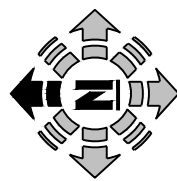
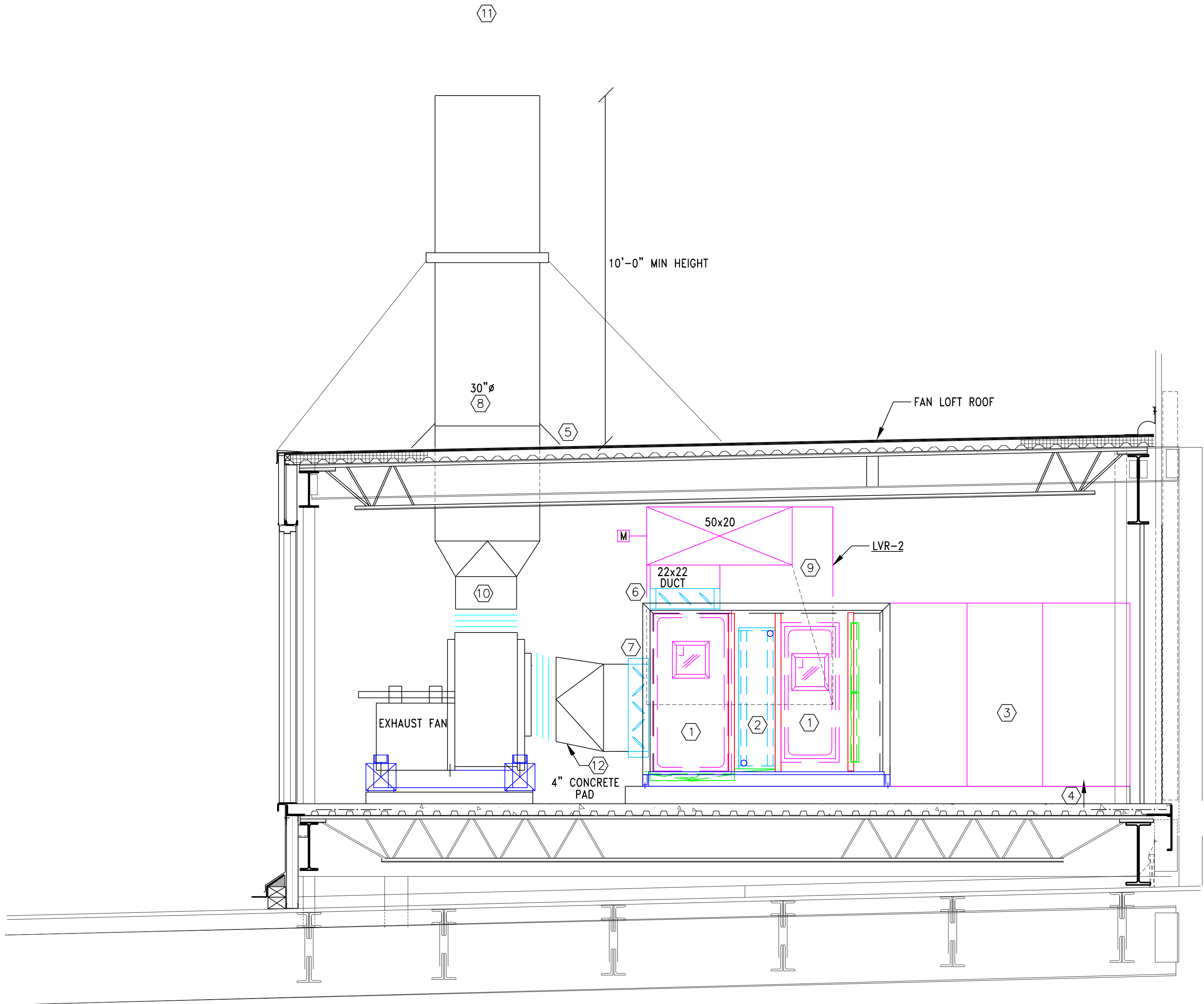


