Reviewed for Code Compliance

04/08/2025

VERIZON TELECOMM SITE

HEAT LOAD STUDY

SITE NUMBER
2061798

CO1 Catamount
31800 CR 14C
Steamboat Springs, CO
80487

Presented by:

EE Parker LLC
PARKER, CO

20, October 2024

Table of Contents

1. Introduction

The intent of this study is to determine the total heat load within an existing antenna cupola. The cupola is located at the peak of an existing barn structure. The cupola is approximately 30 feet AGL with antennas mounted at 28 feet, 26 feet-7 inches and 25 feet AGL. Also includes recommended cooling system sized to prevent overheating of equipment. This report includes the following:

- Calculated internal heat gain (Verizon equipment)
- Calculated structure heat gain from walls and roof (Summer Ambient Conditions)

2. Existing Conditions

Structure

Antenna cupola consists of an approximate 86 square feet of antenna mounting space. The cupola structure is framed and, based on site pictures, the exterior consists of FRP panels. The cupola houses the Alpha, Beta, and Gamma sector antennas and RRUs.

3. Recommendation

Based on the calculated heat loads as shown in appendices, it is recommended to install (3) fans rated for 500 cfm at 0.25“ W.C. static each, for a total of 1500 cfm, for antenna cupola. Fans to be mounted to induce draft across heat sinks of cell equipment. Fans to be Pelonis Fans-Tech model W1D180-AA 48 V DC axial fan, or matching equal, see cutsheet for details. Fans to be controlled by Ehresmann Engineering Arial fan controller. Fan controller requires 85 to 256 V AC for power and operation. Antenna cupola requires intake louvers/grille with 1.9 sqft of free area and exhaust louvers/grille with 1.4 sqft of free area. Intake louvers/grille to be mounted below lowest heat generating equipment on the east and west sides of the cupola almost to roof level. Exhaust louvers/grilles/hoods to be mounted above the highest heat generating equipment, likely at the cupola roof.

4. Appendices

Appendix A – Calculations and Assumptions

Assumptions

No canister insulation

Max operating temp for telecom equipment, 130°F

Peak Summer cooling day temperature, 87°F

Altitude 6867’ ASL

Equipment Heat Gain				
Equipment Type	**Watts/Unit**	**QTY**	**Total W**	**Heat Gain (W)**
AIR6419	1280	3	3840	1536
Existing 4890 RRH	1370	3	4110	1644
Existing 4449 RRH	2800	3	8400	3360
BTUH/Watt	3.412		Total Heat Gain (W)	3180
BTUH/Ton	12000		Total Heat Gain (BTUH)	10851
			Total Heat Gain (Tons)	1

Antenna Cupola Heat Gain (BTUH)	12500
Loads calculated with Carrier HAP Load calc program, see attached.	
Total Load, Shelter and Equipment (BTUH)	23351
Total Load, Shelter and Equipment (Tons)	2

Air System Sizing Summary for Default System

Project Name: 24XXXX - REI C01 CATAMOUNT 10/16/2024
Prepared by: EE LLC 07:13PM

Air System Information

Air System Name	**Default System**		Number of zones	**1**	
Equipment Class	**UNDEF**		Floor Area	**86.0**	ft²
Air System Type	**SZCAV**		Location	**Steamboat, Colorado**	

Sizing Calculation Information

Calculation Months	**Jan to Dec**		Zone CFM Sizing	**Sum of space airflow rates**	
Sizing Data	**Calculated**		Space CFM Sizing	**Individual peak space loads**	

