

TIDYNE INC.

Advanced engineering solutions.

Life-Saving, Emergency Evacuation & Rescue Operations Plan

Application-Specific Procedures for the TIDYNE Unit

Pilot Transfer Fall-Arrest · Emergency Evacuation

Cargo Hold & Confined-Space Retrieval · General Emergency Rescue

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TIDYNE Inc. · tidyne.com · solutions@tidyne.com

Document Control

This is a controlled document. The TIDYNE unit is a self-contained, 48 V DC battery-powered electric winch, dual-certified for the lifting and lowering of both personnel and cargo. This plan governs its use in life-saving, emergency-evacuation, and rescue roles across the four operational applications published by TIDYNE Inc. It is a companion to, and must be read with, the TIDYNE Operator's Manual (TDY-MAN-WCH-001) and the TIDYNE Lift / Lower Plan (TDY-PLN-LFT-001).

Document Identification

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Companion documents	Operator's Manual (TDY-MAN-WCH-001); Lift / Lower Plan (TDY-PLN-LFT-001)
Review cycle	Annual, or after any incident, near-miss, regulatory change, or unit modification

Revision Record

Rev	Date	Description	Approved
1.0	June 2026	Initial issue — four-application life-saving, evacuation, and rescue operations plan.	_____
2.0	June 2026	Added anchor-rating verification method (§11.4); clarified 200 lb personnel limit (50% rule); corrected rated line speed to ~193 ft/min; checkbox rendering fix.	_____

Controlled Use — OEM-Certified Personnel Only

Every rescue, evacuation, and life-saving operation described in this plan shall be conducted only by TIDYNE OEM-certified operators and supervisors. This plan does not replace statutory training, vessel safety-management procedures, or the judgement of the responsible officer. Where this plan and a governing regulation differ, the more stringent requirement applies.

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1. Purpose, Scope & How to Use This Plan

1.1 Purpose

This plan establishes the procedures, hazard controls, and authorization records for using the TIDYNE unit in life-saving, emergency-evacuation, and rescue operations. It exists so that, when a person's life depends on a controlled lift or lower, every operator works to the same verified, pre-planned standard — and so that each operation is documented for the vessel's safety-management system and the unit's OEM-certified service record.

1.2 Scope — Four Operational Applications

This plan covers the four operational applications for which the TIDYNE unit is offered:

Application	Role of the TIDYNE Unit	Primary Standards
A — Pilot Transfer Fall-Arrest	Dedicated fall-arrest & rescue support while a pilot climbs a crew-rigged ladder.	SOLAS V/23; OSHA 1926.502(d)
B — Life-Saving & Emergency Evacuation	Controlled lowering and hoisting of personnel from vessels, platforms, and elevated structures.	SOLAS III / LSA Code; OSHA 1926.1431; ASME B30.23
C — Cargo Hold & Confined-Space Retrieval	Mechanical retrieval device for controlled descent into and rescue from confined spaces.	OSHA 1910.146; ASME B30.7
D — General Emergency Rescue	Rapidly-deployed rescue appliance for man-overboard recovery and rescue at height.	IMO MSC.1/Circ.1182; SOLAS III-1/17-1

1.3 How to Use This Plan

Sections 1–7 are the common foundation and apply to every operation. Before any rescue or evacuation, the responsible team completes the General Pre-Operation Requirements (Section 5). The team then turns to the application-specific section (A, B, C, or D) that matches the scenario and follows it in full. Sections 8–12 provide detailed cross-cutting procedures (man-overboard recovery, suspension-trauma medical response, lockout/tagout) and the master sign-off.

Last-Resort Principle

Powered hoisting and lowering of personnel is used only where conventional means of access or escape are unavailable, more hazardous, or infeasible — consistent with OSHA 29 CFR 1926.1431(a) and ASME B30.23. The TIDYNE unit supplements, and never replaces, primary life-saving appliances required by SOLAS and flag-state rules.

2. The TIDYNE Unit — System & Safety Architecture

Effective rescue planning depends on understanding the appliance. The TIDYNE unit is a compact, portable, marine-grade electric winch engineered for the safe transfer of personnel and cargo. The characteristics below are the ones that matter most when a human life is on the line.

2.1 Published Specifications

Rated capacity (WLL)	400 lb / 180 kg — dual-certified for personnel and cargo, lifting and lowering
Rated line speed	~193 ft/min (3.2 ft/s, 0.98 m/s) — reference descent 45 ft in ~14 s
Power supply	Self-contained 48 V DC battery pack; no vessel power tie-in required
Battery backup	Dedicated onboard lithium backup for control and brake-release power
Motor / drive	1 kW servo motor with absolute encoder; programmable speed profiles
Braking	Three independent brakes (B1 / B2 / B3) plus centrifugal overspeed brake
Monitoring	Real-time load, speed, and brake telemetry with anomaly detection (Smart Winch)
Mounting	Clamp-mounts to boom, jib arm, king post, pad eye, or docking station — no hull modification

2.2 Triple-Redundant Braking — Why It Matters for Rescue

Brake	Type	Behaviour Relevant to Life-Saving Duty
B1	Motor torque control	Electronically governs descent speed via regenerative torque — smooth, controlled lowering of a casualty.
B2	High-ratio worm gear	Self-locking geometry; the load cannot backdrive the motor. Holds a suspended person with zero power.
B3	Emergency gravity brake	Normally-engaged, held open electromagnetically. Any power loss closes it instantly — fail-safe arrest of a fall.
—	Centrifugal overspeed	Mounted on the worm high-speed shaft; mechanically limits descent speed during an uncontrolled-descent event.

Controlled Lowering — No Free Fall

In every application in this plan, free fall of the load line is prohibited. The TIDYNE unit lowers personnel only under powered, controlled descent. This is the same principle required of crane-suspended personnel work by OSHA 29 CFR 1926.1431 and ASME B30.23, and it is enforced mechanically by the B2 worm gear and B3 gravity brake.

3. Regulatory Framework & Standards

The procedures in this plan are built on the standards below. Numeric thresholds cited in this document were verified against the primary regulatory text. Operators must always work to the current edition of each standard and to the governing flag-state and class-society rules.

