Regulations for the

Installation of Blower and Exhaust Systems

For Heating and Ventilating, Removal of Flammable Vapors, and Conveying of Dust, Stock and Refuse

Prepared by N. F. P. A. Committee on Blower Systems for Heating, Ventilating, Stock and Refuse Conveying;
Adopted by National Fire Protection Association, 1933.

AMERICAN STANDARD
Approved January 31, 1935
by American Standards Association

Price ten cents

National Fire Protection Association
International
60 BATTERYMARCH STREET
BOSTON, MASS.

1935

National Fire Protection Association

International

COMMITTEE ON BLOWER SYSTEMS FOR HEATING, VENTILATING, STOCK AND REFUSE CONVEYING.

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HISTORY

The National Fire Protection Association as early as 1899 (Proceedings 1899, page 102), recognized the fire hazard of blower and exhaust systems as a source of fire or means of spreading fire. Reports of the N.F.P.A. Committee on Blower Systems presented in 1900 and 1901 (Proceedings 1900, page 70; 1901, page 44) outlined methods for safeguarding this hazard. With the increasing use of blower and exhaust systems, the need for a more detailed standard for the installation of these systems became apparent, and work was started in 1913 which resulted in the adoption in 1915 of the first edition of the present standard (Proceedings 1913, page 280; 1914, page 203; 1915, page 46). Since that time the committee has given continuing attention to this subject and at frequent intervals has made revisions to meet new developments. The most important of such changes was the addition in 1924 of a new section to cover systems for the removal of flammable vapors. Record of the adoption of amendments by the National Fire Protection Association will be found in the annual Proceedings. The present text includes the latest amendment adopted in 1932 (Proceedings 1932, page 292).

This standard has been widely circulated and applied through its adoption and publication in successive editions as the Regulations of the National Board of Fire Underwriters.

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NOTE

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The present text is the same as that of the 1929 edition, adopted by the N.F.P.A. and published by the National Board of Fire Underwriters, with revisions in rules 105, 153, 210 (c), 231, 414, 427, 436 and 464.

In these regulations the following words are used as defined below:

SHALL is intended to indicate requirements.

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

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REGULATIONS
for the Installation of
BLOWER AND EXHAUST SYSTEMS.
For Heating and Ventilating, Removal of Flammable Vapors, and Conveying of Dust, Stock and Refuse.

Introduction.

101. Blower and exhaust systems constitute fire hazards in themselves or introduce hazards contributing to the causes and the spread of fires, even though they are properly located, installed and safeguarded.

102. These regulations are prepared as a guide for the proper installation and safeguarding of these systems, taking into consideration the purposes for which they are intended and the functions which they perform. The object of these regulations is to eliminate or reduce the fire and explosion hazards inherent in these systems and to prevent them from becoming the means of spreading fires.

103. The design and installation of such systems should be in the hands of competent engineers, and their maintenance and operation should be in charge of reliable persons.

104. These requirements are not intended to cover portable exhaust (vacuum) systems. The underlying principles, however, apply to them.

105. In the regulations of the National Fire Protection Association for specific industries or operations there will be found special requirements not incorporated in these regulations, or modifications of certain of these regulations. The Regulations for Blower and Exhaust Systems should be consulted in connection with these regulations.

Wherever the requirements of these regulations differ from the legal requirements, the latter shall apply.

Note—Attention is called to the following regulations governing special industries, operations or processes to which the Regulations for the Installation of Blower and Exhaust Systems apply as modified therein.

Finishing Processes.
Paint Spraying and Spray Booths.
Pulverizing Systems for Sugar and Cocoa.
Installation of Pulverized Fuel Systems.
Prevention of Dust Explosions in Terminal Grain Elevators.
Prevention of Dust Explosions in Flour and Feed Mills.
Prevention of Dust Explosions in Starch Factories.
Dry Cleaning and Dry Dyeing Plants.
Garages.
Hangars.

Classes.

106. Blower and Exhaust Systems covered by these regulations are divided into three classes:

A. Heating and Ventilating Systems.
B. Systems for Removal of Flammable Vapors.
C. Dust, Stock and Refuse Conveying Systems.

GENERAL REQUIREMENTS.

110. **Fans.**

111. The term fans as used in these regulations refers to both runners and housings or casings, and includes both blowers and exhausters.

