MECHANICAL SYMBOLS

THIS IS A MASTER LEGEND AND NOT ALL SYMBOLS OR ABBREVIATIONS ARE USED. V2.04

STANDARD MOUNTING HEIGHT

THERMOSTATS (USER ADJUSTABLE)(TOP OF DEVICE)	48"
CONTROLS (TOP OF DEVICE)	48"

INSTALL DEVICES AT THE MOUNTING HEIGHTS SHOWN ABOVE UNO IN THE CONSTRUCTION DOCUMENTS. MOUNTING HEIGHTS LISTED ABOVE OR ELSEWHERE IN THE CONSTRUCTION DOCUMENTS ARE AFF OR AFG TO BOTTOM OF DEVICE UNO. ALL DEVICES SHALL BE INSTALLED IN COMPLIANCE WITH CURRENT ADA AND LOCAL REQUIREMENTS.

ANNOTATION

- 1 — MECHANICAL PLAN NOTE CALLOUT
- CU 1 — MECHANICAL EQUIPMENT DESIGNATION (CONTRACTOR FURNISHED AND INSTALLED UNLESS NOTED OTHERWISE)
- CONNECTION POINT OF NEW WORK TO EXISTING
- 1 M1 — DETAIL REFERENCE. UPPER NUMBER INDICATES DETAIL NUMBER LOWER NUMBER INDICATES SHEET NUMBER
- 1 M1 — SECTION CUT DESIGNATION

ABBREVIATIONS

A/C	AIR CONDITIONING
ACC	AIR COOLED CHILLER
ACCU	AIR COOLED CONDENSING UNIT
AFC	ABOVE FINISHED CEILING
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHJ	AUTHORITY HAVING JURISDICTION
AHU	AIR HANDLING UNIT
AI	ANALOG INPUT
AO	ANALOG OUTPUT
AP	ACCESS PANEL
APD	AIR PRESSURE DROP
AWG	AMERICAN WIRE GAUGE
B	BOILER
BAS	BUILDING AUTOMATION SYSTEM
BB	BACKBONE
BD	BACKDRAFT DAMPER
BD	BLOWDOWN
BFC	BELOW FINISHED CEILING
BFF	BELOW FINISHED FLOOR
BFG	BELOW FINISHED GRADE
BFP	BOILER FEED PUMP
BHP	BRAKE HORSEPOWER
BI	BINARY INPUT
BO	BINARY OUTPUT
BOD	BOTTOM OF DUCT
BOS	BOTTOM OF STRUCTURE
BTU	BRITISH THERMAL UNIT
CFM	CUBIC FEET PER MINUTE
CH	CHILLER
CLG	COOLING
CP	CONDENSATE PUMP
CPT	CONTROL POWER TRANSFORMER
CRAC	COMPUTER ROOM AIR CONDITIONING UNIT
CRU	COMPUTER ROOM UNIT
CT	COOLING TOWER
CV	CONTROL VALVE
CWP	CONDENSER WATER PUMP
CU	CONDENSING UNIT
CHWP	CHILLED WATER PUMP
DB	DECIBELS
DBA	DECIBEL AVERAGE
DDC	DIRECT DIGITAL CONTROL
DI	DIGITAL INPUT
DISC	DISCONNECT
DN	DOWN
DS	DUCT SILENCER
DX	DIRECT EXPANSION
(E)	EXISTING
EA	EXHAUST AIR
EAT	ENTERING AIR TEMPERATURE
ED	EXHAUST DUCT
EDB	ENTERING DRY BULB
EF	EXHAUST FAN
EFF	EFFICIENCY
EMS	ENERGY MANAGEMENT SYSTEM
ESP	EXTERNAL STATIC PRESSURE
ETR	EXISTING TO REMAIN
EWB	ENTERING WET BULB
EWT	ENTERING WATER TEMPERATURE
FCU	FAN COIL UNIT
FFA	FROM FLOOR ABOVE
FFB	FROM FLOOR BELOW
FF	FINISHED FLOOR
FPI	FINS PER INCH
FPM	FEET PER MINUTE
GC	GENERAL CONTRACTOR
GPM	GALLONS PER MINUTE
HOA	HAND-OFF-AUTOMATIC
HP	HORSEPOWER
HTG	HEATING
HWP	HEATING WATER PUMP
IN WC	INCHES OF WATER COLUMN
L	LOUVER
LAT	LEAVING AIR TEMPERATURE
LDB	LEAVING DRY BULB
LP	LOW PRESSURE
LWB	LEAVING WET BULB
LWT	LEAVING WATER TEMPERATURE
MAU	MAKE-UP AIR UNIT
MAX	MAXIMUM
MBH	1000 BTU PER HOUR
MD	MOTORIZED DAMPER
MFR	MANUFACTURER
MIN	MINIMUM
N/A	NOT APPLICABLE
N/C	NORMALLY CLOSED
N/O	NORMALLY OPEN
NOM	NOMINAL
NC	NOISE CRITERIA
NF	NON-FUSED
NIC	NOT IN CONTRACT
OA	OUTSIDE AIR
PICV	PRESSURE INDEP. CONTROL VALVE
PROVIDE	FURNISH AND INSTALL
QTY	QUANTITY
RA	RETURN AIR
RC	ROOM CRITERIA
RD	RETURN DUCT
REA	RELIEF AIR
RF	RETURN FAN
RFR	REFRIGERANT
RH	RELATIVE HUMIDITY
RH	ROOF HOOD
RPM	REVOLUTIONS PER MINUTE
RTU	ROOFTOP UNIT
SA	SUPPLY AIR
SCP	STEAM CONDENSATE PUMP
SD	SMOKE DUCT DETECTOR
SD	SUPPLY DUCT
SF	SUPPLY FAN
SH	SENSIBLE HEAT CAPACITY
SOW	SCOPE OF WORK
SP	STATIC PRESSURE
ST	STEAM TRAP
STM	STEAM
TBD	TO BE DETERMINED
TC/C	TEMPERATURE CONTROLS CONTRACTOR
TCP	TEMPERATURE CONTROL PANEL
TF	TRANSFER FAN
TFA	TO FLOOR ABOVE
TFB	TO FLOOR BELOW
TH	TOTAL HEAT CAPACITY
TSP	TOTAL STATIC PRESSURE
TT	TEMPERATURE TRANSMITTAL
TYP	TYPICAL
U/F	UNDERFLOOR
U/G	UNDERGROUND
U/S	UNDERSLAB
UH	UNIT HEATER
UNO	UNLESS NOTED OTHERWISE
VAV	VARIABLE AIR VOLUME
VEL	VELOCITY
VFD	VARIABLE FREQUENCY DRIVE
VRF	VARIABLE REFRIGERANT FLOW
VRV	VARIABLE REFRIGERANT VOLUME
W/	WITH
W/O	WITHOUT
WB	WET BULB
WC	WATER COLUMN
WPD	WATER PRESSURE DROP
XP	EXPLOSION PROOF

HVAC DUCTWORK AND ACCESSORIES

- LINEAR SLOT DIFFUSER
- INSULATED FLEXIBLE DUCT (MAX. 5'-0" LONG)
- BRANCH DUCT WITH 45° RECTANGLE-ROUND BRANCH FITTING AND MANUAL VOLUME DAMPER
- ELBOW WITH TURNING VANES
- BRANCH DUCT WITH BELL-MOUTH FITTING & MANUAL VOLUME CONTROL DAMPER
- RETURN, EXHAUST, OR OUTSIDE AIR DUCT UP
- RETURN, EXHAUST, OR OUTSIDE AIR DUCT DOWN
- SUPPLY AIR DUCT UP
- SUPPLY AIR DUCT DOWN
- EQUIPMENT WITH FLEXIBLE DUCT CONNECTION
- 10" (NECK SIZE) CSD-1 (TYPE) 300 CFM (CFM OF SUPPLY DIFFUSER OR REGISTER)
- 24x24 (NECK SIZE) CEG-1 (TYPE) 800 CFM (CFM OF EXHAUST GRILLE)
- MANUAL VOLUME DAMPER
- SQUARE TO ROUND TRANSITION
- RD — DUCT MOUNTED SMOKE DETECTOR (SD=SUPPLY/RD=RETURN)
- # — RISER DESIGNATION
- FD — FIRE DAMPER
- FSD — FIRE SMOKE DAMPER
- SD — SMOKE DAMPER
- VD — VOLUME DAMPER
- MD — MOTORIZED DAMPER
- BD — BACKDRAFT DAMPER

ALL DUCT DIMENSIONS SHOWN ON DRAWINGS ARE INSIDE DIMENSIONS. REFER TO DUCTWORK SPECIFICATIONS FOR DUCTWORK INSULATION AND LINER INFORMATION.

HVAC CONTROL DEVICES

- H — HUMIDISTAT
- T — THERMOSTAT
- SP — STATIC PRESSURE SENSOR
- TS — TEMPERATURE SENSOR
- CO — CARBON MONOXIDE SENSOR
- CO2 — CARBON DIOXIDE SENSOR
- DP — DIFFERENTIAL PRESSURE SENSOR
- FS — FLOW SWITCH
- HS — HUMIDITY SENSOR
- PS — PULL STATION

PIPING SYMBOLS

- DIRECTION OF FLOW
- CONTROL VALVE
- THREE-WAY CONTROL VALVE
- SHUTOFF VALVE
- CHECK VALVE
- BALANCING VALVE WITH PRESSURE PORTS
- TRIPLE DUTY VALVE WITH PRESSURE PORTS
- STRAINER
- STRAINER WITH BLOWDOWN VALVE
- RELIEF / SAFETY VALVE
- SOLENOID VALVE
- PRESSURE REDUCING VALVE
- GAS PRESSURE REGULATOR
- THERMOSTATIC MIXING VALVE
- PA — PIPE ANCHOR
- EJ — EXPANSION JOINT
- PIPE GUIDE
- PIPING SUPPORT
- F & T TRAP
- BUCKET TRAP
- THERMOSTATIC TRAP
- BACKFLOW PREVENTER
- PRESSURE GAUGE
- THERMOMETER
- PRESSURE AND TEMPERATURE TEST PLUG
- UNION
- FLANGE CONNECTION
- VACUUM RELIEF VALVE
- AV — AUTOMATIC AIR VENT
- MV — MANUAL AIR VENT
- PRESSURE / VACUUM SWITCH
- CLEANOUT
- CAP
- ELBOW UP
- ELBOW DOWN
- TEE UP
- TEE DOWN
- ELBOW UP WITH SHUT-OFF VALVE (SOV)
- ELBOW DOWN WITH SHUT-OFF VALVE (SOV)
- TEE UP WITH SHUT-OFF VALVE (SOV)
- TEE DOWN WITH SHUT-OFF VALVE (SOV)
- REDUCER
- RECIRCULATION PUMP
- P-TRAP
- GAS COCK
- TOP BEAM CLAMP
- TRAPEZE HANGER
- FLEXIBLE CONNECTION

PIPING LINETYPES

- CD — CONDENSATE DRAIN (CD)
- ACD — AUXILIARY CONDENSATE DRAIN (ACD)
- NPW — NON-POTABLE WATER (NPW)
- G — NATURAL GAS (G)
- G — NATURAL GAS ON ROOF (G)
- MPG — MEDIUM PRESSURE NATURAL GAS (MPG)
- MPG — MEDIUM PRESSURE NATURAL GAS ON ROOF (MGP)
- FOS — FUEL OIL SUPPLY (FOS)
- FOR — FUEL OIL RETURN (FOR)
- FOV — FUEL OIL VENT (FOV)
- LPG — LIQUEFIED PETROLEUM GAS (LPG)
- BFW — BOILER FEED WATER (BFW)
- HPS — HIGH PRESSURE STEAM SUPPLY (HPS)
- HPC — HIGH PRESSURE STEAM CONDENSATE (HPC)
- LPS — LOW PRESSURE STEAM SUPPLY (LPS)
- LPC — LOW PRESSURE STEAM CONDENSATE (LPC)
- PD — CONDENSATE PUMP DISCHARGE (PD)
- HWS — HEATING HOT WATER SUPPLY (HWS)
- HWR — HEATING HOT WATER RETURN (HWR)
- CHWS — CHILLED WATER SUPPLY (CHWS)
- CHWR — CHILLED WATER RETURN (CHR)
- HCS — HOT / CHILLED WATER SUPPLY (HCS)
- HCR — HOT / CHILLED WATER SUPPLY (HCR)
- CWS — CONDENSER WATER SUPPLY (CWS)
- CWR — CONDENSER WATER RETURN (CWR)
- HPWS — HEAT PUMP WATER SUPPLY (HPWS)
- HPWR — HEAT PUMP WATER RETURN (HPWR)
- RL — REFRIGERANT LIQUID (RL)
- RD — REFRIGERANT DISCHARGE (HOT GAS) (RD)
- RS — REFRIGERANT SUCTION (RS)
- RDB — REFRIGERANT DISCHARGE BYPASS (RDB)
- RV — REFRIGERANT VENT (RV)

LINETYPE LEGEND

THROUGHOUT THE DRAWINGS DIFFERENT LINETYPES ARE USED IN COMBINATION WITH THE SYMBOLS TO INDICATE THE STATUS OF ITEMS AS EXISTING, TO BE DEMOLISHED, TO BE INCLUDED AS PART OF NEW WORK AND/OR ITEMS WHICH ARE ANTICIPATED TO BE PROVIDED IN THE FUTURE. THE STATUS OF ITEMS USING THESE LINETYPES ARE RELATIVE TO THE VIEW IN WHICH THEY APPEAR. PHASING SHOWN IN DRAWINGS IS NOT INTENDED TO FULLY DESCRIBE ALL NECESSARY CONSTRUCTION PHASING, WHICH IS DETERMINED BY THE CONTRACTOR AS PART OF THEIR RESPONSIBILITIES. ANY SUCH PHASES DESCRIBED IN THE CONSTRUCTION DOCUMENTS ARE GENERAL AND ONLY INTENDED TO INDICATE A BROAD ORDER FOR THE SAKE OF DESCRIBING THE PROJECT. THE FOLLOWING LINETYPES MAY BE USED ON ANY DEVICE, EQUIPMENT, NOTE, LINE, SHAPE, ETC.

EXISTING	NEW
DEMOLISH	FUTURE

GENERAL NOTES:

1. PRIOR TO SUBMITTING BID, VISIT THE JOB SITE AND BECOME FULLY ACQUAINTED WITH THE EXISTING CONDITIONS OF THE PROJECT. REVIEW THE GENERAL NOTES, SPECIFICATIONS AND OTHER DRAWINGS FOR ADDITIONAL REQUIREMENTS WHICH MAY NOT BE SPECIFICALLY CALLED OUT IN THIS PORTION OF THE CONSTRUCTION DOCUMENTS. NOTIFY ARCHITECT, ENGINEER AND/OR OWNER OF CONFLICTS OR DISCREPANCIES PRIOR TO SUBMISSION OF BID.
2. COORDINATE THE INSTALLATION OF THE MECHANICAL SYSTEMS WITH OTHER TRADES TO ENSURE A NEAT AND ORDERLY INSTALLATION. INSTALL DUCTWORK AND PIPING AS TIGHT TO STRUCTURE AS POSSIBLE. COORDINATE WITH OTHER TRADES TO AVOID CONFLICTS. COORDINATE INSTALLATION OF DUCTWORK AND PIPING TO AVOID CONFLICTS WITH ELECTRICAL PANELS, LIGHTING FIXTURES, ETC. ANY MODIFICATIONS REQUIRED DUE TO LACK OF COORDINATION WILL BE THE RESPONSIBILITY OF THE CONTRACTOR AT NO EXTRA COST TO THE OWNER.
3. DURING INSTALLATION OF NEW WORK, AVOID DAMAGING EXISTING SURFACES AND EQUIPMENT TO REMAIN. REPAIR DAMAGE CAUSED DURING CONSTRUCTION AT NO EXTRA COST TO THE OWNER.
4. ALL MECHANICAL EQUIPMENT SHOWN ON THE MECHANICAL PLANS SHALL BE PROVIDED BY DIVISION 23 UNLESS OTHERWISE NOTED.
5. NEW MECHANICAL EQUIPMENT, DUCTWORK AND PIPING ARE SHOWN AT APPROXIMATE LOCATIONS. FIELD MEASURE FINAL DUCTWORK AND PIPING LOCATIONS PRIOR TO FABRICATION AND MAKE ADJUSTMENTS AS REQUIRED TO FIT THE DUCTWORK AND PIPING WITHIN THE AVAILABLE SPACE. VERIFY THAT FINAL EQUIPMENT LOCATIONS MEET MANUFACTURER'S RECOMMENDATIONS REGARDING SERVICE CLEARANCE AND PROPER AIRFLOW CLEARANCE AROUND EQUIPMENT.
6. REFER TO ARCHITECTURAL DRAWINGS FOR RELATED CONSTRUCTION DETAILS AS APPLICABLE TO THE HVAC SYSTEM. VERIFY CHASES AND PENETRATIONS SHOWN ON ARCHITECTURAL DRAWINGS THAT ARE INTENDED FOR DUCTWORK AND PIPING MEET REQUIREMENTS.
7. COORDINATE LOCATION OF ROOF MOUNTED HVAC EQUIPMENT AND ROOF PENETRATIONS WITH THE ARCHITECTURAL AND STRUCTURAL DRAWINGS.
8. INDOOR AIR QUALITY MEASURES: PROTECT INSIDE OF (INSTALLED AND DELIVERED) DUCTWORK AND HVAC UNITS FROM EXPOSURE TO DUST, DIRT, PAINT AND MOISTURE. REPLACE INSULATION THAT HAS BECOME WET AT ANY TIME DURING CONSTRUCTION, DRYING THE INSULATION IS NOT ACCEPTABLE. SEAL ANY TEARS OR JOINTS OF INTERNAL FIBERGLASS INSULATION. REMOVE DEBRIS FROM CEILING/RETURN AIR PLENUM INCLUDING DUST. AN INDEPENDENT, PROFESSIONAL DUCT CLEANING COMPANY SHALL VACUUM CLEAN ANY DUCTWORK CONNECTED TO HVAC UNITS THAT WERE OPERATED DURING THE CONSTRUCTION PERIOD AFTER NEW FILTERS ARE INSTALLED AND PRIOR TO TURNING SYSTEM OVER TO THE OWNER. THE INTERNAL SURFACES AND ASSOCIATED COILS OF ANY HVAC UNITS THAT WERE OPERATED SHALL ALSO BE CLEANED.
9. INSTALL DUCTWORK AND PIPING PARALLEL TO BUILDING COLUMN LINES UNLESS OTHERWISE SHOWN OR NOTED.
10. OVERHEAD HANGERS AND SUPPORTS FOR EQUIPMENT, DUCTWORK AND PIPING SHALL BE FASTENED TO BUILDING JOISTS OR BEAMS. DO NOT ATTACH HANGERS AND SUPPORTS TO THE ABOVE FLOOR SLAB OR ROOF EXCEPT WHERE CONCRETE INSERTS IN CONCRETE SLABS ARE ALLOWED BY THE SPECIFICATIONS.
11. COORDINATE LOCATION OF EQUIPMENT SUPPORTS WITH LOCATION OF EQUIPMENT ACCESS PANELS/DOORS TO ENABLE SERVICE OF EQUIPMENT AND/OR FILTER REPLACEMENT.
12. SEAL PENETRATIONS THROUGH THE BUILDING COMPONENTS IN ACCORDANCE WITH THE CONTRACT SPECIFICATIONS. FIREPROOF PENETRATIONS THROUGH FIRE RATED COMPONENTS IN ACCORDANCE WITH U.L. REQUIREMENTS.
13. COORDINATE THE EXACT MOUNTING SIZE AND FRAME TYPE OF DIFFUSERS, REGISTERS AND GRILLES WITH THE SUPPLIER TO MEET THE CEILING, WALL AND DUCT INSTALLATION REQUIREMENTS.
14. ADJUST LOCATION OF CEILING DIFFUSERS, REGISTERS AND GRILLES AS REQUIRED TO ACCOMMODATE FINAL CEILING GRID AND LIGHTING LOCATIONS.
15. PAINT PORTIONS OF DUCTWORK AND INSULATION THAT ARE EXPOSED TO VIEW BY THE INSTALLATION OF DIFFUSERS, REGISTERS, AND GRILLES IN CEILINGS OR WALLS FLAT BLACK. PORTIONS INCLUDE BOTH THE INTERIOR OF UNLINED DUCTWORK AND THE EXTERIOR OF DUCTWORK AND INSULATION.
16. DUCTWORK CROSSING FIRE RATED WALLS OR OTHER FIRE RATED ASSEMBLIES SHALL BE MINIMUM 26 GAUGE SHEET METAL.
17. PROVIDE FIRE OR FIRE/SMOKE DAMPERS, AS APPLICABLE, IN DUCTWORK AT CEILINGS AND WALLS AT LOCATIONS SHOWN ON THE PLANS. FIRE AND FIRE/SMOKE DAMPERS SHALL CONFORM TO NFPA AS APPLICABLE. COORDINATE SLEEVE LENGTH WITH REQUIREMENTS OF INSTALLED LOCATION.
18. PROVIDE WALL OR DUCT ACCESS PANELS OR DOORS FOR ACCESS TO FIRE AND FIRE/SMOKE DAMPERS. ACCESS PANEL OR DOOR SHALL BE MINIMUM SIZE OF 10" BY 10" AND SHALL BE INSTALLED WITHIN 12" OF DAMPER. PROVIDE A REMOVABLE DUCT SECTION WHERE DUCT SIZE IS TOO SMALL FOR A 10" BY 10" ACCESS DOOR.
19. LOCATE AND SET THERMOSTATS AND HUMIDISTATS AT LOCATIONS SHOWN ON PLANS. VERIFY EXACT LOCATIONS WITH ARCHITECT PRIOR TO INSTALLATION. INSTALL DEVICES WITH TOP OF DEVICE AT MAXIMUM 48" AFF TO MEET ADA REQUIREMENTS UNLESS NOTED OTHERWISE ON PLANS. PROVIDE INSULATED BACKING FOR THERMOSTATS MOUNTED ON EXTERIOR BUILDING WALLS. INSTALL WIRING IN CONDUIT PROVIDED BY DIVISION 26. AT A MINIMUM, PROVIDE CONDUIT IN THE WALL FROM THE JUNCTION BOX TO 6" ABOVE THE CEILING.
20. COORDINATE THE LOCATION AND ELEVATION OF WALL-MOUNTED DEVICES WITH PRESENTATION BOARDS, DISPLAY CABINETS, SHELVES OR OTHER COMPONENTS SHOWN ON THE ARCHITECTURAL DRAWINGS THAT ARE TO BE INSTALLED UNDER OTHER DIVISIONS. CONTRACTOR WILL NOT BE REIMBURSED FOR RELOCATION OF WALL-MOUNTED DEVICES CAUSED BY A LACK OF COORDINATION.
21. PROVIDE A MANUAL BALANCING DAMPER IN EACH DUCT TAKEOFF FROM SUPPLY, RETURN, OUTDOOR AND EXHAUST AIR DUCTS.
22. PROVIDE A PREFABRICATED 45 DEGREE, HIGH EFFICIENCY, RECTANGULAR/ROUND BRANCH DUCT TAKEOFF FITTING FOR BRANCH DUCT CONNECTIONS AND TAKE-OFFS TO INDIVIDUAL DIFFUSERS, REGISTERS AND GRILLES. PROVIDE WITH INTEGRAL MANUAL BALANCING DAMPER AND LOCKING QUADRANT WHERE INDICATED ON PLANS.
23. BRANCH DUCTWORK TO AIR OUTLETS SHALL BE SAME SIZE AS OUTLET NECK SIZE UNLESS OTHERWISE NOTED.
24. REFER TO SPECIFICATIONS FOR DUCTWORK AND PIPING INSULATION REQUIREMENTS. DUCT SIZES ON MECHANICAL PLANS INDICATE CLEAR INSIDE AIRFLOW DIMENSIONS. INCREASE SHEET METAL SIZES ACCORDINGLY TO ACCOUNT FOR THICKNESS OF DUCT LINER.
25. FLEXIBLE DUCTWORK SHALL NOT EXCEED 5'-0" IN LENGTH AND SHALL BE INSTALLED AND SUPPORTED TO AVOID SHARP BENDS AND SAGGING. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
26. RIGIDLY SUSPEND UNIT HEATER FROM STRUCTURE WITH SUPPORTING ANGLES AND ALL-THREAD HANGING RODS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
27. PROVIDE WALL MOUNTED LOUVERS AND DAMPERS WITH SUITABLE MOUNTING FRAME TO MATCH WALL CONSTRUCTION. COORDINATE WITH ARCHITECTURAL DRAWINGS.
28. PROVIDE A NEW SET OF AIR FILTERS IN UNITS PRIOR TO TESTING, ADJUSTING AND BALANCING AND BEFORE TURNING SYSTEM(S) OVER TO OWNER.

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.:	1850004412
Date:	10.25.19
Issued For:	SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI — JOSHUA N. HOVER — NUMBER PE-2017008503 — PROFESSIONAL ENGINEER

Oct 25 2019
JOSHUA N. HOVER
LICENSE # PE-2017008503

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
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EXPIRES 12/31/2020

SHEET TITLE

MECHANICAL LEGENDS AND GENERAL NOTES

SHEET NUMBER

M000

JOSHUA N. HOVER

MECHANICAL PLAN NOTES:

1 MOUNT DUCTLESS SPLIT SYSTEM HIGH ON WALL AT 8'-0" AFF, COORDINATE WITH ELECTRICAL EQUIPMENT SUCH THAT UNIT DOES NOT IMPEDE INSTALLATION OF ELECTRICAL EQUIPMENT.

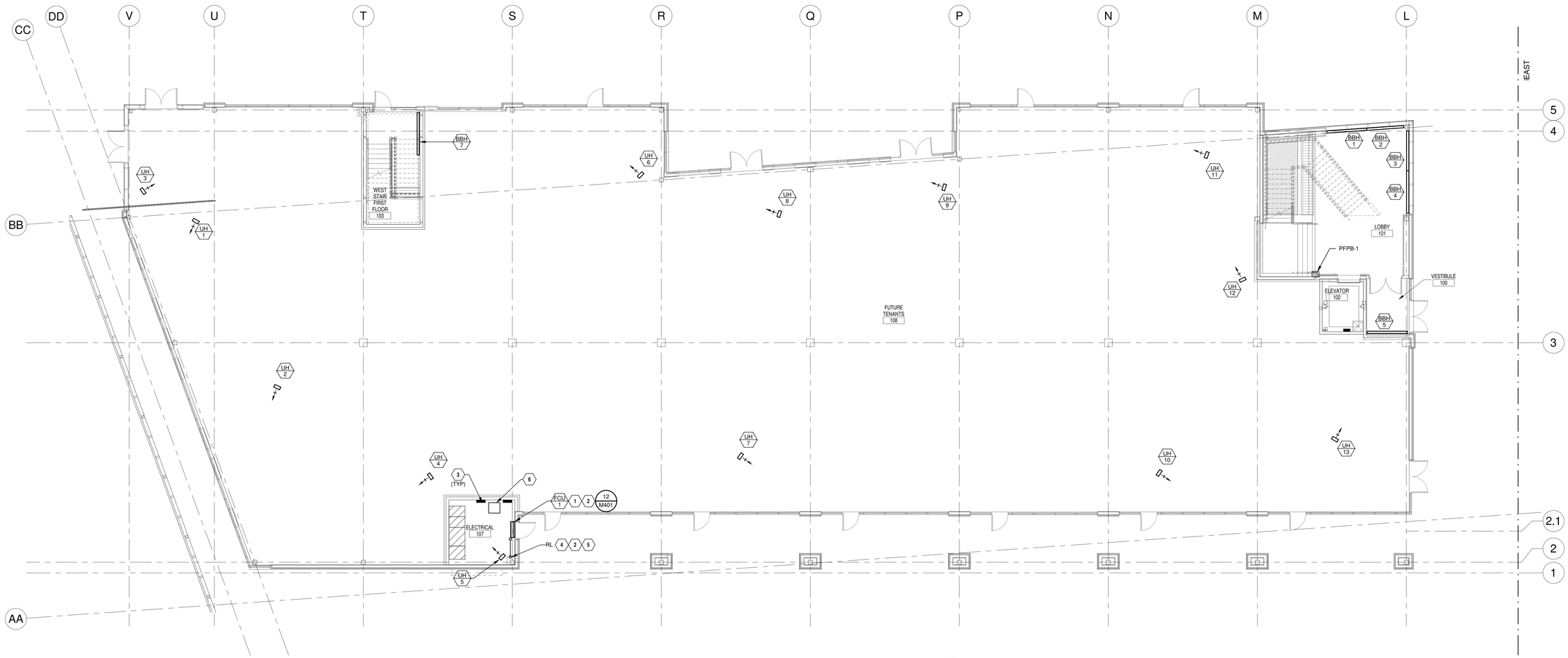
2 REFRIGERANT PIPING SHALL BE ROUTED FROM THE NEW SPLIT SYSTEM UP THE NEW CONDENSING UNIT LOCATED ON THE ROOF. FIELD VERIFY EXACT ROUTING OF REFRIGERANT PIPING WITH OWNER PRIOR TO INSTALLATION. SUBMIT REFRIGERANT PIPING AND ISOMETRIC DRAWINGS INCLUDING MANUFACTURER SIZED PIPE SIZES AND LENGTHS TO EQUIPMENT MANUFACTURER FOR REVIEW AND APPROVAL. COPY OF APPROVED DRAWINGS SHALL BE SUBMITTED TO ENGINEER OF RECORD PRIOR TO INSTALLATION. REFRIGERANT PIPING SHALL BE ROUTED IN FULL ACCORDANCE WITH THE SPLIT SYSTEM MANUFACTURER'S REQUIREMENTS AND RECOMMENDATIONS.

3 DO NOT ROUTE DUCTWORK OR PIPING ABOVE ELECTRICAL PANELS.

4 REFRIGERANT PIPING IS SHOWN SINGLE LINE FOR CLARITY. VERIFY WITH MANUFACTURER THE PIPE SIZE AND QUANTITY WITH THE FINAL SYSTEM PURCHASED.

5 REFRIGERANT PIPE UP TO FLOOR ABOVE.

6 MAINTAIN A MINIMUM CLEARANCE OF 6" FROM THE SIDE OF THE TRANSFORMER AND 36" FROM THE FRONT OF THE TRANSFORMER.



1 MECHANICAL FIRST FLOOR PLAN - WEST
1/8" = 1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
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EXPIRES 12/31/2020

SHEET TITLE

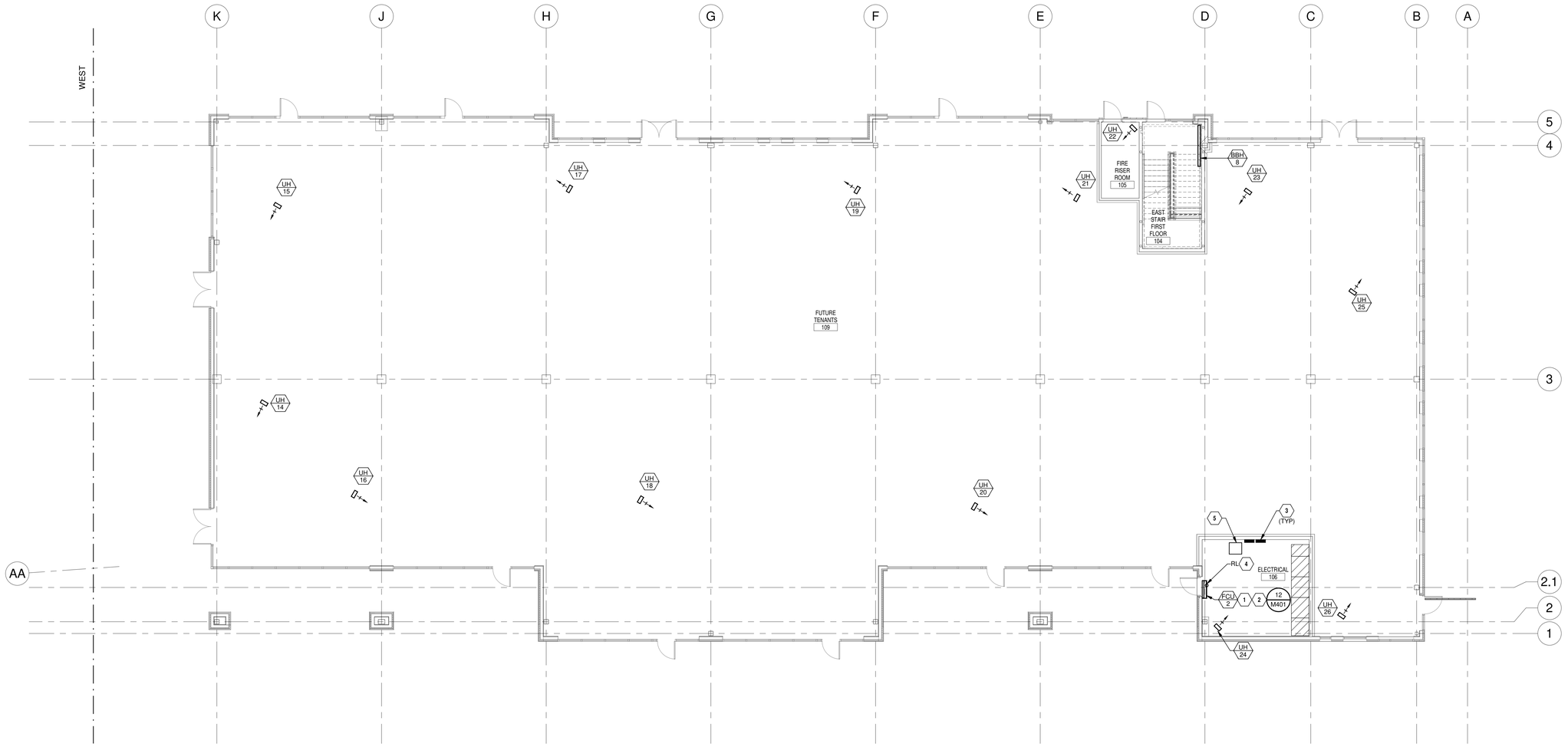
MECHANICAL FIRST FLOOR PLAN - WEST

SHEET NUMBER

M101.1

MECHANICAL PLAN NOTES:

1. MOUNT DUCTLESS SPLIT SYSTEM HIGH ON WALL AT 8'-0" AFF. COORDINATE WITH ELECTRICAL EQUIPMENT SUCH THAT UNIT DOES NOT IMPEDE INSTALLATION OF ELECTRICAL EQUIPMENT.
2. REFRIGERANT PIPING SHALL BE ROUTED FROM THE NEW SPLIT SYSTEM UP THE NEW CONDENSING UNIT LOCATED ON THE ROOF. FIELD VERIFY EXACT ROUTING OF REFRIGERANT PIPING WITH OWNER PRIOR TO INSTALLATION. SUBMIT REFRIGERANT PIPING AND ISOMETRIC DRAWINGS INCLUDING MANUFACTURER SIZED PIPE SIZES AND LENGTHS TO EQUIPMENT MANUFACTURER FOR REVIEW AND APPROVAL. COPY OF APPROVED DRAWINGS SHALL BE SUBMITTED TO ENGINEER OF RECORD PRIOR TO INSTALLATION. REFRIGERANT PIPING SHALL BE ROUTED IN FULL ACCORDANCE WITH THE SPLIT SYSTEM MANUFACTURER'S REQUIREMENTS AND RECOMMENDATIONS.
3. DO NOT ROUTE DUCTWORK OR PIPING ABOVE ELECTRICAL PANELS.
4. REFRIGERANT PIPE UP TO FLOOR ABOVE.
5. MAINTAIN A MINIMUM CLEARANCE OF 6" FROM THE SIDE OF THE TRANSFORMER AND 36" FROM THE FRONT OF THE TRANSFORMER.



1 MECHANICAL FIRST FLOOR PLAN - EAST
1/8" = 1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
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STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

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1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

MECHANICAL FIRST FLOOR PLAN - EAST

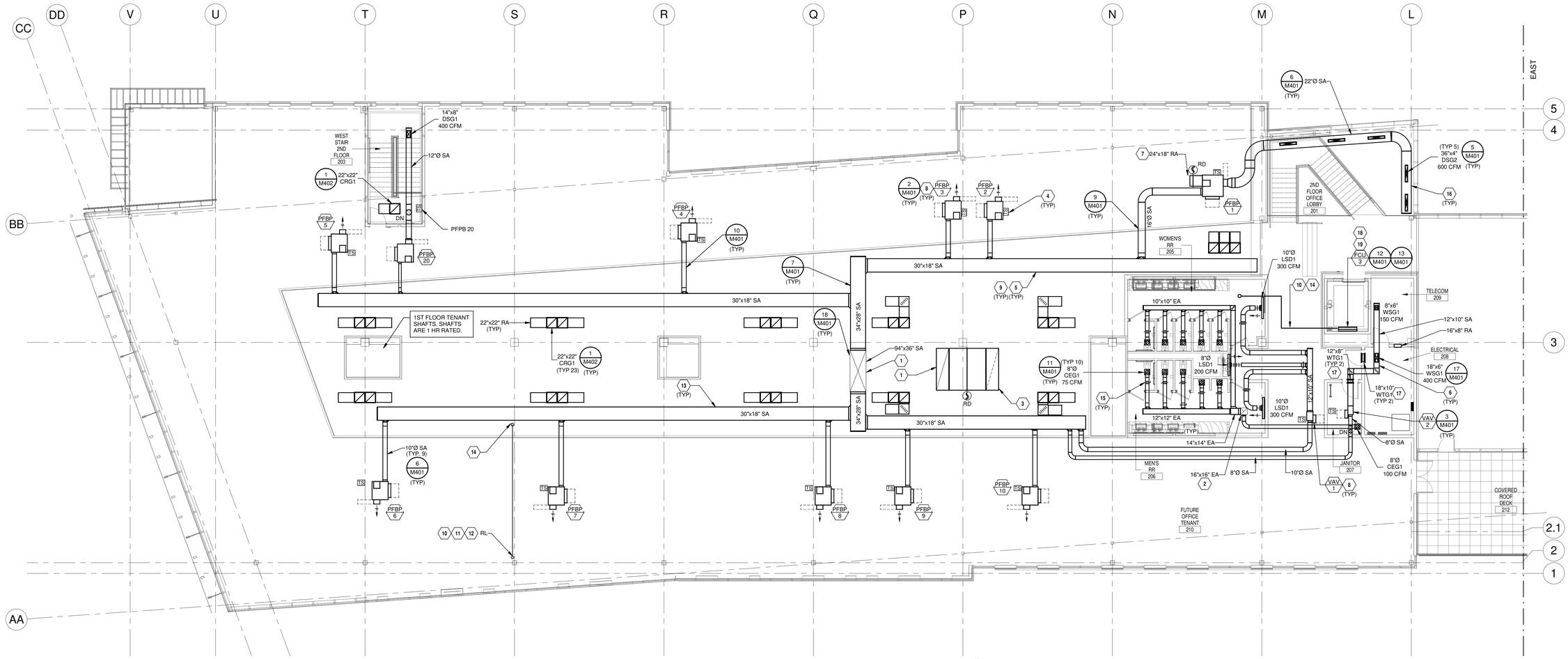
SHEET NUMBER

M101.2

JOSHUA N. HOVER

MECHANICAL PLAN NOTES:

1 SUPPLY/RETURN DUCTS DOWN FROM RTU-1.
2 EXHAUST DUCT UP TO EXHAUST FAN AS SHOWN. COORDINATE EXACT LOCATION WITH STRUCTURAL AND OTHER TRADES. MAINTAIN SERVICE AND OPERATIONAL CLEARANCES BETWEEN FAN, ADJACENT EQUIPMENT AND STRUCTURAL. MAINTAIN 15 FEET MINIMUM DISTANCE TO OUTSIDE AIR INTAKES. RISER SIZE SHALL MATCH FAN INLET SIZE UNLESS OTHERWISE INDICATED.
3 ELBOW RETURN AIR DUCT UP FULL WIDTH AND HEIGHT OF RETURN AIR CONNECTION.
4 PROVIDE 50' OF WIRE WITH TEMPERATURE SENSOR AND NEATLY SUSPEND SENSOR BELOW UNIT.
5 COORDINATE ROUTING OF DUCTWORK WITH LIGHT HOUSINGS, ELECTRICAL CONDUIT, PIPING, ETC.. DUCTWORK INSULATION SHALL BE AT LEAST 3" FROM LIGHT HOUSINGS.
6 DO NOT ROUTE DUCTWORK OR PIPING ABOVE ELECTRICAL PANELS.
7 CONNECT RETURN AIR DUCT FULL WIDTH AND HEIGHT OF RETURN AIR CONNECTION ON PFBP 1 AND INSTALL DUCT DETECTOR. DUCT DETECTOR SHALL BE PROVIDED BY DIV 28.
8 INSTALL FAN POWERED BOXES AND VAVS TIGHT TO STRUCTURE.
9 ROUTE DUCT AS TIGHT TO STRUCTURE AS POSSIBLE.
10 REFRIGERANT PIPING IS SHOWN SINGLE LINE FOR CLARITY. VERIFY WITH MANUFACTURER THE PIPE SIZE AND QUANTITY WITH THE FINAL SYSTEM PURCHASED.
11 PIPE UP/DOWN.
12 ROUTE REFRIGERANT PIPING TIGHT TO STRUCTURAL COLUMN.
13 ALL DUCTWORK IN OFFICE AREA SHALL BE EXPOSED. INSULATE WITH DUCT LINER PER SPEC. PAINT ALL SUPPLY AND RETURN AIR DUCTWORK AND EQUIPMENT. REFER TO ARCHITECTURAL DRAWINGS FOR INFORMATION ON PAINTING AND COLOR.
14 REFRIGERANT PIPE UP TO FLOOR ABOVE.
15 PROVIDE CABLE OPERATED VOLUME DAMPER BY METROPOLITAN AIR TECHNOLOGIES MODEL RT-250 WITH EXTERNAL WORM GEAR OPERATOR OR YOUNG'S REGULATOR EQUIVALENT BUTTERFLY DAMPER WITH 270-275 CONTROLLER IN INDICATED BRANCH DUCTWORK FOR BALANCING. SECURELY ATTACH ADJUSTABLE MOUNTING CLAMP TO CEILING FRAMING MEMBERS.
16 ROUND SPIRAL DUCT SERVING ENTRY SHALL BE DOUBLE WALL INSULATED PER SPECIFICATION. REFER TO ARCHITECTURAL DRAWINGS FOR INFORMATION ON PAINTING AND COLOR.
17 MOUNT TRANSFER GRILLES CENTERED ABOVE DOOR.
18 MOUNT UNIT HIGH ENOUGH IN ELEVATOR SHAFT TO CLEAR TOP OF ELEVATOR CABS AND EQUIPMENT. COORDINATE WITH ELEVATOR MANUFACTURER. REFER TO SCHEDULE ON SHEET M501 FOR MORE INFORMATION.
19 REFRIGERANT PIPING SHALL BE ROUTED FROM THE NEW SPLIT SYSTEM UP THE NEW CONDENSING UNIT LOCATED ON THE ROOF. FIELD VERIFY EXACT ROUTING OF REFRIGERANT PIPING WITH OWNER PRIOR TO INSTALLATION. SUBMIT REFRIGERANT PIPING AND ISOMETRIC DRAWINGS INCLUDING MANUFACTURER SIZED PIPE SIZES AND LENGTHS TO EQUIPMENT MANUFACTURER FOR REVIEW AND APPROVAL. COPY OF APPROVED DRAWINGS SHALL BE SUBMITTED TO ENGINEER OF RECORD PRIOR TO INSTALLATION. REFRIGERANT PIPING SHALL BE ROUTED IN FULL ACCORDANCE WITH THE SPLIT SYSTEM MANUFACTURER'S REQUIREMENTS AND RECOMMENDATIONS.



1 MECHANICAL SECOND FLOOR PLAN - WEST
1/8" = 1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
JOSHUA N. HOVER
NUMBER PE-2017008503
PROFESSIONAL ENGINEER

Oct 25 2019
JOSHUA N. HOVER
LICENSE # PE-2017008503

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
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1850004412

SHEET TITLE

MECHANICAL SECOND FLOOR PLAN - WEST

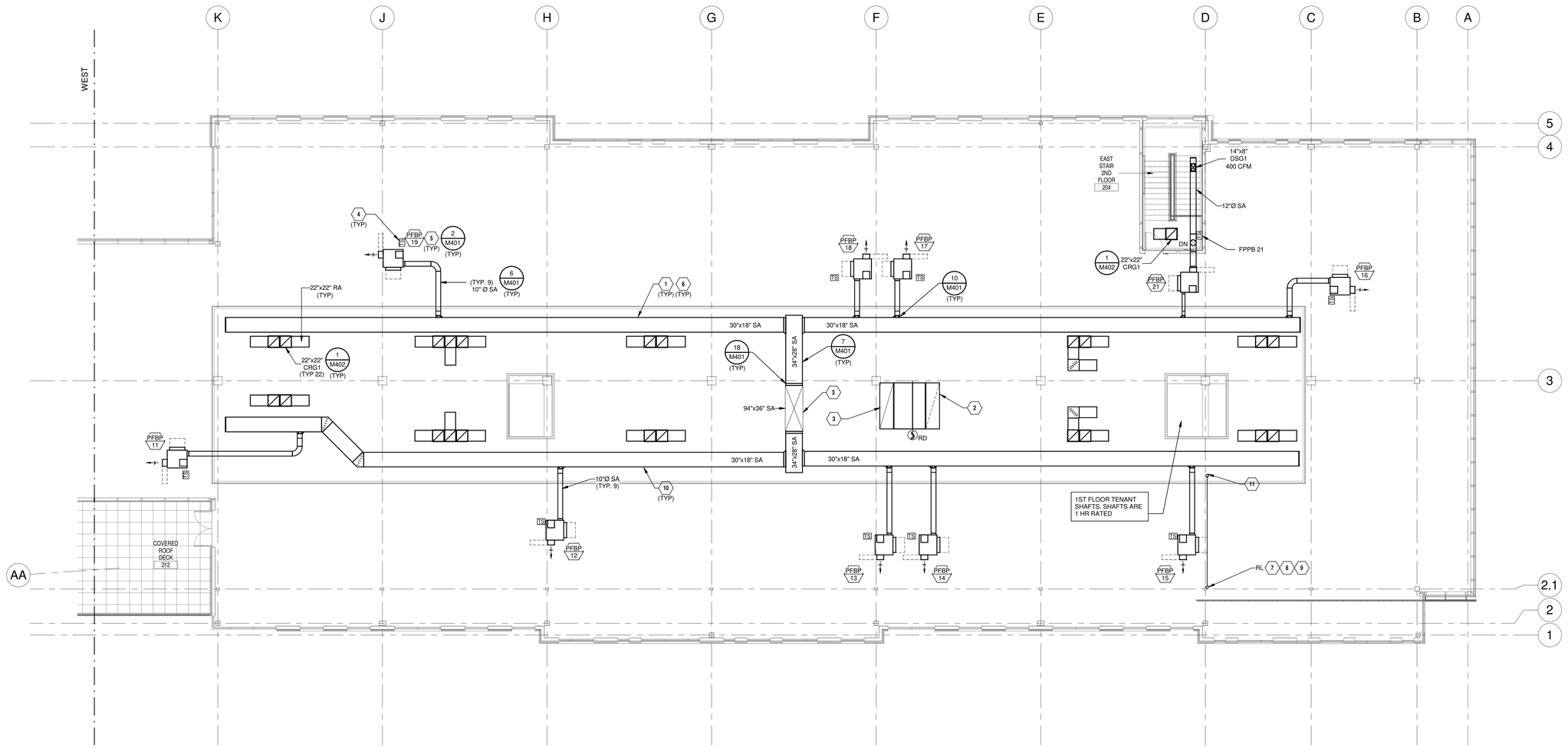
SHEET NUMBER

M102.1

JOSHUA N. HOVER

MECHANICAL PLAN NOTES:

1. COORDINATE ROUTING OF DUCTWORK WITH LIGHT HOUSINGS, ELECTRICAL CONDUIT, PIPING, ETC.. DUCTWORK INSULATION SHALL BE AT LEAST 3" FROM LIGHT HOUSINGS.
2. ELBOW RETURN AIR DUCT UP FULL WIDTH AND HEIGHT OF RETURN AIR CONNECTION.
3. SUPPLY/RETURN DUCTS DOWN FROM RTU-2.
4. PROVIDE 50' OF WIRE WITH TEMPERATURE SENSOR AND NEATLY SUSPEND SENSOR BELOW UNIT.
5. INSTALL FAN POWERED BOXES AND VAVS TIGHT TO STRUCTURE.
6. ROUTE DUCT AS TIGHT TO STRUCTURE AS POSSIBLE.
7. REFRIGERANT PIPING IS SHOWN SINGLE LINE FOR CLARITY. VERIFY WITH MANUFACTURER THE PIPE SIZE AND QUANTITY WITH THE FINAL SYSTEM PURCHASED.
8. PIPE UP/DOWN.
9. ROUTE REFRIGERANT PIPING TIGHT TO STRUCTURAL COLUMN.
10. ALL DUCTWORK IN OFFICE AREA SHALL BE EXPOSED. INSULATE WITH DUCT LINER PER SPEC. PAINT ALL SUPPLY AND RETURN AIR DUCTWORK AND EQUIPMENT. REFER TO ARCHITECTURAL DRAWINGS FOR INFORMATION ON PAINTING AND COLOR.
11. REFRIGERANT PIPE UP TO FLOOR ABOVE.



1 MECHANICAL SECOND FLOOR PLAN - EAST
1/8" = 1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
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SHEET TITLE

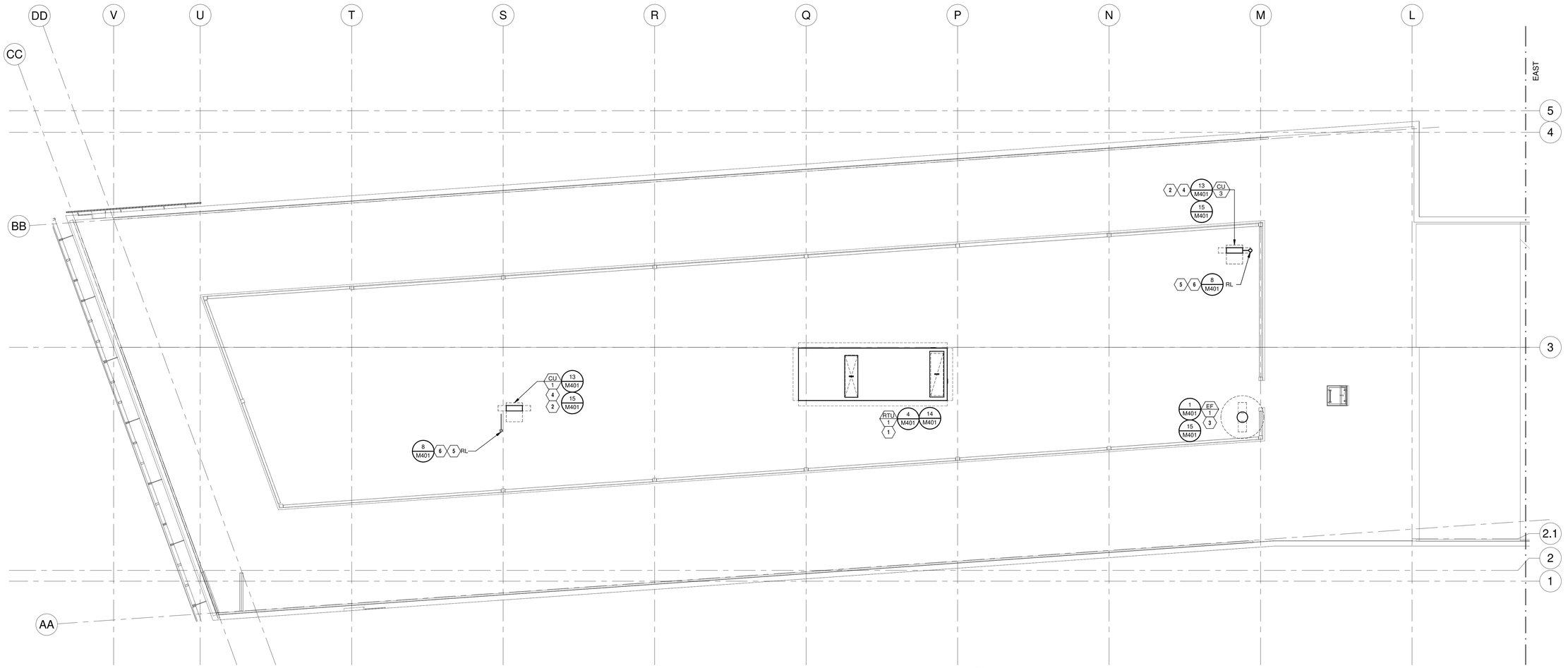
MECHANICAL SECOND FLOOR PLAN - EAST

SHEET NUMBER

M102.2

MECHANICAL PLAN NOTES:

1. PROVIDE ROOF TOP UNIT APPROXIMATELY WHERE SHOWN. COORDINATE FINAL LOCATION WITH ARCHITECT AND STRUCTURAL ENGINEER. ROOF CURB SHALL ACCOUNT FOR SLOPE OF ROOF. TRANSITION SUPPLY DUCTWORK AS SHOWN ON PLANS.
2. PROVIDE SPLIT SYSTEM CONDENSING UNIT WHERE SHOWN. ROUTE REFRIGERANT PIPING TO ASSOCIATED INTERIOR FAN COIL. COORDINATE EXACT REFRIGERANT PIPING ROUTING AND SIZE WITH MANUFACTURER.
3. PROVIDE ROOF MOUNTED EXHAUST FAN APPROXIMATELY WHERE SHOWN. MAINTAIN MINIMUM 10'-0" CLEARANCE FROM BUILDING INTAKE.
4. MOUNT AND ANCHOR CONDENSING UNIT ON ROOF RAIL. ROUTE REFRIGERANT PIPING TO AND FROM FAN COIL UNIT BELOW PER MANUFACTURER'S RECOMMENDATIONS AND IN APPROXIMATE LOCATION SHOWN ON PLANS. REFER TO DETAILS SHEET FOR MORE INFORMATION.
5. REFRIGERANT PIPE DOWN TO FLOOR BELOW.
6. REFRIGERANT PIPING IS SHOWN SINGLE LINE FOR CLARITY. VERIFY WITH MANUFACTURER THE PIPE SIZE AND QUANTITY WITH THE FINAL SYSTEM PURCHASED.



1 MECHANICAL ROOF PLAN - WEST
1/8" = 1'-0"

N

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
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SHEET TITLE

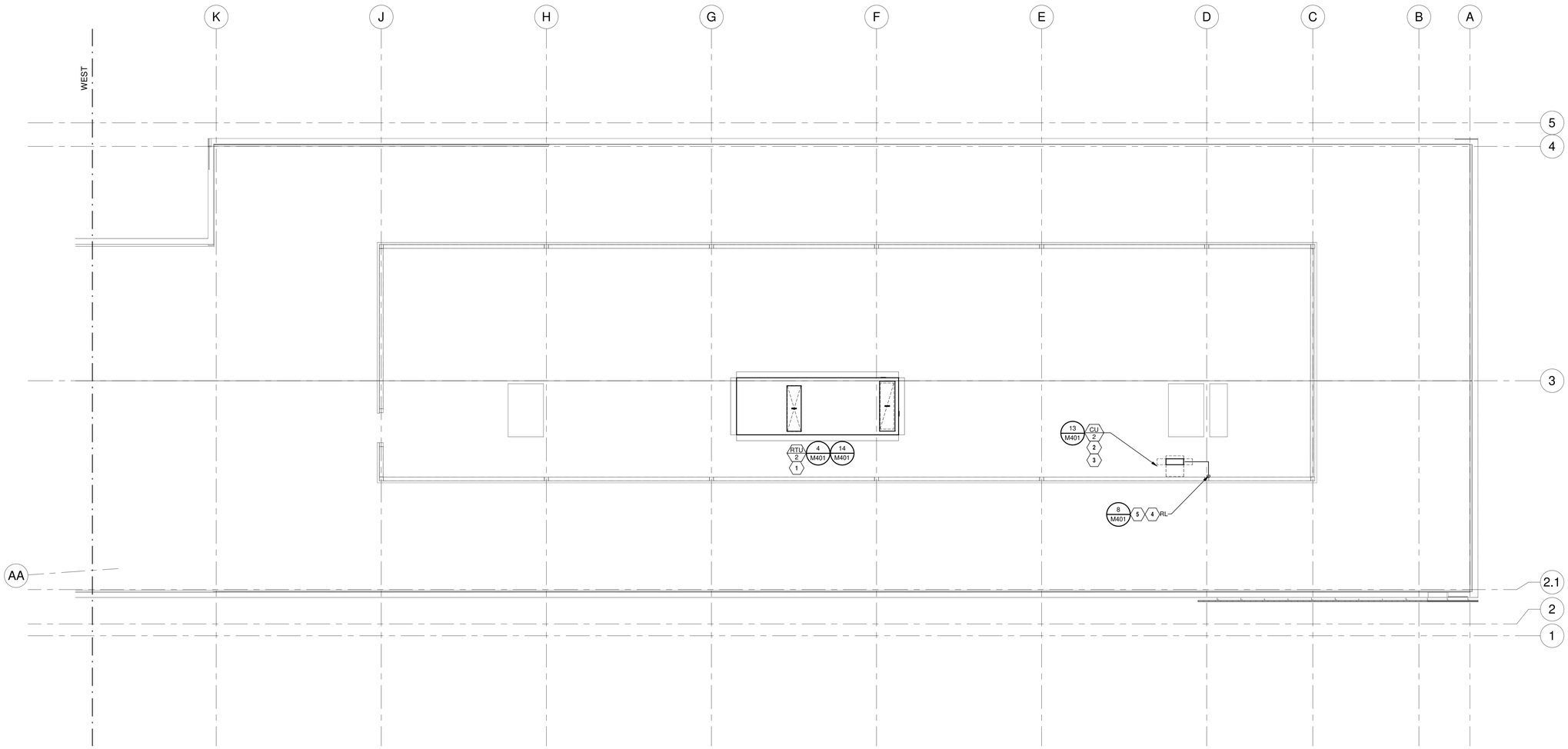
MECHANICAL ROOF PLAN - WEST

SHEET NUMBER

M201.1

MECHANICAL PLAN NOTES:

1. PROVIDE ROOF TOP UNIT APPROXIMATELY WHERE SHOWN. COORDINATE FINAL LOCATION WITH ARCHITECT AND STRUCTURAL ENGINEER. ROOF CURB SHALL ACCOUNT FOR SLOPE OF ROOF. TRANSITION SUPPLY DUCTWORK AS SHOWN ON PLANS.
2. PROVIDE SPLIT SYSTEM CONDENSING UNIT WHERE SHOWN. ROUTE REFRIGERANT PIPING TO ASSOCIATED INTERIOR FAN COIL. COORDINATE EXACT REFRIGERANT PIPING ROUTING AND SIZE WITH MANUFACTURER.
3. MOUNT AND ANCHOR CONDENSING UNIT ON ROOF RAIL ROUTE REFRIGERANT PIPING TO AND FROM FAN COIL UNIT BELOW PER MANUFACTURER'S RECOMMENDATIONS AND IN APPROXIMATE LOCATION SHOWN ON PLANS. REFER TO DETAILS SHEET FOR MORE INFORMATION.
4. REFRIGERANT PIPE DOWN TO FLOOR BELOW.
5. REFRIGERANT PIPING IS SHOWN SINGLE LINE FOR CLARITY. VERIFY WITH MANUFACTURER THE PIPE SIZE AND QUANTITY WITH THE FINAL SYSTEM PURCHASED.



1 MECHANICAL ROOF PLAN - EAST
1/8" = 1'-0"

N

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
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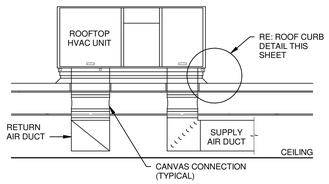
SHEET TITLE

MECHANICAL ROOF PLAN - EAST

SHEET NUMBER

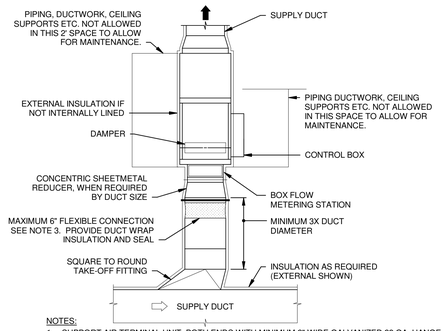
M201.2



NOTES:

1. PROVIDE OPENING THROUGH ROOF AND ROOF DECK INSULATION NO LARGER THAN REQUIRED TO ALLOW DUCTS TO PASS THROUGH. REFER TO PLANS FOR DUCT SIZES. TRANSITION AS REQUIRED IN ROOF CURB TO RTU SUPPLY AND RETURN OPENINGS.
2. PROVIDE SLOPED ROOF CURB TO INSTALL ROOFTOP UNIT LEVEL TO ENSURE PROPER DRAINAGE. COORDINATE ROOF SLOPE WITH ARCHITECTURAL. FLASH AND COUNTER FLASH ROOF PENETRATIONS, ETC. TO ENSURE WEATHER TIGHT INSTALLATION.

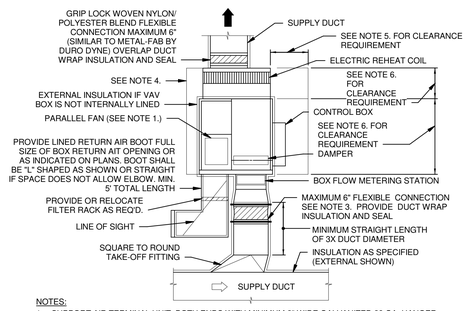
4 ROOFTOP UNIT WITH DUCTWORK DETAIL
NTS



NOTES:

1. SUPPORT AIR TERMINAL UNIT, BOTH ENDS WITH MINIMUM 2" WIDE GALVANIZED 22 GA. HANGER STRAPS.
2. INSTALL BOX NOT MORE THAN 2 FEET ABOVE THE CEILING TO ENABLE ACCESS FOR MAINTENANCE.
3. FLEXIBLE CONNECTION SHALL BE ATCO MODEL UPC# 017 OR DURO-DYNE INSULFLEX.
4. ALL ACCESS DOORS MUST BE ABLE TO OPEN A MINIMUM OF 90 DEGREES.

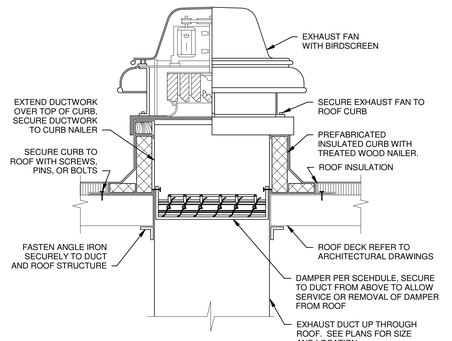
3 VARIABLE AIR VOLUME BOX (COOLING ONLY)
NTS



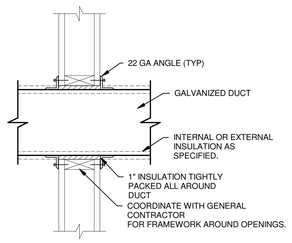
NOTES:

1. SUPPORT AIR TERMINAL UNIT, BOTH ENDS WITH MINIMUM 2" WIDE GALVANIZED 22 GA. HANGER STRAPS. SUPPORT UNIT WITH SPRING VIBRATION ISOLATORS WITH 0.5 STATIC DEFLECTION IF INTERNAL FAN SPRING ISOLATION IS NOT PROVIDED. LOCATE SUPPORTS AROUND UNIT TO MAINTAIN CLEARANCE FOR ACCESS TO UNIT COMPONENTS.
2. INSTALL BOX NOT MORE THAN 2 FEET ABOVE THE CEILING TO ENABLE ACCESS FOR MAINTENANCE.
3. FLEXIBLE CONNECTION SHALL BE ATCO MODEL UPC# 017 OR DURO-DYNE INSULFLEX.
4. PROVIDE 6" CLEARANCE FOR MAINTENANCE UNLESS MORE IS RECOMMENDED BY MANUFACTURER.
5. REFER TO NEC 110.26 TO DETERMINE EXACT CLEARANCE DEPTH REQUIRED BASED ON FIELD CONDITIONS. UNDER NO CIRCUMSTANCE SHALL THE CLEARANCE BE LESS THAN 36".
6. THE GREATER OF A 30" MINIMUM CLEARANCE WIDTH OR THE TOTAL WIDTH OF THE HEATING COIL CONTROLS ENCLOSURE AND BOX CONTROLLER/ACTUATOR IS REQUIRED.
7. ALL ACCESS DOORS MUST BE ABLE TO OPEN A MINIMUM OF 90 DEGREES.

PARALLEL FAN POWERED
2 BOX WITH ELECTRIC REHEAT COIL
NTS



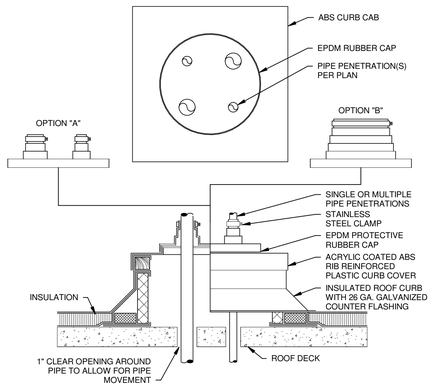
1 DOWNBLAST EXHAUST FAN DETAIL
NTS



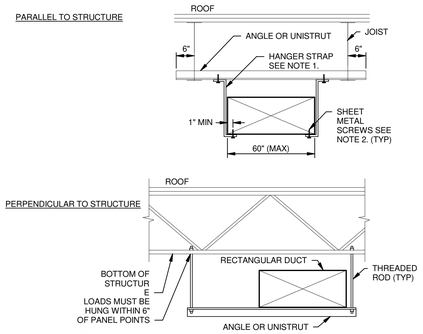
NOTES:

1. DRYWALL, METAL STUDS OR ANY OTHER RIGID MATERIAL MUST NOT TOUCH DUCT.
2. SUPPORT DUCT FROM HANGERS

METAL DUCT NON-FIRE
9 RATED WALL PENETRATION
NTS



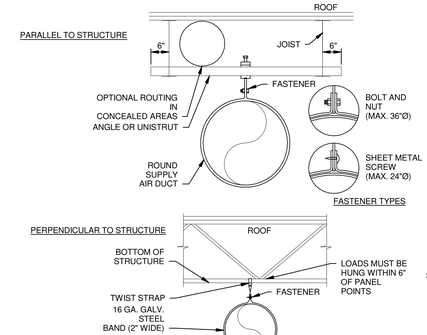
8 PIPE PORTAL ROOF PENETRATION DETAIL
NTS



NOTES:

1. USE THREADED ROD FOR ALL DUCTS LARGER THAN 60"Ø WIDE.
2. SHEET METAL SCREWS MAY BE OMITTED IF HANGER STRAP IS CONTINUOUS AND LOOPS UNDER ENTIRE DUCT.

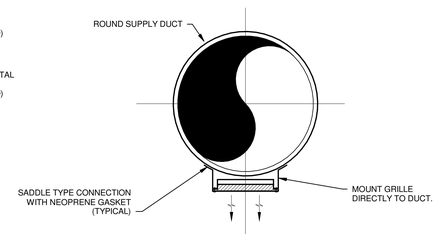
7 RECTANGULAR DUCT SUPPORT DETAIL
NTS



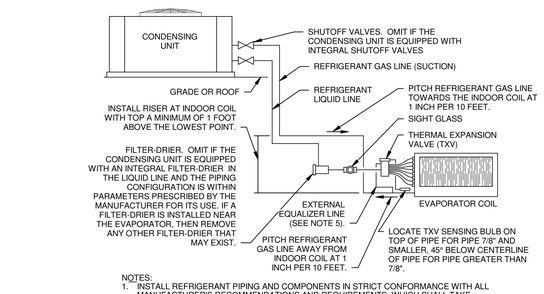
NOTES:

1. FOR DUCTS LARGER THAN 36"Ø, USE TWO HANGER RODS, WIRES OR STRAPS TO SUPPORT DUCT FROM EACH SIDE.

6 ROUND DUCT SUPPORT DETAIL
NTS



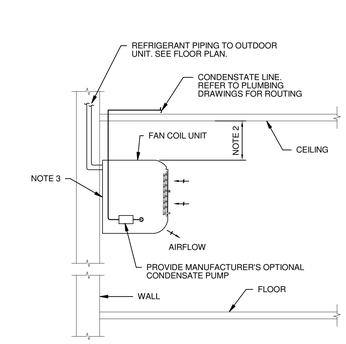
5 REGISTER MOUNTING TO ROUND DUCT DETAIL
NTS



NOTES:

1. INSTALL REFRIGERANT PIPING AND COMPONENTS IN STRICT CONFORMANCE WITH ALL MANUFACTURER'S RECOMMENDATIONS AND REQUIREMENTS, WHICH SHALL TAKE PRECEDENT OVER INFORMATION PRESENTED IN THIS DETAIL.
2. ALL COMPONENTS INSTALLED SHALL BE THE EXACT MODEL RECOMMENDED BY THE MANUFACTURER WITHOUT EXCEPTION.
3. CONSULT THE MANUFACTURER REGARDING THE NEED TO INSTALL A SOLENOID VALVE IN THE LIQUID LINE BETWEEN THE FILTER-DRIER AND SITE GLASS.
4. INSTALL REFRIGERATION PIPE SIZES RECOMMENDED BY THE MANUFACTURER AND CONSULT THE MANUFACTURER REGARDING THE NEED FOR INTERMEDIATE TRAPS BASED ON THE RECOMMENDED PIPE SIZES AND PIPING CONFIGURATION.
5. INSTALL THERMAL EXPANSION VALVE WITH BALANCED PORT CONSTRUCTION AND EXTERNAL EQUALIZER LINES FOR ALL EVAPORATOR COILS EQUIPPED WITH A REFRIGERANT DISTRIBUTOR.

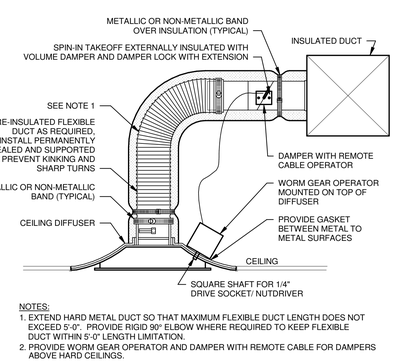
13 REFRIGERANT PIPING DETAIL (SINGLE CIRCUIT WITH COIL ABOVE OR BELOW CU)
NTS



NOTES:

1. ARRANGEMENT SHOWN IS SCHEMATIC, ADJUST TO SUIT FIELD CONDITIONS OR MEET LOCAL CODE REQUIREMENTS.
2. PROVIDE MINIMUM 3.5" OF CLEARANCE AT THE TOP OF THE UNIT.
3. ATTACH FAN COIL UNIT TO MANUFACTURER'S PROVIDED INSTALLATION PLATE. MOUNT INSTALLATION PLATE TO WALL PER MANUFACTURER'S RECOMMENDATIONS.

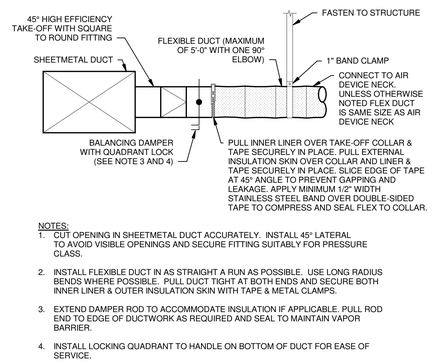
12 VRF - FAN COIL UNIT - WALL MOUNTED
NTS



NOTES:

1. EXTEND HARD METAL DUCT SO THAT MAXIMUM FLEXIBLE DUCT LENGTH DOES NOT EXCEED 5'-0". PROVIDE RIGID 90° ELBOW WHERE REQUIRED TO KEEP FLEXIBLE DUCT WITHIN 5'-0" LENGTH LIMITATION.
2. PROVIDE WORM GEAR OPERATOR AND DAMPER WITH REMOTE CABLE FOR DAMPERS ABOVE HARD CEILINGS.

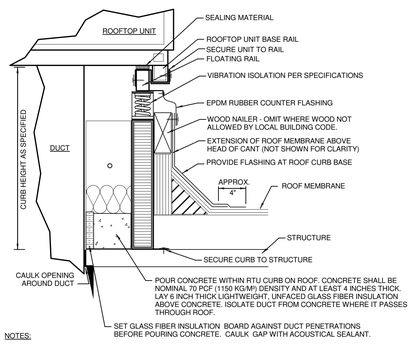
11 HARD CEILING DIFFUSER DETAIL
NTS



NOTES:

1. CUT OPENING IN SHEETMETAL DUCT ACCURATELY. INSTALL 45° LATERAL TO AVOID VISIBLE OPENINGS AND SECURE FITTING SUITABLY FOR PRESSURE CLASS.
2. INSTALL FLEXIBLE DUCT IN AS STRAIGHT A RUN AS POSSIBLE. USE LONG RADIUS BENDS WHERE POSSIBLE. PULL DUCT TIGHT AT BOTH ENDS AND SECURE BOTH INNER LINER & OUTER INSULATION SKIN WITH TAPE & METAL CLAMPS.
3. EXTEND DAMPER ROD TO ACCOMMODATE INSULATION IF APPLICABLE. PULL ROD END TO EDGE OF DUCTWORK AS REQUIRED AND SEAL TO MAINTAIN VAPOR BARRIER.
4. INSTALL LOCKING QUADRANT TO HANDLE ON BOTTOM OF DUCT FOR EASE OF SERVICE.

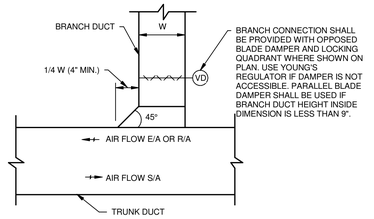
45° LATERAL FLEXIBLE
10 DUCT TAKE OFF DETAIL
NTS



NOTES:

1. CUT METAL DECKING TO ALLOW CURB INSTALLATION ON STEEL FRAMING. AFTER CURB IS SET IN PLACE, TRIM REMAINING METAL DECKING AND INSTALL WITHIN CURB. TACK WELD DECKING TO SUPPORT STEEL. DO NOT WELD INTERIOR DECKING TO ROOF CURB. PROVIDE ADDITIONAL CROSS FRAMING TO SUPPORT INTERIOR DECKING AND FILL MATERIAL AS REQUIRED.

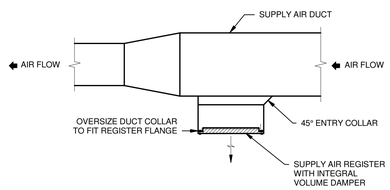
14 VIBRATION ISOLATION ROOF CURB AND DUCT ISOLATION DETAIL
NTS



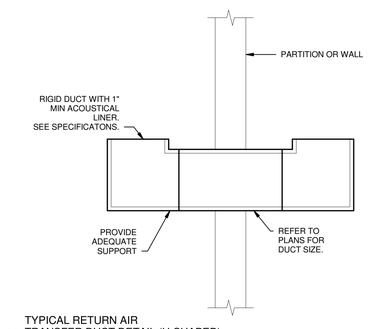
NOTES:

1. THIS CONNECTION SHALL BE TYPICAL FOR ALL RECTANGULAR BRANCH DUCT CONNECTIONS TO RECTANGULAR TRUNK DUCTS, INCLUDING SUPPLY, RETURN, OUTSIDE AIR AND EXHAUST DUCTS.

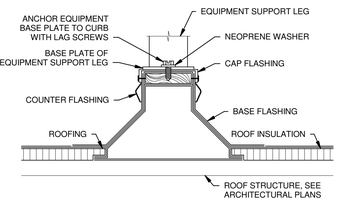
18 RECTANGULAR BRANCH TAP DETAIL
NTS



17 DUCT MOUNTED REGISTER DETAIL
NTS



TYPICAL RETURN AIR
16 TRANSFER DUCT DETAIL (U-SHAPED)
NTS



15 ROOF EQUIPMENT SUPPORT RAIL DETAIL
NTS

JOSHUA N. HOVER

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
JOSHUA N. HOVER
NUMBER PE-2017008503
PROFESSIONAL ENGINEER

Oct 25 2019
JOSHUA N. HOVER
LICENSE # PE-2017008503

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

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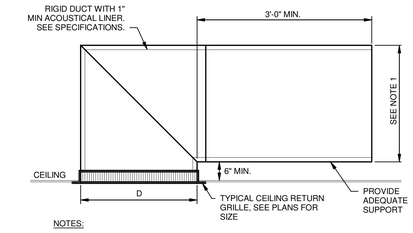
1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

MECHANICAL DETAILS

SHEET NUMBER

M401



NOTES:

1. REFER TO FLOOR PLAN FOR OUTLET DEPTH. WHEN NO DEPTH IS SHOWN, MINIMUM DEPTH SHALL BE AS REQUIRED TO LIMIT AIR VELOCITY TO 500 FPM WITH A MINIMUM SIZE OF 0.5D.

① CEILING RETURN GRILLE BOOT DETAIL
NTS

PARAGON STAR

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SHEET TITLE

MECHANICAL DETAILS

SHEET NUMBER

M402

ROOFTOP UNIT SCHEDULE (DX COOLING, NATURAL GAS HEAT)

MARK	MANUFACTURER	NOMINAL TONS	MODEL	SUPPLY FAN					RELIEF FAN					COOLING COIL								HEAT EXCHANGER						MIN	ELECTRICAL			WEIGHT	NOTES
				CFM	MIN CFM	ESP (IN)	BHP	NOM HP	VFD (Y/N)	CFM	ESP (IN)	BHP	NOM HP	VFD (Y/N)	TH (MBH)	SH (MBH)	EAT (°F DB)	EAT (°F WB)	LAT (°F DB)	LAT (°F WB)	REFR TYPE	MIN EFF (EER)	MIN EFF (IEER)	MIN NO STAGES	MAX VEL (FPM)	MIN OUT (MBH)	INPUT (MBH)	MIN EFF (%)	EAT (°F DB)	LAT (°F DB)	MIN NO STAGES	MAX VEL (FPM)	O/A CFM	V/PH	MCA	MOCP	(LBS)	
RTU-1	TRANE	70	IPAK1	23,000	7,000	2	29.8	40.0	Y	20,000	1.25	9.0	15.0	Y	829.6	670.0	82.0	67.0	55.0	55.0	R410A	9.5	11	4	500	154	500	80	34.6	55.0	4	500	3400	480/3	192.42	225	13,000	ALL
RTU-2	TRANE	70	IPAK1	23,000	7,000	2	29.8	40.0	Y	20,000	1.25	9.0	15.0	Y	829.6	670.0	82.0	67.0	55.0	55.0	R410A	9.5	11	4	500	154	500	80	34.6	55.0	4	500	3400	480/3	192.42	225	13,000	ALL

MODEL NUMBERS SHALL NOT BE CONSIDERED COMPLETE AND MATERIAL SHALL NOT BE ORDERED BY MANUFACTURER AND MODEL NUMBERS ONLY. REVIEW THE COMPLETE DESCRIPTION, NOTES AND SPECIFICATIONS TO DETERMINE THE EXACT MATERIAL AND ACCESSORIES TO BE ORDERED. THE MANUFACTURERS LISTED ARE THE BASIS FOR THE DESIGN.

NOTES:

A. REFER TO SHEET M601 FOR PACKAGED MULTI-ZONE VAV ROOFTOP UNIT CONTROL DRAWING, POINTS LIST, AND SEQUENCE.
B. EQUIPMENT SIZED FOR 105°F AMBIENT TEMPERATURE.
C. PROVIDE MERV 13, EFFICIENT PLEATED THROWAWAY AIR FILTERS.
D. PROVIDE FACTORY MOUNTED DISCONNECT INSTALLED ON SERVICE SIDE OF UNIT.
E. STARTERS FOR ALL MOTORS SHALL BE FURNISHED INTEGRAL WITH UNIT.
F. PROVIDE FACTORY MOUNTED VARIABLE FREQUENCY DRIVE TO FACILITATE MODULATING FAN SPEED CONTROL.
G. PROVIDE SHAFT GROUNDING SYSTEM ON MOTOR. REFER TO MOTOR SPECIFICATION FOR ADDITIONAL INFORMATION.
H. PROVIDE SINGLE POINT POWER CONNECTION.
J. COORDINATE SIZE OF CONDUCTOR TERMINATION LUGS WITH CONDUCTOR SIZES SHOWN ON ELECTRICAL DRAWINGS.
K. PROVIDE 125 VAC, 20 AMP DUPLEX CONVENIENCE RECEPTACLE MOUNTED TO UNIT READY FOR FIELD WIRING WITH A COVER UL LISTED FOR WET AND DAMPER LOCATIONS WHEN IN USE.
L. SPECIFIED FAN ESP ACCOUNTS FOR DUCT LOSSES EXTERNAL TO UNIT.
M. PROVIDE MOTOR HORSEPOWER TO OVERCOME INTERNAL UNIT STATIC PRESSURE DROP PLUS SPECIFIED EXTERNAL STATIC PRESSURE DROP. NOMINAL MOTOR HP SHALL BE NO LARGER THAN THE FIRST AVAILABLE NOMINAL MOTOR SIZE GREATER THAN THE REQUIRED BHP.
N. PROVIDE VIBRATION ISOLATION INSULATED ROOF CURB WITH MINIMUM HEIGHT OF 14" INCHES. REFER TO DETAILS SHEET M401 FOR CURB FILL AND SPRING DEFLECTION REQUIREMENTS. PROVIDE SLOPED CURB IF NEEDED TO MATCH ROOF SLOPE.
P. PROVIDE FULL PERIMETER ISOLATION CURB.
Q. COOLING COIL LAT IS LEAVING AIR TEMPERATURE OF COIL.
R. PROVIDE GUARDS TO PROTECT CONDENSER COIL FROM HAIL OR OTHER DAMAGE.
S. PROVIDE HEATER TO MEET OR EXCEED SCHEDULED MINIMUM MBH OUTPUT. NOMINAL INPUT IS BASED ON LISTED MANUFACTURER'S STANDARD PRODUCT. COORDINATE EQUIPMENT GAS LOAD WITH PLUMBING CONTRACTOR IF DIFFERENT FROM THAT SCHEDULED. MEET MINIMUM EFFICIENCY SCHEDULED.

GRILLE, REGISTER AND DIFFUSER SCHEDULE

MARK	MANUFACTURER	SERVICE	MODEL	CONSTRUCTION TYPE	FACE TYPE	MOUNTING LOCATION	FACE SIZE (IN)	MAX. NC	MAX. PRESS. DROP (IN, W.C.)	NOTES
CSD1	TITUS	SUPPLY	OMNI	ALUMINUM	PLAQUE	CEILING	24"x24"	25	0.10	A, B, C, E, H
CEG1	TITUS	EXHAUST	OMNI	ALUMINUM	PLAQUE	CEILING	12"x12"	25	0.10	B, C, E, H
DSG1	TITUS	SUPPLY	300FL	ALUMINUM	LOUVERED	DUCT	REFER TO PLANS	25	0.10	B, C, D, E, F, H, J, K
DSG2	TITUS	SUPPLY	S300FL	ALUMINUM	LOUVERED	DUCT	REFER TO PLANS	25	0.10	B, D, E, H, K
LSD 1	TITUS	SUPPLY	TBD-80	ALUMINUM	LINEAR SLOT	CEILING	2 SLOT, 1 1/2" WIDTH, 48" LENGTH	25	0.10	B, C, E, L, M
WSG1	TITUS	SUPPLY	300FL	ALUMINUM	LOUVERED	WALL	REFER TO PLANS	25	0.10	B, C, D, E, F, H, J, K
WTG1	TITUS	TRANSFER	350FL	ALUMINUM	LOUVERED	WALL	REFER TO PLANS	25	0.10	B, D, E, H, J

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NOTES:

A. 4-WAY THROW PATTERN UNLESS OTHERWISE INDICATED BY FLOW ARROWS ON DRAWINGS.
B. NECK SIZE SHOWN ON DRAWINGS. PROVIDE BRANCH DUCT TO MATCH NECK SIZE UNLESS OTHERWISE SHOWN ON DRAWINGS.
C. BAKED ENAMEL FINISH, WHITE TO MATCH CEILING COLOR.
D. FRONT BLADES PARALLEL TO LONG DIMENSION.
E. FRAME TYPE TO MATCH CEILING/WALL CONSTRUCTION, COORDINATE WITH ARCHITECTURAL REFLECTED CEILING/WALL PLAN. PROVIDE WITH RAPID MOUNT FRAMING OPTION FOR LAY-IN TYPE DIFFUSERS INSTALLED IN A HARD CEILING.
F. PROVIDE OPPOSED BLADE DAMPER ADJUSTABLE FROM FACE OF DEVICE.
G. CONTRACTOR SHALL PROVIDE REMOTE CABLE-OPERATED VOLUME DAMPER BY METROPOLITAN AIR TECHNOLOGIES MODEL RT-250 WITH EXTERNAL WORM GEAR OPERATOR OR EQUIVALENT YOUNG REGULATOR BUTTERFLY DAMPER WITH 270-275 CONTROLLER. OPERATOR SHALL HAVE A SQUARE DRIVE FOR 1/4" NUT DRIVER. DAMPER ASSEMBLY SHALL INCLUDE GALVANIZED STEEL DUCT WITH ROLLED BEAD STIFFENERS, REINFORCED BLADE, SELF LUBRICATING BEARING AND WORM GEAR MOUNTING PLATE. DAMPER SHALL BE INSTALLED IN BRANCH DUCT NOT INLET OF PLENUM DIFFUSER.
H. PROVIDE DIFFUSERS AND GRILLES WITH NO EXPOSED MOUNTING SCREWS.
J. PAINT ALL INTERIOR SURFACES OF GRILLES FLAT BLACK.
K. DOUBLE DEFLECTION BARS SHALL BE ADJUSTABLE.
L. PROVIDE INSULATED PLENUM AND HIGHTHROW PATTERN CONTROLLER.
M. PAINT ALL INTERIOR SURFACES OF GRILLES FLAT BLACK.

UNIT HEATER SCHEDULE (ELECTRIC)

MARK	MANUFACTURER	MODEL	NOM (KW)	CFM	V/PH	NOTES
UH-1 THRU UH-26	QMARK	MU05-71	5	350	277/1	A, B, D, E

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NOTES:

A. PROVIDE WITH UNIT MOUNTED THERMOSTAT.
B. PROVIDE MANUAL SUMMER/WINTER CHANGE-OVER SWITCH
C. PROVIDE NECESSARY MOUNTING BRACKET AND ACCESSORIES FOR RECESSED WALL MOUNTING.
D. PROVIDE NECESSARY MOUNTING BRACKET AND ACCESSORIES FOR CEILING MOUNTING.
E. PROVIDE FACTORY MOUNTED DISCONNECT INSTALLED ON SERVICE SIDE OF UNIT.

ELECTRIC BASEBOARD HEATER SCHEDULE

MARK	AREA SERVED	MANUFACTURER	MODEL	LENGTH (FT)	OUTPUT (WATTS)	INTAKE	OUTLET	MOUNTING TYPE	V/PH	NOTES
BBH-1	LOBBY	VULCAN	LB-7150	7	1050	FRONT	TOP	PEDESTAL	208/1	A-G
BBH-2	LOBBY	VULCAN	LB-7150	7	1050	FRONT	TOP	PEDESTAL	208/1	A-F
BBH-3	LOBBY	VULCAN	LB-7150	7	1050	FRONT	TOP	PEDESTAL	208/1	A-G
BBH-4	LOBBY	VULCAN	LB-8150	8	1200	FRONT	TOP	PEDESTAL	208/1	A-F
BBH-5	LOBBY	VULCAN	LB-7150	7	1050	FRONT	TOP	PEDESTAL	208/1	A-G
BBH-7	WEST STAIR	VULCAN	LB-8150	8	1200	FRONT	TOP	PEDESTAL	208/1	A-G
BBH-8	EAST STAIR	VULCAN	LB-8150	8	1200	FRONT	TOP	PEDESTAL	208/1	A-G

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NOTES:

A. PROVIDE NECESSARY MOUNTING BRACKETS AND ACCESSORIES (UNIT SHALL BE APPROVED FOR ZERO CLEARANCE).
B. PROVIDE UNIT MOUNTED THERMOSTAT.
C. ENCLOSURE SHALL BE STEEL WITH BAKED ENAMEL FINISH PAINTED BLACK AS SPECIFIED BY ARCHITECT. FRONT COVER TO BE EXTRUDED ALUMINUM.
D. PROVIDE FRONT INTAKE, TOP DISCHARGE.
E. PROVIDE WITH STANDARD ENDCAPS.
F. PROVIDE WITHOUT PEDESTALS.
G. PROVIDE 6" CONTROL CABINET.

FAN-POWERED VARIABLE AIR VOLUME TERMINAL SCHEDULE (ELECTRIC HEAT)

MARK	SERVED FROM	ZONE SERVED	MANUFACTURER	MODEL	BOX SIZE	INLET SIZE (IN)	PRIMARY CFM	MIN PRIM CFM	PRIM AIR TEMP (F)	HEATING COIL						FAN			CP TRANS	SOUND POWER		NOTES
										EAT	LAT	kW	STEPS	VOLT	PH	CFM	HP	V/PH	V/PH	RADIATED	DISCHARGE	
PFPB 1	RTU-1	ENTRYWAY	TITUS	DTQP	6	16	3000	600	55	58.6	91.5	25.0	SCR	480	3	1500	0.75	277/1	120/1	25	25	B-Q
PFPB 2 THRU 10	RTU-1	2ND FLOOR PERIMETER	TITUS	DTQP	3	10	1000	200	55	59.0	90.6	10.0	SCR	480	3	800	0.25	277/1	120/1	25	25	A-P
PFPB 11 THRU 19	RTU-2	2ND FLOOR PERIMETER	TITUS	DTQP	3	10	1000	200	55	59.0	93.8	11.0	SCR	480	3	800	0.25	277/1	120/1	25	25	A-P
PFPB 20	RTU-1	WEST STAIRWELL	TITUS	DTQP	2	6	400	80	55	58.6	92.4	3.0	SCR	480	3	200	0.166	277/1	120/1	25	25	A-P
PFPB 21	RTU-2	EAST STAIRWELL	TITUS	DTQP	2	6	400	80	55	58.6	92.4	3.0	SCR	480	3	200	0.166	277/1	120/1	25	25	A-P

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NOTES:

A. HEATING COIL CAPACITY BASED ON 32°F MAX. AIR TEMPERATURE RISE AND 450 FPM MINIMUM COIL FACE VELOCITY.
B. INSTALL FLEXIBLE DUCT CONNECTOR AT ALL CONNECTIONS.
C. PROVIDE INTEGRAL DISCONNECT SWITCH.
D. PROVIDE FACTORY INSTALLED CONTROL POWER (CP) TRANSFORMER. COORDINATE PRIMARY POWER WITH ELECTRICAL DRAWINGS.
E. BOX NOT TO EXCEED SCHEDULED DISCHARGE OR RADIATED SOUND DB USING 0.5 INCH W.G. INLET PRESSURE IN THE 3RD OCTAVE BAND.
F. PROVIDE FACTORY-INSTALLED, PRESSURE INDEPENDENT DDC CONTROL PACKAGE.
G. PROVIDE FACTORY FURNISHED, FIELD INSTALLED TEMPERATURE SENSOR AT VAV BOX INLET AND INTEGRAL CONTROLS FOR AUTOMATIC CHANGEOVER BETWEEN HEATING AND COOLING MODE.
H. PROVIDE BOX WITH EITHER RIGHT HAND OR LEFT HAND CONFIGURATION AS SHOWN ON DRAWINGS.
J. INLET SIZE SHOWN IS THE MINIMUM ALLOWABLE INLET SIZE. NO SMALLER SIZES SHALL BE ACCEPTED.
K. PROVIDE FILTER FRAME WITH 1 INCH THROWAWAY FILTERS.
L. MOUNT HEATING COIL ON SUPPLY AIR DISCHARGE DUCT.
M. FAN CFM BASED ON 0.35 INCH MINIMUM STATIC PRESSURE LEAVING BOX.
N. INTERNALLY LINE BOX WITH MINIMUM R-3.5 FIBERGLASS LINER HAVING MINIMUM R-3.5 VALUE AND COMPLYING WTH UL 181 AND NFPA-901 PER SPECIFICATION.
P. PROVIDE WITH MANUFACTURER'S ELECTRONICALLY COMMUTATED (EC) MOTOR.
Q. DIVISION 26 CONTRACTOR SHALL PROVIDE SMOKE DETECTORS IN RETURN AIR DUCT.

VAV TERMINAL SCHEDULE (COOLING ONLY)

MARK	SERVED FROM	ZONE SERVED	MANUFACTURER	MODEL	INLET SIZE (IN)	PRIMARY CFM	MIN PRIM CFM	CP TRANS V/PH	SOUND POWER		NOTES
									RADIATED	DISCHARGE	
VAV 1	RTU-1	RESTROOMS/JANITOR	TITUS	DESV	9	800	160	120/1	25	25	ALL
VAV 2	RTU-1	ELECTRICAL/TEL	TITUS	DESV	8	550	110	120/1	25	25	ALL

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NOTES:
A. INSTALL FLEXIBLE DUCT CONNECTOR AT INLET CONNECTION.
B. PROVIDE INTEGRAL DISCONNECT SWITCH.
C. PROVIDE FACTORY INSTALLED CONTROL POWER (CP) TRANSFORMER. COORDINATE PRIMARY POWER WITH ELECTRICAL DRAWINGS.
D. BOX NOT TO EXCEED SCHEDULED DISCHARGE OR RADIATED SOUND DB USING 0.5 INCH W.G. INLET PRESSURE IN THE 3RD OCTAVE BAND.
E. PROVIDE FACTORY-INSTALLED, PRESSURE INDEPENDENT, DDC CONTROL PACKAGE WITH HIGH SPEED ACTUATOR.
F. PROVIDE BOX WITH EITHER RIGHT HAND OR LEFT HAND CONFIGURATION AS SHOWN ON DRAWINGS.
G. INLET SIZE SHOWN IS THE MINIMUM ALLOWABLE INLET SIZE. NO SMALLER SIZES SHALL BE ACCEPTED.
H. INTERNALLY LINE BOX WITH MINIMUM R-3.5 FIBERGLASS LINER HAVING MINIMUM R-3.5 VALUE AND COMPLYING WTH UL 181 AND NFPA-901 PER SPECIFICATION.

FAN SCHEDULE

MARK	SERVICE DESCRIPTION	MANUFACTURER	MOUNTING	MODEL	CFM	ESP (IN)	BHP	NOM HP	FAN RPM	DRIVE (BELT/DIRECT)	VFD (Y/N)	ELECTRICAL V/PH	WEIGHT (LBS)	NOTES
EF-1	EXHAUST AIR	COOK	DOWNBLAST	101C28D (VF)	850	0.8	0.23	0.33	2,800	DIRECT	N	120/1	50	ALL

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NOTES:

A. PROVIDE STANDARD INSULATED ROOF CURB WITH MINIMUM HEIGHT OF 15 INCHES. PROVIDE SLOPED CURB IF NEEDED TO MATCH ROOF SLOPE.
B. PROVIDE BIRDSCREEN AND MOTORIZED DAMPER.
C. PROVIDE FACTORY MOUNTED DISCONNECT SWITCH.
D. PROVIDE WITH MANUFACTURER'S FAN SPEED CONTROLLER FOR BALANCING PURPOSES.
E. PROVIDE WITH MANUFACTURER'S ELECTRONICALLY COMMUTATED (EC) MOTOR.

