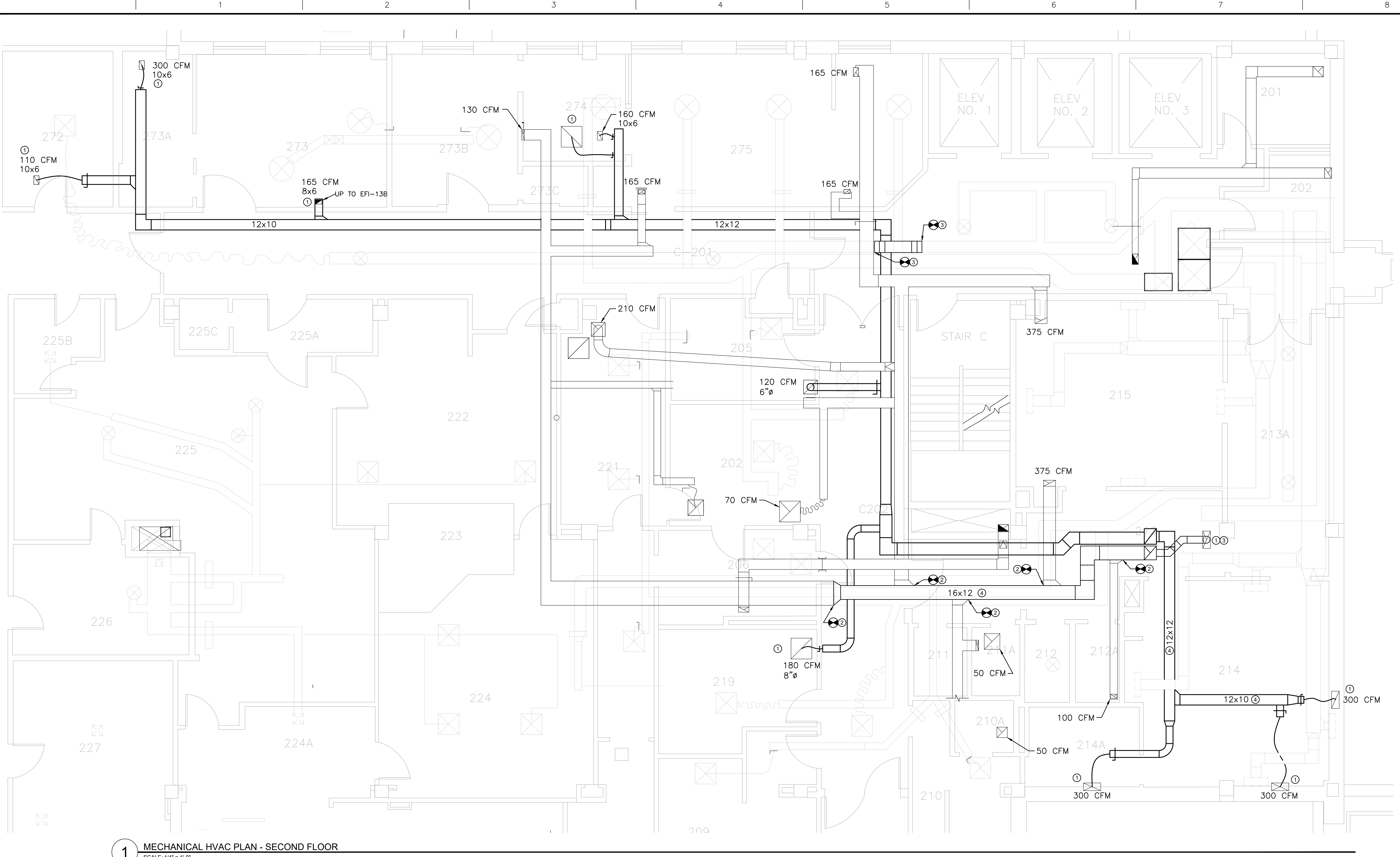


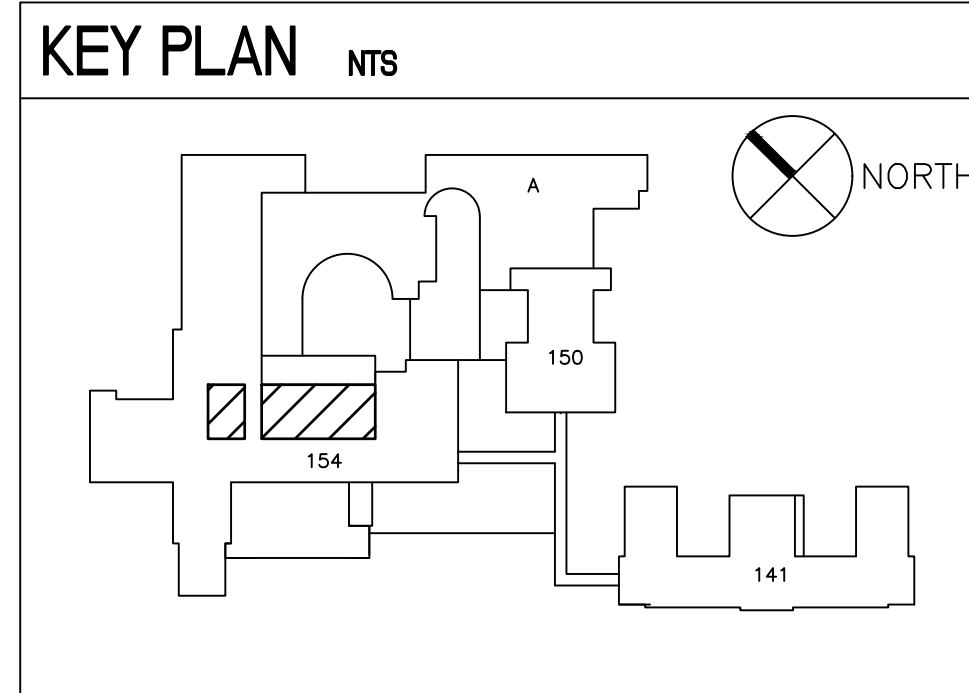
three inches = one foot  
 one and one half inches = one foot  
 one inch = one foot  
 one inch = one foot  
 three quarters inch = one foot  
 one half inch = one foot  
 one half inch = one foot  
 three eighths inch = one foot  
 one quarter inch = one foot  
 one quarter inch = one foot  
 one eighth inch = one foot  
 one eighth inch = one foot



**1 MECHANICAL HVAC PLAN - SECOND FLOOR**  
 SCALE: 1/4" = 1'-0"

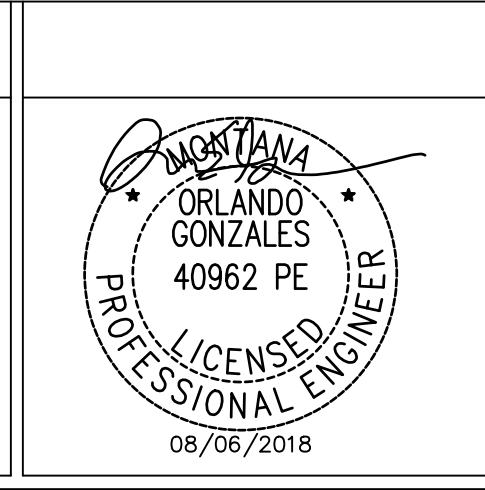
- ### GENERAL NOTES
- LIGHTING AND SPRINKLER HEADS TAKE PRECEDENCE OVER DIFFUSER LOCATION. CONTRACTOR SHALL MAKE NECESSARY ADJUSTMENT TO DIFFUSERS TO AVOID ANY CONFLICT WITH LIGHTING LAYOUT AND SPRINKLER HEADS.
  - THERMOSTATS SHALL BE MOUNTED PER ADA REQUIREMENTS. MAXIMUM HEIGHT FOR FRONT ACCESS SHALL BE 48" AFF. DO NOT MOUNT ABOVE FIXED COUNTER UNLESS KNEE HOLE ACCESS IS PROVIDED.
  - CONTRACTOR SHALL COORDINATE ALL FINAL THERMOSTAT LOCATIONS WITH OWNER AND ARCHITECT PRIOR TO MOUNTING.
  - THE CONTRACTOR SHALL DO ALL NECESSARY CUTTING OF WALL AND CEILINGS.
  - NO STRUCTURAL MEMBER SHALL BE CUT WITHOUT PERMISSION FROM THE ENGINEER.
  - OPENINGS IN FLOORS, WALLS, CEILINGS, ROOFS, ETC. AS A RESULT OF REMOVED PIPING, DUCTWORK, FLUES, EQUIPMENT, FIXTURES, ETC SHALL BE PATCHED TO MATCH EXISTING BUILDING CONSTRUCTION. WORK SHALL BE PERFORMED BY CRAFTSMEN SKILLED IN THEIR RESPECTIVE TRADES.
  - DUCTWORK CONSTRUCTION AND INSTALLATION INCLUDING SHEET METAL GAUGES, REINFORCEMENT, JOINT SEALING, AIR LEAKAGE, AND DETAILS NOT SPECIFICALLY SHOWN ON DRAWINGS SHALL BE IN ACCORDANCE WITH CURRENT IMC & VA DUCT CONSTRUCTION STANDARDS.
  - CONTRACTOR SHALL PROVIDE COORDINATION FOR DUCTWORK ROUTE DRAWINGS. THIS MUST BE APPROVED BY ENGINEER PRIOR TO CONSTRUCTION.
  - ALONG WITH PHASING, THE CONTRACTORS SHALL BE PREPARED TO PROVIDE TEMPORARY HVAC FOR AREAS AFFECTED BY SCOPE OF WORK.
  - REFER TO SHEET G-001 FOR INFECTION CONTROL MEASURES.

- ### KEY NOTES
- CONNECT EXISTING DIFFUSER TO NEW DUCTWORK. VERIFY LOCATION AND SIZE OF EXISTING DIFFUSER IN FIELD. PROVIDE ANY TRANSITIONS AS REQUIRED.
  - CONNECT EXISTING EXHAUST DUCT TO NEW EXHAUST DUCTWORK. VERIFY SIZE OF EXISTING EXHAUST DUCT IN FIELD. PROVIDE ANY NECESSARY TRANSITIONS.
  - PROVIDE NEW SUPPLY AIR DUCT. CONNECT TO EXISTING DUCT & MATCH EXISTING SIZE. ALSO MATCH EXISTING ELEVATION OF ADJACENT DUCT. PROVIDE VERTICAL TRANSITIONS AS REQUIRED.
  - COORDINATE INSTALLATION OF NEW DUCTWORK WITH EXISTING MEDICAL GAS PIPING.



Revisions	Date

**CONSULTANTS:**



**ARCHITECT/ENGINEERS:**

**AESUS** Architecture, Engineering, and Sustainable Design  
 designgroup  
 1000 E. Southern Ave, Suite #C, Tempe, Arizona 85282, (480) 454-2861

Drawing Title  
**MECHANICAL HVAC PLAN SECOND FLOOR**

VAPAHCS PLANNING AND ENGINEERING

Project Title  
**REPLACE PENTHOUSE HVAC SYSTEMS**  
 CONTRACT NO. VA259-17-C-0212

Location  
**FT. HARRISON HELENA, MT**

Date 07/21/17  
 Checked OG  
 Drawn CR

Project Number  
**436-17-102**

Building Number  
**154**

Drawing Number  
**MH102**

Office of Construction and Facilities Management  
 Department of Veterans Affairs







one eighth inch = one foot  
 one quarter inch = one foot  
 three eighths inch = one foot  
 one half inch = one foot  
 three quarters inch = one foot  
 one inch = one foot  
 one and one half inches = one foot  
 one and one half inches = one foot  
 three inches = one foot  
 six inches = one foot

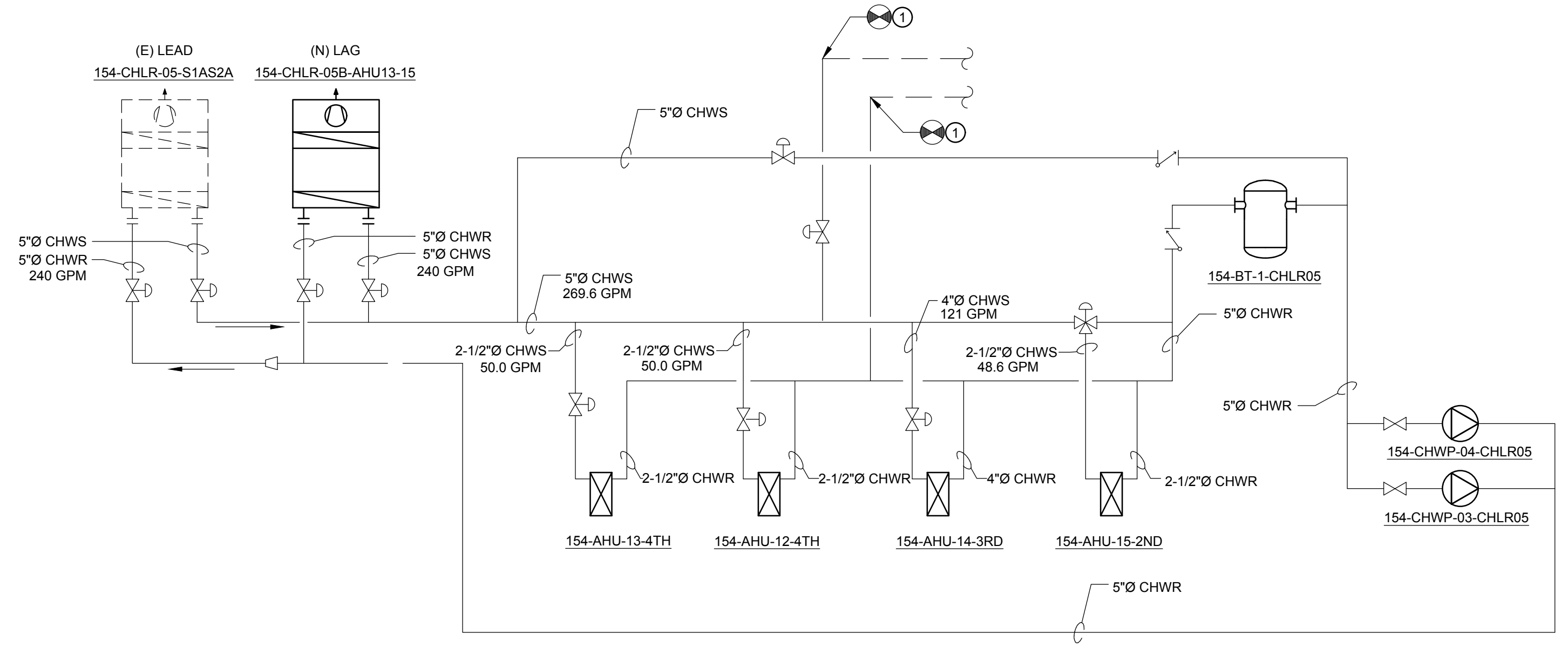
MATCHLINE  
 REFER TO SHEET MP101

### GENERAL NOTES

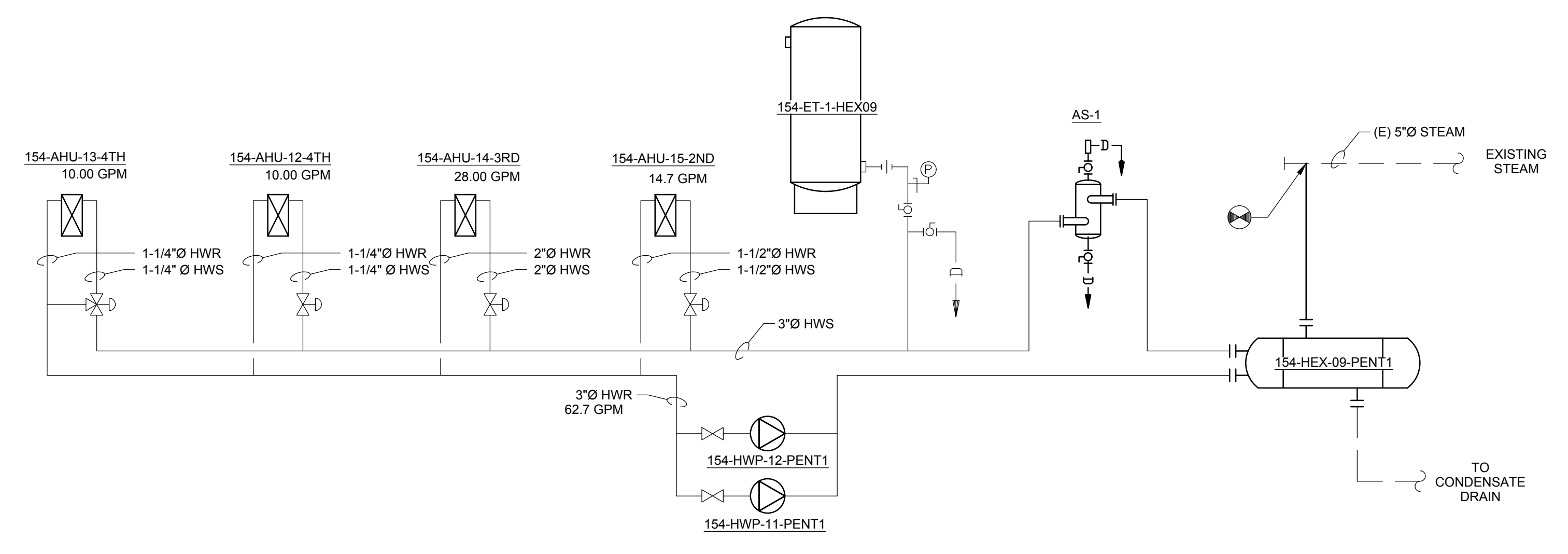
- CONTRACTOR SHALL VERIFY THAT PIPING IS MOUNTED BELOW DUCTWORK, BUT AS HIGH AS POSSIBLE FOR ACCESSIBILITY.
- THE CONTRACTOR SHALL DO ALL NECESSARY CUTTING OF WALL AND CEILINGS.
- NO STRUCTURAL MEMBER SHALL BE CUT WITHOUT PERMISSION FROM THE ENGINEER.
- OPENINGS IN FLOORS, WALLS, CEILINGS, ROOFS, ETC. AS A RESULT OF REMOVED PIPING, DUCTWORK, FLUES, EQUIPMENT, FIXTURES, ETC SHALL BE PATCHED TO MATCH EXISTING BUILDING CONSTRUCTION. WORK SHALL BE PERFORMED BY CRAFTSMEN SKILLED IN THEIR RESPECTIVE TRADES.
- ALL ITEMS THAT REQUIRE ACCESS, SUCH AS FOR OPERATING, CLEANING, SERVICING, MAINTENANCE, AND CALIBRATION, SHALL BE EASILY AND SAFELY ACCESSIBLE BY PERSONS STANDING AT FLOOR LEVEL, OR STANDING ON PERMANENT PLATFORMS, WITHOUT THE USE OF PORTABLE LADDERS. EXAMPLES OF THESE ITEMS INCLUDE, BUT ARE NOT LIMITED TO, ALL TYPES OF VALVES, FILTERS AND STRAINERS, TRANSMITTERS, CONTROL DEVICES. PRIOR TO COMMENCING INSTALLATION WORK, REFER CONFLICTS BETWEEN THIS REQUIREMENT AND CONTRACT DOCUMENTS TO THE COR FOR RESOLUTION. FAILURE OF THE CONTRACTOR TO RESOLVE, OR POINT OUT ANY ISSUES WILL RESULT IN THE CONTRACTOR CORRECTING AT NO ADDITIONAL COST OR TIME TO THE GOVERNMENT.
- REFER TO SHEET G-001 FOR INFECTON CONTROL MEASURES.

### KEY NOTES

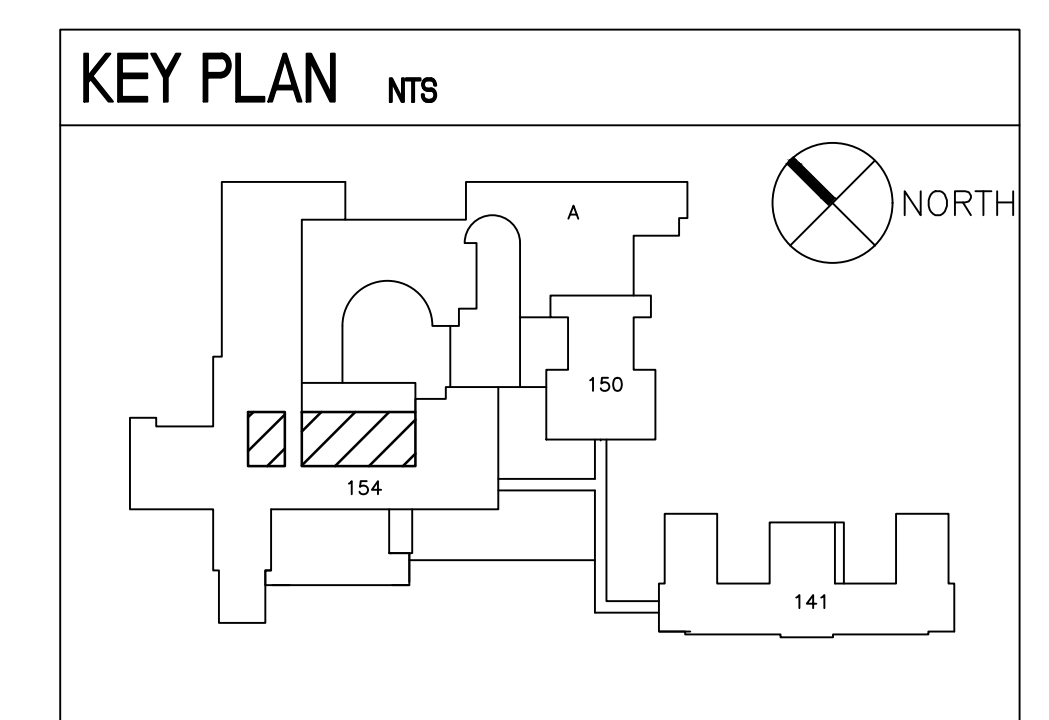
- 3" PIPING CONNECTED TO EXISTING CHILLED WATER SYSTEM A SECONDARY SYSTEM INSTALLED AS BACKUP SYSTEM.



**1** CHILLED WATER PIPING DIAGRAM  
 SCALE: NO SCALE

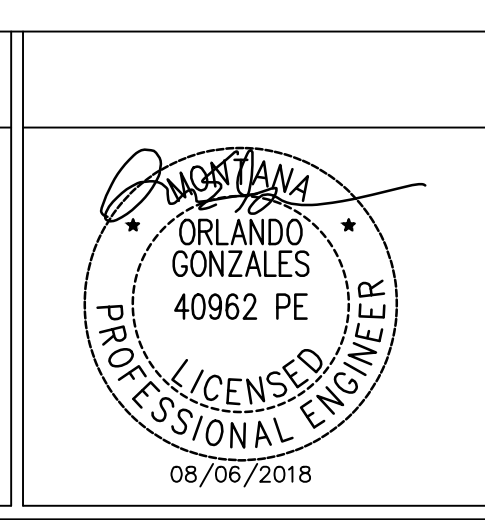


**2** HOT WATER PIPING DIAGRAM  
 SCALE: NO SCALE



Revisions	Date

CONSULTANTS:



ARCHITECT/ENGINEERS:  
**AESUS** Architecture, Engineering, and Sustainable Design  
 designgroup 1000 E. Southern Ave, Suite #D, Tempe, Arizona 85282, (480) 454-2801

Drawing Title  
**MECHANICAL PENTHOUSE PIPING PLAN**

Location  
 FT. HARRISON, HELENA, MT

Date  
 07/21/17

Checked  
 OG

Drawn  
 CR

VAPAHC'S PLANNING AND ENGINEERING

Project Title  
**REPLACE PENTHOUSE HVAC SYSTEMS**  
 CONTRACT NO. VA259-17-C-0212

Project Number  
 436-17-102

Building Number  
 154

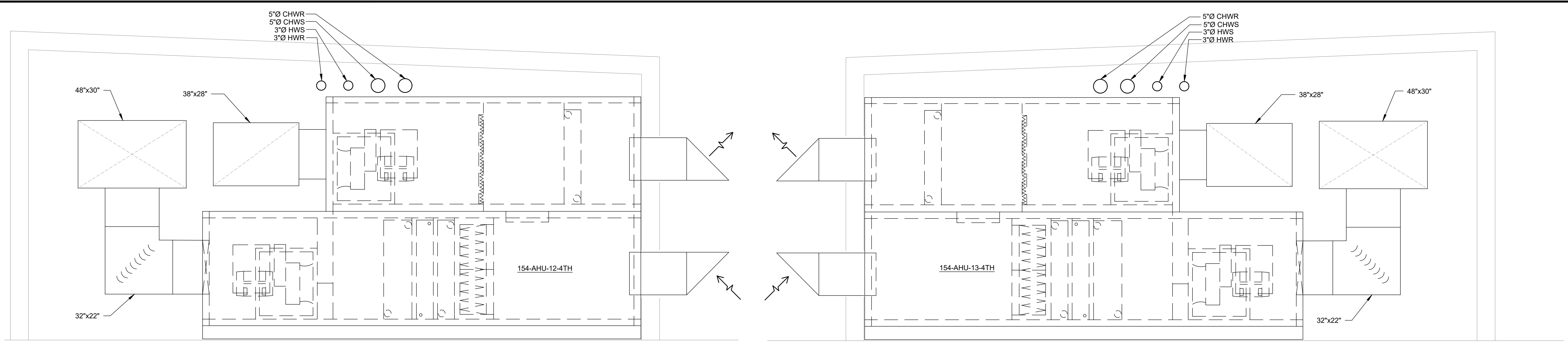
Drawing Number  
**MP200**

Office of Construction and Facilities Management  
 Department of Veterans Affairs



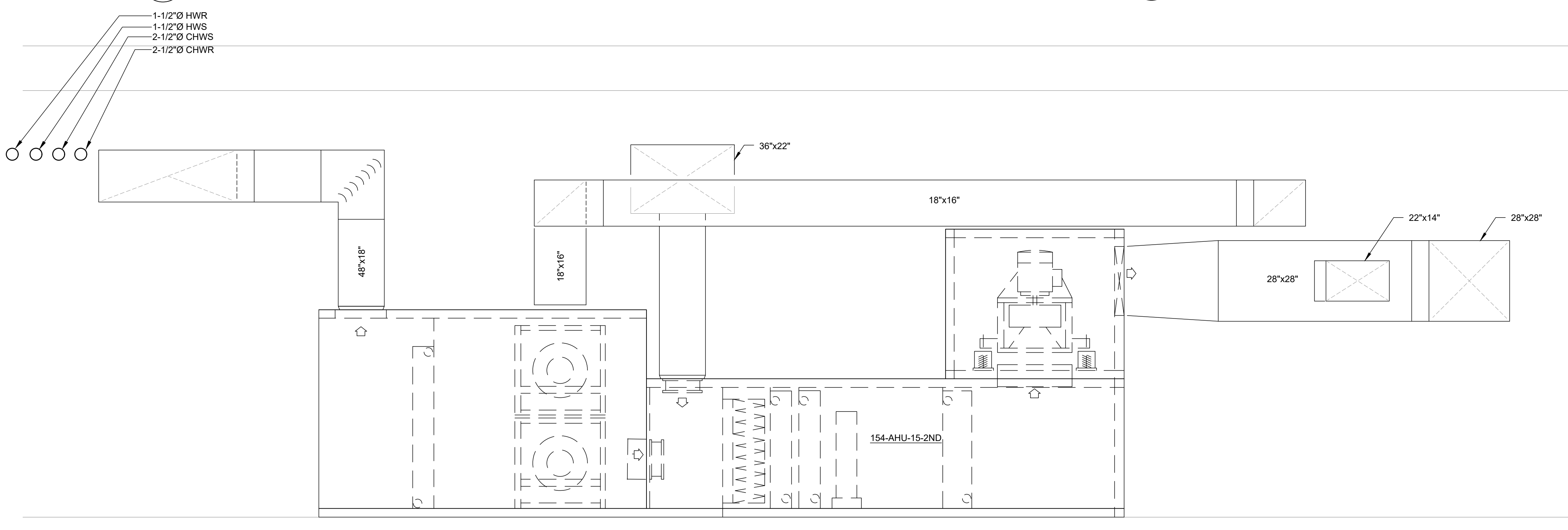
three inches = one foot  
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three eighths inch = one foot  
one quarter inch = one foot  
one eighth inch = one foot  
one eighth inch = one foot

A  
B  
C  
D  
E  
F

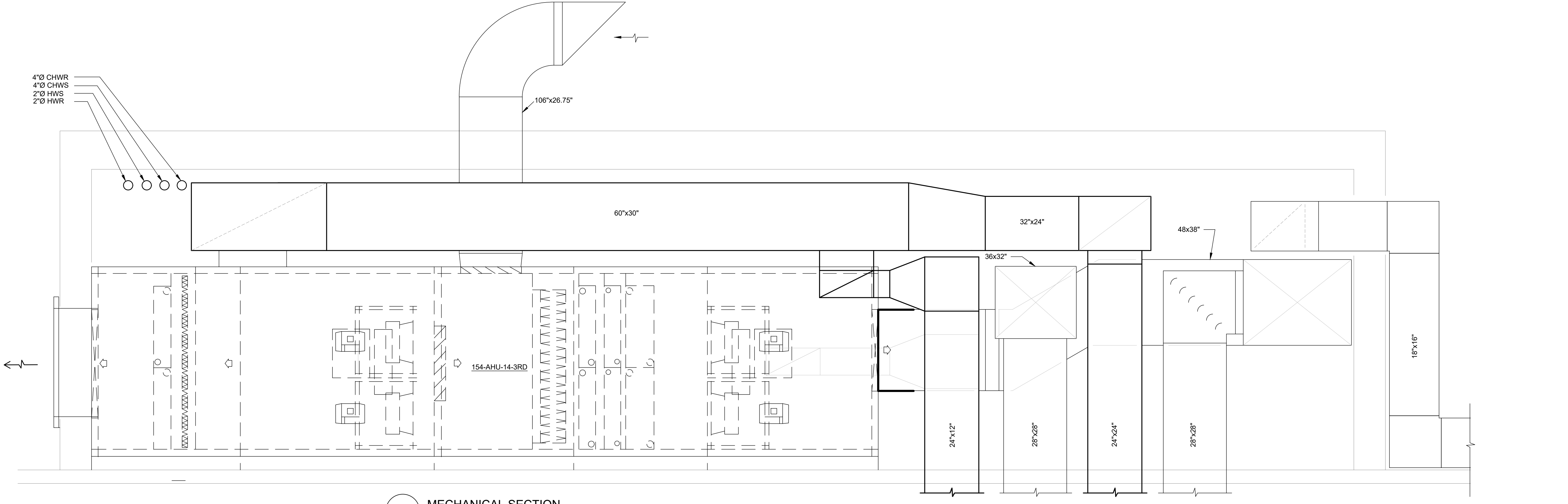


**1 MECHANICAL SECTION**  
SCALE: 1/2" = 1'-0"

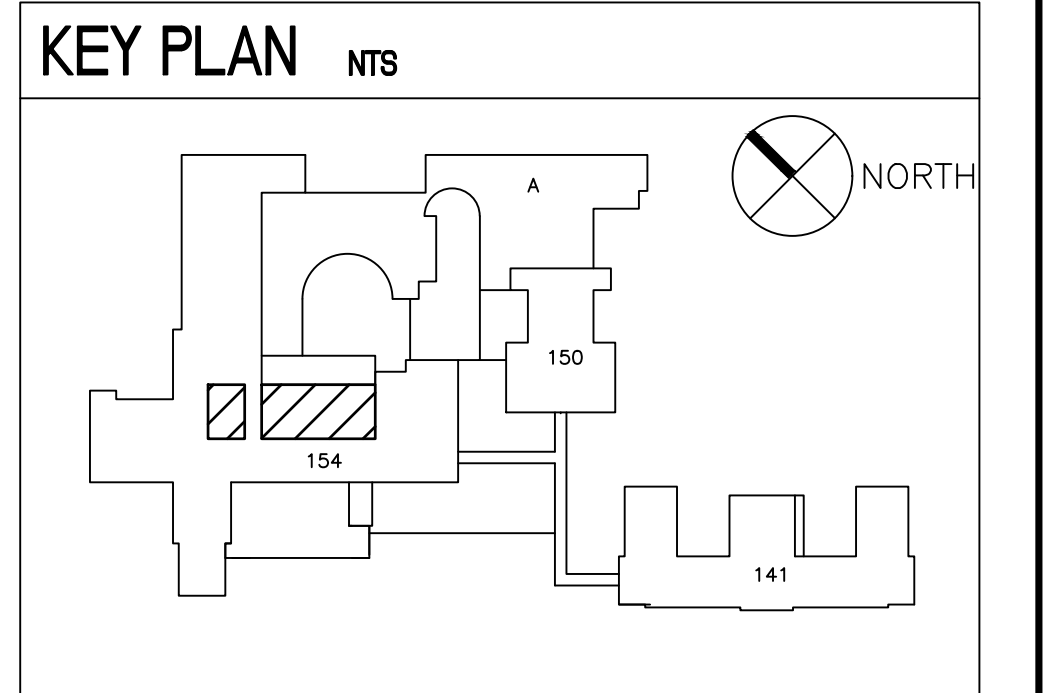
**2 MECHANICAL SECTION**  
SCALE: 1/2" = 1'-0"



**3 MECHANICAL SECTION**  
SCALE: 1/2" = 1'-0"

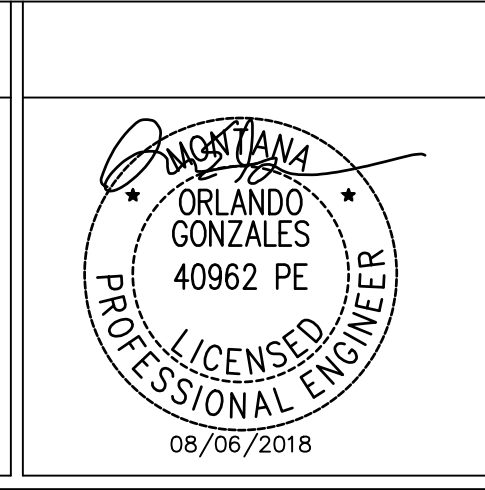


**4 MECHANICAL SECTION**  
SCALE: 1/2" = 1'-0"



Revisions	Date

**CONSULTANTS:**



**ARCHITECT/ENGINEERS:**

**AESUS** Architecture, Engineering, and Sustainable Design  
 designgroup 1050 E. Southern Ave, Suite #D, Tempe, Arizona 85282, (480) 454-2861

Drawing Title  
**MECHANICAL SECTIONS**

VAPAHS PLANNING AND ENGINEERING

Project Title  
**REPLACE PENTHOUSE HVAC SYSTEMS**  
 CONTRACT NO. VA259-17-C-0212

Project Number  
436-17-102

Building Number  
154

Drawing Number  
**M301**

Location  
FT. HARRISON HELENA, MT

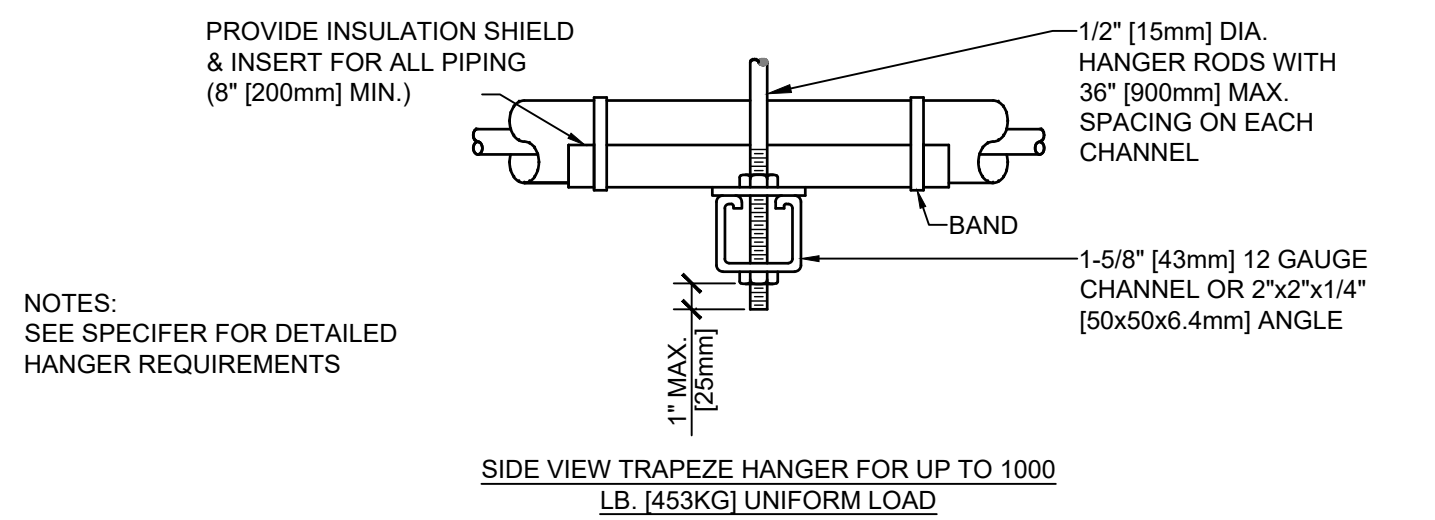
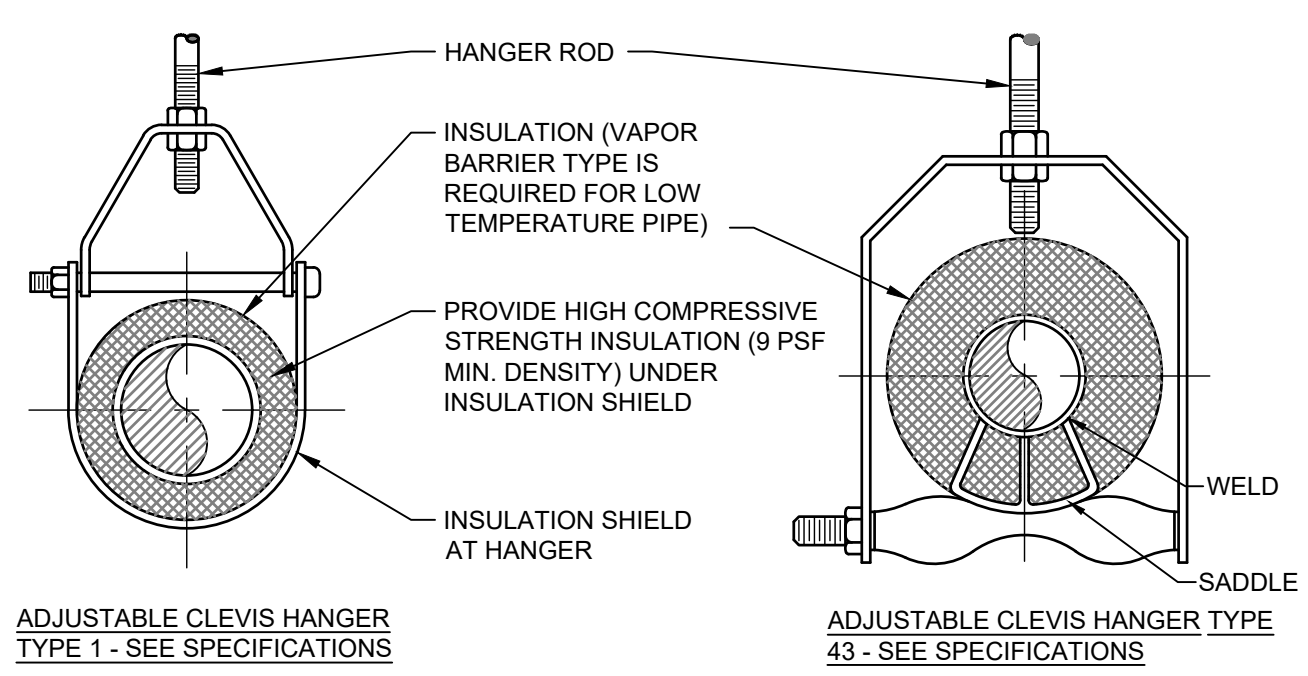
Date  
07/21/17

Checked  
OG

Drawn  
CR

**Office of Construction and Facilities Management**

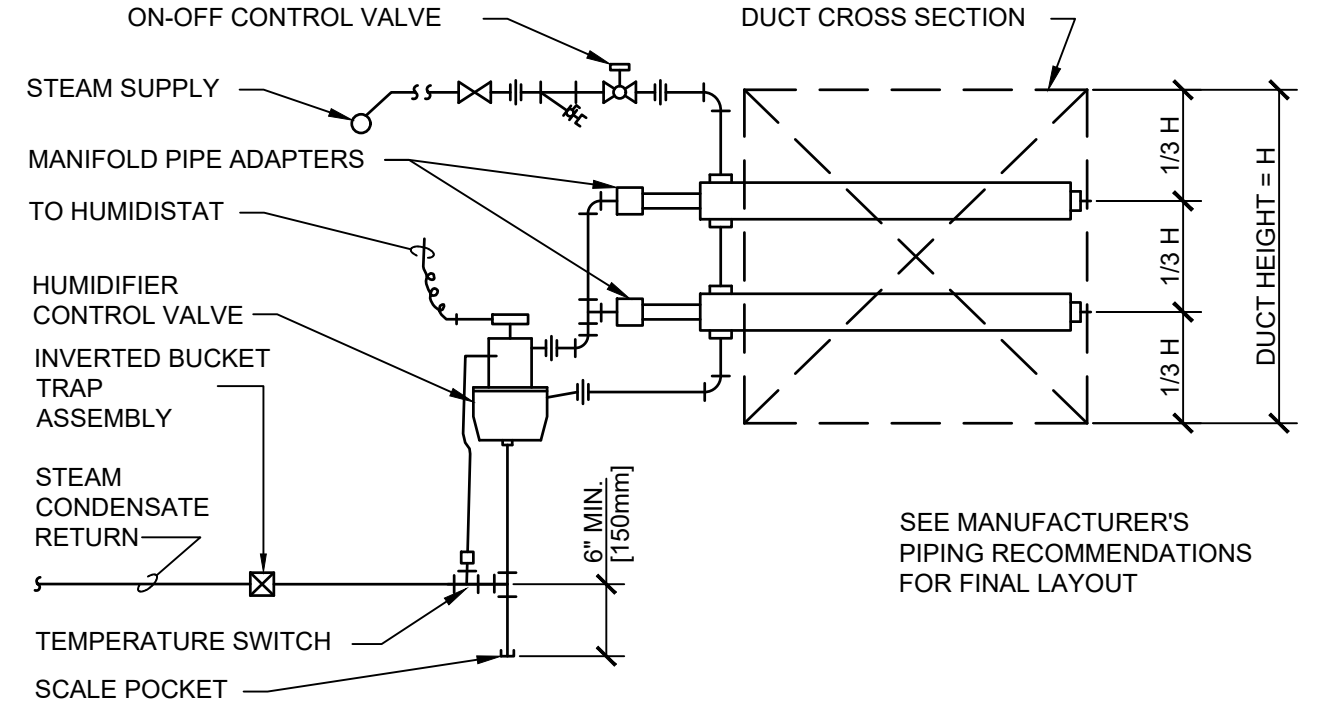
Department of Veterans Affairs



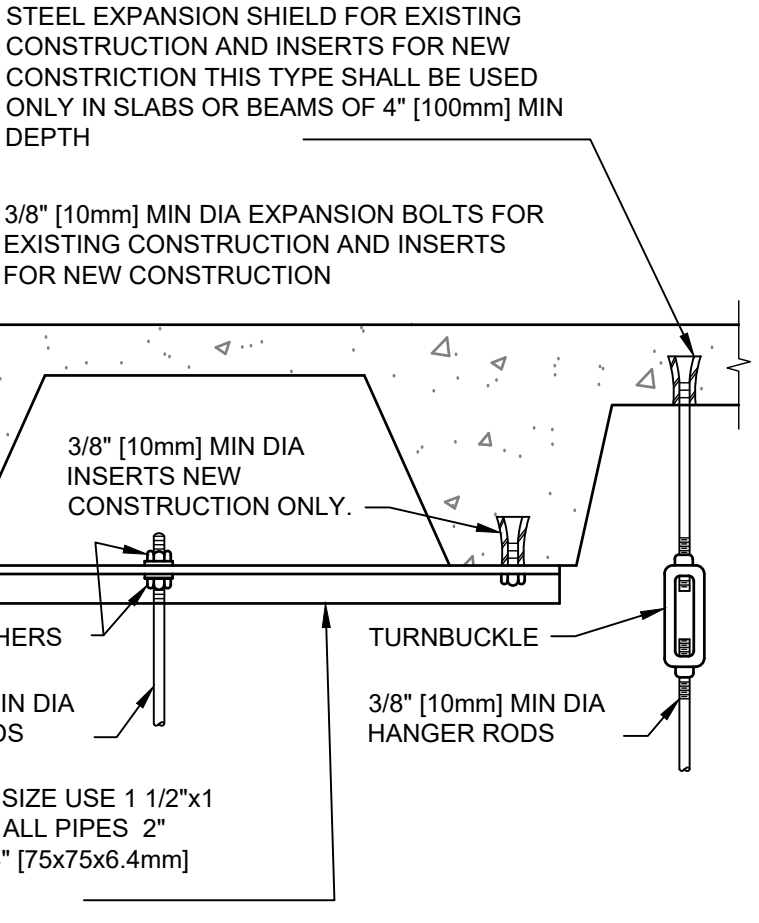
NOTES:  
SEE SPECIFIER FOR DETAILED  
HANGER REQUIREMENTS

Nominal Diameter Pipe (inches)	Recommended maximum space between Hangers (feet)				Recommended Rod Size (inches)	
	Water	Steam	Copper Tube		Copper	Stainless Steel
1/2	7	8	5		3/8	3/8
3/4	7	9	5		3/8	3/8
1	7	9	6		3/8	3/8
1-1/2	9	12	8		3/8	3/8
2	10	13	8		3/8	3/8
2-1/2	11	14	9		1/2	1/2
3	12	15	10		1/2	1/2
4	14	17	12		5/8	5/8
6	17	21	14		5/8	3/4
8	19	24	16		3/4	3/4
10	22	26	18		3/4	7/8
12	23	30	19		3/4	7/8
14	25	32				1
16	27	35				1
18	28	37				1-1/4
20	30	39				1-1/4
24	32	42				1-1/4

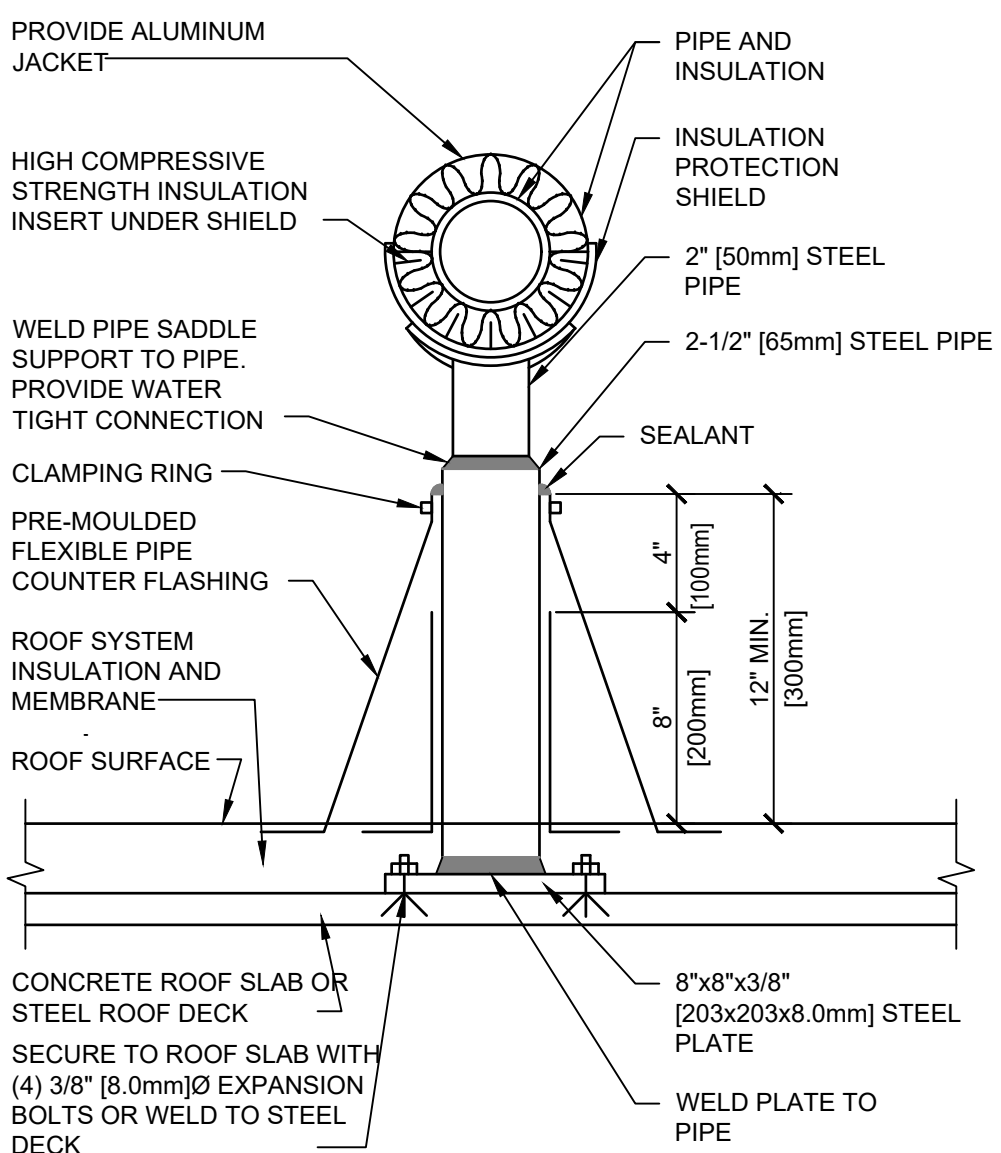
**1 PIPE HANGERS**



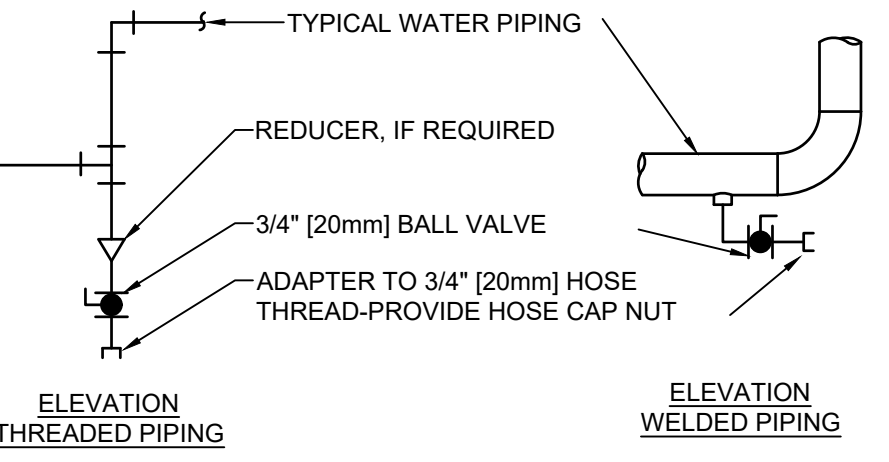
**5 STEAM HUMIDIFIER - PIPING CONNECTIONS (MULTIPLE DISPERSION TUBES)**



**9 SECURING HANGER RODS IN CONCRETE**

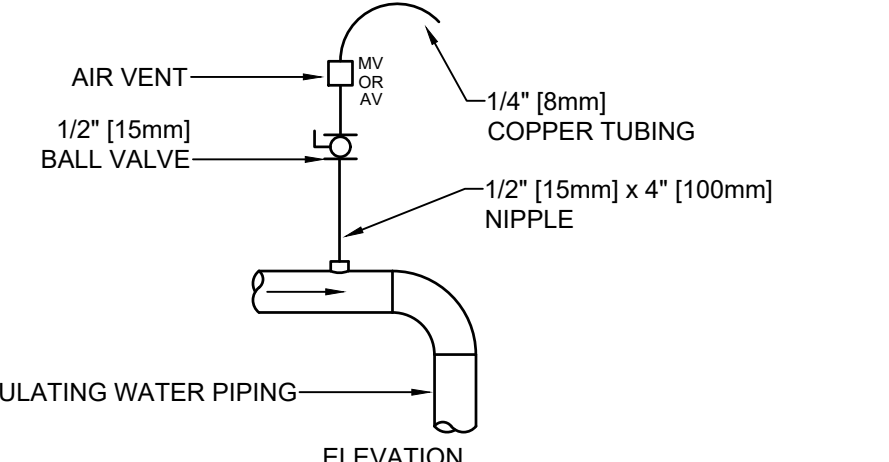


**2 DETAIL FOR SUPPORTING PIPE ON ROOF**



**TYPICAL CHILLED AND HOT WATER PIPING DRAIN VALVE CONNECTIONS**

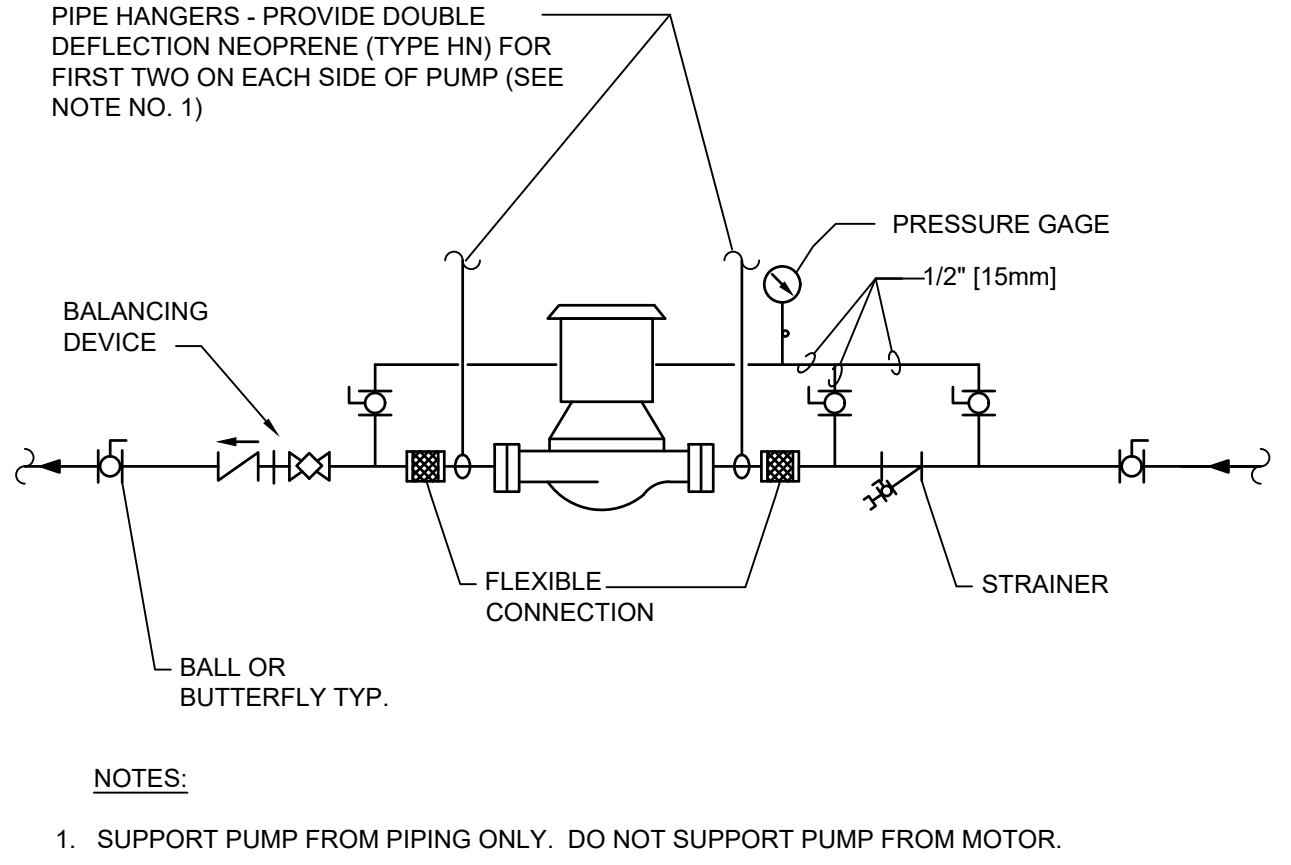
NOTES:  
1. DRAIN ALL LOW POINTS AS INDICATED ABOVE.  
2. WHERE SCALE POCKETS ARE SHOWN ON PIPE RISER DIAGRAMS AND/OR PLANS LOCATE DRAIN AT BOTTOM OF SCALE POCKET.