Under the intent of these regulations: Blowers are fans used to force air into the affected area and work under pressure.

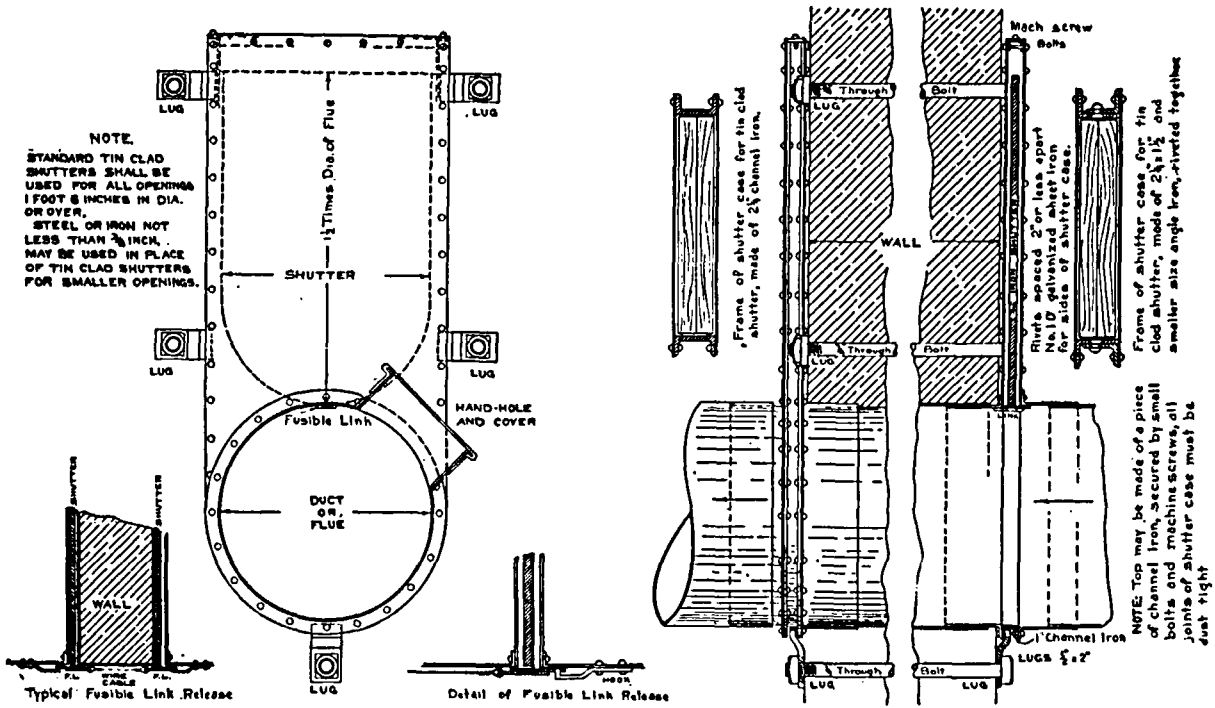

FIG 1.—SUGGESTED TYPE OF VERTICAL DUCT SHUTTER FOR OPENINGS IN FIRE WALLS.

Exhausters are fans used to withdraw air, gases, vapors or solid materials (dust, refuse or stock) from the affected area and work under vacuum.

112. Fans shall be so located and installed as to be readily accessible for repairing, cleaning, inspecting and lubricating. Fans may be either direct connected or belt driven.

Fans shall be installed on proper foundations or otherwise firmly secured to substantial supports, and constructed throughout of non-combustible materials.

The location and installation of fans shall be subject to the inspection department having jurisdiction.

113. Housing (enclosure or casings) shall be of substantial construction, properly reinforced when required; joints shall be air tight.

114. Runners shall be of sufficient size and capacity to perform the required duty without the necessity of overspeeding.

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

116. Bearings shall be constructed in accordance with the best modern practice and shall be so proportioned, secured and aligned as to prevent overheating. The bearings shall be self-lubricating and shall be so designed as to prevent leakage of oil and shall be dust tight. Bearings should be located outside of casings or ducts wherever possible and shall be located outside of same wherever specifically required in these regulations.

120. Ducts.

121. The term ducts shall refer to passages or channels used for the purposes of conveying air, gases, dust, refuse or other materials by means of blower or exhaust systems.

