



NATIONAL FIRE PROTECTION ASSOCIATION

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AGENDA

NFPA Technical Committee on Motor Craft (MOR-AAA) NFPA 302 Second Draft Meeting (A-2024)

Thursday, 19 October 2023
10:00 a.m. – 4:00 p.m. (Eastern)

Web-Teleconference (MS Teams)
To join the meeting, please contact ksmith@nfpa.org

1. **Call to order and Welcome.** John McDevitt, Chairman.
2. **Introductions.** Roll call of members participating in this meeting and any guest. Please note, telephone and email addresses of Committee Members are not included in this agenda. Kindly advise Ms. Kristi Smith, Committee Administrator, of any changes to your telephone or email contact information. [\[See Committee Roster beginning on Page 04 of 63\]](#)
3. **Staff liaison report.** Lawrence B. Russell, Principal Specialist.
 - a. **Review of general procedures for this meeting.** [\[See Second Draft Development Information beginning on Page 06 of 63\]](#)
 - b. **Review the Second Draft balloting process.** [\[See Second Draft Balloting Information beginning on Page 09 of 63\]](#)
4. **Previous meeting minutes.** A-2024 First Draft Meeting on 18 October 2022, MS teams Web-Teleconference. [\[See NFPA 302 A2020 First Draft Minutes beginning on Page 11 of 63\]](#)
5. **NFPA 302 Second Draft. Public Comments.** [\[See Public Comments beginning on Page 14 of 63\]](#)
 - a. Chapter 9 – (1) Public Comment - Table 9.12.5.a (PC-5)
 - b. Chapter 10 – (1) Public Comment - Table 10.12.6 (PC-4)
 - c. Chapter 13 – (6) Public Comments
 - i. (2) Public Comments for Section 13.1 (PC-10, PC-6)
 - ii. (2) Public Comments for Section 13.3 (PC-2, PC-9)
 - iii. (1) Public Comment for Section 13.3.1 (PC-7)
 - iv. (1) Public Comment for Section 13.3.7 (PC-8)

6. Committee Input Review. The following Committee Input was developed at the NFPA 302-A2024 First Draft Meeting on 18 October 2022. [\[See Committee Input items beginning on Page 47 of 63\]](#)

- a. Committee Input No. 9-NFPA 302-2022 [New Section after 5.4]
- b. Committee Input No. 11-NFPA 302-2022 [Section 9.12.5]
- c. Committee Input No. 12-NFPA 302-2022 [Section 12.1.2.1]
- d. Committee Input No. 13-NFPA 302-2022 [New Section after 13.3]

7. Other Business - Task Group Reports.

- a. Task Group on NFPA 302 Lithium-Ion Battery Hazards.
 - i. Participants: Christopher Bloom (Chairman), James Cote, Brian Goodwin, Richard Jones, and Kelly Nicolello (UL).
 - ii. Purpose: This task group is responsible developing recommendation(s) for revisions related to lithium-ion battery powered devices that may be on boats. Any recommendation(s) shall be presented to the Committee on Motor Craft at the Second Draft meeting. Public Comment(s) shall be submitted no later than 05/31/2023. [\[See TG Minutes & Work Product beginning on Page 55 of 63\]](#)
- b. Task Group on NFPA 302 Conductor CM Area Table.
 - i. Participants: Chair: John McDevitt (Chairman), Richard Jones, and Jim Pryor.
 - ii. Purpose: This task group is responsible for revising Table 9.12.5(a) Conductor Circular Mil (CM) Area and Stranding (for Electrical Systems Under 50 Volts); and Table 10.12.5 Conductor Circular Mil (CM) Area and Stranding (for Alternating Current (ac) Electrical Systems on Boats) to reflect consistency of the data that is found within each table. The revisions to the Tables will be submitted as a Public Comment for consideration at the Second Draft meeting. Deadline for Public Comment is: 05/31/2023.
- c. Task Group on NFPA 302 Fire Protection Requirements.
 - i. Participants: Scott Berry, Lisa Cockerill, Perry DeYoung, and Kelly Nicolello.
 - ii. Purpose: This task group is responsible for assessing the fire protection requirements that are within the Standard and, as necessary, develop revisions to be submitted as a Public Comment for consideration at the Second Draft meeting. The deadline for Public Comment is: 05/31/2023.
- d. Task Group on NFPA 302 Fire and Smoke Detection Requirements.

- i. Participants: Kenneth Weinbrecht (Chairman), Scott Berry, and Brian Goodwin.
 - ii. Purpose: This task group will review the existing fire and smoke detection requirements within NFPA 302 as well as but not limited to those found in ISO 9094, Small Craft Fire Protection; and ABYC Standards. The task group is responsible developing revisions as necessary to be submitted as a Public Comment as for consideration at the Second Draft meeting. Deadline for Public Comment is: 05/31/2023.
8. **Future meetings.** The back-up date for the Second Draft Meeting (to complete any unfinished items) will be Friday, 20 October 2023.
9. **Adjournment.**

Address List No Phone

09/19/2023
Lawrence Russell
MOR-AAA

Motor Craft

John J. McDevitt Chair 440 Hampshire Road Drexel Hill, PA 19026	C 4/17/2002 MOR-AAA	Scott M. Berry Principal National Marine Manufacturers Association (NMMA) 249 Kitdare Drive Delaware, OH 43015 Alternate: Robert E. Newsome	M 08/08/2019 MOR-AAA
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Anthony R. Carli Principal Everett Fire Department Chief 384 Broadway Everett, MA 02149	E 12/02/2020 MOR-AAA	Lisa M. Cockerill Principal Mississauga Fire & Emergency Services 300 City Centre Drive 2nd Floor, Fire Prevention Mississauga, ON L5B 3C1 Canada	U 08/08/2019 MOR-AAA
James Coté Principal Coté Marine LLC 260 Brushed Dune Circle Freeport, FL 32439	SE 03/07/2013 MOR-AAA	Joseph A. Derie Principal SW Passage Marine Surveys 1205 SE 57th Avenue Portland, OR 97215 National Association of Marine Surveyors, Inc.	I 10/29/2012 MOR-AAA
Perry Roy Deyoung Principal Fireboy Xintex, Inc. O-379 Lake Michigan Drive Nw Grand Rapids, MI 49534	M 12/07/2021 MOR-AAA	Dwight Escalera Principal Executive Marine Services 64 Deer Trail Road Wakefield, RI 02879	SE 08/08/2019 MOR-AAA
Charles Fort Principal Boat U.S. 880 South Pickett Street Alexandria, VA 22304	C 7/23/2008 MOR-AAA	Brian Goodwin Principal American Boat & Yacht Council 613 Third Street, Suite 10 Annapolis, MD 21403-3248 Alternate: David Broadbent	M 08/17/2015 MOR-AAA
Casey O. Housley Principal Sanders Warren Russell & Scheer LLP 40 Corporate Woods 9401 Indian Creek Parkway Suite 1250 Overland Park, KS 66210	SE 10/29/2012 MOR-AAA	Alan Ross Huguenot Principal Alan Ross Huguenot, Inc. 425 Burnett Avenue San Francisco, CA 94131	IM 8/9/2011 MOR-AAA

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Motor Craft

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Lawrence Russell	1/6/2005		
Staff Liaison National Fire Protection Association One Batterymarch Park Quincy, MA 02169-7471	MOR-AAA		

The following extracts are from *NFPA Regulations Governing the Development of NFPA Standards*, August 2022.

4.4 Committee Activities: Comment Stage.

4.4.1 Introduction.

(a) Development of the Second Draft. During the Comment Stage, the responsible technical committee will develop a second draft, which incorporates any changes to the first draft developed by the technical committee. The revisions in the second draft shall be segmented into a series of second revisions, and each such second revision shall be accompanied by a committee statement. Second revisions shall be developed during the consideration of Public Comments and correlating notes and through other deliberations of the technical committee and correlating committee as further set forth in this chapter.

(b) Purpose of and Action on Public Comments. In developing the second draft, the technical committee reviews and considers all Public Comments. The Comment Stage is the period in which technical committees are required to give consideration to the written views and objections of all Public Commenters and to make efforts to resolve objections within the meaning of the ANSI Essential Requirements. In order to receive consideration of views on and objections to the first draft, an appropriate Public Comment must be submitted during the Comment Stage, and the technical committee shall be required to provide a response to all Public Comments in accordance with these regulations. Any issue raised during the Input Stage but not followed up with the submission of an appropriate Public Comment shall be considered resolved.

4.4.4 Content of Public Comments.

4.4.4.1 Public Comments shall be limited to proposing revisions to the first draft.

4.4.4.2 Public Comments must be related to material that has received public review either through the submission of Public Input, Committee Input, or Correlating Input or through the first revisions. The technical committee may reject but hold any Public Comment that introduces “new material” or that has not had adequate public review. See 4.4.8.3.

4.4.8 Technical Committee Consideration and Action on Public Comments.

(a) Consideration of all Public Comments shall be given by the affected technical committee at a duly called committee meeting, unless the chair, in consultation with the staff liaison, determines that the Public Comments are of such nature that consideration can be given without a meeting.

(b) The technical committee shall develop a committee action on each comment (see 4.4.8.1) and a corresponding committee statement to support that committee action (see 4.4.8.2); where the committee’s position results in further changes in the text of the NFPA Standard, the technical committee shall incorporate the new text into one or more second revisions (see 4.4.9). The committee actions and committee statements developed at the meeting shall be supported by a simple majority of the meeting vote and shall not be subject to a ballot. Second revisions shall be supported at least by a simple majority of the meeting vote and shall be considered preliminary and subject to approval through a ballot (see 4.4.10).

4.4.8.1 Available Technical Committee Actions on Comments. The actions on comments available to the technical committee and the results of these actions are as follows:

(a) Accept the Comment.

(1) Action: The technical committee takes this action when it decides to accept the text proposed in the Public Comment exactly as submitted.

(2) Result: The Public Comment is marked as “Accept,” and the proposed text is incorporated into one or more second revisions.

(b) Reject the Comment, But See Related Second Revision.

(1) Action: The technical committee takes this action when it agrees with the concept of the Public Comment in whole or in part but has developed related text in one or more second revisions that is different from the text in the Public Comment.

(2) Result: The Public Comment is marked as “Reject But See” and a reference is provided to the related second revision(s).

(c) Reject the Comment.

(1) Action: The technical committee takes this action when it disagrees with the proposed changes in the Public Comment.

(2) Result: The Public Comment is marked as “Reject” and no second revision is developed.

(d) Reject But Hold the Comment.

(1) Action: The technical committee takes this action when it decides to reject the Public Comment, but hold it for processing as a Public Input for the next revision cycle in accordance with Section 4.4.8.3.

(2) Result: The comment is marked as “Reject But Hold,” and no second revision is developed.

4.4.8.2 Committee Statements on Comments. The technical committee shall develop a committee statement for all its actions on comments. Committee statements supporting committee actions shall preferably be technical in nature and shall be sufficiently detailed so as to convey the committee’s rationale for its action. Committee statements may consist, in whole or in part, of a cross-reference to committee statements on other comments and second revisions.

4.4.8.3 Reject But Hold the Comment(s).

4.4.8.3.1 Criteria for Hold. The technical committee shall reject but hold for processing as Public Input for the next revision cycle, in accordance with 4.4.8.1(d), a Public Comment that meets any of the following criteria:

(a) It would introduce a concept that has not had public review by being included in a related input or first revision as shown in the first draft.

(b) It would change the text from the first draft to the point that the technical committee would have to restudy the text of the first draft.

(c) It would propose something that could not be properly handled within the timeframe for processing the second draft.

4.4.8.3.2 Basis for Reject But Hold. In determining whether to reject but hold a Public Comment pursuant to 4.4.8.3, the technical committee may consider any relevant factors including but not limited to the extent to which the Public Comment proposes a change that is new or substantial, the complexity of the issues raised, and whether sufficient debate and public review has taken place.

The following extracts are from *NFPA Regulations Governing the Development of NFPA Standards*, August 2022.

4.4.9.6 Preparation of Second Draft for Balloting and Publication.

4.4.9.6.1 When the technical committee has completed its work, NFPA staff shall prepare the complete second draft showing individual revisions for balloting (with associated committee statements) and for eventual publication in the second draft report. Committee statements shall be included in the second draft report, but are not balloted by the committee.

4.4.9.6.2 Prior to the ballot, the second draft and individual revisions shall be reviewed by NFPA staff for editorial consistency and conformance with the Manual of Style for NFPA Technical Committee Documents, and any required editorial changes shall be incorporated into the text of the second draft and individual revisions prior to balloting.

4.4.9.6.3 If, in the course of editorial review, NFPA staff make an editorial change to text that is not part of a second revision, staff may, if committee review is deemed advisable, designate the affected text as a second revision. A notice shall be attached to such a revision indicating that it was developed by staff for editorial purposes.

4.4.10 Technical Committee Balloting on the Second Draft.

4.4.10.1 Ballot on Revisions. Each revision contained in the second draft shall be submitted to a ballot of the technical committee and shall require a two-thirds affirmative vote. The ballot results shall be handled as follows:

(a) Ballot of All Second Revisions. Each second revision shall be submitted to a ballot of the technical committee. Result: Second revisions that pass ballot are included as second revisions in the second draft. When a second revision fails ballot, the changes proposed in the failed second revision are rejected and are deleted from the second draft. A second revision that fails ballot shall be designated as a committee comment, marked as Reject, and published in the comment section of the second draft report with a notation that text proposed in the committee comment was contained in a proposed second revision that failed ballot and is not included in the second draft.

(b) Reballoting of Certain First Revisions. When a first revision has no related second revisions, the committee may decide, through a meeting vote requiring at least one-third support, to reballot a first revision to determine whether it still has the required support of the committee. Result: First revisions that pass ballot are included as second revisions in the second draft. When a first revision fails ballot, the text affected by the first revision returns to previous edition text; if no previous edition text exists, the first revision shall be deleted. A first revision that fails ballot shall be designated as a committee comment, marked as Reject, and published in the comment section of the second draft report with notation that the committee comment represents a failed reballot of a first revision.