CLASSIFICATION IN PROGRESS

Lloyd's Register Classification — In Progress

The TIDYNE unit is in the process of pursuing classification under the **Lloyd's Register Code for Lifting Appliances in a Marine Environment (LR-CO-001)**, whose scope explicitly covers the handling and transfer of personnel on ships. This equipment and its supporting documentation are engineered to this code; formal Lloyd's Register classification is being actively progressed with the class society.

3.1 Marine Life-Saving & Pilot Transfer

Standard	Subject	Key Requirement Applied
SOLAS Chapter III	Life-saving appliances & arrangements	Muster, embarkation, rescue-boat readiness, and launching arrangements; the TIDYNE unit supplements required appliances.
SOLAS III-1 / Reg. 17-1	Recovery of persons from the water	Ship-specific plans and procedures for recovering persons from the water.
IMO LSA Code	Launching & rescue equipment	Design philosophy for controlled lowering and personnel hoisting.
SOLAS V / Reg. 23	Pilot transfer arrangements	Combination arrangement required where freeboard exceeds 9 m; safety line, man-rope, and lifebuoy ready at the point of access.
IMO MSC.1/Circ.1182	Guide to recovery techniques	Recovery method matched to freeboard and casualty condition; horizontal recovery for hypothermic casualties.
Lloyd's Register LR-CO-001	Code for Lifting Appliances in a Marine Environment	Scope explicitly covers handling/transfer of personnel on ships. The TIDYNE unit is in the process of pursuing Lloyd's Register classification under this code.

3.2 Personnel Hoisting, Fall Arrest & Confined Space (verified)

Standard	Subject	Verified Threshold Applied
OSHA 1926.1431	Hoisting personnel	Total load $\leq$ 50% of rated capacity [1431(d)(1)]; platform & rigging design factor $\geq$ 5 [(d)(4)]; proof test to 125% of rated capacity [(j)(1)]; trial lift each shift [(h)(1)].
OSHA 1926.502(d)	Personal fall arrest	Max arresting force $\leq$ 1,800 lbf with body harness [(d)(16)(ii)]; free fall $\leq$ 6 ft [(iii)]; deceleration $\leq$ 3.5 ft [(iv)]; anchorage $\geq$ 5,000 lbf per person or 2 $\times$ safety factor [(d)(15)]; dorsal (center-back) attachment [(d)(17)]; prompt rescue required [(d)(20)].
OSHA 1910.146	Confined spaces	Mechanical retrieval device required for vertical entry $>$ 5 ft deep [(k)(3)(ii)]; chest or full-body harness with line at center of back [(k)(3)(i)]; atmosphere O ₂ 19.5–23.5%, flammable $<$ 10% LFL; test order O ₂ $\rightarrow$ combustible $\rightarrow$ toxic.

ASME B30.23 / B30.7	Personnel lifting / drum hoists	Personnel-duty design factors and proof testing; controlled lowering; brake hold of rated load. Apply the more stringent personnel requirement.
NFPA 1006 / 1670	Technical rescue	Rescuer qualifications and operations levels (Awareness / Operations / Technician) matched to the rescue scenario.

4. Roles, Responsibilities & Competency

Every rescue or evacuation using the TIDYNE unit is run by a defined team. No operation begins until each role is filled by a competent, OEM-certified person and the plan is signed.

4.1 Required Roles

Role	Responsibilities
Supervisor / Lift Director	Owns the plan; conducts the pre-operation brief; sequences the crew; holds authority to call abort at any moment; confirms all sign-offs before commencement.
Operator	Directly controls the TIDYNE unit; executes only commanded movements; monitors telemetry, brakes, and load; initiates power-loss recovery if required.
Competent Person	Independently inspects and verifies the wire rope, hook, harness, lanyard, anchor structure, and unit condition before and after the operation.
Attendant (confined space)	Remains outside the space, maintains continuous communication with the entrant, monitors atmosphere alarms, summons rescue, and never enters to perform rescue unless relieved (OSHA 1910.146(i)).
Rescue / recovery team	Trained to the appropriate NFPA level for the scenario; manages casualty packaging, medical handling, and post-recovery care.
Casualty / transferee	Where conscious and able, briefed on harness, communication, and what to expect; otherwise managed by the rescue team.

4.2 Competency

- All operators and supervisors shall be TIDYNE OEM-certified and current on refresher training (see Section 11).
- Rescue team members shall hold qualifications appropriate to the scenario per NFPA 1006 / 1670 (rope rescue, confined-space rescue, or watercraft/surface-water rescue) at the Operations or Technician level as the hazard demands.
- The Supervisor / Lift Director confirms competency of every team member as part of the pre-operation brief and records it on the sign-off sheet.

5. General Pre-Operation Requirements

This checklist applies to all four applications and is completed before the application-specific section. In a time-critical emergency, the Supervisor may direct an abbreviated verbal verification of items 1–9, but the omission must be recorded and justified in the debrief.

#	Pre-Operation Item	Acceptance Criteria	OK
1	Unit identification	TIDYNE unit S/N recorded; matches commissioning sheet; certification in date.	☐
2	Load vs WLL	Planned load (person + harness + rigging) $\leq$ 400 lb (180 kg) cargo limit; for personnel hoisting with the unit crane-suspended, $\leq$ 50% of rated capacity = 200 lb (90 kg) [1926.1431(d)(1)].	☐
3	Weather / sea state	Within published operating envelope; vessel motion and wind logged; lifting suspended in lightning.	☐
4	Wire rope & hook	Inspected by competent person; no removal-from-service defects; latch functional.	☐
5	Harness & lanyard	Rescue/fall-arrest harness rated, in date, correctly donned; dorsal (center-back) attachment.	☐
6	Anchor structure	Boom, jib, king post, or pad eye rated $\geq$ 2 $\times$ load and inspected; fall path clear.	☐
7	Brake / E-Stop	B1/B2/B3 verified; E-Stop latches and retains Home; centrifugal brake confirmed.	☐
8	Battery / Home	48 V pack SOC adequate for full mission; Home routine completed before any rope movement.	☐
9	Communication	Radio/hand-signal plan confirmed; call-signs assigned; single STOP word agreed.	☐
10	Exclusion zone	Drop, swing, and snap-back zones barricaded; non-essential personnel clear.	☐
11	Permits attached	Confined-space entry permit and/or hot-work permit attached where applicable.	☐
12	Emergency action plan	Power-loss recovery briefed; rescue/medical resources identified and on standby.	☐

6. Personnel Harness, Attachment & Fall-Arrest Fundamentals

Whenever the TIDYNE unit supports, arrests, or recovers a person, that person is connected to the wire rope through a rated harness and connector. The following requirements are drawn directly from OSHA 29 CFR 1926.502(d) and apply across all applications.

