NFPA No.

91

BLOWER and EXHAUST SYSTEMS 1972

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Official NFPA Definitions

Adopted Jan. 23, 1964: Revised Dec. 9, 1969. Where variances to these definitions are found, efforts to eliminate such conflicts are in process.

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

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Standard for the Installation of

Blower and Exhaust Systems

for Dust, Stock and Vapor Removal or Conveying

NFPA No. 91 — 1972

1972 Edition of No. 91

This edition of NFPA No. 91 was adopted at the Annual Meeting in May 1972, and supersedes the 1961 edition. The principal changes include expansion of Section 200, and the addition of a new Section 500, which covers systems for the removal of nonflammable corrosive fumes and vapors involving plastic materials.

Origin and Development of No. 91

The National Fire Protection Association as early as 1899 recognized the hazards of blower and exhaust systems. Since 1900 the NFPA Committees on Blower Systems have given continuing attention to the subject. Following World War II, revisions and additions to the standard were recommended by the NFPA Committee on Blower Systems to cover various new developments in the protection of dust collecting systems and stock and refuse conveying systems, and were adopted by the NFPA at its Annual Meetings in 1946, 1947, 1948 and 1949. Editorially revised editions were published in 1959 and 1961.

The 1961 edition of NFPA No. 91 was approved by the American National Standards Institute as ANSI Standard Z33.1 on Oct. 13, 1961. The 1972 edition has been submitted to ANSI for similar approval. The ANSI designation and date of approval will be printed on the front cover of copies of this edition printed after approval has been received.

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SCOPE: The construction, installation, operation and maintenance of blower and exhaust systems and fans for the removal of dust, vapor, and refuse, including ducts and related equipment and the disposal of materials. The function of such equipment is to protect life and property from fire, from smoke and gases resulting from fire, and from conditions having manifestations similar to fire. Ventilation of restaurant cooking equipment is covered by the Committee on Chimneys and Heating Equipment. Pneumatic conveying of combustible dusts is covered by the Committee on Dust Explosion Hazards.

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Standard for the Installation of

Blower and Exhaust Systems

for Dust, Stock and Vapor Removal or Conveying

NFPA No. 91 — 1972

100. Introduction.

101. This standard is submitted as a guide for the proper installation and safeguarding of these systems, taking into consideration the purpose for which they are intended and the functions that they are designed to perform. The object of this standard is to eliminate or reduce the known fire and explosion hazards inherent in the operation of these systems and to prevent them from becoming the means of spreading fire.

102. The design and installation of systems coming within the scope of this standard should be in the hands of competent engineers and their maintenance and operation should be in charge of reliable and experienced persons.

103. In the standards for specific industries or operations there will be found special requirements not embodied in this standard or modifications of certain of these requirements.

Definitions

BLOWER. A fan used to force air under pressure into a space.

EXHAUSTER. A fan used to withdraw air, gas, or solid materials (dust, refuse and stock) from a space under suction.

FAN. An assembly comprising blades or runners and housings or casings, and being either a blower or exhauster.

DUCTS. Pipes, channels, or other enclosures, used for the purpose of conveying air, gas, dust, refuse or other materials.

FIRE WALL. A wall having adequate fire resistance and structural stability under fire conditions to accomplish the purpose of completely subdividing a building or completely separating adjoining buildings to restrict the spread of fire.

200. General Requirements.

201. These general requirements apply to systems for removal of flammable vapors (including paint spraying residue); corrosive fumes; dust, stock and refuse conveying; except as modified or amplified by the specific rules which follow (Secs. 300 and 400) or by the standards applying to specific industries or operations.

NOTE: The following NFPA standards contain information on the application of blower and exhaust systems to specific industries or operations.

30. Flammable and Combustible Liquids Code
32. Dry Cleaning Plants
33. Spray Finishing
34. Dip Tanks
35. Organic Coatings
36. Solvent Extraction Plants
42. Pyroxylin Plastics in Warehouses
47. Lumber Storage Yards
48. Storage, Handling and Processing of Magnesium
60. Pulverized Fuel Systems
61A. Starch Factories
61B. Grain Elevators
61C. Flour and Feed Mills
62. Pulverized Sugar and Cocoa
63. Prevention of Dust Explosions in Industrial Plants
65. Aluminum Processing and Finishing
68. Explosion Venting Guide
81. Fur Storage, Fumigation and Cleaning
86. Ovens and Furnaces
88. Garages
96. Vapor Removal from Commercial Cooking Equipment
303. Marinas and Boatyards
307. Operation of Marine Terminals
409. Aircraft Hangars
481. Production, Processing, Handling and Storage of Titanium
651. Manufacture of Aluminum Powder
652. Handling Magnesium Powder or Dust
653. Coal Preparation Plants
654. Prevention of Dust Explosions in Plastics Industry
655. Prevention of Sulfur Fires and Explosions
657. Confectionery Manufacturing Plants
664. Woodworking and Wood Flour Manufacturing Plants
801. Facilities Handling Radioactive Materials

202. The design of any air moving equipment (AME) shall include adequate consideration of stock to be handled, its physical and chemical properties and its hazard classification. Two or more materials to be handled by the same AME requires further consideration by the designer to determine if the mixture of two or more materials will be compatible, such as one dust with another dust, flammable vapor with a dust, or a dust with limited amounts of flammable vapors.

203. The engineer who designs the blower system shall coordinate his plans with the architect and structural engineer with respect to construction features.

204. Maintenance Responsibility. An adequate maintenance program for all air moving equipment (AME) requires a periodic inspection over its entire length, from entrance to exhaust hood for duct system to point of discharge, including the roof area where air is discharged outdoors.

