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VRS-MAR-201

# Marine & Subsea — AR Assessment Protocol

How the Marine & Subsea Application Rating letter is determined — sector criteria MAR-1…MAR-9, contributing intrinsic criteria, letter bands, tier ceilings and class applicability, with evidence by tier and underwriting use.

VEYRUM RESEARCH INSTITUTE


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# Contents

> **Foreword.** This Assessment Protocol determines the **Marine & Subsea Application Rating (AR)** letter for a robot model in a declared operation class. It scores a **pool** of criteria — the nine sector criteria of Clause 6 (MAR-1…MAR-9, 100 points) plus the named intrinsic criteria of Clause 5, each scored once under its own standard and counted here — and expresses the earned points as a percentage of the applicable pool, which maps to a letter **C < B < A < AA < AAA (AAA best)** by the bands of VRS-GEN-006 §4. Every criterion is bounded by an evidence tier — Unverified, Verified, Certified — so the best attainable letter rises with substantiation, not assertion. This edition supersedes the re-weighted-mean model of the 0.x drafts: no weighting, no separate grade bands, no separate modifiers — the tier limits follow from the per-criterion ceilings of Clause 6. The defining condition of the sector is the **open sea and the pressure at depth**: a fault far from any operator can strand or sink the unit, and the primary casualty of a subsea loss is often the robot itself, which may be **unrecoverable**. A rating is therefore bounded to the declared **operation classes** and their **depth and sea-state envelopes**, and evidence obtained at a shallower or narrower envelope is inadmissible for a deeper one. A Marine & Subsea AR is an opinion above the compliance floor, not a certification, and nothing here implies that any real robot holds a Veyrum rating (ratings are not published). Requirements use “shall”; recommendations use “should”.

## 1 1 Scope

**1.1** This Protocol defines, for the **Marine & Subsea** sector Application Rating: the determination method (Clause 4); the contributing intrinsic criteria drawn into the pool (Clause 5); the nine sector criteria MAR-1…MAR-9 with their point ladders and tier ceilings (Clause 6); the letter bands, pool ceilings and class applicability (Clause 7); the evidence admissible at each tier (Clause 8); underwriting and credit use (Clause 9); result recording (Clause 10); and the assessor checklist (Clause 11). A worked example is at Annex A.

**1.2** The AR shall be issued **per application class**. The operation classes are **ROV (tethered)**, **AUV (untethered)**, **USV (surface)** and **hull-crawler**, per VRS-MAR-001 §4.3. The launch-and-recovery tether items of MAR-6 apply to the tethered classes; all other criteria apply to all classes. Sector applicability, the marine hazard taxonomy and the class-society anchor regime are defined in VRS-MAR-001 and are not restated here.

**1.3** The AR shall be assessed at one of three **tiers** — Unverified, Verified, Certified. Each criterion states the maximum points reachable at each tier (Clause 6); the AR tier is the tier whose evidence bar the assessed evidence meets and shall not exceed the model’s Intrinsic Rating tier (VRS-GEN-006 §7). The underlying point aggregation and the letter bands are defined in VRS-GEN-005/006 and are not restated here.

## 2 2 Normative references

- **VRS-MAR-001**, Marine & Subsea — Sector Standard — applicability, operation classes, the marine hazard groups and the MAR class-society anchor regime, including the continued-validity survey obligations (Annex C).

- **VRS-GEN-005**, Intrinsic Rating — Methodology — point aggregation, tiers, cold-start parity and the company-wide fallback rule (§6).
- **VRS-GEN-006**, Application Rating — Scheme — the letter bands, the applicable-pool percentage and the tier rule.
- **VRS-GEN-009**, Robot Risk Passport and Registry Schema — the record that carries the AR result.
- **VRS-GEN-012**, Evidence Grades and Data Requirements — evidence kinds and the tier evidence bars.
- **VRS-GEN-101 … VRS-GEN-107**, IR Category Standards — the intrinsic criteria contributed under Clause 5.
- **ABS Rules for Building and Classing Underwater Vehicles, Systems and Hyperbaric Facilities** (edition in force) and **DNV** autoremote/surface class notations — the MAR-1 class-society anchor by operation class.
- **IEC 60529:1989+AMD2:2013** (IP Code) — ingress-protection anchor (MAR-2).
- **IEC 60945:2002** and **COLREGs 1972 (as amended)** — navigation-equipment and collision-avoidance anchors (MAR-5); **IMO MASS Code** (2026) — autoremote surface-operation context.
- **IEC 62443-4-2:2019** — technical security requirements for the control/update link (SL-C against FR1–FR7) (MAR-4).
- **ISO 14224:2016** — collection and exchange of reliability and maintenance data for equipment (MAR-8/MAR-9).
- Data twin: **VRS-MAR-501** (generated from this Protocol, never hand-edited).