**TYPICAL MANUAL AIR VENT**

NOTES:  
1. VENT ALL HIGH POINTS INDICATED ABOVE.  
2. IF AUTOMATIC AIR VENTS ARE USED, PIPE DISCHARGE TO DRAIN.

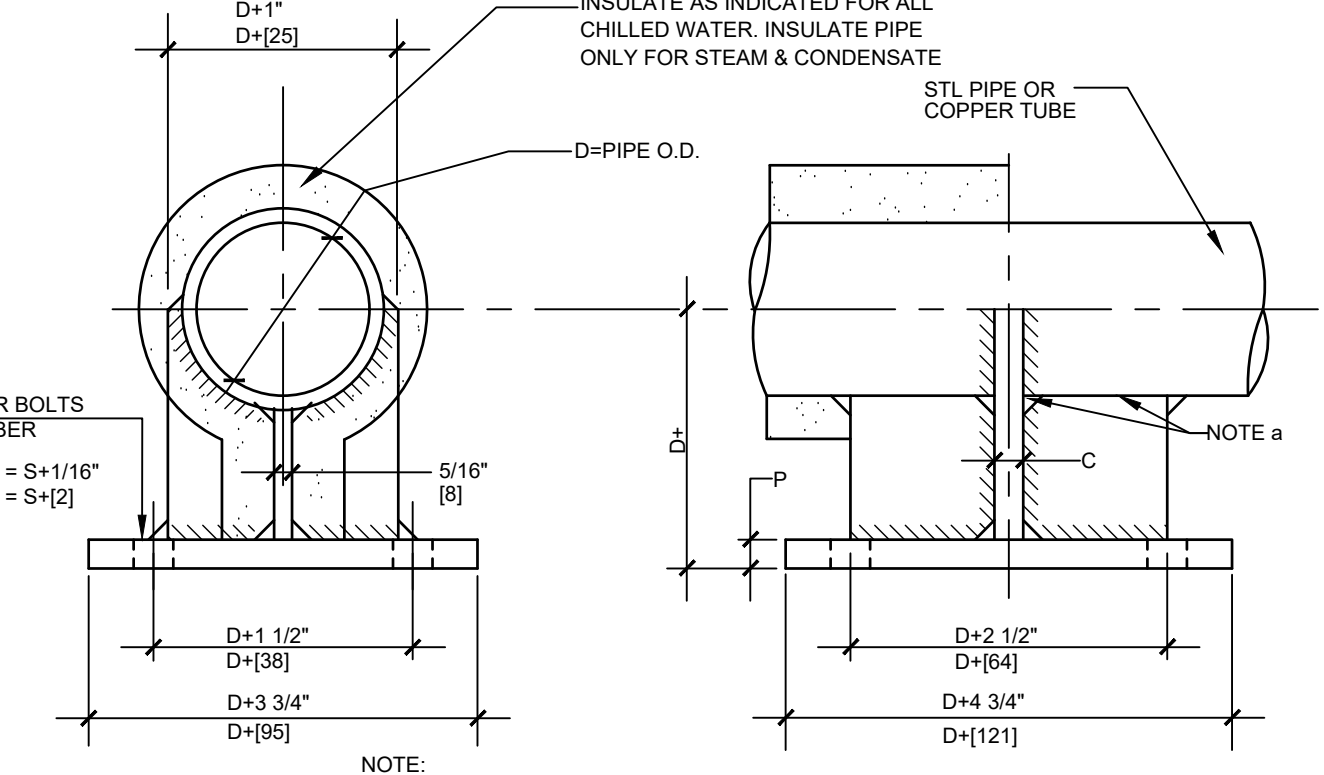
**6 DRAIN VALVE AND AIR VENT CONNECTIONS (HYDRONIC SYSTEMS)**



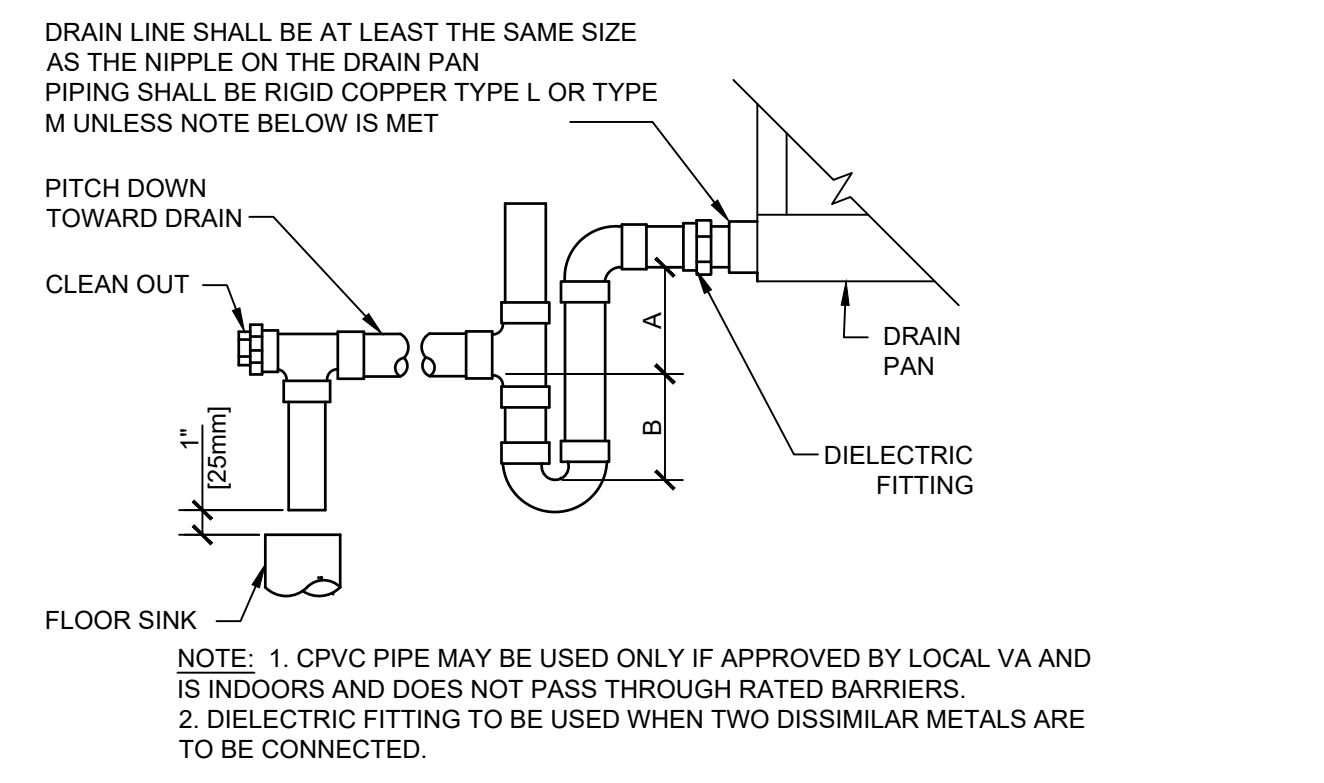
**10 IN-LINE PUMPS - CONNECTIONS**

**PIPE ANCHOR SCHEDULE**

D	P	CC	N	S	BOLT PATTERN
IN	MM	IN	MM	IN	MM
4"	102	16	19	4"	102
3"	76	13	13	4"	102
2 1/2"	64	10	10	4"	102
2"	51	10	10	4"	102
1 1/2"	38	10	6	4"	102



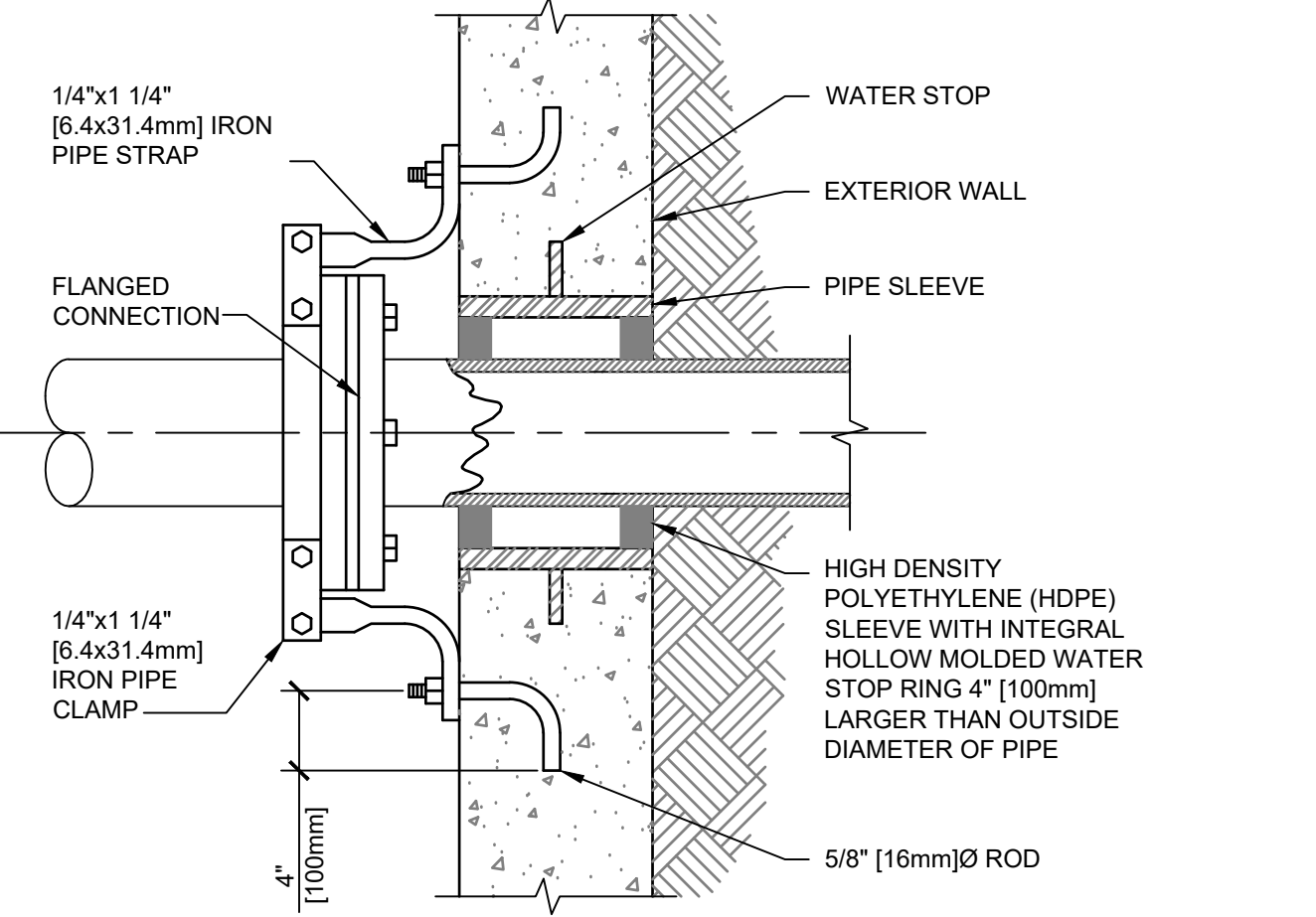
**3 SMALL PIPE ANCHOR 1 1/2" - 4"**



**7 AIR HANDLING UNIT DRAIN TRAP DETAIL**

UNIT TYPE	A	B
DRAW THRU	2" [50mm] PLUS X	X
BLOW THRU	1" [25mm] MINIMUM	2X

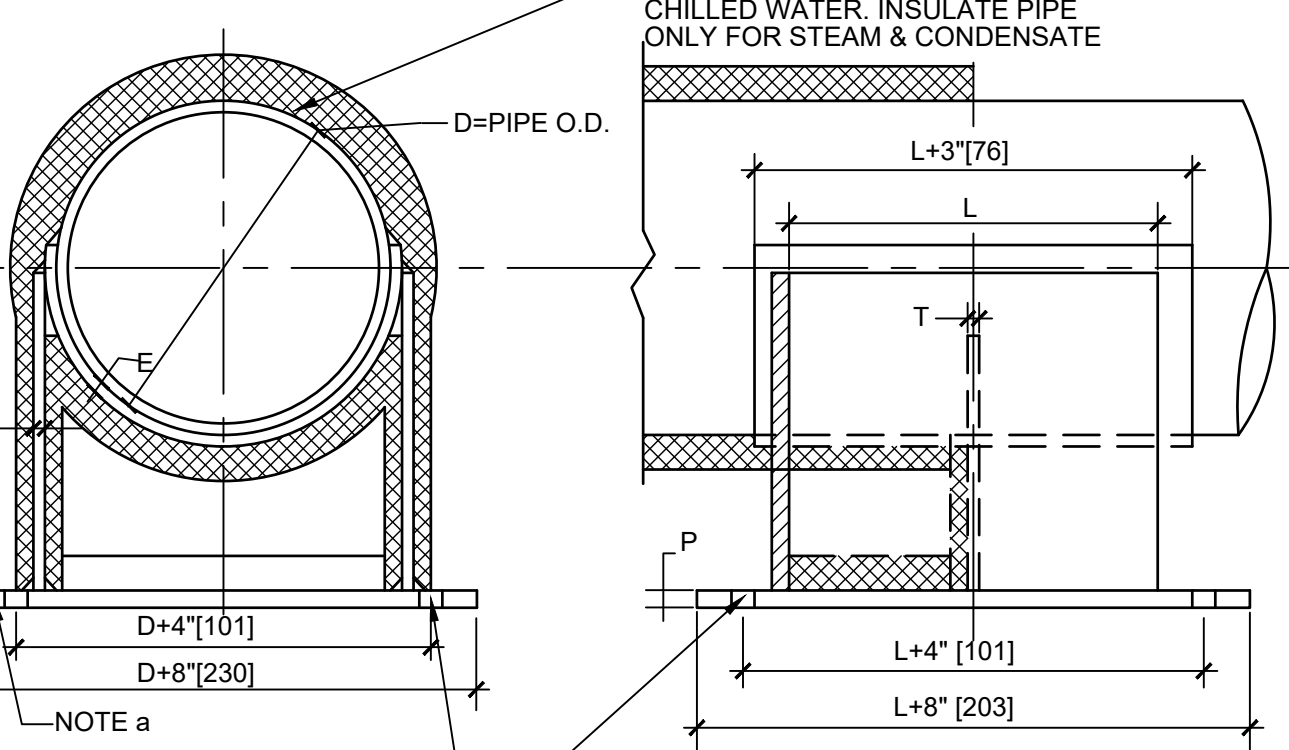
WHERE X = STATIC PRESSURE IN PAN



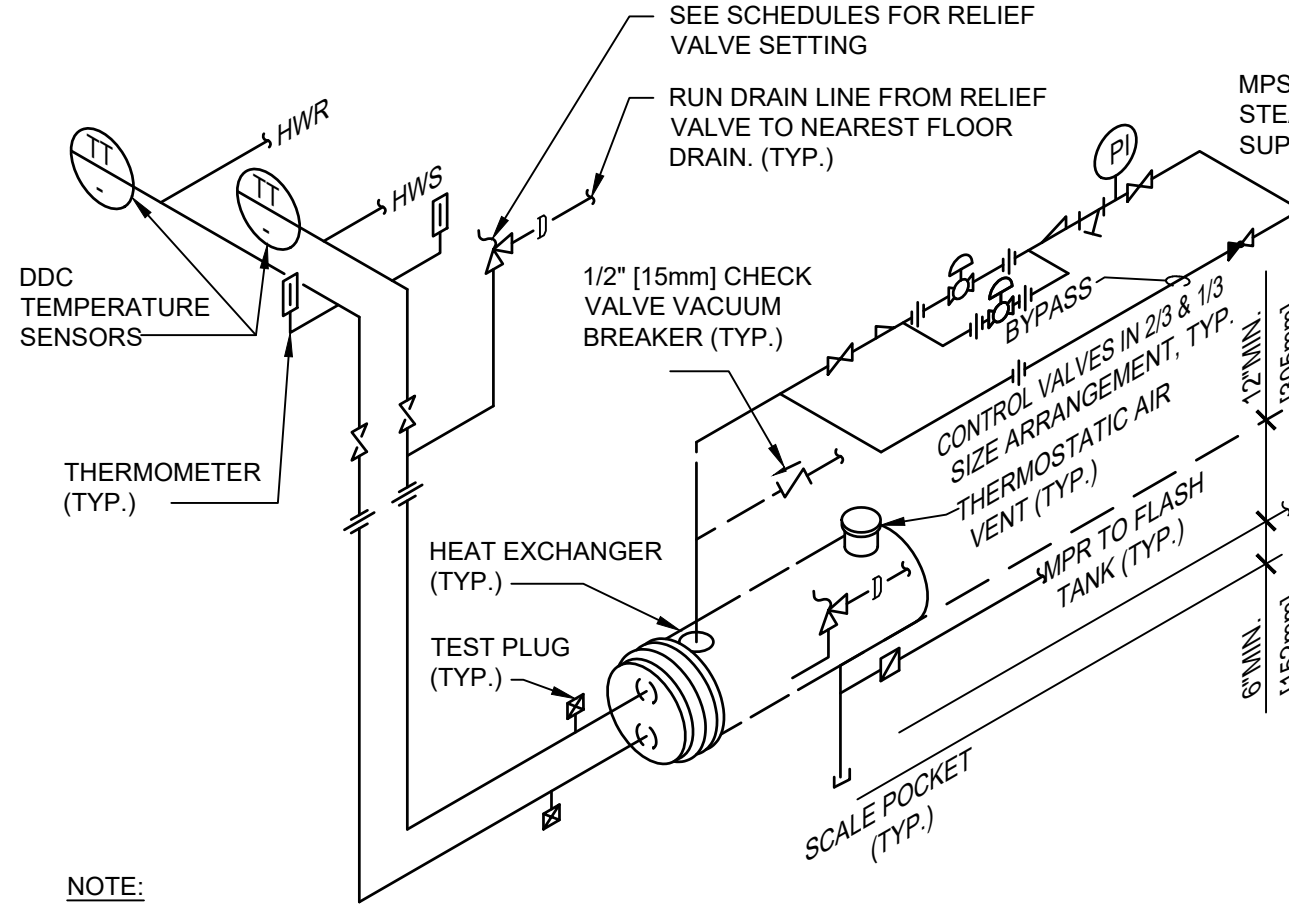
**11 SUPPORT ANCHOR (CHILLED WATER)**

**PIPE ANCHOR SCHEDULE**

D	P	CC	N	S	BOLT PATTERN
IN	MM	IN	MM	IN	MM
6"	152	8 1/2"	216	19	102
8"	203	10"	254	19	102
10"	254	12"	305	19	102
12"	305	14"	356	19	102
14"	356	16"	406	19	102
16"	406	18"	457	19	102
18"	457	20"	508	19	102

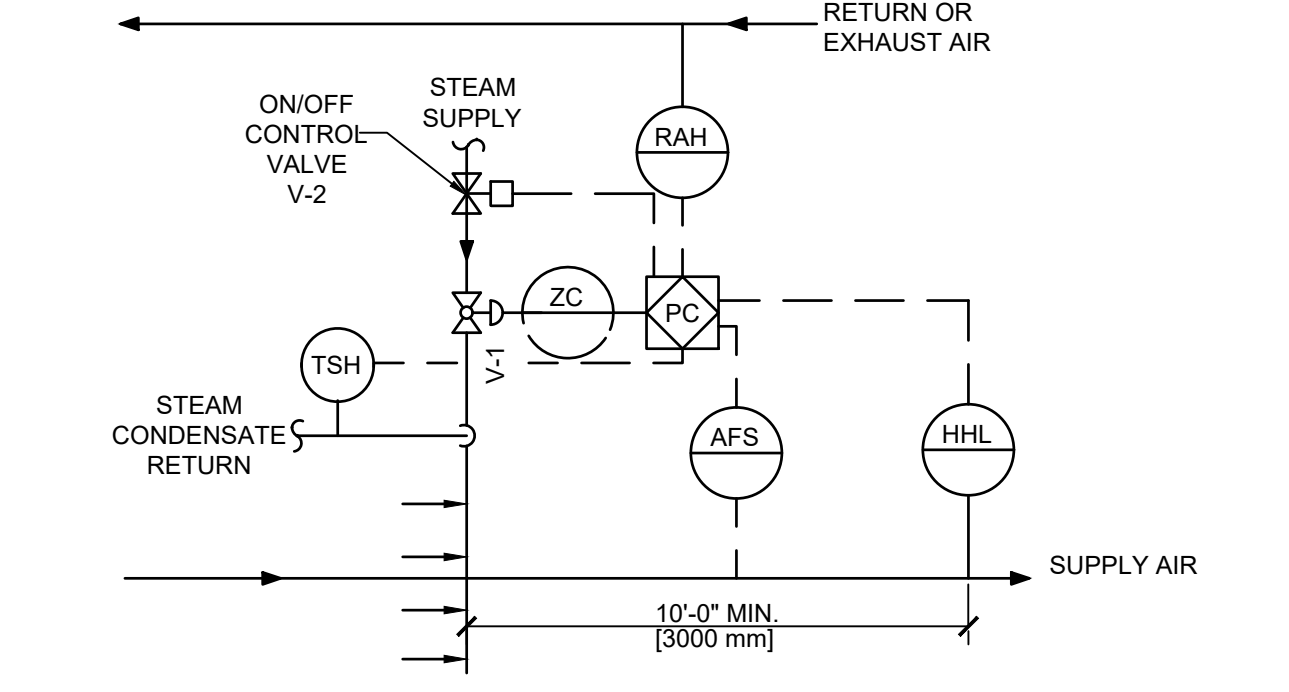


**4 LARGE PIPE ANCHOR 6" - 18"**



**8 HEAT EXCHANGER - STEAM TO HOT WATER**

NOTES:  
1. THE ABOVE DETAIL SHOWS REQUIRED PIPING FOR ONE HEAT EXCHANGER.  
2. PROVIDE SADDLE SUPPORTS AND LEGS OR HANGERS FOR HEAT EXCHANGER. MOUNTING HEIGHT SHALL BE ADJUSTED TO FACILITATE GRAVITY RETURN OF STEAM CONDENSATE.  
3. MAKE THE BYPASS THE SAME SIZE AS THE CONNECTIONS TO THE CONTROL VALVES.  
4. CONTROL VALVES SHALL BE IN A J AND S ARRANGEMENT.



**13 STEAM HUMIDIFIER CONTROLS**

STEAM HUMIDIFIER RETURN (OR EXHAUST) AIR HUMIDITY SHALL BE MONITORED. ON A CALL FOR HUMIDIFICATION, HUMIDIFIER VALVE V-1 SHALL MODULATE TO MAINTAIN THE RETURN (OR EXHAUST) AIR HUMIDITY SET POINT TO 30% (ADJUSTABLE). PRIOR TO ACTIVATION OF V-1, THE ON/OFF CONTROL VALVE V-2 SHALL BE ENABLED THROUGH ECC AND JACKET TEMPERATURE SENSING BY TSH SHALL BE WARM ENOUGH TO PREVENT CONDENSATION. THE HIGH LIMIT HUMIDITY SENSOR, LOCATED IN THE SUPPLY AIR DUCT 10 FEET AWAY FROM THE HUMIDIFIER SHALL DISABLE THE HUMIDIFIER AND GIVE AN ALARM SIGNAL TO THE ECC. IF THE SUPPLY AIR HUMIDITY EXCEEDS 90% RH (ADJUSTABLE), THE AIRFLOW SWITCH SHALL PROVE AIRFLOW BEFORE HUMIDITY CONTROLS ARE ACTIVATED.

CONSULTANTS:

Revisions	Date

ARCHITECT/ENGINEERS:

**AESUS** Architecture, Engineering, and Sustainable Design  
 1050 E. Southern Ave, Suite #C, Tempe, Arizona 85282, (480) 454-2801

Drawing Title: MECHANICAL DETAILS

VAPAHCs PLANNING AND ENGINEERING

Project Title: REPLACE PENTHOUSE HVAC SYSTEMS  
 CONTRACT NO. VA259-17-C-0212

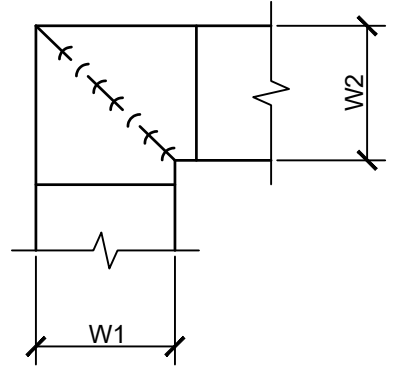
Location: FT. HARRISON, HELENA, MT

Date: 07/14/16 Checked: OQ Drawn: CR

Project Number: 436-17-102  
 Building Number: 154  
 Drawing Number: M501

BID SET

Office of Construction and Facilities Management  
 Department of Veterans Affairs

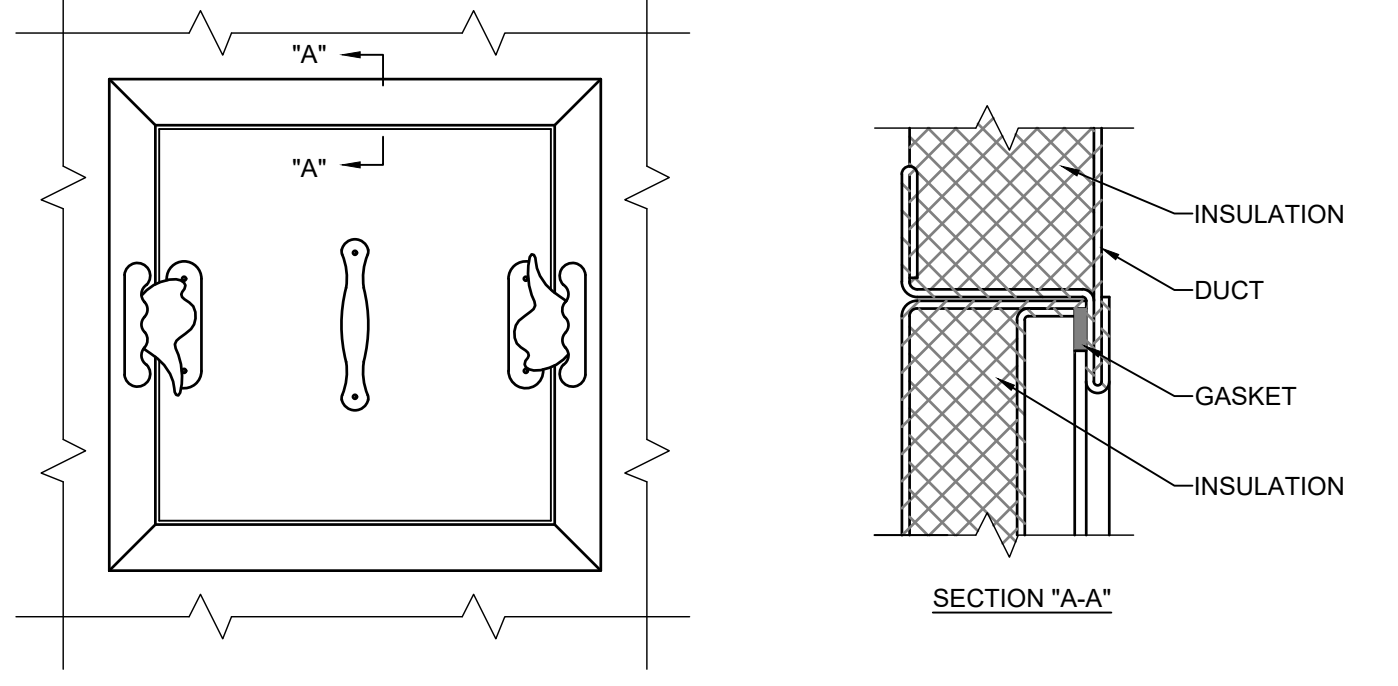


**NOTE:**

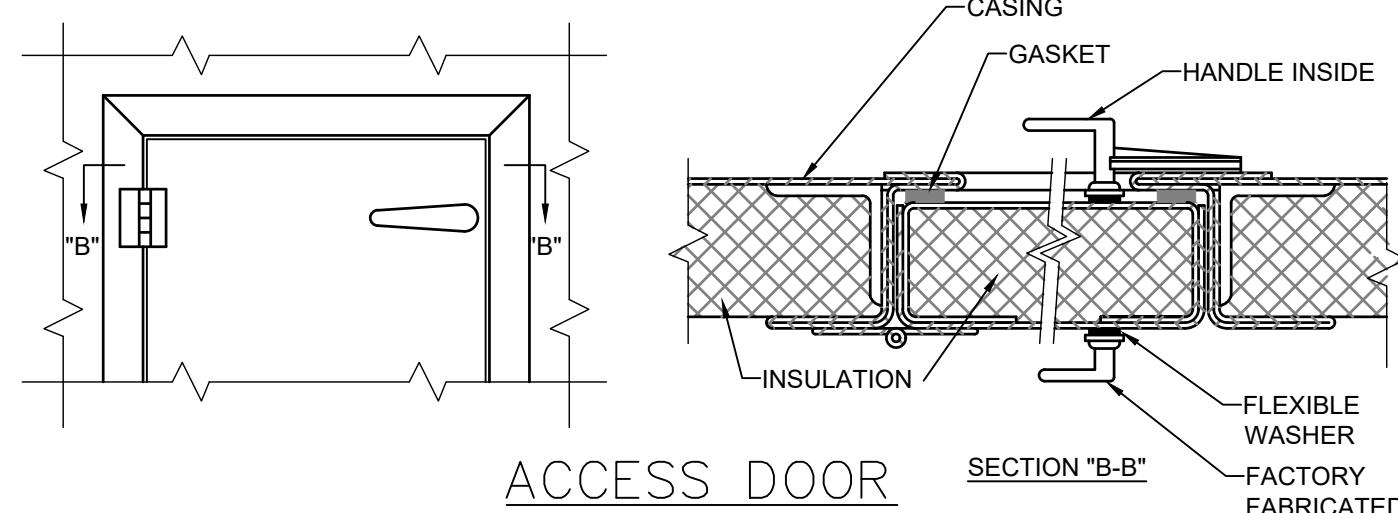
1. ALL VANE ELBOWS SHALL BE CONSTRUCTED AND INSTALLED AS DETAILED BY SMACNA.
2. WHEN W1 DOES NOT EQUAL W2, VANE SHALL BE SINGLE THICKNESS VANE TYPE REGARDLESS OF W DIMENSION.
3. ALL SINGLE THICKNESS VANES SHALL HAVE A 2" [50mm] RADIUS, 1 1/2" [40mm] MAXIMUM SPACE BETWEEN VANES AND A 3/4" [20mm] TRAILING EDGE.
4. WHEN W EQUALS W2 AND W1 IS GREATER THAN 20" [500mm] VANES SHALL BE DOUBLE VANE TYPE.

**1 DUCTWORK SQUARE VANE ELBOWS**

NTS



**ACCESS PANEL**

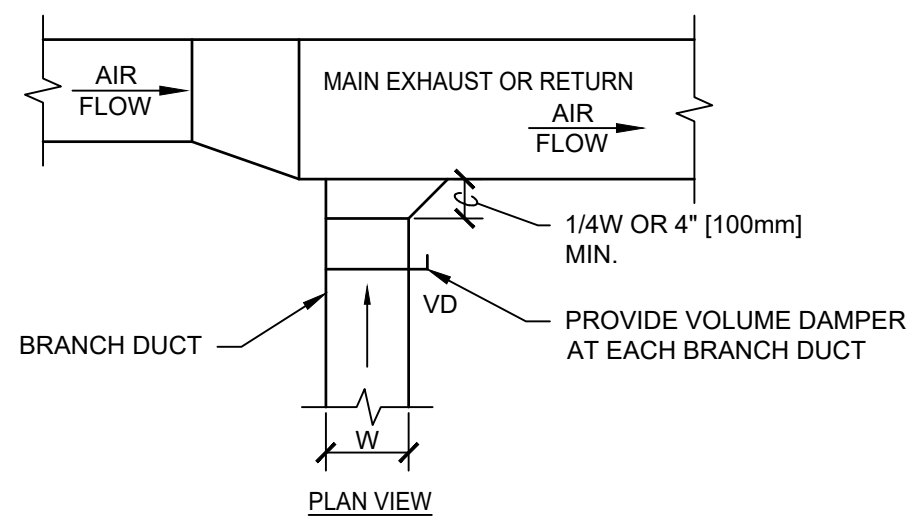


**ACCESS DOOR**

- NOTES:**
1. LATCHES SHALL BE OF THE WEDGE TYPE TO CLOSE DOORS TIGHTLY.
  2. HINGES ON THE ACCESS DOORS SHALL HAVE NON-CORROSIVE PINS.
  3. SEE SMACNA 2005, FIGURE 9-15

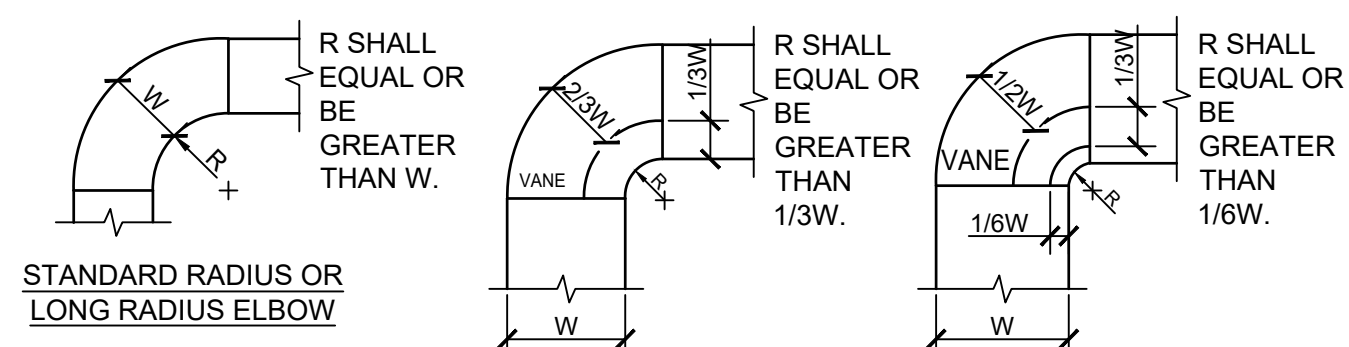
**5 ACCESS PANEL AND DOOR DETAIL**

NTS



**10 EXHAUST OR RETURN BRANCH DUCTWORK**

NTS

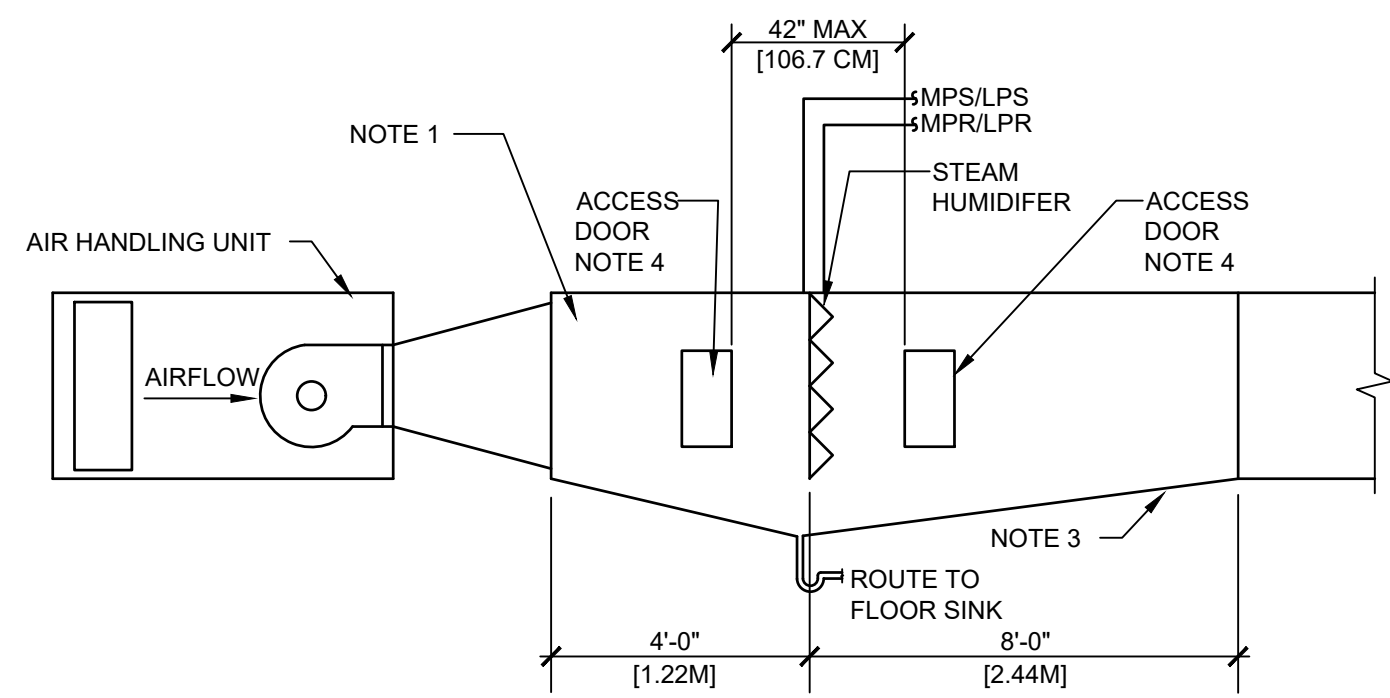


**NOTE:**

1. THE INTERIOR SURFACE OF ALL RADIUS ELBOWS SHALL BE MADE ROUND.
2. ALL STANDARD RADIUS ELBOWS CAN BE SUBSTITUTED WITH SHORT RADIUS ELBOWS. ALL SHORT RADIUS ELBOWS SHALL HAVE VANES. VANES SHALL BE CONSTRUCTED, SUPPORTED AND FASTENED AS RECOMMENDED BY SMACNA.

**2 DUCTWORK RADIUS ELBOWS**

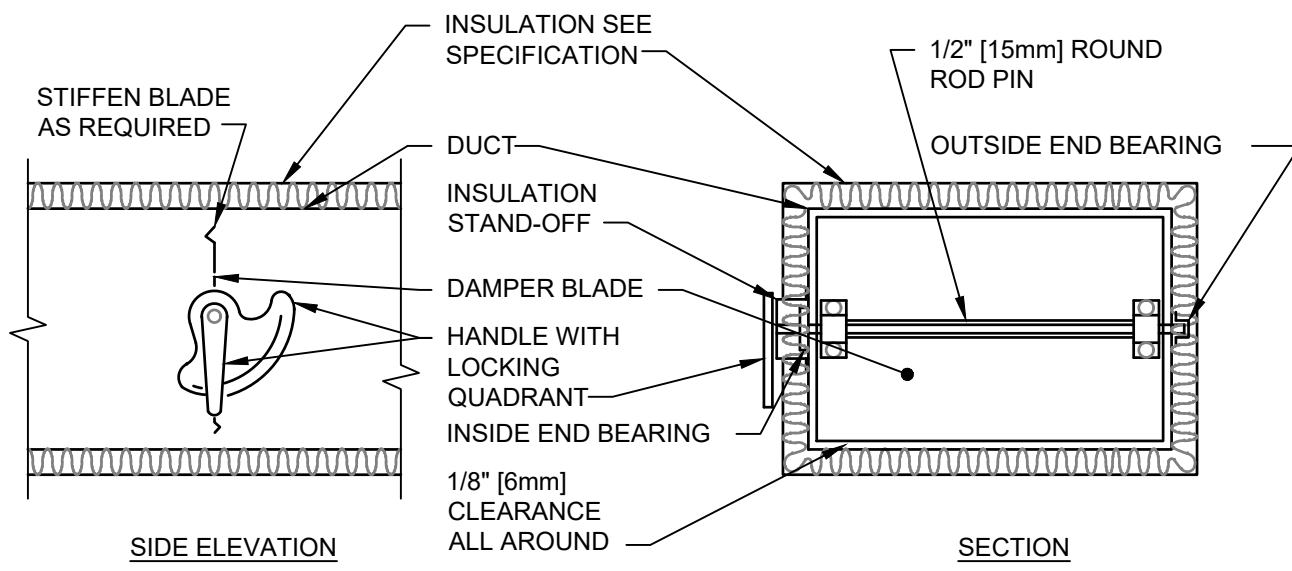
NTS



- NOTES:**
1. TRANSITION WELDED STAINLESS STEEL 41.22M] UPSTREAM OF HUMIDIFIER AND 8" [2.44M] DOWNSTREAM OF HUMIDIFIER.
  2. DETAIL ONLY APPLICABLE TO AHUS WITHOUT AFTER FILTER DOWNSTREAM OF THE SUPPLY AIR FAN.
  3. INTEGRAL STAINLESS STEEL DRAIN PAN SLOPE FROM ALL DIRECTIONS TO DRAIN CONNECTION. SLOPE: 1/2" PER 1'-0" [0.3 CM PER 0.3 M].
  4. PROVIDE MIN. 18" [45 CM] WIDE ACCESS DOOR, DIRECTLY UPSTREAM AND DOWNSTREAM OF HUMIDIFIER.

**6 DUCT MOUNTED HUMIDIFIER**

NTS

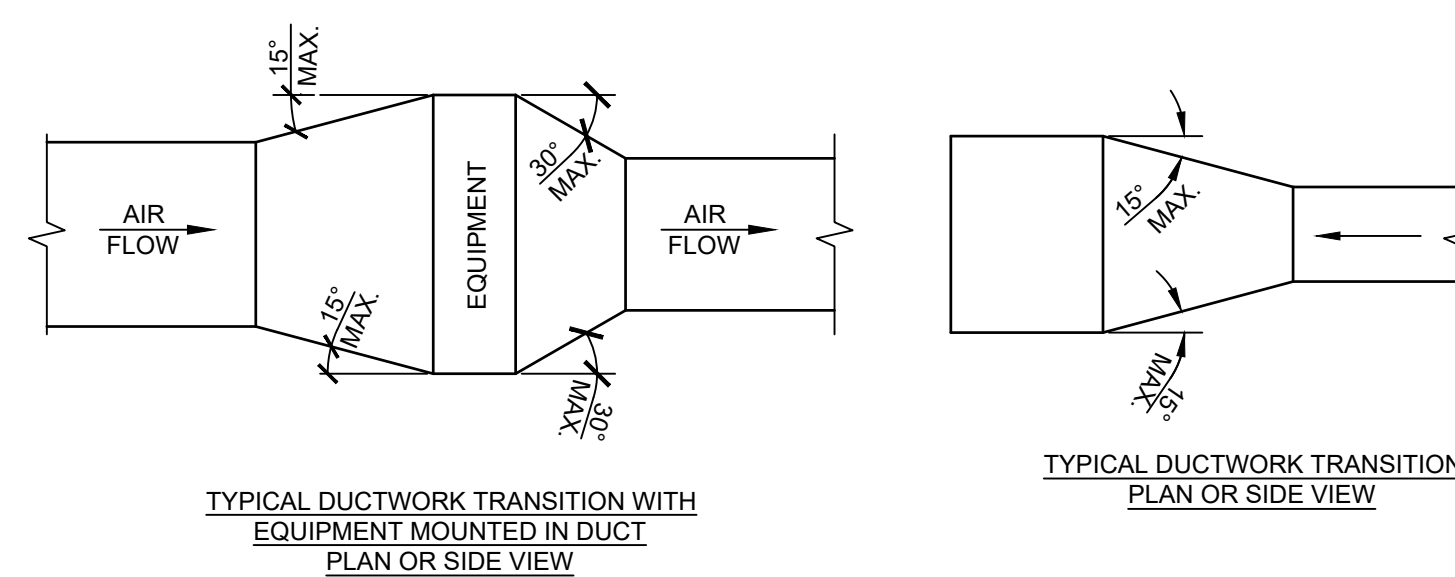


**NOTE:**

1. DELETE INSULATION STAND-OFF ON DUCTWORK WITHOUT EXTERIOR INSULATION.
2. DETAIL SHOWS SINGLE BLADE DAMPER. DAMPER INSTALLATION SHALL BE SIMILAR FOR MULTI-BLADE DAMPERS & ROUND DAMPERS.

**11 VOLUME DAMPER DETAIL**

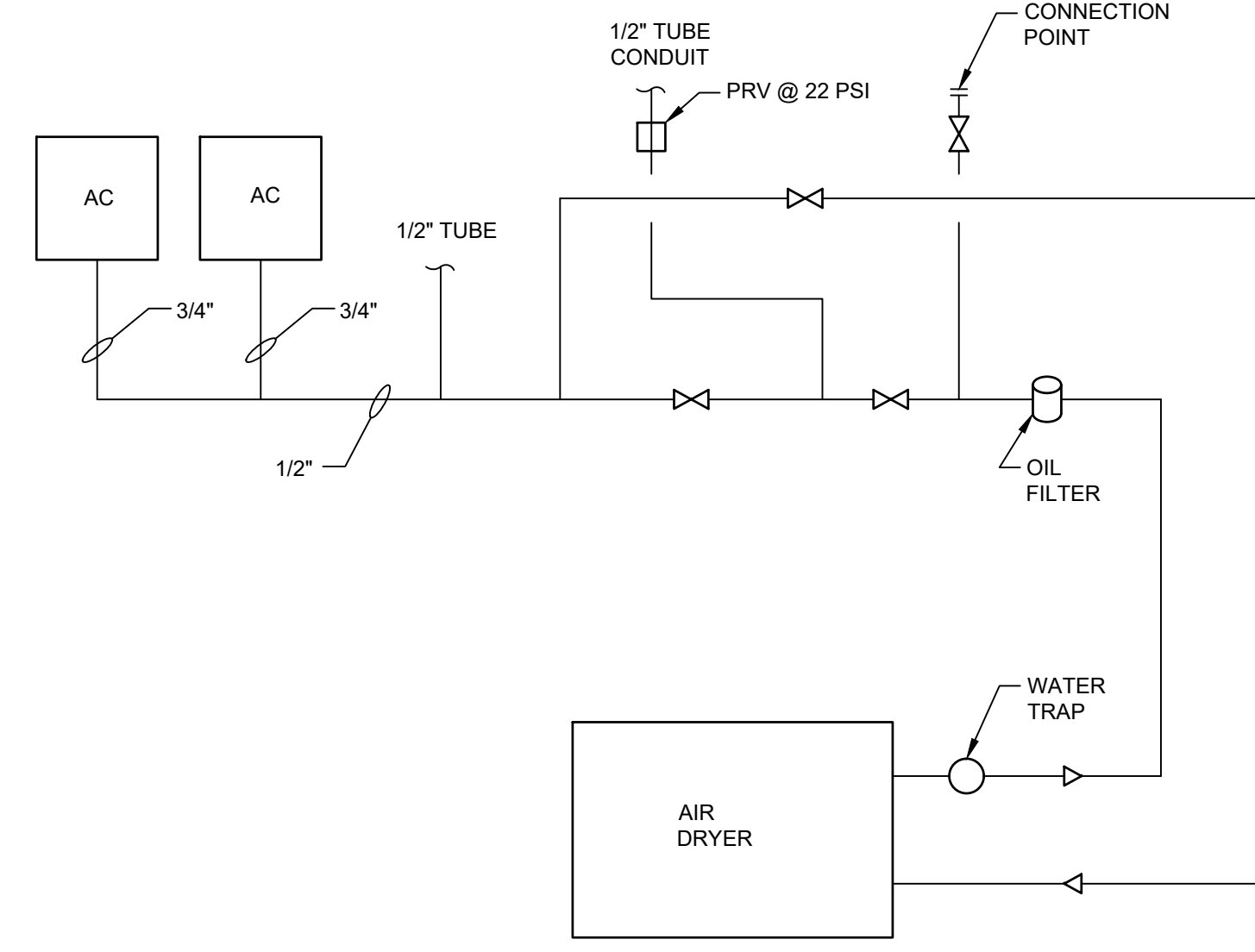
NTS



**NOTE:** UNLESS OTHERWISE INDICATED ON PLANS, MAXIMUM ANGLES SHOWN SHALL APPLY.

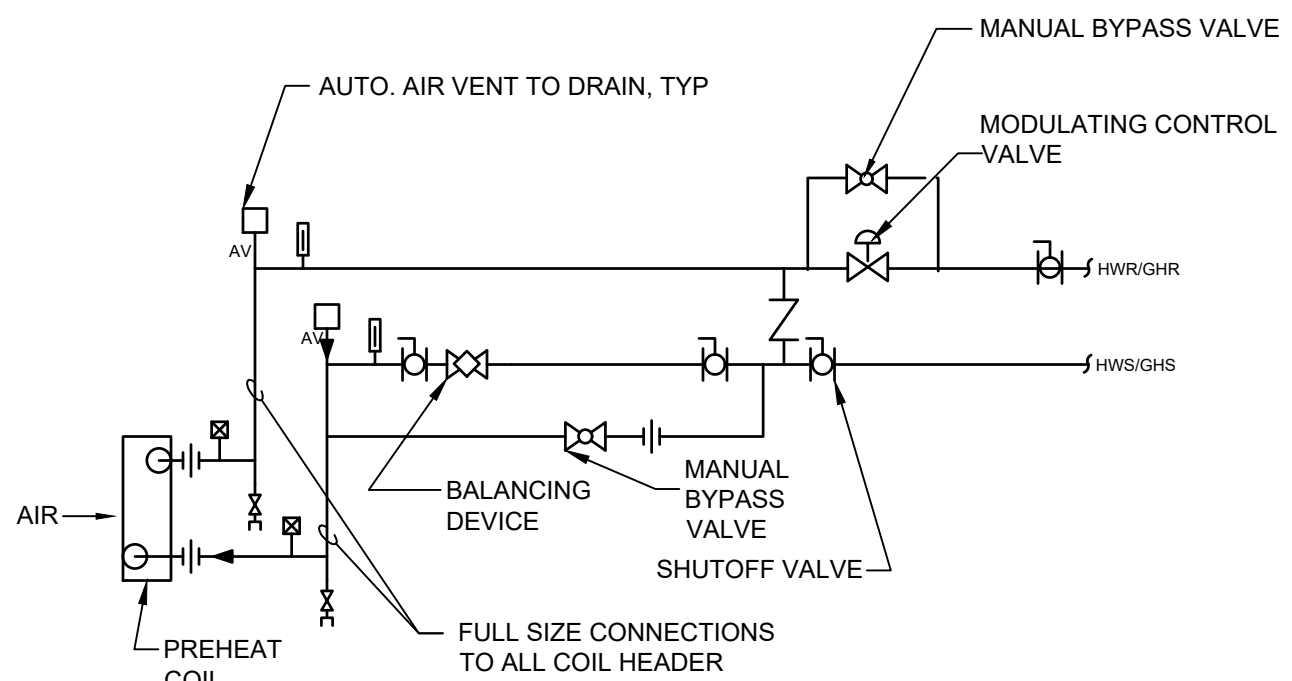
**3 DUCTWORK TRANSITIONS (WITH EQUIPMENT MOUNTED IN DUCT)**

NTS



**7 COMPRESSED AIR SYSTEM - PIPING DIAGRAM**

NTS

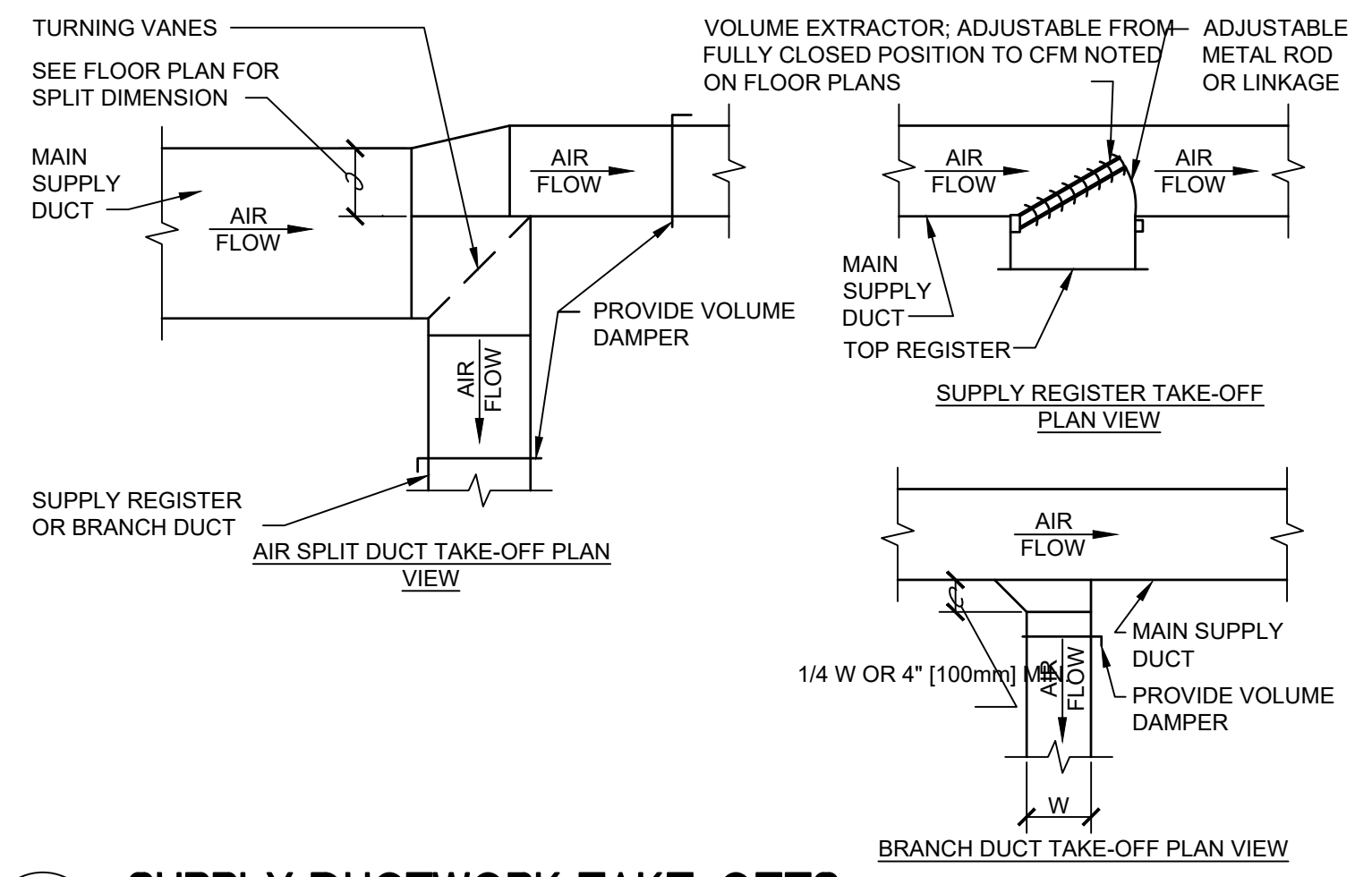


**NOTE:**

1. SIZE AND SELECT COIL FOR PARALLEL FLOW AND MINIMUM TUBE WATER VELOCITY OF 3.0 FEET PER SECOND

**12 PREHEAT COIL (HOT WATER) - PIPING CONNECTIONS**

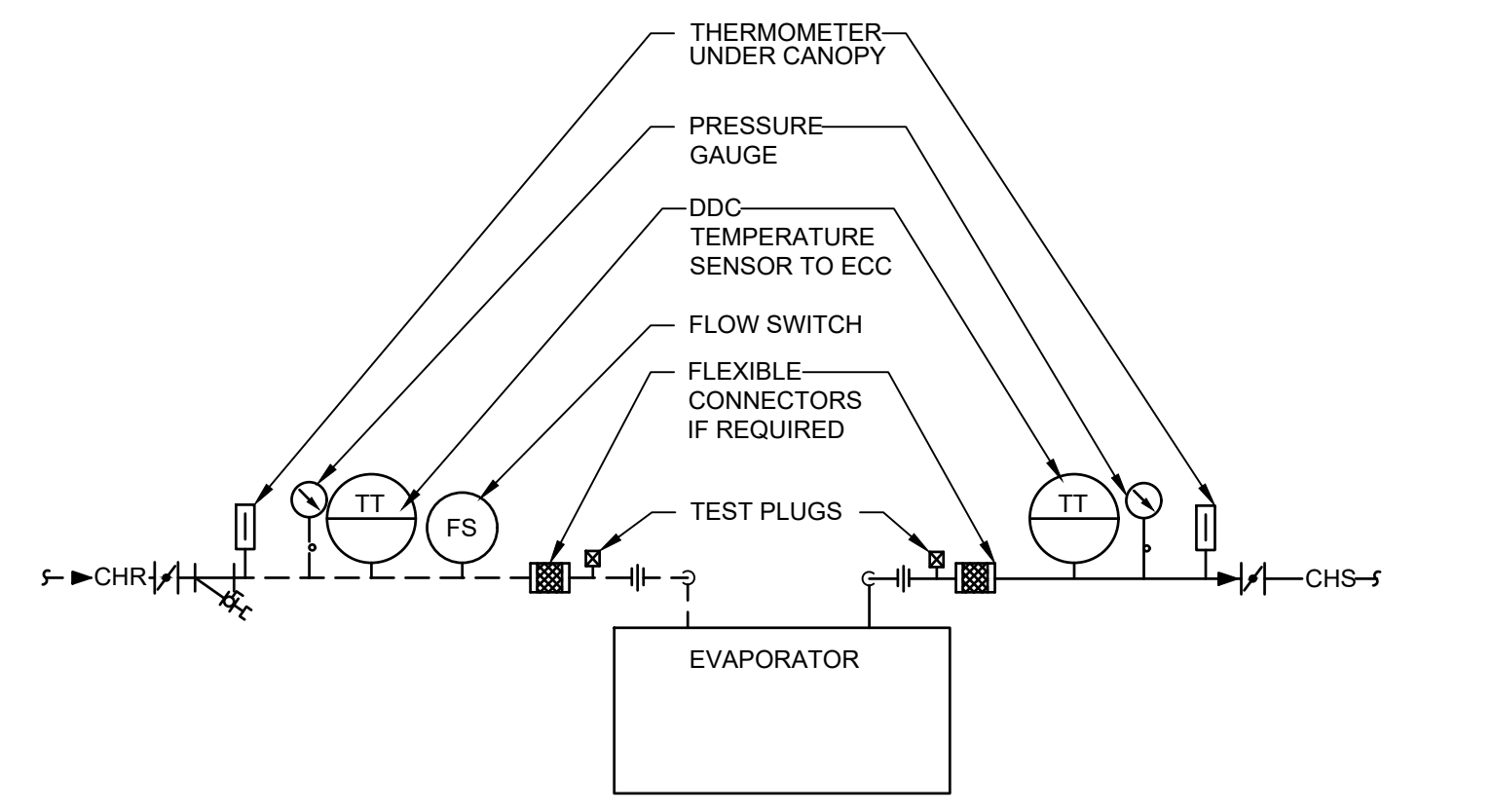
- DESIGNER'S NOTE:**
1. COORDINATE WITH HVAC DESIGN MANUAL.



