Appendix A

CalEEMod Modeling Results

KUSD HS Athletic Facilities Detailed Report

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1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	KUSD HS Athletic Facilities
Construction Start Date	1/1/2028
Operational Year	2030
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.90
Precipitation (days)	21.2
Location	36.73602551417683, -120.0669919628248
County	Fresno
City	Unincorporated
Air District	San Joaquin Valley APCD
Air Basin	San Joaquin Valley
TAZ	2524
EDFZ	5
Electric Utility	Pacific Gas & Electric Company
Gas Utility	Pacific Gas & Electric
App Version	2022.1.1.26

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description
High School	109	1000sqft	25.2	109,400	500,000	500,000	—	—

Parking Lot	743	Space	0.00	0.00	0.00	—	—	—
Other Non-Asphalt Surfaces	108	1000sqft	0.00	0.00	0.00	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	14.7	14.7	10.8	14.7	0.03	0.31	0.80	1.04	0.29	0.18	0.41	—	3,162	3,162	0.12	0.30	3.97	3,258
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	14.7	14.7	12.6	14.5	0.03	0.46	1.20	1.46	0.42	0.29	0.53	—	4,558	4,558	0.12	0.53	0.18	4,720
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.51	1.49	7.48	10.3	0.02	0.22	0.32	0.54	0.21	0.08	0.28	—	2,234	2,234	0.08	0.10	0.63	2,267
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.28	0.27	1.36	1.87	< 0.005	0.04	0.06	0.10	0.04	0.01	0.05	—	370	370	0.01	0.02	0.10	375

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2028	1.50	1.26	10.8	14.7	0.03	0.31	0.80	1.04	0.29	0.18	0.41	—	3,162	3,162	0.12	0.30	3.97	3,258
2029	1.46	1.23	10.4	14.6	0.03	0.30	0.31	0.61	0.27	0.08	0.35	—	3,079	3,079	0.12	0.06	1.06	3,102
2030	14.7	14.7	1.32	2.44	0.01	0.05	0.05	0.10	0.04	0.01	0.05	—	1,164	1,164	0.05	0.01	0.12	1,168
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2028	1.66	1.39	12.6	14.5	0.03	0.46	1.20	1.46	0.42	0.29	0.53	—	4,558	4,558	0.12	0.53	0.18	4,720
2029	1.44	1.21	10.5	14.4	0.03	0.30	0.31	0.61	0.27	0.08	0.35	—	3,051	3,051	0.12	0.06	0.03	3,073
2030	14.7	14.7	10.3	14.3	0.03	0.28	0.31	0.59	0.26	0.08	0.34	—	3,041	3,041	0.12	0.06	0.02	3,063
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2028	0.95	0.79	7.27	9.30	0.02	0.22	0.32	0.54	0.21	0.08	0.28	—	2,234	2,234	0.08	0.10	0.63	2,267
2029	1.03	0.87	7.48	10.3	0.02	0.21	0.22	0.43	0.19	0.05	0.25	—	2,185	2,185	0.08	0.05	0.33	2,201
2030	1.51	1.49	0.85	1.31	< 0.005	0.02	0.02	0.05	0.02	0.01	0.03	—	316	316	0.01	< 0.005	0.03	318
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2028	0.17	0.15	1.33	1.70	< 0.005	0.04	0.06	0.10	0.04	0.01	0.05	—	370	370	0.01	0.02	0.10	375
2029	0.19	0.16	1.36	1.87	< 0.005	0.04	0.04	0.08	0.04	0.01	0.05	—	362	362	0.01	0.01	0.05	364
2030	0.28	0.27	0.15	0.24	< 0.005	< 0.005	< 0.005	0.01	< 0.005	< 0.005	0.01	—	52.4	52.4	< 0.005	< 0.005	< 0.005	52.6

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	3.47	3.33	1.37	5.87	0.01	0.11	0.00	0.11	0.11	0.00	0.11	83.6	1,924	2,008	8.57	0.03	0.42	2,230

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.63	2.55	1.33	1.11	0.01	0.10	0.00	0.10	0.10	0.00	0.10	83.6	1,905	1,988	8.57	0.03	0.42	2,211
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	3.04	2.94	1.35	3.46	0.01	0.10	0.00	0.10	0.10	0.00	0.10	83.6	1,914	1,998	8.57	0.03	0.42	2,220
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.56	0.54	0.25	0.63	< 0.005	0.02	0.00	0.02	0.02	0.00	0.02	13.8	317	331	1.42	< 0.005	0.07	368

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	3.33	3.26	0.04	4.76	< 0.005	0.01	—	0.01	0.01	—	0.01	—	19.6	19.6	< 0.005	< 0.005	—	19.6
Energy	0.15	0.07	1.33	1.11	0.01	0.10	—	0.10	0.10	—	0.10	—	1,876	1,876	0.19	0.01	—	1,883
Water	—	—	—	—	—	—	—	—	—	—	—	6.96	28.6	35.6	0.72	0.02	—	58.8
Waste	—	—	—	—	—	—	—	—	—	—	—	76.6	0.00	76.6	7.66	0.00	—	268
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.42	0.42
Total	3.47	3.33	1.37	5.87	0.01	0.11	0.00	0.11	0.11	0.00	0.11	83.6	1,924	2,008	8.57	0.03	0.42	2,230
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	2.48	2.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.15	0.07	1.33	1.11	0.01	0.10	—	0.10	0.10	—	0.10	—	1,876	1,876	0.19	0.01	—	1,883

Water	—	—	—	—	—	—	—	—	—	—	—	6.96	28.6	35.6	0.72	0.02	—	58.8
Waste	—	—	—	—	—	—	—	—	—	—	—	76.6	0.00	76.6	7.66	0.00	—	268
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.42	0.42
Total	2.63	2.55	1.33	1.11	0.01	0.10	0.00	0.10	0.10	0.00	0.10	83.6	1,905	1,988	8.57	0.03	0.42	2,211
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	2.90	2.87	0.02	2.35	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	9.65	9.65	< 0.005	< 0.005	—	9.68
Energy	0.15	0.07	1.33	1.11	0.01	0.10	—	0.10	0.10	—	0.10	—	1,876	1,876	0.19	0.01	—	1,883
Water	—	—	—	—	—	—	—	—	—	—	—	6.96	28.6	35.6	0.72	0.02	—	58.8
Waste	—	—	—	—	—	—	—	—	—	—	—	76.6	0.00	76.6	7.66	0.00	—	268
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.42	0.42
Total	3.04	2.94	1.35	3.46	0.01	0.10	0.00	0.10	0.10	0.00	0.10	83.6	1,914	1,998	8.57	0.03	0.42	2,220
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Area	0.53	0.52	< 0.005	0.43	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	1.60	1.60	< 0.005	< 0.005	—	1.60
Energy	0.03	0.01	0.24	0.20	< 0.005	0.02	—	0.02	0.02	—	0.02	—	311	311	0.03	< 0.005	—	312
Water	—	—	—	—	—	—	—	—	—	—	—	1.15	4.74	5.89	0.12	< 0.005	—	9.73
Waste	—	—	—	—	—	—	—	—	—	—	—	12.7	0.00	12.7	1.27	0.00	—	44.4
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.07	0.07
Total	0.56	0.54	0.25	0.63	< 0.005	0.02	0.00	0.02	0.02	0.00	0.02	13.8	317	331	1.42	< 0.005	0.07	368

3. Construction Emissions Details

3.1. Demolition (2028) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.61	1.35	12.3	13.4	0.02	0.45	—	0.45	0.42	—	0.42	—	2,362	2,362	0.10	0.02	—	2,370
Demolition	—	—	—	—	—	—	0.14	0.14	—	0.02	0.02	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.13	0.11	1.01	1.10	< 0.005	0.04	—	0.04	0.03	—	0.03	—	194	194	0.01	< 0.005	—	195
Demolition	—	—	—	—	—	—	0.01	0.01	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.18	0.20	< 0.005	0.01	—	0.01	0.01	—	0.01	—	32.1	32.1	< 0.005	< 0.005	—	32.3
Demolition	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.05	0.03	0.36	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	75.9	75.9	< 0.005	< 0.005	0.01	77.2
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.21	0.05	< 0.005	< 0.005	0.05	0.05	< 0.005	0.01	0.02	—	163	163	< 0.005	0.03	0.01	171
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	6.46	6.46	< 0.005	< 0.005	0.01	6.57
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.02	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	13.4	13.4	< 0.005	< 0.005	0.01	14.1
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	1.07	1.07	< 0.005	< 0.005	< 0.005	1.09
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	2.22	2.22	< 0.005	< 0.005	< 0.005	2.33

3.3. Site Preparation (2028) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.65	0.54	4.79	8.10	0.01	0.19	—	0.19	0.17	—	0.17	—	1,246	1,246	0.05	0.01	—	1,250

Dust From Material Movement	—	—	—	—	—	—	0.22	0.22	—	0.02	0.02	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.03	0.26	0.44	< 0.005	0.01	—	0.01	0.01	—	0.01	—	68.3	68.3	< 0.005	< 0.005	—	68.5
Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.05	0.08	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	11.3	11.3	< 0.005	< 0.005	—	11.3
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.03	0.02	0.24	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	50.6	50.6	< 0.005	< 0.005	< 0.005	51.5

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.14	0.06	4.10	1.00	0.02	0.07	0.93	0.99	0.07	0.25	0.32	—	3,262	3,262	0.05	0.52	0.18	3,418
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	2.87	2.87	< 0.005	< 0.005	< 0.005	2.92
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.22	0.05	< 0.005	< 0.005	0.05	0.05	< 0.005	0.01	0.02	—	179	179	< 0.005	0.03	0.16	187
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.48	0.48	< 0.005	< 0.005	< 0.005	0.48
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.04	0.01	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	29.6	29.6	< 0.005	< 0.005	0.03	31.0

3.5. Grading (2028) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.72	0.61	5.08	8.27	0.01	0.21	—	0.21	0.19	—	0.19	—	1,280	1,280	0.05	0.01	—	1,284
Dust From Material Movement	—	—	—	—	—	—	0.21	0.21	—	0.02	0.02	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.72	0.61	5.08	8.27	0.01	0.21	—	0.21	0.19	—	0.19	—	1,280	1,280	0.05	0.01	—	1,284
Dust From Material Movement	—	—	—	—	—	—	0.21	0.21	—	0.02	0.02	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.09	0.07	0.63	1.02	< 0.005	0.03	—	0.03	0.02	—	0.02	—	158	158	0.01	< 0.005	—	158
Dust From Material Movement	—	—	—	—	—	—	0.03	0.03	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.11	0.19	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	26.1	26.1	< 0.005	< 0.005	—	26.2
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.02	0.37	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	71.3	71.3	< 0.005	< 0.005	0.21	72.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Hauling	0.08	0.03	2.13	0.55	0.01	0.04	0.51	0.55	0.04	0.14	0.18	—	1,811	1,811	0.03	0.29	3.77	1,901
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.04	0.03	0.30	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	63.3	63.3	< 0.005	< 0.005	0.01	64.3
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.08	0.03	2.28	0.56	0.01	0.04	0.51	0.55	0.04	0.14	0.18	—	1,812	1,812	0.03	0.29	0.10	1,899
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	< 0.005	< 0.005	0.04	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	8.08	8.08	< 0.005	< 0.005	0.01	8.21
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	< 0.005	0.27	0.07	< 0.005	< 0.005	0.06	0.07	< 0.005	0.02	0.02	—	223	223	< 0.005	0.04	0.20	234
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	1.34	1.34	< 0.005	< 0.005	< 0.005	1.36
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	0.05	0.01	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	37.0	37.0	< 0.005	0.01	0.03	38.8

3.7. Building Construction (2028) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.31	1.10	10.3	13.2	0.03	0.31	—	0.31	0.28	—	0.28	—	2,607	2,607	0.11	0.02	—	2,616
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.31	1.10	10.3	13.2	0.03	0.31	—	0.31	0.28	—	0.28	—	2,607	2,607	0.11	0.02	—	2,616
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.59	0.49	4.66	5.96	0.01	0.14	—	0.14	0.13	—	0.13	—	1,174	1,174	0.05	0.01	—	1,178
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.11	0.09	0.85	1.09	< 0.005	0.03	—	0.03	0.02	—	0.02	—	194	194	0.01	< 0.005	—	195
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.17	0.16	0.08	1.35	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	262	262	0.01	0.01	0.77	266
Vendor	0.02	0.01	0.35	0.16	< 0.005	< 0.005	0.06	0.06	< 0.005	0.02	0.02	—	221	221	0.01	0.03	0.42	231
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.15	0.14	0.10	1.09	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	233	233	0.01	0.01	0.02	236

Vendor	0.02	0.01	0.37	0.16	< 0.005	< 0.005	0.06	0.06	< 0.005	0.02	0.02	—	221	221	0.01	0.03	0.01	231
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.07	0.06	0.04	0.50	0.00	0.00	0.11	0.11	0.00	0.03	0.03	—	108	108	< 0.005	< 0.005	0.15	110
Vendor	0.01	0.01	0.16	0.07	< 0.005	< 0.005	0.03	0.03	< 0.005	0.01	0.01	—	99.5	99.5	< 0.005	0.01	0.08	104
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.09	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	18.0	18.0	< 0.005	< 0.005	0.02	18.2
Vendor	< 0.005	< 0.005	0.03	0.01	< 0.005	< 0.005	< 0.005	0.01	< 0.005	< 0.005	< 0.005	—	16.5	16.5	< 0.005	< 0.005	0.01	17.2
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.9. Building Construction (2029) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.28	1.07	10.0	13.2	0.03	0.29	—	0.29	0.27	—	0.27	—	2,607	2,607	0.11	0.02	—	2,616
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.28	1.07	10.0	13.2	0.03	0.29	—	0.29	0.27	—	0.27	—	2,607	2,607	0.11	0.02	—	2,616

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.92	0.76	7.18	9.42	0.02	0.21	—	0.21	0.19	—	0.19	—	1,862	1,862	0.08	0.02	—	1,869
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.17	0.14	1.31	1.72	< 0.005	0.04	—	0.04	0.04	—	0.04	—	308	308	0.01	< 0.005	—	309
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.16	0.15	0.07	1.26	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	257	257	0.01	0.01	0.69	261
Vendor	0.02	0.01	0.33	0.15	< 0.005	< 0.005	0.06	0.06	< 0.005	0.02	0.02	—	215	215	0.01	0.03	0.37	225
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.14	0.13	0.09	1.02	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	228	228	0.01	0.01	0.02	232
Vendor	0.02	0.01	0.35	0.16	< 0.005	< 0.005	0.06	0.06	< 0.005	0.02	0.02	—	216	216	0.01	0.03	0.01	225
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.09	0.05	0.74	0.00	0.00	0.18	0.18	0.00	0.04	0.04	—	169	169	0.01	0.01	0.21	172
Vendor	0.01	0.01	0.25	0.11	< 0.005	< 0.005	0.04	0.04	< 0.005	0.01	0.01	—	154	154	< 0.005	0.02	0.11	161

Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.01	0.13	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	28.0	28.0	< 0.005	< 0.005	0.04	28.4
Vendor	< 0.005	< 0.005	0.04	0.02	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	25.5	25.5	< 0.005	< 0.005	0.02	26.6
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.11. Building Construction (2030) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.25	1.04	9.89	13.2	0.03	0.28	—	0.28	0.26	—	0.26	—	2,607	2,607	0.11	0.02	—	2,616
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.05	0.04	0.43	0.57	< 0.005	0.01	—	0.01	0.01	—	0.01	—	112	112	< 0.005	< 0.005	—	113
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.01	0.01	0.08	0.10	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	18.6	18.6	< 0.005	< 0.005	—	18.6
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.13	0.12	0.08	0.95	0.00	0.00	0.25	0.25	0.00	0.06	0.06	—	224	224	0.01	0.01	0.02	228
Vendor	0.02	0.01	0.34	0.16	< 0.005	< 0.005	0.06	0.06	< 0.005	0.02	0.02	—	209	209	< 0.005	0.03	0.01	219
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	< 0.005	0.04	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	10.0	10.0	< 0.005	< 0.005	0.01	10.2
Vendor	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	9.00	9.00	< 0.005	< 0.005	0.01	9.41
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	1.66	1.66	< 0.005	< 0.005	< 0.005	1.68
Vendor	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	1.49	1.49	< 0.005	< 0.005	< 0.005	1.56
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.13. Paving (2030) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.35	0.29	2.88	4.61	0.01	0.08	—	0.08	0.08	—	0.08	—	719	719	0.03	0.01	—	722
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.03	0.28	0.44	< 0.005	0.01	—	0.01	0.01	—	0.01	—	69.0	69.0	< 0.005	< 0.005	—	69.2
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.05	0.08	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	11.4	11.4	< 0.005	< 0.005	—	11.5
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.03	0.02	0.21	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	48.8	48.8	< 0.005	< 0.005	< 0.005	49.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	4.85	4.85	< 0.005	< 0.005	0.01	4.93
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.80	0.80	< 0.005	< 0.005	< 0.005	0.82
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.15. Architectural Coating (2030) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.22	0.18	1.30	2.20	0.01	0.05	—	0.05	0.04	—	0.04	—	1,113	1,113	0.05	0.01	—	1,117
Architectural Coatings	14.5	14.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.22	0.18	1.30	2.20	0.01	0.05	—	0.05	0.04	—	0.04	—	1,113	1,113	0.05	0.01	—	1,117
Architectural Coatings	14.5	14.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.13	0.21	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	107	107	< 0.005	< 0.005	—	107
Architectural Coatings	1.39	1.39	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.04	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	17.7	17.7	< 0.005	< 0.005	—	17.7
Architectural Coatings	0.25	0.25	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.03	0.01	0.23	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	50.5	50.5	< 0.005	< 0.005	0.12	50.8
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.02	0.19	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	44.9	44.9	< 0.005	< 0.005	< 0.005	45.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	4.46	4.46	< 0.005	< 0.005	0.01	4.53
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.74	0.74	< 0.005	< 0.005	< 0.005	0.75
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Mobile source emissions results are presented in Sections 2.6. No further detailed breakdown of emissions is available.

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
High School	—	—	—	—	—	—	—	—	—	—	—	—	293	293	0.05	0.01	—	296
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	293	293	0.05	0.01	—	296
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
High School	—	—	—	—	—	—	—	—	—	—	—	—	293	293	0.05	0.01	—	296
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	—	293	293	0.05	0.01	—	296
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
High School	—	—	—	—	—	—	—	—	—	—	—	—	48.5	48.5	0.01	< 0.005	—	49.0
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	—	0.00

Total	—	—	—	—	—	—	—	—	—	—	—	—	48.5	48.5	0.01	< 0.005	—	49.0

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
High School	0.15	0.07	1.33	1.11	0.01	0.10	—	0.10	0.10	—	0.10	—	1,583	1,583	0.14	< 0.005	—	1,587
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.15	0.07	1.33	1.11	0.01	0.10	—	0.10	0.10	—	0.10	—	1,583	1,583	0.14	< 0.005	—	1,587
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
High School	0.15	0.07	1.33	1.11	0.01	0.10	—	0.10	0.10	—	0.10	—	1,583	1,583	0.14	< 0.005	—	1,587
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.15	0.07	1.33	1.11	0.01	0.10	—	0.10	0.10	—	0.10	—	1,583	1,583	0.14	< 0.005	—	1,587
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
High School	0.03	0.01	0.24	0.20	< 0.005	0.02	—	0.02	0.02	—	0.02	—	262	262	0.02	< 0.005	—	263
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00

Other Non-Asphalt Surfaces	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	—	0.00	—	0.00	0.00	0.00	0.00	—	0.00
Total	0.03	0.01	0.24	0.20	< 0.005	0.02	—	0.02	0.02	—	0.02	—	262	262	0.02	< 0.005	—	263

4.3. Area Emissions by Source

4.3.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	2.34	2.34	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.14	0.14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.85	0.78	0.04	4.76	< 0.005	0.01	—	0.01	0.01	—	0.01	—	19.6	19.6	< 0.005	< 0.005	—	19.6
Total	3.33	3.26	0.04	4.76	< 0.005	0.01	—	0.01	0.01	—	0.01	—	19.6	19.6	< 0.005	< 0.005	—	19.6
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	2.34	2.34	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Architectural Coatings	0.14	0.14	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	2.48	2.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.43	0.43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.03	0.03	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.08	0.07	< 0.005	0.43	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	1.60	1.60	< 0.005	< 0.005	—	1.60
Total	0.53	0.52	< 0.005	0.43	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	1.60	1.60	< 0.005	< 0.005	—	1.60

4.4. Water Emissions by Land Use

4.4.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
High School	—	—	—	—	—	—	—	—	—	—	—	6.96	28.6	35.6	0.72	0.02	—	58.8
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00

Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	6.96	28.6	35.6	0.72	0.02	—	58.8
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
High School	—	—	—	—	—	—	—	—	—	—	—	6.96	28.6	35.6	0.72	0.02	—	58.8
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	6.96	28.6	35.6	0.72	0.02	—	58.8
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
High School	—	—	—	—	—	—	—	—	—	—	—	1.15	4.74	5.89	0.12	< 0.005	—	9.73
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	1.15	4.74	5.89	0.12	< 0.005	—	9.73

4.5. Waste Emissions by Land Use

4.5.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

High School	—	—	—	—	—	—	—	—	—	—	—	76.6	0.00	76.6	7.66	0.00	—	268
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	76.6	0.00	76.6	7.66	0.00	—	268
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
High School	—	—	—	—	—	—	—	—	—	—	—	76.6	0.00	76.6	7.66	0.00	—	268
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	76.6	0.00	76.6	7.66	0.00	—	268
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
High School	—	—	—	—	—	—	—	—	—	—	—	12.7	0.00	12.7	1.27	0.00	—	44.4
Parking Lot	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Other Non-Asphalt Surfaces	—	—	—	—	—	—	—	—	—	—	—	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	—	—	—	—	—	12.7	0.00	12.7	1.27	0.00	—	44.4

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
High School	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.42	0.42
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.42	0.42
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
High School	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.42	0.42
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.42	0.42
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
High School	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.07	0.07
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.07	0.07

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Demolition	Demolition	1/1/2028	2/12/2028	5.00	30.0	—
Site Preparation	Site Preparation	2/13/2028	3/12/2028	5.00	20.0	—
Grading	Grading	3/13/2028	5/15/2028	5.00	45.0	—
Building Construction	Building Construction	5/16/2028	1/22/2030	5.00	440	—
Paving	Paving	1/23/2030	3/13/2030	5.00	35.0	—
Architectural Coating	Architectural Coating	3/14/2030	5/2/2030	5.00	35.0	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

Demolition	Concrete/Industrial Saws	Diesel	Average	1.00	8.00	33.0	0.73
Demolition	Rubber Tired Dozers	Diesel	Average	1.00	8.00	367	0.40
Demolition	Dumpers/Tenders	Diesel	Average	1.00	8.00	16.0	0.38
Demolition	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Demolition	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Demolition	Skid Steer Loaders	Diesel	Average	1.00	8.00	71.0	0.37
Site Preparation	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Site Preparation	Graders	Diesel	Average	1.00	8.00	148	0.41
Site Preparation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Site Preparation	Skid Steer Loaders	Diesel	Average	1.00	8.00	71.0	0.37
Grading	Plate Compactors	Diesel	Average	1.00	8.00	8.00	0.43
Grading	Graders	Diesel	Average	1.00	8.00	148	0.41
Grading	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Grading	Rollers	Diesel	Average	1.00	8.00	36.0	0.38
Grading	Skid Steer Loaders	Diesel	Average	1.00	8.00	71.0	0.37
Building Construction	Aerial Lifts	Diesel	Average	1.00	8.00	46.0	0.31
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Building Construction	Cement and Mortar Mixers	Diesel	Average	1.00	8.00	10.0	0.56
Building Construction	Plate Compactors	Diesel	Average	1.00	8.00	8.00	0.43
Building Construction	Air Compressors	Diesel	Average	1.00	8.00	37.0	0.48
Building Construction	Cranes	Diesel	Average	1.00	8.00	367	0.29
Building Construction	Dumpers/Tenders	Diesel	Average	1.00	8.00	16.0	0.38
Building Construction	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Building Construction	Generator Sets	Diesel	Average	1.00	8.00	14.0	0.74
Building Construction	Rough Terrain Forklifts	Diesel	Average	1.00	8.00	96.0	0.40

Building Construction	Skid Steer Loaders	Diesel	Average	1.00	8.00	71.0	0.37
Paving	Plate Compactors	Diesel	Average	1.00	8.00	8.00	0.43
Paving	Paving Equipment	Diesel	Average	1.00	8.00	89.0	0.36
Paving	Rollers	Diesel	Average	1.00	8.00	36.0	0.38
Paving	Skid Steer Loaders	Diesel	Average	1.00	8.00	71.0	0.37
Architectural Coating	Surfacing Equipment	Diesel	Average	1.00	8.00	399	0.30

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Demolition	—	—	—	—
Demolition	Worker	15.0	7.70	LDA,LDT1,LDT2
Demolition	Vendor	—	4.00	HHDT,MHDT
Demolition	Hauling	2.50	20.0	HHDT
Demolition	Onsite truck	—	—	HHDT
Site Preparation	—	—	—	—
Site Preparation	Worker	10.0	7.70	LDA,LDT1,LDT2
Site Preparation	Vendor	—	4.00	HHDT,MHDT
Site Preparation	Hauling	50.0	20.0	HHDT
Site Preparation	Onsite truck	—	—	HHDT
Grading	—	—	—	—
Grading	Worker	12.5	7.70	LDA,LDT1,LDT2
Grading	Vendor	—	4.00	HHDT,MHDT
Grading	Hauling	27.8	20.0	HHDT
Grading	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	45.9	7.70	LDA,LDT1,LDT2

Building Construction	Vendor	17.9	4.00	HHDT,MHDT
Building Construction	Hauling	0.00	20.0	HHDT
Building Construction	Onsite truck	—	—	HHDT
Paving	—	—	—	—
Paving	Worker	10.0	7.70	LDA,LDT1,LDT2
Paving	Vendor	—	4.00	HHDT,MHDT
Paving	Hauling	0.00	20.0	HHDT
Paving	Onsite truck	—	—	HHDT
Architectural Coating	—	—	—	—
Architectural Coating	Worker	9.19	7.70	LDA,LDT1,LDT2
Architectural Coating	Vendor	—	4.00	HHDT,MHDT
Architectural Coating	Hauling	0.00	20.0	HHDT
Architectural Coating	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
Architectural Coating	0.00	0.00	164,100	54,700	—

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (Building Square Footage)	Acres Paved (acres)

Demolition	0.00	0.00	0.00	6,500	—
Site Preparation	10,000	—	10.0	0.00	—
Grading	10,000	—	22.5	0.00	—
Paving	0.00	0.00	0.00	0.00	0.00

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	2	61%	61%
Water Demolished Area	2	36%	36%

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
High School	0.00	0%
Parking Lot	0.00	100%
Other Non-Asphalt Surfaces	0.00	0%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2028	0.00	204	0.03	< 0.005
2029	0.00	204	0.03	< 0.005
2030	0.00	204	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year

Total all Land Uses	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	164,100	54,700	—

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	180

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
High School	524,434	204	0.0330	0.0040	4,938,999
Parking Lot	0.00	204	0.0330	0.0040	0.00
Other Non-Asphalt Surfaces	0.00	204	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
High School	3,632,588	15,252,457
Parking Lot	0.00	0.00
Other Non-Asphalt Surfaces	0.00	0.00

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
High School	142	—
Parking Lot	0.00	—
Other Non-Asphalt Surfaces	0.00	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced
High School	Household refrigerators and/or freezers	R-134a	1,430	0.02	0.60	0.00	1.00
High School	Other commercial A/C and heat pumps	R-410A	2,088	< 0.005	4.00	4.00	18.0
High School	Stand-alone retail refrigerators and freezers	R-134a	1,430	< 0.005	1.00	0.00	1.00
High School	Walk-in refrigerators and freezers	R-404A	3,922	< 0.005	7.50	7.50	20.0

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	30.1	annual days of extreme heat
Extreme Precipitation	0.60	annual days with precipitation above 20 mm
Sea Level Rise	—	meters of inundation depth
Wildfire	0.00	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (Radke et al., 2017, CEC-500-2017-008), and consider inundation location and depth for the San Francisco Bay, the Sacramento-San Joaquin River Delta and California coast resulting different increments of sea level rise coupled with extreme storm events. Users may select from four scenarios to view the range in potential inundation depth for the grid cell. The four scenarios are: No rise, 0.5 meter, 1.0 meter, 1.41 meters
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	4	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	N/A	N/A	N/A	N/A

Wildfire	N/A	N/A	N/A	N/A
Flooding	0	0	0	N/A
Drought	0	0	0	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	4	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	N/A	N/A	N/A	N/A
Wildfire	N/A	N/A	N/A	N/A
Flooding	1	1	1	2
Drought	1	1	1	2
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	71.7
AQ-PM	76.2
AQ-DPM	33.0
Drinking Water	72.2
Lead Risk Housing	42.2
Pesticides	94.6
Toxic Releases	52.3
Traffic	14.2
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	39.4
Haz Waste Facilities/Generators	56.4
Impaired Water Bodies	0.00
Solid Waste	97.2
Sensitive Population	—
Asthma	62.5
Cardio-vascular	68.9
Low Birth Weights	48.0
Socioeconomic Factor Indicators	—
Education	82.0
Housing	61.3
Linguistic	68.9
Poverty	72.4
Unemployment	71.7

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	24.93263185
Employed	45.27139741
Median HI	32.96548184
Education	—
Bachelor's or higher	24.17554215
High school enrollment	17.07943026
Preschool enrollment	23.14897985
Transportation	—
Auto Access	73.42486847
Active commuting	2.361093289
Social	—
2-parent households	86.3852175
Voting	27.44770948
Neighborhood	—
Alcohol availability	72.21865777
Park access	53.52239189
Retail density	17.01527011
Supermarket access	30.20659566
Tree canopy	7.365584499
Housing	—
Homeownership	52.53432568
Housing habitability	37.0973951
Low-inc homeowner severe housing cost burden	9.033748236
Low-inc renter severe housing cost burden	61.14461696

Uncrowded housing	23.82907738
Health Outcomes	—
Insured adults	42.7691518
Arthritis	0.0
Asthma ER Admissions	36.5
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	44.2
Cognitively Disabled	74.6
Physically Disabled	49.3
Heart Attack ER Admissions	9.1
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	42.5
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	0.0
SLR Inundation Area	0.0

Children	2.3
Elderly	83.6
English Speaking	45.8
Foreign-born	60.1
Outdoor Workers	20.7
Climate Change Adaptive Capacity	—
Impervious Surface Cover	63.6
Traffic Density	9.0
Traffic Access	0.0
Other Indices	—
Hardship	78.1
Other Decision Support	—
2016 Voting	29.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	78.0
Healthy Places Index Score for Project Location (b)	32.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	Yes
Project Located in a Low-Income Community (Assembly Bill 1550)	Yes
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Land Use	Landscape area estimated based on site plan and Google Earth imagery
Construction: Off-Road Equipment	Per applicant provided data request
Construction: Trips and VMT	Maximum of 25 truck roundtrips per day based on applicant provided information; Site Prep phase hauling adjusted accordingly

Appendix B

Biological Resources Assessment

Rincon Consultants, Inc.
7080 North Whitney Avenue, Suite 101
Fresno, California 93720
559-228-9925

March 9, 2024
Project No: 23-15468

Kraig Magnussen, Assistant Superintendent/Chief Business Official
Kerman Unified School District
151 South First Street
Kerman, California 93630
Via email: kraig.magnussen@kermanusd.com

Subject: Kerman High School Athletic Facilities Master Plan Expansion Biological Resources Assessment, Kerman, Fresno County, California

Dear Mr. Magnussen:

This report documents the findings of a biological resources assessment conducted by Rincon Consultants, Inc. (Rincon) for the Kerman High School Athletic Facilities Master Plan Expansion Project (project) in the City of Kerman (City), Fresno County, California. The purpose of this report is to document the existing conditions of the project site and to evaluate the potential for impacts to special status biological resources for compliance with the Kerman Unified School District's (KUSD) California Environmental Quality Act (CEQA) review process.

Project Location and Description

The project site is located at 15180 West Whitesbridge Avenue in both the City and unincorporated Fresno County, California. The project site includes Assessor's Parcel Numbers (APN) 020-120-28S, 020-120-32ST, 020-120-26ST, 020-120-27ST, and 020-120-24ST, and extends to the centerline of State Route [SR] 180 (Whitesbridge Avenue) and North Del Norte Avenue. The central and eastern portions of the project site are located within City limits, while the western portion of the project site is located in unincorporated Fresno County, within the City's sphere of influence.

Regulatory Background

Regulatory authority over biological resources is shared by federal, state, and local authorities under a variety of statutes and guidelines. Primary authority for general biological resources lies within the land use control and planning authority of local jurisdictions (in this instance, Fresno County and the City). The California Department of Fish and Wildlife (CDFW) is a trustee agency for biological resources throughout the State under CEQA and also has direct jurisdiction under the California Fish and Game Code (CFGC). Under the California and federal Endangered Species Acts (CESA/ESA), CDFW and U.S. Fish and Wildlife Service (USFWS) also have direct regulatory authority over species formally listed as Threatened or Endangered as well as native bird species listed under the Federal Migratory Bird Treaty Act (MBTA), and the Bald and Golden Eagle Protection Act. The U.S. Army Corps of Engineers (USACE) has regulatory authority over specific biological resources—namely, wetlands and waters of the United States, under Section 404 of the federal Clean Water Act. CDFW, under CFGC Sections 1600-1617, and Regional Water Quality Control Boards (RWQCB), under the Porter-Cologne Water Quality Control Act, protect waters and streambeds at the state level. The analysis in this biological resources assessment is guided by the requirements of these laws, and by the operating standards of the implementing agencies. The project site does not occur in Natural Community Conservation Planning or Habitat Conservation Plan areas.

Methods

The biological resources study for the project consisted of a review of the relevant literature and databases, a field reconnaissance survey to confirm existing conditions and determine which sensitive biological resources are present or may occur at the site, and an evaluation of the development to determine potentially significant impacts to biological resources under CEQA. The level of potential for special status species to occur within study area is based on both the literature review and a field survey designed to assess habitat suitability and presence of, or potential for presence of, target species. The potential for impacts to biological resources was evaluated based on these findings and the assumption of full build-out of the project site. The study area evaluated for this analysis includes the entire project site plus a 50-foot buffer (Figure 2).

Literature Review

The literature review included the background reports database research on special status biological resource occurrences within the *Kerman*, California U.S. Geological Survey (USGS) 7.5-minute quadrangle and eight surrounding quadrangles. Sources included the CDFW California Natural Diversity Data Base (CNDDB) (CDFW 2024a); Biogeographic Information and Observation System (CDFW 2024b); National Wetlands Inventory (USFWS 2024a); USFWS Information for Planning and Consultation (USWFS 2024b); and the USFWS Critical Habitat Portal (USFWS 2024c). Other resources included the California Native Plant Society's (CNPS) online Inventory of Rare and Endangered Plants of California (CNPS 2024); CDFW's Special Vascular Plants, Bryophytes, and Lichens List (CDFW 2024d), and CDFW's Connectivity Areas- California Essential Habitat Connectivity Map (CDFW 2024f). Aerial photographs, topographic maps, soil survey maps, geologic maps, and climatic data in the area were also examined. References are included at the end of this letter. A review of the information contained within these databases, supported by the expert opinion of Rincon's biological staff, resulted in a list of special status species and other resources to be evaluated for their presence or potential to occur at the project site.

Field Survey

Rincon biologist Alana Garza conducted a reconnaissance-level survey to assess and confirm the evaluation of biological resources in the literature review, assess the habitat suitability for potential special status species, and map vegetation communities and land cover types. Rincon documented and mapped the vegetation communities, land cover types, presence of any sensitive biological resources, potential jurisdictional waters and wetlands, and wildlife connectivity/movement features, and recorded all observations of plant and wildlife species within the study area. Ms. Garza conducted the site visit on February 3, 2024, between the hours of 0730 and 1045. The temperature onsite was between 45°F and 51°F. The biologist walked meandering transects over the entire project area and conducted windshield surveys within the 0.5-mile buffer for raptor and bird nesting. The Rincon biologist mapped vegetation communities observed within the study area and conducted a focused search for special status plants that would have been apparent and identifiable during the non-blooming season; however, the survey did not constitute a protocol-level floristic survey. The compilation of a comprehensive floral checklist was limited by survey timing, and the analysis of potential impacts to rare plants is based on a habitat assessment and not protocol survey results. Floral nomenclature for native and non-native plants in this report follows the treatments within the second edition of the Jepson Manual (Baldwin et al. 2012). Wildlife species observed directly or detected from calls, tracks, scat, nests, or other signs were documented. The detection of wildlife species was limited by seasonal and temporal factors. As the survey was performed during the day, identification of nocturnal animals was limited to sign (i.e., tracks, scat, etc.), if present on site.

Existing Conditions

Topography and Soils

At an elevation range of approximately 216-237 feet above mean sea level, the topography of the site is relatively flat. The study area is depicted over the *Kerman*, California USGS 7.5-minute quadrangle. Adjacent land uses include agricultural development.

The study area contains the following soil map units (USDA NRCS 2024a): Hesperia sandy loam, deep; Hesperia sandy loam, deep, saline-sodic; Hanford sandy loam, silty substratum; and Hanford coarse sandy loam. The Hesperia and Hanford series consist of deep, well-drained soils that formed in alluvium derived from granite and are typically associated with alluvial fans. The Hanford series is also associated with floodplains. The Hesperia sandy loam, deep is included on the National Hydric Soils List (USDA NRCS 2024b). Most of the study area consists of Hesperia sandy loam, deep. Hanford sandy loam, silty substratum is present in the northern study area. Hanford coarse sandy loam is located in a small corner of the southeastern study area.

Vegetation and Landcover Types

There are no intact native vegetation communities within the study area. Two land cover types were identified within the study area during the field survey: agricultural and developed. A map of the landcover types within the study area is shown in Figure 3. The agricultural land cover type within the study area includes an unmaintained stone fruit orchard. Non-native forbs and grasses were observed within the orchard. The developed land cover type in the study area includes paved and dirt roads at the perimeter of the project site with patches of ruderal vegetation throughout.

General Wildlife

The project area and surrounding lands consist predominantly of paved and dirt roads, heavily impacted agricultural fields, and orchards. Avian species observed on or adjacent to the site include red-tailed hawk (*Buteo jamaicensis*), common raven (*Corvus corax*), white-crowned sparrow (*Zonotrichia leucophrys*), house sparrow (*Passer domesticus*), and house finch (*Haemorhous mexicanus*).

Special Status Biological Resources

This section discusses sensitive biological resources observed in the study area and evaluates the potential for the study area to support other sensitive biological resources.

Special Status Species

Assessments for the potential occurrence of special status species are based upon known ranges, habitat preferences for the species, species occurrence records from the CNDDB species occurrence records from other sites in the vicinity of the study area (2024a), and previous reports for the study area. The potential for each special status species to occur in the study area was evaluated according to the following criteria:

- **Not expected.** Habitat on and adjacent to the site is clearly unsuitable for the species' requirements (foraging, breeding, cover, substrate, elevation, hydrology, plant community, site history, disturbance regime).

- **Observed but not expected.** Specific to bird species observed flying over the site, however habitat on and adjacent to the site is clearly unsuitable for the species' requirements.
- **Low Potential.** Few of the habitat components meeting the species' requirements are present, and/or the majority of habitat on and adjacent to the site is unsuitable or of very poor quality. The species is not likely to be found on the site.
- **Moderate Potential.** Some of the habitat components meeting the species' requirements are present, and/or only some of the habitat on or adjacent to the site is unsuitable. The species has a moderate probability of being found on the site.
- **High Potential.** All of the habitat components meeting the species' requirements are present and/or most of the habitat on or adjacent to the site is highly suitable. The species has a high probability of being found on the site.
- **Present.** Species is observed on the site or has been recorded (e.g., CNDDB, other reports) on the site recently (within the last 5 years).

For the purpose of this report, special status species are those plants and animals listed, proposed for listing, or candidates for listing as Threatened or Endangered by the USFWS under the ESA; those listed or candidates for listing as Rare, Threatened, or Endangered under the CESA or Native Plant Protection Act; those identified as Fully Protected by the California Fish and Game Code (Sections 3511, 4700, 5050, and 5515); those identified as Species of Special Concern (SSC) or Watch List species by the CDFW; and plants occurring on lists 1 and 2 of the California Native Plant Society (CNPS) California Rare Plant Rank (CRPR) system per the following definitions:

- **Rank 1A:** Plants presumed extinct in California;
- **Rank 1B.1:** Rare or endangered in California and elsewhere; seriously endangered in California (over 80% of occurrences threatened/high degree and immediacy of threat);
- **Rank 1B.2:** Rare or endangered in California and elsewhere; fairly endangered in California (20-80% occurrences threatened);
- **Rank 1B.3:** Rare or endangered in California and elsewhere, not very endangered in California (<20% of occurrences threatened or no current threats known);
- **Rank 2:** Rare, threatened or endangered in California, but more common elsewhere.

Based on a query of the CNDDB (2024a), there are 15 special status plant species, 12 special status wildlife species, and two sensitive natural communities documented within the *Kerman*, California USGS 7.5-minute quad and the eight surrounding quads. These 27 special status species have been evaluated for potential to occur within the study area (Attachment 3).

Special Status Plant Species

Fifteen (15) special status plant species known to occur in the region were evaluated for their potential to occur in the study area (see Attachment 3). None of these 15 species are expected to occur within the project site. The species were excluded based on known range and elevation, the lack of the species' specific habitat requirements within the study area (i.e., vernal pools, rocky soils, natural woodlands), or due to the disturbed nature of the site and its lack of connectivity to natural vegetation communities.

Special Status Wildlife Species

Rincon identified 12 special status wildlife species that have been documented within the nine-quadrangle search radius. These species were reviewed for potential to occur within the study area (see Attachment 3). Nine species are not expected in the study area based upon known ranges, habitat preferences, and presence of suitable habitat Three species (western spadefoot toad, burrowing owl, and Swainson's hawk) were determined to have a low potential to occur, and therefore are discussed in detail below.

Swainson's Hawk

The Swainson's hawk is listed as a state threatened species. The historical breeding range of Swainson's hawk in California included the Great Basin, Sacramento and San Joaquin Basins, the coast from Marin County to San Diego County, and scattered sites in the Mojave and Colorado Deserts (England et al., 1997). The species continues to breed across its entire historical range, but in significantly lower numbers than historically (prior to 1980). In the Central Valley, much of the native habitat has been converted to agricultural and urban uses, thereby limiting nesting and foraging opportunities for Swainson's hawk. This species is often found nesting in trees associated with scattered rural residences, particularly in relation to grasslands or dry-land grain fields. Throughout its range the species nest almost exclusively in trees, typically on the edges of woodland adjacent to grass or shrubland habitat (England et al. 1997). There is one record of Swainson's hawks nesting within 5 miles of the study area, last recorded in 2018 (CDFW 2024c). No Swainson's hawks or raptor nests were observed during the site survey. Suitable foraging habitat within 1 mile of the study area is limited to the orchards and agricultural fields surrounding the study area. Although there is limited habitat for the species within the study area, orchards and other farmlands around the study area could provide marginal foraging habitat for the species. Therefore, Swainson's hawk has a low potential to forage but is not expected to nest within the study area.

Western Spadefoot Toad

The western spadefoot toad is a CDFW SSC. Most of the year, western spadefoot toads are in underground burrows. Toads disperse to breeding ponds at night after the first fall rains. Eggs are laid on plant material in shallow temporary pools and tadpoles transform and disperse during late spring (Baldwin 1998). There is one recorded observation of western spadefoot toad within 5 miles of the study area from 1948. The record was for larvae observed approximately 3.5 miles west of the study area. The ponded water in the study area was from a recent rain event and did not hold eggs or tadpoles at the time of the survey. The study area is surrounded by development and is highly disturbed. Therefore, western spadefoot toad has low potential to occur in the study area.

Burrowing Owl

Burrowing owl is a CDFW SSC that inhabits grassland and desert areas with low vegetation. Burrowing owls use burrows dug by mammals, such as by California ground squirrels, and man-made structures, such as culverts and debris piles for shelter, wintering, and breeding. These owls have high site fidelity and will reuse burrows for years (CBOC 1997). Burrowing owl populations are declining due to habitat loss and eradication of ground squirrels, leading to a reduced number of suitable burrows for nesting and shelter from predators (CDFW 2012). One burrowing owl observation has been recorded within the 5-mile buffer. This observation was recorded in 1984 approximately 5.5 miles west of the study area (CDFW 2024c). California ground squirrel burrows were observed in the study area. The burrows did not contain any sign of burrowing owl (i.e. whitewash, pellets, feathers, etc). However, surrounding habitat is highly disturbed or developed and the area with suitable habitat is restricted to a small (approximately 0.10 acre) corner of the study area. Therefore, based on limited of suitable habitat in the study area and surrounding agriculture and development, there is low potential for this species to occur.

Nesting Birds

Non-game migratory birds protected under the CFGC Section 3503, such as native avian species common to agricultural, developed, and ruderal areas, have the potential to breed and forage throughout the study area. Nesting by a variety of common birds protected by the MBTA and CFGC Section 3503 could occur in virtually any location throughout the study area on the ground surface, within native or non-native vegetation, and within tree debris located in and around the orchard.

Special Status Vegetation Communities and Critical Habitat

Two sensitive natural communities are documented within the nine USGS quadrangles surrounding the project area: Valley Sacaton Grassland and Northern Claypan Vernal Pool (CDFW 2024a, CDFW 2024b). Neither of these communities, nor other sensitive plant communities, occur within the study area.

There is no USFWS designated critical habitat within the study area (USFWS 2024c).

Jurisdictional Waters and Wetlands

No jurisdictional wetlands or waters were mapped within the study area. The project site was originally used as agricultural land with flood-irrigated agricultural production. One unnamed canal occurs north of the study area. The canal is classified as R5UBFx (Riverine [R], Unknown Perennial [5], Unconsolidated Bottom [UB], Semi-permanently Flooded [F], and Excavated [x]) (USFWS 2024a). Ponded water from recent rain events was present along the southern project boundary. The waters had no surface connection to another wetland or water and were not considered jurisdictional.

Wildlife Movement

Wildlife movement corridors, or habitat linkages, are generally defined as connections between habitat patches that allow for physical and genetic exchange between otherwise isolated animal populations. Such linkages may serve a local purpose, such as providing a linkage between foraging and denning areas, or they may be regional in nature. Some habitat linkages may serve as migration corridors, wherein animals periodically move away from an area and then subsequently return. Other corridors may be important as dispersal corridors for young animals. A group of habitat linkages in an area can form a wildlife corridor network.

In the vicinity of the study area, disked fields and existing roads could provide local scale opportunities for wildlife movement, particularly for disturbance-tolerant species such as coyote. There are no Natural Landscape Blocks or Essential Connectivity Areas mapped within the study area and surrounding land has long been disrupted by intensive agriculture.

Local Policies and Ordinances

Part of the project is located in unincorporated Fresno County. Project activities are subject to the Fresno County's General Plan and Municipal Code. The Fresno County General Plan includes open space, conservation, and land use elements. The portion of the project that is located in the City is subject to the City of Kerman General Plan. The City of Kerman General plan includes land use, conservation, and open space elements.

Habitat Conservation Plans

The study area is not within any Habitat Conservation Plan or Natural Community Conservation Plan areas.

Impact Analysis and Mitigation Measures

This section discusses the potential impacts and effects to biological resources that may occur from project implementation.

Special Status Species

The project would have a significant effect on biological resources if it would:

a) *Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service.*

Special Status Plants

Literature review and database searches identified 15 special status plants that have the potential to occur within the study area. Due to a lack of suitable habitat, none are expected to occur within the study area; therefore, impacts to special status plant species are not expected.

Special Status Wildlife

Three special status wildlife species have low potential to occur within the study area: Swainson's hawk, burrowing owl, and western spadefoot toad.

While unlikely, impacts to Swainson's hawk and burrowing owl may occur through removal of vegetation and disturbance from construction activities (physical disturbance and noise) if active nests or burrows are present on the project site or within the project vicinity. Impacts may also occur if active nests, including for any nesting birds, are present on the project site or vicinity, and if these nests are abandoned due to disturbance associated with active construction or staging. These impacts would be significant. Mitigation Measure BIO-1 (Pre-construction Nesting Bird Survey and Impact Avoidance) requires pre-construction surveys for nesting birds, including special status birds, and establishment of the appropriate no-work buffers. With implementation of Mitigation Measure BIO-1, impacts on Swainson's hawk, burrowing owl, and nesting birds would be less than significant.

Impacts to western spadefoot toad could occur through destruction of eggs in seasonal ponded water and mortality of dispersing individuals due to disturbance and strikes caused by construction equipment. The ponded water in the study area was from recent rain events and had no surface connection to other waters or wetlands. However, given the level of surrounding development, marginal habitat, lack of recent species observations, and given no toads or egg masses were observed in ponded water at the time of the site visit (when they would be expected to be present), the probability western spadefoot toads occurring on the project site is exceedingly low and no mitigation is proposed. No impact would occur.

Mitigation Measures

BIO-1 Pre-construction Nesting Bird Survey and Impact Avoidance

a. To prevent the loss of active special-status and non-special-status bird nests, juveniles or adults, project activities including vegetation clearing should be conducted outside of the breeding season from February 1 through August 31 to the extent feasible.

b. If project activities occur between February 1 and August 31, a pre-construction nesting bird survey shall be conducted by qualified biologists no less than 7 working days prior to the activity to survey for special-status and non-special-status bird and raptor nests. The survey area shall include the project footprint and a 100-foot buffer for passerine species, a 150- foot buffer for burrowing owls, a 300-foot buffer for raptor species, and a 0.5-mile buffer for Swainson's hawks. Following the survey, the following will be implemented:

- A nesting bird survey report shall be submitted to KUSD prior to the initiation of project activities. The report shall detail the results of the survey including identification of the location of any active nests and make a determination if ongoing monitoring should be conducted and/or no-disturbance buffers should be established.
- If active nests are identified during the survey and/or work is scheduled to take place within 100 feet of active passerine nests, 150 feet of active burrowing owl burrows, 300-feet of active raptor nests, or 0.5-mile of an active Swainson's hawk nest, a qualified biologist shall determine appropriate no-disturbance buffers. The buffer shall be the minimum distance required to avoid take of the nest and shall be determined based on the species identified, activities proposed, level of existing noise, and line of sight from the disturbance to the nest.
- A qualified biological monitor shall be present at the initiation of project activities occurring within 100 feet of active passerine nests, 150 feet of active burrowing owl burrows, 300-feet of active raptor nests, or 0.5-mile of an active Swainson's hawk nest, to ensure that project activities do not negatively affect the success of the nest. Duration and frequency of monitoring shall be determined at the discretion of the qualified biologist.
- If nesting bird monitoring is conducted, a nesting bird monitoring report shall be submitted to KUSD detailing the results of monitoring activities. The report will be submitted within 30 days of the completion of the activities or nesting season.

Sensitive Plant Communities and Critical Habitat

The project would have a significant effect on biological resources if it would:

b) *Have a substantial adverse impact on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Wildlife or US Fish and Wildlife Service.*

No sensitive plant communities or critical habitat are present within the study area. Therefore, no impacts to sensitive natural communities or critical habitat are expected.

Jurisdictional Waters and Wetlands

The project would have a significant effect on biological resources if it would:

c) *Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.*

The project would have no effect on jurisdictional waters and wetlands as there are none located in the study area.

Wildlife Movement

The project would have a significant effect on biological resources if it would:

d) *Interfere substantially with the movement of any resident or migratory fish or wildlife species or with established resident or migratory wildlife corridors or impede the use of wildlife nursery sites.*

No significant wildlife movement corridors or habitat linkages are present in the study area. The location within the study area and surrounding land has long been disrupted by intensive agriculture. The project is not expected to substantially alter existing wildlife movement or interfere with established resident or migratory wildlife corridors. Therefore, impacts to wildlife movement are not expected.

Local Policies and Ordinance

The proposed project would have a significant effect on biological resources if it would:

e) *Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance*

The Fresno County General Plan includes open space, conservation, and land use elements. Proposed project activities are not in conflict with any elements of the General Plan as the site is located in agricultural zoning.

The City of Kerman General Plan includes land use, conservation and open space elements. Proprosed project activities do not conflict with any of the elements of the General Plan because the site is zoned General Commercial, Open Space, Recreation, & Public Facilities District, Urban Reserve.

No native trees were observed on site or are proposed for removal. The project would not conflict with any local policies or ordinances protecting biological resources.

Habitat Conservation Plan

The proposed project would have a significant effect on biological resources if it would:

f) *Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or state habitat conservation plan.*

The project is not within any applicable habitat conservation plan areas; therefore, no conflicts with state, regional, or local habitat conservation plans would occur.

Conclusions

Significant effects to sensitive species habitats are not expected from this project. The study area is highly disturbed due to agricultural and commercial developments. Orchards and agricultural fields in and around the study area may provide suitable foraging habitat for Swainson's hawk and suitable nesting habitat for nesting birds. Burrows in the study area may provide marginally suitable habitat for burrowing owl and western spadefoot toad, though these species only have a low potential for occurance. With implementation of Mitigation Measure BIO-1, impacts to special status species and nesting birds can be reduced to less than significant levels.

Thank you for the opportunity to work with you on this important project.

Sincerely,
Rincon Consultants, Inc.

Alana Garza
Biologist

Alex Hunt
Director, Natural Resources

Attachments

Figure 1 Regional Location
Figure 2 Project Location
Figure 3 Vegetation Communities
Table 1 Potential to Occur Table

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Figure 1 Regional Location

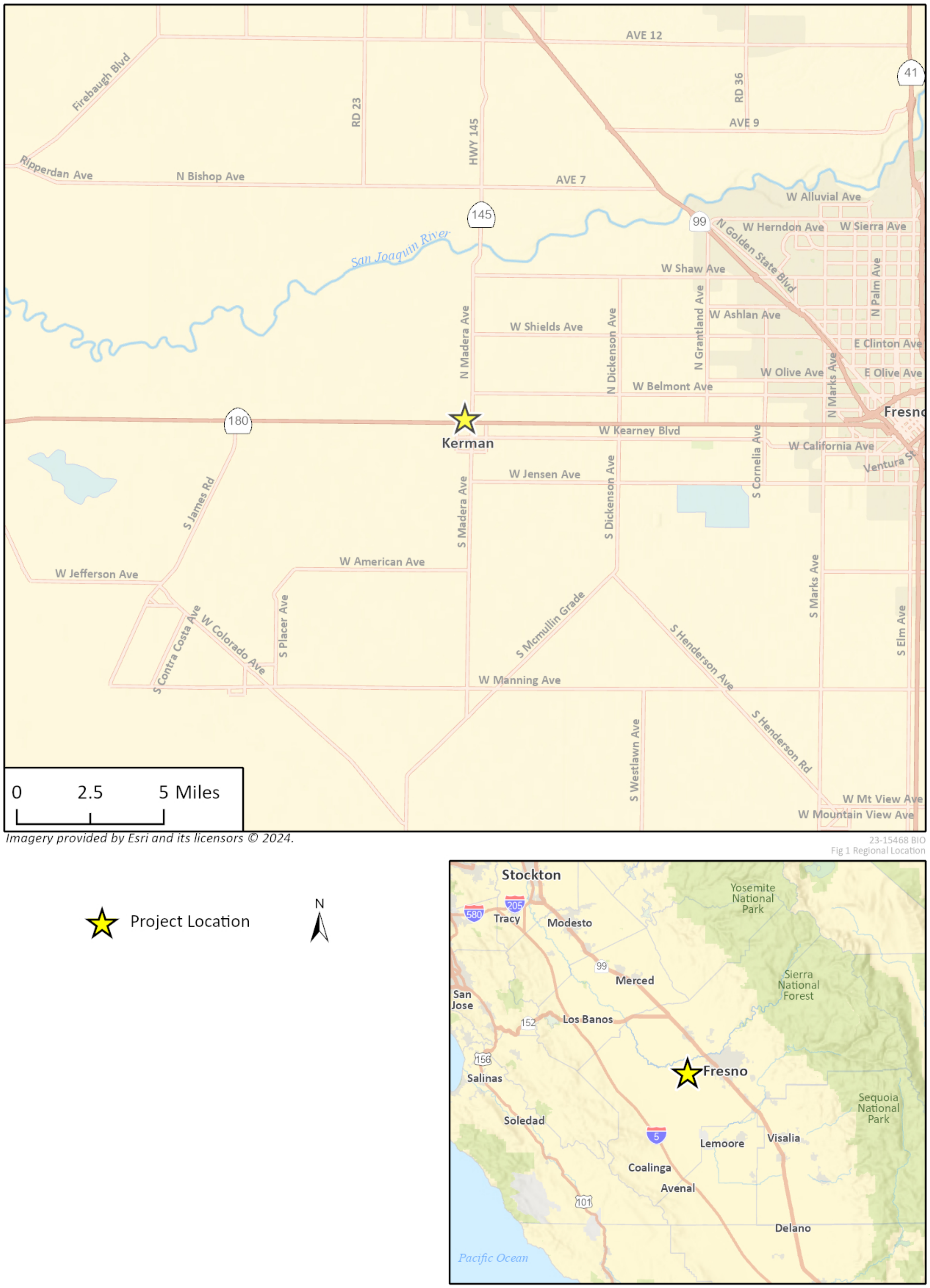
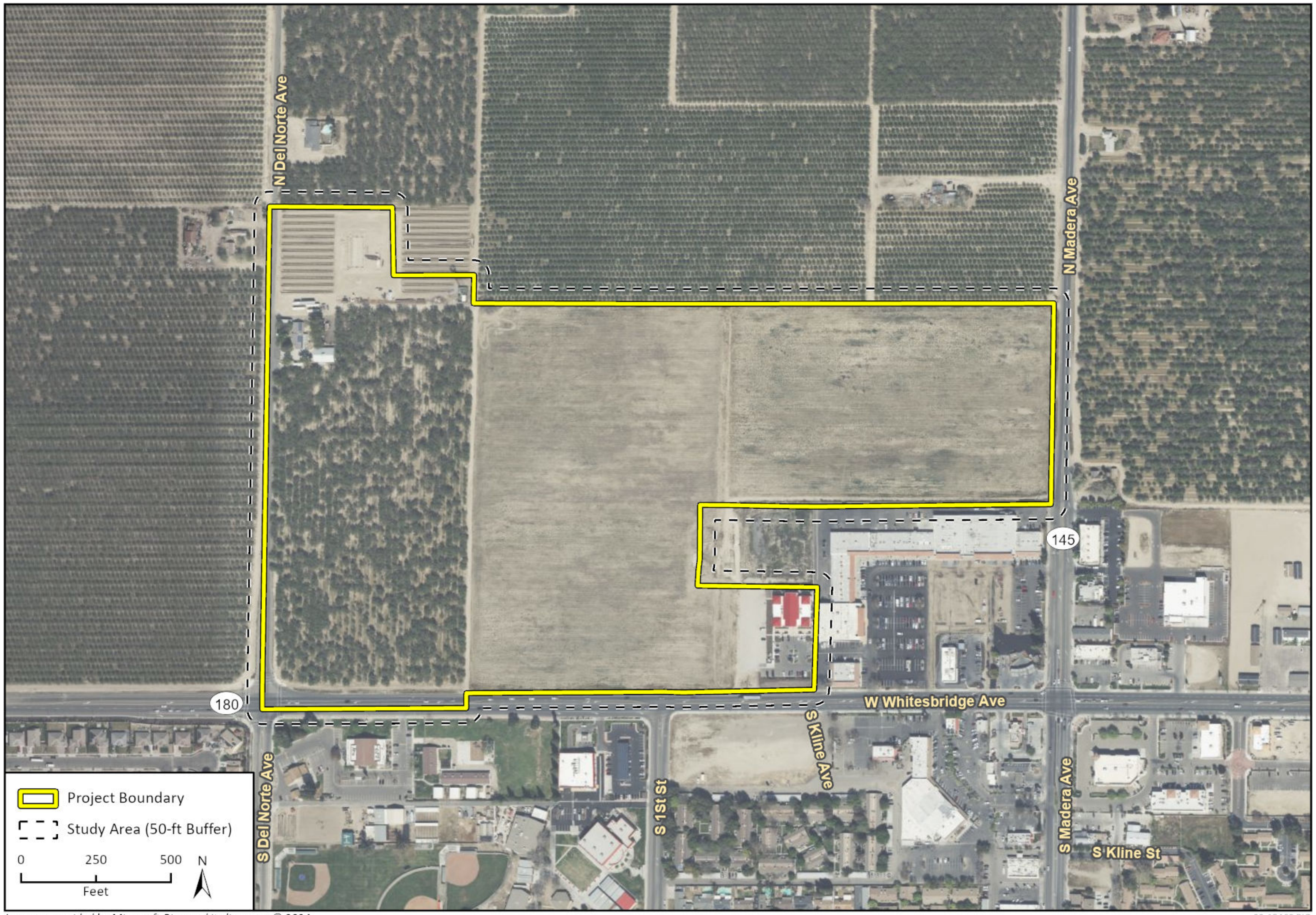


Figure 2 Project Location



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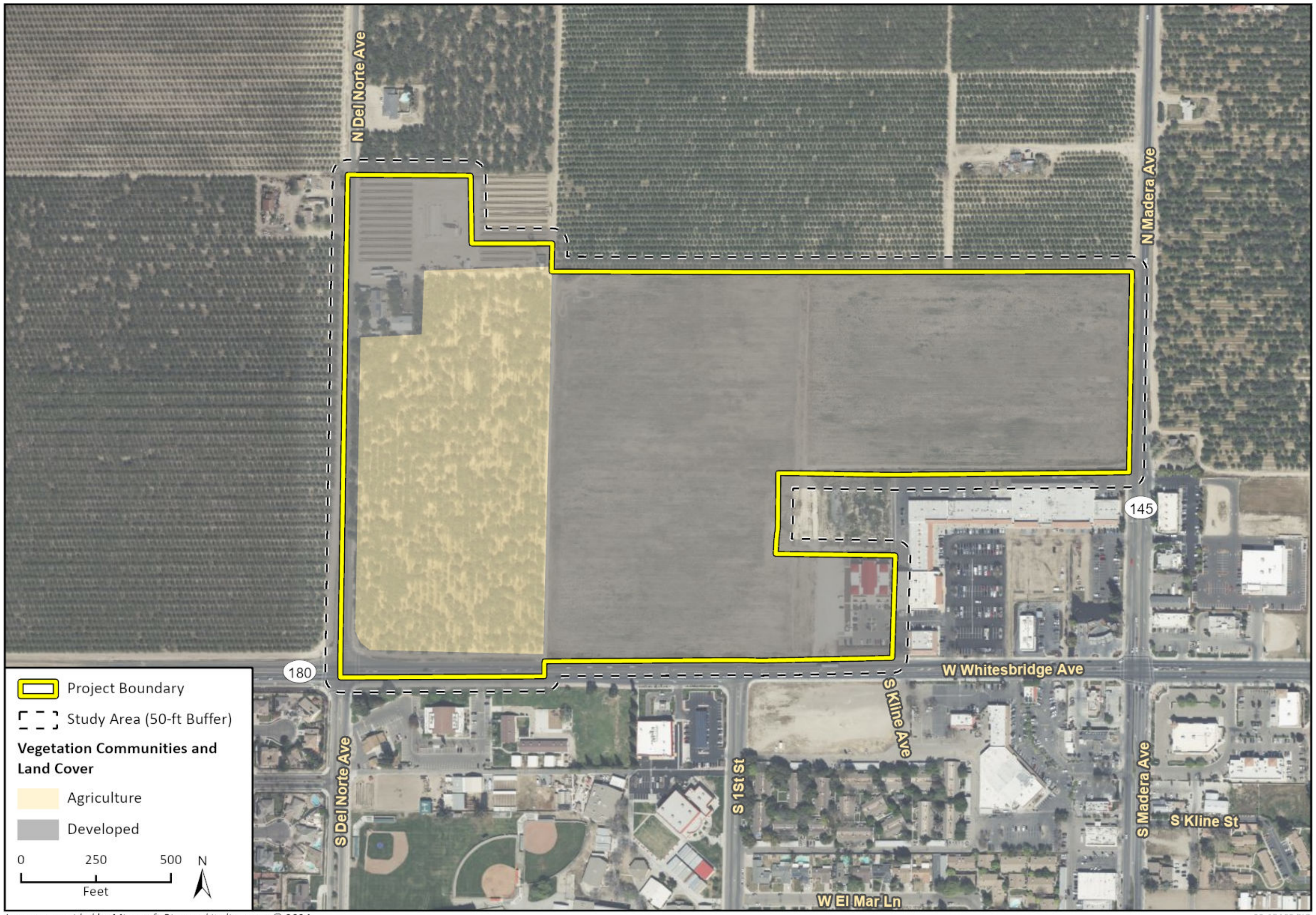
23-15468 BIO
Fig 2 Project Location

Figure 3 Landcover Types



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23-15468 BIO
Fig 3 Vegetation Communities

Table 1 Potential to Occur Table

Scientific Name Common Name	Status	Habitat Requirements	Potential to Occur in Project Area	Habitat Suitability/ Observations
Plants and Lichens				
Atriplex cordulata var. *cordulata* heartscale	None/None G3T2/S2 1B.2	Annual herb. Chenopod scrub, meadows and seeps, valley and foothill grassland. Alkaline (sometimes). Elevations: 0-1835ft. (0-560m.) Blooms Apr-Oct.	Not expected	The study area is an orchard and recently developed. Suitable habitat is absent from the study area. No observations were made during the site visit.
Atriplex cordulata var. *erecticaulis* Earlimart orache	None/None G3T1/S1 1B.2	Annual herb. Valley and foothill grassland. Elevations: 130-330ft. (40-100m.) Blooms Aug-Sep(Nov).	Not expected	The study area is an orchard and recently developed. Suitable habitat is absent from the study area No observations were made during the site visit.
Atriplex coronata var. *vallicola* Lost Hills crownscale	None/None G4T3/S3 1B.2	Annual herb. Chenopod scrub, valley and foothill grassland, vernal pools. Alkaline. Elevations: 165-2085ft. (50-635m.) Blooms Apr-Sep.	Not expected	The site is an orchard and recently developed. Suitable habitat is absent from the study area No observations were made during the site visit.
Atriplex depressa brittlescale	None/None G2/S2 1B.2	Annual herb. Chenopod scrub, meadows and seeps, playas, valley and foothill grassland, vernal pools. Alkaline, clay. Elevations: 5-1050ft. (1-320m.) Blooms Apr-Oct.	Not expected	The site is an orchard and recently developed. Suitable habitat is absent from the study area No observations were made during the site visit.
Atriplex minuscula lesser saltscale	None/None G2/S2 1B.1	Annual herb. Chenopod scrub, playas, valley and foothill grassland. Alkaline, sandy. Elevations: 50-655ft. (15-200m.) Blooms May-Oct.	Not expected	Suitable habitat is absent from the study area. The closest CNDDB occurrence is from 1948 approximately 1.8 miles southeast of Del Norte/SR 180 intersection along SR 145. No observations were made during the site visit.
Atriplex persistens vernal pool smallscale	None/None G2/S2 1B.2	Annual herb. Vernal pools. Alkaline vernal pools. Elevations: 35-375ft. (10-115m.) Blooms Jun-Oct.	Not expected	The study area is an orchard and recently developed. Suitable habitat is absent from the study area No observations were made during the site visit.
Atriplex subtilis subtle orache	None/None G1/S1 1B.2	Annual herb. Valley and foothill grassland. Alkaline. Elevations: 130-330ft. (40-100m.) Blooms (Apr)Jun-Sep(Oct).	Not expected	The study area is an orchard and recently developed. Suitable habitat is absent from the study area No observations were made during the site visit.
Chloropyron palmatum palmate-bracted bird's-beak	FE/SE G1/S1 1B.1	Annual herb (hemiparasitic). Chenopod scrub, valley and foothill grassland. Alkaline. Elevations: 15-510ft. (5-155m.) Blooms May-Oct.	Not expected	The study area is an orchard and recently developed. Suitable habitat is absent from the study area. No observations were made during the site visit.

