# LIGO HANFORD OBSERVATORY

## CALIFORNIA INSTITUTE OF TECHNOLOGY

## STAGING BUILDING MODIFICATIONS

### DRAWING INDEX



### GENERAL NOTES

1. DRAWINGS MAY BE REDUCED, VERIFY SCALE.
2. ALL WORK SHALL CONFORM TO THE LATEST EDITION OF THE FOLLOWING CODES AND GUIDELINES (OR AS DIRECTED BY GOVERNING AGENCIES WITHIN JURISDICTION):

   IBC (INTERNATIONAL BUILDING CODE)
   UMC (UNIFORM MECHANICAL CODE)
   UPC (UNIFORM PLUMBING CODE)
   NEC (NATIONAL ELECTRIC CODE)
3. CONTRACTOR IS RESPONSIBLE FOR VERIFICATION OF SITE CONDITIONS, INSTALLATION STANDARDS AND CONSTRUCTION CONDITIONS, DISCREPANCIES BETWEEN SITE CONDITIONS AND THE CONSTRUCTION DRAWINGS SHALL BE CALLED TO THE ATTENTION OF THE ARCHITECT/ENGINEER. WORK DONE WITHOUT THE ARCHITECT/ENGINEER'S APPROVAL IS THE RESPONSIBILITY OF THE CONTRACTOR.
4. CONTRACTOR ALONE SHALL BE RESPONSIBLE FOR SAFETY. CONTRACTOR SHALL PROVIDE ADEQUATE SAFEGUARDS, SAFETY DEVICES AND PROTECTIVE EQUIPMENT AND TAKE ANY OTHER NEEDED ACTIONS NECESSARY TO PROTECT THE LIFE, HEALTH AND SAFETY OF THE PUBLIC AND TO PROTECT PROPERTY IN CONNECTION WITH THE PERFORMANCE OF THE WORK COVERED BY THE CONTRACT.

### CODE INFORMATION

NEW AIRLOCK TOTAL: 34 SQ FT

NEW MECHANICAL AREA TOTAL: 280 SQ FT)

NEW CONSTRUCTION WITHIN STAGING BUILDING

GROUP F-2 OCCUPANCY

TYPE V N CONSTRUCTION

### PROJECT INFORMATION

PROJECT DESCRIPTION: NEW MECHANICAL EQUIPMENT ISOLATION AREA (280 SQUARE FEET) AND AIRLOCK (34 SQUARE FEET) WITHIN EXISTING CONSTRUCTION. NEW MECHANICAL SYSTEM EQUIPMENT.

OWNER: CALIFORNIA INSTITUTE OF TECHNOLOGY
PO BOX 159
RICHLAND, WA 99352

CONTACT: JOHN WORDEN
(509) 372-8136

ENGINEER: HIBBS ENGINEERING, INC
4308 S GUM ST
KENNEWICK, WA 99337
CONTACT: GILBERT HIBBS, P.E.
(509) 308-8331

PROJECT ADDRESS: HORN ROAD
RICHLAND, WA 99352

### DRAWING SYMBOLS

FLOOR PLAN
SCALE: 1/4" = 1'-0 — TITLE

A1.1 — SECTIONS & DETAILS

1 A1.1 — SECTION, SCALE: 1/4" = 1'-0 — SECTIONS/ELEVATIONS

1 — NOTE NUMBER

A — INTERIOR ELEVATIONS

101 — DOOR NUMBER

NAME
100 — ROOM NAME/NUMBER

### ABBREVIATIONS

| | | | |
|---|---|---|---|
| AC | AIR CONDITIONER | MAX | MAXIMUM |
| A/E | ARCHITECT/ENGINEER | MFR | MANUFACTURER |
| APA | AMERICAN PLYWOOD ASSOCIATION | MIN | MINIMUM |
| ARCH | ARCHITECTURAL | NTS | NOT TO SCALE |
| CH | CHILLER | OC | ON CENTER |
| DET | DETAIL | OPP | OPPOSITE |
| DIA/ø | DIAMETER | PF | POWERED FILTER |
| DWG | DRAWING | PLYWD | PLYWOOD |
| EL | ELEVATION | RB | RUBBER BASE |
| EQPT | EQUIPMENT | SCHED | SCHEDULE |
| EXP | EXPANSION | SIM | SIMILAR |
| EXST | EXISTING | SQ | SQUARE |
| FL | FLOOR | STD | STANDARD |
| FT | FEET | SYM | SYMBOL |
| GA | GAUGE | THKNS | THICKNESS |
| GAL | GALLONS | TYP | TYPICAL |
| GB | GYPSUM BOARD | WG | WATER GAUGE |
| INSUL | INSULATION | W/ | WITH |

### LOCATION PLAN


LIGO-D080563-00-W

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GILBERT L. HIBBS — STATE OF WASHINGTON — 2549 — REGISTERED PROFESSIONAL ENGINEER

EXPIRES 10/31/09



DRAWN BY: GLH | CHECKED BY: | DESIGN A/E | DESIGN GM | HEI APPROVAL

PROJECT INFORMATION

CAD FILE: 100601G1

PROJECT NUMBER: 1006.01

LIGO HANFORD OBSERVATORY
STAGING BUILDING MODIFICATIONS

HIBBS ENGINEERING, INC.
KENNEWICK, WASHINGTON

DRAWING NUMBER: G1.0 | REV: 0

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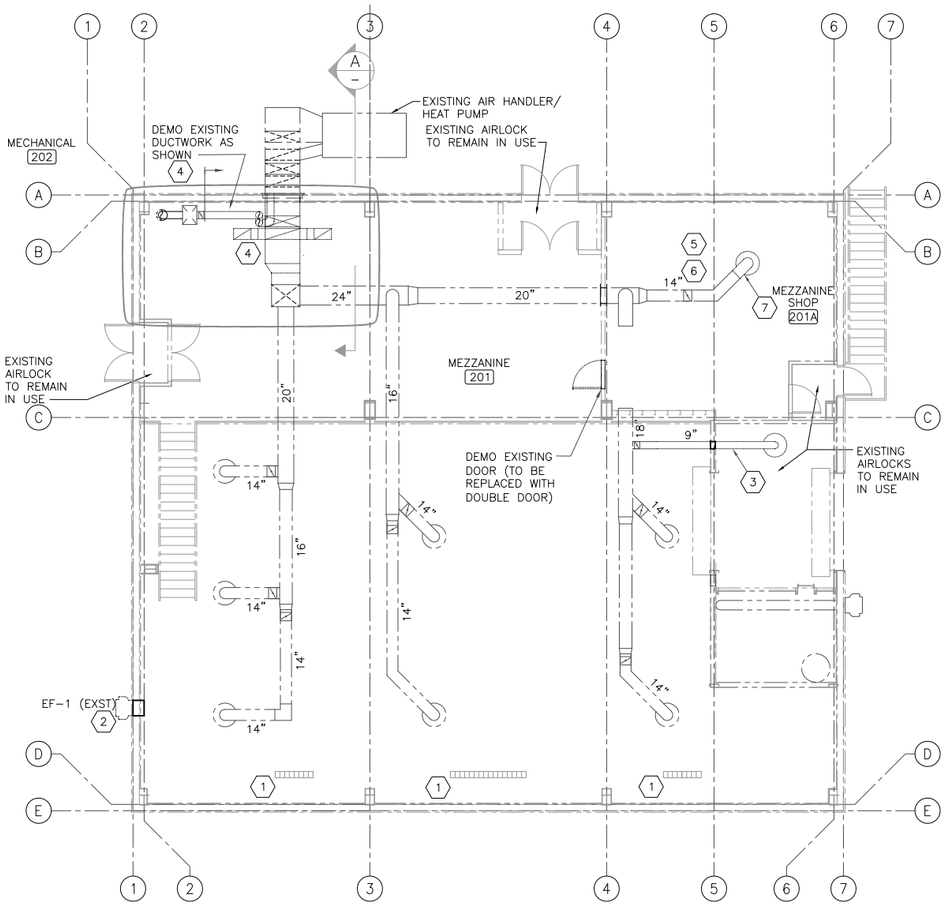
## GENERAL NOTES

1. SEE DRAWING M2.1 FOR GENERAL NOTES AND LEGEND.

## KEYED NOTES

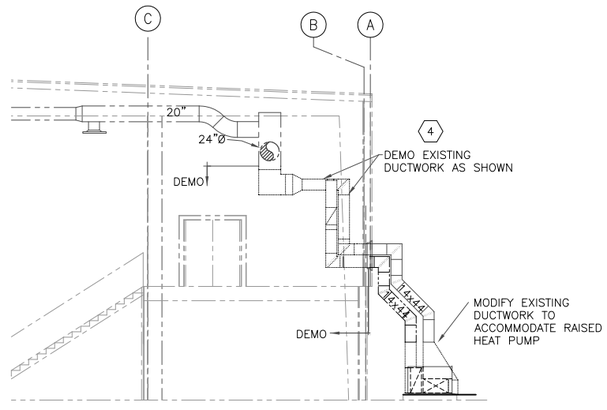
1. REMOVE DRAIN GRATE. SEE M2.1 FOR DRAIN COVER.
2. REMOVE EXHAUST FAN (EF-2). SEE M2.1 FOR SEALING OF PENETRATION.
3. REMOVE BRANCH SUPPLY DUCT TO AIRLOCK.
4. REMOVE SUPPLY AND RETURN DUCT AS INDICATED.
5. REPLACE MISSING SCREWS AT WALL PANELS.
6. REMOVE ABANDONED REFRIGERANT PIPING. REPAIR AND RESEAL ANY PENETRATIONS.
7. REMOVE ELBOW AND DIFFUSER.




