NFPA No.

17

DRY CHEMICAL EXTINGUISHING SYSTEMS 1968

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Official NFPA Definitions

Adopted Jan. 23, 1964. Where variances to these definitions are found, efforts to eliminate such conflicts are in process.

SHALL is intended to indicate requirements.

SHOULD is intended to indicate recommendations or that which is advised but not required.

APPROVED means acceptable to the authority having jurisdiction. The National Fire Protection Association does not approve, inspect or certify any installations, procedures, equipment or materials nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure or use. The authority having jurisdiction may also refer to the listings or labeling practices of nationally recognized testing laboratories,* i.e., laboratories qualified and equipped to conduct the necessary tests, in a position to determine compliance with appropriate standards for the current production of listed items, and the satisfactory performance of such equipment or materials in actual usage.

*Among the laboratories nationally recognized by the authorities having jurisdiction in the United States and Canada are the Underwriters' Laboratories, Inc., the Factory Mutual Engineering Division, the American Gas Association Laboratories, the Underwriters' Laboratories of Canada, the Canadian Standards Association Testing Laboratories, and the Canadian Gas Association Approvals Division.

LISTED: Equipment or materials included in a list published by a nationally recognized testing laboratory that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

LABELED: Equipment or materials to which has been attached a label of a nationally recognized testing laboratory that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling is indicated compliance with nationally recognized standards or the conduct of tests to determine suitable usage in a specified manner.

AUTHORITY HAVING JURISDICTION: The organization, office or individual responsible for "approving" equipment, an installation, or a procedure.

Units of Measurements

Units of measurements used here are U. S. standard. 1 U. S. gallon = 0.83 Imperial gallons = 3.785 liters. One foot = 0.3048 meters. One inch = 25.40 millimeters. One pound per square inch = 0.06805 atmospheres = 2.307 feet of water. One pound = 453.6 grams.

Standard for
Dry Chemical Extinguishing Systems

NFPA No. 17 — 1968

1968 Edition of No. 17

The 1968 edition of this standard supersedes the 1958 edition and contains extensive amendments recommended by the Committee on Dry Chemical Extinguishing Systems. The present edition was adopted by the National Fire Protection Association on May 21, 1968.

Original Development of No. 17

The Dry Chemical Extinguishing Systems Committee was activated in 1952. At that time there was no dry chemical extinguishing system tested and listed by a nationally recognized testing laboratory, but by late 1954 a system was tested and listed by Underwriters' Laboratories, Inc. At its meeting in January 1955 the Committee prepared an outline of a standard on Dry Chemical Extinguishing Systems, and in the following year prepared the standard that was Tentatively Adopted by the National Fire Protection Association on June 7, 1956. Changes to the tentative standard led to approval of the first official NFPA Standard on Dry Chemical Extinguishing Systems in 1957. Some amendments were made in 1958 and this edition supersedes both earlier texts.

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SCOPE: The installation, maintenance and use of dry chemical extinguishing systems for fire protection.

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Standard for

Dry Chemical Extinguishing Systems

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FOREWORD

The dry chemical systems described in this Standard are designed to discharge dry chemical from fixed nozzles and piping, or from hose lines by means of an expellant gas. The intent of the Standard is to present the design considerations applicable to these systems.

Because the flow of dry chemical (solid particles suspended in a gaseous medium) does not follow general hydraulic theories, most of the flow principles have been determined experimentally. The dry chemicals produced by various manufacturers are usually not identical in all characteristics and each manufacturer designs equipment for use with a specific dry chemical. Therefore, system design principles applicable to the products of one manufacturer are not applicable to the products of another manufacturer. As a result it is not practical to include system design details as a part of this Standard.

It is now generally accepted that the flame extinguishing properties of dry chemicals are due to the interaction of the particles to stop the chain reaction that takes place in flame combustion. Dry chemicals vary in their flame extinguishing effectiveness. Multipurpose dry chemical owes its effectiveness in extinguishing fires in ordinary combustibles such as wood and paper to the formation of a glow-retarding coating over the combustible material.

INTRODUCTION

1. Purpose. This Standard is prepared for use and guidance to those charged with the purchasing, designing, installing, testing, inspecting, approving, listing, operating or maintaining dry chemical fire extinguishing systems, in order that such equipment will function as intended throughout its life.

2. Scope. This Standard includes minimum requirements for dry chemical fire extinguishing systems. It contains only the essentials and suggestions to make the Standard workable in the hands of those skilled in this field. Portable dry chemical equipment is covered in the Standard for the Installation of Portable Fire Extinguishers (NFPA No. 10), and in Recommended Good Practice for the Maintenance and Use of Portable Fire Extinguishers (NFPA No. 10A).