Scientific Name Common Name	Status	Habitat Requirements	Potential to Occur in Project Area	Habitat Suitability/ Observations
Delphinium recurvatum recurved larkspur	None/None G2?/S2? 1B.2	Perennial herb. Chenopod scrub, cismontane woodland, valley and foothill grassland. Alkaline. Elevations: 10-2590ft. (3-790m.) Blooms Mar-Jun.	Not expected	The study area is an orchard and recently developed. Suitable habitat is absent from the study area No observations were made during the site visit.
Eryngium spinosepalum spiny-sepaled button-celery	None/None G2/S2 1B.2	Annual/perennial herb. Valley and foothill grassland, vernal pools. Some sites on clay soil of granitic origin; vernal pools, within grassland. Elevations: 260-3200ft. (80-975m.) Blooms Apr-Jun.	Not expected	Suitable habitat is absent within the study area. The study area consists of sandy loam soils of granitic origin. Ponded water found on-site was in the form of an off-road ditch. No observations were made during the site visit.
Lasthenia chrysantha alkali-sink goldfields	None/None G2/S2 1B.1	Annual herb. Vernal pools. Alkaline. Elevations: 0-655ft. (0-200m.) Blooms Feb-Apr.	Not expected	The study area is an orchard and recently developed. Suitable habitat for the species is not present in the study area. No observations were made during the site visit.
Layia munzii Munz's tidy-tips	None/None G2/S2 1B.2	Annual herb. Chenopod scrub, valley and foothill grassland. Hillsides, in white-grey alkaline clay soils, w/grasses and chenopod scrub associates. Elevations: 490-2295ft. (150-700m.) Blooms Mar-Apr.	Not expected	The study area is an orchard and recently developed. Suitable habitat for the species is absent from the study area. No observations were made during the site visit.
Orcuttia pilosa hairy Orcutt grass	FE/SE G1/S1 1B.1	Annual herb. Vernal pools. Elevations: 150-655ft. (46-200m.) Blooms May-Sep.	Not expected	The study area is an orchard and recently developed. Suitable habitat for the species is not present in the study area No observations were made during the site visit.
Puccinellia simplex California alkali grass	None/None G2/S2 1B.2	Annual herb. Chenopod scrub, meadows and seeps, valley and foothill grassland, vernal pools. Alkaline, vernally mesic. Sinks, flats, and lake margins. Elevations: 5-3050ft. (2-930m.) Blooms Mar-May.	Not expected	The study area is an orchard and recently developed. Suitable habitat is not present in the study area. No observations were made during the site visit.
Sagittaria sanfordii Sanford's arrowhead	None/None G3/S3 1B.2	Perennial rhizomatous herb (emergent). Marshes and swamps. In standing or slow-moving freshwater ponds, marshes, and ditches. Elevations: 0-2135ft. (0-650m.) Blooms May-Oct(Nov).	Not expected	The study area is an orchard and recently developed. Suitable habitat for the species is absent from the study area. No observations were made during the site visit.

Scientific Name Common Name	Status	Habitat Requirements	Potential to Occur in Project Area	Habitat Suitability/ Observations
Invertebrates				
Desmocerus californicus dimorphus valley elderberry longhorn beetle	FT/None G3T3/S3	Occurs only in the Central Valley of California, in association with blue elderberry (Sambucus mexicana). Prefers to lay eggs in elderberries 2-8 inches in diameter; some preference shown for "stressed" elderberries.	Not expected	No elderberry shrubs were observed on site; thus, suitable habitat is absent.
Amphibians				
Spea hammondii western spadefoot	FPT/None G2G3/S3S4 SSC	Occurs primarily in grassland habitat, but can be found in valley-foothill hardwood woodlands. Vernal pools are essential for breeding and egg-laying.	Low potential	Ponded water from recent rain events was present on the side of SR 180. The closest CNDDB occurrence was recorded in 1948 approximately 4 miles west of the study area (CDFW 2024c).
Reptiles				
Gambelia sila blunt-nosed leopard lizard	FE/SE G1/S2 FP	Resident of sparsely vegetated alkali and desert scrub habitats, in areas of low topographic relief. Seeks cover in mammal burrows, under shrubs or structures such as fence posts; they do not excavate their own burrows.	Not expected	Suitable habitat is not present for the species. The study area is both heavily vegetated (orchard) and recently disturbed. The closest CNDDB record is more than 5 miles away (CDFW 2024c).
Masticophis flagellum ruddocki San Joaquin coachwhip	None/None G5T2T3/S3 SSC	Open, dry habitats with little or no tree cover. Found in valley grassland and saltbush scrub in the San Joaquin Valley. Needs mammal burrows for refuge and oviposition sites.	Not expected	Suitable habitat is not present for the species. The study area has heavy tree cover (orchard). The closest recorded CNDDB occurrence is more than 5 miles away from the project site (CDFW 2024c).
Thamnophis gigas giant gartersnake	FT/ST G2/S2	Prefers freshwater marsh and low gradient streams. Has adapted to drainage canals and irrigation ditches. This is the most aquatic of the gartersnakes in California.	Not expected	Suitable habitat is not present for the species. No aquatic resources are available in the study area. The closest drainage canal is approximately 0.12 miles north of the study area. The closest CNDDB occurrence was recorded more than 5 miles away from the project site (CDFW 2024c).
Birds				
Agelaius tricolor tricolored blackbird	None/ST G1G2/S2 SSC	Highly colonial species, most numerous in Central Valley and vicinity. Largely endemic to California. Requires open water, protected nesting substrate, and foraging area with insect prey within a few km of the colony.	Not expected	Suitable habitat is not present for the species. The study area does not have open water. The closest CNDDB occurrence is recorded more than 5 miles away from the study area (CDFW 2024c).

Scientific Name Common Name	Status	Habitat Requirements	Potential to Occur in Project Area	Habitat Suitability/ Observations
Athene cunicularia burrowing owl	None/None G4/S2 SSC	Open, dry annual or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. Subterranean nester, dependent upon burrowing mammals, most notably, the California ground squirrel.	Low potential	California ground squirrel burrow complexes were seen in the southwest corner of the orchard. Burrows were not consistent with burrowing owl occupation, i.e. white wash, pellets, etc. One burrowing owl observation has been recorded in the 5 mile buffer. The observation was recorded in 1984 approximately 5.5 miles west of the study area (CDFW 2024c).
Buteo swainsoni Swainson's hawk	None/ST G5/S4	Breeds in grasslands with scattered trees, juniper-sage flats, riparian areas, savannahs, and agricultural or ranch lands with groves or lines of trees. Requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields supporting rodent populations.	Low potential	Surrounding orchards are suitable for foraging. No large nests were seen within 0.5 mi buffer. The closest recorded CNDDB occurrence is approximately 4.5 miles west of the study area in 2018 (CDFW 2024c).
Charadrius montanus mountain plover	None/None G3/S2 SSC	Short grasslands, freshly plowed fields, newly sprouting grain fields, and sometimes sod farms. Short vegetation, bare ground, and flat topography. Prefers grazed areas and areas with burrowing rodents.	Not expected	Suitable habitat is not present for the species. The study area has heavy tree cover (orchard). The closest more than 5 miles away from the project site (CDFW 2024c).
Mammals				
Dipodomys nitratoides exilis Fresno kangaroo rat	FE/SE G3TH/SH	Alkali sink-open grassland habitats in western Fresno County. Bare alkaline clay-based soils subject to seasonal inundation, with more friable soil mounds around shrubs and grasses.	Not expected	Suitable habitat is not present for the species. The study area contains sandy loam soils. The closest CNDDB record is from 1934 approximately 0.5 mile from the project site.
Taxidea taxus American badger	None/None G5/S3 SSC	Most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils. Needs sufficient food, friable soils and open, uncultivated ground. Preys on burrowing rodents. Digs burrows.	Not expected	California ground squirrel burrow complexes were seen in the southwest corner of the orchard. Burrows were not consistent with badger dens, i.e. large claw marks, etc.
Vulpes macrotis mutica San Joaquin kit fox	FE/ST G4T2/S3	Annual grasslands or grassy open stages with scattered shrubby vegetation. Need loose-textured sandy soils for burrowing, and suitable prey base.	Not expected	California ground squirrel burrow complexes were seen in the southwest corner of the orchard. Burrows were not consistent with SJKF burrows, i.e. length of bib, shape of burrow, etc.

Regional Vicinity refers to within a 9-quad search radius of site.

FE = Federally Endangered FT = Federally Threatened FC = Federal Candidate Species FS=Federally Sensitive

SE = State Endangered ST = State Threatened SC = State Candidate SS=State Sensitive

SSC = CDFW Species of Special Concern SFP = State Fully Protected WL=State Watch List

Appendix C

Cultural Resources Technical Report

Kerman High School Athletic Facilities Master Plan Expansion Project

Cultural Resources Technical Report

prepared for

Kerman Unified School District
151 South First Street
Kerman, California 93630
Contact: Kraig Magnussen, Assistant Superintendent/Chief Business Official

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June 2024

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Please cite this report as follows:

Balam, D., C. R. Guardado, Montgomery, and B. Campbell-King

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Executive Summary

The Kerman Unified School District (District) retained Rincon Consultants, Inc. (Rincon) to conduct a cultural resources assessment for the Kerman High School Athletic Facilities Master Plan Expansion Project (proposed project), in Kerman, unincorporated Fresno County, California. The project was originally analyzed in 2016; however, the District proposes to expand the project westward to North Del Norte Avenue for additional parking, a maintenance, operations, and transportation facility, with a food service building and a battery storage/utility yard building. The project site totals 65 acres, and includes the area analyzed in 2016 and the current westward expansion. This assessment analyzes 25 of the 65 acres and includes the westward expansion and the new facilities within the 2016 project area. The project is subject to the California Environmental Quality Act (CEQA). The District is the lead agency under CEQA.

This assessment included a cultural resources records search of the California Historical Resources Information System, a Sacred Lands File (SLF) search of the Native American Heritage Commission, a pedestrian survey of the western portion and new facilities of the proposed project site, and the preparation of this report to summarize the results of these activities. The 2016 cultural resources assessment conducted by C. Kristina Roper studied the eastern portion of the project site and noted it was heavily disturbed due to previous and active construction. No cultural resources were identified as a result of the 2016 study and Roper (2016) stated that it was unlikely that the proposed action would affect cultural resources. Rincon conducted a pedestrian survey of the western portion of the proposed project site and revisited the areas of the 2016 survey where new facilities are proposed.

The pedestrian survey and background research did not identify any built environment resources that may be considered historical resources within the proposed project site. The proposed project therefore does not have the potential to impact built environment historical resources and Rincon recommends a finding of **no impact to historical resources** pursuant to CEQA, consistent with the 2016 study.

The records searches, SLF search, and pedestrian survey identified no archaeological resources at the proposed project site. Additionally, the proposed project site has been heavily disturbed due to agricultural activities. Based on the absence of cultural resources and the amount of disturbance within the project site, the project site is considered to have a low sensitivity for archaeological resources and an unanticipated cultural resources discovery mitigation measure is recommended. With implementation of this recommended mitigation measure, Rincon recommends a ***less than significant impact with mitigation for archaeological resources*** pursuant to CEQA, consistent with the 2016 study.

1 Introduction

The Kerman Unified School District (District) retained Rincon Consultants Inc. (Rincon) to conduct a cultural resources assessment for the Kerman High School Athletic Facilities Master Plan Expansion Project (proposed project) in Kerman, unincorporated Fresno County, California. This technical report documents the results of the study and tasks conducted by Rincon, specifically, a cultural resources records search, Sacred Lands File (SLF) search from the Native American Heritage Commission (NAHC), and a pedestrian survey. This study has been completed pursuant to the requirements of the California Environmental Quality Act (CEQA). The District is the lead agency under CEQA.

1.1 Project Site and Description

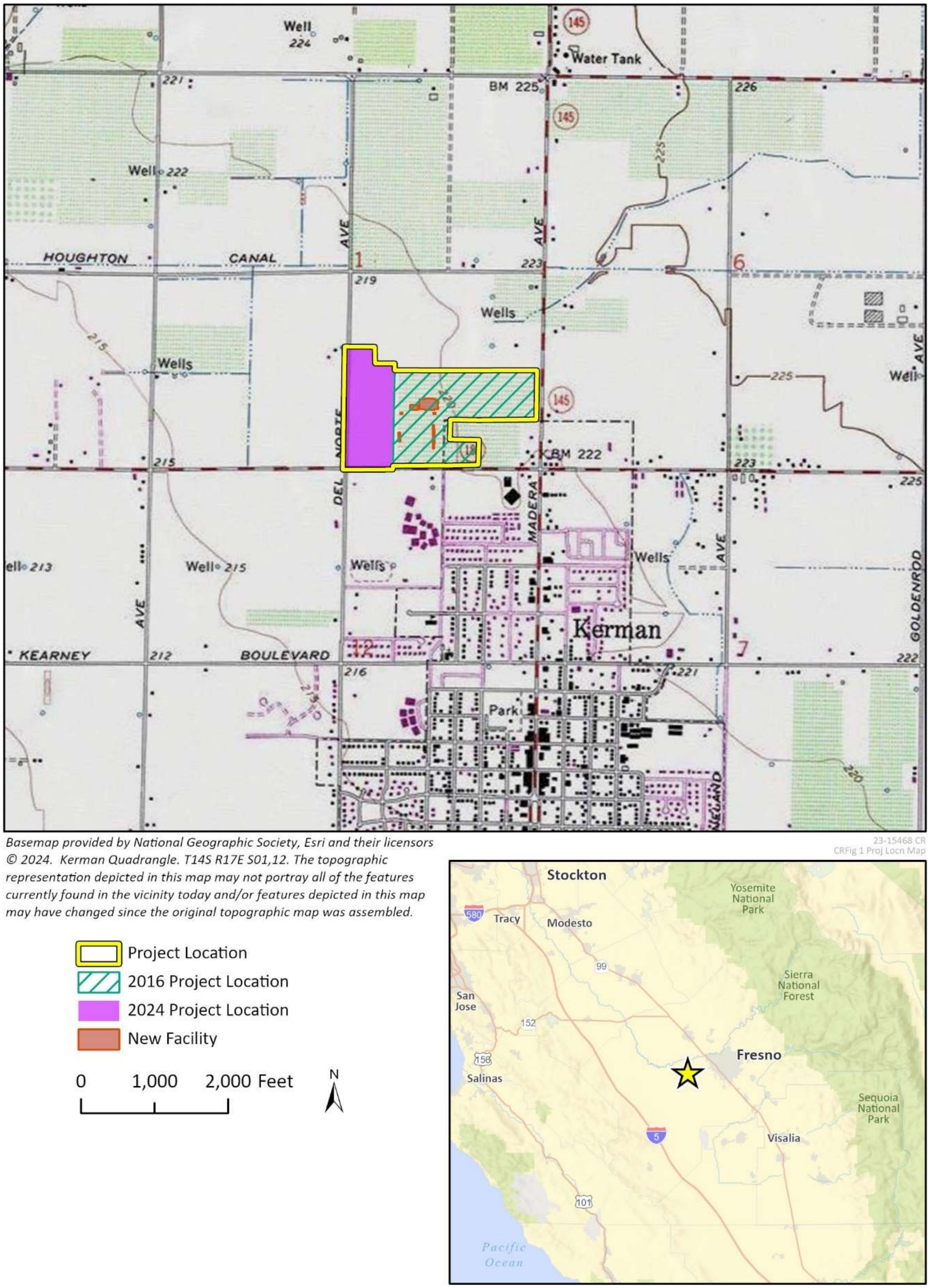
The proposed project site is located at 15180 West Whitesbridge Avenue in the city of Kerman, unincorporated Fresno County, California, totaling approximately 65 acres, of which the 25 acres for the westward expansion and new facilities are analyzed for this assessment. Specifically, the project encompasses portions of Sections 01 and 12 of Township 14 south, Range 17 east on the *Kerman, California* United States Geological Survey (USGS) 7.5-minute topographic quadrangle (Figure 1). The proposed project site includes Assessor's Parcel Numbers [APN] 020-120-28S, 020-120-32ST, 020-120-26ST, 020-120-27ST, and 020-120-24ST, and extends to the centerline of State Route [SR] 180 (Whitesbridge Avenue) and North Del Norte Avenue. The proposed project is bound by agricultural fields to the west and north, residential and commercial development to the east and south, and Kerman High School to the south (Figure 2).

The following project description has been adapted from information provided by Darden Architecture on November 30, 2023, and the District on June 10, 2024. The proposed project consists of the westward expansion of the Kerman High School Athletic Facilities Addition and Elementary School Project site approximately 0.13 mile to meet North Del Norte Avenue ("expansion area"), across the existing orchard; as well as the construction and operation of additional buildings on the site previously analyzed in the 2016 IS-MND. The proposed structures in the expansion area would include additional covered parking with solar panels; a battery storage/utility yard building; a maintenance, operations, and transportation facility; a food service building; and an office/printshop. The proposed project also includes 56,900 square feet of development on the site previously analyzed in the 2016 IS-MND, including a storage facility, a gymnasium, entry booths to the soccer/football stadium, two restroom facilities, two snack bars, grandstand seating for the soccer/football stadium, and three new aquatics facilities (restrooms and showers, a snack bar and coaches/team room, and pool chemical/equipment storage).

1.2 Personnel

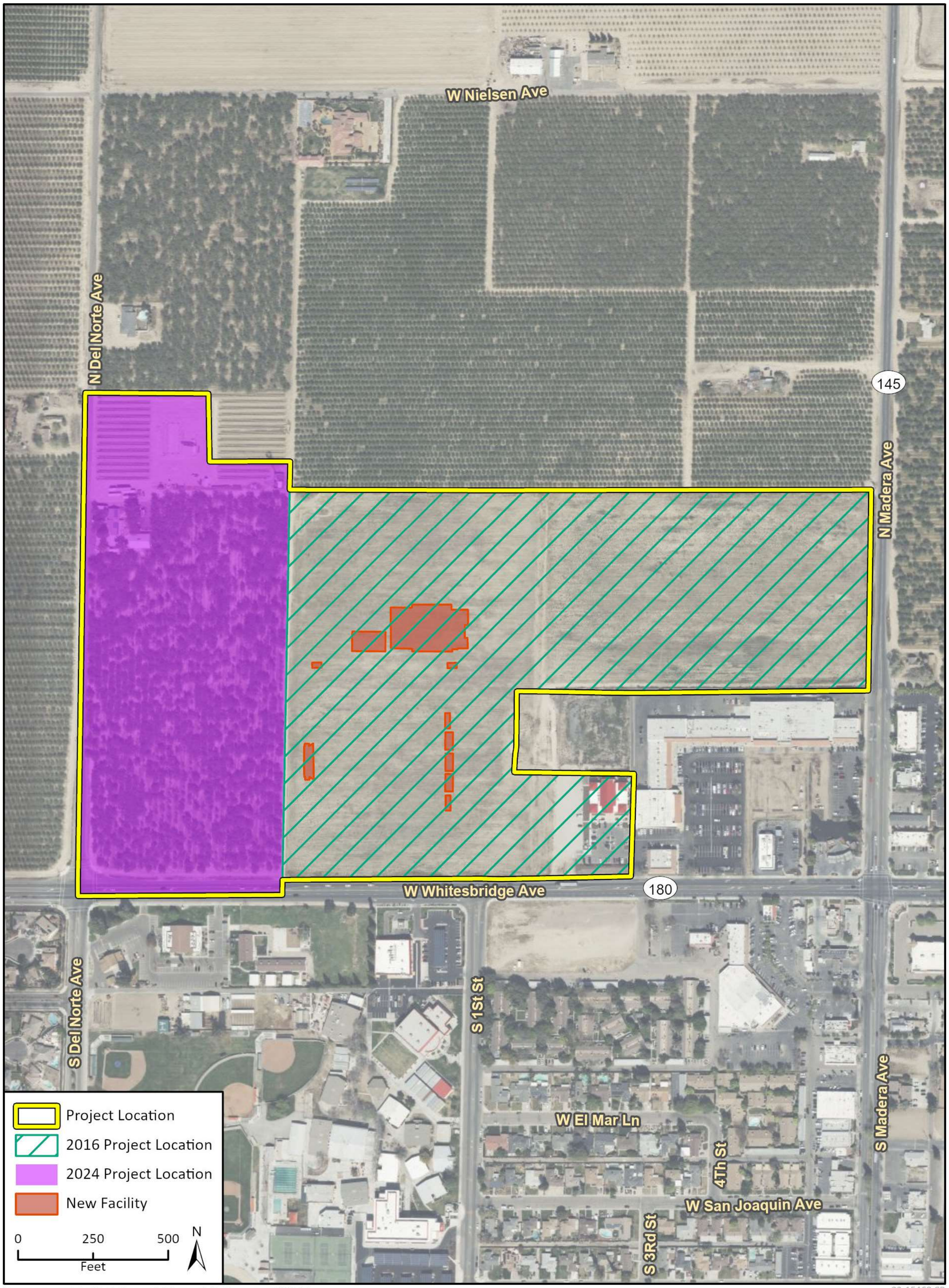
Rincon Archaeologist and Project Manager Courtney Montgomery, MA, provided management oversight for this cultural resources study, is a contributing author of this report, and conducted the field survey. Archaeologist Debbie Balam, BA, completed the SLF search, aerial imagery and historical topographic map review, and is the primary author of this report. Archaeologist Robert Guardado, BA, conducted the geoarchaeological review for the project and is a contributing author. Archaeologist Catherine Johnson, Ph.D., Registered Professional Archaeologist (RPA), performed the cultural resources records search. Geographic Information Systems Analyst Bryan Valladares prepared the figures found in this report. Senior Archaeologist Breana Campbell-King, MA, RPA, reviewed this report for quality control. Ms. Montgomery and Ms. Campbell-King meet and exceed the Secretary of the Interior's Professional Qualifications Standards for archeology (National Park Service 1983).

Figure 1 Regional Location



Basemap provided by National Geographic Society, Esri and their licensors © 2024. Kerman Quadrangle. T14S R17E S01,12. The topographic representation depicted in this map may not portray all of the features currently found in the vicinity today and/or features depicted in this map may have changed since the original topographic map was assembled.

Figure 2 Project Site



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23-15468 CR
CRFig 2 Project Site

2 Regulatory Setting

This section includes a discussion of the applicable state and local laws, ordinances, regulations, and standards governing cultural resources, which must be adhered to before and during implementation of the project.

2.1 California Environmental Quality Act

California Public Resources Code (PRC) Section 21084.1 requires lead agencies to determine if a project could have a significant impact on historical or unique archaeological resources. As defined in PRC Section 21084.1, a historical resource is a resource listed in, or determined eligible for listing in, the California Register of Historical Resources (CRHR), a resource included in a local register of historical resources or identified in a historical resources survey pursuant to PRC Section 5024.1(g), or any object, building, structure, site, area, place, record, or manuscript that a lead agency determines to be historically significant. PRC Section 21084.1 also states resources meeting the above criteria are presumed to be historically or culturally significant unless the preponderance of evidence demonstrates otherwise. Resources listed in the National Register of Historic Places (NRHP) are automatically listed in the CRHR, as are California Historical Landmarks 770 and above; both are therefore historical resources under CEQA. Historical resources may include eligible built environment resources and archaeological resources of the precontact or historic periods.

CEQA Guidelines Section 15064.5(c) provides further guidance on the consideration of archaeological resources. If an archaeological resource does not qualify as a historical resource, it may meet the definition of a "unique archaeological resource" as identified in PRC Section 21083.2. PRC Section 21083.2(g) defines a unique archaeological resource as an artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria: 1) it contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information, 2) has a special and particular quality such as being the oldest of its type or the best available example of its type, or 3) is directly associated with a scientifically recognized important prehistoric or historic event or person.

If an archaeological resource does not qualify as a historical or unique archaeological resource, the impacts of a project on those resources will be less than significant and need not be considered further (CEQA Guidelines Section 15064.5[c][4]). CEQA Guidelines Section 15064.5 also provides guidance for addressing the potential presence of human remains, including those discovered during the implementation of a project.

According to CEQA, an impact that results in a substantial adverse change in the significance of a historical resource is considered a significant impact on the environment. A substantial adverse change could result from physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of the historical resource would be materially impaired (CEQA Guidelines Section 15064.5 [b][1]). Material impairment is defined as demolition or alteration in an adverse manner [of] those characteristics of a historical resource that convey its historical significance and that justify its inclusion in, or eligibility for inclusion in, the CRHR or a local register (CEQA Guidelines Section 15064.5[b][2][A]).

If it can be demonstrated that a project will cause damage to a unique archaeological resource, the lead agency may require reasonable efforts be made to permit any or all of these resources to be preserved in place or left in an undisturbed state. To the extent that resources cannot be left undisturbed, mitigation measures are required (PRC Section 21083.2[a][b]).

The requirements for mitigation measures under CEQA are outlined in CEQA Guidelines Section 15126.4(a)(1). In addition to being fully enforceable, mitigation measures must be completed within a defined time period and be roughly proportional to the impacts of the project. Generally, a project which is found to comply with the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings (the Standards) is considered to be mitigated below a level of significance (CEQA Guidelines Section 15126.4 [b][1]). For historical resources of an archaeological nature, lead agencies should also seek to avoid damaging effects where feasible. Preservation in place is the preferred manner to mitigate impacts to archaeological sites; however, data recovery through excavation may be the only option in certain instances (CEQA Guidelines Section 15126.4[b][3]).

2.1.1 National Register of Historic Places

Although the project does not have a federal nexus, properties which are listed in or have been formally determined eligible for listing in the NRHP are automatically listed in the CRHR. The following is therefore presented to provide applicable regulatory context. The NRHP was authorized by Section 101 of the National Historic Preservation Act and is the nation's official list of cultural resources worthy of preservation. The NRHP recognizes the quality of significance in American, state, and local history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects. Per 36 CFR Part 60.4, a property is eligible for listing in the NRHP if it meets one or more of the following criteria:

Criterion A: Is associated with events that have made a significant contribution to the broad patterns of our history

Criterion B: Is associated with the lives of persons significant in our past

Criterion C: Embodies the distinctive characteristics of a type, period, or method of installation, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction

Criterion D: Has yielded, or may be likely to yield, information important in prehistory or history

In addition to meeting at least one of the above designation criteria, resources must also retain integrity. The National Park Service recognizes seven aspects or qualities that, considered together, define historic integrity. To retain integrity, a property must possess several, if not all, of these seven qualities, defined as follows:

Location: The place where the historic property was constructed or the place where the historic event occurred

Design: The combination of elements that create the form, plan, space, structure, and style of a property

Setting: The physical environment of a historic property

Materials: The physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property

Workmanship: The physical evidence of the crafts of a particular culture or people during any given period in history or prehistory

Feeling: A property's expression of the aesthetic or historic sense of a particular period of time

Association: The direct link between an important historic event or person and a historic property

Certain properties are generally considered ineligible for listing in the NRHP, including cemeteries, birthplaces, graves of historical figures, properties owned by religious institutions, relocated structures, or commemorative properties. Additionally, a property must be at least 50 years of age to be eligible for listing in the NRHP. The National Park Service states that 50 years is the general estimate of the time needed to develop the necessary historical perspective to evaluate significance (National Park Service 1997:41). Properties which are less than 50 years must be determined to have "exceptional importance" to be considered eligible for NRHP listing.

2.1.2 California Register of Historical Resources

The CRHR was established in 1992 and codified by PRC Sections 5024.1 and Title 14 Section 4852. The CRHR is an authoritative listing and guide to be used by state and local agencies, private groups, and citizens in identifying the existing historical resources of the state and to indicate which resources deserve to be protected, to the extent prudent and feasible, from substantial adverse change (Public Resources Code, 5024.1(a)). The criteria for eligibility for the CRHR are consistent with the NRHP criteria but have been modified for state use in order to include a range of historical resources that better reflect the history of California (Public Resources Code, 5024.1(b)). Unlike the NRHP however, the CRHR does not have a defined age threshold for eligibility; rather, a resource may be eligible for the CRHR if it can be demonstrated sufficient time has passed to understand its historical or architectural significance (California Office of Historic Preservation 2011). Furthermore, resources may still be eligible for listing in the CRHR even if they do not retain sufficient integrity for NRHP eligibility (California Office of Historic Preservation 2011). Generally, the California Office of Historic Preservation recommends resources over 45 years of age be recorded and evaluated for historical resources eligibility (California Office of Historic Preservation 1995:2).

A property is eligible for listing in the CRHR if it meets one of more of the following criteria:

Criterion 1: Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage

Criterion 2: Is associated with the lives of persons important to our past

Criterion 3: Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values

Criterion 4: Has yielded, or may be likely to yield, information important in prehistory or history

2.1.3 California Assembly Bill 52 of 2014

As of July 1, 2015, Assembly Bill (AB) 52 was enacted and expands CEQA by defining a new resource category, "tribal cultural resources". AB 52 establishes, "a project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment" (PRC Section 21084.2). It further states the CEQA lead agency shall establish measures to avoid impacts that would alter the significant characteristics of a tribal cultural resource, when feasible (PRC Section 21084.3).

PRC Section 21074 (a)(1)(A) and (B) define tribal cultural resources as "sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe" and that meets at least one of the following criteria, as summarized in CEQA Guidelines Appendix G:

1) Listed or eligible for listing in the CRHR, or in a local register of historical resources as defined in PRC Section 5020.1(k).
2) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of PRC Section 5024.1. In applying these criteria, the lead agency shall consider the significance of the resource to a California Native American tribe.

AB 52 also establishes a formal consultation process with California Native American tribes that must be completed before a CEQA document can be certified. Under AB 52, lead agencies are required to "begin consultation with a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project." California Native American tribes to be included in the process are those that have requested notice of projects proposed within the jurisdiction of the lead agency.

2.2 California Health and Safety Code

Section 7050.5 of the California Health and Safety Code states that in the event of discovery or recognition of any human remains in any location other than a dedicated cemetery, there shall be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent remains until the coroner of the county in which the remains are discovered has determined if the remains are subject to the Coroner's authority. If the human remains are of Native American origin, the coroner must notify the NAHC within 24 hours of this identification.

2.3 California Public Resources Code §5097.98

Section 5097.98 of the California Public Resources Code states that the NAHC, upon notification of the discovery of Native American human remains pursuant to Health and Safety Code §7050.5, shall immediately notify those persons (i.e., the Most Likely Descendant [MLD]) that it believes to be descended from the deceased. With permission of the landowner or a designated representative, the MLD may inspect the remains and any associated cultural materials and make recommendations for treatment or disposition of the remains and associated grave goods. The MLD shall provide recommendations or preferences for treatment of the remains and associated cultural materials within 48 hours of being granted access to the site.

2.4 Local Regulations

2.4.1 City of Kerman 2040 General Plan

The City of Kerman 2040 General Plan was adopted in July 2020. The General Plan contains policies pertaining to cultural resources that apply to the project. As presented in Section 6.3 Cultural Resources of the General Plan, these goals and policies include:

Goal

COS-3 To protect sites and structures of historical and cultural significance, and to enhance the availability of new cultural amenities.

Policies

COS-3.1 **Tribal Consultation Requirements Compliance.** The City shall continue to comply with SB 18 and AB 52 by consulting with local California Native American tribes. If archaeological resources of Native American origin are identified during project construction, a qualified archaeologist shall consult with Kerman to begin native American consultation procedures. Appropriate Native American tribes shall be contacted by the City or qualified archaeologist. As part of this process, it may be determined that archaeological monitoring may be required; a Native American monitor may also be required in addition to the archaeologist. The project proponent shall fund the costs of the qualified archaeologist and Native American monitor (as needed) and required analysis and shall implement any mitigation determined to be necessary by the City, qualified archaeologist, and participating Native American tribe.

COS-3.5 **Discretionary Development Review for Cultural Resources.** The City shall review discretionary development projects, as part of any required CEQA review, to identify and protect important archaeological, paleontological, and cultural sites and their contributing environment from damage, destruction, and abuse. Consistent with CEQA findings, the City shall require project-level mitigation to include accurate site surveys, consideration of project alternatives to preserve archaeological and paleontological resources, provisions for resource recovery, and preservation measures when displacement is unavoidable.

3 Natural and Cultural Setting

This section provides background information pertaining to the natural and cultural context of the proposed project site. It places the proposed project site within the broader natural environment which has sustained populations throughout history. This section also provides an overview of regional indigenous history, local ethnography, and post-contact history. This background information describes the distribution and type of cultural resources documented within the vicinity of the project site to inform the cultural resources sensitivity assessment.

3.1 Natural Setting

The proposed project site is located in northwest, unincorporated Fresno County at an approximate elevation of 69 meters (227 feet) above mean sea level. The proposed project site and surrounding areas have historically been used for agricultural and more recently include commercial and residential development, therefore, the vicinity does not retain its natural setting. The proposed project site lies within 1,000 meters (3,280 feet) southwest of an unnamed water way that appears channelized on historical topographic maps from 1947 (NETR Online 2024). Vegetation within the vicinity of the site consists of a previous walnut orchard and grasses.

3.2 Cultural Setting

3.2.1 Indigenous History

California prehistory is generally divided into three broad time periods: Paleoindian period (ca. 11,550-8550 Before Common Era [BCE]), Archaic Period (8550 BCE-Common Era [CE] 1100) and Emergent Occupation (CE 1000- European Contact) (Fredrickson 1973a, 1973b; Moratto 1984; Rosenthal et al. 2007). Little archaeological work has been completed around Tulare Lake, but the research that has been conducted has shown that humans have inhabited the Tulare lakeshore continuously since as early as 9000 BCE (Wallace 1993). The prehistoric chronological sequence for the Central Valley presented below is based on Rosenthal et al. (2007) and Moratto (1984).

Paleo-Indian Period (ca. 10,000-8550 BCE)

Seldom is known about the Paleoindian period in the Central Valley. Geoarchaeological studies have demonstrated that erosion and deposition have buried or destroyed early archaeological deposits. Most claims of ancient human occupation have been dismissed by Moratto (1984) based on radiocarbon dating. Currently, the earliest accepted date of human occupation in the Central Valley ranges from 11,550 to 9550 BCE and comes from fluted projectile points similar to Clovis points found at sites near Tracy Lake and the Tulare Lake Basin (Rosenthal et al. 2007). The Witt Site (P-16-000032), located along the shoreline of a Late Pleistocene lowstand of Tulare Lake, and the surrounding area reportedly contained upwards of 200 Terminal Pleistocene-style concave base points (Fenenga 1993; Moratto 1984: 81; Rosenthal et al. 2007: 151). It has been suggested that the Witt Site area has produced more Clovis points than any other site in western North America (Gobalet and Fenenga 1993).

Lower Archaic (8550-5550 BCE)

Climate change at the end of the Pleistocene caused significant periods of alluvial deposition beginning around 9050 BCE. The Lower Archaic, like the Paleoindian Period, is represented only by limited isolated finds. Only one Lower Archaic site (KER-116 in Kern County) in the Central Valley proper has been radiocarbon dated and few in the foothills surrounding the valley, though numerous Lower Archaic artifacts have been found on the shores of Tulare Lake (Rosenthal et al. 2007; Rosenthal and Meyer 2004).

Typical Lower Archaic artifacts include flaked stone crescents and stemmed points. The identification of projectile points and a diverse faunal assemblage at KER-116 point to hunting being an important subsistence activity. Milling tools and plant remains are largely absent in the valley, thus plant use or acquisition of plant material in this area during the Lower Archaic remains unclear. Several foothill sites contain milling implements and evidence of the use of nut crops such as acorn and pine (LaJeunesse and Pryor 1996). The relationship between foothill and valley floor adaptations is largely unknown during the Lower Archaic. However, distinct adaptations are apparent in the Middle Archaic, and it is possible that these divergent traditions first emerged in the Lower Archaic (Rosenthal et al. 2007).

Middle Archaic (5550-550 BCE)

The Middle Archaic began with substantial climate change to much warmer, drier conditions. Tulare Lake shrank and eventually disappeared sometime around 5500 BCE (Blunt et al. 2015) during this time span. Fans and floodplains stabilized after an initial period of deposition in 5550 BCE Archaeological deposits dating to the Middle Archaic are rare in the Central Valley proper due to these geomorphic changes. What is available of the Middle Archaic record has revealed a pattern of organized subsistence strategies and increased residential stability. The archetypal pattern of the Middle Archaic has been identified as the Windmiller Pattern. This pattern is represented by extended burials oriented to the west and a sophisticated material culture (Rosenthal et al. 2007). Middle Archaic sites are relatively common in the foothills surrounding the Central Valley and show relatively little change from the Lower Archaic (McGuire 1995).

During this time, the mortar and pestle became widespread, suggesting a shift toward more intensive subsistence practices. Fishing technologies, such as bone gorges, hooks, and spears, also appear during the Middle Archaic suggesting a new focus on fishing. Several other technologies also become apparent during this time. Baked-clay impressions of twined basketry, simple pottery, and other baked clay objects have been found at several sites. Personal adornment items additionally became more frequent. Exchange with outside groups is evidenced by the presence of obsidian, shell beads and ornaments (Rosenthal et al. 2007; Moratto 1984). Trade seemed to be focused on utilitarian items such as obsidian or finished obsidian tools from at least five separate sources (Moratto 1984).

Upper Archaic (550 BCE-1100 CE)

The Upper Archaic began with the onset of the Late Holocene, marked by a cooler, wetter climate. The environmental conditions of the Upper Archaic were characterized by the return of lakes that had disappeared during the Middle Archaic, including Tulare Lake around CE 1000, and a renewed fan and floodplain deposition (Blunt et al. 2015). The Upper Archaic is better represented in the archaeological record than earlier periods. Cultural diversity was more pronounced and is marked by contrasting material cultures throughout the valley (Rosenthal et al. 2007).

During this period, numerous specialized technologies were developed such as bone tools, and implements, manufactured goods such as Olivella and Haliotis beads and ornaments, well-made ceremonial blades, and ground-stone plummets. People living in the San Joaquin Valley region traded with neighboring groups for obsidian.

Upper Archaic period economies varied by region throughout the Central Valley. Economies were apparently primarily focused on seasonal resources such as acorns, salmon, shellfish, rabbits, and deer (Rosenthal et al. 2007).

Emergent Occupation (1100 CE-Historic Period)

The stable climatic conditions of the Upper Archaic continued into the Emergent Period. Research in the San Joaquin Valley has been sporadic and limited on this time period, and thus only the Pacheco Complex on the western edge of the valley has been formally defined. After CE 1000, many of the technologies witnessed during the Archaic disappeared to be replaced by cultural traditions witnessed at European contact. During the Emergent Period, the bow and arrow replaced the atlatl as the preferred hunting method sometime between CE 1000 and 1300.

Increased social complexity is evidenced by increased variation in burial types and offerings and larger residential communities. Grave offerings such as shell beads, ornaments, and ritually “killed” mortars and pestles are often found in burials. Pottery was frequently obtained through trade with groups living in the foothills to the east. The Panoche side-notched point became important in the western side of the San Joaquin Valley (Rosenthal et al. 2007). In addition to the side-notched point, the Panoche Complex featured large circular structures, flexed burials, marine shell beads, bone awls, millingstones, and mortars and pestles (Moratto 1984).

As with the Archaic Period, Emergent Period economies varied geographically, though throughout the Central Valley fishing and plant harvesting increased in importance. Most Emergent residential sites contain diverse assemblages of mammal and bird remains and large amounts of fish bone. After 1,000 years ago, the mortar and pestle become the dominant tool type and small seeds increase in archaeological deposits over time (Rosenthal et al. 2007).

3.2.2 Ethnographic Setting

The proposed project site lies within the San Joaquin Valley which is historically occupied by the Penutian-speaking Yokuts (Kroeber 1976; Wallace 1978; Latta 1999), and the project site is located in an area traditionally inhabited by the Southern Valley Yokuts (Wallace 1978). Adjacent native groups include the Northern Valley Yokuts to the north, Salinan and Costanoan to the west, Foothill Yokuts and Sierra Miwok to the east, Kitanemuk and Chumash to the south (Kroeber 1976). The three geographical divisions of the Yokuts are the Northern Valley, Southern Valley, and Foothill Yokuts. The distinction between the three groups is primarily based on language dialect (Mithun 1999).

The Yokuts established permanent villages. Residential structures were most often of two types: single-family dwellings and larger communal residences that housed ten families or more. Villages frequently included mat-covered granaries and a sweathouse (Mithun 1999).

The Yokuts characterized natural features such as mountains, rivers, lakes, and ponds as powerful places called *tripni*. Even humans could be characterized as *tripni* if they were able to cure, cause illness, influence others’ behavior or control natural events. *Tripni* power acquisition was available to every Yokuts and could be attained through ant biting, tobacco or datura consumption, a personal and disciplined process of fasting, walking in nature, and bathing in cold bodies of water at night. *Tripni* was also acquired by going through powerful places and getting songs directly from the place or indirectly from birds listening to the place (Alarcon-Jimenez et al. 2021).

Yokuts subsistence was based on a mixed economy focused on fishing, collecting, and hunting small game. Fishermen employed tule rafts and caught fish with nets, spears, basket traps, and bow and arrow. Yokuts often gathered mussels and hunted turtles in lakes, rivers, and streams. Wild seeds and roots contributed a large portion of the Yokuts' diet. Tule roots were gathered, dried, and pounded into flour to be prepared as a mush. Tule seeds and grass and flowering herb seeds were prepared in the same way. Leaves and stems of certain plants, such as clover and fiddleneck, were also collected. Acorns, a staple of most California Native Americans, were not readily available in the Yokuts ethnographic territory. Acorns were gathered in early fall, after acorns had fallen to the ground into a basket (Woodrow 2013). Some Yokuts tribes journeyed to neighboring groups to trade for acorns. The Yokuts frequently hunted waterfowl with snares, nets, and bow and arrow. Land mammals and birds contributed a smaller part of the Yokuts diet. Small game animals were occasionally taken in snares or traps or shot with bows and arrows (Wallace 1978).

The basic economic unit among the Yokuts was the nuclear family. Totemic lineages were based on patrilineal descent. Totem symbols were passed from father to offspring and families sharing the same totem formed an exogamous lineage. Totems were associated with one or two moieties, a division which played a role during ceremonies and other social events (Wallace 1978).

Yokuts were split into self-governing local groups, most often including several villages. Each group had a chief who directed ceremonies, mediated disputes, handled punishment of those doing wrong, hosted visitors, and provided aid to the impoverished. In certain cases, settlements had two chiefs, one for each moiety. Other political positions included the chief's messenger and the spokesman (Wallace 1978).

Shamans were also an important part of Yokuts village life. The Yokuts' Shaman gained power through a dream or vision. If, after this vision, the man accepted the role as shaman, he would pray, fast, and acquire talismans to aid him in his future work. Shamans had the ability to heal the sick and served the primary role in religious life (Wallace 1978).

Yokuts technology depended primarily on tule. Stems of the plant served as the raw material for baskets, cradles, boats, housing, and many other items. Tools such as knives, projectile points, and scraping tools were made from imported lithic materials as stone was not readily available in the Central Valley. Marine shells secured through trade with coastal peoples were used in the manufacture of shell money and personal adornment items (Wallace 1978).

3.2.3 Post-Contact Setting

Post-Contact history for the state of California is generally divided into three periods: the Spanish Period (1769–1822), Mexican Period (1822–1848), and American Period (1848–present). Although Spanish, Russian, and British explorers visited the area for brief periods between 1529 and 1769, the Spanish Period in California begins with the establishment in 1769 of a settlement at San Diego and the founding of Mission San Diego de Alcalá, the first of 21 missions constructed between 1769 and 1823. Independence from Spain in 1821 marks the beginning of the Mexican Period, and the signing of the Treaty of Guadalupe Hidalgo in 1848, ending the Mexican-American War, signals the beginning of the American Period when California became a territory of the United States.

Spanish Period (1769–1822)

Spanish explorers made sailing expeditions along the coast of what was then known as Alta (upper) California between the mid-1500s and mid-1700s. In 1542, while in search of the legendary Northwest Passage, Juan Rodríquez Cabríllo recorded a visit to the Santa Barbara area. Sebastian Vizcaíno also conducted exploration of the coast in 1602 and named the Santa Barbara Channel when his ship entered it on the feast day of Saint Barbara (Kyle 2002). The Spanish crown laid claim to Alta California based on the surveys conducted by Cabríllo and Vizcaíno (Bancroft 1885; Gumprecht 1999).

By the 18th century, Spain developed a three-pronged approach to secure its hold on the territory and counter against other foreign explorers. The Spanish established military forts known as presidios, as well as missions and pueblos (towns) throughout Alta California. The 1769 overland expedition by Captain Gaspár de Portolá marks the beginning of California's Historic period, occurring just after the King of Spain installed the Franciscan Order to direct religious and colonization matters in assigned territories of the Americas. Portolá established the Presidio of San Diego as the first Spanish settlement in Alta California in 1769. Franciscan Father Junípero Serra also founded Mission San Diego de Alcalá that same year, the first of the 21 missions that would be established in Alta California by the Spanish and the Franciscan Order between 1769 and 1823. The Santa Barbara presidio was established in 1782, and the Santa Barbara Mission was founded four years later (Graffy 2010).

The mission and presidio relied on Chumash labor; eventually, the majority of the native population lived at the mission complex (Cole 1999). Construction of missions and associated presidios was a major emphasis during the Spanish Period in California to integrate the Native American population into Christianity and communal enterprise. Incentives were also provided to bring settlers to pueblos or towns; just three pueblos were established during the Spanish Period, only two of which were successful and remain as California cities (San José and Los Angeles).

Spain began making land grants in 1784, typically to retiring soldiers, although the grantees were only permitted to inhabit and work the land. The land titles technically remained property of the Spanish king (Livingston 1914).

Mexican Period (1822–1848)

Several factors kept growth within Alta California to a minimum, including the threat of foreign invasion, political dissatisfaction, and unrest among the indigenous population. After more than a decade of intermittent rebellion and warfare, New Spain won independence from Spain in 1821. In 1822, the Mexican legislative body in California ended isolationist policies designed to protect the Spanish monopoly on trade, and decreed California ports open to foreign merchants (Dallas 1955).

Extensive land grants were established in the interior during the Mexican Period, in part to increase the population inland from the more settled coastal areas where the Spanish had first concentrated their colonization efforts. The secularization of the missions following Mexico's independence from Spain resulted in the subdivision of former mission lands and establishment of many additional ranchos. Commonly, former soldiers and well-connected Mexican families were the recipients of these land grants, which now included the title to the land. Forty-one ranchos were granted between 1835 and 1846 in what would become Santa Barbara County (Graffy 2010).

During the supremacy of the ranchos (1834–1848), landowners largely focused on the cattle industry and devoted large tracts to grazing. Cattle hides became a primary southern California export, providing a commodity to trade for goods from the east and other areas in the United States and Mexico. The number of nonnative inhabitants increased during this period because of the influx of explorers, trappers, and ranchers associated with the land grants. The rising California population contributed to the introduction and rise of diseases foreign to the Native American population, who had no associated immunities.

American Period (1848–Present)

The United States went to war with Mexico in 1846. During the first year of the war, John C. Fremont traveled from Monterey to Los Angeles with reinforcements for Commodore Stockton and evaded Californian soldiers in Santa Barbara's Gaviota Pass by taking the route over the San Marcos grade instead (Kyle 2002). The war ended in 1848 with the Treaty of Guadalupe Hidalgo, ushering California into its American Period.

California officially became a state with the Compromise of 1850, which also designated Utah and New Mexico (with present-day Arizona) as US territories (Waugh 2003). Horticulture and livestock, based primarily on cattle as the currency and staple of the rancho system, continued to dominate the southern California economy through 1850s. The discovery of gold in the northern part of the state led to the Gold Rush beginning in 1848, and with the influx of people seeking gold, cattle were no longer desired mainly for their hides but also as a source of meat and other goods. During the 1850s cattle boom, rancho vaqueros drove large herds from southern to northern California to feed that region's burgeoning mining and commercial boom.

A severe drought in the 1860s decimated cattle herds and drastically affected rancheros' source of income. In addition, property boundaries that were loosely established during the Mexican era led to disputes with new incoming settlers, problems with squatters, and lawsuits. Rancheros often were encumbered by debt and the cost of legal fees to defend their property. As a result, much of the rancho lands were sold or otherwise acquired by Americans. Most of these ranchos were subdivided into agricultural parcels or towns (Dumke 1944).

County of Fresno

In the 1880s, Fresno County's population soared, and Fresno County was established on April 19, 1856. With the completion of the transcontinental railroad, thousands of settlers and immigrants continued to move into the state and Fresno County through 1869. Later, the Central Pacific Railroad reached Fresno County by 1872 (Planning and Development n.d) which brought minders and farmers which helped the population grow. During this time, land speculators acquired undeveloped land to subdivide and sell to settlers. With the development of large-scale irrigation projects in the final quarter of the nineteenth century, much of the previously undeveloped lands within the country were converted into prosperous farmland and various agricultural colonies were established (Hattersley-Drayton 2013).

Kerman History

The following history of Kerman was taken from the City of Kerman's website (City of Kerman 2024).

> The site of Kerman was first established by the Southern Pacific Railroad Company as a station with a pump and watering tank in 1891. The site was originally named Collis in honor of the president of the railroad Collis P. Huntington. It was at this site, in 1892, that the famous Sontag and Evans gang held up the San Francisco-Los Angeles passenger train; one of the last train robberies in the country and perhaps the most historical event to occur in Kerman. European settlement and cultivation of the Kerman area began and continued through the turn of the

century as irrigation projects brought water to the area, primarily from the Kings River to the south. In 1900, William G. Kerckhoff and Jacob Mansar purchased 3,027 acres of land from the Bank of California and formed the Fresno Irrigated Farms Company.

In 1906, Collis was renamed Kerman after Kerckhoff and Mansar. At this time, Fresno Irrigated Farms the Company began promoting land sales near Kerman across the country. The company also filed the original townsite subdivision map with Fresno County, establishing the street grid encompassed by California Avenue, G Street, First Street and Ninth Street [all of which are south of the proposed project site]. By 1914, Kerman had an estimated population of 400 persons surrounded by 29,000 acres of crop producing land. The Kerman Creamery produced about 1,600 pounds of butter daily. In 1921, Madera Avenue was paved starting at the Southern Pacific railroad tracks north to the San Joaquin River [south of the proposed project site] and streetlights were installed from the tracks to Whitesbridge Road [south of the proposed project site]. By 1936, development of Kerckhoff Park had begun.

Oil and gas exploration was being conducted several miles south of town and in 1941 culminated with the development of the largest gas well in the state at that time. In 1946, the residents of Kerman voted to incorporate, and the City of Kerman was born, with a population of 1,050 residents. Kerman remains predominantly agricultural but is reaching out to industry through the development of an industrial park and development of strong businesses.

4 Methods

This section presents the methods for each task completed during the preparation of this study.

4.1 Background and Archival Research

4.1.1 Archival Research

Rincon completed background and archival research in support of this study in February 2024. A variety of primary and secondary source materials were consulted. Sources included, but were not limited to, historical maps, aerial photographs, and written histories of the area. The following sources were utilized to develop an understanding of the proposed project site and its context:

- Roper, C. Kristina. 2016. Cultural Resources Assessment, Kerman High School Athletic Facilities Addition and New Elementary School Project, State Routes 180 and 145, City of Kerman, Fresno County, California
- Historical aerial photographs accessed via NETR Online
- Historical aerial photographs accessed via University of California, Santa Barbara Library FrameFinder
- Sanborn Fire Insurance Company Maps accessed through the Los Angeles County Public Library
- Historical USGS topographic maps
- Geologic Maps via the USGS National Geologic Map Database
- USDA Web Soil Survey
- Bureau of Land Management General Land Office Records
- ParcelQuest

4.1.2 California Historical Resources Information System Records Search

On February 5, 2024, Rincon received California Historical Resources Information System (CHRIS) records search results (Records Search File No: 24-041) from the Southern San Joaquin Valley Information Center (SSJVIC) (Appendix A). The SSJVIC is the official state repository for cultural resources records and reports for Fresno County. The purpose of the records search was to identify previously recorded cultural resources, as well as previously conducted cultural resources studies within the proposed project site and a 0.5-mile radius surrounding it. Rincon also reviewed the NRHP, the CRHR, the California Historical Landmarks list, and the Built Environment Resources Directory, as well as its predecessor the California State Historic Property Data File. Additionally, Rincon reviewed the Archaeological Determination of Eligibility list.

4.1.3 Sacred Lands File Search

Rincon contacted the NAHC on January 25, 2024, to request a search of the Sacred Lands File (SLF), as well as a contact list of Native Americans culturally affiliated with the proposed project area (Appendix B).

4.2 Field Survey

Rincon Archaeologist and Project Manager Courtney Montgomery, MA, conducted a pedestrian survey of the proposed project site on February 10, 2024. Rincon conducted a pedestrian survey using transect intervals spaced 15 meters and oriented generally from north to south. Exposed ground surfaces were examined for artifacts (e.g., flaked stone tools, tool-making debris, stone milling tools, ceramics, fire-affected rock), ecofacts (bone), soil discoloration that might indicate the presence of a cultural midden, soil depressions, and features indicative of the former presence of structures or buildings (e.g., standing exterior walls, postholes, foundations) or historical debris (e.g., metal, glass, ceramics). Ground disturbances such as burrows and drainages were also visually inspected. Survey accuracy was maintained using a handheld Global Positioning Satellite unit and a georeferenced map of the proposed project site. Site characteristics and survey conditions were documented using field records and a digital camera which are maintained at the Rincon Fresno office.

5 Findings

5.1 Known Cultural Resources Studies

The CHRIS records search and background research identified 10 previously conducted cultural resources studies within 0.5 mile of the proposed project site (Appendix A). Of these studies, four (FR-02501, FR-02505, FR-02506, and FR-02754) include a portion of the proposed project site and approximately 100 percent of the proposed project site has been studied within the last 16 years. Additionally, C. Kristina Roper conducted a study for the Kerman High School Athletic Facility Addition and New Elementary School Project. A summary of known studies that occurred within the proposed project site are discussed in further detail below.

5.1.1 FR-02501

Jeanne Binning (2008) of the California Department of Transportation (Caltrans) prepared study FR-02501, *Historic Property Survey Report for Route 180 Planned Westside Expressway from I-5 to Valentine Ave, Fresno, Fresno County, California*. The study included the results of a literature review, background research, and a field survey. The study documented three pre-contact archaeological resources, 16 historic-period bridges, and five eligible historic bridges (Binning 2008), of which none were located within the current proposed project site. The 2008 study included the entire current proposed project site.

5.1.2 FR-02505

Leach-Palm et al. (2006) prepared study FR-02505, *Preliminary Assessment of the Archaeological Sensitivity for the Route 180 Westside Expressway Route Adoption Study Between Interstate 5 and the City of Fresno*, Fresno County, California Interstate 5 PM 9.0 (KP 14.5) to 06-FRE-180 PM 54.2 (KP 87 Valentine Avenue) EA06-451400, for Caltrans. The report documented the results of a literature review, background research, and a field survey. The study documented three Native American archaeological resources, none of which were located within the current project site. The 2006 study included the southern portion of the current proposed project site.

5.1.3 FR-02506

Jon Brady and Rebecca Bunse (2006) of Caltrans prepared study FR-02506, *Historic Resources Sensitivity Study for the Route 180 Westside Expressway Route Adoption,* Fresno County, California, for Caltrans. The report summarized the methods and results of a literature and background review, and an evaluation of historic resources. The study documented five types of historic-period architectural resources consisting of commercial, agricultural, residential, industrial and infrastructure. None of the identified resources were located within the current proposed project site and the 2006 study included the southern portion of the current proposed project site.

5.1.4 FR-02754

Mark Kile (2013) prepared study FR-02754, *Cultural Resources Assessment for the Proposed Construction of Well No.18 Project*, *Fresno County, California*. The report summarized the methods and results of a literature and background review, Native American Consultation, and a field survey.

The study did not identify any archaeological resources within the study area or the current proposed project site. The 2013 study included the southern portion of the current proposed project site.

5.1.5 2016 Study of the Proposed Project Site

C. Kristina Roper (2016) prepared the *Cultural Resource Assessment Kerman High School Athletic Facilities Addition and New Elementary School Project, State Routes 180 and 145 City of Kerman*, *Fresno County, California* study. The study included the eastern most portion of the current proposed project site as identified in Figure 2 above. Roper (2016) described the study area as primarily used for agriculture, with evidence of construction, and an obscured ground surface due to various crops. The study does not identify the dates in which the study area was utilized for agricultural purposes. The pedestrian survey identified drip irrigation systems, other agricultural debris, and chunks of asphalt. No cultural resources were identified as a result of this study and Roper (2016) stated that it was unlikely that the 2016 project would affect cultural resources.

5.2 Known Cultural Resources

The CHRIS records search and background research identified one cultural resource within a 0.5-mile radius of the proposed project site, listed in Table 1. No cultural resources are recorded within or adjacent to the proposed project site.

Table 1 Known Cultural Resources

Primary Number	Trinomial	Resource Type	Description	Recorder(s) and Year(s)	Eligibility Status	Relationship to Project Site
P-10-007097	–	Historic-Period Site	Houghton Canal	2013 (Anderson)	Recommended Ineligible	Outside

Source: SSJVIC 2024

5.3 Historical Topographic Maps and Aerial Imagery Review

Rincon completed a review of historical topographic maps and aerial imagery to ascertain the development history of the project site. From 1946 to 1962, the proposed project site is identified as vacant land, surrounded by agricultural fields and the Southern Pacific Railroad is identified approximately 1.1 miles west and approximately 0.9 mile south of the proposed project site on topographic maps (NETR Online 2024; USGS 2024). Aerial imagery from 1946 confirms the agricultural history of the vicinity and present-day Whitesbridge Avenue is depicted along the southern boundary of the proposed project site. Between 1962 and 1981, topographic maps and aerial imagery identified commercial development to the east and residential development to the south of the proposed project site (NETR Online 2024; USGS 2024). Kerman High School is identified south of the proposed project site by 1981, with further residential development in the surrounding areas. During this period, the proposed project site remained vacant. A residential property is identified in the northwest corner of the proposed project site, as well as an orchard throughout the westernmost portion of the proposed project site by 1981 (NETR Online 2024). According to records, the residence was built in 1987 and therefore does not meet the age threshold for evaluation for listing in the CRHR (ParcelQuest 2024). Historical topographic and aerial maps identified the residential property and orchard through 2021 (NETR Online 2024; USGS 2024).

5.4 Geoarchaeological Review

The proposed project site is underlain by the Modesto Formation geologic unit, which consists of light brown to reddish-brown gravel, sand, and silt, deposited along alluvial fans that emanate from the Sierra Nevada region (Wahrhaftig et al. 1993). The Modesto Formation dates to the late-Pleistocene, which largely pre-dates human occupation and is therefore less likely to contain buried archaeological deposits. Archaeological resources present within Pleistocene sediments would most likely be located on or near the ground surface. Based on the lack of previously recorded archaeological resources within the vicinity, the surface is considered to not be sensitive for archaeological resources.

Soils recorded in the proposed project site are formed in alluvium derived primarily from granite and other related rocks (California Soil Resource Lab 1999; 1997; 2017). Alluvial sediments are episodic in nature and have a higher probability for the sudden burial of artifacts, and therefore, there is an increased likelihood for containing buried archaeological deposits (Waters 1983). Sudden burial of artifacts is most identified when there are buried A horizons in a soil series. Only one series identified within the proposed project site, the Tujunga Series, is recorded as containing human-transported cultural materials within C horizons at a potential of 0 to 10 percent (California Soil Resource Lab 2017). No other soils within the proposed project site (Hanford or Hesperia) are identified as containing previously recorded buried A horizons or as containing buried cultural materials, according to the California Soil Resources Lab (California Soil Resource Lab 2024).

Although the proposed project site consists of alluvial soils and human transported materials have been identified within the C horizon of the Tujunga Series, the sediments date to the late-Pleistocene which predates human occupation. Further, the lack of previously identified archaeological deposits within and surrounding the proposed project site, along with the level of previous ground disturbance suggests that the geoarchaeological sensitivity of the project site is low.

5.5 Sacred Land File Search

On February 5, 2024, the NAHC responded to Rincon’s SLF request, stating that the results of the SLF search were negative. See Appendix B for the NAHC response, including Tribal contacts list(s).

5.6 Survey Results

No archaeological resources were identified during the field survey. Ground visibility throughout the proposed project site was poor with approximately zero to fifteen percent visibility. The surface was obscured due to various grasses, walnut shell litter, and downed trees (Photograph 1). Boot scrapes were conducted periodically throughout the proposed project site to increase ground visibility. Soil within the project site consisted of brown to dark brown loamy clay. The residential property along the northwestern portion of the proposed project was extant and the area was graveled with various farm equipment and a barn (Photograph 2 and Photograph 3). Irrigation systems were identified throughout the proposed project site along the rows of trees (Photograph 4). The walnut orchard identified in the map and imagery review above is no longer active and walnut trees within the proposed project site show signs of decay and walnut husks were observed decaying on the ground and on branches (Photograph 5). This survey did not include the entirety of the 2016 study area of the eastern portion of the proposed project site; however, the areas of new facilities (Figure 2) were reviewed in the field. Previous ground disturbance, construction, and various grasses were observed within the new facilities areas of the 2016 IS-MND project site (Photograph 6).

Photograph 1 Ground Visibility throughout Proposed Project Site, Facing South

Photograph 2 Extant Residence within the Proposed Project Site, Facing Northeast

Photograph 3 Extant Residence within the Proposed Project Site, Facing Northeast

Photograph 4 Irrigation Systems Remnants within the Proposed Project Site, Facing South

Photograph 5 Decaying Walnut trees Observed within the Proposed Project Site, Facing West

Photograph 6 Disturbance Observed within the New Facilities Portion of the Proposed Project Site, Facing South

6 Impacts Analysis and Conclusions

The impact analysis included here is organized based on the cultural resources thresholds included in CEQA Guidelines Appendix G: Environmental Checklist Form:

a) Would the project cause a substantial adverse change in the significance of a historical resource pursuant to § 15064.5?
b) Would the project cause a substantial adverse change in the significance of an archaeological resource pursuant to § 15064.5?
c) Would the project disturb any human remains, including those interred outside of dedicated cemeteries?

Threshold A broadly refers to historical resources. To more clearly differentiate between archaeological and built environment resources, we have chosen to limit analysis under Threshold A to built environment resources. Archaeological resources, including those that may be considered historical resources pursuant to Section 15064.5 and those that may be considered unique archaeological resources pursuant to Section 21083.2, are considered under Threshold B.

6.1 Historical Built Environment Resources

The pedestrian survey and background research did not identify any built environment resources that may be considered historical resources within the proposed project site. The proposed project therefore does not have the potential to impact built environment historical resources and Rincon recommends a finding of ***no impact to historical resources*** pursuant to CEQA, consistent with the findings presented by Roper (2016).

6.2 Historical and Unique Archaeological Resources

This study did not identify any archaeological resources or archaeological deposits in the proposed project site. Historical topographic maps and aerial imagery depicts the agricultural history of the proposed project site and surrounding areas from at least 1946 (NETR Online 2024), to the present-day walnut orchard, suggesting that the project site has been heavily disturbed. Although the project site consists of alluvial soils, the sediments date to the late-Pleistocene which predate human occupation, and the lack of previously identified archaeological deposits and the level of previous ground disturbance within the project site suggests that the geoarchaeological sensitivity of the project site is low. Additionally, the 2016 IS-MND study area was noted as heavily disturbed due to construction by Roper (2016) and no cultural resources were identified. The lack of surface evidence of archaeological materials does not preclude their subsurface existence. However, the absence of substantial prehistoric or historic-period archaeological remains within the immediate vicinity, along with the existing level of disturbance in the proposed project site, suggest there is a low potential for encountering intact subsurface archaeological deposits. Rincon presents the following recommended mitigation measure for unanticipated discoveries during construction. With adherence to this measure, Rincon recommends a finding of **less-than-significant impact with mitigation for archaeological resources** under CEQA consistent with the 2016 findings.

