MEMO

To: Margaret Oscilia, PE (DEQ)

From: Jill Betts, R.G.

Date: December 22, 2024

SUBJECT: **M Carter Commons (MCC) Development**
Request to Review and Advise on Vapor and Radon Mitigation System Plans and Specifications
3715-3717 N Interstate Ave, Portland, OR 97227

The MCC design and construction team are requesting DEQ review the enclosed plans and specifications prior to construction and advise on the design of the vapor and radon mitigation system that will be installed in the event contaminated soil be left in-place. While contamination is not anticipated based on investigation data gathered to date, the MCC team appreciates DEQ's review and advisement to avoid costly construction delays and to protect future building occupants.

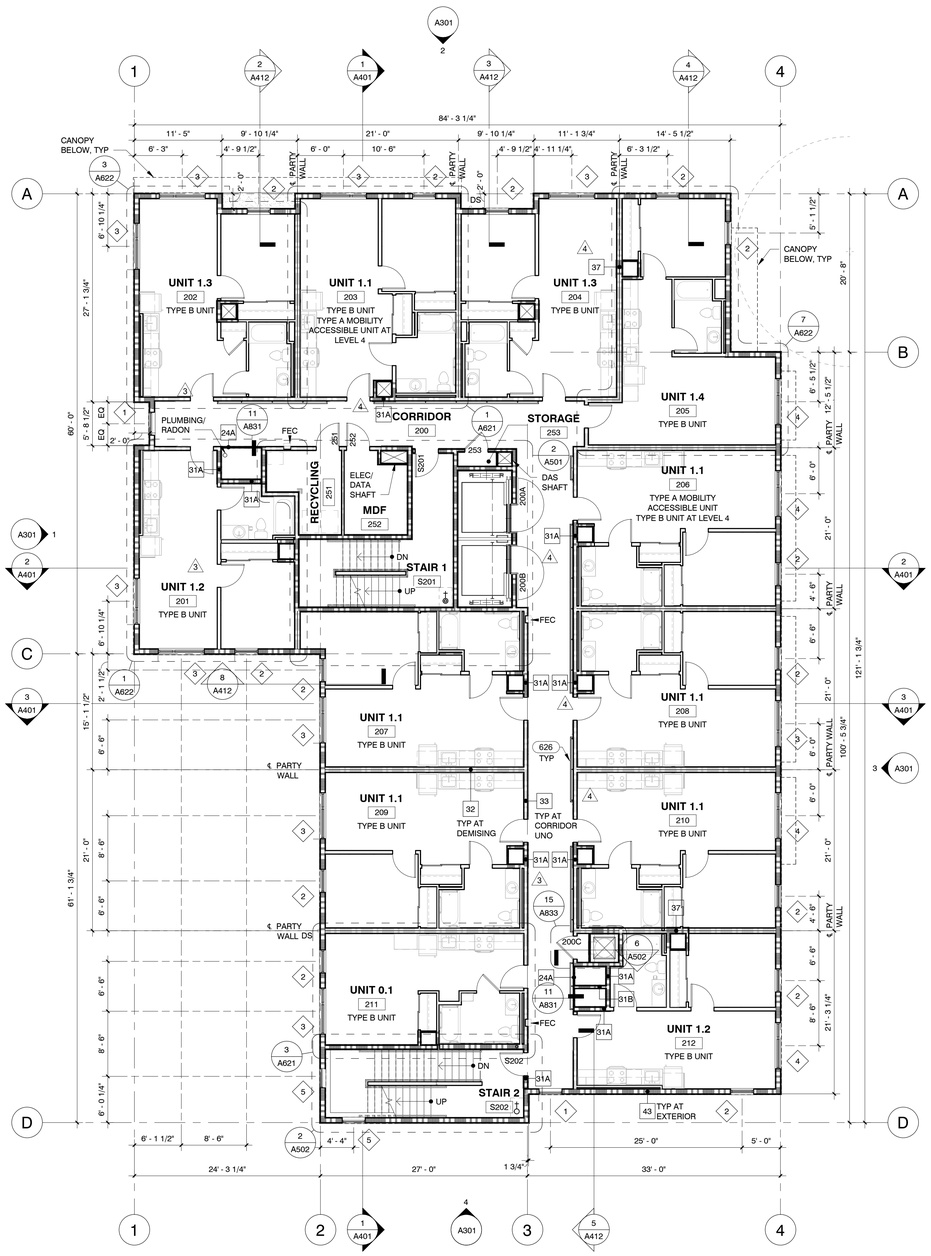
Two plan sets, architectural plans and mechanical plans, and the specifications are attached. Notes regarding these documents are listed below:

- The size of the active vapor/radon mitigation system is based on Code 1811.3.4, Gas Conveyance Piping Systems (GCPS).
- The fan(s) to be used for the vapor/radon mitigation system are the Rn Radon fan by fintech®.
- Vapor barrier installation and the vertical piping sealing and taping are highlighted and described in the plans and specifications, and the manufacturer's installation instructions are referenced. The contractor will use Stego products.
- The architectural plans show the ground floor plan, slab plan, building section and assembly sheet. Assembly #1 has information about the vapor retarder. The slab assembly is tagged, and the floor and slab plans show the sections location.

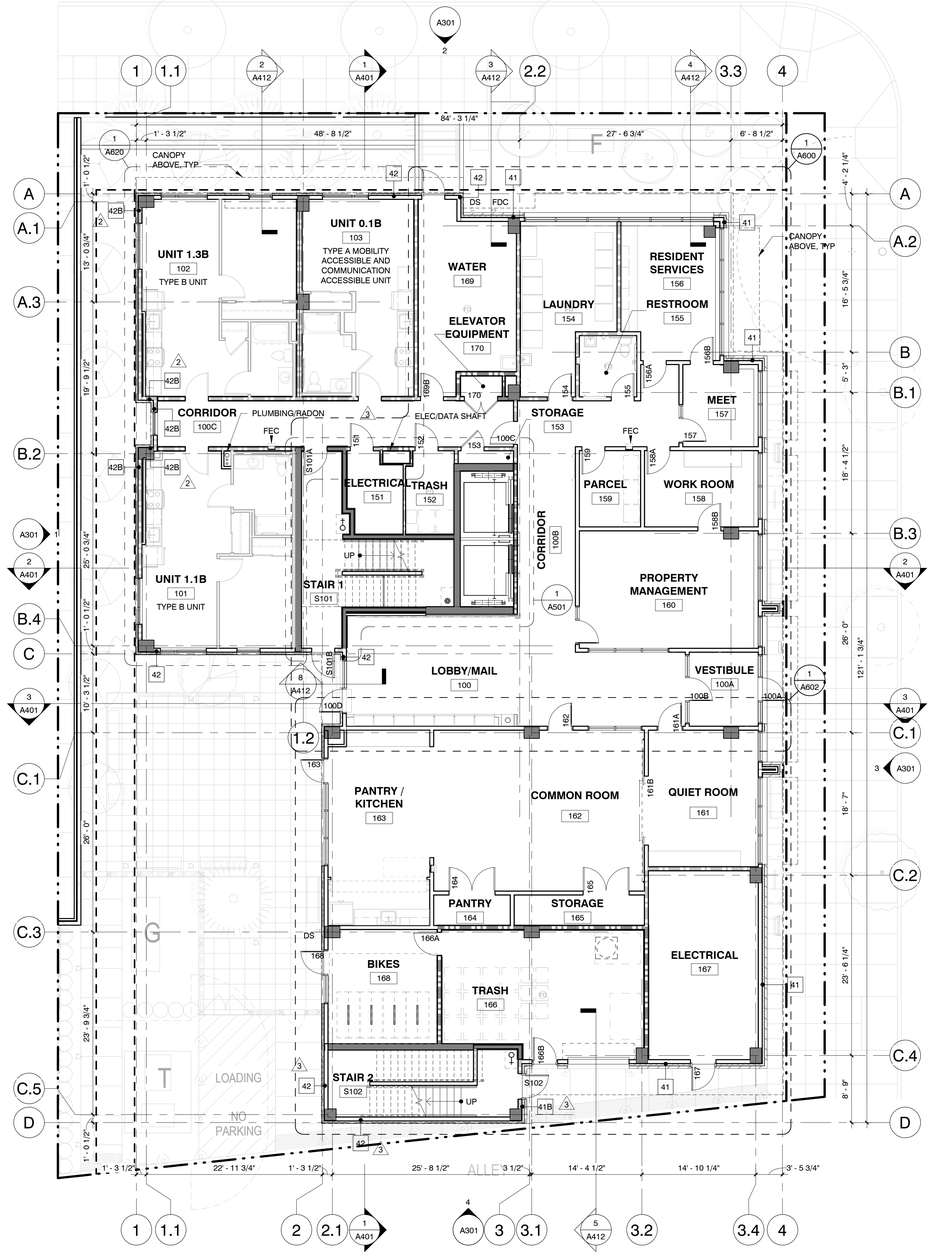
Please reach out to Jill Betts with any questions. We look forward to meeting with you soon to discuss any questions and comments you and DEQ may have.

cc:
Jeff Schatz, R.G., DEQ
Brian Church, DEQ
Lorenzo Danielson, DEQ
Mary Bradshaw, Northwest Housing Alternatives
Carson Bowler, Law Office of Carson Bowler

Attachments:
Architectural Plans with Vapor Barrier Details
Mechanical Plans for the Radon Mitigation System
Specifications, Dated August 20, 2024



2 A201 **FLOOR PLAN - LEVEL 2 (LEVEL 4 SIM)**
1/8" = 1'-0"



1 A201 **FLOOR PLAN - LEVEL 1**
1/8" = 1'-0"

FLOOR PLAN NOTES

1. ALL DIMENSIONS ARE TO FACE OF STUD, FACE OF SLAB, AND CENTERLINE OF COLUMN OR OPENING, UNO. DIMENSIONS INDICATED AS "CLR" ARE TO FACE OF FINISH UNO.
2. ALIGN ALL FINISHES ALONG WALL WITHIN ROOM.
3. SEE EXTERIOR ELEVATIONS FOR ALL MECHANICAL VENT LOCATIONS. ALL VENTS TO BE GREATER THAN 3'-0" FROM ALL OPERABLE OPENINGS.
4. ROOMS CONTAINING FIRE PROTECTION EQUIPTMENT SHALL BE IDENTIFIED IN AN APPROVED MANNER. SIGNS SHALL BE CONSTRUCTED OF DURABLE MATERIALS, PERMANENTLY INSTALLED AND READILY VISIBLE.
5. ALL FIXTURES, FURNISHINGS & EQUIPMENT NOT IN CONTRACT SHOWN DASHED FOR REFERENCE ONLY.
6. SEE **A831** FOR FIRE-RATED WALL INTERSECTION DETAILS.
7. SEE **A832** FOR RATED ASSEMBLY PENETRATION DETAILS AND FIRE EXTINGUISHER CABINET DETAIL. COORDINATE FEC LOCATIONS WITH FIRE MARSHALL.
8. SEE **A850** FOR STANDARD ACCESSIBILITY REQUIREMENTS INCLUDING SIGNAGE, FIXTURE AND ACCESSORY MOUNTING HEIGHTS, BLOCKING AND CLEARANCES.
9. COMBINATION SMOKE & CARBON MONOXIDE DETECTORS SHALL BE HARDWIRED AND PROVIDED THROUGHOUT COMMON AREAS AND WITHIN EACH LIVING ROOM & BEDROOM. CARBON MONOXIDE DETECTORS SHALL COMPLY WITH OSSC 915 & SMOKE ALARMS PER OSSC 907.2.
10. SEE ENLARGED PLANS FOR ADDITIONAL DIMENSIONS AND ANNOTATIONS.

WALL TYPE NOTES

1. SEE SPECIFIC WALL ASSEMBLY TYPES ON FLOOR PLANS AND **A801** FOR DETAILS.
2. AT RATED WALLS ADDITIONAL PROTECTION FEATURES ARE REQUIRED. SEE DOOR AND WINDOW SCHEDULES FOR RATINGS, MECHANICAL DRAWINGS, INTERSECTION DETAILS, PENETRATION DETAILS, AND JOINT DETAILS.
3. AT RATED WALLS, IN ACCESSIBLE CONCEALED SPACES PER OSSC 703.5, PROVIDE PERMANENT SIGNAGE NOTING 'FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS'.
4. FIRE PARTITIONS SHALL EXTEND FROM THE TOP OF THE FLOOR ASSEMBLY BELOW AND BE SECURELY ATTACHED TO EITHER THE UNDERSIDE OF THE FLOOR OR ROOF SHEATHING, DECK OR SLAB ABOVE OR THE UNDERSIDE OF A FLOOR/CEILING OR ROOF/CEILING ASSEMBLY HAVING A FIRE-RESISTANCE RATING THAT IS NOT LESS THAN THAT OF THE FIRE PARTITION.
5. FIRE BARRIERS SHALL EXTEND FROM THE TOP OF THE FLOOR ASSEMBLY BELOW TO THE UNDERSIDE OF THE FLOOR OR ROOF SHEATHING, SLAB OR DECK ABOVE AND SHALL BE SECURELY ATTACHED THERETO. FIRE BARRIERS SHALL BE CONTINUOUS THROUGH CONCEALED SPACE

WALL TYPE LEGEND

3-HR RATED WALL OR COLUMN
ADDITIONAL PROTECTION FEATURES REQUIRED

2-HR RATED WALL
ADDITIONAL PROTECTION FEATURES REQUIRED

1-HR RATED WALL
ADDITIONAL PROTECTION FEATURES REQUIRED

NON-RATED WALL
NO ADDITIONAL PROTECTION FEATURES

SEE FLS PLANS FOR SPECIFIC WALL TYPE CLASSIFICATIONS

NOTES AND DIMENSIONS ADDED FOR CLARIFICATION 4

0 4' 8' 16'

N

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SALAZAR ARCHITECT
2222 NE OREGON ST., SUITE 101
PORTLAND, OR 97232
503.702.2575
WWW.SALAZARCH.COM

PROJECT NUMBER: 2225

M. CARTER COMMONS

3675 N INTERSTATE AVE
PORTLAND, OR 97227

CLIENT:

Northwest Housing Alternatives
2316 SE WILLARD ST., MILWAUKIE OR 97222

Urban League of Portland
10 N RUSSELL ST., PORTLAND OR 97227

PHASE:
PERMIT SET

REVISIONS:

#	DATE	DESCRIPTION
4	09.13.24	BID SET ADDENDUM 1
3	09.06.24	PLAN REVIEW CYCLE 1 ADDENDUM 1
2	08.20.24	PLAN REVIEW CYCLE 1

SHEET TITLE:
LEVEL 1 & LEVEL 2 PLANS

DRAWN BY: ANS
CHECKED BY: DV, JN
DATE: 04.01.24

SHEET:
A201

12/10/2024 4:00:04 PM
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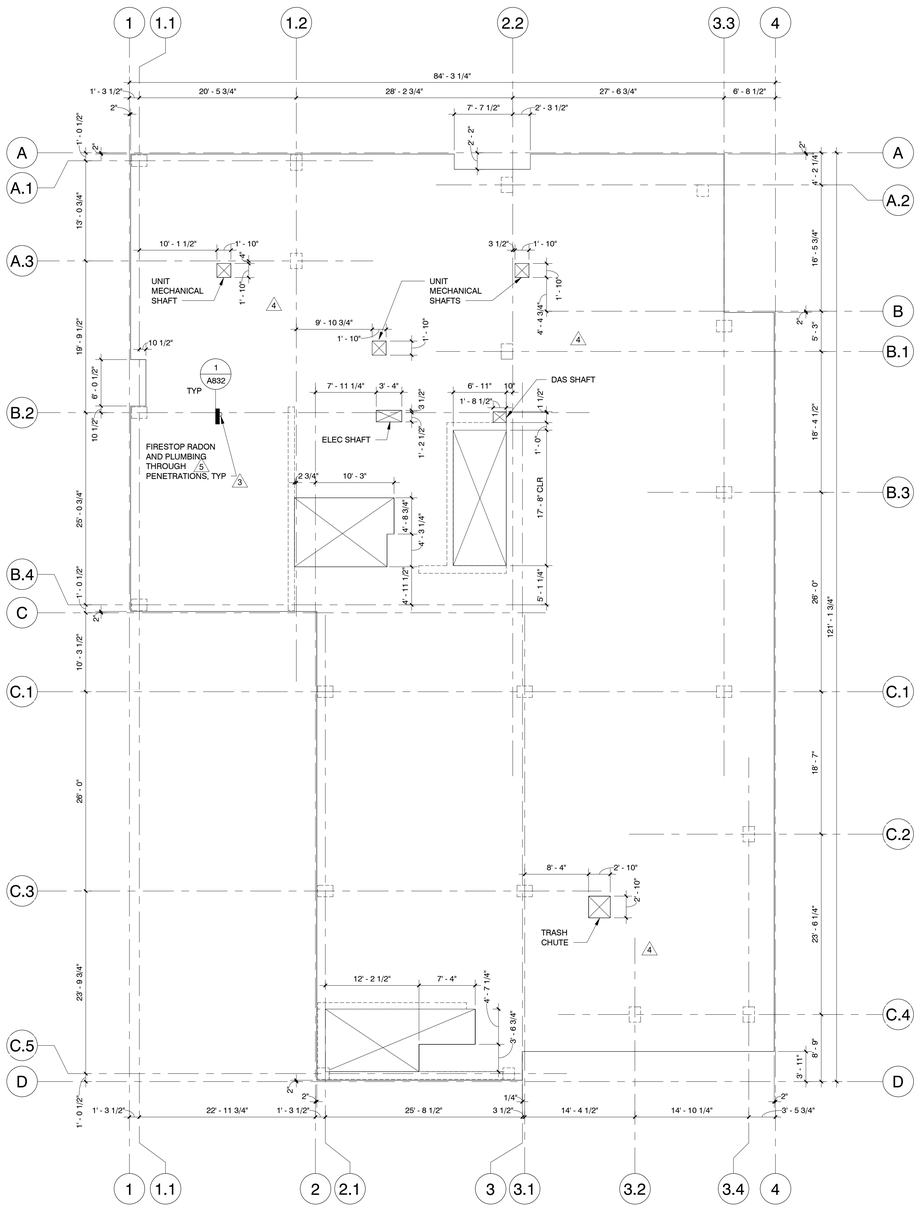
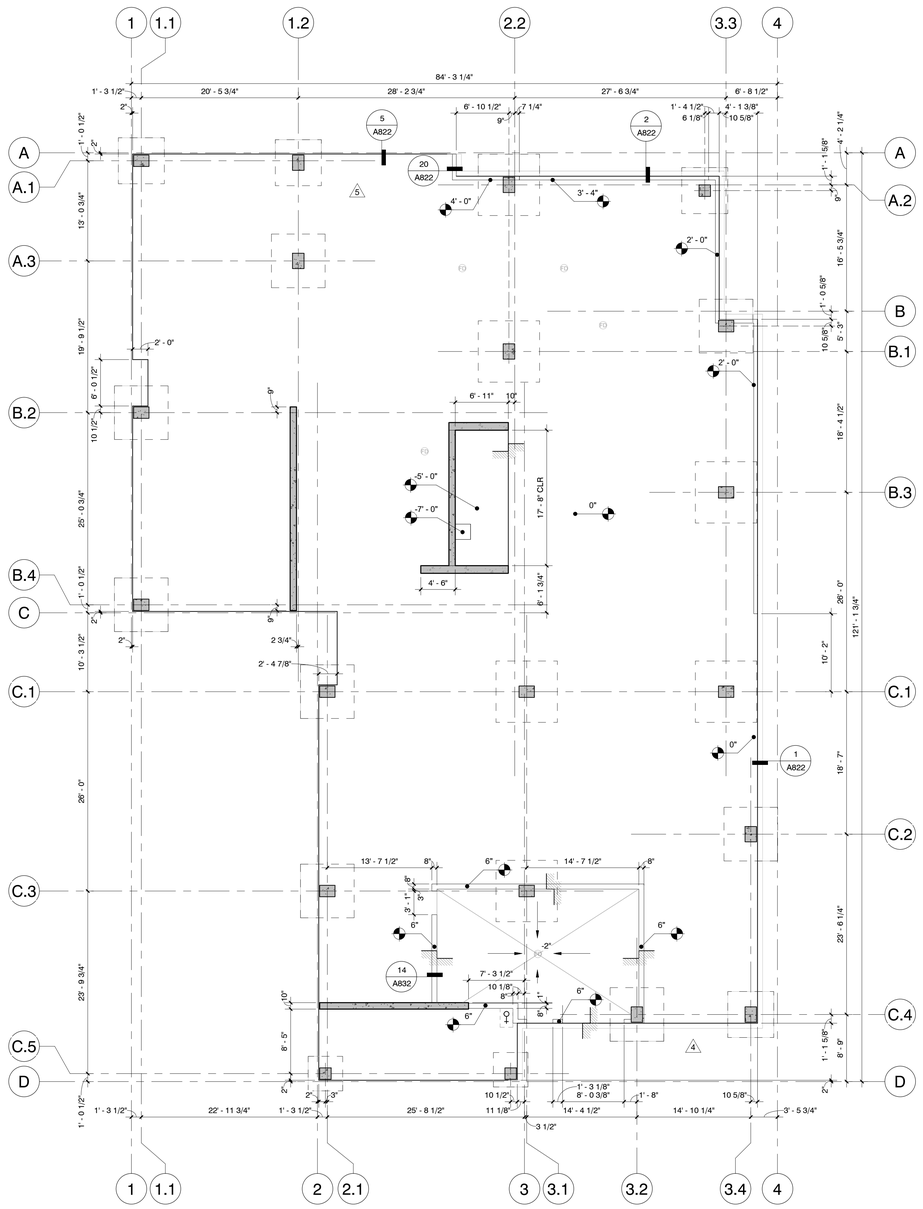
SLAB PLAN NOTES