## 3 3 Terms and definitions

Terms per VRS-GEN-001 (aligned to ISO 8373:2021) and VRS-MAR-001. Locally:

- **pool** — the set of criteria whose points determine the AR letter: the nine sector criteria of Clause 6 together with the contributing intrinsic criteria of Clause 5.
- **applicable pool** — the pool for a given operation class after criteria not applicable to that class are removed from both the earned points and the pool range (Clause 4; VRS-GEN-006 §6).
- **contributor** — an intrinsic criterion scored once under its own IR category standard and counted again in the sector pool at the same points (Clause 5).
- **tier** — the evidence stringency at which a criterion is assessed: **Unverified** (public evidence only), **Verified** (manufacturer evidence pack examined), **Certified** (behaviour witnessed).
- **ceiling** — the maximum points a criterion awards at a given tier; points earned are held at the ceiling of the assessed tier.
- **evidence bar** — the minimum evidence a criterion requires before any points are awarded; below it the criterion scores 0.
- **company-wide fallback** — the substitute points a criterion allows from manufacturer-wide evidence when model-specific evidence is unavailable (VRS-GEN-005 §6).
- **operation class** — a declared category of assessed marine operation (ROV tethered, AUV untethered, USV surface, hull-crawler), recorded as a protocol applicability field.

- **exposure envelope** — the declared limits within which evidence is attributable and the letter is valid, recorded per operation class as the **depth** rating (in metres, m) and the **sea state** (Douglas/Beaufort scale).

## 4 4 Method of assessment

**4.1** The Marine & Subsea AR shall be determined as a percentage of the **applicable pool** and mapped to a letter by the bands of VRS-GEN-006 §4 (Clause 7.1). The pool is the nine sector criteria of Clause 6 (MAR-1…MAR-9, 100 points) together with the contributing intrinsic criteria of Clause 5, each scored once under its own standard and counted here at the same points. For an operation class the assessor shall add the points earned across the applicable criteria and divide by the sum of the point ranges of those same criteria; a criterion not applicable to the class (Clause 6 Applicability row; VRS-GEN-006 §6) shall be removed from both the earned points and the pool range. No weighting is applied — each criterion's point range sizes its own importance — and no separate modifiers operate on the letter: the tier limits follow from the per-criterion ceilings of Clause 6 (Clause 7.2; VRS-GEN-006 §8).

**4.2** Evidence shall be attributable to the declared **operation classes** of the assessed envelope (at minimum one of ROV tethered, AUV untethered, USV surface or hull-crawler; Clause 1.2) and to each class's declared **depth and sea-state envelope**; the AR letter covers only the assessed classes and envelopes.

**4.3** Letters shall be issued **per operation class** where evidence diverges materially between classes; the displayed sector letter shall be the **lowest issued class letter**. A class for which no letter can be issued shall be displayed as *not covered*, and the assessed **exposure envelope shall contract** to the depth and sea-state conditions the evidence actually covers rather than the score being stretched to conditions never observed.

**4.4** Evidence obtained outside a declared operation class or its depth/sea-state envelope shall be **inadmissible** as support for that class and shall not raise the score. In particular, shallow-water evidence shall not support a deep-rated envelope: survivability, pressure-boundary and comms behaviour are depth-dependent, so the case for a deep envelope shall rest on evidence at or beyond the rated depth.

## 5 5 Contributing IR criteria

**5.1** The sector pool consists of the sector criteria of Clause 6 and the following intrinsic criteria, scored once under their own standards and counted again here at the same points:

| IR CRITERION | SCORED UNDER |
|---|---|
| SF-1 | VRS-GEN-101 §6.1 |
| SF-2 | VRS-GEN-101 §6.2 |
| SF-5 | VRS-GEN-101 §6.5 |
| SF-8 | VRS-GEN-101 §6.8 |
| RL-1 | VRS-GEN-102 §6.1 |
| RL-2 | VRS-GEN-102 §6.2 |
| RL-5 | VRS-GEN-102 §6.5 |
| SV-2 | VRS-GEN-103 §6.2 |
| SV-5 | VRS-GEN-103 §6.5 |
| CY-4 | VRS-GEN-105 §6.4 |
| MS-1 | VRS-GEN-106 §6.1 |
| MS-7 | VRS-GEN-106 §6.7 |
| SI-1 | VRS-GEN-104 §6.1 |
| SI-2 | VRS-GEN-104 §6.2 |
| SI-6 | VRS-GEN-104 §6.5 |
| EC-3 | VRS-GEN-107 §6.3 |

**5.2** No other intrinsic criterion contributes. Points, ceilings and applicability of a contributing criterion are those of its own standard; where a contributing criterion is not applicable to the assessed application class it is removed from the pool for that class (VRS-GEN-006 §6).