6.2.1 Recommended Mitigation

Unanticipated Discovery of Cultural Resources

In the event that archaeological resources are unexpectedly encountered during ground-disturbing activities, work within 50 feet of the find shall halt and an archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards for archaeology (National Park Service 1983) shall be contacted immediately to evaluate the resource. If the resource is determined by the qualified archaeologist to be prehistoric, then a Native American representative shall also be contacted to participate in the evaluation of the resource. If the qualified archaeologist and/or Native American representative determines it to be appropriate, archaeological testing for CRHR eligibility shall be completed. If the resource proves to be eligible for the CRHR and significant impacts to the resource cannot be avoided via project redesign, a qualified archaeologist shall prepare a data recovery plan tailored to the physical nature and characteristics of the resource, per the requirements of the California Code of Regulations (CCR) Guidelines Section 15126.4(b)(3)(C). The data recovery plan shall identify data recovery excavation methods, measurable objectives, and data thresholds to reduce any significant impacts to cultural resources related to the resource. Pursuant to the data recovery plan, the qualified archaeologist and Native American representative, as appropriate, shall recover and document the scientifically consequential information that justifies the resource's significance. The District shall review and approve the treatment plan and archaeological testing as appropriate, and the resulting documentation shall be submitted to the Southern San Joaquin Valley Information Center, the regional repository of the California Historical Resources Information System, per CCR Guidelines Section 15126.4(b)(3)(C).

6.3 Human Remains

No human remains are known to be present within the project site. However, the discovery of human remains is always a possibility during ground disturbing activities. If human remains are found, the State of California Health and Safety Code Section 7050.5 states that no further disturbance shall occur until the County Coroner has made a determination of origin and disposition pursuant to Public Resources Code Section 5097.98. In the event of an unanticipated discovery of human remains, the County Coroner must be notified immediately. If the human remains are determined to be of Native American origin, the Coroner will notify the NAHC, which will determine and notify an MLD. The MLD has 48 hours from being granted site access to make recommendations for the disposition of the remains. If the MLD does not make recommendations within 48 hours, the landowner shall reinter the remains in an area of the property secure from subsequent disturbance. With adherence to existing regulations, Rincon recommends a finding of **less-than-significant impact to human remains** under CEQA, consistent with the 2016 findings.

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Appendix A

CHRIS Results

California Historical Resources Information System

CHRIS Data Request Form

ACCESS AND USE AGREEMENT NO.: 56 **IC FILE NO.:** ____________

To: Southern San Joaquin Valley Information Center

Print Name: Catherine Johnson Date: 1/24/2024

Affiliation: Rincon Consultants, Inc.

Address: 180 N. Ashwood Avenue

City: Ventura State: CA Zip: 93003

Phone: 805-644-4455 Fax: 805-644-4455 Email: cjohnson@rinconconsultants.com

Billing Address (if different than above): ____________

Billing Email: ap@rinconconsultants.com Billing Phone: 805-644-4455

Project Name / Reference: 23-15468 Kerman High School Athletic Factilities Addition and Elemen

Project Street Address: North Del Norte Avenue/Whitesbridge Avenue, Kerman, California

County or Counties: Fresno

Township/Range/UTMs: Kerman

USGS 7.5' Quad(s): Township 14 South; Range 17 East; Section 01

PRIORITY RESPONSE (Additional Fee): yes ☐ / no ☒

TOTAL FEE NOT TO EXCEED: $ 1,000
(If blank, the Information Center will contact you if the fee is expected to exceed $1,000.00)

Special Instructions:

Information Center Use Only

Date of CHRIS Data Provided for this Request: ____________

Confidential Data Included in Response: yes ☐ / no ☐

Notes: ____________

California Historical Resources Information System

CHRIS Data Request Form

Mark the request form as needed. Attach a PDF of your project area (with the radius if applicable) mapped on a 7.5' USGS topographic quadrangle to scale 1:24000 ratio 1:1 neither enlarged nor reduced and include a shapefile of your project area, if available. Shapefiles are the current CHRIS standard for submitting digital spatial data for your project area or radius. **Check with the appropriate IC for current availability of digital data products.**

- Documents will be provided in PDF format. Paper copies will only be provided if PDFs are not available at the time of the request or under specially arranged circumstances.
- Location information will be provided as a digital map product (Custom Maps or GIS data) unless the area has not yet been digitized. In such circumstances, the IC may provide hand drawn maps.
- In addition to the $150/hr. staff time fee, client will be charged the Custom Map fee when GIS is required to complete the request [e.g., a map printout or map image/PDF is requested and no GIS Data is requested, or an electronic product is requested (derived from GIS data) but no mapping is requested].

For product fees, see the CHRIS IC Fee Structure on the OHP website.

1. Map Format Choice:

Select One: Custom GIS Maps ☐ GIS Data ☒ Custom GIS Maps **and** GIS Data ☐ No Maps ☐

Any selection below left unmarked will be considered a "no. "

Location Information:

	Within project area	Within 0.5 mi. radius
ARCHAEOLOGICAL Resource Locations[1]	yes ☒ / no ☐	yes ☒ / no ☐
NON-ARCHAEOLOGICAL Resource Locations	yes ☒ / no ☐	yes ☒ / no ☐
Report Locations[1]	yes ☒ / no ☐	yes ☒ / no ☐
"Other" Report Locations[2]	yes ☐ / no ☒	yes ☐ / no ☒

3. Database Information:
(contact the IC for product examples, or visit the SSJVIC website for examples)

	Within project area	Within 0.5 mi. radius
ARCHAEOLOGICAL Resource Database[1]		
List (PDF format)	yes ☒ / no ☐	yes ☒ / no ☐
Detail (PDF format)	yes ☐ / no ☒	yes ☐ / no ☒
Excel Spreadsheet	yes ☐ / no ☒	yes ☐ / no ☒
NON-ARCHAEOLOGICAL Resource Database		
List (PDF format)	yes ☒ / no ☐	yes ☒ / no ☐
Detail (PDF format)	yes ☐ / no ☒	yes ☐ / no ☒
Excel Spreadsheet	yes ☐ / no ☒	yes ☐ / no ☒
Report Database[1]		
List (PDF format)	yes ☒ / no ☐	yes ☒ / no ☐
Detail (PDF format)	yes ☐ / no ☒	yes ☐ / no ☒
Excel Spreadsheet	yes ☐ / no ☒	yes ☐ / no ☒
Include "Other" Reports [2]	yes ☐ / no ☒	yes ☐ / no ☒

4. Document PDFs (paper copy only upon request)**:**

	Within project area	Within 0.5 mi. radius
ARCHAEOLOGICAL Resource Records[1]	yes ☒ / no ☐	yes ☒ / no ☐
NON-ARCHAEOLOGICAL Resource Records	yes ☒ / no ☐	yes ☒ / no ☐
Reports[1]	yes ☒ / no ☐	yes ☐ / no ☒
"Other" Reports[2]	yes ☐ / no ☒	yes ☐ / no ☒

CHRIS Data Request Form

5. Eligibility Listings and Documentation:

	Within project area	Within 0.5 mi. radius
OHP Built Environment Resources Directory[3]:		
Directory listing only (Excel format)	yes ☒ / no ☐	yes ☐ / no ☒
Associated documentation[4]	yes ☐ / no ☒	yes ☐ / no ☒
OHP Archaeological Resources Directory[1,5]:		
Directory listing only (Excel format)	yes ☒ / no ☐	yes ☐ / no ☒
Associated documentation[4]	yes ☐ / no ☒	yes ☐ / no ☒
***California Inventory of Historic Resources* (1976):**		
Directory listing only (PDF format)	yes ☒ / no ☐	yes ☐ / no ☒
Associated documentation[4]	yes ☐ / no ☒	yes ☐ / no ☒

6. Additional Information:

The following sources of information may be available through the Information Center. However, several of these sources are now available on the OHP website and can be accessed directly. The Office of Historic Preservation makes no guarantees about the availability, completeness, or accuracy of the information provided through these sources. Indicate below if the Information Center should review and provide documentation (if available) of any of the following sources as part of this request.

Caltrans Bridge Survey	yes ☐ / no ☒
Ethnographic Information	yes ☐ / no ☒
Historical Literature	yes ☐ / no ☒
Historical Maps	yes ☐ / no ☒
Local Inventories	yes ☐ / no ☒
GLO and/or Rancho Plat Maps	yes ☐ / no ☒
Shipwreck Inventory	yes ☐ / no ☒
Soil Survey Maps	yes ☐ / no ☒

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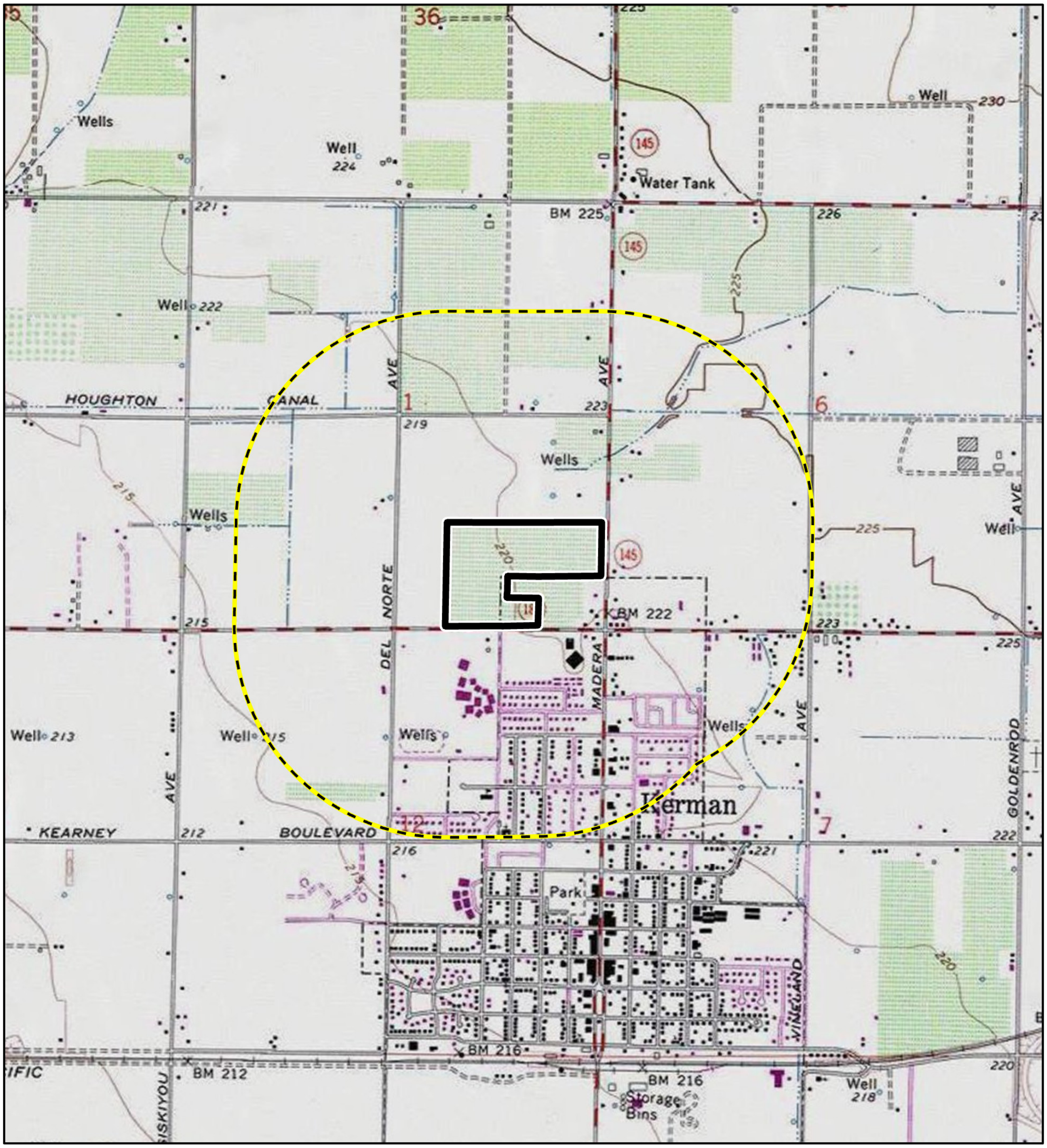
[1] In order to receive archaeological information, requestor must meet qualifications as specified in Section III of the current version of the California Historical Resources Information System Information Center Rules of Operation Manual and be identified as an Authorized User or Conditional User under an active CHRIS Access and Use Agreement.

[2] "Other" Reports GIS layer consists of report study areas for which the report content is almost entirely non-fieldwork related (e.g., local/regional history, or overview) and/or for which the presentation of the study area boundary may or may not add value to a record search.

[3] Provided as Excel spreadsheets with no cost for the rows; the only cost for this component is IC staff time. Includes, but not limited to, information regarding National Register of Historic Places, California Register of Historical Resources, California State Historical Landmarks, California State Points of Historical Interest, and historic building surveys. Previously known as the HRI and then as the HPD, it is now known as the Built Environment Resources Directory (BERD). The Office of Historic Preservation compiles this documentation and it is the source of the official status codes for evaluated resources.

[4] Associated documentation will vary by resource. Contact the IC for further details.

[5] Provided as Excel spreadsheets with no cost for the rows; the only cost for this component is IC staff time. Previously known as the Archaeological Determinations of Eligibility, now it is known as the Archaeological Resources Directory (ARD). The Office of Historic Preservation compiles this documentation and it is the source of the official status codes for evaluated resources.



Imagery provided by National Geographic Society, Esri and its licensors © 2024. Kerman Quadrangle. T14S R17E S01,12; T14S R18E S06,07. The topographic representation depicted in this map may not portray all of the features currently found in the vicinity today and/or features depicted in this map may have changed since the original topographic map was assembled.

Half-Mile Buffer

Area of Potential Effects

N

0 1,000 2,000 Feet

0 250 500 Meters

1:24,000

Records Search Map

California
Historical
Resources
Information
System

Fresno
Kern
Kings
Madera
Tulare

Southern San Joaquin Valley Information Center
California State University, Bakersfield
Mail Stop: 72 DOB
9001 Stockdale Highway
Bakersfield, California 93311-1022
(661) 654-2289
E-mail: ssjvic@csub.edu
Website: www.csub.edu/ssjvic

2/5/2024

Catherine Johnson
Rincon Consultants, Inc.
180 N. Ashwood Avenue
Ventura, CA 93003

Re: 23-15468 Kerman High School Athletic Facilities Addition and Elementary School
Records Search File No.: 24-041

The Southern San Joaquin Valley Information Center received your record search request for the project area referenced above, located on the Kerman USGS 7.5’ quad. The following reflects the results of the records search for the project area and the 0.5 mile radius:

As indicated on the data request form, the locations of resources and reports are provided in the following format: ☐ custom GIS maps ☒ GIS data

Resources within project area:	None
Resources within 0.5 mile radius	P-10-007097
Reports within project area:	FR-02501, 02505, 02506, 02754
Reports within 0.5 mile radius:	FR-00245, 00246, 00247, 02414, 02582, 03140

Resource Database Printout (list): ☒ enclosed ☐ not requested ☐ nothing listed

Resource Database Printout (details): ☐ enclosed ☒ not requested ☐ nothing listed

Resource Digital Database Records: ☐ enclosed ☒ not requested ☐ nothing listed

Report Database Printout (list): ☒ enclosed ☐ not requested ☐ nothing listed

Report Database Printout (details): ☐ enclosed ☒ not requested ☐ nothing listed

Report Digital Database Records: ☐ enclosed ☒ not requested ☐ nothing listed

Resource Record Copies: ☒ enclosed ☐ not requested ☐ nothing listed

Report Copies: ☒ enclosed ☐ not requested ☐ nothing listed

OHP Built Environment Resources Directory: ☐ enclosed ☐ not requested ☒ nothing listed

Archaeological Determinations of Eligibility: ☐ enclosed ☐ not requested ☒ nothing listed

CA Inventory of Historic Resources (1976): ☐ enclosed ☐ not requested ☒ nothing listed

Caltrans Bridge Survey: Not available at SSJVIC; please see https://dot.ca.gov/programs/environmental-analysis/cultural-studies/california-historical-bridges-tunnels

Ethnographic Information: Not available at SSJVIC

Historical Literature: Not available at SSJVIC

Historical Maps: Not available at SSJVIC; please see http://historicalmaps.arcgis.com/usgs/

Local Inventories: Not available at SSJVIC

GLO and/or Rancho Plat Maps: Not available at SSJVIC; please see http://www.glorecords.blm.gov/search/default.aspx#searchTabIndex=0&searchByTypeIndex=1 and/or http://www.oac.cdlib.org/view?docId=hb8489p15p;developer=local;style=oac4;doc.view=items

Shipwreck Inventory: Not available at SSJVIC; please see https://www.slc.ca.gov/shipwrecks/

Soil Survey Maps: Not available at SSJVIC; please see http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Please forward a copy of any resulting reports from this project to the office as soon as possible. Due to the sensitive nature of archaeological site location data, we ask that you do not include resource location maps and resource location descriptions in your report if the report is for public distribution. If you have any questions regarding the results presented herein, please contact the office at the phone number listed above.

The provision of CHRIS Data via this records search response does not in any way constitute public disclosure of records otherwise exempt from disclosure under the California Public Records Act or any other law, including, but not limited to, records related to archeological site information maintained by or on behalf of, or in the possession of, the State of California, Department of Parks and Recreation, State Historic Preservation Officer, Office of Historic Preservation, or the State Historical Resources Commission.

Due to processing delays and other factors, not all of the historical resource reports and resource records that have been submitted to the Office of Historic Preservation are available via this records search. Additional information may be available through the federal, state, and local agencies that produced or paid for historical resource management work in the search area. Additionally, Native American tribes have historical resource information not in the CHRIS Inventory, and you should contact the California Native American Heritage Commission for information on local/regional tribal contacts.

Should you require any additional information for the above referenced project, reference the record search number listed above when making inquiries. Invoices for Information Center services will be sent under separate cover from the California State University, Bakersfield Accounting Office.

Thank you for using the California Historical Resources Information System (CHRIS).

Sincerely,

Celeste M. Thomson
Coordinator

Report List

SSJVIC Record Search 24-041

Report No.	Other IDs	Year	Author(s)	Title	Affiliation	Resources
FR-00245	Caltrans - 06-FRE-180 PM 27.3/31.4 CU 06254 EA 343230; Caltrans - 06-FRE-180 PM 31.4/34.6 CU 06254 EA 343240; Caltrans - 06-FRE-180 PM 34.6/42.4 CU 06254 EA 343250	1988	Brady, Jon L. and Beck, Allan C.	Negative Archaeological Survey Report for Route 180 Widening	California State University, Fresno	
FR-00246	Caltrans - 06-Fre-180 KP 43.9/50.5 PM 27.3/31.4 EA 06-343230; Caltrans - 06-Fre-180 KP 50.5/58.9 PM 31.4/36.6 EA 06-343240; Caltrans - 06-Fre-180 KP 58-9/68.4 PM 36.6/42.5 EA 06-343250	1996	Unknown	Historic Property Survey Report: Widening and AC Overlay of Route 180 Between Mendota and Kerman in Fresno County	California Department of Transportation	
FR-00247	Caltrans - 06-FRE-180 PM 24.6/42.4 06254-343220; Caltrans - 06-FRE-180 PM 24.6/42.4 06254-343230; Caltrans - 06-FRE-180 PM 24.6/42.4 06254-343240; Caltrans - 06-FRE-180 PM 24.6/42.4 06254-343250	1989	Parks, Bonnie W.	Historic Architectural Survey Report Historic Resource Evaluation Report for Widening and AC Overlay of Route 180 Between Mendota and Kerman in Fresno County	California Department of Transportation	
FR-02414	Submitter - Contract No. 06A1106; Submitter - Expenditure Authorization No. 06-0A7408	2010	Leach-Palm, Laura, Brandy, Paul, King, Jay, Mikkelson, Pat, Seil, Libby, Hartman, Lindsay, and Bradeen, Jill	Cultural Resources Inventory of Caltrans District 6 Rural Conventional Highways in Fresno, Western Kern, Kings, Madera, and Tulare Counties Summary of Methods and Findings	Far Western Anthrpological Research Group, Inc., Davis and JRP Historical Consulting, LLC, Davis	10-004703, 10-005795, 10-005796, 10-005797, 10-005809, 10-005810, 10-006207

Report List

SSJVIC Record Search 24-041

Report No.	Other IDs	Year	Author(s)	Title	Affiliation	Resources
FR-02501		2008	Binning, Jeanne	Historic Property Survey Report for Route 180 Planned Westside Expressway from I-5 to Valentine Ave, Fresno, Fresno County, California	California Department of Transportation	
FR-02505		2006	Leach-Palm, Laura, Rosenthal, Jeffrey, Byrd, Brian, Mikkelson, Pat, and Waechter, Sharon	Preliminary Assessment of the Archaeological Sensitivity for the Route 180 Westside Expressway Route Adoption Study Between Interstate 5 and the City of Fresno, Fresno County, California Interstate 5 PM 9.0 (KP 14.5) to 06-FRE-180 PM 54.2 (KP 87 Valentine Avenue) EA06-451400	Far Western Anthropological Research Group, Inc.	
FR-02506		2006	Brady, Jon and Bunse, Rebecca	Final Historic Resources Sensitivity Study Route 180 Westside Expressway Route Adoption Study	California Department of Transportation	
FR-02582	Submitter - Project Name: Kerman High School; Submitter - Project Number: CN2712	2013	Billat, Lorna	New Tower Submission Packet, FCC Form 620, for Kerman High School, CN2712	EarthTouch, Inc.	
FR-02754		2013	Kile, Mark	Cultural Resources Assessment for the Proposed Construction of Well No. 18, Kerman, Fresno County, California	URS Corp	
FR-03140	Submitter - PN 36790.09	2022	Whitley, David S. and Carey, Peter A.	Class III Inventory/Phase I Survey, Kerman Sewer Improvement Project, Kerman, Fresno County, California	ASM Affiliates, Inc.	

Resource List

SSJVIC Record Search 24-041

Primary No.	Trinomial	Other IDs	Type	Age	Attribute codes	Recorded by	Reports
P-10-007097		Resource Name - Houghton Canal	Structure	Historic	HP20	2013 (Katherine Anderson, ESA)	

Appendix B

NAHC Sacred Lands File Search Results

Local Government Tribal Consultation List Request

Native American Heritage Commission

1550 Harbor Blvd, Suite 100
West Sacramento, CA 95691
916-373-3710
916-373-5471 – Fax
nahc@nahc.ca.gov

Type of List Requested

☑ **CEQA Tribal Consultation List (AB 52)** – ***Per Public Resources Code § 21080.3.1, subs. (b), (d), (e) and 21080.3.2***

☐ **General Plan (SB 18)** - ***Per Government Code § 65352.3.***

Local Action Type:

☐ **General Plan** ☐ **General Plan Element** ☐ **General Plan Amendment**

☐ **Specific Plan** ☐ **Specific Plan Amendment** ☐ **Pre-planning Outreach Activity**

Required Information

Project Title: 23-15468 Kerman High School Athletic Facilities Addition and Elementary School

Local Government/Lead Agency: Kerman Unified School District

Contact Person: Catherine Johnson (on behalf of the Kerman Unified School District)

Street Address: 1530 Monterey Street, Suite D

City: San Luis Obispo, California **Zip:** 93401

Phone: (805) 947-4824 **Fax:**

Email: cjohnson@rinconconsultants.com

Specific Area Subject to Proposed Action

County: Fresno **City/Community:** Kerman

Project Description:

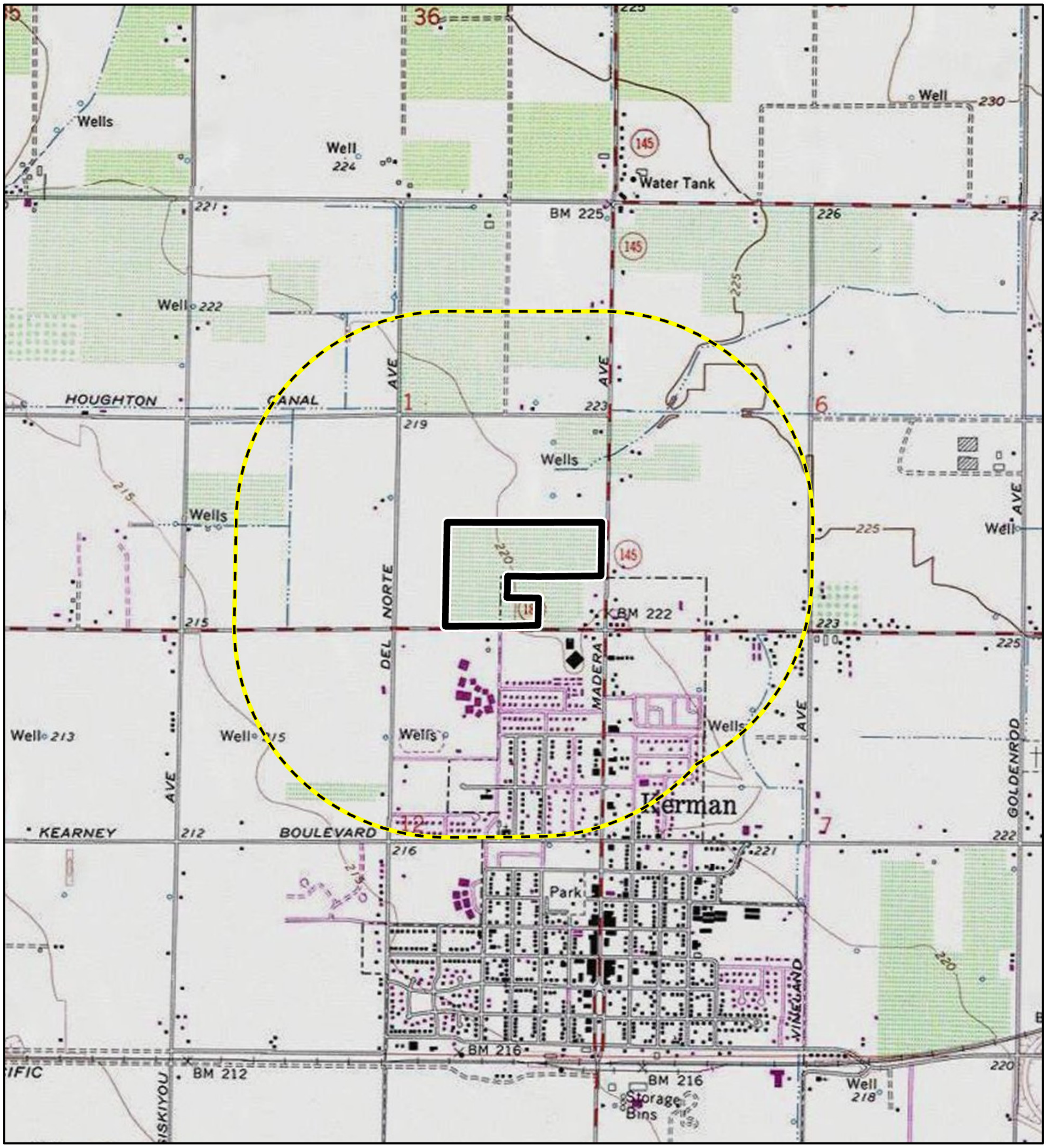
This project includes the addition of new facilities in the Facilities Master Plan for the project, including the expansion of the project site westward to North del Norte Avenue; a maintenance, operations, and transportation facility; and a food services building with a battery storage/utility yard building.

Additional Request

☑ **Sacred Lands File Search** - ***Required Information:***

USGS Quadrangle Name(s): Kerman

Township: 14 South **Range:** 17 East **Section(s):** 01



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Records Search Map

NATIVE AMERICAN HERITAGE COMMISSION

NAHC HEADQUARTERS
1550 Harbor Boulevard
Suite 100
West Sacramento,
California 95691
(916) 373-3710
nahc@nahc.ca.gov
NAHC.ca.gov

February 5, 2024

Catherine Johnson
RINCON Consultants

Via Email to: cjohnson@rinconconsultants.com

Re: Native American Tribal Consultation, Pursuant to the Assembly Bill 52 (AB 52), Amendments to the California Environmental Quality Act (CEQA) (Chapter 532, Statutes of 2014), Public Resources Code Sections 5097.94 (m), 21073, 21074, 21080.3.1, 21080.3.2, 21082.3, 21083.09, 21084.2 and 21084.3, 23-15468 Kerman High School Athletic Facilities Addition and Elementary School Project, Fresno County

Dear Ms. Johnson:

Pursuant to Public Resources Code section 21080.3.1 (c), attached is a consultation list of tribes that are traditionally and culturally affiliated with the geographic area of the above-listed project. Please note that the intent of the AB 52 amendments to CEQA is to avoid and/or mitigate impacts to tribal cultural resources, (Pub. Resources Code §21084.3 (a)) ("Public agencies shall, when feasible, avoid damaging effects to any tribal cultural resource.")

Public Resources Code sections 21080.3.1 and 21084.3(c) require CEQA lead agencies to consult with California Native American tribes that have requested notice from such agencies of proposed projects in the geographic area that are traditionally and culturally affiliated with the tribes on projects for which a Notice of Preparation or Notice of Negative Declaration or Mitigated Negative Declaration has been filed on or after July 1, 2015. Specifically, Public Resources Code section 21080.3.1 (d) provides:

Within 14 days of determining that an application for a project is complete or a decision by a public agency to undertake a project, the lead agency shall provide formal notification to the designated contact of, or a tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, which shall be accomplished by means of at least one written notification that includes a brief description of the proposed project and its location, the lead agency contact information, and a notification that the California Native American tribe has 30 days to request consultation pursuant to this section.

The AB 52 amendments to CEQA law does not preclude initiating consultation with the tribes that are culturally and traditionally affiliated within your jurisdiction prior to receiving requests for notification of projects in the tribe's areas of traditional and cultural affiliation. The Native American Heritage Commission (NAHC) recommends, but does not require, early consultation as a best practice to ensure that lead agencies receive sufficient information about cultural resources in a project area to avoid damaging effects to tribal cultural resources.

The NAHC also recommends, but does not require that agencies should also include with their notification letters, information regarding any cultural resources assessment that has been completed on the area of potential effect (APE), such as:

1. The results of any record search that may have been conducted at an Information Center of the California Historical Resources Information System (CHRIS), including, but not limited to:

- A listing of any and all known cultural resources that have already been recorded on or adjacent to the APE, such as known archaeological sites;
- Copies of any and all cultural resource records and study reports that may have been provided by the Information Center as part of the records search response;
- Whether the records search indicates a low, moderate, or high probability that unrecorded cultural resources are located in the APE; and
- If a survey is recommended by the Information Center to determine whether previously unrecorded cultural resources are present.

2. The results of any archaeological inventory survey that was conducted, including:

   - Any report that may contain site forms, site significance, and suggested mitigation measures.

     All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum, and not be made available for public disclosure in accordance with Government Code section 6254.10.

3. The result of any Sacred Lands File (SLF) check conducted through the Native American Heritage Commission was negative.

4. Any ethnographic studies conducted for any area including all or part of the APE; and

5. Any geotechnical reports regarding all or part of the APE.

Lead agencies should be aware that records maintained by the NAHC and CHRIS are not exhaustive and a negative response to these searches does not preclude the existence of a tribal cultural resource. A tribe may be the only source of information regarding the existence of a tribal cultural resource.

This information will aid tribes in determining whether to request formal consultation. In the event that they do, having the information beforehand will help to facilitate the consultation process.

If you receive notification of change of addresses and phone numbers from tribes, please notify the NAHC. With your assistance, we can assure that our consultation list remains current.

If you have any questions, please contact me at my email address: Cameron.vela@nahc.ca.gov.

Sincerely,

Cameron Vela

Cameron Vela
Cultural Resources Analyst

Attachment

Native American Heritage Commission
Native American Contact List
Fresno County
2/5/2024

County	Tribe Name	Fed (F) Non-Fed (N)	Contact Person	Contact Address	Phone #	Fax #	Email Address	Cultural Affiliation	Counties	Last Updated
Fresno	North Fork Rancheria of Mono Indians	F	Fred Beihn, Chairperson	P.O. Box 929 North Fork, CA, 93643	(559) 877-2461	(559) 877-2467	fbeihn@nfr-nsn.gov	Mono	Fresno,Inyo,Madera,Mariposa,Merced,Mono,Tuolumne	6/26/2023
	North Fork Rancheria of Mono Indians	F	Mary Stalter, Environmental/Heritage Manager	P.O. Box 929 North Fork, CA, 93643	(559) 877-2461		mstalter@nfr-nsn.gov	Mono	Fresno,Inyo,Madera,Mariposa,Merced,Mono,Tuolumne	6/26/2023
	Northern Valley Yokut / Ohlone Tribe	N	Timothy Perez, Tribal Compliance Officer	P.O. Box 717 Linden, CA, 95236	(209) 662-2788		huskanam@gmail.com	Costanoan Northern Valley Yokut	Alameda,Calaveras,Contra Costa,Fresno,Madera,Mariposa,Merced,Sacramento,San Benito,San Joaquin,Santa	11/21/2023
	Picayune Rancheria of the Chukchansi Indians	F	Tracey Hopkins, Chairperson	P.O. Box 2226 Oakhurst, CA, 93644	(559) 412-5590		council@chukchansi-nsn.gov	Foothill Yokut	Fresno,Madera,Mariposa,Merced,Tuolumne	12/12/2023
	Picayune Rancheria of the Chukchansi Indians	F	Heather Airey, Tribal Historic Preservation Officer	P.O. Box 2226 Oakhurst, CA, 93644	(559) 795-5986		hairey@chukchansi-nsn.gov	Foothill Yokut	Fresno,Madera,Mariposa,Merced,Tuolumne	6/20/2023
	Santa Rosa Rancheria Tachi Yokut Tribe	F	Samantha McCarty, Cultural Specialist II	P.O. Box 8 Lemoore, CA, 93245	(559) 633-3440		smccarty@tachi-yokut-nsn.gov	Southern Valley Yokut	Fresno,Kern,Kings,Merced,Monterey,San Benito,San Luis Obispo,Tulare	10/3/2023
	Santa Rosa Rancheria Tachi Yokut Tribe	F	Nichole Escalon, Cultural Specialist I	P.O. Box 8 Lemoore, CA, 93245	(559) 924-1278		nescalone@tachi-yokut-nsn.gov	Southern Valley Yokut	Fresno,Kern,Kings,Merced,Monterey,San Benito,San Luis Obispo,Tulare	10/3/2023
	Santa Rosa Rancheria Tachi Yokut Tribe	F	Shana Powers, THPO	P.O. Box 8 Lemoore, CA, 93245	(559) 423-3900		spowers@tachi-yokut-nsn.gov	Southern Valley Yokut	Fresno,Kern,Kings,Merced,Monterey,San Benito,San Luis Obispo,Tulare	10/3/2023
	Table Mountain Rancheria	F	Michelle Heredia-Cordova, Chairperson	P.O. Box 410 Friant, CA, 93626	(559) 822-2587	(559) 822-2693	mhcordova@tmr.org	Yokut	Fresno,Madera,Merced	12/21/2023
	Tule River Indian Tribe	F	Neil Peyron, Chairperson	P.O. Box 589 Porterville, CA, 93258	(559) 781-4271	(559) 781-4610	neil.peyron@tulerivertribe-nsn.gov	Yokut	Alameda,Amador,Calaveras,Contra Costa,Fresno,Inyo,Kern,Kings,Madera,Mariposa,Merced,Monterey,Sacramento,San	
	Wuksachi Indian Tribe/Eshom Valley Band	N	Kenneth Woodrow, Chairperson	1179 Rock Haven Ct. Salinas, CA, 93906	(831) 443-9702		kwood8934@aol.com	Foothill Yokut Mono	Alameda,Calaveras,Contra Costa,Fresno,Inyo,Kings,Madera,Marin,Mariposa,Merced,Mono,Monterey,San Benito,San	6/19/2023

This list is current only as of the date of this document. Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and section 5097.98 of the Public Resources Code.

This list is only applicable for consultation with Native American tribes under Public Resources Code Sections 21080.3.1 for the proposed 23-15468 Kerman High School Athletic Facilities Addition and Elementary School Project, Fresno County.

Record: PROJ-2024-000539
Report Type: AB52 GIS
Counties: Fresno
NAHC Group: All

Appendix D

Construction Energy Fuel Consumption Calculations

KUSD Athletic Facilities Expansion Project

Last Updated: 9/19/2024

Compression-Ignition Engine Brake-Specific Fuel Consumption (BSFC) Factors **[1]**:

HP: 0 to 100	0.0588	HP: Greater than 100	0.0529

Values above are expressed in gallons per horsepower-hour/BSFC.

CONSTRUCTION EQUIPMENT

Construction Equipment	#	Hours per Day	Horsepower	Load Factor	Construction Phase	Fuel Used (gallons)
Concrete/Industrial Saws	1	8	33	0.73	Demolition Phase	340
Rubber Tired Dozers	1	8	367	0.4	Demolition Phase	1,862
Dumpers/Tenders	1	8	16	0.38	Demolition Phase	86
Excavators	1	8	36	0.38	Demolition Phase	193
Tractors/Loaders/Backhoes	1	8	84	0.37	Demolition Phase	438
Skid Steer Loaders	1	8	71	0.37	Demolition Phase	370
Excavators	1	8	36	0.38	Site Preparation Phase	129
Graders	1	8	148	0.41	Site Preparation Phase	513
Tractors/Loaders/Backhoes	1	8	84	0.37	Site Preparation Phase	292
Skid Steer Loaders	1	8	71	0.37	Site Preparation Phase	247
Plate Compactors	1	8	8	0.43	Grading Phase	73
Graders	1	8	148	0.41	Grading Phase	1,155
Tractors/Loaders/Backhoes	1	8	84	0.37	Grading Phase	658
Rollers	1	8	36	0.38	Grading Phase	289
Skid Steer Loaders	1	8	71	0.37	Grading Phase	556
Aerial Lifts	1	8	46	0.31	Building Construction Phase	2,950
Tractors/Loaders/Backhoes	1	8	84	0.37	Building Construction Phase	6,429
Cement and Mortar Mixers	1	8	10	0.56	Building Construction Phase	1,158
Plate Compactors	1	8	8	0.43	Building Construction Phase	712
Air Compressors	1	8	37	0.48	Building Construction Phase	3,674
Cranes	1	8	367	0.29	Building Construction Phase	19,803
Dumpers/Tenders	1	8	16	0.38	Building Construction Phase	1,258
Excavators	1	8	36	0.38	Building Construction Phase	2,830
Generator Sets	1	8	14	0.74	Building Construction Phase	2,143
Rough Terrain Forklifts	1	8	96	0.4	Building Construction Phase	7,943
Skid Steer Loaders	1	8	71	0.37	Building Construction Phase	5,434
Plate Compactors	1	8	8	0.43	Paving Phase	57
Paving Equipment	1	8	89	0.36	Paving Phase	527
Rollers	1	8	36	0.38	Paving Phase	225
Skid Steer Loaders	1	8	71	0.37	Paving Phase	432
Surfacing Equipment	1	8	399	0.3	Architectural Coating Phase	1,772
					Total Fuel Used	**64,546**
						(Gallons)

Construction Phase	Days of Operation
Demolition Phase	30
Site Preparation Phase	20
Grading Phase	45
Building Construction Phase	440
Paving Phase	35
Architectural Coating Phase	35
Total Days	605

WORKER TRIPS				
Constuction Phase	MPG [2]	Trips	Trip Length (miles)	Fuel Used (gallons)
Demolition Phase	24.1	15	7.7	143.78
Site Preparation Phase	24.1	10	7.7	63.90
Grading Phase	24.1	13	7.7	179.72
Building Construction Phase	24.1	46	7.7	6452.66
Paving Phase	24.1	10	7.7	111.83
Architectural Coating Phase	24.1	9	7.7	102.77
			Total	**7,054.65**

HAULING AND VENDOR TRIPS				
Trip Class	MPG [2]	Trips	Trip Length (miles)	Fuel Used (gallons)
HAULING TRIPS				
Demolition Phase	7.5	3	20.0	6.67
Site Preparation Phase	7.5	50	20.0	133.33
Grading Phase	7.5	28	20.0	74.13
Building Construction Phase	7.5	0	20.0	0.00
Paving Phase	7.5	0	20.0	0.00
Architectural Coating Phase	7.5	0	20.0	0.00
			Total	**214.13**
VENDOR TRIPS				
Demolition Phase	7.5	0	4.0	0.00
Site Preparation Phase	7.5	0	4.0	0.00
Grading Phase	7.5	0	4.0	0.00
Building Construction Phase	7.5	18	4.0	4200.53
Paving Phase	7.5	0	4.0	0.00
Architectural Coating Phase	7.5	0	4.0	0.00
			Total	**4,200.53**

Total Gasoline Consumption (gallons)	**7,055**
Total Diesel Consumption (gallons)	**68,960**

Sources:

[1] United States Environmental Protection Agency. 2021. *Exhaust and Crankcase Emission Factors for Nonroad Compression-Ignition Engines in MOVES3.0.2* . September. Available at: https://www.epa.gov/system/files/documents/2021-08/420r21021.pdf.

[2] United States Department of Transportation, Bureau of Transportation Statistics. 2021. *National Transportation Statistics* . Available at: https://www.bts.gov/topics/national-transportation-statistics.

Appendix E

Construction Noise Modelling

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 07/18/2024
Case Description: Kerman HS Athletic Facilities Project

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Demolition	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Concrete Saw	No	20	90.0		50.0	0.0
Dozer	No	40	85.0		50.0	0.0
Dump Truck	No	40	84.0		50.0	0.0
Excavator	No	40	85.0		50.0	0.0
Front End Loader	No	40	80.0		50.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Concrete Saw	90.0	83.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dozer	85.0	81.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dump Truck	84.0	80.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Excavator	85.0	81.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	80.0	76.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Total	90.0	87.7	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 07/18/2024
Case Description: Kerman HS Athletic Facilities Project

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Site Preparation	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Excavator	No	40	85.0		50.0	0.0
Grader	No	40	85.0		50.0	0.0
Front End Loader	No	40	80.0		50.0	0.0
Front End Loader	No	40	80.0		50.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Excavator	85.0	81.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Grader	85.0	81.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	80.0	76.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	80.0	76.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	85.0	85.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 07/18/2024
Case Description: Kerman HS Athletic Facilities Project

**** Receptor #1 ****

		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
Grading	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Compactor (ground)	No	20	80.0		50.0	0.0
Grader	No	40	85.0		50.0	0.0
Front End Loader	No	40	80.0		50.0	0.0
Front End Loader	No	40	80.0		50.0	0.0
Roller	No	20	85.0		50.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA)						Noise Limit Exceedance (dBA)					
			Day		Evening		Night		Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Compactor (ground)	80.0	73.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Grader	85.0	81.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	80.0	76.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	80.0	76.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Roller	85.0	78.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Total	85.0	84.6	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 07/18/2024
Case Description: Kerman HS Athletic Facilities Project

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Building Construction	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Man Lift	No	20	85.0		50.0	0.0
Backhoe	No	40	80.0		50.0	0.0
Concrete Mixer Truck	No	40	85.0		50.0	0.0
Compactor (ground)	No	20	80.0		50.0	0.0
Crane	No	16	85.0		50.0	0.0
Excavator	No	40	85.0		50.0	0.0
Front End Loader	No	40	80.0		50.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Man Lift	85.0	78.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Backhoe	80.0	76.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Concrete Mixer Truck	85.0	81.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Compactor (ground)	80.0	73.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Crane	85.0	77.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Excavator	85.0	81.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	80.0	76.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	85.0	86.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 07/18/2024
Case Description: Kerman HS Athletic Facilities Project

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Paving	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Compactor (ground)	No	20	80.0		50.0	0.0
Paver	No	50	85.0		50.0	0.0
Roller	No	20	85.0		50.0	0.0
Front End Loader	No	40	80.0		50.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Compactor (ground)	80.0	73.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Paver	85.0	82.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Roller	85.0	78.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Front End Loader	80.0	76.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	85.0	84.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Roadway Construction Noise Model (RCNM),Version 1.1

Report date: 07/18/2024
Case Description: Kerman HS Athletic Facilities Project

**** Receptor #1 ****

Description	Land Use	Baselines (dBA) Daytime	Evening	Night
Architectural Coating	Residential	60.0	55.0	50.0

Equipment

Description	Impact Device	Usage (%)	Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Pavement Scarafier	No	20	85.0		50.0	0.0

Results

	Calculated (dBA)		Noise Limits (dBA) Day		Evening		Night		Noise Limit Exceedance (dBA) Day		Evening		Night	
Equipment	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq	Lmax	Leq
Pavement Scarafier	85.0	78.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	85.0	78.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Appendix F

Battery Specs

Ener C+ Noise test Report

Report summary

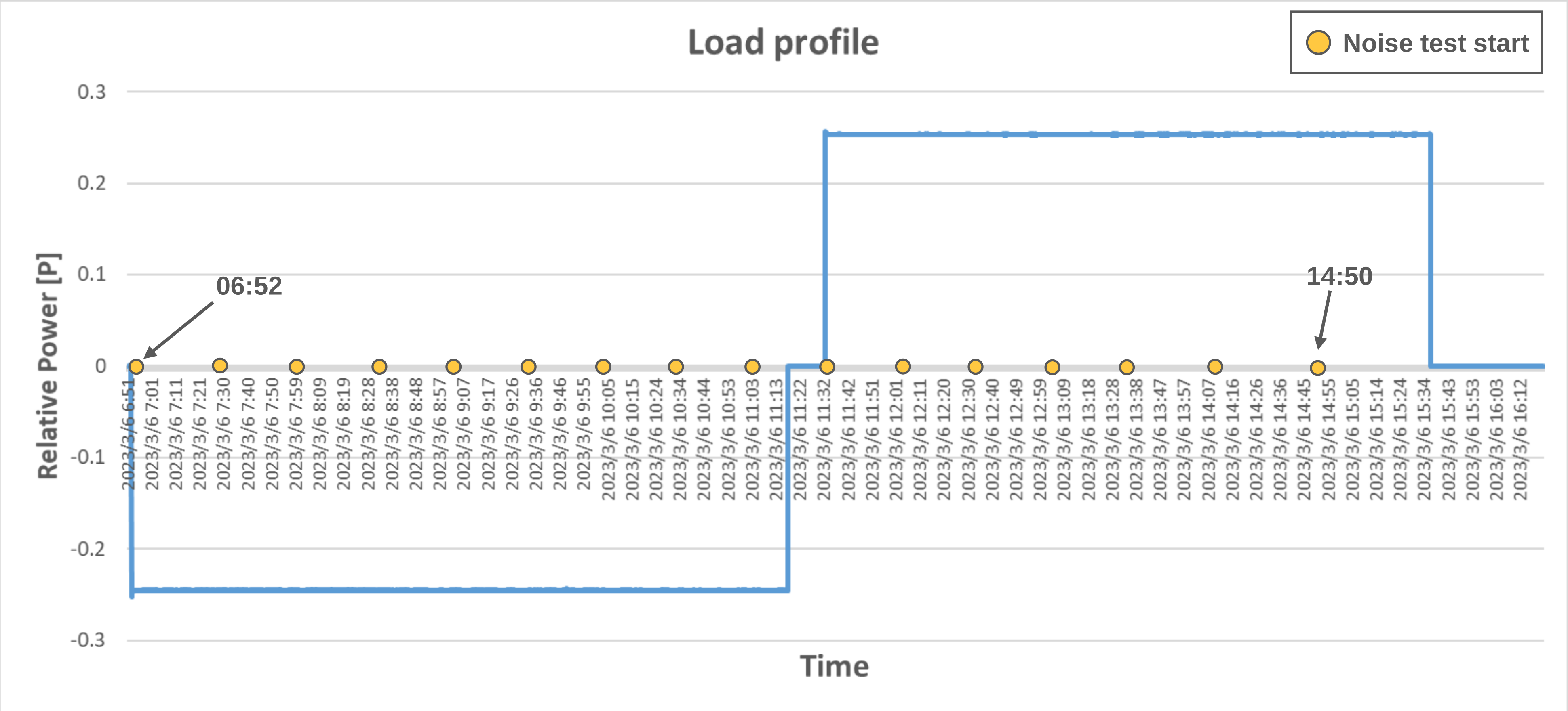
Result
Max: 82.1 dB(A) @1m Daily noise exposure level :76.2 dB(A)@1m

Information Introduction

1. The test site was Nantong CIMC Shunda Container Co., Ltd., and the address is No.155 Chenggang Road, Gangzha District, Nantong City, Jiangsu Province.
2. This test is a noise test for container level batteries provided from CATL during normal operation in 8 hours. (2023/03/06)
3. Stop the test when there was a car passing by.
4. The test process and noise evaluation mainly refer to ISO 3744-2010, IEC61672-1:2013 & ISO 9612： 2009 .

Operation Introduction

1. The container was charged and discharged at 0.25P, resting for 15 minutes between charging and discharging



Introduction - layout

1. The test site has a wide space, and there are no obvious walls and other reflecting surfaces within 8 meters.
2. The main source of noise is EnerC + (container-level battery) equipped during 0.25P operation.

Introduction – noise detection equipment

Hangzhou Aihua Instruments：AWA6228+

AWA6223+F

sound level meter	Specification
Standards	GB/T 3785.1-2010 /IEC61672-1:2013； GB/T 3241-2010 /IEC 61260-1:2014
Range of frequency	10Hz~20kHz
Frequency weighting	A,C,Z
Measuring range	20 dB(A)～142 dB(A)
Resolution	0.1dB
Type	Sound pressure level
sound calibrator	**Specification**
Standards	IEC 60942：2017 requirements of class 1 sound calibrator
Accuracy	class 1

The sound level meter is calibrated every year by sound calibrator

Contents

Test Process

Test Process

No	Step	Remark
1	Instrument calibration test	Measure the point twice, and the difference of the same point should be less than 1 dB(A)
2	Record the environmental noise at each point	
3	Record ambient temperature & wind speed	
4	0.5P discharge to 2.5V	Since the factory limited the power discharge at this time, the discharge was completed the day before
5	Rest for 15 minutes	
6	0.25P charge to cell voltage at 3.65V/system voltage at 1497.6V	
7	Noise measurement shall be made every 30min and recorded in the test point table	
8	0.25P discharge to 2.5V	
9	Open the high voltage connector & Test finish	
10	Record the operation state of the product from BMS data	

Standard： ISO 3744-2010

Test started when the battery started to operate

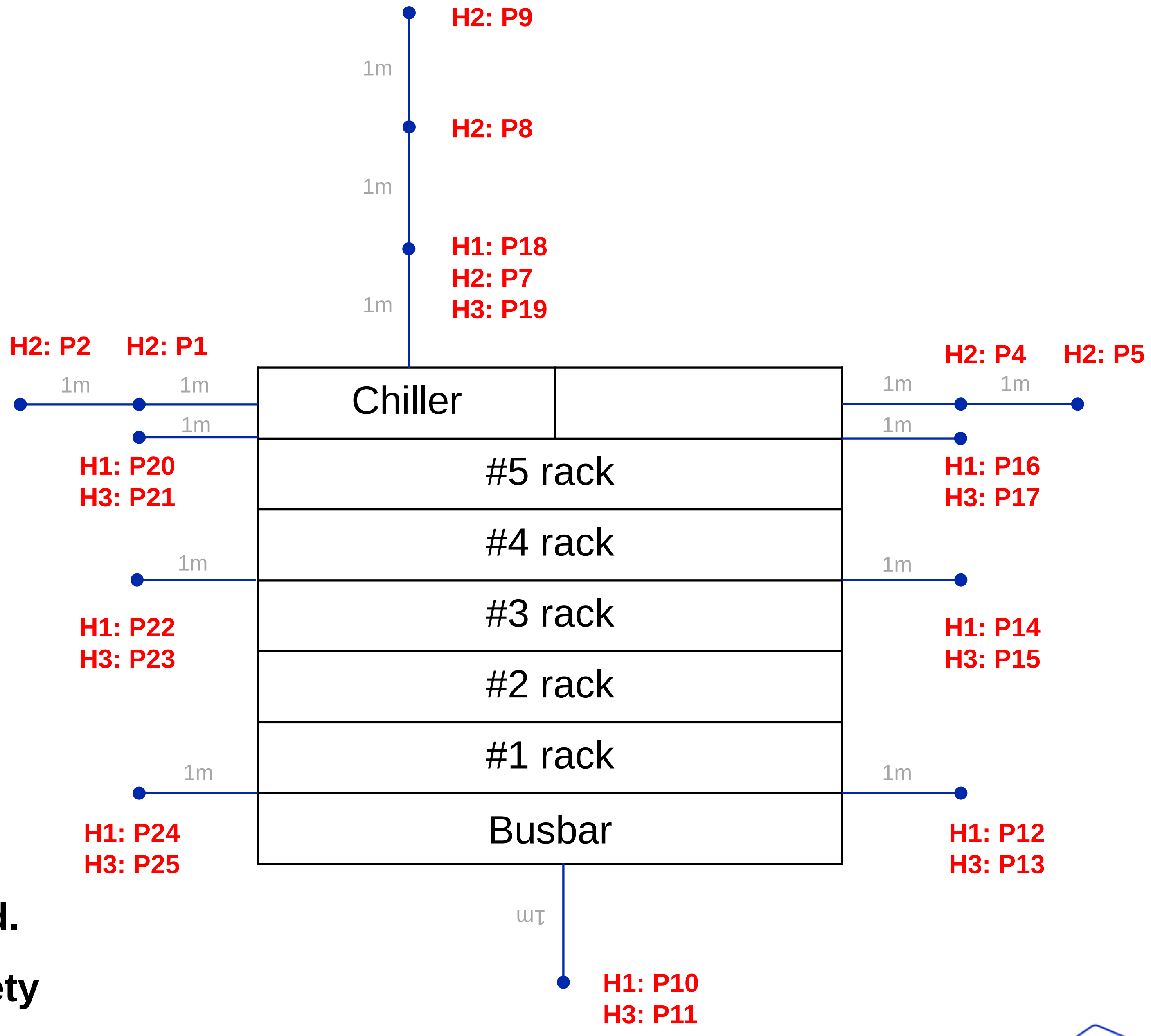
Test Point layout

1. Ambient temperature：
   maximum is 22℃
   minimum is 10℃
2. The max. wind speed is 0.44 m/s

Standard： ISO 3744-2010

Height of the noise meter set point：

H1:1000mm
H2:1448mm
H3:2000mm



There are more test points than the standard.

The top point was cancelled because of safety

Photos during the test

Contents

Test Result

Calculation formula - A-weighted equivalent noise $L_{p,Aeq,T}$ dB(A)

Standard： GB/T 3785.1-2010 /IEC61672-1:2013 （According equipment introduction）

- The instrument will calculate the result by it self according to IEC 61672-1:2013 & IEC 61260-1:2014
- According to the above standards, we set the test time to 10S each time, so as to obtain equivalent results

Note 1 to entry: Time-averaged or equivalent continuous sound level is expressed in decibels (dB).

Note 2 to entry: In symbols and as an example, time-averaged, A-weighted sound level $L_{\mathrm{Aeq},T}$ is given by

$$L_{\mathrm{Aeq},T} = 10 \lg \left[\frac{(1/T)\int_{t-T}^{t} p_{\mathrm{A}}^{2}(\xi)\mathrm{d}\xi}{p_0^2} \right] \mathrm{dB} \qquad (2)$$

where

- ξ is a dummy variable of time integration over the averaging time interval ending at the time of observation t;
- T is the averaging time interval;
- $p_{\mathrm{A}}(\xi)$ is the A-weighted sound-pressure signal; and
- p_0 is the reference value of 20 µPa.

Note 3 to entry: In principle, time weighting is not involved in a determination of time-averaged sound level.

The calculation method of $L_{p,Ceq,T}$ is the same as this, substituting pA(ξ) with pC(ξ)

Calculation formula – Daily noise exposure level $L_{AE,8h}$ dB(A)

Standard： GB/T 21230-2014 / ISO 9612： 2009

- Since the equipment has been running for 8 hours, and there is no difference between charging and discharging for noise changes and considering that each task (test for 25 points) took about 20 minutes, we defined 30 minutes as the duration of each task, and a total of 16 tasks were made up of one working day.
- Calculate the daily noise exposure contribution value (Formula 8) for a part, and calculate the daily exposure sound pressure level according to Formula 10 according to ISO 9612:2009

$$L_{\text{EX,8h},m} = L_{p,\text{A,eq}T,m} + 10 \lg\left(\frac{\overline{T}_m}{T_0}\right) \text{ dB} \quad (8)$$

where

$L_{p,\text{A,eq}T,m}$ is the A-weighted equivalent continuous sound pressure level for task m as given by Equation (7);

$\overline{T}_m$ is the arithmetic average duration of task m as given by Equation (5);

T_0 is the reference duration, $T_0 = 8$ h.

$$L_{\text{EX,8h}} = 10 \lg\left(\sum_{m=1}^{M} 10^{0,1 \times L_{\text{EX,8h},m}}\right) \text{ dB} \quad (10)$$

where

$L_{\text{EX,8h},m}$ is the A-weighted noise exposure level of task m contributing to the daily noise exposure level;

m is the task number;

M is the total number of tasks contributing to the daily noise exposure level.

Result 1: Environmental A-weighted pressure level matrix

1. The ambient noise results can only represent the noise level before the test begins

Environmental noise [dB(A)]	
1	48.7
2	49.4
3	48.8
5	49.4
7	50.1
8	49.5
9	49.5
10	48.4
11	48.5
12	49.1
13	48.7
14	48.7
15	49.5
16	49.3
17	48.8
18	49.7
19	49.5
20	48.4
21	48.2
22	49.1
23	48.5
24	48.6
25	48.5

Result 2: A-weighted pressure level matrix under normal operation

A-weighted noise result (dB(A))																
Point/time(h)	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5
1	57.1	60.8	60.4	67.6	67.1	67	69.5	69.9	69.2	72.7	71.4	73.9	61.1	63.9	63.5	63
2	57.2	60.5	59.9	65.5	66.7	65.4	67.8	68.4	68.3	70.7	69.6	71.8	60.4	63	62.1	62
4	54.9	55.8	56.6	62.5	61.9	61.7	62.2	63.7	64.2	66.2	65.3	68.9	59.4	62.5	61.5	58.4
5	54.2	57	59	62.7	60.4	60.8	61.6	63.3	62.5	65.3	66	67.4	59.2	60.4	58.1	59.8
7	58.4	58.3	62.5	74.2	74	74.3	76.8	77.4	77.5	81.8	80	82.1	60.1	60.4	61.2	60.8
8	58.7	59.1	64.7	70.9	70	70.4	73.6	74.6	74.6	78.5	77.5	78.9	60	59.1	59.5	60.9
9	58.3	58.3	68	68.6	67.8	68.6	71.2	72.8	72	76	74.7	76.2	60.5	60.2	60.3	60.6
10	60.7	61.3	62.8	63.6	60.5	62.2	62.9	64.6	62.5	63	62.7	63.2	65	63.8	63.4	62
11	60.8	62.6	65.1	62.9	63.6	63.4	63.5	61.8	62.7	63.1	64.9	62.9	62.7	64.7	62.8	61.6
12	57.8	60.1	61	60.7	59.3	60.9	60.6	60.1	59.5	61.8	63.6	63.2	60.6	60.6	61	61.7
13	57.7	60.7	61.1	63	58.6	62.4	60.4	60.1	60.6	63	65	63.4	61.4	58.9	61.5	61.1
14	56.3	59.1	62.3	61.5	58.1	60.6	59.9	60.7	60.5	63.9	62.8	64.3	62.1	58.8	62.6	61.1
15	57.3	58.4	62.6	62.3	58.3	61	60.2	61.1	60.3	62.6	63	63.2	59.2	57.5	61.1	58.7
16	58.6	58.1	60.9	60.5	59	61	61.6	61.1	61.4	64.1	64.9	64.3	60.3	59.8	60.8	58.1
17	57.2	59.8	61.9	62.8	59.6	62.3	62.3	61.4	61.5	64.5	65.4	64.5	60.5	59.9	62.6	57.7
18	57.8	59.3	73.5	65.3	72.4	74.5	77.2	76.3	77.1	79.8	78.9	80.4	61.8	62	61.5	60.2
19	56	58	73.8	64.7	72.3	74.8	77.3	77.2	77.3	80.1	79.7	80.8	60	60.8	59.6	60.6
20	59.2	60.1	66.9	64.3	65.9	67.2	68.8	68.4	68.2	69.8	70	70.2	61.1	62.7	62.7	63
21	60.2	61.3	65.9	63.7	65.9	66.5	68.8	67.7	67.8	69	68.2	69.7	61.2	63	62.6	63.2
22	60.1	61.3	63	63.9	62.8	64.9	64.9	65.5	65.2	65.7	66.5	67.3	60.3	63.9	63.3	63.7
23	61.7	61.5	63.3	63.8	62.3	65.7	65.6	65.8	65.5	65.9	65.7	66.6	62.2	63.1	63.7	64.1
24	61.6	60.7	63.8	63.4	62	65.1	64	64.3	63.2	64.8	63.1	65.6	62.2	62.6	61.8	62.8
25	63.6	63.8	64.7	62.6	62.8	65.8	64.6	64.5	65	65.1	63.7	65.3	63.4	64.5	62.4	63.2

The maximum A-weighted sound pressure level is 82.1 dB(A)

Result 3: Daily noise exposure level $L_{AE,8h}$ dB(A)

- According to "*Calculation formula – Daily noise exposure level* $L_{AE,8h}$ *dB(A)*", We calculated each point for the daily noise exposure level.

Daily noise exposure level	
Point	Value [dB(A)]
1	68.40
2	66.79
4	63.10
5	62.35
7	76.15
8	73.10
9	70.78
10	62.93
11	63.22
12	61.00
13	61.57
14	61.37
15	60.84
16	61.41
17	62.05
18	75.01
19	75.40
20	66.81
21	66.26
22	64.33
23	64.45
24	63.39
25	64.17

The maximum daily noise exposure level is 76.15 dBA @point 7.

Result 4: Noise level for 20Hz~20kHz (dB)

- The frequency range of 20Hz~20kHz was selected to draw the spectrogram of the response.
- The sound level data of each point showed in the table at the moment when the maximum noise (82.1 dB(A))was happened

Sound pressure level in 20Hz~20kHz (dB)																																
Point/Frequency(Hz)	**A-weighted sound pressure level (dBA)**	**20kHz**	**16kHz**	**12k5Hz**	**10kHz**	**8kHz**	**6k3Hz**	**5kHz**	**4kHz**	**3k15Hz**	**2k5Hz**	**2kHz**	**1k6Hz**	**1k25Hz**	**1kHz**	**800Hz**	**630Hz**	**500Hz**	**400Hz**	**315Hz**	**250Hz**	**200Hz**	**160Hz**	**125Hz**	**100Hz**	**80Hz**	**63Hz**	**50Hz**	**40Hz**	**31.5Hz**	**25Hz**	**20Hz**
1	73.9	26.2	32.4	45.2	44.4	48.7	54.7	53.2	52.9	55	57.6	59.7	60.7	64.1	63.3	65.5	69.3	66.9	66.2	69.8	66.9	66.2	64.2	62.5	65.1	61.8	69.9	63.4	66	67.9	64.3	62.6
2	71.8	23.4	27.7	37.3	39.8	44	51.4	52.2	51.5	53.2	55.4	57.4	59.2	61.2	62.8	63	66.2	67.3	65.6	64.7	65	63.3	61.1	62.3	65.1	61.2	63.8	64	73.9	67.3	65.7	64.2
4	68.9	14.2	19.2	25.2	29.2	34.5	39.9	44.1	48.9	51	51.8	53.9	56.3	59.2	59.6	63.6	63.6	58.8	59.1	62.1	62	61.6	58.3	58.6	60	58.1	64.2	63.1	65.2	63.2	63.2	62.9
5	67.4	11.8	16.8	23.8	26.2	32.1	38.3	40.5	45	48.5	50.8	53	55.2	56.9	59.1	62.1	61.3	57.5	58.4	61.7	60.6	58.4	57.4	57.4	59.3	56.2	65.3	65	64.8	65	67.7	68.8
7	**82.1**	39.8	43.9	49.4	51.6	55	58.9	60.3	63.6	66.2	67.5	69.1	70	74.5	70.3	75.6	77.5	71.9	69.9	71.3	68.5	71.1	69.8	67.8	70.6	64.5	72.3	70.9	67	68.4	69	71.6
8	78.9	36.1	40.4	46.1	48.3	52	56.2	57.2	60.2	63.3	64.4	65.7	67.3	70.3	67.7	73.3	73.5	68.2	67.7	70.3	66.5	67	65	65.9	69.3	60.5	65.1	70.5	65	64.9	64.8	67.1
9	76.2	32.7	37.1	43.5	45.2	49	53.3	54.6	57.6	60.8	61.3	62.9	64.8	66.7	66.6	71.2	70	64.9	66.5	67	66	63.6	63.8	64.6	63.8	59.9	63.6	67.8	64.3	67.3	63.9	67.4
10	63.2	14	17.3	20.6	23.9	28.9	39.9	38.7	45.7	45.8	47	48.7	50.9	52.7	53.4	54.9	57.5	56.1	55.9	58	59.2	58.5	58.2	57.1	60.3	62.7	66.1	68.4	68.5	65.4	68.9	66.2
11	62.9	11.9	15.4	19.4	23.1	28.3	38.9	39	46.8	46.2	46.8	47.9	50.7	52.5	53.5	55.6	56.5	56.4	56.3	57	57	55.8	58.6	55.2	57.9	59.4	59.2	61.9	68	64.6	70	69.1
12	63.2	10.3	13.4	19.5	22	27.5	36.1	37.2	43.5	45.2	47.2	48.2	51.6	53.9	54.6	55.8	56.4	55.9	54.8	56.9	58.8	58.8	57.3	55.9	56.8	59	62.2	69.2	67.9	65.1	65.3	65.2
13	63.4	10.3	13.1	21.6	26	29.6	36.2	38.8	44.5	47.1	48.7	50	52.7	53.7	54.2	54.8	55.6	56	56.6	57.3	57.2	57.3	58.7	60.8	58.6	59	65.8	66	70.6	68.1	65.4	71.5
14	64.3	13	17.5	25.2	26.5	29.4	37.1	37.9	42.7	45.8	47.3	49.6	52.7	54.6	55.1	56.2	57.5	56.4	56	59.1	59.8	63.1	61.9	58.9	60.3	62.1	63.1	69.6	73	72.8	71.4	72.4
15	63.2	11.9	16.5	22.1	26.7	28.9	35.5	37.2	42.2	44.8	46.1	48.8	51.7	53.6	53.7	54.7	56.3	57.6	57.1	57.8	57	57.1	57	57.4	59.2	57.8	59.9	68.1	68.5	66.4	65.2	68.6
16	64.3	14.3	17.6	23.8	24.7	29.4	37.3	38.1	42.3	46.2	47.5	49.2	52.4	54.5	55.2	56.4	59	58	55.4	57.2	58.7	57.9	59.1	56.7	58	61.2	63.7	66.7	66.4	66.5	64.6	63
17	64.5	12	17	22.8	24.4	29.9	35.8	38.2	42.6	45.5	47.8	49.9	52.3	54.5	55.5	56.9	58.1	59	58.7	58	57.7	57.1	56.1	55.9	58	59.1	60.3	65.1	64.4	64.5	64.5	64.1
18	80.4	37.1	41.8	48.8	49.6	52.9	57	58.5	60.4	64.1	66.8	66.3	67.1	70	72.6	70.9	75.6	75.9	71.2	68.8	67	70	67.2	65.9	69	68	60.8	66.1	67.5	65.8	67.6	66.4
19	80.8	39.3	43.5	50.6	50.8	54.8	58.8	59.8	62.3	65.8	66.5	67.1	69.9	71.2	71.6	73.6	74.7	73.4	73.2	72.5	67.2	66.6	69.2	65.7	68	66.4	63.3	67.5	65.1	66.1	64.7	63.9
20	70.2	26	29.1	42.7	40.6	46.1	54.1	54.5	48.8	51.5	53.9	55.1	57.6	60	62	61.7	64.6	63.5	62.2	63.9	63.9	62.2	61	57.9	61.6	61.7	62	63.8	68.5	70.7	67.1	68.2
21	69.7	20.5	24.9	38.1	36.3	42.7	50.1	47	49.2	51.2	53.7	55.3	57.1	58.6	61.1	63.2	63.1	62.6	63.8	64.1	62.3	60.8	60.8	57.5	58.2	60.9	59.2	61.9	66.8	69.7	66	62.9
22	67.3	18	22.9	33.8	32.1	38	48.3	44	47.1	49.1	51.2	53.5	55.6	57.4	57.8	59	60.2	59.4	60	64.9	62.1	59.2	59.7	56.5	58.6	59.6	61	63.3	70.1	71.4	66.2	62.8
23	66.6	16.4	20.6	32.2	30.9	36.3	48.8	43.5	48	49.1	51.1	52.5	54.9	56.3	56.9	58.5	59.8	60.4	60.5	61.4	61.1	59.4	59.5	57.6	56.1	57.9	58.5	61.6	68.2	71.3	65.3	64.2
24	65.6	12.4	17	27.1	27.4	33.5	45.7	43.6	47.1	48.2	50.3	51.7	54	56	56.3	57.1	59	58.7	58.6	59.4	59.5	59.9	58.9	56.7	55.3	60.1	61.3	65.2	69.6	70	64	64.6
25	65.3	13.5	17.9	26.9	26.8	33.6	44.8	42.8	47.8	48.1	49.5	51	53.4	55.3	56	56.9	58.1	58.6	59.9	60.4	59.3	58.4	58.8	57.4	56.1	61.5	60.2	64.2	67.2	69.8	66.1	64.8

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立足中华文化、包容全球文化
打造世界一流创新科技公司
为人类新能源事业做出卓越贡献！

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Appendix G

HVAC Unit Specs

Product Data

WeatherMaker®
Single Package Heat Pump Rooftop

15 to 25 Nominal Tons

50FCQ*17, 24, 28

Single-Packaged Heat Pump with Optional Electric Heat and Puron® Refrigerant (R-410A)

Form 50FCQ-17-28-02PD Rev. B

Features/Benefits

The New Carrier WeatherMaker® packaged heat pump rooftop units (RTU) with EcoBlue™ Technology were designed by customers to provide value added benefits never seen in this type of equipment before.