1. VERIFY ALL DOOR OPENINGS SIZED IN CURBS WITH DOOR MFR.
2. ALL DIMENSIONS ARE TO FACE OF CONCRETE, FACE OF FOUNDATION, OR CENTER OF COLUMN UNO.



2 / A201s **SLAB PLAN - LEVEL 2**

1/8" = 1'-0"



1 / A201s **SLAB PLAN - LEVEL 1**

1/8" = 1'-0"

NOTES AND DIMENSIONS ADDED FOR CLARIFICATION

4

0 4' 8' 16'

N

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PERMIT SET

REVISIONS:

#	DATE	DESCRIPTION
5	10.25.24	PLAN REVIEW CYCLE 2
4	09.13.24	BID SET ADDENDUM 1
3	09.06.24	PLAN REVIEW CYCLE 1 ADDENDUM 1

SHEET TITLE:

LEVEL 1 & LEVEL 2 SLAB PLANS

DRAWN BY:	AS
CHECKED BY:	DV, JN
DATE:	04.01.24

SHEET:

A201s

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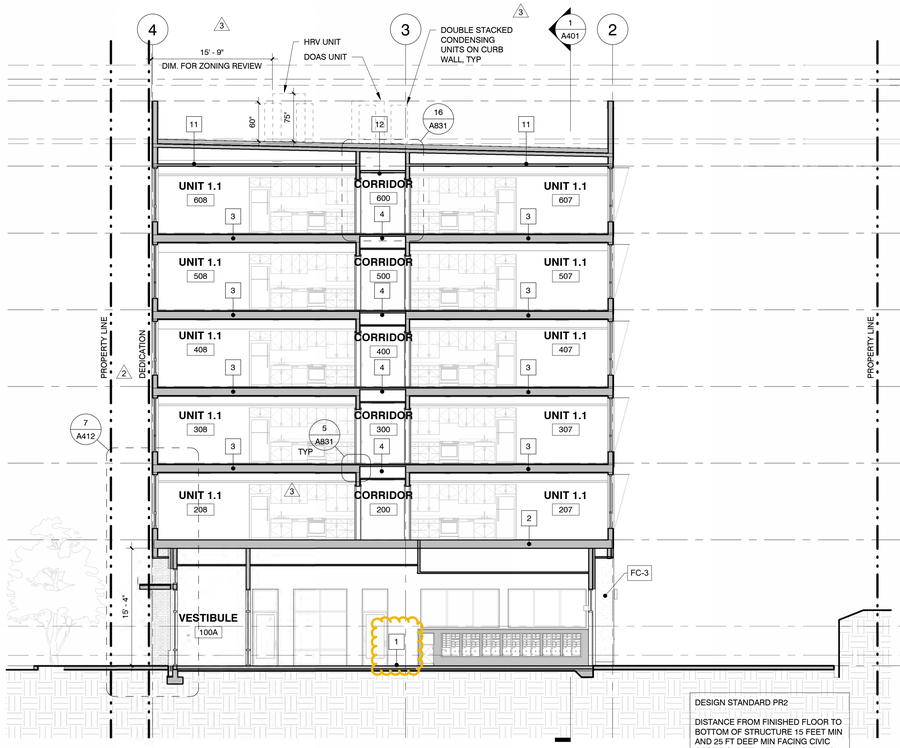
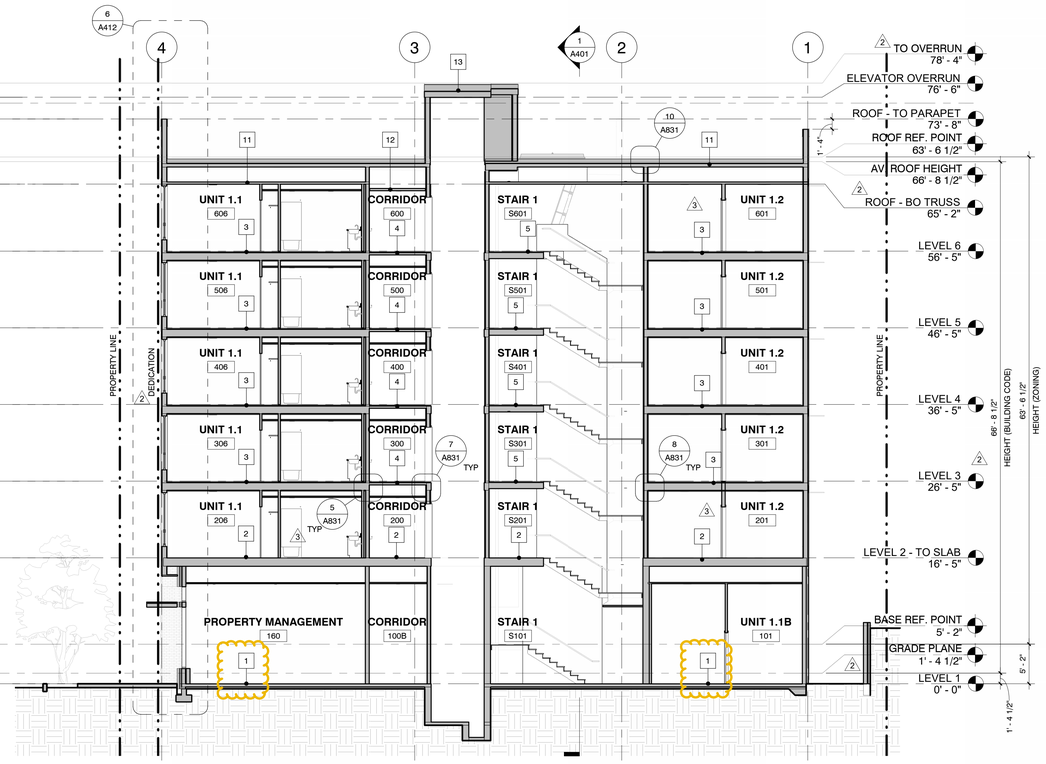


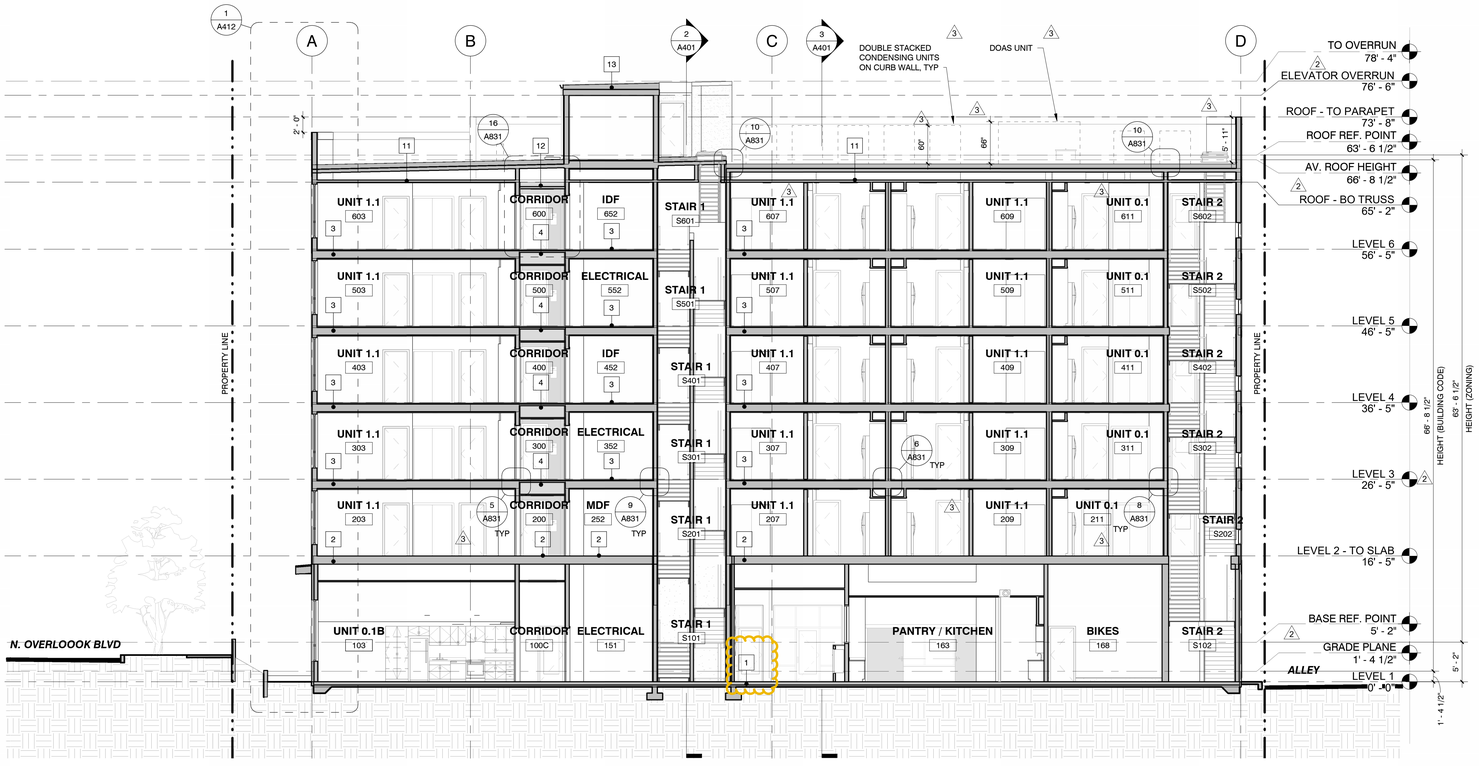
DESIGN STANDARD PR2

DISTANCE FROM FINISHED FLOOR TO BOTTOM OF STRUCTURE 15 FEET MIN AND 25 FT DEEP MIN FACING CIVIC CORRIDO (METAL FRAMED GROUND FLOOR INTERIOR WALLS ARE NOT LOAD BEARING)

3 A401 **SECTION 3**
1/8" = 1'-0"



2 A401 **SECTION 2**
1/8" = 1'-0"



1 A401 **SECTION 1**
1/8" = 1'-0"

BUILDING SECTION NOTES

1. REFER TO G010 FOR ENERGY CODE COMPLIANCE REQUIREMENTS.
2. SEE WALL SECTIONS AND DETAILS FOR INFORMATION ON CONTINUITY OF ALL EXTERIOR CONTROL LAYERS.
3. WHERE EXTERIOR ELEMENTS INTERFACE WITH INTERIOR SEE ENLARGED PLAN SHEETS FOR ADDITIONAL INFORMATION.
4. TYPICAL ROOF CONDITIONS SHOWN - SEE ROOF PLANS FOR ROOF CONFIGURATION AND PITCH.

KEYNOTES

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PERMIT SET

REVISIONS:

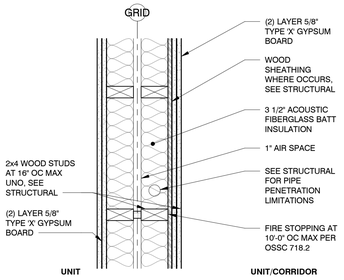
#	DATE	DESCRIPTION
3	09.06.24	PLAN REVIEW CYCLE 1 ADDENDUM 1
2	08.20.24	PLAN REVIEW CYCLE 1

SHEET TITLE:
BUILDING SECTIONS

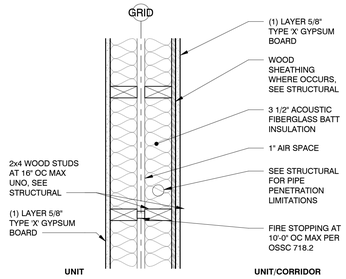
DRAWN BY:	ANS
CHECKED BY:	DV, JN
DATE:	04.01.24

SHEET:
A401

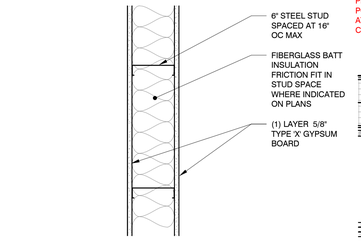
0 4' 8' 16'



37 **2HR PARTY WALL - WOOD STUD**
ASSEMBLY: UL V324 (5) SOUND TEST: OC DLDWS167 — FIRE: 2HR SOUND: 64 STC



32 **1HR PARTY WALL - WOOD STUD**
ASSEMBLY: ULV324 (5) SOUND TEST: OC SLDWS257 — FIRE: 1HR SOUND: 55 STC

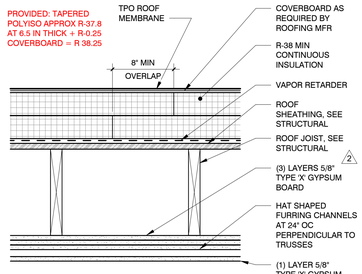


25B 3 5/8" STEEL STUDS IN LIEU OF 6" STEEL STUDS

25A **1HR INTERIOR WALL - METAL STUD**
ASSEMBLY: GA WP 1072 — FIRE: 1HR

REQUIRED: R38

PROVIDED: TAPERED POLYISO APPROX R-37.8 AT 6.5 IN THICK + R-0.25 COVERBOARD = R 38.25



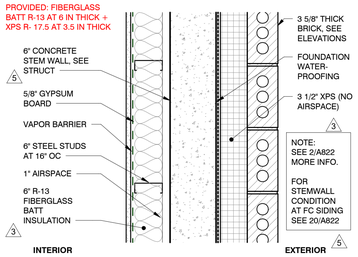
13 **2HR OVERRUN ROOF/CEILING**
ASSEMBLY: GA RC 2750 — FIRE: 2HR

ASSEMBLY NOTES

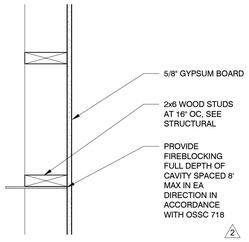
1. WHERE A NON-SHEARWALL EXTENDS AND ALIGNS PARALLEL WITH A SHEAR WALL, PROVIDE ADDITIONAL SHEATHING LAYERS TO THE NONSHEAR WALL TO PROVIDE CONTINUOUS FACE OF FINISH.
2. LOCATE THERMAL INSULATION ON THE COLD SIDE (IN WINTER) OF DOMESTIC WATER PIPES AS REQUIRED TO PROTECT PIPE FROM FREEZING.
3. PROVIDE ADDITIONAL FRAMING, BLOCKING, AND FINISHES AS REQUIRED FOR PLUMBING ACCESS PANELS.
4. PROVIDE ADDITIONAL BLOCKING AS REQUIRED TO SUPPORT SHELVING, TOWEL BARS, GRAB BARS, RAILINGS, AND ALL OTHER WALL-MOUNTED ACCESSORIES AND EQUIPMENT.
5. PROVIDE UL APPROVED THROUGH PENETRATION AND MEMBRANE PENETRATION FIRESTOP SYSTEMS AS REQUIRED BY CODE AT ALL ELECTRICAL, PLUMBING, AND MECHANICAL PENETRATIONS IN FIRE-RATED ASSEMBLIES, SEE XX/XX.
6. PROVIDE WATER RESISTANT GYPSUM BOARD AT BATH TUB AND SHOWER WALLS.
7. PROVIDE FIRE BLOCKING & DRAFTSTOPS IN CONCEALED SPACES BETWEEN RATED ASSEMBLIES, PROVIDE FIRE BLOCKS AND DRAFT STOPS PER 2014 OSSC SECTION 718.
8. PROVIDE FIRE BLOCKING IN CONCEALED SPACES OF WALLS, PARTITIONS, AND FURRED SPACES AT 10 FT OC MIN IN BOTH VERTICAL AND HORIZONTAL DIRECTIONS AND AT ALL INTERCONNECTIONS BETWEEN CONCEALED VERTICAL AND HORIZONTAL SPACES.
9. PROVIDE FLUID APPLIED WATERPROOFING AT EXTERIOR FOUNDATIONS, FOOTINGS AND SUBGRADE WALLS. BLIND-SIDE ATTACHED BENTONITE WATERPROOFING TO BE USED AT SHORED WALLS.
10. SEE LISTED ASSEMBLIES SHEETS FOR DETAILED ASSEMBLY INFORMATION