**4 SUPPLY DUCTWORK TAKE-OFFS**

NTS

- DESIGNER'S NOTES:**
1. THE SUPPLY REGISTER TAKE-OFF MAY BE USED FOR UP TO 25% OF THE MAIN DUCT CFM. THE BRANCH DUCT TAKE-OFF MAY BE USED FOR UP TO 15% OF THE MAIN DUCT CFM ANYTIME AND UP TO 40% WHEN THE MAIN DUCT VELOCITY IS 1000 FPM (5.1 M/S) OR LESS. THE AIR SPLIT DUCT TAKE-OFF SHALL BE USED IN ALL OTHER CASES AND MAY BE USED AT ANYTIME.
  2. SHOW ALL VOLUME DAMPERS ON FLOOR PLANS.



**NOTES:**

1. PROVIDE HEAT TRACING WHEN THE EXPOSED PIPING CARRYING CHILLED WATER IS LOCATED ON THE EXTERIOR OF THE BUILDING. ALL VALVES, STRAINER, FLOW SWITCH, FLEXIBLE CONNECTORS, ETC., SHALL BE WRAPPED WITH ELECTRIC HEAT TRACE CABLE UNDER INSULATION.
2. PROVIDE ALUMINUM JACKETING ON ALL EXPOSED, INSULATED PIPING.

**8 AIR COOLED CHILLER - PIPING CONNECTIONS**

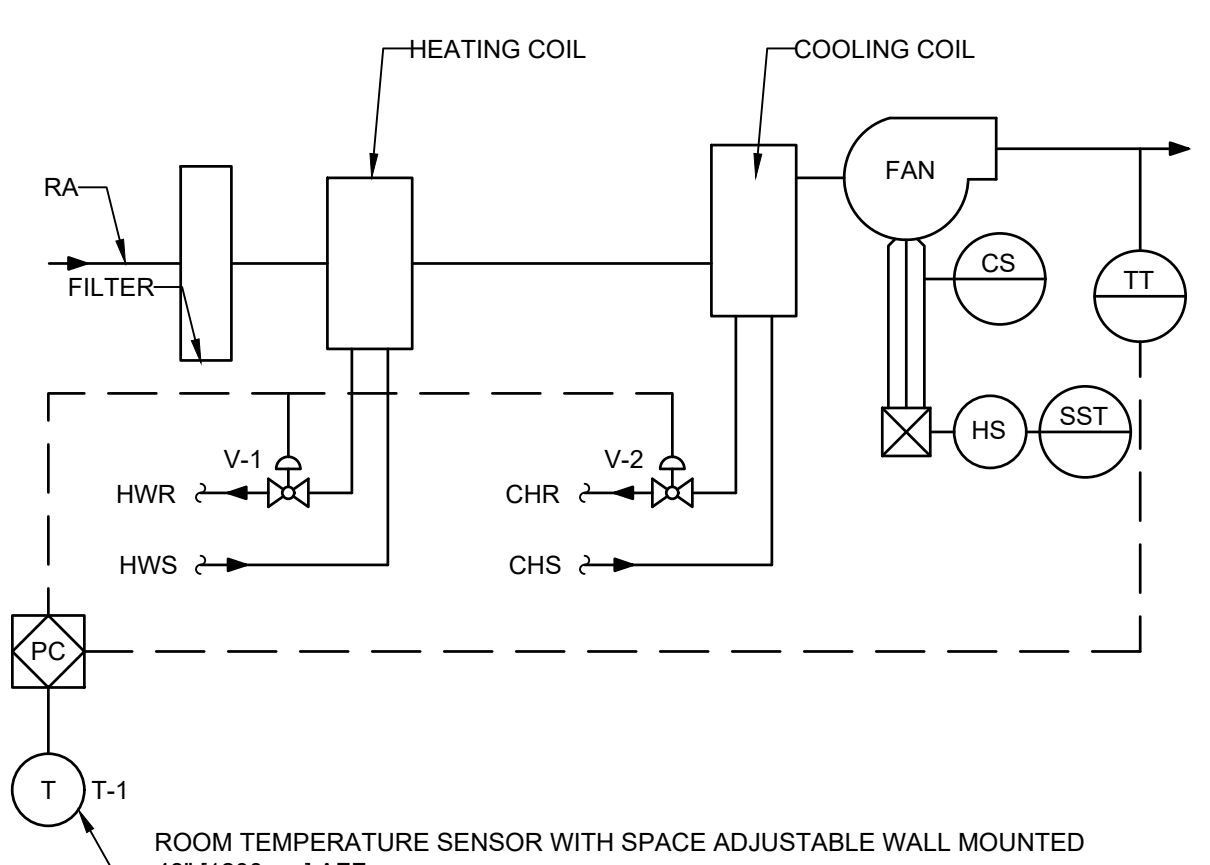
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**FAN COIL SEQUENCE OF OPERATION (PATIENT ROOMS)**

FAN COIL UNIT SHALL OPERATE ON A SCHEDULE AS SET BY THE ECC. FAN SHALL RUN CONTINUOUSLY. FAN STATUS SHALL BE MONITORED AND AN ALARM MESSAGE SHALL BE GENERATED IN THE EVENT THE UNIT FAILS TO RUN. THE ADJUSTABLE ROOM TEMP SET POINT WILL BE 70°-75° WITH 0.5° HEATING/Cooling OFFSETS. VALVE V-1 & V-2 WILL NOT BE OPEN SIMULTANEOUSLY. ROOM OCCUPANT WILL HAVE ABILITY OF ADJUSTING ROOM TEMPERATURE BETWEEN 70°-75°.

**FAN COIL SEQUENCE OF OPERATION (NONPATIENT ROOMS)**

FAN COIL SHALL OPERATE ON A SCHEDULE AS SET BY ECC. FAN SHALL RUN CONTINUOUSLY IN OCCUPIED MODE. FAN STATUS SHALL BE MONITORED AND AN ALARM MESSAGE SHALL BE GENERATED IN THE EVENT THE UNIT FAILS TO RUN BETWEEN THE RANGE OF 70°-75° SPACE TEMPERATURE BOTH V-1 & V-2 SHALL BE CLOSED. UPON RISE IN TEMPERATURE ABOVE 75° V-2 SHALL MODULATE OPEN TO MAINTAIN 70° F. UPON FALL IN TEMPERATURE BELOW 70° F. HEATING VALVE V-1 SHALL MODULATE TO OPEN TO MAINTAIN 70° F.

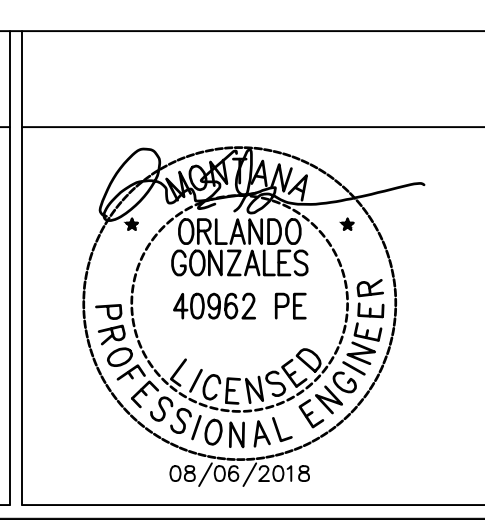


**13 FOUR PIPE FAN COIL UNIT CONTROLS**

NTS

Revisions	Date

CONSULTANTS:	



**ARCHITECT/ENGINEERS:**

**AESUS** Architecture, Engineering, and Sustainable Design  
 1050 E. Southern Ave, Suite #C, Tempe, Arizona 85282, (480) 454-2861

Drawing Title	MECHANICAL DETAILS
VAPAHS PLANNING AND ENGINEERING	

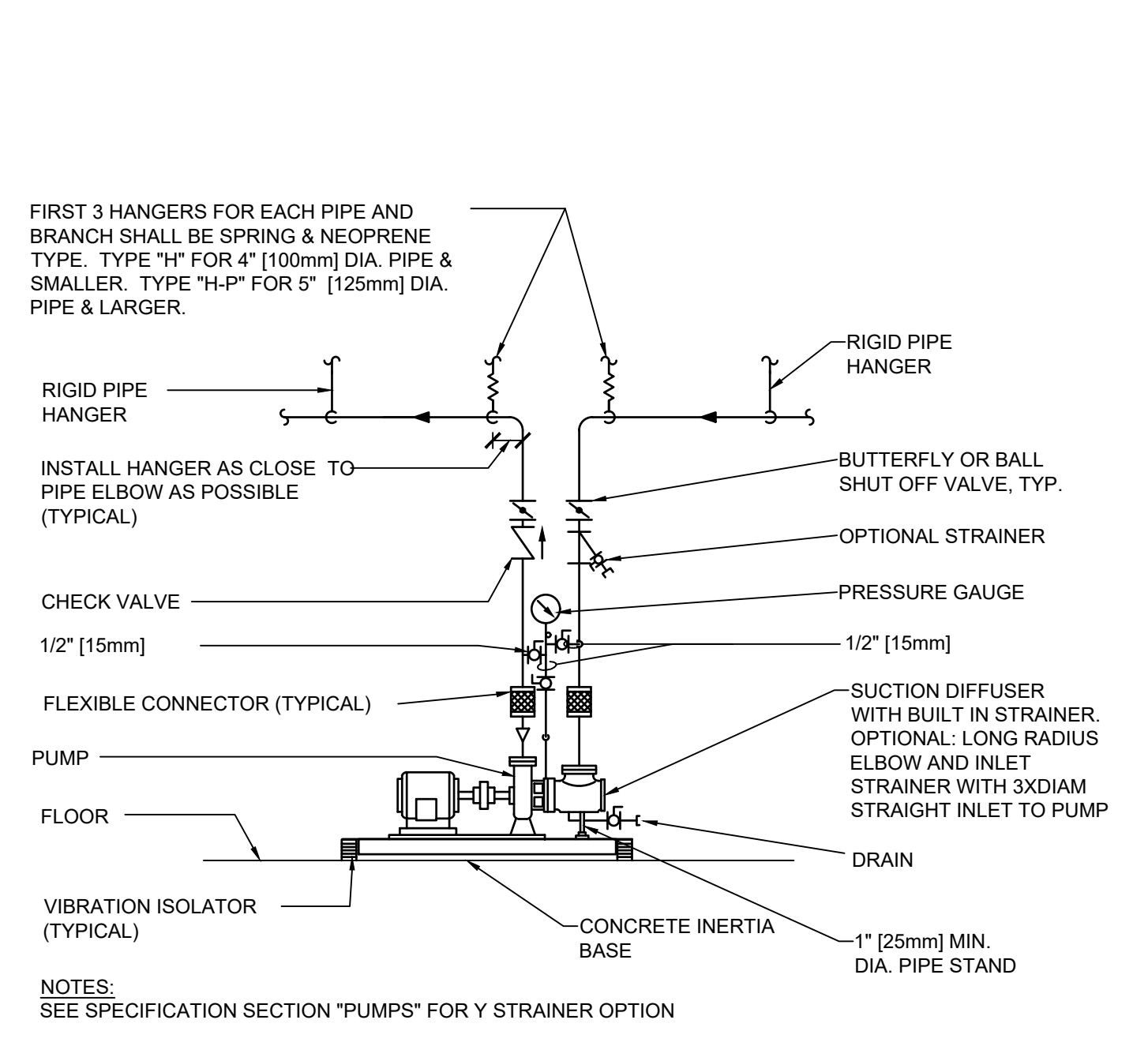
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Contract No.	VA259-17-C-0212
Location	FT. HARRISON, HELENA, MT
Date	07/14/16
Checked	OQ
Drawn	CR
Project Number	436-17-102
Building Number	154
Drawing Number	M502

**BID SET**

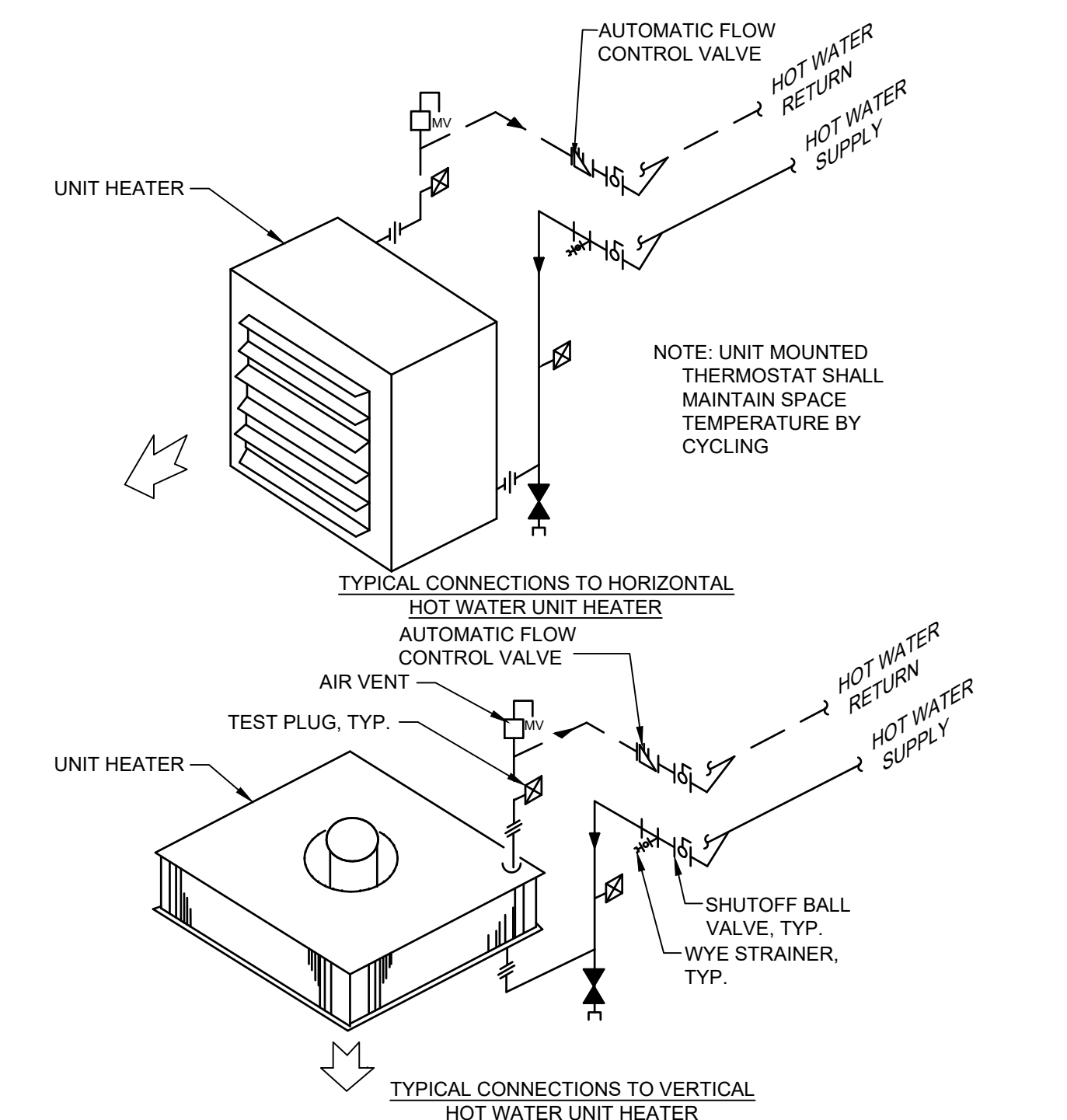
Office of Construction and Facilities Management

Department of Veterans Affairs

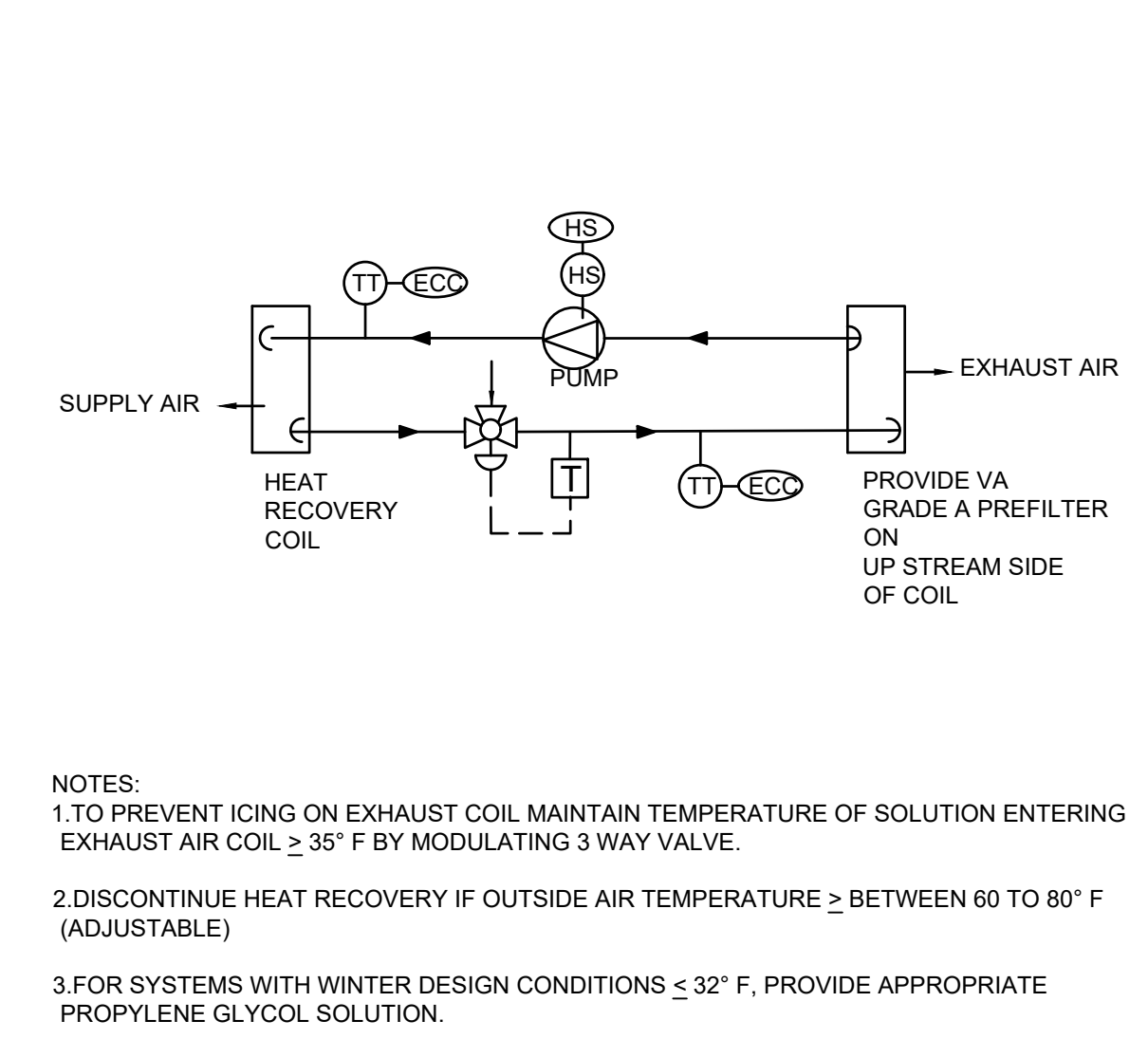




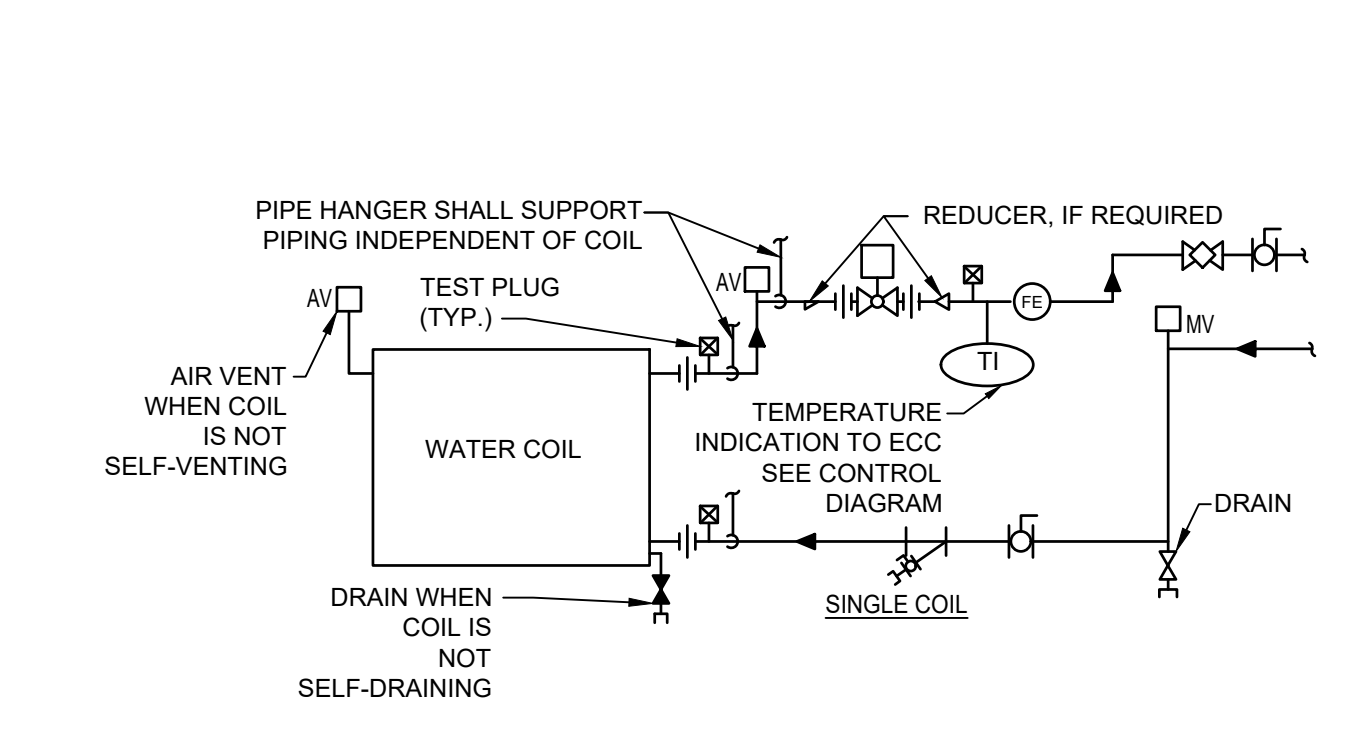
**1 SINGLE SUCTION FLOOR-MOUNTED PUMPS - CONNECTIONS WITH FLEXIBLE CONNECTORS**  
NTS



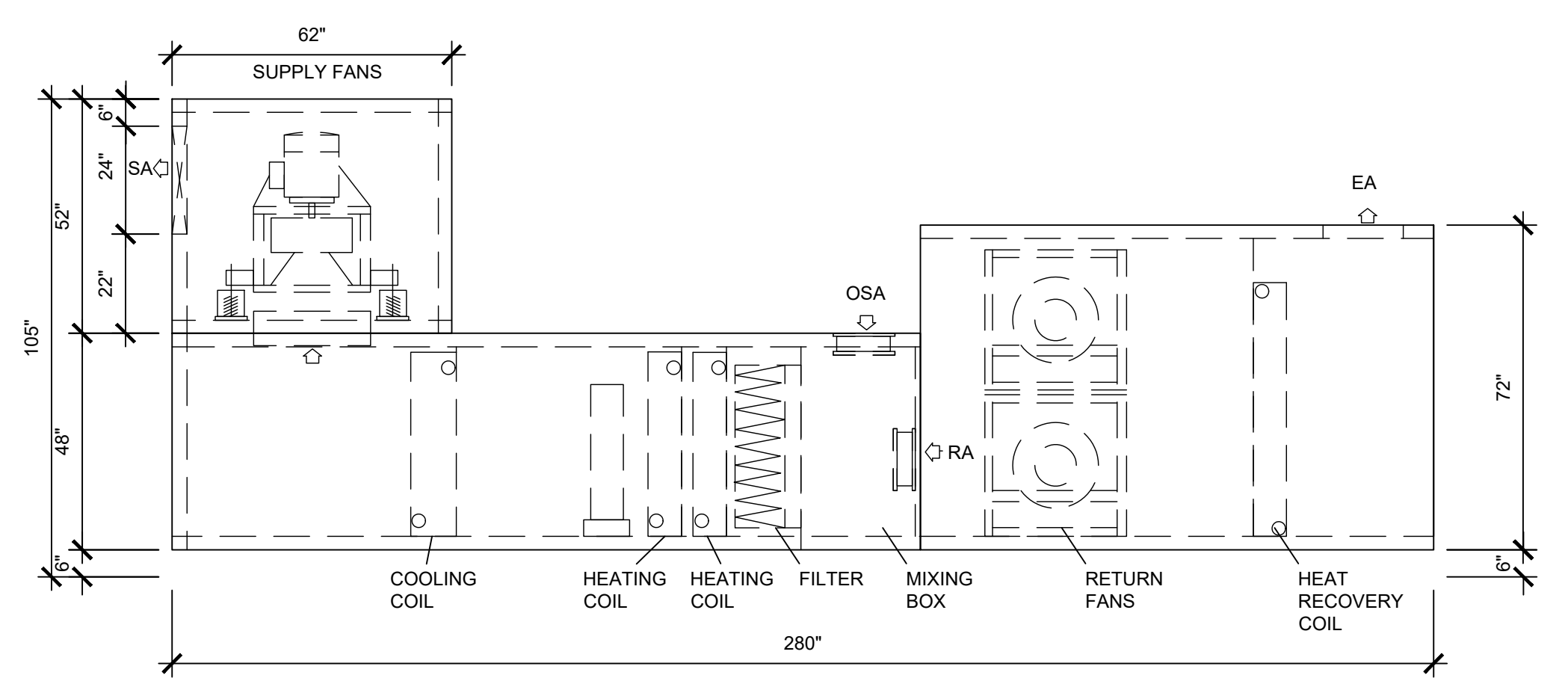
**2 UNIT HEATERS (HOT WATER) - PIPING CONNECTIONS**  
NTS



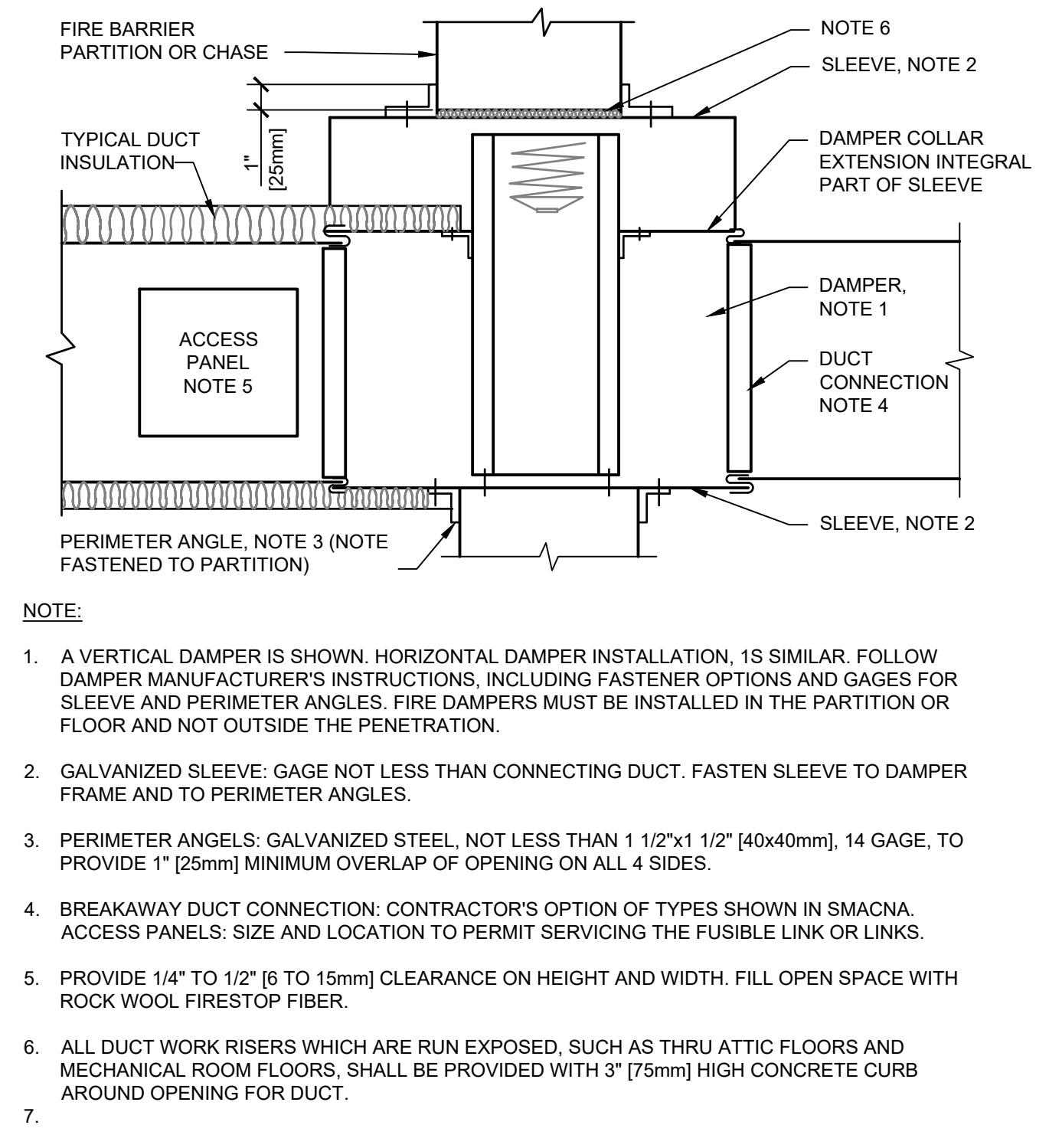
**3 RUN AROUND HEAT RECOVERY COIL DETAIL**  
NTS



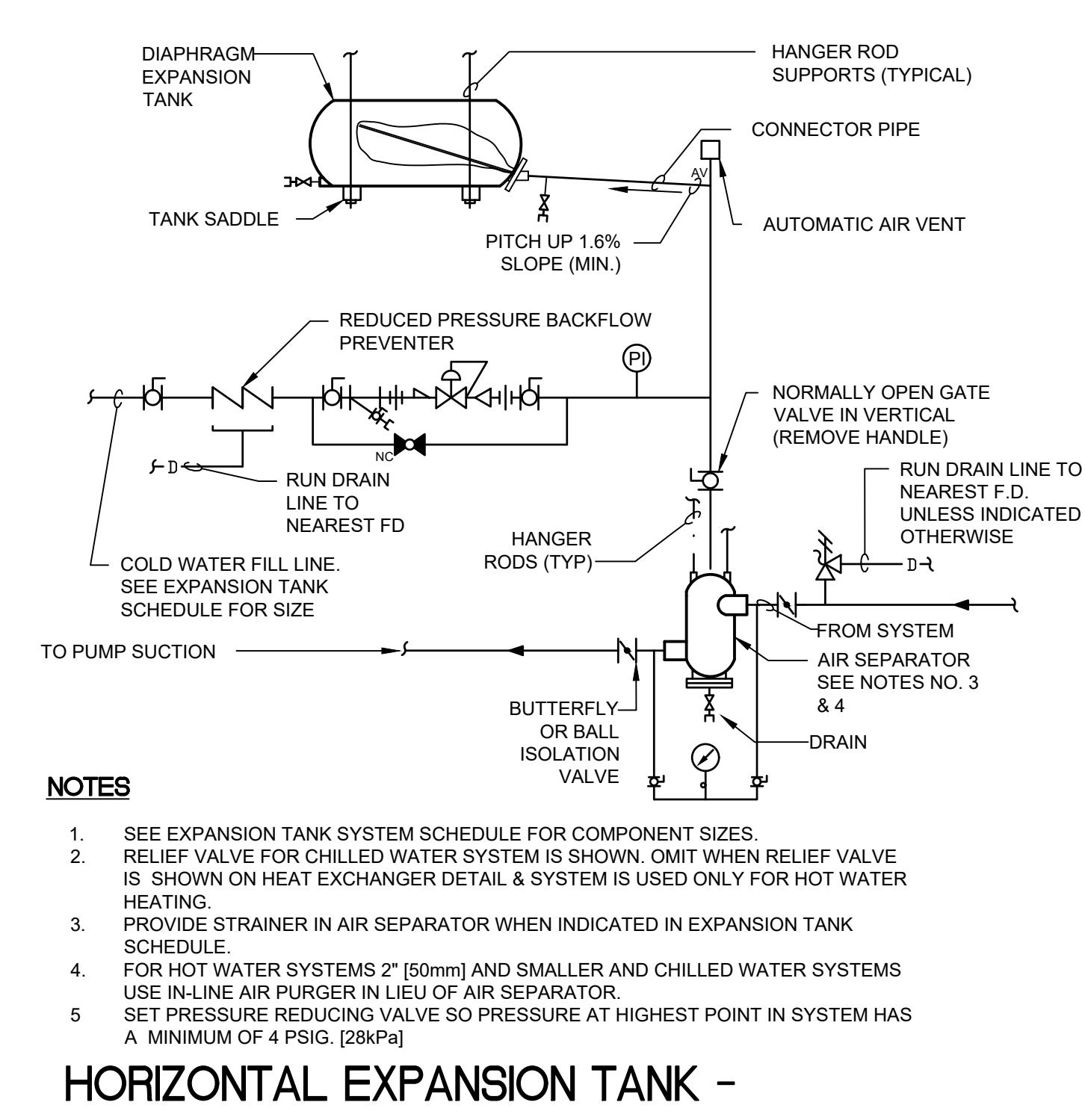
**4 WATER COILS - PIPING CONNECTIONS**  
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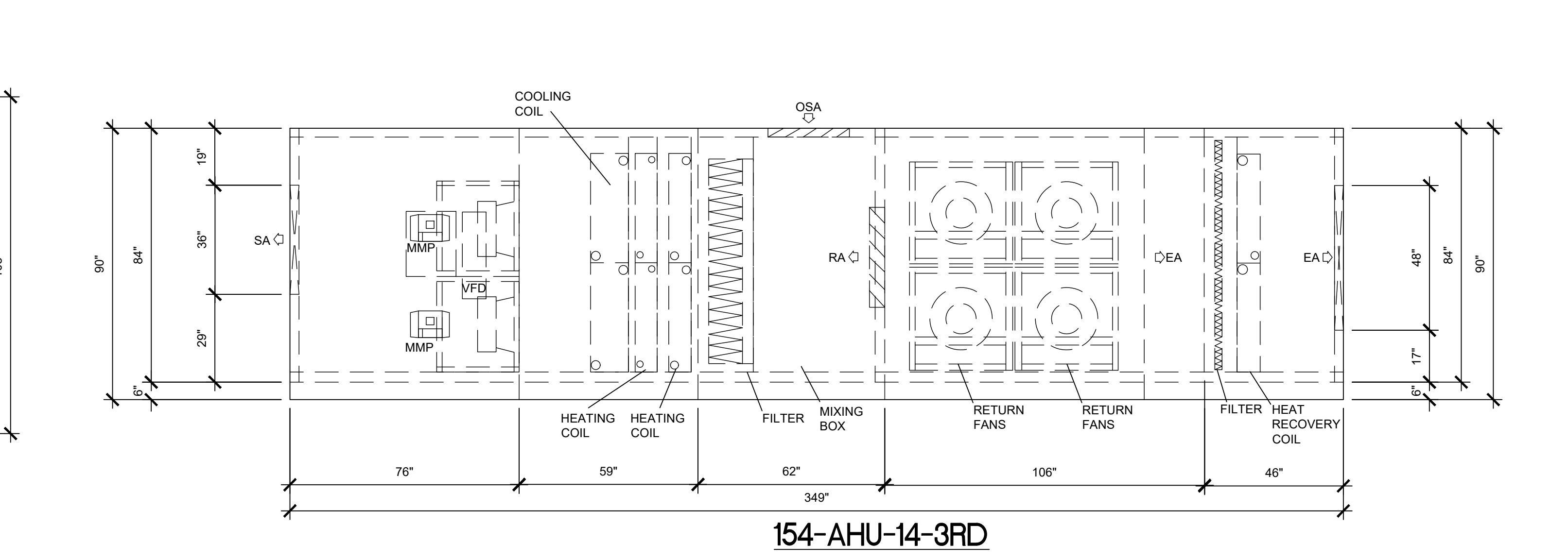
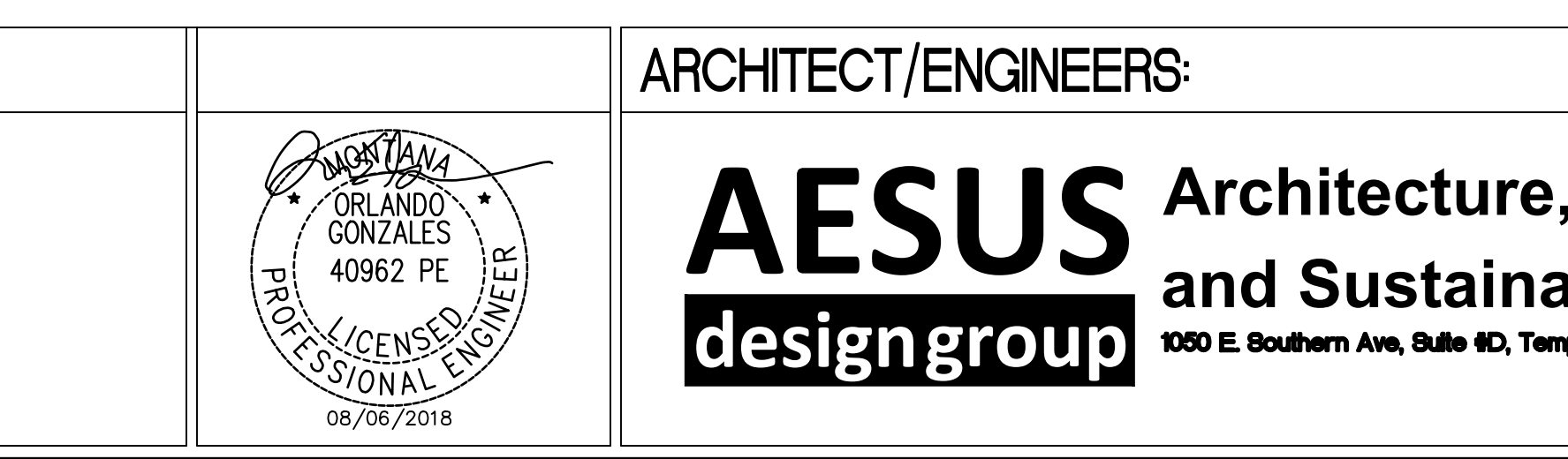
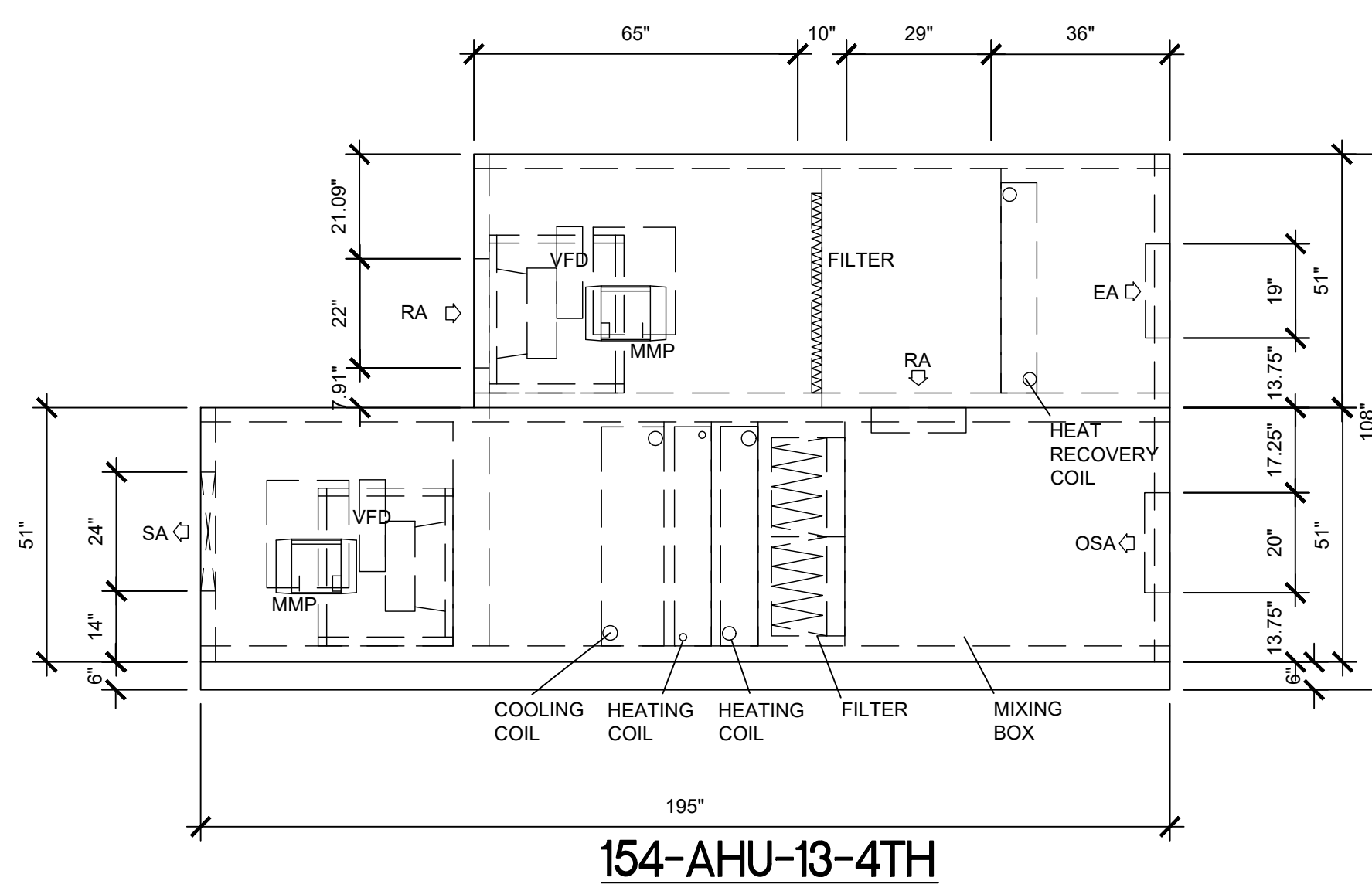
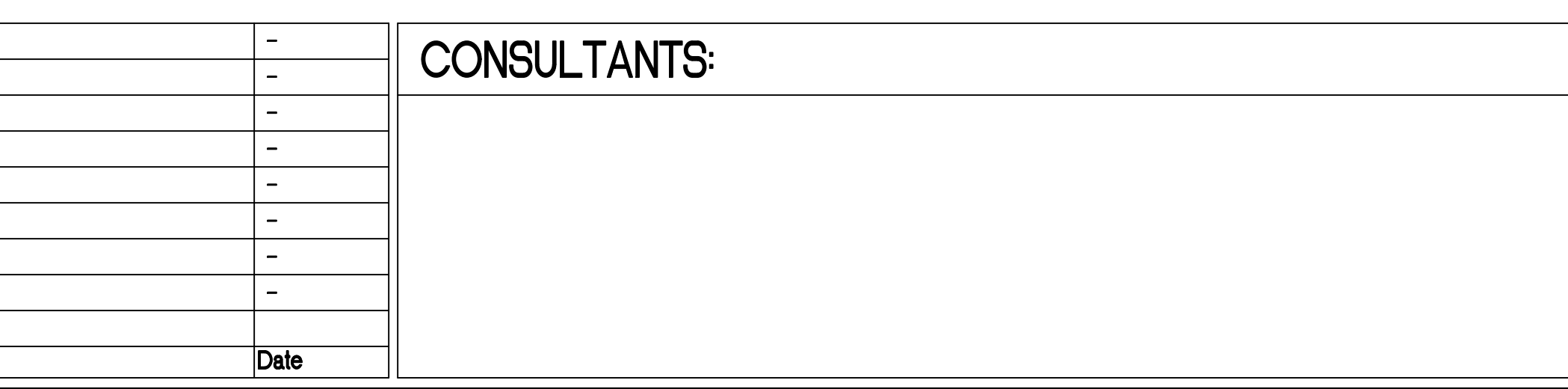
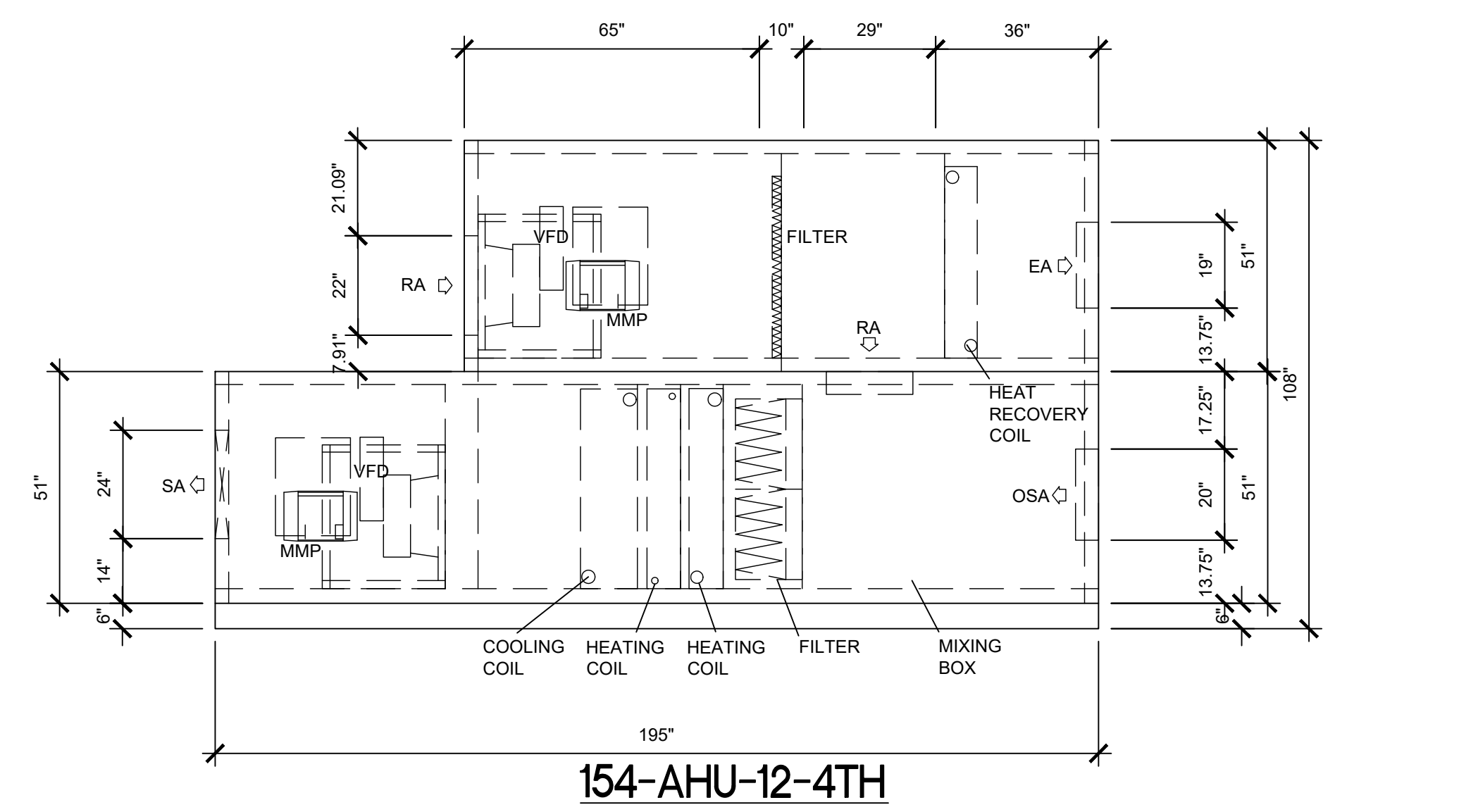
**5 DUCT RISER SUPPORTS**  
NTS



**6 SECTION THRU FIRE DAMPER INSTALLATION**  
NTS

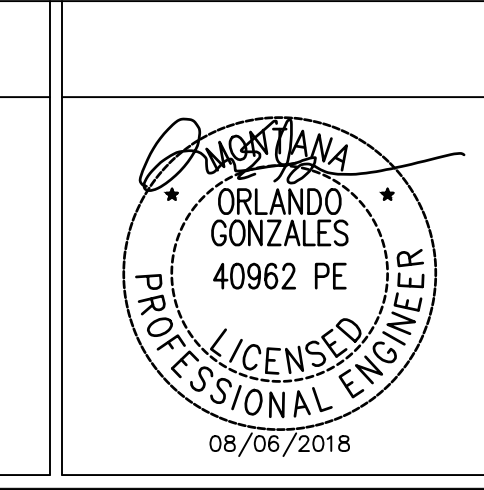


**7 HORIZONTAL EXPANSION TANK - PIPING CONNECTIONS**  
NTS



Revisions	Date

**CONSULTANTS:**



**ARCHITECT/ENGINEERS:**  
**AESUS** Architecture, Engineering, and Sustainable Design  
designgroup 1000 E. Southern Ave, Suite #C, Tempe, Arizona 85282, (480) 454-2801

Drawing Title  
**MECHANICAL DETAILS**  
VAPAHCs PLANNING AND ENGINEERING

Project Title  
**REPLACE PENTHOUSE HVAC SYSTEMS**  
CONTRACT NO. VA259-17-C-0212  
Location  
FT. HARRISON HELENA, MT  
Date  
07/14/16  
Checked  
OG  
Draw  
CR

Project Number  
436-17-102  
Building Number  
154  
Drawing Number  
M503

**BID SET**  
Office of Construction and Facilities Management  
Department of Veterans Affairs





three inches = one foot  
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 one half inch = one foot  
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 three eighths inch = one foot  
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**NOTE:**  
 CONTRACTOR TO INSULATE ALL PIPE  
 FLANGES, VALVES, AND EQUIPMENT WITH  
 EVERGREEN "CUT 'N WRAP INSULATION  
 KITS" OR APPROVED EQUAL.



