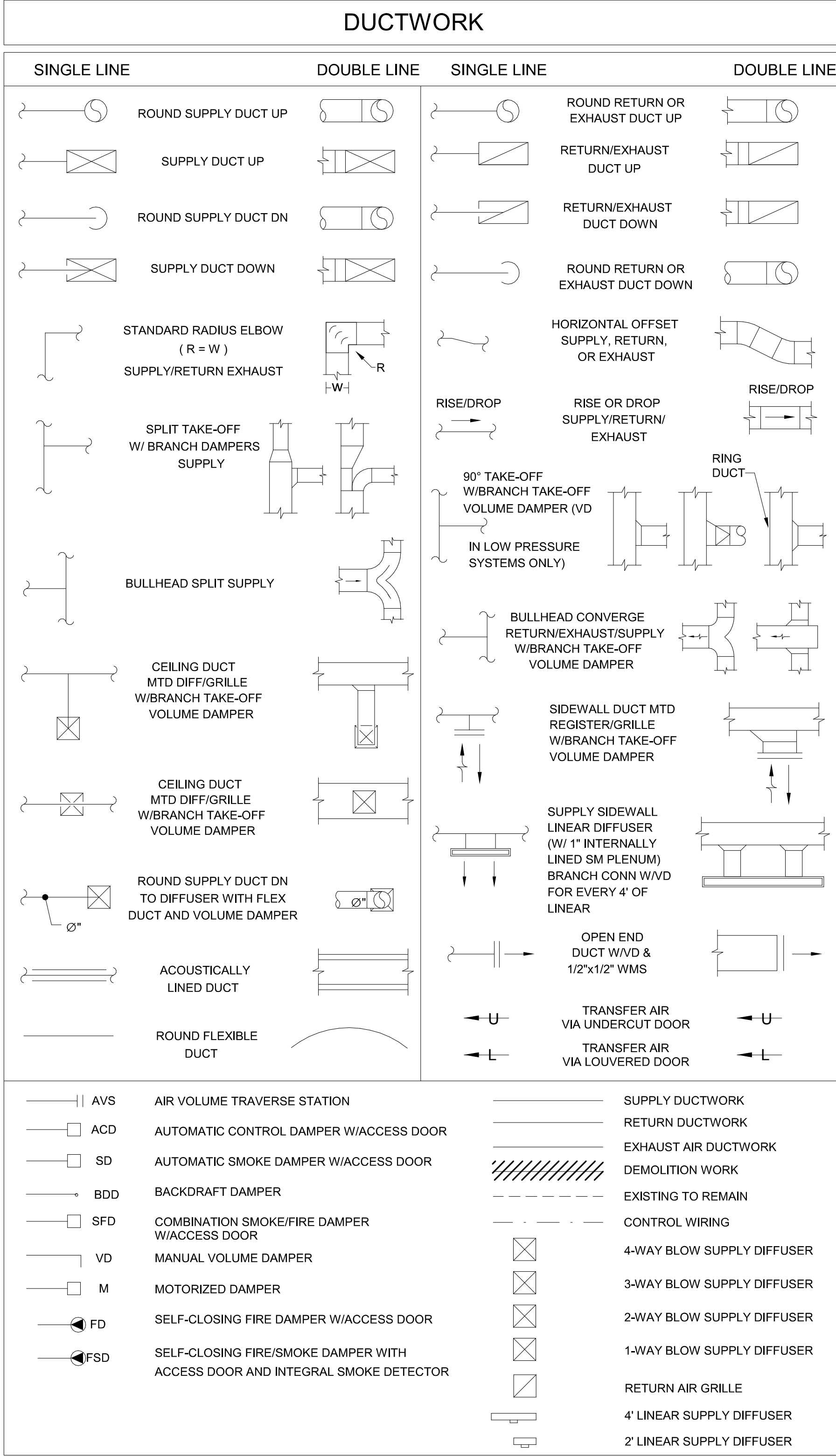
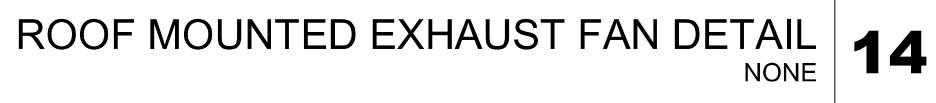






VARIABLE VOLUME TERMINAL BOX (VAV) SCHEDULE										
TAG	MAXIMUM COOLING CFM	MINIMUM HEATING CFM	MAXIMUM DROPT HEATING CFM	MIN. S.P. DROP (IN WG)	KW/STEPS	HEATING COIL			MANUFACTURER & MODEL No.	REMARKS
						VOLTI/O	EAT (°F)	LAT (°F)		
VAV-1-1	1000	300	600	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-10	1 - 12
VAV-1-2	355	120	240	0.17	2/1	208/1	55	80	ENVIRO-TEC SDR-6	1 - 12
VAV-1-3	890	300	600	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-1-4	1260	400	800	0.17	5/2	208/1	55	80	ENVIRO-TEC SDR-10	1 - 12
VAV-1-5	760	250	600	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-1-6	780	250	600	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-1-7	340	120	240	0.17	2/1	208/1	55	80	ENVIRO-TEC SDR-6	1 - 12
VAV-1-8	520	170	340	0.17	3/2	208/1	55	80	ENVIRO-TEC SDR-6	1 - 12
VAV-1-9	680	220	450	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-2-1	500	150	300	0.17	3/2	208/1	55	80	ENVIRO-TEC SDR-6	1 - 12
VAV-2-2	630	200	400	0.17	3/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-2-3	885	300	600	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-2-4	930	300	600	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-10	1 - 12
VAV-2-5	410	130	260	0.17	3/2	208/1	55	80	ENVIRO-TEC SDR-6	1 - 12
VAV-2-6	850	300	600	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-2-7	750	250	500	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-2-8	750	250	500	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-2-9	800	250	500	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-2-10	675	230	460	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-2-11	675	230	460	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-2-12	565	230	460	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-3-1	810	250	500	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-3-2	1200	400	800	0.17	5/2	208/1	55	80	ENVIRO-TEC SDR-10	1 - 12
VAV-3-3	950	300	600	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-10	1 - 12
VAV-3-4	500	150	300	0.17	3/2	208/1	55	80	ENVIRO-TEC SDR-6	1 - 12
VAV-3-5	750	250	500	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-3-6	500	150	300	0.17	3/2	208/1	55	80	ENVIRO-TEC SDR-6	1 - 12
VAV-3-7	165	50	120	0.17	2/1	208/1	55	80	ENVIRO-TEC SDR-5	1 - 12
VAV-3-8	540	150	300	0.17	3/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-3-9	410	120	240	0.17	3/2	208/1	55	80	ENVIRO-TEC SDR-6	1 - 12
VAV-3-10	900	300	600	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-3-11	700	250	500	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-3-12	1000	300	600	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-10	1 - 12
VAV-3-13	460	150	300	0.17	3/2	208/1	55	80	ENVIRO-TEC SDR-6	1 - 12
VAV-3-14	350	120	-	0.17	-	208/1	55	-	ENVIRO-TEC SDR-6	1 - 12
VAV-4-1	850	300	600	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-4-2	800	250	500	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-4-3	800	250	500	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-4-4	880	300	600	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-4-5	1700	500	1000	0.17	8/2	208/3	55	80	ENVIRO-TEC SDR-12	1 - 12
VAV-4-6	800	250	500	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-4-7	1500	250	250	0.17	3/2	208/1	55	80	ENVIRO-TEC SDR-12	1 - 12
VAV-4-8	320	100	200	0.17	2/1	208/1	55	80	ENVIRO-TEC SDR-6	1 - 12
VAV-4-9	650	220	450	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-4-10	690	220	450	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-4-11	640	220	450	0.17	4/2	208/1	55	80	ENVIRO-TEC SDR-8	1 - 12
VAV-4-12	290	120	-	0.17	-	208/1	55	-	ENVIRO-TEC SDR-6	1 - 12
NOTES: 1. COORDINATE CONTROL REQUIREMENTS WITH BASE BUILDING CONTROL SYSTEM. 2. ALL VAV BOXES SHALL BE TESTED, CERTIFIED AND SEALED IN ACCORDANCE WITH ARI STANDARD 880. 3. ALL WIRING REQUIRED FOR CONTROL FUNCTION BY HVAC CONTRACTOR. 4. CONTROLS TO BE PROVIDED AND MOUNTED BY THE VAV BOX MANUFACTURER. 5. STATIC PRESSURE BASED ON MAXIMUM DESIGN CFM WITH VOLUME CONTROL DAMPER IN FULL OPEN POSITION. 6. PROVIDE RADIATED SOUND INDUCTION DAMPER TO ASSIST IN BALANCING. 7. PROVIDE 7-DAY PROGRAMMABLE HEATING/COOLING THERMOSTAT WITH NIGHT SETBACK & ON/OFF/AUTO SWITCH. 8. VAV BOXES SHALL BE GALVANIZED, GALLNEALED METAL IS NOT ACCEPTABLE. 9. DUCTWORK DOWNSTREAM OF ALL VAV BOXES SHALL BE LINED WITH 1" ACOUSTICAL LINING, MINIMUM OF 6'-0" FROM VAV BOX. 10. CONTROL SEQUENCE SHALL INCLUDE EARLY MORNING ARM UP CONTROL BOTH FOR HEATING AND COOLING AND AUTOMATIC CHANGE OVER. 11. PROVIDE REQUIRED SERVICE SPACE IN FRONT OF CONTROL PANEL OF VAV BOXES AS PER MANUFACTURER'S RECOMMENDATION. 12. VAV BOX DAMPER SHALL BE PERMITTED TO OPEN (ABOVE MINIMUM POSITION) IN THE HEATING MODE TO SATISFY THERMOSTAT SETPOINT.										