REQUIRED: R-19

PROVIDED: FIBERGLASS BATT R-13 AT 6 IN THICK + XPS R- 17.5 AT 3.5 IN THICK

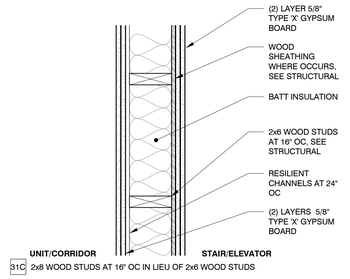


44 **NR MASS WALL**
ASSEMBLY: N/A — FIRE: NR



36B 2x4 WOOD STUDS AT 16" OC IN LIEU OF 2x6 WOOD STUDS

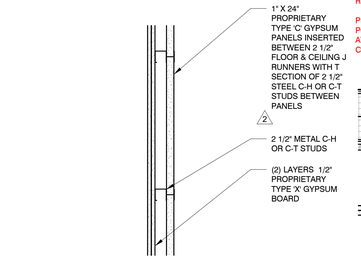
36A **NR INT FURRING WALL - WOOD STUD**
ASSEMBLY: N/A



31C 2x8 WOOD STUDS AT 16" OC IN LIEU OF 2x6 WOOD STUDS

31B 2x4 WOOD STUDS AT 16" OC IN LIEU OF 2x6 WOOD STUDS

31A **2HR INTERIOR WALL - WOOD STUD**
ASSEMBLY: UL U334 — FIRE: 2HR SOUND: 62 STC

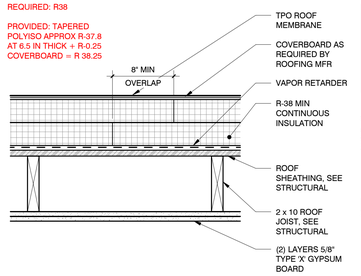


24B REPLACE 2 1/2" RUNNERS & STUDS WITH 6"

24A **2HR INTERIOR SHAFT WALL**
ASSEMBLY: GA WP 7051 — FIRE: 2HR

REQUIRED: R38

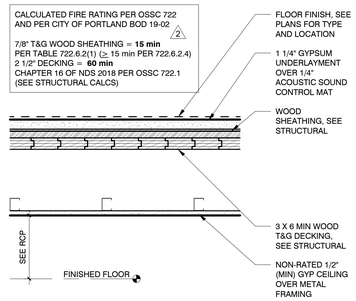
PROVIDED: TAPERED POLYISO APPROX R-37.8 AT 6.5 IN THICK + R-0.25 COVERBOARD = R 38.25



12 **1 HR CORRIDOR ROOF/CEILING**
ASSEMBLY: GA RC 2601 — FIRE: 1HR

CALCULATED FIRE RATING PER OSSC 722 AND PER CITY OF PORTLAND BOD 19-02 (2)

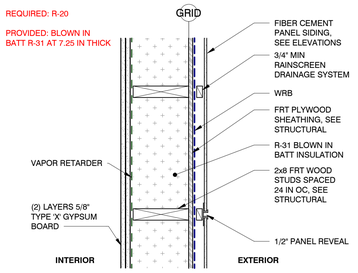
7/8" T&G WOOD SHEATHING = **15 min** PER TABLE 722.6.2(1) (≥ 15 min PER 722.6.2.4)
2 1/2" DECKING = **60 min**
CHAPTER 16 OF NDS 2018 PER OSSC 722.1
(SEE STRUCTURAL CALCS)



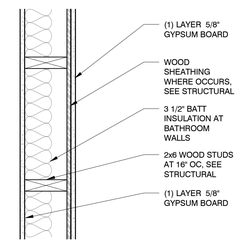
4 **1 HR CORRIDOR FLOOR/CEILING**
ASSEMBLY: OSSC 722.1 - NDS - SEE STRUCTURAL — FIRE: 1HR

REQUIRED: R-20

PROVIDED: BLOWN IN BATT R-31 AT 7.25 IN THICK

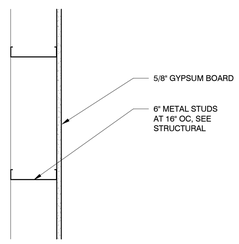


43 **2HR EXTERIOR WALL - FIBER CEMENT**
ASSEMBLY: UL V314 — FIRE: 2HR



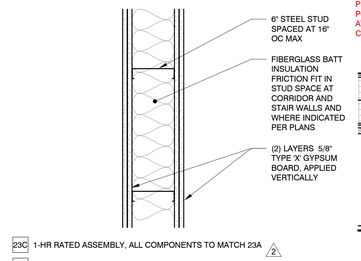
35B 2x4 WOOD STUDS AT 16" OC IN LIEU OF 2x6 WOOD STUDS

35A **NR INTERIOR WALL - WOOD STUD**
ASSEMBLY: N/A



28B 3 5/8" METAL STUDS AT 16" OC IN LIEU OF 6" METAL STUDS

28A **NR INT FURRING WALL - METAL STUD**
ASSEMBLY: N/A



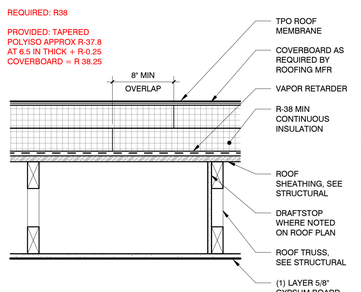
23C 1-HR RATED ASSEMBLY, ALL COMPONENTS TO MATCH 23A

23B 3 5/8" STEEL STUDS IN LIEU OF 6" STEEL STUDS

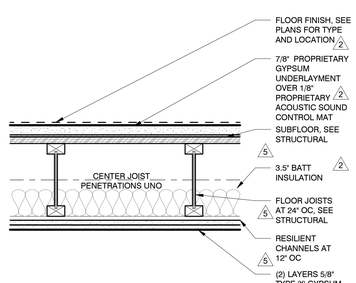
23A **2HR INTERIOR WALL - METAL STUD**
ASSEMBLY: GA WP 1522 NRCC 818-NV, 2-3-81 — FIRE: 2HR SOUND: STC 55

REQUIRED: R38

PROVIDED: TAPERED POLYISO APPROX R-37.8 AT 6.5 IN THICK + R-0.25 COVERBOARD = R 38.25



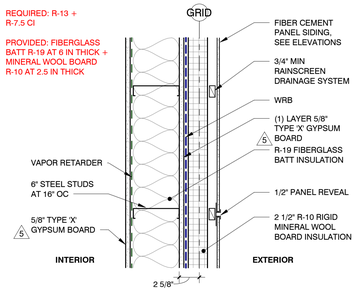
11 **NON-RATED ROOF/CEILING**
ASSEMBLY: N/A



3 **1HR FLOOR/CEILING**
ASSEMBLY: UL L570, SYSTEM NO. 2 (2) (5) SOUND REPORT: F2586.06-113-R0 — FIRE: 1HR SOUND: STC 61, IIC 54

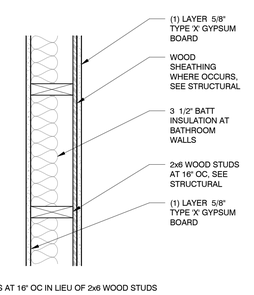
REQUIRED: R-13 + R-7.5 CI

PROVIDED: FIBERGLASS BATT R-19 AT 6 IN THICK + MINERAL WOOL BOARD R-10 AT 2.5 IN THICK



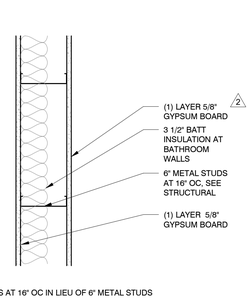
42B ASSEMBLY GA WP 1072 FOR 1-HR RATED GROUND FLOOR EXTERIOR WALLS WITH FSD < 30'

42 **NR EXTERIOR WALL - FIBER CEMENT**
ASSEMBLY: N/A — FIRE: NR



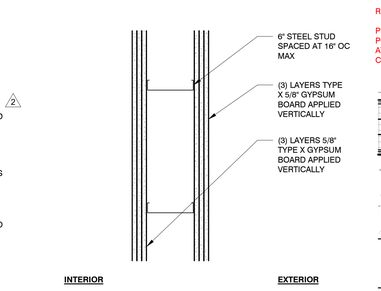
34B 2x4 WOOD STUDS AT 16" OC IN LIEU OF 2x6 WOOD STUDS

34A **1HR INTERIOR WALL - WOOD STUD**
ASSEMBLY: GA WP 3510 — FIRE: 1HR



27B 3 5/8" METAL STUDS AT 16" OC IN LIEU OF 6" METAL STUDS

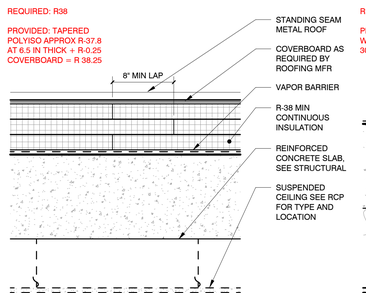
27A **NR INTERIOR WALL - METAL STUD**
ASSEMBLY: N/A



22 **3HR INTERIOR WALL - METAL STUD**
ASSEMBLY: UL W460 — FIRE: 3HR

REQUIRED: R38

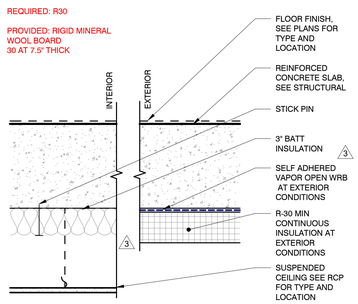
PROVIDED: TAPERED POLYISO APPROX R-37.8 AT 6.5 IN THICK + R-0.25 COVERBOARD = R 38.25



10 **3HR ROOF - PT CONCRETE**
ASSEMBLY: OSSC TABLE 721.1(3) 1-1.1 (2) — FIRE: 3HR

REQUIRED: R30

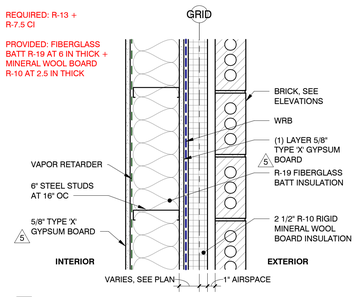
PROVIDED: RIGID MINERAL WOOL BOARD 30 AT 7.5" THICK



2 **3HR FLOOR/CEILING - PT CONCRETE**
ASSEMBLY: OSSC TABLE 721.1(3) (5) SOUND REPORT: 23-05L2 — FIRE: 3HR (5) SOUND: STC 57, IIC 53

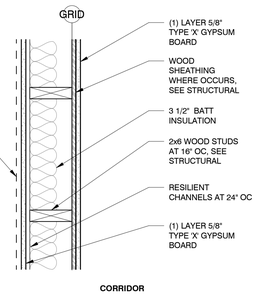
REQUIRED: R-13 + R-7.5 CI

PROVIDED: FIBERGLASS BATT R-19 AT 6 IN THICK + MINERAL WOOL BOARD R-10 AT 2.5 IN THICK

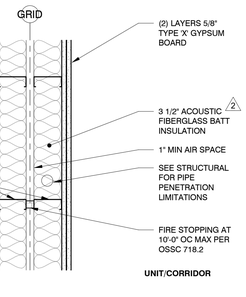


41B ASSEMBLY GA WP 1072 FOR 1-HR RATED GROUND FLOOR EXTERIOR WALLS

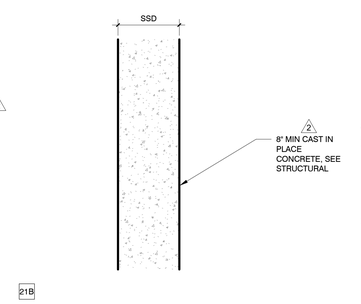
41 **NR EXTERIOR WALL - BRICK**
ASSEMBLY: N/A — FIRE: NR



33 **1HR CORRIDOR WALL - WOOD STUD**
ASSEMBLY: GA WP 3243 SOUND TEST NRC-TL-97-003 — FIRE: 1HR SOUND: STC 51

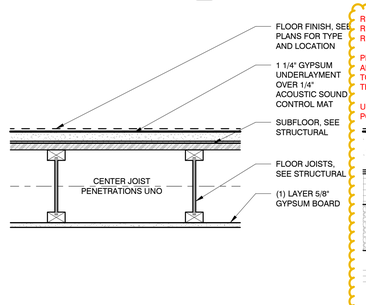


26 **1HR PARTY WALL - METAL STUD**
ASSEMBLY: GA WP 5006 — FIRE: 1HR SOUND: 60-64 STC



21B

21 **3HR INTERIOR WALL - CONCRETE**
ASSEMBLY: OSSC TABLE 721.1(2) 4-1.1 SILICEOUS PORTLAND CEMENT ASSOC. 76-77 — FIRE: 3HR SOUND: STC 58 (2)

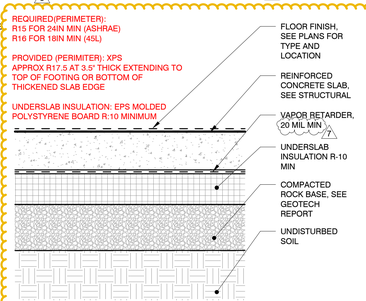


5 **NON-RATED STAIR LANDING**
ASSEMBLY: N/A

REQUIRED(PERIMETER): R15 FOR 24IN MIN (ASHRAE) R16 FOR 18IN MIN (45L)

PROVIDED (PERIMITER): XPS APPROX R17.5 AT 3.5" THICK EXTENDING TO TOP OF FOOTING OR BOTTOM OF THICKENED SLAB EDGE

UNDERSLAB INSULATION: EPS MOLDED POLYSTYRENE BOARD R:10 MINIMUM



1 **FLOOR - SLAB ON GRADE**
ASSEMBLY: N/A

SALAZAR ARCHITECT
2222 NE OREGON ST., SUITE 101
PORTLAND, OR 97232
503.702.2575
WWW.SALAZARCH.COM

RESERVED FOR CITY STAMP

PROJECT NUMBER: 2225

M. CARTER COMMONS
3675 N INTERSTATE AVE
PORTLAND, OR 97227

CLIENT:
Northwest Housing Alternatives
2316 SE WILLARD ST., MILWAUKIE OR 97222
Urban League of Portland
10 N RUSSELL ST., PORTLAND OR 97227

PHASE:
PERMIT SET

REVISIONS:

#	DATE	DESCRIPTION
7	01.30.25	CONSTRUCTION SET
5	10.25.24	PLAN REVIEW CYCLE 2
3	09.06.24	PLAN REVIEW CYCLE 1 ADDENDUM 1
2	08.20.24	PLAN REVIEW CYCLE 1

SHEET TITLE:
ASSEMBLIES

DRAWN BY: ANS, AP
CHECKED BY: DV, JN
DATE: 04.01.24

SHEET:
A801

DESIGN CONDITIONS - PORTLAND, OR

SPACE	WINTER		SUMMER	
	TEMPERATURE	HUMIDITY	TEMPERATURE	HUMIDITY
OUTDOOR	25.9˚ F DB	11.0˚ F DP / 9.6 HR / 31.7˚ F MCWB	91.7˚ F DB / 67.4˚ F MCWB	62.9˚ F DP / 85.9 HR / 74.8˚ F MCDB
INDOOR	70˚ F ± 2˚ F DB	60˚ F DP MAX, NO MINIMUM	75˚ F ± 2˚ F DB	60˚ F DP MAX, NO MINIMUM

GENERAL NOTES:
A. OUTDOOR CONDITIONS BASED ON ASHRAE STANDARD 62.1-2019 AND FUNDAMENTALS 2021 99.6% AND 0.4% DATA.