1 REMOVABLE PAD INSULATORS  
 NTS



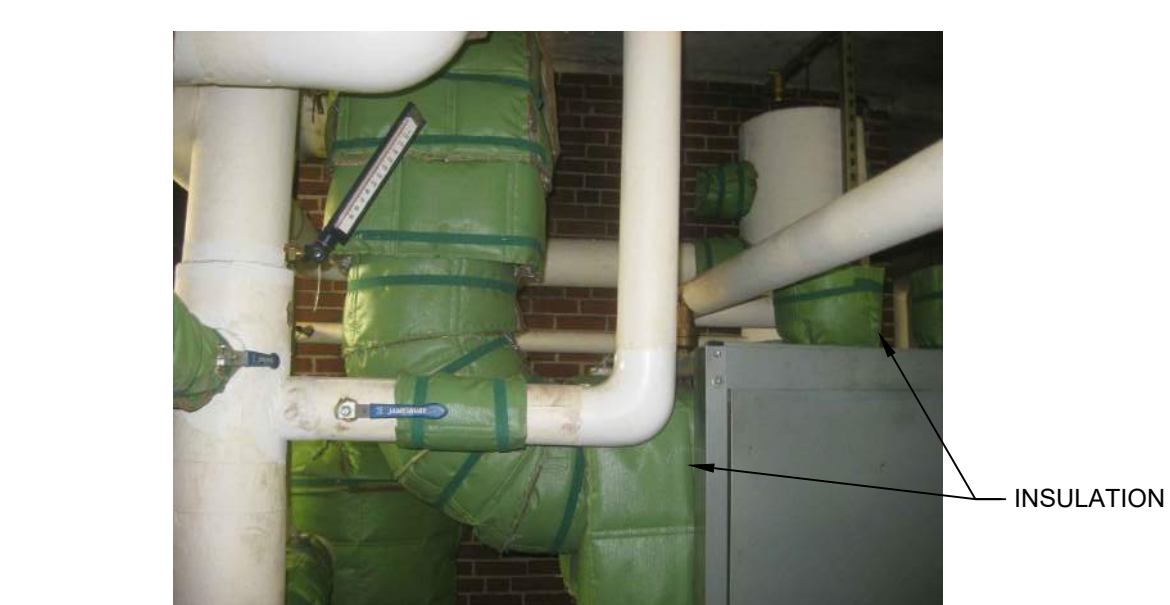
3 REMOVABLE PAD INSULATORS  
 NTS



5 REMOVABLE PAD INSULATORS  
 NTS



2 REMOVABLE PAD INSULATORS  
 NTS



4 REMOVABLE PAD INSULATORS  
 NTS



6 REMOVABLE PAD INSULATORS  
 NTS

**EverGreen®** Cut 'n Wrap™ Insulation Kits\*  
 Flanges and Valves

**Installation (Steps 1-10)**

**Required Tools:**

- Stapling pliers with galvanized staples. Recommend Bostitch P6CB which shoots STCR-5019 type staples up to 3/8 inch in length
- Scissors or Utility Knife  
 (Note: cutting through fiberglass insulation dulls scissors quickly; high quality scissors capable of being re-sharpened are recommended)

**Required Materials:**

- Roll(s) of EverGreen® Cut 'n Wrap™ Reusable Insulation 48" wide and 96" long
- Roll(s) of double-sided hook and loop fastener

**References:**

- Auburn Manufacturing, Inc.'s Cut 'n Wrap Material Calculator

- Assemble the necessary tools and unroll the Cut 'n Wrap.
- Determine the size and shape of Cut 'n Wrap necessary to insulate the pipe component being insulated.
- Cut the required blanket pieces from the roll of Cut 'n Wrap.  
 Note: Insulation for a flange should consist of one blanket piece of the proper dimension whereas insulation for a gate valve may consist of two or three separate blanket pieces of the proper dimensions.
- Peel hook and loop strips from the roll equal in lengths to the Cut 'n Wrap blanket plus 6 inches.
- Staple one end of each strip of hook and loop to one end of the Cut 'n Wrap blanket piece. Use at least 2 staples per strip.
- Make a small loop at the loose end of the hook and loop material and staple. This makes it easier to work with gloves and to detach the hook and loop strip from itself.
- Wrap the first blanket around the valve or flange to be insulated (Note: for a gate valve, that should be the stem, immediately beneath the wheel). Pull the hook and loop straps so as to tighten the Cut 'n Wrap blanket. If insulating a flange, you are done with that pipe component.
- For a gate valve, continue installing the second blanket around the lower part of the valve stem, closest to the valve blanket.
- For a gate valve, continue installing the third blanket around the valve body. It may help to snip several inches into the Cut 'n Wrap blanket seams to get a better fit on the pipe and around the valve stem. Wrap the valve blanket around one side of the valve stem, and then around the second side. Then come back to tighten the first hook and loop strap. You should loosen the hook and loop strap holding the second blanket in place so as to secure part of the third blanket around the valve stem.
- Inspect the insulated component to make certain that all bare surfaces have been covered with Cut 'n Wrap.

**EverGreen®** Cut 'n Wrap™ Insulation Kits\*  
 Flanges and Valves

**Installation (Steps 1-10)**

**EverGreen®** Cut 'n Wrap™ Insulation Kits\*  
 Flanges and Valves

**Installation (Steps 1-10)**

- For a gate valve, continue installing the second blanket around the lower part of the valve stem, closest to the valve blanket.
- For a gate valve, continue installing the third blanket around the valve body. It may help to snip several inches into the Cut 'n Wrap blanket seams to get a better fit on the pipe and around the valve stem. Wrap the valve blanket around one side of the valve stem, and then around the second side. Then come back to tighten the first hook and loop strap. You should loosen the hook and loop strap holding the second blanket in place so as to secure part of the third blanket around the valve stem.
- Inspect the insulated component to make certain that all bare surfaces have been covered with Cut 'n Wrap.

**Disclaimer:** Anyone intending to use the products identified and described in this publication, as well as the information or specifications concerning these products, should, before using them, be satisfied that the products are suitable for the intended use and meet all appropriate and applicable safety and health standards. The products identified and described in this publication will perform to any expressly indicated specifications only when properly used, and the user, not Auburn Manufacturing, is responsible for their proper use.

U.S. Patent 7914872.8039080 3/17

Revisions:	Date

**CONSULTANTS:**



**ARCHITECT/ENGINEERS:**  
**AESUS** Architecture, Engineering, and Sustainable Design  
 designgroup  
 1000 E. Southern Ave, Suite 400, Tempe, Arizona 85282, (480) 454-2861

Drawing Title  
 MECHANICAL DETAILS  
 VAPAHCs PLANNING AND ENGINEERING

Project Title  
 REPLACE PENTHOUSE HVAC SYSTEMS  
 CONTRACT NO. VA259-17-C-0212

Location  
 FT. HARRISON HELENA, MT

Date  
 07/14/16

Checked  
 OG

Drawn  
 CR

Project Number  
 436-17-102

Building Number  
 154

Drawing Number  
 M505

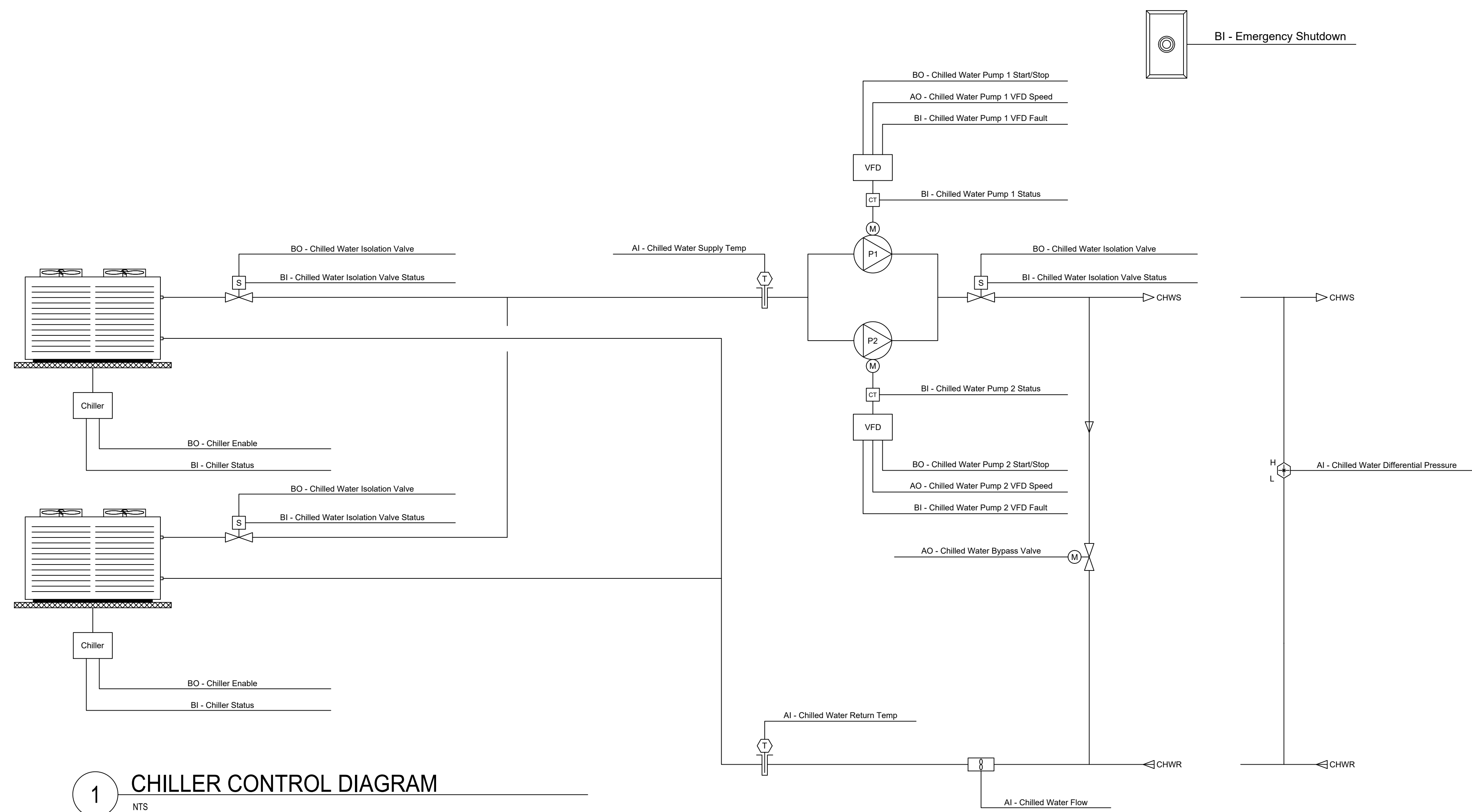
**BID SET**

Office of Construction and Facilities Management  
 Department of Veterans Affairs

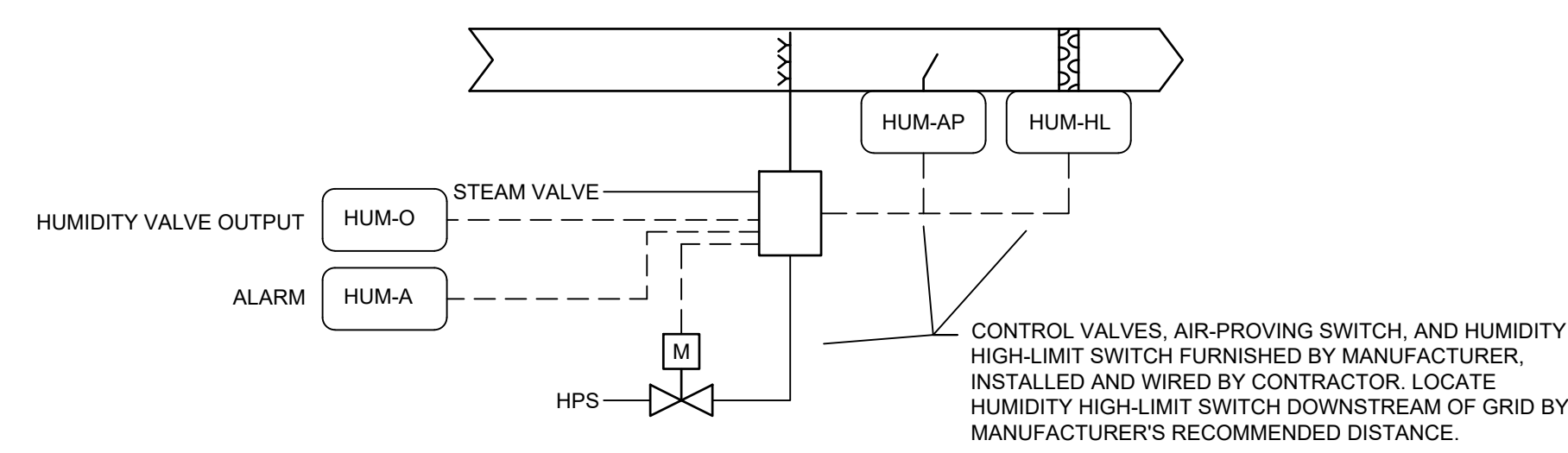




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**1 CHILLER CONTROL DIAGRAM**  
 NTS



**SEQUENCE OF OPERATION**

HUMIDIFICATION: HUMIDIFIER IS FURNISHED WITH INTERNAL CONTROLS. PROVIDE OUTPUT SIGNAL TO CONTROLS PROPORTIONAL TO THE AMOUNT OF HUMIDITY REQUIRED TO MAINTAIN THE EXHAUST AIR HUMIDITY SETPOINT OF 45% RELATIVE HUMIDITY (ADJUSTABLE) WHILE KEEPING THE COLD DECK HUMIDITY BELOW 80% RELATIVE HUMIDITY (ADJUSTABLE). THE SAFETIES (AIR PROVING SWITCH AND HIGH-HUMIDITY OF 80%, ADJUSTABLE) SHALL BE WIRED AND INTERLOCKED TO THE INTERNAL CONTROLS.

**2 HUMIDIFIER CONTROL DIAGRAM**  
 NTS

**AIR COOLED CHILLERS**

**LEAD CHILLER - RUN CONDITIONS:**

- THE CHILLER SHALL BE ENABLED TO RUN WHENEVER:
  - A DEFINABLE NUMBER OF CHILLED WATER COILS NEED COOLING
  - AND THE OUTSIDE AIR TEMPERATURE IS GREATER THAN 54°F (ADJ.).

**LAG CHILLER - RUN CONDITIONS:**

- THE CHILLER SHALL BE ENABLED TO RUN WHENEVER:
  - THE LEAD CHILLER REACHES 90% OF ITS CAPACITY AND A DEFINABLE NUMBER OF CHILLED WATER COILS NEED COOLING
  - AND THE OUTSIDE AIR TEMPERATURE IS GREATER THAN 54°F (ADJ.).

TO PREVENT SHORT CYCLING, THE CHILLER SHALL RUN FOR AND BE OFF FOR MINIMUM ADJUSTABLE TIMES (BOTH USER DEFINABLE), UNLESS SHUTDOWN ON SAFETIES OR OUTSIDE AIR CONDITIONS.

THE CHILLER SHALL RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS.

**CHILLED WATER ISOLATION VALVE:**

THE VALVE SHALL OPEN ANYTIME THE CHILLER IS CALLED TO RUN. THE VALVE SHALL ALSO OPEN WHENEVER THE CHILLED WATER PUMP RUNS FOR FREEZE PROTECTION.

THE VALVE SHALL OPEN PRIOR TO THE CHILLER BEING ENABLED AND SHALL CLOSE ONLY AFTER THE CHILLER IS DISABLED. THE VALVE SHALL THEREFORE HAVE:

- A USER ADJUSTABLE DELAY ON START.
- AND A USER ADJUSTABLE DELAY ON STOP.

THE DELAY TIMES SHALL BE SET APPROPRIATELY TO ALLOW FOR ORDERLY CHILLED WATER SYSTEM START-UP, SHUTDOWN AND SEQUENCING.

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**

- FAILURE: VALVE COMMANDED OPEN BUT THE STATUS INDICATES CLOSED.
- OPEN IN HAND: VALVE COMMANDED CLOSED BUT THE STATUS INDICATES OPEN.
- RUNTIME EXCEEDED: VALVE STATUS RUNTIME EXCEEDS A USER-DEFINABLE LIMIT.

**CHILLED WATER PUMP LEAD/STANDBY OPERATION:**

THE TWO CHILLED WATER PUMPS SHALL RUN ANYTIME THE CHILLER IS CALLED TO RUN. THE CHILLED WATER PUMP SHALL ALSO RUN FOR FREEZE PROTECTION WHENEVER THE OUTSIDE AIR TEMPERATURE IS LESS THAN A USER DEFINABLE SETPOINT (ADJ.).

THE LEAD PUMP SHALL START PRIOR TO THE CHILLER BEING ENABLED AND SHALL STOP ONLY AFTER THE CHILLER IS DISABLED. THE PUMP(S) SHALL THEREFORE HAVE:

- A USER ADJUSTABLE DELAY ON START.
- AND A USER ADJUSTABLE DELAY ON STOP.

THE DELAY TIMES SHALL BE SET APPROPRIATELY TO ALLOW FOR ORDERLY CHILLED WATER SYSTEM START-UP, SHUTDOWN AND SEQUENCING.

**THE TWO PUMPS SHALL OPERATE IN A LEAD/STANDBY FASHION.**

- THE LEAD PUMP SHALL RUN FIRST.
- ON FAILURE OF THE LEAD PUMP, THE STANDBY PUMP SHALL RUN AND THE LEAD PUMP SHALL TURN OFF.

THE DESIGNATED LEAD PUMP SHALL ROTATE UPON ONE OF THE FOLLOWING CONDITIONS (USER SELECTABLE):

- MANUALLY THROUGH A SOFTWARE SWITCH
- IF PUMP RUNTIME (ADJ.) IS EXCEEDED
- DAILY
- WEEKLY
- MONTHLY

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**

- CHILLED WATER PUMP 1
- FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.

- RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.
- VFD FAULT.

- CHILLED WATER PUMP 2
- FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.
- VFD FAULT.

**CHILLED WATER DIFFERENTIAL PRESSURE CONTROL:**  
 THE CONTROLLER SHALL MEASURE CHILLED WATER DIFFERENTIAL PRESSURE AND MODULATE THE LEAD CHILLED WATER PUMP VFD TO MAINTAIN ITS CHILLED WATER DIFFERENTIAL PRESSURE SETPOINT. THE FOLLOWING SETPOINTS ARE RECOMMENDED VALUES. ALL SETPOINTS SHALL BE FIELD ADJUSTED DURING THE COMMISSIONING PERIOD TO MEET THE REQUIREMENTS OF ACTUAL FIELD CONDITIONS.

THE CONTROLLER SHALL MODULATE CHILLED WATER PUMP SPEED TO MAINTAIN A CHILLED WATER DIFFERENTIAL PRESSURE OF 12LBF/IN<sup>2</sup> (ADJ.). THE VFD MINIMUM SPEED SHALL NOT DROP BELOW 10% (ADJ.).

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**

- HIGH CHILLED WATER DIFFERENTIAL PRESSURE: IF THE CHILLED WATER DIFFERENTIAL PRESSURE IS 25% (ADJ.) GREATER THAN SETPOINT.
- LOW CHILLED WATER DIFFERENTIAL PRESSURE: IF THE CHILLED WATER DIFFERENTIAL PRESSURE IS 25% (ADJ.) LESS THAN SETPOINT.

**CHILLED WATER BYPASS VALVE - MINIMUM FLOW CONTROL:**  
 THE CONTROLLER SHALL MEASURE CHILLED WATER FLOW THROUGH THE CHILLER AND, AS THE CHILLED WATER FLOW DROPS BELOW SETPOINT, THE CONTROLLER SHALL MODULATE THE CHILLED WATER BYPASS VALVE OPEN TO MAINTAIN THE MINIMUM CHILLED WATER FLOW SETPOINT.

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**

- LOW CHILLED WATER FLOW: IF THE CHILLED WATER FLOW IS 25% (ADJ.) LESS THAN SETPOINT.

**CHILLER:**

THE CHILLER SHALL BE ENABLED A USER ADJUSTABLE TIME AFTER PUMP STATUSES ARE PROVEN ON. THE CHILLER SHALL THEREFORE HAVE A USER ADJUSTABLE DELAY ON START.

THE DELAY TIME SHALL BE SET APPROPRIATELY TO ALLOW FOR ORDERLY CHILLED WATER SYSTEM START-UP, SHUTDOWN AND SEQUENCING.

THE CHILLER SHALL RUN SUBJECT TO ITS OWN INTERNAL SAFETIES AND CONTROLS.

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**

- CHILLER FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- CHILLER RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- CHILLER RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.

**CHILLER CHILLED WATER SUPPLY SETPOINT:**

THE CHILLER SHALL MAINTAIN A CHILLED WATER SUPPLY TEMPERATURE SETPOINT AS DETERMINED BY ITS OWN INTERNAL CONTROLS (PROVIDED BY OTHERS).

**CHILLED WATER TEMPERATURE MONITORING:**

THE FOLLOWING TEMPERATURES SHALL BE MONITORED:

- CHILLED WATER SUPPLY.
- CHILLED WATER RETURN.

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**

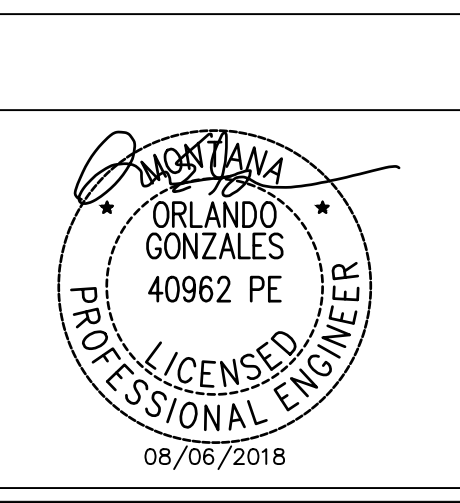
- HIGH CHILLED WATER SUPPLY TEMP: IF THE CHILLED WATER SUPPLY TEMPERATURE IS GREATER THAN 55°F (ADJ.).
- LOW CHILLED WATER SUPPLY TEMP: IF THE CHILLED WATER SUPPLY TEMPERATURE IS LESS THAN 38°F (ADJ.).

ABBREVIATIONS	
DDC	DIRECT DIGITAL CONTROL
NO	NORMALLY OPEN
NC	NORMALLY CLOSED
SR	SPRING RANGE
TR	THROTTLING RANGE
PH	PREHEAT
CPA	CONTROL POINT ADJUSTMENT
DA	DIRECT ACTING
RA	REVERSE ACTING
FMS	FACILITY MANAGEMENT SYSTEM
EMS	ENTERPRISE MANAGEMENT SYSTEM

SYMBOLS	
	HARD-WIRED SAFETY INTERLOCK
	HARDWARE POINT

Revisions	Date

CONSULTANTS:	



**ARCHITECT/ENGINEERS:**

**AESUS** Architecture, Engineering, and Sustainable Design  
 designgroup  
 1000 E. Southern Ave, Suite #D, Tempe, Arizona 85282, (480) 454-2801

Drawing Title	HVAC CONTROL DIAGRAMS
Project Title	REPLACE PENTHOUSE HVAC SYSTEMS CONTRACT NO. VA259-17-C-0212
Location	FT. HARRISON, HELENA, MT
Date	04/29/16
Checked	OQ
Drawn	CR
VAPAHCs PLANNING AND ENGINEERING	

Project Number	436-17-102
Building Number	154
Drawing Number	M801

**BID SET**

Office of Construction and Facilities Management

Department of Veterans Affairs



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**SEQUENCE OF CONTROLS**

**RUN CONDITIONS - REQUESTED:**  
 THE UNIT SHALL RUN WHENEVER:  
 • ANY ZONE IS OCCUPIED.  
 • OR A DEFINABLE NUMBER OF UNOCCUPIED ZONES NEED HEATING OR COOLING.

**EMERGENCY SHUTDOWN:**  
 THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING AN EMERGENCY SHUTDOWN SIGNAL.

**FREEZE PROTECTION:**  
 THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A FREEZESTAT STATUS.

**HIGH/LOW STATIC SHUTDOWN:**  
 THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING AN HIGH OR LOW STATIC SHUTDOWN SIGNAL.

**RETURN AIR SMOKE DETECTION:**  
 THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A RETURN AIR SMOKE DETECTOR STATUS.

**SUPPLY AIR SMOKE DETECTION:**  
 THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A SUPPLY AIR SMOKE DETECTOR STATUS.

**AHU OPTIMAL START:**  
 THE UNIT SHALL START PRIOR TO SCHEDULED OCCUPANCY BASED ON THE TIME NECESSARY FOR THE ZONES TO REACH THEIR OCCUPIED SETPOINTS. THE START TIME SHALL AUTOMATICALLY ADJUST BASED ON CHANGES IN OUTSIDE AIR TEMPERATURE AND ZONE TEMPERATURES.

**SUPPLY FAN (12 FANS):**  
 THE SUPPLY FANS SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE SUPPLY FANS SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME. SUPPLY FANS SHALL RAMP UP AS ONE FAN.

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**  
 • SUPPLY FAN FAILURE, COMMANDED ON, BUT THE STATUS IS OFF.  
 • SUPPLY FAN IN HAND, COMMANDED OFF, BUT THE STATUS IS ON.  
 • SUPPLY FAN RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT (ADJ.).

**SUPPLY AIR DUCT STATIC PRESSURE CONTROL:**  
 THE CONTROLLER SHALL MEASURE DUCT STATIC PRESSURE AND MODULATE THE SUPPLY FAN VFD SPEED TO MAINTAIN A DUCT STATIC PRESSURE SETPOINT. THE SPEED SHALL NOT DROP BELOW 30% (ADJ.). THE STATIC PRESSURE SETPOINT SHALL BE RESET BASED UPON THE POSITION OF THE ZONE DAMPERS, WITH A GOAL OF REDUCING THE STATIC PRESSURE UNTIL AT LEAST ONE ZONE DAMPER IS NEARLY WIDE OPEN.  
 • THE INITIAL DUCT STATIC PRESSURE SETPOINT SHALL BE 1.5IN H2O (ADJ.).  
 • IF NO ZONE DAMPER IS NEARLY WIDE OPEN, THE SETPOINT SHALL INCREMENTALLY RESET DOWN TO A MINIMUM OF 1.3IN H2O (ADJ.).  
 • AS ONE OR MORE DAMPERS NEARS THE WIDE OPEN POSITION, THE SETPOINT SHALL INCREMENTALLY RESET UP TO A MAXIMUM OF 1.8IN H2O (ADJ.).

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**  
 • HIGH SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS 25% (ADJ.) GREATER THAN SETPOINT.  
 • LOW SUPPLY AIR STATIC PRESSURE: IF THE SUPPLY AIR STATIC PRESSURE IS 25% (ADJ.) LESS THAN SETPOINT.  
 • SUPPLY FAN VFD FAULT.

**RETURN FANS (12 FANS):**  
 THE RETURN FANS SHALL RUN WHENEVER THE SUPPLY FANS RUN. RETURN FANS SHALL RAMP UP AND DOWN AS ONE FAN AND NOT BE STAGED.

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**  
 • RETURN FAN FAILURE, COMMANDED ON, BUT THE STATUS IS OFF.  
 • RETURN FAN IN HAND, COMMANDED OFF, BUT THE STATUS IS ON.  
 • RETURN FAN RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT (ADJ.).  
 • RETURN FAN VFD FAULT.

**RETURN PLENUM STATIC PRESSURE CONTROL:**  
 THE CONTROLLER SHALL MEASURE RETURN PLENUM STATIC PRESSURE AND MODULATE THE RETURN FAN VFD SPEED TO MAINTAIN A RETURN PLENUM STATIC PRESSURE SETPOINT OF 0.2IN H2O (ADJ.). THE RETURN FAN VFD SPEED SHALL NOT DROP BELOW 20% (ADJ.).

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**  
 • HIGH RETURN PLENUM STATIC PRESSURE: IF THE RETURN AIR PLENUM STATIC PRESSURE IS 25% (ADJ.) GREATER THAN SETPOINT.  
 • LOW RETURN PLENUM STATIC PRESSURE: IF THE RETURN AIR PLENUM STATIC PRESSURE IS 25% (ADJ.) LESS THAN SETPOINT.

**ENERGY RECOVERY - RUN-AROUND LOOP COILS:**  
 THE CONTROLLER SHALL MODULATE THE RUN-AROUND LOOP MIXING VALVE FOR ENERGY RECOVERY AS FOLLOWS:  
 • THE CONTROLLER SHALL MEASURE THE RUN-AROUND LOOP COIL DISCHARGE AIR TEMPERATURE (DOWNSTREAM OF THE OUTSIDE AIR COIL) AND MODULATE THE RUN-AROUND LOOP MIXING VALVE TO MAINTAIN A SETPOINT 2°F (ADJ.) LESS THAN THE UNIT SUPPLY AIR TEMPERATURE SETPOINT. THE RUN-AROUND LOOP SHALL RUN FOR COOL RECOVERY WHENEVER:  
 • UNIT RETURN AIR TEMPERATURE IS 5°F (ADJ.) OR MORE BELOW THE OUTSIDE AIR TEMPERATURE.  
 • AND THE UNIT IS IN A COOLING MODE.  
 • AND THE ECONOMIZER IS OFF.  
 • AND THE SUPPLY FAN IS ON.

**HEATING RECOVERY MODE:**  
 THE CONTROLLER SHALL MEASURE THE RUN-AROUND LOOP COIL DISCHARGE AIR TEMPERATURE (DOWNSTREAM OF THE OUTSIDE AIR COIL) AND MODULATE THE RUN-AROUND LOOP MIXING VALVE TO MAINTAIN A SETPOINT 2°F (ADJ.) GREATER THAN THE UNIT SUPPLY AIR TEMPERATURE SETPOINT. THE RUN-AROUND LOOP SHALL RUN FOR HEAT RECOVERY WHENEVER:  
 • UNIT RETURN AIR TEMPERATURE IS 5°F (ADJ.) OR MORE ABOVE THE OUTSIDE AIR TEMPERATURE.  
 • AND THE UNIT IS IN A HEATING MODE.  
 • AND THE ECONOMIZER IS OFF.  
 • AND THE SUPPLY FAN IS ON.

**FROST PROTECTION:**  
 THE RUN-AROUND LOOP PUMP SHALL RUN AND THE RUN-AROUND LOOP MIXING VALVE SHALL CLOSE TO 0% (ADJ.) IN ORDER TO CIRCULATE WATER THROUGH THE RUN-AROUND LOOP EXHAUST AIR COIL WHENEVER:  
 • RUN-AROUND LOOP TEMPERATURE DROPS BELOW 33°F (ADJ.).  
 • OR THE EXHAUST AIR TEMPERATURE DROPS BELOW 30°F (ADJ.).

**PREHEATING COIL VALVE:**  
 THE PREHEATING COIL VALVE SHALL BE ENABLED WHENEVER:  
 • OUTSIDE AIR TEMPERATURE IS LESS THAN 60°F (ADJ.).  
 • AND THE ECONOMIZER IS DISABLED.  
 • AND THE SUPPLY FAN STATUS IS ON.

**THE PREHEATING COIL VALVE SHALL OPEN FOR FREEZE PROTECTION WHENEVER:**  
 • MIXED AIR TEMPERATURE DROPS FROM 40°F TO 35°F (ADJ.).  
 • OR THE FREEZESTAT IS ON.

**SUPPLY AIR TEMPERATURE SETPOINT - OPTIMIZED:**  
 THE CONTROLLER SHALL MONITOR THE SUPPLY AIR TEMPERATURE AND SHALL MAINTAIN A SUPPLY AIR TEMPERATURE SETPOINT RESET BASED ON ZONE COOLING AND HEATING REQUIREMENTS

**THE SUPPLY AIR TEMPERATURE SETPOINT SHALL BE RESET FOR COOLING BASED ON ZONE COOLING REQUIREMENTS AS FOLLOWS:**  
 • THE INITIAL SUPPLY AIR TEMPERATURE SETPOINT SHALL BE 55°F (ADJ.).  
 • AS COOLING DEMAND INCREASES, THE SETPOINT SHALL INCREMENTALLY RESET DOWN TO A MINIMUM OF 53°F (ADJ.).  
 • AS COOLING DEMAND DECREASES, THE SETPOINT SHALL INCREMENTALLY RESET UP TO A MAXIMUM OF 72°F (ADJ.).

**IF MORE ZONES NEED HEATING THAN COOLING, THEN THE SUPPLY AIR TEMPERATURE SETPOINT SHALL BE RESET FOR HEATING AS FOLLOWS:**  
 • THE INITIAL SUPPLY AIR TEMPERATURE SETPOINT SHALL BE 82°F (ADJ.).  
 • AS HEATING DEMAND INCREASES, THE SETPOINT SHALL INCREMENTALLY RESET UP TO A MAXIMUM OF 85°F (ADJ.).  
 • AS HEATING DEMAND DECREASES, THE SETPOINT SHALL INCREMENTALLY RESET DOWN TO A MINIMUM OF 72°F (ADJ.).

**SEQUENCE OF CONTROLS (CONT.)**

**COOLING COIL VALVE:**  
 THE CONTROLLER SHALL MEASURE THE SUPPLY AIR TEMPERATURE AND MODULATE THE COOLING COIL VALVE TO MAINTAIN ITS COOLING SETPOINT.

**THE COOLING SHALL BE ENABLED WHENEVER:**  
 • OUTSIDE AIR TEMPERATURE IS GREATER THAN 60°F (ADJ.).  
 • AND THE ECONOMIZER IS DISABLED OR FULLY OPEN.  
 • AND THE SUPPLY FAN STATUS IS ON.  
 • AND THE HEATING IS NOT ACTIVE.

**THE COOLING COIL VALVE SHALL OPEN TO 50% (ADJ.) WHENEVER THE FREEZESTAT IS ON.**

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**  
 • HIGH SUPPLY AIR TEMP: IF THE SUPPLY AIR TEMPERATURE IS 5°F (ADJ.) GREATER THAN SETPOINT.

**LOW SUPPLY AIR TEMPERATURE ALARM:**  
 THE CONTROLLER SHALL ALARM IF THE SUPPLY AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

**ECONOMIZER:**  
 THE CONTROLLER SHALL MEASURE THE MIXED AIR TEMPERATURE AND MODULATE THE ECONOMIZER DAMPERS IN SEQUENCE TO MAINTAIN A SETPOINT 2°F (ADJ.) LESS THAN THE SUPPLY AIR TEMPERATURE SETPOINT. THE OUTSIDE AIR DAMPERS SHALL MAINTAIN A MINIMUM ADJUSTABLE POSITION OF 20% (ADJ.) OPEN WHENEVER OCCUPIED.

**THE ECONOMIZER SHALL BE ENABLED WHENEVER:**  
 • OUTSIDE AIR TEMPERATURE IS LESS THAN 65°F (ADJ.).  
 • AND THE OUTSIDE AIR TEMPERATURE IS LESS THAN THE RETURN AIR TEMPERATURE.  
 • AND THE SUPPLY FAN STATUS IS ON.

**THE ECONOMIZER SHALL CLOSE WHENEVER:**  
 • MIXED AIR TEMPERATURE DROPS FROM 40°F TO 35°F (ADJ.).  
 • OR THE FREEZESTAT IS ON.  
 • OR ON LOSS OF SUPPLY FAN STATUS.

**THE OUTSIDE AND EXHAUST AIR DAMPERS SHALL CLOSE AND THE RETURN AIR DAMPER SHALL OPEN WHEN THE UNIT IS OFF. IF OPTIMAL START UP IS AVAILABLE THE MIXED AIR DAMPER SHALL OPERATE AS DESCRIBED IN THE OCCUPIED MODE EXCEPT THAT THE OUTSIDE AIR DAMPER SHALL MODULATE TO FULLY CLOSED.**

**MINIMUM OUTSIDE AIR VENTILATION - FIXED PERCENTAGE:**  
 THE OUTSIDE AIR DAMPERS SHALL MAINTAIN A MINIMUM ADJUSTABLE POSITION DURING BUILDING OCCUPIED HOURS AND BE CLOSED DURING UNOCCUPIED HOURS.

**HUMIDIFIER CONTROL:**  
 THE CONTROLLER SHALL MEASURE THE RETURN AIR HUMIDITY AND MODULATE THE HUMIDIFIER TO MAINTAIN A SETPOINT OF 50% RH (ADJ.). THE HUMIDIFIER SHALL BE ENABLED WHENEVER THE SUPPLY FAN STATUS IS ON.

**THE HUMIDIFIER SHALL TURN OFF WHENEVER:**  
 • SUPPLY AIR HUMIDITY RISES FROM 90% RH TO 95% RH (ADJ.).  
 • OR ON LOSS OF SUPPLY FAN STATUS.

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**  
 • HIGH SUPPLY AIR HUMIDITY: IF THE SUPPLY AIR HUMIDITY IS GREATER THAN 80% RH (ADJ.).  
 • LOW SUPPLY AIR HUMIDITY: IF THE SUPPLY AIR HUMIDITY IS LESS THAN 30% RH (ADJ.).

**PREFILTER DIFFERENTIAL PRESSURE MONITOR:**  
 THE CONTROLLER SHALL MONITOR THE DIFFERENTIAL PRESSURE ACROSS THE PREFILTER.

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**  
 • PREFILTER CHANGE REQUIRED: PREFILTER DIFFERENTIAL PRESSURE EXCEEDS A USER DEFINABLE LIMIT (ADJ.).

**FINAL FILTER DIFFERENTIAL PRESSURE MONITOR:**  
 THE CONTROLLER SHALL MONITOR THE DIFFERENTIAL PRESSURE ACROSS THE FINAL FILTER.

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**  
 • FINAL FILTER CHANGE REQUIRED: FINAL FILTER DIFFERENTIAL PRESSURE EXCEEDS A USER DEFINABLE LIMIT (ADJ.).

**MIXED AIR TEMPERATURE:**  
 THE CONTROLLER SHALL MONITOR THE MIXED AIR TEMPERATURE AND USE AS REQUIRED FOR ECONOMIZER CONTROL OR PREHEATING CONTROL.

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**  
 • HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).  
 • LOW MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

**RETURN AIR HUMIDITY:**  
 THE CONTROLLER SHALL MONITOR THE RETURN AIR HUMIDITY AND USE AS REQUIRED FOR ECONOMIZER CONTROL OR HUMIDITY CONTROL.

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**  
 • HIGH RETURN AIR HUMIDITY: IF THE RETURN AIR HUMIDITY IS GREATER THAN 70% (ADJ.).  
 • LOW RETURN AIR HUMIDITY: IF THE RETURN AIR HUMIDITY IS LESS THAN 35% (ADJ.).

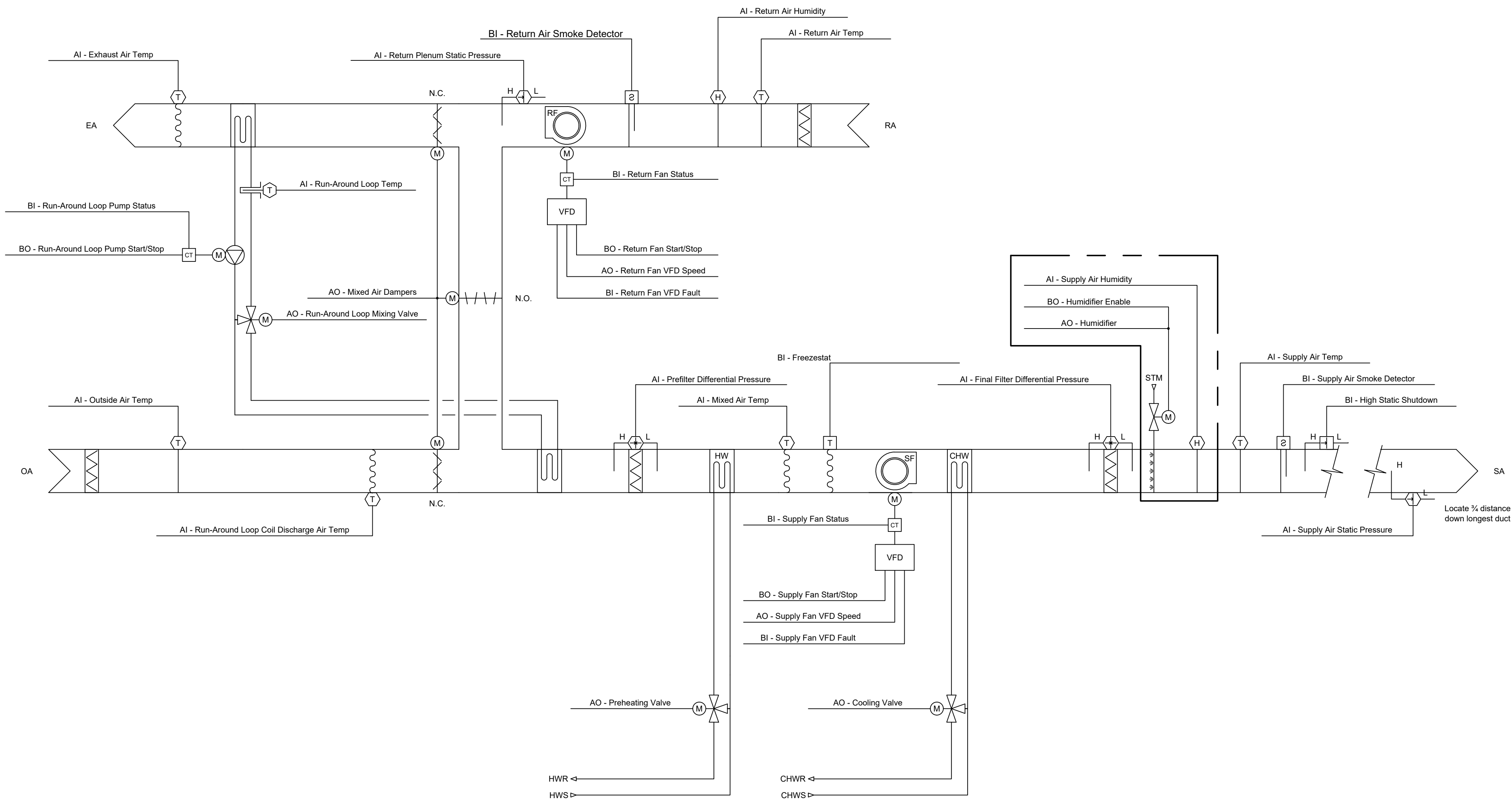
**RETURN AIR TEMPERATURE:**  
 THE CONTROLLER SHALL MONITOR THE RETURN AIR TEMPERATURE AND USE AS REQUIRED FOR SETPOINT CONTROL OR ECONOMIZER CONTROL.

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**  
 • HIGH RETURN AIR TEMP: IF THE RETURN AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.).  
 • LOW RETURN AIR TEMP: IF THE RETURN AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

**SUPPLY AIR TEMPERATURE:**  
 THE CONTROLLER SHALL MONITOR THE SUPPLY AIR TEMPERATURE.

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**  
 • HIGH SUPPLY AIR TEMP: IF THE SUPPLY AIR TEMPERATURE IS GREATER THAN 120°F (ADJ.).  
 • LOW SUPPLY AIR TEMP: IF THE SUPPLY AIR TEMPERATURE IS LESS THAN 45°F (ADJ.).

**AHU CONTROL DIAGRAM**



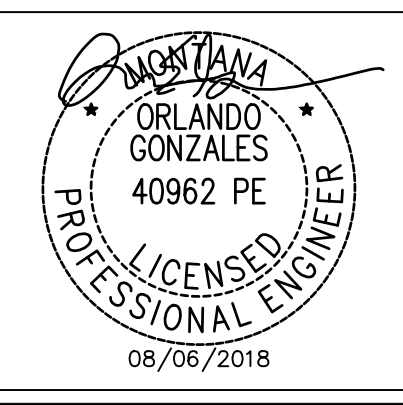
Point Name	Hardware Points				Software Points						
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Exhaust Air Temp	x								x		x
Final Filter Differential Pressure	x								x		x
Mixed Air Temp	x								x		x
Outside Air Temp	x								x		x
Prefilter Differential Pressure	x								x		x
High Mixed Air Temp	x								x		x
High Return Air Humidity	x								x		x
High Return Air Temp	x								x		x
High Return Plenum Static Pressure	x								x		x
Run-Around Loop Coil Discharge Air Temp	x								x		x
Run-Around Loop Temp	x								x		x
Supply Air Humidity	x								x		x
High Supply Air Static Pressure	x								x		x
High Supply Air Temp	x								x		x
Supply Air Temp	x								x		x
Cooling Valve		x							x		x
Humidifier		x							x		x
Mixed Air Dampers		x							x		x
Preheating Valve		x							x		x
Return Fan VFD Speed		x							x		x
Run-Around Loop Mixing Valve		x							x		x
Supply Fan VFD Speed		x							x		x
FreezeStat			x						x	x	x
High Static Shutdown			x						x	x	x
Return Air Smoke Detector			x						x	x	x
Return Fan Status			x						x		x
Return Fan VFD Fault			x						x		x
Run-Around Loop Pump Status			x						x		x
Supply Air Smoke Detector			x						x	x	x
Supply Fan Status			x						x		x
Supply Fan VFD Fault			x						x	x	x
Humidifier Enable				x					x		x
Return Fan Start/Stop				x					x		x
Run-Around Loop Pump Start/Stop				x					x		x
Supply Fan Start/Stop				x					x		x
Economizer Mixed Air Temp Setpoint					x				x		x
Humidifier Setpoint						x			x		x
Preheating Mixed Air Temp Setpoint						x			x		x
Return Plenum Static Pressure Setpoint						x			x		x

Point Name	Hardware Points				Software Points						
	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Supply Air Static Pressure Setpoint					x					x	x
Supply Air Temp Setpoint					x					x	x
Emergency Shutdown						x				x	x
Final Filter Change Required										x	x
High Mixed Air Temp										x	x
High Return Air Humidity										x	x
High Return Air Temp										x	x
High Return Plenum Static Pressure										x	x
High Supply Air Humidity										x	x
High Supply Air Static Pressure										x	x
High Supply Air Temp										x	x
Supply Air Temp										x	x
Low Mixed Air Temp										x	x
Low Return Air Humidity										x	x
Low Return Air Temp										x	x
Low Return Plenum Static Pressure										x	x
Low Supply Air Humidity										x	x
Low Supply Air Static Pressure										x	x
Low Supply Air Temp										x	x
Low Supply Air Temp										x	x
Low Supply Air Temp										x	x
Prefilter Change Required										x	x
Return Fan Failure										x	x
Return Fan in Hand										x	x
Return Fan Runtime Exceeded										x	x
Run-Around Loop Pump Failure										x	x
Run-Around Loop Pump in Hand										x	x
Run-Around Loop Pump Runtime Exceeded										x	x
Supply Fan Failure										x	x
Supply Fan in Hand										x	x
Supply Fan Runtime Exceeded										x	x
Totals	13	7	9	4	6	1	0	0	36	35	40

**CONTROLS POINTS LIST**

**CONSULTANTS:**

**ARCHITECT/ENGINEERS:**



**AESUS** Architecture, Engineering, and Sustainable Design  
 1000 E. Southern Ave, Suite #10, Tempe, Arizona 85282, (480) 454-2801

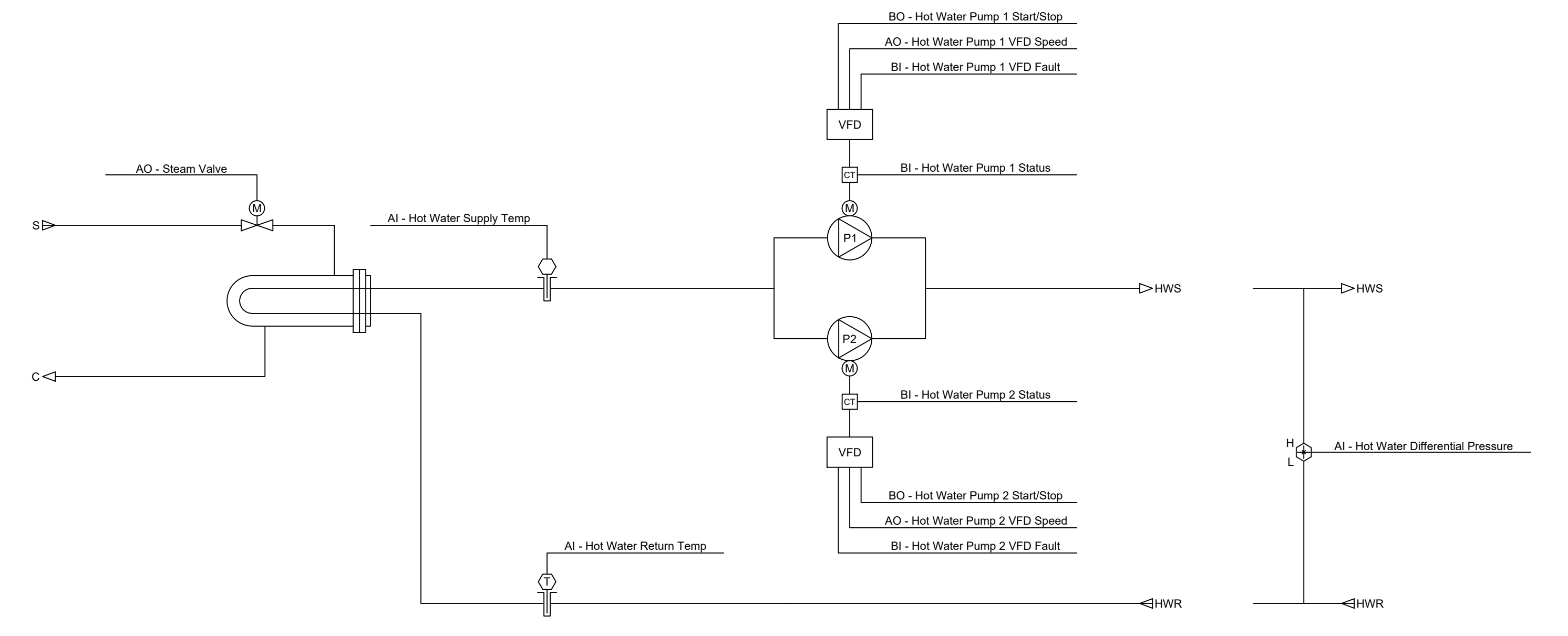
Drawing Title	HVAC CONTROL DIAGRAMS		
Project Title	REPLACE PENTHOUSE HVAC SYSTEMS		
Contract No.	VA259-17-C-0212		
Location	FT. HARRISON	HELENA, MT	
Date	07/14/16	Checked	OQ
		Drawn	CR
VAPAHS PLANNING AND ENGINEERING			

Project Number	436-17-102
Building Number	154
Drawing Number	M802

Office of Construction and Facilities Management  
 Department of Veterans Affairs



three inches = one foot  
 one and one half inches = one foot  
 one inch = one foot  
 one inch = one foot  
 one inch = one foot  
 three quarters inch = one foot  
 one half inch = one foot  
 one half inch = one foot  
 three eighths inch = one foot  
 one quarter inch = one foot  
 one eighth inch = one foot  
 one eighth inch = one foot



**1 STEAM TO HOT WATER CONTROL DIAGRAM**

**STEAM TO HOT WATER CONVERTER**

**HEAT EXCHANGER SYSTEM RUN CONDITIONS:**  
 THE HEAT EXCHANGER SYSTEM SHALL BE ENABLED TO RUN WHENEVER:

- A DEFINABLE NUMBER OF HOT WATER COILS NEED HEATING.
- AND OUTSIDE AIR TEMPERATURE IS LESS THAN 65°F (ADJ.).

**TO PREVENT SHORT CYCLING, THE HEAT EXCHANGER SHALL RUN FOR AND BE OFF FOR MINIMUM ADJUSTABLE TIMES (BOTH USER DEFINABLE).**

**THE HEAT EXCHANGER SYSTEM SHALL ALSO RUN FOR FREEZE PROTECTION WHENEVER OUTSIDE AIR TEMPERATURE IS LESS THAN 38°F (ADJ.).**

**HOT WATER PUMP LEAD/LAG OPERATION:**  
 THE TWO HOT WATER PUMPS SHALL OPERATE IN A LEAD/LAG FASHION.

- THE LEAD PUMP SHALL RUN FIRST.
- ON FAILURE OF THE LEAD PUMP, THE LAG PUMP SHALL RUN AND THE LEAD PUMP SHALL TURN OFF.
- ON DECREASING HOT WATER DIFFERENTIAL PRESSURE, THE LAG PUMP SHALL STAGE ON AND RUN IN UNISON WITH THE LEAD PUMP TO MAINTAIN HOT WATER DIFFERENTIAL PRESSURE SETPOINT.

**THE DESIGNATED LEAD PUMP SHALL ROTATE UPON ONE OF THE FOLLOWING CONDITIONS (USER SELECTABLE):**

- MANUALLY THROUGH A SOFTWARE SWITCH
- IF PUMP RUNTIME (ADJ.) IS EXCEEDED
- DAILY
- WEEKLY
- MONTHLY

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**

- HOT WATER PUMP 1
- FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- RUNTIME EXCEEDED; STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.
- VFD FAULT.

- HOT WATER PUMP 2
- FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
- RUNNING IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
- RUNTIME EXCEEDED; STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT.
- VFD FAULT.

**HOT WATER DIFFERENTIAL PRESSURE CONTROL:**  
 THE CONTROLLER SHALL MEASURE HOT WATER DIFFERENTIAL PRESSURE AND MODULATE THE HOT WATER PUMP VFDS IN SEQUENCE TO MAINTAIN ITS HOT WATER DIFFERENTIAL PRESSURE SETPOINT.

**THE FOLLOWING SETPOINTS ARE RECOMMENDED VALUES. ALL SETPOINTS SHALL BE FIELD ADJUSTED DURING THE COMMISSIONING PERIOD TO MEET THE REQUIREMENTS OF ACTUAL FIELD CONDITIONS.**

**THE CONTROLLER SHALL MODULATE HOT WATER PUMP SPEEDS TO MAINTAIN A HOT WATER DIFFERENTIAL PRESSURE OF 12LB/IN<sup>2</sup> (ADJ.). THE VFDS MINIMUM SPEED SHALL NOT DROP BELOW 20% (ADJ.).**

**ON DROPPING HOT WATER DIFFERENTIAL PRESSURE, THE VFDS SHALL STAGE ON AND RUN TO MAINTAIN SETPOINT AS FOLLOWS:**

- THE CONTROLLER SHALL MODULATE THE LEAD VFD TO MAINTAIN SETPOINT.
- IF THE LEAD VFD SPEED IS GREATER THAN A SETPOINT OF 90% (ADJ.), THE LAG VFD SHALL STAGE ON.
- THE LAG VFD SHALL RAMP UP TO MATCH THE LEAD VFD SPEED AND THEN RUN IN UNISON WITH THE LEAD VFD TO MAINTAIN SETPOINT.

**ON RISING HOT WATER DIFFERENTIAL PRESSURE, THE VFDS SHALL STAGE OFF AS FOLLOWS:**

- IF THE VFDS SPEEDS DROPS BACK TO 60% (ADJ.) BELOW SETPOINT, THE LAG VFD SHALL STAGE OFF.
- THE LEAD VFD SHALL CONTINUE TO RUN TO MAINTAIN SETPOINT.

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**

- HIGH HOT WATER DIFFERENTIAL PRESSURE: IF 25% (ADJ.) GREATER THAN SETPOINT.
- LOW HOT WATER DIFFERENTIAL PRESSURE: IF 25% (ADJ.) LESS THAN SETPOINT.

**HOT WATER SUPPLY TEMPERATURE SETPOINT:**  
 THE HOT WATER SUPPLY TEMPERATURE SETPOINT SHALL BE A FIXED SETPOINT OF 180°F (ADJ.).

**ALARMS SHALL BE PROVIDED AS FOLLOWS:**

- HIGH HOT WATER SUPPLY TEMP: IF GREATER THAN 200°F (ADJ.).
- LOW HOT WATER SUPPLY TEMP: IF LESS THAN 100°F (ADJ.).

**HEAT EXCHANGER STEAM VALVE - HOT WATER CONTROL:**  
 THE CONTROLLER SHALL MEASURE THE HOT WATER SUPPLY TEMPERATURE AND MODULATE THE STEAM VALVE TO MAINTAIN ITS SETPOINT.

