



DPC: 25/30473196 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

Date: 18 April 2025

Origin: International

Latest date for receipt of comments: 11 June 2025

Project No. 2023/00923

Responsible committee: SME/32 Ships and marine technology - Steering committee

Interested committees:

Title: BS ISO 20682 Draft of Autonomous Underwater Vehicles - Risk and Reliability.

Please notify admin.start@bsigroup.com if you are aware of any keywords that might assist in clarifying or identifying the standard or of the content of this standard:

- i) has any issues related to 3rd party IPR, patent or copyright
- ii) affects other national standard(s)
- iii) requires additional national guidance or information

WARNING: THIS IS A DRAFT AND MUST NOT BE REGARDED OR USED AS A BRITISH STANDARD. THIS DRAFT IS NOT CURRENT BEYOND 11 June 2025

This draft is issued to allow comments from interested parties; all comments will be given consideration prior to publication. No acknowledgement will normally be sent. **See overleaf for information on the submission of comments.**

No copying is allowed, in any form, without prior written permission from BSI except as permitted under the Copyright, Designs and Patent Act 1988 or for circulation within a nominating organization for briefing purposes. Electronic circulation is limited to dissemination by e-mail within such an organization by committee members.

Further copies of this draft may be purchased from BSI Shop <http://shop.bsigroup.com> or from BSI Customer Services, Tel: +44(0) 20 8996 9001 or email cservices@bsigroup.com. British, International and foreign standards are also available from BSI Customer Services.

Information on the co-operating organizations represented on the committees referenced above may be obtained from <https://standardsdevelopment.bsigroup.com/>.

E-mail: admin.start@bsigroup.com

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
------------------	------------------------

1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 20682

Autonomous Underwater Vehicles — Risk and Reliability

ICS: 47.080

ISO/TC 8/SC 13

Secretariat: **SAC**

Voting begins on:
2025-04-18

Voting terminates on:
2025-07-11

This document is circulated as received from the committee secretariat.

THIS DOCUMENT IS A DRAFT CIRCULATED FOR COMMENTS AND APPROVAL. IT IS THEREFORE SUBJECT TO CHANGE AND MAY NOT BE REFERRED TO AS AN INTERNATIONAL STANDARD UNTIL PUBLISHED AS SUCH.

IN ADDITION TO THEIR EVALUATION AS BEING ACCEPTABLE FOR INDUSTRIAL, TECHNOLOGICAL, COMMERCIAL AND USER PURPOSES, DRAFT INTERNATIONAL STANDARDS MAY ON OCCASION HAVE TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL TO BECOME STANDARDS TO WHICH REFERENCE MAY BE MADE IN NATIONAL REGULATIONS.

RECIPIENTS OF THIS DRAFT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.

Reference number
ISO/DIS 20682:2025(en)

© ISO 2025



Documents

Document Sharing Hub



COPYRIGHT PROTECTED DOCUMENT

© ISO 2025

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Abbreviated terms	4
5 General Requirements	4
5.1 Control	4
5.2 Sensors	4
5.3 Structure	4
5.4 Mechanical moving elements	5
5.5 Power	5
5.6 Navigation and communication	5
5.7 Product identification and traceability	6
6 Digital Mission Engineering	6
6.1 Extreme mission	6
6.2 Simulation, verification, and validation	7
6.2.1 Virtual testing	7
6.2.2 Maximum Allowable Uncertainties	7
7 Fault tree analysis	8
7.1 Markov chain: state transition	9
8 Strategy for risk assessment and risk reduction	9
8.1 Communication for Safety	10
8.2 Hardware Controls	10
8.3 Judgment	10
8.4 Reasonableness check	10
8.5 Search, Rescue and Recovery	11
8.6 Signal Filtering	11
8.7 Dependability engineering	11
8.8 Safety case	11
Annex A (informative) Reliability engineering mathematical background	13
Annex B (Informative) Design, verification, and testing philosophy for AUVs	17
Annex C (Informative) Parallels to Autonomous Land Vehicles	19
Bibliography	20

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 8 *Ships and Marine Technology*, Subcommittee SC 13, *Marine Technology*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Autonomous Underwater Vehicles (AUVs) are unmanned vehicles. They rely on sensors, control units, and mechanical parts to maneuver and complete mostly pre-defined tasks in the ocean environment. A rapidly growing trend in underwater technology is to face the “extreme environment”. The side-effect, however, would be a higher risk and probability of failure. The capacity to perform an extreme mission is unknown for unmanned underwater vehicles. Usually, a team of experts works the vehicle within a trial-and-error process to 1. Achieve the system identification, and 2. Measure (most of the time qualitatively) the reliability of the AUV for a specific mission.

So, the capacity of an AUV to perform an extreme mission is being questioned here in order to provide tips and advice for knowing and identifying this capacity. As such, the vehicle's owner and operator can refer to this document to gain confidence in designing any mission for it. Note that risk and reliability by nature are probabilistic. The present material serves as a linkage between the capabilities of the vehicle and its intended mission. With the assistance of such a bridge in ideas and actions, one can avoid many foreseeable undesired settings and circumstances. As helpful as this is, any faults and failures of the vehicle are, to some extent, due to uniquely encountered states that have never been observed before. One solution is the dynamic risk analysis and the online topic models that can expand the operational proficiency of an autonomous vehicle.

Autonomous Underwater Vehicles — Risk and Reliability

1 Scope

This standard is developed to link product engineering and the successful performance of an autonomous underwater vehicle, in an underwater expedition that is increasing in difficulty level. While these vehicles have been and are being manufactured by many companies all around the globe for several decades, their risk of failure, safety, and reliability in the sea is not commonly discussed as a standard summary of information. The scope of this standard is to define risks and reliability of an AUV in its underwater realm. Excluded from this standard are any subjects related to the manufacturing and/ or operation of the following items:

- Autonomous underwater gliders (AUGs) as they use a narrowly modifiable set of operational commands.
- Batteries for the use of AUVs.
- Electrical motors for the use of AUVs.

NOTE sensors, communication devices, and any other pieces and parts directly influencing the “digital mission” of the vehicle must be held responsible for its risk of failure and are not excluded from the scope of this standard. The success of a digital mission means that a successful algorithm conducts the vehicle to achieve its sequential and final goal.

NOTE In developing this standard, it is assumed that AUVs are no risk to human lives including divers, swimmers and/or any personnel and crew working at sea. If in the future a different case is prevailing, this standard needs to be updated according to the safety of human life.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 abort

To terminate, in a controlled manner, a processing activity in a computer system because it is impossible, or undesirable, or unsafe for an activity to proceed^[1].

3.2 availability

The degree to which a system or resource is ready when needed.

3.3 backout and Recovery

Accidents have a life cycle; the adverse sequence is initiated and it progresses until the sequence is stopped by early action or the sequence progresses until harm occurs. Backout and recovery activities are conducted to bring the system back to a stable state, ending the accident life cycle.