New features include:

- A patented, industry first, Vane Axial Indoor Fan System, powered by an electronically commutated motor for quiet, efficient, and reliable operation. Compared to traditional belt driven forwards curved fans, this system has:
  - 75% fewer moving parts
  - No fan belts, pulleys, shaft, and shaft bearings
  - Up to 40% better efficiency than traditional belt drive forward curve fans
  - Slow ramp up capability for better sound and comfort control
  - Internal protection from phase reversal and phase loss situations
  - High external static capability
  - Slide out blower assembly design
- Reliable 2 stage cooling with tandem scroll compressors technology, fully active evaporator coil, and mixed air temperature protection on all models
- New unit control board with intuitive indoor fan adjustment that uses simple dial and switch adjustments
- An industry first 25 ton packaged heat pump
- Reliable copper tube/aluminum fin condenser coil with 5/16 in. tubing to help reduce refrigerant charge and reduce weight versus prior designs

WeatherMaker® 50FCQ units up to 25 tons are specifically designed for dedicated factory-supplied vertical air flow or horizontal air flow. No special field kits are required. All footprints were maintained to easily fit on R-410A Carrier and select competitor curbs, making replacements easier than ever.

With "no-strip" screw collars, handled access panels, and more, the unit is easy to install, easy to maintain, and easy to use.

Our 2 speed staged air volume through our Vane Axial fan allows our 15 to 25 ton 50FCQ WeatherMaker units to deliver IEER values up to 14.0 and provide optimum comfort and control.

Value-added features include:

- SystemVu™ intuitive intelligent controls option that provides:
  - Large full text, multi-line display
  - USB Flash Port for data transfer
  - Built in i-Vu®, CCN and BACnet[1]
  - Read refrigerant pressures from display — no gauges
  - Quick LED Status — Run, Alert, Fault
  - Conventional thermostat or sensor capabilities
  - Historical component runtime and starts
  - Supply air tempering
  - Navigator™ and Network Service Tool compatible
- Single point electrical connections
- All 15 to 25 ton models use TXV refrigerant metering devices
- Scroll compressors with internal line-break overload protection
- Units come with an easy access tool-less filter door. Filter track tilts out for filter removal and replacement. All filters are the same size in each unit

1. Third-party trademarks and logos are the property of their respective owners.

Installation ease

Lighter units make for easy replacement and aid in the structural approval process. Units have simple, fast plug-in connections to the standard integrated unit control board (UCB). Clearly labeled connections points to reduce installation time. Also, a large control box provides room to work and room to mount Carrier accessory controls.

Easy to maintain

With the new EcoBlue Vane Axial fan system and direct drive ECM motor, there is no longer a need to adjust or replace belts or pulleys as in past designs. This frees up maintenance, installation and commissioning time.

Table of contents

Features/Benefits (cont)

Easy access handles by Carrier provide quick and easy access to all normally serviced components. Our "no-strip" screw system has superior holding power and guides screws into position while preventing the screw from stripping the unit's metal.

Sloped, corrosion resistant composite drain pan sheds water and won't rust.

Easy to use

The newly re-designed Unit Control Board by Carrier puts all connections and troubleshooting points in one convenient place. Most low voltage connections are made to the same board and make it easy to access it. Setting up the fan is simple by an intuitive switch and rotary dial arrangement.

Carrier rooftops have high and low pressure switches, a new mixed air temperature switch, a filter drier, and 2 in. filters standard.

EcoBlue™ Technology

Direct drive EcoBlue Technology indoor fan system uses Vane Axial fan design and electrically commutated motors.

This new Vane Axial design has 75% fewer moving parts, uses up to 40% less energy and has no fan belts, blower bearings and shaft when compared with past belt drive systems. The full fan and motor assembly also slides out for easier maintenance and service.

Streamlined control and integration

Carrier controllers make connecting WeatherMaker® rooftop heat pump units into existing building automation systems easy. The units are compatible with conventional thermostat controls or SystemVu™ controls for greater comfort, diagnostics and building network integration.

Operating efficiency and flexibility

These 50FCQ packaged rooftops meet the Department of Energy (DOE) 2023 efficiency standard, as well as the latest ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) 90.1 and IECC®[1] (International Energy Conservation Code) minimum IEER efficiency requirements.

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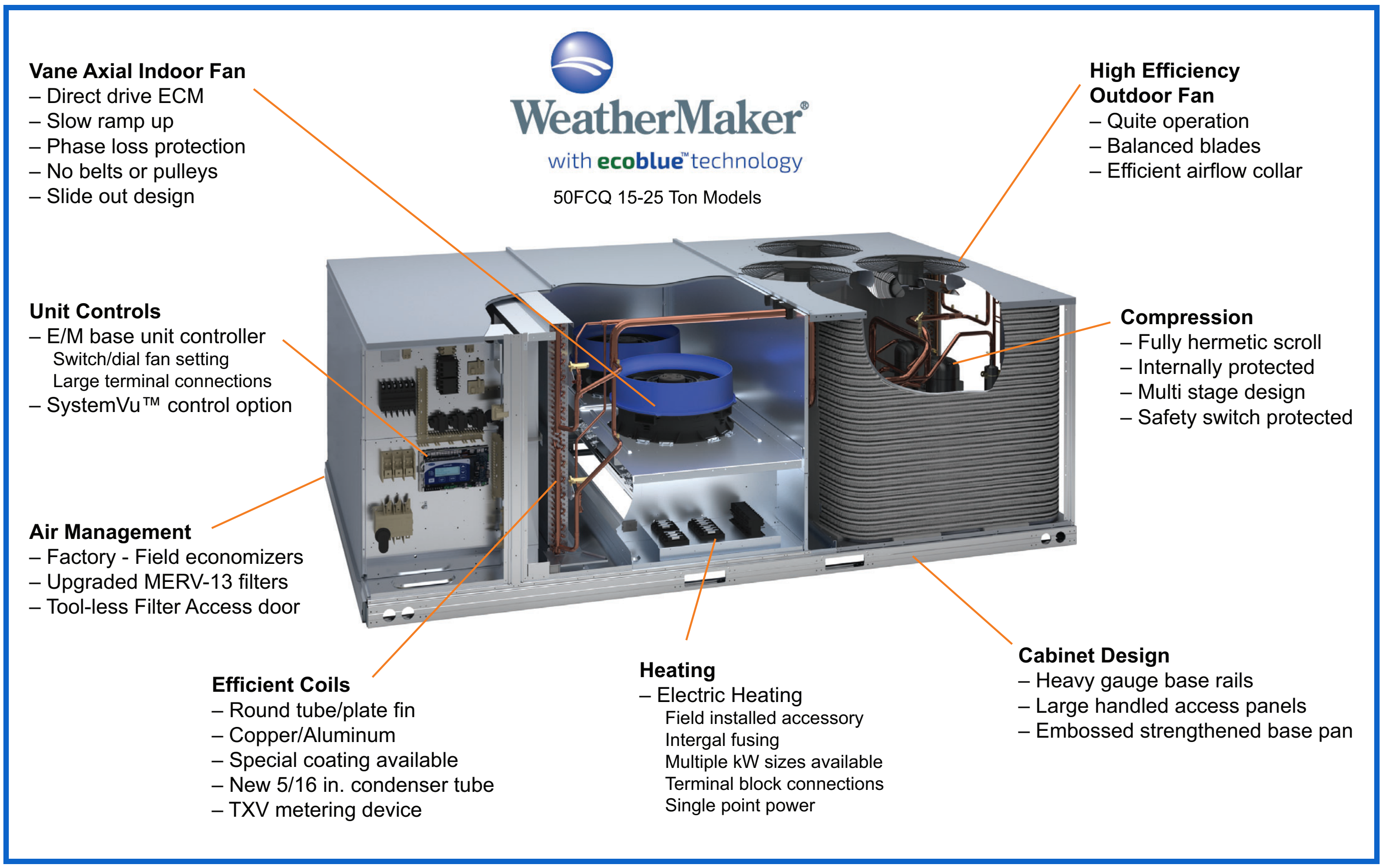
1. Third-party trademarks and logos are the property of their respective owners.



Model number nomenclature

50FCQ*17-28 Model Number Nomenclature

Position:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Example:	5	0	F	C	Q	M	2	4	A	2	A	6	-	0	A	0	A	0

Unit Heat Type
50 = Cooling Packaged Rooftop

Model Series - WeatherMaker®
FC = Standard Efficiency (EcoBlue™ Technology)

Heat Type
Q = Heat Pump
(Field-Installed Electic Heat)

Refrig. Systems Options
M = Two Stage Cooling/One Circuit Models

Cooling Tons
17 = 15.0 tons
24 = 20.0 tons
28 = 25.0 tons

Sensor Options
A = None
B = Return Air Smoke Detector (RA)
C = Supply Air Smoke Detector (SA)
D = RA + SA Smoke Detector
E = CO_2 Sensor
F = RA Smoke Detector and CO_2 Sensor
G = SA Smoke Detector and CO_2 Sensor
H = RA + SA Smoke Detector and CO_2 Sensor
J = Condensate Overflow Switch (COFS)
K = COFS + RA Smoke Detector
L = COFS + RA and SA Smoke Detectors
M = COFS + SA Smoke Detector
N = COFS + CO_2 Sensor
P = COFS + RA Smoke Detector and CO_2 Sensor
Q = COFS + SA Smoke Detector and CO_2 Sensor
R = COFS + RA and SA Smoke Detector and CO_2 Sensor

Indoor Fan Options - Vane Axial EcoBlue Fan System
2 = Standard/Medium Static Motor - Vertical Supply
3 = High Static Motor - Vertical Supply
5 = Standard/Medium Static Motor - Vertical Supply and Filter Status Switch
6 = High Static Motor - Vertical Supply and Filter Status Switch
J = High Static Motor - Horizontal Supply
L = High Static Motor - Horizontal Supply and Filter Status Switch

Coil Options – RTPF (Outdoor – Indoor) – Hail Guards
A = Al/Cu – Al/Cu
B = Precoat Al/Cu – Al/Cu
C = E-coat Al/Cu – Al/Cu
D = E-coat Al/Cu – E-coat Al/Cu
E = Cu/Cu – Al/Cu
F = Cu/Cu – Cu/Cu
M = Al/Cu – Al/Cu – Louvered Hail Guards
N = Precoat Al/Cu – Al/Cu – Louvered Hail Guards
P = E-coat Al/Cu – Al/Cu – Louvered Hail Guards
Q = E-coat Al/Cu – E-coat Al/Cu – Louvered Hail Guards
R = Cu/Cu – Al/Cu – Louvered Hail Guards
S = Cu/Cu – Cu/Cu – Louvered Hail Guards

Voltage
1 = 575-3-60
5 = 208/230-3-60
6 = 460-3-60

Packaging Compliance
0 = Standard

Electrical Options
A = None
C = Non-Fused Disconnect
N = Phase Monitor/Protection
Q = Phase Monitor/Protection and Non-Fused Disconnect
1 = HSCCR Protection

Service Options
0 = None
1 = Unpowered Convenience Outlet
2 = Powered Convenience Outlet
3 = Hinged Access Panels
4 = Hinged Access Panels and Unpowered Convenience Outlet
5 = Hinged Access Panels and Powered Convenience Outlet
6 = 4" MERV 13 High Efficiency Filter Track
7 = Unpowered Convenience Outlet and 4" MERV 13 High Efficiency Filter Track
8 = Powered Convenience Outlet and 4" MERV 13 High Efficiency Filter Track
9 = Hinged Access Panels and 4" MERV 13 High Efficiency Filter Track
A = Hinged Access Panels, Unpowered Convenience Outlet and 4" MERV 13 High Efficiency Filter Track
B = Hinged Access Panels, Powered Convenience Outlet and 4" MERV 13 High Efficiency Filter Track

Intake / Exhaust Options
A = None
B = Low Leak Temp Economizer w/ Baro Relief
D = Low Leak Temp Economizer w/ PE (cent) Vert Only
F = Low Leak Enthalpy Economizer w/ Baro Relief
H = Low Leak Enthalpy Economizer w/ PE (cent) Vert Only
U = ULTRA Low Leak Temp Economizer w/ Baro Relief
V = ULTRA Low Leak Temp Economizer w/ PE (cent) Vert Only
W= ULTRA Low Leak Enthalpy Economizer w/ Baro Relief
X = ULTRA Low Leak Enthalpy Economizer w/ PE (cent) Vert Only

Base Unit Controls
0 = Electromechanical Controller (can be used with field installed W7212 EconoMi$er® IV — no FDD[a])
3 = SystemVu™ Controller
8 = Electromechanical Controls — with POL224 EconomizerONE (includes FDD[a])

Design Revision
- = Factory Design Revision

[a] FDD (Fault Detection and Diagnostic) capability per California Title 24 section 120.2.

Capacity ratings

50FCQ AHRI Ratings, Cooling Mode[a,b,c]

UNIT	COOLING STAGES	NOMINAL CAPACITY (tons)	NET COOLING CAPACITY (Btuh)	TOTAL POWER (kW)	EER	IEER WITH 2-SPEED INDOOR FAN MOTOR	AHRI RATING CFM
50FCQM17	2	15	172,000	16.2	10.60	14.0	6,300
50FCQM24	2	20	240,000	24.5	9.80	14.0	8,000
50FCQM28	2	25	278,000	29.3	9.50	14.0	10,000

NOTE(S):

a. Rated in accordance with AHRI Standards 340/360.
b. Rating are based on:
   Cooling Standard: 80°F (27°C) db, 67°F (19°C) wb indoor air temperature and 95°F (35°C) db outdoor air temperature.
   IEER Standard: A measure that expresses cooling part-load EER efficiency for commercial unitary air-conditioning and heat pump equipment on the basis of weighted operation at various load capacities.
c. All 50FCQ units comply with ASHRAE 90.1-2019 (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) and DOE-2023 (Department of Energy) Energy Standard for minimum IEER requirements.

LEGEND

AHRI — Air-Conditioning, Heating and Refrigeration Institute
EER — Energy Efficiency Ratio
IEER — Integrated Energy Efficiency Ratio

50FCQ AHRI Ratings, Heating Mode[a,b,c]

UNIT	HEATING, LOW 17°F(–8°C) AMBIENT		HEATING, HIGH 47°F (8°C) AMBIENT		AHRI RATING CFM
	Net Capacity (Btuh)	COP	Net Capacity (Btuh)	COP	
50FCQM17	106,000	2.30	168,000	3.30	6300
50FCQM24	136,000	2.30	234,000	3.30	8000
50FCQM28	158,000	2.30	274,000	3.30	9500

NOTE(S):

a. Rated in accordance with AHRI Standards 340/360.
b. Rating are based on:
   Cooling Standard: 80°F (27°C) db, 67°F (19°C) wb indoor air temperature and 95°F (35°C) db outdoor air temperature.
   IEER Standard: A measure that expresses cooling part-load EER efficiency for commercial unitary air-conditioning and heat pump equipment on the basis of weighted operation at various load capacities.
c. All 50FCQ units comply with ASHRAE 90.1-2019 (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) and DOE-2023 (Department of Energy) Energy Standard for minimum IEER requirements.

LEGEND

AHRI — Air-Conditioning, Heating and Refrigeration Institute
COP — Coefficient of Performance

Sound Rating Table[a]

UNIT	COOLING STAGES	OUTDOOR SOUND (dB) AT 60 Hz[b]								
		A-WEIGHTED[c]	63	125	250	500	1000	2000	4000	8000
50FCQM17	2	84.1	92.2	83.9	80.4	81.8	78.7	76.5	72.2	65.4
50FCQM17	2	85.9	97.1	88.3	84.4	83.3	80.7	77.4	73.4	67.3
50FCQM28	2	85.9	97.1	88.3	84.4	83.3	80.7	77.4	73.4	67.3

NOTE(S):

a. Outdoor sound data is measured in accordance with AHRI.
b. Measurements are expressed in terms of sound power. Do not compare these values to sound pressure values because sound pressure depends on specific environmental factors which normally do not match individual applications. Sound power values are independent of the environment and therefore more accurate.
c. A-weighted sound ratings filter out very high and very low frequencies, to better approximate the response of "average" human ear. A-weighted measurements for Carrier units are taken in accordance with AHRI.

LEGEND

dB — Decibel

Minimum - Maximum Airflow Ratings (cfm) — Cooling Units and Accessory Electric Heat

UNIT	COOLING			ELECTRIC HEAT[a]	
	MINIMUM 2-SPEED AIRFLOW (LOW SPEED)	MINIMUM 2-SPEED AIRFLOW (HIGH SPEED)	MAXIMUM AIRFLOW CFM	MINIMUM AIRFLOW CFM	MAXIMUM AIRFLOW CFM
50FCQM17	2700	4500	7500	4500	7500
50FCQM24	3000	6000	10,000	6000	10,000
50FCQM28	3750	7500	12,500	7500	12,500

NOTE(S):

a. Electric heat modules and single point kits are available as field-installed accessories for 50FCQ units.

Carrier

50FCQ 17 to 28 Physical Data

50FCQ UNIT	50FCQM17	50FCQM24	50FCQM28
NOMINAL TONS	15	20	25
BASE UNIT OPERATING WT (lb)[a]	1627	2057	2125
REFRIGERATION SYSTEM			
No. Circuits/No. Compressors/Type	1/2/Scroll	1/2/Scroll	1/2/Scroll
Puron® (R-410A) Charge (lb-oz)	27-0	48-0	48-0
Cooling Metering Device	TXV	TXV	TXV
Heating Metering Device	TXV	TXV	TXV
High-Pressure Trip/Reset (psig)	630/505	630/505	630/505
Loss of Charge Trip/Reset	27/44	27/44	27/44
EVAPORATOR COIL			
Material (Tube/Fin)	Cu/Al	Cu/Al	Cu/Al
Coil Type	3/8 in. RTPF	3/8 in. RTPF	3/8 in. RTPF
Rows/FPI	4/15	4/15	4/15
Total Face Area (ft^2)	22	26	26
Condensate Drain Connection Size	3/4 in.	3/4 in.	3/4 in.
CONDENSER COIL			
Material (Tube/Fin)	Cu/Al	Cu/Al	Cu/Al
Coil Type	5/16 in. RTPF	5/16 in. RTPF	5/16 in. RTPF
Rows/FPI	2/18	2/18	2/18
Total Face Area (ft^2)	41.6	59.2	59.2
EVAPORATOR FAN AND MOTOR			
Standard/Medium Static 3 Phase			
Motor Qty / Drive Type	2 / Direct	2 / Direct	2 / Direct
Max Cont bhp	2.4	2.4	3
Range (rpm)	250-2000	250-2000	250-2200
Fan Qty / Type	2 / Vane Axial	2 / Vane Axial	2 / Vane Axial
Fan Diameter (in.)	22	22	22
Vertical High Static 3 Phase			
Motor Qty / Drive Type	2 / Direct	2 / Direct	2 / Direct
Max Cont bhp	3	5	5
Range (rpm)	250-2200	250-2200	250-2200
Fan Qty / Type	2 / Vane Axial	2 / Vane Axial	2 / Vane Axial
Fan Diameter (in.)	22	22	22
Horizontal High Static 3 Phase			
Motor Qty / Drive Type	2 / Direct	2 / Direct	2 / Direct
Max Cont bhp	5	5	5
Range (rpm)	250-2200	250-2200	250-2200
Fan Qty / Type	2 / Vane Axial	2 / Vane Axial	2 / Vane Axial
Fan Diameter (in.)	22	22	22
CONDENSER FAN AND MOTOR			
Qty / Motor Drive Type	3 / Direct	4 / Direct	4 / Direct
Motor hp / rpm	1/4 / 1100	1/4 /1100	1/4 /1100
Fan Diameter (in.)	22	22	22
FILTERS			
RA Filter Qty / Size (in.)	6 / 25x25x2	9 / 20x25x2	9 / 20x25x2
OA Inlet Screen Qty / Size (in.)	4 / 16x25x1	4 / 16x25/1	4 / 16x25/1

NOTE(S):

a. Base unit operating weight does not include weight of options.

LEGEND

bhp — Brake Horsepower
FPI — Fins Per Inch
OA — Outdoor Air
RA — Return Air

Options and accessories

ITEM	FACTORY-INSTALLED OPTION	FIELD-INSTALLED ACCESSORY
ELECTRIC HEAT		
Electric Resistance Heaters		X
Single Point Kits		X
CABINET		
Hinged Access Panels	X	
MERV-13, 4 in. Filters	X	
MERV-13, 2 in. Filters		X
MERV-8, 2 in. Filters		X
4 in. Filter Rack (filters not included)		X
Condenser Coil Hail Guard	X	X
COIL OPTIONS		
Cu/Cu Indoor and/or Outdoor Coils	X	
Pre-Coated Outdoor Coils	X	
Premium, E-Coated Indoor and/or Outdoor Coils	X	
CONTROLS		
Thermostats, Temperature Sensors, and Subbases		X
SystemVu™ DDC Communicating Controller	X	
Smoke Detector (supply and/or return air)	X	X
Horn Strobe Annunciator[a]		X
Time Guard II Compressor Delay Control Circuit		X
Phase Monitor	X	X
Condensate Overflow Switch	X	X
ECONOMIZERS AND OUTDOOR AIR DAMPERS		
EconomizerONE for Electromechanical Controls, complies with FDD (standard and ultra low leak damper models)[b]	X	X
Wi-Fi Stick for EconomizerONE (optional)		X
EconoMi$er® 2 for DDC Controls (standard and ultra low leak damper models)[c]	X	X
Motorized Two-Position Outdoor-Air Damper		X
Manual Outdoor-Air Damper (25% and 50%)		X
Barometric Relief[d]	X	X

ITEM	FACTORY-INSTALLED OPTION	FIELD-INSTALLED ACCESSORY
Power Exhaust — Centrifugal Design	X	X
ECONOMIZER SENSORS AND IAQ DEVICES		
Single Dry Bulb Temperature Sensors[e]	X	X
Differential Dry Bulb Temperature Sensors[e]		X
Single Enthalpy Sensors[e]	X	X
Differential Enthalpy Sensors[e]		X
CO_2 Sensor (wall, duct, or unit mounted)[e]	X	X
INDOOR MOTOR AND DRIVE		
Multiple Motor and Drive Packages	X	
LOW AMBIENT CONTROLS		
Winter Start Kit[f]		X
Low Ambient Controller to 0°F (–18°C)[f]		X
POWER OPTIONS		
Convenience Outlet (powered)	X	
Convenience Outlet (unpowered)	X	
Convenience Outlet, 20 amp (unpowered)		X
Non-Fused Disconnect[g]	X	
High SCCR Protection[h]	X	
ROOF CURBS		
Roof Curb 14 in. (356 mm)		X
Roof Curb 24 in. (610 mm)		X

NOTE(S):

a. Requires a field-supplied 24V transformer for each application. See price pages for details.
b. FDD (Fault Detection and Diagnostic) capability per California Title 24 section 120.2.
c. Models with SystemVu controls comply with California Title 24 Fault Detection and Diagnostic (FDD).
d. Included with economizer.
e. Sensors used to optimize economizer performance.
f. See application data for assistance.
g. Non-fused disconnect switch cannot be used when unit FLA electrical rating exceeds 200 amps (all voltages).
h. High SCCR (Short Circuit Current Rating) is not available on the following: units with Low Ambient controls, Phase loss monitor, Non-fused disconnect, Powered convenience outlet, and 575-v models.

Factory-installed options

Economizer (dry-bulb or enthalpy)

Economizers save money. They bring in fresh, outside air for ventilation; and provide cool, outside air to cool your building. This is the preferred method of low-ambient cooling. When coupled to CO_2 sensors, economizers can provide even more savings by coupling the ventilation air to only that amount required.

Economizers are available, installed and tested by the factory, with either enthalpy or dry-bulb temperature inputs. Additional sensors are available as accessories to optimize the economizers. Economizers include a powered exhaust system to help equalize building pressures.

Economizers can be factory-installed or easily field-installed.

Unit mounted CO_2 sensor

The CO_2 sensor works with the economizer to intake only the correct amount of outside air for ventilation. As occupants fill your building, the CO_2 sensor detects their presence through increasing CO_2 levels, and opens the economizer appropriately. When the occupants leave, the CO_2 levels decrease, and the sensor appropriately closes the economizer. This intelligent control of the ventilation air, called demand controlled ventilation (DCV), reduces the overall load on the rooftop, saving money. It is also available as a field-installed accessory.

Phase monitor protection

The Phase Monitor Control will monitor the sequence of 3-phase electrical system to provide a phase reversal protection; and monitor the 3-phase voltage inputs to provide a phase loss protection for the 3-phase device. It will work on either a Delta or Wye power connection.

Smoke detector (supply and/or return air)

Trust the experts. Smoke detectors make your application safer and your job easier. Carrier smoke detectors immediately shut down the rooftop unit when smoke is detected. They are available, installed by the factory, for supply air, return air, or both.

Thru-the-base connections

Thru-the-base connections, included as standard, are necessary to ensure proper connection and seal when routing wire and piping through the rooftop's basepan and curb. These couplings eliminate roof penetration and should be considered for gas lines, main power lines, as well as control power.

Hinged access panels

Allows access to unit's major components with specifically designed hinged access panels. Panels are filter, control box access, and indoor fan motor access.

Cu/Cu (indoor and outdoor) coils

Copper fins and copper tubes are mechanically bonded to copper tubes and copper tube sheets. A polymer strip prevents coil assembly from contacting the sheet metal coil pan to minimize potential for galvanic corrosion between coil and pan.

E-coated (outdoor and indoor) coils

A flexible epoxy polymer coating uniformly applied to all coil surface areas without material bridging between fins. Coating process shall ensure complete coil encapsulation of tubes, fins and headers.

Pre-coated outdoor coils

A durable epoxy-phenolic coating to provide protection in mildly corrosive coastal environments. The coating minimizes galvanic action between dissimilar metals. Coating is applied to the aluminum fin stock prior to the fin stamping process to create an inert barrier between the aluminum fin and copper tube.

Condenser coil hail guard

Sleek, louvered panels protect the condenser coil from hail damage, foreign objects, and incidental contact.

Convenience outlet (powered or un-powered)

Reduce service and/or installation costs by including a convenience outlet in your specification. Carrier will install this service feature at our factory. Provides a convenient, 15 amp, 115-v GFCI receptacle with "Wet in Use" cover. The "powered" option allows the installer to power the outlet from the line side of the disconnect or load side as required by code. The "unpowered" option is to be powered from a separate 115/120-v power source.

The unpowered convenience outlet is available as a 15 amp factory-installed option or a 20 amp field-installed accessory.

Non-fused disconnect

This OSHA-compliant, factory-installed, safety switch allows a service technician to locally secure power to the rooftop. When selecting a factory-installed non-fused disconnect, note they are sized for the unit as ordered from the factory. The sizing of these do not accommodate field-installed items such as power exhaust devices, etc. If field installing electric heat with factory-installed non-fused disconnect switch, a single point kit may or may not be required.

SystemVu™ controller

Carrier's SystemVu controller is an optional factory-installed and tested controller.

This controller takes on a whole new approach to provide an intuitive, intelligent controller that not only monitors and controls the unit, but also provides linkage to multiple building automation systems.

Each SystemVu controller makes it easy to set up, service, troubleshoot, gain historical data, generate reports and provide comfort only Carrier is noted for.

Key features include:

- Easy to read back lit 4 line text screen for superior visibility.
- Quick operational condition LEDs of: Run, Alert, and Fault.
- Simple navigation with large keypad buttons of: Navigation arrows, Test, Back, Enter and Menu.
- Capable of being controlled with a conventional thermostat, space sensor or build automation system.
- Service capabilities include:
  - Auto run test
  - Manual run test
  - Component run hours and starts
  - Commissioning reports
  - Data logging
- Full range of diagnosis:
  - Read refrigerant pressures without the need of gauges

Options and accessories (cont)

- Sensor faults
- Compressor reverse rotation
- Economizer diagnostics that meet California Title 24 requirements

- Quick data transfer via USB port:
  - Unit configuration uploading/downloading
  - Data logging
  - Software upgrades
- Built in capacity for:
  - i-Vu® open systems
  - BACnet systems
  - CCN systems
- Configuration and alarm point capability:
  - Contain over 100 alarm codes
  - Contain over 260 status, troubleshooting, diagnostic and maintenance points
  - Contain over 270 control configuration setpoints

Condensate overflow switch

This sensor and related controller monitors the condensate level in the drain pan and shuts down compression operation when overflow conditions occur. It includes:

- Indicator light — solid red (more than 10 seconds on water contact — compressors disabled), blinking red (sensor disconnected)
- 10-second delay to break — eliminates nuisance trips from splashing or waves in pan (sensor needs 10 seconds of constant water contact before tripping)
- Disables the compressors operation when condensate plug is detected, but still allows fans to run for economizer.

MERV-13 4 in. return air filters

This factory option upgrades the return air filters from standard unit filters to high efficiency MERV-13 filters. Non-woven MERV-13 filter media with high strength, moisture-resistant frame. Filter media is securely fasted inside the filter frame on all 4 sides.

High Short Circuit Current Rating (SCCR) protection

This factory-installed option provides high short circuit current protection to each compressor, plus all indoor and outdoor fan motors of 60 kA (for 208/230-3-60 units) and 65 kA (for 460-3-60 units) against high potential fault current situations.

Standard unit comes with 5 kA rating.

This option is not available with factory installed Non-Fused Disconnect, Low Ambient controls, Phase loss monitor/ protection and 575 Volt models.

Filter maintenance indicator

When the optional factory-installed filter maintenance indicator is used, a factory-installed differential pressure switch measures pressure drop across the outside air filter and activates a field-supplied dry contact indicator when the pressure differential exceeds the adjustable switch setpoint.

Field-installed accessories

Condenser coil hail guard

Sleek, louvered panels protect the condenser coil from hail damage, foreign objects, and incidental contact. This can be purchased as a factory-installed option or as a field-installed accessory.

Differential enthalpy sensor

The differential enthalpy sensor is comprised of an outdoor and return air enthalpy sensors to provide differential enthalpy control. The sensor allows the unit to determine if outside air is suitable for free cooling.

Wall or duct mounted CO_2 sensor

The IAQ sensor shall be available in duct or wall mount. The sensor provides demand ventilation indoor air quality (IAQ) control.

4 in. filter rack kit

The 4 in. filter rack accessory kit is designed to hold 4 in. MERV-8 or MERV-13 filters. Filters not included in kit.

MERV-13 2 in. return air filters

This kit includes MERV-13 2 in. filters to accommodate unit filter rack size. Kit available through RDC (Replacement Components Division).

MERV-8 2 in. return air filters

This kit includes MERV-8 2 in. filters to accommodate unit filter rack size. Kit available through RDC.

Phase monitor protection

The Phase Monitor Control will monitor the sequence of 3-phase electrical system to provide a phase reversal protection; and monitor the 3-phase voltage inputs to provide a phase loss protection for the 3-phase device. It will work on either a Delta or Wye power connection.

Winter start kit

The winter start kit by Carrier extends the low ambient limit of your rooftop to 25°F (–4°C). The kit bypasses the low pressure switch, preventing nuisance tripping of the low pressure switch. Other low ambient precautions may still be prudent.

Low ambient controller

The low ambient controller is a head pressure controller kit that is designed to maintain the unit's condenser head pressure during periods of low ambient cooling operation. This device should be used as an alternative to economizer free cooling when economizer usage is either not appropriate or desired. The low ambient controller will either cycle the outdoor fan motors or operate them at reduced speed to maintain the unit operation, depending on the model. This controller allows cooling operation down to 0°F (–18°C) ambient conditions.

Roof curb (14 in./356 mm or 24 in./610 mm)

Full perimeter roof curb with exhaust capability provides separate air streams for energy recovery from the exhaust air without supply air contamination.

Filter status indicator accessory

Monitors static pressure across supply and exhaust filters and provides indication when filters become clogged.

Power exhaust

Superior internal building pressure control. This field-installed accessory may eliminate the need for costly, external pressure control fans.

Manual OA damper

Manual outdoor air dampers are an economical way to bring in ventilation air. The dampers are available in 25% and 50% versions.

NOTE: See application tip "ROOFTOP-18-01" prior to use of this damper on 17-28 size models.

Motorized two-position damper

The Carrier two-position, motorized outdoor air damper admits up to 100% outside air. Using reliable, gear-driven technology, the two-position damper opens to allow ventilation air and closes when the rooftop stops, stopping unwanted infiltration.

NOTE: See application tip "ROOFTOP-18-01" prior to use of this damper on 17-28 size models.

Electric heaters

Carrier offers a full-line of field-installed accessory heaters. The heaters are very easy to use, install and are all pre-engineered and certified.

Time Guard II control circuit

This accessory protects your compressor by preventing short-cycling in the event of some other failure, prevents the compressor from restarting for 30 seconds after stopping. Not required with SystemVu™ controller or authorized commercial thermostats.

Wi-Fi stick for EconomizerONE (optional)

The accessory Wi-Fi/WLAN stick can be connected to the EconomizerONE POL224 economizer controller via the USB host interface. The Wi-Fi stick enables a wireless connection to be made between a smartphone and the economizer controller via the Climatix™[1] mobile application for commissioning, troubleshooting, and maintenance operations. The Wi-Fi stick is required to utilize the mobile application.

Climatix™ mobile application

The Climatix™ mobile application offers a best-in-class user interface and a simple step-by-step commissioning workflow using a mobile device. The user interface walks users through the setup of the controller and allows users to view the operating mode and parameters. Users can adjust setpoints, initiate damper tests, and save the final configuration as a favorite to expedite setup in the future.

The application is available on Android™[1] and Apple iOS®[1] platforms. The Wi-Fi stick for the EconomizerONE is required to join the Siemens-WiFi-Stick network and setup the controller on a smartphone.

1. Third-party trademarks and logos are the property of their respective owners.

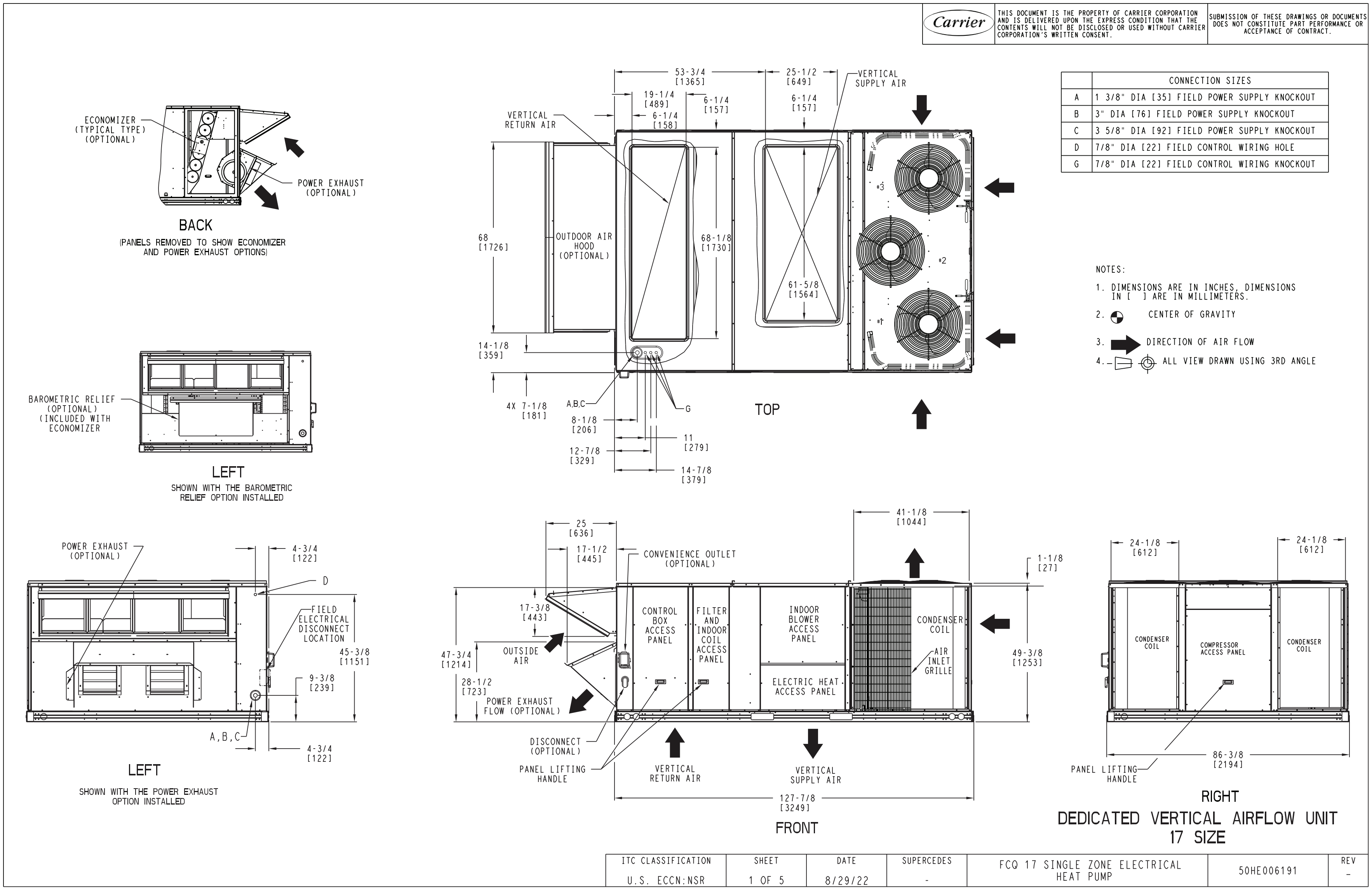
Option and Accessory Weights[a]

OPTION / ACCESSORY NAME	50FCQ UNIT WEIGHT					
	17		24		28	
	lb	kg	lb	kg	lb	kg
Power Exhaust	198	90	198	90	198	90
EconomizerONE and EconoMi$er® 2	293	133	304	138	304	138
Two-Position Damper	50	23	50	23	50	23
Manual Damper	35	16	35	16	35	16
Electric Heater	85	39	85	39	85	39
Hail Guard (louvered)	90	41	90	41	100	46
Cu/Cu Condenser and Evaporator Coils	305	139	448	204	448	204
Roof Curb (14 in. curb)	240	109	255	116	255	116
Roof Curb (24 in. curb)	340	154	355	161	355	161
CO_2 Sensor	5	3	5	3	5	3
Optional Indoor Motor[b]	30	14	30	14	0	0
Low Ambient Controller	9	4	9	4	9	4
Winter Start Kit	5	2	5	2	5	2
Return Air Smoke Detector	7	3	7	3	7	3
Supply Air Smoke Detector	7	3	7	3	7	3
Fan Filter Switch	2	1	2	1	2	1
Non-Fused Disconnect	15	7	15	7	15	7
Powered Convenience Outlet	36	16	36	16	36	16
Unpowered Convenience Outlet	4	2	4	2	4	2
Enthalpy Sensor	2	1	2	1	2	1
Differential Enthalpy Sensor	3	2	3	2	3	2
4 in. MERV 13 Filters	22	10	22	10	22	10

NOTE(S):

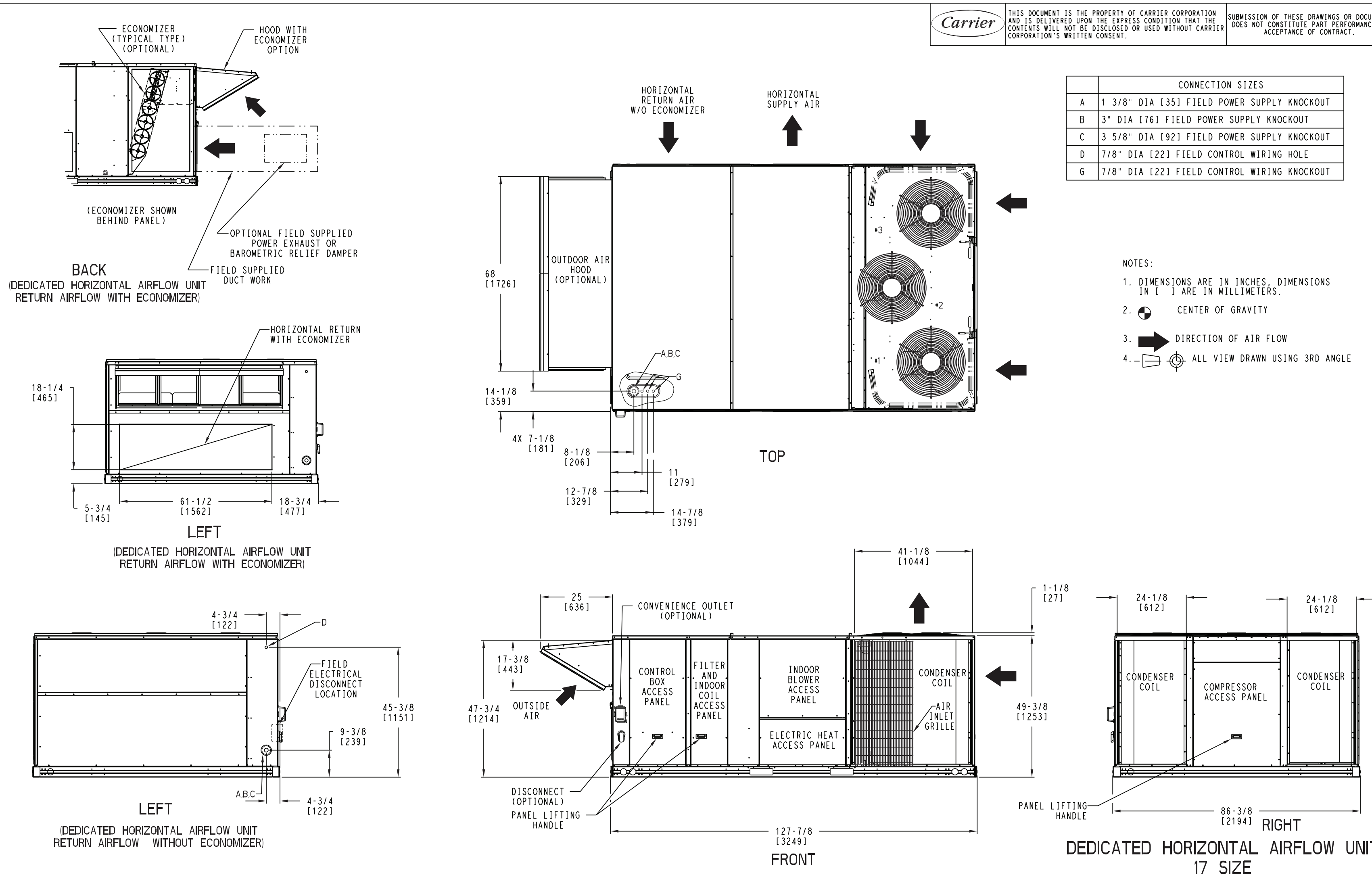
a. Where multiple variations are available, the heaviest combination is listed.
b. Add the Optional Indoor Motor weight to the weight of the base unit.

50FCQ*17 Base Unit Dimensions



	CONNECTION SIZES
A	1 3/8" DIA [35] FIELD POWER SUPPLY KNOCKOUT
B	3" DIA [76] FIELD POWER SUPPLY KNOCKOUT
C	3 5/8" DIA [92] FIELD POWER SUPPLY KNOCKOUT
D	7/8" DIA [22] FIELD CONTROL WIRING HOLE
G	7/8" DIA [22] FIELD CONTROL WIRING KNOCKOUT

50FCQ*17 Base Unit Dimensions (cont)



Carrier

	CONNECTION SIZES
A	1 3/8" DIA [35] FIELD POWER SUPPLY KNOCKOUT
B	3" DIA [76] FIELD POWER SUPPLY KNOCKOUT
C	3 5/8" DIA [92] FIELD POWER SUPPLY KNOCKOUT
D	7/8" DIA [22] FIELD CONTROL WIRING HOLE
G	7/8" DIA [22] FIELD CONTROL WIRING KNOCKOUT

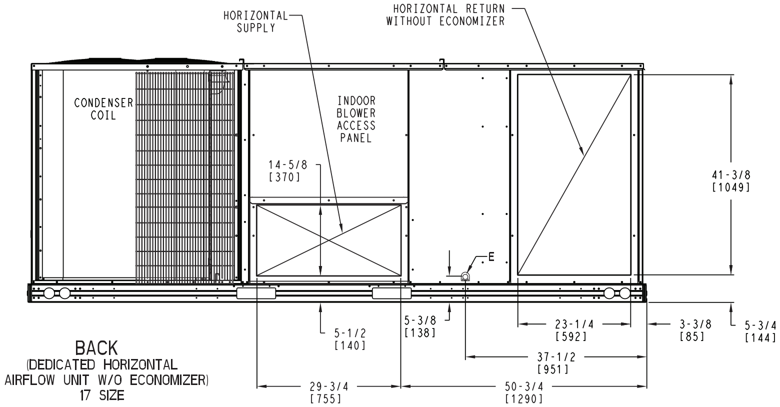
NOTES:

1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. CENTER OF GRAVITY
3. DIRECTION OF AIR FLOW
4. ALL VIEW DRAWN USING 3RD ANGLE

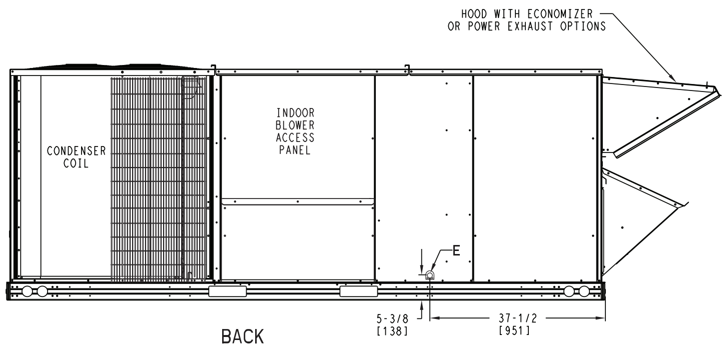
ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	2 OF 5	8/29/22	-	FCQ 17 SINGLE ZONE ELECTRICAL HEAT PUMP	50HE006191	-

50FCQ*17 Base Unit Dimensions (cont)

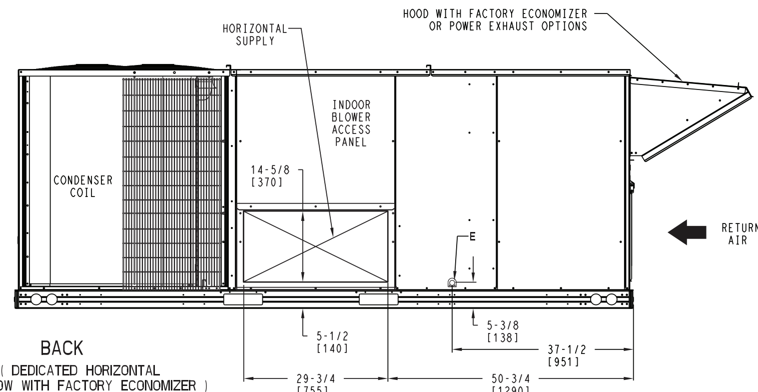
	CONNECTION SIZES
E	3/4"-14 NPT CONDENSATE DRAIN



BACK
(DEDICATED HORIZONTAL AIRFLOW UNIT W/O ECONOMIZER)
17 SIZE



BACK
(DEDICATED VERTICAL AIRFLOW UNIT W/ECONOMIZER)
17 SIZE



BACK
(DEDICATED HORIZONTAL AIRFLOW WITH FACTORY ECONOMIZER)
17 SIZE

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	3 OF 5	8/29/22	-	FCQ 17 SINGLE ZONE ELECTRICAL HEAT PUMP	50HE006191	-

50FCQ*17 Base Unit Dimensions (cont)

UNIT	STD UNIT WEIGHT *		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		
	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
FCQ-17	1627	738	357	162	460	209	456	207	354	161	72 [1829]	43 [1092]	16 1/2 [419]

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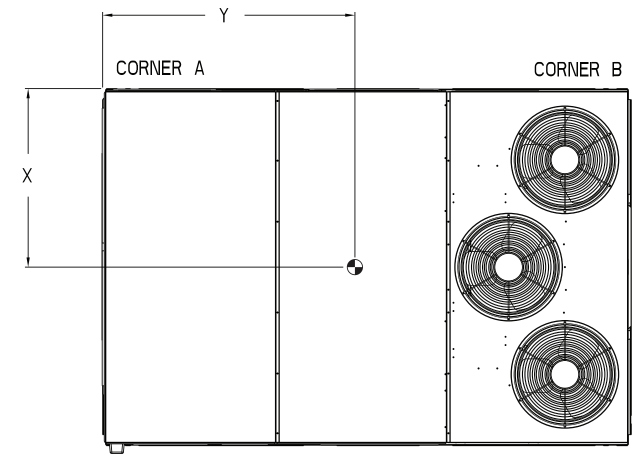
* STANDARD UNIT WEIGHT IS WITHOUT ELECTRIC HEAT AND WITHOUT PACKAGING. FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.



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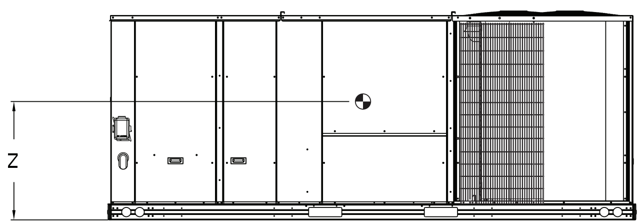

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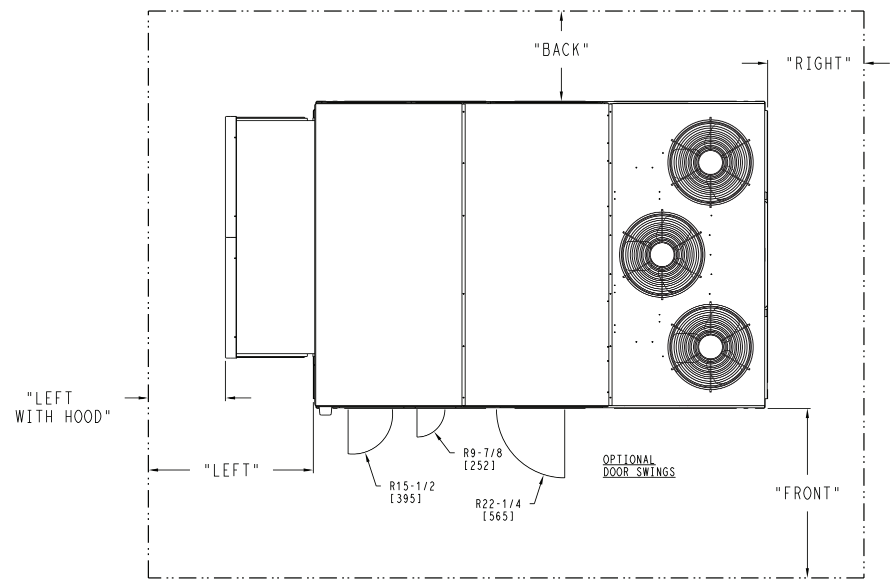


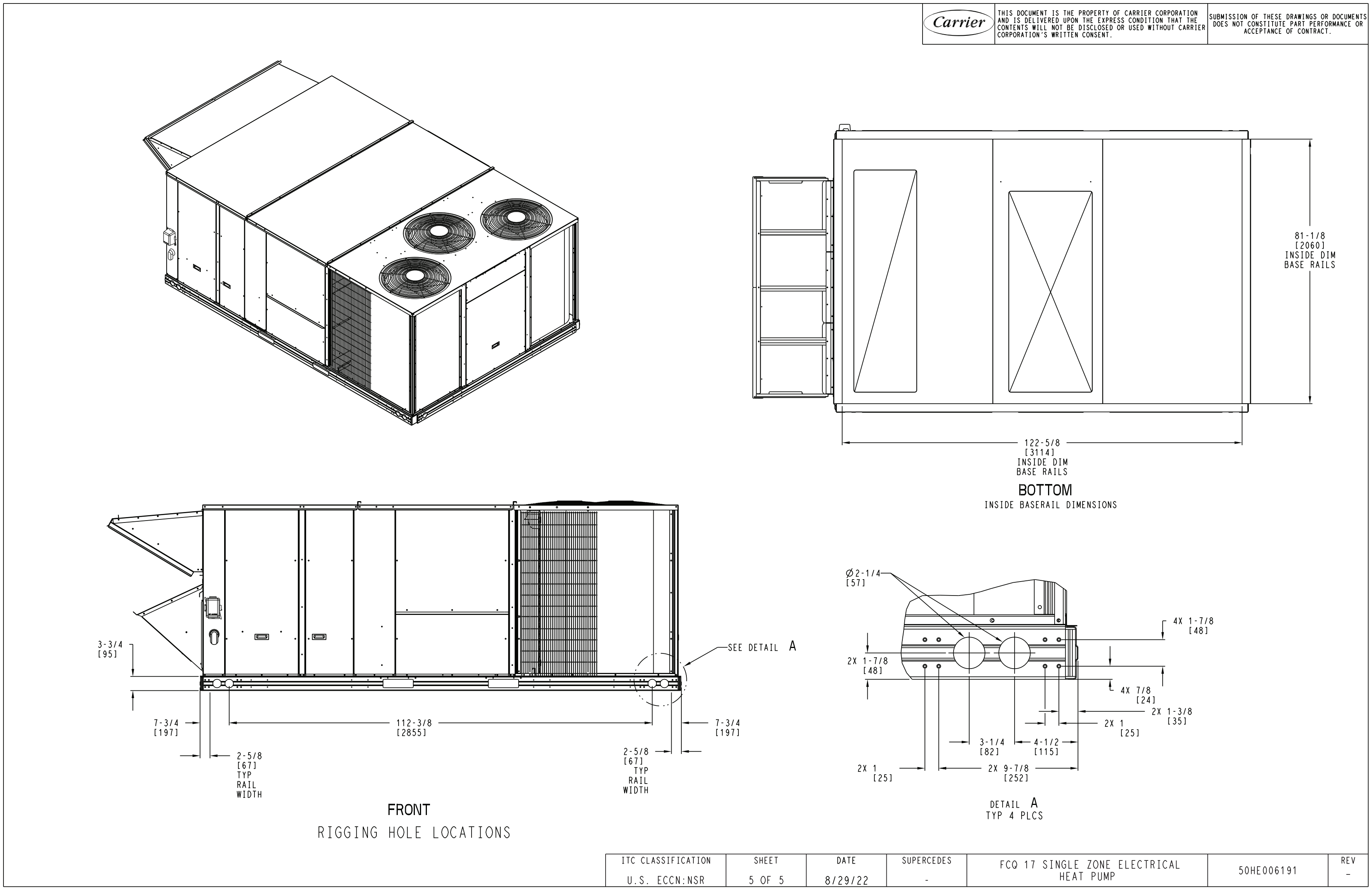
NOTES:

1. CLEARANCE ABOVE THE UNIT TO BE 72"
2. FOR ALL MINIMUM CLEARANCES LOCAL CODES OR JURISDICTIONS MAY PREVAIL.

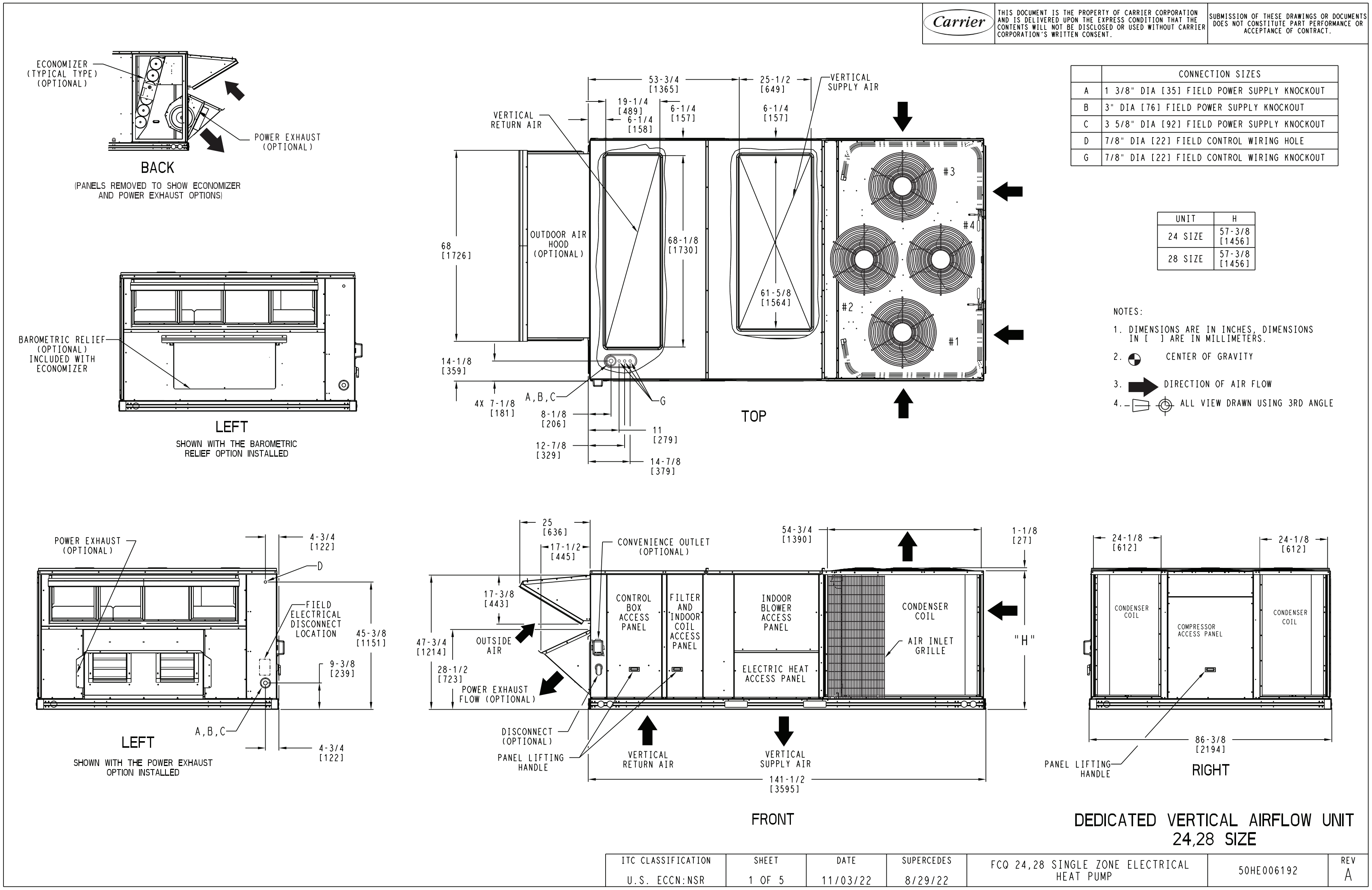
CLEARANCE			
SURFACE	SERVICE WITH: CONDUCTIVE BARRIER	SERVICE WITH: NONCONDUCTIVE BARRIER	OPERATING CLEARANCE
FRONT	48 [1219mm]	36 [914mm]	18 [457mm]
LEFT	48 [1219mm]	42 [1067mm]	18 [457mm]
BACK	42 [1067mm]	36 [914mm]	18 [457mm]
LEFT WITH HOOD	36 [914mm]	36 [914mm]	18 [457mm]
RIGHT	36 [914mm]	36 [914mm]	18 [457mm]
TOP	72 [1829mm]	72 [1829mm]	72 [1829mm]

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	4 OF 5	8/29/22	-	FCQ 17 SINGLE ZONE ELECTRICAL HEAT PUMP	50HE006191	-

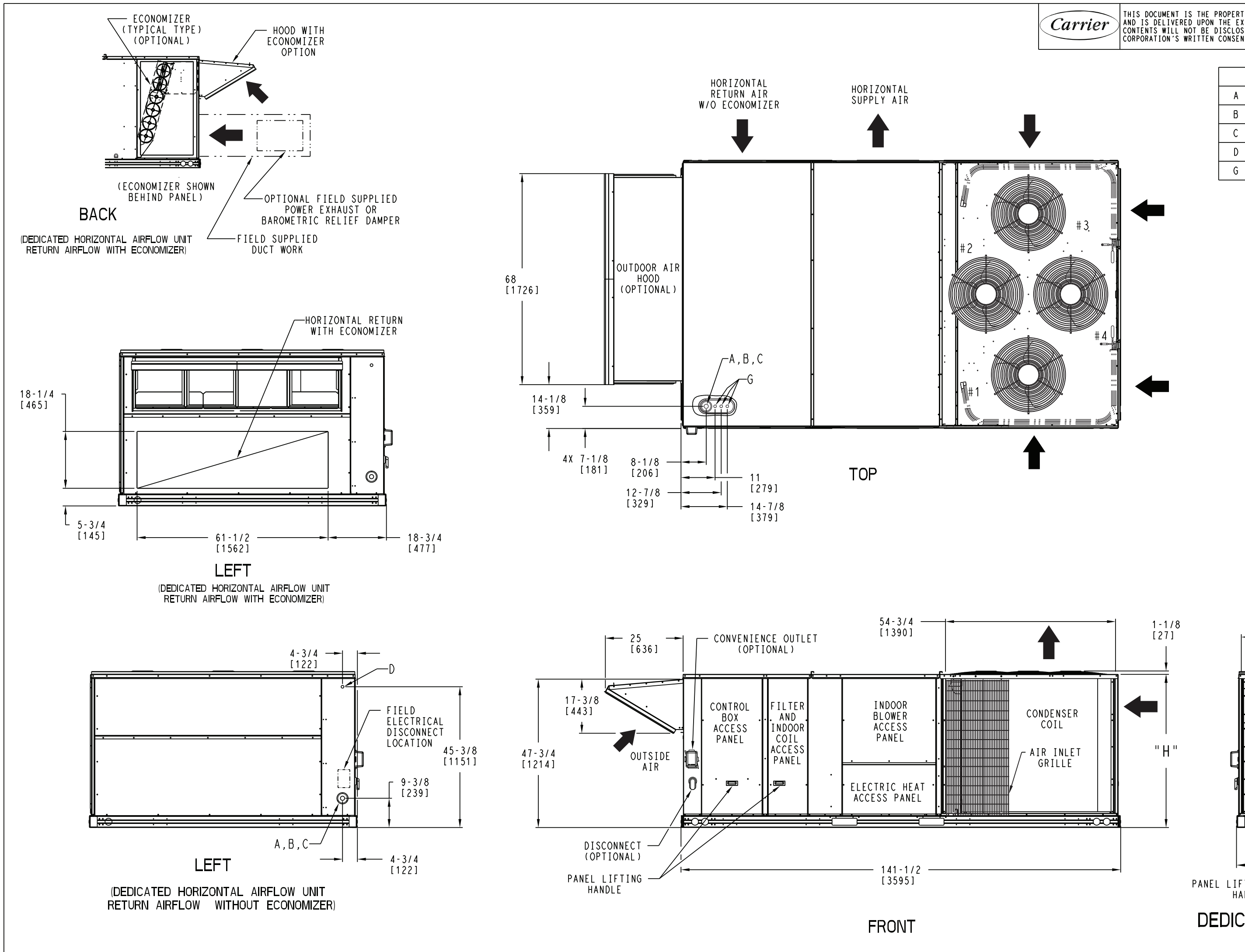
50FCQ*17 Base Unit Dimensions (cont)



50FCQ*24-28 Base Unit Dimensions



50FCQ*24-28 Base Unit Dimensions (cont)



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	CONNECTION SIZES
A	1 3/8" DIA [35] FIELD POWER SUPPLY KNOCKOUT
B	3" DIA [76] FIELD POWER SUPPLY KNOCKOUT
C	3 5/8" DIA [92] FIELD POWER SUPPLY KNOCKOUT
D	7/8" DIA [22] FIELD CONTROL WIRING HOLE
G	7/8" DIA [22] FIELD CONTROL WIRING KNOCKOUT

UNIT	H
24 SIZE	57-3/8 [1456]
28 SIZE	57-3/8 [1456]

NOTES:

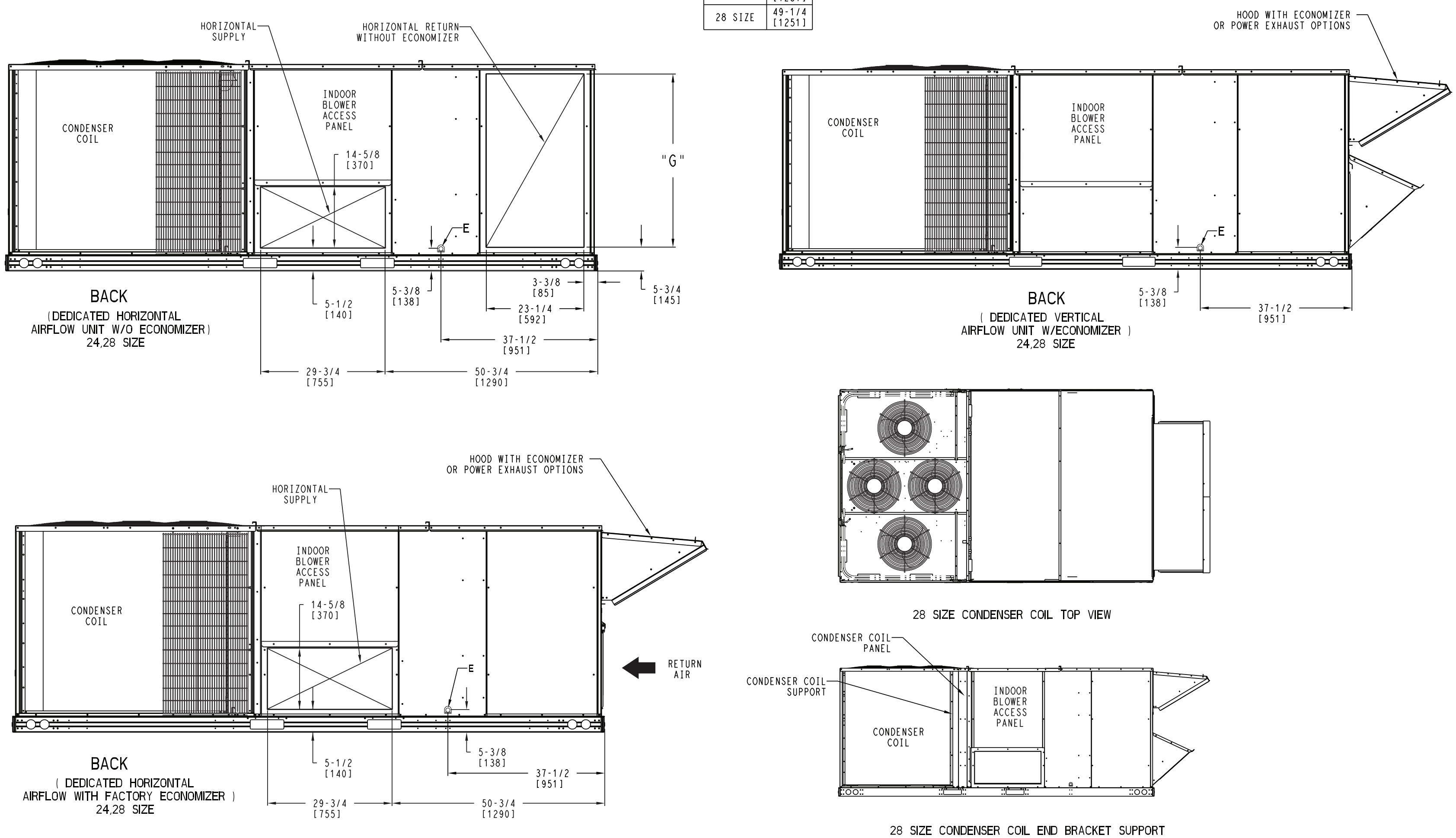
1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN [ ] ARE IN MILLIMETERS.
2. CENTER OF GRAVITY
3. DIRECTION OF AIR FLOW
4. ALL VIEW DRAWN USING 3RD ANGLE

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES	FCQ 24,28 SINGLE ZONE ELECTRICAL HEAT PUMP	50HE006192	REV
U.S. ECCN:NSR	2 OF 5	11/03/22	8/30/22			A

50FCQ*24-28 Base Unit Dimensions (cont)

	CONNECTION SIZES
E	3/4"-14 NPT CONDENSATE DRAIN

UNIT	G
24 SIZE	49-1/4 [1251]
28 SIZE	49-1/4 [1251]

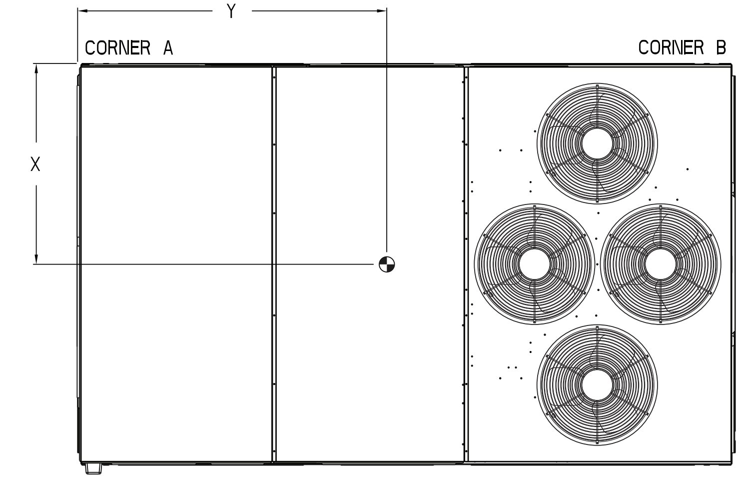


ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	3 OF 5	11/03/22	8/30/22	FCQ 24,28 SINGLE ZONE ELECTRICAL HEAT PUMP	50HE006192	A

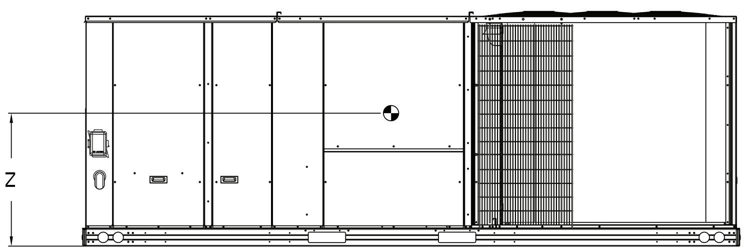
50FCQ*24-28 Base Unit Dimensions (cont)

UNIT	STD. UNIT WEIGHT *		CORNER WEIGHT (A)		CORNER WEIGHT (B)		CORNER WEIGHT (C)		CORNER WEIGHT (D)		C.G.		
	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	LBS.	KG.	X	Y	Z
FCQ-24	2057	933	466	211	531	241	565	256	495	225	75 3/8 [1915]	44 1/2 [1130]	19 [483]
FCQ-28	2125	964	465	211	556	252	601	273	503	228	77 [1956]	44 7/8 [1140]	19 [483]

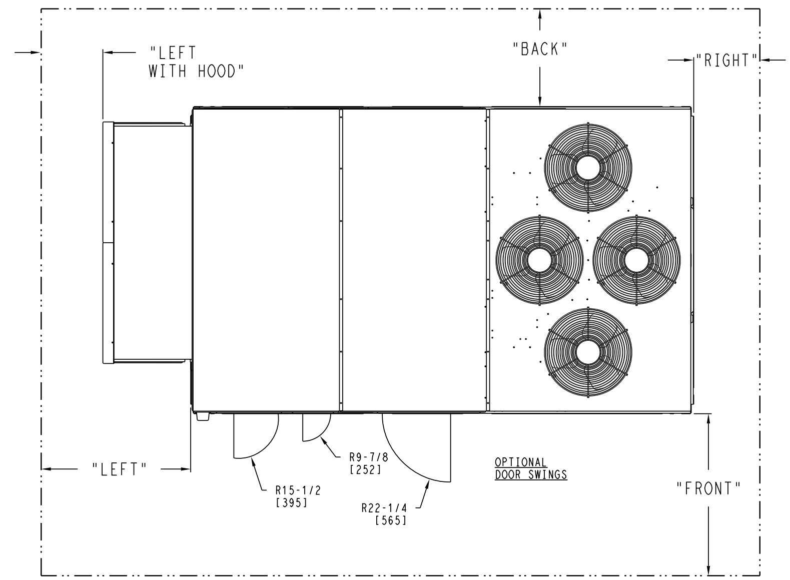
* STANDARD UNIT WEIGHT IS WITHOUT ELECTRIC HEAT AND WITHOUT PACKAGING. FOR OTHER OPTIONS AND ACCESSORIES, REFER TO THE PRODUCT DATA CATALOG.



