATED AS EMERGENCY FIXTURES ARE TO FUNCTION AS NIGHT LIGHTS UNLESS SPECIFICALLY SHOWN SWITCHED.
3. ALL CIRCUITING SHOWN ON THIS PLAN IS DIAGRAMMATIC.
 - 3.1. ALL FIXTURES SHALL BE FED FROM JUNCTION BOXES WITH LIGHT FIXTURE WHIPS (<6'). DAISY-CHAINING OF FIXTURES IS NOT ALLOWED.
 - 3.2. SWITCH BOX LOCATIONS SHALL BE WIRED SO THAT A NEUTRAL WIRE IS AVAILABLE AT THE SWITCH BOX LOCATION, EITHER IN THE BOX OR AVAILABLE TO BE ADDED VIA RACEWAY OR AN ACCESSIBLE WALL CAVITY.
 - 3.3. WALL SWITCHES FOR SEPARATE LOAD TYPES (EM/NORMAL, 120/277V, ETC.) SHALL NOT BE IN A SINGLE BOX.
 - 3.4. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

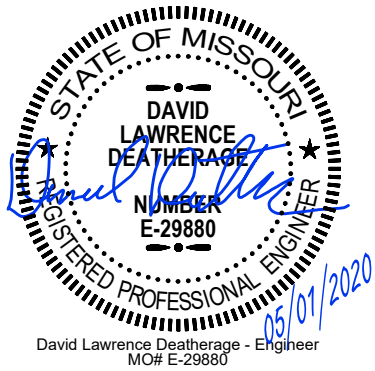
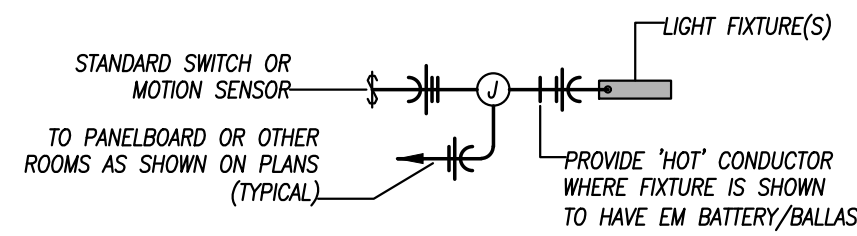
ELECTRICAL PLAN KEYED NOTES

- ① EXISTING LIGHTING, CIRCUITING, AND CONTROL(S) THIS AREA TO REMAIN.
- ② HOMERUN TO EXISTING 20A-1P CIRCUIT BREAKER IN EXISTING PANELBOARD SERVING AREA. IF NO CIRCUIT BREAKER IS AVAILABLE, PROVIDE NEW CIRCUIT BREAKER TO MATCH EXISTING. FIELD VERIFY.
- ③ DIMMER SWITCH SHALL BE COMPATIBLE WITH LOAD BEING CONTROLLED. PROVIDE LINE VOLTAGE SWITCH LEGS OR 0-10V LOW VOLTAGE WIRING AS REQUIRED.
- ④ RELOCATED LIGHT FIXTURE LOCATION.

TYPICAL WIRING OF CONTROLS AND LIGHT FIXTURES

THE WIRING AND/OR TIC MARKS SHOWN BELOW ARE NOT SHOWN ON PLANS FOR CLARITY. PROVIDE WIRING FROM JUNCTION BOX(ES) TO SWITCHES/CONTROLLERS AND LIGHTS AS SHOWN BELOW FOR EACH ROOM/AREA.

LINE VOLTAGE STANDARD WALL SWITCHES



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FIRST FLOOR PLAN -
LIGHTING

SHEET:
E100

OF: DATE: MAY 2020



PEARSON KENT MCKINLEY RAAF ENGINEERS LLC
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LENEKA, KS 66215
913.482.2400
WWW.PKMRENG.COM
MO State Certificate of Authority #E-2002020886

1. REFER TO GENERAL NOTES ON MEP COVER SHEET FOR ADDITIONAL REQUIREMENTS OF WORK.
2. COORDINATE EXACT NEMA CONFIGURATIONS OF RECEPTACLES SERVING EQUIPMENT WITH EXACT EQUIPMENT BEING FURNISHED.
3. REFER TO THE SPECIFICATIONS FOR ADDITIONAL LOCATIONS/REQUIREMENTS FOR RECEPTACLES, INCLUDING GFCI, WEATHER-RESISTANT, HOSPITAL-GRADE, AND TAMPER-RESISTANT RECEPTACLES.
4. EXACT MECHANICAL EQUIPMENT LOCATIONS MAY NOT BE SHOWN FOR CLARITY. COORDINATE EXACT LOCATIONS OF ALL MECHANICAL EQUIPMENT, DUCT DETECTORS, ETC. WITH MECHANICAL DRAWINGS AND CONTRACTOR.
5. COORDINATE EXACT LOCATIONS OF SMOKE DETECTORS WITH CEILING FANS, HVAC DIFFUSERS, SPRINKLER HEADS, ETC. PER NFPA REQUIREMENTS.
7. FIRE ALARM: EXPAND ON EXISTING FIRE ALARM SYSTEM. PROVIDE ALL NECESSARY EQUIPMENT TO ACCOMMODATE NEW DEVICES WHERE SHOWN. FIELD VERIFY CENTRAL FIRE ALARM PANEL PRIOR TO BID.
8. FIRE ALARM DEVICE FINISH TO BE DETERMINED BY ARCHITECT.