KEY NOTES



- 1 ACCESS PANEL
- 2 ENERGY RECOVERY COIL
- 3 FUTURE BAG IN BAG OUT HEPA FILTER PLENUM.
- 4 EXHAUST AIR INTAKE. MAX EXHAUST AIR, FOR NOW, WILL BE 10530 CFM, 5000 CFM FROM LAB 104 PLUS 5530 CFM FROM LAB 101. MINIMUM EXHAUST AIR, FOR NOW, WILL BE 780 CFM FROM LAB 101, PLUS, 5000 CFM FROM LAB 104 FOR A TOTAL OF 5,780 CFM. MAX EXHAUST AIR WHEN FUTURE SECOND FLOOR SYSTEM IS IN OPERATION WILL BE 15000 CFM.
- 5 COORDINATE WITH STRUCTURAL FOR MORE INFORMATION ON MOUNTING AND SUPPORTING EXHAUST STACK.
- 6 BYPASS AIR DAMPER. DAMPER AT WEST END OF UNIT TO BE BLANKED OFF.
- 7 EXHAUST AIR DAMPER. DAMPER AT WEST END OF UNIT TO BE BLANKED OFF.
- 8 30"Ø SHALL BE THE CLEAR INSIDE DIAMETER OF THE DUCT. DUCT SHALL BE TESTED HIGH AS PRESSURE DUCT WORK. DUCTWORK SHALL BE PVC LINED, REFER TO SPECIFICATIONS FOR LAB EXHAUST DUCT.
- 9 PROVIDE TRANSITION FROM LVR-2 (60"x68") TO A 50"x20" DUCT TO BE MOUNTED AS HIGH AS POSSIBLE. THIS IS BYPASS AIR THAT WILL BE SUPPLIED TO THE EXHAUST FAN TO MAINTAIN THE MIN 12,950 CFM THAT THE EXHAUST FAN WILL RUN AT WHEN THE MIN 5,780 CFM OF EXHAUST AIR IS BEING EXHAUSTED FROM LAB 101 AND LAB 104. THIS LOUVER, LVR-2, IS SIZED TO PROVIDE OVER 7,000 CFM, AND IS THE DIFFERENCE BETWEEN 12,950 AND 5,780 AND WILL PROVIDED TO THE EXHAUST FAN TO PREVENT DAMAGING THE FAN AND TO ALLOW FOR THE MINIMUM EXHAUST VELOCITY OF 2500 FPM AT THE STACK DISCHARGE. WHEN LAB 101 IS OPERATING AND EXHAUSTING AIR ABOVE THE MIN 780 CFM, THE MOTORIZED DAMPER ON THE 50"x20" DUCT WILL RAMP DOWN AS REQUIRED. THE FAN WILL NEED A MIN OF 12,950 CFM AT ALL TIMES. THE POINT OF THIS BYPASS AIR IS TO ENSURE THAT THERE IS A MINIMUM OF 12,950 CFM GOING TO THE EXHAUST FAN SO THE FLOW VELOCITY IS AT OR ABOVE THE NREL SPECIFIED 2,500 FPM. SEE NEXT NOTE FOR MORE INFORMATION.
- 10 CONTAMINATED EXHAUST AIR. THIS IS THE EXHAUST AIR THAT IS FLOWING FROM THE FAN. AT THE EXHAUST FAN MINIMUM OPERATING POINT OF 12,950 CFM, THE VELOCITY OF THIS AIR, CALLED NOZZLE VELOCITY, WILL BE APPROXIMATELY 2,500 FPM WITH A NOZZLE DIAMETER OF 30". AT THE MAXIMUM EXHAUST FAN OPERATION OF 15,000 CFM, THE NOZZLE VELOCITY WILL BE APPROXIMATELY 3,000 FPM. NOZZLE VELOCITY IS CALCULATED USING THE EQUATION; VELOCITY= CFM/πx(DUCT DIAMETER (ft))<sup>2</sup>. THIS CALCULATION, COUPLED WITH THE ANSI REQUIREMENT, IS THE BASIS FOR SELECTING THE EXHAUST FAN MINIMUM OF 12,950 CFM.
- 11 PLUME HEIGHT. AT 12,950 CFM THE MINIMUM THE EXHAUST FAN WILL RUN AT, THE PLUME HEIGHT IS APPROXIMATELY 31.6FT FROM THE ROOF OF THE PENTHOUSE WITH THE NREL MINIMUM 2,500 FPM. AT 15,000 CFM, THE MAXIMUM EXHAUST CFM OF THE EXHAUST FAN, THE PLUME HEIGHT WILL BE APPROXIMATELY 35.6 FT ABOVE THE PENTHOUSE ROOF WITH THE ANSI REQUIRED 3,000 FPM. AHSRAE HAS PROVIDED AN EQUATION:  
THE EQUATION IS AS FOLLOWS:  
IF: he = PLUME HEIGHT (ft)  
hs = STACK HEIGHT (ft)  
V = NOZZLE EXIT VELOCITY (ft/min)  
d = NOZZLE DIAMETER (ft)  
\*u = WIND SPEED (ft/min)  
\*FROM ASHRAE FUNDAMENTALS, CHP. 14 CLIMATE DESIGN INFORMATION.  
  