AIR HANDLING UNIT

TAG	LOCATION	SERVICE	MIXING BOX OSA (CFM)	MIXING BOX MAX EXH (CFM)	MIXING BOX MIN EXH (CFM)	FILTERS PRE (MERV)	FILTERS FINAL (MERV)	SUPPLY FAN AIRFLOW (CFM)	SUPPLY FAN FAN TYPE	SUPPLY FAN TSP (IN.WG)	SUPPLY FAN ESP (IN.WG)	SUPPLY FAN SPEED (RPM)	SUPPLY FAN MOTOR POWER (BHP)	SUPPLY FAN MOTOR RATING (HP)	SUPPLY FAN MOTOR VOLT/ PHASE	SUPPLY FAN MOTOR VFD (Y/N)	RETURN/EXHAUST FAN AIRFLOW (CFM)	RETURN/EXHAUST FAN FAN TYPE	RETURN/EXHAUST FAN TSP (IN.WG)	RETURN/EXHAUST FAN ESP (IN.WG)	RETURN/EXHAUST FAN SPEED (RPM)	RETURN/EXHAUST FAN MOTOR POWER (BHP)	RETURN/EXHAUST FAN MOTOR RATING (HP)	RETURN/EXHAUST FAN MOTOR VFD (Y/N)	HEAT RECOVERY OSA (CFM)	HEAT RECOVERY EXHAUST (CFM)	HEAT RECOVERY TYPE	HEAT RECOVERY WINTER OSA EAT (°F DB)	HEAT RECOVERY WINTER OSA LAT (°F DB)	HEAT RECOVERY WINTER EXH EAT (°F DB)	HEAT RECOVERY WINTER EFF. (%)	HEAT RECOVERY SUMMER OSA EAT (°F DB/WB)	HEAT RECOVERY SUMMER OSA LAT (°F DB/WB)	HEAT RECOVERY SUMMER EXH EAT (°F DB/WB)	HEAT RECOVERY SUMMER EFF. (%)	ELECTRIC HEATING COIL CAPACITY (KW)	ELECTRIC HEATING COIL CONTROL	ELECTRIC HEATING COIL EAT (°F)	ELECTRIC HEATING COIL LAT (°F)	REFRIGERANT COIL COOLING EAT (°F DB/WB)	REFRIGERANT COIL COOLING LAT (°F DB/WB)	REFRIGERANT COIL HEATING EAT (°F DB)	REFRIGERANT COIL HEATING LAT (°F DB)	REFRIGERANT TYPE	ELECTRICAL VOLT/ PHASE	ELECTRICAL FLA (A)	ELECTRICAL MCA (A)	ELECTRICAL MOCP (A)	ELECTRICAL SCCR (kA)	GEN. POWER (Y/N)	APPROX. WEIGHT (LBS)	MANUFACTURER & MODEL	NOTES
DOAS-R-01	ROOF	CORRIDORS + UNITS	3,800	4,000	2,000	8	13A	3,800	-	3.16	0.75	1,600	3.0	5.0	208/3	Y	4,000	-	1.80	0.75	2,200	2.7	3.0	Y	3,800	2,000	WHEEL	26	46	70	70	92 / 67	85 / 66	75 / 62	70	60.0	SCR	45	85	85 / 66	55 / 44	46	85	R-454B	208/3	183 + 11	187 + 13	225 + 20	10 K	NOTE 1	2,700	AAON RN	ALL

GENERAL NOTES:
A. UNITS MOUNTED ON VIBRATION ISOLATING ROOF CURB
B. MINIMUM OSA CALCULATED BASED ON CODE AND ASHRAE STANDARD 62.
C. HEATING COILS BASED ON MAXIMUM FACE VELOCITY OF 750 FPM, 0.15 IN WG MAXIMUM AIR PRESSURE DROP, 5 FT WG MAXIMUM WATER PRESSURE DROP.
D. COOLING COILS BASED ON MAXIMUM FACE VELOCITY OF 500 FPM, 0.75 IN WG MAXIMUM AIR PRESSURE DROP AND 18 FT WG MAXIMUM WATER PRESSURE DROP.
E. HEAT RECOVERY SECTION EFFECTIVENESS IS BASED ON AHRI 1060.
F. PROVIDE DUCT SMOKE DETECTOR. INTERLOCK DETECTOR WITH ELECTRICAL SERVICE TO DE-ENERGIZE UNIT UPON DETECTION OF SMOKE.
G. FAN ENERGY INDEX (FEI) BASED ON MANUFACTURERS' CERTIFIED DATA, RATIO OF THE ELECTRIC INPUT POWER OF A REFERENCE FAN TO THE ELECTRIC INPUT POWER OF THE ACTUAL FAN, AS CALCULATED PER AMCA 208.
H. PROVIDE DRAIN PANS DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH ASHRAE STANDARD 62.1 INCLUDING BUT NOT LIMITED TO 1/8-INCH PER FOOT SLOPE TOWARD DRAIN OUTLET, PAN LENGTH OF 1/2 THE INSTALLED VERTICAL DIMENSION OF THE COOLING COIL.

NOTES:
1. ARRANGE UNIT FOR MULTIPLE POINT POWER CONNECTION W/ DISCONNECT SWITCHES. PROVIDE GENERATOR POWER FOR RETURN FAN SECTION (LISTED SECOND) ONLY.
2. PROVIDE UNIT WITH FILTER SLOT CAPABLE OF HOLDING MERV 14A FILTER FOR USE DURING POOR OUTSIDE AIR QUALITY EVENTS.

ENERGY RECOVERY VENTILATOR SCHEDULE

TAG NUMBER	LOCATION	SERVICE	SUPPLY FAN RATING (MERV)	SUPPLY FAN NOMINAL AIRFLOW CFM	RETURN/EXHAUST FAN AIRFLOW CFM	RETURN/EXHAUST FAN ESP (IN. WG.)	RETURN/EXHAUST FAN MOTOR	TYPE	SUMMER OSA EAT (°F DB/WB)	SUMMER OSA LAT (°F DB)	SUMMER EXH LAT (°F DB)	WINTER OSA EAT (°F DB)	WINTER OSA LAT (°F DB)	WINTER EXH LAT (°F DB)	POWER REQUIREMENTS VOLT/ PHASE	POWER REQUIREMENTS MCA (A)	POWER REQUIREMENTS MOCP (A)	APPROX. WEIGHT (LBS)	MANUFACTURER & MODEL	NOTES
ERV-1-01	LEVEL 1	AMENITIES NORTH	13	270	270	0.75	ECM	POLYMER MEMBRANE	84/64	78.3/63	81.7/64	34.0	59.9	44.1	208/1	5.91	8.4	356	OXYGEN8 NOVA A16	ALL
ERV-1-02	LEVEL 1	AMENITIES SOUTH	13	550	550	0.75	ECM	POLYMER MEMBRANE	84/64	78.3/63	81.7/64	34.0	59.9	44.1	208/1	5.91	8.4	356	OXYGEN8 NOVA A16	ALL

GENERAL NOTES:
A. UNITS MOUNTED WITHIN CEILING DISCONNECT PROVIDED BY DIV. 26.
B. MINIMUM OSA CALCULATED BASED ON OREGON MECHANICAL CODE ASHRAE STANDARD 62.1. REFER TO VENTILATION SCHEDULE FOR FURTHER DETAIL.
C. PROVIDE SCCR SUFFICIENT TO MEET THE AVAILABLE FAULT CURRENT AT THE PANELBOARD OR SWITCHBOARD FROM WHICH THE UNIT IS FED. COORDINATE WITH ELECTRICAL DRAWINGS AND ELECTRICAL CONTRACTOR.
D. HEAT RECOVERY SECTION EFFECTIVENESS IS BASED ON AHRI 1060.

NOTES:
1. UNIT TO BE SUPPLIED WITH ONBOARD DDC CONTROLLER.
2. PROVIDE CO2 SENSOR/CONTROL. SENSOR LOCATED ADJACENT TO THERMOSTAT. ERV MINIMUM AIRFLOW BASED ON CO2 LEVEL.

ELECTRIC HEATER SCHEDULE

TAG	LOCATION	TYPE	ELEC. COIL CAPACITY (kW)	LENGTH (IN)	ELECTRICAL VOLT/ PHASE	ELECTRICAL MOCP (A)	ELECTRICAL MCA (A)	GEN. POWER (Y/N)	APPROX. WEIGHT (LBS)	MANUFACTURER & MODEL	NOTES
EH-X-01	UNIT BEDROOMS	HIGH WALL COVE HEATER	0.45	34"	208/1	2	-	NO	10	QMARK RCC	ALL

GENERAL NOTES:
A. PROVIDE MINIMUM 4" CLEAR FROM TOP OF HEATER TO CEILING ABOVE

NOTES:
1. WALL MOUNTED THERMOSTAT
2. TYPICAL OF 57 UNITS

SPLIT SYSTEM HEAT PUMP SCHEDULE

TAG	LOCATION	SERVICE	TYPE	AIRFLOW (CFM)	COOLING CAPACITY TOTAL (MBH)	COOLING CAPACITY SENSIBLE (MBH)	COOLING CAPACITY EAT (°F DB/WB)	HEATING CAPACITY TOTAL (MBH)	HEATING CAPACITY EAT (°F)	MIN EFFICIENCY (S)EER	MIN EFFICIENCY COP	REFRIGERANT TYPE	REFRIGERANT CHARGE (LBS)	ELECTRICAL VOLT/ PHASE	ELECTRICAL FLA (A)	ELECTRICAL MCA (A)	ELECTRICAL MOCP (A)	GEN. POWER (Y/N)	APPROX. WEIGHT (LBS)	MANUFACTURER & MODEL	NOTES
ACCU-R-A / HP-X-A	ROOF / LEVEL X	TYPICAL UNIT	WALL-MOUNT	350	12	-	75	18	75	20.8	4.31	R-410a	2	208/1	13	11	28	N	50	MITSUBISHI PKA/PUZ	1,4
ACCU-R-01 / AC-1-01	ROOF/LEVEL 1	MAIN ELECTRICAL	WALL-MOUNT	700	24	-	-	-	-	14.1	-	R-410a	2	208/3	13	20	30	N	75	MITSUBISHI PKA/PUY	1,2,3
ACCU-R-02 / AC-1-02	ROOF/LEVEL 1	EMERGENCY ELEC	WALL-MOUNT	400	12	-	-	-	-	13.8	-	R-410a	2	208/3	13	20	30	Y	50	MITSUBISHI PKA/PUY	1,2,3
ACCU-R-03 / AC-1-03	ROOF/LEVEL 1	MDF ROOM	WALL-MOUNT	700	24	-	-	-	-	14.1	-	R-410a	2	208/3	13	20	30	N	75	MITSUBISHI PKA/PUY	1,2,3
ACCU-R-04 / AC-1-04	ROOF/LEVEL 1	INVERTER ROOM	WALL-MOUNT	400	12	-	-	-	-	13.8	-	R-410a	2	208/3	13	20	30	N	50	MITSUBISHI PKA/PUY	1,2,3

GENERAL NOTES:
A. MINIMUM EFFICIENCY IS AT ARI STANDARD CONDITIONS.
B. PROVIDE WASHABLE MERV 8 FILTERS

NOTES:
1. PROVIDE CONDENSATE PUMP.
2. INDOOR UNIT RECEIVES POWER FROM OUTDOOR UNIT.
3. COOLING ONLY UNIT.
4. TYPICAL OF 63 UNITS

FIRE SMOKE DAMPERS

TAG	LOCATION	SERVICE	ASSOCIATED RISER TAG	DIMENSIONS DAMPER WIDTH (INCHES)	DIMENSIONS DAMPER HEIGHT (INCHES)	DIMENSIONS DAMPER PLUS ACTUATOR (GRILLE) WIDTH (INCHES)	DIMENSIONS DAMPER PLUS ACTUATOR (GRILLE) HEIGHT (INCHES)	STAT TEMP (°F)	INITIATING DEVICE	ELECTRICAL VOLT/ PHASE	ELECTRICAL QUANTITY	MANUFACTURER & MODEL	NOTES
FSD-01-01	LEVEL 1	CORRIDOR EXHAUST	CX-01	10	10	16	10	165	AD	120/1	1	RUSKIN FSD-60-FA	1,2
FSD-01-02	LEVEL 1	TRASH EXHAUST	TRX-01	8	6	-	-	165	AD	120/1	1	RUSKIN FSD60	1
FSD-01-03	LEVEL 1	RESIDENTIAL SUPPLY	SA-01	8	6	-	-	165	AD	120/1	1	RUSKIN FSD60	1
FSD-01-04	LEVEL 1	RESIDENTIAL SUPPLY	SA-01	6	6	-	-	165	AD	120/1	1	RUSKIN FSD60	1
FSD-01-05	LEVEL 1	RESIDENTIAL SUPPLY	SA-01	6	6	-	-	165	AD	120/1	1	RUSKIN FSD60	1
FSD-01-06	LEVEL 1	ERV-01-01	-	8" DIA.	-	-	-	165	AD	120/1	1	RUSKIN FSD60	1
FSD-01-07	LEVEL 1	FCU-01-01	-	6" DIA.	-	-	-	165	AD	120/1	1	RUSKIN FSD60	1
FSD-01-08	LEVEL 1	SF-01-01	-	18	18	24	18	165	AD	120/1	1	RUSKIN FSD-60-FA	1,2
FSD-02-01	LEVEL 2	CORRIDOR EXHAUST	CX-01	10	10	-	-	165	AD	120/1	1	RUSKIN FSD-60-FA	1,2
FSD-02-02	LEVEL 2	TRASH EXHAUST	TRX-01	8	6	-	-	165	AD	120/1	1	RUSKIN FSD60	1
FSD-02-03	LEVEL 2	RESIDENTIAL SUPPLY	SA-01	12	8	-	-	165	AD	120/1	1	RUSKIN FSD60	1
FSD-02-04	LEVEL 2	CORRIDOR SUPPLY	CS-01	10	10	16	10	165	AD	120/1	1	RUSKIN FSD-60-FA	1,2
FSD-03-01	LEVEL 3	CORRIDOR EXHAUST	CX-01	10	10	16	10	165	AD	120/1	1	RUSKIN FSD-60-FA	1,2
FSD-03-02	LEVEL 3	TRASH EXHAUST	TRX-01	8	6	-	-	165	AD	120/1	1	RUSKIN FSD60	1
FSD-03-03	LEVEL 3	RESIDENTIAL SUPPLY	SA-01	12	8	-	-	165	AD	120/1	1	RUSKIN FSD60	1
FSD-03-04	LEVEL 3	CORRIDOR SUPPLY	CS-01	10	10	16	10	165	AD	120/1	1	RUSKIN FSD-60-FA	1,2
FSD-04-01	LEVEL 4	CORRIDOR EXHAUST	CX-01	10	10	16	10	165	AD	120/1	1	RUSKIN FSD-60-FA	1,2
FSD-04-02	LEVEL 4	TRASH EXHAUST	TRX-01	8	6	-	-	165	AD	120/1	1	RUSKIN FSD60	1
FSD-04-03	LEVEL 4	RESIDENTIAL SUPPLY	SA-01	12	8	-	-	165	AD	120/1	1	RUSKIN FSD60	1
FSD-04-04	LEVEL 4	CORRIDOR SUPPLY	CS-01	10	10	16	10	165	AD	120/1	1	RUSKIN FSD-60-FA	1,2
FSD-05-01	LEVEL 5	CORRIDOR EXHAUST	CX-01	10	10	16	10	165	AD	120/1	1	RUSKIN FSD-60-FA	1,2
FSD-05-02	LEVEL 5	TRASH EXHAUST	TRX-01	8	6	-	-	165	AD	120/1	1	RUSKIN FSD60	1
FSD-05-03	LEVEL 5	RESIDENTIAL SUPPLY	SA-01	12	8	-	-	165	AD	120/1	1	RUSKIN FSD60	1
FSD-05-04	LEVEL 5	CORRIDOR SUPPLY	CS-01	10	10	16	10	165	AD	120/1	1	RUSKIN FSD-60-FA	1,2
FSD-06-01	LEVEL 6	CORRIDOR EXHAUST	CX-01	10	10	16	10	165	AD	120/1	1	RUSKIN FSD-60-FA	1,2
FSD-06-02	LEVEL 6	TRASH EXHAUST	TRX-01	8	6	-	-	165	AD	120/1	1	RUSKIN FSD60	1
FSD-06-03	LEVEL 6	RESIDENTIAL SUPPLY	SA-01	12	8	-	-	165	AD	120/1	1	RUSKIN FSD60	1
FSD-06-04	LEVEL 6	CORRIDOR SUPPLY	CS-01	10	10	16	10	165	AD	120/1	1	RUSKIN FSD-60-FA	1,2

GENERAL NOTES:
A. PROVIDE WITH REMOTE DAMPER BLADE POSITION INDICATOR.
B. INITIATING DEVICES: DUCT SMOKE DETECTOR (DD), AREA SMOKE DETECTOR (AD) OR FIRE ALARM SYSTEM (FA).
C. ALL FIRE SMOKE DAMPERS ON A SINGLE SYSTEM CLOSE ON DETECTION OF SMOKE AND SHUTDOWN OF THE AIR MOVING SYSTEMS.
D. GRILLE DIMENSIONS INCLUDES DAMPER SIZE PLUS ACTUATOR CABINET. ACTUATOR IS ACCESSED BY REMOVING GRILLE.

NOTES:
1. PROVIDE RUSKIN SP100 SWITCH PACKAGE. WIRE TO FIRE ALARM SYSTEM FOR UUKL WEEKLY SELF-TEST.
2. PROVIDE WITH FRONT ACCESS THROUGH GRILLE.

FAN SCHEDULE

TAG	LOCATION	SERVICE (ASSOCIATED RISER TAG)	TYPE	DRIVE	AIRFLOW MAX (CFM)	AIRFLOW MIN (CFM)	AIRFLOW TSP (IN WG)	AIRFLOW FAN SPEED (RPM)	ELECTRICAL VOLT/ PHASE	ELECTRICAL POWER (BHP)	ELECTRICAL RATING (HP)	ELECTRICAL VFD (Y/N)	GEN. POWER (Y/N)	APPROX. WEIGHT (LBS)	MANUFACTURER & MODEL	NOTES
EF-BA	RESIDENTIAL UNITS	LOCAL BATHROOM EXHAUST	CEILING	ECM	110	SEE NOTE 2	-	-	120/1	-	-	N	N	25	PANASONIC FV-0511VKS2	1
EF-R-01	ROOF	RESIDENTIAL TRASH ROOMS	UTILITY SET	ECM	690	690	0.5	1090	208/1	0.08	1/4	N	N	200	GREENHECK USF	3
EF-R-02	ROOF	RESIDENTIAL CORRIDORS	UTILITY SET	BELT	1560	1560	0.5	1025	208/1	0.27	1/3	Y	N	200	GREENHECK USF	3
EF-1-01	LEVEL 1	LEVEL 1 TRASH ROOM	CABINET IN-LINE	ECM	250	250	0.25	1220	208/1	0.2	1/3	N	N	50	GREENHECK CSP-VG	3
EF-1-02	LEVEL 1	BIKE ROOM	CABINET IN-LINE	ECM	200	200	0.25	950	208/1	0.03	1/15	N	N	30	GREENHECK CSP-VG	3
SF-1-01	LEVEL 1	LAUNDRY ROOM MAKUP	CABINET IN-LINE	ECM	1000	400	0.25	1150	208/	0.31	1/3	N	N	50	GREENHECK CSP-VG	4
REF-R-01	ROOF	RADON ZONE 1	VERTICAL IN-LINE	DIRECT	200	-	2.5	4300	120/1	0.23	1/4	N	N	20	FANTECH RN4	3

GENERAL NOTES:
A. PROVIDE FLEXIBLE EQUIPMENT CONNECTION AT DUCT CONNECTIONS.
B. SEE MECHANICAL SPEOFICATIONS AND ACOUSTICAL REPORT FOR MOUNTING AND VIBRATION ISOLATION REQUIREMENTS.