FAN COIL AND CONDENSING UNIT SCHEDULE

MARK	MANUFACTURER	MODEL	REFR. TYPE	EVAPORATOR SECTION						CONDENSING SECTION			NOTES
				CFM	TC (MBH)	EAT (DB/WB)	V (DC)	MCA	FLA	AMB (°F)	V/PH	MCA / MOCP	
FCU-1/CU-1	MITSUBISHI	PKA-A12/PUY-A12	410A	425	12	75/62	24	1	0.33	100	208/1	13/15	ALL
FCU-2/CU-2	MITSUBISHI	PKA-A12/PUY-A12	410A	425	12	75/62	24	1	0.33	100	208/1	13/15	ALL
FCU-3/CU-3	MITSUBISHI	PKA-A12/PUY-A12	410A	425	12	75/62	24	1	0.33	100	208/1	13/15	ALL

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NOTES:

A. CONTRACTOR SHALL VERIFY WITH EQUIPMENT SUPPLIER EXACT ROUTING AND SIZE OF INSULATED REFRIGERANT PIPING. INSTALL PER MANUFACTURERS RECOMMENDATIONS.
B. DIVISION 26 CONTRACTOR TO PROVIDE DISCONNECT SWITCH FOR INDOOR EVAPORATOR SECTION AND OUTDOOR CONDENSING SECTION.
C. PROVIDE WITH WIRED, WALL MOUNTED THERMOSTAT BY UNIT MANUFACTURER.
D. INDOOR UNIT POWERED FROM OUTDOOR UNIT.

PARAGON STAR

PARAGON STAR
- LOT 9 -
BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

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ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

HENDERSON ENGINEERS
8345 LENEXA DRIVE, SUITE 300
LENEXA, KS 66214
TEL 913.742.5000 FAX 913.742.5001
WWW.HENDERSONENGINEERS.COM
1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

MECHANICAL SCHEDULES

SHEET NUMBER

M501

JOSHUA N. HOVER

PROJECT DESIGN CONDITIONS

CLIMATE CONDITONS

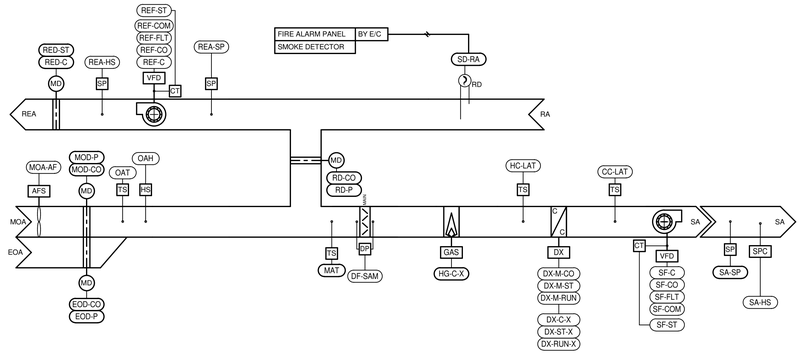
WEATHER STATION:		LEE'S SUMMIT MUNICIPAL, MO				
CLIMATE ZONE:		4A				
HEATING (DB):	99.6%	4.7	°F			
DESIGN HEATING CONDITIONS (DB):		-10	°F			
HUMIDIFICATION (DP/ HR/ MCDB):	99.6%	-5.6	°F/	4.2	gr/lb	8.0 °F
COOLING (DB/MCWB):	0.4%	96.4	°F/	74.7	°F/	
DESIGN COOLING CONDITIONS (DB/ MCWB):		96.4	°F/	74.7	°F/	
DEHUMIDIFICATION (DP/ HR/ MCDB):	0.4%	74.9	°F/	135.8	gr/lb	85.9 °F

BUILDING OPERATING HOURS:

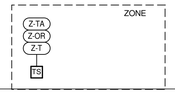
MONDAY - FRIDAY	TBD BY OWNER
SATURDAY	TBD BY OWNER
SUNDAY	TBD BY OWNER
HOLIDAY	TBD BY OWNER

SPACE / UNIT DESCRIPTION	SET POINTS											SPACE OPERATING HOURS OCCUPIED / UNOCCUPIED			NOTES
	COOLING / DE-HUMIDIFICATION				HEATING		HUMIDIFICATION		ZONE VENTILATION RESET						
	OCC °F	UNOCC °F	MAX RH %	MIN RH %	OCC °F	UNOCC °F	MIN RH %	MAX RH %	CONTROL METHOD	BASE PPM	MAXIMUM PPM	M-F	SAT	SUN	
SHELL SPACE	72	80	50%	NA	60	60	NA	NA	NA	NA	NA	TBD	TBD	TBD	ALL
ENTRYWAY / VESTIBULE	72	80	50%	NA	72	60	NA	NA	NA	NA	NA	TBD	TBD	TBD	ALL

NOTES:
A. ZONE LEVEL SET POINT CONDITIONS SHALL BE AS SCHEDULED UNLESS OTHERWISE SCHEDULED OR NOTED ON THE DRAWINGS FOR ROOM SPECIFIC SPACE CONDITIONS.
B. ZONE LEVEL OCCUPANCY HOUR SCHEDULE SHALL BE PER BUILDING OPERATING HOURS UNLESS OTHERWISE SCHEDULED.
C. ZONE LEVEL CONTROLS SHALL BE CAPABLE OF OPERATING WITH INDEPENDENT OCCUPANCY SCHEDULES.



1 VAV RTU-1 AND RTU-2 GAS/DX/REF
NTS



POINTS LIST - AIR HANDLING UNIT

POINT ID	DESCRIPTION	POINT TYPE	DEFAULT SET POINT	SET POINT RESET RANGE	FAIL POSITION	STATUS ALARM	ALARM RANGE	NOTES
AIR SENSING								
SAT	SUPPLY AIR TEMPERATURE	AI	55 F CLG; 90 F HTG	52 - 65 F CLG		X	50 F > SAT > 100 F	D
SAH	SUPPLY AIR HUMIDITY	AI	85 PCT			X	SAH > 90 RH	
OAT	OUTSIDE AIR TEMPERATURE	AI						
OAH	OUTSIDE AIR HUMIDITY	AI						
MAT	MIXED AIR TEMPERATURE	AI	55 F	52 - 65 F CLG				D
HC-LAT	HEATING COIL LEAVING AIR TEMPERATURE	AI	SCHED			X	50 F > HC-LAT > 100 F	D
CC-LAT	COOLING COIL LEAVING AIR TEMPERATURE	AI	SCHED			X	50 F > CC-LAT > 100 F	D
SA-AF	SUPPLY AIRFLOW QUANTITY MAX./MIN. (CFM)	AI	SCHED					D
MOA-AF	MINIMUM OUTSIDE AIR AIRFLOW QUANTITY ABSOL. MIN./ MIN.(CFM)	AI	SCHED			X	MOA-AF < SCHED - 15%	D
SUPPLY FAN								
SF-COM	SUPPLY FAN VFD COMMUNICATION	COM						
SF-C	SUPPLY FAN COMMAND (START/STOP)	BO						
SF-CO	SUPPLY FAN CONTROL OUTPUT - SPEED (PERCENT)	AO		MONITORING ONLY				
SF-ST	SUPPLY FAN STATUS	BI				X	SF-ST <> SF-C	
SF-FLT	SUPPLY FAN VFD FAULT	BI				X	COMMON ALARM	
SA-SP	SUPPLY DUCT STATIC PRESSURE	AI	1.2 INWG	0.5 < SA-SP < SPT		X		G
SA-HS	SUPPLY DUCT HIGH STATIC CONTROLLER	BI	3.0-INWG			X	ON ACTIVATION	
REA-SP	RELIEF-EXHAUST AIR MIXING BOX PLENUM STATIC PRESSURE	AI	0.05 INWG					G
RELIEF-EXHAUST FAN								
REF-COM	RELIEF-EXHAUSTFAN VFD COMMUNICATION	COM						
REF-C	RELIEF-EXHAUST FAN COMMAND (START/STOP)	BO						
REF-CO	RELIEF-EXHAUST FAN CONTROL OUTPUT - SPEED (PERCENT)	AO		MONITORING ONLY				
REF-ST	RELIEF-EXHAUST FAN STATUS	BI				X	REF-ST <> REF-C	
REF-FLT	RELIEF-EXHAUST FAN VFD FAULT	BI				X	COMMON ALARM	
REA-HS	RELIEF-EXHAUST AIR HIGH STATIC CONTROLLER	BI	3.0-INWG			X	REA-HS > SPT	G
RETURN AIR DAMPER (MODULATING)								
RD-CO	RETURN AIR DAMPER CONTROL OUTPUT	AO			NO			
RD-P	RETURN AIR DAMPER POSITION	AI				X	RD-P <> RD-CO	
RELIEF-EXHAUST AIR DAMPER (2 POSITION)								
RED-C	RELIEF-EXHAUST AIR DAMPER COMMAND	BO			NC			
RED-ST	RELIEF-EXHAUST AIR DAMPER STATUS (END SWITCH)	BI					RED-ST <> RED-C	
MINIMUM OUTSIDE AIR DAMPER (MODULATING)								
MOD-CO	MINIMUM OUTSIDE AIR DAMPER CONTROL OUTPUT	AO			NC			
MOD-P	MINIMUM OUTSIDE AIR DAMPER POSITION	AI				X	MOD-P <> MOD-CO	
ECONOMIZER OUTSIDE AIR DAMPER (MODULATING)								
EOD-CO	ECONOMIZER OUTSIDE AIR DAMPER CONTROL OUTPUT	AO			NC			
EOD-P	ECONOMIZER OUTSIDE AIR DAMPER POSITION	AI				X	EOD-P <> EOD-CO	
FILTERS								
DF-SAM	DIRTY FILTER INDICATION (SA MAIN FILTER)	BI	SCHED.			X	ON ACTIVATION	D
COOLING COIL - DX MODULATING AND BINARY STAGES								
DX-M-CO	DX MODULATING COMPRESSOR CONTROL OUTPUT	AO						J
DX-M-ST	DX MODULATING COMPRESSOR STATUS	AI				X	DX-M-ST <> DX-M-CO	J
DX-M-RUN	DX MODULATING COMPRESSOR RUNTIME	AV						J
DX-C-X	DX COMPRESSOR STAGE "X" COMMAND	BO						J
DX-ST-X	DX COMPRESSOR STAGE "X" STATUS	BI				X	DX-ST-X <> DX-C-X	J
DX-RUN-X	DX COMPRESSOR STAGE "X" RUNTIME	AV						J
HEATING COIL - GAS FURNACE BINARY STAGED								
HG-C-X	GAS FURNACE HEAT STAGE "X" COMMAND	BO						J
FIRE ALARM/SMOKE DETECTORS								
SD	SMOKE DETECTOR STATUS	BI				X	ON ACTIVATION	K

ALL POINTS SHOWN SHALL BE PROVIDED BY BAS CONTRACTOR UNLESS NOTED OTHERWISE.

NOTES:
A. DISPLAY VALUE WITH AHU GRAPHIC AT BAS FRONT-END. REFERENCE GLOBAL BUILDING MONITORING SCHEDULE FOR CONTROL POINT.
B. DIVISION 26 SHALL PROVIDE SENSOR WITH DRY CONTACT FOR BAS INTERFACE.
C. REFERENCE PROJECT DESIGN CONDITIONS SCHEDULE FOR SETPOINT.
D. POINT SHALL BE ADJUSTABLE.
E. DAMPER SHALL FAIL NORMALLY OPEN TO BYPASS THE COIL.
F. REFERENCE AIR TERMINAL UNIT CONTROL DIAGRAMS FOR PRIMARY AIRFLOW POINT DEFINITION (CFM). COORDINATE SETPOINT WITH AIR TERMINAL UNIT SCHEDULES (VAV BOXES).
G. DETERMINE SETPOINT DURING TESTING AND BALANCING. COORDINATE WITH THE TEST AND BALANCE CONTRACTOR.
H. DAMPER SHALL FAIL NORMALLY OPEN TO THE COIL.
J. COORDINATE NUMBER OF STAGES FOR CONTROL WITH EQUIPMENT FURNISHED.
K. DEVICE AND RELAY FROM FIRE ALARM SYSTEM PROVIDED BY DIVISION 28. DISPLAY DETECTOR RELAY STATUS (NORMAL/ALARM) AT BAS FRONT END.

SEQUENCE OF OPERATIONS MULTI-ZONE VARIABLE AIR VOLUME ROOF TOP UNIT (RTU-1 AND RTU-2)

This sequence of operations is organized into the following main categories: operating modes; control setpoint resets; safeties, overrides and interlocks; and component control loops. The operating modes describe the criteria that either enable or disable the various modes of operation. If a mode of operation is not listed within a component control loop section then that mode of operation has no direct influence on the operation of the component. The control setpoint reset section describes the logic and reference variables that will be used to reset control setpoints to a new value within its reset range. The safeties, overrides, and interlocks section outlines the hardwired interlocks that are required to meet life safety requirements. Safeties and interlocks take precedence over all other control strategies outlined in this document. The control responses of each component for the various modes of operation are described in the component control loop sections. Setpoints shall be adjustable (adj.) as noted.

The sequence of operations, the points list and control diagrams shall be used to provide a complete description of the control philosophy for the controlled equipment. Individual setpoint values, reset ranges, and alarm action levels are listed in the points list. Components and control sensor locations are graphically depicted on the control diagram. The controls contractor shall be responsible for coordinating any necessary time delay setpoints to establish stable system operation.

GENERAL DESCRIPTION

The variable air volume (VAV) air handling unit(s) covered by this sequence of operations consist(s) of a variable speed supply fan, variable speed relief-exhaust fan, gas-fired heat exchanger, direct expansion cooling coil, that operate with zone level variable air volume terminal units to provide heating, ventilation and air-conditioning, for the conditioned space as shown on the drawings.

OPERATING MODES

OCCUPIED MODE:

The unit shall be in occupied mode per the Project Design Conditions Schedule shown on the control drawings.

UNOCCUPIED MODE:

The AHU shall be in unoccupied mode for all periods not included in the occupied hours of operation. Overrides of unoccupied schedule are defined at the zone level control.

ECONOMIZER MODE - FIXED ENTHALPY WITH FIXED DRY-BULB TEMPERATURE ENABLED:

The unit shall be in economizer mode when:

The supply fan status is on;

And- the outside air enthalpy is less than 28 Btu/lb (adj.);

And- the outside air temperature is less than 75 F (adj.);

MORNING WARM-UP/COOL-DOWN MODE:

The unit shall be in morning warm-up/cool-down mode according to an optimum start sequence to allow the temperature control zones to reach their scheduled occupied setpoints before the scheduled occupancy time .

CONTROL SETPOINT RESETS

SUPPLY FAN STATIC PRESSURE RESET:

The supply air static pressure (SA-SP) setpoint shall be reset using trim and respond logic within the range as listed in the "Setpoint Reset Range" column of the points list. The control system shall monitor the zone level VAV box cooling loop output to determine the direction of reset (i.e., up or down). The control system shall be capable of excluding zones from the analysis.

Trim and respond logic:

When fan is off, reset setpoint to the default value.

While fan is proven on:

If all zone dampers included in the analysis are less than 90% of cooling loop output (adj.), every 2 minutes (adj.) decrease setpoint by 0.04 in-wg (adj). Repeat trim and respond logic until at least one (adj.) damper is greater than 90% open.

If at least one zone damper is greater than 95% open (adj.), every 2 minutes (adj.) increase setpoint by 0.03 in-wg times the number of dampers greater than 95% open, but no more than 0.12 in-wg. Repeat trim and respond logic until all zone dampers are less than 95% open.

SUPPLY AIR TEMPERATURE RESET - TRIM AND RESPOND - COOLING ONLY:

The supply air temperature reset sequence shall not be enabled until the supply air static pressure is reset to its lowest setpoint as defined in the "Setpoint Reset Range" column of the points list for 5 minutes (adj.). While the supply air temperature reset is enabled, the supply air static pressure setpoint shall be held at its minimum value.

The supply air temperature (SAT) setpoint shall be reset using trim and respond logic within the range as listed in the "Setpoint Reset Range" column of the points list. The control system shall monitor the zone level VAV box damper positions to determine the direction of reset (i.e., up or down). The control system shall be capable of excluding zones from the analysis.

Trim and respond logic:

When fan is off, reset setpoint to the default value.

While fan is proven on:

If all zone dampers included in the analysis are less than 90% open (adj.), every 2 minutes (adj.), increase the setpoint by 0.5° F (adj.). Repeat trim and respond logic until at least one (adj) damper is greater than 90% open.

If at least one zone damper is greater than 95% open (adj.), every 2 minutes (adj.), decrease setpoint by 0.5° F. Repeat trim and respond logic until all zone dampers are less than 95% open.

The reset sequence shall be disabled when the supply air temperature is reset to its lowest setpoint in the "Setpoint Reset Range" column of the points list and has remained at this setpoint for 5 minutes (adj.)

When in economizer mode, reset the mixed air temperature setpoint (MAT) to be equal to the SAT.

SAFETIES, OVERRIDES AND INTERLOCKS

SMOKE DETECTOR INTERLOCK:

The unit shall be disabled via hard wired interlock on activation of a system smoke detector. Display smoke detector relay status (normal or alarm) at the BAS front end.

FIRE ALARM CONTROL PANEL INTERLOCK:

The unit shall be disabled via relay circuit signal from the fire alarm control panel. Division 28 shall provide the relay and leads from relay to unit. BAS contractor shall connect leads to unit. Display relay status (normal or alarm) at BAS front end.

HIGH SUPPLY AIR STATIC PRESSURE INTERLOCK:

The unit shall be disabled via hard wired interlock at the fan start circuit upon activation of duct high static pressure controller.

HIGH RELIEF AIR STATIC PRESSURE INTERLOCK:

The unit shall be disabled via hard wired interlock at the fan start circuit upon activation of duct high static pressure controller.

RELIEF-EXHAUST FAN INTERLOCK(S):

The relief-exhaust air damper (RED) shall be interlocked with the relief-exhaust fan (REF) so that the damper is open when the exhaust fan is on.

The relief-exhaust fan shall be interlocked to be OFF when the associated unit supply fan is OFF.

COMPONENT CONTROL LOOPS

SUPPLY FAN CONTROL - VFD:

When the HOA switch is in hand position, the variable speed supply fan shall operate at a speed set manually by the operator at the user interface of the drive.

When the HOA switch is in off position, the fan shall be off.

When the HOA switch is in auto position, the variable speed supply fan shall operate subject to the unit enable signal, and unit operating modes.

When in Occupied Mode:

The fan shall energize and slowly ramp to the initial minimum fan speed determined during system startup. Minimum fan speed shall be established during balancing.

The fan VFD shall modulate to control duct static pressure (SA-SP) at setpoint. Provide multiple sensors as shown on the drawings and control to the sensor furthest from setpoint.

When in Unoccupied Mode:

The fan shall be OFF. On a call for cooling/heating or override signal from the zone level, the fan shall operate as in occupied mode until the call is cleared or the override is removed.

When in Morning Warm **-Up/Cool-Mode:**

The fan shall operate as in occupied mode.

RELIEF - EXHAUST FAN (REF) - BUILDING PRESSURE SENSOR CONTROL

When in Occupied Mode:

The fan shall be OFF.

When in Economizer Mode:

The fan shall energize ON and slowly ramp to the fan speed determined during systems startup.

When in Unoccupied Mode:

The fan shall be OFF unless the MOA and EOA dampers are allowed to modulate as defined in the Mixed Air Damper Control Loop. When the MOA and EOA dampers are allowed to modulate, the fan shall operate as in Occupied Mode.

When in Morning Warm-Up/Cool-Down Mode:

The fan shall be OFF unless the MOA and EOA dampers are allowed to modulate as defined in the Mixed Air Damper Control Loop. When the MOA and EOA dampers are allowed to modulate, the fan shall operate as in Occupied Mode.

MIXED AIR DAMPERS WITH ECONOMIZER

The mixed air damper assembly consists of a minimum outside air (MOA) damper, return air (RA) damper and economizer outside air (EOA) damper.

When in Occupied Mode:

MOA Active Control- The MOA and RA dampers shall vary together to satisfy the minimum outside airflow setpoint as indicated by the minimum OA airflow measuring station (MOA-AF).

When in Unoccupied Mode:

The MOA and EOA dampers shall be fully closed and RA damper shall be fully open. On a call for cooling/heating or override signal, the MOA and EOA dampers shall remain closed unless beneficial for cooling.

When in Economizer Mode:

The MOA shall remain open and the EOA and RA dampers shall modulate in opposing directions to maintain the supply air temperature (SAT) setpoint .

When in Morning Warm-Up/Cool-Down Mode:

The MOA and EOA dampers shall be fully closed and the RA damper shall be fully open. The MOA and EOA dampers shall be allowed to open if beneficial for cooling or heating

RELIEF-EXHAUST AIR DAMPERS (NO PRESSURE CONTROL)

When in Economizer Mode:

The damper shall be open.

When in All Other Modes:

The damper shall be closed.

FILTER MONITORING

When in All Modes:

The controller shall monitor the differential pressure across each filter bank and shall provide a signal when the setpoint is exceeded.

The controller shall monitor the fan runtime to provide maintenance reminder at 50% of filter elapsed time of 1100 hours (adj.) and an alarm at 100% elapsed time of 2200 hours (adj.) .

HEATING COIL - GAS MODULATED

When in Occupied Mode:

The controller shall modulate the heating to maintain the heating coil leaving air temperature setpoint (HC-LAT).

When in Unoccupied Mode:

The coil shall be OFF.

On a call for heating or override signal from the zone level the coil shall operate as in occupied mode until the call is cleared or the override is removed.

When in Economizer Mode:

The coil shall be OFF.

When in Morning Warm-Up Mode:

The coil shall operate as in occupied mode.

COOLING COIL DX STAGED + VARIABLE CONTROL (MULTIPLE COMPRESSORS)

When in Occupied Mode:

The variable compressor shall modulate in coordination with the constant speed compressor(s) (subject to the unit manufacturer's standard safeties) to maintain the supply air temperature setpoint (SAT).

The variable compressor represents the primary stage of cooling and shall vary continuously between minimum capacity and 100% capacity to maintain the supply air set point temperature. When the supply air temperature setpoint cannot be maintained and the variable compressor is at 100%, then the constant speed compressor shall be energized and the variable compressor shall return to minimum speed and modulate to maintain the supply air setpoint. Units with subsequent stages of cooling shall follow a similar loading and unloading logic.

When in Unoccupied Mode:

The compressor(s) shall be OFF.

On a call for cooling or override signal from the zone level the compressor(s) shall operate as in occupied mode until the call is cleared or the override is removed.

When in Morning Cool-Down Mode:

The compressor(s) shall operate as in occupied mode.

Flown

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
JOSHUA N. HOVER
NUMBER PE-2017008503
PROFESSIONAL ENGINEER

Oct 25 2019

JOSHUA N. HOVER
LICENSE # PE-2017008503

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
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1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

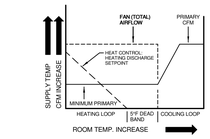
MECHANICAL CONTROLS

SHEET NUMBER

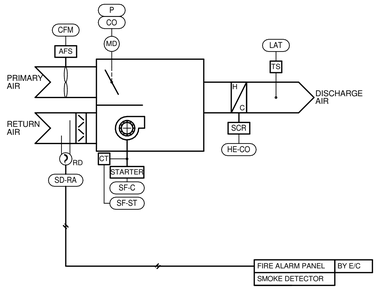
M601

JOSHUA N. HOVER

FPB CONTROL SCHEMATIC
VAV COOLING AND HEATING
SINGLE MAXIMUM
MODULATING HEAT



TC/C TO PROVIDE CONTROL TRANSFORMER FOR CONTROLS WIRING. REFER TO ELECTRICAL DRAWINGS FOR LOCATIONS OF DEDICATED 120V CONTROLS CIRCUIT(S).



(SPACE OCCUPANCY SENSOR PROVIDED BY ELECTRICAL CONTRACTOR. TC/C SHALL MONITOR OCCUPANCY SENSOR AUXILIARY CONTACTS AT BAS FOR UNIT CONTROL PER SEQUENCE. REFER TO ELECTRICAL PLANS FOR OCCUPANCY SENSOR REQUIREMENT IN EACH ZONE. REFER TO PLANS FOR ZONE SENSOR LOCATIONS.)

POINTS LIST - AIR TERMINAL UNIT BOX

POINT ID	DESCRIPTION	POINT TYPE	DEFAULT SETPOINT	FAIL POSITION	STATUS ALARM	ALARM RANGE	NOTES
ZONE LEVEL SENSORS							
Z-T	ZONE TEMPERATURE	AI	SCHED.				C, D
Z-T-DB	ZONE TEMPERATURE DEADBAND	BV	5 F				C
FAN-POWERED BOX							
CFM	PRIMARY AIRFLOW	AI	SCHED.				
CO	PRIMARY AIR DAMPER CONTROL OUTPUT	AO					
P	DAMPER POSITION	AI		FIP			
LAT	DISCHARGE AIR TEMPERATURE	AI	SCHED.				
SF-C	SUPPLY FAN COMMAND	BO					
SF-ST	SUPPLY FAN STATUS	BI			X	SF-ST <> SF-C	
TERMINAL HEATING COIL - ELECTRIC SCR MODULATING							
HE-CO	ELECTRIC HEAT SCR CONTROL OUTPUT	AO					
FIRE ALARM/SMOKE DETECTORS							
SD-RA	RETURN AIR SMOKE DETECTOR STATUS	BI			X	ON ACTIVATION	B

NOTES:
B. REFERENCE PLANS FOR UNITS PROVIDED WITH RETURN AIR SMOKE DETECTORS. SENSOR PROVIDED BY DIV 28.
C. POINT SHALL BE ADJUSTABLE.
D. REFERENCE PROJECT DESIGN CONDITIONS SCHEDULE FOR SETPOINT.

SEQUENCE OF OPERATIONS
PARALLEL FAN POWERED BOX (PFPB-1-19)

This sequence of operations is organized into the following main categories: operating modes, control setpoint resets, safeties, overrides and interlocks, and component control loops. The operating modes describe the criteria that either enable or disable the various modes of operation. If a mode of operation is not listed within a component control loop section then that mode of operation has no direct influence on the operation of the component. The control setpoint reset section describes the logic and reference variables that will be used to reset control setpoints to a new value within its reset range. The safeties, overrides, and interlocks section outlines the hardwired interlocks that are required to meet life safety requirements. Safeties and interlocks take precedence over all other control strategies outlined in this document. The control responses of each component for the various modes of operation are described in the component control loop sections. Setpoints shall be adjustable (adj.) as noted.

The sequence of operations, the points list and control diagrams shall be used to provide a complete description of the control philosophy for the controlled equipment. Individual setpoint values, reset ranges, and alarm action levels are listed in the points list. Components and control sensor locations are graphically depicted on the control diagram. The controls contractor shall be responsible for coordinating any necessary time delay setpoints to establish stable system operation.

GENERAL DESCRIPTION

The parallel fan powered box unit(s) consist of variable volume induced air fan, primary air damper, induced air inlet, electric SCR heater, discharge airflow sensor. Discharge air temperature sensor, and primary air temperature sensor to provide heating, air-conditioning and ventilation for the conditioned space as shown on the drawings.

OPERATING MODES

UNOCCUPIED MODE:

The unit shall be in unoccupied mode for all periods not included in the occupied hours of operation. Overrides of unoccupied schedule are defined at the zone level control.

OCCUPIED MODE:

The unit shall be in occupied mode per the Project Design Conditions schedule shown on the control drawings.

COOLING MODE:

The unit shall be in cooling mode when the zone temperature (Z-T) rises above the dead band (Z-T-DB).

HEATING MODE (HEATING BOXES ONLY):

The unit shall be in heating mode when the zone temperature (Z-T) falls below the dead band (Z-T-DB).

MORNING WARM UP/COOL DOWN MODE:

The unit shall be in morning warm up/cool down mode when the associated air handler activates its morning warm up/cool down mode.

CONTROL SETPOINT RESETS

UNOCCUPIED MODE SPACE TEMPERATURE SETPOINT RESET

When in unoccupied mode the zone temperature set point shall be reset to the setback value indicated in the Project Design Conditions Schedule on the controls drawings.

SAFETIES, OVERRIDES AND INTERLOCKS

ELECTRIC HEATER AIRFLOW INTERLOCK:

The unit electric heating coil shall not energize unless minimum airflow is across the heating coil.

SMOKE DETECTOR INTERLOCK:

For fan powered boxes with fans sized to deliver 2,000 cfm or more, the fan shall be disabled on activation of a system smoke detector.

COMPONENT CONTROL LOOPS

Supply Fan

PARALLEL SUPPLY FAN (TEMPERATURE)

When in Occupied Mode:

When in Cooling Mode:
The fan shall be off.

When in Heating Mode or when zone temperature (Z-T) is within the dead band between the heating and cooling setpoints:
The fan shall be on.

When in Unoccupied Mode:

The fan shall be off. On a call for cooling/heating or override signal from the zone, the fan shall operate as if in occupied mode until the call is cleared or the override is removed.

When in Morning Warm Up/Cool Down Mode:

The fan shall operate as in Occupied Mode.

Damper Control

PRIMARY AIR DAMPER - SINGLE MAXIMUM, SINGLE MINIMUM

Correlate the minimum primary airflow setpoint and design primary airflow cooling setpoint to a 0-10 Vac signal for each box.

When in Occupied Mode:

When in Cooling Mode:
The unit shall modulate the primary air damper between the primary airflow setpoint and minimum primary airflow setpoint as required to maintain zone temperature setpoint. An increase in room temperature causes airflow to increase.

When in Heating Mode:
The unit shall remain at the minimum primary airflow setpoint.

When in Unoccupied Mode:

The unit shall operate as if in Occupied Mode, but the damper shall be allowed to modulate to a fully closed position.

When in Morning Warm Up/Cool Down Mode:

The primary air damper shall operate as if in Occupied Mode when in cool down mode and shall actuate to full open in morning warm up.

Heating Coil

HEATING COIL - ELECTRIC SCR - MODULATING

When in Cooling Mode:
The heating coil shall remain off.

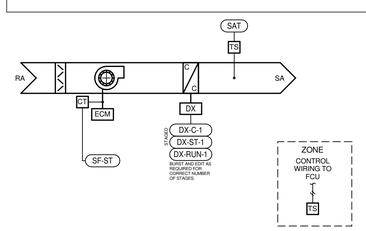
When in Heating Mode:

The heating coil SCR controller shall modulate as required to maintain zone temperature setpoint as measured by the zone temp sensor (Z-T).

POINTS LIST - FAN COIL UNIT

POINT ID	DESCRIPTION	POINT TYPE	DEFAULT SET POINT	FAIL POSITION	STATUS ALARM	ALARM RANGE	NOTES
SUPPLY FAN							
SF-ST	SUPPLY FAN STATUS	BI			X	SF-ST <> SF-C	
COOLING COIL - DX BINARY STAGED							
DX-C-1	DX COMPRESSOR STAGE "1" COMMAND	BO					A
DX-ST-1	DX COMPRESSOR STAGE "1" STATUS	BI			X	DX-ST <> DX-C	A
DX-RUN-1	DX COMPRESSOR STAGE "1" RUNTIME	AV					A

NOTES:
A. COORDINATE NUMBER OF STAGES FOR CONTROL WITH EQUIPMENT FURNISHED.



ALL POINTS SHALL BE DISPLAYED GRAPHICALLY AND BE ADJUSTABLE AT THE BUILDING AUTOMATION SYSTEM OPERATOR WORKSTATION.

SEQUENCE OF OPERATIONS
DUCTLESS SPLIT FAN COIL UNIT (FCU-1-3 AND CU-1-3)

GENERAL DESCRIPTION

FCU-1-3 / CU-1-3 are ductless direct expansion split systems with cooling only operation. Computer room units and their associated roof mounted condensing unit shall be controlled by the manufacturer provided thermostat to maintain temperature set point of 75°F. Space temperature shall be monitored by the building automation system.

SPACE TEMPERATURE MONITORING

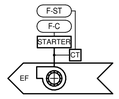
If the zone space temperature sensor senses space temperature above 80°F or below 40°F, and alarm shall be annunciated at the building automation system.

POINTS LIST - EF-1

POINT ID	DESCRIPTION	POINT TYPE	DEFAULT SET POINT	SET POINT RESET RANGE	FAIL POSITION	ALARM STATUS	ALARM RANGE	NOTES
FAN								
F-C	FAN COMMAND (START/STOP)	BO						
F-ST	FAN STATUS	BI				X	EF-ST <> EF-C	

PROVIDE UNIQUE POINT NAME FOR EACH CONTROL POINT CONSISTENT WITH THE MARK IDENTIFER ON THE EQUIPMENT SCHEDULE (E.G. EF01-F-C).
REFER TO SPECIFICATION FOR ADDITIONAL REQUIREMENTS.
BAS CONTRACTOR SHALL PROVIDE POINT AND DEVICE UNLESS OTHERWISE NOTED.

ALL POINTS SHALL BE DISPLAYED GRAPHICALLY AND BE ADJUSTABLE AT THE BUILDING AUTOMATION SYSTEM OPERATOR WORKSTATION.



SEQUENCE OF OPERATIONS
GENERAL EXHAUST FAN (EF-1)

This sequence of operations is organized into the following main categories: operating modes, safeties, overrides and interlocks. The operating modes describe the criteria that either enable or disable the various modes of operation. The safeties and interlocks section outlines the hardwired interlocks. Safeties and interlocks take precedence over all other control strategies outlined in this document.

The sequence of operations, the points list and control diagrams shall be used to provide a complete description of the control philosophy for the controlled equipment. Individual setpoint values, reset ranges, and alarm action levels are listed in the points list. Components and control sensor locations are graphically depicted on the control diagram.

GENERAL DESCRIPTION.

The general exhaust fans consist of a constant speed exhaust fan that operates based off the occupied / unoccupied schedule of the building as established by the building automation system (bas).

OPERATING MODES

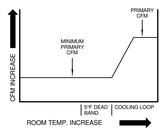
OCCUPIED MODE:

During occupied periods, the exhaust fan shall run continuously. If the current switch does not prove operation after 30 seconds (adj) a fan failure alarm shall be annunciated at the BAS, the unit shall stop.

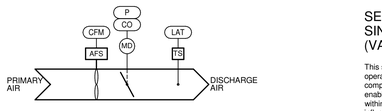
UNOCCUPIED MODE:

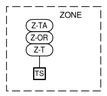
During unoccupied periods, the exhaust fan shall be off.

VAV CONTROL SCHEMATIC
VAV COOLING
SINGLE MAXIMUM
NO HEATER



TC/C TO PROVIDE CONTROL TRANSFORMER FOR CONTROLS WIRING. REFER TO ELECTRICAL DRAWINGS FOR LOCATIONS OF DEDICATED 120V CONTROLS CIRCUIT(S).





POINTS LIST - AIR TERMINAL UNIT BOX

POINT ID	DESCRIPTION	POINT TYPE	DEFAULT SETPOINT	FAIL POSITION	STATUS ALARM	ALARM RANGE	NOTES
ZONE LEVEL SENSORS							
Z-T	ZONE TEMPERATURE	AI	SCHED.				A, B
Z-T-DB	ZONE TEMPERATURE DEADBAND	BV	5 F				C
SINGLE DUCT BOX							
CFM	PRIMARY AIRFLOW	AI	SCHED.				
CO	PRIMARY AIR DAMPER CONTROL OUTPUT	AO					
P	DAMPER POSITION	AI		FIP			
LAT	DISCHARGE AIR TEMPERATURE	AI	SCHED.				

NOTES:
A. POINT SHALL BE ADJUSTABLE.
B. REFERENCE PROJECT DESIGN CONDITIONS SCHEDULE FOR SETPOINT.

SEQUENCE OF OPERATIONS
SINGLE DUCT BOX (COOLING ONLY)
(VAV-1-2)

This sequence of operations is organized into the following main categories: operating modes, control setpoint resets, safeties, overrides and interlocks, and component control loops. The operating modes describe the criteria that either enable or disable the various modes of operation. If a mode of operation is not listed within a component control loop section then that mode of operation has no direct influence on the operation of the component. The control setpoint reset section describes the logic and reference variables that will be used to reset control setpoints to a new value within its reset range. The safeties, overrides, and interlocks section outlines the hardwired interlocks that are required to meet life safety requirements. Safeties and interlocks take precedence over all other control strategies outlined in this document. The control responses of each component for the various modes of operation are described in the component control loop sections. Setpoints shall be adjustable (adj.) as noted.

The sequence of operations, the points list and control diagrams shall be used to provide a complete description of the control philosophy for the controlled equipment. Individual setpoint values, reset ranges, and alarm action levels are listed in the points list. Components and control sensor locations are graphically depicted on the control diagram. The controls contractor shall be responsible for coordinating any necessary time delay setpoints to establish stable system operation.

GENERAL DESCRIPTION

The single duct variable air volume terminal unit(s) consist of primary air damper and discharge airflow sensor. Discharge air temperature sensor to provide air-conditioning and ventilation for the conditioned space as shown on the drawings.

OPERATING MODES

UNOCCUPIED MODE:

The unit shall be in unoccupied mode for all periods not included in the occupied hours of operation. Overrides of unoccupied schedule are defined at the zone level control.

OCCUPIED MODE:

The unit shall be in occupied mode per the Project Design Conditions schedule shown on the control drawings.

COOLING MODE:

The unit shall be in cooling mode when the zone temperature (Z-T) rises above the dead band (Z-T-DB).

MORNING WARM UP/COOL DOWN MODE:

The unit shall be in morning warm up/cool down mode when the associated air handler activates its morning warm up/cool down mode.

CONTROL SETPOINT RESETS

UNOCCUPIED MODE SPACE TEMPERATURE SETPOINT RESET

When in unoccupied mode the zone temperature set point shall be reset to the setback value indicated in the Project Design Conditions Schedule on the controls drawings.

COMPONENT CONTROL LOOPS

Damper Control

PRIMARY AIR DAMPER - SINGLE MAXIMUM, SINGLE MINIMUM

Correlate the minimum primary airflow setpoint and design primary airflow cooling setpoint to a 0-10 Vac signal for each box.

When in Occupied Mode:

When in Cooling Mode:
The unit shall modulate the primary air damper between the primary airflow setpoint and minimum primary airflow setpoint as required to maintain zone temperature setpoint. An increase in room temperature causes airflow to increase.

When in Unoccupied Mode:

The unit shall operate as if in Occupied Mode, but the damper shall be allowed to modulate to a fully closed position.

When in Morning Warm Up/Cool Down Mode:

The primary air damper shall operate as if in Occupied Mode when in cool down mode and shall actuate to full open in morning warm up.

JOSHUA N. HOVER

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

Oct 25 2019

JOSHUA N. HOVER
LICENSE # PE-2017008503

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

HENDERSON ENGINEERS
8345 LENEXA DRIVE, SUITE 300
LENEXA, KS 66214
TEL 913.742.5000 **FAX** 913.742.5001
WWW.HENDERSONENGINEERS.COM

1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

MECHANICAL CONTROLS

SHEET NUMBER

M602

Division 23: HEATING, VENTILATING, AND AIR CONDITIONING

1. GENERAL INSTRUCTIONS

A. GENERAL REQUIREMENTS

All requirements under Division 01 and the general and supplementary conditions of these specifications apply to this section and division. Where the requirements of this section and division exceed those of Division 01, this section and division take precedence. Become thoroughly familiar with all its contents as to requirements that affect this division, section, or both. Work required under this division includes all material, equipment, appliances, transportation, services, and labor required to complete the entire system as required by the drawings and specifications, or reasonably inferred to be necessary to facilitate the function of each system as implied by the design and the equipment specified.

The specifications and drawings for the project are complementary, and any portion of work described in one shall be provided as if described in both. In the event of discrepancies, notify the Engineer and request clarification prior to proceeding with the work involved.

Drawings are graphic representations of the work upon which the contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They convey the scope of work, indicating the intended general arrangement of the systems without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements. Use the drawings as a guide when laying out the work and to verify that materials and equipment will fit into the designated spaces, and which when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory, and properly operating system.

B. DEFINITIONS

Division: References contained in this specification follow the numbering system defined in the Construction Specifications Institute (CSI) MasterFormat 2004 Edition. Specification Divisions 01 through 13 provided with this project may reference the CSI MasterFormat 1995 Edition. The corresponding division references between the 2004 Edition and 1995 Edition are as follows:

2004 Edition	1995 Edition
1. Division 21 - Fire Suppression	Division 15
2. Division 22 - Plumbing	Division 15
3. Division 23 - HVAC	Division 15
4. Division 26 - Electrical	Division 16
5. Division 27 - Communications	Division 16
6. Division 28 - Electronic Safety and Security	Division 16

Furnish: "to supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations."

Install: "to perform all operations at the project site including, but not limited to, the actual unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use."

Provide: "to furnish and install."

Furnished by Owner (or Owner-Furnished) or Furnished by Others: "an item furnished by the Owner or under other divisions or contracts, and installed under the requirements of this division, complete and ready for intended use, including all items and services incidental to the work necessary for proper installation and operation. Include the installation under the warranty required by this division."

Engineer: Where referenced in this division, "Engineer" is the Engineer of Record and the Design Professional for the work under this division, and is a consultant to, and an authorized representative of the Architect, as defined in the General and/or Supplementary Conditions. When used in this division, Engineer means increased involvement by and obligations to the Engineer, in addition to involvement by and obligations to the Architect.

AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the work.

NRTL: Nationally recognized testing laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA), and acceptable to the AHJ over this project. Nationally recognized testing laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTLs that are acceptable to the AHJ and standards that meet the specified criteria.

Substitution: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Substitutions include Value Engineering proposals.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by or acceptable to the Engineer as equivalent to the item or manufacturer specified". The term "approved" shall mean labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.

C. PREBID SITE VISIT

Prior to submitting bid, visit the site of the proposed work and become fully informed as to the conditions under which the work is to be done. Failure to comply with this requirement shall not be considered sufficient justification to request or obtain extra compensation over and above the contract price.

D. MATERIAL AND WORKMANSHIP

Provide new material, equipment, and apparatus under this contract unless otherwise stated herein, of best quality normally used for the purpose in good commercial practice, and free from defects. Install material and equipment in accordance with the manufacturer's installation instructions. Model numbers listed in the specifications or shown on the drawings are not necessarily intended to designate the required trim, written descriptions of the trim govern model numbers.

Pipe, pipe fittings, pipe specialties and valves shall be manufactured in plants located in the United States or certified to meet the specified ASTM and ANSI standards.

Work performed under this contract shall provide a neat and "workmanlike" appearance when completed, to the satisfaction of the Architect and Engineer. Workmanship shall be the finest possible by experienced mechanics. Installations shall comply with applicable codes and laws.

The complete installation shall function as designed and intended with respect to efficiency, capacity, noise level, etc. Abnormal noise caused by rattling equipment, piping, ducts, air devices, and squeaks in rotating components shall not be acceptable. Materials and equipment shall be of commercial specification grade in quality. Light duty and residential grade equipment shall not be accepted unless otherwise indicated.

Remove from the premises waste material present as a result of work, including cartons, crating, paper, stickers, and/or excavation material not used in backfilling, etc. Clean equipment installed under this contract to present a neat and clean installation at the termination of the work.

Repair or replace public and private property damaged as a result of work performed under this contract to the satisfaction of authorities and regulations having jurisdiction. Provide all safety lights, guards, and warning signs required for the performance of the work and for the safety of the public.

E. MANUFACTURERS

In other articles where lists of manufacturers are introduced, subject to compliance with requirements, provide products by one of the manufacturers specified.

Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

Where manufacturers are not listed, provide products subject to compliance with requirements from manufacturers that have been actively involved in manufacturing the specified product for no less than 5 years.

F. COORDINATION

Coordinate work with that of other trades so that the various components of the systems are installed at the proper time, will fit the available space, and will allow proper service access to those items requiring maintenance. Components which are installed without regard to the above shall be relocated at no additional cost to the Owner.

Unless otherwise indicated, the General Contractor shall provide chases and openings in building construction required for installation of the systems specified herein. Contractor shall furnish the General Contractor with information where chases and openings are required. Contractor shall keep informed as to the work of other trades engaged in the construction of the project and shall execute work in a manner as to not interfere with or delay the work of other trades.

Figured dimensions shall be taken in preference to scale dimensions. Contractor shall take his own measurements at the building, as variations may occur. Contractor shall be held responsible for errors that could have been avoided by proper checking and inspection.

Provide materials with trim that will properly fit the types of ceiling, wall, or floor finishes actually installed. Model numbers listed in the specifications or shown on the drawings are not intended to designate the required trim.

G. ORDINANCES AND CODES

Work performed under this contract shall, at a minimum, be in conformance with applicable national, state and local codes having jurisdiction. Equipment furnished and associated installation work performed under this contract shall be in strict compliance with current applicable codes adopted by the local AHJ, including any amendments and standards as set forth by the following:

1. National Electrical Code (NEC)
2. National Fire Protection Association (NFPA)
3. Underwriters Laboratories (UL)
4. Occupational Safety and Health Administration (OSHA)
5. American Society of Mechanical Engineers (ASME)
6. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
7. American National Standards Institute (ANSI)
8. American Society of Testing and Materials (ASTM)
9. Other national standards and codes where applicable.

Where the contract documents exceed the requirements of the referenced codes, standards, etc., the contract documents shall take precedence. Where conflicts between various codes, ordinances, rules, and regulations exist, comply with the most stringent.

Promptly bring all conflicts observed between codes, ordinances, rules, regulations, referenced standards, and these documents to the attention of the Architect and Engineer for final resolution. Contractor will be held responsible for any violation of the law.

Procure and pay for permits and licenses required for the accomplishment of the work herein described. Where required, obtain, pay for, and furnish certificates of inspection to Owner.

H. PROTECTION OF EQUIPMENT AND MATERIALS

Store and protect from damage equipment and materials delivered to job site. For materials and equipment susceptible to changing weather conditions, dampness, or temperature variations, store inside in conditioned spaces. For materials and equipment not susceptible to these conditions, cover with waterproof, tear-resistant, heavy tarp or polyethylene plastic as required to protect from plaster, dust, dirt, paint, water, or physical damage. Replace insulation that has become wet at any time during construction. Drying the insulation is not acceptable. Seal any tears or joints of internal fiberglass insulation. Equipment and material damaged by construction activities shall be rejected and Contractor shall furnish new equipment and material of a like kind at his own expense.

Keep premises broom clean of foreign material created during work performed under this contract. Piping, equipment, etc. shall have a neat and clean appearance at the termination of the work. Remove debris from ceiling/return air plenum, including dust.

Plug, seal, or cap open ends of ductwork and piping systems while stored and installed during construction when not in use to prevent the entrance of debris into the systems. Remove temporary protection prior to starting equipment and turning the system over to the owner.

I. SUBSTITUTIONS

Materials, products, equipment, and systems described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by the proposed substitution. The base bid shall include only the products from manufacturers specifically named in the drawings and specifications. To request a substitution, request the Substitution Request Form from the Architect or Engineer. Complete and send the Substitution Request Form for each material, product, equipment, or system that is proposed to be substituted. The burden of proof of the merit of the proposed substitution is upon the proposer.

Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Architect, and Owner the following:

1. Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects unless stated otherwise in the substitution request.
2. Proposed substitution is consistent with the Contract Documents and will produce indicated results, including functional clearances, maintenance service, and sourcing of replacement parts.
3. Proposed substitution has received necessary approvals of authorities having jurisdiction.
4. Same warranty will be furnished for proposed substitution as for specified Work.
5. If accepted substitution fails to perform as required, Contractor shall replace substitute material or system with that originally specified and bear costs incurred thereby.
6. Coordination, installation and changes in the Work as necessary for accepted substitution will be complete in all respects.

No substitutions will be considered unless the Substitution Request Form is completed and attached with the appropriate substitution documentation. No substitution will be considered prior to receipt of bids unless written request for approval to bid has been received by the Engineer at least ten (10) calendar days prior to the date for receipt of bids.

If the proposed substitution is approved prior to receipt of bids, such approval will be stated in an addendum. Bidders shall not rely upon approvals made in any other way. Verbal approval will not be given. No substitutions will be considered after the contract is awarded unless specifically provided in the contract documents.

J. SUBMITTALS

Assemble and submit for review shop drawings, material lists, manufacturer product literature for equipment to be furnished, and items requiring coordination between contractors under this contract. Provide submittals in sufficient detail so as to demonstrate compliance with these contract documents and the design concept. Prior to transmitting submittals, verify that the equipment submitted is mutually compatible and suitable for the intended use, will fit the available space, and maintain manufacturer recommended service clearances. If the size of equipment furnished makes necessary any change in location or configuration, submit a shop drawing showing the proposed layout.

Transmit submittals as early as required to support the project schedule. Allow for two weeks Engineer review time, plus to/from mailing time via the Architect, plus a duplication of this time for resubmittal, if required. Only resubmit those sections requested for resubmittal.

Submittals shall contain the project name, applicable specification section, submittal date, equipment identification acronym as used on the drawings, and the Contractor's stamp. The stamp shall certify that the submittal has been checked by the Contractor, complies with the drawings and specifications, and is coordinated with other trades. Manufacturer product literature shall include shop drawings, product data, performance sheets, samples and other submittals required by this division. Highlight, mark, list, or indicate the materials, performance criteria, and accessories that are being proposed. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.

Submittals and shop drawings shall not contain the firm name, logo, seal, or signature of the Engineer. They shall not be copies of the work product of the Engineer. If the Contractor desires to use elements of such product, refer to paragraph "Electronic Drawing Files" for procedures to be used.

Separate submittals according to individual specification sections. Illegible submittals will be rejected and returned without review. Catalog data shall be properly bound, identified, indexed and tabbed in a 3-ring binder. Each item or model number shall be clearly marked and accessories indicated. Label the catalog data with the equipment identification acronym or number as used on the drawings and include performance curves, capacities, sizes, weights, materials, finishes, wiring diagrams, electrical requirements and deviations from specified equipment or materials. For equipment with motor starters or VFDs, include short circuit current ratings. Mark out inapplicable items. Shop drawings will be returned without review if the above mentioned requirements are not met.

Provide the quantity of submittals required by Division 01. If not indicated and hard-copy sets are provided, submit a minimum of six (6) copies. Refer to Division 01 for acceptance of electronic submittals for this project. For electronic submittals, Contractor shall submit the documents in accordance with the procedures specified in Division 01. Contractor shall notify the Architect and Engineer that the submittals have been posted. If electronic submittal procedures are not defined in Division 01, Contractor shall include the website, user name, and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the designated representatives of the Architect and Engineer. Contractor shall allow for the Engineer review time as specified above in the construction schedule. Contractor shall submit only the documents as required to purchase the materials and/or equipment in the electronic submittal.

The checking and subsequent acceptance of submittals by the Engineer and/or Architect shall not relieve the Contractor from responsibility for deviations from the drawings and specifications, errors in dimensions, details, size of members, or quantities, omissions of components or fittings; coordination of electrical requirements; and not coordinating items with actual building conditions and adjacent work. Proceed with the procurement and installation of equipment only after receiving approved shop drawings relative to each item.

K. ELECTRONIC DRAWING FILES

In preparation of shop drawings or record drawings, Contractor may, at his option, obtain electronic drawing files in AutoCAD or DXF format on CD-ROM disk, DVD disk, flash drive or direct download, as desired, from the Engineer for a shipping and handling fee of $200 for a drawing set up to 12 sheets and $15 per sheet for each additional sheet. Contact the Architect for written authorization and Engineer for the necessary release agreement form and to specify shipping method and drawing format. In addition to payment, the written authorization from the Architect and release agreement form from the Engineer must be received before electronic drawing files will be sent.

L. RECORD DRAWINGS (AS-BUILT DRAWINGS)

During progress of the work in this division, Contractor shall maintain an accurate record of all changes made during the installation of the system. Upon completion of the work, accurately transfer all record information to three identical sets of the approved shop drawings. Insert one set into each copy of the manual described below.

See Division 01 and General Conditions for additional information.

M. OPERATION AND MAINTENANCE INSTRUCTIONS

During the course of construction, collect and compile a complete brochure of equipment furnished and installed on this project. Include operational and maintenance instructions, manufacturer's catalog sheets, wiring diagrams, parts lists, approved submittals and shop drawings, warranties, and descriptive literature as furnished by the equipment manufacturer. Include an inside cover sheet that lists the project name, date, Owner, Architect, Engineer, General Contractor, Sub-Contractor, and an index of contents.

Submit three copies of literature bound in approved binders with index and tabs separating equipment types to the Architect, for Engineer's review, at the termination of the work. Paper clips, staples, rubber bands, loose-leaf binding, and mailing envelopes are not considered approved binders. Final approval of systems installed under this contract shall be withheld until this equipment brochure is received and deemed complete by the Architect and Engineer. Instruct workmen to save required literature shipped with the equipment itself for inclusion in this brochure.

Include Record Drawings as described above.

Refer to Division 01 for acceptance of electronic manuals for this project. For electronic manuals, refer to paragraph "Submittals" for requirements.

N. SPARE PARTS

Furnish to Owner, with receipt, the following spare parts for the equipment furnished for this project:

1. One set of spare filters of each type required for each unit. In addition to the spare set of filters, install new filters prior to testing, adjusting, and balancing work and before turning system over to Owner.
2. Furnish one complete set of belts for each fan.
3. Furnish three operating keys for each type of air outlet and inlet that require them.

O. TRAINING

At a time mutually agreed upon between the Owner and Contractor, provide the services of a factory trained and authorized representative to train Owner's designated personnel on the operation and maintenance of the equipment provided for this project.

Provide training to include, but not be limited to, an overview of the system and/or equipment as it relates to the facility as a whole; operation and maintenance procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance and appropriate operator intervention; and review of data included in the operation and maintenance manuals.

Submit a certification letter to the Architect stating that the Owner's designated representative has been trained as specified herein. Letter shall include date, time, attendees and subject of training. The Contractor and the Owner's representative shall sign the certification letter indicating agreement that the training has been provided.

Schedule training with Owner with at least 7 days advance notice.

P. WARRANTIES

Warrant each system and each element thereof against all defects due to faulty workmanship, design, or material for a period of 12 months from date of Substantial Completion, unless specific items are noted to carry a longer warranty in the construction documents or manufacturer's standard warranty exceeds 12 months. Remedy all defects, occurring within the warranty period(s), as stated in the General Conditions and Division 01.

Warranties shall include labor and material, including travel expenses. Make repairs or replacements without any additional costs to the Owner, and to the satisfaction of the Owner, Architect, and Engineer.

Perform the remedial work promptly, upon written notice from the Engineer or Owner.

At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period and any actions the Owner must take in order to maintain warranty status. Each warranty instrument shall be addressed to the Owner and state the commencement date and term.

2. GENERAL MATERIALS AND INSTALLATION

A. BUILDING OPERATION

Comply with the schedule of operations as outlined in the architectural portions of this specification. Accomplish work requiring interruption of building operation at a time when the building is not in operation and only with written approval of building Owner and/or tenant. Coordinate interruption of building operation with the Owner and/or tenant a minimum of seven (7) days in advance of work.

B. COINCIDENTAL DAMAGE

Repair streets, sidewalks, drives, paving, walls, finishes, and other facilities damaged in the course of the work. Repair materials shall match existing construction. Repair work shall meet all requirements of the Owner, local authorities having jurisdiction, and meet the satisfaction of the Architect.

C. CUTTING AND PATCHING

Conform to the requirements in Division 01. Cut walls, floors, ceilings, and other portions of the facility as required to install work under this division. Obtain permission from the Architect prior to cutting. Do not cut or disturb structural members without prior approval from the Architect and Structural Engineer. For post-tension slabs, x-ray slab and closely coordinate all core drill locations with Architect and Structural Engineer prior to performing any work. Obtain approval from Architect and Structural Engineer for all core drills and penetrations at least four days prior to performing work. Penetrations shall be made as small as possible while maintaining required clearances between the building element penetrated and the system component. Patch around openings to match the adjacent construction including fire ratings, if applicable. Repair and refinish areas disturbed by work to the condition of adjoining surfaces in a manner satisfactory to the Architect.

D. ROUGH-IN

Coordinate without delay all roughing-in with other divisions. Conceal piping, conduit, and rough-in except in unfinished areas and where otherwise shown.

E. SUPPORT SYSTEMS

Structural steel used for support of equipment, ductwork and piping shall be new, clean, and conform to ASTM Designation A-36.

Support mechanical components from the building structure. Do not support mechanical components from ceilings, other mechanical or electrical components, and other non-structural elements.

F. PENETRATIONS

Provide sleeves for pipes passing through above grade concrete or masonry walls, concrete floor or roof slabs. Sleeves are not required for core drilled holes in existing masonry walls, concrete floors or roofs. Provide 10 gauge galvanized steel sleeves for sleeves 6 inches and smaller. Provide galvanized sheet metal sleeves for larger than 6 inches. Schedule 40 PVC sleeves are acceptable for installation in areas without return air plenums.

Seal elevated floor, exterior wall and roof penetrations watertight and weathertight with non-shrink, non-hardening commercial sealant. Pack with mineral wool and seal both ends with minimum of 1/2 inch of sealant.

Seal around penetrations of fire rated assemblies. Coordinate fire ratings and locations with the architectural drawings. Refer to architectural specifications for fire stoppings. Provide a product schedule for UL listing, location, wall or floor rating and installation drawing for each penetration fire stop system.

Extend pipe insulation for insulated pipe through floor, wall and roof penetrations, including fire rated walls and floors. The vapor barrier shall be maintained. Size sleeve for a minimum of 1 inch annular clear space between inside of sleeve and outside of insulation.

Provide prefabricated roof curbs manufactured by AES Industries, Custom Curb, Inc., Pate Company, Thybar or approved equal. Provide roof curb with factory installed wood nailer; welded, 18 gauge galvanized steel shell, base plate and flashing; 1-1/2 inch thick, 3 pound rigid insulation; fully mitered 3-inch raised cant; cover of weather-resistant, weather-proof material and pipe collar of weather-resistant material with stainless steel pipe clamps. Attach curb to roof structure.

Provide box frames for rectangular openings welded 12 gauge galvanized steel attached to forms and of a maximum dimension established by the Architect. Notify the General Contractor or Architect before installing any box openings not shown on the Architectural or Structural drawings.

G. FIRESTOPPING

Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with UL 2079 or ASTM E 814, or other NRTL acceptable to AHJ.

Manufacturers: Hilti, RectorSeal, Specified Technologies Inc., United States Gypsum Company, or 3M corp.

Through and Membrane Penetration Firestopping Systems Product Schedule: Provide UL listing, location, wall or floor rating, and installation drawing for each penetration fire stop system.

Where project conditions require modification to qualified testing and inspecting agency's illustrations for a particular firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Include qualifications data for testing agency.

H. MOTORS AND STARTERS

Provide motors and starting equipment where not furnished with the equipment package. Motors shall have copper windings, Class B insulation, and standard squirrel cage with starting torque characteristics suitable for the equipment served. Motors controlled by variable frequency drives shall be rated for voltage peaks and minimum rise times in accordance with NEMA MG1, Part 31. Motors 5 horsepower and larger controlled by variable frequency drives shall be provided with a shaft grounding system equal to Aegis SGR Bearing Protection Ring, Inpro/Seal Current Diverter Ring (CDR) or approved equal. 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 and not in air stream of fan; and totally enclosed fan cooled enclosure for motors exposed to weather. Motors shall be manufactured by Century, General Electric, Louis Allis, Westinghouse, or approved equal.

Provide every motor, except fractional horsepower single phase motors with an approved type of "built-in" thermal overload protection, with a motor starter. Each starter shall be provided with overload heaters sized to the motor rating, and 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 the Division 23 Contractor for installation and connection by the Division 26 Contractor. Starters shall be Allen-Bradley, Clark, Furnas, Square D, or approved equal.

I. VARIABLE FREQUENCY DRIVES

Provide PWM variable frequency drives (VFD) to control fan motors as indicated on the drawings. Provide VFD as manufactured by AC Technology, Asea Brown Boveri, Danfoss, Reliance Electric, or Yaskawa. Include an integral, door-interlocked input circuit breaker or fused disconnect which may be padlocked in the "OFF" position.

Provide a magnetic contactor manual bypass integral to each drive. Provide two magnetic contactors, mechanically and electrically interlocked, to isolate the inverter output from line voltage. The inverter input shall be isolated by either a third magnetic contactor or a second disconnect switch to allow removal of power to the inverter for service while still operating the motor across the line. Bypass shall include a 120/1/60 control transformer, fused on both the primary and secondary, and bi-metallic thermal motor overload relays with adjustable trip settings.

Provide input AC line reactors without exception. Reactors shall be minimum 3 percent impedance, and "K" rated per IEEE C57-110 for harmonic current content. Reactors shall be integral to the drive enclosure without need for field wiring.

The VFD shall have an RS-485 port as standard. The standard protocols shall be Johnson Controls N2 bus, Modbus, and Siemens Building Technologies FLN. Optional protocols for BACnetc, DeviceNet, Ethernet, LonWorks, and Profibus shall be available. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority. Use of non-certified protocols is not allowed. The VFD shall allow the DDC system to control the digital and analog outputs of the drive via the serial interface. This control shall be independent of any VFD function. In addition, all the digital and analog inputs of the drive shall be capable of being monitored by the DDC system.

Drive supplier shall provide jobsite start-up, Owner training, and a one-year parts and on-site labor warranty. Multiple visits shall be included to allow for tuning and troubleshooting of the controls system as required.

J. ELECTRICAL WIRING

High voltage wiring is defined as 50 Volts or higher. Low voltage wiring is defined as less than 50 Volts. Line voltage wiring shall be provided by Division 26. Line voltage control and interlock wiring for mechanical systems shall also be provided by Division 26. Low voltage control wiring shall be provided by Division 23. Furnish wiring diagrams to Division 26 as required for proper equipment hookup. Coordinate with Division 26 the actual wire sizing amps for mechanical equipment (from the equipment nameplate) to ensure proper installation.

Provide power and communication wiring with transient protection in accordance with IEEE C62.41.2. All control and interlock wiring shall comply with the NEC. Control wiring shall be sized to accommodate the voltage drop associated with the distance between the control device and the controller. Control wiring not installed in conduit shall be UL rated for plenum installation. All NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway according to the NEC and Division 26 requirements. Maximum allowable voltage for control wiring shall be 120 V. All low-voltage wiring shall meet NEC Class 2 requirements. Low-voltage power circuits shall be sub-fused when required to meet Class 2 current limit.

Conduit for Control Wiring: EMT with compression fittings, cold rolled steel, zinc coated or zinc-coated rigid steel with threaded connections.

Pull and Junction Boxes: Size according to number, size, and position of entering raceway as required by National Electrical Codes. Enclosure type shall be suited to location.

Install wiring parallel to building lines wherever possible. Conceal all control wiring in finished rooms. Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two wires (e.g., relays and transformers). All wire-to device and wire-to-wire connections shall be made at a terminal block or terminal strip. All runs of communication wiring shall be unspliced length when that length is commercially available. Verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable. Label all wiring and cabling at each end within 2 inches of termination with the controller termination number. Label control devices used in the system with permanent labels using the identifiers that match the record documents.

Install BACnet MS/TP communication wiring in accordance with ASHRAE/ANSI Standard 135. Maximum length of MS/TP communication wiring shall be 4000 ft with AWG 22 or 24 cable. Splices in shielded cables shall consist of terminations and the use of shielded cable couplers that maintain the integrity of the shielding.

K. SYSTEM TESTING ADJUSTING, AND BALANCING

Upon completion of each phase of the installation, test each system in conformance with local code requirements and as noted below. Furnish labor and equipment required to test each system installed under this contract. Assume all costs involved in making the tests and repairing and/or replacing any damages resulting therefrom.

Final system testing, balancing and adjustments (TAB) shall be performed by a Contractor certified by the National Environmental Balancing Bureau (NEBB), Associated Air Balance Council (AABC) or Testing, Adjusting and Balancing Bureau (TABB). TAB shall be performed in accordance with the most current edition of the certified agencies procedural standard for testing, adjusting and balancing and shall comply with the strictest interpretation of that standard for execution and reporting of all TAB work.

Work shall include but not be limited to: Perform test readings on fans, units, coils, etc. and adjust equipment to deliver specified amounts of air. Prepare testing and balancing report log showing air supply quantities, air entering and leaving temperatures and pressures at design flow, fan and unit test readings, motor voltage and amp draws, etc., and submit six copies of the final compilation of data to the Architect for evaluation and approval before final inspection of the project. Balance air systems to within plus or minus 10 percent for terminal devices and branch lines and plus or minus 5 percent for main ducts and air handling equipment of the amount of air shown on the drawings. TAB Contractor shall record space temperatures and make adjustments in airflow to each diffuser to obtain uniform temperature (no greater than +/- 3 F) in spaces. Document temperatures and adjustments in tab report. Adjust equipment to operate as intended by the specification. TAB report shall include a 'report summary/remarks' section in accordance with the procedural standard that provides both system set up and a summary of deficiencies as defined by the procedural standard.

TAB Contractor shall be responsible to calibrate, set, and adjust automatic temperature control sensors, actuators and control devices. Check proper sequencing of interlock systems, and operation of safety controls, adjust thermostats, and control setpoints, limits and time based adjustment to operate in accordance with the performance requirements of the Construction Documents. Adjust pumps, fans, etc. for proper and efficient operation. Certify to Architect that adjustments have been made and that system is operating satisfactorily. Calibrate, set, and adjust automatic temperature controls. Check proper sequencing of interlock systems, and operation of safety controls.

Division 23 contractor shall align bearings and replace bearings that have dirt or foreign material in them with new bearings without additional cost to the Owner.

L. VIBRATION ISOLATION

Provide vibration isolation equipment and materials by a single manufacturer. If type and deflection for specific equipment is not specified within the contract documents, reference ASHRAE Handbook "HVAC Applications" or provide per manufacturer's recommendations. Approved manufacturers include Amber Booth, Kinetics Noise Control, Mason Industries, Inc., Vibration Eliminator Co., Inc., and Vibration Mounting and Controls, provided their systems are in compliance with the specified design and performance requirements.

General Requirements: Select vibration isolators by the weight distribution to produce uniform deflection. Vibration isolators shall have either known un-deflected heights or calibration markings so that, after adjustment, the static deflection can be verified, thus determining that the load is within the proper range of the isolator. Isolators shall operate in the linear portion of their load versus deflection curves. Spring isolators shall have 50 percent excess capacity without becoming coil bound. Coat vibration isolators with factory-applied paint. Coat vibration isolators exposed to weather and other corrosive environments with factory-applied corrosion resistance protection. Install and adjust vibration isolators in accordance with manufacturers written instructions.

Isolator Types:

1. Type WP (Waffle Pads): Provide 5/16 inch thick neoprene pads ribbed or waffled on both sides. Manufacture pads with bridge bearing quality neoprene, and select for a maximum durometer of 50 and designed for 15 percent strain. Incorporate steel load_spreading plates where required between the equipment and the neoprene pad. If the isolator is bolted to the structure, install a neoprene vibration isolation washer and sleeve (Uniroyal Type 620/660 or as approved) shall be installed under the bolt head between the steel washer and the base plate. Provide Mason Industries Type W or equal.
2. Type SPNH (Spring and Neoprene Hangers): Provide a steel spring in series with a neoprene isolating element. The spring shall have a minimum additional travel to solid equal to 50 percent of the specified deflection. The neoprene element shall have a static deflection of not less than 0.3 inches with a strain not exceeding 15 percent. Unless otherwise specified, the static deflection of SPNH hangers shall be 2 inches. Spring diameter and hanger box hole size shall be large enough to permit the hanger rod to swing through a 30 degree arc. Provide neoprene sleeve where the lower hanger rod passes through the steel hanger box, such that the hanger rod cannot contact the steel hanger. The diameter of the clear hole in the hanger box shall be at least 3/4 inch larger than the diameter of the hanger rod. When installed, do not cock the spring element and do not allow the hanger box to rotate through a full 360 degree arc without encountering obstructions. Provide Mason Industries Type 30N or equal.
3. Type SPNM (Spring and Neoprene Mounts): Provide free_standing and laterally stable steel spring without a housing. Design springs so the ratio of the horizontal to vertical spring constant is between one and two. The spring diameter shall be not less than 80 percent of the compressed height of the spring at rated load. Loaded springs shall have a minimum additional travel to solid equal to 50 percent of the specified static deflection. Unless otherwise specified, the minimum static deflection of SPNM isolators for equipment mounted on grade slabs shall be 1 inch, and the minimum static deflection for equipment mounted above grade level shall be 2 inches. Bond two Type WP isolation pads sandwiching a 16 gauge stainless or galvanized steel separator plate to the isolator baseplate. Unless otherwise specified, isolators need not be bolted to the floor for indoor installations. If the base plates are bolted to the structure, install a neoprene vibration isolation washer and sleeve (Uniroyal Type 620/660 or as approved) under the bolt head between the steel washer and the base plate. Provide Mason Industries Type SLFH or equal.
4. Type NR (Neoprene Mounts): Provide neoprene, rubber-in-shear mounts for light weight, suspended equipment supported from structure with all thread rod and angle iron or unistrut. Provide Mason Industries Type HMIB or equal.

M. AIR FILTERS

Provide Farr 30/30, pleated, throwaway type filters, minimum MERV 8, or similar as manufactured by Air Filter, Inc., American Air Filter, Flanders, or approved equal, unless otherwise indicated.

Temporary filters used to protect openings in ductwork and inside equipment when permanent HVAC equipment is used during the construction period shall be pleated, throwaway type filters, minimum MERV 6.

N. REFRIGERANT AND OIL

Provide full refrigerant and oil charge in new air conditioning refrigeration systems, and maintain it for full term of the guarantee.

O. IDENTIFICATION

Provide stenciled signs for equipment identification at Contractor's option or where distance of required identification requires lettering larger than 1 inch height. Stencil paint shall be exterior type, oil-based, alkyd enamel, minimum 1-1/4 inch height or greater as required for long distance identification, white or black color for best contrast.

Provide duct markers or provide stenciled signs and arrows indicating ductwork service and flow direction in black or white lettering for best contrast with duct or insulation color. Locate markers maximum 50 feet along each duct side and within 5 feet of all control and balancing dampers or branch ducts more than 25 feet length and within 5 feet on each side of wall, floor, and ceiling penetrations. Provide additional markers in congested areas or at multiple duct runs as required for clarity.

3. DUCT INSULATION, DUCTWORK, ACCESSORIES, AND FANS

A. DUCT INSULATION

Provide fiberglass duct liner with fibers firmly bonded together with a thermosetting resin. Liner surface shall serve as a barrier against infiltration of dust and dirt, shall meet ASTM C1338 for fungi resistance, and shall be cleanable using duct cleaning methods and equipment outlined by North American Insulation Manufacturers Association (NAIMA) duct cleaning guide. Install with liner adhesive and mechanical fasteners in accordance with manufacturer's instructions and recommendations. Ductwork sizes shown on drawings are inside clear dimensions. Increase sheet metal by liner thickness in both directions where liner is installed.

Provide rectangular liner conforming to ASTM C1071, Type I or II that is 2 inch thick, 1-1/2 pound density, minimum R-8.3 Certainteed Corp. "Toughgard" or equivalent, Johns Manville, Owens-Corning, or Knauf.

Provide round liner that is 2 inch thick, 4 pound density, minimum R-8.4 Johns Manville "Spiracoustic Plus" or equivalent, Certainteed or Owens-Corning.

Provide liner on the following interior air ducts and where specified on the drawings:

1. Exposed round and rectangular supply ductwork and the first 15 feet of duct downstream of equipment outlets or 5 feet past first elbow, whichever is greater.
2. All return ductwork

At interface of lined and wrapped ductwork, overlap lined ductwork at least 2 feet beyond wrapped insulation.

Cover concealed, rigid ductwork with ASTM C553, Type II flexible fiberglass insulation. Installed insulation shall be 3 inch thick, 1-1/2 pound density, minimum R-8.0 duct wrap, Certainteed or equivalent Johns Manville, Owens-Corning, or Knauf with heavy-duty foil-scrim-kraft facing, and with joints taped with 3 inch wide foil tape as follows:

1. Unlined Round and rectangular supply and return air ductwork.
2. Round and rectangular exhaust and relief air ductwork within 10 feet of exterior discharge.

Insulating materials, adhesives, coatings, etc., shall not exceed flame spread rating of 25 and smoke developed rating of 50 per ASTM E84. Containers for mastics and adhesives shall have U.L. Label.

B. DUCTWORK

Provide galvanized steel ductwork and housings as shown on drawings. Construct ductwork including fittings and transitions in conformance with current SMACNA standards relative to gauge, bracing, joints, etc. Minimum thickness of duct shall be 26-gauge sheet metal. Reinforce housings and ductwork over 30 inches with 1-1/4 inch angles not less than 5'-6" on centers, and closer if required for sufficient rigidity to prevent vibration. Support horizontal runs of duct from strap iron hangers on centers not to exceed 8'-0". Do not support ceiling grid, conduits, pipes, equipment, etc. from ductwork. Coordinate routing of ductwork with other contractors such that piping, electrical conduit, and associated supports are not routed through the ductwork.

Construct non-VAV supply ducts to meet SMACNA positive pressure of 2 inches w.g. Construct Return, Outdoor and Exhaust ductwork upstream of fans to meet SMACNA negative pressure of 1 inch w.g.

Construct VAV primary supply air ducts (upstream of terminal boxes) to meet SMACNA positive pressure of 4 inches w.g. Construct VAV secondary supply air ducts (downstream of terminal boxes) to meet SMACNA positive pressure of 2 inches w.g.

Provide mill phosphatized or galvanealed finish for exposed ductwork to be field painted. Shop treated sheet metal shall have galvanized metal primer applied in the shop after fabrication and prior to shipping.

Seal ductwork with heavy liquid sealant, Hardcast Irongrip 601, Design Polymer DP 1010, United Mcgill duct sealer or approved equal, applied according to sealant manufacturer's instructions. Seal all longitudinal and transverse ductwork joints airtight to meet SMACNA Seal Class A. Tapes and mastics shall be listed and labeled in accordance with UL 181A.

Provide radius elbows, turns, and offsets with a minimum centerline radius of 1-1/2 times the duct width. Where space does not permit full radius elbows, provide short radius elbows with a minimum of two continuous splitter vanes. Vanes shall be the entire length of the bend. Provide mitered elbows where space does not permit radius elbows, where shown on the drawings, or at the option of the contractor with the engineer's approval. Mitered elbows less than 45 degrees shall not require turning vanes. Mitered elbows 45 degrees and greater shall have single thickness turning vanes of same gauge as ductwork, rigidly fastened with guide strips in ductwork. Vanes for mitered elbows shall be provided in all supply and exhaust ductwork and in return and outside air ductwork that has an air velocity exceeding 1000 fpm. Do not install vanes in grease ductwork. The use of square throat, radius heel elbows is prohibited. Remove and replace all installed elbows of this type with an approved elbow at no additional cost to the owner.

Ducts shall be connected to fans, fan casings and fan plenums by means of flexible connectors. Flexible connectors shall be neoprene coated glass cloth canvas connections, Duro-Dyne, Elgen, Ventfabric or equal. Flexible connectors shall have a flame spread of 25 or less and smoke developed rating not higher than 50. Make airtight joints and install with minimum 1-1/2 inches slack.

Provide balancing dampers, manufactured by Cesco, Greenheck, Louvers & Dampers, Nailor Industries, Pottorff, Ruskin, Tamco, or approved equal, where shown on drawings and wherever necessary for complete control of air flow. Splitter dampers shall be controlled by locking quadrants; provide Young Regulator or Ventlok end bearings for the damper rod. Rectangular volume dampers shall be opposed blade interlocking type. Round volume dampers shall be single-blade type consisting of circular blade mounted to a shaft. Provide Flexmaster model STO or equal 45 degree rectangular/round side takeoff fitting with model BO3 damper with locking quadrant and insulation build out for round ductwork branch takeoffs to individual air devices. Omit damper at takeoff fitting when damper is located downstream of takeoff.

Where access to dampers through a hard ceiling is required, provide a Metropolitan Air Technology model RT-250 or equal by Young's Regulator concealed, cable operated volume damper with remote operator. Damper shall be adjustable through the diffuser face or frame with standard 1/4 inch nutdriver or flat screwdriver. Cable assembly shall attach to damper as one piece with no linkage adjustment. Positive, direct, two-way damper control shall be provided with no sleeves, springs or screw adjustments to come loose after installation. Support cable assembly to avoid bends and kinks in cable.

Round or oval ductwork shall be FlaktGroup Semco, United, Hercules Industries or equal, sheetmetal, with smooth interior surface, with low pressure (duct pressure class up to and including 2 inches w.g.) Round ductwork gauges per the following table (reference SMACNA HVAC duct construction standards for gauges when pressures exceed 2 inches w.g.):

Size	Duct Gauge	Fitting Gauge
14" & under	26	24
15" thru 26"	24	22
28" thru 36"	22	20

Provide double wall insulated round ductwork where indicated. Fabricate double-wall insulated ducts and fittings with an outer shell, insulation, and an inner liner as specified below. Dimensions indicated on internally insulated ducts are inside dimensions. Outer shell shall be 2 inches longer than inner shell and insulation and shall be gauge as specified for single wall duct. Insulation shall be fiberglass with thickness as required for thermal resistance of R-8. Perforated inner liner shall be 24 gauge up to 34 inches. Provide 3/32-inch perforations with an overall open area of 23 percent. Maintain concentricity of liner to outer shell be mechanical means. Retain insulation from dislocation by mechanical means.

Lewis & Lambert, Linx Industries Lindab Safe, or approved equal factory-manufactured round ductwork and fittings may be substituted for specified round branch ductwork, at Contractors option. Heavy liquid joint sealant may be omitted on factory-manufactured round ductwork.

Low pressure (duct pressure class up to and including 2 inches w.g.) Fittings 24 inches in diameter and less shall be prefabricated, spot-welded and internally sealed. Continuously weld fittings larger than 24 inches in diameter. Fitting gauge shall be 22 gauge for 36 inch fittings and under, 20 gauge for larger sizes. 90 degree tees shall be conical type. Seal longitudinal and transverse ductwork joints airtight with heavy liquid sealant applied according to manufacturer's instructions. Provide gauge thickness in medium pressure (duct pressure class 3 inches to 6 inches w.g.) ductwork as recommended by SMACNA.

At Contractors option, provide Ductmate, Gripple, or approved equal wire rope duct hanging system. Provide Ductmate WR10 through WR40 or Gripple No. 1 through No. 5 wire rope using 7x7 or 7x19 aircraft quality zinc coated cable or galvanized steel wire rope. Secure wire rope to duct using Ductmate Clutcher or Gripple hang fast adjustable rope attachment. For seismic applications, wire rope systems shall be seismic tested, conforming to GR 63, Level 4 Seismic. Where applicable for upper attachment, provide Ductmate EZ-Lock wire rope beam clamp with locking nut adjustment or Gripple ceiling, beam, or purlin clips. Wire rope, adjustable duct attachment, and upper attachment to structure shall each have minimum 5 to 1 load safety factor.

If permanent HVAC equipment is used during the construction period, provide temporary filters at all openings in the ductwork and inside equipment to protect the system from dust, dirt, paint, and moisture. Replace and maintain filters when needed, but not less than every month. On the day of Substantial Completion, clean the unit and ductwork and provide a new set of filters in the unit. Refer to section "Air Filters" for filter requirements.

An independent, professional duct cleaning company shall vacuum clean all internal surfaces of equipment, coils, and ductwork connected to permanent HVAC units that are operated during the construction period. Conduct cleaning after new air filters are installed and prior to turning the system over to the owner.

C. FLEXIBLE DUCT

Low pressure (duct pressure class up to and including 2 inches w.g.) and medium pressure (duct pressure class 2.1 inch to 6 inches w.g.) flexible duct shall be Flexmaster type 8B, Thermaflex type G-KM, M-KE, JPL type Silver Jacket, or equal (fire retardant polyethylene) protective vapor barrier, U.L.181 Class 1, acoustical insulated duct, R-8.0 fiberglass insulation. Provide CPE liner with steel wire helix mechanically locked or permanently bonded to the liner.

Flexible duct runs shall not exceed 5 feet in length, and shall be installed fully extended and straight as possible avoiding tight turns. Install flexible duct in accordance with manufacturer's instructions. Support flexible duct at maximum 5 feet on center and within 6 inches of bends. Bends shall not exceed a centerline radius of one duct diameter. Duct sag shall not exceed 1/2 inch. Supporting material in direct contact with the duct shall not be less than 1-1/2 inches in width.

Connect flexible duct to rigid metal duct or air devices as recommended by the manufacturer. At a minimum, install two wraps of duct tape around the inner core connection and a metallic or non-metallic clamp over the tape and two wraps of duct tape or a clamp over the outer jacket. Duct clamps shall be labeled in accordance with UL-181B and marked 181B-C. Duct tape shall be labeled in accordance with UL 181B and marked 181B-FX.

D. AIR DEVICES

Provide air devices as scheduled on drawings, manufactured by Carnes, Krueger, Metalaire, Nailor Industries, Price, Titus, or Tuttle & Bailey. Select air devices to limit room noise level to no higher than NC-30 unless otherwise shown. Provide devices with a soft plastic gasket to make an airtight seal against the mounting surface. Coordinate final location, frame, and mounting type of air devices with Architectural reflected ceiling plans.

Submit complete shop drawings including information on noise level, pressure drop, throw, CFM for each air device, styles, borders, etc. Clearly marked with specified equipment number. Submit samples of each air device as requested by the Engineer.

Provide wall supply air registers with double deflection blades and opposed blade dampers. Provide wall return air grilles and exhaust air registers with horizontal 35 or 45 degree angle vision-proof bars. Provide concealed fasteners for wall mounted registers and grilles.

Provide ceiling supply air registers of aluminum curved blade type with blades parallel to long dimension and with throw pattern as indicated on drawings. Provide opposed blade dampers for supply air registers and exhaust air registers unless indicated otherwise.

Provide ceiling mounted air devices of lay-in or surface mounted type as required to be compatible with ceiling construction. Provide ceiling diffusers and grilles with white enamel finish unless noted otherwise.

E. CONTROL DAMPERS

Provide factory fabricated, parallel blade control dampers sized as shown on the drawings and as specified. Individual damper sections shall not be larger than 48 inches x 60 inches with maximum blade width of 6 inches. Frame construction shall be minimum 16 gauge galvanized steel for rectangular dampers, 20 gauge for round, 1/8 inch thick for aluminum, with flanges for duct mounting. Provide elastomeric or neoprene seals, mechanically attached and field replaceable. Provide a minimum of one damper actuator per section. Test damper performance in accordance with AMCA 500-D.

Provide modulating dampers with linear flow characteristics. Size modulating dampers based on the smaller of 1,500 FPM through the damper or full open air pressure drop of 0.1 inches W.C. Size two-position dampers full duct size and select to minimize pressure drop.

Motorized dampers used for ventilation air intake, exhaust air, or relief air shall have leakage rates not to exceed 4.0 CFM/square foot in full closed position at 1 inch W.G. pressure differential across the damper.

Provide dampers as manufactured by Greenheck, CESCO, Pottorff, Nailor, or Ruskin. Reference manufacturer with model number for outside air dampers is Ruskin CD-50 constructed of aluminum, [fire and smoke control is Ruskin FSD-60 constructed of galvanized steel,] and all other applications is Ruskin CD-35 constructed of galvanized steel.

Provide damper operator for each automatic damper with sufficient capacity to operate the damper under all conditions and to guarantee tight close-off of dampers against system pressure encountered. Each operator shall be provided with spring-return for normally closed or normally open position for fail safe operation to account for fire, low temperatures, or power interruption as required by the control systems specified on the drawings. Damper operators shall be manufactured by Belimo, Johnson Controls or approved equal. Provide transformer for damper motors if different voltages are required.

F. SMOKE DETECTORS

Provide smoke detectors where shown on drawings in addition to locations required by the specifications. Provide smoke detectors manufactured by the following manufacturers: Notifier; SimplexGrinnell; Siemens-Cerberus Division; Kidde/Edwards; Gamewell-FCI; FIKE Corporation; Farenhyt or approved equal.

Duct Mounted Smoke Detector: Photoelectric detector along with a standard, relay or isolator detector mounting base. Provide for variations in duct air velocity between 100 and 4000 feet per minute. Protect the measuring chamber from damage and insects. Provide an air exhaust tube and an air sampling inlet tube that extends the full width of the duct. Support tubing longer than 36 inches at both ends. Provide drilling templates and gaskets to facilitate locating and mounting of the housing.

Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72 for smoke detector spacing. Do not install smoke detectors in a direct air flow and not closer than 3 feet from an air supply diffuser or return air opening. Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover. Test all detectors in accordance with NFPA 72 and local fire department requirements.

G. EXHAUST AIR SYSTEMS

Provide roof mounted exhaust fans as scheduled on the drawings, or equal ACME, Carnes, Cook, Greenheck, Pennbarry, or Twin City Fans complete with aluminum housing, aluminum centrifugal wheel, motor with integral thermal overload protection, disconnect switch mounted inside the housing, birdscreen, backdraft damper, and pate prefabricated roof curb. Three phase fans shall be furnished with magnetic starters with push button station.

4. HVAC EQUIPMENT

A. ELECTRIC UNIT HEATERS

Provide electric unit heaters as scheduled on the drawings, manufactured by Berko, Brasch, Indeeco, Markel, QMark, or Raywall, standard type propeller unit heaters with sidewall mounting brackets and hardware for horizontal airflow. Furnish heater fan motors complete with a manual motor starter with automatic thermal cutouts sized to the motor load, disconnect switch, and other code required safety devices. Provide unit mounted thermostat and manual summer/winter changeover switch.

B. ELECTRIC BASEBOARD HEATERS

Provide electric baseboard heaters as scheduled on the drawings, manufactured by Runtal, Berko, Erincraft, Markel, Q-Mark, or Raywall,. Enclosures shall be extruded aluminum, nominally 7 inches tall x 5 inches wide. They shall have an 18 gauge rear panel, A 16 gauge front panel and A 14 gauge grille with anodized finish, color as selected by the Architect. Provide tamper proof hardware for all removable covers. Air inlet shall be through the bottom or side and the air discharge shall be through the top. Provide blank sections, corner and end caps as required. All sections shall be factory fabricated, no section shall be field fabricated.

Baseboard heaters shall be provided with a continuous raceway, equivalent to a 3/4 inch conduit, the entire length of the enclosure. Conductors shall be suitable for the temperatures encountered. Where indicated, the baseboard heater shall have a blank section for a duplex receptacle. Receptacles shall not be wired to the same circuit as the heater. Receptacles shall match other wiring devices and shall be field installed.

C. AIR HANDLING UNITS

Provide modular air handling unit manufactured by Carrier, Daikin, Trane, or York as scheduled on the drawings, complete with 1 inch, 1.5 PCF insulated heavy gauge steel housing, centrifugal fan section with double wall access door, motor and V-belt drive assembly, DX coil section (staggered coils not acceptable), drain pan, combination filter and mixing damper section with double wall access door and control dampers, belt guard, and magnetic starter. Provide 2 inch thick throwaway type filters, Farr 30/30 or equal.

Construct cabinet of formed and reinforced galvanized steel panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed. Provide access panels and doors of same materials and finishes as cabinet complete with hinges, latches, handles, and gaskets. Provide full height double wall access doors located to allow periodic maintenance and inspections of fan and filter sections. Provide base rail to support sections of unit if mounting configuration requires it.

Provide double-wall drain pan sections constructed of minimum 18 gauge galvanized sheet steel. Fabricate pans in sizes and shapes to collect condensate from cooling coils (including coil piping connections and return bends) when units are operating at the maximum cataloged face velocity across the cooling coil. Fill space between double-wall construction with foam insulation and seal moisture tight. For units with stacked coils, provide an intermediate drain pan or a drain trough to collect condensate from top coil.

Equip fan section with a formed steel channel base for integral mounting of fan, motor, and casing panels. Mount the fan wheel, shaft, bearings, and motor on a structural steel frame with frame mounted base. Statically and dynamically balance fans and shafts and design units for continuous operation at the maximum rated fan speed and motor horsepower. Provide fan wheel with backward-inclined airfoil section blades as indicated. Paint steel airfoil wheels with zinc chromate primer and an enamel finish coat. Fan shaft shall be solid steel, turned, ground, and polished. Key fan wheels to the shaft. Provide shaft bearings of grease-lubricated ball bearings selected for 200,000 hours' average life, with grease fittings extended to an accessible location outside the fan section. Design fan drives for a 1.4 service factor and factory mount with final alignment and belt adjustment made after installation.

Provide motors of sufficient size to accelerate the driven loads satisfactorily. Minimum motor sizes are as indicated. If not indicated, provide motors large enough so that the driven load will not require the motor to operate in the service factor range. Provide motors with a maximum temperature rating of 50 degrees C temperature rise at 40 degrees C ambient for continuous duty at full load (Class A Insulation). Rate motors for a service factor of 1.15 for polyphase motors and 1.35 for single-phase motors. Motor construction shall be NEMA Standard MG 1, general purpose, continuous duty, energy-efficient, Design B with adjustable bases, rated for service with variable frequency drive where applicable, ball or roller bearings with inner and outer shaft seals, grease lubricated, and designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor. Provide open drip-proof motors where satisfactorily housed or remotely located during operation or guarded drip-proof motors where exposed to contact by employees or building occupants. Provide built-in, automatic reset, thermal overload protection for all motors. Refer to paragraph "Motors and Starters" for additional requirements.

Provide coil sections of common or individual insulated, galvanized steel casings for heating and cooling coils. Design and construct coil sections to facilitate removal of coil for maintenance and replacement and to assure full air flow through coils. Provide double gaskets between sections and coil connection penetrations through casing sealed to minimize leakage on medium and high pressure units. Provide drainable coils, rigidly supported across the full face of the coil, and pitched to allow drainage. Staggered coils are not acceptable. Provide fins of aluminum or copper, constructed from flat plate with belled collars for tubes. Bond fins to tubes by mechanically expanding copper tubes. Provide seamless copper tubes. Provide coil casing of galvanized steel. Provide headers for steam and water coils of steel or cast iron, with connections for drain valve and air vent and threaded piping connections. Provide bronze, spring-type water coil turbulators.

Provide aluminized steel heat exchanger, minimum AFUE rating (heating) as required by the applicable energy code or greater if scheduled on the drawings, forced combustion air blower; complete factory installed micro-processor controls including anti-short cycle timers, time delay relays and minimum "on" time controls, 100 percent safety gas shutoff, direct spark ignition system.

Design and fabricate direct-expansion refrigerant coils to be in compliance with ASHRAE Standard 15, "Safety Code for Mechanical Refrigeration." Provide coils with seamless copper suction headers and distributor tubes. Venturi-type refrigerant distributor, designed for low pressure drop, arranged for down feed with solder connections, and having a maximum of 12 circuits for each distributor. Provide two distributors for coils with more than 12 circuits and for split circuit coils.

Dampers shall conform to performance requirements as specified under section "Control Dampers." For units equipped with an economizer assembly, the assembly shall be covered with minimum 5 year manufacturer warranty, certified to operate through 60,000 damper opening and closing cycles, and certified to meet leakage requirements specified under the section, "Control Dampers."

Provide mixing boxes with parallel-blade dampers in a reinforced, galvanized steel cabinet. Fabricate damper blades mechanically fastened to steel operating rod. Connect operating rods for each set of dampers together with a common linkage and interconnect linkages so dampers operate simultaneously and in the opposite direction (one opens when the other closes).

Provide air filters to comply with NFPA Standard 90A "Standard for the Installation of Air Conditioning and Ventilating Systems". Match the filter section cabinet material and finish with the air handling unit cabinet. Arrange filter media holding frames for flat or angular orientation. Provide access doors on both sides of the unit. Provide 2 inch thick disposable air filters, consisting of viscous coated fibers with filtering media encased in fiberboard cell sides having perforated metal grids on each face to provide media support. Airflow resistance with clean media shall not exceeding 0.10 inch w.g. At face velocity of 300 fpm, and filter arrestance efficiency of 70 to 82 percent based on ASHRAE Test Standard 52 - Method of Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

Air handling units with smoke detection shall shutdown fan-powered terminal units that are less than 2,000 cfm when the respective air handling unit shuts down.

D. SPLIT DUCTLESS AIR-CONDITIONING SYSTEMS

Provide split ductless system consisting of evaporator section for wall mounting as indicated and remote condensing section similar to Carrier, Daikin, Lennox, LG, Mitsubishi, Sanyo, Trane, or York. Evaporator cabinet shall be factory assembled pre-wired consisting of furniture-grade steel with baked-enamel finish, front access, with direct-drive centrifugal fans, 2-speed motor, and cleanable foam filter. Evaporator coil shall be direct-expansion cooling coil of seamless copper tubes expanded into aluminum fins, with thermal-expansion valve with external equalizer. Air-cooled condenser shall be of corrosion-resistant cabinet containing compressor, copper-tube aluminum-fin coils, direct-drive propeller fans with motors with internal overload protection; capacity control to 0 degrees Fahrenheit.

Provide refrigerant piping sized as recommended by equipment manufacturer with foamed plastic insulation on the suction line as specified in this section.

Control System: Unit-mounted panel with contactors, control transformer with circuit breaker, solid-state temperature- and humidity-control modules. Provide solid-state, unit-mounted control panel with start-stop switch, adjustable humidity set point, and adjustable temperature set point. Refer to sequence of operation.

E. VAV BOXES

Provide Carnes, Environmental Technologies Inc., Johnson Controls, Kreuger, Price Industries, Titus or Trane single duct, variable air volume terminal of sizes and capacities shown on drawings.

Construct box casing of 22 gauge zinc coated steel, internally lined with minimum R-3.5 fiberglass liner having minimum R-3.5 value and complying with UL 181 and NFPA-90A. Fully cover edges of insulation with metal cover strips. Provide removable access panels with airtight gaskets and quarter-turn latches for access to internal box components requiring service.

Construct the damper blade of heavy gauge steel with shaft rotating in Delrin or bronze oilite self-lubricating bearings. Damper blades shall seat against gasketed stops to limit leakage in full closed position to 10 percent of rated airflow when subjected to 6 inches static pressure.

Provide pressure independent controls accurate to 1.5 degrees Fahrenheit and adjustable from 65 to 85 degrees Fahrenheit. Factory install direct digital controls for the control sequence specified in the schedule and control diagram. Air flow sensors shall be cross configuration with a minimum of 12 pick-up points.

The static pressure drop shall not exceed 0.35 inches WG at the scheduled maximum air flow and the noise criteria discharge shall not exceed 30 at a differential static pressure of 0.15 inches including room and ceiling effects.