Central Cooling Coil Sizing Data

Total coil load	**1.0**	Tons	Load occurs at	**Jul 1500**	
Total coil load	**12.5**	MBH	OA DB / WB	**87.0 / 55.0**	°F
Sensible coil load	**12.5**	MBH	Entering DB / WB	**75.5 / 42.5**	°F
Coil CFM at Jul 1500	**1134**	CFM	Leaving DB / WB	**62.3 / 36.4**	°F
Max block CFM	**1134**	CFM	Coil ADP	**60.8**	°F
Sum of peak zone CFM	**1134**	CFM	Bypass Factor	**0.100**	
Sensible heat ratio	**1.000**		Resulting RH	**0**	%
CFM/Ton	**1085.6**		Design supply temp.	**58.0**	°F
ft²/Ton	**82.3**		Zone T-stat Check	**1 of 1**	OK
BTU/(hr·ft²)	**145.8**		Max zone temperature deviation	**0.0**	°F
Water flow @ 10.0 °F rise	**2.51**	gpm			

Central Heating Coil Sizing Data

Max coil load	**23.3**	MBH	Load occurs at	**Des Htg**	
Coil CFM at Des Htg	**1134**	CFM	BTU/(hr·ft²)	**270.4**	
Max coil CFM	**1134**	CFM	Ent. DB / Lvg DB	**68.4 / 92.9**	°F
Water flow @ 20.0 °F drop	**2.33**	gpm			

Supply Fan Sizing Data

Actual max CFM	**1134**	CFM	Fan motor BHP	**0.00**	BHP
Standard CFM	**879**	CFM	Fan motor kW	**0.00**	kW
Actual max CFM/ft²	**13.19**	CFM/ft²	Fan static	**0.00**	in wg

Outdoor Ventilation Air Data

Design airflow CFM	**0**	CFM	CFM/person	**0.00**	CFM/person
CFM/ft²	**0.00**	CFM/ft²			

Zone Sizing Summary for Default System

Project Name: 24XXXX - REI C01 CATAMOUNT 10/16/2024
Prepared by: EE LLC 07:13PM

Air System Information

Air System Name ..... **Default System**
Equipment Class ..... **UNDEF**
Air System Type ..... **SZCAV**

Number of zones **1**
Floor Area ..... **86.0** ft²
Location ..... **Steamboat, Colorado**

Sizing Calculation Information

Calculation Months ..... **Jan to Dec**
Sizing Data ..... **Calculated**

Zone CFM Sizing ..... **Sum of space airflow rates**
Space CFM Sizing ..... **Individual peak space loads**

Zone Terminal Sizing Data

Zone Name	Design Supply Airflow (CFM)	Minimum Supply Airflow (CFM)	Zone CFM/ft²	Reheat Coil Load (MBH)	Reheat Coil Water gpm @ 20.0 °F	Zone Htg Unit Coil Load (MBH)	Zone Htg Unit Water gpm @ 20.0 °F	Mixing Box Fan Airflow (CFM)
Zone 1	1134	1134	13.19	0.0	0.00	0.0	0.00	0

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (ft²)
Zone 1	12.9	Jul 1500	23.7	86.0

Space Loads and Airflows

Zone Name / Space Name	Mult.	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (ft²)	Space CFM/ft²
Zone 1							
ANTENNA CUPOLA	1	12.9	Jul 1500	1134	23.7	86.0	13.19