THEN: he = [3.0x(Vxd/u)]+hs
- 12 RECTANGLE TO ROUND CONNECTION BEFORE DUCT FROM ENERGY RECOVERY UNIT CONNECTS TO FAN.



PENTHOUSE ELEVATION

SCALE: 1/2" = 1'

| REVISIONS |                             |         |    |        |     | REVISIONS |   |      |    |        |     | FILE INFORMATION           |                 |               |       | ENGINEERING REVIEW |                  |                 |      |
|-----------|-----------------------------|---------|----|--------|-----|-----------|---|------|----|--------|-----|----------------------------|-----------------|---------------|-------|--------------------|------------------|-----------------|------|
| NO.       |                             | DATE    | BY | APP'D. | BAE | NO.       |   | DATE | BY | APP'D. | BAE | USER:                      | DLD             | DATE: 1/20/12 | TIME: | XREF'S:            | DESIGNER         | APPROVAL        | DATE |
| 0         | 50% CONSTRUCTION DOCUMENTS  | 8-25-11 | -  | -      | -   | -         | - | -    | -  | -      | -   | DWG. FILE:                 |                 |               |       |                    | ENGINEER         |                 |      |
| 1         | 90% CONSTRUCTION DOCUMENTS  | 9-30-11 | -  | -      | -   | -         | - | -    | -  | -      | -   | DWG. FOLDER:               |                 |               |       |                    | CHECKED BY       |                 |      |
| 2         | 100% CONSTRUCTION DOCUMENTS | 11-3-11 | -  | -      | -   | -         | - | -    | -  | -      | -   | ACAD VERSION: AUTOCAD 2010 |                 |               |       |                    | A/E APPROVED BY  | -               | -    |
| 3         | FOR CONSTRUCTION            | 1-20-12 | -  | -      | -   | -         | - | -    | -  | -      | -   | PLATFORM: WINDOWS XP       |                 |               |       |                    | NREL APPROVED BY | -               | -    |
| -         | -                           | -       | -  | -      | -   | -         | - | -    | -  | -      | -   | BORDER: ZBD2234D-3.DWG     | PLOT SCALE: 1:1 |               |       |                    | UNITS: ARCH      | BLDG. AREA ENG. | -    |
| -         | -                           | -       | -  | -      | -   | -         | - | -    | -  | -      | -   | PLOT INFO.: NREL.STB       |                 |               |       |                    |                  |                 |      |

|   |                     |  |                               |   |                          |
|---|---------------------|--|-------------------------------|---|--------------------------|
| <br>M.E.P. ENGINEERING<br>2005 S. Yosemite St.<br>Denver, CO 80227<br>info@mep-eng.com |                     | <br>National Renewable Energy Laboratory<br>1617 Cole Boulevard<br>Golden, Colorado 80401-3393<br>Operated for the<br>U.S. Department of Energy<br>by Midwest Research Institute • Battelle • Bechtel |                               | FLTB<br>THERMO-CHEM LABORATORY 101 CONVERSION<br>TASK ORDER 13<br>PENTHOUSE ELEVATION | MECH                     |
| DRAWING NO. PREFIX<br>FLTB-135-   | DRAWING NO.<br>M-10 | REVISION NO.<br>3  | NREL PROJECT NO.<br>EX2010034 | NREL WORK ORDER NO.<br>13   | A/E PROJECT NO.<br>11261 |