**THE STEAM VALVE SHALL BE ENABLED WHENEVER:**

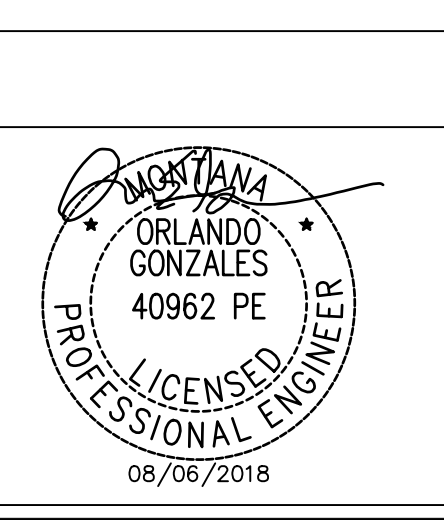
- THE HEAT EXCHANGER IS CALLED TO RUN.
- AND HOT WATER SUPPLY TEMPERATURE IS BELOW SETPOINT.

**THE STEAM VALVE SHALL OPEN TO 100% (ADJ.) WHENEVER THE HEAT EXCHANGER IS IN FREEZE PROTECTION DUE TO LOW OUTSIDE AIR TEMPERATURE.**

**THE STEAM VALVE SHALL CLOSE WHENEVER THE HOT WATER SUPPLY TEMPERATURE RISES FROM 180°F TO 200°F (ADJ.).**

Revisions	Date

**CONSULTANTS:**



**ARCHITECT/ENGINEERS:**

**AESUS** Architecture, Engineering, and Sustainable Design  
 designgroup 1000 E. Southern Ave, Suite #D, Tempe, Arizona 85282, (480) 454-2801

**Drawing Title**

HVAC CONTROL DIAGRAMS

—  
 VAPAHCs PLANNING AND ENGINEERING

**Project Title**

REPLACE PENTHOUSE HVAC SYSTEMS  
 CONTRACT NO. VA259-17-C-0212

**Location**

FT. HARRISON HELENA, MT

**Date** 07/14/16 **Checked** OQ **Drawn** CR

**Project Number** 436-17-102

**Building Number** 154

**Drawing Number** M803

**BID SET**

Office of Construction and Facilities Management

Department of Veterans Affairs



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ABBREVIATIONS

Table with 4 columns and 20 rows of electrical abbreviations and their full names, such as 1PH SINGLE-PHASE, 2/C TWO-CONDUCTOR, CAB CABINET, etc.

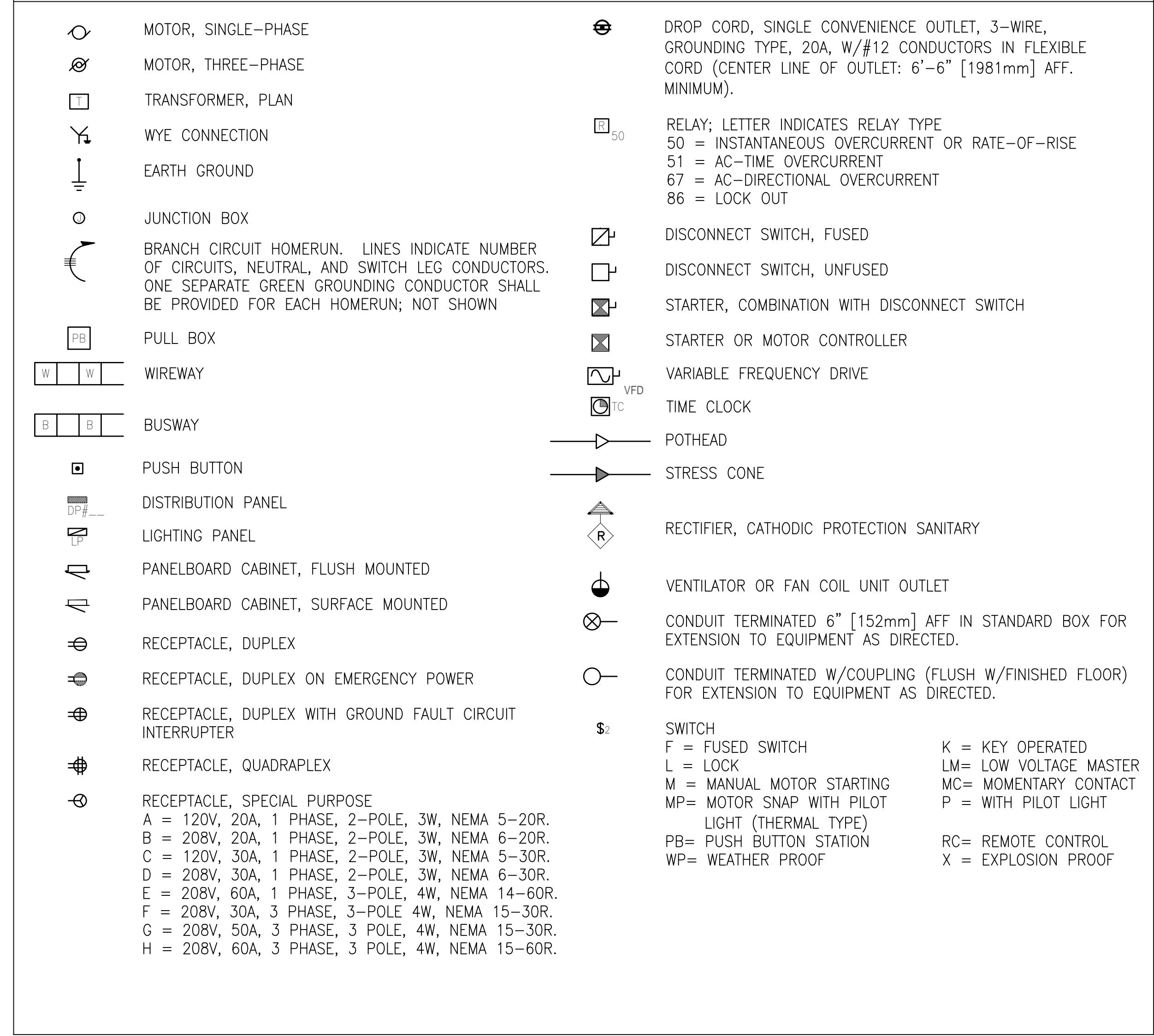
GENERAL NOTES:

- A. THE ELECTRICAL CONTRACTOR WILL BE RESPONSIBLE FOR VISITING THE SITE AND PERFORMING A FULL EXAMINATION AS NECESSARY TO DETERMINE THE LIMITS OF DEMOLITION WORK AND OF NEW CONSTRUCTION.
B. ALL WORK IS TO BE PERFORMED IN STRICT ACCORDANCE TO ALL NATIONAL AND LOCAL CODES, STANDARDS AND SAFE WORK PROCEDURES.
C. FOR EXISTING EQUIPMENT, SUCH AS LIGHTING FIXTURES, WIRING DEVICES, CONDUITS, ETC., SHOWN ON PLANS TO BE REMOVED, REMOVE CONDUIT AND CONDUCTORS BACK TO THE SOURCE OR TO THE LAST ACTIVE JUNCTION BOX. RE-LABEL PANEL SCHEDULES TO INDICATE ABANDONED CIRCUITS AS SPARE.
D. DISCONNECT ALL ABANDONED WIRING OF ALL TYPES AT THE OVERCURRENT PROTECTIVE DEVICE. COMPLETELY REMOVE ALL ABANDONED WIRING.
E. MAINTAIN AND RESTORE, IF INTERRUPTED, ALL CONDUITS AND CONDUCTORS PASSING THROUGH RENOVATED AREAS AND SERVICING UNDISTURBED AREAS.
F. THE CONTRACTOR IS RESPONSIBLE FOR DISPOSAL OF DEMOLISHED EQUIPMENT AND DEVICES. THE CONTRACTOR WILL COORDINATE WITH VA ENGINEERING FOR DISPOSITION OF ALL EQUIPMENT PRIOR TO DISPOSAL.
G. COORDINATE WITH ARCHITECTURAL DRAWINGS FOR EXACT LOCATION OF ALL DEVICES. ALL PENETRATIONS THROUGH FIRE RATED WALLS, FLOORS, CEILINGS OR ROOF SHALL BE SEALED WITH U.L. LISTED MATERIALS RATED FOR SUCH USE.
H. COORDINATE WITH MECHANICAL AND PLUMBING DRAWINGS AND CONTRACTOR FOR ANY MECHANICAL OR PLUMBING EQUIPMENT WHICH MAY NEED TO BE DEMOLISHED, RELOCATED OR NEW WORK TO BE PROVIDED WITH NEW CIRCUITS.
I. EACH BRANCH CIRCUIT HOMERUN SHALL HAVE NO MORE THAN THREE CIRCUITS. EACH BRANCH CIRCUIT HOMERUN SHALL HAVE A SEPARATE GREEN INSULATED EQUIPMENT GROUNDING CONDUCTOR. GROUND ALL CIRCUITS PER N.E.C. AND NFPA REQUIREMENTS.
J. MULTI-GANG BACKBOXES FOR DIFFERENT VOLTAGES AND TYPES OF EMERGENCY AND NORMAL BRANCH WIRING DEVICES SHALL HAVE DIVIDERS BETWEEN DEVICES.
K. ALL WORK IS TO BE PERFORMED BY QUALIFIED TRADESMEN WITH EXPERIENCE IN THE TYPE OF WORK TO BE PERFORMED. ALL WORK WILL BE PERFORMED TO THE SATISFACTION OF THE ENGINEER.
L. ANY EXISTING DEVICES WHOSE CIRCUITS MAY HAVE BEEN REASSIGNED TO NEW WORK WILL BE RE-FED FROM SPARE BREAKERS IN THE NEAREST AVAILABLE PANEL SUITABLE TO THE ENGINEER. NOTIFY ENGINEER OF SUCH OCCURRENCES FOR FURTHER DIRECTION. THE ENGINEER WILL EVALUATE FIELD SUGGESTIONS REGARDING NEW SOURCES FOR REFERENCED DEVICES.
M. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH ALL TRADES AND PROVIDING ALL EQUIPMENT, DEVICES APPURTENANCES AND SUPPORT AS REQUIRED FOR A FULLY FUNCTIONAL SYSTEM.
N. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH ALL VENDORS AND PROVIDING ALL CONNECTIONS AND APPURTENANCES AS REQUIRED FOR A FULLY FUNCTIONING SYSTEM TO THE SATISFACTION OF THE OWNER, TENANT AND ENGINEER.
O. COORDINATE WITH ARCHITECTURAL DRAWINGS FOR EXACT PLACEMENT OF LUMINAIRES, RECEPTACLES AND DEVICES.
P. CONTRACTOR WILL MAINTAIN CLEARANCES ABOUT ELECTRICAL EQUIPMENT PER NEC 110.26.

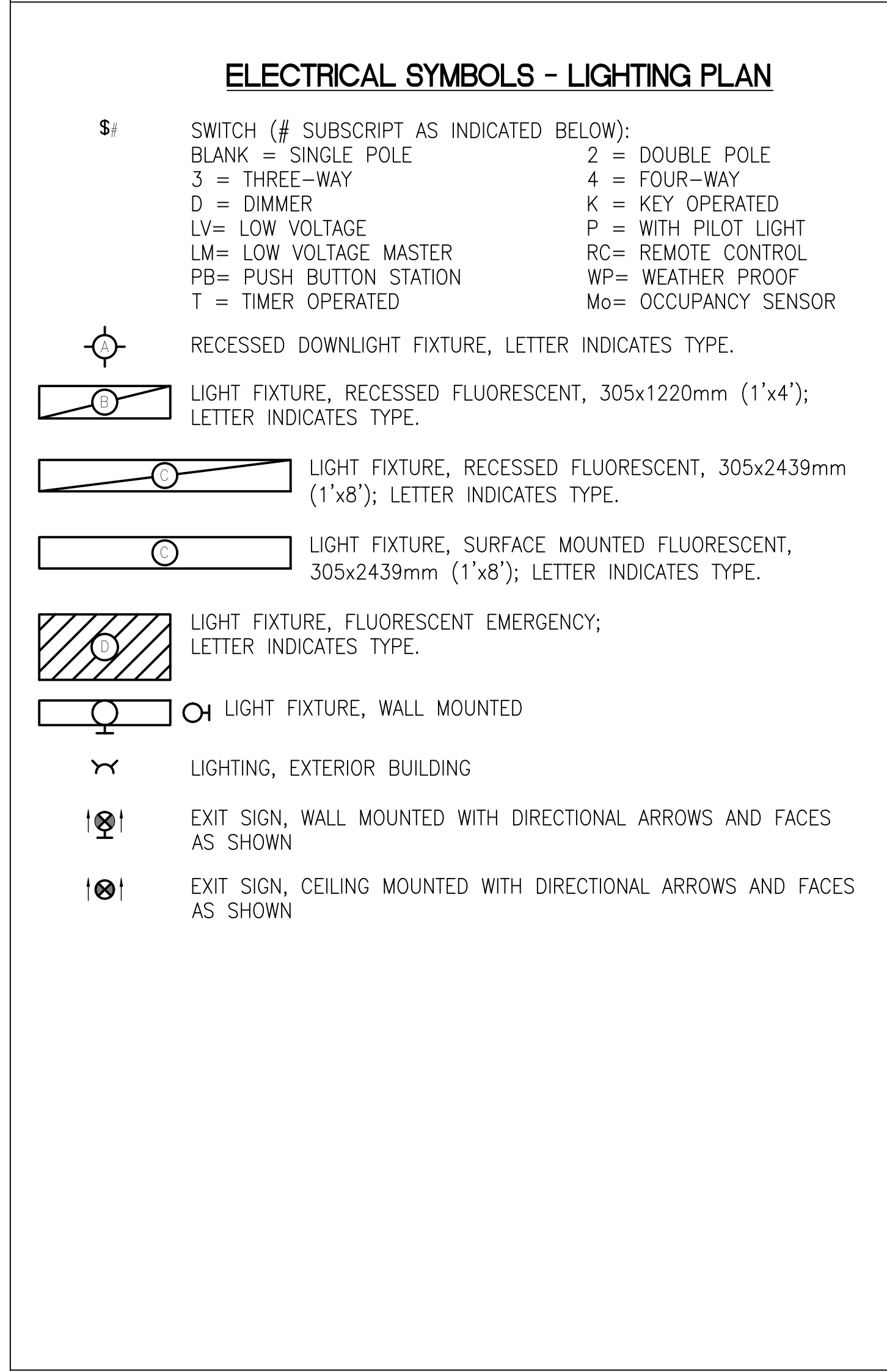
ELECTRICAL SYMBOLS - DIAGRAM



ELECTRICAL SYMBOLS - POWER PLAN



ELECTRICAL SYMBOLS - LIGHTING PLAN



CONSULTANTS:

Table with 2 columns: Name and Date. Includes a section for Revisions.



ARCHITECT/ENGINEERS: AESUS Architecture, Engineering, and Sustainable Design. 1000 E. Southern Ave, Suite 65, Tempe, Arizona 85282. (480) 791-9542

Drawing Title: ELECTRICAL SYMBOLS AND ABBREVIATIONS. Approved Project Director: FT. HARRISON.

Project Title: REPLACE PENTHOUSE HVAC SYSTEMS. Contract No. VA29-17-C-0212. Location: FT. HARRISON, HELENA, MT. Date: 08/03/2018. Checked: OG. Draw: DC.

Project Number: 436-17-102. Building Number: 154. Drawing Number: E001.

Office of Construction and Facilities Management. Department of Veterans Affairs.



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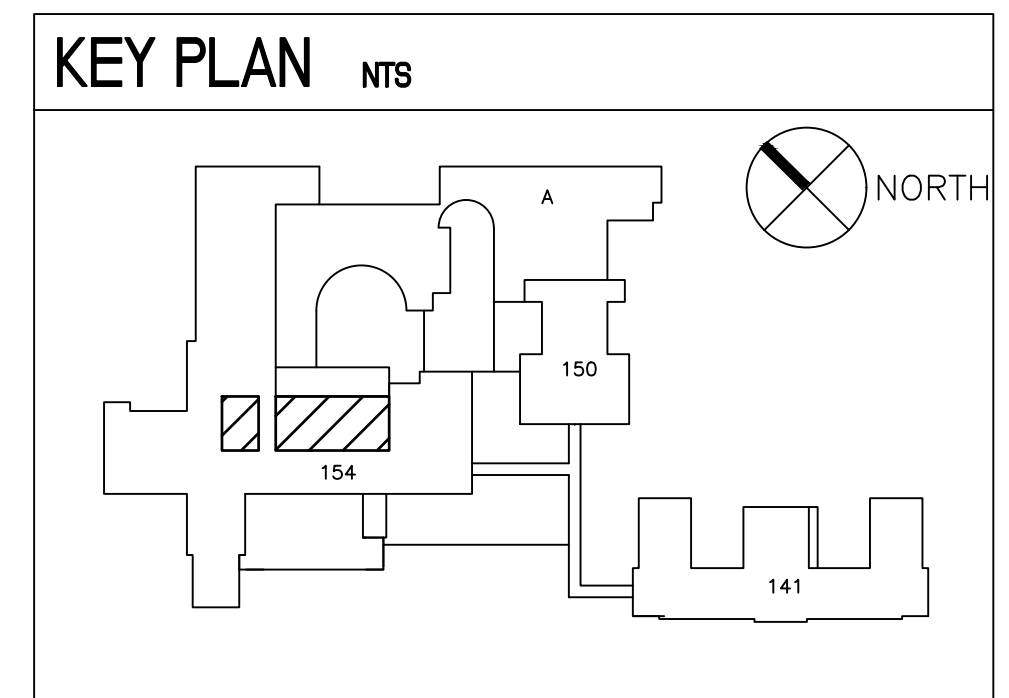
**1** ELECTRICAL SERVICE LOCATION PLAN  
SCALE: 1" = 20'-0"

**GENERAL NOTES**

- A. ALL EXTERIOR DEVICES SHALL BE WEATHERPROOF AND GFCI PROTECTED.
- B. MEMBRANE PENETRATION THROUGH WALLS SHALL BE PROTECTED IN ACCORDANCE WITH THE LATEST ADOPTED EDITION OF I.B.C. 712.32.
- C. ALL WORK WILL BE PERFORMED IN STRICT ACCORDANCE WITH ALL NATIONAL AND LOCAL CODES, STANDARDS AND SAFE WORK PROCEDURES.
- D. ALL DEMOLITION AND NEW WORK MUST BE PERFORMED SUCH THAT EXISTING DEVICES, EQUIPMENT, ETC. ARE TO BE PROTECTED SO AS THEY REMAIN FULLY FUNCTIONAL FOR CONTINUED USE. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR MAINTAINING CIRCUIT INTEGRITY TO ALL EQUIPMENT AND DEVICES TO REMAIN. THE CONTRACTOR WILL REPAIR ANY DAMAGE TO EXISTING EQUIPMENT OR DEVICES TO THE SATISFACTION OF THE ENGINEER.
- E. COORDINATE WITH MECHANICAL AND PLUMBING DRAWINGS AND CONTRACTOR FOR ANY MECHANICAL OR PLUMBING EQUIPMENT WHICH MAY NEED TO BE DEMOLISHED, RELOCATED OR NEW WORK TO BE PROVIDED WITH NEW CIRCUITS.
- F. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH ALL TRADES AND PROVIDING ALL EQUIPMENT, DEVICES, APPURTENANCES AND SUPPORT AS REQUIRED FOR A FULLY FUNCTIONAL SYSTEM.
- G. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH ALL VENDORS AND PROVIDING ALL CONNECTIONS AND APPURTENANCES AS REQUIRED FOR A FULLY FUNCTIONING SYSTEM TO THE SATISFACTION OF THE OWNER, TENANT AND ENGINEER.
- H. CONTRACTOR WILL MAINTAIN CLEARANCES ABOUT ELECTRICAL EQUIPMENT PER NEC 110.26.
- I. ALL WIRING FOR EXTERIOR LIGHTING AND POWER DEVICES SHALL BE A MINIMUM OF 10 A.W.G. COPPER WITH TYPE THWN-2 INSULATION (UNO) FOR UNDERGROUND CIRCUITS RUN IN PVC. PROVIDE A 10 A.W.G. COPPER GROUND IN ADDITION TO CIRCUIT CONDUCTORS (UNO).
- J. VERIFY ALL EXISTING LOCATIONS AND CONDITIONS IN THE FIELD PRIOR TO START OF WORK.
- K. NO DESIGN CHANGE MAY BE MADE TO THE SYSTEM WITHOUT THE PRIOR APPROVAL OF THE DESIGN ELECTRICAL ENGINEER AND THE ELECTRICAL INSPECTOR.
- L. PLANS WERE DESIGNED USING INFORMATION AVAILABLE TO ENGINEER. THIS INFORMATION MAY CONSIST OF ORIGINAL BUILDING PLANS, PRIOR TENANT IMPROVEMENT PLANS, EXISTING PANEL SCHEDULES, FIELD NOTES, ETC.
- M. HOWEVER, AS EXISTING INFORMATION MAY BE INCOMPLETE OR MAY PROVE TO CONTAIN INACCURACIES, THE ENGINEER CANNOT CERTIFY PRIOR INSTALLATIONS AS PERFORMED BY OTHERS. THEREFORE, THE CONTRACTOR SHALL INCLUDE IN HIS BID ALL WORK AS REQUIRED TO FIELD VERIFY EXISTING CONDITIONS AND AVAILABLE CIRCUITS.
- N. THE CONTRACTOR WILL PROVIDE ENGINEER AND OWNER WITH COMPLETE AND ACCURATE "AS-BUILTS". THESE SHALL INCLUDE THE LOCATION, CIRCUITING AND ROUTING OF ALL NEW AND RELOCATED EQUIPMENT (I.E., AIR HANDLERS, CHILLERS, FANS, RECEPTACLES, LUMINAIRES, SWITCHES, ETC) OVER-CURRENT DEVICES, STARTING DEVICES, CONDUIT, CONDUCTORS, AND ALL OTHER DEVICES IMPACTED BY THIS PROJECT.

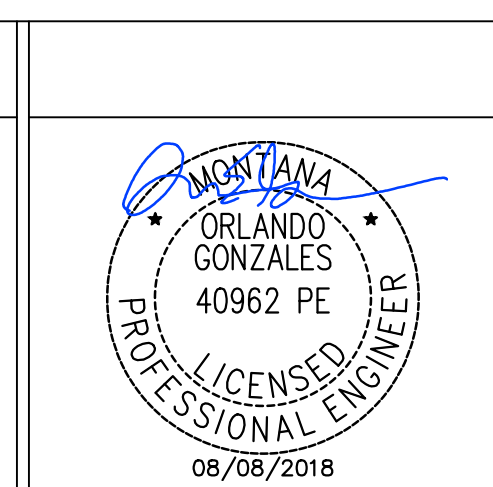
**KEY NOTES**

- 1. LOCATION OF ROOM 144, BUILDING 154 ELECTRICAL SERVICE ROOM.
- 2. LOCATION OF ROOM 144-A, ELECTRICAL SERVICE ROOM, ADJACENT TO ROOM 144-B, THE GENERATOR ROOM.
- 3. LOCATION OF EXISTING MAIN SWITCHBOARD "MSB".
- 4. LOCATION OF EXISTING SWITCHBOARD "SES-144B".
- 5. LOCATION OF EXISTING GENERATOR PANELBOARD "G-144-BSD".
- 6. LOCATION OF AUTOMATIC TRANSFER SWITCH "ATS-TSEE".
- 7. LOCATION OF EXISTING PANELBOARD "154-DEE".



Revisions	Date

CONSULTANTS:



ARCHITECT/ENGINEERS:

**AESUS** Architecture, Engineering, and Sustainable Design  
designgroup  
1000 E. Southern Ave, Suite #5, Tempe, Arizona 85282, (480) 791-9542

Drawing Title <b>ELECTRICAL SERVICE LOCATIONS</b>
Approved Project Director

Project Title <b>REPLACE PENTHOUSE HVAC SYSTEMS</b> CONTRACT NO. VA259-17-C-0212
Location FT. HARRISON HELENA, MT
Date 08/03/2018
Checked OG
Drawn DC

Project Number 436-17-102
Building Number 154
Drawing Number <b>E002</b>

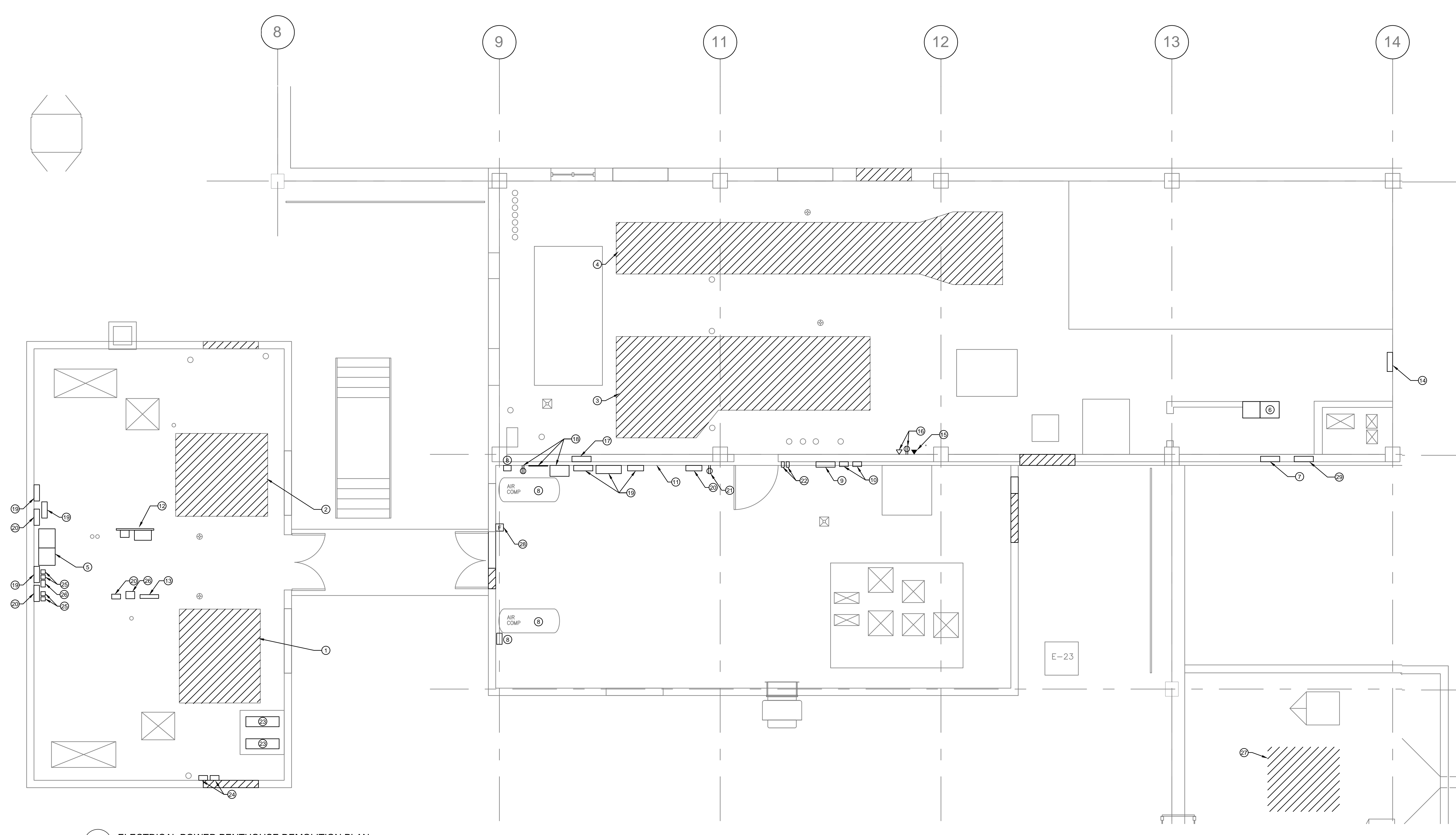
**Office of Construction and Facilities Management**

Department of Veterans Affairs



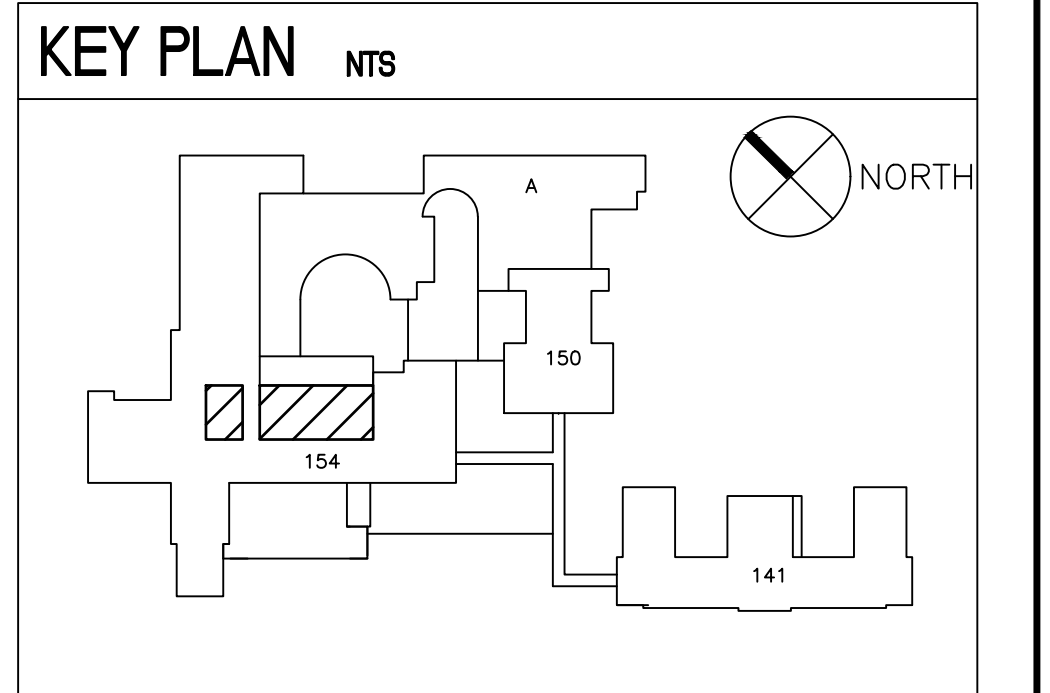
three inches = one foot  
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REFER TO SHEET ED101  
MATCHLINE



**1** ELECTRICAL POWER PENTHOUSE DEMOLITION PLAN  
SCALE: 1/4" = 1'-0"

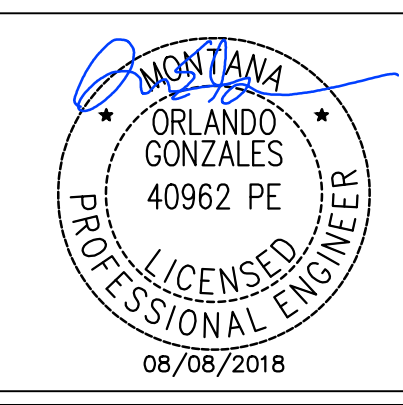
- GENERAL NOTES**  
SEE SHEET ED-101 FOR DEMOLITION GENERAL NOTES.
- KEY NOTES**
- EXISTING AIR HANDLING UNIT S1A AND STARTING UNIT TO BE DEMOLISHED. DEMO CONDUIT AND CONDUCTORS BACK TO SOURCE.
  - EXISTING AIR HANDLING UNIT S2A AND STARTING UNIT TO BE DEMOLISHED. DEMO CONDUIT AND CONDUCTORS BACK TO SOURCE.
  - EXISTING AIR HANDLING UNIT S2 AND STARTING UNIT TO BE DEMOLISHED. DEMO CONDUIT AND CONDUCTORS BACK TO SOURCE.
  - EXISTING AIR HANDLING UNIT AC2 AND STARTING UNIT TO BE DEMOLISHED. DEMO CONDUIT AND CONDUCTORS BACK TO SOURCE.
  - LOCATION OF EXISTING MOTOR CONTROL CENTER 'MCC-5'.
  - LOCATION OF EXISTING MOTOR CONTROL CENTER 'MCC-3'.
  - LOCATION OF EXISTING PANELBOARD '154-PEE4'.
  - EXISTING AIR COMPRESSOR, DISCONNECTING MEANS AND CONTROLLERS AT THIS LOCATION TO BE RELOCATED. EXTEND, RE-ROUTE OR REPLACE FEED AS REQUIRED. SEE SHEET E100 FOR NEW LOCATION.
  - EXISTING PANELBOARD 154-P5 TO BE RELOCATED. SEE SHEET E100 FOR NEW LOCATION.
  - EXISTING DISCONNECT AND VSD SERVING 154-RF-01-AHU-14-3RD TO BE REMOVED. DEMO CONDUIT AND CONDUCTORS BACK TO SOURCE.
  - EXISTING WALL TO BE REMOVED BETWEEN COLUMNS 9 AND 12. VARIOUS ITEMS ALONG THIS WALL ARE BEING REMOVED. SOME ITEMS ARE BEING RELOCATED. ALL CONDUIT AND CONDUCTORS THAT REMAIN SHALL BE SUPPORTED FOR THE STRUCTURE ABOVE.
  - EXISTING GUTTER WITH 200 AMPERE DISCONNECT SERVING MCC-5 AND 609 A. DISCONNECT SERVING EXISTING CHILLER TO REMAIN.
  - EXISTING PANELBOARD A TO REMAIN.
  - EXISTING PANELBOARD 154-PEE2 TO REMAIN.
  - EXISTING TELEPHONE OUTLET TO BE RELOCATED APPROX. 3' S. OF THIS LOCATION TO OTHER SIDE OF COLUMN. SEE SHE E100 FOR LOCATION.
  - EXISTING POWER RECEPTACLE AND 4-PLEX DATA RECEPTACLE SERVING ETHERNET TRANSMITTER TO BE RELOCATED APPROX. 3' S. OF THIS LOCATION TO OTHER SIDE OF COLUMN. SEE SHEET E100 FOR LOCATION.
  - EXISTING JOHNSON CONTROL CABINET AT THIS LOCATION. CURRENTLY NOT IN USE. TO BE REMOVED.
  - EXISTING AIR COMPRESSOR DRYER SYSTEM AND RECEPTACLE SERVING UNIT TO BE RELOCATED.
  - EXISTING HVAC CONTROL PANELS ALONG WALL TO BE REMOVED. DEMO CONDUIT AND CONDUCTORS BACK TO SOURCE.
  - EXISTING JOHNSON CONTROL CABINET TO BE REMOVED.
  - EXISTING RECEPTACLE TO BE REMOVED. DEMO CONDUIT AND CONDUCTORS BACK TO SOURCE.
  - EXISTING SIMPLEX FIRE ALARM DEVICES TO BE RELOCATED. DEMO CONDUIT AND CONDUCTORS BACK TO SOURCE.
  - EXISTING CIRCULATION WATER PUMPS 1 AND 2 TO BE REMOVED. DEMO CONDUIT AND CONDUCTORS BACK TO SOURCE.
  - EXISTING HOA'S SERVING CIRCULATION WATER PUMPS 1 AND 2 TO BE REMOVED. DEMO CONDUIT AND CONDUCTORS BACK TO SOURCE.
  - EXISTING VSD TO BE REMOVED. DEMO CONDUIT AND CONDUCTORS BACK TO SOURCE.
  - EXISTING J-BOX TO BE REMOVED. DEMO CONDUIT AND CONDUCTORS BACK TO SOURCE.
  - EXISTING EXHAUST FAN EF14 TO BE REMOVED. DEMO CONDUCTORS BACK TO SOURCE. VERIFY EXISTING CONDUIT IS IN GOOD CONDITION. IF SO, EXISTING CONDUIT TO BE RE-USED TO SERVE NEW EF-14.
  - EXISTING FIRE ALARM PULL BOX TO BE RELOCATED. SEE SHEET E100 FOR NEW LOCATION.
  - LOCATION OF ELEVATOR MAIN SHUTOFF PANEL. ENSURE THAT NO DISRUPTION TO ELEVATOR EQUIPMENT OCCURS DURING THIS PROJECT.



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Office of Construction and Facilities Management  
Department of Veterans Affairs

Revisions	Date

**CONSULTANTS:**



**ARCHITECT/ENGINEERS:**  
**AESUS** Architecture, Engineering, and Sustainable Design  
**designgroup**  
1000 E. Southern Ave, Suite 65, Tempe, Arizona 85282. (480) 791-9542

Drawing Title  
**ELECTRICAL POWER PENTHOUSE DEMOLITION PLAN**  
Approved Project Director

Project Title  
**REPLACE PENTHOUSE HVAC SYSTEMS**  
CONTRACT NO. VA259-17-C-0212  
Location  
**FT. HARRISON** HELENA, MT  
Date  
**08/03/2018**  
Checked  
**OG**  
Drawn  
**DC**

Project Number  
**436-17-102**  
Building Number  
**154**  
Drawing Number  
**ED100**

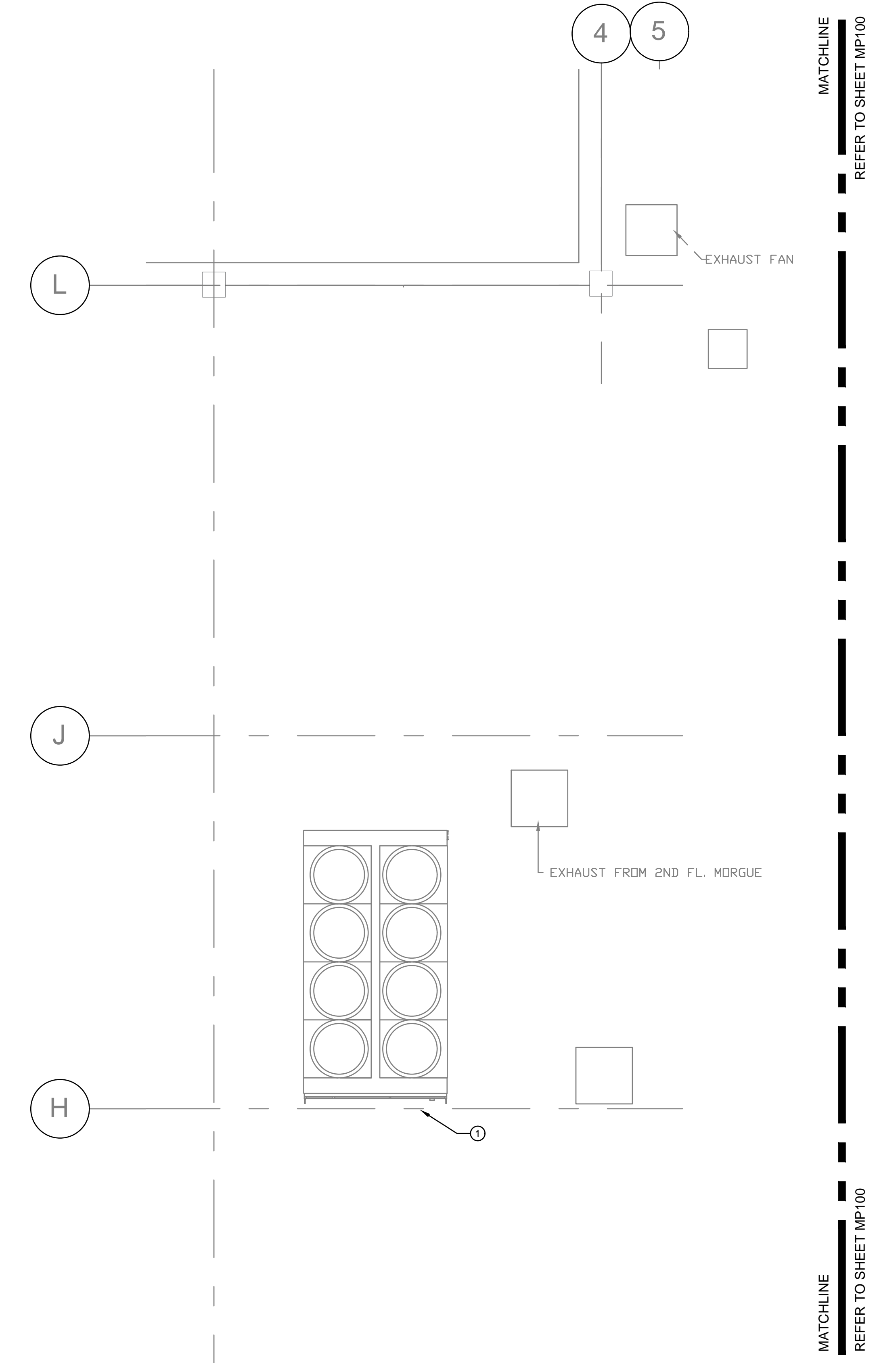
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**DEMOLITION GENERAL NOTES**

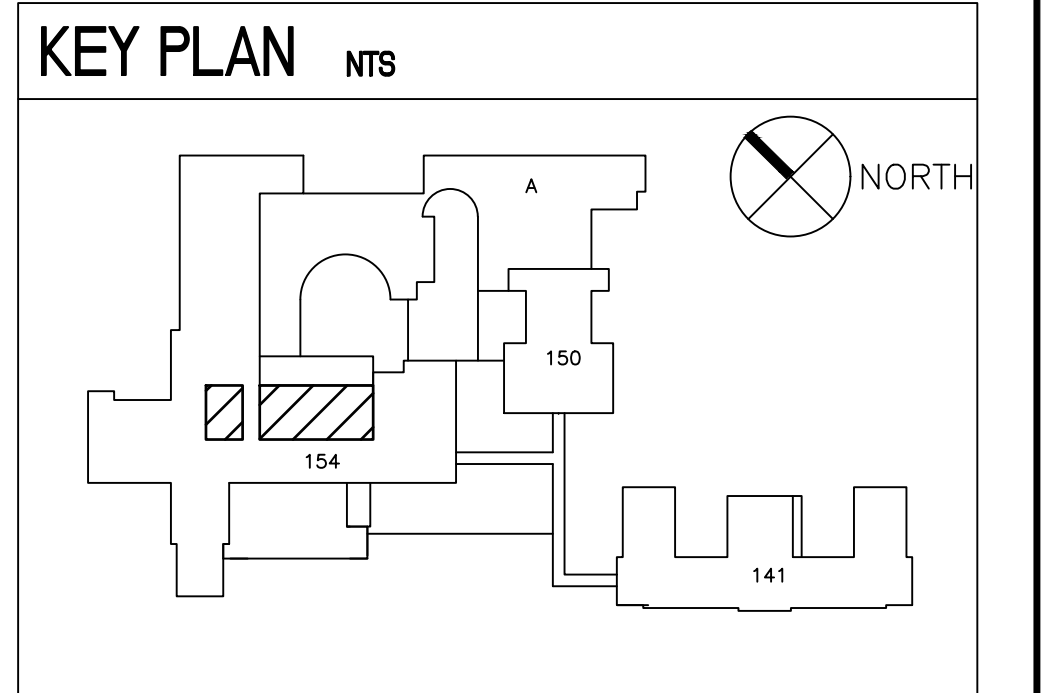
- A. ALL WORK WILL BE PERFORMED IN STRICT ACCORDANCE WITH ALL NATIONAL AND LOCAL CODES, STANDARDS AND SAFE WORK PROCEDURES.
- B. ALL WORK SHALL BE PERFORMED IN A CLEAN AND WORKMANLIKE MANNER. CARE SHALL BE EXERCISED TO MINIMIZE ANY INCONVENIENCE OR DISTURBANCE TO OTHER AREAS OF THE BUILDING WHICH ARE TO REMAIN IN OPERATION.
- C. ALL UTILITY OR SYSTEM SHUTDOWNS SHALL BE COORDINATED WITH THE OWNER AND ENGINEER. NO SHUTDOWNS CAN OCCUR WITHOUT PRIOR PERMISSION FROM THE OWNER.
- D. THE CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND FIELD CONDITIONS PRIOR TO PROCEEDING WITH ANY WORK. ANY DISCREPANCIES SHALL BE REPORTED TO THE ENGINEER FOR RESOLUTION.
- E. ALL DEMOLITION AND NEW WORK MUST BE PERFORMED SUCH THAT EXISTING DEVICES, EQUIPMENT, ETC. ARE TO BE PROTECTED SO AS THEY REMAIN FULLY FUNCTIONAL FOR CONTINUED USE. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR MAINTAINING CIRCUIT INTEGRITY TO ALL EQUIPMENT AND DEVICES TO REMAIN. THE CONTRACTOR WILL REPAIR ANY DAMAGE TO EXISTING EQUIPMENT OR DEVICES TO THE SATISFACTION OF THE ENGINEER.
- F. ANY EXISTING DEVICES WHOSE CIRCUITS MAY HAVE BEEN REASSIGNED TO NEW WORK WILL BE RE-FED FROM SPARE BREAKERS IN THE NEAREST AVAILABLE PANEL, SUITABLE TO THE ENGINEER. NOTIFY ENGINEER OF SUCH OCCURRENCES FOR FURTHER DIRECTION. THE ENGINEER WILL EVALUATE FIELD SUGGESTIONS REGARDING NEW SOURCES FOR REFERENCED DEVICES.
- G. THE CONTRACTOR IS RESPONSIBLE FOR DISPOSAL OF DEMOLISHED EQUIPMENT AND DEVICES. THE CONTRACTOR WILL COORDINATE WITH THE OWNER AND ARCHITECT FOR ANY EQUIPMENT TO BE RETURNED TO OWNER STOCK PRIOR TO DISPOSAL.
- H. THE CONTRACTOR SHALL COORDINATE WITH MECHANICAL AND PLUMBING DRAWINGS AND CONTRACTOR FOR ANY MECHANICAL OR PLUMBING EQUIPMENT WHICH MAY NEED TO BE DEMOLISHED, RELOCATED OR NEW WORK TO BE PROVIDED WITH NEW CIRCUITS.
- I. ALL SHUT DOWNS AND DEMOLITION SHALL BE PHASED AND COORDINATED WITH NEW WORK. CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATION SHUT DOWNS AND REMOVAL OF ITEMS WITH THE OWNER'S REPRESENTATIVE AND THE OWNER'S PHASING REQUIREMENTS.
- J. OPENINGS IN FLOORS, WALLS, CEILINGS, ROOFS, ETC. AS A RESULT OF REMOVED CONDUIT AND CONDUCTORS, BUSWAY, ETC SHALL BE PATCHED TO MATCH EXISTING BUILDING CONSTRUCTION. WORK SHALL BE PERFORMED BY CRAFTSMEN SKILLED IN THEIR RESPECTIVE TRADES.
- K. CONTRACTOR SHALL BE RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES, AND SAFETY TO THE PUBLIC AND TO PROPERTY BOTH PRIVATE AND PUBLIC.
- L. FOR EXISTING CIRCUITS SERVING DEMOLISHED EQUIPMENT OR DEVICES, REMOVE CONDUIT TO NEAREST USABLE J-BOX OR TO SOURCE AND REMOVE CONDUCTORS TO SOURCE. EXISTING BREAKERS ARE TO REMAIN IN PANEL. RE-LABEL PANEL SCHEDULES TO INDICATE ABANDONED CIRCUITS AS SPARE.
- M. PLANS WERE DESIGNED USING INFORMATION AVAILABLE TO ENGINEER. THIS INFORMATION MAY CONSIST OF ORIGINAL BUILDING PLANS, PRIOR TENANT IMPROVEMENT PLANS, EXISTING PANEL SCHEDULES, FIELD NOTES, ETC.
- N. HOWEVER, AS EXISTING INFORMATION MAY BE INCOMPLETE OR MAY PROVE TO CONTAIN INACCURACIES, THE ENGINEER CANNOT CERTIFY PRIOR INSTALLATIONS AS PERFORMED BY OTHERS. THEREFORE, THE CONTRACTOR SHALL INCLUDE IN HIS BID ALL WORK AS REQUIRED TO FIELD VERIFY EXISTING CONDITIONS AND AVAILABLE CIRCUITS.
- O. THE CONTRACTOR WILL PROVIDE ENGINEER AND OWNER WITH COMPLETE AND ACCURATE 'AS-BUILTS'. THESE SHALL INCLUDE THE LOCATION, CIRCUITING AND ROUTING OF ALL NEW AND RELOCATED EQUIPMENT (I.E. AIR HANDLERS, CHILLERS, FANS, RECEPTACLES, LUMINAIRES, SWITCHES, ETC) OVER-CURRENT DEVICES, STARTING DEVICES, CONDUIT, CONDUCTORS, AND ALL OTHER DEVICES IMPACTED BY THIS PROJECT.

**GENERAL NOTES**

SEE SHEET ED-100 FOR DEMOLITION GENERAL NOTES.



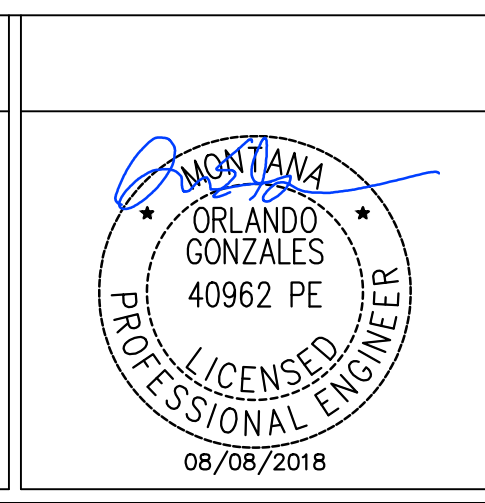
**1 ELECTRICAL POWER ROOF DEMOLITION PLAN**  
SCALE: 1/4" = 1'-0"



'BID SET'

Revisions:	Date

CONSULTANTS:	



**ARCHITECT/ENGINEERS:**

**AESUS** Architecture, Engineering, and Sustainable Design  
designgroup

1000 E. Southern Ave, Suite #5, Tempe, Arizona 85282. (480) 791-9542

Drawing Title <b>ELECTRICAL POWER ROOF DEMOLITION PLAN</b>	
Approved Project Director	

Project Title <b>REPLACE PENTHOUSE HVAC SYSTEMS</b> CONTRACT NO. VA259-17-C-0212		
Location <b>FT. HARRISON</b> HELENA, MT		
Date 08/03/2018	Checked OG	Draw DC

Project Number 436-17-102
Building Number 154
Drawing Number <b>ED101</b>
-- --

**Office of Construction and Facilities Management**

Department of Veterans Affairs



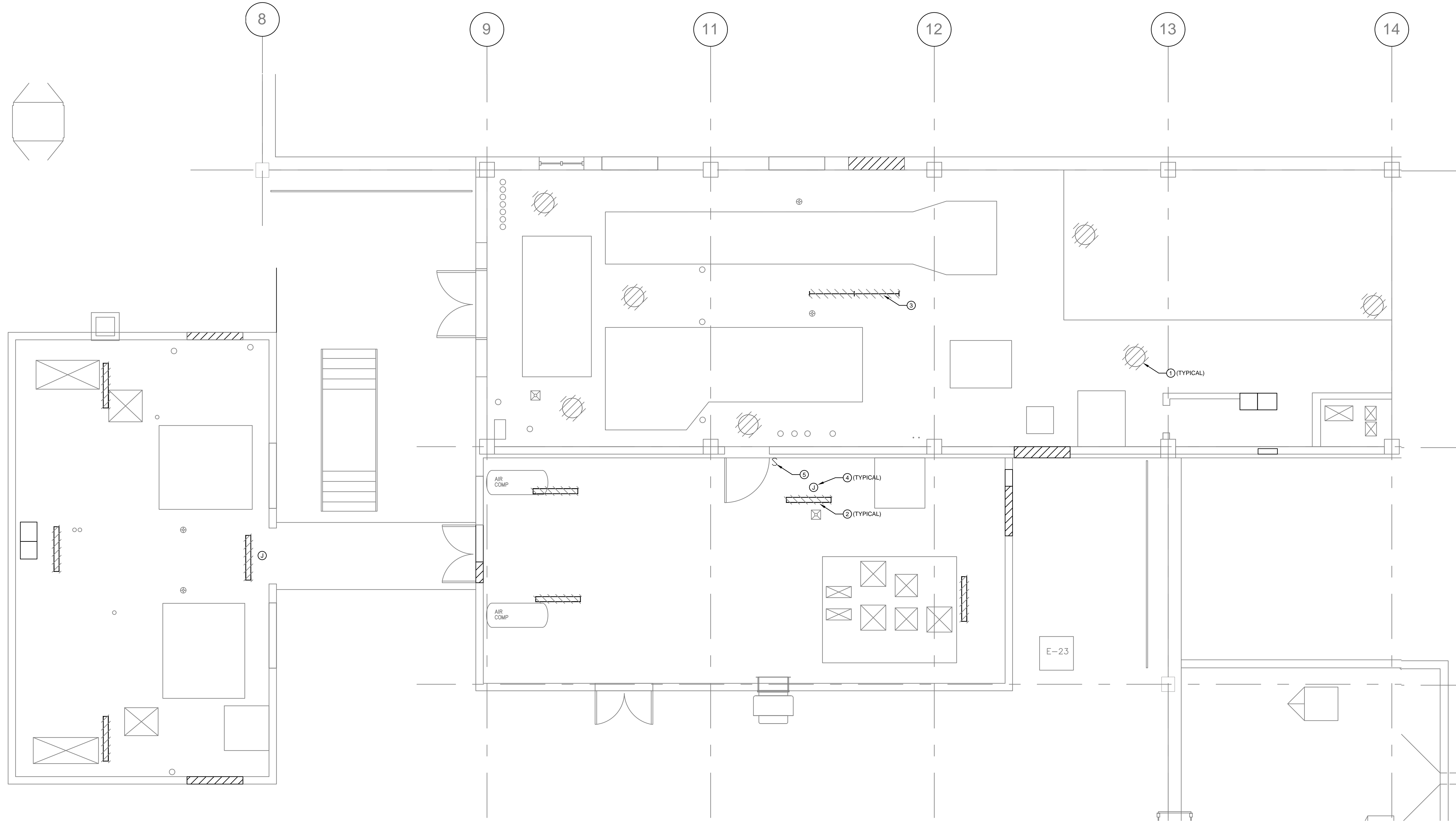
GENERAL NOTES

SEE SHEET E-101 FOR DEMOLITION GENERAL NOTES.