Air System Design Load Summary for Default System

Project Name: 24XXXX - REI C01 CATAMOUNT 10/16/2024
Prepared by: EE LLC 07:13PM

	DESIGN COOLING			DESIGN HEATING		
	COOLING DATA AT Jul 1500 COOLING OA DB / WB 87.0 °F / 55.0 °F			HEATING DATA AT DES HTG HEATING OA DB / WB -7.2 °F / -9.0 °F		
ZONE LOADS	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**	**Details**	**Sensible (BTU/hr)**	**Latent (BTU/hr)**
Window & Skylight Solar Loads	0 ft²	0	-	0 ft²	-	-
Wall Transmission	360 ft²	9591	-	360 ft²	17312	-
Roof Transmission	100 ft²	3410	-	100 ft²	5717	-
Window Transmission	0 ft²	0	-	0 ft²	0	-
Skylight Transmission	0 ft²	0	-	0 ft²	0	-
Door Loads	0 ft²	0	-	0 ft²	0	-
Floor Transmission	86 ft²	-147	-	86 ft²	705	-
Partitions	0 ft²	0	-	0 ft²	0	-
Ceiling	0 ft²	0	-	0 ft²	0	-
Overhead Lighting	0 W	0	-	0	0	-
Task Lighting	0 W	0	-	0	0	-
Electric Equipment	0 W	0	-	0	0	-
People	0	0	0	0	0	0
Infiltration	-	0	0	-	0	0
Miscellaneous	-	0	0	-	0	0
Safety Factor	0% / 0%	0	0	0%	0	0
>> Total Zone Loads	**-**	**12854**	**0**	**-**	**23734**	**0**
Zone Conditioning	-	12535	0	-	23253	0
Plenum Wall Load	0%	0	-	0	0	-
Plenum Roof Load	0%	0	-	0	0	-
Plenum Lighting Load	0%	0	-	0	0	-
Return Fan Load	1134 CFM	0	-	1134 CFM	0	-
Ventilation Load	0 CFM	0	0	0 CFM	0	0
Supply Fan Load	1134 CFM	0	-	1134 CFM	0	-
Space Fan Coil Fans	-	0	-	-	0	-
Duct Heat Gain / Loss	0%	0	-	0%	0	-
>> Total System Loads	**-**	**12535**	**0**	**-**	**23253**	**0**
Central Cooling Coil	-	12535	0	-	0	0
Central Heating Coil	-	0	-	-	23253	-
>> Total Conditioning	**-**	**12535**	**0**	**-**	**23253**	**0**
Key:	**Positive values are clg loads Negative values are htg loads**			**Positive values are htg loads Negative values are clg loads**		

Appendix B – Equipment Cut Sheets

DC *Fan Motor*

W1D180 Axial Fan

180mm (7.1in)

