The Evolution of Reefer Operations

MCI Reefer Conference 2025

STAR COOL

Test Chamber
Introduction

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Content

1. What are the test chambers used for?
    - Reefer box
    - Functional (SW & HW) and reliability testing
    - Capacity and efficiency testing
2. The rationale behind load profile & test points
3. Introduction to MCI test chamber

Functional SW & HW reliability testing

We use the test chambers to ensure that the reefer units operate safely from -30°C to + 50°C (80°C span) ambient X setpoints ranging from -30° to +30°C (60°C span).

Reefer box: Testing of U-value [W/K]
Testing for thermal expansion (minus -30°C inside and +50°C outside)

Reefer: Capacity and efficiency (power consumption in the relevant operation points)

Reefer unit: SW functionalities regulated according to the specified behavior in the different operation points
Ventilation programs are working according to specification
Compressor inverter cooling
Compressor motor and oil pre-heating
Component temperature testing (verifying that components do not exceed their allowable operational temperature limits)
Motor winding temperature
Compressor oil temperature
Changes in resistance of electrical components (valve coils and motor windings) has no impact on operation
Controller and other electrical components

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SEKSTANT
Global Guidance

Utilizing connectivity to understand the operation – improving the best performing reefer machine

From Sekstant

1 Billion Data Measurements

Click here to
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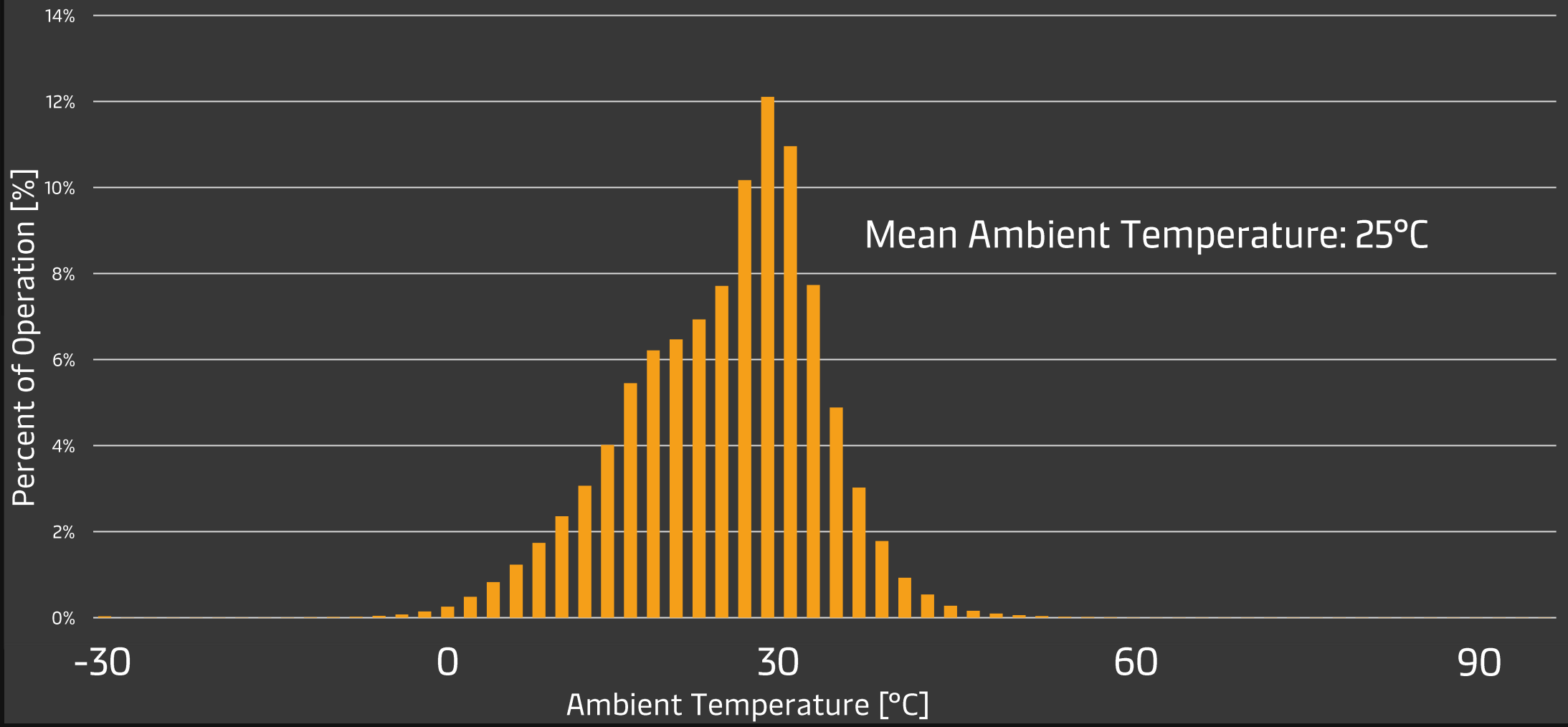
Home
Reefer Tracking
Dashboard
Watch List
Alarms
Fleet Management

