EXHIBIT 164

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA

AMERICAN SOCIETY FOR TESTING AND MATERIALS d/b/a ASTM INTERNATIONAL; NATIONAL FIRE PRODUCTION ASSOCIATION, INC.; and AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR CONDITIONING ENGINEERS, Plaintiff/ Counter-Defendants, v. PUBLIC.RESOURCE.ORG, INC., Defendant/ Counter-Plaintiff.	Case No. 1:13-cv-01215-TSC

DEFENDANT-COUNTERCLAIMANT PUBLIC.RESOURCE.ORG, INC.'S RESPONSES AND OBJECTIONS TO PLAINTIFF-COUNTERDEFENDANTS' THIRD SET OF INTERROGATORIES

Defendant Public.Resource.Org, Inc. ("Public Resource") hereby objects, answers, and otherwise responds to Plaintiff American Society for Testing and Materials d/b/a ASTM International's ("ASTM") Third Set of Interrogatories, as follows:

STATEMENT ON SUPPLEMENTATION

Public Resource's investigation in this action is ongoing, and Public Resource reserves the right to rely on and introduce information in addition to any information provided in these responses at the trial of this matter or in other related proceedings. Information it discovers later in the litigation may be responsive to the interrogatory and Public Resource reserves its right to supplement its responses at appropriate points throughout this litigation without prejudice or to

otherwise make available to ASTM such information. Public Resource also reserves the right to change, modify, or enlarge the following objections and responses based on amendments to pleadings, additional information, further analysis, or in light of other events in the litigation.

INTERROGATORIES

INTERROGATORY NO. 17:

For each Standard at Issue, identify each national, federal, state, and local law, statute, regulation, or ordinance into which Public Resource asserts that the Standard at Issue are incorporated.

RESPONSE TO INTERROGATORY NO. 17:

Public Resource objects to the interrogatory to the extent that it seeks information that falls under the attorney-client privilege, work-product doctrine, common interest privilege, or other applicable privileges or protections. Public Resource will not provide such information, and any inadvertent production is not a waiver of any applicable privilege or protection. Public Resource objects to this interrogatory to the extent that it calls for a legal conclusion, or requests legal research to be conducted by Public Resource. Public Resource objects to the definition of "Public Resource" on the grounds that it is vague, ambiguous, overbroad, unduly burdensome, particularly to the extent that it purports to include any predecessors, successors, affiliates, subsidiaries, divisions, parents, assignees, joint ventures, and each other person directly or indirectly, wholly or in part, owned or controlled by it, and all present or former partners, principals, employees, officers, agents, legal representatives, consultants, when such persons are acting outside of a capacity of representing Public Resource; or any person "acting or purporting to act on its behalf" who is not an agent of Public Resource. Public Resource objects to the interrogatory to the extent it is cumulative and/or duplicative of other of Plaintiff's discovery requests. Public Resource objects to this interrogatory to the extent that it is overly broad,

unduly burdensome, oppressive, or to the extent it is inconsistent with, or purport to impose obligations on Public Resource beyond those set forth by the Federal Rules of Civil Procedure, the Local Rules of the United States District Court for the District of Columbia, the Federal Rules of Evidence, or any applicable regulations and case law, particularly to the extent that compliance would force Public Resource to incur a substantial expense that outweighs any likely benefit of the discovery. Public Resource's responses do not constitute an adoption or acceptance of the definitions and instructions that Plaintiffs seek to impose. Public Resource objects to the interrogatory as overbroad and unduly burdensome to the extent that it seeks documents and information that are not in Public Resource's possession, custody, or control, are in Plaintiffs' possession, custody, or control, or are beyond the scope of a reasonable search. Public Resource objects to this interrogatory on the grounds that it is a contention interrogatory, and Public Resource's investigation is ongoing. Public Resource objects to this interrogatory on the ground that it seeks to impose obligations on Public Resource that are unduly burdensome, especially to the extent that it requests information that is publicly available or burdensome to search for or obtain.

Public Resource's responses to this interrogatory is made without waiving, or intending to waive, but on the contrary, preserving and intending to preserve: (a) the right to object, on the grounds of competency, privilege, relevance or materiality, or any other proper grounds, to the use of any documents or other information for any purpose in whole or in part, in any subsequent proceeding in this action or in any other action; (b) the right to object on any and all grounds, at any time, to other requests for production, interrogatories, or other discovery procedures involving or relating to the subject matter of the interrogatory to which Defendants respond; and (c) the right at any time to revise, correct, add to, or clarify the responses.

Pursuant to and without waiving the foregoing objections, Public Resource responds as follows: Pursuant to Federal Rule of Civil Procedure 33(d), Public Resource identifies the following documents produced by it in this action:

PRO_00061928, PRO_00077073-77948, PRO_00079099-79108, PRO_00079360-79365, PRO_79370-79373, PRO_00080317-80324, PRO_00081454-81457, PRO_00082342-82345, PRO_82352-82356, PRO_00082439-82446, PRO_00082472-82659, PRO_00082835-83026, PRO_00083032-83109, PRO_00084233-84250, PRO_00084262-84335, PRO_00085147-85152, PRO_00086329-86335, PRO_00086342-86347, PRO_00087627-87630, PRO_00088099-88108, PRO_00089127-89135, PRO_00090507-90512, PRO_00090539-90543, PRO_00090715-90720, PRO_00091613-91616, PRO_00091622-91625, PRO_00091632-91641, PRO_00091642-91646, PRO_00091647-91652, PRO_00091664-91667, PRO_00091668-91680, PRO_00091686-91689, PRO_00091690-91692, PRO_00091693-91700, PRO_00091723-91729, PRO_00091744-91750, PRO_00091751-91757, PRO_00091758-91801, PRO_00091802-91847, PRO_00091848-91855, PRO_00091856-91861, PRO_00091862-91873, PRO_00091887-91890, PRO_00091912-91914, PRO_00091915-91918, PRO_00091927-91930, PRO_00091931-91936, PRO_00091937-91941, PRO_00091959-91968, PRO_00091969-91978, PRO_00091979-91982, PRO_00092022-92030, PRO_00092052-92059, PRO_00092077-92084, PRO_00092094-92099, PRO_00092176-92193, PRO_00092264-92271, PRO_00092306-92315, PRO_00092362-92373, PRO_00092386-92390, PRO_00092428-92435, PRO_00092802-92813, PRO_00092827-92833, PRO_00092847-92852, PRO_00092883-92892, PRO_00092925-92934, PRO_00092980-92989, PRO_00093012-93019, PRO_00093063-93067, PRO_00093103-93114, PRO_00093139-93145, PRO_00093196-93211, PRO_00093248-93253, PRO_00093301-93314, PRO_00093351-93360, PRO_00093401-93415, PRO_00093469-93478, PRO_00093489-93495, PRO_00093534-93543,

PRO_00093556-93562, PRO_00093566-93569, PRO_00093588-93634, PRO_00093700-93709, PRO_00093841-93864, PRO_00093904-93916, PRO_00093937-93942, PRO_00093990-93993, PRO_00094023-94027, PRO_00094070-94083, PRO_00094118-94134, PRO_00094140-94143, PRO_00094157-94162, PRO_00094210-94218, PRO_00094396-94408, PRO_00094536-94540, PRO_00094565-94569, PRO_00094575-94580, PRO_00094595-94601, PRO_00094642-94649, PRO_00094699-94704, PRO_00094717-94722, PRO_00094770-94774, PRO_00094794-94803, PRO_00094822-94827, PRO_00094856-94862, PRO_00095007-95016, PRO_00095760-95783, PRO_00095921-95949, PRO_00097524-97542, PRO_00097934-97942, PRO_00101043-101048, PRO_00101136-101152, PRO_00101220-101233, PRO_00101783-101809, PRO_00102865- PRO_00102871, PRO_00102894-102899, PRO_00103038-103042, PRO_00103260-103275, PRO_00103290-103297, PRO_00103368-103375, PRO_00103410-103417, PRO_00103429-103436, PRO_00103457-103461, PRO_00103727-103732, PRO_00103749-103758, PRO_00103788-103797, PRO_00103821-103829, PRO_00103893-103898, PRO_00103921-103929, PRO_00103975-103991, PRO_00104044-104054, PRO_00104128-104135, PRO_00104177-104184, PRO_00104274-104286, PRO_00104295-104301, PRO_00104411-104421, PRO_00104441-104449, PRO_00104481-104487, PRO_00104527-104534, PRO_00104549-104556, PRO_00104644-104651, PRO_00104686-104696, PRO_00104729-104736, PRO_00104757-104765, PRO_00104786-104793, PRO_00104803-104808, PRO_00104938-104946, PRO_00104991-105002, PRO_00105023-105031, PRO_00105128-105135, PRO_00105267-105277, PRO_00105286-105290, PRO_00105322-105326, PRO_00105869-105876, PRO_00105881-105884, PRO_00105998-106023, PRO_00106152-106181, PRO_00106193-106201, PRO_00106258-106275, PRO_00106312-106331, PRO_00106399-106403, PRO_00106404-106410, PRO_00106469-

106492, PRO_00106516-106519, PRO_00106520-106527, PRO_00106607-106615, PRO_00106641-106657, PRO_00106690-106715, PRO_00106726-106731, PRO_00106751-106757, PRO_00106758-106763, PRO_00106769-106774, PRO_00106805-106809, PRO_00106810-106818, PRO_00106820-106839, PRO_00106851-106856, PRO_00106859-106867, PRO_00106889-106895, PRO_00106896-106900, PRO_00106901-106906, PRO_00106908-106915, PRO_00107009-10713, PRO_00107023-107028, PRO_00107, PRO_00107047-107050, PRO_00107055-107068, PRO_00107074-107079, PRO_00107144-107149, PRO_00107162-107165, PRO_00107183-107188, PRO_00107189-107213, PRO_00107247-107255, PRO_00107297-107305, PRO_00107322-107338, PRO_00107374-107382, PRO_00107383-107391, PRO_00107393-107413, PRO_00107415-107420, PRO_00107445-107450, PRO_00107471-107482, PRO_00107483-107492, PRO_00107496-107507, PRO_00107520-107525, PRO_00107, PRO_00165936-165945, PRO_00095017-95229, PRO_00095230-95713, PRO_00095950-96510, PRO_00096531-96948, PRO_00096985-97429, PRO_00097430-97523, PRO_00097564-97730, PRO_00097761-97933, PRO_00097984-98611, PRO_00098612-99334, PRO_00099398-100184, PRO_00100207-101042, PRO_00101955-102843, PRO_00108355-108419, PRO_00109946-110342, PRO_00111914-112014, PRO_00112495-112559, PRO_00112770-113115, PRO_00113373-113495, PRO_00114153-114277, PRO_00115800-115969, PRO_00117459-117572, PRO_00118005-118128, PRO_00118133-118182, PRO_00119098-119349, PRO_00120221-120488, PRO_00077073-77948, PRO_00082472-82659, PRO_00082835-83026, PRO_00083032-83109, PRO_00084233-84250, PRO_00084262-84335, PRO_00203780-203783, PRO_00203784-203787, PRO_00203788-203791, PRO_00203782-203795, PRO_00203796-203799, PRO_00203800-203804, PRO_00203805-203809, PRO_00203810-

203814, PRO_00222230-222276, PRO_00222277-222286, PRO_00222304-222309, PRO_00222323-222346, PRO_00222406-222430, PRO_000204314-204315, PRO_00232653, PRO_00241253-241259, PRO_00241289, PRO_00241165-241170, PRO_00241171-241176, PRO_00241177-241182, PRO_00241218-241221, PRO_00241222-241225, PRO_00241226-241229, PRO_00241230-241233, PRO_00241234-241237, PRO_00241238-241242, PRO_00241243-241247, PRO_00241248-241252, PRO_00241308-241310, PRO_00166332-166539, PRO_00181851-182198, and https://archive.org/details/gov.law.nfpa.nec.2014.

Public Resource's investigation is ongoing, and Public Resource reserves the right to amend this response as additional information becomes available.

INTERROGATORY NO. 18:

Identify each instance of a Standard at Issue being incorporated into a national, federal, state, or local law, statute, regulation or ordinance that Public Resource contends gives rise to a defense of fair use.

RESPONSE TO INTERROGATORY NO. 18:

Public Resource objects to the interrogatory to the extent that it seeks information that falls under the attorney-client privilege, work-product doctrine, common interest privilege, or other applicable privileges or protections. Public Resource will not provide such information, and any inadvertent production is not a waiver of any applicable privilege or protection. Public Resource objects to this interrogatory to the extent that it calls for a legal conclusion, or requests legal research to be conducted by Public Resource. Public Resource objects to the definition of "Defendant," "Public Resource," "You," and "Your" on the grounds that it is vague, ambiguous, overbroad, unduly burdensome, particularly to the extent that it purports to include any predecessors, successors, affiliates, subsidiaries, divisions, parents, assignees, joint ventures, and

each other person directly or indirectly, wholly or in part, owned or controlled by it, and all present or former partners, principals, employees, officers, agents, legal representatives, consultants, when such persons are acting outside of a capacity of representing Public Resource; or any person "acting or purporting to act on its behalf" who is not an agent of Public Resource. Public Resource objects to the interrogatory to the extent it is cumulative and/or duplicative of any other of Plaintiff's discovery requests. Public Resource objects to this interrogatory to the extent that it is overly broad, unduly burdensome, oppressive, or to the extent it is inconsistent with, or purport to impose obligations on Public Resource beyond those set forth by the Federal Rules of Civil Procedure, the Local Rules of the United States District Court for the District of Columbia, the Federal Rules of Evidence, or any applicable regulations and case law, particularly to the extent that compliance would force Public Resource to incur a substantial expense that outweighs any likely benefit of the discovery. Public Resource's responses do not constitute an adoption or acceptance of the definitions and instructions that Plaintiffs seek to impose. Public Resource objects to the interrogatory as overbroad and unduly burdensome to the extent that it seeks documents and information that are not in Public Resource's possession, custody, or control, are in Plaintiffs' possession, custody, or control, or are beyond the scope of a reasonable search. Public Resource objects to this interrogatory on the grounds that it is a contention interrogatory, and Public Resource's investigation is ongoing. Public Resource objects to this interrogatory on the ground that it seeks to impose obligations on Public Resource that are unduly burdensome, especially to the extent that it requests information that is publicly available or burdensome to search for or obtain.

Public Resource's responses to this interrogatory is made without waiving, or intending to waive, but on the contrary, preserving and intending to preserve: (a) the right to object, on the

grounds of competency, privilege, relevance or materiality, or any other proper grounds, to the use of any documents or other information for any purpose in whole or in part, in any subsequent proceeding in this action or in any other action; (b) the right to object on any and all grounds, at any time, to other requests for production, interrogatories, or other discovery procedures involving or relating to the subject matter of the interrogatory to which Defendants respond; and (c) the right at any time to revise, correct, add to, or clarify the responses.

Pursuant to and without waiving the foregoing objections, Public Resource responds as follows: Pursuant to Federal Rule of Civil Procedure 33(d), Public Resource identifies the following documents produced by it in this action:

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PRO_00092176-92193, PRO_00092264-92271, PRO_00092306-92315, PRO_00092362-92373, PRO_00092386-92390, PRO_00092428-92435, PRO_00092802-92813, PRO_00092827-92833, PRO_00092847-92852, PRO_00092883-92892, PRO_00092925-92934, PRO_00092980-92989, PRO_00093012-93019, PRO_00093063-93067, PRO_00093103-93114, PRO_00093139-93145, PRO_00093196-93211, PRO_00093248-93253, PRO_00093301-93314, PRO_00093351-93360, PRO_00093401-93415, PRO_00093469-93478, PRO_00093489-93495, PRO_00093534-93543, PRO_00093556-93562, PRO_00093566-93569, PRO_00093588-93634, PRO_00093700-93709, PRO_00093841-93864, PRO_00093904-93916, PRO_00093937-93942, PRO_00093990-93993, PRO_00094023-94027, PRO_00094070-94083, PRO_00094118-94134, PRO_00094140-94143, PRO_00094157-94162, PRO_00094210-94218, PRO_00094396-94408, PRO_00094536-94540, PRO_00094565-94569, PRO_00094575-94580, PRO_00094595-94601, PRO_00094642-94649, PRO_00094699-94704, PRO_00094717-94722, PRO_00094770-94774, PRO_00094794-94803, PRO_00094822-94827, PRO_00094856-94862, PRO_00095007-95016, PRO_00095760-95783, PRO_00095921-95949, PRO_00097524-97542, PRO_00097934-97942, PRO_00101043-101048, PRO_00101136-101152, PRO_00101220-101233, PRO_00101783-101809, PRO_00102865- PRO_00102871, PRO_00102894-102899, PRO_00103038-103042, PRO_00103260-103275, PRO_00103290-103297, PRO_00103368-103375, PRO_00103410-103417, PRO_00103429-103436, PRO_00103457-103461, PRO_00103727-103732, PRO_00103749-103758, PRO_00103788-103797, PRO_00103821-103829, PRO_00103893-103898, PRO_00103921-103929, PRO_00103975-103991, PRO_00104044-104054, PRO_00104128-104135, PRO_00104177-104184, PRO_00104274-104286, PRO_00104295-104301, PRO_00104411-104421, PRO_00104441-104449, PRO_00104481-104487, PRO_00104527-104534, PRO_00104549-104556, PRO_00104644-104651, PRO_00104686-

104696, PRO_00104729-104736, PRO_00104757-104765, PRO_00104786-104793, PRO_00104803-104808, PRO_00104938-104946, PRO_00104991-105002, PRO_00105023-105031, PRO_00105128-105135, PRO_00105267-105277, PRO_00105286-105290, PRO_00105322-105326, PRO_00105869-105876, PRO_00105881-105884, PRO_00105998-106023, PRO_00106152-106181, PRO_00106193-106201, PRO_00106258-106275, PRO_00106312-106331, PRO_00106399-106403, PRO_00106404-106410, PRO_00106469-106492, PRO_00106516-106519, PRO_00106520-106527, PRO_00106607-106615, PRO_00106641-106657, PRO_00106690-106715, PRO_00106726-106731, PRO_00106751-106757, PRO_00106758-106763, PRO_00106769-106774, PRO_00106805-106809, PRO_00106810-106818, PRO_00106820-106839, PRO_00106851-106856, PRO_00106859-106867, PRO_00106889-106895, PRO_00106896-106900, PRO_00106901-106906, PRO_00106908-106915, PRO_00107009-10713, PRO_00107023-107028, PRO_00107, PRO_00107047-107050, PRO_00107055-107068, PRO_00107074-107079, PRO_00107144-107149, PRO_00107162-107165, PRO_00107183-107188, PRO_00107189-107213, PRO_00107247-107255, PRO_00107297-107305, PRO_00107322-107338, PRO_00107374-107382, PRO_00107383-107391, PRO_00107393-107413, PRO_00107415-107420, PRO_00107445-107450, PRO_00107471-107482, PRO_00107483-107492, PRO_00107496-107507, PRO_00107520-107525, PRO_00107, PRO_00165936-165945, PRO_00095017-95229, PRO_00095230-95713, PRO_00095950-96510, PRO_00096531-96948, PRO_00096985-97429, PRO_00097430-97523, PRO_00097564-97730, PRO_00097761-97933, PRO_00097984-98611, PRO_00098612-99334, PRO_00099398-100184, PRO_00100207-101042, PRO_00101955-102843, PRO_00108355-108419, PRO_00109946-110342, PRO_00111914-112014, PRO_00112495-112559, PRO_00112770-113115, PRO_00113373-

113495, PRO_00114153-114277, PRO_00115800-115969, PRO_00117459-117572, PRO_00118005-118128, PRO_00118133-118182, PRO_00119098-119349, PRO_00120221-120488, PRO_00077073-77948, PRO_00082472-82659, PRO_00082835-83026, PRO_00083032-83109, PRO_00084233-84250, PRO_00084262-84335, PRO_00203780-203783, PRO_00203784-203787, PRO_00203788-203791, PRO_00203782-203795, PRO_00203796-203799, PRO_00203800-203804, PRO_00203805-203809, PRO_00203810-203814, PRO_00222230-222276, PRO_00222277-222286, PRO_00222304-222309, PRO_00222323-222346, PRO_00222406-222430, PRO_000204314-204315, PRO_00232653, PRO_00241253-241259, PRO_00241289, PRO_00241165-241170, PRO_00241171-241176, PRO_00241177-241182, PRO_00241218-241221, PRO_00241222-241225, PRO_00241226-241229, PRO_00241230-241233, PRO_00241234-241237, PRO_00241238-241242, PRO_00241243-241247, PRO_00241248-241252, PRO_00241308-241310, PRO_00166332-166539, PRO_00181851-182198, and https://archive.org/details/gov.law.nfpa.nec.2014.

Public Resource's investigation is ongoing, and Public Resource reserves the right to amend this response as additional information becomes available.

PROVIDEINTERROGATORY NO. 19:

For each Standard at Issue, describe with specificity each portion(s) of the Standard at Issue that Public Resource asserts imposes a legal obligation on an individual or entity.

RESPONSE TO INTERROGATORY NO. 19:

Public Resource objects to the interrogatory to the extent that it seeks information that falls under the attorney-client privilege, work-product doctrine, common interest privilege, or other applicable privileges or protections. Public Resource will not provide such information, and any inadvertent production is not a waiver of any applicable privilege or protection. Public

Resource objects to this interrogatory to the extent that it calls for a legal conclusion, or requests legal research to be conducted by Public Resource. Public Resource objects to the definition of "Defendant," "Public Resource," "You," and "Your" on the grounds that it is vague, ambiguous, overbroad, unduly burdensome, particularly to the extent that it purports to include any predecessors, successors, affiliates, subsidiaries, divisions, parents, assignees, joint ventures, and each other person directly or indirectly, wholly or in part, owned or controlled by it, and all present or former partners, principals, employees, officers, agents, legal representatives, consultants, when such persons are acting outside of a capacity of representing Public Resource; or any person "acting or purporting to act on its behalf" who is not an agent of Public Resource. Public Resource objects to the interrogatory to the extent it is cumulative and/or duplicative of any other of Plaintiff's discovery requests. Public Resource objects to this interrogatory to the extent that it is overly broad, unduly burdensome, oppressive, or to the extent it is inconsistent with, or purport to impose obligations on Public Resource beyond those set forth by the Federal Rules of Civil Procedure, the Local Rules of the United States District Court for the District of Columbia, the Federal Rules of Evidence, or any applicable regulations and case law, particularly to the extent that compliance would force Public Resource to incur a substantial expense that outweighs any likely benefit of the discovery. Public Resource's responses do not constitute an adoption or acceptance of the definitions and instructions that Plaintiffs seek to impose. Public Resource objects to the interrogatory as overbroad and unduly burdensome to the extent that it seeks documents and information that are not in Public Resource's possession, custody, or control, are in Plaintiffs' possession, custody, or control, or are beyond the scope of a reasonable search. Public Resource objects to this interrogatory on the grounds that it is a contention interrogatory, and Public Resource's investigation is ongoing. Public Resource

objects to this interrogatory on the grounds that the term "entity" is vague and ambiguous, and Public Resource will define it to have the same meaning as Plaintiff's definition for "Person". Public Resource objects to this interrogatory on the ground that it seeks to impose obligations on Public Resource that are unduly burdensome, especially to the extent that it requests information that is publicly available or burdensome to search for or obtain.

Public Resource's responses to this interrogatory is made without waiving, or intending to waive, but on the contrary, preserving and intending to preserve: (a) the right to object, on the grounds of competency, privilege, relevance or materiality, or any other proper grounds, to the use of any documents or other information for any purpose in whole or in part, in any subsequent proceeding in this action or in any other action; (b) the right to object on any and all grounds, at any time, to other requests for production, interrogatories, or other discovery procedures involving or relating to the subject matter of the interrogatory to which Defendants respond; and (c) the right at any time to revise, correct, add to, or clarify the responses.

Pursuant to and without waiving the foregoing objections, Public Resource responds as follows:

The entirety of each standard listed on Exhibit A, Amended Exhibit B, and Exhibit C to the complaint is incorporated by reference into the law. Public Resource is not an attorney and does not provide legal advice, and cannot provide advice regarding what legal obligations an individual or entity may face as a result of hundreds of different federal, state, and local laws.

Pursuant to Federal Rule of Civil Procedure 33(d), Public Resource further identifies the following documents produced by it in this action:

PRO_00061928, PRO_00077073-77948, PRO_00079099-79108, PRO_00079360-79365, PRO_79370-79373, PRO_00080317-80324, PRO_00081454-81457, PRO_00082342-

82345, PRO_82352-82356, PRO_00082439-82446, PRO_00082472-82659, PRO_00082835-83026, PRO_00083032-83109, PRO_00084233-84250, PRO_00084262-84335, PRO_00085147-85152, PRO_00086329-86335, PRO_00086342-86347, PRO_00087627-87630, PRO_00088099-88108, PRO_00089127-89135, PRO_00090507-90512, PRO_00090539-90543, PRO_00090715-90720, PRO_00091613-91616, PRO_00091622-91625, PRO_00091632-91641, PRO_00091642-91646, PRO_00091647-91652, PRO_00091664-91667, PRO_00091668-91680, PRO_00091686-91689, PRO_00091690-91692, PRO_00091693-91700, PRO_00091723-91729, PRO_00091744-91750, PRO_00091751-91757, PRO_00091758-91801, PRO_00091802-91847, PRO_00091848-91855, PRO_00091856-91861, PRO_00091862-91873, PRO_00091887-91890, PRO_00091912-91914, PRO_00091915-91918, PRO_00091927-91930, PRO_00091931-91936, PRO_00091937-91941, PRO_00091959-91968, PRO_00091969-91978, PRO_00091979-91982, PRO_00092022-92030, PRO_00092052-92059, PRO_00092077-92084, PRO_00092094-92099, PRO_00092176-92193, PRO_00092264-92271, PRO_00092306-92315, PRO_00092362-92373, PRO_00092386-92390, PRO_00092428-92435, PRO_00092802-92813, PRO_00092827-92833, PRO_00092847-92852, PRO_00092883-92892, PRO_00092925-92934, PRO_00092980-92989, PRO_00093012-93019, PRO_00093063-93067, PRO_00093103-93114, PRO_00093139-93145, PRO_00093196-93211, PRO_00093248-93253, PRO_00093301-93314, PRO_00093351-93360, PRO_00093401-93415, PRO_00093469-93478, PRO_00093489-93495, PRO_00093534-93543, PRO_00093556-93562, PRO_00093566-93569, PRO_00093588-93634, PRO_00093700-93709, PRO_00093841-93864, PRO_00093904-93916, PRO_00093937-93942, PRO_00093990-93993, PRO_00094023-94027, PRO_00094070-94083, PRO_00094118-94134, PRO_00094140-94143, PRO_00094157-94162, PRO_00094210-94218, PRO_00094396-94408, PRO_00094536-94540, PRO_00094565-94569, PRO_00094575-94580, PRO_00094595-94601, PRO_00094642-94649,

PRO_00094699-94704, PRO_00094717-94722, PRO_00094770-94774, PRO_00094794-94803, PRO_00094822-94827, PRO_00094856-94862, PRO_00095007-95016, PRO_00095760-95783, PRO_00095921-95949, PRO_00097524-97542, PRO_00097934-97942, PRO_00101043-101048, PRO_00101136-101152, PRO_00101220-101233, PRO_00101783-101809, PRO_00102865- PRO_00102871, PRO_00102894-102899, PRO_00103038-103042, PRO_00103260-103275, PRO_00103290-103297, PRO_00103368-103375, PRO_00103410-103417, PRO_00103429-103436, PRO_00103457-103461, PRO_00103727-103732, PRO_00103749-103758, PRO_00103788-103797, PRO_00103821-103829, PRO_00103893-103898, PRO_00103921-103929, PRO_00103975-103991, PRO_00104044-104054, PRO_00104128-104135, PRO_00104177-104184, PRO_00104274-104286, PRO_00104295-104301, PRO_00104411-104421, PRO_00104441-104449, PRO_00104481-104487, PRO_00104527-104534, PRO_00104549-104556, PRO_00104644-104651, PRO_00104686-104696, PRO_00104729-104736, PRO_00104757-104765, PRO_00104786-104793, PRO_00104803-104808, PRO_00104938-104946, PRO_00104991-105002, PRO_00105023-105031, PRO_00105128-105135, PRO_00105267-105277, PRO_00105286-105290, PRO_00105322-105326, PRO_00105869-105876, PRO_00105881-105884, PRO_00105998-106023, PRO_00106152-106181, PRO_00106193-106201, PRO_00106258-106275, PRO_00106312-106331, PRO_00106399-106403, PRO_00106404-106410, PRO_00106469-106492, PRO_00106516-106519, PRO_00106520-106527, PRO_00106607-106615, PRO_00106641-106657, PRO_00106690-106715, PRO_00106726-106731, PRO_00106751-106757, PRO_00106758-106763, PRO_00106769-106774, PRO_00106805-106809, PRO_00106810-106818, PRO_00106820-106839, PRO_00106851-106856, PRO_00106859-106867, PRO_00106889-106895, PRO_00106896-106900, PRO_00106901-106906,

PRO_00106908-106915, PRO_00107009-10713, PRO_00107023-107028, PRO_00107, PRO_00107047-107050, PRO_00107055-107068, PRO_00107074-107079, PRO_00107144-107149, PRO_00107162-107165, PRO_00107183-107188, PRO_00107189-107213, PRO_00107247-107255, PRO_00107297-107305, PRO_00107322-107338, PRO_00107374-107382, PRO_00107383-107391, PRO_00107393-107413, PRO_00107415-107420, PRO_00107445-107450, PRO_00107471-107482, PRO_00107483-107492, PRO_00107496-107507, PRO_00107520-107525, PRO_00107, PRO_00165936-165945, PRO_00095017-95229, PRO_00095230-95713, PRO_00095950-96510, PRO_00096531-96948, PRO_00096985-97429, PRO_00097430-97523, PRO_00097564-97730, PRO_00097761-97933, PRO_00097984-98611, PRO_00098612-99334, PRO_00099398-100184, PRO_00100207-101042, PRO_00101955-102843, PRO_00108355-108419, PRO_00109946-110342, PRO_00111914-112014, PRO_00112495-112559, PRO_00112770-113115, PRO_00113373-113495, PRO_00114153-114277, PRO_00115800-115969, PRO_00117459-117572, PRO_00118005-118128, PRO_00118133-118182, PRO_00119098-119349, PRO_00120221-120488, PRO_00077073-77948, PRO_00082472-82659, PRO_00082835-83026, PRO_00083032-83109, PRO_00084233-84250, PRO_00084262-84335, PRO_00203780-203783, PRO_00203784-203787, PRO_00203788-203791, PRO_00203782-203795, PRO_00203796-203799, PRO_00203800-203804, PRO_00203805-203809, PRO_00203810-203814, PRO_00222230-222276, PRO_00222277-222286, PRO_00222304-222309, PRO_00222323-222346, PRO_00222406-222430, PRO_000204314-204315, PRO_00232653, PRO_00241253-241259, PRO_00241289, PRO_00241165-241170, PRO_00241171-241176, PRO_00241177-241182, PRO_00241218-241221, PRO_00241222-241225, PRO_00241226-241229, PRO_00241230-241233, PRO_00241234-241237, PRO_00241238-241242,

PRO_00241243-241247, PRO_00241248-241252, PRO_00241308-241310, PRO_00166332-166539, PRO_00181851-182198, and https://archive.org/details/gov.law.nfpa.nec.2014.

Public Resource's investigation is ongoing, and Public Resource reserves the right to amend this response as additional information becomes available.

INTERROGATORY NO. 20:

To the extent Public.Resource.Org contends that its response to Interrogatory No. 19 depends on specific instances in which a Standard at Issue is incorporated into a law, statute or regulation, specifically identify (including by reference to each part or subpart of any law, statute, or regulation) each instance in which Public Resource contends that incorporation into a law, statute, or regulation imposes a legal obligation on an individual or entity or has a direct legal effect on any private party's conduct.

RESPONSE TO INTERROGATORY NO. 20:

Public Resource objects to the interrogatory to the extent that it seeks information that falls under the attorney-client privilege, work-product doctrine, common interest privilege, or other applicable privileges or protections. Public Resource will not provide such information, and any inadvertent production is not a waiver of any applicable privilege or protection. Public Resource objects to this interrogatory to the extent that it calls for a legal conclusion, or requests legal research to be conducted by Public Resource. Public Resource objects to the definition of "Defendant," "Public Resource," "You," and "Your" on the grounds that it is vague, ambiguous, overbroad, unduly burdensome, particularly to the extent that it purports to include any predecessors, successors, affiliates, subsidiaries, divisions, parents, assignees, joint ventures, and each other person directly or indirectly, wholly or in part, owned or controlled by it, and all present or former partners, principals, employees, officers, agents, legal representatives,

consultants, when such persons are acting outside of a capacity of representing Public Resource; or any person "acting or purporting to act on its behalf" who is not an agent of Public Resource. Public Resource objects to the interrogatory to the extent it is cumulative and/or duplicative of any other of Plaintiff's discovery requests. Public Resource objects to this interrogatory to the extent that it is overly broad, unduly burdensome, oppressive, or to the extent it is inconsistent with, or purport to impose obligations on Public Resource beyond those set forth by the Federal Rules of Civil Procedure, the Local Rules of the United States District Court for the District of Columbia, the Federal Rules of Evidence, or any applicable regulations and case law, particularly to the extent that compliance would force Public Resource to incur a substantial expense that outweighs any likely benefit of the discovery. Public Resource's responses do not constitute an adoption or acceptance of the definitions and instructions that Plaintiffs seek to impose. Public Resource objects to the interrogatory as overbroad and unduly burdensome to the extent that it seeks documents and information that are not in Public Resource's possession, custody, or control, are in Plaintiffs' possession, custody, or control, or are beyond the scope of a reasonable search. Public Resource objects to this interrogatory on the grounds that it is a contention interrogatory, and Public Resource's investigation is ongoing. Public Resource objects to this interrogatory on the grounds that the term "entity" is vague and ambiguous, and Public Resource will define it to have the same meaning as Plaintiff's definition for "Person". Public Resource objects to this interrogatory on the ground that it seeks to impose obligations on Public Resource that are unduly burdensome, especially to the extent that it requests information that is publicly available or burdensome to search for or obtain.