NOTES:
1. PROVIDE EXHAUST FAN WITH CONDENSATION SENSING MODULE (PANASONIC FV-CSVK1), AND OCCUPANCY SENSOR (PANASONIC FV-MSVK1) FOR BOOST MODE OPERATION.
2. MINIMUM TOILET EXHAUST SETPOINT IS THE GREATER OF CODE MINIMUM VENTILATION CALCULATION AND CODE MINIMUM TOILET EXHAUST, SEE RESIDENTIAL VENTILATION SCHEDULE FOR MORE INFORMATION.
3. PROVIDE FAN WITH SPEED CONTROLLER.
4. PROVIDE STATIC PRESSURE SENSOR IN LAUNDRY ROOM TO CONTROL FAN SPEED

UNIT HEATER SCHEDULE

TAG	LOCATION	SERVICE	TYPE	ELEC. COIL CAPACITY (kW)	ELECTRICAL VOLT/ PHASE	ELECTRICAL MOCP (A)	ELECTRICAL MCA (A)	GEN. POWER (Y/N)	APPROX. WEIGHT (LBS)	MANUFACTURER & MODEL	NOTES
UH-1-01	STAIR 1	STAIR 1	HORIZONTAL	3.0	208/3	-	-	NO	50	MODINE HER	1
UH-1-02	STAIR 2	STAIR 2	HORIZONTAL	3.0	208/3	-	-	NO	50	MODINE HER	1
UH-1-03	DOMMESTIC WATER	DOMMESTIC WATER	HORIZONTAL	3.0	208/3	-	-	NO	50	MODINE HER	1
UH-1-04	FIRE PUMP	FIRE PUMP	HORIZONTAL	3.0	208/3	-	-	NO	50	MODINE HER	1
UH-1-05	BIKE ROOM	BIKE ROOM	HORIZONTAL	3.0	208/3	-	-	NO	50	MODINE HER	1
UH-1-06	TRASH ROOM	TRASH ROOM	HORIZONTAL	3.0	208/3	-	-	NO	50	MODINE HER	1

GENERAL NOTES:
A. NONE

NOTES:
1. UNIT MOUNTED THERMOSTAT; SET TO 50 °F

SALAZAR ARCHITECT
2222 NE OREGON ST., SUITE 101
PORTLAND, OR 97232
503.702.2575
WWW.SALAZARCH.COM

REGISTERED PROFESSIONAL ENGINEER
83722PE
OREGON
JAN. 12, 2010
RUWAN H. JAYAWEERA
11/01/2024
EXPIRES: 06/30/2025

PROJECT NUMBER: 2225

M. CARTER COMMONS

CLIENT:

Northwest Housing Alternatives
2316 SE WILLARD ST., MILWAUKIE OR 97222

Urban League of Portland
10 N RUSSELL ST., PORTLAND OR 97227

CONSULTANT:

PAE
pae-engineers.com

PHASE:

BID SET

REVISIONS:

#	DATE	DESCRIPTION
5	10.25.24	PLAN REVIEW CYCLE 2 ADDENDUM 2
3	09.06.24	PLAN REVIEW CYCLE 1 ADDENDUM 1

SHEET TITLE:

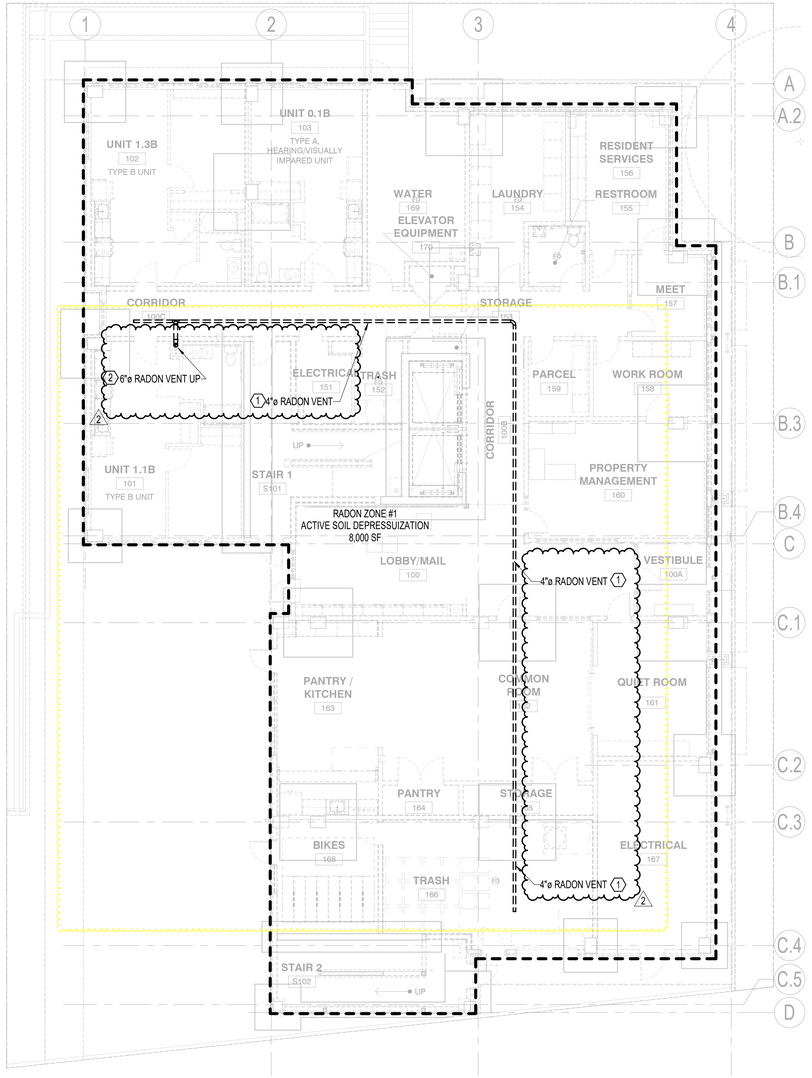
EQUIPMENT SCHEDULES - MECHANICAL

DRAWN BY: PAE
CHECKED BY: PAE
DATE: 04.01.24

SHEET:

M002

11/1/2024 3:58:03 PM
BIM 360://23-1386 M Carter Commons_MP21/23-1386 Carter Commons Housing_MP.rvt



1 Print - 00 - Mechanical
1/8" = 1'-0"

GENERAL NOTES:

A. MECHANICAL DUCT PLANS ARE DIAGRAMMATIC IN NATURE. PROVIDE SHOP DRAWINGS DEPICTING EXACT DUCT AND EQUIPMENT LOCATIONS COORDINATED WITH OTHER TRADES.
B. COORDINATE EXACT LOCATION OF VISIBLE WALL, FLOOR AND CEILING DEVICES WITH OWNER PRIOR TO ROUGH-IN. PROVIDE A MOCK-UP FOR THE OWNER'S REVIEW. LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE LOCATIONS. INSTALL DEVICES IN AN ORDERLY MANNER AT THE SAME ELEVATION FOR ADJACENT DEVICES. INSTALL DEVICES REQUIRING ADJUSTMENT IN CONFORMANCE WITH ADA REQUIREMENTS.
C. INSTALL MEPT WORK TIGHT TO STRUCTURE, SUSPENDED HIGH AS POSSIBLE UNLESS OTHER WISE NOTED. ENSURE PROPER ACCESS CLEARANCES AND MAINTENANCE ACCESSIBILITY FOR MOUNTING HEIGHT OF EQUIPMENT. COORDINATE INSTALLATION OF WORK WITH OTHER TRADES TO BE ROUTED TOGETHER ALONG SHARED PATHWAY.
D. PROVIDE SHEET METAL DUCTWORK AND COMPONENTS INCLUDING HANGING, SEALING, PLENUMS, AND ACCESSORIES IN ACCORDANCE WITH THE LATEST EDITION OF SMACNA STANDARDS FOR HVAC DUCT CONSTRUCTION, NFPA 90A, AND 90B STANDARDS.
E. DUCT DIMENSIONS SHOWN ARE INSIDE SHEET METAL DIMENSIONS OR CLEAR OPENING INSIDE LINED DUCT. THE FIRST NUMBER REPRESENTS THE WIDTH OF DUCT IN PLAN VIEW. REFER TO RISER DIAGRAMS FOR VERTICAL DUCTWORK SIZES.
F. PROVIDE VOLUME DAMPERS WHERE INDICATED AND IN EACH BRANCH DUCT SERVING INDIVIDUAL DIFFUSERS AND GRILLES.
G. SIZE BRANCH DUCTWORK TO MATCH EQUIPMENT CONNECTION SIZE, UNLESS OTHERWISE NOTED.
H. SIZE BRANCH DUCTWORK TO DIFFUSERS AND GRILLES TO MATCH DIFFUSER OR GRILLE CONNECTION SIZE, UNLESS OTHERWISE NOTED.
I. PROVIDE TRANSFER OPENINGS FOR RETURN AIR SIZED AT 300 FPM IN FULL HEIGHT WALLS, SEE ARCHITECTURAL DRAWINGS FOR FULL HEIGHT WALL LOCATIONS.
J. PROVIDE CABLE OPERATED VOLUME DAMPERS AT INACCESSIBLE VOLUME DAMPERS.
K. VERIFY EQUIPMENT CONNECTIONS WITH MANUFACTURER'S CERTIFIED DRAWINGS. VERIFY AND PROVIDE DUCT TRANSITIONS TO FURNISHED EQUIPMENT. FIELD VERIFY AND COORDINATE DIMENSIONS PRIOR TO FABRICATION.
L. REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATIONS OF AIR DEVICES.
M. PROVIDE SLEEVES WHERE DUCTWORK PASSES THROUGH WALLS, FLOORS, OR ROOFS. FILL ANNULAR SPACE WITH MINERAL FIBER (OR FIRE STOPPING MATERIAL WHERE FIRE RATED) AND SEAL WATERTIGHT.
N. MAINTAIN MINIMUM SEPARATION OF 10-FEET BETWEEN EXHAUST TERMINATIONS AND FORCED AIR INLETS AND A MINIMUM SEPARATION OF 3-FEET BETWEEN EXHAUST TERMINATIONS AND OPENINGS INTO THE BUILDING (DOORS, OPERABLE WINDOWS, ETC.).
O. CONTAIN HORIZONTAL DUCT OFFSETS OF AIR SHAFTS WITHIN A TWO HOUR ARCHITECTURAL RATED ENCLOSURE.
P. ENLARGED PLANS SHOWN ON RESIDENTIAL UNIT PLAN SEGMENT SHEETS APPLY TO ALL UNITS IN BUILDING, UNLESS OTHERWISE NOTED. FOR UNIT TYPES OTHER THAN THOSE SHOWN ON RESIDENTIAL UNIT PLAN SHEETS, APPLY LAYOUTS SHOWN ON THESE SHEETS AND EXTRAPOLATE LAYOUT AND QUANTITY OF DEVICES AS REQUIRED TO MAINTAIN THE DESIGN AND CODE REQUIREMENTS.
2 Q. RISER LABELS:
CS - CORRIDOR SUPPLY
CX - CORRIDOR EXHAUST
SA - SUPPLY AIR
TX - TOILET EXHAUST
TRX - TRASH EXHAUST
SEE SHEET M901 FOR RISER DIAGRAM

NOTES:

1. 3-INCH PERFORATED PIPING FOR RADON GAS CONVEYANCE SYSTEM. BED PIPE IN 12"X8" GRAVEL TRENCH AND RUN TIGHT WITH TOP OF FOOTINGS. SEE DETAIL 4/M502.
2. 6-INCH PIPE ROUTED UP THROUGH BUILDING TO ROOFTOP EXHAUST FAN. SEE DETAIL 4/M502.

SALAZAR ARCHITECT
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CONSULTANT:
PAE
pae-engineers.com

PHASE:
BID SET

REVISIONS:

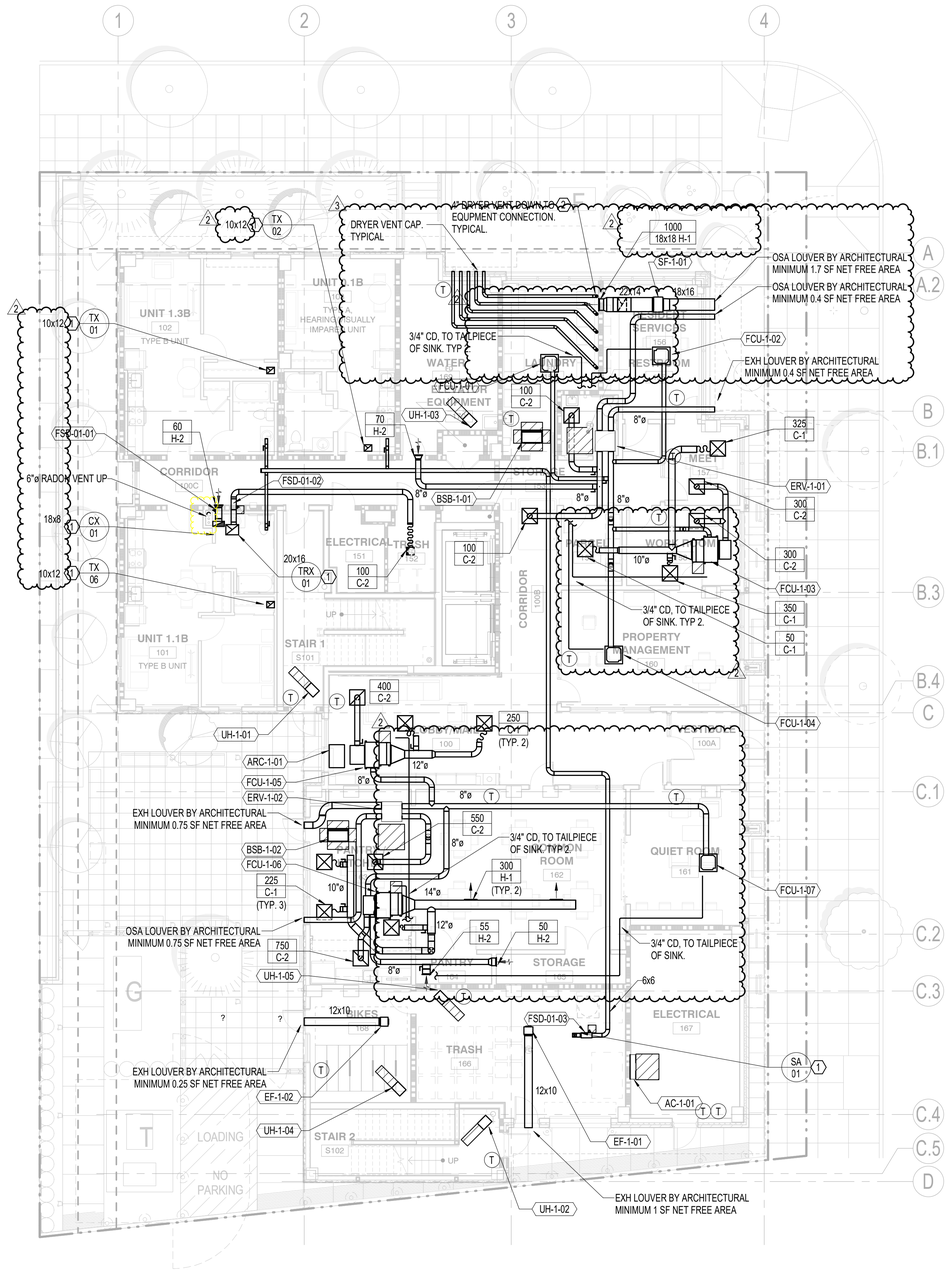
#	DATE	DESCRIPTION
2	08.20.24	PLAN REVIEW CYCLE 1

SHEET TITLE:
LEVEL 0 PLAN - MECHANICAL

DRAWN BY: PAE
CHECKED BY: PAE
DATE: 04.01.24

SHEET:
M200

9/9/2024 9:17:03 AM
BIM 360://23-1386 M Carter Commons_MP21/23-1386 Carter Commons Housing_MP.rvt



1 LEVEL 1 PLAN - MECHANICAL
1/8" = 1'-0"

GENERAL NOTES:

A. MECHANICAL DUCT PLANS ARE DIAGRAMMATIC IN NATURE. PROVIDE SHOP DRAWINGS DEPICTING EXACT DUCT AND EQUIPMENT LOCATIONS COORDINATED WITH OTHER TRADES.
B. COORDINATE EXACT LOCATION OF VISIBLE WALL, FLOOR AND CEILING DEVICES WITH OWNER PRIOR TO ROUGH-IN. PROVIDE A MOCK-UP FOR THE OWNER'S REVIEW. LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE LOCATIONS. INSTALL DEVICES IN AN ORDERLY MANNER AT THE SAME ELEVATION FOR ADJACENT DEVICES. INSTALL DEVICES REQUIRING ADJUSTMENT IN CONFORMANCE WITH ADA REQUIREMENTS.
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F. PROVIDE VOLUME DAMPERS WHERE INDICATED AND IN EACH BRANCH DUCT SERVING INDIVIDUAL DIFFUSERS AND GRILLES.
G. SIZE BRANCH DUCTWORK TO MATCH EQUIPMENT CONNECTION SIZE, UNLESS OTHERWISE NOTED.
H. SIZE BRANCH DUCTWORK TO DIFFUSERS AND GRILLES TO MATCH DIFFUSER OR GRILLE CONNECTION SIZE, UNLESS OTHERWISE NOTED.
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2 Q. RISER LABELS:
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TRX - TRASH EXHAUST
SEE SHEET M001 FOR RISER DIAGRAM

NOTES:

1. DUCT/SHAFT DOES NOT EXTEND TO LEVEL 01 SLAB. DUCTWORK POPS THROUGH LEVEL 02 SLAB AND STOPS ABOVE CEILING. ARCHITECT TO PROVIDE RATED ENCLOSURE AROUND DUCTWORK.