Only those skilled in this field are competent to design and install this equipment. It may be necessary for many of those charged with the purchasing, inspecting, testing, approving, operating, and maintaining this equipment to consult an experienced fire protection engineer, competent in this field, in order to effectively discharge their respective duties.

The Appendix contains material that will aid in the understanding and application of this Standard.

3. Definitions. For the purpose of clarification, the following general terms used with special technical meanings in this Standard are defined.

AUTHORITY HAVING JURISDICTION is the organization, office, or individual responsible for "approving" equipment, an installation, or a procedure.

NOTE: The phrase "authority having jurisdiction" is used in NFPA standards in a broad manner since jurisdictions and "approval" agencies vary as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department, health department,

building official, electrical inspector, or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances the property owner or his delegated agent assumes the role of the authority having jurisdiction; at government installations the commanding officer or a departmental official may be the authority having jurisdiction.

CALCULATION AND DESIGN refers to the process of computing, with the use of equations, graphs, or tables, the system characteristics such as flow rate, nozzle pressure, and pressure drop. This information is not required for listed pre-engineered systems.

DRY CHEMICAL is a powder composed of very small particles, usually of sodium bicarbonate, potassium bicarbonate, or monoammonium phosphate, with added particulate material supplemented by special treatment to prevent caking and to provide flowability.

MULTIPURPOSE DRY CHEMICAL is usually monoammonium phosphate-base and is effective on fires in ordinary combustibles, such as wood or paper, as well as on fires in flammable liquids, etc.

ENGINEERED SYSTEMS are those requiring individual calculation and design to determine the flow rates, nozzle pressures, quantities of dry chemical, and the number and types of nozzles and their placement in a specific system.

PRE-ENGINEERED SYSTEMS (SOMETIMES KNOWN AS "PACKAGE" SYSTEMS) are those having predetermined flow rates, nozzle pressures, and quantities of dry chemical. These systems have the specific pipe size, maximum and minimum pipe lengths, number of fittings, and number and type of nozzles, prescribed by a nationally recognized testing laboratory. The hazards protected by these systems are specifically limited as to type and size by a nationally recognized testing laboratory based upon actual fire tests.

CHAPTER 1.
GENERAL INFORMATION AND REQUIREMENTS

11. General Information

111. Scope. Chapter 1 contains general information and the design and installation requirements for all features that are generally common to all dry chemical systems.

112. Dry Chemical. Systems are designed on the basis of the flow and extinguishing characteristics of a specific make and type of dry chemical. The type of dry chemical used in the system shall not be changed unless proved to be changeable by a nationally recognized testing laboratory, recommended by the manufacturer of the equipment, and approved by the authority having jurisdiction.

CAUTION: Types of dry chemical shall not be mixed. Mixtures of certain dry chemicals will generate dangerous pressures and will form lumps.

113. Use and Limitations. Dry chemical extinguishing systems are useful within the limits of this Standard in extinguishing fires in specific hazards or equipment, and in areas where rapid flame knockdown is essential.

1131. Some important types of hazards and equipment that dry chemical systems may satisfactorily protect include:

1. Flammable or combustible liquids.

2. Combustible solids having burning characteristics similar to naphthalene and pitch, which melt when involved in fire.

3. Flammable liquids or combustible gases issuing under pressure.

4. Electrical hazards such as transformers or oil circuit breakers.

5. Ordinary combustibles such as wood, paper, or textiles using multipurpose dry chemical when it can reach all surfaces involved in combustion.

6. Kitchen hoods, ducts, and associated range-top hazards such as deep fat fryers.

1132. Dry chemical systems shall not be used on fires involving the following:

1. Chemicals containing their own oxygen supply such as cellulose nitrate.

2. Combustible metals such as sodium, potassium, magnesium, titanium, and zirconium.

3. Deep-seated or burrowing fires in ordinary combustibles where the multipurpose dry chemical cannot reach the point of combustion.

1133. Dry chemical extinguishing equipment should not be used in areas where residual deposits may affect electronic equipment or delicate electrical relays.

114. Types of Systems. The types of systems recognized in this Standard include:

Total Flooding Systems.
Local Application Systems.
Hand Hose Line Systems.

115. Systems Protecting One Or More Hazards. Systems may be used to protect one or more hazards or groups of hazards as provided in the following paragraphs.