(c) Treatment of Global Revisions. Global revisions are balloted in the same manner as other revisions, and a global revision that passes ballot is applied, as directed, throughout the standard, independently of the results of balloting on other revisions.

4.4.11.4 Preparation of Second Draft for Balloting.

4.4.11.4.1 When the correlating committee has completed its work, NFPA staff shall prepare the complete second draft showing individual second correlating revisions for balloting (with associated committee statement) and for eventual publication in the second draft report. Committee statements shall be included in the second draft report, but are not balloted by the committee.

4.4.11.4.2 Prior to the ballot, the second draft and individual second correlating revisions shall be reviewed by NFPA staff for editorial consistency and conformance with the Manual of Style for NFPA Technical Committee Documents, and any required editorial changes shall be incorporated into the text of the second draft and individual second correlating revisions prior to balloting.

4.4.11.4.3 If, in the course of editorial review, NFPA staff make an editorial change to text that is not part of a second correlating revision, staff may, if committee review is deemed advisable, designate the affected text as a second correlating revision. A notice shall be attached to such a revision indicating that it was developed by staff for editorial purposes.

4.4.12 Publication of Public Comments and Second Draft. Technical committee reports shall be published as follows:

(a) Form and Content of Second Draft Report. At the conclusion of ballot of the second draft and related comments and revisions, a second draft report shall be created in a form suitable for online publication that contains all content designated for publication within these regulations.

(b) Submission of Second Draft. The second draft report shall be submitted to the Standards Council Secretary for publication in the NFPA Standards development site within the timeframe established by the published calendar of the NFPA.

(c) Publication and Distribution of the Second Draft and the Technical Committee Report. The NFPA shall make available and publicize the availability of the second draft report. Notice of the availability shall be published.



NATIONAL FIRE PROTECTION ASSOCIATION

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MINUTES

Technical Committee on Motor Craft (MOR-AAA) NFPA 302 First Draft Meeting (A2024)

18 October 2022
08:15 – 14:10 (Eastern Daylight Time)

Microsoft Team Web-meeting

1. **Call to order.** Mr. John McDevitt, Chairman, called the meeting to order at 08:15 on 18 October 2022.
2. **Introductions.** Attendees introduced themselves and identified their affiliation and NFPA staff took attendance. A participant list is provided on page 3 of these minutes.
3. **Chair report.** Mr. McDevitt welcomed attendees and thanked them for their contributions and efforts during this revision cycle for NFPA 302, *Fire Protection Standard for Pleasure and Commercial Motor Craft*.
4. **Staff liaison report.** At the direction of the Chair, Mr. Lawrence Russell provided an overview of the standards development process, and overview of the meeting and the revision cycle schedule.
5. **Previous meeting minutes.** The minutes from 25 September 2018 Second Draft Meeting were approved without revision.
6. **NFPA 302 First Draft.**
 - a. **Review of Public Inputs.** The Technical Committee reviewed 26 Public Inputs; and developed 19 First Revisions, and 4 Committee Inputs. These will be available in the First Draft Report at www.nfpa.org/302 .

There were no task group reports or recommendations presented at this meeting.
 - b. **New task groups.** The following task groups were appointed to work subsequent to the meeting:
 - i. **Lithium-Ion Electric Motor Propulsion.** TG Chair: Christopher Bloom. Members: James Cote, Brian Goodwin, Richard Jones and Kelly Nicolello (UL). This task group is responsible developing revisions to be submitted as a Public Comment as necessary for consideration at the Second Draft meeting. Deadline for Public Comment is: 05/31/2023. Other members of the Committee and members of the public are welcome to participate in this task group. Interested persons should contact the NFPA Staff Liaison for NFPA 302 for more information.

- ii. **NFPA 302 Conductor CM Area Table Revision.** TG Chair: J. McDevitt. Members: R. Jones and J. Pryor. This task group is responsible for revising Table 9.12.5(a) Conductor Circular Mil (CM) Area and Stranding (for Electrical Systems Under 50 Volts); and Table 10.12.5 Conductor Circular Mil (CM) Area and Stranding (for Alternating Current (ac) Electrical Systems on Boats) to reflect consistency of the data that is found within each table. The revisions to the Tables will be submitted as a Public Comment for consideration at the Second Draft meeting. Deadline for Public Comment is: 05/31/2023. Other members of the committee and members of the public are welcome to participate in this task group. Interested persons should contact the NFPA Staff Liaison for NFPA 302 for more information.
 - iii. **NFPA 302 Fire Protection Requirements.** TG Chair: TBD. Members: Scott Berry, Lisa Cockerill, Perry Deyoung, and Kelly Nicoletto (UL). This task group is responsible for assessing the fire protection requirements that are within the Standard and, as necessary, develop revisions to be submitted as a Public Comment for consideration at the Second Draft meeting. The deadline for Public Comment is: 05/31/2023. The task group is open for participation by other members of the committee and other persons who are not members of the Committee. Interested persons should contact the NFPA Staff Liaison for NFPA 302 for more information.
 - iv. **NFPA 302 Fire and Smoke Detection Requirements.** TG Chair: Kenneth Weinbrecht. Members: Scott Berry, and Brian Goodwin. This task group will review the existing fire and smoke detection requirements within NFPA 302 as well as but not limited to those found in ISO 9094, Small Craft Fire Protection; and ABYC Standards. The task group is responsible developing revisions as necessary to be submitted as a Public Comment as for consideration at the Second Draft meeting. Deadline for Public Comment is: 05/31/2023. The task group is open for participation by other members of the committee and other persons who are not members of the Committee. Interested persons should contact the NFPA Staff Liaison for NFPA 302 for more information.
7. **Future meetings.** The next committee meeting for developing the second draft of the 2025 edition of NFPA 302 will be after 01 June 2023 and before 22 November 2023. A meeting notification will be posted at www.nfpa.org/302 when the next meeting is scheduled.
8. **Adjournment.** The meeting was adjourned at 14:10 on 18 October 2022.

Attendees**Committee Members:**

McDevitt, John	Chair	
Berry, Scott	Principal	National Marine Manufacturers Association
Bloom, Christopher	Principal	CJB Fire Consultants
Bowman, David	Principal	Bowman Global Enterprise Group
Cockerill, Lisa	Principal	Mississauga Fire & Emergency Services
Coté, James	Principal	Coté Marine LLC
Deyoung, Perry	Principal	Fireboy Xintex, Inc.
Goodwin, Brian	Principal	American Boat & Yacht Council
Jones, Richard	Principal	Forensic Investigations Group, LLC
MacCartney, Kim	Principal	Marine Claims Technical Services
Pryor, Jim	Alternate (for J Coté)	James M Pryor Consulting
Seifert, Charles	Principal	Miami Dade Fire Rescue
Weinbrecht, Kenneth	Principal	Society of Accredited Marine Surveyors
Russell, Lawrence	Staff Liaison	National Fire Protection Association

Total number of principal members participating: 12



Public Comment No. 5-NFPA 302-2023 [Section No. 9.12.5]

9.12.5

Conductors and flexible cords shall be stranded copper according to Table 9.12.5(a) and shall be sized in accordance with Table 9.12.5(b).

Table 9.12.5(a) Conductor Circular Mil (CM) Area and Stranding (for Electrical Systems Under 50 Volts)

<u>Conductor Size (AWG)</u>	<u>Minimum Acceptable CM Area^a</u>	<u>Minimum Number of Strands</u>	
		<u>Type 2^b</u>	<u>Type 3^c</u>
18	1,537	16	—
16	2,336	19	26
14	3,702	19	41
12	5,833	19	65
10	9,343	19	105
8	14,810	19	168
6	25,910	37	266
4	37,360	49	420
2	62,450	127	665
1	77,790	127	836
1/0	98,980	127	1064
2/0	125,100	127	1323
3/0	158,600	259	1666
4/0	205,500	418	2107

Note: Metric wire sizes are to be used if of equivalent circular mil area. If the circular mil area of the metric conductor is less than that specified, the wire ampacity can be corrected based on the ratio of the circular mil area.

^aApplies only to systems under 50 volts.

^bConductors with Type 2 stranding, used for general-purpose wiring, which is subject to some movement from vibration or minor flexing.

^cConductors with Type 3 stranding, used for any wiring where flexing is involved in normal use.

Table 9.12.5(b) Allowable Amperage of Conductors for Under 50 Volts

<u>Conductor Size</u>		<u>Temperature Rating of Conductor Insulation</u>								
		<u>60°C (140°F)</u>		<u>75°C (167°F)</u>		<u>80°C (176°F)</u>		<u>90°C (194°F)</u>		<u>105°C</u>
<u>English</u>	<u>Metric</u>	<u>Outside Engine Spaces</u>	<u>Inside Engine Spaces</u>	<u>Outside Engine Spaces</u>	<u>Inside Engine Spaces</u>	<u>Outside Engine Spaces</u>	<u>Inside Engine Spaces</u>	<u>Outside Engine Spaces</u>	<u>Inside Engine Spaces</u>	<u>Outside Engine Spaces</u>
18	0.8	10	5.8	10	7.5	15	11.7	20	16.4	20
16	1	15	8.7	15	11.3	20	15.6	25	20.5	25
14	2	20	11.6	20	15.0	25	19.5	30	24.6	35
12	3	25	14.5	25	18.8	35	27.3	40	32.8	45
10	5	40	23.2	40	30.0	50	39.0	55	45.1	60
8	8	55	31.9	65	48.8	70	54.6	70	57.4	80
6	13	80	46.4	95	71.3	100	78.0	100	82.0	120

<u>Conductor Size</u>		<u>Temperature Rating of Conductor Insulation</u>								
		<u>60°C (140°F)</u>		<u>75°C (167°F)</u>		<u>80°C (176°F)</u>		<u>90°C (194°F)</u>		<u>105°C</u>
<u>English</u>	<u>Metric</u>	<u>Outside Engine Spaces</u>	<u>Inside Engine Spaces</u>	<u>Outside Engine Spaces</u>	<u>Inside Engine Spaces</u>	<u>Outside Engine Spaces</u>	<u>Inside Engine Spaces</u>	<u>Outside Engine Spaces</u>	<u>Inside Engine Spaces</u>	<u>Outside Engine Spaces</u>
4	19	105	60.9	125	93.8	130	101.4	135	110.7	160
2	32	140	81.2	170	127.5	175	136.5	180	147.6	210
1	40	165	95.7	195	146.3	210	163.8	210	172.2	245
0	50	195	113.1	230	172.5	245	191.1	245	200.9	285
00	62	225	130.5	265	198.8	285	222.3	285	233.7	330
000	81	260	150.8	310	232.5	330	257.4	330	270.6	385
0000	130	300	174.0	360	270.0	385	330.3	385	315.7	445

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Suggested_replacement_table_for_10.12.5_and_9.12.5_a_.docx	Replacement table for 9.12.5(a) and Table 10.12.5	✓

Statement of Problem and Substantiation for Public Comment

For consistency, Table 9.12.5(a) should be combined with Table 10.12.5, which will effectively add one column to each of these tables. The same table will be placed in both sections, and reflect both nominal and minimum areas.

Related Item

- CI-11-NFPA302-2022

Submitter Information Verification

Submitter Full Name: Richard Jones

Organization: Forensic Investigations Group,

Street Address:

City:

State:

Zip:

Submission Date: Tue May 30 17:05:33 EDT 2023

Committee: MOR-AAA

Copyright Assignment

I, Richard Jones, hereby irrevocably grant and assign to the National Fire Protection Association (NFPA) all and full rights in copyright in this Public Comment (including both the Proposed Change and the Statement of Problem and Substantiation). I understand and intend that I acquire no rights, including rights as a joint author, in any publication of the NFPA in which this Public Comment in this or another similar or derivative form is used. I hereby warrant that I am the author of this Public Comment and that I have full power and authority to enter into this copyright assignment.

By checking this box I affirm that I am Richard Jones, and I agree to be legally bound by the above Copyright Assignment and the terms and conditions contained therein. I understand and intend that, by checking this box, I am creating an electronic signature that will, upon my submission of this form, have the same legal force and effect as a handwritten signature

ATTACHMENT to PC-5 - Suggested_replacement_table_for_10.12.5_and_9.12.5_a_.docx

Below is the suggested replacement table for 10.12.5 and 9.12.5(a)

<i>Conductor Circular Mil (CM) Area and Stranding for Electrical Systems Under 50 Volts and for Alternating Current (ac) Electrical Systems on Boats</i>				
Conductor Size (AWG)	Conductor Size (Nominal CM Area ^a)	Minimum (Acceptable CM Area ^b)	Minimum Number of Strands Type 2 ^c	Minimum Number of Strands Type 3 ^d
18	1,620	1,537	16	-
16	2,580	2,336	19	26
14	4,110	3,702	19	41
12	6,530	5,833	19	65
10	10,380	9,343	19	105
8	16,510	14,810	19	168
6	26,240	25,910	37	266
4	41,740	37,360	49	420
2	66,360	62,450	127	665
1	83,690	77,790	127	836
1/0	105,600	98,980	127	1064
2/0	133,100	125,100	127	1323
3/0	167,800	158,600	259	1666
4/0	211,600	205,300	418	2107

NOTE: Metric wire sizes can be used if equivalent circular mil area. If the circular mil area of the metric conductor is less than that listed, the wire ampacity needs to be corrected based on the ratio of the circular mil area.

^a To recognize stranded conductors made of AWG elements, note that the actual nominal CM area can differ from the specified nominal CM area but no more than 7 percent. The circular mil area is equal to the mathematical square of the specified diameter of the AWG stranded solid copper conductor measured in one-thousandths of an inch, as shown in the following equation:

$$\text{Area in.}^2 = \frac{\pi \times (\text{circular mils})}{4(1,000,000)}$$

^b Applies only to systems under 50 volts.

^c Conductors with Type 2 stranding are permitted to be used for wiring that is subject to movement from vibration or minor flexing. If four or more conductors are run in a cable. Type 2 stranding is permitted to be used for frequent flexing applications.