Public Resource's responses to this interrogatory is made without waiving, or intending to waive, but on the contrary, preserving and intending to preserve: (a) the right to object, on the

grounds of competency, privilege, relevance or materiality, or any other proper grounds, to the use of any documents or other information for any purpose in whole or in part, in any subsequent proceeding in this action or in any other action; (b) the right to object on any and all grounds, at any time, to other requests for production, interrogatories, or other discovery procedures involving or relating to the subject matter of the interrogatory to which Defendants respond; and (c) the right at any time to revise, correct, add to, or clarify the responses.

Pursuant to and without waiving the foregoing objections, Public Resource responds as follows:

The entirety of each standard listed on Exhibit A, Amended Exhibit B, and Exhibit C to the complaint is incorporated by reference into the law. Public Resource is not an attorney and does not provide legal advice, and cannot provide advice regarding what legal obligations an individual or entity may face as a result of hundreds of different federal, state, and local laws.

Pursuant to Federal Rule of Civil Procedure 33(d), Public Resource further identifies the following documents produced by it in this action:

PRO_00061928, PRO_00077073-77948, PRO_00079099-79108, PRO_00079360-79365, PRO_79370-79373, PRO_00080317-80324, PRO_00081454-81457, PRO_00082342-82345, PRO_82352-82356, PRO_00082439-82446, PRO_00082472-82659, PRO_00082835-83026, PRO_00083032-83109, PRO_00084233-84250, PRO_00084262-84335, PRO_00085147-85152, PRO_00086329-86335, PRO_00086342-86347, PRO_00087627-87630, PRO_00088099-88108, PRO_00089127-89135, PRO_00090507-90512, PRO_00090539-90543, PRO_00090715-90720, PRO_00091613-91616, PRO_00091622-91625, PRO_00091632-91641, PRO_00091642-91646, PRO_00091647-91652, PRO_00091664-91667, PRO_00091668-91680, PRO_00091686-91689, PRO_00091690-91692, PRO_00091693-91700, PRO_00091723-91729,

PRO_00091744-91750, PRO_00091751-91757, PRO_00091758-91801, PRO_00091802-91847, PRO_00091848-91855, PRO_00091856-91861, PRO_00091862-91873, PRO_00091887-91890, PRO_00091912-91914, PRO_00091915-91918, PRO_00091927-91930, PRO_00091931-91936, PRO_00091937-91941, PRO_00091959-91968, PRO_00091969-91978, PRO_00091979-91982, PRO_00092022-92030, PRO_00092052-92059, PRO_00092077-92084, PRO_00092094-92099, PRO_00092176-92193, PRO_00092264-92271, PRO_00092306-92315, PRO_00092362-92373, PRO_00092386-92390, PRO_00092428-92435, PRO_00092802-92813, PRO_00092827-92833, PRO_00092847-92852, PRO_00092883-92892, PRO_00092925-92934, PRO_00092980-92989, PRO_00093012-93019, PRO_00093063-93067, PRO_00093103-93114, PRO_00093139-93145, PRO_00093196-93211, PRO_00093248-93253, PRO_00093301-93314, PRO_00093351-93360, PRO_00093401-93415, PRO_00093469-93478, PRO_00093489-93495, PRO_00093534-93543, PRO_00093556-93562, PRO_00093566-93569, PRO_00093588-93634, PRO_00093700-93709, PRO_00093841-93864, PRO_00093904-93916, PRO_00093937-93942, PRO_00093990-93993, PRO_00094023-94027, PRO_00094070-94083, PRO_00094118-94134, PRO_00094140-94143, PRO_00094157-94162, PRO_00094210-94218, PRO_00094396-94408, PRO_00094536-94540, PRO_00094565-94569, PRO_00094575-94580, PRO_00094595-94601, PRO_00094642-94649, PRO_00094699-94704, PRO_00094717-94722, PRO_00094770-94774, PRO_00094794-94803, PRO_00094822-94827, PRO_00094856-94862, PRO_00095007-95016, PRO_00095760-95783, PRO_00095921-95949, PRO_00097524-97542, PRO_00097934-97942, PRO_00101043-101048, PRO_00101136-101152, PRO_00101220-101233, PRO_00101783-101809, PRO_00102865- PRO_00102871, PRO_00102894-102899, PRO_00103038-103042, PRO_00103260-103275, PRO_00103290-103297, PRO_00103368-103375, PRO_00103410-103417, PRO_00103429-103436, PRO_00103457-103461, PRO_00103727-103732,

PRO_00103749-103758, PRO_00103788-103797, PRO_00103821-103829, PRO_00103893-103898, PRO_00103921-103929, PRO_00103975-103991, PRO_00104044-104054, PRO_00104128-104135, PRO_00104177-104184, PRO_00104274-104286, PRO_00104295-104301, PRO_00104411-104421, PRO_00104441-104449, PRO_00104481-104487, PRO_00104527-104534, PRO_00104549-104556, PRO_00104644-104651, PRO_00104686-104696, PRO_00104729-104736, PRO_00104757-104765, PRO_00104786-104793, PRO_00104803-104808, PRO_00104938-104946, PRO_00104991-105002, PRO_00105023-105031, PRO_00105128-105135, PRO_00105267-105277, PRO_00105286-105290, PRO_00105322-105326, PRO_00105869-105876, PRO_00105881-105884, PRO_00105998-106023, PRO_00106152-106181, PRO_00106193-106201, PRO_00106258-106275, PRO_00106312-106331, PRO_00106399-106403, PRO_00106404-106410, PRO_00106469-106492, PRO_00106516-106519, PRO_00106520-106527, PRO_00106607-106615, PRO_00106641-106657, PRO_00106690-106715, PRO_00106726-106731, PRO_00106751-106757, PRO_00106758-106763, PRO_00106769-106774, PRO_00106805-106809, PRO_00106810-106818, PRO_00106820-106839, PRO_00106851-106856, PRO_00106859-106867, PRO_00106889-106895, PRO_00106896-106900, PRO_00106901-106906, PRO_00106908-106915, PRO_00107009-10713, PRO_00107023-107028, PRO_00107, PRO_00107047-107050, PRO_00107055-107068, PRO_00107074-107079, PRO_00107144-107149, PRO_00107162-107165, PRO_00107183-107188, PRO_00107189-107213, PRO_00107247-107255, PRO_00107297-107305, PRO_00107322-107338, PRO_00107374-107382, PRO_00107383-107391, PRO_00107393-107413, PRO_00107415-107420, PRO_00107445-107450, PRO_00107471-107482, PRO_00107483-107492, PRO_00107496-107507, PRO_00107520-107525, PRO_00107, PRO_00165936-165945, PRO_00095017-

95229, PRO_00095230-95713, PRO_00095950-96510, PRO_00096531-96948, PRO_00096985-97429, PRO_00097430-97523, PRO_00097564-97730, PRO_00097761-97933, PRO_00097984-98611, PRO_00098612-99334, PRO_00099398-100184, PRO_00100207-101042, PRO_00101955-102843, PRO_00108355-108419, PRO_00109946-110342, PRO_00111914-112014, PRO_00112495-112559, PRO_00112770-113115, PRO_00113373-113495, PRO_00114153-114277, PRO_00115800-115969, PRO_00117459-117572, PRO_00118005-118128, PRO_00118133-118182, PRO_00119098-119349, PRO_00120221-120488, PRO_00077073-77948, PRO_00082472-82659, PRO_00082835-83026, PRO_00083032-83109, PRO_00084233-84250, PRO_00084262-84335, PRO_00203780-203783, PRO_00203784-203787, PRO_00203788-203791, PRO_00203782-203795, PRO_00203796-203799, PRO_00203800-203804, PRO_00203805-203809, PRO_00203810-203814, PRO_00222230-222276, PRO_00222277-222286, PRO_00222304-222309, PRO_00222323-222346, PRO_00222406-222430, PRO_000204314-204315, PRO_00232653, PRO_00241253-241259, PRO_00241289, PRO_00241165-241170, PRO_00241171-241176, PRO_00241177-241182, PRO_00241218-241221, PRO_00241222-241225, PRO_00241226-241229, PRO_00241230-241233, PRO_00241234-241237, PRO_00241238-241242, PRO_00241243-241247, PRO_00241248-241252, PRO_00241308-241310, PRO_00166332-166539, PRO_00181851-182198, and https://archive.org/details/gov.law.nfpa.nec.2014.

Public Resource's investigation is ongoing, and Public Resource reserves the right to amend this response as additional information becomes available.

INTERROGATORY NO. 21:

For each portion of each Standard at Issue that Public Resource asserts was necessary to reproduce verbatim (as opposed to paraphrasing or providing a summary) in order to describe

fairly the standard's legal import, describe with specificity the bases for such assertion and all supporting evidence.

RESPONSE TO INTERROGATORY NO. 21:

Public Resource objects to the interrogatory to the extent that it seeks information that falls under the attorney-client privilege, work-product doctrine, common interest privilege, or other applicable privileges or protections. Public Resource will not provide such information, and any inadvertent production is not a waiver of any applicable privilege or protection. Public Resource objects to this interrogatory to the extent that it calls for a legal conclusion, or requests legal research to be conducted by Public Resource. Public Resource objects to the definition of "Defendant," "Public Resource," "You," and "Your" on the grounds that it is vague, ambiguous, overbroad, unduly burdensome, particularly to the extent that it purports to include any predecessors, successors, affiliates, subsidiaries, divisions, parents, assignees, joint ventures, and each other person directly or indirectly, wholly or in part, owned or controlled by it, and all present or former partners, principals, employees, officers, agents, legal representatives, consultants, when such persons are acting outside of a capacity of representing Public Resource; or any person "acting or purporting to act on its behalf" who is not an agent of Public Resource. Public Resource objects to the interrogatory to the extent it is cumulative and/or duplicative of any other of Plaintiff's discovery requests. Public Resource objects to this interrogatory to the extent that it is overly broad, unduly burdensome, oppressive, or to the extent it is inconsistent with, or purport to impose obligations on Public Resource beyond those set forth by the Federal Rules of Civil Procedure, the Local Rules of the United States District Court for the District of Columbia, the Federal Rules of Evidence, or any applicable regulations and case law, particularly to the extent that compliance would force Public Resource to incur a substantial

expense that outweighs any likely benefit of the discovery. Public Resource's responses do not constitute an adoption or acceptance of the definitions and instructions that Plaintiffs seek to impose. Public Resource objects to the interrogatory as overbroad and unduly burdensome to the extent that it seeks documents and information that are not in Public Resource's possession, custody, or control, are in Plaintiffs' possession, custody, or control, or are beyond the scope of a reasonable search. Public Resource objects to this interrogatory on the grounds that it is a contention interrogatory, and Public Resource's investigation is ongoing. Public Resource objects to this interrogatory on the ground that it seeks to impose obligations on Public Resource that are unduly burdensome, especially to the extent that it requests information that is publicly available or burdensome to search for or obtain.

Public Resource's responses to this interrogatory is made without waiving, or intending to waive, but on the contrary, preserving and intending to preserve: (a) the right to object, on the grounds of competency, privilege, relevance or materiality, or any other proper grounds, to the use of any documents or other information for any purpose in whole or in part, in any subsequent proceeding in this action or in any other action; (b) the right to object on any and all grounds, at any time, to other requests for production, interrogatories, or other discovery procedures involving or relating to the subject matter of the interrogatory to which Defendants respond; and (c) the right at any time to revise, correct, add to, or clarify the responses.

Pursuant to and without waiving the foregoing objections, Public Resource responds as follows: The entirety of each standard identified on Exhibit A, Amended Exhibit B, and Exhibit C to the complaint is incorporated by reference into the law, and it is therefore necessary to reproduce the entire standard verbatim in order to accurately state what the law is.

Public Resource's investigation is ongoing, and Public Resource reserves the right to amend this response as additional information becomes available.

INTERROGATORY NO. 22:

Describe with specificity any changes Public Resource made since January 30, 2015 to its process used to rekey text, convert graphics, reset mathematical formulas, and/or add metadata to the document headers of any of the Standards at Issue, or any other standards issued by any Plaintiff, including any quality control measures Public Resource uses or has used to prevent the content of the Standards at Issue, or any other standards issued by any Plaintiff, from being altered.

RESPONSE TO INTERROGATORY NO. 22:

Public Resource objects to the interrogatory to the extent that it seeks information that falls under the attorney-client privilege, work-product doctrine, common interest privilege, or other applicable privileges or protections. Public Resource will not provide such information, and any inadvertent production is not a waiver of any applicable privilege or protection. Public Resource objects to this interrogatory to the extent that it calls for a legal conclusion, or requests legal research to be conducted by Public Resource. Public Resource objects to the definition of "Defendant," "Public Resource," "You," and "Your" on the grounds that it is vague, ambiguous, overbroad, unduly burdensome, particularly to the extent that it purports to include any predecessors, successors, affiliates, subsidiaries, divisions, parents, assignees, joint ventures, and each other person directly or indirectly, wholly or in part, owned or controlled by it, and all present or former partners, principals, employees, officers, agents, legal representatives, consultants, when such persons are acting outside of a capacity of representing Public Resource; or any person "acting or purporting to act on its behalf" who is not an agent of Public Resource.

Public Resource objects to the interrogatory to the extent it is cumulative and/or duplicative of any other of Plaintiff's discovery requests. Public Resource objects to this interrogatory to the extent that it is overly broad, unduly burdensome, oppressive, or to the extent it is inconsistent with, or purport to impose obligations on Public Resource beyond those set forth by the Federal Rules of Civil Procedure, the Local Rules of the United States District Court for the District of Columbia, the Federal Rules of Evidence, or any applicable regulations and case law, particularly to the extent that compliance would force Public Resource to incur a substantial expense that outweighs any likely benefit of the discovery. Public Resource's responses do not constitute an adoption or acceptance of the definitions and instructions that Plaintiffs seek to impose. Public Resource objects to the interrogatory as overbroad and unduly burdensome to the extent that it seeks documents and information that are not in Public Resource's possession, custody, or control, are in Plaintiffs' possession, custody, or control, or are beyond the scope of a reasonable search. Public Resource objects to this interrogatory on the grounds that it is a contention interrogatory, and Public Resource's investigation is ongoing. Public Resource objects to this interrogatory because it is vague and ambiguous concerning whether it requests information about Public Resource's prior process, and what it means by "changes." Public Resource will describe its current process. Public Resource objects to this interrogatory because it is compound, in that it asks about changes to Public Resource's process for posting standards, and then asks about changes to Public Resource's "quality control" measures ostensibly aimed at preventing alteration of the standards. Public Resource will count this as two separate interrogatories. Public Resource objects to this interrogatory on the ground that it seeks to impose obligations on Public Resource that are unduly burdensome, especially to the extent that it requests information that is publicly available or burdensome to search for or obtain.

Public Resource's responses to this interrogatory is made without waiving, or intending to waive, but on the contrary, preserving and intending to preserve: (a) the right to object, on the grounds of competency, privilege, relevance or materiality, or any other proper grounds, to the use of any documents or other information for any purpose in whole or in part, in any subsequent proceeding in this action or in any other action; (b) the right to object on any and all grounds, at any time, to other requests for production, interrogatories, or other discovery procedures involving or relating to the subject matter of the interrogatory to which Defendants respond; and (c) the right at any time to revise, correct, add to, or clarify the responses.

Pursuant to and without waiving the foregoing objections, Public Resource responds as follows: Upon lifting of the injunction, Public Resource subsequently reposted the standards at issue with the following changes: Public Resource no longer makes the standards at issue available on its own web site, and instead all references therein resolve to the Internet Archive collection identifier "publicsafetycode"; all plaintiff logos were redacted; additional disclaimers were added to each document to make even more clear that the posting of any standards at issue was an independent act of Public Resource which was not authorized by Plaintiffs and was done so for the purpose of informing our fellow citizens.

In terms of disclaimers, Public Resource has added two prominent red stamps on the cover sheets, one stating "This Document Posted by Public.Resource.Org, Inc., a California Nonprofit Organization" and the second stating "Not Affiliated or Authorized by [SDO name] or by the United States or State Government" (adjusted appropriately to include the names of the particular standard development organization as appropriate). This is in addition to the standard cover sheet which makes clear that each document is being posted as part of the incorporation by

reference into law by the federal or state government, including the name of the incorporating authority.

In addition, each description area for a document includes the following disclaimers and statement of purpose:

> *This document was posted by Public.Resource.Org, which is not affiliated with nor authorized by the United States government, any state government, or the Standards Development Organizations (SDOs) that created the model codes on which this law is based. We posted this document in order to allow citizens to read the laws that govern us.*
>
> *Note that many of these documents had to be procured on the used marketplace. Many of the laws in this collection were re-keyed into HTML and diagrams redrawn for increased usability and accessibility. Please note that the process of scanning, OCR, and rekeying might introduce errors. In addition, standards bodies will frequently issue errata or reissue standards over time and governmental bodies may change which standards they incorporate to law.*
>
> *You are urged to check with the standards organizations or governmental authorities for further information and access to definitive versions of these important laws.*

A similar disclaimer is in place on documents that were recoded into HTML:

> *PREAMBLE (NOT PART OF THE STANDARD)*
>
> *In order to promote public education and public safety, equal justice for all, a better informed citizenry, the rule of law, world trade and world peace, this legal document is hereby made available on a noncommercial basis, as it is the right of all humans to know and speak the laws that govern them.*
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> *This document was prepared and posted by Public.Resource.Org (Public Resource), a U.S.-based charity certified under section 501(c)(3) of the Internal Revenue Code. Public Resource is not affiliated with, nor has it received authorization from, any standards development organization, for the posting of this document. Please note that the posting of this document has been subject to litigation in U.S. federal courts and was done so by Public Resource for the non-commercial purpose of informing our fellow citizens about their rights and obligations under the laws of the United States.*
>
> *END OF PREAMBLE (NOT PART OF THE STANDARD)*

Public Resource also added a PDF file of the digital version of the California Electrical Code for 2016 which was posted on the Building Standards Commission web site. This file was added to the previous scan of the printed document. This document may be found on the Internet at https://archive.org/details/gov.ca.bsc.title24.2016.03.

Public Resource has continued its efforts to make new standards it posts more accessible, more usable, more attractive, and usable across different platforms. In particular, a great deal of time has been spent on proper coding of accessibility to make the standards usable by the visually impaired.

These efforts are detailed in three formal comments submitted by Public Resource to administrative proceedings conducted by the executive branch of the federal government. As part of these efforts, Public Resource also recoded several standards into the new format, including the Infant Safety and Toy standards that were specifically mentioned and mandated by the U.S. Congress as part of the Danny Keysar Product Safety Notification Act (Pub. Law 110-314). Public Resource also demonstrated these new coding techniques on other documents, including a section of the Federal Register. The three formal comments in question are:

- Comment on Safety Standard for Infant Bath Tubs, Consumer Product Safety Commission, October 28, 2015, Docket CPSC-2015-0019, https://law.resource.org/pub/us/cfr/regulations.gov.docket.14/cpsc.gov.20151028.pdf
- Comment on Safety Standard for Automatic Residential, Garage Door Operators, Consumer Product Safety Commission, November 16, 2015, Docket CPSC-2015-0025, https://law.resource.org/pub/us/cfr/regulations.gov.docket.15/cpsc.gov.20151116.pdf
- Comment of Public.Resource.Org and Co-Signatories, United States Access Board, May 28, 2015, Docket Number ATBCB-2015-0002, https://law.resource.org/pub/us/cfr/regulations.gov.docket.09/ATBCB-2015-0002-0076.html

Those documents are also available on the federal rulemaking dockets.

On the Internet Archive, every document has three forms of authentication that allow a user to verify that the document in their possession has not been altered since Public Resource posted it. For example, for "ASTM C1371: Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers", which was incorporated into reference in 16 CFR 460.5(b), the file may be accessed at https://archive.org/details/gov.law.astm.c1371.2004. The Internet Archive authentication is

contained in the file gov.law.astm.c1371.2004_files.xml and includes the following MD5, CRC32, and SHA1 authenticators which are cryptographic digital signatures that allow the user to verify they have not been altered:

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<file name="astm.c1371.2004.pdf" source="original">
<mtime>1535828637</mtime>
<size>3162527</size>
<format>Text PDF</format>
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<sha1>f797adb62fb35b7aa345203598e8bea0f4c7271e</sha1>
```

Public Resource does have a practice of including technical errata in the postings of standards where they are available. For example, NFPA has a process in which they identify errors in NFPA standards, and periodically issues corrections in the form of errata. To Public Resource's knowledge, ASTM does not have a practice of issuing errata, even when they are aware of errors in a document, meaning that any such errors remain unidentified in the printed document until a revision of the standard in question at a subsequent point in time, usually numerous years later. Even at that point, there is no explicit mention of which errors were fixed.

Public Resource's investigation is ongoing, and Public Resource reserves the right to amend this response as additional information becomes available.

INTERROGATORY NO. 23:

Describe with specificity all instances of which you are aware when a third party, after accessing or downloading any of the Standards at Issue from the Public Resource Website, has used the Standards at Issue for an educational or research purpose.

RESPONSE TO INTERROGATORY NO. 23:

Public Resource objects to the interrogatory to the extent that it seeks information that falls under the attorney-client privilege, work-product doctrine, common interest privilege, or

other applicable privileges or protections. Public Resource will not provide such information, and any inadvertent production is not a waiver of any applicable privilege or protection. Public Resource objects to the definition of "Defendant," "Public Resource," "You," and "Your" on the grounds that it is vague, ambiguous, overbroad, unduly burdensome, particularly to the extent that it purports to include any predecessors, successors, affiliates, subsidiaries, divisions, parents, assignees, joint ventures, and each other person directly or indirectly, wholly or in part, owned or controlled by it, and all present or former partners, principals, employees, officers, agents, legal representatives, consultants, when such persons are acting outside of a capacity of representing Public Resource; or any person "acting or purporting to act on its behalf" who is not an agent of Public Resource. Public Resource objects to the interrogatory to the extent it is cumulative and/or duplicative of any other of Plaintiff's discovery requests. Public Resource objects to this interrogatory to the extent that it is overly broad, unduly burdensome, oppressive, or to the extent it is inconsistent with, or purport to impose obligations on Public Resource beyond those set forth by the Federal Rules of Civil Procedure, the Local Rules of the United States District Court for the District of Columbia, the Federal Rules of Evidence, or any applicable regulations and case law, particularly to the extent that compliance would force Public Resource to incur a substantial expense that outweighs any likely benefit of the discovery. Public Resource's responses do not constitute an adoption or acceptance of the definitions and instructions that Plaintiffs seek to impose. Public Resource objects to the interrogatory as overbroad and unduly burdensome to the extent that it seeks documents and information that are not in Public Resource's possession, custody, or control, are in Plaintiffs' possession, custody, or control, or are beyond the scope of a reasonable search. Public Resource objects to this interrogatory on the grounds that it is a contention interrogatory, and Public Resource's investigation is ongoing.

Public Resource objects to this interrogatory to the extent that it calls for confidential third party information, that may interfere with the rights of private individuals to access the law or otherwise educate themselves on the content of the law. Public Resource objects to the term "educational or research purpose" as vague and ambiguous. Public Resource objects to this interrogatory on the ground that it seeks to impose obligations on Public Resource that are unduly burdensome, especially to the extent that it requests information that is publicly available or burdensome to search for or obtain.

Public Resource's responses to this interrogatory is made without waiving, or intending to waive, but on the contrary, preserving and intending to preserve: (a) the right to object, on the grounds of competency, privilege, relevance or materiality, or any other proper grounds, to the use of any documents or other information for any purpose in whole or in part, in any subsequent proceeding in this action or in any other action; (b) the right to object on any and all grounds, at any time, to other requests for production, interrogatories, or other discovery procedures involving or relating to the subject matter of the interrogatory to which Defendants respond; and (c) the right at any time to revise, correct, add to, or clarify the responses.

Pursuant to and without waiving the foregoing objections, Public Resource responds as follows:

Public Resource protects the privacy of its users, particularly so because of the aggressive legal posture taken by Plaintiffs, both against Public Resource and against others who work with the text of technical standards that have been incorporated into law. Plaintiffs have produced documented examples in this litigation where Plaintiffs asserted their alleged copyright rights to prevent students and other educational users from using the text of standards in their research projects or writings.

To preserve the privacy interests of its users, Public Resource adopted a policy of not talking to its users and not answering any questions or asking questions having to do with the standards at issue. In spite of this policy, there are numerous examples where Public Resource's users have used the standards it posts for educational, research, and other noncommercial uses based on other information that Public Resource has learned through public channels. Those include three prominent examples:

1. In the video "Show Me the Manual" on the Public Resource home page at law.resource.org, there are statements by a local building inspector and a supervisor of a local county explaining how the standards posted have been useful in educating them and assisting them in the conduct of their duties. The use of public safety standards by local government officials is one of the noncommercial uses Public Resource is most proud of.

2. Mr. Sina Bahram, in his brief as amicus curiae before this court (Dkt. 146) and before the U.S. Court of Appeals explained in great length how our posting of the standards were significantly more useful him after our transformation of the standards to make them more accessible. Mr. Bahram is a research user, pursuing a Ph.D. in computer science. Mr. Bahram was joined at the District Court in a similar amicus curiae brief by the Association of Research Libraries, the Association of College and Research Libraries, the American Association of Law Libraries, and the American Library Association, expressing the need for this information in the research and education community.

3. The Supreme Court of Indiana, while researching the law, was unable to find a public safety standard incorporated into the Code of Federal Regulations. It was finally able to find a posting made by Public Resource on the Internet Archive, which the Court used to educate itself on the law as it applied to that case. *Bellwether Properties, LLC, v. Duke Energy Indiana,*

Inc., no. 53S04-1703-CT-121 (Ind. filed Dec. 20, 2017). That dispute in that case turned upon compliance with a Rhode Island law that incorporated the 1987 version of one of the standards at issue: NFPA's Standard 30. Like every standard at issue, that version of the document was obsolete as a standard but still current as law. The trial judge asked for a copy. Counsel could find the 2000 version but not the 1987 version. The court then looked for a copy but could not locate it. *Id.* at 320. The court ruled against the party that relied on the law because neither that party nor the court could find the document. *Id.* at 321. A concurring opinion specifically noted that the 1987 edition of NFPA 30 was "not so readily available" and that "it is neither reproduced in the Rhode Island statute books nor retrievable via commonly used legal research methods." *Id.* at 330 (Lipez, J., concurring).

Public Resource's investigation is ongoing, and Public Resource reserves the right to amend this response as additional information becomes available.

Dated: June 3, 2019

Respectfully submitted,

/s/ Matthew B. Becker

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VERIFICATION

I, Carl Malamud, declare:

I am the President and Founder of Public.Resource.Org, Inc. and am duly authorized to sign this Verification on its behalf. I have read DEFENDANT-COUNTERCLAIMANT PUBLIC.RESOURCE.ORG, INC.'S RESPONSES AND OBJECTIONS TO PLAINTIFF-COUNTERDEFENDANTS' THIRD SET OF INTERROGATORIES and know the contents thereof. I either have personal knowledge that the matters stated therein are true, or I am informed and believe that the matters stated therein are true.

I declare this under penalty of perjury under the laws of the United States of America that the foregoing is true and correct and that this Verification is executed at Healdsburg, California California on this 3 day of June, 2019.

Carl Malamud

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing DEFENDANT-COUNTERCLAIMANT PUBLIC.RESOURCE.ORG, INC.'S RESPONSES AND OBJECTIONS TO PLAINTIFF-COUNTERDEFENDANTS' THIRD SET OF INTERROGATORIES was served this 3rd day of June, 2019 ***via email*** upon the following:

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EXHIBIT 165

An American National Standard

Designation: D 86 – 07

Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure[1]

This standard is issued under the fixed designation D 86; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval A superscript epsilon (∈) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This test method covers the atmospheric distillation of petroleum products using a laboratory batch distillation unit to determine quantitatively the boiling range characteristics of such products as light and middle distillates, automotive spark-ignition engine fuels, aviation gasolines, aviation turbine fuels, 1-D and 2-D regular and low sulfur diesel fuels, special petroleum spirits, naphthas, white spirits, kerosines, and Grades 1 and 2 burner fuels.

1.2 The test method is designed for the analysis of distillate fuels; it is not applicable to products containing appreciable quantities of residual material.

1.3 This test method covers both manual and automated instruments.

1.4 Unless otherwise noted, the values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information only.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 All standards are subject to revision, and parties to agreement on this test method are to apply the most recent edition of the standards indicated below, unless otherwise specified, such as in contractual agreements or regulatory rules where earlier versions of the method(s) identified may be required.

2.2 *ASTM Standards:* [2]

D 97 Test Method for Pour Point of Petroleum Products

D 323 Test Method for Vapor Pressure of Petroleum Products (Reid Method)

D 2892 Test Method for Distillation of Crude Petroleum (15-Theoretical Plate Column)

D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D 4177 Practice for Automatic Sampling of Petroleum and Petroleum Products

D 4953 Test Method for Vapor Pressure of Gasoline and Gasoline-Oxygenate Blends (Dry Method)

D 5190 Test Method for Vapor Pressure of Petroleum Products (Automatic Method)

D 5191 Test Method for Vapor Pressure of Petroleum Products (Mini Method)

D 5842 Practice for Sampling and Handling of Fuels for Volatility Measurement

D 5949 Test Method for Pour Point of Petroleum Products (Automatic Pressure Pulsing Method)

D 5950 Test Method for Pour Point of Petroleum Products (Automatic Tilt Method)

D 5985 Test Method for Pour Point of Petroleum Products (Rotational Method)

E 1 Specification for ASTM Liquid-in-Glass Thermometers

E 77 Test Method for Inspection and Verification of Thermometers

E 1272 Specification for Laboratory Glass Graduated Cylinders

E 1405 Specification for Laboratory Glass Distillation Flasks

2.3 *Energy Institute Standards:*[3]

IP 69 Determination of Vapour Pressure—Reid Method

IP 123 Petroleum Products—Determination of Distillation Characteristics

IP 394 Determination of Air Saturated Vapour Pressure

IP Standard Methods for Analysis and Testing of Petroleum and Related Products 1996—Appendix A

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.08.0A on Distillation.

In the IP, the equivalent test method is published under the designation IP 123. It is under the jurisdiction of the Standardization Committee.

Current edition approved Jan. 15, 2007. Published February 2007. Originally approved in 1921. Last previous edition approved in 2005 as D 86–05.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from Energy Institute, 61 New Cavendish St., London, WIG 7AR, U.K., http://www.energyinst.org.uk.

***A Summary of Changes section appears at the end of this standard.**

1

TABLE 1 Preparation of Apparatus

	Group 1	Group 2	Group 3	Group 4
Flask, mL	125	125	125	125
ASTM distillation thermometer	7C (7F)	7C (7F)	7C (7F)	8C (8F)
IP distillation thermometer range	low	low	low	high
Flask support board	B	B	C	C
diameter of hole, mm	38	38	50	50
Temperature at start of test				
Flask C	13–18	13–18	13–18	not above
°F	55–65	55–65	55–65	ambient
Flask support and shield	not above ambient	not above ambient	not above ambient	
Receiving cylinder and 100 mL charge				
°C	13–18	13–18	13–18[A]	13-ambient[A]
°F	55–65	55–65	55–65[A]	55-ambient[A]
[A]See 10.3.1.1 for exceptions.				

3. Terminology

3.1 *Definitions:*

3.1.1 *charge volume, n*—the volume of the specimen, 100 mL, charged to the distillation flask at the temperature specified in Table 1.

3.1.2 *decomposition, n—of a hydrocarbon,* the pyrolysis or cracking of a molecule yielding smaller molecules with lower boiling points than the original molecule.

3.1.2.1 *Discussion*—Characteristic indications of thermal decomposition are evolution of fumes and erratic temperature readings that usually decrease after any attempt is made to adjust the heat.

3.1.3 *decomposition point, n*—the corrected thermometer reading that coincides with the first indications of thermal decomposition of the liquid in the flask.

3.1.3.1 *Discussion*—The decomposition point, as determined under the conditions of this test method, does not necessarily correspond to the decomposition temperature in other applications.

3.1.4 *dry point, n*—the corrected thermometer reading that is observed at the instant the last drop of liquid (exclusive of any drops or film of liquid on the side of the flask or on the temperature sensor), evaporates from the lowest point in the distillation flask.

3.1.4.1 *Discussion*—The end point (final boiling point), rather than the dry point, is intended for general use. The dry point can be reported in connection with special purpose naphthas, such as those used in the paint industry. Also, it is substituted for the end point (final boiling point) whenever the sample is of such a nature that the precision of the end point (final boiling point) cannot consistently meet the requirements given in the precision section.

3.1.5 *dynamic holdup, n*—the amount of material present in the neck of the flask, in the sidearm of the flask, and in the condenser tube during the distillation.

3.1.6 *emergent stem effect, n*—the offset in temperature reading caused by the use of total immersion mercury-in-glass thermometers in the partial immersion mode.

3.1.6.1 *Discussion*—In the partial immersion mode, a portion of the mercury thread, that is, the emergent portion, is at a lower temperature than the immersed portion, resulting in a shrinkage of the mercury thread and a lower temperature reading.

3.1.7 *end point (EP) or final boiling point (FBP), n*—the maximum corrected thermometer reading obtained during the test.

3.1.7.1 *Discussion*—This usually occurs after the evaporation of all liquid from the bottom of the flask. The term maximum temperature is a frequently used synonym.

3.1.8 *front end loss, n*—loss due to evaporation during transfer from receiving cylinder to distillation flask, vapor loss during the distillation, and uncondensed vapor in the flask at the end of the distillation.

3.1.9 *initial boiling point (IBP), n*—the corrected thermometer reading that is observed at the instant the first drop of condensate falls from the lower end of the condenser tube.

3.1.10 *percent evaporated, n*—the sum of the percent recovered and the percent loss.

3.1.11 *percent loss (or observed loss), n*—one hundred minus the percent total recovery.

3.1.11.1 *corrected loss, n*—percent loss corrected for barometric pressure.

3.1.12 *percent recovered, n*—the volume of condensate observed in the receiving cylinder, expressed as a percentage of the charge volume, associated with a simultaneous temperature reading.

3.1.13 *percent recovery, n*—the maximum percent recovered, as observed in accordance with 10.18.

3.1.13.1 *corrected percent recovery, n*—the percent recovery, adjusted for the difference between the observed loss and the corrected loss, as described in Eq 8.

3.1.13.2 *percent total recovery, n*—the combined percent recovery and residue in the flask, as determined in accordance with 11.1.

3.1.14 *percent residue, n*—the volume of residue in the flask, measured in accordance with 10.19, and expressed as a percentage of the charge volume.

3.1.15 *rate of change (or slope), n*—the change in temperature reading per percent evaporated or recovered, as described in 13.2.

3.1.16 *temperature lag, n*—the offset between the temperature reading obtained by a temperature sensing device and the true temperature at that time.

3.1.17 *temperature measurement device, n*—a thermometer, as described in 6.3.1, or a temperature sensor, as described in 6.3.2.

2

3.1.18 *temperature reading, n*—the temperature obtained by a temperature measuring device or system that is equal to the thermometer reading described in 3.1.19.

3.1.18.1 *corrected temperature reading, n*—the temperature reading, as described in 3.1.18, corrected for barometric pressure.

3.1.19 *thermometer reading (or thermometer result), n*—the temperature of the saturated vapor measured in the neck of the flask below the vapor tube, as determined by the prescribed thermometer under the conditions of the test.

3.1.19.1 *corrected thermometer reading, n*—the thermometer reading, as described in 3.1.19, corrected for barometric pressure.

4. Summary of Test Method

4.1 Based on its composition, vapor pressure, expected B3P or expected EP, or combination thereof, the sample is placed in one of four groups. Apparatus arrangement, condenser temperature, and other operational variables are defined by the group in which the sample falls.

4.2 A 100-mL specimen of the sample is distilled under prescribed conditions for the group in which the sample falls. The distillation is performed in a laboratory batch distillation unit at ambient pressure under conditions that are designed to provide approximately one theoretical plate fractionation. Systematic observations of temperature readings and volumes of condensate are made, depending on the needs of the user of the data. The volume of the residue and the losses are also recorded.

4.3 At the conclusion of the distillation, the observed vapor temperatures can be corrected for barometric pressure and the data are examined for conformance to procedural requirements, such as distillation rates. The test is repeated if any specified condition has not been met.

4.4 Test results are commonly expressed as percent evaporated or percent recovered versus corresponding temperature, either in a table or graphically, as a plot of the distillation curve.

5. Significance and Use

5.1 The basic test method of determining the boiling range of a petroleum product by performing a simple batch distillation has been in use as long as the petroleum industry has existed. It is one of the oldest test methods under the jurisdiction of ASTM Committee D02, dating from the time when it was still referred to as the Engler distillation. Since the test method has been in use for such an extended period, a tremendous number of historical data bases exist for estimating end-use sensitivity on products and processes.

5.2 The distillation (volatility) characteristics of hydrocarbons have an important effect on their safety and performance, especially in the case of fuels and solvents. The boiling range gives information on the composition, the properties, and the behavior of the fuel during storage and use. Volatility is the major determinant of the tendency of a hydrocarbon mixture to produce potentially explosive vapors.

5.3 The distillation characteristics are critically important for both automotive and aviation gasolines, affecting starting, warm-up, and tendency to vapor lock at high operating

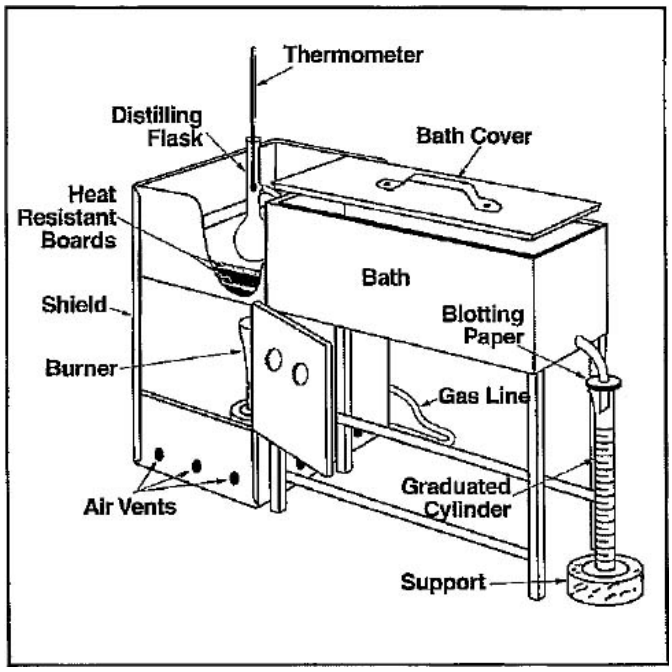


FIG. 1 Apparatus Assembly Using Gas Burner

temperature or at high altitude, or both. The presence of high boiling point components in these and other fuels can significantly affect the degree of formation of solid combustion deposits.

5.4 Volatility, as it affects rate of evaporation, is an important factor in the application of many solvents, particularly those used in paints.

5.5 Distillation limits are often included in petroleum product specifications, in commercial contract agreements, process refinery/control applications, and for compliance to regulatory rules.

6. Apparatus

6.1 *Basic Components of the Apparatus:*

6.1.1 The basic components of the distillation unit are the distillation flask, the condenser and associated cooling bath, a metal shield or enclosure for the distillation flask, the heat source, the flask support, the temperature measuring device, and the receiving cylinder to collect the distillate.

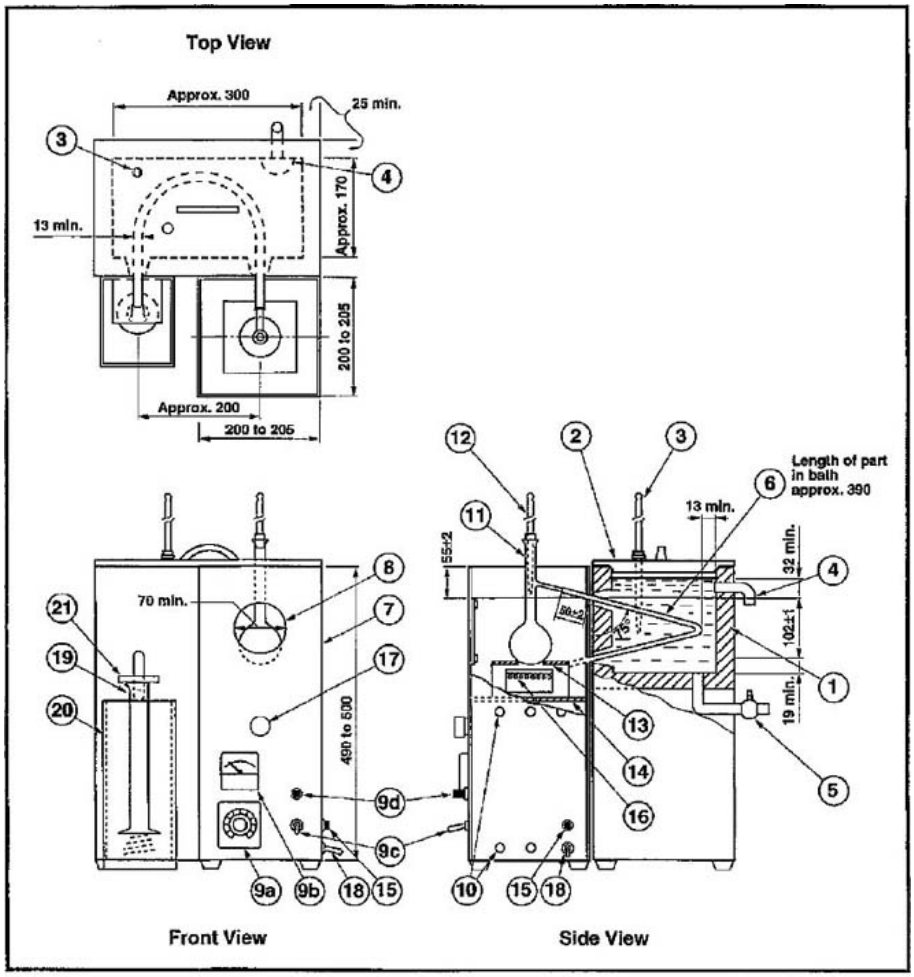
6.1.2 Figs. 1 and 2 are examples of manual distillation units.

6.1.3 In addition to the basic components described in 6.1.1, automated units also are equipped with a system to measure and automatically record the temperature and the associated recovered volume in the receiving cylinder.

6.2 A detailed description of the apparatus is given in Annex A2.

6.3 *Temperature Measuring Device:*

6.3.1 Mercury-in-glass thermometers, if used, shall be filled with an inert gas, graduated on the stem and enamel backed. They shall conform to Specification E1 or IP Standard Methods for Analysis and Testing of Petroleum and Related Products 1996—Appendix A, or both, for thermometers ASTM



1–Condenser bath
2–Bath cover
3–Bath temperature sensor
4–Bath overflow
5–Bath drain
6–Condenser tube
7–Shield
8–Viewing window
9a–Voltage regulator
9b–Voltmeter or ammeter
9c–Power switch
9d–Power light indicator
10–Vent
11–Distillation flask
12–Temperature sensor
13–Flask support board
14–Flask support platform
15–Ground connection
16–Electric heater
17–Knob for adjusting level of support platform
18–Power source cord
19–Receiver cylinder
20–Receiver cooling bath
21–Receiver cover

FIG. 2 Apparatus Assembly Using Electric Heater

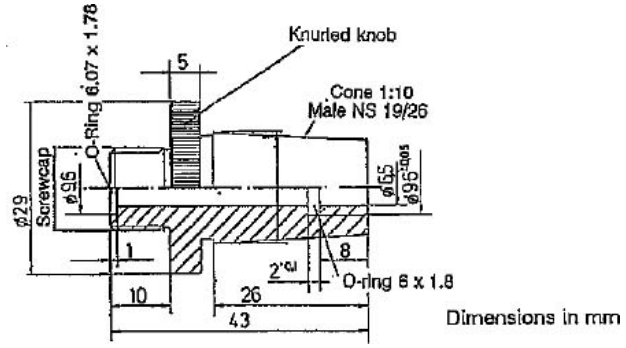


FIG. 3 PTFE Centering Device for Ground Glass Joint

7C/IP 5C and ASTM 7F for the low range thermometers, and ASTM 8C/IP 6C and ASTM 8F for the high range thermometers.

6.3.1.1 Thermometers that have been exposed for an extended period above an observed temperature of 370°C shall not be reused without a verification of the ice point or checked as prescribed in Specification E 1 and Test Method E 77.

NOTE 1—At an observed thermometer reading of 370°C, the temperature of the bulb is approaching a critical range in the glass and the thermometer may lose its calibration.

6.3.2 Temperature measurement systems other than those described in 6.3.1 are satisfactory for this test method, provided that they exhibit the same temperature lag, emergent stem effect, and accuracy as the equivalent mercury-in-glass thermometer.

6.3.2.1 The electronic circuitry or the algorithms, or both, used shall include the capability to simulate the temperature lag of a mercury-in-glass thermometer.

6.3.2.2 Alternatively, the sensor can also be placed in a casing with the tip of the sensor covered so that the assembly, because of its adjusted thermal mass and conductivity, has a temperature lag time similar to that of a mercury-in-glass thermometer.

NOTE 2—In a region where the temperature is changing rapidly during the distillation, the temperature lag of a thermometer can be as much as 3 seconds.

6.3.3 In case of dispute, the referee test method shall be carried out with the specified mercury-in-glass thermometer.

6.4 *Temperature Sensor Centering Device:*

6.4.1 The temperature sensor shall be mounted through a snug-fitting device designed for mechanically centering the sensor in the neck of the flask without vapor leakage. Examples of acceptable centering devices are shown in Figs. 3 and 4. (**Warning**—The use of a plain stopper with a hole drilled through the center is not acceptable for the purpose described in 6.4.1.)

NOTE 3—Other centering devices are also acceptable, as long as they position and hold the temperature sensing device in the proper position in the neck of the distillation column, as shown in Fig. 5 and described in 10.5.

NOTE 4—When running the test by the manual method, products with

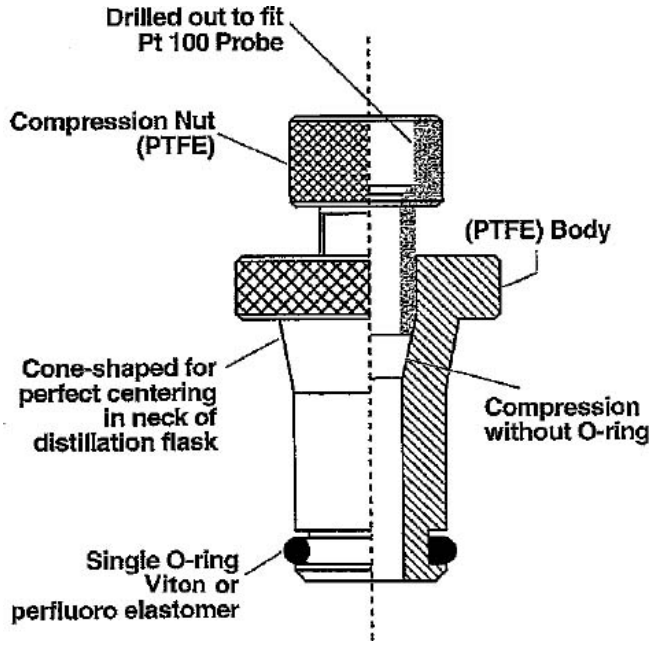


FIG. 4 Example of Centering Device Designs for Straight-Bore Neck Flasks

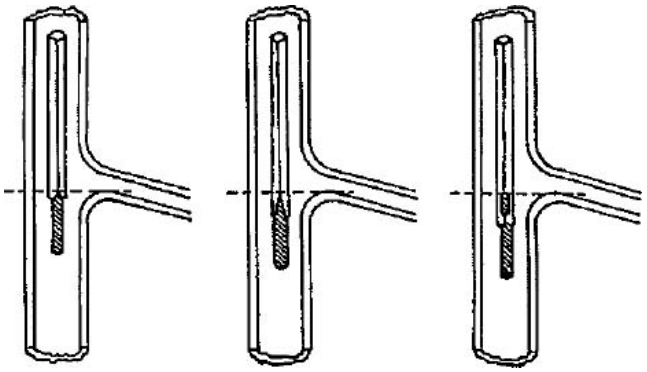


FIG. 5 Position of Thermometer in Distillation Flask

a low IBP may have one or more readings obscured by the centering device. See also 10.14.3.1.

6.5 Automated equipment manufactured in 1999 and later shall be equipped with a device to automatically shut down power to the unit and to spray an inert gas or vapor in the chamber where the distillation flask is mounted in the event of fire.

NOTE 5—Some causes of fires are breakage of the distillation flask, electrical shorts, and foaming and spilling of liquid sample through the top opening of the flask.

6.6 *Barometer*—A pressure measuring device capable of measuring local station pressure with an accuracy of 0.1 kPa (1 mm Hg) or better, at the same elevation relative to sea level as the apparatus in the laboratory. (**Warning**—Do not take readings from ordinary aneroid barometers, such as those used

TABLE 2 Group Characteristics

	Group 1	Group 2	Group 3	Group 4
Sample characteristics Distillate type Vapor pressure at				

	Group 1	Group 2	Group 3	Group 4
37.8°C, kPa	≥65.5	<65.5	<65.5	<65.5
100°F, psi	≥9.5	<9.5	<9.5	<9.5
(Test Methods D 323, D 4953, D 5190, D 5191, D 5482, IP 69 or IP 394)				
Distillation, IBP °C			≤100	>100
°F			≤212	>212
EP °C	≤250	≤250	>250	>250
°F	≤482	≤482	>482	>482

at weather stations and airports, since these are precorrected to give sea level readings.)

7. Sampling, Storage, and Sample Conditioning

7.1 Determine the Group characteristics that correspond to the sample to be tested (see Table 2). Where the procedure is dependent upon the group, the section headings will be so marked.

7.2 *Sampling:*

7.2.1 Sampling shall be done in accordance with Practice D 4057 or D 4177 and as described in Table 3.

7.2.1.1 *Group 1*—Condition the sample container to below 10°C, preferably by filling the bottle with the cold liquid sample and discarding the first sample. If this is not possible because, for instance, the product to be sampled is at ambient temperature, the sample shall be drawn into a bottle prechilled to below 10°C, in such a manner that agitation is kept at a minimum. Close the bottle immediately with a tight-fitting closure. (**Warning**—Do not completely fill and tightly seal a cold bottle of sample because of the likelihood of breakage on warming.)

7.2.1.2 *Groups 2, 3, and 4*—Collect the sample at ambient temperature. After sampling, close the sample bottle immediately with a tight-fitting closure.

7.2.1.3 If the sample received by the testing laboratory has been sampled by others and it is not known whether sampling has been performed as described in 7.2, the sample shall be assumed to have been so sampled.

7.3 *Sample Storage:*

7.3.1 If testing is not to start immediately after collection, store the samples as indicated in 7.3.2, 7.3.3, and Table 3. All samples shall be stored away from direct sunlight or sources of direct heat.

7.3.2 *Group 1*—Store the sample at a temperature below 10°C.

NOTE 6—If there are no, or inadequate, facilities for storage below 10°C, the sample may also be stored at a temperature below 20°C, provided the operator ensures that the sample container is tightly closed and leak-free.

7.3.3 *Group 2*—Store the sample at a temperature below 10°C.

NOTE 7—If there are no, or inadequate, facilities for storage below 10°C, the sample may also be stored at a temperature below 20°C, provided the operator ensures that the sample container is tightly closed and leak-free.

7.3.4 *Groups 3 and 4*—Store the sample at ambient or lower temperature.

7.4 *Sample Conditioning Prior to Analysis:*

7.4.1 Samples shall be conditioned to the temperature shown in Table 3 before opening the sample container.

7.4.1.1 *Groups 1 and 2*—Samples shall be conditioned to a temperature of less than 10°C (50°F) before opening the sample container.

7.4.1.2 *Groups 3 and 4*—If the sample is not fluid at ambient temperature, it is to be heated to a temperature of 9 to 21°C above its pour point (Test Method D 97, D 5949, or D 5985) prior to analysis. If the sample has partially or completely solidified during storage, it shall be vigorously shaken after melting prior to opening the sample container to ensure homogeneity.

7.4.1.3 If the sample is not fluid at room temperature, the temperature ranges shown in Table 3 for the flask and for the sample do not apply.

7.5 *Wet Samples:*

7.5.1 Samples of materials that visibly contain water are not suitable for testing. If the sample is not dry, obtain another sample that is free from suspended water.

7.5.2 *Groups 1 and 2*—If such a sample cannot be obtained, the suspended water can be removed by maintaining the sample at 0 to 10°C, adding approximately 10 g of anhydrous sodium sulfate per 100 mL of sample, shaking the mixture for approximately 2 min, and then allowing the mixture to settle for approximately 15 min. Once the sample shows no visible signs of water, use a decanted portion of the sample, maintained between 1 and 10°C, for the analysis. Note in the report that the sample has been dried by the addition of a desiccant.

NOTE 8—Suspended water in hazy samples in Groups 1 and 2 can be removed by the addition of anhydrous sodium sulfate and separating the liquid sample from the drying agent by decanting without statistically affecting the results of the test.[4]