2 2. PROVIDE LINT TRAP AT DRYER

SALAZAR ARCHITECT
2222 NE OREGON ST., SUITE 101
PORTLAND, OR 97232
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REGISTERED PROFESSIONAL ENGINEER
83722PE
OREGON
JANUARY 12, 2010
RAWAN H. JAYAWEERA
09/09/2024
EXPIRES: 06/30/2025

PROJECT NUMBER: 2225

M. CARTER COMMONS

CLIENT:
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2316 SE WILLARD ST., MILWAUKIE OR 97222
Urban League of Portland
10 N RUSSELL ST., PORTLAND OR 97227

CONSULTANT:
PAE
pae-engineers.com

PHASE:
BID SET

REVISIONS:

#	DATE	DESCRIPTION
3	09.06.24	PLAN REVIEW CYCLE 1 ADDENDUM 1
2	08.20.24	PLAN REVIEW CYCLE 1

SHEET TITLE:
LEVEL 1 PLAN - MECHANICAL

DRAWN BY: PAE
CHECKED BY: PAE
DATE: 04.01.24

SHEET:
M201

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N

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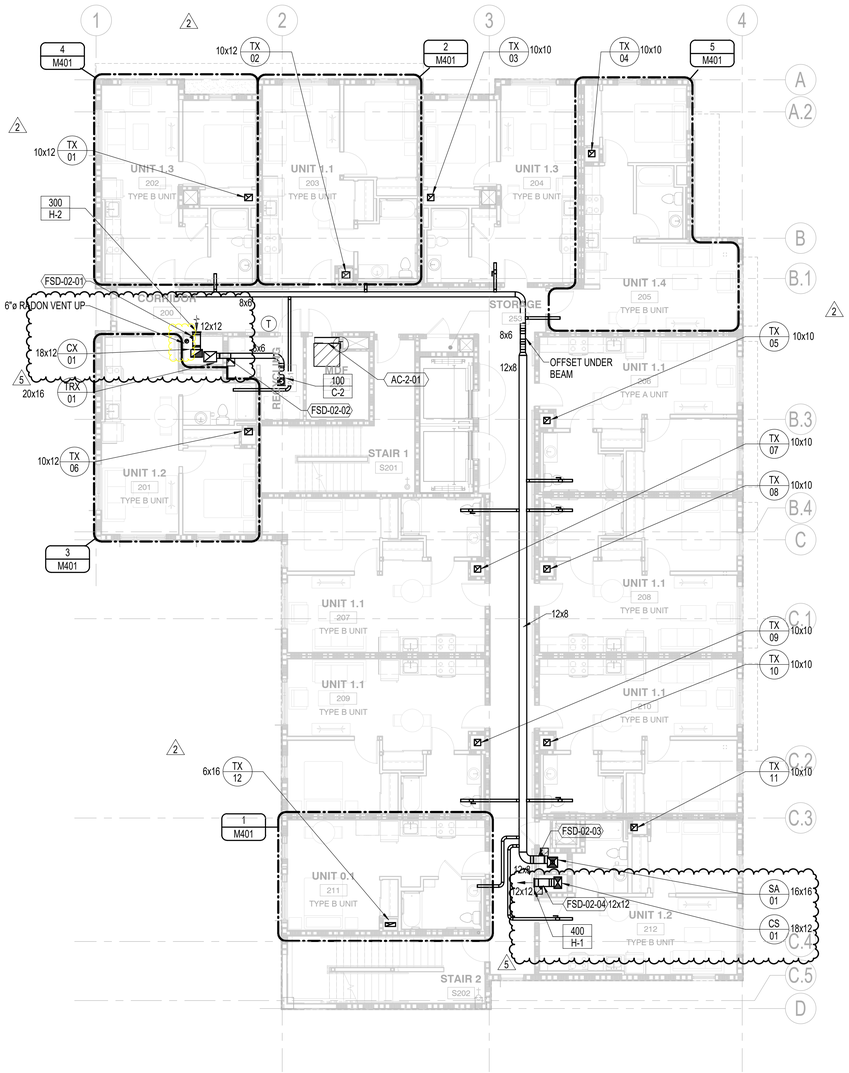
BIM 360://23-1386 M Carter Commons_MP21/23-1386 Carter Commons Housing_MP.rvt



1 LEVEL 2 PLAN (LEVEL 4 SIM) - MECHANICAL
1/8" = 1'-0"

GENERAL NOTES:

A. MECHANICAL DUCT PLANS ARE DIAGRAMMATIC IN NATURE. PROVIDE SHOP DRAWINGS DEPICTING EXACT DUCT AND EQUIPMENT LOCATIONS COORDINATED WITH OTHER TRADES.
B. COORDINATE EXACT LOCATION OF VISIBLE WALL, FLOOR AND CEILING DEVICES WITH OWNER PRIOR TO ROUGH-IN. PROVIDE A MOCK-UP FOR THE OWNER'S REVIEW. LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE LOCATIONS. INSTALL DEVICES IN AN ORDERLY MANNER AT THE SAME ELEVATION FOR ADJACENT DEVICES. INSTALL DEVICES REQUIRING ADJUSTMENT IN CONFORMANCE WITH ADA REQUIREMENTS.
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F. PROVIDE VOLUME DAMPERS WHERE INDICATED AND IN EACH BRANCH DUCT SERVING INDIVIDUAL DIFFUSERS AND GRILLES.
G. SIZE BRANCH DUCTWORK TO MATCH EQUIPMENT CONNECTION SIZE, UNLESS OTHERWISE NOTED.
H. SIZE BRANCH DUCTWORK TO DIFFUSERS AND GRILLES TO MATCH DIFFUSER OR GRILLE CONNECTION SIZE, UNLESS OTHERWISE NOTED.
I. PROVIDE TRANSFER OPENINGS FOR RETURN AIR SIZED AT 300 FPM IN FULL HEIGHT WALLS, SEE ARCHITECTURAL DRAWINGS FOR FULL HEIGHT WALL LOCATIONS.
J. PROVIDE CABLE OPERATED VOLUME DAMPERS AT INACCESSIBLE VOLUME DAMPERS.
K. VERIFY EQUIPMENT CONNECTIONS WITH MANUFACTURER'S CERTIFIED DRAWINGS. VERIFY AND PROVIDE DUCT TRANSITIONS TO FURNISHED EQUIPMENT. FIELD VERIFY AND COORDINATE DIMENSIONS PRIOR TO FABRICATION.
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M. PROVIDE SLEEVES WHERE DUCTWORK PASSES THROUGH WALLS, FLOORS, OR ROOFS. FILL ANNULAR SPACE WITH MINERAL FIBER (OR FIRE STOPPING MATERIAL WHERE FIRE RATED) AND SEAL WATERTIGHT.
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O. CONTAIN HORIZONTAL DUCT OFFSETS OF AIR SHAFTS WITHIN A TWO HOUR ARCHITECTURAL RATED ENCLOSURE.
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CS - CORRIDOR SUPPLY
CX - CORRIDOR EXHAUST
SA - SUPPLY AIR
TX - TOILET EXHAUST
TRX - TRASH EXHAUST
SEE SHEET M/601 FOR RISER DIAGRAM

NOTES:

1. NOT USED.

SALAZAR ARCHITECT
2222 NE OREGON ST., SUITE 101
PORTLAND, OR 97232
503.702.2575
WWW.SALAZARCH.COM

REGISTERED PROFESSIONAL ENGINEER
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OREGON
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RUWAN H. JAYAWEERA
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EXPIRES: 06/30/2025

PROJECT NUMBER: 2225

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CONSULTANT:

PAE
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PHASE:

BID SET

REVISIONS:

#	DATE	DESCRIPTION
5	10.25.24	PLAN REVIEW CYCLE 2 ADDENDUM 2
2	08.20.24	PLAN REVIEW CYCLE 1

SHEET TITLE:

LEVEL 2 PLAN (LEVEL 4 SIM) - MECHANICAL

DRAWN BY: PAE
CHECKED BY: PAE
DATE: 04.01.24

SHEET:

M202

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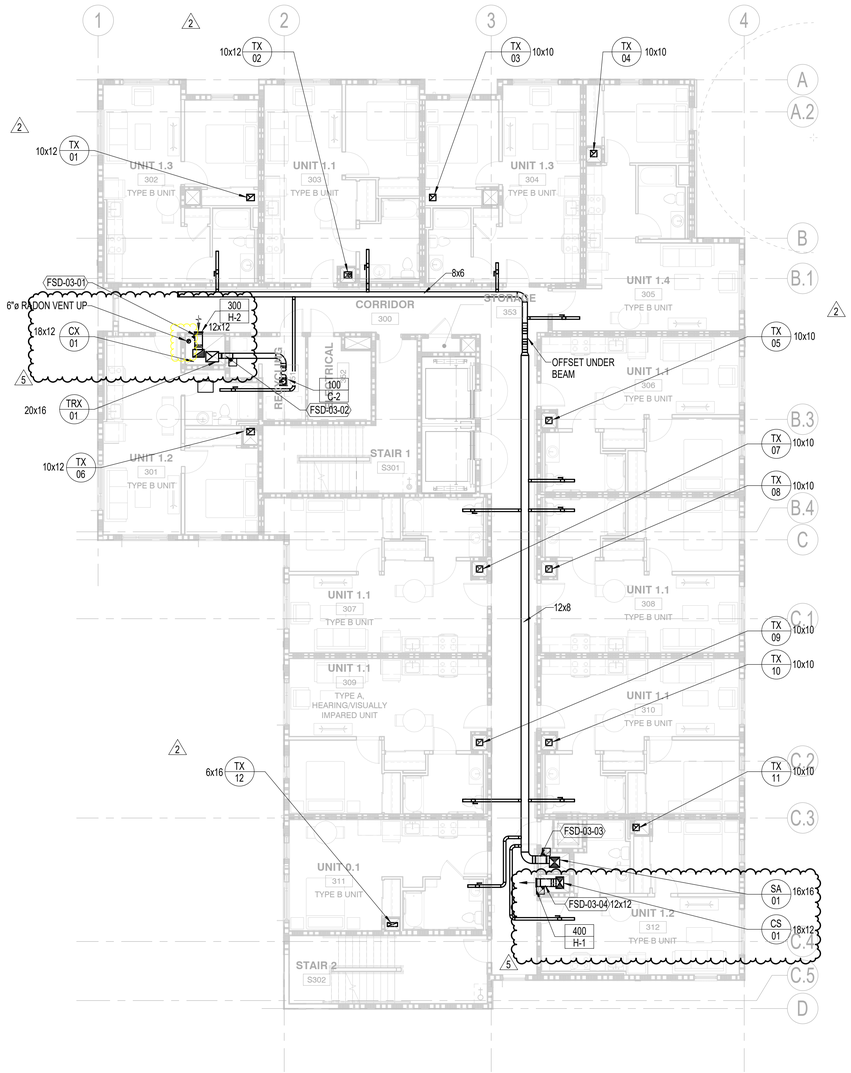
N

11/1/2024 3:58:05 PM
BIM 360://23-1386 M Carter Commons_MP21/23-1386 Carter Commons Housing_MP.rvt



1 LEVEL 3 PLAN (LEVEL 5 SIM) - MECHANICAL
1/8" = 1'-0"

GENERAL NOTES:

A. MECHANICAL DUCT PLANS ARE DIAGRAMMATIC IN NATURE. PROVIDE SHOP DRAWINGS DEPICTING EXACT DUCT AND EQUIPMENT LOCATIONS COORDINATED WITH OTHER TRADES.
B. COORDINATE EXACT LOCATION OF VISIBLE WALL, FLOOR AND CEILING DEVICES WITH OWNER PRIOR TO ROUGH-IN. PROVIDE A MOCK-UP FOR THE OWNER'S REVIEW. LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE LOCATIONS. INSTALL DEVICES IN AN ORDERLY MANNER AT THE SAME ELEVATION FOR ADJACENT DEVICES. INSTALL DEVICES REQUIRING ADJUSTMENT IN CONFORMANCE WITH ADA REQUIREMENTS.
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F. PROVIDE VOLUME DAMPERS WHERE INDICATED AND IN EACH BRANCH DUCT SERVING INDIVIDUAL DIFFUSERS AND GRILLES.
G. SIZE BRANCH DUCTWORK TO MATCH EQUIPMENT CONNECTION SIZE, UNLESS OTHERWISE NOTED.
H. SIZE BRANCH DUCTWORK TO DIFFUSERS AND GRILLES TO MATCH DIFFUSER OR GRILLE CONNECTION SIZE, UNLESS OTHERWISE NOTED.
I. PROVIDE TRANSFER OPENINGS FOR RETURN AIR SIZED AT 300 FPM IN FULL HEIGHT WALLS, SEE ARCHITECTURAL DRAWINGS FOR FULL HEIGHT WALL LOCATIONS.
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K. VERIFY EQUIPMENT CONNECTIONS WITH MANUFACTURER'S CERTIFIED DRAWINGS. VERIFY AND PROVIDE DUCT TRANSITIONS TO FURNISHED EQUIPMENT. FIELD VERIFY AND COORDINATE DIMENSIONS PRIOR TO FABRICATION.
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N. MAINTAIN MINIMUM SEPARATION OF 10-FEET BETWEEN EXHAUST TERMINATIONS AND FORCED AIR INLETS AND A MINIMUM SEPARATION OF 3-FEET BETWEEN EXHAUST TERMINATIONS AND OPENINGS INTO THE BUILDING (DOORS, OPERABLE WINDOWS, ETC.).
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SEE SHEET M/601 FOR RISER DIAGRAM

NOTES:

1. NOT USED.

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PHASE:
BID SET

REVISIONS:

#	DATE	DESCRIPTION
5	10.25.24	PLAN REVIEW CYCLE 2 ADDENDUM 2
2	08.20.24	PLAN REVIEW CYCLE 1

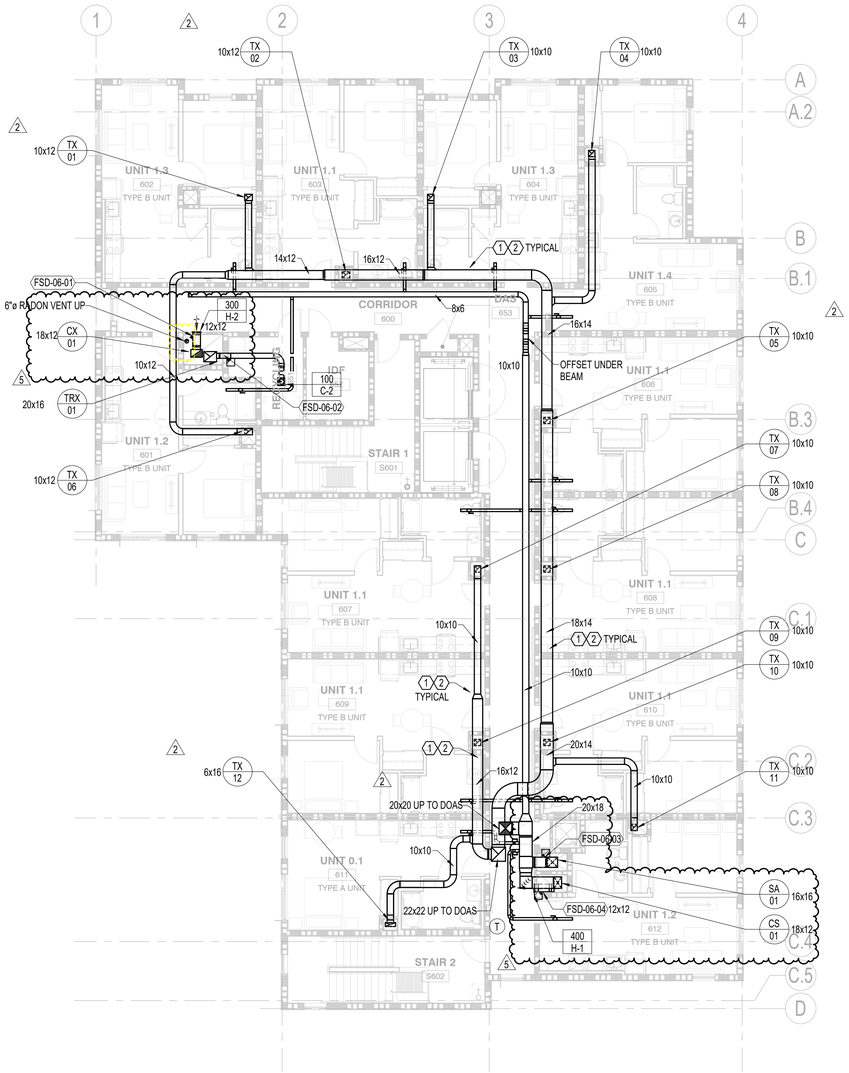
SHEET TITLE:
LEVEL 3 PLAN (LEVEL 5 SIM) - MECHANICAL

DRAWN BY: PAE
CHECKED BY: PAE
DATE: 04.01.24

SHEET:
M203

0 4' 8' 16'
N

11/1/2024 3:58:09 PM
BIM 360://23-1366 M Carter Commons_MP21/23-1366 Carter Commons Housing_MP.rvt



1 LEVEL 6 PLAN - MECHANICAL
1/8" = 1'-0"

GENERAL NOTES:

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G. SIZE BRANCH DUCTWORK TO MATCH EQUIPMENT CONNECTION SIZE, UNLESS OTHERWISE NOTED.
H. SIZE BRANCH DUCTWORK TO DIFFUSERS AND GRILLES TO MATCH DIFFUSER OR GRILLE CONNECTION SIZE, UNLESS OTHERWISE NOTED.
I. PROVIDE TRANSFER OPENINGS FOR RETURN AIR SIZED AT 300 FPM IN FULL HEIGHT WALLS, SEE ARCHITECTURAL DRAWINGS FOR FULL HEIGHT WALL LOCATIONS.
J. PROVIDE CABLE OPERATED VOLUME DAMPERS AT INACCESSIBLE VOLUME DAMPERS.
K. VERIFY EQUIPMENT CONNECTIONS WITH MANUFACTURER'S CERTIFIED DRAWINGS. VERIFY AND PROVIDE DUCT TRANSITIONS TO FURNISHED EQUIPMENT. FIELD VERIFY AND COORDINATE DIMENSIONS PRIOR TO FABRICATION.
L. REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATIONS OF AIR DEVICES.
M. PROVIDE SLEEVES WHERE DUCTWORK PASSES THROUGH WALLS, FLOORS, OR ROOFS. FILL ANNULAR SPACE WITH MINERAL FIBER (OR FIRE STOPPING MATERIAL WHERE FIRE RATED) AND SEAL WATERTIGHT.
N. MAINTAIN MINIMUM SEPARATION OF 10-FEET BETWEEN EXHAUST TERMINATIONS AND FORCED AIR INLETS AND A MINIMUM SEPARATION OF 3-FEET BETWEEN EXHAUST TERMINATIONS AND OPENINGS INTO THE BUILDING (DOORS, OPERABLE WINDOWS, ETC.).
O. CONTAIN HORIZONTAL DUCT OFFSETS OF AIR SHAFTS WITHIN A TWO HOUR ARCHITECTURAL RATED ENCLOSURE.
P. ENLARGED PLANS SHOWN ON RESIDENTIAL UNIT PLAN SEGMENT SHEETS APPLY TO ALL UNITS IN BUILDING, UNLESS OTHERWISE NOTED. FOR UNIT TYPES OTHER THAN THOSE SHOWN ON RESIDENTIAL UNIT PLAN SHEETS, APPLY LAYOUTS SHOWN ON THESE SHEETS AND EXTRAPOLATE LAYOUT AND QUANTITY OF DEVICES AS REQUIRED TO MAINTAIN THE DESIGN AND CODE REQUIREMENTS.
2 Q. RISER LABELS:
CS - CORRIDOR SUPPLY
CX - CORRIDOR EXHAUST
SA - SUPPLY AIR
TX - TOILET EXHAUST
TRX - TRASH EXHAUST
SEE SHEET M/601 FOR RISER DIAGRAM

NOTES:

1. DUCTS RUN IN FRAMED OUT TRUSS OPENING TIGHT TO CORRIDOR WALL, COORDINATE WITH ARCHITECTURAL.
2. PROVIDE PRE-FABRICATED 2 HOUR FIRE RATED DUCT SYSTEM FOR ROUTING IN ATTIC. FLAMEBAR BW-11 OR EQUAL.