^d Conductors with Type 3 stranding can be used for any wiring where frequent flexing is involved in normal use.



Public Comment No. 4-NFPA 302-2023 [Section No. 10.12.6]

10.12.6

Conductor sizes, as determined by Table 10.12.5, shall not carry current greater than that indicated in Table 10.12.6(a), based on the temperature rating of the wire, and the following derating factors:

- (1) Conductors used in or routed through an engine space shall be corrected in accordance with Table 10.12.6(b).
- (2) Current-carrying conductors that are bundled shall be derated in accordance with Table 10.12.6(c).

Table 10.12.6(a) Ampacities of Insulated Conductors

Conductor Size (AWG)	Temperature Rating of Conductor Insulation						
	60°C (140°F)	75°C (167°F)	80°C (176°F)	90°C (194°F)	105°C (221°F)	125°C (257°F)	200°C (392°F)
18	10	10	15	20	20	25	25
16	15	15	20	25	25	30	35
14	20	20	25	30	35	40	45
12	25	25	35	40	45	50	55
10	40	40	50	55	60	70	70
8	55	65	70	70	80	90	100
6	80	95	100	100	120	125	135
4	105	125	130	135	160	170	180
3	120	145	150	155	180	195	210
2	140	170	175	180	210	225	240
1	165	195	210	210	245	265	280
0	195	230	245	245	285	305	325
00	225	265	285	285	330	355	370
000	260	310	330	330	385	410	430
0000	300	360	385	385	445	475	510

Table 10.12.6(b) Engine Room Temperature Derating Factor

-	60°C (140°F)	75°C (167°F)	80°C (176°F)	90°C (194°F)	105°C (221°F)	125°C (257°F)	220°C (392°F)
Temperature rating of conductor	0.58	0.75	0.78	0.82	0.85	0.89	1.00

Table 10.12.6(c) Current-Carrying Conductor Bundling Derating Factor

Number of Energized Wires in a Bundle	Correction Factor
3	0.70
4 to 6	0.60
7 to 24	0.50
25 and above	0.40

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NFPA_302_Amperage_and_Temp_Table.PDF	Table 9.12.5 (b) to replace Tables 10.12.6(a) and 10.12.6 (b)	✓

Statement of Problem and Substantiation for Public Comment

To ensure a consistent format, Table 9.12.5(b) which shows amperage ratings for different size conductors at different temperatures should remain. There are two columns for each, one column outside engine spaces and one column inside engine spaces. This shows the engine room derating in the same presentation. Table 10.12.6(a) shows amperage ratings but the derating factors are shown separately in Table 10.12.6(b). Once consistent format should be adopted for this information; therefore, Table 9.12.5(b) should be used in place of 10.12.6(a) and 10.12.6(b).

Related Item

- CI-11-NFPA302-2022

Submitter Information Verification

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Submittal Date: Tue May 30 16:50:32 EDT 2023

Committee: MOR-AAA

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Conductor Size		Temperature Rating of Conductor Insulation												
		60°C (140°F)		75°C (167°F)		80°C (176°F)		90°C (194°F)		105°C (221°F)		125°C (257°F)		200°C (392°F)
English	Metric	Outside Engine Spaces	Inside Engine Spaces	Outside Engine Spaces	Inside Engine Spaces	Outside Engine Spaces	Inside Engine Spaces	Outside Engine Spaces	Inside Engine Spaces	Outside Engine Spaces	Inside Engine Spaces	Outside Engine Spaces	Inside Engine Spaces	Outside or Inside Engine Spaces
18	0.8	10	5.8	10	7.5	15	11.7	20	16.4	20	17.0	25	22.3	25
16	1	15	8.7	15	11.3	20	15.6	25	20.5	25	21.3	30	26.7	35
14	2	20	11.6	20	15.0	25	19.5	30	24.6	35	29.8	40	35.6	45
12	3	25	14.5	25	18.8	35	27.3	40	32.8	45	38.3	50	44.5	55
10	5	40	23.2	40	30.0	50	39.0	55	45.1	60	51.0	70	62.3	70
8	8	55	31.9	65	48.8	70	54.6	70	57.4	80	68.0	90	80.1	100
6	13	80	46.4	95	71.3	100	78.0	100	82.0	120	102.0	125	111.3	135
4	19	105	60.9	125	93.8	130	101.4	135	110.7	160	136.0	170	151.3	180
2	32	140	81.2	170	127.5	175	136.5	180	147.6	210	178.5	225	200.3	240
1	40	165	95.7	195	146.3	210	163.8	210	172.2	245	208.3	265	235.9	280
0	50	195	113.1	230	172.5	245	191.1	245	200.9	285	242.3	305	271.5	325
00	62	225	130.5	265	198.8	285	222.3	285	233.7	330	280.5	355	316.0	370
000	81	260	150.8	310	232.5	330	257.4	330	270.6	385	327.3	410	364.9	430
0000	130	300	174.0	360	270.0	385	330.3	385	315.7	445	378.3	475	422.8	510

**Public Comment No. 10-NFPA 302-2023 [New Section after 13.1]****Markings**

A permanent placard with the following warning in 1/4 inch high lettering or larger shall be installed in a prominent location on all vessels having a smoke alarm, smoke detectors, or carbon monoxide detector

WARNING: Smoke alarms, smoke detectors, and carbon monoxide detectors should be checked for proper operation on a monthly basis and replaced as needed. Failure to test these devices monthly may result in death, injury, or significant property damage

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NFPA_-_Safety_messages_about_smoke_alarms.pdf	NFPA substantiation of monthly testing for smoke alarms	✓
NFPA_-_Carbon_monoxide_alarms.pdf	NFPA substantiation for monthly testing of CO detectors	✓
SUPDET2016FlemingBabrauskas.pdf	Substantiation on the importance of testing smoke alarms	

Statement of Problem and Substantiation for Public Comment

Proposal addresses concerns about boat users developing a false sense of security in the event that an installed smoke alarm fails after a few years in service

Proposal addresses concerns that smoke alarms may fail at an unacceptable rate in the marine environment by improving testing protocols on vessels

Although monthly testing of smoke alarms and carbon monoxide detectors are well established practices, these procedures may be more easily forgotten in marine environments

Related Item

- NFPA 302 Public input No 4 committee ballot negative comment by Goodwin and Berry

Submitter Information Verification

Submitter Full Name: James Coté

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Submittal Date: Wed May 31 10:51:02 EDT 2023

Committee: MOR-AAA

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PUBLIC EDUCATION

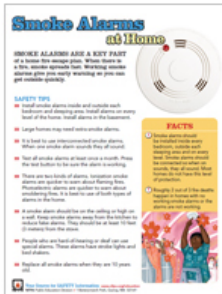
Public Education / Staying safe / Safety equipment / Smoke alarms / Safety messages about smoke alarms

Safety messages about smoke alarms

Smoke alarms are a key part of a home fire escape plan. When there is a fire, smoke spreads fast. Working smoke alarms give you early warning so you can get outside quickly.

- A closed door may slow the spread of smoke, heat and fire. Install smoke alarms in every sleeping room and outside each separate sleeping area. Install alarms on every level of the home. Install alarms in the basement. Smoke alarms should be interconnected. When one sounds, they all sound.
- Large homes may need extra smoke alarms.
- It is best to use interconnected smoke alarms. When one smoke alarm sounds they all sound.
- Test all smoke alarms at least once a month. Press the test button to be sure the alarm is working.
- Today's smoke alarms will be more technologically advanced to respond to a multitude of fire conditions, yet mitigate false alarms.
- A smoke alarm should be on the ceiling or high on a wall. Keep smoke alarms away from the kitchen to reduce false alarms. They should be at least 10 feet (3 meters) from the stove.
- People who are hard-of-hearing or deaf can use special alarms. These alarms have strobe lights and bed shakers.
- Replace all smoke alarms when they are 10 years old.
- Smoke alarms are an important part of a home fire escape plan.

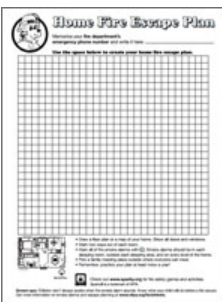
Free resources



Smoke alarm safety tips

When there is a fire, smoke spreads fast. Working smoke alarms give you early warning so you can get outside quickly.

[Download a free safety tip sheet.](#)



Home escape planning grid

Develop and practice a home fire escape plan using our free home escape plan grid.

[Download an escape plan grid.](#)

Children and smoke alarms

NFPA is aware of research indicating that sleeping children don't always awake when a smoke alarm activates. While this research is worrisome, we shouldn't allow them to obscure the fact that smoke alarms are highly effective at reducing fire deaths and injuries.

NFPA reaffirms the value of the smoke alarms already available to protect people from home fire deaths and voice its concern about the number of U.S. households without these early warning devices. While almost all American homes have at least one smoke alarm, no smoke alarms were present or none operated in one-third of the reported home fires from 2014 through 2018. Almost three-fifths of home fire deaths resulted from fires in homes with no smoke alarms or no working smoke alarms.

NFPA emphasizes the need to continue planning and practicing [home fire escape plans](#) and to make sure everyone in a home can be awakened by the sound of the smoke alarm. NFPA suggests practicing the escape plan during which the smoke alarm is activated so all family members know its sound.

Every home fire escape plan is different, and every family should know who will - and who won't - awaken at the sound of the smoke alarm. If someone doesn't wake up when the alarm sounds during a drill, the family should design an escape plan that assigns a grown-up who is easily awakened by the alarm to wake the sleepers, perhaps by yelling "FIRE," pounding on the wall or door, or blowing a whistle.

Plan your escape

Your ability to get out of your house during a fire depends on advance warning from smoke alarms and advance planning.

- Get everyone in your household together and make a [home escape plan](#) (PDF). Walk through your home and look for two ways out of every room.
- Make sure escape routes are clear of debris and doors and windows open easily. Windows with security bars or grills should have an emergency release device.
- Plan an outside meeting place where everyone will meet once they have escaped. A good meeting place is something permanent, like a tree, light pole, or mailbox a safe distance in front of the home.
- If there are infants, older adults, family members with mobility limitations or children who do not wake to the sound of the smoke alarm, make sure that someone is assigned to assist them in the event of an emergency.
- If the smoke alarm sounds, get outside and stay outside. Respond quickly – get up and go, remember to know two ways out of every room, get yourself outside quickly, and go to your outside meeting place with your family.
- [Learn more about home escape planning](#).

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PUBLIC EDUCATION

Public Education / Staying safe / Safety equipment / Carbon monoxide alarms

Carbon monoxide alarms

Although the popularity of carbon monoxide (CO) alarms has been growing in recent years, it cannot be assumed that everyone is familiar with the hazards of carbon monoxide poisoning in the home.

Often called the invisible killer, carbon monoxide is an odorless, colorless gas created when fuels (such as gasoline, wood, coal, natural gas, propane, oil, and methane) burn incompletely. In the home, heating and cooking equipment that burn fuel are potential sources of carbon monoxide. Vehicles or generators running in an attached garage can also produce dangerous levels of carbon monoxide.

- The dangers of CO exposure depend on a number of variables, including the victim's health and activity level. Infants, pregnant women, and people with physical conditions that limit their body's ability to use oxygen (i.e. emphysema, asthma, heart disease) can be more severely affected by lower concentrations of CO than healthy adults would be.
- A person can be poisoned by a small amount of CO over a longer period of time or by a large amount of CO over a shorter amount of time.
- In 2016, local fire departments responded to an estimated 79,600 carbon monoxide incidents, or an average of nine such calls per hour. This does not include the 91,400 carbon monoxide alarm malfunctions and the 68,000 unintentional carbon monoxide alarms.
- Data from the Center of Disease Control and Prevention's (CDC's) National Center for Health Statistics shows that in 2017, 399 people died of unintentional non-fire carbon monoxide poisoning.

Source: NFPA's Applied Research Division

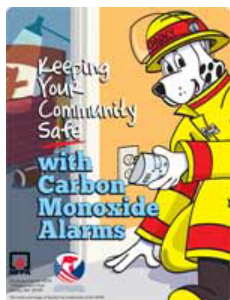
Free resources



Safety tip sheet

In the home, heating and cooking equipment that burn fuel can be sources of carbon monoxide (CO).

Download free tip sheet.



Community toolkit

Use free resources from NFPA and the U.S. Consumer Product Safety Commission to conduct a CO alarm awareness campaign in your community.

Download free toolkit.

Safety tips

- CO alarms should be installed in a central location outside each sleeping area and on every level of the home and in other locations where required by applicable laws, codes or standards. For the best protection, interconnect all CO alarms throughout the home. When one sounds, they all sound.
- Follow the manufacturer's instructions for placement and mounting height.
- Choose a CO alarm that has the label of a recognized testing laboratory.

- Call your local fire department's non-emergency number to find out what number to call if the CO alarm sounds.
- Test CO alarms at least once a month; replace them according to the manufacturer's instructions.
- If the audible trouble signal sounds, check for low batteries. If the battery is low, replace it. If it still sounds, call the fire department.
- If the CO alarm sounds, immediately move to a fresh air location outdoors or by an open window or door. Make sure everyone inside the home is accounted for. Call for help from a fresh air location and stay there until emergency personnel.
- If you need to warm a vehicle, remove it from the garage immediately after starting it. Do not run a vehicle or other fueled engine or motor indoors, even if garage doors are open. Make sure the exhaust pipe of a running vehicle is not covered with snow.
- During and after a snowstorm, make sure vents for the dryer, furnace, stove, and fireplace are clear of snow build-up.
- A generator should be used in a well-ventilated location outdoors away from windows, doors and vent openings.
- Gas or charcoal grills can produce CO — only use outside.

Symptoms of CO poisoning

CO enters the body through breathing. CO poisoning can be confused with flu symptoms, food poisoning and other illnesses. Some symptoms include shortness of breath, nausea, dizziness, light headedness or headaches. High levels of CO can be fatal, causing death within minutes.

The concentration of CO, measured in parts per million (**ppm**) is a determining factor in the symptoms for an average, healthy adult.

