EQUIPMENT SPECIFICATIONS - POLARCOLD WAREHOUSING

Document Reference: PDR-SPEC-2023-114

Effective Date: January 11, 2024

Version: 3.2

1. GENERAL PROVISIONS

1 This Equipment Specifications document ("Specifications") sets forth the mandatory technical requirements and operational parameters for Polar Dynamics Robotics, Inc.'s ("Company") autonomous mobile robot systems deployed in cold storage and refrigerated warehousing environments.

2 These Specifications apply to the IceNav(TM) Series 400 and 500 autonomous mobile robots ("Units") and associated control systems manufactured by the Company for operation in temperature-controlled facilities.

2. ENVIRONMENTAL OPERATING PARAMETERS

1 Temperature Range

- Operating Range: -40 C to +10 C (-40 F to 50 F)
- Storage Range: -45 C to +25 C (-49 F to 77 F)
- Maximum Rate of Temperature Change: 15 C per hour

2 Humidity Requirements

- Operating Range: 10% to 95% relative humidity, non-condensing
- Condensation Protection Rating: IP65
- Anti-icing System Activation Point: -5 C

3 Floor Surface Conditions

- Maximum Operating Slope: 3%
- Surface Friction Coefficient Range: 0.2 to 0.8
- Maximum Ice/Frost Layer: 2mm

3. MECHANICAL SPECIFICATIONS

1 Dimensional Requirements

- Length: 1200mm 5mm
- Width: 900mm 5mm
- Height: 450mm 5mm
- Ground Clearance: 50mm minimum

2 Load Capacity

- Maximum Payload: 1,500kg (Series 400) / 2,000kg (Series 500)
- Dynamic Load Rating: 120% of maximum payload
- Load Distribution: Center of gravity within 500mm of geometric center

3 Mobility Systems

- Drive Type: Dual independent cold-resistant actuators
- Wheel Material: Proprietary polymer compound PDR-X42
- Turning Radius: Zero (rotation in place)
- Maximum Speed: 2.0 m/s
- Emergency Stop Distance: 500mm at maximum speed

4. ELECTRICAL AND CONTROL SYSTEMS

1 Power Requirements

- Operating Voltage: 48VDC 5%
- Battery Type: Lithium Iron Phosphate (LiFePO4)
- Battery Capacity: 300Ah
- Charging Time: 45 minutes (20% to 80%)
- Runtime: 12 hours minimum at 80% duty cycle

2 Control Systems

- Primary Controller: IceNav(TM) Core Processor v4.2
- Sensor Suite: Multi-modal (LiDAR, stereo vision, thermal)
- Navigation Accuracy: 25mm in position, 1 in orientation
- Communication Protocol: IEEE 802.11ax (Wi-Fi 6)
- Emergency Systems: Triple-redundant safety circuits

5. SAFETY AND COMPLIANCE

1 Safety Standards Compliance

- ANSI/ITSDF B56.5-2019
- ISO 3691-4:2020
- CE Marking (Machinery Directive 2006/42/EC)
- UL 1740
- CSA-C22.2 No. 73

2 Safety Features

- 360 LiDAR safety field monitoring
- Emergency stop buttons (minimum 2)
- Visual and audible warning systems
- Anti-collision system with 500ms response time
- Fail-safe braking system

6. MAINTENANCE REQUIREMENTS

1 Scheduled Maintenance Intervals

- Daily: Visual inspection and battery check
- Weekly: Sensor cleaning and calibration
- Monthly: Drive system inspection
- Quarterly: Full system diagnostic
- Annual: Complete overhaul and certification

2 Component Life Expectancy

- Drive Motors: 15,000 operating hours
- Batteries: 3,000 charge cycles
- Control Systems: 5 years
- Mechanical Structure: 8 years

7. WARRANTY AND CERTIFICATION

1 All Units shall be certified for operation in accordance with these Specifications prior to

deployment. Certification testing shall be conducted at Company's facilities under simulated environmental conditions.

2 Units are warranted to maintain compliance with these Specifications for a period of 24 months from date of installation, subject to proper maintenance and operation within specified parameters.

8. MODIFICATIONS AND UPDATES

1 These Specifications may be modified only by written amendment issued by Company's Engineering Department and approved by the Chief Technology Officer.

2 All modifications shall be recorded in the Company's documentation control system and communicated to affected customers.

APPROVED AND ISSUED BY:

/s/ Marcus Chen

Marcus Chen

Chief Technology Officer

Polar Dynamics Robotics, Inc.

Date: January 11, 2024