



VEYRUM ROBOTICS STANDARD



VRS-MAR-110

Marine & Subsea — Demonstration Protocol

The Marine & Subsea sector's witnessed steps for a Certified rating — post-dive ingress check and depth-limit hold, abort ascent and beacons, communications cut and positioning-denied drift, obstacle avoidance and surfacing check, launch-and-recovery walk-through, fluid containment, field module and consumable replacement — run in the same session as the intrinsic protocol.

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Foreword. This Test Protocol is new in the VRS 2026 edition and is the Marine & Subsea sector’s extension of VRS-GEN-203, the intrinsic demonstration protocol. A vehicle that works in water can be lost in a way no land robot can: it floods, it sinks, it drifts away, it surfaces under a hull. The sector’s anchor — classification-society rules for underwater and unmanned surface vehicles, read with the general machinery regime — already requires pressure qualification, abort systems and beacons on paper. This Protocol witnesses them working: the post-dive inspection that shows nothing came in, the abort that brings the vehicle up, the beacon a receiver on the dock can hear, the behaviour when the link is cut at depth, the drift when positioning is denied, the check before surfacing, and the launch-and-recovery handling where most deck injuries happen. Every step is in a basin, dock or pressure chamber the manufacturer or site provides; no diver is in the water during any step and a marker stands in for one. The Protocol carries only what the intrinsic steps do not already witness. Steps run between Parts E and F of VRS-GEN-203, in the same session, on the same feed, into the same export. Standards carry no step identifiers; every step here names the VRS-MAR-201 subclause that requires it. As a protocol it is versioned vX.Y.Z (VRS-GEN-004 §5.4). Requirements use “shall”.

1 Introduction

The Marine & Subsea anchor set is the classification societies’ rules for underwater vehicles, unmanned surface vessels and the launch-and-recovery systems that handle them, read with ISO 12100 for hazards those rules do not reach and with the offshore industry’s guidance on ROV operations. Classification gives a purchaser a pressure certificate and a rules-compliant design; it does not show the vehicle aborting from depth, its beacons lighting up on the dock, or the crew launching it without a hand in a pinch point. This Protocol witnesses those things, on a stock vehicle, in the water the site has, with the manufacturer’s own receivers and test obstacles.

Two accommodations are made for the environment. The depth-limit step accepts either a basin to the declared depth, a pressure chamber on the laboratory route, or — where neither is available — a witnessed enforcement of the depth limit at its margin, with the pressure certificate carrying the qualification itself. And the diver-proximity step uses a marker, never a diver: no person is in the water during any step.

2 1 Scope

This Protocol specifies the Marine & Subsea demonstration steps by which the criteria of VRS-MAR-201 Clause 6 are demonstrated at the Certified tier, for every application class of VRS-MAR-201 §7.3 (ROV (tethered) · AUV (untethered) · USV (surface) · hull-crawler). It applies to every Certified Marine & Subsea assessment, by every Certified route of VRS-GEN-003 §6.9.

It specifies: how this Protocol relates to VRS-GEN-203 (Clause 4); the envelope the manufacturer declares before the session (Clause 5); the steps (Clause 6); and a worked example (Clause 7). Annex A maps every VRS-MAR-201 criterion to its intrinsic steps, its sector steps, or neither.

It does not: repeat any session requirement, step, marking rule or record rule of VRS-GEN-203, all of which apply unchanged; define any criterion, point, ceiling or ladder (VRS-MAR-201); or define the Marine & Subsea information pack (VRS-GEN-013). No diver or swimmer is in the water during any step; a marker stands in. Pressure qualification to depth is witnessed in a basin or chamber where available and otherwise as enforcement of the declared limit; the pressure certificate remains Verified evidence.