7.5.3 *Groups 3 and 4*—In cases in which a water-free sample is not practical, the suspended water can be removed by shaking the sample with anhydrous sodium sulfate or other suitable drying agent and separating it from the drying agent by decanting. Note in the report that the sample has been dried by the addition of a desiccant.

8. Preparation of Apparatus

8.1 Refer to Table 1 and prepare the apparatus by choosing the appropriate distillation flask, temperature measuring device, and flask support board, as directed for the indicated group. Bring the temperature of the receiving cylinder, the flask, and the condenser bath to the

indicated temperature.

8.2 Make any necessary provisions so that the temperature of the condenser bath and the receiving cylinder will be maintained at the required temperatures. The receiving cylinder shall be in a bath such that either the liquid level is at least

[4] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: D02-1455.

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TABLE 3 Sampling, Storage, and Sample Conditioning

		Group 1	Group 2	Group 3	Group 4
Temperature of sample bottle	°C	<10			
	°F	<50			
Temperature of stored sample	°C	<10[A]	<10	ambient	ambient
	°F	<50[A]	<50	ambient	ambient
Temperature of sample after	°C	<10	<10	Ambient or	Ambient or
conditioning prior to analysis				9 to 21°C above pour point[B]	
	°F	<50	<50	Ambient or	Ambient or
				48 to 70°F above pour point[B]	
If sample is wet		resample	resample	dry in accordance with 7.5.3	
If resample is still wet[C]		dry in accordance with 7.5.2			

[A] Under certain circumstances, samples can also be stored at temperatures below 20°C (68°F). See also 7.3.2 and 7.3.3.

[B] If sample is (semi)-solid at ambient temperature, see also 10.3.1.1.

[C] If sample is known to be wet, resampling may be omitted. Dry sample in accordance with 7.5.2 and 7.5.3.

as high as the 100-mL mark or the entire receiving cylinder is surrounded by an air circulation chamber.

8.2.1 *Groups 1, 2, and 3*—Suitable media for low temperature baths include, but are not limited to, chopped ice and water, refrigerated brine, and refrigerated ethylene glycol.

8.2.2 *Group 4*—Suitable media for ambient and higher bath temperatures include, but are not limited to, cold water, hot water, and heated ethylene glycol.

8.3 Remove any residual liquid in the condenser tube by swabbing with a piece of soft, lint-free cloth attached to a cord or wire.

9. Calibration and Standardization

9.1 *Temperature Measurement System*—Temperature measurement systems using other than the specified mercury-in-glass thermometers shall exhibit the same temperature lag, emergent stem effect, and accuracy as the equivalent mercury-in-glass thermometer. Confirmation of the calibration of these temperature measuring systems shall be made at intervals of not more than six months, and after the system has been replaced or repaired.

9.1.1 The accuracy and the calibration of the electronic circuitry or computer algorithms, or both, shall be verified by the use of a standard precision resistance bench. When performing this verification, no algorithms shall be used to correct the temperature for lag and the emergent stem effect (see manufacturer's instructions).

9.1.2 Verification of the calibration of temperature measuring devices shall be conducted by distilling toluene in accordance with Group 1 of this test method and comparing the 50 % recovered temperature with that shown in Table 4.[5]

9.1.2.1 If the temperature reading is not within the values shown in Table 4 for the respective apparatus being used (see Note 10 and Table 4), the temperature measurement system shall be considered defective and shall not be used for the test.

NOTE 9—Toluene is used as a verification fluid for calibration; it will yield almost no information on how well an electronic measurement system simulates the temperature lag of a liquid-in-glass thermometer.

9.1.2.2 Reagent grade toluene and hexadecane (cetane), conforming to the specifications of the Committee on Analytical Reagents of the American Chemical Society,[6] shall be used. However, other grades may also be used, provided it is first ascertained that the reagent is of sufficient purity to permit its use without lessening the accuracy of the determination.

NOTE 10—At 101.3 kPa, toluene is shown in reference manuals as boiling at 110.6°C when measured using a partial immersion thermometer. Because this test method uses thermometers calibrated for total immersion, the results typically will be lower and, depending on the thermometer and the situation, may be different for each thermometer. At 101.3 kPa, hexadecane is shown in reference manuals as boiling at 287.0°C when measured using a partial immersion thermometer. Because this test method uses thermometers calibrated for total immersion, the results typically will be lower, and, depending on the thermometer and the situation, may be different for each thermometer.

9.1.3 A procedure to determine the magnitude of the temperature lag is described in Annex A3.

9.1.4 A procedure to emulate the emergent stem effect is described in Appendix X4.

9.1.5 To verify the calibration of the temperature measurement system at elevated temperatures, use hexadecane. The temperature measurement system shall indicate, at 50% recovered, a temperature comparable to that shown in Table 4 for the respective apparatus under Group 4 distillation conditions.

NOTE 11—Because of the high melting point of hexadecane, Group 4 verification distillations will have to be carried out with condenser temperatures >20°C.

9.2 *Automated Method:*

9.2.1 *Level Follower*—For an automated distillation apparatus, the level follower/recording mechanism of the apparatus shall have a resolution of 0.1 mL or better with a maximum error of 0.3 mL between the 5 and 100 mL points. The calibration of the assembly shall be verified in accordance with manufacturer's instructions at intervals of not more than three months and after the system has been replaced or repaired.

NOTE 12—The typical calibration procedure involves verifying the output with the receiver containing 5 and 100 mL of material respectively.

9.2.2 *Barometric Pressure—At* intervals of not more than six months, and after the system has been replaced or repaired,

[5] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: D02–1580.

[6] *Reagent Chemicals, American Chemical Society Specifications,* American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals,* BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary,* U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

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TABLE 4 True and Min and Max D 86 50 % Recovered Boiling Points (°C)[A]

		Manual		Automated	
		Distillation conditions min D 86 50 % boiling point	Distillation conditions max D 86 50 % boiling point	Distillation conditions min D 86 50 % boiling point	Distillation conditions max D 86 50 % boiling point
Toluene	ASTM/IP true boiling point	Group 1, 2, and 3	Group 1, 2, and 3	Group 1, 2, and 3	Group 1,2, and 3
	110.6	105.9	111.8	108.5	109.7
Hexadecane	ASTM/IP true boiling point	Group 4	Group 4	Group 4	Group 4
	287.0	272.2	283.1	277.0	280.0

[A] The manual and automated temperatures show in this table are the values for the 95 % tolerance interval for the 99 % population coverage. The proposed tolerance is approximately 3 × sigma. Information on the values in this table can be found in RR:D02–1580.

the barometric reading of the instrument shall be verified against a barometer, as described in 6.6.

10. Procedure

10.1 Record the prevailing barometric pressure.

10.2 *Groups 1 and 2*—Fit a low range thermometer provided with a snug-fitting cork or stopper of silicone rubber, or equivalent polymeric material, rightly into the neck of the sample container and bring the temperature of the sample to the temperature indicated in Table 3.

10.3 *Groups 1, 2, 3, and 4*—Check that the temperature of the sample is as shown in Table 3. Pour the specimen precisely to the 100-mL mark of the receiving cylinder, and transfer the contents of the receiving cylinder as completely as practical into the distillation flask, ensuring that none of the liquid flows into the vapor tube.

NOTE 13—It is important that the difference between the temperature of the specimen and the temperature of the bath around the receiving cylinder is as small as practically possible. A difference of 5°C can make a difference of 0.7 mL.

10.3.1 *Groups 3 and 4*—If the sample is not fluid at ambient temperature, it is to be heated to a temperature between 9 and 21°C above its pour point (Test Methods D97, D 5949, D 5950, or D 5985) prior to analysis. If the sample has partially or completely solidified in the intervening period, it shall be vigorously shaken after melting, and prior to sampling, to ensure homogeneity.

10.3.1.1 If the sample is not fluid at ambient temperatures, disregard the temperature range shown in Table 1 for the receiving cylinder and sample. Prior to analysis, heat the receiving cylinder to approximately the same temperature as the sample. Pour the heated specimen precisely to the 100-mL mark of the receiving cylinder, and transfer the contents of the receiving cylinder as completely as practical into the distillation flask, ensuring that none of the liquid flows into the vapor tube.

NOTE 14—Any material that evaporates during the transfer will contribute to the loss; any material that remains in the receiving cylinder will contribute to the observed recovery volume at the time of the IBP.

10.4 If the sample can be expected to demonstrate irregular boiling behavior, that is, bumping, add a few boiling chips to the specimen. The addition of a few boiling chips is acceptable for any distillation.

10.5 Fit the temperature sensor through a snug-fitting device, as described in 6.4, to mechanically center the sensor in the neck of the flask. In the case of a thermometer, the bulb is centered in the neck and the lower end of the capillary is level with the highest point on the bottom of the inner wall of the vapor tube (see Fig. 5). In the case of a thermocouple or resistance thermometer, follow the manufacturer's instructions as to placement (see Fig. 6).

NOTE 15—If vacuum grease is used on the mating surface of the centering device, use the minimum amount of grease that is practical.

10.6 Fit the flask vapor tube, provided with a snug-fitting cork or rubber stopper of silicone, or equivalent polymeric material, tightly into the condenser tube. Adjust the flask in a vertical position so that the vapor tube extends into the condenser tube for a distance from 25 to 50 mm. Raise and adjust the flask support board to fit it snugly against the bottom of the flask.

10.7 Place the receiving cylinder that was used to measure the specimen, without drying the inside of the cylinder, into its temperature-controlled bath under the lower end of the condenser tube. The end of the condenser tube shall be centered in the receiving cylinder and shall extend therein for a distance of at least 25 mm, but not below the 100-mL mark.

10.8 *Initial Boiling Point:*

10.8.1 *Manual Method*—To reduce evaporation loss of the distillate, cover the receiving cylinder with a piece of blotting paper, or similar material, that has been cut to fit the condenser tube snugly. If a receiver deflector is being used, start the distillation with the tip of the deflector just touching the wall of the receiving cylinder. If a receiver deflector is not used, keep the drip tip of the condenser away from the wall of the receiving

cylinder. Note the start time. Observe and record the IBP to the nearest 0.5°C (1.0°F). If a receiver deflector is not being used, immediately move the receiving cylinder so that the tip of the condenser touches its inner wall.

10.8.2 *Automated Method*—To reduce evaporation loss of the distillate, use the device provided by the instrument manufacturer for this purpose. Apply heat to the distillation flask and contents with the tip of the receiver deflector just touching the wall of the receiving cylinder. Note the start time. Record the IBP to the nearest 0.1°C (0.2°F).

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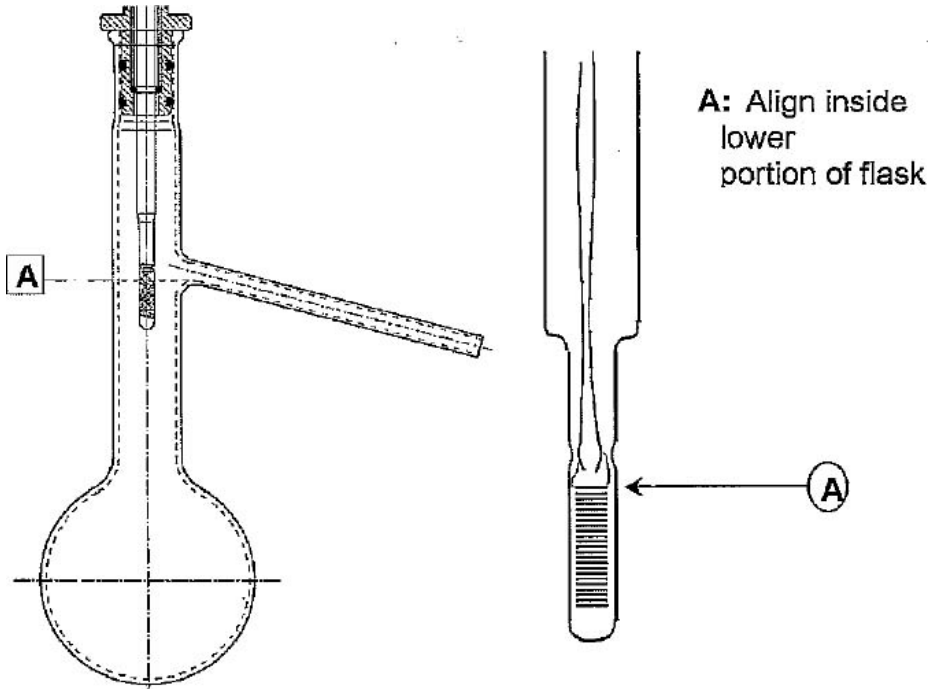

FIG. 6 Example of Recommended Placement of Pt-100 Probe Relative to Distillation Flask Sidearm for Automated D 86 Distillation Instrument

10.9 Regulate the heating so that the time interval between the first application of heat and the IBP is as specified in Table 5.

10.10 Regulate the heating so that the time from IBP to 5 or 10 % recovered is as indicated in Table 5.

10.11 Continue to regulate the heating so that the uniform average rate of condensation from 5 or 10 % recovered to 5 mL residue in the flask is 4 to 5 mL per min. (**Warning**—Due to the configuration of the boiling flask and the conditions of the test, the vapor and liquid around the temperature sensor are not in thermodynamic equilibrium. The distillation rate will consequently have an effect on the measured vapor temperature. The distillation rate shall, therefore, be kept as constant as possible throughout the test.)

NOTE 16—When testing gasoline samples, it is not uncommon to see the condensate suddenly form non-miscible liquid phases and bead up on the temperature measuring device and in the neck of the boiling flask at a vapor temperature of around 160°C. This may be accompanied by a sharp (about 3°C) dip in the vapor temperature and a drop in the recovery rate. The phenomenon, which may be due to the presence of trace water in the sample, may last for 10 to 30 s before the temperature recovers and the condensate starts flowing smoothly again. This point is sometimes colloquially referred to as the Hesitation Point.

10.12 Repeat any distillation that did not meet the requirements described in 10.9, 10.10, and 10.11.

10.13 If a decomposition point, as described in 3.1.3, is observed, discontinue the heating and proceed as directed in 10.17.

10.14 In the interval between the IBP and the end of the distillation, observe and record data necessary for the calculation and reporting of the results of the test as required by the specification involved, or as previously established for the sample under test. These observed data can include temperature readings at prescribed percentages recovered or percentages recovered at prescribed temperature readings, or both.

10.14.1 *Manual Method*—Record all volumes in the graduated cylinder to the nearest 0.5 mL, and all temperature readings to the nearest 0.5°C (1.0°F).

10.14.2 *Automated Method*—Record all volumes in the receiving cylinder to the nearest 0.1 mL, and all temperature readings to the nearest 0.1°C (0.2°F).

10.14.3 *Group 1, 2, 3, and 4*—In cases in which no specific data requirements have been indicated, record the IBP and the EP (FBP) or the dry point, or both, and temperature readings at 5, 15, 85, and 95 % recovered, and at each 10 % multiple of volume recovered from 10 to 90, inclusive.

10.14.3.1 *Group 4*—When a high range thermometer is used in testing aviation turbine fuels and similar products, pertinent thermometer readings can be obscured by the centering device. If these readings are required, perform a second distillation in accordance with Group 3. In such cases, reading from a low range thermometer can be reported in place of the obscured high range thermometer readings, and the test report shall so indicate. If, by agreement, the obscured readings are waived, the test report shall so indicate.

10.14.4 When it is required to report the temperature reading at a prescribed percent evaporated or recovered for a sample that has a rapidly changing slope of the distillation curve in the region of the prescribed percent evaporated or recovered reading, record temperature readings at every 1 % recovered. The slope is considered rapidly changing if the

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TABLE 5 Conditions During Test Procedure

		Group 1	Group 2	Group 3	Group 4

		Group 1	Group 2	Group 3	Group 4
Temperature of cooling bath[A]	°C	0–1	0–5	0–5	0–60
	°F	32–34	32–40	32–40	32–140
Temperature of bath around receiving cylinder	°C	13–18	13–18	13–18	±3
	°F	55–65	55–65	55–65	±5
					of charge temperature
Time from first application of heat to initial boiling point, min		5–10	5–10	5–10	5–15
Time from initial boiling point to 5 % recovered, s to 10 % recovered, min		60–100	60–100		
Uniform average rate of condensation from 5 % recovered to 5 mL in flask, mL/min		4–5	4–5	4–5	4–5
Time recorded from 5 mL residue to end point, min		5 max	5 max	5 max	5 max

[A] the proper condenser bath temperature will depend upon the wax content of the sample and of its distillation fractions. The test is generally performed using one single condenser temperature. Wax formation in the condenser can be deduced from (*a*) the presence of wax particles in the distillate coming oft the drip tip, (*b*) a higher distillation loss than what would be expected based on the initial boiling point of the specimen, (*c*) an erratic recovery rate and (*d*) the presence of wax particles during the removal of residual liquid by swabbing with a lint–free cloth (see: 8.3). The minimum temperature that permits satisfactory operation shall be used. In general, a bath temperature in the 0 to 4°C range is suitable for kerosine, Grade No. 1 fuel oil and Grade No. 1–D diesel fuel oil. In some cases involving Grade No. 2 fuel oil, Grade No. 2–D diesel fuel oil, gas oils and similar distillates, it may be necessary to hold the condenser bath temperature in the 38 to 60°C range.

change in slope (*C*) of the data points described in 10.14.2 in that particular area is greater than 0.6 (change of slope (*F*) is greater than 1.0) as calculated by Eq 1 (Eq 2).

$$\text{Change of Slope } (C) = (C_2 - C_1)/(V_2 - V_1) - (C_3 - C_2)/(V_3 - V_2) \quad (1)$$

$$\text{Change of Slope } (F) = (F_2 - F_1)/(V_2 - V_1) - (F_3 - F_2)/(V_3 - V_2) \quad (2)$$

where:

C_1 = temperature at the volume % recorded one reading prior to the volume % in question, °C,

C_2 = temperature at the volume % recorded in question, °C,

C_3 = temperature at the volume % recorded following the volume % in question, °C,

F_1 = temperature at the volume % recorded one reading prior to the volume % in question, °F,

F_2 = temperature at the volume % recorded in question, °F,

F_3 = temperature at the volume % recorded following the volume % in question, °F,

V_1 = volume % recorded one reading prior to the volume % in question,

V_2 = volume % recorded at the volume % in question, and

V_3 = volume % recorded following the volume % in question.

10.15 When the residual liquid in the flask is approximately 5 mL, make a final adjustment of the heat. The time from the 5 mL of liquid residue in the flask to the EP (FBP) shall be within the limits prescribed in Table 5. If this condition is not satisfied, repeat the test with appropriate modification of the final heat adjustment.

NOTE 17—Since it is difficult to determine when there is 5 mL of boiling liquid left in the flask, this time is determined by observing the amount of liquid recovered in the receiving cylinder. The dynamic holdup has been determined to be approximately 1.5 mL at this point. If there are no front end losses, the amount of 5 mL in the flask can be assumed to correspond with an amount of 93.5 mL in the receiving cylinder. This amount has to be adjusted for the estimated amount of front end loss.

10.15.1 If the actual front end loss differs more than 2 mL from the estimated value, the test shall be rerun.

10.16 Observe and record the EP (FBP) or the dry point, or both, as required, and discontinue the heating.

10.17 Allow the distillate to drain into the receiving cylinder, after heating has been discontinued.

10.17.1 *Manual Method*—While the condenser tube continues to drain into the graduated cylinder, observe and note the volume of condensate to the nearest 0.5 mL at 2 min intervals until two successive observations agree. Measure the volume in the receiving cylinder accurately, and record it to the nearest 0.5 mL.

10.17.2 *Automated Method*—The apparatus shall continually monitor the recovered volume until this volume changes by no more than 0.1 mL in 2 min. Record the volume in the receiving cylinder accurately to the nearest 0.1 mL.

10.18 Record the volume in the receiving cylinder as percent recovery. If the distillation was previously discontinued under the conditions of a decomposition point, deduct the percent recovered from 100, report this difference as the sum of percent residue and percent loss, and omit the procedure given in 10.19.

10.19 After the flask has cooled and no more vapor is observed, disconnect the flask from the condenser, pour its contents into a 5-mL graduated cylinder, and with the flask suspended over the cylinder, allow the flask to drain until no appreciable increase in the volume of liquid in the cylinder is observed. Measure the volume in the graduated cylinder to the nearest 0.1 mL, and record as percent residue.

10.19.1 If the 5-mL graduated cylinder does not have graduations below 1 mL and the volume of liquid is less than 1 mL, prefill the cylinder with 1 mL of a heavy oil to allow a better estimate of the volume of the material recovered.

10.19.1.1 If a residue greater than expected is obtained, and the distillation was not purposely terminated before the EP,

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check whether adequate heat was applied towards the end of the distillation and whether conditions during the test conformed to those specified in Table 5. If not, repeat test.

NOTE 18—The distillation residues of this test method for gasoline, kerosine, and distillate diesel are *typically* 0.9-1.3, 0.9-1.3, and 1.0-1.4 volume %, respectively.

NOTE 19—The test method is not designed for the analysis of distillate fuels containing appreciable quantities of residual material (see 1.2).

10.19.2 *Groups 1, 2, 3, and 4*—Record the volume in the 5-mL graduated cylinder, to the nearest 0.1 mL, as percent residue.

10.20 If the intent of the distillation is to determine the percent evaporated or percent recovered at a predetermined corrected temperature reading, modify the procedure to conform to the instructions described in Annex A4.

10.21 Examine the condenser tube and the side arm of the flask for waxy or solid deposits. If found, repeat the test after making adjustments described in Footnote A of Table 5.

11. Calculations

11.1 The percent total recovery is the sum of the percent recovery (see 10.18) and the percent residue (see 10.19). Deduct the percent total recovery from 100 to obtain the percent loss.

11.2 Do not correct the barometric pressure for meniscus depression, and do not adjust the pressure to what it would be at sea level.

NOTE 20—The observed barometric reading does not have to be corrected to a standard temperature and to standard gravity. Even without performing these corrections, the corrected temperature readings for the same sample between laboratories at two different locations in the world will, in general, differ less than 0.1°C at 100°C. Almost all data obtained earlier have been reported at barometric pressures that have not been corrected to standard temperature and to standard gravity.

11.3 Correct temperature readings to 101.3 kPa (760 mm Hg) pressure. Obtain the correction to be applied to each temperature reading by means of the Sydney Young equation as given in Eq 3, Eq 4, or Eq 5, as appropriate, or by the use of Table 6. For Celsius temperatures:

$$C_c = 0.0009\,(101.3 - P_k)\,(273 + t_c) \qquad (3)$$

$$C_c = 0.00012\,(760 - P)\,(273 + t_c) \qquad (4)$$

For Fahrenheit temperatures:

$$C_f = 0.00012\,(760 - P)\,(460 + t_f) \qquad (5)$$

where:

t_c = the observed temperature reading in °C,

t_f = the observed temperature reading in °F,

C_c and C_f = corrections to be added algebraically to the observed temperature readings,

P_k = barometric pressure, prevailing at the time and location of the test, kPa, and

P = barometric pressure, prevailing at the time and location of the test, mm Hg.

After applying the corrections and rounding each result to the nearest 0.5°C (1.0°F) or 0.1°C (0.2°F), as appropriate to the

TABLE 6 Approximate Thermometer Reading Correction

Temperature Range		Correction[A] per 1.3 kPa (10 mm Hg) Difference in Pressure	
°C	°F	°C	°F
10–30	50–86	0.35	0.63
30–50	86–122	0.38	0.68
50–70	122–158	0.40	0.72
70–90	158–194	0.42	0.76
90–110	194–230	0.45	0.81
110–130	230–266	0.47	0.85
130–150	266–302	0.50	0.89
150–170	302–338	0.52	0.94
170–190	338–374	0.54	0.98
190–210	374–410	0.57	1.02
210–230	410–446	0.59	1.07
230–250	446–482	0.62	1.11

[A]Values to be added when barometric pressure is below 101.3 kPa (760 mm Hg) and to be subtracted when barometric pressure is above 101.3 kPa.

Temperature Range		Correction[A] per 1.3 kPa (10 mm Hg) Difference in Pressure	
°C	°F	°C	°F
250–270	482–518	0.64	1.15
270–290	518–554	0.66	1.20
290–310	554–590	0.69	1.24
310–330	590–626	0.71	1.28
330–350	626–662	0.74	1.33
350–370	662–698	0.76	1.37
370–390	698–734	0.78	1.41
390–410	734–770	0.81	1.46

[A]Values to be added when barometric pressure is below 101.3 kPa (760 mm Hg) and to be subtracted when barometric pressure is above 101.3 kPa.

apparatus being used, use the corrected temperature readings in all further calculations and reporting.

NOTE 21—Temperature readings are not corrected to 101.3 kPa (760 mm Hg) when product definitions, specifications, or agreements between the parties involved indicate, specifically, that such correction is not required or that correction shall be made to some other base pressure.

11.4 Correct the actual loss to 101.3 kPa (760 mm Hg) pressure when temperature readings are corrected to 101.3 kPa pressure. The corrected loss, L_c, is calculated from Eq 6 or Eq 7, as appropriate, or can be read from the tables presented as Fig. X3.1 or Fig. X3.2.

$$L_c = 0.5 + (L - 0.5)/\{1 + (101.3 - P_k)/8.00\} \quad (6)$$

$$L_c = 0.5 + (L - 0.5)/\{1 + (760 - P)/60.0\} \quad (7)$$

where:

L = observed loss,

L_c = corrected loss,

P_k = pressure, kPa, and

P = pressure, mm Hg.

NOTE 22—Eq 6 and 7 above have been derived from the data in Table 7 and Eqs 5 and 6 in Test Method D 86 – 95 and earlier versions. It is probable that Eq 6 and 7 shown were the original empirical equations from which the table and equations in the Test Method D 86 – 95 and earlier versions were derived.

11.4.1 Calculate the corresponding corrected percent recovery in accordance with the following equation:

$$R_c = R + (L - L_c) \quad (8)$$

where:

L = percent loss or observed loss,

L_c = corrected loss,

R = percent recovery, and

R_c = corrected percent recovery.

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TABLE 7 Data Points for Determining Slope, S_C or S_F

Slope at %	IBP	5	10	20	30	40	50	60	70	80	90	95	EP
T_L at %	0	0	0	10	20	30	40	50	60	70	80	90	95
T_U at %	5	10	20	30	40	50	60	70	80	90	90	95	V_{EP}
$V_U - V_L$	5	10	20	20	20	20	20	20	20	20	10	5	$V_{EP} - 95$

11.5 To obtain the percent evaporated at a prescribed temperature reading, add the percent loss to each of the observed percent recovered at the prescribed temperature readings, and report these results as the respective percent evaporated, that is:

$$P_e = P_r + L \quad (9)$$

where:

L = observed loss,

P_e = percent evaporated, and

P_r = percent recovered.

11.6 To obtain temperature readings at prescribed percent evaporated, and if no recorded temperature data is available within 0.1 volume % of the prescribed percent evaporated, use either of the two following procedures, and indicate on the report whether the arithmetical procedure or the graphical procedure has been used.

11.6.1 *Arithmetical Procedure*—Deduct the observed loss from each prescribed percent evaporated to obtain the corresponding percent recovered. Calculate each required temperature reading as follows:

$$T = T_L + (T_H - T_L)\,(R - R_L)/(R_H - R_L) \qquad (10)$$

where:

R = percent recovered corresponding to the prescribed percent evaporated,

R_H = percent recovered adjacent to, and higher than R,

R_L = percent recovered adjacent to, and lower than R,

T = temperature reading at the prescribed percent evaporated,

T_H = temperature reading recorded at R_H, and

T_L = temperature reading recorded at R_L.

Values obtained by the arithmetical procedure are affected by the extent to which the distillation graphs are nonlinear. Intervals between successive data points can, at any stage of the test, be no wider than the intervals indicated in 10.18. In no case shall a calculation be made that involves extrapolation.

11.6.2 *Graphical Procedure*—Using graph paper with uniform subdivisions, plot each temperature reading corrected for barometric pressure, if required (see 11.3), against its corresponding percent recovered. Plot the IBP at 0 % recovered. Draw a smooth curve connecting the points. For each prescribed percent evaporated, deduct the distillation loss to obtain the corresponding percent recovered and take from the graph the temperature reading that this percent recovered indicates. Values obtained by graphical interpolation procedures are affected by the care with which the plot is made.

NOTE 23—See Appendix XI for numerical examples illustrating the arithmetical procedure.

11.6.3 In most automated instruments, temperature-volume data are collected at 0.1 volume % intervals or less and stored in memory. To report a temperature reading at a prescribed percent evaporated, neither of the procedures described in 11.6.1 and 11.6.2 have to be used. Obtain the desired temperature directly from the database as the temperature closest to and within 0.1 volume % of the prescribed percent evaporated.

12. Report

12.1 Report the following information (see Appendix X5 for examples of reports):

12.2 Report the barometric pressure to the nearest 0.1 kPa (1 mm Hg).

12.3 Report all volumetric readings in percentages.

12.3.1 *Manual Method*—Report volumetric readings to the nearest 0.5, and all temperature readings to the nearest 0.5°C (1.0°F).

12.3.2 *Automated Method*—Report volumetric readings to the nearest 0.1, and all temperature readings to the nearest 0.1 °C (0.2°F) or less.

12.4 After barometric corrections of the temperature readings have been made, the following data require no further calculation prior to reporting: IBP, dry point, EP (FBP), decomposition point, and all pairs of corresponding values involving percent recovered and temperature readings.

12.4.1 The report shall state if the temperature readings have not been corrected for barometric pressure.

12.5 When the temperature readings have not been corrected to 101.3 kPa (760 mm Hg) pressure, report the percent residue and percent loss as *observed* in accordance with 10.19 and 11.1, respectively.

12.6 Do not use the corrected loss in the calculation of percent evaporated.

12.7 It is advisable to base the report on relationships between temperature readings and percent evaporated when the sample is a gasoline, or any other product classified under Group 1, or in which the percent loss is greater than 2.0. Otherwise, the report can be based on relationships between temperature readings and percent evaporated or percent recovered. Every report must indicate clearly which basis has been used.