EXHAUST FAN SCHEDULE										
TAG	TYPE	CFM	RPM	EXT. S.P.	DRIVE TYPE	ELECTRICAL DATA		SERVICE	MFR & MODEL	NOTES
						HP	VOLTS/Ø/HZ			
EF-1	ROOF DOWNBLAST	1500	1300	0.6	DIRECT	0.5	208/1/60	RESTROOMS	COOK 135C13D	1 - 5

NOTES:

1. PROVIDE FAN MOUNTED BACKDRAFT DAMPER.
2. PROVIDE UNIT MOUNTED SPEED CONTROLLER.
3. UNIT TO BE INSTALLED LEVEL.
4. PROVIDE WITH 12" FACTORY ROOF CURB.
5. PROVIDE TIMECLOCK OPERATION.

PACKAGED ROOFTOP UNIT SCHEDULE (OFFICE AREA)																							
MARK	MANUFACTURER	MODEL #	TOTAL SA CFM	TOTAL OA CFM	FAN HP	EXTERNAL SUPPLY STATIC PRESSURE	VFD	COOLING				GAS HEATING					ELECTRICAL			EER	IEER	WEIGHT (LB)	REMARKS
								EAT DRWB (°F)	LAT DRWB (°F)	TOTAL COOLING (MBH)	SENSIBLE COOLING (MBH)	EAT/LAT (°F)	HEATING OUTPUT (MBH)	HEATING INPUT (MBH)	GAS CONL. SIZE	AFUE	V/PHHZ	MCA	MOCP				
RTU-1	CARRIER	48K3GU20	10000	1800	15	2.0	YES	79/66	56.1/53.8	300.0	226.5	60/102	350	280	3/4"	80%	208/3/60	117	150	10.3	16.0	4300	1, 2, 4
RTU-2	CARRIER	48K3GU20	10000	1800	15	2.0	YES	79/66	56.1/53.8	300.0	226.5	60/102	350	280	3/4"	80%	208/3/60	117	150	10.3	16.0	4300	1, 2, 4
RTU-3	CARRIER	48K3GU20	10000	1800	15	2.0	YES	79/66	56.1/53.8	300.0	226.5	60/102	350	280	3/4"	80%	208/3/60	117	150	10.3	16.0	4300	1, 2, 4
RTU-4	CARRIER	48K3GU20	10000	1800	15	2.0	YES	79/66	56.1/53.8	300.0	226.5	60/102	350	280	3/4"	80%	208/3/60	117	150	10.3	16.0	4300	1, 2, 4
NOTES: 1. PROVIDE CONTROL CENTER W/DISCONNECT AND STARTERS, 24" ROOF CURB, SERVICE RECEPTACLE, INLET DAMPER, NEOPRENE BLOWER, VIBRATION ISOLATION, GAS PRESSURE REGULATOR, DULB 1/2" INLET, FIREST/ DUCT SMOKE DETECTOR, 10" MIN. WEATHERWOOD W/BRASS/REGEN, MEV'S FILTERS, INLET AIR SENSOR, FILTER GAGE, AND FREEZE/STAT. 2. PROVIDE STAINLESS STEEL HEAT EXCHANGER, STAINLESS STEEL BURNER, STAINLESS STEEL DRIP PAN, MAKE-UP AIR CONTROL DAMPERS, PROVIDE WALL MOUNTED PROGRAMMABLE THERMOSTAT. 3. PROVIDE WITH 10000 CFM POWER EXHAUST. 4. PROVIDE UNIT WITH SUPPLY FAN VFD FOR MULTI-ZONE OPERATION WITH SUPPLY AIR DUCT PRESURE SENSOR.																							

HEAT PUMP UNIT SCHEDULE											
TAG	LOCATION	SERVICE	REFRIGERANT	OUTDOOR AIR TEMP (F)	V/8/HZ	MCA	MOP	SEER	WEIGHT (LB)	MFR & MODEL #	NOTES
ACCU-1	IT ROOM	ACC-1	R-410A	95	208/1/60	16	25	25.0	75	CARRIER 38MARBG18	1-3
ACCU-2	IT ROOM	ACC-2	R-410A	95	208/1/60	15	15	25.0	75	CARRIER 38MARBG12	1-3
ACCU-3	IT ROOM	ACC-3	R-410A	95	208/1/60	15	15	25.0	75	CARRIER 38MARBG12	1-3
ACCU-4	IT ROOM	ACC-4	R-410A	95	208/1/60	15	15	25.0	75	CARRIER 38MARBG12	1-3
ACCU-5	IT ROOM	ACC-5	R-410A	95	208/1/60	15	15	25.0	75	CARRIER 38MARBG12	1-3
ACCU-6	IT ROOM	ACC-1	R-410A	95	208/1/60	16	25	25.0	75	CARRIER 38MARBG18	1-3

NOTES:
1. INDOOR UNITS POWERED BY OUTDOOR UNIT.
2. UNIT TO BE INSTALLED LEVEL.
3. REFRIGERANT PIPING ROUTING AND SIZING TO BE A DELEGATED DESIGN BY THE CONTRACTOR AND MANUFACTURER.

DUCTLESS AIR HANDLING UNIT SCHEDULE									
TAG	SERVICE	TOTAL COOLING MBH	TOTAL HEATING MBH	EAT DB/WB	S/A CFM	O/A CFM	V/O/HZ	MFR & MODEL #	NOTES
ACC-1	ELEVATOR ROOM	18	N/A	75/63	375	N/A	NOTE 5	CARRIER 40MAHBQ18	1-5
ACC-2	IT ROOM	12	N/A	75/63	375	N/A	NOTE 5	CARRIER 40MAHBQ12	1-5
ACC-3	IT ROOM	12	N/A	75/63	375	N/A	NOTE 5	CARRIER 40MAHBQ12	1-5
ACC-4	IT ROOM	12	N/A	75/63	375	N/A	NOTE 5	CARRIER 40MAHBQ12	1-5
ACC-5	IT ROOM	12	N/A	75/63	375	N/A	NOTE 5	CARRIER 40MAHBQ12	1-5
ACC-6	2ND FLOOR MDF ROOM	18	N/A	75/63	375	N/A	NOTE 5	CARRIER 40MAHBQ18	1-5
NOTES:									
1. PROVIDE WITH WIFI ENABLED PROGRAMMABLE HEATING/COOLING THERMOSTAT.									
2. REFRIGERANT PIPING ROUTING TO BE A DELEGATED DESIGN BY THE CONTRACTOR AND MANUFACTURER.									
3. CONTRACTOR SHALL ROUTE PUMPED CONDENSATE TO TRAP SIDE OF WASHER MACHINE DRAIN CONNECTION.									
4. PROVIDE WITH DEHUMIDIFICATION CYCLE.									
5. POWER FOR UNIT PROVIDED BY CONDENSING UNIT.									