122. Ducts may constitute a part of the structure or may be independent thereof; they shall be constructed of fire-resistive or non-combustible materials or be protected in an approved manner by means of fire-resistive materials as may be designated in the regulations relating to specific industries or operations.

123. The entire system of ducts shall be self-contained; no rooms, hallways, attics, hollow or concealed space, voids nor other portions of the building shall be used as any part of the system unless it is an integral part thereof used for no other purposes, and constructed of or adequately protected by fire-resistive materials.

124. All ducts shall be tight throughout and no openings shall be permitted except those necessary to perform the required functions of the system.

125. All ducts shall be so proportioned and designed as to adequately perform the duty for which intended.

126. Metal ducts shall be constructed of materials of ample strength and thickness to meet the conditions of the service for which used and the conditions under which installed. The thickness of the metals shall be increased proportionately with the diameter of the ducts.

127. All ducts shall be thoroughly braced where required, and unless built within masonry work shall be substantially supported by metal hangers, brackets or their equivalent.

128. Where subject to mechanical injury ducts shall be properly protected.

129. The passing of ducts through fire walls should be avoided wherever possible. When ducts or the outlets from or inlets to same pass through fire walls they shall be provided with approved automatic fire doors or shutters, on both sides of the wall through which they pass. (See figures 1, 2 and 3.)

Note—Under certain conditions doors or shutters normally closed, and opening only in the direction of the pressure, i. e., self-closing doors or shut-

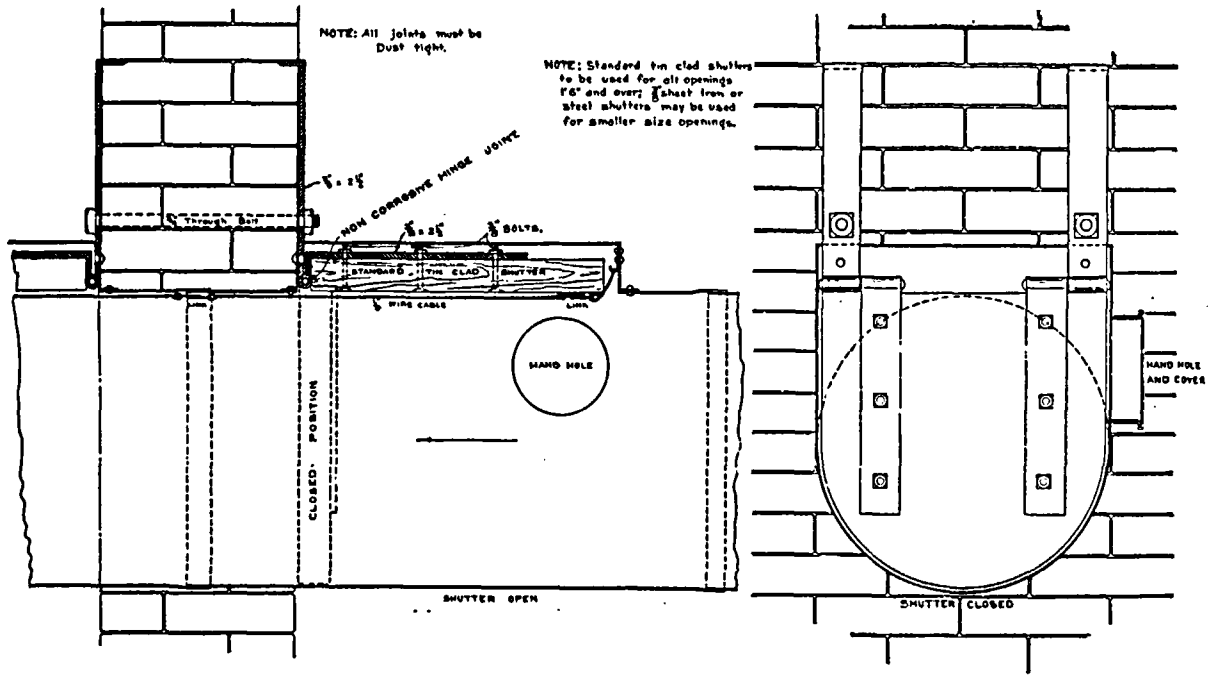

FIG. 2.—SUGGESTED TYPE OF AUTOMATIC HINGED DUCT SHUTTER FOR OPENINGS IN FIRE WALLS.