12.7.1 In the manual method, if results are given in percent evaporated versus temperature readings, report if the arithmetical or the graphical procedure was used (see 11.6).

12.8 Report if a drying agent, as described in 7.5.2 or 7.5.3, was used.

12.9 Fig. X1.1 is an example of a tabular report. It shows the percent recovered versus the corresponding temperature reading and versus the corrected temperature reading. It also shows the percent loss, the corrected loss, and the percent evaporated versus the corrected temperature reading.

TABLE 8 Repeatability and Reproducibility for Group 1

Evaporated Point, %	Manual Repeatability[A]		Manual Reproducibility[A]		Automated Repeatability[A]		Automated Reproducibility[A]	
	°C	°F	°C	°F	°C	°F	°C	°F
IBP	3.3	6	5.6	10	3.9	7	7.2	13
5	$1.9+0.B6S_C$	$3.4+0.86S_F$	$3.1+1.74S_C$	$5.6+1-74S_F$	$2.1+0.67S_C$	$3.8+0.67S_F$	$4.4+2.0S_C$	$7.9+2.0S_F$

[A] S_G or S_F is the average slope (or rate of change) calculated in accordance with 13.2.

Evaporated Point, %	Manual Repeatability[A]		Manual Reproducibility[A]		Automated Repeatability[A]		Automated Reproducibility[A]	
	°C	°F	°C	°F	°C	°F	°C	°F
10	$1.2+0.B6S_C$	$2.2+0.B6S_F$	$2.0+1.74S_C$	$3.6+1.74S_F$	$1.7+0.67S_C$	$3.0+0.67S_F$	$3.3+2.0S_C$	$6.0+2.0S_F$
20	$1.2+0.86S_C$	$2.2+0.86S_F$	$2.0+1.74S_C$	$3.6+1,74S_F$	$1.1+0.67S_C$	$2.0+0.67S_F$	$3.3+2.0S_C$	$6.0+2.0S_F$
30–70	$1.2+0.86S_C$	$2.2+0.86S_F$	$2.0+1.74S_C$	$3.6+1,74S_F$	$1.1+0.67S_C$	$2.0+0.67S_F$	$2.6+2.0S_C$	$4.7+2.0S_F$
80	$1.2+0.86S_C$	$2.2+0.86S_F$	$2.0+1.74S_C$	$3.6+1.74S_F$	$1.1+0.67S_C$	$2.0+0.67S_F$	$1.7+2.0S_C$	$3.0+2.0S_F$
90	$1.2+0.86S_C$	$2.2+0.86S_F$	$0.8+1.74S_C$	$1.4+1.74S_F$	$1.1+0.67S_C$	$2.0+0.67S_F$	$0.7+2.0S_C$	$1.2+2.0S_F$
95	$1.2+0.86S_C$	$2.2+0.86S_F$	$1.1+1.74S_C$	$1.9+1.74S_F$	$2.5+0.67S_C$	$4.5+0.67S_F$	$2.6+2.0S_C$	$4.7+2.0S_F$
FBP	3.9	7	7.2	13	4.4	8	8.9	16

[A] S_G or S_F is the average slope (or rate of change) calculated in accordance with 13.2.

13. Precision and Bias

13.1 *Precision:*

13.1.1 The precision of this test method has been determined by the statistical examination of interlaboratory test results obtained by 26 laboratories on 14 gasolines, by 4 laboratories on 8 samples of kerosine by the manual procedure, 3 laboratories on 6 samples of kerosine by the automated procedure, and 5 laboratories on 10 samples of diesel fuel by both the manual and automated procedures. Table A1.1 lists which tables and figures are to be used for the different fuel groups, distillation methods, and temperature scales.

13.1.2 The following terms are used in this section: (*1*) *r* = repeatability and (2) *R* = reproducibility. The value of any of these terms will depend upon whether the calculations were carried out in °C or °F.

13.2 *Slope or Rate of Change of Temperature:*

13.2.1 To determine the precision of a result, it is generally necessary to determine the slope or rate of change of the temperature at that particular point. This variable, denoted as S_C or S_F, is equal to the change in temperature, either in °C or in °F, respectively, per percent recovered or evaporated.

13.2.2 For Group 1 in the manual method and for all groups in the automated method, the precision of the IBP and EP does not require any slope calculation.

13.2.3 With the exception stated in 13.2.2 and in 13.2.4, the slope at any point during the distillation is calculated from the following equations, using the values shown in Table 7:

$$S_C \text{ (or } S_F) = (T_U - T_L)/(V_U - V_L) \qquad (11)$$

where:

S_C = is the slope, °C/volume %,

S_F = is the slope, °F/volume %,

T_U = is the upper temperature, °C (or °F),

T_L = is the lower temperature, °C (or °F),

V_U = is the volume % recovered or evaporated corresponding to T_U,

V_L = is the volume % recovered or evaporated corresponding to T_L and

V_{EP} = is the volume % recovered or evaporated corresponding to the end point.

13.2.4 In the event that the distillation end point occurs prior to the 95 % point, the slope at the end point is calculated as follows:

$$S_C \text{ (or } S_F) = (T_{EP} - T_{HR})/(V_{EP} - V_{HR}) \qquad (12)$$

where:

T_{EP} or T_{HR} is the temperature, in °C or °F at the percent volume recovered indicated by the subscript,

V_{EP} or V_{HR} is the volume % recovered.

13.2.4.1 The subscripts in Eq 12 refer to:

EP = end point

HR = highest reading, either 80% of 90%, prior to the end point.

13.2.5 For points between 10 to 85 % recovered which are not shown in Table 7, the slope is calculated as follows:

$$S_C \text{ (or } S_F) = 0.05\,(T_{(V+10)} - T_{(V-10)}) \qquad (13)$$

13.2.6 For samples in Group 1, the precision data reported are based on slope values calculated from percent evaporated data.

13.2.7 For samples in Group 2, 3, and 4, the precision data reported (Table 8) are based on slope values calculated from percent recovered data.

13.2.8 When results are reported as volume % recovered, slope values for the calculation of precision are to be determined from percent recovered data; when results are reported as volume % evaporated slope values are to be determined from % evaporated data.

13.3 *Manual Method:*

13.3.1 *Repeatability:*

13.3.1.1 *GROUP 1*—The difference between successive results obtained by the same operator with the same apparatus under constant operating conditions on identical test material would, in the long run, in the normal and correct operation of this test method, exceed the values calculated from Table 9 in only one case in twenty.

13.3.1.2 *GROUPS 2, 3, and 4*—The difference between successive results obtained by the same operator with the same apparatus under constant operating conditions on identical test material would, in the long run, in the normal and correct operation of this test method, exceed the values calculated from the values in Table 9 in only one case in twenty.

13.3.2 *Reproducibility:*

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TABLE 9 Repeatability and Reproducibility for Groups 2, 3 and 4 (Manual Method)

	Repeatability[A]		Reproducibility[A]	
	°C	°F	°C	°F
IBP	$1.0+0.35S_C$	$1.9+0.35S_F$	$2.8+0.93S_C$	$5.0+0.93S_F$
5—95%	$1.0+0.41S_C$	$1.8+0.41S_F$	$1.8+1.33S_C$	$3.3+1.33S_F$
FBP	$0.7+0.36S_C$	$1.3+0.36S_F$	$3.1+0.42S_C$	$5.7+C.42S_F$
% volume at temperature reading	$0.7+0.92/S_C$	$0.7+1,66/S_F$	$1.5+1.78/S_C$	$1.53+3.20/S_F$
[A] Calculate S_C or S_F from 13.2.				

13.3.2.1 *GROUP 1—The* difference between two single and independent results obtained by different operators working in different laboratories on identical Test material would, in the normal and correct operation of this method, exceed the values calculated from Table 9 in only one case in twenty.[7]

13.3.2.2 *GROUPS 2, 3, and 4*—The difference between two single and independent results obtained by different operators working in different laboratories on identical test material would, in the normal and correct operation of this test method, exceed the values calculated from the data in Table 9 in only one case in twenty.[8]

13.4 *Automated Method:*

13.4.1 *Repeatability:*

13.4.1.1 *GROUP 1*—The difference between successive results obtained by the same operator with die same apparatus under constant operating conditions on identical test material would, in the long run, in the normal and correct operation of this test method, exceed the values calculated from Table 8 in only one case in twenty.

13.4.1.2 *GROUPS 2, 3, and 4*—The difference between successive results obtained by the same operator with the same apparatus under constant operating conditions on identical test material would, in the long run, in the normal and correct operation of this test method, exceed the values calculated from Table 10 in only one case in twenty.

13.4.2 *Reproducibility;*

13.4.2.1 *GROUP 1*—The difference between two single and independent results obtained by different operators working in different laboratories on identical test material would, in the normal and correct operation of this test method, exceed the values calculated from Table 8 in only one case in twenty.[7]

13.4.2.2 *GROUPS 2, 3, and 4*—The difference between two single and independent results obtained by different operators working in different laboratories on identical test material would, in the normal and correct operation of this test method, exceed the values calculated from Table 10 in only one case in twenty.

13.5 *Bias:*

13.5.1 *Bias*—Due to the use of total immersion thermometers, or temperature sensing systems designed to emulate them, the distillation temperatures in this test method are somewhat lower than the true temperatures. The amount of bias depends on the product being distilled and the thermometer used.

13.5.2 *Relative Bias*—There exists a bias between the empirical results of distillation properties obtained by this test method and the true boiling point distillation curve obtained by Test Method *D* 2892. The magnitude of this bias, and how it relates to test precision, has not been rigorously studied.

13.5.3 *Relative Bias*—An interlaboratory study[5] conducted in 2003 using manual and automated apparatus has concluded that there is no statistical evidence to suggest that there is a bias between manual and automated results.

14. Keywords

14.1 batch distillation; distillates; distillation; laboratory distillation; petroleum products

[7] Precision data obtained from RR study on bath manual and automated D 86 units by North American and IP Laboratories.

[8] Table 9 has been derived from the nomographs In Figs. 6 and 7 in ASTM D 86–97.

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TABLE 10 Repeatability and Reproducibility for Groups 2, 3 and 4 (Automated)

Collected, %	Repeatability[A]		Reproducibility[A]	
	°C	°F	°C	°F
IBP	3.5	6.3	8.5	15.3
2%	3.5	6.3	$2.6 + 1.92S_C$	$4.7 + 1.92S_F$
5%	$1.1 + 1.08S_C$	$2.0 + 1.08S_F$	$2.0 + 2.53S_C$	$3.6 + 2.53S_F$
10%	$1.2 + 1.42S_C$	$2.2 + 1.42S_F$	$3.0 + 2.64S_C$	$5.4 + 2.64S_F$
20–70 %	$1.2 + 1.42S_C$	$2.2 + 1.42S_F$	$2.9 + 3.97S_C$	$5.2 + 3.97S_F$
80%	$1.2 + 1.42S_C$	$2.2 + 1.42S_F$	$3.0 + 2.64S_C$	$5.4 + Z64S_F$
90–95%	$1.1 + 1.08S_C$	$2.0 + 1.08S_F$	$2.0 + 2.53Sc$	$3.6 + 2,53S_F$
FBP	3.5	6.3	10.5	18.9
[A] S_c or S_F is the average slope (or rate of change) calculated in accordance with 13.5.				

ANNEXES
(Mandatory Information)

A1. REPEATABILITY AND REPRODUCIBILITY DEFINITION AIDS

A1.1 Table A1.1 is an aid for determining which repeatability and reproducibility table or section, is to be used.

TABLE A1.1 Summary of Aids for Definition of Repeatability and Reproducibility

Group	Method	Temperature Scale	Table or Section to Use	
			Reproducibility	Repeatability
1	Manual	°C	Table 8	Table 8
		°F	Table 8	Table 8
1	Automated	°C	Table 8	Table 8
		°F	Table 8	Table 8
2,3,4	Manual	°C	Table 9	Table 9
		°F	Table 9	Table 9
2,3,4	Automated	°C	Table 10	Table 10
		°F	Table 10	Table 10

A2. DETAILED DESCRIPTION OF APPARATUS

A2.1 *Distillation Flasks*—Flasks shall be of heat resistant glass, constructed to the dimensions and tolerances shown in Fig. A2.1 and shall otherwise comply with the requirements of Specification E 1405. Flask A (100 mL) may also be constructed with a ground glass joint, in which case the diameter of the neck shall be the same as the 125-mL flask.

NOTE A2.1—For tests specifying dry point, specially selected flasks with bottoms and walls of uniform thickness are desirable.

A2.2 *Condenser and Condenser Bath*—Typical types of condenser and condenser baths are illustrated in Figs. 1 and 2.

A2.2.1 The condenser shall be made of seamless noncorrosive metal tubing, 560 ± 5 mm in length, with an outside diameter of 14 mm and a wall thickness of 0.8 to 0.9 mm.

NOTE A2.2—Brass or stainless steel has been found to be a suitable material for this purpose.

A2.2.2 The condenser shall be set so that 393 ± 3 mm of the tube is in contact with the cooling medium, with 50 ± 3 mm outside the cooling bath at the upper end, and with 114 ± 3 mm outside at the lower end. The portion of the tube projecting at the upper end shall be set at an angle of 75 ± 3° with the vertical. The portion of the tube inside the condenser bath shall be either straight or bent in any suitable continuous smooth curve. The average gradient shall be 15 ± 1° with respect to the horizontal, with no 10-cm section having a gradient outside of the 15 ± 3° range. The projecting lower portion of the condenser tube shall be curved downward for a length of 76 mm and the lower end shall be cut off at an acute angle. Provisions shall be made to enable the flow of the distillate to run down the side of the receiving cylinder. This can be accomplished by using a drip-deflector, which is attached to the outlet of the tube. Alternatively, the lower portion of the condenser tube can be curved slightly backward to ensure

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contact with the wall of the receiving cylinder at a point 25 to 32 mm below the top of die receiving cylinder. Fig. A2.3 is a drawing of an acceptable configuration of the lower end of the condenser tube.

A2.2.3 The volume and the design of the bath will depend on the cooling medium employed. The cooling capacity of the bath shall be adequate to maintain the required temperature for the desired condenser performance. A single condenser bath may be used for several condenser tubes.

A2.3 *Metal Shield or Enclosure for Flask.* (Manual units only).

A2.3.1 *Shield for Gas Burner (see* Fig. 1)—The purpose of this shield is to provide protection for the operator and yet allow easy access to the burner and to the distillation flask during operation. A typical shield would be 480-mm high, 280-mm long and 200-mm wide, made of sheet metal of 0.8-mm thickness (22 gauge). The shield shall be provided with at least one window to observe the dry point at the end of the distillation.

A2.3.2 *Shield for Electric Heater (see* Fig. *2)*—A typical shield would be 440-mm high, 200-mm long, and 200-mm wide, made of sheet metal of approximately 0.8-mm thickness (22 gauge) and with a window in the front side. The shield shall be provided with at least one window to observe the dry point at the end of the distillation.

A2.4 *Heat Source:*

A2.4.1 *Gas Burner* (see Fig. 1), capable of bringing over the first drop from a cold start within the time specified and of continuing the distillation at the specified rate. A sensitive manual control valve and gas pressure regulator to give complete control of heating shall be provided.

A2.4.2 *Electric Heater* (see Fig. 2), of low heat retention.

NOTE A2.3—Heaters, adjustable from 0 to 1000 W, have been found to be suitable for this purpose.

A2.5 *Flask Support:*

A2.5.1 *Type 7*—Use a Type 1 flask support with a gas burner (see Fig. 1). This support consists of either a ring support of the ordinary laboratory type, 100 mm or larger in diameter, supported on a stand inside the shield, or a platform adjustable from the outside of the shield. On this ring or platform is mounted a hard board made of ceramic or other heat-resistant material, 3 to 6 mm in thickness, with a central opening 76 to 100 mm in diameter, and outside line dimensions slightly smaller than the inside boundaries of the shield.

A2.5.2 *Type 2*—Use a Type 2 flask support assembly with electric heating (see Fig. 2 as one example). The assembly consists of an adjustable system onto which the electric heater is mounted with provision for placement of a flask support board (see A2.6) above the electric heater. The whole assembly is adjustable from the outside of the shield.

A2.6 *Flask Support Board*—The flask support board shall be constructed of ceramic or other heat-resistant material, 3 to 6 mm in thickness. Flask support boards are classified as A, B, or C, based on the size of the centrally located opening, the dimension of which is shown in Table 1. The flask support board shall be of sufficient dimension to ensure that thermal heat to the flask only comes from the central opening and that extraneous heat to the flask other than through the central opening is minimized. (**Warning**—Asbestos-containing materials shall not be used in the construction of the flask support board.)

A2.7 The flask support board can be moved slightly in different directions on the horizontal plane to position the distillation flask so that direct heat is applied to the flask only through the opening in this board. Usually, the position of the flask is set by adjusting the length of the side-arm inserted into the condenser.

A2.8 Provision shall be made for moving the flask support assembly vertically so that the flask support board is in direct contact with the bottom of the distillation flask during the distillation. The assembly is moved down to allow for easy mounting and removal of the distillation flask from the unit.

A2.9 *Receiving Cylinders*—The receiving cylinder shall have a capacity to measure and collect 100 mL. The shape of the base shall be such that the receiver does not topple when placed empty on a surface inclined at an angle of 13° from the horizontal.

A2.9.1 *Manual Method*—The cylinder shall be graduated at intervals of 1 mL and have a graduation at the 100-mL mark. Construction details and tolerances for the graduated cylinder are shown in Fig. A2.4.

A2.9.2 *Automated Method*—The cylinder shall conform to the physical specifications described in Fig. A2.4, except that graduations below the 100-mL mark are permitted, as long as they do not interfere with the operation of the level follower. Receiving cylinders for use in automated units may also have a metal base.

A2.9.3 If required, the receiving cylinder shall be immersed during the distillation to above the 100-mL graduation line in a cooling liquid contained in a cooling bath, such as a tall-form beaker of clear glass or transparent plastic. Alternatively, the receiving cylinder may be placed in a thermostated bath air circulation chamber.

A2.10 *Residue Cylinder*—The graduated cylinder shall have a capacity of 5 or 10 mL, with graduations into 0.1 mL subdivisions, beginning at 0.1 mL. The top of the cylinder may be flared, the other properties shall conform to Specification E 1272.

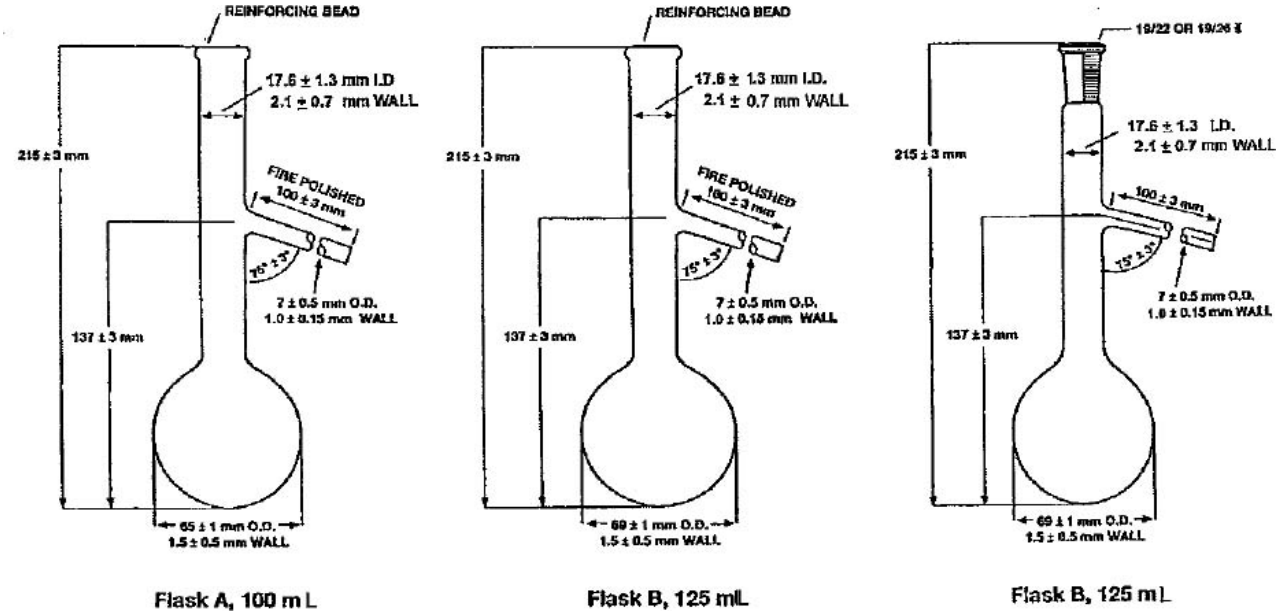

FIG. A2.1 Flask A, 100 mL, Flask B, 125 mL, and Flask B with Ground Glass Joint, 125 mL

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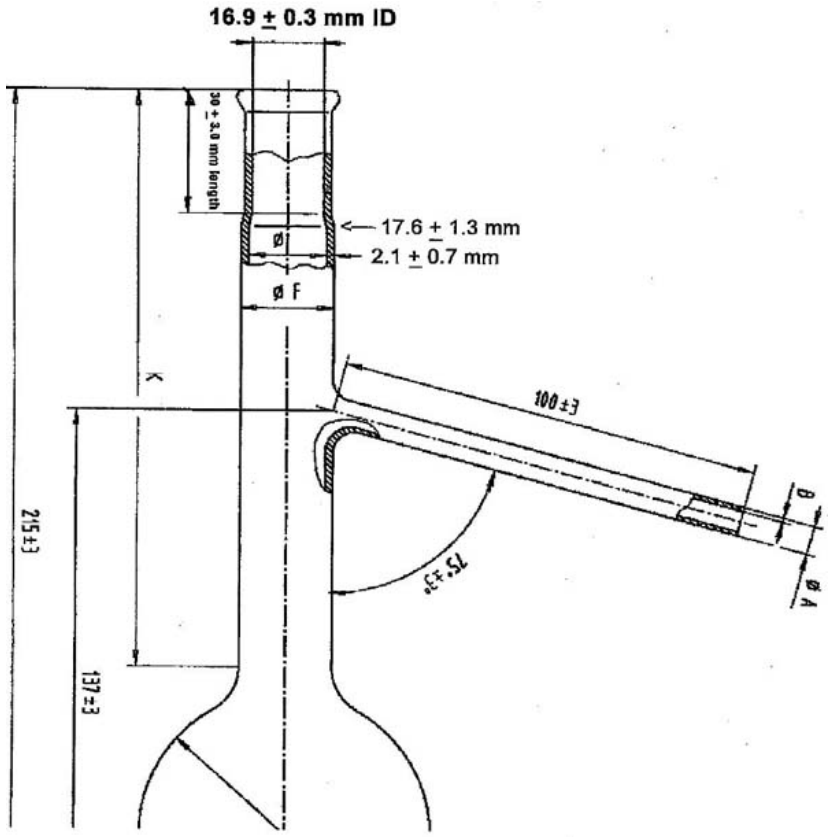

FIG. A2.2 Detail of Upper Neck Section

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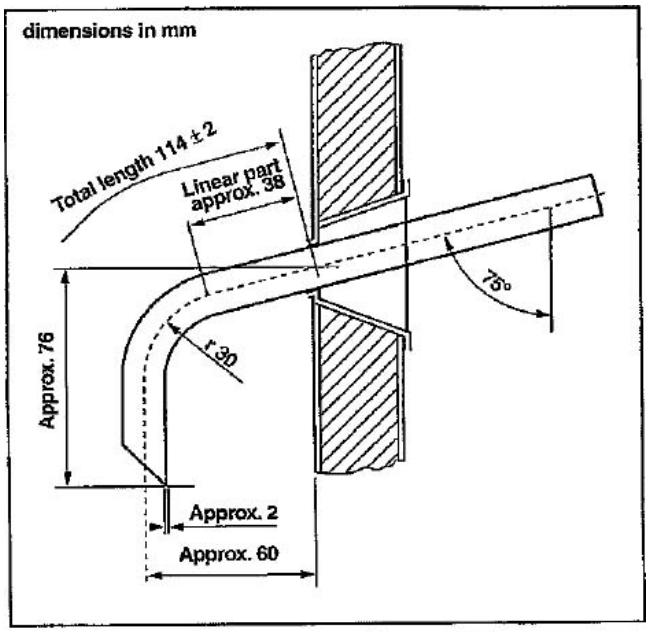
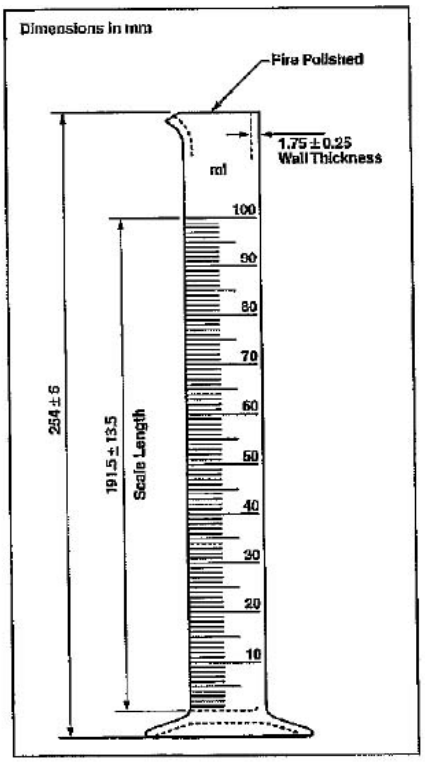


Lower End of Condenser Tube

FIG. A2.3 Lower End of Condenser Tube



NOTE—1 to 100 mL in 1 mL graduations; tolerance ± 1.0 mL.

FIG. A2.4 100 mL Graduated Cylinder

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A3. DETERMINATION OF THE DIFFERENCE IN LAG TIME BETWEEN AN ELECTRONIC TEMPERATURE MEASUREMENT SYSTEM AND A MERCURY-IN-GLASS THERMOMETER

A3.1 The response time of an electronic temperature measuring device is inherently more rapid than that of a mercury-in-glass thermometer. The temperature measuring device assembly in general use, consisting of the sensor and its casing, or an electronic system and its associated software, or both, is so designed that the temperature measuring system will simulate the temperature lag of the mercury-in-glass thermometer.

A3.2 To determine the difference in lag time between such a temperature measuring system and a mercury-in-glass thermometer, analyze a sample such as gasoline, kerosine, jet fuel, or light diesel fuel with the electronic temperature measurement system in place and in accordance with the procedures described in this test method. In most cases this is the standard distillation step performed with an automated unit.

A3.2.1 Do not use a single pure compound, a very narrow boiling range product, or a synthetic blend of less than six compounds for this test.

A3.2.2 Best results are obtained with a sample that is typical of the sample load of the laboratory. Alternatively, use a full-range mixture with a 5 to 95 % boiling range of at least 100°C.

A3.3 Replace the electronic temperature measuring device with a low range or a high range mercury-in-glass thermometer, depending on the boiling range of the sample.

A3.4 Repeat the distillation with this thermometer, and manually record the temperature at the various percent recovered as described in 10.14.

A3.5 Calculate the values for the repeatability for the observed slope ($\Delta T/\Delta V$) for the different readings in the test.

A3.6 Compare the test data obtained using these two temperature measuring devices. The difference at any point shall be equal to, or less than, the repeatability of the method at that point. If this difference is larger, replace the electronic temperature measuring device or adjust the electronics involved, or both.

A4. PROCEDURE TO DETERMINE THE PERCENT EVAPORATED OR PERCENT RECOVERED AT A PRESCRIBED TEMPERATURE READING

A4.1 Many specifications require specific percentages evaporated or recovered at prescribed temperature readings, either as maxima, minima, or ranges. The procedures to determine these values are frequently designated by the terms Exxx or Rxxx, where xxx is the desired temperature.

NOTE A4.1—Regulatory standards on the certification of reformulated gasoline under the complex model procedure require the determination of E 200 and E 300, defined as the percent evaporated fuel at 93.3°C (200°F) and 148.9°C (300°F), respectively. E 158, the percent evaporated at a distillation temperature of 70°C (158°F), is also used in describing fuel volatility characteristics. Other typical temperatures are R 200 for kerosines and R 250 and R 350 for gas oils, where R 200, R 250, and R 350 are the percent recovered fuel at 200°C, 250°C, and 350°C, respectively.

A4.2 Determine the barometric pressure, and calculate the correction to the desired temperature reading using Eq 3, Eq 4, or Eq 5 for t = xxx°C (or t_f = xxx°F).

A4.2.1 *Manual Method*—Determine this correction to 0.5°C (1°F).

A4.2.2 *Automated Method*—Determine this correction to 0.1°C (0.2°F).

A4.3 Determine the expected temperature reading to yield xxx°C (or xxx°F) after the barometric correction. To obtain the expected value, add the absolute value of the calculated correction to the desired temperature if the barometric pressure is above 101.3 kPa. If the barometric pressure is below 101.3 kPa, subtract the absolute value of the calculated correction from the desired temperature.

A4.4 Perform the distillation, as described in Section 10, while taking into account A4.5 and A4.6.

A4.5 *Manual Distillation:*

A4.5.1 In the region between about 10°C below and 10°C above the desired expected temperature reading determined in A4.3 record the temperature reading in intervals of 1 volume %.

A4.5.2 If the intent of the distillation is to solely determine the value of Exxx or Rxxx, discontinue the distillation after at least another 2 mL of distillate have been collected. Otherwise, continue the distillation, as described in Section 10, and determine the observed loss, as described in 11.1.

A4.5.2.1 If the intent of the distillation is to determine the value of Exxx and the distillation was terminated after about 2 mL of distillate was collected beyond the desired temperature, allow the distillate to drain into the receiving graduate. Allow the contents of the flask to cool to below approximately 40°C and then drain its contents into the receiving graduate. Note the volume of product in the receiving graduate to the nearest 0.5 mL at 2 min intervals until two successive observations agree.

A4.5.2.2 The amount recovered in the receiving graduate is the percent recovery. Determine the amount of observed loss by subtracting the percent recovery from 100.0.

A4.6 *Automated Distillation:*

A4.6.1 In the region between about 10°C below and 10°C above the desired expected temperature reading determined in A4.3, collect temperature-volume data at 0.1 volume % intervals or less.

A4.6.2 Continue the distillation, as described in Section 10, and determine the percent loss, as described in 11.1.

A4.7 *Calculations:*

A4.7.1 *Manual Method*—If a volume % recovered reading is not available at the exact temperature calculated in A4.3, determine the percent recovered by interpolation between the two adjacent readings. Either the linear, as described in 11.6.1, or the graphical procedure, as described in 11.6.2, is permitted. The percent recovered is equal to Rxxx.

A4.7.2 *Automated Method*—Report the observed volume to 0.1 volume % corresponding to the temperature closest to the expected temperature reading. This is the percent recovered, or Rxxx.

A4.7.3 *Manual and Automated Methods*—To determine the value of Exxx, add the observed loss to the percent recovered, Rxxx, as determined in A4.7.1 or A4.7.2 and as described in Eq 9.

A4.7.3.1 As prescribed in 12.6, do not use the corrected loss.

A4.8 *Precision:*

A4.8.1 The statistical determination of the precision of the volume % evaporated or recovered at a prescribed temperature has not been directly measured in an interlaboratory program. It can be shown that the precision of the volume % evaporated or recovered at a prescribed temperature is equivalent to the precision of the temperature measurement at that point divided by the rate of change of temperature versus volume % evaporated or recovered. The estimation of precision becomes less precise at high slope values.

A4.8.2 Calculate the slope or rate of change in temperature reading, S_C(or S_F), as described in 13.2 and Eq 11 and using temperature values bracketing the desired temperature.

A4.8.3 Calculate the repeatability, *r,* or the reproducibility, *R,* from the slope, S_C (or S_F), and the data in Table 8, Table 9, or Table 10.

A4.8.4 Determine the repeatability or reproducibility, or both, of the volume % evaporated or recovered at a prescribed temperature from the following formulas:

$$^{r}\text{volume \%} = r/S_C\,(S_F) \qquad \text{(A4.1)}$$

$$^{R}\text{volume \%} = R/S_C\,(S_F) \qquad \text{(A4.2)}$$

where:

^{r}Volume % = repeatability of the volume % evaporated or recovered,

^{R}volume % = reproducibility of the volume % evaporated or recovered,

r = repeatability of the temperature at the prescribed temperature at the observed percent distilled,

R = reproducibility of the temperature at the prescribed temperature at the observed percent distilled, and

$S_C(S_F)$ = rate of change in temperature reading in °C (°F) per the volume % evaporated or recovered.

A4.8.5 Examples on how to calculate the repeatability and the reproducibility are shown in Appendix X2.

APPENDIXES
(Nonmandatory Information)

X1. EXAMPLES ILLUSTRATING CALCULATIONS FOR REPORTING OF DATA

X1.1 The observed distillation data used for the calculation of the examples below are shown in the first three columns of Fig. X1.1.

X1.1.1 Temperature readings corrected to 101.3 kPa (760 mm Hg) pressure (see 11.3) are as follows:

$$\text{correction } (°C) = 0.0009\,(101.3 - 98.6)\,(273 + t_c) \qquad \text{(X1.1)}$$

$$\text{correction } (°F) = 0.00012\,(760 - 740)\,(460 + t_f) \qquad \text{(X1.2)}$$

X1.1.2 Loss correction to 101.3 kPa (see 11.4) are as follows. The data for the examples are taken from Fig. X1.1.

$$\text{corrected loss} = (0.5 + (4.7 - 0.5)/\{1 + (101.3 - 98.6)/8.0\} = 3.6 \qquad \text{(X1.3)}$$

X1.1.3 Recovery correction to 101.3 kPa(see 11.4.1) are as follows:

$$\text{corrected recovery} = 94.2 + (4.7 - 3.6) = 95.3 \qquad \text{(X1.4)}$$

X1.2 *Temperanire Readings at Prescribed Percent Evaporated:*

X1.2.1 Temperature reading at 10% evaporated (4.7% observed loss = 5.3 % recovered) (see 11.6.1) are as follows:

$$T_{10E}\,(°C) = 33.7 + [(40.3 - 33.7)(5.3 - 5)/(10 - 5)] = 34.1°C \qquad \text{(X1.5)}$$

$$T_{10E}(°F) = 92.7 + [(104.5 - 92.7)(5.3 - 5)/(10 - 5)] = 93.1°F \qquad \text{(X1.6)}$$

X1.2.2 Temperature reading at 50% evaporated (45.3% recovered) (see 11.6.1) are as follows:

$$T_{50E}(°C) = 93.9 + [(108.9 - 93.9)(45.3 - 40)/(50 - 40)] = 101.9°C \qquad \text{(X1.7)}$$

$$T_{50E}\,(°F) = 201 + [(228 - 201)(45.3 - 40)/50 - 40)] = 215.3°F \qquad \text{(X1.8)}$$

X1.2.3 Temperature reading at 90 % evaporated (85.3 % recovered) (see 11.6,1) are as follows:

$$T_{90E}\,(°C) = 181.6 + [(201.6 - 181.6)(85.3 - 85)/(90 - 85)\,] = 182.8°C \qquad \text{(X1.9)}$$

$$T_{90E}\,(°F) = 358.9 + [(394.8 - 358.9)(85.3 - 85)/(90 - 85)] = 361.0°F \qquad \text{(XI.10)}$$

X1.2.4 Temperature reading at 90% evaporated (85.3% recovered) not corrected to 101.3 kPa pressure (see 11.6.1) are as follows:

$$T_{90E}(°C) = 180.5 + [(200.4 - 180.5) \quad \text{(X1.11)}$$
$$(85.3 - 85)/(90 - 85)] = 181.7°C$$
$$T_{90E}(°F) = 357 + [(392 - 357) \quad \text{(X1.12)}$$
$$(85.3 - 85)/(90 - 85)] - 359.1°F$$

NOTE X1.1—Results calculated from °C data may not correspond exactly to results calculated from °F data because of errors in rounding.

	Sample ID; Date analyzed: Equipment No: Remarks:				**Barometric pressure: 98.6 kPa Analyst:**		
	Barometric pressure						
	observed 98.6 kPa		**corrected 101.3 kPa**		**procedure arithmetical/ graphical**		
%	**740 mm Hg**		**760 mm Hg**		**%**	**T******	
recovered	**°C**	**°F**	**°C**	**°F**	**evaporated**	**°C**	**°F**
IBP	25.5	78	26.2	79.2	5	26.7	80.0
5	33.0	91	33.7	92.7	10	34.1	93.4
10	39.5	103	40.3	104.5	15	40.7	105.2
15	46.0	115	46.8	116.2	20	47.3	117.1
20	54.5	130	55.3	131.5	30	65.7	150.2
30	74.0	165	74.8	166.7	40	84.9	184.9
40	93.0	199	93.9	201.0	50	101.9	215.3
50	108.0	226	108.9	228.0	60	116.9	242.4
60	123.0	253	124.0	255.1	70	134.1	273.3
70	142.0	288	143.0	289.4	80	156.0	312.8
80	166.5	332	167.6	333.6	85	168.4	335.1
85	180.5	357	181.6	358.9	90	182.8	361.0
90	200.4	393	201.6	394.8	95	202.4	396.3
EP	215.0	419	216.2	421.1			
recovered, %	94.2		95.3				
residue, %	1.1		1.1				
loss, %	4.7		3.6				

FIG. X1.1 Example of Test Report

X2. EXAMPLES OF CALCULATION OF REPEATABILITY AND REPRODUCIBILITY OF VOLUME % (RECOVERED OR EVAPORATED) AT A PRESCRIBED TEMPERATURE READING

X2.1 Some specifications require the reporting of the volume % evaporated or recovered at a prescribed temperature. Table X2.1 shows the distillation data of a Group 1 sample as obtained by an automated unit.

X2.2 *Example Calculation:*

X2.2.1 For a Group 1 sample exhibiting distillation characteristics as per Table X2.1, as determined by an automated unit, the reproducibility of the volume evaporated, ^{R}volume %, at 93.3°C (200°F) is determined as follows:

X2.2.1.1 Determine first the slope at the desired temperature:

$$S_C\,\% = 0.1\,(T_{(20)} - T_{(10)}) \quad \text{(X2.1)}$$
$$= 0.1\,(94 - 83)$$
$$= 1.1$$
$$S_F\,\% = 0.1\,(T_{(20)} - T_{(10)})$$
$$= 0.1\,(201 - 182)$$
$$= 1.9$$

X2.2.2 From Table 9, determine the value of *R*, the reproducibility at the observed percentage distilled. In this case, the observed percentage distilled is 18 % and

$$R = 3.3 + 2.0\,(S_C) \quad \text{(X2.2)}$$
$$= 3.3 + 2.0 \times 1.1$$
$$= 5.5$$
$$R = 6.0 + 2.0\,(S_F)$$
$$= 6.0 + 2.0 \times 1.9$$
$$= 9.8$$

X2.2.3 From the calculated value of *R*, determine the value of volume, as described in A4.8.4.

$$R \text{ volume \%} = R/(S_C) \qquad \text{(X2.3)}$$
$$= 5.5/1.1$$
$$= 5.0$$
$$R \text{ volume \%} = R/(S_F)$$
$$= 9.8/1.9$$
$$= 5.1$$

TABLE X2.1 Distillation Data from a Group 1 Sample Automated Distillation