1151. Where, in the opinion of the authority having jurisdiction, two or more hazards may be simultaneously involved in fire by reason of their proximity, the hazards shall be protected by individual systems installed to operate simultaneously, or by a single system designed to protect all hazards that may be simultaneously involved.

1152. Where hand hose lines may be used on a hazard that is also protected by a fixed system, separate dry chemical supplies shall be provided.

1153. A single dry chemical supply shall be used for both a hand hose line system and a fixed nozzle system only if the hazards protected by the two systems are separated so that the hand hose lines cannot be used on the hazard protected by the fixed nozzle system, and the probability of fire occurring simultaneously in both hazards is slight.

12. Personnel Safety

121. Hazards to Personnel. The discharge of large amounts of dry chemical may create hazards to personnel such as reduced visibility and temporary breathing difficulty.

122. Safety Requirements. Where there is a possibility that personnel may be exposed to a dry chemical discharge, suitable safeguards shall be provided to ensure prompt evacuation of such locations, and also to provide means for prompt rescue of any trapped personnel. Such safety items as personnel training, warning signs, discharge alarms, predischarge alarms, and respiratory protection should be considered.

***123. Electrical Clearances.** All system components shall be so located as to maintain minimum clearances from live parts.

13. Specifications, Plans and Approvals

131. Purchasing Specifications. Specifications for dry chemical fire extinguishing systems shall be drawn up with care under supervision of a competent person, and with the advice of the authority having jurisdiction. To ensure a satisfactory system, the following items shall be in the specifications.

1311. The specifications shall designate the authority having jurisdiction and indicate whether plans are required.

1312. The specifications shall state that the installation shall conform to this Standard and meet the approval of the authority having jurisdiction.

1313. The specifications shall include the specific tests that may be required, if any, to meet the approval of the authority having jurisdiction, and indicate how the cost of testing is to be borne.

1314. These specifications shall indicate the hazard to be protected and shall include such information as physical dimensions, combustibles, air handling equipment, heat sources, etc.

132. Plans. Where plans are required, the responsibility for their preparation shall be entrusted only to competent persons.

1321. These plans shall be drawn to an indicated scale or be suitably dimensioned, and shall be made so that they can be easily reproduced.

1322. These plans shall contain sufficient detail to enable the authority having jurisdiction to evaluate the hazard or hazards, and to evaluate the effectiveness of the system. The details on the hazards shall include materials involved, the location and arrangement, and the exposure to the hazard.

1323. The details on the system shall include sufficient information and calculations on the amount of dry chemical; the size, length and arrangement of connected piping, or piping and hose; description and location of nozzles so that the adequacy of the system can be determined. Information shall be submitted pertaining to the location and function of detection devices, operating devices, auxiliary equipment and electrical circuitry, if used. Sufficient information shall be indicated to identify properly the ap-

*See Appendix.

paratus and devices used. Any special features should be adequately explained.

133. Approval of Plans. Where plans are required, they shall be submitted to the authority having jurisdiction for approval before work starts.

1331. Where field conditions necessitate any substantial change from the approved plan, the corrected as-installed plans shall be submitted to the authority having jurisdiction for approval.

134. Approval of Installations. The completed system shall be tested by qualified personnel as required by the authority having jurisdiction. These tests shall be adequate to determine that the system has been properly installed and will function as intended. Only listed equipment and devices shall be used in these systems.

1341. The installer shall certify to the authority having jurisdiction that the installation has been made in accordance with the approved plans and the listing of a nationally recognized testing laboratory.

1342. Approval tests shall include a discharge of expellant gas through the piping and nozzles. Observations for serious gas leakage and for continuity of piping with free unobstructed flow shall be made. Observations shall be made of the flow of expellant gas through all nozzles. The labeling of devices with proper designations and instructions should be checked.

1343. After any tests, care should be taken to see that all piping and nozzles have been blown clean, using compressed air or nitrogen if necessary. Care also should be taken to see that the system is properly charged and placed in the normal "set" conditions.

14. Operation and Control of Systems

141. Methods of Actuation. Systems shall be classified as manual or automatic in accordance with the method of actuation.

1411. A manual system is one in which human agency is required for actuation, although it may have other features that are automatic.

1412. An automatic system is one which is actuated by automatic means. Such systems shall also have a readily accessible means for manual actuation.

142. Detection of Fires. Fires or conditions likely to produce fire shall be detected by visual (human senses) or by automatic means.

1421. Visual detection only may be used with permission of the authority having jurisdiction, except in manually actuated systems where fire or conditions likely to produce fire can readily be detected by such means.