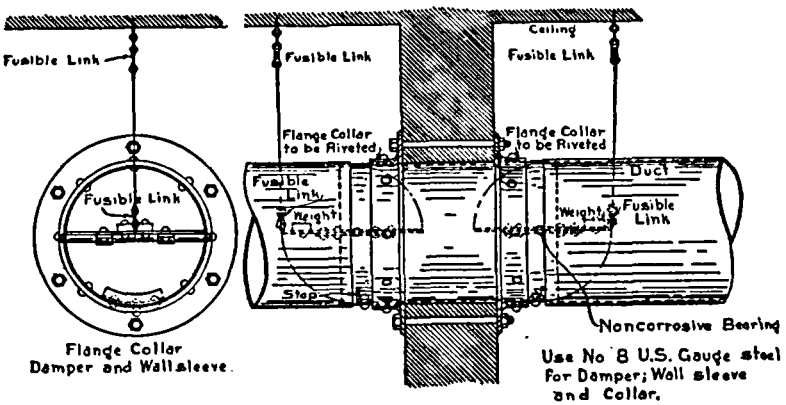

Fig. 3. Suggested type of Automatic Dampers for Duct Openings Not Over 12 in. in diameter in fire walls.

ters, acting as dampers, may be advisable or preferable, and may be substituted by permission of the inspection department having jurisdiction. These dampers shall not be permitted in fire wall openings. They are intended and permitted as guards against back pressure.

130. Approved heat actuated devices shall be located where most readily affected by a rise in temperature inside of the ducts, and in addition thereto on the outside, if the conditions permit or warrant. Such devices shall offer no obstruction to the passage of materials.

131. Joints between ducts and floors, walls or partitions, shall be made tight by means of non-combustible material.

140. Power and Control.

141. If power is by means of electricity the electrical equipment shall be throughout in accordance with the National Electrical Code.

142. Motors, if used in connection with systems for the removal of flammable vapors (Class B) or for the removal of flammable dust (Class C) should preferably be located outside of the room from which such vapors or dust are being removed.

Note—It is recommended that where practicable motors, switches, cut-outs and controlling devices be not installed in locations where the atmosphere is charged or is liable to be charged with flammable vapors or where the circumstances are such that explosive conditions may result.

143. The selection of the type of motor suitable to the varying conditions and the manner of installation shall be subject to the approval of the inspection department having jurisdiction.

144. Remote control shall be provided in all cases in addition to any control that may be provided within the room.

145. Where required, the systems shall have an emergency control to shut them down in case of fire. This may be done manually or automatically by means of devices utilizing approved thermostats, automatic sprinklers or other heat actuated devices. Automatic control systems are recommended.

Note—It is recommended that fans be driven independently of other machinery. Such installations shall be subject to the approval of the inspection department having jurisdiction.

146. Power Transmission. (a) Where power is transmitted to fans located within the rooms from which flammable vapors are being removed, from any driving mechanism or unit outside of same, the transmission shall be by means of shafts passing through close fitting shaft holes.

(b) The transmission of power to fans located within rooms from which flammable dust is being removed shall be by means of shafts as required herein, or by means of belts, chains or similar driving mechanisms, provided the same are encased by means of dust-tight enclosures constructed of substantial non-combustible materials both on the inside and outside of the wall or partition pierced.

150. Protection.

151. GROUNDING. All metal parts of apparatus, used in systems for the removal of flammable gases or vapors, or systems used for conveying combustible or flammable dust, stock or refuse, considered in these requirements, including fans, ducts, etc., as well as shafting in connection therewith, shall be electrically grounded in an effective and approved manner.

152. Whenever satisfactory metallic contact cannot be effected or maintained at joints or between different portions of the apparatus, so as to insure an uninterrupted electrical connection to "ground," copper bands properly and securely attached shall be provided.

153. Belts shall be grounded by means of metallic collectors connected to heavy insulated wires carried to ground, or other safe and effective methods shall be provided to prevent the accumulation of static electricity.