6.1 Harness & Attachment

- Use a full-body harness for fall arrest and personnel hoisting. Body belts are prohibited for fall arrest.
- The fall-arrest attachment shall be at the center of the wearer's back near shoulder level (dorsal D-ring), or above the head [1926.502(d)(17)].
- For confined-space retrieval, a chest or full-body harness is used with the retrieval line attached at the center of the back, above the head, or another small-profile point [1910.146(k)(3)(i)].
- Connectors, D-rings, and snaphooks shall have a minimum tensile strength of 5,000 lbf (22.2 kN).

6.2 Verified Fall-Arrest Limits

Parameter	Limit	Source
Maximum arresting force (full-body harness)	$\leq 1,800$ lbf (8 kN)	1926.502(d)(16)(ii)
Maximum arresting force (body belt — arrest prohibited)	≤ 900 lbf (4 kN)	1926.502(d)(16)(i)
Maximum free-fall distance	≤ 6 ft (1.8 m), and no contact with a lower level	1926.502(d)(16)(iii)
Maximum deceleration distance	≤ 3.5 ft (1.07 m)	1926.502(d)(16)(iv)
Anchorage strength (per person)	$\geq 5,000$ lbf (22.2 kN), or 2× safety factor under a qualified person	1926.502(d)(15)
Lanyards / vertical lifelines (breaking strength)	$\geq 5,000$ lbf (22.2 kN)	1926.502(d)(9)

Minimize Free Fall — Keep the Line Tended

Because free fall is limited to 6 ft and arresting force to 1,800 lbf, the operator keeps the wire rope tended and lightly tensioned, tracking the person's movement so that any fall is arrested early with minimal shock load. The B3 gravity brake provides fail-safe arrest on loss of power.

7. Communication, Signals & Emergency Coordination

Clear, disciplined communication is the single most important non-mechanical control in every operation in this plan. A confused command during a personnel lift can be fatal.

7.1 Communication Rules

- A primary communication method (VHF radio or direct voice) and a backup (hand signals) are agreed and confirmed before the operation.
- A single, pre-agreed STOP word or signal halts all motion instantly. Anyone on the team may call STOP; only the Supervisor authorizes resumption.
- The operator repeats every motion command back to the caller before executing it (closed-loop communication).
- Loss of communication with a suspended or climbing person is itself a STOP condition until comms are restored.

7.2 Standard Hand Signals (ASME B30.5 basis)

Signal	Meaning
Forearm vertical, forefinger up, small circle	HOIST (raise the person/load)
Arm extended, thumb down, fingers open/close	LOWER
Arm extended, palm down, held still then moved	MOVE SLOWLY / inch
Both arms extended, palms down	STOP
Both arms extended, palms down, moved rapidly	EMERGENCY STOP
Both hands clasped in front of body	DOG everything — operator hands off controls

7.3 Emergency Coordination

- The bridge / control room is informed before and throughout any life-saving or man-overboard operation.
- Rescue and medical resources are placed on standby before commencement, not summoned after an incident.
- Where external rescue services are part of the plan, their response capability and time are confirmed in advance (OSHA 1910.146(k) for confined space).

Application A — Pilot Transfer Fall-Arrest & Rescue Support

A.1 Overview

The TIDYNE unit does not deploy or retrieve the pilot ladder. The ladder is rigged and tended by the crew in the conventional manner per SOLAS Ch. V Reg. 23. The TIDYNE unit is positioned at the pilot station as a dedicated fall-arrest and rescue appliance: the pilot climbs up or down the ladder connected to the TIDYNE wire rope via a rescue harness and lanyard. If the pilot loses contact with the ladder — due to swell, ladder failure, loss of grip, or pilot-boat surge — the TIDYNE unit arrests the fall and prevents impact with the water or the deck of the pilot boat, then controllably lifts the pilot to a safe recovery position.

SOLAS V/23 — The Pilot Climbs Under Their Own Power

The pilot ladder remains the primary means of transfer and the pilot climbs it unaided. The TIDYNE rope follows the pilot; the pilot never follows the rope. A combination arrangement (accommodation ladder + pilot ladder) is required where the freeboard exceeds 9 m.

A.2 Application-Specific Hazards & Controls

Hazard	Control
Pilot loses contact with ladder mid-transfer	TIDYNE unit on continuous standby with light line tension; B1/B2/B3 brakes arrest the fall; controlled lift commanded by operator.
Slack line allows free-fall distance before arrest	Operator tracks pilot continuously — pay out on descent, take in on ascent; free fall kept well under the 6 ft limit; no slack permitted.
Inadvertent upward pull on the pilot during climb	Operator never commands Up while the pilot climbs under their own power; the rope follows the pilot.
Pilot-boat surge causing harness shock load	Coordinate with coxswain via radio; pause during heavy surge; programmable rate limits arrest deceleration to ≤ 3.5 ft.
Cross-wind or ladder swing	Choose lee side; abort if relative wind exceeds operating envelope; observer at rail for swing warning.
Wire rope fouling on hull, ladder, or pilot boat	Maintain fleet angle $\leq 4^\circ$; fairlead inspected pre-transfer; clear fall path verified before pilot steps onto ladder.