1422. Automatic detection shall be by any listed or approved device that is capable of detecting and indicating heat, flame, smoke, combustible vapors, or an abnormal condition in the hazard, such as process trouble, that is likely to produce fire.

1423. An adequate and reliable source of energy shall be used in detection systems.

143. Operating Devices. Operating devices include expellant gas releasing mechanisms, dry chemical discharge controls, and shutdown equipment.

1431. Operation shall be by listed mechanical, electrical, or pneumatic means. An adequate and reliable source of energy shall be used.

1432. All operating devices shall be designed for the service they will encounter, and shall not be readily rendered inoperative or susceptible to accidental operation. Devices shall be normally designed to function properly from −40 F to +150 F, or marked to indicate temperature limitations.

1433. All devices shall be located, installed, or suitably protected so that they are not subject to mechanical, chemical, climatic, or other conditions that would render them inoperative.

1434. The normal manual control for actuation shall be located so as to be conveniently and easily accessible at all times including the time of the fire. The control shall cause the complete system to operate.

1435. All automatically operated valves controlling the release and distribution of expellant gas and dry chemical shall be provided with approved independent means for emergency manual operation. If the means for manual actuation of the system required in 1412 provides approved positive operation independent of the automatic actuation, it may be used as the emergency means. The emergency means, preferably mechanical, shall be easily accessible and located close to the valves controlled. If possible, the system shall be designed so that emergency actuation can be accomplished from one location.

1436. Manual controls shall not require a pull of more than 40 lb. (force) nor a movement of more than 14 in. to secure operation.

1437. Means shall be provided for checking the amount of expellant gas to assure that it is sufficient for the proper operation of the system.

1438. All shutdown devices shall be considered integral parts of the system and shall function with the system operation. If the expellant gas is used to pneumatically operate these devices, then the gas must be taken prior to its entry into the dry chemical tank.

1439. All remote manual operating devices shall be identified as to the hazard that they protect.

144. Supervision. Supervision of automatic systems is advisable where the possible loss may be high because of any delay of actuation and/or where the detection or control systems are so extensive and complex that they cannot be readily checked by visual or other inspection. When supervision is provided, it should be so arranged that there will be immediate indication of failure. The extent and type of supervision shall be approved.

145. Alarms and Indicators. Alarms and/or indicators are used to indicate the operation of the system, hazard to personnel, or failure of any supervised device or equipment. The devices may be audible or visual. The type, number, and location of the devices shall be such that their purpose is satisfactorily accomplished. The extent and type of alarm and/or indicator equipment shall be approved.

1451. An alarm or indicator shall be provided to show that the system has operated, that personnel response may be needed, and that the system should be charged.

1452. Alarms should be provided to give ample positive warning of a discharge where hazard to personnel may exist.

1453. Alarms indicating failure of supervised devices or equipment shall give prompt and positive indication of any failure and shall be distinctive from alarms indicating operation or hazardous conditions.

15. Dry Chemical Supply

151. Quantity. The amount of dry chemical in the system shall be at least sufficient for the largest single hazard protected, or for the group of hazards which are to be protected simultaneously.

152. Quality. The dry chemical used in the system shall be supplied by the manufacturer of the equipment. The character-

istics of the system are dependent upon the composition of the dry chemical, as well as upon other factors, and therefore it is imperative to use the dry chemical provided by the manufacturer of the system.

153. Reserve Supply. Where a dry chemical system protects multiple hazards by means of selector valves, sufficient dry chemical and expellant gas shall be kept on hand for one complete charge of the system. For single hazard systems, a similar supply should be kept on hand if the importance of the hazard is such that it cannot be shut down until recharges can be procured. A fully charged reserve unit permanently connected to the system is desirable and may be required by the authority having jurisdiction.

154. Storage. The original dry chemical supplied with the system is maintained in the dry chemical chamber. Storage of charging supplies of dry chemical shall be in a constantly dry area, and the dry chemical shall be contained in metal drums or other containers which will prevent the entrance of moisture even in small quantities. Prior to charging the dry chemical chamber, the dry chemical shall be carefully checked to determine that it is in free-flowing powdery condition, and the pressure or weight of the expellant gas container shall be checked as stipulated by the manufacturer to determine that it is above the required minimum.

1541. The dry chemical tank and expellant gas assemblies shall be located near the hazard or hazards protected, but not where they will be exposed to a fire or explosion in these hazards.