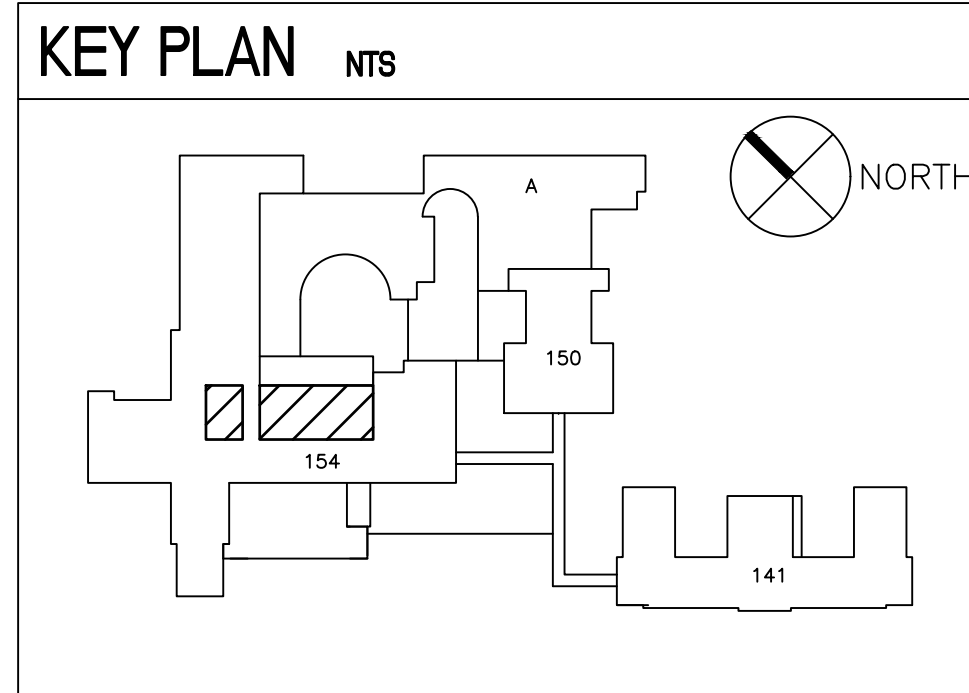
KEY NOTES

- EXISTING INCANDESCENT PENDANT TYPE LUMINAIRE WITH DOWNLIGHTING REFLECTOR AND WIRE GUARD.
- EXISTING 4' STRIP TYPE SUSPENDED FLUORESCENT LUMINAIRE WITH (2) 32 W. T-8 LAMPS, SIDE SHIELDS AND WIRE GUARD TO BE REMOVED.
- EXISTING TANDEM 4' FLUORESCENT LUMINAIRE WITH (2) 32 W. T-8 LAMPS TO BE REMOVED.
- REMOVE CIRCUITING SERVING EXISTING LIGHTING BACK TO FIRST J-BOX SERVING UNITS IN THIS ROOM. FEED TO BE RE-USED TO SERVE NEW LIGHTING.
- EXISTING SWITCH CONTROLLING LIGHTING TO BE REMOVED. DEMO CONDUIT AND CONDUCTORS BACK TO SOURCE.

three inches = one foot  
 one and one half inches = one foot  
 one inch = one foot  
 three quarters inch = one foot  
 one half inch = one foot  
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 one quarter inch = one foot  
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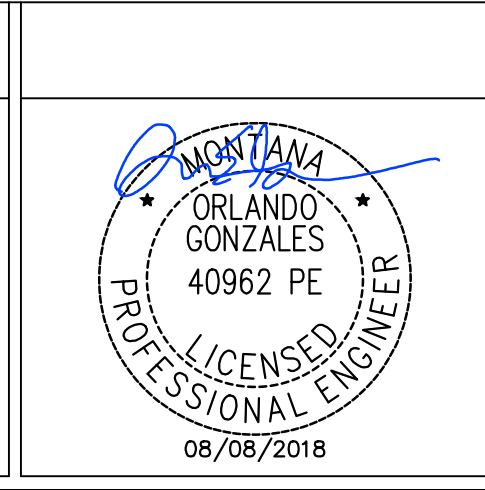
**1** ELECTRICAL LIGHTING PENTHOUSE DEMOLITION PLAN  
 SCALE: 1/4" = 1'-0"



'BID SET'

Revisions	Date

CONSULTANTS:



ARCHITECT/ENGINEERS:  
**AESUS** Architecture, Engineering,  
 and Sustainable Design  
 1000 E. Southern Ave, Suite 85, Tempe, Arizona 85282, (480) 791-9542

Drawing Title  
**ELECTRICAL LIGHTING  
 PENTHOUSE  
 DEMOLITION PLAN**

Approved Project Director

Project Title  
**REPLACE PENTHOUSE  
 HVAC SYSTEMS**  
 CONTRACT NO. VA259-17-C-0212

Location  
 FT. HARRISON HELENA, MT

Date  
 08/03/2018

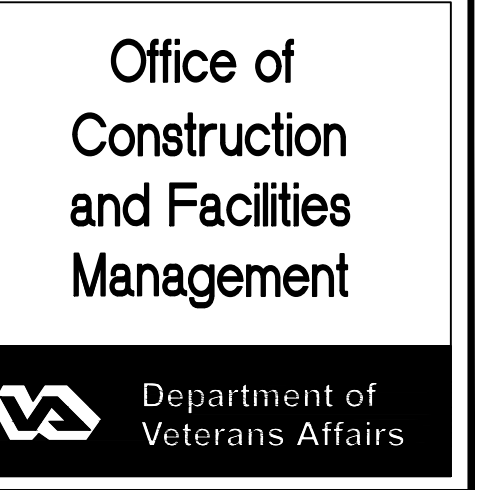
Checked  
 OG

Draw  
 DC

Project Number  
 436-17-102

Building Number  
 154

Drawing Number  
**ED200**



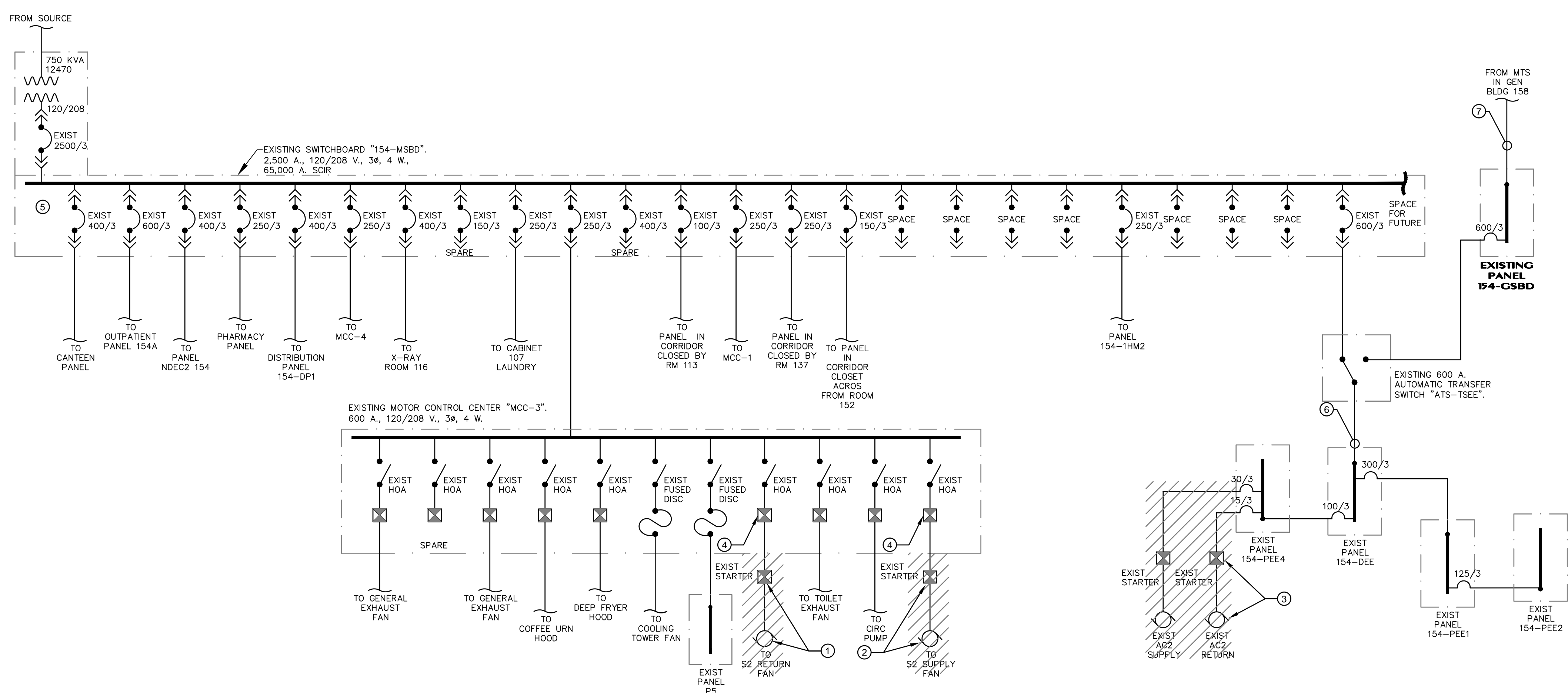
**GENERAL NOTES**

SEE SHEET E-101 FOR DEMOLITION GENERAL NOTES.

**KEY NOTES** Ⓢ

- EXISTING AIR HANDLING UNIT "S2" RETURN FAN AND STARTING DEVICE TO BE REMOVED. DEMO FEED BACK TO SOURCE.
- EXISTING AIR HANDLING UNIT "S2" SUPPLY FAN AND STARTING DEVICE TO BE REMOVED. DEMO FEED BACK TO SOURCE.
- EXISTING AIR HANDLING UNIT "AC2" AND STARTING DEVICE TO BE REMOVED. DEMO FEED BACK TO SOURCE.
- EXISTING HOA IN MOTOR CONTROL CENTER TO BE REMAIN. UNIT TO BE LISTED AS "SPARE".
- ELECTRICAL CONTRACTOR TO PERFORM 30 DAY LOAD TEST ON "154-MSBD" PRIOR TO COMMENCING WORK. VERIFY EXISTING DEMAND LOAD IS LESS THAN 2,100.0 AMPS. PROVIDE ENGINEER OF RECORD WITH RESULTS. IF HIGHER, COORDINATE WITH ENGINEER FOR FURTHER DIRECTION.
- ELECTRICAL CONTRACTOR TO PERFORM 30 DAY LOAD TEST ON "154-DEE" FEEDERS PRIOR TO COMMENCING WORK. VERIFY EXISTING DEMAND LOAD IS LESS THAN 500.0 AMPS. PROVIDE ENGINEER OF RECORD WITH RESULTS. IF HIGHER, COORDINATE WITH ENGINEER FOR FURTHER DIRECTION.
- ELECTRICAL CONTRACTOR TO PERFORM 30 DAY LOAD TEST ON "154-SSBD" FEEDERS PRIOR TO COMMENCING WORK. VERIFY EXISTING DEMAND LOAD IS LESS THAN 1,800.0 AMPS. PROVIDE ENGINEER OF RECORD WITH RESULTS. IF HIGHER, COORDINATE WITH ENGINEER FOR FURTHER DIRECTION.

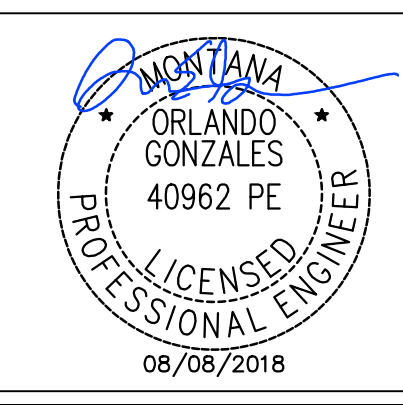
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 one quarter inch = one foot  
 one eighth inch = one foot



**1** ELECTRICAL DEMOLITION ONE-LINE DIAGRAM "154-MSBD"  
SCALE: NOT TO SCALE

Revisions:	Date

**CONSULTANTS:**



**ARCHITECT/ENGINEERS:**

**AESUS** Architecture, Engineering, and Sustainable Design  
 designgroup 1000 E. Southern Ave, Suite 85, Tempe, Arizona 85282, (480) 791-9542

**Drawing Title**  
 ELECTRICAL DEMOLITION ONE-LINE DIAGRAM "154-MSBD"

Approved Project Director

**Project Title**  
 REPLACE PENTHOUSE HVAC SYSTEMS  
 CONTRACT NO. VA259-17-C-0212

**Location**  
 FT. HARRISON HELENA, MT

Date: 08/03/2018  
 Checked: OG  
 Drawn: DC

**Project Number**  
 436-17-102

**Building Number**  
 154

**Drawing Number**  
 ED600

**"BID SET"**

Office of Construction and Facilities Management  
 Department of Veterans Affairs



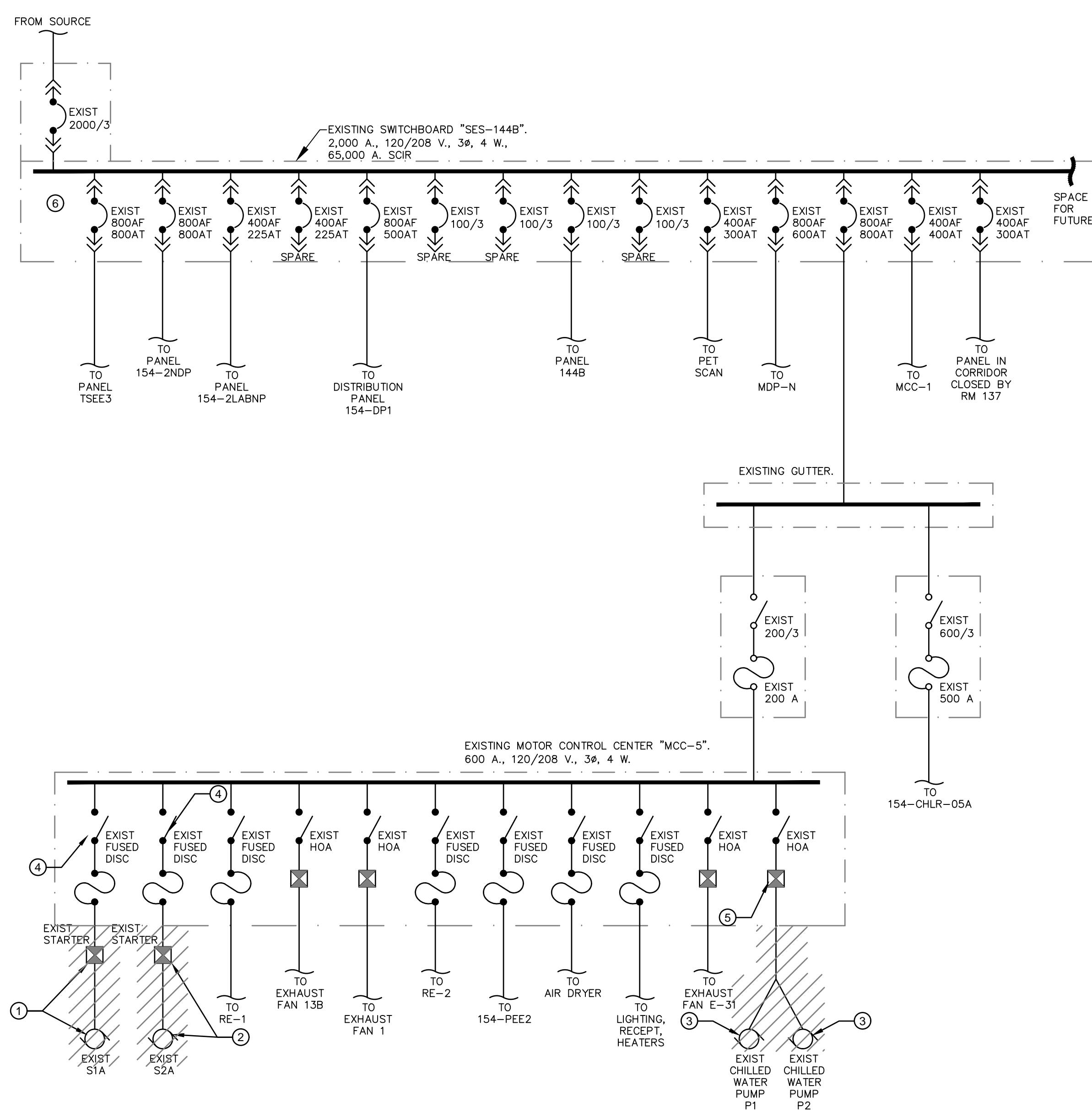
**GENERAL NOTES**

SEE SHEET E-101 FOR DEMOLITION GENERAL NOTES.

**KEY NOTES**

1. EXISTING AIR HANDLING UNIT "S1A" AND STARTING DEVICE TO BE REMOVED. DEMO FEED BACK TO SOURCE.
2. EXISTING AIR HANDLING UNIT "S2A" AND STARTING DEVICE TO BE REMOVED. DEMO FEED BACK TO SOURCE.
3. EXISTING CHILLED WATER PUMPS "P1" AND "P2" TO BE REMOVED. DEMO FEED BACK TO SOURCE.
4. EXISTING FUSED DISCONNECT IN MOTOR CONTROL CENTER TO REMAIN. UNIT TO BE LISTED AS "SPARE".
5. EXISTING HOA IN MOTOR CONTROL CENTER TO REMAIN. UNIT TO BE LISTED AS "SPARE".
6. ELECTRICAL CONTRACTOR TO PERFORM 30 DAY LOAD TEST ON "SES-144B" PRIOR TO COMMENCING WORK. VERIFY EXISTING DEMAND LOAD IS LESS THAN 1,060.0 AMPS. PROVIDE ENGINEER OF RECORD WITH RESULTS. IF HIGHER, COORDINATE WITH ENGINEER FOR FURTHER DIRECTION.

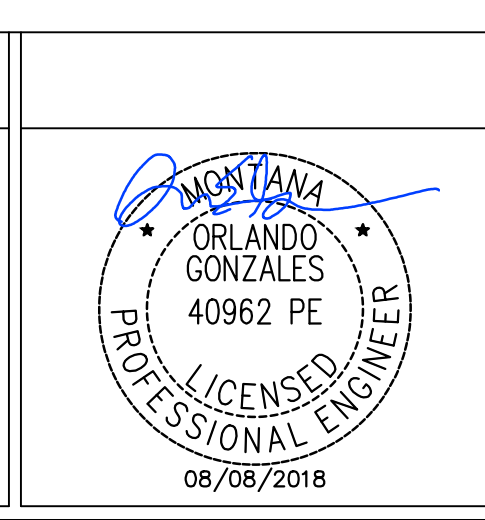
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**1** ELECTRICAL DEMOLITION ONE-LINE DIAGRAM "SES-144B"  
 SCALE: NOT TO SCALE

Revisions	Date

**CONSULTANTS:**



**ARCHITECT/ENGINEERS:**  
**AESUS** Architecture, Engineering, and Sustainable Design  
 designgroup  
 1000 E. Southern Ave, Suite 85, Tempe, Arizona 85282, (480) 791-9542

**Drawing Title:**  
 ELECTRICAL DEMOLITION ONE-LINE DIAGRAM "SES-144B"  
 Approved Project Director:

**Project Title:**  
 REPLACE PENTHOUSE HVAC SYSTEMS  
 CONTRACT NO. VA259-17-C-0212  
**Location:**  
 FT. HARRISON HELENA, MT  
**Date:** 08/03/2018  
**Checked:** OG  
**Drawn:** DC

**Project Number:** 436-17-102  
**Building Number:** 154  
**Drawing Number:** ED601

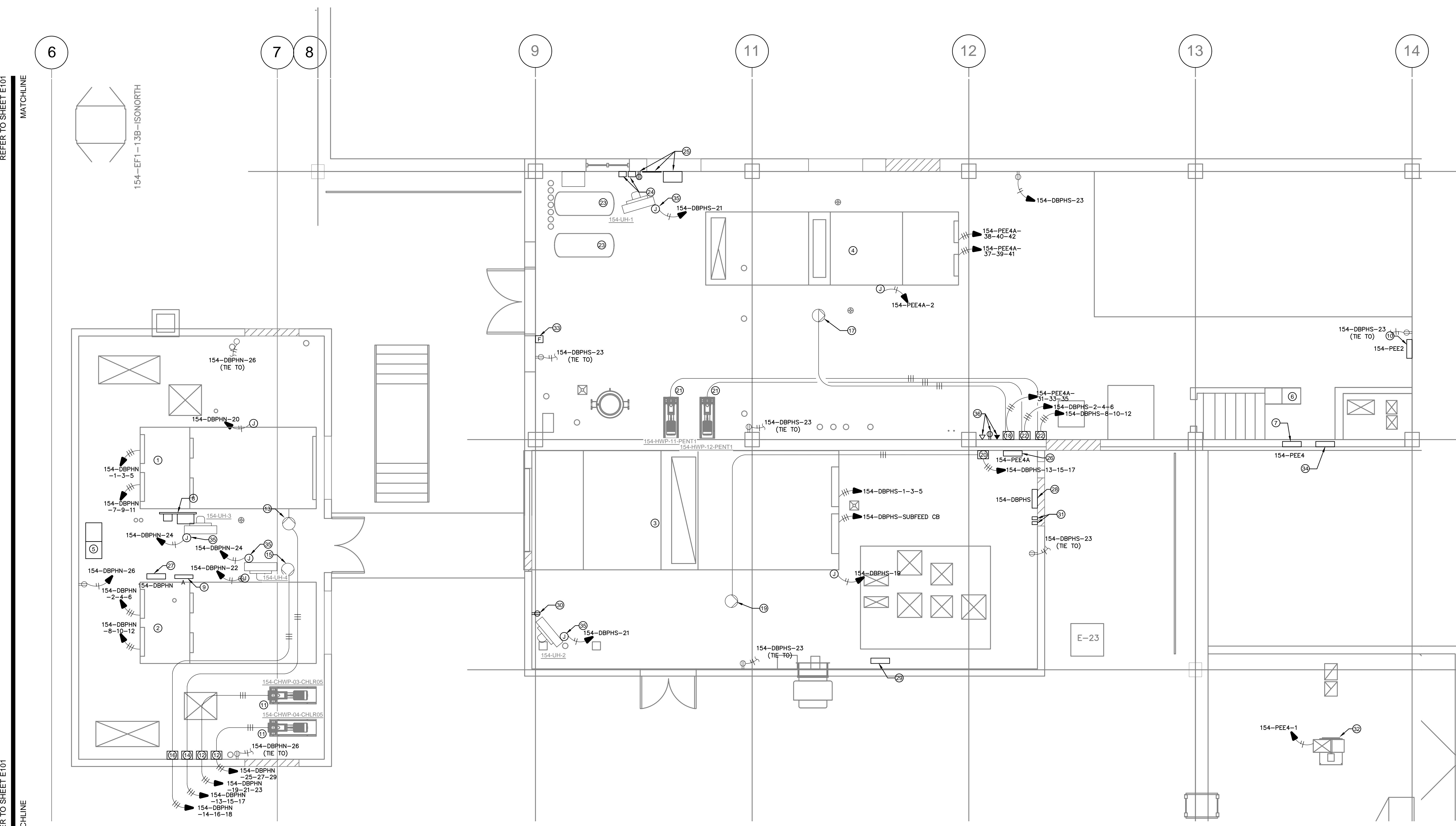
**"BID SET"**  
 Office of Construction and Facilities Management  
 Department of Veterans Affairs

**GENERAL NOTES**

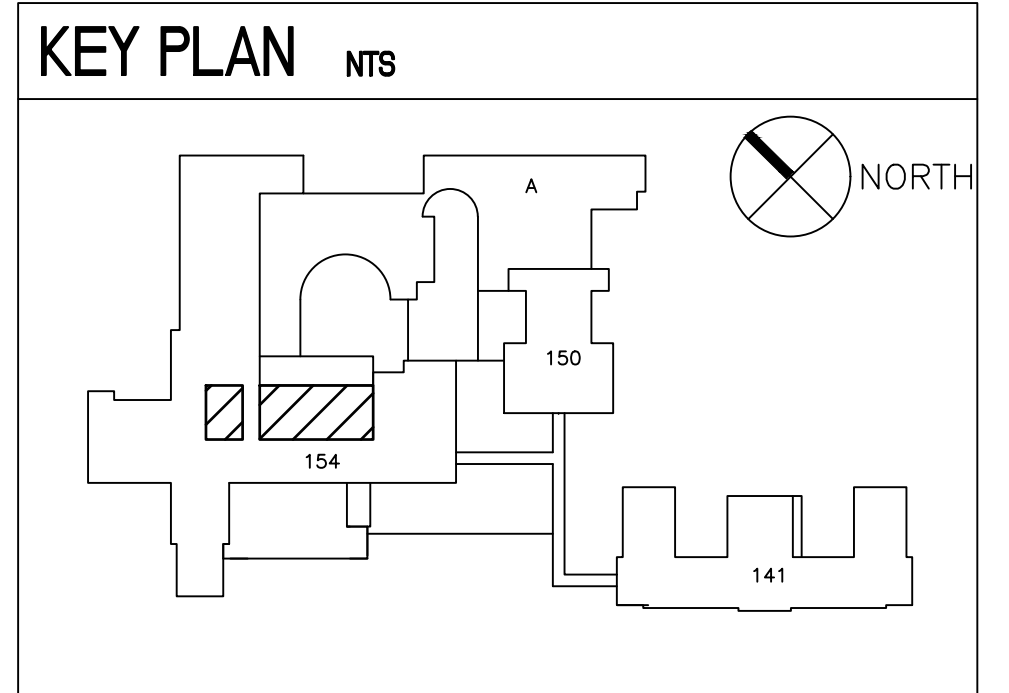
SEE SHEET E-002 FOR GENERAL NOTES.

**KEY NOTES**

1. PROPOSED LOCATION OF NEW AIR HANDLING UNIT 154-AHU-12-4th, WITH DUAL VSD'S WITH DUAL INTEGRAL MAIN DISCONNECTING MEANS, CIRCUIT AS INDICATED.
2. PROPOSED LOCATION OF NEW AIR HANDLING UNIT 154-AHU-13-4th, WITH DUAL VSD'S WITH DUAL INTEGRAL MAIN DISCONNECTING MEANS, CIRCUIT AS INDICATED.
3. PROPOSED LOCATION OF NEW AIR HANDLING UNIT 154-AHU-14-3rd, WITH DUAL VSD'S WITH DUAL INTEGRAL MAIN DISCONNECTING MEANS, CIRCUIT AS INDICATED.
4. PROPOSED LOCATION OF NEW AIR HANDLING UNIT 154-AHU-15-2nd, WITH DUAL VSD'S WITH DUAL INTEGRAL MAIN DISCONNECTING MEANS, CIRCUIT AS INDICATED.
5. LOCATION OF EXISTING MOTOR CONTROL CENTER "MCC-5".
6. LOCATION OF EXISTING MOTOR CONTROL CENTER "MCC-3".
7. LOCATION OF EXISTING PANELBOARD "154-PEE4".
8. LOCATION OF EXISTING GUTTER WITH 600 AMPERE DISCONNECT SERVING "154-CHLR-05A" AND 200 AMPERE DISCONNECT SERVING "MCC-5".
9. LOCATION OF EXISTING PANELBOARD A.
10. LOCATION OF EXISTING PANELBOARD 154-PEE2.
11. PROPOSED LOCATION OF NEW CHILLED WATER PUMPS 154-CHWP-03-CHLR05 AND 154-CHWP-04-CHLR05, CIRCUIT THROUGH VSD.
12. PROPOSED LOCATION OF NEW VSD SERVING CHILLED WATER PUMPS, VSD'S TO BE PROVIDED WITH LOCKABLE OFF PROVISIONS, CIRCUIT AS INDICATED.
13. PROPOSED LOCATION OF NEW HEAT RECOVERY PUMP 154-HRP-1-AHU12, CIRCUIT THROUGH VSD.
14. PROPOSED LOCATION OF NEW VSD SERVING HEAT RECOVERY PUMP 154-HRP-1-AHU12, VSD TO BE PROVIDED WITH LOCKABLE OFF CAPABILITIES, CIRCUIT AS INDICATED.
15. PROPOSED LOCATION OF NEW HEAT RECOVERY PUMP 154-HRP-2-AHU13, CIRCUIT THROUGH VSD.
16. PROPOSED LOCATION OF NEW VSD SERVING HEAT RECOVERY PUMP 154-HRP-12-AHU13, VSD TO BE PROVIDED WITH LOCKABLE OFF CAPABILITIES, CIRCUIT AS INDICATED.
17. PROPOSED LOCATION OF NEW HEAT RECOVERY PUMP 154-HRP-04-AHU15, CIRCUIT THROUGH VSD.
18. PROPOSED LOCATION OF NEW VSD SERVING HEAT RECOVERY PUMP 154-HRP-04-AHU15, CIRCUIT AS INDICATED.
19. PROPOSED LOCATION OF NEW HEAT RECOVERY PUMP 154-HRP-02-AHU14, CIRCUIT THROUGH VSD.
20. PROPOSED LOCATION OF NEW VSD SERVING HEAT RECOVERY PUMP 154-HRP-02-AHU14, CIRCUIT AS INDICATED.
21. PROPOSED LOCATION OF NEW HOT WATER PUMPS 154-HWP-11-PENT1 AND 154-HWP-A2-PENT1, CIRCUIT THROUGH VSD'S.
22. PROPOSED LOCATION OF NEW VSD'S SERVING HOT WATER PUMPS, CIRCUIT AS INDICATED.
23. PROPOSED LOCATION FOR RELOCATED AIR COMPRESSOR, EXTEND, RE-ROUTE OR RE-FEED UNIT AS REQUIRED. SEE SHEET E100 FOR CURRENT LOCATION.
24. PROPOSED LOCATION OF RELOCATED DISCONNECTS AND CONTROLLERS SERVING RELOCATED AIR COMPRESSORS, EXTEND OR RE-ROUTE EXISTING FEED TO THIS LOCATION.
25. PROPOSED LOCATION FOR NEW AIR COMPRESSOR DRYER SYSTEM AND RECEPTACLE SERVING UNIT, EXTEND OR RE-ROUTE FEED TO THIS LOCATION.
26. PROPOSED LOCATION FOR NEW PANELBOARD "154-PEE4A". SEE ONE-LINE DIAGRAM ON SHEET E600 FOR DETAILS.
27. PROPOSED LOCATION FOR NEW DISTRIBUTION BOARD "154-DBPHN". SEE ONE-LINE DIAGRAM ON SHEET E601 FOR DETAILS.
28. PROPOSED LOCATION FOR NEW DISTRIBUTION BOARD "154-DBPHS". SEE ONE-LINE DIAGRAM ON SHEET E600 FOR DETAILS.
29. PROPOSED LOCATION FOR RELOCATED PANELBOARD 154-P5. PROVIDE SUPPORTING MEANS AS REQUIRED, EXTEND, RE-ROUTE OR PROVIDE NEW FEED TO PANELBOARD AND TO ALL DOWNSTREAM UNITS SERVED THROUGH UNIT.
30. PROPOSED LOCATION FOR RELOCATED RECEPTACLE, EXTEND OR RE-ROUTE FEED TO THIS LOCATION.
31. PROPOSED LOCATION FOR RELOCATED SIMPLE FIRE ALARM DEVICES, EXTEND OR RE-ROUTE FEED TO NEW LOCATION.
32. LOCATION OF REPLACEMENT EXHAUST FAN EF-14. PROVIDE NEW CONDUCTORS IN EXISTING CONDUIT BACK TO CIRCUIT BREAKER INDICATED.
33. LOCATION OF RELOCATED FIRE ALARM PULL BOX.
34. LOCATION OF ELEVATOR MAIN SHUTOFF PANEL, ENSURE THAT NO DISRUPTION TO ELEVATOR EQUIPMENT OCCURS DURING THIS PROJECT.
35. PROVIDE J-BOX FOR HARDWARE CONNECTION TO UNIT HEATER WITH HP FAN, CIRCUIT AS INDICATED. COORDINATE WITH MECHANICAL FOR EXACT LOCATION AND REQUIREMENTS.
36. PROPOSED LOCATION OF RELOCATED POWER, DATA AND TELEPHONE RECEPTACLES, EXTEND, RE-ROUTE REFEED AS REQUIRED.



**1 ELECTRICAL POWER PENTHOUSE NEW WORK PLAN**  
SCALE: 1/4" = 1'-0"

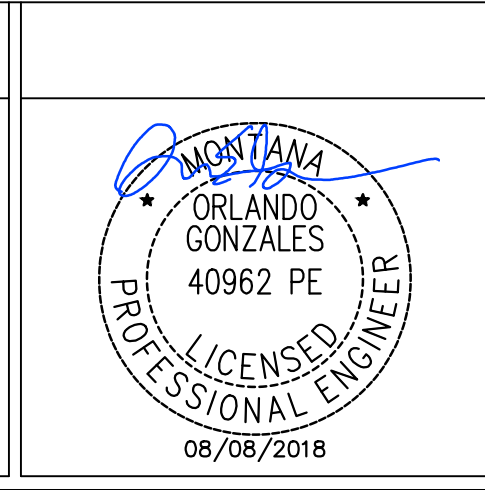


three inches = one foot  
 one and one half inches = one foot  
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 three quarters inch = one foot  
 one half inch = one foot  
 three eighths inch = one foot  
 one quarter inch = one foot  
 one eighth inch = one foot  
 one sixteenth inch = one foot

REFER TO SHEET E101  
 MATCHLINE

Revisions:	Date

CONSULTANTS:	



**ARCHITECT/ENGINEERS:**

**AESUS** Architecture, Engineering, and Sustainable Design  
 designgroup  
 1000 E. Southern Ave, Suite 65, Tempe, Arizona 85282, (480) 791-9542

<b>Drawing Title</b>	<b>ELECTRICAL POWER PENTHOUSE NEW WORK PLAN</b>
<b>Approved Project Director</b>	

<b>Project Title</b>	<b>REPLACE PENTHOUSE HVAC SYSTEMS</b>
<b>Contract No.</b>	VA259-17-C-0212
<b>Location</b>	FT. HARRISON, HELENA, MT
<b>Date</b>	08/03/2018
<b>Checked</b>	OG
<b>Drawn</b>	DC

<b>Project Number</b>	436-17-102
<b>Building Number</b>	154
<b>Drawing Number</b>	E100

**Office of Construction and Facilities Management**

Department of Veterans Affairs

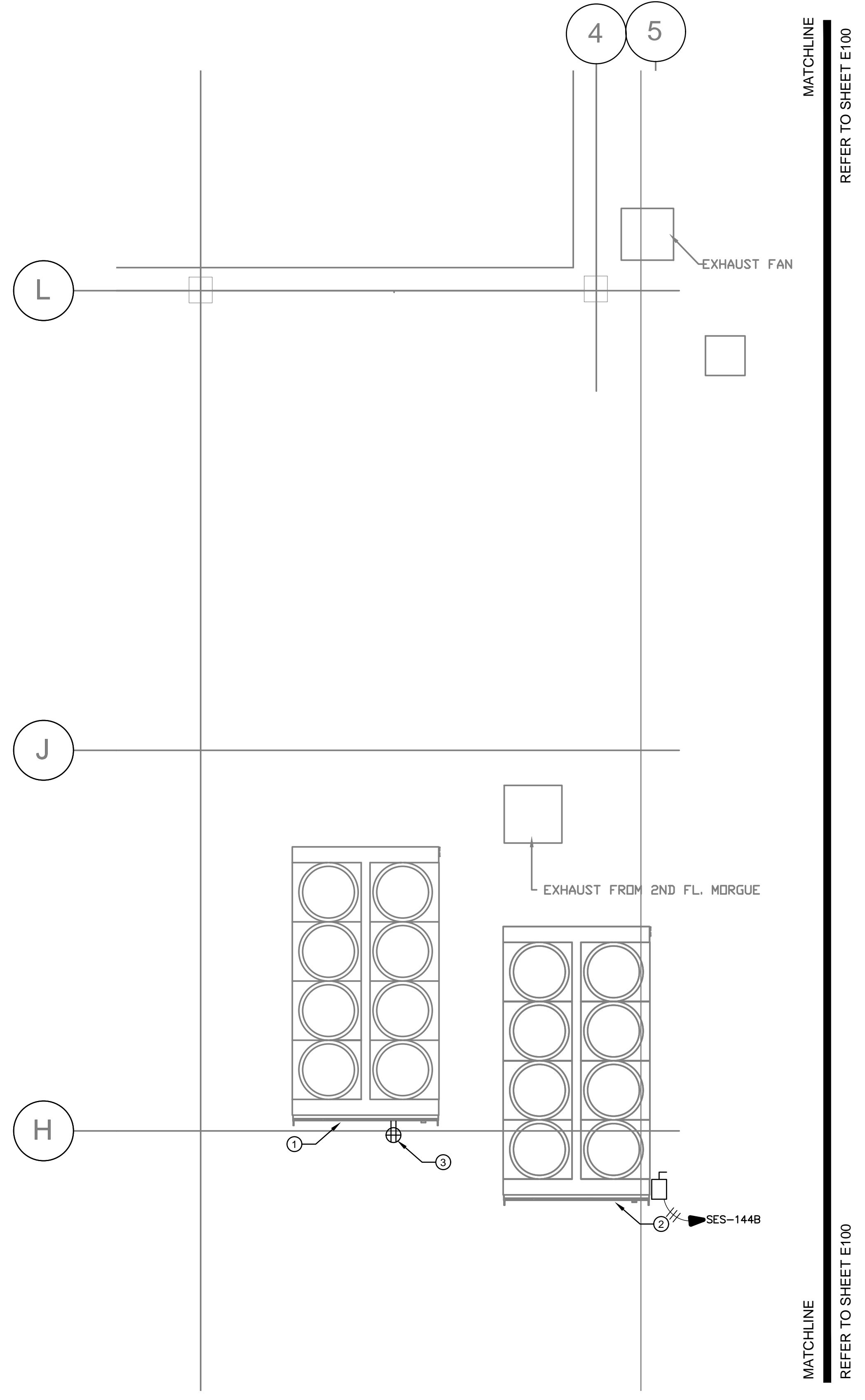
"BID SET"



three inches = one foot  
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 one eighth inch = one foot

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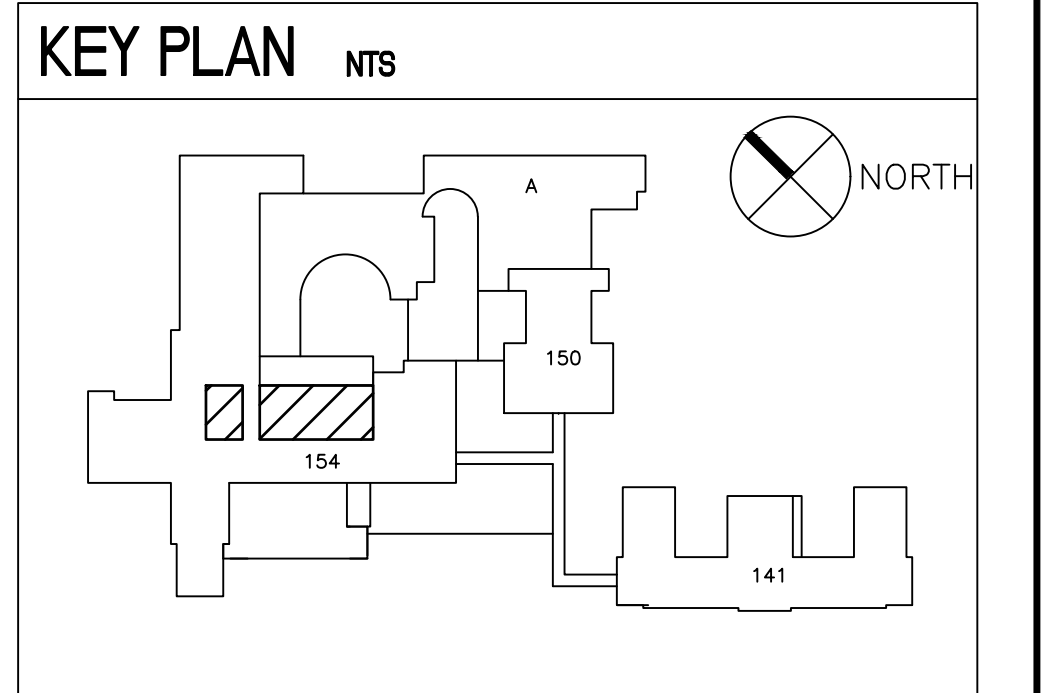
**1** ELECTRICAL POWER ROOF NEW WORK PLAN  
SCALE: 1/4" = 1'-0"

**GENERAL NOTES**

- A. ALL EXTERIOR DEVICES SHALL BE WEATHERPROOF AND GFCI PROTECTED.
- B. MEMBRANE PENETRATION THROUGH WALLS SHALL BE PROTECTED IN ACCORDANCE WITH THE LATEST ADOPTED EDITION OF I.B.C. 712.32.
- C. ALL WORK WILL BE PERFORMED IN STRICT ACCORDANCE WITH ALL NATIONAL AND LOCAL CODES, STANDARDS AND SAFE WORK PROCEDURES.
- D. ALL DEMOLITION AND NEW WORK MUST BE PERFORMED SUCH THAT EXISTING DEVICES, EQUIPMENT, ETC. ARE TO BE PROTECTED SO AS THEY REMAIN FULLY FUNCTIONAL FOR CONTINUED USE. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR MAINTAINING CIRCUIT INTEGRITY TO ALL EQUIPMENT AND DEVICES TO REMAIN. THE CONTRACTOR WILL REPAIR ANY DAMAGE TO EXISTING EQUIPMENT OR DEVICES TO THE SATISFACTION OF THE ENGINEER.
- E. COORDINATE WITH MECHANICAL AND PLUMBING DRAWINGS AND CONTRACTOR FOR ANY MECHANICAL OR PLUMBING EQUIPMENT WHICH MAY NEED TO BE DEMOLISHED, RELOCATED OR NEW WORK TO BE PROVIDED WITH NEW CIRCUITS.
- F. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH ALL TRADES AND PROVIDING ALL EQUIPMENT, DEVICES, APPURTENANCES AND SUPPORT AS REQUIRED FOR A FULLY FUNCTIONAL SYSTEM.
- G. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH ALL VENDORS AND PROVIDING ALL CONNECTIONS AND APPURTENANCES AS REQUIRED FOR A FULLY FUNCTIONING SYSTEM TO THE SATISFACTION OF THE OWNER, TENANT AND ENGINEER.
- H. CONTRACTOR WILL MAINTAIN CLEARANCES ABOUT ELECTRICAL EQUIPMENT PER NEC 110.26.
- I. ALL WIRING FOR EXTERIOR LIGHTING AND POWER DEVICES SHALL BE A MINIMUM OF 10 A.W.G. COPPER WITH TYPE THWN-2 INSULATION (UNO) FOR UNDERGROUND CIRCUITS RUN IN PVC. PROVIDE A 10 A.W.G. COPPER GROUND IN ADDITION TO CIRCUIT CONDUCTORS (UNO).
- J. VERIFY ALL EXISTING LOCATIONS AND CONDITIONS IN THE FIELD PRIOR TO START OF WORK.
- K. NO DESIGN CHANGE MAY BE MADE TO THE SYSTEM WITHOUT THE PRIOR APPROVAL OF THE DESIGN ELECTRICAL ENGINEER AND THE ELECTRICAL INSPECTOR.
- L. PLANS WERE DESIGNED USING INFORMATION AVAILABLE TO ENGINEER. THIS INFORMATION MAY CONSIST OF ORIGINAL BUILDING PLANS, PRIOR TENANT IMPROVEMENT PLANS, EXISTING PANEL SCHEDULES, FIELD NOTES, ETC.
- M. HOWEVER, AS EXISTING INFORMATION MAY BE INCOMPLETE OR MAY PROVE TO CONTAIN INACCURACIES, THE ENGINEER CANNOT CERTIFY PRIOR INSTALLATIONS AS PERFORMED BY OTHERS. THEREFORE, THE CONTRACTOR SHALL INCLUDE IN HIS BID ALL WORK AS REQUIRED TO FIELD VERIFY EXISTING CONDITIONS AND AVAILABLE CIRCUITS.
- N. THE CONTRACTOR WILL PROVIDE ENGINEER AND OWNER WITH COMPLETE AND ACCURATE 'AS-BUILTS'.

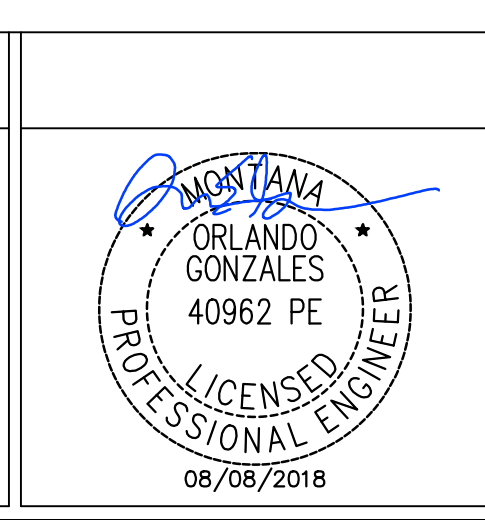
**KEY NOTES**

- 1. LOCATION OF EXISTING CHILLER 154-CHLR-05-AHU13-15.
- 2. PROPOSED LOCATION OF NEW CHILLER 154-CHLR-05B-AHU13-15.
- 3. EXISTING GFCI PROTECTED ROOF MOUNTED EQUIPMENT MAINTENANCE RECEPTACLE WITH WEATHERPROOF WHILE-IN-USE COVER PER N.E.C. 210.63, CIRCUITED THROUGH PANELBOARD A, CIRCUIT 2.



Revisions	Date

**CONSULTANTS:**



**ARCHITECT/ENGINEERS:**  
**AESUS** Architecture, Engineering, and Sustainable Design  
 designgroup 1050 E. Southern Ave, Suite 65, Tempe, Arizona 85282, (480) 791-9542

Drawing Title  
 ELECTRICAL POWER ROOF NEW WORK PLAN

Approved Project Director

Project Title  
 REPLACE PENTHOUSE HVAC SYSTEMS  
 CONTRACT NO. VA259-17-C-0212

Location FT. HARRISON	HELENA, MT
Date 08/03/2018	Checked OG
	Drawn DC

Project Number  
436-17-102

Building Number  
154

**Office of Construction and Facilities Management**  
 Department of Veterans Affairs

'BID SET'

Drawing Number  
**E101**

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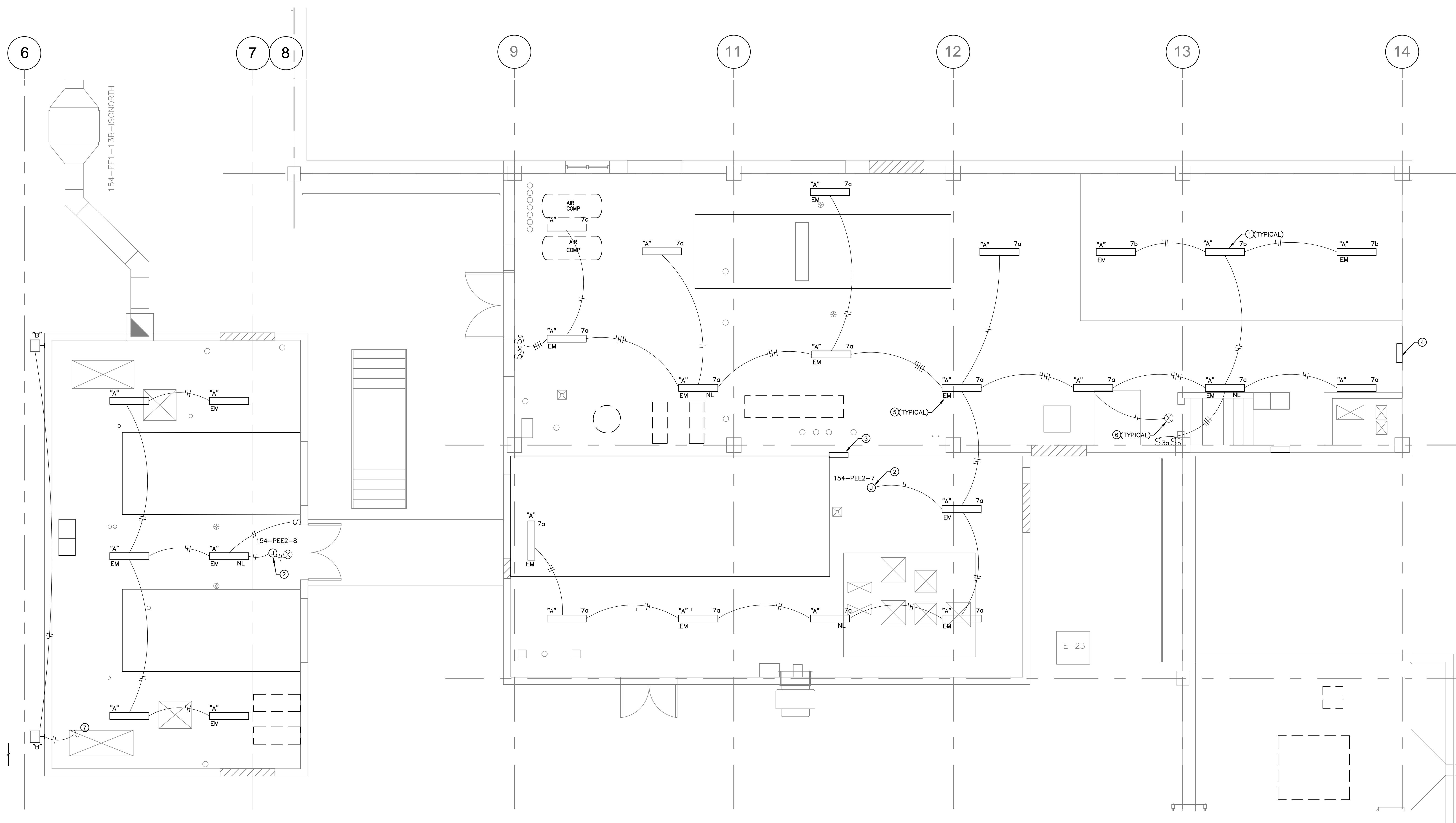
9

**GENERAL NOTES**

SEE SHEET E-002 FOR GENERAL NOTES.

**KEY NOTES**

1. PROVIDE NEW LUMINAIRE AS INDICATED.
2. TIE INTO CIRCUITED J-BOX AS INDICATED, FORMERLY USED TO SERVE LIGHTING REMOVED DURING DEMO PHASE OF THIS PROJECT.
3. LOCATION OF PANELBOARD "154-P5".
4. LOCATION OF PANELBOARD "154-PEE2".
5. SHADING OR EM INDICATES LUMINAIRE PROVIDED WITH INTEGRAL 15 WATT, 90 MINUTE BATTERY PACK. PROVIDE UNSWITCHED LEG TO LUMINAIRE FOR LOSS-0-POWER SENSING.
6. NEW EXIT SIGN TO MATCH BUILDING STANDARD. WHITE WITH RED LETTERS CHLORIDE SYSTEMS # SLNURW-BF/FA WITH FLASHING AND AUDIBLE AT EXIT DOORS IN EMERGENCY MODE PER ADA. FIELD VERIFY FACES AND MOUNTING.
7. TIE INTO UNSWITCHED LEG OF CIRCUIT SERVING LIGHTING IN THE OUTBOARD PENTHOUSE (154-PEE2-8).

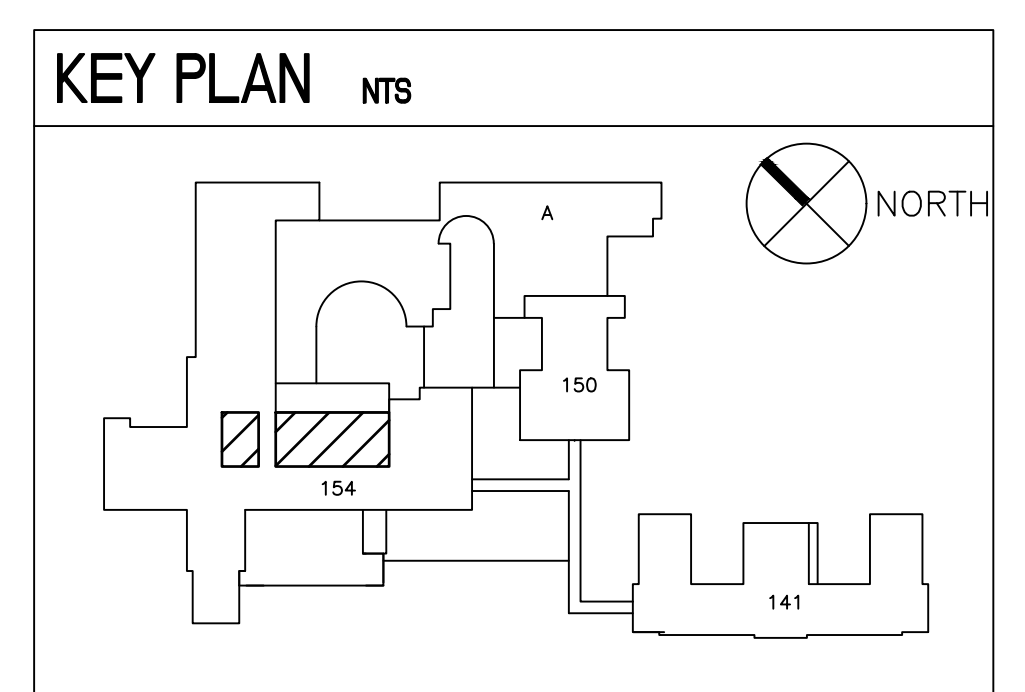


**1 ELECTRICAL LIGHTING PENTHOUSE NEW WORK PLAN**  
SCALE: 1/4" = 1'-0"

**LUMINAIRE SCHEDULE**

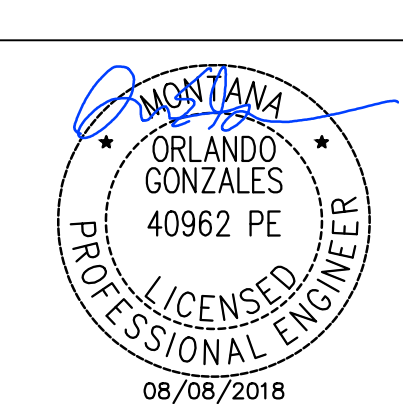
TYPE	SYMBOL	MANUFACTURER CATALOG NUMBER	LAMP QUANTITY AND TYPE	FIXTURE WATTS	VOLTS	DESCRIPTION	LOCATION	MOUNTING HEIGHT	KEYNOTES
A	[Symbol]	CREE LIGHTING # CS18-44L-35K AC5-48-Q14B-TB	LED STRIP WITH CREE TRUEWHITE TECHNOLOGY. CRI OF 90 AND A HIGH EFFICIENCY REFLECTOR.	44	MULTI	8' LOG X 10" WIDE CHAIN HUNG INDIRECT STRIP TYPE L.E.D. LUMINAIRE WITH ADJUSTABLE CABLE PROVISIONS.	PENTHOUSES	9'-0" AFF.	B C D
B	[Symbol]	CREE LIGHTING # SEC-EDG-3M-WM-06-UL-BZ-525-F-P-XA-BRDSPK	6 SETS OF 10 L.E.D.'S ARRANGED FOR TYPE 3 DISTRIBUTION.	66	MULTI	DARK SKY FRIENDLY, WET LOCATION LISTED MOUNTED LUMINAIRE WITH BRONZE HOUSING, INTEGRAL PHOTOCELL AND BIRD SPIKES.	CHILLER AREA	TOP OF EXTERIOR PENTHOUSE WALL.	A B

- A. LUMINAIRE SHALL BE PROVIDED WITH INTEGRAL MOTION/AMBIENT LIGHT SENSOR.
- B. PROVIDE DISCONNECTING MEANS PER N.E.C. 410.130(G).
- C. FIXTURES MARKED "EM" SHALL HAVE FACTORY INSTALLED 90 MINUTE INTEGRAL 90 MINUTE EMERGENCY BATTERY BACK-UP UNIT.
- D. PROVIDE CHAIN LENGTH AS REQUIRED TO ACHIEVE MOUNTING HEIGHT AS INDICATED.