A.3 Step-by-Step Procedure

1. Brief the pilot vessel and bridge on transfer side, freeboard, and pilot harness arrangement.
2. Confirm vessel speed, heading, and lee side per SOLAS Ch. V Reg. 23 and the Master's pilot card.
3. Mount the TIDYNE unit at the pilot station directly above the rigged ladder; verify clamp seating, fairlead alignment, and a clear fall path to both the water and the pilot-boat deck.
4. Press the Home button; allow the Home routine to complete before any rope movement.
5. Function-test Up, Down, and E-Stop with no load; confirm E-Stop retains the Home state.
6. Confirm the pilot's rescue harness is rated, in date, and correctly donned; attach the TIDYNE hook to the harness dorsal-D via approved lanyard before the pilot steps onto the ladder.
7. Pay out wire rope to track the pilot's descent, or take in to track the ascent — keep the line lightly tensioned with no slack and no upward pull on the pilot.
8. Maintain visual contact and radio comms with the pilot-boat coxswain and the climbing pilot throughout the transfer.
9. If the pilot loses contact with the ladder, the TIDYNE unit arrests the fall automatically (B1/B2/B3); the operator then commands a controlled lift to bring the pilot back to deck or up clear of the pilot boat.
10. Once the pilot is safely aboard either vessel and has disconnected from the lanyard, return the TIDYNE unit to Home and stow.
11. Log the cycle (standby, any arrest event, any controlled lift) and complete the debrief on the sign-off sheet.

A.4 Communication & Signal Protocol

Primary VHF working frequency between bridge, pilot station, and pilot boat. A dedicated voice channel links the TIDYNE operator and the climbing pilot. A single agreed STOP word arrests all motion immediately. The operator confirms 'standby ready' before the pilot leaves either vessel.

A.5 Fall-Arrest & Rescue Response

If the pilot loses contact with the ladder, the response is immediate and pre-rehearsed:

1. The TIDYNE unit arrests the fall automatically through the B1/B2/B3 brakes — no operator action is required to stop the fall.
2. The operator calls 'ARREST' on the dedicated channel and confirms the pilot is held and clear of the water and the pilot-boat deck.
3. On the Supervisor's command, the operator commands a slow, controlled lift to bring the pilot to the safest recovery point (vessel deck or clear of the pilot boat).
4. The rescue team receives the pilot, supports them onto a stable surface, and begins casualty assessment.
5. If the pilot was immersed or shows signs of injury or hypothermia, follow Section 8 (man-overboard recovery) and Section 9 (suspension trauma / post-rescue medical).
6. Tag the TIDYNE unit out-of-service for OEM-certified inspection if the arrest involved a significant shock load.

A.6 Abort Criteria

- Pilot or coxswain calls STOP, or radio comms with the climbing pilot are lost.
- Sea state exceeds the agreed operating envelope or vessel motion becomes unpredictable.
- Any TIDYNE telemetry anomaly: overspeed, brake fault, battery undervoltage, or encoder error.
- Any rescue-harness, lanyard, or pilot-ladder defect identified before or during the transfer.

Application A sign-off: Operator _____ Supervisor / Lift Director _____
Competent Person _____ Date _____

Application B — Life-Saving & Emergency Evacuation

B.1 Overview

In an emergency, the TIDYNE unit provides controlled lowering and hoisting of personnel from vessels, offshore platforms, and elevated structures where conventional means of escape are unavailable or compromised. The unit is dual-certified for both lifting and lowering of personnel — a critical distinction in evacuation — and its self-contained 48 V battery with onboard backup keeps it operational during a total ship power failure.

Personnel Evacuation — Controlled, Powered, No Free Fall

Personnel are lowered and raised only under powered, controlled descent. The total suspended load is kept within the unit's 400 lb (180 kg) WLL, and where the unit is crane-suspended the 50%-of-rated-capacity rule (OSHA 1926.1431(d)) governs. Free fall of the load line is prohibited.

B.2 Application-Specific Hazards & Controls

Hazard	Control
Total ship power failure during evacuation	Self-contained 48 V pack with dedicated lithium backup; B3 gravity brake fail-safe; power-loss recovery per Section 10.
Overload from multiple evacuees	One person per cycle unless a rated multi-person device is used; load kept $\leq$ WLL; telemetry load monitored continuously.
Evacuee panic or incapacitation	Evacuee briefed and harnessed by the rescue team; rescue team manages incapacitated persons; controlled descent rate.
Structure on fire / unstable anchor	Anchor inspected and rated $\geq 2\times$ load; alternative mounting point pre-identified; abort if structure integrity is in doubt.
Smoke / reduced visibility	Lighting and high-visibility marking at the landing zone; radio comms maintained; observer at the lowering point.
Landing zone obstructed or moving	Landing zone confirmed clear and stable before each descent; coordinate with receiving party.

B.3 Step-by-Step Evacuation Procedure

1. On the evacuation order, the Supervisor confirms the evacuation route and that conventional means are unavailable or more hazardous.
2. Mount or confirm the TIDYNE unit at the chosen evacuation point; verify the anchor structure is rated $\geq 2\times$ load and inspected.
3. Press Home; complete the Home routine; function-test Up, Down, and E-Stop with no load.
4. Fit the evacuee with a rated full-body harness; attach the TIDYNE hook to the dorsal-D; the competent person verifies the connection.
5. Confirm the landing zone (deck, boat, or ground) is clear, stable, and attended by a receiving party.
6. Brief the evacuee: keep hands clear of the rope, do not grab fixed structure, communicate by the agreed signal.
7. Lower the evacuee at a controlled, programmed speed; the operator monitors load and brake telemetry throughout.
8. On landing, the receiving party supports the evacuee and disconnects the lanyard; the operator returns the hook under power.
9. Repeat for each evacuee. Track battery state of charge; switch to backup or recharge before SOC becomes marginal.
10. For hoisting (upward evacuation), confirm headroom and overhead clearance, then raise at controlled speed to the recovery point.
11. Log every cycle and complete the debrief on the sign-off sheet.

B.4 Communication

Continuous radio contact between the operator, the lowering-point observer, and the landing-zone receiving party. A single STOP word halts all motion. The bridge / control room is kept informed of evacuation progress and headcount.