TAG	SERVICE	TYPE / MATERIAL	COLOR	FACE SIZE	C/W BALANCING DAMPER	NC (dB)	MANUFACTURER & MODEL	NOTES
CD-1	SUPPLY	LAY-IN PLAQUE / STEEL	WHITE B-12	24 X 24	YES	30	EH PRICE - SPD	1 - 6
LD-1	SUPPLY	LINEAR DIFFUSER / ALUMINUM	WHITE B-12	REFER TO NOTES	YES	30	EH PRICE - SDS 75	5- 8
CD-2	SUPPLY	SURFACE	WHITE B-12	VARIES	YES	30	EH PRICE - AMCD	1- 4
CD-3	SUPPLY	SURFACE	WHITE B-12	VARIES	YES	30	EH PRICE - MSRRG	1- 4
EG-1	EXHAUST	SURFACE	WHITE B-12	VARIES	YES	30	EH PRICE - AMCD	
EG-2	EXHAUST	SURFACE	WHITE B-12	VARIES	YES	30	EH PRICE - MSRRG	
RG-1	RETURN	LOUVERED / ALUMINUM	WHITE B-12	24 X 24	NO	30	EH PRICE - 80	1- 4
LR-2	RETURN	LINEAR DIFFUSER / ALUMINUM	WHITE B-12	REFER TO NOTES	YES	30	EH PRICE - SDS 75	5- 8

NOTES:

1. PROVIDE 24X24 DROP PANEL FOR LAY-IN CEILING WITH INSULATED BACK PAN.
2. ALL SIZES INDICATED FOR T-BAR CEILINGS ARE NOMINAL - EXACT SIZE TO BE LESS TO ALLOW DEVICES TO LAY IN CEILING.
3. PROVIDE LIGHT SHIELDS WHERE TRANSFERS ARE NOT PROVIDED.
4. PROVIDE WITH T-BAR LAY-IN FRAME AND RETURN WITH LIGHT SHIELD.
5. FLEXIBLE DUCT SIZE TO MATCH NECK SIZE.
6. PROVIDE SQUARE TO ROUND ADAPTERS AS REQUIRED. PROVIDE FIELD FABRICATED PLENUMS WHERE FACTORY PLENUMS WILL NOT FIT DUE TO FIELD CONDITIONS.
7. 3 SLOTS, 3/4" SLOT WIDTH, C/W 1200 SUPPLY PLENUM.
8. PROVIDE PLASTER FRAMES FOR ALL AIR DEVICES MOUNTED IN PLASTER. SEE ARCHITECTURAL REFLECTED CEILING PLAN.
9. SEE DRAWING 7/8/01 FOR TRANSFER DUCT FOR TRANSFER DUCT DETAILS.
10. PROVIDE 1" THICK ACCOUSTICAL LINING.

UNIT HEATER SCHEDULE								
TAG	TYPE	APPROX. CFM	HEATING	ELECTRICAL DATA		SERVICE	MFR & MODEL	NOTES
			KW	AMPS	VOLTS/Ø/HZ			
CUH-1	WALL-RECESSED CABINET	175	3	14.5	208/1/60	WATER ROOM	QMARK CWH3404	1, 2
CUH-2	WALL-RECESSED CABINET	175	3	14.5	208/1/60	REAR EXIT	QMARK CWH3404	1, 2
CUH-3	WALL-RECESSED CABINET	175	3	14.5	208/1/60	REAR EXIT	QMARK CWH3404	1, 2
NOTES:								
1. PROVIDE WITH INTEGRATED THERMOSTAT.								
2. PROVIDE WITH AUTOMATIC SHUT OFF WHEN OUTDOOR TEMPERATURES EXCEED 45° F.								



One Penn Center
1617 JFK Boulevard, Suite 1600
Philadelphia, PA 19103 U.S.A.
norr.com

0

SEAL

CLIENT:

MONTGOMERY COUNTY

PROJECT TEAM

KIMLEY-HORN

620 W GERMANTOWN PIKE, SUITE 320

PLYMOUTH MEETING, PA 19462

WILLOW GROVE ANNEX

102 NORTH YORK ROAD

WILLOW GROVE, PA 19090

MONTGOMERY COUNTY

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

66

67

68

69

70

71

72

73

74

75

76

77

78

79

80

81

82

83

84

85

86

87

88

89

90

91

92

93

94

95

96

97

98

99

100

101

102

103

104

105

106

107

108

109

110

111

112

113

114

115

116

117

118

119

120

121

122

123

124

125

126

127

128

129

130

131

132

133

134

135

136

137

138

139

140

141

142

143

144

145

146

147

148

149

150

151

152

153

154

155

156

157

158

159

160

161

162

163

164

165

166

167

168

169

170

171

172

173

174

175

176

177

178

179

180

181

182

183

184

185

186

187

188

189

190

191

192

193

194

195

196

197

198

199

200

201

202

203

204

205

206

207

208

209

210

211

212

213

214

215

216

217

218

219

220

221

222

223

224

225

226

227

228

229

230

231

232

233

234

235

236

237

238

239

240

241

242

243

244

245

246

247

248

249

250

251

252

253

254

255

256

257

258

259

260

261

262

263

264

265

266

267

268

269

270

271

272

273

274

275

276

277

278

279

280

281

282

283

284

285

286

287

288

289

290

291

292

293

294

295

296

297

298

299

300

301

302

303

304

305

306

307

308

309

310

311

312

313

314

315

316

317

318

319

320

321

322

323

324

325

326

327

328

329

330

331

332

333

334

335

336

337

338

339

340

341

342

343

344

345

346

347

348

349

350

351

352

353

354

355

356

357

358

359

360

361

362

363

364

365

366

367

368

369

370

371

372

373

374

375

376

377

378

379

380

381

382

383

384

385

386

387

388

389

390

391

392

393

394

395

396

397

398

399

400

401

402

403

404

405

406

407

408

409

410

411

412

413

414

415

416

417

418

419

420

421

422

423

424

425

426

427

428

429

430

431

432

Additional Comments/Assumptions:

Project Title: Willow Grove Annex - 102 N YORK RD Report date: 06/15/26
 Data filename: Page 10 of 12

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)
---	----------------------	---	------------------------	---	---------------------

Project Title: Willow Grove Annex - 102 N YORK RD Report date: 06/15/26
Data filename: Page 11 of 12

Additional Comments/Assumptions:

Project Title: Willow Grove Annex - 102 N YORK RD
Data filename: Report date: 06/15/26
Page 12 of 12

MONTGOMERY COUNTY

PROJECT TEAM

KIMLEY-HORN
620 W GERMANTOWN PIKE, SUITE 320
PLYMOUTH MEETING, PA 19462

C

WILLOW GROVE ANNEX

102 NORTH YORK ROAD
WILLOW GROVE, PA 19090

MONTGOMERY COUNTY

[illegible]

PROJECT NUMBER: **NPPH23-0136-00**
Copyright (c) by ENV All Rights Reserved.

SHEET TITLE:
**ENERGY
COMPLIANCE**

SHEET NUMBER

M004

[illegible]