DEMOLITION
FLOOR PLAN

SCALE: 1/8" = 1'-0

0' 8' 16'




A
–
DEMOLITION
MEZZANINE SECTION

SCALE: 1/8" = 1'-0

0' 8' 16'

| REV NO | DATE | BY | DESCRIPTION | APPROVED |
|---|---|---|---|---|

08/24/2007 DATE OF ISSUE

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| GLH | | | | |

MECHANICAL
DEMOLITION

PROJECT NUMBER: 1006.01

CAD FILE: 1006O1M02D1.DWG

LIGO-CA INSTITUTE OF TECHNOLOGY
STAGING BUILDING MECHANICAL MODIFICATIONS

HIBBS ENGINEERING, INC.
KENNEWICK, WASHINGTON

DRAWING NUMBER M1.1

REV 0

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## SPRING ISOLATOR SCHEDULE

| ID | LOAD | DEFLECTION | SPRING CONSTANT | ISOLATOR MODEL | REMARKS |
|---|---|---|---|---|---|
| A | 189 LB | 1.08" | 174 LB/IN | SLF-B-280 | |
| B | 197 LB | 1.13" | 174 LB/IN | SLF-B-280 | |
| C | 213 LB | 1.22" | 174 LB/IN | SLF-B-280 | |
| D | 131 LB | 0.75" | 174 LB/IN | SLF-B-280 | |
| E | 137 LB | 0.78" | 174 LB/IN | SLF-B-280 | |
| F | 148 LB | 0.85" | 174 LB/IN | SLF-B-280 | |

## LEGEND

12x12 1 500 — CFM; DIFFUSER TYPE (SEE SCHEDULE); NECK SIZE

FLOW ARROW

SUPPLY CEILING DIFFUSER

RETURN/EXHAUST GRILLE/REGISTER

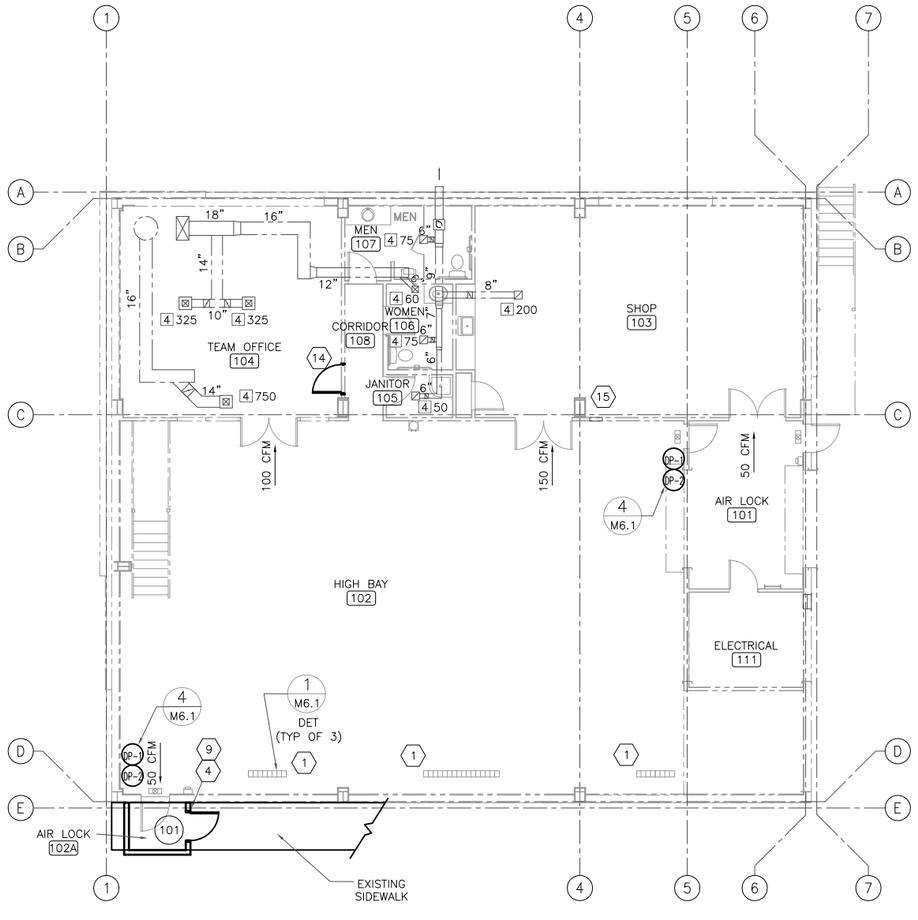
| | |
|---|---|
| AC | AIR CONDITIONING CONDENSER |
| AHU | AIR HANDLING UNIT |
| BF | BOOSTER FAN |
| CFM | CUBIC FEET PER MINUTE |
| DEMO | DEMOLITION |
| EF | EXHAUST FAN |
| EXST | EXISTING |
| F | FILTER |
| FC | FAN COIL UNIT |
| FH | FILTER HOUSING |
| HEPA | HIGH EFFICIENCY PARTICULATE AIR (FILTER) |
| RR | RESTROOM |
| W.G. | WATER GAUGE (PRESSURE) |

## KEYED NOTES

1. INSTALL SECURE PLATE FLUSH WITH FLOOR.
2. SEAL PENETRATION OF REMOVED EXHAUST FAN.
3. ENCLOSURE WALL FOR MECHANICAL ROOM. USE METAL FRAMING WITH 5/8" GWB, BOTH SIDES. FINISH TO MATCH EXISTING. SEAL WALL AT ALL PENETRATIONS.
4. ENCLOSURE WALL FOR AIRLOCK. USE METAL FRAMING WITH 5/8" GWB, INTERIOR, METAL EXTERIOR PANEL TO MATCH EXISTING. FINISH TO MATCH EXISTING. SEAL WALL AT ALL PENETRATIONS AND INTERFACES WEATHERTIGHT. PROVIDE RAISED FOOTING FOR WALL BASE. PROVIDE SLOPED ROOF.
5. SEAL PENETRATION OF REMOVED BRANCH SUPPLY DUCT TO AIRLOCK.
6. BLANK BRANCH DUCT TAKEOFF AT MAIN SUPPLY DUCT.
7. INSTALL DUCT (PREVIOUSLY REMOVED) WHERE SHOWN TO CONNECT EXISTING DUCTS.
8. INSTALL 6 SPRING ISOLATORS – MASON INDUSTRIES SLF-B-(PER SPRING ISOLATOR SCHEDULE) ON EXISTING UNIT. INSTALL VIBRATION ISOLATION FABRIC DUCT CONNECTORS AT AHU DUCT CONNECTIONS. SEE DETAIL 5 ON M6.1
9. PROVIDE 1X4 LIGHT FIXTURE SURFACE MOUNTED ON AIRLOCK CEILING. PROVIDE RECEPTICLE ON NORTH WALL IN AIRLOCK. CIRCUIT TO BE DETERMINED BY OWNER.
10. ATTACH GWB TO EXPOSED FRAMING, TAPE AND PAINT TO MATCH THE ESISTING INTERIOR
11. INSTALL DUCT TRANSITION AND GRILLE FOR DISCHARGE ABOVE SUSPENDED CEILING.
12. SEAL/FINISH AROUND COLUMN SHEETROCK ENCLOSURES. SEAL/CLOSE AT TOP AND AT ALL WALL INTERFACES. NOT ALL LOCATIONS ARE INDICATED, HOWEVER ALL LOCATIONS IN THE HIGH BAY, MEZZANINE AND MEZZANINE WORKROOM REQUIRE SEALING.
13. COVER GRILLE OPENING TO MATCH BUILDING INTERIOR. SEAL WATER AND AIR TIGHT. (REMOVE EXISTING PLYWOOD COVER).
14. INSTALL NEW DOOR.
15. INSTALL BLANKING PANEL IN WALL TRANSFER GRILLE.