1542. The dry chemical tank and expellant gas assemblies shall be located so as not to be subjected to severe weather conditions, or to mechanical, chemical, or other damage. When excessive climatic or mechanical exposures are expected, suitable enclosures or guards shall be provided.

1543. The dry chemical tank and expellant gas assemblies utilizing nitrogen shall be located where the ambient temperature is normally between −40 F and 120 F. Assemblies utilizing carbon dioxide shall be located where the ambient temperature is normally between 32 F and 120 F. Exposure extremes of short duration can be tolerated. Otherwise, methods shall be provided for maintaining the temperatures within the ambient ranges given.

NOTE: Systems for use at higher or lower temperatures can be specially designed.

16. Distribution System

***161. Pipe and Fittings.** The piping for a dry chemical system embodies distinctive features necessitated by the characteristics of the agent. Threaded pipe and fittings shall be galvanized malleable iron, galvanized steel, stainless steel, copper, or brass. Black steel pipe with welded joints may be used when the atmosphere is relatively noncorrosive. Special corrosion resistant materials should be used for corrosive atmospheres. Steel pipe shall not be less than Schedule 40 and brass and copper pipe shall be not less than the approximate Schedule 40 wall thickness (regular pipe) for pipe sizes of 6 in. or less.

1611. Cast iron pipe and fittings shall not be used.

1612. Tubing shall not be used for dry chemical distribution.

162. Arrangement and Installation of Pipe and Fittings. Piping shall be installed in accordance with good commercial practices.

1621. All piping shall be laid out to produce the desired dry chemical flow rate at the nozzles, and care shall be taken to avoid possible restrictions due to foreign matter and faulty fabrication and/or improper installation.

1622. The piping system shall be securely supported and shall not be subject to mechanical, chemical, or other damage. Where explosions are possible, the piping system shall be hung from supports that are least likely to be displaced.

1623. Pipe shall be reamed and cleaned before assembly, and after assembly the entire piping system shall be blown out with dry gas before nozzles or discharge devices are installed. The use of pipe-thread compound or tape is not recommended.

163. Valves. All valves shall be listed for the intended use, particularly in regard to flow capacity and operation. Selector valves shall be of the quick-opening type, allowing essential free passage of the dry chemical without restriction.

1631. Valves shall not be easily subject to mechanical, chemical, or other damage.

164. Discharge Nozzles. Discharge nozzles shall be listed for the use intended, in accordance with subsequent chapters.

1641. Discharge nozzles shall be of adequate strength for use with the expected working pressures.

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*See Appendix.

1642. Discharge nozzles shall be of brass, stainless steel, or other corrosion-resistant materials, or be protected inside and out against corrosion. They shall be made of noncombustible materials, and shall withstand the expected fire exposure without deformation.

1643. Discharge nozzles shall be able to resist damage due to normal mechanical, chemical, climatic, or other conditions.

1644. Discharge nozzles shall be so connected and supported that they may not be readily put out of adjustment.

1645. Discharge nozzles shall be clearly marked for identification of type and size.

1646. Discharge nozzles shall be provided with listed protective caps where external clogging by foreign materials is likely.

165. Pipe Size and Nozzle Determination. Pipe sizes and nozzles shall be selected on the basis of calculations to deliver the required dry chemical flow rate at each nozzle or, for pre-engineered systems, in accordance with limitations set by a nationally recognized testing laboratory.

1651. Equations, or graphs derived therefrom, shall be used to determine the pressure drop in the pipe line in engineered systems. This design information shall be based on tests performed by the manufacturer and confirmed by a nationally recognized testing laboratory. It is not required in pre-engineered systems.

17. Inspection, Maintenance, and Instruction

171. Inspection and Tests. At least annually, all dry chemical systems including alarms, shutdowns, and other associated equipment, shall be thoroughly inspected and checked for proper operation by a competent inspector. Regular service contracts with the manufacturer or his authorized installing or maintenance company are recommended.

1711. The purpose of this inspection and testing shall be not only to ensure that the system is in full operating condition but also to indicate the probable continuance of that condition until the next inspection. Attention at this inspection shall be given to any extension of the hazard protected by the system.

1712. The inspector's report, with recommendations, if any, shall be filed with the owner or with whomever is designated by the owner.

1713. Between the regular service contract inspection or tests, the system shall be inspected visually or otherwise by competent personnel, following an approved schedule.

1714. At least semiannually, all expellant gas containers shall be checked by pressure or weight against the required minimums.

1715. At least semiannually, all stored pressure dry chemical containers shall be checked by pressure and weight against the required minimums.