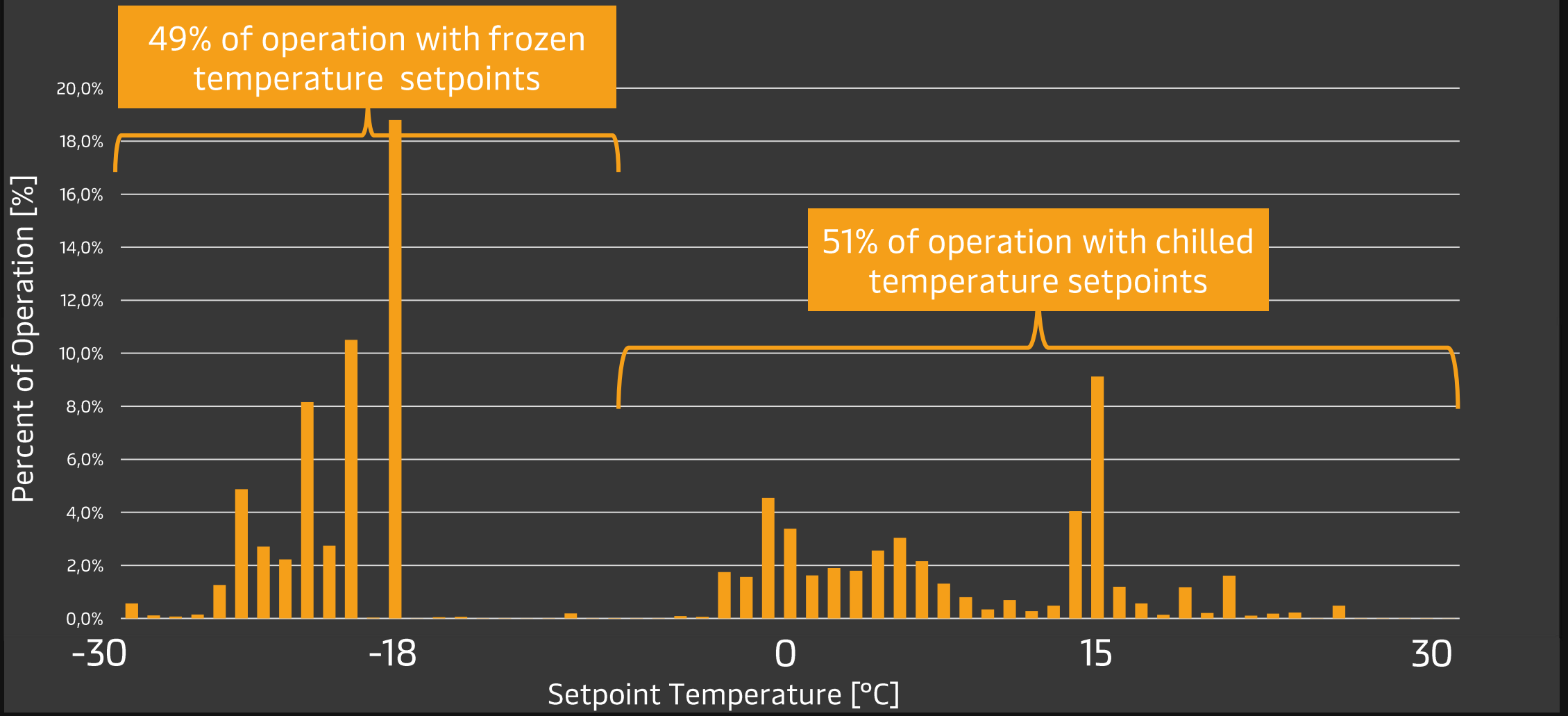
Temperature

Ambient Temperature Profile



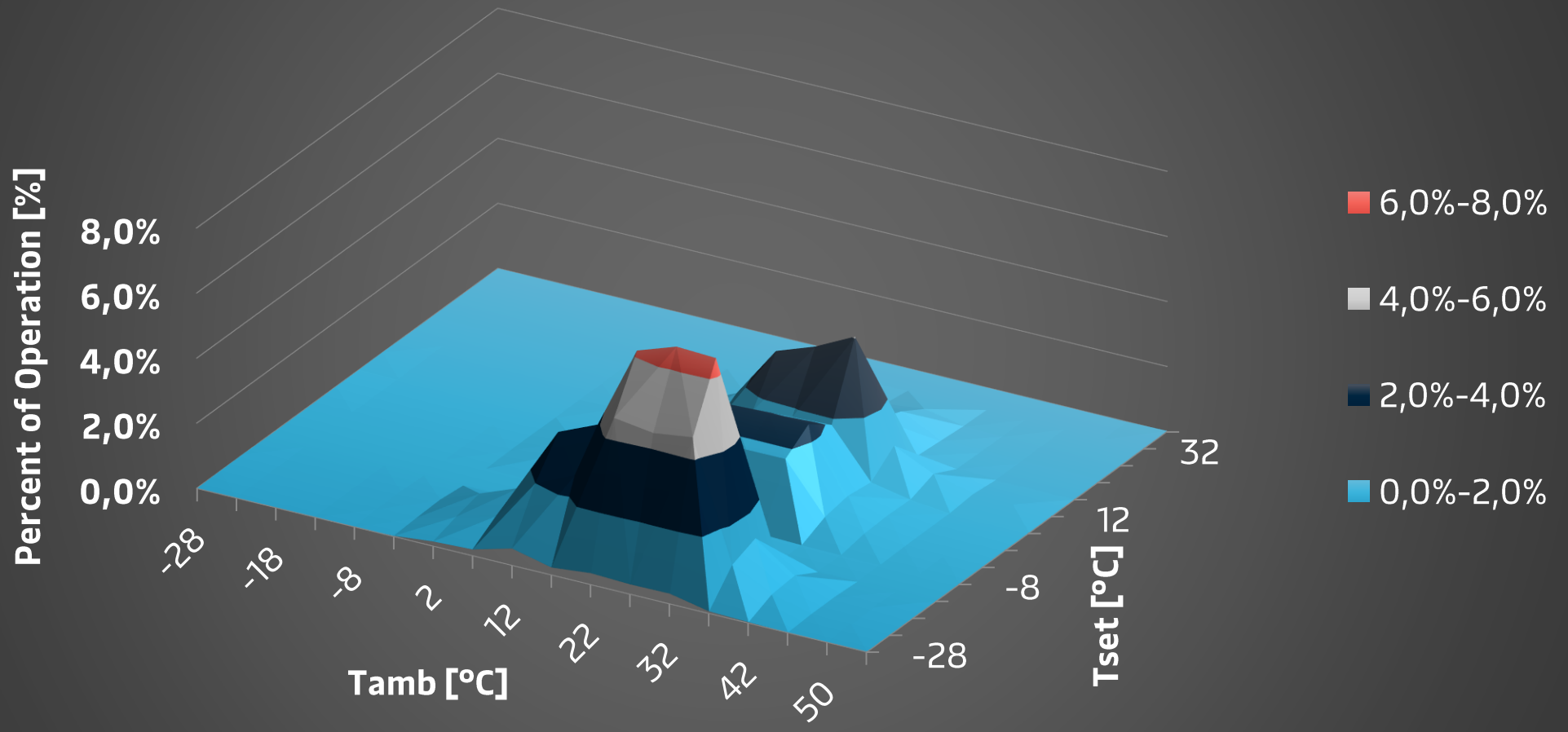
Temperature

Global Set Point Temperature Profile



Temperature

Operational Map



CONCLUSION

AVERAGE AMBIENT TEMPERATURE IS

25°C
= 50% is above 25°C

THE MAIN SETPOINT TEMPERATURES ARE ALMOST EQUALLY DISTRIBUTED BETWEEN

49% FROZEN (-30°C TO -5°C) & 51% CHILLED (-5°C TO 30°C)