F. FAN POWERED BOXES

Provide Carnes, Environmental Technologies Inc., Johnson Controls, Kreuger, Price Industries, Titus or Trane pressure independent variable volume fan powered terminal boxes as noted and scheduled on the drawings. Construct box casing of 22 gauge zinc coated steel, internally lined with minimum R-3.5 fiberglass liner having minimum R-3.5 value and complying with UL 181 and NFPA-90A. Fully cover edges of insulation with metal cover strips. Provide removable access panels with airtight gaskets and quarter-turn latches for access to internal box components requiring service.

Construct the primary air valve damper of metal with peripheral gasket pivoting in self-lubricating bearings. When closed, the damper leakage shall not exceed 2 percent of the rated CFM at 3 inches inlet static pressure. Set minimum position of damper at the factory and allow field adjustment.

Construct fan blower of steel with FC blades, dynamically balanced wheels and direct drive motor. Provide permanent split capacitor type motors with lubricated bearings and thermal overload protection. Design motor for use with electronic fan speed controller. Provide isolation between motor and blower assembly. Provide an electronic speed controller which allows continuously adjustable fan speed from maximum to minimum.

Provide box with a backdraft damper, filter and filter frame, and direct digital controls. Incorporate a single point electrical connection with electrical components enclosed in a single control box with an access panel sealed from primary air flow.

Provide electric resistance heating coils of open coil construction with 80 percent nickel, 20 percent chromium. Provide NEMA 1 control panel, aluminized or galvanized steel frame, airflow switch, thermal overload protection and magnetic contactors.

5. PIPING AND PIPING SPECIALTIES

A. REFRIGERANT PIPING AND INSULATION

Copper tubing: ASTM B 280, alloy C12200, Type ACR, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing. Tubing shall be factory cleaned, ready for installation, and have ends capped to protect cleanliness of pipe interiors prior to shipping.

Fittings: wrought-copper fittings: ANSI B16.22, streamlined pattern.

Brazing filler metals: BCUP - 5: copper (CU), phosphorus (P) 4.8 - 5.2 percent, and silver (AG) 14.5 - 15.5 for joining wrought copper fittings and copper tubing. Braze joints with a slow stream of dry nitrogen passing through the piping.

Insulate suction lines with 1-1/2 inch and liquid lines with 1/2 inch foamed plastic insulation, Armaflex or equal. Piping insulation shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Coat insulation that is exposed to the elements with a protective sealer. Install and support piping to keep noise and vibration to a minimum. Support and secure piping to Unistrut type supports so that no vibration passes to the building structure. Pipe attachments shall be copper-plated or have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing. Install a support within one foot of each change of direction. Mount pipe hangers around the outside of the insulation with saddles to prevent hangers from rupturing the insulation. Replace insulation that is cut or broken by the hangers.

Run refrigerant lines parallel and perpendicular to wall and floor lines and to appear straight and in good order. Pitch suction lines down slightly (1 inch in 20 feet) towards the compressor. Provide oil traps at the base of vertical suction risers over 6 feet high.

Install liquid line sight glasses in liquid lines nearest the expansion valve. Factory mount expansion valves with the sensing bulbs shipped loose. Field mount expansion valve bulb after refrigerant piping is complete (damage may occur if bulbs come in contact with heat).

For systems of 5 ton capacity and smaller, the contractor shall have the option to provide copper refrigerant tubing line set sized as recommended by equipment manufacturer and of length as required for the installation. Provide minimum 1 inch thick foamed plastic insulation, Armaflex or equal, on the suction and liquid lines. Provide quick-connect flare tubing compression fittings or solder connections as required to match the connections of the condensing unit and evaporator coil.

B. SYSTEM EVACUATION AND CHARGING

Blow out refrigeration lines with dry nitrogen at a suitable pressure before making final connection at the condensing unit or coil to ensure against dirt, scale, or other foreign material being in the lines. Draw a vacuum to 29 inches of mercury. Break this vacuum by charging dry refrigerant gas into the system, raising the pressure to 0 PSIG. Repeat the latter two steps for a triple evacuation before the final evacuation is started. Make final evacuation by reducing the system absolute pressure to a maximum of 0.5 millimeters (500 microns) and allowing the pump to run at this pressure for a minimum of two hours.

Repeat the proper amount of refrigerant charge per the manufacturer's recommendations. Record the amount of refrigerant by weight charged into the system for each circuit recorded to the nearest 1/4 pound on tags and attach tags to the liquid line near the condensing unit. Refrigerant shall be supplied by the HVAC Contractor.

6. TEMPERATURE CONTROLS

A. GENERAL REQUIREMENTS

Provide a complete temperature control system including control panels, controllers, control power transformers, thermostats, sensors, time switches, override timers, actuators, relays, and wiring as required to control the systems as specified on the drawings.

Submit shop drawings of equipment provided for temperature control. Submit operation and maintenance data, including trouble-shooting maintenance guide, step-by-step procedures indexed for each controller and thermostat function, inspection period, cleaning methods and materials, and calibration tolerances.

Provide integrated wiring diagrams showing interconnections between field -installed equipment and package wiring furnished with the HVAC equipment. Control wiring shall be sized to accommodate the voltage drop associated with the distance between the control device and the controller.

Provide supervision and on-job checkout service as required to ensure that installation and operation of the temperature control system meets requirements of the drawings, specifications, and sequences of operation. The system shall be guaranteed for a period of one year following the acceptance of the system by the Architect/Engineer. Correct defects occurring during this period at no additional cost to the Owner.

Install control devices with top of device at 48 inches AFF to meet ADA requirements unless otherwise noted on the plans.

B. BUILDING AUTOMATION CONTROL EQUIPMENT

Building automation system (BAS) manufacturers and model numbers are listed for reference as to quality and features required for the control devices. Provide controllers by Automated Logic, Delta Controls, Honeywell, Johnson Controls, KMC Controls, Schneider Electric, Siemens, or Trane with quality and features as indicated. Control devices other than controllers need not be manufactured by the manufacturers listed above.

Provide BACnet Testing Laboratory (BTL) certified controllers conforming to the advanced application controller (B-AAC) device profile or application specific controller (B-ASC) device profile to facilitate the sequences of operation specified.

Controllers shall have the following features: Microprocessor with sufficient memory to support the controller's operating system, database, and programming requirements; real-time clock for scheduling; self-diagnostics; capability of standalone operation if network communication is lost; logging capability; service communication port for local connection to a portable operator's terminal; local keypad and display for interrogating and editing controller data; diagnostic LEDs for power, communication and processor; non-volatile memory which is capable of maintaining all BIOS and programming information for a minimum of 72 hours; power and noise immunity; and surge and transient protection. Provide a keyed security cover over controller.

Controller software shall support the following applications: System security restricting modification without password; object scheduling with daily, weekly, annual, holiday, and exception events; alarm reporting via text message or email and logging; maintenance management; sequencing; PID control characteristics; staggered starting of equipment; anti-short cycling; on-off control with differential; trending; run-time, pulse, and event totalization;

Network all HVAC controllers together, including controllers furnished with packaged equipment, using a common communication backbone that is capable of central access. Network communication protocol shall be based upon BACnet protocol complying with ASHRAE Standard 135. Physical/Data Link communication bus between controllers shall be EIA 485 twisted cable pair according to Master Slave/Token Passing (MS/TP) protocol or Ethernet according to ISO 8802-2 protocol.

Provide password protected web-based or web-accessible interface to the network over the Internet via the Owner's local area network (LAN) connection. Interface shall include system graphics, text-based parameter display, and be compatible with standard web browsers. Interface shall grant the user access to all system data and the ability to view alarms, adjust setpoints, monitor equipment status, adjust schedules, and trend data points.

Provide an independent, standalone controller that provides centralized local interface to the network. Interface shall include system graphics and text-based parameter display. Interface shall grant the user access to all system data and the ability to view alarms, adjust setpoints, monitor equipment status, adjust schedules, and trend data points.

Provide control panels listed according to UL 508A and NEMA rated according to its installation location. Provide common keying for all panels.

C. SENSORS AND RELAYS

Manufacturers and model numbers are listed for reference as to quality and features required for the sensors and relays. Provide general-purpose type sensing elements for use in input and output sensors. Provide transmitters or transducers with sensor as required, compatible with the controllers used, with range suitable for the systems encountered. Transmitters and transducers shall have offset and span adjustments, temperature compensation, shock and vibration immunity, and zeroing capability. Accuracy requirements shall include the combined effects of linearity, hysteresis, repeatability, and the transmitter.

Provide sensors that meet the following minimum performance:

1. Dry-bulb temperature sensors at a minimum shall be accurate to +/- 2 degrees Fahrenheit over the range of 40 to 80 degrees Fahrenheit.
2. Wet-bulb temperature shall be calculated using dry-bulb temperature and humidity and shall be accurate to +/- 2 degrees Fahrenheit.
3. Enthalpy shall be calculated using dry-bulb temperature and humidity and shall be accurate to +/- 3 BTU/lb over the range of 20 to 36 BTU/lb.
4. Humidity sensors at a minimum shall be accurate within +/- 3 percent full range between 20 and 95 percent, with drift less than 1 percent full scale per year.
5. Pressure transmitters at a minimum shall be accurate to +/- 1 percent full scale with drift less than 1 percent full scale per year.
6. Carbon dioxide (CO2) sensors shall measure total percentage of CO2 in ppm. Sensor shall have an accuracy of plus/minus 75 ppm at a 600 and 1000 ppm concentration and certified by the manufacturer to require calibration no more frequently than once every 5 years.

Provide remote sensors where indicated on the drawings and integrate them with the thermostat control equipment. Remote sensors shall have the following features:

1. Wired connection.
2. Temperature sensor.
3. Temperature setpoint adjust button with plus/minus 3 degree setpoint.
4. Operating mode override button.

Provide relays with contact rating, configuration, and coil voltage that is suitable for the application. Relay shall be general purpose, enclosed plug-in type and protected by a heat and shock resistant duct cover. Number of contacts and operational function shall be as required. Transient suppression shall be provided as an integral part of the relay. Contactors shall be single coil, electrically operated, mechanically held, double-break, silver-to-silver type protected by arcing contacts. Positive locking shall be obtained without the use of hooks, latches, or semi-permanent magnets. Operating and release times shall be 100 milliseconds or less.

D. WIRING

Provide electrical and control wiring as specified under the section "Electrical Wiring."

7. SEQUENCE OF OPERATION

Reference mechanical controls sheets for sequences of operation.

8. COMMISSIONING

Provide commissioning that verifies and documents the commissioned building systems have been designed, installed, and function according to the owner's project requirements, construction documents, and to minimum code requirements. Retain the services of a third-party registered design professional or approved agency that is regularly engaged in conducting commissioning to develop a commissioning plan, supporting documentation, and reports. Refer to the latest adopted edition of the applicable energy code for more information. Complete all related commissioning requirements prior to final inspections. Submit final TAB report and final commissioning report to the Engineer and Owner within 90 days of the date of receipt of the certificate of occupancy.

IECC Commissioning Requirements: Provide commissioning of all mechanical systems included in the scope of work, except for packaged equipment not equipped with an economizer. Packaged equipment includes unitary air conditioners and condensing units, unitary air-cooled and water-cooled heat pumps, and packaged terminal air conditioning units. Contract the third-party registered design professional or approved agency to develop a commissioning plan, preliminary commissioning report, and final commissioning report.

Commissioning plan shall include the following:

1. Narrative description of activities and personnel required during commissioning.
2. List of equipment and systems to be tested with description of tests to be performed.
3. List of functions to be tested, including calibration and economizer controls.
4. List of conditions under which the tests shall be performed.
5. List of measurable criteria for performance.

Submit a copy of the preliminary commissioning report to the AHJ. Preliminary commissioning report shall include the following:

1. Results of preliminary functional performance tests. Organize equipment and components specified by other Divisions in separate sections for independent review.
2. List of functional performance testing procedures used during commissioning, including measurable criteria for test acceptance.
3. Completed Commissioning Compliance Checklist. Refer to energy code for the form.
4. Itemization of deficiencies found during testing that have not been corrected at the time of preliminary commissioning report preparation.
5. List of deferred tests that cannot be performed at the time of preliminary commissioning report preparation because of climatic conditions.
6. List of climatic conditions required for the performance of the deferred tests.

Final commissioning report shall include the following:

7. Results of final functional performance tests. Organize equipment and components specified by other Divisions in separate sections for independent review.
8. List of functional performance testing procedures used during commissioning, including measurable criteria for test acceptance.
9. Itemization of resolved deficiencies found during preliminary commissioning.
10. List of deferred tests that cannot be performed at the time of final commissioning report preparation because of climatic conditions.

Conduct functional performance tests on equipment, controls, and economizers. Functional performance tests shall demonstrate the following:

11. The operation, function, and maintenance serviceability for each commissioned equipment, component, and system is confirmed according to the approved plans and specifications.
12. The sequence of operations, including modes, backup modes (if applicable), alarms, and mode of operation upon a loss of power and restoration of power for each control device, equipment, component, and system.
13. Control devices, components, equipment, and systems are calibrated, adjusted, and operate in accordance with the approved plans and specifications.
14. Air economizers operated in accordance with manufacturer's specifications and specified sequence of operation.

9. ALTERNATES

A. DESCRIPTION

Refer to the architectural portion of the specification for list of alternates. Applicable sections of the base specifications shall apply to all work required by the alternate unless otherwise specified. Determine whether or not and how each alternate affects work. Include labor, materials, equipment, and transportation services necessary for and incidental to the completion of work under each particular alternate. Furnish separate bid for each alternate applicable to work, stating the amount to be added or deducted from the base bid.

END OF SECTION 23

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
JOSHUA N. HOVER
NUMBER PE-2017008503
PROFESSIONAL ENGINEER

Oct 25 2019

JOSHUA N. HOVER
LICENSE # PE-2017008503

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

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EXPIRES 12/31/2020

SHEET TITLE

MECHANICAL SPECIFICATIONS

SHEET NUMBER

M701

JOSHUA N. HOVER

GENERAL NOTES:

1. PROVIDE A CONSTRUCTION RECORD SET OF "AS-BUILT" DOCUMENTS TO THE ARCHITECT REFLECTING ANY VARIANCES OF INSTALLED PIPING LOCATIONS OR EQUIPMENT CONTRARY TO THE CONSTRUCTION DOCUMENTS. REFER TO SPECIFICATIONS.
2. DRAWINGS ARE DIAGRAMMATIC ONLY AND REPRESENT THE GENERAL SCOPE OF THE WORK. REVIEW THE GENERAL NOTES, SPECIFICATIONS AND PLANS FOR ADDITIONAL REQUIREMENTS THAT MAY NOT BE SPECIFICALLY CALLED OUT IN THIS PORTION OF THE CONSTRUCTION DOCUMENTS. NOTIFY THE ARCHITECT OF ANY CONFLICTS OR DISCREPANCIES PRIOR TO SUBMISSION OF BID.
3. PROVIDE TO THE ARCHITECT A COPY OF INSPECTION REPORTS AND APPROVAL CERTIFICATES FROM LOCAL AND STATE INSPECTIONS, REFER TO SPECIFICATIONS.
4. INSTALLATION SHALL COMPLY WITH LEGALLY CONSTITUTED CODES AND THE REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION AND ALSO MEET ALL REQUIREMENTS OF THE LANDLORD. OBTAIN A COPY OF THE LANDLORD'S REQUIREMENTS AND REVIEW PRIOR TO SUBMITTING BID.
5. PLANS AND SPECIFICATIONS GOVERN WHERE THEY EXCEED CODE REQUIREMENTS.
6. VERIFY LOCATION AND DEPTH OF UTILITIES AT POINTS OF CONNECTION BEFORE START OF PIPING INSTALLATION.
7. REFER TO ARCHITECTURAL PLANS FOR EXACT LOCATION AND MOUNTING HEIGHTS OF PLUMBING FIXTURES.
8. DO NOT SCALE FLOOR PLANS FOR EXACT HORIZONTAL LOCATION OF PIPE ROUTING.
9. INSTALL CONCEALED PIPING TIGHT TO THE STRUCTURE AND AS HIGH AS POSSIBLE.
10. VALVES SHALL BE LINE SIZE UNLESS OTHERWISE NOTED.
11. INSTALL EXPOSED PIPING, WHERE NECESSARY, IN FINISHED AREAS TIGHT TO THE STRUCTURE, WALL OR CEILING AND AS HIGH AS POSSIBLE. INSTALL PIPING PARALLEL AND / OR PERPENDICULAR TO WALLS. ROUTE PIPING TIGHT TO COLUMNS WHERE POSSIBLE.
12. INSTALL VALVES AND APPURTENANCES A MAXIMUM OF 24" ABOVE CEILING IN ACCESSIBLE LOCATION WITHIN 24" OF ACCESS DOORS OR ACCESSIBLE CEILING TILES. PROVIDE PIPE AND FITTINGS TO INSTALL VALVES AND APPURTENANCES AT REQUIRED HEIGHT AND WITHIN 24" OF ACCESS DOORS OR ACCESSIBLE CEILING TILES.
13. INSTALL NO PLASTIC PIPE OF ANY KIND ABOVE SLAB INSIDE.
14. COORDINATE ALL WORK WITH OTHER TRADES AND CONTRACTORS.
15. COORDINATE PIPING INSTALLATION WITH STRUCTURAL GRADE BEAMS, FOOTINGS, COLUMN PIERS, ETC. SLEEVE PIPING THROUGH GRADE BEAMS, FOOTING, ETC. WHERE REQUIRED AND AS NOTED ON PLANS. COORDINATE SLEEVE INSTALLATIONS WITH THE ARCHITECT, STRUCTURAL ENGINEER, STRUCTURAL CONTRACTOR AND GENERAL CONTRACTOR BEFORE CONCRETE IS INSTALLED.
16. CLEAN FAUCET AERATORS AND PIPE STRAINERS PRIOR TO TURNING BUILDING OVER TO THE OWNER.
17. PROVIDE TRAP PRIMERS WHERE REQUIRED BY LOCAL AUTHORITIES.
18. COORDINATE PIPE ROUTING AWAY FROM ELECTRICAL PANELS. DO NOT INSTALL PIPING OVER ELECTRICAL PANELS.
19. PAINT ALL EXPOSED GAS AND WATER PIPING USING RUST INHIBITOR PAINT. PAINT AND COLOR SHALL BE COORDINATED WITH THE ARCHITECT AND / OR OWNER.
20. COORDINATE ALL ROOF PENETRATIONS WITH OTHER TRADES. MAINTAIN 10' MINIMUM CLEARANCE FROM ALL AIR INTAKES. MAINTAIN 2' CLEARANCE FROM ALL OTHER EQUIPMENT.
21. INSULATE PIPING ROUTED IN EXTERIOR BUILDING WALLS WITH MINIMUM 2" BATT INSULATION TO PREVENT FREEZING.
22. PROVIDE "HEAVY-DUTY" NO-HUB COUPLINGS ON SANITARY PIPING 3" AND LARGER. SEE DIVISION 22 SPECIFICATION SECTION "SANITARY DRAINAGE AND VENT AND PIPING SPECIALTIES" FOR MORE INFORMATION.
23. PROVIDE "HEAVY-DUTY" NO-HUB COUPLINGS ON STORM PIPING, INCLUDING CONNECTIONS TO ROOF DRAINS. SEE DIVISION 22 SPECIFICATION SECTION "STORM DRAINAGE PIPING AND SPECIALTIES" FOR MORE INFORMATION.
24. PROVIDE TRANSITION ADAPTER COUPLINGS FOR CONNECTION OF PVC DWV TO CAST IRON SANITARY, WASTE AND VENT PIPE AT SLAB ON GRADE. SEE DIVISION 22 SPECIFICATION SECTION "SANITARY DRAINAGE AND VENT PIPING AND SPECIALTIES" FOR MORE INFORMATION.
25. PROVIDE TRANSITION ADAPTER COUPLINGS FOR CONNECTION OF PVC DWV TO CAST IRON STORM PIPE AT SLAB ON GRADE. SEE DIVISION 22 SPECIFICATION SECTION "STORM DRAINAGE PIPING AND SPECIALTIES" FOR MORE INFORMATION.
26. FLOW CONTROL VALVES SHALL BE SIZE 1/2" AND SET AT 0.5 GPM UNLESS NOTED OTHERWISE.
27. WATER HAMMER ARRESTORS SHALL BE SIZE "A" UNLESS NOTED OTHERWISE.
28. PROVIDE VERTICAL LIFT SPRING LOADED CHECK VALVES IN HOT AND COLD WATER SUPPLIES FOR MOP SINK FAUCETS DOWNSTREAM OF SHUTOFF VALVES.
29. PROVIDE WALL PIPES AT PIPING PENETRATIONS OF ELEVATED WATERPROOF FLOOR SLABS, REFER TO SPECIFICATIONS.
30. VERIFY EXISTING EQUIPMENT, INCLUDING ACCESSORIES, IS NOT DAMAGED AND IS IN GOOD WORKING ORDER. REPORT ANY DEFICIENCIES TO THE ARCHITECT.
31. PROVIDE SIZE AND LENGTH OF HOT WATER FIXTURE SUPPLY PIPE FROM CIRCULATED HOT WATER BRANCH OR MAIN TO TERMINATION OF HOT WATER FIXTURE SUPPLY PIPE AT EACH FIXTURE PER 2015 INTERNATIONAL ENERGY CONSERVATION CODE, TABLE C404.3.1. FOR ½" HOT WATER FIXTURE SUPPLY PIPE SIZE TO INDIVIDUAL LAVATORIES, PROVIDE MAXIMUM LENGTH OF TWO FEET. FOR ½" HOT WATER FIXTURE SUPPLY PIPE SIZE TO INDIVIDUAL SINKS, PROVIDE MAXIMUM LENGTH OF 43 FEET. FOR 3/4" HOT WATER FIXTURE SUPPLY PIPE SIZE TO INDIVIDUAL SINKS, PROVIDE MAXIMUM LENGTH OF 21 FEET.
32. BASIS OF DESIGN FOR THE DOMESTIC WATER DISTRIBUTION, SIZING, AND PLUMBING FIXTURE SELECTION AS SHOWN IN THESE DOCUMENTS ARE BASED UPON A MINIMUM AVAILABLE WATER SERVICE PRESSURE OF 75 PSI AT THE POINT OF CONNECTION TO THE UTILITY WATER SERVICE PIPING. SHOULD AVAILABLE DOMESTIC WATER PRESSURE BE LESS THAN 75 PSI, AT MINIMUM 186 GPM, THEN OWNER SHALL BE RESPONSIBLE FOR PROVIDING A DOMESTIC WATER BOOSTER PUMP SYSTEM. SHOULD AVAILABLE WATER PRESSURE BE GREATER THAN 80 PSI, THEN OWNER SHALL BE RESPONSIBLE FOR PROVIDING A PRESSURE REDUCING VALVE TO REDUCE DOMESTIC WATER DISTRIBUTION PRESSURES BELOW 80 PSI.

PLUMBING SYMBOLS

THIS IS A MASTER LEGEND AND NOT ALL SYMBOLS OR ABBREVIATIONS ARE USED. V2.01

STANDARD MOUNTING HEIGHTS

REFER TO THE ARCHITECTURAL DRAWINGS FOR PLUMBING FIXTURE MOUNTING HEIGHTS. UNO, INSTALL PLUMBING FIXTURES WITH THE MOUNTING HEIGHTS AS LISTED BELOW WITH FINAL APPROVAL BY THE ARCHITECT.

LAVATORY OR SINK	
STANDARD HEIGHT	31" FLOOR TO RIM
ADA ACCESSIBLE	34" FLOOR TO RIM
CHILD HEIGHT	24" FLOOR TO RIM
URINAL	
STANDARD HEIGHT	24" FLOOR TO RIM
ADA ACCESSIBLE	17" FLOOR TO RIM
CHILD HEIGHT	14" FLOOR TO RIM
WATER CLOSET	
STANDARD HEIGHT	15" FLOOR TO RIM
ADA ACCESSIBLE	17" TO 19" FLOOR TO TOP OF SEAT
CHILD HEIGHT	10" FLOOR TO RIM
WATER COOLER OR DRINKING FOUNTAIN	
STANDARD HEIGHT	41" FLOOR TO SPOUT
ADA ACCESSIBLE	36" FLOOR TO SPOUT
CHILD HEIGHT	30" FLOOR TO SPOUT
SHOWER VALVES	
STANDARD HEIGHT - MEN	48" FLOOR TO CENTERLINE
STANDARD HEIGHT - WOMEN	42" FLOOR TO CENTERLINE
ADA ACCESSIBLE	38" MIN TO 48" MAX FLOOR TO CENTERLINE
SHOWER HEADS	
MEN	6'-6" FLOOR TO CENTERLINE
WOMEN	6'-0" FLOOR TO CENTERLINE
TUB VALVES	
STANDARD HEIGHT	32" FLOOR TO CENTERLINE
ADA ACCESSIBLE	CENTER BETWEEN GRAB BAR AND TUB RIM
CLINIC SERVICE SINKS	30" FLOOR TO RIM
SURGEON'S SCRUB-UP SINKS	35" FLOOR TO FRONT RIM
ICE MAKER OUTLET BOXES	24" FLOOR TO CENTER OF BOX
WASHING MACHINE OUTLET BOXES	42" FLOOR TO RIM
JANITOR'S SINK FAUCET FITTING	42" FLOOR TO CENTERLINE
HOSE BIBBS	36" AFF TO CENTERLINE
NON-FREEZE WALL HYDRANTS	18" AFG TO CENTERLINE

USE THE DEFAULT MOUNTING HEIGHTS SHOWN ABOVE UNLESS NOTED OTHERWISE IN THE SPECIFICATIONS OR ELSEWHERE. MOUNTING HEIGHTS LISTED ARE ABOVE FINISHED FLOOR (AFF) OR ABOVE FINISHED GRADE (AFG). ALL DEVICES SHALL BE INSTALLED IN COMPLIANCE WITH CURRENT ADA AND LOCAL REQUIREMENTS.

ANNOTATION

- (1) PLUMBING PLAN NOTE CALLOUT
- (1) PLUMBING EQUIPMENT DESIGNATION. (CONTRACTOR FURNISHED AND INSTALLED). REFER TO PLUMBING FIXTURE OR EQUIPMENT SCHEDULES
- [1] EQUIPMENT DESIGNATION (OWNER FURNISHED, CONTRACTOR INSTALLED)
- CU 1 MECHANICAL EQUIPMENT DESIGNATION (CONTRACTOR FURNISHED AND INSTALLED UNLESS NOTED OTHERWISE)
- CONNECTION POINT OF NEW WORK TO EXISTING
- 1 / P1 DETAIL REFERENCE UPPER NUMBER INDICATES DETAIL NUMBER LOWER NUMBER INDICATES SHEET NUMBER
- 1 / P1 SECTION CUT DESIGNATION

ABBREVIATIONS

ADA	AMERICANS WITH DISABILITIES ACT
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHU	AIR HANDLING UNIT
AP	ACCESS PANEL
BAS	BUILDING AUTOMATION SYSTEM
BFF	BELOW FINISHED FLOOR
BFG	BELOW FINISHED GRADE
BOP	BOTTOM OF PIPE
BOS	BOTTOM OF STRUCTURE
BTU	BRITISH THERMAL UNIT
CP	CONDENSATE PUMP
CPVC	CHLORINATED POLYVINYL CHLORIDE
CU	COPPER
DI	DUCTILE IRON
DN	DOWN
DFU	DRAINAGE FIXTURE UNIT
DS	DOWNSPOUT
(E)	EXISTING
EMS	ENERGY MANAGEMENT SYSTEM
ETR	EXISTING TO REMAIN
EWC	ELECTRIC WATER COOLER
FD	FLOOR DRAIN
FFA	FROM FLOOR ABOVE
FFB	FROM FLOOR BELOW
FF	FINISHED FLOOR
FL	FLOW LINE
FLA	FULL LOAD AMPS
FLR	FLOOR
GPM	GALLONS PER MINUTE
HD	HEAD, HUB DRAIN
HZ	HERTZ
IE	INVERT ELEVATION
IN WC	INCHES OF WATER COLUMN
JB	JUNCTION BOX
J-BOX	JUNCTION BOX
KW	KILOWATT
MAU	MAKE-UP AIR UNIT
MAX	MAXIMUM
MBH	1000 BTU PER HOUR
MH	MANHOLE
MIN	MINIMUM
N/C	NORMALLY CLOSED
N/O	NORMALLY OPEN
NIC	NOT IN CONTRACT
ORD	OVERFLOW ROOF DRAIN
PDI	PLUMBING DRAINAGE INSTITUTE
PH/Ø	PHASE
PRV	PRESSURE REDUCING VALVE
PVC	POLYVINYL CHLORIDE
RCP	REINFORCED CONCRETE PIPE
RD	ROOF DRAIN
RPM	REVOLUTIONS PER MINUTE
RTU	ROOFTOP UNIT
SF	SQUARE FEET
SP	SUMP
SS	STAINLESS STEEL
	SANITARY SEWER, SOIL STACK
TDH	TOTAL DYNAMIC HEAD
TFA	TO FLOOR ABOVE
TFB	TO FLOOR BELOW
TYP	TYPICAL
UL	UNDERWRITERS LABORATORIES, INC.
UNO	UNLESS NOTED OTHERWISE
UPS	UNINTERRUPTIBLE POWER SUPPLY
VCP	VITRIFIED CLAY PIPE
VFD	VARIABLE FREQUENCY DRIVE
VS	VENT STACK
VTR	VENT THROUGH ROOF
W/	WITH
W/O	WITHOUT
WC	WATER COLUMN
WS	WASTE STACK
WSFU	WATER SUPPLY FIXTURE UNIT
WVS	WASTE VENT STACK

PIPING SYMBOLS

- OXYGEN OUTLET
- NITROUS OXIDE OUTLET
- MEDICAL AIR OUTLET
- NITROGEN OUTLET
- MEDICAL VACUUM INLET
- FLOOR SINK (FS), SIZE & TYPE
- FLOOR DRAIN (FD), SIZE & TYPE
- ROOF DRAIN (RD), SIZE & TYPE
- BALL VALVE
- CONTROL VALVE
- SHUTOFF VALVE
- CHECK VALVE
- BALANCING VALVE WITH PRESSURE PORTS
- WATER METER
- STRAINER
- STRAINER WITH BLOWOFF
- RELIEF/SAFETY VALVE
- SOLENOID VALVE
- PRESSURE REDUCING VALVE
- GAS PRESSURE REGULATOR
- THERMOSTATIC MIXING VALVE
- PA PIPE ANCHOR
- EJ EXPANSION JOINT
- BACKFLOW PREVENTER
- PRESSURE GAUGE
- THERMOMETER
- UNION
- FLANGE CONNECTION
- HOSE BIBB (HB)
- NON-FREEZING WALL HYDRANT (NW)
- MANUAL / AUTOMATIC AIR VENT OR VACUUM RELIEF VALVE
- PRESSURE / VACUUM SWITCH
- CLEANOUT
- CAP
- WALL CLEANOUT (WCO)
- FLOOR CLEANOUT (FCO)
- EXTERIOR CLEANOUT (ECO)
- ELBOW UP
- ELBOW DOWN
- TEE UP
- TEE DOWN
- ELBOW UP WITH SHUT-OFF VALVE (SOV)
- ELBOW DOWN WITH SHUT-OFF VALVE (SOV)
- TEE UP WITH SHUT-OFF VALVE (SOV)
- TEE DOWN WITH SHUT OFF VALVE (SOV)
- "A" WATER HAMMER ARRESTER (WHA) WITH PDI SIZES, (A, B, C, D, & E)
- RECIRCULATION PUMP
- P-TRAP
- GAS COCK
- TRAP PRIMER
- TRAP PRIMER WITH DISTRIBUTION UNIT

PIPING LINETYPES

CW	DOMESTIC COLD WATER (CW)
SCW	SOFTENED COLD WATER (SCW)
HW	DOMESTIC HOT WATER (HW)
HWR	DOMESTIC HOT WATER RECIRC. (HWR)
140°	DOMESTIC HOT WATER (140°)
T	TRAP PRIMER LINE (T)
S	SOIL PIPING - ABOVE FLOOR (S)
-S-	SOIL PIPING - BELOW FLOOR (S)
W	WASTE PIPING - ABOVE FLOOR (W)
-W-	WASTE PIPING - BELOW FLOOR (W)
GW	GREASE WASTER - ABOVE FLOOR (GW)
GW	GREASE WASTE - BELOW FLOOR (GW)
CGWV	COMBINATION GREASE WASTE AND VENT (CGWV)
CWV	COMBINATION WASTE AND VENT (CWV)
ST	STORM DRAIN - ABOVE FLOOR (ST)
ST	STORM DRAIN - BELOW FLOOR (ST)
OST	OVERFLOW STORM DRAIN - ABOVE FLOOR (OST)
VBG	VENT BELOW GRADE (VBG)
VBF	VENT BELOW FLOOR (VBF)
ID	INDIRECT DRAIN (ID)
CDH	CONDENSATE DRAIN - HIGH EFFICIENCY RTU (CDH)
CD	CONDENSATE DRAIN (CD)
ACD	AUXILIARY CONDENSATE DRAIN (ACD)
SPD	SUMP OR SEWAGE PUMP DISCHARGE (SPD)
G	NATURAL GAS (G)
-G-	NATURAL GAS ON ROOF (G)
MPG	MEDIUM PRESSURE NATURAL GAS (MPG)
MPG	MEDIUM PRESSURE NATURAL GAS ON ROOF (MPG)
NPW	NON-POTABLE WATER (NPW)
LPG	LIQUEFIED PETROLEUM GAS (LPG)
WS	WATER SERVICE (WS)
FP	FIRE PROTECTION (FP)
PD	CONDENSATE PUMP DISCHARGE (PD)
V	VENT PIPING (V)
AW	ACID WASTE - ABOVE FLOOR (AW)
AW	ACID WASTE - BELOW FLOOR (AW)
AV	ACID VENT (AV)
GWS	GRAY WATER (GWS)
CA	COMPRESSED AIR (CA)
MA	MEDICAL AIR (MA)
MV	MEDICAL VACUUM (VE)
HE	HELIUM (HE)
IA	INSTRUMENT AIR (IA)
IV	INSTRUMENT VACUUM (IV)
N2	NITROGEN (N2)
N2O	NITROUS OXIDE (N20)
O2	OXYGEN (O2)
EV	EVAC/WAGD (EV)
CO2	CARBON DIOXIDE (CO2)
AI	MEDICAL AIR INTAKE (AI)
VE	MEDICAL VACUUM EXHAUST (VE)
DA	DENTAL AIR (DA)
DV	DENTAL VACUUM (DV)
FW1	FILTERED WATER (FW1)
FW2	FILTERED WATER W/ SCALE INHIBITOR (FW2)
DA	REVERSE OSMOSIS (RO)
ROR	REVERSE OSMOSIS REMINERALIZATION (ROR)

LINETYPE LEGEND

THROUGHOUT THE DRAWINGS DIFFERENT LINETYPES ARE USED IN COMBINATION WITH THE SYMBOLS TO INDICATE THE STATUS OF ITEMS AS EXISTING, TO BE DEMOLISHED, TO BE INCLUDED AS PART OF NEW WORK AND/OR ITEMS WHICH ARE ANTICIPATED TO BE PROVIDED IN THE FUTURE. THE STATUS OF ITEMS USING THESE LINETYPES ARE RELATIVE TO THE VIEW IN WHICH THEY APPEAR. PHASING SHOWN IN DRAWINGS IS NOT INTENDED TO FULLY DESCRIBE ALL NECESSARY CONSTRUCTION PHASING, WHICH IS DETERMINED BY THE CONTRACTOR AS PART OF THEIR RESPONSIBILITIES. ANY SUCH PHASES DESCRIBED IN THE CONSTRUCTION DOCUMENTS ARE GENERAL AND ONLY INTENDED TO INDICATE A BROAD ORDER FOR THE SAKE OF DESCRIBING THE PROJECT. THE FOLLOWING LINETYPES MAY BE USED ON ANY DEVICE, EQUIPMENT, NOTE, LINE, SHAPE, ETC.

EXISTING	NEW
DEMOLISH	FUTURE

PARAGON STAR

PARAGON STAR
- LOT 9 -
BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
JOSHUA N. HOVER
NUMBER PE-2017008503
PROFESSIONAL ENGINEER

Oct 25 2019
JOSHUA N. HOVER
LICENSE # PE-2017008503

PROJECT TEAM

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CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
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MO. CORPORATE NO. E-556D
EXPIRES 12/31/2020

SHEET TITLE

PLUMBING LEGENDS AND GENERAL NOTES

SHEET NUMBER

P000

JOSHUA N. HOVER

PLUMBING PLAN NOTES:

1 4" SANITARY WASTE STUB FOR FUTURE CONNECTION BY RETAIL TENANT; SIZED FOR FUTURE RETAIL TENANT MAXIMUM SANITARY WASTE LOAD OF 13 DFU. SET INVERT ELEVATION AT 2'-6" BFF. TURN PIPE UP TO 6" ABOVE FINISHED FLOOR ELEVATION AND CAP.

2 4" SANITARY WASTE STUB FOR FUTURE CONNECTION BY RESTAURANT TENANT; SIZED FOR FUTURE FOOD SERVICE TENANT MAXIMUM SANITARY WASTE LOAD OF 75 DFU. TURN PIPE UP TO 6" ABOVE FINISHED FLOOR ELEVATION AND CAP.

3 4" SANITARY WASTE STUB FOR FUTURE CONNECTION BY RESTAURANT TENANT; SIZED FOR FUTURE FOOD SERVICE TENANT MAXIMUM SANITARY WASTE LOAD OF 83 DFU. SET INVERT ELEVATION AT 2'-6" BFF. TURN PIPE UP TO 6" ABOVE FINISHED FLOOR ELEVATION AND CAP.

4 4" GREASE WASTE STUB FOR FUTURE CONNECTION BY RESTAURANT TENANT; SIZED FOR FUTURE FOOD SERVICE TENANT MAXIMUM GREASE WASTE LOAD OF 64 DFU. SET INVERT ELEVATION AT 2'-6" BFF. TURN PIPE UP TO 6" ABOVE FINISHED FLOOR ELEVATION AND CAP.

5 4" GREASE WASTE STUB FOR FUTURE CONNECTION BY RESTAURANT TENANT; SIZED FOR FUTURE FOOD SERVICE TENANT MAXIMUM GREASE WASTE LOAD OF 59 DFU. TURN PIPE UP TO 6" ABOVE FINISHED FLOOR ELEVATION AND CAP.

6 4" GREASE WASTE STUB FOR FUTURE CONNECTION BY RESTAURANT TENANT; SIZED FOR FUTURE FOOD SERVICE TENANT MAXIMUM GREASE WASTE LOAD OF 93 DFU. SET INVERT ELEVATION AT 2'-6" BFF. TURN PIPE UP TO 6" ABOVE FINISHED FLOOR ELEVATION AND CAP.

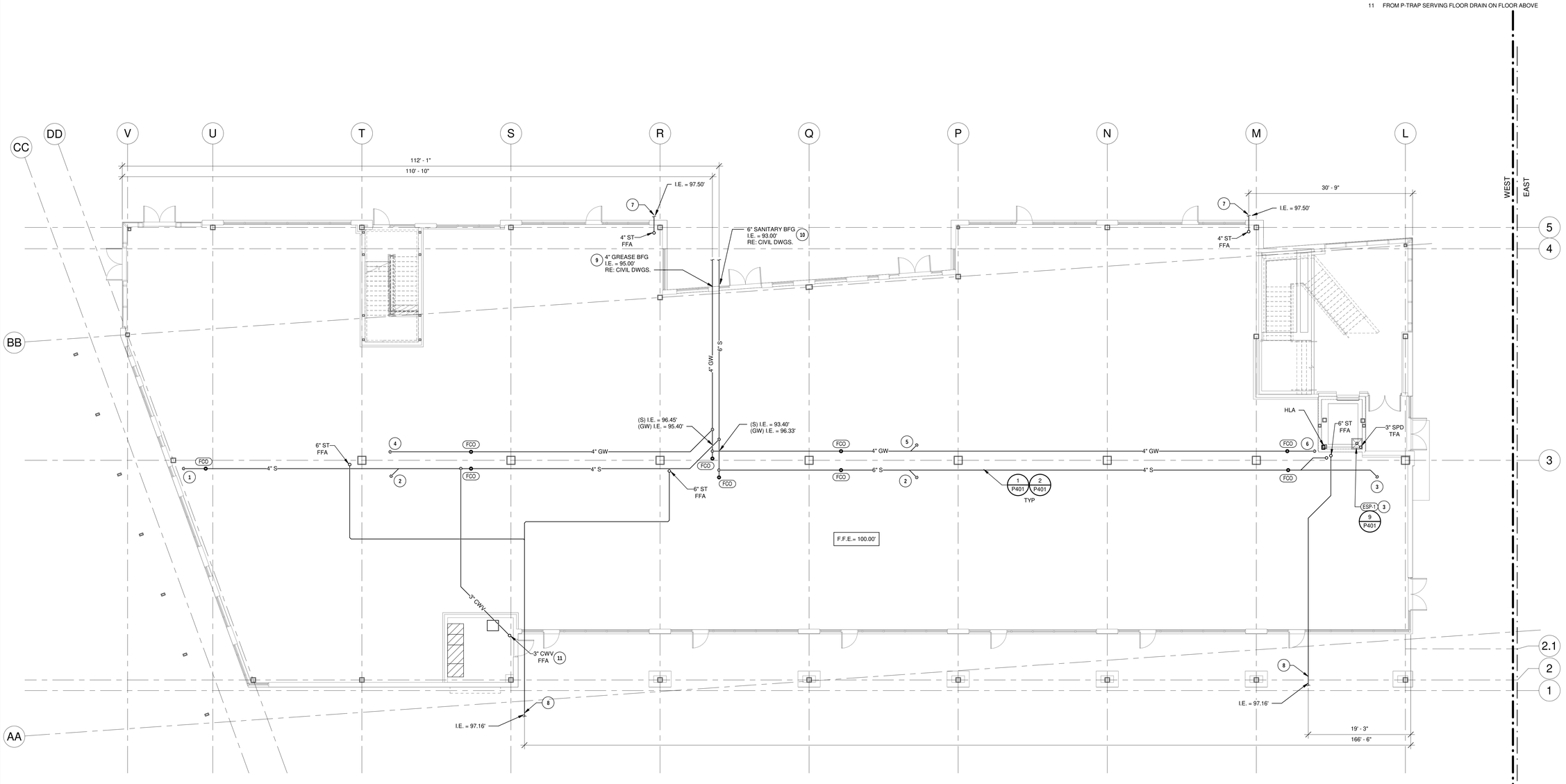
7 EXTEND 4" STORM LINE 5'-0" OUTSIDE THE BUILDING AND CONNECT TO CIVIL PIPING. FIELD VERIFY EXACT LOCATION AND INVERT DEPTH REQUIRED TO MAKE CONNECTION TO CIVIL LINE. COORDINATE WITH CIVIL AS REQUIRED. RE: CIVIL.

8 EXTEND 6" STORM LINE 5'-0" OUTSIDE THE BUILDING AND CONNECT TO CIVIL PIPING. FIELD VERIFY EXACT LOCATION AND INVERT DEPTH REQUIRED TO MAKE CONNECTION TO CIVIL LINE. COORDINATE WITH CIVIL AS REQUIRED. RE: CIVIL.

9 EXTEND 4" GREASE WASTE LINE 5'-0" OUTSIDE THE BUILDING AND CONNECT TO CIVIL PIPING. FIELD VERIFY EXACT LOCATION AND INVERT DEPTH REQUIRED TO MAKE CONNECTION TO CIVIL LINE. COORDINATE WITH CIVIL AS REQUIRED. RE: CIVIL.

10 EXTEND 6" SANITARY WASTE LINE 5'-0" OUTSIDE THE BUILDING AND CONNECT TO CIVIL PIPING. FIELD VERIFY EXACT LOCATION AND INVERT DEPTH REQUIRED TO MAKE CONNECTION TO CIVIL LINE. COORDINATE WITH CIVIL AS REQUIRED. RE: CIVIL.

11 FROM P-TRAP SERVING FLOOR DRAIN ON FLOOR ABOVE



1 PLUMBING FIRST FLOOR UNDERSLAB PLAN - WEST
1/8" = 1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.:	1850004412
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MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

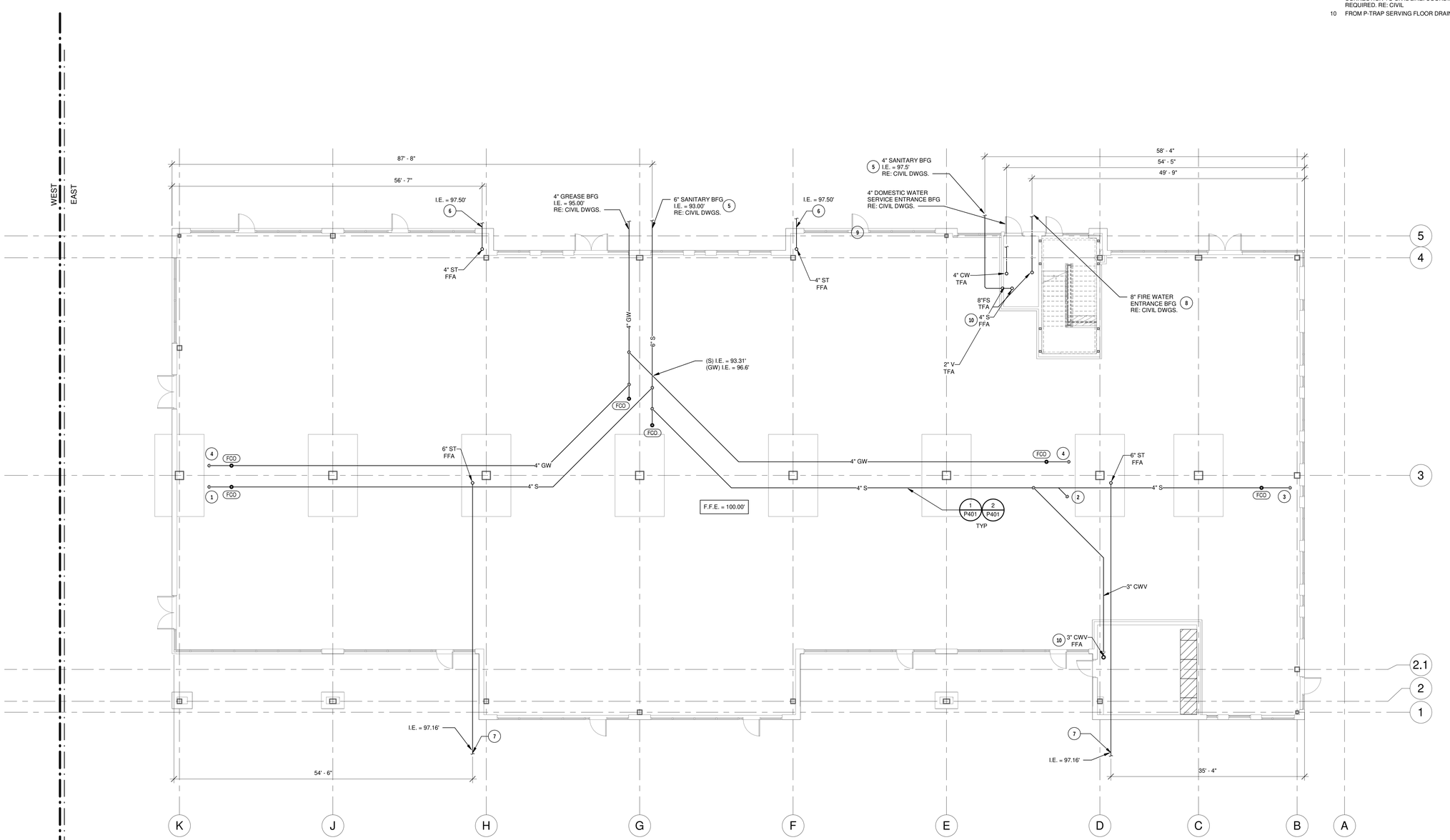
PLUMBING FIRST FLOOR UNDERSLAB PLAN - WEST

SHEET NUMBER

P100.1

PLUMBING PLAN NOTES:

1. 4" SANITARY WASTE STUB FOR FUTURE CONNECTION BY RESTAURANT TENANT; SIZED FOR FUTURE FOOD SERVICE TENANT MAXIMUM SANITARY WASTE LOAD OF 91 DFU. SET INVERT ELEVATION AT 2'-6" BFF. TURN PIPE UP TO 6" ABOVE FINISHED FLOOR ELEVATION AND CAP.
2. 4" SANITARY WASTE STUB FOR FUTURE CONNECTION BY RESTAURANT TENANT; SIZED FOR FUTURE FOOD SERVICE TENANT MAXIMUM SANITARY WASTE LOAD OF 91 DFU. TURN PIPE UP TO 6" ABOVE FINISHED FLOOR ELEVATION AND CAP.
3. 4" SANITARY WASTE STUB FOR FUTURE CONNECTION BY RETAIL TENANT; SIZED FOR FUTURE RETAIL TENANT MAXIMUM SANITARY WASTE LOAD OF 13 DFU. SET INVERT ELEVATION AT 2'-6" BFF. TURN PIPE UP TO 6" ABOVE FINISHED FLOOR ELEVATION AND CAP.
4. 4" GREASE WASTE STUB FOR FUTURE CONNECTION BY RESTAURANT TENANT; SIZED FOR FUTURE FOOD SERVICE TENANT MAXIMUM GREASE WASTE LOAD OF 108 DFU. SET INVERT ELEVATION AT 2'-6" BFF. TURN PIPE UP TO 6" ABOVE FINISHED FLOOR ELEVATION AND CAP.
5. EXTEND 6" SANITARY WASTE LINE 5'-0" OUTSIDE THE BUILDING AND CONNECT TO CIVIL PIPING. FIELD VERIFY EXACT LOCATION AND INVERT DEPTH REQUIRED TO MAKE CONNECTION TO CIVIL LINE. COORDINATE WITH CIVIL AS REQUIRED. RE: CIVIL.
6. EXTEND 4" STORM LINE 5'-0" OUTSIDE THE BUILDING AND CONNECT TO CIVIL PIPING. FIELD VERIFY EXACT LOCATION AND INVERT DEPTH REQUIRED TO MAKE CONNECTION TO CIVIL LINE. COORDINATE WITH CIVIL AS REQUIRED. RE: CIVIL.
7. EXTEND 6" STORM LINE 5'-0" OUTSIDE THE BUILDING AND CONNECT TO CIVIL PIPING. FIELD VERIFY EXACT LOCATION AND INVERT DEPTH REQUIRED TO MAKE CONNECTION TO CIVIL LINE. COORDINATE WITH CIVIL AS REQUIRED. RE: CIVIL.
8. EXTEND 4" FIRE WATER SERVICE LINE 5'-0" OUTSIDE THE BUILDING AND CONNECT TO CIVIL PIPING. FIELD VERIFY EXACT LOCATION AND INVERT DEPTH REQUIRED TO MAKE CONNECTION TO CIVIL LINE. COORDINATE WITH CIVIL AS REQUIRED. RE: CIVIL
9. EXTEND 4" DOMESTIC WATER SERVICE LINE 5'-0" OUTSIDE THE BUILDING AND CONNECT TO CIVIL PIPING. FIELD VERIFY EXACT LOCATION AND INVERT DEPTH REQUIRED TO MAKE CONNECTION TO CIVIL LINE. COORDINATE WITH CIVIL AS REQUIRED. RE: CIVIL
10. FROM P-TRAP SERVING FLOOR DRAIN ON FLOOR ABOVE



1 PLUMBING FIRST FLOOR UNDERSLAB PLAN - EAST
1/8" = 1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

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EXPIRES 12/31/2020

SHEET TITLE

PLUMBING FINISH FLOOR UNDERSLAB PLAN - EAST

SHEET NUMBER

P100.2

JOSHUA N. HOVER

PLUMBING PLAN NOTES:

1 2-1/2" CW STUB VALVED AND CAPPED. SIZED FOR FUTURE FOOD SERVICE TENANT MAXIMUM WATER SUPPLY LOAD OF 111 SFU (FLUSH VALVE).

2 2-1/2" CW STUB VALVED AND CAPPED. SIZED FOR FUTURE FOOD SERVICE TENANT MAXIMUM WATER SUPPLY LOAD OF 130 SFU (FLUSH VALVE).

3 DO NOT INSTALL PLUMBING PIPING OVER ELECTRICAL PANELS OR EQUIPMENT.

4 FROM P-TRAP SERVING MOP SINK ON FLOOR ABOVE.

5 FROM P-TRAP SERVING FLOOR DRAIN ON FLOOR ABOVE.

6 ROUTE 1-1/2" NATURAL GAS LINE DOWN WALL AND CAP 8'-0" AFF FOR FUTURE CONNECTION TO TENANT METER BANK.

7 ROUTE 1-1/2" NATURAL GAS LINE DOWN WALL AND CONNECT TO LANDLORD METER. VERIFY REQUIREMENTS FOR METERING AND PIPING WITH GAS COMPANY. COORDINATE WITH GAS COMPANY WITH REGARD TO INSTALLATION OF OTHER PLUMBING UTILITIES IN VICINITY, IF ANY. APPLY FOR AND PAY GAS COMPANY FEES FOR INSTALLATION. USE WELDED OR SCREWED PIPE AND FITTINGS PER PLUMBING SPECIFICATIONS. RE: TOTAL CONNECTED NATURAL GAS LOAD SCHEDULE FOR LANDLORD DEMANDS.

8 PROPOSED NATURAL GAS METER BANK LOCATION. ARRANGE AND COORDINATE WITH LOCAL GAS PROVIDER FOR GAS SERVICE LINE TO BUILDING FOR FUTURE MULTI-METER SETTING. COORDINATION OF THE INSTALLATION OF EACH FUTURE GAS METER IS BY THE TENANT. ESTIMATED TOTAL FUTURE GAS LOAD FOR BUILDING: 15,000 CFH WITH 2 PSI DELIVERY PRESSURE.

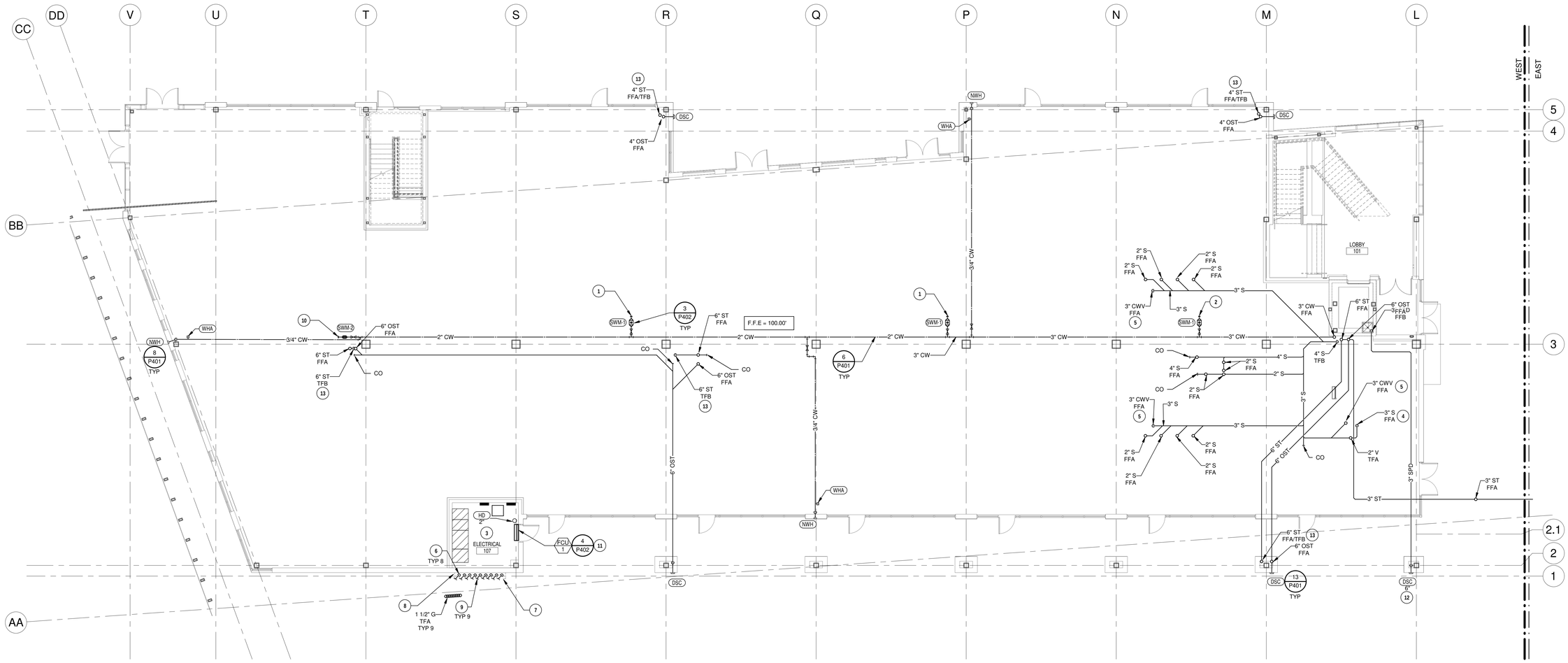
9 ROUTE GAS LINES IN SOFFIT OVER TO LOCATION SHOWN AND ROUTE UP TO ROOF.

10 2" CW STUB VALVED AND CAPPED. SIZED FOR FUTURE RETAIL TENANT MAXIMUM WATER SUPPLY LOAD OF 25 SFU (FLUSH VALVE).

11 3/4" COPPER CONDENSATE PIPING SHALL BE ROUTED DOWN WALL AND DISCHARGE INTO HUB DRAIN.

12 6" DOWNSPOUT COVER TO MATCH OTHERS. UPSIZE 3" SPD TO 6" WHERE CONVENIENT.

13 PROVIDE CLEANOUT 3'-0" AFF AT BASE OF STORM RISER. RE: PLUMBING FIXTURE SCHEDULE



1 PLUMBING FIRST FLOOR PLAN - WEST
1/8" = 1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

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EXPIRES 12/31/2020

SHEET TITLE

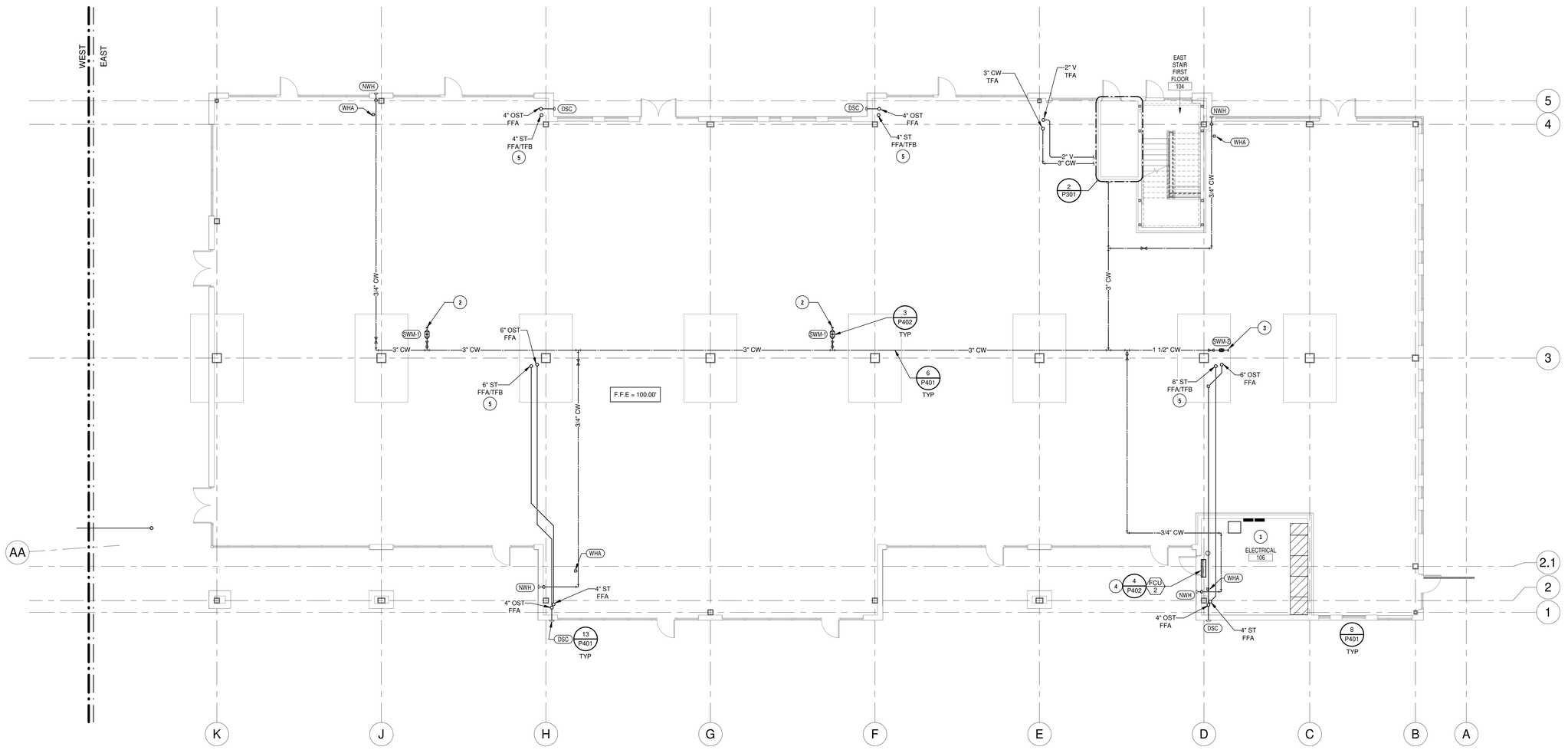
PLUMBING FIRST FLOOR PLAN - WEST

SHEET NUMBER

P101.1

PLUMBING PLAN NOTES:

1. DO NOT INSTALL PLUMBING PIPING OVER ELECTRICAL PANELS OR EQUIPMENT.
2. 2-1/2" CW STUB VALVED AND CAPPED. SIZED FOR FUTURE FOOD SERVICE TENANT MAXIMUM WATER SUPPLY LOAD OF 150 SFU (FLUSH VALVE).
3. 2" CW STUB VALVED AND CAPPED. SIZED FOR FUTURE RETAIL TENANT MAXIMUM WATER SUPPLY LOAD OF 25 SFU (FLUSH VALVE).
4. 3/4" COPPER CONDENSATE PIPING SHALL BE ROUTED DOWN WALL AND DISCHARGE INTO HUB DRAIN.
5. PROVIDE CLEANOUT 3'-0" AFF AT BASE OF STORM RISER. RE: PLUMBING FIXTURE SCHEDULE



1 PLUMBING FIRST FLOOR PLAN - EAST
1/8" = 1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
JOSHUA N. HOVER
NUMBER PE-2017008503
PROFESSIONAL ENGINEER

Oct 25 2019
JOSHUA N. HOVER
LICENSE # PE-2017008503

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

HENDERSON ENGINEERS
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WWW.HENDERSONENGINEERS.COM
1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

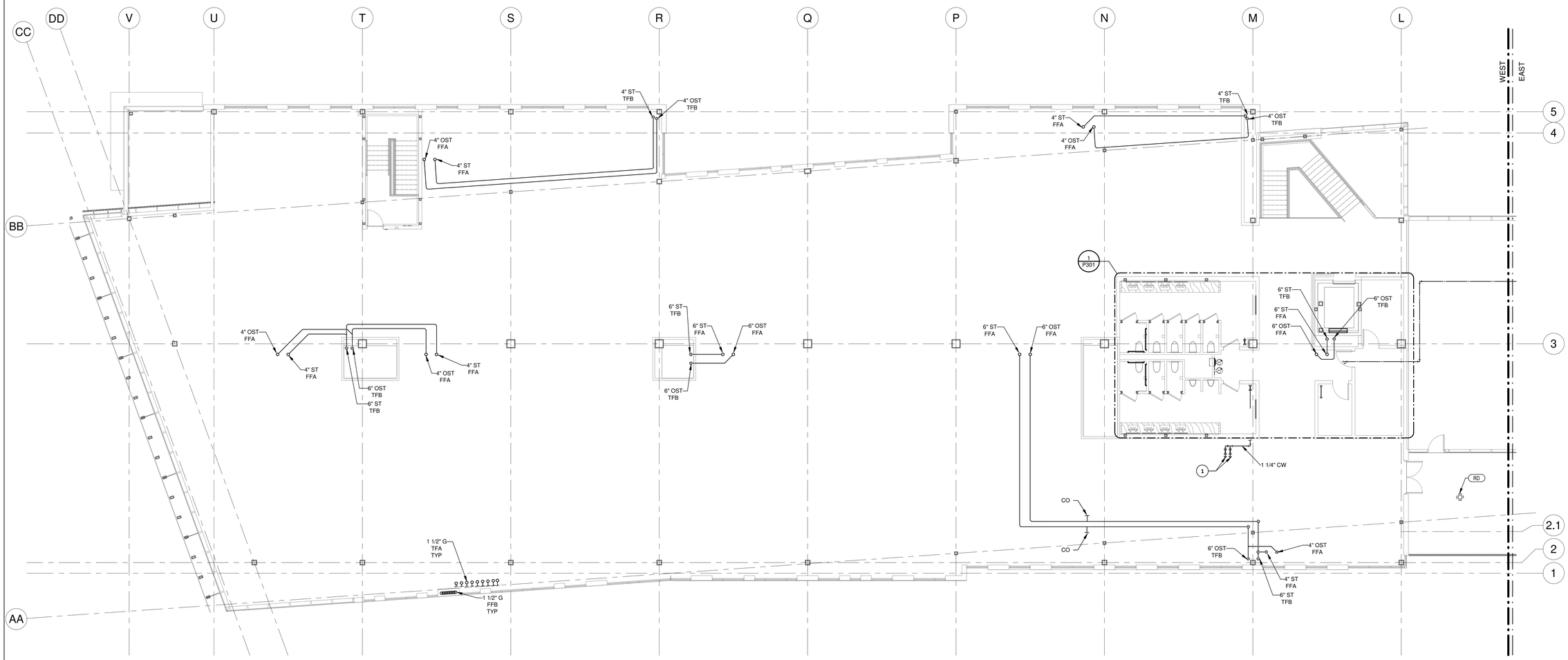
PLUMBING FIRST FLOOR PLAN - EAST

SHEET NUMBER

P101.2

PLUMBING PLAN NOTES:

1 1" CW STUB VALVED AND CAPPED. SIZED FOR FUTURE OFFICE TENANT MAXIMUM WATER SUPPLY LOAD OF 4 SFU (FLUSH VALVE).



1 PLUMBING SECOND FLOOR PLAN - WEST
1/8" = 1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
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SHEET TITLE

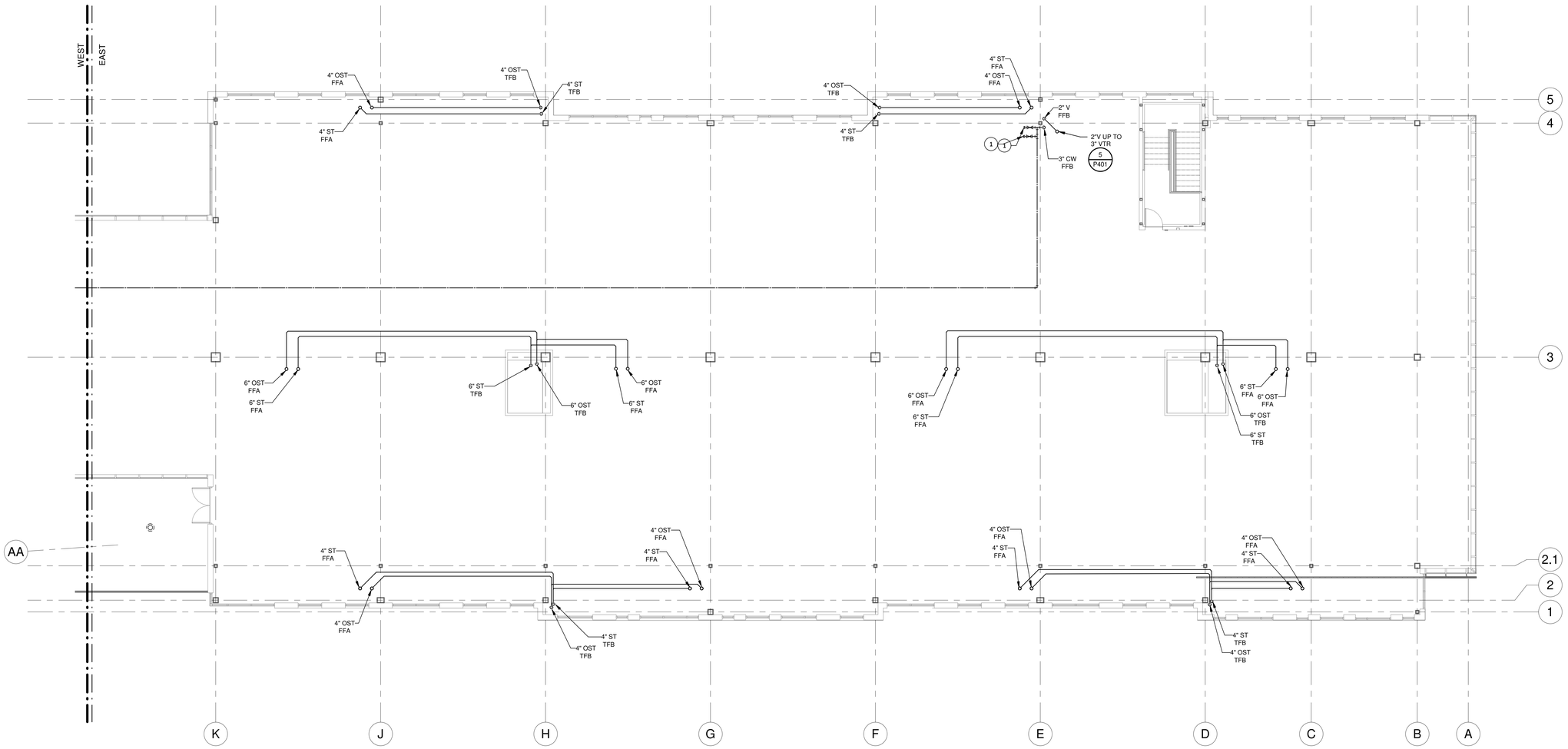
PLUMBING SECOND FLOOR PLAN - WEST

SHEET NUMBER

P102.1

PLUMBING PLAN NOTES:

1 1" CW STUB VALVED AND CAPPED. SIZED FOR FUTURE OFFICE TENANT MAXIMUM WATER SUPPLY LOAD OF 4 SFU (FLUSH VALVE).



1 PLUMBING SECOND FLOOR PLAN - EAST
1/8" = 1'-0"

PARAGON STAR

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PARAGON STAR
FIRST PLAT, LOT 9
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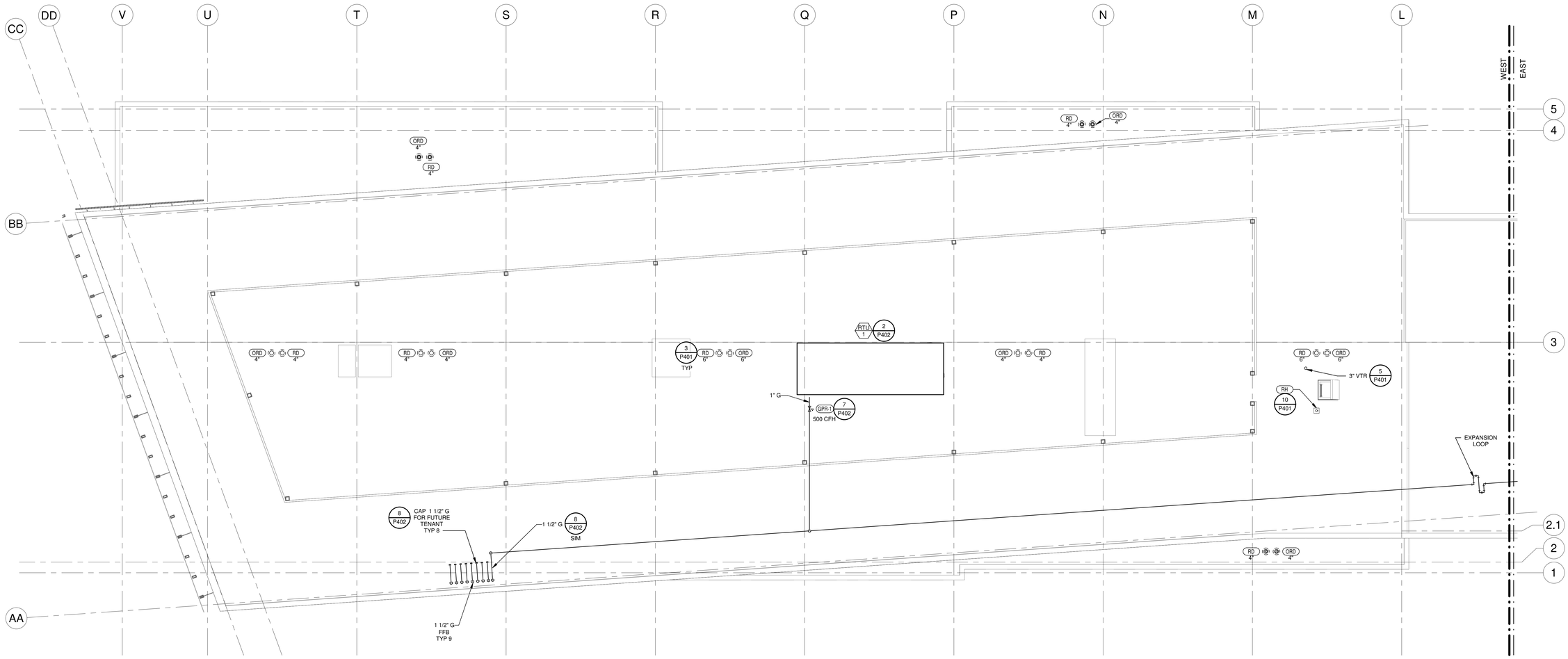
PLUMBING SECOND FLOOR PLAN - EAST

SHEET NUMBER

P102.2

JOSHUA N. HOVER

PLUMBING PLAN NOTES:



1 PLUMBING ROOF PLAN - WEST
1/8" = 1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

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EXPIRES 12/31/2020

SHEET TITLE

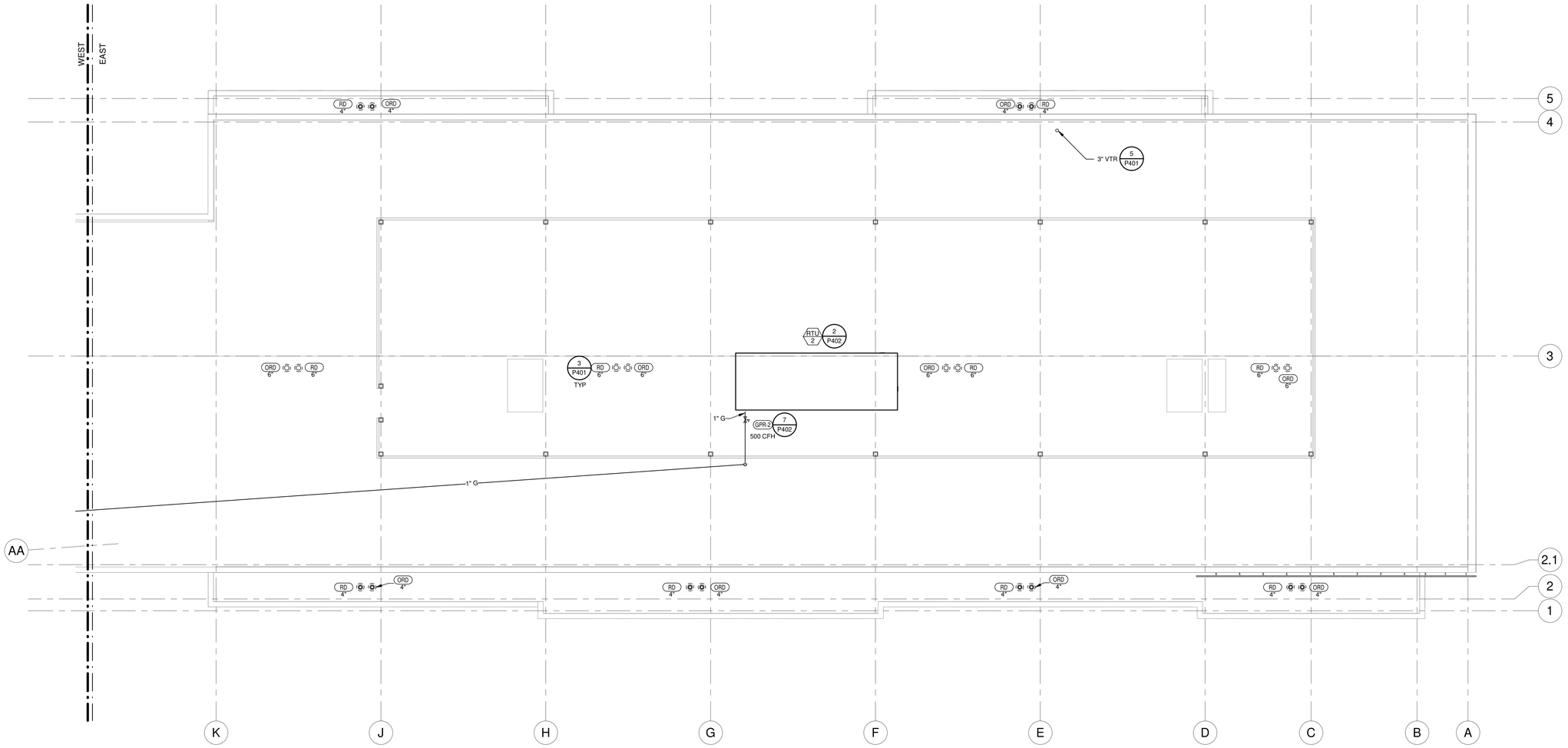
PLUMBING ROOF PLAN - WEST

SHEET NUMBER

P201.1

JOSHUA N. HOVER

PLUMBING PLAN NOTES:



1 PLUMBING ROOF PLAN - EAST
1/8" = 1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
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SHEET TITLE

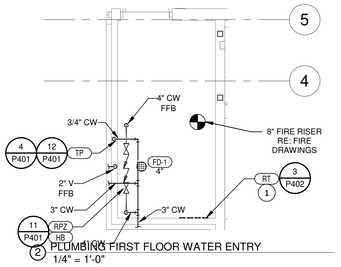
PLUMBING ROOF PLAN - EAST

SHEET NUMBER

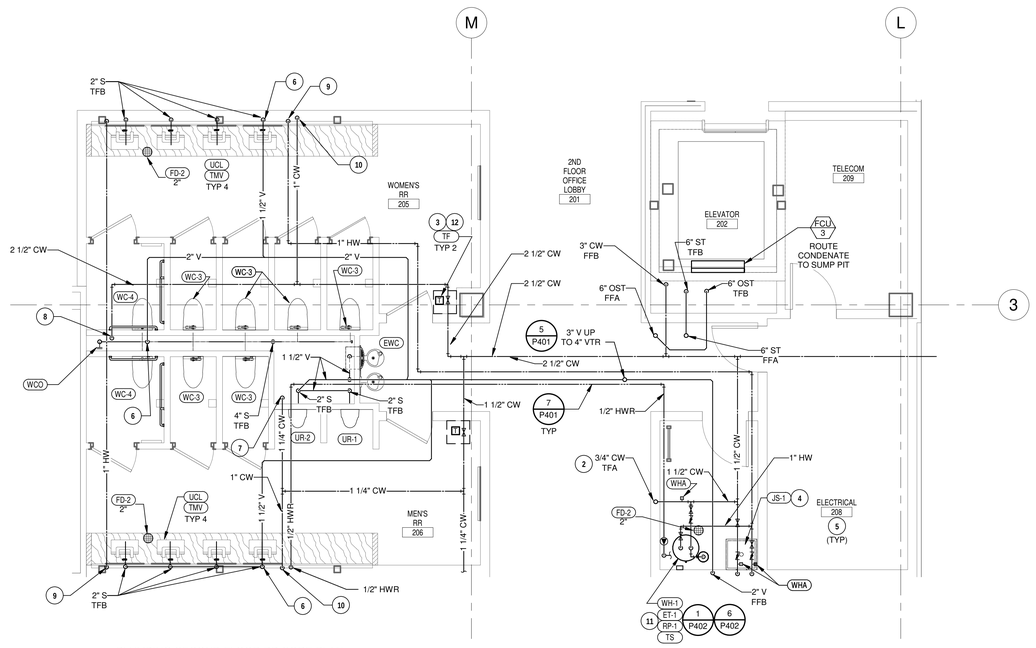
P201.2

PLUMBING PLAN NOTES:

1. MOUNT TENANT WATER METER REMOTE TOTALIZERS ON WALL OF WATER ROOM AT 48" AFF. COORDINATE WITH OTHER DISCIPLES AND INSTALL WITH ADEQUATE CLEARANCE TO ACCESS TOTALIZERS. LABEL EACH TOTALIZER TO INDICATE THE ASSOCIATED TENANT SPACE.
2. ROUTE CW UP TO ROOF HYDRANT.
3. FURNISH TRANSFORMER "TF" TO ELECTRICAL FOR INSTALLATION ABOVE CEILING IN ACCESSIBLE LOCATION FOR CONTROL OF WATER CLOSET FLUSH VALVES, AND URINAL FLUSH VALVES FOR THIS ROOM. PROVIDE LOW VOLTAGE WIRING AS REQUIRED.
4. PROVIDE CHECK VALVES AND SHUTOFF VALVES ON WATER LINES SERVING MOP SINK FAUCET.
5. DO NOT INSTALL PLUMBING PIPING OVER ELECTRICAL PANELS OR EQUIPMENT.
6. RE: RISER FOR VENT PIPING IN WALL.
7. 1-1/4" CW DOWN IN WALL TO HEADER SERVING (2) URINALS AND (1) EWC.
8. 2-1/2" CW DOWN IN WALL TO HEADER SERVING (8) WATER CLOSETS.
9. ROUTE 1" HW LOOP DOWN IN WALL TO SERVE (4) INDIVIDUAL LAVATORY TMV'S.
10. 1" CW DOWN IN WALL TO HEADER SERVING (4) INDIVIDUAL LAVATORY TMV'S.
11. LOCATE WATER HEATER TIGHT IN CORNER. MAINTAIN MANUFACTURER CLEARANCE REQUIREMENTS.
12. PROVIDE ACCESS PANEL.



2 PLUMBING FIRST FLOOR WATER ENTRY
1/4" = 1'-0"



1 PLUMBING SECOND FLOOR RR CORE PLAN
1/4" = 1'-0"

JOSHUA N. HOVER

PARAGON STAR

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MO. CORPORATE NO: E-556D
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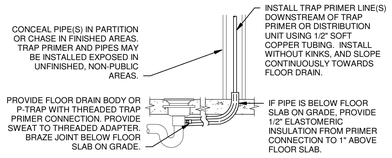
SHEET TITLE

PLUMBING ENLARGED PLANS

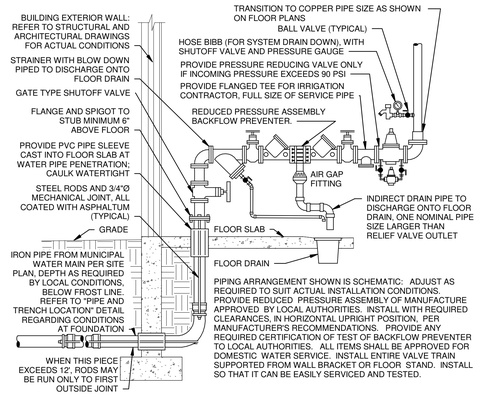
SHEET NUMBER

P301



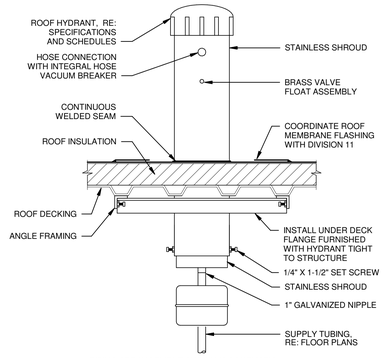
PIPING ARRANGEMENT SHOWN IS SCHEMATIC: ADJUST TO SUIT FIELD CONDITIONS. PROVIDE TWELVE FEET OF SOFT COPPER TUBE ABOVE FLOOR FOR CONNECTION TO TRAP PRIMER TO BE LOCATED ABOVE CEILING.

12 TRAP PRIMER INSTALLATION
NTS



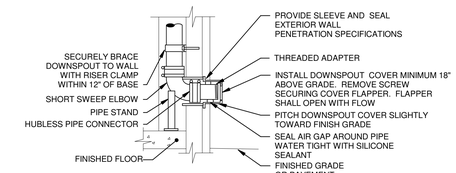
PIPING ARRANGEMENT SHOWN IS SCHEMATIC: ADJUST AS REQUIRED TO SUIT ACTUAL INSTALLATION CONDITIONS. PROVIDE REDUCED PRESSURE ASSEMBLY OF MANUFACTURE APPROVED BY LOCAL AUTHORITIES. INSTALL WITH REQUIRED CLEARANCES, IN HORIZONTAL UPRIGHT POSITION, PER MANUFACTURER'S RECOMMENDATIONS. PROVIDE ANY REQUIRED CERTIFICATION OF TEST OF BACKFLOW PREVENTER TO LOCAL AUTHORITIES. ALL ITEMS SHALL BE APPROVED FOR DOMESTIC WATER SERVICE. INSTALL ENTIRE VALVE TRAIN SUPPORTED FROM WALL BRACKET OR FLOOR STAND. INSTALL SO THAT IT CAN BE EASILY SERVICED AND TESTED.

11 IRON PIPE DOMESTIC WATER SERVICE ENTRY
NTS



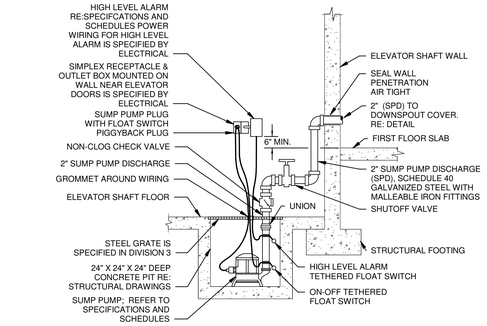
PIPING ARRANGEMENT SHOWN IS SCHEMATIC, ADJUST TO SUIT FIELD CONDITIONS. RE: FLOOR PLANS FOR LOCATION.

10 ROOF HYDRANT DETAIL
NTS



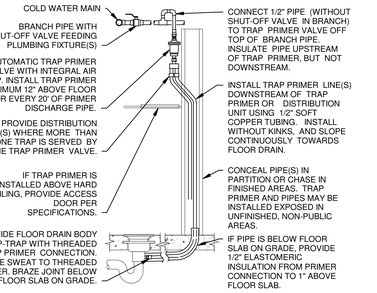
ARRANGEMENT SHOWN IS SCHEMATIC. ADJUST TO SUIT FIELD CONDITIONS. RE: SPECIFICATIONS FOR DOWNSPOUT COVER, AND TYPE OF PIPE, FITTINGS, AND CONNECTORS.

13 DOWNSPOUT COVER
NTS



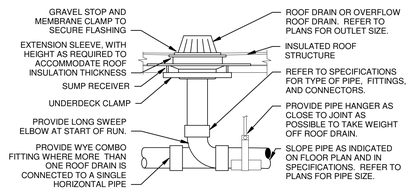
ARRANGEMENT SHOWN IS SCHEMATIC. ADJUST TO SUIT FIELD CONDITIONS. LOCATE FLOATS AT ELEVATIONS AS RECOMMENDED BY PUMP MANUFACTURER. INTERLOCK OF HIGH LEVEL ALARM WITH ALARM BELL. REFER TO FLOOR PLANS IF PROVIDED, IS SPECIFIED BY ELECTRICAL. INTERLOCK OF HIGH LEVEL ALARM WITH BUILDING AUTOMATION SYSTEM, REFER TO SPECIFICATIONS IF PROVIDED, IS SPECIFIED BY MECHANICAL.

9 ELEVATOR SUMP PUMP
NTS



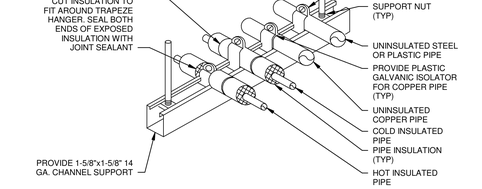
PROVIDE TRAP PRIMERS WHERE SHOWN ON FLOOR PLANS, AND WHERE REQUIRED BY LOCAL AUTHORITIES. PIPING ARRANGEMENT SHOWN IS SCHEMATIC: ADJUST TO SUIT FIELD CONDITIONS. REFER TO SPECIFICATIONS AND PLUMBING FIXTURE SCHEDULE FOR MORE INFORMATION. INSTALL TRAP PRIMER VALVE AND DISTRIBUTION UNIT PER MANUFACTURER'S RECOMMENDATIONS.

4 TRAP PRIMER OVERHEAD
NTS



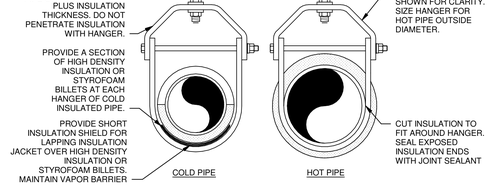
UNDERDECK CLAMP AND SUMP RECEIVER ARE NOT REQUIRED WHEN ROOF DRAIN BODY IS CAST INTO CONCRETE ROOF. INSTALL PER MANUFACTURER'S RECOMMENDATIONS. INSULATE ROOF DRAIN SUMP AND PIPE PER SPECIFICATIONS. LOCATE DRAINS WHERE SHOWN ON ARCHITECTURAL PLANS. VERIFY WITH STRUCTURAL PLANS FOR ROOF LOW POINTS. COORDINATE WITH STRUCTURAL DRAWINGS REGARDING PROVISION FOR SUPPLEMENTARY STEEL FRAMING AROUND ROOF OPENING. COORDINATE ROOF DRAIN INSTALLATION WITH ARCHITECTURAL DETAILS AND ROOFING INSTALLATION. SET OVERFLOW DRAIN WEIR ELEVATION 2" ABOVE PRIMARY ROOF DRAIN WEIR ELEVATION.

3 ROOF DRAIN INSTALLATION
NTS



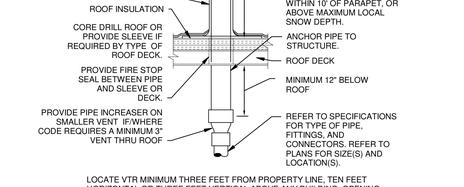
PIPING ARRANGEMENT SHOWN IS SCHEMATIC. ADJUST TO SUIT FIELD CONDITONS. REFER TO SPECIFICATIONS FOR MORE INFORMATION. PIPE AND CONDUIT OF ALL TRADES MAY BE COMBINED ON THE SAME SUPPORT CHANNEL. COORDINATE SUPPORT CHANNEL LENGTH WITH PIPING AND CONDUIT TO BE SUPPORTED. SUPPORT CHANNEL SPACING SHALL BE DETERMINED BY SMALLEST PIPE TO BE SUPPORTED. CHANNEL SUPPORT MAY BE USED AS A WALL BRACKET, ATTACH TO WALL WITH ANCHOR BOLTS PER SPECIFICATIONS. FOR HORIZONTAL INSULATED PIPING, ATTACH CLAMPS AS INDICATED ABOVE, FOR VERTICAL INSULATED PIPING, ATTACH CLAMPS TO THE PIPE AND SEAL INSULATION AT BOTH CLAMP ENDS.

7 TRAPEZE PIPE HANGER
NTS



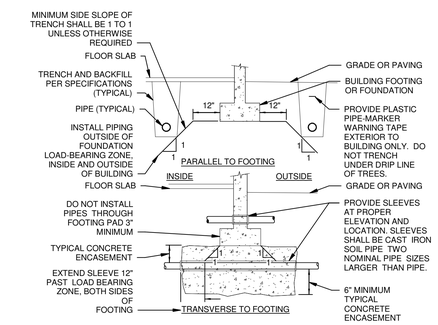
REFER TO SPECIFICATIONS FOR INSULATION TYPES, INSULATION THICKNESSES, HANGER TYPES, HANGER ROD CONNECTIONS TO STRUCTURE AND HANGER SPACING.

6 PIPE HANGER DETAIL
NTS



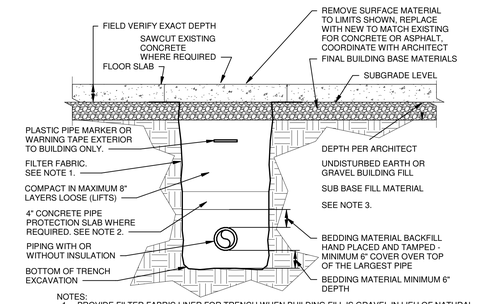
LOCATE VTR MINIMUM THREE FEET FROM PROPERTY LINE, TEN FEET HORIZONTAL OR THREE FEET VERTICAL ABOVE ANY BUILDING OPENING OR FRESH AIR INTAKE, TWENTY FIVE FEET FROM ANY OPENING OR FRESH AIR INTAKE IN MEDICAL FACILITIES AND ONE FOOT FROM ANY VERTICAL SURFACE. REFER TO LOCAL CODES FOR OTHER VENT TERMINATION REQUIREMENTS. LOCATE VTR MINIMUM 18" FROM ADJACENT WALL, PARAPET, EXPANSION JOINT, ROOF DRAIN, EQUIPMENT CURB, OR OTHER ROOF FEATURE. OFFSET IN CEILING SPACE WHERE REQUIRED TO MEET THESE CONDITIONS. INSULATE LAST SIX FEET OF VENT PIPE INSIDE BUILDING PER SPECIFICATIONS.

5 VENT THRU ROOF
NTS



VERIFY EXCAVATION CONDITIONS (SOIL/ROCK) WITH GEOTECHNICAL REPORT AND/OR SITE INVESTIGATIONS. REFER TO SPECIFICATIONS FOR OTHER CONDITIONS. DO NOT INSTALL PIPES UNDER INTERIOR BUILDING SPREAD FOOTINGS OR PILE CAPS. COORDINATE WITH AFFECTED CONTRACTORS PRIOR TO THE START OF WORK.

2 PIPE AND TRENCH LOCATION
NTS



NOTES:
1. PROVIDE FILTER FABRIC LINER FOR TRENCH WHEN BUILDING FILL IS GRAVEL IN LIEU OF NATURAL SOIL.
2. VERIFY WITH LOCAL CODE AND OWNER FOR SPECIFIC LOCATION AND CONCRETE COLOR PRIOR TO INSTALLATION.
3. TRENCH WALL MAY BE VERTICAL TO MAXIMUM OF 4-FEET DEEP IF ALLOWED BY OSHA REQUIREMENTS AND/OR SOIL ENGINEER, ARCHITECT AND CIVIL ENGINEER, OTHERWISE, PROVIDE A MINIMUM SIDE SLOPE OF 1 TO 1 UNLESS OTHERWISE REQUIRED BY SOILS ENGINEER OR CIVIL ENGINEER.