3 2 Normative references

- **VRS-GEN-203**, Demonstration Protocol — Intrinsic — session requirements (Clause 4), step rules (Clause 5), marks and scores (Clause 7), Session Record (Clause 8), all of which apply to this Protocol.
- **VRS-MAR-201**, Marine & Subsea — AR Assessment Protocol — the criteria whose Certified rows this Protocol serves; application classes (§7.3).
- **VRS-MAR-001**, Marine & Subsea Sector Standard — the declared envelope and class fields.
- ○ **VRS-GEN-101**, Safety — the intrinsic safety criteria the Marine & Subsea pool contributes to.
- ○ **VRS-GEN-102**, Reliability & Durability — the intrinsic environmental-sample step that also serves VRS-MAR-201 §6.2.
- ○ **VRS-GEN-103**, Serviceability & Support — the intrinsic module-swap steps that serve parts of VRS-MAR-201 §6.8.
- **VRS-GEN-003**, Governance Charter and Independence — Certified routes and route parity (§6.9).

4 3 Terms and definitions

Terms defined in VRS-GEN-001 and VRS-GEN-203 apply. In addition:

3.1 basin — the body of water — test tank, dock or harbour — provided by the manufacturer or site, of the declared depth and extent, in which in-water steps are performed.

3.2 post-dive checklist — the manufacturer’s declared inspection of housings, penetrators, connectors and indicators after a dive.

3.3 abort — the declared action (command, timer or fault) that ends a dive and brings the vehicle to the surface by drop-weight or buoyancy.

3.4 locator beacon — a declared strobe, radio, satellite or acoustic device that activates on abort or low energy so the vehicle can be found.

3.5 drift bound — the declared maximum position error after a declared course with positioning denied.

3.6 surfacing check — the declared procedure before surfacing — hold below the surface, upward sweep, traffic listen — to avoid surfacing into traffic.

3.7 diver-proximity marker — an acoustic tag or reflective target standing in for a diver; no diver is in the water.

3.8 launch-and-recovery — the declared procedure and equipment by which the vehicle enters and leaves the water, including tether management for tethered classes.

3.9 standoff — the declared distance from infrastructure at which the vehicle’s contact protection acts.

5 4 Relationship to the intrinsic protocol

4.1 This Protocol shall be run only as part of a session under VRS-GEN-203. Every requirement of VRS-GEN-203 Clause 4 applies to every step here without repetition or exception.

4.2 Position in the session. The steps of Clause 6 shall run after VRS-GEN-203 Part E and before VRS-GEN-203 Part F, so that one continuous recording and one export cover both protocols. The endurance sample opened in VRS-GEN-203 Part C continues to run through this Protocol.

4.3 Step identifiers. Steps shall carry identifiers of the form **MAR-110.nn** ; they are Session Record step identifiers under the same rules as VRS-GEN-203 §5.1 and shall never be reused.

4.4 Required by. Every step shall name the VRS-MAR-201 subclause(s) whose Certified row it serves. VRS-MAR-201 carries no reference back to this Protocol.

4.5 Classes and declared subjects. Each step lists the application classes it applies to. A step whose class is not in the assessed envelope shall not be run. A step whose subject the manufacturer has not declared shall be marked *not declared* and has no effect on any score (VRS-GEN-203 §3.10). Parts 1, 2, 3 and 5 shall be run for every Marine & Subsea assessment; the depth-limit and surfacing steps for the submersible classes; tether items in Part 5 for the tethered classes (VRS-MAR-201 §7.3).

4.6 Bound. The sum of step bounds for one class shall not exceed 120 min. Marks, failure, declined steps, continuation sessions and the Session Record follow VRS-GEN-203 Clauses 5, 7 and 8.

4.7 Criteria witnessed by intrinsic steps. Where a sector criterion’s Certified row is already witnessed by intrinsic steps, Annex A names them and the criterion is scored from those marks together with any sector steps listed. VRS-MAR-201 §6.1 (class and anchor fit) is documentary; its Certified row is confirmed by the marks of the pressure and loss-prevention steps of Parts 1 and 2, which are the classification regime’s own tests witnessed live.

4.8 People in the water. No diver or swimmer shall be in the basin during any step; the diver-proximity marker stands in (VRS-GEN-203 §4.8). Launch and recovery shall be performed by the declared crew with the declared lifting equipment, and no person shall be beneath a suspended vehicle. A step so performed shall be marked *not achieved* and the ground recorded.