- 50 ppm: No adverse effects with 8 hours of exposure.
- 200 ppm: Mild headache after 2-3 hours of exposure.
- 400 ppm: Headache and nausea after 1-2 hours of exposure.
- 800 ppm: Headache, nausea, and dizziness after 45 minutes; collapse and unconsciousness after 1 hour of exposure.
- 1,000 ppm: Loss of consciousness after 1 hour of exposure.
- 1,600 ppm: Headache, nausea, and dizziness after 20 minutes of exposure.
- 3,200 ppm: Headache, nausea, and dizziness after 5-10 minutes; collapse and unconsciousness after 30 minutes of exposure.
- 6,400 ppm: Headache and dizziness after 1-2 minutes; unconsciousness and danger of death after 10-15 minutes of exposure.
- 12,800 ppm: Immediate physiological effects, unconsciousness and danger of death after 1-3 minutes of exposure.

Source: [NFPA's Fire Protection Handbook](#), 20th Edition.

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Firewise USA®

NFCSS



Public Comment No. 6-NFPA 302-2023 [New Section after 13.1]

Engine Compartment Fire Detection

A smoke detector or smoke alarm shall be installed every enclosed engine compartment although a heat detector, rate of rise detector, or other suitable fire detector may be installed in lieu of a smoke detector.

Heat detectors shall be designed to alarm before the automatic fire suppression system discharges

The engine room fire detection device shall, at a minimum, provide and audible and visual indication of fire at all helm stations.

Statement of Problem and Substantiation for Public Comment

Early detection of fire is as important in engine compartments as it is in all other instances. There is no reasonable argument for the crew to be ignorant of an engine room fire until an automatic fire suppression system deploys, or the engine room becomes fully involved, particularly where unexpected loss of engine control or loss of engine room equipment would put lives in peril.

However, smoke detection may not be a suitable means of fire detection for engine compartments

This addition will make NFPA 302 more compliant with ISO-9094 which requires fire detection in engine spaces

Related Item

- Public Input No 4 Section 13-3 Committee Ballot Affirmative Comment by Kenneth Weinbrecht

Submitter Information Verification

Submitter Full Name: James Coté

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Submission Date: Tue May 30 20:05:05 EDT 2023

Committee: MOR-AAA

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Public Comment No. 2-NFPA 302-2023 [Section No. 13.3]

13.3 Smoke Detection.

All vessels with enclosed accommodation spaces shall be equipped with smoke alarm(s) or smoke detector(s) that are appropriate for the space(s) served.

13.3.1

Smoke alarms or smoke detectors shall be installed in every accommodation space per the manufacturer's requirements .

13.3.2

If an accommodation space is protected with a smoke detector rather than a smoke alarm, then an audible fire alarm shall also be installed in that accommodation space.

13.3.3 _

All smoke alarms

~~, smoke detectors, and audible fire alarms~~

shall be

~~interconnected so that if smoke is detected in any accommodation space, then the smoke alarms, smoke detectors, and audible fire alarms in every accommodation space will also sound.~~

13.3.4 –

~~All smoke alarms shall be~~

~~listed and labeled in accordance with UL 217, *Safety for Single and Multiple Station Smoke Alarms* for RV or marine use .~~

13.3.

5

4 _

All smoke detectors shall be listed to UL 268, *Smoke Detectors for Fire Alarm Systems* .

13.3.6 –

~~All audible fire alarms that are not a part of a smoke alarm that is listed in accordance with UL 217, *Safety for Single and Multiple Station Smoke Alarms* , shall comply with NFPA 72.~~

13.3.7 –

~~Smoke alarms, smoke detectors, and audible fire alarms shall be installed and maintained according to the device manufacturer's instructions, except that smoke alarms installed in dry locations shall not be required to comply with the requirements for recreational boats in UL 217, *Safety for Single and Multiple Station Smoke Alarms* .~~

Statement of Problem and Substantiation for Public Comment

Vessels less than 300 gross tons operate in a harsh and variety of environments. Detectors installed in these vessels may experience high humidity, high and low temperatures, movements (shock and vibration).

Residential and commercial detectors are not appropriate for this this environment. Most state a limited temperature range (40 to 100F) and some expressly prohibit the use on RV and boats by the manufacturer.

There are not any RV or marine rated single station smoke alarms that have interconnectivity features that the current draft language requires. The standard can not require something that does not exist.

NFPA 72 appears to be written for land based structures, again a different environment than the marine environment.

Related Item

- Fire detection changes

Submitter Information Verification

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Submittal Date: Thu May 25 12:09:16 EDT 2023

Committee: MOR-AAA

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Public Comment No. 9-NFPA 302-2023 [Section No. 13.3 [Excluding any Sub-Sections]]

All vessels shall be equipped with smoke alarm(s) or smoke detector(s) that are appropriate for the space(s) served.

Smoke alarms or smoke detectors should constructed fo a recognized standard for marine environments, such as EN 14604 or UL217RV, if such devices are available.

Fire detection systems that are approved for the application by NFPA 72 or EN 54 may be used in lieu of a smoke detection devices

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
iso_9094.JPG	screen shot of iso 9094 fire detection standard	
SMOKE_ALARMS_- _WHY_DON_T_WE_USE_THEM_ON...pdf	Good discussion on the use of smoke detection on boats	✓

Statement of Problem and Substantiation for Public Comment

As the world leader in fire protection NFPA should not be obsessed with maintaining harmony with other standards, particularly when the evidence is clear that smoke detection is the most effective means of protecting life and property from fire.

Nevertheless the addition of the statement that detectors SHOULD be constructed to a marine standard (not a requirement) improves harmony with ISO 9094

The addition of the statement allowing marine rated fire detectors should satiate those obsessed with the notion of only marine rated devices are suitable for every space on a boat, no matter how well protected it may be

Related Item

- Public input No 4 Committee Ballot Negative comments by Berry, Goodwin, Johnson

Submitter Information Verification

Submitter Full Name: James Côté

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Submission Date: Tue May 30 21:25:44 EDT 2023

Committee: MOR-AAA

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SMOKE ALARMS – WHY DON'T WE USE THEM ON BOATS?

Today, everywhere you spend the night, you can expect the protection of a smoke alarm. Government, insurance and specific industry regulations require smoke alarms to be installed during construction, manufacturing and/or sale, in every type of structure. They are required by all local and state laws in occupied buildings of every type: Single and multiple occupancy dwellings, hospitals, schools, hotels, motels, bed and breakfasts, dormitories, general occupancy, trains, airplanes, buses, RVs, mobile homes, and so on. There is one and only one exception. The recreational boating industry does not install or require smoke alarms for consumers who purchase boats with sleeping quarters.



There is a substantial amount of documentation, dating back to the 1960s, demonstrating significant reduction in property loss, injury and deaths as a result of the installation of working smoke alarms. According to the National Fire Protection Association (NFPA), for decades, smoke alarms have proven effective in two important ways: "alerting people to the presence of unwanted fire thus permitting their timely escape...and by providing a mechanism for setting in motion the early extinguishing of fire by the occupants or others".

BOATING FIRE CAUSES AND PROBLEMS

A pleasure boat contains a number of potential fire dangers, certainly more than we find in a typical home. Aboard a pleasure boat we find a large fire load in the form of flammable or combustible fuel storage, many times supplying multiple devices, an AC electrical system, a DC electrical system, (all of which are regularly subject to moisture, corrosion, vibration and jarring as part of the normal use). The housing industry has taken steps to reduce the combustibility of construction materials that are toxic and volatile when involved in a fire. A boat's construction materials are extremely combustible and are likely to remain that way for the foreseeable future. Most boat fires start slow in a smoldering state. According to Boat US these fires are of electrical origin 55% of the time. Propulsion problems, fuel, engine and exhaust problems, unattended cooking, careless smoking, heating devices, and other appliances are also among the causes. Further, there is no annual inspection requirement (like many automobile regulations) by a qualified technician who may find and correct problems that may cause a fire.

THREE SPECIFIC MARINE FIRE EVENTS

There are three fire events that represent the greatest percentage of marine industry fire losses. The first is a fire that starts aboard a boat in a marina. This fire, usually electrical in origin, starts small and typically smolders for some time. If the fire is not detected, it will continue until the fire gains headway and visibly burns outside the confines of the origin boat. At this point the fire is beyond control by any nearby people or marina personnel. Every year marina fires cause considerable damage to boats and the marina, and create serious environmental issues when boats sink and fuel floats freely to the surface. (Seattle has had 35 serious marina fires in

5 years.) These fires always start aboard a single boat. These same conditions become more dangerous when there are people in the boat and there is no warning of the fire.

The second type of fire event occurs while the boat is underway and out on the open water. According to the Coast Guard, nearly 90% of these fires start in the engine room in the propulsion or related equipment. Many times these fires burn undetected while the crew is on the bridge and unaware of the problem. The fire is eventually discovered but most often well beyond the intercession of the crew. The occupants are forced to flee the vessel, most times into the water. The third is a gasoline vapor event in which a fire or explosion occurs very rapidly when vapors (heavier than air) accumulate in the bilge of boat and come in contact with an ignition source. The result most times is a volatile explosion resulting in injuries, death and damage. These events typically take place during or immediately after fueling the boat. These vapor events also take place during maintenance, usually by unskilled technicians. Fume detection has been available for many years but is typically not installed or required.

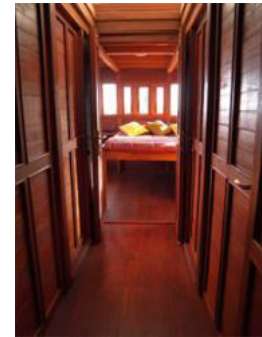


DIFFICULT AND COMPROMISED EGRESS – COMPOUNDS THE FIRE PROBLEM

There are unique egress challenges from a fire that face the occupants of a boat in the above mentioned fire events.

First is the design of the boat. The rule states (both NFPA 302 and ABYC H-3) that the boat must have a second means of egress that is not blocked by an engine room or galley. The rule is satisfied by one 14" x 18" hatch in the forward part of the boat.

Many boats, particularly over 40 feet, have staterooms with no second means of egress. The only way to exit the stateroom is to enter back into the common area in the boat. The new full beam master most times is also a one way out stateroom. The port and starboard windows that are sometimes installed in the hull are not large enough to be effective or considered as egress. The forward stateroom usually does have a properly sized hatch as long as it can be reached and opened and it has not been covered by a rigid inflatable boat.



It is difficult to provide two ways out of every stateroom without compromising the water keeping integrity of the boat. We cannot install an 18" hatch in every stateroom but we should be mindful of these serious stateroom egress limitations when a fire occurs in or near the common area.

Case in point: On March 31st of last year, a fire occurred in a 76 foot Lazzara, with seven people aboard during a stop at the Miami Beach Marina. The official cause was undetermined but interviews indicate careless smoking at about 1AM may have started the fire aboard the boat. Nearly four hours later the occupants were awoken by the sound of the fire ravaging the upper part of the boat. Five of the seven escaped with burns, cuts and fractures. Two were trapped in a port stateroom with only a small porthole, barely large enough to wave an arm. They could not enter the common area, which was now involved in fire. Fortunately, the two remaining victims were cut from the hull of the boat, by fire department personnel, shortly before fire consumed the boat and it sank.

Compromised egress was obviously a life threatening factor at this fire event. But the true injustice here was the lack of any type of inexpensive early warning device aboard the \$5,000,000 Lazzara where people were sleeping.

The second egress concern takes place when the boat is away from the dock.

There is no place to run from a fire while underway. As stated earlier, 90% of the fires that occur on the open water start in the engine room. In vessels over 40 feet the occupants may be two levels above the engine room and have no way of knowing about a fire there.

Engine room fires typically burn undetected for some time. In an unacceptable number of cases, the fixed fire extinguishing system fails to activate in a timely fashion or at all. Many fixed systems are installed too close to natural and/or mechanical ventilation equipment (see picture at left of extinguisher right beside blower), too low in the engine room to effectively meet the trip temperature, or too remote in the engine room for effective application of the extinguishing agent.



Case in point: On February 22 of last year a 56 foot Sunseeker departed Fort Lauderdale enroute to the Keys. Two miles off Elliot Key the owner noticed smoke coming from the engine room. Upon investigation, he discovered an engine room fire that was beyond extinguishment by those aboard the boat. The engine room extinguishing system failed to activate – automatically or manually. The four aboard evacuated the boat into the water and had to be rescued. The boat was a total loss.

Early warning detection should be installed in the engine rooms of vessels over 40 feet. The devices should alarm on the bridge. Fixed fire detection should also be properly installed in the engine room and boat builders should be mindful that the proper installation of fixed fire extinguishing equipment is critical if the system is to activate on a timely basis. Most times an improper installation or maintenance is the reason fixed systems do not function properly.

Early warning detection is critical in circumstances such as these but despite the smoke alarm's safety benefits, obvious track record, inexpensive cost, and public acceptance, we don't employ smoke alarms in the boating industry. It is very important to note that statistics show when a smoke alarm is activated, the fire is extinguished by the occupants over 80% of the time. Most fires, discovered in the early stages can be easily handled.

In the gasoline vapor fire events a smoke alarm would be of little value. However, engine room fume detection is available and should be used for all gasoline powered vessels. A more robust approach to public education about the dangers of flammable vapors aboard a boat is also suggested.



OPPOSITION TO MARINE EARLY WARNING DETECTION

There has been opposition to a smoke alarm requirement for pleasure boats. Some of the justifications for the opposition include:

- The Coast Guard reports no fire deaths or measurable fire losses.
- A special smoke alarm will have to be designed for marine use.
- Smoke alarms will false alarm when used on a boat.
- The Coast Guard does not require smoke alarms.
- There are no UL marine listed smoke alarms

The responses to these positions are listed below:

NO FIRE DEATHS OR MEASURABLE FIRE LOSSES

The United States Coast Guard annually publishes the Boating Safety Statistics Report. The most recent report (2009) shows that there were 260 fire incidents nationwide among over 13,000,000 registered vessels. What the Coast Guard does not state is that this information represents primarily only open water fire events that occur away from the marina. Marina fire events and losses are typically not recorded in this data.