B.5 Emergency Response During Evacuation

1. Power loss: the B3 gravity brake closes instantly and holds the evacuee. Execute the power-loss recovery procedure in Section 10 to complete a controlled descent on backup power.
2. Overspeed: the centrifugal brake limits descent speed automatically; the operator does not attempt to reset; the evacuee is brought to a controlled stop and landed.
3. Evacuee incapacitation in mid-descent: continue the controlled descent to the landing zone; the rescue team receives and assesses the casualty; do not reverse unless the landing zone is unsafe.
4. Anchor or structure failure warning: STOP, hold the evacuee on the brakes, and transfer to the pre-identified alternative mounting point only under Supervisor direction.
5. Apply Section 9 (suspension trauma) if any evacuee is held suspended longer than a few minutes.

B.6 Abort Criteria

- Anchor structure integrity is in doubt or the mounting point is compromised by fire or damage.
- Battery state of charge is insufficient to complete the planned evacuation and no backup or recharge is available.
- TIDYNE telemetry anomaly: brake fault, overspeed, encoder error, or undervoltage.
- Landing zone cannot be kept clear and stable, or communication with the landing party is lost.

Application B sign-off: Operator _____ Supervisor / Lift Director _____
Competent Person _____ Date _____

Application C — Cargo Hold Access & Personnel Retrieval

C.1 Overview

Accessing cargo holds, ballast tanks, voids, and other confined spaces is a routine but high-risk activity. The TIDYNE unit serves as the mechanical retrieval device required for vertical confined-space entry, enabling controlled personnel descent and — critically — non-entry rescue of an incapacitated worker without sending a second person into the hazard.

OSHA 1910.146 — Mechanical Retrieval Device Required

A mechanical device shall be available to retrieve personnel from vertical-type permit spaces more than 5 ft (1.52 m) deep [1910.146(k)(3)(ii)]. The TIDYNE unit, with its controlled lowering, self-locking worm gear, and fail-safe gravity brake, fulfils this role when rigged to a worker in a chest or full-body harness with the retrieval line at the center of the back.

C.2 Confined-Space Entry Permit — Prerequisites

- A written permit-required confined-space entry permit is completed and signed by the entry supervisor before entry [1910.146(f)].
- The permit lists the space, purpose, duration, authorized entrant(s), attendant, hazards, control measures, atmospheric test results, and rescue/emergency arrangements.
- An attendant is stationed outside the space for the entire entry and never enters to perform rescue unless relieved [1910.146(i)].
- Rescue services (in-house or external) are confirmed capable and available; in-house teams practice at least annually.

C.3 Atmospheric Testing

Order	Test	Acceptable Range
1st	Oxygen	19.5% – 23.5% by volume
2nd	Combustible gases / vapors	< 10% of the lower flammable limit (LFL)
3rd	Toxic gases / vapors	Below the applicable permissible exposure limit (e.g. H ₂ S, CO)

Testing is performed with a calibrated direct-reading instrument and continued/periodically repeated during the entry. Workers evacuate immediately on any alarm.

C.4 Step-by-Step Descent & Access Procedure

1. Confirm the entry permit is complete and signed and that atmospheric tests are within the acceptable ranges (Section C.3).
2. Mount the TIDYNE unit to the hatch coaming, king post, or rated temporary rigging point directly above the entry; verify clamp seating and fall path.
3. Press Home; complete the Home routine; function-test Up, Down, and E-Stop with no load.
4. Fit the entrant with a chest or full-body harness; attach the retrieval line at the center of the back; the competent person verifies the connection.
5. Establish continuous voice or radio communication between the entrant and the attendant.
6. Lower the entrant at a controlled, programmed speed; pay out smoothly with no slack; monitor load telemetry.
7. Hold the entrant at the working level on the B2/B3 brakes; keep the retrieval line tended throughout the entry.
8. Maintain continuous atmospheric monitoring; if any alarm sounds, the entrant exits or is retrieved immediately.
9. On completion, raise the entrant under controlled power to the surface; the competent person confirms the entrant is clear before disconnection.
10. Close out the permit and log the cycle.

C.5 Application-Specific Hazards & Controls

Hazard	Control
Oxygen-deficient or toxic atmosphere	Test order $O_2 \rightarrow$ combustible $\rightarrow$ toxic; continuous monitoring; immediate retrieval on alarm.
Entrant incapacitation below deck	Non-entry rescue via the TIDYNE retrieval line; attendant never enters unless relieved.
Retrieval line snag on internal structure	Verify a clear vertical path; fairlead and rope guides inspected; tend the line continuously.

C.6 Non-Entry Rescue Procedure

Non-entry rescue is the primary rescue mode for confined-space entry and is why the TIDYNE retrieval line is rigged before entry. It allows the entrant to be recovered without exposing a second person to the hazard.

1. On recognising an emergency, the attendant calls STOP to all other work and summons the rescue team and the operator.
2. The attendant does NOT enter the space. The operator confirms the retrieval line is attached and clear.
3. The operator commands a controlled lift, raising the entrant under power along the verified vertical path.
4. If the line snags, the operator stops, the team assesses, and the snag is cleared from outside the space where possible; entry rescue is a last resort using a separately-rigged rescuer.
5. On reaching the surface, the rescue team receives the casualty, begins assessment, and applies Section 9 (suspension trauma / post-rescue medical) as required.
6. Tag the unit out-of-service for inspection if any abnormal load or fault occurred during the rescue.

C.7 Abort Criteria

- Atmospheric test outside acceptable range and not correctable by ventilation.
- Loss of communication with the entrant, or attendant unable to maintain the post.
- Retrieval line, harness, or anchor defect identified.
- TIDYNE telemetry anomaly or insufficient battery to complete the entry and a potential rescue.

Application C sign-off: Operator _____ Supervisor / Lift Director _____
Competent Person _____ Date _____

Application D — General Emergency Rescue Operations

D.1 Overview

Maritime emergencies are unpredictable. The TIDYNE unit's portable, clamp-mounted design means it can be rapidly deployed wherever it is needed — from man-overboard recovery to rescue at height from masts, cranes, or elevated work platforms. One device covers multiple emergency use cases, mobilizing to the emergency rather than the reverse.