There shall be an adequate check of the entire AME, including each blower unit, its operating control panel, fume scrubbers, and especially any fire damper for proven tightness when closed, and all flexible connections to determine their tightness.

The responsibility for proper maintenance rests with each plant manager who may assign the daily work to a person trained in this type of work. Such maintenance shall include the determination that a special protection for duct systems are fully operable and that plant automatic sprinkler protection is in service.

205. Approvals, Plans and Specifications

(a) Before new equipment is installed or existing equipment remodeled, complete working plans and specifications shall be submitted for approval to the authority having jurisdiction. Plans shall be drawn to an indicated scale, and show all essential details as to location, construction, ventilation duct work, volume of outside air at standard temperature and pressure introduced for safety ventilation and control wiring diagrams. The plans shall include a list of all equipment giving manufacturer and type number, and show the following data:

Name of owner and occupant

Location, including street address

Point of compass

Ceiling construction

Full height cross section

Location of fire walls

Location of partitions

Materials of duct construction

(b) Any deviation from this standard will require special permission from the authority having jurisdiction.

206. Sections 210 through 460 apply to metal systems, while 210, 220, 230, 240, and 500 apply to plastic systems.

210. Power and Control.

211. All electrical equipment shall be installed in accordance with the National Electrical Code.

212. Motors shall be located outside of rooms in which flammable vapors or flammable dust are being generated and removed, unless of the type approved for the particular conditions or hazard. Where necessary to install switches or other electrical apparatus in areas where explosive atmospheres might be created, only such equipment as is approved for the specific conditions obtaining shall be used. See Art. 500 of the National Electrical Code.

213. Remote control of all blower or exhaust fans shall be provided, in addition to any control located close to the equipment.

220. Fans.

221. Fans shall be of noncombustible construction and of adequate capacity to properly perform the functions required. Excess capacity is undesirable as a producer of unnecessary drafts and should be avoided except where justified by the contemplated extension of operations.

222. Fans shall be so located and arranged as to afford ready access for repairing, cleaning, inspection and lubricating. They should be placed on proper foundations or firmly secured to substantial supports.

223. When flammable solid materials or vapors are passed through the fans, the rotating element shall be of non-ferrous or non-sparking material, or the casing shall consist of or be lined with such material. Where there is a possibility of solid foreign material passing through the fan that would produce a spark, both the rotating element and the casing shall be constructed as required above.

224. Housings or casings shall be of substantial construction to prevent distortion and loss of alignment under operating conditions.

225. Blades or impellers and shafting shall be sufficiently strong and designed with adequate clearance to prevent contact with

casings or prevent distortion under conditions of deposit loading or other factors.

226. Exposed openings into housings shall be protected with substantial metal screens or gratings to prevent accidents or the entry of foreign material.

227. Bearings shall be constructed in accordance with the best modern practice and shall be so proportioned, secured and aligned as to prevent overheating. Bearings shall be accessible for lubrication and shall be well designed to prevent leakage of oil and minimize dust infiltration. They shall be located outside of casings and ducts unless proper shielding and dustproofing is provided.

230. Ducts.

231. Except as provided in Section 500, ducts shall be constructed entirely of sheet metal or other noncombustible material, and of adequate strength and rigidity to meet the conditions of service and installation requirements, and shall be properly protected where subject to mechanical injury. Minimum thicknesses for metal ducts are specified in Articles 323, 421 and 422.

232. The entire duct system should be self-contained. No rooms or portions of the building shall be used as an integral part of the system unless constructed of noncombustible material, and such design and arrangement shall be subject to the approval of the authority having jurisdiction.

233. All ducts shall be made reasonably tight throughout and shall have no openings other than those required for the proper operation and maintenance of the system.

234. All ducts, whether inside or outside of buildings, shall be thoroughly braced where required and substantially supported by metal hangers or brackets. Where ducts are used for conveying explosive gases or dust, the supports shall be designed to afford strength and rigidity against disruption. All laps in the piping should be made in the direction of the air flow.

235. Changes in size of ducts shall be by means of a taper transformation piece, the included angle of the taper being not more than 30°.

236. The passing of ducts through fire walls should be avoided wherever possible (see definitions of fire wall, Section 100). When

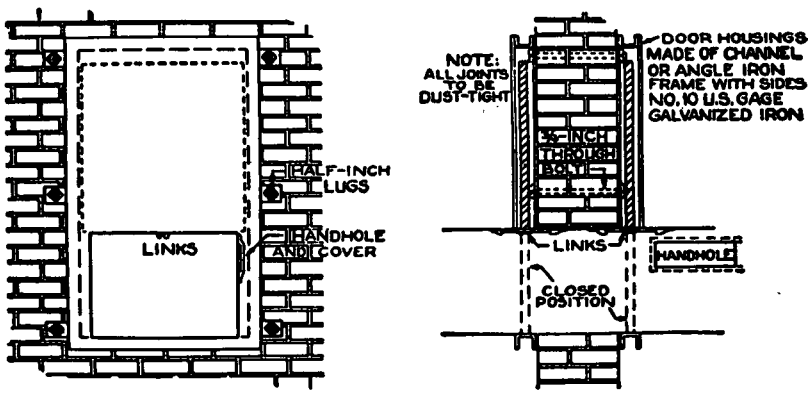

Fig. 1. Suggested type of vertical fire door for duct passing through opening in fire wall.