4.9 Depth qualification. Where neither a basin to the declared depth nor a pressure chamber is available at the site, the depth-limit step shall witness enforcement of the declared limit at its margin only; the pressure certificate remains Verified evidence and the reviewer reads the mark against the criterion’s ladder accordingly.

4.10 Admissibility of a mark. A step’s mark shall be inadmissible, and the step shall be marked *not achieved*, where the dimension, mass, speed, force or condition it depends on was not shown on camera, or where the configuration demonstrated differs from the assessed one. The observer shall record the ground.

6 5 The declared envelope

5.1 Before the session the manufacturer shall have declared, in the information pack and per assessed application class: the application class; the basin available and its depth (m); the housings, penetrators and connectors with the post-dive checklist and the vacuum or pressure-hold test value and time; maximum depth (m) and margin; the abort trigger, drop-weight or buoyancy means and ascent time (s); the beacons and their receivers; the low-energy threshold (%) and behaviour; the link type and the loss-of-comms behaviour with its time (s); the positioning-denied course and drift bound (m); maximum speed (m/s or kn), the test obstacle and minimum detectable size (mm); the surfacing check and diver-proximity protection; the launch-and-recovery procedure, crew number, lifting rating (kg) and tether management; fluid-filled compartments and compensation; the infrastructure standoff (m) and contact protection; and the field-replaceable modules, consumables, tool kit and turnaround (min).

5.2 Every apparatus in Clause 6 shall be sized from those declarations and no other source (VRS-GEN-203 §4.7). A parameter not declared makes the steps that depend on it *not declared* (4.5); a manufacturer that declares a smaller envelope demonstrates a smaller envelope and is scored against it under VRS-MAR-201.

5.3 The declared envelope shall match the one recorded for the rating (VRS-MAR-001, VRS-GEN-009); a step demonstrated at a value other than the declared one shall be inadmissible (4.10).

7 6 The steps

Columns: **ID** — Session Record step identifier · **Step** — outcome to witness · **Classes** — application classes the step applies to (4.5) · **Witness** — means (VRS-GEN-203 §3.13) · **Apparatus** — manufacturer-supplied, at declared value · **Bound** — minutes · **Required by** — VRS-MAR-201 subclause(s) served.

7.1 6.1 Part 1 — Pressure and ingress

The pressure certificate says the housing holds; the post-dive inspection shows nothing came in on this dive, and the depth limit is shown held or enforced.

ID	STEP	CLASSES	WITNESS	APPARATUS	BOUND	REQUIRED BY
MAR-110.01	Post-dive inspection and ingress check. After the representative dive or run of the session, every declared housing, penetrator and connector is opened or inspected on camera per the manufacturer's post-dive checklist: no water ingress, desiccant or humidity indicator within the declared limit, seals intact; the declared vacuum or pressure-hold test is performed and the gauge shown on camera at the declared value for the declared time.	all	CAM+FEED+APP	Manufacturer's checklist; vacuum or pressure test kit; the vehicle's own gauge or sensor	12 min	Required by VRS-MAR-201 §6.2; §6.8
MAR-110.02	Depth-limit hold and pressure-chamber evidence. In the basin or on the laboratory route in a pressure chamber, the	ROV (tethered) · AUV (untethered) · hull-crawler	CAM+FEED+APP	Basin or pressure chamber; depth or pressure reference	12 min	Required by VRS-MAR-201 §6.2

ID	STEP	CLASSES	WITNESS	APPARATUS	BOUND	REQUIRED BY
	vehicle is taken to the declared maximum depth (or equivalent pressure) and holds for the declared time; internal pressure, humidity and leak sensors are shown on the feed throughout; where the site cannot reach the declared depth, the declared depth limit is shown to be enforced (descent refused or abort triggered) at the declared margin.					

7.2 6.2 Part 2 — Loss-at-sea prevention

The behaviours that bring a vehicle back: the abort that surfaces it and the beacons that find it.