Distillation Point Recovered, mL	Temperature °C	Temperature°F	Volume (mL) Recovered at 93.3°C (200°F)
			18.0
10	84	183	
20	94	202	
30	103	217	
40	112	233	
Distillation Point Evaporated, mL	**Temperature°C**	**Temperature°F**	**Volume (mL) Evaporated at 93.3°C (200°F)**
			18.4
10	83	182	
20	94	201	
30	103	217	
40	111	232	

X3. TABLES OF CORRECTED LOSS FROM MEASURED LOSS AND BAROMETRIC PRESSURE

X3.1 The table presented as Fig. X3.1 can be used to determine the corrected loss from the measured loss and the barometric pressure in kPa.

X3.2 The table presented as Fig. X3.2 can be used to determine the corrected loss from the measured loss and the barometric pressure in mm Hg.

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Barometric Pressure, kPa																								
from	76.1	80.9	84.5	87.9	89.6	91.5	93.1	94.1	95.5	96.4	97.2	97.9	98.4	98.9	99.5	100.0	100.4	100.8	101.2	101.5	102.0	102.4	102.8	103.2
through	80.8	84.4	87.2	89.5	91.4	93.0	94.0	95.4	96.3	97.1	97.8	98.3	98.8	99.4	99.9	100.3	100.7	101.1	101.4	101.9	102.3	102.7	103.1	103.5
Observed Loss	/--Corrected Loss----->																							
Units																								
0	0.37	0.35	0.33	0.31	0.29	0.27	0.25	0.23	0.20	0.18	0.16	0.14	0.13	0.11	0.09	0.06	0.04	0.02	−0.00	−0.02	−0.06	−0.09	−0.13	−0.17
1	0.63	0.65	0.67	0.69	0.71	0.73	0.75	0.78	0.80	0.82	0.86	0.86	0.87	0.89	0.92	0.94	0.96	0.98	1.00	1.03	1.06	1.09	1.13	1.17
2	0.89	0.95	1.01	1.08	1.14	1.20	1.26	1.33	1.40	1.46	1.52	1.67	1.62	1.68	1.75	1.81	1.87	1.94	2.00	2.08	2.17	2.27	2.38	2.51
3	1.16	1.25	1.36	1.46	1.57	1.67	1.77	1.88	1.99	2.09	2.19	2.28	2.37	2.47	2.58	2.89	2.79	2.90	3.00	3.13	3.29	3.48	3.63	3.84
4	1.41	1.66	1.70	1.84	1.99	2.14	2.28	2.43	2.59	2.73	2.87	3.00	3.12	3.26	3.41	3.56	3.70	3.85	4.00	4.18	4.40	4.63	4.89	5.18
5	1.68	1.86	2.04	2.23	2.42	2.61	2.79	2.98	3.19	3.37	3.55	3.71	3.87	4.05	4.25	4.44	4.62	4.81	5.00	5.23	5.51	5.81	6.14	6.52
6	1.94	2.16	2.39	2.61	2.84	3.08	3.30	3.53	3.78	4.01	4.23	4.42	4.62	4.84	5.08	5.31	5.53	5.77	6.00	6.28	6.63	6.99	7.40	7.86
7	2.20	2.46	2.73	3.00	3.27	3.55	3.80	4.08	4.38	4.65	4.90	5.14	5.37	5.63	5.91	6.18	6.44	6.73	7.00	7.33	7.74	8.17	8.65	9.20
8	2.49	2.76	3.07	3.38	3.70	4.02	4.31	4.63	4.98	5.28	5.58	5.85	6.12	6.41	6.74	7.06	7.36	7.69	8.00	8.38	8.86	9.35	9.90	10.53
9	2.72	3.07	3.41	3.76	4.12	4.49	4.82	5.18	5.57	5.92	6.26	6.56	6.87	7.20	7.57	7.93	8.27	8.65	9.00	9.43	9.97	10.53	11.16	11.87
10	2.98	3.37	3.76	4.15	4.55	4.96	5.33	5.73	6.17	6.56	6.94	7.28	7.52	7.99	8.41	8.81	9.19	9.60	10.00	10.48	11.08	11.71	12.41	13.21
11	3.24	3.67	4.10	4.53	4.97	5.43	5.84	6.28	6.77	7.20	7.61	7.99	8.37	8.78	9.24	9.68	10.10	10.56	11.00	11.53	12.20	12.89	13.67	14.55
12	3.50	3.97	4.44	4.92	5.40	5.90	6.35	6.83	7.36	7.84	8.29	8.71	9.12	9.57	10.07	10.56	11.02	11.52	12.00	12.59	13.31	14.07	14.92	15.89
13	3.76	4.27	4.78	5.30	5.83	6.36	6.86	7.39	7.96	8.47	8.97	9.42	9.86	10.36	10.90	11.43	11.93	12.48	13.00	13.64	14.43	15.25	16.17	17.22
14	4.03	4.58	5.13	5.69	6.25	6.83	7.38	7.94	8.56	9.11	9.64	10.13	10.61	11.15	11.74	12.31	12.85	13.44	14.00	14.69	15.54	16.43	17.43	18.56
15	4.29	4.88	5.47	6.07	6.68	7.30	7.87	8.49	9.15	9.75	10.32	10.85	11.36	11.93	12.57	13.18	13.76	14.40	15.00	15.74	16.66	17.61	18.68	19.90
16	4.55	5.18	5.81	6.45	7.10	7.77	8.38	9.04	9.75	10.39	11.00	11.58	12.11	12.72	13.40	14.06	14.68	15.36	16.00	16.79	17.77	18.79	19.94	21.24
17	4.81	5.48	6.16	6.84	7.53	8.24	8.89	9.53	10.35	11.03	11.68	12.27	12.66	13.51	14.23	14.93	15.59	16.31	17.00	17.84	18.88	19.97	21.19	22.58
18	5.07	5.78	6.50	7.22	7.96	8.71	9.40	10.14	10.94	11.65	12.35	12.99	13.61	14.30	15.07	15.80	16.50	17.27	18.00	18.89	20.00	21.15	22.44	23.91
19	5.33	6.08	6.84	7.61	8.38	9.18	9.91	10.69	11.54	12.30	13.03	13.70	14.36	15.09	15.90	16.68	17.42	18.23	19.00	19.94	21.11	22.39	23.70	25.25
20	5.59	6.39	7.18	7.99	8.81	9.65	10.41	11.24	12.14	12.94	13.71	14.41	15.11	15.88	16.73	17.55	18.33	19.19	20.00	20.99	22.23	23.51	24.95	26.59
Tenths																								
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.1	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.13	0.13
0.2	0.05	0.06	0.07	0.08	0.09	0.09	0.10	0.11	0.12	0.13	0.14	0.14	0.15	0.16	0.17	0.17	0.18	0.19	0.20	0.21	0.22	0.24	0.25	0.27
0.3	0.08	0.09	0.10	0.12	0.13	0.14	0.15	0.17	0.18	0.19	0.20	0.21	0.22	0.24	0.25	0.26	0.27	0.29	0.30	0.32	0.33	0.35	0.38	0.40

0.4	0.10	0.12	0.14	0.15	0.17	0.19	0.20	0.22	0.24	0.26	0.27	0.29	0.30	0.32	0.33	0.35	0.37	0.38	0.40	0.42	0.45	0.47	0.50	0.54
0.5	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.28	0.30	0.32	0.34	0.36	0.37	0.39	0.42	0.44	0.46	0.48	0.50	0.53	0.56	0.59	0.63	0.67
0.6	0.16	0.18	0.21	0.23	0.26	0.28	0.31	0.33	0.36	0.38	0.41	0.43	0.45	0.47	0.50	0.52	0.55	0.58	0.60	0.63	0.67	0.71	0.75	0.80
0.7	0.18	0.21	0.24	0.27	0.30	0.33	0.36	0.39	0.42	0.45	0.47	0.50	0.52	0.55	0.58	0.61	0.64	0.67	0.70	0.74	0.78	0.83	0.88	0.94
0.8	0.21	0.24	0.27	0.31	0.34	0.38	0.41	0.44	0.48	0.51	0.54	0.57	0.60	0.63	0.67	0.70	0.73	0.77	0.80	0.84	0.89	0.94	1.00	1.07
0.9	0.24	0.27	0.31	0.35	0.38	0.42	0.46	0.50	0.54	0.57	0.61	0.64	0.67	0.71	0.75	0.79	0.82	0.86	0.90	0.95	1.00	1.06	1.13	1.20

FIG. X3.1 Corrected Loss from Observed Loss and Barometric Pressure kPa

Barometric Pressure, mmHg.																								
from	571	607	634	655	672	686	698	706	716	723	729	734	738	742	746	750	753	756	759	762	765	768	771	774
through	806	633	654	671	685	697	706	715	722	728	733	737	741	745	749	752	755	758	761	764	767	770	773	776
Observed Loss	/--Corrected Loss----->																							
Units																								
0	0.37	0.35	0.33	0.31	0.29	0.27	0.25	0.23	0.20	0.18	0.16	0.14	0.13	0.11	0.09	0.07	0.05	0.02	−0.00	−0.03	−0.06	−0.09	−0.13	−0.17
1	0.63	0.65	0.67	0.69	0.71	0.73	0.75	0.77	0.80	0.82	0.84	0.86	0.87	0.89	0.91	0.93	0.95	0.98	1.00	1.03	1.06	1.09	1.13	1.17
2	0.89	0.95	1.01	1.07	1.14	1.20	1.26	1.32	1.39	1.45	1.51	1.57	1.62	1.68	1.74	1.80	1.86	1.93	2.00	2.08	2.17	2.27	2.38	2.50
3	1.15	1.25	1.36	1.48	1.56	1.67	1.77	1.87	1.99	2.09	2.19	2.28	2.36	2.46	2.57	2.67	2.77	2.88	3.00	3.13	3.28	3.44	3.63	3.83
4	1.41	1.55	1.70	1.84	1.99	2.14	2.27	2.42	2.58	2.72	2.86	2.99	3.11	3.25	3.40	3.54	3.68	3.83	4.00	4.19	4.39	4.62	4.88	5.17
5	1.67	1.86	2.04	2.22	2.41	2.61	2.78	2.97	3.18	3.36	3.54	3.70	3.86	4.03	4.23	4.41	4.59	4.79	5.00	5.24	5.50	5.80	6.13	6.50
6	1.93	2.16	2.38	2.61	2.84	3.07	3.29	3.52	3.77	3.99	4.21	4.41	4.60	4.82	5.05	5.28	5.50	5.74	6.00	6.29	6.61	6.97	7.38	7.84
7	2.19	2.46	2.72	2.99	3.26	3.54	3.79	4.07	4.36	4.63	4.86	5.12	5.35	5.60	5.88	6.15	6.41	6.69	7.00	7.34	7.72	8.15	8.63	9.17
8	2.46	2.76	3.07	3.37	3.69	4.01	4.30	4.62	4.98	5.27	5.56	5.83	6.09	6.38	6.71	7.02	7.32	7.64	8.00	8.40	8.84	9.33	9.88	10.50
9	2.72	3.06	3.41	3.76	4.11	4.48	4.81	5.17	5.55	5.90	6.23	6.54	6.84	7.17	7.54	7.89	8.23	8.60	9.00	9.46	9.95	10.50	11.13	11.84
10	2.98	3.38	3.75	4.14	4.54	4.94	5.31	5.71	6.15	6.54	6.31	7.25	7.58	7.95	8.37	8.76	9.14	9.55	10.00	10.50	11.06	11.68	12.38	13.17
11	3.24	3.68	4.09	4.52	4.96	5.41	5.82	6.26	6.74	7.17	7.58	7.96	8.33	8.74	9.19	9.63	10.05	10.50	11.00	11.56	12.17	12.86	13.63	14.51
12	3.50	3.96	4.43	4.91	5.39	5.88	6.33	6.81	7.34	7.81	8.26	8.87	9.07	9.52	10.02	10.50	10.96	11.46	12.00	12.61	13.28	14.03	14.88	15.84
13	3.76	4.27	4.78	5.29	5.81	6.35	6.83	7.36	7.93	8.44	8.93	9.38	9.82	10.31	10.85	11.37	11.87	12.41	13.00	13.66	14.39	15.21	16.13	17.17
14	4.02	4.57	5.12	5.67	6.24	6.82	7.34	7.91	8.53	9.08	9.61	10.09	10.57	11.09	11.68	12.24	12.78	13.36	14.00	14.71	15.51	16.39	17.38	18.51
15	4.28	4.87	5.46	6.06	6.66	7.28	7.85	8.46	9.12	9.71	10.28	10.80	11.31	11.88	12.51	13.11	13.68	14.31	15.00	15.77	16.62	17.57	18.63	19.84
16	4.54	5.17	5.80	6.44	7.09	7.75	8.35	9.01	9.72	10.35	10.95	11.61	12.06	12.65	13.33	13.98	14.59	15.27	16.00	16.82	17.73	18.74	19.88	21.18
17	4.80	5.47	6.14	6.62	7.51	8.22	8.86	9.56	10.31	10.98	11.63	12.22	12.80	13.45	14.16	14.85	15.50	16.22	17.00	17.87	18.84	19.92	21.13	22.51
18	5.06	5.77	6.49	7.21	7.94	8.69	9.37	10.11	10.91	11.62	12.30	12.93	13.66	14.23	14.99	15.72	16.41	17.17	18.00	18.93	19.95	21.10	22.38	23.84
19	5.32	6.07	6.83	7.59	8.36	9.15	9.88	10.66	11.50	12.25	12.98	13.84	14.29	15.02	15.82	16.59	17.32	18.12	19.01	19.98	21.06	22.27	23.64	25.18
20	5.88	6.37	7.17	7.97	8.79	9.62	10.38	11.20	12.09	12.89	13.65	14.35	15.04	15.80	16.64	17.46	18.23	19.08	20.01	21.03	22.17	23.45	24.89	26.51
Tenths																								
0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.1	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.13	0.13
0.2	0.05	0.06	0.07	0.08	0.08	0.09	0.10	0.11	0.12	0.13	0.13	0.14	0.15	0.16	0.17	0.17	0.18	0.19	0.20	0.21	0.22	0.24	0.25	0.27
0.3	0.08	0.09	0.10	0.11	0.13	0.14	0.15	0.16	0.18	0.19	0.20	0.21	0.22	0.24	0.25	0.26	0.27	0.29	0.30	0.32	0.33	0.35	0.38	0.40
0.4	0.10	0.12	0.14	0.15	0.17	0.19	0.20	0.22	0.24	0.25	0.27	0.28	0.30	0.31	0.33	0.35	0.36	0.38	0.40	0.42	0.44	0.47	0.50	0.53
0.5	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.30	0.32	0.34	0.36	0.37	0.39	0.41	0.43	0.45	0.48	0.50	0.53	0.56	0.59	0.63	0.67
0.6	0.16	0.18	0.21	0.23	0.25	0.28	0.30	0.33	0.36	0.38	0.40	0.43	0.45	0.47	0.50	0.52	0.55	0.57	0.60	0.63	0.67	0.71	0.75	0.80
0.7	0.18	0.21	0.24	0.27	0.30	0.33	0.35	0.38	0.42	0.44	0.47	0.50	0.52	0.55	0.58	0.61	0.64	0.67	0.70	0.74	0.78	0.82	0.88	0.93
0.8	0.21	0.24	0.27	0.31	0.34	0.37	0.41	0.44	0.48	0.51	0.54	0.57	0.60	0.63	0.66	0.70	0.73	0.76	0.80	0.84	0.88	0.94	1.00	1.07
0.9	0.23	0.27	0.31	0.34	0.38	0.42	0.46	0.49	0.54	0.57	0.61	0.64	0.67	0.71	0.75	0.78	0.82	0.86	0.90	0.95	1.00	1.06	1.13	1.20

FIG. X3.2 Corrected Loss from Observed Loss and Barometric Pressure mm Hg

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X4. PROCEDURE TO EMULATE THE EMERGENT STEM ERROR OF A MERCURY-IN-GLASS THERMOMETER

X4.1 When an electronic or other sensor without an emergent stem error is used, the output of this sensor or the associated data system should emulate the output of a mercury-in-glass thermometer. Based on information supplied by four manufacturers of automated Test Method D 86 equipment, the averaged equations shown in X4.2 and X4.3 have been reported to be in use.

X4.1.1 The equations shown in X4.2 have limited applicability and are shown for information purposes only. In addition to the correction for the emergent stem, the electronic sensor and associated data system will also have to emulate the lag in response time observed for mercury-in-glass thermometers.

X4.2 When a low range thermometer would have been used, no stem correction is to be applied below 20°C. Above this temperature, the correction is calculated using the following formula:

$$ASTM\ 7C\ T_{elr} = T_t - 1\ 0.000162 \times (T_t - 20°C)^2 \qquad \text{(X4.1)}$$

X4.3 When a high range thermometer would have been used, no stem correction is to be applied below 35°C. Above this temperature the correction is calculated using the following formula:

$$ASTM\ 8C\ T_{ehr} = T_t - 0.000131 \times (T_t - 35°C)^2 \qquad \text{(X4.2)}$$

where:

T_{elr} = emulated temperature in °C for low range thermometers,

T_{ehr} = emulated temperature in °C for high range thermometers, and

T_t = true temperature in °C.

X5. EXPLANATORY REPORT FORMS

X5.1 Fig. X5.1 and Fig. X5.2 show report forms.

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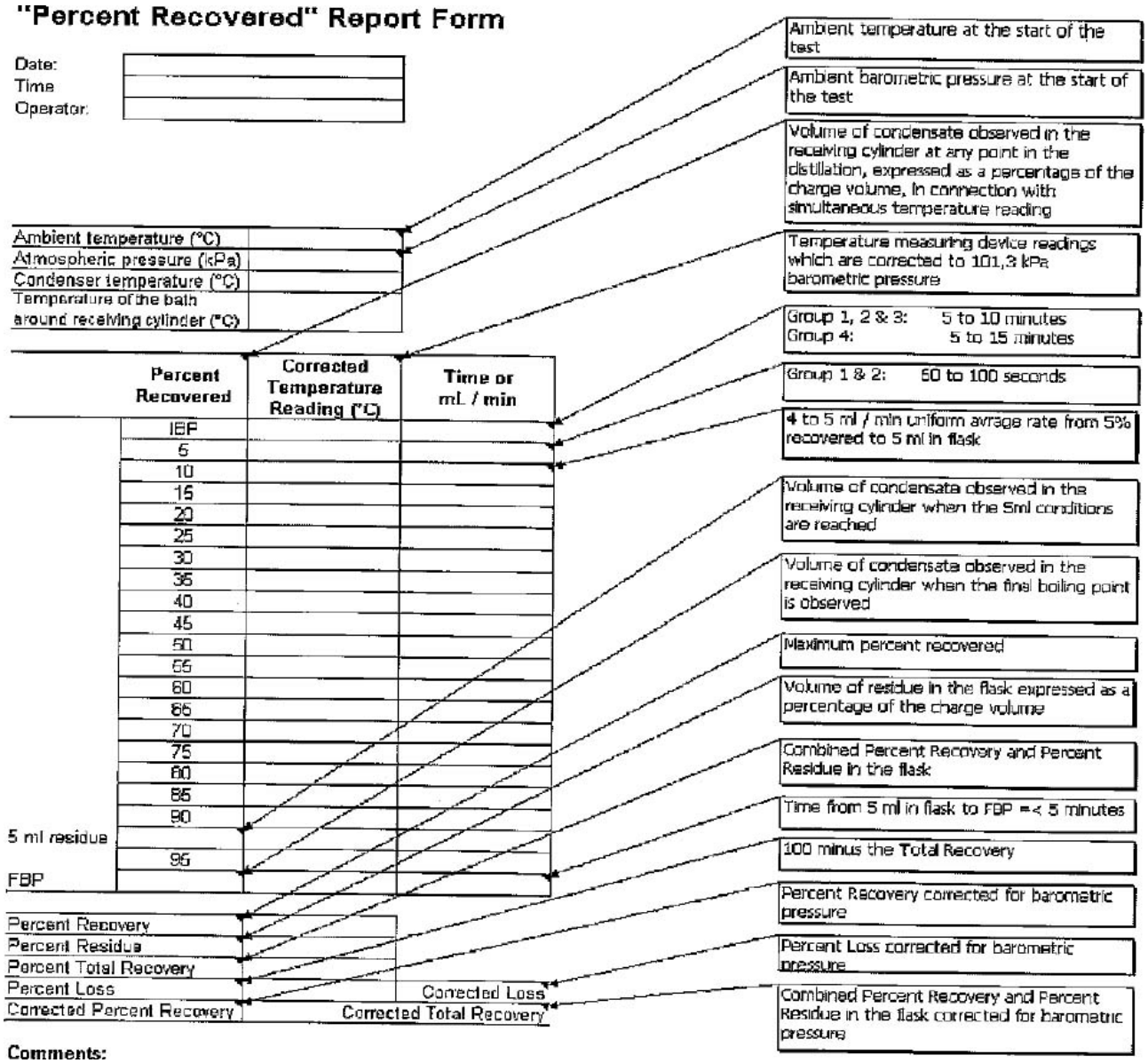

FIG. X5.1 Percent Recovered Report Form

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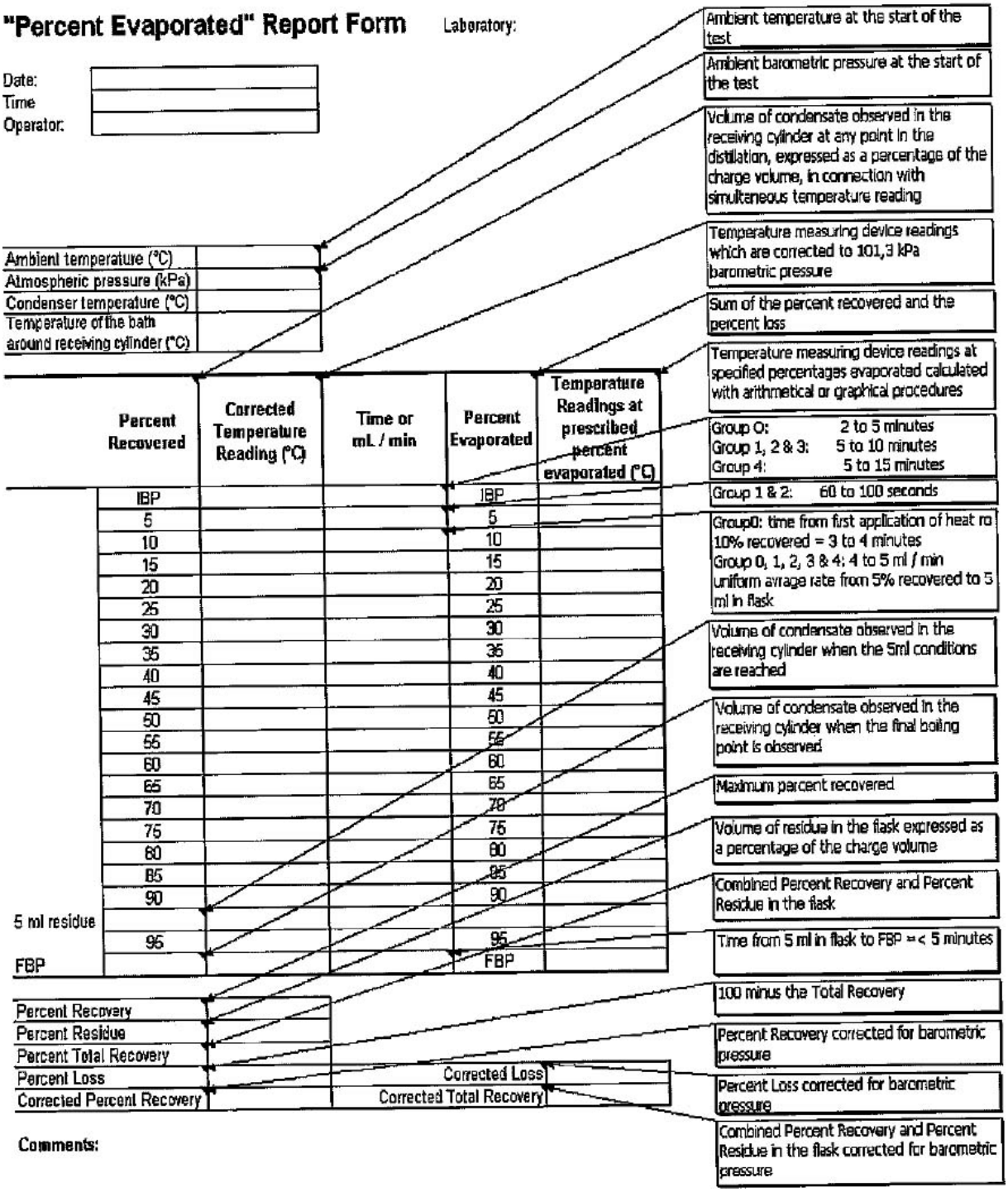

FIG. X5.2 Percent Evaporated Report Form

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SUMMARY OF CHANGES

Subcommittee D02.08 has identified the location of selected changes to this standard since the last issue (D 86–05) that may impact the use of this standard. (Approved Jan. 15, 2007.)

(*1*) Deleted “natural gasolines” from 1.1.

(*2*) Deleted “Group 0” from the entire standard.

(*3*) Added Fig. 6.

Subcommittee D02.08 has identified the location of selected changes to this standard since the last issue, (D 86-04b), that may impact the use of this standard. (Approved July 1, 2005.)

(*1*) Replaced Table 4 with new values.

(*2*) Revised 9.1.2-9.1.2.2, 9.1.5, and Notes 9-11.

(*3*) Added 13.5.3 and footnote reference to the research report.

(*4*) Added Appendix X5, and cross-reference in Section 12.1.

EXHIBIT 166

ARTICLE 310.10

ticle 400. For fixture wires, see Article 402.

310.2 Definitions.

Electrical Ducts, Electrical conduits, or other raceways round in cross section, that are suitable for use underground or embedded in concrete.

Thermal Resistivity. As used in this Code, the heat transfer capability ihuxnih i Mib t..<n ^ by • •onduaion. It is the reciprocal of thermal conductivity and is designated Rho and expressed ii the units "C-cm/W.

II. Installation

310.10 Uses Permitted. The conductors described in 310.104 shall be permitted for use in any of the wiring methods covered in Chapter 3 and as specified in their respective tables or as permitted elsewhere in this Code.

Informational Note: Thermoplastic insulation may stiffen at temperatures lower flsan -10 D C (+ 14°F). Thermoplastic insulation ma) also be deformed ai normal temperature; where 'i-bje. <i»c3 to pres urs such .. at pt "ii ol suppo t I>if rnti>,;U ie insulation, when si ?d on dc circuits in wet l(i',iii',n, ma) f .iii p. electroendosmosis between the conductor i nd insulation

(A) Dry Locations. Insulated conductors and cables used in dry locations shall be any of the types identified in this Code.

(B) Dry and Damp Locations. Insulated conductors and cables used in dry and damp locations shall be Types FEP,

ARTICLE 310 — CONDUCTORS FOR GENERAL WIRING

FEPB, MTW, PFA, RHH, RHW, RHW-2, SA, THHN, THW, THW-2, THHW, THWN, THWN-2, TW, XHH, XHHW, XHHW-2, Z, or ZW.

(C) Wet Locations. Insulated conductors and cables used in wet locations shall comply with one of the following:

(1) Be moisture-impervious metal-sheathed

(2) Be types MTW, RHW, RHW-2, TW, THW, THW-2, THHW, THWN, THWN-2, XHHW, XHHW-2, ZW

(3) Be of a type listed for use in wet locations

(D) Locations Exposed to Direct Sunlight. Insulated conductors or cables used where exposed to direct rays of the sun shall comply with (D)(1) or (D)(2):

(1) Conductors and cables shall be listed, or listed and marked, as being sunlight resistant

(2) Conductors and cables shall be covered with insulating material, such as tape or sleeving, that is listed, or listed and marked, as being sunlight resistant

(E) Shielding. Non-shielded, ozone-resistant in ubted conductor; >> iih .i ui.r ijiiJioplu.' to-phase voltag of 5000 volts shall be; permitted in Hype VJC cables in industrial establishments where ,he conditions ol maintenance arid supervision ensure that onl> {]Uil,<u\l persons serviet the installation. For other establishments, solid dielectric insulated conductors operated above 2000 volts in permanent installations shall have ozone-resistant insulation and shall be shielded. All metallic insulation shields shall be connected to a grounding electrode conductor, a grounding busbar, an equipment grounding conductor, or a grounding electrode.

Informational Note: The primary purpose; ol hielding arc to confine the voltage stresses to the insulation, dissipate insulation leakag< mrKi". drain off the eapac tivs tini; ing irteni ti»l arrj ground fault mn'i i U 1 > litate < i ra tion of ground-fault protective devices in the event of an eleiliical cable l.iull

Exception No. 1: Nonshielded insulated conductors listed by a qualified testing laboratory shall be permitted for use up to 2400 volts under the following conditions:

(a) Conductors shall have insulation resistant to electric discharge and surface tracking, or the insulated conductor(s) shall be covered with a material resistant to ozone, electric discharge, and surface tracking.

(b) Where used in wet locations, the insulated conductor's) shall have an overall nonmetallic jacket or a continuous metallic sheath,

(c) Insulation and jacket thicknesses shall be in accordance with Table 310.104(D).

Exception No. 2: No ishield ! ii sal t d < >n liu <m > listed In a qualified testing laboratory shall be permitted foi ust up to St 00 volts to eplaa exi ting nonshielded <--tf ! ii-

turs, <<n existing equipment in industrial establishments only, unite) the lo^oi ii g conditions:

(a) Where die condition of maintenance and supervision ensurei thai -nl qualified pet onnel install and ser vice the installation.

(b) Conductors shall have insulation resistant to electric lisclmrge i"ul surf act tracking, oi the insulated . m ductor(s) shall be covered with a material resistant to ozone, elect ic dischargt and surf oa tracking.

(c) Where used in wet locations tin insulated conductors) shall hu\ e cit overall nonnu tallii picket or a c ontinuous metallic sheath.

(d) Insulation and jacket thicknesses shall be in accordance with Table 310.13(D).

Informational Note: Ri-u.Mion oi replacement of e nip ment m '\ nol oomph with the term e i ting as related to iliis exception.

Exception No. 3: Where permitted in 310. 10(F), Exception No. 2.

(F) Direct-Burial Conductors. Conductors used for direct-burial applications shall be of a type identified for such use.

Exception No. 1: Nonshielded multiconductor cables rated 2001-2400 volts shall be permitted if the cable has an overall metallic sheath or armor.

The metallic shield, sheath, or armor shall be connected to a grounding electrode conductor, grounding busbar, or a grounding electrode.

Exception No. 2: Airfield lighting cable used in series circuits that are rated up to 5000 volts and are powered by regulators shall be permitted to be nonshielded.

Informational Note to Exception No. 2: Federal Aviation Administration (FAA) Advisory Circulars (ACs) provide additional practices and methods for airport lighting.

Informational Note No. 1: See 300.5 for installation requirements for conductors rated 600 volts or less.

Informational Note No. 2: See 300.50 for installation requirements for conductors rated over 600 volts.

(G) Corrosive Conditions. Conductors exposed to oils, greases, vapors, gases, fumes, liquids, or other substances having a deleterious effect on the conductor or insulation shall be of a type suitable for the application.

(H) Conductors in Parallel.

(1) General. Aluminum copper-clad aluminum, or copper conductors kn sach (Utc-. («.>l:nit\. neutral, oi grounded cii cult k ',i ill >. permitt xi i>> n. :onn< • ti d in o.uftils-1 (electrically

I'n'ieJ at both end'-, only in uzes 1/0 \"«b , i,o Lut,-, where
installed in accordance wnh 510 IOiHi' ') through -H)(6).

ARTICLE 410.140

410.140 General.

(A) Listing. Electric-discharge lighting systems with an open-circuit voltage exceeding 1000 volts shall be listed and installed in conformance with that listing.

(B) Dwelling Occupancies. Equipment that has an open-circuit voltage exceeding 1000 volts shall not be installed in or on dwelling occupancies.

(C) Live Parts. The terminal of an electric-discharge lamp shall be considered as a live part.

(D) Additional Requirements. In addition to complying with the general requirements for luminaires, such equipment shall comply with Part XIV of this article.

Informational Note: For signs and outline lighting, see Article 600.

ARTICLE 424.59

424.59 Airflow. Means shall be provided to ensure uniform and adequate airflow over the face of the heater in accordance with the manufacturer's instructions.

informational Note: Heaters installed within 1 .2 in (4 ft) of the outlet of an air-moving device, heat pump, air conditioner, elbows, battle plates, or other obstructions in duetwork may require turning vanes, pressure plates, or other devices on the inlet side of the duct healer to ensure an even distribution of air over the face of the heater.

ARTICLE 430.35

430.35 Shunting During Starting Period.

(A) Nonautomatically Started. For a nonautomatically started motor, the overload protection shall be permitted to be shunted or cut out of the circuit during the starting period of the motor if the device by which the overload protection is shunted or cut out cannot be left in the starting position and if fuses or inverse time circuit breakers rated or set at not over 400 percent of the full-load current of the motor are located in the circuit so as to be operative during the starting period of the motor.

(B) Automatically Started. The motor overload protection shall not be shunted or cut out during the stalling period if the motor is automatically started.

Exception: The motor overload protection shall be permitted to be shunted or cut out during the starting period on an automatically started motor where the following apply:

(a) The motor starting period exceeds the time delay of available motor overload protective devices, and

(b) Listed means are provided to perform the following:

(1) Sense motor rotation and automatically prevent the shunting or cutout in the event that the motor fails to start, and

(2) Limit the time of overload protection shunting or cutout to less than the locked rotor time rating of the protected motor, and

(3) Provide for shutdown and manual restart if motor running condition is not reached.

ARTICLE 430.75

430.75 Disconnection.

(A) General. Motor control circuits shall be arranged so that they will be disconnected from all sources of supply when the disconnecting means is in the open position. The disconnecting means shall be permitted to consist of two or more separate devices, one of which disconnects the motor and the controller from the source(s) of power supply for the motor, and the other(s), the motor control circuit(s) from its power supply. Where separate devices are used, they shall be located immediately adjacent to each other.

Exception No. 1: Where more than 12 motor control circuit conductors are required to be disconnected, the disconnecting means shall be permitted to be located other than immediately adjacent to each other where all of the following conditions are complied with:

(a) Access to energized parts is limited to qualified persons in accordance with Part XI of this article.

(b) A warning sign is permanently located on the outside of each equipment enclosure door or cover permitting access to the live parts in the motor control circuit(s), warning that motor control circuit disconnecting means are remotely located and specifying the location and identification of each disconnect. Where energiz.ed parts are not in an equipment enclosure as permitted by 430.232 and 430.233, an additional warning sign(s) shall be located where visible to persons who may be working in the area of the energized parts.

Exception No. 2: The motor control circuit disconnecting means shall be permitted to be remote from the motor controller power supply disconnecting means where the opening of one or more motor control circuit disconnecting means is capable of resulting in potentially unsafe conditions for personnel or property and the conditions of items (a) and (b) of Exception No. 1 are complied with.

(B) Control Transformer in Controller Enclosure. Where a transformer or other device is used to obtain a reduced voltage for the motor control circuit and is located in the

controller enclosure, such transformer or other device shall be connected to the load side of the disconnecting means for the motor control circuit.

ARTICLE 504.70

504.70 Sealing. Conduits and cables that are required to be sealed by 501.15, 502.15, 505.16, and 506.16 shall be sealed to minimize the passage of gases, vapors, or dusts. Such seals shall not be required to be explosionproof or flameproof but shall be identified for the purpose of minimizing passage of gases, vapors, or dusts under normal operating conditions and shall be accessible.

Exception: Seals shall not be required for enclosures that contain only intrinsically safe apparatus, except as required by 501.15(F)(3).

504.80 Identification. Labels required by this section shall be suitable for the environment where they are installed with consideration given to exposure to chemicals and sunlight.

(A) Terminals. Intrinsically safe circuits shall be identified at terminal and junction locations in a manner that is inteiided to prevent unintentional interference with the circuits during testing and servicing.

(B) Wiring. Raceways, cable trays, and other wiring methods for intrinsically safe system wiring shall be identified with permanently affixed labels with the wording "Intrinsic Safety Wiring" or equivalent. The labels shall be located so as to be visible after installation and placed so that they may be readily traced through the entire length of the installation. Intrinsic safety circuit labels shall appear in every section of the wiring system that is separated by enclo-

ART1CLE505
Zone 0, 1, and 2 Locations

Informational Note: Text that is followed by a reference in brackets has been extracted from NFPA 497-2008, Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas. Only editorial changes were made to the extracted text to make it consistent with this Code.

ARTICLE 645.10

645.10 Disconnecting Means. An approved means shall be provided to disconnect power to all electronic equipment in the information technology equipment room or in designated zones within the room. There shall also be a similar approved means to disconnect the power to all dedicated HVAC systems serving the room or designated zones and shall cause all required fire/smoke dampers to close. The disconnecting me ins m.iII be implemented b^ eithei t ^ > or (B).

Exception: Installations qualifying under the provisions of Article 685.

(A) Remote Disconnect Controls.

(1) Remote dtwom ci controls • h i'i bt locate ! ul appio*.. d locations re id;, ic essible m r i e of (ire o authorized pet so nils f and emergency responderS;

(2) The remote ilr-.on lect controls for f hc control uf electronic equipiin'i'-i powei md HVAC \sknis shall be grouped and identified. A single means to control both system- ihall be peiaiiis, <1

(3) Where multiple ? mes are created, each o.n sh llh.m an approved neans tp confine fire or ptoitt'ct-. o| combustion to withm the zone.

(4) Additional means to picvent unintentional operation of remote disconnect controls sis/1 be fte«ni ; D>d

Informational Note: hi, fnrtliei ii'i>«,inti, n see 'tFPA 75-2009 Standard foi tin Pmtc tion of Information Tcchnt .<■/•,. / quip nenl

(B) Crit'ial C-p« aiinus li/An S> straits. Remote disconnecting controls 'h'lll not be required for critical operations data systems when all of she t.>!li^\i i;. .-< ■s»dif jon - are met

(1) An approved procedure has b- en establishe , <nd maintained foi removing pitvi and jh movement ^, itiiin the room oi zone.

(2) Qu.ufie.? pei ^ tins i .<k continuously available to meet

emergency respondei and so advise them of disi -

neel ng methods.

(3) A smoke-sensing fire detection system is in place.

Informational Note: For furthei information, see \F> J \ ~2 'PiO. Valionol Fire ilann and Signaling Code.

(4) An approved fire suppression system -tillable for the application is in place.

(5) Cables installed under a raised floor, other than branch-;ircuit wiring and power cord; installed in compliance with 645.5(D)(2) or (D)(3). or in compliance with 300.22(G), 725.154(A), 770.113(C) and Table 770.154(a), 800.113(C): and Table 800.154(a), or 820,1 13(C) and Table 820.154(a).

645.11 Uninterruptible Power Supplies (UPSs). Except for installations and constructions covered in 645.11(1) or (2), UPS systems installed within the information technology equipment room, and their supply and output circuits, shall comply with 645.10. The disconnecting means shall also disconnect the battery from its load.

(1) Installations qualifying under the provisions of Article 685

(2) Power sources limited to 750 volt-amperes or less derived either from UPS equipment or from battery circuits integral to electronic equipment

ARTICLE 670.3

670.3 Machine Nameplate Data.

(A) Permanent Nameplate. A permanent nameplate shall be attached to the control equipment enclosure or machine and shall be plainly visible after installation. The nameplate shall include the following information:

(1) Supply voltage, number of phases, frequency, and full-load current

(2) Maximum ampere rating of the short-circuit and ground-fault protective device

(3) Ampere rating of largest motor, from the motor nameplate, or load

(4) Short-circuit current rating of the machine industrial control panel based on one of the following:

a. Short-circuit current rating of a listed and labeled machine control enclosure or assembly

b. Short-circuit current rating established utilizing an approved method

Informational Note: UL 508A-2001 , Supplement SB, is an example of an approved method.

(5) Electrical diagram number(s) or the number of the index to the electrical drawings

The full-load current shown on the nameplate shall not be less than the sum of the full-load currents required for all motors and other equipment that may be in operation at the same time under normal conditions of use. Where unusual type loads, duty cycles, and so forth require oversized conductors or permit reduced-size conductors, the required capacity shall be included in the marked "full-load current." Where more than one incoming supply circuit is to be provided, the nameplate shall state the preceding information for each circuit.

Informational Note:
cycle requirements.

See 430.22(E) and 430.26 for duty

(B) Overcurrent Protection. Where overcurrent protection is provided in accordance with 670.4(B), the machine shall be marked "overcurrent protection provided at machine supply terminals."

670.4 Supply Conductors and Overcurrent Protection.

(A) Size. The size of the supply conductor shall be such as to have an ampacity not less than 125 percent of the full-load current rating of all resistance heating loads plus 125 percent of the full-load current rating of the highest rated motor plus the sum of the full-load current ratings of all other connected motors and apparatus, based on their duty cycle, that may be in operation at the same time.

Informational Note No. 1: See the 0-2000-volt ampacity tables of Article 310 for ampacity of conductors rated 600 volts and below.

Informational Note No. 2:
duty cycle requirements.

See 430.22(E) and 430.26 for

(B) Disconnecting Means. A machine shall be considered as an individual unit and therefore shall be provided with disconnecting means. The disconnecting means shall be permitted to be supplied by branch circuits protected by either fuses or circuit breakers. The disconnecting means shall not be required to incorporate overcurrent protection.

ARTICLE 680.25

680.25 Feeders. These provisions shall apply to any feeder on the supply side of panelboards supplying branch circuits for pool equipment covered in Part II of this article and on the load side of the service equipment or the source of a separately derived system.

(A) Wiring Methods.

fi) t<t<*vj, Feeders shall be installed in ri t« j ni^-T.tl vr !• it or intermediate metal conduit. (Tie following wiring methods shall be pcrmitti ! il not subject to phys'n al damage:

(1) i iquidtight flexible nonmetallic conduit

(2) Rigid polyvinyl chloride conduit

(3) Reinforced thermosetting resin conduit

(4) Electrical metallic tubing where installed on or within a building

(5) Electrical nonmetallic tubing where installed within a building

(6) Type MC i able where installed v, is hi » a budding and il not subject to corrosive environment