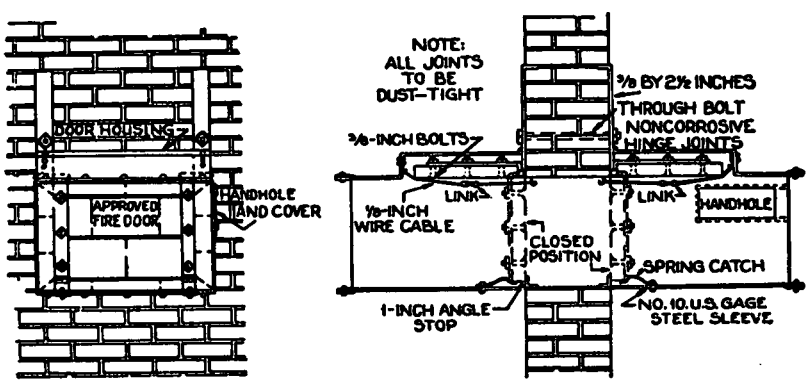

Fig. 2. Suggested type of automatic hinged fire door for duct passing through opening in fire wall.

ducts or the outlets from or inlets to them pass through fire walls, they should be provided with automatic closing fire doors on both sides of the wall through which they pass. (See Figures 1 and 2.)

Such fire doors shall be provided for the protection of openings in fire walls (Class A openings) except that for small openings not exceeding 18 inches in diameter, ⅜-inch steel plates may be used in lieu of fire doors, or fire dampers listed by a nationally recognized testing laboratory may be used in accordance with the conditions of their listing.

237. Actuation of fire doors shall be by fusible links or other approved thermal units, such units to be located on both sides of fire wall.

238. Where ducts pass through walls, floors or partitions the space around the duct shall be sealed with rope asbestos, mineral wool or other noncombustible material to prevent the passage of flame and smoke.

239. Hand holes for damper, sprinkler or fusible link inspection or resetting and for residue clean-out purposes, shall be equipped with tight fitting sliding or swinging doors provided with substantial latches, except in the case of vertical sliding doors held in place by gravity.

240. Duct Clearances.

241. All duct systems handling noncombustible materials and operating at approximately room temperature shall have a clearance of at least 6 inches from stored combustible materials, and not less than ½-inch clearance from combustible construction even though flameproofed, fire-retardant treated or plastered, except as noted in paragraphs 242 and 427.

242. Duct systems handling combustible material shall have a clearance of not less than 18 inches from combustible construction or any combustible material. The clearance to combustible construction may be reduced, provided the combustible construction is protected as described in Table I. If a duct system is equipped with adequate automatic sprinklers, clearance may be as provided in paragraph 241.

243. Duct systems operating at elevated temperatures (above 100°F) shall have clearance from combustible building construction or any combustible material not less than shown in table following:

Duct Gas Temperature	Largest Duct Dimension	Clearance
Up to 600° F. incl.	8 in.	8 in.
	Over 8 in.	12 in.
Over 600°–900° F. incl.	8 in.	18 in.
	Over 8 in.	24 in.
Over 900° F.	All ducts lined with refractories	24 in.

NOTE.—Where experience indicates that fires in duct systems are a fairly common occurrence or there is a likelihood that fires will occur, because of the very nature of the occupancy using such duct systems, a greater clearance may be required as is the case of NFPA No. 33, Spray Finishing Using Flammable Materials; and NFPA No. 96, Vapor Removal from Commercial Cooking Equipment, where a clearance of 18 inches between ducts and unprotected combustible material is required.

Ducts handling materials at temperatures in excess of 900°F shall be lined with refractory material or the equivalent.

The clearance to combustible construction for ducts handling materials not in excess of 900°F may be reduced provided the combustible construction is protected as described in Table I.

TABLE I
Clearances, Inches, with Specified Forms of Protection*

Type of Protection Applied to the Combustible Material. Thicknesses are Minimum	Where the Required Clearance with No Protection is: 8 in.	12 in.	18 in.	24 in.
a) ¼-in. asbestos millboard spaced out 1 in.†	3	6	12	18
b) 28-gauge sheet metal on ¼-in. asbestos millboard	3	6	12	16
c) 28-gauge sheet metal spaced out 1 in.†	2	4	9	12
d) 28-gauge sheet metal on ⅛-in. asbestos millboard spaced out 1 in.†	2	4	9	12

*All clearances shall be measured from the surface of the duct to combustible material disregarding any intervening protection applied to the combustible material.

†Spacers shall be of noncombustible material.

250. Protection Against Static Electricity.

251. All metal parts of apparatus, used in systems for the removal of flammable gases or vapors, or systems used for conveying com-

bustible or flammable dust, stock or refuse, considered in these requirements, including fans, ducts, etc., as well as shafting in connection therewith, shall be electrically bonded and grounded in an effective and approved manner. (See NFPA No. 77.)

252. When metallic contact is broken at duct joints or at other points on the installation assembly, metallic straps, preferably of copper, shall be installed where necessary to afford effective bonding connections.

253. When systems are used for the handling of flammable gases or vapors or combustible or flammable dust, stock or refuse, static electricity shall be removed from belts by grounded metal combs or other effective means. (See recommendations of NFPA No. 77.)

260. Fire Extinguishing Apparatus, Manual and Automatic.

261. The provision of automatic or special extinguishing equipment for systems handling flammable vapors or combustible materials should be subject to the approval of the authority having jurisdiction. Details of such systems are set forth in following sections covering specific materials being handled.

300. Systems for Removal of Flammable Vapors.
(Including Paint Spraying Residue.)

301. Where systems of this class are installed, the following rules and the preceding general rules except as modified herein shall apply.

NOTE.—See paragraph 201.