1 PLASTIC PIPE IN TRENCH DETAIL
NTS

JOSHUA N. HOVER

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

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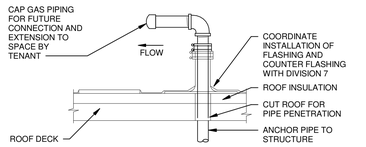
SHEET TITLE

PLUMBING DETAILS

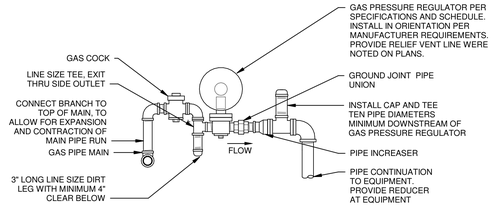
SHEET NUMBER

P401



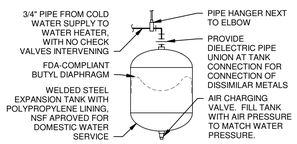
REFER TO PLANS FOR PIPE SIZE(S) AND PENETRATION LOCATION(S). REFER TO SPECIFICATIONS FOR MORE INFORMATION. LOCATE PENETRATION MINIMUM 18" FROM ADJACENT WALLS, VENTS THRU ROOF, EQUIPMENT CURBS, PARAPETS, ROOF DRAINS, EXPANSION JOINTS, AND OTHER ROOF FEATURES.

8 GAS PIPE ROOF PENETRATION
NTS



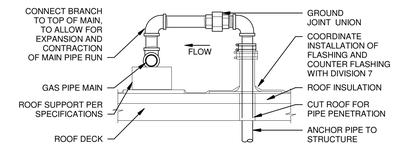
REFER TO PLANS FOR PIPE SIZE(S). ARRANGEMENT SHOWN IS SCHEMATIC. ADJUST TO SUIT FIELD CONDITIONS. PROVIDE CONNECTIONS SHOWN IN EQUIPMENT MANUFACTURER'S INSTALLATION INSTRUCTIONS. VERIFY CONNECTION LOCATIONS BEFORE INSTALL PIPE RUNS. REFER TO SPECIFICATIONS FOR PIPE AND FITTING MATERIALS AND INSTALLATION. PROVIDE GAS COCK, UNION AND DIRT LEG SAME SIZE AS BRANCH PIPE.

7 GAS PRESSURE REGULATOR
NTS



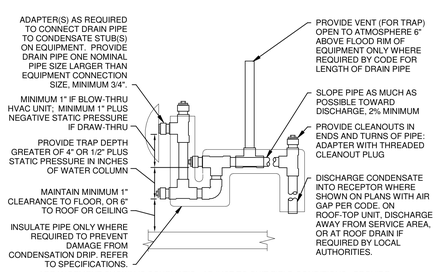
PIPING ARRANGEMENT SHOWN IS SCHEMATIC. ADJUST TO SUIT FIELD CONDITIONS. FOLLOW MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION PROCEDURE. VERIFY PROPER OPERATION WHEN INSTALLED. PROVIDE SEISMIC STRAP OR BRACING WHEN REQUIRED BY LOCAL AUTHORITIES.

6 SMALL EXPANSION TANK
NTS



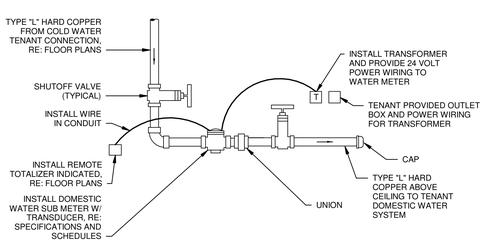
REFER TO PLANS FOR PIPE SIZE(S) AND PENETRATION LOCATION(S). REFER TO SPECIFICATIONS FOR MORE INFORMATION. LOCATE PENETRATION MINIMUM 18" FROM ADJACENT WALLS, VENTS THRU ROOF, EQUIPMENT CURBS, PARAPETS, ROOF DRAINS, EXPANSION JOINTS, AND OTHER ROOF FEATURES.

5 GAS PIPE ROOF PENETRATION
NTS



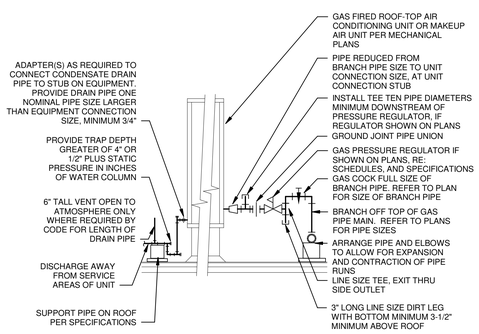
ARRANGEMENT SHOWN IS SCHEMATIC. ADJUST TO SUIT FIELD CONDITIONS. PROVIDE CONNECTIONS SHOWN IN EQUIPMENT MANUFACTURER'S INSTALLATION INSTRUCTIONS. REFER TO SPECIFICATIONS FOR PIPE AND FITTING MATERIALS AND INSTALLATION. PROVIDE DIELECTRIC UNION IF CONNECTING DISSIMILAR METALS. AT MOTORIZED EQUIPMENT ABOVE CEILING, PROVIDE NEOPRENE TUBE AND STAINLESS STEEL SCREW CLAMPS FOR FLEXIBLE CONNECTION. FOR PIPE SIZE(S) REFER TO FLOOR PLANS, OR CODE REQUIREMENTS FOR HVAC UNIT TONNAGE. PROVIDE HANGERS OR SUPPORTS PER SPECIFICATIONS. DO NOT COMBINE CONDENSATE DRAIN PIPES WITH NON-CONDENSATE INDIRECT DRAINS.

4 CONDENSATE DRAIN INSTALLATION
NTS



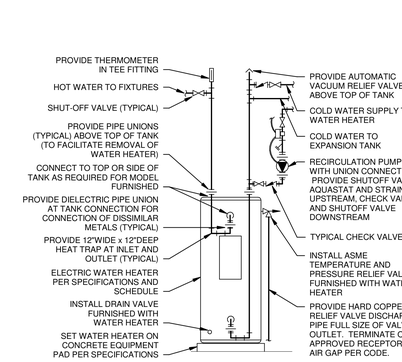
PIPING ARRANGEMENT SHOWN IN SCHEMATIC. ADJUST TO SUIT FIELD CONDITIONS. INSTALL WATER METER IN HORIZONTAL UPRIGHT POSITION PER MANUFACTURERS INSTALLATION INSTRUCTIONS. ATTACH ASSEMBLY TO WALL WITH WALL BRACKETS. PROVIDE ADAPTERS AS REQUIRED. COORDINATE EXACT LOCATION AND INSTALLATION OF WATER METER WITH THE LANDLORD PRIOR TO START OF INSTALLATION.

TENANT WATER SUBMETER WITH REMOTE TOTALIZER AND TRANSFORMER INSTALLATION DETAIL
NTS



ARRANGEMENT SHOWN IS SCHEMATIC. ADJUST TO SUIT FIELD CONDITIONS. PROVIDE CONNECTIONS SHOWN IN EQUIPMENT MANUFACTURER'S INSTALLATION INSTRUCTIONS. VERIFY CONNECTION LOCATIONS BEFORE INSTALLING PIPE RUNS. REFER TO SPECIFICATIONS FOR PIPE AND FITTING MATERIALS AND INSTALLATION. PROVIDE DIELECTRIC UNION IF CONNECTING DISSIMILAR METALS. FOR PIPE SIZE(S) REFER TO FLOOR PLANS, OR CODE REQUIREMENTS FOR HVAC UNIT TONNAGE. PROVIDE GAS COCK, UNION AND DIRT LEG SAME SIZE AS BRANCH PIPE. SLOPE CONDENSATE PIPE AS MUCH AS POSSIBLE TOWARD DISCHARGE, 2% MINIMUM. PROVIDE CLEANOUTS IN ENDS AND TURNS OF PIPE PER LOCAL CODE REQUIREMENTS; ADAPTER WITH THREADED CLEANOUT PLUG. OMIT CONDENSATE DRAIN ON MAKEUP AIR UNIT. PROVIDE MINIMUM 6" CLEARANCE TO ROOF UNDER PIPES.

2 CONNECTIONS TO ROOF-TOP UNIT
NTS



REFER TO SPECIFICATIONS, SCHEDULES, AND NOTES FOR MORE INFORMATION. PIPING ARRANGEMENT SHOWN IS SCHEMATIC. ADJUST TO SUIT FIELD CONDITIONS. VERIFY CONNECTION SIZES AND LOCATIONS WITH WATER HEATER FURNISHED. REFER TO FLOOR PLANS FOR PIPE SIZES AND CONTINUATIONS. PROVIDE SEISMIC STRAP OR BRACING WHEN REQUIRED BY LOCAL AUTHORITIES. POWER WIRING AND DISCONNECT SWITCH ARE SPECIFIED BY ELECTRICAL. INTERLOCK OF AQUASTAT WITH RECIRCULATION PUMP IS SPECIFIED BY ELECTRICAL.

1 ELECTRIC WATER HEATER AND PUMP
NTS

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
JOSHUA N. HOVER
NUMBER PE-2017008503
PROFESSIONAL ENGINEER

Oct 25 2019
JOSHUA N. HOVER
LICENSE # PE-2017008503

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

HENDERSON ENGINEERS
8345 LENEXA DRIVE, SUITE 300
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TEL 913.742.5000 FAX 913.742.5001
WWW.HENDERSONENGINEERS.COM

1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

PLUMBING DETAILS

SHEET NUMBER

P402

ELECTRIC STORAGE WATER HEATER SCHEDULE

MARK	MANUFACTURER	MODEL#	AREA SERVED	TANK SIZE (GALLONS)	ELECTRICAL DATA VOLTS	PHASE	KW	RECOVERY (GPH)	NOTES
WH-1	A.O. SMITH	#DEN-30	FLOOR 2 RESTROOMS	30	208	1	5	22	A, D, F

NOTES:

A. 93°F TEMPERATURE RISE WITH 140°F OPERATING TEMPERATURE
B. 73°F TEMPERATURE RISE WITH 120°F OPERATING TEMPERATURE
C. SINGLE ELEMENT
D. DUAL ELEMENT WIRED FOR NON-SIMULTANEOUS OPERATION
E. DUAL ELEMENT WIRED FOR SIMULTANEOUS OPERATION WITH UNBALANCED THREE PHASE CIRCUIT
F. FURNISH WITH IMMERSION THERMOSTAT
G. "LOW BOY" DESIGN

PLUMBING EXPANSION TANK SCHEDULE

MARK	MANUFACTURER	MODEL	TANK SIZE (GALLONS)	MIN. ACCEPTANCE VOLUME (GALLONS)	SERVICE	NOTES
ET-1	AMTROL	ST-5	2	0.9	WH-1	A

NOTES:

A. CHARGE TANK WITH AIR TO IDENTICAL PRESSURE AS STATIC DOMESTIC WATER PRESSURE.

RECIRCULATION PUMP SCHEDULE

MARK	MANUFACTURER	MODEL	LOCATION	GPM	HEAD (FT.)	CONNECTION SIZE	ELECTRICAL DATA VOLTS	PH	HP	NOTES
RP-1	BELL & GOSSETT	NBF-9U	FLOOR 2 JANITOR	0	3	3/4"	120	1	1/18	A-D

NOTES:

A. ALL LEAD FREE CAST BRONZE BOOSTER.
B. PROVIDE WITH STRAINER UPSTREAM OF PUMP.
C. PROVIDE ADJUSTABLE, SURFACE MOUNTED AQUASTAT - HONEYWELL L6006C.
D. SET AQUASTAT TO SHUT OFF RECIRCULATION PUMP AT WATER HEATER SET POINT AND ON AT 10°F BELOW SET POINT.

ELEVATOR SUMP PUMP SCHEDULE

MARK	MANUFACTURER	MODEL	LOCATION	GPM	HEAD (FT.)	DISCHARGE SIZE (IN.)	ELECTRICAL VOLTS	PH	HP	NOTES
ESP-1	WEIL	1413-500	ELEVATOR PIT	50	20.5	3"	208	1	0.5	A-F

NOTES:

A. PROVIDE WEIL #320.158.523A 208V SINGLE PHASE FLOAT SWITCH WITH POWER CORD AND PIGGYBACK PLUG.
B. PROVIDE WITH WEIL #8341K1015 HIGH LEVEL ALARM WITH AUXILIARY CONTACT, REFER TO SPECIFICATIONS.
C. REFER TO DETAIL FOR MORE INSTALLATION INFORMATION.
D. INSTALL IN 24"SQUARE x 24" DEEP SUMP PIT LOCATED IN ELEVATOR PIT, SEE ARCHITECTURAL DRAWINGS.
E. PROVIDE FIBERBASIN #FIB24SQ 26" X 1.5" THICK SQUARE LIGHT DUTY FIBERGLASS GRID GRATE WITH FRAME.
F. PROVIDE 2" DISCHARGE PIPING, SHUTOFF VALVE AND ZOELLER #30-0030 FLAPPER NON-CLOG CHECK VALVE.

FIXTURE BRANCH CONNECTION SCHEDULE

FIXTURE	COLD WATER	HOT WATER	WASTE	VENT
WATER CLOSET (FV)	1 1/4"		4"	2"
URINAL	1"		2"	2"
MULTI-STATION LAVATORY	1/2"	1/2"	2"	1 1/2"
DRINKING FOUNTAIN	1/2"		2"	1 1/2"
JANITOR'S SINK	1/2"	1/2"	3"	2"
SINK	1/2"	1/2"	2"	2"

NOTE: PIPE SIZES SHOWN ARE MINIMUM.

TOTAL CONNECTED NATURAL GAS LOAD

EQUIPMENT DESIGNATION	QUANTITY	DESCRIPTION	CFH (EACH)	TOTAL CFH
MECHANICAL EQUIPMENT				
RTU 1	1	ROOFTOP UNIT	500	500
RTU 2	1	ROOFTOP UNIT	500	500
				1000
Grand total				1000

NATURAL GAS SYSTEM OPERATING PRESSURE OF 2.0 PSI.

NATURAL GAS SYSTEM SIZED WITH TOTAL DEVELOPED LENGTH FROM GAS METER TO MOST REMOTE PIECE OF EQUIPMENT OF 700' WITH A PRESSURE DROP OF 1.5 PSI.

HIGH PRESSURE GAS PIPE SIZING CHART

PIPE SIZE	LOAD (CFH)
1/2"	199
3/4"	416
1"	784
1-1/4"	1,609
1-1/2"	2,411
2"	4,643
2-1/2"	7,400
3"	13,082
4"	26,684
6"	78,168

SPECIFIC GRAVITY OF GAS =	0.60
UPSTREAM PRESSURE (PSI) =	2
DOWNSTREAM PRESSURE (PSI) =	0.5
PRESSURE LOSS (PSI) =	1.5
TOTAL DEVELOPED LENGTH (FEET) =	700

BASED ON NFPA 54 EQUATION 4-2

WATER PIPE SIZING CHART (IPC)

FIXTURE UNITS VS. PRESSURE LOSS IN PSI / 100 FEET FOR TYPE "L" COPPER TUBE

PIPE SIZE	INTERNAL DIAMETER	COLD WATER @ 3.00 PSI / 100' FLUSH TANK SFU	FLUSH VALVE SFU	VELOCITY FEET / SEC	FLOW GPM	HOT WATER @ 3.0 PSI / 100' FLUSH TANK SFU	VELOCITY FEET / SEC	FLOW GPM
1/2"	0.545	0.6	N/A	2.5	1.8	*	*	*
3/4"	0.785	1.8	N/A	3.1	4.7	*	*	*
1"	1.025	5.1	N/A	3.7	9.5	*	*	*
1-1/4"	1.265	13.3	5.6	4.3	16.6	*	*	*
1-1/2"	1.505	40.0	9.7	4.7	26.3	*	*	*
2"	1.985	148.7	61.1	5.7	54.4	120.9	5	48.2
2-1/2"	2.465	356.4	228.5	6.5	96.2	246.8	5	74.3
3"	2.945	661.5	578.8	7.2	153.7	406	5	106.1
4"	3.905	1764.4	1764.4	8.0	298.6	859.4	5	186.6
6"	5.845	5269.9	5269.9	8.0	669.0	2859.7	5	418.1
8"	7.725	10143.1	10143.1	8.0	1168.6	5653.3	5	730.3
SIZED WITH HAZEN WILLIAMS CONSTANT "C" =					135	*UTILIZE COLD WATER SIZING CHART		

GAS PRESSURE REGULATOR SCHEDULE FOR 2 PSI SYSTEMS

MARK	MANUFACTURER	MODEL	VALVE TYPE	VALVE BODY SIZE (INCHES)	MAX. FLOW RATE CFH	INLET PRESSURE PSI	OUTLET PRESSURE INCHES WATER COLUMN	SERVICE	NOTES
GPR-1	PIETRO-FIORENTINI	31051	C	1/2"	552	1	14	RTU-1	A, C, D, E, F, G, H
GPR-2	PIETRO-FIORENTINI	31051	C	1/2"	552	1	14	RTU-2	A, C, D, E, F, G, H

NOTES:
A. C - SELF CONTAINED "DIRECT ACTING" DIAPHRAGM TYPE WITH INTERNAL VENT LIMITER.
B. DROOP = 1" WATER COLUMN MAXIMUM.
C. DROOP = 2" WATER COLUMN MAXIMUM.
D. 65# ALUMINUM BODY, SCREWED CONNECTIONS AND OVERPRESSURE PROTECTION TO 25#.
E. MAXIMUM FLOW RATE SCHEDULED, MATCH BODY SIZE AND MAXIMUM FLOW RATE TO EQUIPMENT FLOW RATE. REFER TO EQUIPMENT SHOP DRAWINGS FOR EXACT LOADS.
F. LISTED TO MEET ANSI Z21.80 / CSA6.22 WITH CSA LISTING STAMP ON REGULATORY BODY.
G. GAS PRESSURE REGULATOR INLET PRESSURE = OPERATING PRESSURE - DESIGN FRICTION LOSS.
H. 2 PSI MAXIMUM INLET PRESSURE AND 1 PSI MINIMUM INLET PRESSURE.

PLUMBING FIXTURE SCHEDULE

FIXTURES IN THIS SCHEDULE OR THEIR APPROVED EQUIVALENT ARE PROVIDED BY THE PLUMBING CONTRACTOR. SUBMIT SHOP DRAWINGS ON EACH OF THESE ITEMS. REFER TO SPECIFICATIONS FOR FURTHER INFORMATION AND INSTALLATION REQUIREMENTS. VERIFY ROUGH-IN REQUIREMENTS WITH MANUFACTURER'S INSTALLATION INSTRUCTIONS AND INSTALL PER MANUFACTURER'S RECOMMENDATIONS. REFER TO THE ARCHITECTURAL DRAWINGS FOR THE PLUMBING FIXTURE MOUNTING HEIGHTS.

PLUMBING FIXTURE SCHEDULE

PLUMBING PLAN MARK	Description
DSC	DOWNSPOUT COVER: JAY R. SMITH # 1775, ROUND FABRICATED STAINLESS STEEL FRAME WITH FABRICATED SECURED PERFORATED STAINLESS STEEL HINGED COVER. PROVIDE OUTLET SIZE AS SHOWN ON PLANS.
EWC	ELECTRIC WATER COOLER (ADA ACCESSIBLE): ELKAY LZWS-LRPBM28K BARRIER FREE, LEAD FREE WITH BOTTLE FILLING STATION. FRONT PUSH ACTUATORS. STAINLESS STEEL BOWL, FLEXIBLE POLYESTER ELSTOMER SAFETY BUBBLER AND STAINLESS STEEL FRONT. CHILLER WITH CAPACITY OF 8.0 GALLONS PER HOUR CAPACITY, 50° F DRINKING WATER AT 80° F INLET TEMPERATURES 90° F ROOM TEMPERATURE. BOTTLE FILLING STATION: ELECTRONIC SENSOR FOR TOUCHLESS ACTIVATION WITH AUTO 20-SECOND SHUT-OFF TIMER, UNIT PROVIDES 1.1 GPM WITH LAMINAR FLOW TO MINIMIZE SPLASHING. TRIM- McGUIRE # LF2165CC LEAD FREE BRASS COMPRESSION ANGLE STOP VALVE WITH RISER AND ESCUTCHEON, McGUIRE # B8872CF 1-1/4" 17 GAUGE CAST CHROME PLATED BRASS ADJUSTABLE P-TRAP AND WASTE ARM WITH CLEANOUT PLUG AND ESCUTCHEON, AND SUITABLE CARRIER WITH STANCHIONS TO FLOOR. ELECTRICAL REQUIREMENTS: 120-VOLT, 1 FULL LOAD AMPS. NO SUBSTITUTIONS.
FCO	FLOOR CLEANOUT: JAY R. SMITH, CAST IRON BODY, FLASHING FLANGE WITH CLAMPING COLLAR, ABS PLUG, AND ADJUSTABLE, ROUND, SECURED, NICKEL BRONZE, TOP., # 4031L (-F-C), SCORIATED TOP FOR EXPOSED, FLUSH WITH FINISHED FLOOR, APPLICATION(S), # 4031L (-F-C-Y), STAINLESS STEEL MARKER FOR INSTALLATION IN CARPETED FLOOR AREA(S), # 4151 (-F-C), 1/8" RECESS FOR INSTALLATION IN TILED FLOOR AREA(S), # 4191 (-F-C), 1/2" RECESS FOR INSTALLATION IN TERRAZZO AND SIMILAR POURED FLOOR AREA(S). REFER TO SPECIFICATIONS FOR INSTALLATION.
FD-1	FLOOR DRAIN: JAY R. SMITH #2240 (-B), 13" DEEP CAST IRON BODY, 12" ROUND, LOOSE, MEDIUM DUTY, CAST IRON GRATE WITH INTEGRAL SEDIMENT BUCKET, BOTTOM OUTLET, SEEPAGE PAN, MEMBRANE FLASHING CLAMP. PROVIDE TRAP PRIMER PORT IF TRAP PRIMER IS PROVIDED ON THE DRAWINGS. PROVIDE PUSH-ON JOINT OF OUTLET SIZE AS SHOWN ON PLANS.
FD-2	FLOOR DRAIN: JAY R .SMITH # 2005L (-A), CAST IRON BODY AND CLAMPING COLLAR, ADJUSTABLE 6" ROUND NICKEL BRONZE STRAINER. USE PUSH-ON JOINT OF OUTLET SIZE AS SHOWN ON PLANS. TRAP SEAL: PROVIDE TRAP SEAL PER SPECIFICATIONS FOR ACTUAL FLOOR DRAIN MODEL AND SIZE.
HB	HOSE BIBB: PRIER PRODUCTS # C-258CP.75, POLISHED CHROME PLATED BRASS 3/4" MALE INLET, 3/4" THREADED HOSE CONNECTION, LOOSE KEY HANDLE, AND ASSE 1011 INTEGRAL VACUUM BREAKER.
HD	HUB DRAIN FLOOR SINK: JAY R. SMITH # 3821T (-DBS), 7" DEEP x 4" DIAMETER CAST IRON BODY WITH ACID RESISTING ENAMELED INTERIOR AND EXTERIOR FUNNEL WITH 2" CAST IRON P-TRAP WITH THREADED CONNECTION AND ALUMINUM DOME BOTTOM STRAINER.
JS-1	JANITOR'S SINK: FIAT # MSB-2424, 24" x 24" x 10" HIGH MOLDED STONE BASIN WITH FACTORY INSTALLED STAINLESS STEEL DOME STRAINER AND SEDIMENT BASKET. FAUCET: CHICAGO FAUCET # 897-CP FAUCET WITH WALL BRACE, INTEGRAL VACUUM BREAKER, PAIL HOOK, AND 3/4" MALE HOSE THREADED OUTLET. SECURE FAUCET IN WALL WITH BACKBOARD. TRIM: # MSG-2424 TYPE 304, 20 GAUGE, STAINLESS STEEL WALL SURROUNDS, # 832-AA 30" LONG REINFORCED HOSE WITH 3/4" CHROME COUPLING AND WALL HOOK, # E77AA24 EXTRUDED VINYL BUMPER GUARD AND # 889-CC 24" STAINLESS STEEL MOP HANGER.
NWH	NON-FREEZE WALL HYDRANT: PRIER PRODUCTS # C-634NBX1, SATIN NICKEL PLATED BRASS 1" MALE INLET BY 3/4" FEMALE INLET, 3/4" THREADED HOSE CONNECTION, LOOSE KEY HANDLE, HYDRANT LENGTH AS REQUIRED FOR INSTALLED WALL THICKNESS, ADJUSTABLE WALL CLAMP, BRASS BOX WITH SATIN NICKEL PLATED FINISH AND INTEGRAL ASSE 1052 DOUBLE CHECK VACUUM BREAKER.
ORD	OVERFLOW ROOF DRAIN: JAY R. SMITH # 1080Y (-E0X-C-R-CID), 15" DIAMETER CAST IRON BODY, FLASHING CLAMP, GRAVEL STOP, UNDERDECK CLAMP, SUMP RECEIVER, HUBLESS OUTLET, FIXED EXTENSION – HEIGHT AS REQUIRED BY INSTALLED INSULATION THICKNESS, CAST IRON DOME BOLTED OR LOCKED DOWN AND 2" HIGH WATER DAM. PROVIDE OUTLET SIZE AS SHOWN ON PLANS.
RD	ROOF DRAIN: JAY R. SMITH # 1010Y (-E0X-C-R-CID), 15" DIAMETER CAST IRON BODY, FLASHING CLAMP, GRAVEL STOP, UNDERDECK CLAMP, SUMP RECEIVER, HUBLESS OUTLET, FIXED EXTENSION – HEIGHT AS REQUIRED BY INSTALLED INSULATION THICKNESS, AND CAST IRON DOME BOLTED OR LOCKED DOWN. PROVIDE OUTLET SIZE AS SHOWN ON PLANS.
RH	ROOF NON-FREEZE POST HYDRANT: MAPA PRODUCTS # MPH-24FP FREEZE PROOF POST HYDRANT MEETING ASSE #1057 WITH BLACK POWDER COATED CAST ALUMINUM WEATHER-GUARD DOME HANDLE, STAINLESS STEEL SHROUD WITH WELDED STAINLESS STEEL FLANGE, UNDER DECK CLAMP, BRONZE GLOBE ANGLE VALVE, 3/4" HOSE CONNECTION, QUICK DISCONNECT WITH BUILT-IN VACUUM BREAKER, STAINLESS STEEL RESERVOIR.
RPZ	REDUCED PRESSURE ZONE BACKFLOW PREVENTER: WATTS # 957-NRS, MEETING ASSE 1013, 304 STAINLESS STEEL BODY AND SLEEVE, QUARTER TURN TEST COCKS, RESILIENT SEATED NON-RISING STEM GATE VALVES AND WATTS #77F-DI-FDA EPOXY COATED CAST IRON STRAINER AND # 957AG AIR GAP FITTING.
RT	REMOTE TOTALIZER: BADGER METER # RTR PULSE GENERATOR FOR MOUNTING IN METER REGISTER WITH REMOTE TOTALIZER. PULSE GENERATOR WITH SEALED THERMOPLASTIC BODY AND LITHIUM BATTERY POWER. REMOTE TOTALIZER #RED WITH PLASTIC BODY, SOLENOID AND RATCHET ARM AND REGISTERED IN GALLONS. PROVIDE CONTROL WIRING FROM PULSE GENERATOR TO TOTALIZER PER MANUFACTURERS INSTALLATION INSTRUCTIONS.
SWM-1	WATER METER: BADGER METER # M170 2", LEAD FREE BRONZE MAINCASE AND MEASURING CHAMBER, BOTTOM PLATE, STAINLESS STEEL TRIM AND BOLTS, THERMOPLASTIC STRAINER, OSCILLATING PISTON MEASURING ELEMENT, STRAIGHT READING HERMETICALLY SEALED REGISTER, REGISTRATION IN US GALLONS, MAGNETIC DRIVE, AND COMPLIANCE WITH ANSI / AWWA C700. PROVIDE WITH REMOTE READING SYSTEM IF / AS REQUIRED.

PLUMBING FIXTURE SCHEDULE

PLUMBING PLAN MARK	Description
SWM-2	WATER METER: BADGER METER # 55 1", LEAD FREE BRONZE MAINCASE AND MEASURING CHAMBER, BOTTOM PLATE, STAINLESS STEEL TRIM AND BOLTS, THERMOPLASTIC STRAINER, OSCILLATING PISTON MEASURING ELEMENT, STRAIGHT READING HERMETICALLY SEALED REGISTER, REGISTRATION IN US GALLONS, MAGNETIC DRIVE, AND COMPLIANCE WITH ANSI / AWWA C700. PROVIDE WITH REMOTE READING SYSTEM IF / AS REQUIRED.
TF	TRANSFORMER: SLOAN # EL-154 120 VAC / 24 VAC, 50 VA. REFER TO ELECTRICAL DRAWINGS FOR WIRING OF TRANSFORMER.
TMV	THERMOSTATIC MIXING VALVE: POWERS # LFG480, SOLID LEAD FREE BRASS OR BRONZE BODY, THERMOSTATIC WAX ELEMENT, CORROSION RESISTANT INTERNAL PARTS, AND INTEGRAL CHECKS, ASSE 1070 COMPLIANT, CAPABLE OF 1.6 GPM WITH A 20 PSI DIFFERENTIAL AND A MINIMUM FLOW RATE OF 0.25 GPM. SET TEMPERATURE TO 110F FOR DUAL TEMPERATURE LAVATORIES AND HAND SINKS, 100F FOR SINGLE TEMPERATURE LAVATORIES AND HAND SINKS AND 120F FOR SINKS. MOUNT BELOW THE PLUMBING FIXTURE WHERE INDICATED ON PLAN(S).
TP	TRAP PRIMER: PRECISION PLUMBING PRODUCTS # PR-500 "PRIME RITE", CORROSION RESISTANT BRASS BODY, "O" RING SEALS, 1/2" INLET AND OUTLET, AND INTEGRAL VACUUM BREAKER. INSTALL THE VALVE AT A MINIMUM OF 12" ABOVE FINISHED FLOOR. PROVIDE WITH DISTRIBUTION # DU-2 FOR TWO, # DU-3 FOR THREE, OR # DU-4 FOR FOUR DRAIN CONNECTIONS.
TS	TIME SWITCH: INTERMATIC #ET1705CSPST, 7 DAY, ONE CIRCUIT-SINGLE POLE SINGLE THROW, ELECTRONIC TIME SWITCH OR EQUAL BY TORK. TIME SWITCH SHALL BE MOTOR RATED (1 H.P. @ 120 VOLT, SINGLE PHASE), MINIMUM OF 20 SET POINTS (14 ON/OFF CYCLES) AND BATTERY BACK UP. COORDINATE WITH DIVISION 16 FOR INSTALLATION AND INTERLOCK OF TIME SWITCH IN SERIES WITH THE AQUASTAT AND RECIRCULATION PUMP.
UCL	UNDERCOUNTER LAVATORY & FAUCET: BRADLEY WB1-WB-ER1 "WASHBAR WITH EVERO UNDERMOUNT" 24" X 14-7/16" SQUARE CAST EVERO UNDERMOUNT BASIN, PATAGONIA IN COLOR. WASHBAR ALL-IN-ONE FAUCET WITH 0.5 GPM AERATORS, HAND DRYER, AND LIQUID SOAP DISPENSER. STAINLESS STEEL SWING DOWN ACCESS PANEL. SET IN BED OF SILICONE SEALANT WITH PROVIDED CLIPS. TRIM- McGUIRE # LF2165CCLK LEAD FREE BRASS LOOSE KEY COMPRESSION ANGLE STOP VALVES WITH RISERS AND ESCUTCHEONS, McGUIRE # B8872CF 1-1/4" 17 GAUGE CAST CHROME PLATED BRASS ADJUSTABLE P-TRAP AND WASTE ARM WITH CLEANOUT PLUG AND ESCUTCHEON.
UR-1	URINAL: AMERICAN STANDARD # 6561.017 "TRIMBROOK" WHITE VITREOUS CHINA FIXTURE WITH FLUSHING RIM, 3/4" TOP SPUD, AND SIPHON FLUSH ACTION. VALVE- SLOAN "OPTIMA – SLOAN MODEL" # 186 ES-S TMO 1.0 GALLON PER FLUSH, EXPOSED, CHROME-PLATED, HARD WIRED, WALL MOUNTED SENSOR OPERATED, DIAPHRAGM TYPE, FLUSH VALVE LESS TRANSFORMER WITH CHLORAMINE RESISTANT DIAPHRAGM AND PROTECTED ORIFICE, MECHANICAL OVERRIDE BUTTON, ESCUTCHEON, INTEGRAL SCREWDRIVER STOP, VACUUM BREAKER, 3/4" FLUSH TUBE, AND SWEAT ADAPTER KIT. TRIM: SUITABLE CARRIER WITH STANCHIONS TO FLOOR.
UR-2	URINAL (ADA ACCESSIBLE): AMERICAN STANDARD # 6561.017 "TRIMBROOK" WHITE VITREOUS CHINA FIXTURE WITH FLUSHING RIM, 3/4" TOP SPUD, AND SIPHON FLUSH ACTION. VALVE- SLOAN "OPTIMA – SLOAN MODEL" # 186 ES-S TMO 1.0 GALLON PER FLUSH, EXPOSED, CHROME-PLATED, HARD WIRED, WALL MOUNTED SENSOR OPERATED, DIAPHRAGM TYPE, FLUSH VALVE LESS TRANSFORMER WITH CHLORAMINE RESISTANT DIAPHRAGM AND PROTECTED ORIFICE, MECHANICAL OVERRIDE BUTTON, ESCUTCHEON, INTEGRAL SCREWDRIVER STOP, VACUUM BREAKER, 3/4" FLUSH TUBE, AND SWEAT ADAPTER KIT. TRIM: SUITABLE CARRIER WITH STANCHIONS TO FLOOR.
WC-3	WALL-MOUNTED WATER CLOSET: AMERICAN STANDARD # 2257.103 "AFWALL" WHITE VITREOUS CHINA FIXTURE WITH ELONGATED BOWL, 1.6 GALLON PER FLUSH, AND DIRECT-FED SIPHON JET ACTION. VALVE: SLOAN "OPTIMA – ROYAL MODEL" # 111 ES-S EXPOSED, CHROME-PLATED, HARD WIRED, SENSOR OPERATED, DIAPHRAGM TYPE, FLUSH VALVE LESS TRANSFORMER WITH CHLORAMINE RESISTANT DIAPHRAGM AND PROTECTED ORIFICE, ESCUTCHEON, INTEGRAL SCREWDRIVER STOP, VACUUM BREAKER, AND SWEAT ADAPTER KIT. TRIM: CHURCH # 9500SSC WHITE OPEN-FRONT CONTOURED, SOLID PLASTIC, HEAVY DUTY, SEAT LESS COVER WITH SELF-SUSTAINING CHECK HINGES AND STAINLESS STEEL BOLTS. PROVIDE SUITABLE FIXTURE CARRIER.
WC-4	WALL-MOUNTED WATER CLOSET (ADA ACCESSIBLE): AMERICAN STANDARD # 3351.101 "AFWALL MILLENNIUM FLOWISE WHITE VITREOUS CHINA FIXTURE WITH ELONGATED UNIVERSAL BOWL AND DIRECT-FED SIPHON JET ACTION. VALVE- SLOAN "OPTIMA – SLOAN MODEL" # 111-1.6 ES-S TMO 1.6 GALLON PER FLUSH, EXPOSED, CHROME-PLATED, HARD WIRED, SENSOR OPERATED, DIAPHRAGM TYPE, FLUSH VALVE LESS TRANSFORMER WITH CHLORAMINE RESISTANT DIAPHRAGM AND PROTECTED ORIFICE, MANUAL OVERRIDE, ESCUTCHEON, INTEGRAL SCREWDRIVER STOP, VACUUM BREAKER, AND SWEAT ADAPTER KIT. INSTALL FLUSH VALVE HANDLE ON THE WIDE SIDE OF THE STALL. TRIM- CHURCH # 9500SSCT WHITE OPEN-FRONT CONTOURED, SOLID PLASTIC, HEAVY DUTY, SEAT LESS COVER WITH SELF-SUSTAINING CHECK HINGES AND STAINLESS STEEL BOLTS. PROVIDE SUITABLE FIXTURE CARRIER.
WCO	WALL CLEANOUT: SIOUX CHIEF #873 SERIES, BRASS COUNTERSUNK PLUG, 20 GAUGE STAINLESS STEEL COVER AND SCREW. CLEANOUT TEE TO BE PROVIDED SEPARATELY, REFER TO SPECIFICATIONS FOR INSTALLATION.
WHA	WATER HAMMER ARRESTER: PRECISION PLUMBING PRODUCTS, HARD DRAWN COPPER BODY WITH WROUGHT COPPER FITTINGS, PISTON TYPE WITH LUBRICATED EPDM "O" RING SEALS, MEETING ASSE 1010 OR PDI WH-201. PROVIDE PDI SIZES "A" THROUGH "F" AS SHOWN ON PLANS. PROVIDE SIZE "A" UNLESS SHOWN OTHERWISE ON THE PLANS.

PARAGON STAR

PARAGON STAR
- LOT 9 -
BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
JOSHUA N. HOVER
NUMBER PE-2017008503
PROFESSIONAL ENGINEER

Oct 25 2019
JOSHUA N. HOVER
LICENSE # PE-2017008503

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

HENDERSON ENGINEERS
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WWW.HENDERSONENGINEERS.COM
1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

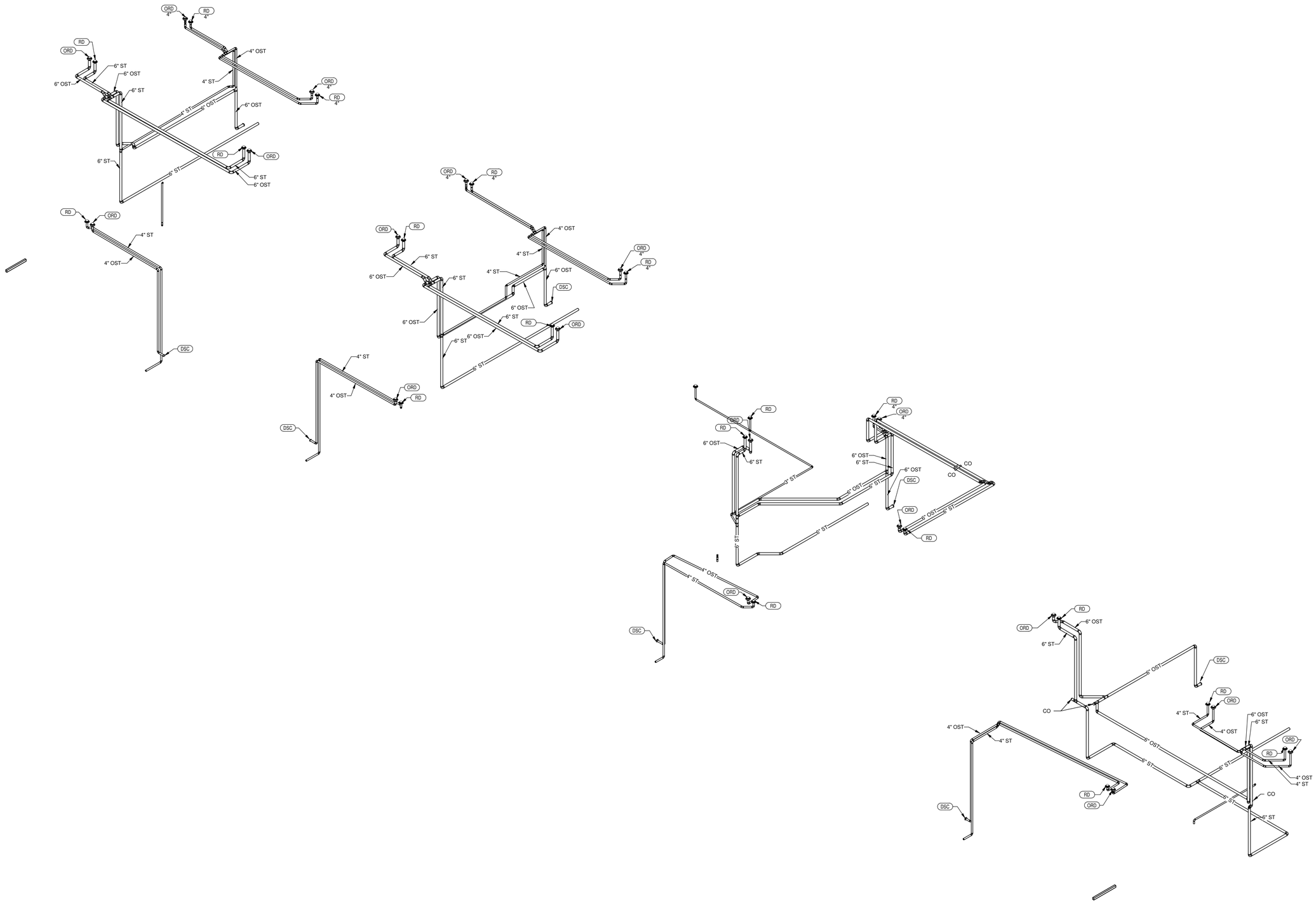
SHEET TITLE

PLUMBING SCHEDULES

SHEET NUMBER

P501

JOSHUA N. HOVER



1 PLUMBING STORM RISER DIAGRAM
NTS

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.:	1850004412
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STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
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ELECTRICAL	HENDERSON ENGINEERS
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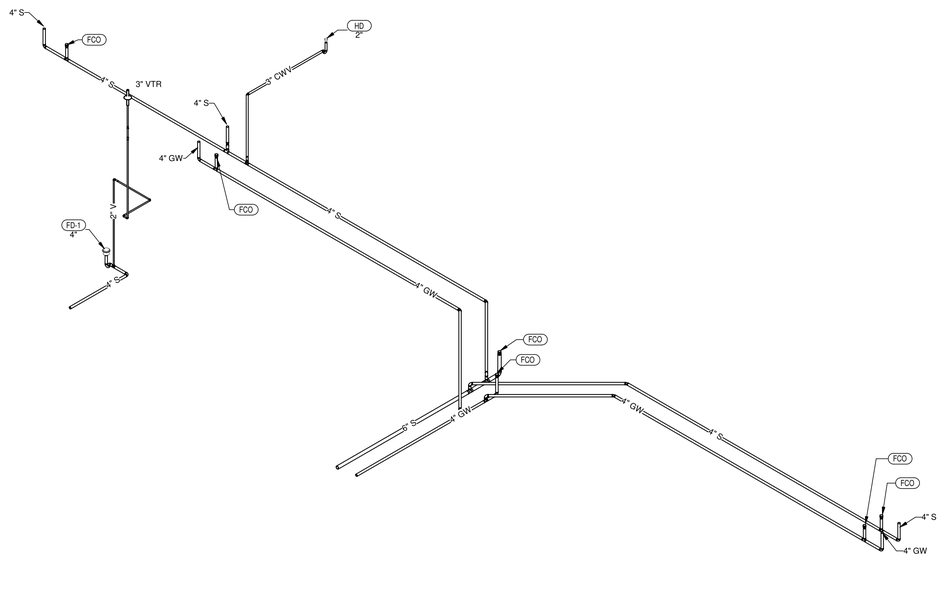
MO. CORPORATE NO. E-556D
EXPIRES 12/31/2020

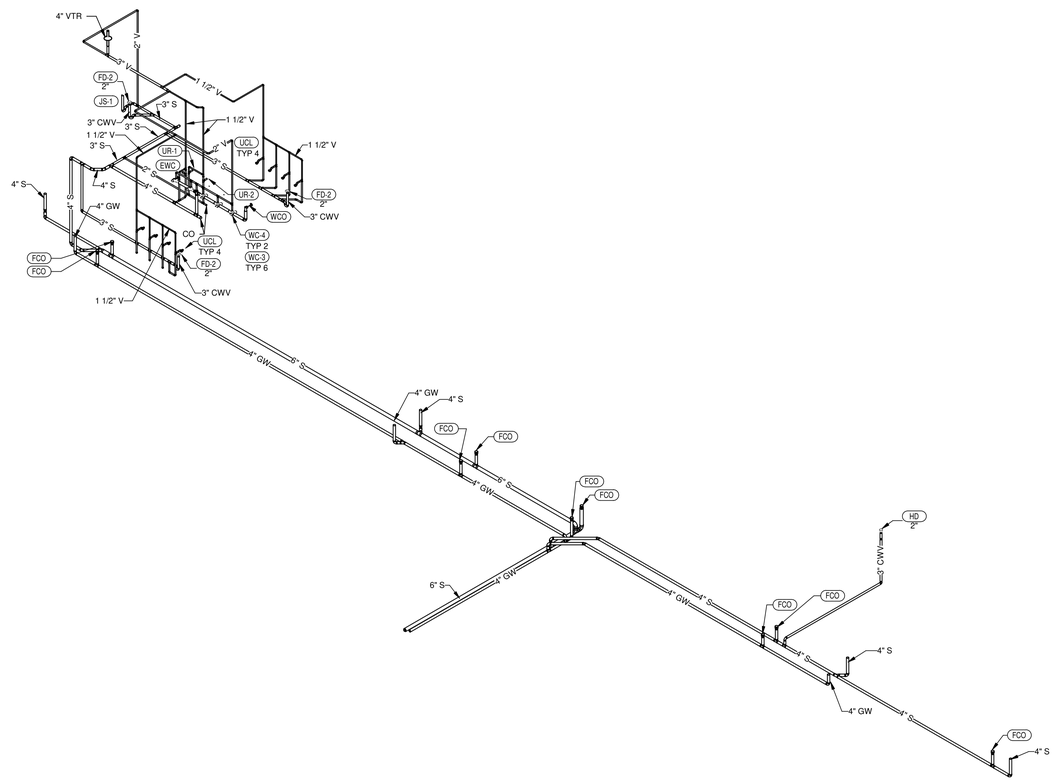
SHEET TITLE

PLUMBING STORM RISER DIAGRAM

SHEET NUMBER

P601





1 PLUMBING WASTE AND VENT RISER DIAGRAM

JOSHUA N. HOVER

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

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JOSHUA N. HOVER
NUMBER PE-2017008503
PROFESSIONAL ENGINEER

Oct 25 2019
JOSHUA N. HOVER
LICENSE # PE-2017008503

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

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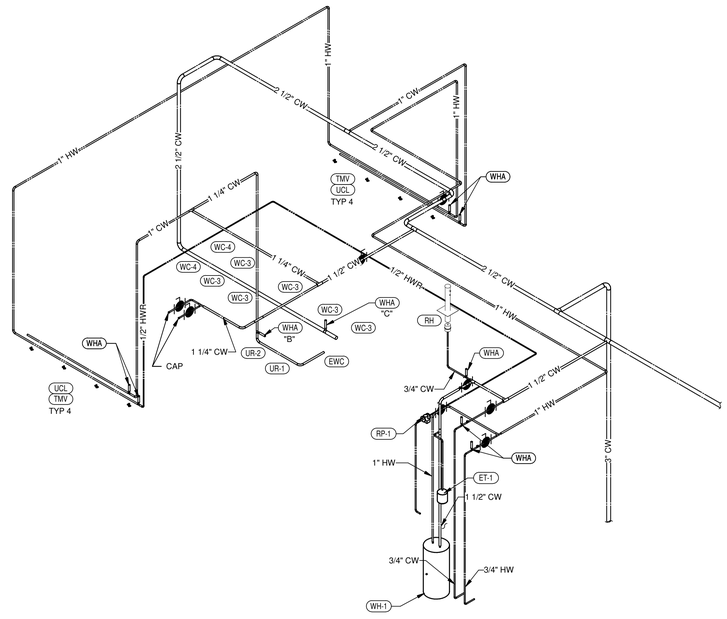
EXPIRES 12/31/2020

SHEET TITLE

PLUMBING WASTE & VENT RISER DIAGRAM

SHEET NUMBER

P602



1 PLUMBING WATER RISER

PARAGON STAR

PARAGON STAR
- LOT 9 -
BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
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Project No.: 1850004412
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PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
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EXPIRES 12/31/2020

SHEET TITLE

PLUMBING WATER RISER DIAGRAM

SHEET NUMBER

P603

Division 22: PLUMBING

1. GENERAL INSTRUCTIONS

A. GENERAL REQUIREMENTS

All requirements under Division 01 and the general and supplementary conditions of these specifications apply to this section and division. Where the requirements of this section and division exceed those of Division 01, this section and division take precedence. Become thoroughly familiar with all its contents as to requirements that affect this division, section, or both. Work required under this division includes all material, equipment, appliances, transportation, services and labor required to complete the entire system as required by the drawings and specifications, or reasonably inferred to be necessary to facilitate the function of each system as implied by the design and equipment specified.

The specifications and drawings for the Project are complementary, and any portion of work described in one shall be provided as if described in both. In the event of discrepancies, notify the Engineer and request clarification prior to proceeding with the work involved.

Drawings are graphic representations of the work upon which the contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They convey the scope of work, indicating the intended general arrangement of the systems without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements. Use the drawings as a guide when laying out the work and to verify that materials and equipment will fit into the designated spaces, and which when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory, and properly operating system.

B. DEFINITIONS

Division: References contained in this specification follow the numbering system defined in the Construction Specifications Institute (CSI) MasterFormat 2004 Edition. Specification Divisions 01 through 13 provided with this project may reference the CSI MasterFormat 1995 Edition. The corresponding division references between the 2004 Edition and 1995 Edition are as follows:

	2004 Edition	1995 Edition
1.	Division 21 – Fire Suppression	Division 15
2.	Division 22 – Plumbing	Division 15
3.	Division 23 – HVAC	Division 15
4.	Division 26 – Electrical	Division 16
5.	Division 27 – Communications	Division 16
6.	Division 28 – Electronic Safety and Security	Division 16

Furnish: “to supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations.”

Install: “to perform all operations at the project site including, but not limited to, the actual unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use.”

Provide: “to furnish and install, complete and ready for the intended use.”

Furnished by Owner (or Owner-Furnished) or Furnished by Others: “an item furnished by the Owner or under other divisions or contracts, and installed under the requirements of this division, complete, and ready for the intended use, including all items and services incidental to the work necessary for proper installation and operation. Include the installation under the warranty required by this division.”

Engineer: Where referenced in this division, “Engineer” is the Engineer of Record and the Design Professional for the work under this division, and is a consultant to, and an authorized representative of the Architect, as defined in the General and/or Supplementary Conditions. When used in this division, Engineer means increased involvement by and obligations to the Engineer, in addition to involvement by and obligations to the Architect.

AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the work.

NRTL: Nationally recognized testing laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA), and acceptable to the AHJ over this project. Nationally recognized testing laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTLs that are acceptable to the AHJ and standards that meet the specified criteria.

Substitution: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Substitutions include Value Engineering proposals.
A Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
B Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

The terms "approved equal", “equivalent”, or "equal" are used synonymously and shall mean “accepted by or acceptable to the Engineer as equivalent to the item or manufacturer specified”. The term "approved" shall mean labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.

The term lead free refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content of less than or equal to 0.25% per safe drinking water act as amended January 4, 2011 Section 1417.

C. PREBID SITE VISIT

Prior to submitting bid, visit the site of the proposed work and become fully informed as to the conditions under which the work is to be done. Failure to comply with this requirement shall not be considered sufficient justification to request or obtain extra compensation over and above the contract price.

D. MATERIAL AND WORKMANSHIP

Provide new material, equipment, and apparatus under this contract unless otherwise stated herein, of best quality normally used for the purpose in good commercial practice, and free from defects. Install material and equipment in accordance with the manufacturer’s installation instructions. Model numbers listed in specifications or shown on the drawings are not necessarily intended to designate the required trim, written descriptions of the trim govern model numbers.

Pipe, pipe fittings, pipe specialties and valves shall be manufactured in plants located in the United States or certified to meet the specified ASTM and ANSI standards.

Work performed under this contract shall provide a neat and "workmanlike" appearance when completed, to the satisfaction of the Architect and Engineer. Workmanship shall be the finest possible by experienced mechanics. Installations shall comply with applicable codes and laws.

The complete installation shall function as designed and intended with respect to efficiency, capacity, noise level, etc. Abnormal noise caused by rattling equipment, piping and squeaks in rotating components shall not be acceptable. Materials and equipment shall be of commercial specification grade in quality. Light duty and residential grade equipment shall not be accepted unless otherwise indicated.

Remove from the premises waste material present as a result of his work, including cartons, crating, paper, stickers, and/or excavation material not used in backfilling, etc. Clean equipment installed under this contract to present a neat and clean installation at the termination of the work.

Repair or replace public and private property damaged as a result of work performed under this contract to the satisfaction of authorities and regulations having jurisdiction. Provide all safety lights, guards, and warning signs required for the performance of the work and for the safety of the public.

E. MANUFACTURERS

In other articles where lists of manufacturers are introduced, subject to compliance with requirements, provide products by one of the manufacturers specified.

Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

Where manufacturers are not listed, provide products subject to compliance with requirements from manufacturers that have been actively involved in manufacturing the specified product for no less than 5 years.

F. COORDINATION

Coordinate work with that of other trades so that the various components of the systems are installed at the proper time, will fit the available space, and will allow proper service access to those items requiring maintenance. Components which are installed without regard to the above shall be relocated at no additional cost to the Owner.

Unless otherwise indicated, General Contractor shall provide chases and openings in building construction required for installation of the systems specified herein. Contractor shall furnish the General Contractor with information where chases and openings when required. Contractor shall keep informed as to the work of other trades engaged in the construction of the project and shall execute his work in such a manner as not to interfere with or delay the work of other trades.

Figured dimensions shall be taken in preference to scaled dimensions. Contractor shall take his own measurements at the building, as variations may occur. Contractor shall be held responsible for errors which could have been avoided by proper checking and verification.

Provide materials with trim that will properly fit the types of ceiling, wall, or floor finishes actually installed. Model numbers listed in the specifications or shown on the drawings are not intended to designate the required trim.

G. ORDINANCES AND CODES

Work performed under this contract shall, at a minimum, be in conformance with applicable national, state and local codes having jurisdiction. Equipment furnished and associated installation work performed under this contract shall be in strict compliance with current applicable codes adopted by the local AHJ, including any amendments and standards as set forth by the following:
1. National Fire Protection Association (NFPA)
2. Underwriters Laboratories (UL)
3. Occupational Safety and Health Administration (OSHA)
4. American Society of Mechanical Engineers (ASME)
5. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
6. American National Standards Institute (ANSI)
7. American Society of Testing Materials (ASTM)
8. Other national standards and codes where applicable.

Where the contract documents exceed the requirements of the referenced codes, standards, etc., the contract documents shall take precedence. Where conflicts between various codes, ordinances, rules, and regulations exist, comply with the most stringent.

Promptly bring all conflicts observed between codes, ordinances, rules, regulations, referenced standards, and these documents to the attention of the Architect and Engineer for final resolution. Contractor will be held responsible for any violation of the law.

Procure and pay for permits and licenses required for the accomplishment of the work herein described. Where required, obtain, pay for, and furnish certificates of inspection to Owner.

H. PROTECTION OF EQUIPMENT AND MATERIAL

Store and protect from damage equipment and material after delivery to job site. For materials and equipment susceptible to changing weather conditions, dampness, or temperature variations, store inside in conditioned spaces. For materials and equipment not susceptible to these conditions, cover with waterproof, tear-resistant, heavy tarp or polyethylene plastic as required to protect from plaster, dirt, paint, water, or physical damage. Equipment and material damaged by construction activities shall be rejected and Contractor shall furnish new equipment and material of a like kind at his own expense.

Keep premises broom clean of foreign material created during work performed under this contract. Piping, equipment, etc. shall have a neat and clean appearance at the termination of the work.

Plug or cap open ends of piping systems while stored and installed during construction when not in use to prevent the entrance of debris into the systems.

Keep the manufacturer-provided protective coverings on floor drains, floor sinks and trench drains during construction. Remove coverings at the termination of the work and polish exposed surfaces.

I. SUBSTITUTIONS

Materials, products, equipment, and systems described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by the proposed substitution. The base bid shall include only the products from manufacturers specifically named in the drawings and specifications. To request a substitution, request the Substitution Request Form from the Architect or Engineer. Complete and send the Substitution Request From for each material, product, equipment, or system that is proposed to be substituted. The burden of proof of the merit of the proposed substitution is upon the proposer.

Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Architect, and Owner the following:
1. Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects unless stated otherwise in the substitution request.
2. Proposed substitution is consistent with the Contract Documents and will produce indicated results, including functional clearances, maintenance service, and sourcing of replacement parts.
3. Proposed substitution has received necessary approvals of authorities having jurisdiction.
4. Same warranty will be furnished for proposed substitution as for specified Work.
5. If accepted substitution fails to perform as required, Contractor shall replace substitute material or system with that originally specified and bear costs incurred thereby.
6. Coordination, installation and changes in the Work as necessary for accepted substitution will be complete in all respects.

No substitutions will be considered unless the Substitution Request Form is completed and attached with the appropriate substitution documentation. No substitution will be considered prior to receipt of bids unless written request for approval to bid has been received by the Engineer at least ten (10) calendar days prior to the date for receipt of bids.

If the proposed substitution is approved prior to receipt of bids, such approval will be stated in an addendum. Bidders shall not rely upon approvals made in any other way. Verbal approval will not be given. No substitutions will be considered after the contract is awarded unless specifically provided in the contract documents.

J. SUBMITTALS

Assemble and submit for review shop drawings, material lists, manufacturer product literature for equipment to be furnished, and items requiring coordination between contractors under this contract. Provide submittals in sufficient detail so as to demonstrate compliance with these Contract Documents and the design concept. Prior to transmitting submittal, verify that the equipment submitted is mutually compatible and suitable for the intended use, will fit the available space, and maintain manufacturer recommended service clearances. If the size of equipment furnished makes necessary any change in location or configuration, submit a shop drawing showing the proposed layout.

Transmit submittals as early as required to support the project schedule. Allow for two weeks Engineer review time, plus to/from mailing time via the Architect, plus a duplication of this time for resubmittal, if required. Only resubmit those sections requested for resubmittal.

Submittals shall contain the project name, applicable specification section, submittal date, equipment identification acronym as used on the drawings, and the Contractor’s stamp. The stamp shall certify that the submittal has been checked by the Contractor, complies with the drawings and specifications, and is coordinated with other trades. Manufacturer product literature shall include shop drawings, product data, performance sheets, samples and other submittals required by this division. Highlight, mark, list, or indicate the materials, performance criteria, and accessories that are being proposed. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.

Submittals and shop drawings shall not contain the firm name, logo, seal, or signature of the Engineer. They shall not be copies of the work product of the Engineer. If the Contractor desires to use elements of such product, refer to paragraph “Electronic Drawing Files” for procedures to be used.

Separate submittals according to individual specification sections. Illegible submittals will be rejected and returned without review. Catalog data shall be properly bound, identified, indexed and tabbed in a 3-ring binder. Each item or model number shall be clearly marked and accessories indicated. Label the catalog data with the equipment identification acronym or number as used on the drawings and include performance curves, capacities, sizes, weights, materials, finishes, wiring diagrams, electrical requirements and deviations from specified equipment or materials. For equipment with motor starters or VFDs, include short circuit current ratings. Mark out inapplicable items. Shop drawings will be returned without review if the above mentioned requirements are not met.

Provide the quantity of submittals required by Division 01. If not indicated and hard-copy sets are provided, submit a minimum of six (6) copies. Refer to Division 01 for acceptance of electronic submittals for this project. For electronic submittals, Contractor shall submit the documents in accordance with the procedures specified in Division 01. Contractor shall notify the Architect and Engineer that the submittals have been posted. If electronic submittal procedures are not defined in Division 01, Contractor shall include the website, user name, and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the designated representatives of the Architect and Engineer. Contractor shall allow for the Engineer review time as specified above in the construction schedule. Contractor shall submit only the documents required to purchase the materials and/or equipment in the electronic submittal.

The checking and subsequent acceptance of submittals by the Engineer and/or Architect shall not relieve the Contractor from responsibility for deviations from the drawings and specifications, errors in dimensions, details, size of members, or quantities, omissions of components or fittings; coordination of electrical requirements; and not coordinating items with actual building conditions and adjacent work. Proceed with the procurement and installation of equipment only after receiving approved shop drawings relative to each item.

K. ELECTRONIC DRAWINGS

In preparation of shop drawings or record drawings, Contractor may, at his option, obtain electronic drawing files in AutoCAD or DXF format on CD-ROM disk, DVD disk, flash drive, or direct download, as desired, from the Engineer for a shipping and handling fee of $200 for a drawing set up to 12 sheets and $15 per sheet for each additional sheet. Contact the Architect for written authorization and Engineer for the necessary release agreement form and to specify shipping method and drawing format. In addition to payment, written authorization from the Architect and release agreement form from the Engineer must be received before electronic drawing files will be sent.

L. RECORD DRAWINGS (AS-BUILT DRAWINGS)

During progress of the work in this division, Contractor shall maintain an accurate record of all changes made during the installation of the system. Upon completion of the work, accurately transfer all record information to three identical sets of the approved shop drawings. Insert one set into each copy of the manual described below.

See Division 01 and General Conditions for additional information.

M. OPERATION AND MAINTENANCE INSTRUCTIONS

During the course of construction, collect and compile a complete brochure of equipment furnished and installed on this project. Include operational and maintenance instructions, manufacturer’s catalog sheets, wiring diagrams, parts lists, approved submittals and shop drawings, warranties, and descriptive literature as furnished by the equipment manufacturer. Include an inside cover sheet that lists the project name, date, Owner, Architect, Engineer, General Contractor, Sub-Contractor, and an index of contents.

Submit three copies of literature bound in approved binders with index and tabs separating equipment types to the Architect, for Engineer’s review, at the termination of the work. Paper clips, staples, rubber bands, loose-leaf binding, and mailing envelopes are not considered approved binders. Final approval of systems installed under this contract shall be withheld until this equipment brochure is received and deemed complete by the Architect and Engineer. Instruct workmen to save required literature shipped with the equipment itself for inclusion in this brochure.

Include record drawings as described above.

Refer to Division 01 for acceptance of electronic manuals for this project. For electronic manuals, refer to paragraph “Submittals” for requirements.

N. SPARE PARTS

Furnish to Owner, with receipt, the spare parts for faucet washers and O-rings, flushometer repair kits, and water closet tank repair kits for the fixtures furnished for this project.

O. WARRANTIES

Warrant each system and each element thereof against all defects due to faulty workmanship, design, or material for a period of 12 months from date of Substantial Completion, unless specific items are noted to carry a longer warranty in the construction documents or manufacturer’s standard warranty exceeds 12 months. Remedy all defects, occurring within the warranty period(s), as stated in the General Conditions and Division 01.

Warranty shall include a guarantee of free circulation of liquids throughout the system as intended without leaks, excessive noise, or water hammer.

Warranties shall include labor and material, including travel expenses. Make repairs or replacements without any additional costs to the Owner, and to the satisfaction of the Owner, Architect, and Engineer.

Perform the remedial work promptly, upon written notice from the Engineer or Owner.

At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period and any actions the Owner must take in order to maintain warranty status. Each warranty instrument shall be addressed to the Owner and state the commencement date and term.

2. GENERAL MATERIALS AND INSTALLATION

A. BUILDING OPERATION

Comply with the schedule of operations as outlined in the architectural portions of this specification. Building shall be in operation during normal workday hours. Accomplish work requiring interruption of building operation at a time when the building is not in operation and only with written approval of building Owner and/or tenant. Coordinate interruption of building operation with the Owner and/or tenant a minimum of seven (7) days in advance of work.

B. EXCAVATION AND BACKFILLING

Perform excavation and backfill required for installation of underground work under this contract. Trenches shall be of sufficient width. Crib or brace trenches to prevent cave-in or settlement. Do not excavate trenches close to columns and walls of new building without prior consultation with the Architect. Use pumping equipment if required to keep trenches free of water. Backfill trenches in maximum 6 inch layers of well-tamped dry earth in a manner to prevent future settlement.

Excavation as specified herein shall be classified as common excavation. Common excavation shall comprise the satisfactory removal and disposition of material of whatever substances and of every description encountered, including rock, if any, within the limits of the work as specified and shown on the drawings. Excavation shall be performed to the lines and grades indicated on the drawings. Dispose of excavated materials that are considered unsuitable for backfill and surplus of excavated material which is not required for backfill to the satisfaction of the Architect.

C. EXTERIOR UTILITY CONNECTIONS

Terminate domestic water, storm, and sewer lines at a point approximately five feet from the building wall, or as shown on the drawings. Make connection to the various services provided by others and coordinate connection requirements with civil engineer. Verify that installation will tie into the various services provided by others at the indicated invert elevation point prior to installation. If the installation will not tie into the indicated invert elevation point while maintaining proper fall, notify architect and civil engineer so that an alternative may be determined.

Provide service piping and accessories required to complete utility connections that are not furnished by the serving utility.

Coordinate with the local gas service company to provide a new gas service, including gas meter, shut-off valves, and regulator as indicated on the drawings. Installation shall be in complete conformance with the requirements of the local gas service company.

D. COINCIDENTAL DAMAGE

Repair work shall meet all requirements of the Owner, local authorities having jurisdiction, and meet the satisfaction of the Architect. Conform to requirements of Division 02 of this specification.

E. CUTTING AND PATCHING

Conform to the requirements in Division 01. Cut walls, floors, ceilings, and other portions of the facility as required to install work under this division. Obtain permission from the Architect prior to cutting. Do not disturb structural members without prior approval from the Architect. Cut holes as small as possible. Patch walls, floors, and other portions of the facility as required by work under this division. Patching shall match original material and construction including fire ratings, if applicable. Repair and refinish areas disturbed by work to the condition of adjoining surfaces in a manner satisfactory to the Architect.

F. ROUGH-IN

Coordinate without delay all roughing-in with other divisions. Conceal piping, conduit, and rough-in except in unfinished areas and where otherwise shown.

G. CONCRETE BASES

Provide concrete bases (e.g., housekeeping pads) for equipment where indicated on the drawings and as specified herein. Concrete bases shall have chamfered edges. Size of base shall be a minimum of 4 inches greater than the footprint of the equipment that it is supporting and shall have a minimum height as described below.

Construct equipment bases of a minimum 28 day, 4000 psi concrete conforming to American Concrete Institute Standard Building Code for Reinforced Concrete (ACI 318-99) and the latest applicable recommendations of the ACI standard practice manual. Concrete shall be composed of cement conforming to ASTM C150 Type I, aggregate conforming to ASTM C33, and potable water. Exposed exterior concrete shall contain 5 to 7 percent air entrainment.

Unless otherwise specified or shown on the structural drawings, reinforce equipment bases and housekeeping pads with No. 4 reinforcing bars conforming to ASTM A615 or 6x6 – W2.9 x W2.9 welded wire mesh conforming to ASTM A185. Place reinforcing bars 24 inches on center with a minimum of two bars each direction.

Provide galvanized anchor bolts for equipment placed on concrete equipment bases and housekeeping pads or on concrete slabs. Anchor bolts size, number and placement shall be as recommended by the manufacturer of the equipment.

Concrete equipment bases shall have minimum heights in accordance with the following:
1. For water heaters minimum height is 3-1/2 inches.

H. SUPPORT SYSTEMS

Structural steel used for pipe supports, equipment supports, etc., shall be new and clean, and shall conform to ASTM designation A-36.

Support plumbing equipment and piping from the building structure. Do not support plumbing equipment and piping from ceilings, other mechanical or electrical components, and other non-structural elements.

I. PENETRATIONS

Provide sleeves for pipes passing through above grade concrete or masonry walls, concrete floor or roof slabs. Sleeves are not required for core drilled holes in existing masonry walls, concrete floors or roofs. Provide 10 gauge galvanized steel sleeves for sleeves 6 inches and smaller. Provide galvanized sheet metal sleeves for larger than 6 inches. Schedule 40 PVC sleeves are acceptable for installation in areas without return air plenums.

Seal elevated floor, exterior wall and roof penetrations watertight and weathertight with non-shrink, non-hardening commercial sealant. Pack with mineral wool and seal both ends with minimum of 1/2 inch of sealant.

Seal around penetrations of fire rated assemblies. Coordinate fire ratings and locations with the architectural drawings. Refer to architectural specifications for fire stoppings. Provide a product schedule for UL listing, location, wall or floor rating and installation drawing for each penetration fire stop system.

Extend pipe insulation for insulated pipe through floor, wall and roof penetrations, including fire rated walls and floors. The vapor barrier shall be maintained. Size sleeve for a minimum of 1 inch annular clear space between inside of sleeve and outside of insulation.

Seal concrete or masonry exterior wall penetrations below grade with wall sleeve and mechanical sleeve seals. Provide galvanized schedule 40 steel wall sleeve with 2” wide metal plate. Wall sleeve is not required for existing concrete walls with core drilled penetrations. Provide modular mechanical sleeve seals, manufactured by Advance Products & Systems, Calpico, GPT Industries/Link Seal, Metraflex, or Proco Products.

Seal elevated concrete slab with water proof membrane penetrations with “wall pipes” and water proof sealant. Secure waterproof membrane flashing between “wall pipe” clamping flange and clamping ring. Provide cast iron “wall pipes” with integral waterstop ring manufactured by Josam, Jay R. Smith, Wade, Watts or Zurn.

Provide sleeves for horizontal pipe passing through or under foundation. Sleeves shall be cast iron soil pipe two nominal pipe sizes larger than the pipe served.

Provide Schedule 40 PVC pipe sleeves for vertical pressure pipe passing through concrete slab on grade. Sleeves shall be one nominal pipe size larger than the pipe served and two pipe sizes larger than pipe served for ductile iron pipes with restraining rods. Seal water-tight with silicone caulk.

Provide 1/2 inch thick cellular foam insulation around perimeter of non-pressure pipe passing thru concrete slab on grade. Insulation shall extend to 2 inches above and below the concrete slab.

J. FIRESTOPPING

Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with UL 2079 or ASTM E 814, or other NRTL acceptable to AHJ.

Manufacturers: Hilti, RectorSeal, Specified Technologies Inc., United States Gypsum Company, or 3M corp.

Through and Membrane Penetration Firestopping Systems Product Schedule: Provide UL listing, location, wall or floor rating, and installation drawing for each penetration fire stop system.

Where project conditions require modification to qualified testing and inspecting agency’s illustrations for a particular firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer’s fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Include qualifications data for testing agency.

K. ELECTRICAL WIRING

Line voltage wiring shall be provided by Division 26. Line voltage control and interlock wiring for plumbing systems shall also be provided by Division 26. Low voltage control wiring shall be provided by Division 23. Furnish wiring diagrams to Division 26 as required for proper equipment hookup. Coordinate with Division 26 the actual wire sizing amps for plumbing equipment (from the equipment nameplate) to ensure proper installation.

L. SYSTEM TESTING AND ADJUSTING

Upon completion of each phase of the installation, test each system in conformance with local code requirements and as noted below. Furnish labor and equipment required to test each system installed under this contract. Assume all costs involved in making the tests and repairing and/or replacing any damages resulting therefrom.

Notify the Architect and the AHJ, three (3) working days prior to making plumbing system tests. Leave concealed work uncovered until the required tests have been completed, but if necessary due to construction procedure, tests on portions of the work may be made, and when satisfactory, the work may be concealed. Test piping before insulation is installed, and before backfill. Pipes, joints, flanges, valve stems, etc., shall be leak tight. Repair or replace system defects with new materials. Caulking of defective joints, cracks or holes will not be permitted. Repeat tests after defects have been eliminated. Make tests in the presence of the administrative authority and/or the Owner’s authorized representative.

Upon completion of the systems installation, and prior to acceptance by the Architect and Engineer, make general operating tests to demonstrate that equipment and systems are in proper working order, and are functioning in conformance with the intent of the drawings and specifications. As a part of these tests, open every water outlet to ensure complete system flushing, remove and clean faucet aerators, clean strainers, light pilot lights, and operate every piece of equipment furnished under this contract to demonstrate proper functioning.

Test the drainage and vent system by plugging openings with test plugs, except those at the top of the stacks. Fill the system with water; test results will be satisfactory if the water level remains stationary for not less than one (1) hour. Subject the drainage and vent system to a pressure of at least ten (10) feet of water. If leaks develop, repair them and repeat the test.

Test the domestic water system by filling it with water and then isolating the system from its source. Keep the system closed for a period of twenty-four hours with no fixture being used. The pressure differential for this test period shall not exceed 10 psig. Test water piping to a 125 PSI hydrostatic pressure.

For low pressure natural gas systems, subject the pipe to 10 psig air pressure for a period of one hour. The resultant pressure differential for this period shall be 0 psig. Test per gas company requirements where required.

For welded natural gas systems and systems with an operating pressure in excess of 14” water column, subject the pipe to 60 psig air pressure for a period of one hour. The resultant pressure differential for this period shall be 0 psig. Test per gas company requirements where required.

3. PLUMBING PIPING

A. PIPING MATERIALS

Materials specified or noted on the drawings are subject to the approval of local code authorities. Verify approval before installing any material or joining method.

Domestic Water (Cold, Hot and Hot Water Recirculation): Domestic water piping installed above the floor slab inside the building shall be Type "L" hard temper copper tube with wrought copper fittings and soldered connections made up with 95/5 solder. Brazed mechanically formed tee connections (T-drill) may be used in copper lines where approved by code; connection shall be brazed joints made with AWS A5.8, BAg Silver filler metal.

Underground domestic water piping 2 inch and smaller shall be Type "K" soft temper copper tubing with flared copper alloy fittings and connections, or Type "K" hard temper copper tubing with conventional wrought copper fittings and brazed joints made with AWS A5.8, BAg Silver filler meta. Install as few underground copper piping joints as possible. At building service entrance, no joints shall be installed under or within 5 feet of the building. Install domestic water piping below grade outside building at adequate depth to prevent freezing.

Underground domestic water piping 3 inch and larger shall be class 52 ductile iron meeting the requirements of ANSI / AWWA Standard C151/A21.51. Piping shall be double cement lined in accordance with ANSI / AWWA Standard C104/A21.4. Fittings shall have mechanical joints. At contractor’s option, pipe joints in straight runs (not at fittings) and not installed under or within 5 feet of the building slab may be push-on joints. Joints shall conform to the requirements of ANSI A21.11.

Interior Waste And Vent Below Slab: Waste and vent pipe below slab inside building shall be service weight cast iron soil pipe with hub and spigot fittings with neoprene gasket joints, meeting ASTM A74, manufactured by AB & I Foundry, Charlotte or Tyler pipe and bearing the trademark of the CISPI and NSF. Hubless waste and vent pipe is not permitted below base slab. PVC schedule 40 DWV ASTM D2665 pipe with PVC meeting ASTM D1784, “solid wall” cell class 12454-B with ASTM 2665 socket fittings with solvent weld joints is also permitted where approved by code.

Interior Waste and Vent Above Slab: Waste and vent pipe above slab inside building shall be hubless cast iron soil pipe and fittings, meeting ASTM A888 and CISPI 301, manufactured by AB & I foundry, Charlotte or Tyler pipe and bearing the trademark of the CISPI and NSF.

Interior Storm: Inside building shall be same as specified for interior waste and vent pipe.

Natural Gas Above Slab: Gas piping above ground shall be Schedule 40 black steel with malleable iron screwed fittings for 2” and smaller and Class 150 welded fittings for 2-1/2” and larger.

Connections to Plumbing Fixtures and Equipment: 1-1/4 inch and larger waste connections from fixture traps to cast iron pipe shall be “DWV” copper with wrought copper drainage pattern fittings with copper sweat or compression joints at fixture trap connections and threaded joints at connections to cast iron pipe.

Indirect and Condensate Drain Inside Building: Indirect and condensate drain pipe installed inside the building shall be Type "M" hard copper with wrought copper fittings for 1” and smaller and “DWV” copper with wrought copper drainage pattern fittings for 1-1/4” and larger hard temper copper tube and soldered connections made with 95/5 solder, Schedule 40 PVC pipe and fittings with solvent weld joints where allowed by code. Install cleanouts at elbows greater than 45 degrees.

Indirect And Condensate Drain Outside Building: Indirect and condensate drain pipe installed outside the building above ground shall be ASTM A53 Schedule 40 galvanized steel pipe with galvanized malleable iron fittings. Schedule 40 PVC pipe and fittings with solvent weld joints where allowed by code and approved by Owner.] Terminate at nearest roof drain, gutter or other location as shown drawings. Install cleanouts at elbows greater than 45 degrees.

Sump Pump Discharge: Sump pump discharge piping above grade shall be ASTM A53 Schedule 40 galvanized steel pipe with galvanized malleable iron fittings.

B. PIPING AND EQUIPMENT INSULATION

Provide domestic cold water, hot water, hot water recirculation, condensate drain pipe (within building), interior horizontal storm drain piping, and all storm piping within exterior unconditioned cavity spaces, with one-piece fiberglass insulation with all-service jacket with self-sealing lap to provide a continuous vapor barrier by Certainteed, Owens-Corning or Armstrong. Provide Insulation thickness as follows:

1” thick for cold piping

1” thick for storm piping and overflow storm piping

1” thick for condensate piping

Up to 140F hot water and hot water return piping: 1” thick for 1-1/4” and smaller and 1-1/2” thick for 1-1/2” and larger.

Greater than 140F to 160F hot water and hot water return piping: 1-1/2” thick for 1-1/4” and smaller and 2” thick for 1-1/2” and larger.

Provide 1 inch fiberglass insulation on vent piping within six feet of vent through the roof.

Provide fiberglass insulation on domestic cold and hot water pipes installed in walls and chases.

Roof Drain Bodies: 2 inch one-piece fiberglass covering with fire-resistant jacket with self-sealing lap to provide a continuous vapor barrier, by Certainteed, Owens-Corning or Armstrong.

For hot and cold water piping installed inside masonry units of walls, provide 1/2 inch flexible unicellular insulation by Armacell

For hot piping, provide pipe hangers and riser clamps sized for the outside diameter of piping. Butt insulation to hanger or riser clamp for vertical pipe. Seal exposed insulation with insulation sealer. Exception for Vertical Piping: Provide clamps sized for the outside diameter of the vertical pipe and extend clamp through insulation. Seal penetrations of insulation and vapor barrier with wet coat of vapor barrier lap cement. For 2-1/2” and larger cold piping at hangers, provide 8 inch long sections of high density, high temperature calcium silicate by Johns-Manville, Fiberglass by Knauf or flexible unicellular piping insulation meeting ASTM C 534-01A, Type I with integral high density pipe supports and encased in steel insulation shield by Cooper B-line, Armacell, or approved equal. Insulation shall be continuous along the pipe surface, except at valves, unions, and where piping is exposed at fixtures. For pipes 2 inch and smaller using fiberglass or flexible elastomeric insulation without pre-insulated supports, provide insulation protection shields installed between hanger and pipe which meets the following minimum length requirements:

Pipe Size (NPS)	Insulation Thickness (inches)	Minimum Shield Length, (in) Hanger Spacing, (ft)						
	5	6	7	8	9	10		
	1		3	5	5	-	-	-
Less than 1”	1.5		3	5	5	-	-	-
	1		5	6	8	9	11	11
1-1/4” to	1.5		5	6	8	8	9	9
2” and Less	2		5	5	6	6	8	8

Cover fittings with Zeston, Knauf, or equal one-piece PVC pre-molded insulating covers. Fitting covers, jackets and adhesives shall not exceed flame spread rating of 25 and smoke development rating of 50 per ASTM E84. Fill voids between covers and piping with fiberglass insulation and tape joints at all elbows and tees. Install pipe insulation in compliance with manufacturer's recommendations. Where pre-molded insulating fittings are not approved by the local AHJ, miter insulation at fittings.

C. PIPING JOINTS

Copper Tubing: Joints in hard temper tubing shall be soldered joints using lead-free 95/5 solder except where tubing is installed below grade or below the base slab, in which case joints shall be soldered with silver solder (Sil-Fos). Joints in soft temper copper tubing shall be of the flared type installed in compliance with the fitting manufacturer's recommendations.

Threaded Steel Pipe: Threaded joints shall be full and clean, cut with not more than three (3) threads exposed beyond the fittings. Make joints tight with graphite base pipe joint compound, use joint compound for gas systems for gas piping (joint tape is not accepted).. No caulking, lamp-wick or other material will be permitted for correction of defective joints.

Welded Steel Pipe: Welded joints shall be of the butt welded single "Vee" type. Bevel pipe at a 45 degree angle to within 1/16 inch of the inside wall, and build up the weld to one fourth greater depth than the pipe wall thickness. Welding shall be either electric or oxy-acetylene, performed in conformance with the ASME code for pressure pipe welding, and only by experienced certified welders.

Cast Iron Pipe Below Grade: Joints in bell and spigot cast iron waste and vent pipe shall be neoprene compression gaskets, Tyseal or equal.

Cast Iron Pipe Above Grade: Joints in hubless pipe shall be standard CISPI 310 NSF certified by Anaco, Ideal, Misson or Tyler. Joints in storm piping, including connections to roof drains, shall be heavy duty couplings meeting ASTM C1540 and FM 1680, Anaco Husky #HD-2000, Clamp-All “Hi Torque” 80 in. lb, Ideal Tridon “HD” or Mission “Heavyweight”.

PVC Pipe: Clean joints free from debris and moisture. Apply PVC primer meeting ASTM F656 to each joint. Apply solvent cement meeting ASTM D2564 and make joint while wet and in accordance with ASTM D2855.

Dissimilar Pipes Above Grade: Make connection of new waste pipe to new or existing dissimilar waste pipe using shielded transition couplings meeting ASTM C1460 with neoprene adapter gasket with stainless steel shield and hose clamps, Fernco, Proflex 3000 Series or Mission Flexseal MR56 Series

Dissimilar Pipes Below Grade: Make connection of new waste pipe to new or existing dissimilar waste pipe using shielded adapter couplings meeting ASTM C1173 with neoprene adapter gasket with stainless steel shield and hose clamps, Fernco, 1056 Series or Mission Sewer Couplings.

D. PIPING INSTALLATION

General: Clean pipe thoroughly prior to installation. Ream ends of pipe to remove burrs. Cut pipe accurately to measurements taken on the job. Install with adequate clearance for installation of coverings where required. Pipe shall not be sprung or bent. Neatly align pipe, connect it securely, and support it from the building structure with hangers as specified below. Provide chrome-plated escutcheons on pipes passing through ceilings, floors or walls of finished spaces. Run pipes freely through floor and wall penetrations using pipe sleeves. Do not grout in place unless required for structural fire integrity. Install pipe concealed in finished spaces wherever possible. Use a dielectric union where ferrous and copper pipe connect. Dielectric union shall have a zinc-plated steel body, a threaded nylon insert, and insulating pressure gasket. No ferrous metal-to-copper connection made without insulating unions will be allowed.

Hanger & Supports: Pipe hangers shall be as described in the specifications by B-Line or equal by Anvil, Elite Components, FNW, Michigan, Truscon, or Unistrut. Connect hangers to the structure with side beam connectors and all thread hanger rods. Provide engineered support struts between joists and other structural members as required to provide a rigid hanging installation. Do not hang pipes from other pipes, conduit or ductwork. Provide hanger rods and space hangers at intervals as specified in “hanger spacing”. Provide support within 1 foot of each elbow and tee. Provide supports within 1 foot of each equipment connection. Provide two nuts on threaded supports to securely fasten the support. Install hanger types or supports for various piping as follows:

Copper Tube: Adjustable band hangers for bare copper tube 3 inches and smaller shall be B-Line #B3170 CT copper plated adjustable band swivel ring type. Adjustable band hangers for insulated copper tube 3 inches and smaller shall be B-Line #B3170 NF adjustable band swivel ring type. Clevis hangers for insulated copper tube 4 inches and larger shall be B-Line #B3100 galvanized steel clevis type. Support exposed copper tube 2 inches and smaller to walls or in chases with B-Line #B3198RCT copper coated extension split ring pipe clamps, 3/8 inch threaded rod and B-Line #B3199CT ceiling flanges. Support copper tube in chases and walls at plumbing fixtures with plastic or copper brackets secured to structure and U-bolts sized to bare on the pipe. Riser clamps to support vertical copper tube shall be B-Line #B3373CT copper coated steel, cut insulation, seal vapor barrier, and attach to bare tube.

Steel Pipe: Adjustable band hangers for 2 inch and smaller shall be B-Line #B3170 NF adjustable band swivel ring type. Clevis hangers for 2-1/2 inch and larger shall be B-Line #B3100 galvanized steel clevis type. Riser clamps to support vertical pipe shall be B-Line #B3373 galvanized steel.

Cast Iron Pipe: Adjustable band hangers for 2 inch and smaller. Clevis hangers for 3 inch and larger shall be B-Line #B3100 galvanized steel clevis type. Riser clamps to support vertical pipe shall be B-Line #B3373 galvanized steel.

Insulation Protection Shields: B-Line #B3151 of 18 gauge galvanized sheet metal. Shield shall cover half of the circumference of the pipe and shall be of length indicated by manufacturer for pipe size and thickness of insulation.

Hanger Spacing, Rod Sizes & Connectors: Connect rods to steel beams or joists with B-Line #B3031 or #B3033 beam clamps as required. Connect rods to concrete with B-Line #3014 malleable iron single type inserts with malleable iron nut. Connect rods in wood construction with B-Line #B3058 side beam connectors. Hang and support piping with spacing and rod sizes as follows:

Copper Tube: 1-1/2 inch and smaller - every 6 feet with 3/8 inch hanger rods; 2 inch - every 10 feet with 3/8inch hanger rods; 2-1/2 inch - every 10 feet with 3/8 inch hanger rods; 3 inch - every 10 feet with 1/2 inch rods, 4 inch - every 10 feet with 5/8 inch hanger rods. Support vertical copper tube every 10 feet.

Steel Pipe: 1 inch and smaller - every 8 feet with 3/8 inch hanger rods; 1-1/4 inch through 2 inch - every 10 feet with 3/8 inch hanger rods; 2-1/2 inch and 3 inch - every 10 feet with 1/2 inch hanger rods, 4 inch - every 10 feet with 5/8 inch hanger rods. Support vertical steel pipe every 10 feet.

Cast Iron Pipe: Every 10 feet and within 1 foot of each joint. 2 inch and smaller with 3/8 inch hanger rods; 3 inch with 1/2 inch hanger rods; 4 inch with 5/8 inch hanger rods; 6 inch with 3/4 inch hanger rods; 8 inch and larger with 7/8 inch hanger rods. Support vertical cast iron pipe every 15 feet.

Supports on Roof: Support piping on roof with pre-engineered roof pipe supports manufactured by B-line, Erico, FNW, Miro or Portable Pipe Hangers: 4 inch x 4 inch x 12 inch long closed cell polyethylene blocks with embedded pre-engineered support strut or pre-engineered support struts with factory plastic bases. Two piece straps shall be captivated at the shoulder when attachment nut is tightened and designed for use with strut system. All nuts, brackets and clamps shall have the same finish as the channels. Support pipe with spacing as described above at a minimum 7 inches above the roof. Set supports on 18 inch x 18 inch x 3/16 inch thick roof walkway material compatible with actual roof material.

Below Ground Installation for Soil, Waste, and Storm: Install soil and waste piping to a uniform slope of not less than 1/8 inch per foot for piping 4 inch or larger, and not less than 1/4 inch per foot for piping 3 inch or smaller. Slope storm piping at 1/8 inch per foot. Lay pipe at uniform slope, free from sags, with hub end upstream. Make changes in direction from horizontal to vertical, at fixture branches and other branch connections with sanitary "tees" or short sweep "ells". Make changes in direction from vertical to horizontal or horizontal to horizontal with long radius fittings, long sweeping "ells", combination “Y and 1/8 bend” fittings, or 45 degree "ells" (1/8 bend fittings), 1/6 bend or 1/16 bend and "Y" fittings. Install pipe with the barrel of the pipe on firm, solid earth for its entire length, and excavate holes for the pipe bells. Lay pipe in a straight line and install with uniform grade to line with batten boards set not more than 24’-0" apart. Close open ends of pipe with a stopper when pipe laying is not in progress. Center spigots accurately in bells for uniform caulking. Provide a smooth and uniform invert in the system. Drilling or tapping of soil and waste lines, and saddle hubs and bands are not permitted. Locate and install soil and waste lines as indicated on the drawings. Determine exact locations in such a manner as to maintain proper clearance. Prior to installation of any building drain pipe, verify elevation of connection point of existing sewer, service line or existing tenant connections indicated on the drawings. If the installation will not tie into the indicated invert elevation point while maintaining proper fall, notify Architect so that an alternative may be determined.

Above Ground Installation for Soil, Waste, and Storm: Install soil and waste piping to a uniform slope of not less than 1/8 inch per foot for piping 4 inch or larger, and not less than 1/4 inch per foot for piping 3 inch or smaller. Slope storm piping at 1/8 inch per foot. Lay pipe at uniform slope free from sags. Support pipe within 12 inches of each joint. Make changes in direction from horizontal to vertical, at fixture branches and other branch connections with sanitary "tees" or short sweep "ells". Make changes in direction from vertical to horizontal or horizontal to horizontal with long radius fittings, long sweeping "ells", combination “Y and 1/8 bend” fittings, or 45 degree "ells" (1/8 bend fittings), 1/6 bend or 1/16 bend and "Y" fittings. Provide a smooth and uniform invert in the system. Drilling or tapping of soil and waste lines, and saddle hubs and bands are not permitted. Locate and install soil and waste lines as indicated on the drawings. Determine exact locations in such a manner as to maintain proper clearance.

Plumbing Vent: Connect plumbing vent pipes to fixture drain pipes as indicated on the drawings or as required by the installation practices adopted and enforced by local codes official, and extend vent pipes full size through the roof line. Grade pipe to a uniform slope so as to drain back by gravity to the drainage piping system. Vents passing through the roof shall be minimum 3 inch size except in tropical climates. Turn flashing down into stacks at least 2 inches, and extend flashing 24 inches in all directions from the pipe at the roof line. Vent lines shall be air and water tight.

Domestic Water: Arrange cold, hot, and hot water recirculation piping to drain at the lowest point in each system. Install at least one pipe union adjacent to all shutoff valves, at connection points of each piece of equipment, and elsewhere in the system where required to allow proper maintenance. Provide unions of the ground joint type. Make allowance for expansion and contraction where required by the installation. Where water piping occurs in exterior walls, hold pipe as close as possible to the interior face of wall and install insulation batt or other insulation (minimum R-8) between piping and the exterior wall face.

Natural Gas: Pitch natural gas piping and provide accessible dirt legs at the low points. Take branch pipes off the top or sides of main pipes to prevent accumulation of water in the branches. Install gas piping valves and unions only in accessible locations. Do not install gas pipe below the base slab.

E. PIPING SANITIZATION

Sanitize the entire domestic water piping system (cold, hot, and hot water return) with a solution containing not less than 50 ppm available chlorine. Keep solution in the system for a minimum of 24 hours, with each valve being operated several times during the period. After completion, flush system with city water until chlorine residual is lowered to incoming city water level.

F. PIPE AND VALVE MARKERS

Provide manufacturer's standard pre-printed, semi-rigid snap-on or permanent adhesive, pressure-sensitive vinyl pipe markers. Pipe markers shall be color-coded complying with ANSA A13.1.

Install pipe markers on each plumbing piping system and include arrows to show normal direction of flow.

Locate pipe markers and color bands wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.

Provide plastic laminate or brass valve tag on every valve, cock and control device in each plumbing piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibbs, and shut-off valves at plumbing fixtures and similar rough-in connections of end-use fixtures and units.

4. PLUMBING SPECIALTIES

A. WATER HAMMER ARRESTORS AND TRAPS

Provide water hammer arrestors at valves or batteries of fixtures as indicated on the drawings to prevent water hammer. Arrestors shall be Josam, Sioux Chief, Smith, Precision Plumbing Products, Proflo, Wade, Watts, or Zurn, stainless steel bellows type, or O-ring sealed and lubricated acetal piston. Install water hammer arrestors per the Plumbing and Drainage Institute (PDI) WH-201 installation instructions. Installation of arrestors at batteries of fixtures precludes the requirement for individual air chambers at each battery fixture. Submit certification that water hammer arrestors comply with NSF 61 Annex G and/or NSF 372.

Provide water-seal traps on floor drains, fixtures and equipment with drain connections, including traps not furnished in combination with fixtures and equipment. Place trap as close to the fixture or drain as possible. Exposed traps in finished spaces shall be chrome-plated brass.

Provide conventional "P" type trap, water-sealed self-cleaning design. Full "S" traps or trap standards shall be used only where specifically called for on the drawings or elsewhere in this specification. Trap water seals shall not be less than 2 inches, and deep seal traps shall be provided where specified or indicated. Each trap not integral with the fixture or floor drain or installed below the base slab shall be provided with an accessible cleanout of adequate size. Provide trap primers where required by code and where indicated on the drawings.

B. CLEANOUTS, FLOOR DRAINS AND ROOF DRAINS

Cleanouts, floor drains and roof drains shall be by one manufacturer if possible. Acceptable manufacturers are Josam, MIFAB, Sioux Chief, Smith, Wade, Watts, and Zurn. Provide long sweep fittings for cleanout extensions; short sweeps at start of runs or change in direction and combination wye and eight bend fittings in horizontal runs. Install cleanouts with a minimum of 18 inches clear all around, consult local codes for other requirements, for easy system maintenance. Install plug with Teflon joint compound.

Floor Drains: As scheduled on the drawings.

Floor Cleanouts: As scheduled on the drawings. Install cleanouts at points as noted on the drawings, at the building exit; at a minimum of every 50 feet in horizontal soil and waste lines; and at turns of pipe greater than 45 degrees cleanouts shall be full size of the pipe up to 4 inches, and 4 inch size for pipes larger than 4 inches. Determine the type of floor covering to be used at each floor cleanout location and provide top with variations suitable for floor covering (carpet markers, recessed for tile and scoriated for unfinished floor). Rough-in and install each floor cleanout flush with the finished floor construction.

Wall Cleanouts: As scheduled on the drawings. Install wall cleanouts at points as noted on the drawings; at the foot of each soil, waste or interior downspout stack; at horizontal soil and waste branches longer than five feet not served by a floor cleanout; consult local codes for installation at specific fixture types. Install wall cleanouts above the flood rim of the fixture served within four feet of the floor and install extensions from the cleanout tee to the wall to locate the plug within 2 inch of the wall where required. Install cleanouts on urinals and sinks where required by code.

Roof Drains: As scheduled on the drawings. Provide with roof sump receiver, extension, secondary flashing clamps and underdeck clamp as required; provide expansion joints where required. Provide overflow roof drains where indicated on the drawings with inlet flow line 2 inches above the primary roof drain inlet.

C. VALVES, STRAINERS, HOSE BIBBS, AND UNIONS

Plumbing system valves shall be designed for 125 psi steam working pressure and 200 psi cold water pressure. Install valves on the hot and cold water lines at the water heater connections and other items of equipment, at branches from mains serving groups of fixtures, and at other places indicated or required by the installation to allow ease of future maintenance. Submit certification that valves, fittings and specialties comply with NSF 61 Annex G and / or NSF 372. Except for the following: Hose bibbs, hydrants, backflow preventers isolating irrigation or mechanical make-up systems, emergency mixing valves and trap primers.

Gate Valves 2 inch and Smaller: Class 125, rising stem, soldered lead free cast bronze body and parts, sweat ends, with wedge disc. By Apollo # 102S-LF, Hammond # UP-668, Milwaukee # UP668 or Nibco # S-113-LF

Gate Valves 2-1/2 inch and Larger: Class 125, non-rising stem, iron body flanged wedge gate with brass seats and stem by Apollo # 611, Hammond IR # 1138, Milwaukee # F-2882 or Nibco #619.