155. AUTOMATIC SPRINKLERS. Where automatic sprinklers are required in conveying systems handling combustible material, there shall be approved sprinkler heads near the feed end and at the discharge outlet, inside the condenser, cyclone or separator if such is used, and also a sprinkler to protect the blower. In cyclones or other conveying apparatus outside of building, sprinklers may be manually controlled. In some cases, sprinklers may be installed inside the ducts. Such sprinklers should be arranged in an offset or dome-shaped casing and not in the direct path of the draft.

156. In systems for the removal of flammable vapors or gases, the use of fire extinguishing or inert gases for fire extinguishing purposes is recommended. These extinguishing mediums may be controlled either automatically or manually.

157. Vaults shall be protected by approved automatic sprinklers. Where such protection is not available, steam jets may be installed or other approved fire protection may be used.

158. To avoid diffusion of dust, when removing contents of vaults, there shall be hand operated spray nozzles, inside the vault, over vault door opening; also approved hand hose shall be provided, outside the vault, near the vault door.

159. An adequate equipment of first aid fire appliances, together with small hose, shall be be provided. (See Regulations for First Aid Fire Appliances.)

CLASS A.

HEATING AND VENTILATING SYSTEMS.

201. DEFINITION. These systems are frequently used for cooling purposes as well as for heating and ventilation. Since these functions are interchangeable the requirements are applicable to cooling systems as well as to heating and ventilating systems.

202. When systems are used exclusively for cooling purposes these regulations shall apply in so far as passages through floors, walls and partitions are concerned and to the required protection of such passages.

203. In addition to the specific requirements for this class the general requirements shall apply.

210. Heating and Ventilating.

211. (a) Intake of air shall be from the outside except in recirculating systems, and shall be taken only from areas containing no combustible

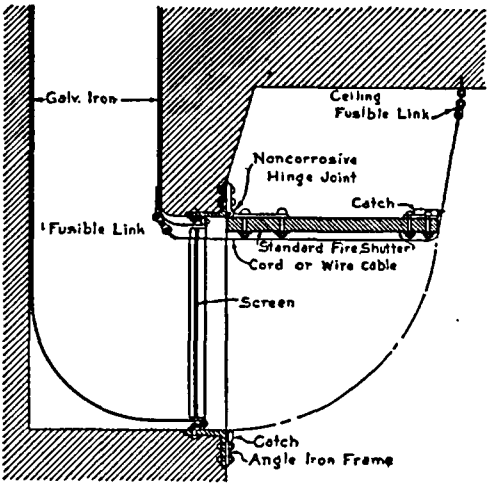

Fig. 4. Suggested Type of Automatic Shutter at Outlet Openings.

materials. Intakes shall be protected by suitable metal screens and substantial automatic shutters or doors.

(b) In no case shall recirculating systems be so designed or installed as to permit the passage of air through or the entry of air from any department, section or room in which operations or processes are carried on that produce or result in flammable vapors, flyings or dust.

(c) When oil is used in air filters for the purpose of eliminating impurities it shall have a minimum flash point of 300° F.

When such filters are of the immersion type, where the oil tanks into which the screens are lowered constitute a part of the apparatus, the tank shall be of substantial metal construction and shall be tight and be kept tight when not in use for the immersion of the screens. They shall be provided with suitable drains to discharge their contents either to the outside of the building or into a closed tank of substantial construction vented to the outside of the building.

When the screens are removed for the purposes of cleaning, the cleaning shall be done either in a separate fire-resistive room of the approved oil room type of construction, or outside of the building in an addition used for no other purpose and cut off in an approved manner, or in a detached building which does not constitute an exposure to any other portion of the plant.

When such filters are of the flush or self-cleaning type, i.e., systems in which the oil might be distributed over *fixed* screens, while the ventilating fan is in operation, the controls of the oil supplies to the screens and the motive power of the ventilating fan shall be so interlocked as to prevent the operation of both at the same time.

(d) Intake and intake rooms, steam coils, blowers, etc., shall be segregated, cut off by substantial non-combustible walls or partitions and ceilings from other portions of the building. Openings into such rooms shall be protected by automatic doors of similar or equivalent construction.

212. Outlets on supply and exhaust ducts shall be provided with registers, register faces or substantial screens of wire or expanded metal of not more than one inch mesh.

213. In no case shall the clearance between metal ducts and combustible material be less than one inch. Any combustible material within six inches of such ducts shall be protected by means of incombustible material.