Autodesk Docs\Willow Grove Annex\NPPH23-0136_WillowGroveAnnex_ME_R23.rvt

6/15/2026 4:45:12 PM

5

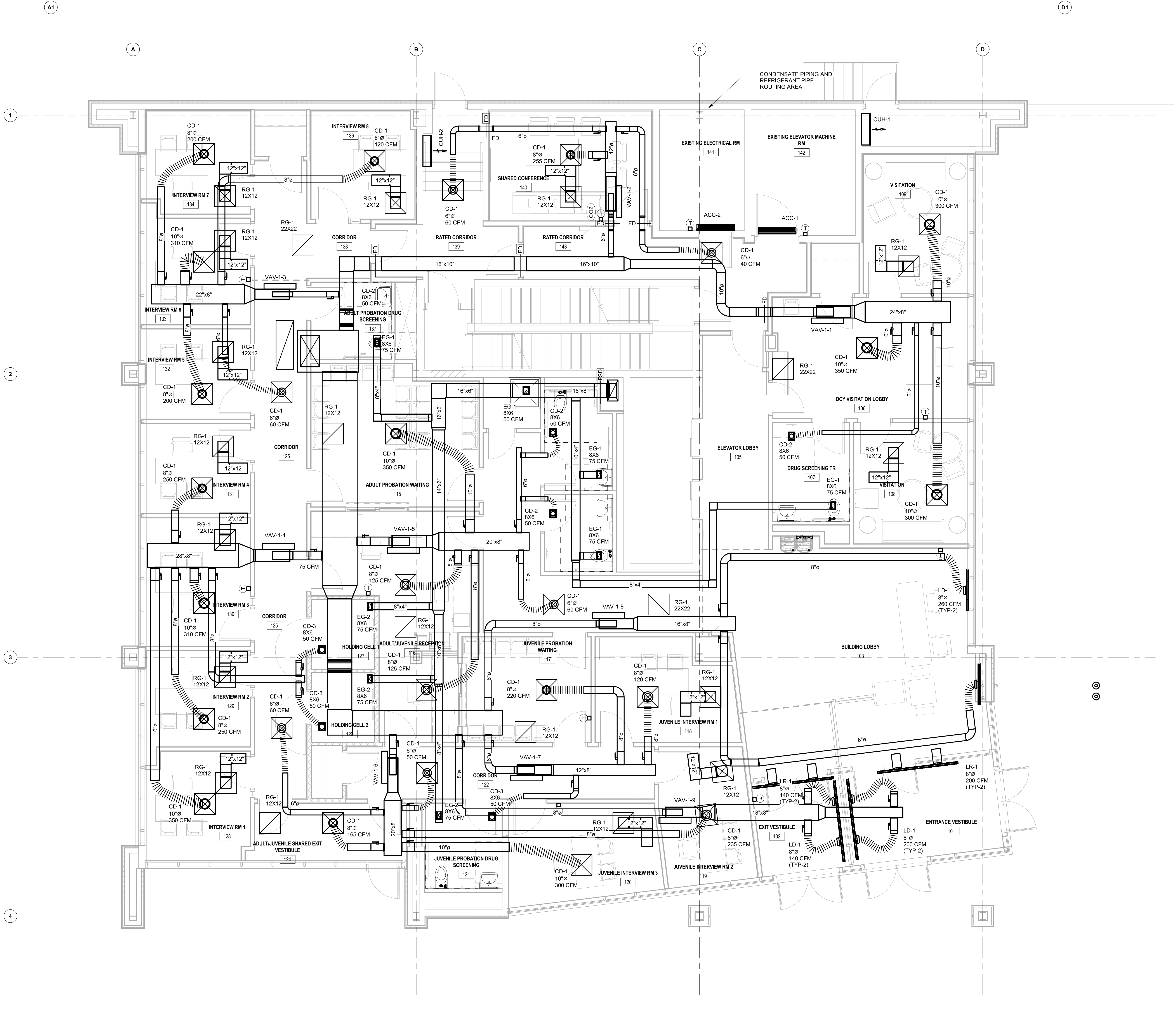
4

3

2

1

MECHANICAL FIRST FLOOR PLAN
1/4" = 1'-0"



NORR

One Penn Center
1617 JFK Boulevard, Suite 1600
Philadelphia, PA 19103 U.S.A.
norr.com

CLIENT:

MONTGOMERY COUNTY

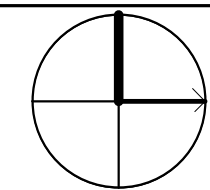
PROJECT TEAM:

KIMLEY-HORN
620 W GERMANTOWN PIKE, SUITE 320
PLYMOUTH MEETING, PA 19062

WILLOW GROVE ANNEX

102 NORTH YORK ROAD
WILLOW GROVE, PA 19090

MONTGOMERY COUNTY



PROJECT
NORTH

REV	DATE	DESCRIPTION	DRAWN	CHECKED
1	2023-06-16	ISSUED FOR BIDDING	JS	BS

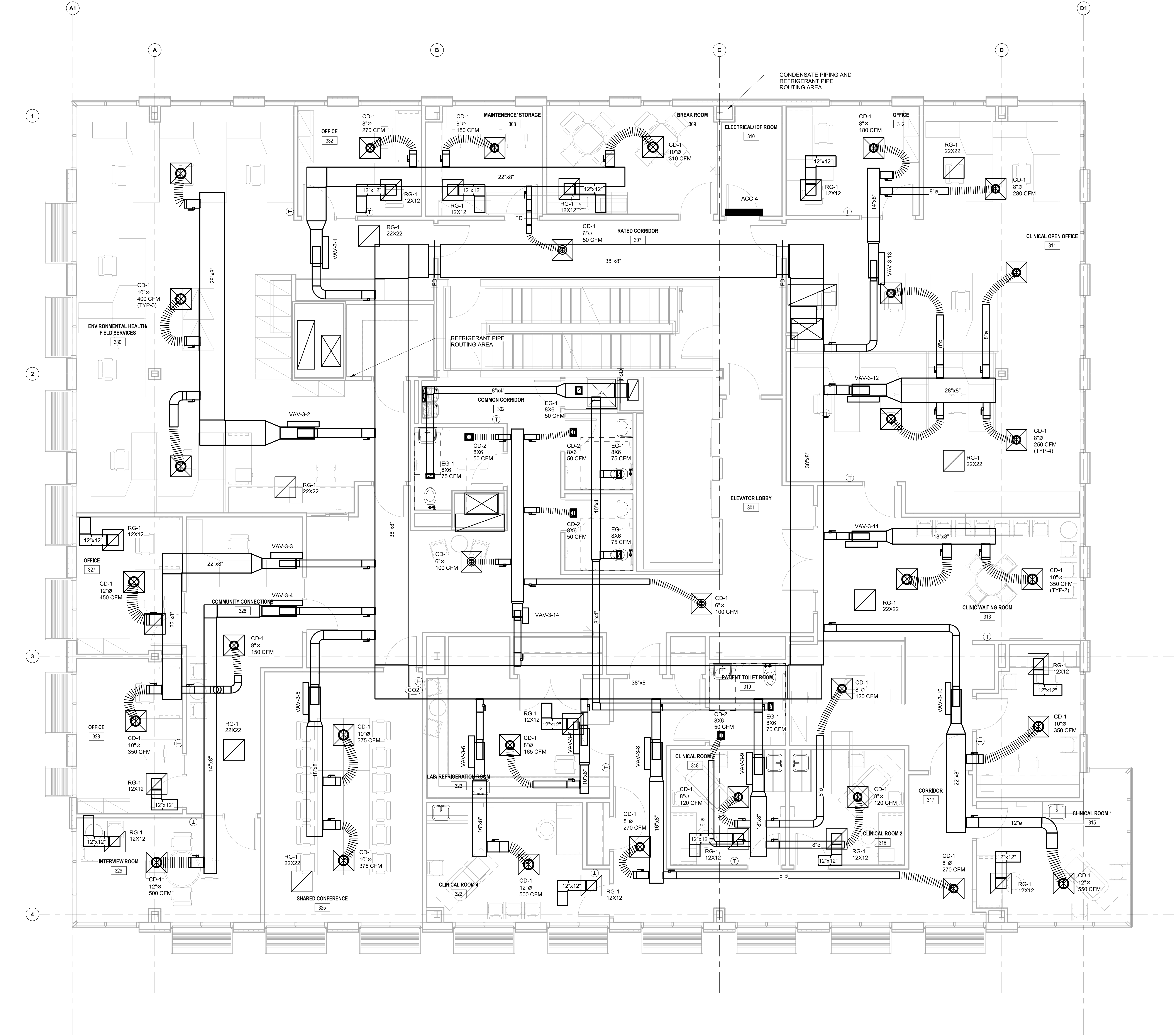
PROJECT NUMBER: NPPH23-0136-00
Copyright (c) by ENR All Rights Reserved.

SHEET TITLE
**MECHANICAL
FIRST FLOOR
PLAN**

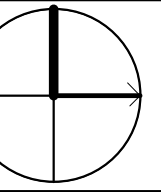
SHEET NUMBER:

M201





1 MECHANICAL THIRD FLOOR PLAN
1/4" = 1'-0"

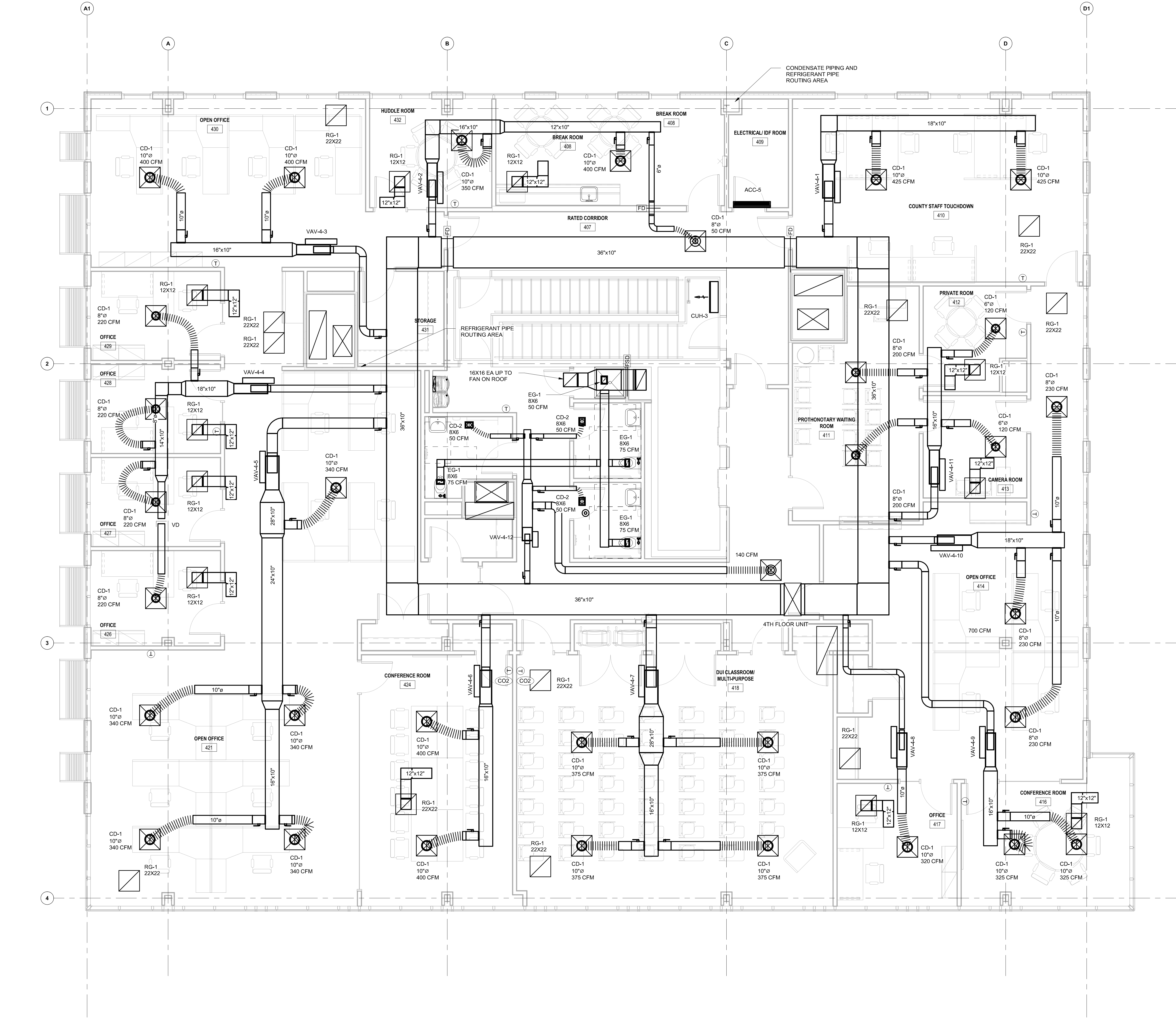


REV	DATE	DESCRIPTION	DRAWN	CHECKED
1	2023-06-10	ISSUED FOR BIDDING	JSD	BS

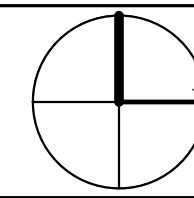
PROJECT NUMBER: NPPH23-0136-00
Copyright (c) by ENR. All Rights Reserved.

SHEET TITLE
**MECHANICAL
THIRD FLOOR
PLAN**

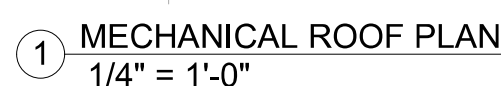
SHEET NUMBER
M203



1 MECHANICAL FOURTH FLOOR PLAN
1/4" = 1'-0"



REV	DATE	DESCRIPTION	DRAWN	CHECKED
A	2026.06.16	ISSUED FOR BIDDING	JS	BS



PROVIDE 6" WEATHERPROOF CONTRAST LETTERING BOTH ABOVE THE ROOF LINE AND BELOW PER FIRE DEPARTMENT REQUIREMENTS.

CLIENT:

MONTGOMERY COUNTY

PROJECT TEAM

KIMLEY-HORN
620 W GERMANTOWN PIKE, SUITE 320
PLYMOUTH MEETING, PA 19462

C

WILLOW GROVE ANNEX

102 NORTH YORK ROAD
WILLOW GROVE, PA 19090

MONTGOMERY COUNTY



REV	DATE	DESCRIPTION	ISSUED FOR	BY	CHK
A	2020.06.16				

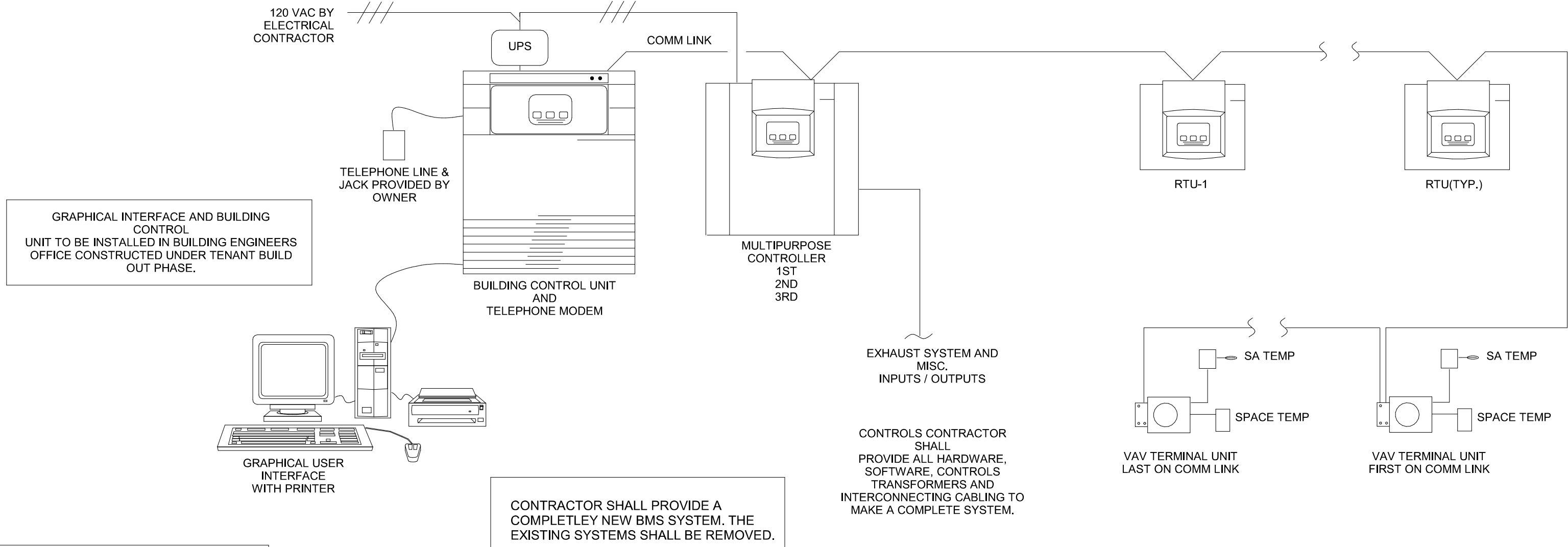
PROJECT NUMBER: **NPPH23-0136-00**
Copyright (c) by ENV All Rights Reserved.