Ball Valves 2 inch and Smaller (may be used in lieu of gate valves up to 2 inch): Class 150, two piece lead free cast bronze body, with sweat ends, chrome plated bronze ball with conventional port, 600 psi, blow-out proof stem by Apollo # 70-LF-200, Hammond # UP8501, Milwaukee # UPBA-150.

Swing Check Valves 2 inch and Smaller: Class 125, lead free cast bronze body and with sweat ends by Apollo # 163S-LF, Milwaukee #UP-1509, or Nibco # S-413-Y-LF. Install in horizontal pipe runs.

Lift Check Valves 2 inch and Smaller: Class 125, lead free cast bronze body, stainless steel spring and with sweat ends by Hammond # LP-947 or Nibco # S-413-Y-LF. Install in vertical pipe or in horizontal runs where required.

Gas Cocks 2 inch and Smaller: Lubricated type with semi-steel body and full area rectangular port with screwed ends by Homestead # 601, Milliken #200M or RM Energy Systems # D125.

Point of Use Thermostatic Mixing Valves: Thermostatic mixing valves shall be Powers as scheduled on the drawings by Powers or equal by Acorn Engineering Co., Cash ACME or Leonard meeting ASSE 1070 with lead free brass body, non-corrosive internal parts, tamper resistant temperature adjustment, union inlets and check stops with strainers. Install valve at public lavatories and handwashing sink locations in accessible location. Set temperature as scheduled on the drawings.

Gas Line Pressure Regulators: Gas line pressure regulators shall be CSA listed by Karl Dungs, Maxitrol or Pietro-Fiorentini with capacities as scheduled on the drawings. Regulators shall be single stage, steel jacketed, corrosion-resistant type with interstitial relief valve with atmospheric vent, vent limiter for indoor installation, elevation compensator; with threaded ends, for inlet and outlet. Install with regulator dome vertically upright and level with listed vent factory vent limiter. Install gas pressure regulators located outside the building with the relief port facing down to prevent the entry of rainwater with the relief port a minimum of 18” above the roof or finish grade. Remove vent limiter and provide with line size (same size as gas vent relief port) insect screen or gas relief vent and 1” long schedule 40 black steel nipple. Where manufacturer does not allow the gas pressure regulator to be installed upside down, install gas pressure regulator with regulator dome horizontal or vertically upright with factory breather plug.

Insect Screens: Black steel body with 20 mesh stainless steel screen and MNPT end by Northtown Pipe Protection Products “BUGSCRN Series”.

Strainers: Strainers 2 inch and smaller shall be Watts #LFS777SI with lead free cast bronze body and soldered ends, brass cap and Monel 40 mesh screen. Strainers 2-1/2 inch and larger shall be Watts #77F-DI-FDA-125 with flanged iron body with fused FDA epoxy coating, bolted iron cap and stainless steel screen with 1/16 inch perforations. Strainers size 2-1/2 inch and larger shall have a 1 inch blow-off line with a 1 inch gate valve connected to the blow-off connection and shall be extended to the nearest floor drain.

Drain Valves and Interior Hose Bibbs: As specified on the drawings by Prier or equal by Woodford or Watts.

Exposed Interior Hose Bibbs: As specified on the drawings by Chicago or equal by Speakman, T&S Brass or Zurn.

Wall Hydrants: As specified on the drawings by Prier or equal Woodford, Josam, Prier, Wade, Watts or Zurn. Provide accessible shutoff valve and water hammer arrestor inside building.

Sanitary Post Hydrants: As specified on the drawings by Hoeptner or equal by Woodford.

Sanitary Roof Hydrants: As scheduled on the drawings by MAPA with no substitutions accepted.

Unions: Ferrous unions shall be Crane or equal, combination iron and brass, ground joint with screwed ends. Copper unions shall be streamline or equal, cast bronze sweat type with ground joint. Ferrous to copper unions shall be universal controls or equal, dielectric type with threaded nylon insert.

Pressure Reducing Valves: Self contained type shall be of the type as scheduled and indicated on the drawings by Watts or equal by Cash-ACME or Wilkins.

Backflow Preventers: Shall be of the type as scheduled and indicated on the drawings by Watts, Conbraco, Febco or Wilkins.

D. WATER SERVICE ENTRANCE: PRESSURE REDUCING VALVE AND BACKFLOW PREVENTER

Provide a backflow preventer (BFP) of type required by local code, and a pressure reducing valve (PRV) if required by water pressure greater than 80 psi, on the domestic water service immediately downstream of the backflow preventer at the water service entry. Set the pressure reducing valve as indicated on the drawings. Provide a pressure gauge and hose bibb with isolation valve down stream of the backflow preventer and / or PRV for system drain down.

For water services 3 inch and larger, provide ductile iron pipe and fittings from five feet outside the building to 12 inches above the floor. Provide a shutoff valve at 12 inches above the floor. Provide a PVC sleeve two pipe sizes larger than the water pipe served and seal with caulk.

E. SYSTEM ACCESSORIES

Thermometers shall be American 3 inch bi-metal dial type with separable socket, and shall be installed where indicated or required.

Pressure gauges shall be Ashcroft 3 inch dial type with shut-off cock, and shall be installed where indicated or required.

Provide trap primers where required by local authorities. Trap primers shall be as specified on the drawings, Precision Plumbing Products “Prime Rite” or equal by Mifab or Sioux Chief with brass body and integral vacuum breaker. Provide distribution box where more than one trap is indicated to be primed on the drawings. Provide access panel where required.

Trap seals shall be by Proset systems or equal by Mifab, Smith, Sure Seal Systems or Zurn of molded PVC elastomer that allows the flow of waste water and closes upon termination of flow. Install per manufacturer’s installation instructions. Do not touch elastomeric plug or allow contact with primer or solvent cement. Or, shall be by Sure Seal, Inc. of smooth, soft, flexible, elastomeric PVC material with a flapper closure. The flow of wastewater allows flapper to open and adequately discharge to floor drain through its interior. The flapper closes and returns to original molded shape after wastewater discharge is complete.

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
JOSHUA N. HOVER
NUMBER PE-2017008503
PROFESSIONAL ENGINEER

Oct 25 2019
JOSHUA N. HOVER
LICENSE # PE-2017008503

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

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MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

PLUMBING SPECIFICATIONS

SHEET NUMBER

P701

JOSHUA N. HOVER

5. PLUMBING FIXTURES AND EQUIPMENT

A. PLUMBING FIXTURES

Furnish and install commercial grade plumbing fixtures, see the drawings for quantities and descriptions. Provide china fixtures as scheduled by American-Standard or approved equal by Gerber, Kohler, PROFLO, Sloan Valve Co, Toto-Kiki or Zurn. Provide stainless steel sinks as scheduled by Elkay or equal by Just. Provide electric water coolers as scheduled by Elkay or approved equal by Acorn / Aqua, Halsey Taylor or Haws. Provide mop sinks as scheduled by Stern-Williams or equal by Acorn Engineering Co., Fiat or Florestone. Provide emergency equipment as scheduled by Bradley or equal by Chicago, Encon, Guardian, Haws or Speakman. Provide fixtures of same manufacturer where possible.

Fixtures shown on the drawings or specified herein shall be furnished and installed, set firm and true, connected to required piping services, thoroughly cleaned, left clean and ready for use. Exposed fittings and piping at the fixtures shall be chrome-plated, and water supply piping shall be valved at each fixture.

Vitreous china fixtures shall be of the best grade vitreous ware, without pit holes or blemishes, and the outlines shall be generally true. The engineer reserves the right to reject any pieces which, in his opinion, are faulty. Fixtures set against walls shall have ground backs and shall be caulked with silicone sealant of a matching color.

B. PLUMBING FIXTURE TRIM

Submit certification that faucets and trim comply with NSF 61 Annex G and / or NSF 372. Except for the following: Faucets not used for drinking water or cooking, shower valves and heads or flush valves.

Fixture trim shall have the manufacturer's name stamped clearly and visibly on each item.

Fixture P-traps shall be 17 gauge brass body with cleanout, 17 gauge seamless tubular wall bend with cast brass slip nut, shallow steel flange, all chrome plated by McGuire, Brass Craft, Dearborn Brass, EBC, Proflo, Watts Brass and Tubular or Zurn.

Lavatory and water closet supplies shall be solid brass angle or straight type with full turn brass stem, wheel handle, or loose key types as noted on drawings, shallow steel flange, 3/8 inch copper riser flange, all chrome plated, final connection as required by McGuire, Brass Craft, EBC, Proflo or Zurn.

Provide diaphragm type flush valves as specified on drawings: Sloan or equal by Delaney or Zurn

Provide Smith, Josam, Wade, Watts, or Zurn chair carriers for mounting wall mounted water closets and lavatories as described on the drawings. Securely fasten carriers to floor and test per manufacturer's recommendations prior to installation of partitions. Secure wall-mounted water closet carriers to floor with 3/8 inch anchor bolts, including the anchor foot. Secure lavatory chair carriers to floor with 1/2 inch anchor bolts.

C. WATER HEATER

Water heater shall be by A.O. Smith, Bradford-White, Lochinvar, State, HTP, Rheem or Ruud with capacity as scheduled on the drawings. Unit shall be electric glass-lined tank type complete with steel jacket, fiberglass insulation, magnesium anode, integral thermostats and controls, and temperature & pressure relief valve. Water heater shall be UL listed and meet ASHRAE 90.1B standards for thermal efficiency and standby heat loss.

Temperature and Pressure Relief Valve: lead free brass body meeting ANSI Z21.22. The temperature shall be normally set to relieve at 210 F and the pressure relief shall be equal to the tank pressure rating . Install line size relief valve discharge line to discharge to an approved receptor with air gap.

Vacuum Relief Valve: Lead free brass body meeting ANSI Z21.22 with silicon disc. Valve shall open at 0.5 inches HG vacuum and be rated for 200 psig working pressure and 250 F operating temperature by Apollo #37, Cash ACME #VR801, Watts #N36 or Wilkins #VR-10. Install in cold water supply to each water heater downstream of the shutoff and check valves.

Recirculation Pump: By B&G as scheduled on the drawings, or equal by Armstrong, Grundfos or Taco, of all bronze construction with Aquastat and/or timer.

Expansion Tank: Expansion tank shall be Amtrol "Therm-X-Trol" as scheduled on the drawings or equal by Armstrong, Bell & Gossett, Proflo, Taco, or Watts. Unit shall be constructed of welded carbon steel listed for 150 psig working pressure, with a FDA approved butyl rubber diaphragm, taps for pressure gage, air charging fitting, and drain fitting. Support as detailed on the drawings. Charge tank with air pressure equal to the static water pressure.

D. ELEVATOR SUMP PUMP AND HIGH LEVEL ALARM

Sump pumps shall be Weil Pump Company as scheduled on the drawings or equal by ABS Pump or Flygt simplex, vertical, centrifugal, direct connected, air filled motor, end suction, single stage, cast iron body, stainless steel shaft, cast iron impeller, mechanical seal, permanently lubricated upper and lower ball bearings complete with integral inlet strainer, mechanical float switch, and power cord with ground.

Oil Sensing Sump Pump Alarm Panel shall be remote type 120V NEMA 3R panel, oil and water sensor, power cord, receptacle for pump power cord, 85 bd alarm horn, oil present alarm light, water present alarm light, silence switch, test switch and alarm contacts for each alarm condition by Weil Pump Company or SeeWater, Inc.

2. COMMISSIONING

Provide commissioning that verifies and documents the commissioned building systems have been designed, installed, and function according to the owner's project requirements, construction documents, and to minimum code requirements. Retain the services of a third-party registered design professional or approved agency that is regularly engaged in conducting commissioning to develop a commissioning plan, supporting documentation, and reports. Refer to the latest adopted edition of the applicable energy code for more information. Complete all related commissioning requirements prior to final inspections. Submit final TAB report and final commissioning report to the Engineer and Owner within 90 days of the date of receipt of the certificate of occupancy.

ASHRAE 90.1 Commissioning Requirements: Test control systems to ensure the control elements are calibrated, adjusted, and in proper working condition. Commission systems according to ASHRAE Guideline 1.1 "HVAC&R Technical Requirements for the Commissioning Process", most current edition.

IECC Commissioning Requirements: Provide commissioning of all service water heating systems included in the scope of work.

Commissioning plan shall include the following:

1. Narrative description of activities and personnel required during commissioning.
2. List of equipment and systems to be tested with description of tests to be performed.
3. List of functions to be tested, including calibration and economizer controls.
4. List of conditions under which the tests shall be performed.
5. List of measurable criteria for performance.

Submit a copy of the preliminary commissioning report to the AHJ. Preliminary commissioning report shall include the following:

1. Results of preliminary functional performance tests. Organize equipment and components specified by other Divisions in separate sections for independent review.
2. List of functional performance testing procedures used during commissioning, including measurable criteria for test acceptance.
3. Completed Commissioning Compliance Checklist. Refer to energy code for the form.
4. Itemization of deficiencies found during testing that have not been corrected at the time of preliminary commissioning report preparation.
5. List of deferred tests that cannot be performed at the time of preliminary commissioning report preparation because of climatic conditions.
6. List of climatic conditions required for the performance of the deferred tests.

Final commissioning report shall include the following:

6.
1. Results of final functional performance tests. Organize equipment and components specified by other Divisions in separate sections for independent review.
2. List of functional performance testing procedures used during commissioning, including measurable criteria for test acceptance.
3. Itemization of resolved deficiencies found during preliminary commissioning.
4. List of deferred tests that cannot be performed at the time of final commissioning report preparation because of climatic conditions.

Conduct functional performance tests on equipment, controls, and economizers. Functional performance tests shall demonstrate the following:

1. The operation, function, and maintenance serviceability for each commissioned equipment, component, and system is confirmed according to the approved plans and specifications.
2. The sequence of operations, including modes, backup modes (if applicable), alarms, and mode of operation upon a loss of power and restoration of power for each control device, equipment, component, and system.
3. Control devices, components, equipment, and systems are calibrated, adjusted, and operate in accordance with the approved plans and specifications.
4. Air economizers operated in accordance with manufacturer's specifications and specified sequence of operation.

END OF SECTION 22

JOSHUA N. HOVER

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
JOSHUA N. HOVER
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PROFESSIONAL ENGINEER

Oct 25 2019
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PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

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MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

PLUMBING SPECIFICATIONS

SHEET NUMBER

P702

SPECIAL SYSTEMS SUPPLEMENTAL SPECIFICATIONS:

1. PROVIDE NECESSARY BOXES, CONDUIT AND MAKE FINAL CONNECTIONS TO TEMPERATURE CONTROL DEVICES PER MANUFACTURER'S RECOMMENDATIONS. THIS INCLUDES BUT IS NOT LIMITED TO: MAIN CONTROL PANELS, THERMOSTATS, HUMIDISTATS, AC SOLENOIDS, HEAT RECLAIM WIRING, AHU CONTROL WIRING, DUCT FURNACE CONTROL WIRING, TIMERS, AND SIMILAR CONTROLS. PROVIDE CONDUIT FOR ALL WIRING WITHIN WALLS. PROVIDE CONTROL AND INTERLOCK WIRING WHEN NOT PROVIDED BY OTHER TRADES. COORDINATE REQUIREMENTS WITH EQUIPMENT SUPPLIERS AND OTHER TRADES PRIOR TO ROUGH-IN.
2. PROVIDE LINE VOLTAGE WIRING AND MAKE FINAL CONNECTIONS TO ALL DUCT-MOUNTED SMOKE DETECTORS, FIRE/SMOKE AND SMOKE DAMPERS WHERE APPLICABLE. COORDINATE REQUIREMENTS WITH OTHER TRADES PRIOR TO INSTALLATION.
3. DEVICES MOUNTED ON ACOUSTICAL TILE CEILINGS SHALL BE CENTERED ON THE TILE, UNO.
4. PROVIDE BOX AND 3/4" CONDUIT FROM EACH THERMOSTAT LOCATION TO MECHANICAL EQUIPMENT, (FLUSH MOUNT BOX WHEREVER PRACTICABLE). COORDINATE LOCATION OF ALL THERMOSTAT BOXES WITH MECHANICAL/CONTROLS CONTRACTOR AND OWNER PRIOR TO ROUGH-IN.
5. PROVIDE BOXES AND CONDUITS FOR THE FIRE PROTECTION SYSTEM LOW VOLTAGE WIRING AS REQUIRED. THIS INCLUDES EXPOSED WIRING LESS THAN 96" AFF. AT A MINIMUM, PROVIDE 3/4" CONDUIT, UNLESS NOTED OTHERWISE. COORDINATE REQUIREMENTS AND LOCATIONS WITH SYSTEM INSTALLER AND FIRE ALARM SPECIFICATIONS.
6. AT A MINIMUM, PROVIDE EXTRA DEEP, DOUBLE GANG COMMUNICATION OUTLET BOXES, (FLUSH MOUNTED WHEREVER PRACTICABLE), WITH SINGLE-GANG PLASTER RING AND 1" CONDUIT STUBBED-UP CONCEALED TO ACCESSIBLE CEILING SPACE, UNLESS NOTED OTHERWISE. PROVIDE SURFACE MOUNTED DATA BOXES WITHIN CABINETRY, AND SELECT OTHER LOCATIONS AS INDICATED ON THE DRAWINGS. COORDINATE TELEPHONE/DATA BOX AND CONDUIT LOCATIONS AND SIZES WITH OWNER AND OTHER TRADES PRIOR TO ROUGH-IN.
7. PROVIDE NYLON BUSHINGS FOR ALL COMMUNICATIONS AND LOW VOLTAGE WIRING CONDUITS AND SLEEVES, UNLESS NOTED OTHERWISE.
8. ALL COMMUNICATIONS AND LOW VOLTAGE WIRING CONDUIT SHALL BE INSTALLED WITH AN ACCESSIBLE PULLBOX BETWEEN EVERY 180 DEGREE CHANGE IN DIRECTION AND AT 100' INTERVALS OF CONTINUOUS RUNS.
9. MINIMUM BEND RADIUS FOR COMMUNICATIONS CONDUIT IS 6 TIMES THE INSIDE DIAMETER FOR CONDUITS 2" IN DIAMETER AND SMALLER AND 10 TIMES THE INSIDE DIAMETER FOR CONDUITS GREATER THAN 2" IN DIAMETER, UNLESS NOTED OTHERWISE.
10. LOW VOLTAGE COMMUNICATION, ENERGY MANAGEMENT, SOUND SYSTEM, SECURITY AND RELATED WIRING IS TO BE PERFORMED BY OTHERS UNDER A SEPARATE CONTRACT, UNLESS NOTED OTHERWISE. PROVIDE BOXES AND CONDUIT IN FINISHED AND RATED FLOORS/WALLS/CEILINGS TO ACCESSIBLE LOCATIONS FOR ALL LOW VOLTAGE WIRING. PROVIDE ALL LINE VOLTAGE CIRCUITRY (120V AND HIGHER) TO OWNER FURNISHED EQUIPMENT AND LOW VOLTAGE STEP-DOWN TRANSFORMERS AS REQUIRED. COORDINATE ELECTRICAL REQUIREMENTS AND LOCATIONS WITH SYSTEM INSTALLER AND OWNER.
11. ALL LOW VOLTAGE CLASS 2 OR 3 WIRING NOT IN CONDUIT SHALL BE PLENUM RATED WHERE APPLICABLE.
12. LOW VOLTAGE CABLE SHEATH LABELS AND RELATED MANUFACTURER INFO SHALL REMAIN APPARENT IN ALL EXPOSED APPLICATIONS. PROTECT ALL EXPOSED CABLING FROM PAINTING AND OVERSPRAY (INCLUDES CABLE NOT ROUTED IN CONDUIT AND THAT IS IN CABLE TRAY).
13. CABLES SHALL BE ROUTED THROUGH THE BUILDING CABLE TRAY/RACEWAY SYSTEM, UNLESS NOTED OTHERWISE. EXPOSED CABLING SHALL NOT BE ROUTED IN AREAS EXPOSED TO STRUCTURE UNLESS SPECIFICALLY PERMITTED BY THE OWNER. IN AREAS WHERE EXPOSED CABLES ARE ALLOWED, IT SHALL BE INSTALLED IN A NEAT AND WORKMAN LIKE MANNER IN ACCORDANCE WITH THE OWNER'S REQUIREMENTS. WHERE REQUIRED, PROVIDE CONDUIT TO ROUTE LOW VOLTAGE CABLING TO THE CABLE TRAY OR NEAREST ACCESSIBLE CEILING SPACE.
14. CONDUITS FOR COMMUNICATIONS OUTLETS SERVING ELEVATOR EQUIPMENT ROOMS, FACP, AND SIMILAR CRITICAL EQUIPMENT AS DESIGNATED BY THE OWNER SHALL BE CONTINUOUS ("HOMERUN") FROM OUTLET TO SERVING COMMUNICATIONS ROOM.

ELECTRICAL SUPPLEMENTAL SPECIFICATIONS:

1. PRIOR TO SUBMITTING BID, VISIT THE JOB SITE AND BECOME FULLY ACQUAINTED WITH THE EXISTING CONDITIONS. AS APPLICABLE, REVIEW THE LANDLORD CRITERIA, GENERAL NOTES, OTHER TRADE DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS THAT MAY NOT BE CALLED OUT IN THIS PORTION OF THE CONSTRUCTION DOCUMENTS. NOTIFY ARCHITECT AND ENGINEER OF ANY CONFLICTS OR DISCREPANCIES PRIOR TO SUBMITTING BID.
2. ALL WORK SHALL CONFORM TO ALL LOCAL CODES AND ORDINANCES AS WELL AS APPLICABLE INDUSTRY STANDARDS. ALL EQUIPMENT SHALL BEAR LABELS FOR THE USE INTENDED BY AN AHJ ACCEPTED NATIONALLY RECOGNIZED TESTING LABORATORY (NRTL), SUCH AS UL OR ETL. THE FINAL ELECTRICAL INSTALLATION OF THE FACILITY OCCUPIED BY OWNER SHALL BE FREE FROM ELECTRICAL DEFECTS TO THE SATISFACTION OF THE AHJ, OWNER, ARCHITECT AND ENGINEER.
3. COORDINATE FINAL LOCATION AND INSTALLATION REQUIREMENTS OF ALL LIGHT FIXTURES, ELECTRICAL EQUIPMENT AND ELECTRICAL DEVICES WITH ARCHITECTURAL DRAWINGS, EXISTING CONDITIONS AND OTHER TRADES PRIOR TO ROUGH-IN. PROVIDE ALL NECESSARY DEVICES, CORDS, PLUGS, DISCONNECTS AND FINAL CONNECTIONS TO ELECTRICAL EQUIPMENT FOR PROPER OPERATION IN ACCORDANCE WITH CODE, OWNER AND MANUFACTURER REQUIREMENTS.
4. ELECTRICAL DRAWINGS ARE DIAGRAMMATIC/SCHEMATIC IN NATURE AND REPRESENT THE GENERAL SCOPE OF WORK. IT IS NOT WITHIN THE SCOPE OF THE ELECTRICAL DRAWINGS TO SHOW ALL NECESSARY RACEWAY ROUTING, BENDS, OFFSETS, PULL BOXES AND OBSTRUCTIONS. CONTRACTOR SHALL COORDINATE THE FINAL LOCATION OF EQUIPMENT AND WIRING DEVICES WITH OTHER TRADES PRIOR TO INSTALLATION AND INSTALL ALL WORK TO CONFORM TO THE OWNER REQUIREMENTS.
5. ALL CONDUCTOR AND CONDUIT LENGTHS SHOWN IN THESE DESIGN DOCUMENTS ARE INTENDED SOLELY FOR USE IN THE DESIGN CALCULATIONS BY THE DESIGN PROFESSIONAL, UNLESS NOTED OTHERWISE. LENGTHS SHOWN SHALL NOT BE USED TO ASSIST IN THE BIDDING TAKEOFF PROCESS. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR THE MATERIAL QUANTITIES REQUIRED TO BID AND CONSTRUCT THE COMPLETE PROJECT.
6. PROVIDE PROPER FIRE PROOFING AND SEALANT FOR PENETRATIONS THROUGH FIRE RATED ASSEMBLIES. THE FIRE STOPPING METHOD, MATERIAL AND ITS APPLICATION SHALL BE NRTL LISTED, CODE COMPLIANT AND APPROVED BY AHJ.
7. FOR CAST-IN-PLACE CONCRETE, TILT-UP WALLS, PRECAST OR SIMILAR PRE-ENGINEERED WALL SYSTEMS: COORDINATE THE FINAL LOCATION OF ALL ELECTRICAL DEVICES, RACEWAYS, LIGHT FIXTURES AND PENETRATIONS WITH ARCHITECT, WALL SUPPLIER AND OTHER TRADES PRIOR TO WALL CONSTRUCTION. CONDUIT/RACEWAY IMBEDDED IN CONCRETE WALLS SHALL BE SCHEDULE 80 PVC OR LFMC; OTHER TYPES MAY BE ALLOWED IF APPROVED BY WALL SYSTEM MANUFACTURER AND ENGINEER.
8. WHEN CONCRETE TRENCHING/CORING IS REQUIRED, THE METHODS, DEPTHS, AND LOCATIONS SHALL BE PRE-APPROVED BY LANDLORD, ARCHITECT, AND STRUCTURAL ENGINEER PRIOR TO THE START OF WORK. X-RAY SLAB AS NECESSARY TO AVOID DAMAGING ANY UNDER-SLAB UTILITIES OR STRUCTURE. SLAB REPLACEMENT SHALL BE INSTALLED WITH DOWELLING AND REINFORCED CONCRETE AS DIRECTED BY THE STRUCTURAL ENGINEER. WHERE SLAB ON GRADE IS SAW-CUT AND REMOVED FOR TRENCHING THE CONTRACTOR SHALL INSTALL MOISTURE BARRIER PER LANDLORD'S REQUIREMENTS. PROVIDE 3/4" MINIMUM CONDUITS ROUTED THROUGH SLAB AND STUBBED UP INTO DEVICES. FOR SLAB ON DECK, THE FLOOR SHALL BE SLEEVED AND EQUIPPED WITH THE APPROPRIATE LISTED ASSEMBLY. PROVIDE 3/4" MINIMUM CONDUITS ROUTED BELOW SLAB, TIGHT TO STRUCTURE, AND STUBBED UP INTO DEVICES.
9. ALL APPLICABLE SWITCHES, RECEPTACLES, OUTLETS, AND CONTROLS SHALL BE PLACED AT HEIGHTS THAT ARE IN ACCORDANCE WITH ADA ACCESSIBILITY GUIDELINES.
10. COORDINATE FLOOR MOUNTED BOX, RECEPTACLE, AND COVER PLATE TYPES WITH ARCHITECT AND OWNER PRIOR TO ORDER.
11. WIRING DEVICES ADJACENT TO EACH OTHER SHALL BE INSTALLED UNDER A SINGLE COVER PLATE, UNO.
12. WIRING DEVICES SHOWN BACK-TO-BACK ON A COMMON WALL SHALL BE OFFSET A MINIMUM OF 12" HORIZONTALLY TO REDUCE SOUND TRANSMISSION BETWEEN ROOMS, UNO.
13. ALL WP OUTLET BOX HOODS SHALL BE "EXTRA-DUTY" AND "WHILE-IN-USE COVER" TYPE. OUTLET BOX HOODS SHALL BE LOW PROFILE WHEREVER PRACTICABLE, UNLESS NOTED OTHERWISE. THE USE OF LARGE BUBBLE COVERS SHALL BE AVOIDED ON THE EXTERIOR OF THE BUILDING OR BEHIND EQUIPMENT IN ORDER TO PREVENT DAMAGE TO THE COVER AND TO ALLOW THE EQUIPMENT TO BE LOCATED CLOSE TO THE WALL.
14. ALL 120V RECEPTACLES 50A OR LESS, 208V AND 240V RECEPTACLES 100A OR LESS, SHALL BE GFCI PROTECTED IN LOCATIONS REQUIRED BY CODE; THIS INCLUDES BATHROOMS, KITCHENS/FOOD PREP AREAS, EXTERIOR LOCATIONS AND RECEPTACLES WITHIN 6 FEET OF A SINK. GFCI RECEPTACLES SHALL BE READILY ACCESSIBLE AND SHALL NOT BE LOCATED BEHIND STATIONARY EQUIPMENT. GFCI PROTECTION MAY BE VIA A GFCI CIRCUIT BREAKER OR GFCI RECEPTACLE, UNLESS NOTED OTHERWISE. WHERE NECESSARY, GFCI PROTECTION MAY BE ACHIEVED VIA A BLANK FACE GFCI DEVICE LOCATED IN A READILY ACCESSIBLE LOCATION NEAR RECEPTACLE BEING PROTECTED. FOR DOWNSTREAM WIRING DEVICES LOCATED ON THE SAME BRANCH CIRCUIT, THE GFCI PROTECTION MAY BE PROVIDED FOR BY A SINGLE UPSTREAM DEVICE IF ALL PROTECTED DEVICES ARE LABELED PER CODE.
15. FLEXIBLE CONDUIT IS ONLY PERMITTED WHERE SPECIFICALLY ALLOWED IN THE CONSTRUCTION DOCUMENTS, WHERE CONCEALED FROM VIEW OR EXPOSED FINAL CONNECTIONS TO LIGHT FIXTURES AND EQUIPMENT IN LENGTHS OF 6'-0" OR LESS.
16. ALL EMPTY CONDUIT/RACEWAY SHALL BE INSTALLED WITH PULL STRINGS. TERMINATE CONDUIT STUB-UP WITH A NYLON BUSHING.
17. EXPOSED CONDUIT/RACEWAY SHALL BE PAINTED TO MATCH ADJACENT SURFACE, UNLESS NOTED OTHERWISE. COORDINATE REQUIREMENTS WITH ARCHITECT AND OWNER PRIOR TO INSTALLATION.
18. CONDUITS/RACEWAYS SHALL BE CONCEALED FROM VIEW WHEREVER PRACTICABLE, UNLESS NOTED OTHERWISE. ROUTE CONDUITS SERVING ROOFTOP EQUIPMENT CONCEALED INSIDE EQUIPMENT CURB AND MINIMIZE ROOF PENETRATIONS AND EXTERIOR CONDUIT RUNS WHERE PRACTICABLE. SUPPORT RACEWAY FROM STRUCTURE, NOT ROOF DECK. MAINTAIN 2" MIN SPACING FROM BOTTOM OF ROOF DECK TO PREVENT ROOFING SCREWS FROM PENETRATING RACEWAY. DO NOT ROUTE CONDUITS ACROSS SKYLIGHTS, ACCESS PANELS, HATCHED TILES, HVAC DIFFUSERS, OR EQUIPMENT WORKING CLEARANCE SPACE. ROUTE ALL EXPOSED NON-FLEXIBLE CONDUITS TIGHT TO STRUCTURE, PARALLEL TO BUILDING LINES AND IN STRUT OR CABLE/PIPE TRAY WHERE PRACTICABLE. INSTALL CONDUITS PLUMB/ LEVEL WHERE EXPOSED TO VIEW. COORDINATE RACEWAY ROUTING AND INSTALLATION WITH OTHER TRADES PRIOR TO ROUGH-IN.
19. WHERE PRACTICABLE, ALL UNDER-FLOOR/UNDER-GROUND CONDUITS/RACEWAY SHALL BE INSTALLED A MINIMUM OF 24" BELOW BOTTOM OF SLAB/PAVING/GRADE, UNLESS NOTED OTHERWISE. NOTE: THE DESIGN INTENT FOR INSTALLING ELECTRICAL CIRCUITRY AT THIS DEPTH IS TO PROTECT THE ELECTRICAL CIRCUITRY FROM DAMAGE DUE TO FUTURE WORK.
20. PROVIDE LABEL AT EACH RECEPTACLE COVER PLATE WITH THE RESPECTIVE "PNLBD-CKT#" DESIGNATION. COORDINATE LABEL REQUIREMENTS WITH THE OWNER PRIOR TO INSTALLATION. REFER TO THE SPECIFICATIONS FOR MORE INFORMATION.
21. MULTIWIRE BRANCH CIRCUITS ARE NOT ALLOWED, UNLESS NOTED OTHERWISE.
22. PROVIDE INSULATED EQUIPMENT GROUNDING CONDUCTOR FOR ALL CIRCUITS, UNLESS NOTED OTHERWISE.

ELECTRICAL SYMBOLS

THIS IS A MASTER LEGEND AND NOT ALL SYMBOLS OR ABBREVIATIONS ARE USED.

V3.00

STANDARD MOUNTING HEIGHTS

AUDIBLE APPLIANCES (CENTERLINE)	84"
ALARMS	48"
ANNUNCIATOR PANELS (DISPLAY)	60"
CONTROLS (TOP OF DEVICE)	48"
EXIT SIGNS (WALL MOUNTED)	80"
FIRE ALARM ANNUNCIATOR PANEL (DISPLAY)	60"
FIRE ALARM BELL (EXTERIOR) (CENTERLINE)	120"
FIRE ALARM CONTROL PANEL/UNIT (DISPLAY)	60"
INTERCOM (AFEA ONLY)	36"
INTERCOMS (TOP OF DEVICE)	48"
PULL STATIONS (TOP OF DEVICE)	48"
PHOTOCELLS	144"
RECEPTACLES	16"
RECEPTACLES (EXTERIOR)	24"
RECEPTACLES (GARAGES)	24"
RECEPTACLES (POOLS)	27"
RECEPTACLES (ABOVE COUNTER)	+6" ABOVE BACKSPLASH/COUNTER, 40" MAX
RECEPTACLES IN EQUIPMENT ROOMS	44"
REMOTE INDICATING LIGHT (EQUIPMENT ROOMS)	48"
REMOTE INDICATING LIGHT (FINISHED AREAS)	CEILING
SAFETY SWITCHES (TOP OF DEVICE)	48"
STARTERS (TOP OF DEVICE)	48"
SWITCHES (TOP OF DEVICE)	44"
TELEPHONE, DATA OUTLETS	SAME AS ADJACENT DEVICE, UNO
TELEPHONE TERMINAL BOARD (BOTTOM)	6"
TELEVISION OUTLETS	REFER TO ARCH DRAWINGS
VISIBLE APPLIANCES (CENTERLINE)	84"

INSTALL OUTLET BOXES AT THE MOUNTING HEIGHTS SHOWN ABOVE UNO IN THE CONSTRUCTION DOCUMENTS. MOUNTING HEIGHTS LISTED ABOVE, OR ELSEWHERE IN THE CONSTRUCTION DOCUMENTS, ARE AFF OR AFG TO BOTTOM OF OUTLET BOX, UNO. ALL DEVICES SHALL BE INSTALLED IN COMPLIANCE WITH CURRENT ADA AND LOCAL REQUIREMENTS.

ABBREVIATIONS

AF	AMPERE FUSE SIZE	MCC	MOTOR CONTROL CENTER
AFC	ABOVE FINISHED CEILING	MFR	MANUFACTURER
AFF	ABOVE FINISHED FLOOR	MIN	MINIMUM
AFG	ABOVE FINISHED GRADE	MLO	MAIN LUGS ONLY
AHJ	AUTHORITY HAVING JURISDICTION	MLV	MAGNETIC LOW-VOLTAGE
AHU	AIR HANDLING UNIT	MOCP	MAXIMUM OVERCURRENT PROTECTION
AIC	AMPERE INTERRUPTING CAPACITY	MTD	MOUNTED
AS	AMPERE SWTICH SIZE	N/A	NOT APPLICABLE
AT	AMPERE TRIP SETTING	NF	NON-FUSED
ATS	AUTOMATIC TRANSFER SWITCH	NL	NIGHT LIGHT (24HR ON)
AV	AUDIO VISUAL	NRTL	NATIONALLY RECOGNIZED TESTING LABORATORY (CSA, ETL, NSF, UL)
BAS	BUILDING AUTOMATION SYSTEM	NTS	NOT TO SCALE
BKR	BREAKER	OS	OCCUPANCY SENSOR
C	CONDUIT	P	POLE
CAT	CATEGORY	PART	PARTIAL CIRCUIT
CATV	CABLE TELEVISION SYSTEM	PH/Ø	PHASE
CCTV	CLOSED CIRCUIT TELEVISION	PNL	PANEL
CD	CANDELA	PNLBD	PANELBOARD
CKT	CIRCUIT	PROVIDE	FURNISH AND INSTALL
CODE	APPLICABLE CODE ADOPTED BY JURISDICTION	PT	POTENTIAL TRANSFORMER
CT	CURRENT TRANSFORMER	QTY	QUANTITY
CTR	CENTER	R/REL	RELOCATE
CVD	CUMULATIVE VOLTAGE DROP	RCPT	RECEPTACLE
D/DEMO	DEMOLITION	RLA	RUNNING LOAD AMPS
DPDT	DOUBLE-POLE, DOUBLE-THROW	RTU	ROOFTOP UNIT
DPST	DOUBLE-POLE, SINGLE-THROW	SCCR	SHORT-CIRCUIT CURRENT RATING
E/ETR/EX	EXISTING TO REMAIN	SD	SMOKE DUCT DETECTOR
EC	ELECTRICAL CONTRACTOR	SF	SQUARE FEET
EF	EXHAUST FAN	SPDT	SINGLE-POLE, DOUBLE-THROW
EM	EMERGENCY	SPST	SINGLE-POLE, SINGLE-THROW
EMS	ENERGY MANAGMENT SYSTEM	SSBJ	SUPPLY-SIDE BONDING JUMPER
ELV	ELECTRONIC LOW-VOLTAGE	ST	SHUNT TRIP
EWC	ELECTRIC WATER COOLER	SWBD	SWITCHBOARD
FAAP	FIRE ALARM ANNUNCIATOR PANEL	SWGR	SWITCHGEAR
FACP	FIRE ALARM CONTROL PANEL	TBB	TELECOMMUNICATIONS BONDING BACKBONE
FCA	FAULT CURRENT AMPS AVAILABLE	TBD	TO BE DETERMINED
FCU	FAN COIL UNIT	TGB	TELECOMMUNICATIONS GROUND BUS BAR
FF	FINISHED FLOOR	TL	TWISTLOCK
FLA	FULL LOAD AMPS	TMGB	TELECOMMUNICATIONS MAIN GROUND BUS BAR
FLR	FLOOR	TX/XFMR	TRANSFORMER
GC	GENERAL CONTRACTOR	TYP	TYPICAL
GEC	GROUNDING ELECTRODE CONDUCTOR	U/F	UNDERFLOOR
GES	GROUNDING ELECTRODE SYSTEM	U/G	UNDERGROUND
GFR	GROUND FAULT RELAY	U/S	UNDERSLAB
G	GROUND	UH	UNIT HEATER
IG	ISOLATED GROUND	UNO	UNLESS NOTED OTHERWISE
ISC	SHORT CIRCUIT CURRENT	UPS	UNITERRUPTIBLE POWER SUPPLY
JB/J-BOX	JUNCTION BOX	VD	VOLTAGE DROP
LF	LINEAR FEET	VFD	VARIABLE FREQUENCY DRIVE
LRA	LOCKED ROTOR AMPS	VS	VACANCY SENSOR
LTG/LTS	LIGHTING/LIGHTS	W	WIRE
MAU	MAKE-UP AIR UNIT	W/	WITH
MAX	MAXIMUM	WP	WEATHER PROOF
MCA	MINIMUM CIRCUIT AMPACITY	WR	WEATHER RESISTANT
MCB	MAIN CIRCUIT BREAKER	WT	WATERTIGHT
		XP	EXPLOSION PROFF

LINETYPE LEGEND

THROUGHOUT THE DRAWINGS DIFFERENT LINETYPES ARE USED IN COMBINATION WITH THE SYMBOLS TO INDICATE THE STATUS OF ITEMS AS EXISTING, TO BE DEMOLISHED, TO BE INCLUDED AS PART OF NEW WORK AND/OR ITEMS WHICH ARE ANTICIPATED TO BE PROVIDED IN THE FUTURE. THE STATUS OF ITEMS USING THESE LINETYPES ARE RELATIVE TO THE VIEW IN WHICH THEY APPEAR. PHASING SHOWN IN DRAWINGS IS NOT INTENDED TO FULLY DESCRIBE ALL NECESSARY CONSTRUCTION PHASING, WHICH IS DETERMINED BY THE CONTRACTOR AS PART OF THEIR RESPONSIBILITIES. ANY SUCH PHASES DESCRIBED IN THE CONSTRUCTION DOCUMENTS ARE GENERAL AND ONLY INTENDED TO INDICATE A BROAD ORDER FOR THE SAKE OF DESCRIBING THE PROJECT. THE FOLLOWING LINETYPES MAY BE USED ON ANY DEVICE, EQUIPMENT, NOTE, LINE, SHAPE, ETC.

EXISTING — NEW
DEMOLISH — FUTURE

ANNOTATION

- MECHANICAL OR FIRE PROTECTION PLAN NOTE CALLOUT
- PLUMBING PLAN NOTE CALLOUTE
- ELECTRICAL OR FIRE ALARM PLAN NOTE CALLOUT
- TECHNOLOGY PLAN CALLOUT
- PLUMBING EQUIPMENT DESIGNATION. (CONTRACTOR FURNISHED AND INSTALLED). REFER TO PLUMBING FIXTURE OR EQUIPMENT SCHEDULES
- EQUIPMENT DESIGNATION (OWNER FURNISHED, CONTRACTOR INSTALLED)
- CU 1 — MECHANICAL EQUIPMENT DESIGNATION (CONTRACTOR FURNISHED AND INSTALLED UNLESS NOTED OTHERWISE)
- CONNECTION POINT OF NEW WORK TO EXISTING
- 1 / E1 — DETAIL REFERENCE UPPER NUMBER INDICATES DETAIL NUMBER LOWER NUMBER INDICATES SHEET NUMBER
- 1 / E1 — SECTION CUT DESIGNATION

CIRCUITING & WIRING

7 5 3 OR P1-3,5,7 (480/277/3) [R#] P1

- HOMERUN TO PANELBOARD. INFORMATION AT ARROWS ARE CIRCUIT NUMBERS AND PANELBOARD FOR TERMINATION. REFER TO PANELBOARD SCHEDULES FOR BRANCH CIRCUIT CONDUCTOR SIZES.
- INDICATES RELAY NUMBER
- INDICATES MULTI-VOLTAGE CIRCUIT - "480/277/3" DENOTES PHASE VOLTAGE/NEUTRAL VOLTAGE/PHASE POLES. CONTRACTOR SHALL PULL NEUTRAL WIRE IN ORDER TO DERIVE NEUTRAL VOLTAGE SHOWN. COORDINATE WITH EQUIPMENT PROVIDED FOR PROPER CONNECTIONS.
- CIRCUIT CONTINUATION OR PARTIAL CIRCUIT
- CONDUIT CONCEALED
- CONDUIT CONCEALED (EMERGENCY)
- CONDUIT IN/UNDER FLOOR/GROUND CONSTRUCTION
- EXPOSED CONDUIT
- EXPOSED CONDUIT (EMERGENCY)
- FLEXIBLE CONDUIT
- LOW VOLTAGE CABLE (NOT ROUTED IN CONDUIT)
- CONDUIT TURNING DOWN
- CONDUIT TURNING UP
- CONNECTION POINT OR EQUIPMENT TERMINATION
- EQUIPMENT TERMINATION

CONDUCTOR TICK MARK LEGEND

WHERE TICK MARKS ARE SHOWN, THE FOLLOWING SHALL GOVERN:

- SWITCHED HOT (PHASE) CONDUCTORS (SHOWN TRAILING NEUTRAL)
- NEUTRAL (GROUNDED) CONDUCTOR
- UNSWITCHED HOT (PHASE) CONDUCTORS (SHOWN LEADING NEUTRAL)
- NOTE: HASH MARKS INDICATE QUANTITY OF CONDUCTORS
- EQUIPMENT GROUNDING CONDUCTOR IN CONDUIT (GREEN INSULATION OR BARE)
- ISOLATED GROUNDING CONDUCTOR IN CONDUIT (GREEN INSULATION WITH YELLOW TRACER)

BRANCH CIRCUIT CONDUCTOR TABLE

WHERE TICK MARKS ARE NOT SHOWN, THE FOLLOWING SHALL GOVERN:

# OF POLES	HOT (PHASE)*	NEUTRAL (GROUNDED)**	GROUNDING***
1P	(1)	(1) UNO	(1)
2P	(2)	(1) UNO	(1)
3P	(3)	(1) UNO	(1)

* PROVIDE ADDITIONAL CONDUCTORS THROUGH ENTIRE CIRCUIT (SWITCHED, UNSWITCHED/EM, ETC.) AS INDICATED THROUGHOUT CONSTRUCTION DOCUMENTS AND AS REQUIRED FOR A COMPLETE AND WORKING SYSTEM.

** REFER TO SPECIFICATIONS FOR LIMITATIONS ON SHARING NEUTRAL (GROUNDED) CONDUCTORS. DO NOT CIRCUIT AS A MULTI-WIRE BRANCH CIRCUIT, UNO.

*** PROVIDE ADDITIONAL ISOLATED GROUNDING CONDUCTORS WHERE INDICATED.

REFER TO SPECIFICATIONS, PLANS, NOTES, WIRING AND CONTROL DIAGRAMS FOR ADDITIONAL CIRCUITING REQUIREMENTS.

SIGNALING

- SIGNALING BELL
- SIGNALING BUZZER
- LV TRANSFORMER

LIGHTING

- LIGHT FIXTURE
  - a = LOWER CASE LETTER IS SWITCH IDENTIFIER
  - A = UPPER CASE LETTER INDICATES LIGHT FIXTURE TYPE
  - = WALL MOUNT
  - = ARROW INDICATED AIMING DIRECTION
- LIGHT FIXTURE CIRCUITED AS A NIGHT LIGHT (NL)
- EMERGENCY LIGHT FIXTURE WITH EMERGENCY LIGHTING BATTERY PACK OR CONNECTED TO EMERGENCY SOURCE
- NIGHT LIGHT/EMERGENCY LIGHT FIXTURE WITH EMERGENCY BATTERY PACK OR CONNECTED TO EMERGENCY SOURCE
- LIGHT FIXTURE WITH DUAL BALLASTS CIRCUITED SEPARATELY (SHADING IMPLIES EMERGENCY LIGHT FIXTURE)
- [#] LIGHTING TRACK (# INDICATES RELAY NUMBER)
- MIRROR LIGHTS
- EXTERIOR PARKING LOT LIGHT FIXTURE
- EXTERIOR PEDESTRIAN POST TOP LIGHT FIXTURE
- EXTERIOR LIT BOLLARD LIGHT
- EXIT SIGN - CEILING / WALL MOUNTED, ARROWS AS INDICATED, FACE HATCHED
- EMERGENCY LIGHTING UNIT EQUIPMENT WITH BATTERY PACK - CEILING/WALL MOUNTED
- AFEA (AREA FOR EVACUATION ASSISTANCE) SIGN - CEILING/WALL MOUNTED, ARROWS AS INDICATED

REFER TO LIGHT FIXTURE SCHEDULE FOR MORE INFORMATION

POWER EQUIPMENT & DEVICES

- ELECTRICAL PANELBOARD (SURFACE OR FLUSH MOUNT)
- ELECTRICAL CABINET (SURFACE OR FLUSH MOUNT), TYPE AS NOTED
- PLYWOOD TERMINAL BOARD FOR TELEPHONE SYSTEM, UNO. SIZE AS NOTED
- SWITCHBOARD OR MOTOR CONTROL CENTER ON HOUSEKEEPING PAD
- ELECTRICAL DISTRIBUTION PANELBOARD
- TRANSFORMER
- 200/3/150/3R — DISCONNECT SWITCH - "200/3/150/3R" DENOTES AMPERES/POLE/FUSE/NEMA ENCLOSURE RATING, NF= NON-FUSED, CB= CIRCUIT BREAKER (200/3/CB), NO VALUE (200/3/150) FOR NEMA ENCLOSURE MEANS STANDARD NEMA 1 RATING
- 30/3/15/1/3R — COMBINATION DISCONNECT (SAFETY) SWITCH AND MOTOR STARTER "30/3/15/1/3R" DENOTES AMPERES/POLE/FUSE/NEMA STARTER SIZE/NEMA ENCLOSURE RATING. NF= NON-FUSED, CB= CIRCUIT BREAKER (30/3/CB/1), NO VALUE (200/3/150/1) FOR NEMA ENCLOSURE MEANS STANDARD NEMA 1 ENCLOSURE RATING
- 2 — MAGNETIC MOTOR STARTER, NEMA SIZE AS NOTED. 3-POLE, UNO
- VFD — VARIABLE FREQUENCY DRIVE
- INDICATING LIGHT
- EMERGENCY POWER OFF BUTTON
- STOP-START PUSH BUTTON CONTROL STATION
- HAND-OFF-AUTO PUSH BUTTON CONTROL STATION
- MUSHROOM-TYPE PUSH BUTTON
- OVERHEAD PADDLE FAN

BOXES, LIGHTING CONTROL & WIRING DEVICES

$# SWITCH LETTER DESIGNATIONS AS FOLLOWS:
- BLANK = SINGLE
- 2 = TWO POLE
- 3 = THREE-WAY
- 4 = FOUR-WAY
- D = DIMMER
- F = FAN SPEED CONTROL
- FH = FRACTIONAL HORSEPOWER MANUAL CONTROLLER
- IH = INTEGRAL HORSEPOWER MANUAL CONTROLLER
- K = KEYED
- LV# = LOW VOLTAGE / DIGITAL
- M = MANUAL MOTOR STARTER DISCONNECT
- OS# = OCCUPANCY SENSOR
- P = SPST PILOT LIGHT
- WP = WEATHER PROOF
- # = REFER TO LIGHTING CONTROL DEVICE SCHEDULE

- ALC — AUTOMATIC LOAD CONTROL RELAY
- BTS — BRANCH CIRCUIT TRANSFER SWITCH
- CEILING / WALL MOUNTED OCCUPANCY SENSOR (# INDICATES TYPE PER SCHEDULE)
  - CORNER 90 DEGREE SENSING
  - ONE-DIRECTION SENSING, CEILING/WALL MOUNT
  - CEILING MOUNT, TWO DIRECTION SENSING
  - CEILING MOUNT, FOUR DIRECTION SENSING
- C# — CONTACTOR (SIZE, COIL VOLTAGE AND NUMBER OF POLES AS INDICATED)
- CL## — TRACK-MOUNTED CURRENT LIMITER (## INDICATES AMPERAGE)
- D# — DAYLIGHT SENSOR (# INDICATES TYPE PER SCHEDULE)
- LC — LIGHTING CONTROLS PROCESSOR AND/OR EQUIPMENT
- P# — POWER PACK (# INDICATES TYPE PER SCHEDULE)
- PS# — PHOTOELECTRIC SWITCH
- R## — ROOM CONTROLLER (# INDICATES TYPE PER SCHEDULE)
- TS# — TIME SWITCH
- SIMPLEX RECEPTICAL - NEMA 5-20R, UNO
- DUPLEX RECEPTICAL - NEMA 5-20R, UNO
- DOUBLE DUPLEX RECEPTICAL - NEMA 5-20R, UNO
- SPECIAL RECEPTICAL - NEMA TYPE AS NOTED
- TWIST-LOCK TYPE RECEPTICAL
- G — BLANK FACE GFCI FEED THROUGH DEVICE
- OR GFCI — GFCI TYPE RECEPTACLE*
- OR IG — ISOLATED GROUND TYPE RECEPTACLE*
- OR EM — EMERGENCY RECEPTACLE*
- RECEPTACLE INSTALLED ABOVE COUNTER OR BACKSPLASH*
- RECEPTACLE INSTALLED IN CEILING*
- RECEPTACLE INSTALLED IN FLOOR*
- RECEPTACLE INSTALLED VIA DROP CORD*

RECEPTACLE LETTER DESIGNATIONS AS FOLLOWS:
- C = AUTOMATICALLY CONTROLLED
- CH = CLOCK HANGER TYPE
- G=RCPT PROTECTED BY GFCI CIRCUIT BREAKER OR UPSTREAM GFCI DEVICE
- H = HORIZONTALLY MOUNTED
- S = MANUALLY CONTROLLED
- SP / TVSS = SURGE PROTECTION
- TR = TAMPER RESISTANT
- TV = TELEVISION
- USB = USB/DUPLEX
- WP = WEATHER PROOF COVER
- WR = WEATHER RESISTANT

- MULTI-OUTLET ASSEMBLY
- TELEPHONE OUTLET
- DATA OUTLET
- MULTI-SERVICE OUTLET; TELEPHONE AND DATA
  - ABOVE COUNTER, TYP
  - WALL, TYP
  - FLOOR, TYP
- A — MULTI-SERVICE POWER POLE WITH TELEPHONE, DATA AND POWER OUTLETS A = TYPE, REFER TO PLANS, SCHEDULES AND SPECIFICATIONS
- A — MULTI-SERVICE FLOOR BOX WITH TELEPHONE, DATA AND POWER OUTLETS A = TYPE, REFER TO PLANS, SCHEDULES AND SPECIFICATIONS
- A — POKE THROUGH, A = TYPE, REFER TO PLANS, SCHEDULES AND SPECIFICATIONS
- THERMOSTAT
- CEILING/FLOOR MOUNT JUNCTION/OUTLET BOX
- WALL MOUNT JUNCTION/OUTLET BOX

* SYMBOL DEMONSTRATED WITH DUPLEX RECEPTACLE, WHEN USED IN COMBINATION WITH OTHER DEVICES MEANING IS SIMILAR FOR THOSE DEVICE TYPES.

REFER TO LIGHTING CONTROL DEVICE SCHEDULE FOR MORE INFORMATION.

ELECTRICAL ONE-LINE & RISER DIAGRAM

- ###A 3P — SWITCH (RATING AS INDICATED)
- ###A 3P — DRAWOUT CIRCUIT BREAKER (RATINGS AS INDICATED)
- ###AS 3P ###AF FRS — FUSED SWITCH (RATING, POLES AND FUSE TYPE AS INDICATED)
- ###AS 3P ###AF FRS NEMA # — COMBINATION FUSED SWITCH/STARTER AND STARTER SIZE
- ###AS 3P FRS NEMA # — CIRCUIT BREAKER (RATINGS AS INDICATED)
- ###A 3P NEMA # — COMBINATION CIRCUIT BREAKER/STARTER AND STARTER SIZE
- PANELBOARD, SINGLE OR MULTI-SECTION (REFER TO SCHEDULES)
- ISOLATED POWER PANELBOARD W/ INTEGRAL TRANSFORMER (REFER TO SCHEDULES)
- TX## — TRANSFORMER (TYPE AND RATINGS AS INDICATED)
- TX## — SHIELDED TRANSFORMER (TYPE AND RATINGS AS INDICATED)
- ATS# ###A ATS# (W/BYPASS) — AUTOMATIC TRANSFER SWITCH (RATINGS AS INDICATED)
- ATS# (W/BYPASS) ###A — AUTOMATIC TRANSFER SWITCH WITH BYPASS (RATINGS AS INDICATED)
- ##KW GENERATOR 480Y/277V, 3Ø, 4W ###A, 3P M/G — GENERATOR (RATINGS AS INDICATED)
  - NON-SEPARATELY DERIVED SOURCE OR SEPARATELY DERIVED SOURCE
- MDP SWITCHBOARD ELEC ROOM ### AMPS 480Y/277V 3Ø 4W — SWITCHGEAR, SWITCHBOARD AND/OR DISTRIBUTION PANELBOARD (TYPE, RATING, DEVICES AND ACCESSORIES AS INDICATED)
- DIGITAL VM AM — COMBINATION DIGITAL VOLT METER/AMMETER
- ### — CIRCUIT IDENTIFICATION (REFER TO CIRCUIT SCHEDULE)
- GFR — GROUND FAULT RELAY
- PFR — PHASE FAILURE RELAY
- KK# — KIRK-KEY INTERLOCK (# INDICATES KEY PAIR)
- ST — SHUNT TRIP
- AM — AMMETER (RANGE AS SPECIFIED OR REQUIRED)
- VM — VOLTMETER (RANGE AS SPECIFIED OR REQUIRED)
- UTILITY METER M — UTILITY METER (AS REQUIRED BY UTILITY)
- AS — AMMETER SWITCH
- VS — VOLTMETER SWITCH
- WH D 15 — WATT-HOUR METER, "D" DENOTES DEMAND REGISTER, "15" DENOTES MINUTES OF DEMAND INTERVAL
- CURRENT TRANSFORMER RATING AS SPECIFIED OR REQUIRED
- POTENTIAL TRANSFORMER RATING AS SPECIFIED OR REQUIRED
- SPD — SURGE-PROTECTIVE DEVICE
- GROUND CONNECTION
- GROUND CONNECTION WITH TEST WELL
- GROUND ROD
- LIGHTNING ARRESTER
- CAPACITOR
- CONTACT (OPEN OR CLOSED)
- HEATER
- HP — MOTOR
- ## — BLOCK LOAD KW OR KVA
- ×F# ×FP# — FAULT POINT REFERENCED IN SHORT CIRCUIT CURRENT AND VOLTAGE DROP SPREADSHEET

APPLICABLE ELECTRICAL CODES:

NOTE: PROJECT IS DESIGNED IN COMPLIANCE WITH THE FOLLOWING CODES. THIS IS NOT AN EXHAUSTIVE LIST. PROJECT SHALL COMPLY WITH ALL APPLICABLE CODES, STANDARDS AND LOCAL REQUIREMENTS. REFER TO THE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

ELECTRICAL CODE: **2017 NATIONAL ELECTRICAL CODE, (NFPA 70)**
BUILDING CODE: **2018 INTERNATIONAL BUILDING CODE**
ENERGY CODE: **2018 INTERNATIONAL ENERGY CONSERVATION CODE**

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.:	1850004412
Date:	10.25.19
Issued For:	SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI ANDREA C. MULVANY NUMBER PE-2013039892 PROFESSIONAL ENGINEER

Oct 24 2019

ANDREA C. MULVANY
LICENSE # PE-2013039892

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

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EXPIRES 12/31/2020

SHEET TITLE

ELECTRICAL LEGENDS AND GENERAL NOTES

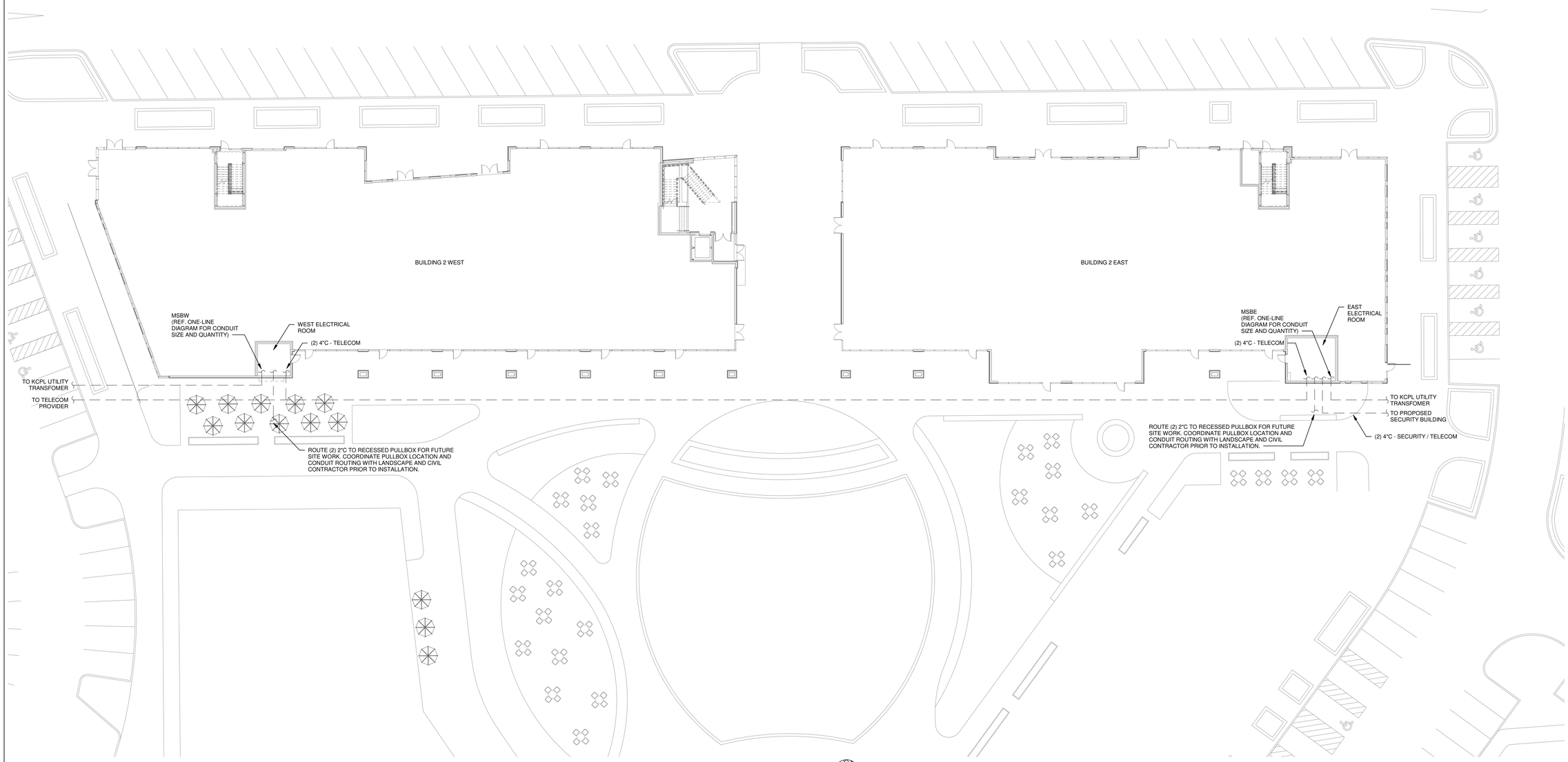
SHEET NUMBER

E000

ANDREA C. MULVANY

ELECTRICAL SITE GENERAL NOTES:

1. REFER TO CIVIL DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL INFORMATION. COORDINATE THE FINAL LOCATION OF ALL SITE LIGHTING POLES, SIGNAGE, UNDERGROUND UTILITIES, CONDUITS, CIRCUITRY, TRANSFORMERS AND OTHER EQUIPMENT WITH CIVIL DRAWINGS, LANDSCAPING DRAWINGS AND OWNER PRIOR TO INSTALLATION.
2. COORDINATE ALL SITE ELECTRICAL REQUIREMENTS WITH EQUIPMENT MANUFACTURER INFORMATION AND OTHER TRADES AND ADJUST ELECTRICAL PROVISIONS AS REQUIRED TO MEET REQUIREMENTS.
3. SITE ELECTRICAL CONDUITS SHALL BE 1" MINIMUM, UNLESS NOTED OTHERWISE. WHERE PRACTICABLE, ALL SITE ELECTRICAL CONDUITS SHALL BE INSTALLED A MINIMUM OF 24" BELOW GRADE, UNLESS NOTED OTHERWISE. COORDINATE FINAL CONDUIT ROUTING WITH EXISTING OBSTRUCTIONS AND OTHER TRADES AND ADJUST AS NECESSARY.
4. CAP AND MARK ALL UNDERGROUND CONDUITS PROVIDED FOR FUTURE USE AND INCLUDE PULL STRINGS. PROVIDE DIMENSIONED LOCATIONS OF TERMINATION POINTS ON AS-BUILT DRAWINGS AND SUBMIT TO OWNER.
5. MINIMUM WIRE SIZE FOR SITE ELECTRICAL CIRCUITS SHALL BE #10 AWG CU, UNLESS NOTED OTHERWISE. ALL SITE ELECTRICAL BRANCH CIRCUIT WIRING SHALL BE SIZED SUCH THAT THE MAXIMUM BRANCH CIRCUIT VOLTAGE DROP IS LESS THAN 3 PERCENT.



1 ELECTRICAL SITE PLAN
1/16" = 1'-0"

N

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
ANDREA C MULVANY
NUMBER PE-2013039892
PROFESSIONAL ENGINEER

Oct 24 2019
ANDREA C. MULVANY
LICENSE # PE-2013039892

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

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1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

ELECTRICAL SITE PLAN

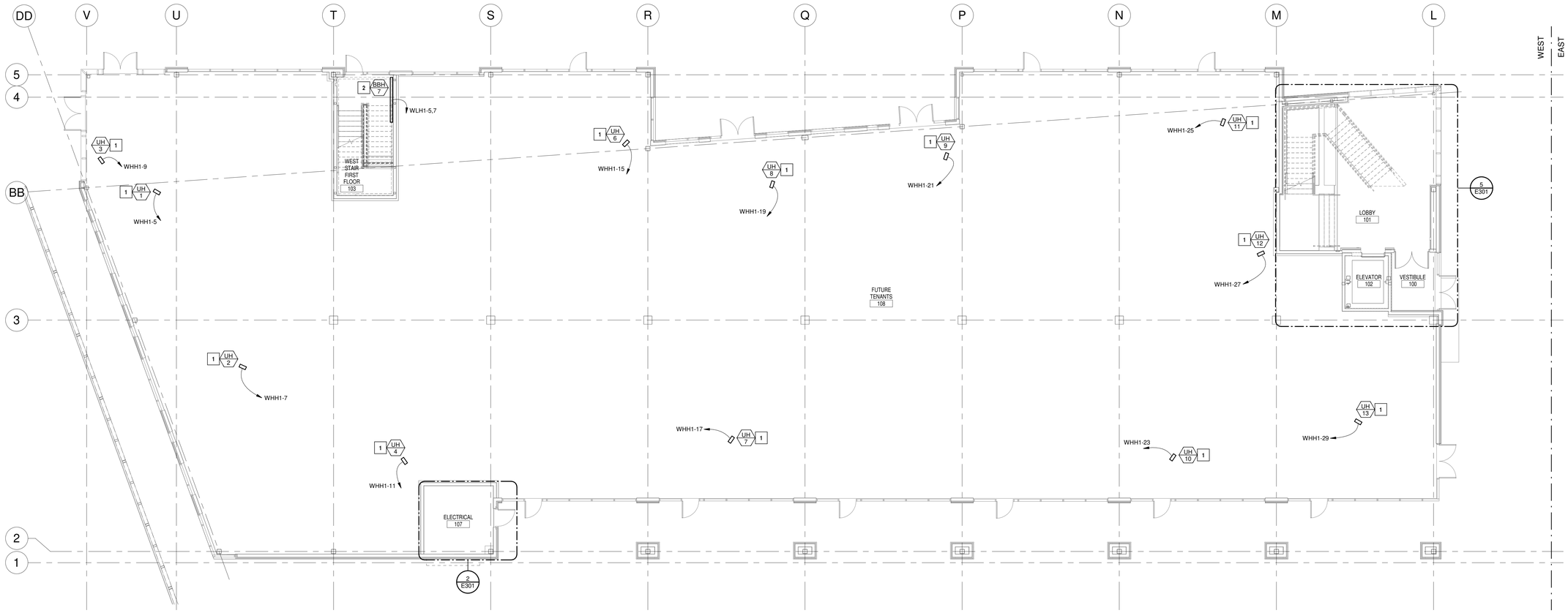
SHEET NUMBER

E101

ELECTRICAL PLAN NOTES:

1 DISCONNECT SWITCH PROVIDED WITH MECHANICAL EQUIPMENT.

2 PROVIDE ELECTRICAL CONNECTION TO MANUFACTURER PROVIDED INTERNAL THERMOSTAT IN BASEBOARD UNIT AS SHOWN ON PLANS. COORDINATE CONNECTION AND ADDITIONAL REQUIREMENTS WITH MECHANICAL CONTRACTOR AND MANUFACTURER'S RECOMMENDATIONS.



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

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

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SHEET TITLE

ELECTRICAL FIRST FLOOR PLAN - WEST

SHEET NUMBER

E101.1

ANDREA C. MULVANY

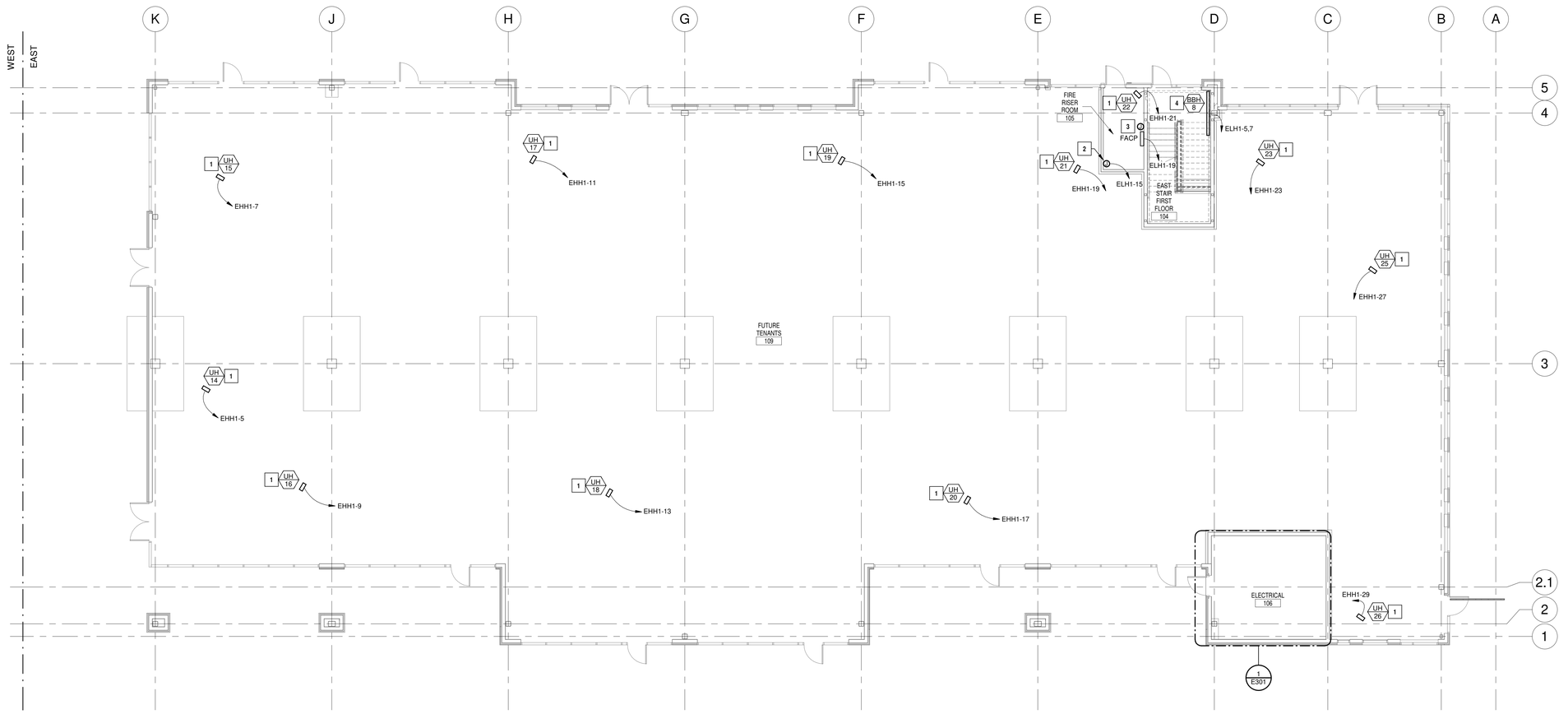
ELECTRICAL PLAN NOTES:

1 DISCONNECT SWITCH PROVIDED WITH MECHANICAL EQUIPMENT.

2 PROVIDE 120V, 20A CONNECTION TO IRRIGATION CONTROLLER AND (1) 1"C STUBBED TO LANDSCAPING PLANTER ADJACENT TO FIRE RISER ROOM FOR CONTROL WIRING. COORDINATE LOCATION AND MOUNTING WITH IRRIGATION CONTRACTOR AND MANUFACTURER'S REQUIREMENTS PRIOR TO ROUGH-IN.

3 PROVIDE 2 WAY NOTIFICATION DEVICE MOUNTED ON WALL NEXT TO FIRE ALARM CONTROL PANEL. COORDINATE MOUNTING AND INSTALLATION WITH GENERAL CONTRACTOR AND FIRE ALARM CONTRACTOR PRIOR TO ROUGH-IN. REFERENCE SPECIFICATIONS FOR MORE INFORMATION.

4 PROVIDE ELECTRICAL CONNECTION TO MANUFACTURER PROVIDED INTERNAL THERMOSTAT IN BASEBOARD UNIT AS SHOWN ON PLANS. COORDINATE CONNECTION AND ADDITIONAL REQUIREMENTS WITH MECHANICAL CONTRACTOR AND MANUFACTURER'S RECOMMENDATIONS.



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

N

ANDREA C. MULVANY

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
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SHEET TITLE

ELECTRICAL FIRST FLOOR PLAN - EAST

SHEET NUMBER

E101.2

ELECTRICAL PLAN NOTES:

1 DISCONNECT SWITCH PROVIDED WITH MECHANICAL EQUIPMENT.

2 PROVIDE 120V, 20A CONNECTION TO VAV CONTROL TRANSFORMERS IN THIS AREA. COORDINATE LOCATIONS AND REQUIREMENTS WITH MECHANICAL CONTRACTOR AND MANUFACTURER'S RECOMMENDATIONS.

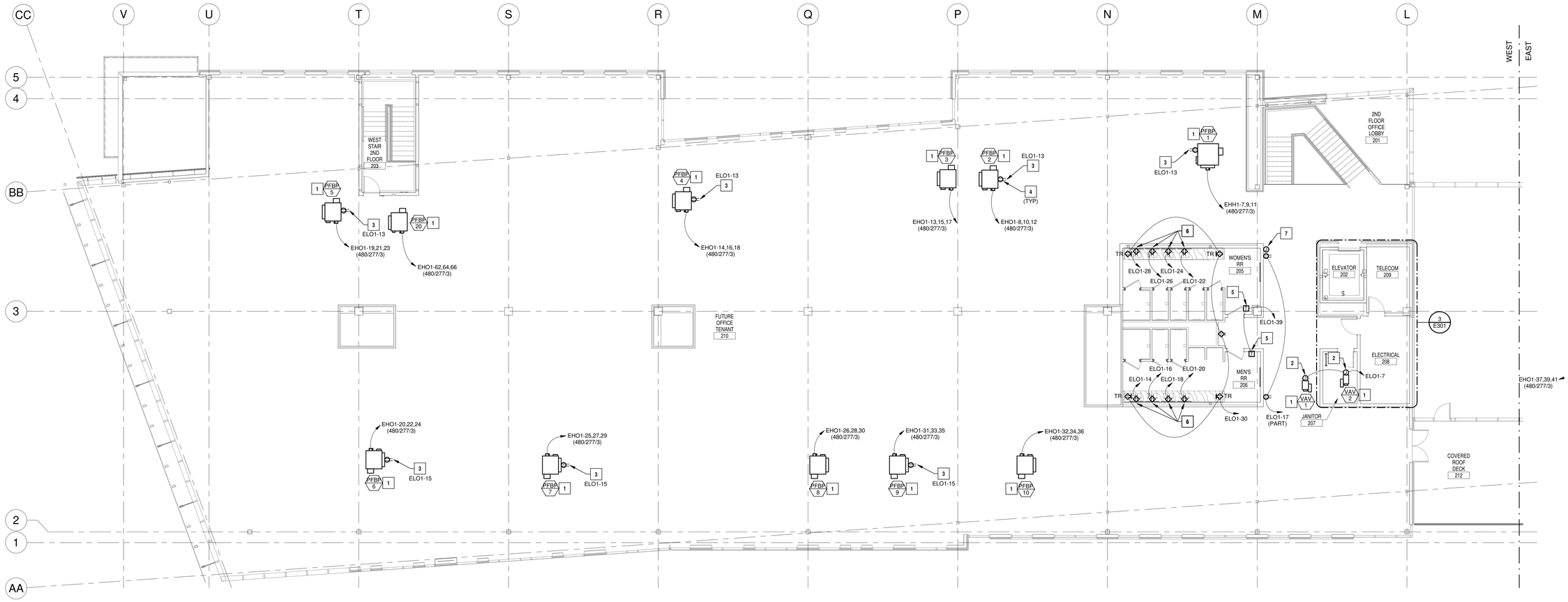
3 PROVIDE MAINTENANCE/CONVENIENCE RECEPTACLE FOR MECHANICAL EQUIPMENT.

4 E.C. TO MOUNT MAINTENANCE/CONVENIENCE RECEPTACLE AND/OR E.C. PROVIDED DISCONNECT SWITCHES SO THAT ALL REQUIRED MECHANICAL EQUIPMENT CLEARANCES ARE MAINTAINED. PROVIDE BUS-STRUT MOUNTING AS NECESSARY. COORDINATE LOCATION WITH MECHANICAL CONTRACTOR PRIOR TO ROUGH-IN.

5 RESTROOM TOILET SENSOR CONTROL TRANSFORMERS: PROVIDED BY PLUMBING CONTRACTOR, INSTALLED BY ELECTRICAL CONTRACTOR. PROVIDE 120V, 20A CONNECTION TO TRANSFORMERS AS SHOWN. COORDINATE WITH PLUMBING CONTRACTOR AND MANUFACTURER'S RECOMMENDATIONS PRIOR TO ROUGH-IN.

6 PROVIDE GFCI DUPLEX OUTLET AND DEDICATED 120V, 20A ELECTRICAL CONNECTION FOR RESTROOM WASHBAR STATION. COORDINATE LOCATION AND REQUIREMENTS WITH PLUMBING CONTRACTOR AND MANUFACTURER'S RECOMMENDATIONS PRIOR TO ROUGH-IN.

7 PROVIDE 2 WAY NOTIFICATION DEVICE MOUNTED ON WALL. COORDINATE MOUNTING AND INSTALLATION WITH GENERAL CONTRACTOR AND FIRE ALARM CONTRACTOR PRIOR TO ROUGH-IN. REFERENCE SPECIFICATIONS FOR MORE INFORMATION.



1 ELECTRICAL SECOND FLOOR PLAN - WEST
1/8" = 1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

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Oct 24 2019

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PROJECT TEAM

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EXPIRES 12/31/2020

SHEET TITLE

ELECTRICAL SECOND FLOOR PLAN - WEST

SHEET NUMBER

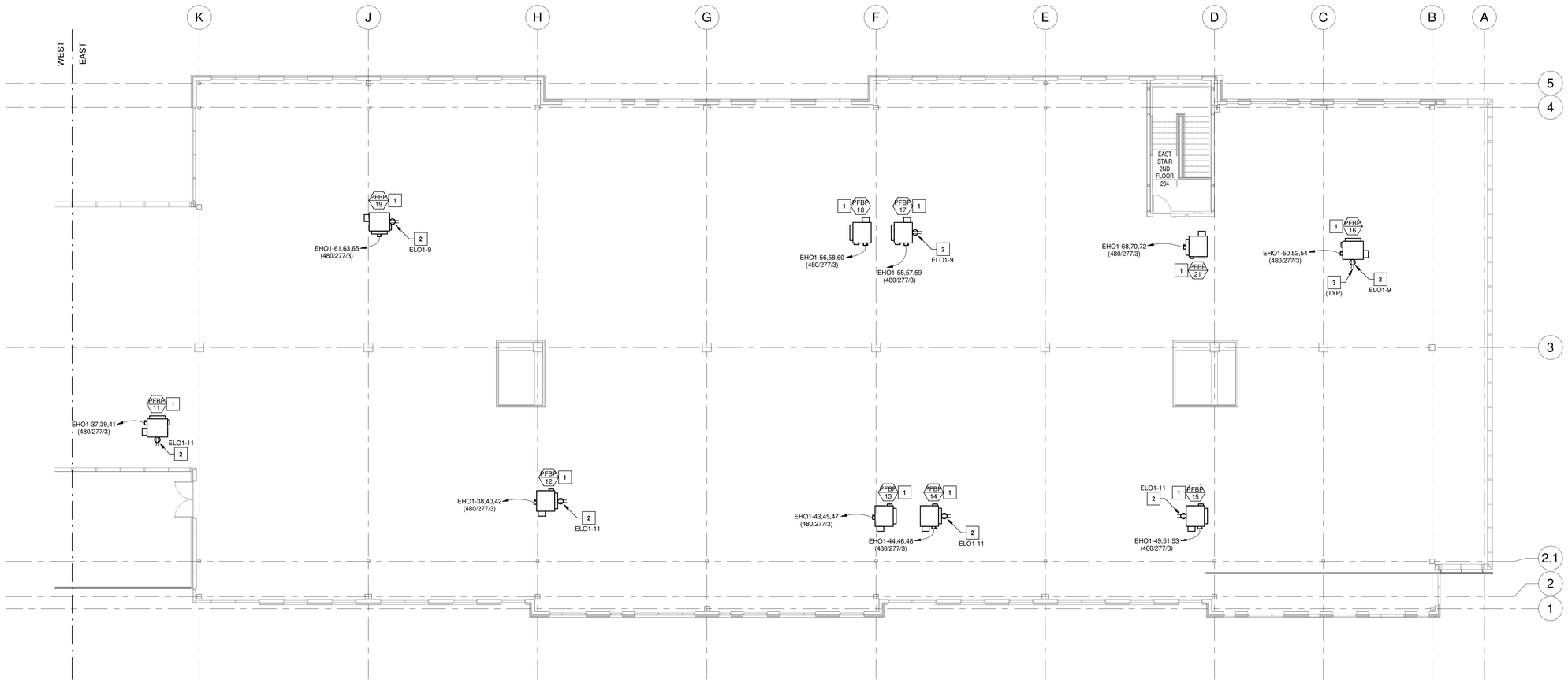
E102.1

ELECTRICAL PLAN NOTES:

1 DISCONNECT SWITCH PROVIDED WITH MECHANICAL EQUIPMENT.

2 PROVIDE MAINTENANCE/CONVENIENCE RECEPTACLE FOR MECHANICAL EQUIPMENT.

3 E.C. TO MOUNT MAINTENANCE/CONVENIENCE RECEPTACLE AND/OR E.C. PROVIDED DISCONNECT SWITCHES SO THAT ALL REQUIRED MECHANICAL EQUIPMENT CLEARANCES ARE MAINTAINED. PROVIDE BUS-STRUT MOUNTING AS NECESSARY. COORDINATE LOCATION WITH MECHANICAL CONTRACTOR PRIOR TO ROUGH-IN.



1 ELECTRICAL SECOND FLOOR PLAN - EAST
1/8" = 1'-0"

N

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

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SHEET TITLE

ELECTRICAL SECOND FLOOR PLAN - EAST

SHEET NUMBER

E102.2

LIGHTING SUPPLEMENTAL SPECIFICATIONS:

1. REFER TO THE ARCHITECTURAL DRAWINGS FOR LIGHT FIXTURE LOCATIONS, MOUNTING HEIGHTS, TRACK LENGTHS AND ADDITIONAL MOUNTING INFORMATION. CONTRACTOR SHALL BE RESPONSIBLE FOR INSURING THAT COORDINATION AND CONFLICT ISSUES ARE RESOLVED PRIOR TO INSTALLATION OF LIGHT FIXTURES. CONTACT ARCHITECT/ENGINEER IMMEDIATELY IF THERE ARE DISCREPANCIES.
2. THROUGH WIRING OF RECESSED LIGHT FIXTURES, IN SUSPENDED CEILINGS, IS NOT PERMITTED. CONNECT EACH LIGHT FIXTURE BY A WHIP TO A JUNCTION BOX. PROVIDE CABLE WHIPS OF SUFFICIENT LENGTHS TO ALLOW FOR RELOCATING EACH LIGHT FIXTURE WITHIN A 5'-0" RADIUS OF ITS INDICATED LOCATION. CABLE WHIPS SHALL NOT EXCEED 6'-0" OF UNSUPPORTED LENGTHS.
3. ALL EMERGENCY LIGHTS AND EXIT SIGNS WITH INTEGRAL BATTERY BACK-UP SHALL BE CONNECTED TO A SEPARATE UNSWITCHED CONDUCTOR BYPASSING ALL OTHER CONTROLS AND CONTACTORS, UNLESS NOTED OTHERWISE. EXIT SIGNS SHALL NOT BE SWITCHED. REFER TO MANUFACTURER'S WRITTEN INSTRUCTIONS FOR PROPER INSTALLATION AND TESTING. ALLOW BATTERY TO CHARGE FOR A MINIMUM OF 48 HOURS BEFORE LIGHT LEVEL TESTING. IN ORDER TO PREVENT BATTERY DAMAGE, DO NOT TURN OFF POWER FOR EXTENDED PERIODS OF TIME AFTER EMERGENCY LIGHT HAS BEEN POWERED.
4. PROVIDE A NEUTRAL CONDUCTOR TO ALL WALL MOUNTED LINE VOLTAGE LIGHT SWITCHES, UNLESS NOTED OTHERWISE. IF NEUTRAL TERMINATION IS NOT REQUIRED FOR THE DEVICE THEN CAP CONDUCTOR AND TAG AS "NEUTRAL FOR FUTURE USE".
5. COORDINATE ALL OCCUPANCY/VACANCY SENSOR SETTINGS WITH OWNER AND ADJUST AS NECESSARY FOR PROPER OPERATION. SETTINGS MUST COMPLY WITH AHJ AND LOCAL ENERGY CODE REQUIREMENTS.
6. DO NOT INSTALL OCCUPANCY/VACANCY SENSORS WITHIN 48" OF AIR DIFFUSER OR SIMILAR OBSTRUCTION THAT MAY ADVERSLY AFFECT THE SENSOR PERFORMANCE. COORDINATE FINAL SENSOR LOCATIONS WITH OTHER TRADES AND INSTALL IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

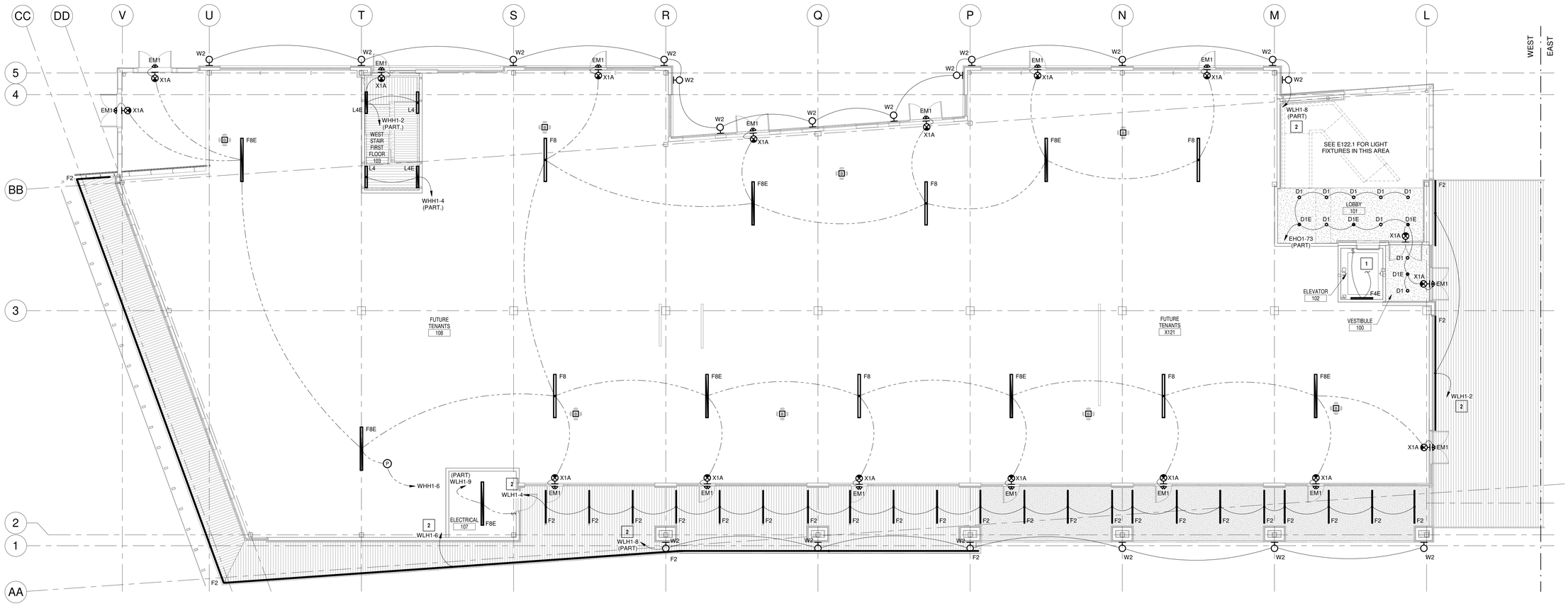
LIGHTING GENERAL NOTES:

1. THE EMERGENCY LIGHTING SYSTEM HAS BEEN DESIGNED TO PROVIDE AN INITIAL FLOOR ILLUMINANCE LEVEL OF 1 FC AVERAGE, 0.1 FC MINIMUM AND NO MORE THAN A 40:1 MAX/MIN RATIO ALONG THE EMERGENCY EGRESS PATHS. WHERE APPLICABLE, ADJUST AIMING OF EMERGENCY LIGHTS AS REQUIRED TO PROVIDE PROPER ILLUMINATION AT FLOOR AVOIDING OBSTACLES AND SHADOWS AFTER STORE SET-UP IS COMPLETE.
2. WALL MOUNTED EXITS SIGNS SHALL BE MOUNTED 12" ABOVE DOOR FRAME AND CENTERED ABOVE DOOR OPENING, UNLESS NOTED OTHERWISE. CEILING/PENDANT MOUNTED EXIT SIGNS SHALL BE SUSPENDED TO 12'-0" AFF IN OPEN STRUCTURE AREAS, UNLESS NOTED OTHERWISE. EXIT SIGNS SHALL BE READILY VISIBLE FROM DIRECTION OF EGRESS TRAVEL. COORDINATE FINAL EXIT SIGN LOCATIONS WITH AHJ AND OWNER.
3. PROVIDE LABEL AT EACH MANUAL LIGHT SWITCH INDICATING THE LIGHT FIXTURE(S) THAT THE SWITCH CONTROLS AND THE RESPECTIVE "PNLBD-CKT#" DESIGNATION. A SINGLE LIGHT SWITCH FOR A SMALL ROOM DOES NOT NEED TO INDICATE THE SPACE CONTROLLED SINCE IT IS INTUITIVELY OBVIOUS. COORDINATE LABEL REQUIREMENTS WITH THE OWNER PRIOR TO INSTALLATION. REFER TO THE SPECIFICATIONS FOR MORE INFORMATION.
4. ALL REMOTELY LOCATED LIGHT FIXTURE POWER SUPPLIES SHALL BE LOCATED IN AN ACCESSIBLE LOCATION WITH PROPER VENTILATION IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. CONCEAL DEVICES AND RELATED WIRING FROM CUSTOMER/PUBLIC VIEW. PROVIDE ENCOSURE IF REQUIRED. COORDINATE LOCATION AND ENCLOSURE TYPE WITH ARCHITECT AND OWNER PRIOR TO INSTALLATION.
5. PER 2017 NEC 700.2 AND 700.24, ALL DIRECTLY CONTROLLED LUMINAIRES USED FOR EMERGENCY ILLUMINATION AND ALL APPLICABLE CONTROLS SHALL HAVE UL 924 LISTING OR EQUIVALENT NRTL LISTING. IF EMERGENCY LUMINAIRE OR CONTROL MANUFACTURER DOES NOT HAVE APPROPRIATE LISTING THEN FIELD LISTING OF EQUIPMENT IS ACCEPTABLE (AT CONTRACTOR'S COST), IF APPROVED BY THE AHJ. ALTERNATIVELY, AS ALLOWED PER 2017 NEC 90.4, THE CONTRACTOR MAY OBTAIN SPECIAL PERMISSION FROM THE AHJ AND SUBMIT SAID PERMISSION IN WRITING TO THE ENGINEER FOR REVIEW. IF USING NON-LISTED EQUIPMENT FOR APPLICABLE EMERGENCY SYSTEMS, THE ALTERNATIVE METHOD MUST BE FIELD TESTED AND ACHIEVE EQUIVALENT OBJECTIVES TO CODE INTENT. IN ADDITION, ALTERNATE METHOD AND EQUIPMENT USED MUST BE DEEMED SAFE AND ACCEPTABLE TO BOTH THE AHJ AND THE ENGINEER.

☐ LIGHTING PLAN NOTES:

1 REFER TO DETAIL 5 SHEET E301 FOR CIRCUIT CONTINUATION.

2 ROUTE LIGHTING BRANCH CIRCUIT THROUGH LIGHTING CONTROL CONTACTOR. REFER TO CONTACTOR DETAILS AND SCHEDULES ON SHEET E401 AND PANELBOARD SCHEDULES ON SHEET E501 FOR MORE INFORMATION.



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

ANDREA C. MULVANY

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
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ANDREA C. MULVANY
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PROFESSIONAL ENGINEER

ANDREA C. MULVANY Oct 24 2019
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PROJECT TEAM

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CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
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SHEET TITLE

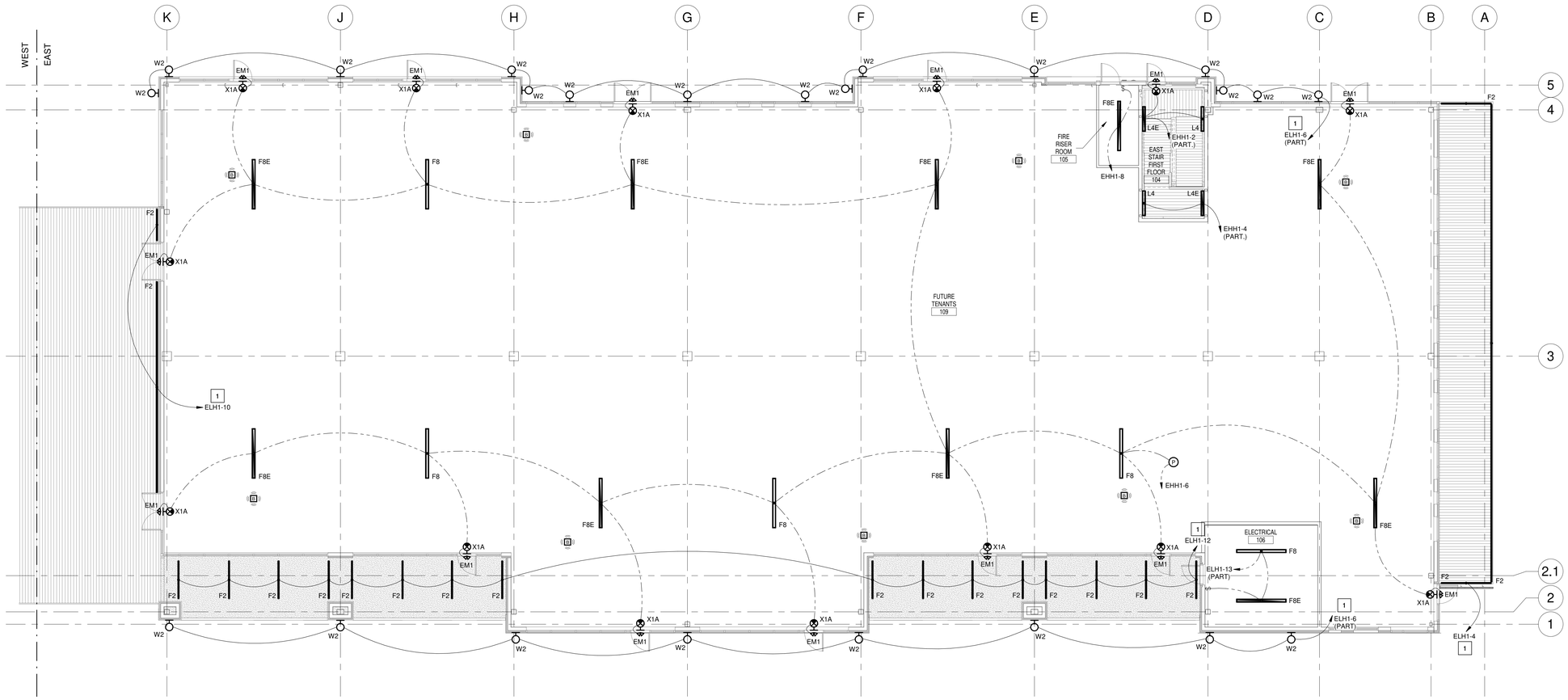
LIGHTING FIRST FLOOR PLAN - WEST

SHEET NUMBER

E121.1

LIGHTING PLAN NOTES:

1 ROUTE LIGHTING BRANCH CIRCUIT THROUGH LIGHTING CONTROL CONTACTOR. REFER TO CONTACTOR DETAILS AND SCHEDULES ON SHEET E401 AND PANELBOARD SCHEDULES ON SHEET E501 FOR MORE INFORMATION.



