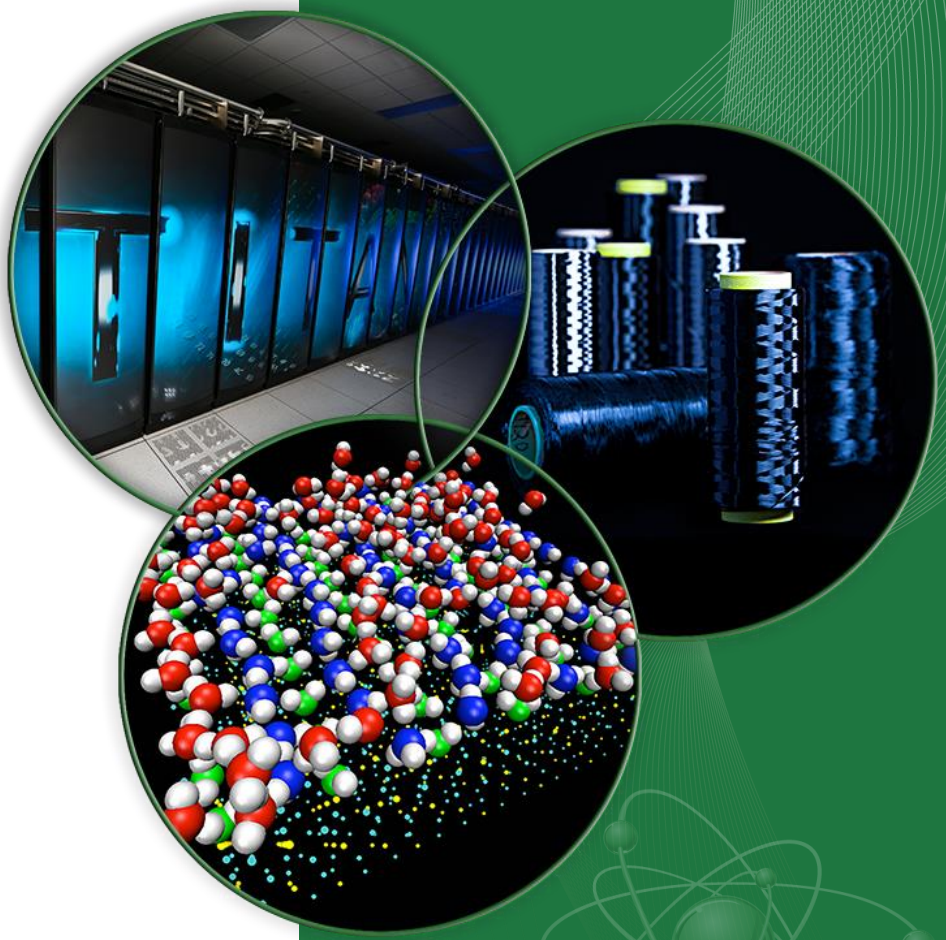
Flexible Research Platform #1 Measurement Overview