302. Due to the hazardous nature of the vapors to be removed, it is important that they be withdrawn from the rooms or equipment in which they are generated and taken to the outside of the building in the most direct manner possible. Processes generating such flammable vapor should be located along an outside wall of of the building to facilitate efficient vapor removal. No ducts or other portions of any vapor removal system should extend into stories or rooms of a building other than those from which the vapor is being removed. Exhaust outlets to atmosphere should extend above or away from surrounding structures to prevent accumulation of combustible residues on such structures.

310. System Design.

311. In the design of any vapor removal system, control at the point of generation should be provided wherever possible. Such

systems will consist of hoods or enclosures connected to suction ducts. They are more positive and require lower exhaust volumes than general ventilation through remote suction openings.

312. When flammable vapors are so generated that they cannot be readily picked up at the source, general ventilation through a system of suction ducts with inlets to the room or area may be employed. As suction inlets have but little directional effect beyond a few inches from the face of the inlet, such inlets should be located to best produce a sweeping or purging effect that will tend to avoid pockets in which vapors may accumulate. An air supply system properly located with reference to point of vapor generation and exhaust openings will be beneficial in vapor dilution and removal.

313. Where heavier than air vapors or mixtures are handled, exhaust openings located near the floor line will be more effective. This is particularly true when exhaust system is not in operation and its stack effect is utilized to remove any residual material. Conversely for vapors or mixtures lighter than air, exhaust system inlets should be located near the top of room, hood, or enclosure.

314. Outlets to atmosphere shall be kept clear of and away from any combustible material.

320. Ducts.

321. Ducts installed under this classification shall be independent structures, and not built in the walls. Exhaust ducts should lead to the outside of the building as directly as possible, and never through intermediate rooms.

322. The installation of dampers, valves and shutters in this type of system is not ordinarily advisable, except where necessary at outlets to afford weather protection when the system is shut down or where such devices are used for the final balancing of the exhaust system. In such cases the dampers shall be securely locked to prevent further manipulation.

323. Ducts shall be so constructed as to provide structural strength and stability at least equivalent to sheet steel of not less than the following thicknesses:

In Greatest Dimension	
Up to 8 in. incl.	No. 24 U. S. gauge
Over 8 in. to 18 in. incl.	No. 22 U. S. gauge
Over 18 in. to 30 in. incl.	No. 20 U. S. gauge
Over 30 in.	No. 18 U. S. gauge

324. Material for duct lining should have a fire hazard classification of 0 when tested in accordance with the Method of Test of Surface Burning Characteristics of Building Materials, NFPA No. 255 or UL 723.

325. No dissimilar matter shall be handled through one exhaust system when the intermingling or contact of one type of material with another would create a fire or explosion hazard in the duct system, collection unit or air flow producing equipment. Operations generating sparks, such as from hot materials or grinding wheels, shall not be consolidated in the same exhaust system that handles flammable or explosive matter.

330. Fire Extinguishing Apparatus, Automatic or Manual.

331. In systems used for the removal of flammable vapors or gases, the installation of an approved fixed pipe system for the application of water, dry chemical, or inert gas is recommended, as conditions warrant. Such systems may be automatically or manually controlled, as required by the authority having jurisdiction. (See Standard for the Installation of Sprinkler Systems, NFPA No. 13, Standard for Water Spray Fixed Systems, NFPA No. 15, Standard for Carbon Dioxide Fire Extinguishing Systems, NFPA No. 12, Standard for Dry Chemical Extinguishing Systems, NFPA No. 17, and Standard on Explosion Prevention Systems, NFPA No. 69.)

400. Dust Collecting Systems; Stock and Refuse Conveying Systems.

401. Where systems of this class are installed, the following rules and the preceding general rules except as modified herein shall apply: (See paragraph 201.)

402. These systems consist of suction ducts and inlets, airflow producing equipment, feeders, discharge ducts and outlets, collecting equipment, vaults and other receptacles, designed to collect by air or gas, powdered, ground or finely divided material.

410. General.

411. Systems collecting highly flammable or explosive dust preferably should be so arranged that the fan is on the clean air side of the collector.

412. Conveying systems for cotton and similar textile materials which are readily ignitable shall be arranged so as not to create suction in machines producing the material.

413. Rooms or bins into which readily ignitable material is discharged by a collecting or conveying system should be of noncombustible material. Such rooms or bins shall be provided with vents, preferably leading to outside the building.

414. Dust collecting systems from grinding and other machines which may produce sparks shall not be combined with collecting systems handling linty or other readily flammable dusts.

415. The use of a trap at the junction of a hood or a branch duct may be permitted by the authority having jurisdiction provided it is not permitted to fill up with dust.

416. Approved magnetic separators of the permanent magnet or electromagnetic types should be installed at those points where combustible materials which may contain ferrous particles enter the system. The separators shall be of sufficient size to insure the removal of all ferrous materials passing over them.

417. Readily ignitable materials should not pass through the fan unless the fan is constructed and installed in accordance with Section 220. Systems handling these materials should be operated entirely under suction with suitable equipment for removing the stock from the air stream before it reaches the fan.

418. Where practical inert gas should be used to create safe atmospheres within the system or parts of the system, especially those handling exceedingly fine stock. (See Explosion Prevention Systems, NFPA No. 69.)

420. Ducts.

421. Metal ducts shall be constructed of sheet steel of not less than the following gauges.

Diameter of duct, inches	U. S. Standard Gauge	
	Non-Abrasive Materials	Abrasive Dusts
Up to 8 inclusive	24	20
Over 8 to 18 inclusive	22	18
Over 18 to 30 inclusive	20	16
Over 30	18	14

Buried ducts may be of concrete or ceramic materials, cast iron, or cement-asbestos and shall also comply with Section 231.