## GENERAL NOTES

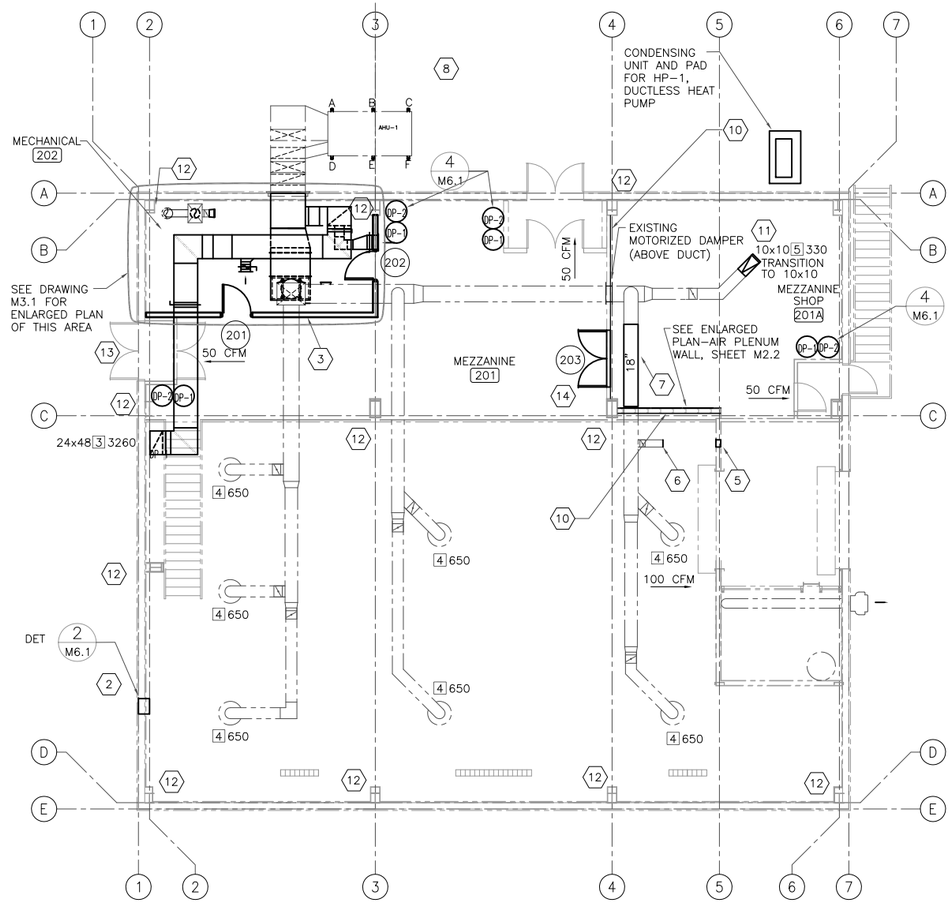
1. ALL DUCTWORK EXTERNAL TO BUILDING AND ALL NEW DUCTWORK SHALL BE TIGHTLY SEALED TO SEAL CLASS A PER ASHRAE FUNDAMENTALS TABLE 8A.
2. ALL FILTER RACKS, DUCT CONNECTIONS AND FAN COMPARTMENT ON THE AIR HANDLER SHALL BE EXAMINED AND ANY LEAKS SEALED AIRTIGHT.




FLOOR PLAN

SCALE: 1/8" = 1'-0

0' 8' 16'




MEZZANINE PLAN

SCALE: 1/8" = 1'-0

0' 8' 16'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| GLH | | | | |

MECHANICAL
FLOOR & MEZZANINE PLAN

PROJECT NUMBER: 1006.01 CAD FILE: 100601M0201.DWG

LIGO-CA INSTITUTE OF TECHNOLOGY
STAGING BUILDING MECHANICAL MODIFICATIONS
HIBBS ENGINEERING, INC.
KENNEWICK, WASHINGTON

DRAWING NUMBER M2.1 REV 0

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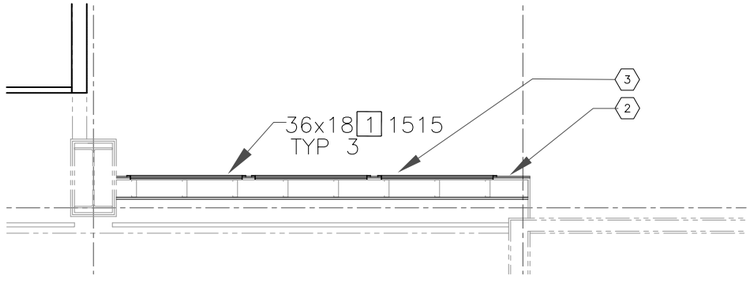
## LEGEND

| | |
|---|---|
| (2) (F) | FAN/FILTER UNIT, PF-1 |
| (3) (L) | 4'-0"x2'-0" FLUORESCENT LIGHT FIXTURE, RECESSED (SIMILAR TO EXST) |
| | 4'-0"x2'-0" SUSPENDED ACOUSTICAL TILE CEILING. |
| (AC) | RECESSED AIR CONDITIONER/HEATER MODULE. |
| (EL) | DUAL BULB EMERGENCY LIGHT FIXTURE. MATCH EXISTING BUILDING EMERGENCY LIGHTS. |

## GENERAL NOTES

## KEYED NOTES

1. INSTALL SUSPENDED CEILING AT 13 FEET ABOVE FINISHED FLOOR.
2. ADD LAYER OF 1/2" GWB OVER EXISTING GWB SURFACE. SEAL, TAPE, PAINT TO MATCH FINISHED INTERIOR
3. INSTALL BOTTOM OF GRILLE 1'-0" ABOVE FLOOR (TYP 3) AND 14'-0" ABOVE FLOOR (TYP 3).
4. INSTALL SWITCHING FOR SIX LIGHT FIXTURES (DESIGNATED "1" ON ONE SWITCH AND FIVE LIGHT FIXTURES DESIGNATED "2" ON A SECOND SWITCH.
5. INSTALL SWITCHING FOR EIGHT FILTER UNITS (DESIGNATED "3" ON ONE SWITCH AND TEN FILTER UNITS DESIGNATED "4" ON A SECOND SWITCH.
6. INSTALL CONDENSATE DRAIN FOR INDOOR UNIT. ROUTE 1" DRAIN THROUGH OUTSIDE WALL, TO GROUND. TERMINATE 6" ABOVE GRADE. SLOPE TO DRAIN.




ENLARGED PLAN
AIR PLENUM WALL

SCALE: 1/2" = 1'-0

0' 2' 4'




MEZZANINE WORKROOM
REFLECTED CEILING PLAN

SCALE: 1/4" = 1'-0

0' 4' 8'

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REFLECTED CEILING AND DETAILS

PROJECT NUMBER: 1006.01

CAD FILE: 100601M0201.DWG

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DRAWING NUMBER M2.2

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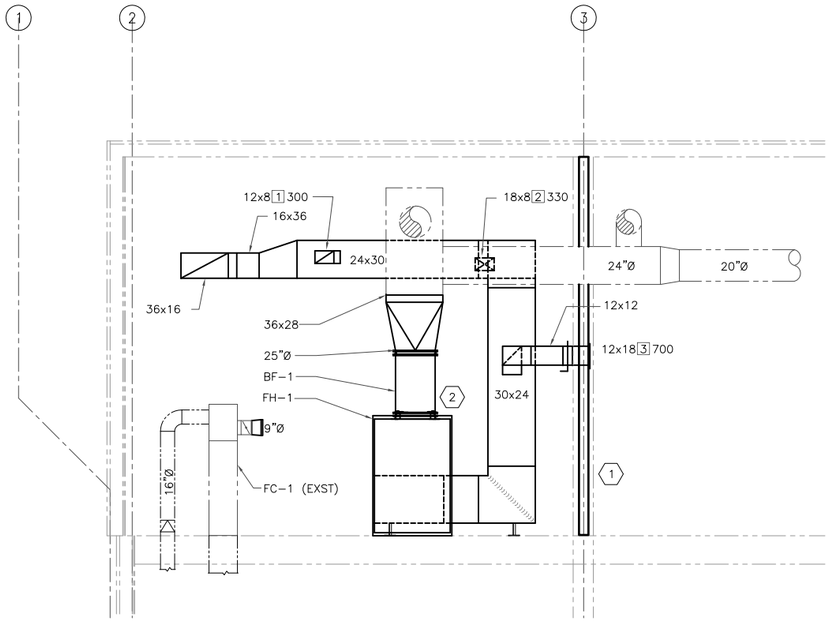
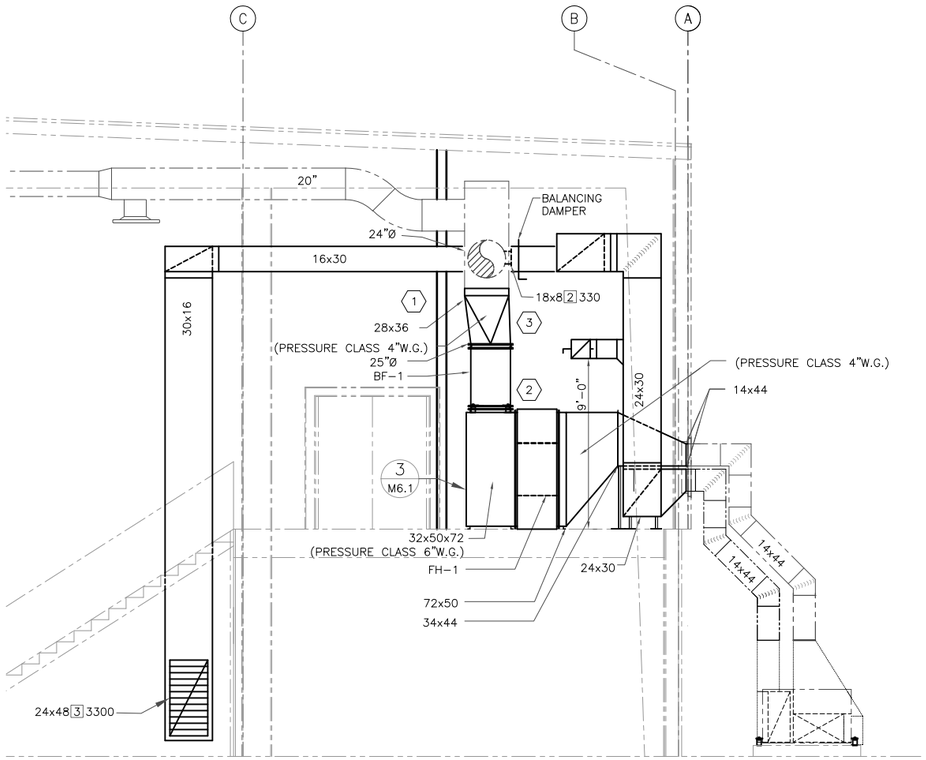