TOP



FRONT



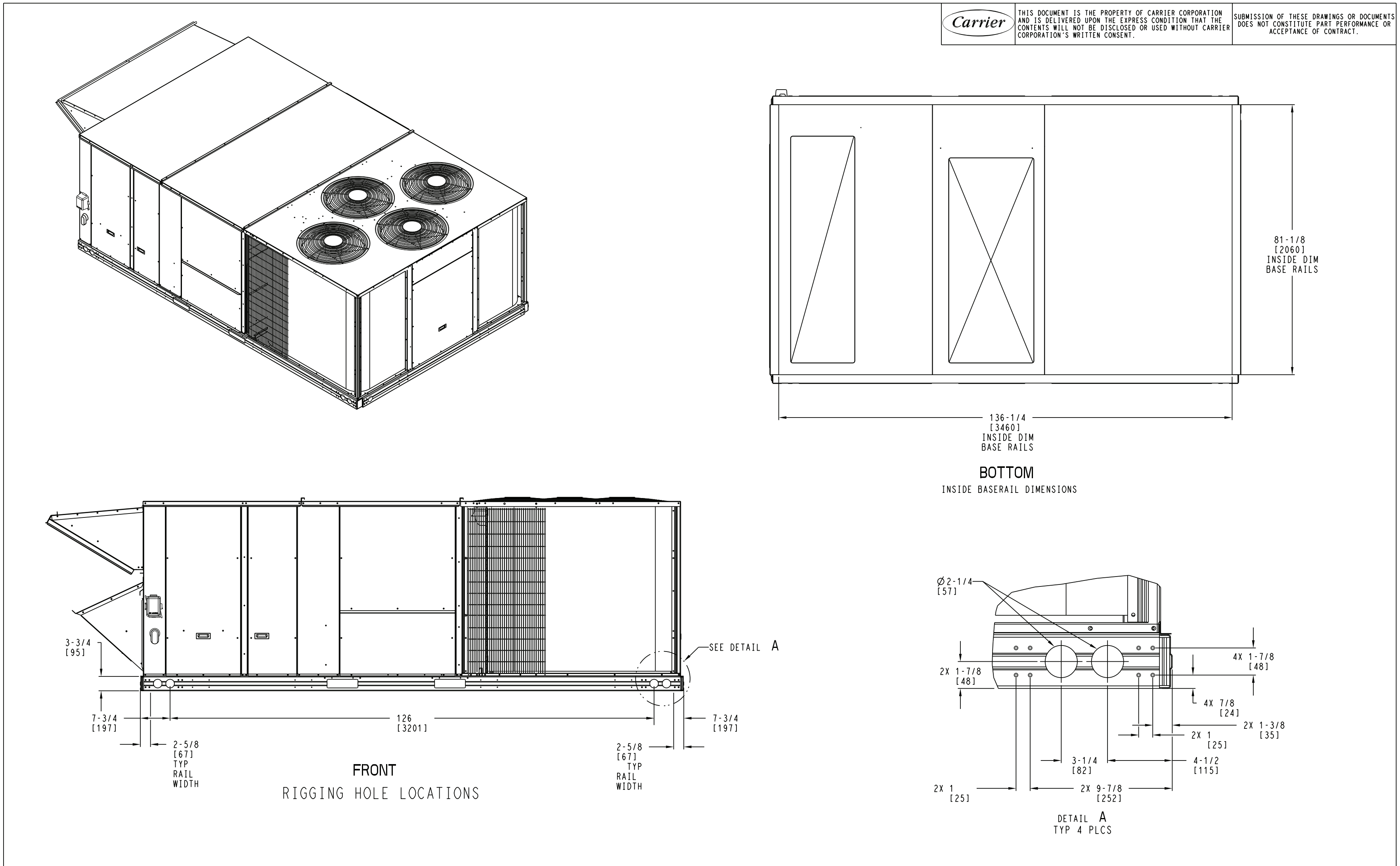
NOTES:

1. CLEARANCE ABOVE THE UNIT TO BE 72"
2. FOR ALL MINIMUM CLEARANCES LOCAL CODES OR JURISDICTIONS MAY PREVAIL.

CLEARANCE			
	SERVICE WITH:	SERVICE WITH:	OPERATING
SURFACE	CONDUCTIVE BARRIER	NONCONDUCTIVE BARRIER	CLEARANCE
FRONT	48 [1219mm]	36 [914mm]	18 [457mm]
LEFT	48 [1219mm]	42 [1067mm]	18 [457mm]
BACK	42 [1067mm]	36 [914mm]	18 [457mm]
LEFT WITH HOOD	36 [914mm]	36 [914mm]	18 [457mm]
RIGHT	36 [914mm]	36 [914mm]	18 [457mm]
TOP	72 [1829mm]	72 [1829mm]	72 [1829mm]

ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES			REV
U.S. ECCN:NSR	4 OF 5	11/03/22	8/30/22	FCQ 24,28 SINGLE ZONE ELECTRICAL HEAT PUMP	50HE006192	A

50FCQ*24-28 Base Unit Dimensions (cont)

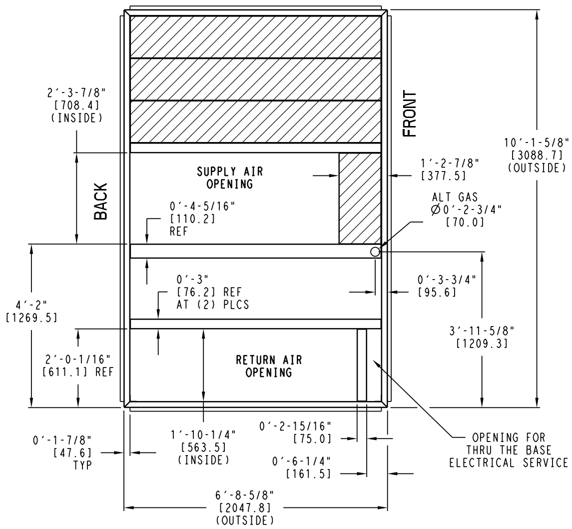


ITC CLASSIFICATION	SHEET	DATE	SUPERCEDES	FCQ 24,28 SINGLE ZONE ELECTRICAL HEAT PUMP	50HE006192	REV
U.S. ECCN:NSR	5 OF 5	11/03/22	-			A

Accessory dimensions

Roof Curb Dimensions — 50FCQ*17

"A"	ROOF CURB ACCESSORY
1′-2" [356.0]	CRRFCURB045A00
2′-0" [610.0]	CRRFCURB046A00



NOTES:

1 ROOF CURB ACCESSORY IS SHIPPED UNASSEMBLED.

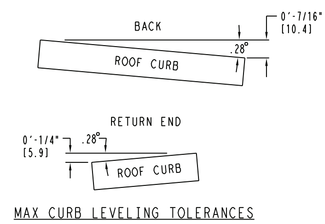
2 DIMENSIONS IN [ ] ARE IN MILLIMETERS.

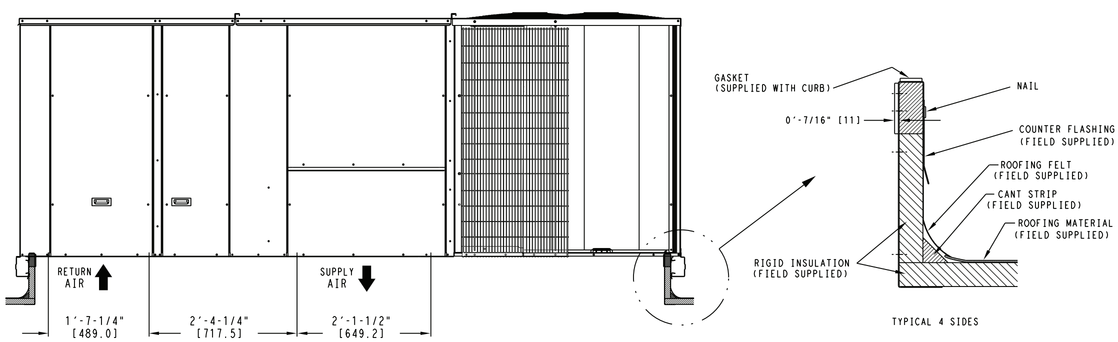
3 ROOF CURB GALVANIZED STEEL.

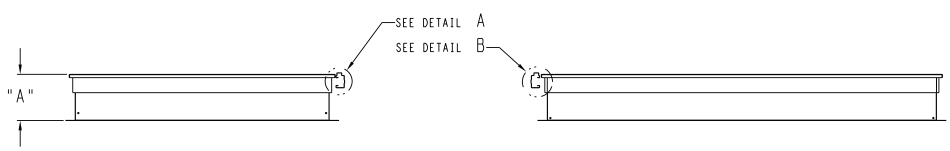
4 ATTACH DUCTWORK TO CURB (FLANGES ON DUCT REST ON CURB)

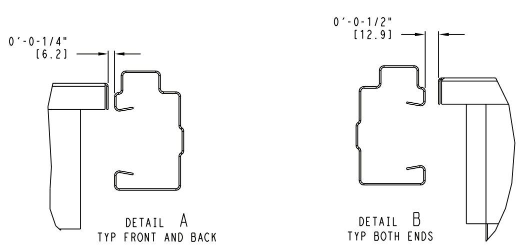
5 SERVICE CLEARANCE 4 ft ON EACH SIDE

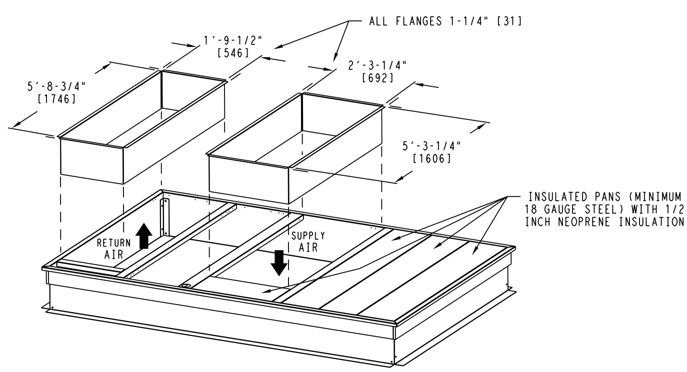
➡ DIRECTION OF AIR FLOW







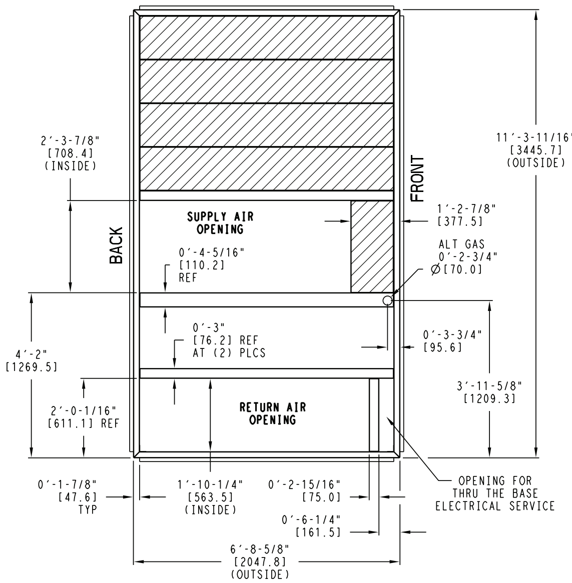




Accessory dimensions (cont)

Roof Curb Dimensions — 50FCQ*24-28

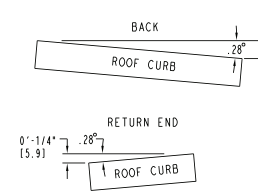
"A"	ROOF CURB ACCESSORY
1'-2" [356.0]	CRRFCURB047A00
2'-0" [610.0]	CRRFCURB048A00



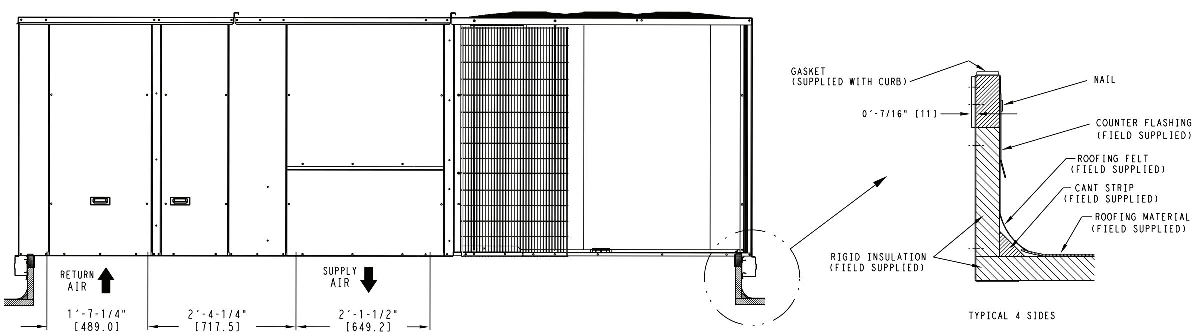
NOTES:

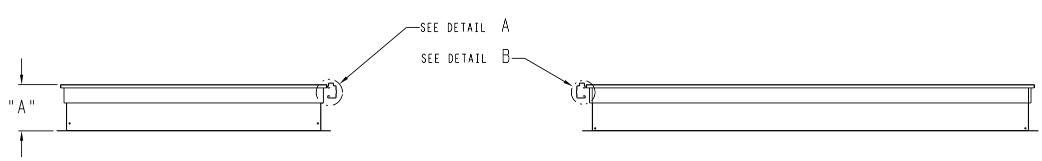
1. ROOF CURB ACCESSORY IS SHIPPED UNASSEMBLED.
2. DIMENSIONS IN [ ] ARE IN MILLIMETERS.
3. ROOF CURB GALVANIZED STEEL.
4. ATTACH DUCTWORK TO CURB (FLANGES ON DUCT REST ON CURB)
5. SERVICE CLEARANCE 4 ft ON EACH SIDE

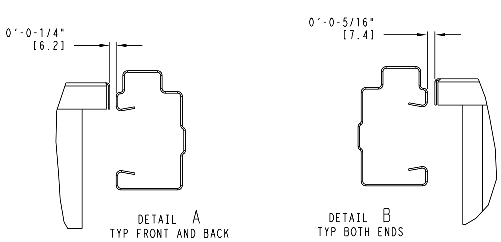
➡ DIRECTION OF AIR FLOW

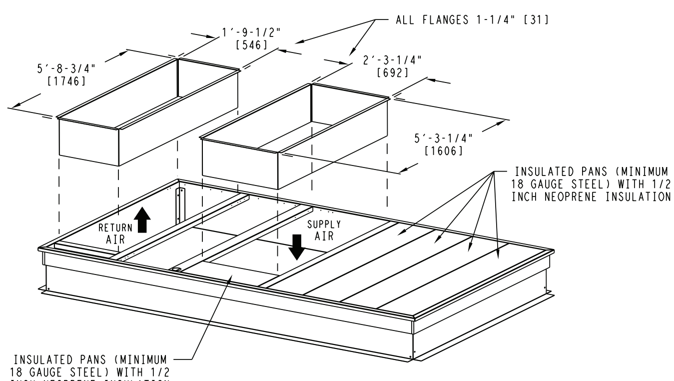


MAX CURB LEVELING TOLERANCES









Carrier

50FCQM17 Two Stage Cooling Capacities

50FCQM17				AMBIENT TEMPERATURE (°F)														
				85			95			105			115			125		
				EAT (db)			EAT (db)			EAT (db)			EAT (db)			EAT (db)		
				75	80	85	75	80	85	75	80	85	75	80	85	75	80	85
4500 cfm	EAT (wb)	58	TC	144.9	144.9	157.4	136.8	136.8	146.8	126.6	126.6	141.0	116.6	116.6	133.8	107.6	107.6	123.9
			SHC	121.1	139.2	157.4	112.7	129.8	146.8	106.4	123.7	141.0	99.5	116.6	133.8	91.3	107.6	123.9
		62	TC	154.0	154.0	154.0	143.9	143.9	143.9	133.2	133.2	135.7	122.6	122.6	129.3	111.6	111.6	122.6
			SHC	108.8	128.5	148.3	102.5	122.3	142.1	96.1	115.9	135.7	89.6	109.5	129.3	83.0	102.8	122.6
		67	TC	170.8	170.8	170.8	159.9	159.9	159.9	148.7	148.7	148.7	137.3	137.3	137.3	125.6	125.6	125.6
			SHC	89.5	108.7	127.9	83.2	102.7	122.1	76.9	96.5	116.1	70.5	90.2	109.9	64.2	84.0	103.8
		72	TC	189.7	189.7	189.7	178.0	178.0	178.0	166.2	166.2	166.2	154.1	154.1	154.1	141.5	141.5	141.5
			SHC	71.7	88.4	105.1	64.8	82.5	100.2	58.2	76.6	94.9	51.7	70.5	89.3	45.1	64.4	83.6
		76	TC	—	205.0	205.0	—	193.7	193.7	—	181.4	181.4	—	168.4	168.4	—	155.0	155.0
			SHC	—	73.7	98.5	—	65.8	90.6	—	58.9	83.6	—	53.3	78.0	—	47.8	72.5
5250 cfm	EAT (wb)	58	TC	153.3	153.3	166.4	142.2	142.2	161.8	133.2	133.2	152.0	123.9	123.9	141.9	114.4	114.4	131.5
			SHC	128.3	147.4	166.4	122.6	142.2	161.8	114.4	133.2	152.0	105.9	123.9	141.9	97.3	114.4	131.5
		62	TC	155.9	155.9	166.7	148.9	148.9	156.3	138.1	138.1	149.6	126.9	126.9	142.3	115.7	115.7	134.1
			SHC	121.0	143.9	166.7	111.1	133.7	156.3	104.5	127.1	149.6	97.6	119.9	142.3	90.2	112.2	134.1
		67	TC	176.2	176.2	176.2	165.0	165.0	165.0	153.4	153.4	153.4	141.6	141.6	141.6	129.4	129.4	129.4
			SHC	95.4	117.6	139.9	89.1	111.5	133.9	82.7	105.2	127.7	76.2	98.9	121.5	69.7	92.5	115.2
		72	TC	195.3	195.3	195.3	183.4	183.4	183.4	171.0	171.0	171.0	158.3	158.3	158.3	145.4	145.4	145.4
			SHC	73.8	94.6	115.4	67.3	88.6	109.9	60.8	82.5	104.2	54.3	76.3	98.4	47.7	70.0	92.3
		76	TC	—	212.2	212.2	—	199.4	199.4	—	186.1	186.1	—	172.6	172.6	—	159.0	159.0
			SHC	—	74.3	103.2	—	68.5	97.4	—	63.3	92.1	—	57.4	86.2	—	51.3	70.8
6000 cfm	EAT (wb)	58	TC	158.1	158.1	179.3	149.1	149.1	169.5	139.7	139.7	159.2	129.9	129.9	148.6	120.0	120.0	137.7
			SHC	136.9	158.1	179.3	128.7	149.1	169.5	120.1	139.7	159.2	111.3	129.9	148.6	102.2	120.0	137.7
		62	TC	163.9	163.9	175.8	152.9	152.9	168.8	142.0	142.0	161.4	132.7	132.7	150.7	122.4	122.4	139.4
			SHC	125.5	150.6	175.8	118.7	143.8	168.8	111.7	136.6	161.4	103.4	127.1	150.7	94.5	117.0	139.4
		67	TC	180.5	180.5	180.5	169.0	169.0	169.0	157.0	157.0	157.0	144.8	144.8	144.8	132.3	132.3	132.3
			SHC	100.7	125.8	150.8	94.4	119.6	144.8	88.0	113.3	138.6	81.4	106.8	132.2	74.8	100.3	125.7
		72	TC	199.7	199.7	199.7	187.3	187.3	187.3	174.6	174.6	174.6	161.6	161.6	161.6	148.3	148.3	148.3
			SHC	76.2	100.2	124.2	69.7	94.1	118.5	63.2	87.9	112.6	56.6	81.5	106.5	50.0	75.2	100.3
		76	TC	—	216.3	216.3	—	203.3	203.3	—	189.8	189.8	—	176.0	176.0	—	162.2	162.2
			SHC	—	78.3	111.3	—	72.6	105.6	—	66.7	86.8	—	60.5	82.6	—	54.5	77.9
6750 cfm	EAT (wb)	58	TC	164.4	164.4	186.3	155.0	155.0	176.0	145.2	145.2	165.3	135.1	135.1	154.3	124.8	124.8	143.1
			SHC	142.5	164.4	186.3	133.9	155.0	176.0	125.0	145.2	165.3	115.8	135.1	154.3	106.5	124.8	143.1
		62	TC	167.5	167.5	187.2	159.2	159.2	169.1	147.9	147.9	165.5	137.7	137.7	155.9	126.9	126.9	143.2
			SHC	132.4	159.8	187.2	120.4	144.8	169.1	115.3	140.4	165.5	107.3	131.6	155.9	97.6	120.4	143.2
		67	TC	184.1	184.1	184.1	161.3	161.3	170.0	159.9	159.9	159.9	147.4	147.4	147.4	134.7	134.7	135.7
			SHC	105.8	133.6	161.4	109.9	140.0	170.0	92.9	120.9	148.8	86.3	114.3	142.3	79.6	107.7	135.7
		72	TC	203.2	203.2	203.2	190.6	190.6	190.6	177.5	177.5	177.5	164.2	164.2	164.2	150.7	150.7	150.7
			SHC	78.4	105.4	132.4	72.0	99.2	126.5	65.4	92.9	120.4	58.8	86.5	114.3	52.1	80.1	108.0
		76	TC	—	219.9	219.9	—	206.5	206.5	—	192.8	192.8	—	179.0	179.0	—	164.7	164.7
			SHC	—	81.8	118.9	—	75.8	98.6	—	69.7	94.3	—	63.6	89.4	—	57.3	83.9
7500 cfm	EAT (wb)	58	TC	169.7	169.7	192.2	160.0	160.0	181.6	149.8	149.8	170.6	139.5	139.5	159.2	128.8	128.8	147.6
			SHC	147.2	169.7	192.2	138.3	160.0	181.6	129.1	149.8	170.6	119.7	139.5	159.2	110.1	128.8	147.6
		62	TC	172.7	172.7	194.8	163.2	163.2	183.6	153.2	153.2	169.9	142.1	142.1	158.8	128.9	128.9	154.0
			SHC	137.6	166.2	194.8	129.0	156.3	183.6	118.9	144.4	169.9	110.0	134.4	158.8	103.9	128.9	154.0
		67	TC	187.0	187.0	187.0	174.8	174.8	174.8	155.0	155.0	173.8	150.0	150.0	152.3	136.6	136.6	145.1
			SHC	110.7	141.0	171.4	104.2	134.6	165.1	110.2	142.0	173.8	91.1	121.7	152.3	84.1	114.6	145.1
		72	TC	206.1	206.1	206.1	193.2	193.2	193.2	179.9	179.9	179.9	166.4	166.4	166.4	152.7	152.7	152.7
			SHC	80.5	110.3	140.0	74.1	104.1	134.1	67.5	97.7	127.9	60.8	91.2	121.6	54.2	84.8	115.4
		76	TC	—	222.9	222.9	—	209.3	209.3	—	195.2	195.2	—	181.2	181.2	—	166.6	166.6
			SHC	—	84.8	110.3	—	78.6	105.4	—	72.5	100.5	—	66.4	95.3	—	60.0	89.6

LEGEND

— — Do Not Operate
cfm — Cubic Feet Per Minute (Supply Air)
EAT (db) — Entering Air Temperature (dry bulb)
EAT (wb) — Entering Air Temperature (wet bulb)
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

NOTE: See minimum-maximum airflow ratings on page 6.

50FCQM17 Single Stage Cooling Capacities

50FCQM17				AMBIENT TEMPERATURE (°F)														
				85			95			105			115			125		
				EAT (db)			EAT (db)			EAT (db)			EAT (db)			EAT (db)		
				75	80	85	75	80	85	75	80	85	75	80	85	75	80	85
2700 cfm	EAT (wb)	58	TC	91.8	91.8	101.9	85.4	85.4	95.1	78.0	78.0	89.8	71.3	71.3	82.8	64.5	64.5	75.4
			SHC	77.0	89.4	101.9	71.1	83.1	95.1	65.9	77.9	89.8	59.9	71.3	82.8	53.6	64.5	75.4
		62	TC	99.8	99.8	99.8	92.2	92.2	92.2	84.6	84.6	84.6	76.3	76.3	78.2	68.1	68.1	73.0
			SHC	68.0	80.7	93.4	62.9	75.7	88.4	57.9	70.7	83.4	52.7	65.4	78.2	47.4	60.2	73.0
		67	TC	111.8	111.8	111.8	103.7	103.7	103.7	95.3	95.3	95.3	86.8	86.8	86.8	78.1	78.1	78.1
			SHC	56.0	68.3	80.7	50.9	63.4	75.8	45.7	58.3	70.9	40.6	53.2	65.8	35.4	48.1	60.8
		72	TC	125.2	125.2	125.2	116.6	116.6	116.6	107.8	107.8	107.8	98.7	98.7	98.7	89.5	89.5	89.5
			SHC	45.2	55.8	66.5	39.6	50.9	62.3	34.2	46.0	57.7	28.9	40.9	53.0	23.5	35.8	48.1
		76	TC	—	136.3	136.3	—	127.5	127.5	—	118.7	118.7	—	109.3	109.3	—	99.4	99.4
			SHC	—	46.6	61.4	—	41.5	56.4	—	35.5	50.4	—	30.2	45.0	—	25.5	40.4
3150 cfm	EAT (wb)	58	TC	97.7	97.7	109.5	90.5	90.5	103.6	83.7	83.7	96.3	76.6	76.6	88.7	69.4	69.4	80.9
			SHC	82.9	96.2	109.5	77.3	90.5	103.6	71.1	83.7	96.3	64.6	76.6	88.7	58.0	69.4	80.9
		62	TC	104.0	104.0	104.0	96.1	96.1	98.3	87.9	87.9	93.0	79.6	79.6	87.7	71.0	71.0	82.0
			SHC	74.3	88.9	103.5	69.1	83.7	98.3	63.8	78.4	93.0	58.5	73.1	87.7	53.0	67.5	82.0
		67	TC	116.0	116.0	116.0	107.5	107.5	107.5	98.9	98.9	98.9	90.0	90.0	90.0	81.0	81.0	81.0
			SHC	60.2	74.5	88.9	55.0	69.5	83.9	49.8	64.3	78.8	44.5	59.1	73.7	39.3	53.9	68.5
		72	TC	129.6	129.6	129.6	120.7	120.7	120.7	111.5	111.5	111.5	102.1	102.1	102.1	92.5	92.5	92.5
			SHC	46.8	60.1	73.5	41.5	55.2	68.9	36.1	50.1	64.0	30.8	44.9	59.1	25.4	39.7	54.0
		76	TC	—	141.7	141.7	—	132.5	132.5	—	122.6	122.6	—	112.6	112.6	—	102.4	102.4
			SHC	—	48.1	65.4	—	42.6	60.0	—	38.0	55.3	—	33.1	50.4	—	28.0	40.2
3600 cfm	EAT (wb)	58	TC	102.5	102.5	116.7	95.6	95.6	109.3	88.5	88.5	101.6	81.1	81.1	93.6	73.6	73.6	85.5
			SHC	88.3	102.5	116.7	81.9	95.6	109.3	75.3	88.5	101.6	68.6	81.1	93.6	61.7	73.6	85.5
		62	TC	107.3	107.3	112.8	99.2	99.2	107.4	90.8	90.8	101.7	82.4	82.4	95.9	74.3	74.3	87.8
			SHC	79.9	96.4	112.8	74.7	91.0	107.4	69.2	85.5	101.7	63.6	79.7	95.9	57.0	72.4	87.8
		67	TC	119.3	119.3	119.3	110.7	110.7	110.7	101.8	101.8	101.8	92.6	92.6	92.6	83.4	83.4	83.4
			SHC	64.1	80.4	96.6	58.9	75.2	91.5	53.6	70.0	86.4	48.3	64.7	81.1	42.9	59.4	75.9
		72	TC	133.1	133.1	133.1	123.9	123.9	123.9	114.4	114.4	114.4	104.7	104.7	104.7	94.8	94.8	94.8
			SHC	48.6	64.1	79.7	43.2	59.0	74.8	37.9	53.9	69.9	32.5	48.6	64.8	27.1	43.3	59.6
		76	TC	—	145.4	145.4	—	135.6	135.6	—	125.5	125.5	—	115.3	115.3	—	105.0	105.0
			SHC	—	50.2	70.0	—	45.5	65.3	—	40.5	60.3	—	35.4	49.5	—	30.3	45.3
4050 cfm	EAT (wb)	58	TC	107.1	107.1	121.9	100.0	100.0	114.1	92.6	92.6	106.2	84.9	84.9	97.9	77.1	77.1	89.4
			SHC	92.4	107.1	121.9	85.8	100.0	114.1	79.0	92.6	106.2	72.0	84.9	97.9	64.8	77.1	89.4
		62	TC	109.8	109.8	120.9	101.9	101.9	115.5	93.6	93.6	108.8	85.2	85.2	101.9	77.7	77.7	92.2
			SHC	84.9	102.9	120.9	79.6	97.6	115.5	73.6	91.2	108.8	67.5	84.7	101.9	60.1	76.2	92.2
		67	TC	122.1	122.1	122.1	113.2	113.2	113.2	104.1	104.1	104.1	94.7	94.7	94.7	85.3	85.3	85.3
			SHC	67.7	85.9	104.0	62.5	80.6	98.8	57.2	75.4	93.6	51.8	70.0	88.2	46.4	64.7	83.0
		72	TC	135.9	135.9	135.9	126.5	126.5	126.5	116.8	116.8	116.8	106.9	106.9	106.9	96.8	96.8	96.8
			SHC	50.2	67.8	85.4	44.9	62.6	80.4	39.6	57.4	75.3	34.2	52.2	70.2	28.7	46.8	65.0
		76	TC	—	148.1	148.1	—	138.2	138.2	—	127.9	127.9	—	117.6	117.6	—	106.9	106.9
			SHC	—	52.8	75.1	—	47.9	62.4	—	42.8	58.6	—	37.6	54.3	—	32.3	49.6
4500 cfm	EAT (wb)	58	TC	111.1	111.1	126.3	103.8	103.8	118.4	96.1	96.1	110.0	88.2	88.2	101.6	80.2	80.2	92.9
			SHC	96.0	111.1	126.3	89.2	103.8	118.4	82.1	96.1	110.0	74.9	88.2	101.6	67.6	80.2	92.9
		62	TC	112.7	112.7	128.6	105.0	105.0	120.8	97.3	97.3	112.3	89.2	89.2	104.2	80.3	80.3	97.2
			SHC	89.7	109.1	128.6	83.3	102.1	120.8	76.4	94.3	112.3	69.7	87.0	104.2	63.4	80.3	97.2
		67	TC	124.3	124.3	124.3	115.3	115.3	115.3	106.0	106.0	106.0	96.4	96.4	96.4	86.6	86.6	89.4
			SHC	71.2	91.1	111.0	65.9	85.8	105.8	60.5	80.5	100.4	55.1	75.1	95.0	49.5	69.5	89.4
		72	TC	138.2	138.2	138.2	128.6	128.6	128.6	118.7	118.7	118.7	108.6	108.6	108.6	98.3	98.3	98.3
			SHC	51.8	71.3	90.7	46.5	66.1	85.7	41.1	60.8	80.5	35.7	55.5	75.3	30.2	50.1	70.0
		76	TC	—	150.5	150.5	—	140.4	140.4	—	130.0	130.0	—	119.3	119.3	—	108.5	108.5
			SHC	—	55.0	71.5	—	49.9	67.5	—	44.8	63.1	—	39.5	58.4	—	34.2	53.4

LEGEND

— — Do Not Operate
cfm — Cubic Feet Per Minute (Supply Air)
EAT (db) — Entering Air Temperature (dry bulb)
EAT (wb) — Entering Air Temperature (wet bulb)
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

NOTE: See minimum-maximum airflow ratings on page 6.

50FCQM24 Two Stage Cooling Capacities

50FCQM24				AMBIENT TEMPERATURE (°F)														
				85			95			105			115			125		
				EAT (db)			EAT (db)			EAT (db)			EAT (db)			EAT (db)		
				75	80	85	75	80	85	75	80	85	75	80	85	75	80	85
6000 cfm	EAT (wb)	58	TC	205.6	205.6	233.9	193.7	193.7	221.0	181.2	181.2	207.3	168.1	168.1	193.1	154.2	154.2	177.9
			SHC	177.3	205.6	233.9	166.5	193.7	221.0	155.0	181.2	207.3	143.1	168.1	193.1	130.5	154.2	177.9
		62	TC	217.8	217.8	222.3	203.5	203.5	213.4	188.3	188.3	204.1	172.4	172.4	194.4	155.9	155.9	184.2
			SHC	159.7	191.0	222.3	150.7	182.0	213.4	141.5	172.8	204.1	132.0	163.2	194.4	122.0	153.1	184.2
		67	TC	242.0	242.0	242.0	226.8	226.8	226.8	210.6	210.6	210.6	193.8	193.8	193.8	176.1	176.1	176.1
			SHC	130.2	161.6	193.0	121.3	152.7	184.1	112.1	143.5	174.9	102.7	134.1	165.5	93.1	124.4	155.8
		72	TC	268.3	268.3	268.3	252.0	252.0	252.0	234.9	234.9	234.9	216.9	216.9	216.9	198.0	198.0	198.0
			SHC	100.2	131.5	162.8	91.4	122.6	153.9	82.2	113.5	144.8	72.9	104.1	135.4	63.2	94.5	125.7
		76	TC	—	290.5	290.5	—	273.4	273.4	—	255.3	255.3	—	236.4	236.4	—	—	—
			SHC	—	106.9	137.1	—	98.1	128.5	—	89.0	119.5	—	79.6	110.2	—	—	—
7000 cfm	EAT (wb)	58	TC	218.8	218.8	248.6	206.2	206.2	234.9	192.9	192.9	220.4	178.9	178.9	205.1	164.5	164.5	189.4
			SHC	189.0	218.8	248.6	177.5	206.2	234.9	165.5	192.9	220.4	152.7	178.9	205.1	139.6	164.5	189.4
		62	TC	225.7	225.7	246.3	210.7	210.7	236.9	195.0	195.0	226.9	181.8	181.8	207.7	168.8	168.8	185.7
			SHC	174.1	210.2	246.3	164.9	200.9	236.9	155.2	191.1	226.9	141.3	174.5	207.7	125.9	155.8	185.7
		67	TC	250.0	250.0	250.0	234.1	234.1	234.1	217.3	217.3	217.3	199.8	199.8	199.8	181.4	181.4	181.4
			SHC	139.6	175.9	212.2	130.6	166.8	203.1	121.3	157.5	193.7	111.7	147.9	184.1	101.9	138.1	174.3
		72	TC	276.5	276.5	276.5	259.6	259.6	259.6	241.7	241.7	241.7	223.0	223.0	223.0	203.4	203.4	203.4
			SHC	104.4	140.5	176.7	95.4	131.5	167.6	86.1	122.2	158.4	76.6	112.7	148.8	66.9	103.0	139.1
		76	TC	—	299.0	299.0	—	281.1	281.1	—	262.3	262.3	—	242.7	242.7	—	—	—
			SHC	—	111.7	146.9	—	102.7	138.0	—	93.5	128.8	—	84.0	119.4	—	—	—
8000 cfm	EAT (wb)	58	TC	229.8	229.8	260.8	216.6	216.6	246.4	202.7	202.7	231.3	188.1	188.1	215.3	172.8	172.8	198.6
			SHC	198.8	229.8	260.8	186.7	216.6	246.4	174.1	202.7	231.3	160.9	188.1	215.3	147.0	172.8	198.6
		62	TC	232.0	232.0	268.1	220.6	220.6	245.6	202.9	202.9	241.1	188.3	188.3	224.7	172.6	172.6	207.0
			SHC	187.2	227.7	268.1	171.9	208.7	245.6	164.7	202.9	241.1	151.9	188.3	224.7	138.2	172.6	207.0
		67	TC	256.1	256.1	256.1	239.7	239.7	239.7	222.3	222.3	222.3	204.3	204.3	204.3	185.4	185.4	192.0
			SHC	148.4	189.4	230.4	139.3	180.2	221.2	129.8	170.8	211.7	120.2	161.1	202.0	110.3	151.2	192.0
		72	TC	282.8	282.8	282.8	265.3	265.3	265.3	246.9	246.9	246.9	227.7	227.7	227.7	207.5	207.5	207.5
			SHC	108.1	148.9	189.8	99.0	139.8	180.6	89.6	130.4	171.2	80.0	120.8	161.6	70.1	110.9	151.7
		76	TC	—	305.3	305.3	—	286.9	286.9	—	267.6	267.6	—	247.4	247.4	—	—	—
			SHC	—	115.9	155.8	—	106.8	146.7	—	97.5	137.5	—	87.9	128.0	—	—	—
9000 cfm	EAT (wb)	58	TC	239.2	239.2	271.2	225.4	225.4	256.2	211.4	211.4	241.0	195.8	195.8	223.9	179.8	179.8	206.4
			SHC	207.1	239.2	271.2	194.5	225.4	256.2	181.8	211.4	241.0	167.7	195.8	223.9	153.2	179.8	206.4
		62	TC	242.8	242.8	271.2	225.6	225.6	266.8	211.1	211.1	250.5	196.0	196.0	233.6	180.0	180.0	215.5
			SHC	191.4	231.3	271.2	184.4	225.6	266.8	171.7	211.1	250.5	158.5	196.0	233.6	144.5	180.0	215.5
		67	TC	261.0	261.0	261.0	244.1	244.1	244.1	226.3	226.3	229.1	207.9	207.9	219.3	188.5	188.5	209.2
			SHC	156.7	202.4	248.0	147.5	193.1	238.7	138.0	183.6	229.1	128.3	173.8	219.3	118.4	163.8	209.2
		72	TC	287.7	287.7	287.7	269.8	269.8	269.8	251.0	251.0	251.0	231.2	231.2	231.2	210.6	210.6	210.6
			SHC	111.3	156.8	202.2	102.2	147.6	193.1	92.7	138.2	183.6	83.0	128.5	173.9	73.1	118.5	163.9
		76	TC	—	310.4	310.4	—	291.5	291.5	—	271.7	271.7	—	251.1	251.1	—	—	—
			SHC	—	119.8	164.2	—	110.6	155.1	—	101.1	145.7	—	91.5	136.0	—	—	—
1000 0 cfm	EAT (wb)	58	TC	247.1	247.1	280.1	232.9	232.9	264.5	217.9	217.9	248.2	202.3	202.3	231.1	185.7	185.7	212.9
			SHC	214.1	247.1	280.1	201.2	232.9	264.5	187.6	217.9	248.2	173.4	202.3	231.1	158.5	185.7	212.9
		62	TC	247.4	247.4	291.4	233.1	233.1	275.5	218.2	218.2	258.7	202.5	202.5	241.0	185.9	185.9	222.3
			SHC	203.3	247.4	291.4	190.8	233.1	275.5	177.7	218.2	258.7	164.0	202.5	241.0	149.5	185.9	222.3
		67	TC	264.9	264.9	265.1	247.7	247.7	255.7	229.6	229.6	246.0	210.8	210.8	236.0	191.1	191.1	225.8
			SHC	164.8	214.9	265.1	155.5	205.6	255.7	145.9	196.0	246.0	136.2	186.1	236.0	126.2	176.0	225.8
		72	TC	291.7	291.7	291.7	273.3	273.3	273.3	254.1	254.1	254.1	234.1	234.1	234.1	—	—	—
			SHC	114.3	164.4	214.4	105.1	155.1	205.1	95.6	145.6	195.5	85.9	135.8	185.8	—	—	—
		76	TC	—	314.5	314.5	—	295.3	295.3	—	275.0	275.0	—	254.0	254.0	—	—	—
			SHC	—	123.2	172.1	—	114.0	163.0	—	104.5	153.5	—	94.8	143.8	—	—	—

LEGEND

— — Do Not Operate
cfm — Cubic Feet Per Minute (Supply Air)
EAT (db) — Entering Air Temperature (dry bulb)
EAT (wb) — Entering Air Temperature (wet bulb)
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

NOTE: See minimum-maximum airflow ratings on page 6.

50FCQM24 Single Stage Cooling Capacities

50FCQM24				AMBIENT TEMPERATURE (°F)														
				85			95			105			115			125		
				EAT (db)			EAT (db)			EAT (db)			EAT (db)			EAT (db)		
				75	80	85	75	80	85	75	80	85	75	80	85	75	80	85
3600 cfm	EAT (wb)	58	TC	118.1	118.1	146.7	109.6	109.6	137.2	100.6	100.6	127.2	91.3	91.3	116.6	81.4	81.4	105.4
			SHC	89.5	118.1	146.7	82.0	109.6	137.2	74.1	100.6	127.2	65.9	91.3	116.6	57.4	81.4	105.4
		62	TC	125.5	125.5	142.3	115.2	115.2	135.3	104.4	104.4	128.1	93.5	93.5	120.8	81.9	81.9	112.9
			SHC	78.2	110.3	142.3	71.2	103.3	135.3	64.1	96.1	128.1	56.9	88.9	120.8	49.4	81.1	112.9
		67	TC	141.1	141.1	141.1	130.5	130.5	130.5	119.3	119.3	119.3	107.6	107.6	107.6	95.1	95.1	96.8
			SHC	61.3	93.4	125.6	54.4	86.5	118.6	47.3	79.5	111.6	40.1	72.2	104.3	32.7	64.8	96.8
		72	TC	158.4	158.4	158.4	147.2	147.2	147.2	135.4	135.4	135.4	123.0	123.0	123.0	109.8	109.8	109.8
			SHC	44.1	76.2	108.3	37.3	69.3	101.4	30.3	62.3	94.4	23.1	55.1	87.1	15.7	47.7	79.7
		76	TC	—	173.4	173.4	—	161.6	161.6	—	149.2	149.2	—	136.1	136.1	—	122.3	122.3
			SHC	—	62.2	93.4	—	55.4	86.6	—	48.4	79.7	—	41.1	72.6	—	33.7	65.2
4200 cfm	EAT (wb)	58	TC	126.8	126.8	157.0	117.8	117.8	146.9	131.6	131.6	150.9	98.5	98.5	125.1	88.0	88.0	113.2
			SHC	96.7	126.8	157.0	88.7	117.8	146.9	112.4	131.6	150.9	71.9	98.5	125.1	62.8	88.0	113.2
		62	TC	130.5	130.5	159.6	120.1	120.1	152.4	109.1	109.1	144.7	98.6	98.6	134.2	88.2	88.2	121.9
			SHC	85.4	122.5	159.6	78.4	115.4	152.4	71.1	107.9	144.7	63.0	98.6	134.2	54.5	88.2	121.9
		67	TC	146.5	146.5	146.5	135.3	135.3	135.3	123.7	123.7	125.7	111.4	111.4	118.3	98.5	98.5	110.7
			SHC	65.5	102.7	139.9	58.4	95.6	132.9	51.3	88.5	125.7	43.9	81.1	118.3	36.3	73.5	110.7
		72	TC	164.1	164.1	164.1	152.3	152.3	152.3	140.0	140.0	140.0	127.0	127.0	127.0	113.4	113.4	113.4
			SHC	45.2	82.4	119.6	38.2	75.4	112.5	31.1	68.2	105.3	23.7	60.8	97.9	16.2	53.3	90.4
		76	TC	—	179.2	179.2	—	166.8	166.8	—	153.9	153.9	—	140.3	140.3	—	125.9	125.9
			SHC	—	65.8	102.1	—	58.8	95.2	—	51.7	88.1	—	44.3	80.7	—	36.8	73.2
4800 cfm	EAT (wb)	58	TC	134.1	134.1	165.6	124.8	124.8	155.2	137.0	137.0	156.8	104.5	104.5	132.2	112.2	112.2	129.9
			SHC	102.6	134.1	165.6	94.5	124.8	155.2	117.2	137.0	156.8	76.8	104.5	132.2	94.5	112.2	129.9
		62	TC	134.8	134.8	175.4	124.9	124.9	165.4	115.0	115.0	153.8	104.6	104.6	141.6	93.7	93.7	128.7
			SHC	92.1	133.7	175.4	84.4	124.9	165.4	76.2	115.0	153.8	67.7	104.6	141.6	58.7	93.7	128.7
		67	TC	150.5	150.5	153.8	139.0	139.0	146.6	127.0	127.0	139.3	114.4	114.4	131.8	101.2	101.2	124.0
			SHC	69.3	111.5	153.8	62.2	104.4	146.6	54.9	97.1	139.3	47.4	89.6	131.8	39.8	81.9	124.0
		72	TC	168.3	168.3	168.3	156.1	156.1	156.1	143.4	143.4	143.4	130.0	130.0	130.0	116.0	116.0	116.0
			SHC	45.9	88.2	130.4	38.8	81.0	123.2	31.6	73.7	115.9	24.1	66.2	108.4	16.5	58.6	100.7
		76	TC	—	183.6	183.6	—	170.8	170.8	—	157.5	157.5	—	143.4	143.4	—	128.6	128.6
			SHC	—	69.0	110.3	—	61.9	103.2	—	54.6	95.9	—	47.2	88.5	—	39.5	80.8
5400 cfm	EAT (wb)	58	TC	140.3	140.3	172.9	130.6	130.6	161.9	120.3	120.3	150.4	109.6	109.6	138.2	98.2	98.2	125.2
			SHC	107.7	140.3	172.9	99.2	130.6	161.9	90.3	120.3	150.4	81.0	109.6	138.2	71.2	98.2	125.2
		62	TC	140.5	140.5	184.0	130.7	130.7	172.6	120.5	120.5	160.6	109.7	109.7	147.9	98.4	98.4	134.4
			SHC	97.0	140.5	184.0	88.8	130.7	172.6	80.4	120.5	160.6	71.5	109.7	147.9	62.3	98.4	134.4
		67	TC	153.7	153.7	167.2	142.0	142.0	160.0	129.7	129.7	152.6	116.7	116.7	144.9	103.3	103.3	137.0
			SHC	72.8	120.0	167.2	65.6	112.8	160.0	58.3	105.4	152.6	50.7	97.8	144.9	43.0	90.0	137.0
		72	TC	171.6	171.6	171.6	159.1	159.1	159.1	146.2	146.2	146.2	132.5	132.5	132.5	118.1	118.1	118.1
			SHC	46.4	93.6	140.8	39.2	86.4	133.5	31.9	79.0	126.1	24.4	71.4	118.5	16.7	63.7	110.7
		76	TC	—	187.0	187.0	—	174.0	174.0	—	160.3	160.3	—	145.9	145.9	—	130.8	130.8
			SHC	—	71.9	118.1	—	64.7	110.9	—	57.4	103.5	—	49.8	95.9	—	42.0	88.0
6000 cfm	EAT (wb)	58	TC	145.7	145.7	179.3	135.7	135.7	168.0	125.1	125.1	155.9	113.9	113.9	143.3	102.2	102.2	130.0
			SHC	112.2	145.7	179.3	103.4	135.7	168.0	94.2	125.1	155.9	84.6	113.9	143.3	74.5	102.2	130.0
		62	TC	145.9	145.9	190.7	135.8	135.8	178.9	125.2	125.2	166.5	114.1	114.1	153.3	102.4	102.4	139.4
			SHC	101.1	145.9	190.7	92.7	135.8	178.9	83.9	125.2	166.5	74.8	114.1	153.3	65.3	102.4	139.4
		67	TC	156.4	156.4	180.3	144.4	144.4	173.0	131.9	131.9	165.5	118.6	118.6	157.7	105.0	105.0	149.5
			SHC	76.2	128.3	180.3	69.0	121.0	173.0	61.6	113.5	165.5	53.9	105.8	157.7	46.1	97.8	149.5
		72	TC	174.4	174.4	174.4	161.6	161.6	161.6	148.4	148.4	148.4	134.5	134.5	134.5	119.8	119.8	120.5
			SHC	46.7	98.8	150.8	39.5	91.5	143.5	32.1	84.1	136.1	24.5	76.4	128.4	16.8	68.6	120.5
		76	TC	—	189.8	189.8	—	176.5	176.5	—	162.5	162.5	—	147.9	147.9	—	132.4	132.4
			SHC	—	74.6	125.6	—	67.4	118.3	—	59.9	110.8	—	52.3	103.0	—	44.4	95.0

LEGEND

— — Do Not Operate
cfm — Cubic Feet Per Minute (Supply Air)
EAT (db) — Entering Air Temperature (dry bulb)
EAT (wb) — Entering Air Temperature (wet bulb)
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

NOTE: See minimum-maximum airflow ratings on page 6.

50FCQM28 Two Stage Cooling Capacities

50FCQM28				AMBIENT TEMPERATURE (°F)														
				85			95			105			115			125		
				EAT (db)			EAT (db)			EAT (db)			EAT (db)			EAT (db)		
				75	80	85	75	80	85	75	80	85	75	80	85	75	80	85
7500 cfm	EAT (wb)	58	TC	253.6	253.6	277.3	237.2	237.2	269.7	222.7	222.7	253.8	207.4	207.4	237.1	191.5	191.5	219.6
			SHC	213.5	245.4	277.3	204.7	237.2	269.7	191.6	222.7	253.8	177.8	207.4	237.1	163.4	191.5	219.6
		62	TC	266.7	266.7	266.7	249.6	249.6	256.9	231.9	231.9	246.8	213.3	213.3	236.0	194.0	194.0	224.0
			SHC	194.1	230.4	266.7	184.1	220.5	256.9	174.0	210.4	246.8	163.3	199.6	236.0	151.9	188.0	224.0
		67	TC	294.5	294.5	294.5	276.2	276.2	276.2	256.7	256.7	256.7	236.9	236.9	236.9	216.4	216.4	216.4
			SHC	158.7	194.6	230.6	148.7	184.8	220.9	138.3	174.6	210.9	128.0	164.3	200.7	117.4	153.8	190.3
		72	TC	325.2	325.2	325.2	305.0	305.0	305.0	284.2	284.2	284.2	262.7	262.7	262.7	—	—	—
			SHC	123.5	158.0	192.4	113.1	148.1	183.1	102.7	138.1	173.5	92.1	127.9	163.7	—	—	—
		76	TC	—	351.7	351.7	—	330.5	330.5	—	308.0	308.0	—	285.1	285.1	—	—	—
			SHC	—	127.6	168.9	—	117.5	158.8	—	108.4	136.2	—	98.5	131.8	—	—	—
8750 cfm	EAT (wb)	58	TC	265.6	265.6	301.1	251.0	251.0	285.1	235.5	235.5	268.1	219.3	219.3	250.4	202.5	202.5	231.8
			SHC	230.2	265.6	301.1	216.9	251.0	285.1	202.9	235.5	268.1	188.3	219.3	250.4	173.2	202.5	231.8
		62	TC	275.4	275.4	293.9	257.3	257.3	282.7	243.3	243.3	274.8	221.8	221.8	255.0	202.7	202.7	241.9
			SHC	210.3	252.1	293.9	199.5	241.1	282.7	192.5	233.6	274.8	175.4	215.2	255.0	163.5	202.7	241.9
		67	TC	303.2	303.2	303.2	284.0	284.0	284.0	264.1	264.1	264.1	243.4	243.4	243.4	222.1	222.1	222.1
			SHC	168.8	210.3	251.8	158.7	200.3	241.9	148.4	190.1	231.8	137.8	179.6	221.4	127.1	169.0	210.8
		72	TC	333.6	333.6	333.6	312.7	312.7	312.7	291.3	291.3	291.3	269.2	269.2	269.2	—	—	—
			SHC	127.4	167.8	208.2	117.0	157.8	198.6	106.6	147.7	188.7	96.0	137.3	178.6	—	—	—
		76	TC	—	360.2	360.2	—	337.9	337.9	—	314.9	314.9	—	291.0	291.0	—	—	—
			SHC	—	133.1	181.3	—	123.5	160.1	—	113.6	152.3	—	103.3	143.3	—	—	—
10000 cfm	EAT (wb)	58	TC	277.9	277.9	314.8	262.4	262.4	297.8	246.0	246.0	279.8	229.1	229.1	261.2	211.3	211.3	241.7
			SHC	241.0	277.9	314.8	227.0	262.4	297.8	212.2	246.0	279.8	197.0	229.1	261.2	181.0	211.3	241.7
		62	TC	282.9	282.9	317.3	264.4	264.4	304.7	253.8	253.8	273.2	234.1	234.1	258.2	212.5	212.5	250.5
			SHC	224.5	270.9	317.3	212.9	258.8	304.7	193.0	233.1	273.2	180.0	219.1	258.2	170.4	210.4	250.5
		67	TC	310.2	310.2	310.2	290.2	290.2	290.2	269.8	269.8	269.8	248.5	248.5	248.5	—	—	—
			SHC	178.4	225.2	272.0	168.1	215.0	261.9	157.7	204.7	251.7	147.1	194.1	241.1	—	—	—
		72	TC	340.4	340.4	340.4	319.0	319.0	319.0	296.9	296.9	296.9	274.2	274.2	274.2	—	—	—
			SHC	131.1	177.0	223.0	120.7	166.9	213.1	110.2	156.6	203.0	99.5	146.1	192.7	—	—	—
		76	TC	—	366.8	366.8	—	343.9	343.9	—	320.0	320.0	—	295.7	295.7	—	—	—
			SHC	—	138.1	180.3	—	128.2	172.1	—	117.9	162.9	—	107.5	153.3	—	—	—
11250 cfm	EAT (wb)	58	TC	288.0	288.0	326.0	271.8	271.8	308.2	254.8	254.8	289.6	237.1	237.1	270.1	219.0	219.0	250.2
			SHC	249.9	288.0	326.0	235.3	271.8	308.2	220.0	254.8	289.6	204.1	237.1	270.1	187.8	219.0	250.2
		62	TC	289.6	289.6	334.9	274.7	274.7	312.9	259.0	259.0	289.6	238.2	238.2	279.2	219.1	219.1	260.8
			SHC	235.5	285.2	334.9	219.7	266.3	312.9	203.0	246.3	289.6	192.2	235.7	279.2	177.4	219.1	260.8
		67	TC	315.7	315.7	315.7	295.2	295.2	295.2	274.1	274.1	274.1	252.4	252.4	260.1	—	—	—
			SHC	187.5	239.5	291.5	177.2	229.2	281.3	166.6	218.7	270.8	156.0	208.0	260.1	—	—	—
		72	TC	345.8	345.8	345.8	323.9	323.9	323.9	301.4	301.4	301.4	278.1	278.1	278.1	—	—	—
			SHC	134.4	185.6	236.8	123.9	175.4	226.8	113.4	165.0	216.6	102.7	154.4	206.2	—	—	—
		76	TC	—	372.3	372.3	—	348.6	348.6	—	324.0	324.0	—	299.3	299.3	—	—	—
			SHC	—	142.3	191.1	—	132.2	182.0	—	121.7	172.3	—	111.2	162.4	—	—	—
12500 cfm	EAT (wb)	58	TC	296.7	296.7	335.7	279.8	279.8	317.2	262.4	262.4	298.1	244.3	244.3	278.1	—	—	—
			SHC	257.6	296.7	335.7	242.4	279.8	317.2	226.8	262.4	298.1	210.4	244.3	278.1	—	—	—
		62	TC	301.5	301.5	334.8	282.2	282.2	323.6	263.8	263.8	307.4	244.4	244.4	289.6	—	—	—
			SHC	238.1	286.5	334.8	227.1	275.4	323.6	213.7	260.5	307.4	199.2	244.4	289.6	—	—	—
		67	TC	320.2	320.2	320.2	299.3	299.3	299.9	277.8	277.8	289.3	255.7	255.7	278.3	—	—	—
			SHC	196.3	253.2	310.2	185.9	242.9	299.9	175.3	232.3	289.3	164.5	221.4	278.3	—	—	—
		72	TC	350.3	350.3	350.3	328.2	328.2	328.2	305.0	305.0	305.0	281.3	281.3	281.3	—	—	—
			SHC	137.4	193.7	250.1	127.0	183.5	240.0	116.3	173.0	229.6	105.6	162.3	219.1	—	—	—
		76	TC	—	376.4	376.4	—	352.2	352.2	—	327.5	327.5	—	302.6	302.6	—	—	—
			SHC	—	146.1	200.6	—	135.7	191.0	—	125.2	181.1	—	114.7	170.9	—	—	—

LEGEND

— — Do Not Operate
cfm — Cubic Feet Per Minute (Supply Air)
EAT (db) — Entering Air Temperature (dry bulb)
EAT (wb) — Entering Air Temperature (wet bulb)
SHC — Sensible Heat Capacity (1000 Btuh) Gross
TC — Total Capacity (1000 Btuh) Gross

NOTE: See minimum-maximum airflow ratings on page 6.