Rough Draft

V2



David Fugate

November 6, 2014

ORNL is managed by UT-Battelle
for the US Department of Energy

OAK RIDGE National Laboratory

Flexible Research Platform #1
Measurement Overview

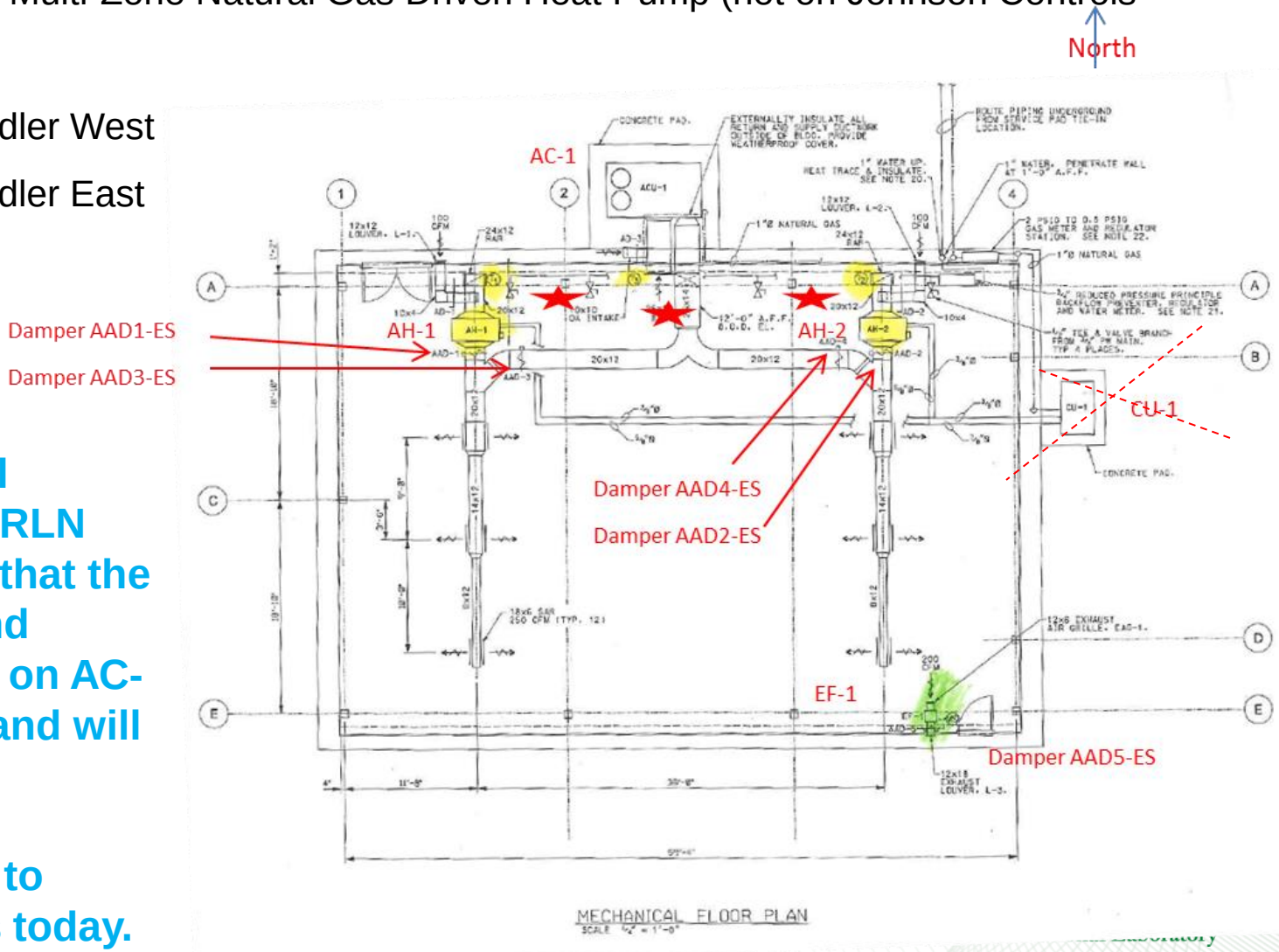
FRP 1 Building Equipment Summary

- The 1-story FRP is 2,400 ft2 and is currently targeted at the energy efficiency of metal buildings.
- It has two HVAC systems to facilitate operation of either a conventional gas-pack (air-conditioner with natural gas heat) or a gas-engine–driven heat pump.

Flexible Research Platform #1 Measurement Overview

FRP 1 Building Equipment Summary

1. **AC-1** Single Package Gas/Electric Air Conditioning Unit (Johnson Controls System)
2. **CU-1** Split System Multi-Zone Natural Gas Driven Heat Pump (not on Johnson Controls System)
   - **A. AH-1** Air Handler West
   - **B. AH-2** Air Handler East
3. **EF-1** Exhaust Fan



After some internal discussions, the ORLN team is proposing that the instrumentation and experiments focus on AC-1, AH-1, and AH-2 and will not include CU-1.

CU-1 is not typical to standard buildings today.