FEMA, through the National Fire Incident Reporting System (NFIRS) program and the National Fire Protection Association (NFPA) also attempt to track marine fire loss information. Both agencies acknowledge and report that they can provide only incomplete boating fire loss statistics at best. A number of local fire departments do not use the NFIRS reporting system and in many cases boat fires are recorded as 'miscellaneous' on fire reports and cannot be retrieved nationally by category.

Case in point: In 2005, NFIRS reported two fire deaths in sailboats. Random articles were emailed to me on two other 2005 fire deaths in powerboats on the east coast. The 2005 Coast Guard Boating Safety Statistics Report lists zero fire deaths in 2005. The regulatory authority granted to the Coast Guard does not require them to investigate marina fires. Their responsibility in a marina fire event is limited to environmental issues.

We cannot identify or quantify fire losses in the boating industry. Despite this, there have been marine safety concerns who continue to use the incomplete Coast Guard information as a basis for fire safety considerations and justifications – specifically smoke alarms.

SPECIAL MARINE SMOKE ALARMS

In the 1990s, a tax payer funded study was conducted by the Coast Guard, the American Boat and Yacht Council (ABYC) and Underwriters Laboratories (UL) in order to assess the feasibility of smoke alarms aboard pleasure boats. Off the shelf household devices were evaluated. As a result, Underwriters Laboratories published UL Report 92NK26482 – Fire Detection in Recreational Vessels. The report states: "included testing of fire detection devices to shock, vibration, and salt fog corrosion similar to what the devices may be expected to encounter in actual (marine) use". The UL report also noted favorably that "Some presently (1990s) available (smoke alarm) models successfully completed the marine tests. Thus it is possible that at least some manufacturers may not need to produce special marine use models, thus minimizing the costs to the boat builders and ultimately to the consumers." Despite these findings, the US Coast Guard, the Underwriters Laboratories and the ABYC did nothing with the information obtained during the study. No requirements, recommendations or advisories were ever brought forward and for many years UL did not have or develop a marine listing for smoke alarms.

SMOKE ALARMS WILL FALSE ALARMS

According to device manufacturers there is no credible current test information (including the above mentioned UL report detail) that supports a false alarming problem. As with every smoke alarm installation there is always a chance that the occupant will disable the alarm or won't maintain the batteries. The potential of improper use by a small percentage of users is not cause to deny the other responsible boating consumers smoke alarm protection. The boat builder and the boating industry are far more exposed to substantial legal challenges by not providing widely accepted safety devices to the consumer.

THE COAST GUARD REQUIREMENTS

The Coast Guard has for a number of years mandated smoke alarms in small inspected vessels with sleeping quarters. The Coast Guard (CFR 46 Part 181.4 and 181.45) states that "small passenger vessels ..must be fitted with an independent modular smoke detecting and alarm unit..and must meet UL217 and be listed as a single station smoke detector suitable for use in recreational vehicles". (The National Fire Protection Association in NFPA 302 Fire Protection Standard for Pleasure and Motorcraft requires the same UL217 recreational vehicle smoke alarm device in vessels over 26 feet.) The Coast Guard has also recently expanded the requirements for early warning fire detection aboard uninspected commercial fishing (46 CFR Part 28.325) and commercial towing vessels (46 CFR Part 27.203).

The Coast Guard does not have a smoke alarm requirement for uninspected, non commercial, vessels (pleasure boats) and it is unlikely they ever will. The Coast Guard has invested very few resources in its regulatory role within the pleasure boating industry for a number of years. The Coast Guard depends upon the boating industry's rule making organizations to manage pleasure boat safety regulations and occasionally provides government funding in order to do so.

The Coast Guard does not usually promote pro-active fire protection and has been criticized publicly for its position on early warning detection in the engine room of some small passenger ferries by the National Transportation Safety Board (NTSB). There have been a number of NTSB recommendations that have been disregarded by the Coast Guard dating back to the mid 1980s.

NTSB to the Coast Guard dated October 1, 1985 following a fire aboard fishing vessel Judith Lee Rose:

"..the lack of fire detectors allowed the fire to burn out of control before it was discovered. This is the tenth accident which the Safety Board has investigated in which the lack of fire detectors was a factor which contributed to the loss of an uninspected vessel. Because the earliest possible detection allows the best response to a fire, the Safety Board believes that if the fire detector had been installed in the unmanned engine room, the vessel might have been saved."

NTSB to the Coast Guard dated March 20, 2007 following a fire aboard the Massachusetts carrying 65 passengers:

"..Contributing to the extent of the damage was the absence of a fixed fire detection and suppression system, which precluded the crew from receiving timely notification of the fire and which allowed the blaze to spread throughout the engine room. The absence of a requirement for a fire detection and suppression system aboard the Massachusetts put the vessel, its passengers, and its crew at greater danger. This accident illustrates why the National Transportation Safety Board has previously made recommendations, following its investigation of other engine room fires, to the Coast Guard for certain vessels to be fitted with fire detection and suppression systems".

The Coast Guard has not complied with these NTSB recommendations. The NTSB lists the engine room detection recommendations to the Coast Guard as "Closed - Unacceptable Response".

The Coast Guard maintains a very re-active approach to fire protection. Most of the Coast Guard training, equipment, requirements and emphasis is all about fire fighting - after the fire has occurred.

UL LISTINGS AND MARINE SMOKE ALARMS

In the late 1970s the RV industry recognized the need to protect its customers from the dangers of fire. The RV industry worked with Underwriters Laboratories and developed a UL test for Recreational Vehicles. This test was more stringent than the normal household tests. It included exposure to both higher and lower temperatures and humidity as well as shock and vibration tests. The UL RV test also included a 48 hour salt spray test, a key part of other UL marine tests. Since 1982 the recreational vehicle industry has had a requirement in place for smoke alarms tested to the Underwriters Laboratories UL-217 Smoke Alarm Standard RV testing criteria. Despite the participation in the mid-nineties tax payer funded marine smoke alarm study, Underwriters Laboratories still did not develop a marine smoke alarm listing. The Coast Guard and the NFPA 302 Watercraft committee were left to designate the UL RV testing criteria for their smoke alarm requirements or be without a smoke alarm requirement completely.

Many opposed the use of the RV testing criteria stating "the UL Recreational Vehicle testing was inappropriate for marine use". But a comparison of the test criteria showed that the UL RV tests were acceptable for marine use and in some cases the UL RV tests were more stringent than the UL marine tests. The test criteria actually appeared to be more appropriate for marine uses than the title suggests. For a number of years Underwriters Laboratories has been effectively holding the marine industry over the terminology barrel. Industry standards writers don't want to recognize the RV device and won't move forward with a requirement until UL marine tested product is available. A UL 217 Marine Smoke Alarm test criteria was finally added in 2006. As of this writing no smoke alarm manufacturer has submitted a device to UL for marine testing. The smoke alarm manufacturers cite that testing the same product, using nearly the same UL test criteria for a different listing title is just too expensive. This is a big problem our industry needs to overcome. The marine industry must specify the RV alarms or be without a properly tested smoke alarm for the marine consumer.

Acknowledging the lack of marine product availability, in a recent "Fire Safety Guidance" advisory, the Coast Guard has allowed the installation of non marine use (and RV) devices stating: "Option two is the use of a fire alarm system that is UL listed or FM approved. This is the type of fire alarm system commonly installed in buildings. These systems are not specifically approved for marine use, and are designed to be installed in accordance with the guidance in NFPA 72 and their manufacturer's design manual." Today's smoke alarm manufacturers produce devices for use in many harsh environments. When a device is manufactured it may be installed in a garage in Alaska, a cabana in Central America or a shed on the Outer Banks. Smoke alarm manufacturers feel that their

products, when installed and maintained according to the instructions, will function properly in the enclosed spaces of a boat. The above mentioned UL report supports these opinions as many off the shelf, non-marine devices “successfully completed the marine tests” and “some manufacturers may not need to produce special marine use models”.

CARBON MONOXIDE – SOME COMPARISONS

In stark contrast, there are a number of dedicated industry individuals and organizations who have spent many worthwhile hours educating the boating public about the causes, dangers, production and detection of carbon monoxide. The positive industry momentum on this issue is remarkable. We can see the impact this effort has made particularly in the awareness the boating public now has about CO. There are many similarities that apply to fire protection and the consumer could benefit from the help of these same individuals and organizations.

Injuries recorded from fire incidents are far greater than the CO incidents. CO events typically do not have any monetary or environmental losses while fire causes tens of millions of dollars in losses in property and environmental damages annually.

Carbon monoxide has received a lot of attention and CO detection is now required and installed aboard all gas boats with accommodation spaces. Smoke detection is not recognized as necessary. The 2009 USCG Boating Safety Statistics show (fire data is not complete):

2009 Carbon Monoxide	17 events	39 injuries	1 death	\$0 in losses
2009 Fires	260 events	130 injuries	5 deaths	\$12,500,000+ in losses

Carbon monoxide events usually occur on the open water and it can be expected that these CO statistics are fairly accurate. Many fire losses occur in marinas where the Coast Guard is not the lead investigating agency. It is the author's opinion that the fires losses in the annual Coast Guard Boating Safety Report are greatly understated.

THE COAST GUARD AND THE ABYC

The Coast Guard has been challenged with a new and important agenda with Homeland Security efforts and is not actively managing the CFRs for pleasure boats. The Coast Guard will not be adding a smoke alarm requirement to the CFRs for pleasure boats.

The ABYC, the boating industry's primary standards writing organization, does not have a smoke alarm requirement. Although a smoke alarm proposal was written in early 2006, there has been little activity in moving forward with a requirement.

Some industry rule-makers have scrutinized the addition of a smoke alarm requirement and have spent more time on the why nots than the whys. The ABYC participated in the earlier referenced and favorable UL marine smoke alarm study in the mid nineties but took no action on the findings. The ABYC has also paid a consultant who used the incomplete Coast Guard fire loss data in his report to the ABYC Gas Detector committee regarding fire losses vs. the justification for the installation of smoke alarms. No mention of the incomplete nature of the USCG safety statistics was ever made in the study.

ABSENT A BOATING INDUSTRY SMOKE ALARM REQUIREMENT

The boating industry frequently draws comparisons with the RV industry and both compete for the same recreational spending dollars. The RV industry has required smoke alarms for nearly 30 years – since 1982. The smoke alarm is required, by the RVIA and the NFPA (who collaborate to write one RV industry safety standard – NFPA 1192), because it provides an important and expected level of basic consumer safety.

Recently there has been large unprecedented civil awards that the boating industry has been ordered to pay to individuals who were injured in boating accidents. One would think that the boat builders would also be at risk should a fire cause injury or death where a smoke alarm was not installed.

The established precedence of smoke alarm installation, by the builder, in every type of sleeping accommodation found in the United States should be considered. Further, the NFPA 302 smoke alarm requirement for pleasure boats, the Coast Guard requirements for inspected vessels, the new Coast Guard requirements for uninspected commercial vessels, and the long standing RV requirements and history add an additional level of precedence for smoke alarm installation that the boating industry should consider. Civil risk is present should a fire loss occur on a boat where early warning detection may have had a positive impact on the outcome. The public is used to having smoke alarm protection provided for them by the builder and they expect this type of protection when they purchase a boat they will be sleeping in.

The next generation of boaters and their families has entering the boating market place. This safety conscious generation has never spent the night without the inexpensive protection of a smoke alarm while sleeping. The typical boating consumer is spending discretionary money. They consider basic life and property protection to be essential, not discretionary. The lack of an inexpensive smoke alarms doesn't help sell more boats!

A CAUSE FOR (SMOKE) ALARM

The key components to any successful fire protection program are: fire prevention, detection, egress and suppression. All of these necessary components then need to be supported by solid fire protection standards. Fire protection specialist stress, after prevention, that early detection is most critical to timely intervention and limiting losses caused by fire.

The use of smoke alarms is the single most important addition in the reduction of life, injury and property losses from fires all over the United States during the last century. For over four decades smoke alarms have been required and have successfully contributed to the reduction of losses caused by fire in every kind of structure. It is a proven fact that fires discovered in the early stages by smoke alarms are successfully handled by the occupants, or other nearby persons, before the arrival of fire department units. Fires that are permitted to gain headway typically result in much larger fire losses.

The installation of smoke alarms will have a positive impact for the sleeping occupants aboard a boat. A smoke alarm can also alert marina occupants and employees to a fire in an unoccupied boat before the fire burns beyond the confines of the vessel and damages other property. Engine room smoke detection will alert the captain of a fire while underway and provide him a better opportunity to shut down propulsion and handle the fire before he is forced to leave the vessel and enter the water.

There are a number of industry leaders – individuals, organizations and corporations who have stayed on the sidelines when it comes to improving marine early warning fire detection. It's time the recreational boating industry discovered smoke alarms and make them part of the standard safety equipment found on a boat.

Written by John McDevitt, SAMS®-SA

Captain **John McDevitt** is an experienced fire fighter/officer and holds an Associates Degree in Fire Protection. He holds a 100 Ton USCG Masters License since 1992. He is active with SAMS, the ABYC, and the NFPA. He can be reached at jmcdevittcaptain@aol.com or 610-220-5619. Your questions, comments, thoughts and concerns are always welcome.