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

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
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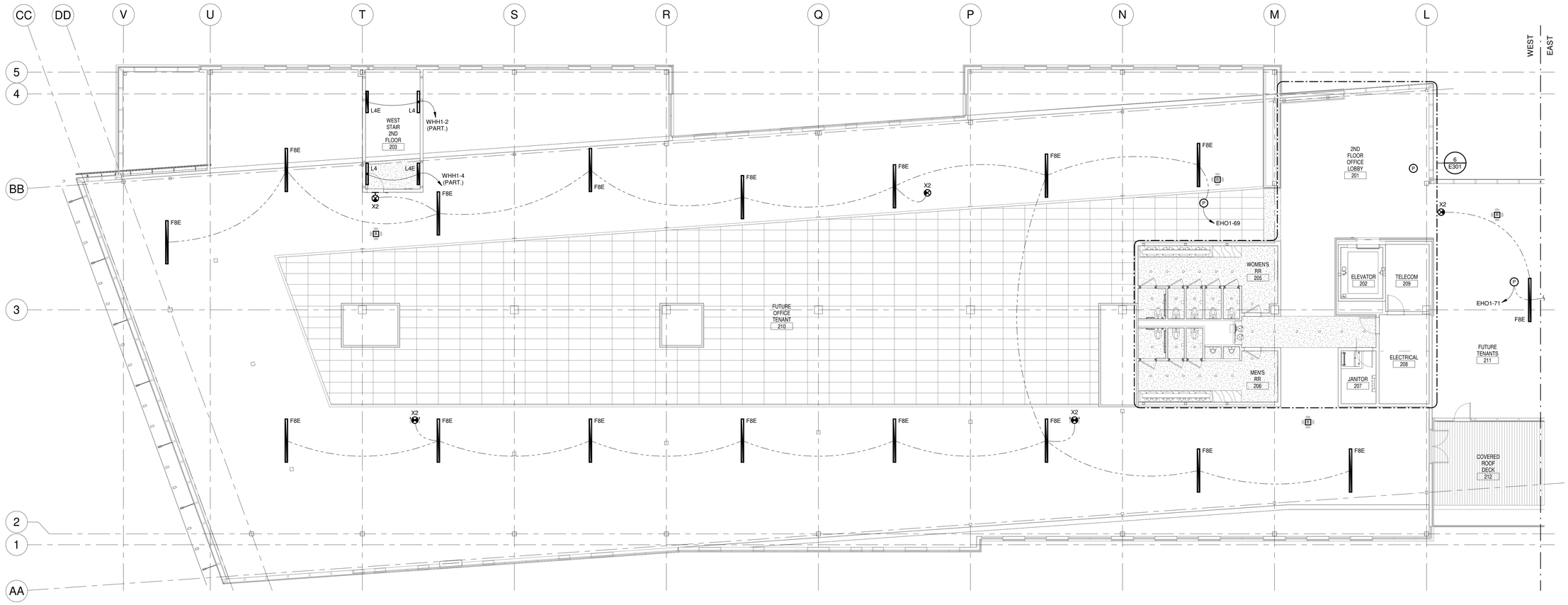
SHEET TITLE

LIGHTING FIRST FLOOR PLAN - EAST

SHEET NUMBER

E121.2



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1/8" = 1'-0"

ANDREA C. MULVANY

PARAGON STAR

PARAGON STAR
- LOT 9 -
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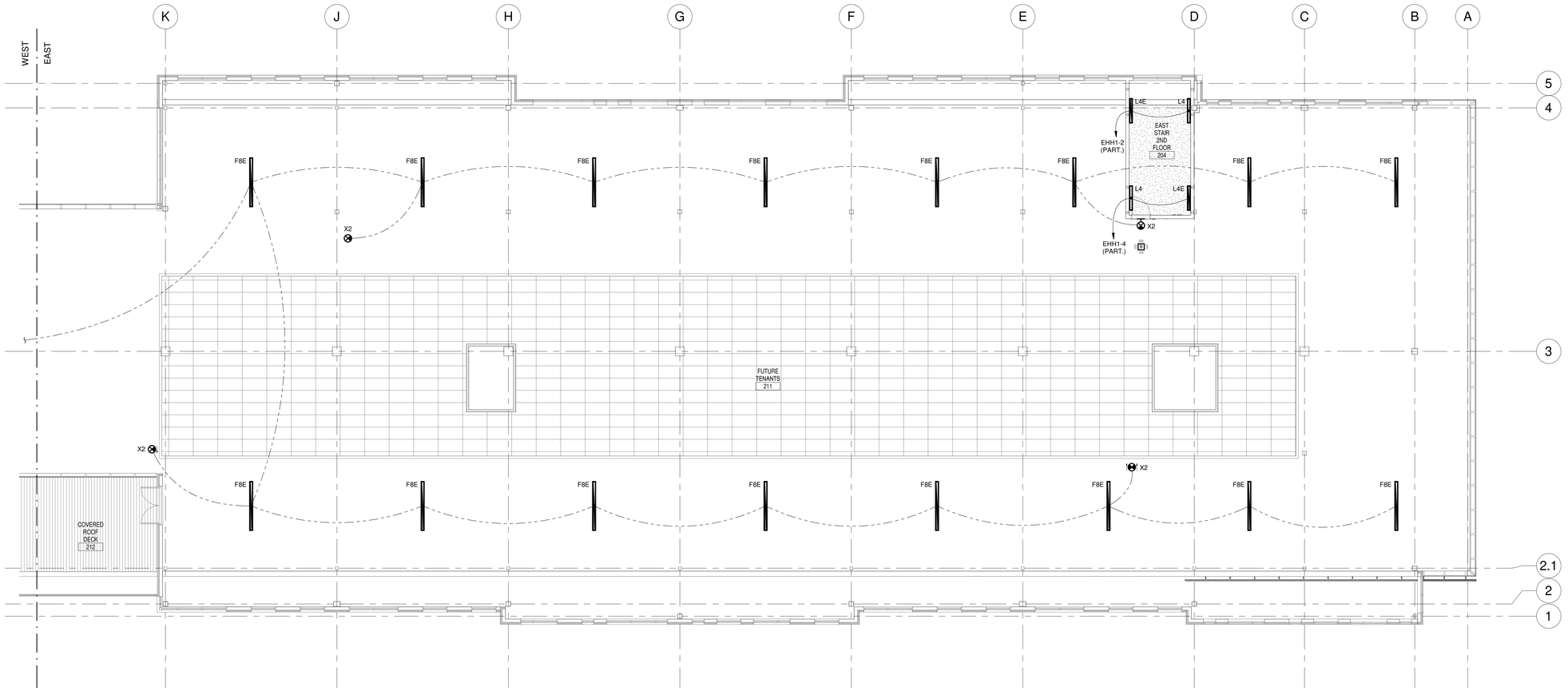

1 LIGHTING SECOND FLOOR PLAN - EAST
1/8" = 1'-0"

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ANDREA C. MULVANY

PARAGON STAR

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FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

HENDERSON ENGINEERS
1801 MAIN STREET, SUITE 300
KANSAS CITY, MO 64108
TEL 816.663.8700 **FAX** 816.663.8701
WWW.HENDERSONENGINEERS.COM
1850004412
MO. CORPORATE NO. E-556D
EXPIRES 12/31/2020

SHEET TITLE

LIGHTING SECOND FLOOR PLAN - EAST

SHEET NUMBER

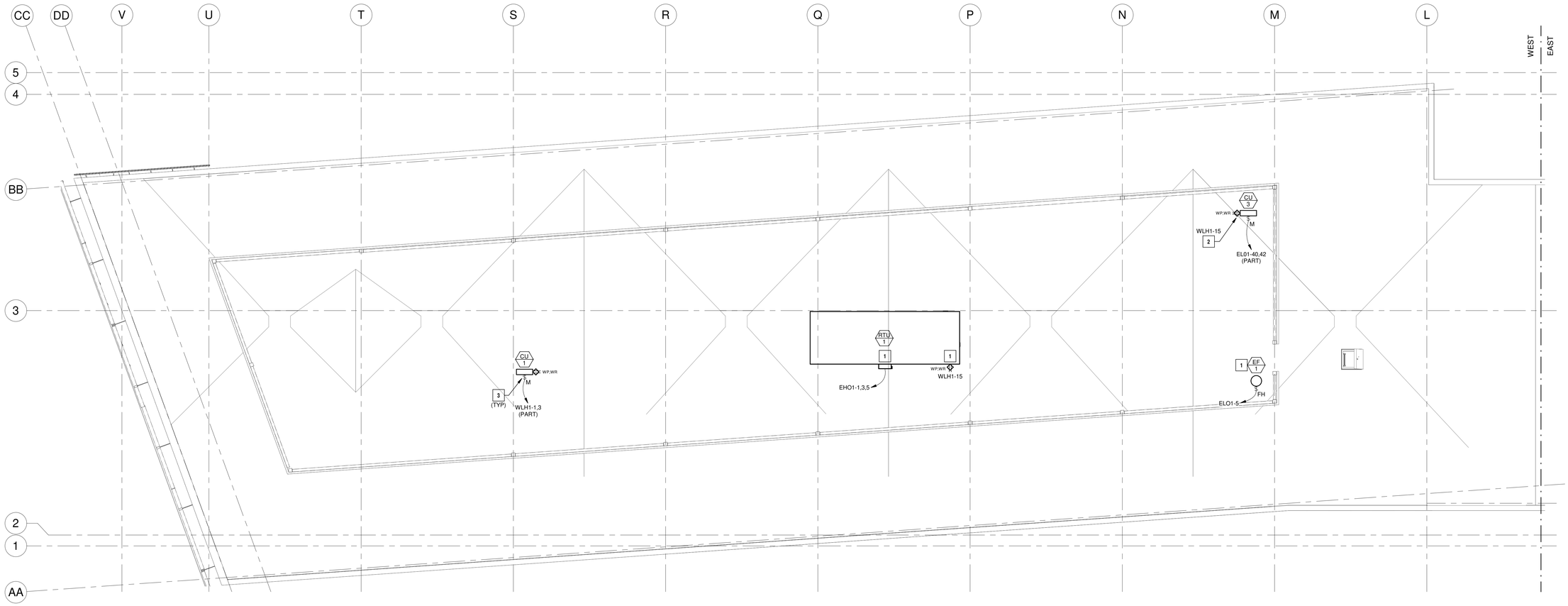
E122.2

ELECTRICAL PLAN NOTES:

1 DISCONNECT SWITCH PROVIDED WITH MECHANICAL EQUIPMENT.

2 PROVIDE MAINTENANCE/CONVENIENCE RECEPTACLE FOR MECHANICAL EQUIPMENT.

3 E.C. TO MOUNT MAINTENANCE/CONVENIENCE RECEPTACLE AND/OR E.C. PROVIDED DISCONNECT SWITCHES SO THAT ALL REQUIRED MECHANICAL EQUIPMENT CLEARANCES ARE MAINTAINED. PROVIDE BUS-STRUT MOUNTING AS NECESSARY. COORDINATE LOCATION WITH MECHANICAL CONTRACTOR PRIOR TO ROUGH-IN.



1 ELECTRICAL ROOF PLAN - WEST
1/8" = 1'-0"

N

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
ANDREA C. MULVANY
NUMBER PE-2013039892
PROFESSIONAL ENGINEER

Oct 24 2019

ANDREA C. MULVANY
LICENSE # PE-2013039892

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
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1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

ELECTRICAL ROOF PLAN - WEST

SHEET NUMBER

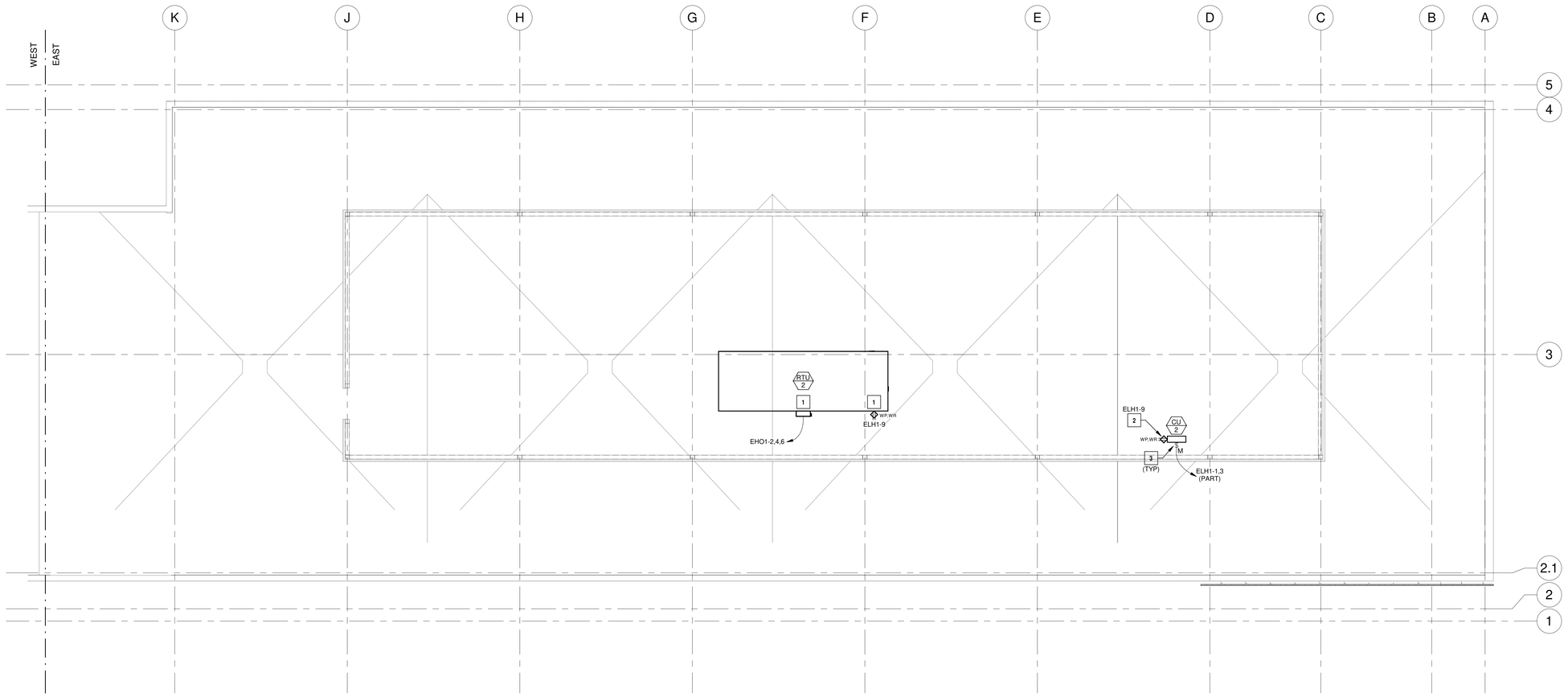
E201.1

ELECTRICAL PLAN NOTES:

1 DISCONNECT SWITCH PROVIDED WITH MECHANICAL EQUIPMENT.

2 PROVIDE MAINTENANCE/CONVENIENCE RECEPTACLE FOR MECHANICAL EQUIPMENT.

3 E.C. TO MOUNT MAINTENANCE/CONVENIENCE RECEPTACLE AND/OR E.C. PROVIDED DISCONNECT SWITCHES SO THAT ALL REQUIRED MECHANICAL EQUIPMENT CLEARANCES ARE MAINTAINED. PROVIDE BUS-STRUT MOUNTING AS NECESSARY. COORDINATE LOCATION WITH MECHANICAL CONTRACTOR PRIOR TO ROUGH-IN.



1 ELECTRICAL ROOF PLAN - EAST
1/8" = 1'-0"

N

ANDREA C. MULVANY

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
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ANDREA C. MULVANY
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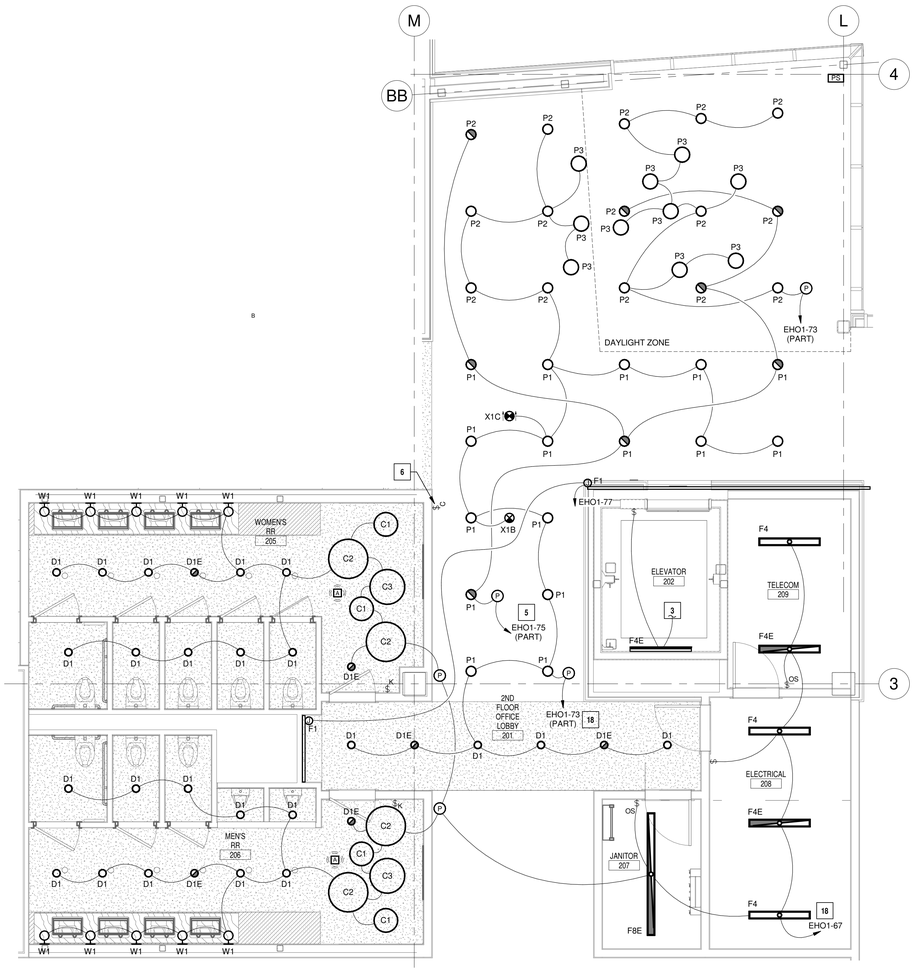
1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

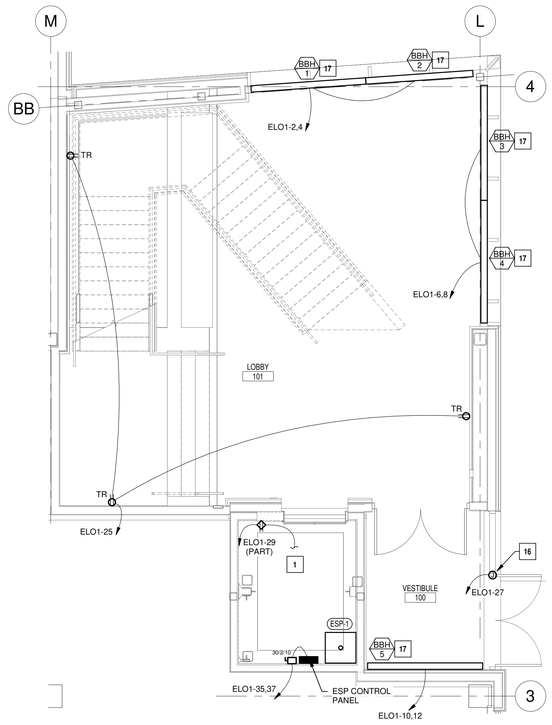
ELECTRICAL ROOF PLAN - EAST

SHEET NUMBER

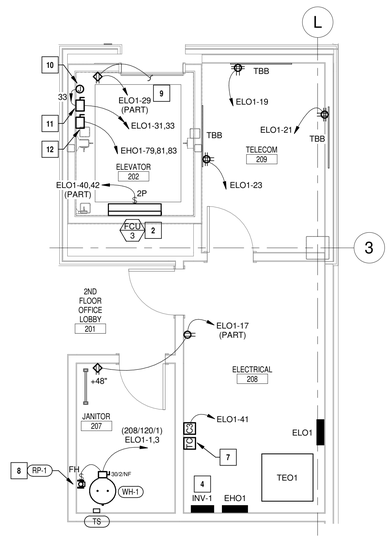
E201.2



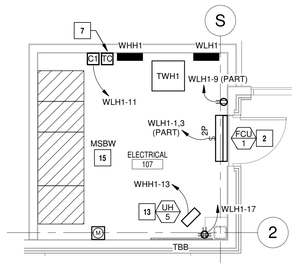
6 ENLARGED 2ND FLOOR LOBBY LIGHTING PLAN
1/4" = 1'-0"



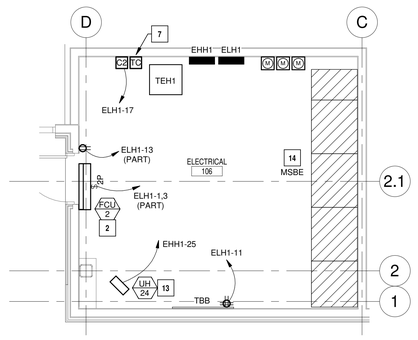
5 ENLARGED LOBBY POWER PLAN
1/4" = 1'-0"



3 2ND FLOOR OFFICE ELECTRICAL ROOM POWER PLAN
1/4" = 1'-0"



2 ELECTRICAL ROOM WEST POWER PLAN
1/4" = 1'-0"



1 ELECTRICAL ROOM EAST POWER PLAN
1/4" = 1'-0"

ELECTRICAL PLAN NOTES:

1. REFER TO SHEET E121.1 FOR CIRCUIT CONTINUATION.
2. FAN COIL UNIT TO BE POWERED FROM ASSOCIATED CONDENSING UNIT ON ROOF. COORDINATE CONNECTION WITH MECHANICAL CONTRACTOR AND MANUFACTURER'S REQUIREMENTS PRIOR TO ROUGH-IN.
3. REFER TO SHEET E102.1 FOR CIRCUIT CONTINUATION.
4. PROVIDE 500W/277V/1PH INPUT/OUTPUT EMERGENCY LIGHTING INVERTER TYPE ISOLITE "E3-50" (OR APPROVED EQUAL) FOR EMERGENCY BATTERY BACKUP OF LIGHTING FIXTURES. ROUTE BRANCH CIRCUIT "EHO1-75" THROUGH INVERTER FOR EMERGENCY LIGHTING BATTERY BACKUP. REFER TO LIGHTING PLANS FOR ADDITIONAL INFORMATION.
5. ROUTE LIGHTING BRANCH CIRCUIT THROUGH EMERGENCY LIGHTING INVERTER. PROVIDE UL-924 SHUNT TYPE RELAY FOR CONTROL OF EMERGENCY LIGHTING FIXTURES. EMERGENCY LIGHTING FIXTURES SHALL BE CONTROLLED UNDER NORMAL CONDITIONS AND RETURN TO FULL OUTPUT UPON LOSS OF NORMAL POWER.
6. PROVIDE SWITCH FOR CONTROL OF TYPE F1 RGB TAPE-LIGHT ABOVE ELEVATOR FACADE AND IN SOFFIT ABOVE ELECTRIC WATER COOLER ALCOVE. REFER TO LIGHTING CONTROL DEVICE SCHEDULE ON SHEET E502 FOR MORE INFORMATION. COORDINATE REQUIREMENTS WITH LIGHT FIXTURE AND CONTROLS MANUFACTURERS PRIOR TO ORDERING.
7. PROVIDE DIGITAL TIME SWITCH FOR EXTERIOR AND LOBBY LIGHTING CONTROL. TORK CAT. NO DG100A OR EQUAL.
8. PROVIDE CONNECTION FOR RECIRCULATION PUMP RP-1 AND TIME SWITCH TS FROM CIRCUIT SERVING HOT WATER HEATER WH-1. COORDINATE WITH PLUMBING CONTRACTOR AND MANUFACTURER'S RECOMMENDATIONS PRIOR TO ROUGH-IN.
9. REFER TO SHEET E122.1 FOR CIRCUIT CONTINUATION.
10. PROVIDE 120V, 20A ELECTRICAL CONNECTION FOR ELEVATOR CAB LIGHTING. PROVIDE 30A/1P, 15A FRN-R FUSED DISCONNECT SWITCH. COORDINATE LOCATION AND REQUIREMENTS WITH ELEVATOR CONTRACTOR AND SHOP DRAWINGS PRIOR TO ROUGH-IN.
11. PROVIDE 120V, 20A ELECTRICAL CONNECTION FOR ELEVATOR CONTROLLER. COORDINATE LOCATION AND REQUIREMENTS WITH ELEVATOR CONTRACTOR AND SHOP DRAWINGS PRIOR TO ROUGH-IN.
12. PROVIDE 480V, 3PH ELECTRICAL CONNECTION FOR ELEVATOR MOTOR. COORDINATE LOCATION AND REQUIREMENTS WITH ELEVATOR CONTRACTOR AND SHOP DRAWINGS PRIOR TO ROUGH-IN.
13. DISCONNECT SWITCH PROVIDED WITH MECHANICAL EQUIPMENT.
14. BUILDING ELECTRICAL SERVICE 1 OF 2. PROVIDE PERMANENT PLAQUE OR DIRECTORY AT SERVICE DISCONNECT INDICATING NAME AND LOCATION OF SECOND ELECTRICAL SERVICE SERVING BUILDING TO MEET REQUIREMENTS OF NEC 225.37.
15. BUILDING ELECTRICAL SERVICE 2 OF 2. PROVIDE PERMANENT PLAQUE OR DIRECTORY AT SERVICE DISCONNECT INDICATING NAME AND LOCATION OF FIRST ELECTRICAL SERVICE SERVING BUILDING TO MEET REQUIREMENTS OF NEC 225.37.
16. PROVIDE JUNCTION BOX AND 120V CONNECTION FOR DOOR ACCESS CONTROLS. COORDINATE MOUNTING AND EXACT REQUIREMENTS WITH ARCHITECTURAL DOOR HARDWARE SCHEDULES. GENERAL CONTRACTOR AND SECURITY CONTRACTOR PRIOR TO ROUGH-IN.
17. PROVIDE ELECTRICAL CONNECTION TO MANUFACTURER PROVIDED INTERNAL THERMOSTAT IN BASEBOARD UNIT AS SHOWN ON PLANS. COORDINATE CONNECTION AND ADDITIONAL REQUIREMENTS WITH MECHANICAL CONTRACTOR AND MANUFACTURER'S RECOMMENDATIONS.
18. ROUTE LIGHTING BRANCH CIRCUIT THROUGH LIGHTING CONTROL CONTACTOR. REFER TO CONTACTOR DETAILS AND SCHEDULES ON SHEET E401 AND PANELBOARD SCHEDULES ON SHEET E501 FOR MORE INFORMATION.

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.:	1850004412
Date:	10.25.19
Issued For:	SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
ANDREA C. MULVANY
NUMBER PE-2013039892
PROFESSIONAL ENGINEER

ANDREA C. MULVANY Oct 24, 2019
LICENSE # PE-2013039892

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
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1850004412
MO. CORPORATE NO. E-556D
EXPIRES 12/31/2020

SHEET TITLE

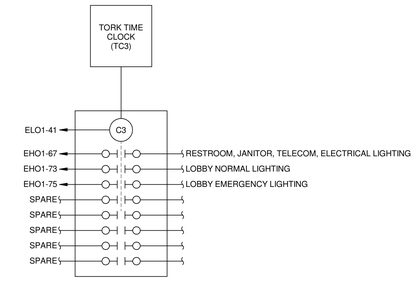
ELECTRICAL ENLARGED PLAN

SHEET NUMBER

E301

CONTACTOR SCHEDULE						
	CONTACTOR			CONTROL CIRCUIT		LOAD DESCRIPTION
CONTACTOR NUMBER	AMPS	POLES	CIRCUIT NUMBER	VOLTS	OPERATION BY	
C3	30	8	EHO1-67,73,75	120	TORK TIME CLOCK	OFFICE LIGHTING

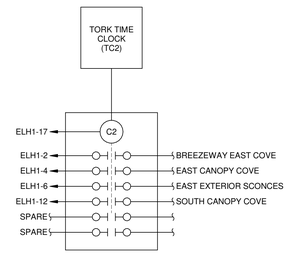
GENERAL NOTES:
1. CONTACTORS SHALL BE ELECTRONICALLY OPERATED AND MECHANICALLY HELD.
2. PROVIDE ALL REQUIRED CONTROL ACCESSORIES NECESSARY FOR SPECIFIED OPERATION.
3. PROVIDE LABELS FOR EACH CONTACTOR INDICATING THE LOAD CONTROLLED.
4. NUMBER ALL WIRES AT EACH CONTACTOR.



③ OFFICE LIGHTING CONTROL CONTACTOR DETAIL
12" = 1'-0"

CONTACTOR SCHEDULE						
	CONTACTOR			CONTROL CIRCUIT		LOAD DESCRIPTION
CONTACTOR NUMBER	AMPS	POLES	CIRCUIT NUMBER	VOLTS	OPERATION BY	
C2	30	6	ELH1-2,4,6,12	120	TORK TIME CLOCK	EXTERIOR LIGHTING

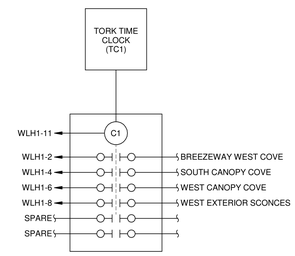
GENERAL NOTES:
1. CONTACTORS SHALL BE ELECTRONICALLY OPERATED AND MECHANICALLY HELD.
2. PROVIDE ALL REQUIRED CONTROL ACCESSORIES NECESSARY FOR SPECIFIED OPERATION.
3. PROVIDE LABELS FOR EACH CONTACTOR INDICATING THE LOAD CONTROLLED.
4. NUMBER ALL WIRES AT EACH CONTACTOR.



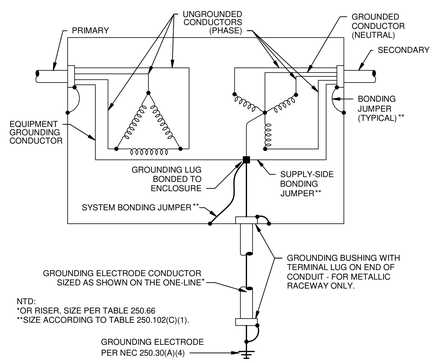
⑤ EAST LIGHTING CONTROL CONTACTOR DETAIL
12" = 1'-0"

CONTACTOR SCHEDULE						
	CONTACTOR			CONTROL CIRCUIT		LOAD DESCRIPTION
CONTACTOR NUMBER	AMPS	POLES	CIRCUIT NUMBER	VOLTS	OPERATION BY	
C1	30	6	WLH1-2,4,6,8	120	TORK TIME CLOCK	EXTERIOR LIGHTING

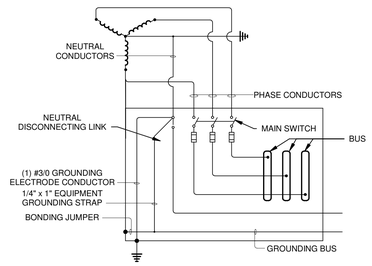
GENERAL NOTES:
1. CONTACTORS SHALL BE ELECTRONICALLY OPERATED AND MECHANICALLY HELD.
2. PROVIDE ALL REQUIRED CONTROL ACCESSORIES NECESSARY FOR SPECIFIED OPERATION.
3. PROVIDE LABELS FOR EACH CONTACTOR INDICATING THE LOAD CONTROLLED.
4. NUMBER ALL WIRES AT EACH CONTACTOR.



④ WEST LIGHTING CONTROL CONTACTOR DETAIL
12" = 1'-0"



② DRY TYPE TRANSFORMER GROUNDING
NTS



① SERVICE ENTRANCE GROUNDING DIAGRAM
NTS

ANDREA C. MULVANY

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
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REVISIONS

No.	Date	Description

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STATE OF MISSOURI
ANDREA C. MULVANY
NUMBER PE-2013039892
PROFESSIONAL ENGINEER

ANDREA C. MULVANY
LICENSE # PE-2013039892

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
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MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

ELECTRICAL DETAILS

SHEET NUMBER

E401

PANELBOARD: WHH1 (NEW)

BUS AMPS: 250A
MAIN SIZE/TYPE: MLO
VOLTS/PHASE: 480Y/277V, 3PH, 4W
SECTION: 1

FED FROM: MSBW
AIC RATING: FCA +10% MINIMUM FULLY RATED — EQUIPMENT GROUND BUS
SERVES: 480V HOUSE LOADS
MOUNTING: SURFACE
LOCATION: WEST ELECTRICAL ROOM

CKT NO.	DESCRIPTION	VOLTAMPS/PHASE A	B	C	WIRE NO.	BKR AMP	P	P	BKR AMP	WIRE NO.	VOLTAMPS/PHASE A	B	C	DESCRIPTION	CKT NO.	
1	PWR - UH-1	5,000			10	25	1	1	20	12	152			LTG - W STAIRWELL CIRC 1	2	EM
3	PWR - UH-2		5,000		10	25	1	1	20	12		140		LTG - W STAIRWELL CIRC 2	4	EM
5	PWR - UH-3			5,000	10	25	1	1	20	12			961	LTG - TENANT SPACE WEST	6	EM
7	PWR - UH-4	5,000			10	25	1	1						SPACE	8	
9	PWR - UH-5		5,000		10	25	1	1						SPACE	10	
11	PWR - UH-6			5,000	10	25	1	1						SPACE	12	
13	PWR - UH-7	5,000			10	25	1	1						SPACE	14	
15	PWR - UH-8		5,000		10	25	1	1						SPACE	16	
17	PWR - UH-9			5,000	10	25	1	1						SPACE	18	
19	PWR - UH-10	5,000			10	25	1	1						SPACE	20	
VD 21	PWR - UH-11		5,000		8	25	1	1						SPACE	22	
23	PWR - UH-12			5,000	10	25	1	1						SPACE	24	
25	PWR - UH-13	5,000			10	25	1	1						SPACE	26	
27	SPACE						1	1						SPACE	28	
29	SPACE						1	1						SPACE	30	
31	SPACE						1	1						SPACE	32	
33	SPACE						1	1						SPACE	34	
35	SPACE						1	1						SPACE	36	
37	SPACE						1				2,644				38	
39	SPACE						1	3	50	OL		2,760		PANELBOARD WLH1	40	
41	SPACE						1						2,624	VIA 30KVA XFMR TWH1	42	
	SUBTOTAL	25,000	20,000	20,000							2,796	2,900	3,585	SUBTOTAL		

		LOAD	CONN. VA	DF	LOAD	CONN. VA	DF	
TOTAL PHASE A - VA	27,796	COOLING	2,704	1.00	REFRIG		1.00	
AMPS	100	HEATING		0	SIGN/DISP		1.25	
TOTAL PHASE B - VA	22,900	LIGHTING	3,697	1.25	KITCHEN		1.00	
AMPS	83	RECEPTACLES	1,080	1.0/.5	EXISTING		1.00	
TOTAL PHASE C - VA	23,585	MOTORS		1.00	LRG MOTOR		1.25	TOTAL DEMAND
AMPS	85	SUPP HEAT	66,200	1.00	SHOW WNDW		1.25	75,205 VA
TOTAL PNLBD - VA	74,281	MISC EQUIP	600	1.00	LTG TRACK		1.00	90 A
AMPS	89							

PANELBOARD NOTES

PANELBOARD: WLH1 (NEW)

BUS AMPS: 100A
MAIN SIZE/TYPE: 100A MCB
VOLTS/PHASE: 208Y/120V, 3PH, 4W
SECTION: 1

FED FROM: WHH1 VIA XFMR TWH1
AIC RATING: FCA +10% MINIMUM FULLY RATED — EQUIPMENT GROUND BUS
SERVES: 208V HOUSE LOADS
MOUNTING: SURFACE
LOCATION: WEST ELECTRICAL ROOM

CKT NO.	DESCRIPTION	VOLTAMPS/PHASE A	B	C	WIRE NO.	BKR AMP	P	P	BKR AMP	WIRE NO.	VOLTAMPS/PHASE A	B	C	DESCRIPTION	CKT NO.	
1	PWR - CU-1 / FCU-1	1,352			12	15	2	1	20	12	160			LTG - BREEZEWAY WEST COVE	2	C1
3			1,352					1	20	12		627		LTG - SOUTH CANOPY COVE	4	C1
LCK 5	PWR - BBH-7			600	10	20	2	1	20	12			1,064	LTG - WEST CANOPY COVE	6	C1
7		600						1	20	10	532			LTG - WEST EXT SCONCES	8	C1,VD
9	RCPT/LTG - ELEC ROOM WEST		241		12	20	1	1						SPACE	10	
11	PWR - CONTACTOR 1 / TC			600	10	20	1	1						SPACE	12	
13	SPARE					20	1	1						SPACE	14	
15	RCPT - ROOF MECH CONV. W		540		12	20	1	1						SPACE	16	
17	RCPT - TBB			360	10	20	1	1						SPACE	18	
19	SPACE						1	1						SPACE	20	
21	SPACE						1	1						SPACE	22	
23	SPACE						1	1						SPACE	24	
25	SPACE						1	1						SPACE	26	
27	SPACE						1	1						SPACE	28	
29	SPACE						1	1						SPACE	30	
	SUBTOTAL	1,952	2,133	1,560							692	627	1,064	SUBTOTAL		

		LOAD	CONN. VA	DF	LOAD	CONN. VA	DF	
TOTAL PHASE A - VA	2,644	COOLING	2,704	1.00	REFRIG		1.00	
AMPS	22	HEATING		0	SIGN/DISP		1.25	
TOTAL PHASE B - VA	2,760	LIGHTING	2,444	1.25	KITCHEN		1.00	
AMPS	23	RECEPTACLES	1,080	1.0/.5	EXISTING		1.00	
TOTAL PHASE C - VA	2,624	MOTORS		1.00	LRG MOTOR		1.25	TOTAL DEMAND
AMPS	22	SUPP HEAT	1,200	1.00	SHOW WNDW		1.25	8,639 VA
TOTAL PNLBD - VA	8,028	MISC EQUIP	600	1.00	LTG TRACK		1.00	24 A
AMPS	22							

PANELBOARD NOTES

PANELBOARD: EHH1 (NEW)

BUS AMPS: 125A
MAIN SIZE/TYPE: MLO
VOLTS/PHASE: 480Y/277V, 3PH, 4W
SECTION: 1

FED FROM: MSBE
AIC RATING: FCA +10% MINIMUM FULLY RATED — EQUIPMENT GROUND BUS
SERVES: 480V HOUSE LOADS
MOUNTING: SURFACE
LOCATION: EAST ELECTRICAL ROOM

CKT NO.	DESCRIPTION	VOLTAMPS/PHASE A	B	C	WIRE NO.	BKR AMP	P	P	BKR AMP	WIRE NO.	VOLTAMPS/PHASE A	B	C	DESCRIPTION	CKT NO.	
1	PWR - UH-14	5,000			10	25	1	1	20	12	152			LTG - E STAIRWELL CIRC 1	2	EM
3	PWR - UH-15		5,000		8	25	1	1	20	12		140		LTG - E STAIRWELL CIRC 2	4	EM
VD 5	PWR - UH-16			5,000	10	25	1	1	20	12			888	LTG - TENANT SPACE EAST	6	EM
7	PWR - UH-17	5,000			10	25	1	1	20	12	61			LTG - FIRE RISER ROOM	8	EM
9	PWR - UH-18		5,000		10	25	1	1						SPACE	10	
11	PWR - UH-19			5,000	10	25	1	1						SPACE	12	
13	PWR - UH-20	5,000			10	25	1	1						SPACE	14	
15	PWR - UH-21		5,000		10	25	1	1						SPACE	16	
17	PWR - UH-22			5,000	10	25	1	1						SPACE	18	
19	PWR - UH-23	5,000			10	25	1	1						SPACE	20	
21	PWR - UH-24		5,000		10	25	1	1						SPACE	22	
23	PWR - UH-25			5,000	10	25	1	1						SPACE	24	
25	PWR - UH-26	5,000			10	25	1	1						SPACE	26	
27	SPACE						1	1						SPACE	28	
29	SPACE						1	1						SPACE	30	
31	SPACE						1	1						SPACE	32	
33	SPACE						1	1						SPACE	34	
35	SPACE						1	1						SPACE	36	
37	SPACE						1				2,754				38	
39	SPACE						1	3	50	OL		2,939		PANELBOARD ELH1	40	
41	SPACE						1						2,660	VIA 30KVA XFMR TEH1	42	
	SUBTOTAL	25,000	20,000	20,000							2,967	3,079	3,548	SUBTOTAL		

		LOAD	CONN. VA	DF	LOAD	CONN. VA	DF	
TOTAL PHASE A - VA	27,967	COOLING	2,704	1.00	REFRIG		1.00	
AMPS	101	HEATING		0	SIGN/DISP		1.25	
TOTAL PHASE B - VA	23,079	LIGHTING	3,090	1.25	KITCHEN		1.00	
AMPS	83	RECEPTACLES	900	1.0/.5	EXISTING		1.00	
TOTAL PHASE C - VA	23,548	MOTORS		1.00	LRG MOTOR		1.25	TOTAL DEMAND
AMPS	85	SUPP HEAT	66,200	1.00	SHOW WNDW		1.25	75,367 VA
TOTAL PNLBD - VA	74,594	MISC EQUIP	1,700	1.00	LTG TRACK		1.00	91 A
AMPS	90							

PANELBOARD NOTES

PANELBOARD: ELH1 (NEW)

BUS AMPS: 100A
MAIN SIZE/TYPE: 100A MCB
VOLTS/PHASE: 208Y/120V, 3PH, 4W
SECTION: 1

FED FROM: EHH1 VIA XFMR TEH1
AIC RATING: FCA +10% MINIMUM FULLY RATED — LINE-SIDE LUGS: MECHANICAL, EQUIPMENT GROUND BUS
SERVES: 208V HOUSE LOADS
MOUNTING: SURFACE
LOCATION: EAST ELECTRICAL ROOM

CKT NO.	DESCRIPTION	VOLTAMPS/PHASE A	B	C	WIRE NO.	BKR AMP	P	P	BKR AMP	WIRE NO.	VOLTAMPS/PHASE A	B	C	DESCRIPTION	CKT NO.	
1	PWR - CU-3 / FCU-3	1,352			12	15	2	1	20					SPARE	2	
3			1,352					1	20	12		442		LTG - EAST CANOPY COVE	4	C2
5	PWR - BBH-8			600	12	20	2	1	20	10			644	LTG - EAST EXT SCONCES	6	C2,VD
7		600						1	20					SPARE	8	
9	RCPT - ROOF MECH CONV.		360		12	20	1	1	20	12		185		LTG - BREEZEWAY EAST COVE	10	C2
11	RCPT - TBB EAST			360	12	20	1	1	20	12			456	LTG - SOUTH CANOPY COVE	12	C2
13	RCPT/LTG - ELEC ROOM EAST	302			12	20	1	1						SPACE	14	
15	PWR - IRRIGATION CONTROL		600		12	20	1	1						SPACE	16	
FA 17	PWR - CONTACTOR 2 / TC			600	12	20	1	1						SPACE	18	
19	PWR - FACP	500			12	20	1	1						SPACE	20	
21	SPACE						1	1						SPACE	22	
23	SPACE						1	1						SPACE	24	
25	SPACE						1	1						SPACE	26	
27	SPACE						1	1						SPACE	28	
29	SPACE						1	1						SPACE	30	
	SUBTOTAL	2,754	2,312	1,560								627	1,100	SUBTOTAL		

		LOAD	CONN. VA	DF	LOAD	CONN. VA	DF	
TOTAL PHASE A - VA	2,754	COOLING	2,704	1.00	REFRIG		1.00	
AMPS	23	HEATING		0	SIGN/DISP		1.25	
TOTAL PHASE B - VA	2,939	LIGHTING	1,849	1.25	KITCHEN		1.00	
AMPS	24	RECEPTACLES	900	1.0/.5	EXISTING		1.00	
TOTAL PHASE C - VA	2,660	MOTORS		1.00	LRG MOTOR		1.25	TOTAL DEMAND
AMPS	22	SUPP HEAT	1,200	1.00	SHOW WNDW		1.25	8,815 VA
TOTAL PNLBD - VA	8,353	MISC EQUIP	1,700	1.00	LTG TRACK		1.00	24 A
AMPS	23							

PANELBOARD NOTES

PANELBOARD: EHO1 (NEW)

BUS AMPS: 1000A
MAIN SIZE/TYPE: 1000A MCB
VOLTS/PHASE: 480Y/277V, 3PH, 4W
SECTION: 1

FED FROM: MSBE
AIC RATING: FCA +10% MINIMUM FULLY RATED — EQUIPMENT GROUND BUS
SERVES: 480V OFFICE LOADS
MOUNTING: SURFACE
LOCATION: 2ND FLOOR ELECTRICAL ROOM

CKT NO.	DESCRIPTION	VOLTAMPS/PHASE A	B	C	WIRE NO.	BKR AMP	P	P	BKR AMP	WIRE NO.	VOLTAMPS/PHASE A	B	C	DESCRIPTION	CKT NO.	
1		45,643									45,643				2	
3	RTU-1		45,643		4/0	225	3	3	225	4/0		45,643		RTU-2	4	
5				45,643									45,643		6	
7		10,243									4,133				8	
9	PFBP-1		8,333		8	40	3	3	20	12		3,333		PFBP-2	10	
11				8,333									3,333		12	
13		4,133									3,333				14	
15	PFBP-3		3,333		12	20	3	3	20	12		4,133		PFBP-4	16	
17				3,333									3,333		18	
19		3,333									3,333				20	
21	PFBP-5		4,133		12	20	3	3	20	12		3,333		PFBP-6	22	
23				3,333									4,133		24	
25		3,333									4,133				26	
27	PFBP-7		3,333		12	20	3	3	20	12		3,333		PFBP-8	28	
29				4,133									3,333		30	
31		4,133									3,333				32	
33	PFBP-9		3,333		12	20	3	3	20	12		4,133		PFBP-10	34	
35				3,333									3,333		36	
37		3,666									3,666				38	
39	PFBP-11		4,466		12	20	3	3	20	12		3,666		PFBP-12	40	
41				3,666									4,466		42	
43		3,666									4,466				44	
45	PFBP-13		3,666		12	20	3	3	20	12		3,666		PFBP-14	46	
47				4,466									3,666		48	
49		4,466									3,666				50	
51	PFBP-15		3,666		12	20	3	3	20	10		4,466		PFBP-16	52	VD
53				3,666									3,666		54	
55		3,666									3,666				56	
57	PFBP-17		4,466		12	20	3	3	20	12		3,666		PFBP-18	58	
59				3,666									4,466		60	
61		3,666									1,610				62	
63	PFBP-19		3,666		12	20	3	3	20	12		1,000		PFBP-20	64	
65				4,466									1,000		66	
C3, EM 67	LTG - RR, JAN, TEL, ELEC	972			12	20	1				1,000				68	
EM 69	LTG - WEST OFFICE		980		12	20	1	3	20	12		1,610		PFBP-21	70	
EM 71	LTG - EAST OFFICE			1,042	12	20	1						1,000		72	
C3 73	LTG - LOBBY NORMAL	752			12	20	1	1						SPACE	74	
C3,EM 75	LTG - LOBBY EM		128		12	20	1	1						SPACE	76	
77	LTG - LOBBY ELEVATOR COVE			176	12	20	1	1						SPACE	78	
79		6,928									11,635				80	
81	PWR - ELEVATOR		6,928		10	30	3	3	250	OL		11,767		PANELBOARD ELO1	82	
83			6,928										11,774	VIA 150KVA XFMR TEO1	84	
	SUBTOTAL	98,600	96,074	96,184							93,617	93,749	93,146	SUBTOTAL		

		LOAD	CONN. VA	DF	LOAD	CONN. VA	DF	
TOTAL PHASE A - VA	192,217	COOLING	195,472	1.00	REFRIG		1.00	
AMPS	694	HEATING		0	SIGN/DISP		1.25	
TOTAL PHASE B - VA	189,823	LIGHTING	4,750	1.25	KITCHEN		1.00	
AMPS	685	RECEPTACLES	5,580	1.0/.5	EXISTING		1.00	
TOTAL PHASE C - VA	189,330	MOTORS	100,951	1.00	LRG MOTOR	22,447	1.25	TOTAL DEMAND
AMPS	684	SUPP HEAT	229,322	1.00	SHOW WNDW		1.25	578,169 VA
TOTAL PNLBD - VA	571,370	MISC EQUIP	12,848	1.00	LTG TRACK		1.00	695 A
AMPS	687							

PANELBOARD NOTES

SINGLE SECTION PANELBOARD

PANELBOARD: ELO1 (NEW)

BUS AMPS: 600A
MAIN SIZE/TYPE: MLO
VOLTS/PHASE: 208Y/120V, 3PH, 4W
SECTION: 1

FED FROM: EHO1 VIA XFMR TEO1
AIC RATING: FCA +10% MINIMUM FULLY RATED — EQUIPMENT GROUND BUS
SERVES: 208V OFFICE LOADS
MOUNTING: SURFACE — FEED THRU LUGS
LOCATION: 2ND FLOOR ELECTRICAL ROOM

CKT NO.	DESCRIPTION	VOLTAMPS/PHASE A	B	C	WIRE NO.	BKR AMP	P	P	BKR AMP	WIRE NO.	VOLTAMPS/PHASE A	B	C	DESCRIPTION	CKT NO.	
1	PWR - WH-1 / RP-1	2,500			10	30	2	2	20	12	1,050			PWR - BBH-1, BBH-2	2	LCK
3	5KW / 1/18HP		2,500									1,050			4	
5	PWR - EF-1			864	12	15	1	2	20	12			1,125	PWR - BBH-3, BBH-4	6	LCK
7	PWR - VAV-1, VAV-2	100			12	20	1				1,125				8	
VD 9	RCPT - OFFICE N EAST MECH		540		10	20	1	2	20	12		525		PWR - BBH-5	10	LCK
VD 11	RCPT - OFFICE S EAST MECH			720	10	20	1						525		12	
13	RCPT - OFFICE N WEST MECH	720			12	20	1	1	20	12	1,200			PWR - M RR WASHBAR 1	14	
15	RCPT - OFFICE S WEST MECH		540		12	20	1	1	20	12		1,200		PWR - M RR WASHBAR 2	16	
17	RCPT - ELEC, JAN, HALL			720	12	20	1	1	20	12			1,200	PWR - M RR WASHBAR 3	18	
19	RCPT - TBB NORTH	360			12	20	1	1	20	12	1,200			PWR - M RR WASHBAR 4	20	
21	RCPT - TBB EAST		360		12	20	1	1	20	12		1,200		PWR - W RR WASHBAR 1	22	
23	RCPT - TBB SOUTH			360	12	20	1	1	20	12			1,200	PWR - W RR WASHBAR 2	24	
25	RCPT - LOBBY	540			12	20	1	1	20	12	1,200			PWR - W RR WASHBAR 3	26	
27	PWR - LOBBY DOOR		600		12	20	1	1	20	12		1,200		PWR - W RR WASHBAR 4	28	
EM 29	RCPT/LTG - ELEVATOR SHAFT			820	12	20	1	1	20	12			1,248	RCPT - RR'S / EWC	30	
31	PWR - ELEVATOR CONTROL	600			12	20	1	1	20					SPARE	32	
33	PWR - ELEVATOR CAB LTS		600		12	20	1	1	20					SPARE	34	
35	PWR - ELEVATOR SUMP			1,040	12	20	2	1	20					SPARE	36	
37		1,040						1	20					SPARE	38	
39	PWR - RR SENSOR XFMRS		100		12	20	1	2	15	12		1,352		PWR - CU-3 / FCU-3	40	
41	PWR - CONTACTOR 3 / TC			600	12	20	1						1,352		42	
	SUBTOTAL	5,860	5,240	5,124							5,775	6,527	6,650	SUBTOTAL		

		LOAD	CONN. VA	DF	LOAD	CONN. VA	DF	
TOTAL PHASE A - VA	11,635	COOLING	3,754	1.00	REFRIG		1.00	
AMPS	97	HEATING		0	SIGN/DISP		1.25	
TOTAL PHASE B - VA	11,767	LIGHTING	700	1.25	KITCHEN		1.00	
AMPS	98	RECEPTACLES	5,580	1.0/.5	EXISTING		1.00	
TOTAL PHASE C - VA	11,774	MOTORS	458	1.00	LRG MOTOR	2,486	1.25	TOTAL DEMAND
AMPS	98	SUPP HEAT	9,350	1.00	SHOW WNDW		1.25	35,973 VA
TOTAL PNLBD - VA	35,176	MISC EQUIP	12,848	1.00	LTG TRACK		1.00	100 A
AMPS	98							

PANELBOARD NOTES

PANELBOARD LEGEND

ABBREVIATIONS — V1.00

AF	ARC FAULT CIRCUIT INTERRUPTER.
C#	CIRCUIT VIA LIGHTING CONTACTOR #.
CL	CIRCUIT VIA CURRENT LIMITING DEVICE.
D	DISCONNECT CIRCUITRY FOR REMOVED LOAD, UPDATE CIRCUIT DIRECTORY TO SPARE AND TURN OFF.
EM	EMERGENCY LIGHTING HANDLE-ON CLAMP.
EX	EXISTING.
F	FUTURE LOAD; NOTE AS SPARE AND TURN OFF.
FA	RED/HANDLE-ON CLAMP.
GF	GROUND-FAULT CIRCUIT INTERRUPTER TYPE CIRCUIT BREAKER (5 mA).
GFEP	GROUND FAULT EQUIPMENT PROTECTION BREAKER (30 mA).
HT	PROVIDE HANDLE-TIE FOR MULTI-WIRE BRANCH CIRCUIT PER CODE.
IG	ISOLATED GROUND CIRCUIT.
L#	LIGHTING CONTROL SCHEME NUMBER.
LCK	HANDLE PADLOCKABLE-OFF DEVICE.
LO	HANDLE-ON CLAMP.
N	PROVIDE NEW CIRCUIT BREAKER.
OL	REFER TO ELECTRICAL ONE-LINE/RISER DIAGRAM.
PS	POWER-SWITCHING CIRCUIT BREAKER.
PSE	EMERGENCY POWER-SWITCHING CIRCUIT BREAKER.
R	REUSE EXISTING CIRCUIT BREAKER FOR NEW/REVISED LOAD.
RP	CIRCUIT VIA RELAY PANEL.
ST	SHUNT TRIP CIRCUIT BREAKER.
V	VERIFY EXISTING LOAD AND UPDATE DIRECTORY, IF UNUSED, NOTE AS SPARE AND TURN OFF.
VD	BRANCH CIRCUITRY HAS BEEN UPSIZED TO REDUCE VOLTAGE DROP. ADJUST GROUND WIRE SIZE PER CODE. PROVIDE LUG ADAPTORS IF REQUIRED.
Z	CORRECT/REPAIR EXISTING HAZARD TO MAKE CODE COMPLIANT INSTALLATION.

NOT ALL ABBREVIATIONS ARE USED.

PARAGON STAR

PARAGON STAR
- LOT 9 -
BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
ANDREA C. MULVANY
NUMBER PE-2013039892
PROFESSIONAL ENGINEER

Oct 24 2019
ANDREA C. MULVANY
LICENSE # PE-2013039892

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

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1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

ELECTRICAL SCHEDULES

SHEET NUMBER

E501

LIGHTING CONTROL DEVICE SCHEDULE

LINE-VOLTAGE WALL SWITCH OCCUPANCY SENSORS

SYMBOL TAG	MANUFACTURER MODEL/SERIES	ALTERNATE MANUFACTURER	DEVICE DESCRIPTION	COVERAGE (W X D)	VOLTAGE	NOTES
$^{OS}	LEGRAND PW-100	ACUITY, COOPER HUBBELL, LEVITON LUTRON	WALL MOUNT PASSIVE INFRARED OCCUPANCY SENSOR. INTEGRAL MANUAL OVERRIDE SWITCH. SINGLE RELAY. LINE VOLTAGE. LOAD: 120V=800W, 277V=1200W.	MAJOR 30' x 35' MINOR 15' x 20'	120/ 277	

STAND-ALONE LOW-VOLTAGE LIGHTING CONTROL SYSTEMS

STAND-ALONE LOW-VOLTAGE OCCUPANCY SENSORS

SYMBOL TAG	MANUFACTURER MODEL/SERIES	ALTERNATE MANUFACTURER	DEVICE DESCRIPTION	COVERAGE (W X D)	VOLTAGE	NOTES
	LEGRAND CI-300	ACUITY, COOPER HUBBELL, LEVITON	CEILING MOUNT PASSIVE INFRARED OCCUPANCY SENSOR. 360 DEGREE COVERAGE. LOW VOLTAGE. ISOLATED RELAY.	MAJOR 44' Ø MINOR 25' Ø	24	
	LEGRAND UT-300-1	COOPER, HUBBELL LEVITON	CEILING MOUNT ULTRASONIC OCCUPANCY SENSOR. 360 DEGREE COVERAGE. LOW VOLTAGE. ISOLATED RELAY.	24' x 24'	24	

STAND-ALONE LOW-VOLTAGE PHOTOELECTRIC SWITCHES

SYMBOL TAG	MANUFACTURER MODEL/SERIES	ALTERNATE MANUFACTURER	DEVICE DESCRIPTION	VOLTAGE	NOTES
PS	LEGRAND LS-301	ACUITY HUBBELL LEVITON	INTERIOR LOW-VOLTAGE PHOTOELECTRIC SWITCH WITH SETUP REMOTE CONTROL. CLOSED LOOP. WORKS WITH UP TO (50) 0-10V DIMMING BALLASTS PER SENSOR. 20-60 FC.	24	

STAND-ALONE LOW-VOLTAGE POWER PACKS

SYMBOL TAG	MANUFACTURER MODEL/SERIES	ALTERNATE MANUFACTURER	DEVICE DESCRIPTION	VOLTAGE	NOTES
P	LEGRAND BZ-250	ACUITY, COOPER HUBBELL, LEVITON	POWER PACK FOR LOW VOLTAGE OCCUPANCY SENSORS. 20A LOAD. (1) RELAY. MANUAL-AND AUTO-ON MODES. HOLD-ON AND -OFF INPUTS. LOAD: 16A AT 120V OR 277V. OUTPUT: 225mA AT 24V. PLENUM RATED.	120/ 277	

STAND-ALONE LOW-VOLTAGE SWITCHES

SYMBOL TAG	MANUFACTURER MODEL/SERIES	ALTERNATE MANUFACTURER	DEVICE DESCRIPTION	VOLTAGE	NOTES
$^{C}	SUPERBRIGHT LEDS EZD-RGB-WM EZD-4C8A	ACUITY, COOPER HUBBELL, LEGRAND	WALL MOUNT WIRELESS RGB LED CONTROLLER. LOW VOLTAGE.	24	

GENERAL NOTES:

A. OCCUPANCY SENSOR LAYOUT DESIGNED FROM BASIS-OF-DESIGN COVERAGE PATTERNS. IF SUBMITTING ALTERNATE PER 'EQUIVALENT MANUFACTURER' COLUMN, ADJUST SENSOR QUANTITIES AND LOCATIONS PER MANUFACTURER-SPECIFIC SPACING CRITERIA.
B. PROVIDE SHOP DRAWINGS FOR ENGINEER AND ARCHITECT REVIEW THAT INCLUDE PRODUCT CUTSHEETS AND PROJECT-SPECIFIC LAYOUTS. LAYOUTS MUST INCLUDE SENSOR LOCATIONS, HEIGHTS, ORIENTATION, AND COVERAGE AREAS. SHOW COORDINATION WITH ALL OTHER CEILING DEVICES INCLUDING BUT NOT LIMITED TO HVAC SUPPLY AND RETURN GRILLES, SPRINKLERS, LIGHT FIXTURES, AND OTHER OWNER-PROVIDED CEILING MOUNTED DEVICES SUCH AS SPEAKERS, SECURITY CAMERAS, PROJECTORS, ETC. (SENSORS MAY BE ADVERSELY AFFECTED IF LOCATED TOO CLOSE TO OTHER CEILING MOUNTED DEVICES). ALSO PROVIDE SCHEMATICS AND SCHEDULES WHEN APPLICABLE.
C. LIGHTING CONTROLS PRICING SHALL BE COMPLETELY SEPARATE OF ANY LIGHT FIXTURE PRICING.
D. VERIFY COLOR(S) FOR ALL WALL AND CEILING MOUNTED DEVICES WITH THE ARCHITECT.
E. ALL WALL SWITCH AND CEILING SENSORS SHALL HAVE AN ADJUSTABLE TIME DELAY RANGE OF 0-30 MIN, UNO. CONFIRM SENSOR SETTINGS WITH SEQUENCE OF OPERATIONS AND OWNER PRIOR TO SYSTEM COMMISSIONING.
F. PROVIDE COPIES OF OPERATION AND MAINTENANCE INSTRUCTIONS FOR ALL DEVICES TO OWNER.
G. PROVIDE A NEUTRAL CONDUCTOR TO ALL WALL SWITCH LOCATIONS PER NEC REQUIREMENTS.
H. DO NOT SHARE NEUTRAL CONDUCTOR ON LOAD SIDE OF DIMMERS.

VERSION: 4

LIGHT FIXTURE SCHEDULE

TYPE	MANUFACTURER / MODEL #	APPROVED ALTERNATES	LAMPING / LIGHT SOURCE	DIMMING TYPE	VOLTAGE	INPUT WATTS	INPUT VA	DESCRIPTION	NOTES
C1	VIBIA - DUO - 4870 4870-18	-	LED 90 CRI, 2700K 1705 LUMENS	0-10V	UNV (120-277V)	31	34	19" ROUND LED SURFACE MOUNT DOWNLIGHT, ALUMINUM HOUSING WITH WOOD SHADE, UNIVERSAL VOLTAGE (120-277V) 0-10V DIMMING DRIVER, 1705 LUMENS, 2700K CCT, 90 CRI, BLACK FINISH	
C2	VIBIA - DUO - 4872 4872-18	-	LED 90 CRI, 2700K 4032 LUMENS	0-10V	UNV (120-277V)	62	69	31" ROUND LED SURFACE MOUNT DOWNLIGHT, ALUMINUM HOUSING WITH WOOD SHADE, UNIVERSAL VOLTAGE (120-277V) 0-10V DIMMING DRIVER, 4032 LUMENS, 2700K CCT, 90 CRI, BLACK FINISH	
C3	VIBIA - DUO - 4880 4880-18	-	LED 90 CRI, 2700K 1705 LUMENS	0-10V	UNV (120-277V)	31	34	28" ROUND LED SURFACE MOUNT DOWNLIGHT, ALUMINUM HOUSING WITH WOOD SHADE, UNIVERSAL VOLTAGE (120-277V) 0-10V DIMMING DRIVER, 1705 LUMENS, 2700K CCT, 90 CRI, BLACK FINISH	
D1	FOCAL POINT - ID+ TRIMLESS FLC4D-RT-1000L-UNV-LD1 LC4-RT-1000L-835K-DN-FL2-CD	-	LED 80 CRI, 3500K 1000 LUMENS 204,000 HRS	0-10V	UNV (120-277V)	11	12	4" TRIMLESS LED DOWNLIGHT, ALUMINUM HOUSING, UNIVERSAL VOLTAGE (120-277V) 0-10V DIMMING DRIVER, 1000 LUMENS, 3500K CCT, 80 CRI, 50 DEGREE CUT-OFF, FLOOD 2 DISTRIBUTION WITH CLEAR DIFFUSE LENS	
D1E	FOCAL POINT - ID+ TRIMLESS FLC4D-RT-1000L-UNV-LD1-EM LC4EM-RT-1000L-835K-DN-FL2-CD	-	LED 80 CRI, 3500K 1000 LUMENS 204,000 HRS	0-10V	UNV (120-277V)	11	12	SAME AS FIXTURE TYPE D1 EXCEPT WITH INTEGRAL 7 WATT EMERGENCY BATTERY CAPABLE OF PROVIDING AT LEAST 650 LUMENS FOR 90 MINUTES, UL 924 LISTED. H	
EM1	EELP - OMEL OMEL-10W-W-EM-CC-SD	-	LED	N/A	UNV (120-277V)	10	10	ARCHITECTURAL MULLION MOUNTED LED EMERGENCY EGRESS LIGHT, ALUMINUM HOUSING, UNIVERSAL VOLTAGE (120-277V) DRIVER, INTEGRAL BATTERY PACK CAPABLE OF PROVIDING AT LEAST 90 MINS OF RUN TIME, UL 924 LISTED SELF DIAGNOSTIC, CUSTOM COLOR	1
F1	BEULUX - FLORENCE - RGBW CT02-F-RGB-IP20 DTR-150-IP67 POWER SUPPLY	-	LED RGB 330 LUMENS/FT	0-10V	277-24V	7.3 PER FT	8.1 PER FT	RGB LED TAPE LIGHT, CT02 SURFACE MOUNT ALUMINUM EXTRUSION, 277-24V 0-10V DIMMING DRIVER, SATINED LENS, 330 LUMENS PER FOOT	2
F2	FOCAL POINT - SEEM 2 FSM2LWL-FL-375LF-35K-1C-UNV-LD1-XFN-FW-WH-XX	-	LED 80 CRI, 3500K 375 LUMENS/FT 270,000 HRS	0-10V	UNV (120-277V)	4.75 PER FT	5.2 PER FT	RECESSED WET LOCATION LED COVE LIGHT, ALUMINUM HOUSING, UNIVERSAL VOLTAGE (120-277V) 0-10V DIMMING DRIVER, 375 LUMENS PER FOOT, 3500K CCT, 80 CRI, HARD SURFACE MOUNTING HARDWARE, WHITE FINISH	2
F4	EATON - METALUX - SNLED LENSED 4SNLED-LD5-29SL-SLW-UNV-L840-CD1	-	LED 80 CRI, 4000K 2900 LUMENS 60,000 HRS	0-10V	UNV (120-277V)	25	28	4 FT LED STRIP LIGHT, COLD ROLLED STEEL HOUSING, FROSTED SQUARE LENS, UNIVERSAL (120-277V) 0-10V DIMMING DRIVER, 2900 LUMENS, 4000K CCT, 80 CRI	
F4E	EATON - METALUX - SNLED LENSED 4SNLED-LD5-29SL-SLW-UNV-EL14W-L840-CD1	-	LED 80 CRI, 4000K 2900 LUMENS 60,000 HRS	0-10V	UNV (120-277V)	25	28	SAME AS FIXTURE TYPE F4 EXCEPT WITH INTEGRAL 14 WATT EMERGENCY BATTERY AND TEST / INDICATOR LIGHT CAPABLE OF PROVIDING AT LEAST 1600 LUMENS FOR 90 MINUTES. UL 924 LISTED.	
F8	EATON - METALUX - SNLED LENSED 8TSNLED-LD5-70SL-SLW-UNV-L840-CD1	-	LED 80 CRI, 4000K 7000 LUMENS 60,000 HRS	0-10V	UNV (120-277V)	61	68	8 FT LED STRIP LIGHT, COLD ROLLED STEEL HOUSING, FROSTED SQUARE LENS, UNIVERSAL (120-277V) 0-10V DIMMING DRIVER, 7000 LUMENS, 4000K CCT, 80 CRI	
F8E	EATON - METALUX - SNLED LENSED 8TSNLED-LD5-70SL-SLW-UNV-EL14W-L840-CD1	-	LED 80 CRI, 4000K 7000 LUMENS 60,000 HRS	0-10V	UNV (120-277V)	61	68	SAME AS FIXTURE TYPE F8 EXCEPT WITH INTEGRAL 14 WATT EMERGENCY BATTERY AND TEST / INDICATOR LIGHT CAPABLE OF PROVIDING AT LEAST 1600 LUMENS FOR 90 MINUTES. UL 924 LISTED.	
L4	EATON - CORELITE - CONTINUA WALL LED CTW-F-2575-40L-835-1D-UNV-STD-W-WM-4	-	LED 80 CRI, 3500K 4000 LUMENS 121,000 HRS	0-10V	UNV (120-277V)	35	39	4 FT LED DIRECT / INDIRECT WALL MOUNT STRIP FIXTURE, ALUMINUM HOUSING WITH FROSTED LENS, UNIVERSAL VOLTAGE (120-277V) 0-10V DIMMING DRIVER, 25% UP - 75% DOWN DISTRIBUTION, 4000 LUMENS, 3500K CCT, 80 CRI WHITE FINISH	
L4E	EATON - CORELITE - CONTINUA WALL LED CTW-F-2575-40L-835-1D-UNV-STD-BSL6-W-WM-4	-	LED 80 CRI, 3500K 4000 LUMENS 121,000 HRS	0-10V	UNV (120-277V)	35	39	SAME AS FIXTURE TYPE L4 EXCEPT WITH INTEGRAL 6 WATT EMERGENCY BATTERY PACK CAPABLE OF PROVIDING AT LEAST 690 LUMENS FOR 90 MINUTES. UL 924 LISTED.	
P1	EATON - PORTFOLIO - LSR8B LSR8B10D010MB-EC8B10208035-8LBM3B-P836MB-SP60	-	LED 80 CRI, 3500K 1000 LUMENS 50,000 HRS	0-10V	UNV (120-277V)	11	12	8 INCH ROUND DECORATIVE SURFACE MOUNT CYLINDER, ALUMINUM HOUSING, UNIVERSAL VOLTAGE (120-277V) DIMMING DRIVER, 1000 LUMENS, 3500K CCT, 80 CRI, MATTE BLACK FINISH WITH SPECULAR BLACK MEDIUM DISTRIBUTION REFLECTOR, 60° MATTE BLACK PENDANT STEM KIT	
P2	EATON - PORTFOLIO - LSR8B LSR8B20D010MB-EC8B10208035-8LBM3B-P836MB-SP60	-	LED 80 CRI, 3500K 2000 LUMENS 50,000 HRS	0-10V	UNV (120-277V)	21	23	8 INCH ROUND DECORATIVE SURFACE MOUNT CYLINDER, ALUMINUM HOUSING, UNIVERSAL VOLTAGE (120-277V) DIMMING DRIVER, 2000 LUMENS, 3500K CCT, 80 CRI, MATTE BLACK FINISH WITH SPECULAR BLACK MEDIUM DISTRIBUTION REFLECTOR, 60° MATTE BLACK PENDANT STEM KIT	
P3	BARBICAN - SALSA 16-2001-52D-42H-XX-SM-BLK-9W/LF-277V-3500K-90CRI-DB(0-10V)	-	LED 90 CRI, 3500K 900 LUMENS	0-10V	277V	18	20	DECORATIVE LED PENDANT FIXTURE, FABRIC PETAL SHADES OVER ALUMINUM HOUSING, 277V 0-10V DIMMING DRIVER, 900 LUMENS, 3500K CCT, 90 CRI, BLACK STEM AND CANOPY COORDINATE FABRIC FINISH WITH ARCHITECT AND OWNER PRIOR TO ORDERING	
W1	TECH LIGHTING - KENWAY WALL 700WSKNWBLED930-277	-	LED 90 CRI, 3000K 734 LUMENS 50,000 HRS	0-10V	277V	11	12	17 INCH TALL WALL MOUNTED LED VANITY FIXTURE, ALUMINUM HOUSING WITH ACRYLIC SHADE, 277 VOLT 0-10V DIMMING DRIVER, 734 LUMENS, 3000K CCT, 90 CRI, MATTE BLACK FINISH	
W2	LBL LIGHTING - SAVINO 2 OUTDOOR OD1006-CH-LEDWD-W	-	LED 90 CRI, 3000K 1000 LUMENS 70,000 HRS	ELV	120V	28	31	LED DECORATIVE WALL SCONCE, ALUMINUM HOUSING, 120V ELV DIMMING DRIVER, 1000 LUMENS, 3000K CCT, 90 CRI, CHARCOAL FINISH	
X1A	EATON - SURE-LITES - ES SERIES ES7-1-70-S-BL-G-W	-	LED	N/A	UNV (120-277V)	2	3.2	LED EDGE LIT SURFACE WALL MOUNT EXIT SIGN, STEEL HOUSING, GREEN LETTERS ON HIGH IMPACT ACRYLIC PANEL SINGLE FACE, NO CHEVRONS, BLACK FINISH. INTEGRAL BATTERY BACKUP CAPABLE OF PROVIDING AT LEAST 90 MINUTES OF RUN TIME, UL 924 LISTED.	
X1B	EATON - SURE-LITES - ES SERIES ES7-1-70-S-BL-G-C	-	LED	N/A	UNV (120-277V)	2	3.2	LED EDGE LIT SURFACE CEILING MOUNT EXIT SIGN, STEEL HOUSING, GREEN LETTERS ON HIGH IMPACT ACRYLIC PANEL, SINGLE FACE, NO CHEVRONS, BLACK FINISH. INTEGRAL BATTERY BACKUP CAPABLE OF PROVIDING AT LEAST 90 MINUTES OF RUN TIME, UL 924 LISTED.	
X1C	EATON - SURE-LITES - ES SERIES ES7-2-70-S-BL-G-DA-C	-	LED	N/A	UNV (120-277V)	2	3.2	LED EDGE LIT SURFACE CEILING MOUNT EXIT SIGN, STEEL HOUSING, GREEN LETTERS ON HIGH IMPACT ACRYLIC PANEL, DOUBLE FACE, DOUBLE CHEVRONS, BLACK FINISH. INTEGRAL BATTERY BACKUP CAPABLE OF PROVIDING AT LEAST 90 MINUTES OF RUN TIME, UL 924 LISTED.	
X2	EATON - SURE-LITES - LPX SERIES LPX7SD	-	LED	N/A	UNV (120-277V)	1	1	LED EXIT SIGN, GREEN LETTERING ON WHITE HIGH IMPACT POLYCARBONATE HOUSING, INTEGRAL BATTERY BACKUP CAPABLE OF PROVIDING AT LEAST 90 MINUTES OF RUN TIME, SELF DIAGNOSTIC, UL 924 LISTED.	

GENERAL NOTES:

A. REFER TO LIGHT FIXTURE SCHEDULE GENERAL NOTES AND SPECIFICATIONS FOR ADDITIONAL INFORMATION.

NOTES:

1. COORDINATE LIGHT FIXTURE FINISH COLOR WITH ARCHITECT, GENERAL CONTRACTOR AND CURTAIN WALL SYSTEM MANUFACTURER PRIOR TO ORDERING.
2. CONTRACTOR TO FIELD VERIFY AND COORDINATE LENGTHS WITH ARCHITECT PRIOR TO ORDERING.

LIGHT FIXTURE SCHEDULE GENERAL NOTES:

1. ALL LIGHT FIXTURES AND RELATED COMPONENTS SHALL BE PROVIDED BY THE CONTRACTOR, UNLESS NOTED OTHERWISE.
2. THE PARTY SUPPLYING THE LIGHT FIXTURES IS RESPONSIBLE FOR SUPPLYING THE PROPER QUANTITY OF LIGHT FIXTURES.

LIGHT FIXTURE SCHEDULE SUPPLEMENTAL SPECIFICATIONS:

1. ANY PROPRIETARY, SOLE-SOURCED LIGHT FIXTURE LISTED IN THE LIGHT FIXTURE SCHEDULE SHALL BE UNIT PRICED ONLY. NO PACKAGING OR LOT PRICING OF THESE LIGHT FIXTURES SHALL BE ALLOWED. UNIT PRICES SHALL BE CLEARLY IDENTIFIED ON THE BID FORM.
2. PACKAGING OF LIGHT FIXTURES WILL NOT BE CONSIDERED OR APPROVED. REPRESENTATIVE AGENTS SHALL BE ALLOWED TO OFFER MINI-LOT PRICING (MLP) FOR LIGHT FIXTURES AS ALLOWED IN ELECTRICAL SPECIFICATIONS.
3. LIGHTING CONTROLS PRICING, INCLUDING BUT NOT LIMITED TO THOSE REFERENCED IN ELECTRICAL SPECIFICATIONS, SHALL BE COMPLETELY SEPARATE OF ANY LIGHT FIXTURE PRICING. ANY LIGHTING CONTROLS PRICING THAT IS SUBMITTED WITH LIGHT FIXTURE PRICING (UNIT OR MINI-LOT) WILL BE IMMEDIATELY REJECTED IN ITS ENTIRETY.
4. CATALOG NUMBERS SHALL NOT BE CONSIDERED COMPLETE AND MATERIAL SHALL NOT BE ORDERED BY MANUFACTURER AND CATALOG NUMBERS ONLY. FIRST READ THE COMPLETE DESCRIPTION, NOTES AND SPECIFICATIONS IN CONJUNCTION WITH THE CATALOG NUMBER TO DETERMINE THE MATERIAL AND ACCESSORIES TO BE ORDERED. THE MANUFACTURERS LISTED ARE THE BASIS FOR THE DESIGN.
5. FOR SUBSTITUTIONS: PROVIDE PHOTOMETRIC CALCULATIONS AND OTHER NECESSARY INFORMATION FOR ENGINEER REVIEW. REFER TO SPECIFICATIONS FOR MORE INFORMATION.
6. COORDINATE LIGHT FIXTURE MOUNTING HARDWARE AND TRIMS NEEDED TO SUIT CEILING CONDITIONS. LIGHT FIXTURES NEAR OR IN CONTACT WITH INSULATION SHALL COMPLY WITH CODE. MAINTAIN 3" MINIMUM WORKING CLEARANCE BETWEEN NON-IC RATED LIGHT FIXTURE HOUSINGS AND INSULATION ON ALL ADJACENT DUCTWORK, PIPING, WALLS, AND CEILINGS.
7. STRIP LIGHT FIXTURES SUBJECT TO DAMAGE, INCLUDING THOSE MOUNTED ON EQUIPMENT MEZZANINES, STORAGE, RECEIVING AND STOCKROOM AREAS, SHALL BE PROVIDED WITH WIRE GUARDS, PROTECT-A-LAMP COVERS OR EQUIVALENT SHIELDED OR SHATTERPROOF LAMPS/LIGHT SOURCES. COORDINATE REQUIREMENTS AND AFFECTED LIGHT FIXTURES WITH OWNER.

PARAGON STAR

PARAGON STAR
- LOT 9 -
BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
ANDREA C. MULVANY
NUMBER PE-2013039892
PROFESSIONAL ENGINEER

ANDREA C. MULVANY
LICENSE # PE-2013039892

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

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MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

ELECTRICAL SCHEDULES

SHEET NUMBER

E502

Short-Circuit and Voltage Drop Calculations

Distances are for calculation purposes only and shall not be used for contractor takeoffs nor bidding - Contractor shall notify Engineer of any field condition that results in a change of 10% or greater circuit distance

The following calculations are based on the "Point-by-Point" method where:

ISC (2) = ISC(1) x M(1) M= 1/(1+f)

ISC (1) = short circuit current at fault point 1

ISC (2) = short circuit current at fault point 2

Feeder: f (3Ø) = $\frac{1.732 \times L \times Isc}{C \times E}$ XFMR: f (3Ø) = $\frac{IP(sca) \times Vp \times 1.73 \times \%Z}{100{,}000 \times KVA}$ IS(sca)= $\frac{Vp \times M \times IP(sca)}{Vs}$

Feeder: f (1Ø)= $\frac{2 \times L \times Isc}{C \times E}$ XFMR: f (1Ø)= $\frac{IP(sca) \times Vp \times \%Z}{100{,}000 \times KVA}$

VOLTAGE DROP (3Ø):
%VD= ((R x cos(arccos(pf)) + X x sin (arccos(pf))) x L/# x I x 1.73) / E

VOLTAGE DROP (1Ø):
%VD= ((R x cos(arccos(pf)) + X x sin(arccos(pf))) x 2 x L/# x I) / E

IP = Primary short circuit current
Vp = Primary voltage
IS= Secondary short circuit current
Vs= Secondary voltage
L = Length of circuit E = Line to line volts
C = "C" Factor from Bussman table where "C" = 1 / impedance per linear foot

%VD CUM= Cumulative Voltage Drop from Fault Point 1 to Fault Point #
R= resistance in ohms per LF
X= reactances in ohms per LF

Feeder Types =
NM - Non Magnetic Conduit, M - Magnetic Conduit, FB - Feeder Busway, PB - Plug-in Busway, TX - Transformer

Date of Calculations: Sept 11 2019
System Voltage: 480Y/277V - 3 phase

Fault Point (F#)	Bus/Feeder Description	Source (Fault Point)	Phase	Source Isc (amps)	Feeder: Conduit Type/ TX	Feeder: Material	Feeder: Quantity of Parallel Sets and Bus/ Phase & Neutral Size	Conductor 'C' Value	Busway 'C' Value	L-L Voltage (E)	Circuit Length (L)	Load Power Factor (pf)	Circuit Load (Amperage)	Conductor: Resistance (R)	Conductor: Reactance (X)	Conductor: Arccos (pf) (Radians)	Transformer: Type	Degree Rise	kVA	New Xfmr Z	Existing Xfmr Z	Secondary Voltage	Tap Setting	f	M	Fault Current (amps)	Voltage Drop (%VD)	Cumulative Voltage Drop (%VD)	Fault Point (F#)
1	Utility Service Point			30,106	at the secondary of the utility transformer																					Source Isc + 6X Motor Contribution =		31546			1
	Motor Contribution			240	The connected full load motor amps (includes compressors) on the system																									
2	At Switchboard MSBW	1	3	31546	NM	AL	3 Set(s) of 400 kcmil	18506	--	480	175	0.9	640	0.000054	0.000040	0.451027								0.359	0.74	23216	-0.89%	-0.89%	2
3	At Panelboard WHH1	2	3	23216	M	CU	1 Set(s) of 3/0 AWG	12844	--	480	25	0.9	160	0.000079	0.000052	0.451027								0.163	0.86	19961	-0.14%	-1.02%	3
4	At Transformer TWH1	3	3	19961	M	CU	1 Set(s) of 8 AWG	1557	--	480	5	0.9	40	0.000780	0.000065	0.451027								0.231	0.81	16211	-0.05%	-1.08%	4
5	Thru Transformer TWH1	4	3	16211	TX					480							DOE	150	30	2.44		208		10.962	0.08	3128		-1.08%	5
6	At Panelboard WLH1	5	3	3128	M	CU	1 Set(s) of 3 AWG	4774	--	208	5	0.9	80	0.000250	0.000059	0.451027								0.027	0.97	3045	-0.08%	-1.16%	6

Short-Circuit and Voltage Drop Calculations

Distances are for calculation purposes only and shall not be used for contractor takeoffs nor bidding - Contractor shall notify Engineer of any field condition that results in a change of 10% or greater circuit distance

The following calculations are based on the "Point-by-Point" method where:

ISC (2) = ISC(1) x M(1) M= 1/(1+f)

ISC (1) = short circuit current at fault point 1

ISC (2) = short circuit current at fault point 2

Feeder: f (3Ø) = $\frac{1.732 \times L \times Isc}{C \times E}$ XFMR: f (3Ø) = $\frac{IP(sca) \times Vp \times 1.73 \times \%Z}{100{,}000 \times KVA}$ IS(sca)= $\frac{Vp \times M \times IP(sca)}{Vs}$

Feeder: f (1Ø)= $\frac{2 \times L \times Isc}{C \times E}$ XFMR: f (1Ø)= $\frac{IP(sca) \times Vp \times \%Z}{100{,}000 \times KVA}$

VOLTAGE DROP (3Ø):
%VD= ((R x cos(arccos(pf)) + X x sin (arccos(pf))) x L/# x I x 1.73) / E

VOLTAGE DROP (1Ø):
%VD= ((R x cos(arccos(pf)) + X x sin(arccos(pf))) x 2 x L/# x I) / E

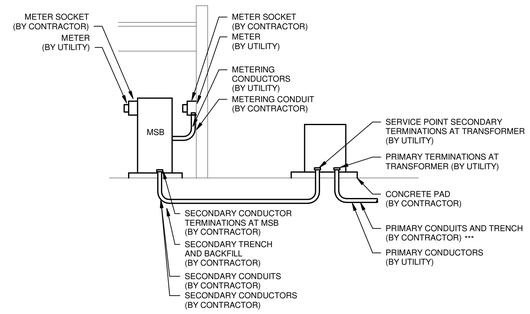
IP = Primary short circuit current
Vp = Primary voltage
IS= Secondary short circuit current
Vs= Secondary voltage
L = Length of circuit E = Line to line volts
C = "C" Factor from Bussman table where "C" = 1 / impedance per linear foot

%VD CUM= Cumulative Voltage Drop from Fault Point 1 to Fault Point #
R= resistance in ohms per LF
X= reactances in ohms per LF

Feeder Types =
NM - Non Magnetic Conduit, M - Magnetic Conduit, FB - Feeder Busway, PB - Plug-in Busway, TX - Transformer

Date of Calculations: Sept 11 2019
System Voltage: 480Y/277V - 3 phase

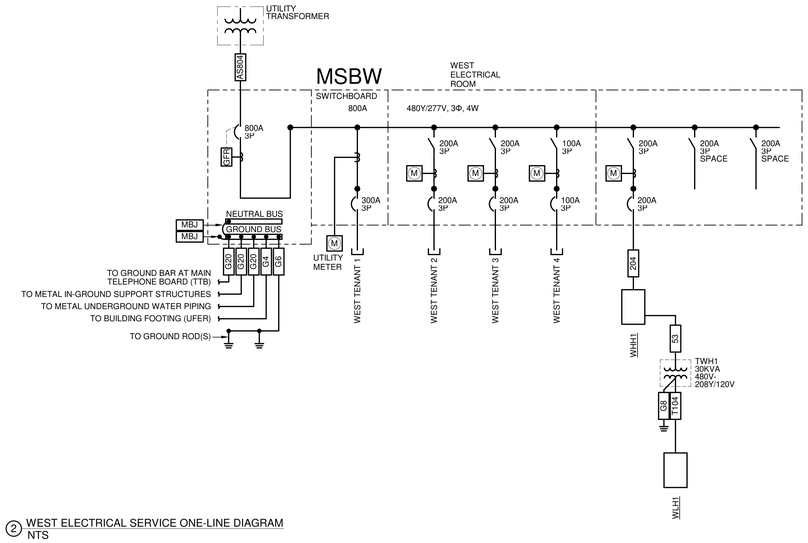
Fault Point (F#)	Bus/Feeder Description	Source (Fault Point)	Phase	Source Isc (amps)	Feeder: Conduit Type/ TX	Feeder: Material	Feeder: Quantity of Parallel Sets and Bus/ Phase & Neutral Size	Conductor 'C' Value	Busway 'C' Value	L-L Voltage (E)	Circuit Length (L)	Load Power Factor (pf)	Circuit Load (Amperage)	Conductor: Resistance (R)	Conductor: Reactance (X)	Conductor: Arccos (pf) (Radians)	Transformer: Type	Degree Rise	kVA	New Xfmr Z	Existing Xfmr Z	Secondary Voltage	Tap Setting	f	M	Fault Current (amps)	Voltage Drop (%VD)	Cumulative Voltage Drop (%VD)	Fault Point (F#)
1	Utility Service Point			90,318	at the secondary of the utility transformer																					Source Isc + 6X Motor Contribution =		93918			1
	Motor Contribution			600	The connected full load motor amps (includes compressors) on the system																									
2	At Switchboard MSBE	1	3	93918	NM	AL	6 Set(s) of 600 kcmil	23451	--	480	145	0.9	1600	0.000036	0.000039	0.451027								0.349	0.74	69608	-0.69%	-0.69%	2
3	At Panelboard EHO1	2	3	69608	M	CU	3 Set(s) of 600 kcmil	22965	--	480	330	0.9	700	0.000025	0.000048	0.451027								1.203	0.45	31595	-1.21%	-1.90%	3
4	At Transformer TEO1	3	3	31595	M	CU	1 Set(s) of 250 kcmil	16483	--	480	5	0.9	200	0.000054	0.000052	0.451027								0.035	0.97	30539	-0.03%	-1.92%	4
5	Thru Transformer TEO1	4	3	30539	TX					480							DOE	150	150	3.46		208		5.856	0.15	10279		-1.92%	5
6	At Panelboard ELO1	5	3	10279	M	CU	2 Set(s) of 350 kcmil	19704	--	208	5	0.9	480	0.000039	0.000050	0.451027								0.011	0.99	10168	-0.06%	-1.98%	6
7	At Panelboard EHH1	2	3	69608	M	CU	1 Set(s) of 1 AWG	7293	--	480	20	0.9	100	0.000160	0.000057	0.451027								0.689	0.59	41217	-0.12%	-0.81%	7
8	At Transformer TEH1	7	3	41217	M	CU	1 Set(s) of 8 AWG	1557	--	480	5	0.9	40	0.000780	0.000065	0.451027								0.478	0.68	27894	-0.05%	-0.86%	8
9	Thru Transformer TEH1	8	3	27894	TX					480							DOE	150	30	2.44		208		18.861	0.05	3241		-0.86%	9
10	At Panelboard ELH1	9	3	3241	M	CU	1 Set(s) of 3 AWG	4774	--	208	5	0.9	80	0.000250	0.000059	0.451027								0.028	0.97	3152	-0.08%	-0.95%	10



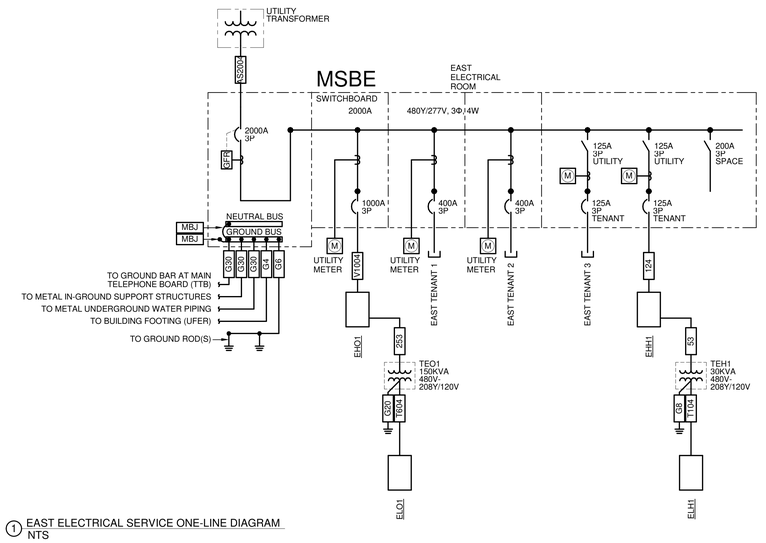
3 UTILITY COORDINATION DETAIL
12" = 1'-0"

PANELBOARD MSBW LOAD SUMMARY	480Y/277V, 3PH, 4W		
LOAD DESCRIPTION	Connected KVA	Demand FACTOR	Demand KVA
HVAC - SUMMER	2.70	100%	2.70
HVAC - WINTER	0.00	100%	0.00
LIGHTING	1.31	125%	1.64
RECEPTACLES	1.08	100%;50%	1.08
KITCHEN EQUIPMENT	0.00	65%	0.00
MOTOR LOADS	0.00	100%	0.00
LARGEST MOTOR LOAD	0.00	125%	0.00
SUPPLEMENTAL ELECTRIC HEAT	66.20	100%	66.20
MISCELLANEOUS EQUIPMENT	0.60	100%	0.60
REFRIGERATION EQUIPMENT	0.00	100%	0.00
SHOW WINDOW	0.00	PER NEC	0.00
EXTERIOR LIGHTING	2.38	125%	2.98
TOTAL LOAD	74.28	KVA	75.21
TOTAL AMPACITY	89.35	AMPS	90.46
PANEL AMPACITY	800	AMPS	800.00
SPARE CAPACITY		AMPS	710

PANELBOARD MSBE LOAD SUMMARY	480Y/277V, 3PH, 4W		
LOAD DESCRIPTION	Connected KVA	Demand FACTOR	Demand KVA
HVAC - SUMMER	198.18	100%	198.18
HVAC - WINTER	0.00	100%	0.00
LIGHTING	6.11	125%	7.64
RECEPTACLES	6.48	100%;50%	6.48
KITCHEN EQUIPMENT	0.00	65%	0.00
MOTOR LOADS	100.95	100%	100.95
LARGEST MOTOR LOAD	22.45	125%	28.06
SUPPLEMENTAL ELECTRIC HEAT	295.52	100%	295.52
MISCELLANEOUS EQUIPMENT	14.55	100%	14.55
DISPLAY CASE	0.00	125%	0.00
SHOW WINDOW	0.00	PER NEC	0.00
EXTERIOR LIGHTING	1.73	125%	2.16
TOTAL LOAD	645.96	KVA	653.54
TOTAL AMPACITY	776.97	AMPS	786.08
PANEL AMPACITY	2000	AMPS	2000.00
SPARE CAPACITY		AMPS	1214



2 WEST ELECTRICAL SERVICE ONE-LINE DIAGRAM
NTS



1 EAST ELECTRICAL SERVICE ONE-LINE DIAGRAM
NTS

CIRCUIT SCHEDULE:

ALL CONDUCTOR SIZES ARE BASED ON 75 DEG C RATED TERMINATIONS. COPPER CONDUCTORS ARE BASED ON THHN/THWN-2 INSULATION. ALUMINUM CONDUCTORS (PREFIX "A") ARE BASED ON XHHW-2 INSULATION. FOR ANY OTHER CONDITIONS ALLOWED PER SPECIFICATIONS, OR FOR TERMINATIONS OR INSULATION TYPES RATED LESS THAN 75 DEG C, MODIFY SIZES ACCORDING TO NFPA 70.