## 6 6 Sector criteria

**6.0 Summary.** Points and tier ceilings per criterion; totals reproduce by addition.

| § | CRITERION | POINTS | UNVERIFIED CEILING | VERIFIED CEILING | CERTIFIED CEILING |
|---|---|---|---|---|---|
| 6.1 | MAR-1 Class / anchor fit (classification rules, ISO 12100) | 0–14 | 11 | 12 | 14 |
| 6.2 | MAR-2 Pressure and ingress qualification at depth | 0–14 | 9 | 12 | 14 |
| 6.3 | MAR-3 Loss-at-sea prevention | 0–12 | 8 | 10 | 12 |
| 6.4 | MAR-4 Loss-of-comms behaviour and GNSS-denied drift | 0–12 | 8 | 10 | 12 |
| 6.5 | MAR-5 Collision avoidance and surfacing protections | 0–12 | 6 | 10 | 12 |
| 6.6 | MAR-6 Launch-and-recovery deck-operation hazards | 0–10 | 7 | 8 | 10 |
| 6.7 | MAR-7 Environmental release and sensitive-site controls | 0–8 | 7 | 7 | 8 |
| 6.8 | MAR-8 Corrosion, bio-fouling and maintenance programme | 0–10 | 8 | 9 | 10 |
| 6.9 | MAR-9 Incident and loss record | 0–8 | 6 | 7 | 8 |
| | **Total** | **100** | **70** | **85** | **100** |

## 6.1 6.1 MAR-1 Class / anchor fit (classification rules, ISO 12100) (0–14)

| ROW | |
|---|---|
| What is measured | . |
| Ladder | 14 = class certificate + validated · 12 = class certificate or third-party survey public · **11 = publicly evidenced only (no pack, no demonstration)** · 9 = self-declared + internal validation · 5 = declared · 0 = not established |
| Unverified — evidence & ceiling | Class registers; DoC. **Ceiling 11.** |
| Verified — evidence & ceiling | Class documents + validation. **Ceiling 12.** |
| Certified — evidence & ceiling | — (documentary; confirmed by MAR-2/3). **Ceiling 14.** |
| Company-wide fallback | n/a |
| Evidence bar | Class and depth rating declared. |
| Applicability | ROV (tethered) · AUV (untethered) · USV (surface) · hull-crawler. MAR-6 tether items apply to tethered classes; all other criteria apply to all classes. |

## 6.2 6.2 MAR-2 Pressure and ingress qualification at depth (0–14)

| ROW | |
|---|---|
| What is measured | Hull/penetrator pressure test to declared depth with margin; ingress after cycling. |
| Ladder | 14 = witnessed pressure test (lab route) or certified with published data · 12 = certified ((public)) · 9 = test reports · 5 = declared · 0 = not established |
| Unverified — evidence & ceiling | Datasheet; certificates. **Ceiling 9.** |
| Verified — evidence & ceiling | Pressure/ingress test reports. **Ceiling 12.** |
| Certified — evidence & ceiling | Witnessed pressure-chamber test (lab route) or certificate + post-dive inspection. **Ceiling 14.** |
| Company-wide fallback | n/a |
| Evidence bar | Depth rating declared. |
| Applicability | ROV (tethered) · AUV (untethered) · USV (surface) · hull-crawler. MAR-6 tether items apply to tethered classes; all other criteria apply to all classes. |

## 6.3 6.3 MAR-3 Loss-at-sea prevention (0–12)

| ROW | |
|---|---|
| What is measured | Abort ascent/buoyancy, drop-weight, locator beacons, drift-away prevention. |
| Ladder | 12 = witnessed · **10 = pack-evidenced (documents), not demonstrated** · 9 = validated · **8 = publicly evidenced only (no pack, no demonstration)** · 6 = documented · 0 = not established |
| Unverified — evidence & ceiling | Manual. **Ceiling 8.** |
| Verified — evidence & ceiling | Validation evidence. **Ceiling 10.** |
| Certified — evidence & ceiling | Witnessed abort/beacon activation in a tank or dock. **Ceiling 12.** |
| Company-wide fallback | n/a |
| Evidence bar | Recovery aids declared. |
| Applicability | ROV (tethered) · AUV (untethered) · USV (surface) · hull-crawler. MAR-6 tether items apply to tethered classes; all other criteria apply to all classes. |