MAJORITY OF THE TIME (80-90%)

=

PART-LOAD

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PART-LOAD

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The average load profile

Part-load is time dominant = most important for high efficiency

% Operation	Tset = -20°C	Tset = +1.7°C	Tset = +14°C	Distribution
Part-load	46%	24%	23%	93%
Full-load	4%	2%	1%	7%
Total	**50%**	**26%**	**24%**	**100%**

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Thermal shock/Solder joint test station

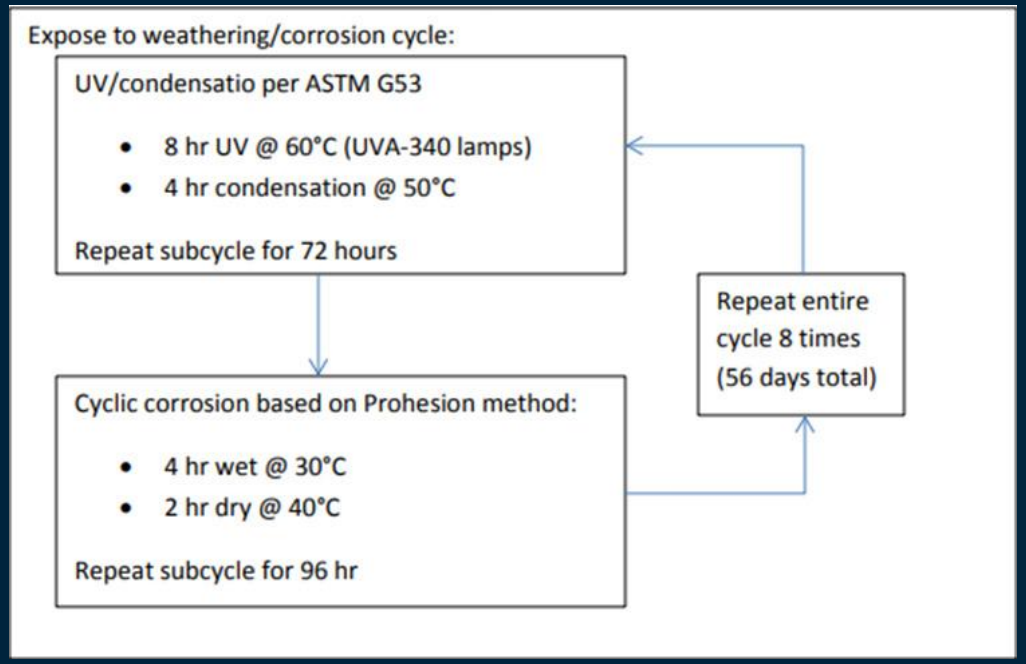
a. Cold water bath 5°C
b. Hot water bath 85°C
c. Test components transferred automatically between hot and cold baths (repeated typically 1000-2500 times)

Climate chambers

a. Temperature from -40°C to +100°C
b. Humidity 20% RH to 100% RH
c. Programable user defined temperature and humidity cycles

Salt spray & UV chambers

Salt spray test acc. to ICLL



30°C using an electrolyte of 0.35% (weight) ammonium sulfate [(NH4)2SO4] and 0.05% (weight) sodium chloride (NaCl)

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MCI thermal test chambers

A cornerstone in developing efficient and robust reefer units

CO2 refrigeration systems provide accurate temperature control

An accurate airflow (temperature and air speed) is moving in longitudinal direction

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Test chambers are ISO certified to provide accurate test data

ISO certified every year including verification of below:

- ✓ Power meters
- ✓ Temperature sensors
- ✓ Airflow speed along reefers
- ✓ Water-cooling flow

Feel the difference