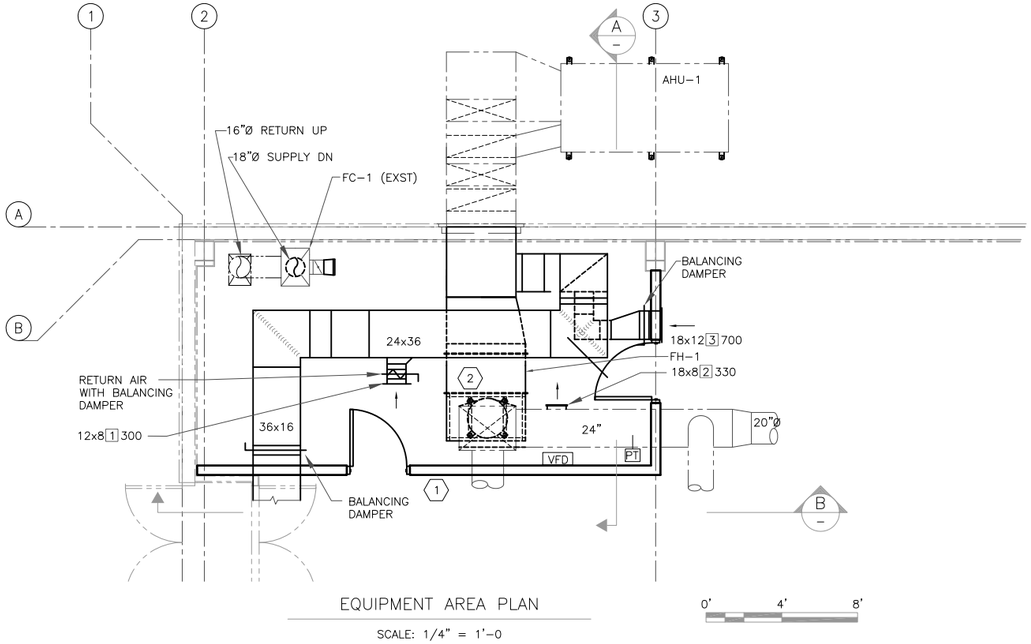

B — EQUIPMENT AREA SECTION
SCALE: 1/4" = 1'-0

0' 4' 8'




A — EQUIPMENT AREA SECTION
SCALE: 1/4" = 1'-0

0' 4' 8'




EQUIPMENT AREA PLAN
SCALE: 1/4" = 1'-0

0' 4' 8'

## KEYED NOTES

1. ENCLOSURE WALL FOR MECHANICAL EQUIPMENT AREA. USE METAL FRAMING WITH 5/8" GWB, BOTH SIDES. FINISH TO MATCH EXISTING. SEAL WALL AT ALL PENETRATIONS AND AT ROOF.
2. INSTALL 4 SPRING ISOLATORS – MASON INDUSTRIES SLF-B-150 – ON BASE OF NEW FAN. INSTALL VIBRATION ISOLATION FABRIC DUCT CONNECTORS AT FAN INLET AND OUTLET. SEE DETAIL 6 ON M6.1
3. FAN ELECTRICAL POWER PANEL AND CIRCUIT TO BE DETERMINED BY OWNER.

## GENERAL NOTES

1. SEE DRAWING M2.1 FOR GENERAL NOTES AND LEGEND.

## ROOM FINISH SCHEDULE

| No | ROOM NAME | FLOOR | BASE | WALLS | | | | CEILING | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | NORTH | EAST | SOUTH | WEST | MATERIAL | HEIGHT | |
| 102 | HIGH BAY | VINYL | RB | EXST | EXST | EXST | EXST | NA | – | |
| 102A | AIR LOCK | VINYL | RB | GB | GB | GB | GB | GB | 9'-0" | |
| 104 | OFFICE | VINYL | RB | EXST | EXST | EXST | EXST | EXST | – | |
| 201 | MEZZANINE | VINYL | RB | EXST | EXST | EXST | EXST | NA | – | MECH RM WALLS GB |
| 201A | AIR LOCK | VINYL | RB | EXST | EXST | GB | GB | SATC | 13 | |
| 202 | MECHANICAL | CT | RB | GB | GB | EXST | EXST | NA | – | |

## MATERIAL/FINISH LEGEND

| ABBREVIATION | MATERIAL DESCRIPTION |
|---|---|
| GB | 5/8" TYPE 'X' GYPSUM BOARD, TAPE, SEAL, AND PAINT. SUBMIT COLOR SAMPLES FOR APPROVAL. |
| RB | 4" HIGH RUBBER BASE. |
| CT | CONCRETE. |
| SATC | SUSPENDED ACCOUSTIC TILE CEILING |
| VINYL | WELDED SEAM SHEET VINYL, SUBMIT FOR OWNER APPROVAL |

## DOOR SCHEDULE

| No | DOOR OPENING SIZE | THKNS | TYPE | MATL | FRAME MATL | FRAME HEAD | FRAME JAMB | FRAME SILL | LOUVER SIZE | GLASS | UL LABEL | HDW GP | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 101 | 3'-0 x 7'-0 | 1 3/4" | | HM | HM | | | | NA | SG | | | |
| 201 | 3'-0 x 7'-0 | 1 3/4" | | HM | HM | | | | NA | NA | – | | |
| 202 | 3'-0 x 7'-0 | 1 3/4" | | HM | HM | | | | NA | NA | – | | |
| 203 | 6'-0 x 7'-0 | 1 3/4" | | HM | HM | | | | NA | NA | – | | |