Exception: An existing feeder between an existing remote panelboard and service equipment shall be permitted to run in flexible metal conduit or an approved cable assembly that includes an equipment grounding conductor within its outer sheath. The equipment grounding conductor shall comply with 250.24(A)(5).

(2) Aluminum Conduit. Aluminum conduit shall not be permitted in the pool area where subject to corrosion.

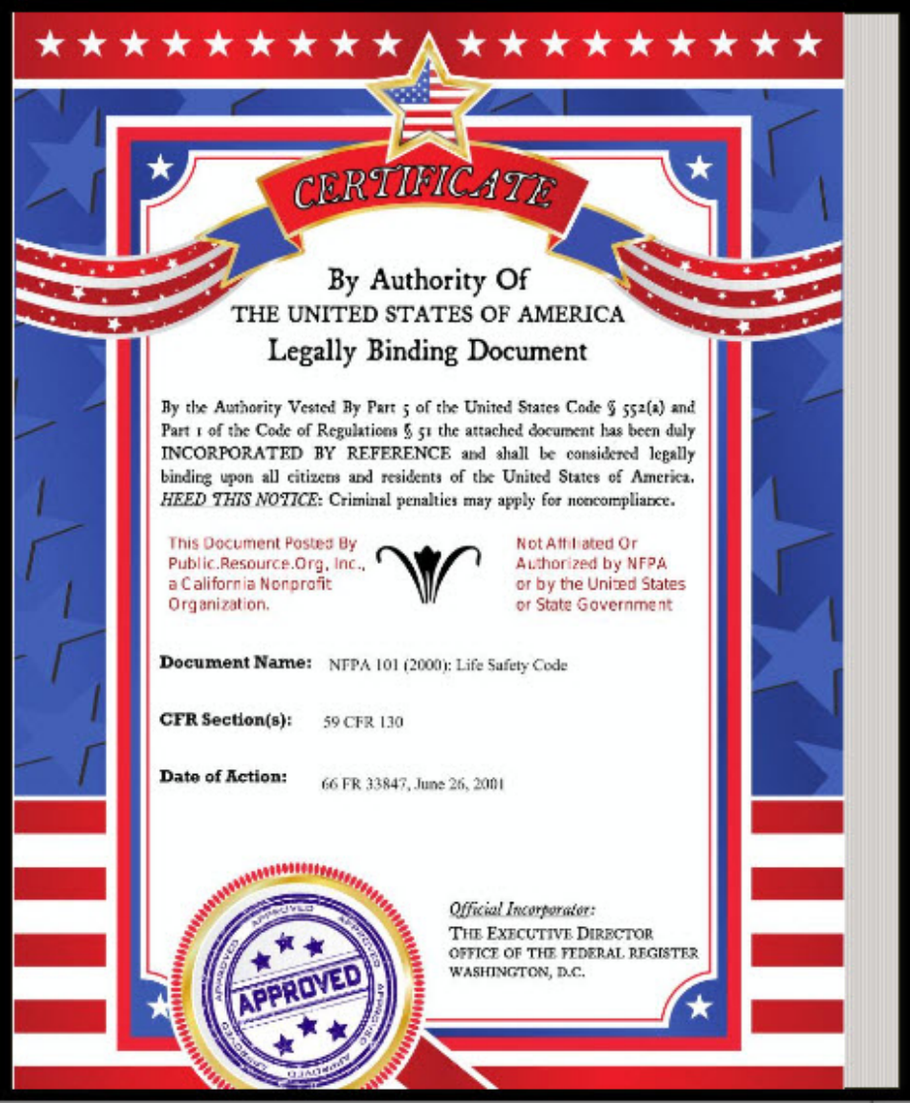
(B) Grounding. An equipment grounding conductor shall be installed with the feeder conductors between the grounding terminal of the pool equipment panelboard and the grounding terminal of the applicable service equipment or source of a separately derived system. For other than (1) existing feeders covered in 680.25(A), exception, or (2) feeders to separate buildings that do not utilize an insulated equipment grounding

conductor in accordance with 680.25(B)(2), this equipment grounding conductor shall be insulated.

(1) Size. This conductor shall be sized in accordance with 250.122 but not smaller than 12 AWG. On separately derived systems, this conductor shall be sized in accordance with 250.30(A)(8) but not smaller than 8 AWG.

(2) Separate Buildings. A feeder to a separate building or structure shall be permitted to supply swimming pool equipment branch circuits, or feeders supplying swimming pool equipment branch circuits, if the grounding arrangements in the separate building meet the requirements in 250.32(B). Where installed in other than existing feeders covered in 680.25(A), Exception, a separate equipment grounding conductor shall be an insulated conductor.

EXHIBIT 167



NFPA 101: Life Safety Code

by National Fire Protection Association

Publication date	2000
Usage	CC0 1.0 Universal
Topics	federalregister.gov, public.resource.org
Collection	publicsafetycode; USGovernmentDocuments; additional_collections
Language	English

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BY ORDER OF THE EXECUTIVE DIRECTOR
Office of the Federal Register
Washington, D.C.

By Authority of the Code of Federal Regulations: 59 CFR 130

Name of Legally Binding Document: NFPA 101: Life Safety Code
Name of Standards Organization: National Fire Protection Association

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Ppi	400

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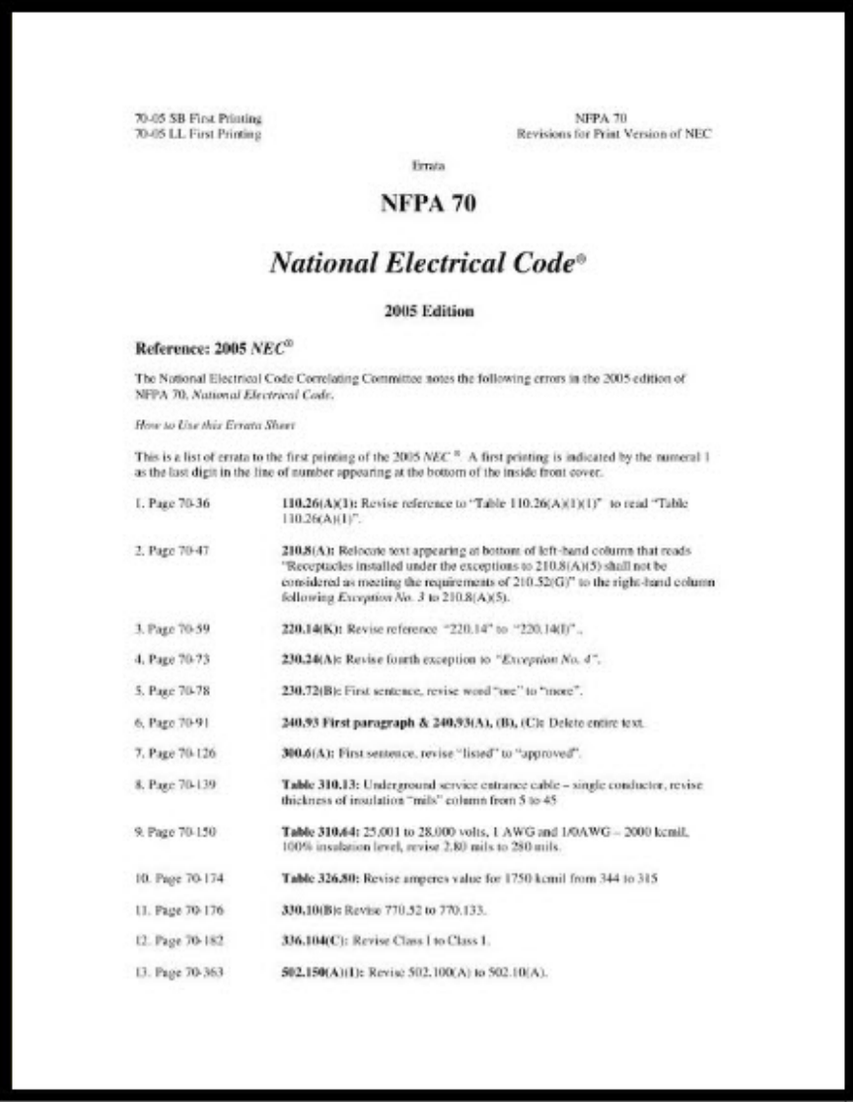

70-05 SB First Printing
70-05 LL First Printing

NFPA 70
Revisions for Print Version of NEC

Errata

NFPA 70

National Electrical Code®

2005 Edition

Reference: 2005 *NEC*®

The National Electrical Code Coordinating Committee notes the following errors in the 2005 edition of NFPA 70, *National Electrical Code*.

How to Use this Errata Sheet

This is a list of errata to the first printing of the 2005 *NEC* ®. A first printing is indicated by the numeral 1 as the last digit in the line of number appearing at the bottom of the inside front cover.

1. Page 70-36 **110.26(A)(1):** Revise reference to "Table 110.26(A)(1)(1)" to read "Table 110.26(A)(1)".

2. Page 70-47 **210.8(A):** Relocate text appearing at bottom of left-hand column that reads "Receptacles installed under the exceptions to 210.8(A)(5) shall not be considered as meeting the requirements of 210.52(G)" to the right-hand column following *Exception No. 3* to 210.8(A)(5).

3. Page 70-59 **220.14(K):** Revise reference "220.14" to "220.14(I)".

4. Page 70-73 **230.24(A):** Revise fourth exception to "*Exception No. 4*".

5. Page 70-78 **230.72(B):** First sentence, revise word "one" to "more".

6. Page 70-91 **240.93 First paragraph & 240.93(A), (B), (C):** Delete entire text.

7. Page 70-126 **300.6(A):** First sentence, revise "listed" to "approved".

8. Page 70-139 **Table 310.13:** Underground service entrance cable – single conductor, revise thickness of insulation "mils" column from 5 to 45

9. Page 70-150 **Table 310.64:** 25,001 to 28,000 volts, 1 AWG and 1/0AWG – 2000 kcmil, 100% insulation level, revise 2.80 mils to 280 mils.

10. Page 70-174 **Table 326.80:** Revise amperes value for 1750 kcmil from 344 to 315

11. Page 70-176 **330.10(B):** Revise 770.52 to 770.133.

12. Page 70-182 **336.104(C):** Revise Class I to Class 1.

13. Page 70-363 **502.150(A)(1):** Revise 502.100(A) to 502.10(A).

NFPA 70: National Electrical Code

by National Fire Protection Association

Publication date	2005-01-01
Usage	CC0 1.0 Universal
Topics	federalregister.gov, public.resource.org
Collection	publicsafetycode; USGovernmentDocuments; additional_collections
Language	English

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BY ORDER OF THE EXECUTIVE DIRECTOR
Office of the Federal Register
Washington, D.C.

By Authority of the Code of Federal Regulations: 49 CFR 192.189(c)

Name of Legally Binding Document: NFPA 70: National Electrical Code
Name of Standards Organization: National Fire Protection Association

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Errata
Errata 05-1 (issued 12/24/2004)

Identifier	gov.law.nfpa.nec.2005
Identifier-ark	ark:/13960/t34184v9f
Ocr	ABBYY FineReader 11.0 (Extended OCR)
Ppi	300
Year	2005

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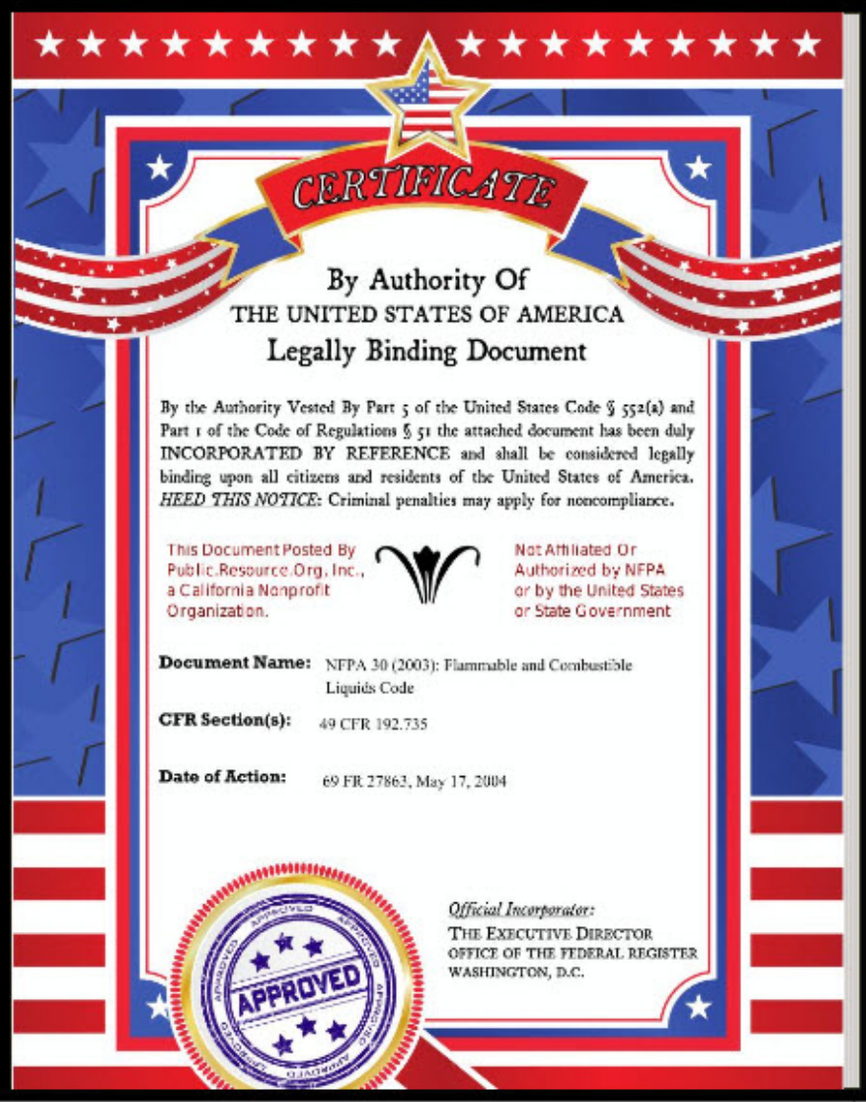

NFPA 30: Flammable and Combustible Liquids Code

by National Fire Protection Association

Publication date	2003
Usage	CC0 1.0 Universal
Topics	federalregister.gov, public.resource.org
Collection	publicsafetycode; USGovernmentDocuments; additional_collections
Language	English

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BY ORDER OF THE EXECUTIVE DIRECTOR
Office of the Federal Register
Washington, D.C.

By Authority of the Code of Federal Regulations: 49 CFR 192

Name of Legally Binding Document: NFPA 30: Flammable and Combustible Liquids Code
Name of Standards Organization: National Fire Protection Association

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Year	2003

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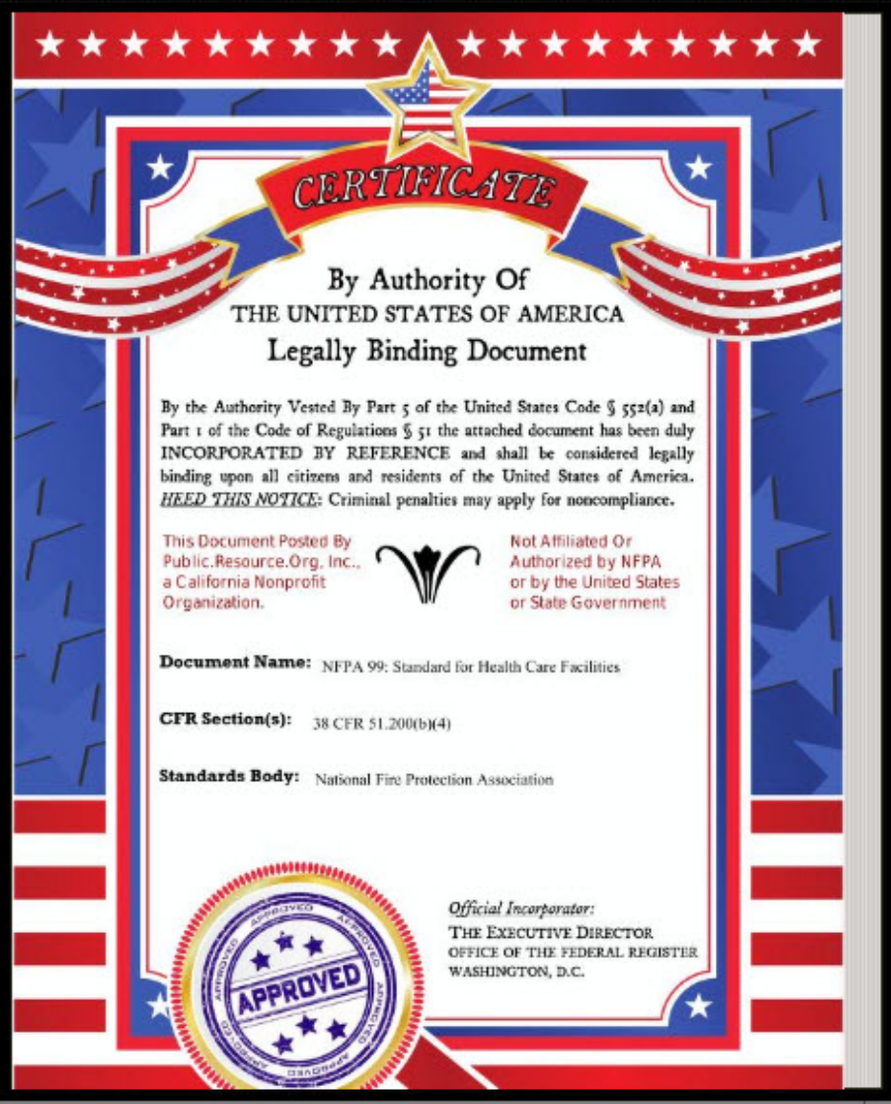

NFPA 99: Standard for Health Care Facilities

by National Fire Protection Association

Publication date	2005
Usage	CC0 1.0 Universal
Topics	federalregister.gov, public.resource.org
Collection	publicsafetycode; USGovernmentDocuments; additional_collections
Language	English

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BY ORDER OF THE EXECUTIVE DIRECTOR
Office of the Federal Register
Washington, D.C.

By Authority of the Code of Federal Regulations: 38 CFR 51.200(b)(4)

Name of Legally Binding Document: NFPA 99: Standard for Health Care Facilities
Name of Standards Organization: National Fire Protection Association

LEGALLY BINDING DOCUMENT

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Errata

NFPA 70®

National Electrical Code®

2011 Edition

Reference: Various
Errata No.: 70-11-1

The National Electrical Code Correlating Committee notes the following errors in the 2011 edition of NFPA 70, *National Electrical Code*.

How to Use this Errata Sheet

This is a list of errata to the first printing of the 2011 *NEC*®. A first printing is indicated by the numeral 1 as the last digit in the line of number appearing at the bottom of the first page.

1. Page 70-36 **110.14(C)(1):** Revise 310.15(B)(6) to 310.15(B)(7)
2. Page 70-78 **Figure 230.1:** Revise "Source" to "Serving Utility" and 230.49 to 230.32
3. Page 70-86 **230.90 Exception No. 5:** Revise 310.15(B)(6) to 310.15(B)(7)
4. Page 70-102 **Table 250.3:** Revise 300.50(B) to 300.50(C)
5. Page 70-116 **250.68(C)(2)(b):** Revise to read : "By bonding the structural metal frame to one or more of the grounding electrodes, as specified in 250.52(A)(5) or (A)(7) that comply with 250.53(A)(2)."
6. Page 70-129 **250.180:** Revise 250.190 to 250.191
7. Page 70-139 **300.5(C) Exception No. 2:** Revise 330.10(11) to 330.10(A)(11)
8. Page 70-148 **310.10(E) Exception No. 2 (d):** Revise Table 310.13(D) to Table 310.104(D)
9. Page 70-148 **310.10(F):** Remove deletion bullet and add second paragraph to read : "Cables rated above 2000 volts shall be shielded."
10. Page 70-154 **Table 310.15(B)(16):** Add double asterisk to 18 AWG and 16 AWG copper
11. Page 70-178 **314.16(C)(1):** Revise 314.16(C)(2) to 314.16(C)(3)
12. Page 70-240 **392.18(E):** Revise 392.10(D) to 392.18(D)

NFPA NEC (2011): National Electrical Code

by National Fire Protection Association

Publication date	2011-01-01
Usage	CC0 1.0 Universal
Topics	public.resource.org
Collection	publicsafetycode; USGovernmentDocuments; additional_collections
Language	English

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Name of Legally Binding Document: NFPA NEC (2011): National Electrical Code
Name of Standards Organization: National Fire Protection Association

Errata
Errata 70-11-2 (issued 1/24/2012) (PDF, 18 KB)
Errata 70-11-1 (issued 4/8/2011) (PDF, 48 KB)

Identifier	gov.law.nfpa.nec.2011
Identifier-ark	ark:/13960/t0bv8p02s
Ocr	ABBYY FineReader 11.0 (Extended OCR)
Ppi	300
Year	2011

Reviews

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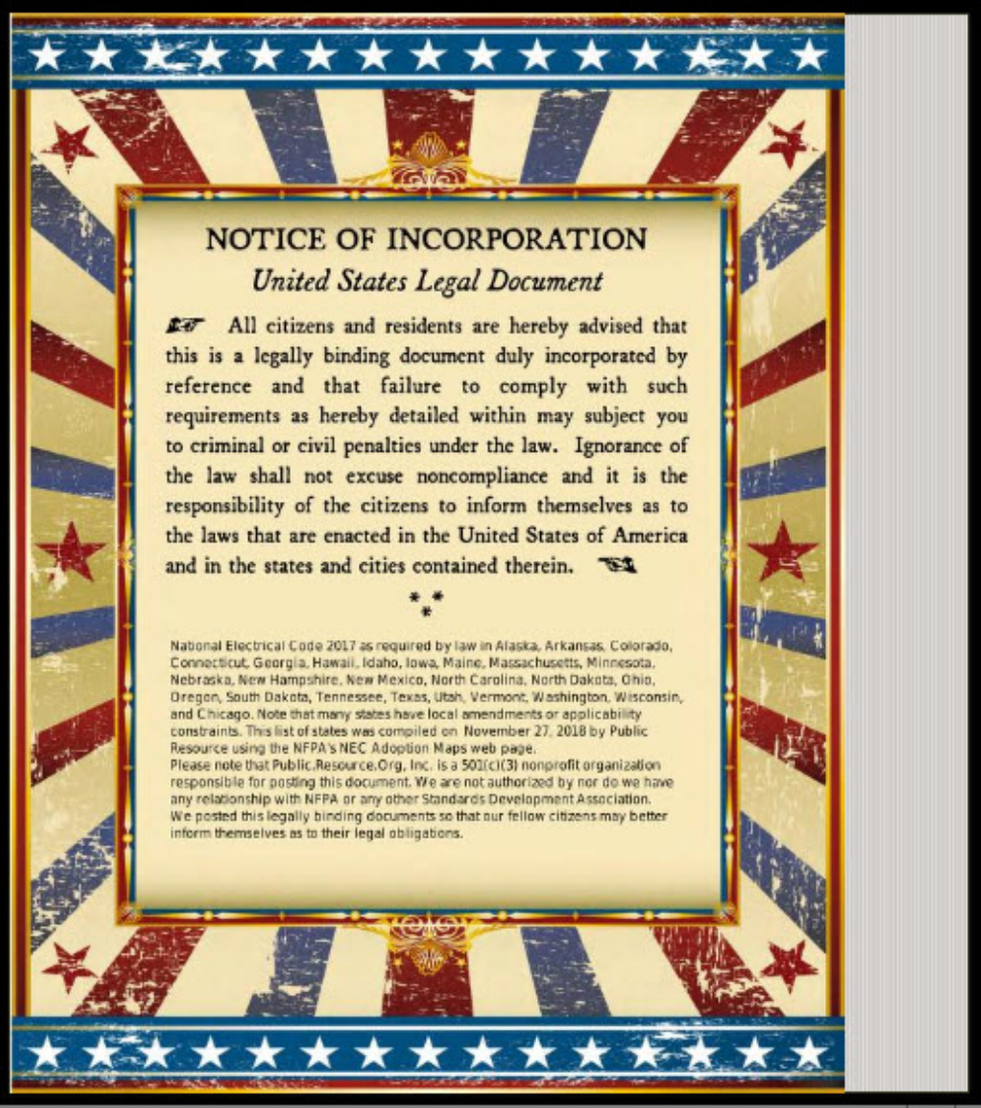
Reviewer: seokmin, choi - ★★★★★ - August 12, 2013
Subject: NEC 2011
NEC 2011



2017 National Electrical Code

by National Fire Protection Association in the Form of A Model Public Safety Legal Code and Subsequently Enacted Into Law By Federal, State, and Local Governmental Jurisdictions

Topics	Binding Under State Laws, Public Safety, Rule of Law, Informed Citizenry
Collection	publicsafetycode; USGovernmentDocuments; additional_collections
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Name of Legally Binding Document: NFPA NEC (2017) National Electrical Code
Name of Standards Organization: National Fire Protection Association
Standards Organization Source: NFPA National Electrical Code (Free Access Available Form Original Publisher)
Name of Incorporating Jurisdictions: (Source: NFPA Adoption Maps (Last accessed November 27, 2018). Alaska, Arkansas, Colorado, Connecticut, Georgia, Hawaii, Idaho, Iowa, Maine, Massachusetts, Minnesota, Nebraska, New Hampshire, New Mexico, North Carolina, North Dakota, Ohio,Oregon, South Dakota, Tennessee, Texas, Utah, Vermont, Washington, Wisconsin,and Chicago. PLEASE CONSULT THE NFPA *Tentative Interim Amendment and Errata Site* FOR ANY IMPORTANT UPDATES.

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EXHIBIT 169

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* *
*

ASHRAE 90.1 (2004), Energy Standard for Buildings Except Low-Rise Residential Buildings,
as mandated by and incorporated by the States and Municipalities including Minnesota, Maine, Nevada and the Code of Federal Regulations at 10 CFR 433.4.

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* * *

ASHRAE 90.1 (2007), Energy Standard for Buildings Except Low-Rise Residential Buildings, as mandated by and incorporated by the States and Municipalities including Illinois, California, and the Code of Federal Regulations at 10 CFR 433.4.

EXHIBIT 170

State Code Status: Maine

Current Commercial Code

Maine Uniform Building and Energy Code (MUBEC), based on the 2009 IECC and ASHRAE 90.1-2007
Passed 4/24/2008, effective 6/1/2010

✓ Can use **COM*check*** to show compliance.

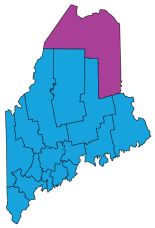
Current Residential Code

Maine Uniform Building and Energy Code (MUBEC), based on the 2009 IECC
Passed 4/24/2008, effective 6/1/2010

✓ Can use **RES*check*** to show compliance.

As of September 2011, municipalities with 4,000 or more residents must enforce the MUBEC if that municipality had a building code in place before August 2008. As of July 1, 2012, the MUBEC must be enforced in a municipality with a population of 4,000 residents or more that had NOT adopted any building code on or before August 2008. If smaller municipalities choose to enforce a building code, they have several options for doing so. See the Codes Adoption History section of **this page** for more information.

As of July 2015, about 63% of Maine's population lived in a city or town with a population of 4,000 or more.



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Contacts

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News and Events

Comprehensive State Energy Plans: A Brief Comparison October 29, 2015

High Performance Schools: Northeast States Pa The Way For This And Future Generations June 2015

BCAP Resources

Northeast Regional Code Status as of 2009
Third-party Code Compliance for Energy Code Implementation in Maine

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Code Adoption and Change Process

Code Change Process

Code adoptions and amendments originate from the Maine Technical Codes and Standards Board (TCSB), which is part of the Department of Public Safety. The TCSB issues draft and final rules through their ordinary rulemaking process, which includes public comment. The rule also must be approved by the Attorney Generals' office to ensure legal and procedural compliance. The law requires the TCSB to maintain an adoption cycle such that codes do not lapse more than 5 years or one national model code version cycle.

Code Change Cycle

For its commercial energy code, Maine considers the most recent version of 90.1 with positive DOE determination.

Next Code Update

The Technical Codes and Standards Board is currently working on the adoption of the 2015 IECC for commercial buildings. The 2009 IECC will continue to apply to residential buildings. As of February 2017, the board is waiting for a return of Rules for Rule-Making from the Governor's Office and will have a Public Hearing as soon as they receive them back.

History

July 1, 2012	A change in law requires municipalities of 4,000 or more in population (formerly 2,000) to enforce the MUBEC if they had a building code in place by August 2008. Article: **34 towns across Maine to enforce new building code**
September 28, 2011	The MUBEC now must be enforced in municipalities of 4,000 or more in population that did not adopt any building code on or before August 1, 2008.
May 6, 2011	Two other bills addressing the MUBEC are considered by the Committee on State and Local Government. **LD 1416** would return the power of adopting building codes to municipalities, shrinking the statewide application of the MUBEC. **LD 1442** would clarify enforcement of the MUBEC and reaffirm its position as the statewide construction code.
January 11, 2011	A bill (**HP 36 LD 43**) was introduced in the Maine Legislature that would repeal the Maine Uniform Building and Energy Code (MUBEC). A hearing on the bill is scheduled for April 7 before the House Committee on Labor, Commerce, Research and Economic Development. On April 14th, House Committee on Labor, Commerce, Research and Economic Development of the Maine Legislature votes that this bill ought not to pass. Other legislation has also been introduced to delay, modify, or alter the application of the MUBEC.
June 1, 2010	After the legislative establishment of the Maine Uniform Building and Energy Code (MUBEC) in April 2008 by **LD 2257 (enacted as P.L. 699)**, the Bureau of Building Codes and Standards (within the Department of Public Safety) issues regulations setting the 2009 IECC and ASHRAE 90.1-2007 as the mandatory energy standards for residential, commercial, and public buildings statewide. The MUBEC becomes effective on this date. There

	will a six-month transition period during which towns may still enforce their previous codes. Among the new rules: • Towns with a population of 2,000 that had a building code on August 1, 2008 will be required to begin enforcing the code December 1, 2010. • Towns with a population of 2,000 that did not have a building code on August 1, 2008 will be required to begin enforcing the code December 1, 2012. • Towns with a population under 2,000 are not required to enforce the code. • The MUBEC replaces all local municipal building codes. Cities and towns may not amend any MUBEC provisions, even to make it more stringent. • Enforcement is the responsibility of local jurisdictions. Municipalities without a CEO certified by the State Planning Office may authorize a third-party inspector to conduct compliance inspections and prepare a report to be given to the municipal CEO as an application for the Certificate of Occupancy.
December 2004	The completed Climate Action Plan is submitted to the legislature.
June 2003	The Maine State Legislature passes a bill that requires the DEP to develop a climate action plan with the goals of reducing emissions.
1979	PL 503, "The Energy Building Performance Standards Act," establishes 10 MRSA, Chapter 214, which directs the Office of Energy Resources (OER) to adopt voluntary energy standards for residential and commercial new construction and substantial renovations. In 1980, the legislature adopts the voluntary standards into law.
1977	The state legislature adopts what is now Chapter 57 of the Private and Special Laws, which directs the OER to establish the Maine Commission on Energy Efficiency Building Performance Standards (the Commission). The Commission is directed to investigate energy building standards and make recommendations to the next biennial legislature.

State Code Status: Minnesota

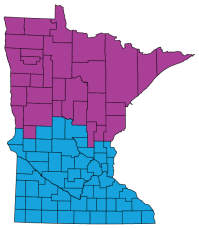
Current Commercial Code

Minnesota Commercial State Building Code, Chapter 1323, based on the 2012 IECC with state-specific amendments; ASHRAE 90.1-2010 is also a compliance option.
passed 8/18/14, effective 6/2/15

✓ Can use **COM*check*** to show compliance.

This code is also applicable for public Minnesota buildings. The following are exemptions from the code:

- Buildings that do not use either electricity or fossil fuel; and
- Equipment and portions of building systems that use energy primarily to provide for industrial or manufacturing processes



Climate Zones: 6A, 7

Current Residential Code

Minnesota Residential State Building Code, based on the 2012 IECC with state-specific amendments.
passed 8/18/14, effective 2/14/15

Code Book Fact Sheet: 2015 Minnesota Energy Code

Code Adoption and Change Process

Code Change Process

Regulatory: Authority for adopting the state energy codes has been given to the Department of Labor and Industry. The state's Administrative Procedures Act provides for a minimum update process of 18 months. Its procedures require a formal public hearing only if requested by 25 or more individuals. The Building Codes and Standards Division delivers an executive summary of the proposed rule changes to the office of the Governor. After the Governor and State Reviser's Office approve the rule changes, a Notice of Adoption is published in the state register.

Code Change Cycle

No set schedule

Next Code Update

Unknown

History

Effective Dates of Minnesota Code Adoptions

June 2, 2015	The current commercial energy code, based on the 2012 IECC and ASHRAE Standard 90.1-2010, becomes effective. The code establishes minimum standards for the construction, reconstruction, alteration, and repair of non-residential buildings governing matters including design and construction standards regarding heat loss control, illumination, and climate control pursuant to Minnesota Statutes, sections 326B.101, 326B.106, and 326B.13.
February 14, 2015	The current residential energy code, based on the 2012 IECC with amendments, becomes effective. The following are exemptions from the code: • Portions of the building that do not enclose conditioned space, including garages • Insulation R-values, air barrier, and vapor retarder requirements are not required for existing foundations, crawl space walls, and basements in existing dwellings or existing dwelling units whose alteration or repair require a permit if the original dwelling's permit was issued before the effective date of this chapter • Additions to existing dwellings or dwelling units may be made without making the entire dwelling or dwelling unit comply, provided that the addition complies with all the requirements of this chapter • Alteration or repairs to existing dwellings or dwelling units may be made without making the entire dwelling or dwelling unit comply, provided the alteration complies with as many requirements of this chapter as feasible, as determined by the designated building official • Buildings that have been specifically designated as historically significant by the state or local governing body, or listed or determined to be eligible for listing in the National Register of Historic Places • If a building houses more than one occupancy, each portion of the building must conform to the requirements for the occupancy housed in that portion • This chapter does not cover buildings, structures, or portions of buildings or structures whose peak design energy rate usage is less than 3.4 Btu per hour per square foot or 1.0 Watt per square foot of floor area for all purposes

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News and Events

New Year, New Codes February 24, 2015

A Tale of Bright Highs and Dark Lows: The Stat
Energy Efficiency in the Midwest August 11, 201

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BCAP Projects

Compliance Collaboratives
Compliance Planning Assistance

BCAP Resources

All-Collaborative Bulletin - 2015 Q1
All-Collaborative Bulletin - 2015 Q2
All-Collaborative Bulletin - 2016 Q2
All-Collaboratives Webinar Slides 2014
All-Collaboratives Webinar Slides 2015
All-Collaboratives Webinar Slides 2016
Energy Code Compliance in Minnesota 2012-20
Baseline for ARRA Compliance
Minnesota Gap Analysis Report
Residential Energy Code Evaluations: Review a
Future Directions
True Cost of the 2009 IECC for New Homes in Minnesota

Helpful Links

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August 18, 2014	The adoption notice for the updated commercial energy code is posted in the Minnesota State Register. The notice for the updated residential energy code is posted as well.
April 7, 2014	The Minnesota Department of Labor and Industry (DLI) releases the first draft of the updated commercial and residential energy codes.
June 1, 2009	The 2007 Minnesota State Building Code becomes effective.
2008	After seven and a half years, the state adopts new residential and commercial energy codes based on the 2006 IRC and ASHRAE 90.1-2004, respectively.
2008	After seven and a half years, the state adopts new residential and commercial energy codes based on the 2006 IRC and ASHRAE 90.1-2004, respectively.
April 2008	The State of Minnesota works closely with the Center for Climate Strategies to create a **Climate Mitigation Action Plan** which includes improving the energy code and incentives for more efficient buildings.
July 20, 1999	A commercial energy code exceeding ASHRAE 90.1-1989 becomes effective.
1979	Individual counties outside of the seven-county Minneapolis/St. Paul area and incorporated cities with populations of less than 2,500 were given the option of enforcing a statewide building code. Many elected to have no enforcement within their area.

State Code Status: Nevada

Current Commercial Code

2012 IECC with Nevada amendments; ASHRAE Standard 90.1-2010 as an acceptable compliance path through Chapter 5 of the 2012 IECC.
Passed 5/1/2014, effective 7/1/2015

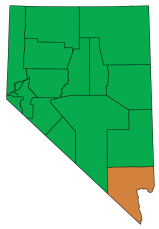
✓ Can use **COM*check*** to show compliance.

Current Residential Code

2012 IECC with Nevada amendments
Passed 5/1/2014, effective 7/1/2015

Southern Nevada amendments to the 2012 IECC
Northern Nevada amendments to the 2012 IECC

✓ Can use **RES*check*** to show compliance.



Climate Zones: 3B, 5B

Code Adoption and Change Process

Code Change Process

Regulatory: Before 2009, the state legislature was required to authorize the Nevada State Energy Office (NSOE) to make changes to the state energy code. However, after the establishment of NRS 701.220 through SB 73 in 2009, NSOE is required to promulgate rules to adopt the most recent version of the IECC every three years. Many local jurisdictions like Southern Nevada and the City of Las Vegas have adopted their own energy codes beyond the statewide minimum code.

Although Nevada has adopted the 2012 IECC statewide, municipalities then adopt the code individually. In January 2016, the city of Reno **formally adopted the 2012 IECC**; this code became effective July 2016.

Code Change Cycle

NRS 701.220 requires NSOE to promulgate regulations adopting the most recent version of the IECC on or before July 1, 2015 and on or before July 1 of every third year thereafter.

Next Code Update

Nevada plans to adopt the 2015 IECC on July 1, 2018. The state will start the process in January 2017 to educate and obtain feedback from stakeholders. Nevada also plans to hold four stakeholder training workshops/webinars during 2017.

History

July 1, 2015	The new energy codes become effective. The residential code is based on the 2012 IECC with Nevada amendments. The commercial code is based on the 2012 IECC with Nevada amendments with ASHRAE Standard 90.1-2010 as an acceptable compliance path through Chapter 5 of the 2012 IECC. Local jurisdictions may not adopt less efficient energy codes
May 2014	The Nevada State Energy Office (NSOE) adopts the 2012 IECC.
December 30, 2011	NSOE adopts final regulations (LCB File No. R024-11). These regulations will become effective July 1, 2012.
July 5, 2011	The 2009 IECC with amendments becomes effective in the city of Las Vegas.
May 26, 2011	The Nevada Renewable Energy and Energy Efficiency Authority (REEEA) hosts a workshop to accept written and oral public comments on the state's rulemaking process to adopt the 2009 IECC as required under **NRS 701.220**. Three regulation hearings are scheduled for the summer around the state.
April 6, 2011	The Las Vegas City Council adopts the SNBO amendments to the 2009 IECC.
January 2011	The Nevada Renewable Energy and Energy Efficiency Authority (REEEA) holds stakeholder meetings on January 11th in Reno and January 12th in Las Vegas to provide building jurisdiction, building professional and interested parties an opportunity to work with REEEA to develop the process for meeting 90% compliance with the 2009 IECC by 2017.
October 2010	REEEA opens a rulemaking to adopt, amend, or repeal regulations to update the state energy code to the 2009 IECC. The Nevada Energy Commissioner must conduct at least three hearings on proposed regulations in different locations in the state and give 30 days notice for each hearing.
September	The **Southern Nevada Building Officials** approve the 2009 Amendments for Southern Nevada for use within

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News and Events

Northern Nevada Welcomes a New Compliance
September 28, 2016

Nebraska Energy Code Compliance Collaborati
Case Study On An Emerging Best Practice *Nov*
5, 2013

Compliance Collaboratives Convene To Share Lessons Learned *August 29, 2013*

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BCAP Projects

Compliance Collaboratives
Compliance Planning Assistance
Energy Code Ambassadors Program

BCAP Resources

Advanced Energy Code Training Assessment: N
All-Collaborative Bulletin - 2013 Q4
All-Collaborative Bulletin - 2014 Q2
All-Collaborative Bulletin - 2015 Q1
All-Collaborative Bulletin - 2015 Q2
All-Collaborative Bulletin - 2016 Q2
All-Collaboratives Webinar Slides 2014
All-Collaboratives Webinar Slides 2015
All-Collaboratives Webinar Slides 2016
Five-Year Nevada Strategic Plan for the Adoptic
Implementation of New Energy Codes
Information Sharing Webinar
Nevada Gap Analysis Report
Residential Energy Code Evaluations: Review a
Future Directions
True Cost of the 2009 IECC for New Homes in N

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2010	its eight member jurisdictions, including Las Vegas and the surrounding areas.
May 22, 2009	Governor Jim Gibbons signs into law legislation (**SB 73** and **SB 358**) that revises the process of updating the state's building energy codes by establishing the standards adopted by the NSOE as the minimum standards for building energy efficiency and conservation. The law requires local governments to adopt the codes set by the Office of Energy and to enforce them (they are also allowed to adopt more stringent standards provided they give notice to the Office of Energy). The law mandates the adoption of the most recent version of the IECC and requires the adoption of the most recent updated version of the IECC every three years. The Office of Energy must still hold public hearings in three different locations in the state after giving 30 days' notice of such hearings before adopting any new standards.
June 17, 2005	The 2003 IECC becomes mandatory for all jurisdictions that did not have an energy code in effect by the beginning of 2005, when Nevada Chapter 701 was passed. RES*check* and COM*check* can be used to show compliance for the envelope and mechanical only.
Fall 1993	The Nevada Office of Community Services is dissolved.
July 8, 1988	Nevada adopts the "Regulations for the Conservation of Energy in New Building Construction", formulated based on the 1986 MEC with minor state amendments. This code is applicable only in areas where the local jurisdiction has not previously adopted an energy code. This remains the basis for the statewide energy code.
1985	The legislature gives the Nevada Office of Community Services authority to formulate new statewide standards for energy conservation in new buildings.
1983	The Nevada Department of Energy is disbanded. Between 1983 and 1986, the state does not support or enforce the energy code.
January 1, 1978	Nevada's first energy code, "Energy Conservation Standards for New Building Construction," is adopted. This code, based on ASHRAE Standard 90-75, was written by the state and formulated by the Nevada Department of Energy. All cities and counties are required to enforce the energy code requirements.

State Code Status: Illinois

Current Commercial Code

2015 IECC and ASHRAE 90.1-2013 with **state-specific amendments**
effective 1/1/16

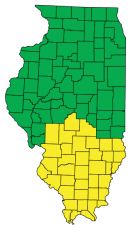
✓ Can use **COM*check*** to show compliance.

Current Residential Code

2015 IECC with **state-specific amendments**
effective 1/1/16

✓ Can use **RES*check*** to show compliance.

Capital Development Board Notice of Adopted Amendments for the 2015 IECC



Climate Zones: 4A, 5A

Enforcement

CDB and the Department of Commerce and Economic Opportunity (DCEO) are responsible for defining compliance procedures. Code enforcement is the duty of the local jurisdiction, which must meet minimum compliance documentation requirements.

Code Adoption and Change Process

Code Change Process

When developing code adaptations, rules, and procedures for compliance with the code, the Capital Development Board (CDB) is required to seek input from representatives of the building trades, design professionals, construction professionals, code administrators, and other interested entities affected by the new code. To ensure input from these groups, CDB created the Illinois Energy Code Advisory Council (ILECAC) which has representatives from each of the groups listed above. The ILECAC reviews proposed amendments and votes to accept or reject them; the council's recommendations are then brought to the CDB. After the CDB accepts the recommendations, they are finally then submitted to the Joint Committee on Administrative Rules (JCAR) for acceptance and implementation.

Code Change Cycle

In accordance with the **Energy Efficient Building Act**, the Illinois Capital Development Board (CDB) is required to review and adopt the most current version of the IECC within one year following its publication date. The code will then become effective within six months following its adoption by the CDB.

