PDR-2023-445 POWER CONSUMPTION ANALYSIS - ARCTIC OPS

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CONFIDENTIAL AND PROPRIETARY

Polar Dynamics Robotics, Inc.

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1. EXECUTIVE SUMMARY

This Power Consumption Analysis Report ("Report") documents the e
requirements and efficiency metrics for Polar Dynamics Robotics, Inc.

BlueCore(TM)-enabled autonomous mobile robots operating in extrem
environments (-40 C to -5 C). This analysis has been prepared in acc
ISO/IEC 25051:2014 and IEEE 1012-2016 standards for mission-critic
systems.

2. SCOPE OF ANALYSIS

1. This Report encompasses:

(a) Base power consumption metrics for PDR Model Arctic-X series (u
AX-2023-001 through AX-2023-150)

(b) Peak load calculations during extreme temperature operation

(c) Battery performance degradation analysis

(d) Emergency power systems evaluation

(e) Charging infrastructure requirements

2. Testing Parameters:

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Temperature Range: -40 C to -5 C

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Humidity: 15% to 85% RH

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Operating Duration: 168 hours continuous

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Load Conditions: 0-1500kg payload

3. TECHNICAL SPECIFICATIONS

1. Power System Configuration

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Primary Power: 48V DC lithium iron phosphate (LiFePO4) battery sys

- Capacity: 280Ah nominal
- Backup Power: Redundant 24V DC system
- BlueCore(TM) Power Management System v4.2
- UL 1642 certified battery modules

2. Consumption Metrics

- Standby Mode: 85W 5W
- Normal Operation: 450W 25W
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Peak Operation: 1200W 50W

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Emergency Systems: 150W 10W

4. PERFORMANCE ANALYSIS

1. Cold Environment Impact

The BlueCore(TM) system demonstrates power consumption variance
operating at -40 C compared to baseline measurements at -5 C. This
falls within acceptable parameters per PDR Engineering Specification
ES-2023-112.

2. Battery Performance

(a) Cycle life expectancy: 3,000 cycles at 80% depth of discharge

(b) Temperature-adjusted capacity: 92% at -40 C

(c) Self-discharge rate: <3% per month at -40 C

(d) Charging efficiency: 94% at standard charging rate

5. COMPLIANCE AND CERTIFICATION

1. This analysis confirms compliance with:

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IEC 61508 SIL 2 requirements

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EN 50272-2 battery safety standards

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ISO/TS 15066:2016 robotics safety requirements

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ANSI/RIA R15.06-2012 industrial robot safety

2. Testing Methodology

All measurements were conducted using calibrated Fluke 87V Industr

Multimeters and Tektronix PA1000 Power Analyzers, certified per NIS

6. OPERATIONAL RECOMMENDATIONS

1. To maintain optimal power efficiency:

(a) Implement charging cycles at 20% remaining capacity

(b) Maintain ambient temperature above -45 C

(c) Schedule preventive maintenance every 500 operating hours

(d) Monitor power consumption patterns via BlueCore(TM) Analytics F

2. Infrastructure Requirements

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480V AC, 3-phase power supply

Minimum 100A service per charging station

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UPS backup rated for 30 minutes continuous operation

7. LEGAL DISCLAIMERS

1. This Report contains confidential and proprietary information of Pol

2. The analysis and recommendations contained herein are based on

3. PDR makes no warranties, express or implied, regarding the accur

8. CERTIFICATION

The undersigned hereby certify that this power consumption analysis

conducted in accordance with PDR's quality management system and

industry standards.

APPROVED BY:

/s/ Dr. James Barrett

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Dr. James Barrett

Chief Robotics Officer

Polar Dynamics Robotics, Inc.

Date: January 11, 2024

/s/ Marcus Chen

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Marcus Chen

Chief Technology Officer

Polar Dynamics Robotics, Inc.

Date: January 11, 2024