**CONSULTANTS:**

**ARCHITECT/ENGINEERS:**  
**AESUS** Architecture, Engineering, and Sustainable Design  
 designgroup  
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Drawing Title <b>ELECTRICAL LIGHTING PENTHOUSE NEW WORK PLAN</b>		Project Title <b>REPLACE PENTHOUSE HVAC SYSTEMS</b> CONTRACT NO. VA259-17-C-0212		Project Number 436-17-102	
Approved Project Director		Location FT. HARRISON, HELENA, MT		Building Number 154	
Date 08/03/2018	Checked OG	Drawn DC	Drawing Number <b>E200</b>		

**Office of Construction and Facilities Management**  
Department of Veterans Affairs

three eighths inch = one foot  
 one eighth inch = one foot  
 one quarter inch = one foot  
 three quarters inch = one foot  
 one half inch = one foot  
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 one and one half inches = one foot  
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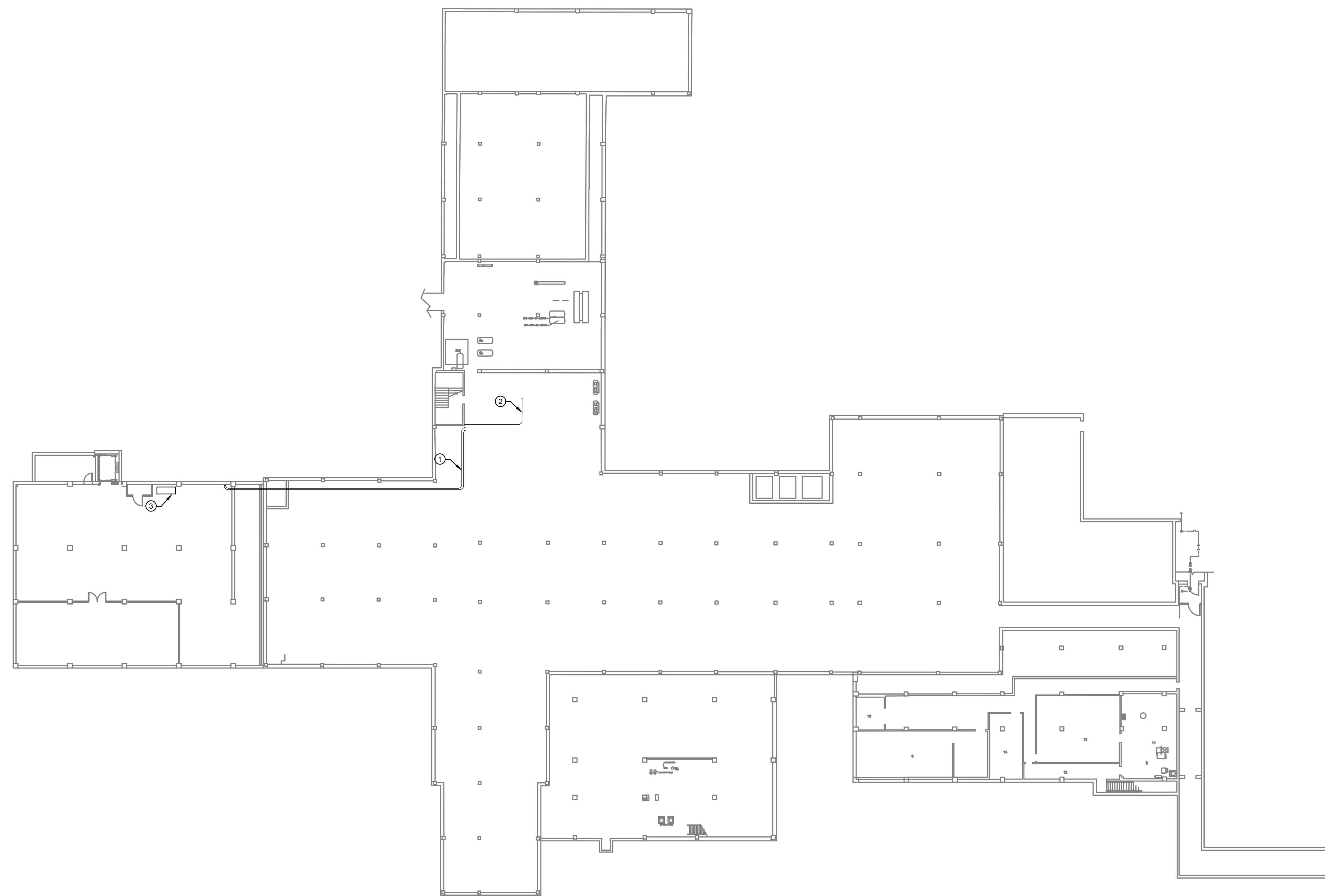


GENERAL NOTES

SEE SHEET E-002 FOR GENERAL NOTES.

KEY NOTES

1. INTERCEPT EXISTING CONDUIT STUBS AT BASEMENT WALL AND ROUTE CONDUIT AND CONDUCTORS SERVING "154-DBPHN" AND NEW CHILLER "154-CHLR-05B" TO AREA BELOW MOP ROOMS ADJACENT TO STAIRWAY. ROUTE UP TO LEVEL 4, PROVIDING NEW CONDUIT AND CONDUCTORS THOROUGH EXISTING PULL BOXES AT EACH LEVEL.
2. ROUTE CONDUIT AND CONDUCTORS SERVING "154-DBPHS" TO AREA BELOW MOP ROOMS ADJACENT TO STAIRWAY. ROUTE UP TO LEVEL 3, PROVIDING NEW CONDUIT AND CONDUCTORS THROUGH EXISTING PULL BOXES AT EACH LEVEL.
3. PROPOSED LOCATION FOR NEW DISTRIBUTION BOARD "SES-144C". TO BE BID AS PART OF A LINE ITEM. SEE ONE-LINE DIAGRAM ON SHEET E602 FOR DETAILS.



1 ELECTRICAL BASEMENT CONDUIT ROUTING PLAN  
SCALE: 1" = 20'-0"

three inches = one foot  
one and one half inches = one foot  
one inch = one foot  
one inch = one foot  
three quarters inch = one foot  
one half inch = one foot  
three eighths inch = one foot  
one quarter inch = one foot  
one eighth inch = one foot  
one eighth inch = one foot

Revisions	Date



ARCHITECT/ENGINEERS:  
**AESUS** Architecture, Engineering,  
**designgroup** and Sustainable Design  
1000 E. Southern Ave, Suite #5, Tempe, Arizona 85282, (480) 791-9542

Drawing Title  
ELECTRICAL  
BASEMENT CONDUIT  
ROUTING PLAN  
Approved Project Director

Project Title  
REPLACE PENTHOUSE  
HVAC SYSTEMS  
CONTRACT NO. VA259-17-C-0212  
Location  
FT. HARRISON HELENA, MT  
Date  
08/03/2018  
Checked  
OG  
Drawn  
DC

Project Number  
436-17-102  
Building Number  
154  
Drawing Number  
E300

'BID SET'  
Office of  
Construction  
and Facilities  
Management  
Department of  
Veterans Affairs

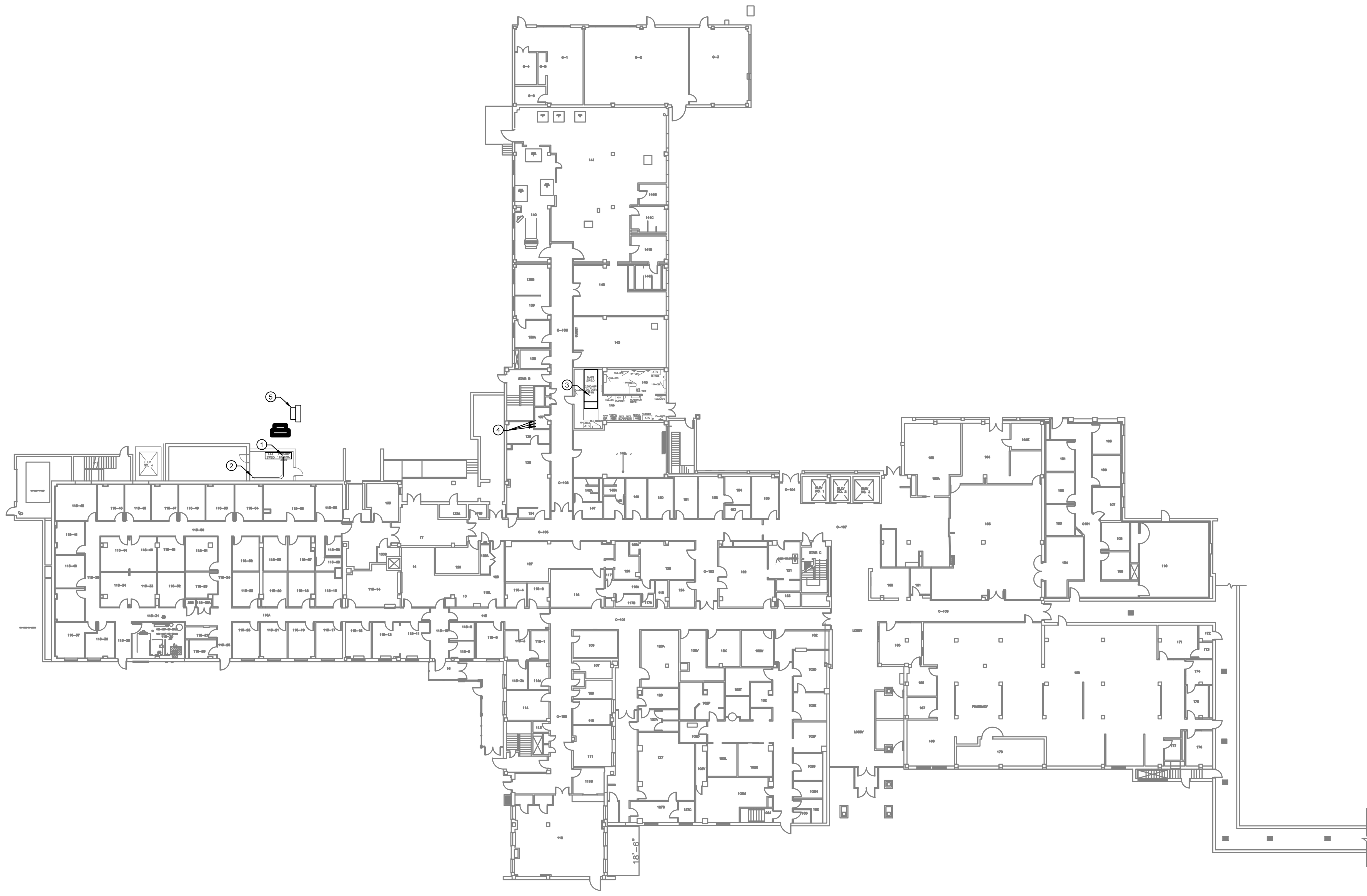
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**GENERAL NOTES**

SEE SHEET E-002 FOR GENERAL NOTES.

**KEY NOTES**

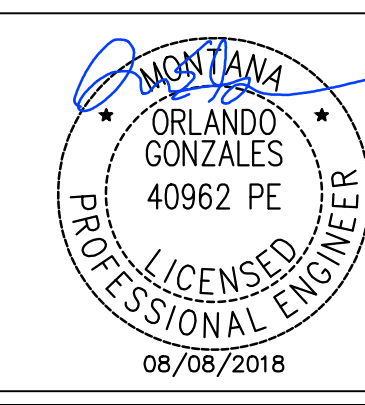
- 1. CONDUITS AND CONDUCTORS SERVING NEW DISTRIBUTION BOARD "154-DBPHN" AND NEW CHILLER "154-CHLR-05B" TO BE ROUTED THROUGH TOP OF SES-144B TO CEILING AREA, TO WALL ACROSS FROM SES, TO CORNER ACROSS FROM SERVICE AND DOWN.
- 2. INTERCEPT TWO EXISTING 4" CONDUITS STUBBED INTO BASEMENT AND USE THESE TO ROUTE FEEDS INTO BASEMENT. SEE SHEET E300.
- 3. CONDUIT AND CONDUCTORS SERVING "154-DBPHS" TO BE ROUTED THROUGH FLOOR TO BASEMENT.
- 4. (3) 4" CONDUITS AND CONDUCTORS ROUTED THROUGH MOP ROOM, ONE FROM BASEMENT TO THIRD LEVEL, 2 FROM BASEMENT TO FOURTH LEVEL.
- 5. PROPOSED LOCATION FOR NEW DISTRIBUTION TRANSFORMER, TO BE BID AS PART OF A LINE ITEM. SEE ONE-LINE DIAGRAM ON SHEET E602 FOR DETAILS.



**1** ELECTRICAL FIRST FLOOR CONDUIT ROUTING PLAN  
SCALE: 1" = 20'-0"

Revisions	Date

**CONSULTANTS:**



**ARCHITECT/ENGINEERS:**  
**AESUS** Architecture, Engineering,  
and Sustainable Design  
1000 E. Southern Ave, Suite #5, Tempe, Arizona 85282, (480) 791-9542

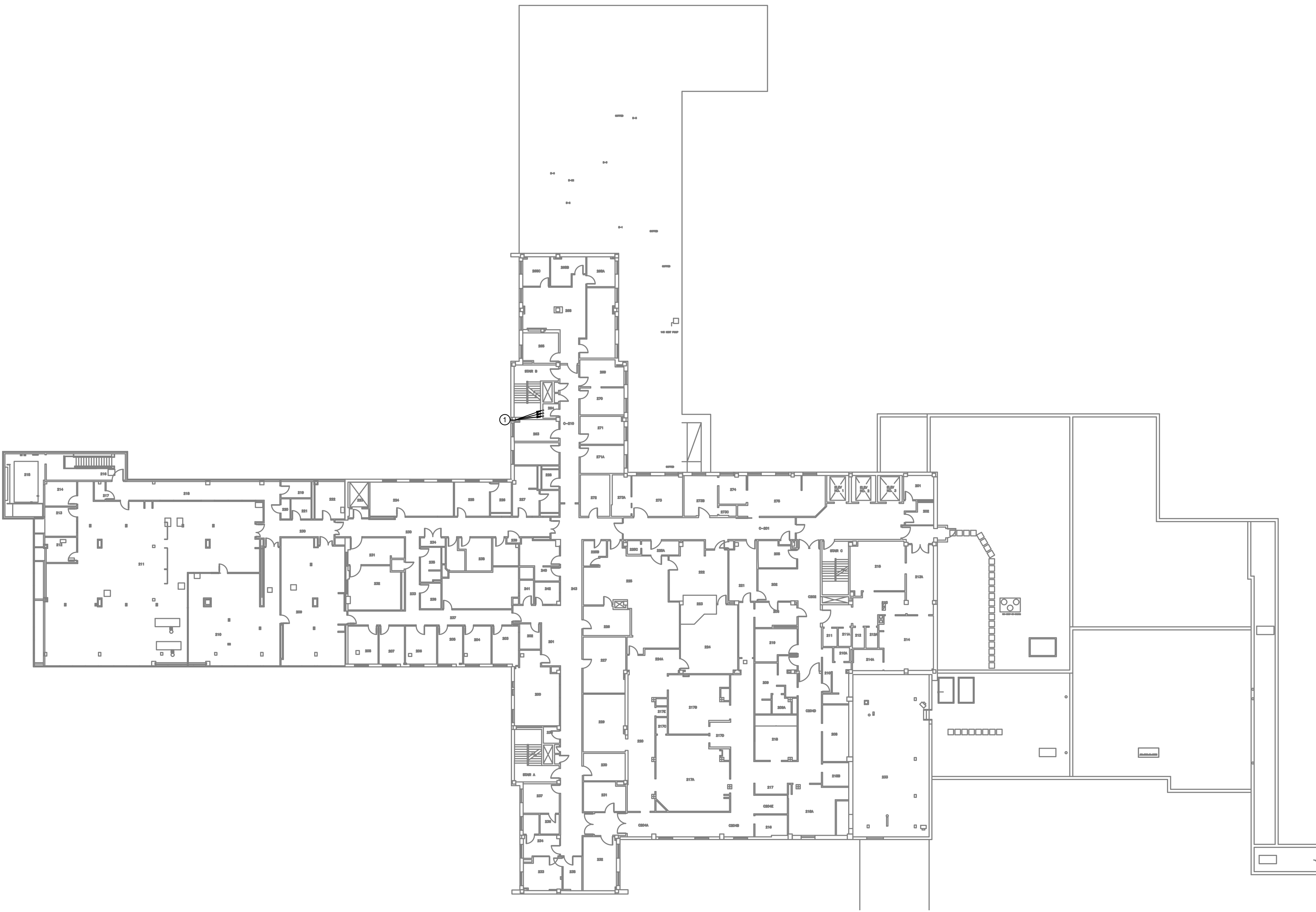
Drawing Title  
**ELECTRICAL  
FIRST FLOOR CONDUIT  
ROUTING PLAN**  
Approved Project Director

Project Title  
**REPLACE PENTHOUSE  
HVAC SYSTEMS**  
CONTRACT NO. VA259-17-C-0212  
Location  
FT. HARRISON HELENA, MT  
Date  
08/03/2018  
Checked  
OG  
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DC

Project Number  
436-17-102  
Building Number  
154  
Drawing Number  
**E301**

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Veterans Affairs





1 ELECTRICAL SECOND FLOOR CONDUIT ROUTING PLAN  
SCALE: 1" = 20'-0"

### GENERAL NOTES

SEE SHEET E-002 FOR GENERAL NOTES.

### KEY NOTES

- (3) 4" CONDUITS AND CONDUCTORS ROUTED THROUGH MOP ROOM, ONE FROM BASEMENT TO THIRD LEVEL, 2 FROM BASEMENT TO FOURTH LEVEL.

### CONDUIT PENETRATION NOTE

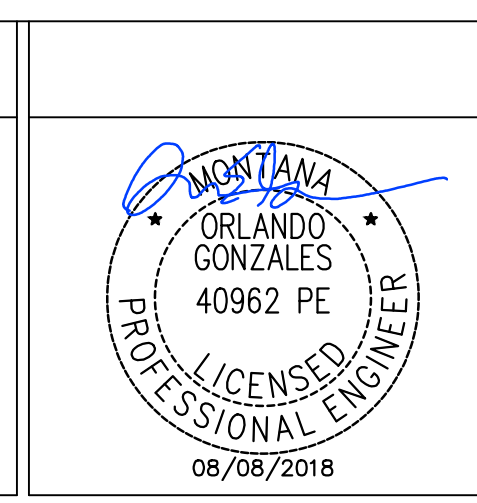
ADDITIONAL CONDUIT STUBS BETWEEN FLOORS ARE BEING PROVIDED AS PART OF A SEPARATE PROJECT. SPARE CONDUITS MAY EXIST. FIELD VERIFY NUMBER, SIZES AND AVAILABILITY OF SPARE PENETRATIONS AND CONDUIT STUBS BETWEEN FLOORS PRIOR TO BID.

three inches = one foot  
one and one half inches = one foot  
one inch = one foot  
three quarters inch = one foot  
one half inch = one foot  
three eighths inch = one foot  
one quarter inch = one foot  
one eighth inch = one foot  
one eighth inch = one foot

A  
B  
C  
D  
E  
F

Revisions:	Date

CONSULTANTS:	



ARCHITECT/ENGINEERS:

**AESUS** Architecture, Engineering, and Sustainable Design  
**designgroup**

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Drawing Title
ELECTRICAL SECOND FLOOR CONDUIT ROUTING PLAN
Approved Project Director

Project Title		
REPLACE PENTHOUSE HVAC SYSTEMS		
CONTRACT NO. VA259-17-C-0212		
Location		HELENA, MT
Date	Checked	Drawn
08/03/2018	OG	DC

Project Number	
436-17-102	
Building Number	
154	
Drawing Number	
E302	
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Office of  
Construction  
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Management

Department of  
Veterans Affairs

"BID SET"





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### GENERAL NOTES

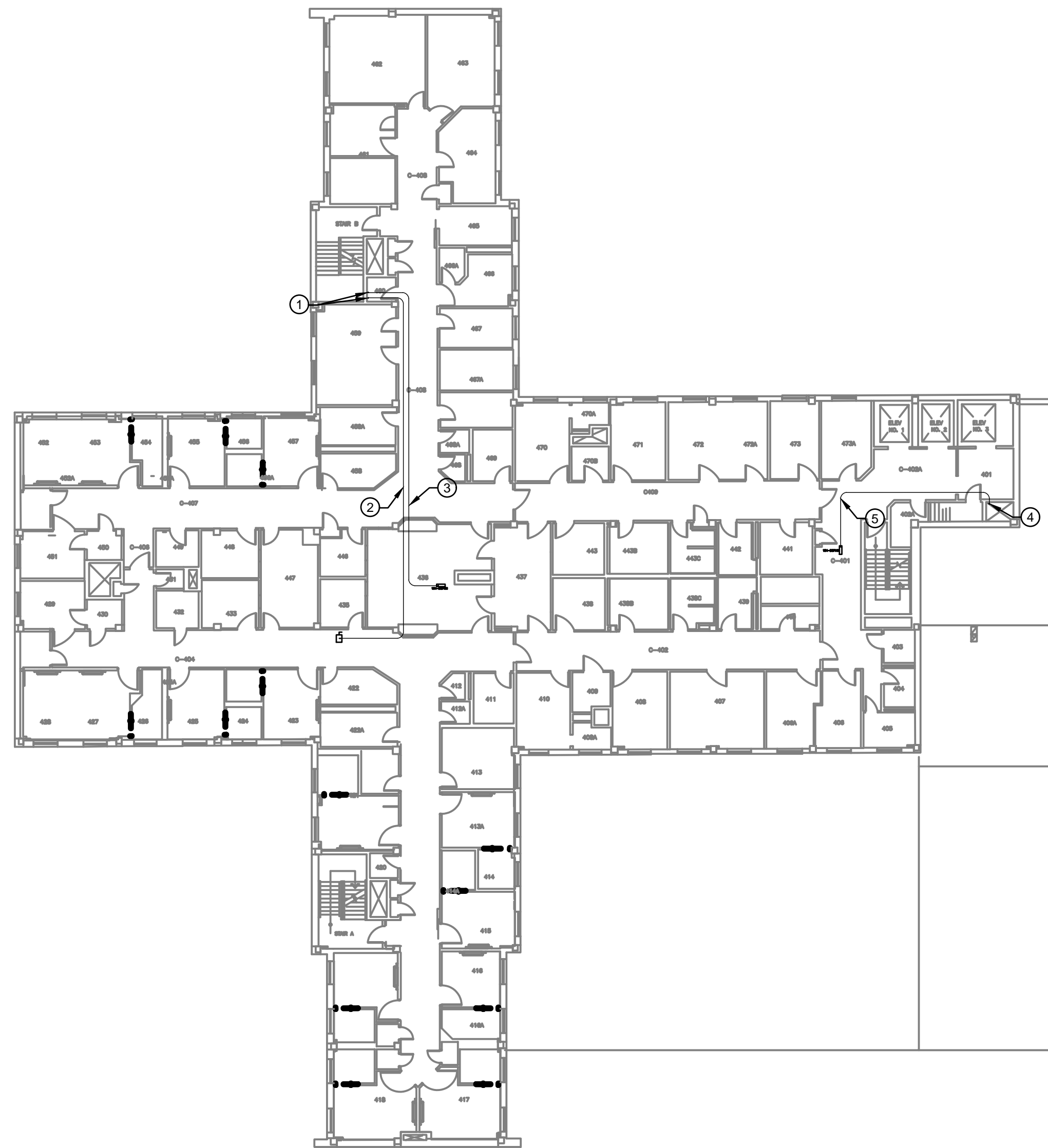
SEE SHEET E-002 FOR GENERAL NOTES.

### KEY NOTES (1)

- (2) 4" CONDUITS AND CONDUCTORS ROUTED THROUGH MOP ROOM, FROM BASEMENT TO FOURTH LEVEL.
- ROUTE 4" CONDUIT AND CONDUCTORS SERVING CHILLER "154-CHLR-05B" THROUGH FOURTH FLOOR CHASE AREA AS INDICATED TO SPACE IMMEDIATELY BELOW CHILLER DISCONNECT AND UP THROUGH ROOF DIRECTLY INTO CHILLER DISCONNECT. SEE SHEET E305 FOR LOCATION OF CHILLER AND CHILLER DISCONNECT.
- ROUTE 4" CONDUIT AND CONDUCTORS SERVING DISTRIBUTION BOARD "154-DBPHN" THROUGH FOURTH FLOOR CHASE AREA AS INDICATED TO SPACE IMMEDIATELY BELOW DISTRIBUTION BOARD AND UP THROUGH PENTHOUSE FLOOR DIRECTLY INTO DISTRIBUTION BOARD. SEE SHEET E305 FOR LOCATION OF DISTRIBUTION BOARD "154-DBPHN".
- (1) 4" CONDUIT ROUTED THROUGH UTILITY CHASE FROM LEVEL THREE.
- ROUTE 4" CONDUIT AND CONDUCTORS SERVING DISTRIBUTION BOARD "154-DBPHS" THROUGH FOURTH FLOOR CHASE AREA AS INDICATED TO SPACE IMMEDIATELY BELOW DISTRIBUTION BOARD AND UP THROUGH PENTHOUSE FLOOR DIRECTLY INTO DISTRIBUTION BOARD. SEE SHEET E305 FOR LOCATION OF DISTRIBUTION BOARD "154-DBPHS".

### CONDUIT PENETRATION NOTE

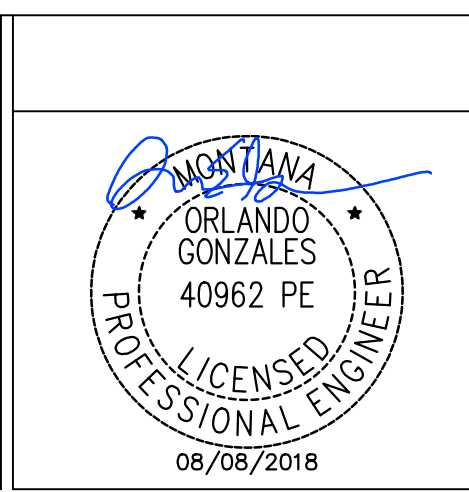
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1 ELECTRICAL FOURTH FLOOR CONDUIT ROUTING PLAN  
SCALE: 1" = 20'-0"

Revisions	Date

CONSULTANTS:



ARCHITECT/ENGINEERS:

**AESUS** Architecture, Engineering, and Sustainable Design  
**designgroup**

1000 E. Southern Ave, Suite 65, Tempe, Arizona 85282. (480) 791-9542

Drawing Title	ELECTRICAL FOURTH FLOOR CONDUIT ROUTING PLAN
Approved Project Director	

Project Title		
REPLACE PENTHOUSE HVAC SYSTEMS		
CONTRACT NO. VA259-17-C-0212		
Location		
FT. HARRISON		HELENA, MT
Date	Checked	Drawn
08/03/2018	OG	DC

Project Number	436-17-102
Building Number	154
Drawing Number	E304

'BID SET'

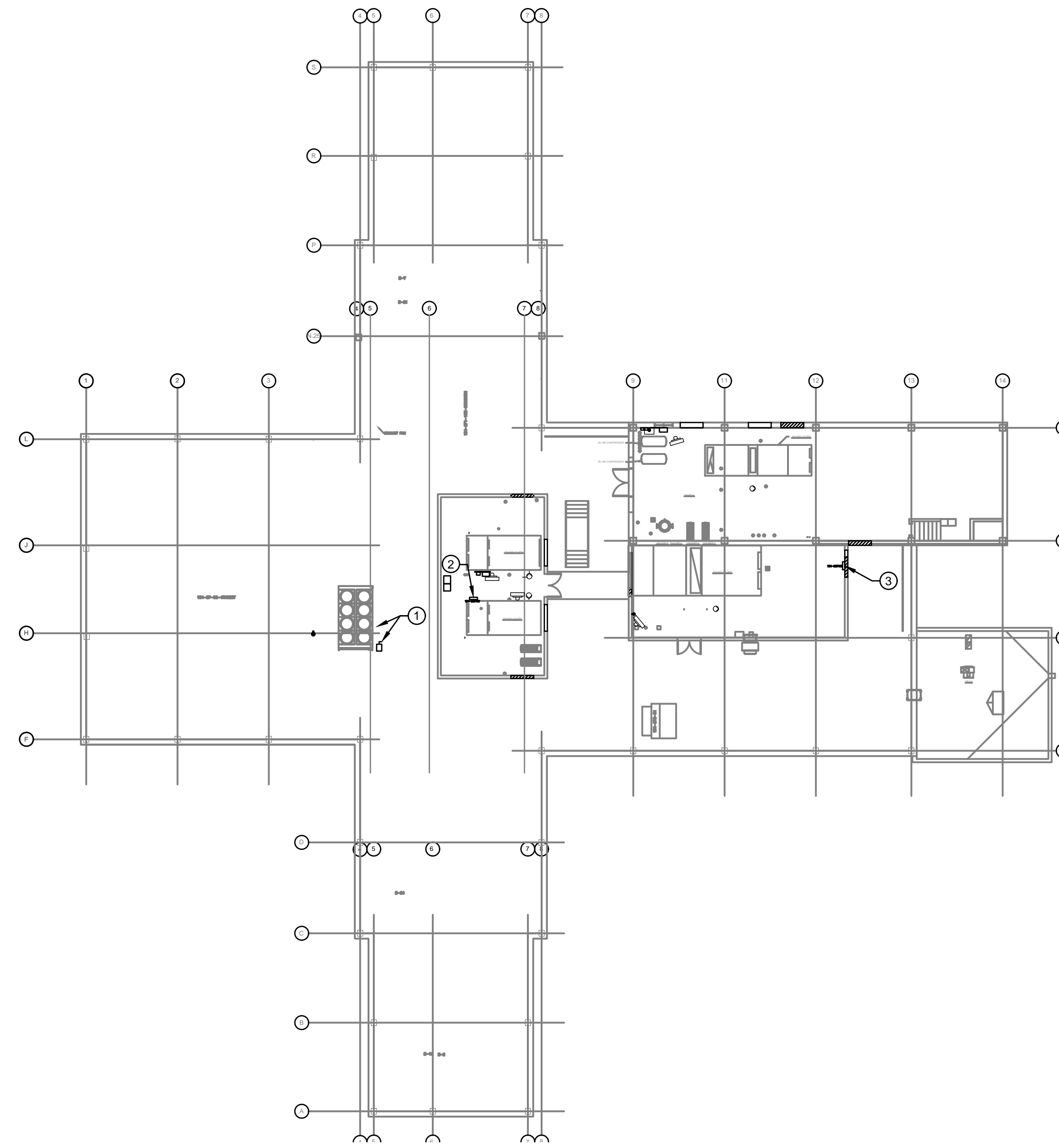
Office of  
Construction  
and Facilities  
Management

**GENERAL NOTES**

SEE SHEET E-002 FOR GENERAL NOTES.

**KEY NOTES ①**

1. LOCATION OF CHILLER "154-CHLR-05B" AND CHILLER DISCONNECT. ELECTRICAL FEED TO UNIT ROUTED TO AREA DIRECTLY BELOW UNIT UNDER ROOF AND FED THROUGH NEW PENETRATION THROUGH ROOF. SEE SHEET E304 FOR DETAILS.
2. LOCATION OF DISTRIBUTION BOARD "154-DBPHN". ELECTRICAL FEED TO UNIT ROUTED TO AREA DIRECTLY BELOW UNIT UNDER ROOF AND FED THROUGH NEW PENETRATION THROUGH ROOF. SEE SHEET E304 FOR DETAILS.
3. LOCATION OF DISTRIBUTION BOARD "154-DBPHS". ELECTRICAL FEED TO UNIT ROUTED TO AREA DIRECTLY BELOW UNIT UNDER ROOF AND FED THROUGH NEW PENETRATION THROUGH ROOF. SEE SHEET E304 FOR DETAILS.



**1** ELECTRICAL PENTHOUSE LEVEL CONDUIT ROUTING PLAN  
SCALE: 1" = 20'-0"

**CONSULTANTS:**

**ARCHITECT/ENGINEERS:**



**AESUS** Architecture, Engineering, and Sustainable Design  
designgroup  
1000 E. Southern Ave, Suite 65, Tempe, Arizona 85282. (480) 791-9542

Drawing Title  
**ELECTRICAL PENTHOUSE LEVEL CONDUIT ROUTING PLAN**

Approved Project Director

Project Title  
**REPLACE PENTHOUSE HVAC SYSTEMS**  
CONTRACT NO. VA259-17-C-0212

Location  
FT. HARRISON HELENA, MT

Date	Checked	Drawn
08/03/2018	OG	DC

Project Number  
436-17-102

Building Number  
154

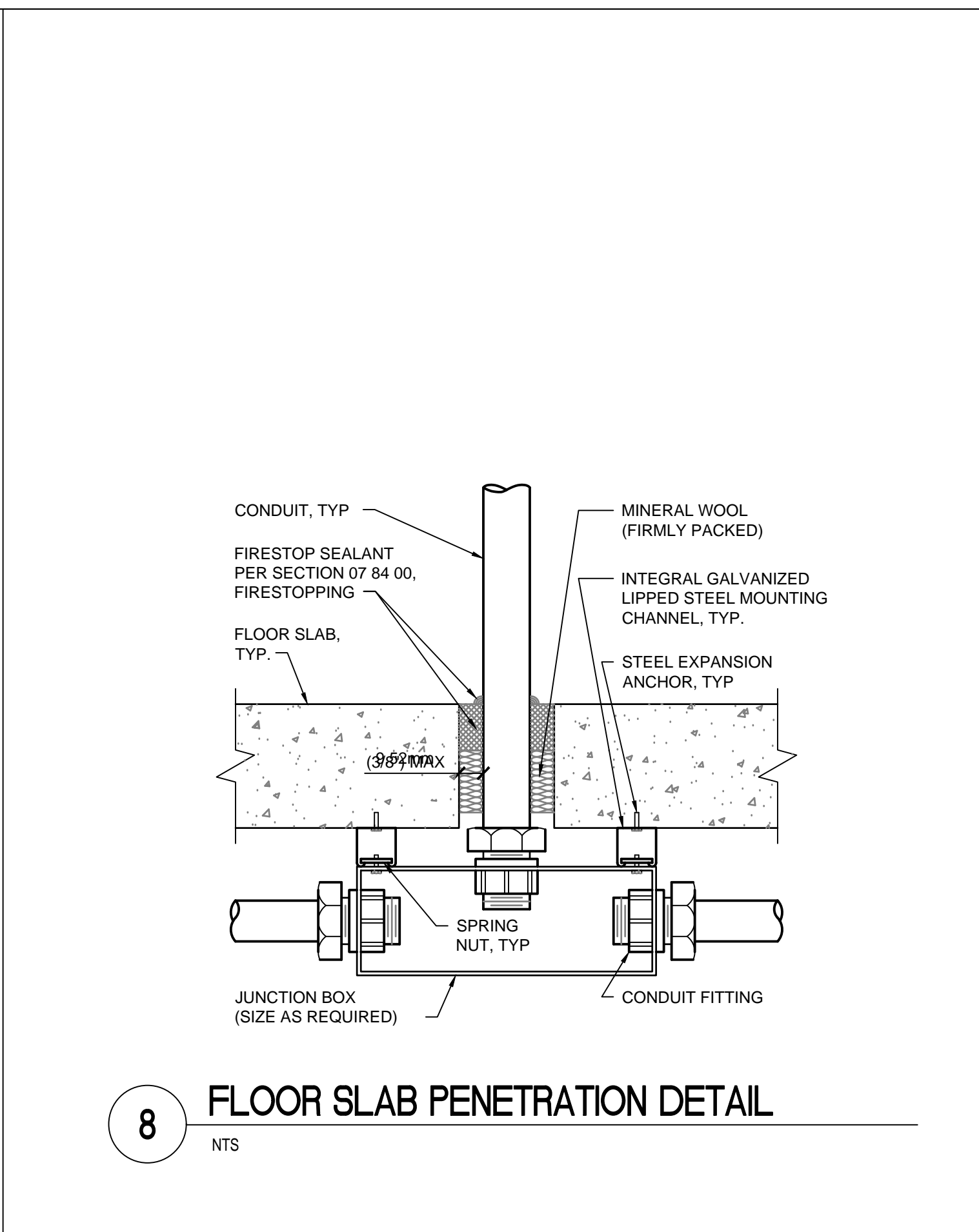
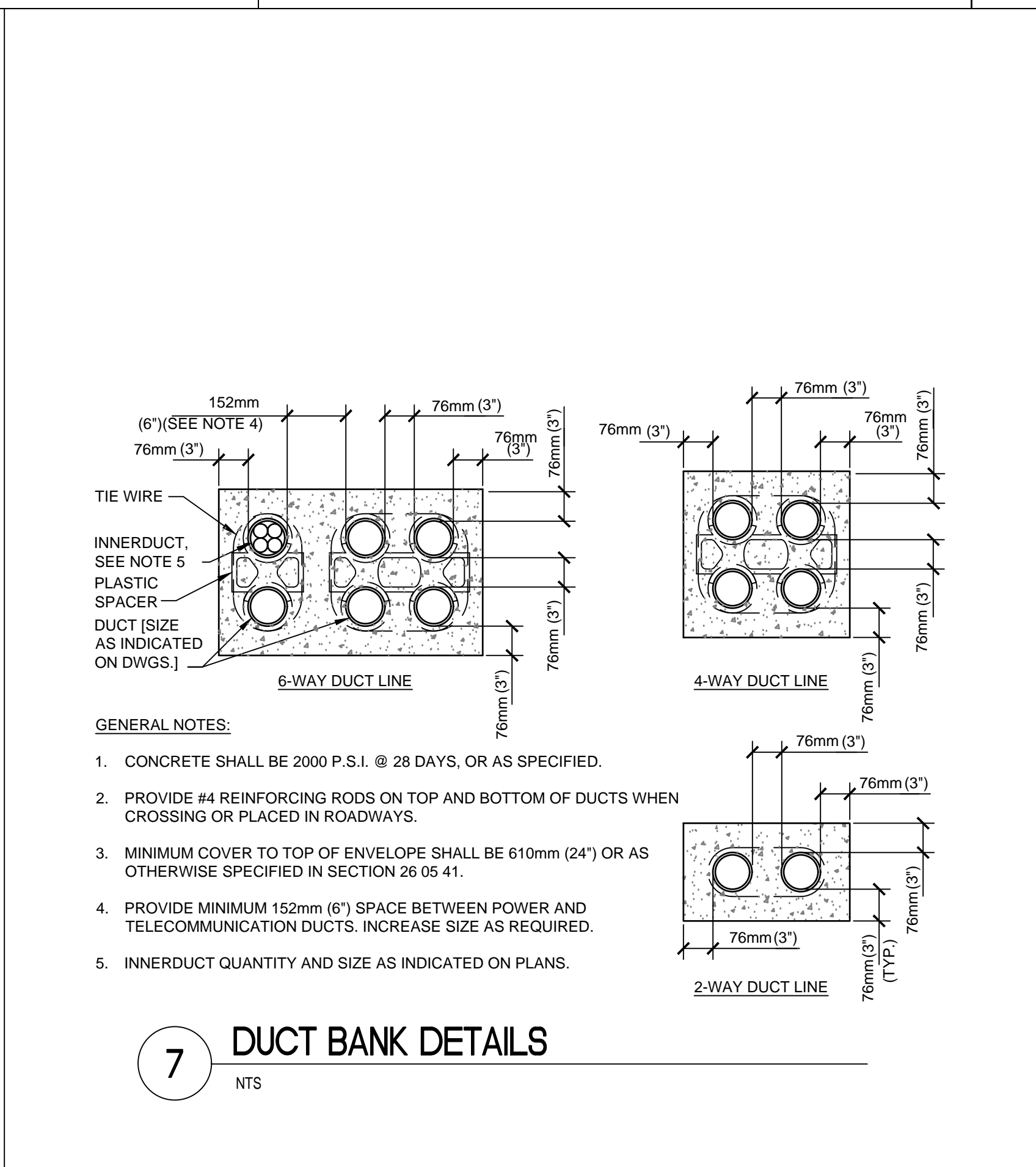
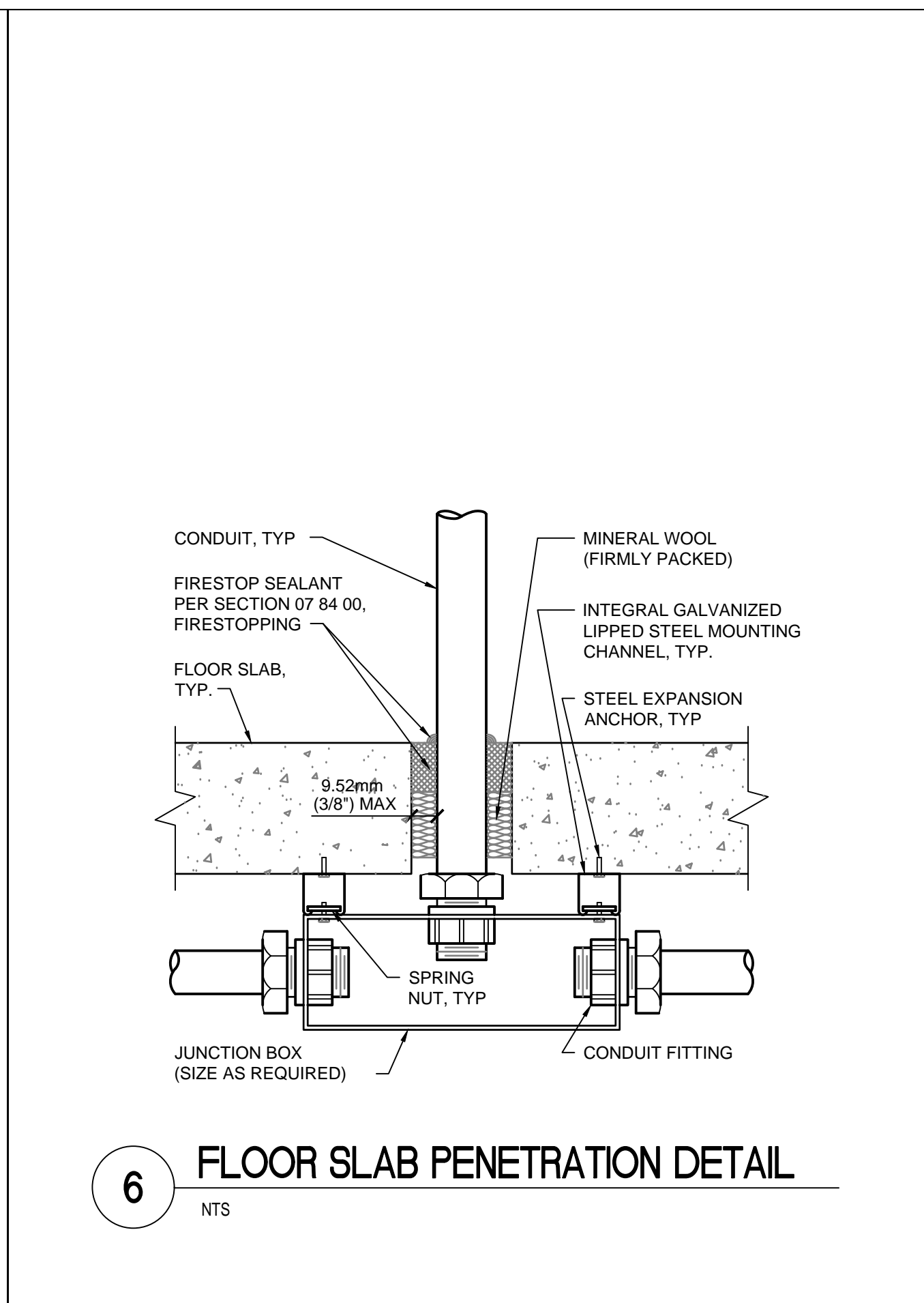
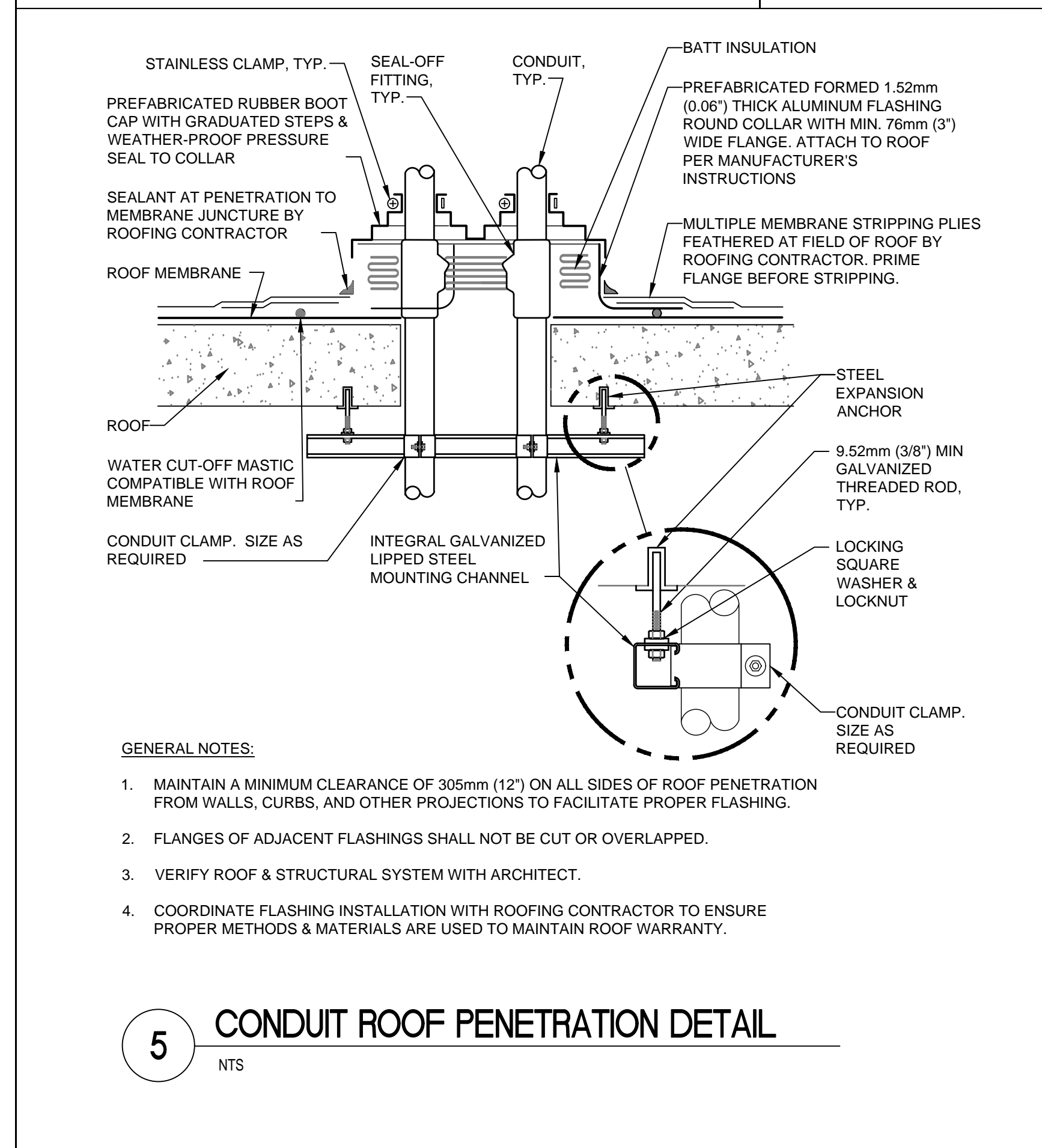
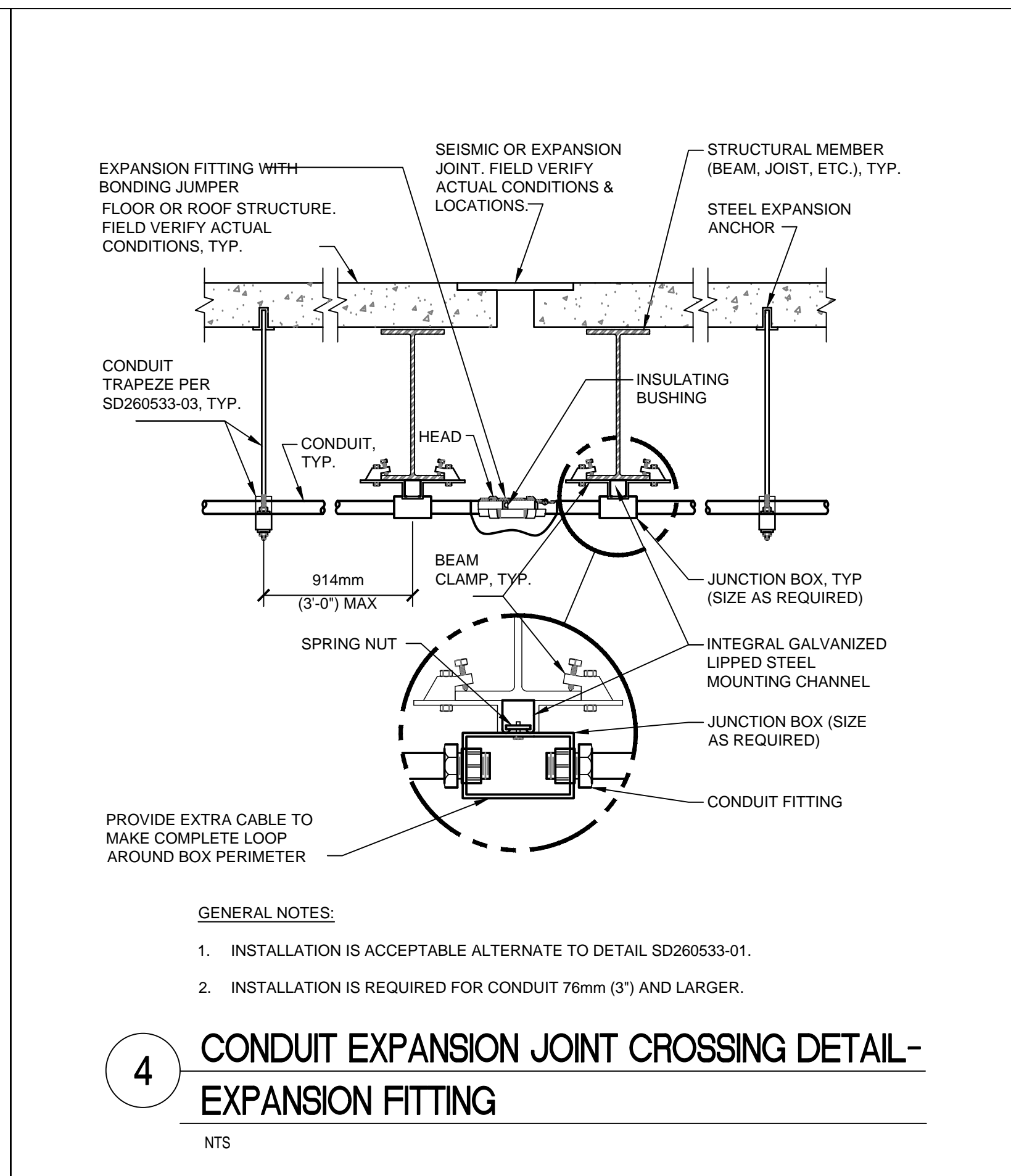
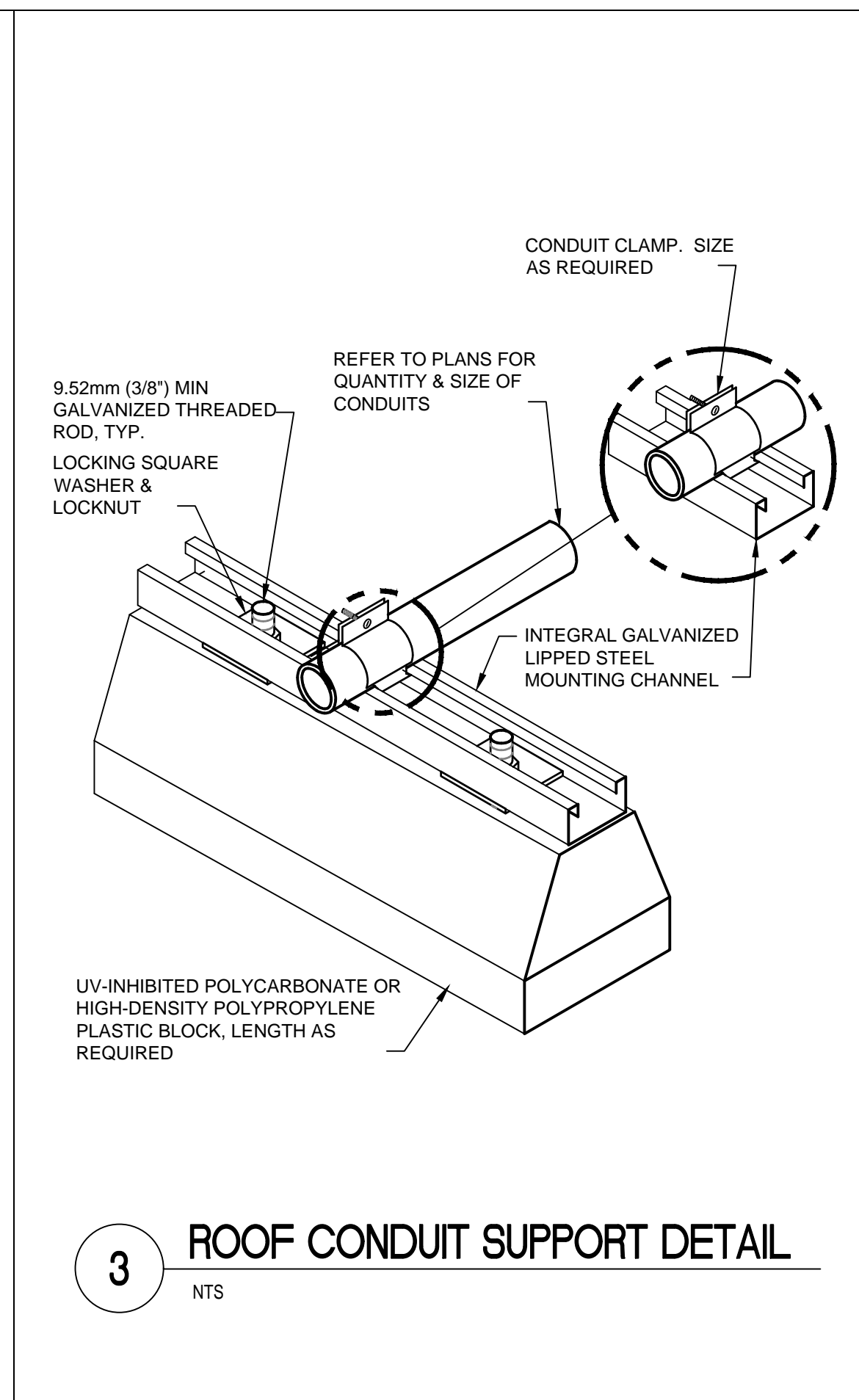
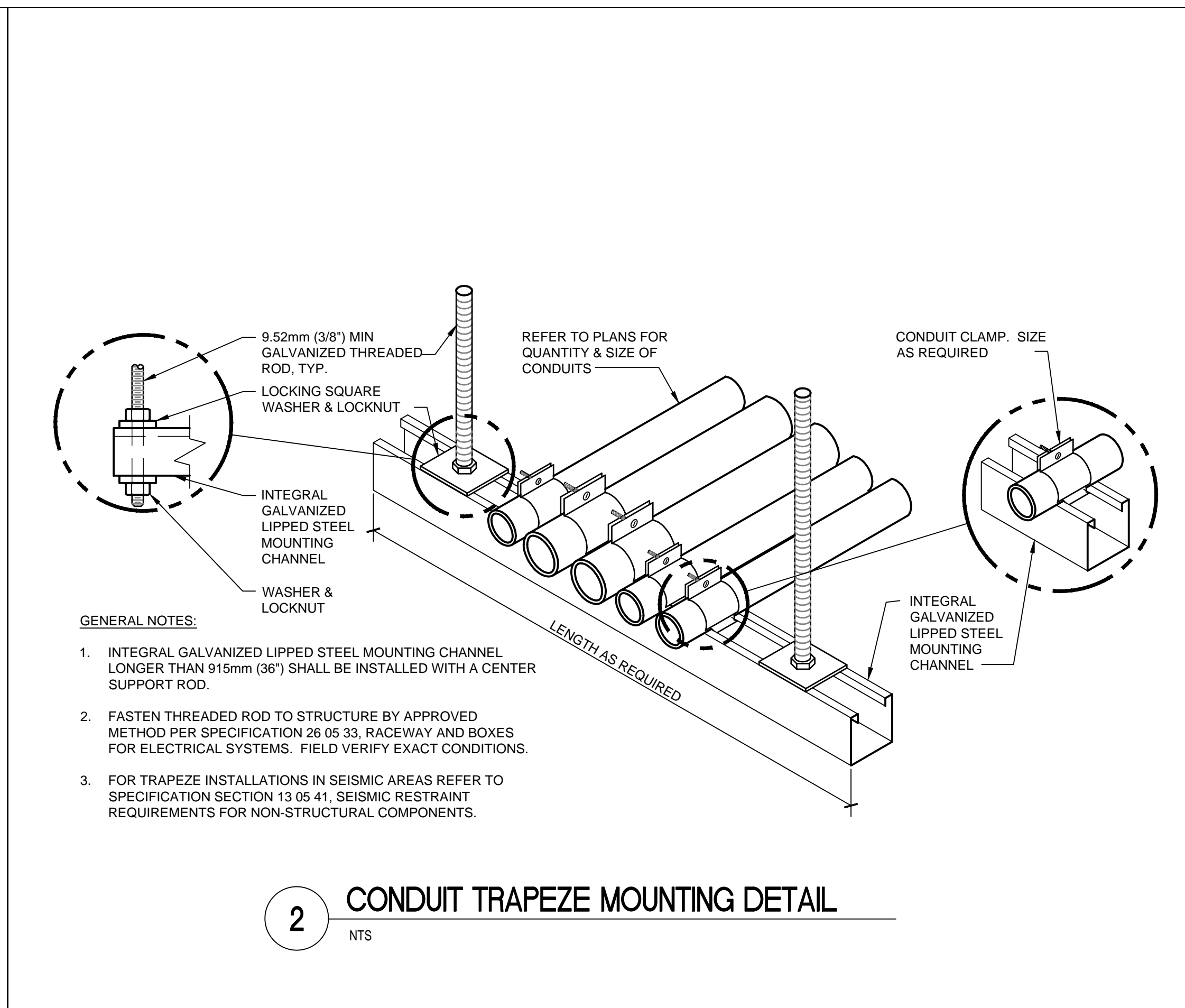
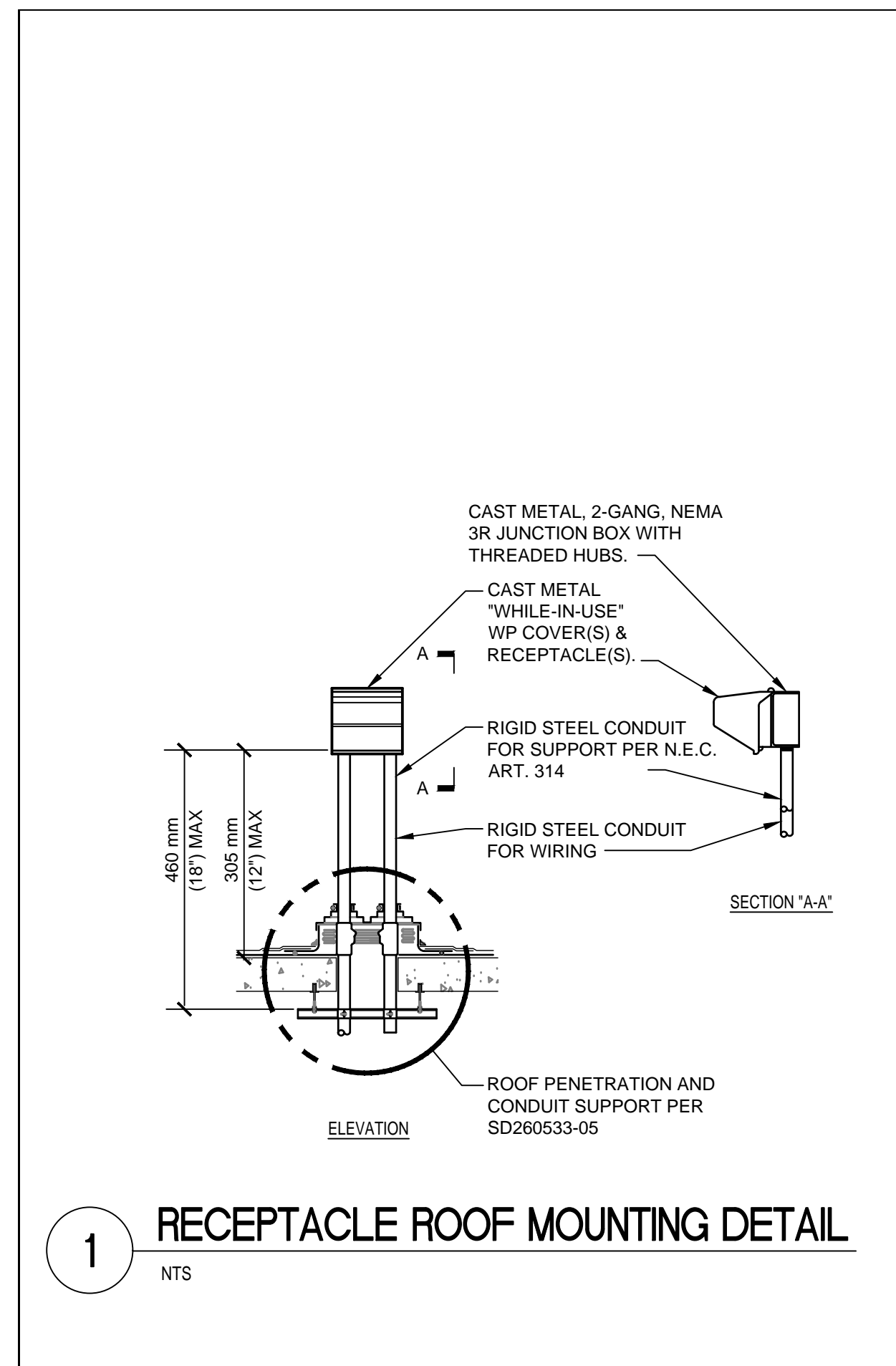
Drawing Number  
**E305**

"BID SET"

Office of Construction and Facilities Management



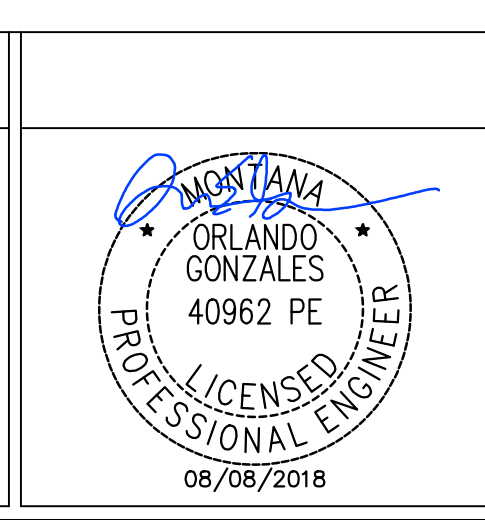




three inches = one foot  
one and one half inches = one foot  
one inch = one foot  
one half inch = one foot  
three quarters inch = one foot  
one quarter inch = one foot  
three eighths inch = one foot  
one eighth inch = one foot  
one eighth inch = one foot

Revisions:	Date

CONSULTANTS:



ARCHITECT/ENGINEERS:  
**AESUS** Architecture, Engineering, and Sustainable Design  
designgroup  
1000 E. Southern Ave., Suite 65, Tempe, Arizona 85282. (480) 791-9542

Drawing Title  
ELECTRICAL DETAILS  
Approved Project Director

Project Title  
REPLACE PENTHOUSE HVAC SYSTEMS  
CONTRACT NO. VA259-17-C-0212  
Location  
FT. HARRISON, HELENA, MT  
Date  
08/03/2018  
Checked  
OG  
Drawn  
DC  
Project Number  
436-17-102  
Building Number  
154  
Drawing Number  
E500

BID SET  
Office of Construction and Facilities Management  
Department of Veterans Affairs



GENERAL NOTES

SEE SHEET E-002 FOR GENERAL NOTES.