Performance data (cont)

50FCQM28 Single Stage Cooling Capacities

50FCQM28				AMBIENT TEMPERATURE (°F)														
				85			95			105			115			125		
				EAT (db)			EAT (db)			EAT (db)			EAT (db)			EAT (db)		
				75	80	85	75	80	85	75	80	85	75	80	85	75	80	85
4500 cfm	EAT (wb)	58	TC	147.5	147.5	168.2	137.8	137.8	157.8	128.0	128.0	147.1	117.5	117.5	135.8	106.3	106.3	123.7
			SHC	126.7	147.5	168.2	117.9	137.8	157.8	108.8	128.0	147.1	99.1	117.5	135.8	88.9	106.3	123.7
		62	TC	156.5	156.5	160.3	145.0	145.0	152.9	133.1	133.1	145.3	120.4	120.4	137.2	107.2	107.2	128.4
			SHC	114.2	137.2	160.3	106.7	129.8	152.9	99.2	122.2	145.3	91.2	114.2	137.2	82.8	105.6	128.4
		67	TC	175.1	175.1	175.1	162.7	162.7	162.7	149.9	149.9	149.9	136.4	136.4	136.4	122.3	122.3	122.3
			SHC	93.0	115.8	138.7	85.5	108.4	131.3	77.9	100.9	123.8	70.1	93.1	116.1	62.1	85.1	108.2
		72	TC	195.4	195.4	195.4	182.2	182.2	182.2	168.4	168.4	168.4	154.0	154.0	154.0	138.7	138.7	138.7
			SHC	71.9	94.1	116.2	64.4	86.7	109.1	56.6	79.1	101.6	48.7	71.4	94.0	40.6	63.4	86.2
		76	TC	—	213.2	213.2	—	199.0	199.0	—	184.2	184.2	—	169.0	169.0	—	153.4	153.4
			SHC	—	75.5	100.2	—	68.6	93.4	—	61.2	80.3	—	53.7	74.4	—	46.0	67.6
5250 cfm	EAT (wb)	58	TC	157.4	157.4	179.2	147.3	147.3	168.3	136.7	136.7	156.9	125.5	125.5	144.7	113.7	113.7	131.9
			SHC	135.6	157.4	179.2	126.2	147.3	168.3	116.6	136.7	156.9	106.3	125.5	144.7	95.5	113.7	131.9
		62	TC	162.4	162.4	178.0	150.4	150.4	170.2	138.0	138.0	161.6	125.7	125.7	151.4	113.9	113.9	138.2
			SHC	124.9	151.4	178.0	117.2	143.7	170.2	109.0	135.3	161.6	100.0	125.7	151.4	89.6	113.9	138.2
		67	TC	181.1	181.1	181.1	168.2	168.2	168.2	154.9	154.9	154.9	140.8	140.8	140.8	126.1	126.1	126.1
			SHC	100.1	126.6	153.1	92.5	119.1	145.6	84.8	111.4	138.0	76.8	103.4	130.0	68.7	95.4	122.0
		72	TC	201.9	201.9	201.9	188.1	188.1	188.1	173.8	173.8	173.8	158.7	158.7	158.7	142.9	142.9	142.9
			SHC	75.3	101.2	127.1	67.6	93.7	119.8	59.8	86.0	112.2	51.8	78.1	104.4	43.5	69.9	96.4
		76	TC	—	219.7	219.7	—	204.9	204.9	—	189.7	189.7	—	173.7	173.7	—	157.3	157.3
			SHC	—	80.3	102.0	—	72.8	96.4	—	65.2	89.7	—	57.4	82.5	—	49.4	75.0
6000 cfm	EAT (wb)	58	TC	165.8	165.8	188.5	155.1	155.1	176.9	144.0	144.0	164.9	132.3	132.3	152.2	119.8	119.8	138.6
			SHC	143.0	165.8	188.5	133.2	155.1	176.9	123.0	144.0	164.9	112.3	132.3	152.2	101.0	119.8	138.6
		62	TC	167.2	167.2	193.6	156.9	156.9	180.9	145.2	145.2	169.4	133.0	133.0	159.8	120.3	120.3	145.5
			SHC	134.4	164.0	193.6	124.5	152.7	180.9	115.0	142.2	169.4	106.3	133.0	159.8	95.1	120.3	145.5
		67	TC	185.9	185.9	185.9	172.6	172.6	172.6	158.7	158.7	158.7	144.2	144.2	144.2	128.9	128.9	135.2
			SHC	106.9	136.9	166.9	99.2	129.2	159.3	91.3	121.4	151.4	83.3	113.5	143.7	74.9	105.0	135.2
		72	TC	206.8	206.8	206.8	192.5	192.5	192.5	177.7	177.7	177.7	162.4	162.4	162.4	145.7	145.7	145.7
			SHC	78.2	107.8	137.3	70.5	100.2	129.8	62.6	92.3	122.1	54.5	84.3	114.2	46.1	76.0	106.0
		76	TC	—	224.6	224.6	—	209.6	209.6	—	193.8	193.8	—	177.4	177.4	—	160.4	160.4
			SHC	—	84.0	111.2	—	76.5	104.4	—	68.7	97.2	—	60.7	89.6	—	52.6	81.8
6750 cfm	EAT (wb)	58	TC	172.9	172.9	196.4	161.8	161.8	184.4	150.2	150.2	171.8	137.9	137.9	158.5	125.0	125.0	144.4
			SHC	149.3	172.9	196.4	139.2	161.8	184.4	128.6	150.2	171.8	117.4	137.9	158.5	105.6	125.0	144.4
		62	TC	173.2	173.2	203.8	162.0	162.0	191.7	150.4	150.4	179.2	138.2	138.2	165.7	125.2	125.2	151.1
			SHC	141.3	172.5	203.8	131.5	161.6	191.7	121.5	150.4	179.2	110.8	138.2	165.7	99.2	125.2	151.1
		67	TC	189.7	189.7	189.7	176.0	176.0	176.0	161.7	161.7	164.5	146.8	146.8	156.3	131.2	131.2	148.0
			SHC	113.3	146.7	180.2	105.4	139.0	172.5	97.5	131.0	164.5	89.3	122.8	156.3	81.0	114.5	148.0
		72	TC	210.8	210.8	210.8	195.9	195.9	195.9	180.9	180.9	180.9	164.9	164.9	164.9	148.2	148.2	148.2
			SHC	81.0	114.0	147.0	73.1	106.2	139.4	65.1	98.3	131.6	56.9	90.3	123.6	48.5	81.9	115.3
		76	TC	—	229.0	229.0	—	213.4	213.4	—	197.2	197.2	—	180.6	180.6	—	162.9	162.9
			SHC	—	87.5	118.9	—	79.8	111.6	—	71.9	104.1	—	63.9	96.4	—	55.5	88.3
7500 cfm	EAT (wb)	58	TC	178.9	178.9	203.1	167.5	167.5	190.7	155.5	155.5	177.7	142.8	142.8	163.9	129.5	129.5	149.4
			SHC	154.7	178.9	203.1	144.2	167.5	190.7	133.3	155.5	177.7	121.7	142.8	163.9	109.6	129.5	149.4
		62	TC	179.2	179.2	211.5	167.6	167.6	198.7	155.7	155.7	185.3	143.6	143.6	171.9	129.6	129.6	156.1
			SHC	146.8	179.2	211.5	136.6	167.6	198.7	126.0	155.7	185.3	115.3	143.6	171.9	103.0	129.6	156.1
		67	TC	192.8	192.8	193.0	178.7	178.7	185.1	164.3	164.3	177.1	150.0	150.0	169.1	133.0	133.0	159.8
			SHC	119.3	156.1	193.0	111.4	148.2	185.1	103.4	140.3	177.1	95.5	132.3	169.1	86.5	123.1	159.8
		72	TC	214.1	214.1	214.1	198.9	198.9	198.9	183.4	183.4	183.4	167.1	167.1	167.1	150.1	150.1	150.1
			SHC	83.5	120.0	156.4	75.5	112.1	148.6	67.5	104.2	140.8	59.2	95.9	132.6	50.8	87.5	124.3
		76	TC	—	232.2	232.2	—	216.3	216.3	—	199.9	199.9	—	182.7	182.7	—	165.0	165.0
			SHC	—	90.6	125.6	—	82.8	118.2	—	74.8	110.5	—	66.6	102.6	—	58.3	94.4

LEGEND

—	—	Do Not Operate
cfm	—	Cubic Feet Per Minute (Supply Air)
EAT (db)	—	Entering Air Temperature (dry bulb)
EAT (wb)	—	Entering Air Temperature (wet bulb)
SHC	—	Sensible Heat Capacity (1000 Btuh) Gross
TC	—	Total Capacity (1000 Btuh) Gross

NOTE: See minimum-maximum airflow ratings on page 6.

50FCQM17 Heating Capacities

50FCQM17 (15 Tons)											
Return Air (°F db)	**CFM (Standard Air)**		**Temperature Air Entering Outdoor Coil (°F db at 70% rh)**								
			-10	**0**	**10**	**17**	**30**	**40**	**47**	**50**	**60**
55	**4500**	**Capacity**	—	63.2	85.4	97.9	122.4	149.4	165.1	170.5	193.4
		Int. Cap.	—	58.1	78.4	89.2	107.3	149.4	165.1	170.5	193.4
	6000	**Capacity**	—	65.0	87.7	100.6	126.4	153.9	170.8	176.4	201.3
		Int. Cap.	—	59.8	80.5	91.7	110.8	153.9	170.8	176.4	201.3
	7500	**Capacity**	—	67.0	89.7	102.9	129.5	157.3	174.9	180.7	206.8
		Int. Cap.	—	61.6	82.3	93.8	113.4	157.3	174.9	180.7	206.8
70	**4500**	**Capacity**	42.1	57.2	79.8	91.8	115.2	142.5	157.4	162.7	184.3
		Int. Cap.	38.9	52.7	73.3	83.7	100.9	142.5	157.4	162.7	184.3
	6000	**Capacity**	43.8	59.3	82.2	94.6	119.1	147.0	162.8	168.3	191.6
		Int. Cap.	40.5	54.6	75.5	86.3	104.4	147.0	162.8	168.3	191.6
	7500	**Capacity**	45.5	61.4	84.3	97.0	122.2	150.3	166.8	172.5	196.9
		Int. Cap.	42.1	56.5	77.4	88.4	107.1	150.3	166.8	172.5	196.9
80	**4500**	**Capacity**	38.1	52.8	75.9	87.5	110.3	138.1	152.4	157.6	178.2
		Int. Cap.	35.2	48.6	69.7	79.8	96.6	138.1	152.4	157.6	178.2
	6000	**Capacity**	39.9	55.1	78.4	90.3	114.2	142.4	157.6	163.0	185.3
		Int. Cap.	36.9	50.7	72.0	82.4	100.1	142.4	157.6	163.0	185.3
	7500	**Capacity**	42.5	57.1	80.5	92.7	117.2	145.7	161.5	167.1	190.5
		Int. Cap.	39.3	52.5	73.8	84.5	102.7	145.7	161.5	167.1	190.5

LEGEND

— — Do Not Operate
Capacity — Instantaneous Capacity (1000 Btuh) — includes indoor fan motor heat at AHRI static conditions
Int. Cap. — Integrated Capacity = instantaneous capacity minus the effects of frost on the OD coil and the heat required to defrost it
rh — Relative Humidity
db — Dry Bulb

50FCQM24 Heating Capacities

50FCQM24 (20 Tons)											
Return Air (°F db)	**CFM (Standard Air)**		**Temperature Air Entering Outdoor Coil (°F db at 70% rh)**								
			-10	**0**	**10**	**17**	**30**	**40**	**47**	**50**	**60**
55	**6000**	**Capacity**	—	89.5	121.0	140.6	181.0	220.7	245.6	254.0	292.4
		Int. Cap.	—	82.4	111.1	128.2	158.6	220.7	245.6	254.0	292.4
	8000	**Capacity**	—	92.4	123.9	144.0	185.9	227.2	253.9	262.9	305.0
		Int. Cap.	—	85.0	113.7	131.3	162.9	227.2	253.9	262.9	305.0
	10000	**Capacity**	—	95.0	126.6	146.8	189.4	231.2	259.2	268.3	312.7
		Int. Cap.	—	87.4	116.2	133.9	166.0	231.2	259.2	268.3	312.7
70	**6000**	**Capacity**	56.8	80.0	111.6	130.7	169.5	208.9	232.7	240.7	276.7
		Int. Cap.	52.6	73.6	102.4	119.2	148.5	208.9	232.7	240.7	276.7
	8000	**Capacity**	59.5	82.9	114.6	134.2	174.7	215.5	241.1	249.8	289.5
		Int. Cap.	55.0	76.3	105.2	122.4	153.0	215.5	241.1	249.8	289.5
	10000	**Capacity**	62.3	85.4	117.3	137.1	178.2	219.7	246.3	255.4	297.4
		Int. Cap.	57.6	78.6	107.7	125.0	156.2	219.7	246.3	255.4	297.4
80	**6000**	**Capacity**	50.0	72.9	105.0	123.8	161.5	200.9	223.8	231.6	265.9
		Int. Cap.	46.2	67.1	96.3	112.9	141.5	200.9	223.8	231.6	265.9
	8000	**Capacity**	52.7	76.0	108.0	127.4	167.0	207.7	232.3	240.9	278.8
		Int. Cap.	48.8	69.9	99.1	116.2	146.3	207.7	232.3	240.9	278.8
	10000	**Capacity**	55.3	78.7	110.9	130.4	170.5	211.9	237.7	246.5	286.9
		Int. Cap.	51.2	72.4	101.8	118.9	149.4	211.9	237.7	246.5	286.9

LEGEND

— — Do Not Operate
Capacity — Instantaneous Capacity (1000 Btuh) — includes indoor fan motor heat at AHRI static conditions
Int. Cap. — Integrated Capacity = instantaneous capacity minus the effects of frost on the OD coil and the heat required to defrost it
rh — Relative Humidity
db — Dry Bulb

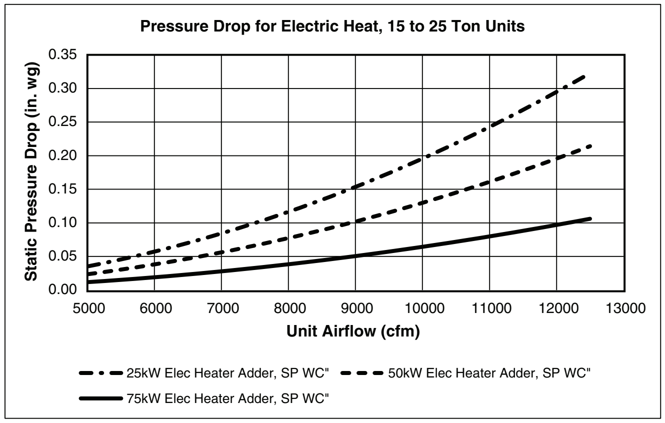
50FCQM28 Heating Capacities

50FCQM28 (25 Tons)											
Return Air (°F db)	CFM (Standard Air)		Temperature Air Entering Outdoor Coil (°F db at 70% rh)								
			-10	0	10	17	30	40	47	50	60
55	7500	Capacity	—	121.3	153.9	175.2	219.1	260.4	287.9	297.1	339.8
		Int. Cap.	—	111.6	141.3	159.8	191.9	260.4	287.9	297.1	339.8
	10000	Capacity	—	124.9	157.5	179.1	224.4	267.1	296.4	306.0	351.8
		Int. Cap.	—	114.9	144.6	163.3	196.6	267.1	296.4	306.0	351.8
	12500	Capacity	—	129.0	161.6	183.3	229.2	272.7	302.9	312.8	360.5
		Int. Cap.	—	118.7	148.4	167.1	200.8	272.7	302.9	312.8	360.5
70	7500	Capacity	—	112.9	145.8	166.6	208.9	249.7	275.8	284.4	324.7
		Int. Cap.	—	103.9	133.8	151.9	183.1	249.7	275.8	284.4	324.7
	10000	Capacity	—	116.4	149.5	170.9	214.6	256.5	284.3	293.6	336.8
		Int. Cap.	—	107.1	137.3	155.8	188.0	256.5	284.3	293.6	336.8
	12500	Capacity	—	120.8	153.8	175.4	219.6	262.2	290.8	300.5	345.8
		Int. Cap.	—	111.2	141.2	159.9	192.4	262.2	290.8	300.5	345.8
80	7500	Capacity	—	107.1	140.1	160.6	202.0	242.2	267.6	276.0	314.3
		Int. Cap.	—	98.6	128.5	146.4	177.0	242.2	267.6	276.0	314.3
	10000	Capacity	—	110.9	144.0	164.9	207.9	249.3	276.3	285.3	326.7
		Int. Cap.	—	102.0	132.2	150.3	182.1	249.3	276.3	285.3	326.7
	12500	Capacity	—	114.8	148.5	169.4	212.9	254.9	283.1	292.2	335.9
		Int. Cap.	—	105.7	136.3	154.5	186.5	254.9	283.1	292.2	335.9

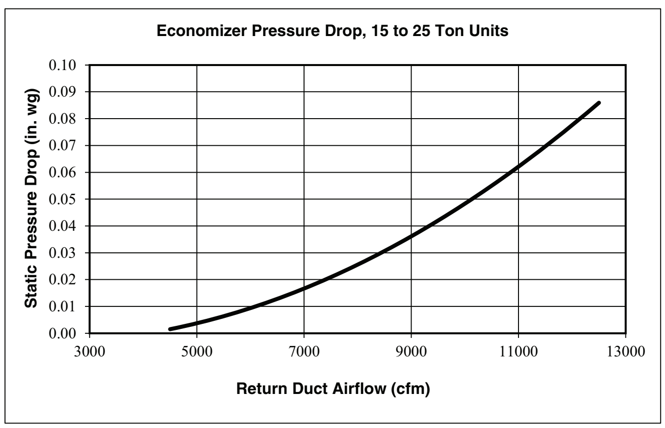
LEGEND

— — Do Not Operate
Capacity — Instantaneous Capacity (1000 Btuh) — includes indoor fan motor heat at AHRI static conditions
Int. Cap. — Integrated Capacity = instantaneous capacity minus the effects of frost on the OD coil and the heat required to defrost it
rh — Relative Humidity
db — Dry Bulb

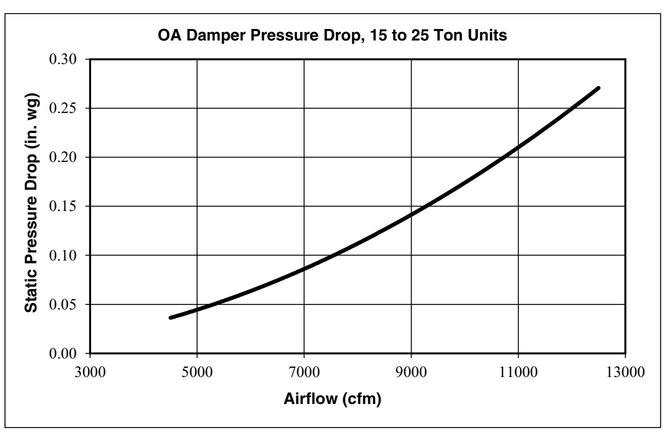
Pressure Drop for Electric Heating Units
15 to 25 Ton Units



Static Pressure Drop — Accessory Economizer
15 to 25 Ton Units



Outside Air Damper Leakage
15 to 25 Ton Units



General Fan Performance Notes

1. Interpolation is permissible. Do not extrapolate.
2. External static pressure is the static pressure difference between the return duct and the supply duct plus the static pressure caused by any FIOPs or accessories.
3. Tabular data accounts for pressure loss due to clean filters, unit casing, and wet coils.
4. Factory options and accessories may effect static pressure losses. Selection software is available, through your salesperson, to help you select the best motor/drive combination for your application.
5. The fan performance tables offer motor/drive recommendations. In cases when 2 motor/drive combinations would work, the lower horsepower option is recommended.
6. For information on the electrical properties of the fan motors, please see the Electrical information section of this book.
7. For more information on the performance limits of the fan motors, see the application data section of this book.
8. The EPACT (Energy Policy Act of 1992) regulates energy requirements for specific types of indoor fan motors. Motors regulated by EPACT include any general purpose, T-frame (3-digit, 143 and larger), single-speed, foot mounted, polyphase, squirrel cage induction motors of NEMA (National Electrical Manufacturers Association) design A and B, manufactured for use in the United States. Ranging from 1 to 200 Hp, these continuous-duty motors operate on 230 and 460 volt, 60 Hz power. If a motor does not fit into these specifications, the motor does not have to be replaced by an EPACT compliant energy-efficient motor. Variable-speed motors are exempt from EPACT compliance requirements.

Fan data (cont)

50FCQM17 — 15 Ton Vertical Supply (rpm - bhp)

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
4500	936	0.61	1065	0.90	1180	1.23	1285	1.59	1380	1.97
4875	991	0.73	1112	1.03	1224	1.37	1325	1.74	1418	2.14
5250	1048	0.86	1161	1.18	1268	1.53	1366	1.91	1457	2.32
5625	1106	1.02	1211	1.34	1314	1.71	1410	2.11	1498	2.53
6000	1166	1.19	1263	1.52	1362	1.90	1454	2.31	1540	2.75
6375	1226	1.38	1317	1.72	1410	2.11	1499	2.53	1584	2.99
6750	1287	1.59	1371	1.93	1460	2.33	1546	2.76	1628	3.23
7125	1349	1.82	1428	2.16	1511	2.56	1594	3.01	1674	3.48
7500	1412	2.07	1485	2.40	1563	2.80	1643	3.26	1721	3.74

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
4500	1470	2.38	1554	2.81	1634	3.27	1710	3.74	1782	4.24
4875	1505	2.55	1588	3.00	1666	3.46	1741	3.95	1812	4.46
5250	1542	2.75	1623	3.21	1700	3.69	1773	4.18	1844	4.71
5625	1581	2.97	1660	3.44	1735	3.93	1807	4.44	1876	4.97
6000	1622	3.21	1699	3.69	1772	4.19	1843	4.71	1911	5.25
6375	1663	3.46	1739	3.95	1811	4.46	1880	4.99	1946	5.54
6750	1706	3.71	1780	4.22	1850	4.74	1918	5.28	1983	5.83
7125	1750	3.98	1822	4.49	1891	5.02	1958	5.57	2022	6.14
7500	1794	4.24	1866	4.77	1933	5.30	1999	5.86	—	—

Std/Med Static 936-2000 rpm, 4.8 Max bhp (2.4 Max bhp per fan motor)

High Static 936-2200 rpm, 6.0 Max bhp (3.0 Max bhp per fan motor)

50FCQM17 — Standard/Medium Static — 15 Ton Vertical Supply (rpm - vdc)

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
4500	936	4.5	1065	5.2	1180	5.8	1285	6.3	1380	6.8
4875	991	4.8	1112	5.4	1224	6.0	1325	6.5	1418	7.0
5250	1048	5.1	1161	5.7	1268	6.2	1366	6.7	1457	7.2
5625	1106	5.4	1211	5.9	1314	6.5	1410	7.0	1498	7.4
6000	1166	5.7	1263	6.2	1362	6.7	1454	7.2	1540	7.6
6375	1226	6.0	1317	6.5	1410	7.0	1499	7.4	1584	7.9
6750	1287	6.3	1371	6.8	1460	7.2	1546	7.7	1628	8.1
7125	1349	6.7	1428	7.1	1511	7.5	1594	7.9	1674	8.3
7500	1412	7.0	1485	7.4	1563	7.8	1643	8.2	1721	8.6

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
4500	1470	7.3	1554	7.7	1634	8.1	1710	8.5	1782	8.9
4875	1505	7.5	1588	7.9	1666	8.3	1741	8.7	1812	9.0
5250	1542	7.6	1623	8.1	1700	8.5	1773	8.8	1844	9.2
5625	1581	7.8	1660	8.3	1735	8.6	1807	9.0	1876	9.4
6000	1622	8.1	1699	8.5	1772	8.8	1843	9.2	—	—
6375	1663	8.3	1739	8.7	1811	9.0	1880	9.4	—	—
6750	1706	8.5	1780	8.9	1850	9.2	—	—	—	—
7125	1750	8.7	1822	9.1	1891	9.4	—	—	—	—
7500	1794	8.9	1866	9.3	—	—	—	—	—	—

Std/Med Static 936-2000 rpm

50FCQM17 — High Static — 15 Ton Vertical Supply (rpm - vdc)

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
4500	936	4.2	1065	4.8	1180	5.3	1285	5.8	1380	6.2
4875	991	4.4	1112	5.0	1224	5.5	1325	6.0	1418	6.4
5250	1048	4.7	1161	5.2	1268	5.7	1366	6.2	1457	6.6
5625	1106	5.0	1211	5.4	1314	5.9	1410	6.4	1498	6.8
6000	1166	5.2	1263	5.7	1362	6.1	1454	6.6	1540	7.0
6375	1226	5.5	1317	5.9	1410	6.4	1499	6.8	1584	7.2
6750	1287	5.8	1371	6.2	1460	6.6	1546	7.0	1628	7.4
7125	1349	6.1	1428	6.4	1511	6.8	1594	7.2	1674	7.6
7500	1412	6.4	1485	6.7	1563	7.1	1643	7.4	1721	7.8

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
4500	1470	6.6	1554	7.0	1634	7.4	1710	7.7	1782	8.1
4875	1505	6.8	1588	7.2	1666	7.5	1741	7.9	1812	8.2
5250	1542	7.0	1623	7.3	1700	7.7	1773	8.0	1844	8.4
5625	1581	7.1	1660	7.5	1735	7.9	1807	8.2	1876	8.5
6000	1622	7.3	1699	7.7	1772	8.0	1843	8.4	1911	8.7
6375	1663	7.5	1739	7.9	1811	8.2	1880	8.5	1946	8.8
6750	1706	7.7	1780	8.1	1850	8.4	1918	8.7	1983	9.0
7125	1750	7.9	1822	8.3	1891	8.6	1958	8.9	2022	9.2
7500	1794	8.1	1866	8.5	1933	8.8	1999	9.1	—	—

High Static 936-2200 rpm

Fan data (cont)

50FCQM24 — 20 Ton Vertical Supply (rpm - bhp)

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
6,000	1038	0.84	1148	1.14	1251	1.47	1351	1.86	1448	2.28
6,500	1103	1.01	1207	1.32	1304	1.66	1398	2.05	1490	2.48
7,000	1169	1.19	1269	1.52	1360	1.87	1448	2.26	1535	2.69
7,500	1234	1.38	1332	1.74	1418	2.09	1501	2.48	1583	2.91
8,000	1299	1.58	1395	1.95	1478	2.32	1557	2.72	1634	3.14
8,500	1364	1.78	1459	2.18	1540	2.56	1615	2.95	1689	3.37
9,000	1427	1.97	1524	2.40	1602	2.79	1674	3.18	1745	3.60
9,500	1491	2.17	1589	2.62	1665	3.02	1735	3.41	1802	3.83
10,000	1553	2.36	1653	2.84	1729	3.25	1797	3.65	1862	4.06

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
6,000	1539	2.74	1624	3.22	1703	3.72	1777	4.22	1847	4.74
6,500	1578	2.95	1662	3.44	1741	3.96	1816	4.49	1887	5.04
7,000	1619	3.16	1701	3.66	1779	4.19	1854	4.74	1924	5.30
7,500	1663	3.38	1742	3.88	1818	4.41	1892	4.97	1962	5.55
8,000	1711	3.60	1786	4.10	1859	4.62	1931	5.18	2000	5.76
8,500	1761	3.83	1832	4.31	1903	4.83	1972	5.37	2039	5.94
9,000	1813	4.04	1882	4.52	1949	5.02	2015	5.55	2081	6.11
9,500	1868	4.26	1933	4.72	1998	5.21	2061	5.72	2124	6.27
10,000	1925	4.49	1987	4.94	2049	5.41	2110	5.91	2170	6.43

Std/Med Static 1038-2000 rpm, 4.8 Max bhp (2.4 Max bhp per fan motor)

High Static 1038-2200 rpm, 10.0 Max bhp (5.0 Max bhp per fan motor)

50FCQM24 — Standard/Medium Static — 20 Ton Vertical Supply (rpm - vdc)

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
6,000	1038	5.1	1148	5.6	1251	6.1	1351	6.7	1448	7.2
6,500	1103	5.4	1207	5.9	1304	6.4	1398	6.9	1490	7.4
7,000	1169	5.7	1269	6.2	1360	6.7	1448	7.2	1535	7.6
7,500	1234	6.1	1332	6.6	1418	7.0	1501	7.4	1583	7.9
8,000	1299	6.4	1395	6.9	1478	7.3	1557	7.7	1634	8.1
8,500	1364	6.7	1459	7.2	1540	7.6	1615	8.0	1689	8.4
9,000	1427	7.1	1524	7.6	1602	8.0	1674	8.3	1745	8.7
9,500	1491	7.4	1589	7.9	1665	8.3	1735	8.6	1802	9.0
10,000	1553	7.7	1653	8.2	1729	8.6	1797	9.0	1862	9.3

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
6,000	1539	7.6	1624	8.1	1703	8.5	1777	8.9	1847	9.2
6,500	1578	7.8	1662	8.3	1741	8.7	1816	9.1	1887	9.4
7,000	1619	8.0	1701	8.5	1779	8.9	1854	9.2	—	—
7,500	1663	8.3	1742	8.7	1818	9.1	1892	9.4	—	—
8,000	1711	8.5	1786	8.9	1859	9.3	—	—	—	—
8,500	1761	8.8	1832	9.1	1903	9.5	—	—	—	—
9,000	1813	9.0	1882	9.4	1949	9.7	—	—	—	—
9,500	1868	9.3	1933	9.7	—	—	—	—	—	—
10,000	1925	9.6	1987	9.9	—	—	—	—	—	—

Std/Med Static 1038-2000 rpm

50FCQM24 — High Static — 20 Ton Vertical Supply (rpm - vdc)

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
6,000	1038	4.6	1148	5.1	1251	5.6	1351	6.1	1448	6.5
6,500	1103	4.9	1207	5.4	1304	5.9	1398	6.3	1490	6.7
7,000	1169	5.2	1269	5.7	1360	6.1	1448	6.5	1535	6.9
7,500	1234	5.5	1332	6.0	1418	6.4	1501	6.8	1583	7.2
8,000	1299	5.8	1395	6.3	1478	6.7	1557	7.0	1634	7.4
8,500	1364	6.1	1459	6.6	1540	7.0	1615	7.3	1689	7.6
9,000	1427	6.4	1524	6.9	1602	7.2	1674	7.6	1745	7.9
9,500	1491	6.7	1589	7.2	1665	7.5	1735	7.9	1802	8.2
10,000	1553	7.0	1653	7.5	1729	7.8	1797	8.1	1862	8.4

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
6,000	1539	6.9	1624	7.3	1703	7.7	1777	8.0	1847	8.4
6,500	1578	7.1	1662	7.5	1741	7.9	1816	8.2	1887	8.6
7,000	1619	7.3	1701	7.7	1779	8.1	1854	8.4	1924	8.7
7,500	1663	7.5	1742	7.9	1818	8.2	1892	8.6	1962	8.9
8,000	1711	7.7	1786	8.1	1859	8.4	1931	8.8	2000	9.1
8,500	1761	8.0	1832	8.3	1903	8.6	1972	8.9	2039	9.3
9,000	1813	8.2	1882	8.5	1949	8.8	2015	9.1	2081	9.5
9,500	1868	8.5	1933	8.8	1998	9.1	2061	9.4	2124	9.6
10,000	1925	8.7	1987	9.0	2049	9.3	2110	9.6	2170	9.9

High Static 1038-2200 rpm

50FCQM28 — 25 Ton Vertical Supply (rpm - bhp)

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
7,500	1099	1.27	1174	1.55	1256	1.90	1343	2.32	1433	2.82
8,125	1177	1.58	1246	1.87	1319	2.22	1397	2.64	1479	3.13
8,750	1256	1.92	1319	2.23	1385	2.58	1456	3.00	1530	3.48
9,375	1337	2.32	1394	2.63	1455	2.99	1519	3.40	1586	3.87
10,000	1417	2.74	1471	3.06	1526	3.42	1585	3.83	1646	4.29
10,625	1498	3.18	1548	3.51	1600	3.88	1654	4.28	1710	4.73
11,250	1579	3.65	1626	3.98	1675	4.36	1725	4.76	1777	5.20
11,875	1661	4.17	1705	4.51	1751	4.88	1798	5.29	1846	5.72
12,500	1743	4.78	1785	5.14	1828	5.52	1872	5.93	1917	6.37

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
7,500	1521	3.38	1604	3.96	1683	4.58	1757	5.21	1828	5.86
8,125	1561	3.68	1642	4.28	1720	4.92	1794	5.58	1864	6.26
8,750	1606	4.02	1683	4.63	1758	5.28	1830	5.95	1900	6.66
9,375	1655	4.40	1727	5.00	1798	5.64	1869	6.33	1937	7.05
10,000	1710	4.81	1776	5.39	1843	6.02	1910	6.70	1976	7.42
10,625	1769	5.24	1829	5.79	1891	6.40	1954	7.06	2018	7.78
11,250	1831	5.69	1887	6.23	1944	6.81	2003	7.45	2063	8.14
11,875	1896	6.20	1948	6.72	2001	7.29	2056	7.90	2111	8.56
12,500	1964	6.85	2012	7.36	2061	7.91	2112	8.51	2164	9.16

Std/Med Static 1099-2200 rpm, 6.0 Max bhp (3.0 Max bhp per fan motor)

High Static 1099-2200 rpm, 10.0 Max bhp (5.0 Max bhp per fan motor)

50FCQM28 — Standard/Medium Static — 25 Ton Vertical Supply (rpm - vdc)

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
7,500	1099	4.9	1174	5.3	1256	5.6	1343	6.0	1433	6.5
8,125	1177	5.3	1246	5.6	1319	5.9	1397	6.3	1479	6.7
8,750	1256	5.6	1319	5.9	1385	6.2	1456	6.6	1530	6.9
9,375	1337	6.0	1394	6.3	1455	6.6	1519	6.9	1586	7.2
10,000	1417	6.4	1471	6.6	1526	6.9	1585	7.2	1646	7.4
10,625	1498	6.8	1548	7.0	1600	7.2	1654	7.5	1710	7.7
11,250	1579	7.1	1626	7.4	1675	7.6	1725	7.8	1777	8.0
11,875	1661	7.5	1705	7.7	1751	7.9	1798	8.1	1846	8.4
12,500	1743	7.9	1785	8.1	1828	8.3	1872	8.5	1917	8.7

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
7,500	1521	6.9	1604	7.2	1683	7.6	1757	8.0	1828	8.3
8,125	1561	7.1	1642	7.4	1720	7.8	1794	8.1	1864	8.4
8,750	1606	7.3	1683	7.6	1758	8.0	1830	8.3	—	—
9,375	1655	7.5	1727	7.8	1798	8.1	1869	8.5	—	—
10,000	1710	7.7	1776	8.0	1843	8.4	—	—	—	—
10,625	1769	8.0	1829	8.3	1891	8.6	—	—	—	—
11,250	1831	8.3	1887	8.6	—	—	—	—	—	—
11,875	1896	8.6	—	—	—	—	—	—	—	—
12,500	—	—	—	—	—	—	—	—	—	—

Std/Med Static 1099-2200 rpm

50FCQM28 — High Static — 25 Ton Vertical Supply (rpm - vdc)

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
7,500	1099	4.9	1174	5.3	1256	5.6	1343	6.0	1433	6.5
8,125	1177	5.3	1246	5.6	1319	5.9	1397	6.3	1479	6.7
8,750	1256	5.6	1319	5.9	1385	6.2	1456	6.6	1530	6.9
9,375	1337	6.0	1394	6.3	1455	6.6	1519	6.9	1586	7.2
10,000	1417	6.4	1471	6.6	1526	6.9	1585	7.2	1646	7.4
10,625	1498	6.8	1548	7.0	1600	7.2	1654	7.5	1710	7.7
11,250	1579	7.1	1626	7.4	1675	7.6	1725	7.8	1777	8.0
11,875	1661	7.5	1705	7.7	1751	7.9	1798	8.1	1846	8.4
12,500	1743	7.9	1785	8.1	1828	8.3	1872	8.5	1917	8.7

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
7,500	1521	6.9	1604	7.2	1683	7.6	1757	8.0	1828	8.3
8,125	1561	7.1	1642	7.4	1720	7.8	1794	8.1	1864	8.4
8,750	1606	7.3	1683	7.6	1758	8.0	1830	8.3	1900	8.6
9,375	1655	7.5	1727	7.8	1798	8.1	1869	8.5	1937	8.8
10,000	1710	7.7	1776	8.0	1843	8.4	1910	8.7	1976	9.0
10,625	1769	8.0	1829	8.3	1891	8.6	1954	8.9	2018	9.2
11,250	1831	8.3	1887	8.6	1944	8.8	2003	9.1	2063	9.4
11,875	1896	8.6	1948	8.8	2001	9.1	2056	9.3	2111	9.6
12,500	1964	8.9	2012	9.1	2061	9.4	2112	9.6	2164	9.8

High Static 1099-2200 rpm

50FCQM17 — 15 Ton Horizontal Supply (rpm - bhp)

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
4500	1055	0.71	1171	0.97	1279	1.26	1379	1.58	1472	1.92
4875	1122	0.85	1231	1.12	1334	1.43	1430	1.76	1520	2.11
5250	1190	1.01	1293	1.30	1390	1.61	1482	1.95	1569	2.32
5625	1259	1.19	1356	1.49	1448	1.81	1536	2.16	1621	2.54
6000	1329	1.39	1420	1.69	1508	2.03	1592	2.39	1674	2.78
6375	1399	1.60	1486	1.92	1570	2.26	1650	2.63	1728	3.02
6750	1470	1.83	1553	2.16	1632	2.51	1710	2.89	1785	3.28
7125	1541	2.08	1620	2.42	1696	2.77	1770	3.15	1842	3.56
7500	1612	2.34	1688	2.69	1761	3.06	1832	3.44	1902	3.85

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
4500	1560	2.29	1642	2.67	1721	3.29	1796	3.74	1870	4.22
4875	1605	2.49	1685	2.88	1762	3.29	1835	3.99	1906	4.47
5250	1652	2.70	1730	3.10	1805	3.53	1877	4.27	1946	4.75
5625	1701	2.94	1777	3.35	1850	3.78	1920	4.57	1988	5.07
6000	1751	3.18	1826	3.60	1897	4.04	1966	4.90	2032	5.41
6375	1803	3.43	1876	3.86	1945	4.31	2013	5.26	2078	5.79
6750	1857	3.70	1927	4.13	1995	4.59	2061	5.65	2125	6.19
7125	1913	3.98	1981	4.42	2047	4.88	2111	6.07	2173	6.62
7500	1969	4.27	2035	4.72	2099	5.18	2162	6.52	—	—

High Static 1055-2200 rpm,10.0 Max bhp (5.0 Max bhp per fan motor

50FCQM17 — High Static — 15 Ton Horizontal Supply (rpm - vdc)

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
4500	1055	4.7	1171	5.3	1279	5.7	1379	6.2	1472	6.6
4875	1122	5.0	1231	5.5	1334	6.0	1430	6.4	1520	6.9
5250	1190	5.3	1293	5.8	1390	6.3	1482	6.7	1569	7.1
5625	1259	5.7	1356	6.1	1448	6.5	1536	6.9	1621	7.3
6000	1329	6.0	1420	6.4	1508	6.8	1592	7.2	1674	7.6
6375	1399	6.3	1486	6.7	1570	7.1	1650	7.5	1728	7.8
6750	1470	6.6	1553	7.0	1632	7.4	1710	7.7	1785	8.1
7125	1541	7.0	1620	7.3	1696	7.7	1770	8.0	1842	8.3
7500	1612	7.3	1688	7.6	1761	8.0	1832	8.3	1902	8.6

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
4500	1560	7.0	1642	7.4	1721	7.8	1796	8.1	1870	8.5
4875	1605	7.3	1685	7.6	1762	8.0	1835	8.3	1906	8.6
5250	1652	7.5	1730	7.8	1805	8.2	1877	8.5	1946	8.8
5625	1701	7.7	1777	8.0	1850	8.4	1920	8.7	1988	9.0
6000	1751	7.9	1826	8.3	1897	8.6	1966	8.9	2032	9.2
6375	1803	8.2	1876	8.5	1945	8.8	2013	9.1	2078	9.4
6750	1857	8.4	1927	8.7	1995	9.1	2061	9.4	2125	9.7
7125	1913	8.7	1981	9.0	2047	9.3	2111	9.6	2173	9.9
7500	1969	8.9	2035	9.2	2099	9.5	2162	9.8	—	—

High Static 1055-2200 rpm

50FCQM24 — 20 Ton Horizontal Supply (rpm - bhp)

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
6,000	1267	1.20	1361	1.49	1451	1.81	1538	2.15	1621	2.52
6,500	1356	1.45	1443	1.75	1527	2.07	1609	2.43	1688	2.80
7,000	1446	1.73	1527	2.04	1606	2.37	1683	2.73	1758	3.11
7,500	1537	2.03	1612	2.35	1687	2.69	1760	3.05	1831	3.44
8,000	1628	2.36	1699	2.68	1769	3.03	1838	3.40	1906	3.79
8,500	1719	2.71	1786	3.04	1853	3.40	1918	3.77	1983	4.16
9,000	1811	3.09	1875	3.43	1938	3.79	2000	4.17	2061	4.56
9,500	1904	3.50	1964	3.85	2024	4.21	2083	4.59	2142	4.99
10,000	1997	3.94	2054	4.29	2111	4.66	2167	5.04	—	—

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
6,000	1700	2.90	1777	3.32	1850	3.74	1921	4.19	1989	4.65
6,500	1764	3.20	1838	3.62	1909	4.05	1977	4.50	2043	4.97
7,000	1831	3.51	1901	3.93	1970	4.37	2036	4.83	2100	5.30
7,500	1900	3.84	1968	4.27	2033	4.71	2098	5.17	2160	5.64
8,000	1972	4.20	2037	4.63	2100	5.07	2162	5.53	—	—
8,500	2046	4.57	2108	5.00	2169	5.45	—	—	—	—
9,000	2122	4.97	2181	5.40	—	—	—	—	—	—
9,500	2199	5.40	—	—	—	—	—	—	—	—
10,000	—	—	—	—	—	—	—	—	—	—

High Static 1267-2000 rpm, 10.0 Max bhp (5.0 Max bhp per fan motor

50FCQM24 — High Static — 20 Ton Horizontal Supply (rpm - vdc)

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
6,000	1267	5.7	1361	6.1	1451	6.5	1538	6.9	1621	7.3
6,500	1356	6.1	1443	6.5	1527	6.9	1609	7.3	1688	7.6
7,000	1446	6.5	1527	6.9	1606	7.3	1683	7.6	1758	8.0
7,500	1537	6.9	1612	7.3	1687	7.6	1760	8.0	1831	8.3
8,000	1628	7.4	1699	7.7	1769	8.0	1838	8.3	1906	8.6
8,500	1719	7.8	1786	8.1	1853	8.4	1918	8.7	1983	9.0
9,000	1811	8.2	1875	8.5	1938	8.8	2000	9.1	2061	9.4
9,500	1904	8.6	1964	8.9	2024	9.2	2083	9.5	2142	9.7
10,000	1997	9.1	2054	9.3	2111	9.6	2167	9.8	—	—

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
6,000	1700	7.7	1777	8.0	1850	8.4	1921	8.7	1989	9.0
6,500	1764	8.0	1838	8.3	1909	8.7	1977	9.0	2043	9.3
7,000	1831	8.3	1901	8.6	1970	8.9	2036	9.2	2100	9.5
7,500	1900	8.6	1968	8.9	2033	9.2	2098	9.5	2160	9.8
8,000	1972	8.9	2037	9.2	2100	9.5	2162	9.8	—	—
8,500	2046	9.3	2108	9.6	2169	9.9	—	—	—	—
9,000	2122	9.6	2181	9.9	—	—	—	—	—	—
9,500	2199	10.0	—	—	—	—	—	—	—	—
10,000	—	—	—	—	—	—	—	—	—	—

High Static 1267-2000 rpm

Fan data (cont)

50FCQM28 — 25 Ton Horizontal Supply (rpm - bhp)

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
7,500	1406	2.11	1483	2.47	1559	2.87	1636	3.32	1711	3.80
8,125	1509	2.60	1580	2.98	1651	3.40	1722	3.86	1792	4.35
8,750	1614	3.16	1679	3.56	1744	3.98	1810	4.45	1876	4.96
9,375	1719	3.78	1779	4.19	1840	4.63	1902	5.11	1963	5.62
10,000	1824	4.44	1880	4.87	1938	5.33	1995	5.81	2053	6.34
10,625	1930	5.16	1983	5.60	2036	6.06	2091	6.56	2145	7.09
11,250	2036	5.91	2086	6.35	2137	6.83	2187	7.32	—	—
11,875	2143	6.67	2190	7.12	—	—	—	—	—	—
12,500	—	—	—	—	—	—	—	—	—	—

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp	rpm	bhp
7,500	1783	4.30	1853	4.82	1921	5.37	1986	5.94	2048	6.51
8,125	1861	4.87	1928	5.42	1993	5.98	2055	6.56	2116	7.16
8,750	1941	5.49	2005	6.05	2067	6.63	2128	7.24	2187	7.86
9,375	2024	6.16	2085	6.74	2144	7.33	—	—	—	—
10,000	2111	6.89	2168	7.46	—	—	—	—	—	—
10,625	2199	7.63	—	—	—	—	—	—	—	—
11,250	—	—	—	—	—	—	—	—	—	—
11,875	—	—	—	—	—	—	—	—	—	—
12,500	—	—	—	—	—	—	—	—	—	—

High Static 1406-2200 rpm, 10.0 Max bhp (5.0 Max bhp per fan motor

50FCQM28 — High Static — 25 Ton Horizontal Supply (rpm - vdc)

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
7,500	1406	6.3	1483	6.7	1559	7.0	1636	7.4	1711	7.7
8,125	1509	6.8	1580	7.1	1651	7.5	1722	7.8	1792	8.1
8,750	1614	7.3	1679	7.6	1744	7.9	1810	8.2	1876	8.5
9,375	1719	7.8	1779	8.1	1840	8.3	1902	8.6	1963	8.9
10,000	1824	8.3	1880	8.5	1938	8.8	1995	9.1	2053	9.3
10,625	1930	8.8	1983	9.0	2036	9.2	2091	9.5	2145	9.7
11,250	2036	9.2	2086	9.5	2137	9.7	2187	9.9	—	—
11,875	2143	9.7	2190	10.0	—	—	—	—	—	—
12,500	—	—	—	—	—	—	—	—	—	—

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc	rpm	vdc
7,500	1783	8.1	1853	8.4	1921	8.7	1986	9.0	2048	9.3
8,125	1861	8.4	1928	8.7	1993	9.0	2055	9.3	2116	9.6
8,750	1941	8.8	2005	9.1	2067	9.4	2128	9.7	2187	9.9
9,375	2024	9.2	2085	9.5	2144	9.7	—	—	—	—
10,000	2111	9.6	2168	9.9	—	—	—	—	—	—
10,625	2199	10.0	—	—	—	—	—	—	—	—
11,250	—	—	—	—	—	—	—	—	—	—
11,875	—	—	—	—	—	—	—	—	—	—
12,500	—	—	—	—	—	—	—	—	—	—

High Static 1406-2200 rpm

Electrical data

Legend and Notes

Applicable for Electrical Data Tables on pages 45 to 57

LEGEND

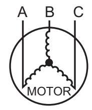
BRKR	— Circuit Breaker
C.O.	— Convenience Outlet
FLA	— Full Load Amps
IFM	— Indoor Fan Motor
LRA	— Locked Rotor Amps
MCA	— Minimum Circuit Amps
P.E.	— Power Exhaust
PWRD C.O.	— Powered Convenience Outlet
RLA	— Rated Load Amps
SCCR	— Short Circuit Current Rating
UNPWR C.O.	— Unpowered Convenience Outlet

NOTES:

1. In compliance with NEC requirements for multi-motor and combination load equipment (refer to NEC Articles 430 and 440), the overcurrent protective device for the unit shall be fuse or HACR breaker. Canadian units may be fuse or circuit breaker.
2. For 208/230 v units, where one value is show it is the same for either 208 or 230 volts.
3. **Unbalanced 3-Phase Supply Voltage**: Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the percentage of voltage imbalance.

$$\%\ \text{Voltage Imbalance} = 100 \times \frac{\text{max voltage deviation from average voltage}}{\text{average voltage}}$$

Example: Supply voltage is 230-3-60



AB = 224-v
BC = 231-v
AC = 226-v

$$\text{Average Voltage} = \frac{(224 + 231 + 226)}{3} = \frac{681}{3} = 227$$

Determine maximum deviation from average voltage.
(AB) 227-224 = 3-v
(BC) 231-227 = 4-v
(AC) 227-226 = 1-v
Maximum deviation is 4-v.
Determine percent of voltage imbalance.

$$\%\ \text{Voltage Imbalance} = 100x \frac{4}{227} = 1.76\%$$

This amount of phase imbalance is satisfactory as it is below the maximum allowable 2%.

IMPORTANT: If the supply voltage phase imbalance is more than 2%, contact your local electric utility company immediately.

50FCQM17-28 Cooling Electrical Data

50FCQ UNIT SIZE	V-Ph-Hz	UNIT VOLTAGE RANGE		STD SCCR kA	HIGH SCCR kA[a]	COMP 1		COMP 2		OFM (EA)		IFM		
		MIN	MAX			RLA	LRA	RLA	LRA	WATTS	FLA	TYPE	EFFCY AT FULL LOAD	FLA
50FCQM17 Vertical	208-3-60	187	253	5	60	28.2	240	19.6	136	350	1.5	STD/MED	90.0%	6.4
												HIGH		7.5
	230-3-60	187	253	5	60	28.2	240	19.6	136	350	1.5	STD/MED	90.0%	6.4
												HIGH		7.5
	460-3-60	414	506	5	65	14.7	130	8.2	66	277	0.9	STD/MED	90.0%	3.0
												HIGH		3.5
	575-3-60	518	633	5	—	11.3	94	6.6	55	397	0.6	STD/MED	90.0%	2.5
												HIGH		3.0
50FCQM17 Horizontal	208-3-60	187	253	5	60	28.2	240	19.6	136	350	1.5	HIGH	90.0%	12.6
	230-3-60	187	253	5	60	28.2	240	19.6	136	350	1.5	HIGH	90.0%	12.6
	460-3-60	414	506	5	65	14.7	130	8.2	66	277	0.9	HIGH	90.0%	5.6
	575-3-60	518	633	5	—	11.3	94	6.6	55	397	0.6	HIGH	90.0%	4.6
50FCQM24 Vertical	208-3-60	187	253	5	60	34.0	240	34.0	240	397	1.9	STD/MED	90.0%	6.4
												HIGH		12.6
	230-3-60	187	253	5	60	34.0	240	34.0	240	397	1.9	STD/MED	90.0%	6.4
												HIGH		12.6
	460-3-60	414	506	5	65	16.0	140	16.0	140	397	0.9	STD/MED	90.0%	3.0
												HIGH		5.6
	575-3-60	518	633	5	—	12.9	108	12.9	108	397	0.7	STD/MED	90.0%	2.5
												HIGH		4.6
50FCQM24 Horizontal	208-3-60	187	253	5	60	34.0	240	34.0	240	397	1.9	HIGH	90.0%	12.6
	230-3-60	187	253	5	60	34.0	240	34.0	240	397	1.9	HIGH	90.0%	12.6
	460-3-60	414	506	5	65	16.0	140	16.0	140	397	0.9	HIGH	90.0%	5.6
	575-3-60	518	633	5	—	12.9	1085	12.9	1085	397	0.7	HIGH	90.0%	4.6
50FCQM28 Vertical	208-3-60	187	253	5	60	51.3	300	48.1	245	350	1.9	STD/MED	90.0%	7.5
												HIGH		12.6
	230-3-60	187	253	5	60	51.3	300	48.1	245	350	1.9	STD/MED	90.0%	7.5
												HIGH		12.6
	460-3-60	414	506	5	65	22.4	150	18.6	125	277	0.9	STD/MED	90.0%	3.5
												HIGH		5.6
	575-3-60	518	633	5	—	19.9	109	14.7	100	397	0.7	STD/MED	90.0%	3.0
												HIGH		4.6
50FCQM28 Horizontal	208-3-60	187	253	5	60	51.3	300	48.1	245	397	1.9	HIGH	90.0%	12.6
	230-3-60	187	253	5	60	51.3	300	48.1	245	397	1.9	HIGH	90.0%	12.6
	460-3-60	414	506	5	65	22.4	150	18.6	125	397	0.9	HIGH	90.0%	5.6
	575-3-60	518	633	5	—	19.9	109	14.7	100	397	0.7	HIGH	90.0%	4.6

NOTE(S):

a. High SCCR (Short Circuit Current Rating) is not available on the following: units with Low Ambient controls, Phase loss monitor, Non-fused disconnect, Powered convenience outlet, and 575-v models.

50FCQM17 MCA MOCP Electrical Data

50FCQ UNIT SIZE	NOM. V-Ph-Hz	IFM TYPE	STD SCCR kA	HIGH SCCR kA[a]	ELECTRIC HEATER				NO CONVENIENCE OUTLET OR UNPOWERED CONVENIENCE OUTLET							
									NO POWER EXHAUST				w/POWER EXHAUST (powered from unit)			
					STD SCCR CRHEATER ****00	HIGH SCCR CRHEATER ****00	NOM (kW)	FLA	MCA	FUSE OR HACR BRKR	DISCONNECT SIZE FLA	DISCONNECT SIZE LRA	MCA	FUSE OR HACR BRKR	DISCONNECT SIZE FLA	DISCONNECT SIZE LRA
50FCQM17 Vertical	208/230-3-60	STD/ MED	5	60	—	—	—	—	72	100	75	403	84	100	88	423
					454A	454A	18.8/25.0	52.1/60.1	137/147	150/150	135/144	455/463	149/159	150/175	148/158	475/483
					455A	455A	37.6/50.0	104.2/120.3	202/192	225/200	195/213	507/523	214/204	225/225	208/227	527/543
					456A	456A	56.3/75.0	156.4/180.4	229/253	250/300	255/282	559/583	240/264	250/300	268/296	579/603
		HIGH	5	60	—	—	—	—	74	100	77	407	86	100	91	427
					454A	454A	18.8/25.0	52.1/60.1	140/150	150/150	137/147	459/467	151/161	175/175	151/160	479/487
					455A	455A	37.6/50.0	104.2/120.3	205/195	225/225	197/216	511/527	216/206	225/225	211/229	531/547
					456A	456A	56.3/75.0	156.4/180.4	231/255	250/300	257/285	563/587	243/267	250/300	271/298	583/607
	460-3-60	STD/ MED	5	65	—	—	—	—	35	45	36	210	42	50	43	222
					457A	457A	25.0	30.1	73	80	71	240	79	80	78	252
					458A	458A	50.0	60.1	95	100	105	270	102	110	113	282
					459A	459A	75.0	90.2	126	150	140	300	132	150	147	312
		HIGH	5	65	—	—	—	—	36	50	37	212	42	50	45	224
					457A	457A	25.0	30.1	74	80	72	242	80	90	79	254
					458A	458A	50.0	60.1	96	110	107	272	103	110	114	284
					459A	459A	75.0	90.2	126	150	141	302	133	150	148	314
	575-3-60	STD/ MED	5	—	—	—	—	—	28	35	28	163	32	40	34	171
					460A	—	24.8	23.9	57	60	56	187	62	70	61	195
					461A	—	49.6	47.7	87	90	83	211	92	100	89	219
					462A	—	74.4	71.6	99	110	111	235	104	110	116	243
		HIGH	5	—	—	—	—	—	28	35	30	163	33	40	35	171
					460A	—	24.8	23.9	58	60	57	187	63	70	63	195
					461A	—	49.6	47.7	88	90	84	211	93	100	90	219
					462A	—	74.4	71.6	100	110	112	235	105	110	117	243
50FCQM17 Horizontal	208/230-3-60	HIGH	5	60	—	—	—	—	85	100	89	421	96	110	103	441
					463A	463A	18.8/25.0	52.1/60.1	150/160	150/175	149/158	473/481	162/172	175/175	163/172	493/501
					464A	464A	37.6/50.0	104.2/120.3	215/205	225/225	209/227	525/541	227/217	250/225	223/241	545/561
					465A	465A	56.3/75.0	156.4/180.4	241/265	250/300	269/297	577/601	253/277	300/300	283/310	597/621
	460-3-60	HIGH	5	65	—	—	—	—	40	50	42	218	47	60	49	230
					466A	466A	25.0	30.1	78	80	77	248	84	90	84	260
					467A	467A	50.0	60.1	101	110	111	278	107	125	119	290
					468A	468A	75.0	90.2	131	150	146	308	137	150	153	320
	575-3-60	HIGH	5	—	—	—	—	—	32	40	33	167	36	45	39	175
					469A	—	24.8	23.9	62	70	61	191	66	70	66	199
					470A	—	49.6	47.7	91	100	88	215	96	100	94	223
					471A	—	74.4	71.6	103	110	116	239	108	125	121	247

NOTE(S):

a. High SCCR (Short Circuit Current Rating) is not available on the following: units with Low Ambient controls, Phase loss monitor, Non-fused disconnect, and 575-v models.

Electrical data (cont)

50FCQM17 MCA MOCP Electrical Data (cont)

50FCQ UNIT SIZE	NOM. V-Ph-Hz	IFM TYPE	STD SCCR kA	ELECTRIC HEATER			W/POWERED CONVENIENCE OUTLET							
							NO POWER EXHAUST				w/POWER EXHAUST (powered from unit)			
									DISCONNECT SIZE				DISCONNECT SIZE	
				STD SCCR CRHEATER ****00	NOM (kW)	FLA	MCA	FUSE OR HACR BRKR	FLA	LRA	MCA	FUSE OR HACR BRKR	FLA	LRA
50FCQM17 Vertical	208/230-3-60	STD/ MED	5	—	—	—	77	100	80	408	89	100	94	428
				454A	18.8/25.0	52.1/60.1	142/152	150/175	140/150	460/468	154/164	175/175	154/163	480/488
				455A	37.6/50.0	104.2/120.3	207/197	225/225	200/219	512/528	219/209	225/225	214/232	532/548
				456A	56.3/75.0	156.4/180.4	233/257	250/300	260/288	564/588	245/269	300/300	274/301	584/608
		HIGH	5	—	—	—	79	100	83	412	91	100	96	432
				454A	18.8/25.0	52.1/60.1	144/154	150/175	143/152	464/472	156/166	175/175	156/166	484/492
				455A	37.6/50.0	104.2/120.3	209/200	225/225	203/221	516/532	221/211	225/225	216/235	536/552
				456A	56.3/75.0	156.4/180.4	236/260	250/300	263/290	568/592	247/271	300/300	276/304	588/612
	460-3-60	STD/ MED	5	—	—	—	38	50	39	212	44	50	46	224
				457A	25.0	30.1	75	80	73	242	81	90	81	254
				458A	50.0	60.1	98	110	108	272	104	110	115	284
				459A	75.0	90.2	128	150	143	302	134	150	150	314
		HIGH	5	—	—	—	38	50	40	214	45	50	47	226
				457A	25.0	30.1	76	80	75	244	82	90	82	256
				458A	50.0	60.1	99	110	109	274	105	110	116	286
				459A	75.0	90.2	129	150	144	304	135	150	151	316
	575-3-60	STD/ MED	5	—	—	—	29	40	30	165	34	45	36	173
				460A	24.8	23.9	59	60	58	189	64	70	63	197
				461A	49.6	47.7	89	90	85	213	94	100	91	221
				462A	74.4	71.6	101	110	113	237	106	110	118	245
		HIGH	5	—	—	—	30	40	32	165	35	45	37	173
				460A	24.8	23.9	60	70	59	189	65	70	65	197
				461A	49.6	47.7	90	90	86	213	95	100	92	221
				462A	74.4	71.6	102	110	114	237	107	110	119	245
50FCQM17 Horizontal	208/230-3-60	HIGH	5	—	—	—	89	100	95	426	101	125	108	446
				463A	18.8/25.0	52.1/60.1	154/164	175/175	155/164	478/486	166/176	175/200	168/177	498/506
				464A	37.6/50.0	104.2/120.3	220/210	225/225	214/233	530/546	231/222	250/250	228/247	550/566
				465A	56.3/75.0	156.4/180.4	246/270	300/300	275/302	582/606	258/282	300/300	288/316	602/626
	460-3-60	HIGH	5	—	—	—	43	50	45	220	49	60	52	232
				466A	25.0	30.1	80	90	79	250	86	90	87	262
				467A	50.0	60.1	103	110	114	280	109	125	121	292
				468A	75.0	90.2	133	150	149	310	139	150	156	322
	575-3-60	HIGH	5	—	—	—	33	40	35	169	38	45	41	177
				469A	24.8	23.9	63	70	63	193	68	70	68	201
				470A	49.6	47.7	93	100	90	217	98	100	96	225
				471A	74.4	71.6	105	110	118	241	110	125	123	249

Electrical data (cont)

50FCQM24 MCA MOCP Electrical Data

50FCQ UNIT SIZE	NOM. V-Ph-Hz	IFM TYPE	STD SCCR kA	HIGH SCCR kA[a]	ELECTRIC HEATER				NO CONVENIENCE OUTLET OR UNPOWERED CONVENIENCE OUTLET							
									NO POWER EXHAUST				w/POWER EXHAUST (powered from unit)			
					STD SCCR CRHEATER ****00	HIGH SCCR CRHEATER ****00	NOM (kW)	FLA	MCA	FUSE OR HACR BRKR	DISCONNECT SIZE		MCA	FUSE OR HACR BRKR	DISCONNECT SIZE	
											FLA	LRA			FLA	LRA
50FCQM24 Vertical	208/230-3-60	STD/ MED	5	60	—	—	—	—	97	125	102	510	109	125	115	530
					454A	454A	18.8/25.0	52.1/60.1	162/172	175/175	162/171	562/570	174/184	175/200	175/184	582/590
					455A	455A	37.6/50.0	104.2/120.3	227/217	250/250	221/240	614/630	239/229	250/250	235/254	634/650
					456A	456A	56.3/75.0	156.4/180.4	253/277	300/300	282/309	666/690	265/289	300/300	295/323	686/710
		HIGH	5	60	—	—	—	—	109	125	116	528	121	150	129	548
					454A	454A	18.8/25.0	52.1/60.1	174/184	175/200	176/185	580/588	186/196	200/200	189/199	600/608
					455A	455A	37.6/50.0	104.2/120.3	240/230	250/250	236/254	632/648	251/241	300/250	249/268	652/668
					456A	456A	56.3/75.0	156.4/180.4	266/290	300/300	296/323	684/708	278/302	300/350	309/337	704/728
	460-3-60	STD/ MED	5	65	—	—	—	—	46	60	48	296	52	60	55	308
					457A	457A	25.0	30.1	83	90	82	326	89	90	90	338
					458A	458A	50.0	60.1	106	110	117	356	112	125	124	368
					459A	459A	75.0	90.2	136	150	152	386	142	150	159	398
		HIGH	5	65	—	—	—	—	51	60	54	304	57	70	61	316
					457A	457A	25.0	30.1	88	90	88	334	95	100	96	346
					458A	458A	50.0	60.1	111	125	123	364	117	125	130	376
					459A	459A	75.0	90.2	141	150	158	394	147	175	165	406
	575-3-60	STD/ MED	5	—	—	—	—	—	37	45	39	232	42	50	44	240
					460A	—	24.8	23.9	67	70	66	256	72	80	72	264
					461A	—	49.6	47.7	96	100	93	280	101	110	99	288
					462A	—	74.4	71.6	108	125	121	304	113	125	127	312
		HIGH	5	—	—	—	—	—	41	50	43	236	46	50	49	244
					460A	—	24.8	23.9	71	80	71	260	76	80	76	268
					461A	—	49.6	47.7	101	110	98	284	106	110	104	292
					462A	—	74.4	71.6	113	125	126	308	117	125	131	316
50FCQM24 Horizontal	208/230-3-60	HIGH	5	60	—	—	—	—	109	125	116	528	121	150	129	548
					463A	463A	18.8/25.0	52.1/60.1	174/184	175/200	176/185	580/588	186/196	200/200	189/199	600/608
					464A	464A	37.6/50.0	104.2/120.3	240/230	250/250	236/254	632/648	251/241	300/250	249/268	652/668
					465A	465A	56.3/75.0	156.4/180.4	266/290	300/300	296/323	684/708	278/302	300/350	309/337	704/728
	460-3-60	HIGH	5	65	—	—	—	—	51	60	54	304	57	70	61	316
					466A	466A	25.0	30.1	88	90	88	334	95	100	96	346
					467A	467A	50.0	60.1	111	125	123	364	117	125	130	376
					468A	468A	75.0	90.2	141	150	158	394	147	175	165	406
	575-3-60	HIGH	5	—	—	—	—	—	41	50	43	236	46	50	49	244
					469A	—	24.8	23.9	71	80	71	260	76	80	76	268
					470A	—	49.6	47.7	101	110	98	284	106	110	104	292
					471A	—	74.4	71.6	113	125	126	308	117	125	131	316

NOTE(S):

a. High SCCR (Short Circuit Current Rating) is not available on the following: units with Low Ambient controls, Phase loss monitor, Non-fused disconnect, and 575-v models.