SALAZAR ARCHITECT
2222 NE OREGON ST., SUITE 101
PORTLAND, OR 97232
503.702.2575
WWW.SALAZARCH.COM

REGISTERED PROFESSIONAL ENGINEER
83722PE
OREGON
JAN. 12, 2016
RUWAN H. JAYAWEERA
11/01/2024
EXPIRES: 06/30/2025

PROJECT NUMBER: 2225

M. CARTER COMMONS

CLIENT:
Northwest Housing Alternatives
2316 SE WILLARD ST., MILWAUKIE OR 97222
Urban League of Portland
10 N RUSSELL ST., PORTLAND OR 97227

CONSULTANT:
PAE
pae-engineers.com

PHASE:
BID SET

REVISIONS:

#	DATE	DESCRIPTION
5	10.25.24	PLAN REVIEW CYCLE 2 ADDENDUM 2
2	08.20.24	PLAN REVIEW CYCLE 1

SHEET TITLE:
LEVEL 6 PLAN - MECHANICAL

DRAWN BY: PAE
CHECKED BY: PAE
DATE: 04.01.24

SHEET:
M206

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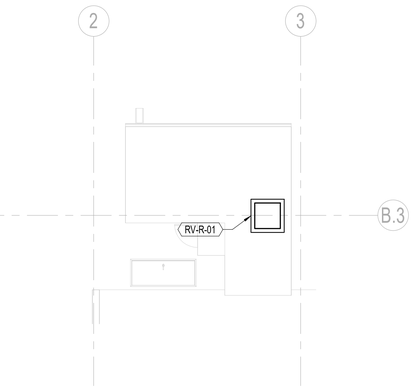
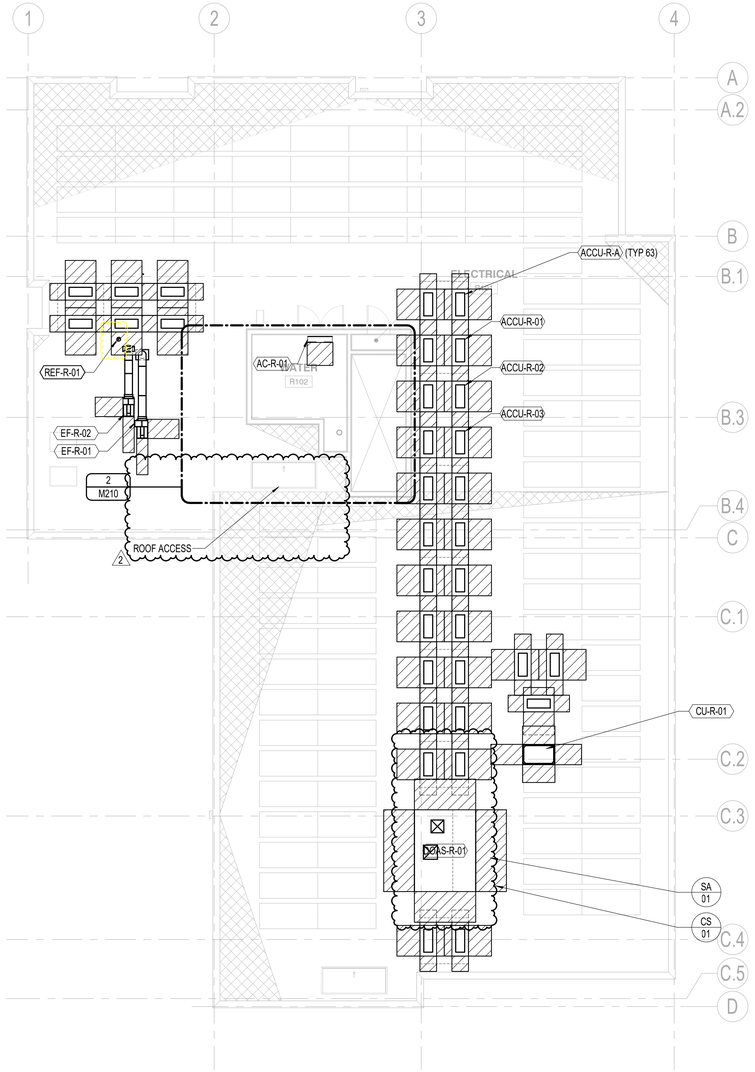


2 PARTIAL PLAN - ROOF PENTHOUSE - MECHANICAL
1/8" = 1'-0"



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

GENERAL NOTES:

A. MECHANICAL DUCT PLANS ARE DIAGRAMMATIC IN NATURE. PROVIDE SHOP DRAWINGS DEPICTING EXACT DUCT AND EQUIPMENT LOCATIONS COORDINATED WITH OTHER TRADES.
B. COORDINATE EXACT LOCATION OF VISIBLE WALL, FLOOR AND CEILING DEVICES WITH OWNER PRIOR TO ROUGH-IN. PROVIDE A MOCK-UP FOR THE OWNER'S REVIEW. LOCATIONS SHOWN ON THE PLANS ARE APPROXIMATE LOCATIONS. INSTALL DEVICES IN AN ORDERLY MANNER AT THE SAME ELEVATION FOR ADJACENT DEVICES. INSTALL DEVICES REQUIRING ADJUSTMENT IN CONFORMANCE WITH ADA REQUIREMENTS.
C. INSTALL MEPT WORK TIGHT TO STRUCTURE, SUSPENDED HIGH AS POSSIBLE UNLESS OTHER WISE NOTED. ENSURE PROPER ACCESS CLEARANCES AND MAINTENANCE ACCESSIBILITY FOR MOUNTING HEIGHT OF EQUIPMENT. COORDINATE INSTALLATION OF WORK WITH OTHER TRADES TO BE ROUTED TOGETHER ALONG SHARED PATHWAY.
D. PROVIDE SHEET METAL DUCTWORK AND COMPONENTS INCLUDING HANGING, SEALING, PLENUMS, AND ACCESSORIES IN ACCORDANCE WITH THE LATEST EDITION OF SMACNA STANDARDS FOR HVAC DUCT CONSTRUCTION, NFPA 90A, AND 90B STANDARDS.
E. DUCT DIMENSIONS SHOWN ARE INSIDE SHEET METAL DIMENSIONS OR CLEAR OPENING INSIDE LINED DUCT. THE FIRST NUMBER REPRESENTS THE WIDTH OF DUCT IN PLAN VIEW. REFER TO RISER DIAGRAMS FOR VERTICAL DUCTWORK SIZES.
F. PROVIDE VOLUME DAMPERS WHERE INDICATED AND IN EACH BRANCH DUCT SERVING INDIVIDUAL DIFFUSERS AND GRILLES.
G. SIZE BRANCH DUCTWORK TO MATCH EQUIPMENT CONNECTION SIZE, UNLESS OTHERWISE NOTED.
H. SIZE BRANCH DUCTWORK TO DIFFUSERS AND GRILLES TO MATCH DIFFUSER OR GRILLE CONNECTION SIZE, UNLESS OTHERWISE NOTED.
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2 Q. RISER LABELS:
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CX - CORRIDOR EXHAUST
SA - SUPPLY AIR
TX - TOILET EXHAUST
TRX - TRASH EXHAUST
SEE SHEET M901 FOR RISER DIAGRAM

NOTES:

1. NOT USED

0 4' 8' 16'

N

SALAZAR ARCHITECT
2222 NE OREGON ST., SUITE 101
PORTLAND, OR 97232
503.702.2575
WWW.SALAZARCH.COM

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2316 SE WILLARD ST., MILWAUKIE OR 97222
Urban League of Portland
10 N RUSSELL ST., PORTLAND OR 97227

CONSULTANT:
PAE
pae-engineers.com

PHASE:
BID SET

REVISIONS:

#	DATE	DESCRIPTION
2	08.20.24	PLAN REVIEW CYCLE 1

SHEET TITLE:
ROOF PLAN - MECHANICAL

DRAWN BY: PAE
CHECKED BY: PAE
DATE: 04.01.24

SHEET:
M210

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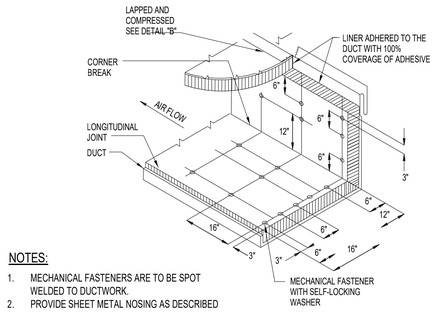
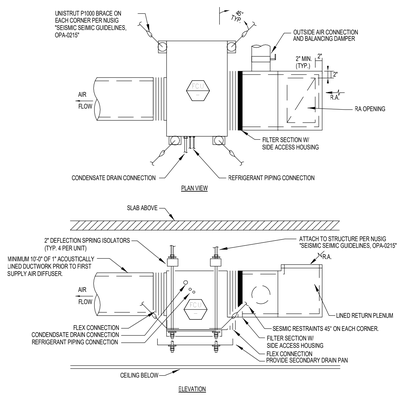


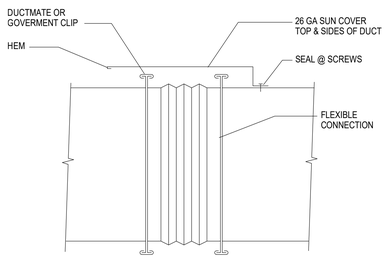
NOTES:

1. MECHANICAL FASTENERS ARE TO BE SPOT WELDED TO DUCTWORK.
2. PROVIDE SHEET METAL NOSING AS DESCRIBED IN SPECIFICATIONS.

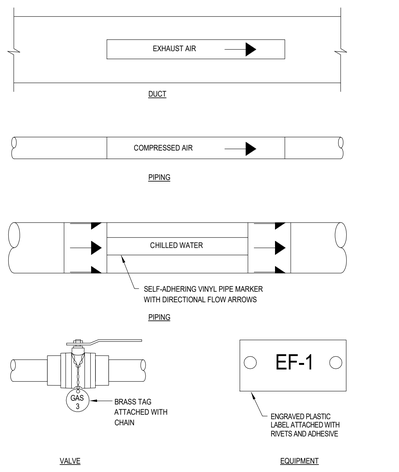
6 M - DETAIL - ACOUSTICAL LINING INSTALLATION
NONE



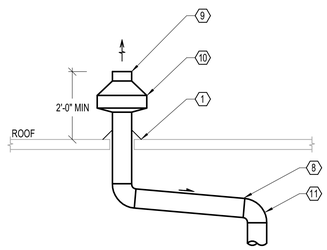
7 M - DETAIL - CEILING HUNG FAN COIL UNIT
NONE



8 M - DETAIL - FLEX DUCT COVER
NONE



9 M - DETAIL - IDENTIFICATION
NONE



GENERAL NOTES:

A. COORDINATE PIPE DEPTH WITH BUILDING FOOTING DEPTH, AND DEPTHS OF OTHER BUILDING SERVICES.

B. COORDINATE ROUTING OF PIPES WITH SUBSLAB BARRIERS (FOOTINGS/GRADE BEAMS) AND COORDINATE ALL SLEEVES WITH STRUCTURAL ENGINEER.

C. EXPOSED PIPING SHALL BE MARKED WITH AT LEAST ONE LABEL PER FLOOR STATING "RADON REDUCTION SYSTEM".

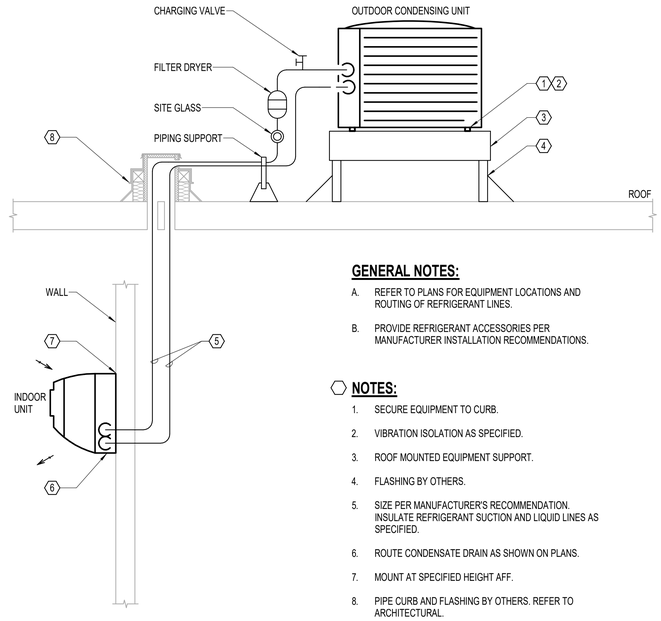
D. PROVIDE STATUS MONITORING FOR EACH EXHAUST FAN. PROVIDE AUDIBLE ALARM IN NORMALLY OCCUPIED LOCATION FOR INDICATION OF FAN FAILURE.

E. PIPE PERFORATIONS ORIENTED FOR BOTH THE FREE PASSAGE OF GAS AS WELL AS DRAINAGE OF ANY MOISTURE.

NOTES:

1. REFER TO ARCHITECTURAL DRAWINGS FOR ROOF PENETRATION AND FLASHING.
2. REFER TO ARCHITECTURAL DRAWINGS FOR PIPE PENETRATION THROUGH SLAB FLOORS.
3. CONCRETE SLAB ON GRADE.
4. 12" W x 8" D GAS PERMEABLE GRAVEL TRENCH.
5. SOIL GAS RETARDER MEMBRANE.
6. 3" SUBSLAB PERFORATED PIPE CENTERED IN TRENCH.
7. SUBSLAB BARRIER (FOOTING/GRADEBEAM).
8. 1/8" SLOPE PER FOOT FOR HORIZONTAL PIPING LOCATED ABOVE GRADE.
9. DISCHARGE WITH 1/2" BIRDSCREEN.
10. INLINE EXHAUST FAN.
11. 6" VERTICAL RISER PIPING (DWV).

4 RADON CONTROL SYSTEM
NONE



GENERAL NOTES:

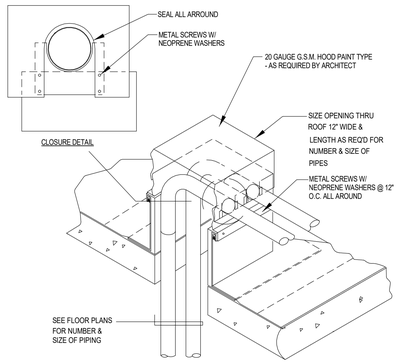
A. REFER TO PLANS FOR EQUIPMENT LOCATIONS AND ROUTING OF REFRIGERANT LINES.

B. PROVIDE REFRIGERANT ACCESSORIES PER MANUFACTURER INSTALLATION RECOMMENDATIONS.

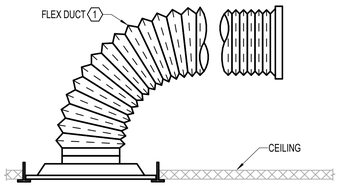
NOTES:

1. SECURE EQUIPMENT TO CURB.
2. VIBRATION ISOLATION AS SPECIFIED.
3. ROOF MOUNTED EQUIPMENT SUPPORT.
4. FLASHING BY OTHERS.
5. SIZE PER MANUFACTURER'S RECOMMENDATION. INSULATE REFRIGERANT SUCTION AND LIQUID LINES AS SPECIFIED.
6. ROUTE CONDENSATE DRAIN AS SHOWN ON PLANS.
7. MOUNT AT SPECIFIED HEIGHT AFF.
8. PIPE CURB AND FLASHING BY OTHERS. REFER TO ARCHITECTURAL.

5 23-40-117 SPLIT SYSTEM DETAIL
NONE



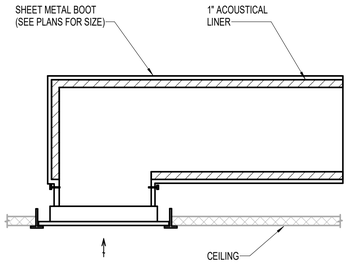
11 M - DETAIL - WEATHERPROOF HOOD
NONE



NOTES:

1. 1.5 DIA MINIMUM FLEX DUCT RADIUS (5' MAX LENGTH).

1 DIFFUSER DETAIL - ACOUSTIC FLEX PLENUM RETURN
NONE



2 RETURN AIR BOOT
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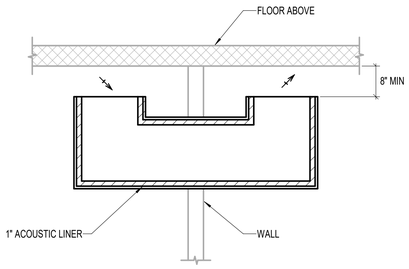
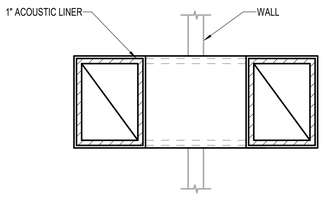
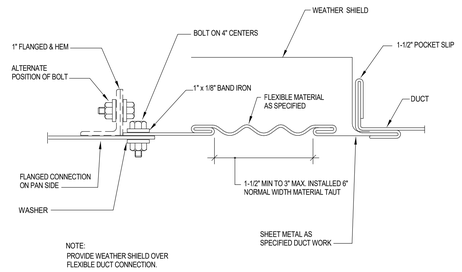


SECTION VIEW



PLAN VIEW

3 TRANSFER DUCT
NONE



10 M - DETAIL - WEATHERPROOF DUCT
NONE

SALAZAR ARCHITECT
2222 NE OREGON ST., SUITE 101
PORTLAND, OR 97232
503.702.2575
WWW.SALAZARCH.COM

REGISTERED PROFESSIONAL ENGINEER
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PHASE:

BID SET

REVISIONS:

#	DATE	DESCRIPTION

SHEET TITLE:

DETAILS - MECHANICAL

DRAWN BY:	PAE
CHECKED BY:	PAE
DATE:	04.01.24

SHEET:

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SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cast-in place concrete (CONC-1), including formwork, reinforcement, concrete materials, mixture design, placement procedures, finishes and following related materials:
    a. Waterstops.
    b. Vapor barriers.
2. Normal-weight concrete used for footings, foundation walls and slabs.
3. Void-filling.