1716. Except for stored pressure systems, at least annually the dry chemical in the system storage container shall be sampled from the top center and also near the wall to determine the existence of lumps harder than will be friable when dropped from a height of 4 in.

172. Maintenance. These systems shall be maintained in full operating condition at all times. Use, impairment, and restoration of this protection shall be reported promptly to the owner.

1721. Any troubles or impairments shall be corrected at once by competent personnel.

173. Instruction. All persons who may be expected to inspect, test, maintain, or operate dry chemical fire extinguishing systems shall be thoroughly trained and kept thoroughly trained in the functions that they are expected to perform.

1731. Training programs shall be established that are approved.

CHAPTER 2. TOTAL FLOODING SYSTEMS

21. General Information

211. Description. A total flooding system consists of a supply of dry chemical permanently connected to fixed piping, with fixed nozzles arranged to discharge dry chemical into an enclosed space or enclosure about the hazard.

212. Uses. This type of system may be used where there is a permanent enclosure about the hazard that is adequate to enable the required concentration to be built up. The total area of unclosable openings shall not exceed 15 percent of the total area of the sides, top, and bottom of the enclosure.

2121. Consideration should be given to the elimination of probable sources of reignition because the extinguishing action of a dry chemical flooding system is transient.

2122. Deep-seated fires involving solids subject to smoldering shall be protected by multipurpose dry chemical systems where the dry chemical can reach all surfaces involved in combustion. Bicarbonate-base dry chemicals shall not be used for protection against this type of fire.

213. General Requirements. Total flooding systems shall be designed, installed, tested, and maintained in accordance with the applicable rules in Chapter 1 and with the additional rules set forth in this chapter.

22. Hazard Specifications

221. Enclosure. In the design of total flooding systems the characteristics of the enclosure shall be considered as follows:

2211. The total area of unclosable openings for which no compensation is provided should not exceed 1 percent of the total area of the sides, top, and bottom of the enclosure. Unclosable openings having an area in excess of 1 percent and not exceeding 5 percent shall be compensated for by the provision of additional dry chemical. Unclosable openings having an area in excess of 5 percent of the total enclosure area and not exceeding 15 percent shall be screened by local application of additional dry chemical. See 2341.

222. Leakage and Ventilation. The effectiveness of the flooding system depends upon obtaining an extinguishing concentration of

dry chemical. The leakage of dry chemical from the protected space should be minimized.

2221. Where possible, openings such as doorways, windows, etc., shall be arranged to close before, or simultaneously with, the start of the dry chemical discharge, or 2341 shall be followed.

2222. Where forced air ventilating systems are involved, they should preferably be shut down and/or closed before, or simultaneously with, the start of the dry chemical discharge, except where the exhaust systems vent directly to the outdoors, or 2342 shall be followed.

23. Dry Chemical Requirements and Distribution

231. General. The factors which must be considered in the total flooding of enclosed spaces with dry chemical are minimum quantity of dry chemical required, the minimum rate of flow of dry chemical, and the limitations of spacing of the nozzles. In the case of pre-engineered systems, the rate of flow need not be considered since it is governed by the piping and nozzle limitations verified by a nationally recognized testing laboratory.

NOTE: The limiting specifications for a dry chemical system are a function of the flow characteristics of the particular dry chemical and equipment used by the manufacturer of the system. Therefore, it is not possible to specify in this Standard the exact values for the quantity required, rate of flow required, or nozzle distribution. The above considerations are carried in this Standard to point out the important features which should be made available to the purchaser, inspector, or other authorities charged with the examination and evaluation of this system. These data should be established by investigation and tests confirmed by a nationally recognized testing laboratory.

2311. The quantity of dry chemical and the flow rate shall be sufficient to create a fire extinguishing concentration in all parts of the enclosure.

2312. The nozzles shall be placed so as to provide not less than the minimum design concentration of dry chemical in all parts of the enclosure. For fires in ordinary combustibles where multipurpose dry chemical shall be used for protection, additional dry chemical applied by local application may be required in order to protect adequately all exposed surfaces.

2313. The nozzles shall be located so that the discharge will not be obstructed.

232. Volume Allowances. In calculating the net volume to be protected, allowance may be made for permanently located structures, etc., that materially reduce the volume.

233. Rate of Application. In engineered systems the minimum design rate of application shall be based on the quantity of dry chemical and the maximum time to obtain the design concentration. In pre-engineered systems, these factors are established for specific volume and other conditions given in the listing of such systems by nationally recognized testing laboratories. See also the Note following section 231.