Electrical data (cont)

50FCQM24 MCA MOCP Electrical Data (cont)

50FCQ UNIT SIZE	NOM. V-Ph-Hz	IFM TYPE	STD SCCR kA	ELECTRIC HEATER			W/POWERED CONVENIENCE OUTLET							
							NO POWER EXHAUST				w/POWER EXHAUST (powered from unit)			
				STD SCCR CRHEATER ****00	NOM (kW)	FLA	MCA	FUSE OR HACR BRKR	DISCONNECT SIZE		MCA	FUSE OR HACR BRKR	DISCONNECT SIZE	
									FLA	LRA			FLA	LRA
50FCQM24 Vertical	208/230-3-60	STD/ MED	5	—	—	—	102	125	107	515	114	125	121	535
				454A	18.8/25.0	52.1/60.1	167/177	175/200	167/176	567/575	179/189	200/200	181/190	587/595
				455A	37.6/50.0	104.2/120.3	232/222	250/250	227/246	619/635	244/234	250/250	241/259	639/655
				456A	56.3/75.0	156.4/180.4	258/282	300/300	287/315	671/695	270/294	300/350	301/328	691/715
		HIGH	5	—	—	—	114	125	121	533	126	150	135	553
				454A	18.8/25.0	52.1/60.1	179/189	200/200	181/191	585/593	191/201	200/225	195/204	605/613
				455A	37.6/50.0	104.2/120.3	244/234	250/250	241/260	637/653	256/246	300/300	255/273	657/673
				456A	56.3/75.0	156.4/180.4	270/294	300/350	301/329	689/713	282/306	300/350	315/342	709/733
	460-3-60	STD/ MED	5	—	—	—	48	60	50	298	54	60	58	310
				457A	25.0	30.1	85	90	85	328	92	100	92	340
				458A	50.0	60.1	108	125	119	358	114	125	127	370
				459A	75.0	90.2	138	150	154	388	144	150	161	400
		HIGH	5	—	—	—	53	60	56	306	59	70	63	318
				457A	25.0	30.1	91	100	91	336	97	100	98	348
				458A	50.0	60.1	113	125	125	366	119	125	133	378
				459A	75.0	90.2	143	150	160	396	149	175	167	408
	575-3-60	STD/ MED	5	—	—	—	38	50	41	234	43	50	46	242
				460A	24.8	23.9	68	70	68	258	73	80	74	266
				461A	49.6	47.7	98	100	95	282	103	110	101	290
				462A	74.4	71.6	110	125	123	306	115	125	128	314
		HIGH	5	—	—	—	43	50	45	238	48	60	51	246
				460A	24.8	23.9	73	80	73	262	77	80	78	270
				461A	49.6	47.7	102	110	100	286	107	110	106	294
				462A	74.4	71.6	114	125	128	310	119	125	133	318
50FCQM24 Horizontal	208/230-3-60	HIGH	5	—	—	—	114	125	121	533	126	150	135	553
				463A	18.8/25.0	52.1/60.1	179/189	200/200	181/191	585/593	191/201	200/225	195/204	605/613
				464A	37.6/50.0	104.2/120.3	244/234	250/250	241/260	637/653	256/246	300/300	255/273	657/673
				465A	56.3/75.0	156.4/180.4	270/294	300/350	301/329	689/713	282/306	300/350	315/342	709/733
	460-3-60	HIGH	5	—	—	—	53	60	56	306	59	70	63	318
				466A	25.0	30.1	91	100	91	336	97	100	98	348
				467A	50.0	60.1	113	125	125	366	119	125	133	378
				468A	75.0	90.2	143	150	160	396	149	175	167	408
	575-3-60	HIGH	5	—	—	—	43	50	45	238	48	60	51	246
				469A	24.8	23.9	73	80	73	262	77	80	78	270
				470A	49.6	47.7	102	110	100	286	107	110	106	294
				471A	74.4	71.6	114	125	128	310	119	125	133	318

Electrical data (cont)

Carrier

50FCQM28 MCA MOCP Electrical Data

50FCQ UNIT SIZE	NOM. V-Ph-Hz	IFM TYPE	STD SCCR kA	HIGH SCCR kA[a]	ELECTRIC HEATER				NO CONVENIENCE OUTLET OR UNPOWERED CONVENIENCE OUTLET							
									NO POWER EXHAUST				w/POWER EXHAUST (powered from unit)			
					STD SCCR CRHEATER ****00	HIGH SCCR CRHEATER ****00	NOM (kW)	FLA	MCA	FUSE OR HACR BRKR	DISCONNECT SIZE		MCA	FUSE OR HACR BRKR	DISCONNECT SIZE	
											FLA	LRA			FLA	LRA
50FCQM28 Vertical	208/230-3-60	STD/ MED	5	60	—	—	—	—	135	175	140	579	147	175	154	599
					454A	454A	18.8/25.0	52.1/60.1	200/210	225/225	200/209	631/639	212/222	250/250	214/223	651/659
					455A	455A	37.6/50.0	104.2/120.3	265/255	300/300	260/279	683/699	277/267	300/300	274/292	703/719
					456A	456A	56.3/75.0	156.4/180.4	291/315	350/350	320/348	735/759	303/327	350/350	334/361	755/779
		HIGH	5	60	—	—	—	—	145	175	152	593	157	200	166	613
					454A	454A	18.8/25.0	52.1/60.1	210/220	225/250	212/221	645/653	222/232	250/250	226/235	665/673
					455A	455A	37.6/50.0	104.2/120.3	275/265	300/300	272/290	697/713	287/277	300/300	285/304	717/733
					456A	456A	56.3/75.0	156.4/180.4	301/325	350/350	332/359	749/773	313/337	350/400	345/373	769/793
	460-3-60	STD/ MED	5	65	—	—	—	—	57	70	59	293	63	80	66	305
					457A	457A	25.0	30.1	95	100	94	323	101	110	101	335
					458A	458A	50.0	60.1	117	125	128	353	124	150	136	365
					459A	459A	75.0	90.2	147	175	163	383	154	175	170	395
		HIGH	5	65	—	—	—	—	61	80	64	299	68	90	71	311
					457A	457A	25.0	30.1	99	100	99	329	105	110	106	341
					458A	458A	50.0	60.1	122	150	133	359	128	150	140	371
					459A	459A	75.0	90.2	152	175	168	389	158	175	175	401
	575-3-60	STD/ MED	5	—	—	—	—	—	48	60	50	225	53	60	55	233
					460A	—	24.8	23.9	78	90	77	249	83	90	83	257
					461A	—	49.6	47.7	108	110	105	273	113	125	110	281
					462A	—	74.4	71.6	120	125	132	297	125	150	138	305
		HIGH	5	—	—	—	—	—	52	60	54	229	56	70	59	237
					460A	—	24.8	23.9	82	90	81	253	86	100	87	261
					461A	—	49.6	47.7	111	125	108	277	116	125	114	285
					462A	—	74.4	71.6	123	150	136	301	128	150	141	309
50FCQM28 Horizontal	208/230-3-60	HIGH	5	65	—	—	—	—	145	175	152	593	157	200	166	613
					463A	463A	18.8/25.0	52.1/60.1	210/220	225/250	212/221	645/653	222/232	250/250	226/235	665/673
					464A	464A	37.6/50.0	104.2/120.3	275/265	300/300	272/290	697/713	287/277	300/300	285/304	717/733
					465A	465A	56.3/75.0	156.4/180.4	301/325	350/350	332/359	749/773	313/337	350/400	345/373	769/793
	460-3-60	HIGH	5	65	—	—	—	—	61	80	64	299	68	90	71	311
					466A	466A	25.0	30.1	99	100	99	329	105	110	106	341
					467A	467A	50.0	60.1	122	150	133	359	128	150	140	371
					468A	468A	75.0	90.2	152	175	168	389	158	175	175	401
	575-3-60	HIGH	5	—	—	—	—	—	52	60	54	229	56	70	59	237
					469A	—	24.8	23.9	82	90	81	253	86	100	87	261
					470A	—	49.6	47.7	111	125	108	277	116	125	114	285
					471A	—	74.4	71.6	123	150	136	301	128	150	141	309

NOTE(S):

a. High SCCR (Short Circuit Current Rating) is not available on the following: units with Low Ambient controls, Phase loss monitor, Non-fused disconnect, and 575-v models.

Electrical data (cont)

50FCQM28 MCA MOCP Electrical Data (cont)

50FCQ UNIT SIZE	NOM. V-Ph-Hz	IFM TYPE	STD SCCR kA	ELECTRIC HEATER			W/POWERED CONVENIENCE OUTLET							
							NO POWER EXHAUST				w/POWER EXHAUST (powered from unit)			
				STD SCCR CRHEATER ****00	NOM (kW)	FLA	MCA	FUSE OR HACR BRKR	DISCONNECT SIZE		MCA	FUSE OR HACR BRKR	DISCONNECT SIZE	
									FLA	LRA			FLA	LRA
50FCQM28 Vertical	208/230-3-60	STD/ MED	5	—	—	—	140	175	146	584	151	200	159	604
				454A	18.8/25.0	52.1/60.1	205/215	225/250	206/215	636/644	217/227	250/250	219/229	656/664
				455A	37.6/50.0	104.2/120.3	270/260	300/300	266/284	688/704	282/272	300/300	279/298	708/724
				456A	56.3/75.0	156.4/180.4	296/320	350/350	326/353	740/764	308/332	350/350	339/367	760/784
		HIGH	5	—	—	—	150	200	158	598	162	200	171	618
				454A	18.8/25.0	52.1/60.1	215/225	250/250	217/227	650/658	227/237	250/250	231/240	670/678
				455A	37.6/50.0	104.2/120.3	280/270	300/300	277/296	702/718	292/282	300/300	291/309	722/738
				456A	56.3/75.0	156.4/180.4	306/330	350/350	337/365	754/778	318/342	350/400	351/379	774/798
	460-3-60	STD/ MED	5	—	—	—	59	80	62	295	66	80	69	307
				457A	25.0	30.1	97	100	96	325	103	110	104	337
				458A	50.0	60.1	120	150	131	355	126	150	138	367
				459A	75.0	90.2	150	175	166	385	156	175	173	397
		HIGH	5	—	—	—	64	80	67	301	70	90	74	313
				457A	25.0	30.1	101	110	101	331	107	110	108	343
				458A	50.0	60.1	124	150	136	361	130	150	143	373
				459A	75.0	90.2	154	175	170	391	160	175	178	403
	575-3-60	STD/ MED	5	—	—	—	50	60	52	227	55	60	57	235
				460A	24.8	23.9	80	90	79	251	85	90	85	259
				461A	49.6	47.7	110	110	107	275	114	125	112	283
				462A	74.4	71.6	122	150	134	299	126	150	140	307
		HIGH	5	—	—	—	53	60	56	231	58	70	61	239
				460A	24.8	23.9	83	90	83	255	88	100	89	263
				461A	49.6	47.7	113	125	110	279	118	125	116	287
				462A	74.4	71.6	125	150	138	303	130	150	143	311
50FCQM28 Horizontal	208/230-3-60	HIGH	5	—	—	—	150	200	158	598	162	200	171	618
				463A	18.8/25.0	52.1/60.1	215/225	250/250	217/227	650/658	227/237	250/250	231/240	670/678
				464A	37.6/50.0	104.2/120.3	280/270	300/300	277/296	702/718	292/282	300/300	291/309	722/738
				465A	56.3/75.0	156.4/180.4	306/330	350/350	337/365	754/778	318/342	350/400	351/379	774/798
	460-3-60	HIGH	5	—	—	—	64	80	67	301	70	90	74	313
				466A	25.0	30.1	101	110	101	331	107	110	108	343
				467A	50.0	60.1	124	150	136	361	130	150	143	373
				468A	75.0	90.2	154	175	170	391	160	175	178	403
	575-3-60	HIGH	5	—	—	—	53	60	56	231	58	70	61	239
				469A	24.8	23.9	83	90	83	255	88	100	89	263
				470A	49.6	47.7	113	125	110	279	118	125	116	287
				471A	74.4	71.6	125	150	138	303	130	150	143	311

Electrical data (cont)

50FCQM17 Electric Heat Data — Standard SCCR Unit

50FCQ UNIT SIZE	NOM. V-Ph-Hz	IFM TYPE	STD SCCR kA	STD ELECTRIC HEATER PART NUMBER	NOMINAL (kW)	APPLICATION (kW)	APPLICATION OUTPUT (MBH)	STD SCCR SINGLE POINT OR JUNCTION KIT PART NUMBER CRSINGLEXXXA00			
								NO C.O. OR UNPOWERED C.O.		w/PWRD C.O.	
								NO P.E.	w/P.E. (pwrd fr/unit)	NO P.E.	w/P.E. (pwrd fr/unit)
50FCQM17 Vertical	208/230-3-60	STD/ MED	5	CRHEATER454A00	25.0	18.8/23.0	64.1/78.3	056	056	056	056
				CRHEATER455A00	50.0	37.6/45.9	128.1/156.7	056	056	056	056
				CRHEATER456A00	75.0	56.3/68.9	192.2/235.0	056	056	056	056
		HIGH	5	CRHEATER454A00	25.0	18.8/23.0	64.1/78.3	056	056	056	056
				CRHEATER455A00	50.0	37.6/45.9	128.1/156.7	056	056	056	056
				CRHEATER456A00	75.0	56.3/68.9	192.2/235.0	056	056	056	056
	460-3-60	STD/ MED	5	CRHEATER457A00	25.0	23.0	78.3	057	057	057	057
				CRHEATER458A00	50.0	45.9	156.7	057	057	057	057
				CRHEATER459A00	75.0	68.9	235.0	057	057	057	057
		HIGH	5	CRHEATER457A00	25.0	23.0	78.3	057	057	057	057
				CRHEATER458A00	50.0	45.9	156.7	057	057	057	057
				CRHEATER459A00	75.0	68.9	235.0	057	057	057	057
	575-3-60	STD/ MED	5	CRHEATER460A00	24.8	22.8	77.7	—	—	—	—
				CRHEATER461A00	49.6	45.6	155.4	057	057	057	057
				CRHEATER462A00	74.4	68.3	233.1	057	057	057	057
		HIGH	5	CRHEATER460A00	24.8	22.8	77.7	—	—	—	—
				CRHEATER461A00	49.6	45.6	155.4	057	057	057	057
				CRHEATER462A00	74.4	68.3	233.1	057	057	057	057
50FCQM17 Horizontal	208/230-3-60	HIGH	5	CRHEATER463A00	25.0	18.8/23.0	64.1/78.3	056	056	056	056
				CRHEATER464A00	50.0	37.6/45.9	128.1/156.7	056	056	056	056
				CRHEATER465A00	75.0	56.3/68.9	192.2/235.0	056	056	056	056
	460-3-60	HIGH	5	CRHEATER466A00	25.0	23.0	78.3	057	057	057	057
				CRHEATER467A00	50.0	45.9	156.7	057	057	057	057
				CRHEATER468A00	75.0	68.9	235.0	057	057	057	057
	575-3-60	HIGH	5	CRHEATER469A00	24.8	22.8	77.7	—	—	—	—
				CRHEATER470A00	49.6	45.6	155.4	057	057	057	057
				CRHEATER471A00	74.4	68.3	233.1	057	057	057	057

50FCQM17 Electric Heat Data — High SCCR Unit

50FCQ UNIT SIZE	NOM. V-Ph-Hz	IFM TYPE	HIGH SCCR kA	HIGH SCCR ELECTRIC HEATER PART NUMBER	NOMINAL (kW)	APPLICATION (kW)	APPLICATION OUTPUT (MBH)	HIGH SCCR SINGLE POINT OR JUNCTION KIT PART NUMBER CRSINGLEXXXA00	
								NO C.O. OR UNPOWERED C.O.	
								NO P.E.	w/P.E. (pwrd fr/unit)
50FCQM17 Vertical	208/230-3-60	STD/ MED	60	CRHEATER454A00	25.0	18.8/23.0	64.1/78.3	058	058
				CRHEATER455A00	50.0	37.6/45.9	128.1/156.7	058	058
				CRHEATER456A00	75.0	56.3/68.9	192.2/235.0	058	058
		HIGH	60	CRHEATER454A00	25.0	18.8/23.0	64.1/78.3	058	058
				CRHEATER455A00	50.0	37.6/45.9	128.1/156.7	058	058
				CRHEATER456A00	75.0	56.3/68.9	192.2/235.0	058	058
	460-3-60	STD/ MED	65	CRHEATER457A00	25.0	23.0	78.3	059	059
				CRHEATER458A00	50.0	45.9	156.7	059	059
				CRHEATER459A00	75.0	68.9	235.0	059	059
		HIGH	65	CRHEATER457A00	25.0	23.0	78.3	059	059
				CRHEATER458A00	50.0	45.9	156.7	059	059
				CRHEATER459A00	75.0	68.9	235.0	059	059
	575-3-60	STD/ MED	—	—	24.8	22.8	77.7	—	—
				—	49.6	45.6	155.4	—	—
				—	74.4	68.3	233.1	—	—
		HIGH	—	—	24.8	22.8	77.7	—	—
				—	49.6	45.6	155.4	—	—
				—	74.4	68.3	233.1	—	—
50FCQM17 Horizontal	208/230-3-60	HIGH	60	CRHEATER463A00	25.0	18.8/23.0	64.1/78.3	058	058
				CRHEATER464A00	50.0	37.6/45.9	128.1/156.7	058	058
				CRHEATER465A00	75.0	56.3/68.9	192.2/235.0	058	058
	460-3-60	HIGH	65	CRHEATER466A00	25.0	23.0	78.3	059	059
				CRHEATER467A00	50.0	45.9	156.7	059	059
				CRHEATER468A00	75.0	68.9	235.0	059	059
	575-3-60	HIGH	—	—	24.8	22.8	77.7	—	—
				—	49.6	45.6	155.4	—	—
				—	74.4	68.3	233.1	—	—

50FCQM24 Electric Heat Data — Standard SCCR Unit

50FCQ UNIT SIZE	NOM. V-Ph-Hz	IFM TYPE	STD SCCR kA	STD ELECTRIC HEATER PART NUMBER	NOMINAL (kW)	APPLICATION (kW)	APPLICATION OUTPUT (MBH)	STD SCCR SINGLE POINT OR JUNCTION KIT PART NUMBER CRSINGLEXXXA00			
								NO C.O. OR UNPOWERED C.O.		w/PWRD C.O.	
								NO P.E.	w/P.E. (pwrd fr/unit)	NO P.E.	w/P.E. (pwrd fr/unit)
50FCQM24 Vertical	208/230-3-60	STD/ MED	5	CRHEATER454A00	25.0	18.8/23.0	64.1/78.3	056	056	056	056
				CRHEATER455A00	50.0	37.6/45.9	128.1/156.7	056	056	056	056
				CRHEATER456A00	75.0	56.3/68.9	192.2/235.0	056	056	056	056
		HIGH	5	CRHEATER454A00	25.0	18.8/23.0	64.1/78.3	056	056	056	056
				CRHEATER455A00	50.0	37.6/45.9	128.1/156.7	056	056	056	056
				CRHEATER456A00	75.0	56.3/68.9	192.2/235.0	056	056	056	056
	460-3-60	STD/ MED	5	CRHEATER457A00	25.0	23.0	78.3	057	057	057	057
				CRHEATER458A00	50.0	45.9	156.7	057	057	057	057
				CRHEATER459A00	75.0	68.9	235.0	057	057	057	057
		HIGH	5	CRHEATER457A00	25.0	23.0	78.3	057	057	057	057
				CRHEATER458A00	50.0	45.9	156.7	057	057	057	057
				CRHEATER459A00	75.0	68.9	235.0	057	057	057	057
	575-3-60	STD/ MED	5	CRHEATER460A00	24.8	22.8	77.7	—	057	—	057
				CRHEATER461A00	49.6	45.6	155.4	057	057	057	057
				CRHEATER462A00	74.4	68.3	233.1	057	057	057	057
		HIGH	5	CRHEATER460A00	24.8	22.8	77.7	057	057	057	057
				CRHEATER461A00	49.6	45.6	155.4	057	057	057	057
				CRHEATER462A00	74.4	68.3	233.1	057	057	057	057
50FCQM24 Horizontal	208/230-3-60	HIGH	5	CRHEATER463A00	25.0	18.8/23.0	64.1/78.3	056	056	056	056
				CRHEATER464A00	50.0	37.6/45.9	128.1/156.7	056	056	056	056
				CRHEATER465A00	75.0	56.3/68.9	192.2/235.0	056	056	056	056
	460-3-60	HIGH	5	CRHEATER466A00	25.0	23.0	78.3	057	057	057	057
				CRHEATER467A00	50.0	45.9	156.7	057	057	057	057
				CRHEATER468A00	75.0	68.9	235.0	057	057	057	057
	575-3-60	HIGH	5	CRHEATER469A00	24.8	22.8	77.7	—	—	—	—
				CRHEATER470A00	49.6	45.6	155.4	057	057	057	057
				CRHEATER471A00	74.4	68.3	233.1	057	057	057	057

50FCQM24 Electric Heat Data — High SCCR Unit

50FCQ UNIT SIZE	NOM. V-Ph-Hz	IFM TYPE	HIGH SCCR kA	HIGH SCCR ELECTRIC HEATER PART NUMBER	NOMINAL (kW)	APPLICATION (kW)	APPLICATION OUTPUT (MBH)	HIGH SCCR SINGLE POINT OR JUNCTION KIT PART NUMBER CRSINGLEXXXA00 — NO C.O. OR UNPOWERED C.O. — NO P.E.	w/P.E. (pwrd fr/unit)
50FCQM24 Vertical	208/230-3-60	STD/ MED	60	CRHEATER454A00	25.0	18.8/23.0	64.1/78.3	058	058
				CRHEATER455A00	50.0	37.6/45.9	128.1/156.7	058	058
				CRHEATER456A00	75.0	56.3/68.9	192.2/235.0	058	058
		HIGH	60	CRHEATER454A00	25.0	18.8/23.0	64.1/78.3	058	058
				CRHEATER455A00	50.0	37.6/45.9	128.1/156.7	058	058
				CRHEATER456A00	75.0	56.3/68.9	192.2/235.0	058	058
	460-3-60	STD/ MED	65	CRHEATER457A00	25.0	23.0	78.3	059	059
				CRHEATER458A00	50.0	45.9	156.7	059	059
				CRHEATER459A00	75.0	68.9	235.0	059	059
		HIGH	55	CRHEATER457A00	25.0	23.0	78.3	059	059
				CRHEATER458A00	50.0	45.9	156.7	059	059
				CRHEATER459A00	75.0	68.9	235.0	059	059
	575-3-60	STD/ MED	—	—	24.8	22.8	77.7	—	—
				—	49.6	45.6	155.4	—	—
				—	74.4	68.3	233.1	—	—
		HIGH	—	—	24.8	22.8	77.7	—	—
				—	49.6	45.6	155.4	—	—
				—	74.4	68.3	233.1	—	—
50FCQM24 Horizontal	208/230-3-60	HIGH	60	CRHEATER463A00	25.0	18.8/23.0	64.1/78.3	058	058
				CRHEATER464A00	50.0	37.6/45.9	128.1/156.7	058	058
				CRHEATER465A00	75.0	56.3/68.9	192.2/235.0	058	058
	460-3-60	HIGH	65	CRHEATER466A00	25.0	23.0	78.3	059	059
				CRHEATER467A00	50.0	45.9	156.7	059	059
				CRHEATER468A00	75.0	68.9	235.0	059	059
	575-3-60	HIGH	—	—	24.8	22.8	77.7	—	—
				—	49.6	45.6	155.4	—	—
				—	74.4	68.3	233.1	—	—

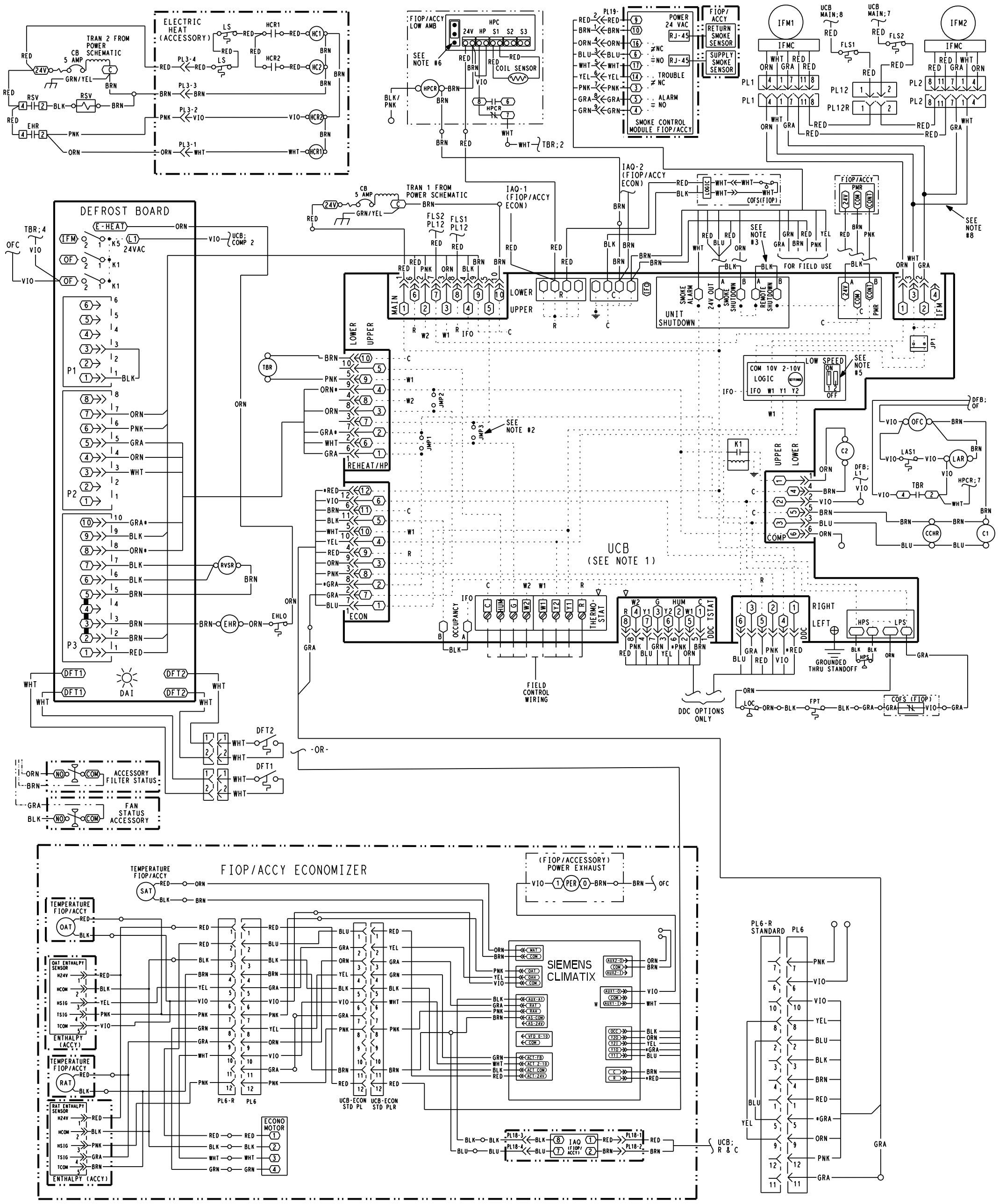
50FCQM28 Electric Heat Data — Standard SCCR Unit

50FCQ UNIT SIZE	NOM. V-Ph-Hz	IFM TYPE	STD SCCR kA	STD ELECTRIC HEATER PART NUMBER	NOMINAL (kW)	APPLICATION (kW)	APPLICATION OUTPUT (MBH)	STD SCCR SINGLE POINT OR JUNCTION KIT PART NUMBER CRSINGLEXXXA00			
								NO C.O. OR UNPOWERED C.O.		w/PWRD C.O.	
								NO P.E.	w/P.E. (pwrd fr/unit)	NO P.E.	w/P.E. (pwrd fr/unit)
50FCQM28 Vertical	208/230-3-60	STD/ MED	5	CRHEATER454A00	25.0	18.8/23.0	64.1/78.3	056	056	056	056
				CRHEATER455A00	50.0	37.6/45.9	128.1/156.7	056	056	056	056
				CRHEATER456A00	75.0	56.3/68.9	192.2/235.0	056	056	056	056
		HIGH	5	CRHEATER454A00	25.0	18.8/23.0	64.1/78.3	056	056	056	056
				CRHEATER455A00	50.0	37.6/45.9	128.1/156.7	056	056	056	056
				CRHEATER456A00	75.0	56.3/68.9	192.2/235.0	056	056	056	056
	460-3-60	STD/ MED	5	CRHEATER457A00	25.0	23.0	78.3	057	057	057	057
				CRHEATER458A00	50.0	45.9	156.7	057	057	057	057
				CRHEATER459A00	75.0	68.9	235.0	057	057	057	057
		HIGH	5	CRHEATER457A00	25.0	23.0	78.3	057	057	057	057
				CRHEATER458A00	50.0	45.9	156.7	057	057	057	057
				CRHEATER459A00	75.0	68.9	235.0	057	057	057	057
	575-3-60	STD/ MED	5	CRHEATER460A00	24.8	22.8	77.7	057	057	057	057
				CRHEATER461A00	49.6	45.6	155.4	057	057	057	057
				CRHEATER462A00	74.4	68.3	233.1	057	057	057	057
		HIGH	5	CRHEATER460A00	24.8	22.8	77.7	057	057	057	057
				CRHEATER461A00	49.6	45.6	155.4	057	057	057	057
				CRHEATER462A00	74.4	68.3	233.1	057	057	057	057
50FCQM28 Horizontal	208/230-3-60	HIGH	5	CRHEATER463A00	25.0	18.8/23.0	64.1/78.3	056	056	056	056
				CRHEATER464A00	50.0	37.6/45.9	128.1/156.7	056	056	056	056
				CRHEATER465A00	75.0	56.3/68.9	192.2/235.0	056	056	056	056
	460-3-60	HIGH	5	CRHEATER466A00	25.0	23.0	78.3	057	057	057	057
				CRHEATER467A00	50.0	45.9	156.7	057	057	057	057
				CRHEATER468A00	75.0	68.9	235.0	057	057	057	057
	575-3-60	HIGH	5	CRHEATER469A00	24.8	22.8	77.7	057	057	057	057
				CRHEATER470A00	49.6	45.6	155.4	057	057	057	057
				CRHEATER471A00	74.4	68.3	233.1	057	057	057	057

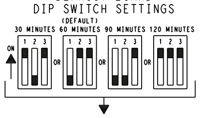
50FCQM28 Electric Heat Data — High SCCR Unit

50FCQ UNIT SIZE	NOM. V-Ph-Hz	IFM TYPE	HIGH SCCR kA	HIGH SCCR ELECTRIC HEATER PART NUMBER	NOMINAL (kW)	APPLICATION (kW)	APPLICATION OUTPUT (MBH)	HIGH SCCR SINGLE POINT OR JUNCTION KIT PART NUMBER CRSINGLEXXXA00 — NO C.O. OR UNPOWERED C.O. — NO P.E.	HIGH SCCR SINGLE POINT OR JUNCTION KIT PART NUMBER CRSINGLEXXXA00 — NO C.O. OR UNPOWERED C.O. — w/P.E. (pwrd fr/unit)
50FCQM28 Vertical	208/230-3-60	STD/ MED	60	CRHEATER454A00	25.0	18.8/23.0	64.1/78.3	058	058
				CRHEATER455A00	50.0	37.6/45.9	128.1/156.7	058	058
				CRHEATER456A00	75.0	56.3/68.9	192.2/235.0	058	058
		HIGH	60	CRHEATER454A00	25.0	18.8/23.0	64.1/78.3	058	058
				CRHEATER455A00	50.0	37.6/45.9	128.1/156.7	058	058
				CRHEATER456A00	75.0	56.3/68.9	192.2/235.0	058	058
	460-3-60	STD/ MED	65	CRHEATER457A00	25.0	23.0	78.3	059	059
				CRHEATER458A00	50.0	45.9	156.7	059	059
				CRHEATER459A00	75.0	68.9	235.0	059	059
		HIGH	65	CRHEATER457A00	25.0	23.0	78.3	059	059
				CRHEATER458A00	50.0	45.9	156.7	059	059
				CRHEATER459A00	75.0	68.9	235.0	059	059
	575-3-60	STD/ MED	—	—	24.8	22.8	77.7	—	—
				—	49.6	45.6	155.4	—	—
				—	74.4	68.3	233.1	—	—
		HIGH	—	—	24.8	22.8	77.7	—	—
				—	49.6	45.6	155.4	—	—
				—	74.4	68.3	233.1	—	—
50FCQM28 Horizontal	208/230-3-60	HIGH	60	CRHEATER463A00	25.0	18.8/23.0	64.1/78.3	058	058
				CRHEATER464A00	50.0	37.6/45.9	128.1/156.7	058	058
				CRHEATER465A00	75.0	56.3/68.9	192.2/235.0	058	058
	460-3-60	HIGH	65	CRHEATER466A00	25.0	23.0	78.3	059	059
				CRHEATER467A00	50.0	45.9	156.7	059	059
				CRHEATER468A00	75.0	68.9	235.0	059	059
	575-3-60	HIGH	—	—	24.8	22.8	77.7	—	—
				—	49.6	45.6	155.4	—	—
				—	74.4	68.3	233.1	—	—

Typical 50FCQ*17-28 Control Wiring Diagram, Electromechanical with POL224 Controller, 460/575-3-60 Unit Shown



DEFROST BOARD
DIP SWITCH SETTINGS



FIELD SELECTABLE OPTIONS FOR TIME PERIOD BETWEEN DEFROST CYCLES (MINUTES).

SPEED UP — SHORT — SHORT TEST WIRES (USE METAL OBJECT) FIELD SPEED-UP CYCLE

1) MOMENTARILY SHORT WIRES AND RELEASE TO BYPASS COMPRESSOR OFF DELAY.
2) SHORT FOR 1-10 SEC. AND RELEASE FOR FORCED DEFROST.
3) PERMANENT SHORT WILL BE IGNORED.

DEFROST WILL TERMINATE IN 30 SEC. IF DFT IS OPEN.
DEFROST WILL TERMINATE NORMALLY IF DFT IS CLOSED.

NOTES:

1. TERMINAL BOARD SCHEMATIC LAYOUT DOES NOT MATCH ACTUAL TERMINAL BOARD LAYOUT.
2. TERMINAL BOARD JUMPERS 1,2 AND 3 ARE CUT FROM THE FACTORY.
3. REMOVE DESIGNATED JUMPERS ON TERMINAL BOARD WHEN ADDING SMOKE DETECTORS, OCCUPANCY AND REMOTE SHUTDOWN.
4. USE ABC AS COARSE AND AS POT FINE ADJUSTMENTS FOR SETTING HIGH FAN SPEED. LOW SPEED IS AN OFFSET BASED ON DIP SWITCHES.

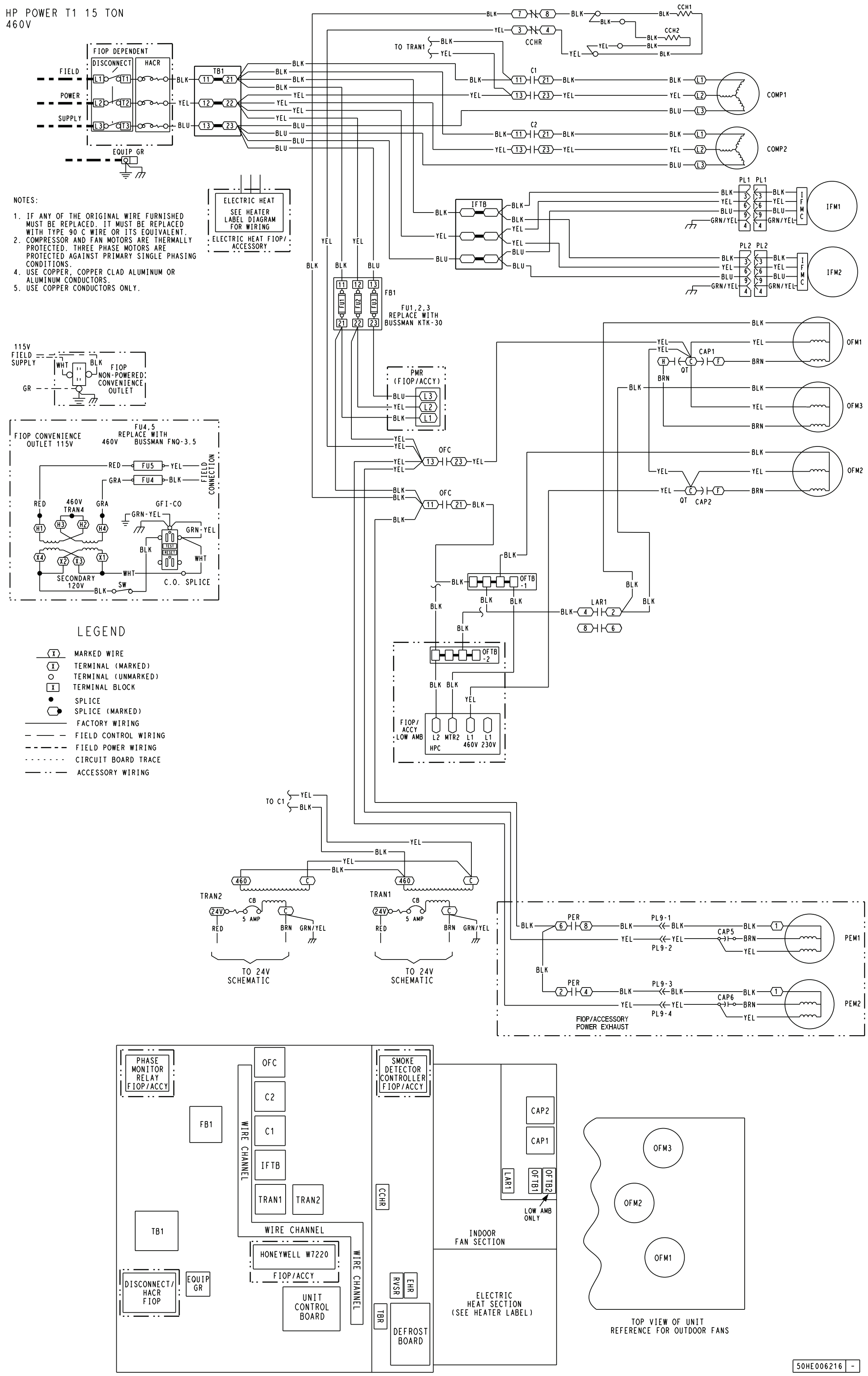
5. 2-PIN LOW SPEED DIP SWITCH POSITIONS ARE FACTORY SET AS SHOWN.
6. HARDSTART AND CUTOUT SET TO "MIN", JUMPER PIN ON TOP 2-PINS AS SHOWN.
7. THE * WIRE COLOR IS FOR DIFFERENTIATION WITHIN THIS SCHEMATIC.
8. ON HORIZONTAL SUPPLY UNITS, IFM2 GRA AND WHT WIRES WILL INCLUDE IN-LINE RESISTORS TO REDUCE IT'S SPEED.

ACCY	ACCESSORY
AMB	AMBIENT
C	CONTACTOR,COMPRESSOR
CAP	CAPACITOR
CB	CIRCUIT BREAKER
CCH	CRANKCASE HEATER
CCHR	CRANKCASE HEATER RELAY
CMB	COMBUSTION
COFS	CONDENSATE OVERFLOW SWT
COMP	COMPRESSOR MOTOR
DDC	DIRECT DIGITAL CONTROL
EHLO	ELECTRIC HEAT LOCKOUT
EHR	ELECTRIC HEAT RELEAY
ERV	ENERGY RECOVERY VENTILATOR
FIOP	FACTORY INSTALLED OPTION
FLS	FAN LIMIT SWITCH
FPT	FREEZE PROTECTION THERMOSTAT
FSD	FIRE SHUT DOWN
FS	FLAME SENSOR
FU	FUSE
GND	GROUND
GVR	GAS VALVE RELAY
HPC	HEAD PRESSURE CONTROL
HPS	HIGH PRESSURE SWITCH
HS	HALL EFFECT SENSOR
I	IGNITOR
IAQ	INDOOR AIR QUALITY SENSORS
IDM	INDUCED DRAFT MOTOR
IFCB	INDOOR FAN CIRCUIT BREAKER
IFM	INDOOR FAN MOTOR
IFMC	INDOOR FAN CONTROLLER
IGC	INTEGRATED GAS CONTROL
JMP	JUMPER
LA	LOW AMBIENT
LDV	LIQUID DIVERTER VALVE
LOC	LOSS OF CHARGE
LPS	LOW PRESSURE SWITCH
LSM	LIMIT SWITCH (MANUAL RESET)
LS	LIMIT SWITCH
LTLO	LOW TEMPERATURE LOCKOUT
MGV	MAIN GAS VALVE
MOV	VOLTAGE RESTRICTOR
MTR	MOTOR
MTS	MIXED AIR TEMPERATURE SWITCH
OAQ	OUTDOOR AIR QUALITY
OARH	OUTSIDE AIR RELATIVE HUMIDITY
OAT	OUTDOOR AIR TEMP. SENSOR
OFC	OUTDOOR FAN CONTACTOR
OFM	OUTDOOR FAN MOTOR
OFR	OUTDOOR FAN RELAY
OL	OVERLOAD
PER	POWER EXHAUST RELAY
PL	PLUG ASSEMBLY
POT	POTENTIOMETER
PMR	PHASE MONITOR RELAY
QT	QUADRUPLE TERMINAL
RARH	RETURN AIR RELATIVE HUMIDITY
RAT	RETURN AIR TEMP. SENSOR
RDV	REHEAT DISCHARGE VALVE
RS	ROLLOUT SWITCH
RVSR	REVERSING VALVE RELAY
SAT	SUPPLY AIR TEMP. SENSOR
SEN	SENSOR
SPRH	SPACE RELATIVE HUMIDITY
SPT	SPACE TEMPERATURE SENSOR
SPTO	SPACE TEMPERATURE OFFSET
STD	STANDARD
TB	TERMINAL BLOCK
TBR	TEMPERATURE BYPASS RELAY
TDR	TIME DELAY RELAY(WINTER START)
TRAN	TRANSFORMER
UCB	UNIT CONTROL BOARD

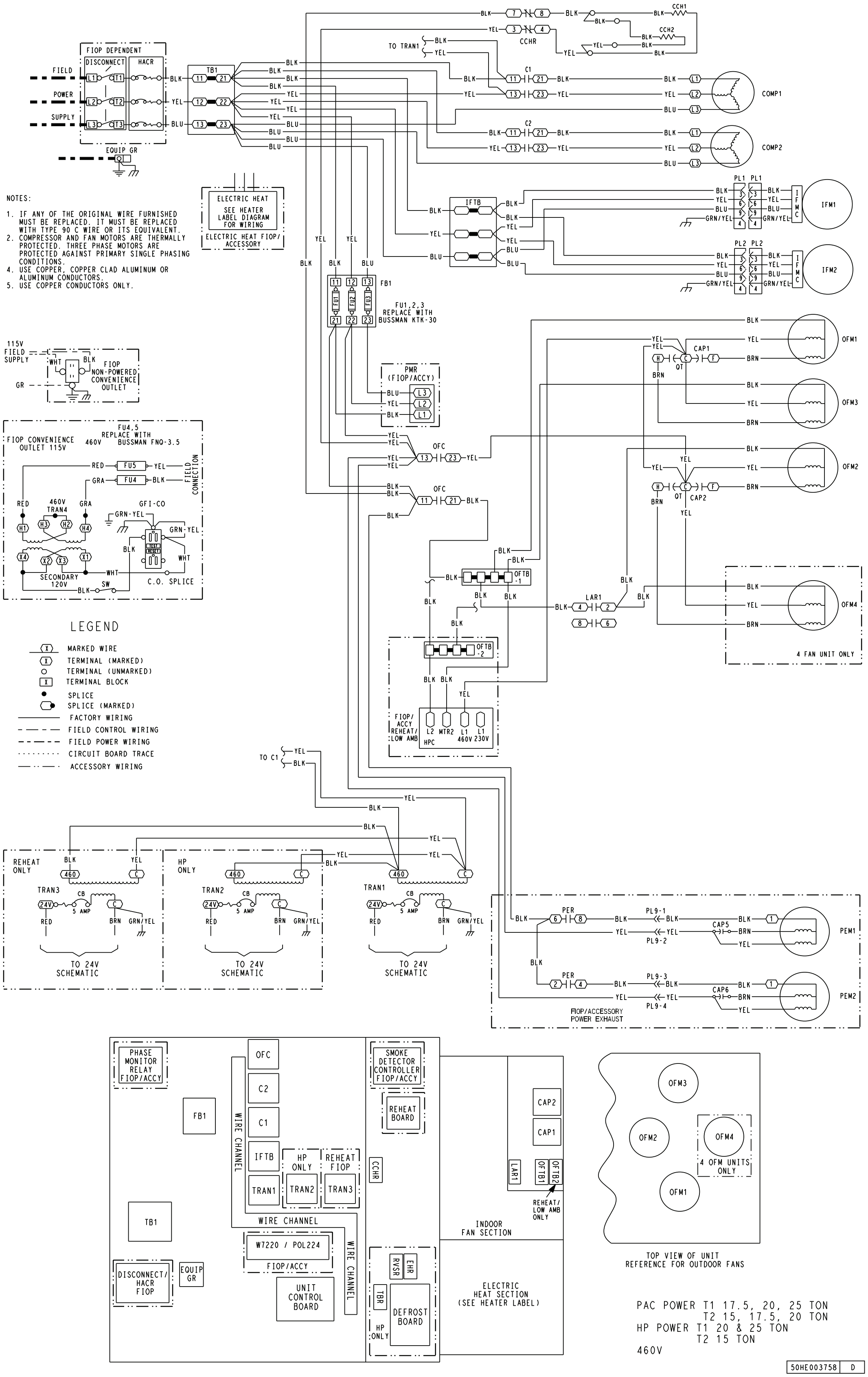
HP CONTROL 460V , 575V T1 15-25 TON

50HE006336 A

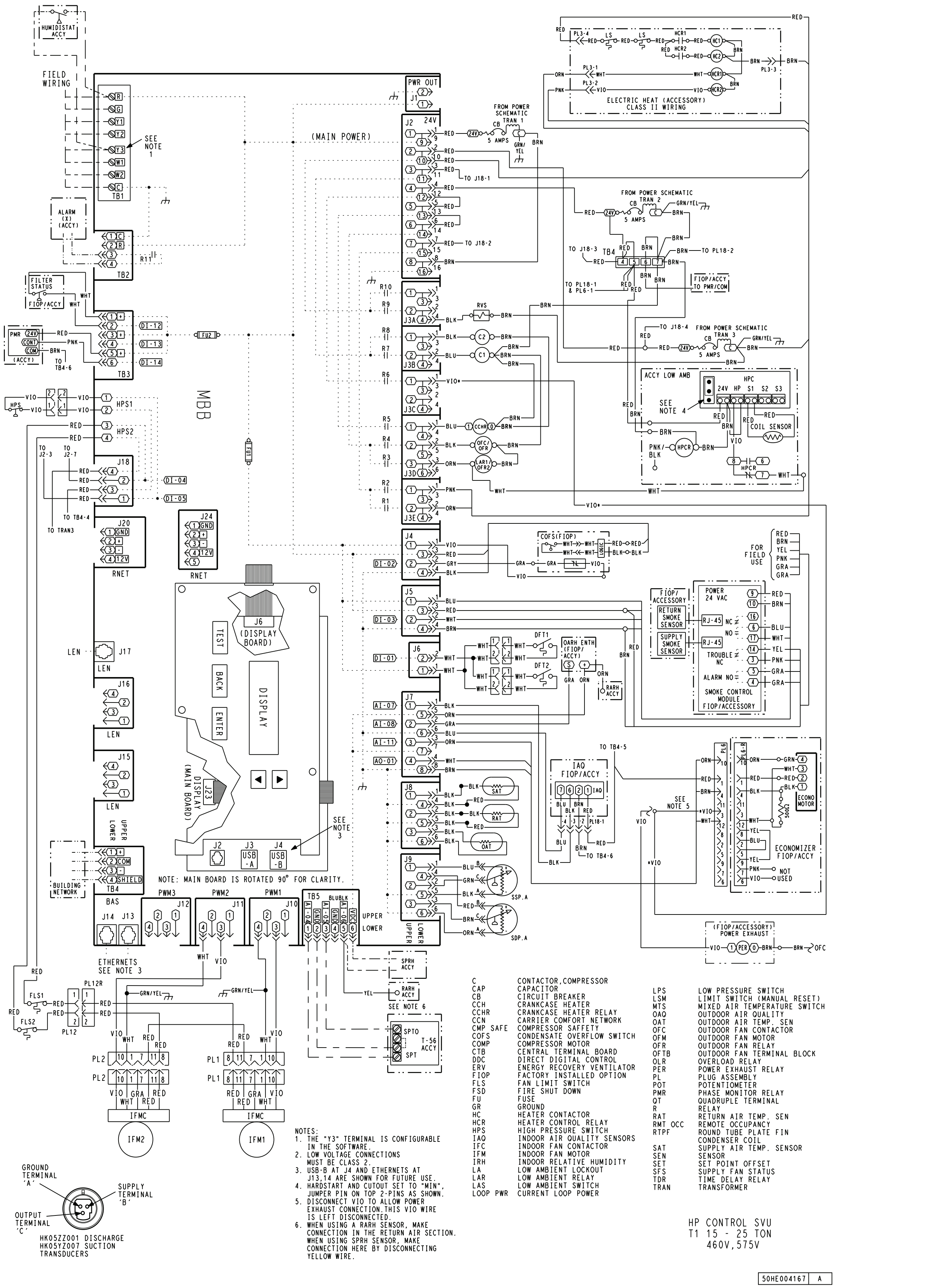
Typical 50FCQ*17 Power Wiring Diagram, Electromechanical Controller, 15 Ton 460-3-60 Unit Shown



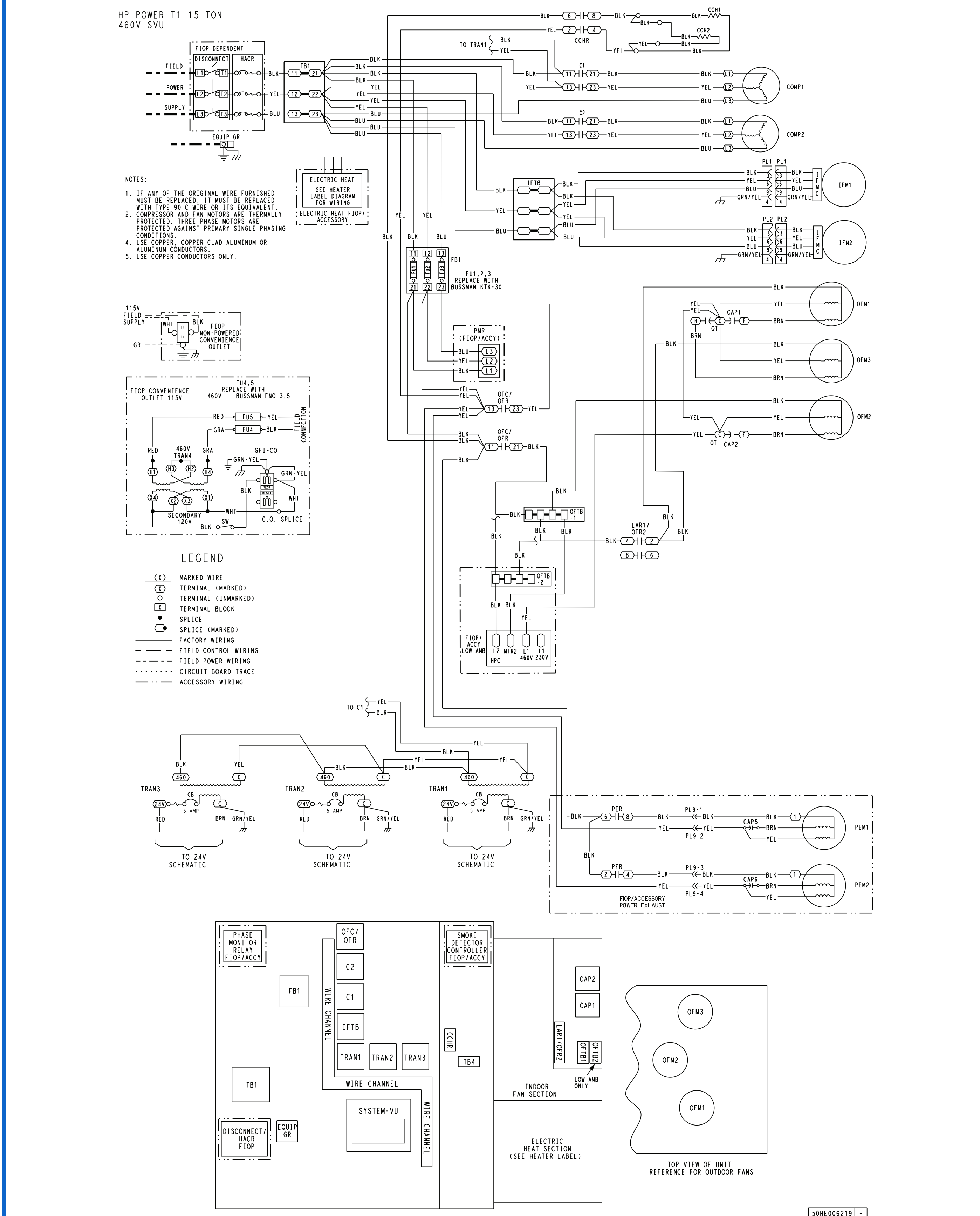
Typical 50FCQ*24-28 Power Wiring Diagram, Electromechanical Controller, 460-3-60 Unit Shown



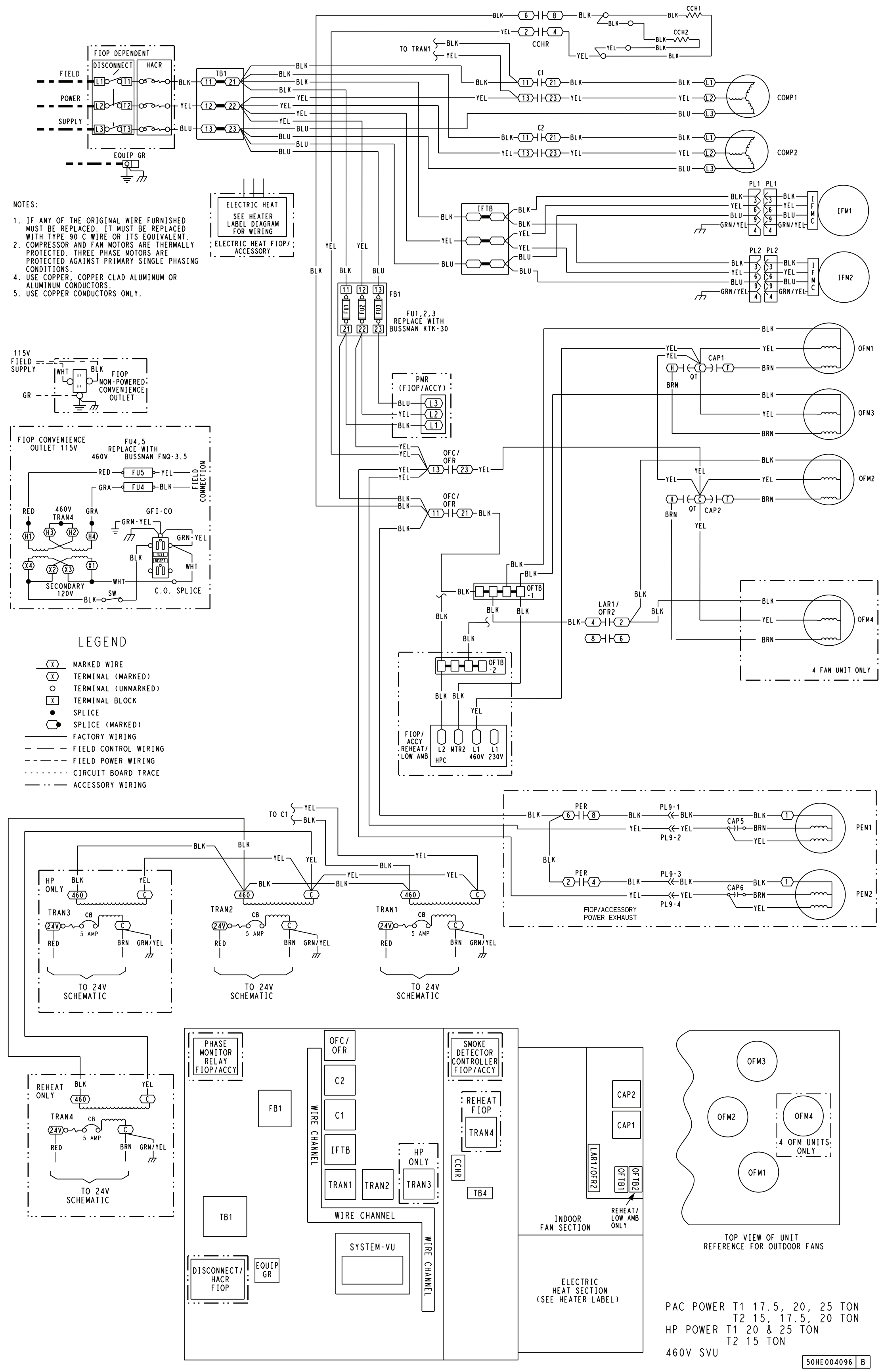
Typical 50FCQ*17-28 Control Wiring Diagram, SystemVu™ Controller, 460-3-60 Unit Shown



Typical 50FCQ*17 Power Wiring Diagram, SystemVu™ Controller, 15 Ton 460-3-60 Unit Shown



Typical 50FCQ*24-28 Power Wiring Diagram, SystemVu™ Controller, 460-3-60 Unit Shown



Sequence of operation

General

The sequence below describes the sequence of operation for an electromechanical unit with and without a factory-installed EconomizerONE (POL224 controller). For information regarding a direct digital controller, see the start-up, operations, and troubleshooting manual for the applicable controller.

Electromechanical units without economizer

Cooling

When the thermostat calls for cooling, terminals G and Y1 are energized. The indoor fan will run at the low fan speed and the C1 compressor contactor (CC) is energized causing the compressor and outdoor fan to run. The low indoor fan speed is 60% or 66% of the user set fan speed depending on unit size.

If additional cooling is needed, the thermostat will add the call for Y2. This will increase the indoor fan speed to the user set fan speed and energize the C2 contactor and second compressor for full compressor capacity. The outdoor fan is the same speed for Y1 and Y2.

When the thermostat removes the call for Y2 but leaves the Y1, the indoor fan will slow to the reduced percentage of the user set fan speed, the C2 contactor will de-energize, the second compressor will turn off, and the outdoor fan will remain on. When the thermostat removes the call for Y1 the compressor contactor will de-energize shutting down the compressor and the outdoor fan. When the thermostat removes the call for G, the indoor fan will turn off after the specific unit fan off delay.

NOTE: Per ASHRAE 90.1-2019 and IECC-2018 standards, during the first stage cooling operation the Unit Control Board (UCB) will adjust the fan motor speed to provide 60% or 66% of the total cfm established for the unit.

Defrost

When the temperature of the outdoor coil drops below 28°F (–2°C) as sensed by the defrost thermostat (DFT2) and the defrost timer is at the end of a timed period (adjustable at 30, 60, 90 or 120 minutes), the reversing valve solenoid (RVS) is energized and the OFC is de-energized. This switches the position of the reversing valve and shuts off the outdoor fan. The electric heaters (if installed) will be energized.

Heating, unit with economizer

Upon a request for heating from the space thermostat terminal, W1 will be energized with 24V. The indoor fan will run at high speed, and outdoor fan contactor (OFC), C1 and C2 will be energized in heating. The indoor fan, outdoor fans, and both stages of the compressor are energized. The reversing valve is de-energized and switch positions. The economizer is set to minimum position (ventilation position). If the space temperature continues to fall with W1 energized, W2 will bring on all electric heat (HC).

As the space temperature rises the W2 will de-energize and the compressors will continue to operate, until the thermostat set point is achieved de-energizing W1. If the thermostat is set to Auto, the indoor fan will de-energize and the economizer will close. If the indoor fan is set to On, the indoor fan will continue to operate and the economizer will remain at minimum position (vent position).

On units equipped for 2 stages of heat, when additional heat is needed, heater contactor no. 2 is energized through W2. The economizer damper moves to the minimum position. When the thermostat is satisfied, the damper moves to the fully closed position.

Heating, unit without economizer

Upon a request for heating from the space thermostat, terminal W1 will be energized with 24V. The IFC, outdoor fan contactor (OFC), C1, and C2 will be energized. The indoor fan, outdoor fans, and compressor no. 1, and compressor no. 2 are energized and reversing valves are de-energized and switch position.

If the space temperature continues to fall while W1 is energized, W2 will be energized with 24V, and the heater contactor(s) (HC) will be energized, which will energize the electric heater(s).

When the space thermostat is satisfied, W2 will be de-energized first, and the electric heater(s) will be de-energized. Upon a further rise in space temperature, W1 will be de-energized.

IMPORTANT: The thermostat must be configured for Electric Heat so it will energize G with the W1 call.

Electromechanical units with factory-installed EconomizerONE

When free cooling is not available, the compressors will be controlled by the zone thermostat. When free cooling is available, the outdoor-air damper is modulated by the EconomizerONE control to provide a 50°F (10°C) to 55°F (13°C) mixed-air temperature into the zone. As the mixed air temperature fluctuates above 55°F (13°C) or below 50°F (10°C) dampers will be modulated (open or close) to bring the mixed-air temperature back within control. If mechanical cooling is utilized with free cooling, the outdoor-air damper will maintain its current position at the time the compressor is started. If the increase in cooling capacity causes the mixed-air temperature to drop below 45°F (7°C), then the outdoor-air damper position will be decreased to the minimum position. If the mixed-air temperature continues to fall, the outdoor-air damper will close. Control returns to normal once the mixed-air temperature rises above 48°F (9°C). The power exhaust fans will be energized and de-energized, if installed, as the outdoor-air damper opens and closes.

If field-installed accessory CO_2 sensors are connected to the EconomizerONE control, a demand controlled ventilation strategy will begin to operate. As the CO_2 level in the zone increases above the CO_2 set-point (on the EconomizerONE controller), the minimum position of the damper will be increased proportionally until the Maximum Ventilation setting is reached. As the CO_2 level decreases because of the increase in fresh air, the outdoor-air damper will follow the higher demand condition from either the DCV mode or from the free cooling mode. For EconomizerONE operation, there must be a thermostat call for the fan (G). If the unit is occupied and the fan is on, the damper will operate at minimum position. Otherwise, the damper will be closed.

When the EconomizerONE control is in the occupied mode and a call for cooling exists (Y1 on the thermostat), the control will first check for indoor fan operation. If the fan is not on, then cooling will not be activated. If the fan is on, then the control will open the EconomizerONE damper to the minimum position.

On the initial power to the EconomizerONE control, it will take the damper up to 2-1/2 minutes before it begins to position itself. After the initial power-up, further changes in damper position can take up to 90 seconds to initiate. Damper movement from full closed to full open (or vice versa) will take between 1-1/2 and 2-1/2 minutes. If free cooling can be used as determined from the appropriate changeover command (dry bulb, outdoor enthalpy, differential dry bulb, or differential enthalpy), then the control will modulate the dampers open and closed to maintain the mixed-air temperature set-point at 50°F (10°C) to 55°F (13°C). If there is a further demand for cooling (cooling second stage — Y2 is energized), then the control will bring on compressor stage 1 to maintain the mixed-air temperature setpoint. The EconomizerONE damper will be open at maximum position.

NOTE: On 2-speed units, the EconomizerONE controller will adjust the damper position as the Indoor Fan Speed changes, per its configured values.

Heating

The sequence of operation for the heating is the same as an electromechanical unit without economizer. The only difference is how the economizer acts. The economizer will stay at the Economizer Minimum Position while the evaporator fan is operating. The outdoor-air damper is closed when the indoor fan is not operating. Refer to Service and Maintenance manual for further details.

SystemVu™ controller (factory option)

For details on operating 50FCQ units equipped with the factory-installed SystemVu controller option, refer to FCQ/GCQ Series Single Package Rooftop Units with SystemVu Controller Controls, Start-Up, Operation and Troubleshooting manual.

Minimum operating ambient temperature (cooling)

In mechanical cooling mode, your Carrier rooftop unit can safely operate down to an outdoor ambient temperature of 40°F (4°C). It is possible to provide cooling at lower outdoor ambient temperatures by using less outside air, economizers, and/or accessory low ambient kits.

Maximum operating ambient temperature (cooling)

The maximum operating ambient temperature for cooling mode is 125°F (52°C). While cooling operation above 125°F (52°C) may be possible, it could cause either a reduction in performance, reliability, or a protective action by the unit's internal safety devices.

Multiple motor and drive packages

Some applications need larger horsepower motors, some need more airflow, and some need both. Regardless of the case, your Carrier expert has a factory installed combination to meet your application. A wide selection of motors are available, factory installed, to handle nearly any application.

Minimum and maximum airflow (heating and cooling)

To maintain safe and reliable operation of your rooftop, operate within the heating airflow limits during heating mode and cooling airflow limits during cooling mode. Operating above the maximum may cause blow-off, undesired airflow noise, or airflow related problems with the rooftop unit. Operating below the minimum may cause problems with coil freeze-up and unsafe heating operation. Heating and cooling limitations differ when evaluating operating CFM, minimum value is the HIGHER of the cooling and heating minimum CFM values published on page 6 and the maximum value is the LOWER of the cooling and heating minimum values published on page 6.

Heating-to-cooling changeover

Your unit will automatically change from heating to cooling mode when using a thermostat with an auto-changeover feature.

Airflow

All units are draw-though in cooling mode and blow-through in heating mode.

Outdoor air application strategies

Economizers reduce operating expenses and compressor run time by providing a free source of cooling and a means of ventilation to match application changing needs. In fact, they should be considered for most applications. Also, consider the various economizer control methods and their benefits, as well as sensors required to accomplish your application goals. Please contact your local Carrier representative for assistance.

Motor limits, brake horsepower (bhp)

Due to internal design of Carrier units, the air path, and specially designed motors, the full horsepower (maximum continuous bhp) band, as listed in the Fan Performance tables, can be used with the utmost confidence. There is no need for extra safety factors, as Carrier motors are designed and rigorously tested to use the entire, listed bhp range without either nuisance tripping or premature motor failure.

Sizing a rooftop

Bigger is not necessarily better. While an air conditioner needs to have enough capacity to meet the design loads, it does not need excess capacity. In fact, excess capacity typically results in very poor part load performance and humidity control.

Using higher design temperatures than ASHRAE recommends for your location, adding "safety factors" to the calculated load, are all signs of oversizing air conditioners. Oversizing the air conditioner leads to poor humidity control, reduced efficiency, higher utility bills, larger indoor temperature swings, excessive noise, and increased wear and tear on the air conditioner.

Rather than oversizing an air conditioner, engineers should "right-size" or even slightly "under-size" air conditioners. Correctly sizing an air conditioner controls humidity better; promotes efficiency; reduces utility bills; extends equipment life, and maintains even, comfortable temperatures. Please contact your local Carrier representative for assistance.