## 6.4 6.4 MAR-4 Loss-of-comms behaviour and GNSS-denied drift (0–12)

| ROW | |
|---|---|
| What is measured | Acoustic/RF loss → declared behaviour; navigation drift bounds stated and tested. |
| Ladder | 12 = witnessed · **10 = pack-evidenced (documents), not demonstrated** · 9 = validated · **8 = publicly evidenced only (no pack, no demonstration)** · 6 = documented · 0 = not established |
| Unverified — evidence & ceiling | Manual; tests. **Ceiling 8.** |
| Verified — evidence & ceiling | Validation evidence. **Ceiling 10.** |
| Certified — evidence & ceiling | Witnessed comms cut → declared behaviour. **Ceiling 12.** |
| Company-wide fallback | n/a |
| Evidence bar | Comms/navigation architecture declared. |
| Applicability | ROV (tethered) · AUV (untethered) · USV (surface) · hull-crawler. MAR-6 tether items apply to tethered classes; all other criteria apply to all classes. |

## 6.5 6.5 MAR-5 Collision avoidance and surfacing protections (0–12)

| ROW | |
|---|---|
| What is measured | Obstacle avoidance; surfacing-into-traffic checks; diver-proximity protections. |
| Ladder | 12 = witnessed · **10 = pack-evidenced (documents), not demonstrated** · 9 = validated · 6 = documented · 0 = not established |
| Unverified — evidence & ceiling | Manual; tests. **Ceiling 6.** |
| Verified — evidence & ceiling | Validation evidence. **Ceiling 10.** |
| Certified — evidence & ceiling | Witnessed obstacle avoidance and surfacing check in a controlled basin. **Ceiling 12.** |
| Company-wide fallback | n/a |
| Evidence bar | Protections declared. |
| Applicability | ROV (tethered) · AUV (untethered) · USV (surface) · hull-crawler. MAR-6 tether items apply to tethered classes; all other criteria apply to all classes. |

## 6.6 6.6 MAR-6 Launch-and-recovery deck-operation hazards (0–10)

| ROW | |
|---|---|
| What is measured | Lift points, handling procedures, tether management, pinch/crush points during LARS. |
| Ladder | 10 = witnessed procedure · 8 = documented in detail + certified lift points · **7 = publicly evidenced only (no pack, no demonstration)** · 4 = documented · 0 = not established |
| Unverified — evidence & ceiling | Manual. **Ceiling 7.** |
| Verified — evidence & ceiling | Procedures + lift-point certification. **Ceiling 8.** |
| Certified — evidence & ceiling | Witnessed launch/recovery procedure walk-through. **Ceiling 10.** |
| Company-wide fallback | n/a |
| Evidence bar | Tether items for tethered classes. |
| Applicability | ROV (tethered) · AUV (untethered) · USV (surface) · hull-crawler. MAR-6 tether items apply to tethered classes; all other criteria apply to all classes. |

## 6.7 6.7 MAR-7 Environmental release and sensitive-site controls (0–8)

| ROW | |
|---|---|
| What is measured | Fluid containment, contact-with-infrastructure protections. |
| Ladder | 8 = witnessed + certified · 7 = documented in detail · 4 = documented · 0 = not established |
| Unverified — evidence & ceiling | Datasheet; manual. **Ceiling 7.** |
| Verified — evidence & ceiling | Design evidence. **Ceiling 7.** |
| Certified — evidence & ceiling | Witnessed containment/inspection. **Ceiling 8.** |
| Company-wide fallback | n/a |
| Evidence bar | None. |
| Applicability | ROV (tethered) · AUV (untethered) · USV (surface) · hull-crawler. MAR-6 tether items apply to tethered classes; all other criteria apply to all classes. |

## 6.8 6.8 MAR-8 Corrosion, bio-fouling and maintenance programme (0–10)

| ROW | |
|---|---|
| What is measured | Published maintenance programme; anode/coating regime; post-dive inspection. |
| Ladder | 10 = witnessed inspection + programme · 9 = programme documented in detail · **8 = publicly evidenced or company-wide record** · 5 = partial · 0 = not established |
| Unverified — evidence & ceiling | Public maintenance programme. **Ceiling 8.** |
| Verified — evidence & ceiling | Programme + record. **Ceiling 9.** |
| Certified — evidence & ceiling | Witnessed post-dive inspection steps. **Ceiling 10.** |
| Company-wide fallback | Record company-wide → 8 |
| Evidence bar | None. |
| Applicability | ROV (tethered) · AUV (untethered) · USV (surface) · hull-crawler. MAR-6 tether items apply to tethered classes; all other criteria apply to all classes. |

### 6.9 6.9 MAR-9 Incident and loss record (0–8)

| ROW | |
|---|---|
| What is measured | Vehicle losses/incidents over the window. |
| Ladder | 8 = none (model) · **7 = pack-evidenced (documents), not demonstrated** · 6 = null-result rung · 5 = remediated · 0 = not established |
| Unverified — evidence & ceiling | Databases; press. **Ceiling 6.** |
| Verified — evidence & ceiling | Register + exposure. **Ceiling 7.** |
| Certified — evidence & ceiling | From Verified evidence. **Ceiling 8.** |
| Company-wide fallback | Company-wide → 6 |
| Evidence bar | Exposure or null search. |
| Applicability | ROV (tethered) · AUV (untethered) · USV (surface) · hull-crawler. MAR-6 tether items apply to tethered classes; all other criteria apply to all classes. |