D.2 Application-Specific Hazards & Controls

Hazard	Control
Delay mobilizing the unit to the emergency	Pre-identified mounting points around the vessel; unit stored charged and ready; crew drilled on rapid deployment.
Casualty in the water — drowning / hypothermia	Horizontal recovery per Section 8; rescue swimmer or device deployed; minimize immersion time.
Rescue at height — secondary fall	Rescuer and casualty both connected; fall-arrest limits per Section 6; controlled lowering only.
Unknown casualty weight / entanglement	Confirm load $\leq$ WLL; cut-away plan briefed; telemetry load monitored.
Adverse weather during rescue	Within operating envelope; lifting suspended in lightning; Supervisor weighs risk vs. urgency.

D.3 Rapid-Deployment Procedure

1. On the rescue alarm, the Supervisor selects the nearest pre-identified, rated mounting point appropriate to the casualty's location.
2. The operator clamp-mounts the TIDYNE unit, verifies seating, presses Home, and function-tests with no load.
3. The competent person prepares the appropriate end attachment: rescue harness, rescue strop, or horizontal recovery device.
4. The Supervisor briefs the team on the casualty's location, condition, and the recovery method.
5. Proceed to the scenario-specific procedure: man-overboard recovery (Section 8) or rescue at height (D.4 below).

D.4 Rescue at Height Procedure

1. Confirm the anchor structure above the casualty is rated $\geq 2\times$ load and inspected.
2. A rescuer, connected to the TIDYNE line via dorsal attachment, is lowered or positioned to reach the casualty (or the casualty is reached directly where access allows).
3. Connect the casualty to the rescue system; verify the connection before taking the load.
4. Take the casualty's weight under controlled power; release them from any entanglement or secondary anchor.
5. Lower (or raise) the casualty under controlled, powered descent to the recovery point — no free fall.
6. The rescue team receives the casualty and begins assessment; apply Section 9 for suspension trauma.

D.5 Communication

Direct voice or radio between the operator, the rescuer, and the Supervisor. A single STOP word halts all motion. The bridge is informed and the casualty's status relayed for medical preparation ashore or aboard.

D.6 Abort Criteria

- Anchor structure cannot be confirmed rated and sound.
- Casualty weight or entanglement exceeds safe single-cycle recovery and no alternative is rigged.
- Weather deteriorates beyond the operating envelope or lightning is present.
- TIDYNE telemetry anomaly or insufficient battery for the recovery.

Application D sign-off: Operator _____ Supervisor / Lift Director _____
Competent Person _____ Date _____

8. Man-Overboard Recovery — Detailed Procedure

Recovery of a person from the water is governed by ship-specific procedures under SOLAS III-1/Reg. 17-1 and guided by IMO MSC.1/Circ.1182 (Guide to Recovery Techniques). The recovery method is matched to the vessel's freeboard, the available equipment, and — most importantly — the casualty's condition.

Horizontal Recovery for Hypothermic Casualties

A casualty who has been immersed in cold water should be recovered as close to horizontal as possible and kept horizontal afterwards. Vertical lifting of a hypothermic person can trigger post-rescue circulatory collapse (afterdrop). Use a horizontal recovery device or strop arrangement, not a single vertical sling, wherever the casualty's condition allows.

8.1 Procedure

1. Sound the man-overboard alarm; mark the position; post a dedicated lookout; manoeuvre the vessel per the bridge MOB procedure.
2. Deploy the TIDYNE unit to the nearest rated mounting point on the recovery side.
3. Prepare a horizontal recovery device (recovery strop, basket, or stretcher) as the default for an immersed casualty; a rescue swimmer connects the casualty where required.
4. Take the casualty's weight under controlled power; recover slowly and as horizontally as the equipment allows.
5. Bring the casualty inboard to a prepared reception area; keep them horizontal.
6. Hand over to the medical team; treat for hypothermia with gentle handling and rewarming; do not allow vigorous movement.
7. Log the recovery and the casualty's condition; preserve telemetry for the incident record.

8.2 Key Points

- Minimize the casualty's time in the water — pre-position the unit and device as part of MOB readiness.
- Keep the recovery line tended and the descent/ascent controlled; never free-fall the recovery device toward the water.

9. Suspension Trauma & Post-Rescue Medical

A person suspended motionless in a harness can develop suspension trauma (orthostatic intolerance) as blood pools in the legs. OSHA requires the employer to provide for prompt rescue in the event of a fall [1926.502(d)(20)]. Rescue should therefore be performed as quickly as safely possible — do not leave a person hanging.

9.1 Recognising Suspension Trauma

- Early signs: faintness, breathlessness, sweating, paleness, nausea, dizziness, and numbness of the legs.
- A motionless suspended person is at greatest risk; encourage them to move their legs and use trauma-relief straps if fitted.

9.2 Response

1. Treat any suspended-fall casualty as time-critical; bring them to a safe surface under controlled power without delay.
2. If trauma-relief straps are fitted, instruct a conscious casualty to deploy and stand in them to relieve leg pressure while the lift is prepared.
3. On recovery, follow current first-aid guidance for post-suspension casualties; monitor for delayed deterioration and obtain medical assessment.
4. Record the suspension duration, casualty condition, and actions taken.

9.3 Cold-Water & Immersion Casualties

- Keep immersion casualties horizontal during and after recovery (Section 8); handle gently.
- Begin rewarming per medical guidance; avoid vigorous movement that can precipitate cardiac complications.
- Hand over to qualified medical care as soon as possible; relay condition ahead for shoreside or aboard treatment.

Prompt Rescue Is a Planning Requirement, Not an Afterthought

Every operation in this plan identifies, before commencement, how a suspended or fallen person will be promptly recovered. If prompt rescue cannot be assured, the operation does not proceed.

10. Lockout / Tagout & Power-Loss Recovery

10.1 Energy Control (OSHA 1910.147)

Before any rigging adjustment, maintenance, or fault clearance on the TIDYNE unit that is not part of a live rescue, hazardous energy is controlled per the six-step lockout/tagout sequence.