Next Code Update

The next code update for Illinois depends on the publication date of the 2018 IECC, which is still in preliminary code development stages. Illinois' next code update should not take effect until at least early 2019.

History

January 1, 2016	The 2015 IECC becomes effective for both commercial and residential buildings.
2014	The Capital Development Board (CDB), in conjunction with the Department of Commerce and Economic Opportunity, begins the update cycle for the Illinois Energy Conservation Code from the 2012 International Energy Conservation Code (IECC) to the 2015 IECC. Proposed amendments are accepted by the Illinois Energy Conservation Advisory Committee from July 1, 2014 – December 1, 2014.
January 11, 2013	The 2012 Illinois Energy Conservation Code for residential buildings is implemented. Senate Bill 3724 amended the implementation date of this code and also lengthened the time that the ILECAC and CDB have to review and adopt future building code editions. A new energy code for privately funded commercial facilities is also implemented. It is the 2012 Illinois Energy Conservation Code and is based on the 2012 IECC with Illinois-specific amendments. ASHRAE Standard 90.1-2010 is an acceptable compliance path through Chapter CE-4 of the 2012 IECC.
December 11, 2012	JCAR approves a rule adopting the 2012 Illinois Energy Conservation Code (the 2012 IECC with Illinois-specific amendments). Amendments to the residential provisions of the 2012 IECC include: • Building envelope tightness testing has been amended to allow 5 ACH 50 instead of 3 ACH 50 • The ventilation chapter from the 2012 IRC was imported into the 2012 IECC • Basement insulation must only go down four feet and not the full depth of the basement wall • The state will not require a blower door test on additions or alterations, but the checklist requirements must be followed
August 17, 2012	The Illinois General assembly approves **SB 3724**, setting the implementation date for CDB's pending rule adopting the 2012 IECC at no earlier than January 1, 2013. The new code shall apply to any new building or

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News and Events

Energy Code Adoptions in 2015 February 1, 201

A Tale of Bright Highs and Dark Lows: The Stat Energy Efficiency in the Midwest August 11, 201

Not Taking "No Can Do" For An Answer Novem 2013

2012 Winners Of The Excellence In Energy Cod Compliance Award October 24, 2012

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BCAP Resources

Adopted Amendments for the 2015 IECC
Energy Code Checklist: New Homes in Illinois
Illinois 2012 IECC Incremental Cost Memo
Illinois Consumer Home Energy Code Guide
Illinois Gap Analysis Report
Illinois Strategic Compliance Plan
Measuring the Baseline Compliance Rate for Residential and Non-Residential Buildings in Ill Against the 2009 IECC
True Cost of the 2012 IECC for New Homes in Il Climate Zone 4
True Cost of the 2012 IECC for New Homes in Il Climate Zone 5

Helpful Links

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	structure in Illinois for which a building permit application is received by a municipality or county.
November 28, 2011	The Illinois Energy Code Advisory Council votes to recommend adoption of the 2012 IECC to update the Illinois Energy Conservation Code (currently based on the 2009 IECC). The update proposal amendment includes: • Air infiltration will be 5 ACH50 instead of 3 ACH50; • For additions, alternations, etc., a blower door test will not be required. Instead, builders are required to follow the air infiltration checklist only; • Section M1507.3 of the IRC will be imported into the residential energy chapter. The next step is for the proposal to go before the Illinois Capital Development Board (CDB) and the General Assembly's Joint Committee on Administrative Review (JCAR).
February 15, 2011	A bill (**HB 1612**) is introduced in the Illinois General Assembly that would exempt residential alterations, renovations, and additions from needing to comply with the Illinois Energy Conservation Code (based on the 2009 IECC), significantly reducing the energy savings potential of the code. It would also add confusion to enforcement of the code by identifying the undefined term of "energy inspectors" as responsible for enforcing the energy efficiency provisions. This bill eventually dies in the House.
January 29, 2010	New requirements for residential buildings as stipulated by amendments to the **Energy Efficient Building Act** go into effect. The 2009 IECC is established as the first energy code for residential buildings in Illinois. The new statewide code (71 IAC 600) also incorporates the 2009 IECC for privately funded commercial buildings and ASHRAE 90.1-2007 for publicly funded commercial buildings.
January 2010	The Midwest Energy Efficiency Alliance (MEEA) releases a **Request for Proposal** (RFP) to measure the baseline compliance rate for residential and non-residential buildings in Illinois with the 2009 IECC. The work to be carried out in the RFP is funded as part of the recent U.S. Department of Energy solicitation.
September 2009	The Chicago Chapter of the US Green Building Council releases **a report** looking at the post-occupancy performance of LEED projects in the state.
August 28, 2009	Gov. Pat Quinn signs HB 3987 into law on, establishing **Public Act 096-0778**.
May 31, 2009	the Illinois General Assembly approves the Energy Efficient Buildings Act (**HB 3987**), modifying the previous Energy Efficient Commercial Buildings Act to require the latest version of the IECC as the building energy code for both commercial and residential buildings. This legislation preempts local jurisdiction home rule power over energy codes. An automatic update provision of the bill requires the state's Capital Development Board to adopt the most recent version of the IECC within nine months of its publication and take effect three months thereafter. The requirements of the new energy code will apply to all new residential and commercial buildings (including alterations, additions, renovations, and repairs). Local jurisdictions will be prohibited from adopting energy codes more or less stringent for residential buildings (although exemptions are provided for municipalities that have already adopted a code equivalent to or more stringent than the 2006 IECC [before May 15, 2009] or those that have a population of more than 1 million) and from adopting energy codes less stringent for commercial buildings. Local jurisdictions that do not currently administer building energy standards will not be required to adopt or enforce the new state code, but the state government will implement and enforce the new state code on their behalf.

For a comprehensive history of energy code legislation in Illinois, please **click here**.

State Code Status: California

Current Commercial Code

2016 Building Energy Efficiency Standards (Title 24)
Meets or exceeds the stringency of ASHRAE 90.1-2013
Effective 1/1/2017

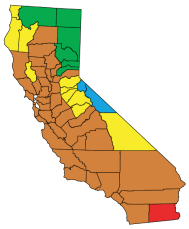
2013 California Green Building Standards Code (CALGreen) (Title 24, Part 11) is the nation's first mandatory statewide green building standard. The California Air Resources Board has estimated that CALGreen will curb greenhouse gas emissions (GHG) by 3 million metric tons in 2020, helping the state reach its goal of 33% GHG reduction this decade.

Current Residential Code

2016 Building Energy Efficiency Standards (Title 24)
Meets or exceeds the stringency of the 2015 IECC
Effective 1/1/2017

What's new in the residential and non-residential standards?

Locally Adopted Standards exceeding Title 24



Climate Zones: 2B, 3B, 3C, 4B, 4C, 5B, 6B
See also:
California Building Climate Zone Areas

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News and Events

Success Story: California Dreams: Title 24 Ener Code On Target For Net Zero Energy Standards By 2020 August 28, 2012

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Code Adoption and Change Process

Code Change Process

The California Energy Commission (CEC) is authorized to establish building energy efficiency requirements, both the California Energy Code and CALGreen. CEC is responsible for overseeing the public process and rulemaking proceeding.

Code Change Cycle

California's Building Energy Efficiency Standards are updated on an approximately three-year cycle.

Next Code Update

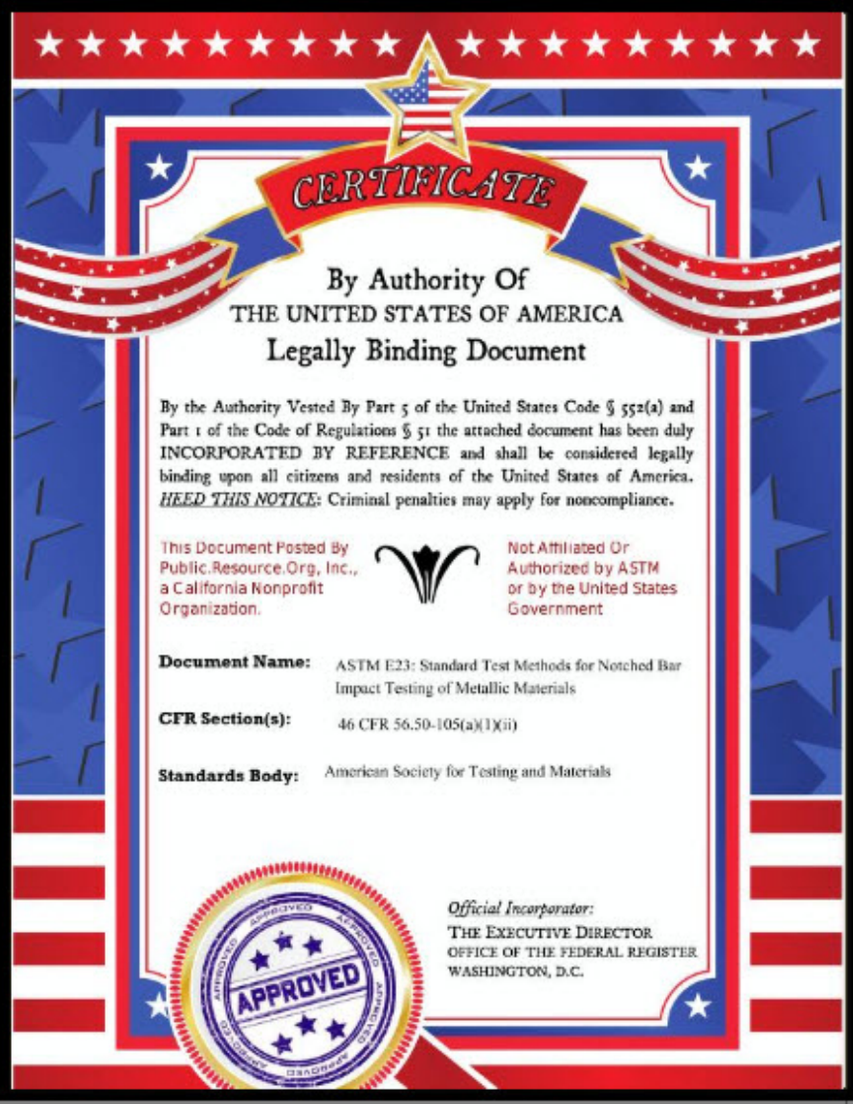
History

Information on previous California energy standards is available here.

January 1, 2017	The **2016 Building Energy Efficiency Standards** go into effect. **Read the press release on the new standards here**.
September 4, 2015	The California Energy Commission publishes the **Existing Buildings Energy Efficiency Action Plan**.
July 1, 2014	The 2013 Standards become effective. They are expected to save 25% more energy than the 2008 Standards. The commercial provisions exceed the efficiency of ASHRAE 90.1-2010; the residential provisions exceed the efficiency of the 2012 IECC. Both standards are mandatory statewide. Approved by a 4-0 vote by the CEC, the upgraded standards include improved windows, insulation, lighting, air-conditioning systems and other features to reduce energy consumption in California homes and businesses.
January 23, 2013	The Building Standards Commission approves the 2013 Standards for publication.
May 24, 2012	The San Francisco Chronicle publishes a lengthy editorial, titled **A Green Future Starts a Home for Californians**, in favor of the update to California's state building energy code (Title 24, Part 6), a part of the 2013 Building Energy Efficiency Standards (BEES). The article highlights the California Energy Commission's ability to enlist the support of major stakeholders including builders, utilities, and environmental groups. Additionally, the editorial mentions that the adoption of these regulations will have a relatively minimal effect on the cost of housing.
2012	The California Energy Commission (CEC) prepares a 2013 update to the state building energy code (Title 24, Part 6). On May 31, the CEC approves the updates. The original draft represents a 30% energy savings over the current 2008 version. The next draft version of the energy code is roughly 10% above the 2012 IECC and 25% over the previous 2008 standards. Public comment periods and hearings take place. **Slide Presentation on 2013 Building Energy Efficiency Standards**
February 2011	San Francisco approves ground-breaking green building legislation to improve energy efficiency in existing

	buildings. The Board of Supervisors passes an ordinance codifying the recommendations of the Existing Commercial Building Task Force. Under the ordinance, non-residential building owners are required to benchmark the energy use of their buildings and disclose the results annually to the city and, thereby, the public. The next phase of the ordinance requires building owners to conduct energy audits, starting with commercial properties larger than 50,000 ft^2 in October 2011. By 2013, the rules are to apply to all commercial properties 10,000 ft^2 or larger.
January 12, 2010	California adopts the nation's first mandatory green building standards. Effective January 1, 2011, all new buildings must comply with the 2010 California Green Building Standards Code (CALGREEN). The California Air Resources Board estimates that the mandatory provisions will curb greenhouse gas emissions (GHG) by 3 million metric tons in 2020, helping the state reach its goal of 33 percent GHG reduction this decade. Among other provisions, CALGREEN will require 20 percent mandatory reduction in indoor water use, separate water meters for nonresidential buildings' indoor and outdoor water use, diversion of 50 percent of construction waste from landfills, mandatory inspections of energy systems for nonresidential buildings over 10,000 square feet, and the use of low-pollutant emitting interior finish materials such as paints, carpet, vinyl flooring and particle board.
January 1, 2010	The 2008 Standards become effective. A first analysis of the 2008 Standards reveals an average energy performance at least 21% more efficient than ASHRAE 90.1-2004.
October 11, 2009	**Assembly Bill No. 758** is approved by the governor. This legislation requires the California Energy Commission, by March 1, 2010, to establish a regulatory proceeding to develop a comprehensive program to achieve greater energy savings in the state's existing residential and nonresidential building stock. The Energy Commission is required to consult with specified entities and to hold at least three public hearings. The bill also requires the Public Utilities Commission (PUC), by March 1, 2010, to open a new proceeding or amend an existing proceeding to investigate the ability of electrical corporations and gas corporations to provide energy efficiency financing options to their customers to implement the comprehensive program. Local publicly owned electric utilities, by a specified date, would be responsible for implementing an energy efficiency program that recognizes the Legislature's intent to encourage energy savings and greenhouse gas emission reductions in existing residential and nonresidential buildings.
September 2009	The California Public Utilities Commission approves a three-year $3.1 billion energy efficiency budget for the state's four major investor-owned utilities. The decision also allocates money for retrofitting residential buildings, making public buildings more energy efficient, and delivering zero net energy homes and commercial buildings. Source: **PUC approves $3.1B for energy-efficiency programs**
February 2, 2009	**A bill is introduced** in the state assembly that would mandate "zero net energy" standards for residential buildings starting in 2020. This bill eventually dies in early 2010.
December 14, 2004	Governor Arnold Schwarzenegger issues Executive Order S-20-04 on December 14, 2004, known as the Green Building Initiative. It lays out a comprehensive set of actions for California to take in order to improve energy efficiency in nonresidential buildings. The California Energy Commission is directed to undertake all actions within its authority to increase the efficiency requirements in the Building Energy Efficiency Standards for nonresidential buildings by 20% by 2015.
1974-5	In 1974 the California legislature passes the **Warren-Alquist Act**, establishing the California Energy Commission and authorizing the Commission to establish energy requirements for both residential and commercial buildings. The first statewide energy requirements are established in 1975 by the Department of Housing and Community Development for all low-rise residential buildings.

EXHIBIT 171



ASTM E23: Standard Test Methods for Notched Bar Impact Testing of Metallic Materials

by American Society for Testing and Materials

Publication date	1982-01-01
Usage	CC0 1.0 Universal
Topics	federalregister.gov, public.resource.org
Collection	publicsafetycode; USGovernmentDocuments; additional_collections
Language	English

This document was posted by Public.Resource.Org, which is not affiliated with nor authorized by the United States government, the State governments, or the American Society for Testing and Materials (ASTM). We posted this document in order to allow citizens to read the laws that govern us.

Note that many of these documents had to be procured on the used marketplace. Many of the laws in this collection were re-keyed into HTML and diagrams redrawn for increased usability and accessibility. Please note that the process of scanning, OCR, and rekeying might introduce errors. In addition, standards bodies will frequently issue errata or reissue standards over time and governmental bodies may change which standards they incorporate to law.

You are urged to check with the standards organizations or governmental authorities for further information and access to definitive versions of these important laws.

BY ORDER OF THE EXECUTIVE DIRECTOR
Office of the Federal Register
Washington, D.C.

By Authority of the Code of Federal Regulations: 46 CFR 56.50-105(a)(1)(ii)

Name of Legally Binding Document: ASTM E23: Standard Test Methods for Notched Bar Impact Testing of Metallic Materials
Name of Standards Organization: American Society for Testing and Materials

LEGALLY BINDING DOCUMENT

This document has been duly INCORPORATED BY REFERENCE into Federal Regulations and shall be considered legally binding upon all citizens and residents of the United States of America.

HEED THIS NOTICE! Criminal penalties may apply for noncompliance.

Identifier	gov.law.astm.e23.1982
Identifier-ark	ark:/13960/t2698939r
Ocr	ABBYY FineReader 11.0 (Extended OCR)
Ppi	600
Year	1982

Reviews

Add Review

There are no reviews yet. Be the first one to write a review.

EXHIBIT 172

Sequence of Events Leading to Issuance of an NFPA Committee Document

Step 1: Call for Proposals

- Proposed new Document or new edition of an existing Document is entered into one of two yearly revision cycles, and a Call for Proposals is published.

Step 2: Report on Proposals (ROP)

- Committee meets to act on Proposals, to develop its own Proposals, and to prepare its Report.
- Committee votes by written ballot on Proposals. If two-thirds approve, Report goes forward. Lacking two-thirds approval, Report returns to Committee.
- Report on Proposals (ROP) is published for public review and comment.

Step 3: Report on Comments (ROC)

- Committee meets to act on Public Comments to develop its own Comments, and to prepare its report.
- Committee votes by written ballot on Comments. If two-thirds approve, Report goes forward. Lacking two-thirds approval, Report returns to Committee.
- Report on Comments (ROC) is published for public review.

Step 4: Technical Report Session

- "*Notices of intent to make a motion*" are filed, are reviewed, and valid motions are certified for presentation at the Technical Report Session. ("Consent Documents" that have no certified motions bypass the Technical Report Session and proceed to the Standards Council for issuance.)
- NFPA membership meets each June at the Annual Meeting Technical Report Session and acts on Technical Committee Reports (ROP and ROC) for Documents with "certified amending motions."
- Committee(s) vote on any amendments to Report approved at NFPA Annual Membership Meeting.

Step 5: Standards Council Issuance

- Notification of intent to file an appeal to the Standards Council on Association action must be filed within 20 days of the NFPA Annual Membership Meeting.
- Standards Council decides, based on all evidence, whether or not to issue Document or to take other action, including hearing any appeals.

Committee Membership Classifications

The following classifications apply to Technical Committee members and represent their principal interest in the activity of the committee.

M — *Manufacturer:* A representative of a maker or marketer of a product, assembly, or system, or portion thereof, that is affected by the standard.

U — *User:* A representative of an entity that is subject to the provisions of the standard or that voluntarily uses the standard.

I/M — *Installer/Maintainer:* A representative of an entity that is in the business of installing or maintaining a product, assembly, or system affected by the standard.

L — *Labor:* A labor representative or employee concerned with safety in the workplace.

R/T — *Applied Research/Testing Laboratory:* A representative of an independent testing laboratory or independent applied research organization that promulgates and/or enforces standards.

E — *Enforcing Authority:* A representative of an agency or an organization that promulgates and/or enforces standards.

I — *Insurance:* A representative of an insurance company, broker, agent, bureau, or inspection agency.

C — *Consumer:* A person who is, or represents, the ultimate purchaser of a product, system, or service affected by the standard, but who is not included in the *User* classification.

SE — *Special Expert:* A person not representing any of the previous classifications, but who has a special expertise in the scope of the standard or portion thereof.

NOTES;

1. "Standard" connotes code, standard, recommended practice, or guide.
2. A representative includes an employee.
3. While these classifications will be used by the Standards Council to achieve a balance for Technical Committees, the Standards Council may determine that new classifications of members or unique interests need representation in order to foster the best possible committee deliberations on any project. In this connection, the Standards Council may make appointments as it deems appropriate in the public interest, such as the classification of "Utilities" in the National Electrical Code Committee.
4. Representatives of subsidiaries of any group are generally considered to have the same classification as the parent organization.

NEC SCHEDULE FOR 2014
(2013 NFPA Conference and Expo)

Date	No. of Weeks Between each Event	Event
Nov. 4, 2011	--	Closing Date for Proposals
Jan. 9-21, 2012	10 (+1)	Code-Making Panel Meetings (ROP)
Jan. 27, 2012	1	Mail Ballots to CMPs
Feb. 24, 2012	4	Receipt of Initial Ballots
April 23-27, 2012	8	Correlating Committee Meeting
June 4-7, 2012	--	NFPA Annual Meeting – Las Vegas
June 15, 2012	7	NEC-ROP to Printer
July 13, 2012	4	NEC-ROP to Mailing House
Oct. 17, 2012	14	Closing Date for Comments
Nov. 28-Dec. 8, 2012	5	Code-Making Panel Meetings (ROC)
Dec. 14, 2012	1	Mail Ballots to CMPs
Jan. 11, 2013	3	Receipt of Initial Ballots
Feb. 18-22, 2013	5	Correlating Committee Meeting
March 1, 2013	1	NEC-ROC to Printer
March 22, 2013	3	NEC-ROC to Mailing House
May 3, 2013	6	Notice of Intent to Make Motion (NITMAM)
May 17, 2013	2	Posting of Certified NITMAMs
June 2-6, 2013	2	NFPA Annual Meeting – Chicago
August 2013		Standards Council Issuance
Sept. 2013		Release of 2014 NEC

Rev 6/4/09

Anyone may submit proposals to amend the 2011 *Code*. A sample form for this purpose may be obtained from the Secretary of the Standards Council at NFPA headquarters, and a copy is included in this *Code*.

Method of Submitting a Proposal to Revise the National Electrical Code

The following is based on the NFPA Regulations Governing Committee Projects, adopted by the Board of Directors in October 1996 (last amended in March 2004).

A proposal to revise the 2011 edition of the *National Electrical Code* must be submitted so that the proposal is received at NFPA headquarters by November 4, 2011, as indicated in the time schedule for the 2014 National Electrical Code. A proposal received after this date will be returned to the submitter. The proposal is to be sent to the Secretary of the Standards Council at NFPA Headquarters, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02169-7471.

Each proposal must include the following:

1. Identification of the submitter (the person's name) and his or her affiliation (i.e., committee, organization, company), where appropriate
2. An indication that the proposal is for revision of the 2011 *National Electrical Code* and identification of the specific section number, table number (or equivalent identification) of the section, etc., to be revised
3. A statement of the problem and substantiation for the proposal
4. The proposed text of the proposal including the wording to be added, revised (and how revised), or deleted

Proposals that do not include all of the above information may not be acted on by the National Electrical Code Committee.

It is preferred that the forms available from NFPA for submittal of proposals be used. A separate proposal form should be used for revision of each section of the *Code*.

Proposal forms appear on the following pages.

FORM FOR PROPOSAL FOR 2014 NATIONAL ELECTRICAL CODE®

INSTRUCTIONS — PLEASE READ CAREFULLY

Type or print **legibly** in **black** ink. Use a separate copy for each proposal. Limit each proposal to a **SINGLE** section. All proposals **must be received by NFPA by 5 p.m., EST, Friday, November 4, 2011**, to be considered for the 2014 National Electrical Code. Proposals received after 5:00 p.m., EST, Friday, November 4, 2011, will be returned to the submitter. If supplementary material (photographs, diagrams, reports, etc.) is included, you may be required to submit sufficient copies for all members and alternates of the technical committee.

For technical assistance, please call NFPA at 1-800-344-3555.

FOR OFFICE USE ONLY

Log #:

Date Rec'd:

Please indicate in which format you wish to receive your ROP/ROC ☐ **electronic** ☐ **paper** ☒ **download**
(Note: If choosing the download option, you must view the ROP/ROC from our website; no copy will be sent to you.)

Date 8/1/200X **Name** John B. Smith **Tel. No.** 253-555-1234

Company ABC Electric Company **Email**

Street Address 9 Seattle St. **City** Tacoma **State** WA **Zip** 98402

****If you wish to receive a hard copy, a street address MUST be provided. Deliveries cannot be made to PO boxes.***

Please indicate organization represented (if any) National Electrical Contractors Association

1. **Section/Paragraph** 210-60(A)

2. **Proposal Recommends (check one):** ☐ new text ☒ revised text ☐ deleted text

3. **Proposal (include proposed new or revised wording, or identification of wording to be deleted):** [Note: Proposed text should be in legislative format; i.e., use underscore to denote wording to be inserted (inserted wording) and strike-through to denote wording to be deleted (~~deleted wording~~).]

Guest rooms or guest suites ~~meeting the definition of a dwelling unit~~ provided with permanent provisions for cooking shall have receptacle outlets installed in accordance with all of the applicable rules in 210.52.

4. **Statement of Problem and Substantiation for Proposal:** (Note: State the problem that would be resolved by your recommendation; give the specific reason for your Proposal, including copies of tests, research papers, fire experience, etc. If more than 200 words, it may be abstracted for publication.)

The existing language is modified to eliminate confusion between the electrical and building codes as to the precise definition of these types of accommodations.

5. **Copyright Assignment**

(a) ☒ **I am the author of the text or other material (such as illustrations, graphs) proposed in the Proposal.**

(b) ☐ **Some or all of the text or other material proposed in this Proposal was not authored by me. Its source is as follows:** (please identify which material and provide complete information on its source)

I hereby grant and assign to the NFPA all and full rights in copyright in this Proposal and understand that I acquire no rights in any publication of NFPA in which this Proposal in this or another similar or analogous form is used. Except to the extent that I do not have authority to make an assignment in materials that I have identified in (b) above, I hereby warrant that I am the author of this Proposal and that I have full power and authority to enter into this assignment.

Signature (Required)

PLEASE USE SEPARATE FORM FOR EACH PROPOSAL

Mail to: Secretary, Standards Council · National Fire Protection Association
1 Batterymarch Park · Quincy, MA 02169-7471 OR
Fax to: (617) 770-3500 OR Email to: proposals_comments@nfpa.org

8/5/2010-B

EXHIBIT 173

From: "ghartford" <ghartford@hartfordengineering.com> on behalf of ghartford
Sent: Thu 5/17/2018 1:42 PM (GMT-07:00)
To: "'Carl Malamud'" <carl@media.org>
Cc:
Bcc:
Subject: RE: Contact Page

Mr. Malamud:

Thank you for your timely response, but I don't believe we were asking for legal advice. We have outside legal counsel for that.

We were asking two (2) simple, yet what we believe to be fair, questions:

1. How do you make documents available and not violate copyright laws?

2. How might we access the documents you offer?

Thank you once again for your timely consideration and response.

HARTFORD ENGINEERING
Gerald D. Hartford, Jr., PE, LEED AP, GPD (Jerry)
Principal / Mechanical Engineer
11440 West Bernardo Court – Suite 202
San Diego, CA 92127
858-337-7712
ghartford@hartfordengineering.com
www.hartfordengineering.com
Click here to send me secure files.

From: Carl Malamud [mailto:carl@media.org]
Sent: Thursday, May 17, 2018 1:33 PM
To: ghartford <ghartford@hartfordengineering.com>
Subject: Re: Contact Page

Sorry, I'm not a lawyer and I'm certainly not your lawyer and I'm not about to give you legal advice, which is what you are asking for.

On Thu, May 17, 2018 at 1:30 PM, ghartford <ghartford@hartfordengineering.com> wrote:

Mr. Malamud:

We just recently learned (from a colleague) of your 501(C)(3) corporation and the work you do at Public.Resource.Org.

Being in the engineering business, we are obligated to design buildings in accordance with building codes.

We spend significantly for access to such codes. It always seemed interesting that we should have to pay for what we are obligated to implement. But we have done so for years. It's just the way it's always been done.

The challenge we have is ensuring access to relevant, current codes (whole codes – not just errata) for the states and municipalities in which we provide our engineering services.

We provide engineering services in multiple states, therefore we require different codes, i.e. obviously the CA codes, but as well International codes (ICC), Uniform codes (IAPMO), ASME standards, NFPA standards, ANSI standards, etc.

Please confirm for us how you make documents available and not violate copyright laws, i.e. current and past documents.

Then please share with us how we might access the documents you offer.

Thank you in advance for your timely consideration and response.

HARTFORD ENGINEERING

Gerald D. Hartford, Jr., PE, LEED AP, GPD (Jerry)

Principal / Mechanical Engineer

11440 West Bernardo Court – Suite 202

San Diego, CA 92127

858-337-7712

ghartford@hartfordengineering.com

www.hartfordengineering.com

Click here to send me secure files.

From: Heady, Ralph
Sent: Mon 7/23/2018 6:06 AM (GMT-07:00)
To: "Carl Malamud" <carl@media.org>
Cc:
Bcc:
Subject: RE: Contact Page

Does Friday's decision mean you can update the site?

Thanks for responding to the earlier email,

Ralph D. Heady
Engineering Project Designer
Architecture and Engineering
Gaddis Physical Plant
1845 Fairmount
Wichita, Kansas 67260-0023
ralph.heady@wichita.edu
978-7914

From: Carl Malamud [mailto:carl@media.org]
Sent: Friday, July 20, 2018 3:56 PM
To: Heady, Ralph
Subject: Re: Contact Page

A federal judge has forbidden me from updating that page. Google my name and standards and copyright.

On Fri, Jul 20, 2018 at 1:34 PM Heady, Ralph <Ralph.Heady@wichita.edu> wrote:

I was searching for a standard the other day and noticed the page I was looking at (Guide to State and Local Public Safety Codes) says it was last updated in 2014. Are there any updates forthcoming?

Also, do you have a list of the latest Codes? As some are not published annually I was wondering if there is a list of the latest. Mostly the IBC, IRC, IEBC, IMC, IPC, IFGC and IECC. How about a breakdown of the NFPA family?

Thanks,

Ralph D. Heady

Engineering Project Designer

Architecture and Engineering

Gaddis Physical Plant

1845 Fairmount

Wichita, Kansas 67260-0023

ralph.heady@wichita.edu

978-7914