ID	STEP	CLASSES	WITNESS	APPARATUS	BOUND	REQUIRED BY
MAR-110.03	Abort ascent and drop-weight. From depth in the basin, the declared abort is triggered (command, timer or fault); the vehicle releases its drop-weight or drives its buoyancy and ascends to the surface within the declared time; the abort state is shown on the feed; for a surface vehicle, the declared dead-ship drift-prevention (anchor, sea-anchor, station-keeping) is shown.	all	CAM+FEED+APP	Basin of the declared depth; timing from video	10 min	Required by VRS-MAR-201 §6.3
MAR-110.04	Locator beacons and low-energy surfacing. At the surface the declared locator beacons (strobe, radio, satellite, acoustic pinger) are shown to activate on abort and on the declared low-energy threshold; the receiver held by the demonstrator shows the beacon on camera; the declared low-energy behaviour (surface, hold, beacon) is witnessed from the declared reduced charge.	all	CAM+FEED+APP	Beacon receiver(s)	8 min	Required by VRS-MAR-201 §6.3

7.3 6.3 Part 3 — Loss of communications and drift

Extends the intrinsic lost-link step to the case that matters underwater — at depth or at range, with the drift when positioning is denied bounded and shown.

ID	STEP	CLASSES	WITNESS	APPARATUS	BOUND	REQUIRED BY
MAR-110.05	Communications cut at depth or at range. The acoustic, tether or radio link is cut by the manufacturer’s own means while the vehicle is at depth or at range in the basin; the vehicle performs its declared behaviour (hold, surface, return to the recovery point) within the declared time; the link state and behaviour are shown when the link is restored.	all	CAM+FEED+APP	Means of cutting the link; recovery point marked	10 min	Required by VRS-MAR-201 §6.4; §6.3
MAR-110.06	Positioning-denied drift bound. With surface positioning denied or acoustic positioning disabled by the manufacturer’s means, the vehicle navigates a declared course by dead reckoning and its position error at the end is shown against a marked reference within the declared drift bound; the positioning state is shown on the feed; the declared boundary is not crossed.	all	CAM+FEED+APP	Marked course and end reference; boundary marked	10 min	Required by VRS-MAR-201 §6.4

7.4 6.4 Part 4 — Collision avoidance and surfacing

Detection in water, and the check before surfacing that keeps the vehicle from coming up under a hull. A marker stands in for a diver.

ID	STEP	CLASSES	WITNESS	APPARATUS	BOUND	REQUIRED BY
MAR-110.07	Obstacle avoidance in the basin. A declared test obstacle (net, pile, wall section) is placed in the vehicle's path; at the declared speed the vehicle detects and stops or avoids it before contact; the sonar or camera detection is shown on the feed; repeated with the obstacle at the declared minimum detectable size.	all	CAM+FEED+APP	Test obstacle at declared dimensions; basin	10 min	Required by VRS-MAR-201 §6.5
MAR-110.08	Surfacing check and diver-proximity protection. Before surfacing, the vehicle performs its declared surfacing check (hold below the surface, upward sonar or camera sweep, surface-traffic listen) and the check is shown on the feed; with a declared diver-proximity marker (acoustic tag or reflective target) placed nearby,	ROV (tethered) · AUV (untethered) · hull-crawler	CAM+FEED+APP	Diver-proximity marker or target — never a diver	8 min	Required by VRS-MAR-201 §6.5; §6.6

ID	STEP	CLASSES	WITNESS	APPARATUS	BOUND	REQUIRED BY
	the declared protection (thruster stop, hold, alert) acts; warnings are shown at the surface.					

7.5 6.5 Part 5 — Launch and recovery

Where most deck injuries happen. Lift points, crew, pinch and crush points, and — for tethered classes — the tether.

ID	STEP	CLASSES	WITNESS	APPARATUS	BOUND	REQUIRED BY
MAR-110.09	Launch-and-recovery walk-through. The declared launch-and-recovery procedure is performed at the dock or basin edge: lift points shown and used, handling by the declared crew number, pinch and crush points identified on camera and guarded as declared, the vehicle launched and recovered; for tethered classes, tether management (tether management system, strain relief, deck routing) is shown during the launch and recovery.	all	CAM+FEED+APP	Lifting means at declared rating; tether management as declared	12 min	Required by VRS-MAR-201 §6.6

7.6 6.6 Part 6 — Environmental release

What the vehicle could leave in the water and what it could mark.