SHEET TITLE:
**MECHANICAL
ROOF PLAN**

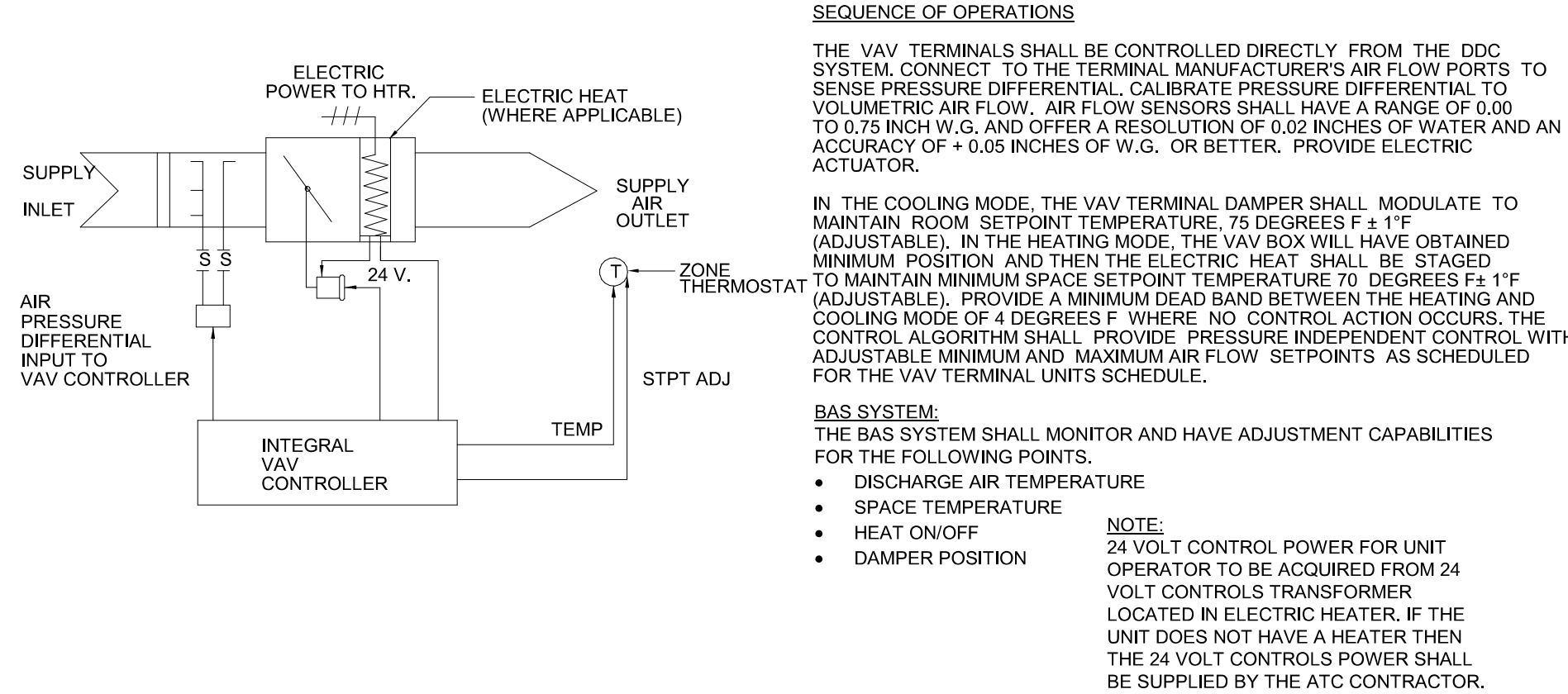
SHEET NUMBER

M205

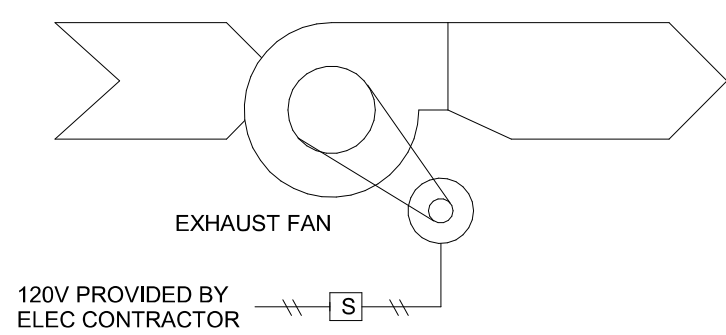
CONTROL POINT ABBREVIATION LEGEND	
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
AI	ANALOG INPUT
AO	ANALOG OUTPUT
S/S	START/STOP
VFD	VARIABLE FREQUENCY DRIVE
CHWS	CHILLED WATER SUPPLY
CHWR	CHILLED WATER RETURN
T	TEMPERATURE
H	HUMIDITY
TH	TEMPERATURE AND HUMIDITY SENSOR
CO2	CARBON DIOXIDE
SP	STATIC PRESSURE
FS	FLOW SWITCH
LAT	LEAVING AIR TEMPERATURE
S	STARTER
DP	DIFFERENTIAL PRESSURE
PPM	PARTS PER MILLION
RH	RELATIVE HUMIDITY
MH	MAGNETIC DIFFERENTIAL PRESSURE GAUGE
RA	RETURN AIR



CONTROLS SYSTEM ARCHITECTURE



SINGLE DUCT TERMINAL BOX



SEQUENCE OF OPERATION:
THE EXHAUST FAN SHALL OPERATE CONTINUOUSLY. SYSTEM HAS FIRE SMOKE DAMPERS INSTALLED. UPON ACTIVATION OF SMOKE DAMPER FAN SHALL SHUT DOWN.

TOILET ROOM EXHAUST FAN

HEATER CONTROLS (ALL CABINET/UTILITY HEATERS)

DEMAND CONTROL VENTILATION SEQUENCE OF OPERATION

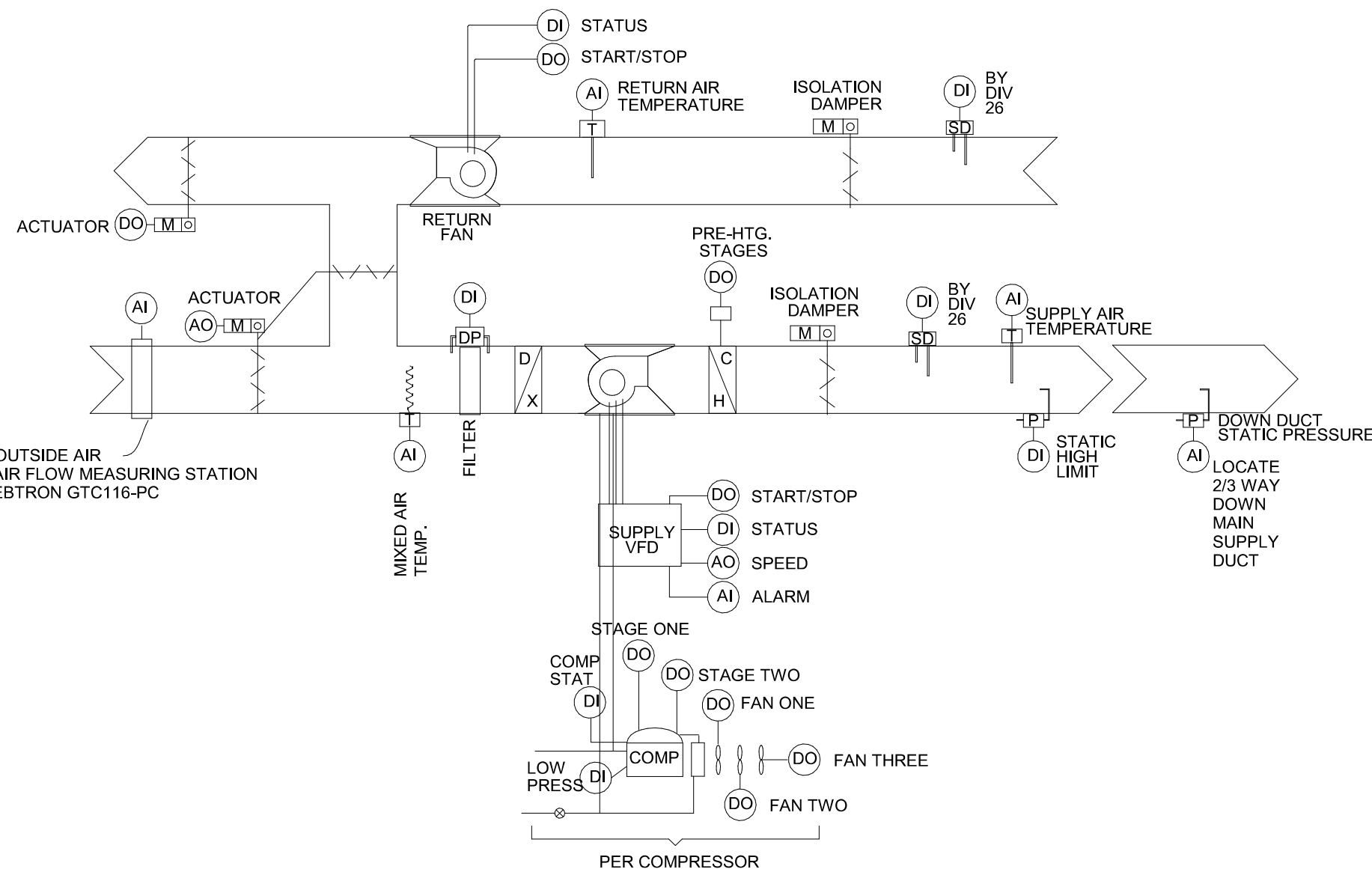
CONFERENCE ROOM 220: DEMAND CONTROL VENTILATION SEQUENCE:
WHEN THE CO2 SENSOR DETECTS CO2 LEVELS ABOVE 800 PPM THE BMS SYSTEM SHALL INCREASE VAV-2-6 TO MAXIMUM AIRFLOW SETPOINT. UPON REDUCTION IN CO2 LEVELS THE VAV BOX SHALL RETURN TO NORMAL OPERATION. IF LEVELS INCREASE ABOVE 1100 PPM THE MINIMUM OUTSIDE AIR DAMPER POSITION ON THE RTU SHALL INCREASE TO 25 %.

CONFERENCE ROOM 24: DEMAND CONTROL VENTILATION SEQUENCE:
WHEN THE CO2 SENSOR DETECTS CO2 LEVELS ABOVE 800 PPM THE BMS SYSTEM SHALL INCREASE VAV-4-6 TO MAXIMUM AIRFLOW SETPOINT. UPON REDUCTION IN CO2 LEVELS THE VAV BOX SHALL RETURN TO NORMAL OPERATION. IF LEVELS INCREASE ABOVE 1100 PPM THE MINIMUM OUTSIDE AIR DAMPER POSITION ON THE RTU SHALL INCREASE TO 25 %.

DUI CLASSROOM/MULTIPURPOSE 418: DEMAND CONTROL VENTILATION SEQUENCE:
WHEN THE CO2 SENSOR DETECTS CO2 LEVELS ABOVE 800 PPM THE BMS SYSTEM SHALL INCREASE VAV-4-7 TO MAXIMUM AIRFLOW SETPOINT. UPON REDUCTION IN CO2 LEVELS THE VAV BOX SHALL RETURN TO NORMAL OPERATION. IF LEVELS INCREASE ABOVE 1100 PPM THE MINIMUM OUTSIDE AIR DAMPER POSITION ON THE RTU SHALL INCREASE TO 25 %.