RoHS COMPLIANT

GENERAL SPECIFICATIONS

Life: 40,000 hours

Operating Temp: -20℃~+60℃

FEATURES

High efficiency design

Lubricated maintenance-free ball bearings

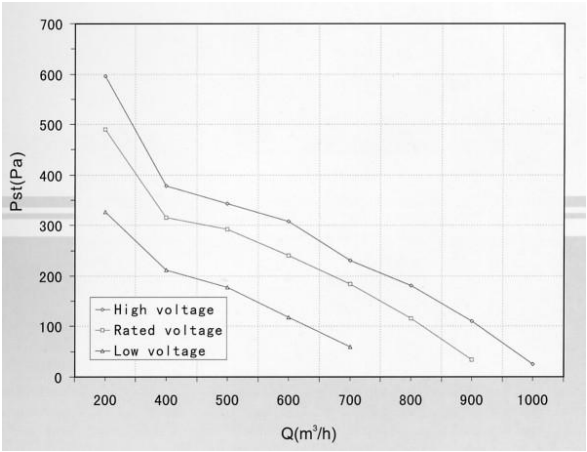
Vibration-free operation

Precision balanced for superior performance

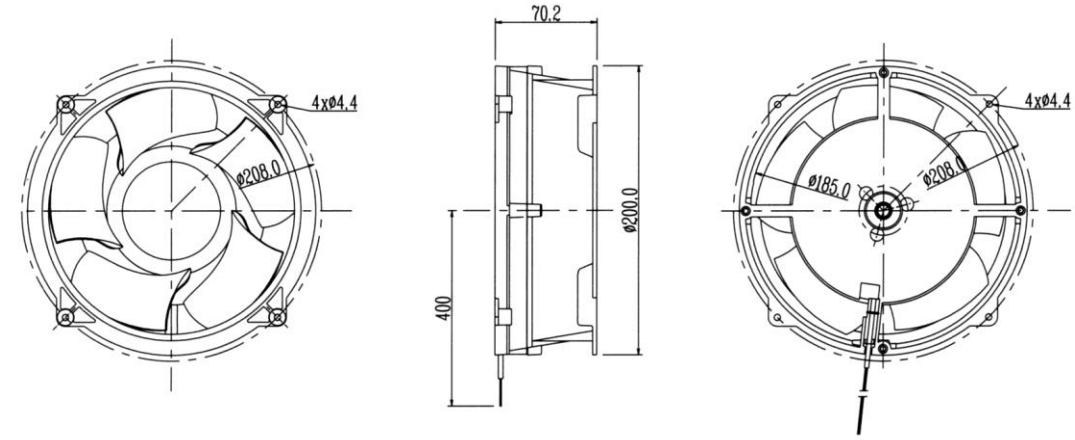
Compact and rugged construction

model	bearings (V)	voltage (V)	range (VDC)	power (W)	speed (RPM)	airflow (m^3/h)	airflow (CFM)	max ambient temp (℃)	noise (dBA)
W1D180-AB	Ball	24	16 to 28	93	1520	911	536	60	68
W1D180-AA	Ball	48	36 to 57	100	1290	935	550	60	69

Performance Curves



Dimensions (mm)



Applications

HVAC, cabinet cooling, medical equipment, military applications, air filtration, semiconductors, commercial and industrial cooling.

Fans-tech by Pelonis Technologies

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PELONIS TECHNOLOGIES, INC.

EHRESMANN ENGINEERING

PATENT PENDING

Introducing the Ehresmann Engineering AERIAL.

Eliminate Extreme Temperatures on your Infrastructure Equipment

A sophisticated cellular tower array cooling system. With up to twelve temperature controlled variable speed fans, array noise|temperature monitoring, and a remote monitoring app, you can count on your equipment running as efficiently as possible even in the most extreme heat!

Download the Aerial App to Learn More!