- 1 POWER AND DATA FOR WALL MOUNTED TV. COORDINATE LOCATION WITH ARCHITECT.
- 2 NEW FIRE ALARM DEVICES TO BE COMPATIBLE WITH EXISTING ADDRESSABLE NOTIFICATION SYSTEM. MODIFY EXISTING SYSTEM AS REQUIRED TO ACCOMMODATE NEW DEVICES. PROVIDE SHOP DRAWINGS SIGNED AND SEALED BY A REGISTERED FIRE PROTECTION ENGINEER LICENSED IN THE STATE OF MINNESOTA.
- 3 GENERAL FEEDER ROUTE INDICATED. FIELD VERIFY OPTIMAL ROUTING OF CONDUITS/CONDUCTORS. CONDUIT/CONDUCTORS SHALL BE ROUTED IN A CONCEALED MANNER ABOVE ACCESSIBLE CEILING. PROVIDE PULL BOXES AS REQUIRED. REFER TO RISER DIAGRAM FOR ADDITIONAL INFORMATION.
- 4 PROVIDE 3/4" x 4W x 6H AC GRADE FIRE RETARDANT PLYWOOD BACKBOARD AS SHOWN, MOUNTED 12" ABOVE FINISHED FLOOR TO BOTTOM. PLYWOOD SHALL BE PRE-PAINTED WHITE (TWO COATS OF WHITE PAINT ON ALL SIDES. NOTE: LEAVE FIRE RETARDANT LABELING VISIBLE IN ONE CORNER ON EACH PIECE OF PLYWOOD). COORDINATE MOUNTING OF POWER AND TECHNOLOGY DEVICES WITH OWNER'S REG. ON WALL.
- 5 TELECOM GROUNDING BUS (TGB), INSTALL TGB AT 84747'. FURNISH AND INSTALL 6" x 2" x 0.25" THICK COPPER BUS BAR WITH RUBBER STANDOFFS AND PREDRILLED HOLES FOR USE WITH STANDARD LUGS. REFER TO DETAIL FOR MOUNTING INFORMATION. CONNECT TO EXISTING MAIN TELECOM GROUNDING BUS IN MECH ROOM LEVEL 1. PROVIDE #3/0 INSULATED COPPER IN 1" WIRE.
- 6 DEDICATED QUADPLEX RECEPTACLE FOR TELECOM EQUIPMENT RACK.
- 7 PROVIDE (2) CHANNEL STEEL RACEWAY WITH (1) CHANNEL FOR POWER AND (1) FOR DATA. LEADEND SERIES 6000000 OR EQUAL. COORDINATE AND LENGTHEN ARCHITECT'S RACEWAY ROUTING. WIRE WITH RECEPTACLE MOUNTED AT 18'47" AND (1) GANG FOR LOW VOLTAGE CABLING AT 18'47". COORDINATE FINISH WITH ARCHITECT.
- 8 POWER AND DATA FOR PORTABLE STAGE. COORDINATE LOCATION WITH OWNER.