214. All ducts passing through and in contact with unprotected combustible floors shall be made of approved fire-resistive material, not less than 4-inch brick, 6-inch hollow tile, 2-inch solid Portland cement plastered partitions with substantial steel reinforcement, or their equivalent. (See General Requirements, 120.)

215. When vertical ducts within the same fire area serve more than one floor substantial and reliable automatic dampers shall be provided on all outlet openings directly from such vertical ducts and at all connections at branch ducts from such vertical ducts. Bearings of such dampers shall be of non-corrodible materials. (See figures 4 and 5.)

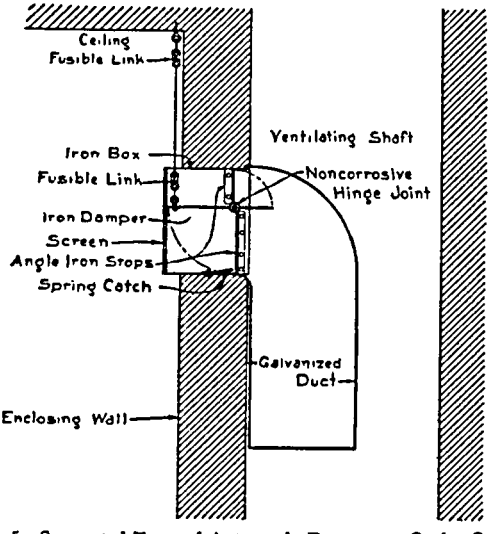

Fig. 5. Suggested Type of Automatic Damper at Outlet Opening or at opening to Branch Ducts.

216. When branch ducts from vertical ducts pass through fire walls the outlets shall be protected in approved manner. (See General Requirements, 129.)

217. Openings through floors, or through fire walls or fire partitions for the circulation of air, unless provided with approved protection, shall not be permitted.

220. Ventilation of Cooking Appliances.

221. Ventilating ducts used to carry off the grease laden vapors from hoods over cooking appliances, especially in kitchens of large restaurants and hotels, shall be constructed of not less than No. 18 U. S. gauge steel, with tight riveted joints, and their installation shall be subject to the approval of the inspection department having jurisdiction.

The ducts shall be substantially built and separated 9 inches from all combustible material, otherwise this material must be protected in an approved manner.

222. The ventilating ducts shall constitute an independent system in no manner connected with other house ventilating systems. They shall not be connected to stacks, chimneys or flues used for other purposes.

223. Where practicable a live steam jet should be provided in the duct.

224. Hoods over cooking or similar appliances shall be constructed of non-combustible materials throughout, with tight sides and tops, and have at least 18 inches clearance from all unprotected combustible materials. The connections between the hoods and the ventilating flues shall be at the highest points of the hoods and be of a size not less than that of the ventilating flues.

230. Unit Heaters.

231. Unit heaters should not be permitted where flammable dust or deposits are possible on the heaters.

When used in such locations, the heaters shall be provided with an air intake duct taking suction only from a source of clean air, or utilize filtered air.

CLASS B.

SYSTEMS FOR REMOVAL OF FLAMMABLE VAPORS.

301. The requirements noted under this class apply specifically to the removal of flammable vapors.

While the functions of these systems in a general way are similar to those of ventilating systems, the extremely hazardous nature of the vapors to be removed necessitates certain departures from the requirements for heating and ventilating systems.

It is important that flammable vapors be removed from the rooms or buildings in which generated to the outside of the building in the most direct manner possible. Ducts should never pass through other rooms or buildings unless unavoidable.

302. In addition to the specific requirements for this class the general requirements shall apply.

See also Regulations governing Finishing Processes, Paint Spraying and Spray Booths, and Dry Cleaning and Dry Dyeing Plants and similar operations.

Note—If in the removal of vapors solid particles of matter are liable to be conveyed through the system, methods of intercepting and/or collecting such solid matter should be provided in accordance with methods noted under sections 460 and 470 of these regulations.

310. Fans.

Note—The use of fans in locations where flammable vapors are present should be avoided wherever possible. When they must be used in such locations the following regulations shall apply.

311. The capacity of the fans used and the motive power employed shall be ample to meet all requirements without the necessity of overspeeding, and to effect a proper, complete and continuous change of air.

