PDR AUTONOMOUS SYSTEMS COLD WEATHER CERTIFICATION

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Document No.: PDR-CWC-2023-114

Effective Date: December 15, 2023

Version: 2.1

1. CERTIFICATION OVERVIEW

This Cold Weather Certification ("Certification") documents that Polar
Robotics, Inc.'s ("PDR") autonomous mobile robot systems have succ
completed comprehensive cold weather performance testing and valid

accordance with industry standards and regulatory requirements for o

temperature-controlled environments.

2. SCOPE OF CERTIFICATION

1. This Certification applies to the following PDR autonomous system

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Arctic Series A-450 AMR Platform

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BlueCore(TM) Navigation System v4.2

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ColdStore CS-780 Mobile Robot

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Frost-Guard FG-220 Control Interface

2. Operating Environment Parameters:

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Temperature Range: -40 C to +25 C (-40 F to +77 F)

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Humidity Range: 10% to 95% non-condensing

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Environmental Classification: IP65

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Operating Surface: Industrial concrete, epoxy-sealed floors

3. TESTING PROTOCOLS AND STANDARDS

1. Testing Standards Compliance:

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ISO 13849-1:2015 Safety of machinery

IEC 60068-2-1 Environmental testing - Cold

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ANSI/RIA R15.08-1-2020 Industrial Mobile Robot Safety

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UL 3300 Outline of Investigation for Service, Communication, Informa

2. Test Facility Certification:

Testing conducted at PDR Cold Environment Testing Facility (CETF-0

Facility Certification: T V S D America #FC-22-1458

Location: Rochester, Minnesota

4. PERFORMANCE VALIDATION

1. Navigation System Performance:

- LiDAR sensor accuracy maintained within 2mm at -30 C
- Vision system operational reliability >99.99% at specified temperature
- Path planning execution success rate >99.95% in frost conditions

2. Mechanical Systems:

- Drive system torque variation <1% across temperature range
- Battery performance degradation <5% at -30 C
- Joint mobility maintained within 98% of room temperature specificatio

3. Safety Systems:

- Emergency stop function operational within 100ms at all temperatures

- Obstacle detection maintained at 360° coverage

- Safety light curtain functionality verified at 100% in frost conditions

5. CERTIFICATION REQUIREMENTS

1. Operational Requirements:

- Regular calibration every 2,000 operating hours

- Temperature monitoring system must be active during operation

Automatic shutdown if environmental parameters exceeded

- Maintenance of specified battery charging protocols

2. Environmental Controls:

- Maximum temperature transition rate: 15 C per hour
- Minimum pre-operation warm-up period: 20 minutes
- Maximum continuous operation time: 16 hours
- Required rest period between cycles: 2 hours

6. COMPLIANCE AND MAINTENANCE

1. Documentation Requirements:

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Maintenance of operational logs

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Temperature exposure records

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Calibration certificates

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Safety incident reports

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Performance deviation documentation

2. Periodic Validation:

Quarterly performance verification

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Annual full system certification renewal

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Bi-annual safety system validation

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Monthly sensor calibration checks

7. CERTIFICATION AUTHORITY

This Certification is issued under the authority of PDR's Quality Assur

Department in accordance with ISO 9001:2015 certification requireme

Testing Supervisor: Dr. Marcus Chen

Quality Assurance Director: Sarah Nordstrom

Certification Number: PDR-CW-2023-785

8. LEGAL DISCLAIMER

This Certification represents PDR's validation of cold weather perform capabilities under specified conditions. PDR makes no warranties bey expressly stated in the product warranty documentation. Operation ou specified parameters or failure to maintain required maintenance prot this Certification.

9. EXECUTION

IN WITNESS WHEREOF, the undersigned, being duly authorized rep Polar Dynamics Robotics, Inc., have executed this Certification as of t

Effective Date.

POLAR DYNAMICS ROBOTICS, INC.

By:

Name: Dr. Elena Frost

Title: Chief Executive Officer

By:

Name: Dr. James Barrett

Title: Chief Robotics Officer

Date: December 15, 2023

[CORPORATE SEAL]