Low ambient applications

The optional Carrier economizer can adequately cool your space by bringing in fresh, cool outside air. In fact, when so equipped, accessory low-ambient kit may not be necessary. In low ambient conditions, unless the outdoor air is excessively humid or contaminated, economizer-based "free cooling" is the preferred less costly and energy conscious method. In low ambient applications where outside air might not be desired (such as contaminated or excessively humid outdoor environments), your Carrier rooftop can operate to ambient temperatures down to –0°F (–18°C) using the recommended accessory low ambient controller.

Note about this specification:

This specification is in the "Masterformat" as published by the Construction Specification Institute. Please feel free to copy this specification directly into your building spec.

Cooling Only/Electric Heat Packaged Rooftop Heat Pump

HVAC Guide Specifications

Size Range: **15 to 25 Nominal Tons**

Carrier Model Number: **50FCQ*17-28**

Part 1 — (23 06 80) Schedules for Decentralized HVAC Equipment

1.01 (23 06 80.13) Decentralized Unitary HVAC Equipment Schedule:

A. (23 06 80.13.A.) Rooftop Unit (RTU) Schedule:

1. Schedule is per the project specification requirements.

Part 2 — (23 07 16) HVAC Equipment Insulation

2.01 (23 07 16.13) Decentralized, Rooftop Units:

A. (23 07 16.13.A.) Evaporator Fan Compartment:

1. Interior cabinet surfaces shall be insulated with a minimum 1/2 in. thick, minimum 1-1/2 lb density, flexible fiberglass insulation bonded with a phenolic binder, neoprene coated on the air side.
2. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

B. (23 07 16.13.B.) Electric Heat Compartment:

1. Aluminum foil-faced fiberglass insulation shall be used.
2. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

Part 3 — (23 09 13) Instrumentation and Control Devices for HVAC

3.01 (23 09 13.23) Sensors and Transmitters:

A. (23 09 13.23.A.) Thermostats:

Thermostat must:

a. energize both "W" and "G" when calling for heat.
b. have capability to energize 1 or 2 different stages of cooling, and 2 different stages of heating.
c. include capability for occupancy scheduling.

Part 4 — (23 09 23) Direct Digital Control system for HVAC

4.01 (23 09 23.13) Decentralized, Rooftop Units:

A. (23 09 23.13.A.) SystemVu™ intelligent integrated Direct Digital Control (DDC) shall provide:

1. Integrated unit operation for comfort cooling, heating ventilation as well as all monitoring, recording and reporting capabilities. Controller shall also provide diagnostics and alarms of abnormal unit operation through the controller. Controller shall have an intuitive user display and be able to be used in a standalone operation or via building automation system (BAS).
2. Quick Unit Status LEDs of: RUN — meaning all systems are go, ALERT — that indicates there is currently a non-critical issue with the unit, like filters need to be replaced and FAULT — that indicates the unit has a critical issue and will possibly shut down.
3. Six large navigation keys for easy access. Navigation keys shall consist of: TEST, BACK, ENTER, and MENU along with UP and DOWN arrows.
4. Full back lit user display with 4 line by 30 character text capabilities. Display menu shall be designed to provide guided major menus and sub menus main menus provided below:
   a. Shutdown Unit
   b. Run Status
   c. Settings
   d. Alerts/Faults
   e. Service
   f. Inputs
   g. Outputs
   h. USB
5. The capability for standalone operation with conventional thermostat/sensor or use with building automation systems (BAS) of Carrier i-Vu®, BACnet[1] MS/TP and Carrier Comfort Network® (CCN) systems. No special modules or boards are required for these capabilities. Has the capability to work with Equipment Touch™ and System Touch™ devices and ZS Sensors.
6. The ability to read refrigerant pressures at display or via BAS network of; Discharge Pressure and Suction Pressure. The need for traditional refrigerant gauges is not required.
7. USB Data Port for flash drive interaction. This will allow the transfer of data for uploads, downloads, perform software upgrades, backup and restore data and file transfer data such as component number of starts and run hours.
8. Reverse Rotation Protection of compressors if field 3-phase wiring is misapplied.

1. Third-party trademarks and logos are the property of their respective owners.

9. Provide Service Capabilities of:
   a. Auto run test
   b. Manual run test
   c. Component run hours and starts
   d. Commissioning reports
   e. Data logging
   f. Alarm history
10. Economizer control and diagnostics. Set up economizer operation, receive feedback from actuator. Also meets the most recent California Title 24, ASHRAE 90.1 and IECC®[1] Fault Detection and Diagnostic (FDD) requirements.
11. Unit cooling operation down to 40°F (4°C).
12. Controller shall have easy access connections around the controller perimeter area and consist of Mate-N-Lok®[1], terminal block and RJ style modular jack connections.
13. 365 day real time clock, 20 holiday schedules along with occupied and unoccupied scheduling.
14. Auto-Recognition for easy installation and commissioning of devices like economizers, space sensors, etc.
15. A 5°F (2.8°C) temperature difference between cooling and heating set points to meet the latest ASHRAE 90.1 Energy Standard.
16. Contains return air sensor, supply air sensor and outdoor air sensor to help monitor and provide data for the unit comfort operation, diagnostic and alarms.
17. Use of Carrier's field accessory hand-held Navigator™ display, Equipment Touch and System Touch devices.
18. Supply Air Tempering control operates the electric heat to maintain a minimum supply air temperature during conditions where very cold outdoor air causes the supply air temperature to fall below the configured Supply Air Tempering Setpoint. This occurs during periods where DCV is active and increasing the amount of outdoor air or in cases where the system is operating at very low airflow and the calculated economizer position has increased to maintain a constant ventilation rate.
19. Demand limiting in units with SystemVu™ controller is achieved through set point expansion. The systems heating and cooling set points are expanded in steps or levels. The degree to which the set points may be expanded is defined by the 6 demand level offsets and the 2 commanded demand limit levels.
20. 3-year limited part warranty.

1. Third-party trademarks and logos are the property of their respective owners.

Part 5 — (23 09 33) Electric and Electronic Control System for HVAC

5.01 (23 09 33.13) Decentralized, Rooftop Units:

A. (23 09 33.13.A.) General:
   1. Shall be complete with self-contained low-voltage control circuit protected by a resettable circuit breaker on the 24-v transformer side. Transformer shall have 75 VA capability.
   2. Shall utilize color-coded wiring.
   3. Shall include a Unit Control Board to conveniently and safely provide connection points for vital control functions such as: smoke detectors, phase monitor, economizer, thermostat, DDC control options, and low and high pressure switches. Controller shall also provide an intuitive means to adjust the indoor fan speed through a simple switch and pot adjustment design.
   4. Unit shall include a minimum of one 8-pin screw terminal connection board for connection of control wiring.
   5. Shall include integrated defrost system to prevent excessive frost accumulation during heating duty, and shall be controlled as follows:
      a. Defrost shall be initiated on the basis of time and coil temperature.
      b. A 30, 60, 90, 120 minute timer shall activate the defrost cycle only if the coil temperature is low enough to indicate a heavy frost condition.
      c. Defrost cycle shall terminate when defrost thermostat is satisfied and shall have a positive termination time of 10 minutes.
   6. Defrost system shall also include:
      a. Defrost Cycle Indicator LED.
      b. DIP switch selectable defrost time between 30, 60, 90 and 120 minutes. Factory set at 30 minutes.
      c. Molded plug connection to ensure proper connection.

B. (23 09 33.13.B.) Safeties:
   1. Compressor over-temperature, over-current. High internal pressure differential.
   2. Low Pressure Switch.
      a. Low pressure switch shall use different color wire than the high pressure switch. The purpose is to assist the installer and service technician to correctly wire and or troubleshoot the rooftop unit.
   3. High Pressure Switch.
      a. High pressure switch shall use different color wire than the low pressure switch. The purpose is to assist the installer and service technician to correctly wire and or troubleshoot the rooftop unit.
   4. Automatic reset, motor thermal overload protector.

Part 6 — (23 09 93) Sequence of Operation for HVAC Controls

6.01 (23 09 93.13) Decentralized, Rooftop Units:

A. (23 09 93.13.A.) INSERT SEQUENCE OF OPERATION

Part 7 — (23 40 13) Panel Air Filters

7.01 (23 40 13.13) Decentralized, Rooftop Units:

A. (23 40 13.13.A.) Standard Filter Section:

1. Shall consist of factory installed, low velocity, disposable 2 in. thick fiberglass filters of commercially available sizes.
2. Filters shall be accessible through a dedicated, weather tight access pane.
3. Four-inch filter capabilities shall be capable with pre-engineered and approved Carrier filter track field installed accessory. This kit requires field furnished filters.

Part 8 — (23 81 19) Self-Contained Air Conditioners

8.01 (23 81 19.13) Small-Capacity Self-Contained Air Conditioners:

A. (23 81 19.13.A.) General:

1. Outdoor, rooftop mounted, electrically controlled, heating and cooling unit utilizing fully hermetic scroll compressors for cooling duty and optional electric heat for heating duty.
2. Factory assembled, single-piece heating and cooling rooftop unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field start-up.
3. Unit shall use Puron® (R-410A) refrigerant.
4. Unit shall be installed in accordance with the manufacturer's instructions.
5. Unit must be selected and installed in compliance with local, state, and federal codes.

B. (23 81 19.13.B.) Quality Assurance:

1. Unit meets ASHRAE 90.1 minimum efficiency requirements.
2. Unit shall be rated in accordance with AHRI Standards 340/360.
3. Unit shall be designed to conform to ASHRAE 15.
4. Unit shall be UL-tested and certified in accordance with ANSI Z21.47 Standards and UL-listed and certified under Canadian standards as a total package for safety requirements.
5. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
6. Unit casing shall be capable of withstanding 500 hour salt spray exposure per ASTM B117 (scribed specimen).
7. Unit shall be designed in accordance with ISO 9001, and shall be manufactured in a facility registered by ISO 9001:2015.
8. Roof curb shall be designed to conform to NRCA Standards.
9. Unit shall be subjected to a completely automated run test on the assembly line. The data for each unit will be stored at the factory, and must be available upon request.
10. Unit shall be designed in accordance with UL Standard 60335-2-40, including tested to withstand rain.
11. Unit shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box up to 40 mph.
12. Unit shake tested to assurance level 1, ASTM D4169 to ensure shipping reliability.

C. (23 81 19.13.C.) Delivery, Storage, and Handling:

1. Unit shall be stored and handled per manufacturer's recommendations.
2. Lifted by crane requires either shipping top panel or spreader bars.
3. Unit shall only be stored or positioned in the upright position.

D. (23 81 19.13.D.) Project Conditions:

1. As specified in the contract.

E. (23 81 19.13.E.) Operating Characteristics:

1. Unit shall be capable of starting and running at 125°F (52°C) ambient outdoor temperature meeting maximum load criteria of AHRI Standard 340/360 at ±10% voltage.
2. Compressor with standard controls shall be capable of operation down to 40°F (4°C) ambient outdoor temperatures. Accessory winter start kit is necessary if mechanically cooling at ambient temperatures down to 25°F (–4°C) or 0°F (–18°C).
3. Unit shall discharge supply air vertically or horizontally as shown on contract drawings.
4. Unit shall be factory configured for vertical supply and return configurations or horizontal supply and return configurations. Dedicated models provided with no special air conversion kits required.

F. (23 81 19.13.F.) Electrical Requirements:

1. Main power supply voltage, phase, and frequency must match those required by the manufacturer.

G. (23 81 19.13.G.) Unit Cabinet:

1. Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a prepainted baked enamel finish on all externally exposed surfaces.
2. Unit cabinet exterior paint shall be: film thickness, (dry) 0.003 in. minimum, gloss (per ASTM D523, 60°F/16°C): 60, Hardness: H-2H Pencil hardness.
3. Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 340/360 minimum exterior sweat criteria.

Interior surfaces shall be insulated with a minimum 1/2 in. thick, 1 lb density, flexible fiberglass insulation, neoprene coated on the air side. Aluminum foil-faced fiberglass insulation shall be used in the heat compartment.

4. Base of unit shall have a minimum of 4 locations for thru-the-base gas and electrical connections (factory-installed or field-installed), standard.
5. Base Rail:
   a. Unit shall have base rails on a minimum of 2 sides.
   b. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.
   c. Holes shall be provided in the base rail for moving the rooftop by fork truck.
   d. Base rail shall be a minimum of 16 gauge thickness.
6. Condensate Pan and Connections:
   a. Shall be a sloped condensate drain pan made of a corrosion resistant material.
   b. Shall comply with ASHRAE Standard 62.
   c. Shall use a 3/4 in. 14 NPT drain connection, possible either through the bottom or side of the drain pan. Connection shall be made per manufacturer's recommendations.
7. Top Panel:
   a. Shall be a multi-top panel with watertight flanges and locking systems.
8. Electrical Connections:
   a. All unit power wiring shall enter unit cabinet at a single, factory prepared, knockout location.
   b. Thru-the-Base Capability.
      1) Thru-the-base provisions/connections are available as standard with every unit. When bottom connections are required, field furnished couplings are required.
      2) No basepan penetration, other than those authorized by the manufacturer, is permitted.
9. Component Access Panels (standard):
   a. Cabinet panels shall be easily removable for servicing.
   b. Unit shall have large removable, filter access panel.
   c. Panels covering control box, indoor fan, indoor fan motor, gas components (where applicable), and compressors shall have molded composite handles.
   d. Handles shall be UV modified, composite. They shall be permanently attached, and recessed into the panel.
   e. Screws on the vertical portion of all removable access panel shall engage into heat resistant, molded composite collars.
   f. Collars shall be removable and easily replaceable using manufacturer recommended parts.

H. (23 81 19.13.H.) Coils:

1. Standard Aluminum Fin-Copper Tube Coils:
   a. Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
   b. Evaporator coils shall be leak tested to 150 psig, pressure tested to 450 psig, and qualified to UL 1995 burst test at 1775 psig.
   c. Condenser coils shall be leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 1995 burst test at 1980 psig.
2. Optional Pre-Coated Aluminum-Fin Condenser Coils:
   a. Shall have a durable epoxy-phenolic coating to provide protection in mildly corrosive coastal environments.
   b. Coating shall be applied to the aluminum fin stock prior to the fin stamping process to create an inert barrier between the aluminum fin and copper tube.
   c. Epoxy-phenolic barrier shall minimize galvanic action between dissimilar metals.
   d. Corrosion durability of fin stock shall be confirmed through testing to be no less than 1000 hours salt spray per ASTM B117-90.
   e. Corrosion durability of fin stock shall be confirmed through testing to have no visible corrosion after 48 hour immersion in a room temperature solution of 5% salt, 1% acetic acid.
   f. Fin stock coating shall pass 2000 hours of the following: one week exposure in the prohesion chamber followed by one week of accelerated ultraviolet light testing. Prohesion chamber: the solution shall contain 3.5% sodium chloride and 0.35% ammonium sulfate. The exposure cycle is one hour of salt fog application at ambient followed by one hour drying at 95°F (35°C).
3. Optional Copper-Fin Evaporator and Condenser Coils:
   a. Shall be constructed of copper fins mechanically bonded to copper tubes and copper tube sheets.
   b. Galvanized steel tube sheets shall not be acceptable.
   c. A polymer strip shall prevent coil assembly from contacting the sheet metal coil pan to minimize potential for galvanic corrosion between coil and pan.

4. Optional E-Coated Aluminum-Fin Evaporator and Condenser Coils:
   a. Shall have a flexible epoxy polymer coating uniformly applied to all coil surface areas without material bridging between fins.
   b. Coating process shall ensure complete coil encapsulation of tubes, fins and headers.
   c. Color shall be high gloss black with gloss per ASTM D523-89.
   d. Uniform dry film thickness from 0.8 to 1.2 mil on all surface areas including fin edges.
   e. Superior hardness characteristics of 2H per ASTM D3363-92A and cross-hatch adhesion of 4B-5B per ASTM D3359-93.
   f. Impact resistance shall be up to 160 in.-lb (ASTM D2794-93).
   g. Humidity and water immersion resistance shall be up to minimum 1000 and 250 hours respectively (ASTM D2247-92 and ASTM D870-92).
   h. Corrosion durability shall be confirmed through testing to be no less than 1000 hours salt spray per ASTM B117-90.

I. (23 81 19.13.I.) Refrigerant Components:
1. Refrigerant circuit shall include the following control, safety, and maintenance features:
   a. Thermostatic Expansion Valve (TXV) shall help provide optimum performance across the entire operating range. Shall contain removable power element to allow change out of power element and bulb without removing the valve body.
   b. Refrigerant filter drier — Solid core design.
   c. Service gauge connections on suction and discharge lines.
   d. Suction line accumulator to provide protection in all operating modes from cooling, heating and reverse cycle switching.
2. Compressors:
   a. Unit shall use 2 tandem scroll compressors on single independent refrigeration circuit.
   b. Units shall have single circuit and 2 stage cooling with 2 compressors.
   c. Evaporator coils shall be a full active design to help better control comfort latent removal.
   d. Compressor motors shall be cooled by refrigerant gas passing through motor windings.
   e. Compressors shall be internally protected from high discharge temperature conditions.
   f. Compressors shall be protected from an over-temperature and over-amperage conditions by an internal, motor overload device.
   g. Compressor shall be factory mounted on rubber grommets.
   h. Compressor motors shall have internal line break thermal, current overload and high pressure differential protection.
   i. Crankcase heaters shall not be required for normal operating range, unless required by compressor manufacturer due to refrigerant charge limits.
   j. Compressors shall be a 2 stage cooling capacity design.

J. (23 81 19.13.J.) Return Air Filter Section:
1. Filters access is specified in the unit cabinet section of this specification.
2. Filters shall be held in place by a pivoting filter tray, facilitating easy removal and installation.
3. Shall consist of factory installed, low velocity, throw-away 2 in. thick fiberglass filters.
4. Filters shall be standard, commercially available sizes.
5. Only one size filter per unit is allowed.

K. (23 81 19.13.K.) Evaporator Fan and Motor with EcoBlue™ Technology:
1. Direct Drive Evaporator Fan Motor:
   a. Shall be a ECM motor design.
   b. Shall have permanently lubricated bearings.
   c. Shall have inherent automatic-reset thermal overload protection.
   d. Shall have slow ramp up to speed capabilities.
   e. Shall require no fan/motor belts for operation, adjustments and or initial fan speed set up.
   f. Fan DC voltage set up on Unit Control Board can eliminate the need of removal of blower access door, required on conventional belt drive systems.
   g. Shall be internally protected from electrical phase reversal and loss.
2. Evaporator Fan:
   a. Shall be easily set with dedicated selection switch and adjustment pot on unit control board or through SystemVu™ controller.
   b. Shall provide 2 stage cooling capacity control, the indoor fan speed is automatically controlled to meet the code-compliant <66% low fan speed and 100% at full fan speed operation.
   c. Blower fan shall be a Vane Axial fan design with 75% less moving parts than a conventional belt drive system.
   d. Shall be constructed of a cast aluminum stator and high impact composite material on stator, rotor and air inlet casing.
   e. Shall be a patented design with a corrosion resistant material and dynamically balanced.
   f. Shall have slow ramp up to speed capabilities to help reduce sound and comfort issues

typically associated with single speed belt drive systems.

g. Units shall contain 2 separate vane axial fan assemblies.

h. Shall be a slide out design with removal of a few support brackets.

3. Shall include an easily accessible Unit Control Board to conveniently and safely provide connection points for vital control functions such as: smoke detectors, phase monitor, economizer, thermostat, DDC control options, and low, high and mixed air temperature switches. Controller shall also provide an intuitive means to adjust the indoor fan speed through a simple switch and pot adjustment design.

L. (23 81 19.13.L.) Condenser Fans and Motors:

1. Condenser Fan Motors:

a. Shall be a totally enclosed motor.

b. Shall use permanently lubricated bearings.

c. Shall have inherent thermal overload protection with an automatic reset feature.

d. Shall use a shaft-down design on all sizes.

2. Condenser Fans:

a. Shall be a direct-driven propeller type fan.

b. Shall have galvalum blades riveted to steel spider that have corrosion-resistant properties and shall be dynamically balanced.

M. (23 81 19.13.M.) Special Features Options and Accessories:

1. Integrated EconomizerONE and EconoMi$er® 2 Low Leak Rate Models.

a. Integrated, gear driven opposing modulating blade design type capable of simultaneous economizer and compressor operation.

b. Independent modules for vertical or horizontal return configuration shall be available. Vertical return modules shall be available as a factory installed option.

c. Damper blades shall be galvanized steel with composite gears. Plastic or composite blades on intake or return shall not be acceptable.

d. Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints.

e. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.

f. Standard leak rate shall be equipped with dampers not to exceed 2% leakage at 1 in. wg pressure differential.

g. Economizer controller on EconomizerONE models shall be Siemens POL224 that provides:

1) Combined minimum and DCV maximum damper position potentiometers with compressor staging relay.

2) Functions with solid-state analog enthalpy or dry bulb changeover control sensing.

3) LED indicators for free cooling, sensor, and damper operation.

4) One-line LCD interface screen for setup, configuration and troubleshooting.

5) Optional configuration via WLAN stick and Siemens Climatix™[1] smartphone app for easy setup.

6) On-board Fault Detection and Diagnostics (FDD) that senses and alerts when the economizer is not operating properly, per California Title 24, ASHRAE 90.1 and IECC.

7) Sensor failure loss of communication identification.

8) Capabilities for use with multiple-speed or single speed indoor fan systems.

9) Utilize digital sensors: Dry bulb and Enthalpy.

h. Economizer controller on EconoMi$er 2 models with SystemVu™ controls shall be a 4 to 20 mA design controlled directly by the controller. SystemVu controller meets California Title 24, ASHRAE 90.1 and IECC Fault Detection and Diagnostic (FDD) requirements.

i. Shall be capable of introducing up to 100% outdoor air.

j. Shall be equipped with a barometric relief damper capable of relieving up to 100% return air and contain seals that meet ASHRAE 90.1 requirements.

k. Shall be designed to close damper(s) during loss-of-power situations with spring return built into motor.

l. Dry bulb outdoor air temperature sensor shall be provided as standard. Enthalpy sensor is also available on factory installed only. Outdoor air sensor setpoint shall be adjustable and shall range from 40°F to 100°F (4°C to 38°C). Additional sensor options shall be available as accessories.

m. The economizer controller shall also provide control of an accessory power exhaust unit function. Factory set at 100%, with a range of 0% to 100%.

1. Third-party trademarks and logos are the property of their respective owners.

n. The economizer shall maintain minimum airflow into the building during occupied period and provide design ventilation rate for full occupancy.

o. Dampers shall be completely closed when the unit is in the unoccupied mode.

p. Economizer controller shall accept a 0 to 10 vdc CO_2 sensor input for IAQ/DCV control. In this mode, dampers shall modulate the outdoor air damper to provide ventilation based on the sensor input.

q. Compressor lockout temperature on POL224 control is adjustable from –45°F to 80°F (–43°C to 27°C), set at a factory default of 32°F (0°C).

r. Actuator shall be direct coupled to economizer gear. No linkage arms or control rods shall be acceptable.

s. Shall contain LED indication for free cooling, sensor, and damper operation.

2. Integrated EconomizerONE and EconoMi$er® 2 Ultra Low Leak Rate Models.

a. Integrated, gear driven opposing modulating blade design type capable of simultaneous economizer and compressor operation.

b. Independent modules for vertical or horizontal return configuration shall be available. Vertical return modules shall be available as a factory-installed option.

c. Damper blades shall be galvanized steel with composite gears. Plastic or composite blades on intake or return shall not be acceptable.

d. Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints.

e. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.

f. Ultra Low Leak design meets California Title 24 section 140.4 and ASHRAE 90.1 requirements for 4 cfm per sq ft on the outside air dampers and 10 cfm per sq ft on the return dampers.

g. Economizer controller on EconomizerONE models shall be the Siemens POL224 that provides:

1) One-line LCD interface screen for setup, configuration and troubleshooting.

2) Optional configuration via WLAN stick and Siemens Climatix™ smartphone app for easy setup.

3) On-board Fault Detection and Diagnostics (FDD) that senses and alerts when the economizer is not operating properly, per California Title 24, ASHRAE 90.1 and IECC.

4) Sensor failure loss of communication identification.

5) Capabilities for use with multiple-speed indoor fan systems.

6) Utilize digital sensors: Dry bulb and Enthalpy.

h. Economizer controller on EconoMi$er 2 models with SystemVu™ controls shall be a 4-20mA design controlled directly by the controller. SystemVu controller meets California Title 24, ASHRAE 90.1 and IECC Fault Detection and Diagnostic (FDD) requirements.

i. Shall be capable of introducing up to 100% outdoor air.

j. Shall be equipped with a barometric relief damper capable of relieving up to 100% return air and contain seals that meet ASHRAE 90.1 requirements.

k. Shall be designed to close damper(s) during loss-of-power situations with spring return built into motor.

l. Dry bulb outdoor air temperature sensor shall be provided as standard. Enthalpy sensor is also available on factory installed only. Outdoor air sensor setpoint shall be adjustable and shall range from 40°F to 100°F (4°C to 38°C). Additional sensor options shall be available as accessories.

m. The economizer controller shall also provide control of an accessory power exhaust unit function. Factory set at 100%, with a range of 0% to 100%.

n. The economizer shall maintain minimum airflow into the building during occupied period and provide design ventilation rate for full occupancy.

o. Dampers shall be completely closed when the unit is in the unoccupied mode.

p. Economizer controller shall accept a 0 to 10 vdc CO_2 sensor input for IAQ/DCV control. In this mode, dampers shall modulate the outdoor air damper to provide ventilation based on the sensor input.

q. Compressor lockout temperature on POL224 control is adjustable from –45°F to 80°F (–43°C to 27°C), set at a factory default of 32°F (0°C).

r. Actuator shall be direct coupled to economizer gear. No linkage arms or control rods shall be acceptable.

s. Shall contain LED indication for free cooling, sensor, and damper operation.

3. Wi-Fi/WLAN stick for EconomizerONE POL224 (field-installed):

This item allows use of the Siemens Climatix™ mobile application.

4. Two-Position Damper (field-installed only):
   a. Damper shall be a Two-Position Damper. Damper travel shall be from the full closed position to the field adjustable %-open setpoint.
   b. Damper shall include adjustable damper travel from 25% to 100% (full open).
   c. Damper shall include single or dual blade, gear driven dampers and actuator motor.
   d. Actuator shall be direct coupled to damper gear. No linkage arms or control rods shall be acceptable.
   e. Damper will admit up to 100% outdoor air for applicable rooftop units.
   f. Damper shall close upon indoor (evaporator) fan shutoff and/or loss of power.
   g. The damper actuator shall plug into the rooftop unit's wiring harness plug. No hard wiring shall be required.
   h. Outside air hood shall include aluminum water entrainment filter.
5. Manual Damper (field-installed only):
   a. Manual damper package shall consist of damper, air inlet screen, and rain hood which can be preset to admit up to 25% or 50% outdoor air for year round ventilation.
6. Low Ambient Control Package:
   a. Controller shall control coil head pressure by condenser fan speed modulation or condenser fan cycling and wind baffles.
   b. Shall consist of solid-state control and condenser coil temperature sensor to maintain condensing temperature between 90°F (32°C) and 110°F (43°C) at outdoor ambient temperatures down to 0°F (–18°C).
7. Condenser Coil Hail Guard Assembly:
   a. Shall protect against damage from hail.
   b. Shall be either hood style or louvered.
8. Unit-Mounted, Non-Fused Disconnect Switch:
   a. Switch shall be factory installed, internally mounted.
   b. National Electric Code (NEC) and UL approved non-fused switch shall provide unit power shutoff.
   c. Shall be accessible from outside the unit.
   d. Shall provide local shutdown and lockout capability.
   e. Sized only for the unit as ordered from the factory. Does not accommodate field-installed devices.
9. Convenience Outlet:
   a. Powered Convenience Outlet.
      1) Outlet shall be powered from main line power to the rooftop unit.
      2) Outlet shall be powered from line side or load side of disconnect by installing contractor, as required by code. If outlet is powered from load side of disconnect, unit electrical ratings shall be UL certified and rated for additional outlet amperage.
      3) Outlet shall be factory-installed and internally mounted with easily accessible 115-v female receptacle.
      4) Outlet shall include 15 amp GFI receptacles with independent fuse protection.
      5) Voltage required to operate convenience outlet shall be provided by a factory installed step-down transformer.
      6) Outlet shall be accessible from outside the unit.
      7) Outlet shall include a field installed "Wet in Use" cover.
   b. Factory-Installed Non-Powered Convenience Outlet.
      1) Outlet shall be powered from a separate 115/120-v power source.
      2) A transformer shall not be included.
      3) Outlet shall be factory-installed and internally mounted with easily accessible 115-v female receptacle.
      4) Outlet shall include 15 amp GFI receptacles with independent fuse protection.
      5) Outlet shall be accessible from outside the unit.
      6) Outlet shall include a field installed "Wet in Use" cover.
   c. Field-Installed Non-Powered Convenience Outlet.
      1) Outlet shall be powered from a separate 115/120-v power source.
      2) A transformer shall not be included.
      3) Outlet shall be field-installed and internally mounted with easily accessible 115-v female receptacle.
      4) Outlet shall include 20 amp GFI receptacles. This kit provides a flexible installation method which allows code compliance for height requirements of the GFCI outlet from the finished roof surface as well as the capability to relocate the outlet to a more convenient location.
      5) Outlet shall be accessible from outside the unit.
      6) Outlet shall include a field installed "Wet in Use" cover.
10. Centrifugal Fan Power Exhaust:
    a. Power exhaust shall be used in conjunction with an integrated economizer.

b. Independent modules for vertical or horizontal return configurations shall be available.

c. Horizontal power exhaust shall be mounted in return ductwork.

d. Power exhaust shall be controlled by economizer controller operation. Exhaust fans shall be energized when dampers open past the 0 to 100% adjustable setpoint on the economizer control.

11. Roof Curbs (Vertical):

a. Full perimeter roof curb with exhaust capability providing separate air streams for energy recovery from the exhaust air without supply air contamination.

b. Formed galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight.

c. Permits installation and securing of ductwork to curb prior to mounting unit on the curb.

12. Outdoor Air Enthalpy Sensor:

a. The outdoor air enthalpy sensor shall be used to provide single enthalpy control. When used in conjunction with a return air enthalpy sensor, the unit will provide differential enthalpy control. The sensor allows the unit to determine if outside air is suitable for free cooling.

13. Return Air Enthalpy Sensor:

a. The return air enthalpy sensor shall be used in conjunction with an outdoor air enthalpy sensor to provide differential enthalpy control.

14. Indoor Air Quality (CO_2) Sensor:

a. Shall be able to provide demand ventilation indoor air quality (IAQ) control.

b. The IAQ sensor shall be available in duct mount, wall mount, or wall mount with LED display. The setpoint shall have adjustment capability.

15. Smoke Detectors:

a. Shall be a 4-wire controller and detector.

b. Shall be environmental compensated with differential sensing for reliable, stable, and drift-free sensitivity.

c. Shall use magnet-activated test/reset sensor switches.

d. Shall have tool-less connection terminal access.

e. Shall have a recessed momentary switch for testing and resetting the detector.

f. Controller shall include:

1) One set of normally open alarm initiation contacts for connection to an initiating device circuit on a fire alarm control panel.

2) Two Form-C auxiliary alarm relays for interface with rooftop unit or other equipment.

3) One Form-C supervision (trouble) relay to control the operation of the Trouble LED on a remote test/reset station.

4) Capable of direct connection to 2 individual detector modules.

5) Can be wired to up to 14 other duct smoke detectors for multiple fan shutdown applications.

16. Winter Start Kit:

a. Shall contain a bypass device around the low pressure switch.

b. Shall be required when mechanical cooling is required down to 25°F (–4°C).

c. Shall not be required to operate on an economizer when below an outdoor ambient of 40°F (4°C).

17. Time Guard:

a. Shall prevent compressor short-cycling by providing a 5 minute delay (±2 minutes) before restarting a compressor after shutdown for any reason.

b. One device shall be required per compressor.

18. Hinged Access Panels:

a. Shall provide easy access through integrated quarter turn latches.

b. Shall be on major panels of: filter, control box, fan motor, and compressor.

19. 4 in. MERV-13 Return Air Filters:

a. Factory option to upgrade standard unit filters to 4 in. MERV-13 filters. Filter media is securely fasted inside the filter frame on all 4 sides.

20. 4 in. Filter Rack Kit:

a. The 4 in. filter rack accessory kit is designed to hold 4 in. MERV-8 or MERV-13 filters. Filters not included in kit.

21. 2 in. MERV-13 Return Air Filters:

a. Accessory kit to field upgrade standard unit filters to 2 in. MERV-13 filters.

22. 2 in. MERV-8 Return Air Filters:

a. Accessory kit to field upgrade standard unit filters to 2 in. MERV-8 filters.

23. Phase Monitor Control:

a. Shall monitor the sequence of 3-phase electrical system to provide a phase reversal protection.

b. Shall monitor the 3-phase voltage inputs to provide a phase loss protection for the 3-phase device.

c. Will work on either a Delta or Wye power connection.

24. Horn/Strobe Annunciator:
    a. Provides an audible/visual signaling device for use with factory-installed option or field installed accessory smoke detectors.
        1) Requires installation of a field-supplied 24-v transformer suitable for 4.2 VA (AC) or 3.0 VA (DC) per horn/strobe accessory.
        2) Requires field-supplied electrical box, North American 1-gang box, 2 in. (51 mm) x 4 in. (102 mm).
        3) Shall have a clear colored lens.
25. Electric Heat:
    a. Heating Section:
        1) Heater element open coil resistance wire, nickel-chrome alloy, 0.29 inches inside diameter, strung through ceramic insulators mounted on metal frame. Coil ends are staked and welded to terminal screw slots.
        2) Heater assemblies are provided with integral fusing for protection of internal heater circuits not exceeding 48 amps each. Auto reset thermo limit controls, magnetic heater contactors (24 v coil) and terminal block all mounted in electric heater control box (minimum 18 ga galvanized steel) attached to end of heater assembly.
26. High Short Circuit Current Rating (SCCR) Protection:
    a. Factory-installed option provides high short circuit current protection to each compressor, plus all indoor and outdoor fan motors of 60 kA for 208/230-3-60 units and 65 kA for 460-3-60 units against high potential fault current situations. (Standard unit comes with 5 kA rating.)
    b. This option is not available with factory installed Non-Fused Disconnect, Low Ambient controls, Phase loss monitor/protection, or 575 Volt models.

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Appendix H

Inverter Specs

Noise measurement test report
HEM/K & PCSM/K GEN 3

Power Electronics

October 2021

Revision Table						
Version	Date			Author	Revised by	Approved by
F	25	10	2021	M. Trenzano		

Historic Revision					
Revision	**Date**			**Author**	**Log**
A	14	9	2021	A. Escobar	New document.
B	17	9	2021	A. Escobar	Added HEMK simulation.
C	21	9	2021	A. Escobar	80% measurement.
D	22	9	2021	M. Trenzano	General review.
E	19	10	2021	A. Escobar	Sound Power Level calculation.
F	25	10	2021	A. Escobar M. Trenzano	Sound Power Level for octave measures.

Table of contents

1 Scope

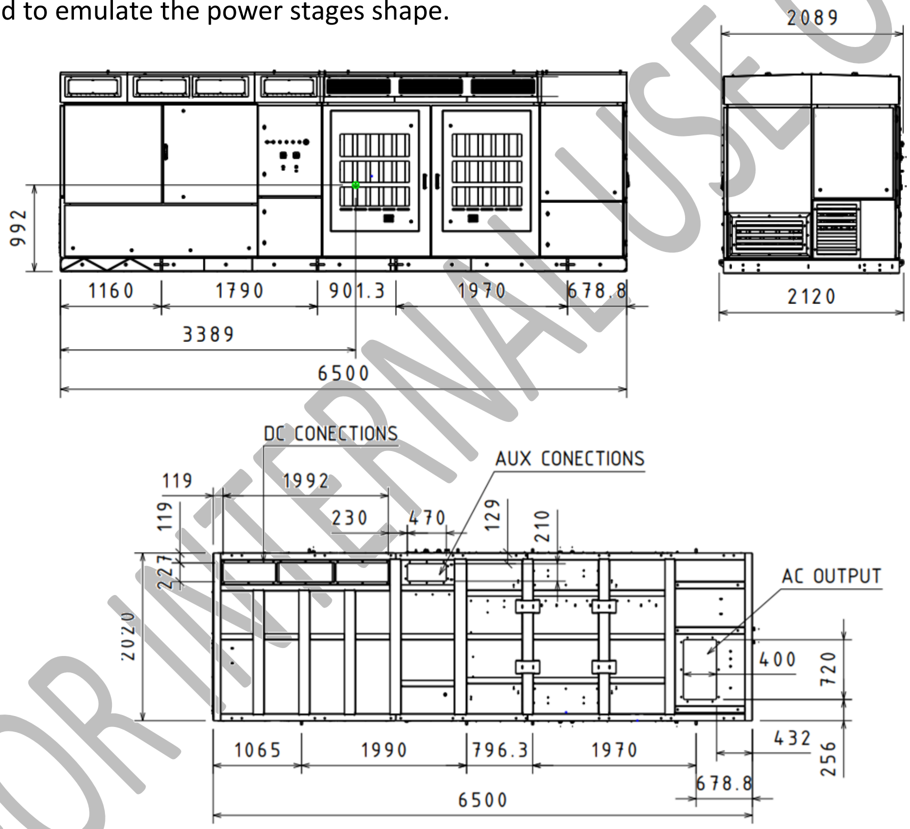
The present document defines a set of measurement test of the noise level emitted by the inverter HEM / PCSM GEN3. All the test has been performed according to the ISO 3746 and ISO 9614. An HEMK / PCSK GEN3 noise simulation is also included in this document.

2 HEM / PCSM GEN3 noise measurements

This section presents the noise measurements performed at the Freesun HEM / Freemaq PCSM GEN3 inverter.

2.1 Inverter under test

The inverter used to perform the test is the HEM / PCSM GEN3 without power stages, so, the main objective of is to evaluate the ventilation system noise level. A set of iron boxes has been placed to emulate the power stages shape.

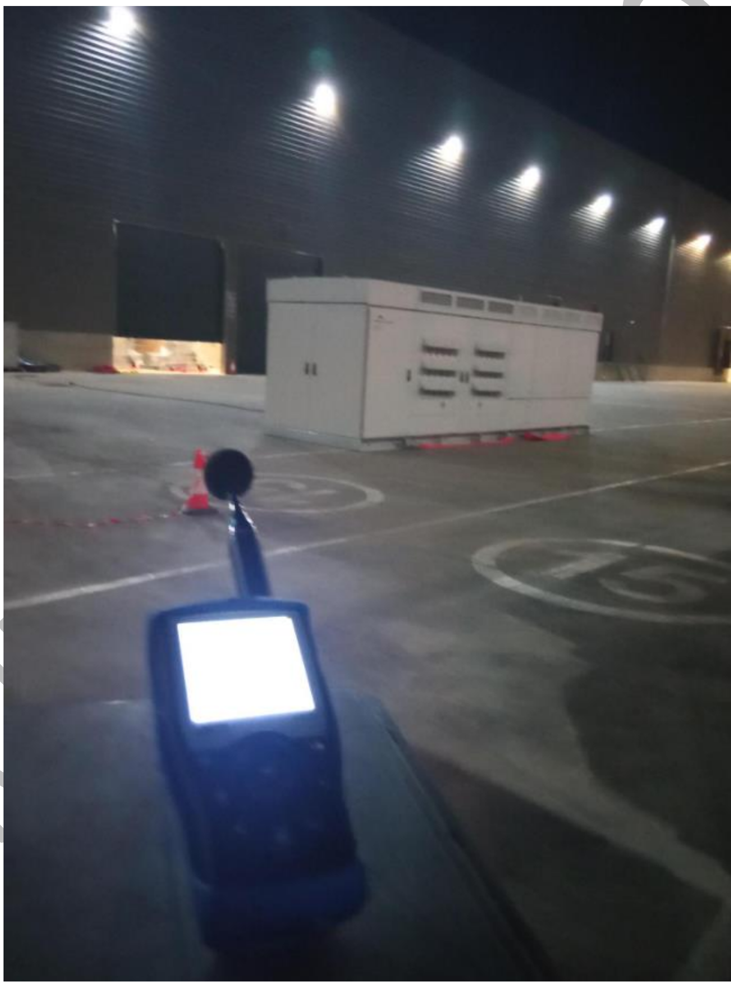


The ventilation system of the prototype includes the next parts:

- Power stages impulsion ventilation (heatsink and inductance).
- Clean zone ventilation (DU, power stages electronics, AC control cabinet, client cabinet).
- Filter and auxiliary transformer ventilation.
- MV ventilation.

2.2 Test bench

To avoid the environment influence in the noise measurements, the inverter under test will be placed at the outside of the I+D facilities, at the outside concrete esplanade without any object at least at 10m of distance. Also, the measurements must be performed in the moment of the day in which there is less noise at the outside environment (production and traffic noise due to the installations are next to the CV35). The auxiliary transformer will be connected through the 430V winding.



2.3 Measurement instrumentation

The measurements will be taken with the NTi XL2 spectrum analyzer. This device allows to get the 1/3 octave attenuation measurements with different ponderation curves to the frequency measurement. According to the ISO 3746 the measurements will be taken with the ponderation curve A. The peak values of the attenuation (dB) will be recorded.

- Measurement bandwidth (-3dB): 4.4 Hz - 23.0 kHz
- Level resolution: 0.1 dB
- Accuracy (RMS calculation): ± 0.5 % @ 1 kHz
- Frequency measurement accuracy: < ± 0.003%
- Range: 50-150 dB
- Sensitivity: 17.7 mV/Pa
- Type Curve: A
- Measurement speed: Low

2.4 Measurement points without commutation

The spectrum analyzer recorded 5 seconds in each measurement point. The noise level will be measured for a distance of 1, 2, 4 and 8 m from the inverter. The number of points to be measured was be defined in a preliminary measuring.

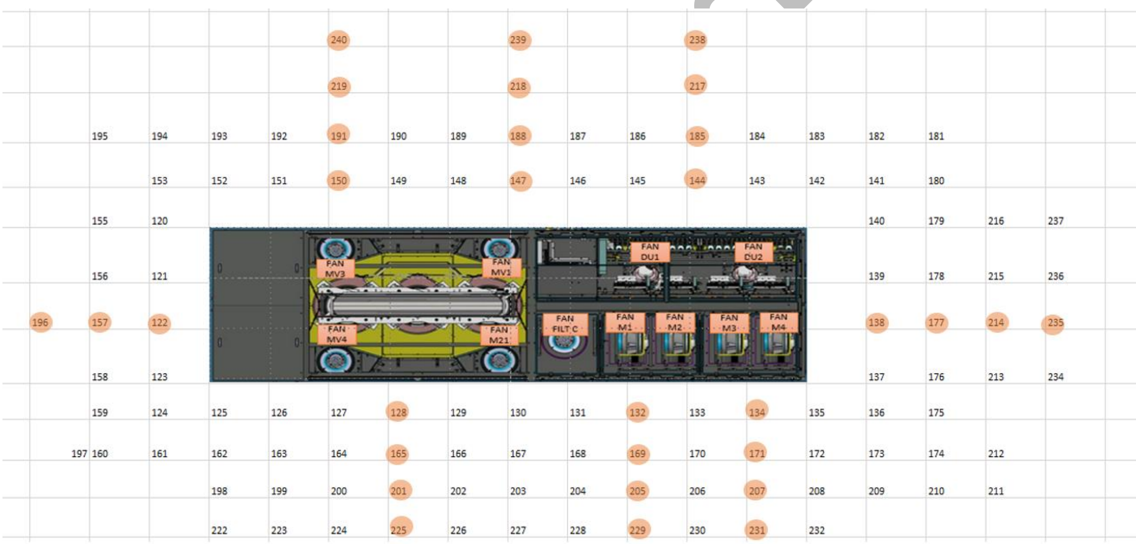
Before performing the measurement in each point, the ambient noise was measured for each side (due to the background noise level was homogeneous in all the sides of the inverter) fixed in the previous point. This has been used after to the ambient noise correction factor calculations.

2.5 Measurement cases

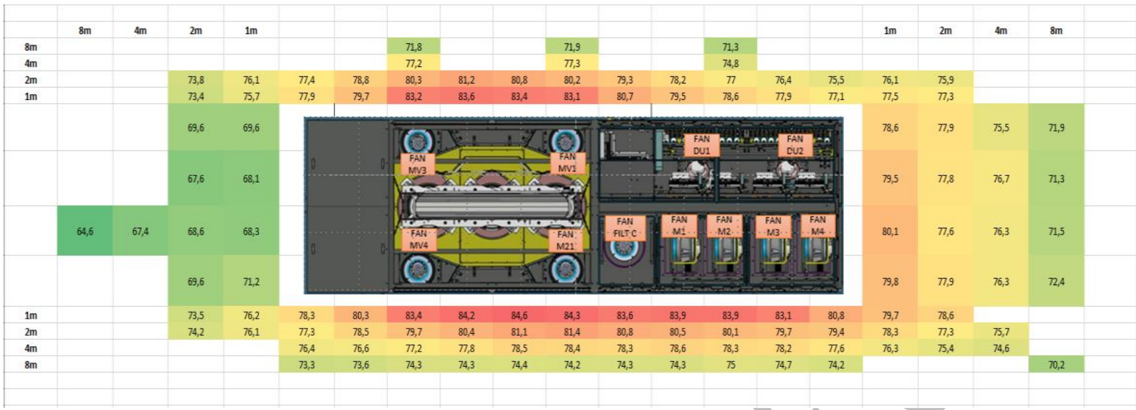
Noise measurements were performed in the conditions listed in the next table.

Case	Distance (m)
1	1
2	2
3	4
4	8

Next figure depicts the measurements points results that are presented in this document.



The next figure represents the sound instantaneous noise level.



2.5.1 1/3 Octave measures from 1 m

Note: Measures in dB. All the points measurements are also available.

	Points							
Frequency (Hz)	128	132	134	138	144	147	150	122
6.3	40.7	38.2	35.4	38.6	31.2	63.1	63.1	35.6
8	47.0	44.8	40.9	45.9	37.5	65.4	65.4	38.3
10	48.1	47.2	44.5	49.0	44.9	71.6	71.6	44.1
12.5	51.0	50.4	49.4	57.3	51.0	76.7	76.7	48.7
16	59.9	58.6	55.7	60.0	60.1	78.4	78.4	54.5
20	62.3	67.3	66.3	61.2	62.9	82.6	82.6	59.5
25	65.7	70.7	70.8	67.9	67.5	82.6	82.6	59.2
31.5	66.6	67.4	67.0	66.0	71.2	85.2	85.2	63.9
40	68.2	67.4	70.8	72.6	74.8	84.7	84.7	63.5
50	74.5	73.5	74.4	75.5	77.8	83.6	83.6	65.4
63	75.2	72.4	72.5	73.3	75.5	83.1	83.1	66.8
80	73.9	72.7	73.0	75.1	72.0	82.5	82.5	69.3
100	74.0	74.8	71.5	77.7	70.1	80.3	80.3	69.0
125	75.3	74.0	72.2	74.7	72.3	78.6	78.6	67.0
160	76.8	75.5	73.2	72.9	73.9	78.0	78.0	66.5
200	79.7	75.8	73.6	75.4	73.5	78.1	78.1	67.7
250	81.2	84.0	83.1	76.4	76.5	80.8	80.8	68.3

315	77.6	80.3	79.8	74.3	73.5	77.0	77.0	64.4
400	75.8	73.0	70.1	72.6	69.3	74.2	74.2	60.8
500	74.4	72.7	71.2	72.0	70.1	74.1	74.1	60.7
630	73.5	71.3	69.5	70.5	67.4	71.9	71.9	57.5
800	72.4	70.7	68.3	69.8	68.8	70.7	70.7	55.1
1000	71.5	70.5	68.7	70.1	66.4	69.9	69.9	53.4
1250	74.7	69.3	67.9	70.1	67.1	73.5	73.5	53.4
1600	75.6	70.9	69.3	67.5	66.8	73.7	73.7	55.1
2000	72.2	72.6	71.4	66.6	66.0	69.0	69.0	54.8
2500	70.2	70.5	69.4	65.3	64.9	68.2	68.2	51.8
3150	69.2	70.3	69.1	61.1	63.1	67.1	67.1	50.4
4000	66.1	68.6	67.2	59.0	61.1	64.4	64.4	48.1
5000	65.2	68.5	67.1	60.0	60.8	62.9	62.9	46.1
6300	61.9	66.3	65.4	57.0	58.9	60.4	60.4	42.7
8000	57.4	63.1	61.9	54.1	54.4	56.2	56.2	38.6
10000	52.9	57.6	56.4	52.6	48.9	51.5	51.5	32.1
12500	48.5	50.2	49.6	46.4	41.9	47.9	47.9	26.2
16000	42.5	42.9	41.7	39.9	35.3	41.3	41.3	21.5
20000	33.8	37.1	35.9	31.4	27.8	32.8	32.8	14.2

2.5.2 1/3 Octave measures from 2 m

Note: Measures in dB. All the points measurements are also available.

	Points							
Frequency (Hz)	165	169	171	177	185	188	191	157
6.3	53.8	22.2	31.1	33.4	26.1	59.8	57.4	29.0
8	58.4	29.3	35.4	37.1	34.9	67.1	59.5	28.7
10	61.1	36.7	40.5	47.0	40.7	70.3	63.4	39.2
12.5	65.0	45.2	46.6	52.7	46.6	72.7	63.2	45.6
16	69.2	53.2	53.0	55.6	57.1	75.2	68.2	52.5
20	70.2	64.7	64.4	57.8	63.2	78.1	69.7	56.0
25	72.1	67.5	67.4	65.0	65.1	80.1	72.3	58.2
31.5	72.0	63.5	64.8	63.1	69.5	79.8	72.9	63.1
40	71.1	67.0	68.3	69.7	71.0	80.0	74.4	61.9

50	74.1	70.6	70.8	72.7	76.2	81.1	73.1	64.4
63	73.6	70.7	70.3	70.9	72.8	80.5	74.5	66.0
80	71.5	69.9	71.4	71.4	71.4	78.1	72.7	67.7
100	71.7	72.0	70.1	74.8	71.8	76.7	72.7	66.3
125	71.5	70.9	69.8	72.6	71.1	76.0	72.3	66.1
160	73.3	72.2	70.7	71.0	70.9	74.9	72.9	64.0
200	74.9	75.1	73.6	74.6	73.6	75.7	75.3	67.5
250	79.2	80.1	78.2	78.4	75.3	77.4	78.5	69.4
315	75.0	73.7	72.9	73.4	71.3	73.3	72.7	65.4
400	71.2	71.2	70.0	64.8	69.5	71.5	70.6	60.2
500	71.8	70.0	68.9	65.1	66.5	70.9	71.4	59.5
630	70.1	68.8	67.4	67.8	65.8	69.9	69.7	56.3
800	67.6	68.5	67.3	68.2	66.9	68.8	68.4	55.5
1000	67.4	67.6	66.8	65.9	65.2	67.8	67.5	52.9
1250	69.8	68.0	66.7	66.2	65.7	70.0	70.7	53.5
1600	70.8	68.8	68.5	66.0	66.0	70.7	70.3	55.3
2000	69.0	68.4	68.5	64.7	63.3	68.2	67.1	55.1
2500	66.8	66.7	66.3	63.4	63.1	66.4	65.7	52.7
3150	65.3	66.9	66.5	60.1	61.7	64.5	63.8	50.4
4000	62.8	65.6	65.0	56.8	60.5	62.3	61.5	48.4
5000	61.8	64.7	64.5	56.7	59.4	60.5	59.7	47.0
6300	59.1	61.8	61.4	53.9	56.9	57.6	56.9	43.5
8000	54.5	58.2	57.8	51.3	52.5	53.3	52.6	39.3
10000	48.6	52.5	52.3	49.7	46.9	48.4	48.8	32.2
12500	44.0	45.3	44.5	43.8	40.6	44.5	44.6	26.9
16000	38.3	42.4	41.8	37.4	35.3	38.6	38.3	22.3
20000	30.2	35.2	35.4	29.1	27.4	30.2	30.9	14.3

2.5.3 1/3 Octave measures from 4 m

Note: Measures in dB. All the points measurements are also available.

	Points							
Frequency (Hz)	201	205	207	214	217	218	219	196
6.3	24.6	29.9	23.4	33.8	25.9	52.6	47.1	26.3

8	29.9	33.4	28.2	42.2	31.2	56.6	50.3	35.8
10	37.5	40.4	34.7	42.9	36.7	59.6	55.2	37.4
12.5	43.5	41.6	42.0	48.0	44.2	63.3	58.2	51.1
16	51.9	50.2	48.7	51.5	55.3	65.7	59.6	51.8
20	57.0	61.4	58.4	55.0	57.8	68.7	64.4	53.6
25	60.8	63.2	61.2	60.4	62.1	68.1	64.9	56.5
31.5	59.7	60.0	58.2	60.1	67.4	70.2	67.4	61.4
40	63.5	61.9	63.9	66.5	68.6	70.1	66.9	60.5
50	68.9	68.2	69.3	68.8	72.6	72.7	70.3	62.4
63	68.3	67.9	68.5	67.6	71.5	71.7	69.9	63.2
80	67.5	67.1	67.1	70.3	70.5	71.5	70.0	64.4
100	70.9	70.1	68.5	73.0	70.6	71.1	70.8	65.6
125	70.5	69.3	67.9	69.9	69.1	71.3	69.9	64.9
160	69.2	67.5	68.4	65.6	67.3	68.3	68.2	62.2
200	68.6	69.9	68.5	68.6	68.8	68.6	70.0	64.3
250	75.4	78.4	78.1	77.7	72.7	72.3	75.2	67.0
315	73.9	75.6	74.8	76.6	70.1	71.7	71.1	64.0
400	69.2	66.9	67.3	66.9	66.1	68.1	68.6	58.9
500	68.8	67.7	66.2	60.9	66.1	68.3	68.3	59.2
630	67.0	66.1	65.8	60.9	65.4	66.9	66.9	54.8
800	65.0	64.8	65.6	59.5	64.0	65.8	66.2	54.4
1000	65.3	64.9	64.4	60.7	63.3	64.3	63.9	53.0
1250	67.0	65.8	64.3	62.8	63.6	67.4	66.8	53.0
1600	68.0	66.5	65.0	63.8	63.5	68.1	67.3	55.1
2000	66.8	65.5	65.4	61.7	61.9	65.6	65.1	55.2
2500	64.2	63.7	63.6	59.8	60.3	62.9	62.6	52.7
3150	63.3	63.4	63.4	57.4	59.2	61.3	60.9	50.7
4000	61.4	62.6	62.9	53.9	57.8	59.0	58.7	49.3
5000	60.3	61.2	61.3	53.7	56.0	56.6	56.3	48.3
6300	57.5	57.7	57.8	50.2	53.2	54.0	53.6	45.0
8000	53.0	53.9	53.9	47.4	48.4	49.6	49.0	40.5
10000	45.8	48.3	47.9	45.5	43.7	44.4	44.0	31.9
12500	40.4	41.1	40.8	40.5	38.2	39.8	39.5	26.1
16000	36.5	37.3	37.2	34.2	32.2	33.1	32.7	22.9
20000	27.8	30.7	30.7	25.6	24.1	24.1	23.8	14.6

2.5.4 1/3 Octave measures from 8 m

Note: Measures in dB. All the points measurements are also available.

	Points							
Frequency (Hz)	225	229	231	235	238	239	240	220
6.3	34.1	18.9	30.0	46.8	23.9	20.7	30.5	27.4
8	37.9	27.1	34.4	50.0	32.4	26.9	32.7	27.1
10	42.3	32.7	40.2	55.9	36.1	30.6	37.8	32.0
12.5	44.7	35.8	40.1	69.2	43.0	37.3	37.6	37.5
16	52.2	46.5	47.1	72.0	48.2	42.6	45.0	41.9
20	59.8	56.1	58.7	66.4	55.9	54.2	55.2	52.4
25	61.3	62.3	62.8	74.3	60.0	59.7	62.5	49.6
31.5	59.2	58.1	57.1	73.5	62.0	59.5	61.6	56.6
40	60.8	61.5	62.6	74.4	62.7	62.9	61.9	57.2
50	64.4	63.5	65.8	72.6	71.0	69.9	69.7	59.3
63	66.2	65.7	67.2	73.0	66.7	65.6	64.9	59.9
80	63.9	64.2	65.6	71.9	67.7	66.8	66.9	62.6
100	63.6	64.0	62.5	70.7	68.1	68.1	66.7	62.4
125	69.6	69.4	65.6	67.8	68.6	69.5	69.2	62.1
160	69.2	68.0	68.1	67.2	66.3	67.6	66.9	60.5
200	65.9	67.2	67.0	68.1	66.3	66.1	65.0	60.8
250	65.6	68.2	66.5	72.5	68.1	66.3	65.8	62.6
315	66.3	67.1	65.7	69.2	63.1	62.9	62.3	58.8
400	64.1	66.4	65.9	63.2	60.9	61.7	60.8	54.8
500	66.4	64.0	64.7	59.7	62.5	62.7	63.3	55.5
630	62.6	61.7	63.6	59.6	59.9	61.0	60.7	52.6
800	61.9	61.1	61.9	57.4	57.6	58.8	59.1	51.5
1000	63.3	63.0	62.4	57.3	60.2	61.8	60.9	50.8
1250	63.9	64.7	64.6	57.4	61.8	62.3	62.3	51.1
1600	64.0	64.1	63.7	58.2	62.4	63.5	63.7	53.5
2000	64.4	63.4	63.5	56.3	58.8	60.8	60.8	54.3
2500	61.0	61.5	62.1	53.5	57.2	58.0	58.3	51.0
3150	60.3	60.4	61.6	52.5	56.0	56.6	56.5	50.1
4000	59.2	59.5	60.3	49.2	53.5	54.4	53.6	47.1

5000	57.4	57.7	58.9	48.1	51.5	51.7	51.2	47.2
6300	54.5	54.2	55.0	43.3	48.6	48.7	48.7	43.4
8000	50.4	49.8	50.9	40.4	43.5	44.2	43.9	38.2
10000	42.7	44.8	45.2	37.1	39.3	39.1	38.8	30.1
12500	36.7	37.3	37.4	32.0	34.1	34.9	34.0	24.2
16000	35.1	33.0	33.5	26.7	27.6	28.6	28.0	20.0
20000	24.6	27.3	27.4	19.0	19.9	19.7	19.2	13.7

2.6 Measurement's corrections

2.6.1 Background noise correction

The background correction factor K_{1A} must be calculated according to the next expression:

$$K_{1A} = -10\log\left[1 - 10^{-0,1\Delta L_{pA}}\right] \mathrm{dB}$$

With:

$$\Delta L_{pA} = \overline{L'_{pA(ST)}} - \overline{L'_{pA(B)}}$$

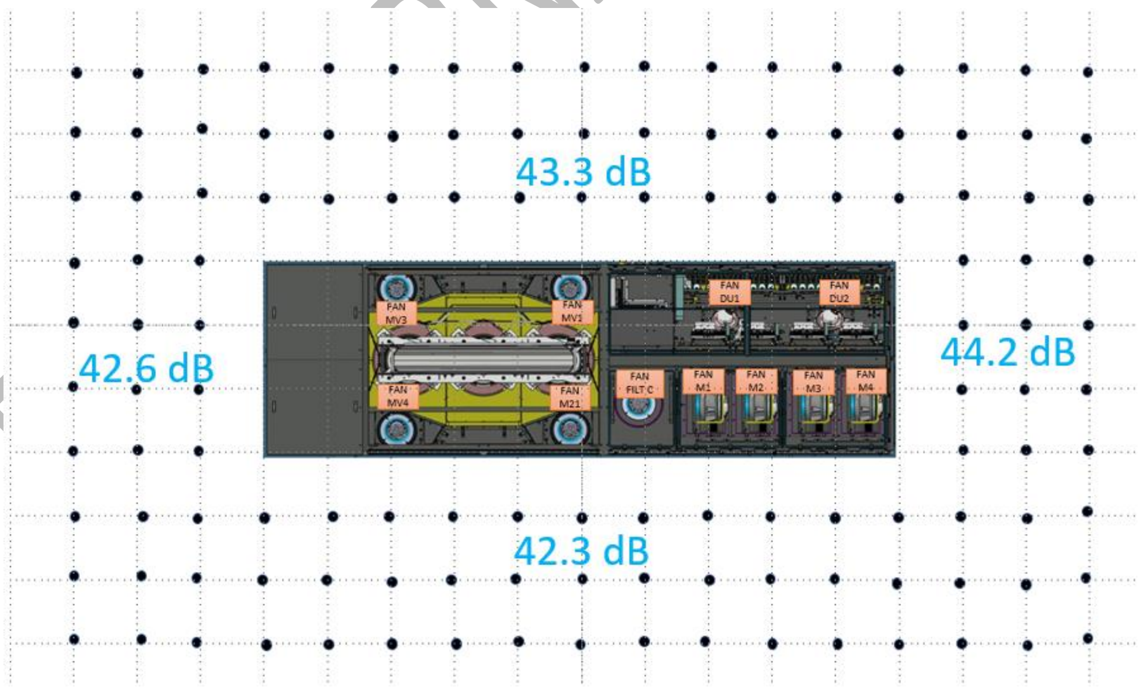
Where:

$\overline{L'_{pA(ST)}}$ is the noise measured at the test.

$\overline{L'_{pA(B)}}$ is the noise measured at the background.

If $\Delta L_{pA} > 10\mathrm{dB}, K_{1A}$ is equal to 0.

In our case, the background measured was around 44dB, so, the background noise correction factor is equal to 0.



2.6.2 Environment correction

The test environment conditions correction is not necessary in this testcase due to the test was performed at the outside of the installations, so, the correction factor K_{2A} is equal to 0.

2.6.3 Acoustic pressure calculation

The acoustic pressure level averaged in time have been calculated using the next equation that takes in account the number of measures taken for each distance.

$$\overline{L'_{pA(ST)}} = 10\lg\left[\frac{1}{N_M}\sum_{i=1}^{N_M} 10^{0,1L'_{pAi(ST)}}\right] dB$$

Where:

$L'_{pAi(ST)}$ is the level of acoustic pressure time averaged for the noise source A of the test in the i-position of the microphone measured in dB.

N_M is the number of individual microphone positions.

The next table gathers the acoustic pressure results:

Acoustic pressure (1 m) (dB)	Acoustic pressure (2 m) (dB)	Acoustic pressure (4 m) (dB)	Acoustic pressure (8 m) (dB)
80.884	77.947	76.714	72.918

2.6.4 Acoustic pressure pondered in the surface

The acoustic pressure level pondered at the measuring surface is calculated with the correction factor of the background noise and the environment noise. In our case, both factors are equal to 0 (K_{1A} and K_{2A}), so the result calculated of the acoustic pressure is the same as the previous paragraph.

2.6.5 Acoustic power calculation

The level of acoustic power of the inverter have been calculated using the acoustic pressure level for the environmental test conditions using the next equation:

$$L_{WA} = \overline{L_{pA}} + 10\lg\frac{S}{S_0}\,dB$$

Where:
S is the measured surface area
$S_0 = 1\ m^2$

Acoustic power (1 m) (dB)	Acoustic power (2 m) (dB)	Acoustic power (4 m) (dB)	Acoustic power (8 m) (dB)
95.119	95.251	97.927	98.775

2.6.6 Acoustic power calculated for octave measures

	Points (acoustic power in dB) - 1 m			
Frequency (Hz)	1 m	2 m	4 m	8 m
6.3	71.351	70.702	62.039	64.113
8	73.704	76.551	65.981	67.396
10	79.857	79.820	69.388	73.173
12.5	84.964	82.115	73.144	86.068
16	86.750	85.220	75.750	88.932
20	90.996	87.966	79.700	85.649
25	91.269	90.141	80.660	92.349
31.5	93.637	90.009	82.500	91.413
40	93.433	90.721	83.615	92.608
50	93.236	92.449	87.290	94.574
63	92.515	91.720	86.504	93.402
80	91.976	90.160	86.382	93.016
100	90.778	90.201	87.796	92.585
125	89.550	89.343	86.734	94.116
160	89.660	89.330	84.795	93.097
200	90.600	91.590	85.972	92.052

250	94.856	95.168	93.060	93.713
315	91.359	90.132	90.758	91.278
400	86.929	87.022	84.510	89.163
500	86.604	86.573	83.991	89.103
630	84.892	85.490	82.696	86.867
800	84.061	84.764	81.590	85.413
1000	83.473	83.725	80.800	86.962
1250	85.398	85.297	82.454	88.249
1600	85.802	85.867	83.149	88.479
2000	83.858	84.194	81.703	87.255
2500	82.216	82.461	79.495	84.938
3150	81.318	81.409	78.523	83.982
4000	79.047	79.570	77.093	82.458
5000	78.562	78.579	75.535	80.722
6300	76.267	75.701	72.389	77.338
8000	72.619	71.819	68.258	73.048
10000	67.637	66.781	62.752	67.330
12500	61.733	60.831	56.881	60.902
16000	54.859	56.221	51.980	56.812
20000	47.570	48.878	44.400	49.261

3 HEMK / PCSK GEN 3 noise simulations

This section presents the noise measurement simulation for the Freesun HEMK / Freemaq PCSK GEN3 inverter. The next figure depicts the simulation of the noise level for the HEMK / PCSK inverter. AC Filter and modules side (1 m of distance) have the highest noise level (83.9 dB).

	8m	4m	2m	1m							1m	2m	4m	8m
8m					71,9			71,3						
4m					73,1			74,8						
2m			72,5	74,5	75,2	79,3	78,2	77	76,4	75,5	76,1	75,9		
1m			71,2	75,1	77,2	80,7	79,5	78,6	77,9	77,1	77,5	77,3		
			69,6	71,9							78,6	77,9	75,5	71,9
			67,6	70,5							79,5	77,8	76,7	71,3
	64,7	67,4	68,6	70,5							80,1	77,6	76,3	71,5
			70,8	73,4							79,8	77,9	76,3	72,4
1m			73,2	77,9	80	83,6	83,9	83,9	83,1	80,8	79,7	78,6		
2m			73	76,3	79,1	80,8	80,5	80,1	79,7	79,4	78,3	77,3		
4m			72,4	75	77,2	78,3	78,6	78,3	78,2	77,6	76,3	75,4		
8m			72	73,1	74,2	74,3	74,3	75	74,7	74,2