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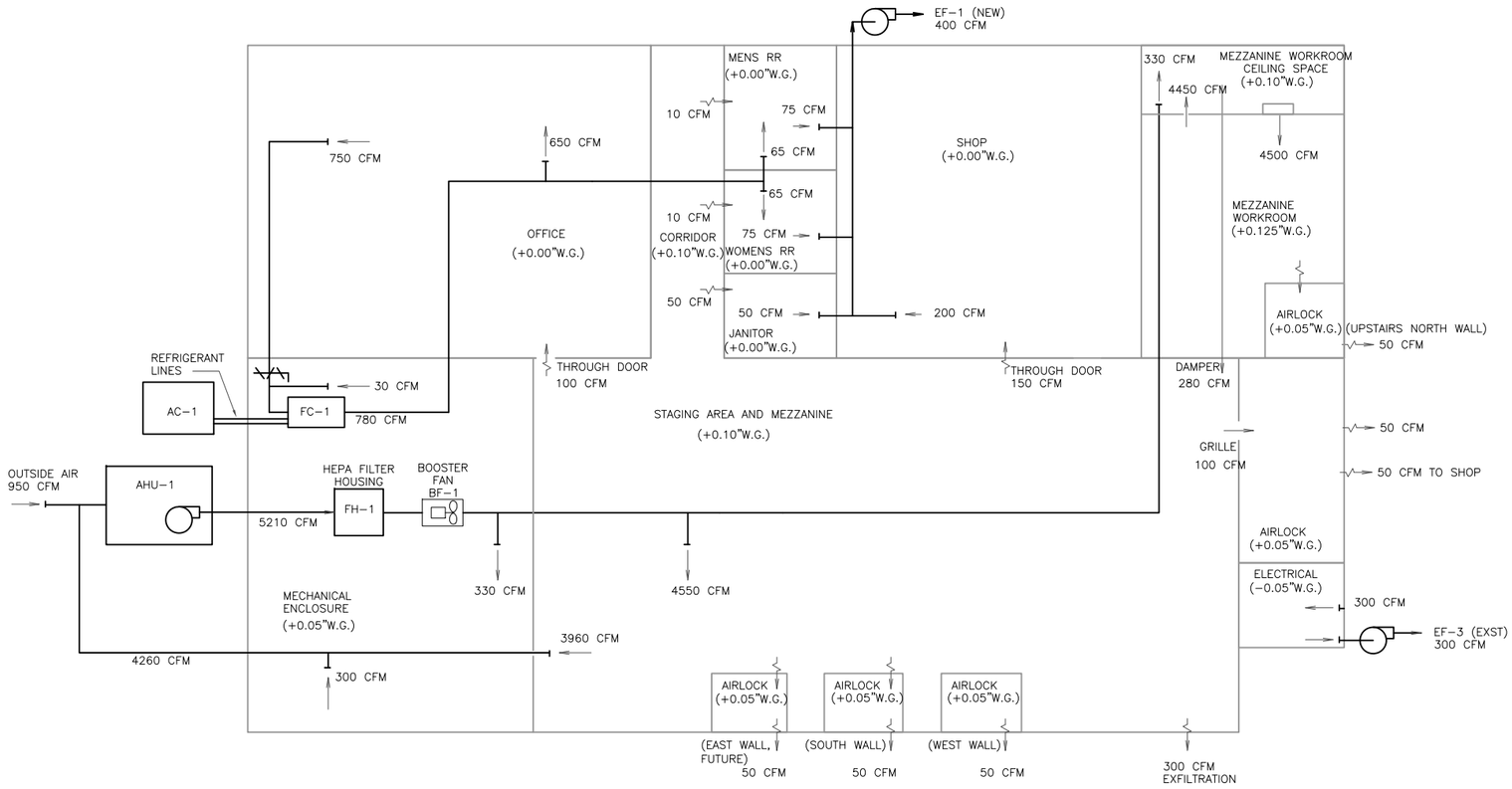
MECHANICAL
ENLARGED PLAN & SECTIONS

PROJECT NUMBER: 1006.01
CAD FILE: 100601M0201.DWG

LIGO-CA INSTITUTE OF TECHNOLOGY
STAGING BUILDING MECHANICAL MODIFICATIONS
HIBBS ENGINEERING, INC.
KENNEWICK, WASHINGTON

DRAWING NUMBER M3.1
REV 0




AIR FLOW DIAGRAM

SCALE: NONE

## GENERAL NOTES

1. SEE DRAWING M2.1 FOR GENERAL NOTES AND LEGEND.

## SEQUENCE OF OPERATION

1. ALL SYSTEMS SHALL BE OPERATIONAL DURING FACILITY USE AS A CLEAN AREA.
2. CIRCULATING FANS FOR AHU-1 AND AC-1 SHALL BE IN THE "ON" MODE.
3. THE VFD FOR FAN BF-1 SHALL VARY FAN SPEED TO MAINTAIN SETPOINT PRESSURE IN THE SUPPLY AIR DUCT. INITIAL SETPOINT SHALL BE 0.5"WG. THIS SETPOINT SHALL BE ADJUSTED BY THE SYSTEM BALANCER TO ACHIEVE INITIAL SYSTEM AND BUILDING BALANCE.
4. A DWYER MS-311 DUCT MOUNTED STATIC PRESSURE TRANSMITTER IS USED TO PROVIDE A 4-20 MA SIGNAL TO THE VFD. THE SIGNAL IS DIRECTLY PROPORTIONAL TO THE STATIC PRESSURE DEVELOPED IN THE SUPPLY AIR DUCT. THE VFD REACTS TO ANY CHANGE IN STATIC PRESSURE BY SIGNALING THE MOTOR CONTROL TO INCREASE OR DECREASE FAN SPEED TO MAINTAIN THE SETPOINT PRESSURE.
5. TEMERATURE CONTROL IS NOT CHANGED FROM EXISTING.

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STATE OF WASHINGTON
22649
REGISTERED
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MECHANICAL
AIR FLOW DIAGRAM

PROJECT NUMBER: 1006.01
CAD FILE: 100601M0201.DWG

LIGO-CA INSTITUTE OF TECHNOLOGY
STAGING BUILDING MECHANICAL MODIFICATIONS
HIBBS ENGINEERING, INC.
KENNEWICK, WASHINGTON

| DRAWING NUMBER | REV |
|---|---|
| M4.1 | 0 |

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## FILTER HOUSING (FH) SCHEDULE

| SYMBOL | LOCATION | DESIGN AIRFLOW (CFM) | # OF FILTERS | | PREFILTER SECTION | HEPA FILTER SECTION | MAXIMUM OVERALL SIZE | MFR/MODEL | FEATURES |
|---|---|---|---|---|---|---|---|---|---|
| | | | HIGH | WIDE | | | | | |
| FH-1 | CHASE-EXT WALL MOUNT | 5000 | 2 | 3 | YES | YES | 52"Wx72"Hx24"D | FARR GLIDE PACK | |

## FILTER (F) SCHEDULE

| SYMBOL | LOCATION | TYPE | AIRFLOW (CFM/FILTER) | FILTER SIZE | EFFICIENCY % | INITIAL RESISTANCE | FINAL RESISTANCE | MFR/MODEL | FEATURES |
|---|---|---|---|---|---|---|---|---|---|
| F-1 | FH-1 | PLEATED PRE-FILTER | 1000 | 24"x24"x4" | 85 | .35 | 1.0 | FARR | |
| F-2 | FH-1 | HEPA | 1000 | 24"x24"x12" | 99.99 | .85 | 3.0 | FARR | |

## BOOSTER FAN (BF) SCHEDULE

| SYMBOL | LOCATION | TYPE | AIRFLOW (CFM) | STATIC PRESSURE (IN WG) | DRIVE | MOTOR | | | CONTROL | MFR/MODEL | FEATURES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | HP | RPM | V/PH | | | |
| BF-1 | MEZZANINE MECH AREA | IN-LINE AXIAL | 5000 | 4.5 | DIRECT | 7.5 | 2594 | 460/3 | VFD/DUCT PRESSURE | NEW YORK BLOWER TUBULAR ACOUSTAFOIL SIZE 18, CLASS 2 | VERTICAL ARRANGEMENT 9, MOUNTING POSITION 7 |

NOTE: ELECTRICAL POWER FEED FROM PANEL "B" IN ELECTRICAL ROOM. PANEL IS 208 V/3PH.
OWNER SHALL DETERMINE PANEL CAPACITY, WIRE AND CONDUIT SIZING AND ROUTING.

## GRILLE, REGISTER AND DIFFUSER SCHEDULE

| SYMBOL | TYPE | FLOW (CFM) | MOUNTING | SIZE | MATERIAL | FINISH | DAMPER | MFR/MODEL | FEATURES |
|---|---|---|---|---|---|---|---|---|---|
| 1 | RTRN/TRANSFER GRILLE | SEE PLAN | TYPE 1 SURFACE MOUNT | SEE PLAN | STEEL | WHITE BAKED ENAMEL | NONE | TITUS 350RL | |
| 2 | SPLY REGISTER SIDEWALL | SEE PLAN | TYPE 1 SIDEWALL | SEE PLAN | STEEL | WHITE BAKED ENAMEL | OPPOSED BLADE DAMPER | TITUS 301RL | SINGLE DEFLECTION BLADES |
| 3 | RTRN GRILLE SIDEWALL | SEE PLAN | TYPE 1 SURFACE MOUNT | SEE PLAN | STEEL | WHITE BAKED ENAMEL | NONE | TITUS 350ZRL | 0° DEFLECTION BLADES |
| 4 | EXISTING DIFFUSER | SEE PLAN | | | | | | | VARIOUS TYPES |
| 5 | SUPPLY REGISTER | SEE PLAN | DUCT MOUNT | SEE PLAN | STEEL | WITE BAKED ENAMEL | NONE | TITUS 301ZRL | |

## POWERED FILTER (PF) SCHEDULE

| SYMBOL | ROOM LOCATION | TYPE | AIRFLOW (CFM) | FILTER SIZE | EFFICIENCY % | FILTER RESISTANCE (IN W.G.) | | MOTOR | | MFR/MODEL | FEATURES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | INITIAL | FINAL | FULL LOAD AMPS | V/PH | | |
| PF-1 | 201A | FAN POWERED FILTER | 640 | 24"x48"x9" | 99.99 | 0.35 | 0.75 | 2.04 | 277/1 | PUREFLO FPM, 2X4 OR EQUAL | SOLID STATE SPEED CONTROL, PLEATED PRE-FILTER |

NOTE: ELECTRICAL POWER FEED SHALL BE DETERMINED BY OWNER. SET AIRFLOW RATE AT 250 CFM PER FILTER UNIT.

