

OPERATIONS DOCUMENT 414

STANDARD OPERATING PROCEDURES FOR AUTONOMOUS MOBILE ROBOT DEPLOYMENT AND MAINTENANCE

Effective Date: January 1, 2024

Document Version: 3.2

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 Robot ("AMR") systems in temperature-controlled environments.
2. This SOP applies to all Company personnel involved in the installation, operation, maintenance, or support of IceNav(TM)-enabled AMR units operating in environments between +25 C and -40 C.

2. DEFINITIONS

1. "IceNav(TM) System" refers to the Company's proprietary cold-environment navigation and operation platform, including all associated software, firmware, and hardware components.
2. "Critical Operating Parameters" means the set of environmental and performance metrics that must be maintained for safe AMR operation, as defined in Schedule A.
3. "Qualified Technician" means any individual who has completed the Company's Cold Environment Robotics Certification Program (CERCP-2023) and maintains current certification status.

3. PRE-DEPLOYMENT PROCEDURES

1. Environmental Assessment
 - a) Conduct full thermal mapping of deployment zone
 - b) Document all thermal transition zones
 - c) Verify floor surface compliance with Specification 317-B
 - d) Validate wireless communication coverage

2. System Configuration

- a) Upload facility-specific navigation maps
- b) Configure thermal compensation parameters
- c) Calibrate cold-resistant actuators
- d) Verify IceNav(TM) sensor array alignment

4. OPERATIONAL PROTOCOLS

1. Daily Startup Sequence

- a) Execute thermal system pre-check
- b) Verify actuator temperature readings
- c) Confirm navigation sensor calibration
- d) Test emergency stop functionality

2. Runtime Monitoring

- a) Maintain continuous telemetry logging
- b) Monitor thermal management system performance
- c) Track battery performance in cold conditions
- d) Record navigation accuracy metrics

5. MAINTENANCE REQUIREMENTS

1. Scheduled Maintenance

- a) Weekly inspection of thermal management systems
- b) Monthly actuator calibration
- c) Quarterly software updates
- d) Semi-annual hardware inspection

2. Preventive Maintenance

- a) Thermal coating inspection every 500 operating hours
- b) Actuator stress testing every 1,000 operating hours
- c) Navigation sensor recalibration every 2,000 operating hours

6. SAFETY PROTOCOLS

1. Emergency Procedures

- a) Immediate shutdown protocols
- b) Emergency extraction procedures
- c) Incident reporting requirements
- d) Recovery procedures

2. Safety Compliance

- a) OSHA cold storage workplace requirements
- b) FDA material handling guidelines
- c) Company safety standards per Policy 278

7. DOCUMENTATION AND REPORTING

1. Required Records

- a) Daily operation logs
- b) Maintenance records
- c) Incident reports
- d) Performance metrics

2. Reporting Schedule

- a) Daily performance summaries
- b) Weekly maintenance reports
- c) Monthly compliance reviews
- d) Quarterly system audits

8. LIABILITY AND COMPLIANCE

1. This document contains confidential and proprietary information of Polar Dynamics Robotics, Inc. Unauthorized disclosure or use is strictly prohibited.

2. Failure to comply with these procedures may result in equipment damage, safety incidents, or operational failures for which the Company disclaims all liability.

3. These procedures must be followed in conjunction with all applicable local, state, and federal regulations governing automated material handling systems.

9. DOCUMENT CONTROL

1. This SOP shall be reviewed annually and updated as required to reflect current best practices and technological capabilities.
2. All revisions must be approved by the Chief Robotics Officer and documented in the Company's document control system.

AUTHORIZATION

APPROVED BY:

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