312. The bearings of the fans shall not extend into the housings or casings, nor into the ducts.

313. Fans shall not be located in separating fire walls, fire division walls or fire partitions.

314. When flammable vapors are passed through the fans the blade and spider shall be of bronze or similar composition, or the casing shall consist of or be lined with such material. Ample clearance shall be provided between the blades and the casing.

315. Exhausters, unless outside of the building, shall be located within the rooms or areas from which flammable vapors are being removed, or in compartments of fire-resistive construction within these rooms or areas.

They shall never be placed in rooms used for different purposes or occupancies. (See also Note, Rule 142.)

Note—It is recommended that when exhausters are used to remove vapors heavier than air they, together with the motors operating them, be located well above the floor level, or above the point or points where these vapors are generated. When used to remove vapors lighter than air they should be located at a lower level than that at which the vapors originate.

316. The inlets of the suction ducts of the exhausters should be located at the different points of the rooms from which the vapors are to be removed.

317. Blowers shall not be used for delivering air into rooms or areas in which flammable vapors are generated, if such rooms communicate with any other portion of the building.

318. Blowers may be located outside of rooms or areas in which flammable vapors are generated, if these do not communicate with any other portion of the building, subject to the approval of the inspection department having jurisdiction, provided, however, the discharge inlets into these rooms do not enter the zone of the natural path of vapor travel. When such blower discharges pass through fire walls or fire partitions, the openings shall be protected in an approved manner. (See General Requirements 129.)

When blowers are located within the room or area in which flammable vapors are generated the blades and spider shall be of bronze or similar composition or the casing shall consist of or be lined with such material. Ample clearance shall be provided between the blades and the casing.

320. Ducts.

(See also General Requirements, Section 120.)

321. Ducts shall be constructed of non-combustible materials.

322. Ducts shall be independent structures, and not built in the walls. Exhaust ducts shall lead to the outside of the buildings as directly as possible, never through other rooms when this can be avoided.

323. The outlets shall be kept clear of and away from any combustible materials, and be protected and guarded against exposures by reliable fire screens.

324. The inlets, whether near the floor or near the ceiling, shall be flared or funnel shaped. Those at or near the floor shall be protected by substantial wire screens of not more than ½-inch mesh.

325. Dampers, valves or shutters shall not be placed within the ducts or at the inlets or outlets of the ducts.

326. Ducts shall be free from pockets or traps.

327. When hoods are used for the removal of flammable vapors from special points or apparatus, they shall be constructed of non-combustible materials throughout. The connections between the hoods and the ventilating ducts shall be at the highest points of the hoods, and be of a size not less than that of the connecting ducts, preferably larger, with reducing connections to the ducts.

CLASS C.

DUST, STOCK AND REFUSE CONVEYING SYSTEMS.

401. The systems considered in this class include the suction inlets, fans, discharge ducts, and points of delivery such as vaults and receptacles.

The high velocity of air and the flammability of the materials which these systems are usually required to handle, make them especially hazardous.

402. When practicable, the separation of flammable or explosive dust or stock shall take place before the dust or stock reaches the exhauster.

403. In addition to the specific requirements for this class the General Requirements shall apply.

See also Regulations governing Pulverizing Systems for Sugar and Cocoa, Installation of Pulverized Fuel Systems, Prevention of Dust Explosions in Terminal Grain Elevators, Prevention of Dust Explosions in Flour and Feed Mills, Prevention of Dust Explosions in Starch Factories, and regulations applying to similar processes or operations.

410. Fans.

411. When flammable materials are passed through the fans the blades and spider shall be of bronze or similar composition or the casing shall consist of or be lined with such material. Ample clearance shall be provided between the blades and the casing.

412. The bearings of the fans shall not extend into the housings or casings, nor into the ducts.

413. Connections between discharge end of the fan and main duct shall be made in such a manner as to prevent leakage of fine dust.

414. Provision should be made to stop fans automatically in case of fire.

420. Ducts.

421. Ducts for conveying stock or refuse shall be made of suitable noncombustible materials. All joints shall be secured and tight.

422. When ducts are made of sheet metal the joints shall be riveted and soldered, except that lock joints are acceptable for longitudinal seams in pipes under suction. Spiral pipe shall be riveted, and soldered unless galvanized after the riveting.