Step	Action
1 — Prepare	Identify all energy sources: 48 V electrical, stored mechanical energy in the drum/brake, and any suspended load.
2 — Shut down	Stop the unit using normal controls; land or secure any suspended load first.
3 — Isolate	Isolate the 48 V supply at the disconnect.
4 — Lock / tag	Apply a durable, standardized lock and tag identifying the authorized person.
5 — Release stored energy	Relieve or restrain stored mechanical energy; confirm no suspended load remains.
6 — Verify	Verify zero energy by attempting a normal start and confirming no response.

Locks and tags are removed only by the person who applied them. Periodic inspection of the energy-control procedure is performed at least annually.

10.2 Power-Loss Recovery During a Live Operation

If power is lost while a person is suspended, the B3 gravity brake closes instantly and holds the load. The unit's dedicated lithium backup powers control and brake release so a controlled descent can be completed.

1. Confirm the person is held and the brake is engaged (telemetry / visual).
2. Communicate calmly with the suspended person; reassure and instruct them to remain still.
3. Switch to backup power per the Operator's Manual; verify control authority is restored.
4. Complete a slow, controlled descent (or the alternating Up / Home recovery as applicable) to the nearest safe landing.
5. Once the person is safe, tag the unit out-of-service for OEM-certified inspection before further use.

11. Equipment, Rigging & PPE Reference

The items below are the standard rigging and personal-protective equipment used with the TIDYNE unit across the four applications. All load-bearing components are inspected by the competent person before each operation and removed from service at the first sign of a removal-from-service defect.

11.1 Rigging & Connection Hardware

Item	Requirement	Inspect For
Wire rope	As specified by TIDYNE for the unit; do not substitute.	Broken wires, kinks, birdcaging, corrosion, diameter reduction.
Hook & latch	Rated $\geq$ load; self-closing latch functional.	Throat opening, deformation, cracks, latch spring.
Shackles	Rated $\geq 2\times$ load; correct pin engagement.	Pin seating, deformation, wear, correct size.
Connectors / D-rings / snaphooks	Minimum tensile strength 5,000 lbf (22.2 kN).	Gate function, distortion, corrosion, markings legible.
Lanyard / lifeline	Breaking strength $\geq 5,000$ lbf (22.2 kN); energy absorber where used.	Cuts, fraying, chemical damage, deployed absorber.

11.2 Personal Protective & Rescue Equipment

Item	Use
Full-body harness	Personnel hoisting and fall arrest; dorsal (center-back) attachment.
Chest or full-body harness	Confined-space retrieval; retrieval line at center of back.
Horizontal recovery device / strop / basket	Man-overboard recovery, especially for immersed or hypothermic casualties.
Trauma-relief straps	Mitigation of suspension trauma for a person held in a harness.
Lifeline with light & heaving line	Ready at the point of access during pilot transfer and over-water work (SOLAS V/23).
PPE	Hard hat, eye protection, gloves (not when handling spooling rope by hand), steel-toe boots, high-visibility clothing, immersion suit / lifejacket over water.

11.3 Anchor & Mounting Points

- Mount only to points rated $\geq 2\times$ the working load: boom, jib arm, king post, pad eye, or TIDYNE docking station.
- Anchorages for personal fall arrest must support $\geq 5,000$ lbf per person, or be designed under a qualified person with a $2\times$ safety factor [1926.502(d)(15)].
- Verify clamp seating, fairlead alignment, and a clear fall/drop path before every operation.

11.4 Verifying an Anchor Meets the Rating

"Rated $\geq 2\times$ load" and " $\geq 5,000$ lbf per person" are acceptance thresholds, not field measurements. Because the operator cannot weigh a boom or pad eye on deck, anchor adequacy is confirmed by one of the following documented means before any personnel hoist — never by visual judgement alone:

- **Certified structure:** the mounting point (king post, pad eye, davit, boom) carries a current class-society or manufacturer load certificate, or appears on the vessel's approved lifting-point register with a stated Safe Working Load $\geq 2\times$ the planned load. Record the certificate / register reference on the lift plan.

- **Engineered sign-off:** where no certificate exists, a qualified person (naval architect or structural/marine engineer) calculates or confirms the anchor capacity to $\geq 5,000$ lbf per attached person (or $2\times$ the maximum applied load under a qualified person) and signs the lift plan. This is the OSHA 1926.502(d)(15) engineered-anchorage route.
- **Proof-tested point:** a purpose-installed TIDYNE docking station or temporary anchor that has been proof-tested to $2\times$ the working load by an OEM-certified technician, with the test recorded in the unit's service file and re-validated at the periodic-inspection interval.
- **If none of the above can be established, the anchor is treated as unrated and personnel hoisting does not proceed** — use an alternative certified point or a different access method. Cargo-only lifts within the 400 lb WLL may proceed from a point rated $\geq 2\times$ the cargo load on the same evidence basis.

12. Incident Reporting & Investigation

Every fall-arrest event, near-miss, equipment fault, or injury during a TIDYNE operation is reported and investigated. Learning from events is how the fleet stays safe; suppressing them is how people get hurt twice.

12.1 Immediate Actions After an Incident

1. Make the scene safe and attend to any casualty before anything else; summon medical help.
2. Preserve the TIDYNE unit's state and telemetry; do not clear faults or reset until recorded.
3. Tag the unit out-of-service pending OEM-certified inspection if any abnormal load, arrest, or fault occurred.
4. Notify the Supervisor / Lift Director and the vessel master; escalate per the company reporting matrix.
5. Report to TIDYNE OEM-certified service within 24 hours.

12.2 Reportable Events

Category	Examples
Fall-arrest event	The unit arrested a person who lost contact with a ladder, structure, or platform.
Equipment fault	Brake fault, overspeed, encoder error, undervoltage, wire-rope or hook defect found in service.
Near-miss	A condition that could have caused harm but did not — slack line, miscommunication, anchor doubt.
Injury / medical	Any injury, suspension trauma, or immersion casualty during an operation.
Regulatory / external	Events requiring notification to OSHA, USCG, flag state, or class society.