FEEDER TAG	FEEDER DESCRIPTION
53	(3)#8, (1)#10 G, 3/4" C
124	(4)#1, (1)#6 G, 1-1/2" C
204	(4)#3/0, (1)#6 G, 2" C
253	(3)-250 kcmil, (1)#4 G, 2" C
AS804	(3) 3"C, EACH W/ (4)-400 kcmil
AS2004	(6) 3-1/2" C, EACH W/ (4)-600 kcmil
G4	#4 COPPER GROUND, 3/4" C
G6	#6 COPPER GROUND, 3/4" C
G8	#8 COPPER GROUND, 3/4" C
G20	#2/0 COPPER GROUND, 3/4" C
G30	#3/0 COPPER GROUND, 1" C
MBJ	MBJ
T104	(4)#3, (1)#8 SSBJ, 1-1/4" C
T604	(2) 3" C, EACH W/ (4)-350 kcmil, (1)#2 SSBJ
V1004	(3) 3-1/2" C, EACH W/ (4)-600 kcmil, (1) #4/0 G

ELECTRICAL PANELBOARD NAMING CONVENTION

E H H 1

PREFIX	E	EAST DISTRIBUTION
	W	WEST DISTRIBUTION
VOLTAGE	H	480Y/277V
	L	208Y/120V
SPACE	H	HOUSE DISTRIBUTION
	O	OFFICE DISTRIBUTION
	T	TENANT DISTRIBUTION
SUFFIX	1	PANEL 1
	2	PANEL 2

ONE-LINE DIAGRAM GENERAL NOTES:

1. THE INFORMATION SHOWN IN THE SHORT-CIRCUIT AND VOLTAGE DROP CALCULATIONS SCHEDULE IS SHOWN FOR CALCULATION PURPOSES ONLY. CONTRACTOR SHALL NOT USE THE CONDUIT TYPES, CONDUCTOR TYPES, SIZES, QUANTITIES OR LENGTHS FOR TAKEOFFS OR BIDDING PURPOSES. CONTRACTOR SHALL NOTIFY ENGINEER OF ANY CONFLICTS BETWEEN THIS SCHEDULE AND OTHER PORTIONS OF THE CONSTRUCTION DOCUMENTS. CONTRACTOR SHALL NOTIFY ENGINEER OF AS-BUILT CONDITIONS THAT CONSTITUTE A CHANGE FROM WHAT IS SHOWN BELOW; THIS INCLUDES CONDUCTOR LENGTHS DIFFERING BY MORE THAN 10%.
2. REFER TO THE SHORT-CIRCUIT AND VOLTAGE DROP CALCULATIONS TABLE ON THIS SHEET. AVAILABLE FAULT CURRENT INFORMATION IS LISTED UNDER THE "FAULT CURRENT" COLUMN. VOLTAGE DROP VALUES ARE LISTED UNDER THE "CUMULATIVE VOLTAGE DROP" COLUMN. THE AIC/SCCR RATING OF THE EQUIPMENT SHALL NOT BE LESS THAN THE AVAILABLE 3-PHASE SYMMETRICAL FAULT CURRENT. ALL SERIES RATED EQUIPMENT SHALL BE PROPERLY LISTED AND LABELED PER CODE.
3. FEEDER NUMBER DESIGNATIONS PRECEDED BY "V" INDICATE THAT THE CONDUCTORS ARE UP-SIZED DUE TO VOLT-DROP CONSIDERATIONS. PROVIDE LUG ADAPTERS AS NEEDED IN ORDER TO PROPERLY LAND CONDUCTORS AT TERMINATION(S).
4. FEEDER SIZES ARE BASED ON COPPER (CU) THHN/THWN-2 INSULATION, UNLESS NOTED OTHERWISE. CONDUIT SIZES SHOWN ARE APPROPRIATE FOR SCHEDULE 40 PVC, EMT, GRS, IMC AND RMC; ADJUST SIZE AS NEEDED FOR OTHER RACEWAY TYPES. NUMBER DESIGNATIONS PRECEDED BY "A" INDICATE THAT THE SIZE IS BASED ON ALUMINUM (AL) WIRE. AL CONDUCTOR SIZES ARE BASED ON XHHW-2 INSULATION, UNLESS NOTED OTHERWISE. AL WIRE MAY BE SUBSTITUTED FOR CU FEEDERS AS ALLOWED BY CODE, SPECIFICATIONS AND OWNER, UNLESS NOTED OTHERWISE. AT CONTRACTOR'S OPTION, CU WIRE MAY BE SUBSTITUTED FOR AL, UNLESS NOTED OTHERWISE. ALL CONDUCTOR SIZES ARE BASED ON 75 DEG C RATED TERMINATIONS, UNLESS NOTED OTHERWISE. FOR ANY OTHER CONDITIONS MODIFY SIZES PER CODE. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.
5. BRANCH CIRCUIT SIZES ARE BASED ON COPPER (CU) THHN/THWN-2 INSULATION, UNLESS NOTED OTHERWISE. CONDUIT SIZES SHOWN ARE APPROPRIATE FOR SCHEDULE 40 PVC, EMT, GRS, IMC AND RMC; ADJUST SIZE AS NEEDED FOR OTHER RACEWAY TYPES. ALL CONDUCTOR SIZES ARE BASED ON 60 DEG C RATED TERMINATIONS, UNLESS NOTED OTHERWISE. FOR ANY OTHER CONDITIONS MODIFY SIZES PER CODE. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.
6. INSTALL FEEDERS OVERHEAD AS HIGH AS PRACTICABLE AND ORTHOGONALLY ALONG BUILDING STRUCTURE, UNLESS NOTED OTHERWISE. COORDINATE FINAL ROUTING WITH OTHER TRADES.
7. CIRCUIT BREAKERS RATED 1200A OR HIGHER SHALL HAVE APPROPRIATE DOCUMENTATION AND METHOD TO REDUCE CLEARING TIME IN ORDER TO REDUCE ARC FLASH ENERGY PER CODE. PROVIDE ELECTRONIC TRIP UNIT WITH INSTANTANEOUS TRIP AND ENERGY-REDUCING MAINTENANCE SWITCH WITH LOCAL STATUS INDICATOR FOR COMPLIANCE. PROVIDE PROVISIONS TO INTERFACE WITH OWNER ALARM/MONITORING SYSTEM TO INDICATE MAINTENANCE SWITCH STATUS.
8. PROVIDE A PERMANENT LABEL ON FRONT OF EQUIPMENT ENCLOSURE; REFER TO SPECIFICATIONS FOR LABEL REQUIREMENTS. LABEL SHALL READ AS FOLLOWS (INCLUDE RESPECTIVE NAMES IN BLANKS):

   SERVICE EQUIPMENT LABEL:

   EXAMPLE:
   208Y/120V, 60HZ
   800A
   SCCR = 65,000A
   MAX AVAILABLE FAULT CURRENT = 58,815A
   CALCULATED: 01/01/2018

   PANELBOARD/SWITCHBOARD LABEL:
   LINE 1: PANELBOARD "_____" SUPPLIED BY UPSTREAM
   LINE 2: PANELBOARD/SWITCHBOARD "_____"
   LINE 3: LOCATED IN "_____"
   LINE 4: PANELBOARD "_____" SUPPLIES DOWNSTREAM
   LINE 5: PANELBOARD(S) "_____"

   TRANSFORMERS LABEL:
   LINE 1: TRANSFORMER "_____" SUPPLIED BY UPSTREAM
   LINE 2: PANELBOARD/SWITCHBOARD "_____"
   LINE 3: LOCATED IN "_____"
   LINE 4: TRANSFORMER "_____" SUPPLIES DOWNSTREAM
   LINE 5: PANELBOARD(S) "_____"

ELECTRICAL UTILITY CONTACT NOTE:

UTILITY COMPANY: KANSAS CITY POWER AND LIGHT
UTILITY CONTACT: JEFF WILLIAMS
PHONE: (816) 220-5204
EMAIL: JEFF.WILLIAMS@KCPL.COM

FAULT CURRENT GENERAL NOTE (ESTIMATED VALUE):

THE MAXIMUM AVAILABLE 3-PHASE SYMMETRICAL FAULT CURRENT VALUE AT THE UTILITY TRANSFORMER SECONDARY/POINT OF SERVICE COULD NOT BE DETERMINED AT THE TIME OF THIS SUBMITTAL. THE ESTIMATED WORST CASE VALUE OF 30,106A FOR THE WEST SERVICE, AND 90,318 FOR THE EAST SERVICE IS BASED ON AN INFINITE BUS CALCULATION AT THE UTILITY TRANSFORMER. CONTRACTOR SHALL VERIFY ACTUAL AVAILABLE FAULT CURRENT VALUE WITH UTILITY. NOTIFY ENGINEER IF ACTUAL VALUE EXCEEDS ESTIMATED CALCULATED VALUE. ESTIMATED DESIGN VALUE IS BASED ON THE FOLLOWING:

UTILITY TRANSFORMER SECONDARY VOLTAGE: 480Y/277V, 3Ø, 4W
UTILITY TRANSFORMER SIZE: WEST - 500KVA, Z=2.0%
EAST - 1500KVA, Z=2.0%

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY GENERAL NOTE:

1. CONTRACTOR SHALL PROVIDE AN OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY TO DETERMINE THE CORRECT SETTINGS FOR THE ADJUSTABLE TRIP CIRCUIT BREAKERS, TO ENSURE SELECTIVE COORDINATION AND TO DOCUMENT ARC-FLASH HAZARDS. CODE REQUIRED EMERGENCY AND LEGALLY REQUIRED STANDBY SYSTEMS SHALL BE SELECTIVELY COORDINATED WITH ALL SUPPLY-SIDE OVERCURRENT PROTECTIVE DEVICES (APPLIES TO BOTH THE NORMAL AND EMERGENCY POWER SOURCES). PROVIDE ALL NECESSARY AS-BUILT INFORMATION REQUIRED FOR COMPLETION OF THE STUDY TO THE ENGINEER DOING THE STUDY. PROVIDE SUBMITTALS INDICATED WITHIN THE SPECIFICATIONS TO OWNER AND ARCHITECT/ENGINEER TO CONFIRM STUDY HAS BEEN COMPLETED. CONTRACTOR SHALL INCLUDE THE COST FOR THIS WORK IN THEIR BID. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.
2. THE OWNER SHALL FURNISH INDICATED PORTIONS OF THE ELECTRICAL DISTRIBUTION EQUIPMENT TO THE CONTRACTOR FOR INSTALLATION. THE OWNER WILL ALSO PROVIDE THE OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY TO THE CONTRACTOR. THE OWNER FURNISHED COORDINATION STUDY SHALL INCLUDE THE CORRECT SETTINGS FOR THE ADJUSTABLE TRIP CIRCUIT BREAKERS, ENSURE SELECTIVE COORDINATION AND DOCUMENT ARC-FLASH HAZARDS. CODE REQUIRED EMERGENCY AND LEGALLY REQUIRED STANDBY SYSTEMS SHALL BE SELECTIVELY COORDINATED WITH ALL SUPPLY-SIDE OVERCURRENT PROTECTIVE DEVICES, (APPLIES TO BOTH THE NORMAL AND EMERGENCY POWER SOURCES). THE CONTRACTOR SHALL PROVIDE NECESSARY AS-BUILT INFORMATION TO COMPLETE THE STUDY.

ONE-LINE DIAGRAM SUPPLEMENTAL SPECIFICATIONS:

1. GROUNDING ELECTRODE SYSTEM SHALL BE PER LOCAL REQUIREMENTS AND SHALL NOT BE LESS STRINGENT THAN THAT SPECIFIED IN THE CONSTRUCTION DOCUMENTS.
2. PROVIDE PROPERLY SIZED LUGS FOR ALL EQUIPMENT, CIRCUIT BREAKERS, AND OTHER ELECTRICAL DEVICES TO ACCOMMODATE INSTALLED CONDUCTORS. A LARGER FRAME, OVERSIZED LUGS OR NON-STANDARD PRODUCT MAY BE REQUIRED IN SOME INSTANCES. UTILIZE PIN ADAPTERS ONLY IF NECESSARY AND ONLY AS ALLOWED BY MANUFACTURER AND AHJ.
3. PROVIDE ANY AVAILABLE SPACE IN SWITCHBOARDS/PANELBOARDS WITH BUSSING.
4. PROVIDE (4) EMPTY 1" CONDUITS WITH PULL STRINGS FROM EACH RECESSED PANELBOARD UP TO ACCESSIBLE CEILING SPACE. CAP AND LABEL CONDUITS FOR FUTURE USE.
5. PROVIDE TYPED FINAL CIRCUIT DIRECTORY FOR ALL PANELBOARDS TO REFLECT ACTUAL AS-BUILT CONDITIONS. COORDINATE FINAL ROOM NAMES, NUMBERS AND DESCRIPTIONS WITH OWNER PRIOR TO COMPLETION. CIRCUIT DESCRIPTIONS SHALL BE PER CODE AND SHALL BE DISTINGUISHABLE FROM ALL OTHERS.

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
ANDREA C MULVANY
NUMBER PE-2013039892
PROFESSIONAL ENGINEER

Oct 24 2019

ANDREA C. MULVANY
LICENSE # PE-2013039892

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

HENDERSON ENGINEERS
1801 MAIN STREET, SUITE 300
KANSAS CITY, MO 64108
TEL 816.663.8700 FAX 816.663.8701
WWW.HENDERSONENGINEERS.COM

1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

ELECTRICAL ONE-LINE DIAGRAM

SHEET NUMBER

E601

ANDREA C. MULVANY

Division 26: GENERAL ELECTRICAL REQUIREMENTS

1. GENERAL INSTRUCTIONS

A. GENERAL REQUIREMENTS

All requirements under Division 01 and the general and supplementary conditions of these specifications apply to this section and division. Where the requirements of this section and division exceed those of Division 01, this section and division take precedence. Become thoroughly familiar with all its contents as to requirements that affect this division, section, or both. Work required under this division includes all material, equipment, appliances, transportation, services, and labor required to complete the entire system as required by the drawings and specifications, or reasonably inferred to be necessary to facilitate the function of each system as implied by the design and the equipment specified.

The specifications and drawings for the project are complementary, and any portion of work described in one shall be provided as if described in both. In the event of discrepancies, notify the Engineer and request clarification prior to proceeding with the Work involved.

Drawings are graphic representations of the work upon which the contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They convey the scope of work, indicating the intended general arrangement of the systems without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements. Use the drawings as a guide when laying out the work and to verify that materials and equipment will fit into the designated spaces, and which when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory, and properly operating system.

B. DEFINITIONS

Division: References contained in this specification follow the numbering system defined in the Construction Specifications Institute (CSI) MasterFormat 2004 Edition. Specification Divisions 01 through 13 provided with this project may reference the CSI MasterFormat 1995 Edition. The corresponding division references between the 2004 Edition and 1995 Edition are as follows:

	2004 Edition	1995 Edition
1.	Division 21 - Fire Suppression	Division 15
2.	Division 22 - Plumbing	Division 15
3.	Division 23 - HVAC	Division 15
4.	Division 26 - Electrical	Division 16
5.	Division 27 - Communications	Division 16
6.	Division 28 - Electronic Safety and Security	Division 16

Furnish: “to supply and deliver to the project site, ready for unloading, unpacking, assembling, installing, and similar operations.”

Install: “to perform all operations at the project site including, but not limited to, the actual unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use.”

Provide: “to furnish and install.”

Furnished by Owner (or Owner-Furnished) or Furnished by Others: “an item furnished by the Owner or under other divisions or contracts, and installed under the requirements of this division, complete, and ready for the intended use, including all items and services incidental to the work necessary for proper installation and operation. Include the installation under the warranty required by this division.

Engineer: Where referenced in this Division, “Engineer” is the Engineer of Record and the Design Professional for the work under this division, and is a consultant to, and an authorized representative of the Architect, as defined in the General and/or Supplementary Conditions. When used in this division, Engineer means increased involvement by and obligations to the Engineer, in addition to involvement by and obligations to the Architect.

AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the Work

NRTL: Nationally Recognized Testing Laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA), and acceptable to the AHJ over this project. Nationally recognized testing laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTLs that are acceptable to the AHJ and standards that meet the specified criteria.

Homerun: That portion of an electrical circuit originating at a junction box, termination box, receptacle, or switch with termination at an electrical panelboard. Note: Where MC cable is utilized for receptacle and/or lighting branch circuiting loads, the originating point of the homerun shall be at the first load in the circuit or at a junction box located in an accessible ceiling space as close as possible to the first load.

Substitution: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Substitutions include Value Engineering proposals.
1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

The terms "approved equal", “equivalent”, or "equal" are used synonymously and shall mean “accepted by or acceptable to the Engineer as equivalent to the item or manufacturer specified”. The term "approved" shall mean labeled, listed, certified, or all three, by an NRTL, and acceptable to the AHJ over this project.

C. PRE-BID SITE VISIT

Prior to submitting bid, visit the site of the proposed work and become fully informed as to the conditions under which the work is to be done. Failure to comply with this requirement shall not be considered sufficient justification to request or obtain extra compensation over and above the contract price.

D. MATERIAL AND WORKMANSHIP

Provide new material, equipment, and apparatus under this contract unless otherwise stated herein, of best quality normally used for the purpose in good commercial practice, and free from defects. Model numbers listed in the specifications or shown on the drawings are not necessarily intended to designate the required trim, written descriptions of the trim govern model numbers.

Provide markings or a nameplate for all material and equipment identifying the manufacturer and providing sufficient reference to establish quality, size, and capacity. All workmanship shall be of the finest possible by experienced mechanics of the proper trade. In general, provide the following quality grade(s) for all materials and equipment.

Commercial specification grade:

Provide all hoists, scaffolds, staging, runways, tools, machinery, and equipment required for the performance of the electrical work. Store and maintain material and equipment in clean condition, and protected from weather, moisture, and physical damage.

Furnish only material and equipment that are listed, labeled, certified, or all three, by an NRTL whenever any listing or labeling exists for the types of material and equipment specified.

At a minimum, general work practices for electrical construction shall be in accordance with NECA 1 (latest edition), “Standard Practices for Good Workmanship in Electrical Construction”.

E. MANUFACTURERS

In other articles where lists of manufacturers are introduced, subject to compliance with requirements, provide products by one of the manufacturers specified.

Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

Where manufacturers are not listed, provide products subject to compliance with requirements from manufacturers that have been actively involved in manufacturing the specified product for no less than 5 years.

F. COORDINATION

Coordinate all work with other divisions and trades so that various components of the systems are installed at the proper time, fit the available space, and allow proper service access to those items requiring maintenance. Components which are installed without regard to the above shall be relocated at no additional cost to the Owner.

Unless otherwise indicated, the General Contractor shall provide chases and openings in building construction required for installation of the systems specified herein. Contractor shall furnish the General Contractor with information where chases and openings are required. Contractor shall keep informed as to the work of other trades engaged in the construction of the project and shall execute work in a manner as to not interfere with or delay the work of other trades.

Figured dimensions shall be taken in preference to scale dimensions. Contractor shall take his own measurements at the building, as variations may occur. Contractor shall be held responsible for errors that could have been avoided by proper checking and inspection.

Provide materials with trim that will properly fit the types of ceiling, wall, or floor finishes actually installed. Model numbers listed in the specifications or shown on the drawings are not intended to designate the required trim.

Make all offsets required to clear equipment, beams, and other structural members, and to facilitate concealing raceways in the manner anticipated in the design. Provide materials with trim that will fit properly the types of ceiling, wall, or floor finishes actually installed.

G. ORDINANCES AND CODES

Work performed under this contract shall, at a minimum, be in conformance with applicable national, state and local codes having jurisdiction. Equipment furnished and associated installation work performed under this contract shall be in strict compliance with current applicable codes adopted by the local AHJ, including any amendments and standards as set forth by the following:
1. National Fire Protection Association (NFPA)
2. Underwriters Laboratories (UL)
3. Occupational Safety and Health Administration (OSHA)
4. American National Standards Institute (ANSI)
5. American Society of Testing Materials (ASTM)
6. Rules and regulations of public utilities and municipal departments affected by connection of services.
7. Other national standards and codes where applicable.

Where the contract documents exceed the requirements of the referenced codes, standards, etc., the contract documents shall take precedence. Where conflicts between various codes, ordinances, rules, and regulations exist, comply with the most stringent.

Promptly bring all conflicts observed between codes, ordinances, rules, regulations, referenced standards, and these documents to the attention of the Architect and Engineer for final resolution. Contractor will be held responsible for any violation of the law.

Procure and pay for permits and licenses required for the accomplishment of the work herein described. Where required, obtain, pay for, and furnish certificates of inspection to Owner. Provide all safety lights, guards, and warning signs required for the performance of the work and for the safety of the public.

H. PROTECTION OF EQUIPMENT AND MATERIALS

Store and protect from damage equipment and materials delivered to job site. For materials and equipment susceptible to changing weather conditions, dampness, or temperature variations, store inside in conditioned spaces. For materials and equipment not susceptible to these conditions, cover with waterproof, tear-resistant, heavy tarp or polyethylene plastic as required to protect from plaster, dirt, paint, water, or physical damage. Equipment and material damaged by construction activities shall be rejected, and Contractor shall furnish new equipment and material of a like kind at his own expense.

Keep premises broom clean of foreign material created during work performed under this contract. Conduit, equipment, etc. shall have a neat and clean appearance at the termination of the work.

Plug or cap open ends of conduits while stored and installed during construction when not in use to prevent the entrance of debris into the systems.

I. SUBSTITUTIONS

Materials, products, equipment, and systems described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by the proposed substitution. The base bid shall include only the products from manufacturers specifically named in the drawings and specifications. To request a substitution, request the Substitution Request Form from the Architect or Engineer. Complete and send the Substitution Request From for each material, product, equipment, or system that is proposed to be substituted. The burden of proof of the merit of the proposed substitution is upon the proposer.

Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Architect, and Owner the following:
1. Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects unless stated otherwise in the substitution request.
2. Proposed substitution is consistent with the Contract Documents and will produce indicated results, including functional clearances, maintenance service, and sourcing of replacement parts.
3. Proposed substitution has received necessary approvals of authorities having jurisdiction.
4. Same warranty will be furnished for proposed substitution as for specified Work.
5. If accepted substitution fails to perform as required, Contractor shall replace substitute material or system with that originally specified and bear costs incurred thereby.
6. Coordination, installation and changes in the Work as necessary for accepted substitution will be complete in all respects.

No substitutions will be considered unless the Substitution Request Form is completed and attached with the appropriate substitution documentation. No substitution will be considered prior to receipt of bids unless written request for approval to bid has been received by the Engineer at least ten (10) calendar days prior to the date for receipt of bids .

If the proposed substitution is approved prior to receipt of bids, such approval will be stated in an addendum. Bidders shall not rely upon approvals made in any other way. Verbal approval will not be given. No substitutions will be considered after the contract is awarded unless specifically provided in the contract documents.

Provide factory generated point-by-point calculations for all exterior light fixtures (photometric files supplied so the engineer can generate a point-by-point do not suffice for the point-by-point calculations). Provide interior point-by-point calculations at the discretion of the engineer.

J. SUBMITTALS

Assemble and submit for review shop drawings, material lists, manufacturer product literature for equipment to be furnished, and items requiring coordination between contractors under this contract. Provide submittals in sufficient detail so as to demonstrate compliance with these Contract Documents and the design concept. Prior to transmitting submittals, verify that the equipment submitted is mutually compatible with and suitable for the intended use, will fit the available space, and maintain manufacturer recommended service clearances. If the size of equipment furnished makes necessary any change in location or configuration, submit a shop drawing showing the proposed layout.

Transmit submittals as early as required to support the project schedule. Allow two weeks for Engineer review time, plus to/from mailing time via the Architect, plus a duplication of this time for resubmittals, if required. Only resubmit those sections requested for resubmittal.

Submittals shall contain the project name, applicable specification section, submittal data, equipment identifications acronym as used on the drawings, and the Contractor's stamp. The stamp shall certify that the submittal has been checked by the Contractor, complies with the drawings and specifications, and is coordinated with other trades. Manufacturer product literature shall include shop drawings, product data, performance sheets, samples, and other submittals required by this division. Highlight, mark, list, or indicate the materials, performance criteria, and accessories that are being proposed. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.

Submittals and shop drawings shall not contain firm name, logo, the seal, or signature of the Engineer. They shall not be copies of the work product of the Engineer. If the Contractor desires to use elements of such product, refer to paragraph “Electronic Drawing Files” for procedures to be used.

Separate submittals according to individual specification sections. Illegible submittals will be rejected and returned without review. Catalog data shall be properly bound, identified, indexed and tabbed in a 3-ring binder. Each item or model number shall be clearly marked and accessories indicated. Label the catalog data with the equipment identification acronym or number as used on the drawings and include performance curves, capacities, sizes, weights, materials, finishes, wiring diagrams, electrical requirements and deviations from specified equipment or materials. Mark out inapplicable items. Shop drawings will be returned without review if the above mentioned requirements are not met.
Provide the quantity of submittals required by Division 01. If not indicated and hard-copy sets are provided, submit a minimum of six (6) copies. Refer to Division 01 for acceptance of electronic submittals for this project. For electronic submittals, Contractor shall submit the documents in accordance with the procedures specified in Division 01. Contractor shall notify the Architect and Engineer that the submittals have been posted. If electronic submittal procedures are not defined in Division 01, Contractor shall include the website, user name, and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the designated representatives of the Architect and Engineer. Contractor shall allow for the Engineer review time as specified above in the construction schedule. Contractor shall submit only the documents required to purchase the materials and/or equipment in the submittal.

The checking and subsequent acceptance of submittals by the Engineer and/or Architect shall not relieve the Contractor from responsibility for deviations from the drawings and specifications, errors in dimensions, details, sizes of equipment, or quantities, omissions of components or fittings, coordination of electrical requirements, and not coordinating items with actual building conditions and adjacent work. Contractor shall request and secure written acceptance from the Engineer and Architect prior to implementing any deviation.

K. ELECTRONIC DRAWING FILES

In preparation of shop drawings or record drawings, Contractor may, at his option, obtain electronic drawing files in AutoCAD or DXF format on CD-ROM disk, DVD disk, flash drive, or direct download, as desired, from the Engineer for a shipping and handling fee of $200 for a drawing set up to 12 sheets and $15 per sheet for each additional sheet. Contact the Architect for written authorization and Engineer for the necessary agreement form and to specify shipping method and drawing format. In addition to payment, the written authorization from the Architect and release agreement form from the Engineer must be received before electronic drawing files will be sent.

L. RECORD DRAWINGS (AS-BUILT DRAWINGS)

During progress of the work in this division, Contractor shall maintain an accurate record of all changes made during the installation of the system. Upon completion of the work, accurately transfer all record information to three identical sets of the approved shop drawings. Insert one set into each copy of the manual described below.

See Division 01 and General Conditions for additional information.

M. OPERATION AND MAINTENANCE INSTRUCTIONS

During the course of construction, collect and compile a complete brochure of equipment furnished and installed on this project. Include operational and maintenance instructions, manufacturer's catalog sheets, wiring diagrams, parts lists, approved submittals and shop drawings, warranties, and descriptive literature as furnished by the equipment manufacturer. Include an inside cover sheet that lists the project name, date, Owner, Architect, Engineer, General Contractor, Sub-Contractor, and an index of contents.

Submit three copies of literature bound in approved binders with index and tabs separating equipment types to the Architect, for Engineer's review, at the termination of the work. Paper clips, staples, rubber bands, loose-leaf binding, and mailing envelopes are not considered approved binders. Final approval of systems installed under this contract shall be withheld until this equipment brochure is received and deemed complete by the Architect and Engineer. Instruct workmen to save required literature shipped with the equipment itself for inclusion in this brochure.

Include Record Drawings as described above.

Refer to Division 01 for acceptance of electronic manuals for this project. For electronic manuals, refer to paragraph “Submittals” for requirements.

N. WARRANTIES

Warrant each system and each element thereof against all defects due to faulty workmanship, design, or material for a period of 12 months from date of Substantial Completion, unless specific items are noted to carry a longer warranty in these construction documents or manufacturer's standard warranty exceeds 12 months. Remedy all defects occurring within the warranty period(s) as stated in the General Conditions and Division 01.

Warranties shall include labor and material, including travel expenses. Make repairs or replacements without any additional costs to the Owner, and to the satisfaction of the Owner, Architect, and Engineer.

Perform the remedial work promptly, upon written notice from the Engineer or Owner.

Also warrant the following additional items:
1. All raceways are free from obstructions, holes, crushing, or breaks of any nature.
2. All raceway seals are effective.
3. The entire electrical system is free from all short circuits and unwanted open circuits and grounds.

At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period and any actions the Owner must take in order to maintain warranty status. Each warranty instrument shall be addressed to the Owner and state the commencement date and term.

2. GENERAL MATERIALS AND INSTALLATION

A. BUILDING OPERATION

Comply with the schedule of operations as outlined in the architectural portions of this specification. Building shall be in operation during normal workday hours . Accomplish work requiring interruption of building operation at a time when the building is not in operation and only with written approval of building Owner and/or tenant. Coordinate interruption of building operation with the Owner and/or tenant a minimum of seven (7) days in advance of work.

B. EXCAVATION AND BACKFILLING

Perform excavation and backfill required for installation of underground work under this contract. Trenches shall be of sufficient width. Crib or brace trenches to prevent cave-in or settlement. Do not excavate trenches close to columns and walls of new building without prior consultation with the Architect. Use pumping equipment if required to keep trenches free of water. Backfill trenches in maximum 6-inch layers of well tamped dry earth in a manner to prevent future settlement.

Excavation as specified herein shall be classified as common excavation. Common excavation shall comprise the satisfactory removal and disposition of material of whatever substances and of every description encountered, including rock, if any, within the limits of the work as specified and shown on the drawings. Excavation shall be performed to the lines and grades indicated on the drawings. Dispose of excavated materials that are considered unsuitable for backfill, and surplus of excavated material, which is not required for backfill, all to the satisfaction of the Engineer.

C. COINCIDENTAL DAMAGE

Repair streets, sidewalks, drives, paving, walls, finishes, and other facilities damaged in the course of this Work. Repair materials shall match existing construction. Repair work shall meet all requirements of the Owner, local authorities having jurisdiction, and meet the satisfaction of the Architect. Repair work shall be thoroughly first class.

D. CUTTING AND PATCHING

Conform to the requirements in Division 01. Cut walls, floors, ceilings, and other portions of the facility as required to install work under this division. Obtain permission of the Architect prior to cutting. Do not cut or disturb structural members without prior approval from the Architect. Cut holes as small as possible. Patch walls, floors, and other portions of the facility as required by work under this division. Patching shall match the original material and construction including fire ratings, if applicable. Repair and refinish areas disturbed by work to the condition of adjoining surfaces in a manner satisfactory to the Architect.

E. ROUGH-IN

Coordinate without delay all roughing-in with other divisions. Conceal all conduit and raceways except in unfinished areas and where otherwise indicated on the drawings.

F. CONCRETE BASES

Provide concrete bases (e.g., housekeeping pads) for equipment where indicated on the drawings and as specified herein. Concrete bases shall have chamfered edges. Size of base shall be a minimum of 4 inches greater than the footprint of the equipment that it is supporting and shall have a minimum height of 3-1/2 inches.

Construct equipment bases of a minimum 28-day, 4000-psi concrete conforming to American Concrete Institute Standard Building Code for Reinforced Concrete (ACI 318) and the latest applicable recommendations of the ACI standard practice manual. Concrete shall be composed of cement conforming to ASTM C 150 Type I, aggregate conforming to ASTM C33, and potable water. Exposed exterior concrete shall contain 5 to 7 percent air entrainment.

Unless otherwise specified or shown on the structural drawings, reinforce equipment bases with No. 4 reinforcing bars conforming to ASTM A615 or 6x6 - W2.9 x W2.9 welded wire mesh conforming to ASTM A185. Place reinforcing bars 24 inches on center with a minimum of two bars each direction.

Provide galvanized anchor bolts for equipment placed on concrete bases or on concrete slabs. Anchor bolts size, number, and placement shall be as recommended by the manufacturer of the equipment.

G. SUPPORT SYSTEMS

Steel Slotted Support Systems (Slotted Channel): Comply with MFMA-3, factory-fabricated components for field assembly; 12-gauge, 1-5/8-inch by 1-5/8-inch.

Finishes:
1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.

Aluminum Slotted Support Systems (Slotted Channel): Comply with MFMA-3, Type 6063-T6, per ASTM B221; factory-fabricated components for field assembly; 12-gauge, 1-5/8-inch by 1-5/8-inch.

Manufacturers: Cooper B-Line, ERICO International, Hilti, Power-Strut, Thomas and Betts, or Unistrut.

Field Fabrication:

Where field cutting of standard lengths of channel are required, make cuts straight and perpendicular to manufactured surfaces.

For field-cut or damaged surfaces of coated channels, dress cut ends, damaged surfaces, or both, with an abrasive material (e.g., file, grinding stone, or similar) and cleanser to remove oils, rust, sharp edges, and shards.

For channel with a factory-applied coating, re-finish cut edges with a coating compatible with the factory finish and as recommended by the manufacturer (e.g., manufacturer's touch-up paint or zinc-rich cold-galvanizing compound, as applicable).

H. ACCESS DOORS

Provide access doors for all concealed equipment where indicated or as required, except where above lay-in ceilings. Access doors shall be adequately sized for the devices served with a minimum size of 18 inches x 18 inches. Access doors must be of the proper construction for the type of construction in which it is installed. Obtain Architect's approval of type, size, location and color before ordering. Provide factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation, concealed hinges, flush screwdriver-operated cam lock, and anchor straps. Provide access doors manufactured by: Bar-Co, J.L. Industries, Karp Associates, Milcor, Nystrom Building Products, Wade, or Zum.

I. PENETRATIONS

Coordinate sleeve selection and application with selection and application of fire-stopping specified in Division 07 section "Through-Penetration Firestop Systems."

Roofs:
1. Coordinate all roof penetrations with Engineer, Owner, and as applicable, the roofing contractor providing a roof warranty.

2. Keep all raceway penetrations within mechanical equipment curbs wherever possible. Coordinate with Division 01 .

3. Flash and counterflash all openings through roof, and/or provide pre-fabricated molded seals compatible with the roof construction installed, or as required by the Engineer, Owner, or roofing contractor. All roof penetrations shall be leaktight at the termination of the work and shall not void any new or existing roof warranties.

Walls and Floors:
1. Steel Pipe Sleeves for Raceways and Cables: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends, and drip rings.

2. Cast-Iron Pipe Sleeves for Raceways and Cables: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

3. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052 inch thickness and of length to suit application.

J. FIRESTOPPING

Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with UL 2079 or ASTM E 814, or other NRTL acceptable to AHJ.

Manufacturers: Hilti, RectorSeal, Specified Technologies Inc., United States Gypsum Company, or 3M corp.

Through and Membrane Penetration Firestopping Systems Product Schedule: Provide UL listing, location, wall or floor rating, and installation drawing for each penetration fire stop system.

Where project conditions require modification to qualified testing and inspecting agency's illustrations for a particular firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Include qualifications data for testing agency.

K. EQUIPMENT FURNISHED BY OTHERS

Provide necessary equipment and accessories that are not provided by the equipment supplier or Owner to complete installation of equipment furnished by others in locations as indicated on the drawings, specified herein, or both. Equipment and accessories not provided by the equipment supplier may include, but not be limited to, flexible cords and plugs as required for proper operation of the complete system, in accordance with the manufacturers' instructions.

Contractor shall be responsible for correct rough-in dimensions, and verify them with Architect and/or equipment supplier prior to rough-in and service installations.

L. SYSTEM TESTING AND ADJUSTING

Adjust, align, and test all electrical equipment on this project provided under this division and all electrical equipment furnished by others for installation or wiring under this division for proper operation.

Test all systems and equipment according to the requirements in NETA ATS (latest edition) and all additional requirements specified in following sections.

Maintain the following on the project premises at all times: a true RMS reading voltmeter, a true RMS reading ammeter, and a megohmmeter insulation resistance tester. Provide test data readings as requested or as required by the Engineer.

M. EQUIPMENT IDENTIFICATION

Provide equipment identification nameplates on all switchboards, panelboards, electrical equipment enclosures, access doors, transformers, disconnect switches, enclosed circuit breakers, motor starters, feeder devices in switchboards, distribution panelboards, and motor control centers .

Nameplates:
1. Engraved, contrasting color, three-layer, laminated plastic , indicating the name of the equipment, load, or circuit as designated on the drawings and in the specifications:
2. Field-applied permanent epoxy adhesive, compatible with the equipment finish.

Attachment method shall be acceptable to the manufacturers of the equipment to which the nameplates are being applied.

Nameplate Color:
1. Black background with white letters for Normal Power;
Letter height: 3/8-inch minimum.

N. SYSTEM START UP

Perform the following prior to starting up the electrical systems:
1. Check all components and devices and lubricate items accordingly.
2. Tighten screws and bolts for connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
3. Adjust taps on each transformer for rated secondary voltage when the transformer is at minimum load.
4. Check and record building's service entrance voltage, grounding conditions, grounding resistance, and proper phasing.
5. Replace all burned-out lamps and lamps used for temporary construction lighting in permanent light fixtures.
6. After all systems have been inspected and adjusted, confirm all operating features required by the drawings and specifications and make final adjustments as necessary.

END OF SECTION 26

Division 26: BASIC ELECTRICAL MATERIALS AND METHODS

1. RACEWAYS

A. METALLIC CONDUIT AND TUBING

Electrical Metallic Tubing, Couplings, and Fittings (EMT): ANSI C80.3, UL 797. Only steel products allowed. Reduced wall EMT is not allowed

Flexible Metal Conduit (FMC): Zinc-coated steel or aluminum, UL 1. Reduced-wall FMC is not allowed.

Intermediate Metal Conduit (IMC): Hot-dip Galvanized Rigid Steel Conduit, ANSI C80.6, UL 1242.

Liquidtight Flexible Metal Conduit (LFMC): Flexible steel conduit with PVC jacket, UL 360; fittings: NEMA FB 1.

Rigid Metal Conduit (RMC):
1. Hot-dip Galvanized Rigid Steel Conduit (GRS): ANSI C80.1, UL 6.
Plastic-Coated IMC, RMC, and Fittings: NEMA RN 1, NRTL listed. Coating thickness of 0.04 inches minimum.

IMC and RMC Fittings: NEMA FB 1; compatible with conduit type and material, NRTL listed.

Manufacturers: AFC Cable, Alflex, Anamet Electrical, Electri-Flex, Indalex, Manhattan/CDT/Cole-Flex, O-Z/Gedney, Republic Raceway, Tyco International, Western Tube and Conduit, or Wheatland Tube.

B. NON-METALLIC CONDUIT AND TUBING

Rigid Nonmetallic Conduit (RNC): Schedule 40 PVC, 90 deg C rated, NEMA TC-2, UL 651

Fittings: NEMA TC 3, TC 6; UL 651, compatible with conduit/tubing type and material, NRTL listed.

Manufacturers: AFC Cable, American International, Anamet Electrical, Amco, Cantex, Certainteed, Condux International, Elecsys, Electri-Flex, Lamson and Sessions, Manhattan/CDT/Cole-Flex, Prime Conduit, Raco, Spiralduct, Superflex Ltd, or Thomas and Betts.

2. RACEWAY INSTALLATION

A. GENERAL RACEWAY INSTALLATION REQUIREMENTS

Install raceways parallel and perpendicular to building lines.

Install raceways to requirements of structure, to requirements of all other work on the project, and to clear all openings, depressions, pipes, ducts, reinforcing steel, and other immovable obstacles.

Install raceways set in forms for concrete structure in such a manner that installation will not affect the strength of the structure.

Except where approved in writing by the Engineer, install no raceway in a slab-on-grade. Locate raceway below granular fill below slabs-on-grade.

Install raceways continuous between connections to outlets, boxes, and cabinets with a minimum possible number of bends and not more than the equivalent of four 90-degree bends between connections. Use manufactured elbows for all 45- and 90-degree bends, unless approved by the Engineer in advance. Make other bends smooth and even and without flattening raceway or flaking galvanizing or enamel. Radii of bends shall be as long as possible and never shorter than the corresponding trade elbow.

Use long radius elbows for all underground installations, where necessary, or where otherwise indicated.

Securely fasten raceways in place with approved straps, hangers, and steel supports as required. Attach raceway supports to the building structure. Hang single raceways for feeders with malleable split ring hangers with rod and turnbuckle suspension from inserts spaced not over 10 feet apart in construction above. 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 the bends. Do not support raceways from suspended ceiling components.

Ream raceway ends, thoroughly clean raceways before installation, and keep clean after installation. Plug or cover openings and boxes as required to keep raceways clean during construction and fish all raceways clear of obstructions before pulling conductor wires. Provide raceways of ample size for pulling of wire, not smaller than code requirements and not less than 1/2-inch in size, unless indicated otherwise on Drawings. Homeruns containing more than one branch circuit shall not be less than 3/4-inch in size.

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 the Owner.

Align and install true and plumb all raceway terminations at panelboards, switchboards, motor control equipment, and junction boxes.

Install approved expansion/deflection fittings where raceways pass through (if embedded) or across (if exposed) expansion joints, and when using RNC or RAC in exposed environments in accordance with NFPA 70 and expansion/contraction properties of RNC or RAC.

Install a 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 with not less than 200-lb tensile strength. Leave at least 24 inches of slack at each end of pull wire.

Make all joints and connections in a manner that will ensure mechanical strength and electrical continuity.

B. ABOVE GROUND RACEWAY USE:

Install all circular raceways concealed above suspended ceilings or concealed in walls or floors wherever possible except where otherwise indicated. Provide GRS for all conduits exposed to weather or other hazardous conditions.

Unless noted otherwise, all other raceway may be EMT where approved by local code. Use compression type fittings for EMT, with all fittings NRTL listed for the environment in which they are used. Unless noted otherwise, set-screw type fittings are not allowed.

C. UNDERGROUND RACEWAY USE:

Provide GRS installed below grade with a corrosion-resistant bonded-plastic or approved mastic coating. This shall include the 90-degree elbow below grade and the entire vertical transition to above grade.

RNC conduit may be used underground where permitted by local code and where not specifically restricted by these documents. When used, provide plastic-coated GRS, as specified above, for all bends greater than 30 degrees, including the 90-degree elbows below grade and the entire vertical risers for transitions from below to above grade or above slab.

D. EQUIPMENT CONNECTIONS

Use FMC for final connection to each motor, transformer, and any device that would otherwise transmit motion, vibration, or noise. Use LFMC where exposed to liquids, vapors, or sunlight. Provide all FMC and LFMC with an insulated bonding conductor.

Use only metal raceways for all power wiring from the output of variable frequency drives to their respective motors.

3. BUSHINGS AND LOCKNUTS

Rigidly terminate conduits entering sheet metal enclosures to the enclosure with a bushing and locknut on the inside and a locknut or an approved hub on the outside. Conduit shall enter the enclosure squarely.

Provide bushings and locknuts made of galvanized malleable iron with sharp, clean-cut threads.

Where EMT enters a box, provide approved EMT compression connectors.

Use insulated, grounding, or combination bushings wherever connection is subject to vibration or moisture, when required by NFPA 70, or both.

4. CONDUCTORS AND CABLES

Annealed (soft) copper complying with ICEA S-95-658/NEMA WC70 and UL standards 44 or 83 as applicable .

Conductor Insulation Types: 90-degree C-rated, Type THHN/THWN-2 or XHHW-2 complying with ICEA S-95-658/NEMA WC70.

Sizes of conductors and cables indicated or specified are in American Wire Gage (AWG - Brown and Sharpe).

All feeder and branch circuit conductors No. 8 AWG and larger: Stranded.

All conductors, No. 10 AWG and smaller: Solid copper.

All Branch Circuit Wiring: Not smaller than No. 12 AWG. If no conductor size is indicated on the Drawings for a branch circuit, provide conductors and conduit sized per NFPA 70 and based on the indicated branch circuit overcurrent protective device (OCPD) rating and number of poles. Where no circuit size (i.e., conductors and OCPD) is indicated on the drawings for a branch circuit, provide three No. 12 AWG conductors, in 3/4-inch raceway, and a 20A circuit breaker.

Control Wiring: Stranded copper conductors, 600V insulation, of the proper type, size, and number as required to accomplish specified function. Minimum size: No. 14 AWG, unless noted otherwise.

Flexible Cords and Cables: Stranded copper conductors for all, unless noted otherwise.

Special Purpose Conductors And Cables, Such As Low Voltage Control And Shielded Instrument Wiring: As recommended by the system equipment manufacturer unless indicated otherwise.

Copper Conductor Manufacturers: Advance Wire and Cable, AFC Cable, Alan Wire, Alflex, American Insulated Wire, Encore Wire, Northern Cables, Okonite, or Southwire.

Connections: Apply a zinc based anti_oxidizing compound to connections. Do not use terminals on wiring devices to feed through to the next device.

5. CONDUCTORS AND CABLES INSTALLATION

Install all wiring in approved raceway and enclosures, except
where specified or indicated for low-voltage wiring, where specified or indicated for direct-buried cables, or where type MC cable is indicated or specified as acceptable.

Install all conductors and cables in raceways continuous without taps or splices. Splice or tap only in approved boxes and enclosures with approved solderless connectors, or crimp connectors and terminal blocks for control wiring, and keep to the minimum required. Insulate all splices, taps, and joints as required by codes.

All materials used to terminate, splice, or tap conductors: designed for, properly sized for, and NRTL listed for the specific application and conductors involved, and installed in strict accordance with the manufacturer's recommendations, using the manufacturer's recommended tools.

Where wiring is indicated as installed, but the connection is indicated "FUTURE" or "BY OTHER DIVISION, TRADES, OR CONTRACTS", leave a minimum 3-foot "Pigtail" at the box, tape the ends of the conductors, and cover the box.

In general, the direction of branch circuit "home run" routing is indicated on the drawings, complete with circuit numbers and panelboard designation. Continue all such "home run" wiring to the designated panelboard, as though "circuit runs" were indicated in their entirety.

Common or shared neutrals are not allowed unless shown on the drawings to be used or specifically noted to be allowed.

Where multi-wire branch circuits (i.e., shared neutral) are allowed, they shall be provided with a means that will simultaneously disconnect all ungrounded conductors at the point the branch circuit originates. Multi-pole breakers or 3 single-pole breakers with a handle tie are two examples.

When multiple home runs are combined into a single raceway such that the number of conductors exceeds four (conductor count is made up of any combination of phase and neutral conductors), the following restrictions apply, which are in addition to those in NFPA 70:

Normal or Non-Essential circuits:

1. Maximum of 16 conductors in a single raceway. For up to eight conductors in a raceway, minimum raceway size: 3/4-inch. For greater than eight conductors, minimum raceway size: 1-inch. Do not install any other type of circuit in this raceway.

2. Minimum wire size for all conductors in this raceway: No. 10 AWG.

3. Only 15A and 20A branch circuit homeruns may be combined into one raceway.

GFCI circuits:

1. Do not use multi-conductor circuits, with a shared neutral, for any GFCI circuit breaker or receptacle circuit.

For branch circuits fed from GFCI circuit breakers, limit the one-way conductor length to 100 feet between the panelboard and the most remote receptacle or load on the GFCI circuit.

Properly identify all terminal blocks and wire terminals for control wiring with vinyl stick-on markers or equivalent. Provide Engineer with a list of proposed identifying numbers for review prior to installing markers.

Provide an equipment-grounding conductor or bonding jumper, as applicable, in all feeders and branch circuits, sized in accordance with NFPA 70 Tables 250.66 or 250.122, as applicable, unless indicated as larger on the drawings.

Wiring shall have insulation of the proper color to match color code system in the table below unless there is a color system currently in use by the facility, in which case the colors are to match the existing system. In larger sizes where properly colored insulation is not available, use vinyl plastic electrical tape of the appropriate color around each conductor at all termination points, junctions, and pull boxes.

System Voltage:

240V and under, including 208Y/120, 120/240, 120/208, and 240D/120 systems:
1. Phase A: Black.
2. Phase B: Red .
3. Phase C: Blue.
4. Neutral: White.
5. Equipment Ground: Green.
6. Isolated Ground: Green with yellow stripe.

480V and 480Y/277V

1. Phase A: Brown
2. Phase B: Orange
3. Phase C: Yellow
4. Neutral: Gray
5. Equipment ground: green.

6. MC CABLE

A. CABLE SPECIFICATIONS

Metal-clad cable (MC Cable): 600V, unjacketed; UL Standard 83, 1569, and 1685; NFPA 70 Article 330; aluminum or galvanized steel interlocked armor; THHN- or XHHW-insulated conductors; color code: ICEA Method 1, with green insulated grounding conductor; listed for use in UL 1, 2, and 3 hour through-penetration firestop systems. MC Cable manufacturers: AFC Cable Systems, Encore Wire Corporation, Kaf-Tech, or Southwire.

B. APPLICATIONS OF MC CABLE

1. In lieu of flexible conduit and wiring from light fixtures located in accessible ceilings to junction boxes attached to building structure directly above the ceiling. Provide cable whips of sufficient lengths to allow for relocating each light fixture within a 5 foot radius of its installed location, but not exceeding 6 feet in unsupported lengths.

2. For vertical drops in stud walls.

3. In lieu of EMT, only for 15A and 20A branch circuits (with up to four (4) conductors, not including ground conductor), and only in dry concealed locations above grade, except where specifically not permitted by NFPA 70 owner, landlord, ahj, or noted in list below.

C. PROHIBITED USE OF MC CABLE UNLESS NOTED ABOVE

Examples of those uses include, but are not limited to the following:
1. Homeruns to panelboards (refer to Section 26: Definitions).
2. Where exposed to view.
3. Where exposed to damage.
4. Hazardous locations.
5. Wet locations.
6. When restricted otherwise.
7. When specifically disallowed by the local AHJ.
8. When specifically disallowed by the landlord.
9. Circuits supplied by an emergency or standby power source.

7. MC CABLE INSTALLATION

Secure and support cable per NFPA 70 Article 330. Secure cable within 12 inches of every box or fitting. Securing and supporting intervals shall not exceed six feet. Maintain consistent spacing to avoid derating due to bundling per NFPA 70 Section 310.15. Utilize steel cable hangers, Arlington SMC series or equivalent, to support wherever possible so cables can be routed in a neat and workmanship like manner.

8. JUNCTION BOXES, PULL BOXES, CABINETS, AND WIREWAYS

Provide junction boxes, pull boxes, cabinets, and wireways wherever necessary for proper installation of various electrical systems according to NFPA 70 and where indicated on the drawings. Size as required for the specific function or as required by NFPA 70 , whichever is larger. Construction shall be of a NEMA design suitable for the environment installed.

Junction boxes installed behind wall cases and in or on other store fixtures, except where otherwise specified, shall be 4 inches square or larger with galvanized covers.

Horizontally mount junction boxes under center fixtures (and cases), handy boxes or 4-inch square boxes with tops of boxes not more than 3-1/2 inches above the floor. Size junction boxes to adequately contain all required conductors and splices.

9. OUTLET BOXES

All outlets including light fixture, switch, receptacle, and similar outlets: galvanized steel knockout boxes, suitable in design to the purpose they serve and the space they occupy. Size as required for the specific function or as required by NFPA 70, whichever is larger. Set all outlet boxes in walls, columns, floors, or ceilings so they are flush with the finished surface, accurately set, and rigidly secured in position. Provide plaster rings, extension rings and/or masonry rings as required for flush mounting. Provide approved cast outlet boxes with hubs and weatherproof covers in all areas subject to damp, wet, or harsh conditions.

Manufacturers: Appleton, Cooper, Erikson Electrical, Hoffman, Killark Electric, O-Z/Gedney, Raco, Robroy Industries, Scott Fetzer, Spring City Electrical, Thomas and Betts, Walker Systems, or Woodhead.

10. OUTLET LOCATIONS

Coordinate locations of outlet boxes. Outlets are only approximately located on the small scale drawings. Use great care in the actual location by consulting the various large scale detailed drawings used by other division trades, and by securing definite locations from the Architect .

11. MOUNTING HEIGHTS

Unless noted otherwise, install wiring devices vertically aligned at height indicated on construction drawings.

A. RECEPTACLES

Unless indicated otherwise, install vertically with the ground slot mounted at the top .

Where installed horizontally, install with the neutral slot mounted at the top .

Above counter: mount vertically aligned.

Mechanical and electrical equipment rooms and janitors closets: mount vertically aligned .

Garages: mount vertically aligned .

Weatherproof exterior receptacles: horizontally aligned.

GFCI receptacles: Same as general receptacles .

Isolated ground receptacles: Same as general receptacles .

SPD receptacles: Same as general receptacles .

Clock Receptacles: 84 inches above finished floor.

Concrete Block Walls: As long as ADA requirements are maintained, dimensions above may be adjusted slightly as required to compensate for variable joint dimensions such that bottom or top of boxes, as applicable, are at block joints.

B. SWITCHES

General: All switches shall be mounted at the same height throughout the project unless noted otherwise.

Above Counters: Same as for receptacles.

Concrete Block Walls: As long as ADA requirements are maintained, dimensions above may be adjusted slightly as required to compensate for variable joint dimensions, such that bottom or top of boxes, as applicable, are at block joints.

Walls with Wainscoting: 6 inches minimum above wainscoting, but not exceeding 48 inches above finished floor.

C. TELEPHONE/DATA OUTLET BOXES

General: Match mounting height of adjacent wiring device listed above.

Wall-mounted Telephone (Public): One at 48 inches above finished floor and one at 36 inches above finished floor.

For other than wiring devices, refer to paragraphs, articles, sections, divisions, or drawings to obtain mounting heights for specific equipment or systems.

12. WIRING DEVICES

The catalog numbers listed for wiring devices are generally for 20A rated devices. Where 15A rated devices are indicated on the drawings or required for circuit rating limitations, provide wiring devices equivalent to those specified for 20A, but rated for 15A.

All receptacles located outdoors or in damp or wet locations: Listed as 'weather Resistant', designated by a 'WR' on the faceplate.

Minor changes relative to the location of electrical equipment may be made to comply with structural and building requirements as determined in the course of construction. Provide all wiring devices of the same manufacturer and not mixed on the project, to the maximum extent possible. Provide color of toggles and receptacles as requested by the Architect. Refer to detail showing receptacles table.

Type of Device	Hubbell	Pass & Seymour	Leviton	Cooper Wiring Devices
Duplex Receptacles - Commercial Grade				
Duplex Receptacle	BR20	CR20	CR20	CR20
Duplex Receptacle - Tamper resistant	BR20TR	TR20	TBR20	TRCR20
Duplex Receptacle - Weather resistant	BR20WR	WR20TRW	WBR20	WRBR20
Other Receptacles				
GFCI Receptacle	GF20LA	2095	7899-H	VGF20
GFCI Receptacle - Weather resistant	GFTR20	2095TRWR	W7899	WRVGF20
GFCI Receptacle - Tamper resistant and weather resistant	GFTR20	2095TRWR	W7899-T	TWRVGF20
Switches - Commerical Grade				
Single Pole Switch	DS120	CS20AC1	CSB1-20	CSB120
Other Switches				
Key Switch	HBL1221L	PS20AC-L	1221-2KL	1221L

Switch Installations in Door/Side Light Frames: Despard type ivory switch, Pass and Seymour ACD201-i or approved equal.

Switch and Pilot Installations: One Despard type ivory switch and one Despard type flush 1/25 Watt neon pilot light, both installed in a single-gang box with cover plate. Pass and Seymour ACD201-IV switch and 1475 pilot light, or approved equals.

Automatic Load Control Relay (ALCR) (also referred to as emergency shunt relay): UL 924 listed as emergency lighting and power equipment. Connect ALCR in parallel with a lighting control device. Loss of normal power shall cause relay to automatically shunt emergency power to lighting circuit regardless of lighting control device position. Emergency lighting circuit shall continue to operate at full power until normal power has been restored. Provide a two-gang junction box with separation barrier and plaster ring for the ALCR, and install it adjacent to its associated lighting control device or above accessible ceiling. Provide Acuity (Lighting Controls and Design) Model GR2001 ALCR, or equivalent by Bodine, Cooper, Hubbell, Legrand, or Leviton.

13. SWITCH AND OUTLET COVER PLATES

Switch and Outlet Plates: Colored, smooth nylon; by the same manufacturer as the wiring devices, wherever possible. Verify desired materials and colors with Architect before installation. Switch plates in unfinished rooms and spaces: Stamped steel, cadmium plated. Install groups of switches under one ganged-plate, usually horizontally; or, where required by details, vertically. Set all cover plates plumb, parallel, and finished flush with the wall.

14. WEATHERPROOF COVER PLATES

Provide GFCI receptacles for designated weatherproof receptacles, unless indicated otherwise on the drawings

Unattended Exterior, Wet Locations or Other Locations as Indicated: In-use, NEMA 3R, recessed or flush mount, NRTL labeled plates molded from a clear high impact ultraviolet stabilized polycarbonate material for easy verification that cords are plugged in and that the GFCI is functioning. Back box must be suitable for conduit connecting. Coordinate back box with wall depth. Intermatic WP1000RC/HRC or equal.

Attended Wet Or Damp Locations: Weatherproof cover plates NRTL listed for wet locations with cover(s) closed; die-cast aluminum or Type 302 stainless steel; single-cover for switches and vertically mounted receptacles; double-cover for horizontally mounted receptacles; self-closing covers.

Cover Plates: By the same manufacturer as the wiring devices; complying with NFPA 70 ARTICLES 406.9 (A) or (B) requirements for attended or unattended use as applicable.

15. ELECTRICAL SERVICE AND GROUNDING

A. ELECTRICAL SERVICE

See drawings for type, size, voltage, phase, and other requirements.

Provide, or arrange with the serving utility for installation to provide, a recording voltmeter at the service point, on the first day the facility is open for business, for a 24-hour voltage test. If voltage and regulation are not within acceptable limits, arrange with the utility for proper voltage. Submit to the Owner a report of maximum and minimum voltage and a copy of the recording voltmeter chart.

B. CONNECTION TO SERVING UTILITIES

Provide raceways, terminations, metering provisions, and miscellaneous equipment as required for electrical and telephone services for connection by the serving utility, in strict compliance with the requirements of all applicable codes and of the serving utility involved. Verify all service terminations and connection points in the field and work in conjunction with the utility involved in the installation of all services. Provide all materials and equipment required for complete utility connection but not furnished by the serving utility. Notify the utility companies involved within two weeks after notice to proceed of all required information necessary for the utility to supply the project without delay. Pay all charges of the serving utility for the electrical service(s).

C. GROUNDING

Permanently and effectively ground and bond the electrical installation in a thorough and efficient manner, and in conformance, at a minimum, with NFPA 70, or these documents, where they exceed code requirements. Use bare or insulated conductors as specified herein, and other materials indicated on the Drawings.

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.:	1850004412
Date:	10.25.19
Issued For:	SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
ANDREA C. MULVANY
NUMBER PE-2013039892
PROFESSIONAL ENGINEER

Oct 24 2019

ANDREA C. MULVANY
LICENSE # PE-2013039892

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

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MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

ELECTRICAL SPECIFICATIONS

SHEET NUMBER

E701

ANDREA C. MULVANY

16. DISTRIBUTION AND CONTROL EQUIPMENT

A. SERVICE ENTRANCE AND POWER DISTRIBUTION SWITCHBOARDS:1600A AND LARGER

Service entrance and power distribution switchboards must conform with the requirements of the local codes and serving utility; manufactured according to current requirements of UL 891, "Dead-Front Switchboards"; NRTL listed and permanently labeled for service entrance use when applicable; short circuit interrupting and bracing rating as shown on the drawings.

Main circuit breaker and feeder circuit breakers as indicated on the drawings .

Integral ground fault relays and operators, self-powered, where indicated or required by NFPA 70.

Contained in a single factory-assembled dead-front enclosure with front accessible connections to incoming mains and outgoing feeder circuit breakers

Circuit Breakers: Bolt-on, thermal magnetic, "quick-make quick-break" type; toggle switching mechanism to provide manual and automatic operation; and automatic tripping clearly indicated by a neutral handle position in-between the "on" and "off" positions.

Manufacturers: Square D QED type or approved equal by Eaton, G E., or Siemens.

Manufacturers: Square D Masterpact NW Type or equal by Eaton, G.E., or Siemens.

B. SERVICE ENTRANCE SWITCH: FUSIBLE, 800A-4000A

Fusible Switch: Number of phases and ratings of switch and fuses as indicated on the drawings; permanently labeled as suitable for use as service entrance equipment; integral ground fault relay and operator where indicated or required by NFPA 70; provisions for bolt-in fuses as appropriate for the fuses specified; interlocked cover and an engraved nameplate for identification. Provide with integral and separate neutral and ground assemblies, suitable for the sizes of conductors indicated. Do not double-lug any terminations not specifically listed as suitable for more than one conductor. Enclosure: Free-standing switchboard section of NEMA design suitable for the environment in which installed or as indicated.

Manufacturers: Square D Type B/I Bolt-Loc or equivalent by Eaton, G.E., or Siemens.

C. SERVICE ENTRANCE CIRCUIT BREAKER: ENCLOSED, 100A-6000A

Enclosed Circuit Breaker: Number of phases and ratings as indicated on the drawings; permanently labeled as suitable for use as service entrance equipment; integral ground fault relay and operator where indicated or required by NFPA 70; interlocked cover and an engraved nameplate for identification. Provide with integral and separate neutral and ground assemblies, suitable for the sizes of conductors indicated. Do not double-lug any terminations not specifically listed as suitable for more than one conductor. Enclosure: NEMA design suitable for the environment in which installed or as indicated.

D. POWER DISTRIBUTION PANELBOARDS: CIRCUIT BREAKER, 1200A BUS OR SMALLER

Panelboards: Dead-front distribution panelboards with number and sizes of circuit breakers as indicated on the drawings; where installed as service entrance equipment, permanently label as suitable for use as service entrance equipment; fully- rated for the available fault current indicated on the drawings; hinged, lockable front door that covers the circuit breaker handles. Circuit breakers: Quick-make, quick-break, indicating type; engraved nameplates for circuit identification of each circuit breaker. Provide a typewritten card directory indicating exactly what each circuit breaker controls on the inside face of the door for circuit identification.

Manufacturers: Square D Type I-Line, Eaton type Pow-R-Line 4, G.E. types CCB or AV-1, or Siemens types S4 or S5.

F. LIGHTING AND APPLIANCE PANELBOARDS

Panelboards: Complete with bolt-on thermal magnetic, molded case circuit breakers assembled in a dead-front finished cabinet containing a typewritten card directory indicating exactly what each circuit breaker controls; fully- rated and with the integrated short circuit current ratings indicated on the drawings. Plug-in type breakers will not be acceptable. All two- and three-pole breakers: Common trip type.

1. Type SWD Circuit Breakers: Use when breaker serves as a switch for 120V or 277V lighting circuits.
2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip). Use as indicated on drawings.
3. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip). Use as indicated on drawings.
4. Handle Clamp: Loose attachment for holding circuit breaker handle in "on" position. Use for all circuits containing emergency lighting loads, fire alarm loads, and as indicated on drawings. Breakers serving fire alarm louds must have a permanently-affixed red label stating "FA" in white letters adjacent to the circuit breaker.
5. Handle padlocking device: fixed attachment for locking circuit breaker handle in "on" or "off" position. Use as indicated on drawings.

Manufacturers: Square D Type NQOD or NF (as applicable, based on voltage and ampere ratings and required short-circuit interrupting ratings as scheduled on the drawings) or approved equal by Eaton, G.E., or Siemens.

G. DISCONNECT (SAFETY) SWITCHES

Disconnect (Safety) Switches: Heavy-duty, fused or non-fused (as indicated on drawings or required) NEMA KS1, externally operated, visible-blade safety switches; NEMA enclosure type indicated on the drawings or suitable for the environment in which installed. based on fusible switch and fuse sizes indicated, include Class R, J, or L fuse provisions as applicable.

Where indicated, provide fusible switches permanently labeled as suitable for use as service entrance equipment, with integral and separate neutral and ground assemblies, suitable for the sizes of conductors indicated. Do not double-lug any terminations not specifically listed as suitable for more than one conductor.

Provide switches where not furnished with the starting equipment, at all other points required by NFPA 70, and where indicated on the drawings.

Where indicated, provide the disconnect switch with an integral auxiliary switch, open when the main switch blades are open, and wire it into the controller to disable the motor whenever the switch is OPEN.

Manufacturers: Eaton, G.E., Siemens, or Square D.

I. FUSES

Provide each circuit and set of fuse clips throughout the work with sizes and types as required or indicated. All fuses larger than 600A: UL Class L, similar to type KRP-C Bussmann Low Peak or equal. Fuses used to protect motors: UL Class RK5, Bussmann Fusetron or equal. Fuses used to protect all other electrical equipment: UL Class RK1, dual element, Bussmann LPS/LPN or equal. All fused devices shall be labeled as to type and size of fuse required.

Furnish three spare fuses of each size and type used on the project (except for main switch fuses, furnish one spare), neatly contained in a properly labeled cabinet.

Manufacturers: Bussmann, Edison Fuse, Mersen/Ferraz Shawmut, or Littlefuse.

J. DRY-TYPE TRANSFORMERS

Transformers: General purpose, NRTL listed/labeled. Comply with NEMA ST 20 and UL 1561.

Insulation Class: For three-phase transformers less than 15 kVA and all single-phase, 185 degrees C, NRTL-component-recognized insulation system with a maximum of 115 degree C rise above a 40 degree C ambient temperature; for three-phase transformers 15 kVA and larger, 220 degrees C, NRTL-component-recognized insulation system with a maximum of 150 degree C rise above a 40 degree C ambient temperature. NRTL-component-recognized insulation system replaces the UL 1446 insulation rating system that used letters.

Phases, Voltages, and Sizes: As indicated on the drawings.

Sound Level: Not exceeding 3 dBa less than NEMA ST 20 standards for the sizes indicated when factory tested according to IEEE C57.12.91.

Full-Capacity Primary Taps: For three-phase below 25 kVA and all single-phase, one 5 percent tap above and one 5 percent tap below; 25 kVA to 500 kVA, six 2.5 percent taps (2 above, 4 below); above 500 kVA, four 2.5 percent (2 above, 2 below).

Transformer Core and Coil Assemblies: Mounted on integral vibration-absorbing pads.

Transformers 75 kVA and larger shall be floor mounted unless indicated otherwise. Transformers 45 kVA and smaller may be wall mounted where wall construction is suitable for the load. Floor mounted transformers shall be securely bolted to a 4 inch house keeping pad with vibration isolation pads. Wall mounted or suspended transformers shall have a means of isolating vibration from the support. Wall mounts must be by same manufacturer as and provided with transformer.

Transformers up through 1000 kVA shall be mounted on elastomeric vibration isolation pads. Pad shall be constructed of neoprene, rubber, glass fiber, or a combination thereof. Pads shall be "ribbed" or "waffled" in texture. Pads shall be selected for smallest durometer (hardness), preferably less than 50. Deflection of pad shall be 0.25 inches static minimum. Stack pads until the desired deflection is achieved.

Make final conduit connections to transformers with flexible conduit, with at least 6 inches of slack in all directions. Minimum flexible conduit length shall be 2 feet.

Transformer Enclosures: Removable front cover, core and coil encapsulated within resin compound, drip-proof, fabricated of heavy gauge sheet steel construction. Dry locations: Ventilated, NEMA 250 Type 2. Damp or wet locations: Ventilated with weather shields, NEMA 250 Type 3R. Corrosive locations: Totally enclosed, non-ventilated, NEMA 250 Type 4X, stainless steel.

Provide energy-efficient transformers complying with federal regulation 10 CFR 431.192 thru 431.196 requirements.

K-rated transformers shall be provided as indicated on the drawings and be listed for 115 degree C rise.

Manufacturers: ACME, Eaton, G.E., Siemens, Hammond, Sola/Hevi-Duty, or Square D.

K. FRACTIONAL HORSEPOWER MANUAL CONTROLLER

Manual motor starters for fractional horsepower single-phase motors shall consist of a manually operated toggle switch equipped with melting alloy type overload relay. Thermal unit shall be of one piece construction and interchangeable. Starter shall be inoperative if thermal unit is removed. Provide flush mounted units in finished areas and surface mounted units in unfinished areas. Starters shall have NEMA I general purpose enclosure, unless otherwise indicated, and be rated for the motor horsepower required. Provide with handle guard with locking provisions and an integral pilot light.

Manufacturers: Square D Class 2510 Type F, Eaton 9101 series, G.E. CR101 series, Siemens MSF series, or Westinghouse MST series.

M. MOTOR STARTING SWITCHES

Motor starting switches shall consist of a toggle operated two- or three-pole switch. Contacts shall be double break silver alloy, visible from both sides of the switch, and shall have a direct linkage to the operator for positive break. Provide flush mounted units in finished areas and surface mounted units in unfinished areas. Starters shall have NEMA I general purpose enclosure, unless otherwise indicated, and be rated for the motor horsepower required. Provide handle guard with locking provisions.

Manufacturers: Square D Class 2510 Type K, Eaton 9115 series, G.E. TC2000 series, Siemens MS series, or Westinghouse MST series.

17. LIGHT FIXTURES, LAMPS AND BALLASTS

A. LIGHT FIXTURE LOCATIONS

Light fixtures shown on the drawings represent general arrangements only. Refer to architectural drawings for more exact locations. Coordinate location with all other trades before installation to avoid conflicts. Coordinate light fixture locations in mechanical rooms with final installed piping and ductwork layouts.

B. LIGHT FIXTURES

Provide light fixtures as scheduled on drawings, including all lamps, all necessary accessories, material and labor to securely hang, clean, and make light fixtures completely ready for use. Light fixture model numbers scheduled on the drawings show only the manufacturer, grade, and style of light fixtures required. Provide all hangers, supports, and miscellaneous hardware required to install light fixtures, proper trim to fit each ceiling condition actually encountered, and additional tie wires connected to structure to conform to seismic requirements where required by the applicable building code.

Packaging of light fixtures will not be allowed. Only those luminaires listed in the Light Fixture Schedule or approved in accordance with substitutions of these specifications will be accepted. Where the Light Fixture Schedule indicates an allowance for a specific light fixture, the price is a Contractor price. Include all additional costs for freight, lamps, and installation of light fixture and lamps.

Install light fixtures hung in continuous rows on channel struts specifically designed for this purpose.

Surface-mount all light fixtures located in areas with a ceiling but without suspended ceilings unless otherwise indicated on the drawings. Provide rigid metal spacers finished in white enamel between the top of each light fixture and the ceiling above to maintain a 1-1/2 inch space. Spacers shall be approved before installation.

Install all light fixtures located in areas without ceilings immediately below the roof-framing members, or suspended from chain hangers suitable in length to provide the indicated mounting height. Hangers: "Hydee" hanger type for outlet box mounting, complete with grounding receptacle, plug, 3-wire cord, and necessary chain.

Through-wiring of recessed light fixtures in suspended ceilings is not permitted. Connect each light fixture by a whip to a junction box. Provide cable whips of sufficient lengths to allow for relocating each light fixture within a 5-foot radius of its installed location, but not exceeding 6 feet in unsupported lengths.

C. EMERGENCY LIGHTING UNITS AND EXIT SIGNS

Description: Self-contained units complying with UL 924

Battery: Sealed, maintenance-free, lead-acid type. The batteries shall be of suitable rating and capacity to supply and maintain at not less than 87-1/2 percent of the nominal battery voltage for the total lamp load associated with the unit for a period of at least 1-1/2 hours, or the unit equipment shall supply and maintain not less than 60 percent of the initial emergency illumination for a period of at least 1-1/2 hours.

Charger: Fully automatic, solid-state type with sealed transfer relay.

Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power, and demonstrates unit operability.

LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge, and bright glow indicates charging at end of discharge cycle.

Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

D. LAMPS

LED Lamps and Luminaires: Comply with ANSI C78.377 for white light LED color range; minimum CRI of 80 unless noted otherwise; LED binning specification tolerance to be within 3 macadam ellipses of rated values; all LEDs used for same fixture type throughout the project must originate from the same production bin; minimum average rated life of 20,000 hours for LED lamps and 50,000 hours for LED luminaires; Rohs compliant. LED lamp manufacturers: Bridgelux, Cree, Nichia, Osram, or Xicato.

E. BALLASTS

LED Drivers: Comply with NRTL requirements and ANSI C82.77; designed for type and quantity of lamps served; sound levels not exceeding Class A ambient noise levels; lamp current crest factor of 1.5 or less; 90-percent power factor or greater; line transient withstand ratings as defined in ANSI/IEEE C62.41, Category A.; total harmonic distortion less than 20 percent; shall tolerate sustained open circuit and short circuit output conditions without damage; shall not over-drive LEDs at a current or voltage above LED rated values; ROHS compliant; meets EN61000 requirements for input harmonics.

F. DIMMABLE LIGHT FIXTURES

For dimmable light fixtures provide both control and power wiring between light fixture and control device and between light fixtures. Quantity of low voltage and line voltage wiring and wire type shall be per manufacturer's recommendations. Coordinate light fixture and control device dimming types for compatibility.

18. MISCELLANEOUS ELECTRICAL

A. WIRING OF MECHANICAL EQUIPMENT

Provide all raceways and power wiring for all Division 23 equipment requiring electrical connections, including but not limited to pumps, water heaters, and HVAC equipment, and all line-voltage control and interlock wiring not provided under Division 23. Connect per manufacturers' wiring diagrams. Coordinate with Division 23 for disconnects and variable frequency drives (VFD) furnished with equipment, and provide all disconnect switches and final connections as required. If VFD is separate or does not have an integral disconnect feature, provide disconnect switch with auxiliary contact such that motor will be turned off if switch is off. provide VFD cable, Belden or approved equivalent, for connection of VFD to motor when required. After installing wiring, verify that each motor load has the correct phase rotation.

Verify the actual "Maximum Overcurrent Protection" (MOCP) device ratings and "Minimum Circuit Ampacity" (MCA) conductor sizing for mechanical equipment from the equipment nameplate. Base electrical installations on actual required amperages, which may vary somewhat from the conductor and equipment sizes shown on the drawings; however, in no case, reduce the size of conductors indicated on the drawings without authorization from the Engineer. Provide properly sized electrical wiring and equipment without extra cost to the Owner. Notify the Engineer of all changes required in the electrical installation due to equipment variances so that the effects on feeders, branch circuits, panelboards, fuses and circuit breakers can be checked prior to purchasing and installation. Be responsible for coordinating with Division 23 to verify the actual ampacities and correct sizes of all conductors and overcurrent protective devices for all equipment, and correct overload heaters for all motors, when starters are provided under Division 26.

B. WIRING OF THERMOSTATS, TIME AND TEMPERATURE CONTROLS

Provide all raceways, power wiring, and line-voltage control and interlock wiring not provided under Division 23, for all thermostats, temperature control devices, and controls, including, but not limited to, night-stats, water heater interlocks, time switches and override timers. See mechanical drawings for locations and temperature control diagrams. Low-voltage conductors for thermostats and temperature control system may be run exposed above finished accessible ceilings, if approved and listed for this purpose, but shall be installed in conduit within walls and where exposed in the work areas.

C. TELEPHONE SYSTEM PROVISIONS

Provide incoming telephone service raceways as indicated on drawings or as required by the serving telephone company. Provide 3/4-inch thick plywood board, fire-retardant-treated and stamped FRT, securely anchored to the wall, at the location and of the size as indicated on the drawings. Provide flush mounted telephone outlet boxes with 1 inch conduit stub-up with pull-string concealed to accessible ceiling space at locations as indicated on the drawings.

D. DATA SYSTEM PROVISIONS

Provide flush mounted data outlet boxes with 1 inch conduit stub-up with pull-string concealed to accessible ceiling space at locations as indicated on the drawings.

E. TIME SWITCHES

Manufacturers: Intermatic, Paragon, or Tork.

Time switches: Electronic digital astronomical, type as indicated, with manual bypass switch, NEMA enclosure suitable for the environment installed; number and types of contacts, sequence, and voltage as indicated on the drawings, or as required, based on the time switch function and the number of branch circuits or contactors controlled. Provide wiring to photocells, contactors, relays or other control points as required.

F. PHOTO CONTROL

The photo control shall:

Provide automatic switching (or dimming, as specified) for lighting loads using a thermal design with built_in delay to ensure that the controlled lighting does not switch off due to ambient light or lightning striking the photocell.

Have a rating based on NRTL testing at 50 percent power factor for ballast loads, be NRTL listed, and meet all applicable agency requirements.

Be stem-mounting type with all necessary mounting hardware and instructions; have a housing constructed of high impact poly-carbonate; photo control components consisting of a metal film resistor, dual temperature compensating bi, metal blades, snap action contact blades, chemically treated/polymer encapsulated cadmium sulfide photocell, and silver alloy contacts to ensure reliable 5 year manufacturer warranted operation. Photo control shall be 100 percent factory tested for function within manufacturer's specified light levels.

Be from the same manufacturer of and totally compatible with the time switches specified above.

G. LIGHTING CONTACTORS

Industrial duty type; silver alloy, double break contacts, convertible with N.O. and N.C. indicators; capable of adding poles in the field; number and rating of poles as indicated on the drawings or required by the load controlled; typed directory affixed to the inside of the enclosure door listing all branch circuits switched and the control power branch circuit; complying with NEMA ICS 2 and UL 508.

Short Circuit Current Rating: 22,000A at 240V maximum and 14,000A at 480V maximum.

Fusing: Provide fuse blocks and fuses in the contactor enclosures, of the ampacity and Class recommended by the manufacturer to obtain a contactor minimum RMS symmetrical short circuit current rating of 100,000A. Mount fuse blocks ahead of the input to each contact, both used and spare (if any). Also provide a fuse puller and spare fuses (25-percent of total fuses or a minimum of 2 of each rating, whichever is greater) affixed to the inside of the enclosure.

Enclosures: NEMA 1.

Coil Voltage: 120V ac.

Mechanically-held type, control interface shall be 2-wire input module with 3-wire output Square D Class 8903 LX or equivalent of G.E., Siemens, Cutler Hammer, or ASCO

H. MISCELLANEOUS EQUIPMENT AND CONNECTIONS

All raceways, wiring, and connections of devices to energy management system that are not the responsibility of Division 23

All wiring and connections of exit door alarms.

I. AUTOMATIC DOOR OPERATORS

Make connection from junction boxes to the entry door operators located in the transom above sliding doors, and from door operators to actuation devices as required. Provide key-operated switches at locations shown on the drawings and provide all other required electrical connections for door systems.

J. AREA OF RESCUE ASSISTANCE COMMUNICATIONS SYSTEM

General: Provide all labor, equipment, materials, and perform all operations in connection with the installation of the area of rescue assistance system as specified, as indicated on the drawings, or both, and conforming to applicable local code requirements, the Americans with Disabilities Act, and NFPA 70

Description: Provide a complete and functioning area of rescue assistance communication system as outlined in the Americans with Disabilities Act guidelines, including a master call station, remote call stations, all wiring, connections to devices, outlet boxes, junction boxes, raceways, and all other necessary materials.

Operation: The system shall allow two-way communications between the remote call stations and the master call station via both voice and visual indicating lights. Label each "AREA OF RESCUE ASSISTANCE" with a lighted sign, and include operating instructions, adjacent to it, on use of the call station.

Call Stations: Master Call Station: Cornell A4204, Remote Call Stations: Cornell 4201.

Testing: Fully test the complete area of rescue assistance system in the presents of the Owner's representative. Certify in writing to the Owner and Engineer that the system has been successfully tested.

END OF SECTION 26

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.:	1850004412
Date:	10.25.19
Issued For:	SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
ANDREA C. MULVANY
NUMBER PE-2013039892
PROFESSIONAL ENGINEER

Oct 24, 2019

ANDREA C. MULVANY
LICENSE # PE-2013039892

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
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1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

ELECTRICAL SPECIFICATIONS

SHEET NUMBER

E702

FIRE PROTECTION GENERAL NOTES:

1. PRIOR TO SUBMITTING BID, VISIT THE JOB SITE AND BECOME FULLY ACQUAINTED WITH THE EXISTING CONDITIONS OF THE PROJECT. REVIEW THE GENERAL NOTES, SPECIFICATIONS AND OTHER DRAWINGS FOR ADDITIONAL REQUIREMENTS WHICH MAY NOT BE SPECIFICALLY CALLED OUT IN THIS PORTION OF THE CONSTRUCTION DOCUMENTS. NOTIFY ARCHITECT, ENGINEER AND/OR OWNER OF CONFLICTS OR DISCREPANCIES PRIOR TO SUBMISSION OF BID.
2. SYSTEM DESIGN, INSTALLATION AND MATERIALS SHALL BE IN ACCORDANCE WITH APPLICABLE NFPA STANDARDS. SYSTEM SHALL ALSO MEET ALL APPLICABLE BUILDING CODES, FIRE CODES AND THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION AND INSURANCE CARRIER. VERIFY REQUIREMENTS PRIOR TO BID SUBMITTAL.
3. INFORMATION ON CONTRACT DOCUMENTS IS GENERAL INFORMATION AND FOR BID PURPOSES ONLY. CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR THE FINAL SYSTEM DESIGN AND LAYOUT OF ALL COMPONENTS, COORDINATION WITH ALL OTHER TRADES, AND SYSTEM CALCULATIONS REQUIRED FOR APPROVAL BY THE AUTHORITY HAVING JURISDICTION, ENGINEER, AND OWNER'S INSURER.
4. THE CONTRACTOR SHALL FOLLOW THE ENGINEER OF RECORD'S SYSTEM DESIGN AND LAYOUT OF ALL COMPONENTS EXCEPT WHERE MODIFICATION TO THE DESIGN IS NECESSARY. MODIFICATIONS SHALL BE REFLECTED IN THE CONTRACTOR'S SHOP DRAWINGS AND CALCULATIONS.
5. DEVIATIONS FROM ENGINEER'S DESIGN WILL NOT BE CONSIDERED UNLESS A FORMALLY SUBMITTED RFI IS RECEIVED AND APPROVED.
6. THE CONTRACTOR SHALL PROVIDE ALL EQUIPMENT AND LABOR REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM AS INDICATED IN THE DRAWINGS AND SPECIFICATIONS.
7. PROVIDE ADDITIONAL MATERIALS AND LABOR REQUIRED DUE TO LACK OF COORDINATION OR TO MEET AUTHORITY HAVING JURISDICTION AND INSURANCE CARRIER REQUIREMENTS AT NO ADDITIONAL COST TO THE OWNER.
8. FORWARD COMPLETED CERTIFICATE OF COMPLETION AND CONTRACTOR MATERIAL TEST CERTIFICATES TO THE OWNER.
9. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.

FIRE ALARM SYMBOLS

THIS IS A MASTER LEGEND AND NOT ALL SYMBOLS OR ABBREVIATIONS ARE USED. V2.01

ABBREVIATIONS

AFF	ABOVE FINISHED FLOOR	NIC	NOT IN CONTRACT
AFG	ABOVE FINISHED GRADE	OC	ON CENTER
CD	CANDELA	PIV	POST INDICATOR VALVE
DI	DUCTILE IRON	PROVIDE	FURNISH AND INSTALL
ESFR	EARLY SUPPRESSION FAST RESPONSE	PRV	PRESSURE REDUCING VALVE
ETR	EXISTING TO REMAIN	RD	RETURN DUCT
FHC	FIRE HOSE CABINET	REV	REVISION
FP	FIRE PROTECTION	SD	SUPPLY DUCT
GC	CONTRACTOR	SF	SQUARE FEET
GPM	GALLONS PER MINUTE	TYP	TYPICAL
JB/J-BOX	JUNCTION BOX	UNO	UNLESS NOTES OTHERWISE
MAX	MAXIMUM	V	VOLT(S)
MIN	MINIMUM	W	WATTS
N/A	NOT APPLICABLE	WP	WEATHERPROOF

ANNOTATION

- (1) FIRE PROTECTION PLAN NOTE CALLOUT
- CONNECTION POINT OF NEW WORK TO EXISTING
- (1 / F1) DETAIL REFERENCE UPPER NUMBER INDICATES DETAIL NUMBER LOWER NUMBER INDICATES SHEET NUMBER
- (1 / F1) SECTION CUT DESIGNATION

STANDARD MOUNTING HEIGHTS

FIRE ALARM	
AUDIBLE APPLIANCES (CENTERLINE)	90"
FIRE ALARM ANNUNCIATOR PANEL (DISPLAY)	60"
FIRE ALARM BELL (EXTERIOR)	120"
FIRE ALARM CONTROL PANEL/UNIT (DISPLAY)	60"
PULL STATIONS (HANDLE)	48"
VISIBLE APPLIANCES (CENTERLINE)	84"

USE THE DEFAULT MOUNTING HEIGHTS SHOWN ABOVE UNLESS NOTED OTHERWISE IN THE SPECIFICATIONS OR ELSEWHERE. MOUNTING HEIGHTS LISTED ARE ABOVE FINISHED FLOOR (AFF) OR ABOVE FINISHED GRADE (AFG). ALL DEVICES SHALL BE INSTALLED IN COMPLIANCE WITH CURRENT ADA AND LOCAL REQUIREMENTS.

LINETYPE LEGEND

THROUGHOUT THE DRAWINGS DIFFERENT LINETYPES ARE USED IN COMBINATION WITH THE SYMBOLS TO INDICATE THE STATUS OF ITEMS AS EXISTING, TO BE DEMOLISHED, TO BE INCLUDED AS PART OF NEW WORK AND/OR ITEMS WHICH ARE ANTICIPATED TO BE PROVIDED IN THE FUTURE. THE STATUS OF ITEMS USING THESE LINETYPES ARE RELATIVE TO THE VIEW IN WHICH THEY APPEAR. PHASING SHOWN IN DRAWINGS IS NOT INTENDED TO FULLY DESCRIBE ALL NECESSARY CONSTRUCTION PHASING, WHICH IS DETERMINED BY THE CONTRACTOR AS PART OF THEIR RESPONSIBILITIES. ANY SUCH PHASES DESCRIBED IN THE CONSTRUCTION DOCUMENTS ARE GENERAL AND ONLY INTENDED TO INDICATE A BROAD ORDER FOR THE SAKE OF DESCRIBING THE PROJECT. THE FOLLOWING LINETYPES MAY BE USED ON ANY DEVICE, EQUIPMENT, NOTE, LINE, SHAPE, ETC.

EXISTING ——— NEW ———

DEMOLISH — — — — FUTURE - - - - - -

FIRE ALARM

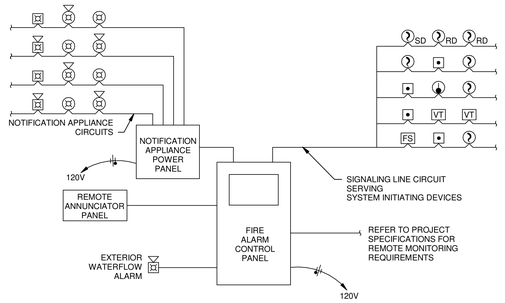
- FACP — FIRE ALARM CONTROL PANEL/UNIT
- FACP — RECESSED FIRE ALARM CONTROL PANEL/UNIT
- FAAP — FIRE ALARM ANNUNCIATOR PANEL
- FAAP — RECESSED FIRE ALARM ANNUNCIATOR PANEL
- AMP — AMPLIFIER PANEL
- RPS — REMOTE POWER SUPPLY
- RT — REMOTE TEST STATION WITH INDICATING LIGHT
- RL — REMOTE INDICATING LIGHT
- PS — PRESSURE SWITCH LOW/HIGH
- FS — WATERFLOW ALARM SWITCH
- VT — CONTROL VALVE TAMPER SWITCH
- DH — MAGNETIC DOOR HOLD OPEN DEVICE
- CM — CONTROL MODULE
- MM — MONITOR MODULE
- K — FIRE DEPARTMENT KEY BOX
- PULL STATION
- F — FIREFIGHTER'S PHONE JACK
- HEAT DETECTOR (E INDICATES ELEVATOR RECALL)
- SMOKE DETECTOR (E INDICATES ELEVATOR RECALL)
- SINGLE STATION SMOKE DETECTOR
- PROJECTED BEAM SMOKE DETECTOR
- RD — DUCT MOUNTED SMOKE DETECTOR (SD=SUPPLY/RD=RETURN)
- CO — CARBON MONOXIDE DETECTOR
- AREA OF REFUGE 2-WAY COMMUNICATION SYSTEM
- F ##W — WALL MOUNTED AUDIBLE NOTIFICATION APPLIANCE #W INDICATES WATTAGE (VOICE EVACUATION SYSTEMS ONLY)
- ## — WALL MOUNTED VISIBLE NOTIFICATION APPLIANCE ## INDICATES CANDELA
- ## ##W — WALL MOUNTED AUDIBLE/VISIBLE NOTIFICATION APPLIANCE ## INDICATES CANDELA #W INDICATES WATTAGE (VOICE EVACUATION SYSTEMS ONLY)
- F ##W — CEILING MOUNTED AUDIBLE NOTIFICATION APPLIANCE #W INDICATES WATTAGE (VOICE EVACUATION SYSTEMS ONLY)
- ## — CEILING MOUNTED VISIBLE NOTIFICATION APPLIANCE ## INDICATES CANDELA
- ## ##W — CEILING MOUNTED AUDIBLE/VISIBLE NOTIFICATION APPLIANCE ## INDICATES CANDELA #W INDICATES WATTAGE (VOICE EVACUATION SYSTEMS ONLY)
- END OF LINE RESISTOR
- ABORT SWITCH
- BELL

SYSTEM INPUTS	ALARM	SUPERVISORY	TROUBLE	REPORT TO FIRE ALARM CONTROL PANEL	SIGNAL SUPERVISING STATION	ACTIVATE GENERAL FIRE ALARM AUDIBLE/VISIBLE NOTIFICATION APPLIANCES	ACTIVATE FDC NOTIFICATION APPLIANCE	SHUTDOWN ALL FAN POWERED MECHANICAL AIR HANDLING EQUIPMENT FOR AFFECTED HVAC SYSTEM	SHUTDOWN ALL FAN POWERED MECHANICAL AIR HANDLING EQUIPMENT	INITIATE ELEVATOR RECALL TO PRIMARY FLOOR	INITIATE ELEVATOR RECALL TO ALTERNATE FLOOR
	PRIORITY			SYSTEM OUTPUTS							
SIGNALING LINE OR NOTIFICATION APPLIANCE CIRCUIT - OPEN			●	●	●						
SIGNALING LINE OR NOTIFICATION APPLIANCE CIRCUIT - SHORT			●	●	●						
SIGNALING LINE OR NOTIFICATION APPLIANCE CIRCUIT - GROUND			●	●	●						
FIRE ALARM CONTROL PANEL LOSS OF POWER			●		●						
MANUAL PULL STATION	●			●	●	●			●		
SMOKE DETECTOR - SPOT TYPE	●			●	●	●			●		
SMOKE DETECTOR - DUCT MOUNTED		●		●	●			●			
HEAT DETECTOR - SPOT TYPE	●			●	●	●			●		
WATERFLOW ALARM SWITCH	●			●	●	●	●		●		
VALVE TAMPER SWITCH		●		●	●						
LOW/HIGH AIR PRESSURE SWITCH		●		●	●						
FIRE DEPARTMENT KEY BOX VALVE TAMPER SWITCH (KNOX BOX)		●		●	●						
SMOKE DETECTOR - ELEVATOR LOBBY - PRIMARY FLOOR	●			●	●	●			●		●
SMOKE DETECTOR - ELEVATOR LOBBY - ALTERNATE FLOOR(S)	●			●	●	●			●	●	
SMOKE DETECTOR - ELEVATOR HOISTWAY	●			●	●	●			●		●

CONTRACTOR TO PROVIDE ALL NECESSARY EQUIPMENT AND CONNECTIONS REQUIRED TO ACCOMPLISH THE FUNCTIONS INDICATED, AT MINIMUM.

SEQUENCE OF OPERATIONS INDICATED IS SCHEMATIC. MODIFY TO SUIT CONDITIONS AND MEET APPLICABLE CODE REQUIREMENTS.

② SEQUENCE OF OPERATIONS
NTS



RISER DIAGRAM IS SCHEMATIC IN NATURE. NOT ALL DEVICES ARE SHOWN. REFER TO PLANS FOR EQUIPMENT QUANTITIES AND LOCATIONS.

DUCT DETECTORS MAY HAVE INTEGRAL RELAYS FOR AIR HANDLING UNIT SHUT-DOWN AND FIRE/SMOKE DAMPER CONTROL. WIRING FOR THIS FUNCTION HAS NOT BEEN SHOWN. COORDINATE WITH MECHANICAL SYSTEM INSTALLER.

REFER TO PLANS AND SPECIFICATIONS FOR ADDITIONAL INFORMATION.

① FIRE ALARM RISER DIAGRAM - ADDRESSABLE SYSTEM (NON-VOICE)
NTS

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
CHRISTOPHER J. CULP
NUMBER PE-2013037646
PROFESSIONAL ENGINEER

Oct 24 2019

CHRISTOPHER J. CULP
LICENSE # PE-2013037646

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

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1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

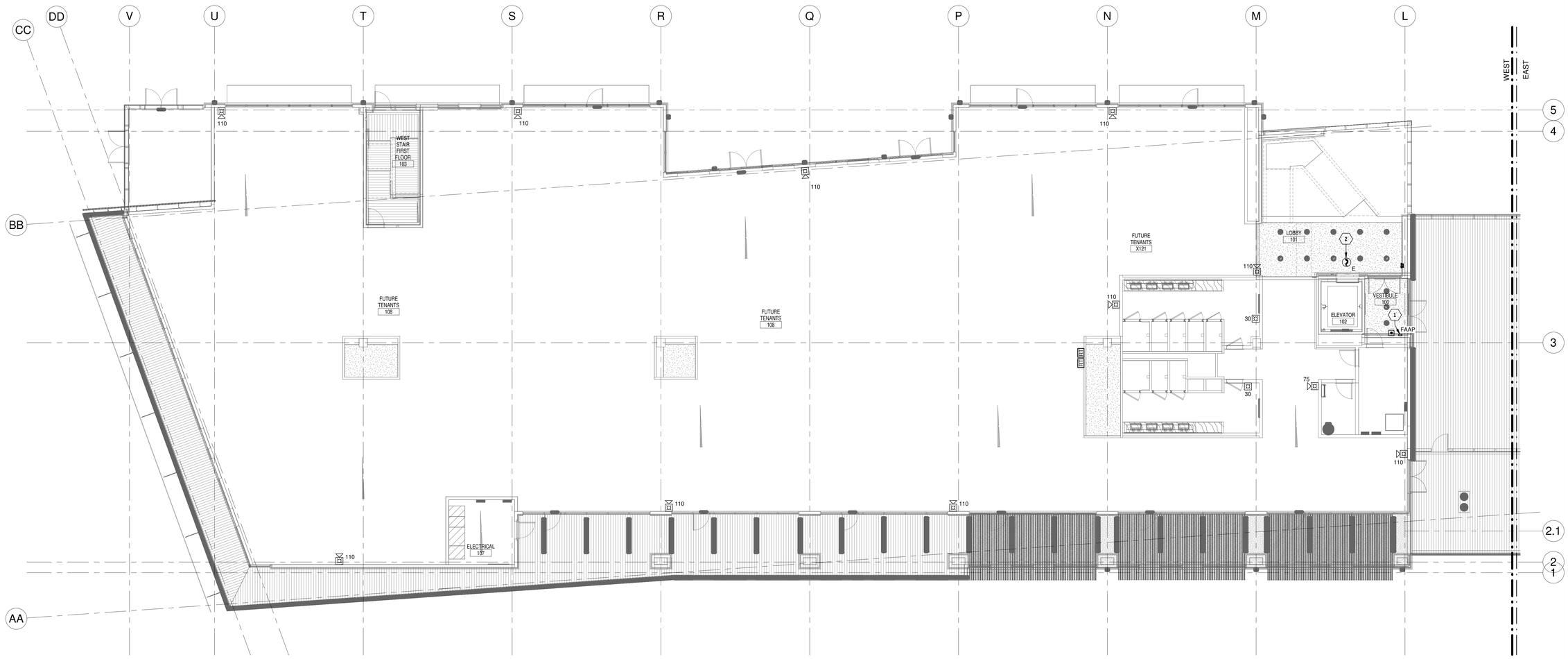
FIRE ALARM LEGENDS AND GENERAL NOTES

SHEET NUMBER

FA000

FIRE ALARM PLAN NOTES:

1 PROVIDE NEW REMOTE FIRE ALARM ANNUNCIATOR PANEL.
2 PROVIDE EQUIPMENT AND CONNECTION(S) REQUIRED FOR ELEVATOR RECALL AND/OR SHUTDOWN. REFER TO SEQUENCE OF OPERATION FOR ADDITIONAL INFORMATION.