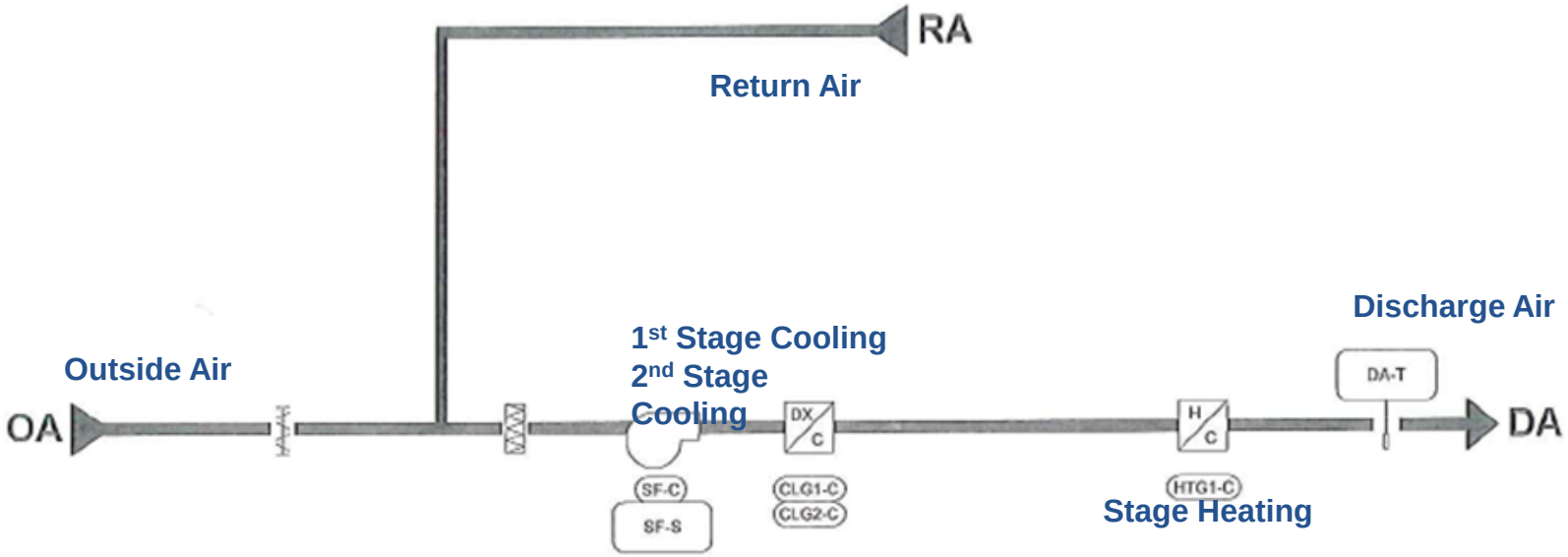
Flexible Research Platform #1 Measurement Overview

FRP 1 Building Equipment Summary

1. AC-1 Single Package Gas/Electric Air Conditioning Unit (Johnson Controls System)

- Nordyne Mammoth R6GP Series Model RGP-090D-200Ca (SN R6F120900062), Nominal 7 ½ Ton, and 460/3/60Hz Power.
- Loads
  - Two Outdoor Condenser Fan
  - Two Compressor
  - Blower
  - Controls

Device	Quantity	Voltage	Current
Blower Drive	1	480vac/3ph	2.9A
Compressor	2	480vac/3ph	6.1A
Condensor Fan	2	480vac/3ph	1.2A