422. All sheet metal elbows and bends shall be made from material at least two (2) gauges heavier than is required for straight

duct-work of the same diameter except that for No. 14 gauge and heavier, the elbows and straight duct-work may be of the same gauge.

423. Round sheet metal elbows should be of at least five-piece construction for ducts six (6) inches in diameter or less and of seven-piece construction for larger ducts, with a throat radius equal to one-half (½) to two (2) times the duct diameter unless space prohibits the use of such long bends. In place of long radius elbows specified above, rectangular elbows, venturi-shaped elbows or other bends of equivalent low-resistance design may be used.

424. The main suction duct should receive only one branch in a section of uniform area, whenever space permits, and in no case shall it receive more than two branches in such a section.

425. The inlet of the fan or exhaust should be at least 20 per cent greater in area than the sum of the areas of all of the branch ducts, and such increase shall be carried proportionately throughout the entire length of the main suction duct, i.e., the area of the main duct at any point shall be at least 20 per cent greater than the combined areas of the branch ducts entering it between such point and the tail end, or dead end of the system.

426. Every branch duct should connect with the main duct at top or side at an angle not exceeding forty-five (45) degrees, inclined in the direction of the air flow.

427. The main suction and discharge ducts should be made as short as practicable. To provide access for sweeping and cleaning, ducts should not be less than 6 inches above the floor at every point, and not closer than 6 inches at any ceiling.

428. Every duct shall be kept open and unobstructed throughout its length, and no screen shall be placed in it. The use of a trap may be permitted by the authority having jurisdiction.

429. Main ducts of systems handling materials which form an explosive mixture with air should be run on the outside of the building where practicable with ducts from each operation and each floor passing out directly through the wall and discharging into the main duct. All ducts shall be adequately supported.

430. Additional branch ducts should not be added to an existing system without redesigning the system. Branch ducts should not be disconnected nor unused portions of a system be blanked off without providing orifice plates to maintain required airflow.

440. Separating and Collecting Equipment.

441. This includes cyclones, condensers, cloth screen and stocking arrestors, centrifugal collectors and other devices used for the purpose of separating solid material from the air stream in which it is carried and hoppers, bins, silos and vaults for collecting the solid material so separated.

442. Separating and collecting equipment should be designed and constructed to withstand anticipated explosion pressures, due consideration being given the reduction in pressure afforded by adequate explosion relief vents.

443. Separating or collecting equipment should be outside the building when conditions permit, and so located as to constitute a minimum hazard to adjacent structures. Their construction shall be of steel or steel enclosed. Supports shall be of steel, masonry or concrete and the structure securely anchored to resist anticipated wind pressures. It is recommended that clean-out doors be provided. Separating or collecting equipment should be located at a safe distance from combustible construction or unprotected openings into buildings.

444. All collectors which must be located indoors and cannot be constructed of sufficient strength to resist maximum calculated explosion pressure should be located close to exterior walls to facilitate explosion relief venting.

445. Discharge ducts shall not come in contact with nor expose combustible material and should terminate above the roofs if within 10 ft. of building of combustible construction or unprotected openings.

446. Delivery ducts from cyclone collectors should not convey refuse directly into the fireboxes of boilers, furnaces (including Dutch ovens), refuse burners, incinerators, etc.

447. Delivery of stock from separator, cyclone or other collection equipment to storage receptacles should be accomplished by means of gravity through tightly fitted ducts.

448. Where refuse is to be used as fuel, the discharge system from the storage receptacle or intermediate feed bin should be so designed that either by means of a choke feeder or choke conveyor, a positive cut-off is provided to prevent a flash-back from the furnace. The installation of a steam spray in the duct to the furnace, blowing steam in the direction of the fluel flow is recommended, as it provides an added safety factor in preventing a flash-back.

449. Small scale dust collecting equipment may, by permission

of the authority having jurisdiction, discharge into a substantial metal box preferably located outside the building.

450. Explosion Relief Venting.

451. Explosion relief vents should be provided on all duct systems used for conveying materials which form an explosive mixture with air. Explosion vents shall have a cross sectional area not less than the cross sectional area of the duct vented. Vents should be provided where direction of flow is changed and at the maximum elevation in the system.

452. Explosion relief vents for ducts should lead by the most direct practical route to the outside of the building and should not deviate more than 22½ degrees from the direction of the duct from which they lead. Such vents shall not pass through adjoining buildings unless designed to resist maximum explosion pressure.

453. Storage bins or other receptacles which contain materials which form an explosive mixture with air shall be provided with adequate explosion relief vents. (See Fig. 3.)

454. Explosion relief vent openings shall be provided with rupture diaphragms fitted with cutters to accelerate rupture or equivalent means of relieving pressure. Where necessary, the discharge opening of the relief vent may be suitably protected against the weather. (See Fig. 3.)

455. Explosion relief vents shall not be connected to chimneys or duct systems used for other purposes.

460. Fire Extinguishing Systems.

461. The buildings or rooms in which the storage processing and handling of combustible material are conducted should be protected by a system of approved automatic sprinklers and shall be equipped with approved portable fire extinguishers, together with approved small hose. (See Standards for Sprinkler Systems, NFPA No. 13, Standpipe and Hose Systems, NFPA No. 14, and Portable Fire Extinguishers, NFPA No. 10.)

462. Inert gas may be effectively used to create safe atmospheres in conveying systems.

463. Equipment of large volume in which pulverized stock is stored or may accumulate, such as bins, dust collectors, etc., should be protected by automatic sprinklers or fixed pipe inert gas extinguishing systems, or both.