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**Public Comment No. 7-NFPA 302-2023 [Section No. 13.3.1]****13.3.1**

~~Smoke alarms~~ A smoke alarm or a smoke detectors shall detector shall be installed in every accommodation space, contiguous space not normally open to a weather deck that is primarily used for sleeping, eating, cooking, socializing, or entertaining

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Smoke_Alarms_NFPA.pdf	NFPA substantiation of the effectiveness of smoke detection at saving life and property	✓
Installing_and_maintaining_smoke_alarms_-_NFPA.pdf	Further NFPA substantiation on effectiveness of smoke detection	✓
SUPDET2016FlemingBabrauskas.pdf	article on the importance of smoke detection and common fallacies accepted as fact	
USCGProjectReport_92NK26482_1_.pdf	Substantiation of the effectiveness of smoke detectors in marine applications	

Statement of Problem and Substantiation for Public Comment

Other marine standards such as ABYC have an unusual definition of accommodation space which could cause confusion for some readers of NFPA 302

Including this description in the requirement rather than attempting to define accommodation space reduces ambiguity and misconceptions

The effectiveness of smoke detection at protecting life and property is beyond dispute. All accommodation spaces should be monitored

The word contiguous should clarify the requirement for those who may imagine that hangin a curtain or a drapery would create a separate accommodation space

Related Item

- Public Input No.4 Section 13.3 Committee Ballot Negative with Comment Berry, Goodwin, Johnson

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Committee: MOR-AAA

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PUBLIC EDUCATION

Public Education / Staying safe / Safety equipment / Smoke alarms

Smoke alarms

Smoke alarms save lives. Smoke alarms that are properly installed and maintained play a vital role in reducing fire deaths and injuries. If there is a fire in your home, smoke spreads fast and you need smoke alarms to give you time to get out.

Here's what you need to know!

- A closed door may slow the spread of smoke, heat and fire. Install smoke alarms in every sleeping room and outside each separate sleeping area. Install alarms on every level of the home.
- Smoke alarms should be interconnected. When one sounds, they all sound.
- Large homes may need extra smoke alarms.
- Test your smoke alarms at least once a month. Press the test button to be sure the alarm is working.
- Today's smoke alarms will be more technologically advanced to respond to a multitude of fire conditions, yet mitigate false alarms.
- When a smoke alarm sounds, get outside and stay outside.
- Replace all smoke alarms in your home every 10 years.
- [More about installation and maintenance of home smoke alarms.](#)

Change your clocks, change your batteries

This year, on **March 12**, states throughout the U.S. will be turning their clocks forward. Many people will use this opportunity to [change their home's smoke alarm batteries](#) as well.

Featured Content

Smoke alarms safety tip sheet

Download this free tip sheet on the use and maintenance of smoke alarms. Working smoke alarms give you early warning so you can get outside quickly.

Download our tip sheet on smoke alarms.



Smoke Alarms in U.S. Home Fires

This report focuses chiefly on smoke alarm presence and performance in home fires reported to local fire departments in the United States.

Download this free NFPA report.

Dan Doofus Realizes Smoke Alarms Are an Alarming Trend



NFPA's Dan Doofus reminds you to have enough smoke alarms in your home, test them monthly, and replace them every 10 years.

[See more NFPA videos about smoke alarms.](#)

Facts and figures about smoke alarms

- In 2014-2018, smoke alarms sounded in more than half (54%) of the home fires reported to U.S. fire departments.
- Almost three of every five home fire deaths resulted from fires in homes with no smoke alarms (41%) or no working smoke alarms (16%).
- The death rate per 1,000 reported home fires was more than twice as high in homes that did not have any working smoke alarms compared to the rate in homes with working smoke alarms (13.0 deaths vs. 5.8 deaths per 1,000 fires).
- In fires in which the smoke alarms were present but did not operate, two of every five (41%) of the smoke alarms had missing or disconnected batteries.
- Dead batteries caused one-quarter (26%) of the smoke alarm failures.

Source: NFPA's "[Smoke Alarms in US Home Fires](#)" report

Featured



Smoke Alarms are Important Brochures

NFPA's Smoke Alarms are Important Brochure and its online music video remind kids to jump to their feet when the smoke alarm sounds!

More Info

Smoke alarms in the news

In This Section

- **Safety messages about smoke alarms** What you need to know about smoke alarms.
- **Changing clocks and batteries**
- **For fire and life safety educators** Free educational resources about smoke alarms for teachers and families
- **Smoke alarm videos** NFPA videos to help you learn about the importance of installing and maintaining smoke alarms.
- **Installing and maintaining smoke alarms** Where to place your smoke alarms and how to keep them working.
- **Ionization vs photoelectric** NFPA recommends using both technologies in the home.



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The leading information and knowledge resource on fire, electrical and related hazards

PUBLIC EDUCATION

Public Education / Staying safe / Safety equipment / Smoke alarms / Installing and maintaining smoke alarms

Installing and maintaining smoke alarms

Installing your smoke alarms correctly - and making sure they are in working order - is an important step to making your home and family safer from fire.

It's important to have enough smoke alarms in your home. Fire research has demonstrated that with today's modern furnishings, fires can spread much more rapidly than in the past when more natural materials were used. Because of this, having a sufficient number of properly located smoke alarms is essential to maximize the amount of available escape time. For many years [NFPA 72, National Fire Alarm and Signaling Code](#), has required as a minimum that smoke alarms be installed inside every sleep room (even for existing homes) in addition to requiring them outside each sleeping area and on every level of the home. (Additional smoke alarms are required for larger homes.) Homes built to earlier standards often don't meet these minimum requirements. Homeowners and enforcement authorities should recognize that detection needs have changed over the years and take proactive steps make sure that every home has a sufficient complement of smoke alarms.

Installation guide



Planning and Implementing a Successful Smoke Alarm Installation Program

A smoke alarm installation program in your community can make a measurable difference in reducing deaths and injuries from fire. The updated "Planning and Implementing a Successful Smoke Alarm Installation Program" (PDF) is a comprehensive guide including everything you'll need to get started, from tips on how to select volunteers, to pointers on soliciting donations and publicizing your program.

Download the program.

Installing smoke alarms

- Choose smoke alarms that have the label of a recognized testing laboratory.

- Install smoke alarms inside each bedroom, outside each sleeping area and on every level of the home, including the basement.
- On levels without bedrooms, install alarms in the living room (or den or family room) or near the stairway to the upper level, or in both locations.
- Smoke alarms installed in the basement should be installed on the ceiling at the bottom of the stairs leading to the next level.
- Smoke alarms should be installed at least 10 feet (3 meters) from a cooking appliance to minimize false alarms when cooking.
- Mount smoke alarms high on walls or ceilings (remember, smoke rises). Wall-mounted alarms should be installed not more than 12 inches away from the ceiling (to the top of the alarm).
- If you have ceilings that are pitched, install the alarm within 3 feet of the peak but not within the apex of the peak (four inches down from the peak).

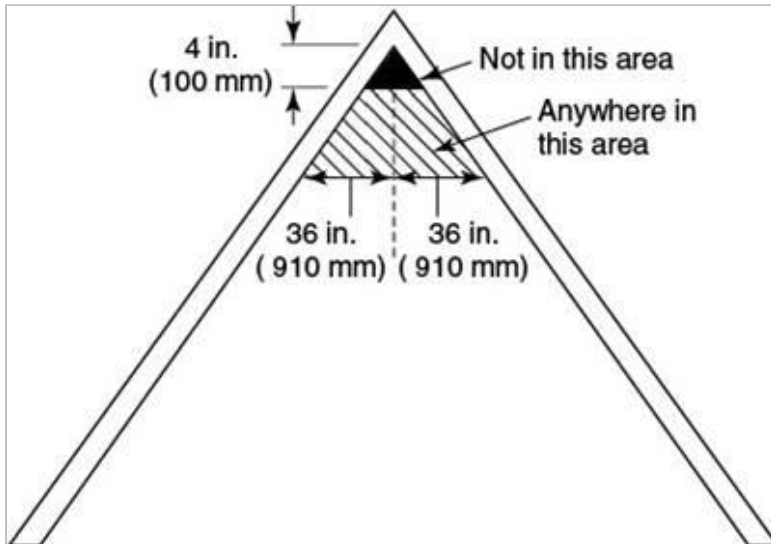


Figure A.29.8.3.1 from *NFPA 72, National Fire Alarm and Signaling Code* (2013 edition).

- Don't install smoke alarms near windows, doors, or ducts where drafts might interfere with their operation.
- Never paint smoke alarms. Paint, stickers, or other decorations could keep the alarms from working.
- For the best protection, interconnect all smoke alarms. When one smoke alarm sounds they all sound. Interconnection can be done using hard-wiring or wireless technology.
- When interconnected smoke alarms are installed, it is important that all of the alarms are from the same manufacturer. If the alarms are not compatible, they may not sound.
- There are two types of smoke alarms – ionization and photoelectric. An ionization smoke alarm is generally more responsive to flaming fires, and a photoelectric smoke alarm is generally more responsive to smoldering fires. For the best protection, both types of alarms or combination ionization-photoelectric alarms, also known as dual sensor smoke alarms, are recommended.
- Keep manufacturer's instructions for reference.

Testing smoke alarms

- Smoke alarms should be maintained according to manufacturer's instructions.
- Test smoke alarms at least once a month using the test button.
- Make sure everyone in the home understands the sound of the smoke alarm and knows how to respond.
- Follow manufacturer's instructions for cleaning to keep smoke alarms working well. The instructions are included in the package or can be found on the internet.
- Smoke alarms with non-replaceable 10-year batteries are designed to remain effective for up to 10 years. If the alarm chirps, warning that the battery is low, replace the entire smoke alarm right away.

- Smoke alarms with any other type of battery need a new battery at least once a year. If that alarm chirps, warning the battery is low, replace the battery right away.
- When replacing a battery, follow manufacturer's list of batteries on the back of the alarm or manufacturer's instructions. Manufacturer's instructions are specific to the batteries (brand and model) that must be used. The smoke alarm may not work properly if a different kind of battery is used.

Interconnected smoke alarms increase safety

In a Consumer Product Safety Commission (CPSC) survey of households with any fires, including fires in which the fire department was not called, interconnected smoke alarms were more likely to operate and alert occupants to a fire.¹ People may know about a fire without hearing a smoke alarm.

- When smoke alarms (interconnected or not) were on all floors, they sounded in 37% of fires and alerted occupants in 15%.
- When smoke alarms were not on all floors, they sounded in only 4% of the fires and alerted occupants in only 2%.
- In homes that had interconnected smoke alarms, the alarms sounded in half (53%) of the fires and alerted people in one-quarter (26%) of the fires.

¹ Michael A. Greene and Craig Andres. 2004-2005 National Sample Survey of Unreported Residential Fires. U.S. Consumer Product Safety Commission, July 2009.

Featured products



Smoke Alarms are Important Brochures

NFPA's Smoke Alarms are Important Brochure and its online music video remind kids to jump to their feet when the smoke alarm sounds!

[More Info](#)



Smoke Alarms: A sound you can live with! DVD

Smoke Alarms: A sound you can live with! DVD

[More Info](#)

**Public Comment No. 8-NFPA 302-2023 [Section No. 13.3.7]****13.3.7**

Smoke alarms, smoke detectors, and audible fire alarms shall be installed and maintained according to the device manufacturer's instructions, except that smoke alarms installed in dry locations ~~shall not~~ (not exposed to precipitation and sea spray or protected against direct sprays of water up to 15 degrees from the vertical) ~~shall not~~ be required to comply with the requirements for recreational boats in UL 217, *Safety for Single and Multiple Station Smoke Alarms*.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
ip-ratings-chart.png	IP rating chart to help explain what dry means	
USCGProjectReport_92NK26482_1_.pdf	substantiation of the effectiveness of smoke detectors in marine environments	

Statement of Problem and Substantiation for Public Comment

The added description should help clarify the meaning of the word "dry"

Many, many, many boats have locations that are not subject to sea spray, precipitation, falling water, etc.

Including the requirement that smoke detection devices in these location should meet an arbitrary salt spray or moisture intrusion test would just make the installation of these most effective life saving devices more difficult and expensive for the builder

Related Item

- NFPA 302 Public Input No. 4 Committee Ballot Negative Comment by Berry, Goodwin, Johnson

Submitter Information Verification

Submitter Full Name: James Coté

Organization: Coté Marine LLC

Street Address:

City:

State:

Zip:

Submittal Date: Tue May 30 21:01:21 EDT 2023

Committee: MOR-AAA

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Committee Input No. 9-NFPA 302-2022 [New Section after 5.4]

New Section for Chapter 5 entitled: "Lithium Ion Electric Motor Propulsion"
add appropriate code language for fire/lifesafety.

Submitter Information Verification

Committee: MOR-AAA

Submittal Date: Thu Oct 20 13:48:37 EDT 2022

Committee Statement

Committee Statement: Technical Committee determined that additional time and public input is needed to consider what fire prevention and life safety requirements are necessary as use of lithium-ion batteries for vessel propulsion, fixed equipment and portable equipment on boats increases. A task group is formed (NFPA 302 Lithium Ion (LI) Batteries Task Group). This task group will also consider what if any information related to battery management systems (BMS) needs to be added to NFPA 302.

The Task Group is responsible developing revisions to be submitted as a Public Comment as necessary for consideration at the Second Draft meeting. Deadline for Public Comment is: 05/31/2023.

Members of the public are welcome to participate in this task group. Interested persons should contact the NFPA Staff Liaison for NFPA 302 for more information.

This Committee Input incorporates Public Input No. 7-NFPA 302-2022 and Public Input No. 6-NFPA 302-2022.

Response Message: CI-9-NFPA 302-2022

[Public Input No. 7-NFPA 302-2022 \[New Section after 5.4\]](#)

[Public Input No. 6-NFPA 302-2022 \[Section No. 9.3.6\]](#)

Ballot Results

This item has not been balloted



Committee Input No. 11-NFPA 302-2022 [Section No. 9.12.5]

9.12.5

Conductors and flexible cords shall be stranded copper according to Table 9.12.5(a) and shall be sized in accordance with Table 9.12.5(b).

Table 9.12.5(a) Conductor Circular Mil (CM) Area and Stranding (for Electrical Systems Under 50 Volts)

<u>Conductor Size (AWG)</u>	<u>Minimum Acceptable CM Area^a</u>	<u>Minimum Number of Strands</u>	
		<u>Type 2^b</u>	<u>Type 3^c</u>
18	1,537	16	—
16	2,336	19	26
14	3,702	19	41
12	5,833	19	65
10	9,343	19	105
8	14,810	19	168
6	25,910	37	266
4	37,360	49	420
2	62,450	127	665
1	77,790	127	836
1/0	98,980	127	1064
2/0	125,100	127	1323
3/0	158,600	259	1666
4/0	205,500	418	2107

Note: Metric wire sizes are to be used if of equivalent circular mil area. If the circular mil area of the metric conductor is less than that specified, the wire ampacity can be corrected based on the ratio of the circular mil area.