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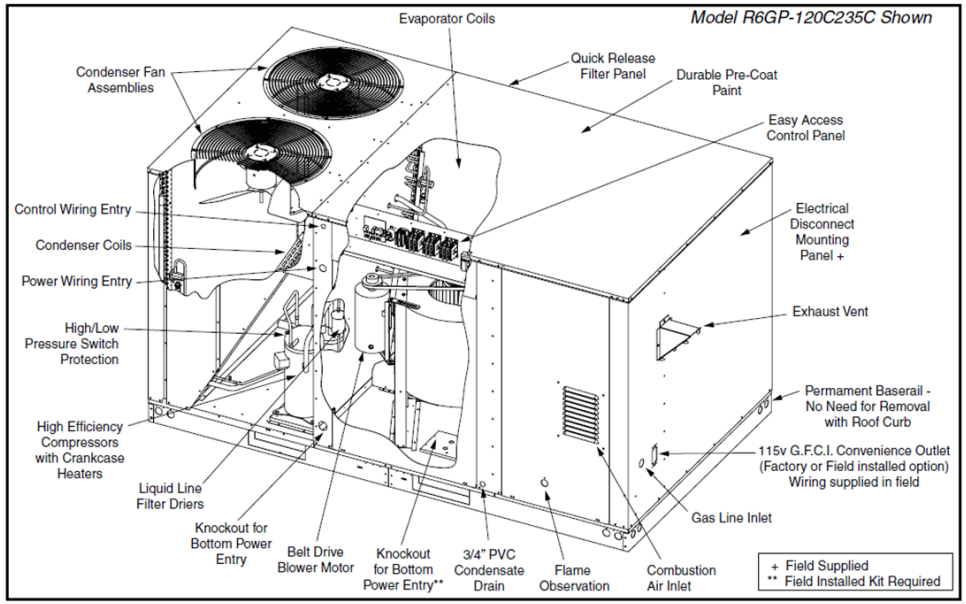


ELECTRICAL INFORMATION

Model Number	Nominal Electric Supply	Voltage Range		Compressors			Outdoor motors (2) ea.	Indoor Motor	Single Circuit	
Factory Drive Data:										
R6GP		Min	Max	RLA	LRA	Qty.	FLA	FLA	MCA	MOP
-072C-100C	208-230/60/3	187	253	19	123	1	1.5	3.2	30.0	45
-072D-100C	460/60/3	414	506	9.7	62	1	0.8	1.5	16.0	20
-072C-166C	208-230/60/3	187	253	19	123	1	1.5	3.2	30.0	45
-072D-166C	460/60/3	414	506	9.7	62	1	0.8	1.5	16.0	20
-090C-200C	208-230/60/3	187	253	13.1	83.1	2	2.3	6.2	40.3	50
-090D-200C	460/60/3	414	506	6.1	41	2	1.2	2.9	19.0	25
-120C-235C	208-230/60/3	187	253	17.8	110	2	2.3	6.2	50.9	60
-120D-235C	460/60/3	414	506	8.6	52	2	1.2	2.9	24.7	30
Medium Static Drive Data:										
0C	208-230/60/3	187	253	19	123	1	1.5	4.4	31.2	50
0C	460/60/3	414	506	9.7	62	1	0.8	2.1	15.8	25
6C	208-230/60/3	187	253	19	123	1	1.5	4.4	31.2	50
6C	460/60/3	414	506	9.7	62	1	0.8	2.1	15.8	25
6C	208-230/60/3	187	253	19	123	1	1.5	5.8	32.6	50
6C	460/60/3	414	506	9.7	62	1	0.8	2.8	16.5	25
0C	208-230/60/3	187	253	13.1	83.1	2	2.3	9.1	43.2	50
0C	460/60/3	414	506	6.1	41	2	1.2	4.4	20.5	25
5C 5C	Not Applicable									
tatic Drive Data:										
0C 0C 6C 6C	Not Applicable									
0C	208-230/60/3	187	253	13.1	83.1	2	2.3	9.1	43.2	50
0C	460/60/3	414	506	6.1	41	2	1.2	4.4	20.5	25
5C	208-230/60/3	187	253	17.8	110	2	2.3	9.1	53.8	60
5C	460/60/3	414	506	8.6	52	2	1.2	4.4	26.2	30

Flexible Research Platform #1
Measurement Overview

FRP 1 Building Equipment Summary

2. **CU-1** Split System Multi-Zone Natural Gas Driven Heat Pump (not on Johnson Controls System)

NEXTAIRE™ MULTI-ZONE GAS HEAT PUMP

Submittal Data: AXGP096D1NHS
8 Ton Multi-Zone Gas Heat Pump

Job Name:	Location:
Purchaser:	
Engineer:	
Submitted To:	For: ☐ Reference ☐ Approval ☐ Construction
Submitted By:	Date:
Unit Designation: Schedule #:	Model No.:

Capacities:
Cooling Capacity (@ 95 °F)....96,000 BTU/h
Heating Capacity (@ 47 °F)....103,000 BTU/h
Cooling Fuel Gas Consumption (@ 95 °F)....75,000 BTU/h
Heating Fuel Gas Consumption (@ 47 °F)....75,000 BTU/h

Power Supply:
Electrical....Single-phase 208 / 230 VAC
Cooling Power Consumption....0.82 kW
Heating Power Consumption....0.86 kW
Minimum Circuit Ampacity (MCA)....7.0 Amps
Maximum Over-Current Protection (MOP)....20 Amps

Engine:
Type....Water-Cooled Straight 4-cycle OHV
Displacement....0.952 Liter
Rated Output....9.74 Hp
Stating System....AC/DC Conversion DC Starter
Speed Range (min/ max)....1,000 / 1,900 rpm

Compressor:
Number of Units/ Type....2 / Scroll
Cooling Speed Range....1,480 to 2,960 rpm
Heating Speed Range....1,572 to 2,960 rpm

Fan:
Number of Units/ Type....2 / Propeller Fan
Motor Output....2 x 1/3 Hp

Refrigerant:
Type....R-410A

Unit Data:
Maximum Number of Indoor Units (IU)....1 to 17
Total capacity....48,000 - 124,800 BTU/h
Sound Pressure....57 dB

Standard Features:
- One Year Parts Warranty
- Three Years or 6,000 hours Compressor Warranty
- Three Years or 6,000 hours Engine Warranty
- VFD Controlled Outdoor Fan Motor
- Variable Refrigerant Flow
- High and Low Pressure Safeties
- Hot Gas Bypass
- Small Physical Footprint
- Small Carbon Footprint
- Waste Heat Recovery
- Remote Location Installation
- Ducted or Ductless Air Handlers
- Microprocesor controlled
- Designed for High Ambient Conditions
- Quiet Operation
- ETL Approved
- EPA Certified

INTELLI CHOICE ENERGY™

Flexible Research Platform #1
Measurement Overview

FRP 1 Building Equipment Summary

3. **A & B AC-1** AH-1 Air Handler West & AH-2 Air Handler East
   - Daikin FXMQ48PVJU equal nominal 4 ton 208/1/60Hz power.

DAIKIN AC
absolute comfort

Submittal Data Sheet

Project Name:	
Location:	
Engineer:	
Submitted to:	
Submitted by:	
Reference:	

Approval:	
Date:	
Construction:	
Unit #:	
Drawing #:	

Performance

Indoor Unit Model No:	FXMQ48PVJU
Cooling Capacity (Btu/hr):	48000
Sensible Capacity (Btu/hr):	35826
Cooling Input Power (kW):	0.46
Heating Capacity (Btu/hr):	54000
Heating Input Power (kW):	0.449
Nominal Ext Static Pressure (inH2O):	0.2
Max Ext Static Pressure (inH2O):	0.8

Indoor Unit Type:	Duct Mounted Standard Static (DC)
Cooling Nominal Conditions	Indoor: 80°F DB/67°F WB Outdoor: 95°F DB/75°F WB
Heating Nominal Conditions	Indoor: 70°F DB/60°F WB Outdoor: 47°F DB/43°F WB
Nominal Piping Length	25
Nominal Height Separation	0