VOLTAGE DROP NOTE

EQUIPMENT FEEDER CONDUCTORS HAVE BEEN SIZED TO MAINTAIN VOLTAGE DROP OF NO MORE THAN 3% TO PROVIDE REASONABLE EFFICIENCY OF OPERATIONS PER N.E.C. 215.2 (A)(4) INFORMATIONAL NOTE #2.

KEY NOTES

- 1. PROVIDE NEW CIRCUIT BREAKER, SIZED AS INDICATED TO SERVE NEW AIR HANDLING UNIT.
2. PROVIDE NEW CIRCUIT BREAKER SIZED AS INDICATED TO SERVE NEW CHILLED WATER PUMP.
3. PROVIDE NEW CIRCUIT BREAKER SIZED AS INDICATED TO SERVE NEW HOT WATER PUMP.
4. PROVIDE NEW CIRCUIT BREAKER SIZED AS INDICATED TO SERVE NEW HEAT RECOVERY PUMP.
5. CONDUCTORS TO BE (3) 10 A.W.G. CU., (1) 10 A.W.G. CU GND., 21mm (3/4") C.
6. CONDUCTORS TO BE (3) 8 A.W.G. CU., (1) 10 A.W.G. CU GND., 27mm (1") C.
7. CONDUCTORS TO BE (3) 4 A.W.G. CU., (1) 10 A.W.G. CU GND., 35mm (1-1/4") C.
8. CONDUCTORS TO BE (3) 1 A.W.G. CU., (1) 6 A.W.G. CU GND., 41mm (1-1/2") C.
9. CONDUCTORS TO BE (3) 1/0 A.W.G. CU., (1) 6 A.W.G. CU GND., 53mm (2") C.
10. CONDUCTORS TO BE (4) 300 KCMIL CU., (1) 1 A.W.G. CU GND., 63mm (2-1/2") C.
11. CONDUCTORS TO BE (3) 600 KCMIL CU., (1) 3/0 A.W.G. CU. NEUTRAL, (1) 2/0 A.W.G. CU. GND., 104mm (4") C.
12. NEW AIR HANDLING UNIT "154-AHU-14-3RD" WITH INTEGRAL DUAL VFD'S CONTROLLING THE SUPPLY AND RETURN MOTORS. CIRCUIT AS INDICATED.
13. NEW HOT WATER PUMP "154-HWP-11-PENT1". CIRCUIT AS INDICATED THROUGH NEW VARIABLE SPEED DRIVE. VARIABLE SPEED DRIVE PROVIDED BY MECHANICAL, INSTALLED AND CIRCUITED BY ELECTRICAL CIRCUIT AS INDICATED.
14. NEW HOT WATER PUMP "154-HWP-12-PENT1". CIRCUIT AS INDICATED THROUGH NEW VARIABLE SPEED DRIVE. VARIABLE SPEED DRIVE PROVIDED BY MECHANICAL, INSTALLED AND CIRCUITED BY ELECTRICAL CIRCUIT AS INDICATED.
15. NEW HEAT RECOVERY PUMP "154-HRP-4-AHU15". CIRCUIT AS INDICATED THROUGH NEW VARIABLE SPEED DRIVE. VARIABLE SPEED DRIVE PROVIDED BY MECHANICAL, INSTALLED AND CIRCUITED BY ELECTRICAL CIRCUIT AS INDICATED.
16. NEW HEAT RECOVERY PUMP "154-HRP-3-AHU14". CIRCUIT AS INDICATED THROUGH NEW VARIABLE SPEED DRIVE. VARIABLE SPEED DRIVE PROVIDED BY MECHANICAL, INSTALLED AND CIRCUITED BY ELECTRICAL CIRCUIT AS INDICATED.
17. NEW AIR HANDLING UNIT "154-AHU-15-2ND" WITH INTEGRAL DUAL VFD'S SERVING THE SUPPLY/RETURN MOTORS. CIRCUIT AS INDICATED.
18. EXISTING SPARE 400 AMPERE, 3 POLE CIRCUIT BREAKER TO BE USED TO SERVE NEW DISTRIBUTION BOARD "154-DBPHS". EXERCISE UNIT AND VERIFY IN GOOD WORKING ORDER. COORDINATE WITH OWNER FOR SCHEDULING.
19. NEW EXHAUST FAN EF-14. EXHAUST FAN TO RUN CONTINUOUSLY. CIRCUIT AS INDICATED.

Scale indicators on the left margin: three inches = one foot, one and one half inches = one foot, three quarters inch = one foot, one half inch = one foot, three eighths inch = one foot, one eighth inch = one foot, one quarter inch = one foot.

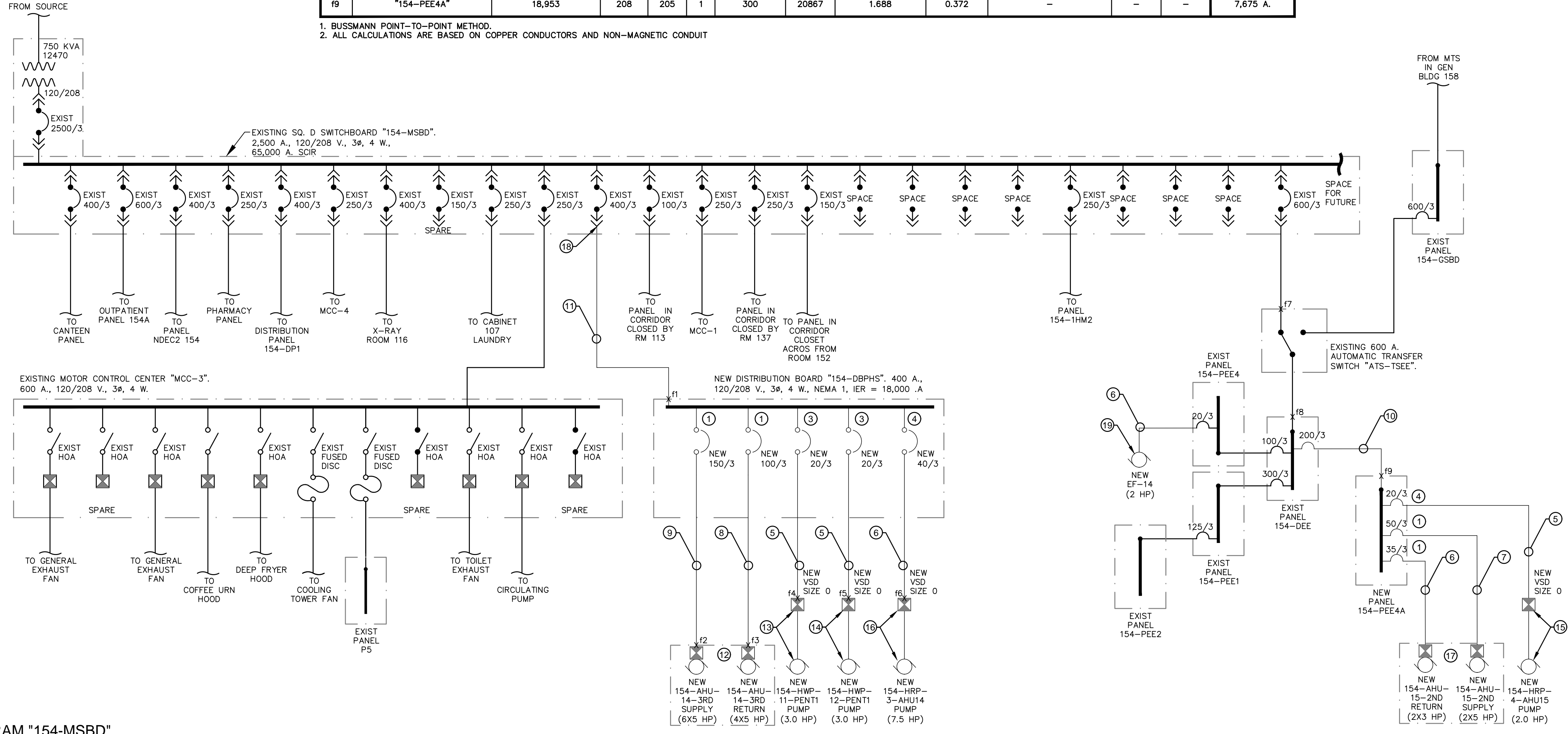
LOAD SUMMARY:

Table with columns for equipment type (e.g., MCC-3, PEE4, DEE, GSBD, MSBD) and corresponding load values in Amperes (A) at 208V, 300 cycles.

NOTES: EXISTING LOADS SHOWN ABOVE PER LOAD TESTS ON RESPECTIVE DISTRIBUTION GEAR. SEE SHEETS ED-600 AND ED-601 FOR LOAD TEST REQUIREMENTS. LIGHTING IN OUTBOARD PENTHOUSE SERVED THROUGH PANEL "154-PEE2". CIRCUIT #8. LIGHTING LOAD REMOVED FROM THIS DISCONNECT DURING DEMO PHASE IS 256 WATTS. LIGHTING ADDED TO THIS DISCONNECT DURING NEW CONSTRUCTION PHASE IS 252 WATTS. NET LOAD REDUCTION OF 4 WATTS RESULTS FROM THIS PORTION OF THE LIGHTING PROJECT.

FAULT CURRENT CALCULATIONS table with columns: FAULT POINT, EQUIPMENT, SHORT CURRENT AT BEGINNING OF RUN, E LINE VOLTAGE, L LENGTH OF RUN, CONDUCTORS PER PHASE (NO., SIZE, KCMIL, M, T), TRANSFORMER (KVA, Z%), and SHORT CIRCUIT CURRENT.

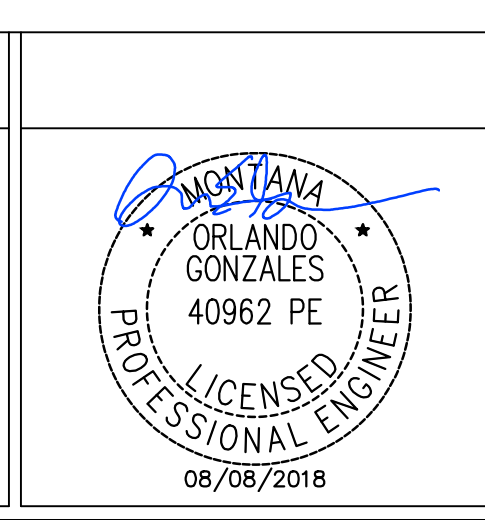
1. BUSSMANN POINT-TO-POINT METHOD. 2. ALL CALCULATIONS ARE BASED ON COPPER CONDUCTORS AND NON-MAGNETIC CONDUIT



1 ELECTRICAL NEW ONE-LINE DIAGRAM "154-MSBD" SCALE: NOT TO SCALE

Revisions table with columns for revision number, description, and date.

CONSULTANTS: [Blank space for consultant information]



ARCHITECT/ENGINEERS: AESUS Architecture, Engineering, and Sustainable Design. 1000 E. Southern Ave, Suite 65, Tempe, Arizona 85282. (480) 798-0542

Drawing Title: ELECTRICAL NEW ONE-LINE DIAGRAM "154-MSBD". Approved Project Director: VAPAHCS PLANNING AND ENGINEERING.

Project Title: REPLACE PENTHOUSE HVAC SYSTEMS CONTRACT NO. VA259-17-C-0212. Location: FT. HARRISON, HELENA, MT. Date: 08/03/2018. Checked: OG, Draw: DC.

Project Number: 436-17-102. Building Number: 154. Drawing Number: E600.

BID SET Office of Construction and Facilities Management. Department of Veterans Affairs.



**GENERAL NOTES**

SEE SHEET E-002 FOR GENERAL NOTES.

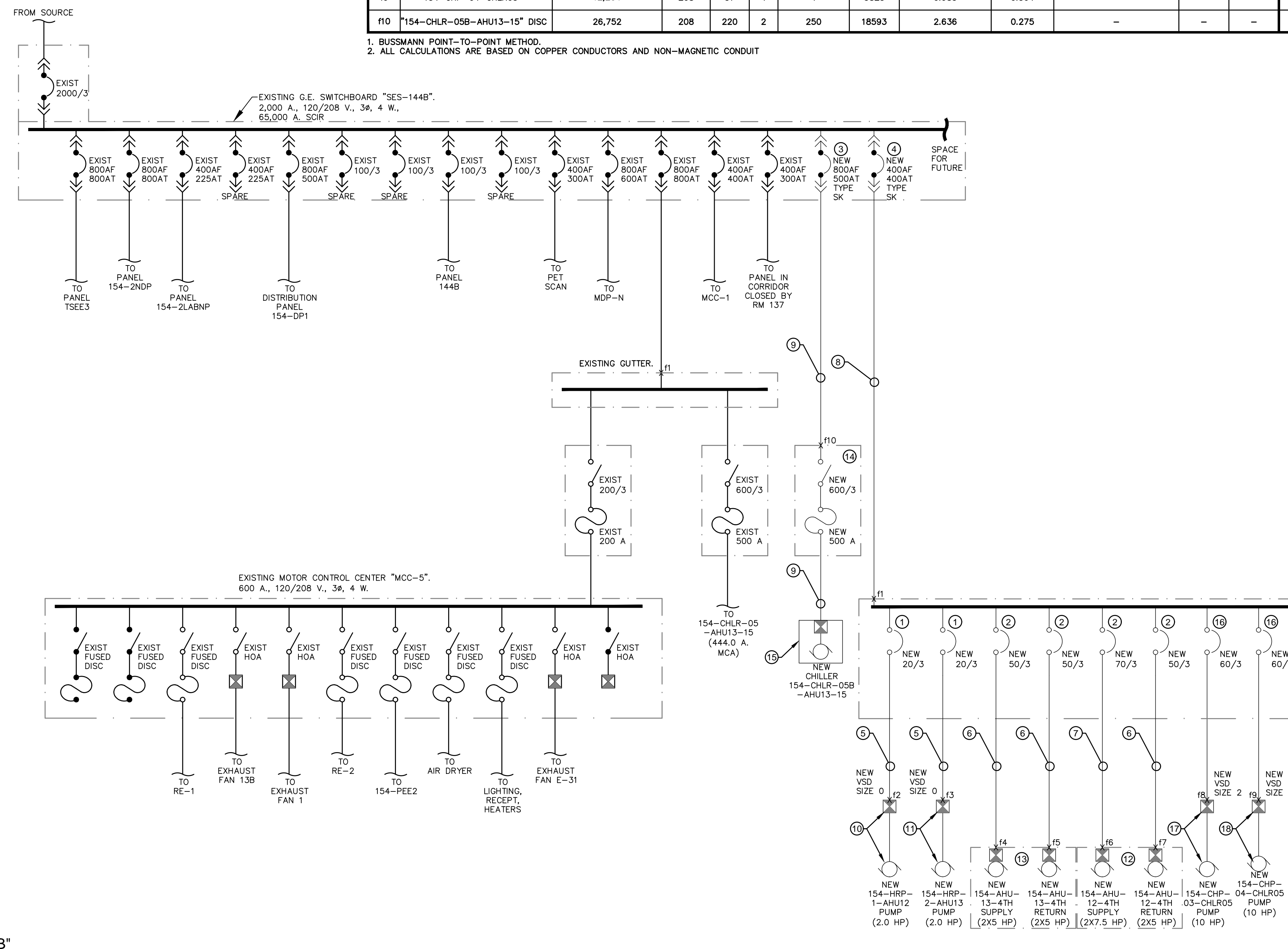
**VOLTAGE DROP NOTE**

EQUIPMENT FEEDER CONDUCTORS HAVE BEEN SIZED TO MAINTAIN VOLTAGE DROP OF NO MORE THAN 3% TO PROVIDE REASONABLE EFFICIENCY OF OPERATIONS PER N.E.C. 215.2(A)(4) INFORMATIONAL NOTE #2.

**FAULT CURRENT CALCULATIONS**

FAULT POINT	EQUIPMENT	I <sub>sc</sub> SHORT CURRENT AT BEGINNING OF RUN	E. LINE VOLTAGE	L LENGTH OF RUN	CONDUCTORS PER PHASE			I <sub>sc</sub> @ F.A.U. C x E.L.	M = 1/F	TRANSFORMER			I <sub>sc</sub> SHORT CIRCUIT CURRENT
					NO.	SIZE	"C"			I <sub>sc</sub> @ 0% VOLTAGE	Z%	Z%	
AFC	"SES-144B"	-	-	-	-	-	-	-	-	-	-	-	26,752 A.
F1	"154-DBPHN"	26,752	208	150	1	600	28033	0.626	0.615	-	-	-	12,204 A.
F2	"154-HRP-1-AHU12 PUMP"	12,204	208	30	1	10	981	3.837	0.207	-	-	-	2,971 A.
F3	"154-HRP-2-AHU13 PUMP"	12,204	208	30	1	10	981	3.837	0.207	-	-	-	2,971 A.
F4	"154-HRP-12-4TH SUPPLY"	12,204	208	15	1	2	6044	0.311	0.763	-	-	-	9,746 A.
F5	"154-HRP-12-4TH RETURN"	12,204	208	17	1	4	3825	0.558	0.642	-	-	-	8,407 A.
F6	"154-HRP-13-4TH SUPPLY"	12,204	208	15	1	2	6044	0.311	0.763	-	-	-	9,746 A.
F7	"154-HRP-13-4TH RETURN"	12,204	208	17	1	4	3825	0.558	0.642	-	-	-	8,407 A.
F8	"154-CHWP-03-CHLR05"	12,204	208	35	1	4	3825	0.930	0.518	-	-	-	6,322 A.
F9	"154-CHP-04-CHLR05"	12,204	208	37	1	4	3825	0.983	0.504	-	-	-	6,151 A.
F10	"154-CHLR-05B-AHU13-15" DISC	26,752	208	220	2	250	18593	2.636	0.275	-	-	-	7,358 A.

1. BUSMANN POINT-TO-POINT METHOD.  
2. ALL CALCULATIONS ARE BASED ON COPPER CONDUCTORS AND NON-MAGNETIC CONDUIT



**LOAD SUMMARY:**

**"MCC-5":**  
LOAD REMOVED:  
S1A = 49.1 A @ 208 V, 3φ.  
S1A = 49.1 A @ 208 V, 3φ.  
CHWP P1 = 30.3 A @ 208 V, 3φ.  
CHWP P2 = 30.3 A @ 208 V, 3φ.  
TOTAL LOAD REMOVED = 158.8 A @ 208 V, 3φ.

**"SES-144B":**  
LOAD REMOVED:  
THROUGH "MCC-5" = 158.8 A @ 208 V, 3φ.  
NET ADDED LOADS:  
THROUGH "154-DBPHN" = 246.7 A @ 208 V, 3φ.  
154-CHLR-05B = 444.0 A @ 208 V, 3φ.  
TOTAL ADDED LOAD = 693.7 A @ 208 V, 3φ.  
NET ADDED LOAD = 531.9

EXISTING LOAD = 1,060.0 A @ 208 V, 3φ.  
ADDED LOAD = 531.9 A @ 208 V, 3φ.  
TOTAL LOAD = 1,591.9 A @ 208 V, 3φ.

**NOTES:**

EXISTING LOADS SHOWN ABOVE FOR "SES-144B" PER LOAD TEST ON UNIT. SEE SHEET ED-601 FOR LOAD TEST REQUIREMENTS.

**1 ELECTRICAL NEW ONE-LINE DIAGRAM "SES-144B"**  
SCALE: NOT TO SCALE

three inches = one foot  
 one and one half inches = one foot  
 one inch = one foot  
 three quarters inch = one foot  
 one half inch = one foot  
 three eighths inch = one foot  
 one quarter inch = one foot  
 three eighths inch = one foot  
 one eighth inch = one foot  
 one eighth inch = one foot  
 one eighth inch = one foot

**KEY NOTES**

- PROVIDE NEW CIRCUIT BREAKER AS INDICATED TO SERVE NEW HEAT RECOVERY PUMP.
- PROVIDE NEW CIRCUIT BREAKER AS INDICATED TO SERVE NEW AIR HANDLING UNIT.
- PROVIDE NEW CIRCUIT BREAKER AS INDICATED TO SERVE NEW CHILLER.
- PROVIDE NEW CIRCUIT BREAKER AS INDICATED TO SERVE NEW DISTRIBUTION BOARD "154-DBPHN"
- CONDUCTORS TO BE (3) 10 A.W.G. CU., (1) 10 A.W.G. CU. GND., 21mm (3/4") C.
- CONDUCTORS TO BE (3) 6 A.W.G. CU., (1) 10 A.W.G. CU. GND., 14mm (1-1/4") C.
- CONDUCTORS TO BE (3) 4 A.W.G. CU., (1) 8 A.W.G. CU. GND., 41mm (1-1/2") C.
- CONDUCTORS TO BE (3) 600 KCMIL CU., (1) 3/0 A.W.G. CU. NEUTRAL, (1) 2/0 A.W.G. CU. GND., 104mm (4") C.
- CONDUCTORS TO BE 2 SETS OF (3) 300 KCMIL XHHW-2 CU., (1) 1/0 A.W.G. CU. GND., IN (1) 103mm (4") C.
- NEW HEAT RECOVERY PUMP "154-HRP-1-AHU12": CIRCUIT AS INDICATED THROUGH NEW VARIABLE SPEED DRIVE. VARIABLE SPEED DRIVE PROVIDED BY MECHANICAL, INSTALLED AND CIRCUITED BY ELECTRICAL. CIRCUIT AS INDICATED.
- NEW HEAT RECOVERY PUMP "154-HRP-2-AHU13": CIRCUIT AS INDICATED THROUGH NEW VARIABLE SPEED DRIVE. VARIABLE SPEED DRIVE PROVIDED BY MECHANICAL, INSTALLED AND CIRCUITED BY ELECTRICAL. CIRCUIT AS INDICATED.
- NEW AIR HANDLING UNIT "154-AHU-12-4TH" WITH INTEGRAL DUAL VFD'S CONTROLLING THE SUPPLY AND RETURN MOTORS. CIRCUIT AS INDICATED.
- NEW AIR HANDLING UNIT "154-AHU-13-4TH" WITH INTEGRAL DUAL VFD'S CONTROLLING THE SUPPLY AND RETURN MOTORS. CIRCUIT AS INDICATED.
- PROVIDE NEW WEATHERPROOF DISCONNECT WITH LPNRSFP FUSES SIZED PER MANUFACTURERS SPECIFICATIONS TO SERVE NEW CHILLER. PROVIDE SUPPORTING MEANS AS REQUIRED. MAINTAIN N.E.C. REQUIRED CLEARANCES ABOUT UNIT.
- NEW CHILLER "154-CHLR-05B-AHU13-15": PROVIDED WITH INTEGRAL VSD. CIRCUIT AS INDICATED.
- PROVIDE NEW CIRCUIT BREAKER SIZED AS INDICATED TO SERVE NEW CHILLED WATER PUMP.
- NEW CHILLED WATER PUMP "154-CHWP-03-CHLR05": CIRCUIT AS INDICATED THROUGH NEW VARIABLE SPEED DRIVE. VARIABLE SPEED DRIVE PROVIDED BY MECHANICAL, INSTALLED AND CIRCUITED BY ELECTRICAL. CIRCUIT AS INDICATED.
- NEW CHILLED WATER PUMP "154-CHWP-04-CHLR05": CIRCUIT AS INDICATED THROUGH NEW VARIABLE SPEED DRIVE. VARIABLE SPEED DRIVE PROVIDED BY MECHANICAL, INSTALLED AND CIRCUITED BY ELECTRICAL. CIRCUIT AS INDICATED.

<p><b>CONSULTANTS:</b></p>		<p><b>ARCHITECT/ENGINEERS:</b></p> <p><b>AESUS</b> Architecture, Engineering, and Sustainable Design 1000 E. Southern Ave, Suite #5, Tempe, Arizona 85282, (480) 791-9542</p>	<p><b>Drawing Title</b> ELECTRICAL NEW ONE-LINE DIAGRAM "SES-144B"</p> <p>Approved Project Director</p>	<p><b>Project Title</b> REPLACE PENTHOUSE HVAC SYSTEMS CONTRACT NO. VA259-17-C-0212</p> <p>Location FT. HARRISON, HELENA, MT</p> <p>Date 08/03/2018</p> <p>Checked OG</p> <p>Drawn DC</p>	<p><b>Project Number</b> 436-17-102</p> <p><b>Building Number</b> 154</p> <p><b>Drawing Number</b> E601</p>	<p><b>Office of Construction and Facilities Management</b></p>
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**GENERAL NOTES**

SEE SHEET E-002 FOR GENERAL NOTES.

**VOLTAGE DROP NOTE**

EQUIPMENT FEEDER CONDUCTORS HAVE BEEN SIZED TO MAINTAIN VOLTAGE DROP OF NO MORE THAN 3% TO PROVIDE REASONABLE EFFICIENCY OF OPERATIONS PER N.E.C. 215.2 (A)(4) INFORMATIONAL NOTE #2.

**ALTERNATE SERVICE NOTE**

PROVIDE LINE ITEM TO BID FOR THE PROVISION OF THE 500 KVA TRANSFORMER, THE TRANSFORMER SECONDARY DISCONNECT AND DISTRIBUTION BOARD 'SES-144C'. THIS EQUIPMENT SHALL ONLY BE PROVIDED AND INSTALLED IF IT IS DETERMINED THAT EXISTING SERVICE ENTRANCE SECTIONS 'SES-144B' AND '154-MSBD' DO NOT HAVE SPARE POWER AVAILABLE TO ACCOMMODATE THE ADDED LOADS. BID SHALL INCLUDE ALL APPURTENANCES (IE. CONDUITS, CONDUCTORS, TRENCHING, CONCRETE PADS, VAULTS, ETC) AS REQUIRED TO ENSURE A FULLY FUNCTIONAL SYSTEM TO THE SATISFACTION OF THE ENGINEER AND THE AHJ.

THE FOLLOWING PROJECT SPECIFICATION SECTIONS HAVE BEEN ADDED TO THIS PROJECT AND APPLY TO THIS ADDTAL ONLY:

- 26 05 13 MEDIUM VOLTAGE CABLES
- 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
- 26 05 41 UNDERGROUND ELECTRICAL CONSTRUCTION
- 26 12 19 PAD MOUNTED, LIQUID FILLED, MEDIUM-VOLTAGE TRANSFORMERS
- 26 24 13 DISTRIBUTION SWITCHBOARDS

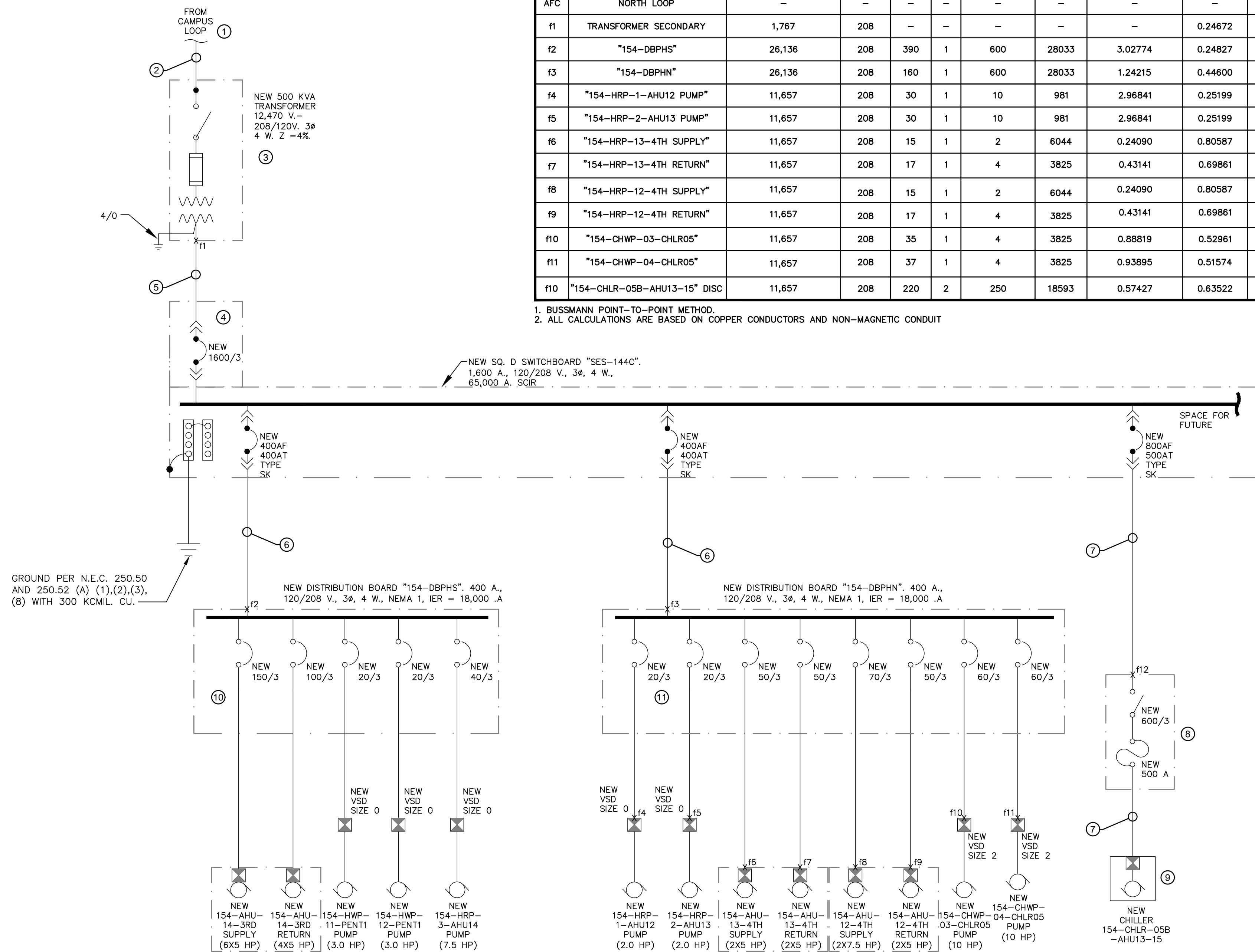
**KEY NOTES**

1. TIE INTO EXISTING MEDIUM VOLTAGE NORTH LOOP.
2. CONDUCTORS TO BE (3) 1/0 MV-105, 15kV, 133% EPR, (1) 1 AWG XHHW GND., 5'C.
3. PROVIDE NEW TRANSFORMER AS INDICATED. SEE SHEET E301 FOR LOCATION.
4. PROVIDE NEW DISTRIBUTION BOARD AS INDICATED. SEE SHEET E300 FOR LOCATION.
5. CONDUCTORS TO BE (5 SETS) 103mm (4"), WITH (4) 600 KCMIL XHHW-2 CU., (1) 300 KCMIL CU. GND., EACH.
6. CONDUCTORS TO BE (3) 600 KCMIL CU., (1) 3/0 A.W.G. CU. NEUTRAL, (1) 2/0 A.W.G. CU. GND., 104mm (4") C.
7. CONDUCTORS TO BE 2 SETS OF (3) 300 KCMIL XHHW-2 CU., (1) 1/0 A.W.G. CU. GND., IN (1) 103mm (4") C.
8. PROVIDE NEW WEATHERPROOF DISCONNECT WITH LPNKRSP FUSES SIZED PER MANUFACTURERS SPECIFICATIONS TO SERVE NEW CHILLER. PROVIDE SUPPORTING MEANS AS REQUIRED. MAINTAIN N.E.C. REQUIRED CLEARANCES ABOUT UNIT.
9. NEW CHILLER '154-CHLR-05B-AHU13-15', PROVIDED WITH INTEGRAL VSD. CIRCUIT AS INDICATED. CHILLER IS RATED @ 65,000 A. SCIR.
10. SEE SHEET E609 FOR CONDUIT AND CONDUCTOR SIZING FOR ALL DEVICES SERVED THROUGH '154-DBPHS'.
11. SEE SHEET E601 FOR CONDUIT AND CONDUCTOR SIZING FOR ALL DEVICES SERVED THROUGH '154-DBPHN'.

**FAULT CURRENT CALCULATIONS**

FAULT POINT	EQUIPMENT	I <sub>a</sub> SHORT CURRENT AT BEGINNING OF RUN	E <sub>L</sub> LINE VOLTAGE OF RUN	L LENGTH OF RUN	CONDUCTORS PER PHASE				TRANSFORMER		I <sub>sc</sub> SHORT CIRCUIT CURRENT		
					NO.	SIZE	°C	$I_a \frac{\sqrt{3} L E_L K}{C \times \sqrt{3}}$	$M = \frac{1}{1 + F}$	$I_a \frac{I_{sc} \times V_{ph} \times \sqrt{3} \times Z_F \times Z_R}{100,000 \times KVA_{base}}$		KVA	Z%
AFC	NORTH LOOP	-	-	-	-	-	-	-	-	-	-	1,767	
F1	TRANSFORMER SECONDARY	1,767	208	-	-	-	-	-	0.24672	3.05310	500	6	26,136
F2	"154-DBPHS"	26,136	208	390	1	600	28033	3.02774	0.24827	-	-	-	6,488
F3	"154-DBPHN"	26,136	208	160	1	600	28033	1.24215	0.44600	-	-	-	11,657
F4	"154-HRP-1-AHU12 PUMP"	11,657	208	30	1	10	981	2.96841	0.25199	-	-	-	2,937
F5	"154-HRP-2-AHU13 PUMP"	11,657	208	30	1	10	981	2.96841	0.25199	-	-	-	2,937
F6	"154-HRP-13-4TH SUPPLY"	11,657	208	15	1	2	6044	0.24090	0.80587	-	-	-	9,394
F7	"154-HRP-13-4TH RETURN"	11,657	208	17	1	4	3825	0.43141	0.69861	-	-	-	8,144
F8	"154-HRP-12-4TH SUPPLY"	11,657	208	15	1	2	6044	0.24090	0.80587	-	-	-	9,394
F9	"154-HRP-12-4TH RETURN"	11,657	208	17	1	4	3825	0.43141	0.69861	-	-	-	8,144
F10	"154-CHWP-03-CHLR05"	11,657	208	35	1	4	3825	0.88819	0.52961	-	-	-	6,174 A.
F11	"154-CHWP-04-CHLR05"	11,657	208	37	1	4	3825	0.93895	0.51574	-	-	-	6,012 A.
F10	"154-CHLR-05B-AHU13-15" DISC	11,657	208	220	2	250	18593	0.57427	0.63522	-	-	-	7,404

1. BUSSMANN POINT-TO-POINT METHOD.  
2. ALL CALCULATIONS ARE BASED ON COPPER CONDUCTORS AND NON-MAGNETIC CONDUIT



**LOAD SUMMARY:**

**"SES-144B":**

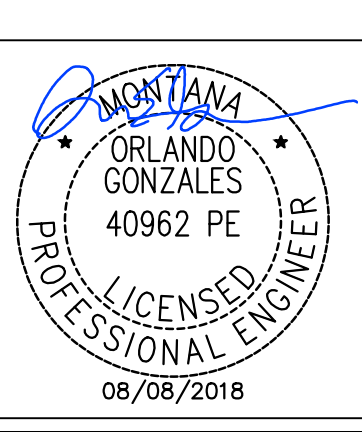
"154-DBPHN"	=	246.7	A @ 208 V., 3φ.
"154-DBPHS"	=	255.9	A @ 208 V., 3φ.
154-CHLR-05B	=	444.0	A @ 208 V., 3φ.
TOTAL LOAD	=	946.6	A @ 208 V., 3φ.

1 ELECTRICAL ALTERNATE ONE-LINE DIAGRAM "SES-144C"  
SCALE: NOT TO SCALE

three inches = one foot  
one and one half inches = one foot  
one inch = one foot  
three quarters inch = one foot  
one half inch = one foot  
three eighths inch = one foot  
one quarter inch = one foot  
one eighth inch = one foot  
one sixteenth inch = one foot

Revisions	Date

CONSULTANTS:	
DATE:	08/08/2018



ARCHITECT/ENGINEERS:

**AESUS** Architecture, Engineering, and Sustainable Design

designgroup

1050 E. Southern Ave., Suite #5, Tempe, Arizona 85282, (480) 791-9542

Drawing Title

ELECTRICAL NEW ONE-LINE DIAGRAM "SES-144B"

Approved Project Director

Project Title

REPLACE PENTHOUSE HVAC SYSTEMS

CONTRACT NO. VA259-17-C-0212

Location

FT. HARRISON HELENA, MT

Date

08/03/2018

Checked

OG

Drawn

DC

Project Number

436-17-102

Building Number

154

Drawing Number

E602

'BID SET'

Office of Construction and Facilities Management

Department of Veterans Affairs



KEY NOTES  
1. EXERCISE CIRCUIT BREAKER PRIOR TO RE-USING TO VERIFY IN GOOD CONDITION. REPLACE AS REQUIRED.

**EXISTING PANELBOARD SCHEDULE "A"** LOCATION: NORTH PENTHOUSE  
C.B. RATING: 22,000 A.I.C.

VOLTAGE: 120/240 V., 1φ, 3 W. MAINS: 125 A. M.L.O. MOUNTING: SURFACE TYPE: SQUARE D NQ

USE and/or AREA SERVED	C/B	CR	NO	SA	LOAD	CR	NO	C/B	USE and/or AREA SERVED
(E) HEAT TRACE CHILLER	20	1	--	--	72	20	1	20	(E) RECEPT CHILLER AREA
(E) HEAT TRACE EXT PIPE	20	3	--	--	4	20	3	20	SPARE
(E) CHEMICAL PUMP	20	5	--	--	8	20	5	20	SPARE
SPACE	20	7	--	--	8	20	7	20	SPARE
SPACE	--	9	--	--	--	--	9	--	SPARE
SPACE	--	11	--	--	--	--	11	--	SPARE
SPACE	--	13	--	--	--	--	13	--	SPARE
SPACE	--	15	--	--	--	--	15	--	SPARE
SPACE	--	17	--	--	--	--	17	--	SPARE
SPACE	--	19	--	--	--	--	19	--	SPARE
SPACE	--	21	--	--	--	--	21	--	SPARE
SPACE	--	23	--	--	--	--	23	--	SPARE
SPACE	--	25	--	--	--	--	25	--	SPARE
SPACE	--	27	--	--	--	--	27	--	SPARE
SPACE	--	29	--	--	--	--	29	--	SPARE

TOTAL LOAD PER PHASE: -- -- -- VA ±120V = -- AMPS

1 PANELBOARD SCHEDULE "A"  
SCALE: NOT TO SCALE

**EXISTING PANELBOARD SCHEDULE "154-PEE2"** LOCATION: MAIN PENTHOUSE  
C.B. RATING: 22,000 A.I.C.

VOLTAGE: 120/208 V., 3φ, 4 W. MAINS: 125 A. M.L.O. MOUNTING: SURFACE TYPE: G.E. TYPE A

USE and/or AREA SERVED	C/B	CR	NO	SA	LOAD	CR	NO	C/B	USE and/or AREA SERVED
EXIST AC2 LTG. FIRE DAMPERS	20	1	--	--	2	20	1	20	SPARE
SPACE	20	3	--	--	--	--	3	20	EXIST RECEPT BELOW PANEL
EXIST RECEPT RADIO, FIRE DAMPER	20	5	--	--	8	20	5	20	REPLACEMENT LTG, EXIST RECEPT OUTBOARD PENTHOUSE
REPLACEMENT LTG PENTHOUSE	20	7	880	--	8	20	7	20	EXIST ELEV FIRE SERVICE
EXIST FIRE DAMPER AC-2	20	9	396	--	12	20	9	20	EXIST LTG ABOVE ELEV CONTROLS
EXIST LTG ABOVE ELEV CONTROLS	20	11	--	--	12	20	11	20	

TOTAL LOAD PER PHASE: 1412 -- -- 1412 VA ±120V = 117 AMPS

ADDED LOAD (PER PHASE): 1276 -- -- 1276 VA ±120V = 10.6 AMPS

NET LOAD REDUCTION: 136 -- -- 136 VA ±120V = 1.1 AMPS

2 PANELBOARD SCHEDULE "154-PEE2"  
SCALE: NOT TO SCALE

**EXISTING PANELBOARD SCHEDULE "154-PEE4"** LOCATION: MAIN PENTHOUSE  
C.B. RATING: 10,000 A.I.C.

VOLTAGE: 120/208 V., 3φ, 4 W. MAINS: 125 A. M.L.O. MOUNTING: SURFACE TYPE: GE NOB

USE and/or AREA SERVED	C/B	CR	NO	SA	LOAD	CR	NO	C/B	USE and/or AREA SERVED
REPLACEMENT EXHAUST FAN EF-14	1	1	900	--	2	1	1	1	SPARE
EXISTING AC-2	30	3	--	--	--	50	3	30	EXISTING EXHAUST FAN ISOLATION ROOMS HRF-1

TOTAL LOAD PER PHASE: 900 900 900 900 VA ±120V = 75 AMPS

ADDED LOAD (PER PHASE): 900 900 900 900 VA ±120V = 75 AMPS

NET LOAD REDUCTION: 0 0 0 0 VA ±120V = 0 AMPS

3 PANELBOARD SCHEDULE "154-PEE4"  
SCALE: NOT TO SCALE

**NEW PANELBOARD SCHEDULE "154-PEE4A"** LOCATION: MAIN PENTHOUSE  
C.B. RATING: 10,000 A.I.C.

VOLTAGE: 120/208 V., 3φ, 4 W. MAINS: 225 A. M.L.O. MOUNTING: SURFACE TYPE: GE AQ OR EQUAL

USE and/or AREA SERVED	C/B	CR	NO	SA	LOAD	CR	NO	C/B	USE and/or AREA SERVED
SPACE	20	1	360	--	2	20	1	20	CONTROLS 154-AHU-15-2ND
SPACE	20	3	--	--	4	20	3	20	SPARE
SPACE	20	5	--	--	8	20	5	20	SPARE
SPACE	20	7	--	--	8	20	7	20	SPARE
SPACE	20	9	--	--	12	20	9	20	SPARE
SPACE	20	11	--	--	12	20	11	20	SPARE
SPACE	20	13	--	--	12	20	13	20	SPARE
SPACE	20	15	--	--	16	20	15	20	SPARE
SPACE	20	17	--	--	18	20	17	20	SPARE
SPACE	20	19	--	--	20	20	19	20	SPARE
SPACE	20	21	--	--	22	20	21	20	SPARE
SPACE	20	23	--	--	24	20	23	20	SPARE
SPACE	20	25	--	--	26	20	25	20	SPARE
SPACE	20	27	--	--	28	20	27	20	SPARE
SPACE	20	29	--	--	30	20	29	20	SPARE
154-HRP-4-AHU15 PUMP	20	31	1128	--	32	20	31	20	SPARE
154-AHU-15-2ND SUPPLY FANS (2 X 5.0 HP, EACH)	70	37	5010	3180	38	70	37	70	154-AHU-15-2ND RETURN FANS (2 X 3.0 HP, EACH)

TOTAL LOAD PER PHASE: 9678 9318 9318 12540 VA ±120V = 80.7 AMPS

4 PANELBOARD SCHEDULE "154-PEE4A"  
SCALE: NOT TO SCALE

**NEW DIST. BOARD SCHEDULE "154-DBPHS"** LOCATION: SOUTH ROOF PENTHOUSE  
C.B. RATING: 18,000 A.I.C.

VOLTAGE: 120/208 V., 3φ, 4 W. MAINS: 400 A. M.L.O. MOUNTING: SURFACE TYPE: SQUARE D NQ

USE and/or AREA SERVED	C/B	CR	NO	SA	LOAD	CR	NO	C/B	USE and/or AREA SERVED	
154-AHU-14-3RD RETURN	100	1	15020	--	2	100	1	100	154-HWP-11-PENT1 PUMP	
SPACE	60	7	--	--	8	60	7	60	154-HWP-12-PENT1 PUMP (NON-SIMULTANEOUS LOAD)	
154-HRP-3-AHU14 PUMP	40	13	3630	--	14	40	13	40	SPARE	
CONTROLS 154-AHU-14-3RD	20	19	360	--	20	20	19	20	SPARE	
154-UH-1, 154-UH-2	20	21	432	--	22	20	21	20	SPARE	
SPACE	20	23	--	--	24	20	23	20	SPARE	
SPACE	20	25	--	--	26	20	25	20	SPARE	
SPACE	20	27	--	--	28	20	27	20	SPARE	
SPACE	20	29	--	--	30	20	29	20	SPARE	
SUBBRED					15030					

TOTAL LOAD PER PHASE: 30636 30708 30270 30708 VA ±120V = 255.9 AMPS

5 PANELBOARD SCHEDULE "154-DBPHS"  
SCALE: NOT TO SCALE

**NEW DIST. BOARD SCHEDULE "154-DBPHN"** LOCATION: SOUTH ROOF PENTHOUSE  
C.B. RATING: 18,000 A.I.C.

VOLTAGE: 120/208 V., 3φ, 4 W. MAINS: 400 A. M.L.O. MOUNTING: SURFACE TYPE: SQUARE D NQ

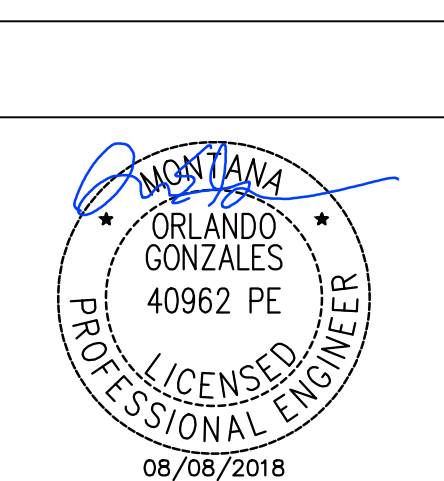
USE and/or AREA SERVED	C/B	CR	NO	SA	LOAD	CR	NO	C/B	USE and/or AREA SERVED
154-AHU-12-4TH SUPPLY	80	1	5010	7260	2	80	1	80	154-AHU-13-4TH SUPPLY
SPACE	50	7	5010	7260	8	50	7	50	154-AHU-13-4TH RETURN
154-HRP-1-AHU12 PUMP	20	13	1128	1128	14	20	13	20	154-HRP-2-AHU13 PUMP
154-CHWP-03-CHLR05 PUMP	60	19	4620	360	20	60	19	60	CONTROLS 154-AHU-12-4TH
154-CHWP-04-CHLR05 PUMP (NON-SIMULTANEOUS LOAD)	60	25	4620	360	24	60	25	60	CONTROLS 154-AHU-13-4TH
SPACE	20	27	--	--	28	20	27	20	154-UH-3, 154-UH-4
SPACE	20	29	--	--	30	20	29	20	SPARE
SPACE	20	31	--	--	32	20	31	20	SPARE
SPACE	20	33	--	--	34	20	33	20	SPARE
SPACE	20	35	--	--	36	20	35	20	SPARE

TOTAL LOAD PER PHASE: 29526 29536 29598 29598 VA ±120V = 246.7 AMPS

6 PANELBOARD SCHEDULE "154-DBPHN"  
SCALE: NOT TO SCALE

Revisions	Date

CONSULTANTS:



ARCHITECT/ENGINEERS:  
**AESUS** Architecture, Engineering, and Sustainable Design  
designgroup  
1000 E. Southern Ave, Suite 65, Tempe, Arizona 85282, (480) 791-9542

Drawing Title:  
PANELBOARD SCHEDULES  
Approved Project Director:

Project Title:  
REPLACE PENTHOUSE HVAC SYSTEMS  
CONTRACT NO. VA259-17-C-0212  
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Date: 08/03/2018  
Checked: OG  
Drawn: DC

Project Number: 436-17-102  
Building Number: 154  
Drawing Number: E700

Office of Construction and Facilities Management  
Department of Veterans Affairs