ID	STEP	CLASSES	WITNESS	APPARATUS	BOUND	REQUIRED BY
MAR-110.10	Fluid containment and infrastructure contact. Every declared fluid-filled compartment and hydraulic circuit is inspected on camera with its containment or compensation shown; the vehicle is brought to the declared standoff from a marked infrastructure surface (pile, hull plate, pipeline section) and its declared contact protection (standoff hold, bumper, soft-contact mode) acts without marking the surface.	all	CAM+FEED+APP	Marked infrastructure surface; the vehicle's own compensation indicators	8 min	Required by VRS-MAR-201 §6.7

7.7 6.7 Part 7 — Maintenance programme

Extends the intrinsic module-swap step with the anodes, seals and filters a marine programme turns over after every dive.

ID	STEP	CLASSES	WITNESS	APPARATUS	BOUND	REQUIRED BY
MAR-110.11	Field-replaceable module and consumable after the dive. One declared field-replaceable module (thruster, light, camera, battery pod) and one consumable (anode, seal set, filter) are replaced at the dock per the manual after the dive; time from video against the declared turnaround; the vehicle is returned to the water or to ready state and the replacement recorded in the maintenance log against the published programme.	all	CAM+FEED	Spare module and consumable; the declared tool kit	15 min	Required by VRS-MAR-201 §6.8

6.8 Timing budget. All 11 steps sum to 115 min. Per class, with every applicable step declared: ROV (tethered) 115 min · AUV (untethered) 115 min · USV (surface) 95 min · hull-crawler 115 min. Every class is within the 120 min bound of 4.6.

8 7 Worked example (informative)

A manufacturer of a hypothetical inspection-class ROV (class: ROV, tethered) declares: a 6 m test tank at the site; eight penetrators and two housings on the post-dive checklist with a –0.5 bar vacuum hold for 10 min; a 300 m depth limit with a 20 % margin (enforced by abort at the limit, chamber-tested per certificate); abort by command or 60 s link timeout with a drop-weight and a 4 m ascent in the tank within 30 s; strobe and radio beacon with a handheld receiver; surface and beacon at 10 % charge; tether-cut behaviour of hold then surface within 60 s; a 20 m dead-reckoning course with a 3 m drift bound; 1.5 kn maximum with a 200 mm net-float obstacle; a hold-and-sweep surfacing check and thruster stop within 2 m of an acoustic tag; a two-person launch with a 100 kg-rated davit and a tether management drum; oil-compensated thruster housings and a 0.5 m standoff mode; and a thruster and anode replacement in 20 min.

After VRS-GEN-203 Part E the sector steps run from 12:40 at the tank. MAR-110.01: after the dive, housings opened, no water, indicators dry, –0.5 bar held 10 min on the gauge (achieved). MAR-110.02: the tank is 6 m; descent past the configured 5 m test limit refused and abort triggered at 5.2 m, margin state shown (achieved with note: depth limit enforced at margin; chamber certificate carries the qualification). MAR-110.03: abort at 5 m, drop-weight released, surface in 22 s (achieved). MAR-110.04: strobe and radio beacon on abort, receiver shows the signal; from 12 %, surfaces and beacons at 10 %

(achieved). MAR-110.05: tether link cut at 5 m, holds 5 s, surfaces in 41 s (achieved). MAR-110.06: acoustic positioning disabled, 20 m course, 2.1 m from the reference (achieved). MAR-110.07: net float at 1.5 kn, sonar detection and stop 1.2 m short; 200 mm float detected (achieved). MAR-110.08: hold at 1 m, upward sweep, surface; acoustic tag placed, thrusters stop at 1.8 m (achieved). MAR-110.09: davit rating plate shown, two-person launch and recovery, pinch points at the drum and A-frame identified and guarded, tether managed on the drum (achieved). MAR-110.10: compensator indicators shown full; approach to the marked pile, standoff hold at 0.5 m, no mark on the surface (achieved). MAR-110.11: thruster and anode replaced dockside in 17 min, logged against the programme (achieved). Sector time 115 min; VRS-GEN-203 Part F follows.