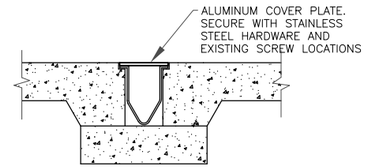
## DUCTLESS HEAT PUMP (HP) SCHEDULE

| SYMBOL | ROOM LOCATION | TYPE | COOLING | | INDOOR UNIT | | | OUTDOOR UNIT | | | MFR/MODEL | FEATURES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | TOTAL CAPACITY (BTU) | SEER | MCA (AMPS) | V/PH | FAN FLA (AMPS) | MCA (AMPS) | V/PH | FAN FLA (AMPS) | | |
| HP-1 | 201A | DUCTLESS CLG MOUNT | 36000 | 13.1 | 2.0 | 208/1 | 1.25 | 25 | 208/1 | 0.75 | MITSUBISHI PLA-A36AA/PUZ-A36NHA, INVERTER POWERED COMPRESSOR | PROVIDE LOW AMBIENT KIT, CONDENSATE PUMP |

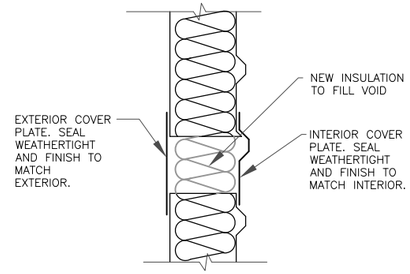
NOTE: PROVIDE CONDENSATE DRAIN PIPING WITH P-TRAP AND DRAIN TO OUTSIDE GROUND.
NOTE: ELECTRICAL POWER FEED SHALL BE DETERMINED BY OWNER.

## GENERAL NOTES

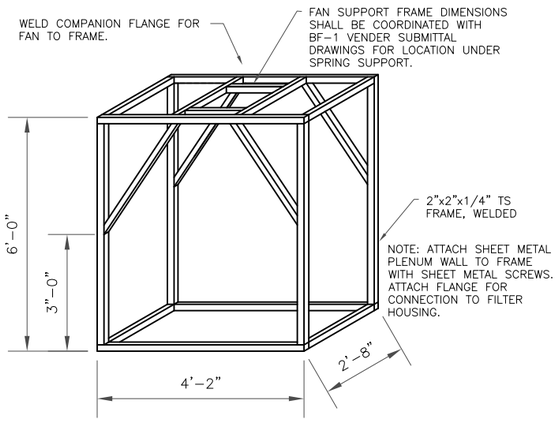
1. SEE DRAWING M2.1 FOR GENERAL NOTES AND LEGEND.



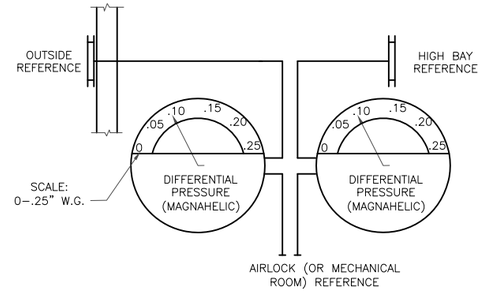

1 / M2.1 DRAIN COVER DETAIL
1" = 1'-0"



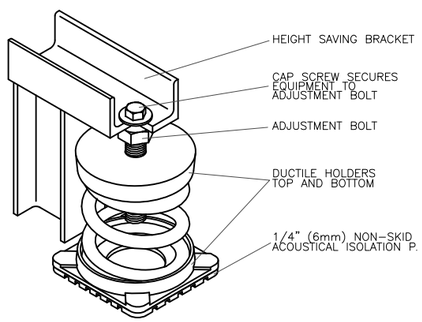

2 / M2.1 WALL CLOSURE DETAIL
1" = 1'-0"




3 / M3.1 PLENUM FRAME DETAIL
NO SCALE




4 / M2.1 DIFFERENTIAL PRESSURE GUAGE ASSEMBLY
1" = 1'-0"




SLF SPRING MOUNT
SPECIFICATION B

5 / M3.1 SPRING ISOLATION MOUNT
NO SCALE

DATE OF ISSUE 8/24/2007

| REV NO | DATE | BY | DESCRIPTION | APPROVED |
|---|---|---|---|---|

GILBERT L. HIBBS STATE OF WASHINGTON 7649 REGISTERED PROFESSIONAL ENGINEER
EXPIRES 10/31/09



DRAWN BY: GLH | CHECKED BY: | DESIGN A/E | DESIGN GM | HEI APPROVAL

MECHANICAL SCHEDULES AND DETAILS

CAD FILE: 100601M0201.DWG
PROJECT NUMBER: 1006.01

LIGO-CA INSTITUTE OF TECHNOLOGY
STAGING BUILDING MECHANICAL MODIFICATIONS
HIBBS ENGINEERING, INC.
KENNEWICK, WASHINGTON

DRAWING NUMBER M6.1 | REV 0

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SPECIFICATIONS

MECHANICAL DEMOLITION

1.2 SCOPE OF WORK

A. THE WORK UNDER THIS SECTION SHALL INCLUDE PROVIDING ALL LABOR, EQUIPMENT, AND MATERIALS OF EVERY KIND NECESSARY TO COMPLETE THE DEMOLITION OF EXISTING MECHANICAL SYSTEMS AS SHOWN ON THE DRAWINGS AND DESCRIBED HEREIN.

1.3 DESCRIPTION OF WORK

A. SELECTIVELY DEMOLISH DESIGNATED DUCTWORK AND OTHER BUILDING COMPONENTS AS NOTED ON THE DRAWINGS. REMOVE DESIGNATED EXISTING MECHANICAL WORK IN ITS ENTIRETY AND ASSOCIATED SUPPORTS AND HANGERS, UNLESS OTHERWISE NOTED, INCLUDING BUT NOT LIMITED TO:
   1. EXHAUST FAN, EF–1.
   2. DUCTWORK AND SHEETMETAL.
   3. FLOOR DRAIN GRATES

1.4 SALVAGE

A. THE OWNER SHALL HAVE FIRST SALVAGE RIGHTS TO ALL REMOVED EQUIPMENT. CONTRACTOR SHALL COORDINATE SELECTION WITH THE OWNER'S REPRESENTATIVE.

B. ALL AIR HANDLING EQUIPMENT, SALVAGED BY THE OWNER SHALL BE CAREFULLY REMOVED AND RELOCATED TO AN ON–SITE LAYDOWN AREA DESIGNATED BY THE OWNER.

C. CONTRACTOR SHALL TRANSPORT AND LEGALLY DISPOSE OF OFF SITE, ALL MATERIALS RESULTING FROM DEMOLITION NOT BEING SALVAGED.

MECHANICAL COMPONENTS

2.1 DUCTWORK

A. DUCTWORK SYSTEMS.

B. DUCTWORK CONSTRUCTION: GALVANIZED STEEL SHEETS IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS, METAL AND FLEXIBLE. PRESSURE CLASSIFICATION: AS INDICATED ON THE DRAWINGS.

C. MATERIAL: SHEET STEEL SHALL BE ASTM A653 WITH G–90 GALVANIZED COATING.

D. DUCTWORK: 20 GAUGE MINIMUM, ROUND SHALL BE SPIRAL SEAM. DO NOT DENT, SCRATCH, WARP OR ALLOW DEFLECTION IN DUCTWORK. INSTALL DUCT WORK NEAT, SQUARE AND TRUE. ALL CUT EDGES SHALL BE SQUARE AND TRUE. NO VISIBLE GAPS OR CRACKS ARE ALLOWED. HANGERS SHALL BE EQUALLY SPACED, ALL THREAD ROD TYPE. FASTENERS SHALL BE INSTALLED IN UNIFORM NEATLY SPACED COLUMNS AND ROWS. TOUCH–UP ALL SCRATCHES AND CUT EDGES WITH ZRC.

E. DUCTWORK SEAL CLASS DESIGNATION IS A FOR ALL DUCTWORK: SEAL ALL TRANSVERSE JOINTS, LONGITUDINAL SEAMS, AND DUCT WALL PENETRATIONS.

