PERFORMANCE STANDARDS - ICEBOT DEPLOYMENT

Document Reference: PDR-PS-2024-001

Effective Date: January 15, 2024

1. INTRODUCTION

1 This Performance Standards document ("Standards") establishes the minimum operational requirements and performance metrics for the deployment and operation of IceBot autonomous mobile robots ("IceBots") manufactured by Polar Dynamics Robotics, Inc. ("PDR").

2 These Standards shall apply to all IceBot deployments in customer facilities and shall be incorporated by reference into all IceBot Purchase and Service Agreements.

2. DEFINITIONS

1 "Cold Environment" means any controlled temperature environment operating at or below 0 C (32 F).

2 "IceBot System" means the complete robotic solution, including hardware, software, IceNav AI platform, and associated control systems.

3 "Operating Cycle" means one complete execution of a programmed task sequence.

4 "Performance Period" means any consecutive 30-day operational period.

3. OPERATIONAL PERFORMANCE REQUIREMENTS

1 Temperature Range Performance

- Continuous operation in environments from +25 C to -30 C (+77 F to -22 F)
- Maintain full functionality during temperature fluctuations of up to 20 C per hour
- No performance degradation after 1,000 thermal cycles

2 Navigation Accuracy

- Positioning accuracy within 15mm in static conditions
- Path-following deviation not to exceed 50mm at maximum rated speed
- Object detection and avoidance at 99.99% reliability

3 Payload Handling

- Maximum payload capacity: 1,500kg
- Load placement accuracy: 10mm horizontal, 5mm vertical
- Zero payload drops or handling incidents per 10,000 Operating Cycles

4. RELIABILITY STANDARDS

1 System Availability

- Minimum 98% uptime during scheduled operation hours
- Maximum 4 hours of unplanned downtime per Performance Period
- Mean Time Between Failures (MTBF): 2,000 operating hours

2 Battery Performance

- Minimum 12-hour continuous operation per charge
- Maximum 45-minute recharge time
- Battery capacity retention: 90% after 1,000 charge cycles

3 Software Reliability

- IceNav platform uptime: 99.99%
- Maximum latency: 100ms for critical operations
- Zero system crashes per Performance Period

5. SAFETY REQUIREMENTS

1 Emergency Systems

- Emergency stop activation time: <100ms
- Automatic shutdown on detection of unsafe conditions
- Redundant safety systems with independent power supply

2 Collision Avoidance

- 360-degree obstacle detection
- Minimum stopping distance: 500mm at full speed
- Dynamic speed adjustment based on environment conditions

3 Compliance

- Full conformance with ISO/TS 15066
- Compliance with ANSI/RIA R15.06
- Adherence to all applicable OSHA standards

6. PERFORMANCE MONITORING AND REPORTING

1 Data Collection

- Continuous logging of all operational parameters
- Real-time performance monitoring through IceNav platform
- Monthly performance reports generated automatically

2 Performance Metrics

- Weekly availability reports
- Incident logging and analysis
- Performance trend analysis

7. MAINTENANCE AND SUPPORT

1 Preventive Maintenance

- Scheduled maintenance intervals: 500 operating hours
- Component replacement schedule per PDR specifications
- Software updates within 48 hours of release

2 Technical Support

- 24/7 remote support availability
- Maximum response time: 30 minutes
- On-site support within 4 hours for critical issues

8. WARRANTY AND REMEDIES

1 Performance Warranty

- PDR warrants that IceBot Systems will meet or exceed these Standards during normal operation
- Warranty period: 12 months from deployment date
- Extended warranty options available per separate agreement

2 Remedies

- PDR shall correct any performance deficiencies at no additional cost
- Replacement of defective components within 24 hours
- Service credits for sustained performance shortfalls

9. AMENDMENTS AND UPDATES

1 These Standards may be updated by PDR with 30 days written notice to customers.

2 Customers shall be entitled to maintain existing Standards for 90 days following any update.

EXECUTION

IN WITNESS WHEREOF, these Performance Standards have been duly authorized and approved by Polar Dynamics Robotics, Inc.

By:

Name: Dr. Elena Frost

Title: Chief Executive Officer

Date: January 15, 2024

By:

Name: Dr. James Barrett

Title: Chief Robotics Officer

Date: January 15, 2024