Indoor Unit Details

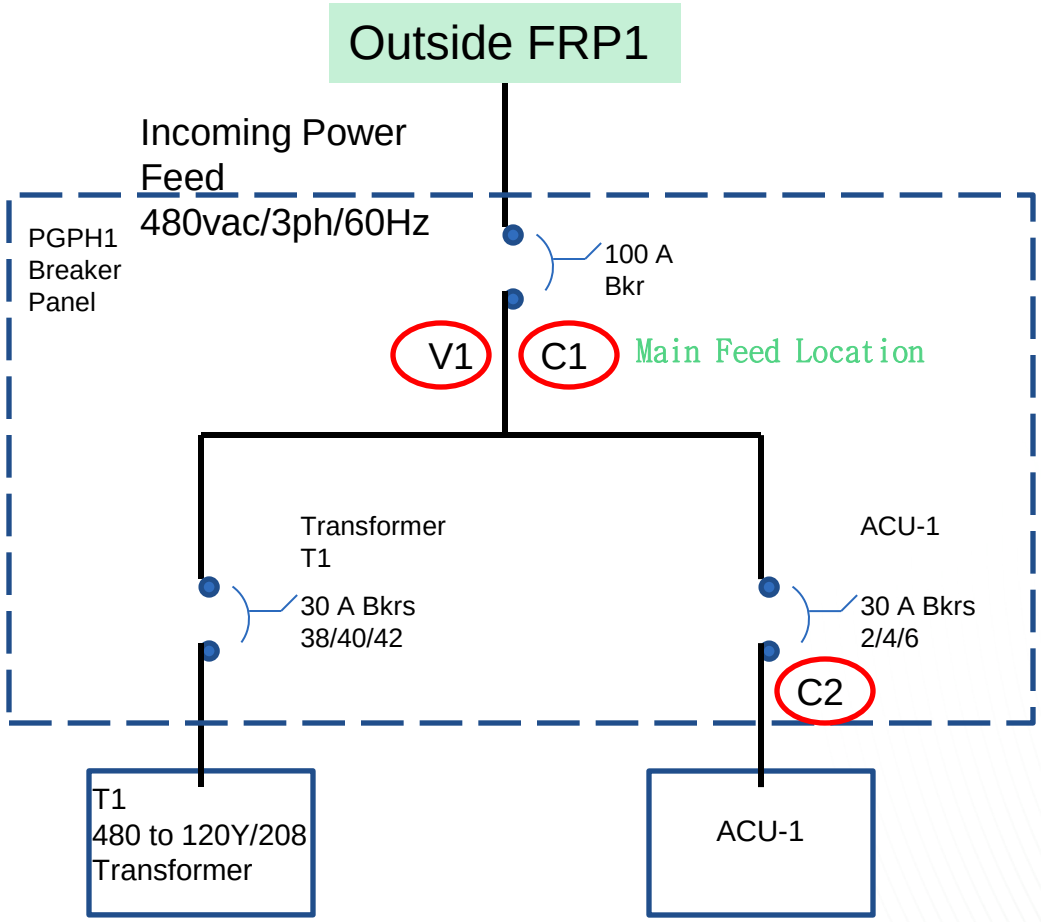
Power Supply (V/Hz/Ph:)	208-230/60/1ph
Power Supply Connections:	L1, L2, Ground
Min. Circuit Amps MCA (A):	3.4
Max. Fusible Amps MFA (A):	15
Dimensions (HxWxD):	11-13/16x55-1/8x27-9/16
Panel (HxWxD):	N/A
Net Weight (lbs):	101
Weight with Panel (lbs):	

Airflow Rate (CFM wet coil)	1377//989
Moisture Removal (pt/h):	
Gas Pipe Connection (inch):	5/8
Liquid Pipe Connection (inch):	3/8
Condensate Connection (inch):	1-1/4
Sound Pressure Level (dBA):	44
Sound Power Level (dBA):	