F. PROVIDE TAPERED TRANSITIONS AT ALL CHANGES IN DUCT SIZE AND AT CONNECTIONS TO FANS AND OTHER EQUIPMENT.

G. TURNING VANES: IN ALL 90 DEGREE TURNS IN DUCTS PROVIDE SINGLE THICKNESS TURNING VANES OR 1–1/2 RADIUS ELBOWS.

H. DUCT SHALL BE ROUND OR RECTANGULAR AS SHOWN ON DRAWINGS, NO EXCEPTIONS. DUCT DIMENSIONS SHOWN ARE NET CLEAR INSIDE DIMENSIONS.

2.2 DUCT ACCESSORIES

A. VOLUME DAMPERS.
   1. PROVIDE AIR VOLUME DAMPERS AS INDICATED ON THE DRAWINGS TO ADJUST THE SYSTEM TO PRODUCE THE DESIGN AIR QUANTITIES, AND AS REQUIRED.

B. DAMPER QUADRANTS: INDICATING DIAL REGULATOR AND SEALED END BEARINGS. PROVIDE REMOTE OPERATORS AT HARD CEILINGS AND OTHER AREAS AS REQUIRED, VENT FABRICS OR APPROVED EQUAL.

C. DAMPER FABRICATION:
   1. MINIMUM GAGE AND DUCT CONSTRUCTION SHALL BE IN ACCORDANCE WITH SMACNA STANDARDS.
   2. AIRFOIL DAMPER BLADE SHALL BE ALIGNED WITH HANDLE AND INDEX POINTER.
   3. ALL OPERATORS ACCESSIBLE AND LOCKABLE.
   4. MAXIMIZE DISTANCE FROM BRANCH DAMPERS TO DIFFUSERS.
   5. ALL DAMPER SHAFTS SHALL HAVE SEALED BEARINGS.

D. FLEXIBLE FABRIC DUCTWORK AND EQUIPMENT CONNECTIONS: 30 OZ. VENTFABRICS VENTGLAS OR DURO–DYNE DUROLON NEOPRENE COATED FIRE RETARDANT GLASS FABRIC.

E. DUCT SEALER: OIL RESISTANT ELASTOMER CONTAINING APPROXIMATELY 50% SOLIDS BY WEIGHT IN BLENDED KETONE SOLVENT. CONTAINER LABEL SHALL SHOW NAME OF MATERIAL, DATE OF MANUFACTURE, SHELF–LIFE, CURING TIME, MIXING AND APPLICATION INSTRUCTIONS. RCD CORPORATION NON–FLAMMABLE WATER BASED AIR DUCT SEALANT OR EQUAL.

F. ZINC RICH COATING: SOUTHERN COATINGS INC. 'GALVICON', ZRC PRODUCTS CO. 'ZRC' OR EQUAL. TOUCH UP DAMAGED SURFACES ON GALVANIZED SURFACES WITH ZINC–RICH COATING.

G. FASTENERS: ASTM A–307, GRADE A OR B WITH ASTM A 563 HEAVY NUTS, UNC THREADS, CADMIUM PLATING OR ELECTRO–GALVANIZING FINISH.

2.3 GRILLES, REGISTERS AND DIFFUSERS

A. PROVIDE GRILLES, REGISTERS, AND DIFFUSERS OF THE TYPES, SIZES AND MANUFACTURER IN THIS SPECIFICATION CALLED FOR ON PLANS AND IN SCHEDULE ON DRAWINGS.
   1. DIFFUSERS SHALL BE TESTED IN ACCORDANCE WITH ASHRAE STANDARD 70–1991.
   2. DIFFUSERS SHALL BE CONSTRUCTED OF STEEL, UNLESS NOTED OTHERWISE.
   3. DIFFUSER FINISH SHALL BE WHITE, BAKED ON, WITH A PENCIL HARDNESS OF HB TO H. THE PAINT MUST PASS A 100–HOUR ASTM D117 CORROSIVE ENVIRONMENTS SALT SPRAY TEST WITHOUT CREEPAGE, BLISTERING, OR DETERIORATION OF FILM. THE PAINT MUST PASS A 250–HOUR ASTM–870 WATER IMMERSION TEST. THE PAINT MUST PASS THE ASTM D–2794 REVERSE IMPACT CRACKING TEST WITH AN APPLIED FORCE OF 50 INCH–POUNDS. MANUFACTURERS: TITUS OR KRUEGER, NO EXCEPTIONS.

2.4 FILTER HOUSINGS AND FILTERS

A. FILTER HOUSING: CAMFIL FARR SIDELOCK HOUSING,
   1. DIMENSIONS, EFFICIENCIES AND CAPACITIES AS SCHEDULED ON THE DRAWINGS.
   2. HOUSING SHALL BE TWO STAGE WITH A 2" PRE–FILTER TRACK AND 12" HEPA FILTER SECTION WITH A SPRING LOADED CRANK MECHANISM FOR FILTER SEALING.
   3. HOUSING SHALL BE CONSTRUCTED OF 14 GA GALVANIZED STEEL WITH MATING FLANGES.
   4. REMOVABLE ACCESS DOORS SHALL INCLUDE HIGH MEMORY SPONGE NEOPRENE GASKET MATERIAL TO FACILITATE A DOOR TO FILTER SEAL. .
   5. UNIT SHALL HAVE INTEGRAL DIFFERENTIAL PRESSURE GAGE.

B. PRE–FILTERS
   1. HIGH CAPACITY PLEATED PANEL FILTER, (MERV 7) FARR 30/30, 2" DEPTH, 24"X24", INITIAL RESISTANCE 0.28"W.G.

C. HEPA FILTERS
   1. STANDARD CAPACITY HEPA FILTER, CAMFIL FARR XS ABSOLUTE, 99.99% EFFICIENT ON 0.3 MICRON PARTICLES AT 1000 CFM FLOW. INITIAL RESISTANCE 0.92? W.G. AT 1000 CFM FLOW RATE.

2.5 BOOSTER FAN

A. THE FANS SHALL BE CAPABLE OF OPERATING OVER THE ENTIRE CLASS RANGE IN ACCORDANCE WITH THE EQUIPMENT SCHEDULE AND AS DEFINED IN AMCA STANDARD 99–2408. FAN SHALL BE AS CALLED OUT IN THE EQUIPMENT SCHEDULE. FAN WHEELS SHALL BE CENTRIFUGAL WITH NONOVERLOADING AIRFOIL BLADES.

B. PERFORMANCE
   1. FAN RATINGS SHALL BE BASED ON TESTS MADE IN ACCORDANCE WITH AMCA STANDARD 210 IN AN ACCREDITED AMCA LABORATORY. FANS SHALL HAVE A SHARPLY RISING PRESSURE CHARACTERISTIC EXTENDING THROUGHOUT THE OPERATING RANGE TO ASSURE QUIET AND STABLE OPERATION FROM WIDE OPEN TO CLOSED OFF. FAN BRAKE HORSEPOWER AND STATIC PRESSURE REQUIREMENTS SHALL BE AS SHOWN ON THE EQUIPMENT SCHEDULE.

D. CONSTRUCTION
   1. FAN HOUSINGS ARE TO BE HEAVY GAUGE TUBULAR DESIGN, CONTINUOUSLY WELDED CONSTRUCTION. HOUSINGS OF SQUARE DESIGN, LOCK SEAMS OR SHEET METAL PANEL CONSTRUCTION ARE NOT ACCEPTABLE. INLET CONE SHALL BE AERODYNAMICALLY DESIGNED AND SPUN PROVIDING A MINIMUM SEPARATION OF AIR FLOW. WHEEL DIAMETERS AND OUTLET AREAS SHALL BE IN ACCORDANCE WITH THE STANDARD DIMENSIONS ADOPTED BY AMCA FOR TUBULAR CENTRIFUGAL FANS. DESIGNS NOT IN ACCORDANCE WITH AMCA STANDARD 99–2411 ARE NOT ACCEPTABLE.

E. PAINT
   1. ALL FAN SURFACES ARE TO BE THOROUGHLY PREPARED PRIOR TO PAINTING USING A COMBINATION OF WASHING AND HAND AND POWER TOOL CLEANING AS REQUIRED. AFTER CLEANING, ALL SURFACES ARE TO BE COATED WITH AN INDUSTRIAL GRADE ALKYD ENAMEL. SURFACES OF BOLTED COMPONENTS NOT ACCESSIBLE AFTER ASSEMBLY SHALL BE COATED AND ALLOWED TO DRY PRIOR TO FINAL ASSEMBLY. PRIMER ONLY WILL NOT BE ACCEPTED.

F. ACCESSORIES:
   1. ACCESSORIES SHALL BE PROVIDED AS CALLED FOR IN THE PLANS AND SPECIFICATIONS. REQUIRED ACCESSORIES INCLUDE:
      a. ACCESS – QUICK OPENING CLEANOUT DOOR – EASY ACCESS CONSTRUCTION
      b. FLANGED OUTLET
      c. OUTLET COMPANION FLANGE
      d. FLANGED INLET
      e. INLET COMPANION FLANGE

G. BALANCING
   1. ALL FAN WHEELS SHALL BE DYNAMICALLY BALANCED ON PRECISION BALANCERS.
   2. PRIOR TO SHIPMENT, COMPLETED FANS WITH MOTORS SHALL RECEIVE A FINAL TEST BALANCE AT THE SPECIFIED OPERATING SPEED.