^aApplies only to systems under 50 volts.

^bConductors with Type 2 stranding, used for general-purpose wiring, which is subject to some movement from vibration or minor flexing.

^cConductors with Type 3 stranding, used for any wiring where flexing is involved in normal use.

Table 9.12.5(b) Allowable Amperage of Conductors for Under 50 Volts

<u>Conductor Size</u>		<u>Temperature Rating of Conductor Insulation</u>								
		<u>60°C (140°F)</u>		<u>75°C (167°F)</u>		<u>80°C (176°F)</u>		<u>90°C (194°F)</u>		<u>100°C (212°F)</u>
<u>English</u>	<u>Metric</u>	<u>Outside Engine Spaces</u>	<u>Inside Engine Spaces</u>	<u>Outside Engine Spaces</u>	<u>Inside Engine Spaces</u>	<u>Outside Engine Spaces</u>	<u>Inside Engine Spaces</u>	<u>Outside Engine Spaces</u>	<u>Inside Engine Spaces</u>	<u>Outside Engine Spaces</u>
18	0.8	10	5.8	10	7.5	15	11.7	20	16.4	20
16	1	15	8.7	15	11.3	20	15.6	25	20.5	25
14	2	20	11.6	20	15.0	25	19.5	30	24.6	35
12	3	25	14.5	25	18.8	35	27.3	40	32.8	45
10	5	40	23.2	40	30.0	50	39.0	55	45.1	60
8	8	55	31.9	65	48.8	70	54.6	70	57.4	80
6	13	80	46.4	95	71.3	100	78.0	100	82.0	120

Conductor Size		Temperature Rating of Conductor Insulation								
		60°C (140°F)		75°C (167°F)		80°C (176°F)		90°C (194°F)		100°C (212°F)
English	Metric	Outside Engine Spaces	Inside Engine Spaces	Outside Engine Spaces	Inside Engine Spaces	Outside Engine Spaces	Inside Engine Spaces	Outside Engine Spaces	Inside Engine Spaces	Outside Engine Spaces
4	19	105	60.9	125	93.8	130	101.4	135	110.7	160
2	32	140	81.2	170	127.5	175	136.5	180	147.6	210
1	40	165	95.7	195	146.3	210	163.8	210	172.2	245
0	50	195	113.1	230	172.5	245	191.1	245	200.9	285
00	62	225	130.5	265	198.8	285	222.3	285	233.7	330
000	81	260	150.8	310	232.5	330	257.4	330	270.6	385
0000	130	300	174.0	360	270.0	385	300.3	385	315.7	445

Submitter Information Verification

Committee: MOR-AAA

Submittal Date: Thu Oct 20 14:18:18 EDT 2022

Committee Statement

Committee Statement: Table 9.12.5 and Table 10.12.5 are Circular Mil (CM) Area tables. Table 9.12.5 is SAE and Table 10.12.5 is AWG. During the First Draft Meeting the Committee agreed that the tables in 9.12.5 and 10.12.5 should be revised to reflect consistency of the data. There was insufficient time during the First Draft Meeting to complete this task. The Committee formed a Task Group (NFPA 302 Conductor CM Area Task Group) to combine the two tables for ease of comparison within the Standard.

The Task Group is responsible developing revisions to be submitted as a Public Comment as necessary for consideration at the Second Draft meeting. Deadline for Public Comment is: 05/31/2023.

Members of the public are welcome to participate in this task group. Interested persons should contact the NFPA Staff Liaison for NFPA 302 for more information.

This Committee Input incorporates Public Input No. 14-NFPA 302-2022 and Public Input No. 15-NFPA 302-2022.

Response Message: CI-11-NFPA 302-2022

[Public Input No. 15-NFPA 302-2022 \[Section No. 9.12.5\]](#)

[Public Input No. 14-NFPA 302-2022 \[Section No. 9.12.5\]](#)

Ballot Results

 This item has not been balloted



Committee Input No. 12-NFPA 302-2022 [Section No. 12.1.2.1]

12.1.2.1*

All boats that are less than 65 ft (20 m) in length shall be equipped with portable fire extinguishers in accordance with Table 12.1.2.1.

Table 12.1.2.1 Number and Distribution of Fire Extinguishers [Boats up to but not including 65 ft (20 m) in length]

<u>Type of Boat</u>	<u>No. of Extinguishers</u>	<u>Minimum ANSI/UL Rating</u>	<u>Minimum USCG Classification</u>	<u>Location</u>
Open boats under 16 ft (5 m) with fiberglass or metal hulls and a light load of flammable Class A materials	1	5 B:C	B-I	Steering position
Open boats under 16 ft (5 m)	1	1A:10B:C	B-I	Steering position
Boats 16 ft (5 m) to, but not including, 26 ft (8 m)	2	1A:10B:C	B-I	Steering position and galley, when onboard, or cockpit
Open boats 16 ft (5 m) to, but not including, 26 ft (8 m)	2	1A:10B:C	B-I	Steering position and galley or cockpit
Boats 26 ft (8 m) to, but not including, 40 ft (12 m)	3	1A:10B:C	B-I	Outside engine compartment, steering position, and near galley or passenger cockpit
Boats 40 ft (12 m) to, but not including, 65 ft (20 m)	4	1A:10B:C	B-I	Outside engine compartment, steering position, crew quarters, and galley, when onboard, or cockpit

Notes:

(1) For enclosed machinery spaces protected by a portable fire extinguisher, see 12.1.1.2.

(2) Extinguishers intended only for machinery space protection are not required to have a Class A rating.

Submitter Information Verification

Committee: MOR-AAA

Submittal Date: Mon Oct 24 13:48:12 EDT 2022

Committee Statement

Committee The Committee determined that it need to look at fire extinguishing requirements within

Statement: the Standard to determine if the existing requirements are satisfactory or need to be revised. To accomplish this the Committee approved the creation of Task Group (NFPA 302 Fire Protection Requirements). This task group is responsible for assessing the fire protection requirements within the Standard and developing revisions to be submitted as a Public Comment as necessary for consideration at the Second Draft meeting.

The Task Group is responsible developing revisions to be submitted as a Public Comment as necessary for consideration at the Second Draft meeting. Deadline for Public Comment is: 05/31/2023.

The task group is open for participation by persons who are not members of the Technical Committee on Motor Craft.

This Committee Input incorporates Public Input items: PI-10; PI-11; PI-19; and PI-25.

**Response
Message:** CI-12-NFPA 302-2022

[Public Input No. 11-NFPA 302-2022 \[Section No. 12.1.3.4\]](#)

[Public Input No. 16-NFPA 302-2022 \[Section No. 12.1.2.1\]](#)

[Public Input No. 10-NFPA 302-2022 \[Section No. 12.1.3.2\]](#)

[Public Input No. 25-NFPA 302-2022 \[Section No. A.12.1.3.4\]](#)

Ballot Results

 **This item has not been balloted**



Committee Input No. 13-NFPA 302-2022 [New Section after 13.3]

TITLE OF NEW ENTRY:

Fire Protection - Detection - All inboard powered vessels, 35 feet and larger, shall be equipped with appropriately rated engine room heat and/or smoke detection that include audible and visual alarms at all operating positions on the vessel.

Submitter Information Verification

Committee: MOR-AAA

Submittal Date: Mon Oct 24 14:25:25 EDT 2022

Committee Statement

Committee Statement: The Committee agreed to create a Task Group (NFPA 302 Fire and Smoke Detection Requirements). This Task Group will review the existing fire and smoke detection requirements within NFPA 302 as well as but not limited to those found in ISO 9094, Small Craft Fire Protection; and ABYC Standards.

The Task Group is responsible developing revisions to be submitted as a Public Comment as necessary for consideration at the Second Draft meeting. Deadline for Public Comment is: 05/31/2023.

This Committee Input Incorporates PI-5 and PI-13.

Response Message: CI-13-NFPA 302-2022

[Public Input No. 13-NFPA 302-2022 \[New Section after 13.3\]](#)

[Public Input No. 5-NFPA 302-2022 \[Section No. 13.3\]](#)

Ballot Results

This item has not been balloted

NFPA 302 (MOR-AAA)

Lithium Ion (LI) Batteries Task Group Meeting Minutes

25 May 2023

10:00 AM – 11:30 AM (ET)

Web/Teleconference

The L-I Batteries Task Group met on 25 May 2023 at 10:00 AM (EDT). The meeting was held on MS Teams. Meeting participants included the following:

- Christopher Bloom (MOR-AAA)– TG Chairman
- James Côté (MOR-AAA), Côté Marine LLC
- Brian Goodwin (MOR-AAA), ABYC
- Kelly Nicoletto, UL
- Lawrence Russell, NFPA Staff

The Lithium-Ion Batteries Task Group was created under Committee Input No. 9-NFPA302-2022. The Task Group is responsible for developing recommendations for fire prevention and life safety requirements focused on lithium-ion batteries that are used for vessel propulsion, fixed equipment and portable equipment on boats.

The Task Group discussed the hazards associated with energy storage systems. The Task Group agreed the best approach at this time to address hazards associated with lithium-ion batteries that are used for power supply on vessels and tools and toys that may be onboard a vessel is incorporate existing requirements, guidance and recommendations. The Task Group's recommended revisions for the 2025 edition of NFPA 302 will be presented to the Technical Committee on Motor Craft during its Second Draft meeting for NFPA 302 that will be scheduled sometime after 31 May 2023 and before 22 November 2023.

The Task Group believes there a need to continue to review hazard mitigation and fire extinguishing methods related to lithium-ion batteries for future revisions to the Standard. It recommends continuing the task group beyond the development of the 2025 edition on NFPA 302.

The Task Group meeting concluded at 11:30 AM (EDT) on 25 May 2023.

NFPA 302 (MOR-AAA)

Lithium Ion (LI) Batteries Task Group Work Product

25 May 2023

The L-I Batteries Task Group recommends the following second revisions for the 2025 edition of NFPA 302:

Revise 9.3.6 as follows:

9.3.6 Lithium-Ion Batteries. ~~Engine-starting and general distribution lithium-ion batteries shall not be used unless they are installed with a battery management system (BMS) that meets the requirements of the battery manufacturer.~~

9.6.3.1* Permanently installed lithium-ion batteries systems shall be installed and maintained in compliance with one of the following: ABYC E-13, *Lithium Ion Batteries*, American Bureau of Shipping (ABS) *Requirements for Use of Lithium-ion Batteries in the Marine and Offshore Industries*, or Lloyd's Register *Type Approval System Test Specification Number 5*; and the manufacturer's instructions.

A.9.3.6.1 Energy storage systems (ESS) such as permanently installed lithium-ion batteries can be a significant fire risk. For additional information ESS, see NFPA publication: *Energy Storage Systems Safety Fact Sheet*.

9.3.6.2 Powered micromobility devices utilizing lithium-ion batteries shall comply with NFPA 1.

A.9.3.6.2 Any size lithium-ion battery can off-gas explosive vapor or ignite if not properly charged and maintained. For additional information on powered micromobility devices, see NFPA publication: *E-Bike and E-Scooter Safety Tip Sheet*.

Substantiation:

Lithium-ion (L-I) battery technology is being used to replace many combustion engines and traditional lead-acid batteries on boats for propulsion and powering vessel equipment. Many tools and toys that are powered by batteries also use L-I battery technology. Damaged or unstable batteries and improper charging, storage or disposal can cause the batteries to overheat, leading to an explosive, aggressive fire that spreads rapidly, can reignite and is challenging to extinguish. Lithium-ion battery fires are very dangerous. This hazard needs to be addressed in NFPA 302. There are existing publications that provide requirements and guidance to mitigate L-I battery related hazards. With this revision, these publications are incorporated by reference in the Standard.

Add the following definition to Chapter 3 and Annex A:

3.3.X* Micromobility Device, Powered. Motorized bicycles, motorized scooters, or other personal transportation devices powered by lithium-ion or lithium metal batteries. [1, 2024]

A.3.3.X Micromobility Device, Powered. Other personal transportation devices powered by lithium-ion or lithium metal batteries can include personal watercraft.

Substantiation:

With the revision to NEW 9.3.6.2 it is necessary to use the definition for micromobility device, powered, that is presented in NFPA 1, 2024 edition.

Add the following to 2.2 NFPA Publications:

NFPA 1, *Fire Code*, 2024 edition.

Add the following to 2.3 Other Publications:

2.3.1 ABS Publications. American Bureau of Shipping, ABS Plaza, 1701 City Plaza Drive
Spring, TX 77389.

Publication 275, *Requirements for Use of Lithium-Ion Batteries in the Marine and Offshore Industries*, 2022.

2.3.42 ABYC Publications. American Boat & Yacht Council, Inc., 613 Third Street, Suite 10, Annapolis, MD 21403.

ABYC A-24, *Installation of Carbon Monoxide Detectors and Alarms*, 2020.

ABYC A-28, *Galvanic Isolators*, 2019.

ABYC A-31, *Battery Chargers and Inverters*, 2020.

ABYC E-11, *AC and DC Electrical Systems on Boats*, 2021.

[ABYC E-13, *Lithium Ion Batteries*, 2022](#)

ABYC H-25, *Portable Marine Gasoline Fuel Systems*, 2019.

ABYC TE-4, *Lightning Protection*, 2019.

ABYC TH-23, *Design, Construction, and Testing of Boats in Consideration of Carbon Monoxide*, 2022.

2.3.X Lloyd's Register Group Limited. 71 Fenchurch Street, London, EC3M 4BS, United Kingdom.

Lloyd's Register Type Approval System – Test Specification Number 5, 2019.

Add the following to 2.4 References for Extracts in Mandatory Sections:

NFPA 1, *Fire Code*, 2024 edition.

Substantiation:

With the revision to NEW 9.3.6.1 and 9.3.6.2 it is necessary to include the publications that are therein referenced under 2.3 Other Publications.