B. Related Requirements:

1. Section 01 33 30 “Sustainability Requirements”.
2. Section 05 50 00 “Metal Fabrications” for coordination and provision of embedments and nosings to this Section for installation in forms prior to concrete placement.
3. Division 07 “Thermal and Moisture Protection” waterproofing sections for coordination and provision of waterstops required to be installed in concrete.
4. Section 07 19 00 “Water Repellents” for concrete sealers.
5. Section 07 21 00 “Thermal Insulation” for other building insulations, including perimeter insulation at back-fill locations.
6. Section 31 20 00 "Earth Moving" for drainage fill under slabs-on-grade.

1.3 DEFINITIONS

A. Finished Appearance Concrete:

1. Concrete Slabs Exposed to View: Smooth-formed finish concrete, exposed to view on surfaces where indicated, and that requires special concrete materials, formwork, placement, and finishes to obtain specified finish appearance.
2. Exposed Concrete Walls: Smooth-formed finish concrete, exposed to view on surfaces of completed walls or other site components where indicated, and that requires special concrete materials, formwork, placement, and finishes to obtain specified finish appearance.

B. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

C. STG: Surface Texture Grade.

1. Ra: Roughness Average.

D. COF: Coefficient of friction.

E. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 SUSTAINABILITY REQUIREMENTS

A. Comply with project requirements intended to achieve sustainable design, measured and documented according to the Earth Advantage Multifamily Rating System Measures Resource guide. Refer to Section 01 33 30 “Sustainability Requirements” for certification goals, volatile organic compounds (VOC) restrictions, and other sustainability requirements. Provide materials, products and procedures indicated in this Section necessary to obtain Earth Advantage measures required. Other Sections may indicate requirements that contribute to the same Earth Advantage measure; nonetheless the Contractor shall meet requirements indicated in this Section as well, to best assure certification.

1.6 SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals: Refer to Section 01 33 30 “Sustainability Requirements”.

1. Low Emitting Materials Measures 7.1.3:

a. Sealants and Caulking: Documentation indicating VOC levels.

2. Waste Management Measure 2.1.4:

a. Concrete Clean Out Pit or Eco-Pans: Installation of concrete clean out pit or Eco-Pans above or below grade, prior to start of construction.

C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

D. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement. The steel reinforcement detailer shall generate all shop drawing bending and installation details from the structural and architectural drawings and specifications. The use of reproductions or photocopies of the contract drawings shall not be permitted.

1. Provide details of fabrication, bending, and placement prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include special reinforcement required for openings through concrete structures.

2. Shop drawings re-submittals shall clearly identify all revisions to previous submittals.

a. Heavy ink clouded outlines (revision clouds) shall be drawn around revised areas of individual sheets.

b. Architect/ Engineer will not review information outside of revision clouds on resubmitted drawings.

E. Formwork Shop Drawings: Prepared by or under the supervision of a structural engineer licensed in the State in which the Project is located detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

2. For Finished Appearance Concrete include the following with the formwork shop drawings:

   a. Formwork Tie Layout and Configuration: Refer to Drawings for formwork tie layout requirements. Provide tie configuration based on 1-1/2 in. nominal breakback and resulting in 1-1/4 in. diameter tie hole.

      1) Proposed construction tie patterns, tie locations, bar sizes, spacings, clearances and disposition related to adjacent items and other items that visually affect.

   b. Construction Joint Layout and Pour Sequence. Include details at construction joints, pour strips, and form joint sealant details conforming with design intent.

      1) Location of construction joints for finished appearance concrete is subject to approval of the Architect.

F. Samples: For vapor barrier, form liners, and form ties, tie cones and tie hole plugs.

G. Samples for Verification: For finished appearance concrete provide samples, approximately 18 by 18 in. by 2 in. thick, for finish and texture produced by form-liner. Include a three- to five-sample set showing the range of variations expected.

H. Qualification Data: For Installer, manufacturer, and testing agency.

1. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and owners, and other information specified.

I. Welding certificates.

J. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Curing compounds.
7. Floor and slab treatments.
8. Bonding agents.
9. Adhesives.
10. Vapor barriers.
11. Semirigid joint filler.
12. Joint-filler strips.
13. Repair materials.

K. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

L. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

M. Field quality-control reports.

N. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

F. Mockups: Prior to casting finished appearance concrete, build mockups to verify selections made under Samples for Verification submittals and to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work

1. Slab-on-Grade Mockup: Build panel approximately 200 sq. ft. for slab-on-grade in the location indicated or, if not indicated, as directed by Architect.

2. Finish Appearance Concrete Mockups: Build at the locations indicated; refer to Drawings. If not indicated, locate as directed by Architect.

3. Items to be evaluated:

a. Concrete finishes.

b. Architectural reveals and patterns.

c. Curing, cleaning and protection procedures.

4. Demonstrate curing, cleaning, and protecting of cast-in-place finished-appearance concrete, finishes, and contraction joints, as applicable.

5. Obtain Architect's approval of mockups prior to casting finished-appearance concrete.

6. Subject to compliance with requirements, approved mockups may become part of the completed Work if undamaged at time of Substantial Completion.

G. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

2. ACI 301, "Specification for Structural Concrete", Sections 1 through 5.

3. ACI 303.R-12, “Guide to Cast-in-Place Architectural Concrete Practice”.

4. ACI 305 “Recommended Practice for Hot Weather Concreting”.
5. ACI 306 “Recommended Practice for Cold Weather Concreting”.
6. ACI 315 “Details and Detailing of Concrete Reinforcement”.
7. ACI 318 “Building Code Requirements for Reinforced Concrete”.

H. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301.
2. ACI 117.
3. ACI 303R, for architectural concrete finishes.

B. Redesign or Departures from Requirements of the Contract Documents Initiated by Contractor:

1. Obtain written acceptance from the Architect and Architect’s consultants.
2. Bear costs for Contractor-initiated or construction error due to changes in type, form, system, or details of construction from those indicated by the contract documents.
3. Costs of review of such changes by Architect and Architect’s consultants will be deducted from the Contract Sum by Change Order.

C. Match Existing: Where concrete is indicated to match existing, concrete appearance shall match existing concrete in finish and quality. Installer shall select mix designs complying with requirements.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, glass-fiber-reinforced plastic, or other approved panel materials.

2. Exterior-grade plywood panels, nonabsorptive, that will provide continuous, true, and smooth architectural concrete surfaces, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1, or better.

b. Medium-density overlay, Class 1, or better, nonabsorptive, mill-release agent treated and edge sealed.

B. Finished Appearance Concrete: Form-facing panels that provide continuous and true concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Smooth-Formed Concrete: As indicated for panels at Smooth-Formed Finished Concrete articles above, except:

a. High-density overlay, Class 1, or better.

2. Do not provide chamfers at corners of smooth-formed concrete.

3. Sealant Corners: Seal interior corners of formwork with joint sealant to avoid excess drainage of “cream” from concrete during placement.

4. Smooth-formed concrete landscape wall.

a. Finish: Smooth form, all exposed sides.

b. Mockup: Produce a mockup prior to initial casting of actual Project concrete work, to represent finish, joints, and edge conditions. Insure review and approval of mockup prior to actual Project concrete work. Size shall be 3 x 3 feet square minimum.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, or smooth surface paper or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Chamfer Strips: Wood, metal, or rubber strips, 3/8 by 3/8 inch for rectangular concrete columns indicated to remain exposed in final construction.

E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal and/or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish ties with integral water-barrier plates at walls indicated to receive dampproofing or waterproofing.

2. At formed concrete exposed to view in the final construction, furnish units that provide 1-1/2 inch nominal break back and leave no corrodible metal closer than 1-1/2 inch to the plane of exposed concrete surface.

   a. Tie Cones: As indicated above for finished appearance concrete.

3. At formed concrete NOT exposed to view in the final construction, furnish units that provide 1 inch nominal break back and leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed. Refer to Structural Notes or structural drawings.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M, deformed.

C. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I/II.

2. Fly Ash: ASTM C618, Class F or C. Refer to Structural Notes in Drawings for allowed quantities.

3. Silica Fume: ASTM C1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C33/C33M, coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: Refer to Structural Notes in Drawings.

2. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 sieve, and less than 8 percent may be retained on sieves finer than No. 50.

3. Aggregate for Polished Concrete Floors: Seed floors to receive polished exposed finish with aggregate as selected by Architect or Owner’s Authorized Representative.

D. Water: ASTM C94/C94M and potable.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260/C260M.

B. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C494/C494M, Type C.

D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

2.7 UNDER-FOOTING AND UNDER-SLAB INSULATION

A. Foundation and Under-Slab Insulation: Molded Polystyrene Board, ASTM C578, Type II, 15-psi minimum compressive strength.

1. Dimensional tolerance: Within 0.5 percent in length, width and thickness.
2. Thickness: As indicated on Structural Drawings.
3. Compressive Strength:
    a. At Under-Slab and Perimeter Applications: Minimum compressive strength of 5.8 psi at 1% deformation.
    b. At Under-Footing Applications: Minimum compressive strength of 18.6 psi at 1% deformation.
4. Basis-of-Design Products:
    a. At Under-Slab and Perimeter Applications: FoamControl EPS 19 by Geofoam; www.geofoam.com.
    b. At Under-Footing Applications: FoamControl EPS 46 by Geofoam; www.geofoam.com.
5. Other Approved Products:
    a. Foam-Control PLUS+ by ACH Foam Technologies, Inc.; www.achfoam.com.
    b. Foam-Control PLUS+ by AFM Corp.; www.afmcorporation.com.
    c. ThremalStar by Atlas EPS.; www.atlaseps.com.
    d. EPS Insulation by Dyplast Products; www.dyplastproducts.com.
    e. R-Tech by Insulfoam; www.insulfoam.com.
    f. Or equal.

2.8 WATERSTOPS

A. Waterstops, General: Provide type and product from the types indicated below as required by waterproofing manufacturer for warranty in Division 07 waterproofing Sections.

2.9 VAPOR BARRIER

A. Sheet Vapor Barrier: ASTM E1745, Class A; not less than 20 mils (0.51 mm) thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Approved Products: Provide one of the following, or other product meeting the moisture vapor emission rate requirement of concrete moisture vapor reduction admixture:

a. VAPORBLOCK® PLUS™ VBP20 by Viaflex.; www.viaflex.com

1) Water-Vapor Permeance: 0.01 Perms per ASTM E96.

b. Stego Wrap 20 mil Class A by Stego Industries, LLC; www.stegoindustries.com.

1) Water-Vapor Permeance: 0.0088 Perms per ASTM E154 Section 8.

c. PERMINATOR® EVOH 20 mil by W. R. Meadows, Inc.; www.wrmeadows.com.

1) Water-Vapor Permeance: 0.0064 Perms per ASTM E96.

2. Manufacturer's recommended tape and mastic for sealing at overlaps and openings.

2.10 CONCRETE CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 ox./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound/ Sealer: ASTM C309, Type 1, Class B, dissipating.

1. Approved Products:

a. MasterKure CC 200 WB by BASF Corp. Construction Systems; www.master-builders-solutions.basf.us.

b. Safe-Cure Clear by ChemMasters, Inc.; www.chemmasters.net.

c. KUREZ W VOX by Euclid Chemical Co. (The); www.euclidchemical.com.

d. TAMMSCURE WB 30 by Euclid Chemical Co. (The).

e. L&M Cure R by Laticrete International, Inc.; www.laticrete.com.

f. 1100 (formerly 1100-CLEAR) by W. R. Meadows, Inc.; www.wrmeadows.com.

2. Application: At Concrete floors, CONC-1, as indicated.

2.11 RELATED MATERIALS

A. Reglets: Fabricate reglets of not less than 0.022-inch-thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

B. Epoxy-Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class, suitable for application temperature and grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

C. Bonding Agent: ASTM C1059, Type II, non-redispersable, acrylic emulsion or styrene butadiene.

2.12 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.

2. Combined Fly Ash or Pozzolan and Slag Cement: 20 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.

3. Silica Fume: 10 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Synthetic Fiber: uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd. (0.90 kg/cu. m).

E. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.

2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio between 0.40 to 0.42.

4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces, including finished appearance concrete.

2. Class B, 1/4 inch for rough-formed finished surfaces and concrete NOT exposed to view in the final construction.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.

2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of exposed cast-in-place concrete.

1. Exception: At finished appearance concrete chamfered corners are NOT permitted unless reviewed by Architect and approved prior to concrete placement.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

M. Additional Requirements for Finished Appearance Concrete:

1. Do not locate form ties at formwork joints.

2. Reusable portions of form ties to be maintained free of rust and damage.

3. Provide sealant at all form tie holes after formwork has been removed; refer to Section 07 92 00 “Joint Sealants” for exterior sealant type and requirements; sealant color shall match concrete color.

3.2 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Installation: Install with adhesive, fasteners, press into tacky waterproofing or dampproofing, or restrain with backfill according to manufacturer's written instructions.

3.3 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.4 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.5 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.

2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.6 VAPOR BARRIER INSTALLATION

A. Sheet Vapor Barriers: Place, protect, and repair sheet vapor barrier according to ASTM E1643 and manufacturer's written instructions.

1. Install vapor barrier with longest dimension parallel with direction of concrete pour.

2. Face laps away from exposed direction of concrete pour.

3. Lap vapor barrier over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.

4. Lap joints 12 inches and seal with manufacturer's recommended tape and mastic or sealed with continuous bead of polyurethane caulk.

5. Terminate vapor barrier at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor barrier manufacturer's instructions.
7. Protect vapor barrier during placement of reinforcement and concrete.
   a. Repair damaged areas by patching with vapor barrier material, overlapping damages area by 6 inches on all sides, and sealing to vapor barrier.
8. Caulk slab joints.

3.7 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
   1. Do not cut or puncture vapor barrier. Repair damage and reseal vapor barrier before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
   1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.8 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated.
   2. Place joints perpendicular to main reinforcement.
      a. Continue reinforcement across construction joints unless otherwise indicated.
      b. Do not continue reinforcement through sides of strip placements of floors and slabs.
   3. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   5. Space vertical joints in walls as indicated. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
   6. Use a bonding agent or roughen interface to 1/4 inch amplitude at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated, or if not indicated, then following column center lines.

1. Slabs Exposed to View: Saw cuts (scoring) are required at exposed slabs-on-grade and elevated slabs as an aesthetic feature to minimize visibility and direct cracking along the cut.

2. Sawed Joints: Cut contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete to a depth equal to at least one-fourth of concrete thickness. Perform when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks, but no more than 12 hours after the slab has been placed.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.9 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.

2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Provide dedicated concrete clean-out pit prior to start of concrete placement.

1. Basis-of-Design Product: Large Pan by Eco-Pan; www.eco-plan.com.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

2. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.

3. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301 ACI.

a. Do not use vibrators to transport concrete inside forms.

b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.

c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.

d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Maintain reinforcement in position on chairs during concrete placement.

3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

G. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mixture designs.

H. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering materials applied directly to concrete.

2. Finished Appearance Concrete: Smooth-formed finish concrete as indicated above, except as indicated elsewhere in this Section to obtain finished appearance.

B. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.

2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: (Tining)

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.

2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.

3. Applications: Apply scratch finish to surfaces to receive concrete floor toppings and to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.

2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.

3. Applications: Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.

2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.

3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

4. Do not add water to concrete surface.

5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.

6. Applications: Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:

a. Slabs on Ground:

1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch and also no more than 1/16 inch in 2 feet.

2) Specified overall values of flatness, FF 25; and of levelness, FL 20; with minimum local values of flatness, FF 17; and of levelness, FL 15.

3) Specified overall values of flatness, FF 35; and of levelness, FL 25; with minimum local values of flatness, FF 24; and of levelness, FL 17.

4) Specified overall values of flatness, FF 45; and of levelness, FL 35; with minimum local values of flatness, FF 30; and of levelness, FL 24.

5) Specified Overall Value (SOV): FF 50 and FL 25 with minimum local value (MLV): FF 40 and FL 17.

6) Specified Overall Value (SOV): FF 25 and FL 20 with minimum local value (MLV): FF 17 and FL 15.

b. Suspended Slabs:

1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch and also no more than 1/16 inch in 2 feet.

2) Specified overall value of flatness, FF 25; with minimum local value of flatness, FF 17.

3) Specified overall value of flatness, FF 35; with minimum local value of flatness, FF 24.

4) Specified overall value of flatness, FF 45; with minimum local value of flatness, FF 30.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated in Drawings. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Architect before application.

2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

3. Applications: Apply a broom finish to interior concrete ramps, pool decks, and locations indicated on Drawings.

F. Broom Finish: Apply a first trowel finish to surfaces indicated in Drawings. While concrete is still plastic, scarify surface with a fine broom perpendicular to main traffic route.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

2. Coordinate required final finish with Architect before application.

3. Applications: Apply a broom finish to exterior concrete platforms, steps, ramps, substrates where tile installation is indicated, and locations indicated on Drawings.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate or aluminum granule finish to concrete stair treads, platforms, ramps as indicated in Drawings

1. Apply in accordance with manufacturer's written instructions and as follows:

a. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate or aluminum granules over surface in one or two applications.

b. Tamp aggregate flush with surface, but do not force below surface.

c. After broadcasting and tamping, apply float finish.

d. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate or aluminum granules.

3.12 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.13 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.

    b. Continuous water-fog spray.

    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.

    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall

within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried.

2. Fill form-tie hole voids with patching preformed cone-shaped tie-hole plugs secured in place with bonding agent.

3. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

4. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that

penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 VOID-FILLING

A. Fill voids at cast-in-place concrete and masonry throughout the project to prevent access to interior spaces, both occupied and not-occupied, by insects and rodents. This includes at openings created for the passage of piping, wiring, or other work which creates openings that could provide access to vermin.

B. Void-Filling Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

3.17 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections: As indicated in the General Structural Notes.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

2. Testing Frequency: Obtain at least one composite sample for each 150 cu. yd. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C231/C231M, pressure method, for normal-weight concrete; ASTM C173/C173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

6. Unit Weight: ASTM C567/C567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

7. Compression Test Specimens: ASTM C31/C31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.

    b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C39/C39M; test one set of two laboratory-cured specimens at 7 days, one set of two specimens at 28 days, and one set of two specimens at 90 days when indicated in the general structural notes.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.

    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days and 90 days if applicable, concrete mixture proportions and materials, compressive

breaking strength, and type of break for both 7-, 28-, and 90-day tests where required in the general structural notes.

12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

13. Additional Tests:

    a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Architect.

        1) Acceptance criteria for concrete strength shall be in accordance with ACI 301, section 1.6.6.3.

14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E1155 within 48 hours of finishing.

END OF SECTION