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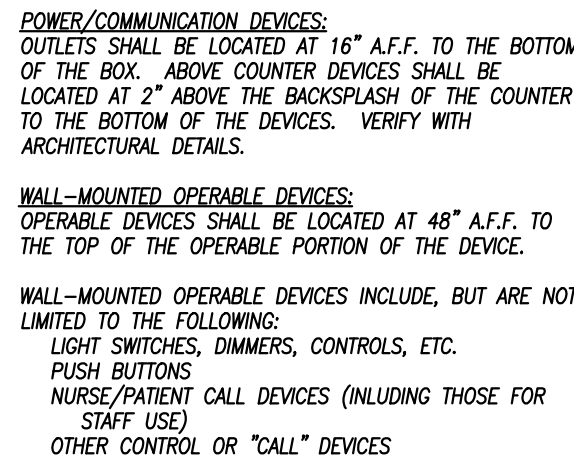
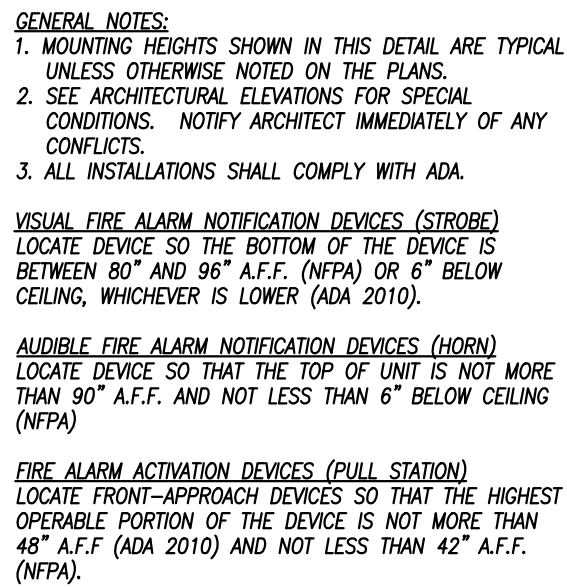
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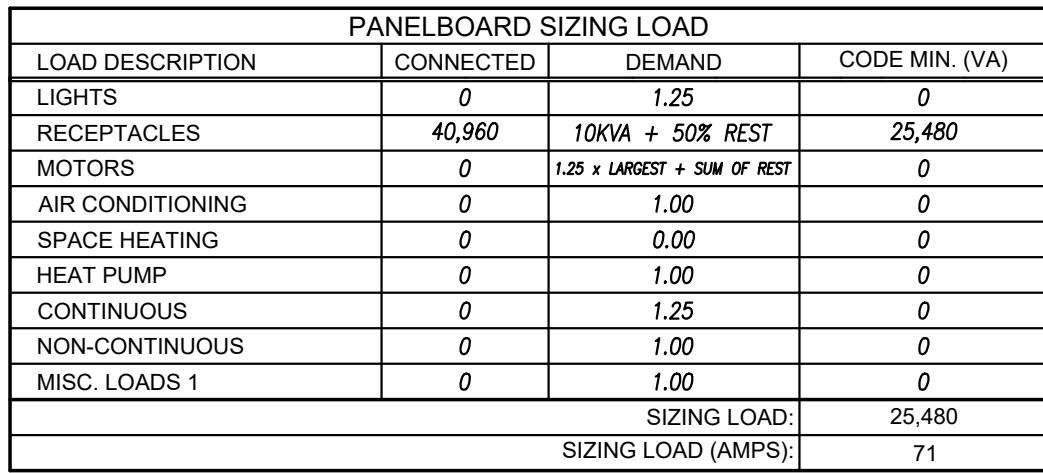
FIRST FLOOR PLAN - POWER

SHEET:
E200

OF: DATE: MAY 2020



- 1) REFER TO SPECIFICATIONS FOR APPROVED EIGHT FIXTURE MANUFACTURERS AND ADDITIONAL FIXTURE/DRIVER/BALLAST REQUIREMENTS.
- 2) LUMENS LISTED FOR LED FIXTURES ARE GENERALLY DELIVERED LUMENS UNLESS NOTED OTHERWISE.
- 3) ALL FIXTURES SHALL BE IC RATED OR PROVIDED WITH INSULATION SHIELDS WHEN INSTALLED IN INSULATED AREAS OF THE TRUSS OR PLenum SPACE.
- 4) FOR ALL FIXTURES INSTALLED IN RATED ASSEMBLIES, FURNISH AND INSTALL APPROVED FIRE BARRIER (E.Z. BARRIER OR TENMAT FT109 SERIES) OVER FIXTURE TO MAINTAIN 1 HOUR CEILING ASSEMBLY RATING.



CONNECTED PHASE LOADS		
PHASE	VA	AMPS
A	14,680	122.2
B	12,420	103.4
C	13,860	115.4
TOTALS	40,960	113.7

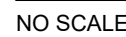
- REMARKS:
1. CUTLER HAMMER POW-R-LINE 1A OR EQUAL.
 2. PROVIDE WITH EXTERNAL SPD, 240KA RATED.

TRANSFORMER SCHEDULE											
PLAN MARK	MANUFACTURER	MODEL	FACTORED LOAD (VA)	TRANSFORMER RATING (KVA)	PRIMARY			SECONDARY			NOTES
					VOLTS	PHASE	WIRES	VOLTS	PHASE	WIRES	
T-1	CUTLER HAMMER	DT-3	25,480	75.0	480	3	3	208/120	3	4	1
REMARKS:											
1. PAD-MOUNTED TRANSFORMER											

NOT TO SCALE



NOT TO SCALE



- 1 PROVIDE SURGE PROTECTION DEVICE (SPD) EXTERNAL TO GEAR. SPD SHALL BE ANSI/JEE CATEGORY/C RATED, WITH MINIMUM SURGE OF 240KA L-L AND PER PHASE.
- 2 FUTURE UPS.
- 3 PROVIDE CONDUIT AND CONDUCTORS TO SUPPORT FUTURE UPGRADE TO 112.5KVA TRANSFORMER TO SUPPORT FUTURE UPS CAPACITY UPGRADE.
- 4 PROVIDE HOUSEKEEPING PAD SIZED TO SUPPORT FUTURE UPGRADE TO 112.5KVA TRANSFORMER.

NTS



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CONSULTANTS

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NO.	REVISION	DESCRIPTION	DATE
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PROJECT:
E-SPORTS

MISSOURI WESTERN
STATE UNIVERSITY

4525 DOWNS DRIVE
ST. JOSEPH, MO

ELECTRICAL - RISER DIAGRAM

SHEET:

E300

OF: DATE: MAY 2020