2331. In engineered systems, the rate of application shall be such that the design concentration in all parts of the enclosure shall be obtained within 30 seconds.

234. Compensation for Special Conditions. Additional quantities of dry chemical, and additional nozzles if necessary, shall be provided to compensate for any special condition that may adversely affect the extinguishing effectiveness of the system.

2341. Unclosable openings having areas in excess of 1 percent of the total area of the sides, top, and bottom of the enclosure, and not exceeding 5 percent, shall be compensated for by the use of supplemental dry chemical in the proportions of not less than 0.5 lb. per sq. ft. of unenclosed opening, applied through the regular distribution system. When the unclosable openings have areas exceeding 5 percent of the total of the sides, top, and bottom of the enclosure, and not exceeding 15 percent, compensation shall be furnished by additional dry chemical in the proportion of not less than 1 lb. per sq. ft. of unclosed opening, applied simultaneously by local application over the openings.

2342. For ventilating systems that will not be shut down, supplementary dry chemical shall be added to the protected volume through the regular distribution system. The supplementary dry chemical shall be added at the point or points of air inlet and shall be in proportion to the volume of air removal during the period of dry chemical discharge, calculating as if it were additional volume to be protected. Pre-engineered systems listed for restaurant hood and duct protection are suitable for use with or without shutdown of the ventilation system or closure of dampers.

CHAPTER 3. LOCAL APPLICATION SYSTEMS

31. General Information

311. Description. A local application system consists of a supply of dry chemical permanently connected to a system of fixed piping with nozzles arranged to discharge directly onto the fire.

312. Uses. Local application systems may be used for the extinguishment of fires in flammable or combustible liquids, gases, and shallow solids such as paint deposits, where the hazard is not enclosed or where the enclosure does not conform to the requirements for total flooding. Application of dry chemical may be from nozzles mounted on the tank side or from overhead nozzles.

3121. Examples of hazards that may be successfully protected by local application systems include dip tanks, quenching oil tanks, spray booths, oil-filled electrical transformers, vapor vents, deep-fat fryers, etc.

313. General Requirements. Local application systems shall be designed, installed, tested, and maintained in accordance with the applicable requirements in Chapter 1 and with the additional requirements set forth in this chapter.

32. Hazard Specifications

321. Extent of Hazard. The hazard shall be so isolated from other hazards or combustibles that fire will not spread outside the protected area. The entire hazard shall be protected. The hazard shall include all areas that are or may become coated by combustible or flammable liquids or shallow solid coatings, such as areas subject to spillage, leakage, dripping, splashing, or condensation, and all associated materials or equipment such as freshly coated stock, drainboards, hoods, ducts, etc., that might extend fire outside or lead fire into the protected area. Protection of the entire hazard may require the combined use of local application and total flooding systems such as in restaurant kitchens where the deep-fat fryers should be protected by local application systems and the space above the grease filters in the hood should be protected by a combination local application — total flooding system.

322. Location of Hazard. The hazard may be indoors, partly sheltered, or completely outdoors. It is essential that the dry chemical discharge be such that winds or other strong air currents do not impair the protection.

33. Dry Chemical Requirements and Distribution

331. General. The factors which must be considered are the minimum quantity of dry chemical required, the minimum flow rate of dry chemical, the nozzle distribution patterns, the limitations of placement of nozzles with respect to flammable liquid surfaces, and possible obstruction of the dry chemical distribution patterns. In the case of the pre-engineered systems, the rate of flow need not be considered since it is governed by the pipe and nozzle limitations gathered by a nationally recognized testing laboratory (see also the Note under Section 231).

332. Draft Conditions. The quantity of dry chemical, the dry chemical flow rate, and the number of nozzles shall be sufficient to extinguish fires under the most severe wind or the most severe draft conditions expected in the hazard area.

3321. The maximum allowable draft condition shall be that specified by a nationally recognized testing laboratory.

333. Nozzle Placement. The nozzles shall be placed so as to provide an extinguishing concentration of dry chemical over the entire hazard during discharge.

3331. The nozzles shall be placed about (tankside) and/or above (overhead) the flammable liquid surface within the limits of the listing in order to prevent splashing during discharge.

334. Coated Surfaces. Coated surfaces, such as drainboards, are defined as those on which no pools of liquid will collect over a total area exceeding 10 percent of the protected surface. Although it is recognized that fires on coated surfaces are less severe than fires in deep layer flammable liquids, such areas shall be treated as if they were deep layer flammable liquid areas because no distinction has been made in this Standard.