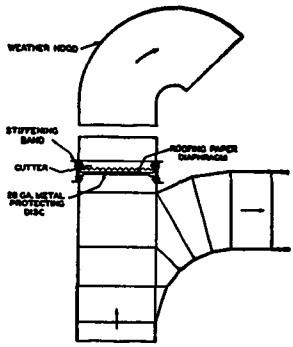

Fig. 3 — Suggested method of explosion relief vent suitable for use at duct turns, at storage bins or other receptacles. The thin metal protecting disk shown beneath the rupture diaphragm serves to prevent abrasion of the diaphragm, and upon operation of the device will blow free.

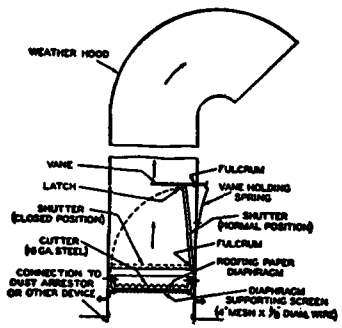

Fig. 4 — Suggested form of providing explosion pressure relief for large sheet steel enclosures such as dust collectors. The automatic shutter is provided to close the opening after the pressure has been safely relieved to atmosphere in order that efficient extinguishment of the resulting fire with CO_2 may be assured. The area of the explosion vent required is determined by the nature of the stock handled, the strength of the device to be protected, the rupturing strength of the diaphragm, the length and characteristics of the relief duct to atmosphere, etc. The diaphragm saw-tooth cutter shown is readily constructed and greatly reduces the bursting pressure required.

NOTE: The vent area for effective relief of explosion pressure will depend on various factors including the properties of the dust, the shape and strength of the structure or equipment, and the location and type of the vent used. In the absence of more specific data, the following are recommended:

For mild explosion hazards
1 sq. ft. for each 100 cu. ft.

For moderate explosion hazards
1 sq. ft. for each 50 cu. ft.

For severe explosion hazards
1 sq. ft. for each 15 cu. ft.

NOTE: If fixed pipe inert gas extinguishing systems are used, it is important that means be provided to automatically close all openings to the enclosure involved, including rupture diaphragm vent openings, also to shut down all blowers in connection therewith in order to confine the extinguishing agent and prevent the spread of fire. (See Fig. 4.)

464. Small hand hose connections, with adequate hose and nozzles or water-spray applicators, should be provided and properly located for use in manually extinguishing smoldering stock fires.

500 Plastic Systems for Removal of Nonflammable Corrosive Fumes and Vapors

510. General

5101. Duct systems of plastic material may be used to handle only nonflammable corrosive fumes and vapors when conventional metal duct systems will not be adequate. The choice of the type material is the responsibility of the design engineer, but contained herein are minimum standards of materials, construction, and workmanship deemed necessary to insure minimum fire hazard in the operation of these systems. All chemical resistant plastics have heat limitations which must be considered when designing a system.

5102. The plastic shall have a flame spread rating of 25 or less as measured in accordance with NFPA No. 255, Standard Method of Test for Surface Burning Characteristics of Building Materials (UL-723, ASTME-84-69).

5103. Plastic duct material used in multistory buildings or which run through concealed spaces other than fire-rated vertical shafts shall have a smoke developed rating of 50 or less, unless the duct system is protected externally by an approved automatic sprinkler system.

5104. System Components. In order to avoid misunderstandings caused by different terminology in various parts of the country and within the air handling industry, the following components of a typical industrial exhaust system and a typical laboratory fume hood exhaust system are described by diagrammatical reference to the numbered and lettered components listed below, shown in Figures 5, 6, 7, and 8;

A. Equipment
   1. Cabinet type laboratory fume hood
   2. Bench type laboratory fume hood
   3. Filter box for special or high efficiency filters
   4. Shaft