1 FIRE ALARM FIRST FLOOR PLAN - WEST
1/8" = 1'-0"

0 4' 8' 12'
SCALE: 1/8"=1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

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SHEET TITLE

FIRE ALARM FIRST FLOOR PLAN - WEST

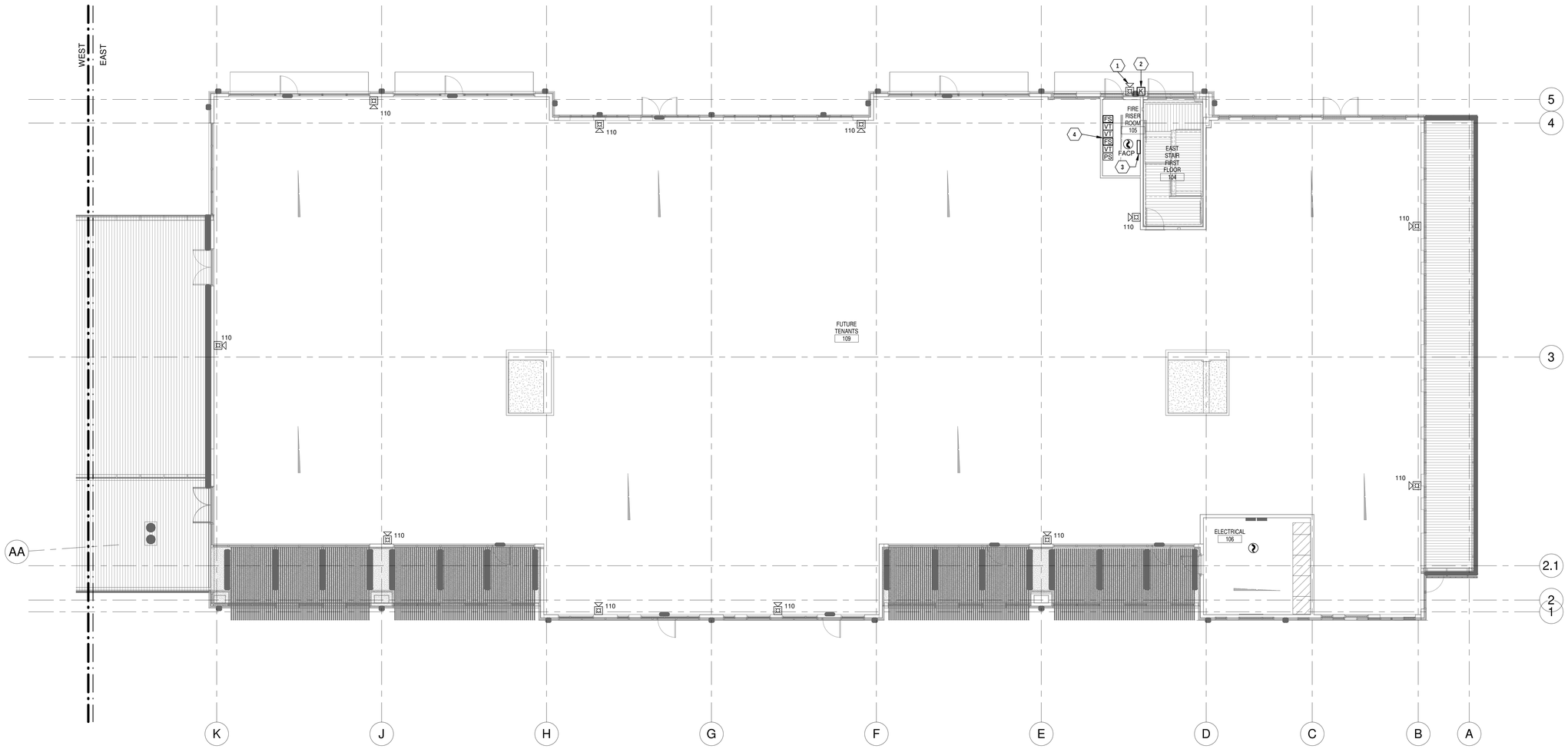
SHEET NUMBER

FA101.1

CHRISTOPHER J. CULP

FIRE ALARM PLAN NOTES:

1. LOCATION OF EXTERIOR WATERFLOW NOTIFICATION. PROVIDE FIRE ALARM EQUIPMENT SUITABLE FOR ENVIRONMENTAL CONDITIONS.
2. PROVIDE FIRE DEPARTMENT KEY BOX FOR FIRE DEPARTMENT ACCESS. PROVIDE EQUIPMENT AND CONNECTIONS NECESSARY TO MONITOR KEY BOX INTERNAL SUPERVISORY SWITCH(ES), AS REQUIRED. CONTACT BRIAN PARSON, 913.888.6066, FOR ORDER FORM AND FINAL APPROVED LOCATION.
3. PROVIDE NEW FIRE ALARM CONTROL PANEL. FIRE ALARM CONTROL PANEL TO BE MINIMUM 150 POINT ADDRESSABLE SYSTEM.
4. CONNECT FIRE SPRINKLER MONITORING DEVICES TO FIRE ALARM SYSTEM. COORDINATE QUANTITY AND LOCATION OF DEVICES WITH FIRE PROTECTION SYSTEMS.



1 FIRE ALARM FIRST FLOOR PLAN - EAST
1/8" = 1'-0"

SCALE: 1/8"=1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

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CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

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SHEET TITLE

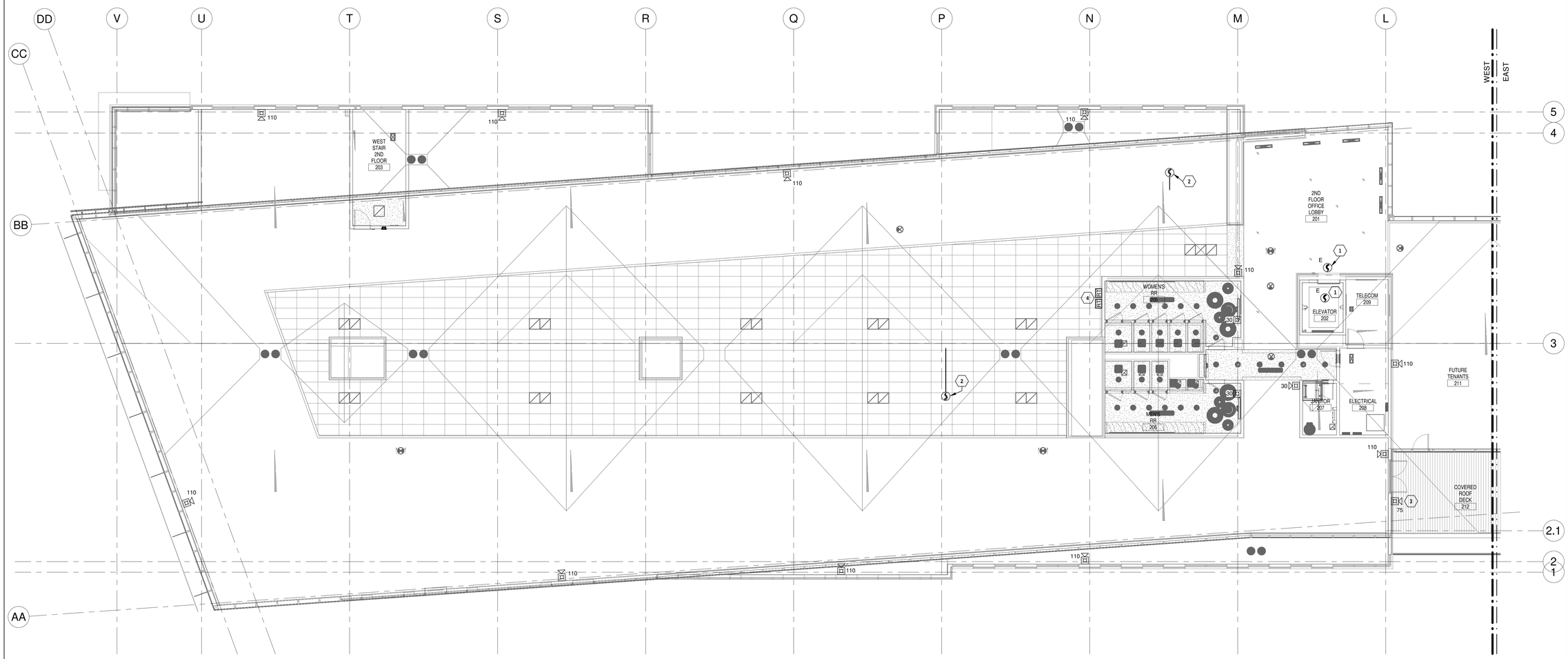
FIRE ALARM FIRST FLOOR PLAN - EAST

SHEET NUMBER

FA101.2

FIRE ALARM PLAN NOTES:

1. PROVIDE EQUIPMENT AND CONNECTION(S) REQUIRED FOR ELEVATOR RECALL AND/OR SHUTDOWN. REFER TO SEQUENCE OF OPERATION FOR ADDITIONAL INFORMATION.
2. PROVIDE DUCT MOUNTED SMOKE DETECTOR FOR FAN POWERED MECHANICAL AIR HANDLING EQUIPMENT SHUTDOWN. INSTALL DETECTOR PER MANUFACTURER'S RECOMMENDATIONS. REFER TO MECHANICAL SHEETS FOR EQUIPMENT AND DUCTWORK LAYOUT AND DETAILS.
3. PROVIDE EQUIPMENT SUITABLE FOR ENVIRONMENTAL CONDITIONS.
4. PROVIDE LOW VOLTAGE WIRING FROM DUCT DETECTOR TO REMOTE TEST STATION. MOUNT REMOTE TEST STATION ON WALL AT 48" AFF.



1 FIRE ALARM SECOND FLOOR PLAN - WEST
1/8" = 1'-0"

0 4' 8' 12'
SCALE: 1/8"=1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

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Oct 24 2019

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PROJECT TEAM

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CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
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SHEET TITLE

FIRE ALARM SECOND FLOOR PLAN - WEST

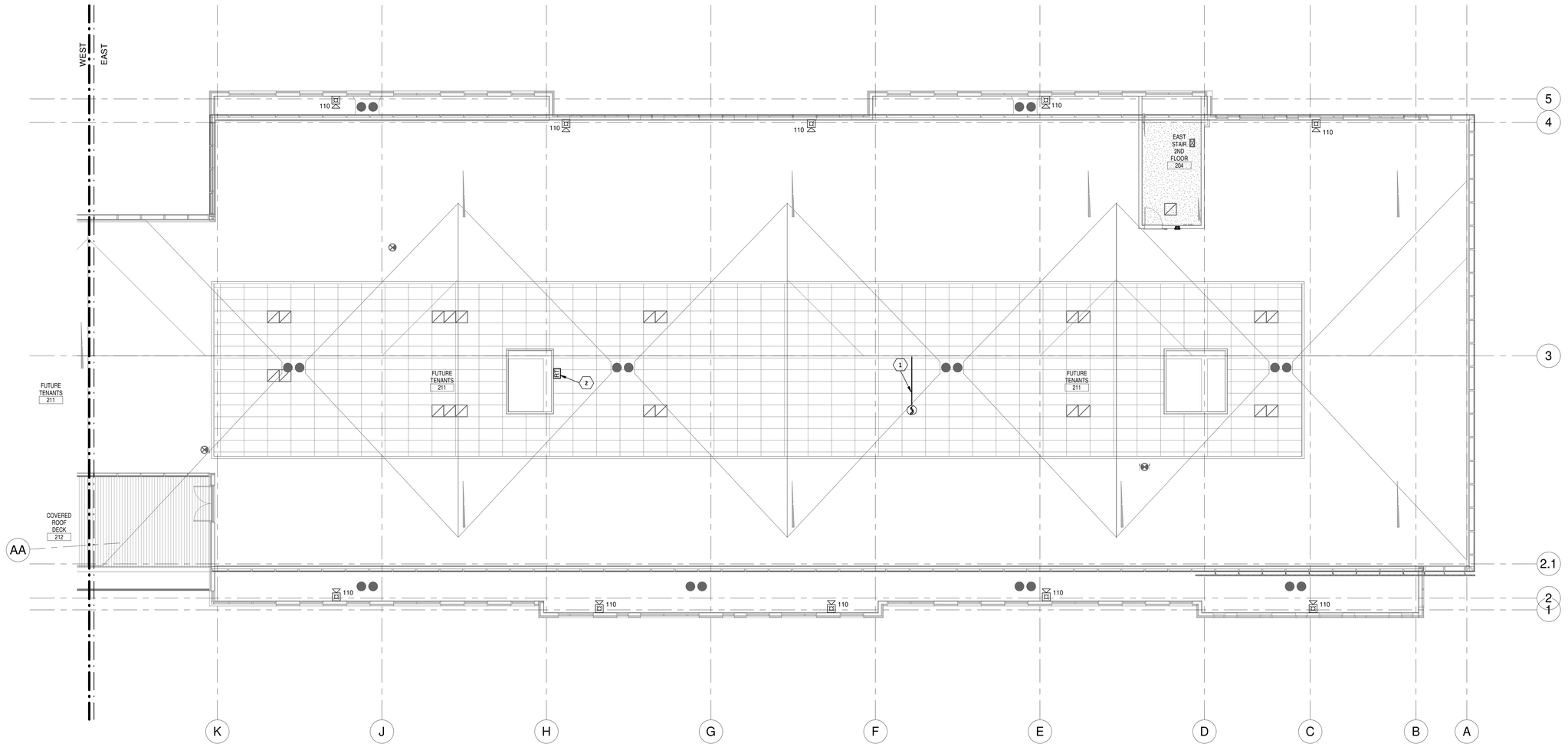
SHEET NUMBER

FA102.1

FIRE ALARM PLAN NOTES:

1 PROVIDE DUCT MOUNTED SMOKE DETECTOR FOR FAN POWERED MECHANICAL AIR HANDLING EQUIPMENT SHUTDOWN. INSTALL DETECTOR PER MANUFACTURER'S RECOMMENDATIONS. REFER TO MECHANICAL SHEETS FOR EQUIPMENT AND DUCTWORK LAYOUT AND DETAILS.

2 PROVIDE LOW VOLTAGE WIRING FROM DUCT DETECTOR TO REMOTE TEST STATION. MOUNT REMOTE TEST STATION ON WALL AT 48" AFF.



1 FIRE ALARM SECOND FLOOR PLAN - EAST
1/8" = 1'-0"

0 4' 8' 12'
SCALE: 1/8"=1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
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CHRISTOPHER J. CULP
LICENSE # PE-2013037646

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
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SHEET TITLE

FIRE ALARM SECOND FLOOR PLAN - EAST

SHEET NUMBER

FA102.2

CHRISTOPHER J. CULP

Division 28: FIRE ALARM SYSTEM

1. GENERAL INSTRUCTIONS

A. GENERAL REQUIREMENTS

All requirements under Division 01 (General Requirements) and the general and supplementary conditions of these specifications apply to this section and division. Where the requirements of this section and division exceed those of Division 01 (General Requirements), this section and division take precedence. Become thoroughly familiar with all its contents as to requirements that affect this division, section, or both. Work required under this division includes all material, equipment, appliances, transportation, services, and labor required to complete the entire system as required by the drawings and specifications, or reasonably inferred to be necessary to facilitate the function of each system as implied by the design and the equipment specified.

The specifications and drawings for the project are complementary, and any portion of work described in one shall be provided as if described in both. In the event of discrepancies, notify the Engineer and request clarification prior to proceeding with the work involved.

Drawings are graphic representations of the work upon which the contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They convey the scope of work, indicating the intended general arrangement of the systems without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements. Use the drawings as a guide when laying out the work and to verify that materials and equipment will fit into the designated spaces, and which when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory, and properly operating system.

Installation of devices shall be performed or supervised by a National Institute for Certification of Engineering Technologies (NICET) Level 2 or higher fire alarm technician. Submit copies of the certification for employees through shop drawing submittals.

B. DEFINITIONS

Division: References contained in this specification follow the numbering system defined in the Construction Specifications Institute (CSI) MasterFormat 2004 Edition. Specification Divisions 01 through 13 provided with this project may reference the CSI MasterFormat 1995 Edition. The corresponding division references between the 2004 Edition and 1995 Edition are as follows:

2004 Edition	1995 Edition
1. Division 21 – Fire Suppression	Division 15
2. Division 22 – Plumbing	Division 15
3. Division 23 – HVAC	Division 15
4. Division 26 – Electrical	Division 16
5. Division 27 – Communications	Division 16
6. Division 28 – Electronic Safety and Security	Division 16

Furnish: "to supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations."

Install: "to perform all operations at the project site including, but not limited to, the actual unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use."

Provide: "to furnish and install, complete and ready for the intended use."

Furnished by Owner (or Owner-Furnished) or Furnished by Others: "an item furnished by the Owner or under other divisions or contracts, and installed under the requirements of this division, complete and ready for the intended use, including all items and services incidental to the work necessary for proper installation and operation. Include the installation under the warranty required by this division."

Engineer: Where referenced in this division, "Engineer" is the Engineer of Record and the Design Professional for the work under this division, and is a consultant to, and an authorized representative of the Architect, as defined in the General and/or Supplementary Conditions. When used in this division, Engineer means increased involvement by and obligations to the Engineer, in addition to involvement by and obligations to the Architect.

AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the work.

NRTL: Nationally recognized testing laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA), and acceptable to the AHJ over this project. Nationally recognized testing laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTLs that are acceptable to the AHJ and standards that meet the specified criteria.

The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by or acceptable to the Engineer as equivalent to the item or manufacturer specified". The term "approved" shall mean labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.

C. PREBID SITE VISIT

Prior to submitting bid, visit the site of the proposed work and become fully informed as to the conditions under which the work is to be done. Failure to comply with this requirement shall not be considered sufficient justification to request or obtain extra compensation over and above the contract price.

D. SCOPE OF WORK

The scope of work in this section includes fire alarm control panels, remote annunciator panels, manual fire alarm pull stations, automatic smoke and heat detectors, fire alarm notification appliances, auxiliary fire alarm equipment, activation and powering of combination fire and smoke dampers, sprinkler system waterflow and valve tamper alarms, air handling unit shutdown, elevator recall, and battery stand-by power.

E. CODES AND STANDARDS

Provide an integrated fire alarm system, which meets the current versions of NFPA 70, National Electrical Code; NFPA 72, National Fire Alarm Code; and all local building and fire codes. All fire alarm equipment shall be Underwriters Laboratory (UL) approved for the type and class of service performed.

F. SYSTEM DESCRIPTION

The fire alarm system shall be a non-coded manual and automatic fire alarm system with connections to a remote supervising station. Control panel shall be micro-processor based, with fully addressable alarm devices.

G. COORDINATION

Coordinate work with that of other trades so that the various components of the systems are installed at the proper time, will fit the available space, and will allow proper service access to those items requiring maintenance. Components installed without regard to the above shall be relocated at no additional cost to the Owner.

H. SUBMITTALS

Upon being awarded a contract, submit to the Architect for approval, six (6) copies of manufacturer's shop drawings for equipment to be furnished under this contract, items requiring coordination between contractors, and sheet metal ductwork fabrication drawings. Before submitting shop drawings and material lists, verify that equipment submitted is mutually compatible and suitable for the intended use, and will fit the available space and allow ample room for maintenance. Highlight, mark, list or indicate the materials, performance criteria and accessories that are being proposed. Submit shop drawings as early as required to support the project schedule. Allow for two weeks Engineer review time plus mailing time plus a duplication of this time for resubmittal if required.

Submittals and shop drawings shall not contain the firm name, logo, seal, or signature of the Engineer. They shall not be copies of the work product of the Engineer. If the Contractor desires to use elements of such product, refer to paragraph "Electronic Drawing Files" for procedures to be used.

The checking and subsequent approval of such shop drawings by the Engineer shall not relieve the 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 with actual building conditions. Proceed with the procurement and installation of equipment only after receiving approved shop drawings relative to each item.

Submit a detailed sequence of operation. Pre-printed, generic material will not be accepted and will be rejected. Highlight, mark, list or indicate the materials, performance criteria and accessories that are being proposed.

Submit shop drawings showing fire alarm floor plans and a full building riser diagram. Fire alarm floor plans and riser diagram shall show fire alarm control panel, annunciator, all fire alarm initiating devices and notification appliances. Show typical wiring diagrams of control panel/s, annunciator and each device and wiring connections required. Show all interfaces to other systems, such as temperature control systems, and security systems.

Where required by the AHJ, Contractor is responsible for obtaining a professional engineer or NICET stamp and signature on their shop drawing submittal. The Engineer is not responsible and will not provide this.

Shop drawings shall be produced using Computer Aided Design. Hand drawn documents will not be reviewed or approved.

Shop drawing scale shall match the Engineer's drawings where possible. Scale shall not be less than 3/32" = 1'-0".

Submit a bill of material and manufacturers product data for all devices and equipment.

Refer to Division 01 for acceptance of electronic submittals for this project. For electronic submittals, Contractor shall submit the documents in accordance with the procedures specified in Division 01. Contractor shall notify the Architect and Engineer that the shop drawings have been posted. If electronic submittal procedures are not defined in Division 01, Contractor shall include the website, user name and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the designated representatives of the Architect and Engineer. Contractor shall allow the Engineer review time as specified above in the construction schedule. Contractor shall submit only the documents required to purchase the materials and/or equipment in the electronic submittal and shall clearly indicate the materials, performance criteria and accessories being proposed. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.

I. ELECTRONIC DRAWINGS

In preparation of shop drawings or record drawings, Contractor may, at his option, obtain electronic drawing files in AutoCAD or DXF format on CD-ROM disk, DVD disk, flash drive, or direct download, as desired, from the Engineer for a fee of $200 for a drawing set up to 12 sheets and $15 per sheet for each additional sheet. Contact the Architect for written authorization and Engineer for the necessary release agreement form and to specify shipping method and drawing format. In addition to payment, written authorization from the Architect and release agreement from the Engineer must be received before electronic drawing files will be sent.

J. RECORD DRAWINGS (AS-BUILT DRAWINGS)

During progress of the work in this division, Contractor shall maintain an accurate record of all changes made during the installation of the system. Upon completion of the work, accurately transfer all record information to three identical sets of the approved shop drawings. Insert one set into each copy of the manual described below.

See Division 01 and General Conditions for additional information.

K. QUALIFICATIONS

The manufacturer shall be a company specializing in manufacturing the products specified in this section with minimum three years documented experience. The installer shall be a company specializing in installing the products specified in this section with minimum three years documented experience, be a bonded and licensed contractor and merchant of electronic automated fire alarm systems, and employ full-time factory-trained installers and technicians. The equipment manufacturer's service department shall be fully stocked in standard parts and components and engaged in the maintenance of fire alarm systems. On-the-premises service shall be available within 4 hours of notification, 7 days a week, 24 hours a day. Furnish service and maintenance of fire alarm system for one year from date of substantial completion.

L. WARRANTIES

Warrant each system and each element thereof against all defects due to faulty workmanship, design, or material for a period of 12 months from date of Substantial Completion, unless specific items are noted to carry a longer warranty in the construction documents or manufacturer's standard warranty exceeds 12 months. Remedy all defects, occurring within the warranty period(s), as stated in the General Conditions and Division 01.

All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks.

Warranties shall include labor and material, including travel expenses. Make repairs or replacements without any additional costs to the Owner, and to the satisfaction of the Owner, Architect, and Engineer.

Perform the remedial work promptly, upon written notice from the Engineer or Owner.

At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period and any actions the Owner must take in order to maintain warranty status. Each warranty instrument shall be addressed to the Owner and state the commencement date and term.

2. MATERIALS AND INSTALLATION

A. MANUFACTURERS

Subject to compliance with requirements, provide products manufactured by the following manufacturers: Notifier; SimplexGrinnell; Siemens-Cerberus Division; Kidde/Edwards; Gamewell-FCI; FIKE Corporation; Farenhyt or Engineer approved equal.

B. FIRE ALARM CONTROL PANEL

The fire alarm system shall be a microprocessor-based system designed specifically for fire applications. The system shall be UL listed under Standard 864 (Control Units for Fire-Protective Signaling Systems). Modular construction with a flush mounted enclosure.

Remote Annunciator: Provide supervised remote annunciator(s) where shown on the plans, including audible and visible indication of fire alarm by address, and audible and visible indication of system trouble and supervisory. Install in flush mounted enclosure.

Power Supply: Provide two separate and reliable power supplies. The control panel shall receive 120 Vac power via a dedicated branch circuit of the building's electrical system. Each shall have adequate capacity for the system. The fire alarm contractor shall submit battery calculations for review and approval. The calculations shall indicate each device and the load required in stand-by and alarm mode. The secondary power system shall be a battery-operated emergency power supply and charger with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes.

System Supervision: Automatically detects and reports open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification appliance circuits. Alarm, supervisory and trouble signals shall be monitored by the supervising station over a Digital Alarm Communicator Transmitter (DACT), or other approved method.

Initiating Device Circuits: Provide circuitry, which meets the performance requirements during abnormal conditions, based upon the style and class of the circuitry selected. Initiating device circuits shall be Class B.

Notification Appliance Circuits: Provide circuitry, which meets the performance requirements during abnormal conditions, based upon the style and class of the circuitry selected. Notification appliance circuits shall be Class B.

Signaling Line Circuits: Provide circuitry, which meets the performance requirements during abnormal conditions, based upon the style and class of the circuitry selected. Signaling line circuitry shall be Class B.

Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts to provide accessory functions specified.

Digital Alarm Communicator Transmitter (DACT): Electrically supervised, capable of transmitting alarm, supervisory and trouble signals over telephone lines to remote station receiver. The installing contractor shall select the appropriate DACT equipment based on the available communication methods. Coordinate with General Contractor to ensure proper connections are provided for communication to and from the DACT. Two (2) separate communication methods are required and shall not be subject to a common failure within the scope of work identified within these contract documents. Unless noted otherwise, the installing contractor shall utilize two (2) of the following communication methods:

1. Copper wire (POTS) telephone line for fire alarm use as required by NFPA 72.
   Exception: If two (2) POTS telephone lines are utilized per NFPA 72, additional communication methods are not required.
2. Building 10/100 Base network (LAN), DSL modem, or cable modem.
3. GSM cellular networks in the area including 2G, 3G and 4G. The transmitter shall automatically detect and choose the best network in the area based on signal strength and immediately self-adjust for operation as necessary.
4. Other alternative method complying with the performance requirements of NFPA 72 for 'Communication Methods for Supervising Station Alarm Systems that is acceptable to the Authority Having Jurisdiction and the Engineer of Record. Approval of any alternative methods must be obtained from the Engineer of Record via an RFI prior to submitting bids for the scope of work.

Provide trouble acknowledge, drill, and alarm silence switch.

The control panel and remote annunciator panel shall have dedicated alarm, supervisory and trouble LED's and dedicated alarm, supervisory and trouble acknowledge switches.

Lamp Test: Manual lamp test function causes each LED to function at fire alarm control panel.

Drill Sequence of Operation: Manual drill function causes alarm mode operation as described above.

Addressable systems shall have silent walk test, history logging for a minimum of 400 events, 80 character LCD display.

C. SEQUENCE OF OPERATIONS

Trouble Sequence of Operation: System or circuit trouble places system in trouble mode, which causes the following system operations:

1. Visible and audible trouble alarm indicated at fire alarm control panel and remote annunciator panel (if provided).
2. Trouble signal transmitted to supervising station.
3. Manual acknowledge function at fire alarm control panel silences audible trouble alarm; visible alarm is displayed until initiating failure or circuit trouble is cleared.

Supervisory Sequence of Operation: The activation of any sprinkler valve tamper switch or duct-mounted smoke detector places system in supervisory mode, which causes the following system operations:

1. Visible and audible supervisory alarm indicated by address at fire alarm control panel and remote annunciator panel (if provided).
2. Supervisory signal transmitted to supervising station.
3. Duct-mounted smoke detectors shall shutdown their respective unit upon detection of smoke and remain down until manually reset.
4. Fan-powered terminal units that are less than 2,000 cfm and are not provided with duct detection shall shutdown when its respective air handling unit is shutdown.
5. Manual acknowledge function at fire alarm control panel and remote annunciator panel silences audible supervisory alarm; visible alarm is displayed until device is returned to its normal position/supervisory condition is cleared.

Alarm Sequence of Operation: Actuation of an alarm initiating device places system in alarm mode, which causes the following system operations.

1. Audible notification appliances shall sound until silenced by the alarm silence switch at the control panel.
2. All visible alarm notification appliances shall display a continuous synchronized pattern until reset by the Alarm Reset Switch.
3. Alarm signal transmitted to supervising station.
4. All fan-powered air-handling equipment shall shutdown and remain down until the fire alarm control panel is reset.
5. The alarm LED shall flash on the control panel and remote annunciator panel until the alarm has been acknowledged at the control panel/remote annunciator panel. Once acknowledged, this same LED shall latch on and the custom label for the address in alarm shall be displayed on the alphanumeric LCD readout. A subsequent alarm received from another address after acknowledged shall flash the alarm LED on the control panel showing the new alarm information.
6. A pulsing alarm tone shall occur within the control panel until acknowledged.

Activation of an elevator lobby or elevator machine room smoke detector or heat detector located in the elevator pit shall place the system in alarm mode and shall initiate Phase I elevator recall per ASME A17.1. Provide output signals and logic as required by code and by the elevator system supplier and installer.

D. INITIATING DEVICES

Manual Pull Station: Provide semi-flush, non-coded type, double action manual pull station.

Smoke Detector (Photoelectric type): Device shall have visible indication of detector actuation, self-restoring, plug-in with an integral addressable module indicating the detector status. Photoelectric detectors shall have sensitivity between 0.5 and 3.5 percent/foot smoke obscuration.

Heat Detector – Fixed Temperature Type: The device shall be actuated by a fixed temperature alarm point rating of 135 degree F. The base shall be plug-in with an integral addressable module indicating the detector status.

Duct Mounted Smoke Detector: Photoelectric detector along with a standard, relay or isolator detector mounting base. Provide for variations in duct air velocity between 100 and 4000 feet per minute. Protect the measuring chamber from damage and insects. Provide an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. Provide drilling templates and gaskets to facilitate locating and mounting the housing. Provide remote alarm LEDs and remote test stations as shown on the plans. Provide duct detection and shutdown for air distribution systems exceeding 2,000 cfm.

E. NOTIFICATION APPLIANCES

Alarm Horn: Surface type fire alarm horn. Sound rating: 90 dB at 10 feet.

Visible Alarm Notification Appliances (Strobes): Strobes shall be xenon or equivalent, unfiltered or clear filtered white light, intensity as indicated on drawings, flash rate range from 1 to 3 Hz, a maximum pulse duration of 0.2 sec with a maximum duty cycle of 40 percent. Strobe shall meet all requirements of the Americans with Disabilities Act.

Audible/Visible Alarm Notification Appliances (Horn/Strobes): Combination units shall provide a common enclosure for the fire alarm audible and visible alarm appliances and be UL listed for its purpose. Minimum audible level and strobe intensity shall meet all requirements for separate appliances.

Provide flush or recessed devices unless otherwise noted.

F. AUXILIARY DEVICES

Waterflow Alarm Switches: Provided by the Fire Sprinkler Installer and shall be wired, complete and ready for use, by the Fire Alarm System Installer. Switch shall have an adjustable delay to minimize false alarms due to fluctuations in water pressure.

Gate Valve (Tamper) Switches: Shall be provided by the Fire Sprinkler Installer and shall be wired complete and ready for use by the Fire Alarm System Installer.

Monitor Module: Addressable microelectronic module providing a system address for alarm initiating devices for wired applications with normally open contacts. Include address setting means on the module.

Control Relay Module: Provide intelligent control relay modules. The control relay module shall provide one form "C" dry relay contact rated at 2 amps at 24 Vdc to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware.

Fire Department Key Box: By Knox Company. Provide with an internal switch to indicate a supervisory condition at the fire alarm control and annunciator panels when the lid is removed.

G. FIRE ALARM WIRE AND CABLE

Fire Alarm Power Branch Circuits: Building wire as specified in Division 26.

Signaling Line, Initiating Device, and Notification Appliance Circuits: Power limited fire-protective signaling cable, solid copper conductor, 300 Volts insulation, suitable for temperature, conditions and location installed. Minimum wire size for initiating device circuits, control circuits and notification appliance circuits shall be determined by calculations and manufacturer's requirements or recommendations. Wire and cable shall be twisted and shielded if recommended by the system manufacturer. Initiating, notification, and control circuits shall be sized based on 20 percent additional power consuming devices. The conductors shall meet the requirements of NEC Article 760.

All wiring provided on this project shall be UL listed for the intended use. All wiring including wiring to existing modified devices and appliances shall be new.

3. EXECUTION

A. GENERAL

Install, program, and test all new equipment identified in this contract and revise existing equipment as noted.

The installation supervisor shall be on the job site during the entire installation. The installation supervisor shall maintain marked up copies of the drawings at the job site showing as-built conditions. These drawings shall be updated daily and available for Owner review.

Provide all required conduit and all associated hardware and install (pull), connect, and test all cable for a complete fire alarm system. Install all wiring in accordance with the guidelines of these specifications and documents as well as the NFPA codes and standards listed in these specifications.

B. INSTALLATION

Pathways above suspended ceilings and in nonaccessible locations may be routed exposed where permitted by NFPA 70 & 72. Exposed pathways located less than 96 inches above the floor shall be installed in conduit. Minimum allowable conduit size shall be 3/4 inch. Size the conduit so that conduit fill does not exceed 75 percent of NFPA 70 maximum fill requirements. Cables in vertical risers shall not exceed 50 percent of NFPA 70 maximum fill requirements. Conduit installation shall be as required by the Contractor's layout and as described in these specifications. All conduit field routing shall be acceptable to the Owner. Routing not acceptable shall be rerouted and replaced without expense to the Owner.

Conceal all wire, cable, conduit, and raceways in walls, ceiling spaces, electrical shafts, or closets in finished areas except as specifically noted otherwise. Conduit and raceways may be exposed in unfinished areas or where specifically approved by the Owner.

Except as otherwise specified or indicated on the drawings, Install all conduit parallel or perpendicular to dominant surfaces with right angle turns made of symmetrical bends or fittings. Except where prevented by the location of other work, a single conduit or a conduit group shall be centered on structural members.

Locate conduit at least six inches from hot water or steam pipes and from other hot surfaces. Conduit shall not block access to any existing equipment or fixtures.

Label all conduits and junction boxes as specified in Division 26.

Terminate all wiring at devices or panels using terminal connectors for screw type terminals. All terminal connectors for conductors shall be pre-insulated ring type or pre-insulated spade type. Pre-insulated terminal connectors shall include a vinyl sleeve, color coded to indicate conductor size. Pre-insulated terminal connectors shall include a metallic support sleeve bonded to the vinyl-insulating sleeve and designed to grip the conductor insulation.

Mount end-of-line device in box with last device or separate box adjacent to last device in circuit for conventional hardwired Class B initiating and notification appliance circuits.

Securely fasten conduit to all boxes and cabinets. Threads on metallic conduit shall project through the wall of the box to allow the bushing to butt against the end of the conduit. The locknuts both inside and outside shall then be tightened sufficiently to bond the conduit securely to the box. Conduit shall enter cabinets from the bottom and sides only.

Install manual stations with operating handle 48 inches above floor unless noted otherwise on drawings.

Install ceiling mounted initiating devices in areas with exposed structure tight to underside of floor/roof deck.

Do not install smoke detectors in a direct air flow nor closer than 3 feet (1 meter) from an air supply diffuser or return air opening.

Install wall mounted visible and audible/visible notification appliances with visible element (strobe) between 80 inches and 96 inches above finished floor unless noted otherwise on drawings.

Install wall mounted audible devices with the top of the device at least 90 inches above finished floor or 6 inches below the ceiling, whichever is lower, unless noted otherwise on drawings. If combination devices are installed, they shall be installed per the visible signal device requirements.

Make conduit and wiring connections to equipment provided by others.

Provide strobe synchronization as required per NFPA 72.

C. FIELD QUALITY CONTROL

Systems shall be checked and tested in accordance with the instructions provided by the manufacturer to ensure that the system functions as required and is free of grounds, opens, and shorts. Each device shall be tested. Smoke detectors shall be tested with products of combustion.

Upon completion of the system installation and before the date of final acceptance, a factory-trained technician shall perform all necessary tests and adjustments and shall file a Letter of Certification and a Certificate of Completion (NFPA 72) with the Owner indicating that the system functions and conforms to the specifications.

Test in accordance with NFPA 72 and local fire department requirements.

D. MANUFACTURER'S FIELD SERVICES

Include services of factory trained and certified technician to supervise installation, adjustments, final connections, and system testing as performed by the Contractor's factory-trained technicians.

The equipment supplier's factory trained technician shall train the Owner's personnel in the proper use and maintenance of the system. Training sessions shall be conducted as needed, not to exceed a total of 2 sessions, with each session lasting a maximum of 4 hours each.

E. ACCEPTANCE TESTING

Upon completion of the system installation, a factory-trained technician shall perform all necessary tests and adjustments in the presence of the Owner's designated personnel.

END OF SECTION 28

CHRISTOPHER J. CULP

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
CHRISTOPHER J. CULP
NUMBER PE-2013037646
PROFESSIONAL ENGINEER

Oct 24 2019

CHRISTOPHER J. CULP
LICENSE # PE-2013037646

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
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1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

FIRE ALARM SPECIFICATIONS

SHEET NUMBER

FA701

FIRE PROTECTION GENERAL NOTES:

1. PRIOR TO SUBMITTING BID, VISIT THE JOB SITE AND BECOME FULLY ACQUAINTED WITH THE EXISTING CONDITIONS OF THE PROJECT. REVIEW THE GENERAL NOTES, SPECIFICATIONS AND OTHER DRAWINGS FOR ADDITIONAL REQUIREMENTS WHICH MAY NOT BE SPECIFICALLY CALLED OUT IN THIS PORTION OF THE CONSTRUCTION DOCUMENTS. NOTIFY ARCHITECT, ENGINEER AND/OR OWNER OF CONFLICTS OR DISCREPANCIES PRIOR TO SUBMISSION OF BID.
2. SYSTEM DESIGN, INSTALLATION AND MATERIALS SHALL BE IN ACCORDANCE WITH APPLICABLE NFPA STANDARDS. SYSTEM SHALL ALSO MEET ALL APPLICABLE BUILDING CODES, FIRE CODES AND THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION AND INSURANCE CARRIER. VERIFY REQUIREMENTS PRIOR TO BID SUBMITTAL.
3. INFORMATION ON CONTRACT DOCUMENTS IS GENERAL INFORMATION AND FOR BID PURPOSES ONLY. CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR THE FINAL SYSTEM DESIGN AND LAYOUT OF ALL COMPONENTS, COORDINATION WITH ALL OTHER TRADES, AND SYSTEM CALCULATIONS REQUIRED FOR APPROVAL BY THE AUTHORITY HAVING JURISDICTION, ENGINEER, AND OWNER'S INSURER.
4. THE CONTRACTOR SHALL FOLLOW THE ENGINEER OF RECORD'S SYSTEM DESIGN AND LAYOUT OF ALL COMPONENTS EXCEPT WHERE MODIFICATION TO THE DESIGN IS NECESSARY. MODIFICATIONS SHALL BE REFLECTED IN THE CONTRACTOR'S SHOP DRAWINGS AND CALCULATIONS.
5. DEVIATIONS FROM ENGINEER'S DESIGN WILL NOT BE CONSIDERED UNLESS A FORMALLY SUBMITTED RFI IS RECEIVED AND APPROVED.
6. THE CONTRACTOR SHALL PROVIDE ALL EQUIPMENT AND LABOR REQUIRED FOR A COMPLETE AND OPERATIONAL SYSTEM AS INDICATED IN THE DRAWINGS AND SPECIFICATIONS.
7. PROVIDE ADDITIONAL MATERIALS AND LABOR REQUIRED DUE TO LACK OF COORDINATION OR TO MEET AUTHORITY HAVING JURISDICTION AND INSURANCE CARRIER REQUIREMENTS AT NO ADDITIONAL COST TO THE OWNER.
8. FORWARD COMPLETED CERTIFICATE OF COMPLETION AND CONTRACTOR MATERIAL TEST CERTIFICATES TO THE OWNER.
9. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.

FIRE SPRINKLER SYMBOLS

THIS IS A MASTER LEGEND AND NOT ALL SYMBOLS OR ABBREVIATIONS ARE USED. V2.01

ABBREVIATIONS

AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
CD	CANDELA
DI	DUCTILE IRON
ESFR	EARLY SUPPRESSION FAST RESPONSE
ETR	EXISTING TO REMAIN
FHC	FIRE HOSE CABINET
FP	FIRE PROTECTION
GC	CONTRACTOR
GPM	GALLONS PER MINUTE
JB/J-BOX	JUNCTION BOX
MAX	MAXIMUM
MIN	MINIMUM
N/A	NOT APPLICABLE
NIC	NOT IN CONTRACT
OC	ON CENTER
PIV	POST INDICATOR VALVE
PROVIDE	FURNISH AND INSTALL
PRV	PRESSURE REDUCING VALVE
RD	RETURN DUCT
REV	REVISION
SD	SUPPLY DUCT
SF	SQUARE FEET
TYP	TYPICAL
UNO	UNLESS NOTES OTHERWISE
V	VOLT(S)
W	WATTS
WP	WEATHERPROOF

ANNOTATION

- FIRE PROTECTION PLAN NOTE CALLOUT
- CONNECTION POINT OF NEW WORK TO EXISTING
- DETAIL REFERENCE UPPER NUMBER INDICATES DETAIL NUMBER LOWER NUMBER INDICATES SHEET NUMBER
- SECTION CUT DESIGNATION

FIRE SPRINKLER PIPING

- FP — FIRE PROTECTION (FP)
- SHUTOFF VALVE
- CHECK VALVE
- BACKFLOW PREVENTER
- CAP
- ELBOW UP
- ELBOW DOWN
- TEE UP
- TEE DOWN
- FIRE DEPARTMENT CONNECTION
- FIRE PUMP TEST HEADER
- INSPECTOR'S TEST CONNECTION / AUXILIARY DRAIN
- SPRINKLER RISER
- TOP BEAM CLAMP
- TRAPEZE HANGER

LINETYPE LEGEND

THROUGHOUT THE DRAWINGS DIFFERENT LINETYPES ARE USED IN COMBINATION WITH THE SYMBOLS TO INDICATE THE STATUS OF ITEMS AS EXISTING, TO BE DEMOLISHED, TO BE INCLUDED AS PART OF NEW WORK AND/OR ITEMS WHICH ARE ANTICIPATED TO BE PROVIDED IN THE FUTURE. THE STATUS OF ITEMS USING THESE LINETYPES ARE RELATIVE TO THE VIEW IN WHICH THEY APPEAR. PHASING SHOWN IN DRAWINGS IS NOT INTENDED TO FULLY DESCRIBE ALL NECESSARY CONSTRUCTION PHASING, WHICH IS DETERMINED BY THE CONTRACTOR AS PART OF THEIR RESPONSIBILITIES. ANY SUCH PHASES DESCRIBED IN THE CONSTRUCTION DOCUMENTS ARE GENERAL AND ONLY INTENDED TO INDICATE A BROAD ORDER FOR THE SAKE OF DESCRIBING THE PROJECT. THE FOLLOWING LINETYPES MAY BE USED ON ANY DEVICE, EQUIPMENT, NOTE, LINE, SHAPE, ETC.

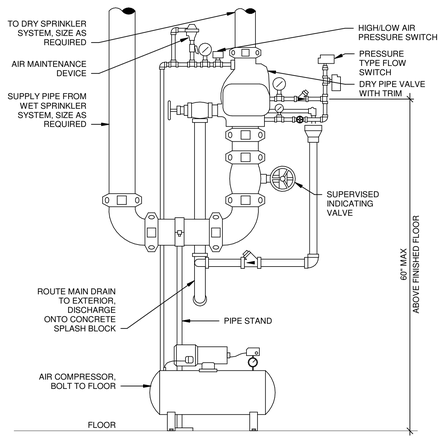
- EXISTING
- DEMOLISH
- NEW
- FUTURE

FIRE SPRINKLERS

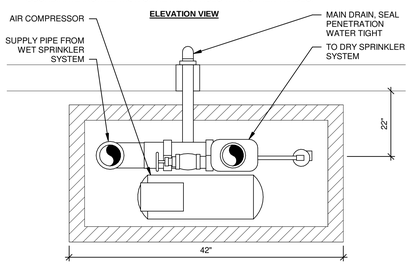
- UPRIGHT SPRINKLER
- PENDENT SPRINKLER
- CONCEALED SPRINKLER
- DRY PENDENT SPRINKLER
- DRY SIDEWALL SPRINKLER
- SIDEWALL SPRINKLER

WATER SUPPLY INFORMATION:

WATER SUPPLY INFORMATION IS NOT AVAILABLE AT THIS TIME. CONTRACTOR SHALL OBTAIN CURRENT WATER SUPPLY INFORMATION PRIOR TO BID SUBMITTAL.



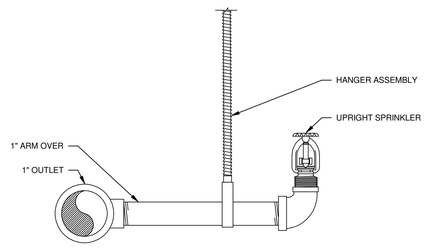
ARRANGEMENT SHOWN IS SCHEMATIC. MODIFY TO SUIT CONDITIONS AND MEET APPLICABLE CODE REQUIREMENTS. BACKFLOW PREVENTER LOCATED AT FIRE SERVICE ENTRY. COORDINATE INSTALLATION OF ALARM DEVICES WITH OTHER TRADES.



CROSS HATCHED AREA IS THE MAXIMUM ALLOWABLE AREA TO BE USED FOR SPRINKLER SYSTEM RISER. INSTALLATION MUST ALLOW FOR ALL REQUIRED MAINTENANCE ACCESS WITHIN CROSS HATCHED AREA.

PLAN VIEW

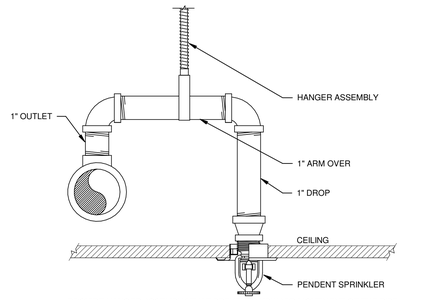
6 FIRE PROTECTION RISER - DRY PIPE
NTS



PROVIDE HANGER WHEN ARMOVER LENGTH EXCEEDS 24 INCHES.

ARRANGEMENT SHOWN IS SCHEMATIC. MODIFY TO SUIT CONDITIONS AND MEET APPLICABLE CODE REQUIREMENTS.

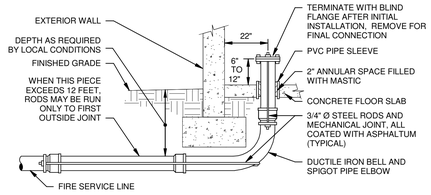
4 UPRIGHT SPRINKLER
NTS



PROVIDE HANGER ASSEMBLY THAT PREVENTS UPWARD MOVEMENT OF THE PIPE WHEN ARMOVER LENGTH EXCEEDS 12-INCHES AND SYSTEM STATIC PRESSURE AT THE SPRINKLER EXCEEDS 100 PSI. PROVIDE HANGER WHEN ARMOVER LENGTH EXCEEDS 24-INCHES AND SYSTEM STATIC PRESSURE AT THE SPRINKLER DOES NOT EXCEED 100 PSI.

ARRANGEMENT SHOWN IS SCHEMATIC. MODIFY TO SUIT CONDITIONS AND MEET APPLICABLE CODE REQUIREMENTS.

3 PENDENT SPRINKLER
NTS

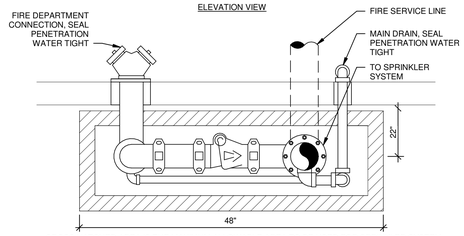


ARRANGEMENT SHOWN IS SCHEMATIC. MODIFY TO SUIT FIELD CONDITIONS AND MEET APPLICABLE CODE REQUIREMENTS. VERIFY FOUNDATION WITH ARCHITECTURAL DRAWINGS. COORDINATE WHO IS TO PROVIDE THE FIRE SERVICE ENTRY WITH THE GENERAL CONTRACTOR OR CONSTRUCTION MANAGER PRIOR TO SUBMITTING BID.

2 FIRE SERVICE ENTRY
NTS

ARRANGEMENT SHOWN IS SCHEMATIC. MODIFY TO SUIT CONDITIONS AND MEET APPLICABLE CODE REQUIREMENTS. COORDINATE INSTALLATION OF ALARM DEVICES WITH OTHER TRADES.

ELEVATION VIEW



CROSS HATCHED AREA IS THE MAXIMUM ALLOWABLE AREA TO BE USED FOR SPRINKLER SYSTEM RISER AND BACKFLOW PREVENTER. INSTALLATION MUST ALLOW FOR ALL REQUIRED MAINTENANCE ACCESS WITHIN CROSS HATCHED AREA.

PLAN VIEW

1 FIRE PROTECTION WET PIPE
NTS

CHRISTOPHER J. CULP

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

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CHRISTOPHER J. CULP
NUMBER PE-2013037646
PROFESSIONAL ENGINEER

Oct 24 2019

CHRISTOPHER J. CULP
LICENSE # PE-2013037646

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

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1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

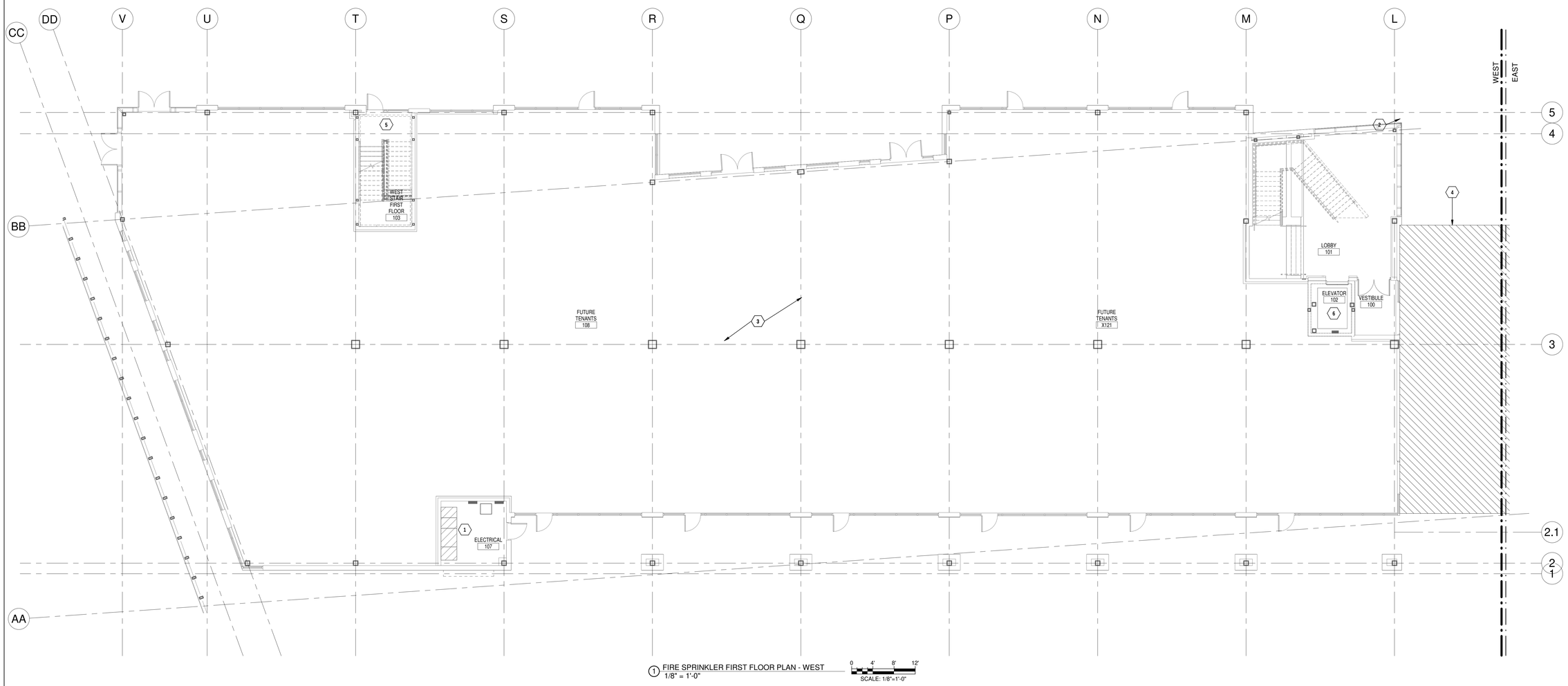
FIRE SPRINKLER LEGENDS AND GENERAL NOTES

SHEET NUMBER

FS000

FIRE SPRINKLER PLAN NOTES:

1. DO NOT ROUTE SPRINKLER PIPING ABOVE ELECTRICAL EQUIPMENT.
2. LOCATION OF DRY SPRINKLER VALVE FOR BREEZEWAY. PROVIDE FLOOR MOUNTED AIR COMPRESSOR. TEST AND DRAIN PIPING IS TO DISCHARGE TO EXTERIOR. COORDINATE PIPE ROUTING WITH OTHER TRADES.
3. PROVIDE FIRE PROTECTION THROUGHOUT SHELL SPACE FOR FUTURE TENANT USE. SIZE AS REQUIRED TO MEET HYDRAULIC DEMANDS FOR ORDINARY HAZARD GROUP II.
4. PROVIDE DRY PIPE SPRINKLER SYSTEM WITH LOW AND HIGH PRESSURE SUPERVISION FOR BREEZEWAY. DRY SPRINKLER SYSTEM SHALL HAVE DRY BARREL PENDENT TYPE SPRINKLERS.
5. PROVIDE SPRINKLER PROTECTION AT THE TOP OF STAIRWAY AND BENEATH THE LOWEST STAIRWAY LANDING
6. INSTALL SIDEWALL SPRINKLER AT ELEVATOR HOISTWAY PIT FLOOR. THE SPRINKLER SHALL BE LOCATED AT AN ELEVATION THAT IS ABOVE THE ELEVATOR PUMP ENCLOSURE AND LESS THAN 4 FEET ABOVE THE PIT FLOOR.



1 FIRE SPRINKLER FIRST FLOOR PLAN - WEST
1/8" = 1'-0"

0 4' 8' 12'
SCALE: 1/8"=1'-0"

CHRISTOPHER J. CULP

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.:	1850004412
Date:	10.25.19
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Oct 24 2019
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LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

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EXPIRES 12/31/2020

SHEET TITLE

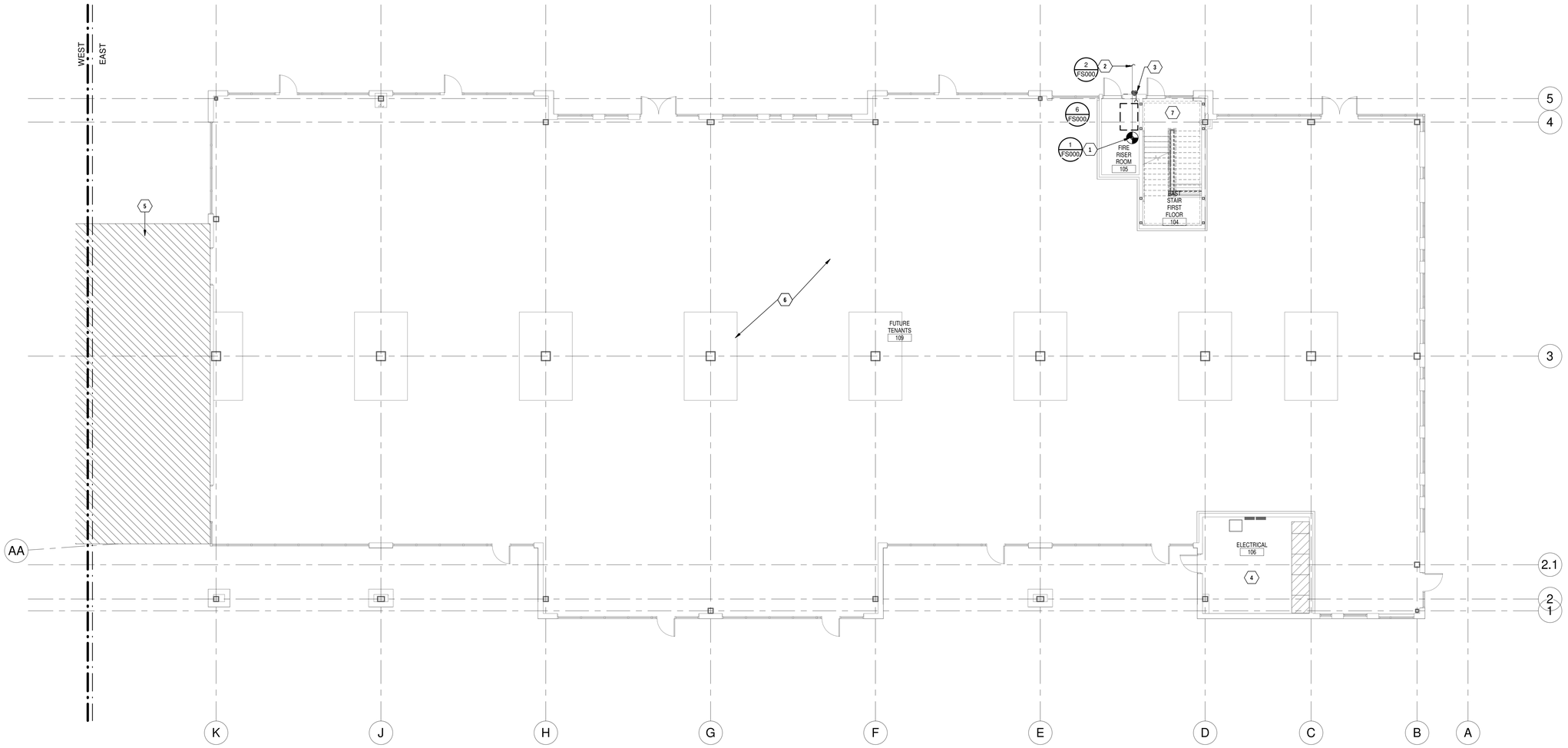
FIRE SPRINKLER FIRST FLOOR PLAN - WEST

SHEET NUMBER

FS101.1

FIRE SPRINKLER PLAN NOTES:

1 8-INCH FIRE SPRINKLER RISER ASSEMBLY.
2 FIRE PROTECTION SERVICE ENTRANCE. REFER TO CIVIL FOR CONTINUATION.
3 4-INCH STORZ FIRE DEPARTMENT CONNECTION, REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION.
4 DO NOT ROUTE SPRINKLER PIPING ABOVE ELECTRICAL EQUIPMENT.
5 PROVIDE DRY PIPE SPRINKLER SYSTEM WITH LOW AND HIGH PRESSURE SUPERVISION FOR BREEZEWAY. DRY SPRINKLER SYSTEM SHALL HAVE DRY BARREL PENDENT TYPE SPRINKLERS.
6 PROVIDE FIRE PROTECTION THROUGHOUT SHELL SPACE FOR FUTURE TENANT USE. SIZE AS REQUIRED TO MEET HYDRAULIC DEMANDS FOR ORDINARY HAZARD GROUP II.
7 PROVIDE SPRINKLER PROTECTION AT THE TOP OF STAIRWAY AND BENEATH THE LOWEST STAIRWAY LANDING



1 FIRE SPRINKLER FIRST FLOOR PLAN - EAST
1/8" = 1'-0"

0 4' 8' 12'
SCALE: 1/8"=1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
CHRISTOPHER J. CULP
NUMBER PE-2013037646
PROFESSIONAL ENGINEER

Oct 24 2019
CHRISTOPHER J. CULP
LICENSE # PE-2013037646

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
CONTRACTOR	FOGEL ANDERSON

HENDERSON ENGINEERS
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1850004412
MO. CORPORATE NO: E-556D
EXPIRES 12/31/2020

SHEET TITLE

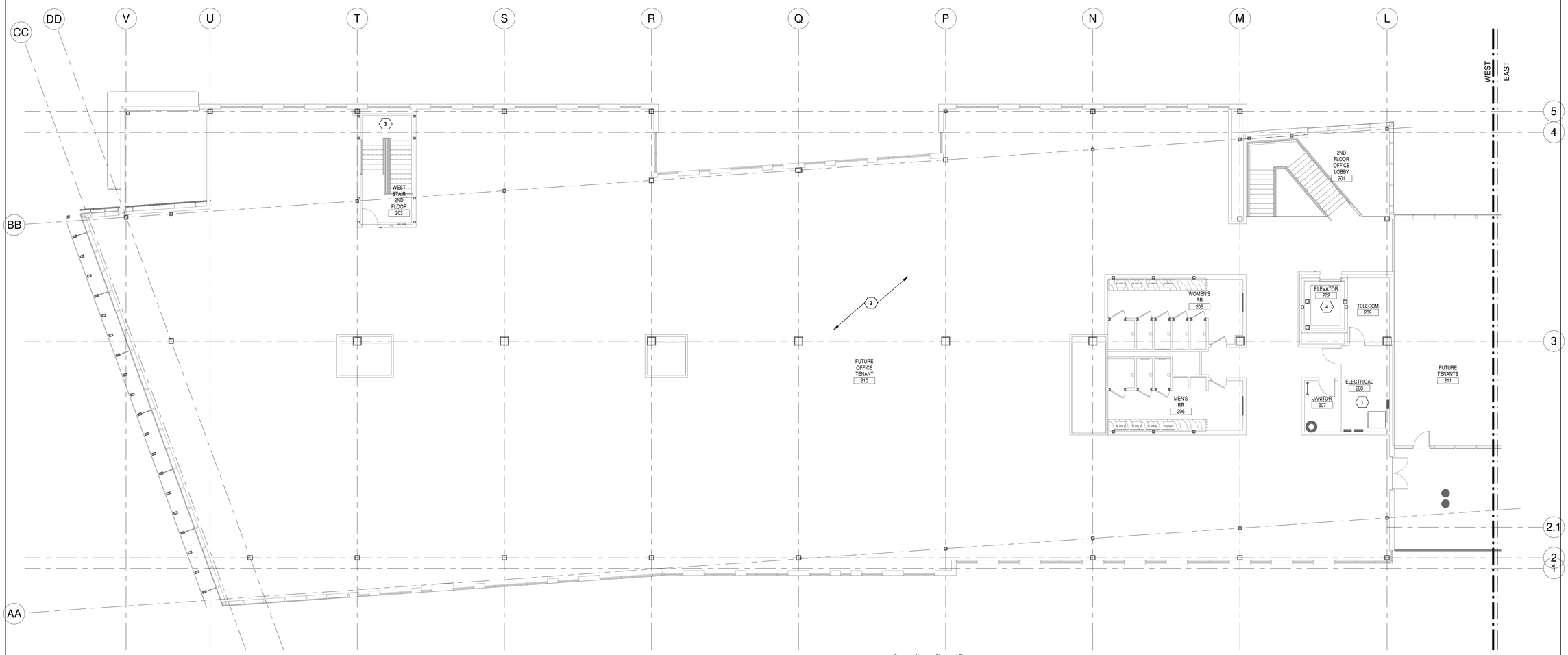
FIRE SPRINKLER FIRST FLOOR PLAN - EAST

SHEET NUMBER

FS101.2

FIRE SPRINKLER PLAN NOTES:

1. DO NOT ROUTE SPRINKLER PIPING ABOVE ELECTRICAL EQUIPMENT.
2. PROVIDE FIRE PROTECTION THROUGHOUT SHELL SPACE FOR FUTURE TENANT USE. SIZE AS REQUIRED TO MEET HYDRAULIC DEMANDS FOR ORDINARY HAZARD GROUP II.
3. PROVIDE SPRINKLER PROTECTION AT THE TOP OF STAIRWAY AND BENEATH THE LOWEST STAIRWAY LANDING
4. SPRINKLER PROTECTION NOT REQUIRED AT THE TOP OF ELEVATOR HOISTWAY.



1 FIRE SPRINKLER SECOND FLOOR PLAN - WEST
1/8" = 1'-0"

0 4' 8' 12'
SCALE: 1/8"=1'-0"

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
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REVISIONS

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REGISTRATION

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NUMBER PE-2013037646
PROFESSIONAL ENGINEER

Oct 24 2019
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LICENSE # PE-2013037646

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
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SHEET TITLE

FIRE SPRINKLER SECOND FLOOR PLAN - WEST

SHEET NUMBER

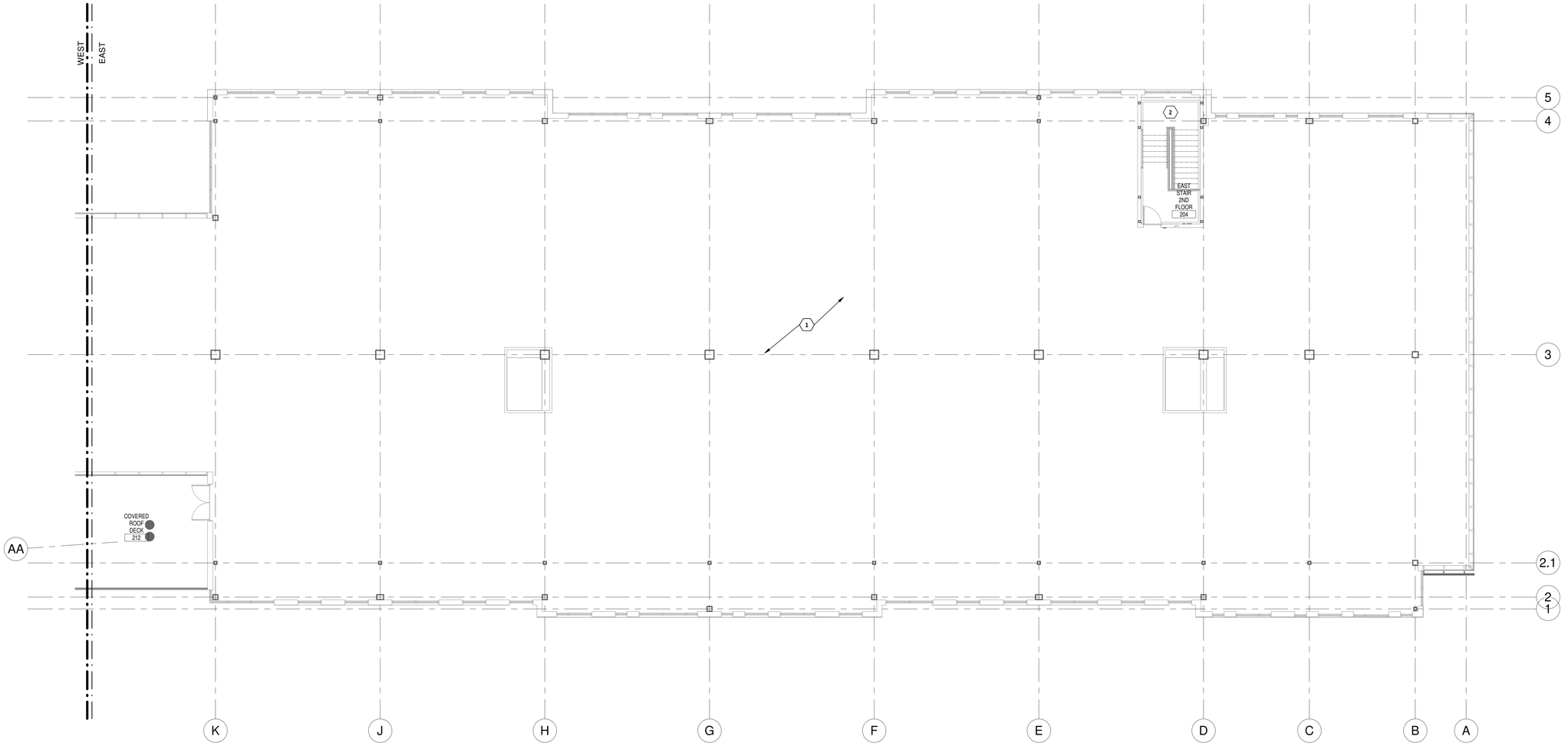
FS102.1

CHRISTOPHER J. CULP

FIRE SPRINKLER PLAN NOTES:

1 PROVIDE FIRE PROTECTION THROUGHOUT SHELL SPACE FOR FUTURE TENANT USE. SIZE AS REQUIRED TO MEET HYDRAULIC DEMANDS FOR ORDINARY HAZARD GROUP II.

2 PROVIDE SPRINKLER PROTECTION AT THE TOP OF STAIRWAY AND BENEATH THE LOWEST STAIRWAY LANDING



1 FIRE SPRINKLER SECOND FLOOR PLAN - EAST
1/8" = 1'-0"

0 4' 8' 12'
SCALE: 1/8"=1'-0"

CHRISTOPHER J. CULP

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
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REVISIONS

No.	Date	Description

REGISTRATION

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Oct 24 2019

CHRISTOPHER J. CULP
LICENSE # PE-2013037646

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
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ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
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SHEET TITLE

FIRE SPRINKLER SECOND FLOOR PLAN - EAST

SHEET NUMBER

FS102.2

Division 21: AUTOMATIC SPRINKLER SYSTEM

1. GENERAL INSTRUCTIONS

A. GENERAL REQUIREMENTS

Requirements under Division 01 and the general and supplementary conditions of these specifications shall apply to this section and division. Where the requirements of this section and division exceed those of Division 01, this section and division take precedence. Become thoroughly familiar with all its contents as to requirements that affect this division, section, or both. Work required under this division includes all material, equipment, appliances, transportation, services, and labor required to complete the entire system as required by the drawings and specifications, or reasonably inferred to be necessary to facilitate the function of each system as implied by the design and the equipment specified.

The specifications and drawings for the project are complementary, and any portion of work described in one shall be provided as if described in both. In the event of discrepancies, notify the Engineer and request clarification prior to proceeding with the work involved.

Drawings are graphic representations of the work upon which the contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They convey the scope of work, indicating the intended general arrangement of the systems without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements. Use the drawings as a guide when laying out the work and to verify that materials and equipment will fit into the designated spaces, and which when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory, and properly operating system.

Refer to Division 22 for additional requirements that apply to this installation that are not written herein.

B. DEFINITIONS

Division: References contained in this specification follow the numbering system defined in the Construction Specifications Institute (CSI) MasterFormat 2004 Edition. Specification Divisions 01 through 13 provided with this project may reference the CSI MasterFormat 1995 Edition. The corresponding division references between the 2004 Edition and 1995 Edition are as follows:

2004 Edition	1995 Edition
1. Division 21 – Fire Suppression	Division 15
2. Division 22 – Plumbing	Division 15
3. Division 23 – HVAC	Division 15
4. Division 26 – Electrical	Division 16
5. Division 27 – Communications	Division 16
6. Division 28 – Electronic Safety and Security	Division 16

Furnish: "to supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations."

Install: "to perform all operations at the project site including, but not limited to, the actual unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use."

Provide: "to furnish and install, complete and ready for the intended use."

Furnished by Owner (or Owner-Furnished) or Furnished by Others: "an item furnished by the Owner or under other divisions or contracts, and installed under the requirements of this division, complete and ready for the intended use, including all items and services incidental to the work necessary for proper installation and operation. Include the installation under the warranty required by this division."

Engineer: Where referenced in this division, "Engineer" is the Engineer of Record and the Design Professional for the work under this division, and is a consultant to, and an authorized representative of the Architect, as defined in the General and/or Supplementary Conditions. When used in this division, Engineer means increased involvement by and obligations to the Engineer, in addition to involvement by and obligations to the Architect.

AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the work.

NRTL: Nationally recognized testing laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA), and acceptable to the AHJ over this project. Nationally recognized testing laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTLs that are acceptable to the AHJ and standards that meet the specified criteria.

Substitution: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Substitutions include Value Engineering proposals.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by or acceptable to the Engineer as equivalent to the item or manufacturer specified". The term "approved" shall mean labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.

C. PREBID SITE VISIT

Prior to submitting bid, visit the site of the proposed work and become fully informed as to the conditions under which the work is to be done. Failure to comply with this requirement shall not be considered sufficient justification to request or obtain extra compensation over and above the contract price.

D. MANUFACTURERS

In other articles where lists of manufacturers are introduced, subject to compliance with requirements, provide products by one of the manufacturers specified.

Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

Where manufacturers are not listed, provide products subject to compliance with requirements from manufacturers that have been actively involved in manufacturing the specified product for no less than 5 years.

E. COORDINATION

Coordinate the connection of the fire sprinkler alarm devices to the fire alarm system.

Coordinate work with that of other trades so that the various components of the systems are installed at the proper time, will fit the available space, and will allow proper service access to those items requiring maintenance. Components installed without regard to the above shall be relocated at no additional cost to the Owner.

F. SUBSTITUTIONS

Materials, products, equipment, and systems described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by the proposed substitution. The base bid shall include only the products from manufacturers specifically named in the drawings and specifications. To request a substitution, request the Substitution Request Form from the Architect or Engineer. Complete and send the Substitution Request From for each material, product, equipment, or system that is proposed to be substituted. The burden of proof of the merit of the proposed substitution is upon the proposer.

Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Architect, and Owner the following:

1. Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects unless stated otherwise in the substitution request.
2. Proposed substitution is consistent with the Contract Documents and will produce indicated results, including functional clearances, maintenance service, and sourcing of replacement parts.
3. Proposed substitution has received necessary approvals of authorities having jurisdiction.
4. Same warranty will be furnished for proposed substitution as for specified Work.
5. If accepted substitution fails to perform as required, Contractor shall replace substitute material or system with that originally specified and bear costs incurred thereby.
6. Coordination, installation and changes in the Work as necessary for accepted substitution will be complete in all respects.

No substitutions will be considered unless the Substitution Request Form is completed and attached with the appropriate substitution documentation. No substitution will be considered prior to receipt of bids unless written request for approval to bid has been received by the Engineer at least ten (10) calendar days prior to the date for receipt of bids.

If the proposed substitution is approved prior to receipt of bids, such approval will be stated in an addendum. Bidders shall not rely upon approvals made in any other way. Verbal approval will not be given. No substitutions will be considered after the contract is awarded unless specifically provided in the contract documents.

G. SUBMITTALS

Assemble and submit for review shop drawings, material lists, manufacturer product literature for equipment to be furnished, and items requiring coordination between contractors under this contract. Provide submittals in sufficient detail so as to demonstrate compliance with these Contract Documents and the design concept. Prior to transmitting submittal, verify that the equipment submitted is mutually compatible and suitable for the intended use, will fit the available space, and maintain manufacturer recommended service clearances. If the size of equipment furnished makes necessary any change in location or configuration, submit a shop drawing showing the proposed layout.

Transmit submittals as early as required to support the project schedule. Allow for two weeks Engineer review time, plus to/from mailing time via the Architect, plus a duplication of this time for resubmittal if required. Only resubmit those sections requested for resubmittal.

Submittals shall contain the project name, applicable specification section, submittal date, equipment identification acronym as used on the drawings, and the Contractor's stamp. The stamp shall certify that the submittal has been checked by the Contractor, complies with the drawings and specifications, and is coordinated with other trades. Manufacturer product literature shall include shop drawings, product data, performance sheets, samples and other submittals required by this division. Highlight, mark, list, or indicate the materials, performance criteria, and accessories that are being proposed. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.

Shop drawings shall meet the requirements of NFPA 13 for working level drawings and shall include the following:

1. Working plans per NFPA 13, including layout drawings of the complete overhead sprinkler system that indicates the relationship of sprinkler piping and sprinklers to all other overhead items, including ceiling grid and tiles, light fixtures, diffusers, registers, grilles, ductwork, structure, soffits, obstructions, etc. Location of risers, piping, etc., shall be as inconspicuous as possible and shall fulfill all functional requirements. System design capabilities and demand shall also be noted on the drawings.

2. Complete details and sections as required to clearly define and clarify the design, including a materials list describing all proposed materials by manufacturer's name and catalog number.

3. Hydraulic calculations.

4. Product data for all fire sprinkler system components. Clearly indicate components to be used where multiple components appear on the same cut sheet.

Where required by the AHJ, Contractor is responsible for obtaining a professional engineer or NICET stamp and signature on their shop drawing submittal. The Engineer is not responsible and will not provide this.

Submittals and shop drawings shall not contain the firm name, logo, seal, or signature of the Engineer. They shall not be copies of the work product of the Engineer. If the Contractor desires to use elements of such product, refer to paragraph "Electronic Drawing Files" for procedures to be used.

Separate submittals according to individual specification sections. Illegible submittals will be rejected and returned without review. Shop drawings shall be produced using Computer Aided Design. Hand drawn documents will not be reviewed or approved. Catalog data shall be properly bound, identified, indexed and tabbed in a 3-ring binder. Each item or model number shall be clearly marked and accessories indicated. Label the catalog data with the equipment identification acronym or number as used on the drawings and include performance curves, capacities, sizes, weights, materials, finishes, wiring diagrams, electrical requirements and deviations from specified equipment or materials. For equipment with motor starters or VFDs, include short circuit current ratings. Mark out inapplicable items. Shop drawings will be returned without review if the above mentioned requirements are not met.

Provide the quantity of submittals required by Division 01. If not indicated and hard-copy sets are provided, submit a minimum of six (6) copies. Refer to Division 01 for acceptance of electronic submittals for this project. For electronic submittals, Contractor shall submit the documents in accordance with the procedures specified in Division 01. Contractor shall notify the Architect and Engineer that the submittals have been posted. If electronic submittal procedures are not defined in Division 01, Contractor shall include the website, user name and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the designated representatives of the Architect and Engineer. Contractor shall allow the Engineer review time as specified above in the construction schedule. Contractor shall submit only the documents required to purchase the materials and/or equipment in the electronic submittal.

The checking and subsequent approval of such shop drawings by the Engineer shall not relieve the 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 with actual building conditions. Proceed with the procurement and installation of equipment only after receiving approved shop drawings relative to each item.

H. ELECTRONIC DRAWINGS

In preparation of shop drawings or record drawings, Contractor may, at his option, obtain electronic drawing files in AutoCAD or DXF format on CD-ROM disk, DVD disk, flash drive, or direct download, as desired, from the Engineer for a fee of $200 for a drawing set up to 12 sheets and $15 per sheet for each additional sheet. Contact the Architect for written authorization and Engineer for the necessary release agreement form and to specify shipping method and drawing format. In addition to payment, written authorization from the Architect and release agreement from the Engineer must be received before electronic drawing files will be sent.

I. RECORD DRAWINGS (AS-BUILT DRAWINGS)

During progress of the work in this division, Contractor shall maintain an accurate record of all changes made during the installation of the system. Upon completion of the work, accurately transfer all record information to three identical sets of the approved shop drawings. Insert one set into each copy of the manual described below.

See Division 01 and General Conditions for additional information.

J. OPERATION AND MAINTENANCE INSTRUCTIONS

During the course of construction, collect and compile a complete brochure of equipment furnished and installed on this project. Include operational and maintenance instructions, manufacturer's catalog sheets, wiring diagrams, parts lists, approved submittals and shop drawings, warranties, and descriptive literature as furnished by the equipment manufacturer. Include an inside cover sheet that lists the project name, date, Owner, Architect, Engineer, General Contractor, Sub-Contractor, and an index of contents.

Submit three copies of literature bound in approved binders with index and tabs separating equipment types to the Architect, for Engineer's review, at the termination of the work. Paper clips, staples, rubber bands, loose-leaf binding, and mailing envelopes are not considered approved binders. Final approval of systems installed under this contract shall be withheld until this equipment brochure is received and deemed complete by the Architect and Engineer. Instruct workmen to save required literature shipped with the equipment itself for inclusion in this brochure.

Literature shall contain the following items:

1. Identification clearly visible on or through the cover, the name of the project, and description "Fire Sprinkler System Manual".
2. Neatly typed index at front with all emergency information clearly identified.
3. Complete list of all system components with manufacturer's names, catalog numbers, and all data for ordering parts.
4. One copy of the record drawings as described above.
5. All information required to secure emergency repairs or service.
6. Test reports and certificates including "Contractor's Material and Test Certificate(s) for Underground Piping" and "Contractor's Material and Test Certificate(s) for Above Ground Piping" as described in NFPA 13.

Refer to Division 01 for acceptance of electronic manuals for this project. For electronic manuals, refer to paragraph "Submittals" for requirements.

K. WARRANTIES

Warrant each system and each element thereof against all defects due to faulty workmanship, design, or material for a period of 12 months from date of Substantial Completion, unless specific items are noted to carry a longer warranty in the construction documents or manufacturer's standard warranty exceeds 12 months. Remedy all defects, occurring within the warranty period(s), as stated in the General Conditions and Division 01.

Warranties shall include labor and material, including travel expenses. Make repairs or replacements without any additional costs to the Owner, and to the satisfaction of the Owner, Architect, and Engineer.

Perform the remedial work promptly, upon written notice from the Engineer or Owner.

At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period, each warranty instrument being addressed to the Owner and stating the commencement date and term.

L. SCOPE

Provide a wet-pipe and dry-pipe, automatic fire sprinkler system for the building as shown on the drawings. Contractor shall be approved and state licensed for design and installation of fire protection systems. The work done under this section shall be performed only by a Contractor whose workmen are experienced and regularly engaged in the installation of fire protection systems. Contractor shall be capable of preparing hydraulic calculations and system layouts.

Provide all fire sprinkler alarm devices including waterflow alarm and valve tamper switches for all system control valves. Provide a notification appliance acceptable to the AHJ on the exterior of the building at 8'-0" above finished grade, adjacent to the fire department connection. Coordinate all wiring and conduit for a complete and functional installation.

System shall, at a minimum, be in accordance with the latest edition of NFPA 13, 24, Underwriters Laboratories (UL), and must be acceptable to the Owner's Insurer, the AHJ, and all applicable local, state and national codes and standards. Where the contract documents exceed the requirements of the referenced codes, standards, etc., the contract documents shall take precedence.

Work shall include, but shall not necessarily be limited to the following:

1. All underground piping (which pertains to the fire sprinkler system) as indicated on the drawings, including all required pipe, valves, etc., as well as the required preparatory and finishing work such as trenching, backfilling, and pavement replacement. Provide thrust blocks, supervised post indicating valve, and valve pit as required or shown on drawings.

2. Connection to city main shall be a wet tap and shall include all required fittings, valves, meter vaults, backflow preventers, backflow preventer vault, etc. Provide backflow prevention equipment as required by local codes.

3. Design and installation of a complete wet-pipe and dry-pipe, automatic fire sprinkler system for the area of work shown on the drawings or specified herein.

4. Portions of systems subject to freezing or temperatures below 40 degrees F shall be protected against freezing as required by NFPA 13. The Contractor shall be responsible for repairs and all costs incurred from damage caused by freezing of the fire protection system.

5. Dry Pipe Sprinkler System for Breezeway: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open a dry pipe valve. Water then flows into piping and discharges from sprinklers that are open.

M. SYSTEM DESIGN

Contractor shall verify design criteria and rating hazards with the Owner's Insurer prior to designing the system. Waterflow and pressure test data shall be acquired before system is calculated and be dated not more than 12 months prior to the submittal of sprinkler shop drawings. Arrangements for and cost of flow tests shall be the responsibility of the Contractor.

Submit hydraulic calculations and plan, including a supply and demand graph; all hydraulic reference points and area of application shall appear on the plan. Contractor shall verify with AHJ any minimum safety factor requirements. Demand shall not be less than 10 percent below the supply at the demand point.

Protect entire building with a wet-type sprinkler system designed in accordance with NFPA 13 unless noted otherwise. Design system for Ordinary Hazard Group 2, 0.20 gpm/SF over the hydraulically remote 1500 SF area. Include minimum 250 gpm hose allowance added at the base of riser.

Protect mechanical and electrical areas/rooms with a wet-type sprinkler system designed in accordance with NFPA 13. Design system for Ordinary Hazard Group 1, 0.15 gpm/SF over the hydraulically remote 1500 SF area or entire area, whichever is smaller. Include minimum 250 gpm hose allowance added at the base of riser.

Protect breezeway with a dry-type sprinkler system designed in accordance with NFPA 13 unless noted otherwise. Design system for Light Hazard, 0.10 gpm/SF over the hydraulically remote 1500 SF area. Include minimum 100 gpm hose allowance added at the base of riser.

The Contractor shall be fully responsible for the hydraulic calculations, the final system design, and the layout of all components of the system as required for approval by the Owner's Insurer and the AHJ.

The Contractor shall be fully responsible for coordinating system layout with other contractors. Changes to system design due to lack of coordination shall be paid for by the Contractor.

Designs requiring cutting of structural members for passage of sprinkler pipes or hangers shall not be accepted. When design appearance or similar aspects require cutting due to economy, it shall be held to an absolute minimum and done only with the Architect and Structural Engineer's written approval. Any excessive requirements of this type shall be identified during the bid period.

Sprinkler spacing shall conform to NFPA 13. Extended coverage sprinklers shall not be used in unfinished (shell) spaces.

The hydraulic area of operation may not be reduced as allowed by NFPA 13 for areas utilizing quick response sprinklers in unfinished shell spaces. For all other areas, the hydraulic area of operation shall not be reduced as allowed by NFPA 13 for areas utilizing quick response sprinklers unless specifically approved by the Engineer via a formally submitted RFI.

2. MATERIALS AND INSTALLATION

A. PRODUCTS

All fire protection system components shall be Underwriter's Laboratories listed for their intended use.

B. PIPING AND COMPONENTS

Underground piping shall be cement lined ductile iron or other approved or listed material, installed in accordance with NFPA and FM standards; fire main shall include all required fittings and valves.

Sprinkler piping 2-1/2" and larger shall be Schedule 10 or Schedule 40 black steel. Threaded sprinkler piping 2" and smaller shall be Schedule 40 black steel. Roll-grooved sprinkler piping 2" and smaller shall be Schedule 10 or Schedule 40 black steel. Pipes shall have welded, threaded, or mechanically joined fittings, based on the pipe material and size per NFPA 13 requirements.

Acceptable alternatives to Schedule 10 and Schedule 40 pipe shall be manufactured to standards recognized by NFPA 13. Pipe shall have a corrosion resistance rating of 1.0 or greater. Crimp-type couplings are not permitted. Threadable thinwall pipe with corrosion resistance rating less than 1.0 is not permitted.

All piping on the exterior of the building and/or exposed to the elements shall be externally galvanized.

Dry-Pipe Valves: Standard: UL 260.
Design: Differential-pressure type.
Include UL 1486, quick-opening devices, trim sets for bypass, air supply, drain, priming level, alarm connections, ball drip valves, pressure gauges, drip cup assembly piped with check valve to main drain piping, priming chamber attachment, and fill-line attachment with strainer.

Air-Pressure Maintenance Device:
Type: Automatic device to maintain minimum air pressure in piping.
Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig outlet pressure.

Air Compressor:
Type: Oil-less, air-cooled
Standard: UL's "Fire Protection Equipment Directory" listing.
Motor Horsepower: Fractional.

C. SPRINKLERS

Sprinklers in areas with gypsum board ceilings shall be one of the following:
1. White–plated, recessed type with white escutcheons.

Sprinklers in areas with suspended acoustical ceilings shall be one of the following:
1. White–plated, recessed type with white escutcheons.

Sprinklers in areas with exposed piping may be pendent or upright types with rough brass finish.

Provide quick response sprinklers in all light hazard areas.

Coordinate sprinkler temperature rating near heat-producing sources in accordance with NFPA 13.

D. SERVICE ENTRANCE

Locate fire protection service entrance where indicated on the drawings. Equip the service with a UL listed backflow preventer assembly as required by the AHJ. Service entrance assembly shall include approved outside screw and yoke (OS&Y) valves with tamper switches.

Equip sprinkler system riser with an approved indicating control valve with tamper switch, waterflow alarm switch, notification appliance, check valve, system drain terminating outdoors, gauges, and fire department connection with check valve. Each riser shall meet NFPA 13 standards and requirements for acceptable valve arrangements. Separate control valve and check valve may be omitted if backflow preventer is located at the service entrance and building is protected with a single riser.

Provide a printed sheet giving brief instructions regarding control, emergency procedure and other data as required by NFPA next to the sprinkler riser. Protect sheet with glass or a transparent plastic cover. Permanently attach a placard indicating the location and basis of design (discharge density and system demand) to the riser for hydraulically designed systems.

Provide all control valve supervisory switches, waterflow alarm switches, and sprinkler system equipment panels requiring interconnection to the fire alarm system. Provide a line seizure type automatic dialer (Ademco or equal) and related telephone wiring for remote monitoring of fire sprinkler alarm devices and operation of the notification appliance.

Provide Storz fire department connection, UL listed, 4" with rough brass connection and drain, located where indicated on Drawings. Fire department connection shall be complete with 30 degree elbow and hose inlet cap with chain. Provide check valve sized per NFPA 13 with 3/4 inch ball drip drain piped to the exterior of the building. Fire department connection shall be permanently labeled "AUTOMATIC SPRINKLER FIRE DEPARTMENT CONNECTION".

Provide a cabinet containing spare sprinklers and appropriate wrench(es) per NFPA 13 at the fire sprinkler system service entrance area.

3. EXECUTION

A. PIPING AND FINISHES

Excavation, trenching and backfilling shall be in accordance with requirements of the excavation and backfill section of the plumbing specifications.

Conceal piping in areas having ceilings, other than the underside of the roof deck. Piping in areas without ceilings may be exposed but kept at a minimum distance from the deck. All piping shall be clean and free of rust. Install system such that all piping is rigidly secured and supported. All ductwork, lights, structural members and main runs of piping shall take precedence over sprinkler piping. Cutting of structural members for passage of sprinkler pipes or hangers shall not be permitted. All horizontal piping in ceiling space shall be at an elevation above the top of light fixtures and air outlets to allow for access to light fixtures and air outlets without removing horizontal piping. Route all sprinkler piping and provide all offsets, bends, and elbows around all mechanical, electrical, and structural members as required.

Where exposed piping passes through finish work, install chrome plated (or other finish acceptable to the architect) split wall plates or escutcheons to fit snugly around the piping. Provide at each penetration to assure effectiveness of construction as a fire stop where piping is concealed or installed in unfinished areas.

All openings for piping shall be anticipated and indicated on the approved shop drawings. Any additional cutting of openings must have the written approval of the Architect.

Route piping parallel to major building lines.

Coordinate pipe routing near electrical equipment in accordance with NFPA 70.

Do not connect more than one sprinkler to a one inch outlet unless hydraulic calculations are included to verify performance.

Installation shall allow for suitable drainage of system to meet with the approval of the AHJ. Provide access panels as required. All drain locations requiring access panels shall be approved by the Architect prior to installation.

Sprinklers in suspended ceilings shall be not less than 6-inches from the grid in all directions.

B. PENETRATIONS

Seal all fire protection floor, wall and roof penetrations watertight and weathertight. Caulk around fire protection penetrations with 3M CP-25, or approved equal fire barrier caulk (thickness as required and recommended by manufacturer) to maintain fire resistance rating of fire-rated assemblies.

C. TESTING AND ACCEPTANCE

Complete the automatic fire sprinkler system, as soon as possible, when building construction allows. Following system installation, Place the system in service. After the system has been placed in service for continuous use, water charges, if any, will be paid by Owner.

Upon completion of the systems installation, and prior to acceptance by the Engineer and Owner, the Contractor shall make general operating tests to demonstrate that all equipment and systems are in proper working order, and are functioning in conformance with the intent of the drawings and specifications.

Prior to connecting to the overhead sprinkler piping, the underground main shall be thoroughly flushed and tested in accordance with NFPA 24. Secure all required approvals and written documentation of the flushing operation. Test above ground piping in accordance with NFPA 13. Hydrostatically test all sprinkler piping at a minimum pressure of 200 psi for a minimum 2-hour period of time. Correct any faulty or leaking joints and pipe. The use of any substance or material added to the water to correct leaks shall not be permitted. Caulking of defective joints, cracks or holes shall not be permitted. Repeat tests after defects have been eliminated. Perform all tests in the presence of the AHJ and/or the Owner's authorized representative.

Upon completion of each phase of the installation, test each system in conformance with local code requirements. Furnish all labor and equipment required to properly test all sprinkler equipment installed under this contract. Assume all costs involved in making the tests and repair and/or replace all damage resulting therefrom.

Notify the Architect and the AHJ three (3) working days prior to making sprinkler system tests. Concealed work shall remain uncovered until the required tests are complete. Portions of the work may be concealed if approved by the AHJ or if necessary due to construction procedure.

A. INSTRUCTIONS

After completion of all installation, tests, etc., and prior to the final acceptance date, instruct the building Owner and his selected personnel in the operation of the sprinkler system. Include in the training the procedure to conduct quarterly main drain tests as required by NFPA 25. Special care shall be taken to make sure the building personnel will immediately recognize whether the main valve is in an open position, know how to drain the system, and know how to test the system. The building personnel shall also be made familiar with the existence and contents of the System Manual described in the Operation and Maintenance section of this specification.

END OF SECTION 21

CHRISTOPHER J. CULP

PARAGON STAR

PARAGON STAR - LOT 9 - BUILDING 2

PARAGON STAR
FIRST PLAT, LOT 9
LEE'S SUMMIT, MO

Project No.: 1850004412
Date: 10.25.19
Issued For: SHELL - CD SET

REVISIONS

No.	Date	Description

REGISTRATION

STATE OF MISSOURI
CHRISTOPHER J. CULP
NUMBER PE-2013037646
PROFESSIONAL ENGINEER

Oct 24 2019
CHRISTOPHER J. CULP
LICENSE # PE-2013037646

PROJECT TEAM

ARCHITECT	FINKLE+WILLIAMS ARCHITECTURE
CIVIL	GBA
LANDSCAPE	HOERR SCHAUDT / LAND3
FOUNDATIONS	BSE STRUCTURAL ENGINEERS
STRUCTURAL	BSE STRUCTURAL ENGINEERS
PLUMBING	HENDERSON ENGINEERS
MECHANICAL	HENDERSON ENGINEERS
ELECTRICAL	HENDERSON ENGINEERS
FIRE PROTECTION	HENDERSON ENGINEERS
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EXPIRES 12/31/2020

SHEET TITLE

FIRE SPRINKLER SPECIFICATIONS

SHEET NUMBER

FS701