## 7 7 Letter bands, tier ceilings and class applicability

**7.1 Bands (VRS-GEN-006 §4).** AAA ≥ 90 % · AA ≥ 75 % · A ≥ 60 % · B ≥ 45 % · C below 45 % of the applicable pool.

**7.2 Pool ceilings.** Sector criteria alone: Unverified 70/100 (70 %) · Verified 85/100 (85 %) · Certified 100. With the contributing criteria of Clause 5 the pool ceilings are as recorded in VRS-MAR-501; in both forms the best attainable letter is A at Unverified, AA at Verified and AAA at Certified (VRS-GEN-006 §8).

**7.3 Application classes.** ROV (tethered) · AUV (untethered) · USV (surface) · hull-crawler. MAR-6 tether items apply to tethered classes; all other criteria apply to all classes… A criterion whose Applicability row excludes the assessed class is removed from both the numerator and the denominator; the letter is issued per class and the displayed letter is the lowest (Clause 4).

**7.4** No modifiers, caps or gates operate on the letter other than the ceilings of Clause 6 and the tier rule of VRS-GEN-006 §7.

**7.5 Continued validity (formerly the survey-lapse modifier).** Where the continued-validity survey obligations of VRS-MAR-001 (continued-validity module) are not met, the issued rating changes **state** under VRS-GEN-004 / VRS-GEN-010 (refresh due, withdrawn) — it is never re-scored or shown as a lower letter. The state and the next survey due date are recorded per Clause 10; the letter itself is untouched by this clause.

# 8 8 Evidence by tier

**8.1 Unverified.** The assessor works only from evidence obtainable without the manufacturer's cooperation: datasheets, manuals and public safety documentation; the class-society registers and any public declaration of conformity (MAR-1); published pressure- and ingress-test data and IEC 60529:1989+AMD2:2013 IP figures (MAR-2); published recovery-aid, loss-of-comms and collision-avoidance descriptions (MAR-3, MAR-4, MAR-5); the public launch-and-recovery and maintenance documentation (MAR-6, MAR-8); and — for the incident-and-loss criterion (MAR-9) — casualty databases and press. Each criterion's Unverified ceiling (Clause 6) is the most an honest reading of such evidence shall earn; the AR tier is **Unverified**.

**8.2 Verified.** The assessor additionally examines a manufacturer evidence pack and shall accept, by mapping, the conformity artefacts the manufacturer already holds — adoption is a mapping, not new testing: the class-society survivability/redundancy assessment and class certificate (ABS UWV rules; DNV notation) by operation class (MAR-1); the hydrostatic pressure-cycle and ingress test reports to the declared depth with margin (MAR-2); the recovery-aid, loss-of-comms and collision-avoidance validation evidence, including the IEC 62443-4-2:2019 SL-C evaluation of the control/update link (MAR-3, MAR-4, MAR-5); the launch-and-recovery procedures with lift-point certification (MAR-6); the ISO 14224:2016 maintenance programme and record (MAR-8); and the incident-and-loss register with its exposure basis (MAR-9). Verified ceilings apply only to criteria whose pack items are present and examined; the AR tier is **Verified**.

**8.3 Certified.** The assessor witnesses the declared behaviour on the robot: a pressure-chamber test and post-dive inspection (MAR-2); an abort/beacon activation in a tank or dock (MAR-3); a comms cut resolving to the declared behaviour (MAR-4); an obstacle-avoidance and surfacing check in a controlled basin (MAR-5); a launch-and-recovery procedure walk-through (MAR-6); a containment/inspection step (MAR-7); and the post-dive inspection steps of the maintenance programme (MAR-8). The documentary criteria (MAR-1, MAR-9) carry their Certified points from the Verified evidence. The AR tier is **Certified**.

**8.4 Evidence bar.** Each criterion states an **evidence bar** (Clause 6). Where the bar is not met the criterion shall score **0** — no evidence is 0 points, never a discard from the pool. A manufacturer self-declaration shall not earn points above the rung its independent corroboration (class survey, test report) supports; MAR-1 class fit and the MAR-2 depth case shall never be inferred from evidence transferred from a shallower or narrower envelope (Clause 4.4). Where the incident-and-loss evidence (MAR-9) rests only on uninstrumented recollection rather than an instrumented register with its exposure basis, the evidence bar is not met above the null-result rung.