Appearance - Indoor Unit

Flexible Research Platform #1
Measurement Overview

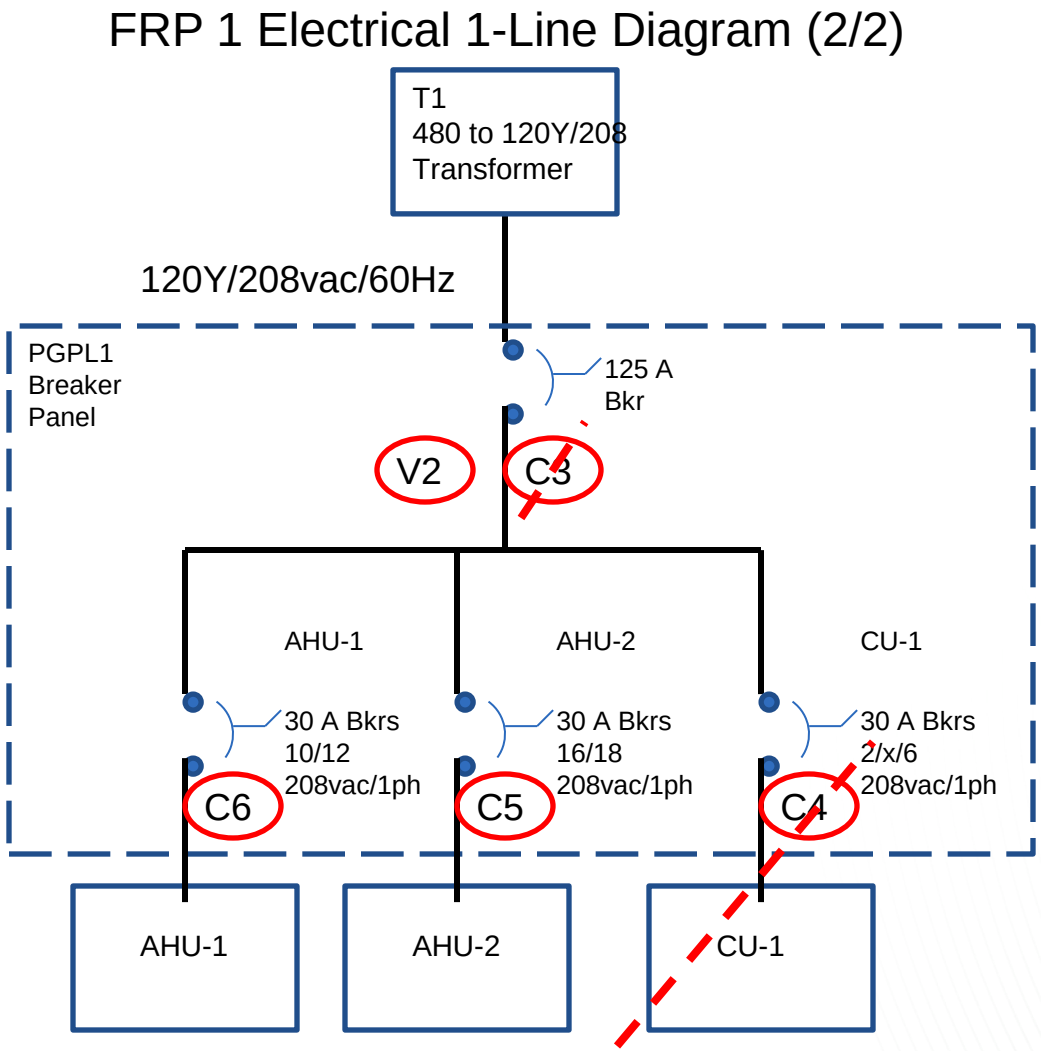
FRP 1 Electrical 1-Line Diagram (1/2)



C1 Current Measurement Location

V1 Voltage Measurement Location

Flexible Research Platform #1
Measurement Overview



Flexible Research Platform #1
Measurement Overview

FRP 1 Building Summary
Current Measurements

- Total of 8 CT's.

Measurement Location	Description	Voltage	Current	Quantity of CT's
C1	FRP Incoming Power Feed	480vac/3ph	100A	3
C2	ACU-1 Power Feed	480vac/3ph	30A	3
C3	T1 Power Feed	120Y208/3ph	125A	3
C4	CU-1	208vac/1ph	15A	1
C5	AHU-1	208vac/1ph	15A	1
C6	AHU-2	208vac/1ph	15A	1

Flexible Research Platform #1
Measurement Overview

FRP 1 Building Summary
Voltage Measurements

- Total of 6 VT measurements.
  - 2 – 3 phase VT's.

Measurement Location	Description	Voltage	Current	Quantity of VT's	Notes
V1	FRP Incoming Power Feed	480vac/3ph	100A	3	Use extra/unused 3-phase circuit breaker
V2	T1 Power Feed	120Y208/3ph	125A	3	Use extra/unused 3-phase circuit breaker

Flexible Research Platform #1
Measurement Overview

ORNL Requirements for Richman Surrey Equipment

1. UL listed components and enclosure.
2. Minimum rating of Nema 1 for enclosure.