Add the following to Annex F Informational References:

F.1.1 NFPA Publications

NFPA Fact Sheet, *Energy Storage Systems Safety Fact Sheet*, 2020.

<https://www.nfpa.org/~media/Files/Code%20or%20topic%20fact%20sheets/ESSFactSheet.pdf>

NFPA Tip Sheet, E-Bike and E-Scooter Safety, 2022.

<https://www.nfpa.org/~media/Files/Public%20Education/Resources/Safety%20tip%20sheets/ElectricBikeSafetyTips.ashx>

Substantiation:

With the revision to NEW 9.3.6.1 and 9.3.6.2 it is necessary to include the publications that are therein referenced under F.1.1 NFPA Publications.



ENERGY STORAGE SYSTEMS SAFETY FACT SHEET

Because of the growing concerns surrounding the use of fossil fuels and a greater demand for a cleaner, more efficient, and more resilient energy grid, the use of energy storage systems, or ESS, has increased dramatically in the past decade. Renewable sources of energy such as solar and wind power are intermittent, and so storage becomes a key factor in supplying reliable energy. ESS also help meet energy demands during peak times and can supply backup power during natural disasters and other emergencies. However, the rise in the number of ESS installations requires the need for a heightened understanding of the hazards involved and more extensive measures to reduce the risks.

What Is an ESS?

An energy storage system, often abbreviated as ESS, is a device or group of devices assembled together, capable of storing energy in order to supply electrical energy at a later time. Battery ESS are the most common type of new installation and are the focus of this fact sheet.

DID YOU KNOW?

According to the US Department of Energy, in 2019, about 18 percent of electricity generated at utility-scale electricity generation facilities in the United States was from renewable energy sources.

What Are the Advantages?

ESS have many useful applications.

Supplement Renewables

Renewable energies such as solar panels or wind turbines only produce electricity when the sun is out or the wind is blowing. Supplementing these with ESS allows users to take advantage of the electricity that is generated when the renewable energy technologies are not producing electricity.

Peak Shaving

ESS allows a user to shift where their electricity comes from by drawing power from the batteries during the higher-cost daytime hours then recharging during the lower-cost nighttime hours. This practice is referred to as peak shaving.

Load Leveling

When power generation facilities ramp up and ramp down to keep up with the changing demand for electricity, it puts stress on the system. ESS can help flatten out the demand curve by charging when electrical demand is low and discharging when it is high.

Uninterruptible Power Supply

ESS can provide near instantaneous protection from power interruptions and are often used in hospitals, data centers, and homes.

What Are Some of the Hazards?

Thermal Runaway

Thermal runaway is a term used for the rapid uncontrolled release of heat energy from a battery cell; it is a condition when a battery creates more heat than it can effectively dissipate. Thermal runaway in a single cell can result in a chain reaction that heats up neighboring cells. As this process continues, it can result in a battery fire or explosion. This can often be the ignition source for larger battery fires.

Stranded Energy

As with most electrical equipment there is a shock hazard present, but what is unique about ESS is that often, even after being involved in a fire, there is still energy within the ESS. This is difficult to discharge since the terminals are often damaged and presents a hazard to those performing overhaul after a fire. Stranded energy can also cause reignition of the fire hours or even days later.

ENERGY STORAGE SYSTEMS SAFETY FACT SHEET *CONTINUED***Toxic and Flammable Gases Generated**

Most batteries create toxic and flammable gases when they undergo thermal runaway. If the gases do not ignite before the lower explosive limit is reached, it can lead to the creation of an explosive atmosphere inside of the ESS room or container.

Deep Seated Fires

ESS are usually comprised of batteries that are housed in a protective metal or plastic casing within larger cabinets. These layers of protection help prevent damage to the system but can also block water from accessing the seat of the fire. This means that it takes large amounts of water to effectively dissipate the heat generated from ESS fires since cooling the hottest part of the fire is often difficult.

Failure Modes

These are ways the batteries can fail, often leading to thermal runaway and subsequent fires or explosions.

Mechanical Abuse

Mechanical abuse is when a battery is physically compromised by either being dropped, crushed, or penetrated.

Thermal Abuse

Thermal abuse can occur when a battery is exposed to external heat sources.

Electrical Abuse

Electrical abuse can happen when the battery is overcharged, charged too rapidly or at high voltage, or discharged too rapidly.

Environmental Impacts

Environmental impacts that can lead to battery failure include seismic activity, rodent damage to wiring, extreme heat, and floods.

How Do We Help Keep People and Property Safe?**For the Designer/Installer:****Explosion Protection/Prevention**

If there are enough batteries in a room to create an explosive atmosphere, then explosion prevention systems or deflagration venting should be installed per NFPA 69, *Standard on Explosion Prevention Systems*, and NFPA 68, *Standard on Explosion Protection by Deflagration Venting*.

Fire Suppression System

Testing has shown water to be the most effective medium for cooling an ESS fire. A sprinkler system that complies with NFPA 13, *Standard for the Installation of Sprinkler Systems*, should be installed in buildings where an ESS is installed.

Battery Management System

A system that monitors, controls, and optimizes performance of an individual or multiple battery modules in an ESS and can control the disconnection of the module(s) from the system in the event of abnormal conditions.

Spacing

ESS units should be grouped into small segments limited to certain kilo-watt hours (kWh) and spaced from other segments and walls to prevent horizontal propagation. The table below, which summarizes information from a Fire Protection Research Foundation (FPRF) report, "Sprinkler Protection Guidance for Lithium-Ion Based Energy Storage Systems" (2019), demonstrates the recommended spacing for the testing for specific chemistries and arrangements.

Recommended Separation of Lithium-Ion Battery Energy Storage Systems

ESS Type & Capacity	Object Combustibility	Sprinklered	Nonsprinklered
LFP 83 kWh	Combustible	–	1.8 m (6 ft)
	Noncombustible	–	1.2 m (4 ft)
NMC 47 kWh	Combustible	2.7 m (9 ft)	4.0 m (13 ft)
	Noncombustible	1.8 m (6 ft)	2.4 m (8 ft)
NMC 125 kWh	Combustible	–	1.2 m (4 ft)
	Noncombustible	–	< 0.9 m (< 3 ft)
LFP 31 kWh	Combustible	1.5 m (5 ft)	1.8 m (6 ft)
	Noncombustible	0.9 m (3 ft)	1.2 m (4 ft)

**For the AHJ:****Permitting Checklist**

Permits should be issued by and in accordance with the procedures of all authorities having jurisdiction and should bear the name and signature of each authority having jurisdiction or their designated representative(s). In addition, the permit should indicate the following:

1. Purpose of the ESS for which the permit is issued

ENERGY STORAGE SYSTEMS SAFETY FACT SHEET *CONTINUED*

2. Type of ESS, size, weight broken down by subcomponents or subsystems, type, and amount of any hazardous materials, general arrangement of the system, and extent of work to be performed
3. Address where the ESS is to be installed and operated
4. Name and address of the permittee
5. Permit number and date of issuance
6. Period of validity of the permit
7. Inspection requirements

**For the Fire Service:****Pre-Incident Planning**

The fire department should develop a pre-incident plan for responding to fires, explosions, and other emergency conditions associated with the ESS installation, and the pre-incident plan should include the following elements:

1. Understanding the procedures included in the facility operation and emergency response plan described
2. Identifying the types of ESS technologies present, the potential hazards associated with the systems, and methods for responding to fires and incidents associated with the particular ESS
3. Identifying the location of all electrical disconnects in the building and understanding that electrical energy stored in ESS equipment cannot always be removed or isolated
4. Understanding the procedures for shutting down and de-energizing or isolating equipment to reduce the risk of fire, electric shock, and personal injury hazards
5. Understanding the procedures for dealing with damaged ESS equipment in a post-fire incident, including the following:
 - a. Recognizing that stranded electrical energy in fire-damaged storage batteries and other ESS has the potential for reignition long after initial extinguishment
 - b. Contacting personnel qualified to safely remove damaged ESS equipment from the facility (This contact information is included in the facility operation and emergency response plan.)

Emergency Operations Planning

An emergency operations plan should be created and contain elements such as procedures to safely shut down the

system, procedures for the removal of damaged ESS, general emergency procedures, and annual staff training.

CASE STUDY: Kahuku Wind Farm Fire

A fire broke out at the Kahuku wind farm in the north shore of Oahu, Hawaii in the summer of 2012. This was a 10,000 ft² battery warehouse where a 15 mega-watt system containing approximately 12,000 lead acid batteries was located. The fire was a challenge to extinguish, burning for over 13 hours and smoldering for over 36 hours. Extensive damage was caused to the system. This event demonstrated the need for first responders to have more education in this area.

Frequently Asked Questions About Battery ESS

Q: Which NFPA standard covers the installation of ESS?

A: If you are installing ESS for either new construction or a renovation, you should review the requirements of NFPA 855, *Standard for the Installation of Energy Storage Systems*.

Q: What is the best extinguishing agent for a fire in a battery ESS?

A: Testing has shown that water is the most effective agent for cooling for a battery ESS. For this reason, a sprinkler system designed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, is required by NFPA 855, *Standard for the Installation of Energy Storage Systems*.

Q: I've heard that an ESS can reignite several days after a fire has been extinguished, is this true?

A: Lithium-ion batteries have shown they can ignite, or reignite, long after they have been damaged or involved in a fire—hours, days, or even weeks later.

Q: Is it OK to use a fire hose to extinguish a lithium-ion battery fire?

A: The UL study "Firefighter Safety and Photovoltaic Installations Research Project" (2011) showed that for voltages up to 1000 volts dc, water can be safely applied given the right conditions. This study demonstrated that using an adjustable nozzle at a minimum of a 10 degree fog pattern allowed for the safe application of water at a distance of 5 ft from the 1000 volts dc electrical source; however, due to the potential conductivity of pooling water, contact with it may expose you to shock.



ENERGY STORAGE SYSTEMS SAFETY FACT SHEET *CONTINUED*

NEXT STEPS

- ✓ Visit nfpa.org/ess to learn more and to access the latest research and reports.
- ✓ Take [Energy Storage and Solar Systems Safety Online Training](#) for fire service personnel.

RESOURCES

US Department of Energy

Energy Storage System Safety: Plan Review and Inspection Checklist (2017)

Underwriters Laboratories Inc.

Firefighter Safety and Photovoltaic Installations Research Project (2011)

FPRF Reports

Projects currently underway:

[Stranded Energy within Lithium-Ion Batteries](#)

[Firefighter Safety in Battery Energy Storage System Fires](#) (advisory project with the University of Texas)

Report: [Energy Storage System Research and Design Challenge](#) (2019)

Report: [Sprinkler Protection Guidance for Lithium-Ion Based Energy Storage Systems](#) (2019)

Reports: [Lithium ion batteries hazard and use assessment](#) Phase I (2011), Phase II (2013), Phase III (2016).

Report: [Hazard Assessment of Lithium Ion Battery Energy Storage Systems](#) (February 2016)

Report: [Development of Fire Mitigation Solutions for Photovoltaic \(PV\) Systems Installed on Building Roofs](#) (2016)

Report: [Commercial Roof-Mounted Photovoltaic System Installation Best Practices Review and All Hazard Assessment](#) (2014)

Report: [Property Insurance Research Group Forum on PV Panel Fire Risk](#) (2014)

Workshop: [Energy Storage Systems and the Built Environment](#) (November 2015)

Report: [Emergency Response to Incident Involving Electric Vehicle Battery Hazards](#) (July 2013)

NFPA Information Sheets

[Energy Storage Systems: Is Your Community Ready?](#)

[Lithium Ion Battery Safety for Consumers](#)

Relevant NFPA Standards

Get free access to NFPA codes and standards at nfpa.org.

- ▶ NFPA 1, *Fire Code*, 2018 edition
- ▶ NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2019 edition
- ▶ NFPA 68, *Standard on Explosion Protection by Deflagration Venting*, 2018 edition
- ▶ NFPA 69, *Standard on Explosion Prevention Systems*, 2019 edition
- ▶ NFPA 70®, *National Electrical Code®*, 2020 edition
- ▶ NFPA 110, *Standard for Emergency and Standby Power Systems*, 2019 edition
- ▶ NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, 2019 edition
- ▶ NFPA 855, *Standard for the Installation of Energy Storage Systems*, 2020 edition
- ▶ NFPA 1620, *Standard for Pre-Incident Planning*, 2020 edition



E-Bike and E-Scooter Safety

The popularity of electric bikes and electric scooters (e-bikes and e-scooters) has taken off over the past few years. Lithium-ion batteries are usually the source of power for both, and if not used correctly, or if damaged, those batteries can catch on fire or explode. Whether you use e-bikes or e-scooters as your main way of getting around, or just for fun, there are important safety tips to keep in mind when charging or storing these devices.

The Problem

- Damaged or defective batteries can over-heat, catch fire, or explode.
- Lithium-ion battery fires give off toxic gases and they burn extremely hot.

Safety Tips

- Only purchase and use devices, batteries, and charging equipment that are listed by a nationally recognized testing lab and labeled accordingly.
- Always follow the instructions from the manufacturer.
- Only use the battery and the charger that were designed for, and came with, the device.
- Do not keep charging the device or device battery after it is fully charged.
- Only charge one device or device battery at a time to prevent overloading the circuit.
- Keep batteries at room temperature when possible. Do not charge them at temperatures below 32°F (0°C) or above 105°F (40°C).
- Do not store batteries in direct sunlight or inside hot vehicles, and keep them away from children and liquids.

- Store e-bikes, e-scooters, and batteries away from exit doors and anything that can get hot or catch fire.
- Only have device repairs performed by a qualified professional.
- Do not put lithium-ion batteries in the trash. Recycling is always the best option. Take the batteries to a battery recycling location or contact your local waste department for disposal instructions.

Signs of a Problem

Stop using the e-bike or e-scooter if you notice any of these problems with the battery: unusual odor, change in color, too much heat, change in shape, leaking, smoking, or not keeping a charge.



If you see a fire ...



Leave the building immediately.



Don't try to fight the fire.



Call 911.

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