**8.5 Null-result rule.** For MAR-9 a recorded search of the casualty and press databases, with its coverage and exposure basis stated, shall earn the criterion's null-result rung where no adverse record is found; an unrecorded search shall not.

**8.6 Company-wide fallback.** Where a criterion offers a company-wide fallback (MAR-8, MAR-9) and model-specific evidence is unavailable, manufacturer-wide records shall earn the stated fallback points (VRS-GEN-005 §6); the substitution shall be recorded per Clause 10.

**8.7 AR tier.** The AR tier is the lowest tier among the criteria that determined the letter, and shall not exceed the model's Intrinsic Rating tier (VRS-GEN-006 §7).

## 9 9 Underwriting and credit use

**9.1** The letter is an opinion above the compliance floor, not a certification, and shall not be published or imply that any real robot holds a Veyrum rating. Class-society conformity for an operation class is scored by MAR-1 (§6.1): where evidenced class fit is absent, MAR-1 scores its low rung and the model is still rated, with the absence recorded on the result — it is not a gate on the letter.

**9.2** The per-class letters and the recorded depth/sea-state envelopes are the underwriting hooks: the letter informs rate relativity, and the covered operation classes and envelopes inform coverage scope, so that operation outside the assessed envelope is an exclusion or a condition rather than an implied covered risk. Loss drivers shall be surfaced separately so an underwriter can weigh them independently of the letter: the **total-asset-loss-at-sea severity driver** (MAR-3 — a sinking, drift-away or unrecoverable unit is the sector-defining hull severity, surfaced with its depth/sea-state envelope rather than averaged into frequency); the **third-party severity driver** (MAR-5 — a vessel, structure or diver collision claim can exceed the unit's own value); and the **correlated fleet driver** (MAR-4 — where many units share one control or update plane, one intrusion event can degrade the fleet at once, so the per-fleet accumulation attribute records whether that regime holds an IEC 62443-4-2:2019 SL-C evaluation).

**9.3** For credit, the recoverability and residual drivers shall be readable from the recorded per-criterion points to inform LTV, residual curves and end-of-support assumptions: MAR-3 governs recoverability — an unrecoverable-loss profile shall be reflected as a near-zero salvage assumption — while MAR-8 corrosion and maintenance posture and the intrinsic economics and support criteria drawn into the pool (Clause 5, EC-3 and the MS contributors) inform the residual curve and the obsolescence assumption.

## 10 10 Result recording

The rating record shall carry, per VRS-GEN-009: the displayed sector letter and the per-class letters with the depth/sea-state envelope each was issued at; the **per-criterion points** earned across the sector criteria (Clause 6) and the contributing intrinsic criteria (Clause 5); the **not-applicable set** removed for each class and the resulting applicable-pool range; the contributing intrinsic criteria used; the AR **tier**; the **edition** (VRS 2026); the VRS-MAR-501 data-twin version; the class certificates/notations relied on; the total-asset-loss-at-sea, third-party and correlated-fleet attributes (Clause 9.2); and the next continued-validity survey due dates (VRS-MAR-001 Annex C). Recording flows to the Passport per VRS-GEN-009; no personal information shall be stored (VRS-GEN-012 §5.2).

## 11 11 Assessor checklist

An assessor with this Protocol and the evidence shall reach the same result by executing the following in order; no step admits an unrecorded judgement call, and any deviation shall be recorded with its basis:

- [ ] Operation class(es) confirmed (ROV tethered / AUV untethered / USV surface / hull-crawler) with each depth/sea-state envelope (Clause 1.2; VRS-MAR-001 §4.3).
- [ ] Assessment tier fixed (Clause 8); the not-applicable set recorded per class (MAR-6 tether items for tethered classes) and the applicable-pool range computed (Clause 4).
- [ ] Contributing intrinsic criteria drawn from their source standards at their own points and tiers (Clause 5).

- [ ] **MAR-1** class / anchor fit scored; class and depth rating are declared (evidence bar); fit not inferred from a shallower or narrower envelope (Clause 4.4).
- [ ] **MAR-2** pressure and ingress qualification at depth scored; the depth rating is declared (evidence bar).
- [ ] **MAR-3** loss-at-sea prevention scored; recovery aids are declared (evidence bar).
- [ ] **MAR-4** loss-of-comms behaviour and GNSS-denied drift scored; the comms/navigation architecture is declared (evidence bar).
- [ ] **MAR-5** collision avoidance and surfacing protections scored; protections are declared (evidence bar).
- [ ] **MAR-6** launch-and-recovery deck-operation hazards scored (tether items for tethered classes).
- [ ] **MAR-7** environmental release and sensitive-site controls scored.
- [ ] **MAR-8** corrosion, bio-fouling and maintenance programme scored; company-wide fallback recorded if used.
- [ ] **MAR-9** incident and loss record scored; null-result search applied per Clause 8.5; the instrumented-register evidence bar checked (Clause 8.4); company-wide fallback recorded if used.
- [ ] Points added and divided by the applicable-pool range; letter read from the bands (Clause 7.1).
- [ ] Letters issued per class; the lowest displayed (Clause 4.3); each award held at its assessed-tier ceiling (Clause 6).
- [ ] Result recorded to the passport: per-criterion points, not-applicable set, contributors, tier, edition, twin version, class certificates relied on and the loss-driver attributes of Clause 9.2 (Clause 10).