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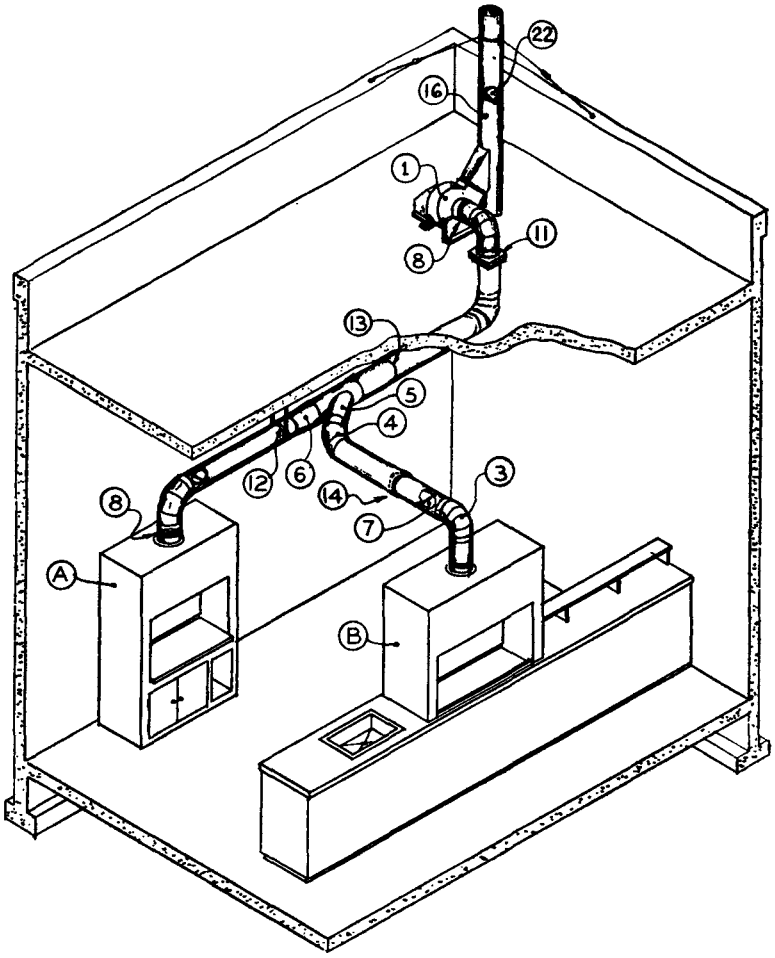
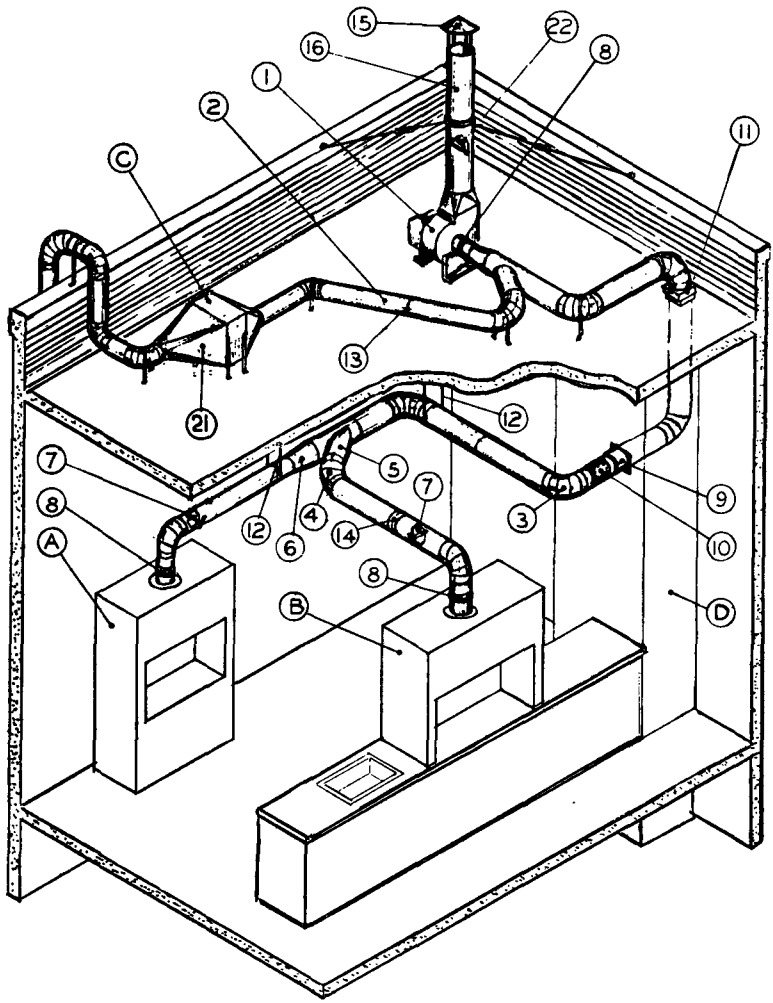


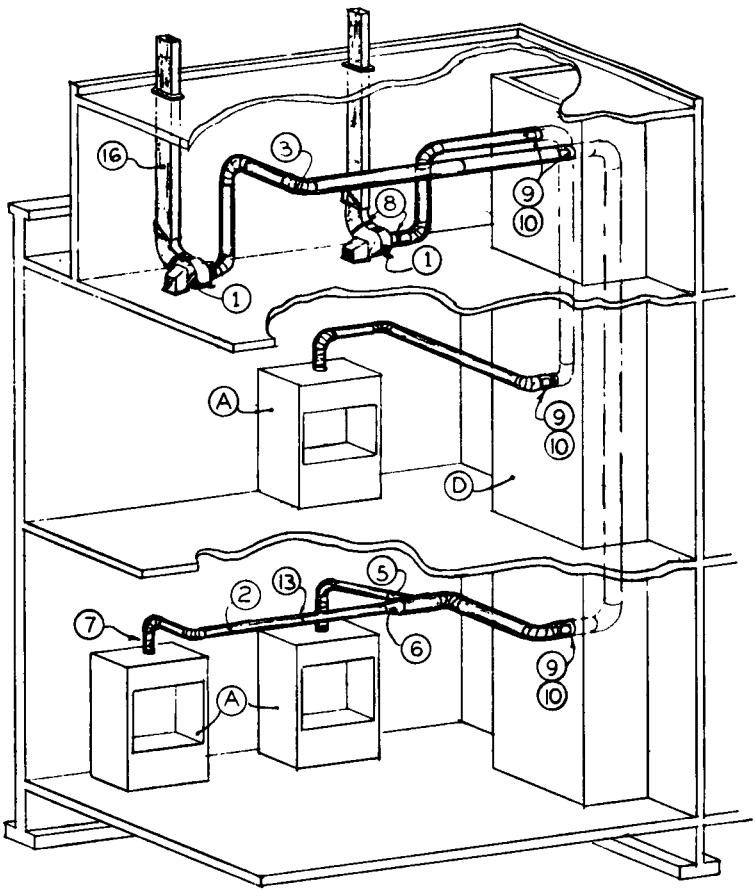
See Legend in Par. 5104.

Fig. 5. Rooftop exhaust system for one-story building occupied by a cabinet type laboratory fume hood and bench type laboratory fume hood.