SHARED CONFERENCE ROOM 140: DEMAND CONTROL VENTILATION SEQUENCE:
WHEN THE CO2 SENSOR DETECTS CO2 LEVELS ABOVE 800 PPM THE BMS SYSTEM SHALL INCREASE VAV-1-2 TO MAXIMUM AIRFLOW SETPOINT. UPON REDUCTION IN CO2 LEVELS THE VAV BOX SHALL RETURN TO NORMAL OPERATION. IF LEVELS INCREASE ABOVE 1100 PPM THE MINIMUM OUTSIDE AIR DAMPER POSITION ON THE RTU SHALL INCREASE TO 25 %.

SHARED CONFERENCE ROOM 325: DEMAND CONTROL VENTILATION SEQUENCE:
WHEN THE CO2 SENSOR DETECTS CO2 LEVELS ABOVE 800 PPM THE BMS SYSTEM SHALL INCREASE VAV-3-5 TO MAXIMUM AIRFLOW SETPOINT. UPON REDUCTION IN CO2 LEVELS THE VAV BOX SHALL RETURN TO NORMAL OPERATION. IF LEVELS INCREASE ABOVE 1100 PPM THE MINIMUM OUTSIDE AIR DAMPER POSITION ON THE RTU SHALL INCREASE TO 25 %.



ROOFTOP UNIT (RTU-1)

UNOCCUPIED MODE - WHEN THE BUILDING AUTOMATION SYSTEM (BAS) INITIATES THE UNOCCUPIED MODE, THE UNIT SHALL STOP AND ASSUME THE USER-DEFINED UNOCCUPIED HEATING AND COOLING SETPOINTS. IF AN UNOCCUPIED ZONE COOLING SETPOINT IS EXCEEDED THE UNIT SHALL BE ENERGIZED AND COOLING SHALL BE INITIATED BY THE ECONOMIZER IF OUTDOOR ENTHALPY CONDITIONS PERMIT OR BY MECHANICAL COOLING IF NOT. SHOULD A ZONE TEMPERATURE FALL BELOW THE UNOCCUPIED ZONE HEATING SETPOINT, THE UNIT SHALL OPERATE IN FULL HEATING WITH THE OUTSIDE AIR DAMPER CLOSED.

STARTUP MODE - THE ROOFTOP UNIT SHALL BE CONTROLLED TO THE START-UP MODE BY THE BAS FOR COOLDOWN/WARMUP. DURING THE STARTUP MODE COOLDOWN, THE COOLING IS ENABLED FOR THE UNIT. THE OUTDOOR AIR DAMPER SHALL REMAIN CLOSED, UNLESS ECONOMIZING. UNTIL THE UNIT'S SCHEDULED OCCUPIED TIME. DURING THE STARTUP MODE WARMUP, THE UNIT'S COOLING REMAINS OFF. THE OUTDOOR AIR DAMPER SHALL REMAIN CLOSED UNTIL THE UNIT'S SCHEDULED OCCUPIED TIME.

TIMED OVERRIDE - WHEN A TIMED OVERRIDE IS INITIATED BY THE USER, THE ROOFTOP UNIT SHALL RETURN TO ITS NORMAL OCCUPIED MODE FOR A PERIOD OF TIME AS SPECIFIED AT THE BAS. WHEN THE TIMED OVERRIDE PERIOD HAS ENDED, THE UNIT SHALL AUTOMATICALLY RETURN TO ITS UNOCCUPIED CYCLE.

OCCUPIED OPERATION - WHEN THE UNIT IS CONTROLLED TO THE OCCUPIED MODE, ALL ROOFTOP UNIT FUNCTIONS SHALL BE ENABLED. THE UNIT SHALL OPERATE IN SUPPLY AIR TEMPERATURE CONTROL MODE. THE UNIT SHALL DEFAULT TO THIS MODE IN THE EVENT THAT COMMUNICATIONS WITH THE BAS ARE LOST.

COOLING MODE - VAV OPERATION:
IF ECONOMIZER COOLING IS NOT POSSIBLE, THE ECONOMIZER ACTUATOR DRIVES THE DAMPER TO THE MINIMUM POSITION SETPOINT WHEN THE INDOOR FAN RELAY IS ENERGIZED AND ALLOWS MECHANICAL COOLING OPERATION.

THE UNIT SHALL DELIVER 58°F DISCHARGE AIR TEMPERATURE DURING OCCUPIED TIMES. THE UNIT SHALL UTILIZE THE VAV SEQUENCE OF OPERATION TO VARY FAN SPEED AS WELL AS COOLING, HEATING AND DEHUMIDIFICATION STAGES AS NECESSARY AND DESCRIBED BELOW.

MECHANICAL COOLING - IF THE CONTROL DETERMINES THAT THERE IS A NEED FOR COMPRESSOR STAGES IN ORDER TO MEET THE DISCHARGE AIR REQUIREMENTS, ONCE SUPPLY FAN PROVING HAS BEEN MADE, THE UNIT WILL BEGIN TO STAGE COMPRESSORS. AS THE ZONE COOLING DEMAND CONTINUES TO INCREASE, IF ADDITIONAL CAPACITY IS REQUIRED, THE SUPPLY FAN OUTPUT WILL BE MODULATED ABOVE MINIMUM SPEED IN ORDER TO MEET THE ZONE REQUIREMENTS. NOTE THAT THE SUPPLY FAN SPEED WILL REMAIN AT THE COMPRESSOR STAGES ASSOCIATED MINIMUM VALUE UNTIL THE CONTROL REQUIRES ADDITIONAL CAPACITY TO MEET THE ZONE DEMAND, AS THE COOLING LOAD IN THE ZONE DECREASES THE CONTROL WILL REDUCE THE SPEED OF THE FAN DOWN TO MINIMUM PER COMPRESSOR STAGE AND CONTROL THE COMPRESSOR OUTPUTS ACCORDINGLY. AS THE COMPRESSORS BEGIN TO DE-ENERGIZE, THE SUPPLY FAN SPEED WILL FALL BACK TO THE COOLING STAGE'S ASSOCIATED MINIMUM FAN SPEED BUT NOT BELOW, AS THE LOAD IN THE ZONE CONTINUES TO DROP, COOLING CAPACITY WILL BE REDUCED IN ORDER TO MAINTAIN THE CALCULATED DISCHARGE AIR SETPOINT.

ECONOMIZER COOLING - THE ECONOMIZER IS UTILIZED TO CONTROL THE ZONE TEMPERATURE PROVIDING THE OUTSIDE AIR CONDITIONS ARE SUITABLE. OUTSIDE AIR IS DRAWN INTO THE UNIT THROUGH MODULATING DAMPERS. WHEN COOLING IS REQUIRED AND ECONOMIZING IS POSSIBLE, THE CONTROL MODULE SENDS THE COOLING REQUEST TO THE UNIT ECONOMIZER ACTUATOR (ECA) TO OPEN THE ECONOMIZER DAMPER. THE CONTROL MODULE UTILIZES THE ECONOMIZER TO SLIGHTLY BELOW THE ZONE TEMPERATURE SETPOINT. IF THE MIXED AIR SENSOR (MAS) SENSES THAT THE MIXED AIR TEMPERATURE IS BELOW 53°F, THE DAMPER MODULATES TOWARD THE CLOSED POSITION. IF THE ZONE TEMPERATURE CONTINUES TO RISE ABOVE THE ZONE TEMPERATURE SETPOINT CONTROLBAND AND THE ECONOMIZER DAMPER IS FULLY OPEN, THE CONTROL MODULE ENERGIZES THE FIRST STAGE COMPRESSOR CONTACTOR (CC1). IF THE ZONE TEMPERATURE CONTINUES TO RISE ABOVE THE ZONE TEMPERATURE SETPOINT CONTROLBAND AND THE ECONOMIZER DAMPER IS FULLY OPEN, THE CONTROL MODULE ENERGIZES THE SECOND STAGE COMPRESSOR CONTACTOR (CC2). THE ECONOMIZER ACTUATOR CONTINUES TO MODULATE THE ECONOMIZER DAMPER OPEN/CLOSED TO KEEP THE MIXED AIR TEMPERATURE THAT IS CALCULATED BY THE CONTROL MODULE.