Wi Fi CERTIFIED

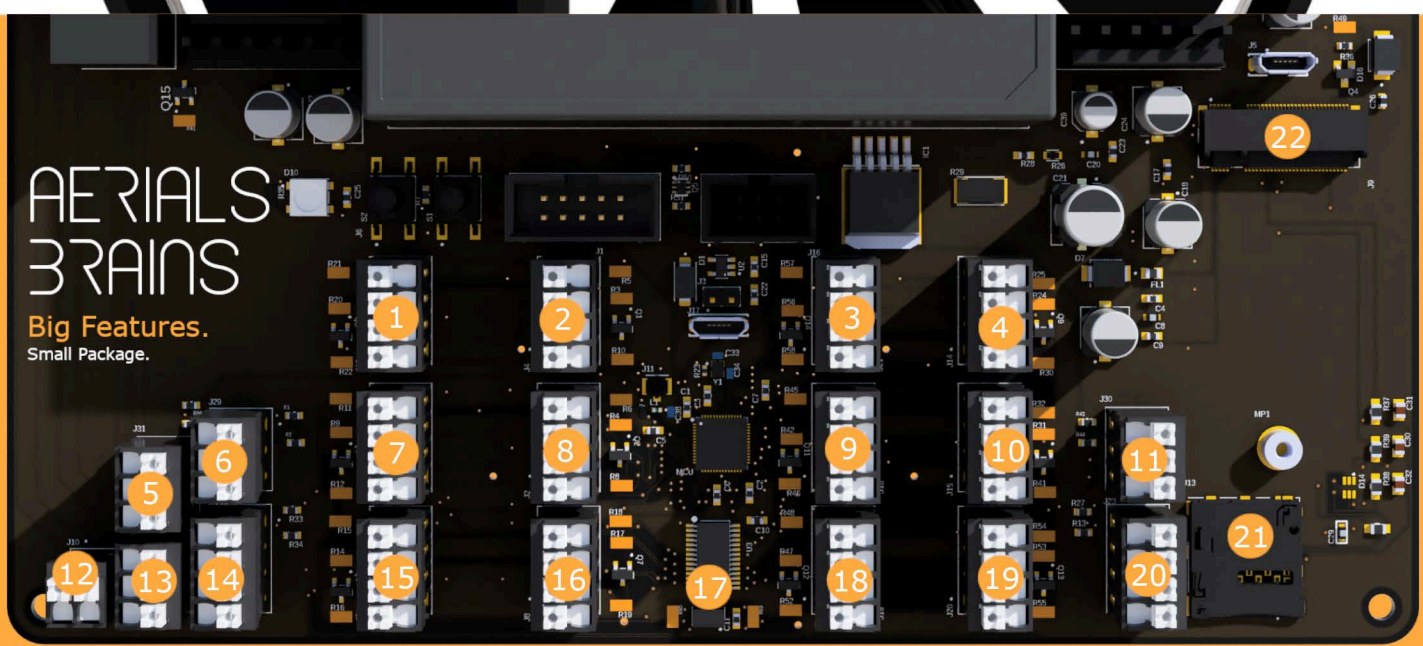
Available on the Google Play

Download on the App Store

CONNECTORS

Fans and Devices utilize a M12 barrel 4-pin male axial connection with an IP67 weatherproof rating

Using M12 barrel connectors for device maintenance can significantly simplify the process by providing a secure and robust connection that is easy to install and remove, reducing the likelihood of errors or damage to Aerial devices. This can lead to faster maintenance times, improved reliability, and overall cost savings in the long term



1. PWM Tachometer Variable Speed Fan#1
2. PWM Tachometer Variable Speed Fan#2
3. PWM Tachometer Variable Speed Fan#3
4. PWM Tachometer Variable Speed Fan#4
5. Fire Suppression System Trigger Contacts
6. Panel Exterior Noise Sensor
7. PWM Tachometer Variable Speed Fan#5
8. PWM Tachometer Variable Speed Fan#6
9. PWM Tachometer Variable Speed Fan#7
10. PWM Tachometer Variable Speed Fan#8
11. Array Noise Sensor
12. AC Power Supply
13. Panel Exterior Temperature Sensor
14. Array Lower Temperature Sensor
15. PWM Tachometer Variable Speed Fan#9
16. PWM Tachometer Variable Speed Fan#10
17. Panel Security Sensor
18. PWM Tachometer Variable Speed Fan#11
19. PPWM Tachometer Variable Speed Fan#12
20. Array Upper Temperature Sensor
21. Customer Provided SIM Card Slot
22. M.2 Slot for Upgradable Cellular Modem

4400 West 31st Street | Yankton, SD 57078-6810
Toll-Free: (800)291-6658 | Local: (605)665-7532 | Fax: (605)665-9780
Email: info@ehresmannengineering.com