12.3 Investigation & Follow-Up

- Establish the sequence of events from telemetry, the plan record, and witness accounts.
- Identify the root cause and contributing factors — equipment, procedure, training, or environment.
- Define corrective actions with owners and dates; verify completion; update this plan or training if a gap is found.
- Preserve a fractured wire-rope sample (including intact rope back from the failure) for analysis where a rope failure occurred.

13. Training, Drills & Competency Records

Rescue capability is only as good as the team's training. The requirements below align with the TIDYNE Operator Training Manual and the technical-rescue qualification framework of NFPA 1006 / 1670.

13.1 Training Requirements

Requirement	Standard
TIDYNE operator certification	OEM-certified initial course plus annual refresher.
Rescue qualification	NFPA 1006 / 1670 level (Awareness / Operations / Technician) matched to the scenario disciplines: rope rescue, confined-space rescue, watercraft/surface-water rescue.
Confined-space rescue practice	In-house rescue teams practice at least annually (OSHA 1910.146(k)).
Drills	Each application (A–D) drilled on a realistic schedule; man-overboard and power-loss recovery drilled regularly.
Record retention	Training and drill records retained per company policy and regulation (typically employment plus three years).

13.2 Drill Log

Date	Application / Scenario	Participants	Outcome / Notes	Lead
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

14. Master Sign-Off, Debrief & Filing

This page is the controlled authorization and post-operation record. It is completed for the operation as a whole, in addition to the application-specific sign-off, and is retained with the vessel safety-management system and the TIDYNE unit's OEM-certified service record.

14.1 Operation Identification

Plan ID	TDY-PLN-RES-001 · Application ____ (A / B / C / D)
Vessel / site	_____
Date / time	_____ Start _____ End _____
TIDYNE unit S/N	_____ Battery SOC at start: _____ %
Supervisor / Lift Director	_____
Weather / sea	Wind: _____ Sea state: _____ Visibility: _____

14.2 Authorized Personnel

Role (TIDYNE OEM-certified)	Printed Name	Signature	Date
Operator	_____	_____	_____
Supervisor / Lift Director	_____	_____	_____
Competent Person	_____	_____	_____
Rescue / Recovery Lead	_____	_____	_____

14.3 Post-Operation Debrief

Outcome, anomalies, near-misses, and equipment condition:

14.4 Filing Requirement

Retain this completed plan with the vessel safety-management system and the TIDYNE unit's OEM-certified service record. Any anomaly, near-miss, or fault shall be reported to TIDYNE OEM-certified service within 24 hours, and the unit removed from service until cleared for return by a TIDYNE OEM-certified technician or engineer.

15. Glossary & Abbreviations

Terms and abbreviations used in this plan and its companion documents.

B1 / B2 / B3	The three independent brakes of the TIDYNE unit: motor torque control (B1), self-locking worm gear (B2), and emergency gravity brake (B3).
Competent Person	A person who, by training and experience, can identify hazards and is authorized to take corrective action.
Confined space	A space large enough to enter, with limited means of entry/exit, not designed for continuous occupancy.
Dorsal D-ring	The fall-arrest attachment at the center of the wearer's back near shoulder level.
Fall arrest	A system that stops a free fall before the person strikes a lower level, limiting arresting force.
Freeboard	The vertical distance from the waterline to the point of access on the vessel.
Home	The reference position the TIDYNE unit establishes at startup before any lifting.
LFL	Lower Flammable Limit — the lowest concentration of a gas/vapor that will burn.
LOTO	Lockout / Tagout — the control of hazardous energy during service (OSHA 1910.147).
MAF	Maximum Arresting Force — the peak force on the body during fall arrest.
MOB	Man Overboard.
Non-entry rescue	Retrieving an entrant from a confined space without a rescuer entering, via a retrieval line and mechanical device.
OEM	Original Equipment Manufacturer — here, TIDYNE Inc.
Permit space	A permit-required confined space requiring a written entry permit (OSHA 1910.146).
PPE	Personal Protective Equipment.
SOC	State of Charge — the charge level of the 48 V battery pack.
Suspension trauma	Orthostatic intolerance from being suspended motionless in a harness.
WLL	Working Load Limit — the maximum load the unit is authorized to handle (400 lb / 180 kg).

Emergency Quick-Reference Card

This page may be detached or laminated for use at the operating position. It summarizes the immediate actions only. It does not replace the full plan, training, or the Supervisor's authority to direct the operation.

STOP — Anyone May Call It

A single agreed STOP word halts all motion instantly. Only the Supervisor / Lift Director authorizes resumption. Loss of communication with a suspended or climbing person is a STOP condition.

Immediate Actions

Event	Immediate Action
Power loss	B3 gravity brake holds the person. Reassure them. Switch to backup power. Complete a controlled descent to the nearest safe landing. Tag unit out-of-service after.
Overspeed	Centrifugal brake limits speed automatically. Do not reset. Bring to a controlled stop and land.
Fall arrested (person held)	Confirm person is held and clear of hazards. On Supervisor command, controlled lift to safe recovery point. Apply suspension-trauma response.
Person suspended > a few minutes	Treat as time-critical. Deploy trauma-relief straps if fitted. Recover promptly. Monitor for delayed deterioration.
Person in water	Horizontal recovery. Minimize immersion time. Keep casualty horizontal. Treat for hypothermia; gentle handling.
Confined-space entrant down	Attendant does NOT enter. Operator performs non-entry rescue via retrieval line under controlled power.
Any brake/encoder/battery fault	STOP. Hold load on brakes. Land person safely. Tag out-of-service for OEM inspection.

Key Limits

- WLL 400 lb (180 kg). Free fall of the load line is prohibited — controlled descent only.
- Fall arrest: max arresting force 1,800 lbf; free fall ≤ 6 ft; deceleration ≤ 3.5 ft; anchor $\geq 5,000$ lbf/person.
- Confined space: mechanical retrieval required for vertical entry > 5 ft; O_2 19.5–23.5%; flammable $< 10\%$ LFL.
- Report any fault or near-miss to TIDYNE OEM-certified service within 24 hours.

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