ECONOMIZER - VAV OPERATION:
THE CONTROLLER WILL CALCULATE THE ACTIVE OA DAMPER MINIMUM POSITION BETWEEN THE USER-SELECTED SETPOINTS BASED ON THE SUPPLY FAN SPEED COMMAND. BY DEFAULT, THE DESIGN MINIMUM POSITION SCHEDULE WILL BE A LINEAR LINE THROUGH ALL USER SELECTABLE DESIGN MINIMUM POSITION SETPOINTS. AS WITH DEMAND CONTROLLED VENTILATION, IF THE DESIGN MINIMUM POSITION AT MIDDLE FAN SPEED COMMAND IS SET TO A POINT THAT WOULD BE HIGHER THAN THE CALCULATED LINEAR LINE BETWEEN THE DESIGN MINIMUM POSITION SETPOINTS AT MINIMUM AND MAXIMUM FAN SPEED COMMAND, THE MINIMUM POSITION WILL BE LIMITED TO THE POINT THAT WOULD MAKE THE DESIGN MINIMUM POSITION SCHEDULE LINEAR.

PROVISIONS HAVE BEEN MADE IN SERVICE TEST MODE TO ALLOW FOR PROPER DAMPER MINIMUM POSITION SETUP

- TO SET THE DESIGN MINIMUM POSITION SETPOINT AT MINIMUM FAN SPEED, SET THE UNIT TO OPERATE AT STEP 1 (FAN ON) OR STEP 2 (ECONOMIZER OPEN) AND MAKE THE PROPER ADJUSTMENT.
- TO SET THE DESIGN MINIMUM POSITION SETPOINT AT MIDDLE FAN SPEED, SET THE UNIT TO OPERATE AT STEP 3 (COOL 1) AND MAKE THE PROPER ADJUSTMENT.
- TO SET THE DESIGN MINIMUM POSITION SETPOINT AT FULL FAN SPEED, SET THE UNIT TO OPERATE AT STEP 4 (COOL 2) AND MAKE THE PROPER ADJUSTMENT.

DEMAND CONTROL VENTILATION - VAV OPERATION:
UNITS CONFIGURED FOR VAV AND DEMAND CONTROLLED VENTILATION (CO2 SENSOR VALUE AVAILABLE) REQUIRE A NEW CONTROL SCHEME COMPRISED OF 2 EXISTING SCHEMES THAT HAVE BEEN TRADITIONALLY MUTUALLY EXCLUSIVE: DCV AND OA CFM COMPENSATION. UNITS CONFIGURED WITH DCV WILL INVOKE THE NEW DEMAND CONTROLLED VENTILATION SCHEME WHICH ALLOWS VARIABLE BLDG. DESIGN AND DCV MINIMUM POSITIONS AND OA DAMPER POSITION TARGET SETPOINTS BASED ON THE SUPPLY FAN. THE NEW DEMAND CONTROLLED VENTILATION SCHEME WILL REQUIRE THE USER TO SELECT 5 OA DAMPER MINIMUM POSITION SETPOINTS IN ADDITION TO THE DESIGN AND DCV CO2 SETPOINTS.

- DESIGN MIN POSITION @ MINIMUM FAN SPEED COMMAND (RTVM R130)
- DESIGN MIN POSITION @ MIDDLE FAN SPEED COMMAND (RTVM R136)
- DESIGN MIN POSITION @ FULL FAN SPEED COMMAND (RTVM DESIGN MIN POSITION)
- DCV MIN POSITION @ MINIMUM FAN SPEED COMMAND (RTVM R41)
- DCV MIN POSITION @ FULL FAN SPEED COMMAND (RTVM DCV MIN POSITION)

AS THE SUPPLY FAN SPEED COMMAND VARIES BETWEEN MINIMUM AND MAXIMUM, THE BUILDING DESIGN AND DCV MINIMUM POSITION TARGETS WILL BE CALCULATED BETWEEN THE USER SELECTED SETPOINTS BASED ON THE INSTANTANEOUS SUPPLY FAN SPEED. THE BLDG. DESIGN AND DCV MINIMUM POSITION TARGETS WILL BE USED TO CALCULATE THE ACTIVE OA DAMPER MINIMUM POSITION TARGET, AS ON TRADITIONAL UNITS. BASED ON THE SPACE CO2 RELATIVE TO THE ACTIVE DESIGN AND DCV CO2 SETPOINTS.

BY DEFAULT, THE DESIGN MINIMUM POSITION SCHEDULE WILL BE A LINEAR LINE THROUGH ALL USER SELECTABLE DESIGN MINIMUM POSITION SETPOINTS. THE USER WILL HAVE THE ABILITY TO SET THE DESIGN MINIMUM POSITION AT MIDDLE FAN SPEED COMMAND TO A POINT THAT WOULD BE LOWER THAN THE CALCULATED LINEAR LINE BETWEEN THE DESIGN MINIMUM POSITION SETPOINTS AT 0% AND 100% FAN SPEED COMMAND IN ORDER TO COMPENSATE FOR THE NON-LINEAR OUTSIDE AIR FLOW THROUGH THE FAN AND DAMPER MODULATION RANGE. HOWEVER, IF THE DESIGN MINIMUM POSITION AT MIDDLE FAN SPEED COMMAND IS SET TO A POINT THAT WOULD BE HIGHER THAN THE CALCULATED LINEAR LINE BETWEEN THE DESIGN MINIMUM POSITION SETPOINTS AT MINIMUM AND FULL FAN SPEED COMMAND, THE MINIMUM POSITION WILL BE LIMITED TO THE POINT THAT WOULD MAKE THE DESIGN MINIMUM POSITION SCHEDULE LINEAR.

PROVISIONS HAVE BEEN MADE IN SERVICE TEST MODE TO ALLOW FOR PROPER DAMPER MINIMUM POSITION SETUP

- TO SET THE DESIGN AND DCV MINIMUM POSITION SETPOINTS AT MINIMUM FAN SPEED, SET THE UNIT TO OPERATE AT STEP 1 (FAN ON) OR STEP 2 (ECONOMIZER OPEN) AND MAKE THE PROPER ADJUSTMENTS.
- TO SET THE DESIGN MINIMUM POSITION SETPOINT AT MIDDLE FAN SPEED, SET THE UNIT TO OPERATE AT STEP 3 (COOL 1) AND MAKE THE PROPER ADJUSTMENT.
- TO SET THE DESIGN AND DCV MINIMUM POSITION SETPOINTS AT FULL FAN SPEED, SET THE UNIT TO OPERATE AT STEP 4 (COOL 2) AND MAKE THE PROPER ADJUSTMENTS.

THE DEHUMIDIFICATION CYCLE IS ONLY PERMITTED ABOVE 40 DEG F AND IS NOT PERMITTED DURING A HEATING CYCLE OR DURING A DEMAND FOR 2ND STAGE COOLING. OTHERWISE, WHEN AN INSTALLED ZONE HUMIDITY SENSOR INDICATES A RELATIVE HUMIDITY EQUAL TO OR GREATER THAN THE RH SET POINT AS ADJUSTED ON THE CONTROL MODULE, A DEHUMIDIFICATION CYCLE IS INITIATED.

RETURN AIR FAN - THE RETURN AIR FAN SHALL MODULATE INDEPENDENT OF THE SUPPLY AIR FAN TO MAINTAIN SPACE PRESSURE CONTROL. DEMAND SHALL TURN THE EXHAUST FAN ON AND OFF AND SHALL MODULATE ITS DISCHARGE DAMPER TO MAINTAIN SPACE PRESSURE AT 0.10 IADU.

SMOKE DETECTION SHUTDOWN - SHOULD THE DUCT SMOKE DETECTOR LOCATED IN THE RETURN AIR AND THE SUPPLY AIR OR THE AIR HANDLING UNIT DETECT SMOKE, THE AIR HANDLING UNIT SHALL SHUT DOWN. THE MOTORIZED SMOKE DAMPERS SHALL CLOSE, ISOLATING THE UNIT FROM THE BUILDING. A MANUAL RESET SHALL BE REQUIRED TO RESUME AIR HANDLER OPERATION. COMMAND FOR SHUTDOWN SHALL COME FROM THE FIRE ALARM SYSTEM THROUGH A UL-864 LISTED BARRIER GATEWAY.

MODULATING GAS HEAT 5:1 TURNDOWN
IN A MODULATING HEAT UNIT, WHEN A CALL FOR HEAT IS RECEIVED, THE BURNER WILL LIGHT AT FULL FIRE (100 PERCENT). AFTER THE BURNER IS LIT, THE UNIT CONTROLS WILL MONITOR THE DISCHARGE AIR TEMPERATURE AND MODULATE THE INPUT RATE DOWN TO MATCH THE LOAD.

ROOF TOP AIR HANDLING UNIT CONTROL DIAGRAM

CLIENT:
MONTGOMERY COUNTY

PROJECT TEAM
KIMLEY-HORN
620 W GERMANTOWN PIKE, SUITE 320
PLYMOUTH MEETING, PA 19062

REV	DATE	DESCRIPTION	ISSUED FOR BLDG	ISS
A	2/28/2016			

PROJECT NUMBER: NPH23-0136-00
Copyright (c) by ENR All Rights Reserved.

CONTROLS

SHEET NUMBER

M701