NOISE PROTECTION

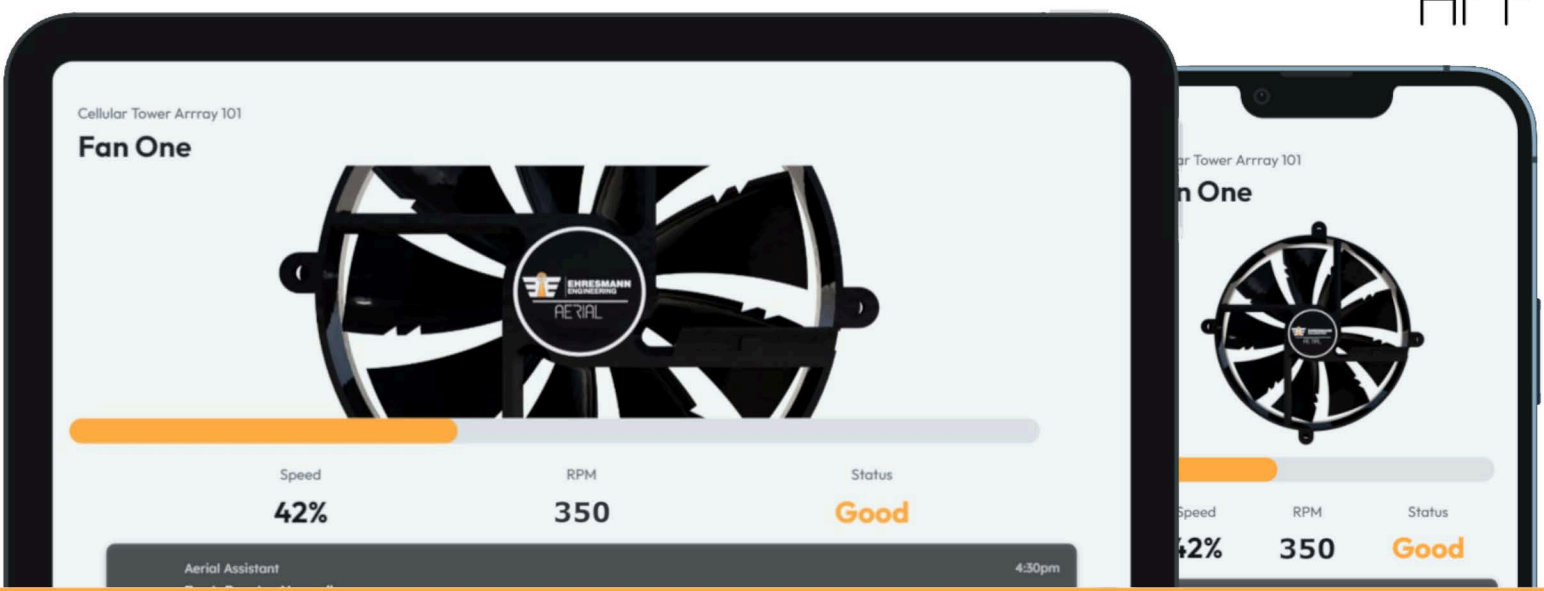
Noise sensors in the array and panel are used to monitor the sound level of fans and provide feedback to the fan control system. This allows the fan speed to be regulated and adjusted to maintain an acceptable noise level, which helps protect people and the environment from excessive noise pollution.

TEMPERATURE MONITORING

Aerial utlilizes three temperature monitors throughout her system. Two are located in the array and the other is located on the exterior of her enclosure. She will use her temperature transmitters to vary the speed of the fans to make sure she only runs them as much as required. Combined with her panel exterior temperature sensor she can provide you an accurate measurement of how she is performing.

Aerials app uses advanced features for real-time monitoring, so users can stay up-to-date with the latest trends and insights, allowing them to make informed decisions and take action when needed.

APP



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CABINET COOLING

Aerials main function is to keep your equipment cool in the most extreme heat. To do that she needs to make sure that she can handle the heat too! Aerial comes with a 175 btu/hour thermoelectric panel cooler to make sure everything runs at peak performance.

GETTING STARTED

Looking for the ultimate solution to cool your infrastructure equipment?
Get started with Aerial in five easy steps:

1. Measure your array cannister diameter and height
2. Height from ground to top of the cannister + horizontal distance to panel location
3. Power source available at proposed panel Location
4. Provide a data only SIM card
5. Contact Your Ehresman Engineering Sales Representative

Toll-Free: (800)291-6658 | Local: (605)665-7532 | Email: info@ehresmannengineering.com

SPECIFICATIONS

Panel Specifications
Dimensions: 12.0" width x 6.0" depth x 16.0" height
Power: 820 Watts
Voltage:85-256 Vac
Frequency:60hz
Amps:3.2-9.5 Amp
Temperature:–10°C to +65°C
Enclosure:UL NEMA TYPE 4
Cabinet Cooling: 175 BTU/hr Thermoelectric cooler
Cellular: 4G/LTE Support w/ Upgradable modem
WIFI: 2.4Ghz IEEE 802.11 b/g/n

Designed and built to UL508 and UL508A standards

Patent Pending

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