The reviewer scores VRS-MAR-201 §6.2 from MAR-110.01 and MAR-110.02 (reading the note) with GEN-203.39; §6.3 from MAR-110.03 to MAR-110.05 with GEN-203.07 and GEN-203.15; §6.1 is confirmed by those marks; §6.4 from MAR-110.05 and MAR-110.06 with GEN-203.15; §6.5 from MAR-110.07 and MAR-110.08 with GEN-203.09; §6.6 from MAR-110.08 and MAR-110.09 with GEN-203.16; §6.7 from MAR-110.10; §6.8 from MAR-110.01 and MAR-110.11 with the intrinsic serviceability steps. No number in this example is a requirement; every apparatus value came from the manufacturer's own declaration.

9 Annex A (normative) — Criterion coverage

Every criterion of VRS-MAR-201 Clause 6 appears once with the intrinsic steps (VRS-GEN-203) and the sector steps (this Protocol) that witness it, or the statement that it has none.

CRITERION	SUBCLAUSE	WITNESSED BY
MAR-1 Class / anchor fit	VRS-MAR-201 §6.1	no step — documentary criterion; its Certified row is confirmed by the marks of MAR-110.01, MAR-110.02, MAR-110.03
MAR-2 Pressure and ingress qualification at depth	VRS-MAR-201 §6.2	intrinsic GEN-203.39; sector MAR-110.01, MAR-110.02
MAR-3 Loss-at-sea prevention	VRS-MAR-201 §6.3	intrinsic GEN-203.07, GEN-203.15; sector MAR-110.03, MAR-110.04, MAR-110.05
MAR-4 Loss-of-comms behaviour and GNSS-denied drift	VRS-MAR-201 §6.4	intrinsic GEN-203.15; sector MAR-110.05, MAR-110.06
MAR-5 Collision avoidance and surfacing protections	VRS-MAR-201 §6.5	intrinsic GEN-203.09; sector MAR-110.07, MAR-110.08
MAR-6 Launch-and-recovery deck-operation hazards	VRS-MAR-201 §6.6	intrinsic GEN-203.16; sector MAR-110.08, MAR-110.09
MAR-7 Environmental release and sensitive-site controls	VRS-MAR-201 §6.7	sector MAR-110.10
MAR-8 Corrosion, bio-fouling and maintenance programme	VRS-MAR-201 §6.8	intrinsic GEN-203.29, GEN-203.30; sector MAR-110.01, MAR-110.11
MAR-9 Incident and loss record	VRS-MAR-201 §6.9	no step — scored at the Certified tier from the Verified evidence

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- IMCA R 018 (2016), *Guidance on ROV Tether Management Systems*.
- ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*.
- IEC 60529:1989+AMD2:2013, *Degrees of protection provided by enclosures (IP Code)*.
- ISO 13628-8:2002, *Petroleum and natural gas industries — Design and operation of subsea production systems — Part 8: Remotely Operated Vehicle (ROV) interfaces on subsea production*

systems.

- IEC 62133-2:2017, *Secondary cells and batteries — Safety requirements for portable sealed secondary lithium cells.*

11

Change history

DATE	VERSION	STATUS	CHANGE	AUTHORITY
2026-09-16	1.0.0 (draft)	Draft	Created for the VRS 2026 edition (rewrite Batch D; sector demonstration protocol). 11 steps in 7 Parts extending VRS-GEN-203 for the Marine & Subsea criteria of VRS-MAR-201: post-dive ingress inspection with vacuum or pressure hold, depth-limit hold or enforcement at margin, abort ascent and drop-weight, beacons and low-energy surfacing, communications cut at depth, positioning-denied drift bound, obstacle avoidance in the basin, surfacing check and diver-proximity marker, launch-and-recovery walk-through with tether management, fluid containment and infrastructure standoff, module and consumable replacement after the dive. No diver in the water in any step. Annex A covers all 9 criteria.	Rewrite instructions §6 (VRS-XXX-110); sector traceability matrix (MAR derived demonstration steps); CEO ruling 2026-09-15 that standards carry no catalogue identifiers

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