

OPERATIONS DOCUMENT 403

STANDARD OPERATING PROCEDURES FOR AUTONOMOUS MOBILE ROBOT DEPLOYMENT AND MAINTENANCE

Effective Date: January 1, 2024

Document Version: 2.4

Last Updated: December 15, 2023

1. PURPOSE AND SCOPE

1. This Standard Operating Procedure ("SOP") document establishes the mandatory operational protocols for the deployment, maintenance, and decommissioning of Polar Dynamics Robotics, Inc. ("Company") autonomous mobile robots ("AMRs") in temperature-controlled environments.
2. This SOP applies to all Company personnel involved in AMR operations, including but not limited to field technicians, maintenance engineers, deployment specialists, and operational supervisors.

2. DEFINITIONS

1. "IceNav System" means the Company's proprietary cold-environment navigation and operation platform.
2. "Critical Operating Temperature" means any ambient temperature below -30 C (-22 F).
3. "Deployment Zone" means any customer facility where Company AMRs are installed and operational.
4. "Thermal Management Protocol" or "TMP" means the Company's standardized procedure for maintaining optimal AMR operating temperature in extreme cold environments.

3. PRE-DEPLOYMENT PROCEDURES

1. Site Assessment Requirements
 - a) Complete thermal mapping of deployment zone
 - b) Verification of floor surface conditions
 - c) RF interference testing
 - d) Emergency power systems evaluation

- e) IceNav sensor calibration assessment

2. Documentation Requirements

- a) Customer facility blueprint integration
- b) Navigation mesh generation
- c) Safety protocol documentation
- d) Emergency response plan filing
- e) Maintenance schedule establishment

4. DEPLOYMENT PROTOCOLS

1. Initial Setup

- a) AMR thermal conditioning (minimum 4 hours)
- b) IceNav system calibration
- c) Emergency stop system verification
- d) Communication system testing
- e) Customer network integration

2. Safety Measures

- a) Establishment of safety zones
- b) Emergency protocol verification
- c) Personnel training documentation
- d) Safety equipment placement
- e) Warning signage installation

5. MAINTENANCE REQUIREMENTS

1. Scheduled Maintenance

- a) Weekly system diagnostics
- b) Monthly actuator inspection
- c) Quarterly thermal management system evaluation
- d) Semi-annual software updates
- e) Annual certification renewal

2. Performance Monitoring

- a) Daily operational metrics review
- b) Temperature tolerance tracking
- c) Navigation accuracy assessment
- d) Battery efficiency monitoring
- e) Collision avoidance system verification

6. EMERGENCY PROCEDURES

1. System Failures

- a) Immediate shutdown protocols
- b) Emergency notification procedures
- c) Customer communication requirements
- d) Technical support escalation
- e) Incident documentation

2. Environmental Incidents

- a) Extreme temperature response
- b) Power failure procedures
- c) Network outage protocols
- d) Facility evacuation coordination
- e) Recovery procedures

7. COMPLIANCE AND REPORTING

1. Documentation Requirements

- a) Maintenance logs
- b) Incident reports
- c) Performance metrics
- d) Safety certifications
- e) Training records

2. Regulatory Compliance

- a) OSHA requirements

- b) ISO 9001:2015 standards
- c) CE marking maintenance
- d) UL certification
- e) Customer-specific compliance requirements

8. PROPRIETARY INFORMATION

1. All procedures, specifications, and technical details contained within this document are confidential and proprietary to Polar Dynamics Robotics, Inc. Unauthorized disclosure is strictly prohibited.

9. DOCUMENT CONTROL

1. This document is subject to annual review and update by the Company's Operations Department.
2. All modifications must be approved by:
 - Chief Operations Officer
 - Chief Technology Officer
 - Chief Robotics Officer

10. AUTHORIZATION

This document is authorized and approved by:

Sarah Nordstrom

Chief Operations Officer

Polar Dynamics Robotics, Inc.

Date: _

Dr. James Barrett

Chief Robotics Officer

Polar Dynamics Robotics, Inc.

Date: _

11. REVISION HISTORY

Version 2.4 - December 15, 2023

- Updated thermal management protocols
- Added new safety requirements
- Revised maintenance schedules

Version 2.3 - June 30, 2023

- Enhanced emergency procedures
- Updated compliance requirements
- Added new deployment protocols

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