## 12 Annex A (informative) — Worked example

> **FICTIONAL EXAMPLE — not a real product; illustrates mechanics only.**

A fictional work-class ROV, model code `MAR-RV-01`, is assessed for the **ROV (tethered)** operation class, declared to a depth envelope of 1,000 m and sea state ≤ 4, at the **Verified** tier: a manufacturer evidence pack is examined and no behaviour is witnessed. The operator holds ABS UWV-rule conformity for the tethered class, an IEC 60529:1989+AMD2:2013 IP68 ingress evaluation, a hydrostatic pressure-cycle test to 1,200 m, an IEC 62443-4-2:2019 SL-2 evaluation of the control link, and ISO 14224:2016 maintenance and loss records. All nine sector criteria apply (the tethered class includes the MAR-6 tether items), and the sixteen contributing intrinsic criteria of Clause 5 are drawn from their source standards at their own Verified points.

*Sector criteria (Verified tier).*

| § | CRITERION | VERIFIED CEILING | POINTS EARNED |
|---|---|---|---|
| 6.1 | MAR-1 | 12 | 12 |
| 6.2 | MAR-2 | 12 | 12 |
| 6.3 | MAR-3 | 10 | 9 |
| 6.4 | MAR-4 | 10 | 8 |
| 6.5 | MAR-5 | 10 | 9 |
| 6.6 | MAR-6 | 8 | 8 |
| 6.7 | MAR-7 | 7 | 7 |
| 6.8 | MAR-8 | 9 | 8 |
| 6.9 | MAR-9 | 7 | 7 |
| | **Sector subtotal** | **85** | **80** |

*Contributing intrinsic criteria (Verified tier).* Drawn at their own points, the sixteen criteria of Clause 5 have a combined range of **146 points** and a combined Verified ceiling of **119**; this model earns **106** of them, each at or below its Verified ceiling (for example SI-2 at 17 of its 19-point Verified ceiling, SF-8 at 9 of 10, and the connectivity contributor CY-4 at 6 of 7).

*Letter.* The applicable pool for the tethered class is the sector range 100 plus the contributor range 146 = **246 points**. Points earned = 80 (sector) + 106 (contributors) = **186**. As a percentage of the pool, 186 ÷ 246 = **75.6 %**, which falls in the **AA** band (≥ 75 %, below AAA's 90 %). The result is **Marine & Subsea AR: AA (VRS 2026) — Verified**.

*Tier ceiling by construction.* At the Verified tier the pool's own ceiling is (85 + 119) ÷ 246 = 204 ÷ 246 = **82.9 %**, so AA is the best letter attainable without a witnessed demonstration (Clause 7.2); AAA would require Certified-tier evidence such as a witnessed pressure-chamber test (MAR-2) and a witnessed abort/beacon activation (MAR-3). No separate modifier is applied — the ceiling does the work.

*Refusal variant.* Had `MAR-RV-01` held no class-society conformity for the tethered class, MAR-1 would score its low rung (5 for a bare declaration, 0 for none) rather than 12, and the letter would fall out of the reduced total; the model is still rated and the missing class fit is recorded on the result (Clause 9.1) rather than blocking the letter. Had only shallow-water (50 m) trial evidence been offered for the 1,000 m envelope, Clause 4.4 / 8.4 would refuse it and the envelope would contract to the depth actually evidenced; and had the continued-validity survey lapsed, the record would carry a maintenance-state change (VRS-GEN-004 / VRS-GEN-010), not a lower letter. Numbers illustrate mechanics only.