335. Duration of Discharge. The minimum effective discharge time varies with the required minimum quantity of dry chemical and the minimum application rate. In the case of pre-engineered systems, these factors need not be considered since they are governed by the piping and nozzle limitations gathered by a nationally recognized testing laboratory. In the case of engineered systems, the minimum discharge time shall be increased to compensate for any hazard condition that would require a longer discharge period to assure complete extinguishment. However, hot saponifiable fats do not require an extended discharge period when sodium bicarbonate-base dry chemical is the extinguishing agent.

NOTE: Sodium bicarbonate is decomposed by heat to form carbon dioxide, water vapor, and sodium carbonate. The latter reacts with saponifiable fats to form soap and simultaneously releases additional carbon dioxide. The resulting soap-foam forms a lasting blanket over the hot fat and prevents both flame ignition and autoignition.

34. Special Considerations

341. Where systems protect hazards which are normally heated, such as deep fat fryers in restaurants, or wax tanks, the power or fuel supply to heaters shall be shut off automatically upon actuation of the extinguishing system.

CHAPTER 4. HAND HOSE LINE SYSTEMS

41. General Information

411. Description. Hand hose line systems consist of a hose and nozzle assembly connected, by fixed piping or directly, to a supply of dry chemical. A separate dry chemical supply can be provided for hand hose line use, or, dry chemical can be piped from a central storage unit which may be supplying several hose lines or fixed manually or automatically operated systems (see 1152 and 1153).

412. Uses. Hand hose line systems may be used to supplement fixed nozzle fire protection systems or to supplement portable fire extinguishers for the protection of specific hazards for which dry chemical is a suitable extinguishing agent. These systems shall not be used as a substitute for dry chemical fire extinguishing systems equipped with fixed nozzles except where the hazard cannot be adequately or economically provided with fixed nozzle protection. The decision as to whether hose lines are applicable to the particular hazard shall rest with the authority having jurisdiction.

413. General Requirements. Hand hose line systems shall be installed and maintained in accordance with the applicable provisions of Chapters 1, 2, and 3, except as outlined below.

42. Hazard Specifications

421. Hand hose line systems may be used to combat fires in all hazards covered under Chapter 1 except those which are inaccessible and beyond the scope of manual fire fighting.

43. Location and Spacing

431. Location. Hand hose line stations shall be placed so that they are easily accessible and have hose lines long enough to reach the most distant hazard that they are expected to protect. In general they shall be located so that they are not exposed to the hazard.

432. Spacing. If multiple hose stations are used, they shall be spaced so that any area within the hazard may be covered by one or more hose lines.

433. Actuation. Manual actuation shall be possible at each hose line station.

44. Dry Chemical Requirements

441. Rate and Duration of Discharge. The rate and duration of discharge, and consequently the amount of dry chemical, shall be determined by the type and potential size of the hazard. A hand hose line shall have a sufficient quantity of dry chemical to permit its effective use for a minimum of 30 seconds. The discharge of dry chemical also depends upon the minimum flow rate required to prevent surging and interrupted discharge. An unusually low flow rate will cause the dry chemical to separate from the expellant gas while within the pipe and/or hose, resulting in uneven flow from the nozzle. These values for minimum flow rate shall be confirmed by a nationally recognized testing laboratory.

442. Provision for Use by Inexperienced Personnel. The possibility of these hose lines being used by inexperienced personnel shall be considered and adequate provision made so that there will be a sufficient supply of dry chemical to enable them to effect extinguishment of fires in the hazards that they are likely to encounter.

443. Simultaneous Use of Hose Lines. Where simultaneous use of two or more hose lines is possible, a sufficient quantity of dry chemical shall be available to supply the maximum number of nozzles that are likely to be used at any one time for at least 30 seconds and at the appropriate flow rates.

45. Equipment Specifications

451. Hose. Hose lines on systems shall incorporate hose listed for this use. Normally, identifying marking on the hose will indicate the acceptability of the hose for this purpose.

452. Nozzle Assemblies. Nozzles shall be so designed that they can be handled by one man and shall incorporate a quick-opening shutoff arrangement to control the flow of dry chemical.

453. Hose Line Storage. The hose shall be coiled on a hose reel or rack so that it will be ready for immediate use without the necessity of coupling and may be uncoiled with a minimum of delay. If installed outdoors, it should be protected against the weather.

454. Charging the Hose Line. Operation of hand hose line systems depends on manual actuation and manipulation of a discharge nozzle. Speed and simplicity of operation is essential.

4541. The hose lines shall be cleared of dry chemical immediately after use.