423. Every lap in the piping shall be made in the direction of the air flow.

424. Metal ducts shall be constructed of metal of not less than the following gauge:

8 inches or less in greatest dimension	24 U. S. gauge
9 to 20 inches " " "	22 U. S. gauge
21 to 30 " " " "	20 U. S. gauge
30 inches and over " " "	18 U. S. gauge

425. Provisions shall be made for the wear due to friction at all points of change in direction by making long bends and using heavier materials, and where abrasive materials are to be conveyed, by using extra heavy materials or by inserting an approved form of inside lining that can readily be replaced. Where such lining is used the diameter of the pipe should be increased accordingly so as not to decrease the effective diameter of the duct.

426. All sheet metal elbows shall be made of metal two gauges heavier than the pipes to which they are connected.

427. Every bend, turn or elbow shall be made with a radius in the center line at least equal to one and one-half times the diameter of the pipe to which it is connected. A radius in the center line of twice the diameter shall be used when conditions require it.

428. The main suction pipe should preferably 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.

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

430. Every branch pipe shall connect with the main pipe at top or side at an angle not exceeding forty-five (45) degrees; it shall incline in the direction of the air flow at the junction with the main pipe. Branch pipes shall not project into the main pipe.

431. The main suction and discharge pipes shall be made as short as practicable. They should not be less than six inches above the floor at every joint, and not closer than six inches to any ceiling under which they may run.

432. Every pipe shall be kept open and unobstructed throughout its length, and no screen shall be placed in it. The use of a trap at the junc-

tion of a hood and a branch pipe may be permitted by the inspection department having jurisdiction, provided it is not permitted to fill up with dust. Mechanical means for removal of sediment are recommended.

433. Suitable tight-fitting sliding clean-cut doors shall be provided on all conveyor ducts at sufficient intervals to facilitate cleaning of ducts or removing obstructions.

434. Suction ducts shall be provided at all machines producing dust or combustible refuse, and shall be connected to exhaust fans.

435. "Sweep-up" pipes should be so installed or protected as not to admit material which would be large enough to damage the fan, or cause obstructions in the ducts.

436. Trunk line should be run on the outside wall of the building with ducts from each machine and each floor passing out directly through the wall and discharging into the trunk line. If inside of building, the trunk duct shall be overhead rather than under the benches; at least six inches from any unprotected combustible materials.

440. Cyclone Collectors or Separators.

441. The cyclones or separators shall be outside the building when conditions permit, and so located as to constitute a minimum hazard to adjacent structures. Their construction and supports shall be of incombustible material. It is recommended that they be provided with clean-out doors which will permit examination of the interior. If the cyclone of necessity is placed within 10 feet of any combustible construction or unprotected openings into buildings, it shall be provided with a metal vent pipe extending to a point above the main roof or other safe location.

Discharge pipes shall not come in contact with or expose combustible materials. (See 213 and 214.)

442. No delivery pipes from cyclone collectors shall convey refuse directly into the fire boxes of boilers, furnaces (including Dutch Ovens), refuse burners, incinerators, etc., which utilize induced or forced draft, and in no case shall the vent outlets of the cyclone be higher than the top of the stack of such fire box, furnaces, etc.

443. The discharge ends of delivery pipes from cyclone collectors shall be kept as far as possible from the grates and shall be so arranged that they can be withdrawn from the furnace when not in use and deliver the refuse to some point as remote from the furnace as possible. Suitable shut-off valves or dampers should be provided which will not interfere with the delivery of the refuse.

444. The delivery pipe from a cyclone collector should be provided with a special outlet or spillway, equipped with a normally closed damper, which will discharge the refuse into some suitable receiver in case the fire box or furnace should become choked with refuse.

Note—The foregoing paragraphs (442), (443) and (444) shall also apply to direct refuse (blower) delivery systems.

450. Vents.

451. All exhaust systems for conveying refuse or stock shall be vented to the outside of the building, either directly—by means of the flues, by way of the separators, or by way of the bins or vaults into which they discharge. Such vents shall be as direct as possible and of ample size.

452. Such vents shall not be connected into chimneys, or pipes, vents or flues used for other purposes.

453. If the air vent carries explosive or combustible dust, the use of a simple air washer, or other suitable filter, is recommended for eliminating such dust.

454. Metal Screens or equally efficient means shall be provided at the outlets of open air vents to prevent the entry of sparks; they shall not be secured when used at safety relief vents.