2.6 VARIABLE FREQUENCY DRIVE FOR BF–1:

A. BOOSTER FAN VARIABLE FREQUENCY DRIVE, GRAHAM VLT SERIES 6000, OR APPROVED EQUAL. PROVIDE WITH (3) CONTACTOR BYPASS ENCLOSURE (DRIVE, OFF, LINE, CAPABLE OF OPERATION WITH THE DRIVE REMOVED FOR REPAIR), MOTOR STARTER, INTEGRAL 3% IMPEDANCE DC LINK REACTORS AND ACCESSORIES.

B. PROVIDE START–UP SERVICES FOR VARIABLE FREQUENCY DRIVE. SUBMIT INTEGRAL 3% IMPEDANCE DC LINK REACTORS START–UP REPORT AND PROVIDE SUPPORT FOR TESTING, ADJUSTING AND BALANCING, AND OWNER TRAINING (2 HOURS).

C. VFD BYPASS SHALL HAVE AN INTEGRAL LOCKABLE MAIN FUSED DISCONNECT AND LOW/OVER VOLTAGE PROTECTION. PROVIDE 36–MONTH WRITTEN WARRANTY FOR LABOR, MATERIALS AND DRIVE EQUIPMENT.

2.7 VIBRATION ISOLATORS

A. SPRING ISOLATORS SHALL BE FREE STANDING AND LATERALLY STABLE WITHOUT ANY HOUSING AND COMPLETE WITH A MOLDED NEOPRENE CUP OR 1/4" (6MM) NEOPRENE ACOUSTICAL FRICTION PAD BETWEEN THE BASEPLATE AND THE SUPPORT.

B. ALL MOUNTINGS SHALL HAVE LEVELING BOLTS THAT MUST BE RIGIDLY BOLTED TO THE EQUIPMENT. INSTALLED AND OPERATING HEIGHTS SHALL BE EQUAL. THE RATIO OF THE SPRING DIAMETER DIVIDED BY THE COMPRESSED SPRING HEIGHT SHALL BE NO LESS THAN 0.8.

C. SPRINGS SHALL HAVE A MINIMUM ADDITIONAL TRAVEL TO SOLID EQUAL TO 50% OF THE RATED DEFLECTION. SUBMITTALS SHALL INCLUDE SPRING DIAMETERS, DEFLECTION, COMPRESSED SPRING HEIGHT AND SOLID SPRING HEIGHT.

D. MOUNTINGS SHALL BE TYPE SLF, AS MANUFACTURED BY MASON INDUSTRIES, INC.

2.8 MECHANICAL SUPPORTING DEVICES

A. GENERAL:
   1. SECURELY FASTEN ALL MECHANICAL WORK TO THE STRUCTURE TO PREVENT HAZARD TO HUMAN LIFE AND LIMB, AND TO PREVENT DAMAGE TO PRODUCTS OF CONSTRUCTION UNDER ALL CONDITIONS OF OPERATION.

B. FOUNDATION AND SUPPORTS:
   1. MOUNT ALL EQUIPMENT, PLENUMS, AND DUCTWORK ON FOUNDATIONS OR SUSPEND FROM PRIMARY BUILDING STRUCTURE WITH ADDITIONAL STRUCTURAL MEMBERS AS REQUIRED TO PROVIDE SECURE AND SAFE PERMANENT INSTALLATION. DESIGN ADDITIONAL STRUCTURAL MEMBERS FOR LOAD IMPOSED. PROVIDE VIBRATION ISOLATION BETWEEN EQUIPMENT AND SUPPORTING STRUCTURE.

2.9 DISCONNECT SWITCHES

A. ALL MECHANICAL EQUIPMENT REQUIRING DISCONNECT SWITCHES AND OVER CURRENT PROTECTION SHALL BE SUPPLIED PER MANUFACTURER RECOMMENDATIONS AND MEET THE NATIONAL ELECTRICAL CODE.

3.1 TESTING, ADJUSTING, AND BALANCING

A. SCOPE.
   1. FURNISH THE SERVICES OF A QUALIFIED AND APPROVED INDEPENDENT BALANCING AND TESTING AGENCY TO PERFORM THE WORK OF THIS SPECIFICATION SECTION.
   2. THE WORK OF THIS SECTION INCLUDES, BUT IS NOT NECESSARILY LIMITED TO:
      a. TESTING AND BALANCING ALL FANS AND ALL AIR HANDLING SYSTEMS.
      b. WORKING DIRECTLY WITH THE MECHANICAL CONTRACTOR TO OBTAIN PROPER SYSTEM OPERATION AND ADJUSTMENTS.
      c. PROVIDING A FINAL REPORT.

B. QUALIFICATION OF AGENCY
   1. SUBCONTRACTOR MINIMUM QUALIFICATIONS INCLUDE:
      a. MAINTAIN A COMPLETE SERVICE ORGANIZATION THAT HAS OPERATED WITHIN WASHINGTON FOR AT LEAST THREE YEARS PRIOR TO BID DATE OF THIS PROJECT.
      b. DEMONSTRATE SATISFACTORY COMPLETION OF FIVE PROJECTS OF SIMILAR SIZE AND SCOPE IN THE STATE OF WASHINGTON. SUBMIT REFERENCES.
      c. BIDS BY SUPPLIERS, CONTRACTORS, OR BY A FIRM THAT DOES NOT MAINTAIN A FULL–TIME STAFF OF ACTIVE AND EXPERIENCED HVAC SYSTEMS BALANCERS ARE NOT ACCEPTABLE.
      d. NEBB – CERTIFIED IN TESTING, ADJUSTING, AND BALANCING, NO EXCEPTIONS.

C. BALANCING REPORT
   1. COMPILE THE TEST DATA AND SUBMIT FOUR COPIES OF THE COMPLETE TEST DATA FOR FORWARDING TO THE ENGINEER FOR ACCEPTANCE AND/OR ANALYSIS AND RECOMMENDATIONS.
   2. INCLUDE A COMPLETE LIST OF ALL TEST EQUIPMENT USED, INCLUDING APPARATUS MANUFACTURER'S NAME, MODEL NUMBER, SERIAL NUMBER, AND DATE LAST CALIBRATED.
   3. PROVIDE FULL SIZE SCALE DRAWINGS OF THE ENTIRE FACILITY. INCLUDE COMPLETE IDENTIFICATION OF ALL ELEMENTS. IDENTIFY BY ROOM NAME AND NUMBER, AIR OUTLET SYMBOL, ORIENTATION IN ROOM, ETC., TO CLEARLY AND POSITIVELY IDENTIFY THE LOCATION OF EACH ELEMENT. RECORD FLOWRATES, BALANCING DAMPER POSITION, AND STATIC PRESSURES FOR ALL DUCTWORK, AIR–HANDLING EQUIPMENT AND TERMINAL AIR DEVICES.
   4. TABULATE DATA SEPARATELY FOR EACH SYSTEM. DESCRIBE BALANCING METHOD USED FOR EACH SYSTEM.
   5. FAN DATA: INCLUDE 8 1/2X11, MINIMUM, FACTORY PERFORMANCE CURVES FOR ALL FANS (AHU, BF, OR EXHAUST). EACH CURVE SHALL CLEARLY INDICATE FAN RPM AT FULL FLOW, FAN CFM AT MAXIMUM AVAILABLE HORSEPOWER, AND OPERATING CONDITIONS OF FAN AT END OF BALANCING PROCEDURE (HP, RPM, AMPS, SPEED CENTRAL SETTING).
   6. INCLUDE AT THE FRONT OF THE REPORT A SUMMARY OF PROBLEMS ENCOUNTERED, DEVIATIONS FROM DESIGN, REMAINING PROBLEMS, RECOMMENDATIONS, AND COMMENTS.

| REV NO | DATE | BY | DESCRIPTION | APPROVED |
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| | | | | |

8/24/2007 DATE OF ISSUE

GILBERT L. HIBBS STATE OF WASHINGTON 13449 REGISTERED PROFESSIONAL ENGINEER

EXPIRES 10/31/09



| DRAWN BY: | GLH | DESIGN GM |
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| CHECKED BY: | | DESIGN A/E |
| | | HEI APPROVAL |

MECHANICAL SPECIFICATIONS

CAD FILE: 100601M0201.DWG

PROJECT NUMBER: 1006.01

LIGO–CA INSTITUTE OF TECHNOLOGY
STAGING BUILDING MECHANICAL MODIFICATIONS

HIBBS ENGINEERING, INC.
KENNEWICK, WASHINGTON

DRAWING NUMBER M6.2 REV 0

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