# 13 Bibliography

The full MAR class-society anchor regime (ABS UWV rules; DNV AROS notations; IACS/IMO regulatory status) is verified in VRS-MAR-001; the following are the specific anchors this Protocol's criteria and evidence tiers (Clauses 6 and 8) rest on, dated at point of use:


- IEC 60529:1989 (Ed 2.2, consolidated with AMD1:1999 + AMD2:2013) — Degrees of protection provided by enclosures (IP Code) (webstore.iec.ch/en/publication/2452) — MAR-2 ingress-integrity lane.
- IEC 60945:2002 (4th ed., 2002-08; COR1:2008) — Maritime navigation and radiocommunication equipment and systems — general requirements and methods of testing (webstore.iec.ch/en/publication/3959) — MAR-5 navigation-equipment lane.
- COLREGs — Convention on the International Regulations for Preventing Collisions at Sea, 1972 (in force 1977; as amended, latest via IMO Resolution A.1085(28) effective 1 January 2016) (imo.org/en/About/Conventions/Pages/COLREG.aspx) — MAR-5 collision-avoidance regime.
- IMO MASS Code — International Code for the Safety of Maritime Autonomous Surface Ships (adopted MSC 111; non-mandatory, in effect 1 July 2026; mandatory phase pending) (imo.org autonomous-shipping) — USV/ autoremote regime context.
- IEC 62443-4-2:2019 (edition 1.0; COR1:2022) — technical security requirements for IACS components (SL-C against FR1–FR7) (webstore.iec.ch/publication/34421) — MAR-4 control/update-plane cyber lane.
- ISO 14224:2016 — Collection and exchange of reliability and maintenance data for equipment (iso.org/standard/64076.html) — MAR-8/MAR-9 reliability, maintenance and loss lane.
- ISO 8373:2021 — Robotics — Vocabulary (iso.org/standard/75539.html) — robot-term basis.
- VRS-MAR-501 — machine-readable data twin of this Protocol (Clause 5/6/7 values).

## 14 Change history

| DATE | VERSION | STATUS | CHANGE | AUTHORITY |
|---|---|---|---|---|
| 2026-09-16 | 1.0.0 | Draft | VRS 2026 rewrite: replaced the re-weighted-mean scoring (Clauses 4–8) with a point-summed pool — nine sector criteria MAR-1…MAR-9 (100 points; Clause 6) plus the named contributing intrinsic criteria (Clause 5), expressed as a percentage of the applicable pool and mapped to a letter by VRS-GEN-006 §4; added per-criterion tier ceilings, the letter-band/pool-ceiling/class-applicability clause (Clause 7), evidence-by-tier (Clause 8), a regenerated Verified-tier worked example (Annex A) and a per-criterion checklist (Clause 11); adopted the operation classes (ROV tethered / AUV untethered / USV surface / hull-crawler) with the MAR-6 tether items applying to tethered classes. Re-anchored the former §7 modifiers into criterion rungs and general clauses (7.1 class-rule-fit cap → MAR-1 §6.1 low rung, robot still rated per §9.1; 7.2 envelope-mismatch contraction → §4.3/§4.4; 7.3 survey-lapse state → maintenance-state change under VRS-GEN-004/VRS-GEN-010, §8/§10). Dropped the mission-hours exposure denominators from procedures; retired the earlier draft's confidence bands, provisional flags, renormalisation, weighted-mean, assessed-unrated and stage-prior markers; dropped the GEN-201/GEN-202 references. VRS-MAR-501 data twin regenerated by the dispatcher from Clauses 5–7; see GEN-005 §6. | VRS 2026 rewrite Stage 4 |
| 2026-09-14 | 0.2.0ε1 | Draft | COHERENCE: corrected stale exposure cross-reference in §8.1 — "VRS-GEN-012 §4.1" (evidence-grade scale) → §7 (Exposure and denominators). Editorial only; no requirement, weight, band, or constant changed; twin VRS-MAR-501 unaffected. | Curator Run #159; charter COHERENCE |
| 2026-09-12 | 0.2.0 | Draft | DEEPEN: brought to publishable depth on the VRS-SVC-201 v0.2.0 exemplar. Added mission-hours exposure denominator with per-L&R-evolution H5 rule (§8.1), evidence-lane conformity-artefact reuse (§8.2, dated anchors verified 2026-09-12: IEC 60529:1989, IEC 60945:2002, COLREGs 1972, IMO MASS Code 2026, IEC 62443-4-2:2019, ISO 14224:2016, ISO 8373:2021), per-criterion loss-driver mapping incl. total-asset-loss-at-sea and third-party collision severities (§5.2), admissibility/refusal gates and depth-envelope contraction (§4.3/§4.4/§7/§8.4), underwriting/credit use (§9, GEN-009), passport | Curator Run #73; charter DEEPEN |

| DATE | VERSION | STATUS | CHANGE | AUTHORITY |
|---|---|---|---|---|
| | | | recording (§10), assessor checklist (§11), worked example producing per-class letters (Annex A), dated Bibliography. Retired all bare pending markers → stage labels (VRS-GEN-202). No weight, band or sufficiency-constant value changed. Twin VRS-MAR-501 regenerated to 0.2.0. Net +≈2,400 words; shall 2→~30. No requirements deleted. | |
| 2026-09-05 | 0.1.0 | Draft | Initial draft — MAR rubric; depth-envelope contraction; survey-lapse state rule | CEO goal 2026-09-05 |

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