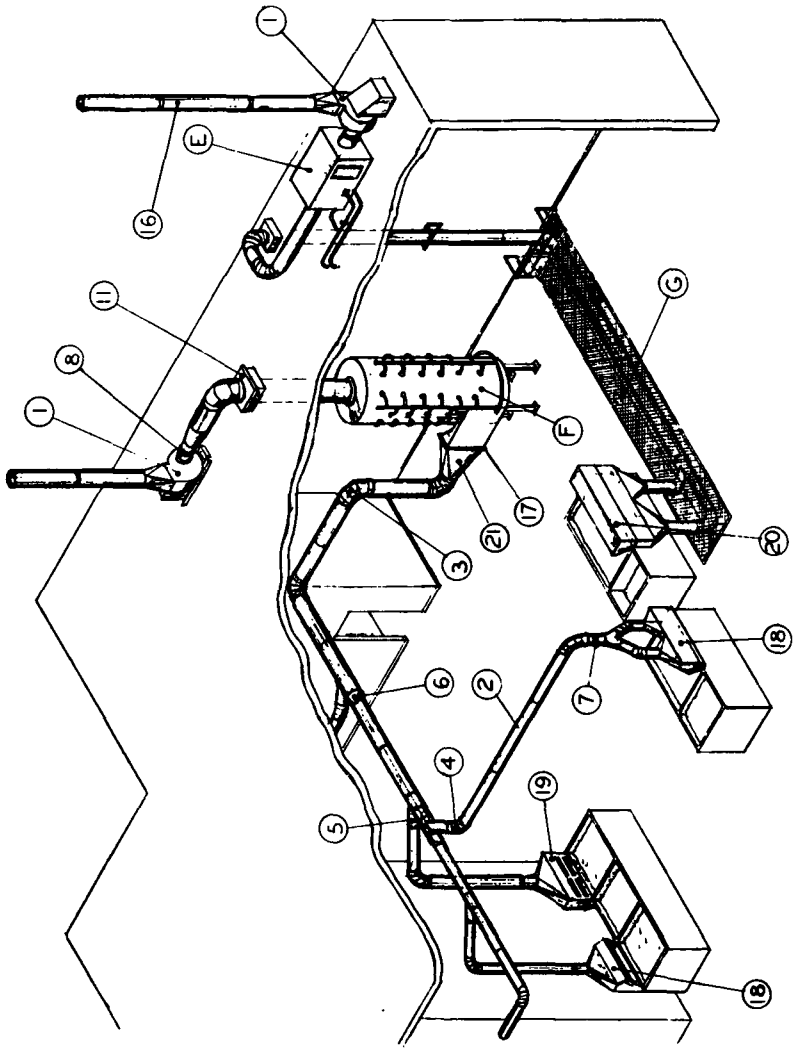
See Legend in Par. 5104.

Fig. 6. Exhaust system with filter box for multistory building occupied by a cabinet type laboratory fume hood and bench type laboratory fume hood.



See Legend in Par. 5104.

Fig. 7. Internal exhaust system for multistory building occupied by cabinet type laboratory fume hoods.



See Legend in Par. 5104.

Fig. 8. Exhaust system for one-story building occupied by various type fume hoods with vertical type fume scrubber and service trench.

5. Horizontal type fume scrubber
6. Vertical type fume scrubber
7. Service pit or trench

B. System Components

1. Air Moving Equipment (Centrifugal type exhaust fan)
2. Horizontal duct section
3. 90° Elbow
4. Elbow (less than 90°)
5. Lateral Entry
6. Transition
7. Manual Balancing Damper
8. Flexible Connection
9. Fire Damper
10. Access Door
11. Counterflashing
12. Duct Hanger
13. Circumferential Girth Joint (Butt Welded)
14. Bell end duct seam
15. Weather Cap
16. Fan discharge stack
17. Flanged duct connection
18. Open face tank exhaust hood (updraft)
19. Slotted face tank exhaust hood (updraft)
20. Open face tank exhaust hood (downdraft)
21. Round to rectangular (or square) Transitional Fitting
22. Gravity operated back draft damper

5105. Installation. The ducts shall lead to the outside as directly as practicable. They shall not penetrate fire walls or fire rated floors. When penetrating a fire rated shaft wall or fire partition, the opening shall be protected by a fire damper, protected against corrosion from the agent being conveyed.

5106. Manifold systems shall be limited to 50,000 cfm (cubic feet per minute) capacity, except when special process engineering considerations necessitate larger manifolded systems. Such systems shall be designed by a registered professional engineer.

5107. Flexible Connections. Vibration isolation between ductwork and air moving equipment can be accomplished by flexible connections at the inlet and discharge of the equipment. Corrosion resistance, smoke developed rating, and flame spread rating of these connections shall be equal to that of the material of the duct system.

5108. All hoods and air moving equipment (AME) which are part of the system shall have flame spread rating equal to the material of the duct system. Design and workmanship shall meet all physical requirements and shall conform to the general sections of this standard.

5109. Fire Protection. Automatic protection shall be provided at the duct intake, hood, canopy and the immediate areas thereof to quickly extinguish source fires. (See NFPA Nos. 11, 12, 15, and 17.)

Sensing elements provided at these aforementioned sources shall be arranged to shut down the blower system. This automatic shutdown may be waived if fire control can be improved through continued operation.

5110. Identification. Plastic duct components shall be identified as to the manufacturer, type of material, flame spread rating, and smoke-developed rating.

5111. Maintenance Responsibility. After a system is installed and turned over to the owner or operator, it is important that the system is maintained in good operating condition. This responsibility entails periodic checks of all components at least twice each year. Check out shall include at least the following parts of the system:

Hood face velocity for all types of hoods

Clean filters in filter boxes

Proper function of fume scrubbers